PRELIMINARY DESIGN
OF
GASTRO-ENTEROLOGICAL
RESEARCH CENTER
IN THE REPUBLIC OF BOLIVIA

--- D R A F T ---

September 1977

Japan International Cooperation Agency

[redacted]

SUMARIO DEL DISEÑO PRIMORDIAL

Designio Básico

Este Centro de Estudio fue planeado en estrecha relación con el proyecto original de cooperación técnica peryinenete al Laboratorio de Enfermedades los Organos Digstivos que se adelanta en la actualidad y tiene por objeto los estudios y educación de alta categoría.

Este Cenrro de Estudio tiene el carácter de un órgano bajo el mado directo del Ministerio de Previsión Social y Salud Pública de la República de Blivia, y su organización interna consiste de la Sección de Inspecciones cuyos ramos principales son Inspección de Radiología, Inspección de Endoscópica, Inspección de Histología Patológica y la Sección de Clínica y Consulta Externa.

El plan básico de este Centro de Estudio ha sido elaborado de acuerdo con el Acuerdo suscrito como la consecuencia del estudio y discusiones entre las Autoridades competentes del Gobierno de Bolivia y la Misión Japonesa de Estudios del Diseno Basico, contandose con las recomendaciones del Equipo de Colaboradores de Proyecto de la Tecnología Terapéutica.

El sumario del diseño básico es como sigue.

Ubicación

En un terreno de unos 3.000 m^2 dentro del recinto del Hospital de Clínica en el Distrito de Miraflores, Ciudad de La Paz.

Proyecto de Disposición

Se tratará de concentrar en una porción reducida el área de ocupación, con el fin de no malparar el ambiente de contornos.

Se utilizarán eficazmente la vía de acceso principal proyectado para el reciento de este hospital; y la vía de acceso principal se ubicará

Aireacondicionamiento: Calefacción y Aireacondicionado para las salas de operación en el 2° Piso.

Calefacción Central: Se instalará el Sistema de calefacción central directa en cada cuarto, mediante el sistema del agua caliente desde la caldera de comstión de petróleo crudo.

Ventilación: En los cuartos donde se prodecen mal olor o humo tales como cocina, lavandería, salas de inspección, etc. se instalará el sistema de ventilación del aire mecánicamente forzado.

Abastatecimiento de agua y Desagüe: Abastecimiento del agua fresca y del agua caliente, Desaüe en general e Instalación especial de tratamiento de desaüe (salas de operación e inspeccion), Instalacion de aparejos sanitarios, Matafuegos de gas de acido carbónico, Instalación de tuberia de distribución de gas de propano, etc.

Otros: Se instalarán - Instalación completa de Cocina, Equipos de lavandería, Tubería de aspiracíon de oxígeno, Equipo de ablandamiento del agua gorda, Instalación de esterizacíon de agua, Cámara de tiro de aire, Alumbrado sin sombras, Autoclave, etc.

Alcance de Obras

Al construir este Centro de Estudio, las obras menionadas a continuacion se preperarán o ejecutuarán por parte bolibiana.

1) Preparación del terreno

2) Vías de acceso provisional, instalación provisional para la energía eléctrica, abastecimiento y mantenimiento porvisionales de agua y desagüe.

en el lado oeste y la vía de acceso de servicios en el lado este.

Paln de Construcción

La función del Centro de Estudio se dividirá en 4 secciones y un Auditorio, y se proyectará la siguiente composición de pisos según las funciones.

2° Piso - Hospital y Sala de operación

1r Piso - Inspecciones y Laboratorios

Piso Bajo - Clínica y Consulta Externa, Sección de Radiologia y Auditorio

Sótano - Sala de máquinas, Sala de Electricidad, Cocina y Lavandería

El paso de subida y bajada se hará por medio de dos escaleras, y se instalarán un asec snor para la camilla y un montaplatos para el abastecimiento de comida.

La superficie total proyectada del pisos de este Centro de Estudio será de 3.795 m^2.

Proyecto de Estructura

Será de hormigón armado con 6 m, de espacio de módulo. El cómputo estructual se sujetará a las normas del Japón, EE. UU. y Alemania Occidental.

Descripción de Infraestructuras

Electricidad: Se instalarán - Subestación eléctrica, Equipo completo de electrogeneración de reserva para energencia, instalación para la fuerza motriz y para la fuerza motriz y para conexión con la red de distribución, Sistema de altavoces, Sistema de llamada de enfermeras, Sistema de teléfonos internos. Sistema de alarma, etc.

3) Instalación de tuberías para abastecimiento de agua y de desagüe.

4) Obra de conexión de línea de electricidad y de telefóno.

5) Obras de lindes.

6) Via principal de acceso y parque de estacionamiento de vehiculos y su mantenimiento respectivo.

7) Muebles y utensilios que no están incluidos en los instrumentos y aparatos de tratamientos medicinales.

Además, todos los trámites legales exigidos por las Leyes y los Reglamentos vigentes en la República de Bolivia se porcederán bajo y por la responsabilidad de parte de boliviana.

Chapter 1 Dispatch of a Survey Team

1-1 The Purpose for Dispatching a Survey Team

1-2 Members of the Survey Team

1-3 Itinerary of the Survey Team

Chapter 1 Dispatch of a Survey Team

1-1 The Purpose for Dispatching a Survey Team

The mission of the Survey Team was to conduct a survey to develop the basic design for the construction of the Gastro-enterological Research Center in the Hospital de Clinicas affiliated with the Medical Department of San Andres University located in the center of La Paz. This is a part of the Japanese grant to Bolivia requested by the Bolivian Government.

1-2 Members of the Survey Team

Member List

Team Leader: General

Toshihiko Kamegai,

Professor
1st Dept. of Surgery
TOHO UNIVERSITY SCHOOL OF MEDICINE

Team Members: Medical Research

Shintaro Kuramoto,

Associate Professor
1st Dept. of Surgery
TOHO UNIVERSITY SCHOOL OF MEDICINE

Medical Facilities

Takayoshi Terai

Architectural Specialist
Architectural Div. Medical Bureau
MINISTRY OF HEALTH & WELFARE

Isao Arikawa

Assistant Chief
Health Information Div. Public Health Bureau
MINISTRY OF HEALTH & Welfare

Yoichi Seki

Councilor
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Hajime Murate

Senior Architect
NIHON ARCHITECTS ENGINEERS & CONSULTANTS INC.

Kohsaku Sera

Structural Engineer
NIHON ARCHITECTS ENGINEERS & CONSULTANTS INC.

Masayoshi Funatsu

Mechanical Engineer
NIHON ARCHITECTS ENGINEERS & CONSULTANTS INC.

Shohei Katsumata

Electrical Engineer
NIHON ARCHITECTS ENGINEERS & CONSULTANTS INC.

Masato Okano

Architect
NIHON ARCHITECTS ENGINEERS & CONSULTANTS INC.

Makoto Satake

Grant Cooperation
Economic Cooperation Bureau,
MINISTRY OF FOREIGN AFFAIRS

1-3 Itinerary of the Survey Team

° June 7 (Tues)

Depart Tokyo - Arrive San Francisco

° June 8 (Wed)

Depart San Francisco - Arrive Lima

° June 9 (Thurs)

Arrive La Paz

° June 10 (Fri)

La Paz

(Morning) Survey of the construction site at the La Paz National Hospital. Visit to the Japanese Embassy to explain the outline of the survey. Visit to the Ministry of Health and Welfare for arrangements.

(Afternoon) Investigation of the building situation in Bolivia and tour of the construction fields.

° June 11 (Sat)

(Morning, Afternoon) Field tour of buildings under construction in La Paz.

° June 12 (Sun)

(Morning, Afternoon) Field study of buildings in La Paz and surrounding areas. Collection and filing of materials. Fact finding.

° June 13 (Mon)

(Morning) Visit to the Ministry of Planning and the Ministry of Foreign Affairs for arrangements. Survey of facilities in the Hospital de Clinicas.

(Afternoon) Arrangements with Bolivian counterparts in the Ministry of Health and Welfare and the National Hospital (medical care, buildings).

° June 14 (Tue)

(Morning) Visit to San Andres University for arrangements.

(Afternoon) Consultation with Dr. Palazzi and Dr. Aliaga of the National Hospital concerning medical buildings in Bolivia. Collection of data.

° June 15 (Wed)

(Morning, Afternoon) Arrangements with Bolivian counterparts in the Ministry of Health and Welfare and the National Hospital. Visit to the Institute de Torax and Institute de Oftalmologia.

° June 16 (Thurs)

(Morning) Exchange of technical information and collection of data about the structure, electricity and equipment with Bolivian counterparts in the Ministry of Health and Welfare.

(Afternoon) General arrangements with persons in charge at the Ministry of Health and Welfare and the National Hospital. Preparation of a draft of the Minutes.

° June 17 (Fri)

(Morning) Arrangements with Bolivian counterparts. Explanation of the draft of the Minutes to the Special Assistant in the Japanese Embassy.

(Afternoon) Survey of buildings in La Paz. Collection of data.

° June 18 (Sat)

(Morning) Visit to the Hospital Viedma and the Hospital Elizabeth Seton (in Cochabamba).

(Afternoon) Exchange of opinions about the medical situation in Santa Cruz with Dr. Canechigo and Dr. Juayani. Visit to the Centro Ohcologico and San Juan de Dios.

° June 19 (Sun)

(Morning, Afternoon) Survey of medical facilities in the Okinawan settlement in San Juan.

° June 20 (Mon)

(Morning) Visit to the Santa Cruz Chapter of JICA and the Japanese Consulate in Santa Cruz for arrangements.

(Afternoon) Visit to the Hospital Santa Cruz. Preparation of a basic design.

° June 21 (Tues)

(Morning) Survey of buildings in Santa Cruz.

(Afternoon) Visit to Sucre National Hospital and Sucre National University. Study tour of the city.

° June 22 (Wed)

(Morning) Study tour in Sucre.

(Afternoon) Visit to Hospital Elizabeth Seton.

° June 23 (Thurs)

(Morning) Discussion of the Minutes with persons in charge in the Ministry of Health and Welfare and National Hospital.

(Afternoon) Attended the test boring at the construction site for the Center. Collection and filing of data.

° June 24 (Fri)

(Morning) Signing and exchange of the Minutes with the Bolivian Minister of Health and Welfare. Briefed on the outline of the Five-Year Social Development Project in Bolivia.

(Afternoon) Filing of data. Getting ready for departure. Farewell party hosted by the Survey Team.

° June 25 (Sat)

(Morning) Arrangements with Bartos Co. Survey of the hospital site, test boring site and installed facilities. Departure (Kamegai, Kuramoto, Terai, Arikawa, Seki)

(Afternoon) Collection and study of data.

° June 26 (Sun)

(Morning) Survey of construction fields in La Paz.

(Afternoon) Filing of data. Discussion of the survey schedule.

° June 27 (Mon)

(Morning) Consultation with Dr. Palazzi about the construction site.

(Afternoon) Inspection of the progress of test boring. Consultation with the Water Works Bureau and the Sewerage Bureau. Return home (Kamegai, Kuramoto, Terai, Arikawa, Seki).

° June 28 (Tues)

(Morning) Discussion with the National Construction Committee concerning statistics, unit cost and labor. Arrangements for electric power, telephone service and fuel supply.

(Afternoon) Arrangements with the Water Works Bureau and the Sewerage Bureau. Arrangements with the Japanese Embassy concerning the construction site.

° June 29 (Wed)

(Morning) Arrangements with SICO, Survey of the construction field. Collection of data.

(Afternoon) Arrangements with Bartos and Tecnoconsult.

° June 30 (Thurs)

(Morning) Collection of data at the Statistics Department. Arrangements with the Ministry of Health and Welfare concerning the construction site.

(Afternoon) Reexamination of the construction site. Confirmation of the drainage system.

° July 1 (Fri)

(Morning) Survey of landscape gardening in La Paz with the Landscaping Department of the Minicipal Office.

(Afternoon) Arrangements with Tecnoconsult, etc. Collection of data. Survey of the construction site.

° July 2 (Sat)

(Morning) Arrangements with LIMS.

(Afternoon) Filing of data.

° July 3 (Sun)

(Morning, Afternoon) Filing of data.

° July 4 (Mon)

(Morning, Afternoon) Farewell visit to the National Hospital, Japanese Embassy and the Ministry of Health and Welfare. Departure (Murata, Sera Funazu, Katsumata, Okano).

° July 5 (Tues)

° July 6 (Wed)

Return home (Murate, Sera Funazu, Katsumata, Okano)

June 13, 1977
General Conference
at I.S.A.P.

June 23, 1977
Discussion Meeting
at the Ministry of
Health

June 24, 1977
" Acueldo" was signed
between the Minister
of Health and the
team leader.

Chapter 2 Survey Report - Part 1

Chapter 2 Survey Report - Part 1

2-1 Investigation and Discussion of Basic Problems

The Survey Team, upon arrival at La Paz on June 9, 1977, talked with Dr. Federico Aliaga, Chairman of the Joint Committee for the gastro-enterological research technical cooperation project which is closely related to this next grant scheme, and confirmed that the person in charge of the project on the Bolivian side was Dr. Dorian Gorena, Vice-Minister for Health and Welfare, the Ministry of Health and Welfare.

On June 10, the Survey Team visited the Hospital de Clinicas (National Hospital in La Paz), which was chosen as a construction site for the project, and surveyed it. Then the Team met with Dr. D. Gorena, Vice-Minister of Health and Welfare; and Dr. Hugo Palazzi, Director of the Hospital de Clinicas, and confirmed the principles of the grant project. At the same time, an office in I.S.A.P. (Institute de Superin Administracion Publica) was offered to the Team for use during the survey period.

On June 13, the Survey Team had a meeting with Dr. H. Palazzi and Dr. F. Aliaga in the office in I.S.A.P. to discuss survey items and a schedule, and asked for cooperation from the Bolivian side.

On June 14, an agreement was made to move the office to the Medical Department of the San Andres University which was closer to the construction site for the project. In the afternoon, the Team met at the Japanese Embassy with Dr. H. Palazzi, Dr. F. Aliaga, Dr. Gastor Mejia and Dr. Rolando Salajar, members of the Joint Committee for the gastro-enterological research technical cooperation project, together with the Special Assistant of the Japanese Embassy, and exchanged views on the basic framework and its concrete make-up on the basis of requests from the Bolivian side and a plan of the Team.

On June 15, the Team visited the Institute de Torax (granted from France), Institute de Oftalmologia (constructed with domestic donations), etc., located within the site of the Hospital de Clinicas. These visits provided useful information for the basic design of the project.

On June 16, the Team met again at the Japanese Embassy with Dr. H. Palazzi, Dr. F. Aliaga, Dr. G. Mejia, Dr. J. Rivelo and Special Assistant of the Japanese Embassy, and discussed matters in detail based on the findings so far gathered.

From June 17 to 22, the Team visited the Hospital Viedma (National Hospital in Cochabamba), the Hospital Elizabeth Seton, the Hospital San Juan Dios (National Hospital in Santa Cruz), the Japanese settlement in San Juan, the Okinawa First and Second Clinics, the Hospital Santa Barbara (National Hospital in Sucre), etc., and was able to grasp the general situation of medical buildings and facilities in Bolivia.

On June 23, the Team made final arrangements with Dr. D. Gorena, Dr. H. Palazzi and others at the Japanese Embassy and came to a mutual agreement on the draft of the Minutes (Acuerdo). The only difference from the draft was that the Survey Team would take over the test borings during its stay in Bolivia in order to improve accuracy and speed of the tests instead of the Bolivian side making the tests as had been previously arranged. Other arrangements were practically the same as the draft.

At 10:00 A.M. on June 24, the Minutes (Acuerdo) were signed by Tcnl. DEM. Guido Vildoso Calderón, Minister of Health and Welfare, and Toshihiko Kamegai, Leader of the Survey Team.

All through the survey period, the Bolivian side was extremely cooperative, which indicated their extraordinary enthusiasm toward this project.

2-2 Basic Plan for the Gastro-enterological Research Center

The Bolivian Government had requested the Japanese Government through the Japanese Embassy in Bolivia for technical cooperation concerning gastro-enterological research. In November 1976, R/D (Record of Discussion) was signed in La Paz and the project started in April 1977. At the same time, the Bolivian Government requested the Japanese Government to construct gastro-enterological research centers as grants in La Paz, Sucre and Cochabamba.

The Japanese Government recognized the importance of these institutes in connection with the on-going technical cooperation project, and decided to grant a research institute in the Hospital de Clinicas in La Paz from this year's budget.

The Survey Team had several conferences with the Bolivian side during its stay in Bolivia and mutually agreed to the following basic plan.

1) Organization Status of the Research Institute

   The Research Center, upon completion, will be placed under the jurisdiction of the Bolivian Ministry of Health and Welfare, and will be operated under the responsibility of the same Ministry.

   The future plan on the Bolivian side is to standardize the names of the Institute de Torax, the Institute de Oftalomologia, the Hospital de Nino, etc., located with the Hospital de Clinicas to "Centro", and consolidate them into a systematic medical center based on the independent operation of each Centro. In accordance with this scheme, the projected Research Institute will be hereafter called "Centro de Gastro-entrologia".

2) The Center will be used for advanced research and education (including pre-graduation education), and will combine medical facilities to implement them.

3) The on-going gastro-enterological research technical cooperation project will be carried out in the Center.

4) The Bolivian Ministry of Health and Welfare will budget personnel expenses and operating cost of the Center on their own responsibility by the time of its completion.

5) Patients to be treated at the Center will be limited to those who are judged by the Hospital de Clinicias and other medical institutions as needing more advanced treatment at the Center. So-called screening system will be employed for the clinical service of this Center.

6) As a rule, patients will be hospitalized in the Center only for a limited period, and when the hospitalization period extends for a long time, patients will be hospitalized in the Hospital de Clinicas or other medical facility.

7) Special examinations other than those related to gastro-enterology, such as pathological anatomy, will be handled in other institutions in the Hospital de Clinicas.

8) The Center will be divided into two parts: A general examination and research department which will mainly conduct X-ray examination, endoscopy, and pathological examination; and a Medical Service Department. The nature of the Center being as it is, enough space will be provided for a research department (including education).

9) Since the introduction of an electronic microscope will be vital in the future, consideration should be given to this matter.

10) There is no auditorium to accommodate a large number of people in medical education facilities in Bolivia, and giving research presentations and lectures is quite difficult now. Therefore, the Center will annex a multi-purpose auditorium.
The Bolivian side expressed a strong desire for this

auditorium, and the Survey Team, having concluded that the request is reasonable, agreed to it.

2-3 Future Outlook and Problems

Bolivia is now implementing the Five-Year Medical Care and Public Health Project, and is trying to improve the lagging public medical care system. This lagging public medical care system is mainly caused by economic difficulties, whereas the technical competence of the medical personnel is quite advanced. Therefore, a good system should be attainable with voluntary progress in this area and with outside assistance providing what is lacking.

Problems Involved in Construction

Considering the economic conditions in Bolivia, necessary consideration should be given to the supply of certain equipment as well as facilities at the time of construction of the Center in order to make the Center operate satisfactorily.

Administrative Problems

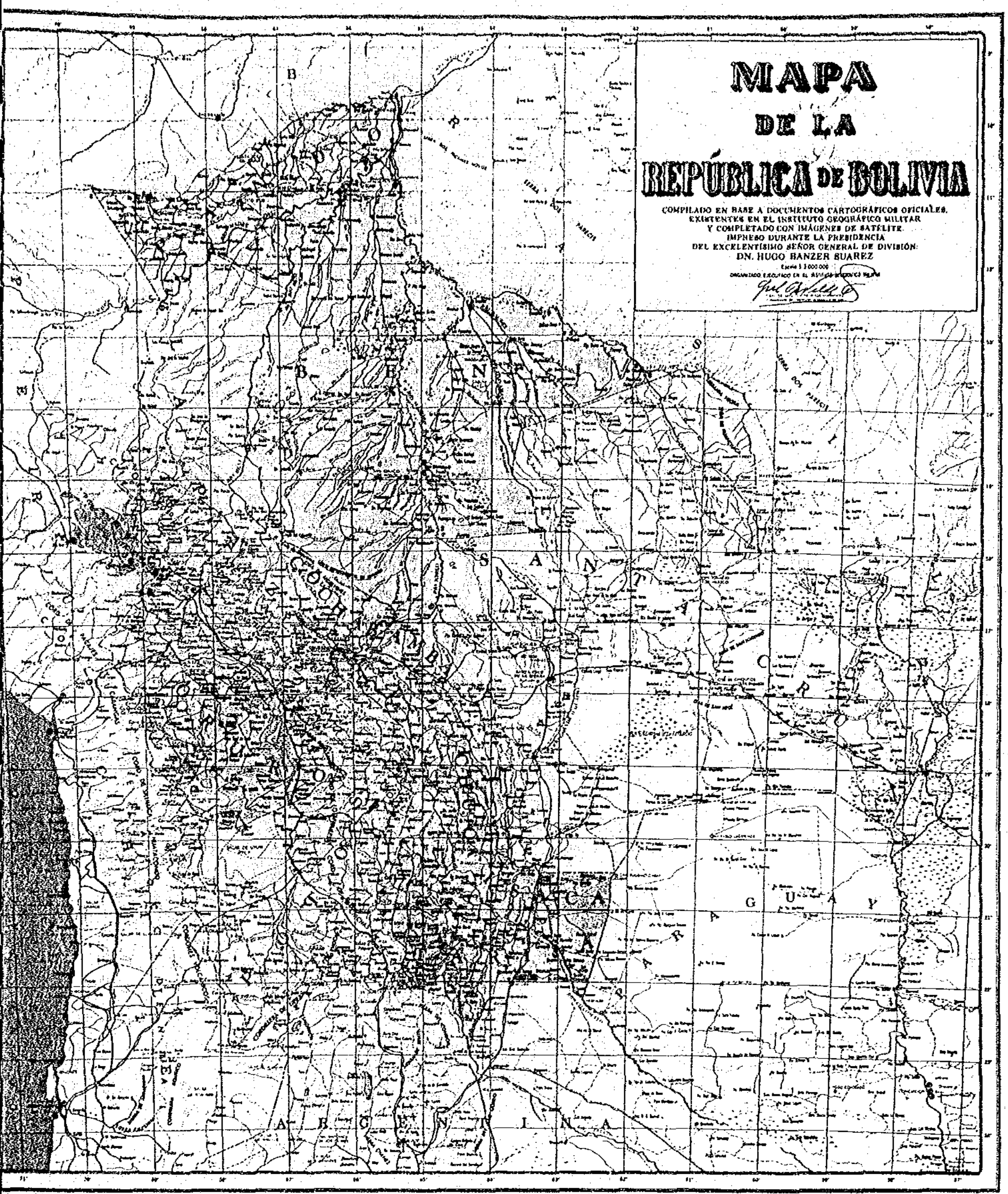
Most of the funds for national medical institutions in Bolivia are appropriated for personnel expenses and food costs for patients, leaving only a small portion for depreciation and maintenance of equipment.

The Bolivian side also agreed on this point and requested that a design that will enhance the economic independence of the Center be fully considered.

Personnel Problems

As we mentioned before, the competence and knowledge of medical personnel in Bolivia are highly evaluated, but the number of these personnel is still insufficient. There is a need to invite more trainees to Japan in order to develop their potentiality along with the present grant scheme.

Despite these problems, we believe that the proper operation of the Gastro-enterological Research Center will contribute tremendously to the medical care in Bolivia, since this projected grant scheme offers what is needed most in Bolivia where endemic gastro-enteritis such as the Chagas disease is prevalent and gastro-enteritis is a cause of a large proportion of infant deaths.



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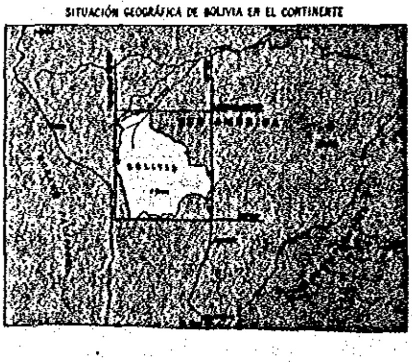

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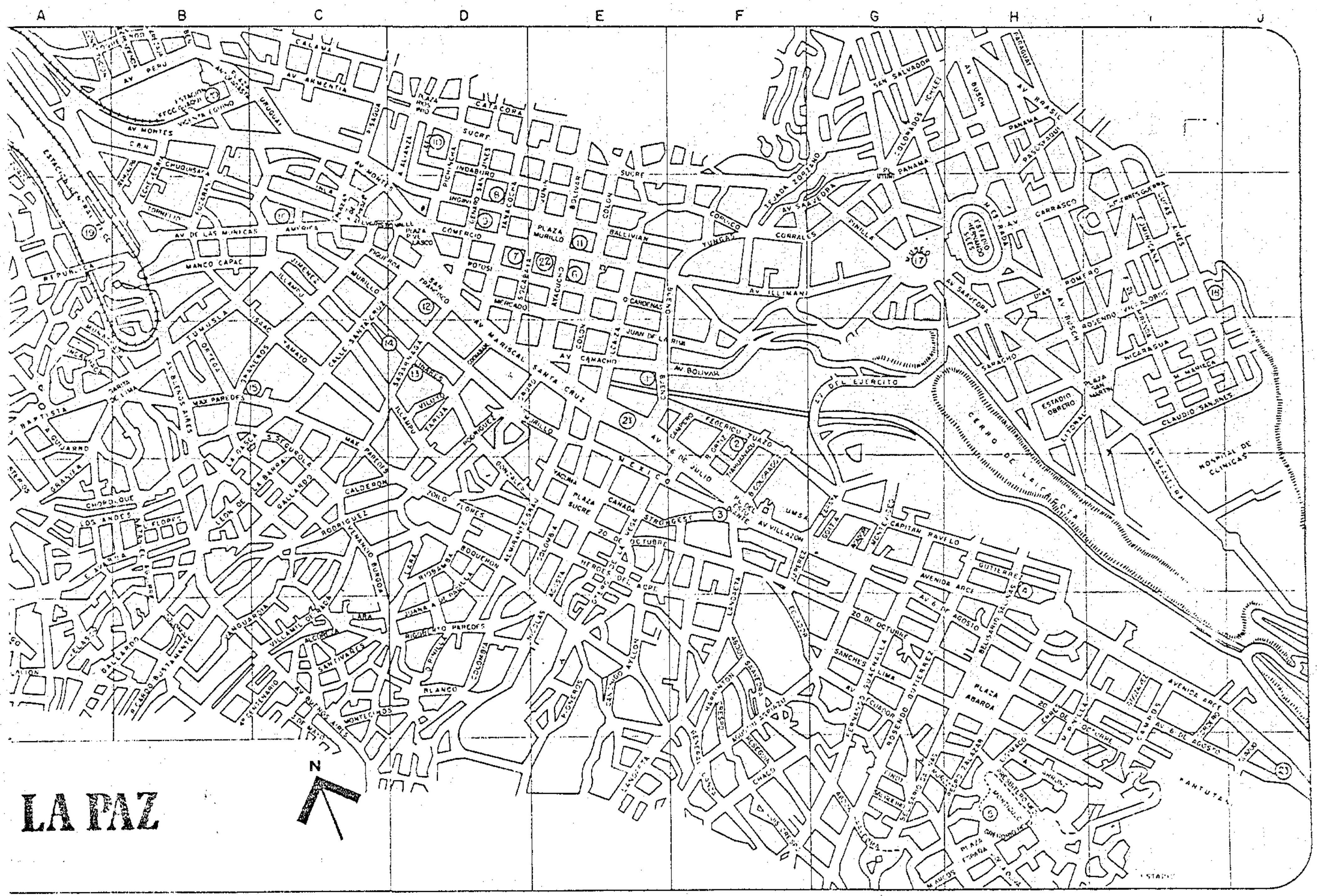
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SAGARNAGA
LINARES
ILLAMPU
MAX PAREDES
BUENOS AIRES
AV. MARISCAL SANTA CRUZ
AV. CAMACHO
LOAYZA
JUAN DE LA RIVA
AV. BOLIVAR
AV. ILLIMANI
YUNGAS
CORRALES
AV. SAAVEDRA
PINILLA
COLORADOS
PANAMA
AV. BUSCH
AV. BRASIL
PARAGUAY
CARRASCO
ESTADIO HERNANDO SILES
MUSEO
DIAS ROMERO
NICARAGUA
CLAUDIO SANJINES
HOSPITAL DE CLINICAS
AV. SAAVEDRA
ESTADIO OBRERO
PLAZA SAN MARTIN
LITORAL
CERRO DE LAICACOTA
AV. DEL EJERCITO
FEDERICO ZUAZO
AV. 16 DE JULIO
MEXICO
PLAZA CANADA
PLAZA SUCRE
STRONGEST
UMSA
AV. VILLAZON
CAPITAN RAVELO
AVENIDA ARCE
AV. 6 DE AGOSTO
20 DE OCTUBRE
HEROES DEL ACRE
SANCHEZ LIMA
AV. ECUADOR
ROSENDO GUTIERREZ
BELISARIO SALINAS
PLAZA ABAROA
PLAZA ESPAÑA
PANTUTA
CALDERON
GALLARDO
RODRIGUEZ
VENANCIO BURGOA
ZOILO FLORES
BOQUERON
COLOMBIA
ALMIRANTE GRAU
RIOBAMBA
LARA
JUANA A. DE PADILLA
RIGOBERTO PAREDES
BLANCO
AV. BUENOS AIRES
MONTECINOS
BAPTISTA
ESTACION CENTRAL FF. CC.
CHOROLQUE
LOS ANDES
LA PAZ

Chapter 3 Survey Report (No. 2)

3-1 Survey on Design and Construction Environment

3-1-1 Country and Natural Features of the City of La Paz

3-1-2 Situation of the Construction Industry

3-1-3 General Construction Methods in the City of La Paz

3-1-4 Survey on Actual Examples of Construction Projects

3-1-5 Utilities and Other Services in the City of La Paz

3-1-6 Situation of Construction Materials

3-1-7 Present Situation in Maintenance Management

3-1-8 Laws, Regulations and Engineering Standards

3-2 Survey on Construction Costs

3-2-1 Increasing Rate of Prices

3-2-2 Present Trend and Changes of Construction Materials

3-2-3 Labor Costs

3-2-4 Transporting of Building Materials

3-2-5 Construction Costs

3-3 Survey on Building Site

3-3-1 Outline of Building Site

3-3-2 Soil Condition of Building Site

3-3-3 Present Condition of Utilities and Services at the Site

Chapter 3 Survey Report (No. 2)

3-1 Survey on Design and Construction Environment

3-1-1 Country and Natural Features of the City of La Paz

This section of the report mainly covers the items related to design and construction activities.

1) General

Bolivia is an inland country located at 10 to 23 degrees south latitude in the western region of the South American Continent. Total land area of the country is 1,090,000 square KM (approximately three times the size of Japan), and about one-third of the land consists of the Andes Planteau and Valley (huge basin of Altiplano) and two-third is made up of plans. The plateau has a cold climate (Tierra Fria), while the plains area is a lowland with warm climate. The population is 5,600,000 (about 1/20 of that of Japan), and 55% of the population is composed of Indians of the Aymara and Quechua groups, 30% is of mixed blood and remaining 15% is Spanish white. The pattern of population distribution forms a pyramidal shape where people younger than 15 years of age total about 50%.

<u>Politics, Economy and Others</u>

This nation was politically unstable until 1971 but it became very stable after Banzer, the present President of Bolivia, took over this position in August of 1971, and also its economic structure has been gradually strengthened and stabilized on the basis of its rich natural resources and agriculture. Main goods for export which support the economy of Bolivia are mineral products such as tin, copper, zinc, antimony, etc. and exports of oil and natural gas have increased in recent years. On the other hand, Bolivia is greatly dependent upon imports of industrial products and garments.

For transportation, airways are well developed. The railways are connected from the city of La Paz to various cities in the plateau region, and an international railway connects with Arica and Antofagasta, Chile, but very few trains are available each day. Truck and bus routes are more developed nationwide, and buses and taxicabs are well developed within the city of La Paz.

2) Climate and Natural Features of the City of La Paz

La Paz is located at 16 degrees south latitude in the cold region 3,600 meters above sea level and is the largest city in Bolivia with a population of about 600,000.

a) Climate:

Annual variation in temperature and humidity is small with a mean air temperature of 10°C and mean relative humidity of 50% but its temperature varies considerably each day. Heavy rainfalls occur during rainy seasons in spring and summer but rains rarely occur during dry seasons in autumn and winter.

Annual Climatic Data of La Paz
(Tabulated from data for 6 years from 1970 to 1975)

Temperature in °C:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Monthly mean temperature	12.0	11.5	12.1	11.7	10.8	9.7	9.4	9.6	10.7	12.2	13.1	12.2
Monthly mean of daily maximum temperature	17.8	16.8	17.9	17.8	17.6	16.3	16.6	17.0	17.2	18.9	19.9	18.1
Monthly mean of daily minimum temperature	6.2	6.2	6.4	5.2	4.0	2.8	2.2	2.9	4.2	5.4	6.3	6.2
Maximum temperature per 6 years	24.7	23.5	23.6	22.0	21.5	22.2	20.9	21.0	22.4	24.2	24.8	23.6
Minimum temperature per 6 years	2.2	3.2	2.4	1.3	-0.5	-2.6	-2.8	-0.6	1.0	0.8	1.6	1.7

Relative Humidity in %:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Monthly mean humidity	73	69	63	60	47	42	44	49	51	55	55	68
Monthly mean of daily minimum humidity	30	28	23	18	16	15	15	13	15	15	16	18

Rainfall in mm:

Month	1	2	3	4	5	6	7	8	9	10	11	12
Number of days of rainfall per month	23	20	18	9	4	2	2	5	11	11	10	19
Cumulative monthly rainfall in mm	145.6	99.2	63.1	27.7	7.9	5.8	4.8	17.0	25.5	36.5	33.2	95.5
Mean daily rainfall per each rainy day in mm	6.3	5.0	3.5	3.1	2.0	2.9	2.4	3.4	2.3	3.3	3.3	5.0

Velocity and Direction of Wind in m/s:

Month		1	2	3	4	5	6	7	8	9	10	11	12
Maximum velocity within 6 years	Wind direction	W	E	SW SE	NW	W	NW	NE	W	NE	N	SW	NW
	Wind velocity	20	20	20	20	20	20	20	20	20	20	20	20
Mean	Most frequent wind direction	SE	SE	SE	SE	SE	NW	NW	E	E	E	SE	SE
	Wind velocity	2.2	4	3.8	3.6	2.2	3.5	3.0	2.0	3.3	4.2	4.5	4.2

b) Geology:

La Paz City is located just in the middle of a huge plateau basin of Altiplano situated between the western Andes Mountains and the eastern Andes Mountains. The present mountain system is comprised mostly of synclinal deposits of the Jurassic Period and it is assumed that the deposits were raised and curved by folding action in the Tertiary Period, turned into a peneplain by eroding action and finally elevated while being accompanied by faults. Many volcanoes are located near the national boundary where the orogenesis zone of the Tertiary Period exists. Stratum of the Cretaceous or Devonian Period is seen near the surface in the city of La Paz. This area is generally formed by alluvial formation made by glacial sediments except for certain areas.

c) Disaster:

Earthquakes: Near the international boundary between Peru, Chile and Bolivia, many earthquakes occur since the orogenesis is still active at the present time. Records of the earthquakes are available for La Paz since the city is located near the boundary of Peru and Chile, but large-scale inland type earthquakes have not occurred within La Paz.

A list of earthquakes that occurred near La Paz and recorded for the last 85 years was compiled by the San Caristo Weather Station and shown as follows.

Record of earthquakes at La Paz (Data of San Charisto Meteorological Station)

Date of occurrence	Scale	Location and condition
1891	III-IV	Possibly Munekas Mountains
1896, Jun	II?	
1896, Jul	III-IV	
1908	II?	Felt in northern Chile and southern Peru.
1909	"	Collapses in southern Bolivia.
1913	"	Collapses in southern Peru.
1920	"	Source at Consata-Mapiri.
1923	"	Felt strongly in Consata.
1928	III	Collapses in southern Peru.
1929	II	Source near Anto Fargasta.
1937	IV	Source at Consata.
1947, Feb 24	V	Source at Consata; Possibly largest in the history of La Paz.
1948	II	Peru southern coast.
1952	II?	Southern Peru.
1956	IV	Mapiri-Consata.
1960, Jan 13	III-IV	Collapses in Alequipa.
1960, Jan 15	II	Replica.
1963	IV	Deep at border of Peru and Bolivia.
1975, Jun 5	II-III	Border of Peru and Bolivia.
1975, Jul 12	"	"
1976, Nov 30	"	Northern Chile.
1976, Dec 28	II?	"

° Fire Disasters; Fire disasters rarely occurred in the City of La Paz because the concentration of air is about two-thirds of that in the lowland so that things are hard to burn. All buildings are made of earth, brick or concrete and none are made of wood. It is said that butts of smoked cigarettes will not start a fire.

° Floods; No flood is expected within the city of La Paz since continuous hours of rainfall seldom occur in the rainy season. The river running through the center of the city has deep beds and many torrents and valleys begin at the city of La Paz. However, roads are occasionally flooded like rivers since the city has topographically steep slopes to the river.

° Damage by Wind; Damage by wind rarely occur since the city of La Paz is within a hollow of valleys where the air moves slowly with very low wind velocity due to low air density.

d) Degree of Air Pollution; The air is not polluted since only few factories are located within the city and the air density is low. Epidemics in the lowlands rarely occur in this city. The dust occasionally rises during the dry season with little rain but it rarely rises up high. Non-paved roads cause rising of dust due to automobile traffic.

e) Vegetation; Short trees and pampases are often seen in the highland region while many broadleaf trees grow in the valleys. Trees for gardening will grow there if watering and care are provided since the annual air temperature is very stable.

3-1-2 Situation of the Construction Industry

1) Contractors in Bolivia

The construction industry is one of the industries which has been considerably active and developed since 1972, and the construction of houses was outstanding in the cities of La Paz, the most active of all, Santa Cruz, Cochabamba, Tarija and Trinidad. Due to increases in the construction of public roads, houses and high-rise office buildings, the growth rate of construction reached 13.5% in 1975.

228 construction firms of various sizes are registered with the construction committee of Bolivia (Camara Boliviana de la Construccion) organized by membership fees paid by the Ministry of Construction, Ministry of Labor and many private construction firms. These construction firms are classified into 5 classes depending upon capital, number of engineers and amount of construction materials owned. These five classes are detailed below.

Class	Capital	Numbers of Engineers & Architects	Percentage of Amount of Owned to Capital
1st Class	$b 2,000,000 min.	2 engineers min. and 2 architects min.	60%
2nd Class	$b 1,000,000 min.	2 engineers or architects min., or 1 engineer min. and 1 architect min.	50%
3rd Class	$b 500,000 min.	1 engineer or architect min.	40%
4th Class	$b 200,000 min.	1 engineer or architect min.	35%
5th Class	$b 50,000 min.	1 skilled construction worker min.	25%

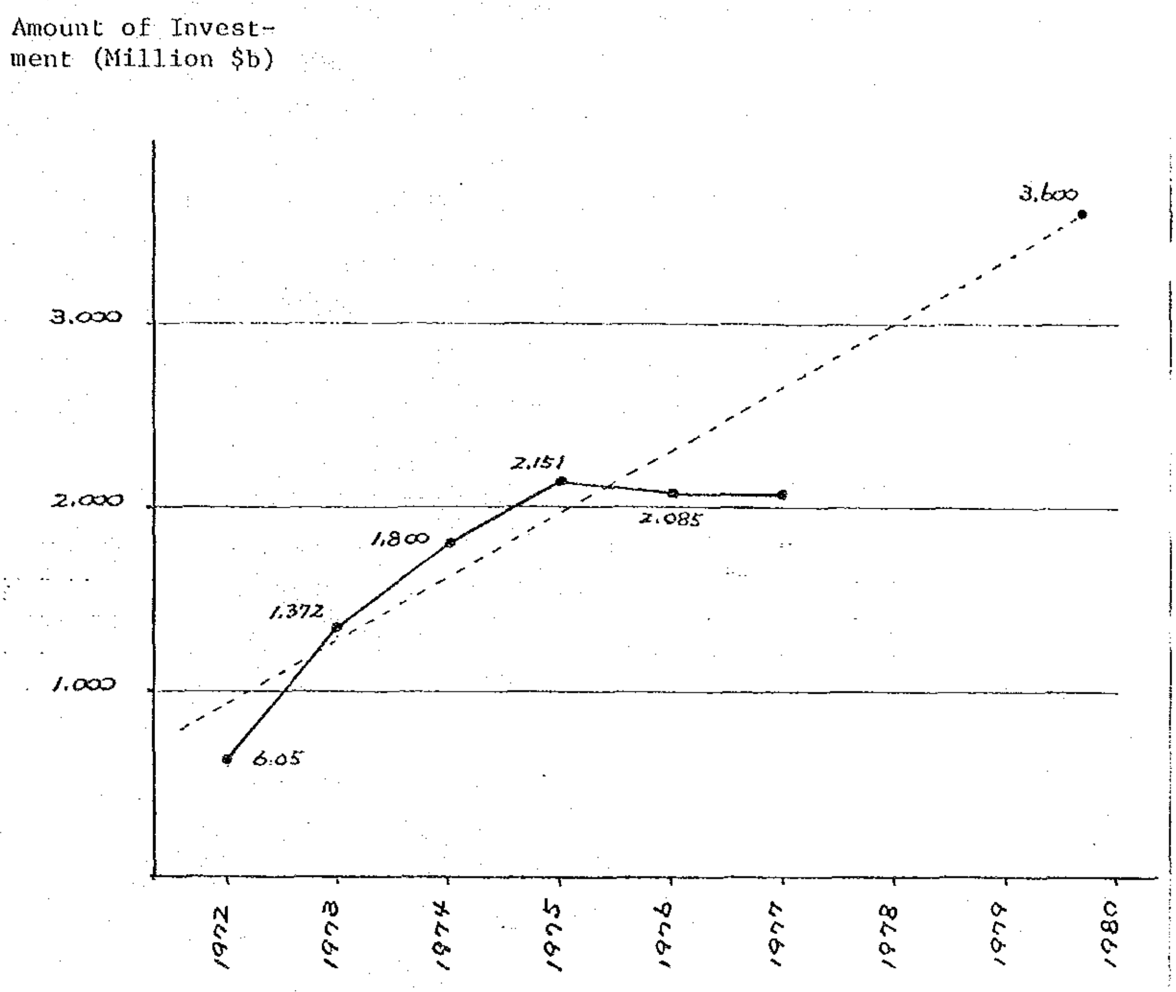
228 construction firms registered with the construction committee of Bolivia are shown by classes and by sections in the table below.

Sections	Total Numbers of Firms	1st Class	2nd Class	3rd Class	4th Class	5th Class	Building equipment contractors.
La Paz Section	130	20	26	40	12	26	6
Cochabamba Section	28	5	9	9	1	1	3
Santa Cruz Section	35	10	5	8	5	1	6
Oruro Section	16	-	6	4	3	2	1
Trinidad Section	6	-	1	4	1	-	-
Sucre Section	5	-	4	1	-	-	-
Potoshi Section	3	-	2	1	-	-	-
Tarija Section	5	-	-	3	1	-	-
Total	228	36	53	70	23	30	16

As indicated in the table above, more than half of the contractors of Bolivia are concentrated in the capital city of La Paz, indicating a large demand for construction in this city.

2) Construction Trend in La Paz

Construction activities in the City of La Paz have greatly increased in the last five years. A construction rush has taken place in this city since many new high-rise office buildings, large hotel buildings and other types of buildings are under construction or are being started at many job sites. Of buildings higher than 7 stories in the city, 73 buildings where completed after 1964 and 15 buildings are currently under construction. This directly reflects the economic growth of Bolivia, especially of La Paz, since there is a concentration of industries, the population has increased tremendously, and they floating population (foreign professionals staying one to two years for example) has also increased in the last few years. Progress of the amount of construction investment in La Paz is shown below.



° This graph shows the growth rate of the construction industry by means of annual investment of the last several years and the assumed value in 1980, in which the assumed values for the years after 1977 were made on the basis of investments in public works designated by a 5-year plan of the government of Bolivia.

° The growth rate in 1976 and 1977 was low mainly because of a cement shortage in La Paz. The actual decrease was about 3% compared to 1975.

° It is assumed that construction investments will be considerably increased in the years of 1978, 1979 and 1980. At the present time, Cemento Viacha, a cement manufacturer, is working to triple its production capacity of cement (220,000 tons/year) and the cement shortage is being solved.

3) Population of Construction Workers in La Paz

The construction committee of Bolivia has not determined the number of skilled and semi-skilled construction workers in La Paz but it is said that about 12.8% of the labor population is working in the construction industry and construction-related manufacturing industries. From statistics, the total number of construction workers in La Paz is about 120,000. This figure means that more than half (about 55%) of the total construction workers in Bolivia is concentrated within the city of La Paz. Nevertheless a shortage of skilled workers exists in all construction firms, and especially the shortage of foremen, maintenance mechanics, electricians, welders, plumbers, stone (or brick) layers is outstanding.

3-1-3 General Construction Methods in the City of La Paz

1) Temporary Work

Temporary fences surrounding the job site are mostly made of wood painted vertically in two-tone color. Scaffolding is used in cantilevered form for the second floor for curing but rarely used for exterior work. External work such as window installation, laying of concrete blocks for spandrel, plastering and finish painting are performed by simple light-weight suspended platforms which have been developed in this country probably because of the extremely low wind velocity peculiar to this country.

All materials for temporary facilities such as temporary fences, scaffolding, forms and supports for temporary structures are made of wood, and steel plates or pipes are not used. Work at the job site is mostly performed by men and more mechanization should be possible in the future.

2) Earthwork

The soil in the City of La Paz is consisted of gravel formed near the ground surface in many locations and many boulders 40 to 50 cm in size are mixed with the gravel in many cases. Occasionally rocks longer than 1 meter are found (this was found at the job site of Terre de Los Americas, Banko Central de Bolivia) and special efforts are required for excavation.

Excavation is performed by power shovel or back hoe, or by hand but excavation for independent footing is done only by hand. It is said that about 6 hours are required to excavate $1M^3$ of earth by one man. When machines are used, 6,000 M^3 of earth can be excavated in three months according to data obtained from the job site of the Holiday Inn. If 25 working hours are assumed for a month, earth excavated per day will the only 80 M^3.

This volume is about 1/3 to 1/4 of that expected in Japan. This slowness is mainly due to the soil condition which imposes extra difficulty in excavation as stated previously. Problems concerning ground water during the excavation rarely occur. The local government designates the places for dumping the excavated earth.

An earth retaining wall after excavation is not required. Even an excavation up to 15 meters in depth can be done without earth-retaining wall. This may be possible because of the excellent soil condition, extremely low rainfall and low ground-water level. Elimination of earth retaining walls and timbering will be very advantageous in conducting excavations and underground work.

3) Reinforced Concrete Work

In constructing reinforced concrete structures, concrete for columns, floors and beams are poured at the same time in Japan except in special cases, but concrete is formed in two stages in La Paz. Concrete is poured only for the columns first, then the concrete for slabs and beams is poured in a subsequent stage. Form work and the placement of reinforcing bars are performed separately for columns, and slabs and beams.
A reinforced concrete structure is built by repeating this two-stage operation.

Walls including exterior walls, low walls and interior partitions are in most cases built by stacking hollow bricks manufactured in Bolivia.

Slabs are mainly constructed by the following two methods:

a) Solid slab method

b) Grid and joist slab method

Method a) is identical to the method practiced in Japan in which a solid floor slab is made by placing reinforcing bars on the wood forms first and then pouring concrete to a predetermined thickness.

According to method b), precast mortar blocks are laid on a wood form first, reinforcing bars are placed next, and then concrete is poured on the form in order to construct the grid floor slab or joist floor slab.

Method b) is more frequently used in La Paz since the amount of concrete for the floor can be reduced by this method.
As a new type of floor system, joist slabs formed by combining both precast panels and blocks are being considered in this city.

A simple wooden lift equipped with a winch is used for covering building materials to each floor level and for pouring of concrete.

The standard time required for pouring concrete for one floor by the method stated above is about 15 to 20 days. In most cases the concrete is mixed at the job sites but a construction firm in La Paz owns a batcher plant and ready-mixed concrete can be purchased from this firm.

Usually 16 to 40 M^3 of concrete is poured per day using a 200-liter mixer for each batch. If used, ready-mixed concrete may be, poured at the rate of 20 M^3 per hour.

4) Architectural Finishing

Examples of finishes most frequently employed in La Paz are indicated below.

a) Interior Finishes:

Floors; Floor finishes most commonly used are wooden mosaic flooring (Parquett) and terrazzo tiles (Mosaico), both being manufactured in this country and widely used. PVC tiles (vinyl) made in Brazil or Argentina are also used. Examples of stone finish and carpeting are also seen.

Walls; Walls are rarely built with concrete but most commonly the finishes are put on structural hollow brick walls (Ladrillo Huecos). The surface of the brick wall is finished by approximately 25mm thick plaster (Yeso) and frequently this plaster is covered again by paint or wall paper. Also, ceramic tiles, stones, and plywood over wood furring are occasionally seen.

Ceilings; The most common ceiling finish is plaster coating applied directly to the bottom of concrete slab. In such case, all conduits for electrical wiring are buried in the concrete. Occasionally, acoustic panels are applied on wood furring. Metal furring for ceiling finish has also been used in recent years.

Doors; Wood-veneered flush doors are mostly used with standard dimensions of 900mm in width and 2,100mm in height. Door hardware is mostly imported from Brazil, Argentina, U.S.A., or Germany.

b) Exterior Finishes:

Exterior walls; Most commonly, about 50mm thick exterior plaster (Cal y Cemento) is coated on the structural hollow brick wall (at least 15cm thick for exterior walls) and it is finally finished with paint.

In recent years, buildings with exposed concrete exterior walls are occasionally seen and foreign-made aluminum or steel curtain walls are also used for exteior walls.

Windows; Steel window sashes finished with paint is most common, but wood sashes are also widely used.

Aluminum sashes are recently increasing and sash materials are imported from Brazil, Argentina and the United States and assembled in Bolivia.

Roofs; Terra-cotta roofing tiles are widely used for sloped roofs. And roof structure for such sloped roofs is mostly wood. For flat roofs of concrete slab, the parapet is generally raised and asphalt is used for waterproofing, the top is finished with silver paint or poured concrete.

5) Electrical Work

The power distribution system by the power company in the City of La Paz is as follows:

(1) An underground cable system is employed and transformers for power distribution are also installed underground in the city area.

(2) An aerial power distribution system is employed with transformers installed on poles in the suburbs.

Electrical work for buildings within the city is generally performed in the following manners;

(1) Pipes, conduits and boxes buried within the concrete structures are mostly made of PVC, and steel products are rarely used. Convenience outlets and telephone outlet boxes are mostly recessed in the wall and rarely installed on the floor.

(2) Electric wires used are mostly PVC wires conforming to American Standards. They are occasionally buried directly in contact with concrete.

(3) Distribution boards are made of covered knife switches mounted on wood bases in many existing buildings but moulded circuit breakers on steel frames are widely used in newly completed buildings.

(4) For lighting fixtures, fluorescent lamps are widely used for office buildings while simple incandescent lamp fixtures are used for houses and hospitals.

(5) Generally, electronic equipment and accident-preventive equipment are not used. Such equipment can be found special-purpose buildings such as hotels.

6) Mechanical Equipment

Heating equipment; Heating is not required for rooms where there is heat by sun light, but rooms in the shade or at night are relatively cold. Heating equipment, in the order of usage, are electric stoves, propane gas stoves, hot water or steam central direct heating systems and hot air heating systems. The last two systems are used only in certain hotels, offices and hospitals.

Ventilating Equipment; Mechanical ventilation is rarely provided for general living quarters, and mechanical ventilation by exhaust fan is seen only in toilets, and mechanical and electrical rooms. Natural ventilation is widely used since most of mechanical devices and equipment are imported.

Air-conditioning Equipment; The climate in La Paz city does not require air-conditioning for buildings and the installation of cooling equipment is not seen in this city.

Water Supply and Drainage; The city water supply system is utilized for each building by means of concrete receiving tanks or elevated water tanks.

Waste water is mainly drained by lead pipes and a central basin is installed in each toilet. Cast iron pipes are generally used for sewer drainage. Waste and sewer lines are connected to main public underground pipes without treatment and the drained water from the outlet of the city line is discharged into the river running through the city.

Fire Equipment; Carbon dioxide gas fire extinguishers are seen in some buildings in the City of La Paz but other types of fire extinguishing equipment are not used.

3-1-4 Survey on Actual Examples of Construction Projects

1) Survey on Actual Construction Examples in La Paz

A survey was made of existing buildings and buildings under construction on; 1. sizes of building; 2 construction method; 3. amount of materials used; 4. construction duration; and 5. construction cost. In performing this survey, building data sheets (Hoja de Patos de Edificio No. 11 reference material) were produced and distributed to contractors, architectural design firms and architectural engineers in La Paz city requesting their cooperation in answering the questionnaires.

In order to avoid misunderstandings due to differences in terms and construction methods between Bolivia and Japan, each survey staff member met with engineers of Bolivia to obtain detailed explanations on each item on the building data sheet. Data recorded and tabulated from this survey are shown in the following table.

General and Scale of Building	Type of Building	Construction Duration	Total Floor Area	Number of Stories	Concrete		Reinforcing Bars		Concrete Form		Architecture (A)	Electrical (E)	Mechanical, Sewer (S)	Mechanical, H.A.& V(C)	Total (T)	Remarks
			m²		m³	m³/m²	Ton	kg/m²	m²	m³/m²						
1) APOLO	Apartment (Block of Flats)	72·5 ~ 75·4 36 M.	3,748.8	17 − B1	825	0.22	78	21.0	2,998	0.8	390,950 104.3/m²	12,550 3.3/m²	58,000 15.5/m²	— —	461,500 123.1/m²	A/T = 84.7%
2) ESMERALDA	〃	75·4 ~ 77·3 24 M.	1,512.1	13 − B1	350	0.23	28	18.5	1,255	0.83	290,180 191.9/m²	9,750 6.4/m²	30,570 20.2/m²	— —	330,500 218.6/m²	A/T = 87.8%
3) ORQUIDA	〃	71·6 ~ 72·12 18 M.	1,160	5 − 0	220	0.19	21	18.1			116,780 100.7/m²	8,500 7.3/m²	11,100 9.5/m²	— —	136,380 117.6/m²	A/T = 85.6%
4) HANSA	Office	76·10 ~ 79·10 36 M.	17,700	23 − B4	5,757	0.327	550	31.0			2,865,000 161.8/m²	180,000 10.2/m²	315,000 17.8/m²	155,000 8.8/m²	3,515,000 198.6/m²	A/T = 81.5%
5) B.I.S.A.	〃	75·4 ~ 78·7 40 M.	8,800	12 − B1	2,740	0.311	264	30.0			2,075,000 235.8/m²	170,200 19.3/m²	144,600 16.4/m²	170,000 19.3/m²	2,559,800 290.9/m²	A/T = 81.1%
6) ENTEL	〃	73·1 ~ 77·8 44 M.	6,000	12 − B1	1,385	0.23	70	12.0							890,000 148.3/m²	
7) CAMARA NACIONAL DE COMERCE	〃			17 − ?											216.3/m²	
8) BANCO CENTRAL DE BOLIVIA	〃		33,000	32 − B2	14,833	0.500	2,246	68.0							15,000,000 454.5/m²	
9) TORRE DE LAS AMERICAS	Apartment (Block of Flats)		17,000	30 − B2	4,250	0.25	370	20.6							3,000,000 176.5/m²	
10) CAMPOS	〃	74·6 ~ 76·12 30 M.	3,543.01	18 − B1	850.3	0.24	347.2	97.0	13,817	3.9						
11) ISABELITA	〃	74·6 ~ 77·3 33 M.	6,026.72	19 − B1	1,386.15	0.23	602.6	100	22,901.5	3.8						
12) SHERATON	Hotel	74·12 ~ 77·5 30 M.	27,700	14 − B2	12,000	0.44	850	30.6			8,864,000 320/m²	1,385,000 50/m²	692,500 25/m²	969,500 35/m²	11,911,000 430/m²	A/T = 74.4%
13) HOLIDAY INN	〃		14,500	16 − B3	4,650	0.32	350 ~ 400	24 ~ 27.6							6,000,000 413.8/m²	

2) Summary Derived from the Survey by Building Data Sheets

a) Structure and Quantity of Materials Used

All buildings surveyed including high-rise buildings have reinforced concrete structures. A steel frame structure or steel frame with reinforced concrete structure is not used even for high-rise buildings.

Quantity of concrete used per 1 M^2 of floor area was 0.25 to 0.50 M^3 per 1 M^2. This is about 50 to 70% of that of reinforced concrete structure built in Japan. However, they cannot be simply compared since a high-rise building in Japan is usually built with a steel frame or a steel frame with reinforced concrete.

The following reasons for the use of less concrete in Bolivia are assumed:

1. Structural members for beams and columns are relatively smaller in Bolivia since design for earthquakes is not required.

2. Walls are mostly built with hollow bricks instead of using concrete.

- The quantity of reinforcing bars were 18 to 100 kg per 1 M^2 of floor area. These quantities widely varied so that the mean value derived was considered to be meaningless.

b) Construction Duration

The length of time required to complete the buildings were surveyed. Considering factors of building scale and contents, the mean time required was about twice as long as that of Japan.

Reasons for the longer time required to complete buildings in Bolivia are:

a. Most of building materials other than concrete, bricks and lumber are imported foreign products so that procurement of materials are frequently delayed especially in room finishing and equipment installation stages.

b. Construction work is greatly dependent on manpower.

c. Occasionally work is delayed due to shortage of funds by the owner.

c) Construction Cost

Refer to Paragraph 3-2-5.

3-1-5 Utilities and Other Services in the City of La Paz

1) Electric Power

Most of electric power supplied in La Paz is generated by water power stations.

Two large electric power supply companies are supplying electric power at present time as indicated below.

(1) A private enterprise "Compañia Boliviana de Energia Electrica (COBEE) is supplying power in the states of La Paz and Oruro.

(2) The other 7 states are supplied by the government-owned enterprise "Empresa National de Electrificación (ENDE).

Actually generated power by COBEE in 1972 to 1976 is shown in the following table:

Year	General Power MWH	Cosnumed Power MWH	Difference MWH	Number of Users
1972	282,488	245,375	37,113	77,032
1973	284,409	238,706	45,703	80,803
1974	309,860	256,212	53,648	81,359
1975	321,738	269,723	52,015	83,784
1976	330,750	280,495	50,255	87,952

* Yearly average of increasing rate of power demand in last 5 years is about 3.6%.

Specification or ratings of power supplied by COBEE is shown below.

Voltage	Power Station o— 66KV →o Substation — 6.6KV →o Distribution Transformer — 220V 110V →o Consumer
Frequency	50 Hz
Voltage Regulation	±8%
Frequency Regulation	±2%

Power rates for high voltage, 6 KV commercial power are shown in table below.

	Japan (Tokyo)	COBEE (La Paz, Bolivia)
Basic Rate	1200 yen/kw	70 $b/kw (980 yen/kw)
Power Rate	15.18 yen/kwh	Up to 100 kwh 0.78 $b/kwh (10.92 yen/kwh) Exceeding 100 kwh 0.58 $b/kwh (8.12 yen/kwh)

Taxes for electric power in the City of La Paz are shown below.

Sales Tax	3%
City Tax	5%
Railroad Tax	0.8%
Total	8.8%

2) Telephone Service

Toll lines of La Paz City are operated by the government-owned telephone and telegram enterprise "Empresa Nacional de Telecomunicaciones Bolivia (ENTEL)" and local lines in La Paz are operated by the private enterprise "Telefonos Automaticos de La Paz Soliedad Anonima (TASA)".

At the present time, four local stations owned by TASA are automatically operated and a total of 32,500 subscribers are being serviced. A total of 13 local stations will be automated and 62,500 subscribers will be serviced by fiscal year 1980.

Telephone rates in the City of La Paz are shown below.

Type of Telephone	Rate	Remarks
General Residential Telephone	$b 86.30	
Business Telephone	$b 215.00	No message rate, monthly fee only.
Commercial (Direct)	$b 393.00	
Commercial (PBX)	$b 585.00	
Installation Fee for Subscriber	$b15,300.00 (US$750.00)	Initial installation only

3) Radio and Television

(1) Television broadcasting in the City of La Paz is operated in black and white by a government-owned station at the present time

The radiowave specifications are:

- Frequency 225 MHz
  Picture output 2 kw, and
  Voice output 1.8 kw

Time for broadcasts is between 17:00 and 24:00 during weekdays and between 10:00 and 24:00 during holidays. Color television broadcasting is presently being planned, but a definite schedule has not been established.

4) City Water Supply

The city water supply system in the City of La Paz is fairly completed. Due to increased demands on city water resulting from the construction rush, the City Water Department is rushing the replacement of existing water main pipes with larger pipes in many places as actually observed in June, 1977. Cast iron pipes are used for the main distribution system.

Carbon steel pipes are frequently used for water lines within buildings, but the reddish sign of rust is not seen probably because the pH value is relatively high.

The quality of water is characterized by high total hardness and high sulphate ion.

Results of water examinations performed by the City Water and Sewer Service Department in March, 1977 are shown below.

	City of La Paz	Japanese Standards for Supply Water	City of Tokyo (March, 1976)
Temperature	7∿14°C	-	5∿20°C
HP	7∿8.8	5.8∿8.6	6.8
Residue on Evaporation	140∿390 mg/ℓ	500 mg/ℓ max.	130 mg/ℓ
Turbidity	1∿4 mg/ℓ	2 max.	0
Color	0	5 max.	1.0
Free Chlorine	0.05∿0.25 mg/ℓ	0.1 max.	0.6
Carbon Dioxide Gas	1∿6 mg/ℓ	-	-
Total Alkali	7∿26 mg/ℓ	-	30.8
Total Hardness	88∿250 mg/ℓ	300 max.	69.8
Manganese Ion	0.1∿0.4 mg/ℓ	0.3 max.	-
Sulphate Ion	64∿150 mg/ℓ	-	6.5
Silicate Ion	2∿5 mg/ℓ	-	14.26

5) Fuels

Electric power, propane gas, kerosene, light oil and heavy oil can be considered as sources for heating and hot water supply in La Paz. In determining the type of heat source, low operating cost and stable supply should be taken into consideration. Generally, there is an over-supply of heavy oil, while kerosene and light oil are in short supply in La Paz. The Bureau of Petroleum, however, is hoping for more use of heavy oil for heating purposes.

Energy Costs for Producing 1000Kcal Hot Water

1$b=14 yen

	Energy Cost	Unit Cost of Energy per 1000Kcal	Equipment	Equipment Efficiency	Running Cost per 1000Kcal
Electric	$b 0.61/kwh	$b0.71	Electric boiler	1.0	
Propane Gas	$b 2.0/kg		Boiler	0.7	
Industrial Kerosene	$b 1.5/ℓ		Boiler	0.6	
Light Oil			Boiler	0.6	
Heavy Oil	$b 11/ℓ	$b0.1	Boiler	0.6	$b0.17

For kitchen appliances, propane gas and electric cooking ranges are widely used. Propane gas used is highly pure gas with 30% propane mixed with 70% butane, and gas is supplied in 10.15 or 45 kg bombs.

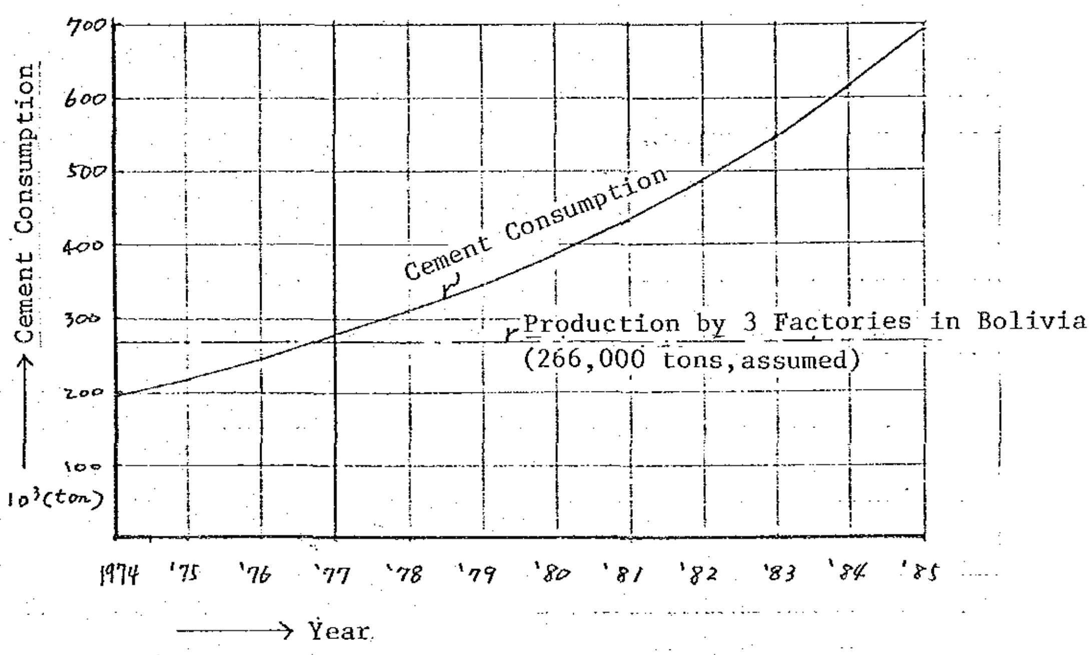
A gas distribution pipeline system with concentrated propane gas bombs is occasionally seen in buildings such as the Sheraton Hotel in La Paz, but generally this sytem is rarely seen in the city.

6) City Sewerage

All sewage is disposed directly into a river running through the center of the city. Sewer pipe lines are buried under the public roads and existing lines are being replaced with larger pipes at present.

3-1-6 Situation of Construction Materirls

Under the leadership of a stable government, Bolivia is now promoting its social and economic development under a new 5-year program from 1976 to 1980. As one of the projects, under this 5-year program, construction work using programmed construction investment funds are actively underway and, accordingly, the amount of consumption of construction materials is increasing each year. To prove this tendency by actual data, changes in cement consumption are shown in the graph below.



Graph for Forecasting Cement Consumption in Bolivia

Since cement consumption is proportional to the investment in construction, shortage in construction materials in the future should be taken into consideration. Hence, effective measures should be fully prepared for construction of the Research Center.

In regard to construction costs, it is said that about 30% of the cost is for imported materials and 70% is for labor and cost for materials made in the country. The construction materials and equipment are

Note:	Daily production by three factories:	Coboce;	300 t/day
		Fancesa;	300 t/day
		Viocho;	200 t/day

3-1-7 Present Situation In Maintenance Management

More than 50 buildings higher than 7-storeys in height have been constructed in the last few years in the City of Paz and each building is being controlled under the maintenance management plan.

Cleaning of Building: Although machines are used for cleaning, they not widely used, and cleaning is performed carefully and thoroughly. Windows that open are commonly used and, hence, gondolas for cleaning glass are unnecessary.

Elevators: Each high-rise building is equipped with elevators imported from the U.S.A., Italy or Switzerland, and maintenance of the elevators is performed by the agencies of the manufacturers. Repair work for defects are smoothly carried, but products imported from countries other than those described above may create some problems in maintenance. For instance, Japanese products may be installed if a specific manufacturer provides the maintenance system.

Water Supply and Drainage, Heating and Ventilating Equipment: Machines such as pumps and boilers are all imported products. Heating equipment is not widely used as yet, but their maintenance is being performed by those related to sales and installation of the equipment. This can be performed smoothly as long as replacement parts are available.

Electrical Equipment: Most of electrical devices or materials are imported goods. If capacities are sufficiently large, high voltage devices are all installed and maintained by power companies. And maintenance for low voltage devices is performed by those related to the instrallation of building equipment.

classified into imports and domestic products as indicated below.

i) Domestic Products

Cement, sand, gravel, concrete products, mortar products, bricks, tiles, terrazzo blocks, lumber, some reinforcing bars, PVC pipes and tubes for mechanical and electrical uses, PVC boxes, some types of vinyl electric wires, some types of lighting fixtures, some type of distribution boards, lead pipes, etc.

ii) Imported Materials

Steel products (reinforcing bars, steel beams, and other materials), steel sashes, aluminum sashes, glass, paint, PVC-tiles, wall paper, and electrical and mechanical equipment, devices, etc. They are imported mainly from the U.S.A., England, West Germany, Japan, Argentina, Brazil, and Italy.

In regard to cement, consumption was higher than the domestic production of 266,000 tons (total* of 3 factories) in 1977 as shown in the graph, and the importation of cement will become necessary very soon. Cement was also imported in the past due to reduced supplies during rainy seasons. It was reported that approval was required from the factory for importing cement since domestic manufacturers are protected by government policies. Other construction materials are also in short supply occasionally.

Main construction materials are mostly imported according to this survey and, therefore, materials required for the construction of the Research Center should be basically obtained from Japan to complete the buildings within the scheduled time, except for materials which are domestically available such as cement. sand, gravel, blocks, concrete products, lumber and pipes for electrical uses stated above, provided that customs duties and import licenses for import materials for this project are exempted.

Telephone Equipment: Most of telephone exchanges used are imported from Japan and their maintenance management is also being performed by Japanese manufacturers.

3-1-8 Laws, Regulations and Engineering Standards

° Zoning and parceling regulations which regulate the zones, building area allowable, height of building, etc. (Reglamento de Parcelacion y Zonificacion) are legislated by the City Planning & Adjustment Bureau of La Paz City (Municipalidad de La Paz Ofcina Del Plan Regulador).

° According to the regulations, the proposed site is located in a residential area, but officials pointed out that these regulations are not applicable to this specific site since it is located within the grounds of the hospital. They are considering revising parts of the regulations and they will respect corresponding Japanese engineering standards as far as building regulations are concerned with relation to the proposed research center.

° In regard to submitting the plans for approval, the building permit must be issued by the city office at the preliminary stage of the plan. Drawings to be submitted for this permit shall include electrical and mechanical drawings in accordance with forms established by the city office.

° Regarding structural design, there is no special regulations for the design, and structural engineers are designing structures in conformity with American standards (ACI) or German standards (DIN) at the present time.

° City officials pointed out that Japanese codes can be applied in designing the structural system for the proposed research center building.

° Regulations for electrical work have not been fully prepared and the work is usually done in conformity with those of the country from which materials are imported.

Norma Para Instalaciones Electricas . . . By Ministry of City & Housing of Bolivia

NEC (National Electric Code) . . . . .U.S.A.

AWG (American Wire Gage) . . . . .U.S.A.

ABNT (Association Brazileas Normas Tecnicos) . . . Brazil

° Regarding civil engineering, the engineering standards were established by the Sewerage Bureau of the City of La Paz in 1963 but they are being prepared for revisions and rarely enforced at this time.

City officials pointed out that Japanese engineering standards will be respected in regard to the design of the proposed research center.

In regard to drainage of waste water from medical activities, the Ministry of Health and Welfare is requesting the installation of sewage treatment facility but its engineering standards are not established as yet.

° Regarding the installation of tanks for propane gas or oil, the Petroleum Bureau has adopted engineering standards for safety methods of installing these tanks.

3-2 Survey on Construction Costs

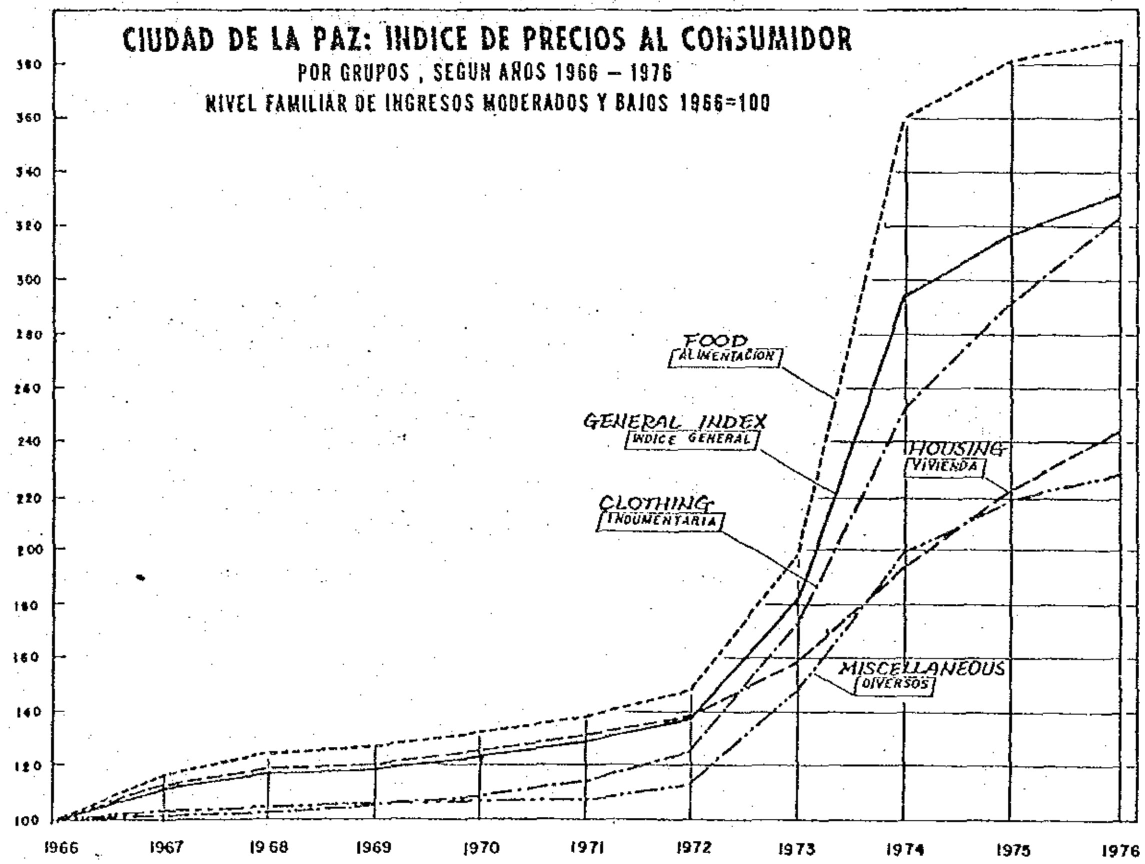
3-2-1 Increasing Rate of Prices

Prices of various commodities in the last several years in La Paz were surveyed to find the rising tendency of prices, especially the prices of construction materials, in the City of La Paz.

Changes in prices indexes for consumer goods after 1967 in La Paz were studies by the National Statistics Bureau (Instituto Nacional de Estadistica) for (1) general, (2) foods, (3) products related to houses, (4) clothing, and (5) others, as indicated below. (Figures are based on 100 in 1966).

(With the figures in 1966 taken as 100)

Category	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
General	111.18	117.28	119.88	124.53	129.11	137.51	180.81	294.43	317.92	332.20
Foods	116.09	124.65	127.27	133.09	138.37	147.20	198.65	360.98	380.19	389.35
House Products	112.32	118.01	120.45	125.21	130.70	138.05	158.64	193.89	221.26	243.81
Clothing	100.36	102.16	105.34	109.23	114.27	124.58	172.60	252.10	291.94	324.01
Others	107.14	103.78	105.92	106.96	107.62	113.82	147.48	199.73	219.54	228.86



The graph shown above indicates that increasing prices for various goods were high in 1972, 1973 and 1974. This was caused assumedly as a result of vital economic activities under the economic high growth in Bolivia after the new government was established in 1971 and of the influence imposed by inflationary trends in foreign countries. However, this graph also shows signs of stabilization in prices after 1974 mainly due to appropriate policies of the government. Increasing rates of consumer prices compared to the previous year are indicated below.

(%)

Fiscal Year	General	Foods	House Products	Clothing	Others
1973 - 1974	62.84	81.71	22.20	46.06	35.43
1974 - 1975	7.98	5.32	14.12	15.80	9.92
1975 - 1976	4.49	2.41	10.19	10.99	4.25

This table shows that increasing rate of the price index for house products (or products related to houses) is greater than that of "general". From this data it is assumed that the yearly increasing rate of prices for construction materials will be about 10%, since the increasing rate of construction materials is closely related to that of house products and the demand for construction in La Paz has considerably increased in recent years and this growth will be continued in the future.

3-2-2 Present Trend and Changes of Construction Materials

Standard prices for basic building materials are shown below.

Name of Material	Types of Size	Unit	First Part in 1976	Middle Part in 1977
Cement (1)	Cement Viacha 241103	50 kg	45.60	55.60
Cement (2)	Cement Viacha 241104	50 kg	42.75	53.88
Reinforcing bars(1)	Deformed, 3/8"	Kg	14.30	10.92
Reinforcing bars(2)	Regular, 1/2"	Kg	12.20	9.50
Steel angles	1-1/4"x1/8" German made	Kg	115.00	115.00
Cement blocks	15x20x30cm	each	4.91	6.05
Hollow bricks	6-hole, 15.5x25x10.5	each		1.85
Glass	Simple, clear	p^2	10.00	10.00
Lumber	Structural, Misc. tree	p^2	4.50	4.50
PVC pipe	4" dia., 6mm thick 6m long	m	180	180
Carbon steel pipe		m		
Water closed	Low tank, domestic product	each	1,250	1,250
Lavatory	German made, *with faucet & siphon*	each	480	480
Paint	Oil paint, American made	gln	770	770
Finish tiles	15x15cm, white	100	384	384
Waterproofing for roof	7-layer, 10-year guarantee	m^2	195	205

3-2-3 Survey on Labor Costs

Wages of construction workers, as surveyed by the Construction Committee of Bolivia, are indicated below.

As of June, 1977

Foreman;	\$b 80 to 90
1st class specialized worker	\$b 70
2nd class specialized worker	\$b 60
stone or brick layer	\$b 50
Carpenter (formwork)	\$b 50
1st class assistant	\$b 43
2nd class assistant	\$b 40
1st class misc. worker	\$b 38
2nd class misc. worker	\$b 35

Figures shown above are basic wages only and an employer must pay social security fees for long-term employment.
Normally a bonus is paid twice a year (Easter and Christmas), each being equivalent to one month's salary. Thus, an employer (contractor) must assume an additional amount of 50 to 80% plus the wages shown above, as direct personnel expenses.

Work Efficiencies

From statistics prepared by the Ministry of Housing and Urban Development of Bolivia, data on work efficiencies of construction workers have been selected and indicated below.

Earthwork; 1 assistant class worker; 2.5 hours per 1 m^3 (soft soil)
Concrete placing; 1 specialized 1 assistant
; 0.3 hour per 1 m^3
Ironwork (reinforcing bars); 1 specialized & 1 assistant
; 4 hours per 1 m^3 (80 kg)

Formwork ; 1 specialized & 1 assistant

; 1 day per 70 m^3

Brick laying; 1 specialized & 1 assistant

; 2.2 to 2.9 hours per 1 m^2 (12cm thick)

Brick laying; 1 specialized & 1 assistant

; 3.4 to 4.1 hours per 1 m^2(25cm thick)

Hollow brick laying; 1 specialized & 1 assistant

; 2.3 to 2.5 hours per 1 m^2(18cm thick)

Hollow brick laying; 1 specialized & 1 assistant

; 2.5 to 2.7 hours per 1 m^2(25cm thick)

Asphalt waterproofing; 1 specialized & 1 assistant

; 5 hours per 1 m^2

Mortar coating; 1 specialized & 1 assistant

; 0.5 hour per 1 m^2

Laying of terrazzo blocks; 1 specialized & 1 assistant

; 3 hours per 1 m^2(20 x 20cm)

Laying of T & G wood flooring; 1 specialized & 1 assistant

; 3 to 3.1 hours per 1 m^2

Painting; 1 specialized & 1 assistant

; 0.15 hour per 1 m^2

Finishing exterior wall; 1 specialized & 1 assistant

; 1.6 to 1.8 hour per 1 m^2 (Caly Cemento)

Finishing interior wall; 1 specialized & 1 assistant

; 1 hour per 1 m^2 (Yeso)

Glass installation; 1 worker ; 0.2 hour per 1 m^2 (window)

The work efficiencies shown above for various types of work should be considered merely as standards. Normally the total working hours per day is 8 hours, but several job sites with men working at night were also seen in La Paz. They work only in the morning on Saturday and no work on Sunday and holidays.

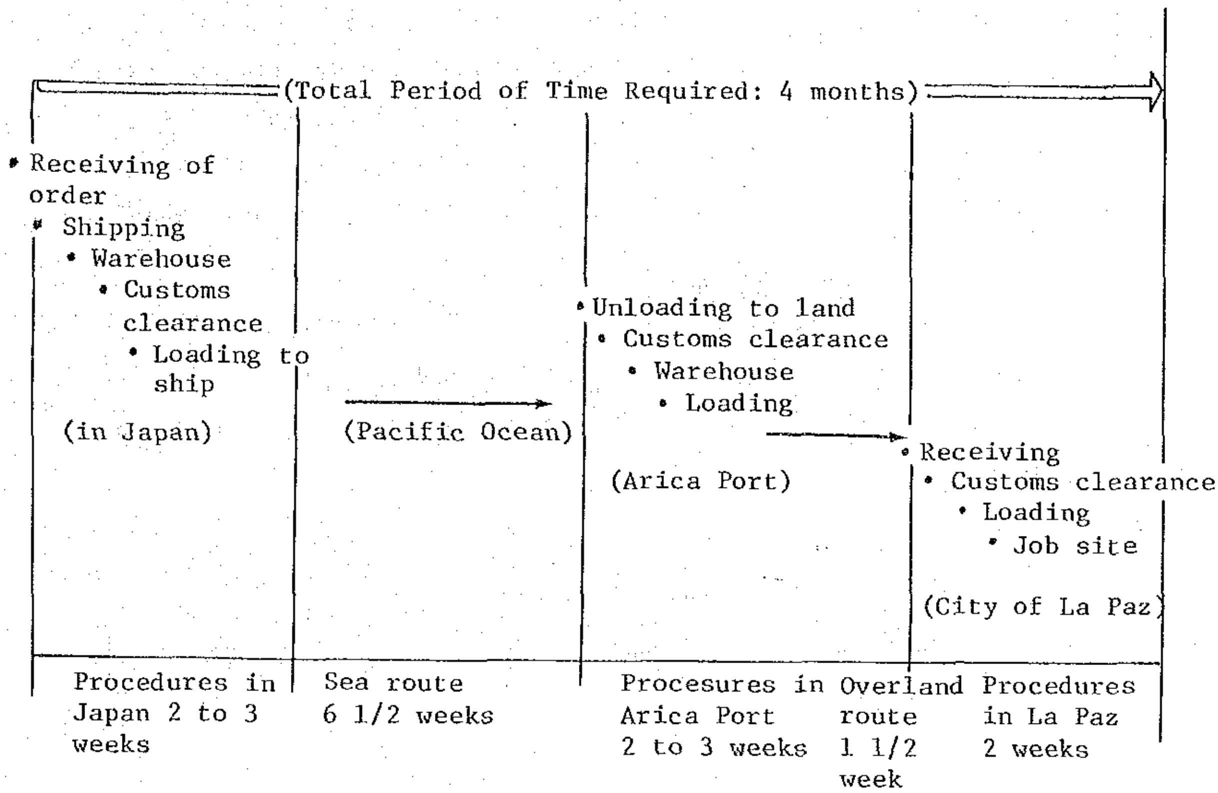
3-2-4 Transporting of Building Materials

Transporting of construction materials will greatly affect the time of completion and construction costs in this project.

As described before, most of construction materials except cement, gravel, bricks, lumber and tiles must be imported from foreign countries. Considering the transporting of construction materials from Japan to the City of La Paz, (1) method and route, (2) time required, and (3) costs of transporting will be discussed in this paragraph.

(1) Method and Route of Transporting

When building materials are transported from Japan, ships will be used. (Airplanes may be considered but they are very costly. For example, $US 10,000 may be required for 1 flight carrying 22 tons.) Bolivia is an inland country in the South American Continent so that it has no port on the Pacific Ocean side. But the nearest ports to La Paz are (1) Arica, Chile, (2) Matarani, Peru, and Antofagasta, Chile. Of these three ports, Arica is the nearest and most realistic as a port for unloading the materials. From Arica to La Paz, goods can be transported by trucks or railroad. When shipping by trucks, it is said that a 10-ton truck is the maximum and roads are not suitable for larger truck.



(2) Time Required

At least four months will be required from time of ordering from Japan to the time of delivery to the job site in La Paz. The required number of days for various procedures and the number of days required for shipping from date of order to delivery to the job site will be sequentially indicated below.

However, the minimum times are shown above as number of days required, and preparation for required documents, procedures for customs clearance and other various arrangements must be completed smoothly to meet the above sample schedule. It should also be noted that occasionally the overland route from Arica Port to La Paz, if trucks are used, cannot be used during the rainy season (3 months from November to January).

(3) Costs of Transporting

Transporting costs and other related expenses required for transporting building materials from Japan to La Paz will be sequentially described hereinafter.

a) Expenses in Japan

Charges for custody

Shipping charge; approx. 5,000 yen/ton or m^3

Fee for customs clearance; 4,200 yen/each item

b) Ocean freight; $US 90 to 100 per ton or m^3

c) Port charge in Arica; approx. 1 % of CIF port value or $US 25/ton

d) Inland transportation

	Via Arica	Via Matarani
Railroad;	$US 20 to 28 per ton	$US 22 to 29 per ton
Truck:	$US 48 per ton	$US 40 per ton

There will be quantity discounts for railroad fees.

e) Fee for customs clearance in La Paz; approx. 1% of CIF custom value (CIF custom value = CIF port value + port charge + inland transport).

f) Transporting cost from customs to job site; $US 14 to 15 per each of 5-ton truck

(4) For importing goods from Japan to Bolivia, normally import taxes must be paid. Rates of import taxes are roughly outlined below for each import item.

Articles	Tax Rate*	Remarks
i) Reinforcing bars;	17.5%	
ii) Portland cement;	34.5%	52.5% for other cement
iii) Lighting fixtures;	79.5%	Regular metal products
iv) Glass;	22.5% + Kbx$b 0.4	Regular plate glass for windows
v) Aluminum sash;	17.5%	Completed
vi) Boiler;	11.5%	For hot water supply
vii) Plumbing fixtures;	12.5%	Metal and ceramic

*Note: Tax rate is on CIF La Paz Custom Value.
Tax rates shown above are for standard products only, and the tax rate will vary depending upon items in the same category

In addition to the above import taxes, the following various taxes and expenses will be applied or charged for customs clearance at La Paz:

Added import taxes; Varies depending upon import goods.
AADAA* charge for custody; approx. 2 to 8% of CIF custom value
AADAA expense; approx. 0.5% of CIF custom value
Noroeste Development Tax; approx. 1% of CIF custom value

For applying tax exemption, stamp duty equivalent to 10% of exempted tax value must be also paid.

*Note: AADAA: Administracion Autonoma de Almacenes Aduaneros

3-2-5 Construction Costs

Unit prices obtained from the survey were corrected to establish prices as of the end of 1977 considering price rises after the start and completion of construction of each building surveyed (price index for end of 1977 is 350 to 370 compared to 100 for 1966). (Refer to Paragraph 3-1-4).

Average construction cost derived was $US 250 to 350 per square meter. This was $US 450 to 500 per square meter for a high-class hotel building and a high-class office building.

However, type or degree of building equipment involved in building cannot be definitely conceived from this unit price alone. Customarily optional elements are more involved in this type of price and it may be dangerous to unconditionally believe this kind of unit price or cnstruction cost. Thus the prices should be used only as reference.

Cost of electrical, plumbing, heating and ventilating is about 15 to 20 percents of the total construction cost. This percentage is relatively low compared to that of Japan. The following reasons are considered for this relatively low percentage:

1. Air conditioning, especially cooling, is not required in the City of La Paz due to its climatic condition.

2. Very few existing buildings are heated. Buildings with heating facilities began to appear only recently.

3. Equipment such as fire hydrants, sprinklers, smoke detectors, etc. which are requested by building and fire codes in Japan, are not required at all in the City of La Paz.

3-3 Survey on Building Site

3-3-1 Outline of Building Site

The building site for the proposed Research Center is located within the site of the La Paz National Hospital (Hospital de Clinicas). Hospital de Clinicas is a general hospital in the Miraflores District located about 3 km to the southeast, which is about a 10 minutes drive by car, from the center of downtown La Paz city, which is 3,700 meters above sea level.

This general hospital is located on plateau 3,600 meters above sea level and surrounded by the Orkajahuira River and Choqueyapu River. The west side of the hospital is facing a street called "Avenida Saavedra" which has a sidewalk at each side of the road. This street is gently sloped from north to south and traffic is relatively heavy.

Across this street, the high-rise building of the medical department of San Andres University is located on the west side of the road. Military facilities (Cuartel General) are located on the south side of the hospital.

Hospital de Clinicas is, as shown on the plot plan (drawing No. PAGE 67), a pavilion hospital where each department of the hospital has its own wing, and a number of low-rise (flat or 2 stories) buildings build in early 1900 are still in service. Among them, the Institute des Torax (Chest Disease Center), Oftalmologia (Ophthalmic Center) and the Hospital del Nino (Pediatries Center) are all functionally independent departments.

The gross site area is about 52,000 m^2 and a vacant lot almost in the center of Hospital des Clinicas was assigned as the construction site for the proposed research center. East side of the site assigned for the Research Center, is occupied by Cocina (central kitchen) and Traumatorogia (orthopedics), and the south side by the Hospital del Niño (pediatrics).

Cirugia Varones (surgical department) is located west of the site and the Institute des Torax (chest disease center) is located at the north side across from basketball court.

The site assigned is a vacant lot with an area of 3,000 m^2 which is about 70 meter long in a south-north direction and 45 meter long in the east-west direction, surrounded by these buildings. An area surrounded by this site and the surgical department building on the west side is assigned for the future burn treatment center.

The site is gently sloped from northwest to southeast and its grade is about 5% with about 4.5 meters in difference in elevation.

At the present time, this vacant lot is not used for any particular purpose except for people going to each department and for cars going for services to the central kitchen (Cocina) and laundry (Lavanderia).

Southeast of the site, there is the front yard of the "Traumatorogia" and about a 2-meter high fence surrounding the yard. This fence must be removed and some trees in the front yard must be relocated prior to the start of construction for the proposed research center.

3-3-2 Soil Condition of Building Site

The soil condition was investigated by boring at two places in the site. Boring hole No.1 was 5.5 meter deep and No.2 was 4.5 meter deep, and soil was sampled for each 1-meter for each hole and a standard penetration test was also conducted. (REFERENCE MATELIAL NO. 4~10)

Generally, this Miraflores district has very excellent soil, even better than that in other areas within the City of La Paz. Results of tests indicated that extraordinarily excellent sandy gravel, called Miraflores Gravel Stratum, was laid in the site and this was assumed to have flowed and deposited during the glacial period. This sandy gravel stratum was about 20-meter deep and a number of boulders mainly composed of granite with a maximum diameter of 50cm were found in the stratum. Solidified clay stratum was laid underneath this gravel.

Ground water was not seen in the depth of the bored holes, and the normal ground water level was probably deeper since water was not seen in construction sites excavated deeper than 20 meters in the City of La Paz.

From the results of the test, the allowable bearing capacity of the ground is expected to be 2.2 kg/cm^2 at a point two meters below the existing ground surface in this site.

3-3-3 Present Condition of Utilities and Services at the Site

1) Electricity

High voltage elevated lines of 3-phase, 3-wire, 6.6 KV are existing in the site of the La Paz National Hospital and this power is dropped to 220V and 110V, 3-phase, 4-wire by transformer on poles for distribution to each facility. (Refer to Fig. 1).

A watt-hour meter is installed at each lead-in point of each facility and equipment at the primary side, including the watt-hour meter, is owned by the power company (COBEE), and the secondary side belongs to the hospital.

The scope of work to be done by the power company for high voltage equipment is limited to the equipment with a transformer capacity of 167 KVA maximum, and equipment with greater capacity must be obtained by the consumer.

2) Telephones

Telephones are brought to the lead-in point of each facility by elevated lines and installations, including office telephones, are all controlled by the La Paz Telephone Company (TASA).

3) Water Supply

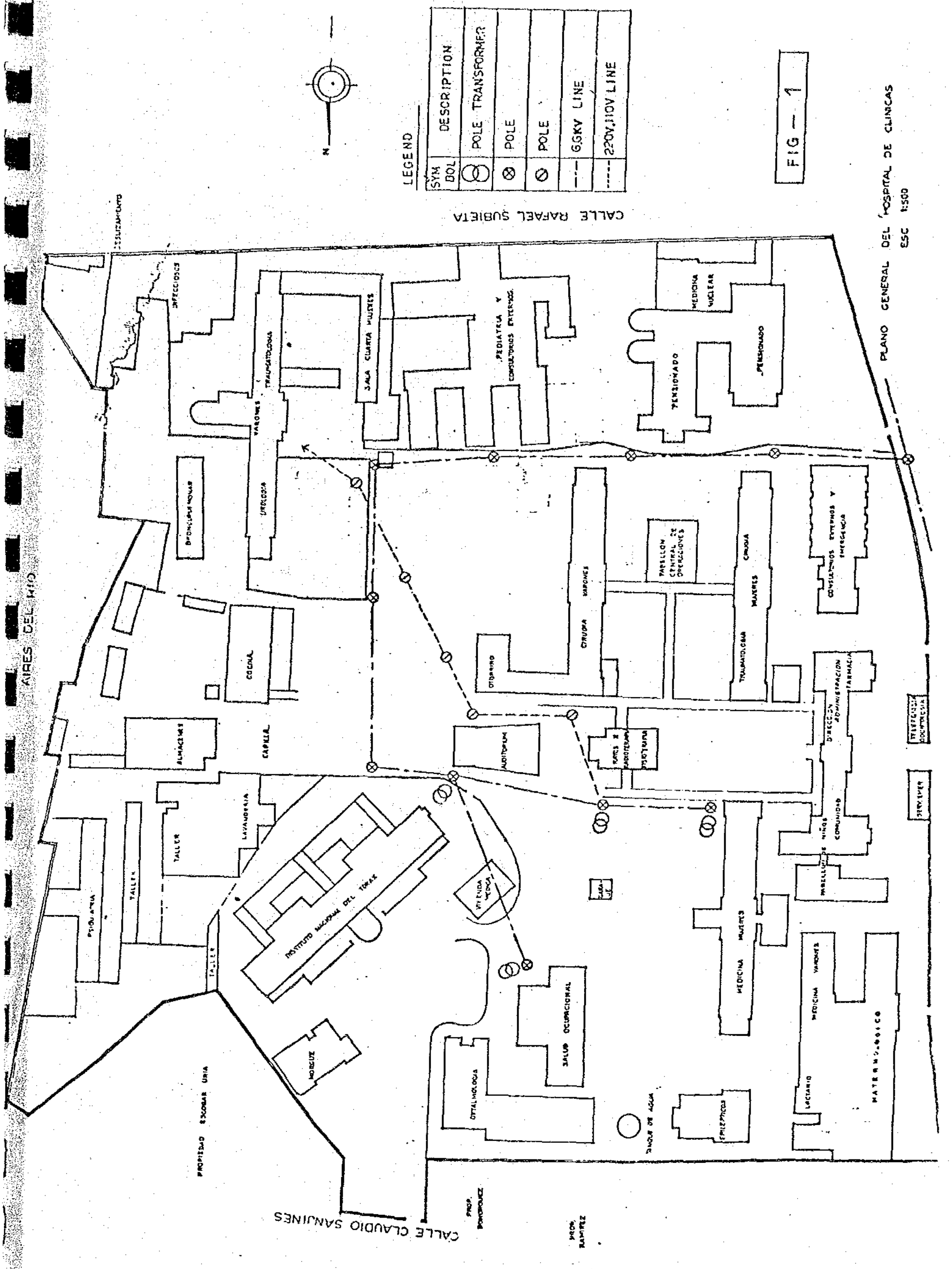
A two-inch main water supply pipe line is located underneath the public road at the west side in front of the hospital site.
A new pipe line with required diameter (2" maximum) can be connected to this main line for storing water in a new receiving tank.

4) Sewer Line
Existing sewer lines are old and their condition is unkown. Thus, it is desired to connect a new line directly to the existing main sewer line (8 to 10 inches) underneath the public road at the west side in front of the hospital. Sewers for buildings surrounding this hospital may be improved in the future.

The site of the new building is reversely sloped by two meters for connecting a new line to the existing public sewer line and this may create a problem. The Ministry of Health and Welfare is suggesting that the sewage be discharged into the river at the east side for solving this problem. Since work of an exterior sewer line for this new research center building is assigned to the Government of Bolivia, further consideration will be made by the Ministry of Health and Welfare. (Refer to Fig. 2)

5) Fuels (Propane Gas or Oil)

Propane-gas for use as fuel can be transported by trucks and oil can be transported by tank lorry to the new research building.


LEGEND
SYMBOL DESCRIPTION
POLE TRANSFORMER
POLE
POLE
6.6KV LINE
220V,110V LINE
FIG — 1
PLANO GENERAL DEL HOSPITAL DE CLINICAS
ESC 1:500
CALLE RAFAEL SUBIETA
CALLE CLAUDIO SANJINES
AIRES DEL RIO
PEDIATRIA Y CONSULTORIOS EXTERNOS
SALA CUARTA MUJERES
TRAUMATOLOGIA
VARONES
UROLOGIA
INFECCIOSOS
PENSIONADO
MEDICINA NUCLEAR
CONSULTORIOS EXTERNOS Y EMERGENCIA
PABELLON CENTRAL DE OPERACIONES
CIRUGIA VARONES
CIRUGIA MUJERES
TRAUMATOLOGIA
OTORRINO
AUDITORIUM
COCINA
CAPILLA
ALMACENES
LAVANDERIA
TALLER
PSIQUIATRIA
INSTITUTO NACIONAL DEL TORAX
MORGUE
PROPIEDAD ESCOBAR URIA
SALUD OCUPACIONAL
OFTALMOLOGIA
TANQUE DE AGUA
EPILEPTICOS
MEDICINA MUJERES
MEDICINA VARONES
MATERNOLOGICO
LACTARIO
DIRECCION ADMINISTRACION FARMACIA
NIÑOS COMUNIDAD
VIVIENDA
PROP. RAMIREZ

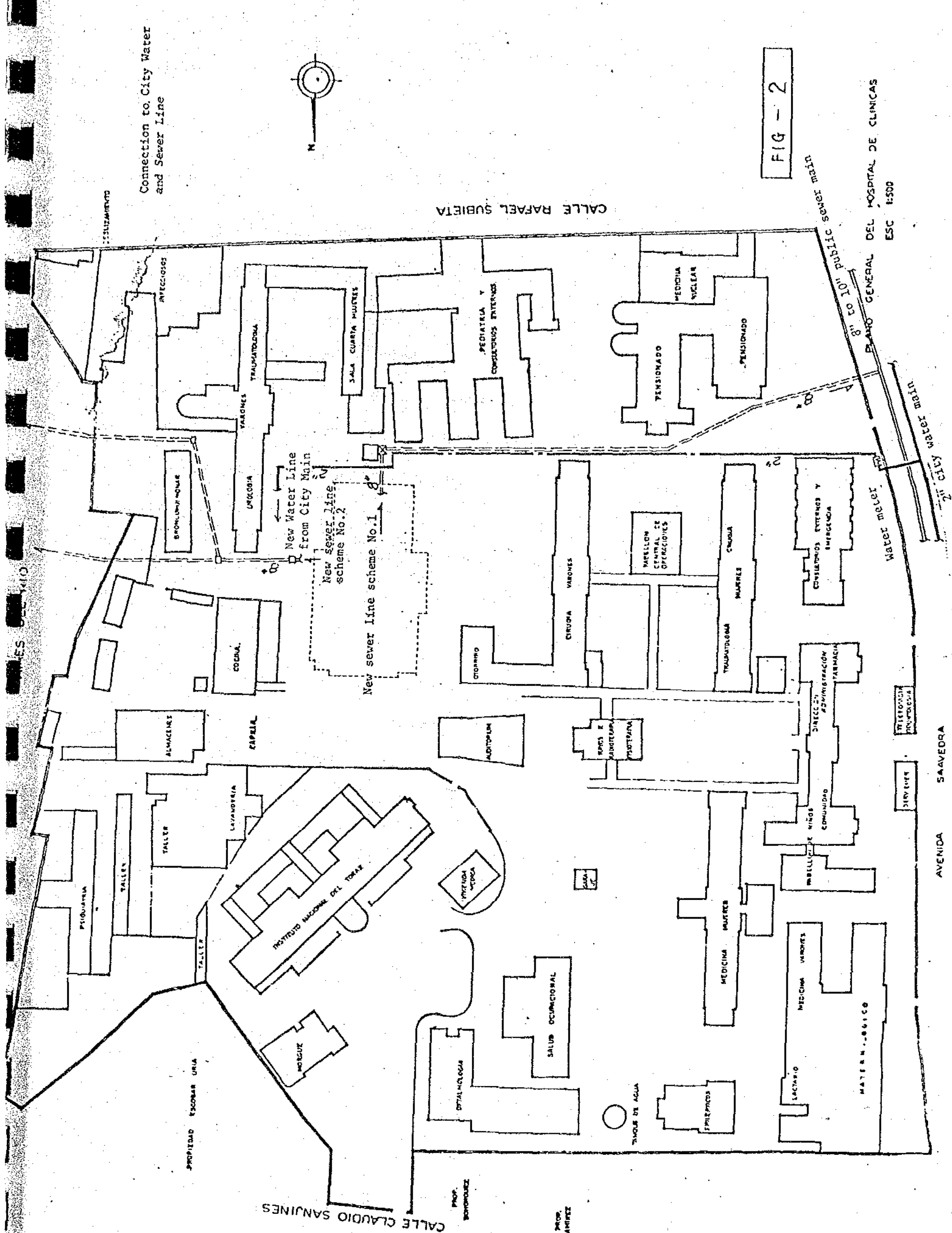


FIG - 2

PLANO GENERAL DEL HOSPITAL DE CLINICAS ESC 1:500

CHAPTER 4 PRELIMINARY DESIGN

CHAPTER 4 PRELIMINARY DESIGN

4-1 Basic Design

The basic plans for the Research Center were based on the results of the survey conducted in June to July, 1977. The basic planning and the agreement (Acuerdo) were reached through several discussions between the Bolivian authorities concerned and the survey team.

The requirements or conditions made by the Bolivian authorities concerned with respect to the Research Center were shown in the preliminary design through analysis and adjustment upon the advice of the gastro-enterological technical cooperation project team of Japan.

4-1-1 Design conditions

The Research Center is being constructed for high level of research and education activities concerning diseases of digestive organs. It will serve as a strategic point for the medical technology cooperation project now in progress for the urban areas of La Paz, Sucre and Cochabamba and perform clinical researches on about 600,000 citizens of La Paz.

The Research Center will be constructed in the site of the La Paz National Hospital (HOSPITAL DE CLINICAS) but will be operated on an independent basis.

The Research Center will be operated initially in a proportion of 30 percent for research and 70 percent for clinics, but there is a plan to change these proportions to 50 percent for research and 50 percent for clinics.

Outpatients are estimated to be about 40 to 50 persons a day, and the number of beds will be 25 to 30 designed mainly for short-term hospitalization.

Assembly facilities designed for academic lectures and conferences will be provided.

Personnel assignment of the Research Center will be:

Clinical doctors	6
X-ray engineers	3
Endoscopic engineers	3
Pathologists and chemists	6
Nurses	25
Clerks	4∿6

except interns and janitors.

4.1.2 Design Concept

Design Concept are prepared according to the following principles.

With the current status as well as the future of the overall operation of the HOSPITAL DE CLINICAS duly taken into consideration, a facility will be constructed to meet advances or changes in the medical system.

A plain functional building plan is to be employed. A simple design is intended to give a sense of cleanliness.

Because of the topography of the site, differences in the elevation of the site is to be utilized to enable separate access routes to different functions, such as the main entrance, the auditorium entrance and service access.

Adequate distance between the existing buildings will be maintained in the perifery of the Research Center.

As much as practicable, the construction method for this building and building materials to be used should reflect the construction procedures done in La Paz and materials available there.

The plans should give due consideration to the operation and management of the building.

While there is substantially no legal restrictions imposed on building the Research Center at present, the plans will take into consideration the future, in compliance with Japanese rules, standards, etc., partially applied.

In the construction of the Research Center, illustrations and reference will be made to matters concerning the work within the scope performed by the Bolivian side.

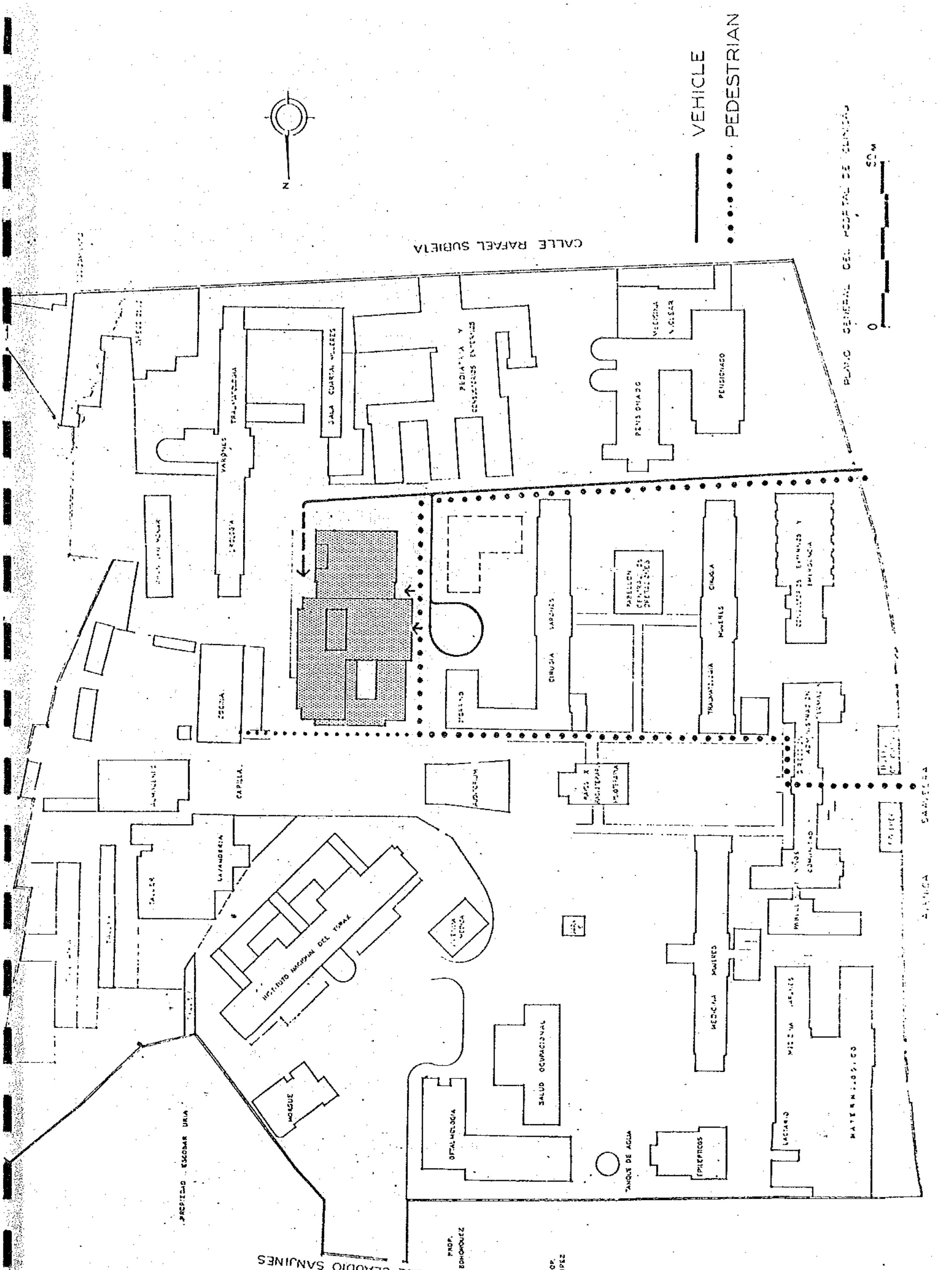
4-1-3 Layout plan

Effective use will be made of the main access road which will be constructed at the site of the hospital.

The Research Center will be in harmony with the existing buildings, attaching importance to the co-relational function.

The Center will oriented in the same direction as the existing buildings and the projected area of the Center will be kept to a minimum within the limited site area so that the existing service route from the kitchen (Cocina) to the various wards will not be hampered. Also the environment in front of the chapel (Capilla) must be kept in tact. Trees and shrubbery will be planted to enhance the environment.

The patient main entrance and the auditorium main entrance will be on the west side for pedestrians and vehicles, while the service access will be on the east side to the basement, utilizing the difference in elevation of the ground, and the flow will thus be clearly separated into east and west.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CALLE CLAUDIO SANJINES
INSTITUTO NACIONAL DEL TORAX
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OFTALMOLOGIA
SALUD OCUPACIONAL
TANQUE DE AGUA
EPILEPTICOS
MATERNOLOGICO
LACTARIO
CAPILLA
AUDITORIUM
PENSIONADO
LAVANDERIA
TALLER
COCINA
PROPIEDAD ESCOBAR URIA

4-1-4 Architectural Design

o The function of the Research Center will be divided largely into the following five departments:

Services (machine room, electrical room, kitchen and laundry);

Medical Examination (outpatient examination, endoscopy and radiotherapy);

Laboratory and Research (laboratories, offices for doctors and conference room);

Words and Surgical operation (wards, operating rooms and sterilization room); and

Auditorium (auditorium and foyer),

The composition of the various floors will be adapted to the respective functions.

o In accordance with the site area available and the limited time for construction and to insure that the flow to the respective departments may not interfere with one another, a three-storied building with one basement will be planned.

o The service department will be in the basement that can be approached by way of a ramp so that the service flow cannot be seen from the surrounding area.

o The medical examination department will be on the first floor so that the outpatients can receive general examinations on this floor only.

A patio with a pleasant atmosphere will be provided to put the patients at ease, who are generally in a distressed state. The waiting corridor will surround the patio.

The outpatient examination, endoscopic and radiotherapic functions will be concentrated in one group surrounding the patio to insure unification of medical examinations.

° For the auditorium, consideration will be made to secure independent flow lines, while the difference in the level of the side will be utilized for arranging the seats stepwise extending from the first floor to the basement.

Taking the multipurpose use of the auditorium into account, a spacious foyer will be provided.

° The laboratory and research functions will be provided on the second floor to insure a good environment for research activities without being bothered by the flow of the patients.

° The ward and surgical operation function will be arranged on the third floor.

Fully equipped operating rooms will be provided to permit a high level of surgery with effective cooperation with the recovery room in the ward area.

The ward will consist of two-bed rooms and five-bed rooms.

° For going between floors, there will be stairways at two locations, and one elevator for stretchers and one dumbwaiter for servicing will be installed.

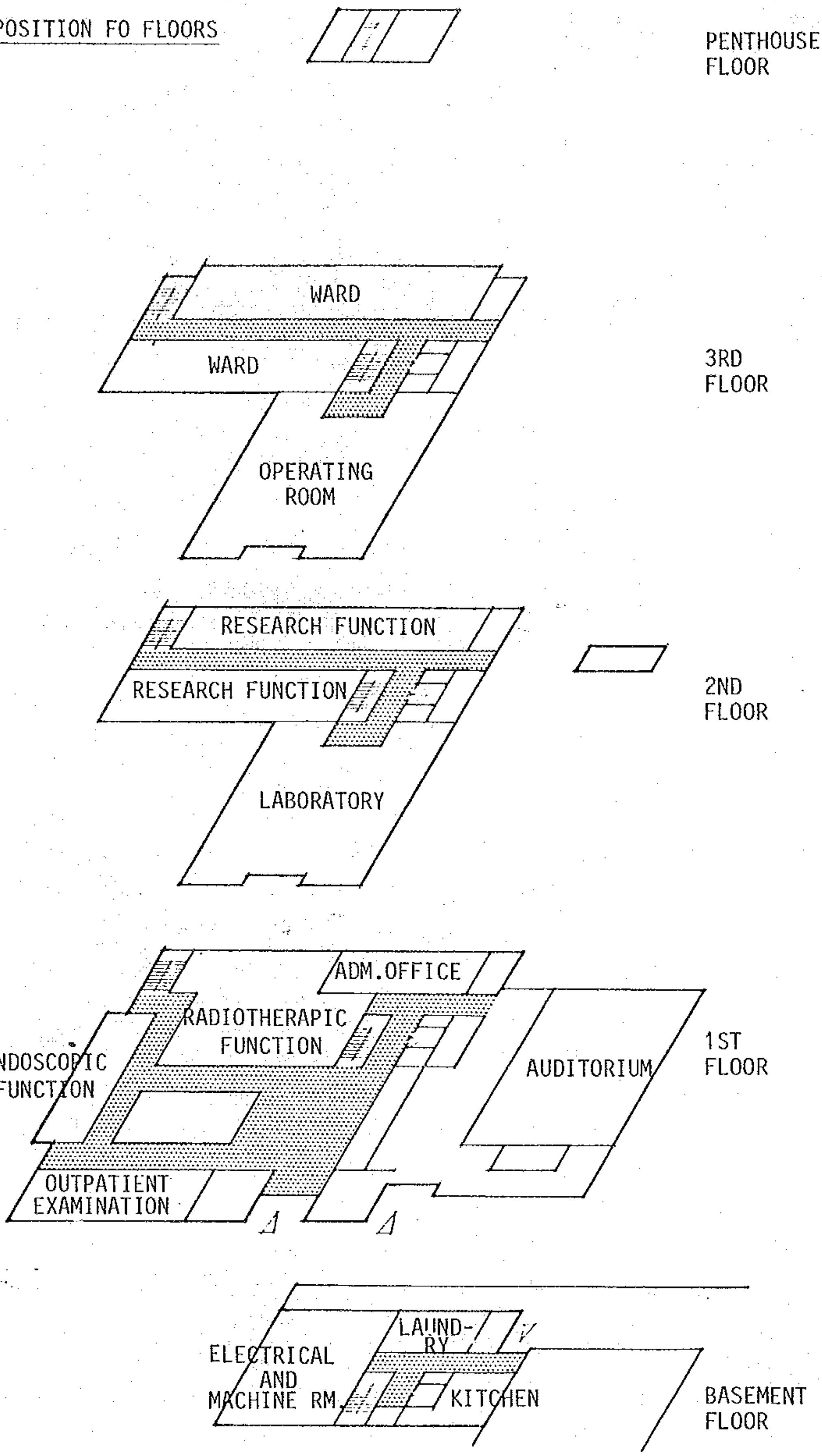
° In the plain plan, a module unit of 6 meters will be used which is a standard span for hospitals, laboratories, etc. and also an economical span for reinforced concrete structures.

4-1-5 Selection of Building Materials

° The structure shall be of reinforced concrete which is mostly used for modern buildings in La Paz.

As for floor structure, solid slabs will be used taking into consideration the number of equipment pipes to be used because of

COMPOSITION FO FLOORS



the specific requirement of the Research Center.

The walls will be made of hollow bricks to which the workers at the site are accustomed.

- The exterior wall will be finished with external plaster with coating or spray coating. Fixtures for the exterior are mainly of aluminum sashes.

- The interior will be planned, so far as practicable, with clean and nonflammable materials.

For the flooring, a PVC flooring material ro terrazo tile (Mosaico tipo Granitico) will be used depending on the particular use of the respective rooms.

The wall will mainly be of plaster with finish coating, and tile work is planned partially according to the particular use of the room.

For the ceiling, acoustic panel will be used, for concealing the service pipings. More important, acoustical requirements due to the character of the hospital as well as a research institution, an asbestos molded cement board of high sound-absorbing quality will be used instead of the direct plaster finish generally used.

4-1-6 Exterior Design

- Efforts will be made to improve the environment by planting trees in the patio and surroundings of the buildings.

Selection of the trees to be planted will be so planned as to be appropriate from the landscape design, balance with the buildings and shape of the tree.

- The land available for construction is relatively limited for the size of the Research Center. When the space allocated for a

Burn Center to be constructed in the future is excluded, it is difficult to secure sufficient parking space corresponding to the facilities. In the compound of the hospital, the buildings are arranged here and there, and vehicles can park near the respective buildings. This is by no means favorable for the hospital environment. It is desirable that a comprehensive plan will be formulated for parking at the Research Center along with parking for the buildings along the main entrance road.

4-1-7 Structural Design

1) Basic lines of structural design

The country of Bolivia deviates from the circum-pan-Pacific earthquake belt, and according to the earthquakes records during the past 85 years, earthquakes are of small in scale, the largest recorded being V degree based to the MM seismic scale. For wind, a speed of 80 KM/h (22.2 M/sec) is taken as the design external force according to the survey results by the municipal office. Such horizontal force is far smaller than that in Japan and, in the structural plan, has little influence on the building plan. As a basic line of the structural plan, a rigid frame structure by means of pillars and beams alone will be used to process the vertical and horizontal forces.

According to field survey results, reinforced structures can be found all over the whole area of La Paz. Therefore, for the plan of the Research Center, a reinforced concrete structure is considered to be the best.

However, reinforced concrete buildings vary greatly in quality, and technical support is required.

2) Policy of structural design

In Bolivia, there are no standards established for structural design, and the structural engineers use the standards of America

(ACI) or West Germany (DIN). Therefore, the structural design is entrusted generally to the qualified designers. Thus, the basic lines of structural design of the Center will be determined as set forth in the following.

a) The intensity of external forces and the assumed load acting upon the building will be determined by the weather, soil condition and the gorund at the site and the use of the specific building.

b) Allowable stress intensities of materials specified in the various standards will be used, as a rule, but determined in accordance with the quality subject to the technical level.

c) Calculating the stress of the framework and estimating strength of the cross-section will be based on the standards of the Building Society of Japan, but ACI and DIN will also be referred to in the design.

The external forces and loads acting upon the building are as follows.

a) Dead load

The fixed load will be obtained from calculations of the materials used.

b) Live load

For the live load, the standard in the Building Standards Law of Japan or that by ASA (American Standard Association), whichever greater, will be used. For a room used for some special purpose, a value conforming to the actual condition will be used. Comparison between Japanese and American standards is shown below.

Comparison of the values of Live load
in Japanese and American Standards

Building Type : Hospital, clinic

(kg/m)

Room	Japan	America (ASA)
Operating room		290
Single room	180	200
Common sickroom	180	200
Public	180	390
Office	300	390

c) Wind pressure

The Center being a 2-3 storied reinforce concrete building, no problems are involved with respect to the wind pressure.

d) Seismic force

As stated in the foregoing, a big earthquake seldom occurs in Bolivia. A record of past earthquakes prepared by the Meteorological Agency in La Paz is shown in the following.

As seen, an earthquake occurred in Consata, about 140 KM north of La Paz, on February 24, 1947. This is noted as the biggest earthquake in the history of La Paz. Its intensity was of V degree on the MM seismic scale. According to literature, this degree V represents "an intensity felt by almost all people, many people were awakened at night, some dishes and window panes were broken, swaying of trees and other fall objects were noted, and pendulum clocks stopped." This seems to correspond to a weak earthquake of the III degree when expressed according to the seismic scale of the

Japanese Metrological Agency.

Record of earthquakes at La Paz (Data of San Charisto Meteorological Station)

Date of occurrence	Scale	Location and condition
1891	III-IV	Possibly Munekas Mountains.
1896, Jun	II?	
1896, Jul	III-IV	
1908	II?	Felt in northern Chile and southern Peru.
1909	"	Collapses in southern Bolivia.
1913	"	Collapses in souther Peru.
1920	"	Source at Consata-Mapiri.
1923	II?	Felt strongly in Consata.
1928	III	Collapses in southern Peru.
1929	II	Source near Anto Fargasta.
1937	IV	Source at Consata.
1947, Feb 24	V	Source at Consata; Possibly largest in the history of La Paz.
1948	II	Peru southern coast.
1952	II?	Southern Peru.
1956	IV	Mapiri-Consata.
1960, Jan 13	II-IV	Collapses in Alequipa.
1960, Jan 15	II	Replica.
1963	IV	Deep at border of Peru and Bolivia.
1975, Jun 5	II-III	Border of Peru and Bolivia.
1975, Jul 12	"	"
1976, Nov 30	"	Northern Chile.
1976, Dec 28	II?	"

In the following is shown the relation between the degrees of the MM seismic scale and the acceleration as reported by the U.S. Coast and Geodetic Survey in 1948. As seen, the MM seismic scale V corresponds to an acceleration range of 2-75 gal. or 13.3 gal. in mean maximum acceleration.

On the other hand, when the acceleration is assumed from the seismic intensity defined in the Building Standards Law of Japan, it is given as about 200 gal., and upon comparison with the acceleration at the MM seismic scale V, it is I/1000-1/2.7 in the acceleration range. Thus, for the seismic force of the Center, a 1/4 value of that in Japan is assumed. In La Paz, designs are made generally without including the seismic load.

MM seismic degrees versus acceleration
(according to U.S.C.G.S.)

MM seismic degrees	II	III	IV	V	VI	VII	VIII	IX
Acceleration range	1∿5	1∿8	2∿46	2∿75	5∿175	180∿140	51∿350	250
Mean maximum acceleration	2.3	3.1	9.3	13.3	40	67	172	250

3) Design strength of concrete

The design standard strength of concrete is: Fc = 180 kg/cm^2, and the deviation is within the range of 45-60 kg/cm^2, although it should be determined depending on the actual situation. Accordingly, the strength of mixture is: Fc = 225-240 kg/cm^2. Temperature compensation is required in winter.

4-1-8 Electrical Service

The electric power of Bolivia is divided largely into two systems: (1) La Paz and Oruro Departments and (2) the other departments.

At present, power to the facilities in the La Paz National Hospital is fed from the Avenida area and Caiconi area transformation substations of the Bolivia Electric Power Company (COBEE).

In the respective transformation substations, a power of 66KV fed from the Zongo Power Plant is reduced to 6.6KV which is then fed to the pole transformers in the hospital. At the pole transformer provided for the respective blocks, the 6.6KV is reduced to 220/110V, 3 phases. A 4-wire system and is then distributed to the respective buildings.

While the electrical equipment of the Research Center will be described later, the following points are to be noted in planning.

a) In the absence of work connected with all existing facilities, the electrical service system of the Research Center will function independently.

b) It is planned to use Japanese materials for almost all electrical work. Thus, in designing, importance is attached to safety and maintenance in order to prevent problems that may occur in maintenance, control or operation of the equipment.

c) Regulations for electrical work are not well defined in Bolivia, and the regulations of the material exporting country have to be used, in such a case.

In the present design, the equipment will be designed to comply with the electrical regulations of Japan in consideration of the Japanese standards for materials.

d) Lightning seldom occurs in La Paz. Buildings as high as 20 stories have no lightning conductors provided.

e) La Paz has very few fires, any rules and regulations for fire defense is not satisfactory. As a result, buildings of 20 stories or more have no fire extinguishing equipment provided.

1) Power reception and transformer equipment

At present, pole transformers in the La Paz National Hospital are owned by the Bolivia Electric Power Company, and their maintenance is carried out by the company.

The service line to the Research Center will be derived from the high voltage overhead line, 6.6KV 50Hz, and will be received through an underground cable at the electric room.

A transformer with a load capacity estimated at 470KVA will be installed in the electric room to reduce the primary 6.6KV to the secondary 220V/110V for supply through switches in a low voltage power panel to the respective loads.

The load capacity is broken down as follows:

Load	Capacity (KVA)
For X-ray	90 KVA
For lighting outlet	140 "
For air conditioning power	210 "
Miscellaneous	30 "
Total	470 KVA

2) Emergency stand-by generator equipment

Current stoppage rarely occurs in La Paz, but for surgical operations, experiments, security lighting and elevator, an AC power generator will be provided as a source of power in emergencies.

From the total load, the generator will have a capacity of about 100KVA and be adapted for automatic start upon current stoppage and automatic stop upon resumption of the power supply.

For the engine, it is planned with considerations (1) that the La Paz district being situated at an altitude of about 3600 meters above sea level and scarce in oxygen content at about 2/3 of that at the level ground, no output reduction should be produced on such account, (2) that for cooling, not water cooling, but an air cooling system should be used since it is intended to operate only in time of emergencies and (3) maintenance can be easily done.

3) Power and Feeder

Power supply is derived from the low voltage power distribution panel in the electric room to the power control panel board, lighting panel board, experiment power, X-ray power, elevator power and telephone exchange power.

For start and stop of power, a separate control system is planned for simplification and clarification.

4) Lighting outlet equipment

Pipe wiring is used to the lighting panel board and to the subsequent lighting instruments, switches and outlets.

For the operating room, it is planned to install an exclusive panel board for the supply of electricity.

5) Lighting Fixtures

Lighting will be mainly with fluorescent lamps, and depending on the function of the room, incandescent lamps, germicidal lamps or mercury lamps will be used.

For the operating room, shadowless lamps will be provided, in addition to overall illumination.

For the auditorium, a circuit enabling a stepwise illumination using incandescent lamps mainly and fluorescent lamps partly and also a rheostat control of illumination for some parts will be planned.

The intensities of illumination of the principal rooms are given as follows.

Room	Illumination Level (Lux)
Operating room	500 Lux
Laboratory	300 Lux - 400 Lux
Radioscopic and endoscopic rooms	100 Lux
General Office	200 - 300 Lux
Auditorium	150 - 250 Lux
Wards	100 - 200 Lux
Passages and hallwarp	100 - 200 Lux
Storage	50 - 150 Lux

6) Telephone exchange

The telephone service in La Paz is undertaken by the La Paz Telegram and Telephone Corporation (ENTEL) for the local exchange and by the La Paz Telephone Company for the trunk exchange.

At present, the telephone lines to the facilities in the La Paz National Hospital are operated under a direct system with office lines introduced into the respective facilities.

As for telephone exchange system in the Research Center, it is planned to install a crossbar switch exchanger, 10 circuits of office lines and 100 circuits of extensions and also apparatus permitting 5 circuits of interconnection of extensions and apparatus permitting 4 circuits of exchange and transfer at the nurse station at night in the event of an exchanger installed in the La Paz National Hospital in the future.

For the extensions, about 60 units of dial type handsets are planned.

7) Public Address System

The public address system in the Research Center will consist of two systems, auditorium system and hospital system.

The main purpose of these systems are:

(1) Auditorium system for smooth execution of lectures, conferences, etc., and

(2) Hospital system for smooth execution of liaison, calls, etc.

They are planned as an independent acoustic system respectively.

For the Research Center, it is planned to install a television antenna on the roof and pipe wiring to the outlet terminals of the office maintenance department.

8) Nurse call equipment

It is planned to install a system permitting mutual communication between the respective beds in the sick-room and the nurse station so that satisfactory care is insured.

9) Interphone equipment

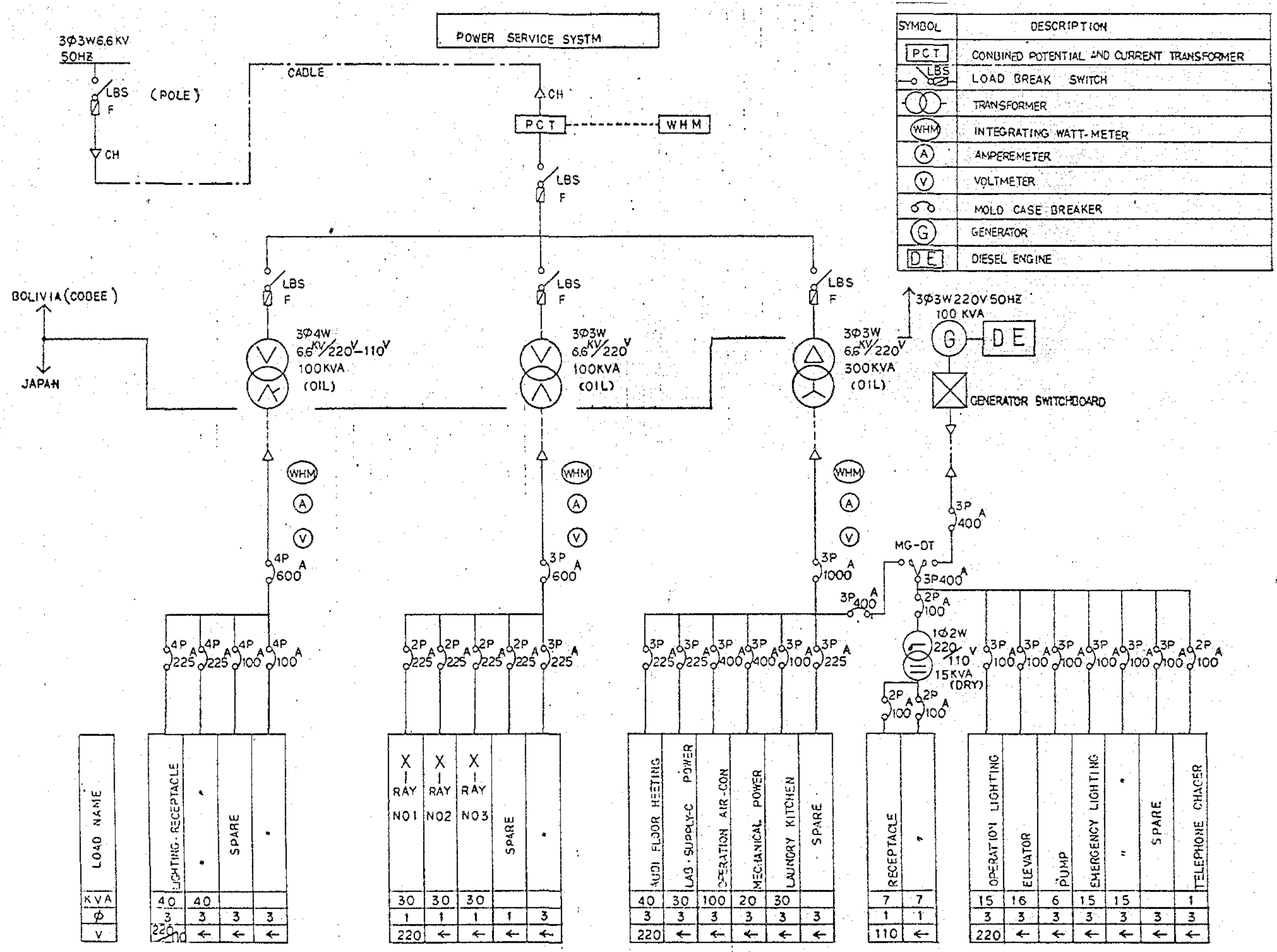
This equipment is provided for communication between the inside and the outside of a room (for example, dark room, operating room) required for operation of the hospital and for communication to a place required for the sake of security (for example, elevator, dumb waiter, etc.).

10) Alarm equipment

In La Paz, fires seldom break out. As contributing factors, the following two points may be cited, (1) The oxygen content in the atmosphere at about 2/3 of that of the lowland, and (2) absence of inflammable objects.

Currently, there are no rules provided for fire defense, and automatic fire detecting apparatus are seldom installed.

In the Research Center, it is planned, upon the premise of discovery of a fire, to install pushbutton switches near the installation of fire extinguishers on the respective floors to sound an alarm.


POWER SERVICE SYSTM
SYMBOL
DESCRIPTION
PCT
COMBINED POTENTIAL AND CURRENT TRANSFORMER
LBS
LOAD BREAK SWITCH
TRANSFORMER
WHM
INTEGRATING WATT-METER
A
AMPEREMETER
V
VOLTMETER
MOLD CASE BREAKER
G
GENERATOR
DE
DIESEL ENGINE
3Φ3W6.6KV
50HZ
LBS
F
(POLE)
CH
CABLE
CH
PCT
WHM
LBS
F
BOLIVIA (CODEE)
JAPAN
3Φ4W
6.6KV/220V-110V
100KVA
(OIL)
3Φ3W
6.6KV/220V
100KVA
(OIL)
3Φ3W
6.6KV/220V
300KVA
(OIL)
3Φ3W220V50HZ
100 KVA
G
DE
GENERATOR SWITCHBOARD
WHM
A
V
4P 600A
3P 600A
3P 1000A
3P 400A
MG-DT
3P400A
3P 400A
2P 100A
1Φ2W
220/110 V
15KVA
(DRY)
2P 100A
2P 100A
4P 225A
4P 225A
4P 100A
4P 100A
2P 225A
2P 225A
2P 225A
2P 225A
3P 225A
3P 225A
3P 225A
3P 400A
3P 400A
3P 100A
3P 225A
3P 100A
3P 100A
3P 100A
3P 100A
3P 100A
3P 100A
2P 100A
LOAD NAME
KVA
Φ
V
LIGHTING · RECEPTACLE
40
3
220/110
"
40
3
←
SPARE
3
←
"
3
←
X-RAY NO1
30
1
220
X-RAY NO2
30
1
←
X-RAY NO3
30
1
←
SPARE
1
←
"
3
←
AUDI FLOOR HEETING
40
3
220
LAB · SUPPLY-C POWER
30
3
←
OPERATION AIR-CON
100
3
←
MECHANICAL POWER
20
3
←
LAUNDRY KITCHEN
30
3
←
SPARE
3
←
RECEPTACLE
7
1
110
"
7
1
←
OPERATION LIGHTING
15
3
220
ELEVATOR
16
3
←
PUMP
6
3
←
EMERGENCY LIGHTING
15
3
←
"
15
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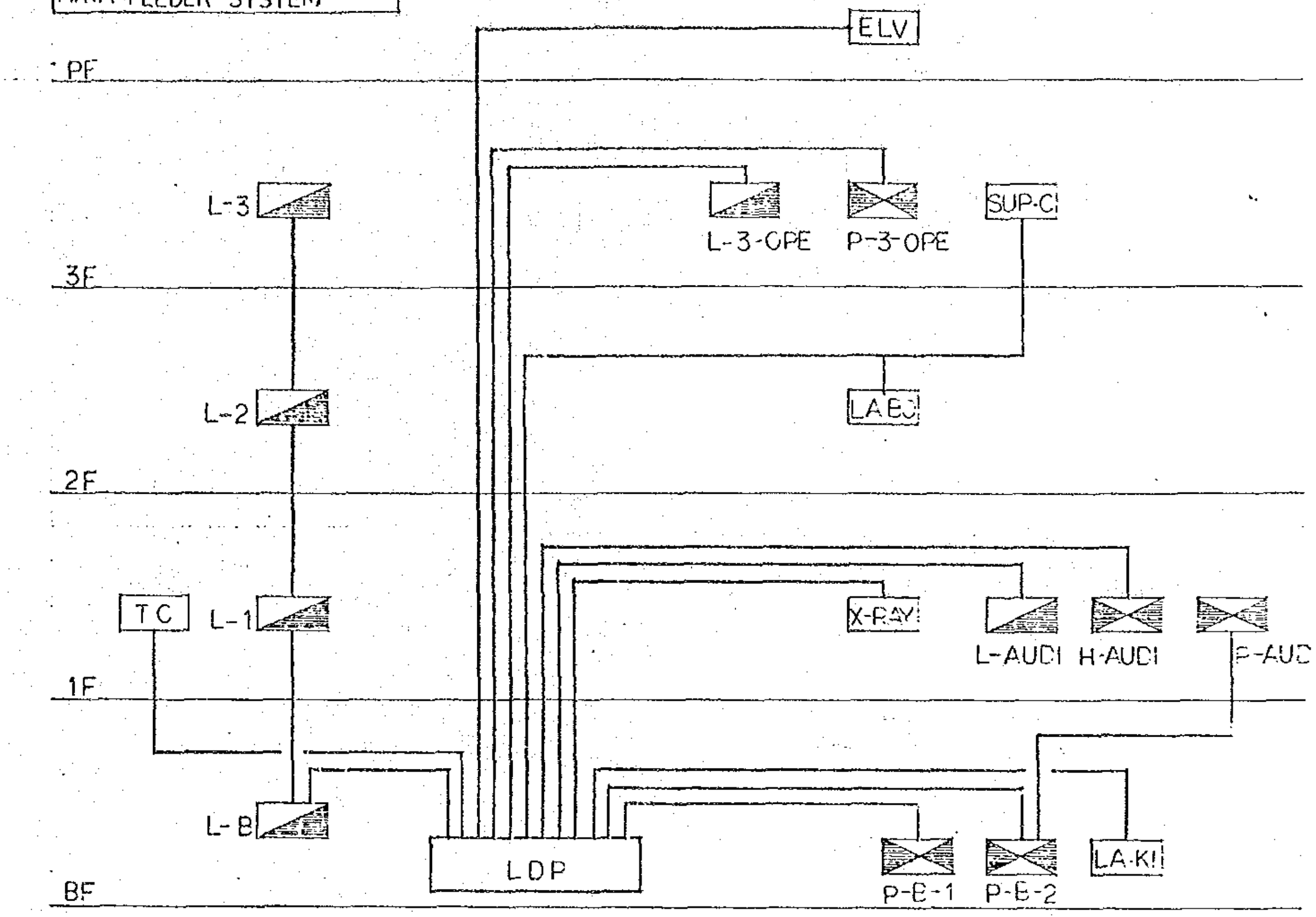
←
SPARE
3
←
TELEPHONE CHACER
1
3
←

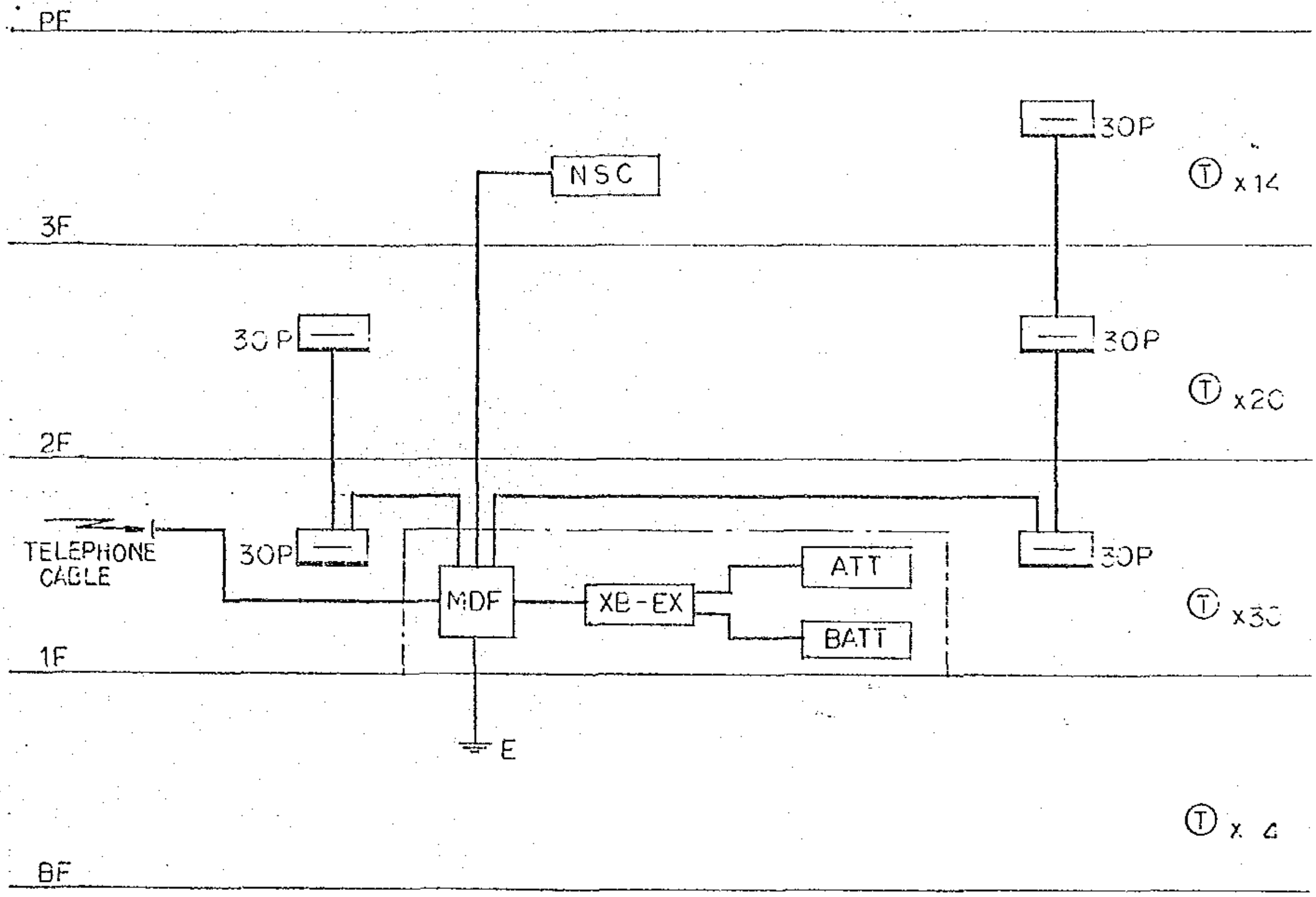
MAIN FEEDER SYSTEM



LEGEND

SYMBOL	DESCRIPTION
⊠	POWER PANEL BOARD
☐	〃
◩	LIGHTING PANEL BOARD
TC	TELEPHONE CHARGER
LDP	POWER DISTRIBUTION PANEL
ELV	ELEVATOR PANEL BOARD

TELEPHONE SYSTEM

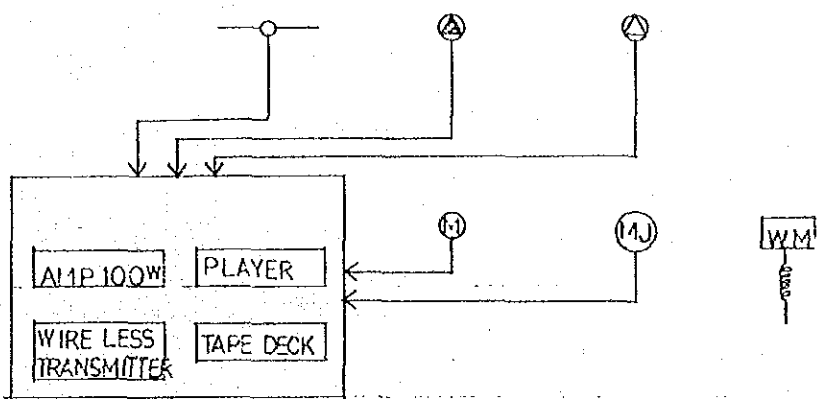


LEGEND

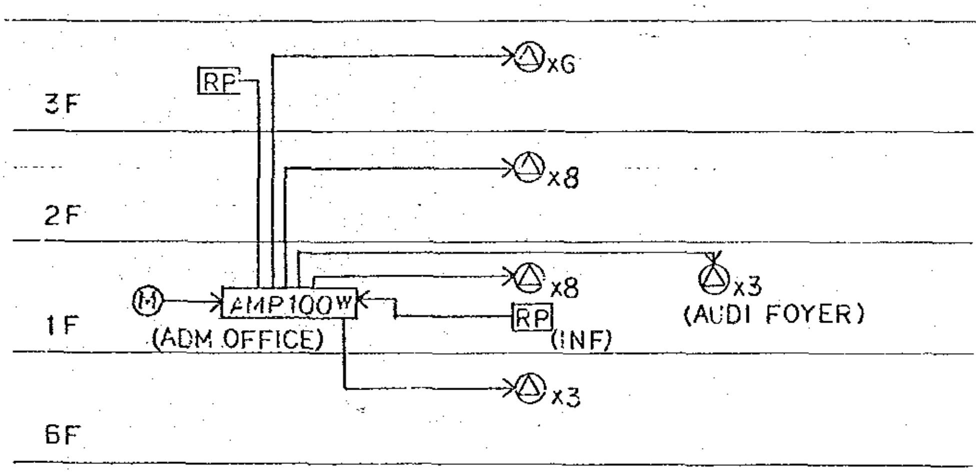
SYMBOL	DESCRIPTION
MDF	MAINDISTRIBUTION FRAME
XB-EX	CROSSBAR SWITCH EXCHAGE CABINET - TYPE
ATT	ATTENDANT CONSOLE
BATT	CHARGER AND BATTERY
NSC	NIGHT SERVICE CONSOLE
▭	TELEPHONE TERMINAL
Ⓣ	TELEPHONE OUTLET BOX

PUBLIC ADDRESS SYSTEM

AUDITORIUM



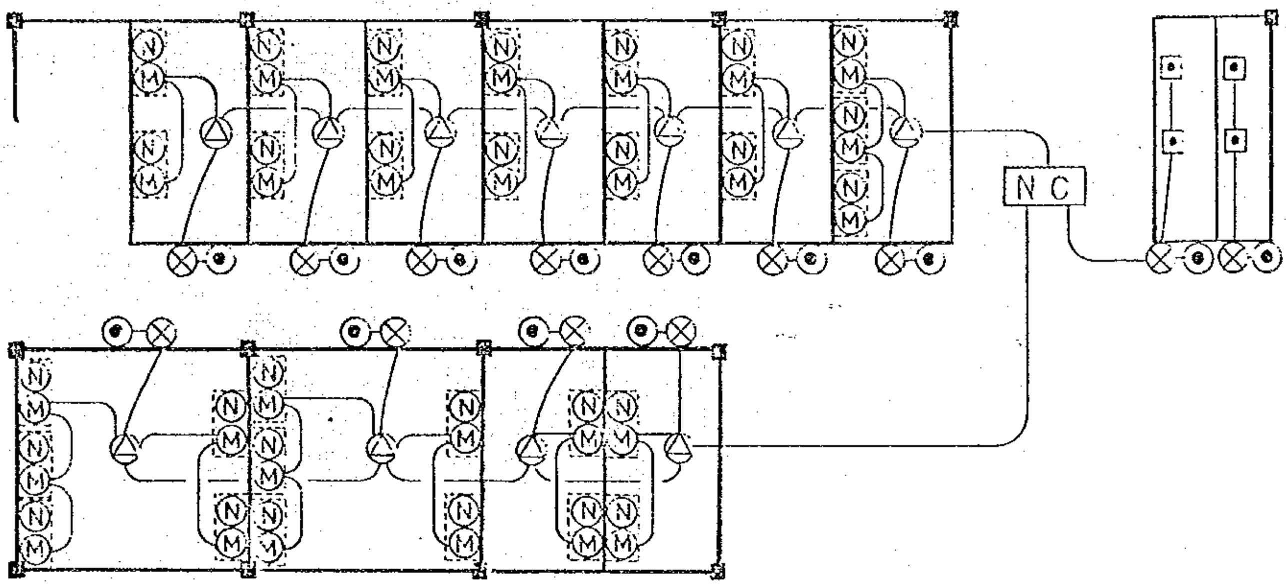
HOSPITAL



LEGEND

SYMBOL	DESCRPTION
AMP	AMPLIFIER
R P	REPEATER
(M)	MICROPHONE
(speaker symbol)	SPEAKER
(speaker symbol, filled)	〃
—○—	WIRELESS ANTENNA
(MJ)	MICROPHONE JAC
W M	WIRELESS MICROPHONE

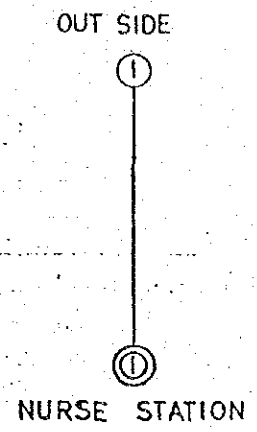
NURSE CALL SYSTEM



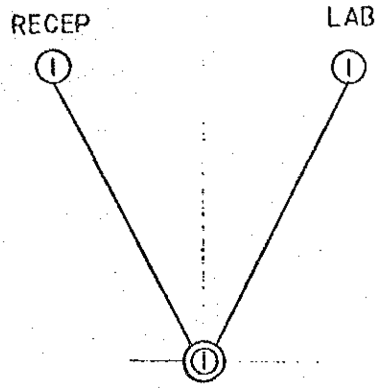
LEGEND

SYMBOL	DESCRIPTION
NC	NURSE CALL
(△)	SPEAKER
(N)	PUSH BUTTON SWITCH
(M)	MICROPHONE
⊗	INDICATION LAMP
⊙	RETURN BUTTON SWITCH
⊡	PUSH BUTTON SWITCH (LAMP)

INTERPHONE SYSTEM

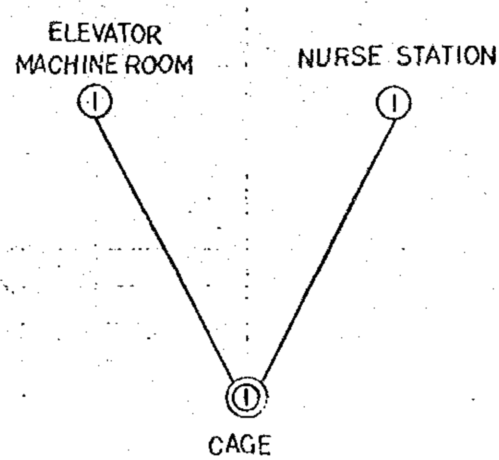


NIGHT RECEPT

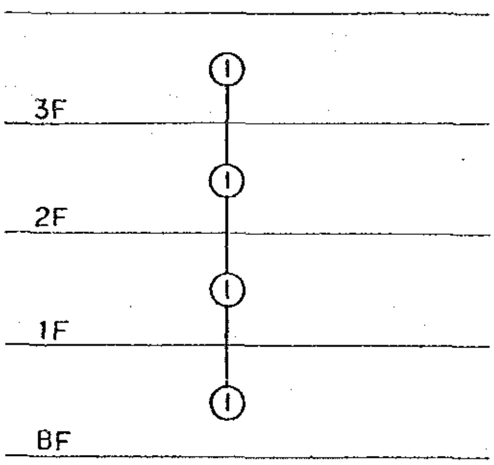


OPERATION

DARK ROOM

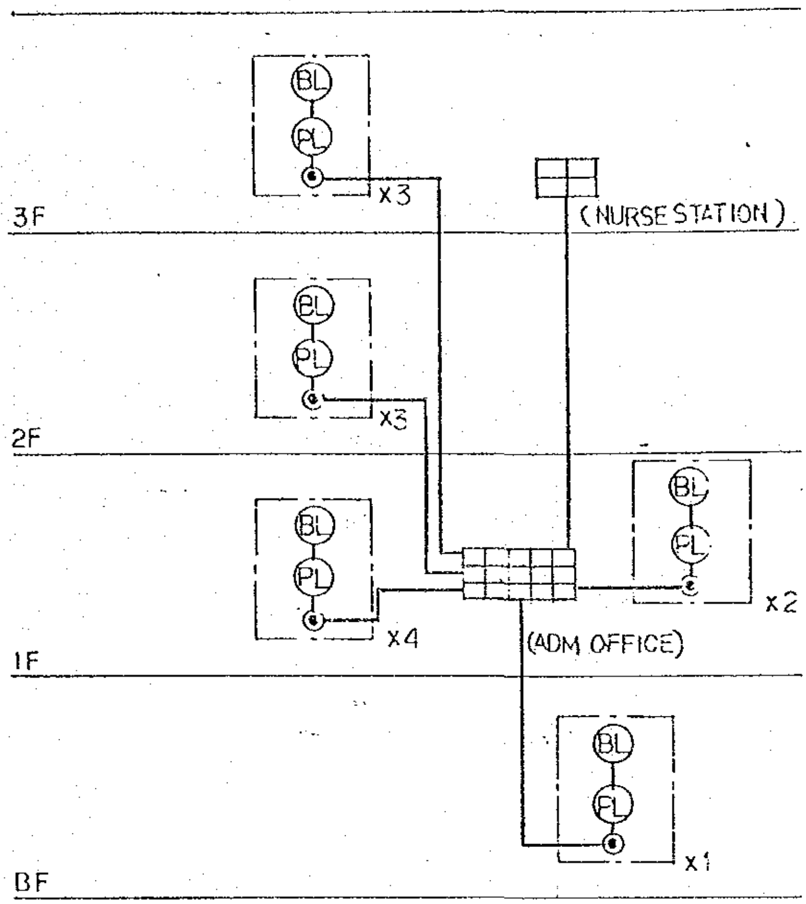


ELEVATOR



DAMUWATOR

ALARM SYSTEM



LEGEND

SYMBOL	DESCRIPTION
(grid symbol)	ALARM PANEL (MAIN)
(grid symbol)	〃 (SAB)
BL	BELL
PL	SIGNAL LAMP
⊙	PUSH BUTTON SWITCH

4-1-9 Heating and Air conditioning

The buildings in La Paz seldom have an air conditioning system; some are heated by hot water or steam but the greater part are heated by propane or electric stove. With the temperature ranging from 5° to 20°C throughout the year, it often feels cold in summer if there is no sun-light so that cooling is not required.

In winter, the humidity is generally about 10 percent, and it is very dry. The buildings existing in the National Hospital in which the present project is to be carried out, have gas stoves provided only in the office rooms but nothing in the hospital wards, and ventilation depends mainly on the natural flow of air through windows.

1) Operating room air conditioning system

All fresh air conditioning will be provided for operating rooms. With the handling unit placed near the operating rooms, space heating will be done by hot water if it is available in winter or electric heaters in summer or when the hot water system is not operating. For humidity control, it is planned to use a steam generator. The cooling to be done in summer is of the type not used by a refrigerator, so that control of dehumidifcation is not practicable. Thus, the humidity will rise to 40 percent or higher in summer. In winter, it is possible to control the humidity to 40±5 percent.

2) General room heating system

A direct heating system will have two hot water boilers and another boiler for the respective heating systems. For the source of heat, kerosene, light oil, heavy oil, propane gas or electricity may be considered. But, from the standpoint of availability, running cost and safety, it is planned to use heavy oil.

The heating will be divided in four systems in consideration of the elements governed by time and presence of intensive sunshine, that is,

1. East ward system,
2. West ward system,
3. Outpatient department system, and
4. General Office and Laboratory system.
5. Auditorium

These systems will be operated or suspended under fully automatic operation by means of electric manipulation, and it is planned basically to simplify the procedure and electric circuit to permit corrective action with ease in the event of a failure.

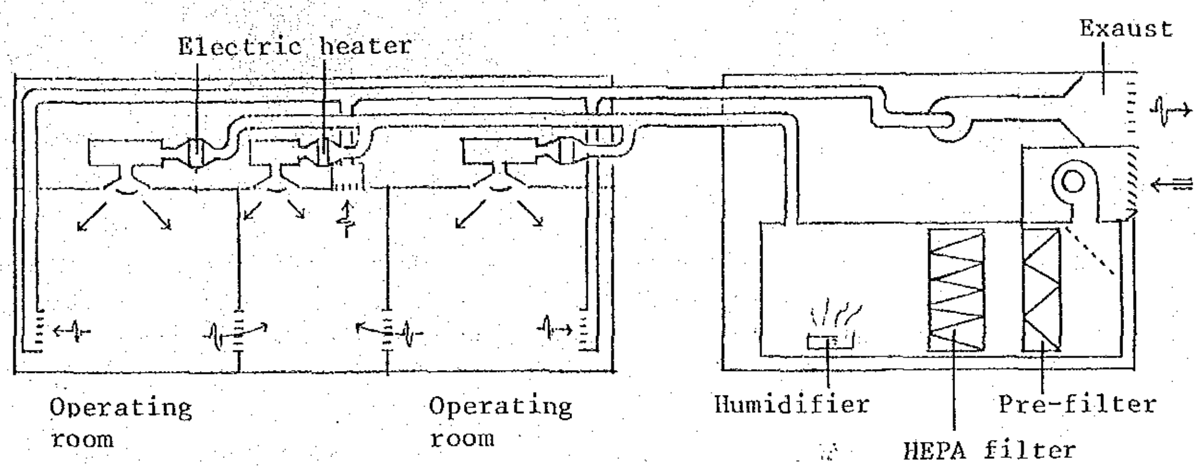
Temperature control can be done by means of a valve installed in the respective rooms.

For humidity control, a system of placing an evaporation dish on the radiator in a room and introducing water into the dish individually will be employed to eliminate failure due to scale adhering in humidification. The lobby, etc. will have heating but no humidification.

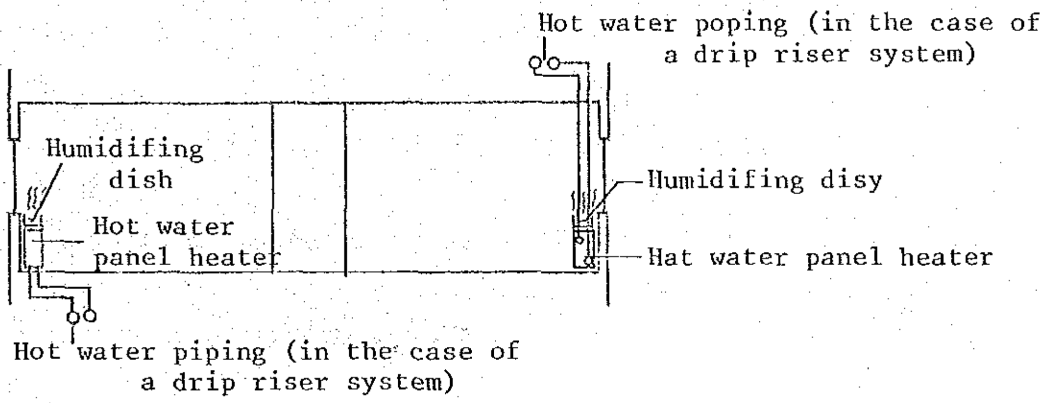
3) Ventilation

Natural ventilation will be used for the rooms of which such ventilation is practicable such as, for example, the toilet of each ward which is located on 3rd floor. For the rooms which do not face to open air, kitchen and laundry, forced ventilation will be used by means of a sirrocco fan. Where an experimental toxic gas is generated, forced ventilation will be done with a draft chamber provided. Where air exhaust is required, a switch is provided, and the room occupant sets the switch to ON or OFF

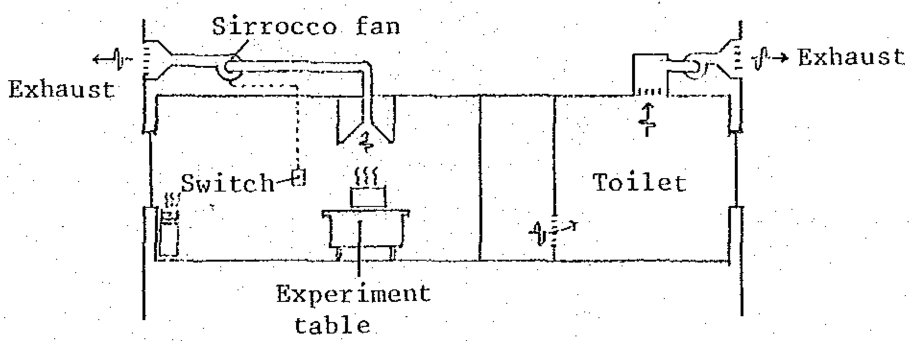
OPERATING ROOM AIR CONDITIONING SYSTEM



GENERAL HEATING SYSTEM



GENERAL VENTILATING SYSTEM



4) Temperature and humidity design conditions

		Operating room	General room	Outdoor air
Winter	Temperature	24°C±2°C	22°C±3°C	0°C
	Humidity	49%±5%	-	15%
Summer	Temperature	25°C±2°C	-	20°C
	Humidity	40% Up	-	73%

5) Auditorium heating/ventilation system

Ventilation will be a mechanical system for air supply as well as exhaust, and dust precipitation, heating and humidification will be done by air supply.

4-1-10 Water supply, drainage and sanitation

What is to be noted particularly in planning the equipment, including air conditioning are: 1) The service water is highly hard
2) Machines and ferrous materials are not produced domestically;
3) The equipment itself is not so complicated and 4) There is doubt involved in maintenance. Thus, simplification of the equipment system and interchangeability of parts were contemplated so that the maintenance would be facilitated.

1) Water supply system

The water supply equipment presently installed in the hospital has only a limited capacity, and thus it is required to introduce city water from the water main buried underneath the public road. The introduced water will be stored in an assembly-type water tank for half-day use and be pumped from the tank up to a similar assembly-type water tank provided on the roof. From there, water will be fed to supply plints by gravity.

About 10% of the total amount of supply water will be softened through ionic water softener, and will be supplied to X-ray photograph developer, distilled water producer and operating room air conditioning humidifier.

PVC pipes have come to be used recently. In the present plan, PVC pipes, PVC coating pipes and PVC lining pipes will be used for the sake of preventing reddish water.

The quantity of water used at the Center is estimated at about 50 m^3 a day, and for intake of water, 50A pipes with a water pressure higher than 1 kg/cm^2 will be required.

2) Hot water supply system

Because of highly hard water, scales will adhere to the heating section. Thus, water supply boilers or electric water heaters with a direct heating system should be avoided. Instead, a central water system will be employed -- two hot water boilers with an indirect heating system and two hot water tanks with a heat exchange system. Piping will be of copper.

For potable hot water supply, no special equipment will be provided, but an electric heater will be provided at each of the required locations.

3) Drainage and vent equipment plan

The city of La Paz in Bolivia has no sewage disposal facility, and the buildings as well as houses discharge waste water into the public sewer pipe at the terminal of which the waste water is discharged directly into the river flowing through the city. According to city regulations, the wast water of this hospital is dischargeable without any treatment except surgical special waste water (chemical waste water incident to surgical operations and experiments). In the present case, it was contemplated, in consideration of the morale and also of the future, that apparatus for treatment of all sorts of waste water should be provided, and the possibility was examined. But, as there is no vacuum car available for extracting the concentrated active sludge nor place of treatment required incident to such treatment apparatus, it is concluded that not the benefits but the inconveniences are caused in the event of a disposal plant provided for the present case alone. Thus, in the present case, all waste water will be discharged into the public sewer system or river except for surgical waste water and chemical waste water which are subject to sterilization and pH adjustment.

The drainage in the building will be of three systems for said treated waste water, living waste water and rain water.

The pipes will include PVC pipe, white gas pipe, cast iron pipe, lead pipe and concrete pipe which are suitable to specific applications.

4) Sanitary fixtures

Sanitary fixtures are not produced domestically but are imported from America, Brazil and Argentina; imports from America constituting a greater part. But, metal fixtures are not readily available. In this respect, acquisition from Japan is desirable. With interchangeability and standardization of the types of fixtures and delivery of 10 percent spare parts, maintenance will be no problem.

5) Fire extinguishing

La Paz is situated at an altitude of 3600 meters with the oxygen content at 2/3 of that in Tokyo. A lit cigarette seldom leads to a fire, and fires are scarcely seen. Accordingly, there are no fire regulations nor fire extinguishing equipment except small fire extinguishers. In the present case, installation of carbon dioxide fire extinguishers at required locations is contemplated.

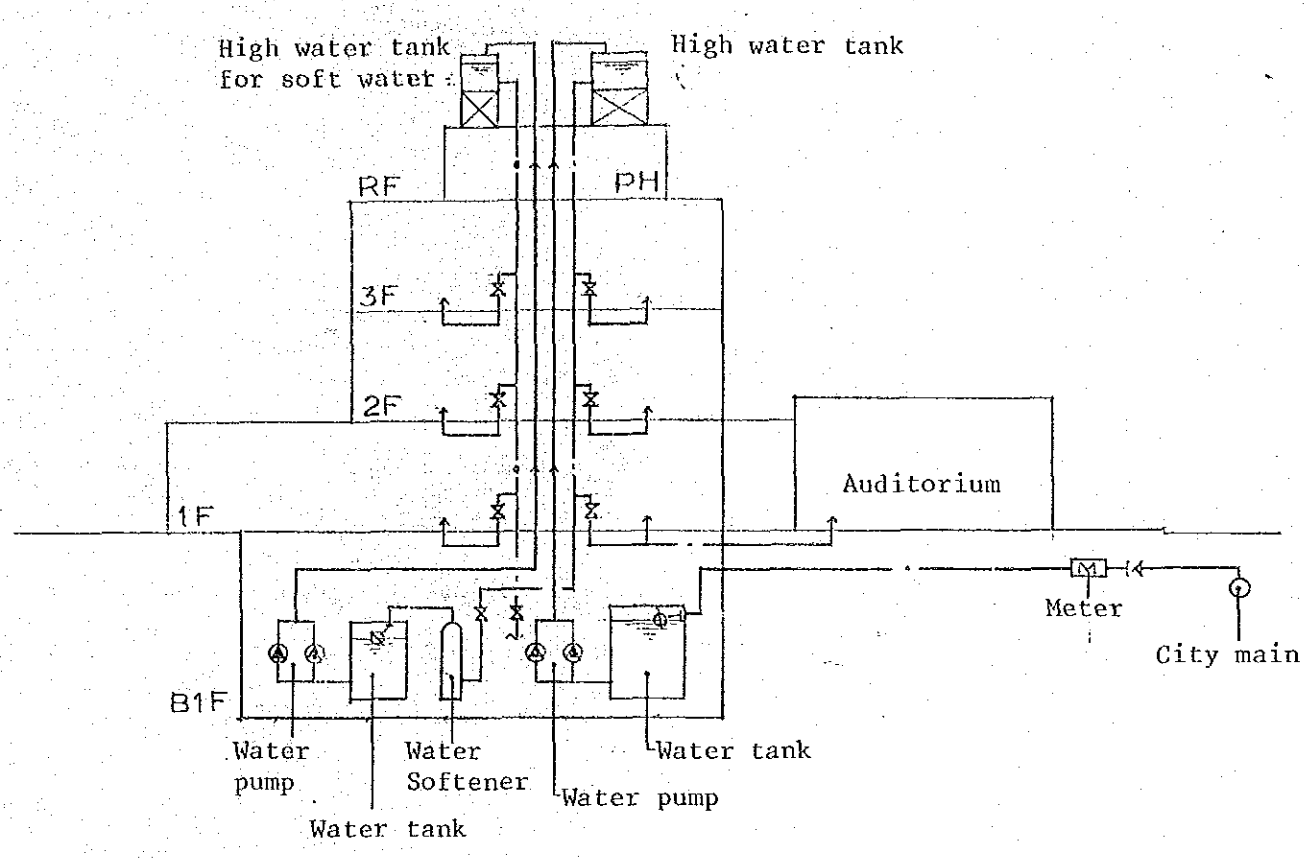
6) Gas

La Paz has no city gas service. Thus, generally a propane gas cylinder is brought into a room for use. The gas is a highly pure liquefied propane or butane gas, and toxication seldom occurs. However, it is highly hazardous so that in the present case, a central gas supply system is planned with the gas cylinders concentrated outdoors.

7) Oxygen Supply and Suction

Oxygen inhalation is required in the operating room, X-ray room etc., and a central system will be used. A vacuum pump for suction will be installed in the machine room, and oxygen cylinders will be placed outdoors near the machine room.

WATER SUPPLY SYSTEM



HOT WATER SUPPLY SYSTEM