

Ministry of Health  
The Former Yugoslav  
Republic of Macedonia

No. 1

**BASIC DESIGN STUDY REPORT  
ON  
THE PROJECT  
FOR  
EQUIPMENT SUPPLY  
FOR THE GENERAL HOSPITAL OF  
THE MEDICAL CENTER OF BITOLA  
IN  
THE FORMER YUGOSLAV  
REPUBLIC OF MACEDONIA**

**MARCH 1999**

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CRC OVERSEAS COOPERATION Inc.**

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## PREFACE

In response to a request from the Government of the Former Yugoslav Republic of Macedonia, the Government of Japan decided to conduct a basic design study on the Project for Equipment Supply for the General Hospital of the Medical Center of Bitola and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Macedonia a study team from September 28 to October 31, 1998.

The team held discussions with the officials concerned of the Government of Macedonia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Macedonia in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Former Yugoslav Republic of Macedonia for their close cooperation extended to the teams.

March, 1999



Kimio Fujita  
President

Japan International Cooperation Agency





March, 1999

### Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Equipment Supply for the General Hospital of the Medical Center of Bitola in the Former Yugoslav Republic of Macedonia.

This study was conducted by CRC Overseas Cooperation Inc., under a contract to JICA, during the period from September 18, 1998 to March 31, 1999. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Macedonia and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

飯村 圭

Keiji IIMURA

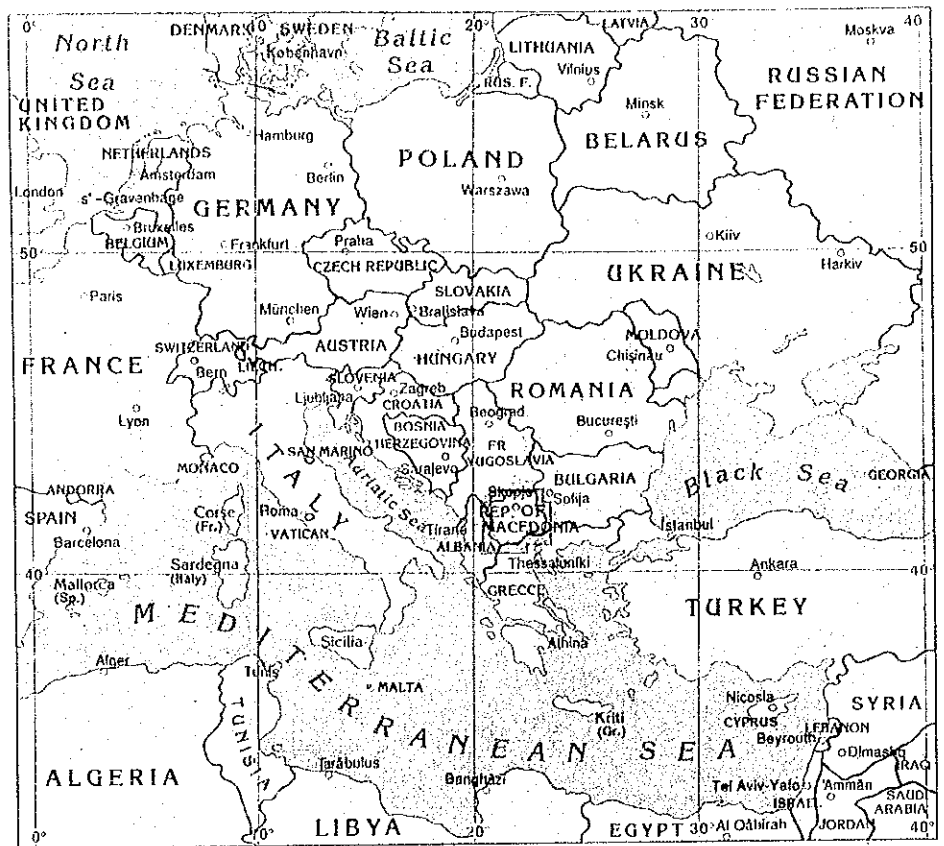
Project manager,

Basic design study team on

the Project for Equipment Supply for

the General Hospital of the Medical Center of Bitola

CRC Overseas Cooperation Inc.



Map of Macedonia

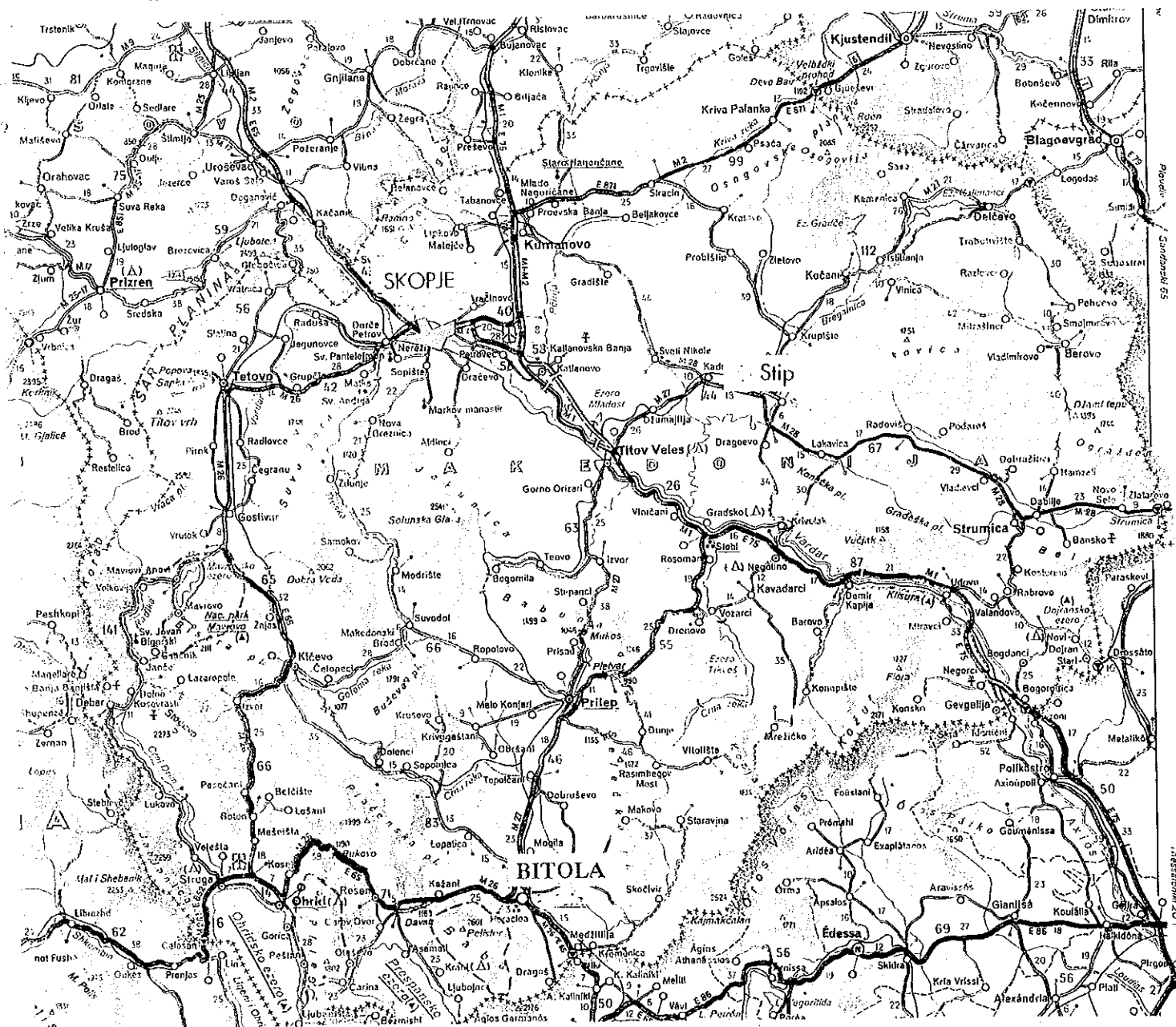




Photo 1.

Bitola City

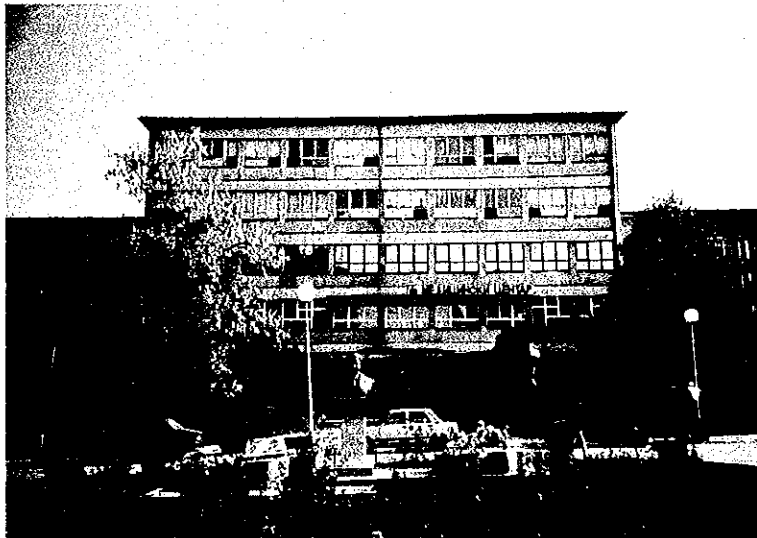


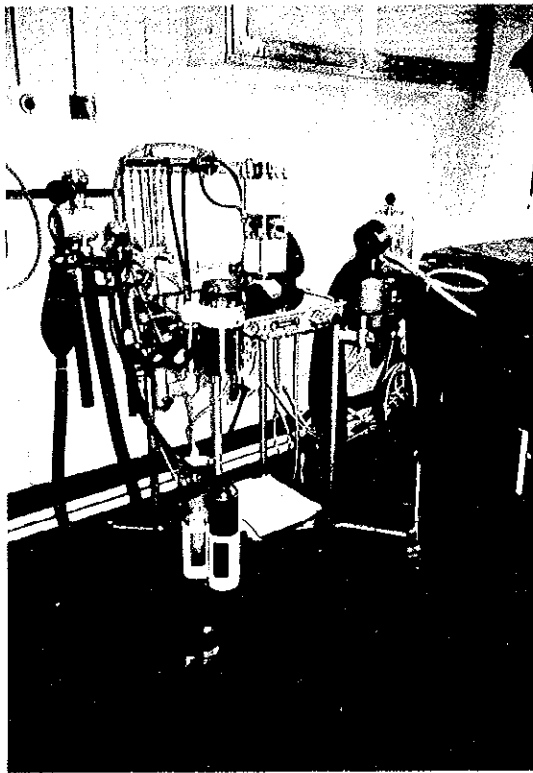
Photo 2.

The Hospital of the  
Medical Center of Bitola

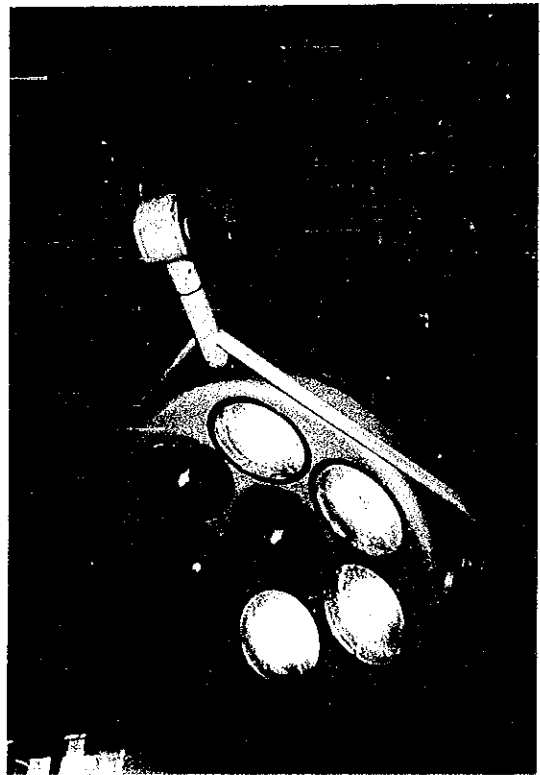


Photo 3.

The Hospital of the  
Medical Center of Bitola



**Photo 4. Obsolete Anesthetic Device  
(Without Ventilator)**



**Photo 5. Obsolete Operation Lamp**



**Photo 6. Obsolete Operating Table for Urology**

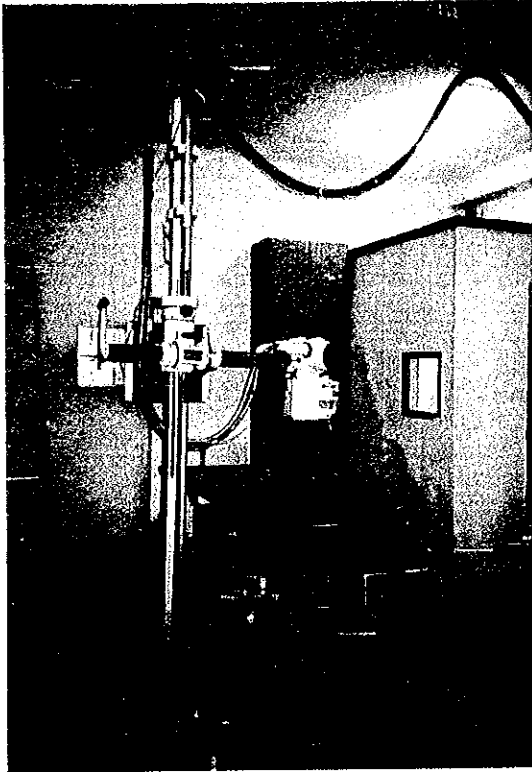


Photo 7.

Obsolete X-ray Unit

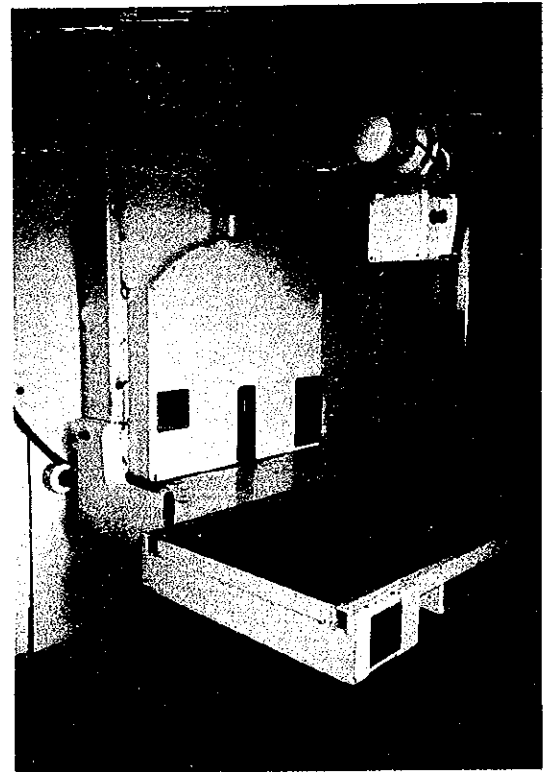


Photo 8. Broken Remote Control Fluoroscopy

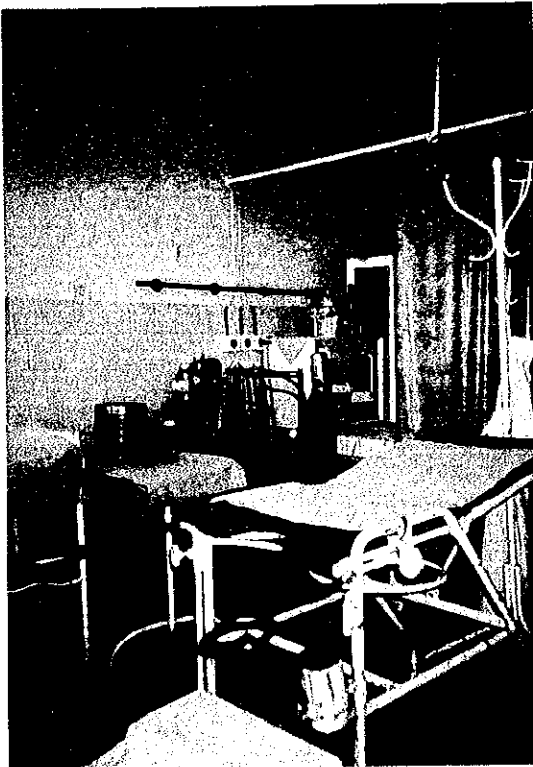


Photo 9.

Gynecology Examination Table

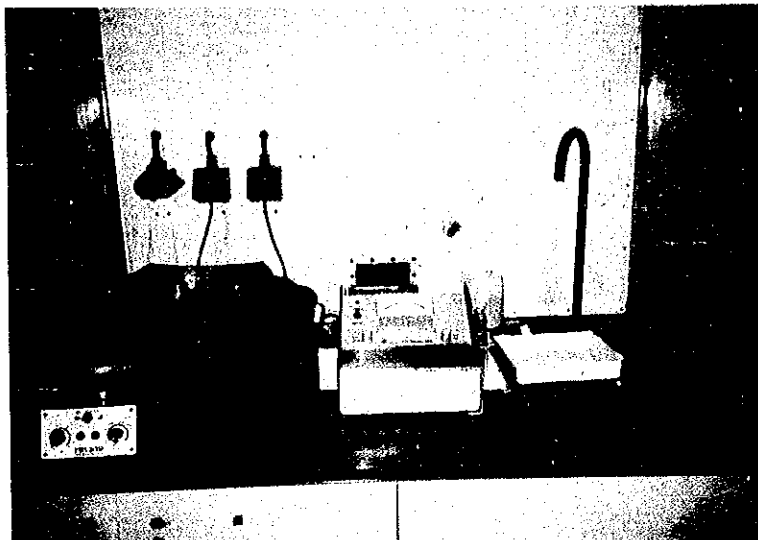


Photo 10.

Obsolete Spectrophotometer

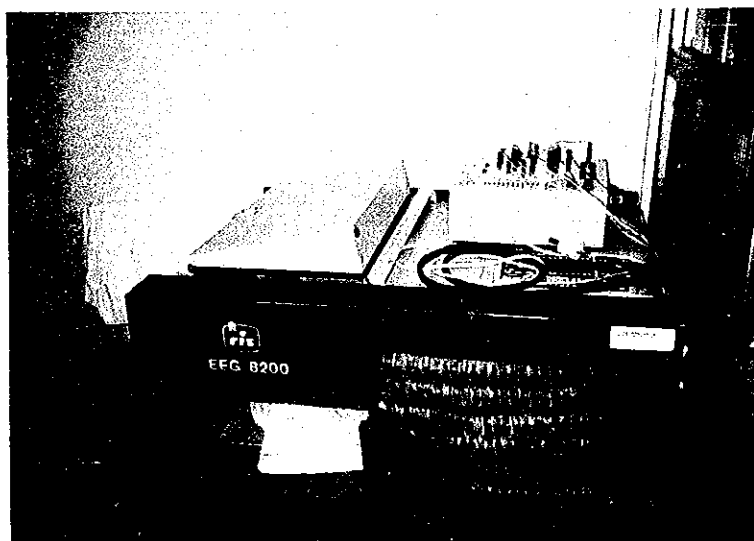


Photo 11.

Broken EEG



Photo 12.

Broken Washing Machine  
for Surgical Instrument

## Abbreviations

CCU	Coronary Care Unit
CT	Computed Tomography
DM	Deutsch Marks
E/N	Exchange of Notes
GDP	Gross Domestic Product
IC/R	Inception Report
ICU	Intensive Care Unit
IMF	International Monetary Fund
IPU	International Project Unit
JICA	Japan International Cooperation Agency
M/D	Minutes of Discussion
MKD	Macedonia Denar
MOH	Ministry of Health
NICU	Neonatal Intensive Care Unit
OECD	Organization for Economic Co-operation and Development
PDM	Project Design Matrix
PHARE	Poland Hungary Aid for Restructuring of Economy
PHC	Primary Health Care
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
US\$	U.S. Dollar
WHO	World Health Organization

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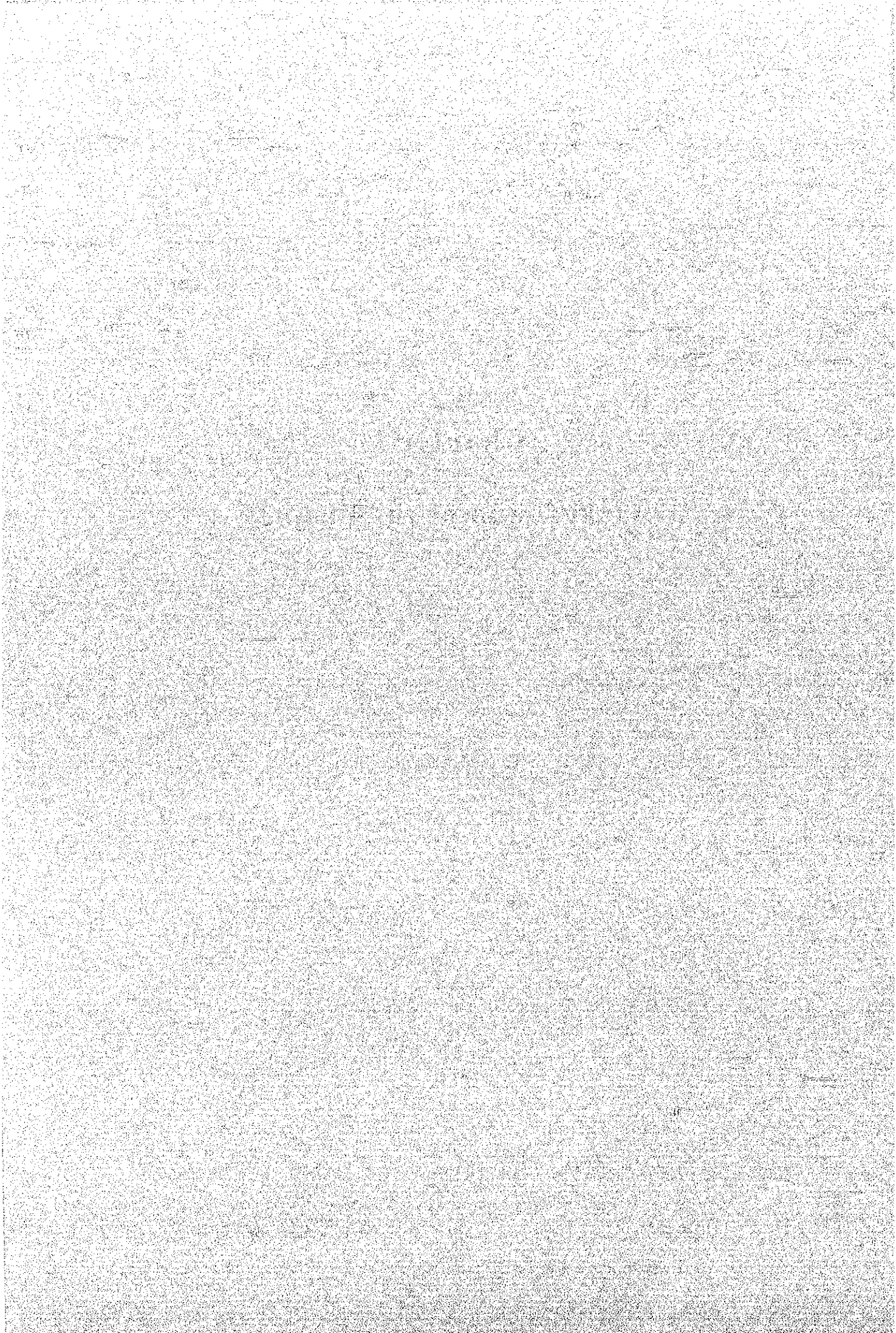
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# **Chapter 1**

## **Background of the Project**



# **Chapter 1 Background of the Project**

## **1.1 Background**

The Former Yugoslav Republic of Macedonia (hereinafter referred to as "the Recipient Country") is a landlocked nation located on the Balkan Peninsula, surrounded by Albania, Bulgaria, Greece, and The Federal Republic of Yugoslavia. Its entire area is approximately 26,000 km<sup>2</sup> (1.4 times that of Shikoku, Japan), and the country has a population of approximately 2.1 million.

The promotion of market economy-induced collapses of domestic industry and the growing rate of unemployment are putting the nation's economy in a severe condition. Therefore, establishment of a socioeconomic infrastructure has been delayed, which is also greatly influencing the public health services. Although improvement of public health services is considered as an important part of the national development program, a sufficient budget cannot be provided, so deterioration of the quality of medical services is rapidly becoming a significant social problem.

Medical skills and technology in the Recipient Country are relatively high, and quality and supply of human resources in medical practice is not a problem. However, the economic conditions of this country have not allowed medical equipment to be renewed, and many of the existing equipment is not functioning properly. Therefore, under the circumstances, appropriate diagnosis and treatment is not provided.

The Project for Equipment Supply for the General Hospital of the Medical Center of Bitola (hereinafter referred to as "the Project") is targeted at the General Hospital of Medical Center of Bitola (hereinafter referred to as "Bitola Hospital") in Bitola, a major city in southwestern Macedonia, about 180 km from the capital, Skopje. Bitola Hospital is one of the three main regional hospitals in Macedonia. The hospital is not only the central hospital in Bitola city but also the hospital in charge of secondary and partial tertiary medical care throughout the southwest region of the population of half million. There are about 650 beds in the hospital, with about 12,000 inpatients, and about 194,000 outpatients annually, which is quite high rate of operation.

About 80% of the equipment at Bitola Hospital was procured and installed in the 1980s and has not been improved for a long time. Consequently, this equipment is obsolete or in disrepair, and incapable of providing adequate basic diagnosis and treatment. Disabled by the condition of its medical equipment, Bitola Hospital is incapable of offering the medical services that would allow it to serve its original function as a regional general hospital. Currently, many patients are transferred to Skopje, the nation's capital.

Macedonia has placed requests the humanitarian aid to its public health sector from various organizations of other countries. However, substantial support given in the past has been limited to three project of grant aid from Japan ("the Project for Upgrading the Medical Equipment" in 1995, "the Project for Equipment Supply for City Hospital-Surgical Clinic" in 1996, and "the Project for Equipment Supply for the General Hospital of the Medical Center of Stip" in 1997) and from German aid providing a CT to Bitola Hospital.

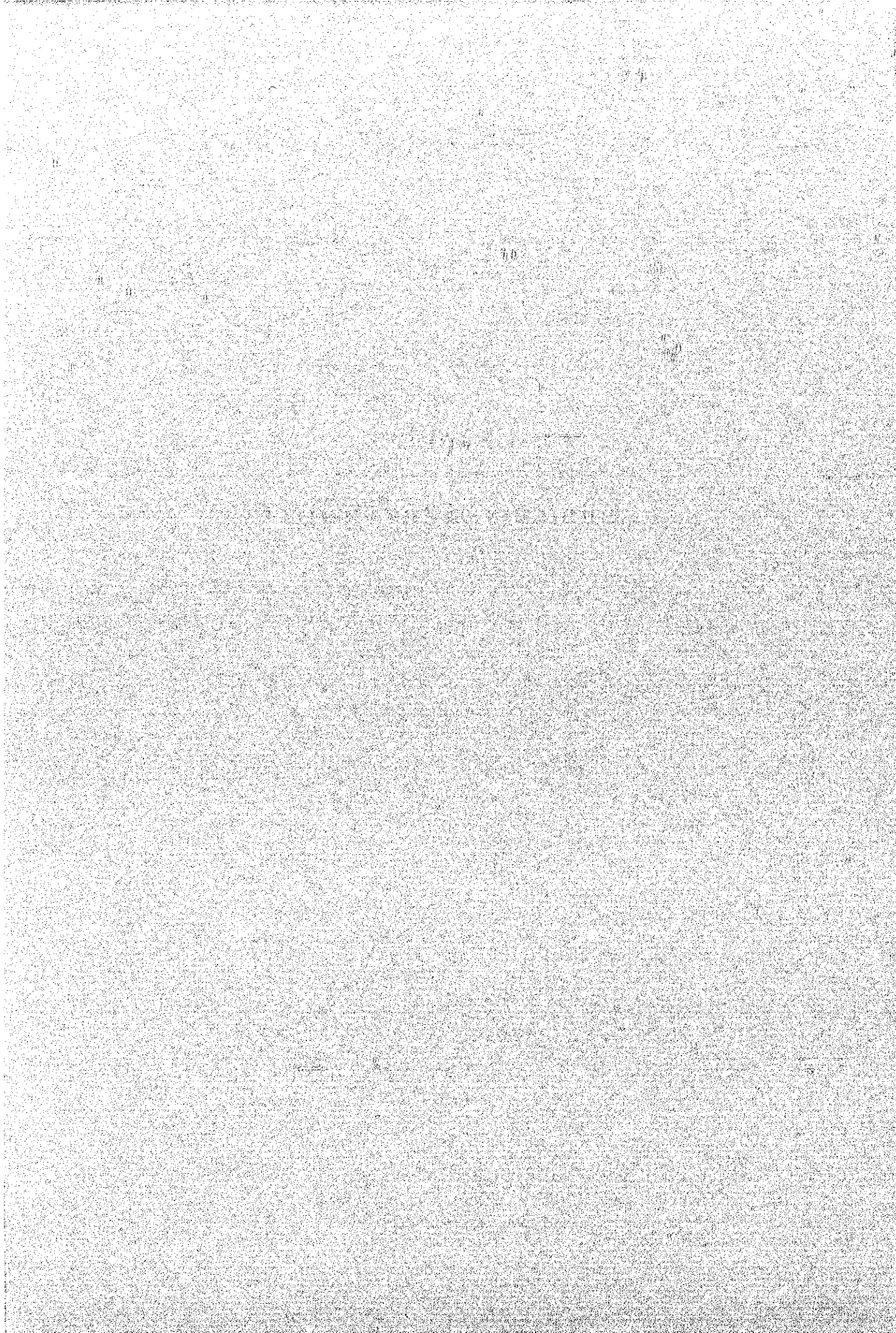
Considering these difficulties, the Government of Macedonia has requested further aid from Japan, which has provided grants for improving medical equipment three times in the past, to renew the antiquated equipment and to introduce new facilities in order to improve the medical services at Bitola Hospital, as well as the level of the medical standard in the southwestern region of Macedonia.

## **1.2 Outline of the Project**

- (1) Request : A request was filed in November 1997
- (2) Authority concerned : Ministry of Health,  
Government of the Former Yugoslav Republic of Macedonia
- (3) Responsible Agency : General Hospital of the Medical Center of Bitola
- (4) Contents : Procurement and installation of medical equipment to be  
provided to the General Hospital of the Medical Center of Bitola.  
(Total number of 129 items)

## **Chapter 2**

### **Contents of the Project**





## **Chapter 2 Contents of the Project**

### **2-1 Objectives of the Project**

The purpose of the Project for Equipment Supply for the General Hospital of the Medical Center of Bitola (hereinafter referred to as "Bitola Hospital") is to improve the quality of the medical service through upgrading the medical equipment as a regional general hospital in the Former Yugoslav Republic of Macedonia (hereinafter referred to as "the Recipient Country"). The Project will also contribute to improving medical service throughout the southwestern region of the country.

### **2-2 Basic Concept of the Project**

#### **2-2-1 Basic Concept**

Bitola Hospital is positioned as one of the three main regional hospitals in Macedonia. The hospital is not only the main hospital in Bitola City, but also the hospital in charge of secondary and partial tertiary medical care throughout the southwestern region, which has a population of a half-million. The hospital possesses about 650 beds and treats over 12,000 inpatients and 194,000 outpatients annually, which is quite a high rate of operation.

Most of the equipment at Bitola Hospital was procured and installed in the 1980s and has not been improved for a long time. Consequently, this equipment is obsolete or in disrepair, and incapable of providing adequate basic diagnosis and treatment. Disabled by the condition of its medical equipment, Bitola Hospital is incapable of offering the medical services that would allow it to serve its original function as a regional general hospital. Currently, many patients are transferred to Skopje, the nation's capital.

The purpose of the Project is to replace existing obsolete equipment and to introduce new facilities in order to permit the Bitola Hospital to recover the functions and level of service required to function as a regional general hospital.

#### **2-2-2 Framework of the Project**

During the initial stage of the site survey, a consensus between Japan and Macedonia concerning the objectives and achievements of this project was obtained. In order to further clarify the roles assumed by each country, a workshop was held for the officials in charge from the Ministry of Health and major officials from Bitola Hospital.

At the beginning of the workshop, problems to be solved and the position of the support from Japan was clarified and an explanation on the proceedings to achieve the objective was given from the Japanese members. All participants were made aware of the overall goal "improvement of the health condition" and the project purpose "improvement of the medical services".

Current problems of Bitola Hospital were presented by the participants as a step towards achieving these objectives. These problems were organized as "Problems analysis" and were summarized in the Project Design Matrix (PDM), attached in **Appendices-5**. For this project, "the health condition of people in Southern region of Macedonia will be improved" was established as the overall goal, while "people in the Southern region will be able to receive the improved medical service by Bitola Hospital" was established as the project purpose. In this workshop, necessity of designing a re-educational program for the hospital personnel (maintenance and management personnel, administrative staff) and put it into practice was emphasized.

Through this workshop, Bitola Hospital personnel were able to understand the impact of this project, and the objectives were clarified both for Macedonia and Japan. This will be quite meaningful in realizing this undertaking in the future.

### **2-2-3 Conclusion - Requested Equipment Investigation**

**Table 2-1** shows the final Equipment List that was compiled by the Basic Design Study Team (hereinafter referred to as "the Team") after discussing the original requests made by the Government of Macedonia with personnel from Bitola Hospital and the Ministry of Health during the Basic Design Study (hereinafter referred to as "the Study").

The original request from the Ministry of Health amounted to 129 items of equipment to be procured, along with associated spare parts and consumables, to be used in 26 departments at Bitola Hospital.

The Team conducted studies to evaluate the activity of the hospital and usage of medical equipment; analyze the validity of the procurement; and determine and select appropriate medical equipment deemed crucial for providing intended medical services from an operational and management perspective. As a part of the Study, specialists in the field of medical equipment and facilities visited all departments within the hospital to ascertain details concerning the request, and the Team evaluated the composition and specifications of the requested equipment. Furthermore, additional discussions were held with staff from the hospital to which the Ministry of Health of Macedonia was invited, as a

part of an effort to avoid repetition in procurement requests, to ensure that procured equipment would be effectively utilized, and to maximize the limited funds. In this manner, each requested item was evaluated in detail, and a priority list was compiled.

The list below shows the number of the equipment items according to the priority. The procurement of 195 items for use in 28 departments was requested; of these, 113 items were confirmed for procurement through the Project (priority "A"), 67 items (additional request items) may be provided depending on the budget allowance (priority "B"), and 15 items with the lowest priority were eliminated from the list, leaving the procurement of 180 items listed as requiring further analysis.

Priority	A (equipment to be provided in the project)	113
	B (equipment to be provided in case of the budget allowance)	67
	C (equipment to be eliminated)	15
	Total	195

Angiography (including DSA unit), that is an advanced equipment, was eliminated from the list due to the position of Bitola Hospital within the referral system and the cost-effectiveness of the equipment. The department of nuclear medicine expressed a strong need for medical equipment such as a gamma camera. However, it was also eliminated from the Project after the explanation of the reason by the Team, and reached an agreement about this matter.

The additional requested items comprise basic medical equipment that is of high necessity, determined as being used frequently according to analysis of the services provided by the hospital.

## **2-3 Basic Design**

### **2-3-1 Design Concept**

#### **(1) Policy concerning external climatic conditions**

For medical equipment to be provided under the Project, no items would be directly affected by climatic conditions. However, temperatures at Bitola can sometimes rise over 30 degrees Celsius in summer and go down to minus 20 degrees Celsius in winter, and significant temperature swings can occur from day to night. Since medical facilities are rarely prepared with temperature adjustment functions, due consideration should be given to temperature control.

## **(2) Policy concerning procurement from third-party countries**

Macedonia is a landlocked nation on the Balkan Peninsula, surrounded by European countries. Since these neighboring countries can provide high-quality medical equipment, it will be necessary to consider procuring some medical equipment (notably those requiring periodical technical services and a continuous supply of spare parts and consumables) from nearby European countries, as well as from Japan.

Some of the medical equipment (e.g., X-ray apparatus) requires periodical technical service. For example, X-ray tubes must be replaced after a specific period of use. The supply of spare parts and consumables and the availability of technical service are important issues for such equipment, so that it is crucial to consider acquiring such medical equipment from neighboring European countries. Under the Project, procurement of five hemodialysis apparatuses is planned. About 90% of the hemodialysis apparatuses currently used in Macedonia are made in Sweden (including all hemodialysis machines at Bitola Hospital), with the remaining 10% in Germany. Furthermore, consumables suited to these hemodialysis machines are available in Macedonia at low cost. All these points should be concerned when selecting hemodialysis apparatus through the Project. The results of the Third-Country Procurement Study, conducted in 1996/97, should be fully utilized to ensure that the hospital receives the equipment that is the most suitable for it. Among other considerations, large sterilizers require frequent maintenance, analyzers require a continuous supply of reagent under stable prices; also, for rigid endoscopes and certain other equipment, physician preferences and maintenance service require attention.

## **(3) Policy concerning operational, maintainable, and managerial capability**

The Bitola Hospital is adequately staffed with medical personnel with the necessary expertise for operating the procured equipment. However, the number of staff experienced in maintenance is scarce. Each item of necessary equipment should be evaluated after due consideration of the availability of technical support and the cost and supply of spare parts and consumables.

## **(4) Policy concerning equipment planning**

### **1) Basic policy for basic medical equipment**

For the basic medical equipment, the suitable quality and quantity should be judged in light of the condition of existing equipment and the principle that the equipment should be suitable to a regional general hospital.

2) **Basic policy for supply of spare parts and consumables**

The disrepair of many existing pieces of equipment at the Bitola Hospital is due in part to an inadequate supply of spare parts and consumables. Plans must be set to ensure a sufficient supply of expendable spare parts and consumables for the equipment in order to obtain maximum utility from the equipment.

**(5) Policy concerning inland transportation**

Three possible routes are currently being considered for inland transportation.

(a) the route from Thessaloniki, Greece, to Bitola

(b) the route through the Black Sea via the Port of Varna/Burgas, Bulgaria

(c) the route via Germany/Austria/Hungary/FR Yugoslavia.

The final decision for the route will be based on the consideration of the loading port. At this point, route (a), from Thessaloniki, Greece, to Bitola, is seen as the most favorable, since it is shorter than others and has good road conditions. However, the diplomatic relationship between the Recipient Country and Greece is not completely normalized, and the potential risk of renewed tensions could conceivably result in a border closure. Since such an occurrence would preclude the use of route (a), changes in the international situation are being closely watched.

Skopje International Airport will be used to service air transportation.

**(6) Policy for the period of the execution of the Project**

The period of time allotted to the Project is one fiscal year. A thorough study is being conducted on the period necessary for procurement, transportation, and installation of the delivered equipment, including procurement from third-party countries, to prevent any disruptions during the implementation period.

**2-3-2 Basic Design**

**(1) Total concept of project planning**

The Project has determined 180 items of medical equipment as appropriate for procurement. Since most of these items will be delivered to replace existing equipment, problems associated with installation space are anticipated only for the remote control fluoroscopy and sterilizer; some construction works will be required to fit these items appropriately into their designated rooms. Meetings with members of the hospital staff were held to discuss the installation of new equipment, and it has been confirmed that

construction work and installation will be performed without disrupting medical activities. Furthermore, the existing operating table, operating light, and washing machine for surgical equipment in each operating room will be replaced, and it has been agreed that the hospital will be responsible for the removal of the existing old equipment.

The plan should provide for careful consideration of management, maintenance, inspection, and repair of equipment following delivery. It is also necessary to calculate the required supply of spare parts and consumables by estimating the frequency of use of each item, so that these figures may be reflected in the plan, which is intended to prevent the expiration of effective dates and dead stocks. The plan should also provide for a continuous supply system for procuring technical services, spare parts, and consumables.

## **(2) Equipment plan**

**Table 2-1** shows the intended uses and main specifications/composition of the equipment planned for procurement.

**Table 2-1 Equipment List of the Project (1/4)**

No.	Department	Equipment	Q'ty
1	Anesthesia	Anesthetic device with ventilator	10
2	Blood Bank	Centrifuge	1
3	Blood Bank	Microscope	1
4	Clinical Labo.	Analytical balance	1
5	Clinical Labo.	Biochemical analyzer	1
6	Clinical Labo.	Blood cell counter	1
7	Clinical Labo.	Blood gas analyzer	1
8	Clinical Labo.	Densitometer	1
9	Clinical Labo.	Electrolytes analyzer	1
10	Clinical Labo.	Electrophoresis apparatus	1
11	Clinical Labo.	Fumehood	1
12	Clinical Labo.	Glucometer	1
13	Clinical Labo.	BUN analyzer	1
14	Clinical Labo.	Incubator	1
15	Clinical Labo.	Microscope	2
16	Clinical Labo.	Spectrophotometer	1
17	Clinical Labo.	Washer for pipet	1
18	Coronary care unit	CCU monitor for 10 beds	1
19	Coronary care unit	Defibrillator	1
20	Coronary care unit	ECG	1
21	Coronary care unit	Infusion pump	10
22	Dental & Maxillofacial	Dental unit	1
23	Dental & Maxillofacial	Dental chair for maxillofacial operation	1
24	Dermatology	Black light	1
25	Dermatology	Infrared/ultraviolet lamp	1
26	Dermatology	Microscope	2
27	Emergency	Pulseoxymeter	2
28	Emergency	Defibrillator	2
29	Emergency	ECG (multi-channel)	2
30	Emergency	Reanimation set	4
31	Emergency	Laryngoscope	4
32	Emergency	Patient monitor	2
33	Emergency	Stretcher	4
34	Emergency	Wheel chair	4
35	Emergency	Ultrasound	1
36	Emergency	Suction pump	5
37	Emergency	Blood pressure apparatus	10
38	General (Ope. room)	Cabinet for instruments	12
39	General (Ope. room)	Electrocauter (bi/mono-polar)	10
40	General (Ope. room)	Multi purpose operation table	9
41	General (Ope. room)	Operation lamp (ceiling type)	11
42	General (Ope. room)	Mobile light	7
43	General (Ope. room)	Operation microscope (multi-purpose)	1
44	General (Ope. room)	Patient monitor for operation	10
45	General (Ope. room)	Suction pump	12
46	General (Ope. room)	Washing machine for surgical instrument	4
47	General (Ope. room)	Table top autoclave	5

**Table 2-1 Equipment List of the Project (2/4)**

No.	Department	Equipment	Q'ty
48	General (Ope. room)	CO2 monitor	2
49	General (Ope. room)	Neuromuscular transmission monitor	2
50	GY.OB.	Colposcope	1
51	GY.OB.	Delivery monitor CTG	2
52	GY.OB.	Gynecology examination table	2
53	GY.OB.	Laparoscope set	1
54	GY.OB.	Mobile light	1
55	GY.OB.	Ultrasound with vaginal probe	1
56	GY.OB.	Vacuum extractor	2
57	GY.OB.	Curettage instrument set	3
58	GY.OB.	Amnioscopy instrument set	2
59	GY.OB.	Instrument set for episiotomy	3
60	GY.OB.	Abdominal hysterectomy instrument set	2
61	GY.OB.	Vaginal hysterectomy instrument set	2
62	GY.OB.	Cesarean section instrument set	2
63	GY.OB.	Cusco vaginal speculum	10
64	GY.OB.	Microscope	1
65	GY.OB.	Delivery bed	3
66	GY.OB.	Operation table for gynecology	1
67	ICU	Pulseoxymeter	2
68	ICU	Laryngofiberscope	1
69	ICU	Central patient monitor system (8 beds)	1
70	ICU	Critical care bed	8
71	ICU	ECG	1
72	ICU	Defibrillator	1
73	ICU	Infusion pump	12
74	ICU	Mobile ventilator for transport of critical ill patient	1
75	ICU	Mobile X-ray apparatus	1
76	ICU	Suction pump	8
77	ICU	Ultrasound	1
78	ICU	Ventilator	6
79	ICU	Blood pressure apparatus	8
80	Infectious D.	ECG	1
81	Infectious D.	Microscope	1
82	Infectious D.	Rectoscope	1
83	Infectious D.	Ultrasound	1
84	Infectious D.	X-ray film illuminator	1
85	Infectious D.	Table top autoclave	1
86	Infectious D.	Suction pump	2
87	Internal Medicine	Bronchofiberscope	1
88	Internal Medicine	Cabinet for endoscopy	1
89	Internal Medicine	Cleaner for endoscopy	1
90	Internal Medicine	Colonofiberscope	1
91	Internal Medicine	Duodenofiberscope	1
92	Internal Medicine	ECG (multi-channel)	2
93	Internal Medicine	Gastrofiberscope	2
94	Internal Medicine	Haemodialysis apparatus	5



**Table 2-1 Equipment List of the Project (3/4)**

No.	Department	Equipment	Q'ty
95	Internal Medicine	Rectoscope	1
96	Internal Medicine	Ultrasound (Doppler)	1
97	Internal Medicine	Ultrasound	1
98	Internal Medicine	Video monitor system for endoscopy	1
99	Internal Medicine	Spirometer	1
100	Internal Medicine	Stress test system	1
101	Internal Medicine	Microscope	1
102	Mental Health	EEG	1
103	Neonatology	Blood gas monitor	1
104	Neonatology	ECG for neonate	1
105	Neonatology	Infant warmer	2
106	Neonatology	Infusion pump	3
107	Neonatology	NICU monitor	4
108	Neonatology	Phototherapy unit	2
109	Neonatology	Ventilator for neonate	1
110	Neonatology	Laryngoscope for neonate	1
111	Neonatology	Ultrasound for infant/neonate	1
112	Neurology	Electromyography (multi-channel)	1
113	Endocrinology	Ultrasound	1
114	Endocrinology	ELISA	1
115	Ophthalmology	Autorefractometer	1
116	Ophthalmology	Perimeter	1
117	Ophthalmology	Argon laser	1
118	Ophthalmology	Slit lamp with tonometer	2
119	Orthopedic	Bone drill set	1
120	Orthopedic	Operating table with extension	1
121	Orthopedic	Mobile X-ray apparatus with TV (C-arm)	1
122	Orthopedic	Arthroscope	1
123	Otorhinolaryngology	Audiometer with silent room	1
124	Otorhinolaryngology	Bronchoscope set (rigid)	1
125	Otorhinolaryngology	Laryngostroboscope set	1
126	Otorhinolaryngology	Oesophagoscope	1
127	Otorhinolaryngology	Rhino septoplastic set	1
128	Otorhinolaryngology	Sinus scope	1
129	Otorhinolaryngology	Examination chair	3
130	Otorhinolaryngology	head light	2
131	Pediatric	Pulseoxymeter	1
132	Pediatric	ECG for pediatric use	2
133	Pediatric	Infant incubator	2
134	Pediatric	Milk warmer	1
135	Pediatric	Patient monitor	2
136	Pediatric	Suction pump for pediatric use	2
137	Pediatric	Infusion pump	2
138	Pediatric	Spirometer	1
139	Physiotherapy	Electromyography	1
140	Physiotherapy	Electrostimulator	1
141	Physiotherapy	Modern equipment for kinesi therapy	1

**Table 2-1 Equipment List of the Project (4/4)**

No.	Department	Equipment	Q'ty
142	Physiotherapy	Short wave therapy	1
143	Physiotherapy	Whirlpool	1
144	Pulmology	Bronchofiberscope	1
145	Pulmology	ECG	1
146	Pulmology	Microscope	1
147	Pulmology	Spirometer	1
148	Pulmology	Mobile X-ray apparatus	1
149	Pulmology	Stretcher	2
150	Pulmology	Wheel chair	2
151	Pulmology	Apparatus for developing X-ray films	1
152	Sterilization	Sterilizer	4
153	Sterilization	Sterilizer (formalin)	1
154	Surgery	Mobile operating light	1
155	Surgery	Recto-sigmoidoscope	1
156	Surgery	Table top autoclave	2
157	Surgery	Duodenofiberscope	1
158	Surgery	Gastrectomy instrument set	2
159	Surgery	Cholecystectomy instrument set	2
160	Surgery	Thoracic surgery instrument set	2
161	Surgery	Pediatric surgery instrument set	1
162	Urology	Cystoscope set	1
163	Urology	Endoscopy table for urology	1
164	Urology	Resectoscope set	1
165	Urology	Uretero-renofiberscope set	1
166	Urology	Ureteroscope with stone punch	1
167	Urology	Video monitor system for endoscopy	1
168	Urology	Ultrasound	1
169	X-Ray unit	Apparatus for developing X-ray films	2
170	X-Ray unit	Mammography	1
171	X-Ray unit	Remote control fluoroscopy	1
172	X-Ray unit	Ultrasound	2
173	X-Ray unit	Ultrasound (Doppler)	1
174	X-Ray unit	X-ray apparatus	1
175	X-Ray unit	X-ray film illuminator	2
176	X-Ray unit	Panoramic dental radiography	1
177	General	Washing mashine for cloth	4
178	General	Drying machine for cloth	4
179	Infusion room	Fumehood	2
180	Infusion room	Analytical balance	2

The section below deals with issues that must be considered when determining the basic specifications of this equipment.

1) Remote control fluoroscopy and X-ray apparatus

Remote control fluoroscopy allows fluoroscopic and X-ray examinations of a patient from a control room via TV monitors. While monitoring a patient through lead glass, an operator can remotely control every aspect of a patient, e.g., changing body positions, selecting fields of fluoroscopy and X-rays, and determining testing conditions (e.g., compression and snapshots). This process minimizes the amount of radiation exposure to the operator. When installing the new fluoroscopy, the examination room will have to be partially modified (by moving the shielding wall) to create more space for the control room.

Based on operability and maneuverability considerations, the bucky table/movable X-ray apparatus should be selected. Since the new fluoroscopy and X-ray apparatus will be installed after the existing machines are removed, there should be no problems with installation.

There are no major problems associated with maintenance costs for these machines, but it will be necessary to consider the cost and availability of technical service after installation.

2) Mobile X-ray apparatus, Mobile C-arm X-ray apparatus with TV, Mammography

Mobile X-ray apparatuses scheduled to be delivered to the ICU and the respiratory department should be of the standard mobile X-ray type. Through use of an inverter, these apparatuses should be able to capture high-frequency output, and they should also be equipped with a current regulating function to minimize the waiting time. Mobile C-arm X-ray apparatus scheduled to be delivered to the orthopedics department will be used for intraoperative and postoperative diagnoses, so a C-arm type apparatus with a TV should be selected. Mammography must be able to capture bucky radiographs, and the point of mammography should be adjustable in both the X and Y directions.

3) Apparatus for developing X-ray film

At present, the X-ray apparatus at Bitola Hospital takes about 400 X-rays a day. Once all new X-ray apparatuses (i.e., general X-ray apparatus, Mammography,

Remote control fluoroscopy, Mobile X-ray apparatus (ICU) are delivered, this number will rise. Currently, there are two X-ray film-developing machines at the hospital, which were installed several years ago and currently work at full capacity. Since these machines take 180 seconds to develop one X-ray film, they will not be able to handle the total film output generated by the new machines. The new automatic X-ray film developing machines should only take 90 seconds to develop each X-ray film.

#### 4) Ultrasound

This general-purpose machine offers several advantages: safe diagnostic method with no radiation exposure; easy visualization of internal organs; easy operation; easy maintenance; and low operating cost.

According to the present procurement plan, twelve ultrasound units will be provided for a total of nine departments. Ten of these ultrasound units will be general-purpose units capable of B/M-mode diagnostic imaging; they should accommodate various types of probes. Different departments will require different probes suitable for examine particular diseases: a shallow-linear type for the endocrinology department, body cavity and needle types for the urology department, a micro-convex type for the pediatrics department, and a vaginal type for the gynecology and obstetrics department.

Ultrasound with doppler should be delivered to the internal medicine department in order to assist in identification of cardiovascular diseases, and to the X-ray unit in order to measure blood flow to and from organs and tumors for the assessment of internal hemodynamics.

#### 5) Endoscope

Flexible and rigid endoscopes that can be equipped with various accessories should be selected. When some endoscopes are scheduled to be delivered to a single department, the number of shared accessories (i.e., light source, electrocautery, aspirator, TV monitor, etc.) should be adjusted. The standard accessory set should be selected for laparoscopes and arthroscopes. Furthermore, the ureteroscope for lithotomic surgery, which will be delivered to the urology department, should include a stone punch.

6) Hemodialysis apparatus

There are numerous patients at Bitola Hospital requiring hemodialysis, and the machines planned for procurement will be utilized to their full capacity. It is thus highly important to arrange for routine maintenance check of these machines, and for a continuous supply of the relevant consumable goods. Therefore, hemodialysis apparatuses that can accommodate locally produced consumable goods, and also can be serviced locally, should be selected.

7) Sterilizers

Based on the current usage of existing sterilizers, four new sterilizers, each having a single swing door and capacity of about 500 liters, should be selected. Also, since medical equipment made of plastic is increasingly being used at the hospital, one of the four new sterilizers should be of the medically safe formalin type. At present, there are two large sterilizers with double swing doors in the central sterilization room; these must be removed so that the four new units (i.e., three regular sterilizers and one formalin-type sterilizer) can be installed along the wall. Also, the rest of the regular sterilizers will be installed in an underground room next to the laundry room, to clean linens. These new sterilizers must be installed without disrupting current sterilization work. Along these lines, there should be no problems with installation space or utility hook-ups in the chosen rooms.

8) Automatic biochemical analyzer

This analyzer is a basic machine for conducting tests in a hospital, and should be selected based on a consideration of costs of reagent and ease of its acquisition. It assesses biological functions by adding a specific reagent to a micro-sized sample and examining it by spectroscopic analysis. Since reagent will have to be replenished frequently, a new biochemical analyzer that can be locally and continuously supplied with reagent should be selected.

9) Blood gas analyzer

This analyzer assesses the emission of carbon dioxide and oxygen into arterial blood during pulmonary respiration by analyzing arterial blood gases. Since it is routinely utilized in hospital laboratory, its reagent must be replenished frequently. Therefore, a blood gas analyzer that can use locally available reagent should be selected.

10) Operating tables

All operating tables planned for procurement are equipped with an electrical adjuster that adapts to the body position of patients in accordance with various types of surgery. The expected operating tables include the multi-purpose operating table (operating rooms), operating table for gynecology (gynecology and obstetrics department), operating table with extensions (orthopedics department), endoscopy table for urology, and dental chair for maxillofacial operation (dental and maxillofacial department). Each of these tables should be equipped with functions suited to their different applications. Once the existing operating tables are removed, the new tables should be installed without any problems, including supply of the electricity.

11) Operation lamp

Shadowless lamps with satellites should be selected so that operations can proceed smoothly under sufficient lighting. Through the use of the main and secondary lamps, formation of shadows will be further suppressed. Since new surgical lamps will be replaced instead of the existing ones, there should not be any problems with the strength for the installation on the ceiling.

12) Various surgical equipment sets and electrocauters

These are basic pieces of surgical equipment. After consulting with physicians at the hospital, it became clear that the standard surgical sets used in Japan should be selected. Also, monopolar and bipolar electrocauters that can be used for coagulation and incision by adjusting output should be selected.

13) Anesthetic device with ventilator

Anesthetic devices equipped with ventilators should be selected, so that intravenous, spinal or epidural anesthesia can be performed. Each machine should be equipped with various safety devices. These should ensure that connection and shut-off can be immediately performed using an oxygen-gas safety block system, and that two anesthetic gases are not administered simultaneously, while maintaining the minimal oxygen concentration. The most commonly utilized halothane or isoflurane vaporizers should be selected.

#### 14) Patient monitor for operation

Patient monitor for operation, which assesses regular biological parameters (ECG, SpO<sub>2</sub>, body temperature, NIBP, respiration and IBP), should be delivered to the emergency, pediatrics and neonatology departments. Since the patient monitor for operation that will be delivered to the ICU will need to monitor several patients simultaneously, one central monitor and eight bedside monitors should be installed. These bedside monitors will measure ECG, SpO<sub>2</sub>, body temperature, NIBP and IBP; the central monitor will record this data. Also, the equipment delivered to the CCU will need to monitor simultaneously the ECG, SpO<sub>2</sub> and respiration of ten patients. Also, since patients with respiratory diseases in the CCU are mobile and awake, a radio transmission system should be installed.

#### Operating rooms

In this hospital, there are a total of twelve operating rooms and four minor operating rooms. **Table 2-2 Equipment will be procured in Operating Room** in the next page shows the number of equipment (anesthetic device, electrocauter, patient monitor for operation, aspirator, tabletop autoclave, and instrument cabinet) that will be delivered to operating rooms. In all operating rooms, the existing, antiquated operating table, operating light, and sterilizer will be replaced with new equipment, so there should not be any problems with installation space or utility (eg. electricity).

##### 1) Surgery department

There are three operating rooms. Each room should have one operating table and one ceiling-mounted operating light. Also, one mobile light should be delivered to serve as a secondary light source. The department currently has one anesthetic device with a ventilator that was purchased after 1990, so two new devices should be delivered. Since none of these rooms have electrocauters, patient monitor, or suction pump, one each should be delivered to each room. Two tabletop autoclaves should be positioned so that surgical equipment can be sterilized easily and used effectively. To allow surgical equipment to be stored sanitarily in the operating rooms, one instrument cabinet should be installed in each room.

**Table 2-2 Equipment will be procured in Operating Room**

	(type)	SU	OT	OP	DM	GY.OB.	UR	OR	TOTAL
Operation Room	Large	3	1	1	1	2	2	2	12
	Small		2		1			1	4
	Delivery room					1			1
Operating Light	Ceiling type	3	1	1	1	2	1	2	11
	Mobile	1	2		1	2	1	1	8
Operating Table	Operating table	3	1	1	1	1	1	1	9
	Examination chair		1						1
	Maxillofacial				1				1
	Gynecology					1			1
	Urology						1		1
	Extension							1	1
Delivery table						3			3
Anesthetic device with ventilator		2	1	1	1	2	1	2	10
Electrocauter		3	1	1	1	1	1	2	10
Patient monitor		3	1	1	1	2	1	1	10
Suction pump		3	1	1	1	2	2	2	12
Table top autoclave		2	1	1		1	1	1	7
Cabinet		3	1	1	1	2	2	2	12

(Note) SU: Surgery OT: Otorhinolaryngology OP: Ophthalmology DM: Dental & Maxillofacial  
GY.OB.: Gynecology & Obstetrics UR: Urology OR: Orthopedic

2) Otorhinolaryngology department

Currently, there are one operating room and two small rooms for minor operation within this department. The antiquated general-purpose operating table should be replaced with a new one, and one examination chair should be replaced with the simple chair-type-operating table currently located in the small operating room. One ceiling-mounted operating light will be renewed, and a mobile operating light will be delivered to each of the two small operating rooms, which currently have no operating light. Furthermore, this department should have one anesthetic device, electrocauter, patient monitor, suction pump, tabletop autoclave, and instrument cabinet.

3) Ophthalmology department

The ceiling-mounted operating light and the operating table in the operating room will be replaced. Each of the following types of equipment should be delivered to this department: anesthetic device, electrocauter, patient monitor, suction pump, tabletop autoclave, and instrument cabinet.

4) Dental and maxillofacial department

This department uses one operating room and one small room for minor operation.



Since the operating table and the ceiling-mounted operating light in the operating room are antiquated, they should be replaced; also, one mobile operating light and a dental chair for maxillofacial surgery should be provided to the small operating room. In addition, each of the following types of equipment should be delivered to this department: anesthetic device, electrocauter, patient monitor, suction pump, and instrument cabinet.

5) Gynecology and Obstetrics department

This department uses two operating rooms. Each room should have a ceiling-mounted operating light. One operating room should have an operating table; and the other should have an operating table for gynecology. This department also has one delivery room; its three existing, antiquated delivery beds, which do not have any mechanical adjustment capabilities, should be replaced. Furthermore, two mobile operating lights should be delivered. Each operating room should be equipped with each of the following types of equipment: anesthetic device, patient monitor, suction pump, and instrument cabinet. One of operating rooms, which is equipped with an operating table, should also be equipped with an electrocauter, and a tabletop autoclave should be placed between the two operating rooms.

6) Urology department

This department uses two operating rooms. The antiquated, ceiling-mounted operating light in one of the operating rooms should be replaced, and a mobile operating light should be delivered as a secondary light source for use in special surgeries. The operating table in one of the operating rooms should be replaced with a new operating table, and an endoscopy table should be installed in the other room. In this department, one each of the following types of equipment should be equipped: anesthetic device, electrocauter, patient monitor, and tabletop autoclave; and two items each of the following types of equipment (suction pump and instrument cabinet).

7) Orthopedics department

This department uses two operating rooms and one small operating room. The operating table in one of the operating rooms should be replaced, an extendable operating table should be delivered to the other operating room, and the ceiling-

mounted operating lights in both rooms also should be replaced. A mobile operating light should be delivered to the small operating room. This department should be totally equipped with two of the following types of equipment: anesthetic device, electrocauter, aspirator and instrument cabinet, with one patient monitor and with a tabletop autoclave.

### **(3) Construction work necessary for installation**

When installing the remote control fluoroscopy and sterilizer, the rooms to which these equipment should be delivered must be modified. To ensure that the present project proceeds smoothly, the construction work required will be implemented under the following plan.

**(See Appendices-6 Plan of Installation Room)**

#### **1) Remote control fluoroscopy**

The remote control fluoroscopy is scheduled to be installed in a room that currently houses unserviceable X-ray apparatus. Even though the height and size of the room is sufficient to accommodate this fluoroscopy, the shielding wall must be moved forward to secure enough space for the control room. Since a part of the examination room will be modified to the control room, the construction work will involve the installation of some kind of a radiation shielding wall (lead glass) as well as a door.

#### **2) Sterilizer**

In the central sterilization room, two large sterilizers are currently located at the center of the room, where they work at full capacity. Four new sterilizers will replace these two existing units, but these new sterilizers will need to be placed in a horizontal line along a wall due to space limitations. However, since all sterilization machines are currently located in this central sterilization room, replacement of the old units will significantly disrupt hospital operations. Therefore, the new sterilizers must be installed while maintaining the current sterilization capacity.