

Feasibility Study on Hospital Construction Project

—Industrial Complexes and Medically Underserved Areas—

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PREFACE

Due to its rapid economic development and the ensuing implementation of a medical insurance system, Korea experienced an accelerated demand for medical care. It is anticipated that this demand will increase still further with the continued expansion of the medical insurance system.

In comparison to other similarly developed countries, Korea lags far behind in meeting inpatient care needs for its citizenry. The present ratio of 1.5 beds per 1,000 persons is considered insufficient in view of the ever-growing demand for such care.

However, the results of previous studies and our experience indicate that the demand for actual medical care does not necessarily translate into an effective demand, nor does the extravagant investment in hospital facilities necessarily result in an immediate and direct increase in hospital utilization.

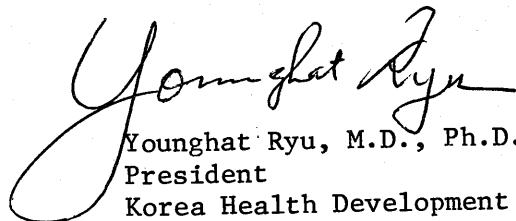
In order to cope effectively with this increasing demand for medical care in both quantitative and qualitative terms, the Government has accorded high priority to the construction of hospitals.

At the request of the Korean Government, this study was prepared by Korean experts in collaboration with Mediplan (West Germany) consultants in order to determine the feasibility of further governmental expansion of hospital facilities.

It should be pointed out that individual sponsor analysis is not included in this study report due to delaying the designation of the sponsorship by the Korean Government.

Due to time constraints requiring that it be completed within a short period of time, the report unfortunately does not deal with the subject matter in sufficient detail. However, it is hoped that the approaches and findings presented herein will assist the Government in arriving at the final decision regarding further hospital construction along with serving as a model for similar undertakings in the future.

Lastly, I would like to express my deep personal gratitude to all who actively participated in this study.



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I. CONCLUSION & RECOMMENDATION

I. CONCLUSION AND RECOMMENDATION

The Korea Health Development Institute has made the following conclusion and recommendation based upon the major findings of hospital construction feasibility study for the Government Plan of the 19 hospitals at the industrial complexes and medically under-served areas under the loan from West Germany.

1. Outline of the Government Plan and Recommended Revision

It is recommended that some part of the original Government plan with regard to the proposed hospital sites and sizes of bed complements be revised as follows:

Table I-1. The Proposed Revision of the Government Plan with Respect to Hospital Construction Sites and Their Bed-sizes.

<u>Original Plan</u>		<u>Proposed Revision</u>		Reason for Change
Hospital Site	No. of Beds	Hospital Site	No. of Beds	
Industrial Complexes				
Guro	100	Guro	250	Hospital beds concentrated in northern part of the Han River and rapid population increase in the Guro area
Daejeon	150	Daejeon	150	As was planned
Mokpo	80	Mokpo	80	As was planned
Banwol	150	Banwol	100	Delayed development of Banwol Industrial Complex
Onsan	100	<u>Cancellation</u>		Located at a short distance from Ulsan city (about 10 minutes ride), thus, could be included in the Ulsan Hospital catchment area
Ulsan	100	Ulsan	200	Rapid increase in the population of the city and absence of a large-scale hospital in the vicinity
Wonju	100	<u>Cancellation</u>		The Wonju Medical College of Yonsei University has the extension plan for the existing facility (600 beds).
Yeocheon	150	Yeocheon	100	Delay of Yeocheon new city development
Cheongju	80	Cheongju	150	Developing as a model medium-size industrial complex, and need for development of a new hospital run by a group practice mode

(continued)

<u>Original Plan</u>		<u>Proposed Revision</u>		Reason for Change
Hospital Site	No. of Beds	Hospital Site	No. of Beds	
Pohang	150	Pohang	100	Moderate increase in the catchment population, and relatively high bed-population ratio. Expansion of St. Mary Hospital to 200-bed rather than establishing a new 100-bed hospital to pursue economies of scale
Medically under-served areas				
Goesan	80	Eumseong	80	Small catchment area for the proposed Goesan Hospital. Eumseong has advantage of accessibility due to its locational efficiency
Nonsan	80	Nonsan	100	Nonsan has a possibility to form a confederate city with Ganggyung and Yeonmu, and no general hospital nearby
Euryong	50	Euryong	50	As was planned
Jecheon	100	<u>Cancellation</u>		Wonju Medical College has a plan to construct a Jecheon branch hospital (land already purchased), so does a private enterprise.
Pyungchang	80	<u>Cancellation</u>		Low population density, surroundings along the Yongdong Expressway belong to the catchment areas of either Gangnung or Wonju city, and already established a small hospital.
Hadong	80	Hadong	50	Sharp decrease in the population, and southern part of the Namhae Expressway and adjacent areas to Jinyang Gun can be excluded from the catchment area.
Hampyuong	80	Younggwang	100	Development of the Naju area which borders on Hampyuong Gun, scheduled to establish a nuclear power plant in Younggwang Gun; and if in Yeonggwang Eup, catchment area will become larger
Jinan	50	Jinan	50	As was planned
Yeoju	50	Yeoju	50	As was planned

* The number in parentheses is the suggested bed-size for the future expansion.

The above contents can be summarized as below; the Government hospital construction plan in the two industrial complexes of Wonju and Onsan is not feasible for the present time. In the medically under-served areas, changes of the original hospital sites would be desirable from Goesan and Hampyung to Eumseong and Younggwang, respectively. However, the necessity for having newly established hospital in Jecheon could not be justified.

As for the changes in number of hospital beds in the industrial complexes, it is recommended that the number be adjusted to 250 each in Ulsan and Guro, 150 in Cheongju, while decreased to 100 in Banwol, Yeochon and Pohang respectively. In the medically under-served area, upward adjustment is required in the Nonsan and Younggwang Hospitals from 80 to 100, where as downward adjustment in Hadong should be 80 to 50. However, Pyungchang could not be justified.

Thus, in the industrial complexes, the proposed 1,160 beds of 10 hospitals be reduced into 1,130 beds of 8 hospitals - a decrease of 20 beds, whereas in the medically underserved areas, the proposed 650 beds of 9 hospitals into 480 beds of 7 hospitals - a decrease of 170 beds. However, if the expansion plan of each 50 beds for Ulsan, Guro and Yeochon Hospital is included in the Government plan, those 8 industrial hospitals demand for 1,280 beds instead of 1,150, there is an increase of 120 beds compared with the original Government proposal. Therefore, it amounts to 1,660 or 1,760 beds for the newly proposed 15 hospitals, which results in 50 to 150 remaining beds. This surplus can be utilized later either in the expansion of the Daejeon Hospital, or in the plan of hospital construction in other medically underserved areas.

2. Priority for Regional Hospital Construction Based upon the Analysis of the 56 Health Districts of the Medicaid Program in Korea

2.1 Analytical Framework

It was assumed in this analytical model that the number of bed requirements would be 2.5 in the urban and 1.0 per 1,000 population in the rural area until 1981. The rationale for the difference comes from the fact that the urban area has more people under health insurance and thus, the medical care utilization rate of urban residents is much higher than that of rural residents. The above 2.5 per 1,000 population was obtained from the 1977 actual utilization rate of health insurance members in Seoul.

Factors considered in the analysis of bed requirements in a certain health district are the number of existing beds, occupancy rates by size of hospital and clinic, population density. The mathematical formula is as follow:

Urban area,

$$BS_i = \left[P_i \text{ 1981} \times \frac{2.5}{1,000} - (\sum B_j \times RO_j) \right] [1 + FD]$$

Rural area,

$$BS_i = \left[P_i \text{ 1981} \times \frac{1.0}{1,000} - (\sum B_j \times RO_j) \right] [1 + FD]$$

Where; BS_i = Bed shortage in i area
 P_i1981 = Population projection in i area in 1981
 B_j = No. of existing beds by j size hospital/clinic
 RO_j = Theoretically occupiable rate of j size hospital
 FD = Density factor

2.2 Priority for Regional Hospital Construction: Number of Bed Shortage by Health District.

Priority ranking can easily be obtained from the list of bed shortage by health district. The following table shows the result.

Table I-2. Government Hospital Construction Plan
Compared with the Priority of Medicaid Regional Hospital Construction

Priority by Medicaid District	Health District	No. of Occupiable Beds	Bed Deficiency
1	Seoul	8,422	10,603
4	Suwon	738	3,094
8	Daejeon	616	1,731
9	Jeonju	765	1,518
10	Eulsan	248	1,506
11	Cheongju	327	1,396
12	Jinju	342	1,192
14	Mokpo	377	1,137
17	Gongju	82	896
18	Choongju	194	885
19	Pohang	342	854
22	Yeosu	54	811
23	Wonju	273	778
38	Icheon	57	341
44	Younggwang	15	292

Comparing the government's plan with this priority list, it is revealed that the majority of the planned hospitals falls within the 23rd rank except Yeosu and Younggwang. However, there are not any hospital beds available to meet the medical care demand of local residents even in Yeosu and Younggwang. Thus, it is confirmed by this study that the originally planned hospital locations are mostly consistent with the priorities of regional hospital construction.

3. Medical Equipment

Medical equipment has been installed in accordance with the size and function of hospitals, and each required item has been spelled out department by department and room by room. The equipment was divided into basic medical equipment and minor medical equipment and also divided into two categories; those which will be procured internally as well as from abroad.

As for the cost of the equipment, the current market prices were applied as of February 28, 1979.

The cost of equipment per hospital bed ranged roughly from \$7,200 to \$10,000. However, it costs less when the size of hospital becomes larger. High cost items such as C.T. Scanner were not considered in this feasibility study.

Table I-3. Estimated Budget Requirement
for Purchasing
Medical Equipment and Furniture by Hospital

Area	Size	Total	(Unit: \$)			
			Medical Equipment			Furniture & Utensils
			Sub-total	Local Item	Imported Item	
Medically Under-served Area						
Nonsan	100	967,590	911,875	54,781	704,864	49,197
Euryong	50	502,358	468,415	37,045	431,370	33,943
Yeonggwang	100	928,692	873,667	67,610	806,057	55,025
Jinan	50	503,620	469,615	38,245	431,370	34,005
Hadong	50	503,620	469,615	38,245	431,370	34,005
Eumseong	80	807,842	758,645	54,781	704,864	49,197
Sub-total		4,213,722	3,951,832	304,820	3,648,012	261,890
Industrial Complex						
Ulsan	250	2,089,312	1,973,973	197,761	1,776,212	115,339
Daejeon	150	1,082,013	1,017,523	80,077	937,446	64,490
Cheongju	150	1,082,013	1,017,523	80,077	937,446	64,490
Pohang	100	878,266	820,107	69,016	751,091	58,159
Mokpo	80	807,842	758,645	54,781	704,864	49,197
Yeocheon	100	870,308	812,839	68,253	744,586	57,469
Sub-total		6,809,754	6,400,010	549,965	5,851,645	409,144
TOTAL		11,023,476	10,352,442	854,785	9,499,657	671,034

4. Hospital Construction

The construction cost for the proposed hospital buildings was estimated at 200,000 Won per square meter by this study team. The estimate is similar to the Government standard.

Space requirement per hospital bed was calculated at 60 square meters, which was wider than the Government standard of 53 square meters. This study chose gross/net ratio of 1.7 as the base of hospital space calculation, which resulted in wider space requirement in comparison with the Government standard. The reasons for using the gross/net ratio of 1.7 are as follows: Firstly, general hospitals have to deal with a large number of outpatients, and, thus, need more space. This will continue to be the tendency in the future because the outpatient department is a major source of hospital revenue income. Secondly, medical care demand will go up resulting from per capita income growth in general and expansion of health insurance in particular. Therefore, it is desirable for a newly establishing hospital to have enough space to meet the rising demand. Thirdly, because of complexities in a hospital operation, it needs higher Gross/Net ratio in order to properly function, and to avoid long waiting lines.

The sponsor, thereby, is responsible for the additional amount of 3,000,000 Won per bed to be used for the hospital construction except the Government provided long term loan 10,000,000 Won per bed through the Commercial Bank (or banks) for hospital building construction.

5. Summary of Financial Analysis

Future expenses and revenues are estimated on the following assumptions; 1) The medical care fees will be increased 3% annually for the hospitals with less than 250 beds. These assumptions are very conservative considering current sky-rocketing increase of medical care fees during the last couple of years in Korea. 2) Expenses have been estimated on the same assumptions above.

The financial plans have been constructed on the following conditions, 1) Government would arrange the commercial loan up to ₩10,000,000 per bed with 7% of the annual interest rate for the hospitals in rural areas and 9.5% interest rate for the hospitals in industrial areas. And also a three year grace period would be granted. 2) A-1 the cost of equipment would be financed from a German loan under the conditions of a 10 year-grace period and 2% of annual interest rate.

The result of financial studies shows in Table I-4 and Table I-5, 1) As shown in Table A, all the hospitals in rural areas will have more or less financial difficulties during first ten year operation. Especially the large hospitals such as the Nonsan and the Yeonggwang Hospitals would have more difficulties than smaller hospitals. For the smaller hospitals, if the sponsor has an ability to supply ₩200,000,000 during first 10 years, they would be in good position afterwards, but larger hospitals would require more funding during the same period of time to maintain an adequate cash balance. The main reason

of these troubles occurs from the heavy loan repayment each year. But most of the hospitals would have a profit within 6 years operation. 2) As shown

Table I-4. Summary of Financial Analysis (Hospitals in Rural Areas)

Area	# of beds	Year profit starts	Year positive growth cash flow
D Nonsan	100	7th	5th
E Euryung	45	6th	5th
F Yeonggwang	100	8th	6th
G Jinan	50	5th	4th
H Pyungchang	45	5th	4th
I Hadong	50	6th	6th
J Eumseong	80	8th	6th

Table I-5. Summary of Financial Analysis (Hospital in Rural Areas)

Area	# of beds	Year profit starts	Year positive growth cash flow
L Ulsan	250	1st	1st
M Daejeon	150	3rd	1st
N Cheongju	150	4th	1st
O Pohang	100	8th	6th
P Mokpo	80	8th	6th
Q Yeochon	100	8th	6th

in Table I-5, among the hospitals in industrial areas, the Ulsan, Daejeon and Cheong-ju Hospitals would not have any trouble from the first year of operation, but the Po-hang, Mokpo and Yeochon Hospitals would have financial trouble unless strong financial supports are received from sponsors or other sources during the first eight years.

In the short-run, some hospitals especially hospitals in rural areas might have difficulties because of operating funds if they don't have sponsors with strong financial backgrounds or government subsidies. Therefore for these hospitals, it is recommended that the terms of local loan be changed; grace period and payback period should be extended. (Rather than a 3 year grace period and 10 year payback period, a 5 year grace period and 15 year payback period is recommended.)

Those financial studies covered only the first 10 years of operation during this period heavy repayment of local loan will press the financial resources of the hospital. But if we would consider 15-20 years of operation, the financial analysis would show that all the hospitals would be able to payback the local and foreign loan as well as enjoy a reasonable profit. Therefore, we conclude that in the long run, these hospitals are worthwhile building.

6. Further Analysis

Increasingly, hospital construction becomes a social issue in Korea. This is simply because a hospital bed is the most expensive item and the tax-payer's money can not be idled away. The problem, then, is where and how to spend the money for hospital construction.

Frankly, the substance of techniques required to do effective area-wide planning for hospital bed complements has been poorly developed for the administrative authorities to thoroughly judge the appropriateness of a proposed hospital facility in a certain area. It is true, however, that the present state of the art of area-wide hospital planning, like any other techniques, can only be developed if it is widely applied in actual practice.

This study is one of the first attempts to develop a model feasibility study to construct hospitals in the industrial complexes and medically under-served areas in Korea. Therefore, this study has to overcome lack of data and all the problems involved in forecasting activities. In order to supplement the weakness of this study and to facilitate the hospital construction activities, it is recommended:

- 1) A Special Committee on Hospital Construction be organized under the Ministry of Health and Social Affairs to review and coordinate hospital construction activities in the private sector as well as in the public sector.
- 2) A Project Management Unit, a team of various experts in the hospital construction process and its day-to-day operation, be established to furthering the development of this study results in reference to the 19 hospitals under the loan from West Germany.
- 3) Further study, on a large scale, is called for to analyze health service districts in particular with a view to efficiently meeting the future demand for hospital bed complements.

II. ANALYSIS OF HEALTH SERVICE DISTRICT

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1. PRINCIPAL FINDINGS

In the body of this study an analysis and evaluation was conducted on the medical care system and on the unmet need for medical facilities within Korea. The principal results and conclusions are as follows:

A. The past development of the medical sector has largely been funded through the private sector. This has resulted in a large number of small facilities having an average of only 6.7 beds per medical facility. This study has found that larger facilities use less manpower per occupied bed and also have a greater percentage of occupiable beds. Additionally, we have found that the low average utilization rate of Korean medical facilities is in large part due to the small size of the average facility coupled often with inefficiency. Therefore, the current status of the medical care system is characterized by;

- 1) A strong private sector centered on the free market system.
- 2) Facility, manpower and fiscal inefficiency.
- 3) A lack of coordination characterized by a low rate of medical referrals.
- 4) A lack of comprehensive organization

B. The Korean government is presently emphasizing social development, and thereby is increasing the public sector's role towards the comprehensive development of the health sector. Three areas of public input that will affect the future development of the health care system are:

- 1) An urbanization plan, where 75% of the populace will reside in urban centers by 1991.
- 2) The introduction of several medical insurance systems that by 1980 will reach 30% of the populace.
- 3) The planning by 1981 for the construction of 35 hospitals in medically underserved industrial and rural areas.

C. In order to appraise the unmet need in the medical sector, this study developed a model that estimates three key criteria, on a regional (health district) basis:

- 1) The medical facility bed requirement of the population.
- 2) The existing occupiable beds, and as a result the efficiency of medical facilities.
- 3) The unmet need or bed deficiency.

Overall, we estimate that by 1981 Korea will require on the average 1.62 occupiable beds/1,000 population, at a 80% occupation rate. Currently Korea has in total 0.64 occupiable medical facility beds per 1,000 population.

One result of this calculation is that almost all areas in Korea have a bed deficiency with respect to 1981 projected medical demand.

D. This study evaluated the government plan for hospital construction with reference to the priority list criteria developed. The results of this analysis are as follows:

1) Of the total of 35 hospitals, and 3,515 beds planned for construction, 25 of the hospitals and 77% of the total beds fell within priority 1 and 23 inclusive.

2) Of the 10 remaining locations that were randomly distributed in priority, due to a small population, each after further analysis, conforms to a rural county with an extreme deficiency in hospital beds (6 beds in all but one of the locations).

Therefore, it is concluded that all of the locations selected in the government plan are areas that have a bed deficiency great enough to require the introduction of hospital beds.

2. NATIONAL HEALTH CARE SYSTEM

A. Background

Western Health Care was originally introduced in Korea in the 1870's. At that time only royalty and the wealthy could afford medical care. In 1910, Korea came under the administrative control of Japan and up until 1945, health care was available in small scale city and provincial hospitals built and operated during the Japanese administration, and through a small private sector of physicians. Again, during this time medical care was reserved for the Japanese residents or the affluent. Most Koreans utilized traditional or herb medicine as their primary health resource.

During the Korean War of 1950-'53, about 70 percent of the existing facilities were damaged or destroyed and many health care personnel lost. During and after this time, health became a major problem with the mass spreading of communicable disease vectors, especially typhoid, smallpox and others. Tuberculosis infection was widespread. Subsequent to 1953, disease epidemics were brought under control with the aid of a massive immunization campaign through private sector physicians.

The health status of the population in the 1950's was typical to that of many underdeveloped countries high infant mortality, inadequate nutrition, widespread disease vectors, although limited control was established. Parasitic infection was widespread. Until 1962, economic and political instability led to little improvement in the populations health status.

HEALTH INDICATORS

	1953-1962
Infant Mortality	86/1,000 live births
Maternal Mortality	200/100,000 live births*
Protein Intake	50g/Person/Day*
Typhoid	7,000 Cases/Year
Dysentery	2,000/Year
Life Expectancy	50 Years

* Regression estimate from more current data.

In 1962 the First Five-Year Economic Development Plan was implemented. This plan included for the health sector the construction and operation of health centers in every county and city. These centers served to provide health care concerned with communicable disease control, T.B. control, family planning and maternal and child health. These county and city health centers were staffed with a director, usually a physician, several nurses, a few technical staff and a number of administrative supporting staff. During the period '63-'66 these centers were expanded both in numbers of staff and in physical size.

During the 2nd and 3rd Five-Year Economic Development Plans, government health planning continued to be organized around these health centers. Additionally, Myon level projects were organized and by 1967 all 1336 Myons in Korea were covered by at least three health workers concentrating respectively on family planning, T.B. control and MCH (Maternal and Child Health). Facility construction such as General hospitals showed an increase of 350%, while total health manpower increased by 217% during this period.

FACILITY AND MANPOWER TREND

	1968	1973	1977	Total % Change '68-'77
Facilities				
General Hospital	12	17	54	+ 350.0
Clinic	5,211	5,993	6,008	+ 15.3
Licence Issued				
Physician	12,727	16,377	18,405	+ 44.6
Dentist	1,854	2,363	2,823	+ 52.3
Herb Doctor	2,446	2,691	2,610	+ 6.7
Nurse	11,925	21,953	30,294	+ 159.3
Nurse Aid	850	24,429	40,210	+ 4,631.0
Total Manpower	29,802	67,813	94,342	+ 217

SOURCE: Yearbook of Public Health and Social Statistics, Ministry of Health and Social Affairs, 1978.

The Japanese medical approach implemented prior to 1945 has continued basically unchanged to the present. Essentially, this approach adopts a free market enterprise system where medical care becomes, in principle, a commodity to be bought at the highest price. However subsequent to this time Korea introduced a qualification system for medical specialties beginning in the 1950's.

During the period 1970-1974 the total national health expenditure remained at approximately 2.7% of the GNP although the GNP increased 160% in the same period. Thereby, per capita health expenditure in Korea almost tripled in this period reaching \$12/Person in 1974. Of the total health expenditures, the private sector has remained as the dominant factor in being responsible for 85% of all expenditures.

NATIONAL HEALTH CARE EXPENDITURE 1970-1974

(in 100 Million Won)

	1970	1971	1972	1973	1974
Public Sector Expenditure	106 (16.4)	147 (18.2)	165 (15.4)	181 (13.8)	214 (11.2)
Central Government	47	73	76	82	95
Local Government	59	74	89	99	119
Private Sector Expenditure	540 (83.6)	659 (91.8)	908 (84.6)	1,127 (86.2)	1,702 (89.8)
Private Expenditure	533	649	896	1,112	1,681
Voluntary Organization	7	10	12	15	21
TOTAL EXPENDITURE	646 (100)	806 (100)	1,073 (100)	1,348 (100)	1,916 (100)
GNP	25,893	31,515	38,600	49,287	67,791
Population	31,435	31,828	32,360	32,905	33,459
Total Health Expenditure to GNP	2.5	2.6	2.8	2.7	2.8
Per Capita Health Expenditure in Won	2,055	2,532	3,316	3,975	5,726

SOURCE: The 4th Five-Year Economic Development Plan.
Ministry of Health, 1976.

During the period 1962 to 1977 the per capita income has shown a dramatic rise from \$86.00 to \$860.00. This along with an increase in geographical accessibility due to more facilities and improved roads has led to a 337% increase in the number of hospitalized patients while in the same period there was only an increase of 164% in the number of hospital beds.

In order to increase the number of qualified health manpower, the government expanded the size of the classes within nursing schools between 1970 and 1976. It also increased the number of medical schools from 14 in 1976 to 17 in 1979. These measures increased the health manpower by 40% per year.

In January 1977 the 4th Five-Year Economic Development Plan organized a medicaid program. The government divided the country into 56 health districts and implemented this program for the low income and indigent sectors of the population. The benefits for the approximately 400,000 indigents (individuals less than 18 years of age or greater than 60 years of age and with no immediate relatives) were cost free medical services at government designated clinics and hospitals. For the low income group of approximately 1,600,000 persons, qualification requires a monthly income of less than \$33.00. Benefits include cost free out-patient visits and inpatient visits at designated facilities, of which 30% is paid by government and 70% by the patient in a short-term loan of 1 to 5 years.

HOSPITAL UTILIZATION TREND

	1962	1967	1972	1977	Total % change '62-'77
Population (in 1,000)	26,513	30,131	33,505	36,450	+ 37.5
No. of Hospital Beds	9,637	14,948	16,373	25,465	+ 164.2
No. of Beds/1,000 persons	0.363	0.496	0.489	0.699	+ 92.6
No. of pts hospitalized/ year	107,020	188,498	239,785	468,016	+ 337.3
Hospitalized pts/1,000 pop./year	4.0	6.3	7.2	12.8	+ 218.1
No. of days hospitalization	1,948,835	3,455,797	3,068,495	5,498,206	+ 182.1
Average length of stay	18	18	13	12	- 33.3
Bed occupancy rate	55.4	63.3	51.3	59.2	+ 6.9
Bed turn over rate	11.2	12.8	14.4	18.0	+ 60.7
OPD visits	4,407,610	5,815,231	5,583,156	11,812,836	+ 168.0

SOURCE: Yearbook of Public Health and Social Statistics, 1978, Ministry of Health and Social Affairs.

NO. OF MEDICAL COLLEGE BY YEAR

Year	Number	Remarks
1976	14	
1977	14	
1978	16	Kang Won : Wonju Yeonsei Univ. Branch Chung Nam : Ah San, Soon Cheon Hang Medical College
1979	17	Pusan : Injae Medical College

* Yeong Nam Univ.,

will be authorized during 1979.

Gae Myong Univ.,

This medicaid program albeit limited in coverage helped to provide basic health service availability to sectors of the population that had previously had no financial accessibility to health care.

Beginning July 1977, a medical insurance system was implemented mandatorily for all companys employing greater than 500 persons. Additionally, smaller firms in the same industrial areas also were required to provide this insurance coverage. Each area affected thereby organized an insurance union. Premiums

PERSONS COVERED BY EMPLOYEE'S MEDICAL INSURANCE SYSTEM

As of Dec.-31-1977

Province	Persons Covered ('000)			Population ('000)	Coverage in %
	Employees	Dependants	Total		
Seoul	628	1,143	1,771	6,879	25.7
Busan	165	229	394	2,451	16.1
Gyeonggi	125	177	302	4,036	7.5
Kangwon	20	56	76	1,862	4.1
Chung-Buk	8	12	20	1,521	1.3
Chung-Nam	30	42	72	2,947	2.4
Jeon-Buk	17	22	39	2,455	1.6
Jeon-Nam	16	30	47	3,983	1.2
Kyong-Buk	71	93	164	4,856	3.4
Kyong-Nam	105	150	255	3,279	7.8
Total	1,185	1,955	3,140	34,269	9.2

SOURCE: Ministry of Health and Social Affairs, Major Statistics of MOHSA, 1978.

range from 3% to 8% of the employees wages, split between the employee and the firm.

The benefits are inclusive of family dependants and range from 50% to 70% of total medical costs paid by the insurance union. In total, this system reached over 3 million persons. In January 1979 medical insurance was implemented for all government employees, and all instructors, as well as their dependants. Premiums are 3.8% of wages and are divided equally between government and employees. Benefits range from 60% to 80% of total medical costs paid by the insurance union. This program reached over 3 million persons.

Therefore, in a very short time health insurance has reached over 8 million Koreans or 22% of the population.

One of the effects the implementation of health insurance has had is to dramatically raise the utilization rate of medical facilities. Early data from Seoul, where 20% of all residents were covered by some form of health insurance, shows that the utilization of medical facilities in terms of hospital beds went up from 55% in 1976 to over 90% in 1977-'78*. This corresponds to a bed requirement of 2.6/1,000 persons up from the 1976 figure of 1.6/1,000.

B. Present Status

OVERVIEW OF KOREAN SITUATION

The Korean medical care situation is very diverse and complex. As the health sector is currently in the developing stage, a trichotomy exists in the utilization and understanding of medical services by the public.

* Before introduction of Public employees insurance

Basically, Korean health care is divided into 3 branches from the public's view:

- 1) Western, physician based medical centered around hospitals, clinics, and health centers including primary care projects.
- 2) Pharmacies
- 3) Oriental medicine and shamanistic practices.

Due to the limited number of medical manpower and facilities, especially in the rural areas, as well as limited financial accessibility, a large number of people utilize pharmacies as their primary health resource. Additionally, while oriental medicine and shamanism are not typically utilized as a primary health resource, they often are utilized secondarily or tertiarily. Of course, the trend is changing rapidly towards a western physician based system including the use of para-medical practitioners for primary care. Hospitals remain by far the primary resource for acute and serious care. Also, as the educational level and the income level of the populace increases, the trend will continue towards the western based system due to its general effectiveness.

Therefore, we must look at the current status of health infrastructure in order to later appraise the areas that are deficient, and to serve as a guide towards the implementation of changes.

HEALTH FACILITIES IN KOREA, 1977

	Hospitals	Private Medical Clinics	Health Center	Pharmacies	Non-Western Clinic	Total
Number	234	6,008	202	10,191	2,353	18,988
Staff	4,563	6,149	5,645	10,648	2,448	29,453

SOURCE: Yearbook of Public Health and Social Affairs, 1978.
Special Hospitals were excluded from these statistics.

Of the total number of health facilities in Korea, only 1% are hospitals, and of these only 54 can be considered general hospitals, which overall give the highest level of care. It is easy to see that each general hospital, all other things being equal, is responsible for over 700,000 Koreans. Of course this is a simplistic approximation but it identifies an overall shortage in Korea of quality medical facilities.

The term 'hospital' in Korea can be used for any facility with 20 or more beds. Taking into account all hospitals, even with perfect distribution, each would have a target population of almost 200,000 persons. Unfortunately, proper distribution is lacking with many areas having totally inadequate or non-existent medical care.

Another concern is that of the large number of pharmacies. Previously, when adequate facilities were lacking, pharmacies partially filled the gap by supplying

various modern medications to the populace. Unfortunately the misuse of pharmacies by the population as diagnostic and prescriptive centers has led to a negative effect instead of serving as ancillary dispensaries for the proper acquisition of prescribed drugs. The existing clinics serve to provide a substantial level of medical care to the populace. As each practitioner is highly qualified, the only drawbacks are that most clinics are not suitable for acute cases and long term care. Also, the medical equipment at clinics is often inadequate. Therefore, clinics do not generally provide a balanced medical delivery service.

The non-western clinics, while considered by some to deliver adequate health care, cannot be considered to contribute in any overall positive way towards the populace's health according to existing data. Instead we often see maltreatment and a lack of proper referrals for serious cases.

We shall now concentrate on the three primary health resources available in Korea that provide supervised western medical care, namely the hospitals, clinics and health centers. Pharmacies and non-western clinics are considered to be ancillary infrastructure in regards to medical and health care.

First, it is clear that of these three types of facilities, private clinics comprise more than 93% of the total, while they house more than half of the 'beds' and employ 55% of the physicians in the Korean health care system. Therefore, clinics have a great impact on the availability of medical care. Clinics on the average have 3.5 beds, but the actual utilization rates of these beds are

MEDICAL FACILITIES IN KOREA, 1977

	Total Hospitals	Gen. Hospitals	Other Hospitals	Clinics	Health Centers	Total
Number	236	54	180	6,008	202	6,446
Number of Beds	22,636	13,977	8,659	23,422	-	46,058
Total Physicians	4,563	4,078	485	6,149	355	11,067
Specialists	2,150	2,150		2,559	-	4,709
General Physicians	2,413	2,413		3,590	-	6,003
Nurses + Midwives	6,693	5,780	913	846	690	8,229
Other Medical Staff	1,429	1,149	280	817	1,555*	3,801

SOURCE: Yearbook of Public Health and Social Affairs, 1978, Special Hospital were excluded from this statistics.

quite low. Therefore, some of the strengths of the private clinics are:

1) They are widespread and there is overall high geographical accessibility.

- 2) They are staffed by a qualified physician or specialist.
- 3) They provide a basic foundation for primary and often secondary care.
- 4) While most are in urban areas they provide services to many areas not within the target area of hospitals.

These advantages make private clinics very desirable, but many drawbacks and areas for improvement still remain:

1) All of the clinics are within the private sector free market system. This leads to a profit maximizing approach that often compromises the quality of the health care.

2) Clinics tend to conglomerate in the urban areas, and in areas of high income in order to optimize profits. Thereby, areas of lower income have increasingly inadequate medical care.

3) Clinics are not generally equipped with the necessary manpower and equipment to treat patients on a secondary or tertiary basis, nor for extended stays.

It is apparent that while clinics serve a needed and useful function towards Korean health, in terms of a coordinated national health care system, the clinics still remain too diverse both in quality and availability. Additionally, clinics are generally not able to meet the secondary and tertiary medical care needs of the populace.

One key element of the national health system in Korea is the implementation of a medical security and insurance system. This system under public control will have reached 30% of the population by July 1979. Therefore, the financial accessibility to quality medical care, especially hospital based care, is currently greatly enhanced for this sector of the populace due to the new medical insurance systems.

POPULATION COVERAGE UNDER THE MEDICAL SECURITY AND INSURANCE SYSTEMS

Program/Plan	As of the 1977 Persons Covered	% to Pop.	July 1979 Persons Covered	% to Pop.
Employee's Insurance	3,140,000	8.9	5,045,000	14.3
Government Official and Private School Teacher	-		3,620,000	9.8
Non-employee's Insurance	57,000	0.2	57,000	0.2
Medical Program	2,096,000	5.7	2,090,000	5.7
	5,293,000	14.8	10,812,000	30.0

SOURCE: MOHSA; Administration Statistics, unpublished.

Although these elements are of great importance and significance and have overall increased the quality and availability of health care to the populace, there still remain many problems in the current strategies:

1) The health center and sub-center systems have limited ability to attract physicians and other professionals resulting in a shortage of medical manpower. Also, the services provided are limited in scope as they are mainly centered around community health services as opposed to personal health services.

HEALTH CENTER MANPOWER

(as of the 30th Sept. 1978)

	No. of Post	No. of Post Occupied	Excess or Shortage
Physician	257	175	- 82
Dentist	62	26	- 36
Technologist			
Clinical Lab.	238	194	- 44
X-Ray	236	211	- 25
Pharmacist	258	194	- 64
Nurse	871	744	- 127
Family Planning Worker	1,062	1,036	- 26
MCH Worker	104	102	- 2
T.B. Worker	490	466	- 24
Leprosy Worker	105	104	- 1
Other Health Worker	572	553	- 19
Clerk	711	689	- 22
Temporary Employee	526	592	+ 66
Others	415	405	- 10
TOTAL	6,125	5,612	- 513

SOURCE: Present Status of the Medical Administration, Ministry of Health and Social Affairs, Oct. 1978.

2) There are only 19 general and 52 other hospitals in the public sector in Korea. This shortage of public hospitals limits accessibility to large sectors of the population.

3) Due to the increased demand for quality medical care by the public since the introduction of medical insurance, it is evident that there are insufficient hospital facilities existing currently, both in quality and number.

4) Because 96% of all medical facilities are in the private sector, the free market system still overwhelmingly dominates the health care system in Korea.

Therefore, until steps are taken to coordinate the development of the private sector in the interest of integrated national health care development, there will be limits to the benefits that the national health care system can produce.

NO. OF HOSPITAL AND HOSPITAL BEDS BY SECTOR

	Public Sector	Private Sector	Total
No. of Hospital			
General Hospital	19 (35.2)	35 (64.8)	54
Hospital	41 (22.8)	139 (77.2)	180
Special Hospital	11 (57.9)	8 (42.1)	19
Total	71 (28.1%)	182 (71.9%)	253
No. of Hospital beds			
General Hospital	5,027 (36.0)	8,950 (64.0)	13,977
Hospital	2,337 (27.0)	6,322 (73.0)	8,659
Special Hospital	3,074 (68.4)	1,421 (31.6)	4,495
Total	10,438 (38.5)	16,693 (61.5)	27,131

SOURCE: Journal of the Korean Hospital Association, Vol. 7, No. 4-5, May 1978.

Overall, the present national health care system has attempted to fill the gap separating medical demand and existing resources. Some of the most positive aspects of the national system are:

- 1) There exists a web of health centers and health subcenters providing primary health care services.
- 2) There are several publicly owned provincial and government hospitals providing secondary and tertiary care.
- 3) Medicaid and medical security insurance systems have been implemented to a large sector of the population. This promises to increase the financial accessibility of medical care.

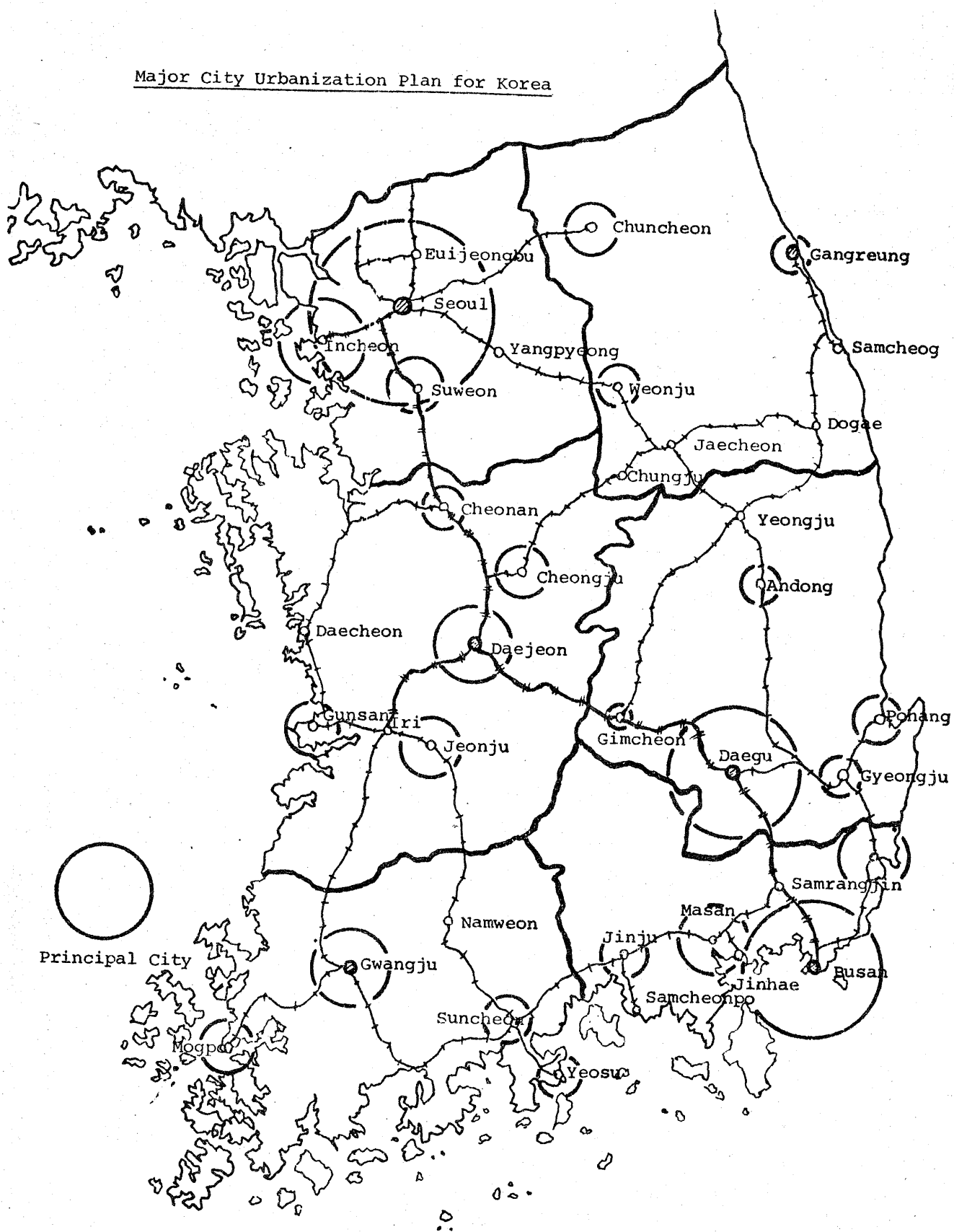
C. INTENDED DEVELOPMENT

GENERAL GOVERNMENT PLAN

In the government 5th Five-Year Economic Development Plan (to begin in 1982), continuous economic growth along with a high rate of social development will be stressed. For the health sector, there are several elements correlated with the country's future growth that will affect the utilization and demand for health directly.

Due to the rapid pace of industrialization presently existing and its continuance as a dominant factor in Korea's economic growth, as well as a less agrarian economy, there will continue to be a high rate of urbanization. By

Major City Urbanization Plan for Korea



1991, 75% of the population will live within cities. In fact many areas now slated to be industrial centers will quickly become highly populated urban centers.

LAND, POPULATION AND URBANIZATION TREND

	1976	1981	1986	1991
Land in Km ²	99,807	98,909	98,865	99,022
Population (in 10,000)	3,586	3,881	4,209	4,525
Pop-Density	363	392	425	457
Urban Population (10,000)	1,865	2,290	2,778	3,394
% of Population Urban	52	59	66	75

SOURCE: Long term Socio-Economic Development Plan 1977-1991, Korea Development Institute.

Age Structure

As Korea becomes increasingly more industrialized, one most noticeable element of change will be the population age structure. Basically, with modernization and improved health care, we see a clear trend identical to that taken by all developed countries in their post-industrial phase, namely, a reduction in infant mortality and disease vectors with a concurrent lowering of the birth rate and the death rate.

Of course, in practical terms for Korea, this means a larger retired and old age group as well as a relatively larger number of people over twenty five. In terms of the health sector, this forebodes an increasing future demand for health care as the health care needs of the population will inevitably increase with the greater number of middle and old age people.

The required medical care will surely require more complex medical services and correspondingly, a higher investment in facilities, equipment and perhaps most importantly, well trained professionals.

Projection of Age Specific Population Structure

	1961		1976		1981		1986		1991	
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%
TOTAL	25,766	100.0	35,860	100.0	38,807	100.0	42,080	100.0	45,251	100.0
0 - 4	4,729	18.4	4,392	12.3	4,162	10.7	4,506	10.9	4,532	10.0
5 - 14	6,336	24.6	9,052	25.2	8,798	22.7	8,357	19.9	8,564	18.9
15 - 24	4,750	18.4	7,828	12.8	8,906	22.9	8,859	21.0	8,614	19.0
25 - 34	3,638	14.1	4,797	13.4	5,786	14.9	7,548	17.9	8,622	19.1
35 - 44	2,532	9.8	4,157	11.6	4,353	11.2	4,575	10.9	5,556	12.3
45 - 59	2,494	9.7	3,627	10.1	4,416	11.4	5,254	12.5	5,855	12.9
60 +	1,287	5.0	2,007	5.6	2,394	6.2	2,909	6.9	3,508	7.8

SOURCE: Long term Socio-Economic Development Plan 1977-1991, Korea Development Institute.

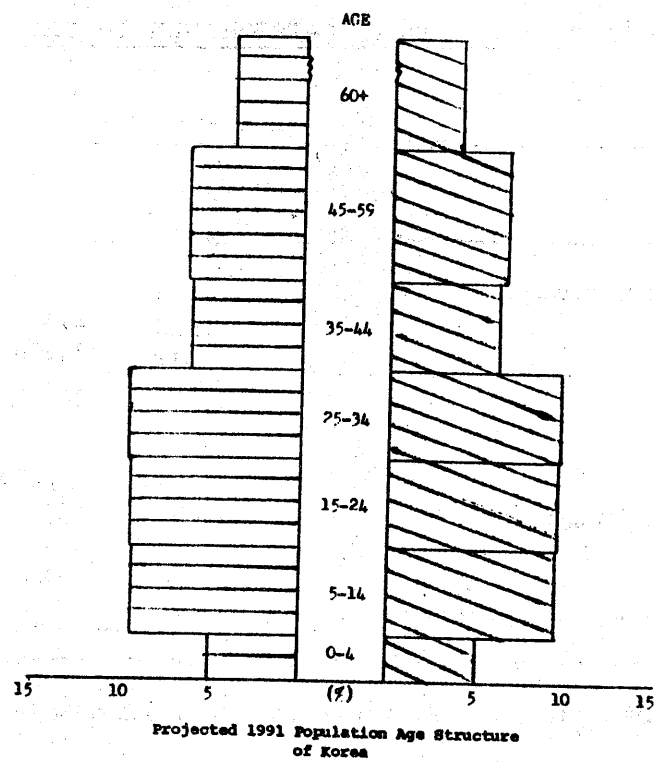
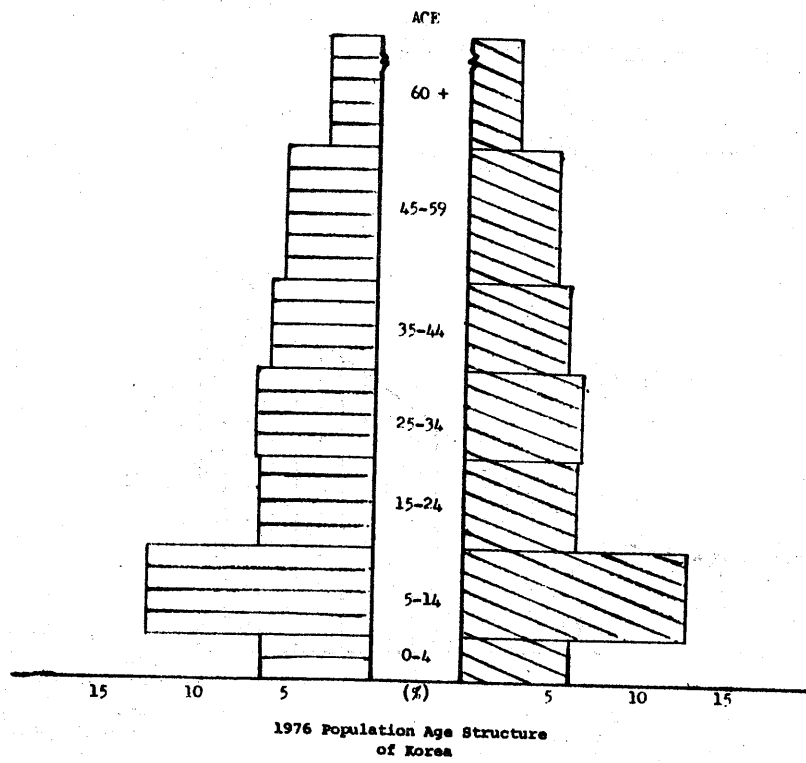
Income

With the rapid increase in gross national product, and correspondingly per-capita income, the liquid income available to the population will rise quickly. Also, the household income of the rural residents is now rapidly equalling that of the urban counterparts. This trend undoubtedly will give rise to an increase in financial accessibility for all sectors of the population, urban and rural, towards high quality health care. Additionally, the demand for medical services by the rural residents who have previously had limited financial accessibility will surely rise.

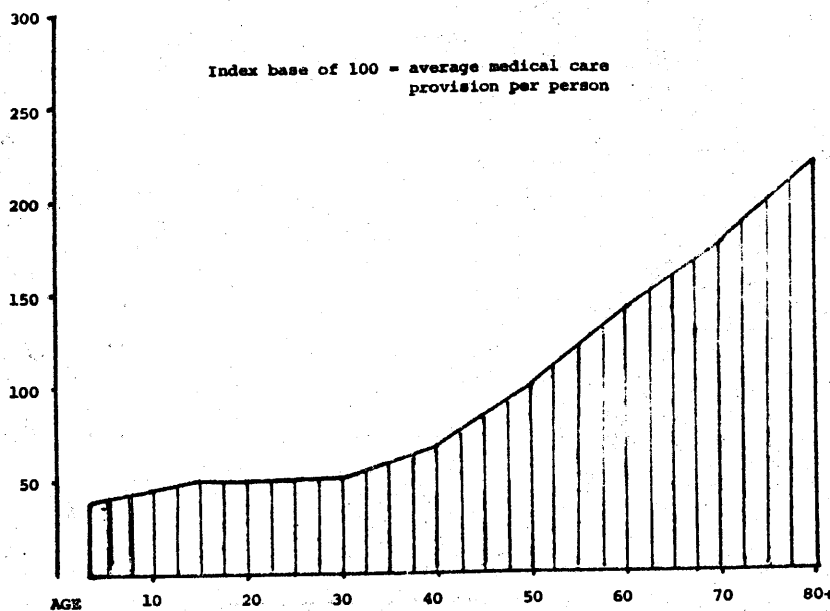
Health Sector Plan

The future development of the health sector must take into account an increased demand for medical services and for the highest quality of care possible. In order to meet this change there must be coordinated activities aimed at increasing the number of health professionals available, as well as increasing the number of facilities. Only by coordinating these increases with the future increase of medical insurance coverage of the population, can an effective and efficient medical system be developed. Therefore, the government plans, on a long term basis, to coordinate these activities in the interest of insuring the adequate availability of medical care for all.

During the fourth Five-Year Economic Development Plan the government is following a policy of developing the health sector in order to meet present and future needs. Also, much emphasis is being put on environmental health and



Medical Care at Different Ages in Sweden



Source: The Needs of Medical Education and Medical Progress
Stockholm, Government Printing Office 1961

PROJECTION OF INCOME BY CATEGORY AND BY YEAR

(Unit : 1,000 Won)

	1970	1976	1981	1986	1991
Household Income of Non Farmer					
Non-Farmer	1,136	1,522	2,132	2,841	3,903
Employee	689	919	1,353	2,006	3,007
Farm Household Income					
Agricultural Expenditure excluded	641	1,003	1,493	2,216	3,388
Proportion of Side Business Income	24.2	20.3	28.3	37.5	50.0

SOURCE: Korea Development Institute; Long term Socio-Economic Development Plan, 1977-1991.

LONG TERM PLAN FOR HEALTH SECTOR

	Unit	1976	1981	1986	1991
Total Population	1,000	35,860	38,807	42,088	45,251
0 - 14	1,000 %	13,444 (37.5)	12,960 (33.4)	12,943 (30.8)	13,097 (28.9)
15 - 59	1,000 %	20,409 (56.9)	23,453 (60.4)	26,236 (62.3)	28,646 (63.3)
60 or more	1,000 %	2,007 (5.6)	2,394 (6.2)	2,909 (6.9)	3,508 (7.8)
Manpower					
Population/physician		2,210	1,740	1,592	1,283
Population/Dentist		13,087	9,653	8,403	6,199
Population/Nurse		1,184	741	578	504 (include nurse-aid)
Population/Bed		796	427	229	123
No. of Beds		45,050	90,880	183,790	367,890
Facility delivery (%)		22	45	65	75
Medical Security					
Total (covered by medical security)	1,000	5,658	15,975	24,148	36,077
To total population		16.0%	41.2%	57.4%	79.7%
Medical Insurance		3,203 9.1	13,272 34.2	21,675 51.5	33,983 75.1
Medicaid		2,455 6.9	2,703 7.0	2,473 5.9	2,094 4.1
Industrial accident compensation insurance		2,270	4,714	8,090	13,878
To employee		43.6	63.9	77.2	93.2

Source: Ministry of Health and Social Affairs; 5th Five Year Economic Plan.

Government Investment Plan for Health Sector During the 4th Five-Year Economic Development Plan

(Unit : Million Won)

	Total Investment	Central Government	Local Government	Others
TOTAL	(\$369 million) 179,081 (100%)	77,478 (62%)	33,601	68,002 (38%)
Health Facility Expansion	73,640	19,816	121	53,703
Health Center Bedding and Equipment Renovation	3,174	3,053	121	-
Health Sub-center renovation including Delivery Facility Bedding	4,230	4,230	-	-
City/Provincial Hosp. renovation	39,472	2,972	-	36,500
Mental Hospital Renovation	2,784	2,784	-	-
TB sanatorium renovation	2,977	2,977	-	-
New Private Hospital Construction	15,000	-	-	15,000
Facilities for Physicianless Area	2,500	2,500	-	-
Health Demonstration Project	2,940	737	-	2,203
Other related project	563	563	-	-
Public Health Project	32,609	25,584	7,061	-
Environmental Project	72,832	32,114	26,419	-

SOURCE: Health Sector Plan for the 4th Five-Year Economic Development Plan, Ministry of Health and Social Affairs.

public health. The government intends to stimulate the growth of the health sector directly by initiating the investment of resources and by coordinating the direction of growth of the private sector, both through policy and mutual investments.

To meet the existing need for hospital beds and other medical facilities, as well as to plan for the future demand for medical care, the government in the Fourth Five-Year Economic Development Plan has planned to increase the number of beds in Korea by over 7,000. 3,400 of these beds are to be in hospitals planned for construction in this development period while another 3,420 beds will be introduced as part of reconstruction and renovation work on existing facilities. The majority of the new hospitals planned for construction in this period will be best utilized in two kinds of areas:

- 1) Industrially developing areas where the population is increasing rapidly.
- 2) Rural medically-underserved areas where there are little or no existing hospital facilities.

HEALTH MANPOWER REQUIREMENTS

	1975		1981		1990	
	No.	To pop.	No.	Population per health worker	No.	Pop. Professional
Physician	13,000	2,713	20,190	1,923	33,610	1,325
Nurse (total)	25,600	1,398	58,000	669	97,474	457
Registered Nurse	11,300	3,122	26,900	1,443	50,420	883
Nurse Aid	14,300	2,467	31,000	1,248	47,054	946
Technician						
X-ray	860	41,024	2,020	19,225	4,030	11,054
Clinical lab.	1,400	25,200	3,030	12,816	5,380	8,280
Midwife	1,600	22,050	4,150	9,357	6,720	6,627
Herb Doctor	2,400	14,700	2,910	13,345	3,900	11,422
Pharmacist	16,500	2,138	18,100	2,145	20,800	2,141
Dentist	2,200	16,036	3,870	10,035	6,720	6,629
Dental Hygienist	680	51,883	970	40,036	1,654	26,934

SOURCE: National Health Plan for the 4th Economic Development Planning Period, MOHSA, 1976.

Therefore, all of these government planned hospitals built during this 4th Five-Year Economic Development Plan will be built in areas characterisable by one of the two above determinants, so that maximum benefit to the nation's health can be realized.

3. MEDICAL INFRASTRUCTURE

A. HEALTH DISTRICTS

In order to appraise the medical and health infrastructural status of Korea to an extent suitable for regional analysis, we must subdivide the country into primary units or districts.

Korea, a country with an area of 98,000 Km², is presently administratively

subdivided into nine provinces and two special cities. Additionally, each province is divided into several cities and counties. Correspondingly, each special city and large city is divided into several districts (Ku's).

BED RELATED FACILITY PLAN FOR 4TH ECONOMIC PLANNING PERIOD

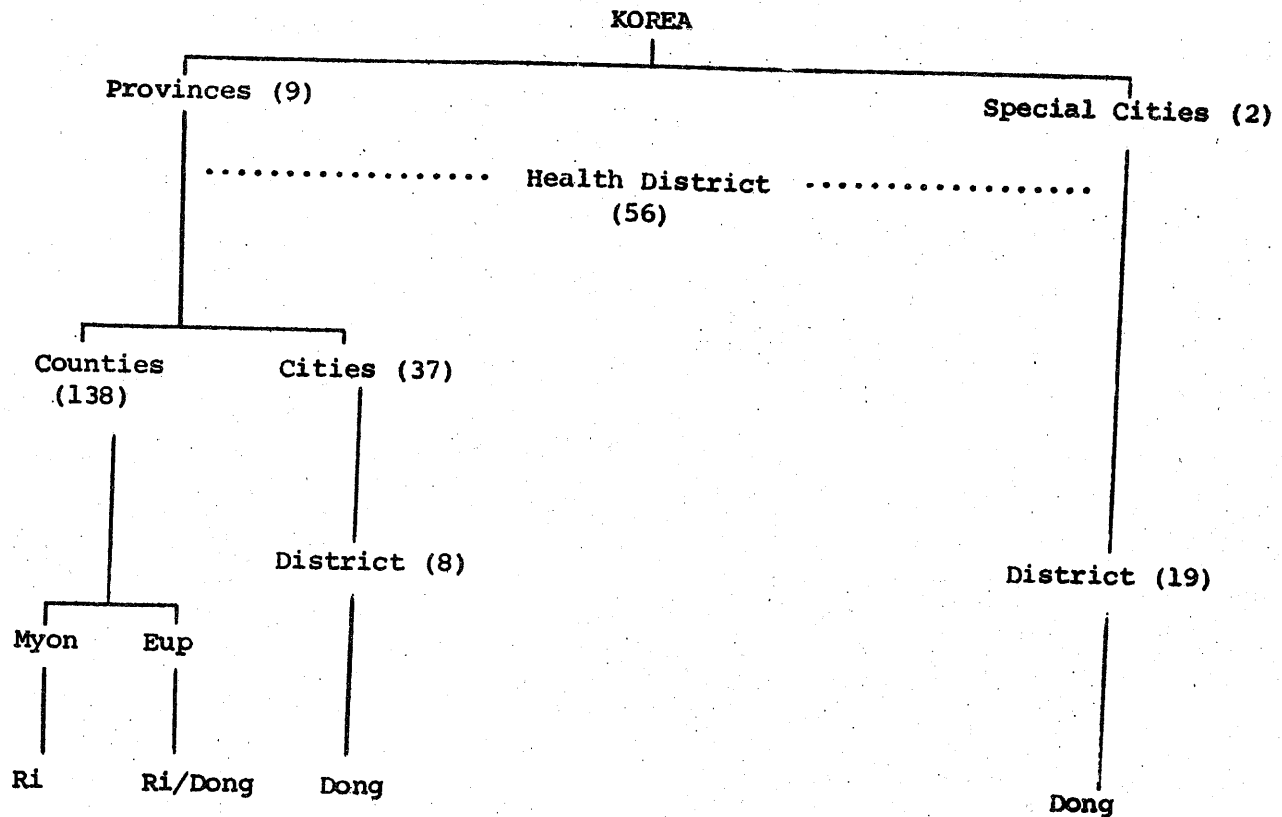
	Total	77	78	79	80	81
Health Sub-center Expansion						
New Building construction	309	26	70	70	70	72
Maternity Facility construction	500	-	125	125	125	125
City/Provincial Hospital						
New Building construction	6	-	-	2	2	2
No. of Beds	1,400	-	-	400	600	400
Reconstruction	33	7	6	7	7	6
No. of Beds	2,640	560	480	560	560	480
Mental Hospital						
Bed Expansion (No. of Beds)	400	-	-	200	200	-
T.B. Sanatorium						
Bed Expansion (No. of Beds)	380	-	-	-	190	190
Private Hospital Support						
No. of Beds	2,000	350	350	400	450	450
Number of Loans for Facilities in Doctor less Area	500	100	100	100	100	100

SOURCE: National Health Plan for 4th Economic Development Planning Period, MOHSA, 1976.

In 1977 the government administratively subdivided the country into 56 health districts. These districts were created in order to efficiently implement a national medicaid program. Some of the advantages of these districts over the previous subdivisions are:

- 1) They take into account geographical divisions such as mountains and rivers.
- 2) They are organized into units larger than counties but smaller than provinces reflecting the close cooperation of health units across county borders.
- 3) Existing health resources are considered.

ADMINISTRATIVE SUBDIVISION OF KOREA



While these points are definitely advantageous, there are also several limitations inherent in these divisions:

- 1) The divisions are not exactly proportional to the distribution of medical need, i.e. each health district is made up of several counties and never contain counties from more than one province. Therefore, each health district was constructed from smaller administrative units (counties) that previously existed.
- 2) Health districts at times contain counties of widely different economic status and environment.
- 3) Health districts at time contain counties isolated from one another in terms of distribution of medical resources.

Therefore, even though the health districts do make an attempt at equity, it is clear that they are not always the best unit of organization in order to appraise a community's health infrastructure.

We have chosen to evaluate the existing health infrastructure in Korea based on these 56 health districts. But, as each individual case emerges for consideration, we often must look closely at a smaller unit of organization in order to fully appraise the status. Therefore, the health status in each of these 56 districts provide a thorough yet incomplete view of any particular community. Nevertheless, in terms of comparisons, they provide sufficient accuracy.

B. FACILITY INFRASTRUCTURE

Basically, the medical facility infrastructure of Korea can be divided into 3 categories:

1) General hospitals

These hospitals provide a minimum of eight disciplines, five clinical and three supportive, inclusive of dentistry. Therefore, they are able to provide a coordinated delivery service of medical care to the populace. General hospitals are generally large by Korean standards, housing an average of 259 beds. Unfortunately, there are only 54 general hospitals within Korea and only 16 of the 56 health districts have one or more general hospitals. Also, general hospitals have the highest overall bed occupancy rate of the medical facilities, averaging 83%. Therefore of the 14,000 beds in general hospitals, approximately 11,600 are occupiable and can directly serve the populace. These 11,000 beds are, by and large, the highest quality of hospital beds in Korea. One area of concern is that only 2 of these general hospitals are located in the rural areas. This is indicative of a generally lower quality of medical care within rural areas.

2) Hospitals (Other than general)

This example, a hospital by definition requires a minimum of only 20 beds. These hospitals can best be viewed as those facilities housing 20 or more beds but generally less than 80 beds. Of these 180 hospitals, the average holds only 48 beds. The small size of these hospitals allows them to be economical in areas of low demand. These hospitals usually employ only a limited number of qualified manpower, and have a reduced rate of bed occupancy in contrast to general hospitals.

These hospitals have an average bed occupancy rate of under 66%. Therefore, of these 8,659 hospital beds, only 5,709 are occupiable. Of the 180 hospitals distributed in Korea, only 21% are situated in the rural areas which have 50% of the population. Still, hospitals are the highest quality facility available in the rural areas (aside from the two general hospitals).

3) Clinics

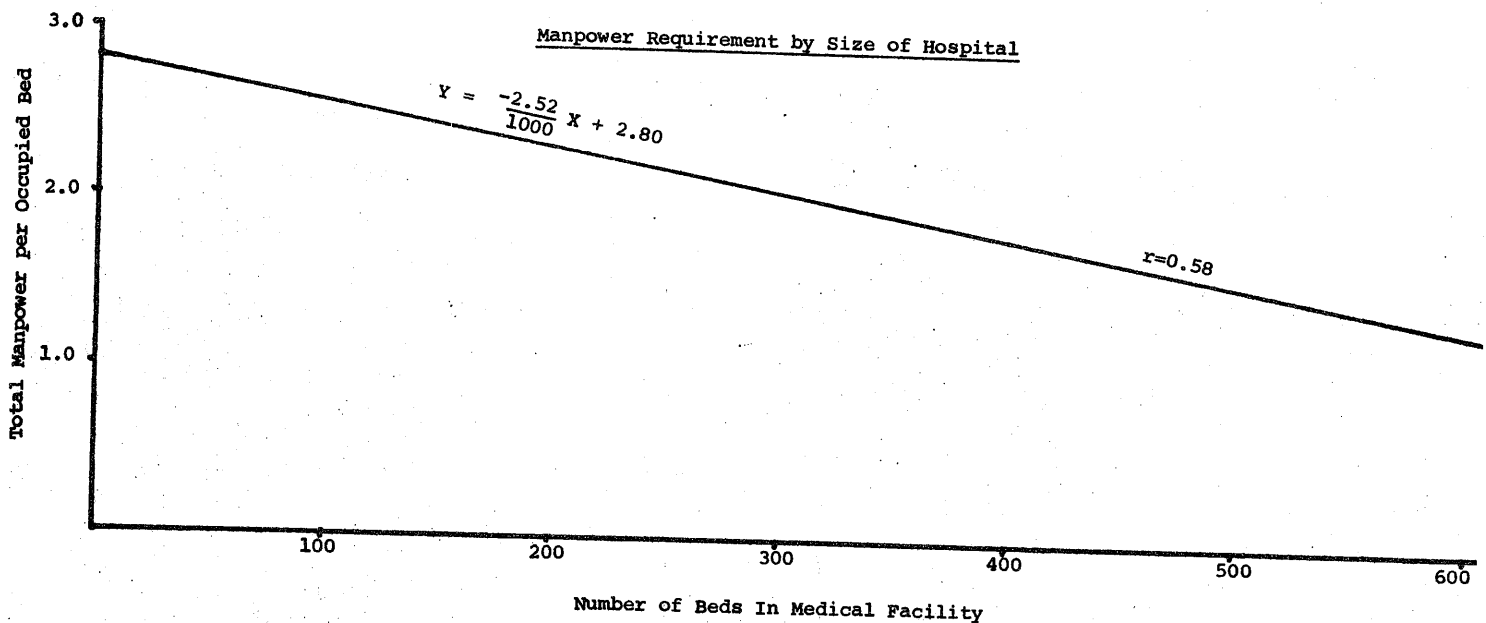
The term clinic refers to a type of facility that is difficult to classify adequately. Clinics are by definition any location where one or more physicians have a private practice. In Korea most private clinics only have one physician. Generally, clinics follow the parameters affecting businesses. They

are enterprises and as in any enterprise, optimization of profits is a compelling objective. There are over 6,600 clinics in Korea, each having an average of 3.5 beds.

There is presently no system of requiring clinics to meet minimum standard before receiving a license to have inpatients beds. Therefore, clinics generally have little in terms of sophisticated medical equipment. The large number of clinics aid in the accessibility of primary care to the populace, especially the rural populace, but unfortunately, clinics are not generally adequate resources for secondary and tertiary care. Due to the low equipment standards and limited number of beds per facilities, clinics only have a 25% occupancy rate for inpatients. This rate is indicative of the low number of beds per facility and of inadequate medical standards for inpatients care. This low occupancy rate, is not, as a cursory assumption might make, singularly indicative of low utilization by the populace.

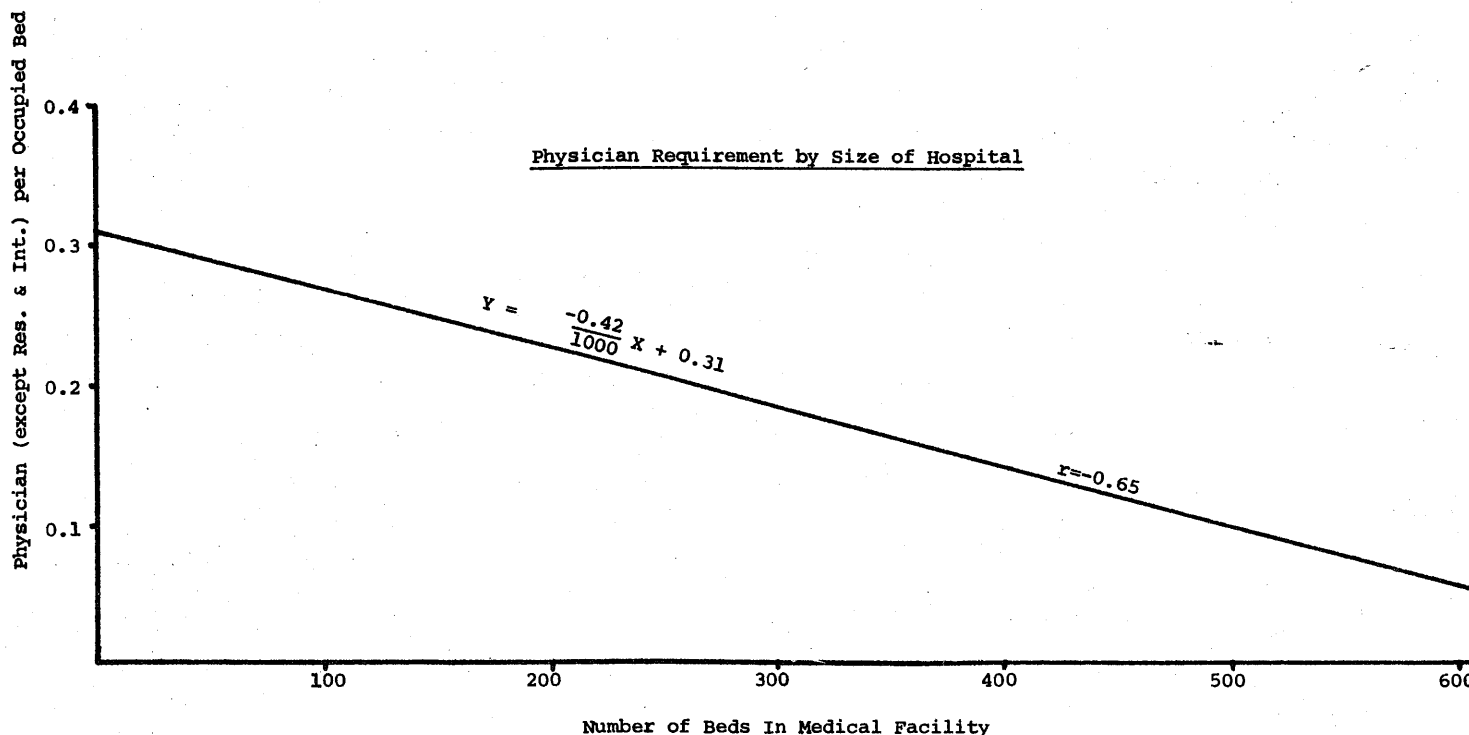
C. MANPOWER INFRASTRUCTURE

Medical facility development in Korea has generally been led by the private sector organized around the private practice physician. This has resulted in a redundant and unorganized approach to medical delivery with respect to national planning. Also, this has, due to economic consideration led to large numbers of very small specialized facilities and low numbers of larger more balanced facilities. Currently, the average medical facility in Korea has only 6.7 beds. Because of this unstructured approach, the efficiency of the current medical care system is quite low. From data on manpower utilization, we have made an analysis to determine the required number of personnel per bed. It is clear, as the following graph shows, that the larger medical facilities have a lower manpower to occupied bed ratio than the smaller facilities;



No. of sample hospitals for this study:
 Total hospital beds:
 Total manpower:

Also, our data shows that there is a corresponding reduction in physician manpower requirements per occupied bed as the size of the facility increases, as follows:



This analysis indicates that very small facilities is inefficient from a manpower perspective and correspondingly from a financial perspective. This is why simply 'counting the beds' in Korea is not an adequate method of evaluating medical infrastructure. Instead, due to the random development in the past, the current system is plagued with inefficiency, multiple coverage in the affluent areas, and with inadequate medical coverage in the poorer regions.

In section 4 a model is developed to take into account the present inefficiency such that a more accurate appraisal of the existing resources can be made.

A list of data on medical infrastructure in Korea is contained in the ANNEX.

4. EVALUATION OF DETERMINANTS AFFECTING THE NEED FOR ADDITIONAL MEDICAL CARE

A. BASE OF CALCULATION

In determining the criteria for the evaluation of the relative need between areas in Korea, there are almost an infinite number of variables that could be incorporated. Unfortunately, in our analysis only a selected few factors could

be considered. Two prerequisites for consideration are first, the correlation or effect a variable has on the determination of future health and medical care and secondly the availability of data concerning this variable.

Therefore in our analysis we started from the available data and then determined the factors most relevant to medical priority. As listed in section 3 we had a fair amount of information available such as;

1) Health District Physical Parameters

A) Population

- (1) Urban
- (2) Rural
- (3) Projected urban and rural population

B) Area of Health District

- (1) Population density

2) Health District Medical Infrastructure

A) Facilities

- (1) General hospital
 - i. Number
 - ii. Number of beds
- (2) Hospitals
 - i. Number
 - ii. Number of beds
- (3) Clinics
 - i. Number
 - ii. Number of beds
- (4) Special hospitals
 - i. Number
 - ii. Number of beds
- (5) Health Centers
 - i. Number

B) Manpower

- (1) Hospital Manpower(4 categories of hospital by size)
- (2) Clinic Manpower
 - i. By discipline
- (3) Health Center Manpower

Out of the above mentioned data our task was to find an equitable method for appraising relative need. It must be pointed out that as there are 56 health districts each added variable adds 56 more determinants to be evaluated and compared in the priority analysis.

In appraising the priority of health districts for additional hospital beds, a calculation must initially be made to determine the bed requirement for that health district. Then existing resources could be evaluated and a determination of the remaining deficit could be calculated.

Therefore, in our first step towards criteria determination, the health district bed requirement must be calculated. The factors used to determine bed requirement consists of:

- 1) The medical care need of the populace
- 2) The population
- 3) The population density of the health district
- 4) Projected near future trends

In terms of the medical care need of the populace, data was analyzed from an insurance program operating in Seoul. In this program over 1.8 million persons are insured which is 26% of the total population of Seoul, according to the statistics, actual hospital utilization rate requires 2.46 beds/1,000 persons for Seoul insured residents. We chose this figure as an estimate for the Korean urban hospital bed requirement. Of course, other urban areas perhaps have lower rates but we believe this figure is indicative of the situation prevailing and conservative for the near future. Assuming over 80% occupatancy rate, additionally a utilization rate of 2.46 beds/1,000 pop. requires a bed provision rate of 3.10 beds/1,000 population. However, we chose a conservative 2.5/1,000 for our estimate of the overall urban population bed requirement.

PERSONS COVERED BY EMPLOYEE'S MEDICAL INSURANCE SYSTEM

As of Dec.-31-1977

Province	Persons Covered (,000)			Population (,000)	Coverage in %
	Employees	Dependants	Total		
Seoul	628	1,143	1,771	6,879	25.7
Busan	165	229	394	2,451	16.1
Gyeong-Ki	125	177	302	4,036	7.5
Kang-Won	20	56	76	1,862	4.1
Chung-Buk	8	12	20	1,521	1.3
Chung-Nam	30	42	72	2,947	2.4
Jeon-Buk	17	22	39	2,455	1.6
Jeon-Nam	16	30	47	3,983	1.2
Kyong-Buk	71	93	164	4,856	3.4
Kyong-Nam	105	150	255	3,279	7.8
Total	1,185	1,955	3,140	34,269	9.2

SOURCE: Ministry of Health and Social Affairs, Major Statistics of MOHSA, 1978.

Also, several studies suggest that rural residents in Korea have a decreased utilization and demand for hospital beds with respect to urban residents. This is partly due to a reduced liquid income in comparison to their urban counterparts, as well as traditional values and beliefs that deemphasize western hospital based medical care. The data estimates a rural resident demand for medical care

URBAN POPULATION BED REQUIREMENT ESTIMATE

Total Insured approximately 500,000 persons in Seoul

	<u>Inpatient cases/1,000 persons</u>	<u>Average length of stay</u>
Subscribers	77.5	8.2
Dependants (Cases except maternity)	127	7.4
'Maternity cases)	48	3.4

Ratio of Dependants to subscribers = 1.28

Therefore 44% = Subscribers
 56% = Dependants

$$\frac{44 \times 77.5 \times 8.2}{365} + \frac{56 \times 127 \times 7.4}{365} + \frac{56 \times 48 \times 3.4}{365} = \frac{2.46 \text{ Beds}}{\text{per 1,000 pop.}}$$

Note : This calculation assumes 100% occupancy.
Source : Employee health insurance data 1977.

to be between 30% and 50% of the urban demand. Careful analysis conservatively estimated this demand at 40% of the urban bed requirement. Therefore with these two criteria we can roughly estimate the bed requirement for each health district. Of course this estimate would be somewhat simplistic. To provide greater accuracy we believe that the urban population projected for 1981 must be used in the calculation principally because Korea is rapidly undergoing urbanization. Therefore we have projected the urban population to 1981, a modest 3 year projection. Now our calculation would be more reliable but still one factor remains.

B. DENSITY FACTOR

In a very dense city such as Seoul or Pusan or various others we have an overlapping of hospital target areas and less areas that are outside of hospital target radii, while in less dense areas often 'gaps' exist in the hospital target area coverage. This means that even given bed requirement ratios applicable to all rural and urban residents, we must take into account also the population density of each health district. For example the Seoul health district has a density of 12,000 persons/Km² while the Chuncheon health district has a density of only 91 persons/Km². Therefore, in order to systematically appraise bed need, we must also consider a 'density factor'. This factor contributes for adjustment of estimated bed need for density. With all of these elements evaluated we can then appraise the bed requirement for each health district depending upon its intrinsic characteristics.

Density Factor

A density factor is calculated by the following equation.

$$\text{Density Factor} = \left[1 + \left[\text{Log} \left[\frac{\text{Pu} + \text{Pr} + \text{Pu81}}{\text{Ahd. Ds}} \right]^{-2} \left[\text{Log} (\text{Pt})^{-1} \right] \right]^2 \right]$$

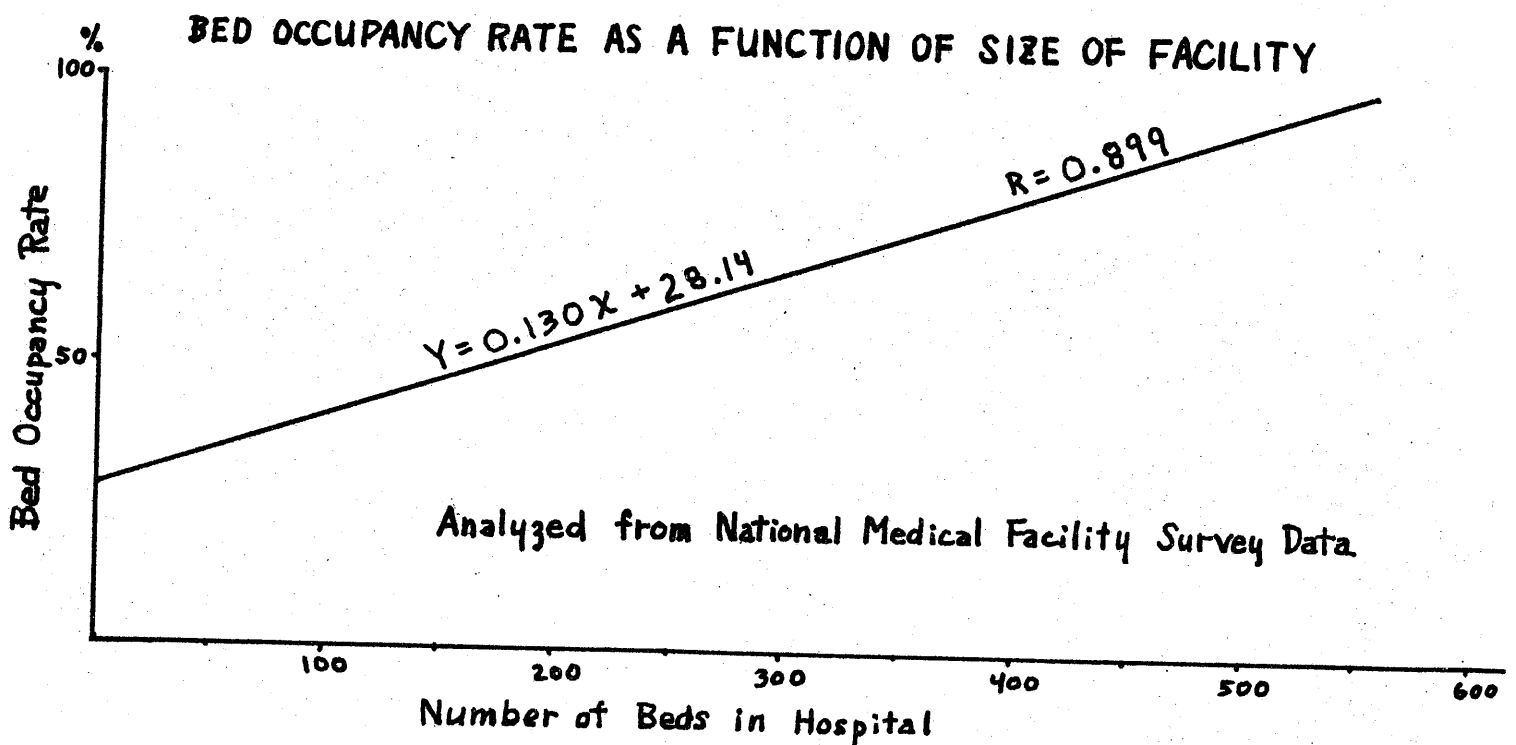
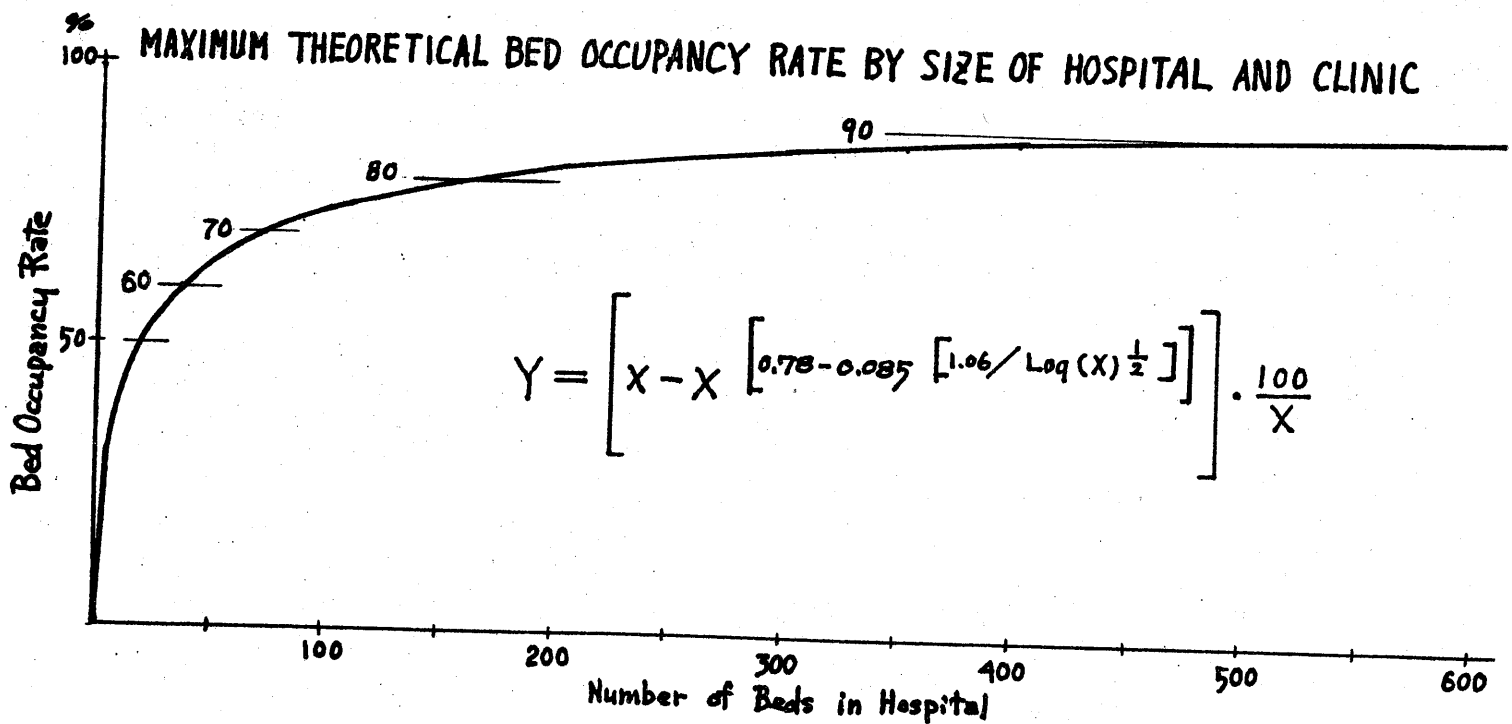
Pu = Urban population of health district
Pr = Rural population of health district
Pu81 = Urban population increase to 1981
Ahd = Area of health district
Ds = Density of Seoul
Pt = Total Population of Korea in 1981

C. EXISTING RESOURCES

Once a bed requirement has been established, the next step in data analysis is to appraise the existing resources and the extent of their effect on meeting the medical requirement. Therefore the crucial criteria here is an estimation of the real and useable elements of the existing facilities. An initial simplistic approach would simply add up all existing medical facility beds. Unfortunately, this approach would be far from accurate, for what is needed is an appraisal of the existing occupiable beds as opposed to total beds. For example the average clinic has only 3.5 beds yet there are 23,500 clinic beds and 6,600 clinics, but each and every clinic bed is not occupiable. Instead we must estimate the ratio that are occupiable. Lacking occupation rate data on each medical facility by health district in Korea, we instead developed a theoretical model that simulates the Korean facility situation. The data we do have on the overall Korean situation supports our theoretical model strongly.

Our approach was primarily statistical and conservative. Our equation determines theoretical occupancy rate as a function of the total number of beds. It is clear to argue hypothetically, that a one bed hospital is extremely unlikely to have a 100% occupancy rate. Using the concept of Poisson distribution, we were able to synthesize an equation that gives the expected average occupancy rate by size of hospital.

The strength of this equation is that it is a continuous function that can be used systematically for each health district. Additionally, this one equation



is equally applicable to all three types of medical facilities under analysis, i.e. general hospitals, hospitals, and clinics. One more factor of importance is that the linear equation analog of the Korean data approximates this curve in a first-order sense. It is clear that our theoretical analog is conservative in providing the maximum occupation rate by size of hospital whereas the Korean data criteria gives us a combination of several factors arranged in a linear equation format. From a careful study of the Korean utilization data, it is clear that our theoretical model yields a higher result for all facilities with greater than 4 beds, and less than 468 beds.

In this light we believe the theoretical construct to be highly correlated with the actual maximum bed occupancy rate of the medical facilities in Korea. By applying this theoretical equation to each type of facility within each health district, we are then able to calculate the number of occupiable beds per health district.

D. UNMET NEED

With both a bed requirement determination and a determination of the existing utilizable facility beds we then can find the unmet need in each health district as follows,

$$\left(\begin{array}{l} \text{Required number of beds} \\ \text{in health district} \end{array} \right) - \left(\text{Existing occupiable beds} \right)$$

= Unmet need (Bed deficiency)

Therefore the final criteria utilized to evaluate priority among the health districts was data that could give us the most accurate determination of the above factors as follows;

1) Health District Bed Requirement

- a. Urban population of health district
- b. Urban population increase of health district in 1981
- c. Rural population of health district
- d. Urban population bed requirement/1,000 persons
- e. Rural population bed requirement/1,000 persons
- f. Area of health district
- g. Density of health district (From a, b, c and f)

2) Health District Existing Occupiable Beds

- a. General hospital
 - i. Total number in health district
 - ii. Total number of beds in health district
- b. Hospital (Other than general)
 - i. Total number in health district
 - ii. Total number of beds in health district

c. Clinic

- i. Total number in health district
- ii. Total number of clinic beds in health district

Therefore, our final equation for the determination of the bed requirement in each health district took the form of;

$$B_r = \left[U_b \left[\frac{P_u + P_{u81}}{1,000} \right] + R_b \left[\frac{P_r}{1,000} \right] \right] \left[1 + \left[\text{Log} \left[\frac{P_u + P_r + P_{u81}}{Ahd.Ds} \right]^{-2} \left[\text{Log} (P_r) \right]^{-1} \right]^2 \right]$$

(Initial Bed Requirement) (Density Factor)

(Crude Bed Requirement) (Adjustment Due to Density)

Br = Total bed requirement
 Ub = Bed requirement urban/1,000 persons
 Rb = Bed requirement rural/1,000 persons
 Pu = Health district urban population
 Pu81 = 1981 urban population increase in health district
 Pr = Health district rural population
 Ahd = Area of health district
 Ds = Density of Seoul
 Pt = Total population of Korea 1981

And our equation for the determination of the occupiable beds in each health district took the following form:

$$T_{ob} = N_{hg} \left[\frac{B_{hg}}{N_{hg}} - \left[\frac{B_{hg}}{N_{hg}} \right] \left[0.78 - 0.085 \left[1.06 / \log \left(\frac{B_{hg}}{N_{hg}} \right) \right]^{\frac{1}{2}} \right] \right] +$$

Occupiable general hospital beds in health district

$$N_{ho} \left[\frac{B_{ho}}{N_{ho}} - \left[\frac{B_{ho}}{N_{ho}} \right] \left[0.78 - 0.085 \left[1.06 / \log \left(\frac{B_{ho}}{N_{ho}} \right) \right]^{\frac{1}{2}} \right] \right] +$$

Occupiable hospital (except general) beds in health district

$$N_c \left[\frac{B_c}{N_c} - \left[\frac{B_c}{N_c} \right] \left[0.78 - 0.085 \left[1.06 / \log \left(\frac{B_c}{N_c} \right) \right]^{\frac{1}{2}} \right] \right]$$

Occupiable clinic beds in health district

T_{ob} = Total occupiable beds in health district
 N_{hg} = Number of general hospitals in health district
 B_{hg} = Total general hospital beds in health district
 N_{ho} = Number of other hospitals in health district
 B_{ho} = Total other hospital beds in health district
 N_c = Number of clinics in health district
 B_c = Total clinic beds in health district

5. UNMET MEDICAL NEED; A PRIORITY LIST OF MEDICAL FACILITY DEFICIENCY IN KOREA

A. PRIORITY EQUATION

From section 4 the necessary criteria and the corresponding required data was determined. Therefore, from these criteria a complete priority equation can be produced that will integrate all of the determinants into one final element corresponding to priority. As explained in the previous section the entire priority equation produces as a result the unmet bed need in each health district. Therefore application of the following formula to each of the 56 health districts will produce a bed deficiency result;

B. MEDICAL FACILITY EFFICIENCY; OCCUPATION RATES

Initially in evaluating this equation it is helpful to analyze partial results. One of the important factors produced by this equation is the number

$$\begin{aligned}
X_p = & \left[U_b \left[\frac{P_u + P_{u81}}{1000} \right] + R_b \left[\frac{P_r}{1000} \right] \right] \left[\left[\frac{\log \left[\frac{P_u + P_r + P_{u81}}{A_{hd} D_s} \right]^{-2} \left[\log [P_t] \right]^{-1}}{2} + 1 \right] \right. \\
& - N_{hg} \left[\frac{B_{hd}}{N_{hg}} - \left[\frac{B_{hg}}{N_{hg}} \right] \left[0.78 - 0.085 \left[1.06 / \log \left[\frac{B_{hg}}{N_{hg}} \right] \right] \right] \right] \\
& - N_{ho} \left[\frac{B_{ho}}{N_{ho}} - \left[\frac{B_{ho}}{N_{ho}} \right] \left[0.78 - 0.085 \left[1.06 / \log \left[\frac{B_{ho}}{N_{ho}} \right] \right] \right] \right] \\
& \left. - N_c \left[\frac{B_c}{N_c} - \left[\frac{B_c}{N_c} \right] \left[0.78 - 0.085 \left[1.06 / \log \left[\frac{B_c}{N_c} \right] \right] \right] \right] \right]
\end{aligned}$$

X_p = Priority based on bed deficiency

U_b = Urban population hospital bed requirement/1,000 persons

R_b = Rural population hospital bed requirement/1,000 persons

P_u = Urban population

P_r = Rural Population

P_{u81} = Additional urban population 1981

A_{hd} = Area of health district Km²

P_t = Population of Korea 1981

D_s = Population density of Seoul

B_{hg} = Total general hospital beds in health district

N_{hg} = Number of general hospital in health district

B_{ho} = Total other hospital beds in health district

N_{ho} = Number of other hospitals in health district

B_c = Total clinic beds in health district

N_c = Number of clinics in health district

of occupiable beds in each health district by type of facility. It is clear from this result that general hospitals have by far the overall greatest impact on the quantity of existing resources. Overall there are 13,977 general hospital beds and after analysis by the previous equation we find 11,632 beds occupiable giving an average 83.2% occupancy rate. Hospitals other than general contributed 5,709 total beds yielding a 65.9% average occupancy rate. And, clinics with the greatest numbers of beds 24,341, yielded only 6,097 occupiable beds a 25% average occupation rate. Therefore, in the following table we can find detailed data on existing medical facilities for each health district in Korea, computed as partial results from the priority equation.

Medical Facility Beds by Health District

Province	Health District	General Hospital			Hospital			Clinic			Total		
		Existing Beds		%	Occupiable		%	Existing		%	Existing		%
		Existing	Occupiable		Existing	Occupiable		Existing	Occupiable		Existing	Occupiable	
Total		13,977	11,632	83.2	8,659	5,709	65.9	24,341	4,093	25.0	46,977	23,434	49.9
Seoul		7,802	6,563	84.1	1,607	1,023	63.7	4,889	836	17.1	14,298	8,422	58.9
Busan		1,219	1,006	82.5	1,444	1,016	70.4	2,484	583	23.5	5,147	2,605	50.6
Gyeonggi	Seoul	685	545	79.0	1,181	761	64.4	3,022	828	27.4	4,888	2,134	43.7
	Incheon	195	157	80.5	510	329	64.5	1,058	297	28.1	1,761	783	44.5
	Eijongbu	480	388	79.2	317	204	64.4	900	247	27.4	1,707	639	49.2
	Icheon	-	-	-	137	83	60.6	463	126	27.2	600	209	34.8
	Paju	-	-	-	54	36	66.7	116	21	18.1	170	57	33.5
	Anseong	-	-	-	83	52	62.7	163	43	26.4	246	95	38.0
Gangwon	Seoul	-	-	-	80	57	71.2	324	94	29.0	404	151	37.4
	Chuncheon	654	519	79.4	296	183	61.8	1,377	446	32.4	2,327	1,148	49.3
	Wonju	154	121	78.6	65	39	60.0	383	98	25.6	602	258	42.9
	Gangneung	220	180	81.8	45	29	64.4	924	64	28.6	489	273	55.8
	Sogcho	-	-	-	50	33	66.0	184	64	34.8	234	97	41.5
	Youngwall	-	-	-	57	38	66.7	62	14	22.6	119	52	43.7
Chungbuk	Seoul	100	74	74.0	44	23	52.3	242	95	39.3	386	192	49.7
	Samcheok	180	144	80.0	35	21	60.0	282	111	39.4	497	276	55.5
	Chungju	150	177	78.0	296	190	64.2	931	250	26.9	1,377	557	40.4
Chungnam	Chungju	150	177	78.0	86	55	64.0	539	155	28.0	775	327	42.2
	Okcheon	-	-	-	170	114	67.1	301	80	26.6	471	194	41.2
	Seoul	-	-	-	40	21	52.5	91	15	16.5	131	36	27.5
	Seoul	300	252	84.0	542	348	64.2	1,776	455	25.6	2,618	1,055	40.3
	Seoul	300	252	84.0	252	173	68.7	716	191	26.7	1,268	616	48.6
	Seoul	-	-	-	14	6	42.9	133	21	15.8	147	27	18.4
Jeonbuk	Chuncheon	-	-	-	75	46	61.3	190	36	18.9	265	82	30.9
	Gongju	-	-	-	56	38	67.9	274	74	27.0	330	112	33.9
	Hongseong	-	-	-	84	53	63.1	278	91	32.7	362	144	39.8
	Boseong	-	-	-	61	32	52.5	105	42	22.7	246	74	30.1
	Seoul	-	-	-	-	-	-	-	-	-	-	-	-
	Seoul	-	-	-	-	-	-	-	-	-	-	-	-
Jeonnam	Seoul	641	542	84.0	370	258	69.7	1,882	544	28.9	2,893	1,344	46.5
	Seoul	641	542	84.6	65	39	60.0	652	184	28.2	1,358	765	56.3
	Seoul	-	-	-	202	150	74.3	539	166	25.5	741	316	42.6
	Seoul	-	-	-	67	47	70.1	262	60	24.8	309	107	34.6
	Seoul	-	-	-	-	-	-	-	115	30.7	374	115	30.7
	Seoul	-	-	-	36	22	61.1	75	19	25.3	111	41	36.9
Gyeongbuk	Seoul	917	773	84.3	985	624	63.4	2,547	695	27.3	4,449	2,092	47.0
	Seoul	917	773	84.3	409	246	60.1	1,063	293	27.6	2,389	1,312	54.9
	Seoul	-	-	-	433	298	68.4	327	81	24.8	760	377	49.6
	Seoul	-	-	-	85	49	57.6	211	61	28.9	296	110	37.2
	Seoul	-	-	-	34	20	58.8	136	34	25.0	170	54	31.8
	Seoul	-	-	-	-	-	-	-	33	26.6	124	33	26.6
	Seoul	-	-	-	-	-	-	-	72	31.2	227	72	31.7
	Seoul	-	-	-	-	-	-	-	63	28.6	244	76	31.1
	Seoul	-	-	-	24	13	54.2	320	43	27.7	155	43	27.7
	Seoul	-	-	-	-	-	-	-	15	17.9	84	15	17.9
	Seoul	-	-	-	-	-	-	-	-	-	-	-	-
	Seoul	-	-	-	-	-	-	-	-	-	-	-	-
Gyeongnam	Seoul	1,264	1,054	83.4	1,083	737	68.1	3,121	864	27.7	5,468	2,655	48.6
	Seoul	1,034	880	85.1	353	247	70.0	1,835	559	30.5	3,222	1,666	51.3
	Seoul	-	-	-	105	70	66.7	291	64	22.0	396	134	33.8
	Seoul	-	-	-	68	47	69.1	162	39	24.1	230	86	37.4
	Seoul	-	-	-	153	101	66.0	250	67	26.8	633	342	54.0
	Seoul	230	174	75.7	172	116	67.4	112	25	22.3	284	141	49.6
	Seoul	-	-	-	157	112	71.3	103	14	13.6	260	126	48.5
	Seoul	-	-	-	49	32	65.3	142	36	25.4	191	68	35.6
	Seoul	-	-	-	-	-	-	-	31	23.8	130	31	23.8
	Seoul	-	-	-	-	-	-	-	14	24.6	77	24	31.2
	Seoul	-	-	-	20	10	50.0	57	15	38.5	45	17	37.8
	Seoul	-	-	-	6	2	33.3	39	-	-	-	-	-
Jeju	Seoul	345	261	75.7	680	463	68.1	2,006	509	25.4	3,031	1,233	40.7
	Seoul	210	157	74.8	108	66	61.1	840	214	25.5	1,158	437	37.7
	Seoul	-	-	-	312	214	68.6	476	128	26.9	788	342	43.4
	Seoul	-	-	-	45	29	64.4	214	54	25.2	259	83	32.0
	Seoul	-	-	-	40	25	62.5	139	15	25.2	179	60	33.5
	Seoul	-	-	-	40	25	62.5	24	3	12.5	64	28	43.8
	Seoul	-	-	-	40	25	62.5	200	40	20.0	470	248	52.8
	Seoul	135	104	77.0	135	104	77.0	-	38	31.0	113	35	31.0
	Seoul	-	-	-	-	-	-	-	-	-	-	-	-
	Seoul	-	-	-	-	-	-	-	-	-	-	-	-
Jeju	Seoul	-	-	-	175	106	60.6	306	83	27.1	481	189	39.3
	Seoul	-	-	-	145	89	61.4	217	57	26.3	362	146	40.3
	Seoul	-	-	-	30	17	56.7	89	26	29.2	119	43	36.1

SOURCE: This data analyzed from the Journal of the Korean Hospital Association, Vol. 7, No. 4-5, May 1978.

NOTE: Special hospital such as leprosy center, TB sanatorium and hospital for mental patients and crippled cases were excluded.

It is interesting to note that the average number of beds per medical facility is less than 7 beds/facility. This extremely low average helps to indicate why our calculation found only a 50% average occupancy rate for all facilities in Korea. The key element is, that what is being witnessed is not an under utilization of facilities by the populace, but instead an excess of facilities that are unable to be highly occupied.

These under utilizable facilities are by and large the clinics. Analyzing all medical facilities without the clinics, yields an average occupancy rate of 77%. It is clear that the larger facilities especially general hospitals show a healthy and substantial occupancy rate. Therefore, the calculation of occupiable beds as opposed to total beds gives us a much more realistic and reliable estimation of the existing medical resources by health district in Korea.

C. PRIORITY PARAMETERS

Now that a calculation has been made for existing resources by health district, a determination of unmet need in bed deficiency can be produced and from this a priority list of locations. The following table lists all key elements and partial products from the entire priority list equation.

Note that the listed data include the bed requirement total, for each health district, as well as the density factor. Also, the total occupiable beds are listed, and finally the bed deficiency. The bed deficiency ranged from 14 beds in Eulreung to 10,603 beds in Seoul. Additionally it is clear that overall Korea has a shortage of at least 59,000 beds. Still, even if all of these 59,000 beds existed by 1981, Korea would still only have 2.02 total beds/1,000 population. Accounting for 80% occupation the real total would be 1.62 occupiable beds per 1,000 population. Therefore, it is clear that these figures are conservative. Additionally, it is believed that these figures are accurate and reflect the actual bed requirement to 1981.

D. PRIORITY LIST

With the bed deficiency calculation we can then rearrange the health districts in order of priority from highest unmet need to lowest unmet need. This then is our finalized priority list taking into account the criteria listed in section 3. Additionally, the strength of this priority list is that it scientifically and uniformly assesses the unmet need throughout all of Korea and yields a result only determined by the existing and projected, medical and geographical, factor.

E. CONCLUSION

While this priority list yields a useable result based upon bed deficiency and thereby unmet need, it can be argued that other factors or results are also as relevant in a priority analysis. It is believed that the real value of any priority list is not the list itself but how the result is analyzed and then

Medical Criteria Analysis by Health Districts within Korea

Province	Health District	Urban Population		Rural Population	Area of Health District (Km ²)	Density Pop./Km ²	Density Factor	Bed Requirement		Existing Occupiable Beds		Bed Deficiency
		Existing	1981 Increase					Number of Beds	Bed Req. 1,000 pop.	Total Number	Beds 1,000 pop.	
Total		17,398	5,500	17,951	98,413	415	-	82,603	2.02	23,434	.66	59,169
Seoul		7,255	355	-	628	12,118	-	19,025	2.50	8,422	1.16	10,603
Pusan		2,574	416	-	375	7,973	.002	7,490	2.50	2,605	1.01	4,885
Gyeonggi		1,612	967	2,538	11,028	464	-	9,988	1.95	2,134	.51	7,854
	Seoul	669	482	647	2,484	724	.10	3,877	2.16	783	.60	3,094
	Incheon	830	384	362	1,293	1,218	.07	3,635	2.31	839	.70	2,796
	Bijongbu	113	101	536	3,385	222	.21	1,298	1.73	209	.32	1,089
	Ichon	-	-	321	1,957	164	.24	398	1.24	57	.18	341
	Paju	-	-	311	926	334	.17	364	1.17	95	.31	269
Gangwon	Anseong	-	-	359	983	363	.16	416	1.16	151	.42	265
		429	332	1,412	16,828	129	-	4,184	1.92	148	.62	3,036
	Chuncheon	142	128	385	7,173	91	.31	1,389	2.12	258	.49	1,131
	Wonju	124	111	247	3,365	143	.26	1,051	2.18	273	.74	778
	Gangneung	91	29	145	1,030	257	.19	530	2.00	97	.41	433
	Sogcho	72	64	97	1,327	176	.23	538	2.31	52	.31	486
Chungbuk	Yongju	-	-	249	2,297	109	.29	321	1.29	192	.77	129
	Saechuk	-	-	289	1,636	177	.23	355	1.23	276	.96	79
		308	277	1,205	7,488	239	-	3,182	1.78	557	.37	2,625
Chungnam	Chungju	201	181	518	2,866	314	.17	1,723	1.91	327	.45	1,396
	Cheungju	107	96	383	2,647	222	.21	1,079	1.84	194	.40	885
	Okcheon	-	-	304	1,975	154	.25	360	1.25	36	.12	344
Jeonbuk		623	316	2,337	8,756	374	-	5,351	1.63	1,055	.36	4,296
	Daejeon	522	188	359	1,478	723	.10	2,347	2.20	616	.70	1,731
	Chunan	101	29	279	1,147	357	.16	702	1.71	27	.07	675
	Gongju	-	99	581	2,215	307	.18	978	1.44	82	.14	896
	Bongseong	-	-	385	1,428	270	.19	458	1.19	112	.29	346
	Boseong	-	-	299	932	321	.17	350	1.17	144	.48	206
Jeonnam	Saenam	-	-	434	1,556	279	.19	516	1.19	74	.17	442
		602	432	1,843	8,058	357	-	5,060	1.76	1,344	.55	3,716
	Jeonju	322	288	478	2,347	464	.14	2,283	2.10	765	.96	1,518
	Gunsan	280	144	289	894	798	.10	1,484	2.08	316	.56	1,168
	Muan	-	-	366	1,886	194	.22	447	1.22	107	.29	340
	Jeongeup	-	-	570	1,756	325	.17	667	1.17	115	.20	552
Gyeongbuk	Jangma	-	-	140	1,175	119	.28	179	1.28	41	.29	138
		1,067	622	2,934	12,043	384	-	8,180	1.77	2,092	.52	6,088
	Gwangju	625	225	688	2,809	548	.13	3,179	2.07	1,312	1.00	1,867
	Mogpo	197	177	405	1,536	507	.13	1,514	1.94	377	.63	1,137
	Buncheon	110	99	225	1,320	329	.17	875	2.02	110	.33	765
	Yosu	135	121	154	487	842	.09	865	2.11	54	.19	811
Gyeongnam	Gukseong	-	-	159	990	161	.24	197	1.24	33	.21	164
	Gohseong	-	-	371	1,360	273	.19	441	1.19	72	.19	369
	Gangjin	-	-	375	1,443	260	.19	446	1.19	76	.20	370
	Seosan	-	-	297	1,257	237	.20	356	1.20	43	.14	313
	Yonghwang	-	-	260	841	309	.18	307	1.18	15	.06	292
		1,788	878	3,115	19,751	293	-	11,282	1.95	2,655	.54	8,627
Gyeonggi	Daegu	1,359	591	883	4,451	634	.11	6,391	2.26	1,686	.75	4,705
	Ginscheon	69	62	482	2,813	218	.21	979	1.60	134	.24	845
	Gyeongju	110	-	175	1,315	214	.21	545	1.91	86	.30	459
	Pohang	152	137	300	1,819	324	.17	1,196	2.03	342	.76	854
	Hiseong	-	-	242	1,757	138	.26	305	1.26	141	.58	164
	Andong	-	-	313	1,139	159	.25	973	1.95	126	.31	847
Gyeongsang	Yongju	98	88	288	1,842	156	.25	360	1.25	68	.24	292
	Hangyeon	-	-	302	1,564	193	.22	368	1.22	31	.10	337
	Buljin	-	-	103	980	105	.30	134	1.30	24	.23	110
	Bulreung	-	-	27	71	386	.16	31	1.15	17	.63	14
		1,001	780	2,285	11,865	342	-	7,780	1.92	1,233	.38	6,547
	Maean	442	305	750	3,024	495	.13	2,958	1.98	437	.37	2,521
Jeju	Sinju	161	145	523	2,999	277	.19	1,534	1.85	342	.50	1,192
	Mapcheon	-	-	378	2,520	150	.25	473	1.25	83	.22	390
	Chungma	68	61	166	748	421	.15	585	1.86	60	.24	525
	Goje	-	-	122	402	279	.19	133	1.19	28	.25	105
	Bulsan	270	242	245	1,759	430	.15	1,754	2.32	248	.48	1,506
	Samcheung	60	27	81	413	407	.15	343	2.04	35	.25	308
Jeju		139	125	282	1,593	343	-	1,081	1.98	189	.45	892
	Jeju	139	125	118	729	524	.13	879	2.30	146	.57	733
	Ham Jeju	-	-	164	864	189	.23	202	1.23	43	.26	159

SOURCE: This data analyzed from the Journal of the Korean Hospital Association, Vol. 7, No. 4-5, May 1978.

NOTE: Special hospitals such as leprosy center, TB sanatorium, mental and crippled pts hospitals were excluded.

Priority List of Health Districts by Bed Deficiency in Korea

Priority	District	Population Projection in 1981	Bed Requirement in 1981	Occupiable Beds in 1977		Bed Deficiency
		(('000 Pop.))	Number	per 1,000 Pop.	Number Pop.	
1	Seoul	7,610	19,025	2.50	8,442	10,603
2	Busan	2,990	7,490	2.50	2,605	4,885
3	Daegu	2,838	6,391	2.26	1,668	4,705
4	Suwon	1,796	3,877	2.16	783	3,094
5	Incheon	1,576	3,615	2.31	839	2,796
6	Masan	1,487	2,958	1.96	437	2,521
7	Gwangju	1,538	3,179	2.07	1,312	1,867
8	Daejeon	1,069	2,347	2.20	616	1,731
9	Jeonju	1,088	2,283	2.10	765	1,518
10	Ulsan	757	1,754	2.32	248	1,506
11	Cheongju	900	1,723	1.91	327	1,396
12	Jinju	829	1,534	1.85	342	1,192
13	Gunsan	713	1,484	2.08	316	1,168
14	Mokpo	779	1,514	1.94	377	1,137
15	Chuncheon	655	1,389	2.12	258	1,131
16	Euijeonbu	752	1,298	1.73	209	1,089
17	Gongju	630	978	1.44	82	896
18	Chungju	586	1,097	1.84	194	885
19	Pohang	586	1,196	2.03	342	854
20	Andong	499	973	1.95	126	847
21	Gimcheon	613	979	1.60	134	845
22	Yeosu	410	865	2.11	54	811
23	Wonju	482	1,051	2.18	273	778
24	Suncheon	613	979	1.60	134	845
25	Jeju	382	879	2.30	146	733
26	Cheonan	409	702	1.71	27	675
27	Jeongeup	570	667	1.17	115	552
28	Chungmu	315	585	1.86	60	525
29	Sogcho	233	583	2.31	52	486
30	Gyeongju	285	545	1.91	86	459
31	Seosan	434	516	1.19	74	442
32	Gangreung	265	530	2.00	97	433
33	Hapcheon	378	473	1.25	83	390
34	Gangjin	375	446	1.19	76	370
35	Goseung	371	441	1.19	72	369
36	Hongseong	385	458	1.19	112	346
37	Okcheon	304	380	1.25	36	344
38	Icheon	321	398	1.24	57	341
39	Namwon	366	447	1.22	107	340
40	Hangyeong	302	368	1.22	31	337
41	Haenam	297	356	1.20	43	313
42	Samcheongpo	168	243	2.04	35	308
43	Youngju	288	360	1.25	68	292
44	Yeonggwang	260	307	1.18	15	292
45	Paju	311	364	1.17	95	269
46	Anseong	359	416	1.16	151	265
47	Boreung	299	350	1.17	144	206
48	Gokseong	159	197	1.24	33	164
49	Eiseong	242	305	1.26	141	164
50	Nam Jeju	164	202	1.23	43	159
51	Jangsu	140	179	1.28	41	138
52	Yeongwoel	249	321	1.29	192	129
53	Euljin	103	134	1.30	24	110
54	Geojae	122	153	1.19	28	105
55	Samcheok	289	355	1.23	276	79
56	Euryong	27	31	1.15	17	14

implemented. This priority list must of course, finally be considered within the framework of the existing fiscal, geographic and political situation, thereby entering in as a part of an overall equation to be evaluated by policy makers, given the non-medical constraints in any policy. In the next section an analysis will be made based on this priority list, in order to determine the areas most suitable for the provision of additional medical facilities.

6. ANALYSIS AND EVALUATION OF PRIORITY LIST AND NATIONAL MEDICAL PLANNING

A. NATIONAL FACILITY PLANNING

In the Fourth Five-Year Economic Development Plan for the health sector a tentative list of locations for the establishment of medical facilities was determined. All of the locations selected as potential facility sites are characterized by one of the following categories:

- 1) Areas where industrial complexes currently or will shortly exist, there are insufficient medical facilities to meet present and/or future needs.
- 2) Rural areas, presently lacking in a hospital based facility care either partially or totally.

The aim of this planning was to introduce medical facilities to the areas of highest need and highest growth. The government planned for the construction, by 1981, of 35 such hospitals.

Twenty of these hospitals are to be constructed in rural medically underserved areas and fifteen are to be constructed within industrial complex target areas.

It is planned that financing for these hospitals will be provided through four sources,

- 1) The Korean government
- 2) A West-German loan
- 3) A Japanese loan
- 4) Private industry and corporations within Korea.

The proposed hospitals, with number of beds and source of finance, are listed in the following table:

We now must evaluate how well the 27 health districts selected in the government plan, integrate with the priority list developed in the previous section. It must be emphasized that the priority list was developed from the data and formula set out in section 5. Government planning was not a factor in the priority list's criteria. It would be beneficial to appraise how well the planned locations compare with the priorities determined above. Therefore we have listed the planned hospital construction locations in the same arrangement as the priority list in order to compare the planned hospitals with priority rank.

B. PRIORITY LIST ANALYSIS

From a careful analysis of the previous table it is interesting to note that the majority of planned hospital locations fall within the first 23 priority locations. In fact 25 of the planned 35 hospitals and 77% of the planned hospital beds occur between ranks 1 and 23 in priority, inclusive.

This correlation is encouraging in that the great majority of planned hospitals are located in areas of greatest need.

- 1) Additional variables

Planned Hospital Bed Construction

Province	Health District	Planned Total	Government	KRW Loan	JICA Loan	Private
Total		3,515	210	1,010	510	995
Seoul		100		100 (Guro)		
Pusan		150			150 (Sasang)	
Gyeonggi		170		170 (Bamwol)		
	Buwon					
	Incheon					
	Hijongbu					
	Icheon	100		50 (Yoju)	50 (Yangpyeong)	
	Paju					
	Anseong					
Gangwon		85				85 (Inje)
	Chuncheon					
	Wonju	100		100 (Wonju) 80 (Pyongchang)		
	Gangneung					
	Sogcho					
	Youngwall					
	Samcheok					
Chungbuk		160		80 (Cheongju) 80 (Gaesan)		
	Chungju			80 (Jecheon)		
	Cheongju	80				
	Okcheon					
Chungnam		150		150 (Daejeon)		
	Daejeon					
	Chunan					
	Gongju	80		80 (Monsan)		
	Booseong					
	Boseong	100				100 (Boseong)
	Seosan					
Jeonbuk		50		50 (Jinan)		
	Jeonju					
	Gunsan	150			150 (Iri)	
	Namwon					
	Jeongeup	100				100 (Jeongeup)
	Jangsu					
Jeonnam		80		80 (Mogpo)		
	Gwangju					
	Mogpo					
	Sunchon	150		150 (Yochon)		
	Yeosu					
	Gukseong	150				150 (Boseong)
	Goheong					
	Gangjin	80				
	Heanam				80 (Haenam)	
	Youngkwang	80		80 (Bamgyong)		
Gyeongbuk		150				150 (Daegu)
	Daegu					150 (Gumi)
	Gimcheon	150				
	Gyeongju					
	Pohang	250		150 (Pohang)		100 (Yongdukt)
	Eiseong	50	50 (Gunsu)			
	Andong					
	Youngju					
	Mangyeong	160	80 (Mungyong)		80 (Jeomchon)	
	Euljin					
	Eulreung					
Gyeongnam		230	80 (Milyang)			150 (Masan)
	Masan					
	Jinju	130		80 (Madong) 50 (Miryong)		
	Hapcheon					
	Chungmu					
	Goje					
	Eulsan	200		100 (Eulsan) 100 (Onsan)		
	Sancheonpo					
Jeju						
	Jeju					
	Nam Jeju					

SOURCE: Logistic Division, Ministry of Health and Social Affairs.

Government Planned Hospital Construction
Arranged by Priority List

Priority Order	Health District	Total	Government	West-German Loan		JICA Loan	Private
				Indus. Complex	Rural		
	Total	3,515	210	1,180	630	510	985
1	Seoul	100		100			
2	Busan	150				150	
3	Daegu	150					150
4	Suweon	170		170			
5	Incheon						150
6	Masan	230	80				
7	Kwangju						
8	Daejeon	150		150			
9	Jeonju	50			50		
10	Eulsan	200		100, 100			
11	Cheongju	160		80	80		
12	Jinju	130			80, 50	150	
13	Gunsan	150					
14	Mogpo	80		80			85
15	Chuncheon	85					
16	Eijeongbu						
17	Gongju	80			80		
18	Chungju	80			80		
19	Pohang	150		150			100
20	Andong						150
21	Gimcheon	150					
22	Yeosu	150		150			
23	Wonju	180		100	80		
24	Suncheon						
25	Jeju						
26	Cheonan						100
27	Jeongeup	100					
28	Chungmu						
29	Sogcho						
30	Kyeongju						
31	Seosan						
32	Kangneung						
33	Hapcheon						
34	Gangjin						150
35	Goheong	150					
36	Hongseong						
37	Okcheon						
38	Icheon	100			50	50	
39	Namwon						
40	Mukyeong	160	80			80	
41	Haenam	80				80	
42	Samchunpo						
43	Youngju						
44	Youngkwang	80			80		
45	Paju						
46	Anseong						100
47	Boreong	100					
48	Kukseong						
49	Eiseong	50	50				
50	Nam Jeju						
51	Jangsu						
52	Yongwall						
53	Euljin						
54	Goje						
55	Samcheok						
56	Eulreong						

Analysis of the previous table shows that four areas between priority and 23 have no hospital construction presently planned. We believe there are good reasons for this. One major element, of course, is in a fiscally limited system only a certain number of hospitals can be built. Still there are other criteria affecting these four areas that were not a part of the priority list equation criteria, but were nevertheless taken into account by policy makers. They are as follows.

Priority Number 5, Incheon

The principal reasons Incheon is presently less satisfactory as a location than the priority order indicates are:

A) Incheon is adjacent to Seoul and has direct subway access to metropolitan Seoul, therefore Incheon is accessible to the many medical facilities in northern Seoul.

B) Because Incheon is an evolving urban center there is already a private company planning to build an additional 150 bed hospital there.

Priority Number 7, Kwangju

Kwangju is less satisfactory as a location due to:

A) Kwangju presently has 14 hospitals, 3 of which are general hospitals, therefore there is good health care distribution.

B) Kwangju as a large urban center is attractive to the private medical sector, and privately initiated medical development is sure to continue.

Priority Number 16, Eijeongbu

Eijeongbu is presently unsatisfactory as a location due to:

A) Eijeongbu is directly adjacent to Seoul and has a high degree of accessibility to the Seoul area for medical care.

B) The existing government operated provincial hospital in Eijeongbu is presently being expanded.

Priority Number 20, Andong

Andong is unsatisfactory as a location due to:

A) Andong has a large rural population that currently is more highly accessible to medical facilities than many other rural areas in Korea.

B) The provincial hospital is currently being expanded to provide services for a larger target population.

2) Analysis of Seoul

It is noted that priority number 1, Seoul was also selected in the government plan. The area selected in the south of Seoul, Guro, satisfies the

criteria of being a key industrial complex area. Of course, the future development of medical facilities in the urban areas are left for private development. Only these areas of extreme deficiency and social importance are considered in the government plan. Other criteria of importance in this selection is that Seoul is geographically divided into northern and southern halves by the Han river. The northern part of Seoul currently has 4.8 million residents. In the last 10 years the northern population has increased by 50%. The northern part of Seoul is the Seoul most commonly known, for it is where the greatest amount of development has occurred. The southern part of Seoul currently has over 2.4 million residents, but in the last 10 years this part has shown a 322% increase in population. The government plans to emphasize growth of the southern part of Seoul over that of the northern part. Currently, there is rapid industrialization occurring in the southern part of Seoul with a rapid increase in population. One of the reasons for this is a government initiated program of reduced property taxes for development of land in parts of the southern areas of Seoul. Of the total hospital beds in Seoul, only 20% exist in the southern areas.

Many satellite cities and areas administratively in Gyeonggi province rely on southern Seoul as a source of employment and as a source of medical care. Due to this the medical facilities in southern Seoul have a target population that considerably exceeds the administrative boundaries. Therefore, the southern part of Seoul is a rapidly developing urban industrial area with few existing medical resources. In order to meet present and future medical care demands, medical resources must be introduced into the area.

The hospital planned for Seoul is to be located in one of the areas of highest need, where rapidly growing industrial complexes are centered. This area (Guro) has a much greater deficiency of medical facilities than the other more well developed areas of Seoul. Therefore, it was selected in the government planning as a location for additional medical facilities due to the fact that it currently is a central industrial complex area with an insufficient number of medical facilities.

C. RURAL MEDICALLY UNDERSERVED AREAS OF LOW POPULATION

Another element to be considered is that the priority list is derived from bed deficiency criteria. While this is a reliable and accurate method, it is correlated strongly with population. Therefore, many rural, medically underserved areas with a relatively low population received a lower priority rating. This reflects true bed need, but does not directly reflect the fact that there is an extreme deficiency of medical resources in these locations. Therefore, several locations were selected by the government that fall lower down on the list of priority. We must emphasize that these areas do have a large unmet need and generally a total lack of adequate medical resources. Therefore, in the following table we give some data on these rural medically underserved areas that were low on the priority list.

It is immediately clear from the following table why these sites were selected even though they were low on the priority list. Only one of these areas had any hospital beds at all.

Data on Rural Medically Under-Served Counties of Low Priority

Priority Number	Health District	County	Population	Existing occupiable Hospital Beds	Beds 1,000 pop.	Number of Beds planned for Construction	Financing source
27	Jeongeup	Jeongeup	245,000	ø	ø	100	Korean Private
35	Goheong	Goheong	220,000	ø	ø	150	Korean Private
38	Incheon	Yeoju	104,000	ø	ø	50	West-Germany
		Yangpyong	105,000	ø	ø	50	Japan
40	Munkyeong	Munkyeong	157,000	ø	ø	80	Korean Government
		Chuncheon	143,000	ø	ø	80	Japan
41	Heanam	Heanam	197,000	ø	ø	80	Korean Govt.
44	Young-kwang	Hampyeong	118,000	ø	ø	80	West-Germany
47	Boreong	Boreong	158,000	53	0.34	100	Korean Private
49	Eiseong	Gunee	66,000	ø	ø	50	Korean Govt.

Therefore, each of the areas in the previous table are in extreme need of medical facilities, and are prudently chosen as sites for the location of new facilities, in the interest of social development.

D. CONCLUSION

After analysis of the entire government plan and priority list, several factors become clear:

- 1) Almost all of the health districts have a large unmet need and require additional medical facilities.
- 2) Due to the limits, both fiscal and temporal, in any system, only a certain rate of development can be sustained. The areas of highest need must be singled out such that an overall development plan can logically proceed deriving the greatest output from a given input.
- 3) The great majority of health district selected by the government for the development of additional medical resources conform well with the priority of health districts calculated by the medical, social and demographic variables in the priority list equation.
- 4) Of the locations not conforming well to the priority list, we could find appropriate reasons of hospital bed construction, therefore, all of them are chosen towards the development of medical resources. All (except one) have no hospital based facilities and are thereby critically medically underserved locations suitable for the construction of a hospital facility. Additionally, these are prime areas where the planned social development can perhaps produce the greatest results from the initial input.

III. ANALYSIS FOR HOSPITALS SPONSORED BY KOREA UNIVERSITY

- A. . Yeosu
- B. . Banwol
- C. . Guro

IN ADVANCE FOR HOSPITALITY
BY KENYA UNIVERSITY

1970
1971
1972
1973

A. YEOJU HOSPITAL

1. THE GENERAL SOCIO-ECONOMIC STATUS OF YEOJU AREA

1.1. Geographic Characteristics

1.1.1. Yeosu County which is located in the southwest extremity of the Kyunggi province borders Weonseong County of Gang Weon province and Jungweon and Eumseong Counties of North Chungcheong province. Yeosu also borders Ichon County, Gwangju County and Yangpyung County to the southwest, west and north, respectively.

1.1.2. The Seoul-Gangreung Expressway and the Suwon-Weonju National Road pass through this county. The transportation is further enhanced by the Janghoweon-Yangpyung provincial Road which crosses this county from north to south. The area of this county is 610,92 km² with the longest distance being 25.6 km east to west and 31 km north to south. The administrative district of this county consists of one Eup and eight Myons.

1.2. Population

1.2.1. Like many other counties, the population of Yeosu County is decreasing annually. However, Yeosu Eup which is the seat of the county office has shown increase due to the favorable transportation facilities as well as the increase in tourism. According to the census of the resident population in October 1978, there are 19,222 households with the total population of 100,799; the average family size per household is 5.2 persons. The population density of Yeosu County is 165 persons per km² (Table A-1). The population density of Yeosu Eup is almost similar to small cities, surpassing the national average. However, at the Myon level, the population density is relatively low. With the exception of Neungsoo Myon, 194/km², and Daesin Myon, 180/km², the other myons have a low population density and are relatively remote. Keumsa and Kangcheon Myons have a population density of less than 100 person per km².

1.2.2. The age and sex specific population composition of Yeosu County shows patterns similar to the rural population composition (Figure-1). The migration of 20-40 age group to urban areas is a phenomenon shared with other rural areas. The population of over 55 age group comprises 12.8% of the population and under 15 years of age is around 33% (Table A-2). The male to female sex ratio is 1.01 : 1. (See Figure A-1 and Table A-2).

1.2.3. According to the 1977 vital statistics, the crude birth rate of Yeosu County was 29.9/1,000 which was considerably higher than the national average of 23.9/1,000. However, this rate is undergoing continual decrease. In the same year, the crude death rate was 9.9/1,000. Therefore, the natural population increase was 19.3 which was slightly higher than the national average of 17.5 (Table A-3, Figure A-2).

1.3. Socio-Economic Characteristics

1.3.1. People engaged in farming activities compose 72% of the total population in Yeosu County. Table A-4 shows the number of households and their respective

Table A-1. Population of Yeosu Gun, October, 1978

Eup or Myon	Household	No. of People			Family Size	Population Density
		Total	Male	Female		
Yeoju	4,403	21,542	10,568	10,974	4.9	385.6
Jumdong	1,627	8,396	4,202	4,194	5.2	118.1
Kanam	2,462	13,458	6,770	6,688	5.5	174.5
Neungseo	1,845	10,204	5,139	5,065	5.5	194.2
Heungchon	1,453	7,847	3,985	3,862	5.4	162.6
Keumsa	1,370	7,286	3,637	3,649	5.3	96.9
Daesin	2,533	13,141	6,652	6,490	5.2	179.9
Buknae	2,373	12,730	6,433	6,297	5.4	155.3
Kangcheon	1,156	6,193	3,174	3,019	5.4	81.6
Total	19,222	100,797	50,559	50,238	5.2	165.0

Source: 1) Yeosu Gun, the 1978 Annual Census Data, 1979
 2) Yeosu Gun, Statistical Yearbook, 1978

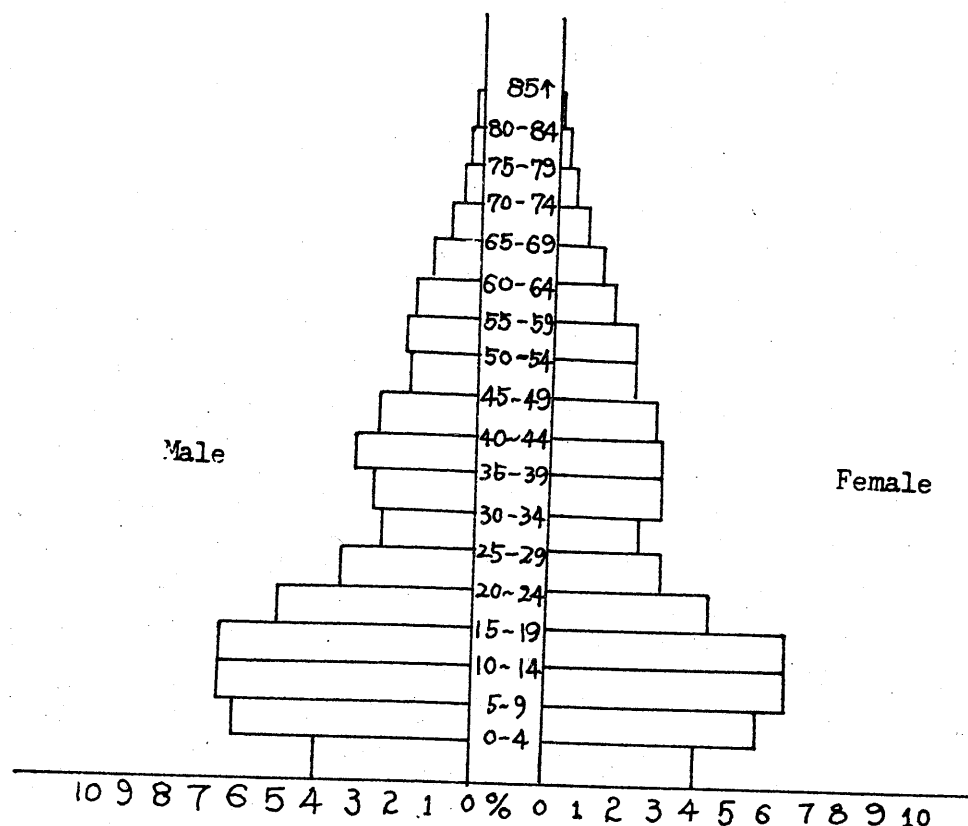


Figure A-1. Population Pyramid of Yeosu Gun

farming activities in terms of their major staple. Approximately 3.6% of the farming population are involved in special produce, stock raising, sericulture and fruits. The average arable land per household in Yeosu is 1.39 hectares, with 42.7% of the household possessing more than 1 hectare (Table A-5).

1.3.2. Average amount of local tax paid per household in Yeosu County in 1977 was \$72.07. This figure was about 2.5% of the annual average income of Korea. The savings accumulated by the Yeosu County residents are shown in Table A-6.

1.3.3. The savings per household, (as of Oct. 1, 1977.) were U.S. \$65.00 which calculates to savings account of \$12 per capita (Table A-7).

1.3.4. The 30 small industries existing in Yeosu County generally employ less than 300 workers. 8 of the industries are involved in export trading, and their volume of trade reached US\$3,738,200 in 1977. The 1978 report indicates that 1,486 workers (Table A-8) of the Yeosu County did not possess employees health insurance association. Also, no self-employed health insurance has been organized in this area.

Table A-2.

Number of People by Age and Sex in Yeoju Gun

Age	Male	%	Female	%	Total	%
0 - 4	4,078	4.0	3,994	4.0	8,072	8.0
5 - 14	12,953	12.9	12,210	12.1	25,163	25.0
15 - 24	11,808	11.7	10,695	10.6	22,503	22.3
25 - 54	15,770	15.7	16,310	16.2	32,080	31.9
55 and above	5,950	5.9	7,029	6.9	21,979	12.8
Total	50,559	50.2	50,238	49.8	100,797	100.0

Source: Yeoju Gun, The 1978 Resident Population Survey, 1979

Table A-3.

Natural Increase Rate of Population, Yeoju Gun

(Per 1,000 Persons)

Year	Crude Birth Rate	Crude Death Rate	Natural Increase Rate
1970	42.4	12.1	30.3
1971	42.8	11.0	31.8
1972	31.1	8.0	23.1
1973	45.5	12.2	33.3
1974	37.1	10.5	26.6
1975	39.3	11.4	27.9
1976	37.0	13.8	23.2
1977	29.2	9.9	19.3

Source : Ibid. pp. 19 - 21

1.3.5. The health insurance program initiated this year for the civil servants and the teachers of private school is covering 1,433 persons; 751 are teachers. Including the dependents of these insured persons, it is estimated that total of 7,738 persons are involved in this program. Also, 5,580 persons are benefitting under the Medicaid program. Among these persons, 4,603 are green card holders (low-income group) and 997 are yellow card insured (indigent group). (See Table A-9).

1.3.6. The plan to provide electricity for all of this area is almost completed, and 9.1% of the households possess telephones. However, this area can be considered to be still remote as only 13.5% of the households, have access to safe water supply. Due to the fact that transportation network to larger cities exists, namely the Yeongdong Expressway, the possibility exists that the utilization rate of the medical facility in the larger cities will be relatively high.

(See Table A-10).

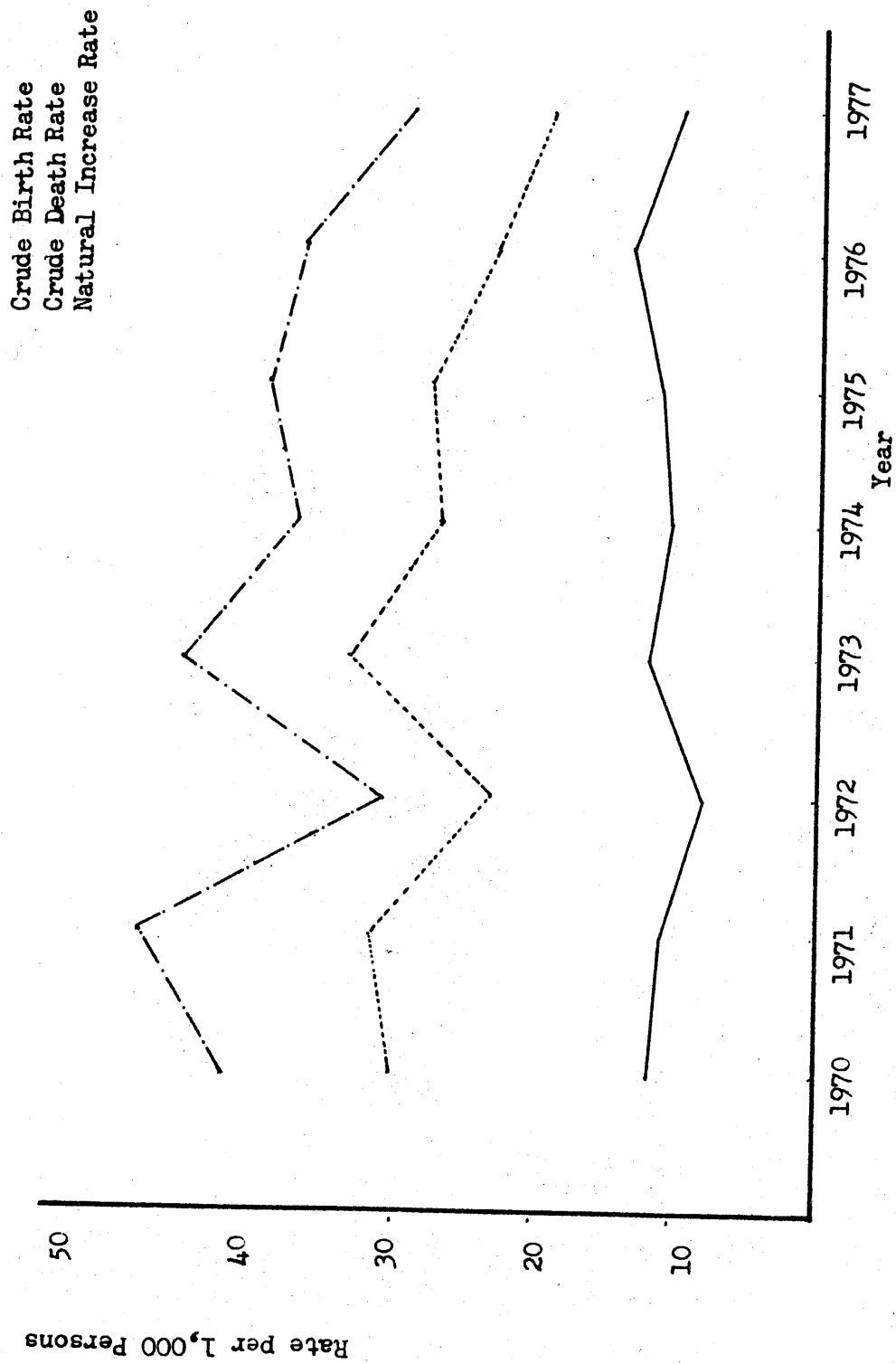


Figure A-2 Natural Increase Rate of Population

Table A-4. Number of Households by Major Staple

Year	Total	Rice	Barley	Fruits	Vege- tables	Cash Crop	Horti- culture	Stock Raising	Seri- culture	Others Other Wage
1973	14,225	12,522	867	36	97	50	4	57	104	- 488
1974	14,199	11,075	1,704	86	128	14	-	184	142	14 852
1975	13,378	11,270	940	80	70	180	-	48	250	- 540
1976	14,081	11,370	1,510	70	40	70	-	51	150	50 770
1977	13,782	11,400	1,180	50	50	200	-	62	130	- 710

Source: Ibid. P.25

Table A-5.

Arable Land Per Households, 1978

Area		No. of Households	%
0 - 30 Tanbo	(0 - 0.3 ha)		
30 - 50	(" (0.3 - 0.5 ha)	1,566	13.3
50 - 100	(" (0.5 - 1 ha)	1,523	13.0
100 +	(" (1 ha +)	3,656	31.0
		5,031	42.7
Average	1.39 ha	11,776	100.0

Source: Data from the Agricultural Section of Yeosu Gun, 1979

Table A-6.

Amount of Local Tax Paid Per Household

Year	Total	(Unit: US dollar)	
		Province Tax	Gun Tax
1973	7.14		
1974	43.20	2.19	4.94
1975	73.76	23.57	19.63
1976	475.36	40.80	32.96
1977	72.07	48.18	427.18
		12.23	59.84

Source: Ibid. p. 153.

Table A-7.

Savings in Bank Account, Yeosu Gun

Year	Empl- yees	Stu- dents	Self- Employed	Total	(in US dollar)	
					Savings/ Household	Savings/ Capita
1973	48,167	23,134	133,464	204,765	11.50	1.99
1974	37,891	72,901	334,647	445,439	24.85	4.29
1975	106,979	81,458	1,164,441	1,352,878	69.90	12.94
1976	101,674	76,293	1,575,781	1,753,748	93.54	16.93
1977	70,784	50,532	1,110,885	1,242,201	65.00	12.07

Source: Ibid. p. 161

The above figures are as of December 31, each year.

Table A-8.

Industries by Number of Employees

No. of Employees	No. of Industries	No. of Workers
1 - 49	23	216
50 - 99	3	223
100 - 199	1	167
200 - 299	1	252
300 - 400	2	628
Total	30	1,486

Source: Ibid. pp. 137 -138

Table A-9. Population Coverage of Civil Servants & Private School Teachers' Health Insurance Program, 1977

Category	No. of Workers
Gun Government	160
Eup or Myon Government	169
Police	110
Education	26
Post Office	164
Teachers	751
Prosecutor Office	19
Local Court	18
Office of Monopoly	10
Agricultural Examination	6
Total	1,433

Table A-10.

Public Utility and Infrastructure, 1977

Households with Electricity	97.0%
Households with Telephone	9.1%
Households with Piped Water	13.5%
Number of Vehicles Registered:	Official: 20
	Private : 124
	Total : 144
Road Conditions (excluding highway)	
	Paved : 31.708 Km
	Non-paved: 247.472 Km
	Total: 279.180 Km
Highway	21.140 Km

Source: Ibid pp. 113, 118, 122, 128, 131

2. DISEASE PATTERN

(See the disease patterns of other medically underserved area)

3. PURPOSE OF YEOJU HOSPITAL CONSTRUCTION AND MANAGEMENT DIRECTION

3.1. Purpose of Yeosu Hospital

3.1.1. Presently, the medical needs of the residents of Yeosu are being served by 6 medical practitioners, 4 area limitedly practicing doctors, 2 dentists and 6 herb doctors. There are 12 pharmacies, 8 drug sellers, and 12 herb drug stores. Although some medical services can be met by these existing facilities, the fact that only 16 beds exist for in-patients indicates the lack of sufficient medical facilities in Yeosu. The residents of Yeosu often utilize the Ichon Provincial Hospital as well as the medical facility in Weonju area. Therefore, the necessity of a proper hospital in this area to meet the medical needs can be seen. (See Tables A-11 and A-12).

3.1.2. In light of these circumstances, primary objective of Yeosu hospital would be to meet the medical care needs of the residents. The residents must be guaranteed accessibility to medical facility such as Yeosu Community Hospital.

Table A-11. Health Manpower in Yeosu Gun, December, 1978

Location (Eup or Myon)	Medical Practi- tioner	Area-limited Practitioner	Dentist	Herb Doctor	Mid- wife	Nurse	Pharma- cist	Druggist			Total
								Modern Drug	Herb Drug	Drug Seller	
Yeosu	5	-	2	3	2	6	7	2	3	-	30
Jumdong	-	-	-	-	2	1	-	1	1	1	6
Kanam	-	1	-	2	-	1	2	2	1	-	9
Neungseo	-	-	-	-	-	1	-	1	1	1	4
Heungchon	-	1	-	-	-	-	-	1	1	-	3
Keunmsa	-	1	-	-	-	1	-	1	1	1	5
Daesin	-	1	-	1	-	1	2	-	2	1	8
Bukne	1	-	-	-	-	1	1	-	1	-	4
Gangchon	-	-	-	-	-	1	-	-	1	-	2
Total	6	4	2	6	4	13	12	8	12	4	71

Source: Statistical Year book, Yeosu Gun, 1978

Table A-12 Medical Facilities in Yeosu Gun, February, 1979

Location	Name of Clinic	No. of Beds	Name of Herb Clinic	Others
Yeosu Eup	St. Anna Clinic	2	Bogundang	Kwon's midwifery
"	St. Mary Clinic	2	Daelim	(2 beds)
"	Jung Ang Clinic	2	Sunwhadang	
"	Koryo Clinic	3		
"	Chang's Surgery Clinic	2		
"	Dr. Jin's Dental Clinic	-		
"	Dr. Han's Dental Clinic	-		
Kanam Myon	Seoul Clinic (Health Subcenter)	2	Samde Choongnam	
Daesin Myon	Guin Clinic (Health Subcenter)	3	Samin	
Jundong Myon	-	-	-	Health Subcenter
Neungseo Myon	-	-	-	"
Heungchon Myon	-	-	-	"
Keumsa Myon	-	-	-	"
Bukne Myon	-	-	-	"
Gangchon Myon	-	-	-	"
Total	7 Clinics 2 Dental Clinics	16 beds	6 Herb Clinics	1 Midwifery (2 beds) 6 Health Subcenters

Source: Yeosu Gun Health Center, February, 1979

3.1.3. Korea University, the sponsor of the Yeosu Hospital, plans to construct the hospital as a center of the community health service pilot health program. From this situation, the hospital can function in various capacities to upgrade the health services manpower. As a field training center, the hospital should meet the needs of medical students as well. These are the primary considerations of Korea University in planning the Yeosu Hospital.

3.2. The Management Goals of Yeosu Hospital

3.2.1. The ideal condition of Yeosu Hospital would be the construction of a hospital large enough to completely meet the effective medical care demands of the residents. However in constructing the Yeosu Hospital, consideration must be given to the economic, social and educational status of the resident; relatively low economic condition, lack of health consciousness, traditional utilization behavior of folk therapy, and drugstore dependency are some of these considerations. Although the hospital will be a non-profit organization, it must maintain a balanced financial transactions. Therefore the expansion and development of a hospital must be within proper financial limits. For these reasons the initial construction should be a small sized hospital to provide services to patients screened by the private practitioners in the area and to refer the serious cases to the tertiary treatment facilities.

3.2.2. The facilities will be separated into 4 basic departments in accordance with the Medical Law; internal medicine, general surgery, pediatrics, and obstetrics & gynecology. In addition, the establishment of orthopedic and community health service department should be beneficial. The development of a community health service can result in the hospital becoming a center for training for the medical students. The orthopedic department is in consideration of the expected traffic accidents arising from the proximity to the expressway.^{1/} The establishment of the orthopedic department can also increase the hospital revenue. Although the nearby Ichon Provincial Hospital is expected to undergo expansion, it appears unlikely that its orthopedic department will function appropriately from the fact that rural hospitals usually have difficulty in recruiting superspecialists like a orthopedician.

3.2.3. If an independent and viable orthopedic department is established in Yeosu Hospital, the traffic accident victims of nearby Ichon County, Eumseong County and Yangpyung County can be treated in this hospital. This will in effect increase the catchment area of the Yeosu Hospital.

3.2.4. In terms of hospital management, a high occupancy rate of hospital beds from the first year cannot be expected. Generally, the occupancy rate of a small hospital is lower than a large one, and the occupancy rate of a rural hospital is lower than an urban one.

^{1/} In the course of the hospital feasibility survey in Yeosu County, many of the interviewed reported on the frequency of traffic accident victims among the residents living near the highways.

The national average for hospital bed utilization rate in 1977 was 59.2% (Table A-13). However, with the introduction of health insurance and Medicaid program, this low occupancy rate has increased rapidly. Therefore, it is reasonable to expect the occupancy rate of Yeosu Hospital in the first year of operation to be 60%, the 1977 national average. In the United States, for example, rural hospitals of 66% bed occupancy rate was assumed to operate normally.^{1/} The future management outlook is to start the first year of operation at 60% occupancy rate followed by gradual annual increase, reaching the normal operation level of 80% occupancy rate by the year of 1984.

3.2.5. The average length of hospital stay is decreasing annually and therefore 10 days can be assumed as the average length of stay.

3.2.6. The percentage of insured patients receiving treatment at Yeosu Hospital will increase with the development and expansion of the health insurance system. According to the 1978 data, in a hospital of 50 bed-size capacity, 25-35% of the in-patients and 10-20% of the out-patients were covered by health insurance. (Table A-14 & A-15). Therefore in the first year of operation, it can be assumed that 35% of the in-patients and 15% of the out-patients will be the insured.

Table A-13

National Data on the Trend of Average Hospital Stay and Bed Utilization Rate

Year	Average Hospital Stay (days)	Bed Utilization Rate (%)
1961	20	52.8
1962	18	55.4
1963	19	60.2
1964	18	61.3
1965	17	56.6
1966	16	55.2
1967	18	63.3
1968	16	56.7
1969	16	57.2
1970	14	58.4
1971	14	56.6
1972	13	51.3
1973	12	56.9
1974	14	57.8
1975	15	64.5
1976	13	55.6
1977	12	59.2

Source: Yearbook of Public Health and Social Statistics, MOHSA

^{1/} Rankin, W.S., Hannaford, H.E., and Van Arsdall, H.P., the small general hospital, Bulletin No.3, pp. 10-12 New York, 1928, revised 1932, Duke Endowment.

Table A-14. Percentage Distribution of Inpatient Cases by Medical Department and Source of Payment for Hospitals with 50 Beds and Less in 1978

Medical Department	Kyung Ju Christian Self payment	Insurance	Kyung Buk Provincial Self payment	Insurance	Chung Buk Provincial Self Payment	Insurance	Average Self payment
Internal Medicine	86.4	13.6	75.9	24.1	77.8	22.2	80.1
Pediatrics	93.3	6.7	-	-	50.0	50.0	92.8
General Surgery	51.0	49.0	61.5	38.5	62.6	37.4	55.9
Orthopedic Surgery	-	-	50.3	49.7	63.7	36.3	55.6
Obs & Gyn	80.3	19.7	46.9	53.1	81.8	18.2	77.1
E.N.T.	78.0	22.0	-	-	25.0	75.0	72.3
Dermatology	-	-	-	-	75.0	25.0	75.0
Urology	-	-	-	-	-	-	-
Physical Check-up	-	-	-	-	-	-	-
Dentistry	-	-	50.0	50.0	-	-	50.0
All or Average	75.5	24.5	65.0	35.0	71.5	28.5	71.8
No. of Beds	40		45		46		
No. of Patients	1,520		798		808		

Source: Data from the KMDI Hospital Feasibility Study Survey, 1979.

Table A-15.

Percentage Distribution of Outpatient Visits by Medical Department and Source of Payment for Hospitals with 50 Beds and Less in 1978

Medical Department	<u>Kyung Ju Christian</u>		<u>Kyung Buk Provincial</u>		<u>Chun Buk Provincial</u>		<u>Average</u>	
	Self payment	Insurance	Self payment	Insurance	Self payment	Insurance	Self payment	Insurance
Internal Medicine	74.4	25.6	99.9	0.1	79.3	20.7	87.0	13.0
Pediatrics	80.7	19.3	-	-	75.6	24.4	80.7	19.3
General Surgery	77.4	22.6	99.7	0.3	81.7	18.3	84.5	15.5
Orthopedic Surgery	-	-	94.5	5.5	83.1	16.9	90.2	9.8
Obs & Gyn	94.0	6.0	100.0	-	83.2	16.8	92.9	7.7
E.N.T.	81.1	18.9	-	-	87.8	12.2	82.4	17.6
Dermatology	-	-	-	-	85.3	14.7	85.3	14.7
Urology	-	-	-	-	-	-	-	-
Physical Check-up	-	-	-	-	100.0	-	100.0	-
Dentistry	-	-	96.8	3.2	-	-	96.8	3.2
Emergency	-	-	-	-	95.8	4.2	95.8	4.2
All or Average	80.9	19.1	98.6	1.4	88.7	11.3	87.7	12.3
No. of Beds	40		45		46			
No. of Patients	40,574		22,926		26,733			

Source: Data from the KNDI Hospital Feasibility Study Survey, 1979.

3.2.7. Community Health Service Department should emphasize the preventive health services. To provide the MCH, family planning, TB control, parasitic disease control, endemic disease control, health education, vital statistics, and medical examination services, co-operation and assistance should be sought from all clinical department.

4. CRITERIA FOR SELECTION OF YEOJU HOSPITAL CONSTRUCTION SITE

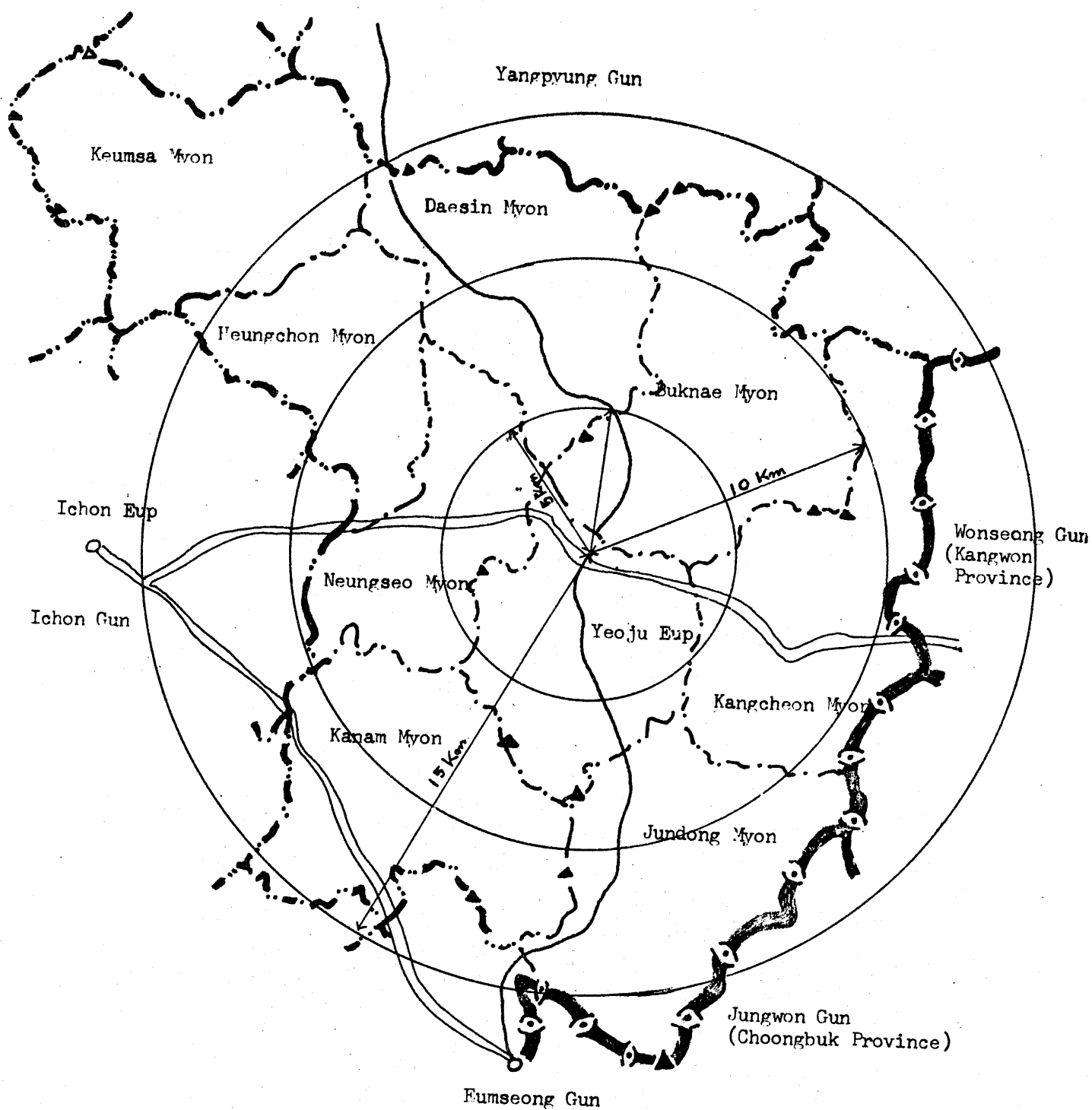
4.1. It should be emphasized that the construction of Yeosu Hospital is to serve the residents of this medically underserved area. Generally a medical facility does not exist in a medically underserved area. Even if a medical facility exists, the distance factor makes it inaccessible or inconvenient for the residents. Therefore, the selection of Yeosu Hospital site should ensure the easy utilization by the residents of this area.

4.2. It is important that the selected site meet the following conditions.

- Geographically, the hospital will be located within the jurisdiction of the Yeosu County and within the living parameter of the residents of Yeosu Eup to allow easy utilization. ^{1/}
- The hospital should be located near a strategic road to take advantage of the transportation facilities.
- The selection of site should take into consideration the existing medical facilities. The site should be selected to promote optimum co-operation and co-ordination as well as transport of patients among all the medical facilities.
- The site must have public installations of water, electricity, telephone, and drainage system.
- The site must be approved by the sponsor that will manage the hospital in the future.
- The opinions of the community residents must be regarded to the maximum extent.

4.3. In considering the above-mentioned criteria, the construction of Yeosu Hospital in the town of Yeosu appears most ideal. The major center of activity extends away from the County Office located in Yeosu Town with stores lining the road to and from this office. Using the County Office as the center of reference, the hospital should be located within the radius extending twice the distance from the county office to the end of major center activity area of Yeosu Town. (See Map A-1) The proposed location of the hospital on the part of the Korea University is approximately 10 minutes from center activity area. This is on the periphery of the above-mentioned area.

^{1/} This is not the first attempt to construct a hospital in Yeosu. When the Yeongdong Expressway was opened several years ago, a private hospital was planned for Ganam Myon of Yeosu County, where this expressway pass through. However, this plan was not realized. (Dialogue with the Chief of Home Affairs Department of Yeosu County Office 12, 1978)



Map A-1.

Yeoju Area

5. TARGET POPULATION OF YEOJU HOSPITAL

5.1. The Status of the Medical Facilities around Yeosu

5.1.1. As mentioned previously, a medical facility up to a hospital standard does not exist in Yeosu County. The patients who cannot be treated at the existing facilities must seek treatment from Ichon Provincial Hospital located 16.8 km from Yeosu, Wonju Christian Hospital located 50 km away, or seek treatment in Seoul which is over 90 km from Yeosu. Also, residents in the northern section of Yeosu County such as Daesin and Keumsa Myons sometimes use the facilities located in Yangpyung County.

5.1.2. Generally the rural hospitals in the West are located some 30 minutes away from the city they are serving. 1/ However, unlike the West, the catchment area in the Korean situation is much smaller due to poor road conditions and lack of rapid transportation means. Contributing to this small catchment area are the small administrative districts. As Map A-1 indicates, with the exception of Keumsa Myon, the jurisdictional myons of the Yeosu County Office are all within 15 km.

5.1.3. In Yangpyung, a private community hospital with 50 beds was constructed by private practitioners. However due to relatively small size and lack of sufficient equipments, the utilization rate of this hospital by the residents of Yeosu County is not expected to be high. 2/ Another important factor of the expected low utilization is the poor traffic condition between Yeosu and Yangpyung which prevents the interaction of livelihood between the residents of these two counties.

5.1.4. The situation in Ichon is different. Unlike Yangpyung, a paved national road as well as a highway connect these two counties, resulting in a spatial and time proximity. Also, the similar agricultural background of the two counties results in close interaction of livelihood. Therefore, the construction of a hospital in Yeosu will likely result in competition between the Ichon Provincial Hospital and the Yeosu Hospital. 3/ To avoid the resulting competition for the catchment area, a detailed analysis of the utilization patterns of Ichon Provincial Hospital is necessary.

5.1.5. Ichon Provincial Hospital has 54 beds and consists of 4 medical departments. Like many other provincial hospitals in the rural area, this hospital is not functioning at full capacity. However, under the government modernization plan of the provincial hospitals, Ichon Hospital will expand to 80 bed-size hospital. This fact should be taken into consideration in the construction of Yeosu Hospital.

1/ R.F. Bridgman, The Rural Hospital, The Concept of Regional Environment.

2/ Dialogue with Dr. Nam, the Director of Kyunggi Provincial Health Department.

3/ Ichon Provincial Hospital operated in 1978 with 5.4% bed occupancy rate.

In order to renovate this hospital, the local government has purchased land for ₩30,000,000. Conversation with the Kyunggi Province Public Health Department.

5.1.6. In 1978, the distribution of in-patient stay according to the medical departments showed 55.2% for internal medicine, 34.3% for general surgery, 5.1% for pediatrics and 5.4% for Ob & Gynecology. The distribution according to the out-patient visits showed 71.6% for internal medicine, 19.0% for Ob-Gyn., 8.9% for pediatrics and 7.5% for general surgery (Table A-16).

5.1.7. The geographical distribution of out-patients showed that 72.5% of the patients were from Ichon County, 14.8% came from Yeosu and the remaining 12% were from other nearby areas (Table A-17). The in-patient distribution showed that 57.9% were Ichon County residents, 22.7% were Yeosu County residents and the remaining from other nearby areas.

Table A-16 Number of Patient Days by Medical Department in the Ichon Provincial Hospital, 1978

Medical Department	Hospitalization	%	Out-patient	%	Both	%
Internal Medicine	1,069	55.2	14,231	71.6	15,300	70.1
Surgery	664	34.3	1,504	7.5	2,168	9.9
Pediatrics	99	5.1	1,771	8.9	1,870	8.6
Ob-Gyn	104	5.4	2,377	12.0	2,481	11.4
Total	1,936	(100.0)	19,883	(100.0)	21,819	(100.0)

Source: Ichon Provincial Hospital, 1979

Table A-17 Monthly Outpatient Cases by Place of Residence in the Ichon Provincial Hospital, 1978, 7-9

Residence (Gun)	July	Aug.	Sept.	Total	%
Ichon	2,283	2,338	2,136	6,757	72.5
Yeosu	508	461	414	1,383	14.8
Yangpyung	34	21	21	76	0.8
Kwangju	239	235	215	689	7.4
Others	135	146	135	416	4.5
Total	3,199	3,201	2,921	9,321	100.0
%	34.3	34.3	31.4	100.0	

Table A-18. Monthly Inpatient Cases by Place of Residence in the Ichon
Provincial Hospital, 1978, 7 - 12.

Residence (Gun)	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	%
Ichon	128	75	132	117	194	85	731	57.9
Yeoju	43	40	11	48	90	55	287	22.7
Yangpyung	25	31	5	4	17	45	127	10.1
Kwangju	27	19	9	-	7	11	73	5.8
Others	1	2	-	23	18	-	44	3.5
Total	224	167	157	192	326	196	1,262	100.0
%	17.8	13.2	12.4	15.2	25.8	15.6	100.0	

* Commitment Index for the Ichon Provincial Hospital was 22.7% for the residents of the Yeoju Gun. (Commitment Index means the percentage of Hospital A's discharges which come from an area)

5.1.8. Yeosu County residents admitted as in-patients in the Ichon Provincial Hospital according to their residing eup or myons are shown in the Table A-19. 45.3% are from Kanam, 18.8% from Yeosu, 14.3% from Keumsa and 13.6% are from Nungseo Myon. This indicates that majority of in-patients from Yeosu County came from with 10 km distance of Ichon. It is evident that in rural areas, the distance factor is important in determining the catchment area.

5.1.9. The extent of catchment area for the out-patient services decreases more rapidly in terms of distance resulting in lower utilization rate. Among the residents of Yeosu utilizing Ichon Hospital 26% were from Keumsa and 19.0% were from Hungchon (Table C-20).

5.2 Catchment Area of Yeosu Hospital

5.2.1. The catchment area of Yeosu Hospital will be partly dependent of the bed-size of Ichon Hospital and its level of treatment capacity. With the expectation that the Ichon Hospital will expand to 80 bed-size capacity, the expected catchment area of Yeosu Hospital should be minimized. This is in consideration of the great costs involved in the operation of empty hospital beds and the financial loss due to high construction cost.

5.2.2. Even if the Ichon Provincial Hospital is modernized, the past experience of poor management gives indication that the Ichon Hospital may experience difficulty in recruiting its professional medical manpower. In this point, the Yeosu Hospital will be in favorable situation. Management under the Korea University will allow the use of medical manpower of Korea University as well as gaining the confidence of the local residents due to the prestige of being associated with the Korea University.

5.2.3. Rather than establishing a first class modern hospital that is able to compete with the Ichon Hospital, the basic plan of the Korea University is to construct a rural-type hospital to provide sufficient services to the residents by providing preventive as well as curative health services. ^{1/} Therefore, this hospital should be able to include most of Yeosu County within the hospital service area.

5.2.4. When considering the modernization program of the Ichon Hospital, the possibility of some Yeosu County residents utilizing the Ichon facility cannot be disregarded. Some patients utilizing the large facilities of Seoul is also inevitable in light of the Yeongdong Expressway. In reference to the previously shown Table A-20 and Map A-1, the elimination of Keumsa Myon and Kanam Myon from the catchment area of Yeosu Hospital is possible. This is due to the fact Kanam is in proximity of Ichon provincial Hospital and Keumsa is located 15 km away from the proposed location of Yeosu Hospital. However, due to the poor road condition between Ichon and Keumsa, the inclusion of Keumsa Myon within the catchment area of Yeosu Hospital becomes a possibility. The bordering counties should be considered. The residents of Eumseong County and Joongwon County of North Choongchung Province as well as the residents of Ichon and Yangpyung are considered.

^{1/} Dialogue with Dr. Lee Sujong, the Dean of Medical School of Korea University.

Table A-19. Yeoju Patients who Have Been Hospitalized in the Ichon Provincial Hospital by Place of Residence, 1978. 7 - 12

Residence (Myon)	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	%
Kanam	17	1	4	41	43	24	130	45.3
Yeoju	4	16	3	-	-	31	54	18.8
Keumsa	-	16	4	-	21	-	41	14.3
Neungseo	3	3	-	7	26	-	39	13.6
Bukne	14	-	-	-	-	-	14	4.9
Heung chun	2	2	-	-	-	-	4	1.4
Jumdong	3	-	-	-	-	-	3	1.0
Daesin	-	2	-	-	-	-	2	0.7
Total	43	40	11	48	90	55	287	100.0

Table A-20. Those Yeoju Patients That Used the Outpatient Department of Ichon Provincial Hospital by Place of Residence, 1978. 7-9

Residence (Myon)	July	Aug.	Sept.	Total	%
Kanam	136	147	77	360	26.0
Yeoju	80	24	56	160	11.6
Keumsa	60	91	118	269	19.5
Neungseo	73	63	54	190	13.7
Bukne	29	11	11	51	3.7
Heungchun	96	98	69	263	19.0
Jumdong	11	13	21	45	3.3
Daesin	9	10	4	23	1.6
Gangchun	14	4	4	22	1.6
Total	508	461	414	1,383	100.0

5.2.5. Accordingly, this survey regards all of Yeoju area with the exception of Kanam Myon to be within the catchment area of Yeoju Hospital.

5.3. The Population Estimation of the Target Area

5.3.1. The population trends in Yeoju County for the past nine years is indicated by Table A-21. With the exception of the decrease in 1971, the population increased gradually up to the year 1975. However, after 1975 the population has been gradually decreasing (Figure A-3). The industrialization policy of the Government, and the subsequent urbanization will result in 75%

Table A-21.

Population Trend in Yeosu Gun

Year	Population size
1970	101,048
1971	99,029
1972	101,201
1973	102,682
1974	103,843
1975	104,550
1976	103,598
1977	102,939
1978	100,797

Source: Statistical Year Book of Yeosu Gun, 1978

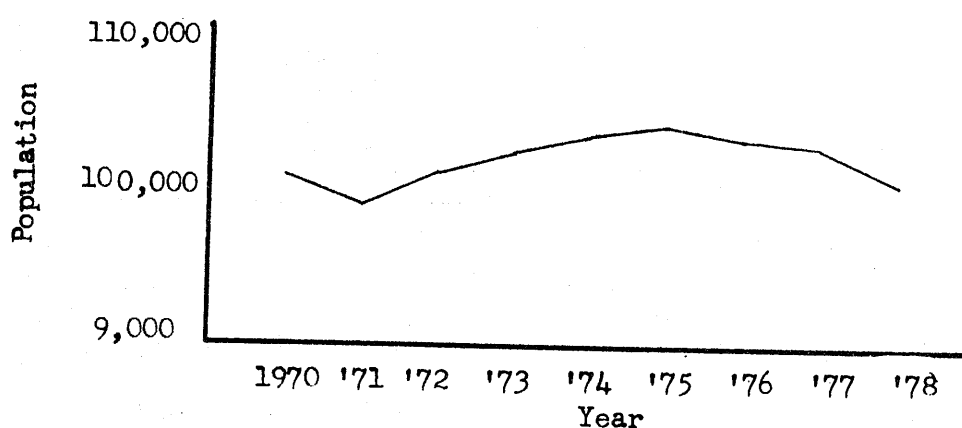


Figure A-3. Population Trend in Yeosu Gun

of the population living in urban areas by the year 1991. ^{1/} Therefore, the population in this rural area of Yeosu is likely to undergo annual decrease.

5.3.2. Using the year 1975 as the base year, the initial year of population decrease, three assumptions are utilized to project the future population trend of Yeosu County (Table A-22).

^{1/} Korea Development Institute, Long-Term Socio-Economic Development Plan, 1977 - 1991, Chapter 10, p. 151, Table 10-1.

Table C-22.

Population Projection in Yeoju Gun

Year	1) Projection I	2) Projection II	3) Projection III
1978	100,797	100,797	100,797
1979	99,991	100,060	100,017
1980	98,799	98,929	98,863
1981	97,607	97,814	97,722
1982	96,416	96,711	96,595
1983	95,224	95,622	95,480
1984	94,032	94,546	94,378
1985	92,840	93,482	93,289
1986	91,648	92,432	92,213
1987	90,457	91,393	91,149
1988	89,265	90,366	90,097
1989	88,073	89,350	89,058
1990	86,881	88,347	88,035
1995	80,923	83,489	83,067
2000	74,964	78,880	78,384

The population is gradually declining in rural Korea due to her rapid industrialization and urbanization. Therefore, it is rational for this projection to use the 1975 population as a starting point. The above figures are obtained from projection using the past four years (1975-1978) of Yeoju population.

Projection I assumes linear relationship in population growth;

$$Y = a + bx$$

Where a is 194,143.7
 b is -1,191.8
 R^2 is 0.93

Projection II assumes logarithmic function in population change;

$$Y = a + b \ln x$$

Where a is 492,657
 b is -89,851
 R^2 is 0.93

Projection III assumes exponential change in the future population;

$$Y = a e^{bx}$$

Where a is 250,177.4
 b is -0.01
 R^2 is 0.93

5.3.3. The Yeosu County residents involved in farming own approximately 1.39 ha per household, which is higher than the national average of 0.96 ha per household. And the industrial activity in this area is limited. Although tourism is a source of income in this area, it is not expected to encourage the inflow of population in this area. The fact that the farming activity in Yeosu is somewhat on an extensive basis, the decrease in population in Yeosu should be less in comparison with other rural areas. Therefore, in projecting the future population decrease in this area, the logarithmic function is assumed rather than the linear decrease. (Assumption II).

5.3.4. Taking into account the various factors described previously, the population in the catchment area of Yeosu Hospital in 1980 is estimated to be around 85,747. This figure is derived by using the projected logarithmic decrease in population of Yeosu County excluding the Kanam area (Table A-23).

Table A-23.. Projection of Service Population in Yeosu Gun

Year	Yeosu Gun (1)	Kanam Myon (2)	(1) - (2)
1975	104,550	13,946	90,604
1976	103,598	13,737	89,861
1977	102,939	13,679	89,260
1978	100,797	13,458	87,339
1979	100,060	13,329	86,731
1980	98,929	13,182	85,747
1981	97,814	13,038	84,776
1982	96,711	12,895	83,816
1983	95,622	12,754	82,868
1984	94,546	12,614	81,932
1985	93,482	12,477	81,005
1986	92,432	12,341	80,091
1987	91,393	12,206	79,187
1988	90,366	12,073	78,293
1989	89,350	11,941	77,409
1990	88,347	11,811	76,536
1991	87,352	11,685	75,667
1995	83,489	11,182	72,307
2000	78,880	10,585	68,295

$$Y = a + b \ln x$$

$$a: 492,657$$

$$b: -89,851$$

$$R^2 = 0.93$$

$$Y = a + b \ln x$$

$$a: 64,196$$

$$b: -11,641$$

$$R^2 = 0.96$$

6. BED-SIZE OF THE YEOJU HOSPITAL

6.1. Estimation of In-Patient Utilization

6.1.1. According to the morbidity interview survey conducted in Yeosu County by this study, on 412 households of 1,953 persons, the possibility of in-patient utilization per person per year was 0.0195 (Table A-24). A similar survey conducted in 6 counties throughout Korea, 2,454 household consisting of 12,406 persons, revealed the average of 0.0238. The results from the Yeosu County survey is considerably lower than the national average.

6.1.2. Generally, in estimating the required number of beds, utilizing the low estimate is more practical than the high one. This becomes specially so, should a competing hospital exist in a nearby area. Therefore in calculating the estimated bed requirement, the result from Yeosu survey is utilized in addition to the national average.

6.1.3. According to the feasibility study on the construction of Korea Electric Company Hospital in Ulsan, the utilization rate of the rural residents of Korea is 13.5-15% of the utilization of the Japanese Health Insurance (Table A-25). ^{1/} By coincidence the results of the utilization survey in Yeosu County is same as the 1976 projection (I) of the Ulsan Hospital feasibility study. Also, the average utilization rate of six counties of Korea is similar to the 1979 projection II of the Ulsan Hospital feasibility study. Therefore in this study the utilization rate for projection I and II will use as a base, 0.0195 and 0.0239 respectively.

6.1.4. Presently, the estimated number of public workers and private school teachers in the Yeosu Hospital catchment area covered under the Medical Insurance is 6,500 persons. Also, 3,500 persons of the indigent group, whose utilization rate is expected to be higher than the general rural residents, are covered by Medicaid. Because utilization data for these insured have not been known yet, they will be combined into total population and classified under the assumption II.

6.2. Determination of the Hospital Bed-Size

6.2.1. The initial step in the process of determining the hospital bed-size is the estimation of inpatient cases occurring within a defined area. This can be done by identifying appropriate utilization level for which provision should be made. Other units for measuring hospital utilization are average length of stay and occupancy rate. Should all the above information be provided, it is easy to calculate bed requirements in a defined area by following the next steps.

^{1/} The feasibility study on the Ulsan Hospital of the Korea Electric Company, 1977, pp. 65-66. Based on Sung Kwan Lee et al: A Study Concerning Health Needs in Rural Korea.

Table A-24. Inpatient Data from the Community Survey*

(1979)				
Area	No. of Samples Studies	No. of Inpatients	Total No. of Inpatient Days	No. of Hospitalization per Persons per Year
Yeoju	1,953	38	776	0.0195
Nonsan	2,079	44	975	0.0212
Hampyung	2,038	47	747	0.0231
Goesan	2,165	68	771	0.0314
Hadong	2,008	35	449	0.0174
Jinan	2,163	63	977	0.0291
Total or average	12,406	295	4,695	0.0238

* The survey was conducted during this hospital feasibility study period.

Table A-25. Projection of Hospitalizations per Person per Year for
Rural Residents of Korea and Japan

Year	Rural Japan	Rural Korea	
	National Health Insurance	Projection (I)	Projection (II)
1973	0.1293	0.0174	0.0194
1976	0.1443	0.0195	0.0217
1977	0.1495	0.0202	0.0224
1978	0.1543	0.0209	0.0232
1979	0.1595	0.0215	0.0239
1980	0.1643	0.0222	0.0247
1981	0.1695	0.0229	0.0254
1982	0.1743	0.0236	0.0262
1983	0.1795	0.0242	0.0269
1984	0.1845	0.0249	0.0277
1985	0.1893	0.0256	0.0284
1990	0.2145	0.0290	0.0322

Source: The Feasibility Study Report of Ulsan Hospital of the Korea Electric Company, December, 1977, p. 66

- 1) Daily number of patients needed to be admitted (called average daily census) is equal to

$$\frac{\text{Number of patients per year} \times \text{Average length of stay}}{365}$$

- 2) Bed requirements of a defined area can be obtained by subtracting the number of patients who can use the existing medical facilities from the above average daily census.

6.2.2. It can safely be assumed that probability for a person to get sick would not be high. Also, the daily fluctuation of hospitalized cases would show random variation. For the measure of average daily variation, it is useful to use coefficient of variation. 1/ Many empirical studies are available for indicating that daily census variation in most hospitals approximates some theoretical distribution, such as Poisson distribution. 2/, 3/, 4/.

5.2.4. However, Blumberg indicated the distribution of daily inpatient fluctuation is probably not Poisson, if any of the following conditions are present. 4/

- A hospital has a high proportion of elective admissions.
- A hospital is frequently overcrowded.
- If epidemic conditions or rapid growth in average census took place during the period observed.

6.2.4. In generalizing the distribution of daily inpatient fluctuation, it is suggested that obstetric, emergency, and medico-surgically serious cases will follow the Poisson distribution. Poisson distribution is not applicable when patients are crowd with long waiting line. 5/

-
- 1/ Coefficient of variation is a technical term explaining the size of variation. The coefficient, by its definition, is equal to standard deviation divided by its average, symbolically $\frac{\sigma}{\mu}$. The coefficient of inpatient variation is growing smaller as its mean number of inpatients increase.
- 2/ Flagle, Charles D., Huggins, W.H., and Roy, R.H., Operations Research and System Engineering, Baltimore, 1959, the Johns Hopkins University Press.
- 3/ Thompson, John B., Avant, Oscar Wade and Spiker, Ellawyne D., How queuing theory works for the hospital, Modern Hospital, 94:75-78, 1960.
- 4/ Blumberg, Mark S., Districtive Patient facilities concept helps predict patient bed needs, Modern Hospital, 97:75-81, 170, December 1961.
- 5/ William Shonick, Elements of planning for area-wide personal health service, p76, pp. 79-86.

6.2.5. In Korea, scheduled admissions are rare except in metropolitan situation. Rural hospitals are usually suffering from low bed occupancy. Thus, daily inpatient census seems to be generally poisson in rural area.

6.2.6. Poisson distribution has the characteristic of the standard deviation being equal to the square root of the mean, $\sigma = \sqrt{M}$. Therefore, the coefficient of the variation ($\frac{\sigma}{M}$) becomes

$$\frac{\sqrt{M}}{M} = \frac{\sqrt{M}}{\sqrt{M} \cdot \sqrt{M}} = \frac{1}{\sqrt{M}}$$

If a certain number of persons requiring inpatient care exists, the maximum number of hospitalizations in the area becomes $M + 3\sqrt{M}$. Suppose a hospital can accommodate all of them (In other words, the hospital is equipped with as many as $M + 3\sqrt{M}$ beds), bed occupancy rate of this hospital becomes $\frac{M}{M + 3\sqrt{M}}$.

6.2.7. Currently, 16 beds are available in Yeosu area of which bed occupancy rate seems to be less than 50%. Data from the Korean Medical Association show that even rural area in which hospital beds are entirely lacking, more than half of clinic beds are idle (Table A-26). The rate will further be reduced when a new health care delivery system under consideration prevents private practitioner from practicing inpatient care. This study used 30 percent for its bed occupancy rate after 1980.

6.2.8. Estimated number of bed requirements in Yeosu area can be calculated as follow:

$$B = \frac{P \cdot Hr \cdot ALS}{365} - (Eb \times Or) + 3 \cdot \sqrt{\frac{P \cdot Hr \cdot ALS}{365} - (Eb \cdot Or)}$$

Where,

- B : Number of beds required in the Yeosu hospital service area.
- P : Population size within the hospital service area.
- Hr : Number of hospitalizations per person per year.
- ALS : Average length of hospital stay for the residents.
- Eb : Existing number of beds in the hospital service area.
- Or : Bed occupancy rate of the existing medical facility.

Table A-26

Occupancy Rate of Clinic Beds

(Unit : %)			
Year	Metropolitan	Medium-size Cities	Rural
1972	44.7	53.6	48.0
1973	42.9	51.6	48.2
1974	41.4	48.1	46.2
1975	37.0	47.0	44.9
1976	33.5	41.8	40.3
No. of Clinics	428	414	336

Source: Korean Medical Association, National Clinic Census, in Health Problems and Their Solution (II), KDI Press December 1977, p. 369

6.2.9. It is estimated that bed requirements in the Yeosu Hospital service area amount to 57 in 1979 and 73 in 1980. The formula indicates that the maximum number of beds required in Yeosu area would be 94 during the study period (Table A-27). Some conditions should be added to this result.

6.2.9.1. Yeosu Hospital is supposed to meet all the inpatient care demand occurring at the Yeosu Hospital service area. In other words, the outflow of Yeosu inpatients to Seoul or Weonju is assumed to be negligible.

6.2.9.2. Also, the influx of hospitalization cases from the neighboring counties, such as Eumseong, Joongweon, and Yangpyung, is assumed to be non-existent. These two conditions are unlikely to be true, because transportation from Yeosu to Seoul is so convenient that such concept of a closed community can hardly be expected. Owing to the limited patient care capacity of the Yeosu Hospital, it is obvious that a substantial number of patients should be referred to the hospitals outside the service area. These facts suggest that outflow will exceed inflow in Yeosu case.

6.2.10. In general, square root formula overestimates bed requirements. Since many hospitals have waiting lists for their patients, they can operate with less beds than called as the square root formula indicates. Therefore, it is recommended that 50 bed-size hospital meet the demand for medical care in the Yeosu Hospital service area.

7. YEOSU HOSPITAL MEDICAL PROGRAM

7.1. Estimated Annual In-patients

7.1.1. Using linear projections, the treatment capacity can be estimated by calculating the number of inpatients in relation to the bed-size of the existing hospitals. During the period of this study, data from 25 hospitals were analyzed with the following results (Figure A-4).

Under 100 beds : $Y_1 = 25.65x - 1.76$ ($r^2 = 0.72$)

Under 200 beds : $Y_2 = 43.19x - 1,162.48$ ($r^2 = 0.72$)

All surveyed hospitals : $Y_3 = 51.51x - 1,065$ ($r^2 = 0.70$) In the case of a 50-bed hospital, the intersection points of Y_1 and Y_2 were 997 cases and 1,281 cases respectively. Assuming the bed occupancy rate to be 100% and the average length of stay to be 10 days, a 50-bed hospital's maximum capacity is 1,825 patients ($50 \times 365 = 1,825$). As shown in Figure A-4, presently hospital with 50 beds can accommodate number of patients within the area shaded with slanted lines. However, with better operation the number of patients can increase within the area shaded with vertical lines.

7.1.2. Based on the Figure A-4, the estimated number of inpatients is shown on Table A-28. In this estimation, during the first year of operation 846 in-patients, a figure lower than 997 cases as shown on Figure A-4 is expected. In the following year, the 1978 level of utilization of the surveyed hospital will be reached. Afterward the rate of increase will gradually decrease. By 1990, it is assumed that the occupancy rate will increase to 87%, thereby handling 1,635 in-patients.

Table A-27. Bed Requirements in the Yeosu Hospital Service Area

Year	Popu- lation	Hospitalization Rate/Person/Year		Average Length of Stay	Days/ Year	No. of Existing Beds	Occu- pancy Rate(%)	Bed Requirement	
		I	II					I	II
1979	86,731	0.0195	0.0239	10	365	16	50	57	60
1980	85,747	0.0202	0.0247	10	365	16	40	60	73
1981	84,776	0.0209	0.0254	11.7	365	16	30	74	88
1982	83,816	0.0215	0.0262	11.7	365	8	30	78	93
1983	82,868	0.0222	0.0269	11.7	365	8	30	79	94
1984	81,932	0.0229	0.0277	10.7	365	9	30	74	88
1985	81,005	0.0236	0.0284	10.7	365	8	30	76	89
1986	80,091	0.0242	0.0292	9.7	365	8	30	70	83
1987	79,187	0.0249	0.0299	9.7	365	4	30	73	85
1988	78,293	0.0256	0.0307	9.7	365	4	30	74	86
1989	77,409	0.0263	0.0314	9.7	365	4	30	75	87
1990	76,536	0.0270	0.0322	9.7	365	4	30	76	88
1991	75,667	0.0277	0.0335	9.7	365	4	30	77	91

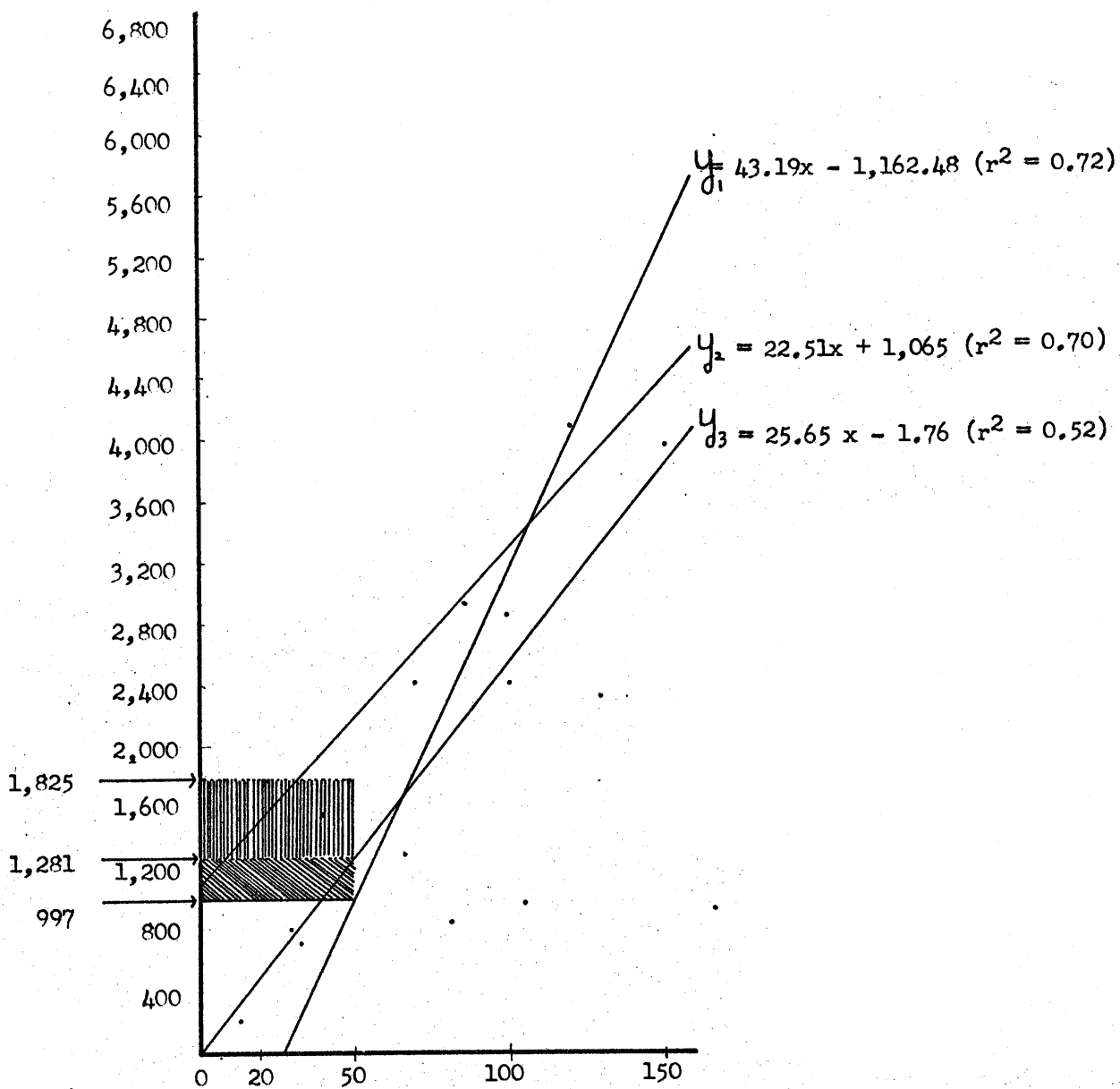


Figure A-4. Relationship between Number of Inpatients and Bed Complements in the Hospital with 50 Beds.

Table A-28. Estimated Number of Inpatient Cases for the Yeoju Hospital by Year

Year	Inpatient Cases	Percentage Increase Per Annum
1980	846	-
1981	997	17.8
1982	1,174	17.8
1983	1,280	9.0
1984	1,357	6.0
1985	1,425	5.0
1986	1,482	4.0
1987	1,526	3.0
1988	1,572	3.0
1989	1,603	2.0
1990	1,635	2.0
1991	1,667	2.0

7.2. In-patient Distribution by Medical Department

7.2.1. As stated previously in the operational target, in determining the scope of treatment and technical level of Yeoju Hospital, two factors are considered ; The opinion of the Korea University, the sponsor organization, and the modernization program of the nearby Ichon Provincial Hospital.

7.2.2. The Korea University proposes to establish a typical rural hospital to meet health needs of the residents. This hospital should be developed into a secondary medical facilities with ties to the mother hospital of Korea University Hospital with a referral system linking these two hospitals. Therefore it should possess an orthopedic department and a community health service department, which can be used as a training center for students, in addition to the 4 basic medical departments.

7.2.3. Even if the Ichon Provincial Hospital expands to a 80-bed hospital, this modernization will not affect the catchment area of Yeoju Hospital. This is due to the fact that Yeoju Hospital will be able to draw from the medical personnel of the Korea University, whereas the Ichon Hospital may find difficulty in recruiting specialists. The close proximity of Ichon to Seoul will require competition with the modern facilities of Seoul. Finally, the poor image of provincial hospitals will work as a benefit to Yeoju Hospital.

7.2.4. We can estimate the in-patient distribution and bed allocation from the operation of other hospitals with similar bed-size. These hospitals are Kyung Ju Catholic Hospital (40 beds), Kyung Bug Provincial Hospital (45 beds) and Chun Buk Provincial Hospital (46 beds). (See Table A-29).

Table A-29.

Inpatient Cases and Distribution of Beds by
Medical Department in 1980

Medical Department	No. of Cases Per Year	Distribution of Beds (Number)
Internal Medicine	380	17
General Surgery	169	12
Orthopedic Surgery	127	13
Pediatrics	85	4
Ob & Gyn	85	4
Total	846	50

7.3. Estimation of Annual Out-patients

7.3.1. The estimation of the number of out-patients is more difficult than of the in-patients. Generally, the number of out-patients of a hospital correlates with the reputation of doctors, the number of doctors, number of departments, and the size of the hospital, etc.. However, information about the complicated correlations is not available, therefore this study estimates the number of out-patients in relation to the size of the hospital.

7.3.2. In determining the number of out-patients, the analysis of the survey of 25 hospitals, resulted in the following correlations.

$$100\text{-bed hospital : } Y_1 = 342.46 x + 16,623.22 \quad (r^2 = 0.39)$$

$$200\text{-bed hospital : } Y_2 = 555.07 x + 4,080.5 \quad (r^2 = 0.63)$$

$$\text{All hospital surveyed : } Y_3 = 456.95 x + 10,699.27 \quad (r^2 = 0.92)$$

The intersection point of these three formula interposed on a graph is in the vicinity of 60 beds (Figure A-5); ordinate being the number of patients and abscissa indicating the number of beds. The range of out-patients is from 31,834 to 33,746 patients.

7.3.3. Table A-30 shows the estimation of out-patients based on Figure A-5. The number of out-patients will increase greatly with the expansion of health insurance. If the national policy to establish a health care system of clinics serving for out-patients, and hospitals for in-patients is implemented, there is a likely of less out-patients. This study did not consider these possible changes.

7.3.4. It is estimated that in the first year of operation there will be 90 out-patients per day followed by an increase to 122 out-patients per day by 1991.

7.4. Distribution of Out-patient by Medical Department

7.4.1. The distribution of out-patients according to department is estimated to be similar as the Ichon Provincial Hospital (See Table A-17). Only the establishment of orthopedic department is considered to be a factor. About 5%

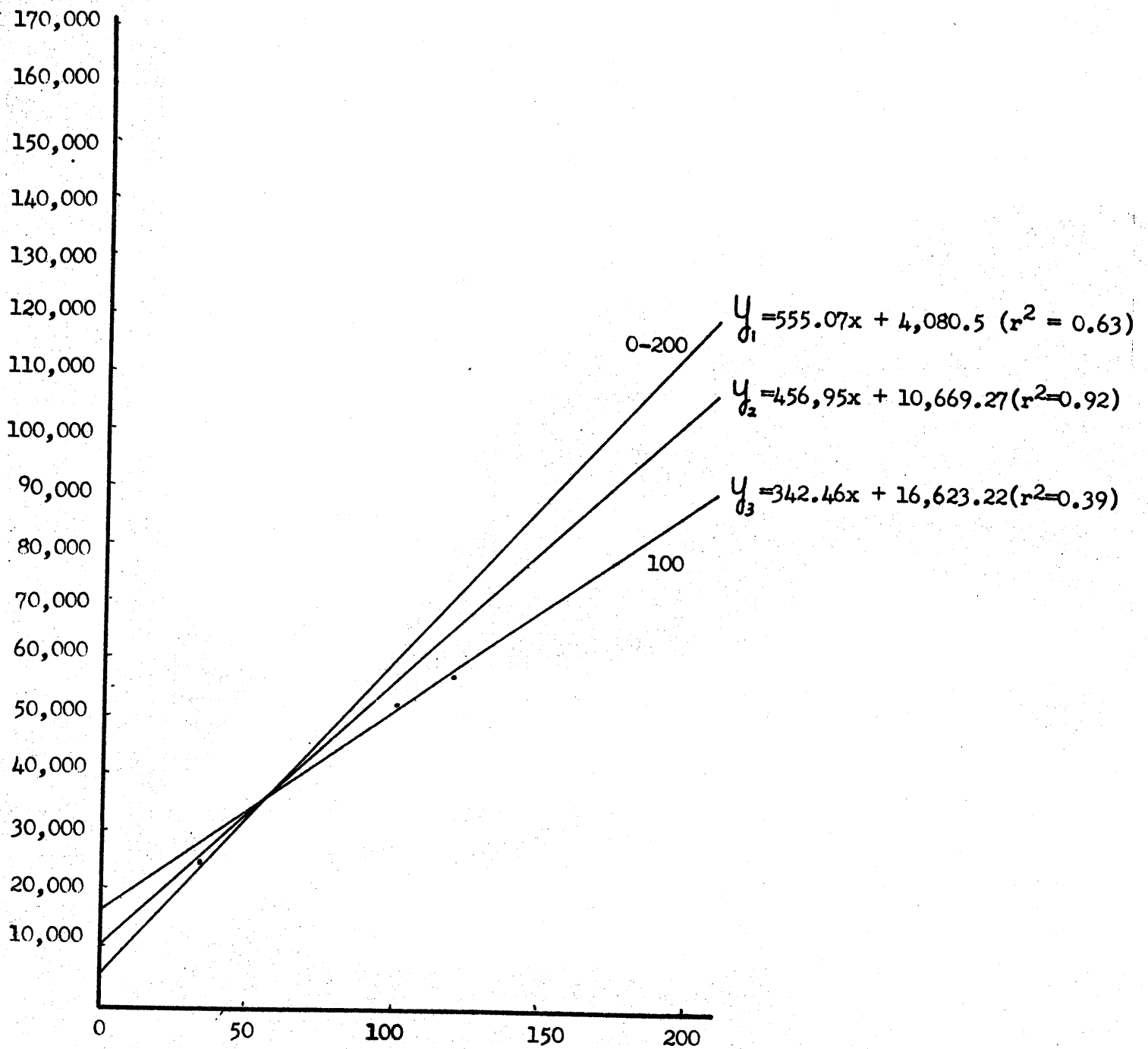


Figure A-5. Relationship between Number of Outpatients and Bed Complements

Table A-30.

Estimated Number of Outpatient Visits for the Yeosu
Hospital by Year

Year	Outpatient Visits	Percentage Increase per Annum
1980	27,267	-
1981	28,357	4
1982	29,491	4
1983	30,671	3
1984	31,591	3
1985	32,539	3
1986	33,515	2
1987	34,185	2
1988	34,869	2
1989	35,566	1
1990	35,922	1
1991	36,644	1

of the total out-patients are decided for the orthopedic department and the percentage of out-patients for the pediatrics is decided at a higher percentage than Ichon Hospital.

7.4.2. Of the out-patients, 5% is estimated to be emergency cases. Therefore the operation of emergency room equipped with simple surgery capacity and an ECG equipment is assumed.

7.5. Estimation of Clinical examinations and Surgery Cases

7.5.1. In Korea, informed statistics does not exist regarding the clinical examinations per inpatient or out-patient, and number of X-ray taken per inpatient or outpatient.

7.5.2. According to the data obtained in the course of the survey, there is great differences among the hospitals. Therefore, in this study the average of frequency of the examinations and X-ray from Samil Hospital (33 beds), Andong Presbyterian Hospital (45 beds) and Hanchoo Hospital (66 beds) were used to estimate the number of clinical examinations and X-rays for the Yeosu Hospital. The result is shown on Table A-31-1 and A-31-2.

8. ROOM AND SPACE PROGRAM OF YEOJU HOSPITAL (50 BEDS)

8.1. General Principles

This Room and Space Program is made by the Medical Program which was previously mentioned in Chapter 6. For the completion of this report, a survey and analysis of 9 existing hospitals in Korea, has been performed, along with a comparison of West German, United States and other developed countries, standards. As the result, this Room and Space Program, which is considered most suitable to the existing conditions in Korea, is established.

Table A-31-1. Medical Program for the Yeoju Hospital: Inpatients & Outpatients

A. INPATIENTS

Medical Department	No. of Cases per Year	Average Length of Stay (days)	Occupancy Rate of Beds (%)	Distribution of Beds (number)
Internal Medicine	380	9	60	17
General Surgery	169	14	60	12
Orthopedic Surgery	127	20	60	13
Pediatrics	85	8	60	4
Ob and Gyn	85	8	60	4
Total or Average	846	11.4	60	50

B. OUTPATIENTS

Medical Department	No. of Cases	Visits per Care	No. of Visits per Year
Internal Medicine	5,397	2.6	14,032
General Surgery	1,276	2.4	3,062
Orthopedics	490	2.8	1,372
Pediatrics	1,472	3.5	5,152
Ob and Gyn	1,177	3.1	3,649
Total	9,812	2.8	27,267

Table A-31-2. Medical Program for the Yeosu Hospital: Medical & Other Function

C. MEDICAL PERFORMANCES

Kind of Performances	No. of Performances per Year		
	Inpatients	Outpatients	Total
Emergency Cases			1,363
Laboratory Diagnostics			
- chemical	179	110	289
- hematological	1,060	7,060	8,120
- serological	354	2,362	2,716
- bacteriological	156	247	403
- stool exam.	100	1,000	1,100
- urinalysis	850	1,517	2,367
Blood Preserves			400 pints
Plain X-ray	2,709	4,198	6,907
Mass X-ray	-	2,088	2,088
Fluoroscopies	85	-	85
Operation	Percentage of		
	nonseptic	septic	
- general surg.	180	20	200
- orthop, surg.	62	-	62
- Ob and Gyn	15	100	115
- Total	257	120	377
Preventive Performances		1,000	1,000
Physical Check-up			
Deliveries	70		70

D. FURTHER FUNCTIONS

Function	quantities per year
Ambulance	
- transportations	150
Student training	200 students
- community health services	120 medical students 80 nursing students (1 dormitory for 20)

8.2. Room and Space Program

The space of the hospital can be divided into 5 main parts, as follows;

- The space for the outpatient departments, laboratory, X-ray, operation, delivery and so on.
- The space for the treatment of inpatients, which including the main facilities of the hospital
- The space for the administration of the hospital
- The space for supply; dispensary, feeding, laundry, and so on
- The space for the maintenance of hospital

8.2.1. Examination and Treatment

In this part, emergency, outpatient departments, laboratory, X-ray, operation, and delivery are included.

8.2.1.1. Entrance and Emergency

The results are obtained in the survey of the existing hospitals (Table A-32-1, A-32-3) and are the same as Table A-33-1.

8.2.1.2. Outpatient Departments

The necessary rooms and the number of rooms for outpatient departments are calculated by the annual number of outpatients of the medical program (Table A-31-1) and the consulting time (cf. Table A-32-6). The size of every rooms is based on the survey results of the existing hospitals (Table A-32-2). In consideration of being a teaching hospital, medical trainees' room is included. And the other auxiliary rooms are based on the empirical standard in Korea. The results are the same as Table A-33-1.

8.2.1.3. Laboratory

The necessary rooms and the size of the rooms are deduced from the number and the kinds of examinations. (Table A-31-2) The other auxiliary rooms are based on the empirical standards. And the whole volume is checked by the survey of the existing hospitals (Table A-32-3). The result are the same as Table A-33-1, A-33-2.

8.2.1.4. Morgue

This is allocated by the survey of the empirical standards. The results are same as Table A-33-2.

8.2.1.5. X-ray

The whole volume and the necessary rooms are deduced by the number and kinds of performances of the medical program (Table A-31-2). The size of every rooms is decided by the survey of the existing hospitals (Table A-32-2). The other auxiliary rooms are based on the empirical standards. The result are the same as Table A-33-2.

8.2.1.6. Operation

Table 8-5 is presented on the base of the expected annual operating cases and the kinds of operations as shown in the medical program (Table A-31-2) and the operating time of every disciplines. As the result, one operating room (aseptic and septic) is required. The size of operating room is based

on the survey of the existing (Table A-32-2) and the other auxiliary rooms are based on the empirical standards. The results are the same as Table 8-7-2.

8.2.1.7. Delivery Room

There are 0.2 cases in a day in delivery as shown in the medical program (Table A-31-2) but rooms and space are allocated in consideration of extension and based on the empirical standards. The results are the same as Table 8-8-2. So, the total net area of Examination and Treatment is 784 m².

8.2.2. Wards

The number of beds according to every department is decided by the medical program (Table A-31-1). The 2 nursing units will be composed of 25 beds. The ratio of the number of bed rooms in a nursing unit, such as 4-bed room, 2-bed room and 1-bed room, is determined by the empirical standards. The size of these rooms is based on the investigation and analysis of the surveyed hospitals (Table A-32-4). By the utilization of an architectural module, efficient dimensions of these rooms are modified and determined. Every bed room is checked by the physical drawing (Fig. A-6-1, A-6-2, A-6-3, A-6-4). The auxiliary rooms, such as nurse's station, doctor's room, pantry, W.C., utility, and so on, are based on the experience of the existing hospitals. But in the light of the present situation in Korea, a 6-bed room may be needed to achieve an economical plan of the hospital. The distribution ratio and the size of 6-bed will be decided by the survey of the existing hospitals (Table A-32-4) and the empirical standards. So, the total net area of wards is 700 m².

8.2.3. Administration

The volume of administration is dependent on the organization table of hospitals, the necessary manpower, and is deduced from the survey of existing hospitals (Table A-32-1, A-32-2, A-32-3).

8.2.4. Supply

This is composed of pharmacy, sterilization, kitchen and dining, laundry storage, garage and so on. The volumes of every part are based on the survey of the existing hospitals (Table A-32-1, A-32-2, A-32-3). The results are the same as Table A-33-4, A-33-5.

8.2.5. Technical Center

This is composed of boiler room, electric room, carpentry, and so on. And the volume of the technical center is based on the survey of the existing hospitals (Table A-32-1, A-32-2, A-32-3). The results are the same as Table 8-9-2.

8.3. Contents of Room and Space Program

8.3.1. The Ratio of Gross Area to Net Area

The net area is the space required for all independent activities to effectively perform their respective functions. This area doesn't include the corridors, restrooms, wall space and other auxiliary areas. The inclusion of these areas is the gross area. Therefore in the planning of the floor, the followings should be taken into consideration.

Table A-32-1.

Room and Space Analysis for the Existing Hospitals in Korea (I)

(Unit: m²)

	No. of Beds	Name of Hospital									
		Daegu Soosung	Yeengju Chung	Bosung Asan	Kunsan Seagrave	Pusan Choon Hae	Andong Presbyterian Koryo	Ulsan	Mokpo Colomban	Cheongju Provincial	
	12	49	100	102	117	130	130	160	289		
G/Gross Area	635.55	1,544.64	5,857.68	3,003.42	2,235.05	3,241.98	4,444.02	6,261.17	11,283.0		
Surgical Theater	43.25	124.1	456.11	173.7	172.35	212.06	335.93	348.65	675.0		
Outpatients Dept.	34.7	206.4	352.02	261.0	151.76	436.87	705.51	190.68	1,030.5		
Wards	131.0	393.44	1,360.85	776.8	1,098.33	984.73	1,339.85	1,759.63	3,258.0		
Central Supply	-	-	101.75	99.36	-	70.65	79.0	75.53	108.0		
Orthopedics Surgery	12.0	24.3	145.35	43.2	34.05	193.19	157.88	143.58	225.0		
Emergency/I.C.U.	-	10.8	136.17	32.4	33.33	31.86	84.0	-	108.0		
Consultation Rooms	14.0	14.85	188.96	57.6	53.55	23.72	102.25	119.63	301.5		
Personnel Quarters	116.0	68.94	65.35	-	10.66	41.82	48.0	326.19	342.0		
Floor/Corridor	141.3	512.3	1,678.73	906.7	641.87	684.28	1,220.45	1,841.52	3,256.35		
Hotel Services	134.55	158.46	1,052.61	530.36	-	182.45	108.38	1,063.45	1,330.65		
Administration	8.75	31.05	319.78	132.3	39.15	380.35	262.77	392.31	648.0		
(Total) m ² /Bed	53.0	31.5	58.6	29.5	20.9	24.9	37.6	39.13	39.04		
(Wards) m ² /Bed	10.9	8.0	13.6	7.6	9.4	11.6	10.3	10.9	11.27		

Table A-32-2.

Room and Space Analysis for the Existing Hospitals in Korea (II)
Room area by Function(Unit : m²)

Name of Hospital										
Daegu Seosung	Yeongju Chung	Bosung Asan	Kusan Seagrave	Pusan Choonhae	Andong Presbyterian Koryo	Ulsan	Mokpo Colomban	Cheongju Provincial	Average	
12	49	100	102	117	130	130	169	289	24.23 m ² /ea	
Internal Medicine	-	16.2	20.24	36.0	11.7	30.15	23.25	14.28	42.0	22.01 m ² /ea
General Surgery	-	16.2	20.52	18.0	11.7	30.15	23.25	14.28	42.0	22.61 m ² /ea
Orthopedics	-	16.2	-	-	(6.48)	33.45	23.25	14.28	42.0	25.88 m ² /ea
Pediatrics	-	-	20.81	36.0	(9.1)	23.67	23.25	14.28	42.0	26.67 m ² /ea
OB/GYN.	-	12.92	39.33	36.0	(10.45)	28.39	23.25	14.28	42.0	28.02 m ² /ea
Physical Check-up	-	-	-	-	-	-	46.5	-	-	(46.5) m ² /ea
Laboratory	-	(0.3)	0.87	0.42	(0.20)	0.45	0.79	0.42	0.95	0.65 m ² /bed
X-ray Room	-	-	-	28.05	(14.4)	-	24.75	26.73	27.0	26.63 m ² /ea
Operator's Stand & Dark	-	-	-	18.96	20.4	-	(38.25)	21.45	24.0	21.20 m ² /ea
Operating Room	(14.0)	(28.35)	29.07	28.8	24.3	40.56	32.55	35.64	36.0	31.91 m ² /ea
Washing Room	-	(3.6)	13.01	10.8	-	(8.1)	-	11.88	18.0	13.42 m ² /ea
Recovery Room	(6.0)	(16.2)	(42.84)	36.0	23.4	25.92	23.25	35.64	27.0	28.54 m ² /ea
Delivery Room	(9.0)	(17.0)	29.07	27.0	23.4	(16.2)	27.23	(18.81)	36.0	28.54 m ² /ea
Labour Room	-	(11.9)	20.24	-	-	24.3	24.75	25.92	(13.5)	23.80 m ² /ea
4-bed Room	-	-	29.07	-	23.4	21.6	23.25	28.98	27.0	25.55 m ² /ea
2-bed Room	13.5	13.86	14.54	18.0	12.15	16.2	11.63	21.42	13.5	14.98 m ² /ea
1-bed Room	(8.75)	(7.92)	-	14.4	11.7	11.7	-	13.86	13.5	13.03 m ² /ea
Nurses' Station	12.0	13.86	18.11	14.4	13.5	36.48	27.07	13.86	13.5	18.08 m ² /ea
Doctor's Room	-	-	23.4	-	-	24.3	-	-	36.0	27.9 m ² /ea
Administration	0.73	0.63	(3.43)	1.33	0.5	1.93	2.02	1.23	2.37	1.34 m ² /bed
Pharmacy	0.37	0.44	1.04	(0.24)	(0.11)	(0.99)	(0.38)	0.31	0.44	0.57 m ² /bed
Sterilization	-	(0.11)	1.45	0.92	(0.10)	0.54	0.79	0.47	0.71	0.81 m ² /bed
Kitchen	0.75	-	1.70	1.01	-	(0.36)	(0.28)	0.94	1.25	1.13 m ² /bed
Dining	-	-	0.86	1.01	-	0.49	0.45	0.60	0.62	0.67 m ² /bed
Laundry	-	-	1.02	0.97	-	-	-	1.08	0.91	1.00 m ² /bed
General Storage	2.43	1.27	2.4	-	-	-	-	1.22	(0.48)	1.83 m ² /bed
Garbage Collection	-	-	5.7	-	-	-	-	-	-	(5.7) m ² /bed
Technical Centers	-	1.62	(2.95)	1.63	-	(0.61)	-	1.05	1.40	1.43 m ² /bed

(NOTE)

As () is unreasonable,
It is not included in calculation.

Table A-32-3. Room and Space Analysis in Terms of Area Ratio for the Existing Hospitals in Korea (III)

Name of Hospital											(Unit : %)
Daegu Soosung	Yeongju Chung	Bosung Asan	Kunsan Seagrave	Pusan Choonhae	Andong Presbyterian Koryo	Ulsan	Mokpo Colomban	Cheongju Provincial			
12	49	100	102	117	130	130	160	289			
Surgical Theater	6.8	8.0	0.8	5.8	7.7	7.6	5.6	6.0			
Outpatients Dept.	5.5	0.4	6.0	8.7	6.8	15.8	3.0	9.1			
Wards	20.6	1.3	23.2	25.9	49.1	30.1	28.1	28.9			
Central Supply	-	-	1.7	3.3	-	1.8	1.2	1.0			
Orthopedics	1.9	1.6	2.5	1.4	1.5	3.6	2.3	2.0			
Emergency/I.C.U	-	0.7	2.3	1.1	1.5	1.9	-	1.0			
Consultation Room	2.2	1.0	3.2	1.9	2.4	2.3	1.9	2.7			
Personnel Quarter	18.3	4.5	1.1	-	0.5	1.1	5.2	3.0			
Floor/Corridor	22.2	33.2	28.7	30.2	28.7	27.5	29.4	28.9			
Hotel Services	21.2	10.3	18.0	17.7	-	2.4	17.0	11.8			
Administration	1.4	2.0	5.5	4.4	1.8	5.9	6.3	5.7			

Table A-32-4. Survey Results Showing the Area of Inpatient Room According to Number of Beds

Hospital Identification	1-Bed			2-Bed			
	Area (M ²)	Length (M)	Width (M ²)	Hospital Identification	Area (M ²)	Length (M)	Width(M ²)
1	6.46	3.4	1.9	1	11.7	4.5	2.6
2	7.20	3.43	2.1	2	12.0	4.0	3.0
3	7.92	3.3	2.4	3	12.15	4.5	2.7
4	8.75	3.5	2.5	4	12.6	4.2	3.0
5	9.00	3.0	3.0	5	13.5	4.5	3.0
6	11.84	4.57	2.59	6	15.36	4.57	3.36
7	12.6	4.2	3.0	7	15.54	4.2	3.7
8	13.5	4.5	3.0	8	19.47	5.9	3.3

Hospital Identification	4-Bed			6-Bed			
	Area (M ²)	Length (M)	Width (M ²)	Hospital Identification	Area (M ²)	Length (M)	Width(M ²)
1	21.504	4.8	4.48	1	30.09	5.49	5.48
2	23.142	5.51	4.2	2	30.15	6.7	4.5
3	23.25	5.0	4.65	3	36.00	6.0	6.0
4	23.40	5.2	4.5	4	40.47	7.1	5.7
5	27.00	6.0	4.5				
6	28.56	6.8	4.2				

YEO JU HOSPITAL (50 BEDS)

Table A-32-5. Table : Calculation of Operation Rooms for the Yeoju Hospital

Medical Department	Op./Year	Op./Day (280d/y)	Min/Op. (incl.room preparat.)	Min/y	#No of op-rooms	Aseptic % Rooms	Septic % Rooms
General Surgery	200	0.8	100	20,000	0.2	80	0.16
Orthopedic Surgery	62	0.3	75	4,650	0.05	100	0.05
OB & Gyn	115	0.5	70	8,050	0.08	65	0.06
		1.6				0.27	0.06

* Capacity = $280 \times 360 = 100,800$ Min/Year.

Table A-32-6 Calculation of Consultation Rooms for the Yeoju Hospital (50 Bed)

Department	Consultation/ year	NIN./ Consultation	NIN./ Year	* Required No. of Room
Internal Medicine	14,032	10	140,320	2
General Surgery	3,062	8	24,496	1
Orthopedics	1,372	15	20,580	1
Neuro Surgery	-	-	-	-
Pediatrics	5,152	15	77,280	1
OB and GYN	3,649	10	36,490	1
ENT	-	-	-	-
Ophthalmology	-	-	-	-
Urology	-	-	-	-
Dental	-	-	-	-
Neuro Psychiatry	-	-	-	-
Other	-	-	-	-

TOTAL: 6R

* CAPACITY: $5^d \times 6^h + 1^d \times 3^h = 33^h/d$
 $33^h \times 50^w = 1,650^h/y$
 $1,650^h \times 60^m = 100,000 \text{ min}/y$

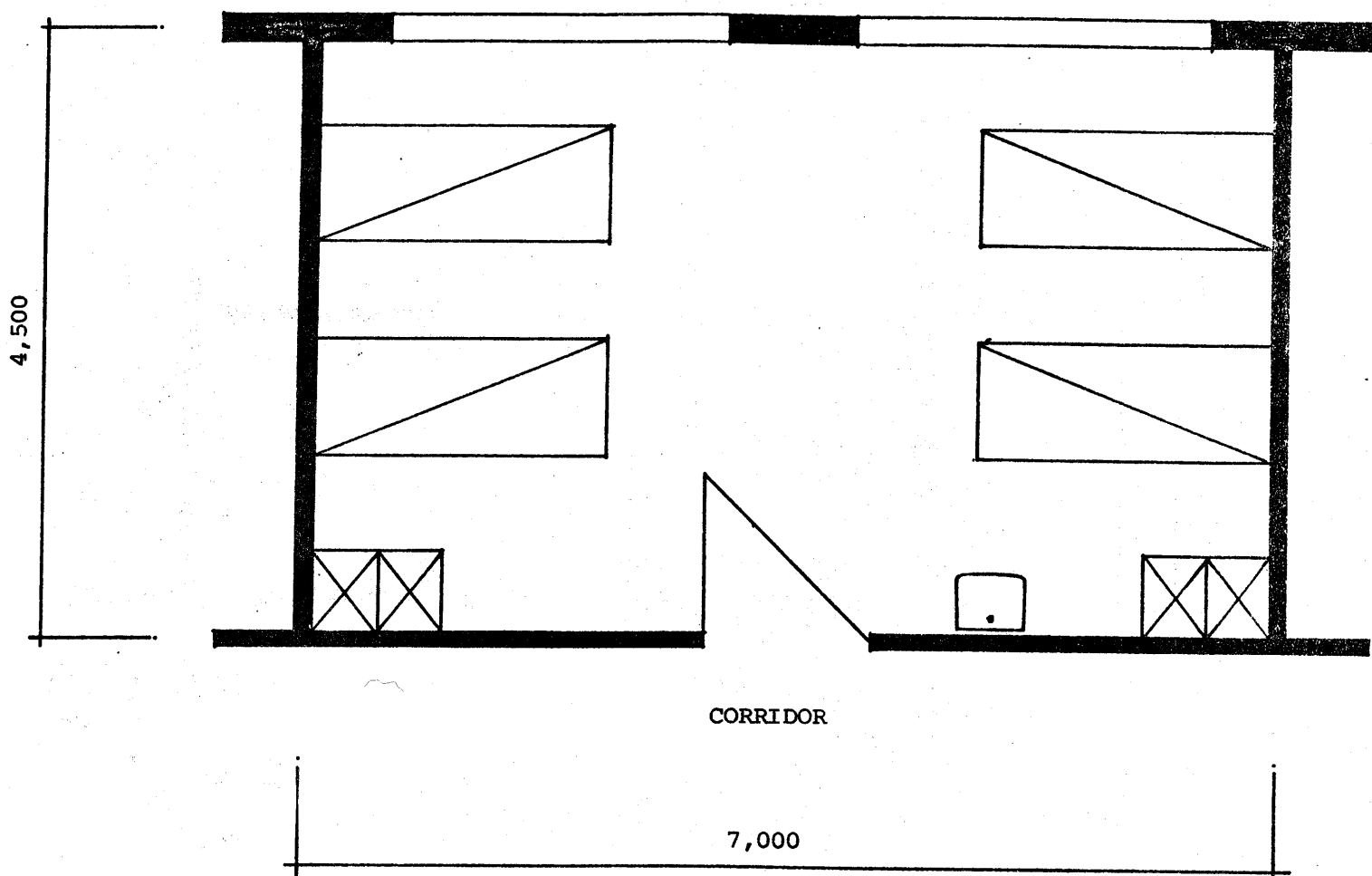


Fig C-6-1. Sample Layout for 4-Bed Room

S:1/50

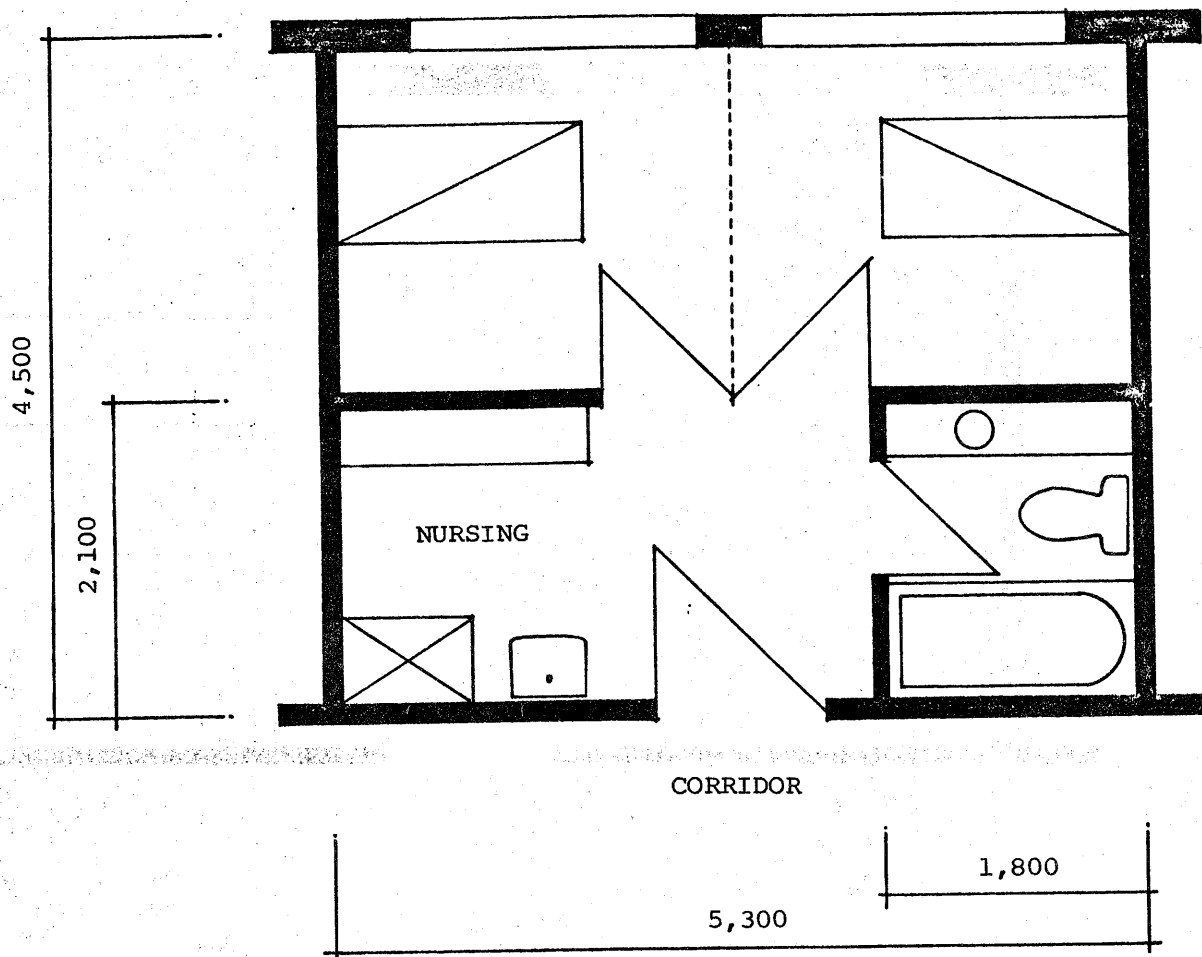


Fig C-6-2. Sample Layout for 2-Bed Room for Pediatric Case

S:1/50

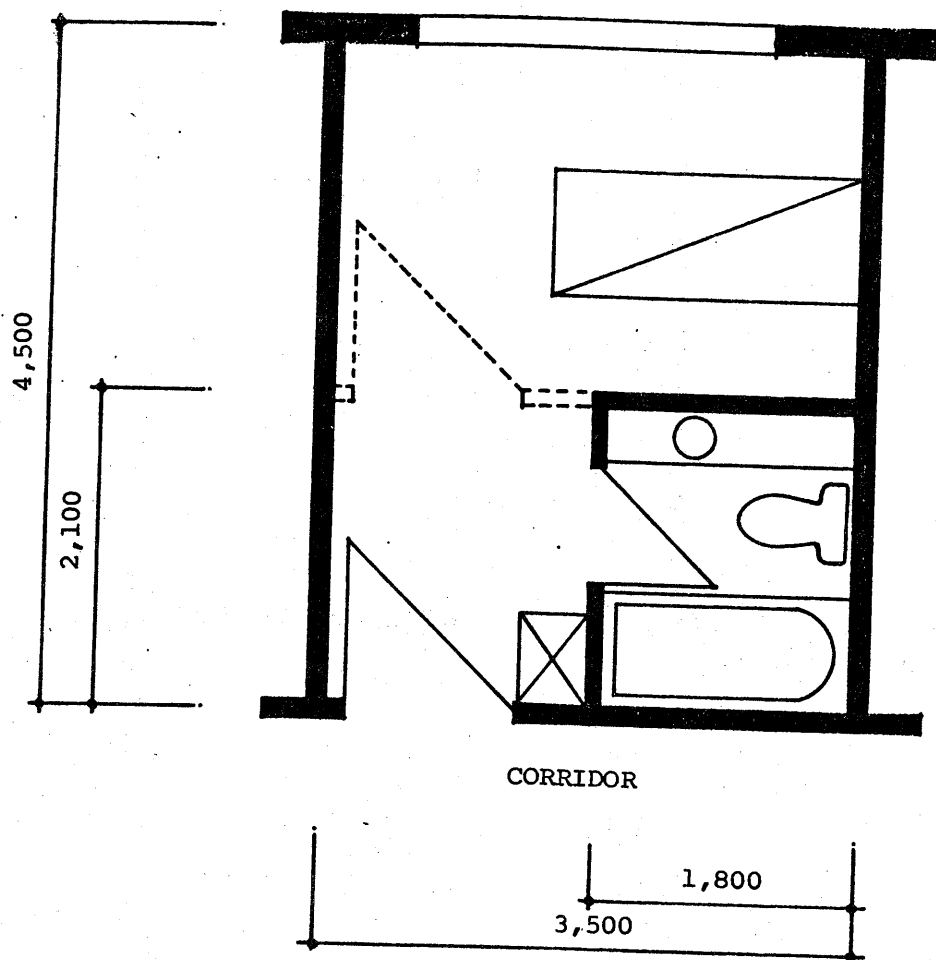


Fig C-6-3. Sample Layout for 1-Bed Room

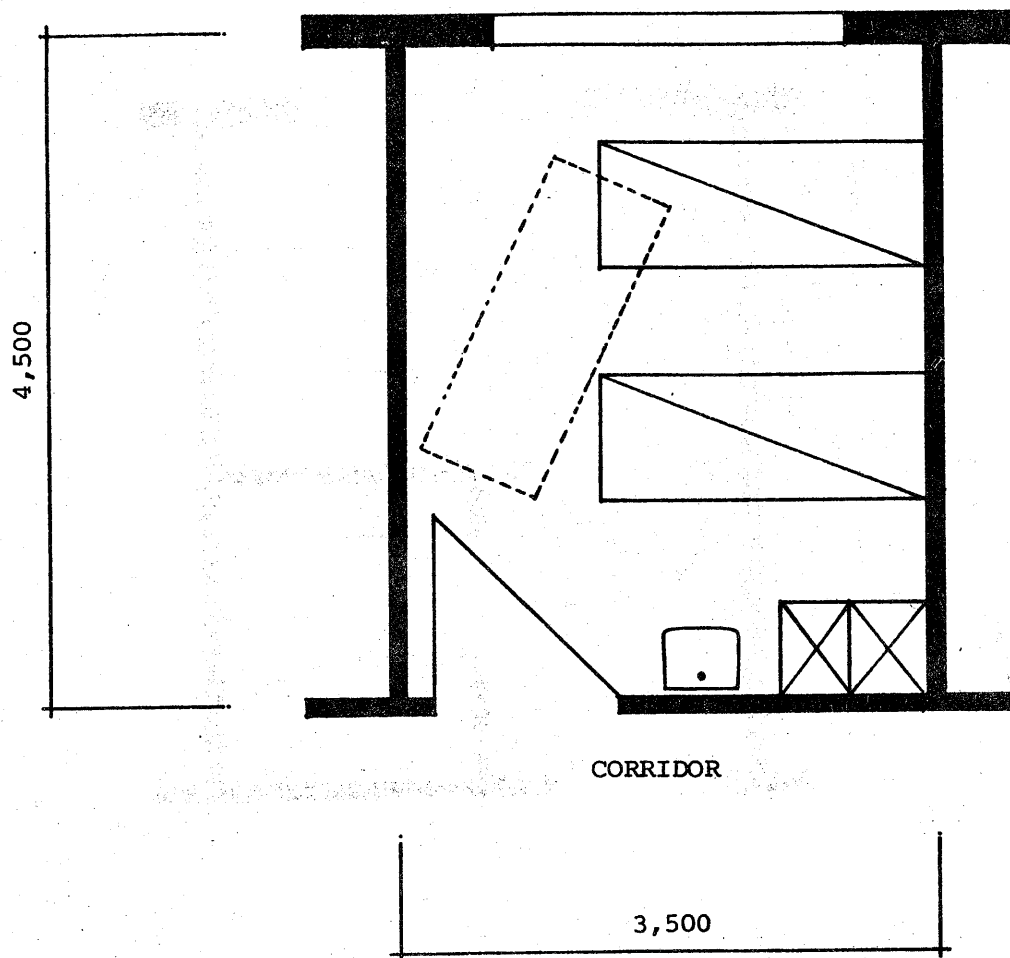


Fig C-6-4. Sample Layout for 2-Bed Room

S:1/50

ROOM & SPACE PROGRAM : YEO JU (50 BEDS)

TABLE A-33-1. ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	.II	III	IV	V
1	EXAMINATION AND TREATMENT			
101	ENTRANCE AND EMERGENCY			
101/01	Entrance hall		40	
/02	Guards room	1	8	
/03	First aid room	1	32	
/04	Preparation room	1	12	
/05	Scrub room + dress changing	1	8	100
102	OUTPATIENTS DEPARTMENT			
102/01	Internal medicine, superintendent consultation	1	24	(to be checked according to manpower requirement list)
/02	Internal medicine	2	(24) 48	
/03	General surgery	1	24	
/04	Orthopedics	1	24	
/05	Pediatrics	1	24	
/06	OB & GYN	1	24	
/07	Physical check-up	1	24	
/08	Waiting areas	6	(12) 72	
/09	Student's room	1	36	
/10	W.C. for patients + anteroom	2	6	
/11	W.C. for staff + anteroom	2	6	
/12	Doctor's locker room (for all departments)	1	18	
/13	Nurses' locker room (for all departments)	1	18	
/14	Night duty	2	(12) 24	372
105	LABORATORY			
105/01	Specimen taking room, incl. W.C.	1	12	
/02	Chemical and haematological	1	16	

ROOM & SPACE PROGRAM : YEO JU (50 BEDS)

TABLE A-33-2 ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
105/03	(105 continued) Bacteriological and serological	1	16	
/04	Storage, cleaning, sterilizing	1	16	60
106	MORGUE			
106/01	Corpses' room	1	16	
/02	Coffin room	1	16	32
107	X-RAY			
107/01	X-ray room	1	32	
/02	Dressing cubicles + 1 W.C.	4	(1.5) 6	
/03	Operator's stand + dark room	1	18	56
109	OPERATION			
109/01	Operating room	1	36	
/02	Preparation room (anaesthesia)	1	12	
/03	Scrub room + dress changing + shower	1	16	
/04	Recovery room (2 beds)	1	16	
/05	Sterilizing room + storage (Septic operations in first aid room)	1	24	104
110	DELIVERY			
110/01	Delivery room (2 beds)	1	32	
/02	Labour room (2 beds)	1	12	
/03	Bath room + W.C.	1	16	60
			TOTAL 1	784

ROOM & SPACE PROGRAM : YEO JU (50 BEDS)

TABLE A-33-3 ROOM & SPACE PROGRAM : WARDS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
2	WARDS			
201	1ST NURSING STATION (25 BEDS)			
201/01	4 - Beds rooms	3	(32) 96	
/02	2 - Beds rooms	5	(16) 80	
/03	1 - Beds rooms, incl. sluice + lavatory	3	(16) 48	
/04	Nurse's station	1	12	
/05	Nurse's room (locker + rest room)	1	12	
/06	Utility room, clean	1	12	
/07	Utility room, dirty	1	12	
/08	Pantry	1	8	
/09	Bath room + shower	1	12	
/10	W.C. for patients + anteroom	4	12	
/11	Doctor's room + examination	1	24	
/12	W.C. for staff + anteroom	2	6	334
202	2ND NURSING STATION (25 BEDS)			
202/01	4 - Bed rooms	2	(32) 64	
/02	2 - Bed rooms	5	(16) 80	
/03	1 - Bed rooms incl. sluice + lavatory	3	(16) 48	
/04	Bassinet room close to two 2-Bed rooms, incl. utility sluice	1	16	
/05	2-Bed rooms, pediatrics, incl. sluices	2	48	
/06	Nurse's station	1	12	
/07	Nurse's room (locker + night duty)	1	12	
/08	Utility room, clean	1	12	
/09	Utility room, dirty	1	12	
/10	Pantry	1	8	
/11	Bath room + Shower	1	12	
/12	W.C. for patients + anteroom	4	12	
/13	Doctor's room + examination	1	24	
/14	W.C. for staff + anteroom	2	6	366
			TOTAL 2	700

ROOM & SPACE PROGRAM : YEO JU (50 BEDS)

TABLE A-33-4 ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
3	ADMINISTRATION			
301/01	Superintendent office	1	18	
/02	" secretary	1	12	
/03	Administration staff	1	90	
/04	Archive	1	30	150
4	SUPPLY			
401	PHARMACY			
	Pharmacist's office + storage + pharmacy reception			30
402	STERILIZATION (See 109, Operation)			
404	KITCHEN AND DINING			
404/01	Cooking + Preparing + wash-up	1	60	
/02	Office	1	12	
/03	Storages	1	40	
/04	Dining (for all staff)	1	30	
/05	W.C. for staff	2	3	
/06	Locker for all supply personnel	1	18	163

ROOM & SPACE PROGRAM : YEO JU (50 BEDS)

TABLE A-33-5 ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
405	LAUNDRY Sorting, Washing, Ironing, Storage, Sewing			75
406	GENERAL STORES			75
407	GARBAGE COLLECTION			18
408	GARAGE + DRIVERS' ROOM			36
			TOTAL 4	397
5	TECHNICAL CENTERS INCL. WORKSHOPS			70
TOTAL 1	Examination and Treatment	784		
TOTAL 2	Wards	700		
TOTAL 3	Administration	150		
TOTAL 4	Supply	397		
TOTAL 5	Technical Centers	70		
GRAND NET TOTAL		2,101 M ²		
GRAND GROSS TOTAL		3,571.7 M ² (G/N = 1.7)		

- thickness of the wall and columns
- corridors
- hall and lobby
- stairs
- elevator shaft and hall
- maintenance and other auxiliary areas.

The ratio of gross to net, which is shown in the table of the Room and Space Program is the statistical data according to the number of small rooms and the main faculty of the building

- G/N = 1.67 : General buildings
- G/N = 1.5 : Residencial facilities
- G/N = 1.4 : Buildings which contain many large rooms

But the ratio of corridor to total area is about 30% (G/N = 1.5) which is shown in the survey of the existing hospitals (Table 8-3). But we choose 1.7 as the ratio of gross to net, in order to secure the space. Also, that is considered most suitable to the characteristics of hospital.

8.4. So, the required Grand Net Total area for 50 beds hospital is 2,101 m² (Grand Gross Total Area is 3,571.7 m²) (Cf. Table A-33-5).

9. ARCHITECTURAL DESIGN PRINCIPLES AND SPECIFICATIONS FOR CONSTRUCTION YEJU HOSPITAL (50 BEDS)

9.1. General Principles

This general hospital, which will be built in Yeosu area, is a rural type district medical center. And it will satisfy the medical requirements from the surrounding rural area including Yeosu district. So, it should be established to perform the ideal, welfare society.

9.2. Design Criteria

The architectural design of this hospital should take into consideration the Medical Program.

9.2.1. In accordance with the Medical Program the Hospital structure will accomodate 50 beds. The distribution of beds by medical departments are as follows.

Internal medicine	17 beds
General surgery	12 beds
Orthopedics surgery	13 beds
Pediatrics	4 beds
Ob. & Gyn.	4 beds
Total	50 beds

9.2.2. In order to construct a hospital which is able to carry out the expected functions to provide high quality medical service, the room and space program should take the following into consideration.

9.2.2.1. The outpatient service of a general hospital is an indispensable element of a hospital function, although the function seems to be declining in the future.

9.2.2.2. The allocation of rooms and medical facilities should be in a manner to permit optional utilization among the departments.

9.2.2.3. The preventive medicine aspect of the hospital operation should be considered.

9.2.2.4. The future alteration and expansion of the hospital should be considered.

9.3. The Hospital Site

The site of the hospital will be located at downtown Yeosu Eup. It takes 10 minutes from the Gun government building to the proposed hospital site on foot. The longitudinal axis of the building will be in the east-west direction and the building will face south to maximize energy conservation.

9.3.1. The master Plan of the Proposed Hospital Location
The physical characteristics of the proposed site should be considered, including soil conditions, under ground water, and meteorological considerations.

9.3.2. Site Preparation
The site preparation for the hospital construction should follow the Master Plan. It is recommendable that the standard height of the proposed site be at least 50 cm higher than that of the main traffic level. Minimum length of frontage for the site would comprise an area of a quarter of the entire facility length.

9.3.3. Public Utilities
A separate drainage system for the storm drain and sewage drain will be constructed. A sewage treatment facility will be constructed. The water will be supplied by the city main water supply. Also, additional water for cleaning and fire prevention will be supplied by an under ground reservoir. The electric power line will be connected to the main power line of the Korea Electric Company and the telephone line will be connected to the main city telephone line.

9.3.4. Building Site Plan
In accordance with the Master Plan the hospital will face south to maximize energy conservation. The separation into the interrelated but independent function will encompass the outpatient area, wards, emergency room and other service facilities. A parking facilities will be constructed at the front and the side of the building and landscaping will enhance the physical appearance of the building.

9.4. Functional Building Layout of the Hospital
The plan of hospital construction should take into the above-mentioned considerations to promote the most efficient medical service delivery. As reflected on the lay-out plan, the hospital features three major sections: outpatient, inpatient department, and support facilities.

9.4.1. The Plan of Room Distribution

9.4.1.1. Outpatient Department

The outpatient section should be located in front of the hospital nearest to the road. It should be located allowing optimal coordination with the interior of the hospital. The outpatient unit can be reached from the hospital by a separate entrance. The location of the outpatient unit is of utmost importance as it is also called upon to handle examination and treatment of inpatients. Beside the examination and treatment rooms, the outpatient unit the X-ray room, the laboratory, the pharmacy (drugstore and distribution) and the emergency surgery room.

9.4.1.2. In-patient Department

The construction of an inpatient department should allow the easy expansion and a modification of the hospital wards should it be necessary in the future. The internal hospital area consists of the individual wards including the surgical unit. The lay-out plan utilizes the sectional system. In addition to the examination room, the wards are equipped with all of the facilities necessary for optimum working efficiency. Room sizes vary between one-bed room and six-bed room. The maternity department includes the delivery section and the required ward with nursing facilities for infants. The surgery unit comprises operating theatres and anaesthetic rooms, with the substerilization and lavatory sandwiched between the operating theatres. There is open space for bed parking. The sterile area also encompasses the recovery room and intensive care area followed by central sterilization which is subdivided into a working room and a store for sterile goods, and finally, yet outside the sterile area, the dressing rooms.

9.4.2. Administrative Department

The administrative department will be located near the hospital entrance and will be separated into 3 sections.

- administration
- locker rooms and lavatories for personnel
- storage

9.4.2.1. The Administrative Section will be the center of hospital operation.

9.4.2.2. The locker rooms and lavatories will be established for all the workers. The ratio of female and male workers probably 2 to 1 will be considered to establish the most convenient utilization among the workers. Washing facilities are provided in accordance with the number of persons starting or ending their duties at the same time.

9.4.2.3. The storage will handle all supplies with the exclusion pharmaceutical supplies, food, and other supplies.

9.4.3. Functional Arrangement of the Supply Unit.

The provision of supplies in the hospital should be at a maximum efficiency in a manner that the suppliers do not cross any internal passages. The machinery operating at a high noise level will be located away from the patients.

9.4.4. Other Facilities

To maximize the hospital efficiency, the optimal size of the kitchen, staff

dining room, laundry, maintenance rooms and mortuary should be determined. Technical centers such as the boiler room, generator, incinerator workshop will be placed underground.

9.5. Design Principle

Hospital design should follow the city planning code, building code, fire laws and other regulations of the Republic of Korea regarding construction of hospitals and buildings.

9.5.1. The architectural planning of the hospital is based on a "modular planning system". The development of this system was preceded by a study of the functions and the operational, economical and constructional interdependence of the individual medical sections, with due regard to constructional and architectural requirements. Separation of interior and exterior traffic routes is considered according to practical requirements for the traffic of persons and materials.

9.5.2. Module System

The system is in its integrity based on a three-dimensional 30 cm module, the basic scanning field being the quadruple module = 120 cm and the large scanning field being the three fold basic scanning field = 360 cm. All dimensions of the building are selected to fall in line with one or any number of large scanning fields. All rooms have an inner height of 270 cm. All wings, except the entrance and the autopsy unit, have the same height. The proposed modular planning system serves the following purposes:

- Construction of hospitals of size varying between 50 and 250 beds, through the assemblage of selfcontained modules.
- Extension of such hospitals whenever desired by simply adding new modules, thus avoiding rebuilding.
- Keeping running costs at a minimum.
- Installation of air-conditioning, required minimally
 - Rearrangement of modules without any special difficulties to meet changing medical requirements.
 - Choice of reinforced concrete construction, and partly movable partition walls.
 - Possibility of continuous adaptation to future requirements.

9.6. Specifications for Architectural Work

Without special notes, construction should follow with general standard specifications for building construction as per the building codes in Korea.

9.6.1. Architecture

Method of carcass work is a reinforced concrete construction system under special consideration of the architectural facade design. Main structure is composed of four basic elements; columns, girders, floor slabs, and wall. The grid dimension is 7.20 m x 7.20 m, the associated suspended ceiling and the floor form a free hall. The weight of the roof and the ceiling as well as of the incorporated installations is transmitted to the foundation through the roof and the outer walls are conveyed to the foundation or the flooring. Under the corridor there is a basement serving as installation passage for all installations. The installation passage can be frequented and permits access from the

outside. Hence, Maintenance and repair can be carried out without interference with the work going on inside the hospital. The outer walls are based on foundations commensurate with the local conditions where as the two side walls of the corridor rest on the two side walls of the installation passage. All the other partitions have no foundation but are supported by a flooring of no less than 10 cm thickness. The floor proper and the wall joints must be carefully executed as they are essential contributing factors to the overall hygiene of the hospital. The floor paving must be carefully jointed, antibacterial and easy to clean. Moreover, the individual rooms, passages and the veranda must all be at the same level so that hospital bedsteads can be wheeled about without being subjected to jolts or vibrations. In rooms where the danger of explosions exists (as in operating rooms), the PVC covering will be of the electrical conductive type, with a conduction resistance value of about 10^5 ohms. A network of copper foil inserts will be underlaid as grounding and connected with the neutralizing conductor. Site location:

Main building area:	Total area :	3,900 m ²	
		<u>Area</u>	<u>Fl. height</u>
Basement :		498.96 m ²	5.1 m
First floor :		2,378.16 m ²	4.2 m
Second floor :		926.64 m ²	3.6 m
Other :		96.24 m ²	3.0 m

9.6.2. Design of facade

Architectural facade should be simply designed with a modern feeling. The hospital building should fit into the environmental conditions, orientation and level of building site, traditional concepts, etc. All exterior surfaces will receive a slightly profiled fair
- faced concrete shuttering finish, and partly showing natural stone or bricks.

9.7. Electrical Installation

In the planning and execution of the entire electrical engineering system, the pertinent regulations of Korea are used as guidelines.

9.7.1. Power installation

The power will be supplied by the main electric power plant of the building from the Korea Electric Company line, 22,900 V-Y, heavy power. First stage of distribution voltage, Received 22,900 V-Y and voltage down to 3,300 V-A. Supply to each station 3,300 V-A. Second stage of distribution voltage

light and heat	:	3φ 4w 380/220v	AC 60Hz
general power	:	3φ 4w 380/220v	AC 60Hz
cobling power	:	3φ 4w 380/220v	AC 60Hz
refrigerator	:	3φ 4w 3,300v	AC 60Hz
medical equipment power	:	3φ 4w 380/220v	AC 60Hz

9.7.2. High tension switches:

Main	:	M. O. C. B
Tie	:	M..O. C. B
Branch	:	M. O. C. B

All connections between the sections and the transformers consist of synthetic resin insulated cables with realed connectors. Supply of power requirement is provided by transformers equipped with thermal circuit breaker and Buchholtz relays.

9.7.3. Low tension switches :

Main : A. C. B

Tie : A. C. B

Branch : N. F. B

The low tension station is a steel construction. The station houses automatic regulation and the power control mechanism of the emergency power supply as well as power switches and fuses.

9.7.4. Emergency power supply

An emergency power supply unit is installed to provide for the necessary supply of emergency power in time of power failure. The generator is a diesel-powered, water cooled, and has a 3-phase exit of 220 V AC 60Hz. The generator automatically self-starts at power failure through the automatically controlled starter battery, and is located in the low tension station.

9.7.5. Low current installations.

The hospital building should have the following facilities installed:

- (1) Telephone installation
- (2) Clock installation
- (3) Fire alarm system
- (4) Collective antenna system
- (5) Public address and nurse paging system
- (6) Elevators

9.8. Mechanical Installation

9.8.1. Heating system

Design and installation of the heating system is based on the relevant regulations. The following heat generators will be installed: Boiler for the supply of the general heating and air exchange system. Boiler for the hot water supply system. Boiler for the generation of steam. The oil burners to be installed use Banker C-Oil. The central boiler plant houses all necessary distributors with pumps and valves or sliding valves. It also accommodates the water treatment plant for the steam generator.

9.8.2. Air Conditioning, Ventilation

Design and installation are based upon the relevant regulations. For ventilation as well as air conditioning, a decentralized system, foreseen. The installations are sectionally sub-divided in such a way as to permit simultaneous operation or individual operation, so that operative sections of the compound can be run or de-activated individually. Extract ventilation ducts are provided for less important rooms, like storage rooms, lavatories, etc., Power ventilation units will be provided for kitchens, corridors, stair cases, and entrance halls. Wards, lobbies, offices, consulting and treatment rooms will be partially airconditioned using power convectors. Operation rooms and adjacent facilities will be fully airconditioned.

9.8.3. Design and development of sanitary equipment and installations conforms to the relevant regulations. Enough water, of potable quality, must be at hand on the site. The sanitary installations comprise : pure water supply, waste water disposal, fire safety piping inside of the building, and

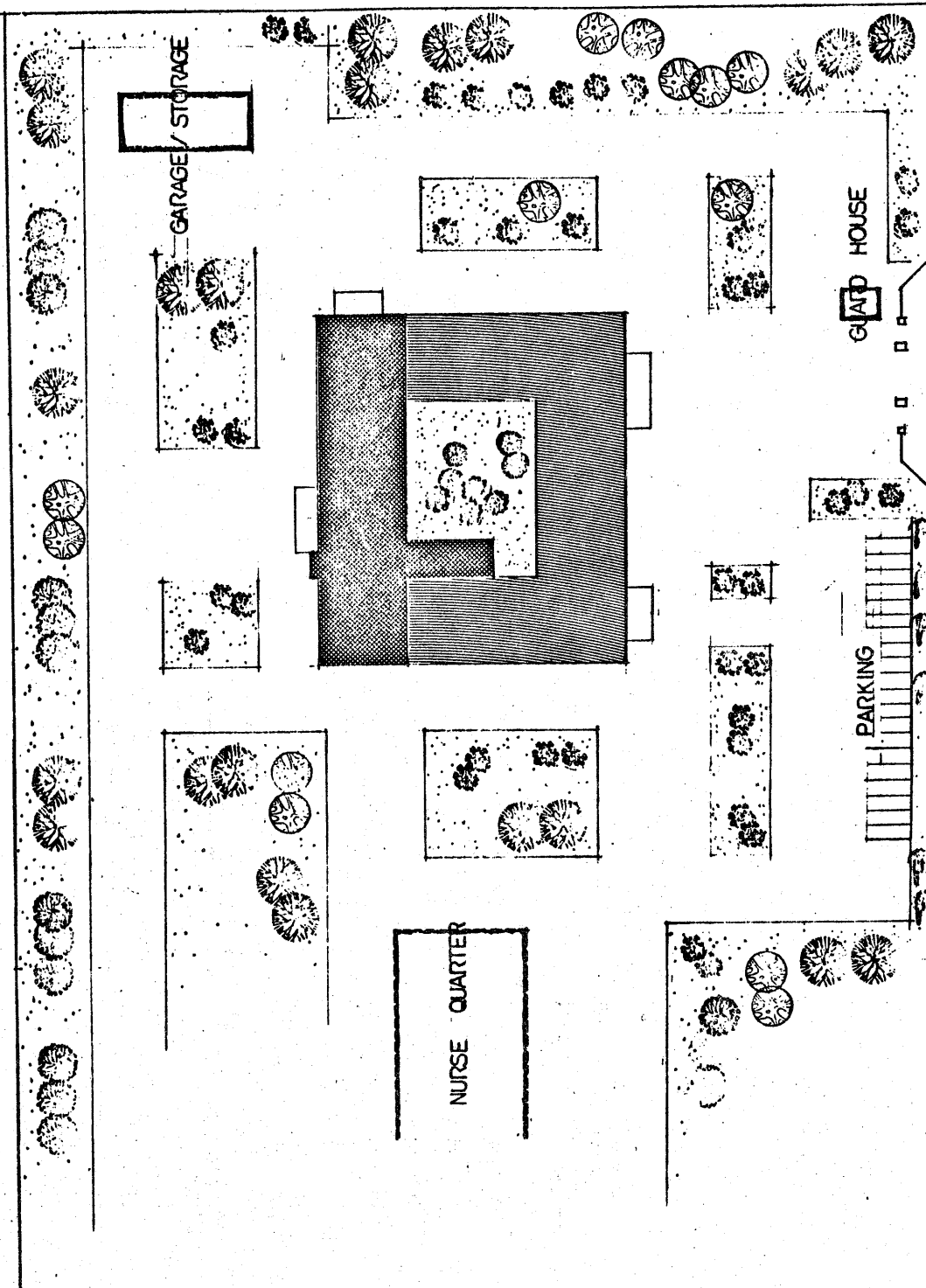
Design Schedule

Works	Month		1		2		3		4	
	Date		15	30	15	30	15	30	15	30
1. Architectural Design										
Preliminary Design										
Working Detail Drawing (Structure)										
Working Detail Drawing (Architecture)										
Specification Writing										
Cost Estimation										
2. Mechanical Design										
Preliminary Design										
Detail Design										
Specification Writing										
Cost Estimation										
3. Electrical and Communication Design										
Preliminary Design										
Detail Design										
Specification Writing										
Cost Estimation										
4. Civil Engineering Design and Cost Estimation										

Construction Working Schedule

Works	Month		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
	Date		15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30
1. Site Preparation and Civil Work																																
2. Building Construction																																
Temporary Work																																
Earth Work																																
Carpentry Work																																
Concrete and Reinforced Concrete Work																																
Masonry Work																																
Door and Windows																																
Plastering Work																																
Glazing Work																																
Tile and Finishing Work																																
Painting Work																																
Miscellaneous Work																																
3. Mechanical Construction																																
Heating																																
Cooling and Ventilation																																
Water Supply and Sanitary Work																																
Gas, Air line etc.																																
Miscellaneous Work																																
4. Electric Construction																																
Conduct Piping Work																																
Conduct Piping																																
Electric Wiring																																
Light Fixture Work																																
Electric Power Work																																
Generator System																																
Communication Work																																

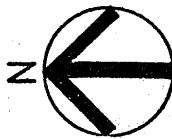
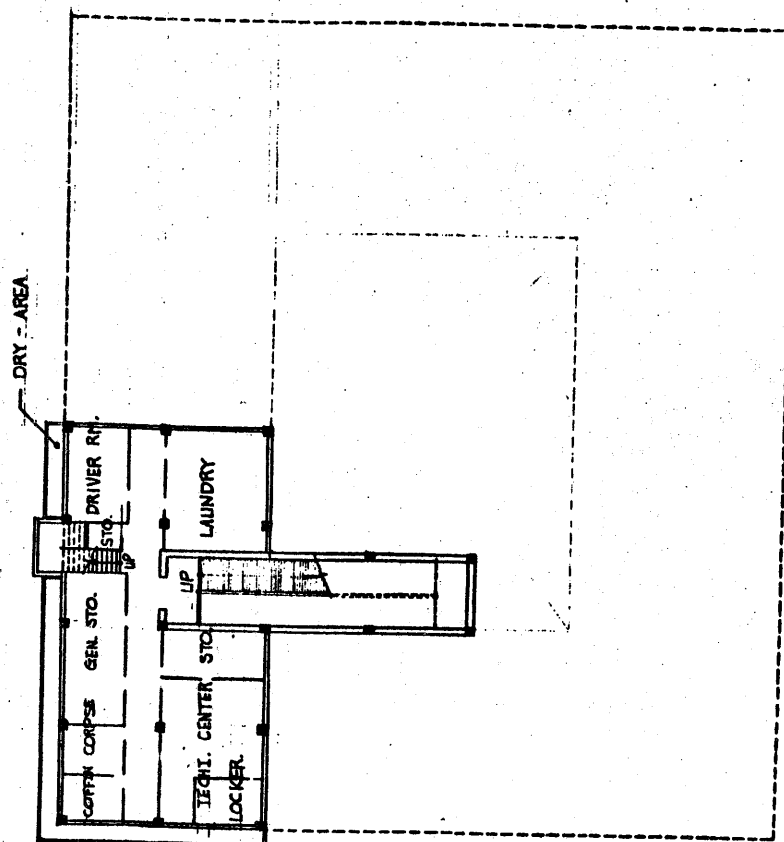
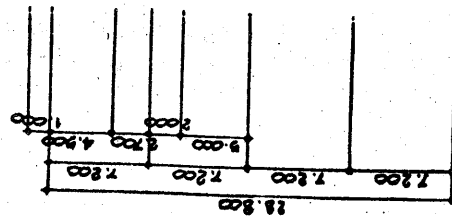
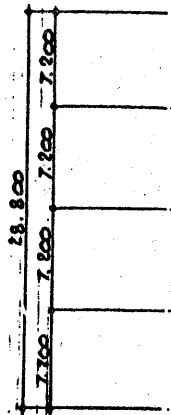
YEO JU
HOSP.



SITE PLAN (50 DED)

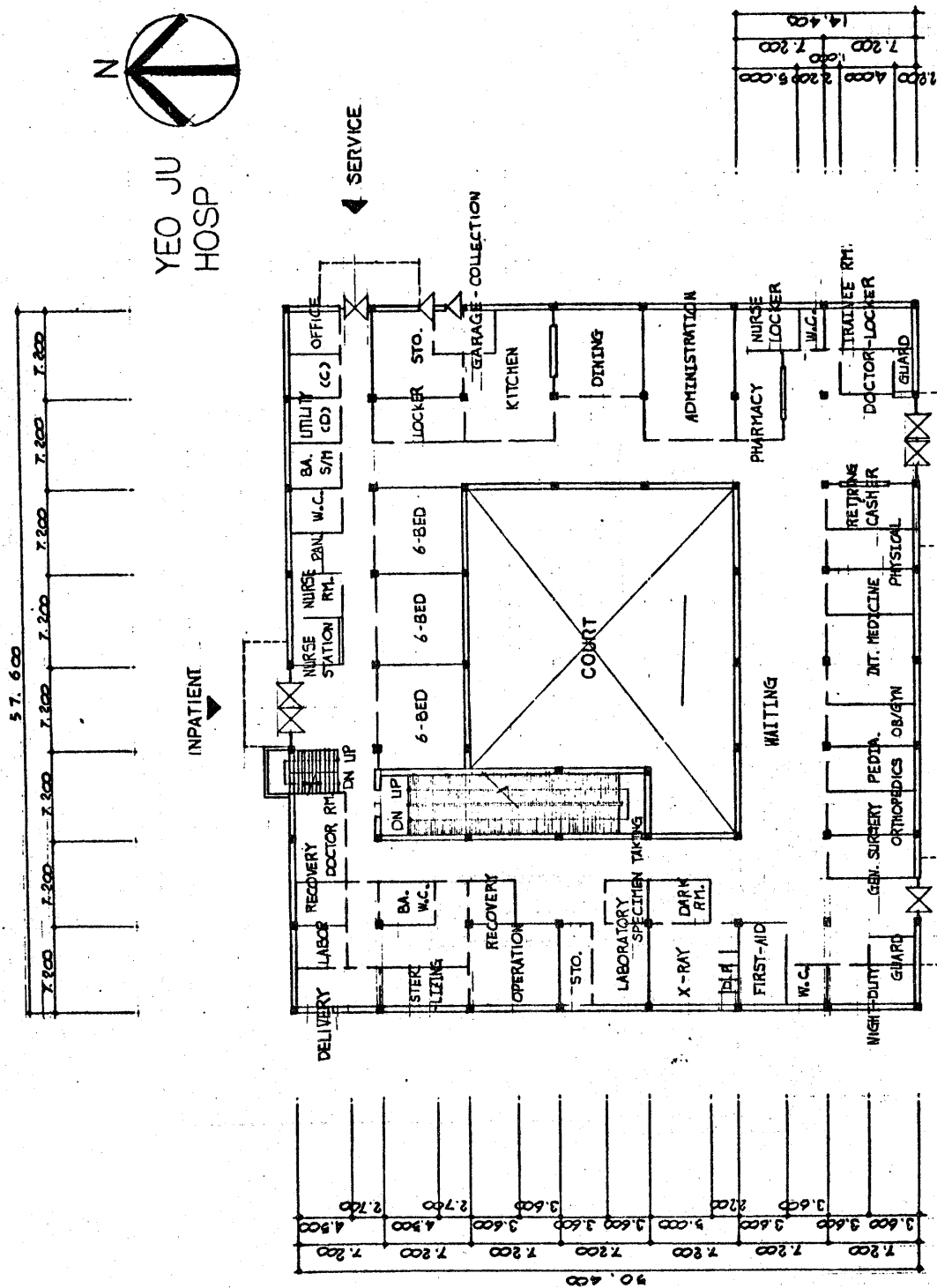
S : 1/1200





YEO JU
HOSP

A BASEMENT FLOOR PLAN (50 BED)
S : 1/600 (498.96 M²)



1st FLOOR PLAN (50 BED)

A

S : 1/600

(2378.16 M²)

Architectural floor plan of the Technical Center. The plan includes the following rooms and dimensions:

- RECEPTION**: 12' x 12'
- OFFICE**: 12' x 12'
- CONFERENCE**: 12' x 12'
- TRAINING**: 12' x 12'
- LABORATORY**: 12' x 12'
- STORAGE**: 12' x 12'
- RESTROOM**: 12' x 12'
- TECHNICAL CENTER**: 12' x 12'
- ENTRY**: 12' x 12'
- LOBBY**: 12' x 12'
- STAIRS**: 12' x 12'
- ELEVATOR**: 12' x 12'
- PLANT**: 12' x 12'
- MECHANICAL**: 12' x 12'
- ELECTRICAL**: 12' x 12'
- TELEPHONE**: 12' x 12'
- MAIL ROOM**: 12' x 12'
- RECEPTION**: 12' x 12'
- OFFICE**: 12' x 12'
- CONFERENCE**: 12' x 12'
- TRAINING**: 12' x 12'
- LABORATORY**: 12' x 12'
- STORAGE**: 12' x 12'
- RESTROOM**: 12' x 12'
- TECHNICAL CENTER**: 12' x 12'
- ENTRY**: 12' x 12'
- LOBBY**: 12' x 12'
- STAIRS**: 12' x 12'
- ELEVATOR**: 12' x 12'
- PLANT**: 12' x 12'
- MECHANICAL**: 12' x 12'
- ELECTRICAL**: 12' x 12'
- TELEPHONE**: 12' x 12'
- MAIL ROOM**: 12' x 12'

○ MAIN SECTION (50 BED) S : 1/600

10. SPONSOR OF HOSPITAL

10.1. Korea University, the sponsor of the proposed hospitals in the Yeosu, Banwol and Guro project areas, assumed the role of the forerunner of the higher educational institutions by establishing Posung College, the first of its kind in Korea, in 1905. Korea-Choongang Education Foundation absorbed Posung College in 1945 and transformed it into a university status in the following year. The foundation incorporated Woosuk University with the College of Medicine, Junior College of Public Health and Medical Technology, and its hospital in 1971. Thus, Korea University has developed into one of the leading higher educational institutions in Korea today. The sponsorship of the project constructing the hospitals in the above-mentioned regions will be assumed by the Korea University under the foundership of Korea-Choongang Educational Foundation.

10.2 Legal qualification of sponsor

Korea University was approved by the Government on August 15, 1948 and Korea-Choongang Educational Foundation was approved as its founder by the authority on April 25, 1964. Intergovernmental agreement between Korea and West Germany regarding the sponsorship of Korea University for the several project hospitals are clearly illustrated in the text of the bilateral contract signed on April 11, 1977 by the governmental authorities.

10.3. Organization and personnel

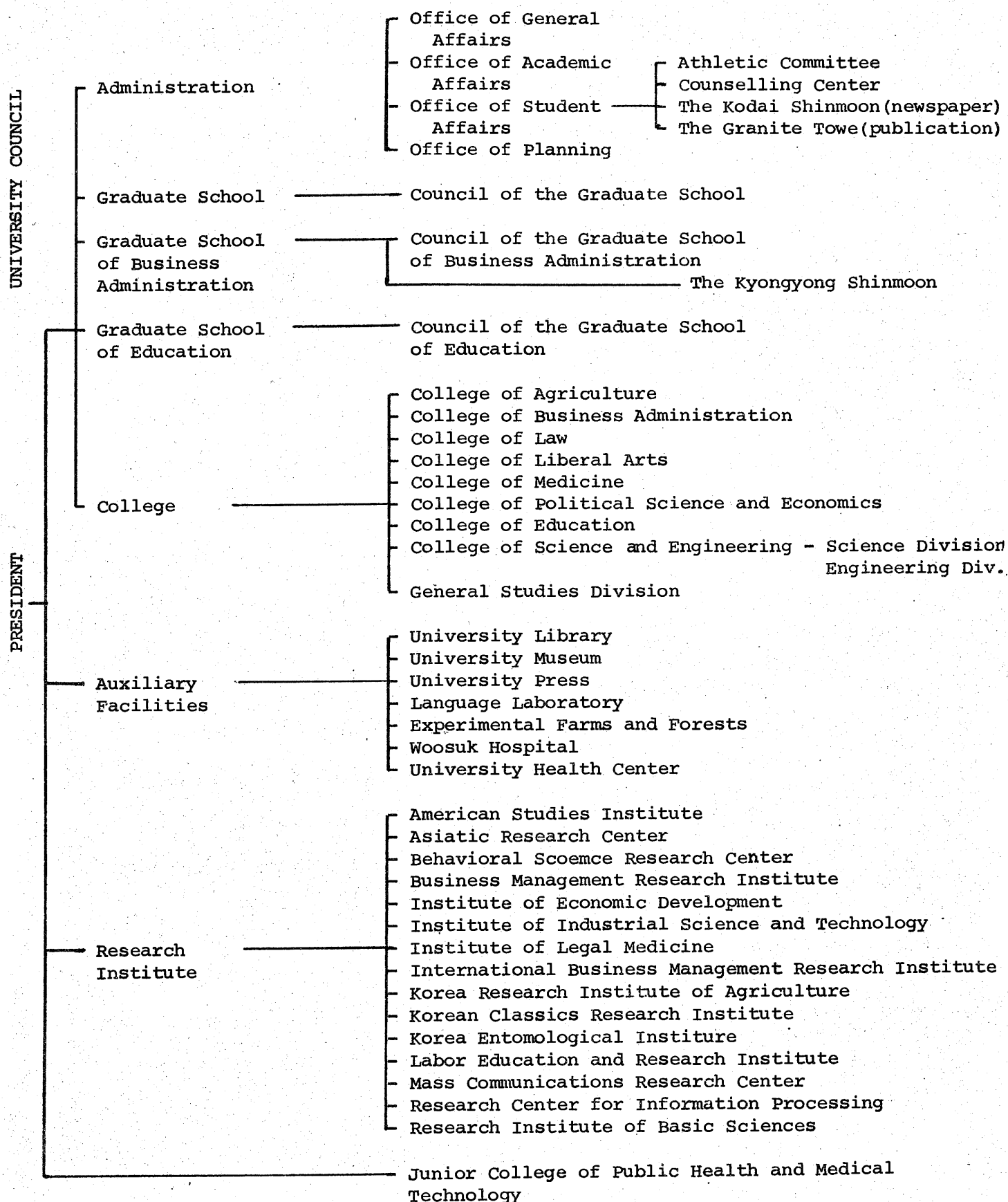
10.3.1. Korea-Choongang Educational Foundation

The Korea-Choongang Educational Foundation comprises of a Board of Trustees and an Administrative Office. The Board of Trustees constitutes of 9 trustee members and 2 auditors. The members are elected by the board and its chairman is selected by voting among the board members and requires the approval of the Minister of Education. The responsibilities of this Board of Trustees are many. Besides the management of educational institutions such as Korea University, the Junior College of Public Health and Medical Technology, Choongang Middle and High School, and the Korea Middle and High Schools, the board is responsible for the accumulation of fund for the maintenance of these institutions. The Korea Forestry Enterprise, Korea Horticulture Garden, and real estates are sources of fund for the Korea-Choongang Educational Foundation. The board is also responsible for appointing the faculty of the schools. The heads of schools are appointed through the resolution of the Board of Trustees with the approval of government authority. The final decision is made by the chairman. The teaching staff are selected with the proposal by the head of school followed by the resolution of the board and the appointment by the chairman.

10.3.2. Korea University

The administrative organization is composed of the General Affairs, Academic Affairs, Student Affairs and Hospital Administration. Along with this administration 4 graduate schools, 9 colleges, 10 auxiliary facilities including the hospital, and 20 research institutes exist (See Table A-34-1). Under this organization 327 teaching staff and 241 administrative personnel are employed. The student enrollment includes 1,817 graduates students and 9,588 undergraduates for the total of 11,405 students.

Table A-34-1

Administrative Organization

10.3.3. College of Medicine

The College of Medicine comprises of the dean and the section of academic affairs, under which the premedical, the graduates and nursing parts are divided. As shown in table A-34-2 and Table A-34-3, basic sciences are functioning in 9 departments, clinical part in 18 departments. The total faculty members number 93 with 32 designated in the basic medical science, 53 in clinical departments and the remaining 8 members assigned at the nursing department. There are 609 students in the premedical and medical programs and 455 students in the nursing program.

10.3.4. The superintendent is responsible for the three departments which are administrative, clinical, and auxilliary. Further division reveals 6 sections under the administrative, 20 specialty services under clinical and 8 auxilliary sections (See Table A-34-3). Of the total 757 employees, there are 53 physicians who serve as faculty, 148 trainees, 3 dentists and 66 administrative workers. They are supported by 151 registered nurses, 42 nurse-aids, 12 pharmacologists and 282 auxilliary employees.

10.4. Accomplishment

10.4.1. College

As of 1978, 2,926 physicians and 1,260 nurses have graduated from the Korea University. In addition, 349 students with Master's Degree in Medicine, 547 students with Doctoral Degree in Medicine, along with 19 students holding Master's Degree in Nursing have accomplished their degrees at the Korea University.

10.4.2. Hospital

The bed capacity of the Korea University Hospital is 375. The cumulative annual number of patients utilizing the hospital beds was 104,655 patients with daily average of 288 patients occupying the hospital beds. This is equivalent to 75% bed occupancy rate. The daily out-patient visits handled by the hospital were on the average 641 patients with the annual total of 197,432 patients. These figures indicate that the hospital maintained rather active services in comparison with other hospitals of similiar capacity (See Table A-34-4 and A-34-5).

10.5. Reorganization of the University

Korea University has rearranged its organizational set-up by integrating the existing medical college, University Hospital and other accessory facilities into a new "Medical Center". The organizational change was intended to meet the growing demand for medical care in general, and to improve efficiency in management of the hospitals including in particular, the proposed three hospitals, and medical college and associated facilities under the Korea-Choongang Educational Foundation.

10.6. Appraisal

Korea-Choong Educational Foundation is an authoritative educational foundation initiated by the Koreans, representing one of the financially sound foundations. Korea University is a prestigious higher learning institution with high aspiration and solidity originated from traditional Korea culture and is capable to

Table A-34-2

CURRENT STATUS OF MEDICAL FACULTY

Basic Science	No. of Faculty	Nursing Department	No. of Faculty	Clinical Science Department	No. of Faculty
Anatomy	4	Nursing	8	Medicine	8
Physiology	4			General surgery	4
Biochemistry	3			Neuro-surgery	3
Pathology	2			Orthopedic surgery	3
Forensic medicine	1			Chest surgery	3
Microbiology	3			Plastic surgery	3
Pharmacology	3			Pediatrics	3
Preventive medicine	2			OB/GYN	4
Parasitology	2			Dermatology	2
				Urology	2
				Otolaryngology	3
				Ophthalmology	3
				Neuro-psychiatry	4
				Radiology	3
				Clinical pathology	1
				Anesthesiology	2
				Physiotherapy	1
				Dentistry	2
Total	32		8		53

Table A-34-3.

Table of Hospital Administration

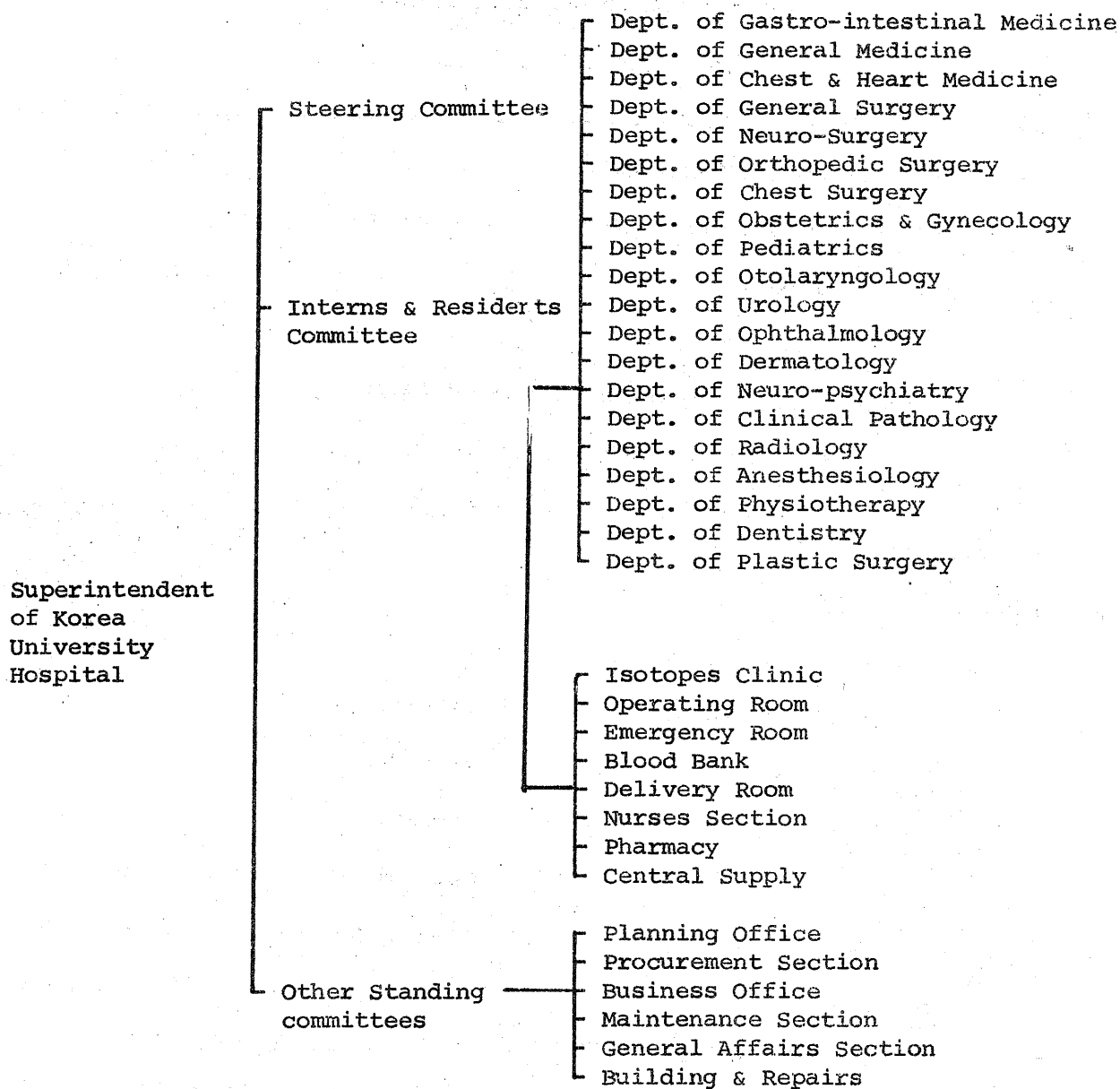


Table A-34-4

PRINCIPAL MEDICAL STATISTICS
(1977.3.1 - 1978.2.28)

1. Total number of OPD visits/year		197,432 visits
average OPD visits/day	641 visits	
2. Total number of inpatient days/year		104,656 patient days
average hospitalized patients/day	288 cases	
average length hospital stay	12 days	
bed occupancy rate	75%	
3. Newborn admission		1,008 cases
4. Number of death		
Within 48 hours	64 cases	
Over 48 hours	91 cases	
5. Radiological Examination	regular	45,908 cases
	special	1,327 cases
	Mass X-ray	1,497 cases
6. Laboratory test	Routine	347,064 cases
	tissue pathology	2,730 cases

SOURCE: Annual report of Korea University Hospital 1978.

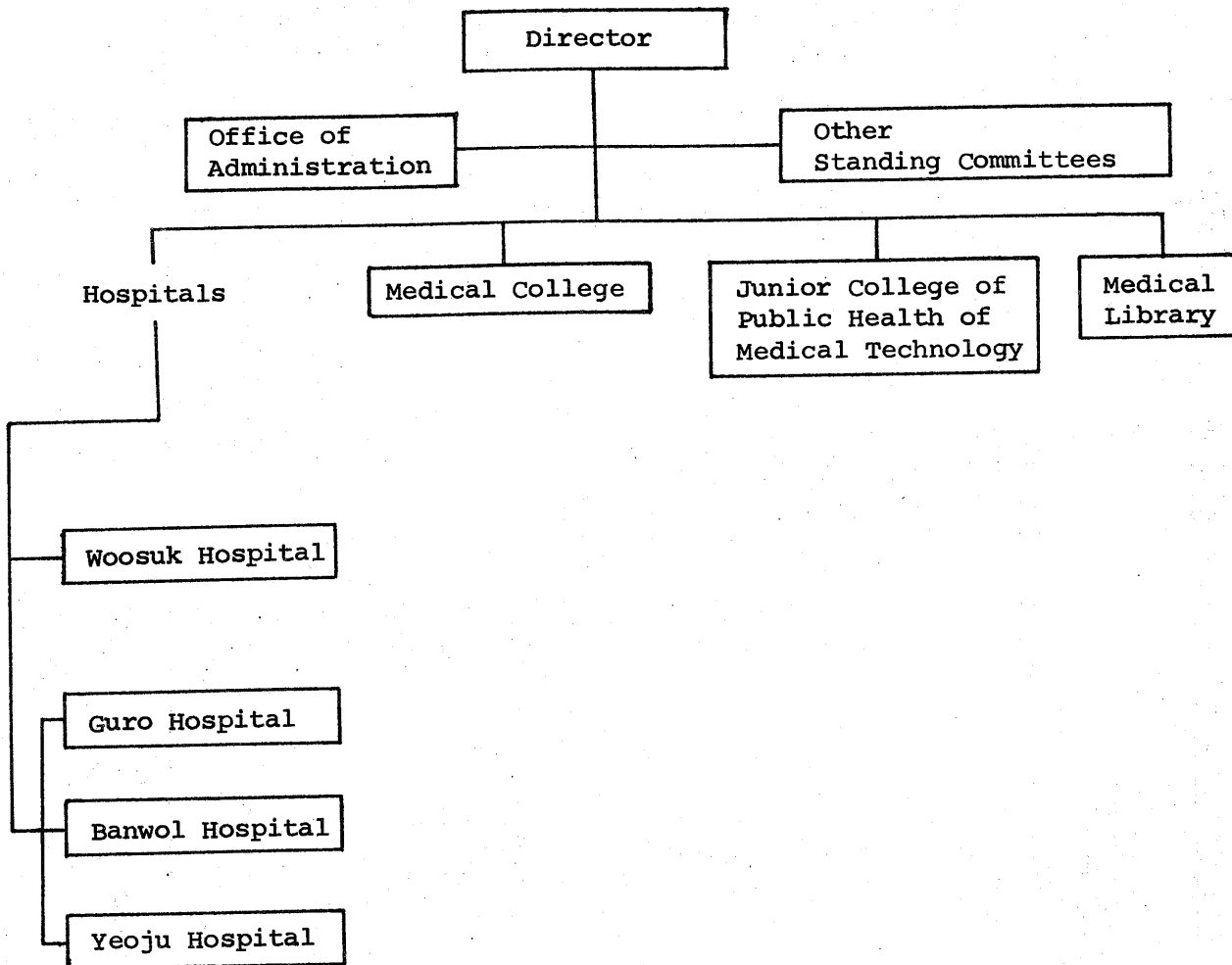
Table A-34-5

MEDICAL PERFORMANCES OF KOREA UNIVERSITY HOSPITAL DURING MARCH 1-'77 - FEB. 28-'78

	Outpatient			Inpatient			
	Total OPD Visits	No. of New Cases	Average No. of Visits	No. of HOSPITALIZED Cases	No. of Discharged Cases	Total Inpatient Discharged Cases	Average Hospital Stay
Chest Medicine	21,830	7,416	2.9	703	658	6,365	9.7
G-I Medicine	15,639	5,250	3.0	875	811	7,763	9.6
General Medicine	8,122	4,589	1.8	413	407	3,455	8.5
Neuro-surgery	5,069	2,608	1.9	813	813	18,619	22.9
Orthopedic surgery	8,146	2,991	2.7	425	431	18,239	42.3
General surgery	11,058	3,237	3.4	888	946	11,385	12.0
Chest surgery	2,965	1,333	2.2	220	239	2,774	11.6
Plastic surgery	1,935	754	2.6	130	126	1,305	10.4
OB-GYN	21,359	5,288	4.0	1,405	1,421	8,095	5.7
Pediatrics	17,865	5,954	3.0	712	700	6,490	9.3
ENT	20,837	4,039	5.2	352	340	2,160	6.4
Dermatology	9,312	3,176	2.9	29	26	121	4.7
Urology	12,825	2,527	5.1	254	277	2,651	9.6
Ophthalmology	9,566	3,405	2.8	154	152	2,440	16.1
Dentistry	5,275	1,511	3.5	9	9	131	14.6
Neuro-psychiatry	15,652	4,537	3.4	222	220	8,077	36.7
Physio-therapy	4,368	704	6.1	10	21	1,400	66.7
Emergency	5,609	5,609	1.0	-	-	-	-
Nursery	-	-	-	1,008	1,008	5,119	5.1
Total	197,432	64,928	3.0	2,651	8,605	106,589	12.4

SOURCE: Korea University Hospital.

Reorganization Plan
Of
Korea Medical Center



maintain proper management in view of its current status of organization, manpower and financial stability.

10.6.1. Achievements

Since the incorporation of Woosuk University in 1971, Korea University has shown its remarkable capability in management of hospital industry as evidenced in the progress of Woosuk Hospital thereafter.

10.6.2. Advantageous Situation

The most difficult problem encountered in the management of the provincial hospitals in Korea at present is the difficulty in attracting medical manpower.

In view of this matter the available medical personnel from Korea University Hospital to assist the new hospitals are advantageous for the new project proposed.

10.6.3. Reorganizing the Existing Organization

Reorganizing the existing medical institutions into the scheme of so called "Medical Center" prior to the establishment of 3 additional hospitals is desirable for efficient management of 4 hospitals.

10.6.4. Appraisal

As mentioned in the foregoing, Korea University is an appropriate organization to assume the responsibility of carrying out the proposed project in view of its financial and managerial capability.

11. ADMINISTRATIVE SYSTEM AND ORGANIZATIONAL SYSTEM OF THE YEOJU HOSPITAL

11.1. Administrative Relationship Between Korea University Medical Center and Yeosu Hospital:

The Korea University plans to establish a medical facility in a rural area to be utilized as a training and practicing center for the students of community health services. The Yeosu Hospital (as an attached institution to the Korea University) expected to meet this purpose as well as serving the health needs of the rural population. Along with this administrative relationship, there will be a functional relationship. Korea University Hospital will serve as a tertiary medical hospital, providing treatment to the serious patients referred by the Yeosu Hospital. Support of medical manpower by the Korea University Medical Center and Yeosu Hospital. Through these support and relationship, Yeosu Hospital will be able to meet the major health needs of the community.

11.2. Organizational System of Yeosu Hospital

Due to the expected limited size of the Yeosu Hospital, it was judged unnecessary to have the various clinical and administrative department of a large modern hospital organization. The Yeosu Hospital have operated a steering committee Administration management section, clinical departments, clinical supporting departments and clinical committees under the superintendent to perform the hospital function effectively. (See organization chart of Yeosu Hospital)

11.2.1. Superintendent

Under the direction of the Director of the Medical Center, the superintendent will represent the hospital (and will be) responsible for the entire operation of the hospital including clinical activities, ancillary activities and administrative activities. Also, the superintendent will be responsible for carrying out community health training program for medical student.

11.2.2. Steering Committee

The steering committee will be the principal advisory agency to the superintendent for the establishment of general policy and procedures and personnel policy for the entire operation of the hospital.

11.2.3. Clinical Departments and ancillary Departments

The hospital will have internal medicine, general surgery, orthopedic surgery, pediatrics, Ob. & Gyn. and community health service departments for clinical functions. To assist the clinical departments the hospital will have ancillary departments such as clinical laboratory, X-ray, anesthesia, recovery, operating,

emergency, labor & delivery room, nursery, pharmacy, nursing section and central supply room. Chief of clinical departments and clinical supporting departments will perform patient care function and management of facility and instruments under the direction of superintendent.

11.2.4. Clinical Committees

In order to promote clinical activities, the hospital will operate a medical ethics committee, operating committee and cost and drug committee under the control of the superintendent.

11.2.5. Administration and Management Section

The hospital will have administration and management section. Under the control of the superintendent, chief of the section will be responsible for management of all administrative activities other than clinical affairs. To do above duty the section will be divided into the general affair subsections, admission and discharge, and Management.

11.2.5.a. General Affair Subsection

The general affair subsection will perform the following duties:

- all general administrations
- personnel management
- finance and accounting
- vehicles and other management
- security guards

11.2.5.b. Admission and Discharge Subsection

The admission and discharge subsection will perform the following duties:

- patient administration
- admission and discharge processing
- out-patient administration
- medical insurance service
- medical record and statistics
- ambulance service
- food service
- laundry service

11.2.5.c. Management Subsection

The management subsection will perform the following duties:

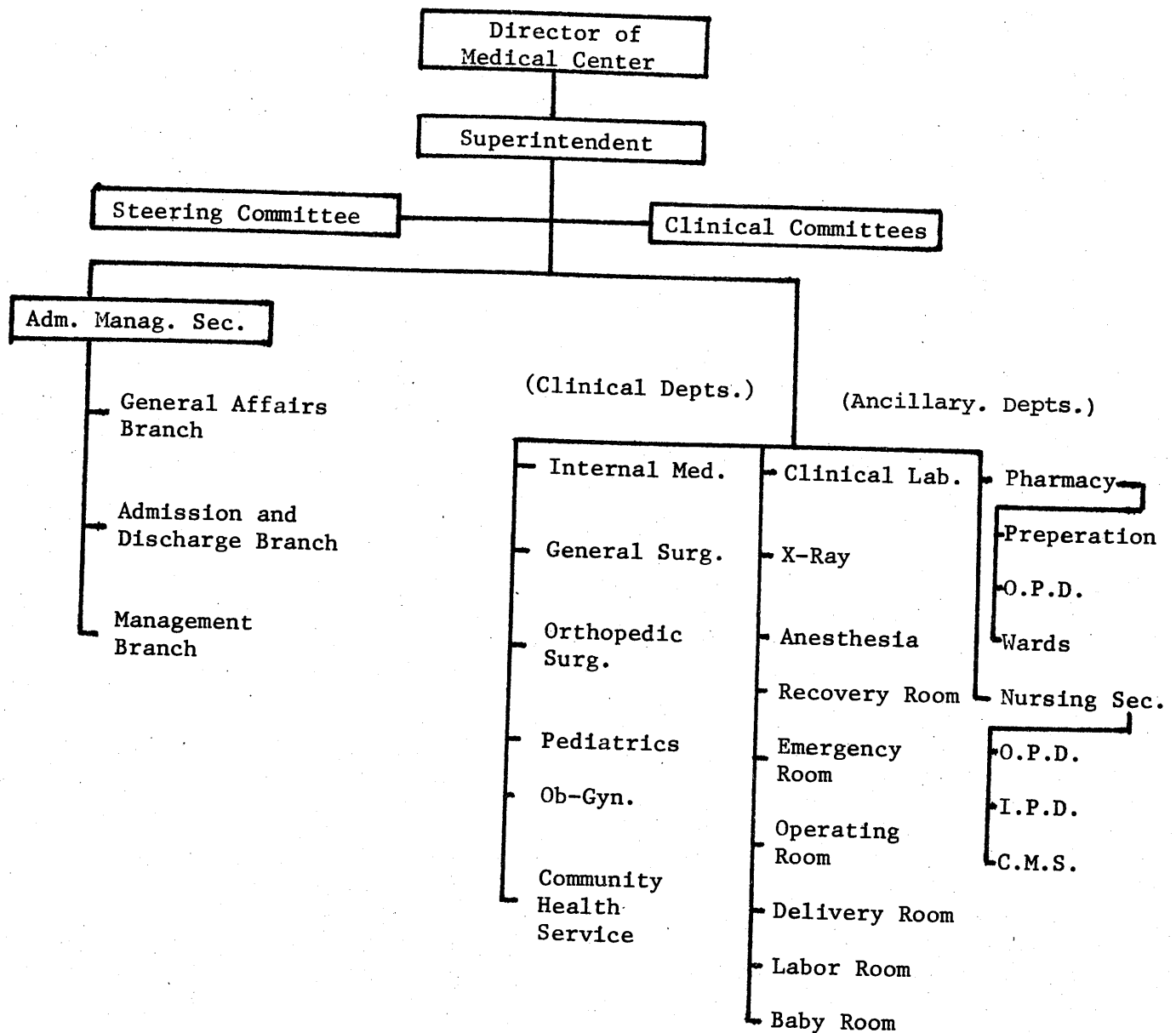
- planning for supplies
- receiving, storage and issuance
- utility and security
- boiler room, power room, water supply
- engineering
- management of other items
- inspection of procured materials

12. MANPOWER REQUIREMENT OF YEOJU HOSPITAL

12.1. Basis of Estimation for Hospital Personnel

Staffing guide for estimation of Yeosu Hospital personnel requirement is as follows:

Organizational Chart of Yeoju Hospital



1. Classification of duty:
All personnel are classified into 5 groups such as medical, nursing, medical technician, administrative and other duty for the purpose of estimation. Each group duty will be broken down in accordance with functions and details of the personnel.
 2. Annual working days: the annual working days will be 280 days per year.
 3. Standard workload for a man per day according to the duty was based on the regulations set by the Medical Law, the workload obtained from survey of existing hospitals, and also specific functions of the hospitals.
- This estimation does not consider the possibility of this hospital becoming a teaching hospital.

12.2. Estimated Manpower Requirement

The estimated personnel requirement for Yeosu Hospital totals 88 personnel, it is classified by group duties and details as follows: (See ANNEX Yeosu Hospital manpower requirement)

- medical group	5
- nursing group	36
- medical technician group	7
- administrative group	6
- other group	34
<hr/> Total	<hr/> 88

This number of personnel was arrived on the basis of the following estimations.

12.2.1. Estimated Requirement of Medical Group Manpower

Estimation of full time physician requirements is based on the following considerations:

- Number of clinical and ancillary departments (medical doctor)
- Number of inpatients and outpatients
- Legal standards of Medical Law (clinical departments and numbers of physicians)
- Characteristics of the area of Yeosu Hospital
- Applied formula

$$Nmd = \frac{Pie}{Ki} + \frac{Poe}{Ko}$$

Where, Nmd: Number of medical doctor
 Pie: Average inpatients per day
 Ki : Legally authorized beds for a doctor per day
 Po : Number of outpatients per day
 Ko : Legally authorized outpatient for a per day

The estimated number of full time physicians including the superintendent are 5 personnels.

12.2.2. Estimated Requirement of Nursing Staff

Estimation of nursing manpower is based on the following considerations:

1. Number of outpatients of clinical departments, general inpatients and intensive care cases in the primary nursing functions.
2. Nursing administration, emergency room, operating room, delivery room, central supply nursing personnel as the specific nursing functions.
3. Applied formula

$$Nrn = \frac{Poe}{Ko} + \frac{Pie}{Koi} + \frac{Piex}{Kix}$$

Where, Nrn : Number of nurses
 Poe : Average number of outpatients per day
 Ko : Legally authorized outpatients for a nurse per day
 Pie : Number of inpatients per day
 Koi : Legally authorized inpatient for a nurse per day
 Piex : Average intensive care patients per day
 Kix : Standard number of intensive care patients for a nurse per day

The estimated requirement for nurses was calculated to be 36, 29 primary function nurses and 7 specific function nurses. Approximately 50% of the primary function nurses can be substituted by nurse-aides.

12.2.3. Estimated Requirement of Medical Technicians Manpower

Estimation of medical technicians manpower is based on the following considerations:

- Number of clinical examinations for inpatients according to specific function
- Number of clinical examinations for outpatients according to specific
- Necessity of night duty requirement
- Standard examination capability for a technician per day according to specific functions

Clinical support manpower according to specific functions is estimated as follows:

- a. Laboratory technician manpower was determined by the following formula yielding a requirement of 4 personnel:

$$Nt = \frac{Pie L + Poe L}{Kt} + C$$

Where, Nt : Number of laboratory technicians

Pie L : Average examinations for inpatients per day

Poe L : Average examinations for outpatients per day

Kt : Standard examination cases for a technician per day

C : Number of night duty laboratory technicians

- b. X-ray technician manpower was determined by the following formula yielding a requirement of 3 personnel:

$$Nx = \frac{Pie X + Poe X}{Kx} + C$$

Where, Nx : Number of X-ray technicians

Pie X : Average No. of X-ray films taken for inpatients per year

Poe X : Average No. of X-ray films taken for outpatients per day

Kx : Standard number of X-ray films taken by a man per day

C : Number of night duty technicians

Therefore, 7 technicians were required for laboratory and X-ray.

12.2.4. Estimated Requirement of Administrative Manpower

Administrative Manpower was estimated based on the following consideration:

- Number of outpatients
- Number of inpatients
- Additional work loads based on the number of hospital beds

Applied formula

$$Na = \frac{Pie}{Ka} + \frac{Poe}{Kb} + \frac{B}{Kb}$$

Where, Na : Number of administrative manpower

Pie : Average number of inpatients per day

Poe : Average number of outpatients per day

Ka : Standard administrative cases for a personnel per day

B : Number of hospital beds

Kb : Additional administrative work loads based on the number of hospital beds

Based on above calculation it was estimated that 6 administrative personnel are required.

12.2.5. Estimated Requirement & Other Manpower

Other manpower was estimated as follows: Required number of pharmacists is calculated based on the following considerations:

- Number of drug preparations for outpatients
- Number of drug preparations for inpatients
- Necessity of night duty man
- Standard capability of drug preparation for a man per day

Applied formula

$$N_p = \frac{P_{ei} P + P_{oe} P}{N_p} + C$$

Where, N_p : Number of pharmacists
 $P_{ei} P$: Average drug preparations for inpatient per day
 $P_{oe} P$: Average drug preparations for outpatients per day
 K_p : Standard preparation for a pharmacist per day
 C : Number of night duty pharmacists

It was estimated that 3 pharmacists are required based on the above calculation. About 30 percent of pharmacists being replacable with aide personnel.

12.2.5.b. The Central Supply Room manpower requirement, based on the existing 50-bed hospital's actual manpower statistics, is estimated to be 6 personnel, 3 expendable medical material workers and 3 sterilization workers.

- c. House-keeping manpower is estimated 4 personnel based on one man for 600 m² of occupied building area.
- d. Food Service manpower requirement is estimated to be 6 personnel. 1 dietician based on one dietician per 100 beds, 1 cook based on one cook per 150 beds, aide cooks based on one aide per 25 beds, and 2 food delivery men based on one man per 25 beds are the means of estimation.
- e. Laundry manpower requirement is estimated to be 3 personnel. 2 laundry men based on one man per 25 beds and 1 repair man based on one man per 50 beds are the means of estimation.
- f. The remaining manpower under the other manpower category include 2 miscellaneous workers based on two men per 100 beds, 2 drivers (including 1 ambulance driver), 2 boiler room workers, 1 electric power room workers, 1 carpenters, and 4 information and guard men. Therefore, the total estimated manpower requirement under the other manpower category are 8 personnel.

12.3. Pay Roll System

The following considerations are taken in determining pay roll system for the hospital personnel.

1. Medical doctors will be well paid in order to employ highly qualified physicians.
2. Administrative personnel will be minimized and paid well in order to employ highly qualified personnel.
3. Pay roll systems will be classified into 5 categories such as physicians, nurses, administrators, technicians and functional workers in order to secure their specialities.
4. Payment will include basic pay and allowances (adjustment, duty, technical, night duty, and danger), 400% of bonus pay based on basic payment. (See ANNEX- standard pay roll system)

The attached pay roll standard was prepared in accordance with above criteria.

13. EXTIMATED REQUIREMENT AND COST OF MEDICAL EQUIPMENTS, FURNITURES,
MEDICAL EXPENDABLE ITEMS FOR YEOJU HOSPITAL

13.1. Medical Equipment

Medical equipments were selected based on the follwoing criteria in order to meet the roles and functions of Yeosu Hospital.

1. Required equipments and quantity are decided to perform the established functions of each clinical department. (See ANNEX-Functional Level of 50 Beds Hospital)
2. The equipments needed as perceived by the Korea University authorities are marked with an asterisk(*) .
3. Equipments are grouped into basic medical equipments and minor medical equipments in accordance with functions of each department.
4. Equipments are classified by department and room in accordance with room space allocation.
5. Mutual use equipments are specially classified in order to avoid duplication of equipment. (Example: mutual use items for surgical department)
6. Domestically purchased equipments and foreign purchased equipments are separately marked.
7. Cost was calculated based on the dollar (\$) exchange rate of 28 Feb., 1979.

13.1.1. Estimated Requirement of Medical Equipments

Estimated total cost required for medical equipment of Yeosu Hospital was \$470,169 for 632 items in about 200 types of equipments. Estimated cost of equipments by departments was as follows: (See ANNEX-Equipment List)

Table A-35-1 ESTIMATED COST OF MEDICAL EQUIPMENT BY DEPARTMENT
(Yeosu Hospital)

Medical Department	Estimated Cost (U.S.\$)
Emergency Room	31,285
Internal Medicine	22,411
Surgery	20,913
Orthopedic Surgery	1,514
Pediatrics	2,065
Ob. & Gun.	29,463
Community Health Service	1,057
Clinical Laboratory	35,463
X-ray Room	78,095
Operating Room	152,783
Delivery Room	20,529
Wards & Nursing Station	69,706
Pharmacy	4,885
Total	470,169

13.2. Furniture and House Goods

Furnitures and house goods are selected based on the following standards:

1. Functions and number of personnel of each department
2. Space allocations of each department and section
3. Domestically purchased and foreign purchasing items
4. Costs is based on the U.S. dollar exchange rate on 28 Feb., 1979.

13.2.1. Estimation of Furnitures and House Goods

Required cost of furnitures and house goods is \$34,497.

Table A-35-2 ESTIMATED COST OF FURNITURES AND HOUSE GOODS

Activity	Estimated Cost (US \$)
Emergency Room	\$815
Outpatient Clinics	\$3,660
Clinical Laboratory	\$2,103
Autopsy Room	\$221
X-ray Department	\$1,190
Operating Room	\$1,237
Delivery Room	\$284
Wards	\$2,537
Administration	\$5,309
Pharmacy	\$2,410
Kitchen	\$11,419
Laundry	\$2,853
Others	\$459
Total	\$34,497

13.3. Drugs, Medical Expendables and Medical Materials

Estimated cost of drugs, medical expendables, medical materials and other supplies for operation of Yeoju Hospital was figured by using percentage of costs similar to in existing hospitals.

1. Percentage of cost for drugs and medical expendables makes up 8% of the total operating expenses of existing 50 beds hospitals.
2. Percentage distributions of consumable goods are as follows:

Drugs	83%
Medical Expendables	5%
Medical Materials	8%
Others	4%
Total	100%

Costs required for one-year supply of drugs, medical expendables, and materials for the Yeoju Hospital was \$120,376 annually based on 1977 cost (inflation factor not included).

Drug	₩48,702,000 (\$100,416)
Medical Expendables	₩2,934,000 (\$ 6,049)
Medical Materials	₩4,107,000 (\$ 8,468)
Others	₩2,640,000 (\$ 5,443)
Total	₩58,667,000 (\$120,376)

13.4. Vehicles

Estimated vehicle requirement and cost are as follows.

Total costs for the vehicles is estimated to be \$23,711.

Detailed costs for Vehicles

Sedan	1	₩6,000,000 (\$12,371)
Ambulance	1	₩5,500,000 (\$11,340)
Total		₩11,500,000 (\$23,711)

13.5. Books

Hospital book will be classified into books and periodicals. Required list of books will be recommended by clinical departments, clinical support departments and administrative sections, and will be decided by library committee.

Cost for the purchasing of books was estimated total of \$10,800:

Text book	200	\$10,000
Periodicals	20	\$800
Total		\$10,800

14. TOTAL INVESTMENT AND PLAN FOR FINANCING

14.1. The total investment cost required for Yeosu Hospital which is to be sponsored by the Korea University is \$2,659,579 (₩1,276,598,000) as shown in Table A-36.

Table A-36

Yeosu Hospital (50 Beds)

INVESTMENT COST ^{1/}

Category	Local Cost	Foreign Cost
Land estate	₩178,220,000	\$371,292
Site preparation	10,000,000	20,833
Construction	746,800,000	1,555,833
Medical and non-medical equipment	242,236,000	504,658
Outside equipment	40,000,000	83,333
Contingencies ^{2/} (price and physical)	41,500,000	86,458
Engineering fees	33,200,000	69,169
Working capital	26,142,000	54,463
Total investment cost	₩1,276,598,000	\$2,659,579

^{1/} See Appendix A 4-1.

^{2/} Contingencies are not included for the total investment because the Korea University Foundation is responsible for these contingencies.

14.2. The sources of financing the investment cost of \$2,659,579 to build a new hospital which will have 50 beds are as follows:

Table A-37

Yeoju Hospital (50 Beds)

SOURCES OF FINANCING

Total Investment	₩1,276,598,000 (\$2,659,579)
Foreign Loan <u>1/</u>	392,236,000 (817,158)
Local Loan <u>2/</u>	300,000,000 (625,000)
Korea University <u>3/</u>	584,362,000 (1,217,421)
Total financing	₩1,276,598,000 (\$2,659,579)
<u>1/</u> equipment	₩242,236,000 (\$504,658)
mechanical facilities	₩50,000,000 (312,500)
<u>2/</u> Local loans : ₩6,000,000 (\$12,500) for each bed	
<u>3/</u> land	₩178,220,000 (\$371,291)
building and facilities	₩380,000,000 (791,667)
working capital	₩ 26,142,000 (54,463)

14.2.1. Of the total amount needed, \$817,158 (₩392,236,000) will be provided by a West German loan. Its use is restricted to purchasing medical equipments and construction materials; \$504,658 (₩242,236,000) to buy the equipments and \$312,500 (₩150,000,000) for construction materials.

14.2.2. Terms of the Foreign loan are repayment of all the principle in 20 years after a ten-year grace period at an annual interest rate of 2%.

14.2.3. The local loan will be secured from a Korea Commercial Bank (or banks). This will be arranged by the Korean Government for the Yeoju Hospital. The use of the local loan is restricted to building costs of the hospital. The maximum amount of the local loan is \$12,500 (₩6,000,000) per hospital bed. Therefore \$625,000 (₩300,000,000) can be borrowed locally by the Yeoju Hospital as it will have 50 beds.

14.2.4. The terms of the local loan are repayment of all the principle in seven years after a three-year grace period. The annual interest rate is 18.5%, out of which the borrower will be charged 7% and the Korean Government will be responsible for 11.5%. Therefore the net interest cost for the Korea University is 7%.

14.2.5. Korea University as sponsor of the Yeoju Hospital will provide \$1,217,421 (₩584,362,000) for land purchase, working capital and additional cost for construction.

14.3. The expected balance sheet of the Yeoju Hospital in the year before operation is shown in Table A-38.

15. ECONOMIC FORECASTING

15.1. For the estimation of total revenues in the future, medical care fees should be determined. To estimate medical charges in the future, two things must be clarified, one is the present medical care fees and the other is the future increase in medical care fees.

Table A-38

Yeoju Hospital (50 beds)
BALANCE SHEET (beginning of operation)

1\$ 480 Won
Unit : Won

Assets		Liabilities	
Cash	₩18,162,000	Bank credit	0
Auxiliary goods	2,357,000	Account payable	0
Pharmaceuticals and medical articles	5,623,000	Draft	0
Equipment	242,236,000	Loans local:	300,000,000
		foreign:	392,236,000
Building	830,000,000	Reserve for Contingency	0
Land	178,220,000	Capital	584,362,000
Total assets	₩1,276,598,000	Total liabilities	₩1,276,598,000
	(\$2,659,597)		(\$2,659,579)

Table A-39.

MEDICAL CARE FEES IN 1978

(under 100 beds hospital)

1\$ = 480 Won
Unit = Won

Classification	Outpatient fee per visit	Inpatient fee per day
Internal medicine	₩3,400	₩13,800
General surgery	3,300	13,900
Orthopedic surgery	2,800	11,200
Neuro-surgery	3,500	15,000
Pediatrics	2,100	10,400
Ob & Gyn	2,800	18,000
ENT	2,800	14,600
Ophthalmology	3,500	12,500
Jaw surgery	3,800	13,100
Neuro-psychiatry	3,200	9,200
Urology	3,200	14,000

Table A-40.

MEDICAL CARE FEE IN 1979

(under 100 bed hospital)

1\$ = 480 Won
Unit = Won

Classification	Out-patient(per visit)		In-patient(per day)	
	Insurance	Private	Insurance	Private
Internal medicine	3,500	4,200	16,200	21,060
General surgery	3,400	4,080	16,400	21,320
Orthopedic surgery	2,900	3,480	13,200	17,160
Neuro-surgery	3,600	4,320	17,700	23,010
Pediatrics	3,200	3,840	12,300	15,990
Ob and Gyn	2,900	3,480	21,200	27,560
Ophthalmology	3,600	4,320	14,700	19,110
Urology and dematology	3,300	3,960	16,500	21,450
Neuro-psychiatry	3,300	3,300	10,900	20,020
Jaw surgery	3,900	4,680	15,400	14,170

15.1.1. To determine present medical care fees, a survey was conducted at several hospitals to determine medical care fees by discipline. Because of limited data, differences in medical charges between medical insurance subscribers and private patients can not be presented. Table A-39 is the result of the survey of 21 hospitals which have similar characteristics as those expected of the Yeosu Hospital.

15.1.2. The average fees in Table A-39 represent gross cost charged by hospitals: inclusive of pharmaceuticals, X-ray's, medical tests, food and others.

15.1.3. Since there is a relatively large difference in the medical care fees charged by hospitals between insured patients and private patients, respective medical care fees should be estimated in order to calculate total future revenues. For this purpose, a survey was conducted to study the fees paid to hospitals by insured patients treated in the Guro area during 1978, and it shows that the average fees of insured patients are \$5.63 (₩2,700) for out-patients per visit, and \$27.1 (₩13,000) for inpatients per day (the classification by discipline was not available).

15.1.4. The following equation is developed to derive the average costs for insured patient by department, utilizing Table A-39 and the survey result mentioned in 15.1.3.

$$\text{Average medical fee} = X_i \times \frac{\bar{X}_1}{\bar{X}_2}$$

Where X_i = Average medical care fee in "i" department shown in Table A-39.
 \bar{X}_1 = Average medical care fee in 1978 for the insured (\$5.63 (₩2,700) per visit for out-patient and \$27.1 (₩13,000) per day for in-patient).
 \bar{X}_2 = Average medical fees in 1978 (calculated from Table A-39).

15.1.5. The medical care fees for private patients are estimated on the basis of a 1977 KPC report; it said medical fees charged for private inpatients were 35% higher than fees charged for insured inpatients and about 23% higher for out-patients. Also we considered the fact that average medical fees for insured patients have increased 20% in 1979, while fees for private patient have not undergone the similar increase. Considering these facts, we concluded that the average medical charge for private in-patients is 30% higher than fees for insured in-patients and 20% higher for out-patient.

15.1.6. Medical care fees in 1979 calculated according to 15.1.1. - 15.1.5. are shown in Table A-40.

15.1.7. The future changes of the medical care fees for private patients and insured patients are predicted on the following three assumptions;

- 1) The fee difference between insured patients and private patients will be reduced gradually and eliminated eventually by the end of 1991 when The Korean Government expects medical insurance to cover 100% of the population.

- 2) The increase rate of medical care fees for private patients would be stable over time, while the medical care fees for the insured would rise to reach the same level of the fees for the private patients.
 - 3) The increase rate of medical care charges is assumed to be 3% annually for next ten years because of quality increase of medical care.
- 15.2. Table A-41 shows total estimated revenues each year for 10 years, which is obtained by multiplying the expected medical care fees (based on 15.1.1.-15.1.7.) by the estimated number of patients per year.
- 15.3. The total expenses include expenses for personnel, pharmaceutical and other materials, food and clothes, maintenance of building and equipment, heating and utilities, and administration. The expenses of each item are estimated for 10 years.
- 15.3.1. Because expenses for personnel are the main portion of total expenses, these have been broken down into expenses for physicians, nurses, technicians and administrative personnel.
- 15.3.2. Expenses for personnel in each category are calculated by multiplying estimated required manpower by average salary surveyed in 1979. For the next ten years, a 3% real increase in salary is assumed per year.
- 15.3.3. Cost of pharmaceuticals and other materials, heating and utilities, and administrative cost have been estimated based on the survey conducted: the ratio of each expense to total expenses, and the ratio of each expense to total revenues of the hospitals which have similar characteristics are those of the planned Yeosu Hospital. Table A-42 shows the result of the survey. The ratio of each expense to the total revenues are used to estimate these expenses for the future, assuming that the ratios would be constant over time. Accordingly the cost of heating and utilities is 5.11% of the total revenues (without considering a quality increase) and administrative cost is 6.10% of total revenues without consideration of quality increase.
- 15.3.4. 24.95% of total revenue is considered as cost for pharmaceuticals and other materials.
- 15.3.5. The cost of food is estimated on the basis that the cost per meal is \$1.25 (₩600) and \$3.75 (₩1,800) per day. \$6.25 (₩3,000) each bed is assumed for costs of clothes a year.
- 15.3.6. Maintenance cost for building is assumed 0.25% of the acquisition value and 2.5% for medical equipment.
- 15.4. Table A-43 presents the all the expenses estimated according to 15.3.1. - 15.3.6.
- 15.5. By combining Table A-41 and Table A-43, the Pro-forma income statement is presented in Table A-44.
- 15.5.1. Expected life of the building is 50 years according to the Korean tax law and average expected life of medical equipments is assumed as 10 years.

Table A-41.

1979 constant price

Yeoju Hospital (50 Beds)
ECONOMIC FORECASTING: ESTIMATION OF REVENUES
(1st-10th year)

1\$=480 Won
Unit: 1,000 Won

Category	Year									
	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
<u>Out-patient</u>										
Insurance	13,281	30,047	37,138	45,899	56,731	64,914	76,890	91,076	107,877	127,789
Private	93,412	85,156	82,889	80,401	77,701	74,756	66,687	58,268	48,875	39,072
<u>In-patient</u>										
Insurance	65,770	95,841	115,004	137,393	164,870	198,203	231,641	266,910	304,111	343,270
Private	118,169	138,866	114,609	150,021	157,070	163,938	147,158	129,100	109,833	89,281
<u>Total</u>										
Insurance	79,051	125,888	152,142	183,292	221,601	263,117	308,531	357,986	411,998	471,059
Private	211,581	224,022	227,558	231,022	234,771	238,694	213,845	187,168	158,708	128,363
<u>Grand Total</u>										
Local	290,632	349,910	379,700	414,314	456,372	501,811	522,376	545,154	570,706	599,422
Foreign (\$=000)	(562)	(729)	(791)	(863)	(951)	(1,048)	(1,088)	(1,136)	(1,189)	(1,249)

Table A-42

COMPOSITIONS OF EXPENSES 1/
(under 200 beds hospitals)

		1979
Category (A)	A/ Total expenses	A/ Total revenues
Personnel expense	46.61%	43.82%
Utilities	2.45%	2.37%
Heating	3.05%	2.74%
Clothes and food	4.45%	4.04%
Pharaceuticals and others	31.03%	24.95%
Equipment and building	5.94%	4.35%
Maintenance		
Operating expenses <u>2/</u>	6.47%	6.10%
Total	100 %	-

1/ This Statistics is obtained from survey of 6 Hospitals; The Han-dok Hospital, The Song-mo Hospital, The Ki-dok (Kyung-ju) Hospital, The An-dong Hospital, The Han-joong Hospital and The Han-Kook Hospital.

2/ Operating expenses include costs for vehicles, administrative expenses, taxes (except income taxes) and others.

Straight line method is used for the calculation of depretiation.

15.5.2. The interest charge has been mentioned in 14.2.2. and 14.2.4; the annual rate is 2% for the foreign loan and 7% for the local loan. But the actual repayment of the principal of the local loan would start in the fourth year and in the 11th year for foreign loan. The schedule of payment and interest charge by the year are presented in Table A-45.

15.5.3. Income tax would be exempted for the Yeoju Hospital because it belings to the Korea University Foundation.

15.5.4. Large deficits from 1st year - 5th year operations (shown in Table A-44) will be offset by the profit from the Guro Hospital or the hospital will be supported by the Korea University Hospital operating now. The statement in 1978 of the hospital is presented in Appendix A 4-2.

15.6. Table A-46 is the pro-forma balance sheet of the Yeoju Hospital for ten years.

15.6.1. For the estimation of current assets, the principle that at least one twelfth of total expenses of the initial operation year should be kept as current assets has been adopted. All the profit excluding loan repayment, is assumed to be invested into current assets (cash, pharmaceuticals, food and others).

15.6.2. The actual principal payment of the local loan would start in the 4th year, and in the 11th year for the foreign loan. The loan payments are assumed as being equal other time as shown in Table A-45.

15.6.3. It is assumed that all current liability is to be cleared out at the end of each year.

Table A-43.

Yeoju Hospital (50 beds)

ECONOMIC FORECASTING : ESTIMATION OF EXPENSES

(1st - 10th year)

1\$= 480 Won
Unit: 1,000 Won

1979 constant price										
Year	1st year	2	3	4	5	6	7	8	9	10
Personnel	190,296	195,995	201,875	207,930	214,168	220,594	227,211	234,029	241,050	248,282
Physician	66,892	68,899	70,966	73,095	75,287	77,546	79,872	82,269	84,737	87,279
Nurse	50,329	51,839	53,395	54,996	56,646	58,346	60,096	61,899	63,756	65,669
Medical assistant and others	46,849	48,255	49,702	51,193	52,729	54,311	55,940	57,619	59,347	61,128
Mpt. and adm.	31,326	13,725	14,137	14,561	14,998	15,448	15,912	16,389	16,881	17,387
Technical service and others	12,890	13,277	13,675	14,085	14,508	14,943	15,391	15,853	16,329	16,819
Pharm. and X Ray	72,512	87,302	94,735	103,371	113,864	125,201	130,332	136,015	142,391	149,555
Food & Clothes	15,624	18,897	20,348	21,799	23,250	24,701	24,899	25,097	25,296	25,494
Maintenance	11,036	26,806	26,806	26,806	26,806	26,806	26,806	26,806	26,806	26,806
Building	4,980						20,750	20,750	20,750	20,750
Equipment	6,056	6,056	6,056	6,056	6,056	6,056	6,056	6,056	6,056	6,056
Utility and heating	14,418	15,404	16,564	17,723	18,883	20,042	20,210	20,378	20,547	20,715
Others	17,212	18,388	19,772	21,157	22,540	23,925	24,126	24,327	24,527	24,728
Total expenses	321,088	347,022	364,330	383,016	403,742	425,499	437,814	450,832	464,819	479,810
Foreign (\$ = '000)	(669)	(723)	(759)	(798)	(841)	(886)	(912)	(939)	(968)	(1,000)

Yeoju Hospital (50 Beds)
ECONOMIC FORECASTING: PRO-FORMA INCOME STATEMENT
(1st-10th Year)

1\$ = 480 Won
Unit: 1,000 Won

Table A-44.

1979 constant price

Year	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Total revenue	290,632	349,910	379,709	414,314	456,372	501,811	522,376	545,154	570,706	509,422
Total expenses	321,088	347,022	364,330	383,016	403,741	425,499	437,814	450,882	464,849	479,810
Operating income	* 30,456	1,888	15,370	31,298	52,631	76,312	84,562	94,272	105,857	119,612
Depreciation	40,824	40,824	40,824	40,824	40,824	40,824	40,824	40,824	40,824	40,824
Interest	28,845	28,845	28,845	28,845	26,419	23,822	21,044	18,072	14,892	11,489
Net profit	*100,125	* 67,781	* 54,299	* 28,371	* 14,612	11,666	22,694	35,376	30,141	67,299
(\$ = 000)	(*209)	(*141)	(*113)	(*80)	(*30)	(24)	(47)	(74)	(104)	(140)

* deficit

Table A-45.

Yeoju Hospital (50 beds)

PRINCIPAL AND INTEREST PAYMENT

\$1 = ₩480
Unit: ₩1,000

Year	1st year	2nd	3th	4th	5th	6th	7th	8th	9th	10th
Each payment	63,507	63,507	63,507	63,507	63,507	63,507	63,507	63,507	63,507	63,507
foreign	7,845	7,845	7,845	7,845	7,845	7,845	7,845	7,845	7,845	7,845
local	55,662	55,662	55,662	55,662	55,662	55,662	55,662	55,662	55,662	55,662
Interest payment	28,845	28,845	28,845	28,845	26,419	23,822	21,044	18,072	14,892	11,4
foreign	7,845	7,845	7,845	7,845	7,845	7,845	7,845	7,845	7,845	7,845
local	21,000	21,000	21,000	21,000	18,574	15,977	13,199	10,227	7,027	3,6
Principal payment	0	0	0	34,662	37,088	39,684	42,462	45,435	48,615	50,0
foreign	0	0	0	0	0	0	0	0	0	0
local	0	0	0	34,662	37,088	39,684	42,462	45,435	48,615	52,0
Balance of loans	692,236	692,236	692,236							
foreign	392,236	392,236	392,236	392,236	392,236	392,236	392,236	392,236	392,236	392,2
local	300,000	300,000	300,000	265,338	228,250	188,565	146,102	100,667	52,051	

Yeosu Hospital (50 beds)
ECONOMIC FORECASTING: PRO-FORMA BALANCE SHEET
(1st-10th year)

Table A-43.

1\$=480 Won
Unit: 1,000 Won

1979 constant price

	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Current assets	26,142	26,142	26,142	26,142	26,142	38,948	60,004	90,769	133,119	189,191
Equipment	242,236	242,236	242,236	242,236	242,236	242,236	242,236	242,236	242,236	242,236
depr.	24,224	48,448	72,672	96,896	121,120	145,345	169,570	193,794	218,019	242,236
Building	830,000	830,000	830,000	830,000	830,000	830,000	830,000	830,000	830,000	830,000
depr.	16,600	33,200	49,800	66,400	83,000	99,600	116,200	132,800	149,400	166,000
Land	178,220	178,220	178,220	178,220	178,220	178,220	178,220	178,220	178,220	178,220
Total assets	<u>1,235,774</u>	<u>1,194,950</u>	<u>1,154,126</u>	<u>1,113,302</u>	<u>1,072,478</u>	<u>1,044,452</u>	<u>1,024,690</u>	<u>1,014,634</u>	<u>1,016,156</u>	<u>1,031,411</u>
Current liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	300,000	300,000	300,000	265,338	228,250	188,565	146,102	100,667	52,051	0
Foreign loan	392,236	392,236	392,236	392,236	392,236	392,236	392,236	392,236	392,236	392,236
capital	643,663	670,620	684,095	716,304	727,180	727,180	727,180	727,180	727,180	727,180
Retained earnings	* 0	* 100,125	* 167,906	* 222,205	* 260,576	* 275,188	* 263,522	* 240,828	* 205,452	* 155,311
profit	* 100,125	* 67,781	* 54,299	* 38,371	* 14,612	* 11,666	* 22,694	* 35,376	* 50,141	* 67,306
Capital and liabilities	<u>1,235,774</u>	<u>1,194,950</u>	<u>1,154,126</u>	<u>1,113,302</u>	<u>1,072,478</u>	<u>1,044,452</u>	<u>1,024,690</u>	<u>1,014,634</u>	<u>1,016,156</u>	<u>1,031,411</u>
foreign (\$=000)	(2,575)	(2,493)	(2,440)	(2,278)	(2,230)	(2,166)	(2,115)	(2,084)	(2,077)	(2,099)
* deficit										

Yeoju, Banwol, Guro Hospitals
ECONOMIC FORECASTING: ESTIMATION OF CASH FLOW
(1st-10th year)

Table A-47

1\$=480 Won
Unit: 1,000

1979 constant price										
Year	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1. Expenses										
1.1. personnel	1,540,925	1,588,155	1,634,770	1,683,812	1,734,327	1,995,064	2,054,915	2,116,562	2,180,061	2,527,351
1.2. other expenses	1,411,823	1,550,706	1,636,170	1,734,785	1,850,399	1,982,544	2,075,146	2,180,153	2,331,299	2,648,716
1.3. maintenance	109,577	109,577	109,577	109,577	109,577	109,577	109,577	109,577	109,577	109,577
1.4. interest	249,666	249,666	249,666	249,666	229,482	209,482	187,258	163,452	138,042	110,818
1.5. operating expenses	3,311,991	3,498,104	3,630,183	3,797,840	3,925,290	4,294,667	4,426,896	4,569,774	4,736,919	5,214,282
1.6. depreciation	416,576	416,576	416,576	416,576	416,576	416,576	416,576	416,576	416,576	416,576
1.7. operating cost	3,728,567	3,914,680	4,046,759	4,214,416	4,341,866	4,711,243	2,843,472	4,986,350	5,153,495	5,630,858
2 Revenues										
2.1. outpatient	716,798	766,629	819,783	880,393	951,044	1,031,128	1,095,261	1,172,171	1,264,101	1,375,454
2.2. inpatient	2,643,185	2,887,570	3,085,269	3,320,979	3,609,140	3,941,975	4,177,652	4,440,634	4,773,053	5,176,410
2.3. other	0	0	0	0	0	0	0	0	0	0
2.4. whole	3,359,983	3,654,199	3,905,052	4,201,372	4,560,184	4,973,103	5,272,913	5,612,805	6,037,154	6,551,861
3. Profit calculation										
3.1. operating income	* 368,584	* 260,481	* 141,707	6,956	218,368	259,860	429,941	626,455	83,659	921,003
3.2. accumulation	* 368,584	* 629,065	* 770,772	* 763,816	* 545,448	* 285,588	144,353	770,808	1,654,467	2,575,470
3.3. income tax	0	0	0	0	0	0	0	0	0	0
4. Cash Flow Calculation										
4.1. gross cash flow	47,992	156,095	274,869	423,532	634,944	676,436	846,517	1,043,031	1,300,235	1,337,579
4.2. payoff/discharge	0	0	0	277,296	296,704	317,472	339,696	363,480	388,920	416,408
4.3. invested capital	0	0	0	0	0	0	0	0	0	0
4.4. net cash flow	47,992	156,095	274,869	146,236	338,240	358,964	506,821	679,551	911,315	921,171
(4.1-4.3-4.2)	(100)	(325)	(573)	(305)	(705)	(748)	(1056)	(1,416)	(1,898)	(1,919)
(\$=000)	47,992	204,087	478,956	625,192	963,432	1,322,396	1,829,217	2,508,768	3,420,083	4,341,254
4.5. accumulation of 4.4	(100)	(425)	(998)	(1,303)	(2,008)	(2,756)	(3,812)	(5,228)	(7,126)	(9,044)
(\$=000)										

* deficit

16. ESTIMATION OF CASH FLOW

16.1. Considering 15.1. - 15.6., estimated cash flow is presented in Table A-47.

16.2. Costs of operating and maintenance (1.1. - 1.7. in Table A-39) are presented in Table A-43.

16.3. Revenues (2.1. - 2.4. in Table A-39) are presented in Table 15-3.

16.4. Profit calculation is presented in Table A-44.

16.5. Cash flow calculation is based on the principle that the Yeosu Hospital should have at least one twelfth of its operating expenses for the initial year of operation as current assets (that is ₩26,142,000 or \$5,400).

16.6. The repayment/discharge (4.2.) includes only the repayment of the principal of the loan which is shown in Table A-45.

16.7. Cross cash flow is calculated by adding operating income (3.1.) and depreciation (1.6.).

17. CONSOLIDATED ECONOMIC FORECASTING OF THE THREE KOREAN UNIVERSITY HOSPITALS

17.1. Korea University will operate not only the Yeosu Hospital but also the Guro Hospital and the Banwol Hospital. Therefore we should consider the economic analysis of the three hospitals (sponsored by Korea University) together rather than each hospital separately. Since the same principles and rules for the consolidated economic forecasting as those for separate analysis, only tables are presented without explanations.

17.2. Total investment and financing plan for three hospitals is shown in Table A-48.

Table A-48

YEOSU, BANWOL, GURO HOSPITALS (400 BEDS)
SOURCES OF FINANCING

1\$ = 480 Won
Unit = 1,000 Won

Total Investment	₩11,575,110	\$24,114,812
Foreign loan 1/	4,085,756	8,511,992
Local Loan	2,400,000	5,000,000
Korea University	5,089,354	10,602,820
Total Financing	11,575,110	24,114,812

1/ \$6,412,000 (₩3,077,756,000) for equipments and
\$2,100,000 (₩1,008,000,000) for mechanical facilities.

17.3. Table A-49 shows the combined balance sheet of three hospitals expected at the beginning of operation.

17.4. Tables of revenue estimation (Table A-50), pro-forma income statement (Table A-51), pro-forma balance sheet (Table A-52) and cash flow (Table A-53)

are presented. Pro-forma balance sheet is not just combination of each hospitals's balance sheet. The consolidated balance sheet is made on the assumption one organization will operate all three hospitals under same management and control. The principles for making the balance sheet and the others are the same ones adopted as those for individual hospitals.

Table A-49. YEOJU, BANWOL, GURO HOSPITAL (400 BEDS)
BALANCE SHEET BEFORE OPERATION

1\$ = 480 Won
Unit = 1,000 Won

Assets		Capital & Liabilities	
Cash	145,965	Foreign Loan	4,085,756
Auxiliary goods	25,102	Local Loan	2,400,000
Pharmaceuticals and medical articles	78,866	Capital	5,089,354
Equipment	3,077,757		
Building	5,440,000		
Land	2,807,420		
Total local	11,575,110	Total local	11,575,110
foreign(\$=000)	(24,114)	foreign	(24,114)
		(\$=000)	

Table A-50

Yeoju, Banwol, Guro Hospitals

ECONOMIC FORECASTING : ESTIMATION OF REVENUES

(1st - 10th year)

\$1 = ₩480
unit: ₩1,000

Category	Year	1st	2	3	4	5	6	7	8	9	10
Out-patient	Insurance	196,392	258,634	322,455	397,866	487,718	587,948	704,875	840,376	997,780	1,181,243
	Private	520,406	507,995	497,328	482,527	463,326	443,180	390,386	331,795	266,321	194,211
In-patient	Insurance	692,928	907,435	1,178,556	1,454,827	1,768,499	2,133,958	2,531,070	2,999,046	3,548,379	4,203,258
	Private	1,950,257	1,900,135	1,906,713	1,866,152	1,840,641	1,808,016	1,646,582	1,441,588	1,224,674	973,152
Sub-Total	Insurance	889,320	1,246,069	1,501,011	1,852,693	2,256,217	2,721,906	3,235,945	3,839,422	4,546,159	5,384,501
	Private	2,470,663	2,408,130	2,404,041	2,348,679	2,303,967	2,251,197	2,036,968	1,773,383	1,490,995	1,167,363
Sub-Total	Outpatient	716,798	766,629	819,783	880,393	951,044	1,031,128	1,095,261	1,172,171	1,264,101	1,375,454
	Inpatient	2,643,185	2,887,570	3,085,269	3,320,279	3,609,140	3,941,975	4,177,652	4,440,634	4,773,053	5,176,410
Grand Total	Local	3,359,983	3,654,199	3,905,052	4,201,372	4,560,184	4,973,103	5,272,913	5,612,805	6,037,154	6,551,864
	Foreign(\$=000)	(7,000)	(7,613)	(8,136)	(8,753)	(9,500)	(10,360)	(10,985)	(11,693)	(12,577)	(13,649)

Table A-51.

Yechin, Barwol and Guro Hospitals
ECONOMIC FORECASTING: PRO-FORMA BALANCE SHEET
(1st-10th year)

1979 constant price		1980-1989 Unit=1,000,000 ₪								
Year	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Assets										
Current assets	298	454	728	875	1,213	1,573	2,079	2,759	3,670	4,591
Equipment	3,078	3,078	3,078	3,078	3,078	3,078	3,078	3,078	3,078	3,078
depreciation	309	617	924	1,232	1,545	1,854	2,163	2,470	2,779	3,078
Building	5,440	5,440	5,440	5,440	5,440	5,440	5,440	5,440	5,440	5,440
depreciation	108	218	325	432	540	648	756	864	970	1,088
Land	2,807	2,807	2,807	2,807	2,807	2,807	2,807	2,807	2,807	2,807
Total assets	11,206	10,946	10,804	10,533	10,455	10,398	10,488	10,750	11,246	11,750
(\$=000)	(23,346)	(22,804)	(22,508)	(21,944)	(21,781)	(21,662)	(21,850)	(22,398)	(23,429)	(24,479)
Capital and Liabilities										
Current Liabilities	0	0	0	0	0	0	0	0	0	0
Local Loan	2,400	2,400	2,400	2,122	1,826	1,508	1,169	805	476	0
Foreign loan	4,086	4,086	4,086	4,086	4,086	4,086	4,086	4,086	4,086	4,086
Capital	5,089	5,089	5,089	5,089	5,089	5,089	5,089	5,089	5,089	5,089
Retained earnings	0	* 369	* 629	* 771	* 764	* 545	* 286	144	771	1,654
Net profit	* 369	* 260	* 142	7	218	260	430	626	884	921
Total	11,206	10,946	10,804	10,533	10,455	10,398	10,488	10,750	11,246	11,750
(\$=000)	(23,346)	(22,804)	(22,508)	(21,944)	(21,781)	(21,662)	(21,850)	(22,398)	(23,429)	(24,479)

* deficit

Yeoju, Banwol, Guro Hospitals
ECONOMIC FORECASTING: PRO-FORMA INCOME STATEMENT
(1st-10th year)

Table A-52.

1979 constant price											
Unit: 1,000 Won											
Year	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
Total Revenue	3,359,983	3,654,199	3,905,052	4,201,372	4,560,184	4,973,103	5,272,913	5,612,805	6,037,154	6,551,864	
Total expenses	3,062,325	3,247,438	3,380,517	3,528,174	3,695,302	4,087,185	4,239,638	4,408,292	4,598,877	5,103,467	
Operating income	297,658	405,761	524,535	673,198	864,932	885,918	1,033,275	1,206,513	1,438,277	1,448,397	
Depretiation	416,576	416,576	416,576	416,576	416,576	416,576	416,576	416,576	416,576	416,576	
Interest	249,666	249,666	249,666	249,666	229,985	209,482	187,258	163,482	138,042	110,818	
Net profit											
local	* 368,584	* 260,481	* 141,707	6,956	218,368	259,860	429,941	626,455	883,659	921,003	
foreign (\$=000)	(768)	(543)	(295)	(14)	(455)	(541)	(895)	(1,305)	(1,841)	(1,919)	

* deficit

Table A-53

Yeoju Hospital (50 Beds)
ECONOMIC FORECASTING: ESTIMATION OF CASH FLOW
(1st-10th year)

1979 constant price										
Unit: 1,000 Won										
Year	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1. <u>Operating and Maintenance</u>										
1.1 personnel	190,286	195,995	201,875	207,930	214,168	220,594	227,211	234,029	241,050	248,282
1.2 other expenses	119,772	139,997	151,425	164,056	178,544	193,875	199,573	205,823	234,829	220,498
1.3 maintenance	11,030	11,030	11,030	11,030	11,030	11,030	11,030	11,030	11,030	11,030
1.4 interest	28,845	28,845	28,845	28,845	26,419	23,822	21,044	18,072	14,892	11,489
1.5 operating expenses	349,933	375,867	393,175	411,861	430,165	448,691	458,858	468,954	479,741	491,299
1.6 depreciation	40,824	40,824	40,824	40,824	40,824	40,824	40,824	40,824	40,824	40,824
1.7 operating cost	390,767	416,691	433,999	452,685	470,989	489,515	499,682	509,778	520,565	532,123
2. <u>Revenue</u>										
2.1 outpatient	106,693	115,203	120,027	126,300	134,432	135,680	143,577	149,344	156,762	166,861
2.2 inpatient	183,939	234,707	259,613	287,414	321,940	362,141	378,799	396,010	413,944	432,551
2.3 other revenue	0	0	0	0	0	0	0	0	0	0
2.4 revenue	290,632	349,910	379,700	414,314	456,372	501,811	522,376	545,154	570,706	599,422
3. <u>Calculation</u>										
3.1 operating income	* 100,125	* 67,781	* 54,299	* 38,371	* 14,612	12,296	22,694	35,376	50,141	67,299
3.2 accumulation	* 100,125	* 167,906	* 222,205	* 260,576	* 275,188	* 262,892	* 240,828	* 205,452	* 155,311	* 88,012
3.3 income tax	0	0	0	0	0	0	0	0	0	0
4. <u>Cash Flow Calculation</u>										
4.1 Gross cash flow	* 59,301	* 26,957	* 13,475	2,453	26,212	53,120	63,518	76,200	90,965	108,123
4.2 Invested capital	59,301	26,957	13,475	32,209	10,876	0	0	0	0	0
4.3 payoff/discharge	0	0	0	34,662	37,088	39,684	42,462	45,435	48,615	52,054
4.4 net cash flow (4.1+4.2-4.3)	0	0	0	0	0	13,436	21,056	30,765	42,350	56,072
(\$=000)	(0)	(0)	(0)	(0)	(0)	(28)	(44)	(64)	(88)	(117)
4.5 accumulation of 4.4	0	0	0	0	0	13,436	34,442	65,247	107,557	163,629
(\$=000)	(0)	(0)	(0)	(0)	(0)	(28)	(72)	(136)	(224)	(341)

* deficit

Appendix
Table A 4-1

Yeoju Hospital
INVESTMENT COST

	Local cost	Foreign cost
No.1: Land estate cost		
1.1 Value: quantity (Won/M ²)		
8,400M ² (21,216Won/M ²)		
1.2 Acquisition cost	₩178,220,000	\$371,292
Total Sum of No.1	178,220,000	371,292
No.2: Site preparation cost		
2.1 Public opening	2,000,000	4,167
2.2 Non-Public opening	8,000,000	16,666
2.3 Other cost (i.e. taxes)		
Total Sum of No.2	10,000,000	20,833
No.3: Construction cost		
3.1 Building (due to room and space program plus traffic ways)	549,000,000	1,143,750
3.2 Installations (Sewage, Water, Heating, Electricity ...)	121,000,000	252,083
3.3 Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-conditioning, elevators ...)	150,000,000	362,500
Total Sum of 3.1 - 3.3	820,000,000	1,708,333
No.4: Equipment		
4.1 Medical equipment		
4.2 Non-medical equipment	₩225,681,000	\$470,169
Sum of 4.1 + 4.2	16,555,000	34,490
No.5: Outside equipment	242,236,000	504,659
No.6: Contingencies		
6.1 Price contingencies	20,750,000	43,229
6.2 Physical contingencies	20,750,000	43,229
No.7: Engineering fees	33,200,000	69,167
and		
a) Classification to space-content: 1/		
3.1 - 3.3 : $\frac{m^3}{\text{Won/m}^3}$	Whole Amount	Outside equipment
15,600 50,000	₩780,000,000	₩40,000,000
Sum of 3.1 - 3.3		

1/ Whole amount is the sum of construction and engineering fees. Therefore for the total investment cost of construction, cost of outside equipment should be added to it.

b) Classification to space				
3.1 - 3.3 :	<u>m</u>	<u>Won/m</u>	<u>Whole Amount</u>	<u>Outside equipment</u>
	3,900	200,000	₩780,000,000	₩40,000,000
Sum of 3.1 - 3.3				

c) Classification to beds				
3.1 - 3.3	<u>No. of beds</u>	<u>Won/Bed</u>	<u>Whole Amt</u>	<u>Outside equipment</u>
	50	156,000	₩780,000,000	₩40,000,000

No.8: Working capital (estimate) : 2/

8.1 Cash, accounts receivable	₩18,162,000	\$37,838
8.2 Ausiliary goods (cleaning, disinfections heating...)	2,357,000	4,910
8.3 Pharmaceuticals, medical articles	5,623,000	11,715
8.4 Bank liabilities	0	0
8.5 Short-term loans, drafts	0	0
8.6 Accounts payable	0	0

Difference of (8.1 + 8.2 + 8.3) -		
(8.4 + 8.5 + 8.6)	26,142,000	54,463

2/ Working capital for the initial year is estimated on the assumption that at least one-twelfth (one month) of annual expenses will be required. Initial investment costs for pharmaceuticals and medical articles and Auxiliary goods are one-twelfth of annual expenses for these items respectively. Cash required is estimated as (working capital required) - (8.2 - 8.3)

Table A 4-2

Korea University Hospital Income Statement
(during 1977. 3 - 1978. 2)

Revenues from operation		2,627,142,228
outpatient	661,406,125	
inpatient	1,933,704,303	
others	32,031,800	
Expenses for materials		654,454,545
pharmaceuticals	420,187,807	
medical materials	145,831,809	
blood	22,512,250	
others	65,922,679	
Operating income before Administrative Expenses		1,972,687,682
Administrative Expenses		1,546,874,165
personnel	990,648,454	
depretiations	106,517,095	
others	47,521,867	
Operating income		425,813,518
Income from outside of operation		131,576,904
Net profit		557,390,422
(\$)		(1,161,230)

B. BANWOL

B. BANWOL HOSPITAL

1. FUTURE OUTLOOK OF BANWOL MODEL CITY

1.1. Background of the Banwol City Development

1.1.1. The development of the Banwol Model City situated 35 Km southwest of Seoul City is a possibility in the future. The development of this Banwol Industrial Complex in the west coast area can alleviate the growing population problem existing in the Capital City and nearby urban areas. The Korean Government is conducting measures to promote a more balanced land development to correct this existing unbalanced situation.

1.1.2. The following general plans are the conceptions visualized by the Korean Government.

- To promote the development of a self-sufficient Banwol City with the population of 200,000.
- To absorb some of the industrial growth from Seoul by means of developing the Banwol Industrial Complex.
- To seek solutions to ease the population and housing problems existing in Seoul.
- To ease the unbalanced land development by broadening the development in this strategically positioned city of Banwol.
- To pilot a new model city development utilizing the theories and experiences of other countries in new city development.

1.1.3. The fact that Banwol City is under progress prevents the complete analysis of the situations in this satellite city. Therefore, the following presentation will be to a great extent based on the plan drawn out on May of 1977 by the Public Industrial Development Corporation under the Ministry of Construction.

1.2. Population Composition and Size.

1.2.1. By the target year of 1986 the expected population of Banwol City will be 200,000. Presently, the residents of Banwol are relatively few, however with the development of Banwol Industrial Complex, the influx of working population is expected to be a main factor of population increase. Due to the rapid social increase factor of the working population, it is rational to use the industrial population growth as a base in estimating Banwol population.

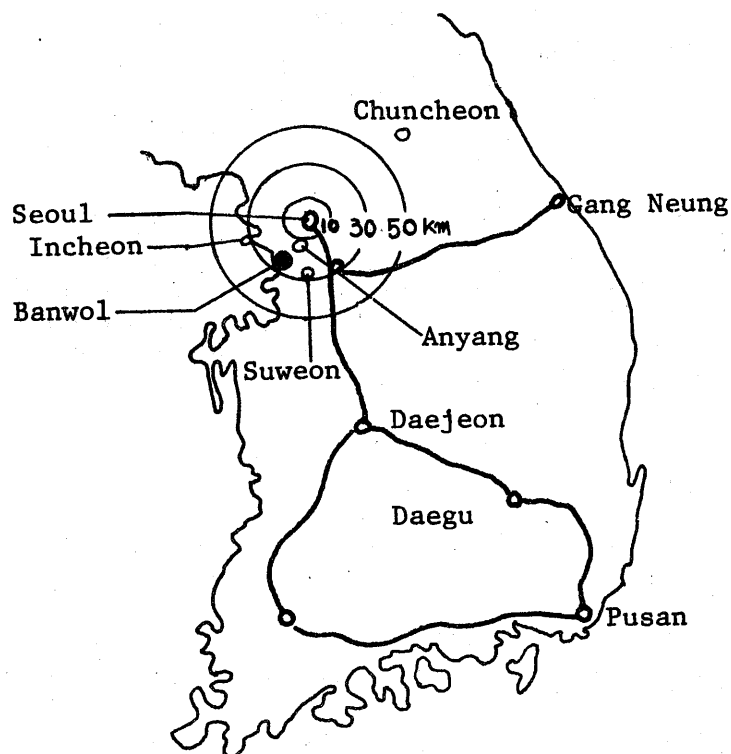


Figure 1-1. Map of Banwol Industrial Complex.

Table B-1

Framework of Banwol Development

Nature of the City:	Industrial
Planned Zone:	317.7 Km ² (Hwasung Gun, Siheung Gun)
Development Zone:	57.8 Km ² (Gunja Myon, Suam Myon, Banwol Myon)
Residential:	15,729 Km ²
Commercial:	1.674 Km ²
Industrial:	8.195 Km ²
Development Period:	1977 - 1986 (short-term) 1977 - 1996 (long-term)
Planned Population:	200,000

Source: Master Plan for Banwol Industrial City, Office of Industrial Estate Development Ministry of Construction, 1977.

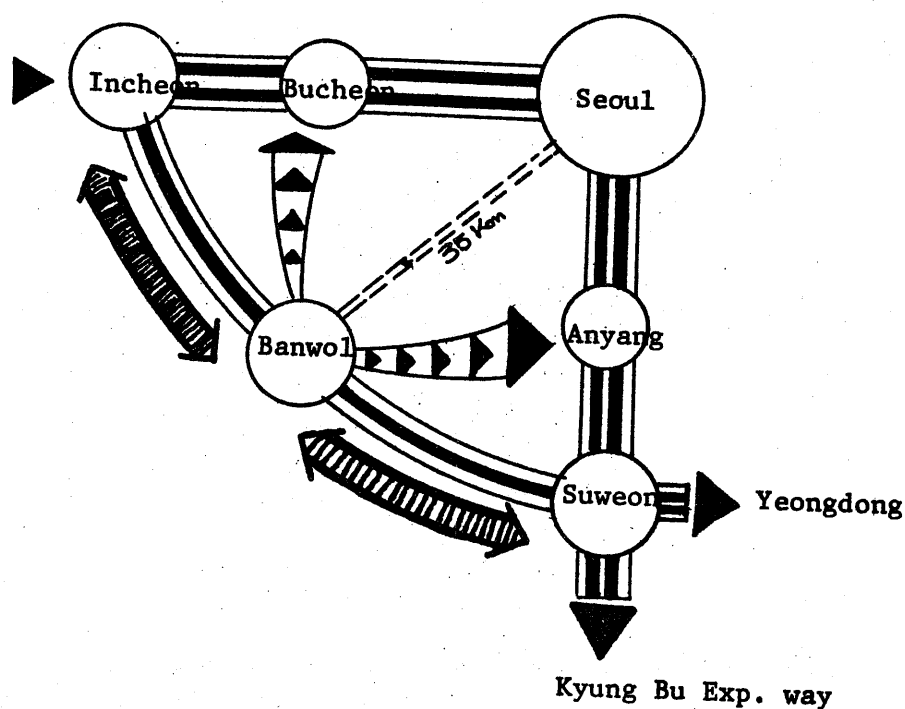


Figure B-1 Location of Banwol in Relation to Major Surrounding Cities.

1.2.2. The population accommodation of Banwol will initially be for the secondary industry workers. Their dependents and tertiary industry workers will follow gradually. In the early stages of Banwol development (1978-1980) the secondary workers will be the main factor of population increase. In the middle stages of development (1981-1983), as the Banwol development is undergoing progression, the dependents and the tertiary industry population will gradually increase to the point where similar increase as the primary workers can be assumed. In the later stages (1984-1986), as the working population increase stabilizes, we can assume the increase of the dependent to be greater.

Table B-2 Population Increase Rate

Period	(Unit:%)	
	Annual Increase Rate (Projected)	
1976 - 1981	1.34	Past Rate of Increase
1981 - 1986	1.50	Government Population Policy
1986 - 1991	1.50	"

SOURCE: Ibid., p. II-6

1.2.3. During and after the development process, presently residing inhabitants of Banwol will probably remain. In the past the tendency has been the migration away from Banwol and the rate of population increase was limited, however after the development, rapid population increase can be assumed. To determine the population increase rate, the past rate of increase can be applied for the early period, and for the later period the government target rate of population increase.

1.2.4. To determine the age-specific composition of population in Banwol, the original population composition was used as the base. Using this method, the expected change of Banwol Population composition according to age is shown on the following table.

Table B-3 Number of Population by Age in Banwol

Age	1976	1981	1986	1991
0 - 14	33.6	29.7	27.5	25.0
15 - 24	22.8	25.5	22.1	16.5
25 - 39	15.6	18.0	25.0	32.1
40 - 59	18.8	18.4	17.4	18.4
60 +	9.2	8.4	8.0	8.0
TOTAL	100.0	100.0	100.0	100.0

SOURCE: Ibid., P. II-7

1.2.5. The economically active population and employment population structure was estimated. Following the rate of development of the model city construction, the employment opportunity in the secondary and tertiary industry will affect the present population structure (Table B-4). Specially, the industry specific population will show marked change due to the change from primary industry to a more productive secondary and tertiary industry. By 1991, the people engaged in primary industry will decrease to 8.1%, whereas the proportion of secondary and tertiary industry will increase to 61.7% and 30.2%, respectively (Table B-5).

1.2.6. The main factors of in-migrant plan of manufacturers, and the inflow of tertiary industry workers as the secondary industry employees and their dependents promote the progress of the Banwol area. The population of Banwol under the above-mentioned assumption is indicated by table B-6 and figure B-2.

1.2.7. Of the population structure of the in-migrants in the early stage, 1978 case, the adult population will compose 52.3% of the total population. After the achievement of economic stability by the in-migrants, we can assume

Table B-4

Economically Active Population

	(Unit: %)			
	1976	1981	1986	1991
Proportion of Economically Active Population to Total Population	66.5	70.0	72.5	75.0
Rate of Employment among Econ. Active Population	82.3	77.5	76.0	73.5
Rate of Employment among Total Population	50.0	68.0	45.0	45.0

Source: Ibid., p. II-7

Table B-5

Percentage Distribution of People by Industry

	(Unit: %)			
Industry	1976	1981	1986	1991
Primary	72.7	25.7	9.2	8.1
Secondary	5.1	40.9	59.2	61.7
Tertiary	22.2	33.4	31.6	30.2

Source: Ibid., p. II-7

Table B-6 Population Projection for Those Residing within the Boundary of City Development Area of Banwol

	'78	'79	'80	'81	'82	'83	'84	'85	'86	'91	Annual Rate of Population Increase (%)				
											'76-'81	'81-'84	'84-'86	'86-'91	
Total Population	17,400	19,100	44,100	82,700	113,000	137,600	163,200	183,400	207,200	241,000	38.4	14.6	45.2	20.2	3.1
Population by Industry															
Primary	13,200	10,800	9,000	7,300	6,100	5,000	4,400	4,300	4,200	3,800					
Secondary	2,300	5,800	28,100	62,200	89,400	112,000	133,100	149,000	166,100	176,600					
Tertiary	1,900	2,500	7,000	13,200	17,500	20,600	25,700	30,100	36,900	60,600					
Employment by Industry															
Total	8,200	10,500	29,600	56,200	72,200	82,400	89,400	90,700	93,300	108,800	47.2	9.7	48.9	10.7	3.1
Primary	4,700	3,800	3,000	2,400	1,900	1,500	1,200	1,100	1,000	900					
Secondary	1,900	4,700	21,300	44,400	58,800	68,300	73,900	74,500	75,500	86,300					
Tertiary	1,600	2,000	5,300	9,400	11,500	12,600	14,300	15,100	16,800	27,600					
Population by Natural Increase	16,700	16,900	17,100	17,400	17,600	17,900	18,100	18,400	18,700	20,200	1.34	1.49	1.42	1.50	
In-migrants	700	2,200	27,000	65,300	95,400	119,700	145,100	165,000	188,500	220,800	353.5	30.5	143.3	23.6	3.2

Source: Ibid., P. II-8.

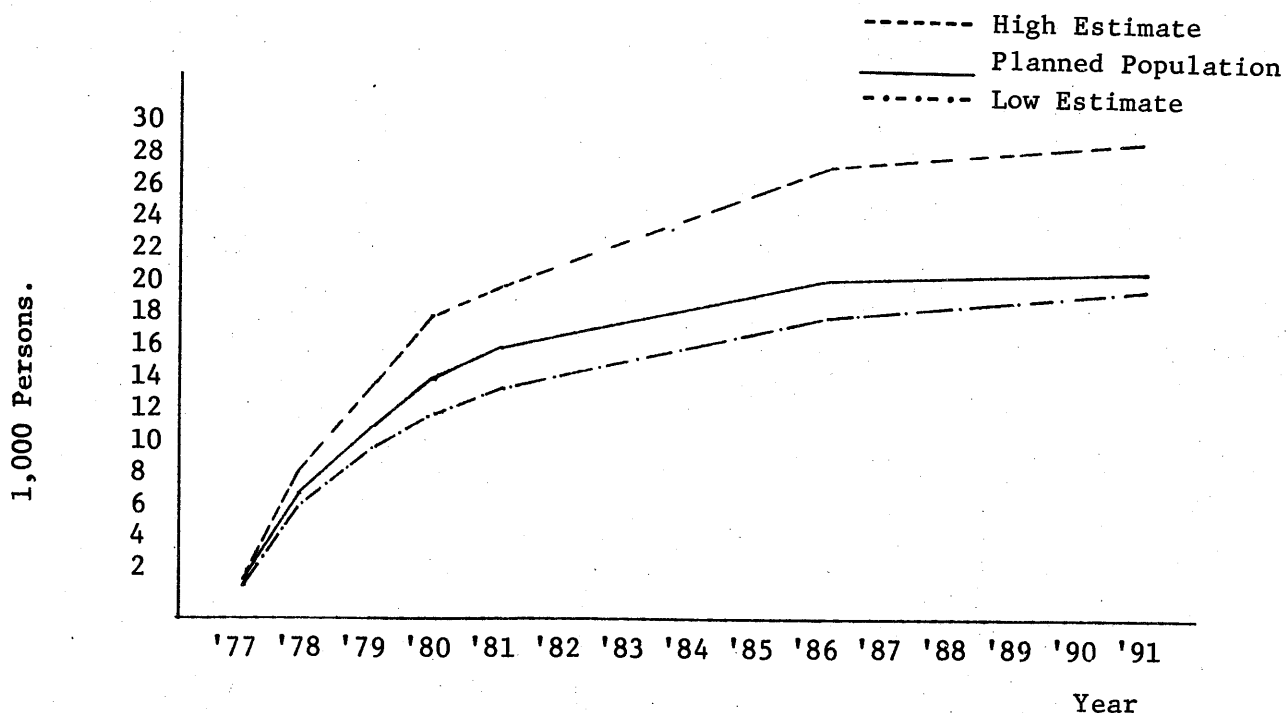


Figure B-2 Estimates of Future Population in Banwol

that their dependents will follow. After this period, called natural population increase period, the population structure will change in a more stable fashion (Table B-7 and Figure B-3).

1.3. Socio-Economic Condition

1.3.1. Banwol Model City will attract and utilize the skilled labor forces from the major cities surrounding this area. Also, the connecting transportation network with Inchon and Seoul will facilitate transport of goods and therefore, Banwol, as an industrial complex, will be ideally situated. Also, the development of the model major city of Banwol is under the framework of the major government policy and this factor prevents the growth of Banwol from following the existing pattern of normal city development, rather an artificial growth pattern is to be expected.

1.3.2. Banwol will absorb many people displaced under the present government policy of population dispersion. Therefore, the status of initial in-migrant population can be expected to be mainly composed of the low-income people. However with the introduction of social welfare system and income maintenance program along with increasing employment opportunities, this situation will be improved. Within the target year, the economic status of these people is expected to be composed of 40% lower class, 40% middle class, and 20% of upper class. In numerical terms, the division will be 83,000 persons, 83,000 persons, and 41,000 persons, respectively. Figure B-4 indicates the type of industry these people will be involved in.

Trend of Population Composition

Table B-7

Age group	1978 (%)	1981 (%)	1986 (%)	1991 (%)	Annual Rate of Increase (%)	
					'78-'86	'86-'91 '78-'91
Toddler(0-4)	1.3(7.5)	5.9(7.1)	23.2(11.2)	19.5(8.1)	43.4	- 3.4 23.2
Children & Adolescent(5-19)	6.3(36.2)	29.9(36.2)	73.4(35.4)	82.9(34.4)	35.9	2.5 21.9
Adult(20-59)	9.1(52.3)	44.3(53.6)	100.9(48.7)	126.8(52.6)	35.1	4.7 22.5
Aged (60+)	0.7(4.0)	2.6(3.1)	9.7(4.7)	11.8(4.9)	38.9	4.0 24.3
Total	17.4(100.0)	82.7(100.0)	207.2(100.0)	241.0(100.0)	36.3	3.0 22.4

Source: Ibid., P. II-13.

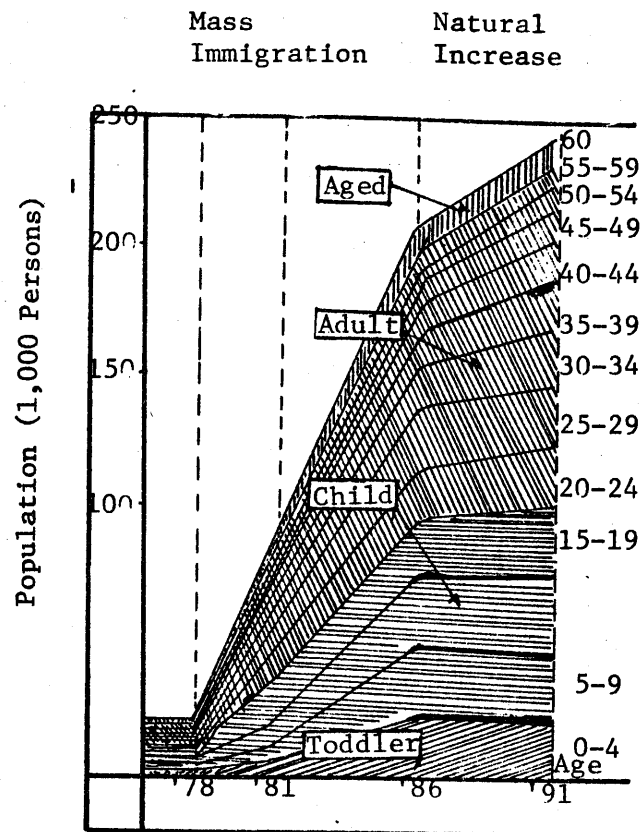


Figure B-3 Trend of Population Composition

Source: Ibid. P. II-13.

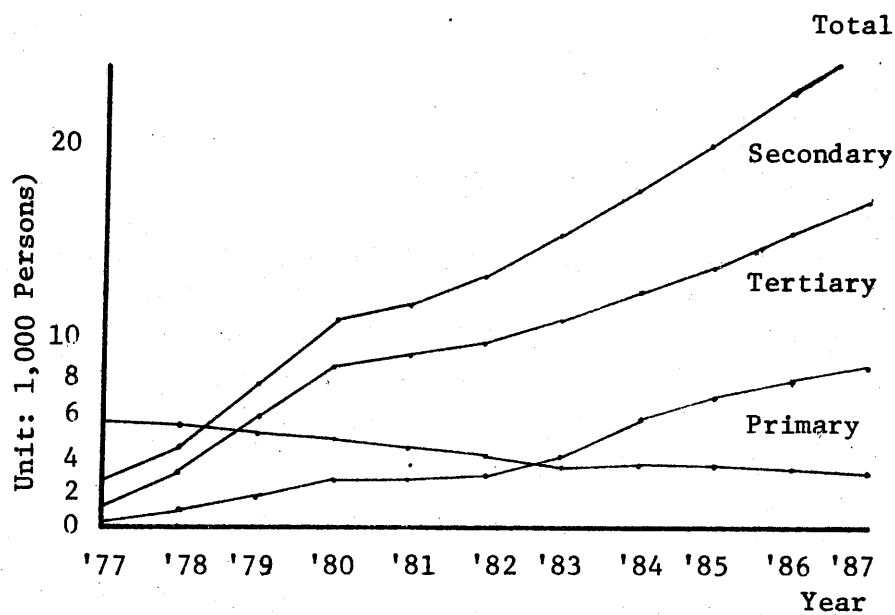


Figure B-4 Estimate of Population by Type of Industry

1.3.3. The following diagram indicates the relative distances (of the social, economic and cultural facilities) from the residential area.

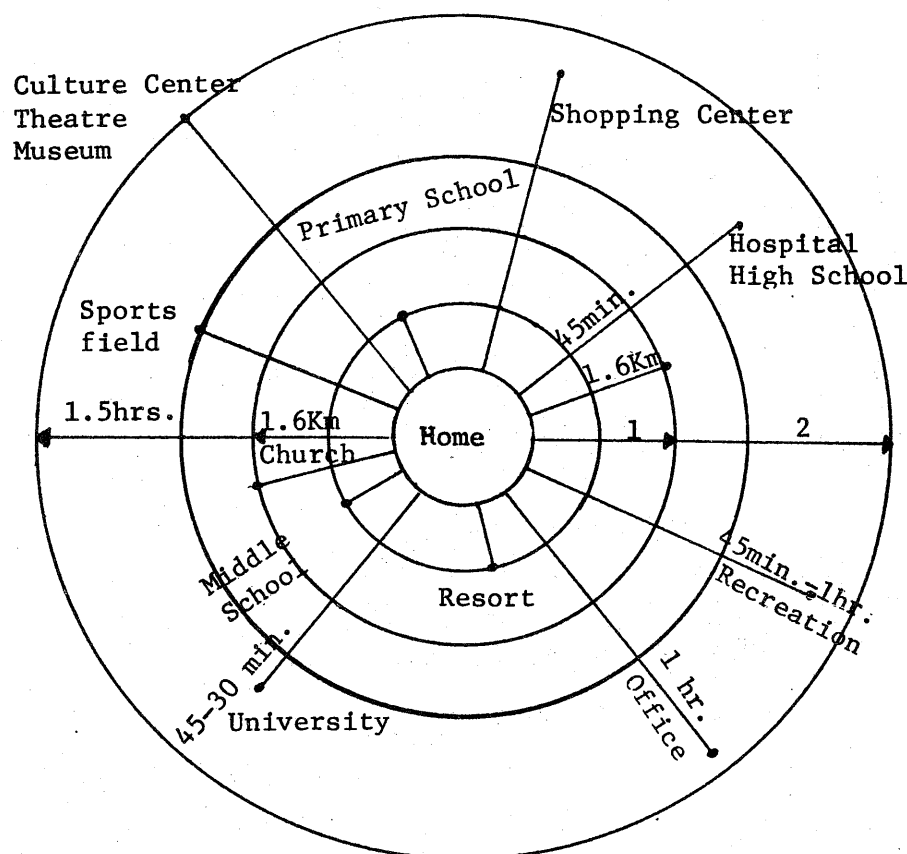


Figure B-5 Distance between Residential Area and Various Destinations

- 1: Circle of walking distance
- 2: Circle of public transportation

Source: Ibid. P. II-55.

1.3.4. In order to create an orderly environment, the city of Banwol will be differentiated into residential; production, consumption and recreational areas. To enhance the efficiency of the city functions, the city will be arranged into several nuclear units with each unit sustaining 70,000 to 80,000 persons.

Table B-8 Area and Location of Development Nucleus

Development Nuclus	Area	Location
First Nucleus Zone	4,425 Km ²	Kunja Myon
Second Nucleus Zone	4,902 Km ²	Suam Myon
Third Nucleus Zone	4,459 Km ²	Banwol Myon
Industrial Complex Zone	13,388 Km ²	Kunja Myon

SOURCE: Ibid. (Synopsis), P. 12

1.3.5. The land utilization plan of the Banwol City is indicated by the following table.

Table B-9 Land Utilization Plan at the Banwol Development Center

Land Use	Area (Km ²)	%
Residential	15,729	27.2
Commercial	1,674	2.9
Industrial	8,195	14.2
Production Green Belt	6,062	10.5
Natural Green Belt	26,140	45.2
TOTAL	57.8	100.0

SOURCE: Ibid. (Synopsis), P. 12

1.3.6. Among the 55,000 households in Banwol, 93% of the Banwol residents will possess their own housing by 1986. In regard to this population, apartment will provide dwelling for 22,000 households and 29,000 households will possess private residence.

Table B-10 Housing Supply Plan

Kinds of Residence	No. of Households	%
Apartment	22,000	43.1
Individual House	29,000	56.9
TOTAL	51,000	100.0

1.3.7. Educational, cultural and other social facilities of Banwol are shown in the following table.

Table B-11 Number of Social Service Facilities

Educational	Primary School	17
	Middle School	9
	High School	7
	Occupational School	1
	University	1
Central Gymnasium		1
General Hospital		1 (500 beds)
Natural Park		29
Open Space		6
TOTAL		72

SOURCE: Ibid., P. 12

1.3.8. The Banwol Industrial Complex will be composed of 615 workshops of various industries and will have the capacity to employ some 66,700 workers. The table shows a more detailed description.

Table B-12 Number of Industries and Workers

Type of Industry	No. of Industries	No. of Workers
Textile, Leathers	248	28,300
Chemical, Coal, Rubber, Plastic	60	7,900
Mechanics, Electricity, Metal	105	13,600
Primary Metal	54	4,500
Non-Metal Mineral	13	1,400
Paper, Printing	36	1,800
Timber, Furniture	45	4,300
Food	24	2,400
Others	30	2,500
TOTAL	615	66,700

SOURCE: Ibid. (Synopsis), P. 16

1.3.9. In integrating the above-mentioned facts, the continuous inflow of population and industrial facilities to Banwol will not only increase the direct productive activities, but it will also promote the establishment of a productive community. By this intensive input of social overhead capital,

the income level of the residents will greatly improve.

2. THE PATTERN OF DISEASE

2.1. It is difficult to predict the disease patterns of future Banwol City. However, the fact that Banwol will be an industrial complex gives certain indication as to the expected disease patterns.

2.1.1. According to the age-specific composition of the population in Banwol, those under the age of 20 are relatively small, whereas the age group of 20-59 compose 53% of the total population. Therefore, the morbidity rate and the medical service utilization are expected to be high in relative terms.

2.1.2. The industrial workers will make up 20-30% of the population, thus the incidences of various occupational diseases and industrial accidents are expected to be somewhat greater than other areas.

2.1.3. Because of the lack of accessible medical facilities in the area, the Banwol Hospital should have the capacity to handle broad range of medical cases including both simple and serious cases.

2.2. For the detailed disease pattern in Banwol industrial area, refer to Guro Hospital.

3. OBJECTIVES OF BANWOL HOSPITAL CONSTRUCTION

3.1. Banwol is an artificially planned city. A city of this nature requires the construction of social welfare facilities including health and medical care service. Therefore the planning of the Banwol hospital construction must be in accordance with the total city development plans and must be able to meet the essential medical care needs of the community population. Due to the lack of medical facilities in this area, consideration must be taken to other medical facilities to be built. Medical service and facility planning for the future are indispensable for constructing a model city.

3.2. Banwol will be a self-sufficient city promoted through the combination of artificially-made and natural environment. After the construction of Banwol City, the Government of Korea will seek to utilize the Banwol experience to model further development of other model cities. Therefore, it is necessary to construct modern hospital to reflect on the special characteristics of this model city and to meet the preference of the population in this area.

3.3. The detailed objectives of the Banwol Hospital construction are listed below.

3.3.1. Presently, there are no existing medical facilities in the Banwol area. Therefore, Banwol Hospital will meet the medical needs of the population in this area.

3.3.2. The concentration of medical facilities in the large cities is an important factor of the increase in population of the urban areas. The idea of constructing Banwol City was conceived to promote the population dispersion policy of the Capital city. The construction of Banwol Hospital will assist the government population dispersion policy by meeting medical needs of the Banwol residents

3.3.3. The construction of Banwol Hospital is to primarily meet the medical demands of the industrial accident victims arising from this industrial complex area. Because of this fact, Banwol Hospital will operate in close connection with the hospital in the Guro Industrial Complex. This will be greatly facilitated by the short distance between these two hospitals: 20 minutes separate the hospitals by the semi-express road connecting the two cities.

4. THE TARGET POPULATION OF BANWOL HOSPITAL

4.1. Determination of Banwol Hospital Service Area

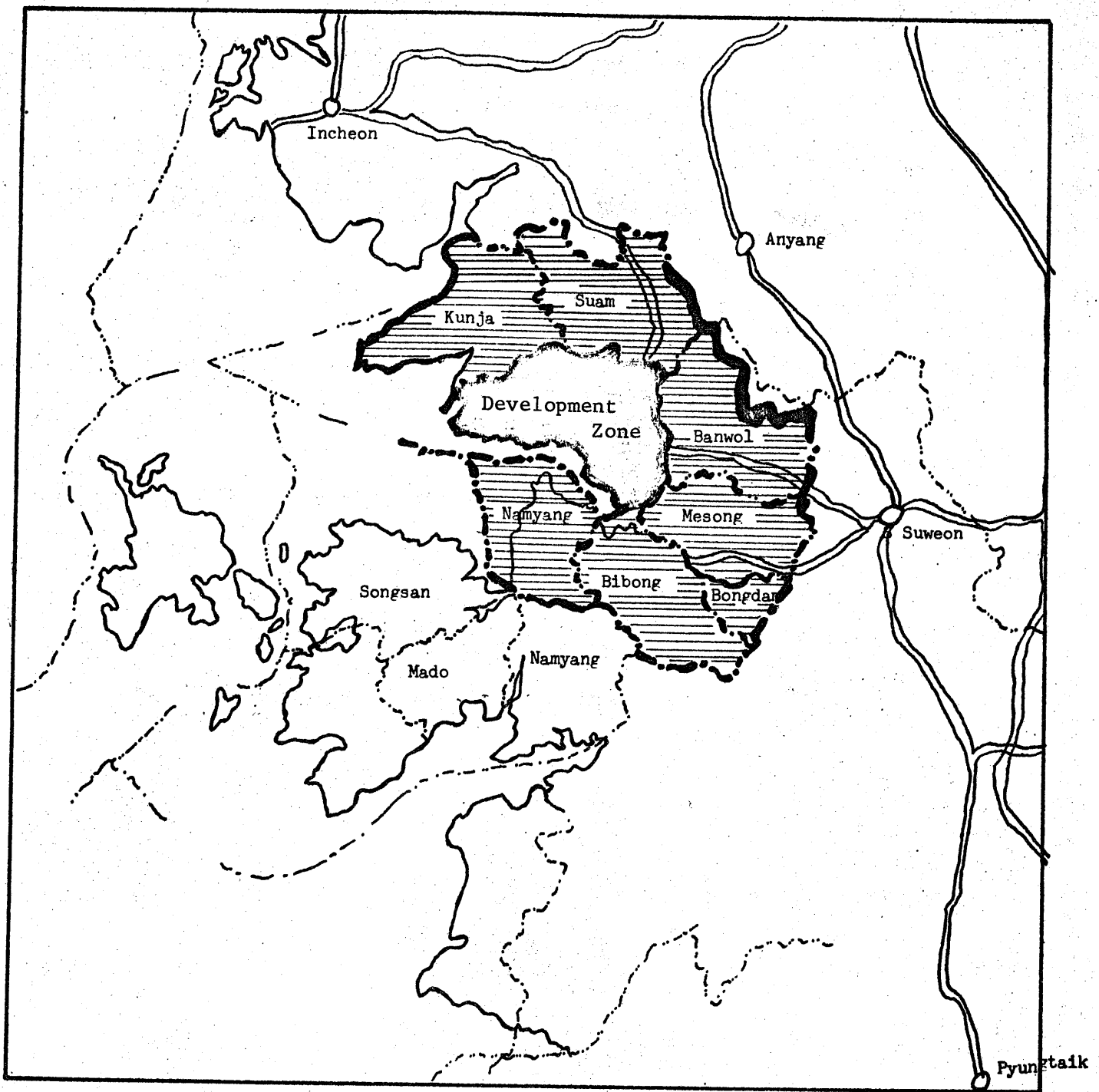
4.1.1. Banwol is located on the triangular line formed by Seoul, Inchon and Suwon. This location is almost equidistant from the three cities and all can be reached within 15-20 minutes by a motor vehicle.

4.1.2. The primary target population of the Banwol Hospital will be the people residing within the Banwol model city development plan area with the secondary aim directed toward the resident outside of the development area. However, the possibility of the residents within the development plan area, especially Banwol and Hwasung Myon, utilizing the medical facilities in the nearby Suwon area is great. Although the resident of the west coast area of Songsan Myon and Mado Myon of Hwasung Gun, Namyang Myon, Paltan Myon, Woojong Myon, and Jangahn Myon are close to Banwol in terms of distance, their livelihood are currently based within the Suwon region. Therefore, the possibility of these residents utilizing the medical facilities in Suwon also exists. This is augmented by the fact nearby Pyungtaek possesses no large medical facility.

4.1.3. In light of the above-mentioned factors, the catchment area of Banwol Hospital is expected to be mainly directed within the Banwol development area. However, it is within reason to include some areas outside of the development area.

4.1.4. If the expansion of the transport network surrounding the Banwol development area is realized, the residents of the Hwasung Gun can be readily absorbed within the Banwol living sphere. Also, the people involved in farming activities who are close to Banwol can be expected to work in more productive industry of Banwol. Therefore, the Banwol Hospital expansion plan should consider these factors and include these people to be within the catchment area of Banwol Hospital.

4.2. Estimated Population within the Catchment Area



Map B-2. Banwol Hospital Catchment.

4.2.1. The population within the above-mentioned catchment area is estimated to be around 19,477 households comprising of 101,540 persons (Table B-13). Within the Banwol development area the population was estimated to be around 2,862 households totaling 14,698 persons (Table B-14).

Table B-13. Existing Population In Banwol Hospital Service Area, 1978

Gun	Myon	No. of Households	No. of People
Siheung	Kunja	3,810	18,509
"	Suam	3,100	16,583
Hwasung	Banwol	3,216	16,985
"	Mesong	1,670	8,956
"	Namyang	2,174	12,249
"	Bibong	1,547	8,313
"	Songsan	2,772	13,958
"	Mado	1,188	5,987
TOTAL		19,477	101,540

SOURCE: Kyunggi Province, The 1978 Residential Population Survey, 1979

Table B-14. Estimated Population in Banwol Development Center*

Gun	Myon	No. of Households	No. of People
Siheung	Kunja	1,112	5,526
"	Suam	848	4,455
Hwasung	Banwol	902	4,717
Sub-total	City Zone	2,862	14,698

* These figures are calculated from using the Banwol Map.

This figure was arrived by utilizing the Banwol map and the 1978 Resident Population Survey. According to the original development plan the population within the development area was expected to be around 16,700 persons, resulting in the difference of about 2,000 persons. This difference originated from the process of mapping. As the difference is not large, 16,700 persons were used for a base population within the development area, and the remaining 84,840 are assumed to be outside of the development area.

4.2.2. The calculation of population within the city plan area was made according to the original plan (Table B-6). The population within the catchment area outside of city development area was under the assumption that the

present population will remain after the development process. The following three assumptions were made.

Assumption 1: The average annual rate of increase will follow the past rate of increase and the population increase rate policy of government. Then, the following formula can be used for the calculation of population within the catchment area, $P_t = P_o (1 + r)^n$

P_o = Population of base year

P_t = Population at the n year

r = Rate of population increase

Table B-15

Annual Population Increase Rate
(Assumption I)

Year	Increase Rate (%)
1978 - 1981	1.34
1981 - 1986	1.50
1986 - 1991	1.50

SOURCE: Master Plan for Banwol Industrial Estate May, '77.
(Synopsis) Office of Industrial Estate Development, Ministry of Construction . P. II-6.

Assumption II: The population of Inchon in the year 1960 was 401,000 persons. The annual increase rate in Inchon was 4.8% between 1960-1966 and 5.1% between the years of 1966-1970. Applying this Inchon situation to Banwol to calculate the population increase in Banwol is the second assumption. This assumption is made due to the fact that Banwol is expected to experience similar pattern of industrial growth as Inchon.

Table B-16

Annual Population Increase Rate
(Assumption II)

Year	Increase Rate (%)
1978 - 1981	4.8
1981 - 1986	5.1
1986 - 1991	5.1

SOURCE: Korea Statistical Year Book & Population and Housing Census, 1974, 1975.

Assumption III: The above-mentioned assumptions are under the risk of low estimate in assumption I and high estimate in assumption II. Thus, the third assumption incorporates the two assumptions. The expected slow growth of Banwol in the initial stage requires the low estimate (Assumption I). As the development progresses the higher estimate is needed. Therefore, after 1982 the Inchon case is utilized.

Table B-17. Annual Population Increase Rate
(Assumption III)

Year	Increase Rate (%)
1978 - 1982	1.34
1982 - 1986	5.10
1986 - 1991	5.10

4.2.3. Utilizing the above-mentioned assumptions, the population within the Banwol catchment area is expected to be around 105,000 persons in 1979 and to increase to 340,000 to 400,000 by the year 1991 (Table B-18). The study has utilized Assumption III and expects the total population in the Banwol catchment area to be around 355,926 persons.

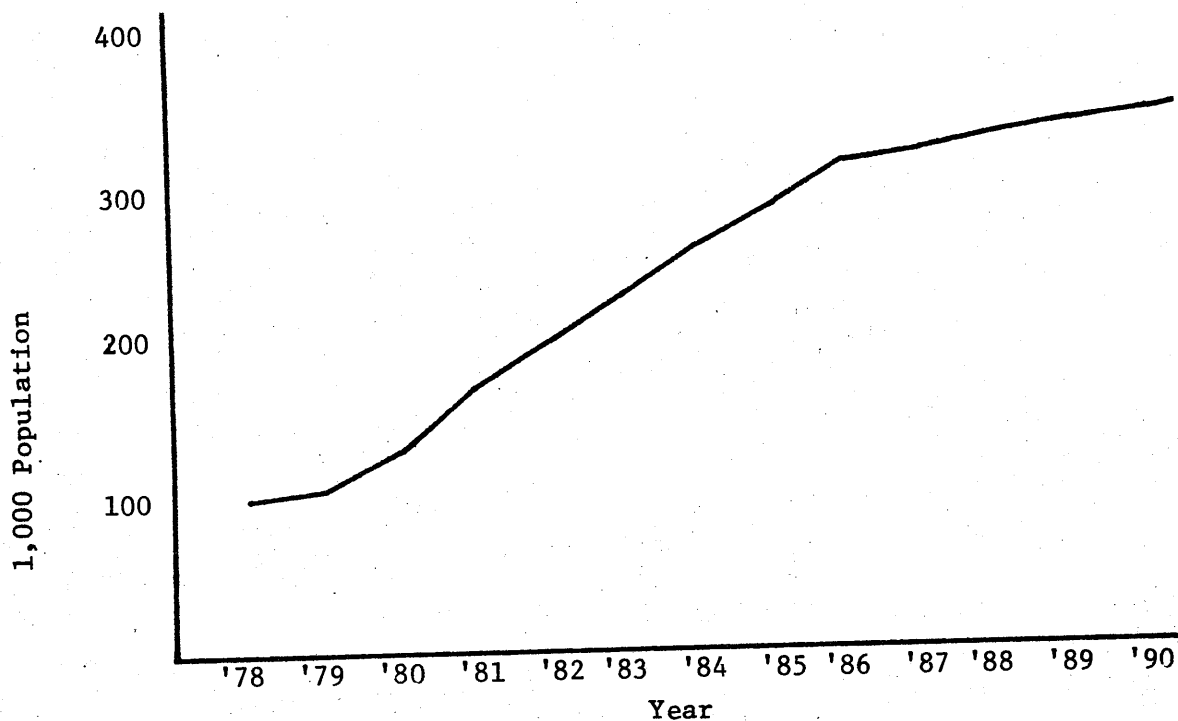


Figure B-6. Population Trend of Banwol

Table B-18

Population Projection in Banwol

Year	Develop- ment Center (A)	Planned Area		Projection I (A) + (B)		Projection II (A) + (C)		Projection III (A) + (D)
		(B)	(C)	(D)				
78	17,400	84,840	84,840	84,840	102,240	102,240	102,240	102,240
79	19,100	85,978	88,912	85,978	105,078	108,012	105,078	105,078
80	44,100	87,129	93,180	87,129	131,229	137,280	131,229	131,229
81	82,700	87,296	97,652	88,296	170,996	180,352	170,996	170,996
82	113,000	89,620	102,632	89,620	202,620	215,632	202,620	202,620
83	137,600	90,965	107,866	94,191	228,565	245,466	231,791	231,791
84	163,200	92,329	113,368	98,994	255,529	276,568	262,194	262,194
85	183,400	93,714	119,149	104,043	277,114	302,549	287,443	287,443
86	207,200	95,120	125,226	109,349	302,320	332,426	316,549	316,549
87	213,960	96,547	131,613	110,464	310,507	345,573	324,424	324,424
88	220,720	97,995	138,324	111,580	318,715	359,044	332,300	332,300
89	227,480	99,465	145,379	112,695	326,945	372,859	340,175	340,175
90	234,240	100,957	152,794	113,810	335,197	387,034	348,050	348,050
91	241,000	102,471	160,586	114,926	343,471	401,586	355,926	355,926

(B): Low Estimate

(C): High estimate

(D): Medium estimate

5. BED SIZE OF THE BANWOL HOSPITAL

5.1. Estimation of In-patient Service Utilization

5.1.1. In order to estimate the in-patient service utilization by the residents of Banwol two assumptions were made.

5.1.1.1. The residents of the Banwol Industrial Complex City will for the most part consist of employees of large and small factories, public officials, private school teachers and their dependents. Therefore, within this complex, most of the residents are assumed to be members of the medical insurance program.

5.1.1.2. Due to the "Greenbelt" policy of the Government, the region outside the development area will not experience rapid progress. Therefore, outside of the development area, assumption is made that the existing population will still be engaged in farming.

5.1.2. According to the national statistics of the medical insurance system, the following figures were computed for the year 1977. The insured members were hospitalized on the average of 0.0187 time due to sickness and 0.0162 time for delivery per year. In others words, the average of hospitalization/person/year was 0.0349 time (Table B-19). This low utilization can be attributed to the fact that 1977 was the first year of operation of the insurance system. Therefore, the following assumptions were made in regard to the expected utilization rate of Banwol residents.

Assumption I: Because Banwol is a new city, the hospital utilization rate of 1977 can be applied to the Banwol Hospital to be constructed in 1980 or 1981. Although it is unrealistic that the rate of utilization will not undergo an increase during this period, we can assume that the utilization rate will not be lower than the 1977 survey.

Assumption II: It is assumed that the utilization rate among Banwol residents will increase at an annual rate of 5% with 1977 as the base year (Table B-23-1, Column 3 and 5).

Assumption III: The utilization rate for delivery by the subscribers of Banwol City is not expected to be different than other areas. However, the utilization rate for delivery by the dependents is assumed to increase at an annual rate of 3% (Table B-23-1, Column 9).

5.1.3. The survey of health insurance members on the national basis revealed that average length of hospitalization due to illness was 8 days and an insured member utilized out-patient service on the average of 2.5 times per year. In the case of delivery, the average length of stay was 3 days and outpatient services were utilized on the average of 1.7 times per year (Table B-20). Since the national statistics did not classify its statistics according to the subscriber and their dependents, this study will attempt to

Table B-20

Days of Treatment per Case in the Employees Health Insurance Benefit, 1977

Month	Sickness Benefit		Maternity Benefit		Average
	Hospitalization	Outpatient	Hospitalization	Outpatient	
July	7.8	2.5	3.0	1.9	3.0
August	30.4	2.5	3.1	2.0	3.3
September	8.0	2.4	3.0	1.6	2.6
October	7.9	2.5	2.9	1.7	2.7
November	8.0	2.5	3.0	1.6	2.7
December	7.7	2.5	2.9	1.6	2.6
Average	8.0	2.5	3.0	1.7	2.7

Source: Bok Sung Lee, The 1977 Service Statistics on the Employees Health Insurance, Health Insurance Vol. 1., No. 3, p. 128

classify it through estimation. As for their dependents, the average length of stay for illness is 10 days and 3.4 days for delivery (Table B-23-1, Columns 4, 6, 8, 10).

5.1.4. The population of industrial workers for the industrial accident compensation insurance is shown on the table B-21. Due to the relatively few factories employing less than 10 workers in Banwol, the assumption is made that all workers are covered under the industrial accident compensation program. The original plan for Banwol Industrial Complex estimated the number of Banwol industrial workers for the years 1980, 1983, and 1990, thus, lacking a continual data. Also, the population in Banwol is directed mainly toward the growth of secondary industry. The fact that secondary industry requires the use of huge water supply will delay the settling of Banwol, resulting in difficulty of reaching the 68,800 persons indicated in the original projections. Therefore, this study assumes the following projection for the number of workers under the industrial accident compensation insurance program. They are 29,600 workers for 1980, 82,400 for 1983, and 105,700 workers for 1990 (Table B-23-1, Column 11).

5.1.5. The incidence of industrial accidents according to the national industrial accident data indicates that 0.044 case per person per year occurs. Among these persons it was estimated that approximately 5.5% will require hospitalization for serious injury (Table B-23-1, Column 12 and 13).

The average length of stay for hospitalization was estimated to be around 30 days. To determine the utilization rate for the people engaged in farming outside the planned development area the figures from Yeosu area were applied due to its similar conditions. (Refer to Yeosu study, Assumption II of Table A-25).

5.2. Determination of Required Bed-Size

5.2.1. The distribution of Banwol area in-patients is assumed to follow the poisson distribution. Therefore, the required bed size can be estimated with the following formula.

$$BC = \frac{(Ps \cdot HRs \cdot ALs)}{365} + \frac{(CPd \cdot HRd \cdot ALSd)}{365} + \frac{(Ps \cdot DRs \cdot ALSs1)}{365} + \frac{(Pd \cdot Drd \cdot ALSs2)}{365} + \frac{(Ps \cdot Ia \cdot Ar \cdot ALSa)}{365} - (Ebc \times ORc) + 3\sqrt{T},$$

Where,

Bc = Number of bed requirements within the Banwol development area

Table B-21.

Banwol Industrial Workers by Year

Industry	1980	(%)	1983	(%)	1990	(%)
Primary	4,200	6.1	3,600	4.4	3,000	2.8
Secondary	52,190	75.9	57,660	70.8	66,750	62.1
Tertiary	12,410	18.0	20,200	24.8	37,660	35.1
Total	68,800	100.0	81,480	100.0	107,400	100.0

Source: Master Plan for Banwol Industrial Estate, May, 77 (Synopsis), Office of Industrial Estate Development, Ministry of Construction, p. 10

Table B-22 Industrial Accident Compensation Insurance Data (Nationwide), 1977

Occupation	No. of the Insured	Accident Cases	No. of Accidents per Person per Year	Death	Cases/Person/Year
Mining	72,237	7,390	0.1023	268	0.10
Manufacturing	1,688,406	75,119	0.0445	325	0.04
Construction	499,283	17,461	0.0350	267	0.03
Elect/Other Service	33,764	382	0.0113	13	0.00
Trans/Communication	234,107	16,985	0.0726	287	0.07
Others	118,754	674	0.0057	14	0.00
Total	2,646,551	118,011	0.0446	1,174	0.044

Average Treatments days 30

Source: Annual Report on Industrial Accident Compensation Insurance 1977, Office of Labour.

Table B-23-1

Bed Requirements in the Banwol Hospital Service Area by Year(1)

Year	(1) Development Zone									
	No. of People		Hospitaliza- tion Rate		A.L.S. (Sickness)		Hospitaliza- tion Rate (Dependents)		A.L.S. (Sickness)	
	Sub- scriber	Depen- dents	I	II	I	II	I	II	I	II
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. 1979	10,500	8,600	.0163	.0163	.0163	8	.0205	.0205	10	.0005
2. 1980	29,600	14,500	.0163	.0171	.0171	8	.0205	.0215	10	.0005
3. 1981	56,200	26,500	.0163	.0179	.0179	8	.0205	.0226	10	.0005
4. 1982	72,200	40,800	.0163	.0189	.0189	8	.0205	.0237	10	.0005
5. 1983	82,400	55,200	.0163	.0198	.0198	8	.0205	.0240	10	.0005
6. 1984	89,400	73,800	.0163	.0208	.0208	8	.0205	.0261	10	.0005
7. 1985	70,700	92,700	.0163	.0218	.0218	8	.0205	.0274	10	.0005
8. 1986	93,300	113,900	.0163	.0229	.0229	8	.0205	.0288	10	.0005
9. 1987	96,400	117,560	.0163	.0241	.0241	8	.0205	.0302	10	.0005
10. 1988	99,500	121,220	.0163	.0253	.0253	8	.0205	.0318	10	.0005
11. 1989	102,600	124,220	.0163	.0265	.0265	8	.0205	.0333	10	.0005
12. 1990	105,700	128,540	.0163	.0279	.0279	8	.0205	.0350	10	.0005
13. 1991	108,800	132,200	.0163	.0293	.0293	8	.0205	.0368	10	.0005

Delivery Rate (Dependents)	A.I.S. (Delivery)	No. of Indust- rial Accident Comp. Insured	Incidence of Acci- dent	Admission Rate (I.A.C.)	A.L. S. (I.A.C.)	No. of Existing Beds	Occupancy Rate	Bed Requirements	
								I	II
(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)		
.0286	3.4	10,500	.0442	.055	30	-	-	38	24
.0295	3.4	29,600	.0442	.055	30	-	-	45	46
.0303	3.4	56,200	.0442	.055	30	-	-	76	80
.0312	3.4	72,200	.0442	.055	30	-	-	101	110
.0320	3.4	82,400	.0442	.055	30	-	-	101	138
.0329	3.4	89,400	.0442	.055	30	-	-	146	169
.0337	3.4	90,700	.0442	.055	30	-	-	167	198
.0346	3.4	93,300	.0442	.055	30	-	-	194	234
.0355	3.4	96,400	.0442	.055	30	-	-	197	250
.0363	3.4	99,500	.0442	.055	30	-	-	203	267
.0372	3.4	102,600	.0442	.055	30	-	-	210	284
.0380	3.4	105,700	.0442	.055	30	-	-	217	303
.0389	3.4	108,800	.0442	.055	30	-	-	264	323

P_s = The number of subscribers
 P_d = The number of dependents
 HR_s = The probability of hospitalization per subscriber per year
 DR_s = The probability of institutional delivery per subscriber per year
 DR_d = The probability of institutional delivery per dependent per year
 I_a = The incidence rate of industrial accident per industrial accident compensation insurance member per year
 AR = The hospitalization rate among the industrial accident victims
 ALS_s = The average length of hospital stay of subscribers
 ALS_d = The average length of hospital stay of dependents
 ALS_{s1} = The average length of hospital stay for delivery of subscriber
 ALS_{s2} = The average length of hospital stay for delivery of dependents
 ALS_a = The average length of hospital stay for industrial accident victims
 OR_c = The average occupancy rate of the existing beds
 EB_c = The number of existing beds within the development area
 T = The overfill rate indicating number of patients per day who should be admitted to newly established facilities, this is derived from the following formula:

$$T = \frac{(P_s \cdot HR_s \cdot ALS_s)}{365} + \frac{(P_d \cdot HR_d \cdot ALS_d)}{365} + \frac{(P_s \cdot DR_s \cdot ALS_{s1})}{365} + \frac{(P_s \cdot I_a \cdot AR \cdot ALS_a)}{365} - (EB_c \cdot OR_c)$$

$$B_p = \frac{(P_p \cdot HR_p \cdot ALS_p)}{365} - (EB_p \cdot OR_p) + \sqrt[3]{\frac{(P_p \cdot HR_p \cdot ALS_p)}{365} - (EB_p \cdot OR_p)}$$

Where,

- Bp = Number of bed requirements in the catchment area outside of the development area
- Pp = The population in the catchment area outside of the development area
- HRp = The probability of hospitalization per person per year in the catchment area outside of the development area
- ALSp = The average length of hospital stay of the patients in the catchment area outside of the development area
- EBp = The number of existing beds in the catchment area outside of the development area
- ORp = The average occupancy rate of the existing beds in the catchment area outside of the development area

Therefore, $B = B_c + B_p$, where B equals the total beds required in the Banwol area.

5.2.2. Presently within the Banwol area, one health sub-center, one drugstore, and one herb drugstore exist and no bed exists in this area. 1/

5.2.3. According to the formulas presented before, bed requirements for the year 1979, 1980, 1985 and 1991 are calculated as 96 to 110, 120 to 121, 265 to 295, and 388 to 447, respectively (Table B-23-2, last Columns).

5.2.4. These estimations are made under the assumption that no other hospitals will be constructed in this area. However, if another hospital is constructed in this area the estimations are to be modified. Also, these estimations are made according to the 1977 utilization rate with the assumption that this rate will remain the same. Therefore, even at the lowest estimation the required bed size in the year 1991 will be 388. The shortage of bed complement in the Banwol area is noticeable.

5.2.5. The settlement program of Banwol Industrial Complex has been delayed owing to the difficulty involved in the provision of industrial water supply. Therefore, the Korea University, sponsor of the Banwol Hospital, will start the construction in 1980 and the completion of the 100-bed hospital will be realized by 1981. Eventually, with the progress of the project, the expansion of the hospital to the capacity of 400 beds is planned. 2/

1/ Data from Kyunggi Province, Section of Public Health, February, 1979.

2/ This statement was made by Dean of the Medical College, Korea University at the joint conference between the sponsor of proposed hospitals and the feasibility study team on 13th March 1979.

Table B-23-2. Bed Requirements in the Banwol Hospital Service Area by Year (II)

(2) Planned Zone		(3) Development Zone + Planned Zone						
Year	No. of People	Hospitalization Rate	Average Length of Stay	Days per Year	No. of Existing Bed	Occupancy Rate	Bed Requirements	Total Bed Requirements
								I II
1979	85,978	.0239	9	365	-	-	72	110 96
1980	87,129	.0247	9	365	-	-	75	120 121
1981	88,296	.0254	9	365	-	-	78	154 158
1982	89,620	.0262	9	365	-	-	81	182 191
1983	94,191	.0269	9	365	-	-	86	187 224
1984	98,994	.0277	9	365	-	-	92	238 261
1985	104,043	.0284	9	365	-	-	98	265 296
1986	109,349	.0292	9	365	-	-	105	299 339
1987	110,464	.0299	9	365	-	-	109	306 359
1988	111,580	.0307	9	365	-	-	112	315 379
1989	112,695	.0314	9	365	-	-	115	325 399
1990	113,810	.0323	9	365	-	-	119	336 422
1991	114,926	.0335	9	365	-	-	124	388 447

5.2.6. In light of all these situations, the construction of a 100 bed-size Banwol hospital could be started. However, in the future expansion plan, consideration should be given to the possible construction of other new medical facilities. 1/

6. THE MEDICAL SERVICE PROGRAM OF BANWOL HOSPITAL

6.1. Estimation of Annual In-patients

6.1.1. The in-patient capacity level of a 100 bed-size hospital is estimated to be between 2,500 to 3,400 patients. The figure is the result of the analysis of 12 hospitals with the bed-size of 100-230 by this study (Figure B-7).

Under the assumption that the number of in-patient cases correlates to the number of beds, the following equation was derived.

Less than 100 beds : $Y_1 = 25.65 X - 1.76$ ($r^2 = 0.52$)

More than 100 beds : $Y_2 = 21.65 X + 1,275.45$ ($r^2 = 0.79$)

Therefore, if $X = 100$, $Y_1 = 2,563$ and $Y_2 = 3,440$. (See Figure B-8).

6.1.2. If we assume the average length of hospital stay to be 10 days, the maximum capacity for is 3,650 patients. However in the early stages of Banwol hospital operation, normal operation is not expected. Therefore, assuming the average length of stay to be 11.8 days and the occupancy rate to be around 75%, the Banwol Hospital can handle approximately 2,316 in-patients. For the following year, the average length of stay was assumed to be 11.5 days with the occupancy rate of 76.3%. Therefore in the second year of operation, Banwol Hospital can be expected to service approximately 2,432 in-patients. In the third year of operation, assumption is made that Banwol hospital will operate at a level similar to the lowest number of in-patients among the existing hospitals, serving approximately 2,529 in-patients. However, by the year 1990, 94.3% occupancy rate is expected thereby handling 3,141 in-patients. (See Table B-24).

Table B-24. Estimated Number of Inpatient Cases for the Banwol Hospital by Year

Year	Inpatient Cases	Percentage Increase per Annum
1980	2,316	-
1981	2,432	5
1982	2,529	4
1983	2,630	4
1984	2,735	4
1985	2,818	3
1986	2,902	3
1987	2,989	3
1988	3,049	2
1989	3,110	2
1990	3,141	1
1991	3,172	1

1/ It is scheduled that the Hanyang University will construct its affiliated colleges in the Banwol area. Therefore, the possibility of a hospital under the Hanyang University should not be disregarded.

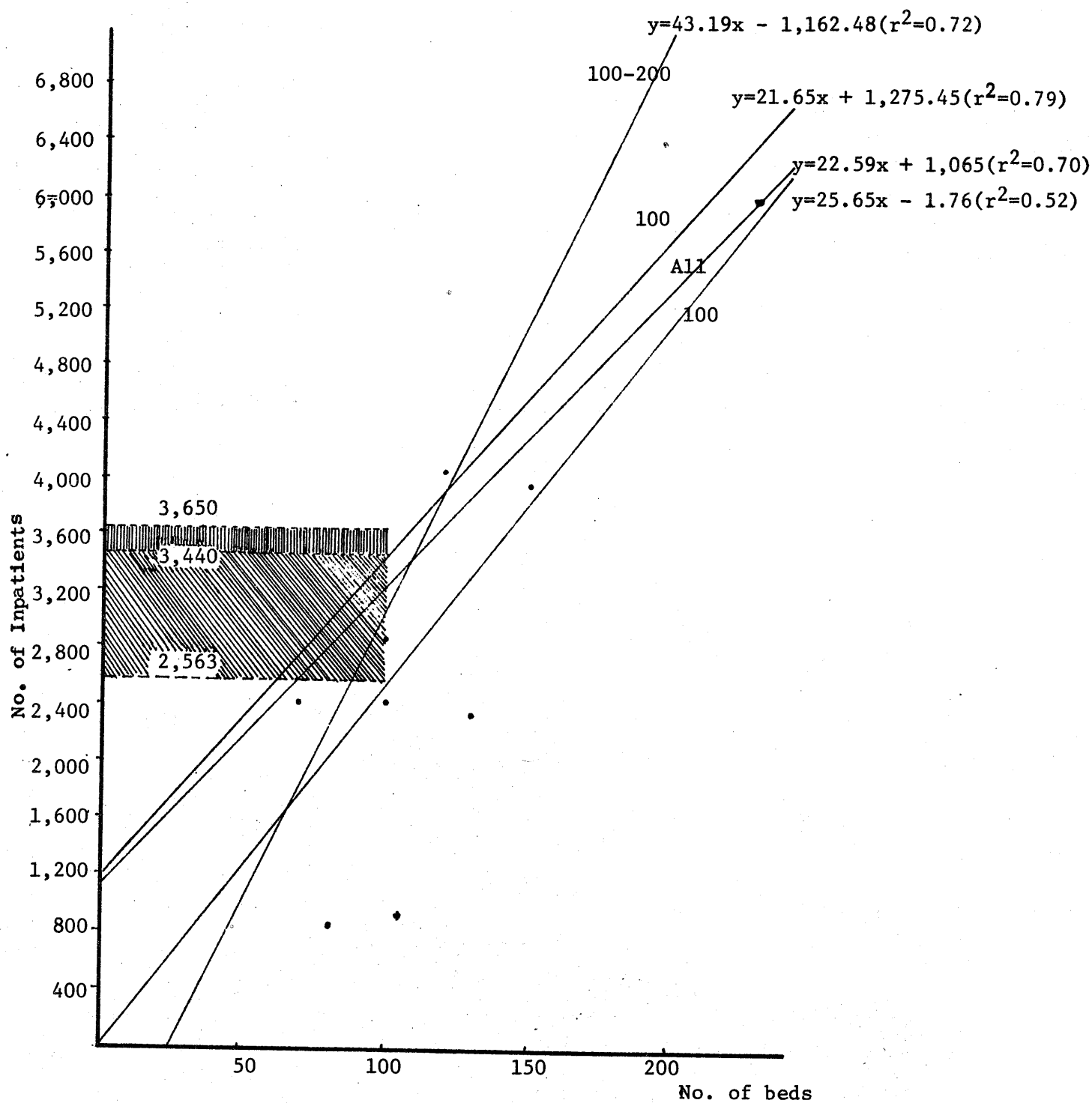


Figure B-7 Relationship between Number of Inpatients and Bed Complements for the 100-bed Hospital.

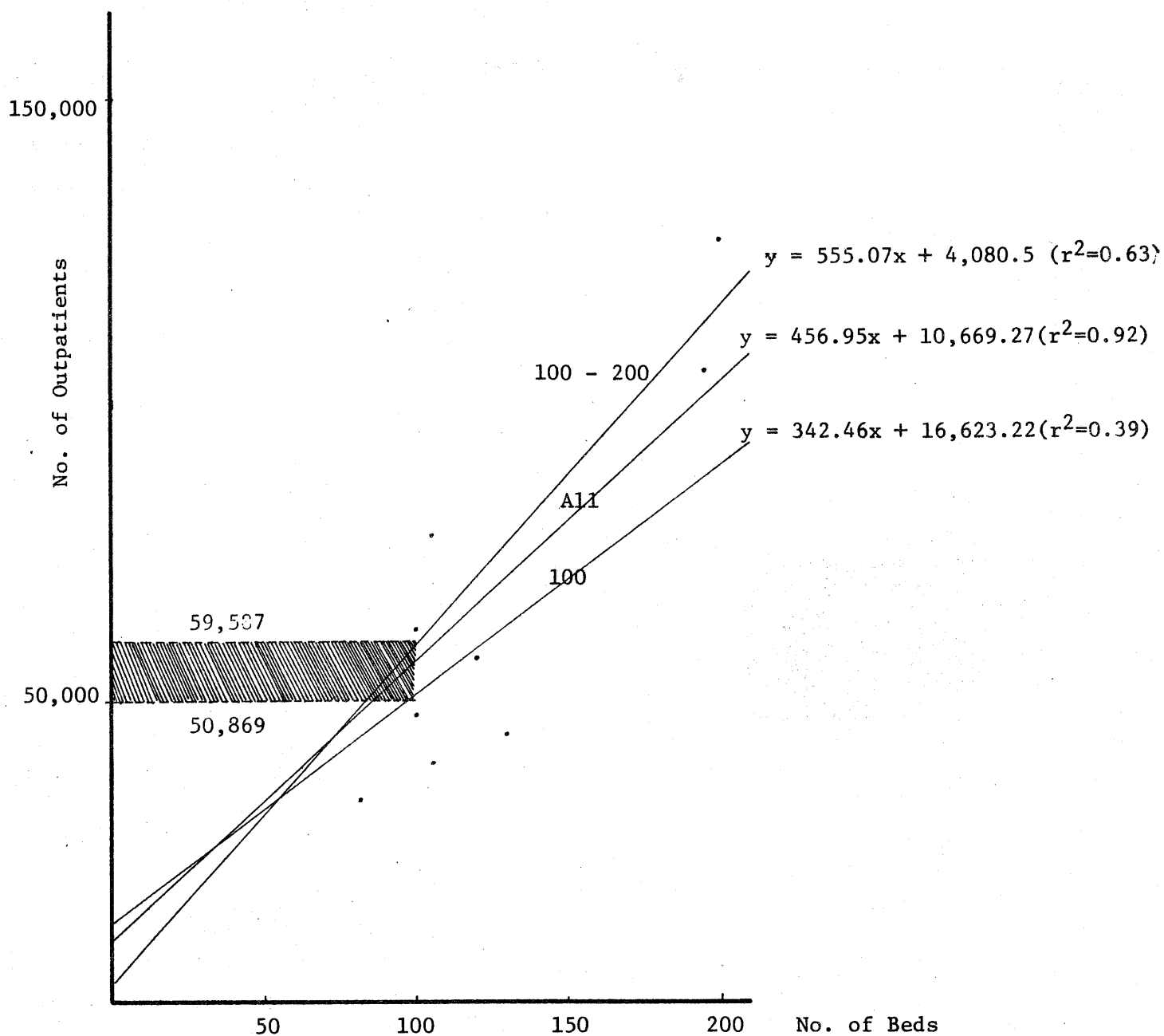


Figure B-8 Relationship between Number of Outpatients and Bed Complements for the 100-bed Hospital

6.2. Distribution of In-patients According to Medical Department

6.2.1. In order to establish a self-sufficient city with the 350,000 population, at least one general hospital is required in the area. The Korea University plans to build a general hospital in this area in accordance with the various Articles of the Medical Law.

6.2.2. To determine the necessary medical departments needed in a 100 bed-size hospital, survey was carried out on Korea Hospital (81 beds), Pusan National Hospital (105 beds), and Kangwon Provincial Hospital (116 beds) with the results shown on Table B-25.

6.2.3. Because of the fact that Banwol is an industrial complex, occurrence of industrial accident cases and serious surgical cases is a strong possibility. In light of the situation, the distribution of patients and beds according to the medical department is indicated by Table B-26.

Table B-25. Percentage Distribution of Inpatient Cases by Medical Department in 1978

Medical Department	Kankuk	Pusan National	Kangwon Provincial
Internal Medicine	43.1	33.7	16.8
Pediatrics	6.9	1.6	7.7
Neuro Psychiatry	2.0	-	-
General Surgery	5.0	20.1	25.3
Orthopedic Surgery	24.9	9.5	5.7
Neuro-Surgery	10.5	16.0	-
Thoracic Surgery	-	-	-
Plastic Surgery	-	-	-
Ob & Gyn	7.1	9.6	22.4
Ophthalmology	-	0.6	-
E.N.T.	0.5	-	18.4
Urology & Dermatology	-	0.1	3.0
Tuberculosis	-	7.8	-
Physical Check-up	-	-	-
Dentistry	-	1.0	0.7
TOTAL (100%)	100.0	100.0	100.0
No. of Patients	860	983	2,391

SOURCE: Data from the KHDI Hospital Feasibility Study Survey, 1979.

6.3. Estimation of Annual Out-patient Visits

6.3.1. It is assumed that number of out-patient visits will increase in relation to the size of the hospital. By analyzing the result of the survey on 12 hospitals, the following formula was derived.

Table B-26. Number of Inpatient Cases and Beds by Medical Department in 1981

Medical Department (Banwol)	No. of Cases per Year	No. of Beds
Internal Medicine	787	26
General Surgery	347	18
Orthopedic Surgery	463	35
Pediatrics	232	6
OB & GYN	278	6
ENT	53	3
Ophthalmology	46	2
Urology and Dermatology	46	2
Dentistry	64	2

Less than 100 Beds: $Y_1 = 342.46 X + 16,623.2$ ($r^2 = 0.39$)

More than 100 Beds: $Y_2 = 555.07 X + 4,085.5$ ($r^2 = 0.63$)

Therefore, if $X = 100$, $Y_1 = 50,869$ and $Y_2 = 59,587$.

6.3.2. Generally the catchment area for the out-patients is less than for the in-patients. However, in the case of Banwol where the medical facilities are lacking, it is a strong possibility that out-patient visits will be greater than usual. Therefore, even if a high estimation of patients is made for the initial stages of Banwol Hospital, it will be inconsequential. With the above-mentioned assumptions and the reference to Figure B-8, the estimation of out-patients are shown in Table B-27. The figures of 222 out-patients daily for 1986, and 240 out-patients daily for 1991 indicate the inevitable increase of out-patient facilities.

6.3.3. According to the Banwol Hospital medical program the ratio of in-patients to out-patients is to be between 1:7.7 and 1:7.3. (See Table B-28).

6.4. Distribution of Out-patients according to Medical Department

6.4.1. Korea Hospital (81 beds), Pusan National Hospital (105 beds) and Kangwon Provincial Hospital (116 beds) were selected as sample hospitals, and the outpatient distribution of these hospitals are shown on Table B-29 and B-30.

6.4.2. The establishment of the 4 basic departments plus orthopedic surgery, ENT, ophthalmology, uro-dermatology, dentistry, and 3 supporting departments at Banwol Hospital is suggested. The out-patient distribution according to each department is shown in Table B-33-2.

6.4.3. The Korean Government plans to cover all Korean people under the National Health Insurance by 1991, the end year of the 6th 5-year Economic Development Plan. In concurrence with this government policy to expand the

Table B-27 Estimated Number of Outpatient Visits for the
Banwol Hospital by Year

Year	No. of Outpatient Visits	Percentage Increase per Annum
1980	52,104	-
1981	54,188	4
1982	56,356	4
1983	58,046	3
1984	59,788	3
1985	60,984	2
1986	62,203	2
1987	63,447	2
1988	64,716	2
1989	66,670	1
1991	67,337	1

Table B-28 In/Out-patient Ratio

Year	Inpatient (A)	Outpatient (B)	$\frac{(B)}{(A)}$
1980	2,316	17,722	7.7
1981	2,432	18,686	7.7
1985	2,818	21,029	7.5
1990	3,141	22,990	7.3

Table B-29. Percentage Distribution of Outpatient Visits by Medical Department in 1978

	Hankuk	Pusan National	Gangwon Provincial
Internal Medicine	40.2	27.6	29.6
Pediatrics	7.9	5.1	6.2
Neuro-Psychiatrics	4.1	0.0	0.0
General Surgery	3.5	5.1	8.5
Orthopedic Surgery	19.4	3.7	0.0
Neuro Surgery	0.6	3.5	0.0
Thoracic Surgery	0.0	0.0	0.0
Plastic Surgery	0.0	0.0	10.5
OB & GYN	3.5	3.9	0.0
Ophthalmology	0.0	2.0	9.4
ENT	13.0	0.0	5.4
Urology & Dermatology	0.0	9.5	5.2
Tuberculosis	0.0	0.0	0.0
Physical Check-up	4.2	8.6	12.1
Dentistry	3.6	25.3	9.1
Total (100%)	100.0	100.0	100.0
No. of Patients	33,484	77,187	53,372

SOURCE: Data from the KHDI Hospital Feasibility Survey, 1979.

Table B-30. Estimated Number of Patients with Health Insurance Coverage for the Banwol Hospital by Year

Year	Outpatient	Inpatient
1980	33.8	30.3
1981	33.8	30.3
1982	40.0	40.0
1983	45.0	50.0
1984	50.0	55.0
1985	55.0	60.0
1986	60.0	65.0
1987	65.0	65.0
1988	80.0	80.0
1989	85.0	85.0
1990	90.0	90.0
1991	100.0	100.0

health insurance program, the proportion of Banwol Hospital patients covered by the insurance program will gradually increase. This assumed increase is shown on Table B-30. Table A 1-3 and A 1-4 indicate this distribution of insured and

non-insured patients by medical department.

6.5. Estimation of Clinical Examinations and Surgery Cases

6.5.1. Although the Banwol Hospital will have 100 beds at the initial construction, the expansion of this hospital to a general hospital with 300-400 beds should include the plans for expanding various clinical laboratories and operating rooms. The incidence of industrial accidents and cases requiring surgery will be relatively high. Also, there are few facilities to provide clinical examination. Therefore, the Banwol Hospital will have the capacity to meet the needs of laboratory examination in Banwol area.

6.5.2. Although tissue pathology examination is beyond the capacity of Banwol Hospital in the early years, this service will be made possible following expansion.

6.5.3. To estimate the number of clinical examinations and surgery the cases from Pohang St. Mary's Hospital located in the Pohang Industrial Complex area, and two other hospitals of efficiency, Choong Buk Province Medical Center and Andong St. Mary's Hospital were analysed. (See Table B-31 and B-32).

6.5.4. Applying the figures from the above-mentioned hospitals the medical program for Banwol Hospital is shown on Table B-33. (See Table B-33-1, B-33-2, B-33-3, B-33-4).

Table B-31 Number of X-ray Examinations per Unit of Measurement in 1978

Hospital	No. of Beds	Per Inpatient Case			Per Outpatient Visit		
		Plain X-ray	Mass X-ray	Fluoro- scope	Plain X-ray	Mass X-ray	Fluoro- scope
St. Columban (Mokpo)	120	0.526	0.051	0.111	0.705	0.007	0.016
Andong Presbyterian	120	1,261	0.047	0.092	0.193	0.022	0.014
Pusan National	105	4,910	0.448	0.348	0.094	0.009	0.007
St. Mary's (Pohang)	100	1,339	0.057	0.368	0.111	0.005	0.020
Choong Buk Medical Center	100	3,020	1.778	0.159	0.240	0.142	0.013
Han Dok	85	2,803	0.707	0.313	0.222	0.056	0.025
Han Kuk	81	4,669	3.149	0.375	0.180	0.121	0.014
Seagrave Memorial	70	1,512	0.054	0.144	0.204	0.007	0.019

Table B-32.

Number of Laboratory Performances per Unit of Measurement in 1978

Hospital	No. of Beds	Per Inpatient Case			Per Outpatient Visit				
		Chemistry	Hematology	Serology	Bacteriology	Chemistry	Hematology	Serology	Bacteriology
St. Columban (Mokpo)	120	0.687	1.721	0.574	3.415	0.097	0.244	0.081	0.484
Andong Presbyterian	120	1.440	1.967	0.656	0.142	0.220	0.301	0.100	0.022
Pusan National	105	0.549	0.781	0.260	0.100	0.010	0.015	0.005	0.002
St. Mary's (Pohang)	100	0.338	0.762	0.254	0.097	0.028	0.006	0.002	0.008
Choong Buk Medical Center	100	0.283	-	-	-	0.023	-	-	-
Han Dok	85	3.340	0.083	0.028	0.493	0.339	0.029	0.010	0.039
Han Kuk	81	4.181	1.177	0.393	1.463	0.161	0.145	0.015	0.056
Seagrave Memorial	70	2.299	3.210	1.070	0.234	0.311	0.434	0.145	0.063

Table B-33-1. Medical Program for the Banwol Hospital: Inpatients

Medical Department	No. of Cases per Year	Average Length of Stay (days)	Occupancy Rate of Beds (%)	Distribution of Beds (number)
1	2	3	4	5
Internal Medicine				
- general				
- infections	787	9	75	26
- intensive care				
General Surgery				
- intensive care	347	14	75	18
Orthopedic Surgery	463	21	75	35
Neuro-Surgery				
Pediatrics				
- neonatology				
- babies				
- children	232	7	75	6
OB and GYN				
- obstetrics				
- gynecology	278	6	75	6
ENT	53	13	75	3
Ophthalmology	46	14	75	2
Urology & Dermatology	46	11	75	2
Jaw Surgery	63	7	75	2
Neuro-Psychiatry				
Total or Average	2,316	11.8	75	100

Table B-33-2.

Medical Program for the Banwol Hospital: Outpatient Visits.

Medical Department	No. of Cases	Visits per Care	No. of Visits per Year
Internal Medicine	7,089	2.6	18,431
General Surgery	1,063	2.4	2,551
Orthopedics	709	2.8	1,985
Neurosurgery	-	-	-
Pediatrics	2,481	3.5	8,684
OB and GYN	1,949	3.1	6,042
ENT	1,418	3.2	4,538
Ophthalmology	886	2.5	2,215
Urology	1,595	3.7	5,902
Dental	532	3.3	1,756
Neuro-Psychiatry	-	-	-
Other	-	-	-
Total	17,722	2.9	52,104

Table B-33-3. Medical Program for the Banwol Hospital: Medical Performance

Kind of Performances	No. of Performances per Year		
	Inpatients	Outpatients	Total
Emergency Cases		3,800	3,800
ECG			595
Endoscopies			40
- with X-ray			
- without X-ray			
Laboratory Diagnostics			
- chemical	1,901	5,707	7,608
- hematological	3,435	10,073	13,508
- serological	1,146	3,341	4,487
- bacteriological	2,821	8,485	11,306
- stool exam.	1,000	2,000	3,000
- urinalysis	3,000	4,000	7,000
Blood Preserves			1,600 pints
Plain X-ray	4,338	9,431	13,769
Mass X-ray	-	3,230	3,230
Fluoroscopies	160	-	160
Thermographics	-	-	-
Operations			
- general surgery	212	255	467
- orthop. surgery	377	69	446
- neuro surgery	-	-	-
- OB and GYN	89	501	590
- ENT	35	14	49
- ophthalmology	39	13	52
- urology & dermatology	50	88	138
- jaw surgery	23	140	163
- others	8	43	51
Total	833	1,123	1,956
Deliveries	171		171
Physiotherapy			
- bathes			-
- massages			5,000
- electrotherapy			(500 persons)
Preventive Performances		2,000	2,000
Physical Check-up			

Table B-33-4. Medical Program of the Banwol Hospital : Further Functions

Function		Quantities per Year
Pathology		
- histological cuts (refer to other hospital)		-
- autopsies		30
Ambulance		
- transportations		500
Nurse training		
- by kind		-
Medical training		
- by kind	Intern	6
	Resident	18
Student training		
- Community health services		-

7. ROOM AND SPACE PROGRAM OF BANWOL HOSPITAL (100 BEDS)

7.1. General Principle

This Room and Space Program is made by the Medical Program which was previously mentioned in Chapter 6. For the completion of this report, a survey and analysis for the 9 existing hospitals in Korea has been performed, compared with the standards of the West Germany, United States and other developed countries. As the result, this Room and Space Program, which is considered most suitable to the existing conditions in Korea, is established.

7.2. Room and Space Program

The space of the hospital can be divided into 5 main parts, as follows;

- The space for the outpatient departments, laboratory, X-ray, operation, delivery and so on.
- The space for the cure of inpatients, which is main facilities of hospital
- The space for the administration of hospital
- The space for supply; dispensary, feeding, laundry, and so on
- The space for maintenance of hospital

7.2.1. Examination and Treatment: In this part, emergency, outpatient departments, laboratory, X-ray, operation, and delivery room are included.

7.2.1.1. Entrance and Emergency: As the Table B-33-3 of Medical Program, about 12 cases per day are performed in emergency. The results are obtained in the survey of the existing hospitals (SEE; Yeoju Report, Table A-32-1, A-32-3) and are the same as Table B-34-1.

7.2.1.2. Outpatient Departments

The necessary rooms and the number of rooms for outpatient departments are calculated by the annual number of outpatients of the Medical Program (Table B-33-2) and the consulting time (SEE Yeoju Report Table A-32-6).

The size of each room is based on the survey results of the existing hospitals (SEE Yeoju Report Table A-32-2). In consideration of teaching hospital, medical trainees' room is seated.

And the other auxiliary rooms are based on the empirical standard in Korea. The results are the same as Table B-34-1.

7.2.1.3. Laboratory

The necessary rooms and the size of the rooms are deduced from the number and the kinds of examinations. (Table B-33-3) The other auxiliary rooms are based on the empirical standards. And the whole volume is checked by the survey of the existing hospitals (SEE Yeoju Report Table A-32-3). The result are the same as Table B-34-2.

7.2.1.4. Morgue

This is allocated by the Medical Program (Table B-33-4) and the survey of the empirical standards. The results are same as Table B-34-2.

7.2.1.5. X-ray

The whole volume and the necessary rooms are deduced by the number and kinds of performances from the Medical Program (Table B-33-3). The size of every rooms is decided by the survey of the existing hospitals (SEE Yeosu Report Table A-32-2). The other auxiliary rooms are based on the empirical standards. The result are the same as Table B-34-2.

7.2.1.6. Operation

Table 7-5 is presented on the base of the expected annual operating cases and the kinds of operations as shown in the Medical Program (Table B-33-3) and the operating time of every disciplines. As the result, 2 operating rooms (aseptic and septic) are required. The size of operating rooms is based on the survey of the existing hospital (SEE Yeosu Report A-32-2) and the other auxiliary rooms are based on the empirical standards. The results are the same as Table 7-7-3.

7.2.1.7. Delivery

There are 0.5 cases in a day in delivery as shown in the Medical Program (Table B-33-3) but room and space are allocated in consideration of extention and based on empirical standards.

7.2.1.8. Physiotherapy

There are 20 cases in a day as shown in the Medical Program (Table B-33-3). The general contents are calculated on the base of the empirical standards.

So, the total net area of Examination and Treatment is 1,229 m².

7.2.2. Wards

The number of beds according to every departments is decided by the Medical Program (Table B-33-1).

The three nursing units will be composed of approximately 32 to 35 beds. The ratio of the number of bed rooms in a nursing unit, such as 4-bed room, 2-bed room and 1-bed room, is determined by the empirical standards. The size of these rooms is based on the investigation and analysis of the surveyed hospitals (SEE Yeosu Report 7.2.2). By the utilization of an architectural module, efficient dimension of these rooms is modified and determined. Every bed room is checked by the physical drawing (See Yeosu Report).

The auxiliary rooms, such as nurse's station, doctor's room pantry, W.C., utility and so on, are based on the experience of the existing hospitals. But in the light of present situation in Korea, a 6-bed room may be needed to achieve economical plan of hospital.

The distribution ratio and the size of 6-bed will be decided by the survey of the existing hospitals and the empirical standards.

So, the total net area of wards is 1,318 m².

7.2.3. Administration

The volume of administration is dependent on the organization table of hospital, the necessary manpower, and is deduced from the survey of existing hospitals. The results are the same as Table B-35-6.

7.2.4. Supply

This is composed of pharmacy, sterilization, kitchen and dining, laundry, storage, garage and so on.

The volumes of every parts are based on the survey of the existing hospitals (Table 7-1, 7-2, 7-3). The results are the same as Table B-35-7.

7.2.5. Technical Center

This is composed of boiler room, electric room, carpentry, and so on. And the volume of technical center is based on the survey of the existing hospitals. The results are the same as Table B-35-7.

7.3. Contents of Room and Space Program

7.3.1. The Ratio of Gross Area to Net Area

The net area is the space required for all independent activities to effectively perform their respective functions. This area doesn't include the corridors, restrooms, wall space and other auxiliary areas. The inclusion of these areas into net area is the gross area. Therefore in the planning of the floor, the followings should be taken into consideration.

- thickness of the wall and columns
- corridors
- hall and lobby
- stairs
- elevator shaft and hall
- maintenance room and other auxiliary areas

The ratio of gross to net, which is shown in the table of Room and Space Program, is the statistical data according to the number of small rooms and the main faculty of the building

- $G/N = 1.67$: General buildings
- $G/N = 1.5$: Residencial facilities
- $G/N = 1.4$: Buildings which contain many large rooms

But the ratio of corridor to total area is about 30% ($G/N = 1.5$), which is shown in the survey of the existing hospitals (See Yeoju Report).

But we choose 1.7 as the ratio of gross to net, in order to secure the space. Also, that is considered most suitable to the characteristics of hospital.

7.4. So, the required Grand Net Total area for 100 beds hospital is 3,697 m² (Grand Gross Total Area is 6,284.9 m²). (Cf. Table B-36)

Table 7-1 Room and Space Analysis for the Existing Hospitals in Korea (I)

(Unit: m²)

	No. of Beds	Name of Hospital								Cheongju Provincial
		Daegu Soosung	Yeengju Chung	Bosung Asan	Kunsan Seagrave	Pusan Choon Hae	Andong Presbyterian Koryo	Ulsan	Mokpo Colomban	
	12	49	100	102	117	130	130	130	160	289
C/Gross Area	635.55	1,544.64	5,857.68	3,003.42	2,235.05	3,241.98	4,444.02	6,261.17	11,283.0	
Surgical Theater	43.25	124.1	456.11	173.7	172.35	212.06	335.93	348.65	675.0	
Outpatients Dept.	34.7	206.4	352.02	261.0	151.76	436.87	705.51	190.68	1,030.5	
Wards	131.0	393.44	1,360.85	776.8	1,098.33	984.73	1,339.85	1,759.63	3,258.0	
Central Supply	-	-	101.75	99.36	-	70.65	79.0	75.53	108.0	
Orthopedics Surgery	12.0	24.3	145.35	43.2	34.05	193.19	157.88	143.58	225.0	
Emergency/I.C.U.	-	10.8	136.17	32.4	33.33	31.86	84.0	-	108.0	
Consultation Rooms	14.0	14.85	188.96	57.6	53.55	23.72	102.25	119.63	301.5	
Personnel Quarters	116.0	68.94	65.35	-	10.66	41.82	48.0	326.19	342.0	
Floor/Corridor	141.3	512.3	1,678.73	906.7	641.87	684.28	1,220.45	1,841.52	3,256.35	
Hotel Services	134.55	158.46	1,052.61	530.36	-	182.45	108.38	1,063.45	1,330.65	
Administration	8.75	31.05	319.78	132.3	39.15	380.35	262.77	392.31	648.0	
(Total) m ² /Bed	53.0	31.5	58.6	29.5	20.9	24.9	37.6	39.13	39.04	
(Wards) m ² /Bed	10.9	8.0	13.6	7.6	9.4	11.6	10.3	10.9	11.27	

Table 7-2

Room and Space Analysis for the Existing Hospitals in Korea (II)
Room area by Function

No. of Beds	Name of Hospital										(Unit : m ²)	
	Daegu Soosung	Yeongju Chung	Bosung Asan	Kusan Seagrave	Pusan Choonhae	Andong Presbyterian Koryo	Ulsan	Mokpo Columban	Cheongju Provincial	Average		
Internal Medicine	12	49	100	102	117	130	130	169	289	24.23 m ² /ea		
General Surgery	-	16.2	20.24	36.0	11.7	30.15	23.25	14.28	42.0	22.01 m ² /ea		
Orthopedics	-	16.2	20.52	18.0	11.7	30.15	23.25	14.28	42.0	22.61 m ² /ea		
Pediatrics	-	16.2	-	-	(6.48)	33.45	23.25	14.28	42.0	25.88 m ² /ea		
OB/GYN.	-	12.92	20.81	36.0	(9.1)	23.67	23.25	14.28	42.0	26.67 m ² /ea		
Physical Check-up	-	-	39.33	36.0	(10.45)	28.39	23.25	14.28	42.0	28.02 m ² /ea		
Laboratory	-	(0.3)	0.87	0.42	(0.20)	0.45	0.79	0.42	0.95	(46.5) m ² /ea		
X-ray Room	-	-	-	28.05	(14.4)	-	24.75	26.73	27.0	0.65 m ² /bed		
Operator's Stand & Dark	-	-	-	18.96	20.4	-	(38.25)	21.45	24.0	26.63 m ² /ea		
Operating Room	(14.0)	(28.35)	29.07	28.8	24.3	40.56	32.55	35.64	36.0	21.20 m ² /ea		
Washing Room	-	(3.6)	13.01	10.8	-	(8.1)	-	11.88	18.0	31.91 m ² /ea		
Recovery Room	(6.0)	(16.2)	(42.84)	36.0	23.4	25.92	23.25	35.64	27.0	13.42 m ² /ea		
Delivery Room	(9.0)	(17.0)	29.07	27.0	23.4	(16.2)	27.23	(18.81)	36.0	28.54 m ² /ea		
Labour Room	-	(11.9)	20.24	-	-	24.3	24.75	25.92	(13.5)	23.80 m ² /ea		
4-bed Room	-	-	29.07	-	23.4	21.6	23.25	28.98	27.0	25.55 m ² /ea		
2-bed Room	13.5	13.86	14.54	18.0	12.15	16.2	11.63	21.42	13.5	14.98 m ² /ea		
1-bed Room	(8.75)	(7.92)	-	14.4	11.7	11.7	-	13.86	13.5	13.03 m ² /ea		
Nurses' Station	12.0	13.86	18.11	14.4	13.5	36.48	27.07	13.86	13.5	18.08 m ² /ea		
Doctor's Room	-	-	23.4	-	-	24.3	-	-	36.0	27.9 m ² /ea		
Administration	0.73	0.63	(3.43)	1.33	0.5	1.93	2.02	1.23	2.37	1.34 m ² /bed		
Pharmacy	0.37	0.44	1.04	(0.24)	(0.11)	(0.99)	(0.38)	0.31	0.44	0.57 m ² /bed		
Sterilization	-	(0.11)	1.45	0.92	(0.10)	0.54	0.79	0.47	0.71	0.81 m ² /bed		
Kitchen	0.75	-	1.70	1.01	-	(0.36)	(0.28)	0.94	1.25	1.13 m ² /bed		
Dining	-	-	0.86	1.01	-	0.49	0.45	0.60	0.62	0.67 m ² /bed		
Laundry	-	-	1.02	0.97	-	-	-	1.08	0.91	1.00 m ² /bed		
General Storage	2.43	1.27	2.4	-	-	-	-	1.22	(0.48)	1.83 m ² /bed		
Garbage Collection	-	-	5.7	-	-	-	-	-	-	(5.7) m ² /bed		
Technical Centers	-	1.62	(2.95)	1.63	-	(0.61)	-	1.05	1.40	1.43 m ² /bed		

(NOTE)

As () is unreasonable,
It is not included in calculation.

Table 7-3 Room and Space Analysis in Terms of Area Ratio for the Existing Hospitals in Korea (III)

	Name of Hospital										(Unit : %)
	Daegu Soosung	Yeongju Chung	Bosung Asan	Kunsan Seagrave	Pusan Choonhae	Andong Presbyterian Koryo	Ulsan	Mokpo Colomban	Cheongju Provincial		
No. of Beds	12	49	100	102	117	130	130	160	289		
Surgical Theater	6.8	8.0	0.8	5.8	7.7	6.5	7.6	5.6	6.0		
Outpatients Dept.	5.5	0.4	6.0	8.7	6.8	13.5	15.8	3.0	9.1		
Wards	20.6	1.3	23.2	25.9	49.1	30.4	30.1	28.1	28.9		
Central Supply	-	-	1.7	3.3	-	2.1	1.8	1.2	1.0		
Orthopedics	1.9	1.6	2.5	1.4	1.5	5.9	3.6	2.3	2.0		
Emergency/I.C.U	-	0.7	2.3	1.1	1.5	1.0	1.9	-	1.0		
Consultation Room	2.2	1.0	3.2	1.9	2.4	0.7	2.3	1.9	2.7		
Personnel Quarter	18.3	4.5	1.1	-	0.5	1.3	1.1	5.2	3.0		
Floor/Corridor	22.2	33.2	28.7	30.2	28.7	21.1	27.5	29.4	28.9		
Hotel Services	21.2	10.3	18.0	17.7	-	5.6	2.4	17.0	11.8		
Administration	1.4	2.0	5.5	4.4	1.8	11.7	5.9	6.3	5.7		

Table 7-4 Survey Results Showing the Area of Inpatient Room According to Number of Beds

Hospital Identification	1-Bed			2-Bed		
	Area (M ²)	Length (M)	Width (M ²)	Hospital Identification	Area (M ²)	Length (M)
1	6.46	3.4	1.9	1	11.7	4.5
2	7.20	3.43	2.1	2	12.0	4.0
3	7.92	3.3	2.4	3	12.15	4.5
4	8.75	3.5	2.5	4	12.6	4.2
5	9.00	3.0	3.0	5	13.5	4.5
6	11.84	4.57	2.59	6	15.36	4.57
7	12.6	4.2	3.0	7	15.54	4.2
8	13.5	4.5	3.0	8	19.47	5.9
						3.3

Hospital Identification	4-Bed			6-Bed		
	Area (M ²)	Length (M)	Width (M ²)	Hospital Identification	Area (M ²)	Length (M)
1	21.504	4.8	4.48	1	30.09	5.49
2	23.142	5.51	4.2	2	30.15	6.7
3	23.25	5.0	4.65	3	36.00	6.0
4	23.40	5.2	4.5	4	40.47	7.1
5	27.00	6.0	4.5			5.7
6	28.56	6.8	4.2			

BANWOL HOSPITAL (100 BEDS)

Table B-34-1 : Calculation of Operation Rooms for the Banwol Hospital

Medical Department	Op./Year	Op./Day (280d/y)	Min/Op. (incl.room preparat.)	Min/y	#No of op-rooms	Aseptic		Septic	
						%	Rooms	%	Rooms
General Surgery	260	1.0	100	26,000	0.26	80	0.21	20	0.05
Orthopedic Surgery	450	1.7	75	33,750	0.34	100	0.34	-	-
OB & Gyn	568	2.1	70	39,760	0.40	65	0.26	35	0.14
ENT	80	0.3	65	5,200	0.06	10	0.01	90	0.05
Ophtalmology	20	0.1	55	1,100	0.02	90	0.01	10	0.01
Urology	120	0.5	65	7,800	0.08	30	0.03	70	0.05
Others	16	0.1	45	720	0.01	5	-	95	0.01
							0.86		0.31
		5.8							

* Capacity = $280 \times 360 = 100,800$ Min/Year

Table B-34-2 Calculation of Consultation Rooms for the Banwol Hospital (100Bed)

Department	Consultation/ Year	MIN./ Consultation	MIN/ Year	* No. of Room
Internal Medicine	18,431	10	184,310	2
General Surgery	2,551	8	20,408	1
Orthopedics	1,985	15	29,775	1
Neuro Surgery	-	-	-	-
Pediatrics	8,684	15	130,260	2
OB and GYN	6,042	10	60,420	1
ENT	4,538	15	68,070	1
Ophthalmology	2,215	20	44,300	1
Urology	5,902	15	88,530	1
Dental	1,756	20	35,120	1
Neuro Psychiatry	-	-	-	-
Other	-	-	-	-

TOTAL: 11R

* CAPACITY: $5^d \times 6^h + 1^d \times 3^h = 33^h/w$

$33^h \times 50^w = 1,650 \text{ h/y}$

$1,650^h \times 60^m = 100,000 \text{ min/y.}$

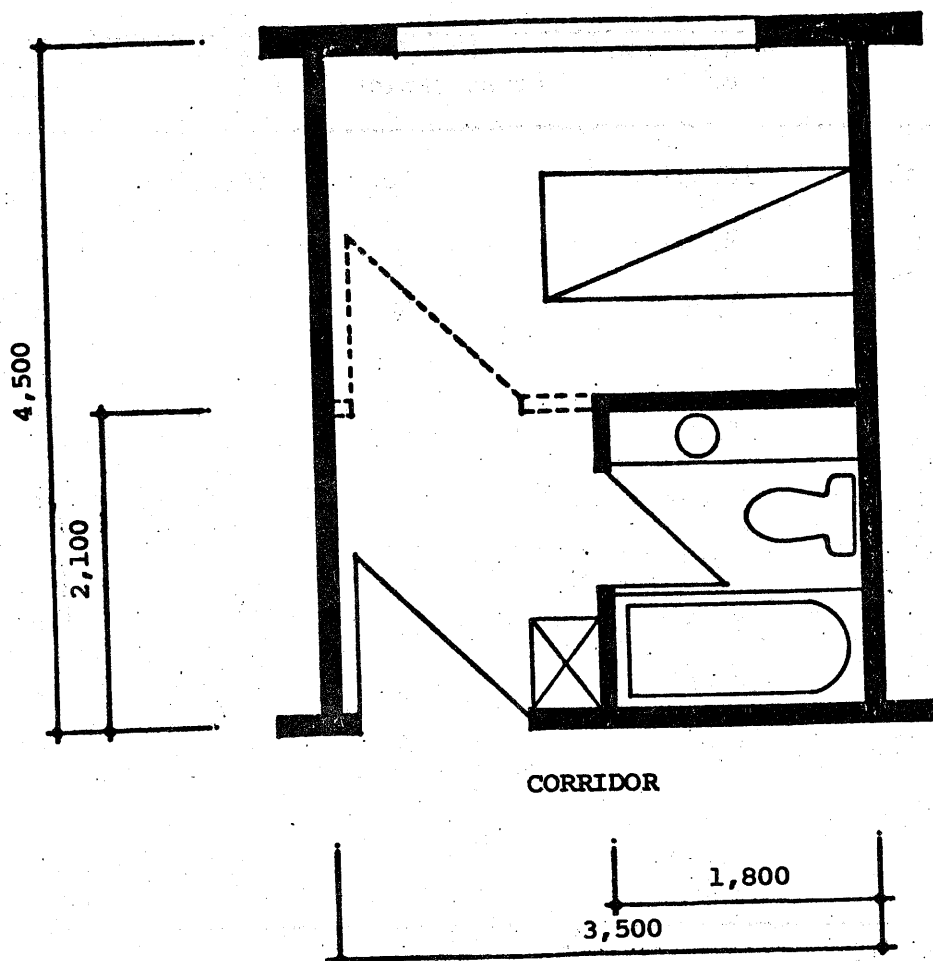


Fig 7-1 Sample Layout for 1-Bed Room

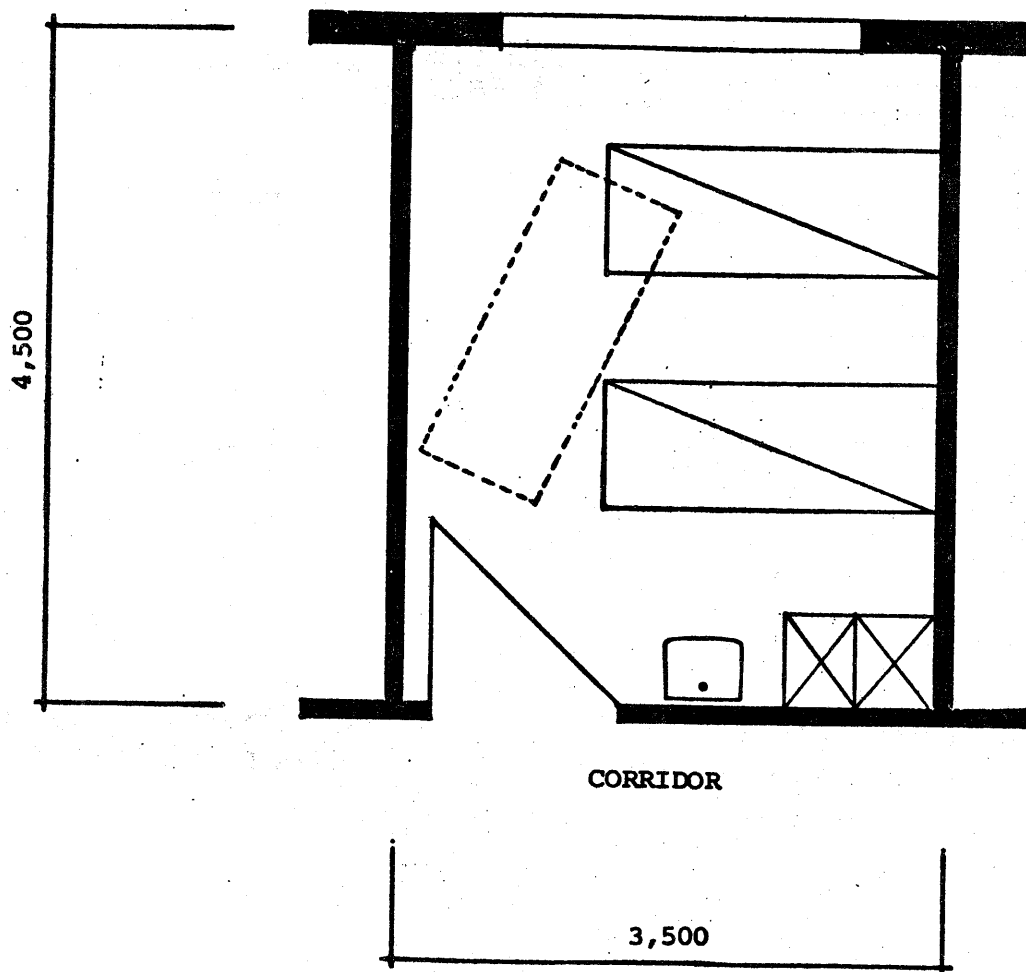


Fig 7-2 Sample Layout for 2-Bed Room

S:1/50

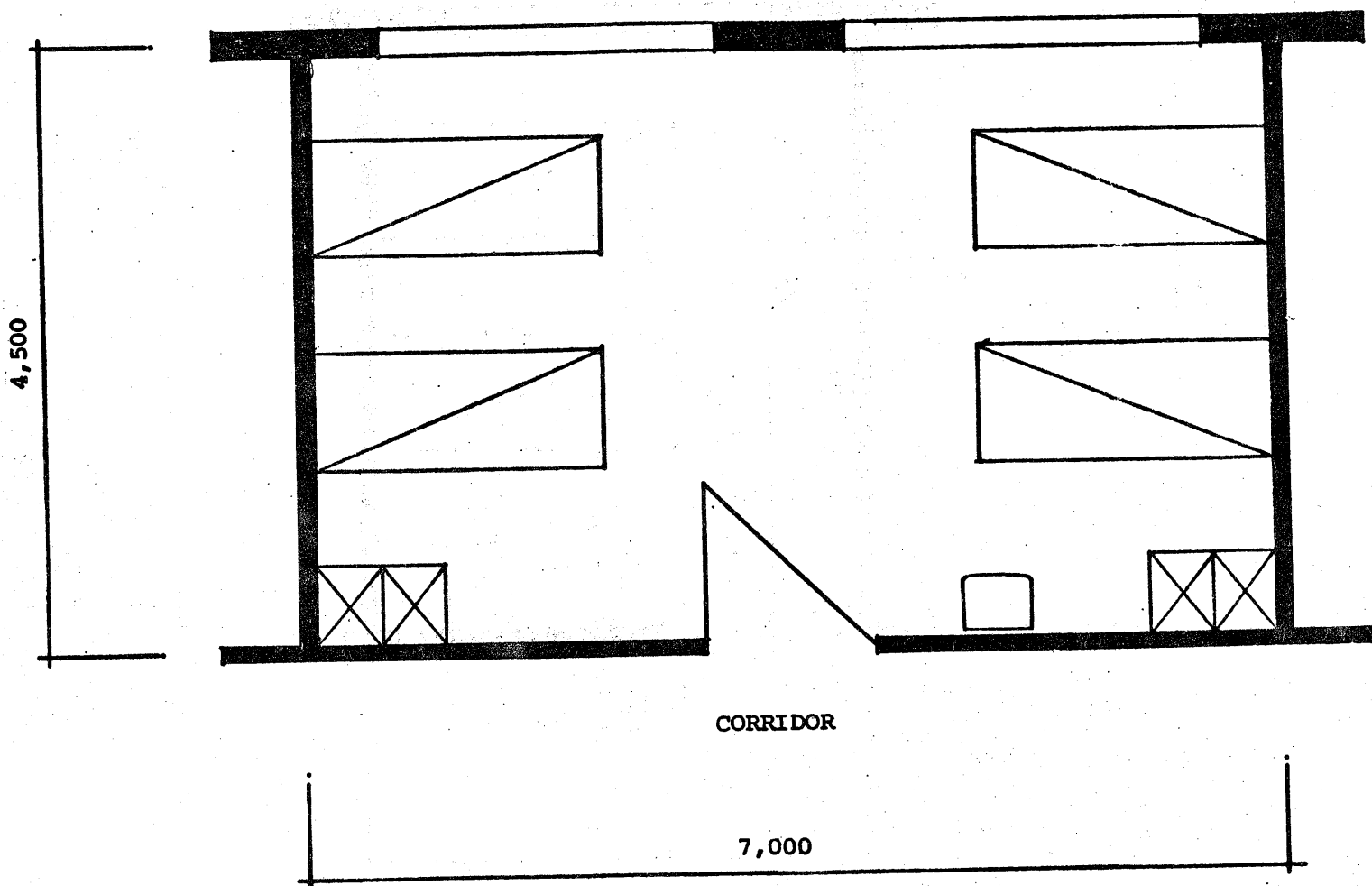


Fig 7-3 Sample Layout for 4-Bed Room

S:1/50

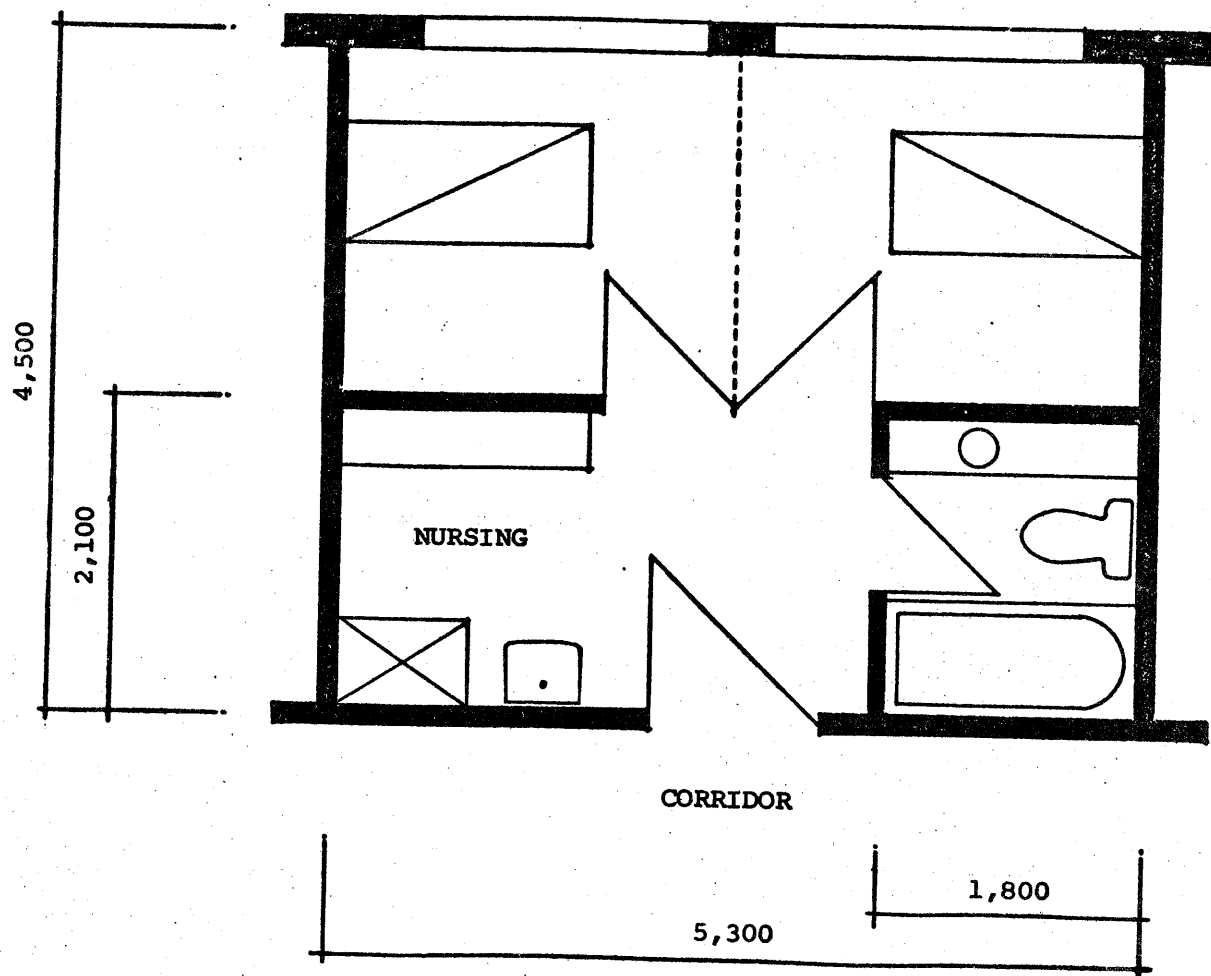


Fig 7-4 Sample Layout for 2-Bed Room for Pediatric Case

s:1/50

ROOM & SPACE PROGRAM : BANWOL (100BEDS)

TABLE : B-35-1 ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
1	EXAMINATION AND TREATMENT			
101	ENTRANCE AND EMERGENCY			
101/01	Entrance hall	1	60	
/02	Guard's room	1	8	
/03	First aid room	1	32	
/04	Preparation room	1	12	
/05	Scrub room + dress changing		8	120
102	OUTPATIENTS DEPARTMENTS			
102/01	Internal medicine (Superintendent) consultation	1	24	(to be checked according to manpower requirement list)
/02	Internal medicine	2	(24) 48	
/03	General surgery	1	24	
/04	Pediatrics	2	(24) 48	
/05	OB & GYN	1	24	
/06	Othopedics	1	24	
/07	ENT	1	24	
/08	Ophthalmology	1	24	
/09	Urology	1	24	
/10	Dental	1	24	
/11	Special exam. (ECG, Endos.)	1	24	
/12	Physical check-up	1	24	
/13	Waiting areas	12	(12) 144	
/14	Medical trainees' room (intern + resident)	1	24	
/15	W.C. for patients + anteroom	4	12	582
/16	W.C. for staff + anteroom	2	6	
/17	Nurses' locker	1	24	
/18	Night duty	3	(12) 36	

ROOM & SPACE PROGRAM : BANWOL (100BEDS)

TABLE : B-35-2 ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
105	LABORATORY			
105/01	Specimen taking room incl. W.C.	1	12	
/02	Chemical-heamatological	1	32	
/03	Bacteriological & serological	1	32	
/04	Storage + Cleaning	1	16	
/05	Waiting area	1	12	104
106	MORGUE			
106/01	Autopsy room incl. 2 refrig. cells	1	36	
/02	Changing and sanitary room	1	12	
/03	Coffin room	1	24	72
107	X-RAY			
107/01	X-ray room	2	(32) 64	
/02	Dressing cubicles + W.C.	6	(1.5) 9	
/03	Operator & dark room	1	24	97

ROOM & SPACE PROGRAM : BANWOL (100BEDS)

TABLE : B-35-3 ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
109	OPERATION			
109/01	Operating room	2	(36) 72	
/02	Preparation room (anaesthesia)	2	(12) 24	
/03	Scrub room	1	12	
/04	Recovery room	1	24	
/05	Instrument room, sub- sterilizing	1	12	
/06	Changing rooms for male and female staff + shower	2	16	160
110	DELIVERY			
110/01	Delivery room (2 beds)	1	32	
/02	Labour room (2 beds)	1	16	
/03	Nurses' room	1	16	
/04	Bath room	1	12	76
111	PHYSIOTHERAPY (DRY ROOM)	1	18	18
			TOTAL 1	1,229

ROOM & SPACE PROGRAM : BANWOL (100 BEDS)

TABLE : B-35-4 ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
2	WARDS			
201	1ST NURSING STATION (35 BEDS) ORTHOPEDICS			
201/01	4 BED room	4	(32) 128	
/02	2 BED room	8	(16) 128	
/03	1 BED room	3	(16) 48	
/04	Nurse's station	1	16	
/05	Nurse's room	1	16	
/06	Utility room, clean.	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & Shower	1	16	
/10	W.C for staff + anteroom	2	6	
/11	W.C for patients + anteroom	6	16	
/12	Doctor's room + examination	1	24	442
202	2ND NURSING STATION (32 BED) INTERNAL + PEDIATRICS			
202/01	4 BED room	3	(32) 96	
/02	2 BED room	6	(16) 96	
/03	1 BED room	2	(16) 32	
/04	2-BED room pediatrics	3	(24) 72	
/05	incl. sluice and sanitary room incl. room for prematured			
	Nurse's station	1	16	
/06	Nurse's room	1	16	
/07	Utility room, clean	1	16	
/08	Utility room, dirty	1	16	
/09	Pantry	1	12	
/10	Bath room & shower	1	16	
/11	W.C. for staff + anteroom	2	6	
/12	W.C. for patients + anteroom	6	16	
/13	Doctor's room + examination	1	24	434

ROOM & SPACE PROGRAM : BANWOL (100 BEDS)

TABLE : B-35-5 ROOM & SPACE PROGRAM : WARDS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
203	3RD NURSING STATIONS (32 BEDS) OTHER DISCIPL.			
203/01	4 Bed room	5	(32) 160	
/02	2 Bed room	5	(16) 80	
/03	1 Bed room	3	(16) 48	
/04	Bassinet room close to two 2-bed rooms, incl. utility sluice	1	16	
/05	Nurse's station	1	16	
/06	Nurse's room	1	16	
/07	Utility room, clean	1	16	
/08	Utility room, dirty	1	16	
/09	Pantry	1	12	
/10	Bath room & shower	1	16	
/11	W.C. for staff + anteroom	2	6	
/12	W.C. for patients + anteroom	6	16	
/13	Doctor's room	1	24	442
			TOTAL 2	1,318

ROOM & SPACE PROGRAM : BANWOL (100BEDS)

TABLE : B-35-6 ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
3	ADMINISTRATION			
301/01	Superintendent office	1	18	
/02	" secretary	1	12	
/03	Administration staff	1	150	
/04	Archive	1	60	
/05	Conference	1	24	264
4	SUPPLY			
401	PHARMACY			
401/01	Pharmacy office			
/02	Manufacturing & store			60
/03	Pharmacy reception			
402	STERILIZATION	1	60	60
404	KITCHEN AND DINING			
404/01	Cooking	1	100	
/02	Prepare			
/03	Washing			
/04	Office	1	18	
/05	Storage	1	70	
/06	Dining	1	60	
/07	W.C. for staff + anteroom	2	6	
/08	Locker for all supply staff	1	36	290

ROOM & SPACE PROGRAM : BANWOL (100 BEDS)

TABLE : B-35-7 ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
405	LAUNDRY			
405/01	Sorting	1	70	
/02	Washing			
/03	Ironing			
/04	Storage	1	50	
/05	Sewing			120
406	General Storage			150
407	Garbage collection			24
407	Garage + driver's room			36
			TOTAL 4	740
5	TECHNICAL CENTERS (incl. Workshop)		140	140

ROOM & SPACE PROGRAM : BANWOL (100 BEDS)

TABLE :B-36 ROOM & SPACE PROGRAM : TOTAL

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
TOTAL 1	Exam. + Treatment	1,229		
TOTAL 2	Wards	1,318		
TOTAL 3	Administration	264		
TOTAL 4	Supply	740		
TOTAL 5	Techn. Centers	140		
	GRAND NET TOTAL	3,697 M ²		
	GRAND GROSS TOTAL	(6,284.9 M ²)	(G/N = 1.7)	

8. ARCHITECTURAL DESIGN PRINCIPLES AND SPECIFICATIONS FOR CONSTRUCTION

BANWOL HOSPITAL (100 BEDS)

8.1. General Principles

The construction of this hospital in the Banwol Industrial Complex is expected to meet the medical care needs of the populace living in nearby areas within the health service area. This hospital must take into consideration the special characteristic of Banwol City. The majority of the residents are expected to be composed of immigrants from nearby cities and rural farming population. The medical demands of these residents to be involved in industrial activities must be met through the provision of preventive medicine and health care thereby maintaining the productivity of these workers.

An important factor in the hospital construction plan is to construct modern facilities to taking into consideration the optional functional operational elements.

8.2. Design Criteria

The architectural design of this hospital should take into consideration the Medical Program.

8.2.1. In accordance with the Medical Program the hospital structure will accomodate 100 beds. The distribution of beds by medical departments are as follows.

Internal medicine	26 beds
General surgery	18 beds
Orthopedics surgery	35 beds
Pediatrics	6 beds
Ob & Gyn.	6 beds
Others	9 beds
TOTAL:	100 beds

8.2.2. In order to construct a hospital which is able to carry out the expected functions to provide high quality medical service, the room and space program should take the following into consideration.

8.2.2.1. The outpatient service of a general hospital is an indispensable element of a hospital function, although the function seems to be delining in the future.

8.2.2.2. The allocation of rooms and medical facilities should be in a manner to permit optional utilization among the departments.

8.2.2.3. The preventive medicine aspect of the hospital operation should be considered.

8.2.2.4. The future alteration and expansion of the hospital should be considered.

8.3. The Hospital Site and Plan

The site of the hospital will be located at near to the previously determined hospital construction site in Banwol City Master Plan. It will be adjacent to the center activity area however away from the city traffic and accompanying noise and pollution. The longitudinal axis of the building will be in the east-west direction and the building will face south to maximize energy conservation.

8.3.1. The Master Plan of the Proposed Hospital Location

The physical characteristics of the proposed site should be considered, including soil conditions, under ground water, and meteorological considerations.

8.3.2. Site Preparation

The site preparation for the hospital construction should follow the Master Plan. It is recommendable that the standard height of the proposed site be at least 50 cm higher than that of the main traffic level. Minimum length of frontage for the site would comprise an area of a quarter of the entire facility length.

8.3.3. Public Utilities

A separate drainage system for the storm drain and sewage drain will be constructed. A sewage treatment facility will be constructed.

The water will be supplied by the city main water supply. Also, additional water for cleaning and fire prevention will be supplied by an under ground reservoir. The electric power line will be connected to the main power line of the Korea Electric Company and the telephone line will be connected to the main city telephone line.

8.3.4. Building Site Plan

In accordance with the Master Plan the hospital will face south to maximize energy conservation.

The separation into the interrelated but independent function will encompass the outpatient area, wards, emergency room and other service facilities.

A parking facilities will be constructed at the front and the side of the building and landscaping will enhance the physical appearance of the building.

8.4. Functional Building Layout of the Hospital

The plan of hospital construction should take into the above-mentioned considerations to promote the most efficient medical service delivery. As

reflected on the lay-out plan, the hospital features three major sections: outpatient, inpatient department, and support facilities.

8.4.1. The Plan of Room Distribution

8.4.1.1. Outpatient Department

The outpatient section should be located in front of the hospital nearest to the road. It should be located allowing optimal coordination with the interior of the hospital.

The outpatient unit can be reached from the hospital by a separate entrance. The location of the outpatient unit is of utmost importance as it is also called upon to handle examination and treatment of inpatients. Beside the examination and treatment rooms, the outpatient unit house the X-ray room, the laboratory, the pharmacy (drugstore and distribution) and the emergency surgery room.

8.4.1.2. Inpatient Department

The construction of an inpatient department should allow the easy expansion and a modification of the hospital wards should it be necessary in the future. The internal hospital area consists of the individual wards including the surgical unit. The lay-out plan utilizes the sectional system. In addition to the examination room, the wards are equipped with all of the facilities necessary for optimum working efficiency. Room sizes vary between one-bed room and six-bed room. The maternity department includes the delivery section and the required ward with nursing facilities for infants. The surgery unit comprises operating theatres and anaesthetic rooms, with the substerilization and lavatory sandwiched between the operating theatres. There is open space for bed parking. The sterile area also encompasses the recovery room and intensive care area followed by central sterilization which is subdivided into a working room and a store for sterile goods, and finally, yet outside the sterile area, the dressing rooms.

8.4.2. Administrative Department

The administrative department will be located near the hospital entrance and will be separated into 3 sections.

- administration
- locker rooms and lavatories for personnel
- storage

8.4.2.1. The administrative Section will be the center of hospital operation.

8.4.2.2. The locker rooms and lavatories will be established for all the workers. The ratio of female and male workers probably 2 to 1 will be considered to establish the most convenient utilization among the workers. Washing facilities are provided in accordance with the number of persons starting or ending their duties at the same time.

8.4.2.3. The storage will handle all supplies with the exclusion pharmaceutical supplies, food, and other supplies.

8.4.3. Functional Arrangement of the Supply Unit.

The provision of supplies in the hospital should be at a maximum efficiency in a manner that the suppliers do not cross any internal passages. The machinery operating at a high noise level will be located away from the patients.

8.4.4. Other Facilities

To maximize the hospital efficiency, the optimal size of the kitchen, staff dining room, laundry, maintenance rooms and mortuary should be determined. Technical centers such as the boiler room, generator, incinerator workshop will be placed underground.

8.5. Design Principle

Hospital design should follow the city planning code, building code, fire laws and other regulations of the Republic of Korea regarding construction of hospitals and buildings.

8.5.1. The architectural planning of the hospital is based on a "modular planning system". The development of this system was preceded by a study of the functions and the operational, economical and constructional interdependence of the individual medical sections, with due regard to constructional and architectural requirements. Separation of interior and exterior traffic routes is considered according to practical requirements for the traffic of persons and materials.

8.5.2. Module System

The system is in its integrity based on a three-dimensional 30 cm module, the basic scanning field being the quadruple module = 120 cm and the large scanning field being the three fold basic scanning field = 360 cm. All dimensions of the building are selected to fall in line with one or any number of large scanning fields. All rooms have an inner height of 270 cm. All wings, except the entrance and the autopsy unit, have the same height.

The proposed modular planning system serves the following purposes:

- Construction of hospitals of size varying between 50 and 250 beds, through the assemblage of selfcontained modules.
- Extension of such hospitals whenever desired by simply adding new modules, thus avoiding rebuilding.
- Keeping running costs at a minimum.
- Installation of air-conditioning, required minimally
 - Rearrangement of modules without any special difficulties to meet changing medical requirements.
 - Choice of reinforced concrete construction, and partly movable partition walls.

- Possibility of continuous adaptation to future requirements.

8.6. Specifications for Architectural Work

Without special notes, construction should follow with general standard specifications for building construction as per the building codes in Korea.

8.6.1. Architecture

Method of carcass work is a reinforced concrete construction system under special consideration of the architectural facade design. Main structure is composed of four basic elements; columns, girders, floor slabs, and wall. The grid dimension is 7.20 m x 7.20 m, the associated suspended ceiling and the floor form a free hall. The weight of the roof and the ceiling as well as of the incorporated installations is transmitted to the foundation through the roof and the outer walls are conveyed to the foundation or the flooring. Under the corridor there is a basement serving as installation passage for all installations. The installation passage can be frequented and permits access from the outside. Hence, Maintenance and repair can be carried out without interference with the work going on inside the hospital. The outer walls are based on foundations commensurate with the local conditions where as the two side walls of the installation passage. All the other partitions have no foundation but are supported by a flooring of no less than 10 cm thickness. The floor proper and the wall joints must be carefully executed as they are essential contributing factors to the overall hygiene of the hospital. The floor paving must be carefully jointed, antibacterial and easy to clean. Moreover, the individual rooms, passages and the veranda must all be at the same level so that hospital bedsteads can be wheeled about without being subjected to jolts or vibrations. In rooms where the danger of explosions exists (as in operating rooms), the PVC covering will be of the electrical conductive type, with a conduction resistance value of about 10^5 ohms. A network of copper foil inserts will be underlaid as grounding and connected with the neutralizing conductor.

Site location:

Main building area: Total area : 6,900 m²

	<u>Area</u>	<u>Fl. height</u>
Basement :	1,267.92 m ²	5.1 m
First floor :	2,543.40 m ²	4.2 m
Second floor :	2,206.44 m ²	4.2 m
Third floor :	933.12 m ²	3.6 m
Other :	39.12 m ²	3.0 m

8.6.2. Design of facade

Architectural facade should be simply designed with a modern feeling. The hospital building should fit into the environmental conditions, orientation and level of building site, traditional concepts, etc.

All exterior surfaces will receive a slightly profiled fair

- faced concrete shuttering finish, and partly showing natural stone or bricks.

8.7. Electrical Installation

In the planning and execution of the entire electrical engineering system, the pertinent regulations of Korea are used as guidelines.

8.7.1. Power installation

The power will be supplied by the main electric power plant of the building from the Korea Electric Company line, 22,900 V-Y, heavy power.

First stage of distribution voltage
Received 22,900 V-Y and voltage down to 3,300 V-A
Supply to each station 3,300 V-A

Second stage of distribution voltage

light and heat	:	3ø 4w 380/220V	AC 60Hz
general power	:	3ø 4w 380/220V	AC 60Hz
cooling power	:	3ø 4w 380/220V	AC 60Hz
refrigerator	:	3ø 4w 3,300V	AC 60Hz
medical equipment power	:	3ø 4w 380/220V	AC 60Hz

8.7.2. High tension switches:

Main : M. O. C. B
Tie : M. O. C. B
Branch : M. O. C. B

All connections between the sections and the transformers consist of synthetic resin insulated cables with realed connectors. Supply of power requirement is provided by transformers equipped with thermal circuit breaker and Buchholtz relays.

8.7.3. Low tension switches:

Main : A.C.B
Tie : A.C.B
Branch : N.F.B.

The low tension station is a steel construction. The station houses automatic regulation and the power control mechanism of the emergency power supply as well as power switches and fuses.

8.7.4. Emergency power supply

An emergency power supply unit is installed to provide for the necessary supply of emergency power in time of power failure. The generator is a diesel-

powered, water cooled, and has a 3-phase exit of 220V AC 60Hz. The generator automatically self-starts at power failure through the automatically controlled starter battery, and is located in the low tension station.

8.7.5. Low current installations.

The hospital building should have the following facilities installed:

- (1) Telephone installation
- (2) Clock installation
- (3) Fire alarm system
- (4) Collective antenna system
- (5) Public address and nurse paging system
- (6) Elevators

8.8. Mechanical Installation

8.8.1. Heating system

Design and installation of the heating system is based on the relevant regulations. The following heat generators will be installed: Boiler for the supply of the general heating and air exchange system.

Boiler for the hot water supply system.

Boiler for the generation of steam.

The oil burners to be installed use Banker C-Oil.

The central boiler plant houses all necessary distributors with pumps and valves or sliding valves.

It also accomodates the water treatment plant for the steam generator.

8.8.2. Air Conditioning, Ventilation

Design and installation are based upon the relevant regulations. For ventilation as well as air conditioning, a decentralized system is foreseen. The installations are sectionally subdivided in such a way as to permit simultaneous operation or individual operation, so that operative sections of the compound can be run or de-activated individually. Extract ventilation ducts are provided for less important rooms, like storage rooms, lavatories, etc..

Power ventilation units will be provided for kitchens, cooridors, stair cases, and entrance halls. Wards, lobbies, offices, consulting and treatment rooms will be partially airconditioned using power convectors.

Operation rooms and adjacent facilities will be fully airconditioned.

8.8.3. Design and development of sanitary equipment and installations conforms to the relevant regulations. Enough water, of potable quality, must be at hand on the site. The sanitary installations comprise: pure water supply, waste water

disposal, fire safety piping inside of the building, and drain-piping for rain water.

The waste water from the sanitary fixtures as well as any water from roof areas (rain) are conducted in pipes running in shafts and, in the basement, connected to the main sewer. The system provides for proper separation of the potable water pipes from the waste water piping and also has a built-in neutralization device. It is not necessary to install a decay and dilution plant.

The hot and cold water distributors are in the central boiler room. The individual fixtures and equipment units are grouped according to their purpose and location so that they may be sectionally shut off, drained, or heated. The design provides for "dry" rising pipes in the staircases. The feeder coupling (B-type) for the fire brigade is located at the entrances of the building. Each wall hydrant is fitted with a fire extinguisher.

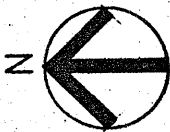
Design Schedule

Works	Month		1		2		3		4	
	Date		15	30	15	30	15	30	15	30
1. Architectural Design										
Preliminary Design										
Working Detail Drawing (Structure)										
Working Detail Drawing (Architecture)										
Specification Writing										
Cost Estimation										
2. Mechanical Design										
Preliminary Design										
Detail Design										
Specification Writing										
Cost Estimation										
3. Electrical and Communication Design										
Preliminary Design										
Detail Design										
Specification Writing										
Cost Estimation										
4. Civil Engineering Design and Cost Estimation										

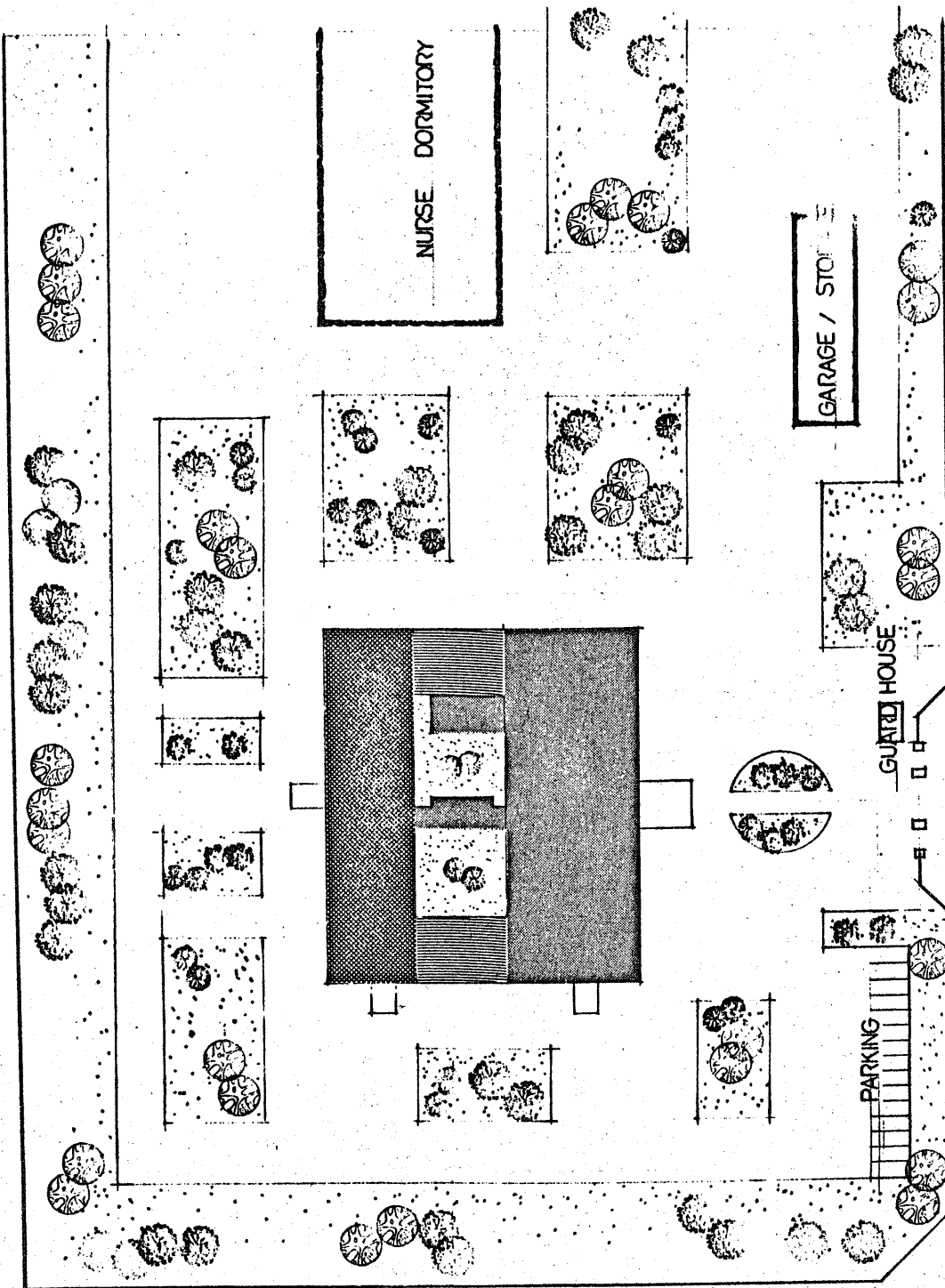
Construction Working Schedule

Works	Month		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
	Date		15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30
1. Site Preparation and Civil Work																																
2. Building Construction																																
Temporary Work																																
Earth Work																																
Carpentry Work																																
Concrete and Reinforced Concrete Work																																
Masonry Work																																
Door and Windows																																
Plastering Work																																
Glazing Work																																
Tile and Finishing Work																																
Painting Work																																
Miscellaneous Work																																
3. Mechanical Construction																																
Heating																																
Cooling and Ventilation																																
Water Supply and Sanitary Work																																
Gas, Air line etc.																																
Miscellaneous Work																																
4. Electric Construction																																
Conduct Piping Work																																
Conduct Piping																																
Electric Wiring																																
Light Fixture Work																																
Electric Power Work																																
Generator System																																
Communication Work																																

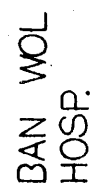
BAN WOL
HOSP.



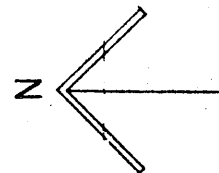
G/GROSS AREA
6900.00 M²



A SITE PLAN c100 BED,
S : 1/1200



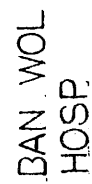
7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200
							57,600



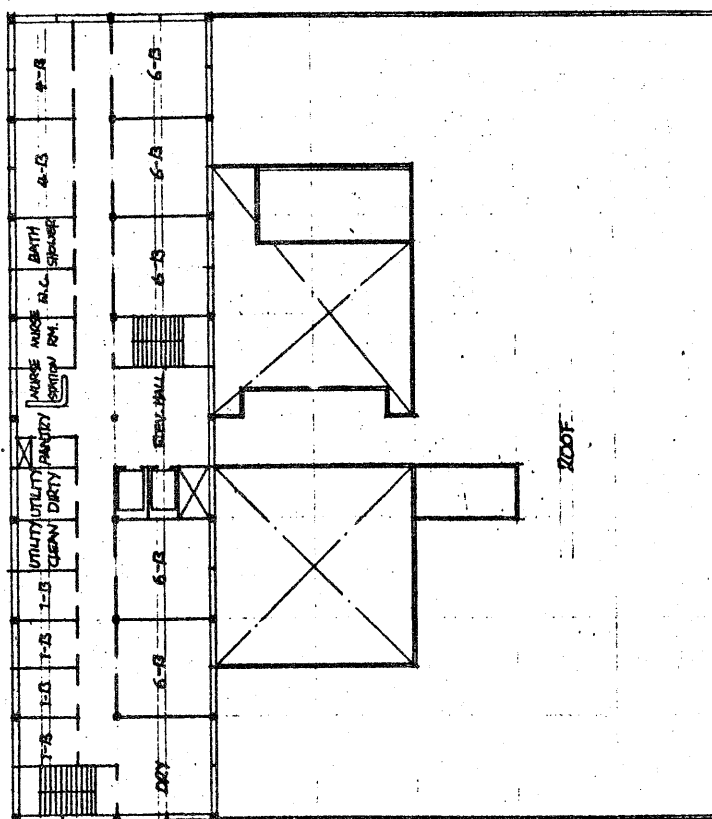
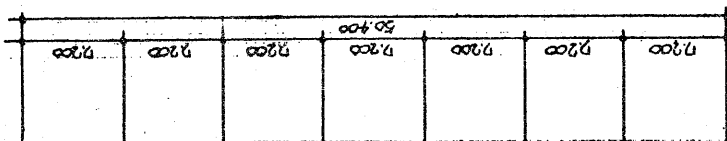
BASEMENT -- PLAN

$$S : 1/600 \quad (1267.92 \text{ m}^2)$$

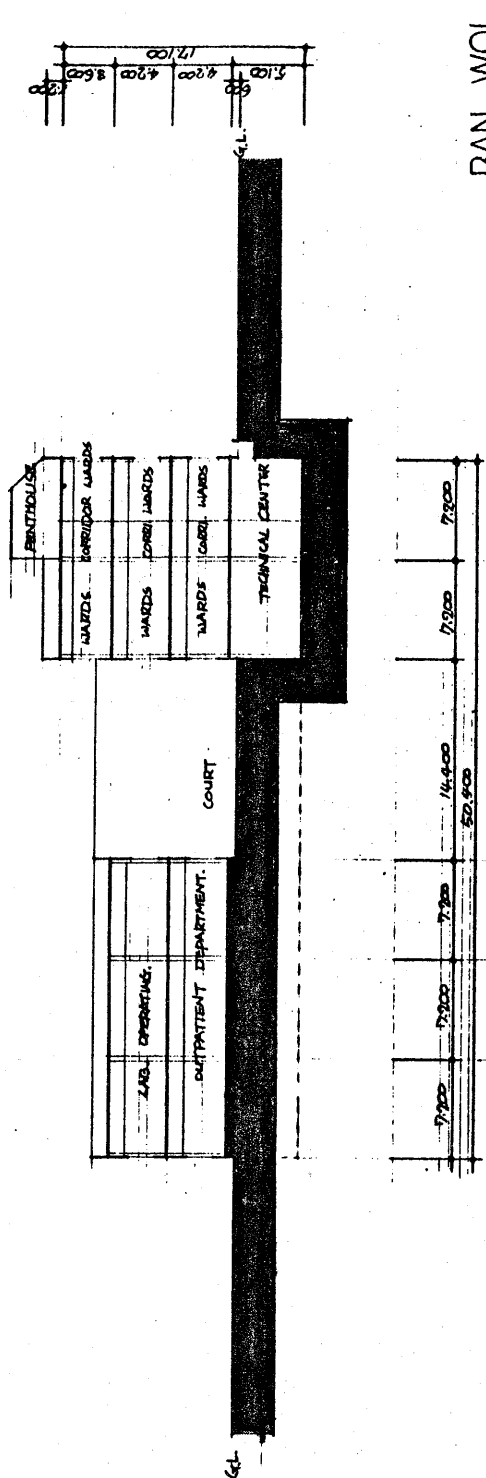
100 BED,



2nd FLOOR PLAN
A S : 1/600
44 M²
(2206)

[illegible]

3rd FLOOR PLAN
A
S: 1/600



MAIN SECTION (100 BED)
S : 1 / 600

9. Sponsor of the Proposed Hospital Refer to the Feasibility Study on Hospital Construction for the Medically Under-served Area (I) Yeosu.

10. ADMINISTRATION AND ORGANIZATION OF BANWOL HOSPITAL

10.1. Administrative relationship of Banwol Hospital and Korea University Medical Center.

The relationship between Banwol Hospital and the Korea University Medical Center has similar qualities as the other affiliated hospitals of Korea University Medical Center. However, due to the unique nature of Banwol Model City, Banwol Hospital also possesses certain differences.

Banwol Hospital will be the first hospital to be constructed in a new model city. Because no medical facility exists in this Banwol Model City, Banwol Hospital will function independently; unlike the other affiliated hospitals which are located in an area with previously existing medical facilities.

Also, Banwol is located approximately 30 minutes away from the large cities where modern medical facilities exist. Therefore Banwol Hospital must be able to deal with wide range medical care delivery, including primary, secondary, as well as tertiary health care delivery. Although Banwol Hospital is expected to carry out this wide range of activities, a referral system to have recourse to in serious industrial accident cases should be established with the Korea University Medical Center.

This referral system will enhance the supporting role of the Korea University Hospital to the Banwol Hospital. Through the supporting role, Korea University Hospital will be responsible for the proper guidance of a hospital in a new model city and through this experience can play a leading role in the future development of hospitals of a similar nature.

In order to succeed in this social experiment and to realize the goal of being the leader in this area, Korea University Medical Center must strengthen the organizational administrative network to effectively evaluate the medical care service. It must effectively control and coordinate the activities of the hospitals in both the Banwol and Guro industrial complex. With these efforts, Korea University Medical Center can play a central role in the development of the industrial health care facilities in order to establish an industrial-health-management system.

10.2. Organizational System of Banwol Hospital

Effective operation of a hospital requires proper relationship and coordination among the various departments of the hospital. In order to assure the effective coordination of the entire hospital operation, the Banwol Hospital has organized a steering committee, planning office, administrative departments, clinical department and clinical committees. In organizing the hospital organizational system, higher priority was given to clinical functional activities and the supporting departments. (See attached organizational chart of Banwol Hospital)

10.2.1. Superintendent

Under the supervision of the Director of the Medical Center, the superintendent will be responsible for the entire operation of the hospital.

10.2.2. Steering Committee

The steering committee will be the principal advisory agency to the superintendent.

Its function is to establish basic guidelines regarding the general policy of the hospital as well as the personnel policy.

10.2.3. Planning Office

Planning office is not a line organization but an assisting staff organization to the superintendent to perform the planning of entire operation of hospital, budgeting, development and auditing activities.

10.2.4. Department of Clinical Affairs

From the chiefs of the clinical department, one person will be selected as the director of the clinical affairs.

In addition to his duty as the chief of his department, the chief of clinical affairs will perform coordinative activities among the clinical departments and ancillary departments in order to develop the entire clinical activities of the hospital. He will work under the superintendent.

10.2.4.a. Clinical departments

The clinical departments consist of internal medicine, general surgery, orthopedic surgery, pediatrics, OB & GYN, ENT, ophthalmology, urodermatology, dentistry and health care delivery.

Under the direction of the superintendent, the chief of each clinical department is responsible for the operation of the department including management of clinical facility and instruments.

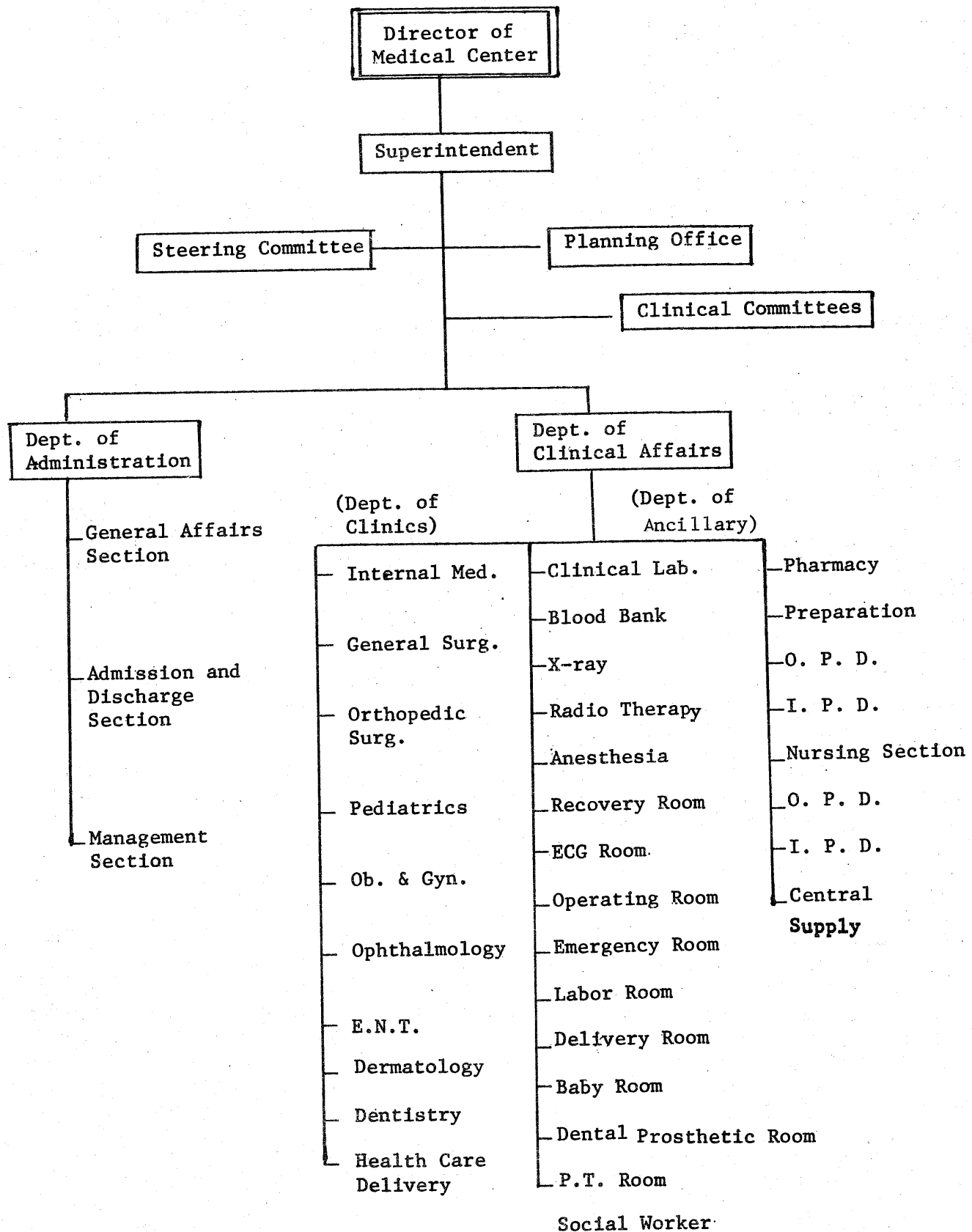
10.2.4.b. Ancillary Department

The hospital organized ancillary departments consist of laboratory, blood bank, X-ray, radio therapy, anesthesia, operating recovery room, emergency room, labor room, delivery room, new born baby room, E.E.G. dental prosthetic laboratory, P-T room, pharmacy nursing section, central material room, and social worker section. Under the order of superintendent, the chief of clinical support departments will be responsible for performing the assigned duty and management of facility and instruments of the department.

10.2.5. Clinical Committees

In order to promote clinical activities, the hospital will operate a medical ethics committee, operating room committee, tissue committee, cost and

Organizational Chart of BAN WOL Hospital



drug committee, medical records committee, patient nutrition committee and research committee under the control of superintendent.

10.2.6. Department of Administration

The department of administration will be separated into general affairs, admission and discharge, and management. The director of this department will be under the superintendent and will be responsible for the management of all administrative activities.

10.2.6.a. General Affairs Section

The general affairs section will perform the following duties:

- general administration
- personnel management
- management of vehicles
- financial and accounting
- security guard

10.2.6.b. Admission and Discharge Section

The admission and discharge section will perform the following duties:

- patient administration
- admission and discharge processing
- out-patient administration
- medical insurance service
- medical record and statistics
- ambulance service
- food service
- laundry service

10.2.6.c. Management Section

The management section will perform the following duties:

- planning for supply
- receiving, storage and insurance
- marketing and purchasing
- inspection of procured materials
- boiler room, power room, water supply
- engineering
- management of other items

11. MANPOWER REQUIREMENT OF BANWOL HOSPITAL

11.1. Basis of Estimation for Hospital Personnel

11.1.1. The personnel of the Banwol Hospital will be classified into 5 groups for the purpose of estimation. They are medical, nursing duty, medical technician duty, administrative duty and others. These five groups are further subdivided in accordance with the detailed functions of the personnel.

11.1.2. The annual total of working days is 280 days

The standard workload per man per day according to the duty was based on the regulations set by the Medical Law. The workload is obtained from the survey of the existing hospital and also the specific functions of the hospital.

The estimation of required manpower does not consider Banwol Hospital to be a training facility.

11.2. Estimated Hospital Manpower

The estimated personnel requirement for the Banwol Hospital totals 166 staff members. (See Annex 2-1)

1	Medical group	18
2	Nursing group	68
3	Medical technician group	13
4	Administrative group	11
5	Other group	56
Total		166

This breakdown was calculated on the basis of the following estimations:

11.2.1. Estimated Requirement of Medical Group Manpower

Estimation of full time physician requirement is based on the following considerations:

- 1 Number of clinical and ancillary departments
- 2 Number of inpatients and outpatients
- 3 Legal standards of the medical law
- 4 Characteristics of the area of Banwol Hospital
- 5 Applied formula

$$Nmd = \frac{Pie}{Ki} + \frac{Poe}{Ko}$$

NOTE:

- Nmd: Number of physicians
- Pie: Average inpatients per day
- Poe: Average outpatients per day
- Ki : Legally authorized beds for a doctor per day
- Ko : Legally authorized outpatient for a doctor per day

32 full-time physicians, including the superintendent, were the estimated required number. Should the Banwol Hospital be designated as a training institution, this requirement will vary in accordance with the number and type of trainees.

11.2.2. Estimated Requirement of Nursing Staff

Estimation of nursing manpower is based on the following considerations;

1. Number of outpatients in the clinical departments and general inpatients and intensive care cases in the primary nursing functions.
2. Nursing administration, emergency room, operating room, delivery room, central supply, nursing personnel as the specific functions.
3. Applied formula

$$\text{Nrn} = \frac{\text{Poe}}{\text{Ko}} + \frac{\text{Pie}}{\text{Koi}} + \frac{\text{Piex}}{\text{Kiex}}$$

Where, Nrn : Number of nurses
Poe : Average number of outpatients for per day
Ko : Legally authorized outpatients for per nurse per day
Pie : Number of inpatients per day
Koi : Legally authorized inpatients for per nurse per day
Piex: Standard number of intensive care patients per day
Kiex: Standard number of intensive care patient for a nurse per day

The estimated requirement for nurses was calculated to be 68; 55 primary function nurses and 13 specific function nurses. Approximately 50% of the primary function nurses can be substituted by nurse-aids.

11.2.3. Estimated Requirement of Medical Technician Manpower

Estimation of medical technician manpower is based on the following considerations:

1. Number of clinical examinations for inpatient according to specific functions.
2. Number of clinical examinations for outpatient according to specific functions.
3. Necessity of night duty requirement
4. Standard examination capability per man per day according to specific functions.

Clinical support manpower according to specific functions is estimated as follows:

11.2.3.a. Laboratory technician manpower is based on the following formula.

$$\text{Nt} = \frac{\text{Pie L} + \text{Poe L}}{\text{Kl}} + \text{C}$$

Where, Nl : Number of laboratory technicians
Pie L: Average number of examinations for inpatients per day
Poe L: Average number of examinations for outpatients per day
Kl : Standard examination cases per man per day
C : Number of night duty laboratory technicians

11.2.3.b. X-ray technician manpower is based on the following formula.

$$N_x = \frac{Pie \ X + Poe \ X}{K_x} + C$$

Where, N_x : Number of X-ray technicians
Pie X: Average X-ray films taken for inpatients per day
Poe X: Average X-ray films taken per man per day
C : Number of night duty technicians

11.2.3.c. 5 technicians of other functions are required; 1 ECG technician, 3 physio-therapist and 1 dental technician.

The estimated total medical technicians required is calculated to be estimated around 13 members. Among this group, 30% can be substituted with aid-technicians.

11.2.4. Estimated Requirement of Administrative Manpower

Administrative manpower estimation is based on the following consideration;

1. Number of outpatients
2. Number of inpatients
3. Additional work loads based on the number of hospital beds
4. Applied formula

$$N_a = \frac{Pie + Poe}{K_a} + \frac{B}{K_b}$$

Where, N_a : Number of administrative manpower
Pie : Average number of inpatients per day
Poe : Average number of outpatients per day
 K_a : Standard administrative cases per man per day
B : Number of hospital beds
 K_b : Additional administrative work loads beds based on the number of hospital beds.

Based on the above calculation it is estimated that 11 administrative personnel are required.

11.2.5. Estimated Requirement of Other Manpower

Other manpower was estimated as follows:

11.2.5.a. Required pharmacists is calculated based on the following considerations;

1. Number of drug preparations for outpatients
2. Number of drug preparations for inpatients
3. Necessity of night duty man

4. Standard capability of drug preparation per man per day
5. Applied formula

$$N_p = \frac{P_{ie} P + P_{oe} P}{K_p} + C$$

Where, N_p : Number of pharmacists
 $P_{ie} P$: Average drug preparations for inpatient per day
 $P_{oe} P$: Average drug preparations for outpatient per day
 K_p : Standard drug preparation per man per day
 C : Number of night duty pharmacists

It was estimated that 5 pharmacists are required based on the above calculation with 30 percent of pharmacists replacable with aide personnel.

11.2.5.b. Teh central material supply room manpower requirement, based on the existing 100 beds hospital's actual manpower statistics, is estimated to be 10 personnel, 5 expendable medical material workers and 5 sterilization workers.

11.2.5.c. Housekeeping manpower is estimated to be 6 personnel based on one man for 600 m² of occupied building area.

11.2.5.d. Food service manpower requirement is estimated to be 10 personnel. 1 dietician based on one dietician per 100 beds, 4 aide cooks based on one aide per 25 beds, and 4 food delivery men based on one man per 25 beds, are the means of estimation.

11.2.5.e. Laundry manpower requirement is estimated to be 6 personnel. 4 laundry men based on one man per 25 beds and 2 repair men based on one man per 50 beds, are the means of estimation.

11.2.5.f. The remaining manpower under the other manpower category include 2 miscellaneous workers based on two men per 100 beds, 3 drivers (including 1 ambulance driver), 4 boiler room workers, 2 electric power room workers, 2 carpenters and 6 information and guard men. Therefore, the total estimated manpower requirements under the other manpower category are 56 personnel.

11.3. Pay Roll System

The following are considerations taken in determining the pay roll system for the hospital personnel.

1. Medical doctors will be well paid in order to employ highly qualified physicians.
2. Administrative personnel will be minimized and paid well in order to employ highly qualified personnel.
3. Pay roll systems will be classified into 5 categories such as physicians, nurses, administrators, technicians and functional workers in order to secure their specialities.

4. Payment will include basic pay and allowances (adjustment, duty, technical, night duty, and danger) and 400% of bonus pay based on basic payment. (See Annex-standard payroll system)

The attached payroll standards were prepared in accordance with above criteria.

12. ESTIMATED REQUIREMENT AND COST OF MEDICAL EQUIPMENT

12.1. Medical Equipment

Medical equipment was selected based on the following criteria in order to meet the roles and functions of Banwol Hospital.

1. Required equipment and quantity are decided to perform the established functions of each clinical department (example: establish the scope and type of operation) (See Annex-functional level of 100 bed hospital)
2. Equipment is grouped into basic medical equipment and minor medical equipment in accordance with functions of each department.
3. Equipment is classified by department and room in accordance with room space allocation.
4. Mutual use equipment is specially classified in order to avoid duplication of equipment. (example: mutual use items for surgical dept.)
5. Domestically purchased equipment and foreign purchased equipment are separately marked.
6. Costs were calculated based on the dollar (\$) exchange rate of 28 Feb. 1979.

12.1.1. Estimated Cost of Medical Equipment

Estimated total costs required for medical equipment of Banwol Hospital are \$910,435.

Medical equipment needed for clinical and administrative departments are listed in the equipment list (See Annex-equipment list) (The equipment list shows 250 types of equipment with a total quantity of 817).

12.2. Furniture and House Goods

Furniture and house goods are selected based on the following standard:

1. Functions and number of personnel of each department
2. Space allocations of each department and section
3. Domestically purchased and foreign purchased items
4. Costs are based on the U.S. dollar exchange rates of dollars as 28 Feb. 1979.

Table 12-1. Cost of Medical Equipment by Department (Banwol Hospital)

Medical Department	Estimated Cost (U.S.\$)
Emergency Room	28,905
Internal Medicine	41,818
Surgery	12,184
Pediatrics	2,765
Ob & Gyn	36,241
Orthopedic surgery	18,834
E.N.T.	23,141
Ophthalmology	25,440
Dermatology & Urology	12,768
Dentistry	30,851
Health maintenance	877
Clinical Laboratory	47,979
Autopsy	22,103
X-ray	161,960
Operating Room	257,489
Delivery Room	24,316
P.T. Room	14,860
Wards & Nursing Station	90,965
Pharmacy	6,430
Central Supply	29,440
Total	910,435

12.2.1. Estimation of Furniture and House Goods

Required costs of furniture and house goods is \$56,100. The distribution according to department is as follows:

Emergency Room	\$1,154
Outpatient Clinics	\$7,224
Clinical Laboratory	\$2,320
Autopsy Room	\$366
X-ray Department	\$2,206
Operating Room	\$2,547
Delivery Room	\$568
Wards	\$5,626
Administration	\$9,671
Pharmacy	\$3,388
Kitchen	\$13,709
Laundry	\$5,917
P.T. Room	\$242
Sterilization Room	\$569
Others	\$593
Total	\$56,100

12.3. Drugs

Estimated cost of drugs, medical expendables, medical materials and other supplies for operation of Banwol Hospital was figured by using percentage of costs similar to existing hospitals.

1. Percentage of cost for drugs and medical expendables makes up 25% of the total operating expenses of existing 100 bed hospitals.
2. Percentage distributions are as follows:

1) Drugs	83%
2) Medical expendables	5%
3) Medical materials	8%
4) Others	4%
<hr/>	
Total	100%

Costs required for one-year supply of drugs, medical expendables and materials for the Banwol Hospital are as follows: based on 1977 costs.

Drugs	W129,130,000 (\$266,250)
Medical expendables	W7,244,000 (\$14,940)
Medical materials	W14,173,000 (\$29,220)
Others	W6,929,000 (\$14,290)
<hr/>	
Total	W157,475,000 (\$324,700)

12.4. Vehicles

Estimated vehicle requirements and costs as follows.

Total costs for the vehicles is estimated to be \$46,390.

Sedan	2	W10,000,000 (\$20,620)
Ambulance	1	W5,500,000 (\$11,340)
Micro bus	1	W7,000,000 (\$14,430)
<hr/>		
Total		W22,550,000 (\$46,390)

12.5. Books

Hospital books will be classified into text books and periodicals. Required list of books will be recommended by clinical departments, clinical support departments and administrative sections, and final section will be made by library committee. It is estimated approximately \$20,000 for text books (400) and \$1,600 for periodicals (40); total of \$21,600 is required for the library.

13. TOTAL INVESTMENT COST AND FINANCING

13.1. The total investment cost required for the Banwol Hospital which is to be sponsored by the Korea University is \$5,640,417 (₩2,707,400,000) as shown in Table B-36.

Table B-36 Banwol Hospital (100 beds)
INVESTMENT COST 1/

Category	Local Cost	Foreign Cost
Land estate	₩720,000,000	\$1,500,000
Site preparation	16,000,000	33,333
Construction	1,321,600,000	2,753,333
Medical and non-medical equipment	463,936,000	966,533
Outside equipment	64,000,000	133,333
Contingencies (price and physical) 2/	73,000,000	152,083
Engineering fees	58,400,000	121,666
Working capital	63,464,000	132,216
Total investment cost	₩2,707,400,000	\$5,640,417

1/ See Appendix A 4-1

2/ Contingencies are not included in total investment cost because the Korea University Foundation is responsible for these contingencies.

13.2. The sources of financing the investment cost of \$5,640,417 to build a new hospital with 100 beds are as follows:

Table B-37 Banwol Hospital (100 beds)
SOURCES OF FINANCING

Total Investment	₩2,707,400,000 (\$5,640,417)
Foreign loan 1/	663,936,000 (\$1,383,200)
Local loan 2/	600,000,000 (\$1,250,000)
Korea University	1,443,464,000 (\$3,007,217)
Total financing	₩2,707,400,000 (\$5,640,417)

1/ Equipment	₩463,937,000 (\$966,535)
Mechanical facilities	₩200,000,000 (\$416,667)
2/ Local loans	₩6,000,000 (\$1,250) for each bed
3/ Land	₩720,000,000 (\$1,500,000)
Building and facilities	₩660,000,000 (\$1,375,000)
Working capital	₩63,464,000 (\$132,217)

13.2.1. Of the total amount needed, \$1,383,200 (₩663,936,000) will be provided by a West German loan. Its use is restricted to purchasing medical equipments

and construction materials; \$966,535 (₩463,937,000) to buy the equipments and \$416,667 (₩200,000,000) for construction materials.

13.2.2. Terms of the foreign loan is repayment of all principal and interest in 20 years after a ten-year grace period at an annual interest of 2%.

13.2.3. The local loan will be secured from a Korean commercial bank (or banks). This will be arranged by the Korean Government for the Banwol Hospital. The use of the local loan is restricted to the building costs of the hospital. The maximum amount of the local loan is \$12,500 (₩6,000,000) per hospital bed. Therefore \$1,250,000 (₩600,000,000) can be borrowed locally by the Banwol Hospital as it will have 100 beds.

13.2.4. The terms of the local loan is repayment of all the principal and interest in seven years after a three-year grace period at an annual interest rate of 18.5%, out of which the borrower will be charged 7% and the Korean Government will be responsible for 11.5%. Therefore the net interest cost for the Korea University is 7%.

13.2.5. Korea University as the sponsor of the Banwol Hospital will provide \$3,007,217 (₩1,443,464,000) for land purchase, working capital and additional cost for construction.

13.3. The expected balance sheet of the Banwol Hospital in the year before the operation is shown in Table B-38.

Table B-38

Banwol Hospital (100 beds)
BALANCE SHEET (BEGINNING OF OPERATION)

\$1 = ₩480
Unit: Won

Assets		Liabilities	
Cash	₩44,187,000	Bank credit	₩0
Auxiliary goods	4,186,000	Account payable	0
Pharmaceuticals and medical articles	15,091,000	Draft	0
Equipment	463,937,000	Loans local:	600,000,000
Building	1,460,000,000	foreign:	663,936,000
Land	720,000,000	Reserve for contingency	0
		Capital	₩1,443,464,000
Total assets	₩2,707,400,000	Total liabilities	₩2,707,400,000
	(\$5,640,417)		(\$5,640,417)

14. ECONOMIC FORECASTING

14.1. For the estimation of total revenues in the future, medical care fees should be determined. To estimate medical charges in the future, two things must be clarified; one is the present medical care fees and the other is the future increase in medical care fees.

14.1.1. To determine present medical care fees, a survey was conducted at several hospitals to determine medical care fees according to the disciplines. Because of limited data, the differences in medical charges between medical insurance subscribers and private patients can not be presented. Table B-34 is the result of the survey of 21 hospitals which had similar characteristics as those expected of the Banwol Hospital.

Table B-39

MEDICAL CARE FEES IN 1978
(under 200 beds hospitals)

\$1 = ₩480
Unit: Won

Classification	Outpatient Fee Per Visit	Inpatient Fee Per Day
Internal medicine	3,400	13,800
General surgery	3,300	13,900
Orthopedic surgery	2,800	11,200
Neuro-surgery	3,500	15,000
Pediatrics	2,100	10,400
OB and GYN	2,800	18,000
ENT	2,800	14,600
Ophthalmology	3,500	12,500
Jaw surgery	3,800	13,100
Neuro-psychiatry	3,200	9,200
Urology	3,200	14,000

14.1.2. The average fees in Table B-39 represent gross costs charged by hospitals; inclusive of pharmaceuticals, X-ray's, medical tests, food and others.

14.1.3. Since there is a relatively large difference in the medical care fees charged by hospitals between insured patients and private patients, respective medical care fees should be estimated in order to calculate total future revenues. For this purpose, a survey was conducted to study the fees paid to hospitals by insured patients treated in the Guro area during 1978. The survey found that the average fees of insured patients were \$5.63 (₩2,700) for outpatient per visit and \$27.1 (₩13,000) for inpatient per day. (The classification by discipline was not available.)

14.1.4. The following equation is developed to derive the average costs for insured patient by department, utilizing Table B-39 and survey result mentioned in 14.1.3.

$$\text{Average medical fee} = X_i \times \left(\frac{X_1}{X_2} \right)$$

Where, X_i = Average medical care fee in "i" department shown in Table B-39
 X_1 = Average medical care fee in 1978 for the insured
 \$5.63 (₩2,700) per visit for outpatient and \$27.1 (₩13,000) per day for inpatient
 X_2 = Average medical fees in 1978 (calculated from Table B-39)

14.1.5. The medical care fees for private patients are estimated on the basis of a 1977 KPC Report, in which medical fees charged for private inpatients were 35% higher than fees charged for insured inpatients and about 23% higher in the case of outpatients. Also we considered the fact that average medical fees for insured patients have increased 20% in 1979, while fees for private patient have not undergone the similar increase. Considering these facts, we concluded that the average medical charge for private inpatients is 30% higher than fees for insured inpatients and 20% higher for outpatient in 1979.

14.1.6. Medical care fees in 1979 calculated according to 14.1.1-14.1.5 are shown in Table B-40.

Table B-40

MEDICAL CARE FEE IN 1979
 (under 100 beds hospital)

\$1 = ₩480
 Unit: Won

Classification	Out-patient (per visit)		In-patient (per day)	
	Insurance	Private	Insurance	Private
Internal medicine	3,500	4,200	16,200	21,060
General surgery	3,400	4,080	16,400	21,320
Orthopedic surgery	2,900	3,480	13,200	17,160
Neuro-surgery	3,600	4,320	17,700	23,010
Pediatrics	3,200	3,840	12,300	15,990
OB & GYN	2,900	3,480	21,200	27,560
ENT	2,900	3,480	21,200	27,560
Ophthalmology	3,600	4,320	14,700	19,110
Urology and dermatology	3,300	3,960	16,500	21,450
Neuro-psychiatry	3,300	3,300	10,900	20,000
Jaw surgery	3,900	4,680	15,400	14,170

14.1.7. The future changes of the medical care fees for private patients and insured patients are predicted on the following three assumptions;

- The fee difference between insured patients and private patients will be reduced gradually and eliminated eventually by the end of 1991 when the Korean government expects medical insurance to cover 100% of the population.
- The rate of increase of the medical care fees for private patients will stabilize over time, while the medical care fees for the insured will increase to reach the same level of the fees for private patients.

Table B-41

Banwol Hospital (100 beds)

ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st-10th year)

1979 Constant Price

\$1 = W480
Unit: W1,000

Category	Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
<u>Outpatients</u>	Insurance	63,054	67,628	86,382	106,119	127,120	149,199	180,230	212,996	247,583	284,028
	Private	142,998	149,769	146,978	141,996	134,672	128,756	112,549	95,256	76,829	57,444
<u>Inpatients</u>	Insurance	149,068	152,024	197,297	256,025	332,281	432,483	498,905	575,539	663,992	765,957
	Private	370,811	431,335	402,238	370,968	337,514	301,684	265,745	227,385	186,498	142,928
<u>Sub-total</u>	Insurance	212,132	219,652	283,679	362,144	459,401	581,682	697,135	788,535	911,575	1,049,985
	Private	513,809	581,104	549,216	512,964	472,186	430,440	388,294	322,641	263,327	200,372
<u>Grand Total</u>	Local	725,942	800,756	832,895	875,108	931,587	1,012,122	1,067,429	1,111,176	1,174,902	1,250,357
	Foreign (\$=000)	(1,512)	(1,668)	(1,735)	(1,823)	(1,941)	(2,109)	(2,224)	(2,315)	(2,448)	(2,605)

c) The real increase in medical care charges will be 3% annually for next ten years because of quality increase.

14.2. Table B-41 shows total estimated annual revenue for 10 years, which is obtained by multiplying the expected medical care fees (based on 14.1.1.-14.1.7) by the estimated number of patients per year.

14.3. The total expenses include expenses for personnel, pharmaceutical and other materials, food and clothes, maintenance of building and equipment, heating and utilities, and administration. The expenses of each item are estimated for 10 years.

14.3.1. Because expenses for personnel are the main portion of total expenses, these have been broken down into expenses for physicians, nurses, technicians and administrative personnels.

14.3.2. Expenses for personnel in each category are calculated by multiplying estimated required manpower by average salary surveyed in 1979. For the next ten years, a 3% real increase in salary is assumed per year.

14.3.3. Costs of pharmaceuticals and other materials, heating and utilities, and administrative cost have been estimated based on the survey conducted: the ratio of each expense to total expenses, and the ratio of each expense to total revenues of the hospitals which have similar characteristics as the planned Banwol Hospital. Table B-42 shows the result of the survey. The ratio of each expense to the total revenues are used to estimate these expenses for the future, assuming that the ratios would be constant over time. Accordingly the cost of heating and utilities is 4.11% of the total revenues (without considering a quality increase) and administrative cost is 6.10% of total revenues without consideration of quality increase.

Table B-42

COMPOSITIONS OF EXPENSES 1/
(under 100 beds hospitals)

Category (A)	A/Total Expenses	A/Total Revenue
Personnel expense	46.61%	43.82%
Utilities	2.45%	2.37%
Heating	3.05%	2.74%
Clothes and food	4.45%	4.04%
Pharmaceuticals and others	31.03%	24.95%
Equipment and building maintenance	5.94%	4.35%
Operating expenses 2/	6.47%	6.10%

1/ This statistics is obtained from survey of 6 hospitals; The Han-dog Hospital, the Song-mo Hospital, the Ki-dok (at Kyungjoo) Hospital, the An-dong Hospital, the Han-Joong Hospital and the Hankook Hospital.

2/ Operating expenses include vehicles, administrative expenses, taxes (except income taxes) and others.

Table B-43

Banwol Hospital (100 beds)

ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st-10th year)\$1 = W480
Unit : W1,000

Year	1st year	2nd	3th	4th	5th	6th	7th	8th	9th	10th
Personnel	450,468	463,984	477,903	492,240	507,007	522,217	537,884	556,019	570,641	587,761
Physician	225,792	232,566	239,543	246,729	254,131	261,755	269,608	277,696	286,027	294,607
Nurse	100,962	103,991	107,111	110,324	113,534	117,043	120,554	124,171	127,896	131,733
Medical assistant	76,628	78,927	81,295	83,734	86,246	88,833	91,498	94,243	97,071	99,983
Mgt. and ad.	23,069	23,762	24,474	25,209	25,965	26,744	27,546	28,373	29,224	30,101
Technical service and others	24,017	24,738	25,480	26,244	27,031	27,842	28,678	29,538	30,424	31,337
Pharma. and X-ray	181,122	199,788	207,807	218,339	232,430	252,524	266,323	277,238	293,138	311,964
Food & Clothes	44,273	45,308	46,649	47,990	49,332	50,673	51,326	51,979	52,631	53,284
Maintenance	20,358	48,098	48,098	48,098	48,098	48,098	20,358	48,098	48,098	48,098
Building	8,960	36,500	36,500	36,500	36,500	36,500	8,760	36,500	36,500	36,500
Equipment	11,598	11,598	11,598	11,598	11,598	11,598	11,598	11,598	11,598	11,598
Utilities and heating	36,015	36,639	37,804	38,968	40,133	41,297	42,094	42,891	43,688	44,485
Others	42,993	43,738	45,128	46,518	47,908	49,298	50,250	51,201	52,152	53,104
Total Expense: Local :	775,229	809,815	835,649	864,413	897,148	936,367	968,235	997,686	1,032,608	1,070,956
Foreign:	(1,615)	(1,687)	(1,741)	(1,801)	(1,869)	(1,951)	(2,017)	(2,079)	(2,151)	(2,231)
(\$ = 000)										

Table B-44

Banwol Hospital (100 Beds)

ECONOMIC FORECASTING : PRO-FORMA INCOME STATEMENT
(1st-10th year)

\$1 = W480
Unit: W1,000

	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Total revenues	725,942	800,756	832,895	875,108	931,587	1,012,122	1,067,429	1,111,176	1,174,902	1,250,357
Total expenses	775,229	809,815	835,649	864,413	897,148	936,367	968,235	997,686	1,032,608	1,070,956
Operating income	*49,287	*9,059	*2,754	10,695	34,439	75,755	99,194	113,490	142,294	179,401
Depreciation	75,594	75,594	75,594	75,594	75,594	75,594	75,594	75,594	75,594	75,594
Interest	55,258	55,258	55,258	55,258	50,406	45,212	39,656	33,712	27,352	20,546
Net profit Local	*180,139	*139,911	*133,606	*120,157	*91,561	*45,051	*16,056	4,184	39,348	83,261
Foreign (\$=000)	*(375)	*(298)	*(292)	*(271)	*(191)	*(94)	*(33)	(9)	(82)	(173)
*deficit										

Table B-45

Banwol Hospital (100 beds)

PRINCIPAL AND INTEREST PAYMENT
(1st-10th year)

1979 Constant Price

\$1 = W480
Unit: 1,000 Won

Year	1st year	2nd	3th	4th	5th	6th	7th	8th	9th	10th
Each payment	55,258	55,258	55,258	124,582	124,582	124,582	124,582	124,582	124,582	124,582
foreign	13,258	13,258	13,258	13,258	13,258	13,258	13,258	13,258	13,258	13,258
local	42,000	42,000	42,000	111,324	111,324	111,324	111,324	111,324	111,324	111,324
Interest payment	55,258	55,258	55,258	55,258	50,406	45,212	39,656	33,712	27,352	20,546
foreign	13,258	13,258	13,258	13,258	13,258	13,258	13,258	13,258	13,258	13,258
local	42,000	42,000	42,000	42,000	37,148	31,954	26,398	20,454	14,094	7,288
Principal payment	0	0	0	69,324	74,176	79,368	84,924	90,870	97,230	104,102
foreign	0	0	0	0	0	0	0	0	0	0
local	0	0	0	69,324	74,176	79,368	84,924	90,870	97,230	104,102
Balance of loans	1,263,936	1,263,936	1,263,936	1,194,612	1,120,436	1,041,066	956,140	865,270	768,038	663,936
foreign	662,936	663,936	663,936	663,936	663,936	663,936	663,936	663,936	663,936	663,936
local	600,000	600,000	600,000	530,676	456,500	377,130	292,204	201,334	104,102	0

Barnes Hospital (100 Beds)
ECONOMIC FORECASTING: PRO-FORMA BALANCE SHEET
(1st-10th year)

Table B-46

1979 constant price

Year	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Current assets	63,464	63,464	63,464	63,464	63,464	63,464	63,464	63,464	81,176	138,258
Equipment	463,937	463,937	463,937	463,937	463,937	463,937	463,937	463,937	463,937	463,937
depr.	46,394	92,788	139,182	185,576	231,970	278,365	324,758	371,152	417,547	463,998
Building	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000	1,460,000
depr.	29,200	58,400	87,600	116,800	146,000	175,200	204,400	233,600	262,800	292,000
Land	720,000	720,000	720,000	720,000	720,000	720,000	720,000	720,000	720,000	720,000
Total	2,631,807	2,556,213	2,554,967	2,405,025	2,329,431	2,253,836	2,178,243	2,102,649	2,044,990	2,024,190
Current liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	600,000	600,000	600,000	530,670	456,490	377,110	292,178	201,300	104,061	0
Foreign loan	663,936	663,936	663,936	663,936	663,936	663,936	663,936	663,936	663,936	663,936
Capital	1,548,010	1,612,327	1,670,339	1,784,226	1,874,369	1,923,464	1,948,850	1,959,942	1,959,942	1,959,942
Retained earnings	-	* 180,139	* 320,050	* 453,650	* 573,813	* 665,374	* 710,425	* 726,481	* 722,297	* 682,949
Profit	* 180,139	* 139,911	* 133,606	* 120,157	* 91,561	* 45,051	* 16,056	* 4,184	* 39,348	* 83,261
Total	2,631,807	2,556,213	2,554,967	2,405,025	2,329,431	2,253,836	2,178,243	2,102,649	2,044,990	2,024,190
local										
foreign (\$-000)	(5,183)	(5,325)	(5,323)	(5,010)	(4,853)	(4,695)	(4,538)	(4,381)	(4,260)	(2,217)

* deficit

Table B-47

Banwol Hospital (100 Beds)
ECONOMIC FORECASTING: ESTIMATION OF CASH FLOW
(1st-10th year)

1979 constant price		1\$=480 Mon Unit: 1,000 Mon								
Year	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
<u>1. Operating and Maintenance</u>										
1.1 personnel	450,468	463,984	477,903	492,240	507,007	522,217	537,884	554,019	570,641	587,761
1.2 other expenses	304,403	325,473	337,388	351,815	367,783	393,792	409,993	423,309	441,609	462,837
1.3 maintenance	20,358	20,358	20,358	20,358	20,358	20,358	20,358	20,358	20,358	20,358
1.4 interest	55,258	55,258	55,258	55,258	50,406	45,212	39,656	33,712	27,352	20,546
1.5 operating expenses	830,487	865,073	890,907	919,671	952,406	991,625	1,023,493	1,052,944	1,087,866	1,125,764
1.6 depr.	75,954	75,954	75,954	75,954	75,954	75,954	75,954	75,954	75,954	75,954
1.7 op. cost.	906,081	940,667	966,501	995,265	1,028,000	1,067,219	1,099,087	1,128,538	1,163,460	1,201,358
<u>2. Revenue</u>										
2.1 outpatient	206,052	217,397	233,360	248,115	261,912	277,955	292,779	208,252	324,412	341,472
2.2 inpatient	519,879	583,359	599,535	626,993	669,795	724,167	764,650	802,924	850,490	908,885
2.3 other revenue	0	0	0	0	0	0	0	0	0	0
2.4 whole revenue	725,942	800,756	832,895	875,108	931,587	1,012,122	1,067,429	1,111,176	1,174,902	1,250,357
<u>3. Profit Calculation</u>										
3.1 operating income	* 180,139	* 139,911	* 133,606	* 120,157	* 91,561	* 45,051	* 16,056	* 4,184	39,348	83,261
3.2 accumulation	0	0	0	0	0	0	0	0	0	0
3.3 income taxes	0	0	0	0	0	0	0	0	0	0
<u>4. Cash Flow Calculation</u>										
4.1 gross cash flow	* 104,545	* 64,317	* 58,012	* 44,563	* 15,967	20,543	59,538	79,778	114,942	158,855
4.2 payoff/discharge	0	0	0	69,324	74,176	79,368	84,924	90,870	97,230	104,102
4.3 invested capied (\$=000)	104,545	64,317	58,012	113,887	90,143	49,095	25,386	11,092	0	0
4.4 net cash flow (\$=000)	(0)	(0)	(0)	(237)	(188)	(102)	(53)	(23)	(0)	(0)
4.5 accumulation of 4.4 (\$=000)	63,464	63,464	63,464	63,464	63,464	63,464	63,464	63,464	63,464	63,464
	(132)	(132)	(132)	(132)	(132)	(132)	(132)	(132)	(169)	(288)

* deficit

14.3.4. 24.95% of total revenue is considered as cost for pharmaceuticals and other materials.

14.3.5. The cost of food is estimated on the basis that the cost per meal is \$1.25 (₩600) and \$3.75 (₩1,800) per day. \$6.25 (₩3,000) per bed a year is assumed for clothes.

14.3.6. Maintenance cost for building is assumed to be 0.25% of the acquisition value and 2.5% for medical equipments a year.

14.4. Table B-43 presents the total cost estimated according to (14.3.1)-(14.3.6).

14.5. By combining Table B-41 and Table B-43, the proforma income statement for ten year is presented in Table B-44.

14.5.1. Expected duration of the building is 50 years according to the Korean tax law and average expected utilization of medical equipment is assumed to be 10 years. Straight line method is used for the calculation of depreciation.

14.5.2. The interest charge has been mentioned in (13.2.2) and (13.2.4); the annual rate is 2% for the foreign loan and 7% for the local loan. But the actual repayment of the principal of the local loan would start in the fourth year and in the 11th year for foreign loan. The schedule of payment and interest charge by the year are presented in Table B-45.

14.5.3. Income tax would be exempted for the Banwol Hospital because it belongs to the Korea University Foundation.

14.5.4. The amount of large deficits from 1st - 8th year shown in Table B-44 will be supported with the profit from the Guro Hospital and from the Korea University Hospital operating now. The income statement in 1978 of the Hospital is presented in Appendix A 4-2.

14.6. Table B-46 is the proforma balance sheet of the Banwol Hospital for ten years.

14.6.1. For the estimation of current assets, the principle that at least one twelfth of total expenses of the initial operation year should be kept as current assets has been adopted. All the profit, excluding loan repayment, will be invested into current assets (cash, pharmaceuticals, food and others).

14.6.2. The actual principal payment of the local loan (interest and principal) would start in the 4th year and in the 11th year for the foreign loan. The loan payments are assumed as being equal over time as shown in Table B-45.

14.6.3. It is assumed that all current liability is to be cleared out at the end of each year.

15. ESTIMATION OF CASH FLOW

- 15.1. Considering (14.1) - (14.6), estimated cash flow is presented in Table B-47.
- 15.2. Costs of operating and maintenance (1.1 - 1.7 in Table B-47 are presented in Table B-43.
- 15.3. Revenues (2.1 - 2.4. in Table B-48) are presented in Table 14-3.
- 15.4. Profit calculation is presented in Table B-44.
- 15.5. Cash flow calculation is based on the principle that the Banwol Hospital should have at least one twelfth of its operating expenses for the initial year of operation as current assets (that is ₩63,464,000).
- 15.6. The Payoff/discharge (4.2) includes only the repayment of the principal of the loan which is shown in Table B-45.
- 15.7. Gross cash flow is calculated by adding operating income (3.1) and depreciation (1.6) or by subtracting operating expenses (1.5) from whole revenue (2.4).

Table A 4-1

Banwol Hospital

INVESTMENT COST

	Local cost	Foreign cost
No.1: Land estate cost		
1.1 Value: quantity(Won/M ² 39,600M (18,181Won/M ²)	₩720,000,000	\$1,500,000
1.2 Acquisition cost	720,000,000	1,500,000
Total Sum of No. 1	720,000,000	1,500,000
No.2: Site preparation cost		
2.1 Public opening	2,000,000	4,167
2.2 Non-public opening	14,000,000	39,167
2.3 Other cost (i.e. taxes)	0	
Total Sum of No. 2	16,000,000	33,333
No.3: Construction cost		
3.1 Building (due to room and space program plus traffic ways)	961,000,000	2,002,083
3.2 Inst allations (Sewage, Water, Heating, Electricity ...)	213,000,000	443,750
3.3 Technical service plants (Waste water, water, warm water, gases, electricity, 270,000,000 telephone and other central communication instrallations, air-conditioning, elevators...)		562,500
Sum of 3.1 - 3.3	1,444,000,000	3,008,333

and:

a) Classification to space-content: 1/

3.1 - 3.3 :	$\frac{m^3}{27,600}$	$\frac{Won/m^3}{50,000}$	<u>Whole amount</u>	<u>Outside equipment</u>
Sum of 3.1 - 3.3			1,380,000,000	64,000,000

b) Classification to space

3.1 - 3.3 :	$\frac{m^2}{6,900}$	$\frac{Won/m^2}{200,000}$		
Sum of 3.1 - 3.3			1,380,000,000	64,000,000

c) Classification to beds

3.1 - 3.3 :	$\frac{No. of beds}{100}$	$\frac{Won/Bed}{138,000}$	1,380,000,000	64,000,000
Sum of 3.1 - 3.3				

No. 4: Equipment

4.1	Medical equipment	₩437,008,800	\$910,435
4.2	Non-medical equipment	26,928,000	56,100
	Sum of 4.1 + 4.2	463,936,800	966,535

No. 5: Outside equipment

64,000,000	133,333
------------	---------

No. 6: Contingencies

6.1	Price contingencies	36,500,000	76,041
6.2.	Physical contingencies	36,500,000	76,041

No. 7: Engineering fees

58,400,000	121,666
------------	---------

No. 8: Working capital (estimate): 2/

8.1	Cash, accounts receivable	44,187,000	92,056
8.2	Auxiliary goods (cleaning, disinfection, heating ...)	4,186,000	8,720
8.3.	Pharmaceuticals, medical articles	15,091,000	31,439
8.4.	Bank liabilities	0	0
8.5.	Short-term loans, drafts	0	0
8.6	Accounts payable	0	0

Difference of (8.1 + 8.2 + 8.3) - (8.4 + 8.5 + 8.6)	63,464,000	132,216
---	------------	---------

1/ Whole amount is the sum of construction and engineering fees. Therefore for total investment cost of construction cost outside equipment should be added to it.

2/ Working capital for the initial year is estimated on the assumption that at least one-twelfth (one month) of annual expenses will be required. Initial investment costs for pharmaceuticals (and medical articles) and auxiliary goods are one twelfth of annual expenses for these items respectively. Required cash is estimated as (working capital required) - (8.2 + 8.3).

Table A 4-2

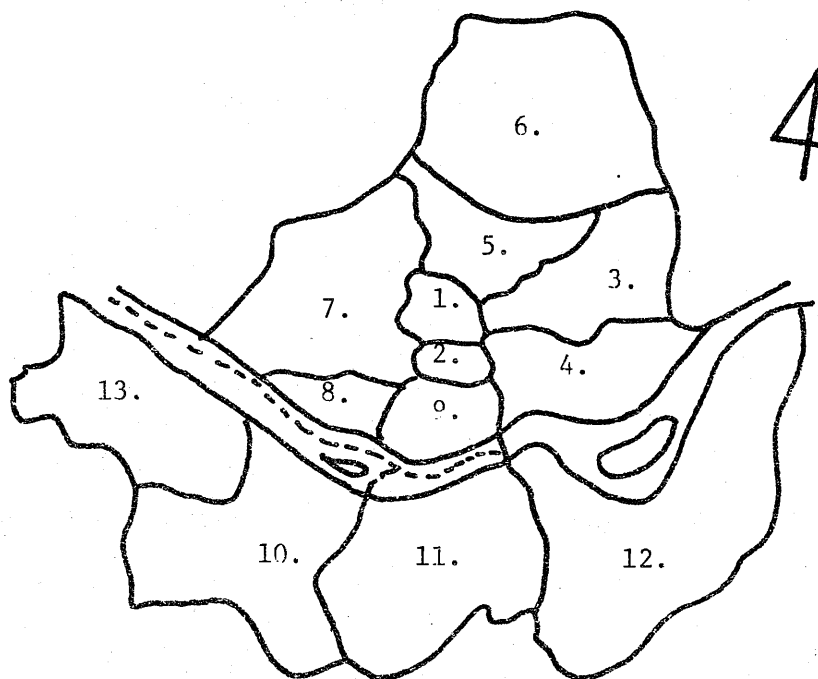
Korea University Hospital Income Statement
(during 1977.3 - 1978.2)

Revenues from operation		2,627,142,228
outpatient	661,406,125	
inpatient	1,933,704,303	
others	32,031,800	
Expenses for materials		654,454,545
pharmaceuticals	420,187,807	
medical materials	145,831,809	
blood	22,512,250	
others	65,922,679	
Operating income before Administrative expenses		1,972,687,682
Administrative Expenses		1,546,874,165
personnel	990,648,454	
depreciation	106,517,095	
others	47,521,867	
Operating income		425,813,518
Income from outside of operation		131,576,904
<u>Net profit</u>		<u>557,390,422</u>
(\$)		(1,161,230)

C. GURO HOSPITAL

1. SOCIO-ECONOMIC STATUS OF YEONGDEUNGPO AREA
 - 1.1. Characteristics of the Area
 - 1.1.1. The Yeongdeungpo District located south of the Han River established an independent jurisdiction in 1943 during the period of Japanese occupation. After the independence of Korea, Seoul has undergone rapid development. During this period, Yeongdeungpo also experienced industrial growth; however, it was not until the aftermath of the revolution in the early sixties that full-scale industrialization took place. With the elevation of Seoul to a special city status by the government on February 2, 1962, and the policy of industrialization, the rapid growth of Yeongdeungpo was promoted.
 - 1.1.2. Under the provision of the Development of Industry for Export Law, the Committee for Export Industry was established on March of 1963. The Korea Industry Export Corporation established in the following year, played a leading role in the development of this area. The establishment of the first industrial complex (462,000 m²) followed by the second (396,000 m²) and third industrial complex (1,105,500 m²) resulted in the total construction of 209 factories in Guro.
 - 1.1.3. When the population in the Yeongdeungpo District exceeded 1.4 million, this district was separated into two districts, the eastern part being Gwanag District. However, due to the continuous growth, the population soon exceeded one million level. In 1977, the outlining section of Yangseu area was abolished and established as Gangseu District, thereby rearranging the administrative district of Yeongdeungpo. The result of this reorganization was 13 administrative districts and two outlying areas within the Seoul jurisdiction (Figure C-1).
 - 1.1.4. The Yeongdeungpo District encompass 66.95 Km² and is the second largest district after Gangnam District. The population density is 13,594/Km² which is somewhat lower than the 15,839/Km² density of the area north of Han River. The average population density of the area south of the Han River is 8,275/Km², indicating that Yeongdeungpo District, with its population density twice of neighboring areas, is the focus of development in southern Seoul (Figure C-2). Table C-1 shows the population of the Seoul according to the districts.
 - 1.1.5. Geographically, Yeongdeungpo occupies a strategic location. The Seoul-Pusan Railway and the Seoul-Inchon Railway both operate in this area. In order to conduct the population dispersion policy in the northern part of Seoul, the Government has concentrated on the development of area south of

1. Jongrogu
2. Junggu
3. Dongdaemungu
4. Seongdonggu
5. Seongbuggu
6. Dobonggu
7. Seodaemungu
8. Mapogu
9. Yongsangu
10. Yeongdengpogu



11. Gwanaggu
12. Gangnamgu
13. Gangseugu

Figure C-1. Administrative Units of Seoul

Han River. To implement this plan, the completion of the 2nd, 3rd and 4th subways in mid-1980's is envisioned. This will be followed by the transfer of present functions of Seoul Station to the Guro Station located in the Yeungdeungpo District. If this plan is realized, the development of Yeungdeungpo District will further increase.

1.2. Socio-Economic Status

1.2.1. Yeongdeungpo is one of the representative industrial districts in Korea. The mostly medium-sized factories in the area are involved in the production of chemical, steel, machinery, electronic, appliance, precision tools, food, wood and textile products. The 209 factories involved in export trade reached the total volume of trade exceeding 150 million dollar, which was 11% of the total national export. ^{1/} These figures indicate the importance of the Guro Industrial Complex and the key role played by Yeongdeungpo in the economic development process of Korea.

1.2.2. The total industrial production of the Seoul residents has increased annually, and by 1976 the level reached 32% of the total GNP (Table C-2). 35.2% of this production by the Seoul residents was accomplished in the Yeongdeungpo District (Table C-3). In other words, 2.5% of the total population were responsible for 11% of the total national GNP.

^{1/} Data from the Guro Industrial Complex, February, 1979

(1 dot denotes 500 person)



Figure C-2. Population Density of Seoul by Gu

Due to the active production activity in the Yeongdeungpo District the tax rates for this area was high, second only to Jung District. Of the districts in Seoul, Yeongdeungpo ranked first in the agency tax, registration tax, acquisition tax and property tax. In 1977, the tax per capita was \$53 (Table C-4)

- 1.2.3. The environmental pollution due to the growing industrialization in Yeongdeungpo has become serious. In order to alleviate

Table C-1.

Seoul Population by Gu and Year

Gu	1971	1972	1973	1974	1975	1976	1977
Jongro	209,203	205,844	200,316	197,250	334,329	329,921	322,215
Jung	127,055	125,315	121,816	120,319	284,705	284,648	275,184
Dongdaemun	771,971	796,068	805,096	842,909	738,255	754,483	780,770
Seongdong	870,938	910,922	956,900	1,027,068	629,803	639,871	640,702
Seongbu	1,062,696	1,109,850	516,671	521,459	604,852	613,619	595,917
Dobong	-	-	618,363	649,319	631,595	662,761	689,600
Seodaemun	842,323	870,696	931,317	946,855	795,661	811,068	804,294
Mapo	351,657	358,806	362,329	347,641	422,454	430,059	436,994
Yongsan	300,764	301,032	309,087	314,761	336,314	338,981	346,954
Yeongdeungpo	1,314,318	1,397,610	820,971	884,114	1,050,663	1,164,561	910,202
Gwanag	-	-	646,690	689,805	734,150	784,655	852,314
Gangseu	-	-	-	-	-	-	353,035
Gangnam	-	-	-	-	326,321	440,331	517,448
Total	5,850,925	6,076,143	6,289,556	6,541,500	6,889,502	7,254,958	7,525,629

Source: Seoul Metropolitan Government, Seoul Statistical Year Book, 1978, pp. 18-19.

Table C-2.

Industrial Origin of Gross Citizen's
Product at 1970 Constant Price

Year	GNP	Seoul	(Unit: million Won)
			(B)/(A) x 100
1974	3,825,500	1,205,340	31.5
1975	4,129,320	1,313,540	31.8
1976	4,767,900	1,526,810	32.0

Source: Ibid. PP.70 - 71

Seoul Statistical Year Book, 1977, p. 68-69.

the sewage problem in the Guro Industrial Complex a construction of integrated sewage disposal system is planned. Also, 24.5% of the 1,512 factories operating in Yeongdeungpo District have been charged for violating the anti-pollution laws. They have been order to suspend operations, displaced, or have had license revoked; 674 factories have been order to improve their anti-pollution facilities (Table C-5).

- 1.2.4. Of the 13 existing administrative districts in Seoul, Yeongdeungpo has the greatest number of industrial population and factories. In this sense, Yeongdeungpo itself can be regarded as an independent industrial city.

- 1.2.5. The employment status of the Korea Export Industrial Complex are shown in Table C-6. As of this year the female employees outnumber male employees in Guro and Incheon Complex is by a margin of 2 to 1. 61.3% of the workers in this area are between the ages of 18 and 23. In the case of the females, 73.4% are within this age range (Table C-7). The distribution of workers according the educational level are shown in Table C-8. Over 68% of the employees have reached the middle school level, and in the case of female, 79% have had middle school education. The distribution of the workers according to their residency shows that 30% live in the industrial complex dormitories, 32% in the Gangnam area (Yeongdeungpo, Gwanag, Gungseu), 19% from Incheon and remaining 12% from north of Han River. Approximately 50% of the workers in the Incheon Industrial Complex commute from Seoul area (Figure C-3). The distribution of workers according to the production indicates that 38% are involved in the electric and electronic production and 31.7% in textiles (Table C-9).

Table C-3. Amount of Manufacturing Exports by Gu in 1977 (Unit: US \$)

Area	No. of Establishments	Total	%	Textile	Machinery	Chemistry	Arts	Others
Jongro	4	37,133,311	3.2	1,451,204	35,404,165	-	277,941	-
Jung	4	28,319,096	2.5	4,138,679	7,239,712	-	2,006,294	14,934,410
Dongdaemun	32	89,500,317	7.7	46,904,956	16,378,083	4,244,254	19,069,033	2,903,991
Seongdong	76	215,674,287	18.7	53,763,175	153,787,349	3,088,296	1,853,327	3,182,140
Seongbug	19	38,192,541	3.3	32,865,975	1,308,622	-	3,239,346	778,598
Dobong	39	106,841,933	9.2	36,164,082	31,611,408	2,045,593	7,030,287	29,990,563
Seodaemun	29	27,677,977	2.4	11,487,653	3,905,862	1,833,148	9,586,386	864,927
Mapo	10	24,294,615	2.1	13,074,529	3,627,340	3,000	6,919,335	670,411
Yongsan	8	38,409,656	3.3	32,531,483	-	21,413	723,640	5,133,120
Yeonpdeungpo	58	407,148,451	35.2	159,751,576	157,126,401	47,078,138	12,120,581	31,071,755
Gwanag	16	40,538,776	3.5	20,458,934	3,726,329	10,633,162	454,098	5,266,253
Gangnam	5	3,285,369	0.3	18,786,838	4,038,902	126,694	2,509,506	2,054,599
Gangseu	34	98,825,376	8.6	7,317,501	63,100,876	2,655,567	2,731,513	7,019,919
Total	334	1,155,841,705	100.0	438,696,585	481,255,049	87,729,265	68,521,287	103,870,687

Source: Ibid. p. 94

Table C-4. Assessment of Municipal Tax, Yeong Deungpo, 1976 - 1977

Kinds of Tax	(Unit 1,000 Won)			
	1976	Rank	1977	Rank
Agency	-	-	1,081,887	1
Registration	-	-	5,303,647	1
Acquisition	5,978,849	1	6,523,653	1
Property	2,662,022	1	2,662,212	1
Agricultural	15,440	2	17,048	2
Slaughter	82,205	2	85,093	2
Fire Service	295,402	2	300,173	2
Establishment				
City Planning	1,144,823	2	1,185,622	2
License	379,822	2	696,088	2
Residents	1,408,382	3	4,257,753	2
Entertainment & Restaurant	813,652	3	-	-
Automobile	830,614	3	1,149,254	3
Total	13,611,211	2	23,262,430	
Tax/Capita	11,699		25,581	

Source: Ibid., pp. 64-65.

Table C-5. Environmental Pollution Control Activities in Yeongdeungpo-Gu

	1976	1977
No. of Establishments	1,691	1,512
No. of Violations	437	370
New Establishment	96	74
Existing Establishment	341	296
Action Taken	433	743
Order to Improve & Repair	384	674
Temporary Suspension	26	48
Order to Remove	22	20
Cancellation	1	1

Source: Ibid. pp. 128-129

Statistical Year Book, 1977, pp. 128-129

Table C-6. Number of Employees of the Korea Export Industry Complex, December 1979

Sex	Guro	%	Inchon	%	Total	%
Male	22,248	30.5	15,842	38.2	38,090	33.3
Female	50,719	69.5	25,647	61.8	76,366	66.7
Total	72,967	100.0	41,487	100.0	114,456	100.0

Source: Office of the Korea Export Industry Complex, January, 1979.

Table C-7. Age and Sex Distribution of Employees for the Korea Export Industry Complex, December 1978

Age	Male	%	Female	%	Both	%
Less than 18	1,506	4.0	7,674	10.1	9,180	8.0
18-23	14,099	37.0	56,061	73.4	70,160	61.3
24-29	10,720	28.1	8,740	11.4	19,460	17.0
30-39	8,718	22.9	2,267	3.0	10,985	9.6
More than 40	3,047	8.0	1,624	2.1	4,671	4.1
Total	38,090	100.0	76,366	100.0	114,456	100.0

Source : Ibid

Table C-8. Educational Level of Employees for the Korea Export Industry Complex, December 1978

Educational Level	Male	%	Female	%	Both	%
Primary School	4,942	13.0	22,450	29.4	27,392	23.9
Middle School	12,737	33.4	37,871	49.6	50,607	44.3
High School	15,260	40.1	15,780	20.7	31,040	27.1
College	5,152	13.5	265	0.3	5,417	4.7
Total	38,090	100.0	76,366	100.0	114,456	100.0

Source: Ibid.

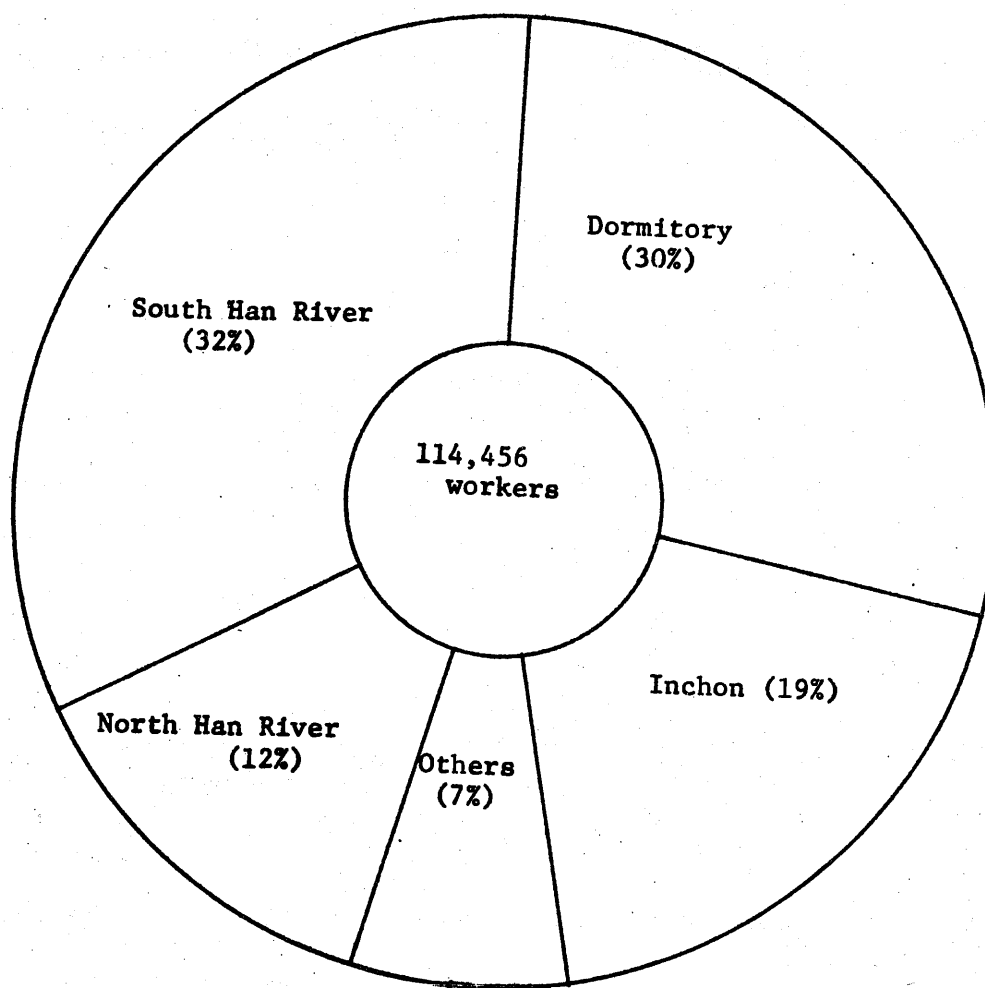


Figure 1-3. Residential Distribution

Table C-9. Employees of the Korea Export Industry Complex by
Kinds of Products

Kinds of Products	Male	Female	Both	%
Food	271	98	369	0.3
Textile	7,652	28,493	36,145	31.7
Cloth	3,445	9,122	12,567	11.0
Leather	87	85	172	0.2
Printing	476	157	633	0.6
Chemical	1,255	889	2,144	1.9
Non-Metal Mineral	446	51	497	0.3
Metal	4,693	939	5,632	4.9
Chemical Instrument	2,400	970	3,370	3.0
Electricity & Electronics	9,579	29,045	38,624	33.8
Others	7,361	6,673	14,034	12.3
Total	37,665	76,522	114,187	100.0

Source: Ibid.

Table C-10. Number of Members for Health Insurance Societies
of the Korea Export Industry Complex

Area	No. of Subscriber	No. of Dependents	Both
Guro	50,720	23,459	74,179
Inchon	32,135	18,991	51,126
Total	82,855	42,450	125,305

Source: Ministry of Health & Social Affairs, The 1979 Roster of Employees Health Insurance Societies.

2. DISEASE PATTERNS

2.1. Presently, data regarding the disease patterns of the Yeongdeungpo residents do not exist. Therefore, this study utilized the disease patterns among the members of the Guro Industrial Complex Insurance Associations. The Korea Export Industry Corporation is separated into Complex I, II, and III in Guro, and Complex IV, V, VI located in Inchon. 209 factories are located in Guro and 135 factories in Inchon, total of 315. In these two areas independent health insurance associations exist. This survey utilized the statistics from Guro area only, with the premise that Inchon area will not be within the catchment of Guro Industrial Complex Hospital. The Guro Industrial Complex Medical Insurance Association is the largest of its kind in Korea with the total of 74,179 persons insured; 50,720 subscribers and 23,459 dependents (Table C-10)

2.2. The disease patterns of the Guro insurance member are shown on Table C-11. The females showed high morbidity rates for diseases of the digestive system and genito-urinary system whereas the males showed high incidence of respiratory diseases and sudden accidents, poisoning and violence.

2.3. The disease patterns according to age in the Guro area showed similar results as the 1973 Hospital census, ^{1/} with the exception of the following two cases: In the number of sudden accident, poisoning and violence cases in Guro is considerably

^{1/} The hospital census was based on inpatient service for one day in the hospitals throughout the country on Oct. 1, 1973. The Guro data are the recent information regarding the sickness benefit of the Guro Insurance members, including the utilization of hospitals and clinics for in-patient and out-patient services.

Table C-11.

Disease Pattern for Members of the Curo Health Insurance Society by Sex

Diseases Classification	1977 (7-12)		1978 (1-12)	
	Male	%	Male	%
Infective & Parasitic Diseases	507	14.6	1,472	10.0
Neoplasms	19	0.5	69	0.5
Endocrine, Nutritional and Metabolic Disease	2	0.1	50	0.3
Diseases of the Blood and Blood-Forming Organs	12	0.3	40	0.3
Mental Disorders	30	0.9	146	1.0
Diseases of the Nervous System and Sense Organs	362	10.4	1,649	11.2
Diseases of the Circulatory System	32	0.9	226	1.5
Diseases of the Respiratory System	904	26.0	4,226	28.6
Diseases of the Digestive System	793	22.8	3,370	22.8
Diseases of the Genito-Urinary System	116	3.3	547	3.7
Complications of Pregnancy, Childbirth and the Puerperium	-	-	-	-
Diseases of the Skin and Subcutaneous Tissue	304	8.7	1,174	8.0
Diseases of the Musculoskeletal System and Connective Tissue	55	1.6	448	3.0
Congenital Anomalies	2	0.1	10	0.1
Certain Causes of Perinatal Morbidity and Mortality	3	0.1	15	0.1
Symptoms and Ill-Defined Conditions	96	2.8	385	2.6
Accidents, Poisonings and Violence (External Cause)	240	6.9	926	6.3
Total	3,477	100.0	14,753	100.0

24,632 100.0

Table C-12 Disease Pattern for Members of the Guro Health Insurance Society in 1978 by Age Group

Disease Classification	Age 1978 (1-12)					Total (%)
	0-4 (%)	5-14 (%)	15-24 (%)	25-54 (%)	55+ (%)	
Infective and Parasitic Disease	842 (15.7)	316 (9.3)	1,171 (7.2)	929 (7.0)	76 (7.3)	3,334 (8.5)
Neoplasms	8 (0.1)	6 (0.2)	70 (0.4)	71 (0.5)	29 (2.8)	184 (0.5)
Endocrine, Nutritional and Metabolic Disease	5 (0.1)	7 (0.2)	36 (0.2)	105 (0.8)	17 (1.6)	170 (0.4)
Diseases of the Blood and Blood-forming Organs	6 (0.1)	17 (0.5)	81 (0.5)	47 (0.4)	1 (0.1)	152 (0.4)
Mental Disorders	4 (0.1)	16 (0.5)	189 (1.2)	262 (2.0)	34 (3.3)	504 (1.3)
Diseases of the Nervous System	301 (5.6)	320 (9.4)	2,093 (12.9)	138 (10.4)	85 (8.2)	4,180 (10.6)
Diseases of Circulatory System	19 (0.4)	34 (1.0)	204 (1.3)	253 (1.9)	70 (6.8)	580 (1.5)
Diseases of the Respiratory System	3,220 (59.9)	1,394 (40.8)	2,372 (14.6)	1,718 (12.8)	113 (11.0)	8,817 (22.3)
Diseases of the Digestive System	391 (7.3)	720 (21.0)	5,375 (33.0)	3,609 (27.1)	317 (30.6)	10,412 (26.3)
Diseases of the Genito-Urinary System	28 (0.5)	74 (2.2)	841 (5.2)	1,468 (11.1)	85 (8.2)	2,496 (6.3)
Complications of Pregnancy Childbirth and the Puerperium	-	-	421 (2.6)	1,193 (9.0)	-	1,614 (4.1)
Diseases of the Skin and Subcutaneous Tissue	313 (5.8)	219 (6.4)	1,632 (10.0)	809 (6.1)	48 (4.6)	3,021 (7.7)
Diseases of the Musculo-skeletal system and Connective Tissue	21 (0.4)	74 (2.2)	541 (3.3)	340 (2.6)	71 (6.8)	1,047 (2.7)
Congenital Anomalies	10 (0.2)	3 (0.1)	5 (0.0)	2 (0.0)	-	20 (0.1)
Certain Causes of Perinatal Morbidity and Mortality	20 (0.4)	-	8 (0.0)	12 (0.1)	-	40 (0.1)
Symptoms and Ill-Defined Conditions	50 (0.9)	46 (1.3)	439 (2.7)	521 (3.9)	44 (4.2)	1,100 (2.8)
Accidents, poisoning and Violence	140 (2.6)	167 (4.9)	795 (4.9)	565 (4.3)	47 (4.5)	1,714 (4.4)
Total	5,378 (100.0)	3,413 (100.0)	16,272 (100.0)	13,285 (100.0)	1,937 (100.0)	39,385 (100.0)

lower than the national average. This is due to the fact that many of these patients are covered by the industrial accident compensation insurance, thereby excluding them from the health insurance benefit (Table C-12 and C-13). The 48.9% distribution for the respiratory diseases and digestive system diseases for Guro are much higher than the national average of 38.8%. This is probably due to inclusion of colds and minor stomach disorders in the statistics.

3. OBJECTIVES OF GURO HOSPITAL CONSTRUCTION AND MANAGEMENT

3.1. Objectives of Construction

3.1.1. As of 1978, the ratio of hospital beds per population in the Seoul area was 1.59/10,000. Geographically, severe imbalance existed between the areas north and south of the Han River; 2.06 and 0.72 respectively 1/ (Table C-14). Therefore, for the purpose of correcting some of this imbalance, the construction of Guro Hospital is being considered.

3.1.2. The concentration of medical facilities in the large cities is one of the factors for the population growth in the cities. In order to decrease the population growth in the area north of the Han River, the government is promoting the development of the south region. Therefore, the construction of the Guro Hospital can be considered to be a part of the south area development, thereby supporting the government policy of population dispersion.

3.1.3. In comparison with the importance of Yeongdeungpo as an industrial area and its future potential to be a region where many people can be relocated, there are relatively few hospitals (Table C-15). There is no university hospital in this area, 2/ and as far as large hospitals are concerned there is only one hospital with 450 beds. Due to this condition there is a strong reason to establish large-size hospital in this area. With the establishment of Guro Hospital as the first large medical facility operated by a University Hospital in this area, the resulting effect can induce the establishment of other large-scale university affiliated hospitals.

3.1.4. The employees of the Guro Industrial Complex and nearby factories face a high risk of incurring various industrial accidents of serious nature. With the establishment of a general hospital in

1/ The population of Yeongdeungpo composes 12.1% of the total Seoul population (including the Gangseu are 16.8%). The areas of Yeongdeungpo and Gangseu possess only 7.7% of the total beds in Seoul.

2/ Choongang University Medical College which is located in Gwanag District has its affiliated hospital established north of the Han River.

Table C-13

Classification of Diseases for the Hospitalized Cases in 1973

(Nationwide)

Disease Classification	Age					Total
	0-4	5-14	15-24	25-54	55+	
Infective and Parasitic Diseases	1,481(13.2)	646(9.2)	745(7.6)	1,853(6.9)	389(6.9)	5,114(8.5)
Neoplasms	271(2.4)	129(1.8)	225(2.3)	1,003(3.7)	314(5.5)	1,942(3.2)
Endocrine, Nutritional and Metabolic Diseases	35(0.3)	27(0.4)	54(0.6)	196(0.7)	94(1.7)	406(0.7)
Diseases of the Blood and Blood-forming Organs	30(0.3)	47(0.7)	75(0.8)	283(1.1)	65(1.1)	500(0.8)
Mental Disorders	17(0.2)	33(0.5)	433(4.4)	1,146(4.3)	189(3.3)	1,818(3.0)
Diseases of the Nervous System and Sense Organs	500(4.5)	617(8.8)	783(8.0)	1,801(6.7)	559(9.9)	4,260(7.0)
Diseases of the Circulatory System	63(0.6)	69(1.0)	96(1.0)	897(3.4)	589(10.4)	1,714(2.8)
Diseases of the Respirat- ory System	4,700(42.1)	1,994(28.2)	1,119(11.5)	2,616(9.8)	652(11.5)	11,081(18.3)
Diseases of the Digestive System	1,995(17.8)	1,109(15.7)	1,839(18.8)	6,077(22.7)	1,347(23.7)	12,367(20.5)
Diseases of the Genito-Urinary System	202(1.8)	415(5.9)	763(7.8)	2,557(9.5)	198(3.5)	4,135(6.8)
Complications of Pregnancy Childbirth and the Puerperium	21(0.1)	6(0.0)	848(8.7)	2,500(9.3)	66(1.2)	3,432(5.7)
Diseases of the Skin and Subcutaneous Tissue	1,045(9.3)	774(11.0)	722(7.4)	1,226(4.6)	259(4.6)	4,026(6.7)
Diseases of the Musculo- skeletal system and Connective Tissue	59(0.5)	138(2.0)	239(2.4)	651(2.4)	226(4.0)	1,313(2.2)
Congenital Anomalies	63(0.6)	25(0.4)	34(0.3)	62(0.2)	17(0.3)	201(0.3)
Certain Causes of Perinatal Morbidity and Mortality	42(0.4)	6(0.0)	15(0.2)	69(0.3)	2(0.0)	134(0.2)
Symptoms and Ill- Defined Conditions	85(0.8)	87(1.2)	103(1.1)	352(1.3)	91(1.6)	718(1.2)
Accidents, Poisoning and Violence	564(5.1)	928(13.2)	1,675(17.1)	3,511(13.1)	614(10.8)	7,292(12.1)
	11,164(100.0)	7,050(100.0)	9,768(100.0)	26,800(100.0)	5,671(100.0)	60,453(100.0)

Source: Ministry of Health & Social Affairs, One-day National Hospital Census in 1973. pp. 66-90

Table C-14 Number of Short-term General Hospital Beds per 1,000 Population by District (Gu)

Area	District	Population	No. of Hospitals	No. of Beds	%	No. of Beds 1,000 People
North Han River	Chongro-Gu	322,215	10	2,413	20.2	7.49
	Jung-Gu	275,184	12	2,165	18.1	7.87
	Dongdaemun-Gu	780,770	9	1,711	14.3	2.19
	Seongdong-Gu	640,702	6	1,344	11.2	2.10
	Seongsbuk-Gu	595,917	2	232	1.9	0.39
	Dobong-Gu	689,600	1	30	0.3	0.04
	Seodaemun-Gu	804,294	6	1,692	14.1	2.10
	Mapo-Gu	436,994	1	50	0.4	0.11
	Yongsan-Gu	346,954	3	428	3.6	1.23
	Subtotal	4,892,630	50	10,065	84.1	2.06
South	Yeongdeungpo-Gu	190,202	10	920	7.7	1.01
	Gwang-Gu	852,314	5	236	1.9	0.28
	Gangnam-Gu	517,448	2	750	6.3	1.45
	Gangseu-Gu	353,035	-	-	-	-
	Subtotal	2,632,999	19	1,906	15.9	0.72
	Total	7,525,629	69	11,971	100.0	1.59

Source: Data Compiled from the 1978 Hospital Roster of the Korean Hospital Association

Table C-15 Major Short-term General Hospitals in Yeongdeungpo-Gu

Identification No.	Hospital	Ownership	No. of Beds	Location
1.	Yeongdeungpo Municipal	Public	150	Yeongdeungpo Dong
2.	Hangang Sacred Heart	Medical Corporation	400	Yeongdeungpo Dong
3.	Sacred Heart Charity	Medical Corporation	50	Yeongdeungpo-Dong
4.	Choongmu	Private	76	Yeongdeungpo-Dong
5.	Sungae	"	75	Sinkil Dong
6.	Sam Il	"	33	Yeongdeungpo-Dong
7.	Yeong Il	"	40	Yeongdeungpo Dong
8.	Do Yeong	"	20	Gaebong Dong
9.	Daelim St. Mary's	"	26	Singolim Dong
10.	Christian	"	50	Yeongdeungpo Dong
Total			920	

Source: Registered Hospitals at the Korean Hospital Association as of April 30, 1978, Journal of the Korean Hospital Association, Vol. 7, No. 4, 5, 1978.

the nearby area, it will be unnecessary to transport serious cases, thereby providing high standard of medical care to the Guro Industrial Complex workers.

- 3.1.5. Guro area is situated at a strategic transportation center. The importance of Guro in term of transportation will be further heightened in the mid-1980's when the Guro Railroad Station undertakes the present functions of Seoul Station. At that time, Guro Hospital will be easily accessible not only to the nearby Suwon, Incheon, Anyang and Banwol residents, but to patients throughout the country.
- 3.2. Operation Target
 - 3.2.1. Guro Hospital will be directly managed by the Korea University Hospital. It will operate as a modern general hospital with 15 specialty departments.
 - 3.2.2. The medical demand in the Guro area is expected to be quite high. It is expected that Guro Hospital will operate at a 80% occupancy in the first year, followed by a gradual annual increase.
 - 3.2.3. In the initial year of operation, the average length of hospital stay is expected to be 12.5 days. By gradually decreasing the hospitalization days, increase in the bed turn-over rate can be accomplished.
 - 3.2.4. Expansion of bed size will be considered when the bed occupancy rate reaches the expected level of 90% around 1983 or 1984. However, for the present time, the hospital is expected to operate at a 250 bed-size capacity.
4. TARGET POPULATION OF THE GURO HOSPITAL
 - 4.1. Determination of Guro Hospital Catchment Area
 - 4.1.1. The proposed location of Guro Hospital is a vacant lot near the Guro station. To determine the catchment area of Guro Hospital, concentric circles with the radius of 5 Km and 10 Km are drawn with Guro Hospital as the center. The area within 5 Km radius is considered to be the primary treatment region, 10 Km area as the secondary treatment region and the area outside the 10 Km radius as tertiary treatment region (Figure C-4).
 - 4.1.2. The primary treatment region includes
 - Entire Yeongdeungpo area except Siheung 1,2,3 dongs
 - Part of Gangseu area: Shinwool dong, Shinjung 1,2,3 dongs, Mok dong, Hwagog dong 1,2 dongs and part of Yeomchang dong included.

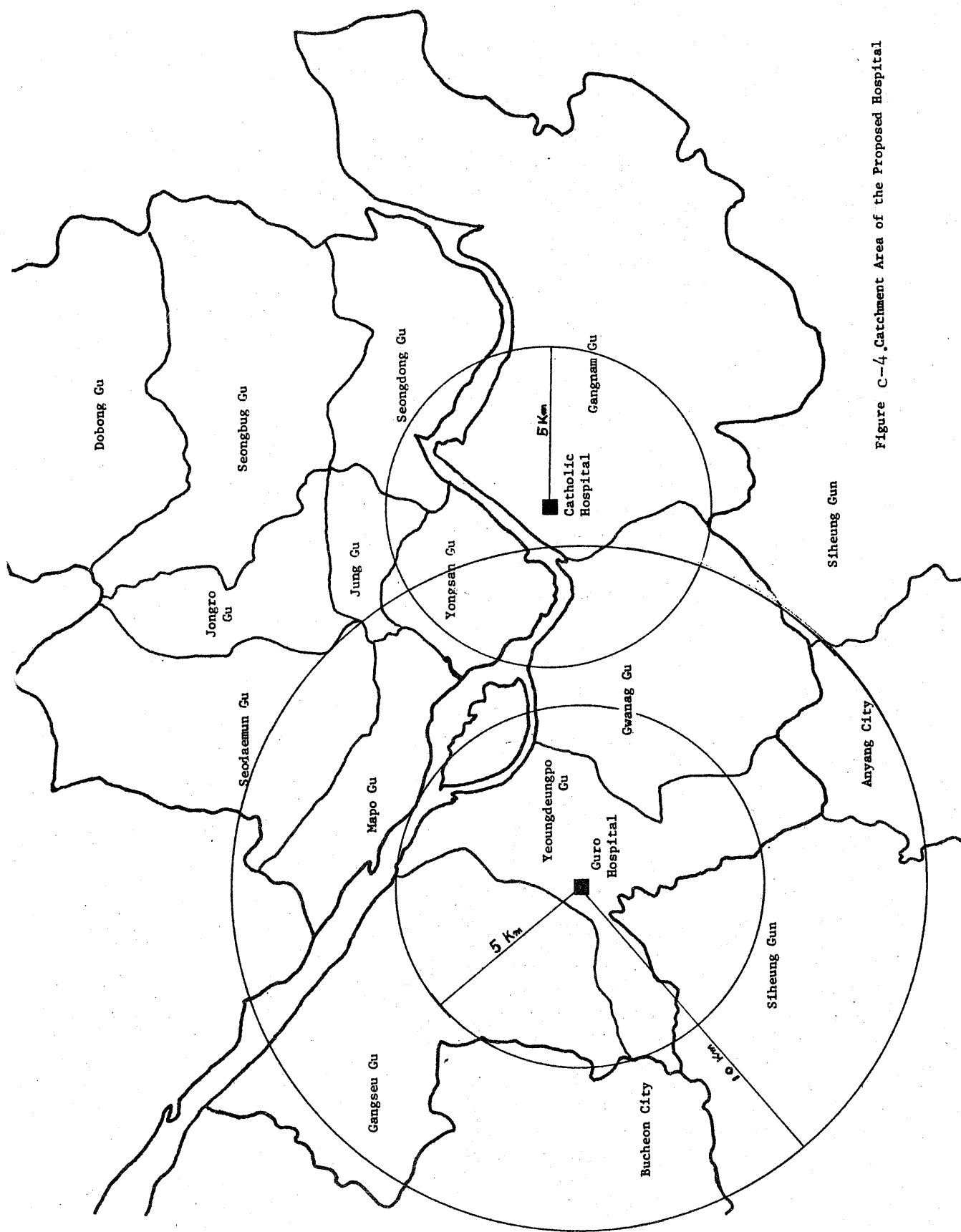


Figure C-4. Catchment Area of the Proposed Hospital

- Part of Gwanag area : Daebang dong, Shindaebang 1, 2 dongs, Shinrim 1,3,4,5 dongs, Noryangjin 2 dong, Sangdo 3 dong and part of 4 dong, and part of Bongcheon 1 dong included.
 - Part of Siheung County : Gwangmyung and Chulsan li's of Seu Myon included.
- 4.1.3. The secondary treatment region includes
- Yeongdeungpo area : Siheung 1,2 dongs included
 - Entire Gangseu area except Bangwha 1,2 dongs and part of Gwahae dong.
 - Entire Gwanag area except part of Bangbae dong
 - Part of Siheung County : Seu Myon and Solae Myon included.
 - Most of Bucheon City except Yagdae dong and part of Joong dong.
 - Part of Anyang City : Suksoo dong included.
 - Part of Area North Han River : Part of Mapo, Yongsan and Seodaemun District included.
- 4.1.4. Because a general hospital does not exist in Gangseu area the residents of Sinweol dong, Sinjung 1,2,3 dongs, which share common boundary with Yeongdeungpo District, can be included in the catchment area of Guro Hospital. However the residents of Yeomchang and Mok dongs, also close to the Yeongdeungpo District, are not included because they can cross the 2nd Han River Bridge into the Seodaemun area utilizing the medical facilities in the area north of Han River.
- 4.1.5. If a large medical facility is realized in the Yeongdeungpo District, there is a possibility that the residents of Hwagog dong will utilize this medical facility. However, the possibility of a medical facility being constructed in Gangseu area exists. Therefore in order to avoid high estimation, the residents of Hwagog dong, is excluded from the catchment area of Guro Hospital.
- 4.1.6. As of April 1978, there were 236 hospital beds in the Gwanag District (Table C-16). However, a 600-bed Community Health Center of Catholic Medical College is under construction in the Shinbanpo area.
- 4.1.7. After the completion of this 600-bed hospital by the Catholic University in Shinbanpo, the primary treatment area of this hospital and Guro Hospital will almost overlap in the peripheral zones. Due to the largeness of the Catholic Hospital in comparison with Guro Hospital, the range of catchment area is expected to exceed the Guro Hospital. Therefore, the area close to Shinbanpo, namely, Sangdo 3 and 4 dong, Bongcheon Dong and Shinlim 2 Dong, is excluded from the Guro Hospital catchment area. Instead, Shinlim 6th and 7th Dongs will be included.

This is due to the fact that the semi-circular road traversing all of south area links Guro with this area.

- 4.1.8. Applying the Meade Formula, the catchment area of Guro Hospital located in Yeongdeungpo District and Catholic Hospital of Gwangag District can be derived. 1/

$$\frac{\text{Distance between Hospital A and B}}{1 + \sqrt{\frac{\text{large hospital bed size}}{\text{small hospital bed size}}}} = \text{the extent of catchment area for the smaller hospital}$$

Therefore the catchment area of Guro Hospital is as follows:

$$\frac{11 \text{ Km}}{1 + \sqrt{\frac{600}{250}}} = 4.3 \text{ Km.}$$

Disregarding other external variables, the catchment area of Guro Hospital as 4.3 Km, rather than 5 Km, is credible. Therefore, the various adjustment made in section 4.1.7. is necessary.

- 4.1.9. Seu Myon and Solae Myon of Siheung County is expected to be incorporated into the Seoul City. The other boundaries of Seoul belonging to the catchment area of Guro Hospital have not been urbanized as of present, and therefore possess very few medical facilities. Consequently, areas such as Seu Myon and Solae Myon can be included in the rural catchment area of Guro Hospital.
- 4.1.10. The secondary catchment area of Guro Hospital, Bucheon and Anyang, has similar characteristics. As satellite cities of Seoul, they are involved in industrial production. Bucheon is situated on the Seoul-Inchon Subway Line and Anyang on the Seoul-Suwon Subway Line. They are within 10-15 minutes distance of Guro Hospital.
- 4.1.11. In estimating the hospital bed requirement, low estimation is favored. Therefore, upon assessing the existing medical facilities near Bucheon and Anyang, it was considered rational to exclude one area within the catchment area of Guro Hospital. In Anyang, 4 medical facilities exist with total number of

1/ James Meade, A Mathematical Model in Deriving Hospital Service Areas, International Journal of Health Services, Vol. 4, No. 2. Spring, 1974 pp. 353-364.

beds equaling 186, as well as the possible utilization of the facilities in nearby Suwon area. In Bucheon, 3 medical facilities with 105 beds exist as well as the nearby city of Incheon. Consequently, Bucheon with its lower population and hospital beds was included whereas Anyang was excluded from the catchment area of Guro Hospital (See Table C-17)

- 4.1.12. The possibility of the residents from the northern Seoul utilizing the Guro Hospital is negligible. In the case of residents of Noryangjin 2 dong, the exclusion within the catchment area was based on the fact that the pedestrian bridge into the north area of Seoul can be easily utilized to seek medical facilities in the north Seoul area.
- 4.1.13. After the transfer of main railway functions from the Seoul Station to Guro Station in the mid-1980's, the number of patients from the tertiary area is likely to increase dramatically. However, at the present time this factor was not considered in determining the Guro Hospital catchment area.

Table C-16. Major Hospitals in Gwang-Gu

Identification	Ownership	No. of Beds	Location
1. Catholic Help	Incorporated Foundation	98	Heuksuk Dong
2. Hyundai	Private	46	Noryangjin Dong
3. Handok	"	48	Sindaebang Dong
4. Gwanag	"	23	Bongchun Dong
5. Nambuk	"	21	Sinlim Dong
Total		236	

Source: Registered hospitals at the Korean Hospital Association as of April 30, 1978, Bulletin of the Korean Hospital Association, Vol. 7, No. 4,5, 1978

Table C-17 Major Hospitals in Anyang and Bucheon

Anyang City			Bucheon City		
Hospital	Ownership	No. of Beds	Hospital	Ownership	No. of Beds
Hankuk	Private	25	St. Joseph	Private	36
Anyang	"	80	Bucheon Hanil	"	20
Anyang Seoul	"	33	Bucheon Seil	"	49
Dong Il	"	48			
Total	-	186	Total	-	105

4.2. Estimated Population of the Guro Hospital Service Area

4.2.1. Estimation of Yeongdeungpo Population:

- The population trend of Yeongdeungpo for the past 13 years is shown on Figure C-5. The present rate of population increase in Yeongdeungpo shows similar increase rate as experienced prior to the division into Yeongdeungpo and Gwanag Districts in 1973.
- The annual population increase rate in Yeongdeungpo is shown on Table C-18
- The annual population increase rate in Seoul is shown on Table C-19.
- In reference to the above-mentioned increase rates, the projected population increase of Yeongdeungpo was based on the increase rate in Yeongdeungpo prior to the division. Table C-20 shows the projected increase rate. Utilizing these increase rates, the projected population of Yeongdeungpo is shown on Table C-21. By 1991, the expected population in Yeongdeungpo is 3,809,567. However, due to the Government policy to limit the population growth in Seoul, 9,000,000 in 1990, and the resulting dispersion policy likely to follow, utilizing the past rate of increase will have some flows.
- The linear projection ($Y = a + bX$) and the logarithmic projection ($Y = a + b \log X$) of the population increase based on the past rate of increase (1973-1976) is indicated on Table C-22. The Government policy of decreasing the population increase rate in Seoul will have the effect of decreasing the population growth rate in Yeongdeungpo. Therefore, this study assumes that the population increase is more likely to follow the logarithmic rather than linear increase.

4.2.2. Estimation of Gangseu Population:

- The population of Gangseu as of 1977 was 365,095. The projected population based on the increase rate of Table C-20, is indicated on Table C-23.
- By subtracting the projected Gangseu population from the projected Yeongdeungpo population based on increase prior to the division results in the projected population of Yeongdeungpo.

4.2.3. Estimation of Gangseu Population in the Health Service Area: Estimates of Gangseu service population were made by using the formula of $P_t = P_o (1 + r)^n$ where, $P_o = 104,343$, $r = 0.124$ (1977-1980), $r = 0.083$ (1980-1986) and $r = 0.049$ (1986-1991). The result is shown on the fourth column of Table C-27.

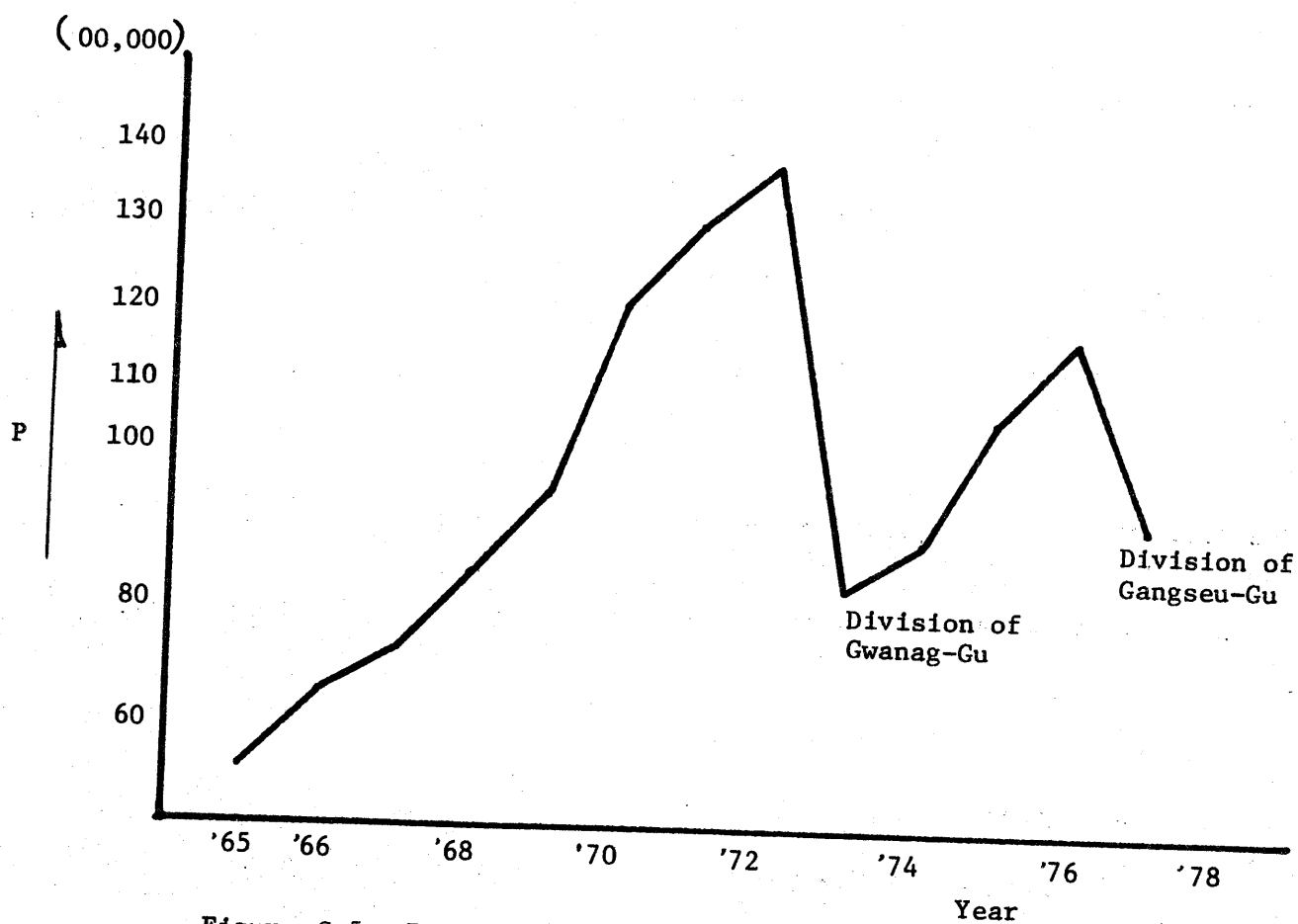


Figure C-5. Population Trend in Yeongdeungpo Gu

Table C-18.

Annual Population Increase Rate in
Yeongdeungpo Gu

Year	Annual Population Increase Rate
1965-1969	0.132
1965-1972	0.136
1973-1976	0.124

Source: Seoul Statistical Year Book, 1978 Seoul Metropolitan Government

Table C-19.

Annual Population Increase Rate in Seoul

Year	Annual Population Increase Rate
1965-1969	0.083
1965-1972	0.083
1973-1976	0.049
1965-1976	0.069

Source: Ibid.

Table C-20.

Population Increase Rate Used for Yeongdeungpo Gu

Year	Population Increase Rate
1977-1980	0.124
1980-1986	0.083
1986-1991	0.049

Table C-21. Projection of Yeongdeungpo Gu Population Assuming That
Gangseu Gu Would Not be Separated from Yeongdeungpo Gu (I)

Year	Population	Year	Population
1976	1,164,561	1984	2,557,062
1977	1,308,967	1985	2,769,298
1978	1,471,278	1986	2,999,150
1979	1,653,717	1987	3,146,109
1980	1,858,778	1988	3,300,268
1981	2,013,056	1989	3,461,981
1982	2,180,140	1990	3,631,618
1983	2,361,092	1991	3,809,567

* $P_t = P_o (1 + r)^n$

Table C-22. Projection of Yeongdeungpo Gu Population Assuming That Gangseu Gu Would Not be Separated from Yeongdeungpo Gu (II)*

Year	Projection I	Projection II
1976	1,164,561	1,158,774
1977	1,279,407	1,275,297
1978	1,399,139	1,390,317
1979	1,518,871	1,503,872
1980	1,638,603	1,615,999
1981	1,758,335	1,726,732
1982	1,878,067	1,836,107
1983	1,997,798	1,944,156
1984	2,117,530	2,050,911
1985	2,237,262	2,156,403
1986	23,556,994	2,260,660
1987	2,476,726	2,363,713
1988	2,596,458	2,465,587
1989	2,716,189	2,566,311
1990	2,835,922	2,665,909
1991	29,556,536	2,764,407

$$* y = a + bx$$

$$r : 0.97$$

$$a : -7,939,949.30$$

$$b : 119,731.90$$

$$y = a + b \log x$$

$$r : 0.97$$

$$a : -37,445,104.83$$

$$b : 8,913,935.65$$

4.2.4. Estimation of Gwanag Population in the Health Service Area:

- After Gwanag District was newly established, the annual population increase rate from 1973 to 1976 was 0.067. Applying this increase rate, the projected exponential increase in population of Gwanag is shown on Projection I of Table C-25.
- Based on the population of Gwanag from 1973 to 1976, the projected linear increase is shown on Projection II of Table C-25. Based on the population of Gwanag from 1973 to 1976, the projected logarithmic increase is shown on Projection III of Table C-25. Due to the fact that this projection is most responsive to the Government policy on population growth, logarithmic increase will be used to project the total population of Gwanag.
- The population residing within the Gangseu service area numbered 222,657 in 1977. This was equivalent to 26.12 percent of the total Gangseu population (See Table C-26). By applying this proportion to the total number of Gangseu population, the following results are obtained. (See the fifth column of Table C-27).

Table C-23. Projection of Gangseu Gu and Yeongdeungpo Gu Population

Year	Yeongdeungpo before Division (A)	Gangseu from Yeongdeungpo (B)	Current Yeongdeungpo (A) - (B)
1976	1,158,774	-	1,158,774
1977	1,275,297	365,095	910,202
1978	1,390,327	410,367	979,960
1979	1,503,872	461,252	1,042,620
1980	1,615,999	518,448	1,097,551
1981	1,726,732	561,479	1,165,253
1982	1,836,107	608,081	1,228,026
1983	1,944,156	658,552	1,285,604
1984	2,050,911	713,212	1,337,699
1985	2,156,403	772,409	1,383,994
1986	2,260,660	836,508	1,424,141
1987	2,363,713	877,508	1,486,205
1988	2,465,587	920,506	1,545,081
1989	2,566,311	965,611	1,600,700
1990	2,665,909	1,012,926	1,652,983
1991	2,764,407	1,062,558	1,701,849

Table C-24. Population of Gangseu Gu Dong

Name of Dong	Population			No. of Households
	Male	Female	Both	
Yeomchang	16,029	16,325	32,264	6,686
Mog	12,710	12,104	24,814	5,250
Deungchon	9,852	11,207	21,059	4,266
Hwagog 1,2	45,678	46,801	92,479	19,149
Gayang	4,101	3,826	7,927	1,549
Balsan	4,785	4,442	9,227	1,988
Conghang	10,035	9,959	19,994	4,379
Banghwa 1,2	18,393	18,541	36,934	7,467
Gwahae	2,014	1,980	3,994	829
Sinweol *	17,233	17,260	34,493	7,247
Sinjeong 1,2,3*	36,074	33,776	69,850	14,027
Total	176,904	176,131	353,035	72,837

* Guro Hospital Service Area

Source: Ibid. p. 33

Table C-25.

Projection of Gwanag Gu Population

Year	Projection I	Projection II	Projection III
1976	784,655	-	-
1977	837,227	852,314	852,314
1978	893,321	893,352	890,924
1979	953,174	943,962	939,230
1980	1,017,036	994,572	986,930
1981	1,085,178	1,045,182	1,034,036
1982	1,157,885	1,095,791	1,080,565
1983	1,235,463	1,146,401	1,126,529
1984	1,318,239	1,197,011	1,171,944
1985	1,406,561	1,247,621	1,216,820
1986	1,500,800	1,298,231	1,261,172
1987	1,601,354	1,348,840	1,305,011
1988	1,708,645	1,399,450	1,348,349
1989	1,823,124	1,450,060	1,391,198
1990	1,945,273	1,500,670	1,433,567
1991	2,075,607	1,551,280	1,475,458

$$P_t = P_o (1 + r)^n$$

$$Y_2 = a + bx$$

$$r^2 : 0.99$$

$$a : -3,054,212$$

$$b : 50,610$$

$$Y_2 = a + b \log x$$

$$r^2 : 0.99$$

$$a : -15,629,875$$

$$b : 3,792,036$$

Table C-26.

Population of Gwanag Gu by Dong

Name of Dong	Population			No. of Households
	Male	Female	Both	
Noryangjin 1,2	21,584	21,624	43,208	8,815
Sangdo 1,2,3,4	49,104	49,773	98,877	19,588
Bongcheon	109,169	109,169	216,159	43,397
1,2,3,4,5,6,7				
Bon	12,049	11,834	23,883	5,093
Heugseog 1,2,3	25,982	25,491	51,473	10,133
Dongjag	12,342	14,443	26,785	5,244
Bangbae	11,628	12,052	23,680	4,853
Sadang	59,461	59,143	118,604	24,041
1,2,3,4,5				
Daebang *	10,544	11,291	21,835	4,297
Shindaebang 1,2 *	15,867	17,876	33,743	6,522
Shinlim 1,3,4,5,6,7 *	98,008	96,059	194,067	39,728
Total	425,738	426,576	852,314	171,711

* Guro Hospital Service Area

Source: Ibid. p. 31.

4.2.5. Estimation of Siheung Population in the Health Service Area:

- As of 1978, the population of Siheung County in the Health Service Area is 59,014. The projected population of Siheung is based on the increase rate of 0.049 which was the lowest rate of increase in Seoul.
- The projected population is shown on the eighth column of Table C-27.

4.2.6. Estimation of Population in Bucheon City:

- The population of Bucheon City, as of October 1976 was 119,598,10 percent increase from 1975
- The course of the industrial complex development in this area has shown a stabilizing trend. Therefore, the annual rate of population increase is expected to undergo gradual decline.
 - 1970-1975 : $r = 0.13$
 - 1975-1976 : $r = 0.10$
 - 1976-1980 : $r = 0.07$
 - 1980-1986 : $r = 0.05$
 - 1986-1991 : $r = 0.04$
- The population projection of Bucheon is shown on the seventh column of Table C-27.

4.2.7. The integration of the previously mentioned results indicates that the population in the Guro Hospital catchment area will be 1,625,875 in 1979, 1,725,254 in 1980, and 2,756,485 by the year 1991. Majority of the estimated population are residents living within the 5 Km primary health service area. In other words, efforts were made intentionally to avoid high estimation by decreasing the catchment area of the proposed hospital.

5. DETERMINATION OF GURO HOSPITAL BED-SIZE

5.1. Estimation of In-patient Utilization Rate

- 5.1.1. The population in the Guro Hospital catchment area can be initially separated in the health insurance members and non-members. The health insurance members and their dependents (Class I), the Self-employed Health Insurance members and their dependents (Class II), and the members of the Insurance for Civil Servants and Private School Teachers and their dependents. Those non-insured can be again divided into the urban and rural residents.

Table C-27

Estimated Population of the Guro Hospital Service Area

Year	Yeongdeung- po before Division	Gangseo from Yeong- deungpo	Current Yeongdeung- po	Gangseo Service Area	Gwanak Service Area	Siheung Service Area	Bucheon City	Total	(C+D+E+F+G)	(C+D+E)	Urban Service Area	Urban Service Area - Insurance Beneficiaries
(A)	(B)	C = (A-B)	(D)	(E)	(F)	(G)	(C+D+E+F+G)	(C+D+E)	(C+D+E+G)			
1976	1,158,774	-	1,158,774	-	-	119,598	-	-	-	-	-	-
1977	1,275,297	365,095	910,202	222,657	-	127,970	-	-	-	1,237,202	1,365,172	-
1978	1,390,327	410,367	979,960	232,743	59,014	136,928	-	-	-	1,329,985	1,466,913	-
1979	1,503,872	461,252	1,042,620	243,012	61,906	146,513	1,525,926	1,625,875	1,625,875	1,417,456	1,563,969	1,068,003
1980	1,615,999	518,448	1,097,551	257,824	64,939	156,769	1,725,254	1,725,254	1,725,254	1,503,546	1,660,315	1,109,688
1981	1,726,732	561,479	1,165,253	270,130	68,121	164,607	1,828,580	1,828,580	1,828,580	1,595,852	1,760,459	1,168,143
1982	1,836,107	608,081	1,228,026	282,285	71,459	172,838	1,928,396	1,928,396	1,928,396	1,684,099	1,856,937	1,145,243
1983	1,944,156	658,552	1,285,604	294,292	74,961	181,480	2,024,549	2,024,549	2,024,549	1,768,108	1,949,588	1,138,673
1984	2,050,911	713,212	1,337,699	306,157	78,634	190,554	2,116,878	2,116,878	2,116,878	1,847,690	2,038,244	1,140,398
1985	2,156,403	772,409	1,383,994	317,880	82,487	200,081	2,205,194	2,205,194	2,205,194	1,922,626	2,122,707	1,054,315
1986	2,260,660	836,519	1,424,141	329,466	86,528	210,085	2,289,294	2,289,294	2,289,294	1,992,681	2,202,766	1,090,090
1987	2,363,713	877,508	1,486,205	340,919	90,768	218,488	2,387,169	2,387,169	2,387,169	2,077,913	2,296,401	1,119,408
1988	2,465,587	920,506	1,545,081	352,240	95,216	227,228	2,482,843	2,482,843	2,482,843	2,160,399	2,387,627	1,162,126
1989	2,566,311	965,611	1,600,700	363,434	99,882	236,317	2,576,301	2,576,301	2,576,301	2,240,102	2,476,419	1,195,852
1990	2,665,909	1,012,926	1,652,983	374,503	104,776	245,770	2,667,523	2,667,523	2,667,523	2,316,977	2,562,747	1,221,503
1991	2,764,407	1,062,558	1,701,849	385,449	109,910	255,601	2,756,485	2,756,485	2,756,485	2,390,974	2,646,575	1,250,710

5.1.2. The data regarding the members of the Class I Health Insurance in the service area were obtained from the current status report of the 1978 National Health Insurance Association. From this report, the insurance associations registered under the Yeongdeungpo District address, within the catchment area of Guro Hospital (Yeongdeungpo, Bucheon City, and parts of Gwanag, Gangseu Districts and Siheung County) were selected. However, some associations with factories located in the catchment area, but headquarters registered in other areas, could have been omitted. Also, the report failed to take into consideration the residential place of the health insurance members. There is a possibility that although the insured may be a member of an association within the health service area, his residency may be outside of this area, and vice versa. Therefore this was not taken into consideration due to the mutual cancellation.

The estimated number of Class I Health Insurance members was estimated to be 351,178 persons; 162,052 subscribers and 189,126 dependents (Table C-28). This is about 21.6% of the total population, within the catchment area, including Bucheon, of the Guro Hospital. In the case of Seoul, the percentage of Class I Insurance members is estimated to be around 27.1% (Table C-29). This lower figure for Yeongdeungpo, where industrial concentration is high indicates that the estimation is considerably low.

5.1.3. According to the Tentative Government Expansion Plan of the Class I Insurance System, the minimum required employees to implement for this type of insurance program will gradually decrease. With this gradual decrease, the present minimum number of 300 employees is expected to decrease annually and by 1990, the required minimum eligibility will be around 5 employees (Table C-30).

5.1.4. The number of establishments employing more than 10 workers has increased at an annual rate of 10.5%. This study presumes that in the future, the rate of increase for the number of establishments employing over 300 workers will increase at a level of 8%, whereas 7.3% increase is expected for establishments employing less than 300 workers. (See Table C-31).
Using this assumption, the Class I Insurance members in the health service area is expected to be around 429,817 and by 1991, approximately 1,211,841 (Table C-32). Table C-33 shows the ratio of subscribers and dependents for this estimated insured members. In the meantime, due to the small number of Class II Insurance members in the Seoul City, they were not included in this study's calculation.

Table C-28. Number of Health Insurance Enrollees within the Guro Hospital Service Area. *1978

Area	Subscriber	Dependents	Total
Yeongdeungpo	153,912	177,329	331,241
Gwanag	5,861	9,768	15,629
Gangseu	-	-	-
Bucheon	2,279	2,029	4,308
Siheung	-	-	-
Total	162,052	189,126	351,178

* This rough estimate was made from the 1978 Roster of Health Insurance Societies. It included all the members of health insurance societies, located within the geographic boundary of the Guro hospital service district. In other words, individual enrollee's actual residence was not considered.

Table C-29. Current Status of Employees Health Insurance Program December 31, 1978

Area	No. of Health Plan	No. of Industrial Companies	No. of the Insured		
			Subscriber	Dependents	Total
Seoul	346	692	845,273	1,195,298	2,040,571
Pusan	77	614	270,919	283,647	554,566
Kyunggi	55	349	167,977	171,697	339,674
Kangwon	19	49	44,073	70,792	114,865
Choongbuk	6	30	13,184	17,657	30,841
Choongnam	21	65	64,855	69,974	134,829
Chunbuk	11	91	41,967	36,397	78,364
Chunnam	13	83	22,661	57,105	79,766
Kyungbuk	24	659	94,319	102,149	196,468
Kyungnam	25	175	142,768	144,781	287,549
Total	597	2,807	1,707,996	2,149,497	3,857,493

Date from the Ministry of Health & Social Affairs, Bureau of Social Insurance, February 1979.

Table C-30. Schedule for Expanding the Employees Health Insurances Program (Tentative)

Year	Target Establishment (No. of Workers)
1979	300 to 499
1982	100 to 299
1985	30 to 99
1987	10 to 29
1990	5 to 9

Source: Ministry of Health & Social Affairs, Bureau of Social Insurance, February, 1979

Table C-31. Number of Annual Workers at Industrial Establishment with 10 Persons and Over

Year	Non-Agricultural Workers	Annual Increase Rate (%)
1970	1,039,612	-
1971	1,145,879	10.2
1972	1,191,290	4.0
1973	1,394,293	17.0
1974	1,530,981	9.8
1975	1,645,589	7.5
1976	1,894,397	15.1
1977	2,086,680	10.2
Average	-	10.5

Source: Administration of Labor Affairs, Republic of Korea, The Labor Magazine, Vol. 12, No. 2, 1978, P. 128

- 5.1.5. The medical care utilization rate of the Guro Industrial Complex Health Insurance members is shown on Table C-34, which indicates that the utilization in 1978 was considerably higher than 1977, the initial year of health insurance system operation. Therefore, the rapid increase in the utilization rate is expected for the immediate future. This is indicated by the fact that the utilization rate for delivery (0.0113 time/person/year) is

very similar to the utilization for illness (0.01717/person/year). In other words, utilization rate for illness is expected to further increase. In addition, the incidence of in-patients per 10,000 persons in 1978 was 28.52; similar to the utilization rate of the rural population. Other things being equal, it is natural to expect the utilization rate of health insurance members to be greater than the general population. A contributing factor to this low utilization rate can be attributed to the age composition of this health insurance members. Many of the health insurance members are in an age-group where the disease incidence rate is generally low. 1/

- 5.1.6. By applying the statistics from Guro Industrial Complex Health Insurance Association, the in-patient utilization rate of the Class I Insurance members is projected in Table C-35. This study estimates that the increase in the in-patient utilization will increase 5% annually, and utilization rate for delivery will increase at an annual rate of 1%.
- 5.1.7. The number of Industrial Accident Compensation Insurance members within the health service area is not available at the present time. For this reason, the number of subscribers in the Class I Health Insurance is used. The incidence probability of an industrial accident for an Industrial Accident Compensation member is 0.0442 per year. (See Banwol Feasibility Study, Table B-23-2). With the assumption that 5.5% of the industrial accident victims require hospitalization, the total in-patient days for industrial accidents is shown on Table C-36.
- 5.1.8. The number of civil servants and private school teachers under the health insurance within the health service area can be obtained as follows. The number of school teachers in Seoul for the past 5 years is shown on Table C-37. The proportion of population in the health service area to the total Seoul population can be used to determine the number of private school teachers in the health service area.
- 5.1.9. The number of civil servants in Seoul for the past 7 years is on Table C-38. Using the same method as in 5.1.8., the number of civil servants in the health service area can be estimated. The number of central government officials covered by this insurance according to district is not made available, therefore the following method was applied. It is estimated that the total number of civil servants and private school teachers under this health insurance in Seoul is approximately 700,000. 2/ Therefore, under the assumption that the population within the catchment area is 14.3% of the total Seoul population, the target

1/ Data on age-specific medical care utilization rate are not available for the health insurance member yet.

2/ Data from the Korean Medical Insurance Corporation, February, 1979.

Table C-32 Estimates of Population Under the Employees Health Insurance

Year	500 Workers and more			300 - 499 Workers			100 - 299 Workers			
	Subscriber	Dependents	Subtotal	Subscriber	Dependents	Subtotal	Subscriber	Dependents	Subtotal	Subscriber
1979	162,052	194,462	356,514	10,534	12,641	23,175	-	-	-	-
1980	175,016	227,521	402,537	11,861	15,419	27,280	-	-	-	-
1981	189,017	245,722	434,739	13,356	18,696	32,054	-	-	-	-
1982	204,138	285,793	489,931	14,424	21,636	36,060	22,114	33,171	55,285	-
1983	220,469	352,750	573,219	15,578	24,925	40,503	23,728	37,965	61,693	-
1984	238,107	404,782	642,889	16,825	28,603	45,428	25,460	43,282	68,742	-
1985	257,155	462,879	720,034	18,171	32,708	50,879	27,319	49,174	76,493	26,679
1986	257,155	488,595	745,750	18,171	34,525	52,696	27,319	51,906	79,225	28,627
1987	257,155	514,310	771,465	18,171	36,342	54,513	27,319	54,638	81,957	30,717
1988	257,155	540,026	797,181	18,171	38,159	56,330	27,319	57,370	84,686	32,959
1989	257,155	570,884	828,039	18,171	39,976	58,147	27,319	60,102	87,421	35,365
1990	257,155	591,457	848,612	18,171	41,703	59,864	27,319	62,834	90,153	37,947
1991	257,155	617,172	874,327	18,171	43,610	61,781	27,319	65,566	92,885	40,717

Program Within the Caro Hospital Service Area

30 - 99 Workers			10 - 29 Workers			5 - 9 Workers			Total		
Dependents	Subtotal	Subscriber	Dependents	Subtotal	Subscriber	Dependents	Subtotal	Subscriber	Dependents	Subtotal	Subscriber
-	-	-	-	-	-	-	-	172,586	207,103	-	379,689
-	-	-	-	-	-	-	-	186,877	242,940	-	429,817
-	-	-	-	-	-	-	-	202,373	264,420	-	466,793
-	-	-	-	-	-	-	-	240,676	340,600	-	581,276
-	-	-	-	-	-	-	-	259,775	415,640	-	675,415
-	-	-	-	-	-	-	-	280,392	476,667	-	757,059
48,022	74,701	-	-	-	-	-	-	329,324	592,783	-	922,107
54,390	83,017	-	-	-	-	-	-	331,272	629,416	-	1,960,688
61,434	92,151	6,330	12,660	18,990	-	-	-	339,692	679,384	-	1,019,076
69,215	102,174	6,792	14,263	21,055	-	-	-	342,396	719,033	-	1,061,429
77,803	113,168	7,288	16,033	23,321	-	-	-	345,298	764,798	-	1,110,096
88,277	125,224	7,820	17,986	25,806	4,353	10,012	14,365	352,765	811,359	-	1,164,124
97,721	138,438	8,391	20,138	28,529	4,671	11,210	15,881	356,424	855,417	-	1,211,841

population within the health service area becomes around 100,000 persons. Subtracting the number of local civil servants and private school teachers and their dependents, the number of central government workers and their dependents can be estimated. Table C-39 shows the resulting calculation. This study assumes that the increase of civil servants and private school teachers will be at an annual rate of 3.9%. In the case of the civil servants, the rate of increase has been 6.4% annually. However, due to the policy of limiting the growth of Seoul and in order to avoid high estimation the combined growth rate of 3.9% of civil servant and private school teachers will be applied to project the increase in civil servants.

5.1.10. Due to the fact that the insurance programs for the civil servants and private school teachers are still in the early stages, the data on their hospital utilization have not been published. Therefore in this study, 20% upward adjustment of the utilization rate of Guro Industrial Complex Health Insurance members was used. By this, the expected level of utilization of the civil servants and public school teachers can be similar to the national rate of the Class I Health Insurance members. In the case of civil servants, their utilization rate is expected to be markedly higher than the Class I insurance members because of their age composition and educational level. Due to the lack of available data, and to avoid high estimation the utilization rate of the Class I insurance members will be applied for the civil servants.

5.1.11. To determine the medical care utilization rate of the non-insured residents in the urban section of the health service area, the following two assumed utilization rates were applied.

Assumption I: The medical utilization rate of Seoul residents within the health service area is similar to the members of the Class I Health Insurance. This is based on the fact that many of the health insurance members are in the age group where the incidence of disease is low.

Assumption II: The utilization rate of the Seoul residents within the catchment area is twice of the rural residents. This is based on the results obtained during this study regarding the utilization rate of the rural residents. (Yeoju Hospital Feasibility Study Table A-24 Table C-40 indicates the base data for this assumption.

The results of assumptions for the utilization rate of civil servants and private school teacher, and their dependents are shown in Table C-41. Also, the presumed utilization rate among the non-insured is presented by this Table.

Table C-35. Estimated Number of Inpatient Days for the Members of Employees Health Insurance within the Guro Hospital Service Area

Year	No. of Members	Hospitalization Rate/Person	A.L.S. (Sickness)	Delivery Rate/Person	A.L.S. (Delivery)	Total No. of Inpatient Days
1979	379,689	.01717	10.2	.01135	3.4	81,149
1980	429,817	.01803	10.2	.01146	3.4	95,793
1981	466,793	.01893	10.2	.01158	3.4	108,510
1982	581,276	.01988	10.2	.01169	3.4	140,972
1983	675,415	.02087	10.2	.01181	3.4	170,899
1984	757,059	.02191	10.2	.01193	3.4	199,897
1985	922,107	.02301	10.2	.01205	3.4	254,199
1986	960,688	.02416	10.2	.01217	3.4	276,496
1987	1,019,076	.02537	10.2	.01229	3.4	306,293
1988	1,061,420	.02664	10.2	.01241	3.4	333,206
1989	1,110,096	.02797	10.2	.01254	3.4	364,034
1990	1,164,124	.02937	10.2	.01266	3.4	398,850
1991	1,211,841	.03083	102.	.01279	3.4	433,781

Table C-36. Estimated Number of Inpatient Days for the Industrial Accident Compensation Insurees within the Guro Hospital Service Area

Year	No. of the Insured	Indicence Rate of Accidents	Admission Rate	A.L.S.	Total No. of Inpatient Days
1979	172,586	.0442	.055	30	12,587
1980	186,877	.0442	.055	30	13,629
1981	202,373	.0442	.055	30	14,759
1982	240,676	.0442	.055	30	17,553
1983	259,775	.0442	.055	30	18,945
1984	280,392	.0442	.055	30	20,449
1985	329,324	.0442	.055	30	24,018
1986	331,272	.0442	.055	30	24,160
1987	339,692	.0442	.055	30	24,774
1988	342,396	.0442	.055	30	24,971
1989	345,298	.0442	.055	30	25,183
1990	352,765	.0442	.055	30	25,727
1991	356,424	.0442	.055	30	25,994

Table C-37.

Number of Public and Private School Teachers
and Administration Personnel in Seoul Area

Year	Teachers	Administration Personnel	Both	Annual Increase Rate (%)
1972	32,694	12,395	45,089	-
1973	35,233	13,189	48,422	7.4
1974	36,718	12,716	49,434	2.0
1975	38,595	15,591	54,186	9.6
1976	39,958	14,010	53,968	0.4
Average	-	-	-	3.9

Table C-38. Local Government Employees in the Special City of Seoul by Year

Year	Main Office	Gu Office	Police & Fire Station	Other Agencies	Total	Annual Increase Rate (%)
1970	1,267	5,497	8,967	3,184	18,915	-
1971	1,492	5,977	9,203	3,466	20,138	6.5
1972	1,411	6,637	10,205	3,340	21,593	7.2
1973	1,391	6,658	10,368	3,267	21,684	0.4
1974	1,326	7,613	11,051	4,260	24,250	11.4
1975	1,396	9,688	10,951	3,386	25,421	4.8
1976	1,582	10,616	11,696	3,530	27,424	7.9
Average	-	-	-	-	-	6.4

Source: Seoul Statistical Year Book, 1977 p. 183.

Table C-39 Estimates of Government Employees & Private School Teachers and Their Dependents Residing
in the Guro Hospital Service Area by Year

Year	Public Official, (1)		Sub- Total	Private & Public School Teachers (2)	Subscribers (1)+(2)	Dependents (3)	Total (1)+(2)+(3)
	Local Gov't	Central Gov't					
1976	3,546	10,633	14,179	6,978	21,157	82,512	103,669
1977	3,684	11,048	14,732	7,200	21,982	85,730	107,712
1978	3,828	11,479	15,307	7,533	22,840	89,076	111,916
1979	3,977	11,926	15,903	7,827	23,730	92,547	116,277
1980	4,132	12,391	16,523	8,132	24,655	96,155	120,810
1981	4,293	12,875	17,168	8,449	25,617	99,906	125,523
1982	4,460	13,377	17,837	8,779	26,616	103,802	130,418
1983	4,634	13,898	18,532	9,121	27,653	107,847	135,500
1984	4,815	14,440	19,225	9,477	28,732	112,055	140,787
1985	5,003	15,004	20,007	9,847	29,854	116,431	146,285
1986	5,198	15,589	20,787	10,231	31,018	120,970	151,988
1987	5,401	16,197	21,598	10,630	32,228	125,689	157,917
1988	5,612	16,828	22,440	11,044	33,484	130,588	164,072
1989	5,830	17,485	23,315	11,475	34,790	135,681	170,471
1990	6,058	18,167	24,225	11,922	36,147	140,973	177,120
1991	6,294	18,875	25,169	12,347	37,556	146,468	184,024

Table C-40

Differential Medical Care Utilization Rate
Per 1,000 Persons per Year by Area

Type of Medical Care	Rural		Urban	
	Average	Range	Average	Range
Physician Visit	22.7	5.7-47.2	30.2	20.5-47.1
Hospitalization	2.7	0.7-6.2	9.0	1.6-15.2

Source: Ok Ryun Moon, Jae Woong Hong, Health Services Outcome Data: A Survey of Data and Research Findings on the Provision of Health Services in Korea. Journal of Family Planning Studies, KIFP, Vol. 3, April 1976, p. 137.

5.2. Distribution of the Existing Beds

5.2.1. The distribution of the existing hospitals in Seoul according to district is depicted on Table C-42

5.2.2. The number of beds and patients in terms of ownership show that 71% of the beds are in private facilities which handle 67% of the total in-patients in Seoul (Table C-43).

5.2.3. Presently, within the catchment area, there are 1,094 hospital beds and 1,695 clinic beds (Table C-44). Figure C-6 diagrams the geographical locations of the hospital beds.

5.2.4. The bed occupancy rate of the acute general hospitals in Seoul is shown on table C-45. There was a sudden decrease in 1977 to 54.4% occupancy rate which has not been explained. In the case of Yeongdeungpo and Gwanag Districts and other areas in the health service area, the expected occupancy rate is low due to the fact that the hospitals in this area are generally small.

5.3. Determination of Hospital Bed-Size

5.3.1. The optimal level of bed-size for a hospital should meet the following criteria. Patients should not be refused admission due to shortage of hospital beds and long waiting should not be required. At the same time, the hospital should maintain the occupancy rate of previously determined level.

5.3.2. The distribution of in-patients of the Guro Hospital should resemble poisson, if the hospital is relatively uncrowded and the cases of scheduled admission is also relatively low.

Table C-41
Estimated Number of Inpatient Days for the Civil Servants, Private School Teachers and Their Dependents and for Those Who Are Not Covered by Any Health Insurances Within the Curo Hospital Service Area

Year	Civil Servants & Teachers	Urban Non-Insured	Hospitalization Rate/Person		A.L.S. Rural Non-Insured	Hospitalization Rate/Person	A.L.S.	Total No. of Inpatient Days	
			(I)	(II)				(I)	(II)
1979	116,277	1,068,003	.03405	.0478	10	61,906	9	416,563	581,658
1980	120,810	1,109,688	.03511	.0494	10	64,939	9	447,600	623,438
1981	125,523	1,168,143	.03623	.0508	10	68,121	9	485,545	674,032
1982	130,418	1,145,243	.03740	.0524	10	71,459	9	495,245	686,594
1983	135,500	1,138,673	.03862	.0538	10	74,961	9	511,689	705,109
1984	140,787	1,140,398	.03990	.0554	10	78,634	9	532,276	730,860
1985	146,285	1,054,315	.04124	.0568	10	82,487	9	517,867	704,680
1986	151,988	1,090,090	.04264	.0584	10	86,528	9	553,476	749,227
1987	157,917	1,119,408	.04410	.0598	10	90,768	9	589,609	790,149
1988	164,072	1,162,126	.04563	.0614	10	95,216	9	633,827	84,2512
1989	170,471	1,195,852	.04723	.0628	10	99,882	9	673,511	886,277
1990	177,120	1,221,503	.04891	.0646	10	104,776	9	714,525	933,969
1991	184,024	1,250,710	.05066	.0670	10	109,910	9	759,974	994,410

Table C-42.

Distribution of Medical Facilities in Seoul, 1977

Medical Facilities	Grand Total	Jongro Gu	Jung Gu	Dongdaemun Gu	Seong- dong Gu	Seong- buk Gu	Dobong Gu	Seodaemun Gu	Mapo Gu	Yongsan Gu	Yeong- deungpo Gu	Gwanag Gu	Gangnam Gu	Gangseo Gu
Total *	4,556	722	641	424	281	343	200	453	244	253	399	334	171	91
General Hospital	24	5	6	3	2	1	-	1	-	2	2	1	1	-
Hospital	41	7	6	6	1	2	1	3	1	1	9	4	-	-
Clinic	2,188	277	258	198	164	180	105	236	125	118	199	173	105	50
Dental Hospital	3	1	-	1	-	-	-	1	-	-	-	-	-	-
Dental Clinic	938	177	218	67	43	61	31	78	44	51	65	58	32	13
Herb doctor Clinic	1,103	236	112	122	55	88	42	104	61	69	92	75	29	18
Midwifery	167	7	5	24	12	10	18	25	10	10	19	18	3	6
Health Center	13	1	1	1	1	1	1	1	1	1	1	1	1	1
Pharmacy	4,620	322	366	504	375	338	339	493	262	228	512	494	223	164

* Pharmacies are not included in grand total.
Source: Ibid. p. 111.

Table C-43.

Number of Beds and Inpatients by Ownership of
Short-term General Hospital in Seoul, 1977

Ownership	No. of Beds	%	No. of Inpatients	%
National	1,782	18.9	423,974	22.7
Municipal	953	10.1	192,803	10.3
Private	6,692	71.0	1,254,836	67.0
Total	9,427	100.0	1,871,613	100.0

Source: Ibid. p. 112

Table C-44. Existing Medical Resources in the Guro Hospital Service Area

Area	General Hospital (short-term)		Clinic	
	No. of Med. Facilities	No. of Beds	No. of Med. Facilities	No. of Beds
Yeongdeungpo	7	920 <u>1/</u>	199	1,345 <u>2/</u>
Kwanak	2	69 <u>3/</u>	44	242 <u>4/</u>
Bucheon	3	105 <u>2/</u>	28	108 <u>2/</u>
Siheung	-	-	14 <u>3/</u>	-

Source: 1/ Data from the Korean Hospital Association, April, 1978
2/ Ministry of Health and Social Affairs, Bureau of Medical Affairs
3/ National Hospital Census, December, 1976
3/ Data from the 1975 Roster of the Korean Medical Association
4/ Estimated from the national average

(See Yeosu Hospital Feasibility Study). In this case the bed requirement can be determined according to average number of in-patients per day + 3 $\sqrt{\text{average number of in-patients per day}}$. The bed requirement for Guro Hospital can be estimated according to the following formula.

$$B = \frac{(P_i \cdot H R_i \cdot A L S_i) + (P_i \cdot D R_i \cdot A L S_d) + (P_a \cdot I_a \cdot A r \cdot A L S_a) + (P_g \cdot H R_g \cdot A L S_g) + (P_u \cdot H R_u \cdot A L S_u) + (P_r \cdot H R_r \cdot A L S_r)}{365} - (E_b \cdot O_r) + 3\sqrt{T}$$

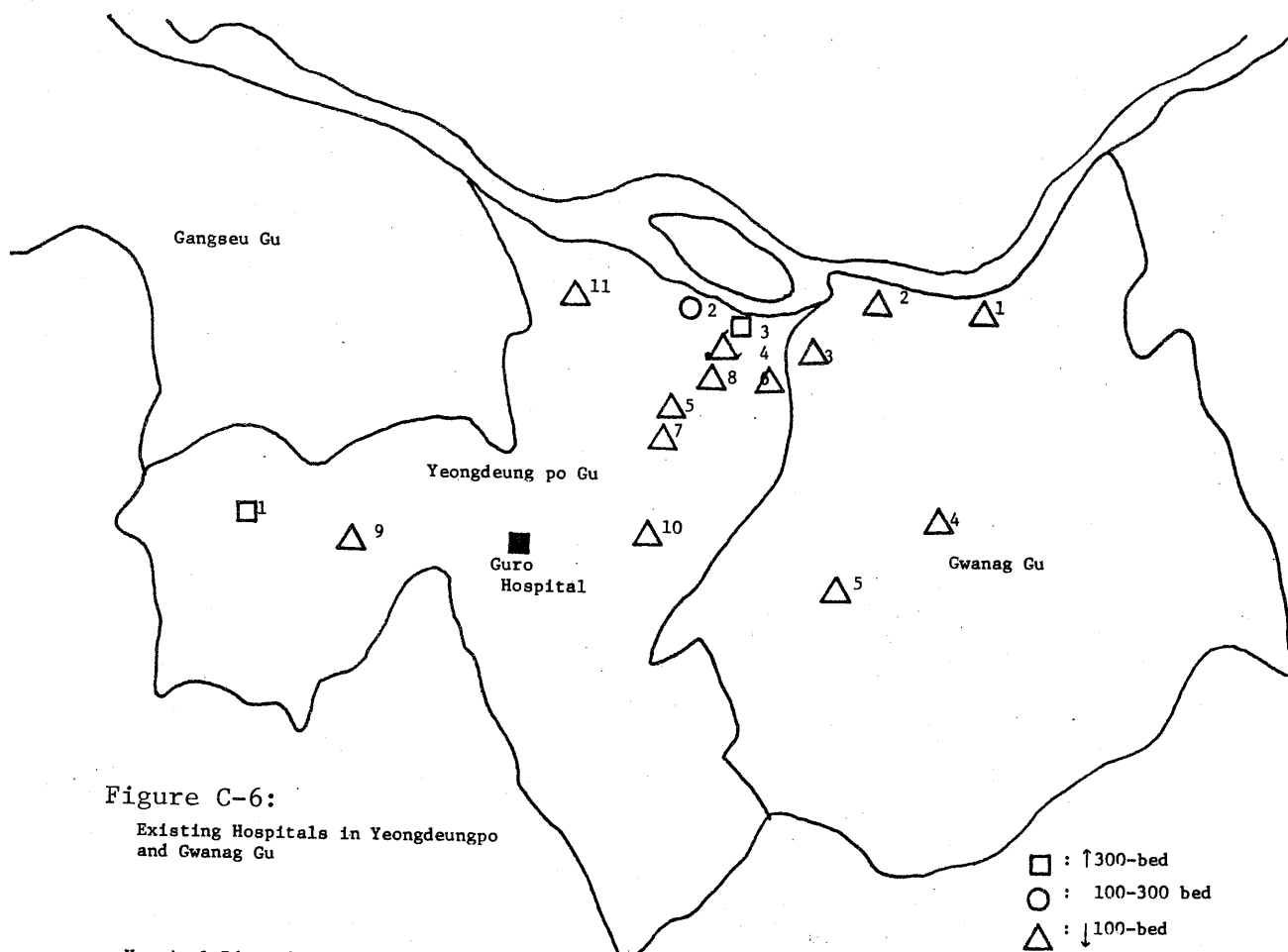


Figure C-6:
Existing Hospitals in Yeongdeungpo
and Gwanag Gu

Hospital Identification

Hospital No.	Yeongdeungpo-Gu	Gwanag-Gu
1.	National Relief	Our Lady of Perpetual Help
2.	Yeongdeungpo Muni- cipal	Hyundai
3.	Hangang Sacred Heart	Handok
4.	Sacred Heart Charity	Nambu
5.	Choongmu	
6.	Sungae	
7.	Sam Il	
8.	Yeong Il	
9.	Do Yeong	
10.	Daelim St. Mary's	
11.	Christian	

Table C-45.

Hospital Bed Occupancy Rates in Seoul

Year	Bed Occupancy Rate			
	General	Communicable	Tuberculosis	Mental
1970	68.2	55.5	91.6	92.5
1971	66.4	16.1	75.2	85.0
1972	63.5	24.8	82.6	82.2
1973	67.7	27.0	71.1	86.8
1974	64.2	37.0	129.5	121.7
1975	67.6	25.9	74.9	136.3
1976	69.4	25.0	80.4	147.9
1977	54.4	14.6	57.0	82.5

Source: Ibid.

Where, B = estimated required beds in the Guro Hospital catchment area

- Pi = number of Class I health insurance members
 HRi = in-patient case probability per Class I insurance member per year
 ALSi = average length of in-patient stays of Class I insurance member
 DRi = delivery case probability of Class I insurance member
 ALSd = average length of delivery stay of Class I insurance member
 Pa = number of industrial accident compensation insurance member
 Ia = incidence of accident probability per industrial accident compensation insurance member per year
 Ar = percentage of industrial accidents requiring in-patient treatment
 ALSa = average length of stay of industrial accident patients
 Pg = number of insured civil servants and public school teachers
 HRg = in-patient utilization rate of civil servants and public school teachers
 ALSg = average length of stay of civil servants and public school teachers
 Pu = number of non-insured in the urban area of health service area
 HRu = in-patient utilization rate of urban residents in the health service area
 ALSu = average length of stay of urban residents in the health service area
 Pr = number of non-insured in the rural area of health service area
 ALSr = average length of stay of rural residents in the health service area
 Eb = existing number of beds
 Or = present occupancy rate of existing beds
 T = dialy number of in-patients not admitted in existing beds, but probably new facilities.

$$\text{Therefore, } T = \frac{(\text{Pi} \cdot \text{Hri} \cdot \text{ALSi}) + (\text{Pi} \cdot \text{DRi} \cdot \text{ALSd}) + 365}{365} + \frac{(\text{Pa} \cdot \text{Ia} \cdot \text{Ar} \cdot \text{ALSa}) + (\text{Pg} \cdot \text{Hrg} \cdot \text{ALSg}) + 365}{365} + \frac{(\text{Pu} \cdot \text{HRu} \cdot \text{ALSu}) + (\text{Pr} \cdot \text{HRr} \cdot \text{ALSr})}{365} - (\text{Eb} \cdot \text{Or})$$

- 5.3.3. The occupancy rate of hospital beds is shown on Table C-45. The occupancy rate of clinic beds has undergone annual decrease. Due to the possibility that in the near future the functions of hospitals and clinics will be separated 1/, it is difficult to predict the occupancy rate of clinic beds. In this study, due to this possible changes of health care delivery system in the near future, assumption is made that the clinic bed occupancy rate will continue to decrease.
- 5.3.4. Presently, the Hangang Sacred Heart Hospital is constructing a 300 bed-size hospital in Shindorim Dong. The operation of this Shindorim Hospital under the Sacred Heart Hospital may result in competition with Guro Hospital due to the geographical proximity between these hospitals. Without other external variables, the Shindorim Hospital will be located in an area which will be convenient for the Anyang residents to utilize, and Guro Hospital for the residents of Bucheon.
- 5.3.5. In the view of this study, additional 200 beds will be necessary by 1985 due to growing population and industrial development in the Yeongdeungpo area. This can be accomplished by the construction of new facilities or the expansion of existing small medical facilities.
- 5.3.6. With these assumptions and by applying the previously mentioned formula, a low estimate of the minimum number of beds required for the Guro Hospital area is calculated. For example, bed shortages in 1979, 1985 and 1991 number 279, 366, 795, and 2,026, respectively (the last columns of Table C-46).
- 5.3.7. In the course of estimating the beds required for the Guro Hospital, with the exception of the square root formula, a high estimate was purposely avoided by this study. Even with this low estimation, one can realize the serious nature of the bed shortage problem, now and in the future.
- 5.3.8. With the success of the Government population dispersion policy, the primary focus being directed for the dispersion of population in the area north of Han River, the population in the south region will increase for the time being. After the connection

1/ Korean Medical Association, Health Care Delivery System under Medical Insurance (Proposal) March, 1979.

Table C-46

Bed Requirements in the Guro Hospital Service Area by Year

Year	Industrial Workers Insured	Hospitalization Rate/Person	A.L.S. (Sickness)	Delivery Rate/Person	A.L.S. (Delivery)	Industrial Accident Compensation Insured	Incidence Rate of Accidents	Admission Rate (I.A.C.)	A.L.S.	Government Officials & Teachers	Hospitalization Rate/Person
	(A)					(B)					
1979	379,689	.01717	10.2	.01135	3.4	172,586	.0442	.055	30	116,277	.03405
1980	429,817	.01803	10.2	.01146	3.4	186,877	.0442	.055	30	120,810	.03511
1981	466,793	.01893	10.2	.01158	3.4	202,373	.0442	.055	30	125,523	.03623
1982	501,276	.01988	10.2	.01169	3.4	240,676	.0442	.055	30	130,418	.03740
1983	675,415	.02087	10.2	.01181	3.4	259,773	.0442	.055	30	135,500	.03862
1984	737,059	.02191	10.2	.01193	3.4	280,392	.0442	.055	30	140,787	.03990
1985	922,107	.02301	10.2	.01205	3.4	329,324	.0442	.055	30	146,285	.04124
1986	960,688	.02416	10.2	.01217	3.4	331,272	.0442	.055	30	151,988	.04264
1987	1,019,076	.02537	10.2	.01229	3.4	339,692	.0442	.055	30	157,917	.04410
1988	1,061,429	.02664	10.2	.01241	3.4	342,396	.0442	.055	30	164,072	.04563
1989	1,110,096	.02797	10.2	.01254	3.4	345,298	.0442	.055	30	170,471	.04723
1990	1,164,124	.02937	10.2	.01266	3.4	352,765	.0442	.055	30	172,120	.04891
1991	1,211,841	.03083	10.2	.01279	3.4	356,424	.0442	.055	30	184,024	.05066

A.L.S.	Urban Service Population	Hospitalization Rate/Person	A.L.S.	Rural Service Population	Hospitalization Rate/Person	A.L.S.	No. of Existing Beds		Occupancy Rate		Bed Requirements		
							Hospital	Clinic	Hospital	Clinic	I	II	
(c)													
		(I)	(II)										
10	1,068,003	.03405	.0478	10	61,906	.0239	9	1,094	1,695	0.6	0.3	279	711
10	1,109,688	.03511	.0494	10	64,939	.0247	9	1,394	1,610	0.65	0.3	258	640
10	1,168,143	.03623	.0508	10	68,121	.0254	9	1, 1,394	1,530	0.75	0.3	366	701
10	1,145,243	.03740	.0523	10	71,459	.0262	9	1,394	1,453	0.75	0.3	515	860
10	1,138,673	.03862	.0538	10	74,961	.0269	9	1,394	1,311	0.75	0.3	684	1,045
10	1,140,398	.03990	.0554	10	78,634	.0277	9	1,394	1,312	0.75	0.3	832	1,203
10	1,054,315	.04124	.0568	10	82,487	.0284	9	1,594	1,246	0.8	0.15	795	1,071
10	1,090,090	.04264	.0584	10	86,528	.0292	9	1,594	1,184	0.8	0.15	973	1,280
10	1,119,408	.04410	.0598	10	90,768	.0299	9	1,594	1,124	0.8	0.15	1,172	1,498
10	1,162,126	.04563	.0614	10	95,216	.0307	9	1,594	1,068	0.8	0.1	1,439	1,738
10	1,195,852	.04723	.0628	10	99,882	.0314	9	1,594	1,015	0.85	0.1	1,570	1,888
10	1,221,503	.04891	.0646	10	104,776	.0323	9	1,594	964	0.85	0.1	1,792	2,136
10	1,250,710	.05066	.0670	10	109,910	.0335	9	1,594	916	0.85	0.1	2,026	2,415

of subways operating in the area north and south of the Han River, the movement of population from the north to the south is likely to be more active.

- 5.3.9. The increase in the national per capita income and the introduction of the health insurance system have altered the medical utilization behavior of the population. The increase in quantitative and qualitative demand for medical care has resulted in a dramatic increase in the utilization rate as well as the increasing demand for modern medical facilities of the general hospitals. This has been followed by increasing demand for the reform of the present medical care system. Due to these changes, the problem of bed shortage in Guro Hospital area is likely to become more serious.
- 5.3.10. To determine the health service area with high population density such as Yeongdeungpo, and the metropolitan areas with high concentration of medical facilities is very difficult. The concept of catchment area cannot be applied in these instances 1/. To determine the catchment area of the medical facilities in metropolitan areas, further research is called for. Research regarding the residence of the patients utilizing the medical facilities (Patient Origin Study) is urgently required.
- 5.3.11. To determine the optimal location of hospitals in the metropolitan area to ease the bed shortage problem is of great importance. In terms of locational efficiency, the proposed location of Guro Hospital near Guro Station can be considered as a positive point.
- 5.3.12. The necessity of 2,000 beds in the Guro Hospital catchment area by 1991 brings the following question, "How many hospitals with how many beds should be constructed to meet this requirement?" For example, is it more beneficial to build 20 hospitals with 100 beds or 4 hospitals with 500 beds? This will require the consideration of the following three points; the concept of economies of scale, hospital location efficiency and convenience of hospital utilization for the population. Further research is necessary regarding these matters.
- 5.3.13. Considering the present conditions, the operation of Guro Hospital with initial bed size of 250 appears most beneficial. This is due to the fact that the hospital of this size can pursue desirable economies of scale. Also, it is judged that a hospital at least this size is needed to meet the rapidly growing medical demands with the introduction of the health insurance system. The establishment of a large hospital in the south Seoul can also contribute to ease the present over-concentration of patients in the medical facilities of the north Seoul.

1/ William Shonick, Elements of Planning for Area-wide Personal Health Service, 1976, p 62..

- 5.3.14. In considering the above-mentioned facts, there is a possibility that the Guro Hospital will expand to a general hospital with 500 beds in near future.
6. GURO HOSPITAL MEDICAL PROGRAM
 - 6.1. Estimation of Annual Number of In-patients
 - 6.1.1. The survey of the existing hospital performance by this study indicates that direct correlation between the hospital size and number of in-patients is manifest. (See Table C-47).
 - 6.1.2. The linear correlation between the number of in-patients and hospital size is as follows:
 - over 100 beds : $Y_1 = 21.65 X + 1,275.45$ ($r^2 = 0.75$)
 - over 150 beds : $Y_2 = 21 X + 1,298.87$ ($r^2 = 0.094$)
 - all the hospital surveyed : $Y_3 = 22.51 X + 1,065$ ($r^2 = 0.70$)
 Therefore, when $X = 250$, $Y_1 = 6,687$, $Y_2 = 6,549$ and $Y_3 = 6,691$
 - 6.1.3. The above data indicates that the hospital bed size is the most important factor in determining the number of annual in-patients ($r^2 = 0.94$ or 0.95). In the case of hospital with 250 beds, approximately 6,500 to 6,700 in-patients can be treated annually (Figure C-7).
 - 6.1.4. The performance of the affiliated hospital of Ewha Womans University (250 beds) over the past 6 years indicates that the number of in-patients have increased markedly over the years (Table C-48). In case of the National Medical Center (450 beds), the number of in-patients have fluctuated during the past 10 years (Figure C-8, Table C-49).
 - 6.1.5. Assuming the average length of stay to be 11 days, the maximum number of in-patient treatment capacity for a 250 bed-size hospital is 8,295 annually. In the case of Guro Hospital, it is expected to operate at an 80% occupancy rate during the initial year of operation. By 1985, with annual number of in-patients being around 7,293 and average length of stay of 11.6 days, the occupancy rate is expected to be around 92.8%, therefore, it is evident that expansion of bed-size will be required (Table 6-6). The annual in-patient distribution is expected to be as shown in Table C-50.
 - 6.2. Distribution of In-patients according to Departments
 - 6.2.1. In order to determine the patient distribution for a general hospital of 250 bed-size, three hospitals were selected as representative samples. The patient distribution according to medical departments in 1978 for Suwon St. Vincent Hospital (195 beds), Pusan National University Hospital (295 beds), and Pusan Marykno-1 Hospital (320 beds) are shown on Table C-51.

Table C-47 Sample Hospital Service Statistics: Inpatient Care

Hospital	No. of Beds	No. of Inpatient Cases	No. of Inpatient Days
Yonsei Hospital	745	16,942	188,674
National Medical Center	450	10,241	130,066
Chun Nam National University Hospital	386	10,179	117,750
Pusan Marynoll Hospital	320	9,256	105,435
Pusan National University Hospital	295	5,595	107,735
Choong Nam National University Hospital	230	6,021	83,702
Kwang Ju Christian Hospital	200	11,469	96,791
St. Vincent Hospital	195	6,426	58,940
Han Il Hospital	150	3,929	44,909
Kyung Buk Dong Hae	130	2,359	11,800
St. Columban Hospital (Mokpo)	120	5,329	33,995
Andong Presbyterian Hospital	120	4,044	32,157
Pusan National Hospital	105	983	7,285
Choong Buk Medical Center	100	2,403	20,496
St. Mary's Hospital (Pohang)	100	2,879	21,574
Han Dok Hospital	85	2,940	25,474
Han Kuk Hospital	81	861	19,781
Seagrave Memorial Hospital	70	2,415	17,316
Han Jung Hospital	66	1,339	16,068
Sung Nam Parental Hospital	60	1,736	21,854
Andong Provincial Hospital	45	795	6,989
Kyung Ju Christian Hospital	40	1,560	6,503
Sam Il Hospital	33	750	2,666
Dong Il Hospital (Anyang)	30	806	6,105
Jin Ju Provincial Hospital	14	220	1,877

Source: Data from the Hospital Survey by KHDI Hospital Construction
Feasibility Study Group 1979.

6.3. Estimation of Annual Distribution of Out-patients

6.3.2. The annual number of out-patients and out-patient visits for
25 surveyed hospitals are depicted on Table C-53.

6.3.2. The number of out-patients in relation to the hospital bed size
are derived as below.
total hospital surveyed (N=25) : $Y_1 = 456.95 X + 10,669.27$ ($r^2 = 0.92$)
over 100 beds (N=15) : $Y_2 = 458.06 X + 10,433.10$ ($r^2 = 0.89$)
over 100 beds (N=10) : $Y_3 = 414.62 X + 31,343.13$ ($r^2 = 0.83$)
These results indicate that the relationship between hospital
size and the number of out-patients is significant. When $X=250$,
 $Y_1 = 124,907$, $Y_2 = 124,948$, and $Y_3 = 134,998$ (Figure C-9)

Table 4-48. Total Number of Patients of Ewha Womans University Hospital.
1973 - 1978

Year	Outpatient	Index *	Patient-days	
			Inpatient	Index *
1973	79,997	100.0	29,229	100.0
1974	98,998	123.8	39,648	135.6
1975	117,104	146.4	47,082	161.1
1976	139,308	174.1	56,674	193.9
1977	166,531	208.2	61,272	209.6
1978	212,413	265.5	79,775	272.9

$$*Index = \frac{\text{Data for each year}}{\text{Data for 1973}} \times 100$$

Source: Ewha Womans University Medical Center Annual Report, 1973 - 1978.

Table C-49. Total Number of Patients of National Medical Center.
1966 - 1975

Year	Outpatient	Index *	Inpatient	Index *
1966	98,198	100.0	6,511	100.0
1967	130,674	133.1	6,085	93.5
1968	104,012	105.9	5,735	88.1
1969	123,906	126.2	5,950	91.4
1970	163,100	166.1	7,019	107.8
1971	153,731	156.6	5,212	80.0
1972	133,709	136.2	4,520	69.4
1973	147,463	150.2	2,726	41.9
1974	158,326	161.1	6,161	94.6
1975	171,650	174.8	7,579	116.4

$$*Index = \frac{\text{Date for each year}}{\text{Data for 1966}} \times 100$$

Source: National Medical Center Annual Report, 1966 - 1975.

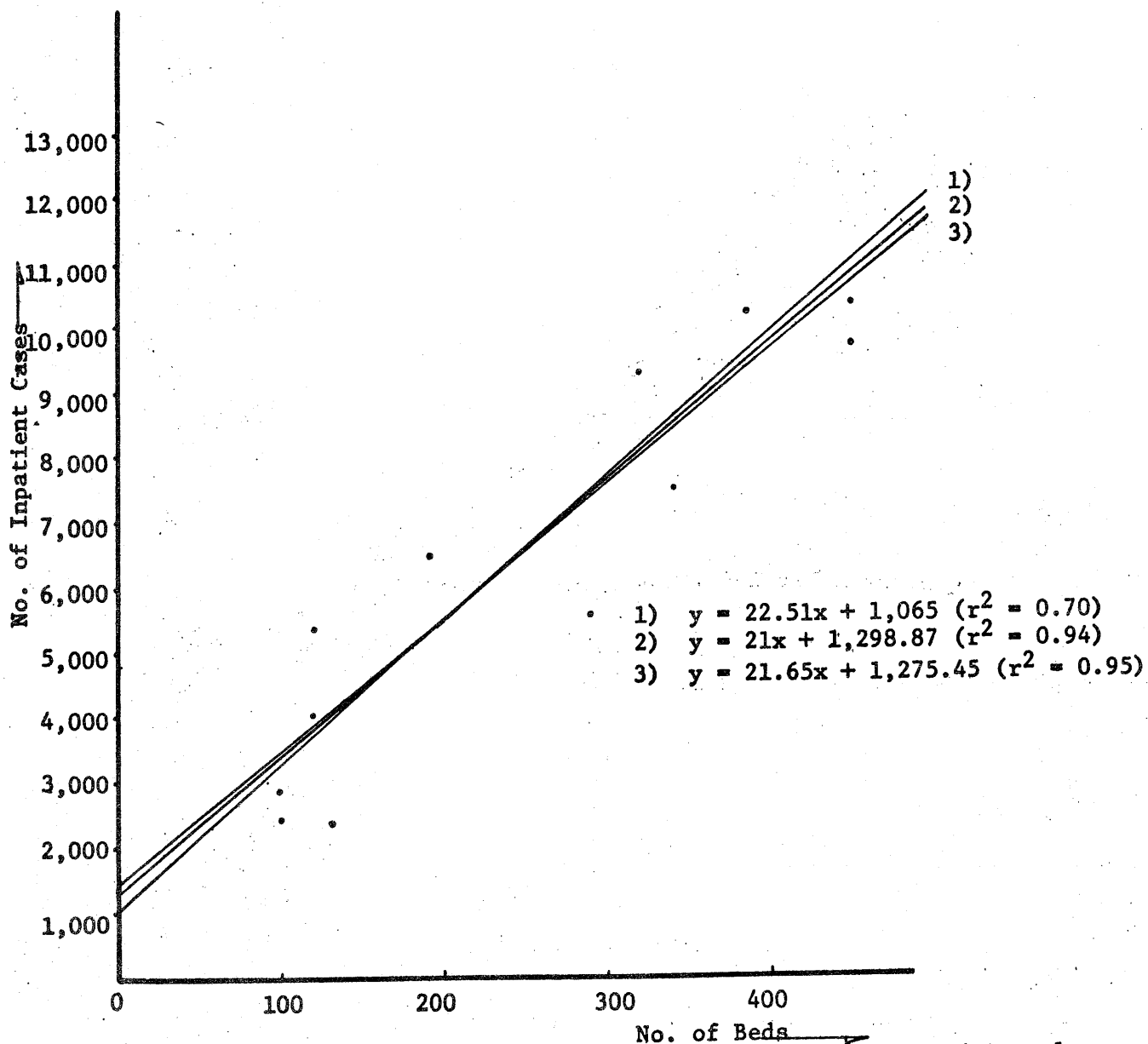


Figure C-7. Relationship between Number of Hospital Beds and Annual Inpatient Cases

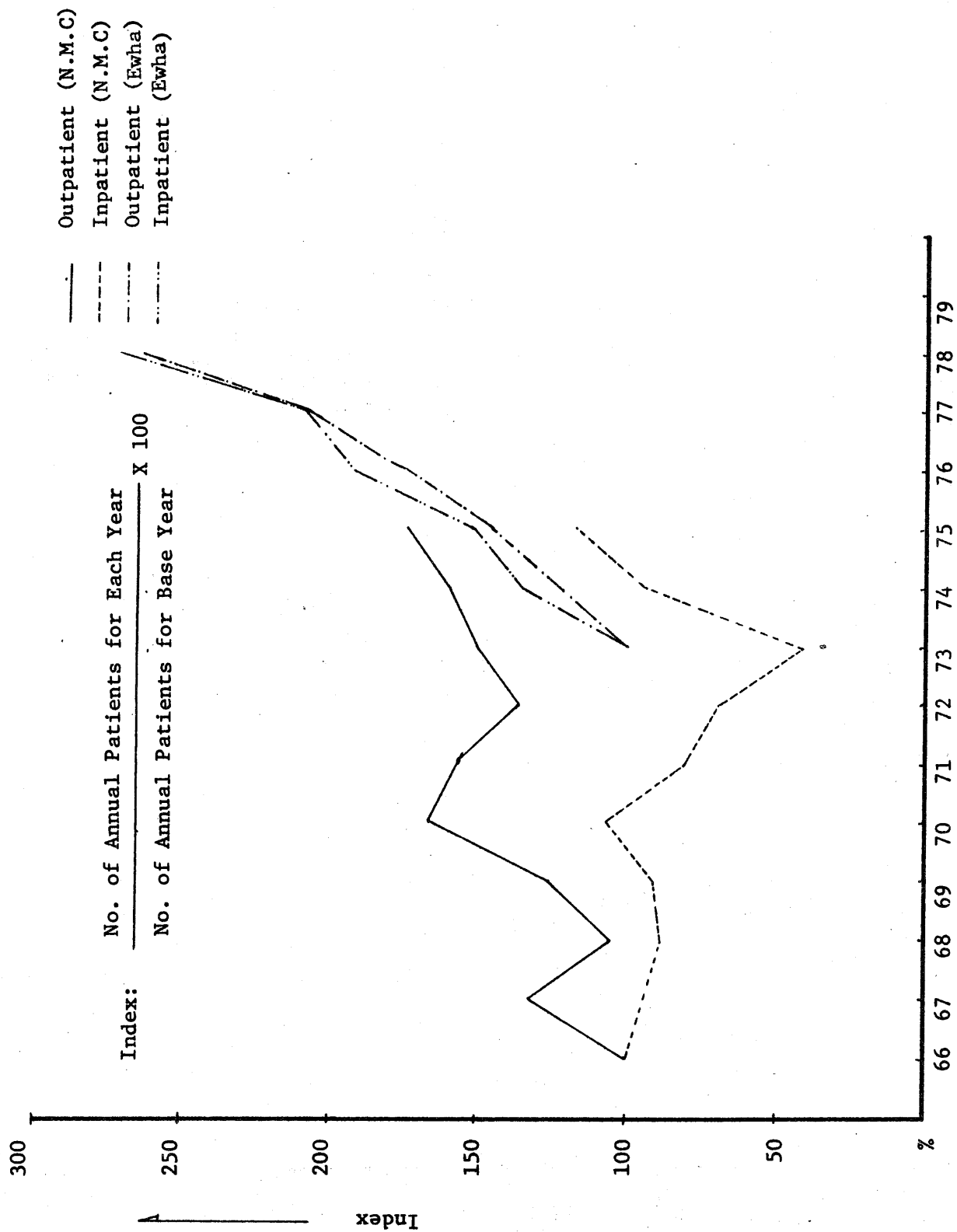


Figure C-8. Patient Care Index for National Medical Center and Ewha Womans University Hospital.

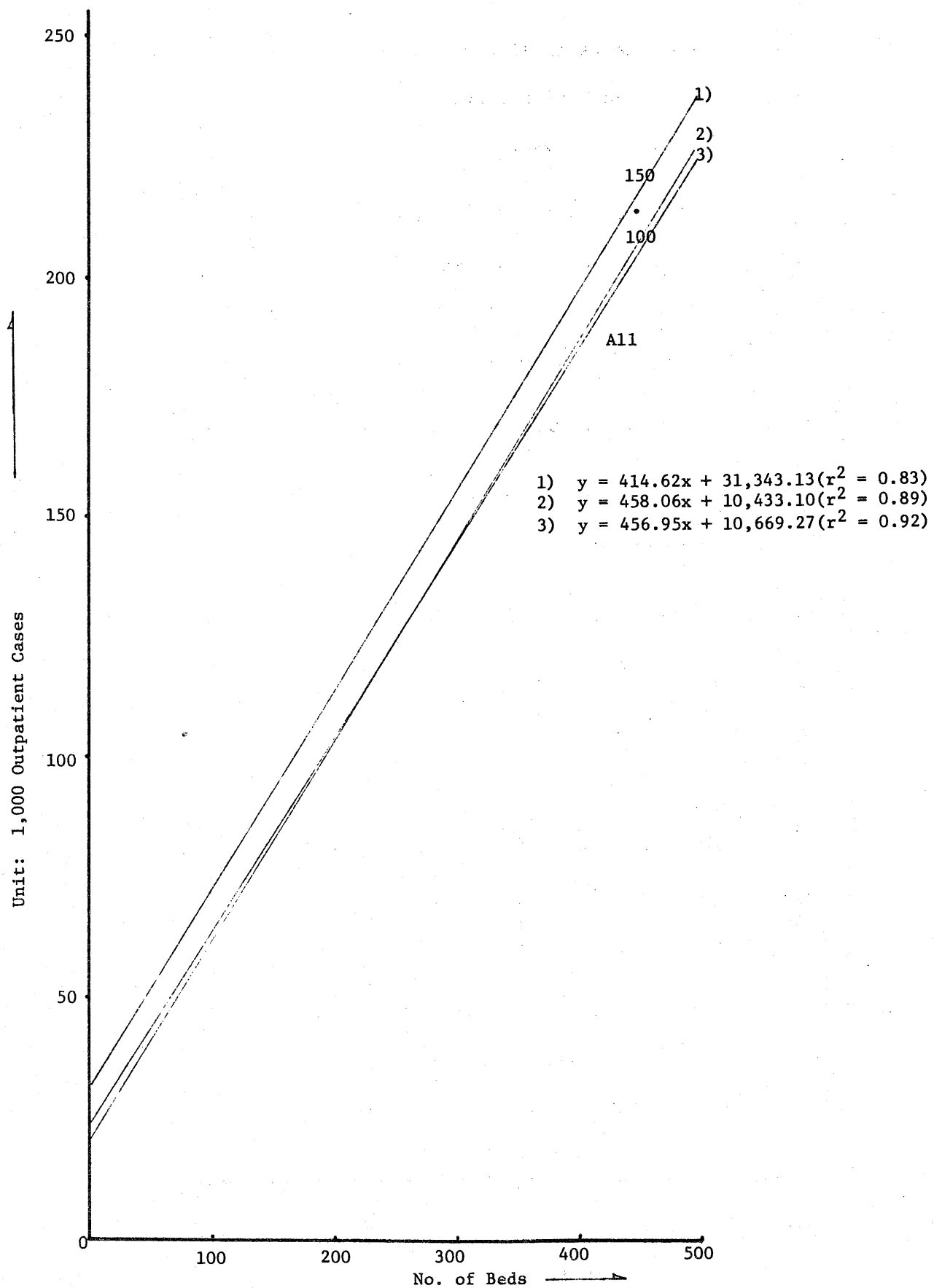


Figure C-9. Relationship between Number of Hospital Beds and Annual Outpatient Cases

Table C-50. Estimated Number of Inpatient Cases for the Guro Hospital
by Year

Year	Inpatient Cases	Percentage Increase per Annum
1980	6,172	-
1981	6,481	5
1982	6,740	4
1983	6,942	3
1984	7,150	3
1985	7,293	2
1986	7,439	2
1987	7,588	2
1988	7,740	2
1989	7,895	2
1990	8,052	2
1991	8,214	2

Table C-51. Percentage Distribution of Inpatient Cases by Medical Department in 1978.

Medical Department	Saint Vincent	Pusan National University	Pusan Marynoll
Internal Medicine	28.0	20.5	23.7
Pediatrics	20.2	10.1	20.6
Neuro-Psychiatry	0.0	4.2	2.7
General Surgery	11.0	8.7	11.1
Orthopedic Surgery	5.9	8.2	6.1
Neuro Surgery	4.7	9.4	5.3
Thoracic Surgery	0.0	5.9	0.0
Plastic Surgery	0.0	2.8	0.0
Ob & Gyn	22.7	12.4	21.3
Ophthalmology	1.0	5.5	2.2
E.N.T.	3.8	6.3	3.0
Dermatology	0.4	0.4	0.6
Urology	1.3	4.9	2.8
Tuberculosis	0.0	0.0	0.0
Physical Check-up	0.0	0.0	0.0
Dentistry	0.0	0.7	0.6
Total	100.0	100.0	100.0
No. of Patients	6,426	5,595	9,256

Table C-52. Distinctive Patient Facilities of the Guro Hospital in 1985

Medical Department	No. of Cases/Year	A.L.S. (days)	Occupancy/Rate
Internal Medicine	2,116	8	92.8
General Surgery	1,021	13	92.8
Orthopedic Surgery	802	20	92.8
Neurosurgery	583	20	92.8
Pediatrics	729	8	92.8
OB-GY	1,094	7	92.8
ENT	292	12	92.8
Ophthalmology	109	14	92.8
Urology	219	14	92.8
Dentistry	73	18	92.8
Neuropsychiatry	182	14	92.8
Dermatology	73	18	92.8
All or Average	7,293	11.6	92.8

- 6.3.3. The possible separation of functions that is out-patient treatments are handled by clinics and in-patient treatments by hospitals is a possibility in the future. This factor, in addition to the expansion of health insurance system, makes the reform of medical delivery systems likely in the future. Therefore, the out-patient function of the general hospitals is expected to decrease. In considering these possible factors, the principle of low estimation was again used to determine the number of out-patients for Guro Hospital (Table C-54).

Table C-53. Sample Hospital Service Statistics: Outpatient Care

Hospital	No. of Beds	No. of Outpatient Cases	No. of Outpatient Visits
Yonsei Hospital	745	104,708	371,701
National Medical Center	450	68,021	213,926
Chun Nam National University Hospital	386	69,456	141,173
Pusan Marynoll Hospital	320	30,916	146,319
Pusan National University Hospital	295	44,872	137,777
Choong Nam National University Hospital	230	-	-
Kwangju Christian Hospital	200	35,548	122,602
Saint Vincent Hospital	195	35,239	104,234
Hanil Hospital	150	43,725	157,831
Kyungbuk, DongHae	130	17,748	44,700
Saint Columban Hospital(Mokpo)	120	15,783	56,396
Andong Presbyterian Hospital	120	16,439	39,680
Pusan National Hospital	105	37,334	77,177
Choong buk Medical Center	100	19,339	45,292
Saint Mary's Hospital (Pohang)	100	16,106	51,973
Handok Hospital	85	36,473	55,626
Hankuk Hospital	81	12,039	33,484
Seagrave Memorial Hospital	70	8,331	26,814
Hanjung Hospital	66	8,447	42,235
Sung Nam Parental Hospital	60	26,324	49,599
Andong Provincial Hospital	45	12,779	22,926
Kyungju Christian Hospital	40	10,832	40,574
Samil Hospital	33	9,041	24,964
Dongil Hospital (Anyang)	30	26,800	35,769
Jinju Provincial Hospital	14	9,433	13,689

Source: Hospital Survey by KHDI Hospital Construction Feasibility Study Group, 1979.

Table C-54. Estimated Number of Outpatient Visits for the Guro Hospital
by Year

Year	Outpatient Visits	Percentage Increase for Annum
1980	101,710	-
1981	106,796	5
1982	111,067	4
1983	115,510	4
1984	120,130	4
1985	123,734	3
1986	127,446	3
1987	129,995	2
1988	132,595	2
1989	133,921	1
1990	135,260	1
1991	136,613	1

6.4. Distribution of Out-patients According to Medical Department

6.4.1. The out-patient distributions according to the medical departments of the three sample hospitals selected (6.2.1.) are shown on Table C-55.

6.4.2. The Guro Hospital out-patient department should consist of the following 12 departments. In addition to the basic 4 departments, orthopedic surgery, neurosurgery, ENT, ophthalmology, urology, dermatology, neuro-psychiatry and dentistry should be considered. The distribution of out-patients according to departments is shown in Table C-60-2. In considering the special characteristics of Guro Industrial Complex, the expected distribution of out-patients is shown in Table C-56.

6.4.3. The distribution of patient according to department by the method of payment, insured or non-insured, was also estimated in consideration of present health insurance members distribution and the Government plan of health insurance expansion.

6.5. Estimation of Clinical Examination and Surgery Cases

6.5.1. Due to the competition expected from the nearby Shindolim Hospital, the clinical departments of the Guro Hospital should be strengthened.

6.5.2. The number of clinical examination and surgery cases of the sample hospitals are shown on Table C-57 and C-58.

Table C-55. Percentage Distribution of Outpatient Visits by Medical Department in 1978

Medical Department	Saint Vincent	Pusan National University	Pusan Marynoll.
Internal Medicine	23.8	27.7	24.8
Pediatrics	22.5	6.8	15.9
Neuro-Psychiatry	0.0	6.2	6.0
General Surgery	6.2	2.3	4.3
Orthopedic Surgery	6.8	6.5	5.8
Neuro Surgery	3.8	4.7	2.5
Thoracic Surgery	0.0	1.0	0.0
Plastic Surgery	0.0	1.1	0.0
Ob & Gyn	13.3	6.2	10.2
Ophthalmology	4.3	9.5	5.2
E.N.T.	8.3	12.3	6.6
Dermatology	7.3	6.6	13.5
Urology	1.3	6.8	3.3
Tuberculosis	0.0	0.0	0.0
Physical Check-up	0.0	0.0	0.0
Dentistry	2.4	2.3	1.9
Total	100.0	100.0	100.0
No. of Patients	104,234	137,777	146,319

Table C-56. Distribution of Annual Outpatient Visits by Department

Medical Department	1980	1981	1985	1990
Internal Medicine	27,462	26,699	28,459	29,757
General Surgery	9,154	7,476	7,424	8,116
Orthopedic Surgery	6,103	5,340	6,187	6,763
Neurosurgery	3,560	3,204	4,949	5,410
Pediatrics	17,799	16,019	17,323	20,289
Ob and Gyn	16,274	13,833	16,086	17,584
ENT	3,051	6,408	8,661	10,821
Ophthalmology	3,560	5,340	6,187	6,763
Urology	2,543	4,272	4,949	5,410
Dental	4,068	5,340	7,424	8,116
Neuro Psychiatry	4,068	4,272	4,949	5,410
Dermatology	4,068	8,544	11,136	10,821
Total	101,710	106,796	123,734	135,260

6.5.3. The past 6 years trend of Ewha Womans University Hospital clinical examination performance is indicated by Table C-59. The number of anesthesia and clinical pathology has increased remarkably to date.

6.5.4. In planning the Guro Hospital Medical Program for the initial year and the following years, the above-mentioned factors were considered (Table C-60-3 & 4).

Table C-57

Number of Laboratory Performances per Unit of Measurement in 1978

Hospital	No. of Beds	Per Inpatient Case			Per Outpatient Visit		
		Chemistry	Hematology	Serology	Chemistry	Hematology	Serology
Pusan Marynoll	320	4.018	4.851	1.617	0.381	0.460	0.153
Pusan National University	295	11.606	6.391	2.130	0.519	0.039	0.130
Chunbuk National University	286	0.303	0.036	0.012	0.219	0.026	0.009
Choongnam National University	230	0.904	6.118	2.039	0.851	0.576	0.192
Kwangju Christian	200	2.047	3.299	1.100	0.287	0.463	0.154
Saint Vincent	195	2.883	3.334	1.111	0.267	0.308	0.103

Source: Hospital Survey by KNDI Hospital Construction Feasibility Study Group, 1979.

Table C-58 Number of X-ray Examinations per Unit of Measurement in 1978

Hospital	No. of Beds	Per Inpatient Case		Per Outpatient Visit		
		Plain X-ray	Mass X-ray	Fluoroscope	Plain X-ray	Mass X-ray Fluoroscope
Pusan Marynoll	320	1.233	0.055	0.207	0.117	0.005 0.020
Pusan National University	295	0.204	0.188	0.005	0.012	0.011 0.000
Chunbuk National University	286	0.252	0.099	0.015	0.182	0.072 0.011
Daegu National University	230	2.029	0.299	0.081	0.191	0.028 0.008
Kwangju Christian	200	0.327	1.219	0.079	0.046	0.171 0.011
Saint Vincent	195	1.394	0.094	0.000	0.129	0.009 0.000

Source: Hospital Survey by KMDI Hospital Construction Feasibility Study Group, 1979.

Table C-59.

Trends of Performances in Various Medical Departments

(Unit: Index *)

Year	Radiology		Anesthesiology		Clinical Pathology		Health Management	
	Outpatient	Inpatient	Outpatient	Inpatient	Outpatient	Inpatient	Outpatient	Inpatient
1973	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1974	109.5	54.0	335.4	125.0	131.6	128.6	47.1	-
1975	108.7	110.0	175.8	101.0	109.6	106.3	47.0	-
1976	126.3	155.6	96.4	131.8	125.8	136.4	347.8	-
1977	113.4	90.5	77.9	113.4	112.5	96.4	57.3	-
1978	132.2	125.8	87.4	140.6	110.3	133.2	141.7	-
Average Annual Increase	118.0	107.2	154.6	122.4	118.0	120.2	128.2	-

$$*Index = \frac{\text{Data for Each year}}{\text{Data for 1973}} \times 100$$

Source: Ewha Womans University Medical Center Annual Report, 1973-1978.

Table C-60-1 Medical Care Program of the Guro Hospital in 1979:
Inpatients

Medical Department	No. of Cases per Year	Average Length of Stay (days)	Occupancy Rate of Beds (%)	Distribution of Beds (number)
Internal Medicine	1,975	9	80	58
General Surgery	802	15	80	38
Orthopedic Surgery	617	24	80	47
Neuro-Surgery	432	26	80	37
Pedistries	555	7	80	14
OB and GYN	1,050	8	80	24
ENT	154	8	80	4
Ophthalmology	154	14	80	7
Urology	142	12	80	6
Jaw Surgery	62	20	80	4
Neuro-psychiatry	167	15	80	7
Other	62	20	80	4
Total or Average	6,172	12.5	80	250

Table C-60-2. Medical Care Program of the Guro Hospital in 1980
Outpatients

Medical Department	No. of Visits per Year
Internal Medicine	27,462
General Surgery	9,154
Orthopedics	6,103
Neuro Surgery	3,560
Pediatrics	17,799
OB and GYN	16,274
ENT	3,051
Ophthalmology	3,560
Neuro Psychistry	4,068
Other (Dermatology)	4,068
Dental	4,068
Total	101,710

Table C-60-3. Medical Care Program of the Guro Hospital in 1979:
Medical Performances

Kind of Performances	No. of Performances per Year		
	Inpatients	Outpatients	Total
Emergency Cases		8,137	8,137
ECG			1,373
Endoscopies			99
Laboratory Diagnostics			
- chemical	15,479	22,681	38,160
- hematological	17,985	36,616	54,601
- serological	6,481	12,815	19,296
- bacteriological	3,246	5,086	8,332
- specially: performances fit for autoanalyzer	-	-	-
- stool exam.	1,876	2,543	4,419
- urinalysis	24,873	33,564	58,437
Blood Preserves			5,000 pints
Plain X-ray	8,573	11,595	20,168
Mass X-ray	-	10,985	10,985
Fluoroscopies	741	-	741
Thermographics	-	-	-
C T Scanning			3,000
Operations			
- general surgery	525	610	1,135
- orthop. surgery	309	203	512
- neuro surgery	108	61	169
- OB and GYN	309	550	859
- ENT	154	102	256
- ophthalmology	54	122	176
- urology	69	61	130
- jaw surgery	15	325	340
Total	1,543	2,034	3,577
Deliveries	550		550
Radiologic therapies by kind			550
Physiotherapy			
- massages			7,000
Preventive performances			
physical check-up		5,000	5,000
(1 physical-checkup room)			

Table C-60-4.

Medical Program of the Guro Hospital in 1979
Further Functions

Function	Quantities per Year
Pathology	
- histological cuts	3,000
- autopsies	60
Ambulance	
- transportations	1,500
Medical training	
- by kind	
Intern	8
Resident	24
1 Medical Record Room	
1 Central Supply Room	

7. ROOM AND SPACE PROGRAM OF GURO HOSPITAL (250 BEDS)

7.1. General Principle

This Room and Space Program is made by the Medical Program which was previously mentioned in Chapter 6. For the completion of this report, a survey and analysis for the 9 existing hospitals in Korea has been performed, compared with the standards of the West Germany, United States and other developed countries. As the result, this Room and Space Program, which is considered most suitable to the existing conditions in Korea, is established.

7.2 Room and Space Program

The space of the hospital can be divided into 5 main parts, as follows:

- The space for the outpatient departments, laboratory, X-ray, operation, delivery and so on.
- The space for the inpatient care, which is main facilities of hospital
- The space for the administration of hospital
- The space for supply; dispensary, feeding, laundry and soon
- The space for maintenance of hospital

7.2.1. Examination and Treatment

In this part, emergency, outpatient departments, laboratory, X-ray, operation, and delivery are included.

7.2.1.1. Entrance and Emergency

As the Table C-60-3 of Medical Program, about 23 cases per day are performed in emergency. The results are obtained in the survey of the existing hospitals (See Yeoju Report Table A-28, A-30) and are the same as Table C-62-1.

7.2.1.2. Outpatient Departments

The necessary rooms and the number of rooms for outpatient departments are calculated by the annual number of outpatients of the Medical Program (Table C-60-2) and the consulting time (cf. Table C-61-2).

The size of each room is based on the survey results of the existing hospitals (See Yeoju Report Table A-29). In consideration of teaching hospital, medical trainees' room is seated. And the other auxiliary rooms are based on the empirical standard in Korea. The results are the same as Table C-62-1.

7.2.1.3. Laboratory

The necessary rooms and the size of the rooms are deduced from the number and the kinds of examinations. (Table C-60-3).

The other auxiliary rooms are based on the empirical standards. And the whole volume is checked by the survey of the existing hospitals (See Yeoju Report Table A-30). The result are the same as Table C-62-2.

7.2.1.4. Morgue

This is allocated by the Medical Program (Table C-60-4) and the survey of the empirical standards. The results are same as Table C-62-2.

7.2.1.5. X-ray

The whole volume and the necessary rooms are deduced by the number and kinds of the Medical Program (Table C-60-3) and the operating time of every disciplines. As the result, 3 aseptic operating rooms and 1 septic operating room are required. The size of operating rooms is based on the survey of the existing hospital (See Yeosu Report Table A-29) and the other auxiliary rooms are based on the empirical standards. The results are the same as Table C-62-4.

7.2.1.7. Delivery

There are 2 cases in a day in delivery as shown in the Medical Program (Table C-60-3) but rooms and space are allocated in consideration of extension and based on the empirical standards. The results are the same as Table C-62-4.

7.2.1.8. Physiotherapy

There are 30 cases in a day as shown in the Medical Program (Table C-60-3). The general contents are calculated on the basis of the empirical standards.

The results are the same as Table C-62-4.

So the total net area of Examination and Treatment is 2,494 m².

7.2.2. Wards

The number of beds according to every departments is decided by the Medical Program (Table C-60-1). The 7 nursing units are needed, and composed of approximately 32 to 38 beds in addition to the intensive care beds. The ratio of the number of bed rooms in a nursing unit, such as 4-bed room, 2-bed room and 1-bed room, is determined by the empirical standards. The size of these rooms is based on the investigation and analysis of the surveyed hospital (See Yeosu Report Table A-31-1). By the utilization of an architectural module, efficient dimension of these rooms is modified and determined. Every bed room is checked by the physical drawing (See Yeosu Report Fig. A-4, A-5, A-6, A-7)

The auxiliary rooms, such as nurse's station, doctor's room pantry, W.C., utility and so on, are based on the experience of the existing hospitals. But in the light of present situation in Korea, a 6-bed room may be needed to achieve an economical plan of hospital. The distribution ratio and the size of 6-bed will be decided by the survey of the existing hospitals and the empirical standards. So, the total net area of wards is 3,223 m².

7.2.3. Administration

The volume of administration is dependent on the organization table of hospitals, the necessary manpower, and is deduced from the survey of existing hospital. The results are the same as Table C-62-9.

7.2.4. Supply

This is composed of pharmacy, sterilization, kitchen and dining, laundry, storage, garage and so on.

the volumes of every parts are based on the survey of the existing hospitals. The results are the same as Table C-62-10.

7.2.5. Technical Center

This is composed of boiler room, electric room, carpentry, and so on. And the volume of technical center is based on the survey of the existing hospitals. The results are same as Table C-62-10.

7.3. Contents of Room and Space Program

7.3.1. The Ratio of Gross Area to Net Area

The net area is the space required for all independent activities to effectively perform their respective functions. This area doesn't include the corridors, restrooms, wall space, and other auxiliary areas.

The inclusion of these areas into net area is the gross area. Therefore in the planning of the floor, the followings should be taken into consideration.

- thickness of the wall and columns
- corridors
- hall and lobby
- stairs
- elevator shaft and hall
- maintenance and other auxiliary areas

The ratio of gross to net, which is shown in the table of Room and Space Program, is the statistical data according to the the number of small rooms and the main faculty of the building.

- $G/N = 1.67$: General buildings
- $G/N = 1.5$: Residencial facilities
- $G/N = 1.4$: Buildings which contain many large rooms.

But the ratio of corridor to total area is about 30% ($G/N = 1.5$), which is shown in the survey of the existing hospitals. But we choose 1.7 as the ratio of gross to net, in order to secure the space. Also, that is considered most suitable to the characteristics of hospital.

7.4. So, the required Grand Net Total area for 250 beds hospital is $8,100 \text{ m}^2$ (Grand Gross Total Area is $13,770 \text{ m}^2$) (cf. Table C-62-11).

Table C-61-1. Calculation of Operation Rooms for the Guro Hospital

Medical Department	OP/Yr.	OP/day (280 d/y)	Min/OP (incl. room) Min/y preparat	* No. of OP-room	Aseptic		Septic	
					z	Rooms	z	Rooms
General Surgery	1,135	4.1	100	1.13	80	A ^{0.90}	20	0.23
Orthopedics Surgery	512	1.8	75	0.38	100	B ^{0.38}	-	-
Neuro-Surgery	169	0.6	200	0.37	100	B ^{0.37}	-	-
OB & GYN	859	3.1	70	0.60	65	C ^{0.39}	35	0.21
ENT	356	0.9	65	0.16	10	C ^{0.02}	90	0.14
Ophthalmology	176	0.6	55	0.10	90	B ^{0.09}	10	0.0
Urology	130	0.5	65	0.08	30	C ^{0.02}	70	0.06
Jaw Surgery	340	1.2	45	0.15	5	B ^{0.01}	95	0.14
Total	-	12.8	-	-	-	2.18	-	0.79

* Capacity = 280,360 = 100,800 Min/year.

A.B.C. : Room Combination

Table C-61-2. Calculation of Consultation Rooms for the Guro Hospital (250 Bed)

Department	Consultation/ Year	MIN./ Consultation	MIN/ Year	* No. of Room
Internal Medicine	27,462	10	274,620	3
General Surgery	9,154	8	73,232	1
Orthopedic	6,103	15	91,545	1
Neuro-Surgery	3,560	15	53,400	1
Pediatrics	17,799	15	266,985	3
OB and GYN	16,274	10	162,740	2
ENT	3,051	15	45,765	1
Ophthalmology	3,560	20	71,200	1
Urology	2,543	15	38,145	1
Dental		20		1
Neuro Psychiatry	4,068	20	81,360	1
Other	4,068	18/d	280d/y	1

TOTAL: 17R

* CAPACITY: $5^d \times 6^h + 1^d \times 3^h = 33^h/w$
 $33^h \times 50^w = 1,650 \text{ h/y}$
 $1,650^h \times 60^m = 100,000 \text{ min/y.}$

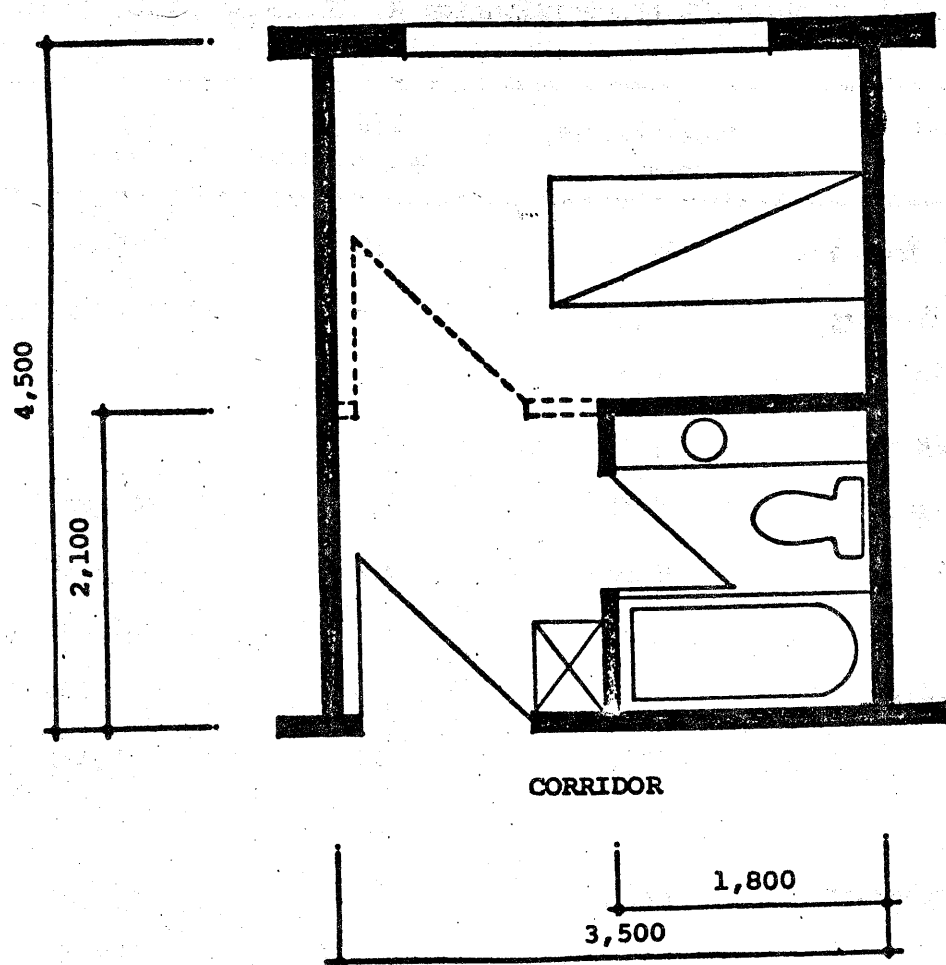


Fig 7-1 Sample Layout for 1-Bed Room

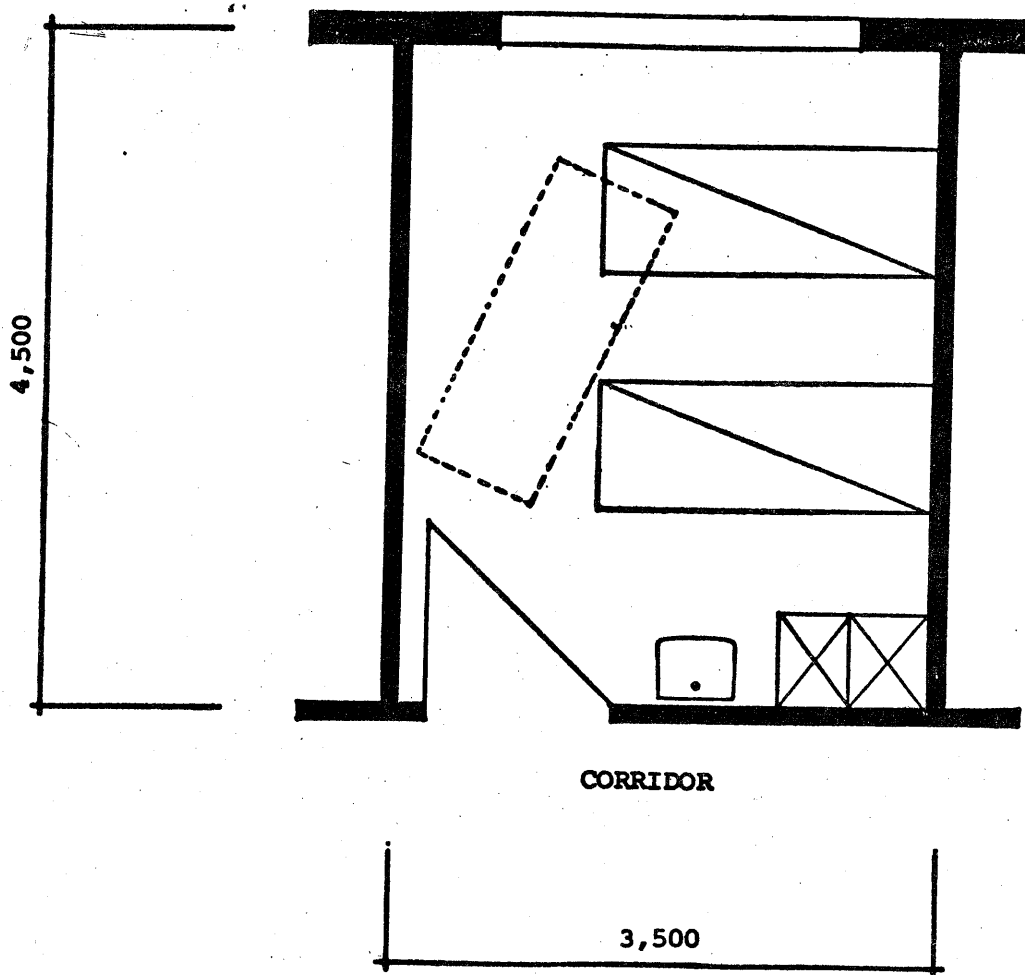


Fig 7-2 Sample Layout for 2-Bed Room

S:1/50

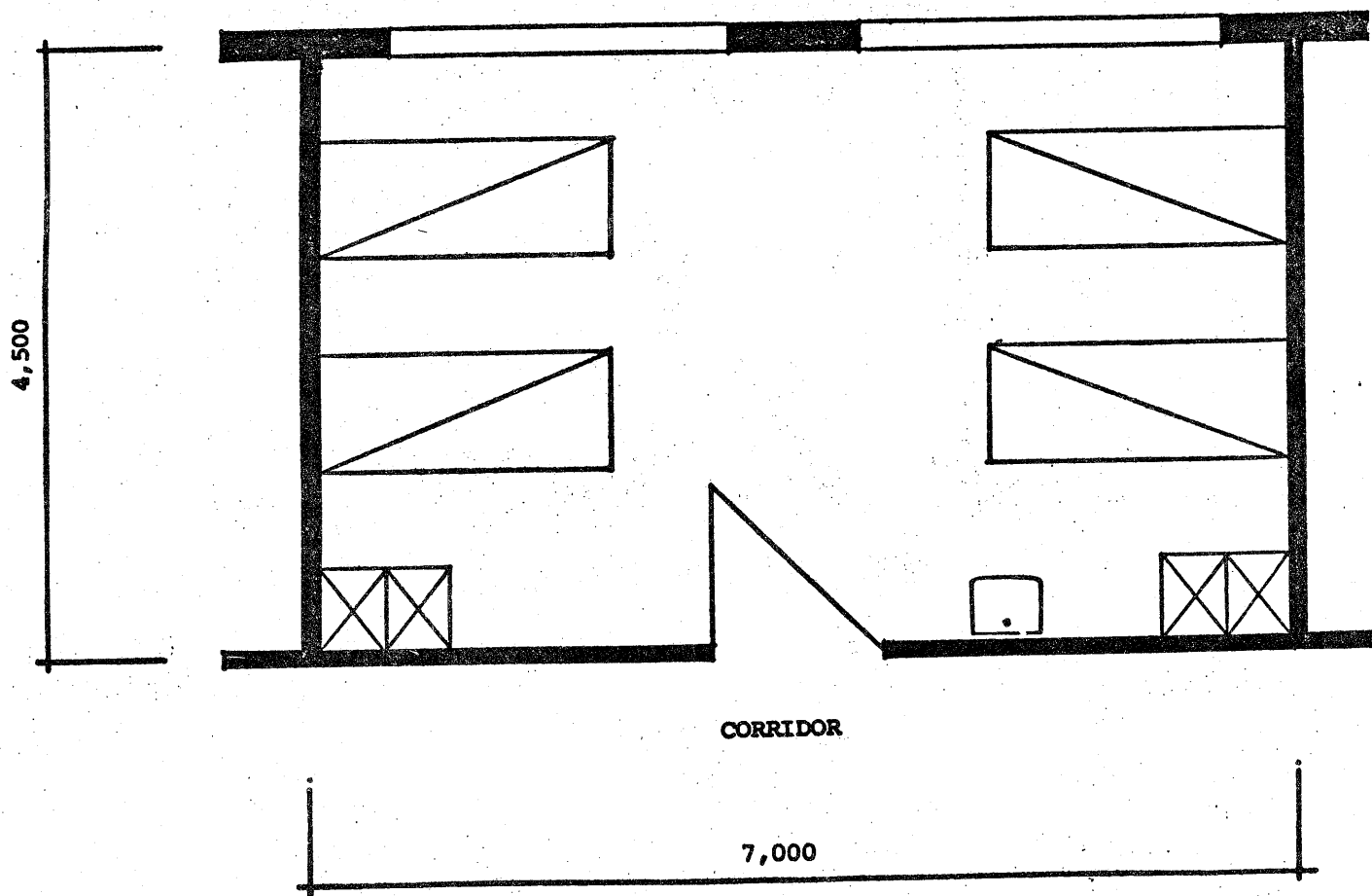


Fig 7-3 Sample Layout for 4-Bed Room

S:1/50

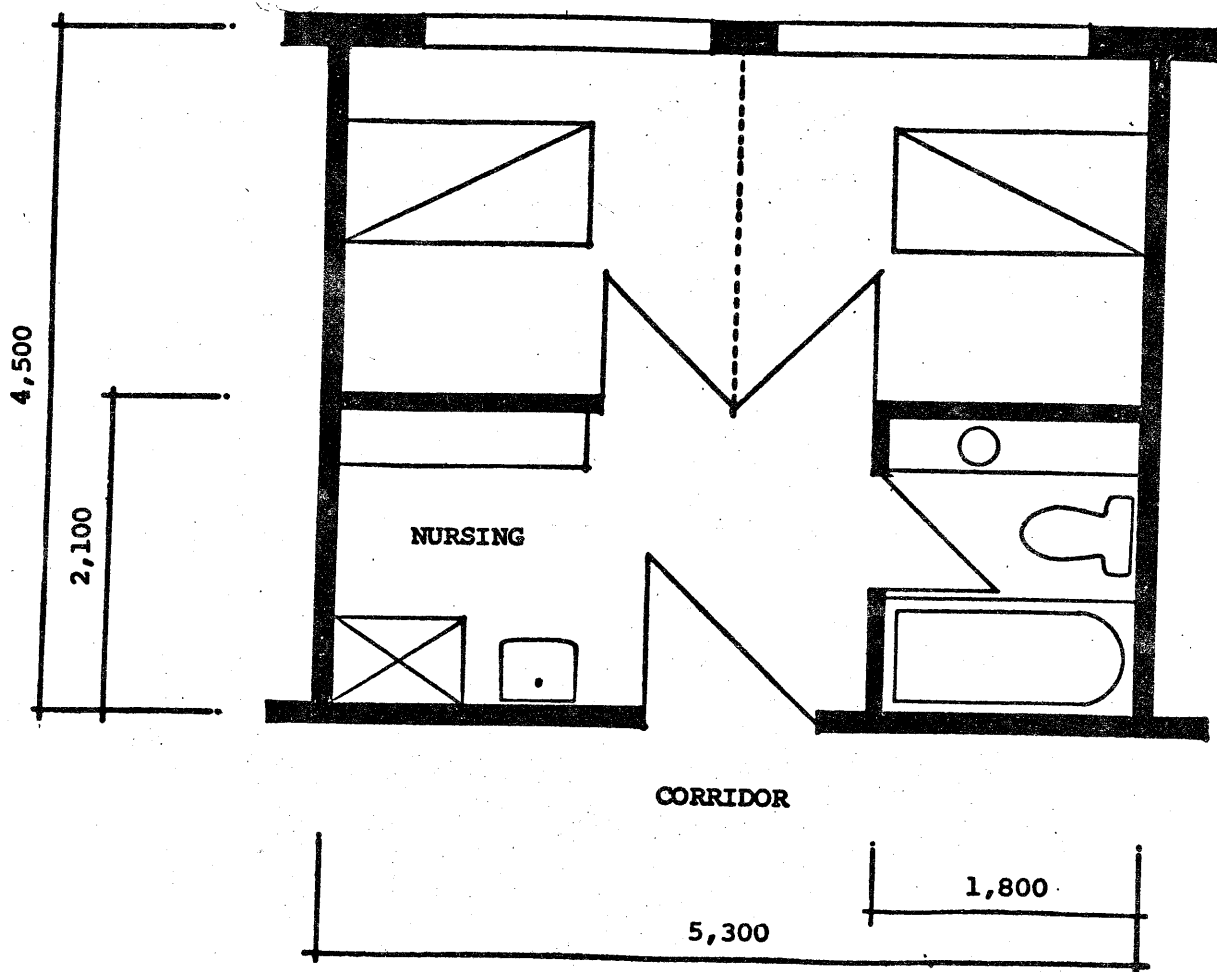


Fig 7-4 Sample Layout for 2-Bed Room for Pediatric Case

S:1/50

ROOM & SPACE PROGRAM : GURO(250 BEDS)

TABLE : G-62-1 ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
1	EXAMINATION AND TREATMENT			
101	ENTRANCE AND EMERGENCY			
101/01	Entrance hall	1	100	
/02	Guard's room	1	12	
/03	First aid admission and X-ray	1	24	
/04	First aid room (Operation)	1	32	
/05	Preparation room	1	12	
/06	Scrub room + dress changing	1	18	
/07	First aid rooms (Plaster + Check)	2	(16) 32	
/08	Waiting room	1	18	248
102	OUTPATIENT DEPARTMENT			
102/01	Superintendent consultation	1	24	
/02	Internal medicine	3	(24) 72	
/03	General surgery	1	24	
/04	Orthopedic	1	24	
/05	Neuro surgery	1	24	
/06	Pediatrics	3	(24) 72	
/07	OB & GYN	2	48	
/08	ENT	1	24	
/09	Ophthalmology	1	24	
/10	Urology	1	24	
/11	Dental	1	24	
/12	Neuro psychiatry	1	24	
/13	Dermatology	1	24	
/14	Special exam. room (ECG and Endoscopy)	1	24	
/15	Physical check-up	1	24	
/16	Waiting areas	19	(12) 228	
/17	Medical trainees' room	1	24	
/18	W.C. for staff + anteroom	4	12	
/19	W.C. for patients + anteroom	6	18	
/20	Nurses' locker room	1	32	
/21	Night duty	6	(12) 72	866

(to be
checked
according
to manpower
requirement
list)

ROOM & SPACE PROGRAM : GURO(250 BEDS)

TABLE : C-62-2 ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
105	LABORATORY			
105/01	Specimen taking room (incl. W. C.)	1	18	
/02	Waiting room	1	36	
/03	Laboratory room subdivided for chemistry, haematology, urinology etc.	1	120	
/04	Weighting room	1	6	
/05	Laboratory room for bacteriology	1	16	
/06	Laboratory room for serology	1	24	
/07	Blood storage		8	
/08	Laboratory room for histology	1	16	
/09	Cleaning and sterilizing room	1	16	
/10	Storage	1	8	
/11	Restroom and locker for staff	1	16	
/12	Doctor's room	1	16	300
106	MORGUE			
106/01	Autopsy room	1	24	
/02	Preparation and coffin room incl. 4 refrig. cells	1	24	
/03	Visitors' room	1	18	
/04	Changing and sanitary room	1	12	78

ROOM & SPACE PROGRAM : GURO(250 BEDS)

TABLE : C-62-3 ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
107	X-RAY			
107/01	Plain X-ray room	1	32	
/02	Dressing cubicles	2	3	
/03	Fluoroscopy and plain X-ray room	1	32	
/04	Dressing cubicles + 1 W.C.	4	6	
/05	Mass X-ray room (also useful for plain X-ray)	1	32	
/06	Dressing cubicles	4	6	
/07	Operators' stands, film processing, dark room	1	36	
/08	Waiting and resting room for patients on stretchers	1	18	
/09	Waiting room	1	24	
/10	Film demonstration and reporting room	1	24	
/11	Reception, archive	1	18	
/12	Doctor's room	1	16	
/13	CT-room (whole body)	1	32	
/14	Auxiliary rooms for CT (operator/computer/ installation)	3	26	
/15	Preparation room	1	12	
/16	Dressing cubicles	2	3	320

ROOM & SPACE PROGRAM : GURO(250 BEDS)

TABLE :C-62-4 ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
109	OPERATION/ASEPTIC AREA			
109/01	Operating rooms	3	(36) 108	
/02	Preparation rooms (anaesthesia)	3	(16) 48	
/03	Scrub rooms	3	(8) 24	
/04	Instruments room	1	16	
/05	Anaesthetist's utility room	1	32	
/06	Storage for diverse accessory	1	18	
/07	Substerilization	1	18	
/08	Operative endoscopies	1	24	
/09	Changing rooms for male + female staff + shower	2	(24) 48	
/10	Nurses' office	1	12	
/11	Rest room for staff	1	24	
/12	Anaesthesist's office	1	16	
/13	Recovery room	1	60	
/14	Entrance area, sluice	1	24	
	SEPTIC AREA			
109/20	Operating room	1	36	
/21	Preparation room	1	16	
/22	Scrub room, dress changing	1	16	
/23	Instrument room	1	12	552
110	DELIVERY			
110/01	Delivery rooms	2	(24) 48	
/02	Washing room	1	6	
/03	Instruments room	1	6	
/04	Labour room	1	18	
/05	Nurse's room	1	16	
/06	Bath room	1	12	106
111	PHYSIOTHERAPY (DRY ROOM)	2	(12) 24	24
			TOTAL 1	2,494

ROOM & SPACE PROGRAM : GURO (250 BEDS)

TABLE : C-62-5 ROOM & SPACE PROGRAM : WARDS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
2	WARDS			
201	1ST NURSING STATION (38 BEDS) INTERNAL MEDICINE			
201/01	4 Bed room	5	(32) 160	
/02	2 Bed room	7	(16) 112	
/03	1 Bed room	4	(16) 64	
/04	Nurse's station	1	16	
/05	Nurse's room	1	16	
/06	Utility room, clean	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & shower	1	16	
/10	W.C. for staff + anteroom	2	6	
/11	W.C. for patients + anteroom	6	16	
/12	Doctor's room + examination	1	24	474
202	2ND NURSING STATION (34 BEDS) INTERNAL + PEDIATRICS			
202/01	4 bed room	3	(32) 96	
/02	2 bed room	3	(16) 48	
/03	1 bed room	2	(16) 32	
/04	2-bed room for pediatrics incl. sluice (incl. room for premature)	7	(24) 148	
/05	Nurses' station	1	16	
/06	Nurses' room	1	16	
/07	Utility room, clean	1	16	
/08	Utility room, dirty	1	16	
/09	Pantry	1	12	
/10	Bath room & shower	1	16	
/11	W.C. for staff + anteroom	2	6	
/12	W.C. for patients + anteroom	6	16	
/13	Doctor's room + examination	1	24	
/14	Playing room	1	16	478

ROOM & SPACE PROGRAM : GURO (250 BEDS)

TABLE :C-62-6 ROOM & SPACE PROGRA : WARDS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
203	3RD NURSING STATION (38 BEDS) GENERAL SURGERY			
203/01	4 bed room	5	(32) 160	
/02	2 bed room	7	(16) 112	
/03	1 bed room	4	(16) 64	
/04	Nurse's station	1	16	
/05	Nurse's room	1	16	
/06	Utility room, clean	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & shower	1	16	
/10	W.C. for staff + anteroom	2	6	
/11	W.C. for patients + anteroom	6	16	
/12	Doctor's room + dressing	2	24	474
204	4TH NURSING STATION (38 BEDS) ORTHOPEDIC SURGERY (EQUAL TO 203)			

ROOM & SPACE PROGRAM : GURO(250 BEDS)

TABLE : C-62-7 ROOM & SPACE PROGRAM : WARDS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
205	5TH NURSING STATION			
	a) ORTHOPEDIC SURG. (ANNEX 9 BEDS)			
205/01	4 bed room	1	32	
/02	2 bed room	2	(16) 32	
/03	1 bed room	1	16	
/04	Nurses' substation	1	12	
/05	Utility rooms	2	(8) 16	
	b) OB AND GYN (24 BEDS)			
205/21	4 bed room	3	(32) 96	
/22	2 bed room	4	(16) 64	
/23	1 bed room	4	(16) 64	
/24	Basinet room incl. utility sluice	1	32	
/25	Nurses' station	1	16	
/26	Nurses' room	1	16	
/27	Utility room, clean	1	16	
/28	Utility room, dirty	1	16	
/29	Pantry	1	12	
/30	Bath room & shower	1	16	
/31	W.C. for staff + anteroom	2	6	
/32	W.C. for patients+ anteroom	6	16	
/33	Doctor's room + examination	1	24	502
206	6TH NURSING STATION (37 BEDS) NEURO-SURGERY			
206/01	4 bed room	4	(32) 128	
/02	2 bed room	9	(16) 144	
/03	1 bed room	4	(16) 64	
/04	Nurse's station	1	16	
/05	Nurse's room	1	16	
/06	Utility room, clean	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & shower	1	16	
/10	W.C. for staff + anteroom	2	6	
/11	W.C. for patients + anteroom	6	16	
/12	Doctor's room	1	24	474

ROOM & SPACE PROGRAM : GURO(250 BEDS)

TABLE : C-62-8 ROOM & SPACE PROGRAM : WARDS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
207	7TH NURSING STATION (32 BEDS) FURTHER DISCIPLINES (RESP. SUBDIVIDED)			
207/01	4 bed room	4	(32) 128	
/02	2 bed room	6	(16) 96	
/03	1 bed room	4	(16) 64	
/04	Nurses station	1	16	
/05	Nurses room	1	16	
/06	Utility room, clean	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & shower	1	16	
/10	W.C. for staff + anteroom	2	6	
/11	W.C. for patients + anteroom	6	16	
/12	Doctor's rooms	2	(24) 48	450
208	INTENSIVE CARE STATION (20 BEDS)			
208/01	10 beds units (4 beds in single rooms)	2 units	(120) 240	
/02	Nurse supervision desk	2	(12) 24	
/03	Utility rooms	2	(12) 24	
/04	Storage for diverse accessory	1	16	
/05	Rest room for staff	1	36	
/06q	Doctor's room	1	16	
/07	W.C. for staff	2	3	
/08	Lab.	1	12	371
			TOTAL 2	3,223

ROOM & SPACE PROGRAM : GURO(250 BEDS)

TABLE :C-62-9 ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
3	ADMINISTRATION			
300/01	Superintendent office	1	18	(to be checked according to manpower requirement list)
/02	" secretary	1	12	
/03	Administration staff	1	250	
/04	Archive	1	100	
/05	Conference	1	36	
				416
4	SUPPLY			
401	PHARMACY			150
401/01	Pharmacy office			
/02	Manufacturing & store			
/03	Pharmacy reception			
402	STERILIZATION		180	180
404	KITCHEN AND DINING			
404/01	Cooking	1	200	542
/02	Prepare			
/03	Washing			
/04	Office	1	24	
/05	Storage	1	150	
/06	Dining	1	120	
/07	W.C. for staff	2	(1.5) 3	
/08	Locker for all supply staff	1	45	

ROOM & SPACE PROGRAM : BANWOL (250 BEDS)

TABLE : C-62-10 ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
405	LAUNDRY			
405/01	Sorting		150	
/02	Washing			
/03	Ironing		100	250
/04	Storage			
/05	Sewing			
406	GENERAL STORE			400
407	GARBAGE COLLECTION			50
408	GARAGE + DRIVER'S ROOM			45
			TOTAL 4	1,617
5	TECHNICAL CENTER			350

ROOM & SPACE PROGRAM : GURO(250 BEDS)

TABLE : C-62-11 ROOM & SPACE PROGRAM : TOTAL

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE (M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
TOTAL 1	Examination & Treatment	2,494		
TOTAL 2	Wards	3,223		
TOTAL 3	Administration	416		
TOTAL 4	Supply	1,617		
TOTAL 5	Technical Centers Incl. Workshop	350		
GRAND NET TOTAL		8,100 m ²		
GRAND GROSS TOTAL		13,770 m ²	(G/N = 1.7)	

8. ARCHITECTURAL DESIGN PRINCIPLES AND SPECIFICATIONS FOR CONSTRUCTION
GURO HOSPITAL (250 BEDS)

8.1. General Principle

This general hospital will be built in Guro, the oldest industrial site.

On the background of Gangseo and Gwanag district in Seoul, Siheung in Gyeonggi-Do where development is accelerating and peoples are gathering, this general hospital will become a unique, modernized medical center. So, this hospital should be established to satisfy the medical requirement from the residence, in addition to the earlier recovery of workman, the health management of technician and the preventive performance in the industrial site.

8.2. Design Criteria

The architectural design of this hospital should take into consideration the Medical Program.

- 8.2.1. In accordance with the Medical Program the hospital structure will accomodate 250 beds. The distribution of beds by medical departments are as follows.

Internal medicine	50 beds
General surgery	38 beds
Orthopedics surgery	47 beds
Neuro-surgery	37 beds
Pediatrics	14 beds
Ob. & Gyn.	24 beds
Others	40 beds
TOTAL	250 beds

- 8.2.2. In order to construct a hospital which is able to carry out the expected functions to provide high quality medical service, the room and space program should take the following into consideration.

8.2.2.1. The outpatient service of a general hospital is an indispensable element of a hospital function, although the function seems to be declining in the future.

8.2.2.2. The allocation of rooms and medical facilities should be in a manner to permit optional utilization among the departments.

8.2.2.3. The preventive medicine aspect of the hospital operation should be considered.

8.2.2.4. The future alteration and expansion of the hospital should be considered.

8.3. The Hospital Site and Plan

The site of the hospital will be located at near to the previously determined hospital construction site in Banwol City Master Plan. It will be adjacent to the center activity area however away from the

city traffic and accompanying noise and pollution. The longitudinal axis of the building will be in the east-west direction and the building will face south to maximize energy conservation.

8.3.1. The master Plan of the Proposed Hospital Location

The physical characteristics of the proposed site should be considered, including soil conditions, under ground water, and meteorological considerations.

8.3.2. Site Preparation

The site preparation for the hospital construction should follow the Master Plan. It is recommendable that the standard height of the proposed site be at least 50 cm higher than that of the main traffic level. Minimum length of frontage for the site would comprize an area of a quarter of the entire facility length.

8.3.3. Public Utilities

A separate drainage system for the storm drain and sewage drain will be constructed. A sewage treatment facility will be constructed. The water will be supplied by the city main water supply. Also, additional water for cleaning and fire prevention will be supplied by an under ground reservoir. The electric power line will be connected to the main power line of the Korea Electric Company and the telephone line will be connected to the main city telephone line.

8.3.4. Building Site Plan

In accordance with the Master Plan the hospital will face south to maximize energy conservation.

The separation into the interrelated but independent function will encompass the outpatient, wards, emergency room and other service facilities.

A parking facilities will be constructed at the front and the side of the building and landscaping will enhance the physical outlook of the building.

8.4. Functional Building Layout of the Hospital

The plan of hospital construction should take into the above-mentioned considerations to promote the most efficient medical service delivery. As reflected on the layout plan, the hospital features three major sections: outpatient, inpatient department, and support facilities.

8.4.1. The Plan of Room Distribution

8.4.1.1. Outpatient Department

The outpatient section should be located in front of the hospital nearest to the road. It should be located allowing optimal coordination with the interior of hospital.

The outpatient unit can be reached from the hospital by a separate entrance. The location of the outpatient unit is of utmost importance as it is also called upon to handle examination and treatment of inpatients. Beside the examination and treatment rooms, the outpatient unit house the X-ray room, the laboratory, the pharmacy (drugstore and distribution) and the emergency surgery room.

8.4.1.2. In-patient Department

The construction of inpatient department should allow the easy expansion and a modification of the hospital wards should it be necessary in the future. The internal hospital area consists of the individual wards including the surgical unit. The layout plan utilizes the sectional system. In addition to the examination room, the wards are equipped with all of the facilities necessary for optimum working efficiency. Room sizes vary between one-bed room and six-bed room. The maternity department includes the delivery section and the required ward with nursing facilities for infants. The surgery unit comprises operating theatres and anaesthetic rooms, with the preparation, scrub room and lavatory sandwiched between the operating theatres. There is open space for bed parking. The sterile area also encompasses the recovery room and intensive care area followed by central sterilization which is subdivided into a working room and a store for sterile goods, and finally, yet outside the sterile area, the dressing rooms.

8.4.2. Administrative Department

The administrative department will be located near the hospital entrance and will be separated into 3 sections.

- administration
- locker rooms and lavatories for personnel
- storage

8.4.2.1. The Administrative Section will be one center of hospital operation.

8.4.2.2. The locker rooms and lavatories will be established for all the workers. The ratio of female and male workers probably 2 to 1 will be considered to establish the most convenient utilization among the workers. Washing facilities are provided in accordance with the number of persons starting or ending their duties at the same time.

8.4.2.3. The storage will handle all supplies with the exclusion pharmaceutical supplies, food, and oil supplies.

8.4.3. Functional Arrangement of the Supply Unit.

The provision of supplies in the hospital should be at a maximum efficiency in a manner that the suppliers do not cross any internal passages. The machinery operating at a high noise level will be located away from the patients.

8.4.4. Other Facilities

To maximize the hospital efficiency, the optimal size of the kitchen, staff dining room, laundry, maintenance rooms and mortuary should be determined. Technical center such as boiler room, generator, incinerator workshop will be placed underground.

8.5. Design Principle

Hospital design should follow the city planning code, building code, fire laws and other regulations of the Republic of Korea regarding construction of hospitals and buildings.

8.5.1. The architectural planning of the hospital is based on a "modular planning system". The development of this system was preceded by a study of the functions and the operational, economical and constructional interdependence of the individual medical sections, with due regard to constructional and architectural requirements. Separation of interior and exterior traffic routes is considered according to practical requirements for the traffic of persons and materials.

8.5.2. Module System

The system is in its integrity based on a three-dimensional 30 cm module, the basic scanning field being the quadruple module = 120 cm and the large scanning field being the three fold basic scanning field = 360 cm. All dimensions of the building are selected to fall in line with one or any number of large scanning fields. All rooms have an inner height of 270 cm. All wings, except the entrance and the autopsy unit, have the same height.

The proposed modular planning system serves the following purposes:

- Construction of hospitals of size varying between 50 and 250 beds, through the assemblage of selfcontained modules.
- Extension of such hospitals whenever desired by simply adding new modules, thus avoiding rebuilding.
- Keeping running costs at a minimum.
- Installation of air-conditioning, required minimally
 - Rearrangement of modules without any special difficulties to meet changing medical requirements.
 - Choice of reinforced concrete construction, and partly movable partition walls.
 - Possibility of continuous adaptation to future requirements.

8.6. Specifications for Architectural Work

Without special notes, construction should be constructed with general standard specifications for building construction as per the building codes in Korea.

8.6.1. Architecture

Method of carcass work is a reinforced concrete construction system under special consideration of architectural facade design. Main structure is composed of four basic elements; columns, girders, floor slabs, and wall. The grid dimension is 7.20 m x 7.20 m,

the associated suspended ceiling and the floor form a free hall. The weight of the roof and the ceiling as well as of the incorporated installations is transmitted to the foundation through the roof and the outer walls are conveyed to the foundation or the flooring. Under the corridor there is a basement serving as installation passage for all installations. The installation passage can be frequented and permits access from the outside. Hence, Maintenance and repair can be carried out without interference with the work going on inside the hospital. The outer walls are based on foundations commensurate with the local conditions where as the two side walls of the corridor rest on the two side walls of the installation passage. All the other partitions have no foundation but are supported by a flooring of no less than 10 cm thickness. The floor proper and the wall joints must be carefully executed as they are essential contributing factors to the overall hygiene of the hospital. The floor paving must be carefully jointed, antibacterial and easy to clean. Moreover, the individual rooms, passages and the veranda must all be at the same level so that hospital bedsteads can be wheeled about without being subjected to jolts or vibrations. In rooms where the danger of explosions exists (as in operating rooms), the PVC covering will be of the electrical conductive type, with a conduction resistance value of about 10^5 ohms. A network of copper foil inserts will be underlaid as grounding and connected with the neutralizing conductor.

Site location:

Main building area: Total area : 15,000 m²

	Area	Fl. height
Basement :	2,125.44m ²	5.1 m ²
First floor :	3,823.20m ²	4.2 m ²
Second floor :	3,823.20m ²	4.2 m ²
Third floor :	1,710.72m ²	3.6 m ²
Fourth floor :	1,710.72m ²	3.6 m ²
Fifth floor :	1,710.72m ²	3.6 m ²
Other :	96 m ²	3.0 m ²

8.6.2. Design of facade

Architectural facade should be simply designed with a modern feeling. The hospital building should fit into the environmental conditions, orientation and level of building site, traditional concepts, etc.

All exterior surfaces will receive a slightly profiled fair - faced concrete shuttering finish, and partly showing natural stone or bricks.

8.7. Electrical Installation

In the planning and execution of the entire electrical engineering system, the pertinent regulations of Korea are used as guidelines.

8.7.1. Power installation

The power will be supplied by the main electric power plant of building from Korea Electric Company line, 22,900 V-Y, heavy power. First stage of distribution voltage Received 22,900 V-Y and voltage down in to 3,300 V-A Supply to each station 3,300 V-A

Second stage of distribution voltage

light and heat	:	3ø 4w 380/220v	AC 60Hz
general power	:	3ø 4w 380/220v	AC 60Hz
cooling power	:	3ø 4w 380/220v	AC 60Hz
refrigerator	:	3ø 4w 3,300v	AC 60Hz
medical equipment power:	:	3ø 4w 380/220v	AC 60Hz

8.7.2. High tension switches:

Main	:	M. O. C. B
Tie	:	M. O. C. B
Branch	:	M. O. C. B

All connections between the sections and the transformers consist of synthetic resin insulated cables with realed connectors. Supply of power requirement is provided by transformers equipped with thermal circuit breaker and Buchholtz relays.

8.7.3. Low tension switches:

Main	:	A. C. B
Tie	:	A. C. B
Branch	:	N. F. B

The low tension station is a steel construction. The station houses automatic regulation and the power control mechanism of the emergency power supply as well as power switches and fuses.

8.7.4. Emergency power supply

An emergency power supply unit is installed to provide for the necessary supply of emergency power in time of power failure. The generator is a diesel-powered, water cooled, and has a 3-phase exist of 220 V AC 60Hz. The generator automatically self-starts at power failure through the automatically controlled starter battery, and is located in the low tension station.

8.7.5. Low current installations.

The hospital building should have the following facilities installed:

- (1) Telephone installation
- (2) Clock installation
- (3) Fire alarm system
- (4) Collective antenna system
- (5) Public address and nurse paging system
- (6) Elevators

8.8. Mechanical Installation

8.8.1. Heating system

Design and installation of the heating system is based on the relevant regulations. The following heat generators will be installed:

Boiler for the supply of the general heating and air exchange system.

Boiler for the hot water supply system.

Boiler for the generation of steam.

The oil burners to be installed use Banker-C Oil.

The central boiler plant houses all necessary distributors with pumps and valves or sliding valves. It also accommodates the water treatment plant for the steam generator.

8.8.2. Air Conditioning, Ventilation

Design and installation are based upon the relevant regulations.

For ventilation as well as air conditioning, a decentralized system is foreseen. The installations are sectionally sub-divided in such a way as to permit simultaneous operation or individual operation, so that operative sections of the compound can be run or de-activated individually. Extract ventilation ducts are provided for less important rooms, like storage rooms, lavatories, etc., Power ventilation units will be provided for kitchens, corridors, stair cases, and entrance halls. Wards, lobbies, offices, consulting and treatment rooms will be partially airconditioned using power convectors.

Operation rooms and adjacent facilities will be fully airconditioned.

8.8.3. Design and development of sanitary equipment and installations conforms to the relevant regulations. Enough water, of potable quality, must be at hand on the site. The sanitary installations comprise: pure water supply, waste water disposal, fire safety piping inside of the building, and drain-piping for rain water.

The waste water from the sanitary fixtures as well as any water from roof areas (rain) are conducted in pipes running in shafts and, in the basement, connected to the main sewer. The system provides for proper separation of the potable water pipes from the waste water piping and also has a built-in neutralization device. It is not necessary to install a decay and dilution plant. The hot and cold water distributors are in the central boiler room. The individual fixtures and equipment units are grouped according to their purpose and location so that they may be sectionally shut off, drained, or heated. The design provides for "dry" rising pipes in the staircases. The feeder coupling (B-type) for the fire brigade is located at the entrances of the building. Each wall hydrant is fitted with a fire extinguisher.

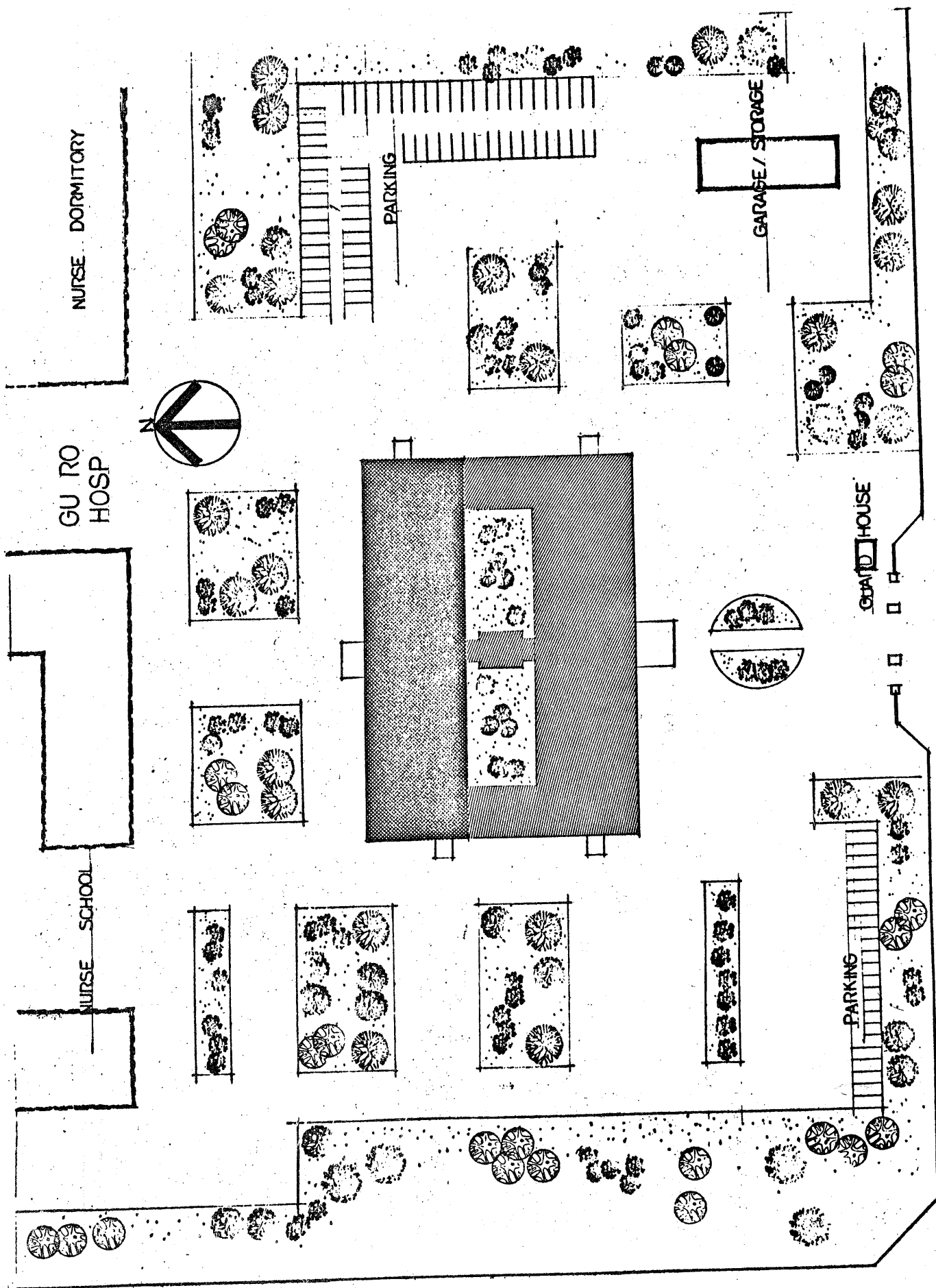
9. Sponsor of the Proposed Hospital Refer to the Feasibility Study on Hospital Construction for the Medically Under-served Area (I) Yeosu.

Design Schedule

Works	Month		1		2		3		4	
	Date		15	30	15	30	15	30	15	30
1. Architectural Design										
Preliminary Design										
Working Detail Drawing (Structure)										
Working Detail Drawing (Architecture)										
Specification Writing										
Cost Estimation										
2. Mechanical Design										
Preliminary Design										
Detail Design										
Specification Writing										
Cost Estimation										
3. Electrical and Communication Design										
Preliminary Design										
Detail Design										
Specification Writing										
Cost Estimation										
4. Civil Engineering Design and Cost Estimation										

Construction Working Schedule

Works	Month		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15	
	Date		15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30
1. Site Preparation and Civil Work																																
2. Building Construction																																
Temporary Work																																
Earth Work																																
Carpentry Work																																
Concrete and Reinforced Concrete Work																																
Masonry Work																																
Door and Windows																																
Plastering Work																																
Glazing Work																																
Tile and Finishing Work																																
Painting Work																																
Miscellaneous Work																																
3. Mechanical Construction																																
Heating																																
Cooling and Ventilation																																
Water Supply and Sanitary Work																																
Gas, Air line etc.																																
Miscellaneous Work																																
4. Electric Construction																																
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Electric Wiring																																
Light Fixture Work																																
Electric Power Work																																
Generator System																																
Communication Work																																

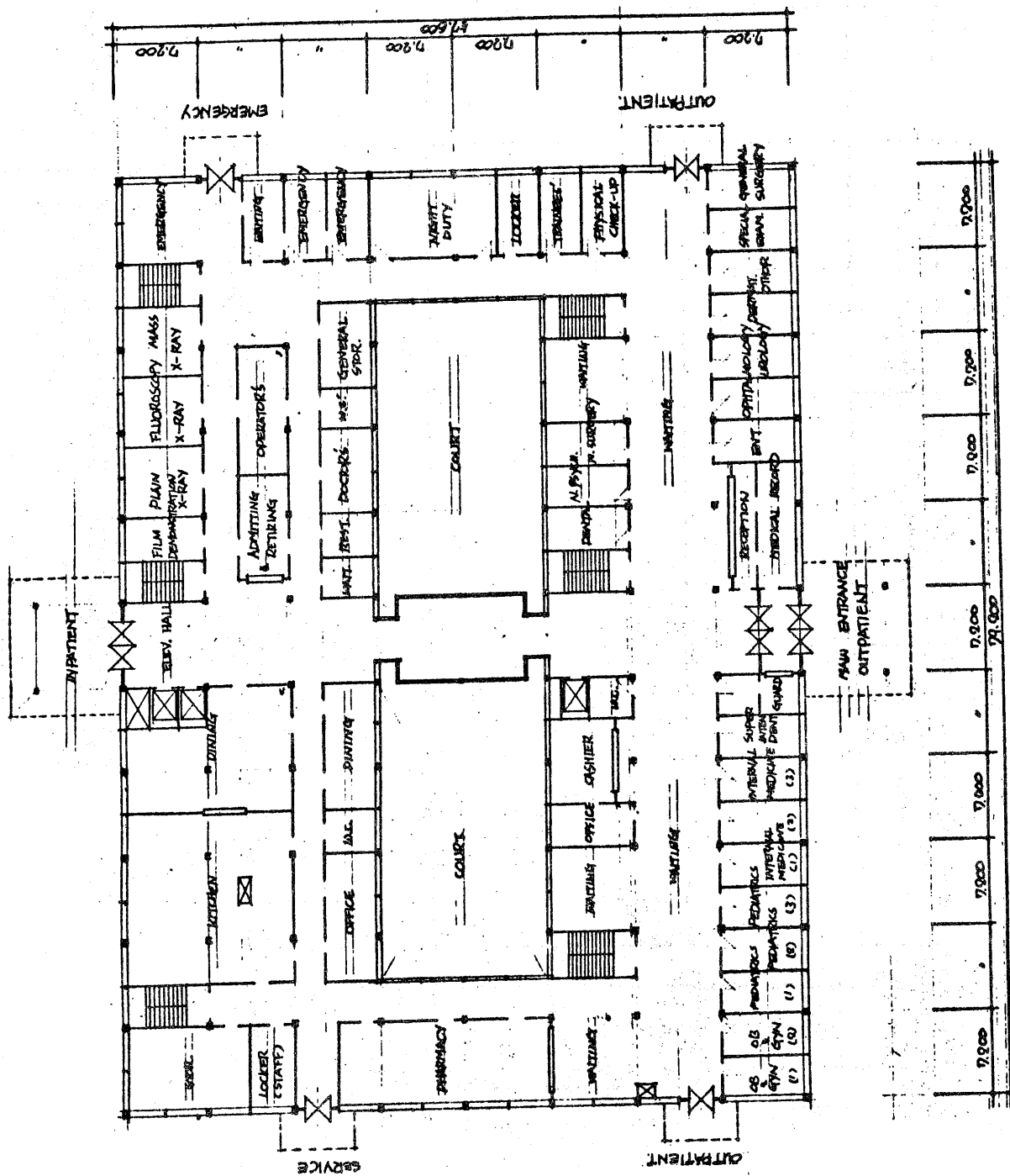


A SITE PLAN c 250 BEDs
 S : 1/1200
 G/GROSS AREA 15,000 M²

This architectural floor plan shows a building layout with the following rooms and dimensions:

- Top Section (Left to Right):**
 - ROOM 1: 7.200 x 7.200
 - ROOM 2: 7.200 x 7.200
 - ROOM 3: 7.200 x 7.200
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 - ROOM 5: 7.200 x 7.200
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 - ROOM 166: 7.200 x 7.20

GU RO
HOSP.



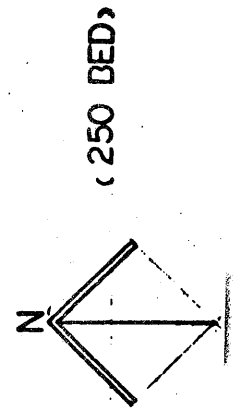
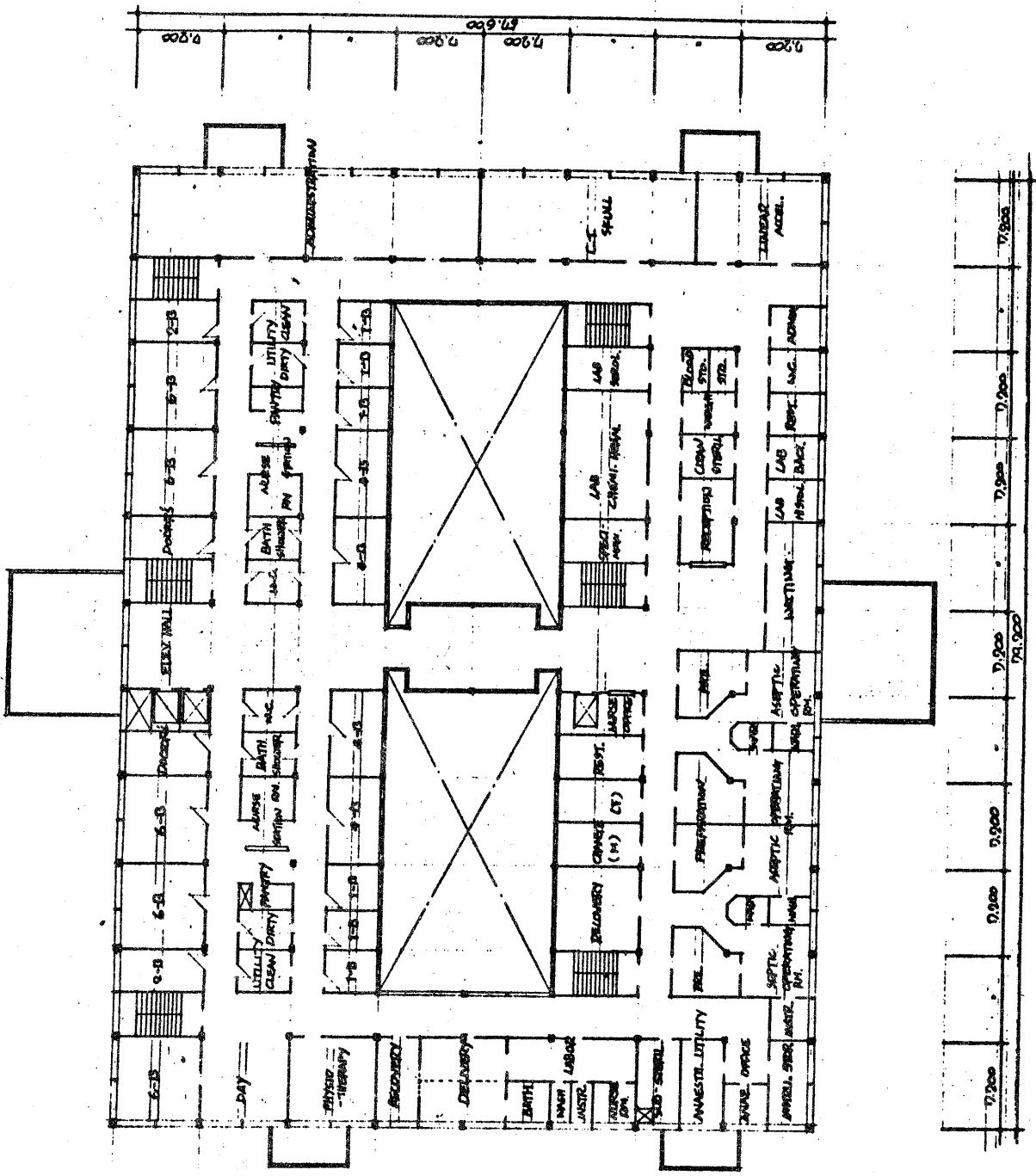
250 BED

1st FLOOR PLAN

S : 1 / 600

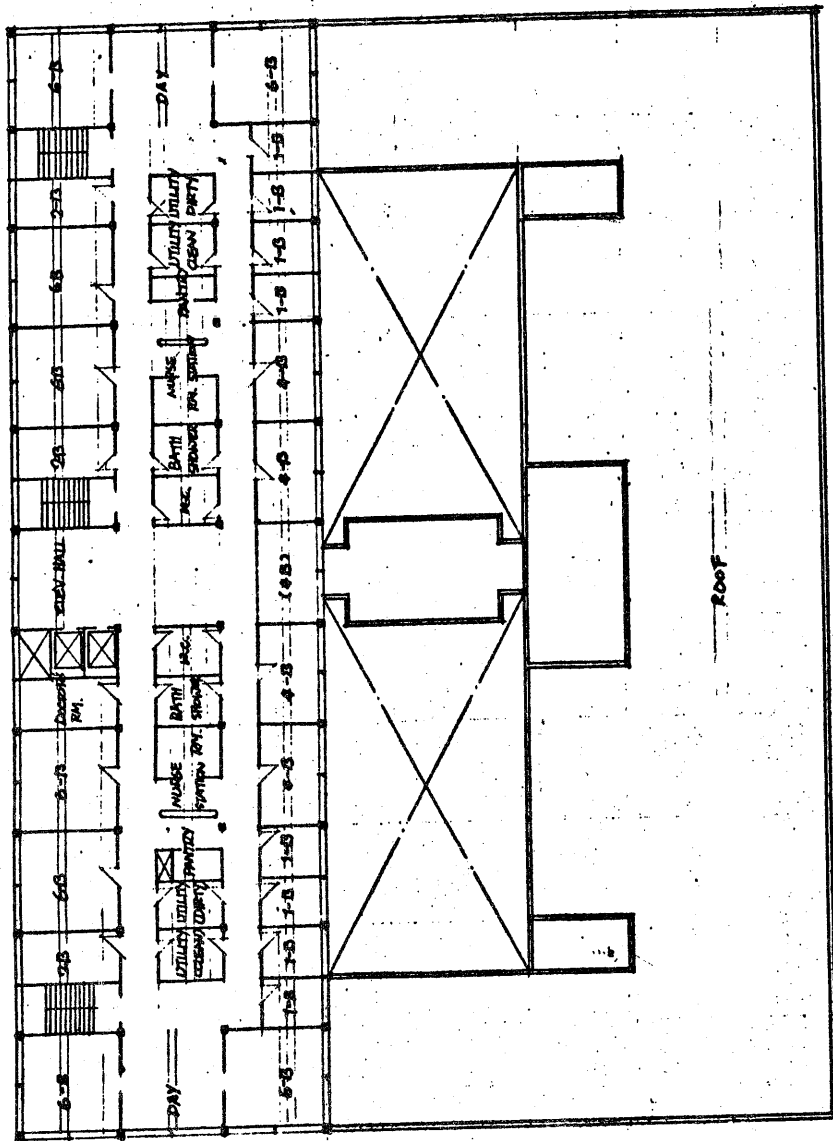
(3823.20 M²)

GU RO
HOSP.



2ND FLOOR PLAN -
A
S : 1/600
(3823.20 M²)

(250 BED)

[illegible]

(250 BED, (3.4.5 FL)

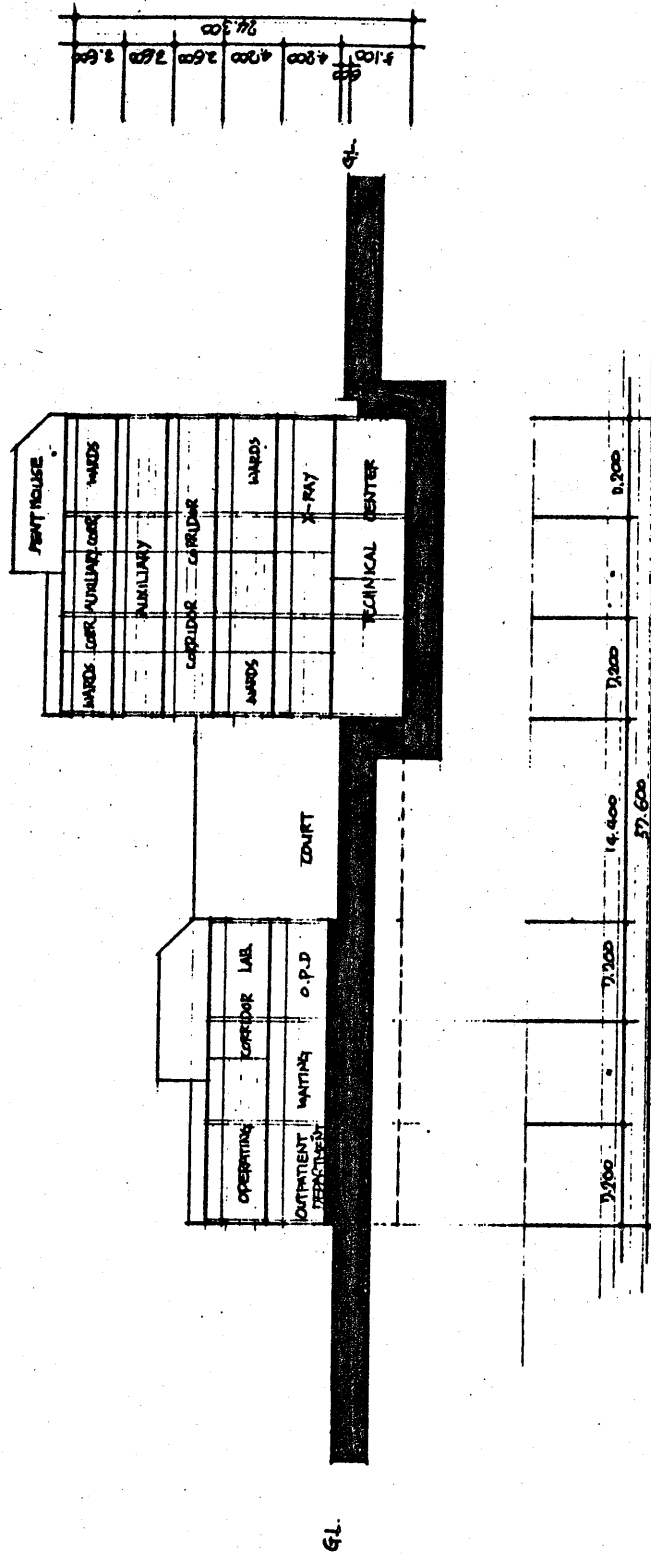
TYPICAL FLOOR PLAN

S : 1/600

S : 1/300

(1710.72 M²)

GU RO
HOSP.



MAIN SECTION (250 BED)
S : 1/600

10 ADMINISTRATIVE SYSTEM OF THE GURO HOSPITAL

10.1. Relationship Between Guro Hospital and Korea University Medical Center

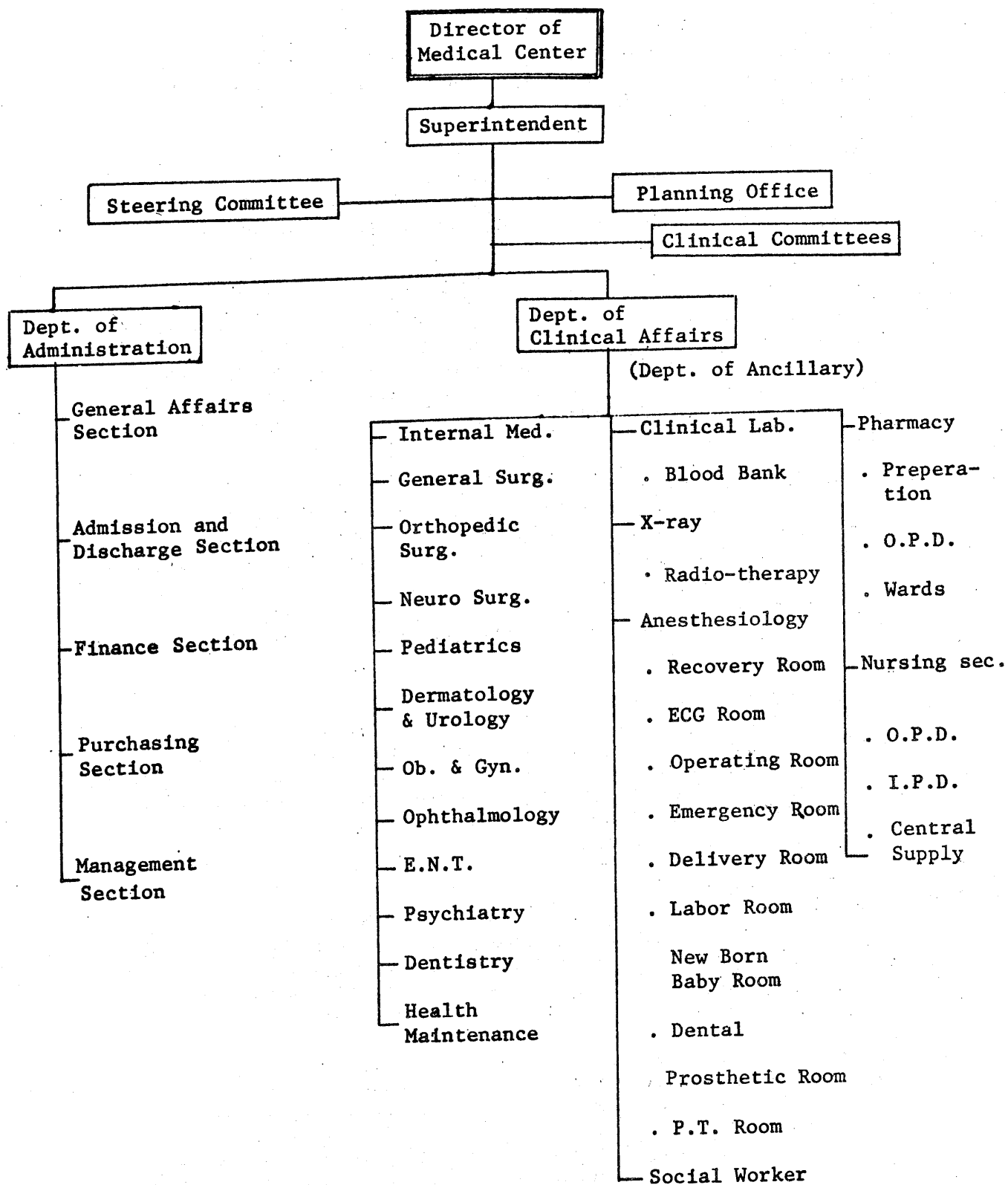
10.1.1. The reorganization process of the Korea University has resulted in the establishment of the University Medical Center. Under this Medical Center, the University Medical College and the University Hospital will perform their respective functions. The Guro Hospital will function as an attached institution to the Korea University Hospital, receiving support from University Hospital. The Guro Hospital is the first university affiliated hospital to be located south of the Han River. This hospital must function in a manner to meet the great expectations of the general population in this area. In order to fulfill this expectation, Guro Hospital will increase its capacity to handle the many cases arising from this industrial complex area. The Guro Hospital with a bed-capacity of 250 must be able to function independently in a manner effectively meeting the expectations and handling the complex clinical problems of the population in this area. Its independent function will be possible through the support of the specialized medical manpower of its mother hospital, the Korea University hospital. The above mentioned situation requires the Guro Hospital to be a modern hospital. Administratively, the Guro Hospital will be controlled by the Medical Center; however its clinical functions will be independent. The Medical Center of the Korea University will give professional support for the further development of Guro Hospital.

10.2. Organization system of Guro Hospital
Effective operation of a hospital can be obtained through rational and effective coordination among the various departments existing in the hospital organization.
In order to assure the general coordination of the entire hospital operation, the Guro Hospital has organized a steering committee, planning office, administrative departments, clinical departments and clinical committees. In organizing the hospital organizational system, higher priority was given to clinical functional activities, and consideration was also given to ancillary department. (See attached organizational chart of Guro Hospital)

10.2.1. Superintendent
The superintendent will represent the hospital and will be responsible for the entire operation of the hospital including clinical activities, ancillary activities, administrative activities, and, under the supervision of the director of the Medical Center, will command and supervise the concerned personnel.

- 10.2.2. Steering Committee
The steering committee is the principal advisory agency of the superintendent for establishment of policy and procedures for the entire operation of the hospital.
- 10.2.3. Planning Office
Planning office is not a line of organization but an assisting staff organization to the superintendent for the planning of entire operation of hospital, budgeting, development and auditing activities.
- 10.2.4. Department of Clinical Affairs
The director of clinical affairs will be appointed from among the chiefs of clinical departments, as an additional duty. The chief of clinical affairs will perform coordinative activities among the clinical departments and ancillary departments in order to promote the entire clinical activities of the hospital under the direction of the superintendent.
- 10.2.4.a. Clinical Departments.
The department of clinical affairs consists of internal medicine, general surgery, orthopedic surgery, neurosurgery, pediatrics, OB. & GYN., ENT, ophthalmology, dermatology and urology, psychiatry, dentistry and health maintenance. Chiefs of clinical departments are responsible for the operation of each department including management of clinical facility and instruments under the direction of the superintendent.
- 10.2.4.b. Ancillary Departments and Office (or Room)
The ancillary department consist of various functions such as clinical laboratory, blood bank, X-ray, radio-therapy, anesthesia, operating theater, recovery, emergency, labor and delivery, nursery, EKG, dental prosthetic laboratory, physio-therapy, nursing section, central supply and social worker section, in order to provide required clinical supportive function.
- 10.2.5. Clinical Committees
In order to improve scientific clinical activities, the hospital will operate a medical ethics committee, operating room committee, tissue committee, cost and drug committee, medical records committee, patient nutrition committee and research committee under the control of superintendent.
- 10.2.6. Department of Administration
The department of administration has a director. Under the direction of the superintendent the chief of the department will be responsible for management of all administrative activities other than clinical and ancillary functions. To do the above duty, the department will be divided into the general affairs section, admission and discharge section, finance section, purchasing section and management section.

Organizational Chart of GU RO Hospital



10.2.6.a. General Affairs Section

The general affairs section will perform the following duties:

- all general administration
- personnel management
- management of vehicles
- patients food service and operation of cafeteria
- library activities
- security
- others

10.2.6.b. Admission and Discharge Section

The admission and discharge section will perform the following duties:

- patient administration
- admission and discharge activities
- outpatient administration
- medical insurance administration
- medical record and statistics activities
- operation of ambulance

10.2.6.c. Finance Section

The finance section will perform the following duties:

- financial affairs
- accounting activities
- cashier services
- payment activities

10.2.6.d. Purchasing Section

The purchasing section will perform the following duties:

- market survey
- purchasing of general materials
- purchasing of food
- purchasing of drugs and medical expendable items
- inspection of purchased materials

10.2.6.e. Management section

The management section will perform the following duties:

- issue and estimation of all material requirements
- receiving, issuance and storage of all materials
- utility and security activities
- operations of power room, boiler room, and water supply
- engineering activities
- management of other items

11. MANPOWER REQUIREMENT OF GURO HOSPITAL

11.1. Basis of Estimation for Hospital Personnel

Staffing guide for estimation of Guro Hospital personnel requirement is as follows:

1. Classification of duty:
All personnel are classified into medical duty, nursing duty, medical technician duty, administrative duty, and other duty for the purpose of estimation. Each duty group will be broken down in accordance with functions and details of the personnel
2. Annual working days:
The annual working days will be 280 days per year.
3. Standard workload for a man per day according to the duty was based on the regulations set by the Medical Law, the workload obtained from survey of existing hospitals, and also specific functions of the hospitals.
This estimation does not consider the possibility of this hospital becoming a teaching hospital.

11.2. Estimated Manpower Requirement

The estimated personnel requirement for Guro Hospital totals 344 personnel. The classification by group duties and details are as follows: (See ANNEX- estimation of Guro Hospital Manpower Requirement.)

Medical group	32
Nursing group	153
Medical Technician group	22
Administrative group	26
Other group	111
<hr/>	
Total	344

This breakdown was calculated on the basis of the following estimations:

11.2.1. Estimated Requirement of Medical Group Manpower

Estimation of full time physician requirement is based on the following considerations:

1. Number of clinical and ancillary departments (medical doctors)
2. Number of inpatients and outpatients
3. Legal standard of medical law (clinical departments and number of physicians)
4. Characteristics of the area of Guro Hospital
5. Applied formula

$$Nmd = \frac{Pie}{Ki} + \frac{Poe}{Ko}$$

Where,

- Nmd : Number of medical doctors
- Pie : Average inpatients per day
- Poe : Average outpatients per day
- Ki : Legally authorized beds for a doctor per day
- Ko : Legally authorized outpatients for a doctor per day

The estimated number of full time physicians including the superintendent are 32 personnel. The above number of physicians will vary should the hospital be designated as a teaching hospital and will depend on teaching subjects and authorization of number of trainers.

11.2.2. Estimated Requirement of Nursing Staff
 Estimation of nursing manpower is based on the following considerations:

1. Number of outpatients of clinical departments, general inpatients and intensive care cases in the primary nursing functions.
2. Nursing administration, emergency room, operating room, delivery room, central supply, nursing personnel in the specific nursing functions.
3. Applied formula

$$\text{Nrn} = \frac{\text{Poe}}{\text{Ko}} + \frac{\text{Pie}}{\text{Koi}} + \frac{\text{Piex}}{\text{Kiex}}$$

Where, Nrn : Number of nurses
 Poe : Average number of outpatients per day
 Ko : Legally authorized outpatients for a nurse per day
 Pie : Number of inpatient beds per day
 Koi : Legally authorized inpatient beds for a nurse per day
 Piex : Average intensive care patient beds per day
 Kiex : Standard number of intensive care patient beds for a nurse per day

The estimated requirement for nurses was calculated to be 153: 130 primary function nurses and 23 specific function nurses. Approximately 50% of the primary function nurses can be substituted by nurse-aides.

11.2.3. Estimated Requirement of Medical Technician Manpower
 Estimation of medical technician manpower is based on the following considerations:

1. Number of clinical support examinations for inpatients according to specific functions.
2. Number of clinical support examinations for outpatients by each function
3. Necessity of night duty requirement
4. Standard examination capability per man per day according to specific functions

Clinical support manpower according to specific functions is estimated as follows:

11.2.3.a. Laboratory Technician Manpower is based on the following formula:

$$\text{NI} = \frac{\text{Pie L} + \text{Poe L}}{\text{KI}} + \text{C}$$

Where, NI : Number of laboratory technicians
 Pie L : Average number of examinations for inpatients per day
 Poe L : Average number of examinations for outpatients per day
 KI : Standard examination cases for a man per day
 C : Number of night duty laboratory technicians

11.2.3.b. X-ray technician manpower was based on the following formula:

$$N_x = \frac{Pie\ X + Poe\ X}{K_x} + C$$

NOTE: N_x : Number of X-ray technicians
 $Pie\ X$: Average X-ray films taken for inpatients
 $Poe\ X$: Average X-ray films taken for outpatients per day
 N_x : Standard number of X-ray films taken by a man per day
 C : Number of night duty technicians

11.2.3.c. Other required medical technician manpower were 5 technicians including 1 E.C.G. technician, 3 P.T. technicians, and 1 dental technician.

It was estimated that a total of 22 technicians were required in accordance with the above calculation. About 30 percent of medical technicians requirements can be substituted with aide personnel.

11.2.4. Estimated Requirement of Administrative Manpower
Administrative manpower was estimated based on the following consideration:

1. Number of outpatients
2. Number of inpatients
3. Additional work loads based on the number of hospital beds
4. Applied formula

$$N_a = \frac{Pie + Poe}{K_a} + \frac{B}{K_b}$$

Where, N_a : Number of administrative manpower
 Pie : Average number of inpatients per day
 Poe : Average number of outpatients per day
 K_a : Standard administrative cases for a man per day
 B : Number of hospital beds
 K_b : Additional administrative work loads based on the number of hospital beds

Based on the above calculation it was estimated that 26 administrative personnel are required.

11.2.5. Estimated Requirement of Other Manpower
Other manpower was estimated as follows:

- a. Required Pharmacists is calculated based on the following considerations:

1. Number of drug preparations for outpatients
2. Number of drug preparations for inpatients
3. Necessity of night duty
4. Standard capability of drug preparation for a man per day

5. Applied formula

$$N_p = \frac{P_{iEP} + P_{oEP}}{K_p} + C$$

Where, N_p : Number of pharmacists
 P_{iEP} : Average drug preparation for inpatients per day
 P_{oEP} : Average drug preparation for outpatients per day
 K_p : Standard preparation per man per day
 C : Number of night duty pharmacists

It was estimated that 9 pharmacists are required based on the above calculation. About 30 percent of pharmacists are replacable with aide personnel.

- b. The central supply room manpower requirement, based on the existing 250 bed hospital's actual manpower statistics, is estimated to be 20 personnel, 10 expendable medical material workers and 10 sterilization workers.
- c. Housekeeping manpower requirement is estimated to be 13 personnel based on one man for 600 m² of occupied building area.
- d. Food service manpower requirement is estimated to be 25 personnel. 3 dieticians based on one dietician per 100 beds, 2 cooks based on one cook per 150 beds, 10 aide cooks based on one aide per 25 beds, and 10 food-delivery men based on one man per 25 beds are the means of estimation.
- e. Laundry manpower requirement is estimated to 15 personnel. 10 laundry men based on one man per 25 beds and 5 repair men based on one man per 50 beds are the means of estimation.
- f. The remaining manpower under the other manpower category include 5 miscellaneous workers based on two men per 100 beds, 4 drivers (including 2 ambulance driver), 4 boiler room workers, 4 electric power room workers, 3 carpenters, and 10 information and guard men. Therefore, the total estimated manpower requirements under the other manpower category are 30 personnel.

11.3. Pay Roll System

The following are considerations taken in determining the pay roll system for the hospital personnel.

1. Medical doctors will be well paid in order to employ highly qualified physicians.
2. Administrative personnel will be minimized and paid well in order to employ highly qualified personnel.
3. Pay roll systems will be classified into 5 categories such as physicians, nurses, administrators, technicians and functional workers in order to secure their specialties.
4. Payment will include basic pay and allowances (Adjustment, duty, technical, night duty and danger) and 400% of bonus pay based on basic payment. (See ANNEX Pay Roll System)

The attached pay roll standard was prepared in accordance with above criteria. (See ANNEX Pay Roll System)

12. ESTIMATED REQUIREMENT AND COST OF MEDICAL EQUIPMENT, FURNITURE,
MEDICAL EXPENDABLE ITEMS AND COSTS FOR GURO HOSPITAL

12.1. Medical Equipment

Medical equipment was selected based on the following criteria in order to meet the roles and functions of Guro Hospital.

1. Required equipment and quantity are decided to perform the established functions of each clinical department. (example: establish the scope and type of operation)
(See ANNEX - Functional Level of 250 Bed Hospital)
2. The equipment needed as perceived by the Korea University authorities are marked with an asterisk(*) .
3. Equipment was grouped into basic medical equipment and minor medical equipment in accordance with functions of each department.
4. Equipment is classified by department and room in accordance with room space allocation.
5. Mutual use equipment is specially classified in order to avoid duplication of equipment. (example: mutual use items for surgical department)
6. Domestically purchased equipment and foreign purchased equipment are separately marked.
7. Cost was calculated based on the dollar(\$) exchange rate of 28 Feb., 1979.

12.1.1. Estimated Requirement of Medical Equipment

Estimated total cost required for medical equipment of Guro Hospital was \$4,830,600. Cost of medical equipment for clinical and administrative departments are as follows (Equipment list shows 2,169 items in about 300 kinds of equipment): (See Table C-63 and ANNEX Equipment Requirement)

Table C-63. Cost of Medical Equipment by Department

Medical Department	(Guro Hospital)
	Estimated Cost (U.S.\$)
Emergency Room	47,610
Internal Medicine	76,901
Surgery	945,049
Orthopedic Surgery	92,468
Neuro Surgery	31,075
Pediatrics	8,887
Ob. & Gyn.	78,086
E.N.T.	35,605
Ophthalmology	75,531
Dermatology & Urology	45,340
Neuro Psychiatry	52,254
Dentistry	34,579
Health Care Delivery	4,335
Clinical Laboratory	111,413
Autopsy Room	40,703

(continued)	
Medical Department	Estimated Cost (U.S.\$)
X-ray Room	2,102,896
Surgical Operating Room	541,784
Delivery Room	48,485
P.T. Room	34,250
Wards & Nursing Stations	267,900
Pharmacy	46,475
Central Supply Room	88,640
Total	4,830,600

12.2. Furniture and House Goods
Furniture and house goods are selected based on the following standard:

1. Functions and number of personnel of each department
2. Space allocations of each department and section
3. Domestically purchased and foreign purchasing item
4. Cost are based on U.S. dollar exchange rates of dollars as 28 Feb., 1979

12.2.1. Estimation of Furniture and House Goods
Required cost of furniture and house goods is \$110,200. The distribution according to department are as follows:

emergency room	\$691
outpatient clinics	\$10,653
clinical laboratory	\$4,025
autopsy room	\$490
x-ray department	\$2,699
operating room	\$5,112
delivery room	\$1,031
wards	\$11,315
administration	\$15,578
pharmacy	\$6,909
kitchen	\$38,448
laundry	\$12,378
others	\$871

12.3. Drugs, Medical Expendables and Medical Materials
Estimated cost of drugs, medical expendables, medical materials and other supplies for operation of Guro Hospital was figured by using percentage of costs similar to existing hospitals.

1. Percentage of cost for drugs and medical expendables makes up 25% of the total operating expenses of existing 250 bed hospitals.
2. Percentage distributions are as follows:

Drugs	83%
Medical expendables	5%
Medical materials	8%
Others	4%
Total	100%

Cost required for one-year supply of drugs, medical expendables, and materials for the Guro Hospital are as follows: based on 1977 cost (inflation factor not considered)

Drugs	₩508,504,000
Medical expendables	₩28,520,000
Medical materials	₩46,117,000
Others	₩23,665,000
Total	₩606,806,000

12.4. Vehicles

Estimated vehicle requirement and cost are as follows:
Total costs for the vehicles is estimated to be \$57,732.

Detailed Costs for Vehicles

Sedan	2	₩10,000,000 (\$20,619)
Ambulance	2	₩11,000,000 (\$22,680)
Micro bus	1	₩7,000,000 (\$14,433)
Total		₩28,000,000 (\$57,732)

12.5. Books

Hospital books will be classified into text books and periodicals, Required list of books will be recommended by clinical departments, clinical support departments and administrative sections, and final selection will be made by library committee. Requirements are estimated at approximately \$25,000 for text books (\$50 x 500 =), and \$2,000 for periodicals (\$40 x 50 =). Total of \$27,000 is required for the library.

13. TOTAL INVESTMENT AND FINANCING

- 13.1. The total investment cost required for the Guro Hospital which is to be sponsored by the Korea University is \$15,814,814 (₩7,591,111,000) as shown in Table C-64-1.

Table C-64-1.

Guro Hospital (250 beds)
INVESTMENT COSTS 1/

Category	Local Cost	Foreign Cost
Land estate	₩1,909,200,000	\$3,977,500
Site preparation	30,000,000	62,500
Construction	2,874,000,000	5,987,500
Medical and non-medical equipment	2,371,584,000	4,940,800
Outside equipment	120,000,000	250,000
Contingencies (price and physical) <u>2/</u>	157,500,000	328,000
Engineering fees	126,000,000	262,500
Working capital	160,327,000	334,014
Total investment	₩7,591,111,000	\$15,814,814

1/ See Appendix A 4-1

2/ Contingencies are not included in total investment cost because the Korea University Foundation is responsible for these contingencies

- 13.2. The sources of financing the investment cost of \$15,814,814 (₩7,591,111,000) to build a new hospital with 250 beds are as follows:

Table C-64-2.

Guro Hospital (250 beds)
SOURCES OF FINANCING

Total Investment	₩7,591,111,000 (\$15,814,814)
Foreign loan <u>1/</u>	3,029,584,000 (\$ 6,311,633)
Local loan <u>2/</u>	1,500,000,000 (\$ 3,125,000)
Korea University <u>3/</u>	3,061,527,000 (\$ 6,378,181)
Total financing	₩7,591,111,000 (\$15,814,814)
<u>1/</u> Equipment	₩2,471,584,000 (\$ 5,149,133)
Mechanical facilities	₩558,000,000 (\$ 1,162,500)
<u>2/</u> Local loans : ₩6,000,000 for each bed	
<u>3/</u> Land	₩1,909,200,000 (\$ 3,977,500)
Building and facilities	₩992,000,000 (\$ 2,066,667)
Working capital	₩160,327,000 (\$ 334,014)

- 13.2.1. Of the total amount needed, \$6,311,633 (₩3,029,584,000) will be provided by a West German loan. Its use is restricted to purchasing medical equipments and construction materials;

\$5,149,133 (₩2,471,584,000) to buy the equipments
\$1,162,500 (₩558,000,000) for construction materials.

- 13.2.2. Term of the foreign loan are repayment of all the principle in 20 years after a ten-year grace period at an annual interest rate of 2%.
- 13.2.3. The local loan will be secured from a Korean commercial bank (or banks). This will be arranged by the Korean Government for the Guro Hospital. The use of the local loan is restricted to the building costs of the hospital. The maximum amount of the local loan is \$12,500 (₩6,000,000) per hospital bed. Therefore \$3,125,000 (₩1,500,000,000) can be borrowed locally by the Guro hospital as it will have 250 beds.
- 13.2.4. The terms of the local loan are repayment of all the principle in seven years after a three-year grace period. The annual interest rate is 18.5%, out of which the borrower will be charged 7% and the Korean Government will be responsible for 11.5%. Therefore the net interest cost for the Korea University is 7%.
- 13.2.5. Korea University as the sponsor of the Guro Hospital will provide \$6,378,181 (₩3,061,527,000) for land purchase, working capital, and additional cost for construction.
- 13.3 The expected balance sheet of the Guro Hospital in the year before the operation is shown in Table C-64-3.

Table C-64-3.

Guro Hospital (250 beds)
BALANCE SHEET (BEGINNING OF OPERATION)

\$1 = ₩480
Unit: won

Assets		Liabilities	
Cash	₩83,616,000	Bank credit	₩0
Auxiliary goods	18,559,000	Account payable	0
Pharmaceuticals and medical articles	58,152,000	Draft	0
Equipment	2,371,584,000	Loans local:	1,500,000,000
		foreign:	3,029,584,000
Building	3,150,000,000	Reserve for Contingency	0
Land	1,909,200,000	Capital	3,061,527,000
Total assets	₩7,591,111,000 (\$15,814,814)	Total liabilities	₩7,591,111,000 (\$15,814,814)

14. ECONOMIC FORECASTING

- 14.1. For the estimation of total revenues in the future, medical care fees should be determined. To estimate medical charges in the future, two things must be classified; one is the present medical care fees and the other is the future increase in medical care fees.

- 14.1.1. To determine present medical care fees, a survey was conducted at several hospitals to determine medical care fees according to the disciplines. Because of limited data, the differences in medical charges between medical insurance subscribers and private patients can not be presented. Table C-65-1 is the result of the survey of 21 hospitals which had similar characteristics as those expected of the Guro Hospital.

Table C-65-1.

MEDICAL CARE FEES IN 1978
(over 200 beds Hospitals)

\$1 = ₩480
Unit: Won

Classification	Outpatient Fee per visit	Inpatient Fee per day
Internal medicine	3,800	16,200
General surgery	3,800	24,000
Orthopedic surgery	3,400	12,300
Neuro-surgery	3,900	17,800
Pediatrics	2,300	11,600
OB and GYN	3,000	19,000
ENT	3,400	15,000
Ophthalmology	2,900	12,000
Jaw surgery	4,200	12,000
Neuro-psychiatry	3,300	11,200
Urology	3,200	13,800

- 14.1.2. The average fees in Table C-65-1 represent gross costs charged by hospitals; inclusive of pharmaceuticals, X-ray's, medical tests, food and others.

- 14.1.3. Since there is a relatively large difference in the medical care fees charged by hospitals between insured patients and private patients, respective medical care fees should be estimated in order to calculate total future revenues. For this purpose, a survey was conducted to study the fees paid to hospitals by insured patients treated in the Guro area during 1978. The survey found that the average fees of insured patients are \$5.63 (₩2,700) for outpatients per visit, and \$27.1 (₩13,000) for inpatients per day (The classification by discipline was not available).

- 14.1.4. The following equation is developed to derive the average costs for insured patient by department, utilizing Table C-65-1 and the survey result mentioned in 14.1.3.

$$\text{Average medical fee} = X_i \times \frac{X_1}{X_2}$$

Where: X_i = Average medical care fee in i th department shown in Table C-65-1

X1 = Average medical care fee in 1978 for the insured
 (\$5.63 (₩2,700) per visit for outpatient and \$27.1
 (₩13,000) per day for inpatient)

X2 = Average medical fees in 1978 (calculated from Table C-65-1)

14.1.5. The medical care fees for private patients are estimated on the basis of a 1977 KPC Report, in which medical fees charged for private inpatients were 35% higher than fees charged for insured inpatients and about 23% higher in the case of outpatients. Also we considered the fact that average medical fees for insured patients have increased 20% in 1979, while fees for private patient have not undergone the similar increase. Considering these facts, we concluded that the average medical charge for private inpatients is 30% higher than fees for insured inpatients and 20% higher for outpatients in 1979.

114.1.6. Medical care fees in 1979 calculated according to 14.1.1 - 14.1.5. are shown in Table C-65-2.

Table C-65-2.

MEDICAL CARE FEE IN 1979
 (over 200 beds hospital)

\$1 = ₩480

Unit: Won

Classification	Out-patient(per visit)		In-patient(per day)	
	Insurance	Private	Insurance	Private
Internal medicine	₩3,900	₩4,680	₩19,000	₩23,400
General surgery	3,900	4,680	28,000	36,400
Orthopedic surgery	3,500	4,200	14,500	18,850
Neuro-surgery	4,000	4,800	20,900	27,170
Pediatrics	2,400	2,880	13,600	17,680
OB and GYN	3,100	3,720	22,300	28,990
ENT	3,600	4,320	17,600	22,880
Ophthalmology	3,000	3,600	14,200	18,460
Urology and dermatology	3,300	3,960	16,200	21,060
Neuro-phychiatry	3,400	4,080	13,200	17,160
Jaw surgery	4,300	5,160	14,100	18,330

14.1.7. The future changes of the medical care fees for private patients and insured patients are predicted on the following three assumptions:

- 1) The fee difference between insured patients and private patients will be reduced gradually and eliminated eventually by the end of 1991 when the Korean government expects medical insurance to cover 100% of the population.
- 2) Increase rate of the medical care charge for private patients will stabilize over time, while the medical care fees for the insured will increase to reach the same level of the fees for the private patients.

Table C-65-3.

Guro Hospital (250 Beds)

ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st - 10th Year)

1979 Constant Price

1\$ = 480 Won
(Unit 1,000 Won)

Category	Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Out-patient	Insurance	120,057	160,959	198,935	245,848	303,867	373,835	447,755	536,305	642,310	769,426
	Private	283,996	273,070	267,461	260,130	250,953	239,668	211,150	178,271	140,617	97,095
In-patient	Insurance	578,090	739,930	886,255	1,061,409	1,271,348	1,503,272	1,800,524	2,156,597	2,583,276	3,094,031
	Private	1,361,261	1,329,574	1,338,325	1,334,563	1,344,231	1,342,394	1,223,678	1,085,301	927,243	740,933
Total	Insurance	98,148	900,889	1,085,190	1,307,257	1,572,215	1,874,108	2,248,280	2,692,902	3,225,686	3,867,457
	Private	1,645,257	1,602,644	1,696,267	1,604,716	1,596,343	1,582,063	1,434,828	1,263,573	1,065,859	838,628
Grand Total	Local	2,343,409	2,503,533	2,692,457	2,911,973	3,171,275	3,459,170	3,683,108	3,956,475	4,291,546	4,702,085
	Foreign (\$ = 000)	(4,881)	(5,217)	(5,608)	(6,067)	(6,606)	(7,206)	(7,673)	(8,242)	(8,942)	(9,796)

- 3) The real increase in medical care charges will be 6% annually for next ten years because of quality increase.
- 14.2. Table C-65-3 shows total estimated revenue each year for 10 years, which is obtained by multiplying the expected medical care fees (based on 14.1.1-14.1.7) by the estimated number of patients per year.
- 14.3. The total expenses include expenses for personnel, pharmaceutical and other materials, food and clothes, maintenance of building and equipment, heating and utilities, and administration. The expenses of each item are estimated for 10 years.
- 14.3.1. Because expenses for personnel are the main portion of total expenses, these have been broken down into expenses for physicians, nurses, technicians and administrative personnels.
- 14.3.2. Expenses for personnel in each category are calculated by multiplying estimated required manpower by average salary surveyed in 1979. For the next ten years a 6% increase in real salary is assumed per year.
- 14.3.2.1. 20% of manpower increases are assumed in 6th year and 10th year of operation.
- 14.3.3. Costs of pharmaceuticals and other materials, heating and utilities, and administrative cost have been estimated based on the survey conducted; the ratio of each expense to total expenses, and the ratio of each expense to total revenues of the hospitals which have similar characteristics as those of the planned Guro Hospital. Table C-65-4 shows the results of the survey. The ratio of each expense to the total revenues are used to estimate these expenses for the future, assuming that the ratios would be constant over time. Accordingly the cost of heating and utilities is 5.07% of the total revenues (without considering a quality increase) and administrative cost is 3.95% of total revenues without consideration of quality increase.
- 14.3.4. 29.8% of the total revenue considered as cost for pharmaceuticals and other materials.
- 14.3.5. The cost of food is estimated on the basis that the cost per meal is \$1.25(600 won) and \$3.75(W1,800) per day.
- 14.3.6. Maintenance cost for building is assumed to be 0.25% of the acquisition value and 2.5% for medical equipments a year.
- 14.4. Table C-65-5 presents the total cost estimated according to 14.3.1. - 14.3.6.

Table C-65-4.

COMPOSITIONS OF EXPENSES
(over 200 beds Hospitals)1/

Category (A)	A/Total expenses	A/Total Revenue
Personnel expense	45.75%	42.54%
Utilities	3.41%	3.17%
Heating	2.03%	1.90%
Clothes, and food	4.45%	4.23%
Pharmaceuticals and others	32.04%	29.80%
Equipment and Building Maintenance	4.62%	4.30%
Operating expenses <u>2/</u>	4.25%	3.95%

- 1/ This statistics is obtained from survey of 6 Hospitals;
The Choong-nam University Hospital, The Ehwa Woman's University Hospital,
The Yeonse University Hospital, The Soonchonhyang Hospital, and The St.
Vinscent Hospital.
- 2/ Operating expenses include vehicles, administrative expenses, taxes
(except income taxes) and others.

Guro Hospital (250 Beds)
ECONOMIC FORECASTING: ESTIMATION OF EXPENSES
(1st - 10th Year)

Table C-65-5.
1979 Constant Price

1\$ = 480 Won
(Unit: 1,000 Won)

Year	1st Year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Personnel	900,171	927,176	954,992	983,642	1,013,152	1,252,253	1,289,820	1,328,514	1,368,370	1,691,308
Physician	441,894	445,151	468,806	482,870	497,356	614,732	633,174	652,169	671,734	830,264
Nurse	214,097	220,520	227,136	233,950	240,969	297,837	306,772	315,975	325,455	402,262
Medical assistant	156,766	161,468	166,313	171,302	176,441	218,080	224,623	231,361	238,302	294,542
Mgt. and ad.	48,185	49,631	51,119	52,653	54,233	67,032	69,042	71,114	73,247	90,534
Technical service and others	39,229	40,406	41,618	42,867	44,153	54,572	56,209	57,895	59,632	73,706
Pharmaceuticals and X-ray	668,535	746,123	802,227	867,767	945,908	1,031,696	1,098,459	1,179,960	1,279,861	1,402,264
Food & Clothes	124,983	128,090	130,330	132,570	134,810	137,050	138,602	140,154	141,705	143,257
Maintenance	78,189	138,039	138,039	138,039	138,039	138,039	78,189	138,039	138,039	138,039
Building	18,900	78,750	78,750	78,750	78,750	78,750	18,900	78,750	78,750	78,750
Equipment	59,289	59,289	59,289	59,289	59,289	59,289	59,289	59,289	59,289	59,289
Utility and heating	108,096	117,892	120,002	122,112	124,222	126,332	127,666	129,000	130,335	131,669
Others	86,034	93,131	94,798	96,465	98,132	99,799	100,853	101,907	120,960	104,014
Total expenses local	1,966,008	2,090,601	2,180,538	2,280,745	2,394,413	2,725,319	2,833,589	2,957,724	3,101,420	3,550,701
foreign (\$ = 000)	(4,096)	(4,355)	(4,543)	(4,752)	(4,988)	(5,678)	(5,903)	(6,285)	(6,592)	(7,397)

Guaro Hospital (250 beds)
ECONOMIC FORECASTING : PRO-FORMA INCOME STATEMENT
(1st-10th year)

Table C-65-6.
 1979 Constant Price

\$1 = W480
 Unit = W1,000

Year	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Total	2,343,409	2,503,533	2,692,457	2,911,950	3,172,275	3,459,170	3,683,108	3,956,475	4,291,546	4,702,085
Total expenses	1,966,008	2,090,651	2,180,538	2,280,745	2,394,413	2,725,319	2,833,589	2,959,724	3,101,420	3,550,701
Operating income	377,401	412,882	511,919	631,205	777,862	733,851	849,519	998,751	1,190,126	1,151,384
Depreciation	300,158	300,158	300,158	300,158	300,158	300,158	300,158	300,158	300,158	300,162
Interest	165,563	165,563	165,563	165,563	153,433	140,448	126,558	111,698	95,798	78,781
Net profit local	* 88,320	* 52,839	46,198	165,484	324,271	293,245	422,803	586,895	794,170	772,441
foreign \$ = 000	* (184)	* (110)	(96)	(345)	(676)	(661)	(881)	(1,223)	(1,655)	(1,609)
* deficit										

Table C-65-7

Guero Hospital (250 beds)

PRINCIPAL AND INTEREST PAYMENT
(1st - 10th year)

\$1 = W480

Unit = W1,000

Year	1	2	3	4	5	6	7	8	9	10
Each payment	165,563	165,563	165,563	338,873	338,873	338,873	338,873	338,873	338,873	338,873
foreign	60,563	60,563	60,563	60,563	60,563	60,563	60,563	60,563	60,563	60,563
local	105,000	105,000	105,000	278,310	278,310	278,310	278,310	278,310	278,310	278,310
Interest payment	165,563	165,563	165,563	165,563	153,433	140,448	126,558	111,698	95,798	78,781
foreign	60,563	60,563	60,563	60,563	60,563	60,563	60,563	60,563	60,563	60,563
local	105,000	105,000	105,000	105,000	92,870	79,885	65,995	51,135	35,235	18,218
Principal payment	0	0	0	173,310	185,440	198,420	212,310	227,175	243,075	260,255
foreign	0	0	0	0	0	0	0	0	0	0
local	0	0	0	173,310	185,440	198,420	212,310	227,175	243,075	260,255
Balance of loans	4,529,584	4,529,584	4,529,584	4,356,274	4,170,834	3,972,409	3,760,094	3,532,919	3,289,839	3,029,584
foreign	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584
local	1,500,000	1,500,000	1,500,000	1,326,690	1,141,250	942,825	730,510	503,335	260,260	0

- 14.5. By combining Table C-65-3 and Table C-65-5, and considering depreciations and interest changes, the pro-forma income statement is presented in Table C-65-6.
- 14.5.1. Expected duration of the building is 50 years according to the Korean tax law and average expected utilization life of medical equipment is assumed to be 10 years. Straight line method is used for the calculation of depreciation.
- 14.5.2. The interest charge has been mentioned in 13.2.2. and 13.2.4; the annual rate is 2% for the foreign loan and 7% for the local loan. But the actual repayment of principal of the local loan would start in the fourth year and in the 11th year for foreign loan. The schedule of payment and interest charge by year is presented in Table C-65-7.
- 14.5.3. Income tax would be exempted for the Guro Hospital because it belongs to the Korea University Foundation.
- 14.6. Table C-65-8 is the pro-forma balance sheet of the Guro Hospital for ten years.
- 14.6.1. For the estimation of current assets, the principle that at least one twelfth of total expenses of the initial operation year should be kept as current assets has been adopted.
- 14.6.2. The principal payment of the local loan would start in the 4th year and in the 11th year for the foreign loan. The loan payments are assumed as being equal over time as shown in Table C-65-7.
- 14.6.3. It is assumed that all current liability is to be cleared out at the end of each year.
15. ESTIMATION OF CASH FLOW
- 15.1. Considering (14.1) - (14.6), estimated cash flow is presented in Table C-66-1.
- 15.2. Costs of operating and maintenance (1.1. - 1.7. in Table C-66-1) are presented in Table C-65-5.
- 15.3. Revenues (2.1 - 2.4 in Table C-66-1) are presented in Table C-65-3.
- 15.4. Profit calculation is presented in Table C-65-6.
- 15.5. Cash flow calculation is based on the principle that the Guro Hospital should have at least one twelfth of its operating expenses for the initial year of operation as current assets.

Table C-65-8

Guro Hospital (250 beds)
ECONOMIC FORECASTING : PRO-FORMA BALANCE SHEET
(1st-10th year)

1st = \$480
Unit = \$1,000

1979 Constant Price

Year	1st year	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Current assets	211,838	459,157	805,513	1,097,845	1,536,834	1,931,812	2,442,458	3,102,336	3,953,589	4,765,932
Equipment	2,371,584	2,371,584	2,371,584	2,371,584	2,371,584	2,371,584	2,371,584	2,371,584	2,371,584	2,371,584
depr.	237,158	474,316	711,474	948,632	1,185,790	1,422,948	1,660,106	1,897,264	2,134,422	2,371,584
Building	3,150,000	3,150,000	3,150,000	3,150,000	3,150,000	3,150,000	3,150,000	3,150,000	3,150,000	3,150,000
depr.	53,000	126,000	189,000	252,000	315,000	378,000	441,000	504,000	567,000	630,000
Land	1,909,200	1,909,200	1,909,200	1,909,200	1,909,200	1,909,200	1,909,200	1,909,200	1,909,200	1,909,200
Total assets	7,342,464	7,289,625	7,335,823	7,327,997	7,466,828	7,561,648	7,772,136	8,131,856	8,682,941	9,195,132
Current liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	1,500,000	1,500,000	1,500,000	1,326,690	1,141,250	942,825	730,510	503,335	260,260	0
Foreign loan	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584	3,029,584
Capital	2,901,200	2,901,200	2,901,200	2,901,200	2,901,200	2,901,200	2,901,200	2,901,200	2,901,200	2,901,200
Accumulated profit	0	* 88,320	* 141,159	* 94,961	70,703	394,794	688,039	1,110,842	1,697,737	2,491,907
profit	* 88,320	* 52,839	46,198	165,484	324,271	293,245	422,803	586,895	794,170	772,441
Total Capital and liabilities	7,342,464	7,289,625	7,335,823	7,327,997	7,466,828	7,561,648	7,772,136	8,131,856	8,682,941	9,195,132
\$ = 000	(15,641)	(15,876)	(16,317)	(15,267)	(15,556)	(15,753)	(16,192)	(16,941)	(18,089)	(20,160)

* deficit

Table C-66-1

1979 Constant Price
 Guro Hospital (250 beds)
 ECONOMIC FORECASTING: ESTIMATION OF CASH FLOW
 (1st-10th year)

	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1. <u>Operating and Maintenance</u>										
1.1 personnel	900,171	927,176	954,992	983,642	1,013,152	1,252,253	1,289,820	1,328,514	1,368,370	1,691,308
1.2 other	987,648	1,085,236	1,147,357	1,218,914	1,302,072	1,394,877	1,465,580	1,551,021	1,654,801	1,965,381
1.3 maint	78,189	78,189	78,189	78,189	78,189	78,189	78,189	78,189	78,189	78,189
1.4 int.	165,563	165,563	165,563	165,563	153,433	140,448	126,558	111,698	95,798	99,781
1.5 operating ex.	2,131,571	2,256,164	2,346,101	2,446,308	2,546,846	2,665,767	2,960,147	3,069,422	3,197,158	3,813,659
1.6 deprec.	300,158	300,158	300,158	300,158	300,158	300,158	300,158	300,158	300,158	300,162
1.7 op. cost.	2,431,729	2,556,322	2,646,259	2,746,466	2,847,004	3,165,925	3,260,305	3,369,580	3,497,316	4,113,821
2. <u>Revenue</u>										
2.1 outpatient	404,043	434,029	466,396	505,978	554,820	618,503	658,905	714,576	782,927	867,121
2.2 inpatient	1,939,352	2,069,504	2,224,580	2,405,972	2,615,579	2,845,666	3,024,203	3,241,899	3,510,519	3,834,964
2.3 other	0	0	0	0	0	0	0	0	0	0
2.4 whole revenue	2,343,409	2,503,533	2,692,457	2,911,950	3,172,275	3,459,170	3,683,108	3,956,475	4,291,546	4,702,085
3. <u>Profit Calculation</u>										
3.1 operating income	* 88,320	* 52,839	46,198	165,484	324,271	293,245	422,803	586,895	794,170	772,439
3.2 accumulation	* 88,320	* 141,159	* 94,961	70,703	394,794	688,039	1,110,843	697,737	2,491,907	3,064,348
3.3 income tax	0	0	0	0	0	0	0	0	0	0
4. <u>Cash Flow Calculation</u>										
4.1 gross, cash. flow	211,838	247,319	346,356	865,642	524,429	593,403	722,961	887,053	1,094,328	1,072,603
4.2 payoffs/discharge.	0	0	0	173,310	185,440	198,425	212,315	227,175	243,075	260,260
4.3 invested capital	0	0	0	0	0	0	0	0	0	0
4.4 net cash flow (4.1 + 4.3 - 4.2)	211,838	247,319	346,356	292,332	338,989	394,978	510,646	659,878	851,253	812,343
(\$ = 000)	(441)	(515)	(722)	(609)	(915)	(823)	(1,064)	(1,375)	(1,773)	(1,692)
4.5 accumulation of 4.4	211,838	459,157	805,513	1,097,845	1,536,834	1,931,812	2,442,458	3,102,336	3,953,589	4,765,932
(\$ = 000)	(441)	(956)	(1,678)	(2,287)	(3,202)	(4,025)	(5,089)	(6,464)	(8,237)	(9,929)
* deficit										

- 15.6. The payoff/discharge (4.2) includes only the repayment of the principal of the loan which is shown in Table C-65-7.
- 15.7. Gross cash flow is calculated by adding operating income (3.1) and depreciation (1.6) or subtracting operating expenses (1.5) from whole revenues (2.4)

Table A 4-1 INVESTMENT COST OF THE GURO HOSPITAL

	Local Cost	Foreign Cost
No. 1: Land estate cost		
1.1. Value: Quantity (Won/M ²)		
21,000 (90,914 won/m ²)		
1.2. Acquisition cost	₩1,909,200,000	\$3,977,500
Total Sum of No. 1	1,909,200,000	
No. 2: Site preparation cost		
2.1. Public opening	6,000,000	12,500
2.2. Non-public opening	24,000,000	50,000
2.3. Other cost (i.e. taxes)		
Total Sum of No. 2	30,000,000	62,500
No. 3: Construction cost		
3.1. Building (due to room and space program plus traffic ways)	2,070,000,000	4,312,500
3.2. Installations (Sewage, Water, Heating, Electricity...)	450,000,000	937,500
3.3. Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-conditioning, elevators...)	600,000,000	1,250,000
Sum of 3.1 - 3.3	₩3,120,000,000	\$6,500,000

and:

a) Classification to space-content: 1/

3.1-3.3:	<u>m²</u>	<u>Won/m³</u>	<u>Whole Amount</u>	<u>Outside Equipment</u>
	60,000	50,000	₩3,000,000,000	₩120,000,000

b) Classification to space

3.1-3.3:	<u>m²</u>	<u>Won/m²</u>	<u>Whole Amount</u>	<u>Outside Equipment</u>
	15,000	200,000	₩3,000,000,000	₩120,000,000

c) Classification to beds

3.1-3.3	<u>No. of beds</u>	<u>Won/Bed</u>	<u>Whole Amount</u>	<u>Outside Equipment</u>
	250	120,000	₩3,000,000,000	₩120,000,000

Sum of 3.1 - 3.3

1/ Whole amount is the sum of construction and engineering fees.
Therefore for the total investment cost of construction for outside equipment should be added to it.

No. 4: Equipment

	<u>Local cost</u>	<u>Foreign cost</u>
4.1 Medical equipment	W2,318,688,000	\$4,830,600. <u>00</u>
4.2 Non-medical equipment	52,896,000	\$110,200. <u>00</u>
Sum of 4.1 + 4.2	2,371,584,000	4,940,800. <u>00</u>

No. 5: Outside equipment	120,000,000	250,000. <u>00</u>
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No. 6: Contingencies

6.1 Price contingencies	W78,750,000	\$164,062. <u>50</u>
6.2 Physical contingencies	78,750,000	

No. 7: Engineering fees	W126,000,000	\$262,500. <u>00</u>
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No. 8: Working capital (estimate)	W83,616,500	\$174,201. <u>00</u>
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8.1 Cash, accounts receivable	W83,616,500	\$174,201. <u>00</u>
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8.2 Auxiliary goods (cleaning, desinfection, heating...)	18,558,500	38,664. <u>00</u>
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8.3 Pharmaceuticals, medical articles	58,152,000	121,150. <u>00</u>
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8.4 Bank liabilities	0	0
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8.5 Short-term loans, drafts	0	0
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8.6 Accounts payable	0	0
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Difference of (8.1+8.2+8.3) - (8.4+8.5+8.6)	<u>W160,327,000</u>	<u>\$334,015.00</u>
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IV. ANALYSIS FOR PLANNED SITES AND HOSPITALS IN MEDICALLY UNDER-SERVED AREAS

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D. NONSAN

D. NONSAN HOSPITAL

1. Geographical Features

1.1. Located on the southernmost corner of Choongchung Namdo, Nonsan County borders on Daeduk County and Geumsan County to the east, Gongju County to the north, Buyeo County to the west, and Cholla Bukto on the south. Although the eastern part of the County is rugged, the western part has a sprawling Nonsan plain, which has been famous for the rich yield of rice, serving as a grain trading center in the area (Figure D-1).

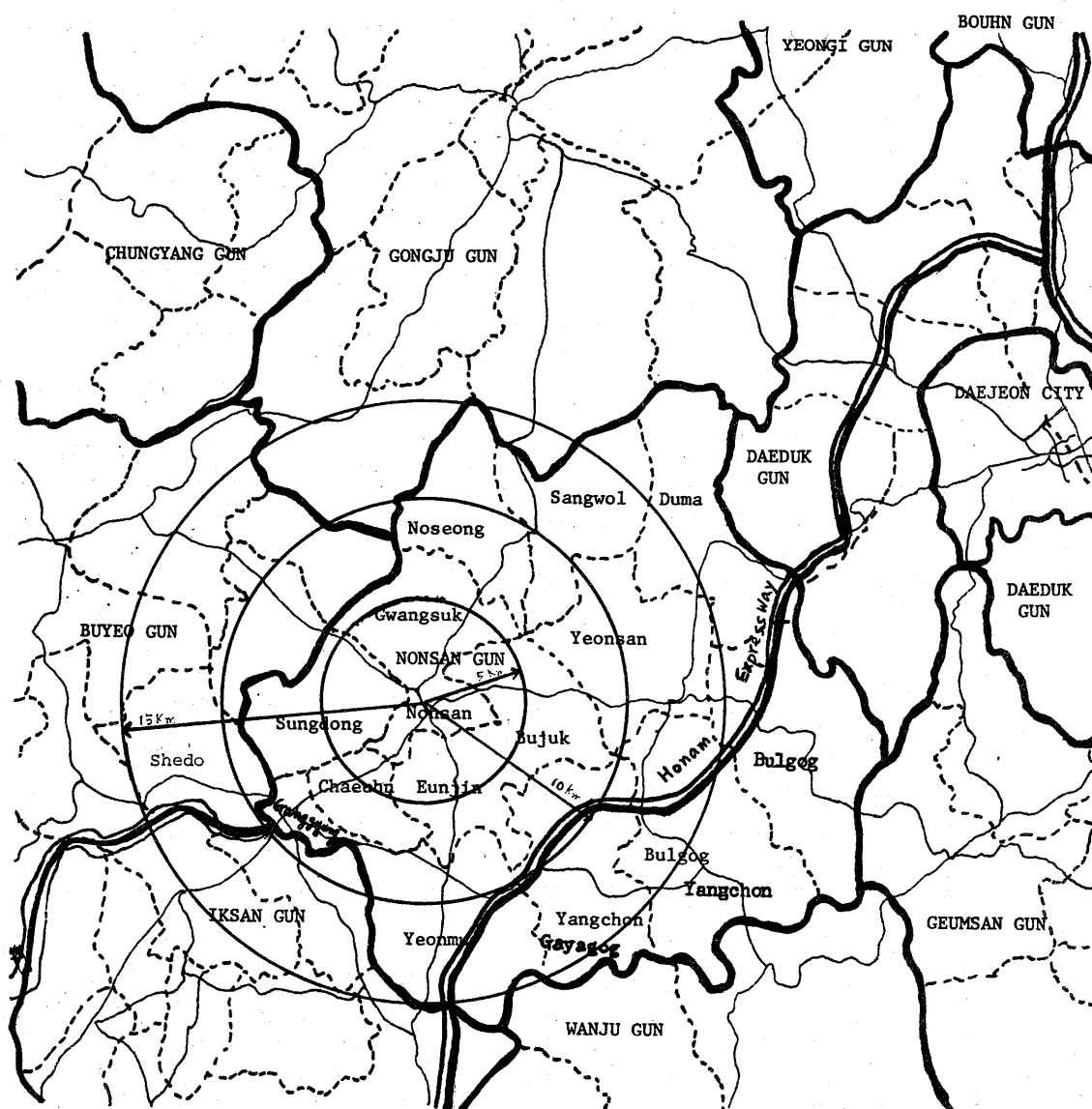


Figure D-1. The Nonsan Map

1.2. Since the Army Recruit Training Center was opened in Nonsan in the middle part of the 1950s, the County has seen a rapid increase in population and the development of brisk commercial activities. Still, Nonsan is widely known as the biggest military training camp in the country.

1.3. Nonsan County has a population totaling about 230,000 on a relatively small land area of 609 square km, with a population density of 370 persons per 1 square km. The population density in Nonsan is slightly higher than the national average. Therefore, Nonsan County should be regarded as a developing urban area rather than the typical rural agricultural area. The jurisdiction of the County consists of 3 Eups and 12 Myons.

1.4. The Honam Expressway runs through the south-east part of Nonsan County, including Duma Myon, Bulgog Myon, Yangchon Myon, Gayagog Myon and Yoenmu Myon. Transportation is convenient by operation of regular bus lines connecting the downtown of Nonsan Eup and other Eups and Myons.

1.5. There has been a movement to form a new confederate city with Nonsan Eup, Ganggyuon Eup and Yonmu Eup which are located in a triangular area. The 3 Eups plus the in-between Chaeuhn Myon could form a medium size city with a population of 100,000. However, the movement has not yet been realized due to the conflicts of vested regional interests. If they form a confederate city, it would be certain that the regional development will be accelerated.

1.6. In contrast with the social and economic development of Nonsan County, there is no hospital-level medical facilities in the County. Most of serious patients should go to the Jeonju Jesus Hospital in Jeonju City, Cholla Bukdo, or to hospitals in Daejeon City, which are located 50 km away.

2. Purpose of Nonsan Hospital Construction

2.1. The construction of Nonsan Hospital has the two objectives as following.

2.1.1. There is no hospital-level medical facilities in Nonsan County, Buyeo County, Gongju County and Cheongyang County. Therefore, the proposed Hospital will greatly help meet the health and medical care needs by providing efficient medical service for the people in the Counties and the remote doctorless areas.

2.1.2. The Hospital can contribute to the completion of developing a medical service system by taking care of those patients referred by the private medical practitioners in Nonsan County. Therefore, the Hospital will help develop the local medical services delivery system and relieve the people from the inconvenience of going to far-off cities for medical care.

3. Medical Service Catchment Area of Nonsan Hospital

3.1. Nonsan County is located southwest of Daejeon, the seat of the provincial government of Choongchung Namdo. In case that Daejeon becomes the nation's administrative capital, Nonsan will become one of the biggest satellite cities of Daejeon. This is due to the fact that Nonsan has been the important transportation crossroad and trading center of agricultural goods produced in its adjacent Buyeo County, Cheongyang County, and Gongju County.

3.2. The proposed Hospital should provide medical services primarily for the large population in Nonsan County. However, the people residing in Myons of Nonsan County and adjacent Daeduk County, through which the Honam Expressway runs, are conveniently located to utilize medical facilities in Jeonju or Daejeon City. Therefore, the areas of Duma Myon, Bulgog Myon, and Yangchon Myon could be safely excluded from the catchment areas of the proposed Hospital.

3.3. Nonsan Eup is the seat of County administration and the transportation center of the County. The Town, which is a local political and economic center, has a population of 34,000, and its population has steadily increased in contrast with the dwindling population of 14 other Myons and Eups in the County. Therefore, it will be reasonable to construct the Hospital within the prosperous Nonsan Town.

3.4. When the bridge connecting Ganggyung Eup of Nonsan County and Saedo Myon of Buyoe County is completed in a few years, the travel time from Buyoe County to the projected Hospital will be greatly shortened. Therefore, the several Myons of Buyoe County could be included within the primary catchment areas of the Hospital. However, the areas have been excluded from the catchment with a view to preventing an overestimation of the shortage of hospital beds.

3.5. Based on the above information, the primary medical service areas of the Hospital will cover the whole area of Nonsan County excluding Duma Myon, Bulgog Myon, and Yangchon Myon (Figure D-2).

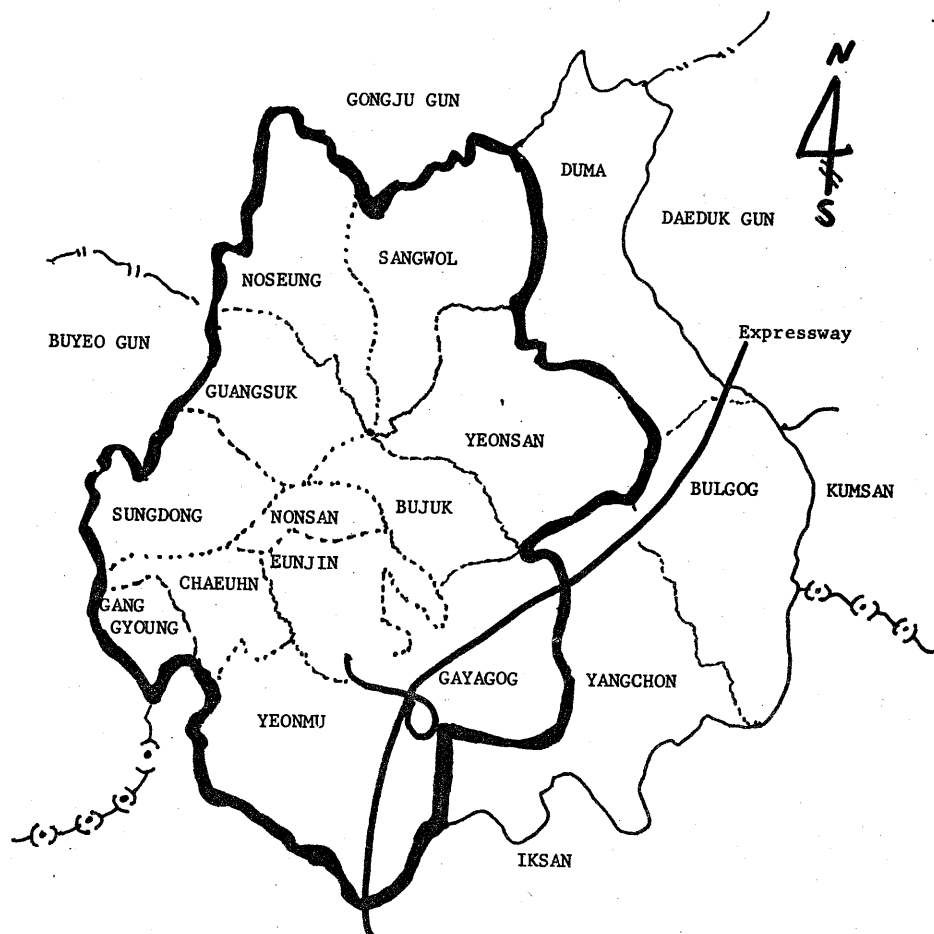


Figure D-2. The Catchment Area for the Proposed Nonsan Hospital

Table D-1 Population Trend in Nonsan Gun by Area

Year	Nonsan	Ganggyung	Yeonmu	Sungdong	Gwangsuk	Nosung	Sangwol	Bujuk	Yeonsan	Duma	Bulgog	Yangchon	Gayagog	Eunjin	Chaeuhn	Total
1970	32,736	25,683	36,194	14,621	13,423	10,501	9,995	10,757	15,800	12,172	8,012	15,431	13,982	14,294	9,245	242,846
1971	33,357	26,031	33,535	14,030	13,011	10,667	11,276	10,846	15,567	11,655	7,388	15,101	13,401	13,976	8,752	238,593
1972	33,220	26,699	33,343	14,055	13,157	10,750	10,049	10,706	15,433	11,564	7,472	15,280	13,349	14,101	8,639	237,817
1973	33,434	27,764	33,747	14,114	13,553	10,925	10,112	10,932	15,168	11,598	7,492	15,851	12,765	14,231	8,618	240,304
1974	33,932	28,525	34,030	14,131	13,551	10,982	10,179	10,566	15,070	11,425	7,311	15,683	12,515	13,789	8,288	239,977
1975*																266,437
1976	33,025	24,646	31,737	13,844	12,989	9,803	9,679	10,041	14,687	11,400	6,729	14,723	12,354	13,243	8,056	226,956
1977	34,313	24,190	32,136	13,599	12,492	9,655	9,455	9,693	14,171	11,193	6,465	14,164	12,077	13,156	8,014	224,773

* Data not available

Source: Statistical Year Book of Nonsan Gun 1971 - 1978.

Estimates of Target Population within the Nonsan Hospital Service Area *

Table D-2.

Year	Nonsan	Ganggyung	Yeonmu	Sungdong	Gwangsuk	Nosung	Bujuk	Gayagog	Eunjin	Chaeuhn	Sangwol	Yeonsan	Total
1979	34,173	24,985	30,950	13,488	12,709	9,702	9,635	11,499	12,922	7,612	9,298	13,945	190,918
1980	34,297	24,780	30,520	13,393	12,633	9,575	9,490	11,263	12,771	7,461	9,164	13,748	189,095
1981	34,419	24,577	30,096	13,300	12,558	9,449	9,347	11,029	12,623	7,313	9,031	13,553	187,295
1982	34,540	24,376	29,677	13,207	12,483	9,324	9,206	10,799	12,476	7,166	8,900	13,361	185,515
1983	34,659	24,179	29,263	13,116	12,410	9,201	9,066	10,571	12,331	7,021	8,770	13,171	183,758
1984	34,776	23,983	28,854	13,026	12,337	9,080	8,929	10,346	12,187	6,878	8,642	12,984	182,022
1985	34,892	23,790	28,450	12,937	12,265	8,960	8,792	10,123	12,045	6,736	8,515	12,799	180,304
1986	35,007	23,599	28,050	12,849	12,195	8,841	8,658	9,904	11,905	6,596	8,390	12,616	178,610
1987	35,121	23,410	27,655	12,762	12,124	8,724	8,524	9,686	11,767	6,458	8,267	12,435	176,933
1988	35,233	23,224	27,265	12,676	12,055	8,608	8,393	9,471	11,630	6,322	8,145	12,256	175,278
1989	35,344	23,039	26,879	12,591	11,987	8,494	8,263	9,259	11,495	6,186	8,024	12,079	173,640
1990	35,454	22,856	26,497	12,507	11,919	8,380	8,134	9,049	11,361	6,053	7,904	11,904	172,018
1991	35,562	22,676	26,120	12,424	11,852	8,268	8,007	8,841	11,229	5,921	7,786	11,731	170,417

* $Y = a + b \log x$

a: -8,737.61 96,338.33 180,178.39 46,354.34 39,210.09 54,013.29 59,952.80 93,629.40 65,237.91 59,868.44 56,013.40 82,343.05

b: 9,820.71 -16,330.03 -34,152.78 -7,521.94 -6,064.98 -10,141.10 -11,515.10 -18,796.44 -11,973.13 -11,959.55 -10,691.35 -15,653.82

r²: 0.41 0.13 0.68 0.71 0.31 0.44 0.76 0.93 0.82 0.92 0.42 0.96

Table D-3. Number of Public Officials, School Teachers, and Medicaid Beneficiaries within the Nonsan Hospital Service Area, 1977

Public Officials		School Teachers		Medicaid Beneficiaries		Total
Self	Dependents	Self	Dependents	Indigent Group	Low Income Group	
531	2,448	1,348	6,214	2,393	9,743	22,677

Source: Statistical Year Book of Nonsan Gun 1978.

Table D-4.

Health Manpower in Nonsan Gun, 1977

Eup or Myon	Physician	Area Limited Doctor	Dentist	Herb Doctor	Midwife	Nurse	Total	Pharmacist	Druggist		Drug Seller	Total
									Modern	Herb		
Nonsan	12	-	3	6	2	-	23	16	6	12	-	34
Ganggyung	3	-	1	2	-	-	6	13	2	8	-	23
Yeonmu	2	-	1	3	-	-	6	4	7	5	2	18
Sungdong	1	-	-	-	-	-	1	-	2	-	-	2
Gwangsuk	-	-	-	2	-	-	2	-	3	1	-	4
Nosung	1	-	-	-	-	-	1	-	1	-	1	2
Sangwol	1	-	-	-	-	-	1	-	2	1	-	3
Bujuk	-	-	-	-	-	-	-	-	3	1	-	4
Yeonsan	1	-	-	2	-	-	3	-	4	-	-	4
Duma	1	-	-	-	-	-	1	1	3	1	-	5
Bulgog	1	-	-	-	-	-	1	-	2	-	-	2
Yangchon	1	-	-	-	-	-	1	-	3	-	-	4
Gayagog	1	-	-	-	-	-	1	-	2	-	-	2
Eunjin	-	-	-	-	-	-	1	1	1	1	-	3
Chaeuhn	-	-	-	1	-	-	1	-	2	-	-	2
Chaeuhn	-	-	-	1	-	-	1	-	2	1	-	3
Total	25	-	5	17	2	15	64	35	43	32	3	113

Source: Statistical Year Book of Nonsan Gun, 1978.

4. Estimation of Target Population

4.1. The population trend in Nonsan County since 1970 is as shown in Table D-1. As of 1977, the population totaled 224,773 (including 112,371 males and 112,402 females), which represents an annual decrease of about 2,500.

4.2. The status of population in the medical service areas defined above in 3.5., is as shown in Table D-2. Because the population decreasing rate in Nonsan County is slow as shown in Table D-1, the number of population of Nonsan County is estimated by the formula, $y = a + b \log x$, resulting in 190,000 in 1979, 189,000 in 1980 and 187,000 in 1981.

4.3. According to Table D-2, the number of the target population has decreased by 1,800 persons annually. However, the target population might have been underestimated by not taking into consideration of the possibility of forming a confederate city in Nonsan County and the possibility that part of Buyoe County could be included in the medical service areas of the Hospital.

4.4. The number of the insured under the Medical Insurance Program and the Medicaid beneficiaries within the catchment area of Nonsan Hospital is as shown in Table D-3. The number of memberships and the Medical Insurance totaled 22,677, including 1,879 subscribers and 8,662 dependents, and 12,136 who are covered by Medicaid. The medically insured people thus account for only 12% of the total population in the areas concerned. The number (22,677) of insurance memberships and the Medicaid beneficiaries is assumed to undergo no great change within the planning period.

5. Requirement of Hospital Beds

5.1. The status of medical personnel in Nonsan County is as shown in Table D-4. As of 1977, there are 25 doctors, 5 dentists, 17 herb doctors, 2 midwives and 15 nurses, with a combined total of 64 medical personnel. It is noteworthy that there is no area-limited doctor in the County. Of the total 15 Eups and Myons in Nonsan County, there is no doctor in 4 Myons, including Gwangsu Myon, Bujuk Myon, Eunjin Myon, and Chaeuhn Myon. The doctorless Myons will be included in the medical service areas to be covered by the Hospital. There are also a relatively great number of pharmacists and druggists amounting to 113, which reflects that the people in the areas have largely relied on drug stores for medical programs.

5.2. There is no hospital-level medical facilities within the catchment area of the Nonsan Hospital. The number of medical facilities and beds are as shown in Table D-5. There are 13 physicians with 89 beds in Nonsan Eup 3, physicians with 18 beds in Ganggyung Eup, 2 physicians with 18 beds in Yeonmu Eup, and a doctor's office with 3 beds in Nonseong Myon, with a combined total of 128 beds. There are 7 medical specialists in the field of general surgery, gynecology, pediatrics and otolaryngology in Nonsan County.

5.3. The annual rate of hospitalization per person in Nonsan County is estimated at 0.0212 (Table D-6). This study used the above probability (Assumption I) and the arithmetic mean value of 6 areas (Assumption II).

Table D-5.

Number of Beds Owned by Private Practitioners in the
Nonsan Hospital Service Area, 1979

Name of Clinic	Location	Number of Beds	Specialty Board
Park's	Nonsan Eup	14	General Surgery
Kim Jae When's	"	5	
Ha's	"	7	
Youngge	"	12	
Koryo	"	10	General Surgery
Kim's	"	2	
Sacred Heart	"	6	
Nonsan	"	9	
Samsun	"	2	Pediatrics
Kim's	"	-	
Jung's	"	11	
Han's	"	4	
Jun's	"	7	OB-GYN
Hanil	Ganggyung	10	
Honam	"	5	OB-GYN
Jung's	"	3	
Jungang	Yeonmu	9	
Pyungwha	"	9	
Daesung	Nosung	3	
Total		128	7

Source: Nonsan Health Center, June, 1979

5.4. There are 128 beds in the catchment, area and it is assumed that there will be no increase in the hospital-bed capacity. It is also assumed that the occupancy rate of the existing hospital-beds in the areas concerned will be the same as the national average of 40% and that the occupancy rate will be gradually decreased.

5.5. As the result, it is estimated that there will be a shortage of 99 hospital beds (low estimate, 89 beds; high estimate, 109 beds) in 1980, 115 beds (low estimate, 102 beds; high estimate, 127 beds) in 1981, 117 beds (low estimate, 102 beds; high estimate, 131 beds) in 1982, and 120 beds (low estimate, 98 beds; high estimate, 142 beds) in 1985 (Table D-6).

5.6. When the Nonsan Hospital is constructed, there will be more inflow of patients into the catchment area than outflow of patients because the Hospital will serve as the only secondary medical care facility in Nonsan County and the vicinity. Therefore, considering the shortage of bed complements in the catchment area, it will be desirable that the Nonsan Hospital will have 100 beds at the initial phase of development.

Bed Requirements in the Nonsan Hospital Service Area

Table D-6.

Year	General Population Excluding the Insured & Medicaid	Hospitalization Rate/Person/Year		Average Length of Stay	The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		Average Length of Stay	No. of Existing Beds	Occupancy Rate (%)	Bed Requirements	
		I	II			I	II				I	II
1979	168,241	0.0212	0.0239	10	22,677	0.0349	0.0349	9	128	40	90	105
1980	166,418	0.0212	0.0247	10	22,677	0.0349	0.0366	9	128	40	89	109
1981	164,618	0.0212	0.0254	10	22,677	0.0349	0.0385	9	128	30	103	127
1982	162,838	0.0212	0.0262	10	22,677	0.0349	0.0404	9	128	30	102	131
1983	161,081	0.0212	0.0269	10	22,677	0.0349	0.0424	9	128	30	101	135
1984	159,345	0.0212	0.0277	10	22,677	0.0349	0.0445	9	128	30	99	139
1985	157,627	0.0212	0.0284	10	22,677	0.0349	0.0468	9	128	30	98	142
1986	155,933	0.0212	0.0292	10	22,677	0.0349	0.0491	9	128	30	97	146
1987	154,256	0.0212	0.0299	10	22,677	0.0349	0.0516	9	128	30	96	149
1988	152,601	0.0212	0.0307	10	22,677	0.0349	0.0541	9	128	30	95	153
1989	150,963	0.0202	0.0314	10	22,677	0.0349	0.0568	9	128	30	94	157
1990	149,341	0.0212	0.0322	10	22,677	0.0349	0.0597	9	128	30	93	161
1991	147,740	0.0212	0.0335	10	22,677	0.0349	0.0627	9	128	30	91	167

6. Medical Program

6.1. By hospital size and number of medical specialists, the Nonsan Hospital can be distinguished from any other hospitals in the medically underserved area. The Hospital should maintain higher standard of medical care because medical specialists are serving as practising doctors in the area. The Hospital should also maintain a close cooperative relationship with them.

6.2. Nonsan Hospital will have 9 clinical disciplines, including the 4 basic departments, orthopedic, otolaryngology, ophthalmology, uro-dermatology, and dental departments.

6.3. The number of inpatient cases is estimated at 2,215 in the first year of operation. It is also expected that the occupancy rate will maintain at least 60% (Table D-7-1).

6.4. The number of outpatient cases is estimated at 14,496 in the first year of its opening, with their visits to the Hospital totaling 41,993. This is equivalent to a daily average of 150 outpatients. The performance of various clinical examination, X-ray examination and surgical operation are as shown in Table D-7-2.

6.5. The estimated number of patients classified by the insured or non-insured under the Medical Insurance Program who are treated at the various departments of the Hospital is shown in Table D-8 and D-9.

Table D-7-1. Medical Program of Nonsan Hospital, 1980

1. INPATIENTS				
Clinical Specialty	No. of cases per year	Average length of stay (days)	Occupancy rate of beds (%)	Distribution of bed (number)
Internal medicine	887	9	60	37
- general				
- infections				
- intensive care				
General surgery	347	14	60	22
- intensive care				
Orthopedic surg.	163	16	60	12
Pediatrics	232	7	60	8
- neonatology				
- babies				
- children				
OB and GYN	378	6	60	10
- obstetrics				
- gynaecology				
ENT	53	13	60	3
Ophthalmology	46	14	60	3
Urology & Dermatology	46	11	60	2
Jaw surgery	63	10	60	3
Total or Average	2,215	9.9	60	100

2. OUTPATIENTS			
Clinical specialty	No. of cases	Visits/Case	No. of visits per year
Internal medicine	5,654	2.6	14,699
General surgery	1,225	2.4	2,940
Orthopedic	600	2.8	1,680
Pediatrics	1,800	3.5	6,300
OB and GYN	1,625	3.1	5,038
ENT	1,181	3.2	3,779
Ophthalmology	840	2.5	2,100
Urology & Dermatology	908	3.7	3,359
Dental	636	3.3	2,098
Total	14,469	2.9	41,993

Table D-7-2. Medical Program of Nonsan Hospital, 1980

3. MEDICAL PERFORMANCES			
Kind of performances	No. of performances per year		
	for inpatients	for outpatients	Total
Emergency cases			
- internal		2,940	2,940
- surgical			
ECG			500
Endoscopies			40
Labortary diagnostics			
- chemical	1,816	4,619	6,435
- heamatological	3,378	7,979	11,357
- serological	1,085	2,520	3,605
- bacteriological	2,702	6,719	9,421
- stool examination	996	1,680	2,676
- urinalysis	3,011	3,359	6,370
Blood preserves			1,400 pints
Plain X-ray	4,142	7,559	11,701
Mass X-ray	-	2,520	2,520
Fluoroscopies	-	-	160
Operations			
- general surgery	212	294	506
- orthop. surgery	132	50	182
- OB and GYN	121	403	524
- ENT	35	12	47
- ophthalmology	39	21	60
- urology & dermatology	23	50	73
- jaw surgery	23	168	191
- Total	585	998	1,583
Deliveries	247		247
Physiotherapy			2,000
Physical check-up		2,000	2,000
4. FURTHER FUNCTIONS			
Function	Quantities per year		
Autopsies			25
Ambulance			500

Table D-8. Number of Inpatient Cases by Clinical Specialty and Insurance Coverage

		1980	1981	1985	1990
Internal Medicine	Total	887	837	1,034	1,092
	Insurance	222	251	620	983
	Non-Insurance	665	586	414	109
General surgery	Total	347	535	626	728
	Insurance	104	161	376	655
	Non-Insurance	243	374	250	73
Orthopedic surg.	Total	163	279	299	234
	Insurance	78	84	179	301
	Non-Insurance	85	195	120	33
Pediatrics	Total	232	186	245	273
	Insurance	51	56	147	246
	Non-Insurance	181	130	98	27
OB and GYN	Total	378	233	245	303
	Insurance	95	70	147	273
	Non-Insurance	283	163	98	30
ENT	Total	53	70	82	61
	Insurance	10	21	49	55
	Non-Insurance	43	49	33	6
Ophthalmology	Total	46	70	54	61
	Insurance	25	22	33	55
	Non-Insurance	21	48	21	6
Urology & Dermatology	Total	46	47	82	91
	Insurance	14	15	49	82
	Non-Insurance	32	32	33	9
Dental	Total	63	69	54	90
	Insurance	12	21	33	81
	Non-Insurance	51	48	21	9
Total	Total	2,215	2,326	2,721	3,033
	Insurance	611	701	1,633	2,731
	Non-Insurance	1,604	1,625	1,088	302

Table D-9. Number of Outpatient Visits by Clinical Specialty and Insurance Coverage

		1980	1981	1985	1990
Internal Medicine	Total	14,699	15,433	17,202	18,615
	Insurance	4,263	5,247	9,461	15,823
	Non-Insurance	10,436	10,186	7,741	2,792
General Surgery	Total	2,940	3,087	4,048	5,077
	Insurance	970	1,050	2,226	4,315
	Non-Insurance	1,970	2,037	1,822	782
Orthopedics	Total	1,680	1,764	2,024	2,256
	Insurance	554	600	1,113	1,918
	Non-Insurance	1,126	1,164	911	338
Pediatrics	Total	6,300	6,614	9,083	8,461
	Insurance	2,961	2,249	3,896	7,192
	Non-Insurance	3,339	4,365	3,187	1,269
OB and GYN	Total	5,038	5,291	6,071	6,205
	Insurance	1,511	1,799	3,339	5,274
	Non-Insurance	3,527	3,492	2,732	931
ENT	Total	3,779	3,968	4,554	4,513
	Insurance	1,663	1,349	2,505	3,836
	Non-Insurance	2,116	2,619	2,049	677
Ophthalmology	Total	2,100	2,205	2,024	2,256
	Insurance	945	750	1,113	1,918
	Non-insurance	1,155	1,455	911	338
Urology & Dermatology	Total	3,359	3,527	4,554	5,641
	Insurance	907	1,200	2,505	4,795
	Non-insurance	2,452	2,327	2,049	846
Dental	Total	2,098	2,204	3,035	3,385
	Insurance	860	749	1,669	2,877
	Non-insurance	1,238	1,455	1,366	508
Total	Total	41,993	44,093	50,595	56,409
	Insurance	14,634	14,993	27,827	47,948
	Non-insurance	27,359	29,100	22,768	8,461

7. TOTAL INVESTMENT COST AND FINANCING

7.1 The total investment cost required for the Nonsan Hospital is \$5,501,733 (W2,640,832,000) as shown in Table D-10-1

Nonsan Hospital (100 Beds)		
Table D-10-1	Investment Cost <u>1/</u>	
Category	Local Cost(W)	Foreign Cost(\$)
Land estate	408,380,000	850,792
Site preparation	15,000,000	31,250
Construction	1,249,000,000	2,602,083
Dormitory	74,528,000	155,267
Medical equipment	464,443,000	967,590
Outside equipment	61,000,000	127,083
Contingencies	268,196,000	558,741
Engineering fees	48,700,000	101,458
Working capital	51,585,000	107,469
TOTAL INVESTMENT	2,640,832,000	5,501,733

1/ See Appendix A 4-1

7.2 The sources of financing of the investment cost of \$5,501,733 to build a new hospital with 100 beds are as follow:

Nonsan Hospital (100 Beds)		
Table D-10-2	Sources of Finance	
Sources	Local currency	Foreign currency
Total investment	W2,640,832,000	\$ 5,501,733
Foreign loan	464,443,000	967,590
Local loan	1,000,000,000	2,083,333
Capital <u>1/</u>	1,176,389,000	2,450,810
Total Financing	W2,640,832,000	\$ 5,501,733

1/ The fund which should be provided by the sponsor of the Nonsan Hospital

7.2.1 Of the total amount needed, \$967,590 (W 464,443,000) will be provided by a West German Loan. Its use is restricted to purchasing medical equipment .

7.2.2 Terms of the foreign loan is repayment of all principal and interest in 20 years after a ten-year grace period at an annual interest of 2%.

7.2.3 The local loan will be secured from a Korean Commercial Bank (or banks). This will be arranged by the Korean Government for the Nonsan Hospital. The

use of the local loan is restricted to the building costs of the hospital. The maximum amount of the local loan is \$20,833 (₩10,000,000) per hospital bed. Therefore \$2,083,333 (₩1,000,000,000) can be borrowed locally by the Nonsan hospital as it will have 100 beds.

7.2.4 The terms of the local loan for the hospitals in rural area is repayment of all the principal and interest in seven years after a three-year grace period at an annual interest rate of 18.5%, out of which the borrower will be charged 7% and the Korean Government will be responsible for 11.5%. Therefore the net interest cost for the Nonsan Hospital is 7%.

7.2.5 The sponsor of the Nonsan Hospital will provide \$2,450,810 (₩1,176,389,000) for land purchase, working capital and additional cost for construction.

7.3. The expected balance sheet of the Nonsan Hospital in the year before the operation is shown in Table D-10-3.

Nonsan Hospital (100 Beds)			
Table D-10-3 Balance Sheet (Beginning of Operation) Unit: ₩1,000			
Assets		Liabilities	
Cash	298,913	Bank Credit	0
Auxiliary goods	8,459	Account payable	0
Pharmaceuticals		Draft	0
and other materials	12,409		
Equipment	464,443	Loans local	11,000,000
Building	1,448,328	foreign	464,443
Land	408,380	Capital	1,176,389
Total	2,640,832	Total	2,640,832
(\$'000)	(5,502)		(5,502)

Note: 1\$ = 480 Won

7.3.1 The fund to be provided by the sponsor is an equity fund, not liabilities from others.

8. ECONOMIC FORECASTING

8.1 For the estimation of total revenues in the future, medical care fees should be determined. To estimate medical charges in the future, two things must be clarified; one is the present medical care fees and the other is the future increase in medical care fees.

8.1.1 To determine present medical care fees, a survey was conducted at several hospitals to determine medical care fees according to the disciplines. Because of limited data, the differences in medical charges between medical insurance subscribers and private patients can not be presented. Table D-11-1 is the result of the survey of 21 hospitals which had similar characteristics as those expected of the Nonsan Hospital.

Table D-11-1	Medical Care Fees in 1978 (under 100 beds hospitals)		Unit : Won
	Classification	Outpatient Fee per visit	Inpatient Fee per day
	Internal medicine	3,400	13,800
	General surgery	3,300	13,900
	Orthopedic surgery	2,800	11,200
	Neuro-surgery	3,500	15,000
	Pediatrics	2,100	10,400
	OB and GYN	2,800	18,000
	ENT	2,800	14,600
	Ophthalmology	3,500	12,500
	Jaw surgery	3,800	13,100
	Neuro-psychiatry	3,200	9,200
	Urology	3,200	14,000

8.1.2 The average fees in Table D-11-1 represent gross costs charged by hospitals; inclusive of pharmaceuticals , X-ray's, medical tests, and others.

8.1.3 Since there is a relatively large difference in the medical care fees charged by hospitals between insured patients and private patients, respective medical care fees should be estimated in order to calculate total future revenues. For this purpose, a survey was conducted to study the fees paid to hospitals by insured patients treated in the Guro area during 1978. The survey found that the average fees of insured patients were \$5.63(₩2,700) for outpatient per visit and \$27.1(₩13,000) for inpatient per hospital stay (The classification by discipline was not available).

8.1.4 The following equation is developed to derive the average costs for the insured patient by department, utilizing Table D-11-1 and the survey result mentioned in 8.1.3.

$$\text{Average medical fee} = X_i \times \left(\frac{X_1}{X_2} \right)$$

where; X_i = Average medical care fee in "i" department shown in Table D-11-1

X_1 = Average medical care fee in 1978 for the insured \$5.63(₩2,700) per visit for outpatient and \$27.1(₩13,000) per day for inpatient

X_2 = Average medical fees in 1978 (calculated from Table D-11-1)

8.1.5 The medical care fees for private patients are estimated on the basis of a 1977 KPC Report, in which medical fees charged for private inpatients were 35% higher than fees charged for insured inpatients and about 23% higher in the case of outpatients. Also we considered the fact that average medical fees for insured patients have increased 20% in 1979, while fees for private patients have not undergone the similar increase. Considering these facts, we concluded that the average medical charge for private inpatients is 30% higher than fees for insured inpatients and 20% higher for outpatients in 1979.

8.1.6 Medical care fees in 1979 calculated according to 8.1.1 - 8.1.5 are shown in Table D-11-2.

Medical Care Fee in 1979
(under 100-Bed hospital)

Table D-11-2.

\$1 = W480
Unit: Won

Classification	Out-patient (per visit)		In-patient (per day)	
	Insurance	Private	Insurance	Private
Internal medicine	3,500	4,200	16,200	21,060
General surgery	3,400	4,080	16,400	21,320
Orthopedic surgery	2,900	3,480	13,200	17,160
Neuro-surgery	3,600	4,320	17,700	23,010
Pediatrics	3,200	3,840	12,300	15,990
OB and GYN	2,900	3,480	21,200	27,560
ENT	2,900	3,480	21,200	27,560
Ophthalmology	3,600	4,320	14,700	19,110
Neuro-psychiatry	3,300	3,300	10,900	20,020
Jaw surgery	3,900	4,680	15,400	14,170

8.1.7 The future changes of the medical care fees for private patients and insured patients are predicted on the following three assumptions;

a) The fee difference between insured patients and private patients will be reduced gradually and eliminated eventually by the end of 1991 when the Korean Government expects medical insurance to cover 100% of the population.

b) The rate of increase of the medical care fees for private patients will stabilize over time, while the medical care fees for the insured will increase to reach the same level of the fees for private patients.

c) The real increase in medical care charges will be 3% annually for next ten years because of quality increase.

8.2 Table D-11-3 shows total estimated annual revenue for 10 years, which is obtained by multiplying the expected medical care fees (based on 8.1.1 - 8.1.7) by the estimated number of patients per year. (See table D-7-1, D-7-2)

8.3 The total expense includes expenses for personnel, pharmaceuticals and other materials, food and clothes, maintainance of buildings and equipment, heating and utilities, and administration. The expenses of each item are estimated for 10 years.

8.3.1 Because expenses for personnel are the main portion of total expenses, these have been broken down into expenses for physicians, nurses, technicians and administrative personnel.

8.3.2 Expenses for personnel in each category are calculated by multiplying estimated required manpower by average salary surveyed in 1979. For the next ten years, a 3% real increase in salary is assumed per year.

8.3.3 Costs of pharmaceuticals and others materials, heating and utilities and administrative cost have been estimated based on the survey conducted; the ratio of each expense to total expenses, and the ratio of each expense to total revenues of the hospitals which have similar characteristics as the planned Nonsan Hospital. Table D-11-4 shows the result of the survey. The ratio of each expense to the total revenues are used to estimate these expenses for the future, assuming that the ratio would be constant over time. Accordingly the cost of heating and utilities is 5.11% of the total revenues (without considering a quality increase) and administrative cost is 6.10% of total revenues without consideration of quality increase.

8.3.3.1 The oil price increase during 1979-1980 have not been considered because the survey was conducted before the oil crisis.

8.3.4 24.95% of the total revenue is considered as cost for pharmaceuticals and other materials.

8.3.5 The cost of food is estimated on the basis that the cost per meal is \$1.25 (₩600) and \$3.75 (₩1,800) per day, \$6.25 (₩3,000) per bed a year is assumed for clothes.

8.3.6 Maintenance cost for building is assumed to be 0.25% of the acquisition value and 2.5% for medical equipment per year.

8.4 Table D-11-5 presents the total expenses estimated according to 8.3.1 - 8.3.6.

8.5 By combining Table D-11-3 and Table D-11-5, the pro-forma income statement for the ten year is presented in Table D-11-6.

Table D-11-3

Nonsan Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OR REVENUES
(1st - 10th year)

Year	1	2	3	4	5	6	7	8	9	10
Unit: 1,000										
Insurance	159,176	193,679	267,596	348,282	436,341	536,434	637,344	748,498	858,937	988,714
Private	440,528	500,064	475,652	450,523	421,380	391,292	347,343	299,367	249,335	186,770
Inpatients	436,448	515,471	552,078	594,119	638,473	692,014	735,563	783,923	828,744	882,630
Outpatients	163,216	178,272	191,170	204,686	219,248	235,712	249,124	263,942	279,528	292,854
Total Revenue	599,704	693,743	743,248	798,805	857,721	927,726	984,687	1,047,865	1,108,292	1,175,484
(\$000)	(1,249)	(1,445)	(1,548)	(1,664)	(1,787)	(1,933)	(2,051)	(2,183)	(2,309)	(2,449)

Table D-11-4

COMPOSITIONS OF EXPENSES 1/
(under 100 beds Hospitals)

Category (A)	A/Total expenses	A/Total revenue
Personnel expense	46.61%	43.82%
Utilities	2.45%	2.37%
Heating	3.05%	2.74%
Clothes and food	4.45%	4.04%
Pharmaceuticals and others	31.03%	24.95%
Equipment and Building Maintenance	5.94%	4.35%
Operating expenses <u>2/</u>	6.47%	6.10%

Table D-11-5

Nonsan Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Personnel	368,609	379,667	391,058	402,789	414,872	427,318	440,140	453,342	466,943	480,951
Physician	158,440	163,193	168,089	173,132	178,326	183,675	189,186	194,861	200,707	206,728
Nurse	98,633	101,592	104,640	107,779	111,012	114,343	117,773	121,306	124,945	128,694
Medical assistant	21,194	21,830	22,485	23,159	23,854	24,570	25,308	26,066	26,848	27,653
Mgt & ad.	22,104	22,767	23,450	24,154	24,878	25,624	26,393	27,185	28,001	28,841
Technical service & others	68,238	70,285	72,394	74,565	76,802	79,106	81,480	83,924	86,442	89,035
Pharma. & X-ray	149,626	173,089	185,440	199,302	214,002	231,243	245,681	261,442	276,514	293,283
Food & clothes	35,524	37,304	39,164	40,737	42,356	43,639	44,938	46,286	47,216	48,162
Heating & utilities	29,752	33,412	34,748	36,251	37,817	39,627	40,909	42,262	43,397	44,693
Maintenance	15,232	15,232	15,232	15,232	15,232	15,232	15,232	15,232	15,232	15,232
Bldg.	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621	3,621
Equip.	11,611	11,611	11,611	11,611	11,611	11,611	11,611	11,611	11,611	11,611
Others	35,516	39,885	41,480	43,274	45,143	47,304	48,834	50,450	56,804	53,351
Total	634,259	678,589	707,122	737,585	769,422	804,313	835,742	869,014	872,433	904,897
Foreign (\$000)	(1,322)	(1,414)	(1,474)	(1,537)	(1,603)	(1,675)	(1,741)	(1,811)	(1,818)	(1,886)

* Others include vehicles, administrative expenses and taxes.

Table D-11-6

Nonsan Hospital (100 beds)
ECONOMIC FORECASTING : PRO FORMA INCOME STATEMENT
 (1st - 10th year)

1\$ = 480 won Unit: ₩1,000										
Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Total Revenue	559,704	693,743	743,248	798,805	857,721	927,726	984,687	1,047,865	1,108,212	1,175,484
Total Expense	634,259	678,589	707,122	737,585	769,422	804,313	835,742	869,014	872,433	904,897
Operating income	*34,555	15,154	36,106	61,220	88,299	123,413	148,945	178,851	235,779	270,589
Depreciation	75,411	75,411	75,411	75,411	75,411	75,411	75,411	75,411	75,411	75,411
Interest	79,289	79,289	79,289	79,289	71,199	62,539	53,279	43,369	32,769	21,429
Netprofit	*189,255	*139,546	*118,574	*93,480	*58,311	*14,537	20,255	60,071	127,599	173,749
(\$000)	(* 395)	(* 291)	(* 247)	(* 195)	(* 122)	(* 30)	(42)	(125)	(266)	(302)

* deficit

8.5.1 Expected duration of the building is 50 years according to the Korea tax law and average expected utilization of medical equipment is assumed to be 10 years. The straight line method is used for the calculation of depreciation.

8.5.2 The interest charge has been mentioned in 7.2.2 and 7.2.4; the annual rate is 2% for the foreign loan and 7% for the local loan. But the actual repayment of the principal of the local loan would start in the fourth year and in the 11th year for the foreign loan.

8.5.3 Repayment of equal amount (principal plus interest) each year is assumed to calculate the interest expense.

8.6 Table D-11-7 is the pro-forma balance sheet of the Nonsan Hospital for ten years.

8.6.1 For the estimation of current assets, the principle that at least one twelfth of total expenses of the initial operation year should be kept as current assets has been adopted. All the profit, excluding loan repayment, will be invested into current assets (cash, pharmaceuticals, food and others).

8.6.2 The actual principal payment of the local loan would start in the 4th year and in the 11th year for the foreign loan. The loan payments (principal plus interest) are assumed as being equal over time.

8.6.3 It is assumed that all current liability is to be cleared out at the end of each year.

9. ESTIMATION OF CASH FLOW

9.1 Considering 8.1 - 8.6, estimated cash flow is presented in Table D-12.

9.2 Costs of operating and maintenance (1.1 - 1.7 in Table D-12) are presented in Table D-11-5.

9.3 Revenues (2.1 - 2.4 in Table D-12) are presented in Table D-11-3.

9.4 Profit calculation is presented in Table D-11-6.

9.5 Cash flow calculation is based on the principle that the Hospital should have at least one twelfth of its operating expenses for the initial year of operation as current assets.

9.6 The payoff/discharge (4.2) include only the repayment of the principal of the loan.

9.7 Gross cash flow is calculated by adding operating income (3.1) and depreciation (1.6) or by subtracting operating expenses (1.5) from the total revenue (2.4).

10. CONCLUSION FROM FINANCIAL ANALYSIS

10.1 The Hospital will be in the red for the first six years after operation starts, and also it will suffer from lack of liquidity because of shortage of cash unless about W700,000,000 is provided by the sponsor during the first eight years (See 4.2 in Table D-12).

10.2 From 9th year, the Hospital will be in a stable position to operate without difficulties.

10.3 In the long run, as long as the sponsor is able to provide initial capital and working capital for the first eight years, it is feasible to build and operate the hospital with reasonable payoff.

Table D-11-7

Nonsan Hospital (100 beds)
ECONOMIC FORECASTING : PROFORMA BALANCE SHEET
(1st - 10th year)

Unit: ₩1,000

Year	1	2	3	4	5	6	7	8	9	10
Current Assets	319,781	319,781	319,781	319,781	319,781	319,781	319,781	319,781	319,781	319,781
Equipment	464,443	464,443	464,443	464,443	464,443	464,443	464,443	464,443	464,443	464,443
Depr.	46,444	92,888	139,332	185,776	232,220	278,664	325,108	371,552	417,996	464,443
Bldg.	1,448,228	1,448,228	1,448,228	1,448,228	1,448,228	1,448,228	1,448,228	1,448,228	1,448,228	1,448,228
Depr.	28,967	57,934	86,901	115,868	144,835	173,802	202,769	231,736	260,703	289,670
Land	408,380	408,380	408,380	408,380	408,380	408,380	408,380	408,380	408,380	408,380
Total	2,565,421	2,470,010	2,414,599	2,339,188	2,263,777	2,188,366	2,112,955	2,037,544	2,003,073	2,003,412
Current liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	1,000,000	1,000,000	1,000,000	884,450	760,810	628,510	486,950	335,480	173,410	0
Foreign loan	464,443	464,443	464,443	464,443	464,443	464,443	464,443	464,443	464,443	464,443
Capital	1,290,233	1,354,368	1,397,531	1,531,150	1,637,690	1,209,116	1,225,010	1,770,999	1,770,999	1,770,999
Retained Earnings	0	*189,255	*328,801	*447,375	*540,855	*599,160	*613,703	*593,448	*533,377	*405,778
Net profit	*189,255	*139,546	*118,574	*93,480	*58,311	*14,537	20,255	60,071	127,599	173,749
Total	2,565,421	2,490,010	2,414,599	2,339,188	2,263,777	2,188,366	2,112,955	2,037,544	2,003,073	2,003,412
(\$000)	(5,345)	(5,188)	(5,030)	(4,873)	(4,716)	(4,559)	(4,402)	(4,173)	(4,173)	(4,174)

* deficit

Table D-12

Nonsan Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

1\$ = 480 won
unit: ₩1,000

Year	1	2	3	4	5	6	7	8	9	10
1. Operating and Maintenance										
1.1 Personnel	368,609	379,667	391,058	402,789	414,872	427,318	440,140	453,342	446,943	480,951
1.2 Other expenses	250,418	283,690	300,832	319,564	339,318	361,813	380,362	400,440	418,931	439,489
1.3 Maintenance	15,232	15,232	15,232	15,232	15,232	15,232	15,232	15,232	15,232	15,232
1.4 Interest	79,289	79,289	79,289	79,289	71,199	62,539	53,279	43,369	32,769	21,429
1.5 Operating expenses	712,918	753,878	786,411	816,304	840,621	866,992	889,021	912,383	905,262	926,324
1.6 Depreciation	75,411	75,411	75,411	75,411	75,411	75,411	75,411	75,411	75,411	75,411
1.7 Operating cost	788,329	829,289	861,822	891,685	916,032	942,303	964,432	987,794	980,673	1,001,735
2. Revenue										
2.1 Outpatient	163,216	178,272	191,170	204,686	219,248	219,248	235,712	249,124	279,528	292,854
2.2 Inpatient	436,488	515,471	552,078	594,119	638,473	692,014	735,563	783,923	828,744	882,630
2.3 Other	0	0	0	0	0	0	0	0	0	0
2.4 Whole revenue	599,704	693,743	743,248	798,805	857,721	927,262	984,687	1,047,865	1,108,272	1,175,484
3. Calculation										
3.1 Operating incomes	*189,255	*139,546	*118,574	*93,480	*58,311	*14,537	20,255	60,071	127,599	173,749
3.2 Accumulation	*189,254	*328,809	*447,375	*540,855	*599,166	*613,703	*593,448	*533,377	*405,778	*232,029
3.3 Income tax	0	0	0	0	0	0	0	0	0	0
4. Cash Flow Calculation										
4.1 Gross cash flow	*113,844	*64,135	*43,163	*8,069	17,100	60,874	95,666	135,481	203,010	249,160
4.2 Invested capital	113,844	64,135	43,163	133,619	106,540	71,426	45,894	15,989	0	0
4.3 Payoff/discharge	0	0	0	115,550	123,640	132,300	141,560	151,470	162,070	173,410
4.4 Net cash flow	0	0	0	0	0	0	0	0	40,940	75,750
4.5 Accumulation of 4.4	0	0	0	0	0	0	0	0	40,940	116,690
(of \$000)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(85)	(243)
* deficit										

Appendix Table A 4-1

		<u>Amount</u>
No. 1: Land estate cost		
1.1.	Value: <u>quantity (Won/M²)</u>	<u>Whole Amount</u>
	13,500 M ² (30,250)	₩408,380,000
1.2.	Acquisition cost	₩408,380,000
Total Sum of No. 1		
No. 2: Site preparation cost		
2.1.	Public opening	₩2,000,000
2.2.	Non-public opening	₩13,000,000
2.3.	Other cost (i.e. taxes)	
Total Sum of No. 2		₩15,000,000
No.3: Construction cost		
3.1.	Building (due to room and space program plus traffic ways)	₩828,000,000
3.2.	Installations (Sewage, Water, Heating, Electricity ...)	₩184,000,000
3.3.	Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators ...)	₩237,000,000
Total Sum of 3.1 - 3.3		₩1,249,000,000

and:

a) Classification to space-content:

3.1 - 3.3 :	$\frac{m^3}{m^3}$	$\frac{Won}{m^3}$
	23,760	50,000
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	<u>Outside Equipment</u>
W1,188,000,000	W61,000,000

b) Classification to space

3.1 - 3.3 :	$\frac{m^2}{m^2}$	$\frac{Won}{m^2}$
	5,940	200,000
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	<u>Whole Amount</u>
W1,188,000,000	W61,000,000

c) Classification to beds

3.1 - 3.3 :	$\frac{No. \text{ of beds}}{No. \text{ of beds}}$	$\frac{Won}{Bed}$
	100	11,880,000
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	<u>Whole Amount</u>
W1,188,000,000	W61,000,000

No. 4:	Equipment	
4.1.	Medical Equipment	\$911,875
4.2.	Non-medical Equipment	\$55,715
	Total Sum of 4.1 + 4.2	
No. 5:	Outside Equipment	₩32,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	₩268,196,000
No. 7:	Engineering Fee	₩48,700,000
No. 8:	Dormitory	₩74,528,000

E. EURYONG

[illegible]

E. EURYONG HOSPITAL

1. Geographical Features

1.1 Euryong Gun is located at the mid-west region of Kyungnam Province where two rivers, the Nakdong River and its tributary stream called the Nam River, join together. South of this Gun is bounded by both Haman Gun and Jinyang Gun; east by Changnyung Gun; north by Hapcheon Gun, and adjoins Sanchun Gun on the west (Figure E-1).

1.2 The southern area facing the Nam River is a plain farmland, but the northern rather a small-sized gun with an area of 472 Km² and population of about 77,000. It has 1 Eup and 12 Myons, and the Eup was recently raised from Myon level. The population density is 165 persons/Km².

1.3 Of the entire population, 81% are farmers, and the average available land per farm-family is 0.77 ha. Euryong Gun mainly raises farm products. As other industries had not been prosperous, the migration of inhabitants has been tremendous. Out-migration was further accelerated because of the geographical proximity to the urban areas, Masan and Jinju City.

1.4 No hospital facilities are available in this area. Thus, several private practitioners and trainee physicians are the only sources of medical care. In other words, many of the patients have to travel along way to obtain some sophisticated medical care.

2. Disease Patterns

• See the report on Hadong Hospital.

3. Determination of the Euryong Hospital Catchment Area and Target Population

3.1 The residents of Nakseu Myon, Bulim Myon and Bongsoo Myon are currently to utilize those medical facilities in Changnyung Gun because the distance is shorter and traffic is more convenient as compared with those of Euryong Eup. The tendency will not be easily changed even after the establishment of a small-sized rural hospital in Euryong Gun. This is because of the fact that a more rapid regional development is expected in Changnyung Gun as local farm products gather here.

3.2 As for Jijung Myon and Yougog Myon, the residents of these two Myons would preferably utilize those medical facilities in and around Masan City because their residence borders Changnyung Gun and is close to the Changnyung-Masan Highway.

3.3 Even though a rural-type hospital is established in Euryong Gun, it is less likely for neighboring residents to utilize this Hospital because of the fact that the Gun is socio-economically less developed. Therefore, the catchment area of this Hospital would be the entire area of Euryong Gun with the exception of the area mentioned in 3.1. and 3.2.

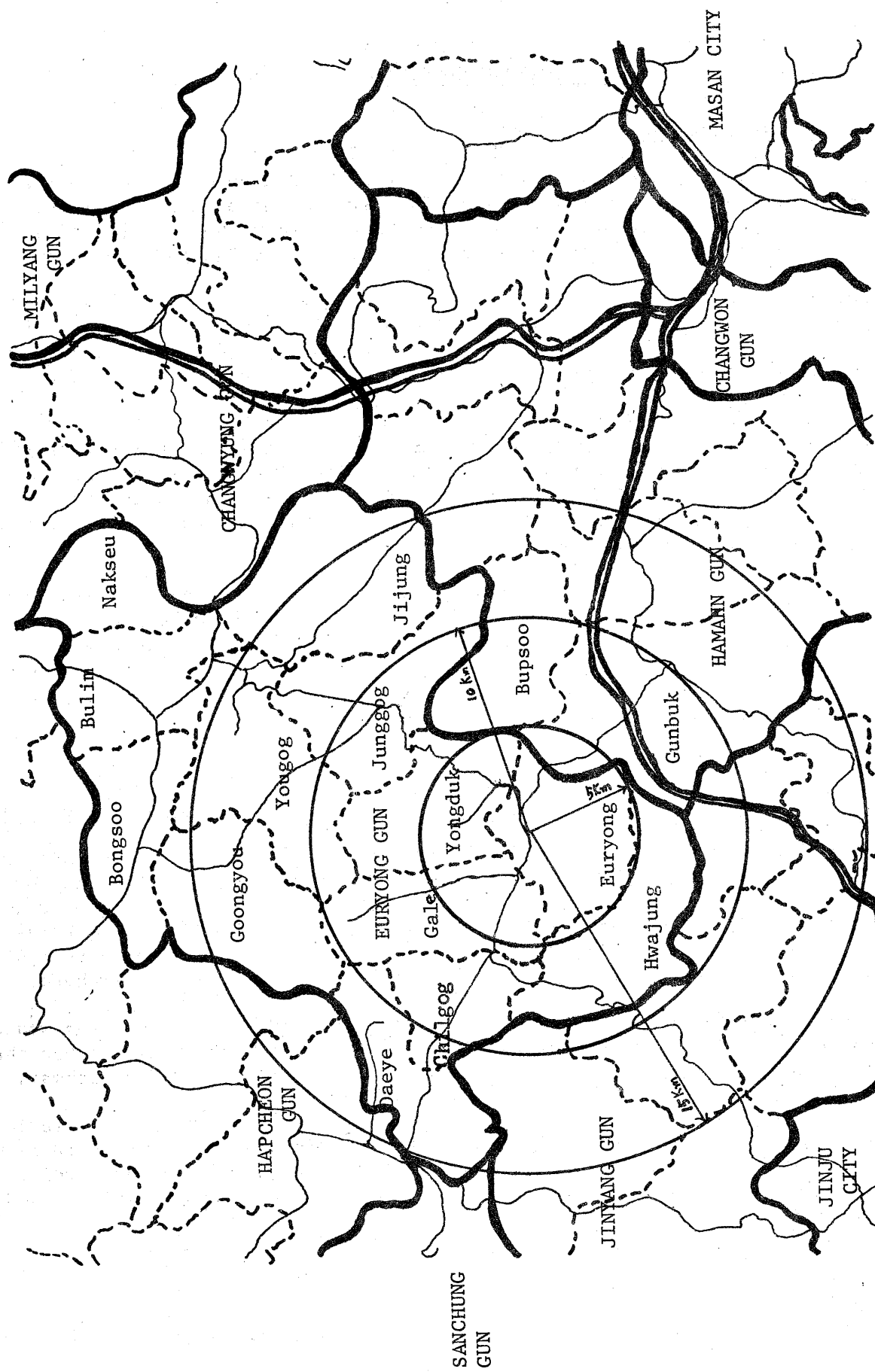


Figure E-1. The Euryong Map

3.4 Haman Gun is apparently included in the Masan living sphere. But Wolchon Li, part of Gunbuk Myon of Haman Gun, shares the Gun boundary with Euryong Eup by means of a bridge. As most of the residents of Wolchon Li now utilize the Euryong Market, it is fair to include Wolchon Li within the catchment area.

3.5 The catchment area for the proposed Hospital will cover as below:

- 8 Myons of Euryong Gun; Euryong Eup, Galye Myon, Chilgog Myon, Daeye Myon, Hwajung Myon, Yongduk Myon, Goongyou Myon and Junggog Myon.
- Wolchon Li of Gunbuk Myon within Haman Gun.

3.6 The population in Euryong Gun for the past several years, is as shown in Table E-1. As of 1978, total number of the population was 73,000 indicating a rapid decrease in population since 1970.

3.7 Assuming that the population in Euryong Gun will decrease logarithmically, the estimated target population during the planning period is as in Table E-2: 49,500 persons in 1980, 47,000 in 1981, 46,000 in 1982 and 42,500 in 1985.

4. Objectives of Euryong Hospital Establishment and Determination of Its Size

4.1 The objective of establishing the Euryong Hospital is to meet the medical care demand for the community people as well as to complete the local medical care delivery system through the implementation of patient referral services.

4.2 Presently, there are 9 physicians in Euryong Gun including three trainee physicians and two public doctors. Of them, three physicians are practicing within the catchment area, and they have owned 11 private beds (Table E-3). The proposed Hospital should be equipped with better facilities so as to take care of those serious cases referred from the existing private clinics.

4.3 The total number of medical insurance enrollees is 3,361 (public servants and their dependents - 1,556 and private school teachers and their dependents - 1,805). As no enterprise with 300 employees or more exists in the Gun, members of the Employees Health Insurance can be ignored. Medicaid recipients number 3,843 (low income group, 2,938 and indigent group, 905). Thus, the total number of target population with a third party payment is 7,204, and this number was assumed to undergo no change during the planning period (Table E-4).

4.4 On the assumption that the bed occupancy rate of private clinics is reduced from the current 40% to 30% and the average length of hospitalization days inpatient is 9 to 10 days, the shortage of hospital beds is estimated as in Table E-5. Namely, 43 beds (low estimate 39 and high estimate 46) in 1980, 45 beds (low estimate 41 and high estimate 48) in 1981, and 46 beds (low estimate 41 and high estimate 50) in 1985. (Table E-5).

4.5 If we consider the rising per capita income, expansion of medical insurance and increasing medical care utilization rate, it is realistic to assume the demand for medical care will go up even in this rural community. These factors are not

taken into account, therefore, the above estimates seem to be conservative figures. As underestimation in bed complements requirement is much safer than an overestimation, this study recommends 45-50 hospital beds to be constructed in Euryong Gun.

5. Medical Program

(Refer to the Report on the Hadong Hospital in this connection)

Table E-1 Population Trend in Euryong Gun

Year	Euryong	Galye	Chilgog	Daeye	Hwajung	Yongduk	Junggog	Jijung	Nakseu	Bulim	Bongsoo	Goongyou	Yongog	Total
1971	14,261	5,872	4,101	4,574	6,363	6,399	6,515	8,475	4,362	10,849	5,980	6,614	6,766	91,131
1972*	13,871	5,909	3,981	4,565	6,319	6,370	6,303	8,389	4,396	10,705	5,698	6,648	6,530	89,664
1973	14,195	5,490	3,954	4,438	6,203	6,068	6,174	8,005	4,537	10,909	5,561	6,314	6,332	88,170
1975	13,564	5,366	3,680	4,360	6,044	5,881	5,983	7,556	4,164	10,424	5,238	5,766	6,190	84,224
1976	13,745	5,074	3,579	4,068	5,697	5,598	5,803	7,396	4,127	10,109	5,011	5,528	5,877	81,612
1977	13,365	4,830	3,574	3,811	5,408	5,397	5,434	7,087	3,846	9,748	4,708	5,056	5,595	77,859
1978	12,901	4,706	3,160	3,475	5,030	4,990	5,146	6,790	3,471	9,163	4,395	4,723	5,085	73,035

* Non available

Source: Statistical Year Book of Euryong Gun.

Table E-2 Estimates of Population within the Euryong Hospital Service Area*

Year	Euryong Gun						Hamahn Gun		
	Euryong	Galye	Chilgog	Daeye	Hwajung	Yongduk	Goongyou	Junggog	Total
1979	13,365	4,830	3,574	3,811	5,408	5,397	5,056	5,434	49,544
1980	13,019	4,705	3,481	3,712	5,268	5,257	4,925	5,293	48,329
1981	12,678	4,582	3,390	3,615	5,130	5,119	4,796	5,154	47,133
1982	12,341	4,460	3,300	3,519	4,994	4,983	4,668	5,017	45,951
1983	12,008	4,340	3,211	3,424	4,859	4,848	4,542	4,882	44,783
1984	11,679	4,221	3,123	3,330	4,726	4,715	4,418	4,748	43,629
1985	11,354	4,104	3,036	3,237	4,595	4,584	4,295	4,616	42,490
1986	11,033	3,988	2,950	3,145	4,465	4,454	4,173	4,485	41,362
1987	10,715	3,873	2,865	3,054	4,336	4,326	4,053	4,356	40,247
1988	10,401	3,760	2,781	2,965	4,209	4,199	3,934	4,228	39,146
1989	10,091	3,648	2,698	2,877	4,084	4,074	3,817	4,102	38,060
1990	9,784	3,537	2,616	2,790	3,960	3,950	3,701	3,977	36,984
1991	9,481	3,427	2,535	2,704	3,837	3,828	3,586	3,854	35,921

* $Y = a + b \log x$

Table E-3 Number of Beds Owned by Private Practitioners in the Euryong Hospital Service Area

Name of Clinic	Location	Number of Beds
Masan	Euryong Eup	5
Park Gang Hee's Surgery	Euryong Eup	4
Park	Chilgog Myon	2
Total		11

Table E-4 Number of Public Officials, School Teachers and Medicaid Beneficiaries within the Euryong

Public Officials		School Teachers		Medicaid Beneficiaries		Total
Self	Dependents	Self	Dependents	Indigent Group	Low Income Group	
305	1,251	354	1,451	905	2,938	7,204

Table E-5 Bed Requirements in the Euryong Hospital Service Area

Year	General Population Excluding the Insured & Medicaid	Hospitalization Rate/Person/Year		The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		Average Length of Stay	No. of Existing Beds	Occupancy Rate (%)		Bed Require- ments	
		I	II		I	II			I	II	I	II
1979	42,340	0.0195	0.0239	7,204	0.0349	0.0349	9	11	40	39	46	
1980	41,125	0.0202	0.0247	7,204	0.0349	0.0366	9	11	40	39	46	
1981	39,929	0.0209	0.0254	7,204	0.0349	0.0385	9	11	30	41	48	
1982	38,747	0.0215	0.0262	7,204	0.0349	0.0404	9	11	30	41	49	
1983	37,579	0.0222	0.0269	7,204	0.0349	0.0424	9	11	30	41	49	
1984	36,425	0.0229	0.0271	7,204	0.0349	0.0445	9	11	30	41	49	
1985	35,286	0.0236	0.0284	7,204	0.0349	0.0468	9	11	30	41	49	
1986	34,158	0.0242	0.0292	7,204	0.0349	0.0491	9	11	30	41	50	
1987	33,043	0.0249	0.0299	7,204	0.0349	0.0516	9	11	30	41	50	
1988	31,942	0.0256	0.0307	7,204	0.0349	0.0541	9	11	30	40	50	
1989	30,856	0.0263	0.0314	7,204	0.0349	0.0568	9	11	30	40	51	
1990	29,780	0.0270	0.0322	7,204	0.0349	0.0597	9	11	30	40	51	
1991	28,717	0.0277	0.0335	7,204	0.0349	0.0627	9	11	30	40	51	

6. INVESTMENT AND FINANCING PLAN

(All the consumptions for the financial analysis of the hospitals in rural areas are the same as those mentioned in the analysis of the Nonsan Hospital. Since the Euryong Hospital is one of those in the rural areas, refer to the analysis of the Nonsan Hospital.)

6.1 Investment Cost

Table E-6-1. Euryong Hospital (45 beds)
Investment Cost 1/

Category	Local cost	Foreign cost
Land estate	₩130,700,000	\$272,292
Site preparation	8,000,000	16,667
Construction	665,000,000	1,385,417
Dormitory	32,880,000	68,500
Medical Equipment	241,131,000	502,356
Outside equipment	35,000,000	72,917
Contingencies	140,852,000	293,441
Engineering fees	38,000,000	79,167
Working capital	23,633,000	49,235
Total investment	₩1,315,196,000	\$2,739,992

1/ See Appendix A 4-1

6.2 Financing Plan

Table E-6-2. Euryong Hospital (45 beds)
Sources of Finance

Category	Local Currency	Foreign Currency
Total Investment	₩1,315,196,000	\$2,739,992
Foreign loan	216,000,000	450,000
Local loan	450,000,000	937,500
Capital	649,196,000	1,352,492
Total Financing	₩1,315,196,000	\$2,739,992

6.3. Pro-forma Balance Sheet (the year before operation starts)

Table E-6-3. Euryong Hospital (45 beds)
Balance Sheet (Beginning of Operation)

Assets		Liabilities	
Cash	154,487	Bank Credit	0
Auxiliary goods	4,335	Account payable	0
Pharmaceuticals and other materials	5,663	Draft	0
Equipment	241,131	Loans local	450,000
Building	778,880	foreign	216,000
Land	130,700	Capital	649,196
Total (\$000)	1,315,196 (2,740)	Total	1,315,196 (2,740)

7. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the study of the Nonsan Hospital.)

7.1 Revenue Estimation (See Table E-7-1)

7.2 Estimation of Expenses (See Table E-7-2)

7.3 Pro-forma Income Statement (See Table E-7-3)

7.4 Pro-forma Balance Sheet (See Table E-7-4)

8. ESTIMATION OF CASH FLOW (See Table E-8-1)

9. CONCLUSION FROM FINANCIAL ANALYSIS

9.1 The sponsor should provide \$1,352,000 (₩649,000,000) for initial operation and ₩190,000,000 (See 4.2 in Table E-8-1) for first seven years because of inadequate cash-inflow.

9.2 From the 8th year, profit and cash-inflow will be improved enough to payback the loan and enough not to need any more money.

9.3 The project is reasonable and will have a considerable effect in the long run.

Table E-7-1.

Euryong Hospital (45 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st - 10ty year)

Unit: ₩1,000 1\$ = 480 won										
Category	1	2	3	4	5	6	7	8	9	10
Insurance Private	63,805	103,734	136,024	159,703	187,282	228,860	278,670	333,189	388,942	354,872
	207,870	196,652	200,111	203,424	200,455	209,518	188,410	166,068	141,783	116,311
Inpatient Outpatients	170,351	194,165	216,875	242,665	263,069	301,410	323,518	348,601	372,457	404,740
	101,254	106,221	113,160	120,462	124,668	136,969	143,562	150,656	158,268	166,444
Total Local Foreign (\$000)	271,605	300,386	330,035	363,127	387,737	438,379	467,080	499,257	530,725	571,184
	(566)	(626)	(688)	(757)	(808)	(913)	(973)	(1,040)	(1,106)	(1,190)

Table E-7-2.

Euryong Hospital (45 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st - 10th year)

Unit: ₩1,000 1\$ = 480 won										
Year	1	2	3	4	5	6	7	8	9	10
Personnel	163,625	168,534	173,590	178,797	184,161	189,686	195,377	201,238	207,275	213,494
Physicians	53,368	54,969	56,618	58,317	60,066	61,868	63,724	65,636	67,605	69,633
Nurses	42,124	43,389	44,689	46,030	47,411	48,833	50,298	51,807	53,361	54,962
Medical assistant										
	11,938	12,296	12,665	13,045	13,436	13,839	14,255	14,682	15,123	15,576
Mgt. and ad.	11,876	12,232	12,599	12,977	13,367	13,768	14,181	14,606	15,044	15,495
Technical services										
and others	45,648	47,019	48,428	49,880	51,378	52,919	54,507	56,142	57,828	59,501
Pharma. and	67,950	74,947	82,344	90,600	96,740	109,376	116,537	124,565	132,416	140,560
X-ray										
Food & clothes	13,459	14,668	15,988	17,277	18,486	19,583	20,570	21,537	22,503	23,479
Heating &	13,474	14,467	15,429	16,479	17,596	18,761	19,414	20,135	20,795	21,509
utilities										
Maintenance	7,975	7,975	7,975	7,975	7,975	7,975	7,975	7,975	7,975	7,975
Bldg.	1,947	1,947	1,947	1,947	1,947	1,947	1,947	1,947	1,947	1,947
Equip.	6,028	6,028	6,028	6,028	6,028	6,028	6,028	6,028	6,028	6,028
Others	16,085	17,270	18,419	19,672	21,005	22,396	23,176	24,036	24,824	25,379
Total local	282,568	297,861	313,745	330,800	345,963	367,777	383,049	407,236	415,318	400,796
foreign (\$000)	(589)	(621)	(654)	(689)	(721)	(766)	(798)	(848)	(865)	(835)

Table E-7-3.

Euryong Hospital (45 beds)
ECONOMIC FORECASTING : PRO FORMA INCOME STATEMENTS
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Total Revenue	271,605	300,386	330,035	363,127	387,737	438,379	467,080	499,257	530,725	571,184
Total Expense	282,568	297,861	313,745	330,800	345,963	367,777	383,049	407,236	415,318	400,796
Operating income	*10,963	2,525	16,290	32,327	41,774	70,602	84,031	92,021	115,407	170,348
Depreciation	39,691	39,691	39,691	39,691	39,691	39,691	39,691	39,691	39,691	39,691
Interest	35,820	35,820	35,820	35,820	32,180	28,283	24,116	19,656	14,886	9,783
Netprofit (\$000)	*86,474 (*180)	*72,986 (*152)	*59,221 (*123)	*43,184 (*90)	*30,097 (*63)	2,628 (5)	20,224 (42)	32,674 (68)	60,830 (127)	120,914 (252)

* : deficit

Euryong Hospital (45 beds)
ECONOMIC FORECASTING : PRO FORMA BALANCE SHEETS
(1st - 10th year)

Table E-7-4.

	1	2	3	4	5	6	7	8	9	10
	Unit: ₩1,000 1\$ = 480 won									
Current Assets	164,485	164,485	164,485	164,485	164,485	164,485	164,485	168,688	796,277	278,847
Equipment	241,131	241,131	241,131	241,131	241,131	241,131	241,131	241,131	241,131	241,131
Depr.	24,113	48,226	72,339	96,452	120,565	144,678	168,791	192,904	217,017	241,131
Bldg.	778,880	778,880	778,880	778,880	778,880	778,880	778,880	778,880	778,880	778,880
Depr.	15,578	31,156	46,734	62,312	77,890	93,468	109,046	124,624	147,202	155,780
Land	130,700	130,700	130,700	130,700	130,700	130,700	130,700	130,700	130,700	130,700
Total	1,275,505	1,235,814	1,196,123	1,156,432	1,116,741	1,077,050	1,037,359	1,001,871	989,769	1,032,648
Current liabilities	-	0	0	0	0	0	0	0	0	0
Local loan	450,000	450,000	450,000	398,003	342,365	282,830	219,128	150,966	78,035	0
Foreign loan	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000	216,000
Capital	695,979	729,274	748,804	804,395	850,439	867,655	871,442	871,442	871,442	871,442
Retained earnings	0	*86,474	*159,460	*218,681	*261,965	*292,062	*289,434	*269,210	*236,536	*175,706
Net profit.	*86,474	*72,986	*59,221	*43,284	*30,097	*2,628	20,224	32,674	60,830	120,314
Total (\$000)	1,275,505	1,235,814	1,196,123	1,156,432	1,116,741	1,077,050	1,037,359	1,001,871	989,769	1,032,648
	(2,657)	(2,575)	(2,492)	(2,409)	(2,327)	(2,244)	(2,161)	(2,087)	(2,062)	(2,151)

* : deficit

Table E-8-1.

Euryong Hospital (45 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
1. Operating and Maintenance										
1.1 Personnel	163,625	168,534	173,590	178,797	184,161	189,686	195,377	201,238	207,275	213,494
1.2 Other expenses	110,968	121,352	132,180	144,028	153,827	170,116	179,697	198,133	200,068	179,327
1.3 Maintenance	7,975	7,975	7,975	7,975	7,975	7,975	7,975	7,975	7,975	7,975
1.4 Interest	35,820	35,820	35,820	35,820	35,820	28,283	24,116	19,656	14,886	9,783
1.5 Operating	318,388	333,681	349,565	366,720	378,143	396,060	407,165	426,892	430,204	410,579
1.6 Depreciation	39,691	39,691	39,691	39,691	39,691	39,691	39,691	39,691	39,691	39,691
1.7 Operating cost	358,079	373,372	389,256	406,411	417,834	435,751	446,856	466,583	469,895	450,270
2. Revenue										
2.1 Outpatient	101,254	106,221	113,160	120,462	124,668	136,969	143,562	150,656	158,268	166,444
2.2 Inpatient	170,351	194,165	216,875	242,665	263,069	301,410	323,518	348,601	372,457	404,740
2.3 Other										
2.4 Whole revenue	271,605	300,386	330,035	363,127	387,737	438,379	467,080	499,257	530,725	571,184
3. Calculation										
3.1 Operating income	86,474	*72,986	*59,221	*43,284	*30,097	2,628	20,224	32,674	60,830	120,914
3.2 Accumulation	*80,474	*159,460	*298,681	*261,965	*292,062	*289,434	*269,210	*236,536	*175,706	*54,792
3.3 Income tax										
4. Cash flow calculation										
4.1 Gross cash flow	*46,783	*33,295	*19,530	*3,593	9,594	42,319	59,915	72,365	100,521	160,605
4.2 Invested capital	46,783	33,295	19,530	55,591	46,044	17,216	3,787	0	0	0
4.3 Payoff/discharge	0	0	0	51,998	55,638	59,535	63,702	68,162	72,932	78,035
4.4 Net cash flow	0	0	0	0	0	0	0	4,203	27,589	82,570
4.5 Accumulation	0	0	0	0	0	0	0	4,203	31,792	114,362
of 4.4										
(\$000)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(8)	(66)	(238)

*: deficit

Appendix Table A 4-1

		Amount
No. 1: Land estate cost		
1.1.	Value: <u>quantity (Won/M²)</u>	
1.2.	Acquisition cost	
	7,200 m ² (18,150 Won/m ²)	
	Total Sum of No. 1	Whole Amount
		₩130,700,000
		₩130,700,000
No. 2: Site preparation cost		
2.1.	Public opening	₩2,000,000
2.2.	Non-public opening	₩6,000,000
2.3.	Other cost (i.e. taxes)	
	Total Sum of No. 2	₩8,000,000
No.3: Construction cost		
3.1.	Building (due to room and space program plus traffic ways)	₩445,000,000
3.2.	Installations (Sewage, Water, Heating, Electricity ...)	₩98,000,000
3.3.	Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators ...)	₩122,000,000
	Total Sum of 3.1 - 3.3	₩665,000,000

and:

a) Classification to space-content:

3.1 - 3.3 :	<u>m³</u>	<u>Won/m³</u>
	12,600	50,000
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	<u>Outside Equipment</u>
₩630,000,000	₩35,000,000

b) Classification to space

3.1 - 3.3 :	<u>m²</u>	<u>Won/m²</u>
	3,150	200,000
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	
₩630,000,000	₩35,000,000

c) Classification to beds

3.1 - 3.3	<u>No. of beds</u>	<u>Won/Bed</u>
	45	14,000,000
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	
₩630,000,000	₩35,000,000

No. 4:	Equipment	\$502,358
4.1.	Medical Equipment	\$468,415
4.2.	Non-medical Equipment	\$33,943
	Total Sum of 4.1 + 4.2	
No. 5:	Outside Equipment	₩25,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	₩140,852,000
No. 7:	Engineering Fee	₩38,000,000
No. 8:	Dormitory	₩32,880,000

F. YOUNG WANG

F. YOUNGGWANG HOSPITAL

1. Geographic Features

1.1 Located on the northwest of Cholla Namdo, Younggwang County borders on Hampyung County on the south, Jangsung County on the east, Cholla Bukdo to the north, and faces the Yellow Sea to the west (See Map F-1).

1.2 Except for limited rugged areas, Younggwang County has rich soil and is known as part of the Honam granary. The western coastal waters are also one of the rich coastal fishing grounds of jogi in Korea.

1.3 As of the end of 1977, the population in Younggwang County totaled 139,041 of 24,365 households, including 69,958 males and 69,083 females. Most of the population are residing within a 15-km radius of Younggwang Town, with a population density amounting to 300 persons per 1 square km.

1.4 As Daesan Myon and Bupseong Myon of Cholla Bukdo is contiguous to Younggwang Town, most of the residents in the two Myons of the province go shopping on market day every 5 days at Younggwang Eup. The same is also true of the residents in Shingwang Myon and Haebo Myon of Hampyung County.

1.5 Generally, most of the borderlands lying between the provinces have poor medical facilities because medical administration in general and hospital construction in particular have been developed in consideration of regional administrative and geographical conveniences rather than the demand for local medical services. In Cholla Bukdo, the borderland area of Gochang County is considered as a medically underserved area. Therefore, if a hospital is constructed at Younggwang Eup, residents in the borderland areas of Cholla Bukdo will also receive a considerable amount of medical services. 1/

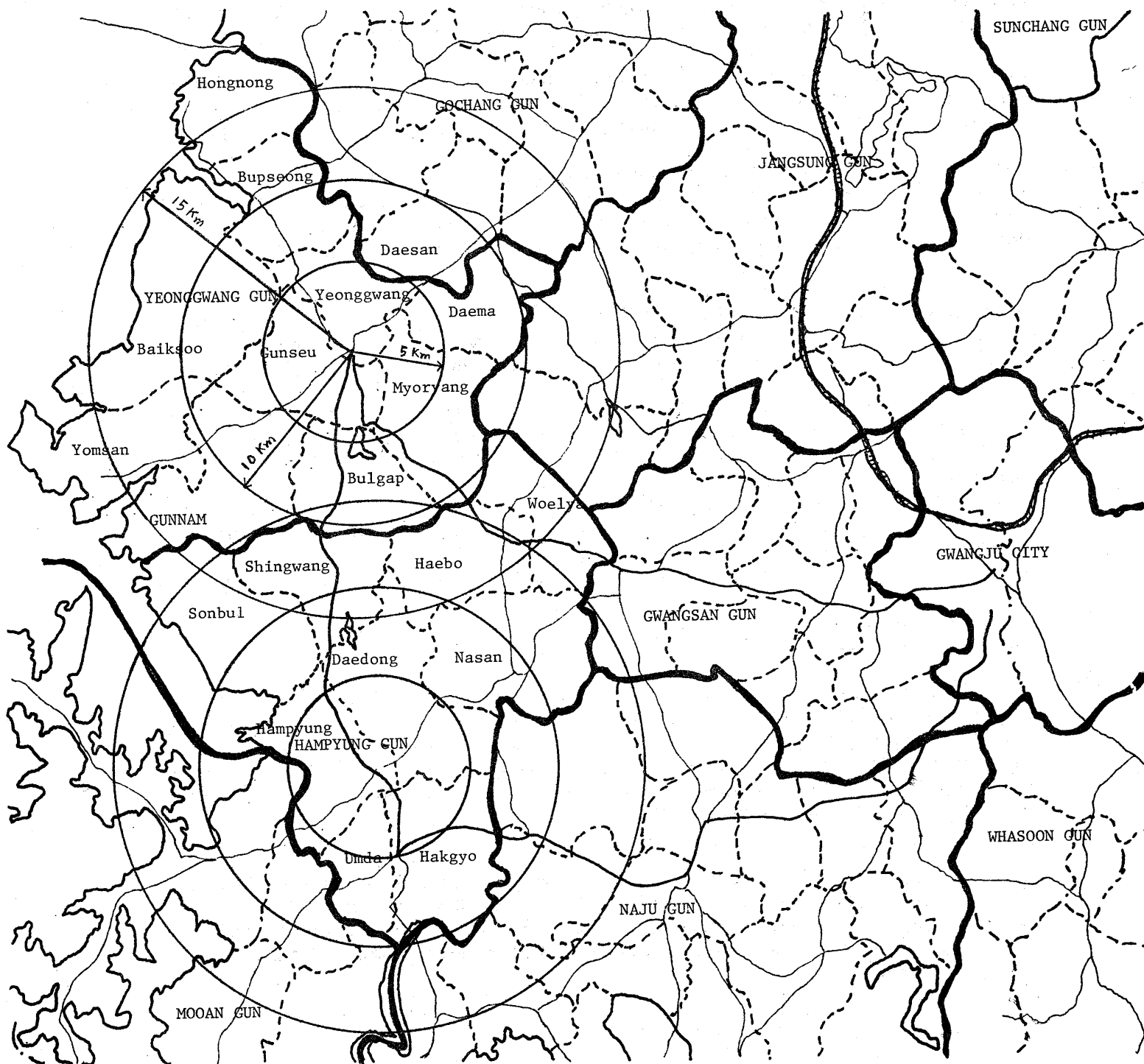
2. Younggwang County vs. Hampyung County: Comparison of prospective Locations for Hospital Construction

2.1 The government has earlier designated Hampyung County and Haenam County as the medically underserved areas in Cholla Namdo. 2/ In the original plan the Hampyung Hospital is to cover Hampyung County and Younggwang County as its catchment of medical services. 3/ In particular, the neighboring Hampyung County and Younggwang County have been included in the same medical service area of Younggwang County.

1/ An interview with an official in charge of social welfare, Department of Internal Affairs, the Office of Gochang County, March 1979.

2/ The Hospital Construction Plan for Industrial Complex and Medically Underserved Areas, the Ministry of Health and Social Affairs, P. 23, May 1979.

3/ *ibid.*



Map F-1. Younggwang Gun and Hampyung Gun

2.2 In determination of a prospective location for hospital construction, this study has concluded that priority should be given to Younggwang County rather than Hampyung County for the following reasons.

2.2.1 The two counties have similar conditions and are included in the living sphere of Kwangju City. However, the travel time and convenience from the two counties to and from Kwangju is different.

The travel time by public transportation from Younggwang Town and Hampyung Town to Kwangju City takes one hour and one hour and twenty minutes, respectively. In particular, travelling from Younggwang Town to and from Kwangju City reaching the road passes through Wolya Myon and Haebo Myon, Hampyung County. In addition, as the Honam Railroad runs through Hakkyo Town, Hampyung County, going from these areas to Kwangju and Seoul is more convenient than going to Younggwang Town.

2.2.2 The two counties have no hospital-level medical facilities. Younggwang County has 11 medical practitioners, of which 6 are in Younggwang Town. Therefore, the doctorless areas number 7 Myons, representing 63.6% of the total 11 Myons in the County.

Hampyung County has 6 medical practitioners, of which 2 are in Hampyung Town. The doctorless areas number 4 Myons, representing 44.4% of the total 9 Myons in the County. Although Hampyung County has a relatively small number of practicing doctors (Table F-1), Younggwang County is more unfavorable in terms of the distribution of medical practitioners among the people. Therefore, Younggwang County is more medically vulnerable than Hampyung County because the former has more doctorless areas than the latter.

2.2.3 If a hospital is constructed in Younggwang Town, the residents in Daesan Myon and Bupseong Myon, Gochang County, as stated above 1.5., will also be able to receive medical services. Therefore, Younggwang Town is a more prospective place for a hospital which could provide medical services for residents in the borderland of the province.

2.2.4 As stated in above 1.4., many residents in adjacent Myons go shopping on the local market every 5 days at Younggwang Town. The number of residents in Hampyung County who visit Younggwang Town on the local market day is larger than that of the residents in Younggwang County who go to local market held in Hampyung Town. 1/

In view of the fact that many rural people visit hospitals and medical facilities on the local market days, it will be more favorable for Younggwang Town to have a hospital.

1/ Interviews with local residents, March 1979.

Table F-1. Younggwang Gun vs. Hampyung Gun, 1976

Items		Younggwang Gun	Hampyung Gun
No. of Population	1976	142,081	118,157
	1977	139,041	116,555
Area (Km ²)		462.42	386.62
Pop. Density (Pers./Km ²)		301	302
Pop. of Farmers (%)		76.7	83.2
Local Tax Collected (1,000 Won)		442,845	275,515
Local Tax/Household		18,265	12,975
Road (Km)	Paved	26.5%	18.0%
	Non-paved	73.5%	82.0%
No. of Cars		217	216
No. of Home Facility per Household	Radio	0.89	0.89
	Television	0.24	0.15
	Newspaper	0.23	0.41
No. of Doctors	1976	9	7
	1977	11	6
No. of Pop./Doctor	1976	15,787	16,880
	1977	12,640	19,426
No. of Non-Doctor Myon		7	4
Railway Transportation		None	Existent

SOURCE: Statistical Year Book of Younggwang Gun, 1977
Statistical Year Book of Hampyung Gun, 1977

2.2 5. The government plans to develop Naju Town as a satellite city of Kwangju City. As Naju is located midway between Kwangju City and Hampyung Town, the development of Naju is expected to increase the medical services to the adjacent areas of Hampyung County.

2.2 6. The government has decided to construct nuclear power plants in Younggwang County. For a balanced development of public service sectors, a hospital should be established in Younggwang County.

2.2 7. Most areas of Shingwang Myon, Haebo Myon and Wolya Myon of Hampyung County are located within a 15 Km radius of Younggwang Town (Map 1). By contrast, most Myons of Younggwang County are located outside of a 15-Km radius of Hampyung Town. Therefore, it is geographically more reasonable to construct a hospital in Younggwang Town than in Hampyung Town.

2.2 8. An industrial highway linking Mokpo and Chonju City is under construction. The west coastal highway will run through Hampyung Town and Younggwang Town, accelerating the regional development of the areas. If a hospital should be constructed in the areas, the place should be in Younggwang Town which has more population and prospects of a rapid industrial development than Hampyung Town.

3. Objectives of Younggwang Hospital Establishment

3.1 The Younggwang Hospital will provide medical services primarily for 11 doctorless Myons of the County in line with the government's medical service development program in rural areas.

3.2 The hospital will serve as the secondary medical facility to take care of the patients referred by 16 medical practitioners in the areas concerned, thus developing the local medical delivery system.

3.3 The Hospital will also provide medical services for the residents in the borderland areas of the province. The Hospital will contribute to the healthful community development in the rapidly industrializing area prompted by the construction of nuclear power plants.

4. Medical Service Catchment Areas of Younggwang Hospital

4.1 Most areas of Younggwang County are located within a 15-Km radius of Younggwang Town, with a travel time of 30-40 minutes by car. Therefore, the whole area of Younggwang County could be covered by the Hospital for medical services.

4.2 Most areas of Shingwang Myon, Haebo Myon and Wolya Myon of Hampyung County are located within a 15-Km radius of the projected hospital. However, as Wolya Myon is located nearer to the sphere of Kwangju City, the Wolya Myon is excluded from the catchment area of the projected Hospital.

4.3 Daesan Myon and Bupseong Myon of Gochang County are located within a 10-15 Km radius of Younggwang Town. The residents in the two Myons are accessible to the Chongup Hospital in Chongup County, Cholla Bukdo, which is located 3-4 times farther off than the projected Younggwang Hospital.

However, Bupseong Myon is excluded from the catchment area to prevent overestimation of the requirement of the bed-capacity of the projected Hospital.

4.4 The primary medical service catchment area of the Younggwang Hospital will be as follows:

- The whole area of Younggwang County
- Shingwang Myon and Haebo Myon, Hampyung County
- Daesan Myon, Gochang County

5. Population Trend in the Target Area

5.1. The population trend in Younggwang County is as shown in Table F-2. Until 1972, the population in the County had increased, but the population has steadily declined since 1973. As of the end of 1977, the population in the County totaled 139,041.

5.2 The population trend in Hampyung County is as shown in Table F-3. Since 1972, the population of Hampyung County has steadily decreased, including that of Shingwang Myon and Haebo Myon. As of the end of 1977, the residents in Shingwang Myon and Haebo Myon totaled 18,541.

5.3 The population trend in Daesan Myon, Gochang County, is as shown in Table F-4. As of the end of 1977, the population totaled 13,007.

Table F-2 Trend of the Younggwang Gun Population by Area

Year	Yeonggwang	Daema	Myoryang	Bulgap	Gunseu	Gunnam	Yonsan	Baiksoo	Bupseong	Hongnong	Nakwol	Total
1970	21,829	8,627	9,266	6,205	14,664	16,048	15,283	21,982	17,303	12,205	4,277	147,689
1971	21,584	8,645	9,223	6,401	14,302	16,174	15,829	22,538	16,658	12,178	4,096	147,628
1972	22,472	8,535	9,172	6,452	14,639	16,260	14,556	22,659	17,277	12,082	4,278	149,582
1973	22,495	8,551	9,389	6,373	14,706	16,287	16,022	22,905	17,821	12,334	4,205	151,088
1974	21,739	8,700	9,125	6,146	15,035	16,414	16,135	22,471	17,040	12,498	4,153	149,456
1975	21,967	7,951	8,686	5,772	14,040	15,627	15,159	21,428	16,344	11,862	3,847	142,693
1976	21,786	7,827	8,664	5,736	13,978	14,999	15,177	21,420	16,848	11,827	3,819	142,081
1977	21,575	7,583	8,133	5,572	13,423	14,465	15,169	21,178	16,534	11,424	3,985	139,041

SOURCE: Statistical Year Book of Younggwang Gun, 1971-1978.

Table F-3. Trend of the Hampyung Gun Population by Area

Year	Hampyung	Sonbul	Shingwang	Hakgyo	Umda	Daedong	Nasan	Haabo	Wolya	Total
1970	22,830	16,332	9,959	20,688	8,911	10,189	14,834	9,850	13,647	127,240
1971	22,367	16,372	9,891	20,362	8,760	10,145	14,503	10,144	13,595	126,139
1972	22,914	16,667	10,293	20,613	9,044	10,293	14,661	10,171	13,541	128,197
1973	22,652	16,695	10,266	17,295	8,915	13,448	14,421	10,235	13,694	127,621
1974	22,445	16,600	10,089	17,143	8,896	13,202	14,203	10,257	13,801	126,636
1975	21,383	15,622	9,423	16,026	8,275	12,341	13,453	9,751	13,134	119,237
1976	21,184	15,596	9,397	15,806	8,176	12,362	13,267	9,418	12,951	118,157
1977	20,911	15,590	9,265	15,577	8,046	12,209	12,895	9,276	12,786	116,555

Table F-4. Population Trend in Daesan Myon, Gochang Gun

Year	Male	Female	Total
1970	6,578	6,730	13,308
1971	6,435	6,379	12,814
1972	6,721	6,654	13,375
1973	6,666	6,641	13,307
1974			
1975	6,745	6,750	13,495
1976	6,635	6,691	13,326
1977	6,520	6,487	13,007

Table F-5. Estimates of the Younggwang Gun Population

Year	No. of Population
1970	147,689
1971	147,628
1972	149,582
1973	151,088
1974	149,456
1975	142,693
1976	142,081

	Projection I	Projection II
1978	135,431	135,569
1979	132,284	132,561
1980	129,137	129,591
1981	125,990	126,658
1982	122,844	123,760
1983	119,697	120,898
1984	116,550	118,070
1985	113,403	115,276
1986	110,256	112,514
1987	107,109	109,784
1988	103,962	107,084
1989	100,815	104,418
1990	97,668	101,780
1991	94,521	99,170

$$Y = a + bx$$

$a : 380,889.30$
 $b : -3,146.90$
 $r^2 : 0.93$

$$Y = a + b \log x$$

$a : 1,164,286.49$
 $b : -236,122.64$
 $r^2 : 0.93$

5.4 The population in the areas concerned is assumed to decline by the linear formula (Projection I) or logarithmic formula (Projection II) as shown in Table F-5, 6, 7, and 8.

5.5 According to the Projection II, the population in the areas concerned is estimated as shown in Table 9. The population will decrease from 162,813 in 1979 to 159,187 in 1980, to 155,605 in 1981, to 152,065 in 1982, and to 138,328 in 1986.

5.6 The number of the insured under the Medical Insurance Program and the Medicaid is as shown in Table F-10. There are few persons insured under the Employees and Self-employed Medical Insurance Program in the area concerned. There are 2,636 civil servants and 6,916 teachers who are insured under the Public Officials and Teachers Medical Insurance Program, and 16,645 persons who receive the Medicaid, with a combined total of 26,197 persons. The medically insured people account for 16% of the total target population.

6. Requirement of Hospital-beds

6.1 The status of medical personnel in Younggwang County and Hampyung County is as shown in Table F-11. There are 16 medical practitioners, 2 dentists, 1 herb doctor, 3 midwives, 10 nurses, 127 nurse aids, with a combined total of 159 medical personnel in the 2 Counties. There are also 102 pharmacists, druggists and drug sellers.

6.2 The number of hospital-beds in the areas concerned amounts to 58 as shown in Table F-12.

It is assumed that there will be no increase in the number of hospital-beds in the areas concerned and that the occupancy rate of hospital-beds will gradually decline from the present 40% to 30% in the coming years.

6.3 This study used the same hospital utilization rate of the general residents, the insured under the Medical Insurance Program and the Medicaid as in the estimation of hospital-bed requirements for Pyungchang Hospital (Table F-13).

6.4 As a result, there will be an additional requirement of 109 hospital-beds in the areas concerned in 1980 (low estimate, 99 beds; high estimate, 119 beds), 117 beds in 1981 (low estimate, 106; high estimate, 127 beds), 118 beds in 1982 (low estimate, 106 beds; high estimate, 129 beds), and 120 beds in 1985 (low estimate, 107 beds; high estimate, 133 beds).

6.5 It will not be necessary for the projected hospital to meet the entire need of hospital-beds within the catchment area. However, in view of the fact that there is no hospital-level medical facilities in the vicinity, it will be most realistic for the projected Hospital to have 100 beds.

Table F-6. Estimates of the Shingwang Myon Population

Year	No. of Population	
1970	9,959	
1971	9,891	
1972	10,293	
1973	10,266	
1974	10,089	
1975	9,423	
1976	9,397	
1977	9,265	
	Projection I	Projection II
1978	8,948	8,962
1979	8,707	8,734
1980	8,467	8,509
1981	8,266	8,287
1982	7,986	8,067
1983	7,746	7,850
1984	7,505	7,636
1985	7,265	7,424
1986	7,025	7,214
1987	6,784	7,007
1988	6,544	6,803
1989	6,303	6,601
1990	6,063	6,401
1991	5,823	6,203

$$Y = a + bx$$

a: 27,696.50
b: -240.37
r²: 0.89

$$Y = a + b \log x$$

a: 86,954.43
b: -17,901.62
r²: 0.89

Table F-7. Estimates of the Haebo Myon Population

Year	No. of Population	
1970	9,850	
1971	10,144	
1972	10,171	
1973	10,235	
1974	10,257	
1975	9,751	
1976	9,418	
1977	9,276	
	Projection I	Projection II
1978	8,857	8,866
1979	8,529	8,550
1980	8,201	8,239
1981	7,874	7,931
1982	7,546	7,627
1983	7,219	7,327
1984	6,891	7,031
1985	6,563	6,737
1986	6,236	6,446
1987	5,908	6,161
1988	5,581	5,878
1989	5,253	5,599
1990	4,925	5,322
1991	4,598	5,048

$Y = a + bx$
 a: 34,409.30
 b: -327.60
 r2: 0.94

$Y = a + b \log x$
 a: 116,767.74
 b: -24,766.81
 r2: 0.94

Table F-8

Estimate of the Daesan Myon Population

Year	Number of Population	
	Projection I	Projection II
1978	13,088	12,794
1979	11,968	12,557
1980	12,848	12,324
1981	12,729	12,094
1982	12,611	11,867
1983	12,495	11,642
1984	12,380	11,420
1985	12,266	11,201
1986	12,154	10,984
1987	12,043	10,770
1988	11,934	10,558
1989	11,825	10,348
1990	11,718	10,141
1991	11,612	9,936

Table F-9

Number of Target Population within the Younggwang Hospital Service Area

Year	Younggwang Gun	Hampyung Gun		Gochang Gun (Daesan)	Total
		Shingwang	Haebo		
1978	135,569	8,962	8,866	13,088	166,485
1979	132,561	8,734	8,550	12,968	162,813
1980	129,591	8,509	8,239	12,848	159,187
1981	126,658	8,287	7,931	12,729	155,605
1982	123,760	8,067	7,627	12,611	152,065
1983	120,898	7,850	7,327	12,495	148,570
1984	118,070	7,636	7,031	12,380	145,117
1985	115,276	7,424	6,737	12,266	141,703
1986	112,514	7,214	6,446	12,154	138,328
1987	109,784	7,007	6,161	12,043	134,995
1988	107,084	6,803	5,878	11,934	131,699
1989	104,418	6,601	5,599	11,825	128,443
1990	101,780	6,401	5,322	11,718	125,221
1991	99,170	6,203	5,048	11,612	122,033

a: 1,164,286.49
b: -236,122.64
r2: 0.93

a: 86,954.43
b: -17,901.62
r2: 0.89

a: 116,767.74
b: -24,766.81
r2: 0.94

a: 712,574.98
b: -124,536.16
r2: 0.81

Table F-10.

Number of Public Officials, School Teachers and Medicaid Beneficiaries Within the Younggwang Hospital Service Area

Gun	Public Officials		School Teachers		Medicaid Beneficiaries		Total
	Sub-scriber	Dependents	Sub-scriber	Dependents	Indigent Group	Low Income Group	
Younggwang	406	1,908	983	4,620	1,666	11,379	20,962
Hampyung	35	154	153	673	327	2,192	3,534
Gochang *	23	110	84	403	168	913	1,701
Total	464	2,172	1,220	5,696	2,161	14,484	26,197

* Estimated from the Gochang Gun figures in the 1978 Statistical Year Book.

Table F-11. Health Manpower in Younggwang and Hampyung, 1977

Gun	Eup or Myon	Physician	Area-limited practitioner	Dentist	Herb Doctor	Mid-wife	Nurse	Nurse -aid	Total	Pharmacist					Druggist		Drug Seller	Total
															Modern	Herb		
Hampyung	Hampyung	1	1	1	1	1	3	48	56	4		2	4				1	11
"	Sonbul	-	-	-	-	1	-	-	1	1		1	2				-	4
"	Shingwang	-	-	-	-	-	-	-	-	-		1	2				1	4
"	Hakgyo	-	1	-	-	-	-	-	1	2		2	1				-	4
"	Umda	-	-	-	-	-	-	-	-	-		1	2				-	5
"	Daedong	-	-	-	-	-	-	-	-	-		2	1				-	3
"	Nasan	-	1	-	-	-	-	-	1	1		-	2				-	3
"	Haabo	-	1	-	-	-	-	-	1	2		1	2				-	5
"	Wolya	-	1	-	-	-	-	-	1	-		2	2				-	4
Sub-total		1	5	1	1	2	3	48	61	10		12	18				2	42
Younggwang	Younggwang	6	-	1	-	1	7	48	63	8		1	8				-	17
"	Daema	-	-	-	-	-	-	3	3	-		2	2				-	4
"	Myoryang	-	-	-	-	-	-	3	3	-		1	1				-	2
"	Bulgap	-	-	-	-	-	-	3	3	-		1	1				-	3
"	Gunseu	-	-	-	-	-	-	3	3	-		-	-				-	1
"	Gunnam	1	-	-	-	-	-	3	4	2		-	3				-	5
"	Yonsan	-	-	-	-	-	-	3	3	-		2	2				-	5
"	Balksoo	1	-	-	-	-	-	4	5	2		2	4				-	8
"	Bupseong	2	-	-	-	-	-	3	5	4		2	4				-	10
"	Hongnong	-	-	-	-	-	-	3	3	-		1	1				-	3
"	Nakwoel	-	-	-	-	-	-	3	3	-		1	1				-	2
Sub-total		10	-	1	-	1	7	79	98	16		13	27				4	60
Grand Total		11	5	2	1	3	10	127	159	26		25	45				6	102

Table F-12. Number of Beds Owned by Private Practitioners in the
Younggwang Hospital Service Area

Name of Clinics	Location	Number of Beds
Gwangju	Younggwang Eup	17
Inje	Younggwang Eup	12
Cho's	Younggwang Eup	8
Oh's	Younggwang Eup	12
Youngseng	Younggwang Eup	3
Haegwang	Gochang (Daeshan Myon)	3
Daein	Hampyung (Haebo Myon)	3
Total		58

Table F-13. Bed Requirements in the Younggwang Hospital Service Area

Year	The Insured & Medicaid Beneficiary	Hospitalization Rate/Person/Yr.		Average Length of Stay	General Population Excluding the Insured & Medicaid	Hospitalization Rate/Person/Yr.		Average Length of Stay	No. of Existing Beds	Occupancy Rate (%)	Bed Requirements	
		I	II			I	II				I	II
1979	26,197	0.0349	0.0349	9	136,615	0.0195	0.0239	10	58	40	98	117
1980	26,197	0.0349	0.0366	9	132,990	0.0202	0.0247	10	58	40	99	119
1981	26,197	0.0349	0.0385	9	129,408	0.0209	0.0254	10	58	30	106	127
1982	26,197	0.0349	0.0404	9	125,868	0.0215	0.0262	10	58	30	106	129
1983	26,197	0.0349	0.0424	9	122,373	0.0222	0.0269	10	58	30	106	130
1984	26,197	0.0349	0.0445	9	118,920	0.0229	0.0277	10	58	30	107	132
1985	26,197	0.0349	0.0468	9	115,506	0.0236	0.0284	10	58	30	107	133
1986	26,197	0.0349	0.0491	9	112,131	0.0242	0.0292	10	58	30	106	135
1987	26,197	0.0349	0.0516	9	108,798	0.0249	0.0299	10	58	30	106	136
1988	26,197	0.0349	0.0541	9	105,502	0.0256	0.0307	10	58	30	106	137
1989	26,197	0.0349	0.0568	9	102,246	0.0263	0.0314	10	58	30	105	138
1990	26,197	0.0349	0.0597	9	99,024	0.0270	0.0322	10	58	30	105	140
1991	26,197	0.0349	0.0627	9	95,836	0.0277	0.0335	10	58	30	104	143

7. Medical Program

7.1 The 100-bed Hospital will be a relatively large hospital in the medically under-served areas, and will have similar conditions as the projected Nonsan Hospital. However, as Younggwang County is located farther away from Seoul and Daejeon than Nonsan County and has been less urbanized, it will be more difficult to recruit sufficient medical staff for the Hospital.

7.2 The Hospital will have 7 clinical departments, including the 4 four basic departments plus orthopedic, otolaryngology and dental departments. The occupancy rate of the hospital-beds is expected to maintain 55% at the initial phase (Table F-14).

7.3 The Hospital is expected to have a total of 1,862 inpatients annually, and outpatients totaling 13,150 annually, with a daily average of 135.

7.4 The number of the patients to be treated at the clinical departments of the Hospital and the distribution of the patients who are insured under the Medical Insurance Program are as shown in Table F-15 and 16.

Table F-14-1. Medical Program of Younggwang Hospital in 1980

1: INPATIENTS

Medical disciplines/specialties	No. of case per year	Average length of stay(days)	Occupancy rate of beds(%)	Distribution of beds (number)
Internal medicine	670	10	55	33
General surgery	279	14	55	20
Orthopedic surgery	186	20	55	18
Pediatrics	205	7	55	7
OB & GYN	354	6	55	11
ENT	149	13	55	10
Jaw surgery	19	10	55	1
TOTAL OR AVERAGE	1,862	10.75	55	100

2: OUTPATIENTS

Medical disciplines	No. of cases	Visits/case	No. of visits per year
Internal medicine	5,670	2.6	14,742
General surgery	1,260	2.4	3,024
Orthopedics	945	2.8	2,646
Pediatrics	1,512	3.5	5,292
OB & GYN	1,219	3.1	3,780
ENT	1,063	3.2	3,402
Dental	1,481	3.3	4,914
TOTAL	13,150	2.9	37,800

Table F-14-2. Medical Program of Younggwang Hospital, 1980.

3: MEDICAL PERFORMANCES

Kind of performances	No. of performances per year		
	for inpatients	for outpatients	Total
Emergency cases		1,890	1,890
Endoscopies			40
Laboratory diagnostics			
- chemical	1,040	2,908	3,948
- hematological	2,248	8,567	10,815
- serological	750	2,852	3,602
- bacteriological	1,489	4,366	5,855
- specially: performances fit for antoanalyzers	-	-	-
- stool exam.	550	1,500	2,050
- urinalysis	1,925	2,759	4,684
Blood preserves			1,000 pints
Plain X-ray	3,524	6,815	10,339
Mass X-ray	-	2,659	2,659
Fluoroscopies	100	-	100
Operations			
- general surg.	168	126	294
- orthop, surg.	90	29	119
- OB & GYN	80	49	129
- ENT	89	53	142
- jaw surgery	3	118	121
Total	430	375	805
Deliveries	264	-	264
Physiotherapy			2,000
Physical check-up		1,500	1,500

4. FURTHER FUNCTIONS

Function	Quantities per year
Ambulance	300
- transportations	
Medical training	
- intern	5 persons
- resident	15 persons

Table F-15. Number of Inpatient Cases by Medical Specialty and Insurance Coverage

<u>Med. Specialty</u>	<u>Insurance Coverage</u>	<u>1980</u>	<u>1981</u>	<u>1985</u>	<u>1990</u>
Internal Medicine	Total	670	711	896	1,069
	Insurance	168	213	538	962
	Non-insurance	502	498	358	107
General Surgery	Total	279	296	291	347
	Insurance	84	89	175	312
	Non-insurance	195	207	116	35
Orthopedics	Total	186	197	218	260
	Insurance	89	59	131	234
	Non-insurance	97	138	87	26
Pediatrics	Total	205	217	266	318
	Insurance	45	65	160	286
	Non-insurance	160	152	106	32
OB & GYN	Total	354	375	484	578
	Insurance	89	113	290	520
	Non-insurance	265	262	194	58
ENT	Total	149	158	194	231
	Insurance	28	47	116	208
	Non-insurance	121	111	78	23
Dental	Total	19	20	73	87
	Insurance	4	6	44	78
	Non-insurance	15	14	29	9
TOTAL	TOTAL	1,862	1,974	2,422	2,890
	INSURANCE	507	592	1,454	2,600
	NON-INSURANCE	1,355	1,382	968	290

Table F-16. Number of Outpatient Visits by Medical Specialty and Insurance Coverage

<u>Med. Specialty</u>	<u>Insurance Coverage</u>	<u>1980</u>	<u>1981</u>	<u>1985</u>	<u>1990</u>
Internal Medicine	Total	14,742	15,479	18,571	20,502
	Insurance	4,275	5,263	10,214	18,452
	Non-insurance	10,467	10,216	8,357	2,050
General Surgery	Total	3,024	3,175	3,714	3,588
	Insurance	998	1,080	2,043	3,229
	Non-insurance	2,026	2,095	1,671	359
Orthopedics	Total	2,646	2,778	2,786	3,075
	Insurance	873	945	1,532	2,768
	Non-insurance	1,773	1,833	1,254	307
Pediatrics	Total	5,292	5,557	5,571	6,151
	Insurance	2,487	1,889	3,064	5,536
	Non-insurance	2,805	3,668	2,507	615
OB & GYN	Total	3,780	3,969	5,571	6,663
	Insurance	1,134	1,349	3,064	5,997
	Non-insurance	2,646	2,620	2,507	666
ENT	Total	3,402	3,572	3,714	4,100
	Insurance	1,497	1,214	2,043	3,690
	Non-insurance	1,905	2,358	1,671	410
Dental	Total	4,914	5,160	6,500	7,176
	Insurance	2,015	1,754	3,575	6,458
	Non-insurance	2,899	3,406	2,925	718
TOTAL	TOTAL	37,800	39,690	46,427	51,255
	INSURANCE	13,279	13,494	25,535	46,130
	NON-INSURANCE	24,521	26,196	20,892	5,125

8. INVESTMENT AND FINANCING PLAN

(All the assumptions for the financial analysis of the hospitals in rural areas are the same as those mentioned in the analysis of the Nonsan Hospital. Since the Yeonggwang Hospital is one of those in rural areas, refer to the analysis of the Nonsan Hospital.)

8.1 Investment Cost

Table F-17-1 Yeonggwang Hospital (100 beds)
Investment Cost ^{1/}

Category	Local Cost	Foreign Cost
Land estate	₩241,400,000	\$502,917
Site preparation	14,000,000	29,167
Construction	1,226,000,000	2,554,167
Dermitory	72,336,000	150,700
Medical equipment	445,772,000	928,692
Outside equipment	56,000,000	116,667
Contingencies	261,616,000	545,033
Engineering fees	50,000,000	104,167
Working capital	48,019,000	100,040
Total investment	₩2,415,143,000	\$5,031,548

^{1/} See Appendix A 4-1.

8.2 Financing Plan

Table F-17-2 Yeonggwang Hospital (100 beds)
Sources of Finance

Category	Local Currency	Foreign Currency
Total investment	₩2,415,143,000	\$5,031,548
Foreign loan	445,772,000	928,692
Local loan	1,000,000,000	2,083,333
Capital	969,371,000	2,019,523
Total financing	₩2,415,143,000	\$5,031,548

8.3. Pro-forma Balance Sheet (the year before operation starts)

Table F-17-3

Yeonggwang Hospital (100 beds)
Balance Sheet (Beginning of Operation)

Unit: ₩1,000
1\$ = 480 Won

Assets		Liabilities	
Cash	289,446	Bank credit	0
Auxiliary goods	8,822	Account payable	0
Pharmaceuticals and other materials	11,367	Draft	0
Equipment	445,772	Loans local	1,000,000
Building	1,416,336	foreign	445,772
Land	241,400	Capital	969,371
Total (\$000)	2,415,143 (5,032)	Total (\$000)	2,415,143 (5,032)

9. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the study of the Nonsan Hospital.)

9.1. Revenue Estimation (See Table F-18-1)

9.2. Estimation of Expenses (See Table F-18-2)

9.3. Pro-forma Income Statement (See Table F-18-3)

9.4. Pro-forma Balance Sheet (See Table F-18-4)

10. ESTIMATION OF CASH FLOW (See Table F-19-1)

11. CONCLUSION FROM FINANCIAL ANALYSIS

11.1 The sponsor should provide ₩969,371,000 (\$2,019,000) for initial operation and additional amount of over 700,000,000 to maintain adequate cash balance and to payback the local loan.

11.2 From eighth year, the operation will be in a profitable position and there will be a need for additional until the 10th year.

11.3. The project is not profitable. Unless the sponsor has determination to sacrifice himself for the society for a while, the project is not considered as adequate.

Table F-18-1

Yeonggwang Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
 (1st - 10th year)

Category	1	2	3	4	5	6	7	8	9	10
Insurance	143,906	164,784	231,049	302,581	381,763	470,080	569,891	679,193	805,069	921,573
Private	398,234	431,076	419,642	383,382	369,489	345,624	305,265	262,117	214,910	165,819
Inpatient	393,565	433,492	475,634	497,476	548,334	596,826	644,322	697,558	749,395	815,007
Outpatient	157,624	162,368	175,057	188,318	202,906	218,878	230,834	243,752	270,584	272,386
Total local	546,710	595,860	650,692	685,963	751,252	815,704	875,156	941,310	1,019,979	1,087,392
foreign (\$000)	(1,139)	(1,241)	(1,356)	(1,429)	(1,565)	(1,699)	(1,823)	(1,961)	(2,125)	(2,265)

Unit : ₩1,000
 1\$ = ₩480

Table F-18-2

Yeonggwang Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES

Year	Unit : ₩1,000 1\$ = ₩480									
	1	2	3	4	5	6	7	8	9	10
Personnel	333,954	343,973	354,292	364,920	375,868	387,145	398,759	410,722	423,042	435,734
Physician	132,824	136,809	140,913	145,140	149,495	153,979	158,599	163,357	168,257	173,305
Nurse	93,603	96,411	99,303	102,283	105,351	108,512	111,767	115,120	118,573	122,131
Medical asst.	21,194	21,830	22,485	23,159	23,854	24,570	25,307	26,066	26,848	27,653
Mgt. & ad.	20,838	21,463	22,107	22,770	23,453	24,157	24,882	25,628	26,397	27,189
Tech. service	65,495	67,460	69,484	71,568	73,715	75,927	78,204	80,551	82,967	85,456
& others										
Pharma. & X-ray	136,404	148,667	162,347	171,127	190,804	203,518	218,351	234,857	254,485	271,304
Food & clothes	32,427	34,377	36,432	38,261	40,176	42,179	43,868	45,627	47,438	48,866
Heating & utilities	26,924	28,698	30,421	31,125	33,122	34,909	36,358	37,964	39,939	41,343
Maintenance	14,690	14,690	14,690	14,690	14,690	14,690	14,690	14,690	14,690	14,690
Bldg.	3,546	3,546	3,546	3,546	3,546	3,546	3,546	3,546	3,546	3,546
Equip.	11,144	11,144	11,144	11,144	11,144	11,144	11,144	11,144	11,144	11,144
Others	32,140	34,258	36,315	37,155	39,539	41,673	43,402	45,319	47,677	49,353
Total (\$000)	576,539 (1,201)	604,663 (1,260)	634,497 (1,322)	657,278 (1,369)	694,199 (1,446)	724,132 (1,509)	755,428 (1,574)	789,179 (1,644)	827,271 (1,723)	861,290 (1,794)

Table F-18-3.

Yeonggwang Hospital (100 beds)
ECONOMIC FORECASTING : PRO FORMA INCOME STATEMENTS

Year	Unit: ₩1,000 1\$ = ₩480									
	1	2	3	4	5	6	7	8	9	10
Total Revenue	546,710	595,860	650,692	685,963	751,252	815,704	875,156	941,310	1,019,979	1,087,392
Total Expense	576,539	604,663	634,497	657,278	694,199	724,132	755,428	789,179	827,271	861,290
Operating Income	*29,829	*9,803	16,195	28,685	57,053	91,572	119,728	152,131	192,708	226,102
Depreciation	72,944	72,944	72,944	72,944	72,944	72,944	72,944	72,944	72,944	72,944
Interest	78,915	78,915	78,915	78,915	70,825	62,165	52,905	42,995	32,395	21,055
Netprofit (\$000)	*181,688 (*377)	*160,662 (*335)	*135,664 (*283)	*123,174 (*257)	*86,716 (*181)	*43,537 (*91)	*6,121 (*13)	36,192 (75)	87,369 (182)	132,098 (275)
*: Deficit										

Table F-18-4.

Yeonggwang Hospital (100 beds)
ECONOMIC FORECASTING : PRO FORMA BALANCE SHEETS
(1st - 10th year)

Unit : ₩1,000
1\$ = ₩480

Year	1	2	3	4	5	6	7	8	9	10
Current Assets	309,635	309,635	309,635	309,635	309,635	309,635	309,635	309,635	309,635	341,267
Equipment	445,772	445,772	445,772	445,772	445,772	445,772	445,772	445,772	445,772	445,772
Depr.	44,577	89,154	133,731	178,308	222,885	267,462	312,039	356,616	401,193	445,770
Bldg.	1,418,336	1,418,336	1,418,336	1,418,336	1,418,336	1,418,336	1,418,336	1,418,336	1,418,336	1,418,336
Depr.	28,367	56,734	85,101	113,468	141,835	170,202	198,569	226,936	255,303	289,670
Land	241,400	241,400	241,400	241,400	241,400	241,400	241,400	241,400	241,400	241,400
Total	2,342,199	2,269,255	2,196,311	2,123,367	2,050,423	1,977,479	1,904,535	1,831,591	1,758,647	1,717,335
Current Liabilities	0	0	0	0	0	0	0	0	0	0
Local Loan	1,000,000	1,000,000	1,000,000	884,450	760,810	628,510	486,950	335,480	173,410	0
Foreign Loan	445,772	445,772	445,772	445,772	445,772	445,772	445,772	445,772	445,772	445,772
Capital	1,077,515	1,165,233	1,227,953	1,393,733	1,531,145	1,634,038	1,708,775	1,751,109	1,752,866	1,416,760
Retained Earnings	0	*181,088	*341,750	*477,414	*600,588	*687,304	*730,841	*735,962	*700,770	*613,401
Net Profit	*181,088	*160,662	*135,664	*123,174	*86,716	*43,537	*6,121	36,192	87,369	132,098
Total (\$000)	2,342,199 (4,880)	2,269,255 (4,728)	2,196,311 (4,576)	2,123,367 (4,424)	2,050,423 (4,272)	1,977,479 (4,120)	1,904,535 (3,968)	1,831,591 (3,816)	1,758,647 (3,663)	1,717,335 (3,578)

*: Deficit

Table 19-1

Yeonggwang Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

Year	1	2	3	4	5	6	7	8	9	10
Unit : ₩1,000 1\$ = ₩480										
1. OPERATING AND MAINTENANCE										
1.1. Personnel	333,954	343,973	354,292	364,920	375,868	387,145	398,759	410,722	423,042	435,734
1.2. Other expenses	227,895	246,000	265,515	277,668	303,641	322,279	341,979	363,767	389,539	410,866
1.3. Maintenance	14,690	14,690	14,690	14,690	14,690	14,690	14,690	14,690	14,690	14,690
1.4. Interest	78,915	78,915	78,915	78,915	70,825	62,165	52,905	42,995	32,395	21,055
1.5. Operating expenses	654,454	683,578	713,412	736,193	765,024	786,297	808,333	832,174	859,666	882,350
1.6. Depreciation	72,944	72,944	72,944	72,944	72,944	72,944	72,944	72,944	72,944	72,944
1.7. Operating cost	728,398	756,522	786,356	809,137	837,968	859,241	881,277	905,118	932,610	955,294
2. REVENUE										
2.1. Outpatient	157,624	162,368	175,057	188,318	202,906	218,878	230,834	243,752	270,584	272,386
2.2. Inpatient	393,624	433,492	475,634	497,476	548,334	596,826	644,322	697,558	749,395	815,007
2.3. Other										
2.4. Whole revenue	546,710	595,860	650,692	685,963	751,252	815,704	875,156	941,310	1,019,979	1,087,392
3. CALCULATION										
3.1. Operating income	*181,688	*160,662	*135,664	*123,174	*86,716	*43,537	*6,121	36,192	87,369	132,098
3.2. Accumulation	*181,688	*341,750	*477,414	*600,588	*687,304	*730,841	*736,962	*700,770	*613,401	*481,303
3.3. Income tax										
4. CASH FLOW CALCULATION										
4.1. Gross cash flow	*108,144	*87,718	*62,720	*50,230	*13,772	29,407	66,823	109,136	160,313	205,042
4.2. Invested capital	108,144	87,718	62,720	165,780	137,412	102,893	74,737	42,334	1,757	0
4.3. Payoff/discharge	0	0	0	115,550	123,640	132,300	141,560	151,470	162,070	173,410
4.4. Net cash flow	0	0	0	0	0	0	0	0	0	31,632
4.5. Accumulation of 4.4.	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	31,632
(\$000)										(66)

*: Deficit

Appendix Table A 4-1

		<u>Amount</u>
No. 1: Land estate cost		
1.1.	Value: <u>quantity (Won/M²)</u>	
	13,300 M ² (18,150)	
1.2.	Acquisition cost	
Total Sum of No. 1		
		<u>Whole Amount</u>
		₩241,400,000
		₩241,400,000
No. 2: Site preparation cost		
2.1.	Public opening	
		₩2,000,000
2.2.	Non-public opening	
		₩12,000,000
2.3.	Other cost (i.e. taxes)	
Total Sum of No. 2		₩14,000,000
No.3: Construction cost		
3.1.	Building (due to room and space program plus traffic ways)	
		₩810,000,000
3.2.	Installations (Sewage, Water, Heating, Electricity ...)	
		₩185,000,000
3.3.	Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations; air-cinditioning, elevators ...)	
		₩231,000,000
Total Sum of 3.1 - 3.3		₩1,226,000,000

and:

a) Classification to space-content:

3.1 - 3.3 :	$\frac{m^3}{23,400}$	$\frac{Won/m^3}{50,000}$
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	<u>Outside Equipment</u>
W1,170,000	W56,000,000

b) Classification to space

3.1 - 3.3 :	$\frac{m^2}{5,850}$	$\frac{Won/m^2}{200,000}$
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	
W1,170,000,000	W56,000,000

c) Classification to beds

3.1 - 3.3	$\frac{No. of beds}{100}$	$\frac{Won/Bed}{11,700,000}$
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	
W1,170,000,000	W56,000,000

No. 4:	Equipment	
4.1.	Medical Equipment	\$873,667
4.2.	Non-medical Equipment	\$55,025
	Total Sum of 4.1 + 4.2	
No. 5:	Outside Equipment	₩56,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	₩261,616,000
No. 7:	Engineering Fee	₩50,000,000
No. 8:	Dormitory	₩72,336,000

G. J I N A N

G. JINAN HOSPITAL

1. Geographic Features

1.1 Jinan Gun lies on the north-eastern portion of inland area of Jeonbuk Province. The northern part of this Gun shares the provincial border with Geumsan Gun of Jeonnam Province, its east borders on both Mooju Gun and Jangsoo Gun, the south on Imsil Gun, the west is contiguous to Wanju Gun (Figure G-1). There are 11 administrative jurisdictions (Myons) within the Gun.

1.2 About 82.4% of the entire region Gun area is mountainous. This is a part of the Noryung Mountains running from south to north. The Gun has an average altitude of 300 to 400 meters. It is about an hour's ride by bus from Jeonju City to Jinan Gun. However, access to the Gun is rather difficult because of the poor transportation due to Geumdeo Gogae, the steepest pass in Jeonbuk Province, lies halfway between the two places. The government is presently paving a road through this pass.

1.3 The population of Jinan Gun totals 91,209 with the population density of 117 persons per square kilometer (Table G-1). Jinan Gun is a typical Korean farming area. About 89% of the total households (15,635) in this Gun are engaged in farm work. Therefore, other industries except for farming are not brisk. Jinan Gun belongs to the Jeonju cosmopolitan area, however the residents in the northern part that borders on the provincial boundary would rather utilize the Daejeon area via Geumsan Gun.

1.4 At present, 10 local practitioners serve Jinan Gun, and they are 4 trainee physicians, 2 area-limited physicians and 4 private practitioners. All the private practitioners are located in Jinan Myon. The majority of local patients including serious cases have to utilize the medical facilities in the city of Jeonju because presently there are no tertiary level medical facilities available in this area.

2. Disease Patterns

See the Hadong Hospital report in this connection.

3. Determination of Catchment Area & Estimated Target Population

3.1 Most of Jinan Gun can be considered as its catchment area except Juchon Myon and Yongdam Myon which are located beyond a 15-km radius north from the proposed Hospital site. The residents of these 2 Myons have easy access to medical facilities in the neighboring Geumsan Eup or Daejeon City.

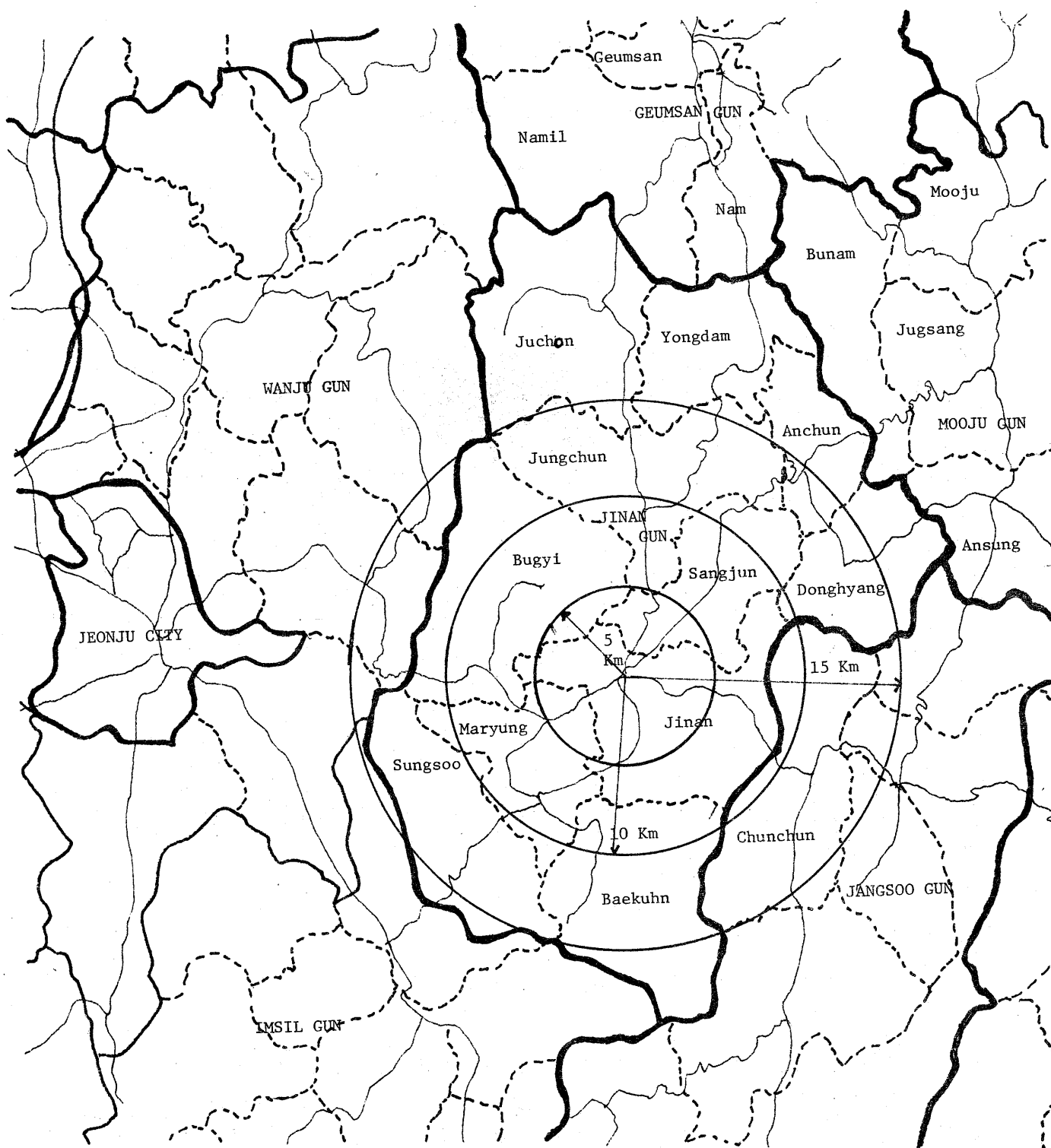


Figure G-1. The Jinan Map.

Table G-1. Population of Jinan Gun, December, 1977

Myon	Household	Number of Population			Family Size	Population Density
		Male	Female	Both		
Jinan	3,275	9,461	9,208	18,669	5.7	204
Sangjeon	1,038	3,125	3,100	6,225	6.0	111
Baekuhn	1,292	3,930	3,933	7,863	6.1	97
Sungsoo	1,316	3,999	4,015	8,014	6.1	113
Maryong	1,566	4,506	4,353	8,859	5.7	165
Bugui	1,318	3,968	3,824	7,792	5.9	74
Yongdam	1,194	3,296	3,192	6,488	5.4	119
Jucheon	1,166	3,344	3,303	6,647	5.7	69
Donghyang	1,110	3,250	3,173	6,423	5.8	121
Ancheon	873	2,826	2,765	5,591	6.4	152
Jungcheon	1,487	4,498	4,140	8,638	5.8	103
TOTAL	15,635	46,203	45,006	91,209	5.8	117

SOURCE: Jinan Gun, Statistical Yearbook, 1978.

3.2 Anchon Myon is also excluded from the catchment area for it is geographically an isolated area, and the residents have access to the Anchon Clinic (5 beds) established and operated by the Miwon Company, and to the Mujoo Daewoo Hospital (4 departments with 20 beds) sponsored by the Daewoo Industrial Company.

3.3 Some areas like Cheonchon Myon of Jangsoo Gun could be included in the catchment area, but were excluded in order to avoid over estimation. Accordingly, the 8 Myons within Jinan Gun are included in the catchment area.

3.4 As of 1978, about 69,800 persons are living within this catchment area. The population, however, is declining each year due to the increased out-migrants to urban areas. Assuming that the population within the catchment area during the planning period is decreasing logarithmically, the target population was estimated as shown in Table G-2: 67,800 persons in 1980, 65,000 in 1982, 66,400 in 1981 and 61,100 in 1985.

4. Objectives of Jinan Hospital Establishment and Determination of Its Size

4.1 The establishment of this Hospital was intended for the purpose of supplementing the community health care delivery system by setting up a patient referral system, and to improve their health status by meeting the unmet need of medical care for the Gun Population.

4.2 Medical manpower in the Gun is shown in Table G-3. Presently, 10 private doctors are practicing in this Gun; namely 4 private physicians, 4 trainee physicians and 2 area limited physicians. However, 7 doctors (4 private physicians, 2 trainee physicians and 1 area limited physician) are actually serving because those 3 Myons (Yongdam, Jucheon and Anchun) were excluded from the catchment area. The total number of beds owned by the private practitioners are 21 (Table G-4).

4.3 Total number of medical insurance enrollees within the catchment area is 5,012 (public officials and their dependents, 1,897 & school teachers and dependents, 3,115), and that of Medicaid beneficiaris 6,138 (low income group, 4,275 & the indigent, 1,863), totaling 11,150 which are equivalent to 16% of the total target population (Table G-5). It is assumed that these numbers will not be changed over the planning period.

4.4. The number of bed requirements in the catchment area was estimated as follows shown in Table G-6: 51 beds in 1980 (low estimate 47, high estimate 55), 55 beds in 1981 (low estimate 50, high estimate 59), 55 beds in 1982 (low estimate 50, high estimate 60), and 55 beds in 1985 (low estimate 50, high estimate 62).

5. Medical Programme

Refer to the Hadong Hospital in this connection.

Table G-2. Estimates of Target Population within the Jinan Hospital Service Area

Year	Jinan	Sangjun	Baikuhn	Sungsoo	Maryong	Bugui	Donghyang	Jungcheon	Total
1974	18,860	6,478	8,346	8,208	9,366	8,505	6,268	9,368	75,399
1975	19,308	6,578	8,254	8,350	9,430	8,150	6,608	9,139	75,817
1976	18,423	6,391	8,060	8,216	9,196	8,195	6,471	8,910	73,862
1977	18,669	6,225	7,863	8,014	8,859	7,792	6,423	8,638	72,483
1978	18,282	5,851	7,426	7,865	8,552	7,417	6,127	8,274	69,794
1979	18,179	5,832	7,332	7,830	8,432	7,264	6,237	8,172	69,278
1980	18,008	5,679	7,119	7,733	8,223	7,022	6,190	7,815	67,789
1981	17,839	5,527	6,909	7,637	8,016	6,783	6,144	7,561	66,416
1982	17,672	5,378	6,701	7,542	7,811	6,547	6,098	7,311	65,060
1983	17,507	5,231	6,496	7,448	7,609	6,314	6,053	7,063	63,721
1984	17,344	5,085	6,294	7,355	7,410	6,084	6,009	6,819	62,400
1985	17,183	4,941	6,094	7,264	7,212	5,856	5,965	6,577	61,092
1986	17,023	4,799	5,896	7,173	7,018	5,631	5,922	6,339	59,801
1987	16,866	4,658	5,700	7,084	6,825	5,409	5,879	6,103	58,524
1988	16,711	4,519	5,507	6,996	6,634	5,189	5,836	5,869	57,261
1989	16,557	4,382	5,316	6,908	6,446	4,972	5,794	5,638	56,013
1990	16,405	4,246	5,127	6,822	6,260	4,757	5,753	5,410	54,780
1991	16,254	4,111	4,940	6,736	6,076	4,545	5,712	5,185	53,559

Y = a + b log x

a : 77,654.25 58,981.75 81,250.76 41,617.85 81,254.69 91,287.63 22,466.16 97,279.71
b : -13,611.60 -12,164.05 -16,917.20 -7,732.78 -16,666.22 -19,229.81 -3,714.26 -20,416.27
r²: 0.50 0.79 0.93 0.71 0.88 0.92 0.26 0.99

Table G-3. Health Manpower in Jinan Gun, 1977

Myon	Medical Practitioner	Area-limited Practitioner	Dentist	Herb Doctor	Midwife	Nurse	Total	Pharmacist	Druggist		Drug Seller	Total
									Modern	Herb		
Jinan	4			8		8	20	8				
Yongdam		1		1			2					
Jungcheon	1*						1					
Bugye	1*						1					
Anchun	1*						1					
Baekuhn				2	1	1	5	1				
Maryung		1					1					
Jungcheon	1*											
Total	8	2		11	1	9	31	9	15	8	3	35

* Trainee physicians dispatched to non-doctor area.

Source: Statistical Year Book of Jinan Gun, 1978

Table G-4. Number of Beds Owned by Private Practitioners in Jinan Gun

Name of Clinics	Location	Number of Beds
Guse	Jinan	8
Jungang	Jinan	4
Jinan	Jinan	10
TOTAL		22

Table G-5 Number of Public Officials, School Teachers and Medicaid Beneficiaries within the Jinan Hospital Service Area

Jinan Gun	Public Officer		School Teacher		Medicaid Beneficiary		Total
	Self	Dependents	Self	Dependents	Indigent Group	Low Income Group	
	327	1,570	537	2,578	1,863	4,275	11,150

Source: Section of Internal Affairs, Jinan Gun

Table C-6. Bed Requirements in the Jinan Hospital Service Area

Year	General Population Excluding the Insured	Hospitalization Rate		Average Length of Stay	The Insured & Medicaid Beneficiaries	Hospitalization Rate		Average Length of Stay	No. of Existing Beds	Occupancy Rate (%)	Bed Requirements	
		/Person/Year				/Person/Year					I	II
		I	II			I	II					
1979	58,128	0.0349	0.0349	10	11,150	0.0195	0.0239	9	22	40	46	54
1980	56,639	0.0349	0.0366	10	11,150	0.0202	0.0247	9	22	40	47	55
1981	55,266	0.0349	0.0385	10	11,150	0.0209	0.0254	9	22	30	50	59
1982	53,910	0.0349	0.0404	10	11,150	0.0215	0.0262	9	22	30	50	60
1983	52,571	0.0349	0.0424	10	11,150	0.0222	0.0269	9	22	30	50	60
1984	51,250	0.0349	0.0445	10	11,150	0.0229	0.0277	9	22	30	50	61
1985	49,942	0.0349	0.0468	10	11,150	0.0236	0.0284	9	22	30	50	62
1986	48,651	0.0349	0.0491	10	11,150	0.0242	0.0292	9	22	30	50	63
1987	47,374	0.0349	0.0516	10	11,150	0.0249	0.0299	9	22	30	50	64
1988	46,111	0.0349	0.0541	10	11,150	0.0256	0.0307	9	22	30	50	65
1989	44,863	0.0349	0.0568	10	11,150	0.0263	0.0314	9	22	30	50	66
1990	43,630	0.0349	0.0597	10	11,150	0.0270	0.0322	9	22	30	50	67
1991	42,409	0.0349	0.0627	10	11,150	0.0277	0.0335	9	22	30	50	68

6. INVESTMENT AND FINANCING PLAN

(All the assumptions for the financial analysis of the hospitals in rural areas are the same as those mentioned in the analysis of the Nonsan Hospital. Since the Jinan Hospital is one of those in rural areas, refer to the analysis of the Nonsan Hospital.)

6.1. Investment Cost

Table G-7-1. Jinan Hospital (50 beds)
Investment Cost ^{1/}

Category	Local cost	Foreign cost
Land estate	₩93,170,000	\$194,106
Site preparation	9,000,000	18,750
Construction	712,000,000	1,483,333
Dormitory	35,072,000	73,067
Medical Equipment	241,700,000	503,542
Outside equipment	32,000,000	66,667
Contingencies	148,316,000	308,991
Engineering fees	39,800,000	82,917
Working Capital	24,528,000	51,100
Total Investment	1,335,586,000	\$2,782,471

^{1/} See Appendix A 4-1

6.2. Financing Plan

Table G-7-2 Jinan Hospital (50 beds)
Sources of Finance

Category	Local Currency	Foreign Currency
Total Investment	₩ 1,335,586,000	\$ 2,782,471
Foreign loan	240,000,000	500,000
Local loan	500,000,000	1,041,667
Capital	595,586,000	1,240,804
Total Financing	₩ 1,335,586,000	\$ 2,782,471

6.3. Pro-forma Balance Sheet (the year before operation starts)

Table G-7-3 Jinan Hospital (50 beds)
Balance Sheet (Beginning of Operation)

1\$ = ₩480
Unit = 1,000 Won

Assets		Liabilities	
Cash	162,254	Bank Credit	0
Auxiliary goods	4,509	Account Payable	0
Pharmaceuticals and medical articles	6,081	Draft	0
Equipment	241,700	Loans local	500,000
Building	827,872	foreign	240,000
Land	93,170	Capital	595,586
Total (\$000)	1,335,586 (2,782)	Total	1,335,586 (2,782)

7. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the study of the Nonsan Hospital.)

7.1. Revenue Estimation (See Table G-8-1)

7.2. Estimation of Expenses (See Table G-8-2)

7.3. Pro-forma Income Statement (See Table G-8-3)

7.4. Pro-forma Balance Sheet (See Table G-8-4)

8. ESTIMATION OF CASH FLOW (See Table G-9-1)

9. CONCLUSION FROM FINANCIAL ANALYSIS

9.1. The sponsor should provide ₩595,586,000 (\$1,240,000) for initial operation and additional amount of about ₩160,000,000 to maintain adequate cash balance during first six years (See 4.2 in Table G-9-1)

9.2. From fifth year, the operation will become profitable and from seventh year, cash position of the hospital will be improved enough not to need additional fund from the sponsor.

9.3. Because of rapid growth of profit after 4 years, we conclude that the project is profitable.

Table G-8-1

Jinan Hospital (50 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
 (1st - 10th year)

Category	<div>\$1 = 480 won</div> <div>Unit : ₩1,000</div>									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Sub-total	Insurance	67,663	109,219	141,006	175,024	211,396	253,552	307,982	354,799	429,555
	Private	224,834	181,297	217,617	222,757	210,247	232,158	214,304	196,083	174,280
	Inpatient	184,332	176,141	236,134	266,792	299,527	335,334	363,349	394,513	425,791
	Outpatient	108,134	114,376	122,489	130,989	142,116	150,376	158,939	156,369	178,044
Total	Local	292,466	290,517	358,623	397,781	441,633	485,710	522,288	550,882	603,835
	Foreign (\$1000)	(609)	(605)	(747)	(829)	(920)	(1,012)	(1,088)	(1,148)	(1,258)
										645,768
										(1,345)

Table C-8-2

Jinan Hospital (50 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st - 10th year)

\$1 = 480 won
Unit: ₩1,000

Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Personnel	167,252	172,270	177,437	188,244	193,890	199,707	205,699	211,869	218,225	224,772
Physician	55,268	56,926	58,634	60,393	62,204	64,070	65,993	67,972	70,012	72,112
Nurse	45,619	46,987	48,397	49,849	51,344	52,885	54,471	56,105	57,788	59,522
Medical assistant	13,502	13,907	14,325	14,754	15,197	15,653	16,122	16,606	17,104	17,617
Mgt. & ad.	12,232	12,599	12,977	13,367	13,768	14,180	14,606	15,044	15,495	15,960
Technical	45,649	47,018	48,429	49,881	51,379	52,919	54,507	56,142	57,826	59,560
service and others										
Pharma. and X-ray	72,974	72,484	89,477	99,246	105,200	121,185	130,311	136,198	150,657	161,119
Food & Clothes	14,347	15,777	17,364	18,920	20,617	21,654	22,738	22,870	24,828	25,818
Heating and	14,511	13,991	16,766	18,052	18,590	20,787	21,698	22,217	23,644	24,552
Utilities										
Maintenance	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113
Bldg.	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070
Equipment	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043
Others	17,322	16,702	20,014	21,549	22,191	24,814	25,902	26,522	28,230	29,309
Total	294,519	299,337	329,171	348,642	362,955	390,443	408,469	421,619	453,697	473,651
Local	(613)	(623)	(685)	(726)	(756)	(813)	(851)	(878)	(945)	(986)
Foreign (\$000)										

Table C-8-3 Jinan Hospital (50 beds)
ECONOMIC FORECASTING : PRO-FORMA INCOME STATEMENT
(1st - 10th year)

Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Total Revenue	292,466	290,517	358,623	397,781	441,633	485,710	522,288	550,882	603,835	645,768
Total Expense	294,519	299,337	329,171	348,642	362,955	390,443	408,469	421,619	453,697	473,651
Operating income	*2,053	*8,820	29,452	49,139	78,678	75,267	113,819	129,263	150,138	172,117
Depreciation	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727
Interest	39,800	39,800	39,800	39,800	35,755	31,425	26,795	21,840	16,540	10,870
Net profit	Local *87,580	*89,347	*51,075	*31,388	2,196	23,115	46,297	66,696	92,871	120,520
Foreign(*170)	(*)184	(*)184	(*)105	(*)64	(6)	(38)	(98)	(141)	(195)	(253)
(\$000)										

* : deficit

Table C-8-4

Jinan Hospital (50 beds)
ECONOMIC FORECASTING : PRO-FORMA BALANCE SHEET
(1st - 10th year)

Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Current Assets	172,844	172,844	172,844	172,844	172,844	172,844	189,088	220,776	273,249	347,791
Equipment	241,700	241,700	241,700	241,700	241,700	241,700	241,700	241,700	241,700	241,700
depr.	24,170	48,340	72,510	96,680	120,850	145,020	169,190	193,360	217,530	241,700
Building	827,872	827,872	827,872	827,872	827,872	827,872	827,872	827,872	827,872	827,872
depr.	16,557	33,114	49,671	66,228	82,785	99,342	115,899	132,456	149,013	165,570
Land	93,170	93,170	93,170	93,170	93,170	93,170	93,170	93,170	93,170	93,170
Total	1,294,859	1,254,132	1,213,405	1,172,678	1,131,959	1,091,224	1,066,741	1,057,702	1,069,448	1,103,263
Current Liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	500,000	500,000	500,000	442,225	380,405	314,255	243,475	167,740	86,705	0
Foreign loan	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
Capital	637,439	686,059	696,407	744,843	763,740	766,048	766,048	766,048	766,048	766,048
Retained Earnings	0	*82,580	*171,927	*223,002	*254,390	*252,194	*229,079	*182,782	*116,086	*23,305
Net profit	* 82,580	*89,347	*51,087	*31,388	2,196	23,115	46,297	66,696	92,871	120,520
Total	1,294,859	1,254,132	1,213,405	1,172,678	1,131,951	1,091,224	1,066,741	1,057,702	1,069,448	1,103,263
Foreign	(2,698)	(2,613)	(2,528)	(2,443)	(2,358)	(2,273)	(2,222)	(2,204)	(2,228)	(2,298)

* : deficit

Table G-9-1

Jinan Hospital (50 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

1\$ = 480 won
Unit: ₩1,000

Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1. Operating and Maintenance										
1.1 Personnel	167,252	172,270	177,437	188,244	193,890	199,707	205,699	211,869	218,225	224,772
1.2 Other expenses	119,154	118,954	143,621	152,285	160,952	182,623	194,657	207,807	227,359	240,766
1.3 Maintenance	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113
1.4 Interest	39,800	39,800	39,800	39,800	35,755	31,425	26,795	21,840	16,540	10,870
1.5 Operating expenses	334,319	339,137	368,971	388,442	398,710	421,868	435,264	443,459	470,237	484,521
1.6 Depreciation	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727
1.7 Operating cost	375,046	379,864	409,698	429,109	439,437	462,595	475,991	484,186	510,964	525,248
2. Revenue										
2.1 Outpatient	108,134	114,376	122,489	130,989	142,116	150,376	158,939	156,369	178,044	188,652
2.2 Inpatient	184,332	176,141	236,134	266,792	299,527	335,334	363,349	394,513	425,791	457,116
2.3 Other										
2.4 Whole revenue	292,466	290,517	358,623	397,781	441,633	485,710	522,288	550,882	603,835	645,768
3. Calculation										
3.1 Operating incomes	*82,580	*89,347	*51,075	*31,388	2,196	23,115	46,297	66,696	92,871	120,520
3.2 Accumulation	*82,580	*171,927	*223,002	*254,390	*252,194	*229,079	*182,782	*116,086	*23,305	97,215
3.3 Income tax										
4. Cash Flow Calculation										
4.1 Gross cash flow	*41,853	*48,620	*10,348	9,339	42,923	63,842	87,024	107,423	133,508	161,249
4.2 Invested capital	41,853	48,620	10,348	48,436	18,897	2,308	0	0	0	0
4.3 Payoff/discharge	0	0	0	57,775	61,820	66,150	70,780	75,735	81,035	86,705
4.4 Net cash flow	0	0	0	0	0	0	16,244	31,688	52,473	74,542
4.5 Accumulation of 4.4 (\$000)	(0)	(0)	(0)	(0)	(0)	(0)	16,244	47,932	100,405	174,947
							(34)	(100)	(209)	(364)

* deficit

Appendix Table A 4-1

		<u>Amount</u>
No. 1: Land estate cost		
1.1.	Value: <u>quantity (Won/M²)</u>	<u>Whole Amount</u>
	7,700 M ² (12,100 Won/M ²)	
1.2.	Acquisition cost	₩93,170,000
	6,700 M ² (12,100 Won/M ²)	
	Total Sum of No. 1	₩93,170,000
No. 2: Site preparation cost		
2.1.	Public opening	₩2,000,000
2.2.	Non-public opening	₩7,000,000
2.3.	Other cost (i.e. taxes)	
	Total Sum of No. 2	₩9,000,000
No.3: Construction cost		
3.1.	Building (due to room and space program plus traffic ways)	₩477,000,000
3.2.	Installations (Sewage, Water, Heating, Electricity ...)	₩105,000,000
3.3.	Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators ...)	₩130,000,000
	Total Sum of 3.1 - 3.3	₩712,000,000

and:

a) Classification to space-content:

3.1 - 3.3 : $\frac{m^3}{m^3}$	Whole Amount	Outside Equipment
13,600	₩680,000,000	₩32,000,000
Sum of 3.1 - 3.3		

b) Classification to space

3.1 - 3.3 : $\frac{m^2}{m^2}$	Whole Amount	
3,400	₩680,000,000	₩32,000,000
Sum of 3.1 - 3.3		

c) Classification to beds

3.1 - 3.3	No. of beds	Won/Bed	Whole Amount	
	50	13,600,000	₩680,000,000	₩32,000,000
Sum of 3.1 - 3.3				

No. 4:	Equipment	
4.1.	Medical Equipment	\$469,615
4.2.	Non-medical Equipment	\$34,005
	Total Sum of 4.1 + 4.2	
No. 5:	Outside Equipment	₩32,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	₩17,800,000
No. 7:	Engineering Fee	₩148,316,000
No. 8:	Dormitory	₩35,072,000

H. PYONGCHANG

H. PYUNGCHANG HOSPITAL

1. Geographical Features

1.1 Pyungchang Gun is a remote mountainous region, located on the southern part of Kangwon Province. Pyungchang Gun, which is 45 Km wide and 60 Km long, has a total of 1,463 square Km of rugged mountainous land in which the Taebaek range runs north to southeast. The Gun borders on Jeongsun Gun on the east, Hoengsung Gun on the west, Yeongwoel Gun to the south, Hongchon Gun to the north, and Myungju Gun to the northeast.

1.2 The Odae River and the Pyungchang River, which originate in the Taebaek Mountains, meander through Pyungchang and Yeongwoel Guns to form the upper waters of the Han River. With the meandering rivers and rugged mountains, Pyungchang Gun is noted for its natural scenic beauty. Last summer, the basin area of Pyungchang River was flooded due to much rain and narrow river beds.

1.3 The road transportation to the remote Pyungchang Gun has been greatly facilitated by the opening of the Youngdong Expressway which runs through the northern part of the Gun. It now takes 4 hours to travel by car, a 195-Km distance, from Seoul to Pyungchang Myon. In addition, the road from Mungog to Jangpyung, 55.8 Km in length, is under construction for expansion and pavement with a loan provided by the World Bank. When the project is completed in 1981, the road will be connected with the Youngdong Expressway, thus greatly facilitating road transportation not only within the Gun but also with the neighboring Guns (Figure H-1).

1.4 Pyungchang Gun has a population of 87,004 as of the end of 1977 on a relatively wide area of 1,463 square Km, with the population density reaching only 60 persons per square Km. About 66% of the total population are farmers who are engaged mostly in the production of alpine crops, vegetables and medicinal herbs.

1.5 As the Gun is a mountainous area with a small population, there are few practicing doctors. There are 2 doctorless Myons, and the medical services in the other Myons have been provided by trainee physicians and area limited doctors. The Rural Area Medical Service Club, comprised mainly of students from the Medical College, Seoul National University, has provided medical services twice a year since January 1977 for the people in the mountainous Pyungchang Gun.

2. Objective of Pyungchang Hospital Establishment

2.1 Most people in Pyungchang Gun have been unable to receive sufficient medical services because there are no high quality medical facilities within the catchment area. Therefore, most patients must go to hospitals in Seoul, Kangnung or Jechon City for medical care.

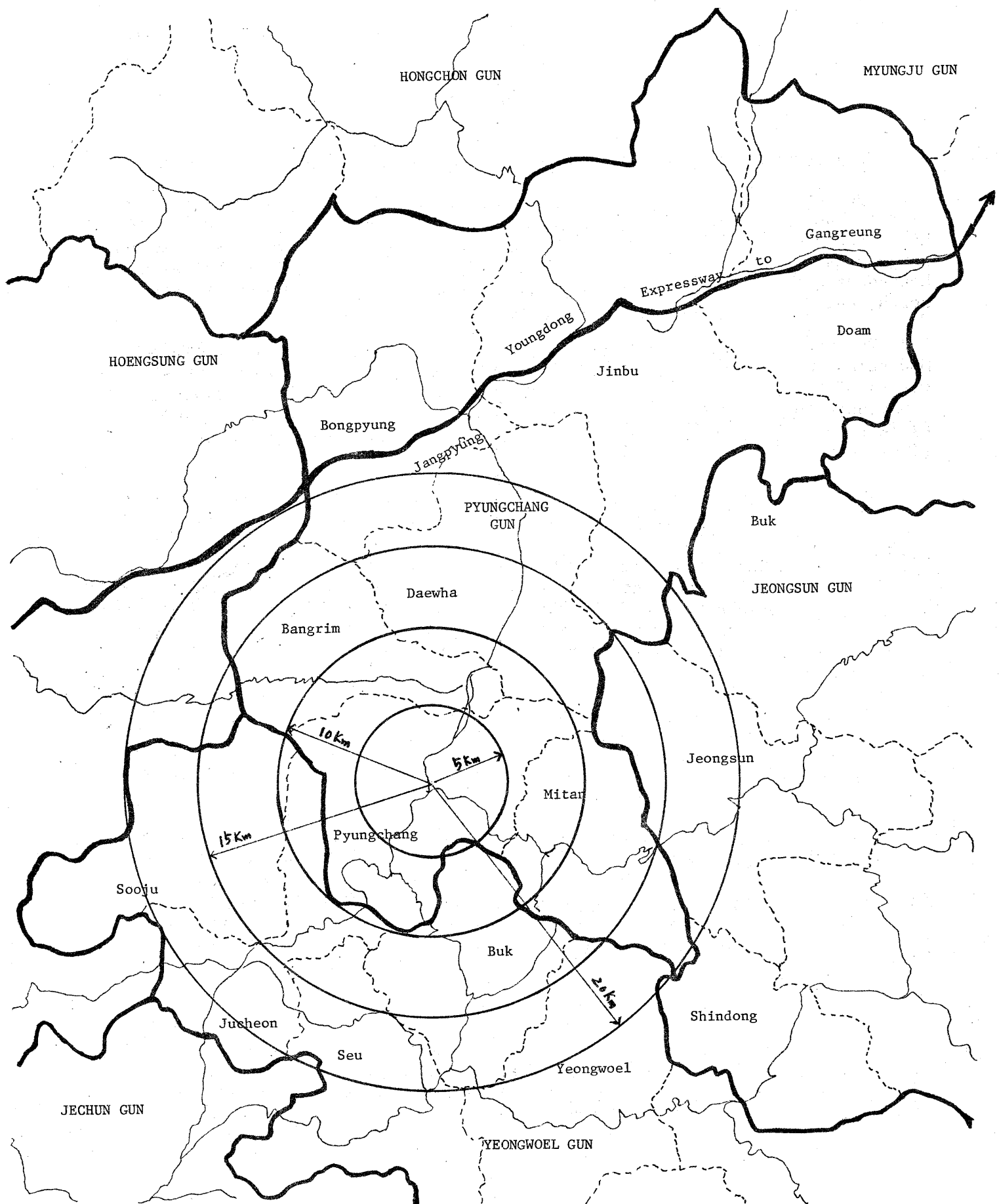


Figure H-1. The Pyungchang Map

2.2 The proposed Hospital is designed to meet medical care demand for the people in the medically underserved areas with the hope to enhance health status of the rural people.

3. Disease Pattern

3.1 According to the report of the Rural Area Medical Service Club of the Medical College, Seoul National University, the pattern of diseases is as follows shown in Table H-1. The report was compiled based on the findings of their clinical activities in Mitan Myon, Pyungchang Gun from July 28 to August 1, 1979.^{1/}

Table H-1. Number of Patients by Medical Specialty

Medical Specialty	July 28	July 29	July 30	July 31	Aug 1	Un- known	Total	%
Internal Medicine	87	86	78	50	34	25	360	33.2
Pediatrics	64	50	53	40	21	12	240	22.1
General Surgery	14	34	20	25	18	14	125	11.5
OB-GYN	19	13	17	15	18	1	83	7.7
Dermatology	33	45	41	27	17	19	182	16.8
ENT	18	16	9	11	10	4	68	6.3
Ophthalmology	5	5	4	1	3	1	19	1.8
Urology	-	-	3	1	1	2	7	0.6
Total	240	249	225	170	122	78	1,084	100.0

Source: Songchon Rural Area Medical Service Club, Medical Activity Report in Mitan Myon Pyungchang Gun in Kangwon Do, 1979. p.46.

3.2 The club members treated a total of 1,084 patients, including 409 males and 675 females, during the 5-day period. Of the total, cases of internal medicine accounted for the largest 33.2%, of pediatrics 22.1%, dermatology 16.8%, with the combined internal medical cases amounting to 72.1%.

3.3 Of the total internal medicine cases, 128 patients or 35.6% were suffering from digestive system troubles, including 33 patients with symptom of chronic gastric ulcer. Patients suffering from respiratory diseases/numbered 78, or 20% of the total cases, including 68 who reported suffering from severe headache (Table H-2).

3.4 About 80% of the total pediatric cases have lymphnode enlargement in their neck, and many of them were suffering from iron deficiency anemia, persistent

^{1/} Mitan Myon, which is surrounded by mountains, is one of the poorest and doctorless areas in Pyungchang County. There is one health subcenter with 2 nurse aids, 2 drug stores and 1 herb drugstore in the Myon.

Table H-2. Number of Cases by Diseases Classification for the Pyungchang Residents (July 28 - Aug. 1, 1979)

Diseases Classification	Number of Cases
Bacillary dysentery and amoebiasis	4
Enteritis and other diarrhoeal diseases	30
Tuberculosis of respiratory system	43
Other tuberculosis, including late effects	1
Measles	1
Infectious hepatitis	3
Helminthiases	34
All other infective and parasitic diseases	6
Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissue	9
Benign neoplasms and neoplasms of unspecified nature	3
Diabetes mellitus	1
Avitaminoses and-other nutritional deficiency	13
Other endocrine and metabolic diseases	1
Anaemias	15
Psychoses and psychotic mental disorders	19
Inflammatory diseases of eye	7
Otitis media and mastoiditis	21
Other diseases of nervous system and sensory organs	86
Chronic rheumatic heart disease	2
Hypertensive disease	11
Cerebrovascular disease	1
Venous thrombosis and embolism	1
Other diseases of circulatory system	13
Acute respiratory infections	44
Pneumonia	4
Bronchitis, emphysema and asthma	14
Hypertrophy of tonsils and adenoids	6
Pneumoconioses and related diseases	1
Other diseases of respiratory system	16
Diseases of teeth and supporting structures	9
Peptic ulcer	41
Cholelithiasis and cholecystitis	2
Other diseases of digestive system	68
Nephritis and nephrosis	5
Calculus of urinary system	1
Other diseases of genito-urinary system	50
Abortion	2
Other complications of pregnancy, childbirth and the puerperium	1
Infections of skin and subcutaneous tissue	96
Other diseases of skin and subcutaneous tissue	85
Arthritis and spondylitis	22

Diseases Classification	Number of Cases
Other diseases of musculoskeletal system and connective tissue	75
Other specified and ill-defined diseases	4
All other accidents	9
Fractures	3
Intracranial and internal injuries	1
Burn	2
All other injuries	11
Normal pregnancy	4
Loop insertion	11
Otitis externa	13
Headache	28
Chronic PID	15
Chronic vaginitis	12
Chronic endometritis	2
Chronic gastritis	11
Others	91
Total	1,084

Source: Songchon Rural Area Medical Service Club, Medical Activity Report in Mitan Myon, Pyungchang Gun, 1979, pp. 48-52.

diarrhea, dyspepsia and stomachache. In particular, many infants were suffering from skin diseases, of which proportions have increased year by year.

3.5 About 75% of the total surgical patients were suffering from arthralgia, pains and numbness in hands, feet and waist. About one third of the total otolaryngology patients were suffering from otitis media and about 20% from otitis externa.

3.6 The data indicate that people in Mitan Myon are suffering mostly from digestive system disorders as in other rural areas. In addition, various skin diseases and otitis media are prevalent due to poor hygienic conditions which are characteristic of the remote rural areas.

4. Medical Service Area of Pyungchang Hospital

4.1 Chinbu Myon and Doam Myon, through which the Youngdong Expressway runs, belong to the living sphere of Gangnung on the east coast, which takes only one hour by bus.

4.2 However, Bongpyung Myon, through which the Youngdong Expressway also runs, is in different situation from the above two Myons. As the road traffic between Jangpyung and Pyungchang Town is convenient, the residents in the southern part

of Bongpyung Myon will be easily accessible to the proposed Pyongchang Hospital. However, the residents in the northern part of Bongpyung Myon are more likely to go to hospitals in Seoul or Gangnung rather than cross the Expressway to go to the Pyungchang Hospital. The distance from Pyungchang Myon to Jangpyung (through which the Expressway runs) is about 20 Km (Figure H-1).

4.3 If a hospital is constructed in Pyungchang Myon, the medical service catchment area will be within a 15-Km radius of the proposed hospital, including the whole areas of Pyungchang Myon, Mitan Myon, Bangrim Myon and Daewha Myon.

4.4 Meanwhile, parts of the residents in Jeongsun Eup, Jeongsun Gun, and the people in Buk Myon, Youngwoel Gun, are located conveniently within a 15-Km radius of the proposed Hospital in Pyungchang Myon.

4.5 Based on the above information, the medical service areas of the proposed Hospital will be as follows:

Pyungchang Myon, Mitan Myon, Bangrim Myon, Daewha Myon, Bongpyung Myon (southern part of the Expressway), part of Jeongsun Eup (Jeongsun Gun) and part of Buk Myon (Yeongwoel Gun).

5. Population Trend in the Areas

5.1 The population trend in Pyungchang Gun is as shown in Table H-3. During the past decade, the population in the Gun has steadily decreased, representing a steady outflow of the rural people. In 1977, the population numbered 87,004, including 45,212 males and 41,792 females.

5.2 The population trend in Buk Myon and Jeongsun Eup is as shown in Table H-4. The population in Buk Myon has decreased sharply, while that of Jeongsun Eup declined gradually.

5.3 The population within the catchment area is estimated by the following two assumptions:

Assumption I : The population decrease rate of the years ahead will be the same as that of the past years. ($Y=a + bx$)

Assumption II: The population decrease rate in the future will be slowing down compared with that of the past years. ($Y= a + b \log x$)

5.4 According to the Assumption I, the population in the catchment area will decrease from 62,847 in 1979 to 61,789 in 1980, and to 60,732 in 1981 (Table H-5). According to the Assumption II, the population will decline from 63,095 in 1979 to 62,133 in 1980, and to 61,182 in 1981 (Table H-6).

The difference between the two assumptions will gradually increase annually to 2,826 by 1991. With a view of avoiding an overestimation of the requirement of hospital-bed complements, this study used the Assumption I as the base of calculation.

Table H-3

Trend of the Pyungchang Gun Population by Myon

Year	Pyungchang	Mitan	Bangrim	Daewha	Bongpyung	Jinbu	Doan	Total
1967	18,862	8,684	9,188	16,642	13,619	21,115	12,939	101,049
1968	18,717	8,490	9,233	16,308	13,114	21,195	13,131	100,188
1969	18,526	7,748	8,845	16,571	13,177	20,355	12,085	97,307
1970	18,785	7,766	8,691	16,829	12,697	20,487	11,704	96,959
1971	18,715	7,641	8,525	16,350	11,944	19,808	12,234	95,217
1972	18,486	7,550	8,317	16,594	11,640	19,790	11,702	94,079
1973	18,227	7,112	8,320	16,365	12,495	20,233	10,188	92,940
1974	17,982	7,060	7,954	16,243	12,436	21,533	10,778	93,986
1975	18,054	6,838	7,698	15,830	12,236	20,570	11,967	93,193
1976	17,586	6,673	7,236	15,636	11,413	19,843	10,239	88,626
1977	16,877	6,251	7,015	15,114	11,111	19,426	11,210	87,004

SOURCE: Statistical Year Book of Pyungchang Gun, 1968-1978.

Table H-4. Estimates of the Youngwoel and Jungseon Gun Population within the Suggested Pyungchang Hospital Service Area

Year	Buk Myon (Youngwoel Gun)		Jungseon Eup (Jungseon Gun)	
1969		13,225		-
1970		13,655		-
1971		13,328		-
1972		12,384		-
1973		10,009		21,236
1974		9,659		21,338
1975		9,245		21,002
1976		8,911		20,748
1977		8,693		20,567
	<u>Projection I</u>	<u>Projection II</u>	<u>Projection I</u>	<u>Projection II</u>
1978	8,289	8,304	20,400	20,410
1979	7,951	7,981	20,207	20,226
1980	7,613	7,662	20,014	20,044
1981	7,275	7,347	19,821	19,865
1982	6,937	7,036	19,629	19,688
1983	6,599	6,729	19,436	19,513
1984	6,261	6,425	19,243	19,340
1985	5,923	6,125	19,050	19,169
1986	5,585	5,828	18,857	19,000
1987	5,247	5,535	18,665	18,834
1988	4,909	5,245	18,472	18,669
1989	4,571	4,958	18,279	18,506
1990	4,233	4,675	18,086	18,344
1991	3,895	4,395	17,893	18,185
<div> $y = a + bx$ $y = a + b \log x$ $y = a + bx$ $y = a + b \log x$ </div> <div> $a : 34,653.50$ $a : 118,793.81$ $a : 35,438.20$ $a : 83,285.46$ </div> <div> $b : -338.00$ $b : -25,360.79$ $b : -192.80$ $b : -14,431.96$ </div> <div> $r^2 : 0.99$ $r^2 : 0.99$ $r^2 : 0.89$ $r^2 : 0.89$ </div>				

Table H-5. Estimates of Target Population within the Pyungchang Hospital Service Area : Projection I

Year	Pyungchang Gun				Jungseon Gun		Youngwoel Gun		Total
	Pyungchang	Mitan	Bangrim	Daewha	One Third of Bongpyung	One Half of Jungseon	One Half of Buk		
1978	17,277	6,123	6,967	15,477	3,715	10,200	4,145	63,904	
1979	17,113	5,904	6,749	15,353	3,648	10,104	3,976	62,847	
1980	16,950	5,685	6,531	15,228	3,581	10,007	3,807	61,789	
1981	16,787	5,465	6,313	15,104	3,514	9,911	3,638	60,732	
1982	16,623	5,246	6,095	14,979	3,447	9,815	3,469	59,674	
1983	16,460	5,027	5,877	14,854	3,380	9,718	3,300	58,616	
1984	16,297	4,808	5,659	14,730	3,313	9,622	3,132	57,561	
1985	16,134	4,589	5,441	14,605	3,246	9,525	2,962	56,502	
1986	15,970	4,370	5,223	14,480	3,178	9,428	2,793	55,442	
1987	15,807	4,151	5,005	14,356	3,111	9,333	2,624	54,387	
1988	15,644	3,932	4,787	14,231	3,044	9,236	2,455	53,329	
1989	15,481	3,712	4,569	14,107	2,977	9,140	2,286	52,272	
1990	15,317	3,493	4,351	13,982	2,910	9,043	2,117	51,213	
1991	15,154	3,274	4,133	13,857	2,843	8,947	1,948	50,156	

Y = a + bx

a : 30,011.07 23,214.71 23,966.00 25,198.15 26,843.24 35,438.20 34,653.50
b : -163.26 -219.13 -217.94 -124.62 -201.25 -192.80 -338.00
r² : 0.80 0.96 0.96 0.66 0.73 0.89 0.99

Table H-6 Estimates of Target Population within the Pyungchang Hospital Service Area : Projection II

Year	Pyungchang Gun				Jungseon Gun		Youngwoel Gun		Total
	Pyungchang	Mitan	Bangrim	Daewha	One Third of Bongpyung	One Half of Jungseon	One Half of Buk		
1978	17,313	6,160	7,008	15,508	3,726	10,205	4,152		64,072
1979	17,164	5,959	6,809	15,395	3,664	10,113	3,991		63,095
1980	17,018	5,761	6,613	15,284	3,604	10,022	3,831		62,133
1981	16,873	5,565	6,419	15,174	3,544	9,933	3,674		61,182
1982	16,730	5,372	6,227	15,065	3,485	9,844	3,518		60,241
1983	16,589	5,180	6,038	14,958	3,426	9,757	3,365		59,313
1984	16,450	4,992	5,850	14,852	3,368	9,670	3,213		58,395
1985	16,312	4,805	5,666	14,747	3,311	9,585	3,063		57,489
1986	16,176	4,621	5,483	14,643	3,254	9,500	2,914		56,591
1987	16,041	4,438	5,302	14,541	3,199	9,417	2,768		55,706
1988	15,908	4,258	5,124	14,440	3,143	9,335	2,623		54,831
1989	15,777	4,080	4,947	14,340	3,089	9,253	2,479		53,965
1990	15,647	3,904	4,772	14,241	3,035	9,172	2,338		53,109
1991	15,518	3,729	4,600	14,143	2,981	9,093	2,918		52,982

$$Y = a + b \log x$$

a : 68,043.35 79,167.29 75,084.72 54,082.74 74,332.36 83,285.46 118,793.81

b : -11,644.24 -16,769.76 -15,625.50 -8,854.01 -14,495.74 -14,431.96 -25,360.79

r²: 0.79 0.94 0.96 0.65 0.73 0.89 0.99

5.5 The number of the people insured under the Medical Insurance Program and the beneficiaries of the Medicaid is as shown in Table H-7. There are no persons subscribed to the employees and self-employed Medical Insurance Program. The number of public servants and private teachers under the Health Insurance totaled 4,550, including their dependents. The beneficiaries of the Medicaid totaled 5,859, including 1,038 indigent people and 4,821 low-income people. The combined total of the medically insured and the Medicaid beneficiaries numbered 10,409, representing 17% of the total population in the areas concerned. It is also assumed that there will be no increase in the number of the medically insured and Medicaid beneficiaries in the coming years for the sake of convenience in calculation.

6. Estimates of Hospital-Beds Requirement

6.1 The number of medical manpower in the catchment area is as shown in Table H-8. There are a total of 49 medical personnel, including 9 doctors, 1 dentist, 1 herb doctor, 2 midwives, 15 nurses and 21 nurse aids. There are also 41 pharmacists, druggists and herb drugstores. Currently, 51 beds are available in the areas and all are owned by local practitioners (Table H-9).

6.2 This study has used the lowest numerical value as well as mean value of the survey data as a base for the hospital utilization rate of the people in the catchment area. The utilization rate is assumed to increase 3-4% annually in the coming years (Table H-10).

6.3 Based on the national average of hospital utilization rates of the medically insured people and the Medicaid beneficiaries, it is assumed that there will be no change in the present utilization rate in the Assumption I, while the present hospital utilization rate will increase 5% annually for following years as per Assumption II (Table H-10).

6.4 There are 40 beds within the catchment area. It is assumed that there will no increase in the number of beds after the proposed Pyungchang Hospital is constructed. The occupancy rate of the existing hospital-beds is estimated at 40%, and is assumed to decrease up to 30%.

6.5 As a result, the additional requirement of bed complements in the medical service areas of the Pyungchang Hospital is estimated as follows (the last column of Table H-10): In 1981 when the proposed Hospital is opened for medical services, 43 beds (low estimate 39, high estimate 47), in 1982, 44 beds (low estimate 39, high estimate 48), and in 1991, 49 beds (low estimate 40, high estimate 57).

6.6 As was shown on the Table H-10, the bed shortage is not serious in this proposed hospital site. For example, the highest number of bed requirement was estimated at only 49 beds in 1991. The proposed hospital of 80 beds in Pyungchang area can hardly be justified. It is thus recommended that the plan to construct a hospital in Pyungchang be cancelled.

6.7 There is a 20-bed clinic (Daewha Clinic) available in Daewha Myon, a 30-minute distance by bus from the proposed hospital site. The Daewha Clinic has been notorious for numerous empty beds and poor staffing. Therefore, it is better to strengthen the existing Daewha Clinic sponsored by the Miwon Company rather than to establish a new hospital.

Table H-7. Number of Public Officials, School Teachers and Medicaid Beneficiaries within the Pyungchang Hospital Service Area

Gun	Public Officer		School Teacher		Medicaid Beneficiary		Total
	Self	Dependents*	Self	Dependents*	Indigent Group	Low Income Group	
Pyungchang	284	1,278	365	1,643	800	3,900	8,270
Jungseon	96	422	428	211	191	239	1,207
Youngwoel	14	59	25	105	47	682	932
TOTAL	394	1,759	438	1,959	1,038	4,821	10,409

* The number of dependents was calculated by subtracting 1 from average number of family size in each area and then multiplying numbers of public officers and school teachers, respectively.

Source: Data from the Statistical Year Book of Each Gun, 1978.

Table H-8 Distribution of Health Manpower within the Pyungchang Hospital Service Area, 1977

Gun	Eup or Myon	Physician	Dentist	Herb Doctor	Midwife	Nurse	Nurse- aid	Total	Pharmacist	Druggist	Herb Druggist	Drug Seller	Total
Pyungchang	Pyungchang	3	-	-	1	4	4	12	2	3	4	1	10
"	Mitan	-	-	-	-	2	1	3	-	2	1	-	3
"	Bangrim	-	-	-	-	-	1	1	-	2	1	1	4
"	Daewha	2	-	-	-	1	4	7	2	2	4	-	8
"	Bongpyung	1	-	-	-	-	4	5	1	1	2	1	5
Jungseon	Jungseon	3	1	1	-	8	5	18	4	2	1	-	7
Yeongwoel	Buk	-	-	-	1	-	2	3	2	-	2	-	4
TOTAL		9	1	1	2	15	21	49	11	12	15	3	41

Source: Ibid.

Table H-9 Number of Beds Owned by Private Practitioners in the
Pyungchang Hospital Service Area

Name of Clinic	Location	Number of Beds
Daewha	Daewha Myon	20
Pyungchang	Pyungchang Eup	5
Seoul	Pyungchang Eup	3
Jungseon	Jungseon Eup	11
Daesung	Jungseon Eup	12
St. Francisco	Jungseon Eup	-
Total		51

* Since half of the Jungseon Gun population are included in the analysis, this study assumes that there exists 12 beds in the service area.

Table H-10 Bed Requirements in the Pyungchang Hospital Service Area

Year	General Population Excluding the Insured	Hospitalization Rate /Person/Year		The Insured & Medicaid Beneficiaries	Average Length of Stay	Hospitalization Rate /Person/Year		Average Length of Stay	No. of Existing Beds	Occupancy Rate (%)	Bed Requirements	
		I	II			I	II				I	II
1979	52,438	0.0195	0.0239	10,409	9	0.0349	0.0349	10	40	40	32	40
1980	51,380	0.0202	0.0247	10,409	9	0.0349	0.0366	10	40	40	33	41
1981	50,323	0.0209	0.0254	10,409	9	0.0349	0.0385	10	40	30	39	47
1982	49,265	0.0215	0.0262	10,409	9	0.0349	0.0404	10	40	30	39	48
1983	48,207	0.0222	0.0269	10,409	9	0.0349	0.0424	10	40	30	39	49 *
1984	47,152	0.0229	0.0277	10,409	9	0.0349	0.0445	10	40	30	39	50
1985	46,093	0.0236	0.0284	10,409	9	0.0349	0.0468	10	40	30	40	51
1986	45,033	0.0242	0.0292	10,409	9	0.0349	0.0491	10	40	30	40	52
1987	43,978	0.0249	0.0299	10,409	9	0.0349	0.0516	10	40	30	40	53
1988	42,920	0.0256	0.0307	10,409	9	0.0349	0.0541	10	40	30	40	54
1989	41,863	0.0263	0.0314	10,409	9	0.0349	0.0568	10	40	30	40	55
1990	40,804	0.0270	0.0322	10,409	9	0.0349	0.0597	10	40	30	40	56
1991	39,747	0.0277	0.0335	10,409	9	0.0349	0.0627	10	40	30	40	57

I . HADONG

I. HADONG HOSPITAL

1. Geographic Features

1.1. Hadong Gun shares the provincial border-line with Jeonnam Province, and the Seomjin River divides Gwangyang and Gurye Gun from Hadong Gun. (Figure I-1). The eastern part of Hadong Gun is bounded by Jinyang Gun and Sacheon Gun; the northern part forms a mountainous area which shares the common boundary of Sancheong Gun and Hamyang Gun of Kyungnam Province and Namwon Gun of Jeonbuk Province. Most of the southern part of Hadong Gun belongs to "Hanryo Sudo" (National Sea Park), a popular tourist area.

1.2. The south of Hadong Gun faces opposite to Namhae Gun over the South Sea. These two Guns are connected by the Namhae Bridge. Most plains lie on the lower reaches of the Seomjin River and along the Namhae coast. There is more forest than arable, and in this Gun. Hadong Gun is expected to develop rich forest resources with its favorable climate. There is much rain in the area, with an annual rainfall of more than 100 mm per month and on the average 1,800 mm per year during the past 5 years.

1.3. Hadong Gun was one of the most remote places in the Gyungnam Province before the opening of the Seomjin Bridge and the Namhae Expressway (Busan-Gwangju). The opening of the Expressway allowed easy access to this Gun. Since then, however, population in the Gun is rapidly declining despite the inflow of many tourists.

1.4. As Hadong Gun is such a remote area from the seat of Gyungnam Province, one can hardly expect sufficient medical resources there. No hospital-sized medical facility exists in the area, and serious cases must be referred to those facilities in the adjacent cities such as Jinju, Masan or Pusan.

2. Disease Conditions

2.1. According to the field survey conducted during this study period, distribution of diseases for rural residents is as in Table I-1. Respiratory diseases were the most prevalent, with 33% of the total cases. Diseases of the nervous system and sense organs ranked the second, 25% of all cases, with a high prevalence rate of neuralgia and arthritis in the area. Disease of the digestive system, ranked third, with 15%. The above three categories together amounted to 73% of the total patients in Hadong Gun. The number of respiratory cases exceeded that of the digestive because this survey was conducted during the cold winter season.

2.2. Table I-1 indicates that there are not been many differences in disease prevalence in rural areas. The data was obtained through a health interview survey. This data can only determine what types of diseases or what kinds of symptoms people frequently suffer from.

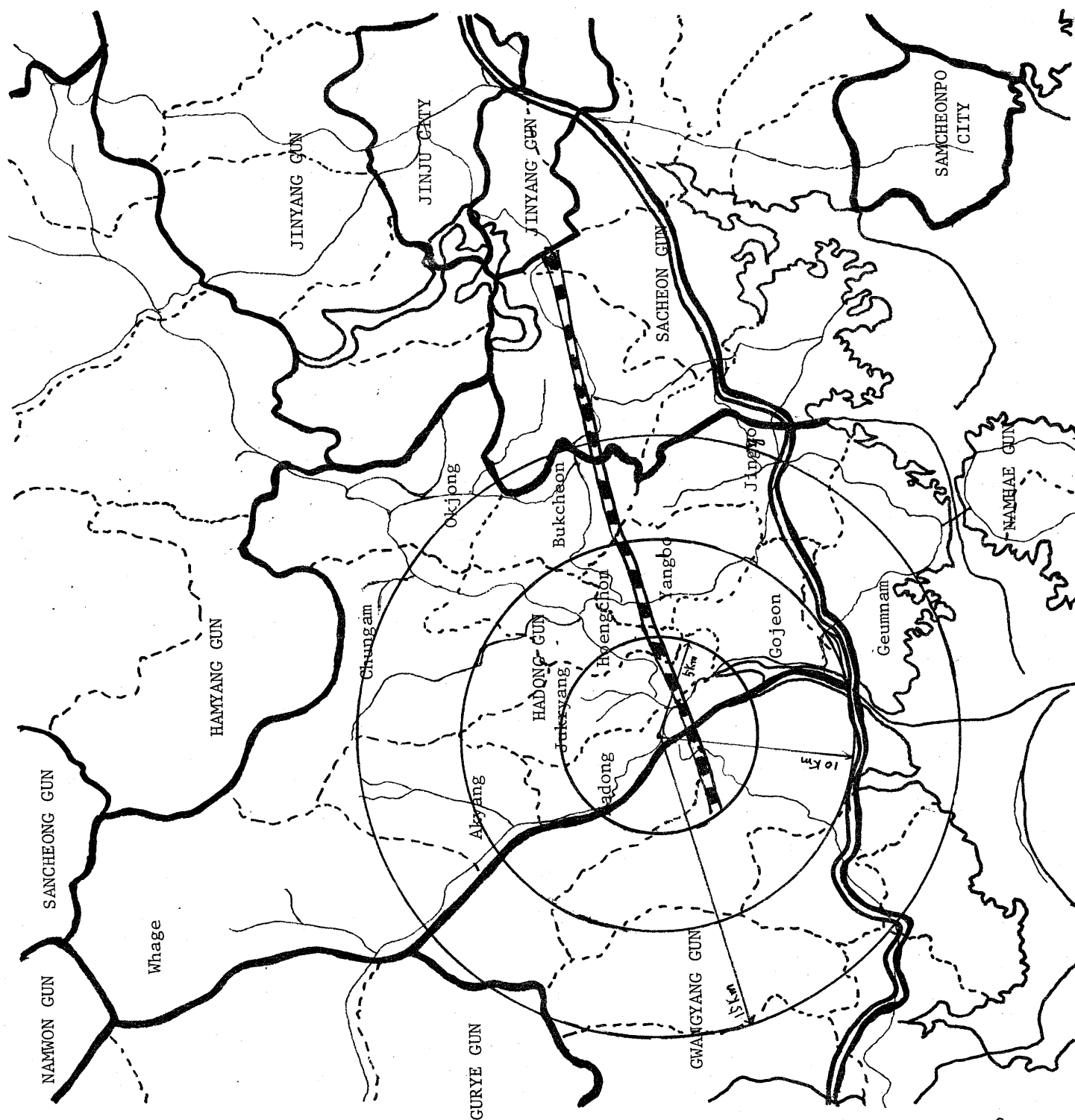


Figure I-1
The Hadong Map

Table I-1. Diseases of Rural Residents through Health Interview Survey, December 1978 - January 1979

Disease Classification	Yeoju		Goesan		Nonsan		Jinan		Hampyung		Hadong		Total	
	Case	%	Case	%	Case	%	Case	%	Case	%	Case	%	Case	%
1	8	1.23	11	1.18	21	2.31	15	1.70	16	1.93	26	3.06	97	1.92
2	3	0.46	1	0.11	1	0.11	-	-	-	-	1	0.12	6	0.12
3	16	2.47	18	1.93	17	1.87	16	1.82	12	1.45	12	1.41	91	1.80
4	5	0.77	7	0.75	15	1.65	5	0.57	4	0.48	11	1.29	47	0.93
5	10	1.54	2	0.21	6	0.66	3	0.34	1	0.12	5	0.59	27	0.53
6	103	15.87	181	19.40	201	22.09	174	19.75	179	21.64	215	25.26	1,053	20.85
7	20	3.08	42	4.50	26	2.86	35	3.97	32	3.87	32	3.76	187	3.70
8	231	35.60	364	39.01	339	37.24	357	40.52	308	37.24	283	33.25	1,882	37.26
9	123	18.95	153	16.40	154	16.92	122	13.85	120	14.51	129	15.16	801	15.86
10	15	2.31	11	1.18	7	0.77	6	0.68	8	0.97	8	0.94	55	1.09
11	13	2.00	12	1.29	9	0.99	11	1.25	17	2.26	17	2.00	79	1.56
12	24	3.70	32	3.43	25	2.75	28	3.18	38	4.59	27	3.17	174	3.44
13	44	6.78	57	6.11	50	5.49	61	6.92	60	7.26	43	5.05	315	6.24
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	1	0.15	1	0.11	1	0.11	-	-	-	-	-	-	3	0.06
16	14	2.16	13	1.39	13	1.43	17	1.93	14	1.69	15	1.76	86	1.70
17	12	1.85	21	2.25	24	2.64	28	3.18	12	1.45	22	2.59	119	2.36
Unknown	7	1.08	7	0.75	1	0.11	3	0.34	6	0.73	5	0.59	29	0.58
Total	649	100.0	933	100.0	910	100.0	881	100.0	827	100.0	851	100.0	5,051	100.0

SOURCE: Data from the Morbidity Survey Conducted by the KHDH Hospital Construction Feasibility Study Team, 1979.

3. Determination of Catchment Area & Estimated Target Population

3.1 Hadong Eup is the center of the Hadong living sphere, and also is the seat of Hadong Gun administrative office. It is located at a 15 to 20 minutes' bus ride from the Namhae Expressway, and has a local railroad station of the Geongjeon line. Therefore, it is recommended that the proposed hospital be located at Hadong Eup.

3.2 As can be seen in Figure I-1, three Myons are situated at the outside area of a 15 Km radius of Hadong Eup, and several Myons of Gwangyang Gun are contiguous to Hadong Gun. Therefore, the parts of Hadong Gun and Gwangyang Gun should be included in the catchment area.

3.3 Whage Myon is excluded from the catchment area, because it adjoins to Namwon and Gurye, and transportation is poor due to the mountainous roads.

3.4 Okjong Myon and Bukcheon Myon, the eastern part of Hadong Gun, borders on Jinyang Gun which belongs to the Jinju living sphere. The two Myons are excluded because of the long distances from the Hadong Eup, 34 Km to Okjong Myon, and 24 Km to Bukcheon Myon.

3.5 The distances of Geumnam Myon and Jingyo Myon from Hadong Eup are 25 Km and 27 Km respectively, and the site of the Hospital will be the other side of the Namhae Expressway. Supposing that the residents utilize the proposed Hospital, they should either cross the highway or go through at a distant crossroad. The two Myons could be excluded from the catchment area for reason that Jingyo Myon which adjoins Sacheon Gun belongs to Jinju living sphere, and many of Geumnam Myon residents presently utilize those medical facilities in Jinju.

3.6 No hospital level of medical institution exists in Gwangyang Gun, and it is a possibility that the residents will utilize the proposed hospital. Some areas of Jinwol Myon and Daap Myon and Gwangyang Gun which is adjacent to Hadong Eup are included in the catchment area. Most of Gwangyang Gun belongs to the Suncheon community possibly with the exception of Jinwol Myon and Daap Myon.

3.7 The following areas are included in the catchment area: Hadong Eup, Akyang Myon, Jukryang Myon, Hoengchon Myon, Gojeon Myon and Yangbo Myon of Hadong Gun. Jinwol Myon and Daap Myon of Gwangyang Gun.

3.8 The population in Hadong Gun stands at a little over 10,000, and its population trend in recent years is shown in Table I-2. All the Myons and Eup show a similar decreasing pattern of population over the years.

3.9 The population trend in Gwangyang Gun in the past few years is shown as in Table I-3. As of 1976, the total population was 89,000 which showed a more gradual decrease in population as compared with Hadong Gun.

3.10 On the assumption that the population in the catchment area, as was mentioned in 3.7, is on a logarithmic decrease, the estimated target population during the planning period was shown as in Table I-4. The total number in 1980 was estimated at 72,700, 70,700 in 1981, and 62,700 in 1985.

Table I-2 Number of Population in Hadong Gun by Area

Year	Hadong	Whage	Akyang	Jukryang	Hoengcheon	Gojeon	Geumnam	Jingyo	Yangbo	Bukcheon	Chungam	Okjong	Total
1972	20,784	7,849	12,961	7,652	6,320	8,401	17,266	12,210	7,684	7,117	8,534	12,614	129,392
1973	20,832	7,700	12,844	7,293	6,127	8,155	17,399	11,978	7,529	7,017	8,397	12,520	127,791
1974	20,609	7,494	12,777	7,329	6,068	7,753	17,481	11,376	7,430	6,752	7,983	12,268	125,320
1975	20,400	7,457	12,162	7,144	5,852	7,349	16,514	11,189	6,946	6,612	7,704	11,847	121,176
1976	20,077	7,112	11,558	6,648	5,699	6,941	16,357	11,033	6,799	6,276	7,231	11,565	117,296
1977*													
1978	20,010	6,336	10,126	6,527	5,150	6,526	15,914	10,090	6,001	5,690	6,359	10,292	109,021

* unavailable

Source: 1/Statistical Year Book of Hadong Gun, 1973-1978, pp. 34-35
2/Residential Population Census of 1978, Hadong Gun

Table I-3 Trend of the Gwangyang Gun Population by Area

Year	Gwangyang	Bonggang	Okryong	Golyak	Okgog	Jinsang	Jinwol	Daup	Total
1970	27,565	5,946	9,572	15,398	8,849	9,943	10,764	6,414	94,451
1971	27,741	5,741	9,321	15,171	8,735	9,675	10,621	6,224	93,229
1972	27,953	5,827	9,497	15,522	9,317	9,930	11,063	6,164	95,273
1973	28,248	5,795	9,509	14,568	9,201	9,603	10,766	5,972	93,662
1974	27,824	5,823	9,478	14,725	8,952	9,767	10,660	6,155	93,384
1975	26,381	5,470	8,783	13,529	8,606	9,818	10,047	6,017	88,662
1976	26,393	5,396	8,863	14,118	8,682	9,726	10,086	5,856	89,120

Source: Statistical Year Book of Gwangyang Gun, 1971-1977

Table I-4 Estimates of Population within the Hadong Hospital Service Area*

Year	Hadong Gun					Gwangyang Gun				Total
	Hadong	Akyang	Jukryang	Hoengcheon	Gojeon	Yangbo	Chungam	Jinwoel	Daup	
1979	19,793	10,024	6,288	5,070	6,115	5,862	6,123	9,837	5,680	74,792
1980	19,647	9,570	6,108	4,893	5,803	5,596	5,774	9,720	5,611	72,722
1981	19,502	9,122	5,931	4,718	5,495	5,333	5,428	9,605	5,543	70,677
1982	19,360	8,680	5,756	4,545	5,191	5,073	5,087	9,491	5,476	68,659
1983	19,219	8,243	5,582	4,374	4,891	4,816	4,750	9,379	5,410	66,664
1984	19,080	7,811	5,411	4,205	4,594	4,562	4,417	9,268	5,344	64,674
1985	18,942	7,384	5,242	4,039	4,301	4,312	4,088	9,158	5,280	62,746
1986	18,807	6,962	5,075	3,874	4,011	4,064	3,763	9,050	5,216	60,822
1987	18,672	6,545	4,910	3,711	3,725	3,819	3,441	8,943	5,152	58,918
1988	18,540	6,133	4,747	3,550	3,441	3,577	3,124	8,837	5,090	57,039
1989	18,408	5,725	4,585	3,391	3,161	3,338	3,124	8,732	5,028	55,492
1990	18,279	5,322	4,426	3,233	3,161	3,101	3,124	8,628	4,967	54,241
1991	18,150	5,322	4,268	3,078	3,161	3,101	3,124	8,526	4,906	53,636

* $Y = a + b \log x$

a: 70,545.16

b: -11,615.30

r^2 : 0.91

167,616.15	68,703.70	66,621.00	114,372.36	98,424.40	127,604.02	50,339.94	29,595.31
-36,066.80	-14,284.57	-14,086.84	-24,776.09	-21,183.91	-27,802.32	-9,269.64	-5,473.26
0.91	0.91	0.96	0.99	0.96	0.98	0.54	0.78

4. Objectives of Hadong Hospital Establishment and Its Bed-Size Determination

4.1 The residents of this area at present utilize those medical institutions in the neighboring cities of Suncheon and Jinju. The goal of the hospital establishment is to meet the medical care demand for the residents of this catchment area of both Hadong Gun and parts of Gwangyang Gun.

4.2 Presently, 8 medical doctors (5 physicians, 2 dentists and 1 herbalist) are serving in the Hadong Gun area, however, 6 of them work in Hadong-Eup, and most of the Myon except Geumnam and Jingyo have no doctor. There are a few pharmacists, druggists and herbal-druggists scattered in the area. (See Table I-5)

4.3 The total number of beds in the 7 private clinics within Hadong Gun adds up to 43 (Table I-6). If the 9 beds located in Jingyo Myon are excluded, there are 34 beds available.

4.4 The combined total number of the employees medical insurance enrollees and medical aid recipients was 11,263 (Table I-7).

4.5 According to the survey on medical care utilization conducted during this study period, the annual hospitalization rate per person in Hadong Gun was 0.0174, the lowest among the 6 areas. Therefore, the average figure of 0.0238 was used as a base of calculation. The estimated hospital-bed requirements amount to 56 (low estimate 54 and high estimate 57) in 1980, 59 (low estimate 57 and high estimate 61) in 1981, 59 (low estimate 55 and high estimate 62) in 1985 respectively as shown in 1985 respectively as shown in Table I-8.

4.6 The medical utilization rate by the medical insurance enrollees is expected to be on the increase. Thus, the above requirement seems to be a conservative estimate. However, the overall medical care utilization rate of rural people is still low so that it is recommended the number of hospital beds be 50 in order to operate the hospital efficiently.

5. Medical Program

5.1 Hadong hospital will be operated with the 4 basic departments, and the estimated number of the inpatients will be 913 for the year of initial operation. When dividing this number by the total hospitalization days of each department, those 50 beds can be allocated as follows: 23 beds for the internal medicine department 16 beds for general surgery, 4 beds for pediatrics and 7 beds for obstetrics-gynecology (Table I-9-1).

5.2 The total number of out-patients in the first year is expected to 9,369, equivalent to 96 out-patients in a day on the basis of 2.8 visits made by a patient.

5.3 The performance of clinical examinations and operation, as in Table I-9-2, are about the same as compared with those of other hospitals in the underserved areas.

5.4 Demand for medical care for the catchment residents is expected to be on the increase. The numbers of in-patients and outpatient visits are estimated on the base of the 1978 survey data and the Government Health Insurance Expansion Scheme (Table I-10 and I-11).

Table I-5 Distribution of Health Professionals in Hadong Gun, 1977.

Eup or Myon	Physician	Dentist	Herb Doctor	Midwife	Total	Pharmacist	Druggist	Herb Druggist	Drug Seller	Total
Hadong	4	1	1	-	6	3	4	2	2	11
Whage	-	-	-	-	-	1	2	1	1	5
Akyang	-	-	-	-	-	1	2	1	1	5
Jukryang	-	-	-	-	-	-	1	-	1	2
Hoengchun	-	-	-	-	-	-	1	1	-	2
Gojun	-	-	-	-	-	-	2	1	1	4
Geumnam	1	-	-	-	1	-	1	1	1	3
Jingyo	2	-	-	-	2	2	-	3	1	6
Yangbo	-	-	-	-	-	-	2	1	-	3
Bukchun	-	-	-	-	-	-	1	1	2	4
Chungam	-	-	-	-	-	-	1	-	1	2
Okjong	-	1	-	-	1	1	2	1	1	5
Total	7	2	1	-	10	8	19	13	12	52

Source: Statistical Year Book of Hadong Gun, 1978

Table I-6 Number of Beds Owned by Private Practitioners in Hadong Gun, 1976

Name of Clinic	No. of Doctors	Location	No. of Beds
Hadong Clinic	1	Hadong	12
Park "	1	Hadong	7
Dongje "	1	Hadong	9
Jungang "	1	Hadong	6
Jingyo "	1	Jingyo	3
Jejung "	1	Jingyo	6
Yeonghae "	1	Geumnam	-
Yeongnam Dental Clinic	1	Hadong	-
Hanam Herb Clinic	1	Hadong	-
Jejunggang Herb Clinic	1	Okjong	-
Total	10		43

Source: Statistical Year Book of Hadong Gun, 1977, p.191

Table I-7 Number of Public Officials, School Teachers and Medicaid Beneficiaries Within the Hadong Hospital Service Area

	Public Officials		School Teachers		Medicaid Beneficiaries		
	Self	Dependents	Self	Dependents	Indigent Group	Low Income Group	Total
339	1,550	604	2,718	1,808	4,244	11,263	

Table I-8 Bed Requirements in the Hadong Hospital Service Area

Year	General Population Excluding the Insured & Medicaid	Hospitalization Rate/Person/Year		Average Length of Stay	The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		Average Length of Stay	No. of Existing Beds	Occupancy Rate (%)	Bed Require- ments	
		I	II			I	II				I	II
1979	63,529	0.0238	0.0239	10	11,263	0.0349	0.0349	9	34	40	56	56
1980	61,459	0.0238	0.0247	10	11,263	0.0349	0.0366	9	34	40	54	57
1981	59,414	0.0238	0.0254	10	11,263	0.0349	0.0385	9	34	30	57	61
1982	57,396	0.0238	0.0262	10	11,263	0.0349	0.0404	9	34	30	55	62
1983	55,401	0.0238	0.0269	10	11,263	0.0349	0.0424	9	34	30	54	62
1984	53,411	0.0238	0.0277	10	11,263	0.0349	0.0445	9	34	30	52	62
1985	51,483	0.0238	0.0284	10	11,263	0.0349	0.0468	9	34	30	50	62
1986	49,559	0.0238	0.0292	10	11,263	0.0349	0.0491	9	34	30	49	63
1987	47,655	0.0238	0.0299	10	11,263	0.0349	0.0516	9	34	30	47	63
1988	45,776	0.0238	0.0307	10	11,263	0.0349	0.0541	9	34	30	46	63
1989	44,229	0.0238	0.0314	10	11,263	0.0349	0.0568	9	34	30	44	63
1990	42,978	0.0238	0.0322	10	11,263	0.0349	0.0597	9	34	30	43	64
1991	42,373	0.0238	0.0335	10	11,263	0.0349	0.0627	9	34	30	43	66

Table I-9-1 Medical Program of the Hadong Hospital (1)

1: INPATIENTS

Medical disciplines/ specialties	No. of cases per year	Average length of stay(days)	Occupancy rate of bed(%)	Distribu- tion of beds(number)
Internal medicine - general - infections - intensive care	411	10	49	23
General surgery - intensive care	229	12	49	16
Pediatrics - neonatology - babies -children	91	8	49	4
OB & GYN - obstetrics - gynaecology	182	7	49	7
TOTAL OR AVERAGE	913	9.7	49	50

2: OUTPATIENTS

Medical disciplines	No. of visits	No. of visits /patient	No. of visits per year
Internal medicine	4,154	2.6	10,800
General surgery	2,250	2.4	5,400
Pediatrics	1,929	3.5	6,750
OB & GYN	1,306	3.1	4,050
TOTAL	9,639	2.8	27,000

Table I-9-2. Medical Program of the Hadong Hospital (II)

3: MEDICAL PERFORMANCES

Kind of performances	No. of performances per year		
	Inpatients	Outpatients	Total
Emergency cases			1,350
Laboratory diagnostics			
- chemical	179	110	289
- hematological	1,060	7,060	8,120
- serological	354	2,362	2,716
- bacteriological	156	247	403
- stool exam.	100	1,000	1,100
- urinalysis	850	1,517	2,367
Plain X-ray	2,709	4,198	6,907
Mass X-ray	-	2,088	2,088
Fluoroscopies	85	-	85
Operations			
- general surg.	103	306	409
- OB & GYN	82	172	254
- pediatrics	8	28	36
- total	193	506	699
Deliveries	100	-	100
Physical check-up		1,000	1,000

Table I-10. Estimates of Inpatients by Medical Department and Coverage of Health Insurance for the Hadong Hospital

<u>Medical Department</u>		<u>1980</u>	<u>1981</u>	<u>1985</u>	<u>1990</u>
Internal Medicine	Total	411	448	599	690
	Insurance	103	166	329	587
	Non-insurance	308	282	270	103
General Surgery	Total	229	249	376	517
	Insurance	98	120	207	439
	Non-insurance	131	129	169	78
Pediatrics	Total	91	100	125	155
	Insurance	28	37	69	132
	Non-insurance	63	63	56	23
OB & GYN	Total	182	198	292	362
	Insurance	71	89	160	308
	Non-insurance	111	109	132	54
TOTAL	TOTAL	913	995	1,392	1,724
	INSURANCE	300	412	765	1,466
	NON-INSURANCE	613	583	627	258

Table I-11. Estimates of Outpatient Visits by Medical Department and Coverage of Health Insurance for the Hadong Hospital

Internal Medicine	Total	10,800	11,340	13,265	14,500
	Insurance	1,188	3,402	6,632	12,325
	Non-Insurance	9,612	7,938	6,633	2,175
General Surgery	Total	5,400	5,670	6,301	6,525
	Insurance	918	1,701	3,150	5,546
	Non-Insurance	4,482	3,969	3,151	979
Pediatrics	Total	6,750	7,088	8,291	9,063
	Insurance	1,620	2,126	4,146	7,704
	Non-insurance	5,130	4,962	4,145	1,359
OB & GYN	Total	4,050	4,252	5,305	6,164
	Insurance	567	1,276	2,653	5,239
	Non-insurance	3,483	2,976	2,652	925
TOTAL	TOTAL	27,000	28,350	33,162	36,252
	INSURANCE	4,293	8,505	16,581	30,814
	NON-INSURANCE	22,707	19,845	16,581	5,438

6. INVESTMENT AND FINANCING PLAN

(All the assumptions for the financial analysis of the hospitals in rural areas are the same as those mentioned in the analysis of the Nonsan Hospital. Since the Hadong Hospital is one of those in rural areas, refer to the analysis of the Nonsan Hospital.)

6.1. Investment Cost

Table I-12-1. Hadong Hospital (50 beds)
Investment Cost 1/

Category	Local cost	Foreign cost
Land estate	₩186,340,000	\$388,208
Site preparation	9,000,000	18,750
Construction	712,000,000	1,483,333
Medical Equipment	241,700,000	503,542
Dormitory	35,072,000	73,066
Outside equipment	32,000,000	66,667
Contingencies	148,316,000	308,992
Engineering fees	39,800,000	82,917
Working capital	22,728,000	47,350
Total investment	₩1,426,956,000	\$ 2,972,825

1/ See Appendix A 4-1.

6.2. Financing Plan

Table I-12-2. Hadong Hospital (50 beds)
Sources of Finance

Category	Local Currency	Foreign Currency
Total Investment	₩1,426,956,000	\$2,972,825
Foreign loan	240,000,000	500,000
Local loan	500,000,000	1,041,667
Capital	686,956,000	1,431,158
Total Financing	₩1,426,956,000	\$2,972,825

6.3. Pro-forma Balance Sheet (the year before operation starts)

Table I-12-3. Hadong Hospital (50 beds)
Balance Sheet (Beginning of Operation)

Unit: W1,000

Assets		Liabilities	
Cash	162,253	Bank Credit	0
Auxiliary goods	3,962	Account payable	0
Pharmaceuticals and other materials	4,829	Draft	0
Equipment	241,700	Loans local	500,000
Building	827,872	foreign	240,000
Land	186,340	Capital	686,956
Total	1,426,956	Total	1,426,956
(\$000)	(2,973)	(\$000)	(2,973)

7. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the study of the Nonsan Hospital.)

7.1. Revenue Estimation (See Table I-13-1)

7.2. Estimation of Expenses (See Table I-13-2)

7.3. Pro-forma Income Statement (See Table I-13-3)

7.4. Pro-forma Balance Sheet (See Table I-13-4)

8. ESTIMATION OF CASH FLOW (See Table I-14-1)

9. CONCLUSION FROM FINANCIAL ANALYSIS

9.1. Sponsor should provide about \$1,431,000 (W687,000,000) for initial fund and about W1,800,000,000 during first five years to maintain reasonable cash balance because of inadequate cash-inflow from operations. (See 4.2 in Table I-14-1)

9.2. Even though the loss from operation will last five years, after that, the profit and cash-inflow will be improved.

9.3. Considering operations of 10 years, the project is profitable.

Table I-13-1.

Hadong Hospital (50 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Insurance	67,775	109,051	142,107	177,500	215,846	258,144	320,700	386,952	456,809	521,173
Private	164,463	212,387	218,584	224,825	230,677	237,120	214,259	189,983	163,458	135,701
Inpatient	184,440	205,958	236,416	268,763	302,953	341,513	372,344	405,716	439,660	462,582
Outpatient	47,798	115,479	124,275	133,563	143,570	154,551	162,615	171,219	180,607	194,293
Total local	232,238	321,437	360,681	402,326	446,523	496,064	534,949	576,935	620,267	656,875
foreign (484)		(670)	(751)	(838)	(930)	(1,033)	(1,114)	(1,202)	(1,292)	(1,358)
(\$000)										

Table I-13-2.

Hadong Hospital (50 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st - 10th year)

		Unit: ₩1,000 1\$ = 480 won									
Year		1	2	3	4	5	6	7	8	9	10
Personnel		167,252	172,270	177,437	188,244	193,890	199,707	205,699	211,869	218,225	224,772
Physician		55,268	56,926	58,634	60,393	62,204	64,070	65,993	67,972	70,012	72,112
Nurse		45,619	46,987	48,397	49,849	51,344	52,885	54,471	56,105	57,788	59,522
Medical assistant		13,502	13,907	14,325	14,754	15,197	15,653	16,122	16,606	17,104	17,617
Mgt. & ad.		12,232	12,599	12,977	13,367	13,768	14,180	14,606	15,044	15,495	15,960
Technical service and others		45,649	47,018	48,429	49,881	51,379	52,919	54,507	56,142	57,826	59,561
Pharma. & X-ray		57,944	80,199	89,992	100,380	111,408	123,768	133,472	145,068	154,757	138,940
Food & clothes		14,347	15,635	17,050	18,574	20,255	21,874	23,618	24,797	26,038	26,557
Heating and utilities		11,521	15,481	16,863	18,258	19,687	21,230	22,224	23,268	24,287	21,172
Maintenance Bldg.		8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113
Equip.		2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070	2,070
Others		6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043	6,043
		13,754	18,480	20,130	21,795	23,501	25,343	26,530	27,776	28,993	25,274
Total local		272,930	310,178	329,585	349,882	371,208	394,218	413,664	434,721	454,157	438,281
foreign (\$000)		(568)	(646)	(687)	(521)	(773)	(821)	(862)	(906)	(946)	(913)

Table I-13-3.

Hadong Hospital (50 beds)
ECONOMIC FORECASTING : PRO FORMA INCOME STATEMENTS
 (1st - 10th year)

Year	1	2	3	4	5	6	7	8	9	10
Total Revenue	232,238	321,437	360,681	402,326	446,523	496,064	534,949	576,935	620,267	656,875
Total Expense	272,930	310,178	329,585	349,882	371,208	394,218	413,664	434,721	454,157	438,281
Operating income	*40,692	*11,259	31,096	52,444	75,315	101,846	121,285	142,214	166,110	218,594
Depreciation	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727
Interest	39,800	39,800	39,800	39,800	35,755	31,425	26,795	21,840	16,540	10,870
Net profit (\$000)	*121,219 (*252)	*69,268 (*144)	*49,431 (*103)	*28,083 (*59)	*1,167 (*2)	29,694 (62)	53,763 (112)	79,647 (166)	108,843 (226)	166,998 (348)

* : deficit

Table I-13-4.

Hadong Hospital (50 beds)
ECONOMIC FORECASTING : PROFORMA BALANCE SHEETS
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Current Assets	171,044	171,044	171,044	171,044	171,044	175,315	199,025	243,664	312,199	433,219
Equipment	241,700	241,700	241,700	241,700	241,700	241,700	241,700	241,700	241,700	241,700
Depr.	24,170	48,340	72,510	96,680	120,850	145,020	169,190	193,360	217,530	241,700
Bldg.	827,872	827,872	827,872	827,872	827,872	827,872	827,872	827,872	827,872	827,872
Depr.	16,557	33,114	49,671	66,228	82,785	99,342	115,899	132,456	149,013	165,570
Land	186,340	186,340	186,340	186,340	186,340	186,340	186,340	186,340	186,340	186,340
Total	1,385,869	1,345,142	1,304,415	1,263,688	1,222,961	1,186,505	1,169,488	1,173,400	1,201,208	1,281,861
Current liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	500,000	500,000	500,000	442,225	380,405	314,255	243,475	167,740	86,705	0
Foreign loan	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
Capital	767,448	795,989	804,693	849,824	872,084	872,084	872,084	872,084	872,084	872,084
Retained Earnings	0	*121,219	*190,487	*230,918	*268,001	*269,168	*239,474	*185,711	*106,004	2,779
Net profit	*121,219	*69,268	*49,431	*28,083	*1,167	29,694	53,763	79,647	108,843	166,998
Total	1,385,869	1,345,142	1,304,415	1,263,688	1,202,961	1,186,505	1,169,488	1,173,400	1,201,208	1,281,861
(\$000)	(2,887)	(2,803)	(2,718)	(2,632)	(2,548)	(2,472)	(2,436)	(2,445)	(2,503)	(2,671)

* : deficit

Table I-14-1.

Hadong Hospital (50 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
1. Operating and Maintenance										
1.1 Personnel	167,252	172,270	177,437	188,244	193,890	199,707	205,699	211,869	218,225	224,772
1.2 Other expenses	97,566	129,795	144,035	153,525	169,205	186,398	200,152	214,739	227,819	205,796
1.3 Maintenance	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113	8,113
1.4 Interest	39,800	39,800	39,800	39,800	35,755	31,425	26,795	21,840	16,540	10,870
1.5 Operating expenses	312,731	349,978	369,385	389,682	406,963	425,643	440,759	456,561	470,697	449,151
1.6 Depreciation	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727	40,727
1.7 Operating cost	353,458	390,705	410,122	430,409	447,690	466,370	481,186	497,288	511,424	489,877
2. Revenue										
2.1 Outpatient	47,798	115,479	124,275	133,563	143,570	154,551	162,615	171,219	180,607	194,293
2.2 Inpatient	184,440	205,958	236,416	268,763	302,953	341,513	372,344	405,716	439,660	462,582
2.3 Other										
2.4 Whole revenue	232,238	321,437	360,681	402,326	446,523	496,064	534,949	576,935	620,267	656,875
3. Calculation										
3.1 Operating incomes	*121,219	*69,268	*49,431	*28,083	*1,167	29,694	53,763	79,647	108,843	166,998
3.2 Accumulation	*121,219	*190,487	*239,918	*268,001	*269,168	*239,474	*185,711	*106,064	2,779	169,777
3.3 Income tax										
4. Cash flow calculation										
4.1 Gross cash flow	80,492	28,541	8,704	12,644	39,560	70,421	94,490	130,374	149,570	207,725
4.2 Invested capital	80,492	28,541	8,704	45,131	22,260	0	0	0	0	0
4.3 Payoff/discharge	0	0	0	57,775	61,820	66,150	70,780	75,735	81,035	86,705
4.4 Net cash flow	0	0	0	0	0	4,271	23,710	44,639	68,535	121,020
4.5 Accumulation of 4.4	0	0	0	0	0	4,271	27,981	72,620	141,155	262,575
(\$000)	(0)	(0)	(0)	(0)	(0)	(9)	(58)	(151)	(294)	(547)

* : deficit

Appendix Table A 4-1

			<u>Amount</u>
No. 1: Land estate cost			
1.1.	Value: <u>quantity (Won/M²)</u>		<u>Whole Amount</u>
	7,700 M ² (24,200 Won/M ²)		
1.2.	Acquisition cost		₩186,340,000
Total Sum of No. 1			₩186,340,000
No. 2: Site preparation cost			
2.1.	Public opening		₩2,000,000
2.2.	Non-public opening		₩7,000,000
2.3.	Other cost (i.e. taxes)		
Total Sum of No. 2			₩9,000,000
No.3: Construction cost			
3.1.	Building (due to room and space program plus traffic ways)		₩477,000,000
3.2.	Installations (Sewage, Water, Heating, Electricity ...)		₩105,000,000
3.3.	Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators)		₩130,000,000
Total Sum of 3.1 - 3.3			₩712,000,000

and:

a) Classification to space-content:

3.1 - 3.3 :	<u>m³</u>	<u>Won/m³</u>	<u>Whole Amount</u>	<u>Outside Equipment</u>
	13,600	50,000	₩680,000,000	₩32,000,000
Sum of 3.1 - 3.3				

b) Classification to space

3.1 - 3.3 :	<u>m²</u>	<u>Won/m²</u>	<u>Whole Amount</u>	<u>Whole Amount</u>
	3,400	200,000	₩680,000,000	₩32,000,000
Sum of 3.1 - 3.3				

c) Classification to beds

3.1 - 3.3	<u>No. of beds</u>	<u>Won/Bed</u>	<u>Whole Amount</u>	<u>Whole Amount</u>
	50	13,600,000	₩680,000,000	₩32,000,000
Sum of 3.1 - 3.3				

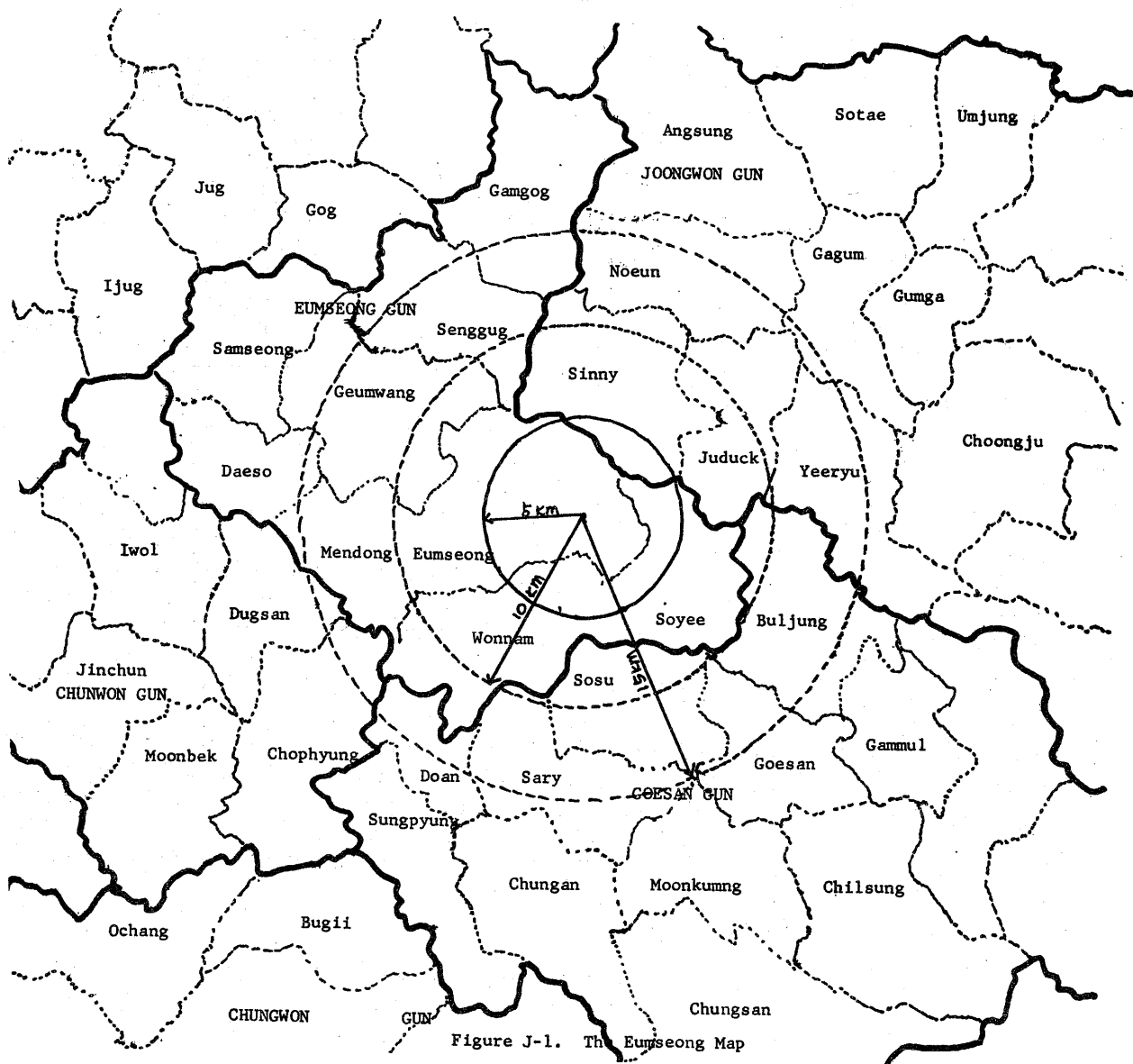
No. 4:	Equipment	
4.1.	Medical Equipment	\$469,615
4.2.	Non-medical Equipment	\$34,005
	Total Sum of 4.1 + 4.2	
No. 5:	Outside Equipment	₩32,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	
No. 7:	Engineering Fee	₩148,316,000
No. 8:	Dormitory	₩39,800,000
		₩35,072,000

J . EUMSEONG

J. EUMSEONG HOSPITAL

1. Geographic Features

1.1 Eumseong Gun is situated at the north-eastern part of Choongchung Buk Province, 114.4 Km away from Seoul, 44 Km from Cheongju and 25.4 Km from Choongju. This Gun shares the provincial borderline with Icheon Gun of Kyunggi Province on the north, bordered by Goesan Gun on the south, by Joongwon Gun on the east, and by Jincheon Gun on the west (Figure J-1). The south-eastern part of the Gun extends with hills and plains for most of the area, however, a rugged branch of the Taebak Mountain range stretches out in the middle area. This Gun forms a plateau farmland of an elevation of 500 to 700 meters.



1.2 Administratively, Eumseong Gun is composed of 2 Eups, Eumseong and Keumwang, and 7 Myons. The entire area covers 517.5 Km² with 19,545 households of 104,552 residents. The population density is 220 persons/Km², and about 72% of the total households are engaged in farming.

1.3 Eumseong Gun is known as one of the highest income Guns in Korea. The Gun is famous for the production of tobacco and redpepper of high quality, as well as Ginseng and fruits as apples and peaches are grown on a large scale. The household income has reached nearly 2,300,000 Won per year, as a result of recent successful harvests. Eumseong Gun is number one in income per household in Korea, except for Nam Jeju Gun of Jeju Island which is noted for its tangerine crop (Table J-1).

Table J-1 Eumseong Gun Household Income Per Year, 1978

Eup or Myon	Income per Annual
Eumseong	2,321,238
Keumwang	2,223,381
Soyee	2,196,558
Wonnam	2,084,952
Mengdong	2,098,025
Daeso	2,154,787
Samsung	2,271,051
Senggug	2,156,529
Gamgog	2,216,709
Average	2,214,502

1.4 Eumseong area has now become a place of easy access because of the opening of the Cheongju-Choongju Highway, and of completing the double-tracking of the Choongbuk Railway. The future of this area is bright because of the comprehensive land reclamation program under way in the Miho River basin, a part of the national modernization plan in the rural community.

1.5 Medical resources in the Gun are much the same as those of other medically underserved areas, although the socio-economic development of Eumseong Gun is far ahead of others. Furthermore, no medical facilities of hospital-level exist in the areas adjacent to this Gun, Goesan, Jincheon and Choongwon Gun. These are some of the reasons why Eumseong Gun is included in the medically underserved area. It is possible that a substantial amount of medical care could be provided to those neighbors if this hospital is established at the proposed site.

2. Disease Pattern

Refer to Hadong Hospital's report in this connection.

3. Catchment Area and Estimated Target Population

3.1 On the whole, the catchment area of this hospital will reach the entire Gun.

3.2 This hospital should be placed in Eumseong Eup because it is easily accessible to most area within the Province, and is the seat of the Gun administrative office. Choongju City and Joongwon Gun are located in the vicinity, a distance of about 30-minute bus ride. However, residents far from the center of the metropolitan area find it difficult to seek high quality medical care because of the scarce medical facilities. Therefore, parts of Joongwon Gun that adjoin Eumseong Eup (Iryu Myon, Judeuk Myon, Shinni Myon and Noeun Myon) could be included in the catchment area.

3.3 Goesan Gun is the most remote area of the Province. In Goesan Eup, seat of its Gun administrative office, hospital level medical facilities do not exist. It is, therefore, expected that the majority of the residents in Sosu Myon, Buljung Myon and Gammul Myon of Goesan Gun, adjacent to Eumseong Gun, can utilize the proposed hospital. Goesan Eup might be included in this catchment area, however, it is excluded with the view of avoiding to overestimation of hospital-bed complements requirements.

3.4 Jincheon Gun is not included in the catchment area, though it borders on Eumseong Gun geographically, for the reason that it belongs to the Cheongju metropolitan area. The catchment area of the proposed hospital is listed as below:

- the entire Eumseong Gun area
- Iryu Myon, Judeuk Myon, Shinni Myon and Noeun Myon of Joongwon Gun
- Sosu Myon, Buljung Myon and Gammul Myon of Goesan Gun

3.5 As for of population in the catchment area as of 1977, there were 108,791 persons in Eumseong Gun, 38,416 in Joongwon Gun, and 21,739 in Goesan Gun, totaling 168,946 persons (Table J-2). On the assumption that the catchment population is logarithmically on the decrease, the population during the planning

Table J-2. Number of Population within the Eumseong Hospital Catchment Area, 1977

Gun	Eup or Myon	Male	Female	Total
Eumseong	Eumseong	10,871	10,826	21,697
"	Geumwang	9,685	9,430	19,115
"	Soyee	4,576	4,342	8,918
"	Wonnam	5,107	4,909	10,016
"	Mengdong	3,167	3,104	6,271
"	Daeso	5,080	4,947	10,027
"	Samseong	5,949	5,779	11,728
"	Senggug	4,508	4,180	8,688
"	Gamgog	6,265	6,066	12,331

Jungwon	Yeeryu	4,973	4,822	9,795
"	Juduck	6,189	5,894	12,083
"	Sinyee	4,791	4,593	9,384
"	Noeun	3,659	3,495	7,154
Goesan	Sosu	3,116	2,862	5,978
"	Buljung	4,758	4,501	9,259
"	Gammul	3,298	3,204	6,502
Total		85,992	82,954	168,946

SOURCE: Statistical Year Book of Eumseong Gun, 1978.

period is projected as shown on Table J-3, with a total population of 157,569 in 1980, 154,133 in 1981, 150,738 in 1982, and 140,798 in 1985.

4. Objectives of Eumseong Hospital Establishment and Determination of Its Size

4.1 The objective is to meet the medical care demand for the rural population in the medically underserved areas including parts of Joongwon Gun and Goesan Gun. When the proposed hospital is established and operated successfully, serving the presently poorly served Eumseong catchment area, it would be separated into an independent health district. The hospital will fulfil its function as a major medical center for the community residents in the above areas.

4.2 Medical manpower in the area is shown on Table J-4. Presently, 10 physicians are practicing in Eumseong Gun, 2 in Joongwon Gun, and 3 in the Goesan Gun, a combined total of 15 physicians. Also 9 herbalists and 1 dentist serve the area. The total number of hospital beds owned by them is 69 (Table J-5).

4.3 The medical insurance enrollees in this area number 9,408, and Medicaid recipients 6,476. These two groups are equivalent to 9.9% of the total population (Table J-6). It was assumed that the above figures will remain the same during the planning period.

4.4 The shortage of hospital-bed complements are calculated as in Table J-7. To be brief, 112 beds (low estimate, 105 and high estimate 118) in 1980, 115 beds (low estimate 111, high estimated 119) in 1981, 115 beds (low estimate 108, high estimate 121) in 1982, and 112 beds (low estimate 100, high estimate 124) in 1985.

4.5 The proposed Hospital does not have to cover all the bed shortages. This is because it will take some years to make the residents aware of the medical care services. And moreover, some of the target population has access to the hospitals in Cheongju and Choongju. It is, therefore, desirable that the Hospital should start its operation with 80 beds as was originally designed by the Government.

5. Medical Care Services

5.1 Eumseong Hospital will consist of 6 departments of uro-dermatology and dental care together with the basic four departments. The hospital is expected to run by the Suncheunhyang Medical College, therefore it can easily be expanded in its clinical capacity. However, in the beginning, it will have the above mentioned 6 departments, and it is recommended that other medical specialists from the Suncheunhyang Hospital be sent to serve the resident regularly once a week (the present system of Samwha Clinic backed by the Hospital is preferable).

5.2 During the first year of its operation, the total number of in-patients is estimated at 1,530, and bed occupancy rate at 52% (Table J-8-1). The number of annual out-patients is estimated at 11,571 with a total of 32,998 out-patient visits, equivalent to 20 patients per day in each department, or 118 out-patients a day.

5.3 The total number of 22,910 clinical examinations, 182 deliveries and 1,366 surgical operations are estimated during the first year of the hospital operation (Table J-8-2).

5.4 The numbers of inpatients as well as outpatients by health insurance membership and clinical department are projected on Table J-9 and J-10.

Table J-3. Estimates of Target Population within the Eumseong Hospital Service Area

Year	Eumseong Gun		Jungwon Gun				Goesan Gun			Total
	Yeeryu	Juduck	Sinyee	Noeun	Sosu	Buljung	Gammul			
1973	114,432	12,548	11,072	7,943	6,630	10,430	8,009	182,065		
1974	114,447	12,398	10,423	7,842	6,641	10,116	7,068	179,318		
1975	111,195	12,693	10,026	7,647	6,624	9,976	6,962	175,279		
1976	110,701	12,268	9,891	7,557	6,206	9,712	6,760	173,349		
1977	108,791	12,083	9,384	7,154	5,978	9,259	6,502	168,946		
1978	104,552	12,086	9,004	7,079	5,904	8,607	6,186	162,984		
1979	104,130	11,986	8,630	6,902	5,738	8,512	5,830	161,051		
1980	102,320	11,886	8,261	6,726	5,575	8,188	5,530	157,569		
1981	100,532	11,788	7,897	6,553	5,413	7,869	5,235	154,133		
1982	98,767	11,691	7,537	6,382	5,254	7,553	4,943	150,738		
1983	97,023	11,595	7,182	6,213	5,096	7,242	4,654	147,385		
1984	95,300	11,500	6,830	6,046	4,941	6,934	4,369	144,071		
1985	93,597	11,407	6,483	5,881	4,787	6,629	4,088	140,798		
1986	91,914	11,314	6,140	5,718	4,635	6,329	4,088	137,840		
1987	90,251	11,223	5,801	5,557	4,485	6,301	4,088	134,918		
1988	88,607	11,132	5,801	5,397	4,336	5,737	4,088	132,362		
1989	86,981	11,043	5,801	5,240	4,189	5,447	4,088	129,837		
1990	85,373	10,955	5,801	5,084	4,044	5,160	4,088	127,340		
1991	83,783	10,867	5,801	4,930	3,901	5,160	4,088	125,154		

$$Y = a + b \log. x$$

$$r^2: 0.91$$

$$a: 732,803.80$$

$$b: -143,879.56$$

$$0.84$$

$$92,715.37$$

$$-19,085.39$$

$$0.49$$

$$46,542.18$$

$$-7,908.67$$

$$0.96$$

$$136,787.00$$

$$-29,330.25$$

$$0.92$$

$$67,829.86$$

$$-13,944.16$$

$$0.80$$

$$62,519.86$$

$$-12,995.14$$

$$0.94$$

$$120,864.53$$

$$-25,713.31$$

$$0.89$$

$$109,828.82$$

$$-23,801.40$$

Table J-4. Medical Professionals in the Eumseong Hospital Service Area, 1977

Gun	Eup or Myon	Physician	Area Limited Doctor	Herb Doctor	Dentist	Total
Eumseong	Eumseong	4	-	3	1	8
"	Geumwang	2	-	1	-	3
"	Soyee	-	1	1	-	2
"	Wonnam	-	-	-	-	-
"	Mendong	-	-	-	-	-
"	Daeso	-	-	-	-	-
"	Samseong	-	1	-	-	1
"	Senggng	-	-	1	-	1
"	Gangog	1	1	1	-	3
Jungwon	Yeeryu	-	-	-	-	-
"	Juduck	1	-	-	-	1
"	Sinyee	1	-	-	-	1
"	Noeun	-	-	-	-	-
Goesan	Sosu	-	-	1	-	1
"	Buljung	-	1	1	1	2
"	Gammul	1	1	-	-	2
Total		10	5	9	1	25

SOURCE: Statistical Year Book of Eumseong, Jungwon and Goesan, 1978.

Table J-5. Number of Beds Owned by Private Practitioners, 1979

Name of Clinic	Location (Myon)	Beds
Jung's clinic	Eumseong	12
Choong Il clinic	"	4
Eumseong clinic	"	5
Se Il clinic	"	2
Kwon's clinic	Geumwang	8
Dong Guk clinic	"	3
Dong In clinic	Soyee	2
Kang's clinic	Samseong	5
Ham Chung clinic	Gangog	8
Koryo clinic	"	4
Others	Goesan & Jungwon	10
Total		69

SOURCE: Eumseong Gun Health Center, 1979.

Table J-6. Number of Health Insurance Memberships and Medicaid Beneficiaries, 1979.

Area(Myon)	Health Insurance		Medicaid		Total
	Industrial Workers	Civil Servants & Teachers	Yellow	Green	
Eumseong	-	2,355	308	871	3,534
Geumwang	-	939	259	797	1,995
Soyee	-	343	108	171	622
Wonnam	-	365	86	217	668
Mengdong	-	254	69	351	674
Daeso	-	436	74	517	1,027
Samseong	-	530	92	351	653
Senggug	-	402	169	467	1,038
Gamgog	-	609	222	298	1,129
Yeeryu	-	405	97	55	557
Juduck	-	625	53	65	743
Sinyee	-	475	30	81	1,098
Noeun	-	435	55	100	590
Sosu	-	405	71	20	1,086
Buljung	-	440	106	137	683
Gammul	-	390	42	137	569
Total	-	9,408	1,841	4,635	16,666

SOURCE: Statistical Year Book of Eumseong, Jungwon and Goesan Gun, 1978.

Table J-7. Bed Requirements in the Eunseong Hospital Service Area

Year	General Population Excluding Insurees & Medicaid	Hospitalization Rate/Person/Yr.		Average Length of Stay	Insurees and Medicaid Beneficiaries	Hospitalization Rate/Person/Yr.		Average Length of Stay	No. of Existing Beds	Occupancy Rate (%)		Bed Require- ment
		I	II			I	II			I	II	
1979	144,385	0.0238	0.0239	10	16,666	0.0349	0.0349	9	69	40		108
1980	140,903	0.0238	0.0247	10	16,666	0.0349	0.0366	9	69	40		105
1981	137,467	0.0238	0.0254	10	16,666	0.0349	0.0385	9	69	30		111
1982	134,072	0.0238	0.0262	10	16,666	0.0349	0.0404	9	69	30		119
1983	130,719	0.0238	0.0269	10	16,666	0.0349	0.0424	9	69	30		108
1984	127,405	0.0238	0.0277	10	16,666	0.0349	0.0445	9	69	30		121
1985	124,132	0.0238	0.0284	10	16,666	0.0349	0.0468	9	69	30		106
1986	121,174	0.0238	0.0292	10	16,666	0.0349	0.0491	9	69	30		103
1987	118,252	0.0238	0.0299	10	16,666	0.0349	0.0516	9	69	30		100
1988	115,696	0.0238	0.0307	10	16,666	0.0349	0.0541	9	69	30		96
1989	113,171	0.0238	0.0314	10	16,666	0.0349	0.0568	9	69	30		96
1990	110,674	0.0238	0.0322	10	16,666	0.0349	0.0597	9	69	30		94
1991	108,488	0.0238	0.0335	10	16,666	0.0349	0.0627	9	69	30		92
												90
												88
												135

Table J-8-1

Medical Program for the Eumseong Hospital: Inpatients & Outpatients

A. Inpatients

Medical Department	No. of Cases	Average Length of Stay (Days)	Occupancy Rate of Beds (%)	Distribution of Beds (Number)
Internal Medicine	613	10	52	32
General Surgery	382	12	52	24
Pediatrics	199	8	52	8
OB & GYN	260	8	52	11
Urology & Dermatology	46	10	52	3
Dental	30	10	52	2
Total or Average	1,530	9.9	52	80

B. Outpatients

Medical Department	No. of Cases	Visits Per Case	No. of Visits/Year
Internal Medicine	5,077	2.6	13,200
General Surgery	2,200	2.4	5,280
Pediatrics	1,320	3.5	4,620
OB & GYN	1,171	3.1	3,630
Urology & Dermatology	803	3.7	2,970
Dental	1,000	3.3	3,298
Total	11,571	2.9	32,998

Table J-8-2

Medical Program for the Eumseong Hospital: Medical & Other Function

C. Medical Performances

Kind of Performances	(1980)		
	No. of Performances Per Year		
	Inpatients	Outpatients	Total
Emergency Cases			1,650
Laboratory Diagnostics			
- chemical	980	1,504	2,484
- hematological	2,166	7,167	9,333
- serological	534	2,300	2,834
- bacteriological	815	2,294	3,109
- stool exam.	543	1,200	1,743
- urinalysis	1,345	2,062	3,407
- total	6,383	16,527	22,910
Blood Preserves			800
Plain X-ray	3,290	5,669	8,959
Mass X-ray	-	2,200	2,200
Fluoroscopies	-	-	108
Operations			
- general surgical	229	508	737
- OB & GYN	60	290	350
- dental	15	264	279
- total	304	1,062	1,366
Deliveries	182		182
Physical Check-up		1,500	1,500

D. Further Functions

Function	Quantities Per Year
Ambulance	300
Student training	
- community health services	60 medical students

Table J-9

Estimated Number of Inpatient Cases (Eumseong)

Medical Department		1980	1981	1985	1990
Internal Medicine	Total	613	673	863	1,049
	Insurance	184	269	432	734
	Non-Insurance	429	404	431	315
General Surgery	Total	382	421	505	561
	Insurance	115	168	253	393
	Non-Insurance	267	253	252	168
Pediatrics	Total	199	219	252	268
	Insurance	60	88	126	188
	Non-Insurance	139	131	126	80
OB & GYN	Total	260	286	379	439
	Insurance	78	114	190	307
	Non-Insurance	182	172	189	132
Uro-Dermatology	Total	46	50	63	74
	Insurance	14	20	32	52
	Non-Insurance	32	30	31	22
Dental	Total	30	34	42	49
	Insurance	9	14	21	34
	Non-Insurance	21	20	21	15
Total	Total	1,530	1,683	2,104	2,440
	Insurance	460	673	1,054	1,708
	Non-Insurance	1,070	1,010	1,050	732

Table J-10

Estimated Number of Outpatient Visits (Eumseong)

Medical Department		1980	1981	1985	1990
Internal Medicine	Total	13,200	13,727	15,990	18,989
	Insurance	3,960	5,491	8,795	15,191
	Non-Insurance	9,240	8,236	7,195	3,798
General Surgery	Total	5,280	5,491	5,850	6,782
	Insurance	1,584	2,196	3,218	5,426
	Non-Insurance	3,696	3,295	2,632	1,356
Pediatrics	Total	4,620	5,148	5,460	5,878
	Insurance	1,386	2,059	3,003	4,702
	Non-Insurance	3,234	3,089	2,457	1,176
OB & GYN	Total	3,630	3,432	4,290	4,973
	Insurance	1,089	1,373	2,360	3,978
	Non-Insurance	2,541	2,059	1,930	995
Uro-Dermatology	Total	2,970	3,089	3,120	3,165
	Insurance	891	1,236	1,716	2,532
	Non-Insurance	2,079	1,853	1,404	633
Dental	Total	3,298	3,431	4,290	5,425
	Insurance	989	1,372	2,360	4,340
	Non-Insurance	2,309	2,059	1,930	1,085
Total	Total	32,998	34,318	39,000	45,212
	Insurance	8,899	13,727	21,452	36,169
	Non-Insurance	23,099	20,591	17,548	9,043

6. INVESTMENT AND FINANCING PLAN

(All the assumptions for financial studies of the Hospitals in industrial areas are the same as those mentioned in the study of the Ulsan Hospital. So refer to the feasibility study of the Ulsan Hospital for further information.)

6.1. Investment Cost

Table J-11-1. Eumseong Hospital (80 beds)
Investment Cost 1/

Category	Local Cost	Foreign Cost
Land estate	₩75,460,000	\$157,208
Site Preparation	13,000,000	27,083
Construction	1,126,000,000	2,345,833
Medical and Non-medical Equipment	387,764,000	807,842
Outside Equipment	53,000,000	110,417
Contingencies	56,300,000	117,292
Engineering fees	45,000,000	93,750
Dormitory	28,150,000	58,646
Working capital	40,909,000	85,227
Total	₩1,825,583,000	\$3,803,298

1/ See Appendix A 4-1.

6.2. Financing Plan

Table J-11-2. Eumseong Hospital (80 beds)
Sources of Financing

Category	Local Currency	Foreign Currency
Total Investment	₩1,825,583,000	\$3,803,298
Foreign loan	383,766,000	799,513
Local loan	800,000,000	1,666,667
Eumseong Hospital Capital	641,817,000	1,337,118
Total financing	₩1,825,583,000	\$3,803,298

6.3. Pro-forma Balance Sheet (the year before operation starts)

Table J-11-3.

Eumseong Hospital (80 beds) Balance Sheet (Beginning of operation)

Unit: ₩1,000
1\$ = 480 won

Assets		Liabilities	
Cash	80,642,000	Bank credit	0
Auxiliary goods	7,437,000	Account payable	0
Pharmaceuticals	9,130,000	Draft	0
& medical articles		Loans local	800,000,000
Equipment	387,764,000	foreign	383,766,000
Building	1,265,150,000	Reserve for contingency	0
Land	75,460,000	Capital	641,817
Total	1,825,583,000	Total	1,825,583,000
(\$000)	(3,803)	(\$000)	(3,803)

7. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the study of the Ulsan Hospital)

- 7.1. Estimation of Revenues (See Table J-12-1)
- 7.2. Estimation of Expenses (See Table J-12-2)
- 7.3. Proforma Income Statement (See Table J-12-3)
- 7.4. Proforma Balance Sheet (See Table J-12-4)

8. ESTIMATION OF CASH FLOW (See Table J-13-1)

9. CONCLUSION FROM FINANCIAL ANALYSIS

- 9.1 The Hospital will suffer losses for 7 years, after that it will have profit. Because of heavy loan payments each year from third year of operation, the cash position will be in trouble unless the sponsor will subsidy large sum of fund for working capital.
- 9.2 But in the long run, (after 10 years) it will be in good position to have profit enough to payback the local and foreign loan and maintain enough cash.

Table J-12-1.

Eumseong Hospital (80 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st - 10th year)

Unit: ₩1,000
1\$ = ₩480

Year	1	2	3	4	5	6	7	8	9	10
Inpatient Insurance Private	83,053	126,351	156,410	186,469	246,587	246,587	304,885	363,183	421,481	479,782
	233,198	226,775	233,828	240,881	247,934	254,987	241,963	228,940	215,917	202,894
Outpatient Insurance Private	35,850	52,441	63,791	75,141	86,491	97,842	121,775	145,708	169,640	193,573
	97,015	89,154	87,644	86,134	84,624	83,116	74,421	65,726	57,031	48,336
Inpatient Total	316,251	353,126	390,238	427,350	464,462	501,574	546,848	592,123	637,398	682,676
Outpatient Total	132,865	141,595	151,435	161,275	171,105	180,958	196,196	211,434	226,671	241,909
Insurance Total	118,903	178,792	220,201	261,610	303,019	344,429	426,650	508,891	591,121	673,355
Private Total	330,213	315,929	321,472	327,015	332,558	338,103	316,384	294,666	272,948	251,230
Grand Total (\$000)	439,116 (915)	494,721 (1,031)	541,673 (1,128)	588,625 (1,226)	635,577 (1,324)	682,532 (1,422)	743,044 (1,548)	803,557 (1,674)	864,069 (1,800)	924,585 (1,926)

Table J-12-2.

Eumseong Hospital (80 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st - 10th year)

Unit: 1,000 won
1\$ = ₩480

Year	1	2	3	4	5	6	7	8	9	10
Personnel	292,110	300,873	309,899	319,196	328,772	338,635	348,794	359,258	370,036	381,137
Physician	120,016	123,616	127,324	131,144	135,079	139,131	143,305	147,604	152,032	156,593
Nurses	84,309	86,838	89,443	92,126	94,890	97,737	100,669	103,689	106,800	110,004
Medical Assistant & others	10,485	10,799	11,123	11,457	11,800	12,154	12,519	12,895	13,282	13,680
Administration Others	16,795 60,505	17,298 62,320	17,817 64,189	18,352 66,115	18,902 68,098	19,470 70,141	20,054 72,246	20,655 74,413	21,275 76,645	21,913 78,945
Pharm. & X-ray	109,559	123,432	135,147	146,861	158,576	170,291	185,389	200,487	215,585	230,683
Food & Clothes	27,505	30,231	32,106	33,981	35,856	37,733	39,230	40,727	42,224	43,721
Maintenance	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854
Bldg.	3,163	3,163	3,163	3,163	3,163	3,163	3,163	3,163	3,163	3,163
Equip.	9,694	9,694	9,694	9,694	9,694	9,694	9,694	9,694	9,694	9,694
Utility & Heatings	22,281	23,829	25,265	26,702	28,139	30,087	31,618	33,149	34,681	36,212
Others	26,598	28,445	30,160	31,876	33,591	35,916	37,744	39,572	41,400	43,228
Total (\$000)	490,907 (1,023)	519,664 (1,083)	545,431 (1,136)	571,470 (1,191)	597,788 (1,245)	625,516 (1,303)	655,629 (1,366)	686,047 (1,429)	716,780 (1,493)	747,835 (1,558)

Table J-12-3.

Eumseong Hospital (80 beds)
ECONOMIC FORECASTING : PROFORMA INCOME STATEMENTS
(1st - 10th year)

Year	1	2	3	4	5	6	7	8	9	10
Total Revenue	439,116	494,721	541,673	588,625	635,577	682,532	743,044	803,557	864,069	924,585
Total Expenses	490,907	519,664	545,431	571,470	597,788	625,516	655,629	686,047	716,782	747,835
Operating Income	*51,791	*24,943	*3,758	17,155	37,789	57,016	87,415	117,510	147,289	176,750
Interest	63,675	63,675	63,675	63,675	57,203	50,275	42,867	34,939	26,459	17,387
Depreciation	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079
Net Income (\$000)	*179,545 (*374)	*152,697 (*318)	*131,512 (*274)	*110,599 (*230)	*83,493 (*174)	*57,338 (*119)	*19,531 (*41)	18,492 (39)	56,751 (118)	95,284 (198)

* : deficit

Table J-12-4.

Eumseong Hospital (80 beds)
ECONOMIC FORECASTING : PRO FORMA BALANCE SHEETS
(1st - 10th year)

Year	1	2	3	4	5	6	7	8	9	10
	Unit: ₩1,000 1\$ = 480 won									
Current Assets	97,209	97,209	97,209	97,209	97,209	97,209	97,209	97,209	97,209	97,209
Equipment	387,764	387,764	387,764	387,764	387,764	387,764	387,764	387,764	387,764	387,764
Depreciation	38,776	77,552	116,328	155,104	193,880	232,656	271,432	310,208	348,984	387,760
Building	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150
Depreciation	25,303	50,606	75,909	101,212	126,515	151,818	177,121	202,424	227,727	253,030
Land	75,460	75,460	75,460	75,460	75,460	75,460	75,460	75,460	75,460	75,460
Total	1,761,504	1,697,425	1,633,346	1,569,267	1,505,188	1,441,109	1,377,030	1,312,951	1,248,872	1,205,428
Current Liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	800,000	800,000	800,000	707,560	608,648	502,808	389,560	268,384	138,728	0
Foreign loan	383,766	383,766	383,766	383,766	383,766	383,766	383,766	383,766	383,766	383,766
Capital	757,283	845,901	913,334	1,052,294	1,170,620	1,269,719	1,338,419	1,377,024	1,385,850	1,385,850
Retain Earnings	0	*179,545	*332,242	*463,754	*574,353	*657,846	*715,184	*734,715	*716,223	*659,472
Net Profit	*179,545	*152,697	*131,512	*110,599	*83,493	*57,338	*19,531	18,492	56,751	95,284
Total	1,761,504	1,697,425	1,633,346	1,569,267	1,505,188	1,441,109	1,377,030	1,312,951	1,248,872	1,205,428
(\$000)	(3,670)	(3,536)	(3,403)	(3,269)	(3,136)	(3,002)	(2,869)	(2,735)	(2,602)	(2,511)

* L deficit

Table J-13-1.

Eumseong Hospital (80 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

Year	Unit: 1,000 won 1\$ = 480 won									
	1	2	3	4	5	6	7	8	9	10
1. Expenses										
1.1 Personnel	292,110	300,873	309,899	319,196	328,772	338,635	348,794	359,258	370,036	381,137
1.2 Other expenses	185,943	205,937	222,678	239,420	256,162	274,027	293,981	313,935	323,890	353,844
1.3 Maintenance	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854
1.4 Interest	63,675	63,675	63,675	63,675	57,203	50,275	42,867	34,939	26,459	17,387
1.5 Operating expenses	554,582	583,339	609,106	635,145	654,991	675,791	698,496	720,986	743,239	765,222
1.6 Depreciation	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079
1.7 Operating cost	618,661	647,418	673,185	699,224	719,070	739,870	762,575	785,065	807,318	829,301
2. Revenues										
2.1 Outpatient	132,865	141,595	151,435	161,275	171,105	180,958	196,196	211,434	226,671	241,909
2.2 Inpatient	316,251	353,126	390,238	427,350	464,462	501,574	546,848	592,123	637,398	682,676
2.3 Other										
2.4 Whole	439,116	494,721	541,673	588,625	635,577	682,532	743,044	803,557	864,069	924,585
3. Profit calculation										
3.1 Net profit	*179,545	*152,697	*131,512	*110,599	*83,493	*57,338	*19,531	18,492	56,751	95,284
3.2 Accumulation	*179,545	*332,242	*463,754	*574,353	*657,846	*715,184	*734,715	*716,223	*659,472	*564,188
3.3 Tax										
4. Cash Flow Calculation										
4.1 Gross cash flow	*115,466	*88,618	*67,433	*46,520	*19,414	6,741	44,548	82,571	120,830	159,363
4.2 Payoff/discharge	0	0	0	92,440	98,912	105,840	113,248	121,176	129,656	138,728
4.3 Invested capital	115,466	88,618	67,433	138,960	118,326	99,099	68,700	38,605	8,826	0
4.4 Net cash flow	0	0	0	0	0	0	0	0	0	0
4.5 Accumulation of 4.4	0	0	0	0	0	0	0	0	0	20,635
(\$000)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	20,635
										(43)
* : deficit										

Appendix Table A 4-1

		<u>Amount</u>
No. 1: Land estate cost		
1.1. Value: <u>quantity (Won/M²)</u>		<u>Whole Amount</u>
	9,800 m ² (7,700 won/m ²)	₩75,460,000
1.2. Acquisition cost		₩75,460,000
Total Sum of No. 1		
No. 2: Site preparation cost		
2.1. Public opening		₩2,000,000
2.2. Non-public opening		₩11,000,000
2.3. Other cost (i.e. taxes)		
Total Sum of No. 2		₩13,000,000
No. 3: Construction cost		
3.1. Building (due to room and space program plus traffic ways)		₩748,000,000
3.2. Installations (Sewage, Water, Heating, Electricity ...)		₩166,000,000
3.3. Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators ...)		₩212,000,000
Total Sum of 3.1 - 3.3		₩1,126,000,000

and:

a) Classification to space-content:

3.1 - 3.3 :	$\frac{m^3}{m^3}$	$\frac{Whole\ Amount}{Outside\ Equipment}$
	50,000	
Sum of 3.1 - 3.3		1,120,000,000

b) Classification to space

3.1 - 3.3 :	$\frac{m^2}{m^2}$	$\frac{Whole\ Amount}{Whole\ Amount}$
	5,600	
Sum of 3.1 - 3.3		1,120,000

c) Classification to beds

3.1 - 3.3	$\frac{No.\ of\ beds}{No./Bed}$	$\frac{Whole\ Amount}{Whole\ Amount}$
	80	
Sum of 3.1 - 3.3		1,120,000

No. 4:	Equipment	
4.1.	Medical Equipment	
4.2.	Non-medical Equipment	
	Total Sum of 4.1 + 4.2	
No. 5:	Outside Equipment	<u>W53,000,000</u>
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	<u>W56,300,000</u>
No. 7:	Engineering Fee	<u>W28,150,000</u>
No. 8:	Dormitory	<u>W28,150,000</u>

V. ANALYSIS FOR PLANNED SITES AND HOSPITALS IN INDUSTRIAL COMPLEX AREAS

K. Ulsan

L. Daejeon

M. Cheongju

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K. ULSAN

K. ULSAN HOSPITAL

1. Geographical Features

1.1 Ulsan is the nation's largest industrial complex area except for Seoul and Busan. Ulsan has the nation's major industrial centers with two thermal power plants, a nuclear power plant, a transformer station, the Ulsan Petrochemical Complex, the Hyundai Shipyard and the Hyundai Automobile Plant.

Ulsan will become one of the nation's regional power industrial centers by turning out 80% of the total power production in the southeastern part of Korea when the Kori Nuclear Power Plant and the Ulsan Thermal Power Plant are expanded and the projected Wolseong Nuclear Power Plant is constructed.

1.2 There is the Onsan Industrial Estate in Onsan Myon, Ulju Gun, located within a 10-minute travel distance by car from downtown of Ulsan. Due to the short distance and comparatively small scale of the nonferrous metal industrial estate, most of the employees at the Onsan Estate are residing in Ulsan City. For that reason, the plan to construct a hospital in the Onsan Estate by Korea University was scrapped.

1.3 In contrast with the rapid development of the heavy and chemical industry in Ulsan, the medical services and other social service sectors have been neglected and lagged far behind the industrial sector. Most of serious victims and patients suffering from industrial accidents must be transferred to Busan for medical care.^{1/}

Ulsan area manufactures about 10% of the nation's total annual export goods. However, most of the medical facilities in Ulsan are small-scale with out-of-date equipment and are not organized in a cooperative and coordinated manner.

1.4 The projected Ulsan Hospital should provide the secondary medical care for the patients referred from private practitioners and other medical facilities in addition to the provision of general medical examination and treatment. The hospital also should conduct periodic medical check-ups for those who are insured under the Medical Insurance Program and treat patients suffering from industrial accidents.

In order to provide such medical services, a feasibility study for the construction of a hospital to be run by the Korea Electric Company was conducted in 1977, but the project was scrapped.

1.5 The Hyundai Shipyard and the Hyundai Automobile Plant are located in Bangeojin area of Ulsan City. About 60%-70% of the population totaling 100,000

^{1/} The Report on the Feasibility Study on the Ulsan Hospital of the Korea Electric Company by the Korea Development Institute, p.33, December 1977.

are employees in the shipyard and motor plant and their dependents.

The Hyundai companies manage medical insurance and industrial accident insurance systems for their employees and their dependents. The Hyundai Shipyard has a hospital with 135 beds and the Hyundai Automobile Plant has a clinic. The Hyundai Hospital provides medical services not only for the employees in the shipyard and their dependents numbering about 60,000 but also for the needy people residing around the shipyard area. Therefore, this feasibility study has excluded the Bangeojin area from the catchment of the proposed Hospital.

1.6 Therefore, it will be reasonable to cover the following areas for medical services to be provided by the Ulsan Hospital: Ulsan City (excluding Bangeojin area), Ulju Gun, Jangan Myon and Seuseng Myon of Yangsan Gun, Yangnam Myon and Uaedong Myon of Wolseong Gun (Figure K-1).

2. Population of Ulsan City and the Onsan Industrial Estate ^{1/}

2.1 In terms of provision of medical services, the residents in the Onsan Industrial Estate should be considered as the people receiving medical services from the medical facilities in Ulsan City.

2.2 The population in Ulsan City increased sharply from 91,641 in 1963 to 269,635 in 1976. The sharp increase was due to the influx of manpower into Ulsan City prompted by the construction of the Ulsan Oil Refinery and other industrial plants in the area. As shown in Figure K-2 and Figure K-3, the increase in manpower of the manufacturing industry has a close relationship with the increase in total population in Ulsan City. The Table K-1 shows that the number of employees in large plants which employ more than 200 persons greatly increased in contrast with the occasional decreased number of employees in small-sized factories.

2.3 As for the age structure of the population, the economically active 15-44 age bracket has increased sharply since 1963. The population under the age of 14 also increased, whereas the people above the age of 45 decreased.

2.4 The population in Ulsan City could be estimated by the following two methods. The first will be based on the assumption that the population increase rate registered during the relatively stable 1974-1976 period will continue until 1985. The second will be by the estimation of the increase rate of employees in the large manufacturing plants and then a mathematical formula can be used, which is relating the number of employees with that of total population.

2.5 As there is no available data for the accurate estimation of the employment increase of the manufacturing industrial plants, it will be reasonable to estimate the ceiling of the employment increase of the industrial plants by taking

^{1/} Two members of this study team engaged in the feasibility study of the project for the construction of a hospital to be run by Korea Electric Company. Therefore, the population projection will be made based on the data used in 1977 when the project feasibility survey was conducted.

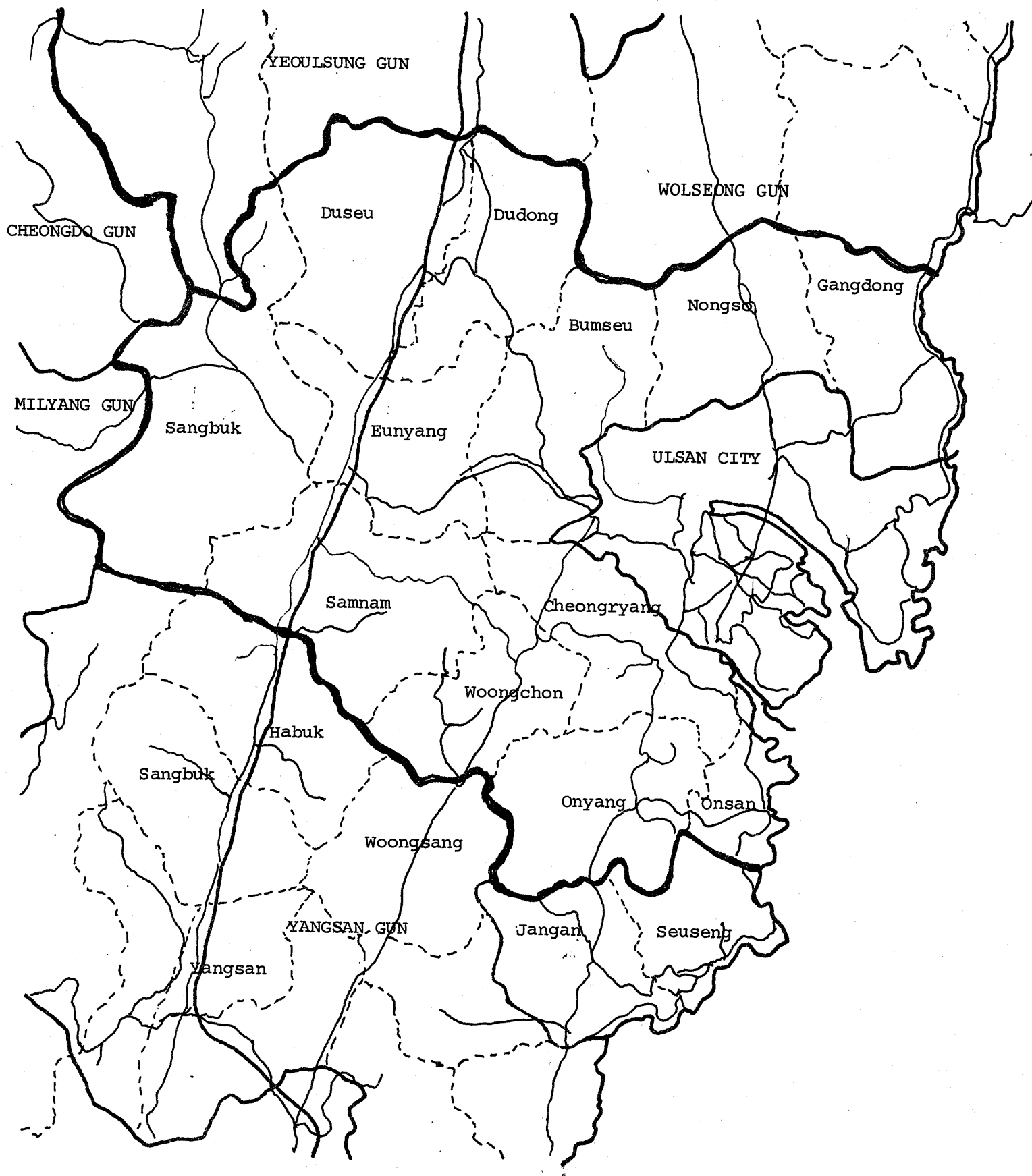


Figure K-1. The Ulsan Map

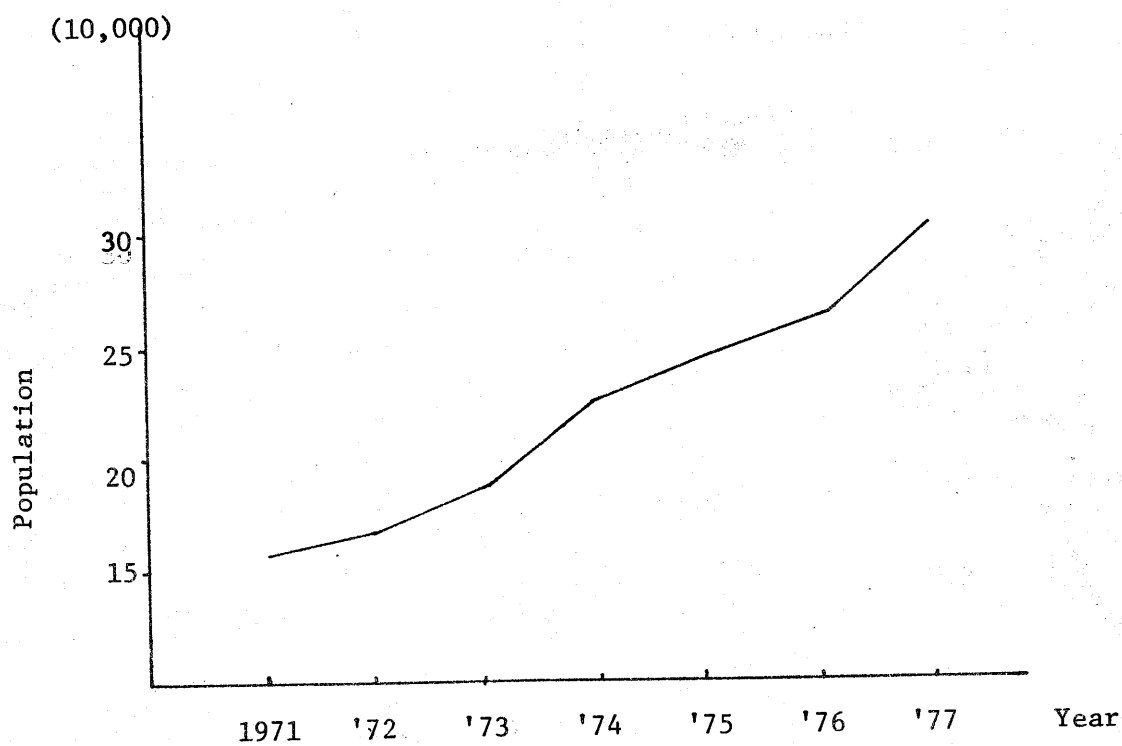


Figure K-2. Trend of Population Increase in Ulsan City

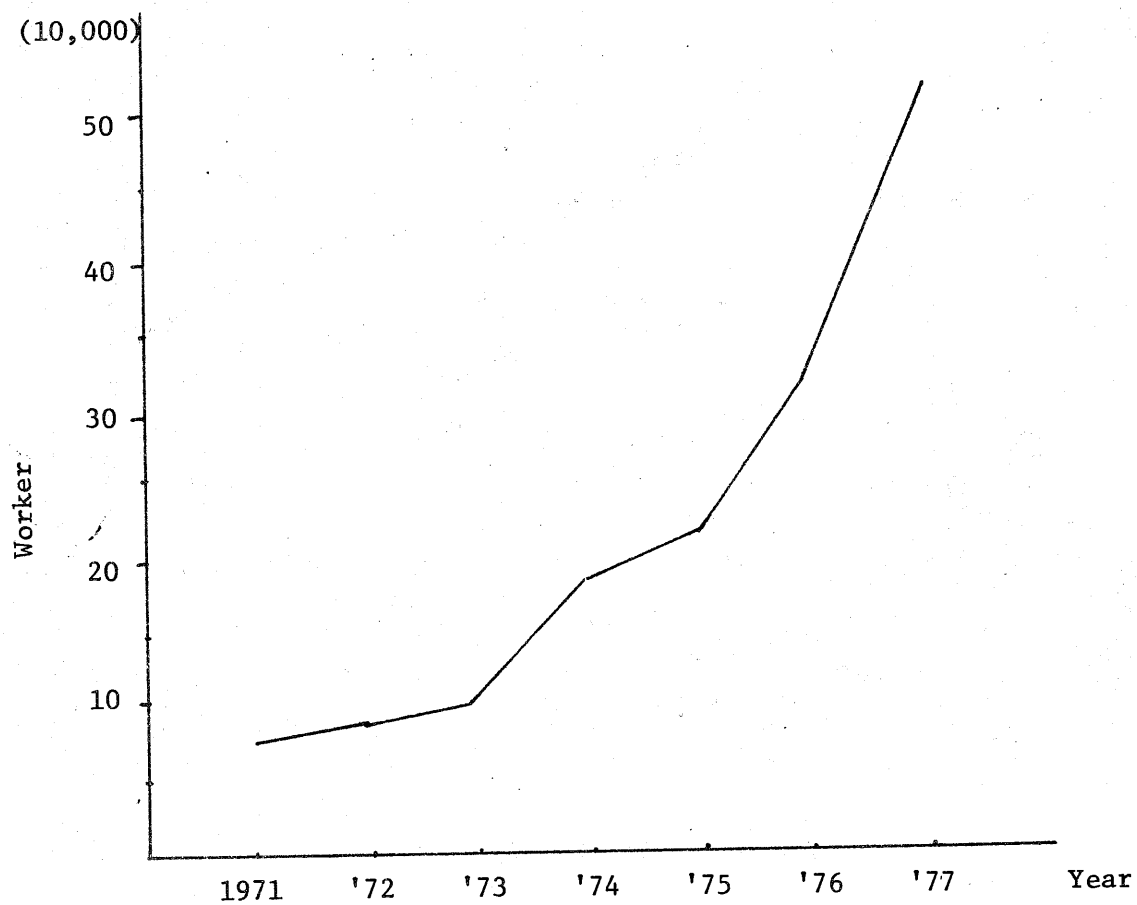


Figure K-3. Number of Workers at Manufacturing Establishment with 200 and above

Table K-1. Population Trend in Ulsan City

(Unit : Person)			
Year	Population	No. of Workers at the Establishment with 200 and Above	No. of Workers at the Establishment with 200 and Less
1971	159,676	8,584	1,329
1972	162,346	9,121	1,730
1973	186,907	10,541	1,718
1974	233,916	18,196	2,691
1975	252,639	22,613	2,270
1976	269,635	32,328	2,387
1977	304,496	52,059	4,317
Annual Increase			
Rate $\frac{1}{t}$ (1971-1977)	11.4%	35.0%	21.7%
Annual Increase			
Rate $\frac{1}{t}$ (1974-1977)	9.2%	42.0%	17.1%

$\frac{1}{t}$ Using the formula $r = (P_t/P)^{1/t} - 1$

Source: The Statistical Year Book of Ulsan, 1977, 1978.

into consideration of the size of area earmarked for the plant construction and the magnitude of the plants under operation (Table K-3),

2.6 The total population estimated on the above method is as shown in Table K-4. The Projection I and II, which are based on different numerical values of employees, represent the increasing trend of the population in Ulsan City affected by the employment increase of the manufacturing plants. From 1982 onward when the employment of the manufacturing plants will reach its peak, the population in Ulsan City, based on assumptions I + II, will increase by an annual average of 4%, which is slightly lower than the nationwide average city population increase rate in Korea. Projection III is based on the assumption that the population of Ulsan City will grow until 1985 by the same population increase rate with an annual average of 7.4% registered during the stable 1974-1976 period. Projection I shows the most population, and Projection II the least by the year 1985. Therefore, this study used Projection III to avoid overestimation of the requirement of hospital beds.

Table K-2 Trend of Population Composition in Ulsan (Unit: %)

Year	Age				Total
	0 - 14	15 - 44	45 - 59	60+	
1963	41.2	42.1	10.7	6.1	100.0
1965	39.3	44.0	10.3	6.4	100.0
1968	38.3	46.9	9.2	5.5	100.0
1971	38.4	48.4	8.3	4.9	100.0
1972	38.8	48.6	8.3	4.3	100.0
1974	36.1	52.9	7.1	4.0	100.0
1976	36.6	52.5	7.0	3.9	100.0
No. of population in 1976	(98.698)	(141.567)	(18.774)	(10.596)	(269.635)

Source: The Statistical Year Book of Ulsan City 1977

Table K-3. Estimated Number of Workers at the Manufacturing Establishment
With 200 Persons and Above in Ulsan

Year	(Unit : Person)	
	1) Projection I	2) Projection II
1978	53,253	51,758
1979	70,665	66,481
1980	93,770 3)	71,188
1981	93,770	85,911
1982	93,770	90,618 3)
1983	93,770	90,618
1984	93,770	90,618
1985	93,770	90,618
1990	93,770	90,618

1) Projection I was based on the previous data of 1971-1976.

The exponential growth showed the following curve:

$$\ln W = 8.9025 + 0.2829 t$$

$$R^2 = 0.95$$

where,

W : Number of workers at the industrial
establishment with 200 persons and
above

t : Target year - 1971

2) Projection II was made on the basis of the increase rate between 1975 and 1977.

3) Both Projection I and II assumed that the upper limit of employees of large manufacturing companies would be about 90,000 in the Ulsan Industrial Complex.

Source: Feasibility Study on the Construction of Ulsan Hospital of Korea Electric Company, K.D.I., 1977, 12, pp. 39-40.

Table K-4. Population Projection in Ulsan City

Year	(Unit : Person)		
	1) Projection I	1) Projection II	2) Projection III
1978	347,100	343,103	311,483
1979	389,392	379,853	334,436
1980	436,835	390,564	359,080
1981	454,308	421,569	385,540
1982	472,483	430,805	413,949
1983	491,380	448,037	444,453
1984	511,035	465,959	477,204
1985	531,475	484,597	512,368
1990	646,623	589,586	731,096
1991	672,489	613,170	784,969

- 1) Projection I & II were based on the formula,
 $\ln P = 8.3346 + 0.4064 \ln W$ ($R^2 = 0.97$), which indicates
the total population of Ulsan is a logarithmic function of the
number of employees at the manufacturing establishments with
200 persons and above.

After 1980, in Projection I and 1982 in Projection II, when the
number of employees at the large establishments reached 90,000,

$P_t = P_o (1 + 0.04)^n$ was used.

where P_t : Population in year t

P_o : Population at the year when W reaches 90,000

n : Year t minus the year when W reaches 90,000

- 2) Projection III was made by applying the population increase between
1974 and 1976, the formula was

$\ln P = 12.3647 + 0.0711 t$

($R^2 = 0.998$)

where P : The population of target year

t : Target year - 1974

Source: Ibid, pp. 45-46.

2.7 The total Ulsan City population minus the residents in Bangeojin area will be the Ulsan catchment population of the Ulsan Hospital. The population increase rate in Bangeojin area is expected to be lower than that of Ulsan City because the former area has limited land for plant expansion. With a view of avoiding an overestimation of the hospital bed complements the total population of Ulsan City is estimated to increase by 1985 at an annual average rate of 7.4% which was registered during 1974-1976, and at an annual average rate of 4% from 1986 onward. The population increase is as shown in Table K-5.

Table K-5. No. of Population in Ulsan City Excluding Those Residing in Bangeojin

(Unit Person)			
Year	Ulsan Population (1)	Bangeojin Population <u>1/</u> (2)	Target Population (1) - (2)
1978	343,103	81,082	262,021
1979	379,853	87,082	292,771
1980	390,564	93,527	297,037
1981	421,569	100,448	321,121
1982	430,805	107,881	322,924
1983	448,037	115,864	332,173
1984	465,959	124,438	341,521
1985	484,597	133,646	350,951
1990	589,586	162,601	426,985
1991	613,170	169,105	444,065

1/ Those residing in the Yeompo-dong, Bangeo-dong, Ilsan-dong, Jeonha-dong, Nammok-dong and Jujeon-dong were included.

Source: Ibid., p.48.

2.8 The increase in employees, their dependents and other in-migrants, which is estimated based on the plant construction program of the Onsan Industrial Estate, is as shown in Table K-6.

2.9 The target population in urban area for the proposed Hospital will comprise the population of Ulsan City plus the residents in the Onsan Industrial Estate (Table K-7).

3. Estimates of the Rural Target Population for the Ulsan Hospital

Table K-6. Population Estimates of the Onsan Industrial Complex

(Unit : Person)			
Year	Workers	Dependents	Total
1978	1,100	2,000	3,300
1979	2,050	5,000	7,050
1980	3,000	8,000	11,000
1981	4,000	11,500	15,500
1982	5,000	15,000	20,000
1983	7,000	21,000	28,000
1984	9,000	27,000	36,000
1985	10,000	35,000	45,000
1990 <u>1/</u>	12,167	42,582	54,749
1991 <u>1/</u>	12,653	44,286	56,939

1/ After 1985, the number of population was extrapolated by annual increase rate of 4 percent.

Source: Data from the Onsan Industrial Complex in Uljoo Gun. Ibid., p.49.

Table K-7. Estimates of Urban Population within the Ulsan Hospital Service Area

(Unit : Person)			
Year	Ulsan Population <u>1/</u> (1)	Onsan Population (2)	Total (1) + (2)
1978	262,021	3,300	265,321
1979	292,771	7,050	299,821
1980	297,037	11,000	308,037
1981	321,121	15,500	336,621
1982	322,924	20,000	342,924
1983	332,173	28,000	360,173
1984	341,521	36,000	377,521
1985	350,951	45,000	395,951
1990	426,985	54,749	481,734
1991	444,065	56,939	501,004

1/ Bangeojin Population was excluded.

Source: Table K-5 and K-6.

3.1 As stated above, the Ulsan Hospital will cover the whole area of Ulju Gun, Jangan Myon and Seuseng Myon of Yangsan Gun, Yangnam Myon and Uaedong Myon of Wolseong Gun, in addition to Ulsan City. The total population in the rural areas decreased slightly during the past decade as shown in Table K-8. Even if the construction of the projected Kori No. 2 Nuclear Power Generator and the Wolseong Nuclear Power Plant are taken into consideration, the fluctuation in the population trend in the Guns concerned will be negligible. It will be so particularly because only two Myons each of Yangsan Gun and Wolseong Gun are covered within the catchment area of the Ulsan Hospital.

Table K-8. Population Trend of Rural Area Adjacent to Ulsan

Year	Ulju Gun	Yangsan Gun	Wolseong Gun	Total
1966	120,637	113,503	205,964	440,104
1970	113,494	116,279	184,438	414,211
1976	115,846	127,432	179,392	422,310
1977	117,385	131,161		

Source: The Statistical Year Book of Ulju, Yangsan, and Wolseong Gun, 1967, 1971, 1977.

3.2 The total target population of the Ulsan Hospital is as shown in Table K-9. The population will be 500,000 in 1981, 570,000 in 1985 and 670,000 in 1991.

Table K-9. Projection of Target Population within the Ulsan Hospital Service Area

Year	Urban Population	Rural Population	Total
1978	265,321	170,820	436,141
1979	299,821	170,820	470,641
1980	308,037	170,820	478,857
1981	336,621	170,820	507,441
1982	342,924	170,820	513,744
1983	360,173	170,820	530,993
1984	377,521	170,820	548,341
1985	395,951	170,820	566,771
1990	481,734	170,820	652,554
1991	501,004	170,820	671,824

Source: Ibid., p.51.

4. Characteristics of the Target Population

4.1 Characteristics related to medical services of the target population are as follows:

4.1.1 The annual average income of the target population will be higher than the national average. The average annual income taxes and local taxes paid by them almost double the national average of the tax payment. The number of the needy people on the list of welfare program accounts for only 2% of the total target population, which contrasts sharply with the national average of 6%.

4.1.2 There will be a great number of people who are insured under the Medical Insurance Program, therefore the utilization rate of hospital services will be greater than other areas.

4.1.3 There will be a great number of patients suffering from industrial accidents and pollution requiring the treatment of orthopedic neurosurgeon, dermatologist, and ophthalmologists. Also, there will be a great demand for obstetricians and pediatricians due to a great number of dependents of the young workers.

5. Estimates of Hospital Bed Requirement

5.1 In General the Utilization rate of the urban citizen is much higher than the rural people. In 1977, a feasibility study conducted for the Korea Electric Company divided the medical service areas into urban and rural ones. However since the introduction of the Medical Insurance Plan and Medicaid, the use of medical facilities has increased rapidly. Even though it is reasonable to distinguish between those who use the above insurance systems, at that time there was no data to determine what those utilization rates were, locally much less nationally.

5.2 Taking into consideration the above factors, this study has classified the populace two categories, into (1) those who are covered by a health insurance program and Medicaid and (2) those who are not covered by such programs rather than dividing them by area. As shown in Tables K-10 & K-11, the people who are insured under the Medical Insurance Program accounted for about 30% of the total population of Ulsan City.

5.3 In 1979, the number of civil servants, teachers at private schools, members of the employees health insurance and the Medicaid beneficiaries totaled 65,160 (Table K-12). From 1980 onward, the number of the insured under the Health Insurance Program will be enlarged in line with the expansion of the Onsan Industrial Estate add to the above total figure (Table K-12).

5.4 The number of hospitals and medical facilities in the catchment area is as shown in Table K-13. There are 3 hospitals with 135 beds, 54 doctors offices with 135 beds, with a combined total of 270 beds. It can be assumed in the future that the number of patients hospitalized in doctors' offices will decrease. This will be more likely when the Ulsan Hospital of 250 beds established.

Table K-10. Employees in Manufacturing Plants by Number of Workers and Major Product, 1977.

No. of Employees	No. of Establishment	No. of Employees
5-49	43	1,465
50-99	13	860
100-149	6	772
150-200	7	1,220
more than 200	33	52,059
Total	102	56,476
Textile Industry	6	5,733
Machinery Industry	30	38,827
Chemical Industry	40	8,295
Miscellaneous	26	3,621

Source: Statistical Year Book of Ulsan City, 1978, p. 138.

Table K-11. Health Insurance Associations within the Ulsan Hospital Service Area

Name of Company	Place	Subscriber	Dependents	Total
Ulsan Iron Complex	Ulsan	5,644	11,576	17,220
Korea Chemical	Ulsan	613	1,021	1,634
Donghae Shipbuilding	Ulsan	628	1,041	1,669
Samseong Electronic	Ulju	2,317	1,458	3,775
Korea Manure	Ulsan	820	2,497	3,317
Mipo Shipbuilding	Ulsan	1,932	2,898	4,830
Hyundai Heavy Industry	Ulsan	26,913	42,192	69,105
Hyundai Car Industry	Ulsan	3,039	4,254	7,293
Total	-	41,906	66,937	108,843 ^{1/}

^{1/} If the Hyundai Ulsan Hospital Service Population is excluded, then, the above total decreases to 27,615 (10,022 subscribers and 17,593 dependents).

Source: Ministry of Health and Social Affairs, The Roster of Health Insurance Association, 1979.

Table K-12. Number of the Insured and Medical Beneficiaries within the Ulsan Hospital Service Area

Area	Health Insurance (1)				Medicaid Beneficiaries (2)						Total (1)+ (2)
	Public Officials		Private School Teacher		Industrial Workers		Indigent Group				
	A	B	A	B	A	B	A'	B'	A'	B'	
Ulsan	1,967	5,901	1,724	5,172	7,705	16,135	493	359	1,098	3,919	44,478
Ulju	855	2,565	718	2,154	2,317	1,458	876	1,264	859	2,698	15,764
Woelsung	106	318	194	582	-	-	223	286	356	1,076	3,141
Yangsan	126	378	148	444	-	-	107	5	157	412	1,777
Total	3,054	9,162	2,784	8,352	10,002	17,593	1,704	1,914	2,470	8,105	65,160

A: Subscriber
B: Dependents

A': Head of Household
B': Dependents

Source: Statistical Year Book of Ulsan City and, Ulju, Woelsung and Yangsan Gun, 1976-1978.

Table K-13. Number of Existing Beds within the Ulsan Hospital Service Area

Area	General Hospital			Hospital			Clinic			Total	
	No. of Facilities	No. of Beds	No. of Beds	No. of Facilities	No. of Beds	No. of Beds	No. of Facilities	No. of Beds	No. of Facilities	No. of Beds	No. of Beds
Ulsan	-	-	-	3	135	135	42	126	45	261	261
Ulju	-	-	-	-	-	-	6	6	6	6	6
Woelsung	-	-	-	-	-	-	3	3	3	3	3
Yangsan	-	-	-	-	-	-	3	-	3	-	-
Total	-	-	-	3	135	135	54	135	57	270	270

5.5 In calculation of the hospital beds requirement, this study used the formula of $N + 3/\sqrt{N}$ (N is the average daily number of hospitalized persons). Based on the above formula, the shortage of hospital beds is estimated as follows (Table K-14). To avoid the overestimation of the hospital-bed complements, the estimation was made on both the minimum and maximum level. In 1980 when the Ulsan Hospital is completed, there will be an additional requirement of 163 hospital beds (low estimate, 133 beds; high estimate, 192 beds), 213 beds in 1981 (low estimate, 182 beds; high estimate, 244 beds), 234 beds in 1982 (low estimate, 200 beds; high estimate, 267 beds), and thereafter 250 beds at the minimum. The estimation does not take into consideration the possible construction of a new hospital and expansion of the existing medical facilities during the years. Therefore, it will not be necessary for the Ulsan Hospital to have all the required number of hospital beds. However, it will be desirable that the Ulsan Hospital will have 250 beds by because of the following reasons. Firstly, as this study used the data of medical care utilization rate in the initial period of the Health Insurance Program, the real utilization rate of medical services will be greater than the estimate made by this study. Secondly, the Ulsan Hospital will have a target population of over 500,000 in the industrial city. Thus, the Hospital is expected to have sufficient modern equipment to handle those patients involved in serious industrial accidents. Thirdly, in case that the Ulsan Hospital is too small to satisfy the requirements of medical services in the industrial city, another hospital should be constructed. In such a case, the construction of a large Ulsan Hospital will be more economical than the construction of two small hospitals.

5.6 The government plan calls for the construction of a 100-bed hospital each in Ulsan City and Onsan area. The plan is unrealistic in view of the following reasons.

- 1) It will be unreasonable to build a 100-bed hospital in Onsan in view of the fact that the Onsan Industrial Complex has a relatively small number of employees.
- 2) As most of the employees in the Onsan Industrial Estate are residing in Ulsan City, they will utilize the medical facilities in Ulsan City.
- 3) As it takes only 10 minutes to 15 minutes by car from Ulsan City to Onsan Industrial Estate, the construction of two hospitals, as envisioned in the government plan, will bring about an unnecessary competition between the two hospitals.

Therefore, it will be reasonable to construct a large hospital, say 200 beds in Ulsan City rather than the construction of 2 100-bed hospitals in the Ulsan and Onsan areas.

5.7 It will be desirable to construct a 200-bed Ulsan hospital in Ulsan City, which will be designed to expand to have 250 beds or more.

6. Medical Specialty and Allocation of Beds for Departments

6.1 In the determination of the scope of medical treatment and the technical standard, the following two factors should be taken into consideration.

1) The Ulsan Hospital should be able to satisfy the medical services required to meet large industrial accidents arising in the industrial city.

2) The Ulsan Hospital should develop a full-fledged local medical referral system to provide effective medical treatment with high standard for patients sent by private physicians.

6.2 On the division of medical functions among the medical facilities, the existing medical delivery system in Ulsan area has been inefficient and in-harmonious and lacking in a patient referral system. The general medical practitioners and small hospitals in Ulsan are unable to meet the demand for secondary and tertiary medical care. Therefore, the Ulsan Hospital should assume those medical functions to develop an efficient local medical referral system.

6.4 The Ulsan Hospital will have the following 4 functional departments. 1) Internal Medicine (including the general internal medicine, dermatology, pediatrics, and neuro-psychiatry), 2) Surgery (including general surgery, orthopedic, neuro-surgery, urology, ophthalmology, and otolaryngology), 3) Obstetrics and Gynecology (including labor and newborn baby rooms), and Others (including anaesthesiology, radiology, community health service and clinical pathology). Therefore, the hospital will have a total of 15 departments, consisting of 12 clinical and 3 supporting departments.

6.5 It is customary to allocate the beds based on the number of inpatient days. However, it is desirable to allow flexibility in the mutual utilization of the departmental beds as the number of inpatients fluctuate on a wide range. In case that the Ulsan Hospital has a total of 250 beds, the quota will be 47 beds for general internal medicine, 20 beds for pediatrics, 16 beds for neuro-psychiatry, 9 beds for dermatology, 40 beds for general surgery, 40 beds for orthopedic, 31 beds for neuro-surgery, 12 beds for otolaryngology, 8 beds for urology, and 7 beds for ophthalmology, and 20 beds for the Obstetrics & Gynecology (Table K-15).

Table K-14. Bed Requirements in the Ulsan Hospital Service Area

Bed Requirements in the Ulsan Hospital Service Area																		
Year	The Insured & Medicaid Beneficiaries		Hospitalization Rate/Person/Year		ALS	General Population Excluding the Insured & Medicaid		ALS	Industrial Accident Compensation Insurees		Incidence Rate of Accidents	Admission Rate	No. of Existing Beds		Occupancy Rate (%)		Bed Requirements	
	I	II	I	II		I	II		Hosp. Clinic	Rate (%)			Hosp. Clinic	Rate (%)	I	II		
1979	65,160	0.0349	0.0349	9	405,481	0.0195	0.0239	10	13,091	0.0442	0.055	30	135	270	60	40	114	170
1980	68,160	0.0366	0.0373	9	410,697	0.0202	0.0247	10	14,041	0.0442	0.055	30	135	270	60	40	133	192
1981	72,660	0.0385	0.0399	9	434,781	0.0209	0.0254	10	15,041	0.0442	0.055	30	135	270	70	30	182	244
1982	77,160	0.0404	0.0427	9	436,584	0.0215	0.0262	10	16,041	0.0442	0.055	30	135	270	70	30	200	267
1983	85,160	0.0424	0.0457	9	445,833	0.0222	0.0269	10	17,041	0.0442	0.055	30	135	270	70	30	229	300
1984	93,160	0.0445	0.0489	9	455,181	0.0229	0.0277	10	18,041	0.0442	0.055	30	135	270	75	20	282	359
1985	102,160	0.0468	0.0523	9	464,611	0.0236	0.0284	10	19,041	0.0442	0.055	30	135	270	75	20	316	397
1986	111,909	0.0491	0.0560	9	540,645	0.0242	0.0292	10	21,208	0.0442	0.055	30	135	270	80	20	391	491
1991	114,099	0.0427	0.0785	9	557,725	0.0277	0.0334	10	21,694	0.0442	0.055	30	135	270	80	20	505	647

Table K-15-1. Medical Program of the Ulsan Hospital

1: INPATIENTS

Medical disciplines/ specialties	No. of cases per year	Average length of stay(days)	Occupancy rate of beds(%)	Distribution of beds (number)
Internal medicine				
- general	1,481	9	77	47
- infections				
- intensive care				
General surgery	802	14	77	40
- intensive care				
Orthopedic surgery	617	18	77	40
Neuro-surgery	432	20	77	31
Pediatrics	802	7	77	20
- neonatology				
- babies				
- children				
OB & GYN	988	6	77	20
- obstetrics				
- gynaecology				
ENT	278	12	77	12
Ophtalmology	154	12	77	7
Urology	185	12	77	8
Neuro-psychiatry	309	15	77	16
Dermatology	124	20	77	9
TOTAL OR AVERAGE	6,172	11.4	77	250

Table K-15-2. Medical Program of the Ulsan Hospital, 1981

2: OUTPATIENTS

Medical disciplines	No. of cases	Visits/Case	No. of visits per year
Internal medicine	10,562	2.6	27,462
General surgery	3,814	2.4	9,154
Orthopedics	2,180	2.8	6,103
Neuro surg.	1,483	2.4	3,560
Pediatrics	5,085	3.5	17,799
OB & GYN	5,250	3.1	16,274
ENT	953	3.2	3,051
Ophtalmology	1,424	2.5	3,560
Urology	687	3.7	2,543
Neuro psychiatry	1,233	3.3	4,068
TOTAL	32,671	3.0	97,642

Table K-15-3. Medical Program of the Ulsan Hospital, 1981

3: MEDICAL PERFORMANCES

Kind of performances	No. of performances per year		Total
	Inpatients	Outpatients	
Emergency cases		7,811	7,811
ECG			1,373
Endoscopies			104
Laboratory diagnostics			
- chemical	15,000	21,774	36,774
- hematological	17,985	35,151	53,136
- serological	6,500	12,302	18,802
- bacteriological	3,200	4,883	8,083
- stool exam.	2,000	2,441	4,441
- urinalysis	24,000	30,000	54,000
- total	68,685	106,551	175,236
Blood preserves			5,000
Plain X-ray	8,573	11,000	19,573
Mass X-ray	-	10,000	10,000
Fluoroscopies	741	-	741
Total	9,314	21,000	30,314
Operations			
- general surgery	525	586	1,111
- orthop. surgery	309	195	504
- neuro surgery	108	59	167
- OB & GYN	309	528	837
- ENT	154	98	252
- ophthalmology	54	117	171
- urology	69	59	128
- total	1,528	1,642	3,170
Deliveries	679		679
Physiotherapy			6,000
Preventive performances		6,000	6,000
Physical check-up			

(Continued)

4: FURTHER FUNCTIONS

Function	Quantities per year	
Ambulance - transportations	15,00	
Medical training - by kind	Intern	6 persons
	Resident	8 persons
Medical Record Room	+	
Central Supply Room	+	
Garage, etc.	+	

Table K-15-4. Number of Inpatient Cases by Medical Specialty and Insurance Coverage

Med. Specialty		1980	1981	1985	1990
Internal Medicine	Total	670	711	896	1,069
	Insurance	168	213	538	962
	Non-insurance	502	498	358	107
General Surgery	Total	279	296	291	347
	Insurance	84	89	175	312
	Non-insurance	195	207	116	35
Orthopedics	Total	186	197	218	260
	Insurance	89	59	131	234
	Non-insurance	97	138	87	26
Pediatrics	Total	205	217	266	318
	Insurance	45	65	160	286
	Non-insurance	160	152	106	32
OB & GYN	Total	354	375	484	578
	Insurance	89	113	290	520
	Non-insurance	265	262	194	58
ENT	Total	149	158	194	231
	Insurance	28	47	116	208
	Non-insurance	121	111	78	23
Dental	Total	19	20	73	87
	Insurance	4	6	44	78
	Non-insurance	15	14	29	9
TOTAL	TOTAL	1,862	1,974	2,422	2,890
	INSURANCE	507	592	1,454	2,600
	NON-INSURANCE	1,355	1,382	968	290

Table K-15-5. Number of Outpatient Visits by Medical Specialty and Insurance Coverage

<u>Med. Specialty</u>		<u>1980</u>	<u>1981</u>	<u>1985</u>	<u>1990</u>
Internal Medicine	Total	14,742	15,479	18,571	20,502
	Insurance	4,275	5,263	10,214	18,452
	Non-insurance	10,467	10,216	8,357	2,050
General Surgery	Total	3,024	3,175	3,714	3,588
	Insurance	998	1,080	2,043	3,229
	Non-insurance	2,026	2,095	1,671	359
Orthopedics	Total	2,646	2,778	2,786	3,075
	Insurance	873	945	1,532	2,768
	Non-insurance	1,773	1,833	1,254	307
Pediatrics	Total	5,292	5,557	5,571	6,151
	Insurance	2,487	1,889	3,064	5,536
	Non-insurance	2,805	3,668	2,507	615
OB & GYN	Total	3,780	3,969	5,571	6,663
	Insurance	1,134	1,349	3,064	5,997
	Non-insurance	2,646	2,620	2,507	666
ENT	Total	3,402	3,572	3,714	4,100
	Insurance	1,497	1,214	2,043	3,690
	Non-insurance	1,905	2,358	1,671	410
Dental	Total	4,914	5,160	6,500	7,176
	Insurance	2,015	1,754	3,575	6,458
	Non-insurance	2,899	3,406	2,925	718
TOTAL	TOTAL	37,800	39,690	46,427	51,255
	INSURANCE	13,279	13,494	25,535	46,130
	NON-INSURANCE	24,521	26,196	20,892	5,125

7. INVESTMENT AND FINANCING PLAN

7.1 The total investment cost required for the Ulsan Hospital is \$11,236,514 (₩5,393,527,000) as shown in Table K-16-1

Table K-16-1 Ulsan Hospital (250 beds)
Investment Cost 1/

Category	Local cost(₩)	Foreign Cost(\$)
Land estate	₩154,710,000	\$322,313
Site preparation	33,000,000	68,750
Construction	3,089,000,000	6,435,417
Dormitory	107,408,000	223,917
Medical equipment	1,002,870,000	2,089,312
Outside equipment	120,000,000	250,000
Contingencies	629,892,000	1,312,275
Engineering fees	123,560,000	257,417
Working capital	133,087,000	277,265
Total investment	5,393,527,000	\$11,236,514

1/ See Appendix A 4-1

7.2 The sources of financing the investment cost of \$11,236,514 to build a new hospital with 250 beds are as follows:

Table K-16-2 Ulsan Hospital (250 beds)
Sources of Finance

Sources	Local currency	Foreign currency
Total Investment	₩5,393,527,000	\$11,236,514
Foreign loan	1,002,870,000	2,089,312
Local loan	2,500,000,000	5,208,333
Capital 1/	1,890,657,000	3,938,869
Total Financing	₩5,393,527,000	\$11,236,514

1/ The fund should be supplied by the sponsor of the Hospital.

7.2.1 Of the total amount needed, \$2,089,312 (₩1,002,870,000) will be provided by a West German loan. Its use is restricted to purchasing medical equipments.

7.2.2 Terms of the foreign loan is repayment of all principal and interest in 20 years after a ten-year grace period at an annual interest of 2%.

7.2.3 The local loan will be secured from a Korean commercial bank (or banks). This will be arranged by the Korean Government for the hospital. The use of the local loan is restricted to the building costs of the hospital. The maximum amount of the local loan is \$20,833 (₩10,000,000) per hospital bed. Therefore \$5,208,333 (₩2,500,000,000) can be borrowed locally by the Ulsan Hospital as it will have 250 beds.

7.2.4 The terms of the local loan for the projected Hospitals in industrial areas is repayment of all the principal and interest in seven years after a three-year grace period at an annual interest rate of 18.5%, out of which the borrower will be charged 9.5% and the Korean Government will be responsible for 9%. Therefore the net interest cost for sponsors is 9.5% for the hospitals in the industrial areas.

7.2.5 The sponsor of the Ulsan Hospital should provide \$3,938,869 (₩1,890,657,000) for land purchase, working capital and additional cost for construction.

7.3 The expected balance sheet of the Hospital in the year before the operation is shown in Table k-16-3

Table K-16-3

Ulsan Hospital (250 beds)
Balance Sheet (Beginning of Operation)

Unit: ₩1,000
1\$ = 480 Won

Assets			Liabilities		
Cash		685,171	Bank Credit		0
Auxiliary goods		27,300	Account Payable		0
Pharmaceuticals		50,508	Draft		0
and other materials					
Equipment		1,002,870	Loans local		2,500,000
Building		3,472,968	foreign		1,002,870
Land		154,710	Capital		1,890,657
Total	Local	5,393,527	Total	Local	5,373,527
	Foreign	(11,236)		Foreign	(11,236)
	(\$000)			(\$000)	

7.3.1. The fund to be supplied by the sponsor is an assumed equity fund, not liabilities from others.

7.3.2. Cost for building includes costs of site preparation, construction, dormitory, outside equipment and engineering fees.

8. ECONOMIC FORECASTING

8.1 For the estimation of total revenues in the future, medical care fees should be determined. To estimate medical charges in the future, two things must be classified; one is the present medical care fees and the other is the future increase in medical care fees.

8.1.1 To determine present medical care fees, a survey was conducted at several hospitals to determine medical care fees according to the disciplines. Because of limited data, the differences in medical charges between medical insurance subscribers and private patients can not be presented. Table K-17-1 is the result of the survey of 21 hospitals which had similar characteristics as those expected of the Ulsan Hospital.

Table K-17-1 Medical Care Fees in 1978
(over 200 beds hospitals)

Unit: Won
1\$ = ₩480

Classification	Outpatient Fee per Visit	Inpatient Fee per Day
Internal medicine	3,800	16,200
General surgery	3,800	24,000
Orthopedic surgery	3,400	12,300
Neuro- surgery	3,900	17,800
Pediatrics	2,300	11,600
OB & GYN	3,000	19,000
ENT	3,400	3,400
Ophthalmology	2,900	12,000
Jaw surgery	4,200	12,000
Neuro-psychiatry	3,300	11,000
Urology	3,200	13,800

8.1.2 The average fees in Table K-17-1 represent gross costs charged by hospitals; inclusive of pharmaceuticals, X-ray's, medical tests food and others.

8.1.3 Since there is a relatively large difference in the medical care fees charged by hospitals between insured patients and private patients, respective medical care fees should be estimated in order to calculate total future revenues. For this purpose, a survey was conducted to study the fees paid to hospitals by insured patients treated in the Guro area during 1978. The survey found that the average fees of insured patients are \$5.63 (₩2,700) for outpatients per visit, and \$27.1 (₩13,000) for inpatients per day (The classification by discipline was not available.).

8.1.4 The following equation is developed to derive the average costs for insured patient by department, utilizing Table K-17-1 and the survey result mentioned in 8.1.3

$$\text{Average medical fee} = X_i \times \frac{X_1}{X_2}$$

Where X_i = Average medical care fee in i th department shown in Table K-17-1

X_1 = Average medical care fee in 1978 for the insured (\$5.63 (₩2,700) per visit for outpatient and \$27.1 (₩13,000) per day for inpatient)

X_2 = Average medical fees in 1978 (calculated from Table K-17-1)

8.1.5 The medical care fees for private patients are estimated on the basis of a 1977 KPC Report, in which medical fees charged for private inpatients were 35% higher than fees charged for insured inpatients and about 23% higher in the case of outpatients. Also we considered the fact that average medical fees for insured patients have increased 20% in 1979, while fees for private patient have not undergone the similar increase. Considering these facts, we concluded that the average medical charge for private inpatients is 30% higher than fees for insured inpatients and 20% higher for outpatients in 1979.

8.1.6 Medical care fees in 1979 calculated according to 8.1.1-8.1.5. are shown in Table K-17-2

Table K-17-2 Medical Care Fee in 1979
(over 200 beds hospitals)

Classification	Unit: Won 1\$ = ₩480			
	Out-patient (per visit)		In-patient (per day)	
	Insurance	Private	Insurance	Private
Internal medicine	₩3,900	₩4,680	₩19,000	₩23,400
General surgery	3,900	4,680	28,000	36,400
Orthopedic surgery	3,500	4,200	14,500	18,850
Neuro-surgery	4,000	4,800	20,900	27,170
Pediatrics	2,400	2,880	13,600	17,680
OB & GYN	3,100	3,720	22,300	28,990
ENT	3,600	4,320	17,600	22,880
Ophthalmology	3,000	3,600	14,200	18,460
Urology and dermatology	3,300	3,960	16,200	21,060
Neuro-psychiatry	3,400	4,080	13,200	17,160
Jaw surgery	4,300	5,160	14,100	18,330

8.1.7 The future changes of the medical care fees for private patients and insured patients are predicted on the following three assumptions;

Table K-17-3

Ulsan Hospital (250 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
 (1st - 10th year)

		1\$ = 480 won Unit: ₩1,000								
Category	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Insurance	712,932	1,106,712	1,448,834	1,790,957	2,133,079	2,475,202	2,678,379	2,881,557	3,084,735	7,287,913
Private	1,290,949	1,100,143	1,047,966	995,798	943,671	891,523	752,538	613,552	474,566	335,579
Outpatient	350,111	370,128	383,524	396,721	410,318	423,715	473,654	523,593	573,532	623,471
Inpatient	1,653,770	1,976,697	2,113,276	2,389,854	2,666,332	2,943,010	2,957,563	2,971,516	2,985,769	3,000,021
Total	2,003,881	2,206,825	2,496,800	2,786,775	3,076,750	3,366,725	3,430,917	3,495,109	3,559,301	3,623,492
Local Foreign (\$000)	(4,175)	(4,598)	(5,202)	(5,806)	(6,410)	(7,214)	(7,148)	(7,281)	(7,415)	(7,549)

1) The fee difference between insured patients and private patients will be reduced gradually and eliminated eventually by the end of 1991 when the Korean Government expects medical insurance to cover 100% of the population.

2) Increase rate of the medical care charge for private patients will stabilize over time, while the medical care fees for the insured will increase to reach the same level of the fees for the private patients.

3) The real increase in medical care charges will be 6% annually for the hospitals of 200 beds or more and 3% for the hospitals which have less than 200 beds for next ten years because of quality increase.

8.2 Table K-17-3 shows total estimated revenue each year for 10 years, which is obtained by multiplying the expected medical care fees (based on 8.1.1 - 8.1.7) by the estimated number of patients per year which are presented in Appendix A-2. (See table K-15-1, K-15-2, K-15-3)

8.3 The total expenses include expenses for personnel, pharmaceutical and other materials, food and clothes, maintenance of building and equipment, heating and utilities, and administration. The expenses of each item are estimated for 10 years.

8.3.1 Because expenses for personnel are the main portion of total expenses, these have been broken down into expenses for physicians, nurses, technicians and administrative personnels.

8.3.2 Expenses for personnel in each category are calculated by multiplying estimated required manpower by average salary surveyed in 1979. For the next ten years a 6% increase in real salary for the hospitals with 200 beds or more, & 3% increase for the hospitals which have less than 200 beds is assumed per year.

8.3.3 Costs of pharmaceuticals and other materials, heating and utilities, and administrative cost have been estimated based on the survey conducted: the ratio of each expense to total expenses, and the ratio of each expense to total revenues of the hospitals which have similar characteristics as the planned Ulsan Hospital. Table K-17-4 shows the results of the survey. The ratio of each expense to the total revenues are used to estimate these expenses for the future, assuming that the ratios would be constant over time. Accordingly the cost of heating and utilities is 5.07% of the total revenues (without considering a quality increase) and administrative cost is 3.95% of total revenues without consideration of quality increase.

8.3.3.1 The oil price increases during 1979-1980 have not been considered because the survey was conducted before oil crisis.

8.3.4 29.80% of the total revenue considered as cost for pharmaceuticals and other materials.

8.3.5 The cost of food is estimated on the basis that the cost per meal is \$1.25 (₩600) and \$3.75 (₩1,800) per day.

Table K-17-4

Compositions of Expenses
(over 200 beds hospitals) 1/

Category (A)	A/Total Expenses	A/Total Revenue
Personnel expense	47.75%	42.54%
Utilities	3.41%	3.17%
Heating	2.03%	4.23%
Clothes, and food	4.45%	4.23%
Pharmaceuticals and others	32.04%	29.80%
Equipment and Building Maintenance	4.62%	4.30%
Operating expenses <u>2/</u>	4.25%	3.95%

1/ These statistics are obtained from a survey of 6 Hospitals; Choong-nam Medical School Hospital, Ehwa Medical School Hospital, Yeonse Hospital, Soonchunhyang Hospital, and St. Vinscent Hospital.

2/ Operating expenses include vehicles, administrative expenses, taxes (except income taxes) and others.

8.3.6 Maintenance cost for building is assumed to be 0.25% of the acquisition value and 2.5% for medical equipments a year.

8.4 Table K-17-5 presents the total expenses estimated according to 8.3.1-8.3.6.

8.5. By combining Table K-17-3 and Table K-17-5, and considering depreciations and interest changes, the pro-forma income statement is presented in Table K-17-6.

8.5.1 Expected duration of the building is 50 years according to the Korean tax law and average expected utilization life of medical equipment is assumed to be 10 years. Straight line method is used for the calculation of depreciation.

8.5.2 The interest charge has been mentioned in 7.2.2 and 7.2.4; the annual rate is 2% for the foreign loan and 9.5% for the local loan. But the actual repayment of principal of the local loan would start in the fourth year and in the 11th year for foreign loan.

8.6 Table K-17-7 is the pro-forma balance sheet of the Ulsan Hospital for ten years.

8.6.1 For the estimation of current assets, the principle that at least one twelfth of total expenses of the initial operation year should be kept as current assets has been adopted. All the profit, excluding loan repayment, will be invested into current assets (cash, pharmaceuticals, food and others).

8.6.2 The actual principal payment of the local loan (interest and principal) would start in the 4th year and in the 11th year for the foreign loan. The loan payments (principal plus interest) are assumed as being equal over time.

8.6.3 It is assumed that all current liability is to be cleared out at the end of each year.

9. ESTIMATIONS OF CASH FLOW

9.1 Considering (8.1) - (8.6), estimated cash flow is presented in Table K-18-1.

9.2 Costs of operating and maintenance (1.1 - 1.7 in Table K-18-1) are presented in Table K-17-5.

9.3 Revenues (2.1 - 2.4 in Table K-18-1) are presented in Table K-17-3.

9.4 Profit calculation is presented in Table K-17-6.

9.5 Cash flow calculation is based on the principle that the Hospital should have at least one twelfth of its operating expenses for the initial year of operation as current assets.

9.6 The payoff/discharge (4.3) includes only the repayment of the principal of the loan.

9.7 Gross cash flow is calculated by adding operating income (3.1) and depreciation (1.6) or by subtracting operating expenses (1.5) from whole revenue (2.4).

10. CONCLUSION FROM FINANCIAL ANALYSIS

10.1 From the first year of operation, the project is profitable. The operating income during first year of operation would be W9,268,000 and increase rapidly over time as shown 3.1 of Table K-18-1.

10.2 As shown in Table K-18-1, accumulated net cash flow (after repayment of loan) at the end of 10th year would be \$12,597,000.

10.3 The project is profitable enough to repay the loan from the local banks and the hospital is expected to have enough liquidity to payback the foreign loan after 10 year,

Table K-17-5

Ulsan Hospital (250 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
 (1st - 10th year)

1\$ = 480 won
 Unit: ₩1,000

Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Personnel	665,364	685,325	705,885	727,061	748,873	771,339	754,479	818,314	842,863	868,149
Physician	249,440	256,923	264,631	272,570	280,747	289,169	297,844	306,780	315,983	325,462
Nurse	204,126	210,250	216,557	223,054	229,745	236,638	243,737	251,049	258,581	266,338
Medical assistant	30,247	31,154	32,089	33,051	34,043	35,064	36,116	37,200	38,316	39,465
Mgt. & adm.	41,332	42,572	43,849	45,164	46,519	47,915	49,353	50,833	52,358	53,929
Technical	140,319	144,529	148,864	153,330	157,930	162,668	167,548	172,575	177,752	183,084
service and others										
Pharma. &	606,096	657,644	744,050	830,467	916,876	1,003,284	1,022,413	1,041,542	1,060,671	1,079,800
X-ray										
Food &	113,984	119,691	122,780	125,869	128,958	132,046	135,486	138,926	142,366	145,805
clothes.										
Heating &	100,114	105,463	109,180	112,898	116,615	120,332	124,423	128,515	132,607	136,698
utilities										
Maintenance	33,754	33,754	33,754	33,754	33,754	33,754	33,754	33,754	33,754	33,754
Bldg.	8,682	8,682	8,682	8,682	8,682	8,682	8,682	8,682	8,682	8,682
Equip.	25,072	25,072	25,072	25,072	25,072	25,072	25,072	25,072	25,072	25,072
Others*	77,998	82,166	85,062	87,958	90,854	93,750	96,937	100,125	103,313	106,501
Total Local	1,597,310	1,684,048	1,800,718	1,918,007	2,035,930	2,154,505	2,207,492	2,261,176	2,315,574	2,370,707
Foreign (\$000)	(3,328)	(3,508)	(3,751)	(3,996)	(4,242)	(4,489)	(4,599)	(4,711)	(4,824)	(4,939)

* Other expenses include expenses for vehicles, administration and taxes.

Table K-17-6.

Ulsan Hospital (250 beds)
ECONOMIC FORECASTING : PROFORMA INCOME STATEMENTS
(1st - 10th year)

Year	1	2	3	4	5	6	7	8	9	10
Total Revenue										
	2,033,881	2,206,825	2,496,800	2,786,775	3,076,750	3,366,725	3,430,917	3,495,109	3,559,301	3,623,492
Total Expense										
	1,597,310	1,684,048	1,800,718	1,918,007	2,035,930	2,154,505	2,207,492	2,261,176	2,315,574	2,370,707
Operating income										
	436,571	522,767	696,082	868,768	1,040,820	1,212,220	1,223,425	1,233,933	1,243,727	1,252,785
Depreciation										
	169,748	169,748	169,748	169,748	169,748	169,748	169,748	169,748	169,748	169,749
Interest										
	257,557	267,557	257,557	257,557	257,557	257,557	257,557	257,557	257,557	257,557
Net profit Local										
	9,268	95,464	268,779	444,465	639,017	838,167	880,592	923,880	970,174	1,019,482
Foreign (\$000)										
	(19)	(199)	(560)	(920)	(1,331)	(1,746)	(1,835)	(1,925)	(2,021)	(2,124)

1\$ = 480 won
Unit: ₩1,000

Table K-17-7

Ulsan Hospital (250 beds)
ECONOMIC FORECASTING : PROFORMA BALANCE SHEET
(1st - 10th year)

Year	1	2	3	4	5	6	7	8	9	10
Current Assets										
Equipment	941,993	1,207,203	1,645,728	1,989,439	2,505,202	3,192,365	3,891,453	4,600,329	5,318,999	6,046,727
Depr.	1,000,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870
Bldg.	100,287	200,574	300,861	401,148	501,435	601,722	702,009	802,296	902,583	1,002,870
Depr.	3,472,968	3,472,968	3,472,968	3,472,968	3,472,968	3,472,968	3,472,968	3,472,968	3,472,968	3,472,968
Land	69,459	138,918	208,307	277,863	347,295	416,754	486,213	555,672	625,131	694,590
Total	154,710	154,710	154,710	154,710	154,710	154,710	154,710	154,710	154,710	154,710
	5,402,795	5,498,259	5,767,038	5,941,003	6,287,020	6,804,437	7,340,729	7,872,909	8,361,833	8,977,815
Current Liabilities										
Local loan	0	0	0	0	0	0	0	0	0	0
Foreign loan	2,500,000	2,500,000	2,500,000	2,232,500	1,939,500	1,618,750	1,267,500	882,750	461,500	0
Capital	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870	1,002,870
Retained Earnings	1,890,657	1,890,657	1,890,657	1,890,657	1,890,657	1,890,657	1,890,657	1,890,657	1,890,657	1,890,657
Net profit	0	9,268	104,732	373,511	814,976	1,453,993	2,292,160	3,172,752	4,096,632	5,006,806
Total	9,268	95,464	268,779	441,465	639,017	838,167	880,592	923,880	970,174	1,019,482
Foreign	5,402,795	5,498,259	5,767,038	5,941,003	6,287,020	6,804,437	7,342,779	7,872,909	8,361,833	8,979,815
	(11,256)	(11,455)	(12,015)	(12,377)	(13,098)	(14,176)	(15,297)	(16,402)	(17,420)	(18,707)

1\$ = 480 won
Unit: ₩1,000

Table K-18

Ulsan Hospital (250 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

1\$ = 480 won
Unit: ₩1,000

Year	1	2	3	4	5	6	7	8	9	10
1. Operating and Maintenance										
1.1 Personnel	665,364	685,325	705,885	727,061	748,873	771,339	794,479	818,314	842,863	868,149
1.2 Other expenses	898,192	966,969	1,061,079	1,157,192	1,253,303	1,349,412	1,379,259	1,409,108	1,438,957	1,468,774
1.3 Maintenance	33,754	33,754	33,754	33,754	33,754	33,754	33,754	33,754	33,754	33,754
1.4 Interest	257,557	257,557	257,557	257,557	232,057	204,307	173,807	140,307	103,807	63,557
1.5 Operating expenses	1,854,867	1,941,115	2,058,275	2,175,564	2,267,887	2,338,812	2,380,579	2,365,483	2,419,381	2,433,264
1.6 Depreciation	169,746	169,746	169,746	169,746	169,746	169,746	169,746	169,746	169,746	169,746
1.7 Operating Cost	2,024,613	2,111,361	2,228,021	2,345,310	2,437,633	2,528,558	2,550,325	2,595,229	2,589,127	2,603,010
2. Revenue										
2.1 Outpatient	350,111	370,128	383,524	396,921	410,318	423,715	473,654	523,593	573,532	623,471
2.2 Inpatient	1,653,770	1,976,697	2,113,276	2,389,854	2,666,332	2,943,010	2,957,263	2,971,516	2,985,719	2,999,021
2.3 Other										
2.4 Whole revenue	2,033,881	2,206,825	2,496,800	2,786,775	3,076,650	3,366,725	3,430,917	3,495,109	3,559,301	3,622,492
3. Profit Calculation										
3.1 Operating incomes	9,268	95,464	268,779	441,465	639,017	838,167	880,592	923,880	970,174	1,019,482
3.2 Accumulation	9,268	104,732	373,511	814,976	1,453,993	2,292,160	3,172,752	4,096,632	5,066,806	6,086,288
3.3 Income tax										
4. Cash Flow Calculation										
4.1 Gross cash flow	179,014	265,210	438,525	611,211	808,763	1,007,913	1,050,338	1,093,626	1,139,920	1,189,228
4.2 Invested capital	0	0	0	0	0	0	0	0	0	0
4.3 Payoff/discharge	0	0	0	267,500	293,000	320,750	351,250	384,750	421,250	461,500
4.4 Net cash flow	179,014	265,210	438,525	343,711	515,763	687,163	699,088	708,876	718,670	727,728
4.5 Accumulation of 4.4 (\$000)	179,014	444,224	882,749	1,226,460	1,742,223	2,429,385	3,128,474	3,837,350	4,556,020	5,283,748
	(373)	(925)	(1,839)	(2,555)	(3,629)	(5,061)	(6,518)	(7,994)	(9,492)	(11,007)

Appendix Table A 4-1,

			Amount
No. 1: Land estate cost			
1.1.	Value: <u>quantity (Won/M²)</u>		<u>Whole Amount</u>
	14,459 (4,537 Won/M ²)		
1.2.	Acquisition cost		₩65,600,000
Total Sum of No. 1			₩65,600,000
No. 2: Site preparation cost			
2.1.	Public opening		₩2,000,000
2.2.	Non-public opening		₩12,700,000
2.3.	Other cost (i.e. taxes)		₩14,700,000
Total Sum of No. 2			
No.3: Construction cost			
3.1.	Building (due to room and space program plus traffic ways)		₩878,000,000
3.2.	Installations (Sewage, Water, Heating, Electricity ...)		₩191,000,000
3.3.	Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators ...)		₩252,000,000
Total Sum of 3.1 - 3.3			₩1,321,000,000

and:

a) Classification to space-content:

3.1 - 3.3 :	$\frac{m^3}{m^3}$	$\frac{Won}{m^3}$
	25,000	50,000
Sum of 3.1 - 3.3		

Whole Amount	Outside Equipment
₩1,250,000	₩71,000,000

b) Classification to space

3.1 - 3.3 :	$\frac{m^2}{m^2}$	$\frac{Won}{m^2}$
	6,250	200,000
Sum of 3.1 - 3.3		

Whole Amount
₩1,250,000,000

₩71,000,000

c) Classification to beds

3.1 - 3.3	$\frac{No. \text{ of beds}}{No. \text{ of beds}}$	$\frac{Won}{Bed}$
	100	12,500,000
Sum of 3.1 - 3.3		

Whole Amount
₩1,250,000,000

₩71,000,000

No. 4:	Equipment	
4.1.	Medical Equipment	\$812,839
4.2.	Non-medical Equipment	\$57,469
	Total Sum of 4.1 + 4.2	\$870,308
No. 5:	Outside Equipment	₩71,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	₩268,375,000
No. 7:	Engineering Fee	₩52,840,000
No. 8:	Dormitory	₩74,528,000

L. DAEJEON

L. DAEJEON HOSPITAL

1. Geographical Features

1.1. Daejeon City is situated about the midportion of the Republic of Korea, 167.3 Km to the south of Seoul and 238.2 Km of Busan City. As the provincial seat of Choongnam Province, this City is not only the center of politics, economics and culture of this region but it is the cross-road of transportation for the southern provinces. Daejeon City is the junction of the Seoul-Busan Railroad and Seoul-Gwangju Railroad lines. The junction of this railroad is within 2 hours' reach of Seoul. In Daejeon, people can reach most of other major cities within several hours from a one day cosmopolitan area across the country.

1.2 The city of Daejeon which was in ruins during the Korean War has been reconstructed. Daejeon is a growing tourist city in view of the fact that it has in its vicinity scenic mountains, famous Buddhist temples and spas. They are Mt. Gyeryong, Mt. Sokri, and the spas of Onyang, Yuseong and Dogo. Daejeon City is now one of the 6 largest cities of Korea, with a population of about 600,000 and area of 87 Km², and consists of 2 administrative Gu and 45 Dongs.

1.3 At present, 2 industrial complexes exist in Daejeon; the first industrial complex has 38 factories which are in full operation within an area of 479,000 m² (145,218 Pyongs). Three other factories are under construction. Now, 4,101 employees are working at the complex site. In the vicinity of the existing complex, a second industrial complex is being planned within an area of 660,000 m² (about 200,000 Pyongs). The Government plans to induce 50 business enterprises to move in upon completing the construction. It is planned to employ about 7,000 workers in the second complex.

1.4 In the neighboring Daeduck Gun, the Science and Technology Research Institute Complex is being prepared by the Government, which will lead as the advanced base of Korea's science and technology in the future. Daeduck Gun, Geographically surrounding the city of Daejeon, belongs to the Daejeon cosmopolitan area. Therefore, when the complex is established, it is certain that an increase in social development the Daejeon population will follow. Meanwhile, the Government plans to develop the basin area of the Miho River as one of the most suitable places for the administrative capital of Korea in the future. 1/ When this plan is carried out, the development in the Daejeon area will be accelerated, and thereby the population in these areas will be greatly increase. The site for the future administrative capital has not been confirmed yet, however, the capital will be somewhere between

1/ The idea of the administrative capital was originated from both the population dispersion policy of Seoul and the defense purpose. The details of the plan are not yet known in public. Anyway, the plan is under review by cabinet members, and Daejeon area is one of the possibility.

north of Daejeon and south of Seoul. Thus, the expansion of the Daejeon area is almost certain.

1.5 The Daejeon Hospital, as stated above, should be carefully planned in due consideration of the favorable conditions of its location such as the expansion of industries, increase of the population, the possibility of moving the administrative capital and the core of nation-wide transportation networks.

2. The Catchment Area

2.1 The Daejeon Cosmopolitan area is very widely spread out for it is as convenient location for transportation in all directions. Geographically, Cheongwon Gun lies to the north of Daejeon, Gongju Gun to the northwest, Buyeo Gun to the west, Nonsan Gun to the southwest, Geumsan Gun to the south, and Okcheon Gun lies to the east of Daejeon. In other words the area has an easy access in most direction except for the northeast where traffic is intercepted by mountains. (Figure L-1).

2.2 In general, those rural areas which surround large cities have poor medical facilities. The surrounding areas of Daejeon City are not the exception. The Gun areas mentioned above do not have large medical facilities, and the residents have to make visits to Daejeon for medical care.

2.3 Referring to the above geographical conditions, the primary medical service area of the Daejeon Hospital will cover Daejeon City and Daeduck Gun. Besides these two areas, the adjoining areas will be included in the secondary medical service area. They are Yeongi Gun, Geumsan Gun, Goeun Gun, Okcheon Gun, and part of Gongju Gun and Nonsan Gun.

2.4 In the case of Nonsan Gun, Duma Myon and Bulgog Myon which are close to Daejeon they also can be included in the catchment area (These 2 Myons were previously excluded from the Nonsan Hospital catchment area).

2.5 Since the north of Boeun Gun adjoins Cheongwon Gun, the residents of the community can utilize those medical facilities in Choongju City. Hwabuk Myon, Hwanam Myon and Suhan Myon are considered to belong to the Daejeon cosmopolitan area. The transportation to Cheongju City from these Myons is very inconvenient because of mountains and hills in the area.

2.6 Okcheon Gun has an easy access to Daejeon City since the expressway bus runs between the two areas. In order to avoid an over-estimation of hospital beds, Cheongsan Myon and Cheongsung Myon are excluded from the catchment area. These 2 Myons are near Okcheon Eup and Youngdong Eup, and lies halfway between Daejeon City and Gimcheon City. Thereby, it is an area whose patients would be distributed to all directions.

2.7 Parts of Gongju Gun bordering Daeduck Gun as Banpo Myon, Gyeryong Myon, Janggi Myon, Eidang Myon and Gongju Eup are all included in the catchment area. The transportation between Daejeon City and Gongju Gun is very convenient with a newly paved road.

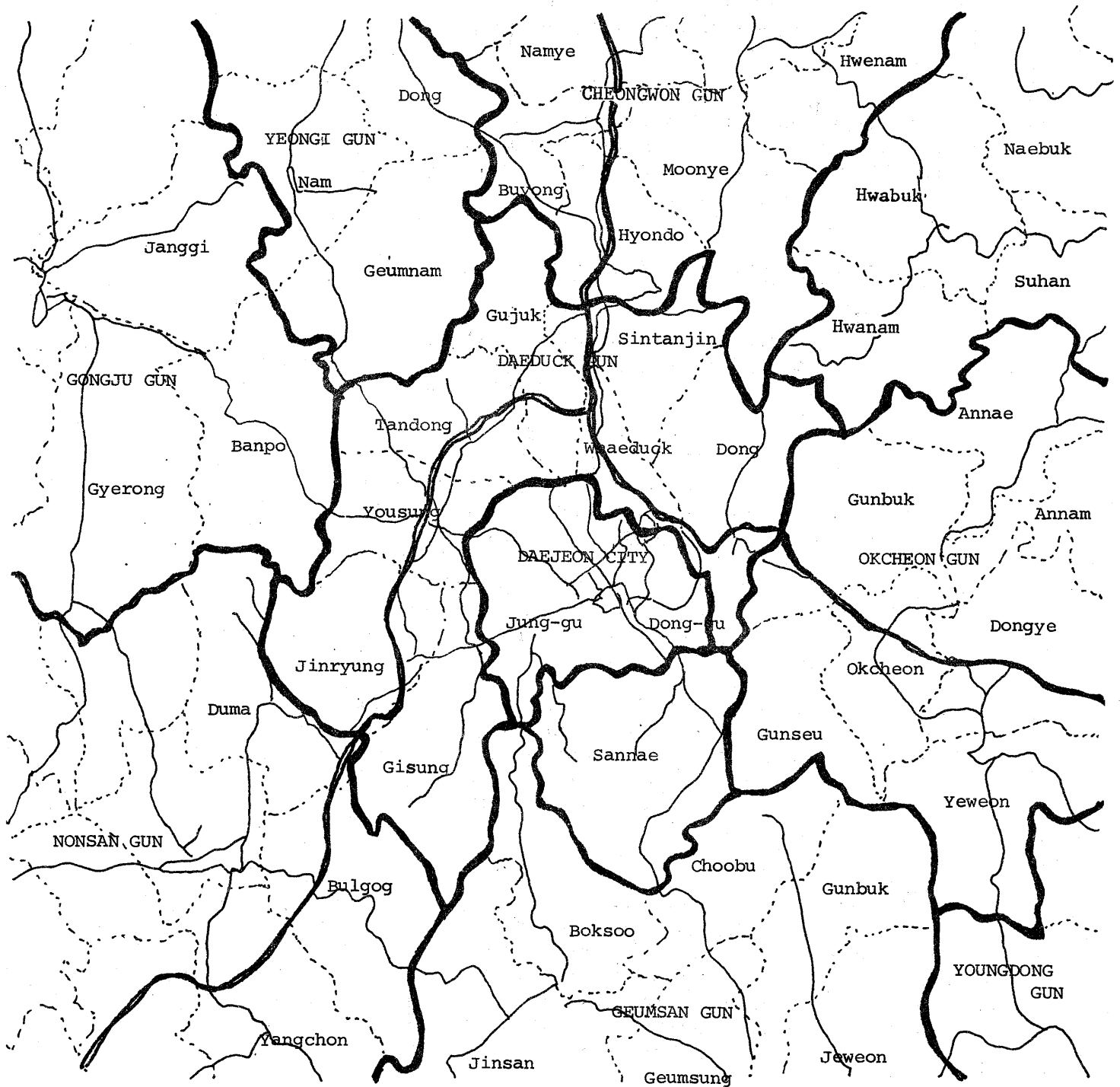


Figure L-1. The Daejeon Map

2.8 Geumsan Gun borders on Jung Ku of Daejeon City. This Gun belongs to Daejeon cosmopolitan area and is of 40-60 minutes away by bus. The Myons of Namil, Nami and Buri located south of Geumsan Eup are excluded from the catchment area to avoid an overestimation of the hospital beds. These 3 Myons adjoining Jinan Gun of Jeonbuk Province have the possibility of utilizing the medical resources in the city of Jeonju. There will be an increasing utilization of the road because of the paving between Jeonju and Jinan.

2.9 It is suggestable in Yeongi Gun that only those Myons of Geumnam, Nam and Dong adjacent to Daeduck Gun be included in the catchment area, because of the possibility of the development of Jochiwon Eup. Exclusion of most of Yeongi Gun from the catchment area is believed to be reasonable in a way to avoid over-estimation of beds.

3. Estimation of the Target Population

3.1 The trend of population in the catchment area since 1970, is the same as in Table L-1. The populations of Daejeon City and Daeduck Gun are increasing rapidly while those of Yeongi Gun and Gongju Gun are stagnant, while in the remaining area the population is gradually decreasing.

3.2 On the assumption that a logarithmic increase or decrease in population of the catchment area will be expected in future, the population projection is made in Table L-2. The present population in the catchment area exceeds 1,000,000 persons. The number will increase to 1,100,000 in 1981 when the Daejeon hospital is expected to be in full operation, and 1,200,000 in 1988. This estimation shows an annual increase of 15,000 persons. In the above estimation, the social factor of the population increase due to the moving of the administrative capital was not considered at all. Meantime, the efforts of avoiding the possible over-estimation by reducing the size of the catchment area should be pointed out.

3.3 If a linear increase in the population of Daejeon City and Daeduck Gun is assumed in the case of moving the administrative capital into the Daejeon area, the expected trend of the population then is as the Table L-3. In comparison with the previous logarithmical increase, the linear equation will project 5,300 more persons in 1980, 14,000 more in 1984, 20,000 more in 1986, and 39,000 persons more in 1991.

3.4 The workers in the Daejeon industrial complex are as in Table L-4. As of 1978, the total number of the workers is 7,100 and the employment plan of the complex is extremely flexible. In this study, the trend of population increases was estimated on the base that the trend of a larger work force for the past 4 years will undergo an increase in the forms of linear, logarithmical and exponential curves. As a result, the numbers were calculated as 23,170, 21,615 and 137,025 persons respectively in 1991. (See Table L-5) For this study, the linear equation was adopted.

4. Pattern of Diseases

4.1 According to the data from the Health Insurance Association of the Daejeon Industrial Complex, a total of 13,924 members are enrolled under the program, including 5,907 subscribers and 8,017 dependents, as of June 1979.

4.2 Latest statistics show that the leading cause of their morbid conditions was the diseases of respiratory tract, which accounted for 40% of the total sickness episodes. The next most prevalent disease was neurologic and sense organ disorder, 16.4%, and diseases of digestive system, 14.8%. Diseases of skin and various accidents occupied 8% and 5.2% of total episodes, respectively, which was remarkably higher than the national average (Table L-6).

4.3 In general, the disease pattern of the Daejeon Industrial Complex is similar to that the other industrial complexes.

5. Estimation of Hospital Bed Requirement

5.1 The number of the beneficiaries for industrial accident compensation insurance in the target area is equivalent to the added number of the entire industrial complex workers and that of the workers employed by general manufacturing establishments outside the industrial complex. The number of workers in the industrial complex was the same figure of Estimate I in Table L-5. The number of those workers outside the complex totalling 26, 188 persons in 1977, was assumed to remain the same during the projected year 1/.

5.2 The numbers of the health insurance subscribers and the Medicaid beneficiaries within the catchment area is shown as in Table L-7. They are 182,429 persons, including 126,132 insurance enrollees and 56,297 Medicaid recipients, which is equivalent to 17.2% of the total target population.

5.3 There exists 1 general hospital and 5 hospitals of medium size in the catchment area excluding the Gongju National Tuberculosis Hospital. Currently, a total of 547 beds are available for the residents (Table L-8). As for the private facilities, 182 physician-offices are serving with their bed capacities of 701. Therefore, the catchment area has 188 medical facilities and 1,248 beds (Table L-9).

5.4 Hospital bed requirements within the Daejeon Hospital catchment area was projected on the base of the patterned square root formula. Projection I applied the low estimated number of the insured in the catchment area and lower utilization rate of either no annual change or a 5% increase per year during the projected period (Table L-10). Projection II applied the high estimated number of the insured and higher utilization rates of 5% and 7% increase per year (Table L-11). The number of bed requirement is as follows:

1/ Source: Statistical Year Book of Daejeon City, 1978.

In the low projection (Table L-10), 140 beds in 1980 (low estimate 72, high estimate 207), 193 beds in 1981 (low estimate 121, high estimate 265), 230 beds in 1982 (low estimate 150, high estimate 310), 361 beds in 1985 (low estimate 262, high estimate 460), and 617 beds in 1991 (low estimate 455, high estimate 778). Meanwhile, in high projection (Table L-11), 151 beds in 1980 (low estimate 87, high estimate 215), 214 beds in 1981 (low estimate 148, high estimate 280), 258 beds in 1982 (low estimate 186, high estimate 329), 497 beds in 1985 (low estimate 482, high estimate 512), and 891 beds in 1991 (low estimate 841, high estimate 940).

5.5 The results shown above indicate that the bed shortage problem is rather serious in the Daejeon Hospital catchment area despite various endeavours to project moderately. Thus, the original plan to construct a 150-bed hospital in the Daejeon Industrial Complex can be justified in every way.

6. Medical Program

6.1 The number of patients for the Daejeon Hospital was calculated by extrapolating the data from the KHDI survey under the linear relationship. Table L-12-1 shows the numbers of inpatient cases and of outpatient visits in 1980, and Table L-12-2 shows various medical performances of a 150-bed hospital.

6.2 The numbers of inpatient cases and outpatient visits were projected over the 10 years with the assumption that the Government will cover at least 80% of the people under a health insurance program in 1991. The results are shown in Table L-13 and L-14.

Table L-1 Population Trend in Daejeon Hospital Service Area

Year	Daejeon	Daeduck	Geumsan	Yeongi	Nonsan <u>1/</u>	Boeun <u>2/</u>	Okcheon <u>3/</u>	Gongju <u>4/</u>
1970	414,598				20,184			
1971	436,630	121,286	122,580	101,403	19,043			87,876
1972	452,402	124,877	124,634	102,030	19,036	33,871	78,261	90,356
1973	462,834	127,273	124,588	105,687	19,090		78,815	88,406
1974	476,660	128,877	125,607	106,284	18,736	32,834	78,625	89,923
1975	506,703	132,912	122,709	105,271		31,640	78,933	90,617
1976	522,439	135,601	119,294	103,709	18,129	30,803	77,387	90,981
1977	553,326	140,690	116,675	103,945	17,658	29,869	76,684	90,866

1/ Only Duma and Bulgog myon are included.

2/ Only Hwabuk, Hwanam, and Suhan myon are included.

3/ Chungseong and Chungsan Myon are excluded from the 9 myons of Okcheon Gun.

4/ Five Myons, Namely, Gongju, Geryong, Banpo, Janggi, and Eidang are included.

Source: Statistical Year Book of Daejeon and Relevant Guns, 1971-1978

Table L-2. Estimates of Population within the Daejeon Hospital Service Area

Year	Gongju	Daejeon	Daeduck	Geumsan 1)	Yeongi 2)	Nonsan	Boeun	Okcheon	Total
1979	91,561	578,223	145,014	83,033	38,705	17,046	28,466	75,946	1,057,994
1980	91,854	595,541	147,845	80,881	38,395	16,718	27,702	75,429	1,074,365
1981	92,142	612,645	150,641	78,756	38,088	16,395	26,947	74,919	1,090,533
1982	92,428	629,539	153,403	76,657	37,786	16,076	26,201	74,414	1,106,504
1983	92,710	646,227	156,131	74,583	37,487	15,761	25,464	73,916	1,122,279
1984	92,988	662,716	158,826	72,535	37,192	15,449	24,736	73,424	1,137,866
1985	93,263	679,010	161,490	70,510	36,900	15,141	24,016	72,938	1,153,268
1986	93,535	695,113	164,122	68,509	36,611	14,837	23,305	72,457	1,168,489
1987	93,804	711,031	166,724	66,532	36,326	14,536	22,603	71,982	1,183,538
1988	94,070	726,766	169,296	64,577	36,045	14,239	21,908	71,512	1,198,413
1989	94,332	742,323	171,840	62,644	35,766	13,945	21,221	71,048	1,213,119
1990	94,592	757,707	174,354	60,732	35,491	13,654	20,542	70,589	1,227,661
1991	94,849	772,920	176,841	58,842	35,218	13,367	19,870	70,135	1,242,042

$$Y = a + b \log x$$

r^2 : 0.38 0.98 0.98 1.00 0.85 0.99 0.98 0.75
 a : -10,027.92 -5,437,690.27 -838,401.74 1,107,334.68 385,372.39 130,725.71 294,077.91 255,511.71
 b : 23,249.87 1,376,813.10 225,066.43 228,089.31 -64,886.37 -26,017.04 -60,788.36 -41,095.71

1/ : Buli, Namil, and Namyong Myon are excluded from the 10 Myons of Geumsan Gun.

2/ : Only Geumnam, Nam, and Dong Myon are included.

Table L-3 Estimates of Daejeon and Daeduck Population Assuming that the Population will Increase in Linear Pattern

Year	Daejeon	Daeduck	Difference <u>1/</u>
79	581,446	145,449	3,658
80	600,219	148,495	5,328
81	618,991	151,541	7,246
82	637,763	154,588	9,409
83	656,535	157,634	11,811
84	675,308	160,681	14,447
85	694,080	163,727	17,307
86	712,852	166,773	20,390
87	731,625	169,820	23,690
88	750,397	172,866	27,201
89	769,169	175,912	30,918
90	787,941	178,959	34,839
91	806,713	182,005	38,957

$$Y = a + b x \quad r^2 = 0.98 \quad 0.98$$

$$a : -901,562.25 \quad -95,216.50$$

$$b : 18,772.26 \quad 3,046.39$$

1/ This is equal to the difference in number of population between the two assumptions, logarithmic and linear growth.

Table L-4. Number of Employees in Daejeon Industrial Complex

Year	Number of Employees
1975	3,400
1976	3,800
1977	5,300
1978	7,100

Source: Ministry of Commerce and Industry, Employment Status in Industrial Complex, 1979.

Table L-5. Estimates of Employees in Daejeon Industrial Complex

Year	Projection I	Projection II	Projection III
1979	8,050	8,050	8,788
1980	9,310	9,216	11,220
1981	10,570	10,411	14,282
1982	11,830	11,592	18,125
1983	13,090	12,759	22,937
1984	14,350	13,912	28,945
1985	15,610	15,051	36,425
1986	16,870	16,176	45,716
1991	23,170	21,615	137,025

$$Y = a + bx$$

$$r^2 = 0.94$$

$$a: -91,490.00$$

$$b: 1260.00$$

$$Y = a + b \log x$$

$$0.94$$

$$-412,524.50$$

$$96,243.21$$

$$Y = ae^{bx}$$

$$0.96$$

$$0.00121$$

$$19.42$$

Table L-6

Number of Cases by Sex and Disease Classification for the members of the Daejeon Industrial Health Insurance Association

Disease classifica- tion	Jan. - Mar. 1979			Apr. - Jun. 1979			Jan. - Jun. 1979		
	Male		Total	Male		Total	Male		Total
	Female	%		Female	%		Female	%	
1	23	18	41	33	24	57	56	42	98
2	1	2	3	1	3	4	2	5	7
3	7	11	18	6	8	14	13	19	32
4	6	1	7	1	6	7	7	7	14
5	2	4	6	3	-	3	5	4	9
6	158	109	267	279	234	513	437	343	780
7	8	8	16	14	25	39	22	33	55
8	361	323	684	681	525	1,206	1,042	848	1,890
9	183	191	374	164	166	330	347	357	740
10	12	48	60	37	114	151	49	199	248
11	-	128	128	-	118	118	-	246	246
12	74	38	112	161	109	270	1,235	147	382
13	12	7	19	25	19	44	37	26	63
14	3	-	3	2	-	2	5	-	5
15	-	-	-	-	-	-	-	-	-
16	3	1	4	4	5	9	7	6	13
17	91	44	135	67	43	110	158	87	245
Total	944	933	1,877	1,478	1,399	2,877	2,422	2,332	4,754
			100.00			100.00			100.00

Source: Data from the Health Insurance Association of the Daejeon Industrial Complex, January-June, 1979

Table L-7

Number of the Insured and the Medicaid Beneficiaries within the Daejeon Hospital Service Area (1977)

Area	Health Insurance (1)				Medicaid Beneficiaries (2)						Total (1)* (2)
	Public Officials		Private School Teacher		Industrial Workers		Indigent Group		Low Income Group		
	A	B	A	B	A	B	A'	B'	A'	B'	
Daejeon	3,146	14,067	3,521	15,744	20,633	24,981	1,107	2,060	5,189	20,168	110,616
Daeduck	625	2,813	646	2,908	2,307	2,344	890	2,090	1,305	5,375	21,303
Gongju	375	1,125	794	2,382			566	952	788	2,911	9,893
Geumsan	635	2,985	720	3,385			587	704	407	1,423	10,846
Yeongi	563	2,477	823	3,621	880	875	356	419	499	1,745	12,258
Nonsan	102	459	120	540			139	130	148	602	2,240
Boeun	167	735	168	739			90	210	166	773	3,048
Okcheon	737	3,316	668	3,006			322	350	692	3,134	12,225
Total	6,350	27,977	7,460	32,325	23,820	28,200	4,057	6,915	9,194	36,131	182,429

A: Subscriber
B: Dependents

A': Head of Household
B': Dependents

Source: 1/ Data from the Government concerned
2/ Statistical Year Book of Daejeon City, Daeduck, Gongju, Geumsan, Yeongi, Nonsan, Bueun, and Okcheon Gun. 1978

Table L-8 Hospitals in the Daejeon Hospital Service Area

Name of Hospital	Number of Beds	Location
Choongnam Medical College	250	Daejeon, Daeheung Dong
Daejeon St. Mary	150	Daejeon, Daeheung Dong
Park's Surgery	40	Daejeon, Eunhung Dong
Yoo's Surgery	28	Daejeon, Eunheung Dong
Sun's Othopedic	34	Daejeon, Seonwha Dong
Gongju Provincial	45	Gongju Gun, Gongju Eup
Gongju National TB	(337)	Gongju Gun, Janggi Myon
Total	547 (884)	-

Source: Health Center, Daejeon City, 1979

Table L-9. Number of Existing Beds within the Daejeon Hospital Service Area

Area	General Hospital			Clinics			Total		
	No. of Facilities	No. of Beds	No. of Facilities	No. of Beds	No. of Facilities	No. of Beds	No. of Facilities	No. of Beds	No. of Beds
Daejeon	1	250	4	252	135	571	140	1,073	
Daeduck	-	-	-	-	12	35	12	35	
Geunsan	-	-	-	-	13	32	13	32	
Yeongi	-	-	-	-	3	4	3	4	
Nonsan	-	-	-	-	2	-	2	-	
Boeun	-	-	-	-	1	2	1	2	
Okcheon	-	-	-	-	4	13	4	13	
Gongju	-	-	-	45	12	44	13	89	
Total	1	250	5	297	182	701	188	1,248	

Source: Communication with the authorities of the above health centers, 1979

Table L-10 Bed Requirements in the Daejeon Hospital Service Area (Projection I)

Year	The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		A.L.S. the Insured & Medicaid	Hospitalization Rate/Person/Year		Industrial Accident Compensation Insurees	Incidence Rate of Accidents	Admission Rate	A.L.S.	No. of Existing Beds	Occupancy Rate (%)		Bed Requirements				
		I	II		I	II						Clinic	Hospital		Clinic	I	II	
1979	184,949	0.0349	0.0349	9	873,045	0.0195	0.0239	10	34,238	0.0442	0.055	30	547	701	60	40	38	163
1980	186,209	0.0349	0.0366	9	888,156	0.0202	0.0247	10	35,498	0.0442	0.055	30	547	701	60	40	72	207
1981	187,419	0.0349	0.0385	9	903,064	0.0209	0.0254	10	36,758	0.0442	0.055	30	547	701	70	30	121	265
1982	188,729	0.0349	0.0404	9	917,775	0.0215	0.0262	10	38,018	0.0442	0.055	30	547	701	70	30	150	310
1983	189,989	0.0349	0.0424	9	932,290	0.0222	0.0269	10	39,278	0.0442	0.055	30	547	701	75	30	150	323
1984	191,249	0.0349	0.0445	9	946,617	0.0277	0.0277	10	40,538	0.0442	0.055	30	547	701	75	20	260	445
1985	192,509	0.0349	0.0468	9	960,759	0.0284	0.0284	10	41,798	0.0442	0.055	30	547	701	80	20	262	460
1986	193,769	0.0349	0.0491	9	974,720	0.0292	0.0292	10	43,058	0.0442	0.055	30	547	701	80	20	291	508
1991	201,329	0.0349	0.0627	9	1,040,713	0.0335	0.0335	10	49,358	0.0442	0.055	30	547	701	80	20	455	778

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Table L-11 Bed Requirements in the Daejeon Hospital Service Area (Projection II)

Year	The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		General Population Excluding the A.L.S.	Hospitalization Rate/Person/Year		Industrial Accident Compensation Insurees	Incidence Rate of Accidents	Admission Rate	A.L.S.	No. of Existing Beds	Occupancy Rate (%)		Bed Requirements				
		I	II		I	II						Hospi- tal	Clinic		Hospi- tal	Clinic		
1979	188,607	0.0349	0.0349	9	873,045	0.0195	0.0239	10	34,238	0.0442	0.055	30	547	701	60	40	43	167
1980	191,537	0.0366	0.0373	9	888,156	0.0202	0.0247	10	35,498	0.0442	0.055	30	547	701	60	40	87	215
1981	194,665	0.0385	0.0399	9	903,064	0.0209	0.0254	10	36,758	0.0442	0.055	30	547	701	70	30	148	280
1982	195,138	0.0404	0.0427	9	917,775	0.0215	0.0262	10	38,018	0.0442	0.055	30	547	701	70	30	186	329
1983	201,800	0.0424	0.0457	9	932,290	0.0222	0.0269	10	39,278	0.0442	0.055	30	547	701	75	30	204	354
1984	205,696	0.0445	0.0489	9	946,617	0.0277	0.0277	10	40,538	0.0442	0.055	30	547	701	75	20	462	486
1985	209,816	0.0468	0.0523	9	960,759	0.0284	0.0284	10	41,798	0.0442	0.055	30	547	701	80	20	482	512
1986	214,159	0.0491	0.0560	9	974,720	0.0292	0.0292	10	43,058	0.0442	0.055	30	547	701	80	20	535	574
1991	240,286	0.0627	0.0785	9	1,040,713	0.0335	0.0335	10	49,358	0.0442	0.055	30	547	701	80	20	841	940

Table L-12-1 Medical Program of the Daejeon Hospital

(1980)

1: INPATIENTS

Medical disciplines/ specialties	No. of cases per year	Average length of stay(days)	Occupancy rate of beds(%)	Distribu- tion of beds(number)
Internal medicine	1,285	9	75	42
General surgery	539	14	75	27
orthopedic surgery	343	20	75	24
Neuro-surgery	200	20	75	15
Pediatrics	380	7	75	10
ENT	150	10	75	5
OB and GYN	702	7	75	18
Ophthalmology	100	13	75	5
Dermatology	40	12	75	2
Dentistry	30	15	75	2
Total or Average	3,769	11.0	75	150

2: OUTPATIENTS

Medical disciplines	No. of cases	Visits/ case	No. of visits per year
Internal medicine	8,085	2.6	21,021
General surgery	2,237	2.4	5,369
Orthopedics	1,362	2.8	3,814
Neuro-surgery	800	2.4	1,920
Pediatrics	3,298	3.5	11,543
OB and GYN	2,438	3.1	7,558
ENT	1,063	3.2	3,402
Ophthalmology	854	2.5	2,135
Dermatology	1,062	3.7	3,929
Dental	935	3.3	3,086
Total	22,134	2.9	63,777

Table L-12-2. Medical Program of the Daejeon Hospital

(1980)			
3: MEDICAL PERFORMANCES			
Kind of performances	No. of performances per year		Total
	for inpatients	for outpatients	
Emergency cases		4,464	4,464
ECG			1,051
Endoscopies			65
Laboratory diagnostics			
- chemical	9,287	13,609	22,896
- heamatological	10,791	21,967	32,758
- serological	3,889	7,689	11,578
- bacteriological	1,948	3,052	5,000
- stool exam.	1,126	1,273	2,399
- urinalysis	14,923	20,138	35,061
Blood preserves			3,200 pints
Plain X-ray	5,144	6,957	12,101
Mass X-ray	-	6,600	6,600
Fluoroscopies	445	-	445
Operations			
- general surgery	323	336	659
- orthop, surgery	172	82	254
- neuro surgery	80	24	104
- OB and GYN	211	250	461
- ENT	105	117	222
- Ophthalmology	35	45	80
- Dermatology	-	106	106
- Dentistry	6	187	193
- Total	932	1,147	2,079
Deliveries	460		460
Physiotherapy			5,000
Physical check-up		3,000	3,000

4: FURTHER FUNCTIONS

Function	Quantities per year
Autopsy	50
Ambulance	1,000

Table L-13. Number of Inpatient Cases by Insurance Coverage for the Daejeon Hospital

Medical Department	Insurance	1979	1980	1981	1985	1990
Internal Medicine	Total		1,285	1,320	1,385	1,470
	Insurance		514	660	831	1,323
	Non-Insurance		771	660	554	147
General Surgery	Total		539	543	649	689
	Insurance		216	272	389	620
	Non-Insurance		323	271	260	69
Orthopedics	Total		343	311	389	413
	Insurance		137	155	233	372
	Non-Insurance		206	156	156	41
Neuro Surgery	Total		200	194	216	230
	Insurance		80	97	130	207
	Non-Insurance		120	97	86	23
Pediatrics	Total		380	427	476	505
	Insurance		152	214	286	455
	Non-Insurance		228	213	190	50
OB and GYN	Total		702	699	692	643
	Insurance		281	349	415	579
	Non-Insurance		421	350	277	64
ENT	Total		150	155	216	275
	Insurance		60	77	130	247
	Non-Insurance		90	78	86	28
Ophthalmology	Total		100	116	130	138
	Insurance		40	58	78	124
	Non-Insurance		60	58	52	14
Dermatology	Total		40	78	87	138
	Insurance		16	39	52	124
	Non-Insurance		24	39	35	14
Dental	Total		30	39	87	92
	Insurance		12	20	52	83
	Non-Insurance		18	19	35	9
Total	Total		3,769	3,882	4,327	4,593
	Insurance		1,508	1,941	2,596	4,134
	Non-Insurance		2,261	1,941	1,731	459

Table L-14 Number of Outpatient Visits by Insurance Coverage for the Daejeon Hospital

Medical Department	Insurance	1979	1980	1981	1985	1990
Internal Medicine	Total	21,021	21,225	24,830	29,110	
	Insurance	8,408	10,612	14,898	26,199	
	Non-Insurance	12,613	10,613	9,932	2,911	
General Surgery	Total	5,369	5,306	5,431	6,175	
	Insurance	2,148	2,653	3,258	5,557	
	Non-Insurance	3,221	2,653	2,173	618	
Orthopedics	Total	3,814	3,980	3,880	4,411	
	Insurance	1,526	1,990	2,328	3,970	
	Non-Insurance	2,288	1,990	1,552	441	
Neuro Surgery	Total	1,920	1,990	3,104	3,529	
	Insurance	768	995	1,862	3,176	
	Non-Insurance	1,152	995	1,242	353	
Pediatrics	Total	11,543	11,939	13,191	14,114	
	Insurance	4,617	5,969	7,915	12,703	
	Non-Insurance	6,926	5,970	5,276	1,411	
OB and GYN	Total	7,558	7,959	8,535	10,586	
	Insurance	3,023	3,980	5,121	9,527	
	Non-Insurance	4,535	3,979	3,414	1,059	
ENT	Total	3,402	3,980	5,431	6,175	
	Insurance	1,361	1,990	3,259	5,558	
	Non-Insurance	2,041	1,990	2,172	617	
Ophtalmology	Total	2,135	2,653	3,880	4,411	
	Insurance	854	1,327	2,328	3,970	
	Non-Insurance	1,281	1,326	1,552	441	
Dermatology	Total	3,929	3,980	5,432	5,293	
	Insurance	1,572	1,990	3,259	4,764	
	Non-Insurance	2,357	1,990	2,173	529	
Dental	Total	3,086	3,316	3,880	4,411	
	Insurance	1,234	1,658	2,328	3,970	
	Non-Insurance	1,852	1,658	1,552	441	
Total	Total	63,777	66,328	77,594	88,215	
	Insurance	25,511	33,164	46,556	79,394	
	Non-Insurance	38,266	33,164	31,038	8,821	

6. INVESTMENT AND FINANCING PLAN

(All the assumption for financial studies of the hospitals in industrial areas are the same as those mentioned in the studies of the Ulsan and Pohang Hospitals. Since the Daejeon Hospital is one of those in industrial areas, refer to the feasibility studies of the Ulsan and Pohang Hospitals.)

6.1 Investment Cost

Daejeon Hospital (150 Beds)		
Table L-15-1	Investment Cost <u>1/</u>	
Category.	Local Cost	Foreign Cost
Land estate	₩222,300,000	\$463,125
Site preparation	21,000,000	43,750
Construction	1,921,000,000	4,002,083
Dormitory	74,528,000	152,267
Medical equipment	519,366,000	1,080,013
Outside equipment	121,000,000	252,083
Contingencies	377,234,000	785,904
Engineering fees	76,800,000	160,000
Working capital	90,247,000	188,015
Total Investment	₩3,423,475,000	\$7,132,000

1/ See Appendix A 4-1.

6.2 Financing Plan

Daejeon Hospital (150 Beds)		
Table L-15-2	Source of Finance	
Category	Local Currency	Foreign Currency
Total Investment	₩3,423,475,000	\$7,132,000
Foreign Loan	519,366,000	1,082,000
Local Loan	1,500,000,000	3,125,000
Capital	₩1,404,109,000	\$2,925,000

6.3 Pro-forma Balance Sheet (the year before operation starts)

Daejeon Hospital (150 Beds)			
Balance Sheet (Beginning of Operation)			
Table L-15-3		Unit: W1,000	
Assets		Liabilities	
Cash	419,705	Bank Credit	0
Auxiliary goods	16,368	Account Payable	0
Pharmaceutical and other materials	31,418	Draft	0
Equipment	519,366	Loans local	1,500,000
Building	2,214,328	foreign	519,366
Land	222,300	Capital	1,404,109
Total	3,423,475	Total	3,423,475
(\$,000)	(7,132)	(\$,000)	(7,132)

Note: 1\$ = 480 Won

7. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the studies of the Ulsan and Pohang Hospitals .)

- 7.1 Revenue Estimation (See Table L-16-1)
- 7.2 Estimation of Expenses (See Table L-16-2)
- 7.3 Pro-forma Income Statement (See Table L-16-3)
- 7.4 Pro-forma Balance Sheet (See Table L-16-4)

8. ESTIMATION OF CASH FLOW (See Table L-17-1)

9. CONCLUSION FROM FINANCIAL ANALYSIS

9.1. Even though the projected hospital will loss until the second year of operation, the amount is very small and cash flows are enough from the first year to cover all the necessary cash out-flow.

9.2 The hospital does not need any additional fund to be invested after the sponsor supplies \$2,925,000 before operation.

9.3 The hospital is profitable.

Table L-16-1

Daejeon Hospital (150 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Category	1	2	3	4	5	6	7	8	9	10
Insurance	453,422	598,164	706,376	814,598	922,802	1,013,015	1,255,543	1,498,071	1,740,599	3,001,128
Private	811,744	735,125	742,357	749,579	756,819	782,050	725,353	504,685	395,957	249,258
Inpatient	1,000,285	1,051,285	1,152,952	1,254,619	1,356,286	1,457,954	1,533,618	1,609,282	1,684,946	1,760,610
Outpatient	264,881	282,004	295,781	309,558	323,335	337,111	395,278	413,444	451,610	489,776
Total (\$000)	1,265,166 (2,636)	1,333,289 (2,778)	1,448,733 (3,018)	1,564,117 (3,259)	1,679,621 (3,499)	1,795,065 (3,740)	1,908,896 (3,977)	2,002,726 (4,172)	2,136,556 (4,576)	2,250,386 (4,688)

Table L-16-2

Daejeon Hospital (150 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st - 10ty year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Personnel	509,656	524,946	540,694	556,915	573,622	590,831	608,556	626,813	645,617	664,985
Physician	207,144	213,358	219,759	226,351	233,142	240,136	247,340	254,760	262,403	270,275
Nurse	149,526	154,011	158,632	163,391	168,292	173,341	178,541	183,898	189,415	195,097
Medical assistant	26,327	27,096	27,909	28,746	29,608	30,497	31,411	32,354	33,324	34,324
Mgt. and ad.	33,636	33,615	34,623	35,662	36,732	37,934	38,969	40,138	41,342	42,582
Technical service	93,203	95,999	98,879	101,845	104,900	108,047	111,289	114,627	118,066	121,608
and others										
Pharma.	377,019	397,320	431,722	446,124	500,527	534,929	568,850	602,772	636,694	670,615
Food & clothes	67,164	69,177	71,160	73,142	75,124	77,107	78,292	79,477	80,662	81,847
Heating & utilities	62,275	63,717	66,842	69,968	73,094	76,219	78,389	80,558	82,727	84,897
Maintenance	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520
Bldg.	5,536	5,536	5,536	5,536	5,536	5,536	5,536	5,536	5,536	5,536
Equip.	12,984	12,984	12,984	12,984	12,984	12,984	12,984	12,984	12,984	12,984
Others	48,518	49,642	52,077	54,512	56,947	59,382	61,072	62,763	64,453	66,143
Total (\$000)	1,083,152 (2,257)	1,123,322 (2,340)	1,181,015 (2,460)	1,239,183 (2,582)	1,297,834 (2,704)	1,356,985 (2,827)	1,413,982 (2,946)	1,470,903 (3,064)	1,528,673 (3,185)	1,587,007 (3,306)

Table L-16-3

Daejeon Hospital (150 beds)
ECONOMIC FORECASTING : PRO FORMA INCOME STATEMENTS
(1st - 10th year)

Year	Unit: ₩1,000 1\$ = 480 won									
	1	2	3	4	5	6	7	8	9	10
Total Revenue	1,265,166	1,333,289	1,448,733	1,564,177	1,679,621	1,795,065	1,908,896	2,022,726	2,136,556	2,250,386
Total Expense	1,083,152	1,123,322	1,181,015	1,239,183	1,297,834	1,356,988	1,413,982	1,470,903	1,508,673	1,586,007
Operating income	182,014	209,967	267,718	324,996	381,787	438,077	494,914	551,823	607,883	663,379
Depreciation	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224
Interest	152,887	152,887	152,887	152,887	137,587	120,937	102,637	82,537	60,637	36,487
Netprofit (\$000)	*67,097 (*140)	*39,144 (*82)	18,607 (39)	75,885 (158)	147,976 (308)	220,916 (460)	296,053 (617)	373,062 (777)	451,022 (940)	530,668 (1,106)

* : deficit

Table L-16-4

Daejeon Hospital (150 beds)
ECONOMIC FORECASTING : PRO FORMA BALANCE SHEETS
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Current Assets	496,608	553,688	668,519	680,128	248,528	873,278	1,054,805	1,293,041	1,587,737	1,937,729
Equipment	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366
Depr.	51,937	103,874	155,811	207,748	259,685	311,622	363,559	415,496	467,433	519,370
Bldg.	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328
Depr.	44,287	88,574	132,861	177,148	221,435	265,722	310,009	354,296	398,583	440,870
Land	222,300	222,300	222,300	222,300	222,300	222,300	222,300	222,300	222,300	222,300
Total	3,356,378	3,317,234	3,335,841	3,251,226	3,223,402	3,251,928	3,337,231	3,479,443	3,677,715	3,931,483
Current liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	1,500,000	1,500,000	1,500,000	1,339,500	1,163,700	971,250	760,500	529,650	276,900	0
Foreign loan	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366
Capital	1,404,109	1,404,109	1,404,109	1,404,109	1,404,109	1,404,109	1,404,109	1,404,109	1,404,109	1,404,109
Retained Earnings	0	*67,097	*106,241	*87,634	*11,749	136,227	357,203	653,256	1,026,318	1,477,340
Net profit	* 67,097	* 39,144	18,607	75,885	147,976	220,916	296,053	373,062	451,022	530,668
Total	3,356,378	3,317,234	3,335,841	3,251,226	3,223,402	3,251,928	3,337,231	3,479,443	3,677,715	3,931,483
(\$000)	(6,992)	(6,911)	(6,950)	(6,773)	(6,715)	(6,775)	(6,953)	(7,249)	(7,662)	(8,191)

* : deficit

Table L-17

Daejeon Hospital (150 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
1. Operating and Maintenance										
1.1 Personnel	509,656	524,946	540,694	556,915	573,627	590,831	608,556	626,813	645,617	664,985
1.2 Other expenses	554,976	579,856	621,801	663,746	705,692	747,637	786,906	843,903	864,536	885,502
1.3 Maintenance	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520
1.4 Interest	152,887	152,887	152,887	152,887	137,587	120,937	102,637	82,537	60,637	36,487
1.5 Operating expenses	1,236,039	1,276,209	1,333,902	1,392,068	1,435,421	1,477,865	1,566,619	1,553,440	1,589,310	1,623,494
1.6 Depreciation	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224
1.7 Operating cost	1,332,263	1,372,433	1,430,126	1,488,292	1,531,645	1,574,089	1,612,843	1,649,664	1,685,534	1,779,758
2. Revenue										
2.1 Outpatient	264,881	282,004	295,781	309,558	323,335	337,111	395,278	413,444	451,610	489,776
2.2 Inpatient	1,000,285	1,051,285	1,152,952	1,254,619	1,356,286	1,457,954	1,533,618	1,609,282	1,684,946	1,760,610
2.3 Other										
2.4 Whole revenue	1,265,166	1,333,289	1,448,733	1,564,177	1,679,621	1,795,065	1,908,896	2,022,726	2,136,556	2,250,386
3. Calculation										
3.1 Operating incomes	*67,097	*39,144	18,607	75,885	147,976	220,916	296,053	373,062	451,022	530,668
3.2 Accumulation	*67,097	*106,241	*87,634	*11,749	136,227	357,203	653,256	1,026,318	1,477,340	2,008,008
3.3 Income tax										
4. Cash flow calculation										
4.1 Gross cash flow	29,127	57,080	114,831	172,109	244,200	317,200	392,277	469,286	547,246	626,892
4.2 Invested capital	0	0	0	0	0	0	0	0	0	0
4.3 Payoff/discharge	0	0	0	160,500	175,800	192,450	210,750	230,850	252,750	276,900
4.4 Net cash flow	29,127	57,080	114,831	11,609	68,400	124,750	181,527	238,436	294,496	349,992
4.5 Accumulation of 4.4	29,127	86,207	201,038	212,647	281,047	405,797	587,324	825,760	1,120,258	1,470,248
(\$000)	(60)	(180)	(419)	(443)	(585)	(845)	(1,223)	(1,720)	(2,334)	(3,063)

* : deficit

Appendix Table A 4-1

			<u>Amount</u>
No. 1: Land estate cost			
1.1.	Value: <u>quantity (Won/M²)</u>		<u>Whole Amount</u>
	21,000 (10,587 Won/M ²)		
1.2.	Acquisition cost		₩222,300,000
Total Sum of No. 1			₩222,300,000
No. 2: Site preparation cost			
2.1.	Public opening		₩3,000,000
2.2.	Non-public opening		₩18,000,000
2.3.	Other cost (i.e. taxes)		
Total Sum of No. 2			₩21,000,000
No.3: Construction cost			
3.1.	Building (due to room and space program plus traffic ways)		₩1,280,000,000
3.2.	Installations (Sewage, Water, Heating, Electricity ...)		₩276,000,000
3.3.	Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators ...)		₩365,000,000
Total Sum of 3.1 - 3.3			₩1,921,000,000

and:

a) Classification to space-content:

3.1 - 3.3 :	<u>m³</u>	<u>Won/m³</u>
	36,000	50,000
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	<u>Outside Equipment</u>
₩1,800,000,000	₩121,000,000

b) Classification to space

3.1 - 3.3 :	<u>m²</u>	<u>Won/m²</u>
	9,000	200,000
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	<u>Whole Amount</u>
₩1,800,000,000	₩121,000,000

c) Classification to beds

3.1 - 3.3	<u>No. of beds</u>	<u>Won/Bed</u>
	150	12,000,000
Sum of 3.1 - 3.3		

<u>Whole Amount</u>	<u>Whole Amount</u>
₩1,800,000,000	₩121,000,000

No. 4:	Equipment	₩519,366,000
4.1.	Medical Equipment	
4.2.	Non-medical Equipment	
	Total Sum of 4.1 + 4.2	
No. 5:	Outside Equipment	₩121,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	₩377,234,000
No. 7:	Engineering Fee	₩76,800,000
No. 8:	Dormitory	₩74,528,000

M. CHEONGJ U

M. CHEONGJU HOSPITAL

1. Geographical Features

1.1 Choongbuk Province is the only inland province away from the coast among the Korea's 9 provinces. Located in the central and southern part of the Korean peninsula, Choongbuk Province is rugged country with 75% of its total land 100-500 meters above sea level. The province has limited arable land, but has comparatively rich mineral resources.

1.2 Cheongju is the seat of the Choongbuk Provincial Government, and has been the inland center of trade, transportation, political, economic, cultural and educational activities since the old times. In recent years, Cheongju has seen a rapid development of small and medium-industries in the Cheongju Industrial Estate.

1.3 Choongbuk Province is the smallest province, except for Cheju Province, in terms of population and land area of the nation's 9 provinces. Geographically, the province can be divided into the two cosmopolitan areas by a hypothetical borderline connecting Eumseong Gun and Goesan Gun. The northeast cosmopolitan area centered by Choongju City encompasses Goesan, Jecheon and Joongwon Gun, and the southwestern cosmopolitan area centered by Cheongju City encompasses Cheongwon, Jincheon, Boeun and Okcheon Gun. However, the southern part of the southwestern cosmopolitan area, including Okcheon, Youngdong and Boeun Gun, are more closely adjoining the Daejeon cosmopolitan area after the opening of the Seoul-Pusan Expressway. Therefore, those areas have been excluded from the cosmopolitan area of Cheongju (Figure M-1).

1.4 Choongbuk Province has the lowest rate of hospital beds to population in Korea, 84 beds per 100,000 persons. The rate contrasts sharply with the national average of 156 beds and the average in Seoul City of 264 beds per 100,000 population (Table M-1). Choongbuk Province has 72 beds less than the national average and also 28 beds less than the average of 112 hospital beds per 100,000 population in Cheju Province.

2. Determination of the Cheongju Hospital Catchment Area

2.1 The medical service area of a hospital could be determined by identifying medical care utilization pattern of residents. In general, medical care utilization behavior is influenced by their daily livelihood, location of medical facilities, patient referral systems, norms & standards of ways of living. The division of administrative districts should also be taken into consideration, because most available data has been compiled in accordance with the administrative units and a community development has been carried out as a part of the regional development scheme of the administrative district.

2.2 Cheongju City is doubtlessly the center of Choongbuk Province. Therefore, the proposed Cheongju Hospital will have to serve for Cheongju City and its surrounding areas of Cheongwon Gun, Jincheon Gun and part of Goesan Gun, which are located within a convenient distance of 20 Km from Cheongju City.

Meanwhile, the area of Okcheon Gun and part of Boeun Gun, located within 30 Km from Cheongju City, will be nearer to Daejeon City, therefore, the area has been excluded from the catchment area of the Cheongju Hospital.

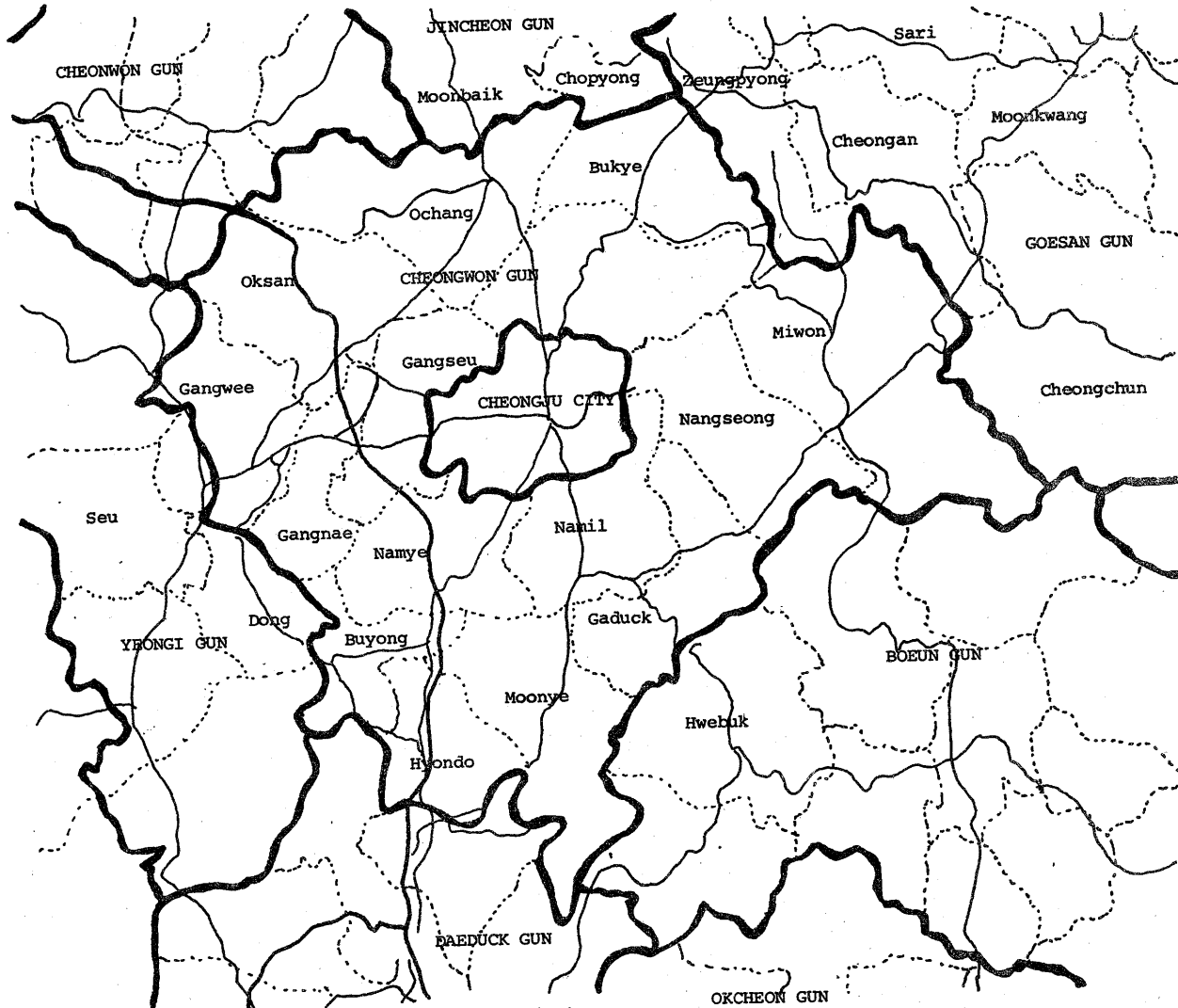


Figure M-1. The Cheongju Map

Table M-1.

Number of Beds by Medical Facility as of December 1977

Area	Population	General Hospital	Hospital	Clinic	Dispensary	Other 2/	Oriental Medical Hospital	Dental Hospital	Dental Clinic	Total No. of Beds	(Unit; Number)	
											Beds per 100,000	Population
Seoul	6,889,502	7,644	3,923	5,867	286	136	245	67	9	18,179	264	
Busan	2,453,173	1,219	1,505	2,786	410	108	-	22	5	6,055	247	
Gyeonggi	4,039,132	675	1,215	2,835	134	161	-	-	2	5,022	124	
Gangwon	1,861,560	662	344	1,328	263	48	-	-	8	2,653	142	
Chungbuk	1,522,203	150	270	799	24	35	-	-	4	1,282	84	
Chungnam	2,948,553	215	742	2,212	50	109	-	-	2	3,330	113	
Jeonbuk	2,456,403	641	507	1,732	125	48	-	-	3	3,056	124	
Jeonnam	3,984,123	917	1,254	2,358	237	49	20	-	3	4,838	121	
Gyeongbuk	4,858,551	1,314	1,007	3,153	10	72	42	-	3	5,601	115	
Gyeongnam	3,280,052	325	1,442	1,887	5	120	-	-	3	3,782	115	
Cheju	411,732	-	168	293	-	-	-	-	-	461	112	
Total	34,706,620	13,762	12,377	25,252	1,544	886	307	89	42	54,259		156

1/ As of October 1, 1975

2/ These belong to herb clinic, midwifery, health center and M.C.H. Center.

Source: Ministry of Health and Social Affairs, Yearbook of Public Health and Social Statistics, 1978, pp. 32 - 33

2.3 The present status of medical facilities in Cheongju area is as follows (Table M-2). There are the Choongbuk Provincial Hospital with 100 beds, two hospitals, and 48 doctors' offices in the Cheongju area. The Chungbuk Provincial Hospital is the largest of its kind in the province, however, operation and management of the hospital have not been satisfactory due to the problems inherent in a public hospital organization. 1/ Although the Choongbuk Provincial Hospital was authorized with 150 beds, the occupancy rate of the hospital reached less than 50% in 1978. 2/

Table M-2. Existing Medical Facilities within the Cheongju Hospital
Catchment Area in 1979

Area	(Unit: Number)					
	Hospital		Clinic		Total	
	No. of Facilities	No. of Beds	No. of Facilities	No. of Beds	No. of Facilities	No. of Beds
Cheongju	3	186	48	289	51	475
Cheongwon	-	-	10	-	10	-
Jincheon	-	-	6	14	6	14
Part of Goesan	-	-	7	11	7	11
Total	3	186	71	314	74	500

Source: Health Center, Cheongju City, Cheongwon, Jincheon and Goesan Gun, 1979

2.5 Based on the above considerations, the medical service areas of Cheongju Hospital are determined as follows: The whole area of Cheongju City, Cheongwon Gun, Jincheon Gun, part of Goesan Gun including Zeungpyung Eup, Yeonpoong Myon, Cheongchon Myon, Cheongan Myon and Doan Myon.

3. Target Population of Cheongju Hospital

3.1 The population in the medical service area totaled 543,771 as of 1977 (Table M-3). Of the total population, the population of Cheongju City and Cheongwon Gun accounted for 39% and 36%, respectively, with their combined population amounting to 75%.

3.2 During the past 6 years, the population in Cheongju City steadily increased, while the population in other areas showed the opposite trend. On the average, the population within the catchment area has increased gradually due to the population rise in the Cheongju area.

1/ Generally, city and province-run hospitals have been operating unsatisfactorily with insufficient facilities, equipment and manpower due largely to the fact that such hospitals should pursue simultaneously the two conflicting goals of satisfying the task of providing public medical services and securing a self-reliant financial footing. As there has not been the remedial policy measures to correct such a dilemma, the hospitals have been unable to perform successfully the function of medical institution. (Report on the Improvement of Management of City and Provincial Hospitals, Korea Development Institute, Sept. 18, 1979.

2/ Data from the Hospital Construction Feasibility Survey, KHDI, 1979.

Table M-3. Population Trend within the Cheongju Hospital Service Area

Year	Cheongju	Cheongwon	Jincheon	Parts of Goesan ^{1/}	Total
1972	159,287	204,657	-	71,962	-
1973	167,018	203,323	78,820	73,084	522,245
1974	177,630	203,798	77,570	72,177	531,175
1975	192,734	199,315	75,717	69,001	536,767
1976	200,573	196,283	73,819	67,762	538,437
1977	211,445	193,318	72,784	66,224	543,771

^{1/} Zungpyung, Yeonpoong, Chungcheon, Chungan and Doan Myon are included.

Source: Statistical Year Book of Cheongju, Cheongwon, Jincheon, and Goesan, 1973 - 1978.

3.3. The number of employees of the manufacturing industry in Cheongju area is as shown in Table M-4. The production of the manufacturing industry increased more than two-fold in 1976 over 1975. There are about 37,000 workers employed at the manufacturing plants in Cheongju. The Cheongju Industrial Estate, which has been developed on 429,000 square meters of land, employs about 6,500 workers (Table M-5). Therefore, the employees in Cheongju Industrial Estate account for only 18% of the total manufacturing workers. While the Cheongju Industrial Estate will be expanded in the coming years, it will be unreasonable to construct the Cheongju Hospital only for the industrial estate. In short, the proposed Cheongju Hospital should provide medical services not only for the employees and their dependents in the Cheongju Industrial Estate but also for the people in the whole area concerned.

Table M-4. Manufacturing Establishments in Cheongju

Year	No. of Manufacturers	No. of Employees
1968	167	4,763
1969	200	3,831
1970	203	4,600
1971	205	5,067
1972	204	5,106
1973	205	4,722
1974	207	5,895
1975	206	15,059
1976	202	36,677
1977	208	36,896

Source: Statistical Year Book of Cheongju, 1978, p. 135

Table M-5. Number of Employees in Cheongju Industrial Complex

Name	Area (Pyung)	Product	No. of Employees
Saman Food	2,000	Bread	70
Cheongju Textile	18,000	Textile	763
Namhan Heungsan	10,412	Raw Silk	140
Woojin Electricity	6,235	Electronic	121
Youngtal Electronic	1,250	Electronic accessory	295
Daeyang Chemical	6,000	Adhesive	44
Chogwang Leather	10,000	Leather	733
Far East Industry	2,415	P.V.C.	113
Korea Metal Refinery	4,685	Metal	210
Sam Ryun Co.	2,783	Bag	285
Jeonbang	2,500	Towel	163
Samwha Electricity	9,424	Electronic accessory	986
Han Eum Pa	1,665	Sonic equipment	140
Seoheung Co.	1,250	Condom	167
Wonil Mechanic	995	Food making machine	35
A.M.K.	12,052	Computer head	413
Dong shin Electronic	9,252	Electronic	47
Shin Heung Co	2,101	Heating machine	27
Ildong Co.	7,719	Pharmaceuticals	27
Shin A Co.	1,019	Bag	31
Han Yang Cork	1,186	Cork Wall paper	247
Korea Ceramic	5,000	Ceramics	240
Maxon Electronic	2,150	Wireless instrument	667
Dae myung chemical	2,548	Chemical Hex	37
Dae Yang Textile	2,052	Textile	117
Sejin Textile	3,000	Textile	114
Dae sung textile	2,113	Textile	23
Han Yang Co.	1,119	Cork	24
Han Kuk Galpo	2,466	Wall Paper	80
Dae Han Cork	2,372	Cork	131
Poongjin Chemical	2,548	Chemicals	23
Hankuk coating	3.094	Furniture	36
Total	131,405	-	6,549

Source: Statistical Year Book of Cheongju, 1978, pp. 134 - 135.

3.4 Assuming that the population will increase logarithmically in the catchment area, the population will increase by 5,000 annually from 560,000 in 1980 to 580,000 in 1982 and to 600,000 in 1987 (Table M-6).

3.5 The number of the insured under health insurance and the recipients under medical aid program in the areas concerned is as follows (Table M-7). The subscribers to the medical insurance program numbered 144,205 and the recipients of the medical aid program numbered 26,920, aggregating 171,125, which represents 30.8% of the total population.

Table M-6. Estimated Number of Population within the Cheongju Hospital Service Area

Year	Cheongju	Cheongwon	Jincheon	Goesan	Total
1979	231,977	189,825	69,555	64,056	555,413
1980	242,054	187,627	68,063	62,779	560,523
1981	252,006	185,457	66,589	61,519	565,571
1982	261,836	183,314	65,133	60,273	570,556
1983	271,547	181,197	63,694	59,043	575,481
1984	281,141	179,105	62,273	57,828	580,347
1985	290,622	177,037	60,869	56,626	585,154
1986	299,922	174,994	59,481	55,439	589,836
1991	345,266	165,122	52,775	49,704	612,867

$$Y = a + b \log x$$

r^2 : 0.99	r^2 : 0.91	r^2 : 0.99	r^2 : 0.85
a : -3,268,507.30	a : 953,098.81	a : 588,040.59	a : 507,517.82
b : 801,127.35	b : -174,684.33	b : -118,661.52	b : -101,491.51

Table M-7 Number of the Insured and Medicaid Beneficiaries within the Cheongju Hospital Service Area

Area	Health Insurance				Medicaid 3/		Total
	Public Officials & Private School Teachers 1/		Industrial workers 2/		Indigent Group	Low Income Group	
	Subscriber	Dependents	Subscriber	Dependents			
Cheongju	10,153	30,159	25,700	52,000	1,956	6,762	126,730
Cheongwon	1,914	5,826	3,900	7,400	3,089	9,131	31,260
Jincheon	1,043	3,110	-	-	1,065	3,289	8,507
Goesan	600	2,400	-	-	797	831	4,628
Total	13,710	41,495	29,600	59,400	6,907	20,013	171,125

- 1/ Data from the Cheongju Office of the Korean Medical Insurance Corporation, 1979
 2/ Data from the Cheongju Office of the Federation of the Medical Insurance Societies, 1979
 3/ Data from the Concerning Local Government, 1979

4. Estimate Hospital-Bed Requirement

4.1 The utilization of the hospital beds by the members of the health insurance program is as follows (Table M-8).

4.2 The insured in the Cheongju Industrial Estate used less hospitalization than those in other industrial plants. As the number of the employees in the Cheongju Industrial Estate accounted for only 18% of total employees in Cheongju City, the national average utilization rate was applied in actual calculation instead of the figures in Table M-8.

Table M-8. Utilization Data for the Members of the Cheongju Industrial Health Insurance Program, 1979 ^{1/}

Category	Subscriber	Dependents	Total
No. of members	3,037	2,995	6,032
Inpatient cases	21	42	63
Inpatient days	111	125	236
Outpatient cases	767	1,071	1,838
Outpatient days	2,305	2,546	4,851
No. of Hospitalizations/person/ year ^{2/}	0.01383	0.02805	0.02089
No. of Inpatient days/person/ year ^{2/}	0.07310	0.08347	0.07825
Average length of stay	5.3	3.0	3.7
No. of outpatient visits/case	3.0	2.4	2.6

^{1/} These were the data for the last six months from January to June, 1979

^{2/} The figure was converted into the annual rate of utilization

Source: Record of the Health Insurance Association of the Cheongju Industrial Estate, 1979.

4.3. Square root formula ($N + 3\sqrt{N}$) was again used to estimate hospital-bed requirements in the catchment area. All the assumptions involved were the same as those in other hospitals.

4.4 The requirement of hospital beds within the catchment area will amount to 203 beds (low estimate 172, high estimate 234) in 1980, 199 beds (low estimate 162, high estimate 235) in 1981, 211 beds (low estimate 171, high estimate 251) in 1982, and 242 beds (low estimate 184, high estimate 300) in 1985 (Table M-9).

4.5 The above estimate shows that bed shortage is rather acute in the Cheongju catchment area. However, two factors should be kept in mind in this regard: Choongbuk Provincial Hospital has maintained low bed occupancy rate since its start-up despite the absence of other general hospitals around. Therefore, caution must be used not to overestimate the bed shortage. Another thing is a possibility that private practitioners may build a hospital in Cheongju City. ^{1/}

4.6 The proposed Cheongju Hospital does not have to meet all the medical care demand in the area. It is, thus, recommended that the Hospital be opened to have at least 80 beds with an expansion plan of 150 beds in mind.

5. Location of the Cheongju Hospital

5.1 Cheongju City is divided into two areas by the Ushim River (a branch of the Miho River) flowing through the city. The eastern side of the river is the old town, the Cheongju City Hall and business streets, and the western side of the river is a developing area with the Cheongju Industrial Estate. Although the two areas have almost the same size of land space, the eastern area has population 1.7 times that of the western area (Table M-10). Most of the medical facilities (45) are located in the eastern part. There are only three medical facilities in the western area, including the Choongbuk Provincial Hospital and two other doctors' offices. Such concentration of medical facilities in the eastern section indicates that the cosmopolitan area of the citizens is centered in the eastern area of the city.

^{1/} An uninformed source revealed that an OB-GYN doctor has the plan to construct a 100-bed hospital in Cheongju.

Tabel M-9.

Bed Requirements in the Cheongju Hospital Service Area

Year	The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		A.L.S. Excluding the Insured & Medicaid	General Population	Hospitalization Rate/Person/Year		A.L.S. Excluding the Insured & Medicaid	Industrial Accident Compensation Insurees	Incidence Rate of Accidents	Admission Rate	A.L.S.	No. of Existing Beds	Hosp. Clinic		Occupancy Rate (%)	Bed Requirements	
		I	II			I	II							Hosp.	Clinic		I	II
1979	171,125	0.0349	0.0349	9	384,288	0.0195	0.0239	10	29,600	0.0442	0.055	30	186	314	60	40	154	206
1980	171,125	0.0349	0.0366	9	389,398	0.0202	0.0247	10	29,600	0.0442	0.055	30	186	314	60	40	172	234
1981	171,125	0.0349	0.0385	9	394,446	0.0209	0.0254	10	29,600	0.0442	0.055	30	186	314	70	40	162	235
1982	174,205	0.0349	0.0404	9	396,351	0.0215	0.0262	10	29,600	0.0442	0.055	30	186	314	70	40	171	251
1983	174,205	0.0349	0.0424	9	401,276	0.0222	0.0269	10	29,600	0.0442	0.055	30	186	314	75	40	170	263
1984	174,205	0.0349	0.0445	9	406,142	0.0229	0.0277	10	29,600	0.0442	0.055	30	186	314	75	40	182	287
1985	174,205	0.0349	0.0468	9	410,949	0.0236	0.0284	10	29,600	0.0442	0.044	30	186	314	80	50	184	300
1986	190,000	0.0349	0.0491	9	399,836	0.0242	0.0292	10	29,600	0.0442	0.055	30	186	314	80	40	198	332
1991	210,000	0.0349	0.0627	9	402,867	0.0277	0.0335	10	29,600	0.0442	0.055	30	186	314	80	40	262	488

Table M-10

Regional Characteristics of Cheongju City

	Eastern part of Ushim River	Western part of Ushim River	Whole Cheongju
Area	33.6 km ²	31.2 km ²	64.8 km ²
Population	134,002	77,443	211,445
No. of Regional Administration Offices (Dong)	14	7	21
No. of General Hospital	-	1	1
No. of Hospital	2	-	2
No. of Clinic	45	3	48

Source: Statistical Year Book of Cheongju, 1978

5.2 The Choongbuk Provincial Hospital is located 2.5 Km away from the City Hall. As stated above in 2.3., the hospital has been operated insufficiently. The hospital was constructed by a loan from Denmark, and has up-to-date medical equipment and facilities. However, the unsatisfactory operation of the hospital is attributable to the organizational bureaucracy, insufficient employment of competent doctors, and the unsuitable location of the hospital.

5.3 The proposed site of the Cheongju Hospital is located in the central area near the City Hall (Bukmoonro 3 Ga, Cheongju City), where several private clinics are located. When the Cheongju Hospital develops into a general hospital, the hospital will serve as a referral source of serious patients from the private clinics.

5.4 Under the current health care system, which allows competition between hospitals and private clinics for inpatient care as well as outpatient care, it is difficult to maintain a close functional cooperation between the Cheongju Hospital and other private clinics. To overcome the difficulties, the Cheongju Hospital should be operated as the following.

5.4.1 The hospital should employ sufficient number of specialized doctors who are devoted to service for the public health of the community.

5.4.2 The hospital should have various clinical departments of medical examination and treatment.

5.4.3 It is desirable to operate the hospital on a group practice mode with the participation of local physicians.^{1/}

5.4.4 Although it is difficult under the present situations, it is worth trying to develop the attending system for practising doctors to join medical care activities of the Cheongju Hospital.

5.4.5 The hospital should have a high standard of medical care to win the confidence of private physicians for referral of patients.

^{1/} Cho Im-ho, who will be the founder of the Cheongju Hospital, has mentioned that the general hospital will be operated on a collective management like group practice expressed their several local physicians expressed their intention to participate in the group practice as of Aug. 10, 1979.

5.4.6 The public relations should be promoted to enlighten the outpatients receiving medical care mainly in doctors' offices and the inpatients receiving medical care mainly in hospitals.

5.5 The relations between the Cheongju Hospital and the Choongbuk Provincial Hospital will be delicate for some time, for the former will have more advantages in terms of convenient location, efficient medical services by enlisting the cooperation of local physicians, and more successful performance of secondary and tertiary medical care.

5.6 Under the present free competitive medical market system, the establishment of the Cheongju Hospital will help strengthen the competitiveness of the Choongbuk Provincial Hospital, resulting in the improvement of hospital management. The demand for medical services will steadily increase by the rising income of the people and the expansion of the health insurance program among the people. Therefore, if the Choongbuk Provincial Hospital rationalizes its management, the hospital and the Cheongju Hospital will have a desirous competition in good faith for the development of medical services for the benefit of the people. In particular, the Choongbuk Provincial Hospital will play an important role in the provision of medical services as the nearby Cheongju Industrial Estate expands and develops. Furthermore, the bottlenecks hampering the sound development of municipal and provincial hospitals will be removed when the central government authorities work out a comprehensive management improvement plan for such hospitals.

6. Medical Program

(Refer to the report on the Daejeon Hospital in this connection.)

7. INVESTMENT AND FINANCING PLAN

(All the assumptions for the financial studies of the hospitals in industrial areas are the same as those mentioned in the studies of the Ulsan and Pohang hospitals. Since Cheong-ju hospital is one of those in industrial areas, refer to the feasibility studies of the Ulsan and Pohang Hospitals.)

7.1. Investment Cost

Table M-10-1 Cheongju Hospital (150 beds)
Investment Cost 1/

Category	Local cost	Foreign cost
Land estate	₩158,800,000	\$330,833
Site preparation	21,000,000	43,750
Construction	1,921,000,000	4,002,083
Dormitory	74,528,000	152,257
Medical equipment	519,366,000	1,092,013
Outside equipment	121,000,000	252,083
Contingencies	377,234,000	785,904
Engineering fees	76,800,000	160,000
Working capital	90,247,000	188,015
Total investment	₩3,359,975,000	\$6,999,948

1/ See Appendix A 4-1

7.2. Financing Plan

Table M-10-2 Cheongju Hospital (150 beds)
Sources of Finance

Category	Local Currency	Foreign Currency
Total Investment	₩3,359,975,000	\$6,999,948
Foreign loan	519,366,000	1,082,013
Local loan	1,500,000,000	3,125,000
Capital	1,340,609,000	2,792,935
Total Financing	₩3,359,975,000	\$6,999,948

7.3. Pro-forma Balance Sheet (the year before operation starts)

Table M-10-3

Cheongju Hospital (150 beds)
Balance Sheet (Beginning of Operation)

Unit: ₩1,000
1\$ = 480 Won

Assets		Liabilities	
Cash	419,705	Bank Credit	0
Auxiliary goods	16,368	Account Payable	0
Pharmaceuticals	31,418	Draft	0
and other materials		Loans	
Equipment	519,366	local	1,500,000
Building	2,214,328	foreign	519,366
Land	158,800	Capital	1,340,609
Total	3,359,975	Total	3,359,975
(\$000)	(7,000)	(\$000)	(7,000)

8. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the studies of the Ulsan and Pohang Hospitals.)

8.1. Revenue Estimation

(See Table M-11-1)

8.2. Estimation of Expenses (See Table M-11-2)

8.3. Pro-forma Income Statement (See Table M-11-3)

8.4. Pro-forma Balance Sheet (See Table M-11-4)

9. ESTIMATION OF CASH FLOW (See Table M-12-1)

10. CONCLUSION FROM FINANCIAL ANALYSIS

10.1. The sponsor should provide ₩1,340,600,000 (\$2,793,000) for initial operation and no additional fund.

10.2. The project is profitable.

Table M-11-1

Cheongju Hospital (150 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st - 10th year)

Unit : ₩1,000
1\$ = 480 won

Category	1	2	3	4	5	6	7	8	9	10
Insurance	453,422	598,164	706,376	814,598	922,822	1,013,015	1,255,543	1,498,071	1,740,599	2,001,128
Private	811,744	735,125	742,357	749,579	756,819	782,950	725,353	504,685	395,957	249,258
Inpatient	1,000,285	1,051,285	1,152,952	1,254,619	1,356,286	1,457,954	1,533,618	1,609,282	1,684,946	1,760,610
Outpatient	264,881	282,004	295,781	309,558	323,335	337,111	395,278	413,444	451,610	489,776
Total (\$000)	1,265,166 (2,636)	1,333,289 (2,778)	1,448,733 (3,018)	1,564,117 (3,259)	1,679,621 (3,499)	1,795,065 (3,740)	1,908,896 (3,977)	2,002,726 (4,172)	2,136,556 (4,576)	2,250,386 (4,688)

Table M-11-2

Cheongju Hospital (150 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st - 10th year)

Year	Unit: ₩1,000 1\$ = 480 won									
	1	2	3	4	5	6	7	8	9	10
Personnel										
Physician	509,656	524,946	540,694	556,915	573,622	590,831	608,556	626,813	645,617	664,985
Nurse	207,144	213,358	219,759	226,351	233,142	240,136	247,340	254,760	262,403	270,275
Medical assistant	149,526	154,011	158,632	163,391	168,292	173,341	178,541	183,898	189,415	195,097
Mgt. and ad.	26,327	270,096	27,909	28,746	29,608	30,497	31,411	32,354	33,324	34,324
Technical service	33,636	33,615	34,623	35,662	36,732	37,834	38,969	40,138	41,342	42,582
and others	93,203	95,999	98,879	101,845	104,900	108,047	111,289	114,627	118,066	121,608
Pharmacy	377,019	397,320	431,722	466,124	500,527	534,929	568,850	602,772	636,694	670,615
Food & clothes	67,164	69,177	71,160	73,142	75,124	77,107	78,292	79,477	80,662	81,847
Heating & utilities	62,275	63,717	66,842	69,968	73,094	76,219	78,389	80,558	82,727	84,897
Maintenance	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520
Bldg.	5,536	5,536	5,536	5,536	5,536	5,536	5,536	5,536	5,536	5,536
Equip.	12,984	12,984	12,984	12,984	12,984	12,984	12,984	12,984	12,984	12,984
Others	48,518	49,642	52,077	54,512	56,947	59,382	61,072	62,763	64,453	66,143
Total (\$000)	1,083,152 (2,257)	1,123,322 (2,340)	1,181,015 (2,460)	1,239,183 (2,582)	1,297,834 (2,204)	1,356,988 (2,827)	1,413,982 (2,946)	1,420,903 (3,064)	1,528,673 (3,185)	1,587,007 (3,326)

Table M-11-3

Cheongju Hospital (150 beds)
ECONOMIC FORECASTING : PRO FORMA INCOME STATEMENTS
 (1st - 10th year)

Unit : ₩1,000
 1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Total Revenue	1,265,166	1,333,289	1,448,733	1,564,177	1,679,621	1,795,065	1,908,896	2,022,726	2,136,556	2,250,386
Total Expense	1,083,152	1,123,322	1,181,015	1,239,182	1,297,834	1,356,988	1,413,982	1,470,903	1,528,673	1,586,027
Operating Income	182,014	209,967	267,718	324,996	381,787	438,077	494,914	551,823	607,883	663,379
Depreciation	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224
Interest	152,887	152,887	152,887	152,887	137,587	120,937	102,637	82,537	60,637	36,487
Net profit	67,097	39,144	18,607	75,885	147,976	220,916	296,053	373,062	451,022	530,668
(\$000)	(140)	(82)	(39)	(158)	(308)	(460)	(617)	(777)	(940)	(1,106)

* : deficit

Table M-11-4 Cheongju Hospital (150 beds)
ECONOMIC FORECASTING : PRO FORMA BALANCE SHEETS
(1st - 10ty year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Current Assets	496,608	553,688	668,519	680,128	748,528	873,278	1,054,805	1,293,041	1,587,737	1,937,729
Equipment	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366
Depr.	51,937	103,874	155,811	259,685	259,685	311,622	363,559	415,496	467,433	519,366
Bldg.	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328	2,214,328
Depr.	44,287	88,574	132,861	177,148	221,435	265,732	310,009	354,296	398,583	442,870
Land	158,800	158,800	158,800	158,800	158,800	158,800	158,800	158,800	158,800	158,800
Total	3,292,778	3,253,734	3,272,341	3,187,726	3,159,902	3,188,425	3,273,731	3,415,343	3,614,215	3,867,983
Current liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	1,500,000	1,500,000	1,500,000	1,339,500	1,163,700	971,250	760,500	509,650	276,900	0
Foreign loan	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366	519,366
Capital	1,340,609	1,340,609	1,340,609	1,340,609	1,340,609	1,340,609	1,340,609	1,340,609	1,340,609	1,340,609
Retained Earnings	0	67,197	106,241	87,634	11,749	136,227	357,203	653,256	1,026,318	1,477,340
Net profit	67,197	39,144	18,607	75,885	147,976	220,976	296,053	373,262	451,022	530,668
Total (\$000)	3,292,778 (6,860)	3,253,734 (6,779)	3,272,341 (6,817)	3,187,726 (6,641)	3,159,902 (6,583)	3,188,425 (6,643)	3,273,731 (6,820)	3,415,943 (7,117)	3,614,215 (7,530)	3,867,983 (8,058)

Table M-12-1

Cheongju Hospital (150 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
1. Operating and Maintenance										
1.1 Personnel	509,656	524,946	540,694	556,915	573,622	590,831	628,556	626,813	645,617	664,985
1.2 Other expenses	554,976	579,856	621,801	663,746	705,692	747,637	786,906	843,903	864,536	885,302
1.3 Maintenance	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520	18,520
1.4 Interest	152,887	152,887	152,887	152,887	137,587	120,937	102,637	82,537	60,637	36,487
1.5 Operating expenses	1,236,039	1,276,902	1,333,902	1,392,068	1,435,401	1,477,865	1,516,619	1,553,440	1,589,310	1,623,494
1.6 Depreciation	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224	96,224
1.7 Operating cost	1,332,263	1,372,433	1,430,126	1,488,292	1,531,645	1,574,089	1,612,843	1,649,664	1,685,534	1,719,718
2. Revenue										
2.1 Outpatient	264,881	282,004	295,781	309,558	323,335	337,111	395,278	413,444	451,610	489,776
2.2 Inpatient	1,000,285	1,051,285	1,152,952	1,254,619	1,356,286	1,457,954	1,533,618	1,609,282	1,684,946	1,760,610
2.3 Other										
2.4 Whole revenue	1,265,166	1,333,289	1,448,733	1,564,177	1,679,621	1,795,065	1,908,896	2,022,726	2,136,556	2,250,386
3. Calculation										
3.1 Operating incomes	*67,097	*39,144	*18,607	75,885	147,976	220,976	296,053	373,062	451,022	530,668
3.2 Accumulation	67,097	106,241	87,634	11,749	136,227	357,203	653,256	1,026,318	1,477,340	2,008,008
3.3 Income tax										
4. Cash flow calculation										
4.1 Gross cash flow	29,127	57,080	114,831	172,109	244,200	317,200	392,277	469,286	547,246	626,892
4.2 Invested capital	0	0	0	0	0	0	0	0	0	0
4.3 Payoff/discharge	0	0	0	160,500	175,800	192,450	210,750	230,850	252,750	276,900
4.4 Net cash flow	29,127	57,080	114,831	11,609	68,400	124,750	181,527	238,436	294,496	1,937,729
4.5 Accumulation of 4.4	29,127	86,207	201,038	212,647	281,047	405,797	587,324	825,760	1,120,258	1,470,248
((\$000))	(60)	(180)	(419)	(443)	(585)	(845)	(1,223)	(1,720)	(2,334)	(3,063)

* : deficit

Appendix Table A 4-1

			<u>Amount</u>
No. 1: Land estate cost			
1.1.	Value: <u>quantity (Won/M²)</u>		<u>Whole Amount</u>
	21,000 (7,562 Won/M ²)		
1.2.	Acquisition cost		₩158,800,000
Total Sum of No. 1			₩158,800,000
No. 2: Site preparation cost			
2.1.	Public opening		₩3,000,000
2.2.	Non-public opening		₩18,000,000
2.3.	Other cost (i.e. taxes)		
Total Sum of No. 2			₩21,000,000
No.3: Construction cost			
3.1.	Building (due to room and space program plus traffic ways)		₩1,280,000,000
3.2.	Installations (Sewage, Water, Heating, Electricity ...)		₩276,000,000
3.3.	Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators ...)		₩365,000,000
Total Sum of 3.1 - 3.3			₩1,921,000,000

and:

a) Classification to space-content:

3.1 - 3.3 :	$\frac{m^3}{m^3}$	<u>Whole Amount</u>	<u>Outside Equipment</u>
36,000	50,000	₩1,800,000,000	₩121,000,000
Sum of 3.1 - 3.3			

b) Classification to space

3.1 - 3.3 :	$\frac{m^2}{m^2}$	<u>Whole Amount</u>	
900	200,000	₩1,800,000,000	₩121,000,000
Sum of 3.1 - 3.3			

c) Classification to beds

3.1 - 3.3	<u>No. of beds</u>	<u>Won/Bed</u>	<u>Whole Amount</u>	
	150	12,000,000	₩1,800,000,000	₩121,000,000
Sum of 3.1 - 3.3				

No. 4:	Equipment	
4.1.	Medical Equipment	₩519,366,000
4.2.	Non-medical Equipment	₩121,000,000
	Total Sum of 4.1 + 4.2	₩640,366,000
No. 5:	Outside Equipment	₩121,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	₩377,234,000
No. 7:	Engineering Fee	₩76,800,000
No. 8:	Dormitory	₩74,528,000

N. POHANG

DIAGNOSIS

N. POHANG HOSPITAL

1. Geographical Features

1.1 Pohang was a small fishing port located on the southeastern coast of the Korean peninsula. The small fishing port has grown rapidly as the nation's steel industrial center by the development of the Pohang Iron and Steel Co (POSCO) plant under the Second and Third Five-Year Economic Development Plans. The annual production capacity of POSCO increased from 1,030,000 tons of crude steel in 1973 to 2,600,000 tons in 1976 and to 5,500,000 tons in 1978. The production capacity of POSCO will increase to 8,500,000 tons by 1981. ^{1/}

The Pohang Industrial Complex has also 46 steel-related industrial plants and several other affiliated industries.

1.2 In the course of a rapid industrialization, Pohang has suffered from serious social problems such as the rapid increase in population, shortage of housing, and lack of medical and public health facilities.

1.3 Under such situations, the Catholic Convent of the Sacred Heart of Jesus in Pohang opened a 100-bed Pohang St. Mary Hospital in cooperation with the Catholic Medical Center in Seoul in June 1977. In order to provide medical services for the employees in the Pohang Industrial Complex, the hospital is located in Daejam-dong, Youngil Myon, Youngil Gun. The location of the hospital is at the triangular point within 4 Km a Pohang City 3 Km from the Industrial Complex, and is also adjacent to the Hyoja Housing Area of POSCO.

1.4 It is doubtless that the demand for medical services in the area will increase rapidly in line with the expansion of Pohang City and the expansion of the Health Insurance Program. In particular, as the Pohang St. Mary Hospital is located conveniently, the residents in adjacent Wolseong Gun and Youngcheon Gun have increasingly utilized the Hospital. Therefore, the Pohang St. Mary Hospital has planned to expand the hospital.

2. Medical Service Catchment Area of the Pohang Hospital

2.1 Geographically, Pohang borders on Youngduck Gun and Andong Gun on the north, Youngcheon Gun and Daegu City to the west, and Gyungju City and Ulsan City to the south. Therefore, the medical service areas of the projected Pohang Hospital will be within this area (Figure N-1).

2.2 The proposed Pohang Hospital could be developed in the form of either an independent hospital or an expansion of the existing Pohang St. Mary Hospital. In any case, the medical service area of the Hospital could be determined by analyzing utilization rates of the existing Pohang St. Mary Hospital.

^{1/} The Brochure of POSCO, P.4, 1974.

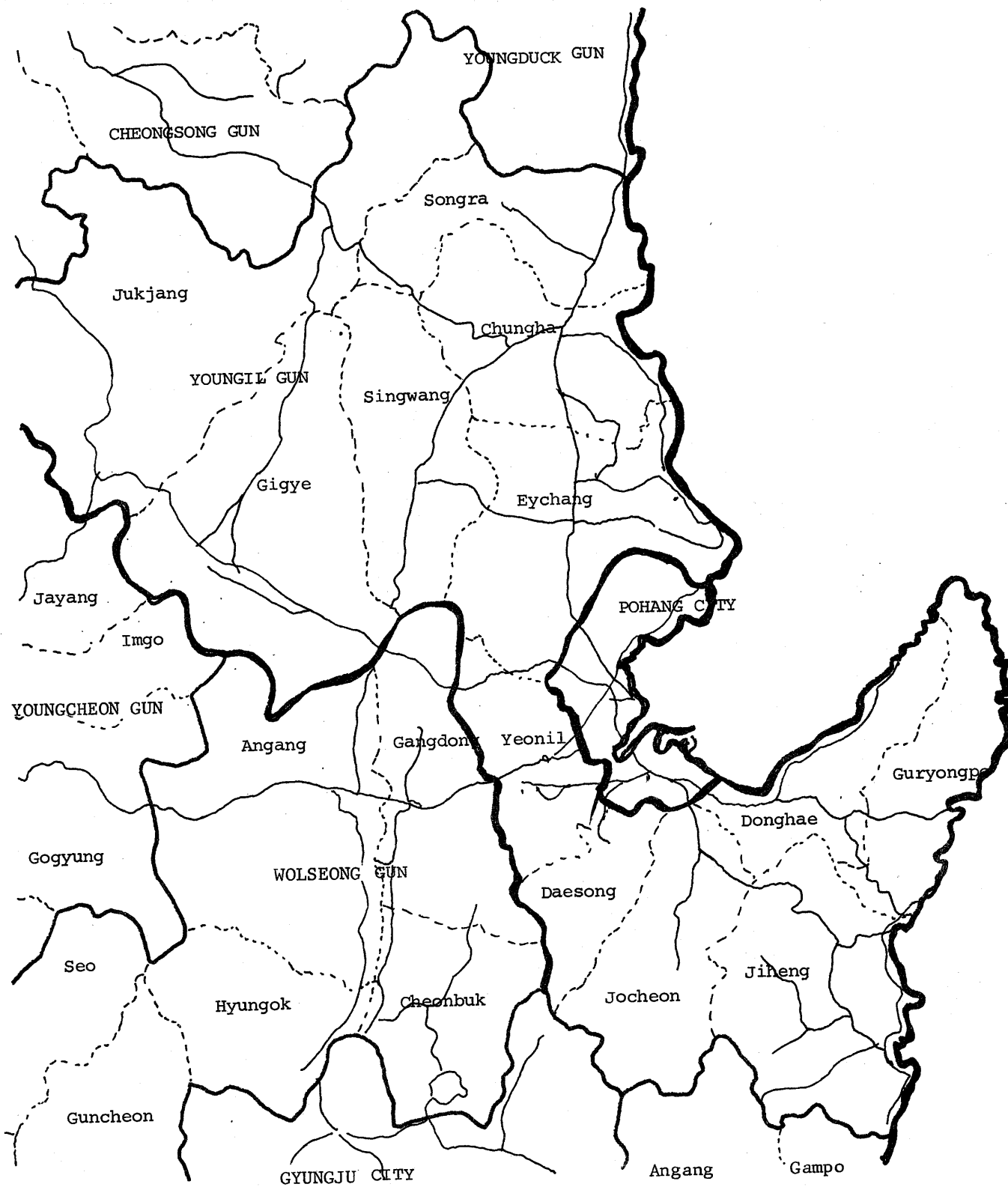


Figure N-1. The Pohang Map

2.3 The distribution of inpatients of the Pohang St. Mary Hospital by area is as follows; 44.8% of the total patients are from Youngil Gun where the Hospital is located (including the 12.2% by Hyoja-ri residents, 36% from Pohang City, 6.4% from Wolseong Gun, 2.6% from Youngduck Gun, and 2.2% from the residents in Uljin Gun (Table N-1). The distribution of outpatients also shows similar composition, with the largest 52.5% of the patients from the adjacent Youngil Gun (including the 32.9% from the residents in Hyoja-ri where the housing for the employees of POSCO is located), and 38.3% from Pohang City (Table N-2).

2.4 The Pohang St. Mary Hospital has estimated its target population as 740,000 residing in Pohang City, Youngil Gun, Wolseong Gun, Youngduck Gun and Uljin County.^{1/} However, the estimated number should be modified for the following reasons.

2.4.1 The Asan Foundation established the 100-bed Youngduck Hospital in Yonghae Myon, Youngduck Gun in May 1975. Therefore, Youngduck Gun and adjacent Uljin Gun should be included in the medical service area of the Youngduck Hospital. In this regard, the above two Guns should be excluded from the catchment areas of the proposed Pohang Hospital.

2.4.2 As a large part of Wolseong Gun is contiguous to Gyungju City, the area belongs to the cosmopolitan area of Gyungju City. Therefore, most of Wolseong Gun should be excluded from the catchment area. However, Kampo Eup, Gyungok Myon and Jayang Myon of Wolseong Gun, which are not contiguous to Gyungju City, can be included within the catchment area of the Hospital.

2.4.3 Part of the doctorless Cheongsong Gun and Youngcheon Gun, which are located conveniently to Pohang City, can be included in the medical service catchment area of the proposed Hospital.

2.5 The Pohang Hospital will have the following medical service areas: Pohang City, the whole area of Youngil Gun, Gampo Eup, Angang Eup, Gyungok Myon, Gangdong Myon of Wolseong Gun, Cheongsong Myon, Jipum Myon, Budong Myon, Bunam Myon, Anduck Myon, Hyunseu Myon and Hyundong Myon of Cheongsong Gun, Jayang Myon, Imgo Myon, and Kogyung Myon of Youngcheon Gun.

3. Estimation of Target Population

3.1 The population in the medical service areas of the proposed Hospital is as shown in Table N-3.

3.2 The population of Pohang City totals above 170,000, which represents an increase of twofold over 1971. As the POSCO expands its production capacity under the Fourth Phase Expansion Program, the population of Pohang City is expected to increase at the same rate.

3.3 In contrast with the nationwide population in the rural areas, decrease the population in Youngil Gun has recently increased due to the population influx

^{1/} Report on the Status of Pohang St. Mary Hospital, May 1979.

Table N-1. Distribution of Inpatient Cases by Area, Pohang Sacred Heart Convent Hospital (in 1978)

Month	Pohang	Youngil	Youngduck	Uljin	Woelsung	Other	Total
Jan.	71	87	3	8	5	15	189
Feb.	63	63	1	6	6	23	162
Mar.	69	77	4	3	14	13	180
Apr.	80	65	16	2	3	6	172
May	86	129	5	5	13	19	257
June	78	81	7	3	15	10	194
July	86	102	4	5	19	13	229
Aug.	84	99	1	4	15	16	219
Sept.	68	139	6	7	22	16	258
Oct.	84	94	3	1	25	21	228
Nov.	48	91	1	5	16	27	188
Dec.	79	86	13	5	7	21	211
Total	896	1,113	64	54	160	200	2,487
(%)	(36)	(44.8)	(2.6)	(2.2)	(6.4)	(8.0)	(100.0)

Table N-2. Distribution of Outpatient Cases by Area, Pohang Sacred Heart Convent Hospital (in 1978)

Month	Pohang	Youngil	Youngduck	Uljin	Woelsung	Other	Total
Jan.	1,516	1,795	25	33	114	92	3,575
Feb.	1,390	1,729	17	10	102	97	3,345
Mar.	1,606	2,214	36	22	127	228	4,233
Apr.	1,786	2,319	58	30	166	235	4,594
May	2,249	2,577	33	14	162	235	5,270
June	1,900	2,587	33	10	150	204	4,884
July	1,751	2,525	15	11	158	231	4,691
Aug.	2,049	2,752	36	8	155	336	5,336
Sept.	1,585	2,330	32	2	120	350	4,419
Oct.	1,455	2,189	6	8	124	226	4,008
Nov.	1,366	2,221	7	4	128	198	3,924
Dec.	1,276	2,058	8	1	115	236	3,694
Total	19,929	27,296	306	153	1,621	2,668	51,913
(%)	(38.3)	(52.5)	(0.6)	(0.3)	(3.1)	(5.2)	(100.0)

Table N-3. Population Trend within the Pohang Hospital Service Area

Year	Pohang	Yeongil	Wolseong <u>1/</u>	Youngcheon <u>2/</u>	Total
1971	84,615	-	-	38,522	-
1972	92,590	-	-	38,596	-
1973	108,854	196,026	45,918	-	-
1974	123,335	198,908	47,519	38,378	408,140
1975	134,404	193,983	47,878	36,492	412,757
1976	151,891	194,148	47,233	35,984	429,256
1977	170,138	195,969	48,440	34,538	449,085

1/ Only Gangdong Myon and Angang Myon are included.

2/ Only Jayang Myon, Imgo, and Gogyung Myon are included.

Source: Statistical Year Book, Pohang, Yeongil, Wolseong and Youngcheon, 1972-1978.

into the industrially expanding Pohang City. The population increase is expected to continue as long as Pohang City expands.

3.4 The population in parts of Wolseong Gun, Youngcheon Gun and Cheongsong Gun, which are included in the medical service areas, have recently decreased, and such a trend will continue for some time.

Based on the above population trend, the target population is estimated as shown in Table N-4. The population now stands at 540,000 and it will increase to 580,000 in 1982 when the proposed Pohang Hospital is opened for medical services. The population is expected to increase by 10,000 annually to a total of 680,000 by 1991.

3.5 The number of the insured under the Employees Health Insurance Program in Pohang area is as follows (Table N-5). There are about 50,000 insured people under the 4 health insurance associations, including 18,955 subscribers and dependents.

4. Pattern of Diseases

4.1 The general pattern of diseases is similar to that of other areas. However, there will be some prevalent diseases related to the steel industry among the employees which are characteristic in this area. The status of medical treatment of the two large medical insurance associations in the area in 1978 is as follows.

4.2 The pattern of diseases of the insured under the POSCO Health Insurance Program by age and sex is as shown in Table N-6.

4.3 The disease pattern of the insured under the Health Insurance Program of Pohang Steel Industrial Complex is as shown in Table N-7.

4.4 The disease pattern of the above two medical insurance associations is almost the same (Table N-8). The respiratory diseases accounted for the largest 44.4% of the total; digestive trouble, 14.9%; infectious and parasitic diseases, 10.5%; neuro-sensory organ diseases, 7.4%; and skin diseases, 6.8%. As these statistics include diseases of both subscribers (37.2%) and their dependents (62.8%) the statistics of the industrial workers alone could be obtainable by referring to the data of the attached dispensary.

4.5 The result of the medical examination for the POSCO employees is as follows (Table N-9). Tuberculosis patients accounted for the largest 1% of the total employees followed by hypertensive heart diseases with 0.9%, hearing disturbance with 0.8% and eye trouble with 0.2%. The patients suffering from the above diseases accounted for 2.9% of the total industrial workers.

4.6 The number of outpatients at the dispensary of POSCO in 1978 is as follows (Table N-10). In case of the employees of POSCO, respiratory diseases accounted for the largest 36.8% of the total, followed by traumatic injury with 31.4%. The great percentage of traumatic injuries is attributable to the frequent incidences of industrial accidents in the plant.

5. Estimation of the Requirement of Hospital Beds

5.1 The utilization rate of medical services by the insured under the Medical Insurance Program of POSCO and the Pohang Steel Complex in 1978 is as follows (Table N-11). As a whole, the annual hospitalization rate is 4.5% with an average of stay of 7.1 days. The utilization rate of medical services by the POSCO employees amounted to 3.8%, which is threefold the 1.1% of the employees in the Pohang Steel Complex. The difference of the hospital utilization rates between the two groups is attributable to the employees characteristics such as age and educational level. The average age and educational level of the POSCO employees are much higher than those of the Pohang Steel Industrial Complex. Also, Table N-11 shows the hospitalization rate of the dependents was more than twofold that of the subscribers.

5.2 As shown in Table N-11, the hospitalization rate in the Pohang area is higher than the nationwide average. In 1978, 4.5% of the medically insured persons were hospitalized in the Pohang area as against the national average of 3.5%. However, as the average length of stay in Pohang is 7.3 days compared with the national average of 9 days, the product of the two variables is almost equivalent (32.85 days: 31.5 days). 1/

1/ The total inpatient days in the hospital can be obtained by multiplying the hospitalization rate by the average length of stay. In the case of Pohang the total length of stay in hospital per 100 persons will be 32.85 days (7.3 days x 4.5). In the case of national average, 31.5 days (9 days x 3.5).

Table N-4. Estimates of Population within the Pohang Hospital Service Area

Year	Pohang	Yeongil	Wolseong	Cheongsong	Youngcheon	Total
1979	193,223	197,621	71,297	47,964	33,989	544,094
1980	206,526	198,569	71,063	46,886	33,376	556,420
1981	219,663	199,504	70,831	45,821	32,771	568,590
1982	232,640	200,429	70,603	44,769	32,173	580,614
1983	245,459	201,342	70,377	43,730	31,583	592,491
1984	258,124	202,244	70,154	42,704	30,999	604,225
1985	270,640	203,136	69,934	41,689	30,423	615,822
1986	283,009	204,017	69,716	40,686	29,853	627,281
1987	295,236	204,887	69,501	39,695	29,289	638,608
1988	307,322	205,749	69,288	38,716	28,733	649,808
1989	319,272	206,600	69,078	37,747	28,182	660,879
1990	331,089	207,442	68,870	36,789	27,638	671,828
1991	342,775	208,274	68,664	35,842	27,099	682,654

$$Y = a + b \log x$$

r ² :	0.99	0.81	0.38	0.70	0.83
a :	-4,427,755.74	-131,551.57	152,648.26	422,517.99	246,877.58
b :	1,057,565.75	75,335.03	-18,618.24	-85,721.09	-48,722.05

Table N-5. Members of Employees Health Insurance Program, Pohang, 1979

Health Insurance	No. of Establishments	Products	Subscriber	Dependents	Total
Pohang Steel	34	Steel manufacturing	5,939	9,090	15,029
Dong Il	1	Transportation	475	1,125	1,600
Sam Poong	1	Manufacturing	704	698	1,402
POSCO	1	Metal refinery	11,837	20,101	31,938
Total	37		18,955	31,014	49,969

Source: The Roster of Health Insurance Associations Ministry of Health and Social Affairs, 1979.

Table N-6. Disease Classification by Age and Sex for the POSCO Health Insurance Members, 1978

Disease Classifica- tion	0		1-4		5-14		15-24		25-34		35-44		45-54		55-64		65 over		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	267	227	2,543	1,677	365	264	172	66	583	292	124	58	28	31	40	25	16	15	4,138	2,655
2	0	7	9	7	4	3	9	3	36	28	2	9	8	19	31	13	3	1	102	84
3	0	0	1	3	2	1	2	0	12	25	2	2	2	7	5	25	0	2	26	66
4	4	0	4	0	1	0	2	10	17	30	2	5	0	1	3	3	0	0	33	49
5	1	0	8	10	9	10	38	24	147	222	31	42	6	36	9	25	2	24	251	373
6	168	95	452	339	244	302	311	112	1,095	605	261	116	22	52	23	58	24	16	2,770	1,695
7	1	0	8	15	14	4	25	14	134	85	38	15	15	28	19	37	12	21	266	219
8	807	582	10,804	7,899	2,102	1,552	385	204	1,250	853	365	167	22	49	35	66	17	30	15,789	7,402
9	61	25	1,186	866	654	563	468	281	2,195	1,675	505	338	69	118	80	120	38	41	5,256	4,027
10	9	0	59	62	52	31	359	372	1,351	1,490	172	192	11	40	8	38	3	10	2,024	2,235
11	0	0	0	0	0	0	0	713	0	2,106	0	79	0	0	0	0	0	0	0	2,898
12	95	51	892	675	317	287	260	111	816	478	143	54	15	32	13	22	8	7	2,559	1,717
13	0	1	35	27	35	8	44	22	114	106	25	32	6	23	21	31	2	22	282	272
14	0	1	9	11	2	2	1	3	4	3	1	0	0	1	2	1	0	2	19	24
15	25	21	7	4	0	1	0	1	2	3	1	1	0	1	1	1	1	1	37	34
16	2	2	7	12	11	10	18	8	54	50	22	14	7	3	11	10	10	7	142	116
17	13	11	440	307	267	127	261	47	947	222	162	41	12	26	15	25	9	15	2,126	821
	1,453	1,017	16,464	11,914	4,249	3,165	2,355	1,991	8,757	8,273	1,856	1,165	223	467	316	500	145	195	35,818	28,687

Source: Data from the POSCO Health Insurance Association, 1978.

Table N-7. Disease Classification by Age and Sex for the Pohang Steel Complex Health Insurance Members, 1978

Disease Classifica- tion	0		1-4		5-14		15-24		25-34		35-44		45-54		55-64		65 over		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	44	36	663	495	159	116	103	74	165	65	80	18	17	7	8	13	5	10	1,244	834
2	0	0	3	5	2	5	4	2	4	11	4	4	6	0	0	0	1	1	24	28
3	1	0	1	0	3	0	0	2	3	3	5	2	1	0	0	4	0	1	14	12
4	1	0	1	0	0	2	2	3	0	9	4	2	1	1	0	0	1	0	10	17
5	0	1	3	5	6	1	11	14	42	57	20	29	2	5	1	9	0	6	85	127
6	49	62	210	166	152	122	173	101	293	180	89	69	14	11	7	15	3	1	990	787
7	0	0	84	69	17	15	5	8	40	27	16	6	3	5	13	11	6	4	184	145
8	184	145	2,870	2,107	837	523	190	77	370	196	148	70	23	19	14	23	9	12	4,645	3,172
9	120	115	675	489	319	190	142	134	442	322	179	107	38	16	16	25	4	17	1,935	1,415
10	2	0	39	39	38	23	64	83	256	272	47	59	28	9	2	4	1	4	477	493
11	0	0	0	0	0	0	0	240	0	559	0	80	6	1	0	0	0	0	0	880
12	36	16	246	211	132	105	111	108	251	127	78	30	19	4	3	6	1	3	877	610
13	0	0	13	5	10	16	10	13	13	20	23	4	1	3	0	8	2	2	72	71
14	0	0	1	4	0	0	0	0	0	0	1	1	0	0	0	0	2	0	4	5
15	5	6	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	7	9
16	1	0	2	2	3	2	6	7	11	11	4	10	2	2	0	4	0	0	29	38
17	5	2	110	56	98	27	78	30	190	52	75	12	15	4	2	3	0	0	579	186
Total	448	383	4,928	3,654	1,776	1,147	900	957	2,080	1,912	773	503	170	87	66	125	35	61	1,176	8,829

Source: Data from the Health Insurance Association of the Pohang Steel Complex, 1978.

Table N-8. Number of Cases by Disease Classification for the Health Insurance Member of POSCO and Pohang Steel Company, 1978

Disease Classification	POSCO		Pohang Steel		Total	
	No. of Cases	%	No. of Cases	%	No. of Cases	%
1	6,793	10.5	2,078	10.4	8,871	10.5
2	186	0.3	52	0.3	238	0.3
3	92	0.1	26	0.1	118	0.1
4	82	0.1	27	0.1	109	0.1
5	624	1.0	212	1.1	836	1.0
6	4,465	6.9	1,777	8.9	6,242	7.4
7	485	0.8	329	1.6	814	1.0
8	27,189	42.1	7,817	39.1	35,006	41.4
9	9,283	14.4	3,350	16.7	12,633	14.9
10	4,259	6.6	970	4.8	5,229	6.2
11	2,898	4.5	880	4.4	3,778	4.5
12	4,276	6.6	1,487	7.5	5,763	6.8
13	554	0.9	143	0.7	697	0.8
14	43	0.1	9	0.0	52	0.1
15	71	0.1	16	0.1	87	0.1
16	258	0.4	67	0.4	325	0.4
17	2,947	4.6	765	3.8	3,712	4.4
Total	64,505	100.0	20,005	100.0	84,510	100.0

Source: From the Tables N-6 and N-7.

Table N-9. The Record of Health Examination for the Employees, POSCO, 1973-1975

Disease	1973	(%)*	1974	(%)*	1975	(%)*	Total (%)*
Tuberculosis	24	(0.9)	62	(1.4)	43	(0.8)	129 (1.0)
Hypertension	39	(1.2)	70	(1.6)	14	(0.3)	123 (0.9)
Hearing disturbance	24	(0.8)	27	(0.6)	49	(0.6)	100 (0.8)
Visual abnormality	4	(0.1)	10	(0.2)	13	(0.3)	27 (0.2)
Diabetes mellitus	2	(0.06)	3	(0.1)	1	(0.02)	6 (0.05)
Nephritis	-		1	(0.02)	2	(0.04)	3 (0.05)
Total	97	(3.0)	173	(3.9)	102	(2.3)	392 (2.9)

* The percent indicates the proportion to the total number of POSCO employees.
Source: Data from the Attached Dispensary of POSCO, 1973-1975.

Table N-10. Number of Outpatients in POSCO Clinic, 1978

Disease	No. of Cases	%
Disease of Respiratory Tract.	11,846	36.8
Disease of Circulatory System	81	0.2
Disease of Digestive System	4,406	13.7
Trauma	10,099	31.4
Others	5,745	17.9
Total	32,127	100.0

Source: POSCO Medical Care Development Plan, 1976.7. p.5.

Table N-11. Utilization Data for the POSCO and Pohang Steel Complex Health Insurance Members, 1978

Members		No. of Member-ships	In-patient Cases	Inpatient Rate/Member/Year	Inpatient Days	Average Length of Stay
POSCO	Subscriber	12,088	411	0.0340	3,126	7.6
	Dependents	20,103	1,072	0.0533	6,882	6.4
	Subtotal	32,191	1,483	0.0461	10,008	6.7
Pohang Steel Complex	Subscriber	6,800	73	0.0107	1,496	20.5
	Dependents	11,766	706	0.0600	5,116	7.2
	Subtotal	18,566	779	0.0420	6,612	8.5
Total	Subscriber	18,888	484	0.0256	4,622	9.5
	Dependents	31,869	1,778	0.0558	11,998	6.7
	Total	50,757	2,262	0.0446	16,620	7.3

Source: Data from the Performances of POSCO and Pohang Steel Complex Health Insurance, 1978.

Therefore, for the sake of calculation or the requirement of hospital beds in other areas, this study used the national average hospitalization rate of 3.5% and the average length of stay of 9 days.

5.3 The number of the insured under the Health Insurance Program and Medicaid in the medical service areas of the Pohang Hospital is as shown in Table K-12.

The medically insured people totaled 112,036, including 77,872 subscribers and dependents and 34,164 medicaid beneficiaries. These numbers accounted for 20.6% of the target population. It is estimated that the population in Pohang will increase by 3,000 in 1981 when the POSCO expands its production capacity and by an additional 6,000 in 1982 when the steel-related industry estate is constructed. By 1985, when the Pohang Industrial Estate is completed, the population is expected to increase an additional 3,000-4,500 people.

Table N-12. Number of the Insured and Medicaid Beneficiaries within the Pohang Hospital Service Area

Area	Health Insurance (1)				Medicaid Beneficiaries (2)				Total (1)+ (2)		
	Public Officials		Private School Teachers		Industrial Workers		Indigent Group			Low Income Group	
	A	B	A	B	A	B	A'	B'			
Pohang	1,483	4,449	961	2,883	18,955	31,014	386	463	1,259	2,518	64,371
Yeongil	868	3,472	1,040	4,160	-	-	1,693	2,228	2,977	10,439	26,877
Wolseong	246	812	353	1,871	-	-	485	865	591	2,079	7,302
Youngcheon	140	560	230	920	-	-	231	490	310	1,431	4,312
Cheongsong	263	1,052	428	1,712	-	-	420	267	1,029	4,003	9,174
Total	3,000	10,345	3,012	11,546	18,955	31,014	3,215	4,313	6,166	20,470	112,036

A: Subscriber
B: Dependent

A': Head of Household
B': Dependents

Source: Statistical Year Book, Pohang, Yeongil, Wolseong, Youngcheon and Cheongsong, 1978.

5.4 The number of medical facilities in the areas is as shown in Table N-13. There are 4 hospitals with 241 beds in Pohang City; the St. Mary Hospital with 100 beds, Sunrin Hospital with 80 beds, Donggwang Hospital with 46 beds and Christian Hospital with 35 beds. There are also 34 doctors' offices with 202 beds. The combined total number of medical facilities amounted to 39 establishments with 543 beds.

The number of hospital beds per 1,000 persons in Pohang averaged 2.8, which is higher than the national average. In the rural areas exists 74 beds owned by private physicians, however, there are no hospital-level medical facilities.

Thus, there are a total of 61 medical facilities with 617 beds within the catchment area of the Hospital. Based on the figure, the number of hospital beds per 1,000 persons in the whole catchment area becomes only 1.1.

5.5 Applying the same formula used in other hospitals of this study, the shortage of hospital beds is estimated as follows (Table N-14). If the construction of the Hospital begins in 1980, it will open in 1981. The additional requirements of hospital beds in 1981 will be 109 beds (low estimate, 74 beds; high estimate, 144 beds), 136 (low estimate, 101 beds; high estimate, 171 beds) in 1982, and at least 150 beds from 1983 onward when the Hospital will operate at normal capacity.

5.6 The above estimate has not assumed any possibility that the existing hospitals would expand its bed-capacity and a new hospital would be constructed. In addition, the occupancy rate of the existing beds owned by private physicians is assumed to decrease steadily by the development of a medical service delivery system under which the medical function of hospitals will be coordinated with that of clinics.

5.7 As Pohang City has a high rate of hospital beds to population, it is desirable to place the Pohang Hospital in Hyoja-ri, Youngil Gun, where the Pohang St. Mary Hospital is located, rather than in downtown Pohang City. ^{1/} In such a case, the proposed Hospital will serve as an expansion of the Pohang St. Mary Hospital, bringing about an economic utilization of hospital manpower and equipment.

6. Scope of Medical Treatment and Allocation of Hospital Beds by Department

6.1 Currently, the Pohang St. Mary Hospital has 8 clinical departments (internal medicine, pediatrics, general surgery, orthopedic, neurosurgery, obstetrics and gynecology, otolaryngology, and dental), and 3 supporting departments (radiology, anesthesiology, and clinical pathology).

In case that the new Hospital with 100 beds is constructed in Pohang City, the new Hospital will have the same number of departments and allocation of

^{1/} The Pohang St. Mary Hospital has secured two hospital sites, one in Hyoja-ri, Youngil Gun, and the other in downtown Pohang City.

hospital beds by department as for the St. Mary Hospital.

However, in case that the St. Mary Hospital is expanded to have 200 beds, the Hospital is expected to add dermatology urology and a psychiatry department to the existing departments. The Hospital is also expected to use efficiently interns and resident physicians.

6.2 About 20% of the total employees in the Pohang Industrial Complex are residing in Youngil Gun, and the rest are living in Pohang City. If Pohang St. Mary Hospital is expanded to have 200 beds, the Hospital should develop into a major general hospital to provide medical services for not only the industrial workers in Pohang but also the people residing in Wolseong Gun, Cheongsong Gun, and part of Youngcheon Gun. Therefore, the Hospital should maintain a sufficient number of medical personnel and equipment to treat the patients who are referred by the private medical facilities in Pohang City. The Pohang St. Mary Hospital has maintained the patient-referral linkage with Patima Hospital and the Gyungbuk University Hospital in Daegu.

6.3 Considering the above factors, it is determined to construct a new 100-bed hospital as a expansion facility for the existing Pohang St. Mary Hospital to have 200 beds.

Of the existing 8 departments, it will not be necessary to maintain the neuro-surgery department because the number of inpatients and outpatients of the department are considerably smaller than those of the orthopedic and general surgery departments (Table N-15). Instead, it will be necessary to set up the ophthalmology, dermatology and urology departments to strengthen the medical services of the Hospital. The other departments should be strengthened by increasing the medical staff thereof. Detailed medical program is shown in Table N-16-1 and N-16-2.

Table N-13. Number of Existing Beds within the Pohang Hospital Service Area

Area	General Hospital			Hospital			Clinic			Total	
	No. of Facilities	No. of Beds	No. of Facilities	No. of Facilities	No. of Beds	No. of Beds	No. of Facilities	No. of Beds	No. of Facilities	No. of Facilities	No. of Beds
Pohang	1	100	4	241	34	202	39	543			
Yeongil	-	-	-	-	11	23	11	23			
Woelsung	-	-	-	-	5	26	5	26			
Youngcheon	-	-	-	-	-	-	-	-			
Cheongsong	-	-	-	-	6	25	6	25			
Total	1	100	4	241	56	276	61	617			

Source: Data from the above health centers, 1979.

Table N-14. Bed Requirements in the Pohang Hospital Service Area

Year	The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		A.L.S.	General Population Excluding the Medicaid	Hospitalization Rate/Person/Year		A.L.S.	Industrial Accident Compensation Insurees	Incidence Rate of Accidents	Admission Rate	A.L.S.	No. of Existing Beds	Occupancy Rate (%)		Bed Requirements	
		I	II			I	II							Hosp. Clinic	Hosp. Clinic		
1979	112,036	0.0349	0.0349	9	432,058	0.0195	0.0239	10	20,000	0.0442	0.055	30	341	274	60	29	94
1980	112,036	0.0366	0.0373	9	444,384	0.0202	0.0247	10	20,500	0.0442	0.055	30	341	274	60	55	123
1981	115,036	0.0385	0.0399	9	453,554	0.0209	0.0254	10	21,000	0.0442	0.055	30	341	274	70	74	144
1982	121,036	0.0404	0.0427	9	459,578	0.0215	0.0262	10	21,500	0.0442	0.055	30	341	274	70	101	171
1983	121,306	0.0424	0.0457	9	471,455	0.0222	0.0269	10	22,000	0.0442	0.055	30	341	274	75	107	187
1984	121,036	0.0445	0.0489	9	483,189	0.0229	0.0277	10	23,500	0.0442	0.055	30	341	274	75	164	250
1985	124,036	0.0468	0.0523	9	491,786	0.0236	0.0284	10	24,000	0.0442	0.055	30	341	274	80	174	264
1986	128,536	0.0491	0.0560	9	498,745	0.0242	0.0292	10	24,500	0.0442	0.055	30	341	274	80	202	302
1991	128,536	0.0627	0.0785	9	554,118	0.0277	0.0335	10	27,000	0.0442	0.055	30	341	274	80	349	498

Table N-15. Inpatient Days by Medical Speciality, Pohang Sacred Heart Convent Hospital, 1978

Medical Specialty	Inpatient Days	%
Internal Medicine	4,938	
General Surgery	2,601	
Orthopedic Surgery	6,242	
Neurosurgery	2,372	
ENT	258	
OB and GYN	1,874	
Pediatrics	2,399	
Dental	156	
Newborn	734	
Total	21,574	

Source: Data from the Pohang Sacred Heart Convent Hospital, 1978.

Table N-16-1. Medical Program of the Pohang Hospital (1981)

1: INPATIENTS

Medical disciplines/ specialties	No. of cases per year	Average length of stay(days)	Occupancy rate of beds(%)	Distribution of beds (number)
Internal medicine	779	9	57.7	33
General surgery	313	14	57.7	21
Orthopedic surgery	175	16	57.7	13
Pediatrics	219	7	57.7	7
OB and GYN	366	6	57.7	11
ENT	101	13	57.7	6
Ophtalmology	46	12	57.7	3
Urology & Dermatology	78	11	57.7	4
Dental	41	10	57.7	2
TOTAL OR AVERAGE	2,118	9.9	57.7	100

2: OUTPATIENTS

Medical disciplines	No. of cases	Visits/case	No. of visits per year
Internal medicine	5,670	2.6	14,742
General surgery	1,225	2.4	2,940
Orthopedics	773	2.8	2,164
Pediatrics	1,600	3.5	5,600
OB and GYN	1,625	3.1	5,038
ENT	1,100	3.2	3,520
Ophtalmology	840	2.5	2,100
Urology	1,200	3.7	4,440
Dental	860	3.3	2,838
TOTAL	14,893		43,382

Table N-16-2. Medical Program of the Pohang Hospital (1981)

3: MEDICAL PERFORMANCES

Kind of performances	No. of performances per year		
	Inpatients	Outpatients	Total
Emergency cases		2,000	2,000
ECG			500
Endoscopies			70
Laboratory diagnostics			
- chemical	1,820	5,219	7,039
- hematological	3,408	8,979	12,387
- serological	1,285	4,520	5,805
- bacteriological	2,702	6,719	9,421
- stool exam.	996	1,680	2,676
- urinalysis	3,011	3,359	6,370
Blood preserves			1,500 pints
Plain X-ray	4,342	8,000	12,342
Mass X-ray	-	2,520	2,520
Fluoroscopies	200	-	200
Operations			
- General surgery	190	210	400
- Ortho. surgery	132	50	182
- OB and GYN	100	200	300
- ENT	62	50	112
- Ophthalmology	39	21	60
- Urology	50	100	150
- Dental	20	150	170
- Total	593	781	1,374
Physiotherapy			2,000
Preventive performances		5,000	5,000

4: FURTHER FUNCTIONS

Function	Quantities per year
Pathology	50
Transportations	700

7. INVESTMENT AND FINANCING PLAN

(All the assumptions for financial studies of the Hospitals in industrial areas are the same as those mentioned in the study of the Ulsan Hospital. So refer to the feasibility study of the Ulsan Hospital to understand complemently.)

7.1. Investment Cost

Table N-17-1 Pohang Hospital (100 beds)
Investment Cost 1/

Category	Local Cost	Foreign Cost
Land estate	₩52,500,000	\$109,375
Site preparation	14,700,000	30,625
Construction	1,321,000,000	2,752,083
Dormitory	50,416,000	105,033
Medical equipment	421,568,000	878,266
Outside equipment	71,000,000	147,917
Contingencies	268,948,000	560,308
Engineering fees	52,840,000	110,083
Working capital	53,000,000	110,417
Total investment	₩2,305,972,000	\$4,804,108

1/ See Appendix A 4-1.

7.2. Financing Plan

Table N-17-2 Pohang Hospital (100 beds)
Sources of Finance

Category	Local Currency	Foreign Currency
Total investment	₩2,305,972,000	\$4,804,108
Foreign loan	421,568,000	878,266
Local loan	1,000,000,000	2,083,333
Capital	884,404,000	1,842,509
Total financing	₩2,305,972,000	\$4,804,108

7.3. Pro-forma Balance Sheet

Table N-17-3

Pohang Hospital (100 beds) Balance Sheet (Beginning of Operation)

Unit: ₩1,000
1\$ = ₩480

Assets		Liabilities	
Cash	301,055	Bank credit	0
Auxiliary goods	11,816	Account payable	0
Pharmaceuticals	9,167	Draft	0
& other material		Loans local	1,000,000
Equipment	421,568	foreign	421,568
Building	1,509,956	Capital	884,404
Land	52,500		
Total (\$000)	2,305,972 (4,804)	Total (\$000)	2,305,972 (4,804)

8. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the study of the Ulsan Hospital)

8.1. Medical Care Fees for the hospitals which had less than 200 beds in 1978 and 1979.

Table N-18-1

MEDICAL CARE FEES IN 1978
(under 200 beds hospitals)

\$1 = ₩480
Unit: Won

Classification	Outpatient Fee per visit	Inpatient Fee per day
Internal medicine	3,400	13,800
General surgery	3,300	13,900
Orthopedic surgery	2,800	11,200
Neuro-surgery	3,500	15,000
Pediatrics	2,100	10,400
OB and GYN	2,800	18,000
ENT	2,800	14,600
Ophthalmology	3,500	12,500
Jaw surgery	3,800	13,100
Neuro-psychiatry	3,200	9,200
Urology	3,200	14,000

Table N-18-2

MEDICAL CARE FEE IN 1979
(under 100 bed hospital)

\$1 = ₩480
Unit: Won

Classification	Outpatient(per visit)		Inpatient (per day)	
	Insurance	Private	Insurance	Private
Internal medicine	3,500	4,200	16,200	21,060
General surgery	3,400	4,080	16,400	21,320
Orthopedic surgery	2,900	3,480	13,200	17,160
Neuro-surgery	3,600	4,320	17,700	23,010
Pediatrics	3,200	3,840	12,300	15,990
OB and GYN	2,900	3,480	21,200	27,560
ENT	2,900	3,480	21,200	27,560
Ophthalmology	3,600	4,320	14,700	19,110
Urology and dermatology	3,300	3,960	16,500	21,450
Neuro-psychiatry	3,300	3,300	10,900	20,020
Jaw surgery	3,900	4,680	15,400	14,170

8.2. Revenue Estimation (See Table N-18-3)

Table N-18-3

Pohang Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
 (1st - 10th year)

Unit : ₩1,000
 1\$ = ₩480

Category	1	2	3	4	5	6	7	8	9	10
Insurance	200,551	350,801	417,830	484,860	551,889	618,919	743,715	868,512	993,309	1,118,016
Private	367,745	311,818	308,508	305,297	302,117	298,776	254,213	209,649	105,085	120,611
Inpatient	405,628	465,123	520,623	576,124	631,624	687,125	731,375	784,626	837,876	900,127
Outpatient	162,668	197,496	205,715	214,033	222,302	230,570	266,553	293,535	320,518	338,500
Total (local)	568,296	662,619	726,338	790,157	853,926	917,659	997,928	1,078,161	1,159,394	1,238,627
(foreign)										
(\$000)	(1,184)	(1,380)	(1,513)	(1,646)	(1,779)	(1,912)	(2,079)	(2,246)	(2,415)	(2,580)

8.3 Estimation of Expenses

8.3.1 Composition of expenses

Table N-18-4

Compositions of Expenses 1/
(Under 200 Beds Hospitals)

Category (A)	A/Total expenses	A/Total revenue
Personnel expense	46.61%	43.82%
Utilities	2.45%	2.37%
Heating	3.05%	2.74%
Clothes and food	4.45%	4.04%
Pharmaceuticals and others	31.03%	24.95%
Equipment and Building	5.94%	4.35%
Maintenance		
Operating expenses 2/	6.47%	6.10%

1/ This statistics is obtained from survey of 6 Hospitals:
Handong Hospital, Song-mo Hospital, Kidok (at Kyung-ju) Hospital,
An-dong Hospital, Han-Joong Hospital and Hankuk Hospital.

2/ Operating expenses include vehicles, administrative expenses,
taxes (except income taxes) and others.

8.3.2 Estimation of Expenses

(See Table N-18-5)

8.4 Pro-forma Income Statement (See Table N-18-6)

8.5 Pro-forma Balance Sheet (See Table N-18-7)

9. ESTIMATION OF CASH FLOW (See Table N-19-1)

10. CONCLUSION FROM FINANCIAL ANALYSIS

10.1 The sponsor should provide ₩884,404,000 (\$1,842,509) for initial operation and additional amount of about ₩800,000,000 to maintain adequate cash balance and to payback the local loan. (See 4.2 in Table N-19-1)

10.2 The projected hospital would suffer loss for first seven years, but cash position will be turned into good position after 4 years if the sponsor of the hospital will supply new capital to maintain adequate cash balance for four years.

10.3 As long as the sponsor has sources for the fund to maintain adequate cash balance for four years, the projected Hospital will be successful because from fifth year, the cash position will be improved.

Table N-18-5

Pohang Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st - 10th year)

Unit : ₩1,000
1\$ = ₩480

Year	1	2	3	4	5	6	7	8	9	10
Personnel	384,200	395,726	407,598	419,826	432,420	445,393	458,755	472,517	486,693	501,294
Physician	166,504	171,499	176,644	181,943	187,402	193,024	198,814	204,779	210,922	217,250
Nurse	103,924	107,042	110,253	113,561	116,967	120,476	124,091	127,813	131,648	135,597
Medical Assistant	19,491	20,076	20,678	21,298	21,937	22,595	23,273	23,971	24,691	25,431
Mgt. and Ad.	20,835	21,460	22,104	22,767	23,450	24,153	24,878	25,624	26,393	27,185
Technical service and others	73,446	75,649	77,919	80,256	82,664	85,144	87,698	90,329	93,039	95,830
Pharma.	141,790	165,323	181,234	197,144	213,054	228,965	248,983	269,001	289,019	309,039
Food & Clothes	33,968	36,053	37,484	38,916	40,347	41,779	43,840	45,901	47,962	50,023
Heating & Utilities	28,194	31,916	33,746	35,576	37,406	39,237	41,202	43,166	45,131	47,096
Maintenance	14,314	14,314	14,314	14,314	14,314	14,314	14,314	14,314	14,314	14,314
Bldg.	3,775	3,775	3,775	3,775	3,775	3,775	3,775	3,775	3,775	3,775
Equip.	10,539	10,839	10,819	10,539	10,539	10,539	10,539	10,539	10,539	10,539
Others	33,656	38,100	40,295	42,491	44,686	46,882	49,217	51,552	53,886	56,221
Total (\$000)	635,122 (1,325)	681,427 (1,420)	714,671 (1,489)	748,267 (1,559)	782,227 (1,630)	816,564 (1,701)	856,311 (1,784)	896,451 (1,868)	937,005 (1,952)	977,985 (2,307)

Table N-18-6

Pohang Hospital (100 beds)
ECONOMIC FORECASTING : PRO FORMA INCOME STATEMENTS
(1st - 10th year)

Unit: ₩1,000
1\$ = ₩480

Year	1	2	3	4	5	6	7	8	9	10
Total Revenue	568,296	662,619	726,388	790,157	853,926	917,695	997,928	1,078,161	1,158,394	1,238,627
Total Expense	636,122	681,427	714,671	748,267	782,227	816,564	856,311	896,451	937,005	977,985
Operating Income	*67,826	*18,813	11,713	41,890	71,699	101,130	141,617	181,710	221,389	260,642
Depreciation Interest	72,356 103,431	72,356 103,431	72,356 103,431	72,356 103,431	72,356 93,231	72,356 82,231	72,356 69,931	72,356 56,531	72,356 41,931	72,356 25,831
Netprofit (\$000)	*243,613 (*508)	*194,600 (*405)	*164,074 (*342)	*133,897 (*279)	*93,888 (*196)	*53,357 (*111)	*670 (*1)	52,823 (110)	107,102 (223)	162,455 (338)
* Deficit										

Pohang Hospital (100 beds)
ECONOMIC FORECASTING : PRO FORMA BALANCE SHEETS
(1st - 10th year)

Table N-18-7

Unit: ₩1,000
1\$ = ₩480

Year	1	2	3	4	5	6	7	8	9	10
Current Assets	321,948	321,948	321,948	321,948	321,948	321,948	321,948	321,948	332,906	383,117
Equipment	421,568	421,568	421,568	421,568	421,568	421,568	421,568	421,568	421,568	421,568
Depr.	42,157	84,314	126,471	168,628	210,785	252,942	295,099	337,256	379,413	421,568
Bldg.	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956
Depr.	30,199	60,398	90,597	120,796	150,995	181,194	211,393	241,592	271,791	301,970
Land	52,500	52,500	52,500	52,500	52,500	52,500	52,500	52,500	52,500	52,500
Total	2,233,616	2,161,260	2,088,904	2,016,548	1,944,192	1,871,836	1,799,482	1,727,124	1,665,726	1,643,581
Current Liabilities										
Local Loan	1,000,000	1,000,000	1,000,000	893,000	775,800	647,500	507,000	353,100	184,600	-
Foreign Loan	421,568	421,568	421,568	421,568	421,568	421,568	421,568	421,568	421,568	421,568
Capital	1,055,661	1,177,905	1,269,673	1,438,164	1,576,896	1,686,197	1,755,011	1,783,732	1,783,732	1,783,732
Retained Earnings		*243,613	*438,213	*602,287	*736,184	*830,072	*883,429	*884,099	*831,276	*724,174
Netprofit	*243,613	*194,600	*164,074	*133,897	*93,888	*53,357	*670	52,823	107,102	162,455
Total (\$000)	2,233,616 (4,653)	2,161,260 (4,503)	2,088,904 (4,352)	2,016,548 (4,201)	1,944,192 (4,050)	1,871,836 (3,900)	1,799,480 (3,749)	1,727,124 (3,598)	1,665,726 (3,470)	1,643,581 (3,424)

* Deficit

Table N-19-1

Pohang Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

Unit: ₩1,000
1\$ = ₩480

Year	1	2	3	4	5	6	7	8	9	10
1. OPERATING AND MAINTENANCE										
1.1. Personnel	384,200	395,726	407,598	419,826	432,420	445,393	458,755	472,517	486,693	501,294
1.2. Other expenses	237,608	271,392	292,763	314,127	335,493	356,858	383,242	409,620	435,998	462,377
1.3. Maintenance	14,314	14,314	14,314	14,314	14,314	14,314	14,314	14,314	14,314	14,314
1.4. Interest	103,431	103,431	103,431	103,431	103,431	93,231	82,131	56,531	41,931	25,831
1.5. Operating expenses	739,553	784,863	818,106	851,698	875,458	898,696	926,242	952,982	978,936	1,003,816
1.6. Depreciation	72,356	72,356	72,356	72,356	72,356	72,356	72,356	72,356	72,356	72,356
1.7. Operating cost	811,909	857,219	890,462	924,054	947,814	971,052	998,598	1,225,338	1,051,292	1,076,172
2. REVENUE										
2.1. Outpatient	162,668	197,496	205,765	214,033	222,302	229,970	266,553	293,535	320,518	338,500
2.2. Inpatient	405,628	465,123	520,623	576,124	631,624	687,125	731,375	784,626	837,876	900,127
2.3. Other										
2.4. Whole revenue	568,296	662,619	726,388	890,157	853,926	917,095	997,928	1,078,161	1,158,394	1,238,627
3. CALCULATION										
3.1. Operating incomes	*243,613	*194,600	*164,074	*133,897	* 93,888	*53,357	*670	52,823	107,102	162,455
3.2. Accumulation	*243,613	*438,213	*602,287	*736,184	*830,072	*883,429	*884,099	*831,276	*704,174	*561,719
3.3. Income tax										
4. CASH FLOW CALCULATION										
4.1. Gross cash flow	*171,257	*122,244	*91,718	*61,541	*21,532	18,999	71,686	125,179	179,458	234,811
4.2. Invested capital	171,257	122,244	91,718	168,541	138,732	109,301	68,814	28,721	-	-
4.3. Payoff/discharge	-	-	-	107,000	117,200	128,300	140,500	153,900	168,500	184,600
4.4. Net cash flow	-	-	-	-	-	-	-	-	10,958	50,211
4.5. Accumulation of 4.4.	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	10,958	61,169
(\$000)									(23)	(127)

* Deficit

Appendix Table A 4-1

	<u>Amount</u>
No. 1: Land estate cost	
1.1. Value: <u>quantity (Won/M²)</u>	<u>Whole Amount</u>
14,459 (3,630 Won/M ²)	₩52,500,000
1.2. Acquisition cost	₩52,500,000
Total Sum of No. 1	
No. 2: Site preparation cost	₩2,000,000
2.1. Public opening	₩12,700,000
2.2. Non-public opening	
2.3. Other cost (i.e. taxes)	₩14,700,000
Total Sum of No. 2	
No.3: Construction cost	₩878,000,000
3.1. Building (due to room and space program plus traffic ways)	₩191,000,000
3.2. Installations (Sewage, Water, Heating, Electricity ...)	₩252,000,000
3.3. Technical service plants (Waste water, water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators ...)	₩1,321,000,000
Total Sum of 3.1 - 3.3	

and:

a) Classification to space-content:

3.1 - 3.3 :	<u>m³</u>	<u>Won/m³</u>	<u>Whole Amount</u>	<u>Outside Equipment</u>
	25,000	50,000	₩1,250,000	₩71,000,000
Sum of 3.1 - 3.3				

b) Classification to space

3.1 - 3.3 :	<u>m²</u>	<u>Won/m²</u>	<u>Whole Amount</u>	<u>Outside Equipment</u>
	6,250	200,000	₩1,250,000,000	₩71,000,000
Sum of 3.1 - 3.3				

c) Classification to beds

3.1 - 3.3	<u>No. of beds</u>	<u>Won/Bed</u>	<u>Whole Amount</u>	<u>Outside Equipment</u>
	100	12,500,000	₩1,250,000,000	₩71,000,000
Sum of 3.1 - 3.3				

No. 4:	Equipment	
4.1.	Medical Equipment	\$820,107
4.2.	Non-medical Equipment	\$58,159
	Total Sum of 4.1 + 4.2	\$878,266
No. 5:	Outside Equipment	₩71,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	₩268,948,000
No. 7:	Engineering Fee	₩52,840,000
No. 8:	Dormitory	₩74,528,000

О. МОКРО

OPTIONAL

O. MOKPO HOSPITAL

1. Geographical Features

1.1 Mokpo, which opened its port in 1897, has been the largest port city in the southwestern part of Korea. Mokpo has served as an important trading port in the southwestern coast of the country, connecting the economic and cultural activities of the residents on the neighboring islands with those of the inland people. By 1949, Mokpo grew to have a population of 130,000 but most of the port city was destroyed during the Korean War (Figure O-1).

1.2 Following the readjustments of the administrative districts of Mokpo, the port city has become the third largest city in the southwestern Honam area, with a population of about 200,000 on 33 square Km of land. However, the development of Mokpo has lagged far behind other cities in view of the fact that the port city was one of the six largest cities in Korea in 1932.

1.3 The construction of an industrial estate in Mokpo has accelerated the regional industrial development in the port city. In particular, when the port expansion project, which is being carried out, is completed, Mokpo will be able to handle more cargoes as the largest port in the southwestern part of the nation. In line with the port development, the population of Mokpo is expected to steadily increase in the coming years.

1.4 Recently, some leading business firms have constructed medical facilities for the inhabitants on islands off the southwestern coast. Daewoo Co. has established a 30-bed hospital on Bigeum island, Sinan Gun, and a 10-bed clinic on Hajo Island, Jindo Gun. Although it is too early to evaluate the performance of their medical activities because they have been opened for only six months, it seems that they are far short of achieving the original goal of providing access to medical care to the remote islanders. The problem lies in that the transportation between the islands and Mokpo is more convenient than the traffic between the islands themselves. Therefore, most patients on the islands go to hospitals in Mokpo rather than to the hospital on the neighboring Bigeum Island. ^{1/} The above fact points out that conveniency in transportation as well as the cosmopolitan area is one of the most important factors in the determination of the location of a hospital. It is recalled that most patients on the islands in Jindo Gun and Sinan Gun off the southwest coast go to the medical facilities in Mokpo.

2. Medical Service Areas of Mokpo Hospital

2.1 Considering the geographical features of Mokpo, it will be reasonable to determine the medical service areas by taking into account the factors involved in the coastal ferry services and overland traffic to and from the port city. Connected by the ferry services, Jindo Gun, Sinan Gun, Haenam Gun and part of Yuongam Gun belong to the cosmopolitan area of Mokpo. Connected by overland roads, Muan Gun and part of Yuongam Gun belong to the sphere of Mokpo.

^{1/} An interview with Prof. Kim Il-soon, Yonsei University, August 27, 1979. Prof. Kim conducted the survey of the operational status of the medical facilities founded by Daewoo Co.

2.2 The 10-bed clinic on Hajo Island, Jindo Gun, which was founded by Daewoo Co., is accessible only by the inhabitants on Hajo Island, Sangjo Island and Gocha Islands. The residents in Gogun Myon and Uysin Myon of the main Jindo Island are more conveniently located to go to the medical facilities in Haenam Gun, which faces the island.

2.3 As the medical practitioners in Haenam Gun are jointly constructing an 80-bed hospital, Haenam Gun should be excluded from the medical service areas of the proposed Mokpo Hospital. Although Hwawon Myon of Haenam Gun is located more conveniently to Mokpo than to Haenam Eup, this study excluded Hwawon Myon from the medical service catchment area in order to avoid an overestimation.

2.4 The 30-bed clinic on Bigeum Island, Sinan Gun, which the Daewoo Co. established, will provide medical services to the residents in Bigeum Myon and the neighboring Dojo Myon (above 1.4). The remaining 8 Myons of Sinan Gun except for the above 2 Myons should be included in the medical service areas of the proposed Hospital.

2.5 The southwestern part of Youngam Gun is connected conveniently by ferry service with Mokpo, while the northeastern part of the Gun is adjoining to the cosmopolitan area of Naju and Gwangju City. Samho Myon of Youngam Gun is located within a 15-minute travel distance by ferry to Mokpo. In addition, as the secondary medical facilities of the Medicaid Program for Youngam Gun are located in Mokpo, most residents on the coastal areas go to Mokpo for medical care rather than to Gwangju City. ^{1/} Therefore, Samho Myon, Seuho Myon, Miam Myon, Gunseo Myon, and Haksan Myon, which face Mokpo City, should be included in the medical service areas of the proposed Hospital.

2.6 Although Muan Gun is located in the middle part between Mokpo City and Naju Eup, most areas of the Gun belong to the cosmopolitan area of Mokpo. It takes only 30 minutes by car from the Office of Muan Myon to Mokpo City. The most serious patients in Muan Gun are referred to the medical facilities in Mokpo. Meanwhile, the Government plans to develop Naju Eup as a satellite city of Gwangju under a population dispersion program. Should Naju develop into a satellite city, it would be possible that Muan Gun will become a part of the cosmopolitan area of Naju. Although it is not possible at present to measure accurately the extent of the change, this study has taken into account such a possibility in the estimation of the population trend in the area.

3. Estimation of Population in the Projected Areas

3.1 The population trend in Mokpo City is as shown in Table O-1.

3.2 The population trend in the catchment area during the past several years is as shown in Table O-2. As of 1977, the population totaled 675,000. The total population includes one half of the total residents in Jindo Gun and two thirds of the total people in Muan Gun (refer to above 2.2 and 2.6).

3.3 Assuming that the population will decrease on the logarithmic trend in the coming years, the total population is estimated to decrease by 3,000 annually

^{1/} An interview with Mr. Jung Sok Joo, chief of the Internal Affairs Section, Office of Youngam Gun, July 6, 1979.

from 666,000 in 1979 to 652,000 in 1984. The population decrease would be attributable to the immigration of rural people out of the areas concerned, with the exception of Mokpo City (Table O-3).

Population Trend in Mokpo City, 1970-1977

Table O-1.

Year	Male	Female	Total
1970	91,105	86,696	177,801
1971	91,457	91,028	182,485
1972	93,703	93,159	186,862
1973	96,576	95,748	192,324
1974	98,314	96,211	194,525
1975	97,894	94,033	192,927
1976	98,926	97,928	196,854
1977	101,496	101,608	203,104

Source: Statistical Year Book of Mokpo, 1978.

Number of Population in the Mokpo Hospital Service Area

Table O-2.

Year	Mokpo	Jindo 1/	Muan 2/	Sinan	Youngam	Total
1972	186,862	104,197	132,583	134,133	127,537	685,312
1974	194,525	104,031	132,882	132,753	126,455	690,646
1975	192,927	100,376	128,035	128,423	118,606	668,367
1976	196,854	99,896	128,964	128,106	119,136	672,956
1977	203,104	98,426	128,472	126,405	118,504	674,911

1/ One half of Jindo Population

2/ Two thirds of Muan Population

Source: The Statistical Year Book of Mokpo City, Muan, Sinan and Youngam Gun 1973-1978.

Number of Estimated Population Within the Mokpo Hospital Service Area

Table O-3

Year	Mokpo	Jindo	Muan	Sinan	Youngam	Total
1979	206,655	96,292	126,174	123,508	47,404	666,147
1980	209,359	94,124	125,255	122,014	46,308	663,316
1981	212,030	93,970	124,346	120,540	45,224	660,520
1982	214,667	92,832	123,449	119,084	44,154	657,759
1983	217,273	91,706	122,562	117,644	43,098	655,029
1984	219,847	90,594	121,686	116,222	43,098	652,332
1985	222,391	89,496	120,821	114,818	41,022	649,671
1986	224,906	88,410	119,966	113,430	40,002	647,039
1991	237,054	83,166	115,835	106,720	35,074	634,322

$$Y = a + b \log x$$

$$r^2 = 0.88$$

$$a = -732,632.19$$

$$b = 214,965$$

$$r^2 = 0.86$$

$$a = 250,914.48$$

$$b = -46,406.14$$

$$r^2 = 0.65$$

$$a = 297,102.37$$

$$b = -48,744.53$$

$$r^2 = 0.91$$

$$a = 321,104.42$$

$$b = -59,355.42$$

$$r^2 = 0.78$$

$$a = 792,401.17$$

$$b = -155,370.39$$

4. Estimation of Hospital-bed Requirement

4.1 The number of the insured under the Health Insurance Program and the Medicaid beneficiaries in the catchment area is as shown in Table O-4. The medically insured people amounted to 110,696, including 51,489 insured persons under the Health Insurance and 59,207 Medicaid recipients. They accounted for 16.6% of the total population in the areas.

4.2 Mokpo City has a total of 9 hospital-level medical facilities, including a Municipal Tuberculosis Hospital, with a total of 539 beds (Table O-5).

4.3 There are a total of 54 doctors' offices with 252 beds in the areas. The numbers of doctors' offices are 40 in Mokpo City, 4 in Muan Gun, 5 in Sinan Gun, 3 in Jindo Gun, and 2 in Youngam Gun. The combined hospital-beds in the areas total 791 (Table O-6).

4.4 The hospital utilization rate of the insured under the Health Insurance and the Medicaid recipients is assumed to be the same as that of the national average. It is also assumed that the number of such medically insured people will increase by 3,000 during 1981-1984 due to the development of the Mokpo Industrial Estate. It is expected that there will be no construction of new hospitals and expansion of the existing medical facilities. The occupancy rate of hospital beds is expected to increase from the present 50% to 80%, while that of small medical facilities will decline from 40% to 20% as in the other study area.

4.5 As the result, the requirement of additional hospital-beds in the areas concerned was estimated as follows (Table O-7): 98 beds (low estimate 56, high estimate 139) in 1980, 82 beds (low estimate 39, high estimate 125) in 1981, 101 beds (low estimate 55, high estimate 146) in 1982, 126 beds (low estimate 76, high estimate 176) in 1985. The government plans to construct the proposed Mokpo Hospital sometime after 1980. ^{1/} Therefore, it is recommended that the Mokpo Hospital be constructed to have 80 beds as was originally proposed by the Government.

5. Scope of Medical Care Provision and Allocation of Beds by Clinical Department.

5.1 Mokpo City has 3 general hospitals with over 50 beds. St. Colomban Hospital with 138 beds has 7 clinical departments (internal medicine, pediatrics, general surgery, Ob. & Gyn., anesthesiology, radiology, clinical laboratory). Mokpo Red Cross Hospital with 82 beds has 8 clinical departments (internal medicine, pediatrics, general surgery, Ob. & Gyn., psychiatry, clinical laboratory, community health service). Mokpo Municipal Hospital has not yet completed its construction. St. Colomban Hospital is the largest and most prestigious hospital in Mokpo, and Mokpo Red Cross Hospital provides medical services primarily for the low-income people. Even the two most well known hospitals have limited functions of clinical services except for the 4 basic clinical departments. Therefore, most patients in otolaryngology, urology, ophthalmology and dermatology depend on the care provided by private practitioners.

^{1/} The Ministry of Health and Social Affairs plans to build 3 hospitals in industrial areas in Cheongju, Ulsan, and Daejeon, and another 3 hospitals in medically under-served areas in Jinan, Eumseong, and Nonsan in 1979.

Table O-4. Number of Insured and Medicaid Beneficiaries within the Mokpo Hospital Service Area

Area	Health Insurance (Subscriber + Dependents)			Medicaid <u>3/</u>		Total
	Civil Servants <u>1/</u>	Private School Teachers	Industrial Employees <u>2/</u>	Indigent Group	Low Income Group	
Mokpo	14,756	2,564	10,405	3,473	18,201	49,399
Jindo	5,112	596	-	1,920	5,468	13,096
Muan	5,604	216	-	3,180	9,942	18,942
Sinan	5,904	40	-	2,082	6,140	14,160
Youngam	5,932	360	-	1,471	7,330	15,093
Total	37,308	3,776	10,405	12,126	47,081	110,696

1/ Data from the Gwangju Office of the Korean Medical Insurance Corporation, 1979.

2/ Data from the Mokpo Municipal Government, June, 1979.

3/ Data from the Statistical Year Book of the Concerned Local Government, 1979.

Hospitals in Mokpo City, 1979

Table O-5.

Name of Hospital	No. of Beds	Location
Mokpo Municipal Hospital	101	Kyung Dong
St. Colomban Hospial	138	Sanjung Dong
Mokpo Red Cross Hospital	82	Sanjung Dong
Namyang Hospital	28	Daeahn Dong
Cha Nam Soo Hospital	33	Daeahn Dong
Citizens' Hospital	21	Namgyo Dong
Kim Young Shik Hospital	30	Honam Dong
Labor Hospital	36	Hengbok Dong
Municipal TB Hospital	70	Daesung Dong
9 Hospitals	539	-

Number of Existing Beds in Mokpo Hospital Service Area

Table O-6.

Area	Hospital Beds	Clinic Beds	Total
Mokpo	539	204	743
Muan	-	29	29
Jindo	-	9 <u>2/</u>	9
Sinan	- <u>1/</u>	5	5
Youngam	-	5	5
Total	539	252	791

1/ The Daewoo Sinan Hospital was excluded, because Bigeum Myon and Docho Myon of which population the hospital has served was not included in the target area of the proposed Mokpo hospital.

2/ The 10-bed Daewoo Hajodo Clinic was not included.

5.2 The proposed 80-bed Mokpo Hospital should have at least 8 clinical departments; 4 basic clinical departments, Uro-dermatology and Dental, Anesthesiology and X-ray.

5.3 Mokpo Municipal Hospital is to move to another place with a new building to be constructed. However, the hospital will not expand its present 100-bed-capacity. 1/ The municipal hospital is expected to increase its clinical departments from the present 4 basic clinical departments with a view of improving its medical services to the level of the private hospitals. Therefore, the proposed Hospital should be designed to contribute to the development of the local medical care system and to the efficient division of medical functions among the hospitals.

6. Medical Program
(Refer to the report on the Eumseong Hospital)

1/ An interview with Park So-soon, director of the Socio-Economic Affairs Bureau, Mokpo City, July 7, 1979.

Table O-7. Bed Requirements in the Mokpo Hospital Service Area

Table O-7. Bed Requirements in the MORPO Hospital Service Area																	
Year	The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		A.L.S.	General Population Excluding the Insured & Medicaid	Hospitalization Rate/Person/Year		Industrial Accident Compensation Insurees	Incidence Rate of Accidents	Admission Rate	A.L.S.	No. of Existing Beds		Occupancy Rate (%)		Bed Requirements	
		I	II			I	II					Hosp.	Clinic	Hosp.	Clinic	I	II
1979	110,690	0.0349	0.0349	9	555,457	0.0195	0.0239	10	6,376	0.0442	0.055	539	252	50	40	39	119
1980	110,690	0.0366	0.0373	9	552,626	0.0202	0.0247	10	6,376	0.0442	0.055	539	252	50	40	56	139
1981	113,521	0.0385	0.0399	9	546,999	0.0209	0.0254	10	9,207	0.0442	0.055	539	252	60	30	39	125
1982	113,521	0.0404	0.0427	9	544,238	0.0215	0.0262	10	9,207	0.0442	0.055	539	252	60	30	55	146
1983	113,521	0.0424	0.0457	9	541,508	0.0222	0.0269	10	9,207	0.0442	0.055	539	252	60	30	37	132
1984	116,521	0.0445	0.0489	9	535,811	0.0229	0.0277	10	12,207	0.0442	0.055	539	252	70	20	58	155
1985	116,521	0.0468	0.0523	9	533,150	0.0236	0.0284	10	12,207	0.0442	0.055	539	252	70	20	76	176
1986	116,521	0.0491	0.0560	9	530,518	0.0242	0.0292	10	12,207	0.0442	0.055	539	252	70	20	93	198
1991	119,521	0.0627	0.0785	9	514,801	0.0277	0.0335	10	15,207	0.0442	0.055	539	252	70	20	188	330

7. INVESTMENT AND FINANCING PLAN

(All the assumptions for financial studies of the Hospitals in industrial areas are the same as those mentioned in the study of the Ulsan Hospital. So refer to the feasibility study of the Ulsan Hospital for further information.)

7.1 Investment Cost

Table 0-8-1

Mokpo Hospital (80 beds)
Investment Cost 1/

Category	Local Cost	Foreign Cost
Land estate	₩75,460,000	\$157,208
Site Preparation	13,000,000	27,083
Construction	1,126,000,000	2,345,833
Medical and Non-medical Equipment	387,764,000	807,842
Outside Equipment	53,000,000	110,417
Contingencies	56,300,000	117,292
Engineering fees	45,000,000	93,750
Dormitory	28,150,000	58,646
Working capital	40,909,000	85,227
Total	₩1,825,583,000	\$3,803,298

1/ See Appendix A 4-1. (Refer to the report on the Eumseong hospital)

7.2 Financing Plan

Table 0-8-2

Mokpo Hospital (80 beds)
Sources of Financing

Category	Local Currency	Foreign Currency
Total Investment	₩1,825,583,000	\$3,803,298
Foreign loan	383,766,000	799,513
Local loan	800,000,000	1,666,667
Eumseong Hospital Capital	641,817,000	1,337,118
Total financing	₩1,825,583,000	\$3,803,298

7.3 Pro-forma Balance Sheet (the year before operation starts)

Table O-8-3

Mokpo Hospital (80 beds) Balance Sheet (Beginning of operation)

Unit: W1,000
1\$ = 480 won

Assets		Liabilities	
Cash	80,642,000	Bank credit	0
Auxiliary goods	7,437,000	Account payable	0
Pharmaceuticals	9,130,000	Draft	0
& medical articles		Loans local	800,000,000
Equipment	387,764,000	foreign	383,766,000
Building	1,265,150,000	Reserve for contingency	0
Land	75,460,000	Capital	641,817
Total	1,825,583,000	Total	1,825,583,000
(\$000)	(3,803)	(\$000)	(3,803)

8. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the study of the Ulsan Hospital)

- 8.1 Estimation of Revenues (See Table O-9-1)
- 8.2 Estimation of Expenses (See Table O-9-2)
- 8.3 Proforma Income Statement (See Table O-9-3)
- 8.4 Proforma Balance Sheet (See Table O-9-4)

9. ESTIMATION OF CASH FLOW (See Table O-10-1)

10. CONCLUSION AND RECOMMENDATION

- 10.1 The Hospital will suffer losses for 7 years, after that it will have profit. Because of heavy loan payments each year from third year of operation, the cash position will be in trouble unless the sponsor will subsidy large sum of fund for working capital.
- 10.2 But in the long run, (after 10 years) it will be in good position to have profit enough to payback the local and foreign loan and maintain enough cash.

Table 0-9-1.

Mokpo Hospital (80 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st - 10th year)

		Unit: W1,000 1\$ = W480									
Year		1	2	3	4	5	6	7	8	9	10
Inpatient											
Insurance		83,053	126,351	156,410	186,469	246,587	246,587	304,885	363,183	421,481	479,782
Private		233,198	226,775	233,828	240,881	247,934	254,987	241,963	228,940	215,917	202,894
Outpatient											
Insurance		35,850	52,441	63,791	75,141	86,491	97,842	121,775	145,708	169,640	193,573
Private		97,015	89,154	87,644	86,134	84,624	83,116	74,421	65,726	57,031	48,336
Inpatient											
Total		316,251	353,126	390,238	427,350	464,462	501,574	546,848	592,123	637,398	682,676
Outpatient											
Total		132,865	141,595	151,435	161,275	171,105	180,958	196,196	211,434	226,671	241,909
Insurance Total		118,903	178,792	220,201	261,610	303,019	344,429	426,650	508,891	591,121	673,355
Private Total		330,213	315,929	321,472	327,015	332,558	338,103	316,384	294,666	272,948	251,230
Grand Total		439,116	494,721	541,673	588,625	635,577	682,532	743,044	803,557	864,069	924,585
(S000)		(915)	(1,031)	(1,128)	(1,226)	(1,324)	(1,422)	(1,548)	(1,674)	(1,800)	(1,926)

Table 0-9-2.

Mokpo Hospital (80 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st - 10th year)

Unit: 1,000 won
1\$ = ₩480

Year	1	2	3	4	5	6	7	8	9	10
Personnel	292,110	300,873	309,899	319,196	328,772	338,635	348,794	359,258	370,036	381,137
Physician	120,016	123,616	127,324	131,144	135,079	139,131	143,305	147,604	152,032	156,593
Nurses	84,309	86,838	89,443	92,126	94,890	97,737	100,669	103,689	106,800	110,004
Medical Assistant	10,485	10,799	11,123	11,457	11,800	12,154	12,519	12,895	13,282	13,680
& others										
Administration	16,795	17,298	17,817	18,352	18,902	19,470	20,054	20,655	21,275	21,913
Others	60,505	62,320	64,189	66,115	68,098	70,141	72,246	74,413	76,645	78,945
Pharm. & X-ray	109,559	123,432	135,147	146,861	158,576	170,291	185,389	200,487	215,585	230,683
Food & Clothes	27,505	30,231	32,106	33,981	35,856	37,733	39,230	40,727	42,224	43,721
Maintenance	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854
Bldg.	3,163	3,163	3,163	3,163	3,163	3,163	3,163	3,163	3,163	3,163
Equip.	9,694	9,694	9,694	9,694	9,694	9,694	9,694	9,694	9,694	9,694
Utility & Heatings	22,281	23,829	25,265	26,702	28,139	30,087	31,618	33,149	34,681	36,212
Others	26,598	28,445	30,160	31,876	33,591	35,916	37,744	39,572	41,400	43,228
Total (\$000)	490,907 (1,023)	519,664 (1,083)	545,431 (1,136)	571,470 (1,191)	597,788 (1,245)	625,516 (1,303)	655,629 (1,366)	686,047 (1,429)	716,780 (1,493)	747,835 (1,558)

Table 0-9-3.

Mokpo Hospital (80 beds)
ECONOMIC FORECASTING : PROFORMA INCOME STATEMENTS
(1st - 10th year)

Unit: 1,000 won
1\$ = ₩480

Year	1	2	3	4	5	6	7	8	9	10
Total Revenue	439,116	494,721	541,673	588,625	635,577	682,532	743,044	803,557	864,069	924,585
Total Expenses	490,907	519,664	545,431	571,470	597,788	625,516	655,629	686,047	716,782	747,835
Operating Income	*51,791	*24,943	*3,758	17,155	37,789	57,016	87,415	117,510	147,289	176,750
Interest	63,675	63,675	63,675	63,675	57,203	50,275	42,867	34,939	26,459	17,387
Depreciation	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079
Net Income (\$000)	*179,545 (*374)	*152,697 (*318)	*131,512 (*274)	*110,599 (*230)	*83,493 (*174)	*57,338 (*119)	*19,531 (*41)	18,492 (39)	56,751 (118)	95,284 (198)

*: deficit

Table 0-9-4.

Mokpo Hospital (80 beds)
ECONOMIC FORECASTING : PRO FORMA BALANCE SHEETS
(1st - 10th year)

Year	1	2	3	4	5	6	7	8	9	10
Unit: ₩1,000 1\$ = 480 won										
Current Assets	97,209	97,209	97,209	97,209	97,209	97,209	97,209	97,209	97,209	97,209
Equipment	387,764	387,764	387,764	387,764	387,764	387,764	387,764	387,764	387,764	387,764
Depreciation	38,776	77,552	116,328	155,104	193,880	232,656	271,432	310,208	348,984	387,760
Building	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150	1,265,150
Depreciation	25,303	50,606	75,909	101,212	126,515	151,818	177,121	202,424	227,727	253,030
Land	75,460	75,460	75,460	75,460	75,460	75,460	75,460	75,460	75,460	75,460
Total	1,761,504	1,697,425	1,633,346	1,569,267	1,505,188	1,441,109	1,377,030	1,312,951	1,248,872	1,205,428
Current Liabilities	0	0	0	0	0	0	0	0	0	0
Local loan	800,000	800,000	800,000	707,560	608,648	502,808	389,560	268,384	138,728	0
Foreign loan	383,766	383,766	383,766	383,766	383,766	383,766	383,766	383,766	383,766	383,766
Capital	757,283	845,901	913,334	1,052,294	1,170,620	1,269,719	1,338,419	1,377,024	1,385,850	1,385,850
Retain Earnings	0	*179,545	*332,242	*463,754	*574,353	*657,846	*715,184	*734,715	*716,223	*659,472
Net Profit	*179,545	*152,697	*131,512	*110,599	*83,493	*57,338	*19,531	18,492	56,751	95,284
Total	1,761,504	1,697,425	1,633,346	1,569,267	1,505,188	1,441,109	1,377,030	1,312,951	1,248,872	1,205,428
(\$000)	(3,670)	(3,536)	(3,403)	(3,269)	(3,136)	(3,002)	(2,869)	(2,735)	(2,602)	(2,511)

* L deficit

Mokpo Hospital (80 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

Table O-10-1.

Unit: 1,000 won
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
1. Expenses										
1.1 Personnel	292,110	300,873	309,899	319,196	328,772	338,635	348,794	359,258	370,036	381,137
1.2 Other expenses	185,943	205,937	222,678	239,420	256,162	274,027	293,981	313,935	323,890	353,844
1.3 Maintenance	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854	12,854
1.4 Interest	63,675	63,675	63,675	63,675	57,203	50,275	42,867	34,939	26,459	17,387
1.5 Operating expenses										
1.5.1	554,582	583,339	609,106	635,145	654,991	675,791	698,496	720,986	743,239	765,222
1.5.2	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079	64,079
1.5.3	618,661	647,418	673,185	699,224	719,070	739,870	762,575	785,065	807,318	829,301
1.6 Depreciation										
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2. Revenues										
2.1 Outpatient	132,865	141,595	151,435	161,275	171,105	180,958	196,196	211,434	226,671	241,909
2.2 Inpatient	316,251	353,126	390,238	427,350	464,462	501,574	546,848	592,123	637,398	682,676
2.3 Other										
2.4 Whole	439,116	494,721	541,673	588,625	635,577	682,532	743,044	803,557	864,069	924,585
3. Profit calculation										
3.1 Net profit	*179,545	*152,697	*131,512	*110,599	*83,493	*57,338	*19,531	18,492	56,751	95,284
3.2 Accumulation	*179,545	*332,242	*463,754	*574,353	*657,846	*715,184	*734,715	*716,223	*659,472	*564,188
3.3 Tax										
4. Cash Flow Calculation										
4.1 Gross cash flow	*115,466	*88,618	*67,433	*46,520	*19,414	6,741	44,548	82,571	120,830	159,363
4.2 Payoff/discharge	0	0	0	92,440	98,912	105,840	113,248	121,176	129,656	138,728
4.3 Invested capital	115,466	88,618	67,433	138,960	118,326	99,099	68,700	38,605	8,826	0
4.4 Net cash flow	0	0	0	0	0	0	0	0	0	20,635
4.5 Accumulation of 4.4	0	0	0	0	0	0	0	0	0	20,635
(\$000)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(43)

* : deficit

P. YEOCHEON

P. YEOCHEON HOSPITAL

1. Geographical Features

1.1 Yecheon City is under development in the rear side of the Yecheon Industrial Complex. In the national land development plan, the new Yecheon city belongs to the nation's southwestern sphere with its major regional features including the rich agricultural-light industrial basin area of the Youngsan River with its center located in Gwangju City and to its peripheral sphere around Suncheon City. Yecheon City is located at the central part of the Yecheon Peninsula formed by the branch of the Noryung Range developed to the northeast, and is contiguous to the scenic National Sea Park (Hanryo Waterway) along the southern coast.

1.2 The Yeochon Peninsula is rugged and the arable land accounts for only about 30% of the total land of the peninsula. Yecheon City is a planned city located within a radius of 25 Km of the adjacent Yeosu City and Yulchon Town to the northeast (Figure P-1).

1.3 The Yecheon area will become one of the major industrial centers in the southwestern part of Korea, with the 7th Fertilizer Complex, the largest of its kind in the Orient, and the adjacent Honam Oil Refinery and the Southern Coast Industrial Belt.

1.4 The construction of Yecheon City has progressed to 30% of its goal since ground was broken in October 1977. 1/ The purpose of Yecheon City development is as follows.

- The new city is designed to accomodate the inhabitants living around the heavy and chemical industrial complex to protect them from industrial pollution.
- The new city is aimed at accomodating the employees in the industrial complex and their dependents.
- Yecheon City, together with the city development in Yulchon and Gwangyang to the northeast, is aimed at balanced development of industrial cities in the southern coastal area to prevent the lateral expansion of Yeosu City.

1.5 As in the case of development of Banwol City, there is no medical establishment in the Yecheon City development area. Furthermore, the adjacent Yeosu City has no general hospital, and serious patients must go to Suncheon and Gwangju for treatment.

2. The Pattern of Diseases

2.1 As the city development project has progressed only 30%, it is impossible to

1/ Report by the Construction Office of the Yecheon Industrial Complex in May 1975.

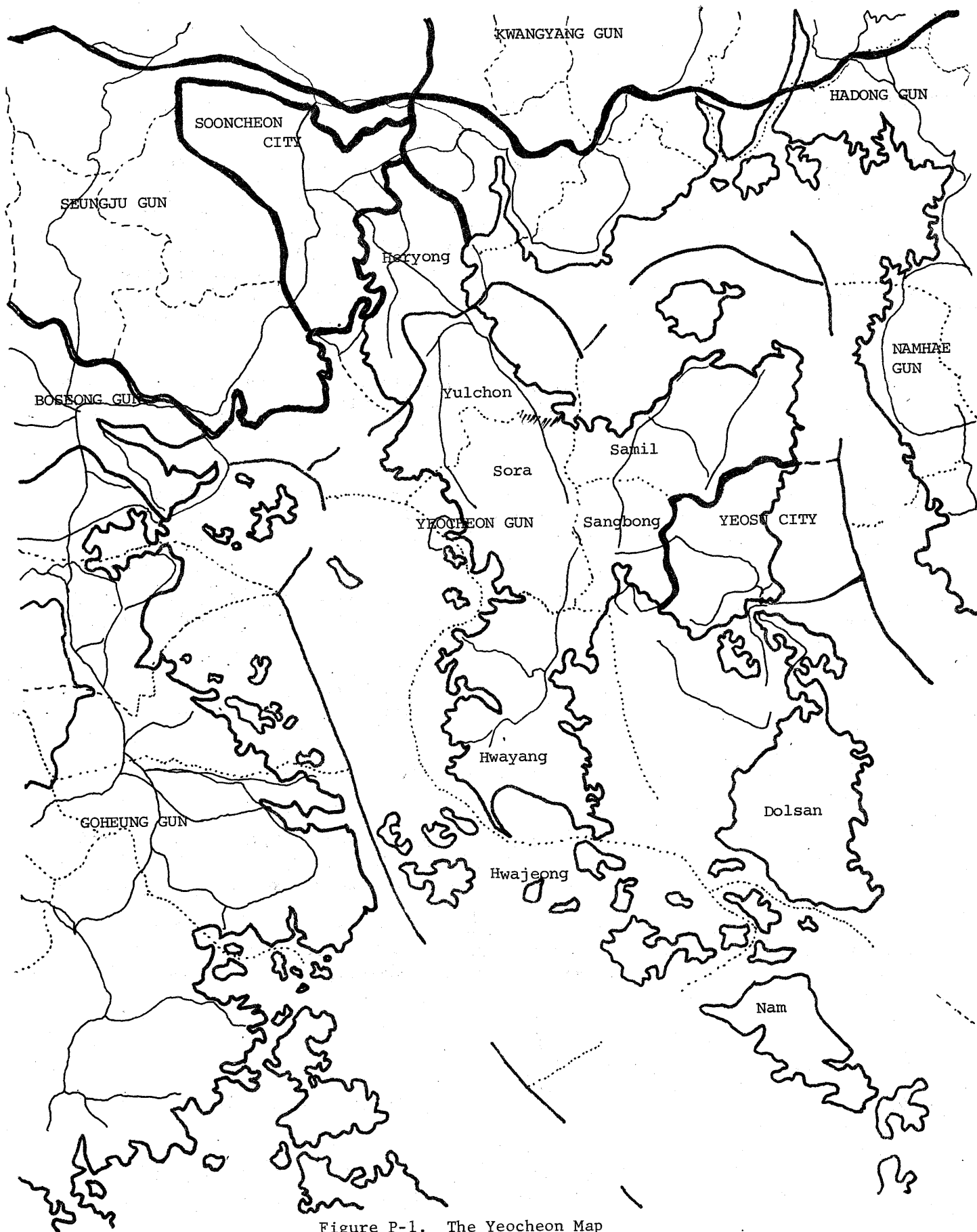


Figure P-1. The Yeocheon Map

to know the pattern of diseases in the city project area. However, it is foreseeable that diseases caused by industrial pollution will be prevalent in the industrial area.

2.2 As the industrial plants in the Yecheon Complex are being operated by a semiautomatic system, it can be assumed that there will be no high incidence of industrial accidents.

2.3 There is no general hospital in Yecheon area and Yeosu City. Therefore, if a general hospital is constructed in Yecheon, all the people in that area as well as in Yeosu City will be accessible to the medical services of the Hospital. Yeosu City is the largest fishing base on the southwestern coast of Korea. ^{1/} About 50-60% of the population of Yeosu City have depend on the fishing industry. Therefore, there will be a considerable number of patients involved in sea accidents and fishing activities.

3. The Target Population of the Yecheon Hospital

3.1 According to the Yecheon City Development Plan, the population of the new city will comprise the existing inhabitants in the area, the in-migrant workers employed in the secondary and tertiary industries and their dependents. City planning experts reported that it would be ideal to develop Yecheon City to accomodate about a 100,000 population by the target year 1986.

3.2 In the estimation of an optimum level of population in Yecheon City, it should be remembered that the conditions and situations for the creation of the new city are different from those of existing cities. That is, Yecheon City will be developed in compliance with the national policy of planned development rather than a natural and spontaneous growth.

3.3 The population in Yecheon City is estimated based on the following assumptions.

3.3.1 The existing inhabitants in the developing area will live in the developed Yecheon City area.

3.3.2 The population is considered to increase by three stages, and the population increase rate is as shown in Table P-1.

Table P-1. Population Increase Rate, Yecheon City

Stage	Year	Increase Rate (%)
First Immigration Period	1978-1981	1.80
Second Immigration Period	1981-1986	1.50
Third Natural Increase Period	1986-1991	1.50

Source: The Yecheon Industrial Complex Development Plan, the Ministry of Construction, p.33.

^{1/} The Yecheon Industrial Complex Development Plan, the Ministry of Construction, and the Industrial Base Development Corp., p.33.

3.3.3 As for economically active population and the structure of employment, most of the present primary industrial workers are expected to shift their employment status to the secondary and tertiary industry as the industrial area develops.

3.3.4 The age structure of the population in the development area in the future is estimated provisionally according to the age structure of the current population as of 1976 (Table P-2).

3.3.5 The number of in-migrants should be estimated according to the employment plan of industrial plants and their dependents as well as the migrant people engaged in the tertiary industry based on the expansion plan of the industrial estate. In fact, the migrant employees are estimated according to the operational program of the industrial plants, and other migrating people are forecasted by the results of survey and analysis conducted in other similar industrial cities.

3.4 Based on the data, the population of Yecheon City is estimated to increase from 68,700 in 1979 to 78,900 in 1981, 94,200 in 1985, 94,200 in 1985, and to 106,000 in 1991 (Table P-3).

3.5 As there is no general hospital in the Yecheon area, it will be reasonable to expect that the proposed Yecheon Hospital will cover a wide area for its medical services, including Yeosu City and the whole area of Yecheon Gun. Therefore this study considered two alternatives--one that the Yecheon Hospital cover only the people in the new Yecheon City and the other that the Hospital cover wide areas including Yeosu City, Yecheon Gun and the new Yecheon City.

3.6 The population increase rate in Yeosu City and Yecheon Gun will be as follows (Table P-4 and P-5).

3.7 As was the other industrial areas, it is assumed that the population in Yecheon Gun will increase on the logarithmic base. As the population in Yecheon City increases rapidly, it is assumed that the population in Yeosu City will not increase from 1980. Therefore, the combined population in Yecheon City, Yecheon Gun and Yeosu City is estimated to increase from 328,000 in 1979 to 333,000 in 1980, 342,000 in 1985 and to 350,000 in 1991 (Table P-6).

4. Bed Requirement of the Yecheon Hospital

4.1 Using the same method of calculation applied to the feasibility study of other industrial areas, the requirement of hospital-beds was estimated as following two ways.

4.2 As there is no hospital-beds in the Yecheon development area, the requirement of hospital-beds in Yecheon City will amount to 75 beds (low estimate, 71 beds; high estimate, 79 beds) in 1980, 83 beds (low estimate, 78 beds; high estimate, 88 beds) in 1981, and at least 100 beds in 1983 onwards (Table P-7).

Table P-2. Estimates of Industrial Employees by Industrial Plants in Yecheon Industrial Complex

Industrial Plant	1979	1980	1981	1982	1983	1984	1985	1986
Oil Refinery	380	380	380	380	380	380	380	380
Oil Chemical								
Manufacturing	3,280	3,340	3,440	3,480	3,480	3,480	3,480	3,480
Plastic, P.V.C.	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Electricity, Gas	540	540	540	540	540	540	540	540
Others	-	940	2,240	3,600	5,000	5,900	6,700	7,900
Total	5,600	6,600	8,000	9,400	10,800	11,700	12,500	13,700

Source: Ibid. p.34.

Table P-3. Estimates of Population Increase in Yecheon City by Year.

Year	Natural Increase Population	Social Increase Population	Industrial Workers	Worker's Dependents	Total Population
1979	49,200	19,500	5,600	13,900	68,700
1980	50,100	23,000	6,600	16,400	73,100
1981	51,000	27,900	8,000	19,900	78,900
1982	51,800	33,000	9,400	23,600	84,800
1983	52,500	37,900	10,800	27,100	90,400
1984	53,300	40,900	11,700	29,200	94,200
1985	54,100	43,700	12,500	31,200	97,800
1986	55,000	45,000	13,700	31,300	100,000
1991	59,000	47,000	14,000	33,000	106,000

Source: Ibid. p.35.

Table P-4. Population Trend of Yeosu City

Year	Male	Female	Total
1971	52,250	58,144	116,394
1972	59,280	59,561	118,841
1973	61,617	61,792	123,409
1974	64,060	63,865	127,925
1975	65,923	64,718	130,641
1976	67,558	67,350	134,908
1977	70,426	70,160	140,586

Source: Yeosu Statistical Yearbook, Yeosu City, 1978, p.42.

Table P-5. Population Trend of Yecheon Gun

Year	Male	Female	Total
1975	78,046	73,370	151,416
1976	79,181	74,808	153,989
1977 <u>1/</u>	62,696	60,023	122,719
1978 <u>2/</u>	57,434	54,961	112,395

1/ Samil Myon was separated from Yecheon Gun and merged into Yecheon City.

2/ Sangbong Myon was separated from Yecheon Gun and merged into Yecheon City.

Source: Yecheon Statistical Yearbook, 1978, p.50.

Table P-6. Estimated Number of Population in Yecheon Hospital Service Area

Year	Yeosu <u>1/</u>	Yecheon Gun <u>2/</u>	Yecheon Model City <u>3/</u>	Total
1979	146,957	112,395	68,700	328,052
1980	150,674	109,512	73,100	333,286
1981	150,674	106,227	78,900	335,801
1982	150,674	103,040	84,800	338,514
1983	150,674	99,949	90,400	341,023
1984	150,674	96,951	94,200	341,825
1985	150,674	94,042	97,800	342,516
1986	150,674	91,221	100,000	341,895
1991	150,674	91,221	106,000	347,895

- 1/ The estimates for 1979 and 1980 were made under the assumption that the population increase would show a logarithmic curve. After 1980, when the settlement program of Yecheon Industrial City being active, it is assumed that the growth of Yeosu City will be stopped.
- 2/ It is assumed that the Yecheon Gun population will decrease 3% annually as the model city will develop.
- 3/ Data from the Master Plan of Yecheon Industrial Complex. p.35.

4.3 The requirement of hospital-beds in the combined area of Yeosu City and Yecheon Gun as well as Yecheon City will amount to 175 beds (low estimate, 154; high estimate, 196) in 1980, 162 beds (low estimate, 139; high estimate, 184) in 1981, 172 beds in 1982, 159 beds in 1983, 168 beds in 1984, 154 beds in 1985 and 161 beds in 1986 (Table P-8). In this estimation, a relatively high bed occupancy rate of the existing facilities was applied for the reason that there was no general hospital at all within the urban catchment area.

4.4 The present status of medical facilities in Yeosu City and Yecheon Gun is as follows (Table P-9). There is only a health subcenter without a bed in the Yecheon area. Yeosu City has a small hospital with 30 beds and therefore 39 doctor's offices, with combined total of 209 beds.

4.5 It is unreasonable to expect that the Yecheon Hospital will provide medical services only for the people living in Yecheon City because there is no general hospital in all of the Yecheon area and Yeosu City. Therefore, to provide medical services to the population in the entire catchment area, the proposed hospital is desirable to have at least 150 beds.

4.6 The development of the 3rd Block of the Yecheon Petrochemical Complex has been put off due to the recent oil price inflation. 1/

The delay of the project has been prompted by the gloomy prospects of securing supply of the industrial raw material naphtha caused by the recent oil crisis and the hesitation on the part of local businessmen concerned.

In addition, the government has yet no definite plan to construct a hospital in Yecheon City. 2/ Considering the above factors, it will be reasonable to construct the Yecheon Hospital with an initial capacity of 100 beds and increase the beds to 150 taking into consideration an increasing trend of patients. It will be noted that there is no other plan to construct and develop any hospital in the Yecheon area.

4.7 The medical service program of the Yecheon Hospital is based on a plan that the Hospital will have 100 beds. (Refer to the Medical Program of the Pohang Hospital) The medical service program in case that the hospital has 150 beds in initial capacity or expanded capacity will be similar in other equivalent hospitals (for example, the Chongju Hospital).

1/ The top headline story on page 2, Dong-a Ilbo, Aug. 22, 1979, No. 17808.

2/ Management Division, Bureau of Medical Affairs, the Ministry of Health and Social Affairs.

Table P-7. Bed Requirements in the Yecheon Hospital Service Area (Estimate I)

Year	The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		General Population Excluding the Insured & Medicaid	Hospitalization Rate/Person/Year		Average No. of Existing Beds	Occupancy Rate (%)	Industrial Accident Compensation	Incidence Rate of Accidents	Admission Rate	Average Length of Stay	Bed Requirements	
		I	II		I	II							I	II
1979	21,710	0.0349	0.0349	46,990	0.0195	0.0239	10	-	5,600	0.0442	0.055	30	65	72
1980	25,210	0.0349	0.0366	47,890	0.0202	0.0247	10	-	6,600	0.0442	0.055	30	71	79
1981	30,110	0.0349	0.0385	48,790	0.0209	0.0254	10	-	8,000	0.0442	0.055	30	78	88
1982	35,210	0.0349	0.0404	49,590	0.0215	0.0262	10	-	9,400	0.0442	0.055	30	85	98
1983	40,110	0.0349	0.0424	50,290	0.0222	0.0269	10	-	10,800	0.0442	0.055	30	92	108
1984	43,110	0.0349	0.0445	51,090	0.0229	0.0277	10	-	11,700	0.0442	0.055	30	97	117
1985	45,910	0.0349	0.0468	51,890	0.0236	0.0284	10	-	12,500	0.0442	0.055	30	102	125
1986	47,210	0.0349	0.0491	52,790	0.0242	0.0292	10	-	13,700	0.0442	0.055	30	105	132
1991	49,210	0.0349	0.0627	56,790	0.0277	0.0335	10	-	14,000	0.0442	0.055	30	116	165

(I) Only Yecheon City was considered for its catchment area.

Table P-8. Bed Requirements in the Yecheon Hospital Service Area (Estimate II)

Year	The Insured & Medicaid Beneficiaries	Hospitalization Rate/Person/Year		General Population Excluding the Insured & Medicaid	Hospitalization Rate/Person/Year		Average Length of Stay	No. of Existing Beds	Occupancy Rate (%)	Industrial Accident Compensation	Incidence Rate of Accidents	Admission Rate	Average Length of Stay	Bed Requirements	
		I	II		I	II								I	II
1979	46,314	0.0349	0.0349	281,738	0.0195	0.0239	10	209	50	133,110	0.0442	0.055	30	144	183
1980	47,314	0.0349	0.0366	285,972	0.0202	0.0247	10	209	50	134,110	0.0442	0.055	30	154	196
1981	48,714	0.0349	0.0385	287,087	0.0209	0.0254	10	209	60	135,510	0.0442	0.055	30	139	184
1982	50,114	0.0349	0.0404	288,400	0.0215	0.0262	10	209	60	136,910	0.0442	0.055	30	147	197
1983	51,514	0.0349	0.0424	289,509	0.0222	0.0269	10	209	70	138,310	0.0442	0.055	30	132	185
1984	52,414	0.0349	0.0445	289,411	0.0229	0.0277	10	209	70	139,210	0.0442	0.055	30	139	196
1985	53,214	0.0349	0.0468	289,302	0.0236	0.0284	10	209	80	140,010	0.0442	0.055	30	123	184
1986	54,414	0.0349	0.0491	287,481	0.0242	0.0292	10	209	80	141,210	0.0442	0.055	30	128	194
1991	54,714	0.0349	0.0627	293,181	0.0277	0.0335	10	209	80	141,510	0.0442	0.055	30	164	259

(II) Yecheon Gun + Yecheon Model City + Yeosu City.

Table P-9. Number of Medical Facilities and Beds, Yeosu City and Yecheon Area, 1979

Area	Hospital		Clinic		Total	
	No. of facility	No. of beds	No. of facility	No. of beds	No. of facility	No. of beds
Yeosu City	1	30	39	179	40	209
Yecheon Gun	-	-	-	-	-	-
Total	1	30	39	179	40	209

Source: Data from Health Center, Yeosu City & Yecheon Gun, 1979.

5. INVESTMENT AND FINANCING PLAN

(All the assumptions for the financial studies of the hospitals in industrial areas are the same as those mentioned in the studies of the Ulsan and Pohang Hospitals. Since Yecheon Hospital is one of those in industrial areas, refer to the feasibility studies of the Ulsan and Pohang Hospitals.)

5.1 Investment Cost

Table P-10-1 Yecheon Hospital (100 beds)
Investment Cost 1/

Category	Local cost	Foreign cost
Land estate	₩65,600,000	\$136,607
Site preparation	14,700,000	30,625
Construction	1,321,000,000	2,752,083
Dormitory	50,416,000	105,033
Medical equipment	417,748,000	870,308
Outside equipment	71,000,000	147,917
Contingencies	268,375,000	559,114
Engineering fees	52,840,000	110,083
Working Capital	50,916,000	106,075
Total investment	₩2,312,595,000	\$4,817,906

1/ See Appendix A 4-1.

5.2 Financing Plan

Table P-10-2 Yecheon Hospital (100 beds)
Sources of Finance

Category	Local Currency	Foreign Currency
Total Investment	₩2,312,595,000	\$4,817,906
Foreign loan	417,748,000	870,308
Local loan	1,000,000,000	2,083,333
Capital	894,847,000	1,864,264
Total Financing	₩2,312,595,000	\$4,817,906

5.3 Pro-forma Balance Sheet (the year before operation starts)

Table P-10-3

Yeocheon Hospital (100 beds)
Balance Sheet (Beginning of Operation)

Unit: ₩1,000
1\$ = 480 Won

Assets		Liabilities	
Cash	299,547	Bank Credit	0
Auxiliary goods	8,540	Account payable	0
Pharmaceuticals	11,204	Draft	0
and other materials			
Equipment	417,748	Loans local	1,000,000
Building	1,509,956	foreign	417,748
Land	65,600	Capital	894,847
Total	2,312,595	Total	2,312,595
(\$000)	(4,818)	(\$000)	(4,818)

6. ECONOMIC FORECASTING

(Assumptions and methods for calculating revenues and expenses are the same as those in the studies of the Ulsan and Pohang Hospitals.)

6.1 Revenue Estimation (See Table P-11-1)

6.2 Estimation of Expenses (See Table P-11-2)

6.3. Pro-forma Income Statement (See Table P-11-3)

6.4 Pro-forma Balance Sheet (See Table P-11-4)

7. ESTIMATION OF CASH FLOW (See Table P-12-1)

8. CONCLUSION FROM FINANCIAL ANALYSIS

8.1 The feasibility study shows the hospital will not survive without strong financial support from the sponsor.

8.2 The hospital's operation will be in profit after seven years and, the cash flow situation is more troublesome because the sponsor should contribute new fund to operate the hospital properly 9 years.

Table P-11-1

Yeocheon Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF REVENUES
(1st - 10th year)

Category	1	2	3	4	5	6	7	8	9	10
Unit: ₩1,000 1\$ = 480 won										
Insurance	179,698	303,472	368,789	434,106	499,423	564,741	693,865	822,989	952,113	1,081,237
Private	359,172	333,171	324,529	315,887	307,246	298,603	253,077	207,552	162,027	116,501
Inpatient	388,677	460,129	495,251	530,374	565,496	600,619	669,531	738,443	807,355	876,268
Outpatient	150,253	176,514	198,067	219,619	241,173	262,725	277,741	292,098	306,785	321,470
Total (\$000)	538,870 (1,123)	636,643 (1,326)	693,318 (1,444)	749,993 (1,562)	806,669 (1,681)	863,344 (1,799)	946,942 (1,973)	1,030,541 (2,147)	1,114,940 (2,321)	1,197,738 (2,495)

Table P-11-2

Yeocheon Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF EXPENSES
(1st - 10th year)

Year	1	2	3	4	5	6	7	8	9	10
Unit: ₩1,000 1\$ = 480 won										
Personnel	374,065	385,286	396,846	408,751	421,013	433,644	446,653	460,053	473,854	488,070
Physician	158,440	163,193	168,089	173,132	178,326	183,675	189,186	194,861	200,707	206,728
Nurse	101,853	104,909	111,298	114,636	118,076	121,618	125,266	129,024	132,895	136,882
Medical assistant	19,491	20,076	20,678	21,298	21,937	22,595	23,273	23,971	24,393	25,431
Mgt. and ad. Technical service	20,835	21,460	22,104	22,767	23,450	24,153	24,878	25,624	26,393	27,185
and others	73,446	75,649	77,919	80,256	82,664	85,144	87,698	90,329	93,039	95,830
Pharma.	134,448	158,842	172,983	187,123	201,264	215,404	236,262	257,120	277,978	298,836
Food & clothes	29,743	31,347	32,586	33,826	35,265	36,304	38,163	40,022	41,881	43,740
Heating . etc	26,734	30,665	32,235	33,806	35,376	36,947	38,846	40,744	42,643	44,542
Maintenance	14,219	14,219	14,219	14,219	14,219	14,219	14,219	14,219	14,219	14,219
Bldg.	3,775	3,775	3,775	3,775	3,775	3,775	3,775	3,775	3,775	3,775
Equip.	10,444	10,444	10,444	10,444	10,444	10,444	10,444	10,444	10,444	10,444
Others	31,914	36,606	38,481	40,355	42,230	44,105	46,670	49,235	51,800	54,365
Total (\$000)	611,123 (1,273)	656,965 (1,368)	687,350 (1,432)	718,080 (1,496)	749,167 (1,561)	780,623 (1,626)	820,813 (1,710)	861,393 (1,774)	902,375 (1,880)	943,772 (1,966)

Table P-11-3 Yeocheon Hospital (100 beds)
ECONOMIC FORECASTING : PRO FORMA INCOME STATEMENTS
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Total Revenue	538,870	636,643	693,318	749,993	806,669	863,344	946,942	1,030,541	1,114,140	1,197,738
Total Expense	611,123	656,965	687,350	718,080	749,167	780,623	820,813	861,393	902,375	943,772
Operating income	*72,253	*20,312	5,968	31,913	57,502	82,721	126,129	169,148	193,765	253,966
Depreciation	71,974	71,974	71,974	71,974	71,974	71,974	71,974	71,974	71,974	71,974
Interest	103,355	103,355	103,355	103,355	93,155	82,055	69,855	56,455	41,855	25,755
Net profit	*247,582	*195,641	*169,361	*143,416	*107,627	*71,308	*18,700	40,719	79,936	156,237
(\$000)	(*515)	(*407)	(*352)	(*298)	(*224)	(*148)	(*39)	(84)	(166)	(325)

* : deficit

Table P-11-4

Yeocheon Hospital (100 beds)
ECONOMIC FORECASTING : PRO FORMA BALANCE SHEETS
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
Current Assets	319,291	319,291	319,291	319,291	319,291	319,291	319,291	319,291	319,291	355,902
Equip.	417,748	417,748	417,748	417,748	417,748	417,748	417,748	417,748	417,748	417,748
Depr.	41,775	83,550	125,325	167,100	308,875	250,650	292,425	334,200	375,975	417,750
Bldg.	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956	1,509,956
Depr.	30,199	60,398	90,597	120,796	150,995	181,194	211,393	241,592	271,792	301,990
Land	65,600	65,600	65,600	65,600	65,600	65,600	65,600	65,600	65,600	65,600
Total	2,240,621	2,168,641	2,096,673	2,024,699	1,952,725	1,880,751	1,808,777	1,736,803	1,664,829	1,635,868
Current liabilities	0									
Local loan	1,000,000	1,000,000	1,000,000	893,000	775,800	647,500	507,000	353,100	184,600	0
Foreign loan	417,748	417,748	417,748	417,748	417,748	417,748	417,748	417,748	417,748	417,748
Capital	1,070,455	1,194,122	1,291,509	1,496,951	1,622,804	1,750,438	1,837,664	1,878,871	1,895,461	1,896,001
Retained Earnings	0	* 247,582	* 443,223	* 612,584	* 756,000	* 863,627	* 934,935	* 953,635	* 912,916	* 832,980
Net profit	* 247,582	* 195,641	* 169,361	* 143,416	* 107,627	* 71,308	* 18,200	* 40,719	* 79,936	* 156,327
Total	2,240,621	2,168,647	2,096,673	2,024,699	1,952,725	1,880,751	1,808,777	1,736,803	1,664,829	1,635,868
(\$000)	(4,592)	(4,518)	(4,368)	(4,218)	(4,068)	(3,918)	(3,768)	(3,618)	(2,843)	(3,408)

* : deficit

Table P-12-1

Yeocheon Hospital (100 beds)
ECONOMIC FORECASTING : ESTIMATION OF CASH FLOW
(1st - 10th year)

Unit: ₩1,000
1\$ = 480 won

Year	1	2	3	4	5	6	7	8	9	10
1. Operating and Maintenance										
1.1 Personnel	374,065	385,268	395,846	408,751	421,013	433,644	446,653	460,053	473,854	488,070
1.2 Other expenses	222,839	257,473	276,280	295,105	313,935	332,740	359,941	387,121	414,301	441,483
1.3 Maintenance	14,219	14,219	14,219	14,219	14,219	14,219	14,219	14,219	14,219	14,219
1.4 Interest	103,355	103,355	103,355	103,355	93,155	82,055	69,855	56,455	41,855	25,755
1.5 Operating expenses	714,478	760,310	738,599	821,435	842,322	862,678	893,668	917,848	962,290	969,527
1.6 Depreciation	71,974	71,974	71,974	71,974	71,974	71,974	71,974	71,974	71,974	71,974
1.7 Operating cost	786,452	832,284	862,679	893,409	941,296	934,652	965,642	989,822	1,034,204	1,041,501
2. Revenue										
2.1 Outpatient	150,253	176,513	198,067	219,619	241,173	262,725	277,741	292,098	306,785	321,470
2.2 Inpatient	388,617	460,129	495,251	530,374	565,496	600,619	669,531	738,443	807,355	876,268
2.3 Other										
2.4 Whole revenue	538,870	636,643	693,318	749,993	806,619	863,344	946,942	1,030,541	1,114,140	1,197,738
3. Calculation										
3.1 Operating incomes	* 247,582	* 195,641	* 169,361	* 143,416	* 107,627	* 71,308	* 18,700	40,719	79,936	156,237
3.2 Accumulation	* 247,582	* 443,223	* 612,584	* 756,000	* 863,627	* 934,935	* 953,635	* 912,916	* 832,980	* 676,743
3.3 Income tax										
4. Cash flow calculation										
4.1 Gross cash flow	* 175,608	* 123,667	* 97,387	* 71,442	* 35,653	666	53,274	112,693	151,910	228,211
4.2 Invested capital	175,608	123,667	97,387	178,442	152,853	127,634	87,226	41,207	16,590	0
4.3 Payoff/discharge	0	0	0	107,000	117,200	128,300	140,500	153,900	168,500	184,600
4.4 Net cash flow	0	0	0	0	0	0	0	0	0	43,611
4.5 Accumulation of 4.4	0	0	0	0	0	0	0	0	0	43,610
(\$000)										(91)

* : deficit

Appendix Table A 4-1

			Amount
No. 1: Land estate cost			
1.1.	Value: <u>quantity (Won/M²)</u>		<u>Whole Amount</u>
	34,100 (4,537 Won/M ²)		
1.2.	Acquisition cost		
			₩154,710,000
	Total Sum of No. 1		₩154,710,000
No. 2: Site preparation cost			
2.1.	Public opening		₩2,000,000
2.2.	Non-public opening		₩31,000,000
2.3.	Other cost (i.e. taxes)		₩33,000,000
	Total Sum of No. 2		
No.3: Construction cost			
3.1.	Building (due to room and space program plus traffic ways)		₩2,046,000,000
3.2.	Installations (Sewage, Water, Heating, Electricity ...)		₩450,000,000
3.3.	Technical service plants (Waste water; water, warm water, gases, electricity, telephone and other central communication installations, air-cinditioning, elevators ...)		₩593,000,000
	Total Sum of 3.1 - 3.3		₩3,089,000,000

and:

a) Classification to space-content:

3.1 - 3.3 :	<u>m³</u>	<u>Won/m³</u>	<u>Whole Amount</u>	<u>Outside Equipment</u>
	59,380	50,000	₩2,969,000,000	₩120,000,000
Sum of 3.1 - 3.3				

b) Classification to space

3.1 - 3.3 :	<u>m²</u>	<u>Won/m²</u>	<u>Whole Amount</u>	
	14,845	200,000	₩2,969,000,000	₩120,000,000
Sum of 3.1 - 3.3				

c) Classification to beds

3.1 - 3.3	<u>No. of beds</u>	<u>Won/Bed</u>	<u>Whole Amount</u>	
	250	11,876,000	₩2,969,000,000	₩120,000,000
Sum of 3.1 - 3.3				

No. 4:	Equipment	
4.1.	Medical Equipment	\$1,981,662
4.2.	Non-medical Equipment	\$107,650
	Total Sum of 4.1 + 4.2	\$2,089,312
No. 5:	Outside Equipment	₩120,000,000
No. 6:	Contingency (15% of construction, dormitory and medical equipment)	₩629,892,000
No. 7:	Engineering Fee	₩123,560,000
No. 8:	Dormitory	₩107,408,000

VI. GENERAL DESCRIPTION: HOSPITAL CONSTRUCTION AND MANAGEMENT

1. Room and Space Programe
2. Construction
3. Sponsor
4. Manpower
5. Equipment

THE HISTORY OF THE CITY OF BOSTON

FROM THE
FIFTH
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VI. GENERAL DESCRIPTION : HOSPITAL CONSTRUCTION AND MANAGEMENT

1. Room and Space Programme

1.1 Bases of calculation for Room and Space Requirement

The number of rooms for specific medical purpose is calculated according to the performances given by the medical programme of each hospital. For example, operation room: See Nonsan and Ulsan Hospitals, consulting room: See Nonsan and Ulsan Hospitals. The space for auxiliary hospital services (administration, supply, etc.) is calculated by area on the basis of average standards. The itemized space list is calculated in terms of m² net area. The ratio of net to gross area is 1:1.7 (See Guro Report, Room and Space Program).

1.2 Room and Space Standards

Standards are derived from survey and analysis of existing hospitals in Korea and from data in comparison with those of West Germany, USA and others (See the Table attached at the end of this section).

13. Room and Space List

The internal arrangement of room and space is made on the basis of hospital functions: Examination and Treatment, Wards, Supply, Administration, and Technical Centers. The model lists of room and space programs are attached at the end of this section (For Ulsan hospitals; Table VI-7, for Nonsan Hospitals, Table VI-6).

2. Construction

2.1 Opening Measures

A separated drainage system for storm and sewage will be constructed from the main sewer to the service pipe of the hospital site. The water will be supplied by the city main water treatment plant. A piping system will be constructed from the main water pipe along the street to the service pipe of the site. The electric power line will be constructed by the Korea Electric Company from the main distribution line to the connection of the building. The telephone line also will be constructed by the Telephone Office from the main city telephone line to the connection of the building. The city authorities will be responsible for a road connection from the existing road to the site of the entrance. All dimensions of the pipes, power connections should be sufficient to serve the hospital. The sponsor of the hospital will be responsible for the cost of the above mentioned opening measures, and the cost is included in the investment cost.

2.2 Design principles for basic layout

The basic layout was designed to show the internal structure of the building, space arrangement, corridors, vertical traffic connections according to hospital functions. The entrance to the buildings will be separated for outpatients, inpatients, emergency cases, supply, morgue and dormitory. The basic layout takes into consideration future alternations and expansions of the facility. The layout is based on a modular planning system (See Guro report 8.5.1 & 8.5.2). Architectural details, such as final layout, facade are subject to the future project planning process.

2.3 Technical Installations

The electricity will be supplied according to the uses after lowering the voltage of the building's transformer facilities from the transformer station of the Korea Electric Company. An interception device and emergency electrical resources must be installed. Communication system should be an efficient one (See Guro report 8.7.5). Heating system should be installed in accordance with the related laws and regulations of the Government. Air conditioning and ventilation should also be installed according to the regulations. Operation room should be equipped with both heating and air conditioning. Ventilation device should be properly placed. Sanitary equipment and installation should be followed in accordance with the related codes. For example, water pipes installation should take sanitary problems into consideration. Particularly, the soil pipes should be sanitarily installed.

2.4 Time schedule for planning and construction

Planning period will range from 3 to 6 months, which depends on the number of hospital-bed complements. Planning of building structure, mechanical installation, electricity, communication facilities and engineering works, will be adjusted case by case accordingly. However, the total construction period should be adjusted taking the cold winter months or other conditions into consideration. In general, the full construction period from the beginning of planning activities will vary hospital by hospital. It will take at least 12 months to construct a 50-bed hospital, 15 months for a 100-bed, 18 months for a 150-bed, and 24 months for a 200-bed hospital.

2.5 Basis for Cost Calculation

Land purchasing price of hospital sites was provided by the Korea Appraisal Board (See following Table).

VI-1 Estimated Price of Land Estates for the Proposed Hospital Sites (1979)
(Unit: Won)

1) Medically Under-served Area						
	Commercial Area			Residential Area		
	High	Middle	Low	High	Middle	Low
Goesan	100,000	70,000	50,000	60,000	40,000	20,000
Nonsan	1,000,000	400,000	60,000	100,000	70,000	20,000
Hadong	610,000	130,000	80,000	80,000	70,000	20,000
Younggang	500,000	300,000	80,000	50,000	30,000	8,000
Pyungchang	50,000	40,000	30,000	30,000	25,000	5,000
Euryong	180,000	-	60,000	40,000	-	15,000
Jinan	300,000	150,000	50,000	40,000	25,000	10,000
2) Industrial Complexes						
	High	Middle		Low		
Cheongju	30,000	25,000		20,000		
Pohang	20,000	12,000		7,000		
Ulsan	15,000	15,000		15,000		
Mokpo	20,000	15,000		15,000		
Yeocheon	20,000	15,000		10,000		
Daejeon	40,000	35,000		2,5000		

Source: Korea Appraisal Board

All the expenses for site preparation, building construction, other facilities contingencies and engineering fee were calculated in reference to the precedents in Korea. Average cost for a square meter of the grand gross total was also calculated.

Table VI-2. Calculation of Consultation Rooms for the Nonsan Hospital

Department	Consultation/ Year	Minute/ Consultation	Minute/ Year	* No. of Room
Internal medicine	14,699	10	146,990	2
General surgery	2,940	8	23,520	1
Orthopedic surgery	1,680	15	25,200	1
Pediatrics	6,300	15	94,500	1
OB & GYN	5,038	10	50,380	1
ENT	3,778	15	56,670	1
Ophthalmology	2,100	20	42,000	1
Uro-dermatology	3,359	15	50,385	1
Dental surgery	2,098	20	41,960	1
Total	41,993			

* CAPACITY: $5^d \times 6^h + 1^d \times 3^h = 33^h/\text{week}$
 $33^h \times 50^w = 1,650^h/\text{y}$
 $1,650^h \times 6^m = 100,000 \text{ minute/year}$

Table VI-3. Calculation of Operation Rooms for the Nonsan Hospital

Medical Department	OP/ yr.	Op/day (280 d/y)	Min/OP (includ- ing room Preparation)	Min/ yr.	*No. of OP-room	Aseptic % Rooms	Septic % Rooms
General surgery	506	2.4	100	50,600	0.50	80	0.40
Orthopedic surgery	182	0.9	75	13,650	0.14	100	0.14
OB - GYN	524	2.5	70	36,680	0.36	65	0.23
ENT	47	0.2	65	3,055	0.03	10	0.003
Ophthalmology	60	0.3	55	3,300	0.03	90	0.03
Uro-dermatology	73	0.4	65	4,745	0.05	30	0.02
Dental surgery	191	0.9	45	8,595	0.09	5	0.005
Total		7.6 cases		120,625	1.20	0.83	0.38

* CAPACITY = 100,800 min/yr.

Table VI-4, Calculation of Consultation Rooms for the Ulsan Hospital
(250 bed)

Department	Consultation/year	Minutes/Consultation	Minutes/year	No. of Room
Internal Medicine	27,462	10	234,620	3
General surgery	9,154	8	73,232	1
Orthopedic surg.	6,103	15	91,545	1
Neuro-surgery	3,560	15	53,400	1
Pediatrics	17,799	15	266,985	3
OB and GYN	16,274	10	162,740	2
ENT	3,051	15	45,765	1
Ophthalmology	3,560	20	71,200	1
Urology	2,543	15	38,145	1
Dental surgery		20		1
Neuro-Psychiatry	4,068	20	81,360	1
Other	4,068	18/d	280d/y	1

* CAPACITY : $5^d \times 6^h + 1^d \times 3^h = 33^h/w$
 $33^h \times 50^w = 1,650 \text{ h/y}$
 $1,650^h \times 60^m = 100,000 \text{ min/y}$

Table VI-5. Calculation of Operation Rooms for the Ulsan Hospital

Medical Department	OP/year	OP/day (280 d/y)	Min/OP (including room preparation)	Minute/year	*No. of BP room	Aseptic % Rooms	Septic % Rooms
General surgery	1,111	4.0	100	111,100	1.10	80	0.88
Orthopedic surg.	504	1.8	75	37,800	0.38	100	0.38
Neuro-surg.	167	0.6	200	33,400	0.33	100	0.33
OB & GYN	837	3.0	70	58,590	0.58	65	0.38
ENT	252	0.9	65	16,380	0.16	10	0.02
Ophthalmology	171	0.6	55	9,405	0.09	90	0.08
Urology	128	0.5	65	8,320	0.08	30	0.02
Total		11.4		274,955	2.73		2.09

* Capacity = 100,800 minutes/year

Table VI-6.

ROOM & SPACE PROGRAM : (100 BEDS HOSP.)

ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
1	EXAMINATION AND TREATMENT			
101	ENTRANCE AND EMERGENCY			
101/01	Entrance hall	1	60	
/02	Guard's room	1	8	
/03	First aid room	1	32	
/04	Preparation room	1	12	
/05	Scrub room + dress changing		8	120
102	OUTPATIENTS DEPARTMENTS			
102/01	Internal medicine (Superintendent) consultation	1	24	(to be checked according to manpower requirement list)
/02	Internal medicine	2	(24) 48	
/03	General surgery	1	24	
/04	Pediatrics	1	(24) 24	
/05	OB & GYN	1	24	
/06	Othopedics	1	24	
/07	ENT	1	24	
/08	Ophtalmology	1	24	
/09	Urology	1	24	
/10	Dental	1	24	
/11	Special exam. (ECG, Endos.)	1	24	
/12	Physical check-up	1	24	
/13	Waiting areas	11	(12) 132	
/14	Medical trainees' room (intern + resident)	1	24	
/15	W.C. for patients + anteroom	4	12	
/16	W.C. for staff + anteroom	2	6	
/17	Nurse's locker	1	24	
/18	Night duty	3	(12) 36	546

ROOM & SPACE PROGRAM : (100 BEDS HOSP.)

ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
105	LABORATORY			
105/01	Specimen taking room incl. W.C.	1	12	
/02	Chemical-heamatological	1	32	
/03	Bacteriological serological	1	32	
/04	Storage + Cleaning	1	16	
/05	Waiting area	1	12	104
106	MORGUE			
106/01	Autopsy room incl. 2 refrig. cells	1	24	
/02	Changing and sanitary room	1	12	
/03	Coffin room	1	24	60
107	X-RAY			
107/01	X-ray room	2	(32) 64	
/02	Dressing cubicles + W.C.	6	(1.5) 9	
/03	Operator & dark room	1	24	97

ROOM & SPACE PROGRAM : (100 BEDS HOSP.)

ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
109	OPERATION			
109/01	Operating room	2	(36) 72	
/02	Preparation room (anaesthesia)	2	(12) 24	
/03	Scrub room	1	12	
/04	Recovery room	1	24	
/05	Instrument room, sub- sterilizing	1	12	
/06	Changing rooms for male and female staff + shower	2	16	160
110	DELIVERY			
110/01	Delivery room (2 beds)	1	32	
/02	Labour room (2 beds)	1	16	
/03	Nurses' room	1	16	
/04	Bath room	1	12	76
111	PHYSIOTHERAPY (DRY ROOM)	1	18	18
			TOTAL 1	1,181

ROOM & SPACE PROGRAM : (100 BEDS HOSP.)

ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
2	WARDS			
201	1ST NURSING STATION (35BEDS) ORTHOPEDICS + GEN. SURGERY			
	6BED Room	4	(42) 168	
201/01	4 BED ROOM	1	(28) 28	
/02	2 Bed room	2	(14) 28	
/03	1 Bed room	3	(3) 42	
/04	Nurse's station	1	16	
/05	Nurse's room	1	16	
/06	Utility room, clean.	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & Shower	1	16	
/10	W.C. for staff + anteroom	2	6	
/11	W.C. for patients + anteroom	6	16	
/12	Doctor's room + examination	1	24	404
202	2ND NURSING STATION (38BED) INTERNAL + EDIATRICS			
	6 Bed room	4	(42) 168	
202/01	4 Bed room	2	(28) 56	
/02	2 Bed room	2	(14) 28	
/03	1 Bed room	2	(14)	
/04	2-Bed room pediatrics	3	(24) 72	
/05	incl. sluice and sanitary room incl. room for prematured			
	Nurse's station	1	16	
/06	Nurse's room	1	16	
/07	Utility room, clean	1	16	
/08	Utility room, dirty	1	16	
/09	Pantry	1	12	
/10	Bath room & shower	1	16	
/11	W.C. for staff + anteroom	2	6	
/12	W.C. for patients + anteroom	6	16	
/13	Doctor's room + examination	1	24	474

ROOM & SPACE PROGRAM : (100 BEDS HOSP.)

ROOM & SPACE PROGRAM : WARDS				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
203	3RD NURSING STATIONS (27 Beds)			
	OTHER DISCIPL.			
	6 Bed room	3	(42) 126	
203/01	4 Bed room	1	(28) 28	
/02	2 Bed room	2	(14) 28	
/03	1 Bed room	1	(14) 14	
/04	Bassinet room close to two 2-bed rooms, incl. utility sluice	1		
/05	Nurse's station	1	16	
/06	Nurse's room	1	16	
/07	Utility room, clean	1	16	
/08	Utility room, dirty	1	16	
/09	Pantry	1	12	
/10	Bath room & shower	1	16	
/11	W.C. for staff + anteroom	2	6	
/12	W.C. for patients + anteroom	6	16	
/13	Doctor's room	1	24	350
			TOTAL 2	1,228

ROOM & SPACE PROGRAM : (100 BEDS HOSP.)

ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS.				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
3	ADMINISTRATION			
301/01	Superintendent office	1	18	
/02	Superintendent secretary	1	12	
/03	Administration staff	1	120	
/04	Archive	1	60	
/05	Conference	1	24	234
4	SUPPLY			
401	PHARMACY			
401/01	Pharmacy office			
/02	Manufacturing & store			60
/03	Pharmacy reception			
402	STERILIZATION	1	60	60
404	KITCHEN AND DINING			
404/01	Cooking	1	80	
/02	Prepare			
/03	Washing			
/04	Office	1	18	
/05	Storage	1	60	
/06	Dining	1	60	
/07	W.C. for staff+ anteroom	2	6	
/08	Locker for all supply staff	1	36	260

ROOM & SPACE PROGRAM : (100 BEDS HOSP.)

ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
405	LAUNDRY			
405/01	Sorting	1	70	
/02	Washing			
/03	Ironing			
/04	Storage	1	50	
/05	Sewing			120
406	GENERAL STORAGE			100
407	GARBAGE COLLECTION			24
408	GARAGE + DRIVER'S ROOM			36
			TOTAL4	660
5	TECHNICAL CENTERS (incl. Workshop)		80	80

ROOM & SPACE PROGRAM : (100 BEDS HOSP.)

ROOM & SPACE PROGRAM : TOTAL				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
TOTAL 1	Exam. + Treatment	1,181		
TOTAL 2	Wards	1,228		
TOTAL 3	Administration	234		
TOTAL 4	Supply	660		
TOTAL 5	Tech. Centers	80		
	GRAND NET TOTAL	3,383		
	GRAND GROSS TOTAL	5,412.8m ²	(G/N = 1.6)	

Table VI-7.

ROOM & SPACE PROGRAM : ULSAN (250 BEDS)

ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
1	EXAMINATION AND TREATMENT			
101	ENTRANCE AND EMERGENCY			
101/01	Entrance hall	1	100	
/02	Guard's room	1	12	
/03	First aid admission and X-ray	1	24	
/04	First aid room (operation)	1	32	
/05	Preparation room	1	12	
/06	Scrub + dress changing	1	18	
/07	First aid rooms (plaster + chock)	2	(16) 32	
/08	Waiting room	1	18	
				248
102	OUTPATIENT DEPARTMENT			
102/01	Superintendent	1	24	(to be checked according to manpower requirement list)
/02	Internal medicine	3	(24) 72	
/03	General surgery	1	24	
/04	Orthopedics	1	24	
/05	Neuro surgery	1	24	
/06	Pediatrics	3	(24) 72	
/07	OB & GYN	2	(24) 48	
/08	ENT	1	24	
/09	Ophthalmology	1	24	
/10	Urology	1	24	
/11	Neuro psychiatry	1	24	
/12	Dermatology	1	24	
/13	Special exam. (ECG & Endos.)	1	24	
/14	Physical check-up	1	24	
/15	Waiting areas	19	(12) 228	
/16	Medical trainees' room	1	24	
/17	W.C. for staff, patients	1	30	
/18	Nurses' locker room	1	32	
/19	Night duty	6	(12) 72	842
105	LABORATORY			
105/01	Specimen taking room(incl. W.C)	1	18	
/02	Waiting room	1	36	
/03	Taboratory subdivided for chemistry, haematology, urinology etc.	1	120	
/04	Weighting room	1	6	

ROOM & SPACE PROGRAM : ULSAN (250 Beds)

ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
105/05	Laboratory for bacteriology	1	16	
/06	Laboratory for serology	1	24	
/07	Blood storage	1	8	
/08	Laboratory for histology	1	16	
/09	Cleaning and sterilizing room	1	16	
/10	Storage	1	8	
/11	Restroom and locker for staff	1	16	
/12	Doctor's room	1	16	
				300
106	MORGUE			
106/01	Autopsy room	1	24	
/02	Preparation and coffin room incl. 4 refig. cells	1	24	
/03	Visitors' room	1	18	
/04	Changing and sanitary room	1	12	
				78
107	X-RAY			
107/01	Plain X-ray room	1	32	
/02	Dressing cubicles	2	3	
/03	Fluoroscopy and plain X-ray room	1	32	
/04	Dressing cubicles + 1 W.C.	4	6	
/05	Mass X-ray room (also useful for plain X-ray)	1	32	
/06	Dressing cubicles	4	6	
/07	Operator's stands, film processing dark	1	36	
/08	Waiting and resting room for patients on stretchers	1	18	
/09	Waiting room	1	24	
/10	Film demonstration and reporting room	1	24	
/11	Reception, archive	1	18	
/12	Doctor's room	1	16	
/13	Preparation	1	12	
/14	Dressing cubicle	2	3	
				262

ROOM & SPACE PROGRAM : ULSAN (250 BEDS)

ROOM & SPACE PROGRAM : EXAMINATION AND TREATMENT				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
109	OPERATION/ASEPTIC AREA			
109/01	Operating room	3	(36) 108	
/02	Preparation room (anaesthesia)	3	(16) 48	
/03	Scrub room	3	(8) 24	
/04	Instrument room	1	16	
/05	Anaesthesist's utility	1	32	
/06	Storage for diverse accessory	1	18	
/07	Substerilization	1	18	
/08	Operative endoscope	1	24	
/09	Changing room for male, female	1	(24) 48	
/10	Nurses' office	1	12	
/11	Rest room for staff	1	24	
/12	Anaesthesist's office	1	16	
/13	Recovery room	1	60	
/14	Entrance area, sluice	1	24	
	SEPTIC AREA			
109/20	Operating room	1	36	
/21	Preparation room	1	16	
/22	Scrub room, dress changing	1	16	
/23	Instrument room	1	12	
				552
110	DELIVERY			
110/01	Delivery rooms	2	(24) 48	
/02	Washing room	1	6	
/03	Instruments room	1	6	
/04	Labour room	1	18	
/05	Nurse's room	1	16	
/06	Bath room	1	12	
				106
111	PHYSIOTHERAPY (DRY ROOM)	2	(12) 24	24
			TOTAL 1	2,412

ROOM & SPACE PROGRAM : ULSAN (250 BEDS)

ROOM & SPACE PROGRAM : WARDS				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
2	WARDS			
201	1ST NURSING STATION (37 BEDS) INTERNAL MEDICINE			
201/01	6 Bed room	4	(42) 168	
/02	2 Bed room	4	(14) 56	
/03	1 Bed room	5	(14) 70	
/04	Nurses' station	1	16	
/05	Nurses' room	1	16	
/06	Utility room, clean	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & shower	1	16	
/10	W.C. for staff + anteroom	2	6	
/11	W.C. for patients + anteroom	6	16	
/12	Doctor's room + examination	1	24	
				432
202	2ND NURSING STATION (34 BEDS) INTERNAL + PEDIAT. + OPHTHAL.			
202/01	6 Bed room	3	(42) 128	
/02	2 Bed room	3	(14) 42	
/03	1 Bed room	5	(14) 70	
/04	2-bed room for pediatrics incl. sluice (incl. room for premature)	4	(24) 96	
/05	Nurses' station	1	16	
/06	Nurses' room	1	16	
/07	Utility room, clean	1	16	
/08	Utility room, dirty	1	16	
/09	Pantry	1	12	
/10	Bath room & shower	1	16	
/11	W.C. for staff + anteroom	2	6	
/12	W.C. for patients + anteroom	6	16	
/13	Doctor's room + examination	1	24	
/14	Playing room	1	16	
				490

ROOM & SPACE PROGRAM : ULSAN (250 BEDS)

- ROOM & SPACE PROGRAM : WARDS				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
203	3RD NURSING STATION (36 BEDS) GENERAL SURGERY			
203/01	6 Bed room	4	(42) 168	
/02	2 Bed room	4	(14) 56	
/03	1 Bed room	4	(14) 56	
/04	Nurse's station	1	16	
/05	Nurse's room	1	16	
/06	Utility room, clean	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & shower	1	16	
/10	W.C. for staff + anteroom	2	6	
/11	W.C. for patients + anteroom	6	16	
/12	Doctor's room + dressing	2	24	
				418
204	4TH NURSING STATION (38 BEDS) ORTHOPEDIC SURGERY (EQUAL TO 203)			
				418
205	5TH NURSING STATION (39 BEDS)			
	a) ORTHOPEDIC SURG. (ANNEX 8 BEDS)			
205/01	4 Bed room	1	28	
/02	2 Bed room	2	(14) 28	
/03	Nurses' substation	1	12	
/04	Utility rooms	2	(8) 16	

ROOM & SPACE PROGRAM : ULSAN (250 BEDS)

ROOM & SPACE PROGRAM : WARDS				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
	b) NEURO-SURGERY (31 BEDS)			
205/21	6 bed room	3	(42) 126	
/22	4 bed room	2	(28) 56	
/23	2 bed room	2	(14) 28	
/24	1 bed room	3	(14) 42	
/25	Nurses' station	1	16	
/26	Nurses' room	1	16	
/27	Utility room, clean	1	16	
/28	Utility room, dirty	1	16	
/29	Pantry	1	12	
/30	Bath room & shower	1	16	
/31	W.C. for staff + anteroom	2	6	
/32	W.C. for patients + anteroom	6	16	
/33	Doctor's room + examination	1	24	
				474
206	6TH NURSING STATION (37 BEDS) OB-GYN + URO. + DERMA.			
206/01	6 bed room	4	(42) 168	
/02	2 bed room	4	(16) 56	
/03	1 bed room	5	(14) 70	
/04	Nurse's station	1	16	
/05	Nurse's room	1	16	
/06	Utility room, clean	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & shower	1	16	
/10	W.C. for staff + anteroom	2	6	
/11	W.C. for patients + anteroom	6	16	
/12	Doctor's room	1	24	
/13	Basinet room incl. sluice	1	32	
				464

ROOM & SPACE PROGRAM : ULSAN (250 BEDS)

ROOM & SPACE PROGRAM : WARDS

INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
207	7TH NURSING STATION (28 BEDS) FURTHER DISCIPLINES (RESP. SUBDIVIDED)			
207/01	6 bed room	3	(42) 126	
/02	2 bed room	3	(14) 42	
/03	1 bed room	4	(14) 52	
/04	Nurses' station	1	16	
/05	Nurses' room	1	16	
/06	Utility room, clean	1	16	
/07	Utility room, dirty	1	16	
/08	Pantry	1	12	
/09	Bath room & shower	1	16	
/10	W.C. for staff + anteroom	2	6	
/11	W.C. for patients + anteroom	6	16	
/12	Doctor's rooms	2	(24) 48	
				382
			TOTAL 2	3,078

ROOM & SPACE PROGRAM : ULSAN (250 BEDS)

ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
3	ADMINISTRATION			
300/01	Superintendent office	1	18	(to be checked according to manpower requirement list)
/02	" , secretary	1	12	
/03	Administration staff	1	250	
/04	Archive	1	100	
/05	Conference	1	36	
				416
4	SUPPLY			
401	PHARMACY			150
401/01	Pharmacy office			
/02	Manufacturing & store			
/03	Pharmacy reception			
402	STERILIZATION		180	180
404	KITCHEN AND DINING			
404/01	Cooking	1	200	
/02	Prepare			
/03	Washing			
/04	Office	1	24	
/05	Storage	1	150	
/06	Dining	1	120	
/07	W.C. for staff	2	(1.5) 3	
/08	Locker for all supply staff	1	45	
				542
405	LAUNDRY			
405/01	Sorting		150	
/02	Washing			
/03	Ironing		100	
/04	Storage			
/05	Sewing			
				250

ROOM & SPACE PROGRAM : ULSAN (250 BEDS)

ROOM & SPACE PROGRAM : ADMINISTRATION AND OTHERS

[illegible]

ROOM & SPACE PROGRAM : ULSAN (250 BEDS)

ROOM & SPACE PROGRAM : TOTAL				
INDEX	NAME OF FUNCTIONAL UNITS & ROOMS	NUMBER OF ROOMS	SPACE(M ²) DETAILED	IN TOTAL (M ²)
I	II	III	IV	V
TOTAL 1	Examination & Treatment	2,412		
TOTAL 2	Wards	3,078		
TOTAL 3	Administration	416		
TOTAL 4	Supply	1,617		
TOTAL 5	Technical Centers Incl. Workshop	350		
GRAND NET TOTAL		7,873 m ²		
GRAND GROSS TOTAL		12,596.8 m ² (G/N = 1.6) 15.24 pyong/bed		

3. Sponsor of the Project

3.1 Legal Status of the Project Sponsor

The proposed hospitals will be established by the joint support of the central and local government. These hospitals are to be managed by local non-profit medical corporations in the areas concerned. In areas where such corporations are hardly organized, the provincial authorities together with the related local administrative office will manage the operation of the newly established hospitals. In case that a medical corporation manages the hospital, the corporation should be organized by obtaining an approval of the Minister of Health and Social Affairs. The medical corporation should assume the responsibility for carrying out successfully the medical service for the local people under the national health care delivery system.

3.2 Organization

In case that a medical corporation founded a hospital, the board of directors of the hospital and the representatives of the local community will organize the steering committee of the hospital. In case that the Provincial Government or the Gun Office found a hospital, the superintendent of the hospital and representatives of the local community will organize the steering committee of the hospital.

3.3 Board of Directors (in Medical Corporation)

The board of directors, as the deliberative organization with the voting right, will determine the overall management policy and guidelines of the hospital and will approve the annual budget and the settlement of the accounts of the hospital.

3.4 Steering Committee

It is desirable that the local hospital should be managed with the participation in by the representatives of the total community. Therefore, the board of directors (in case of a medical corporation), who has the voting right in the determination of hospital policy, and the steering committee, which is organized together with the representative of the local community, will discuss and determine the scope of the activities of the hospital, the maintenance of the hospital, medical fees and other relevant medical programs.

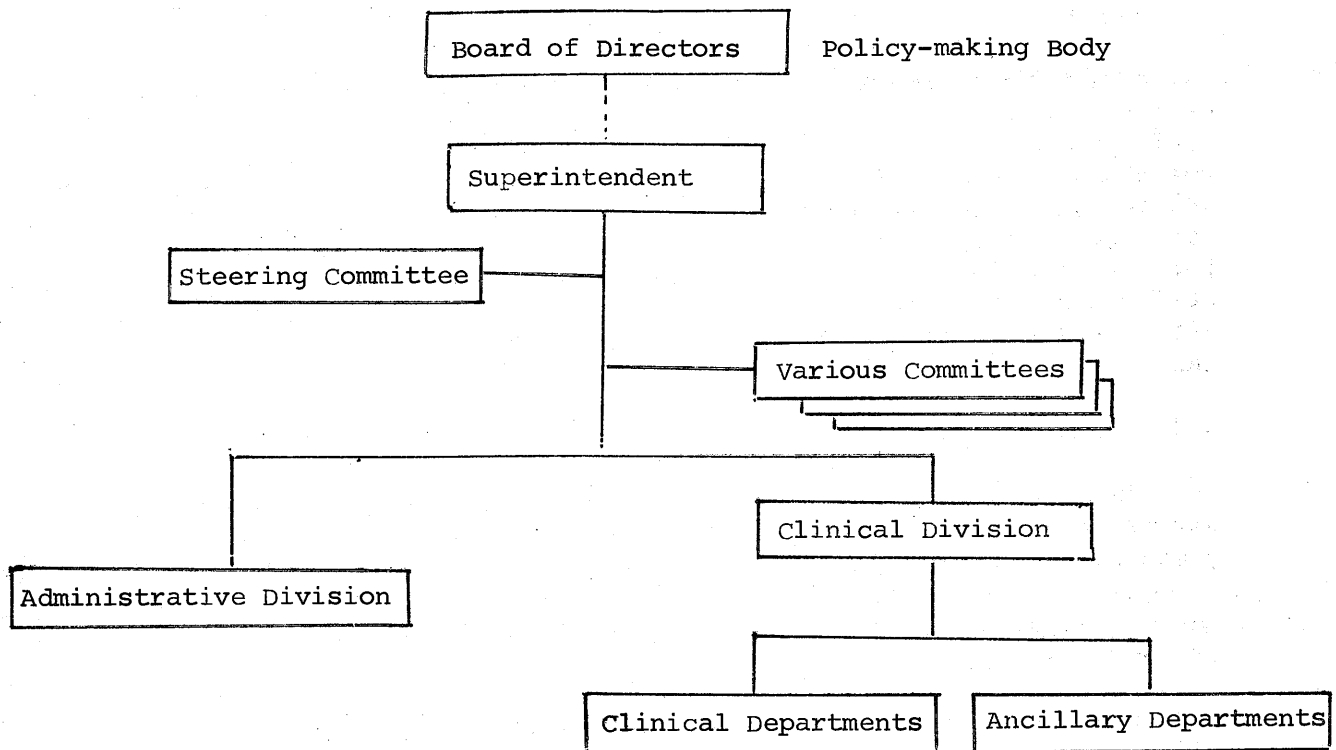
3.5 Internal Organization of the Hospital

The internal organization of a hospital will be varied according to the location of the hospital, size of the catchment population the capacity of hospital-beds, the types of the existing medical facilities in the areas concerned, and the hospital management policy which are determined by the pertinent corporation or the local government. However, the hospital should have the basic internal organization composed of the clinical departments, ancillary departments, and administrative departments as following:

3.6 Clinical Departments by Size of Hospital

Generally, the hospitals in Korea have four basic clinical departments, comprised internal medicine, general surgery, pediatrics, and Ob. & Gyn., and the

Figure VI-1

Basic Organization of a Proposed Hospital

three ancillary departments, composed of the clinical laboratory, X-ray, and anesthesiology. Therefore, a small-size hospital with about 50 beds has the above four basic clinical departments and the three ancillary departments. However, as the services of the three ancillary departments in the small-size hospital are carried out generally by medical technologists due to the limited work-volume this study has assigned medical technologists to perform the services of three ancillary departments in the small-size hospital. The number of the clinical departments of the medium-size hospital with above 100-bed is determined according to the medical program thereof. The detailed number of clinical departments by size of the hospital and by area is as shown in the following table.

3.7 Sponsor Analysis

The detailed analysis of sponsors for the projected 13 Hospitals are deleted because of the following reasons; 1) Sponsors will be selected by the Minister of Health and Social Affairs in the first part of each fiscal year according to the original hospital construction plan of MOHSA, 2) Six sponsors were determined already, the Ulzi Hospital for the Daejeon area, the Sooncheon-hyang Hospital for the Eumseong area, the St. Mary Hospital for the Pohang area and three others for the Ulsan, Cheongju and Nonsan. The Government requires legal medical corporations to be sponsors for the newly projected Hospitals, however, only three big hospitals mentioned above are eligible to construct and operate the projected Hospital. And remaining three sponsors are in process to register themselves as a legal medical corporation which should be organized according to the laws by obtaining an approval of the Minister of Health and Social Affairs. 3) The three big sponsors are not expected to have any problems to maintain the Daejeon, Eumseong and Pohang hospitals because they have enough profit

and retained earnings because of their performances so far and the new projected Hospitals are not big enough to effect the existing operation of the large three Hospitals. 4) The Analysis of sponsors should scrutinize the financial conditions of the legal medical corporation (not the natural persons) to see whether they are eligible to construct the new hospitals. As mentioned in 2), the legal corporation of these three for the Nonsan, Cheongju and Ulsan are in the process and it will be finished by next year. So the feasibility study team concludes it is more reasonable to see their financial condition later on after the corporations are formal 5) The sponsors of 7 other new hospitals will be determined gradually after 1980. Therefore at this moment, it is not possible to include the analysis in this report. If it is hardly possible to find sponsors or to government (Provincial Government and together) will take over the operations of the newly projected hospitals.

Table VI-8.

Number of Clinical and Ancillary Departments by Hospital

	Bed Size	Int. Medicine	Gen. Surgery	Pediatrics	OB-GYN	Ortho. Surgery	Neuro-Surgery	ENT	Ophthalmology	Derma-Urology	Neuro-Psychiatry	Urology	Dentistry	Clinical Lab.	X-Ray	Anesthesiology
Daejeon	150	0	0	0	0	0	0	0	0	0	0		0	0	0	0
Mokpo	80	0	0	0	0					0			0	0	0	0
Ulsan	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yeocheon	100	0	0	0	0	0	0	0	0	0	0		0	0	0	0
Cheongju	150	0	0	0	0	0	0	0	0	0	0		0	0	0	0
Pohang	100	0	0	0	0	0		0	0	0			0	0	0	0
Eumseong	80	0	0	0	0					0			0	Δ	0	0
Nonsan	100	0	0	0	0	0		0	0	0			0	Δ	0	0
Euryong	50	0	0	0	0									Δ	Δ	Δ
Jinan	50	0	0	0	0									Δ	Δ	Δ
Hadong	50	0	0	0	0									Δ	Δ	Δ
Youngwang	100	0	0	0	0	0		0					0	Δ	0	0

Note: 0 = Physician
Δ = Technologist

4. Manpower Requirement

4.1 The estimation of the manpower requirement of a hospital has been made on the basis of the results of the field survey conducted by KHDI as well as the required staffing criteria as stipulated in the Medical Law.

4.2 Manpower Classification: The manpower requirement is estimated based on the professional groups which are classified, for convenience' sake, into 5 large categories--physicians, nurses, medical technologists, administrative personnel and others.

4.3 Estimation of Manpower Requirement

4.3.1 Physician: In the estimation of the requirement of full-time physician, the following factors are taken into consideration: The number of clinical departments and ancillary departments, the number of inpatients and outpatients, and the number of the clinical departments, and the authorized staffing criteria.

The requirement was calculated based on the following formula.

$$Nmd = \frac{Pie}{Ki} + \frac{Poe}{Ko}$$

Where, Nmd: Number of physician requirement
Pie: Average number of inpatients per day
Poe: Average number of outpatients per day
Ki: Legally authorized number of beds per physician
Ko: Legally authorized number of outpatients per physician per day

4.3.2 Nurses: The requirement of nurses was estimated by taking the following factors into consideration: For the primary nursing functions, the number of clinical departments, general inpatients, and intensive-care unit. For the specific nursing functions, administrative job opening, emergency room, operation room, delivery room, and the central supply room, etc.

The applied formula was as follows:

$$Nrn = \sum Rij + \frac{Pie}{Ki} + \frac{Piex}{Kix}$$

Where, Nrn: Number of nurse requirement
Rij: Number of nurses at specific job posts
Pie: Average number of inpatient per day
Piex: Average number of intensivecare patients per day
Ki: Legally authorized number of beds per nurse
Kix: Number of intensivecare patients per nurse

About 50% of the total number of nurses could be substituted, if necessary, by nurse-aids.

4.3.3 Medical Technologist: The medical technologists include clinical laboratory technicians, X-ray technicians, and anesthetists. The requirement of medical technologists was estimated by taking the following factors into account: Number of clinical examinations for inpatients and outpatients by specific functions, requirement of night duty, and examination capability by specific functions per technologist per day.

4.3.4 Laboratory Technicians: The requirement of laboratory technicians was determined by the following formula, assuming the standard number of laboratory tests per day numbering 60 cases per technician.

$$NL = \frac{Li + Lo}{KL} + C$$

where, NL: Number of laboratory technician requirement
 Li: Average number of laboratory tests for inpatients per day
 Lo: Average number of laboratory tests for outpatients per day
 KL: Standard number of laboratory tests per technician per day
 C: Required number of technicians on night duty

4.3.5 X-ray technicians: The requirement of X-ray technicians was determined by the above same formula, with the daily photographing capability amounting to 20 cases per technician. The requirement of other medical technicians was determined by taking into account their specific functions and work-load.

4.3.6 Administrative personnel and others: The administrative staff and other manpower were determined based on the number of outpatients and inpatients:

The manpower requirement by occupational group for the proposed hospitals is as shown in the following table.

Table VI-9. Manpower Requirement by Hospital

Area	No. of Beds	Total Manpower	Physi- cian	Nurse	Medical Tech.	Adminis- trator	Others
Medically Under-served Area							
Nonsan	100	157	12	68	13	11	53
Euryong	50	80	4	30	7	6	33
Yeonggwang	100	150	10	66	13	10	51
Jinan	50	83	4	32	8	6	33
Hadong	50	83	4	32	8	6	33
Eumseong	80	128	9	57	9	8	45
Yeoju	50	88	5	36	7	6	34

Table VI-10. Manpower Requirement by Hospital (Continued)

Area	No. of Beds	Total Manpower	Physi- cian	Nurse	Medical Tech.	Adminis- trator	Others
Industrial Complex							
Ulsan	250	321	29	147	18	22	105
Daejeon	150	224	19	102	16	16	71
Cheongju	150	224	19	102	16	16	71
Pohang	100	158	12	69	12	10	55
Mokpo	80	128	9	57	9	8	45
Yeocheon	100	158	12	69	12	10	55
Guro	250	344	32	135	22	26	111
Banwol	100	166	18	68	13	11	56

5. Cost of Medical Equipment, Medical Expendables, Sanitary Materials, and Utensils

5.1 The type, amount and cost of various medical equipment, utensils and furnishing required in the hospital were estimated based on the following principles.

5.2 Medical Equipment: The medical equipments were selected based on the following criteria to meet the size of hospital and also the role and function of the hospital.

5.2.1 The type and amount of medical equipment were determined to properly perform the functions of the hospital concerned.

5.2.2 The item and quantity of medical equipment was determined according to the space program, departments and rooms. Medical equipment are classified into 2 large groups: basic medical equipment and minor medical equipment.

5.2.3 The commonly used equipment is grouped into basic medical equipment at one place to avoid duplication.

5.2.4 Domestically-purchased equipment and the equipment to be imported are separately marked.

5.2.5 Cost of equipment was calculated based on the market price and the official Won & US dollar exchange rate as of Feb. 28, 1979.

The cost of the basic medical equipment and the minor medical equipment for the proposed hospitals are estimated as shown in the following table.

Table VI-11. Estimated Budget Requirement for Medical Equipments, Furnitures and Utensils by Hospital

and Utensils by Hospital				(Unit = \$)		
Area	No. of Beds	TOTAL	Medical Equipment		Furniture & Utensils	
			Total	Korean Product		Imported Item
Medically Under-served Area						
Nonsan	100	967,590	911,875	68,894	842,981	55,715
Euryong	50	502,358	468,415	37,045	431,370	33,943
Yeonggwang	100	928,692	873,667	67,610	806,057	55,025
Jinan	50	503,620	469,615	38,245	431,370	34,005
Hadong	50	503,620	469,615	38,245	431,370	34,005
Eumseong	80	799,513	747,696	60,356	687,340	51,817
Sub-total	480	4,205,393	3,940,883	310,395	3,630,488	264,510
Industrial Complex						
Ulsan	250	2,089,312	1,973,973	197,761	1,776,212	115,339
Daejeon	150	1,082,013	1,017,523	80,077	937,446	64,490
Cheongju	150	1,082,013	1,017,523	80,077	937,446	64,490
Pohang	80	807,842	758,645	54,781	703,864	49,197
Mokpo	100	870,308	812,839	68,253	744,586	57,469
Yeocheon	100	870,308	812,839	68,253	744,586	57,469
Sub-total	850	6,801,796	6,393,342	549,202	5,844,140	408,454
TOTAL	1,330	11,007,189	10,334,225	859,597	9,474,628	672,964

5.3 Drugs, Medical Expendables and Sanitary Materials

The cost of drugs, medical expendable goods, sanitary materials and other medical supplies for the proposed hospital was calculated based on the percentage of those goods and materials of the total operational expenses and their individual composition ratio to the total cost thereof in the existing similar-size hospital. The criteria applied is as shown in the following table.

Table VI-12. Estimated Proportion of Expenditure for Drugs and Medical Supplies of a Hospital

Total Hospital Expenditure	100.0%	
Expenditure for total consumable goods	25.0	100.0%
Drugs	20.8	83.0
Medical expendables	1.2	5.0
Medical supplies (sanitary)	2.0	8.0
Others	1.0	4.0

KHDI study team analyzed from 47 hospital statistics

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