OFFICE OF CIVIL AVIATION
DEPARTMENT OF TRANSPORT
PAPUA NEW GUINEA

# BASIC DESIGN STUDY REPORT ON THE PROJECT FOR UPGRADING OF NEW RABAUL AIRPORT (TOKUA) IN PAPUA NEW GUINEA

FEBRUARY 1996



JAPAN INTERNATIONAL COOPERATION AGENCY
NIPPON KOEI CO., LTD.

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# PREFACE

In response to a request from the Government of Papua New Guinea, the Government of Japan decided to conduct a basic design study on the Project for Upgrading of the New Rabaul Airport (TOKUA) and entrusted the Study to the Japan International Cooperation Agency (JICA).

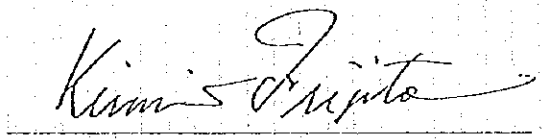
JICA sent to Papua New Guinea a study team from 22nd August to 20th September 1995.

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

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

I wish to express my sincere appreciation to the officials concerned of the Government of Papua New Guinea for their close cooperation extended to the teams.

February, 1996



Kimio Fujita
President
Japan International Cooperation Agency

February, 1996

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Upgrading of the New Rabaul Airport (TOKUA) in Papua New Guinea.

This study was conducted by Nippon Koei Co., Ltd. under a contract to JICA, during the period from 10th August 1995 to 5th February 1996.
In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Papua New Guinea and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

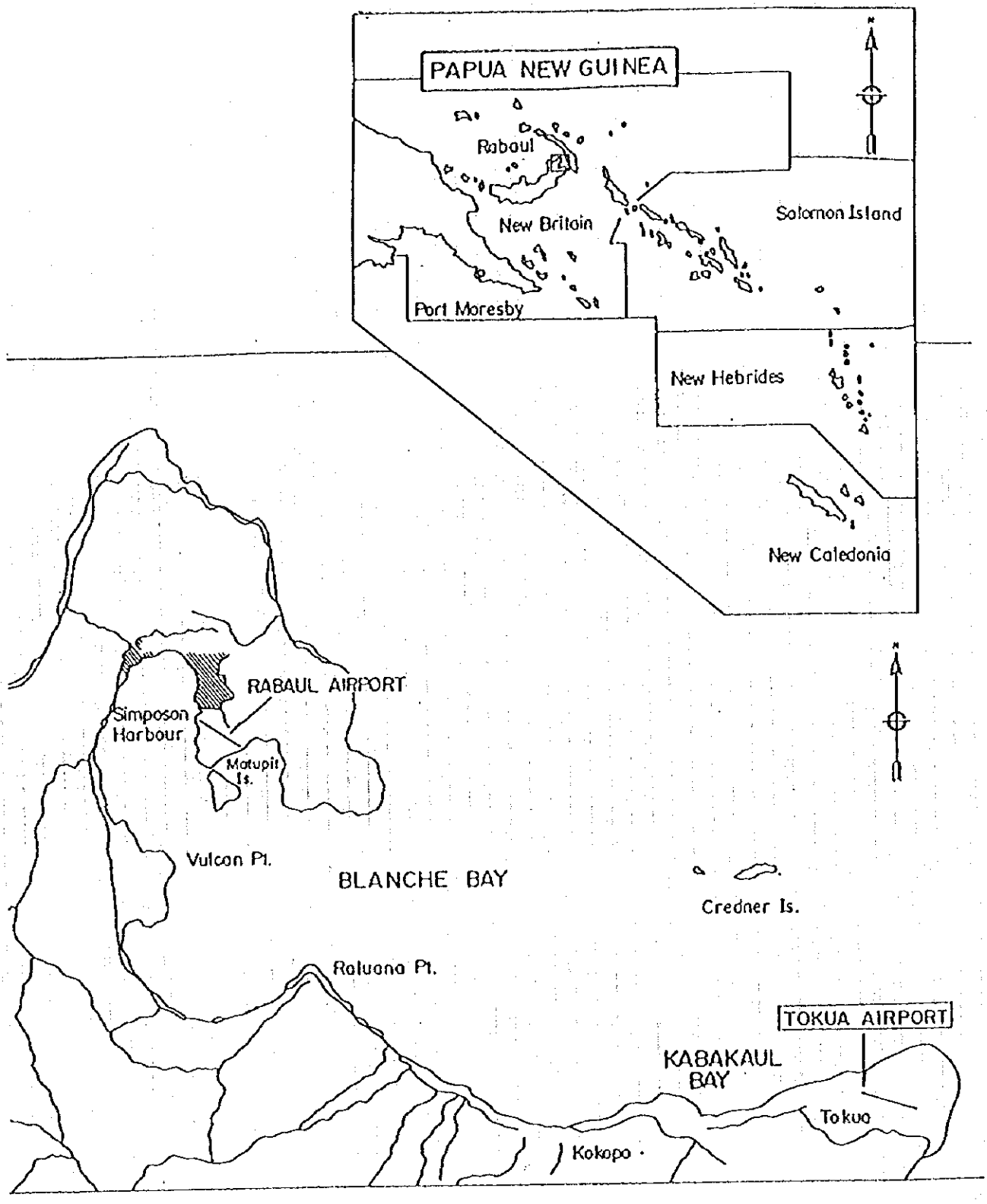
Finally, we hope that this report will contribute to further promotion of the project.

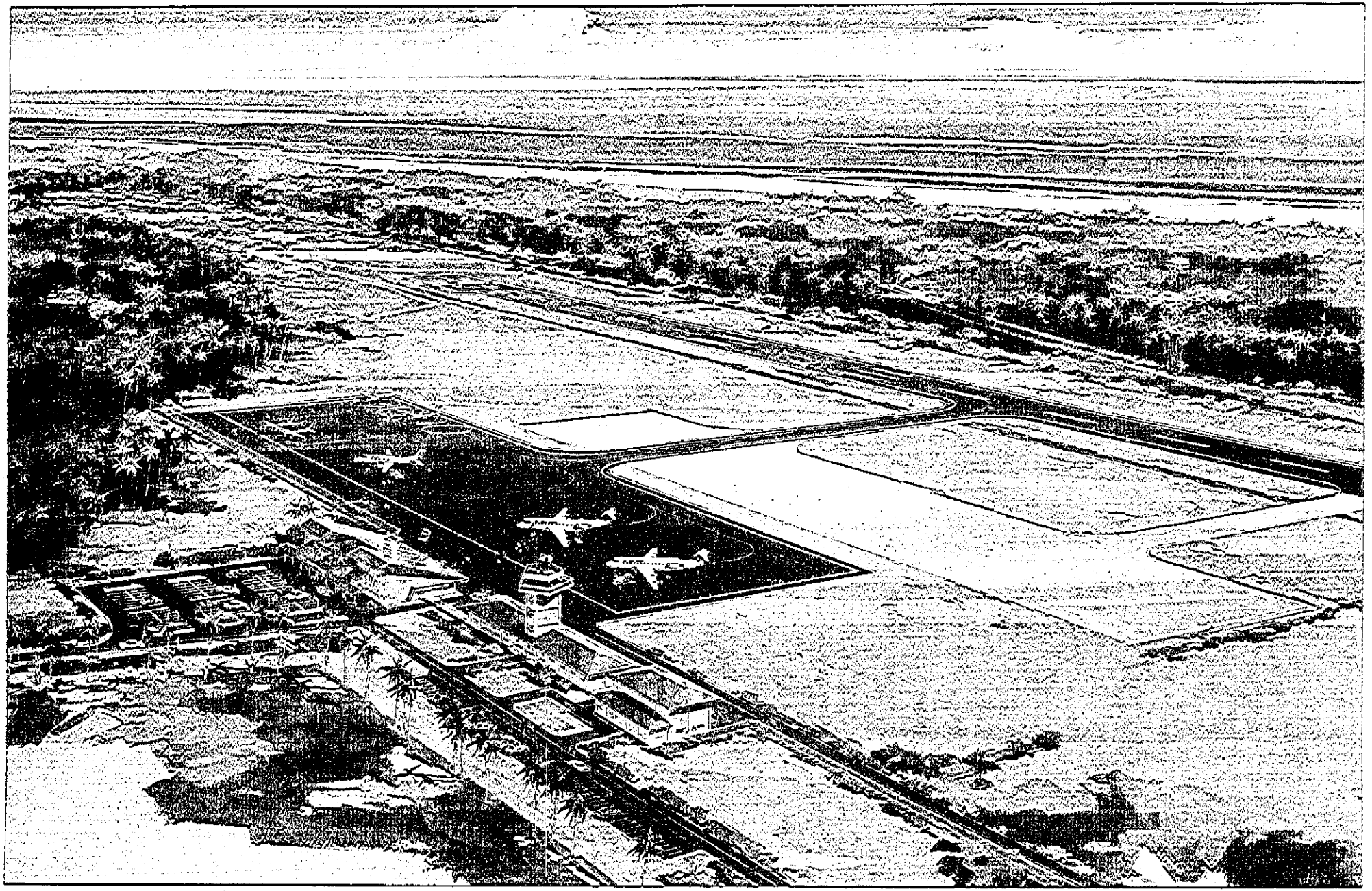
Very truly yours,

Fumishige Tamura

Fumishige Tamura
Project Manager
Basic design study team on
The Project for Upgrading
of New Rabaul Airport (TOKUA)
Nippon Koei Co., Ltd.

# Location Map





NEW RABAUL AIRPORT ( TOKUA )

ABBREVIATIONS

| | |
|---|---|
| ABN | Aerodrome Beacon |
| AC | Asphalt Concrete |
| A/C | Aircraft |
| ACC | Area Control Center |
| ACN | Aircraft Classification Number |
| ADC | Aerodrome Control |
| AFS | Aeronautical Fixed Services |
| AFIS | Aerodrome Flight Information Services |
| AFTN | Aeronautical Fixed Telecommunication Network |
| A/G | Air to Ground and Ground to Air |
| AIS | Aeronautical Information Services |
| AMS | Aeronautical Mobile Services |
| AP | Airport |
| APC | Approach Control |
| AS | Asphalt |
| ASDA | Accelerated Stop Distance Available |
| ASR | Airport Surveillance Radar |
| ATA | Actual Time of Arrival |
| ATC | Air Traffic Control(ler) |
| ATD | Actual Time of Departure |
| ATS | Air Traffic Services |
| ATSO | Air Traffic Service Officers |
| AWS | Aerodrome Weather Observation System |
| C (Value) | Ratio of Compaction Volume |
| CAT | Category |
| CBR | California Bearing Ratio |
| CCR | Constant Current Regulator |
| CCTV | Closed Circuit Television |
| CCU | Central Control Unit |
| CFR | Crash, Fire and Rescue |
| CIQ | Custom, Immigration and Quarantine |
| CVCF | Constant Voltage Control Frequency |
| DME | Distance Measuring Equipment |
| EPNL | Effective Perceived Noise Level |
| FAA | Federal Aviation Administration |
| FIS | Flight Information Services |
| FL | Flight Level |

| | |
|---|---|
| FLO | Apron Flood Lights |
| GDP | Gross Domestic Product |
| G/G | Ground to Ground |
| GHz | Giga Hertz |
| GPS | Global Positioning Satellite |
| GSE | Ground Service Equipment |
| HF | High Frequency |
| HIRL | High Intensity Runway Edge Lights |
| IDF | Intermediate Distribution Frame |
| IFR | Instrument Flight Rules |
| ILS | Instrument Landing System |
| IMC | Instrument Meteorological Condition |
| ISB | Independent Side Band |
| K (Value) | Modulus Subgrade Reaction |
| KHz | Kilo Hertz |
| LDA | Landing Distance Available |
| LLZ | Localizer |
| MBIT | Mega Bit |
| MDA | Minimum Descent Altitude |
| MDF | Main Distribution Frame |
| MHz | Mega Hertz |
| MLS | Microwave Landing System |
| MM | Middle Marker |
| MOO | Meteorological Observation Office |
| MSA | Minimum Safe Altitude |
| MSL | Mean Sea Level |
| MTOW | Maximum Take-off Weight |
| MTN | Magnetic True North |
| MV | Magnetic Variation |
| MVA | Mega Voltage Ampere |
| NAVAIDS | Navigation Aids |
| NDB | Non-Directional Beacon |
| NM | Nautical Mile |
| OD | Origin and Destination |
| OLS | Obstacle Limitation Surface |
| OM | Outer Marker |
| PABX | Private Automatic Branch Exchange |
| PAPI | Precision Approach Path Indicator |
| PANCAP | Practical Annual Capacity |

| | |
|---|---|
| PAX | Passenger |
| PBX | Private Branch Exchange |
| PCC | Portland Cement Concrete |
| PCN | Pavement Classification Number |
| PDR | Peak Day Ratio |
| PHR | Peak Hour Ratio |
| PIP | Public Investment Project |
| PMR | Peak Month Ratio |
| PNG | Papua New Guinea |
| PNL | Perceived Noise Level |
| PDB | Power Distribution Board |
| PTC | Public Telephone Corporation |
| QFE | Atmospheric Pressure at Aerodrome Elevation |
| QNH | Altimeter Sub-scale Setting to obtain when on ground |
| RAPCON | Radar Approach Control |
| REDL | Runway Edge Lights |
| REIL | Runway End Indicator Lights |
| RENL | Runway End Lights |
| RIV | Rapid Intervention Vehicle |
| RTHL | Runway Threshold Lights |
| RTTY | Radio Teletypewriter |
| RVR | Runway Visual Range |
| RWCL | Runway Centerline Lights |
| RWTL | Runway Threshold Lights |
| RWY | Runway |
| RVR | Runway Visual Range |
| RX | Receiver |
| SALS | Simple Approach Light System |
| SELCAL | Selective Calling System |
| SIDs | Standard Instrument Departure |
| SSB | Single Side Band |
| SSR | Secondary Surveillance Radar |
| STARs | Standard Terminal Approach Route Procedures |
| SM | Statute Mile |
| TBM-KY | Tool Box Meeting - Kiken Yochi (Danger Forecasting) |
| TN | True North |
| TODA | Take-off Distance Available |
| TORA | Take-off Run Available |
| TMA | Terminal Control Area |

| | |
|---|---|
| TWCL | Taxiway Centerline Lights |
| TWL | Taxiway Edge Lights |
| TWR | Aerodrome Control Tower |
| TWY | Taxiway |
| TX | Transmitter |
| UHF | Ultra High Frequency |
| UPS | Uninterrupted Power Supply |
| VASIS | Visual Approach Slope Indicator System |
| VDU | Visual Display Unit |
| VFR | Visual Flight Rules |
| VHF | Very High Frequency |
| VMC | Visual Meteorological Conditions |
| VOR | Very High Frequency Omnidirectional Radio Range |
| VTOL | Vertical Takeoff and Lift |
| WDIL | Wind Direction Indicator Lights |
| WECPNL | Weighted Equivalent Continuous Perceived Noise Level |
| WX | Weather |

# TABLE OF CONTENTS

Pages

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION



APPENDICES

# CHAPTER 1 BACKGROUND OF THE PROJECT

## 1-1 Outline of the Request

Papua New Guinea (PNG) lies north of the continent of Australia from south latitude 1° 20' to 11° 40' and east longitude 141° to 155°.It is composed of more than 600 islands including the main island with 85% of land area, New Britain Island, New Ireland Island, Bougainville Island, the Solomon Islands, etc,and is the largest nation in the South Pacific Oceania region.

Topographicaly, except for some plains along the north and south shore of the main island, it consists of steep mountains ranging from 3000 to 4000 m high and highland areas. The total land area is 463,000 $km^2$ , the population as of the 1994 census is 4,200,000 and the population density is 9.3 persons per $km^2$ .Concerning land transportation ,there are no railroads and total road length is about 24,000 km of which 22% is paved. However, due to the rugged terrain, tropical jungles, and lack of sufficient population density, even the major cities are not connected and the road infrastructure cannot be said to be adequately developed. Inter-island transport utilizing marine transport connects 13 major ports, but is mainly for cargo transport and there is little passenger traffic.

Supplementing the undeveloped land and marine transport systems, there are about 450 airports and airstrips scattered throughout PNG. Of these, 23 major airports under the State's control have been playing an increasingly significant role in the socio-economic development of PNG, handling 1,833,000 passengers and 20,000 tons cargoes in 1989.The 4 major airports ,Port Moresby, Lae, Rabaul,and Mount Hagen accounted for 65% of passenger and 67% of cargo traffic. Rabaul Airport in East New Britain Province, which was the hub airport for the area, was handling 146,255 passengers and 1,455 tons cargo as of 1989, approximately 8% of the total volume of the entire PNG. However total volume has unexpectedly dropped since the economic situation has deteriorated caused mainly by the PNG's internal dispute.

Under the situation mentioned above, the volcanoes around Rabaul airport erupted on September 19, 1994 and demolished the airport and the township as well. The Government of PNG closed the airport operational activity permanently and decided that Tokua Airport located 45km to the southeast from Rabaul city would be the alternate airport and to implement emergency development to allow FK28 operational capability. Tokua airport used to be the alternate or temporary airport for Rabaul Airport when the latter was closed due to bad weather.

After the disater at Rabaul Airport, Tokua Airport has been operating under tentative conditions. However, the actual traffic demand (number of take-off and landings ) has dropped 70% compared to the same period for Rabaul Airport of the previous year. Therefore, Tokua Airport will hereafter replace the functions Rabaul Airport, which was a major airport for inter-island transport.The problem with the highest priority is to secure a transport means to supply essential necessities for the inhabitants of East New Britain and the neighboring islands. Moreover, it is essential to secure safe, reliable and convenient air transport for the development of the area by implementing the captioned Project.

Under the above mentioned conditions, the PNG Government submitted a grant aid application to the Government of Japan for an immediate implementation of urgent development of Tokua Airport, citing the JICA report "The Study on the Tokua Airport Development Project, 1991 ~ 1992".

### 1-2 Major Components of the Project

The project scope is to cater for FK28 standard operation for the year 2003 and includes the following components.

(1) Civil works for runway, landing strip, over-run, taxiway, apron, drainage, sewerage
(2) Building works for Passenger Terminal, Control Tower, Administration Office, Maintenance Shop
(3) Air traffic control equipment (AMS, AFS, Meteorological system,etc. )
(4) Air traffic support facilities (D-VOR/DME, etc.)
(5) Airfield lighting system and electrical supply equipment

# CHAPTER 2 CONTENTS OF THE PROJECT

## 2.1 Objectives of the Project

The development of an air traffic network in PNG is an essential and highly important policy for the development of the country and stability of public welfare.
On September 19th. 1994, Rabaul airport, an important domestic hub airport of Papua New Guinea with more than 40 daily scheduled flights, was completely demolished and closed down due to extensive volcanic eruptions of the mountains around Rabaul.
Therefore, Tokua airport was designated to handle the above air traffic and the emergency improvement of Tokua airport has become the most urgent project in the "Gazelle Peninsula Restoration Plan" for the province. However, due to the financial difficulties of the Government of Papua New Guinea, a request was made for Grant Aid and the Government of Japan has decided to respond to the request.
This project, therefore, aims at the urgent installation of necessary Facilities and Equipment in order to insure safety of aircraft operations for FK28 aircraft at Tokua airport.

## 2.2 Basic Concept of the Project

As a result of extensive on-site investigations following the request of the Government of Papua New Guinea, the basic concept of the Project has been finalized as follows,

(1) Subjects and Scope of Improvement
To construct and install necessary Facilities and Equipment for unconditional operation of FK28-4000 aircraft for target year 2003.

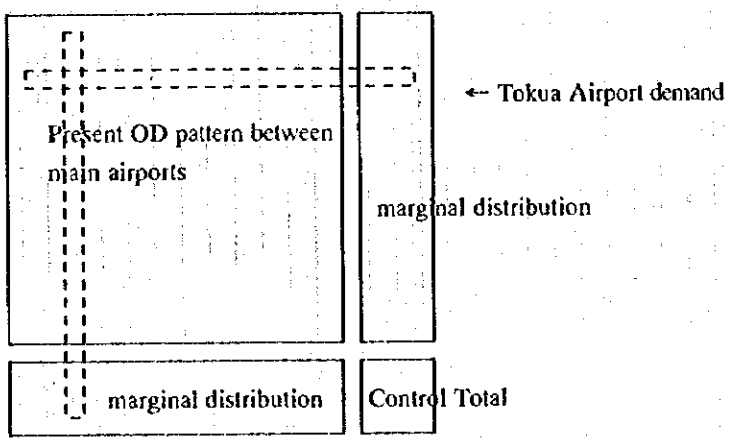
(2) Improvement Targets and Demand Forecast
The foremost objective of the Project is the urgent improvement of the Facilities and Equipment necessary for aircraft operations. For this purpose air traffic control operations will be introduced to allow daytime and partial night time VFR and Instrumental Flight Rules operation. This will be the number one priority of the Project.
Next, air traffic demand must be forecast up to the target year 2003. (The main civil facilities and equipment will be required to be implemented without direct influence of the demand forecast, but passenger terminal facilities will be based directly on the demand forecast.)
Therefore, the JICA F/S report for this project and the actual air traffic demand in PNG after the study period will be analyzed.

1) Demand Forecast in F/S report

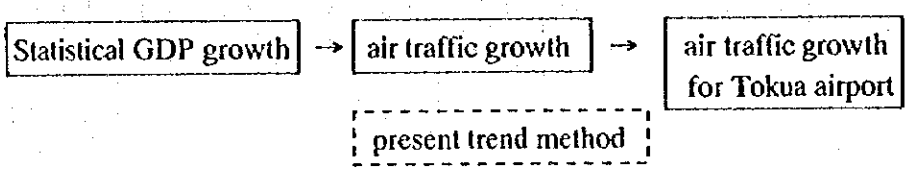
The traffic structure of Tokua airport is mainly domestic flights and the total capacity is equal to a small local airport in Japan. Therefore, considering that the data goes back only seven years and the analysis based on particular data (for Rabaul airport) has possibility of statistical unreliability, demand forecast based on national data will be applied.
In this case, on the basis of the actual present domestic passenger number the present trend method is used to calculate the future demand for total domestic routes (between 23 main airports). From this figure, the demand for Tokua airport is deduced and put in table form as annual passenger demand forecast.
The control total domestic demand for all domestic flights in Papua New Guinea is calculated using GDP. The future value of GDP growth is forecast in "Economic Policy Vol 2. (Paul Pora : Minister of Finance and Planning)" as 6.5% and recent economic trend (4.7% ~ 9.9%) gives the following figures ;

| | |
|---|---|
| middle case | 6% |
| high growth case | 9% |
| low growth case | 3% |

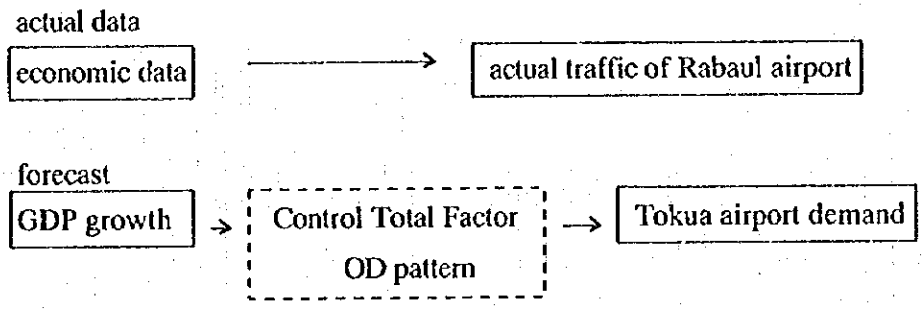
Furthermore, the particular passenger demand for each airport is a marginal distribution factor which is calculated by regression analysis from present actual passenger numbers for each airport.




As a result, the forecast results for Tokua airport are equivalent with trend pattern extrapolation of Rabaul statistics and yield 3.9% annual increase for middle growth case.



In the present study, there are 4 years additional data available from the time of the F/S report. The present study has conducted a review by comparing actual data with the F/S forecast. As a result, it has been confirmed that there has been a drop in passenger traffic due to drastic reduction in flight numbers after the civil war and also the lack of some data due to the same war.
In order to carry out the same analysis as the F/S, there is a need to gather data on current trends to forecast the future marginal distribution, etc. but in the present study, these data could not be obtained.
Furthermore, the continuity of actual data has been compromised and although analysis using a turning point factor should be attempted, the available data for the final half of the calculations is insufficient. Therefore, the review was based on economic factors and actual passenger traffic for Rabaul airport.




In the F/S report the GDP elasticity coefficient for air traffic was calculated to be 1.05 on the basis of investigation data. Similarly the elasticity coefficient for population was 1.38. From this it can be stated that air traffic reflects stability of civilian life more than economic trends. (However evaluation criteria was low for both analysis.)

$$PNG = 10^{-0.177913} * GDP^{1.053326}$$

$$r^2 = 0.490712$$

$$PNG = 10^{-0.533153} * POP^{1.379613}$$

$$r^2 = 0.6928498$$

Therefore, it was assumed that it will require some time for stability to return to the domestic scene (return to pre-civil war conditions) and as a result it will be difficult to rebound from the present situation back to the level forecast in the F/S report. It has been assumed that growth will resume with the F/S growth factor from a base of the present demand.

Furthermore, as is shown below, it can be deduced from an analysis of GDP that the forecast value based on this assumption has validity. This fact has been considered in the report.

By analyzing data obtained during the F/S period when the domestic scene was stable, the growth factor of about 2.5% was obtained by regression analysis. Furthermore, the elasticity coefficient of population for GDP is 1.056 and the economic growth and population growth of PNG is about equivalent.

$$GDP = 1.959442845 + 1.025474133^{\text{year 1980}}$$

(25.77526) (6.096254)

$$r^2 = 0.9028282$$

$$GDP = 0.627381632 * POP^{1.05573000}$$

(-2.404319) (6.656937)

$$r^2 = 0.9172096$$

From now on, the political situation in PNG will stabilize and the growth trend factors should revert to the values obtained during the F/S study. It is, therefore, possible to assume the growth rate factor of 3.9% for Tokua airport as was calculated in the characteristics of the Tokua airport passenger demand. However, there is a strong possibility of a growth factor lower than 3.9% and the value 3% obtained from the ICAO forecast can be assumed to be valid as is described below.

2) Characteristics of Tokua airport passenger demand

a. The annual increase ratio for the year 1986 to 1989 was 10%, a high figure, but the F/S report calculated on the basis of annual increase of 3.9%.

b. The statistics for the recent five years shows a drastic drop of 33% for the two years following 1989, but this is a reflection of exceptional social and economic factors such as civil war, the pull out of MBA airline (1989 - 1991) and economic recession, etc. and the succeeding two years show a rebound of 20% increase. Due to these fluctuations the trend values for these years can not be used as a basis for long range permanent demand forecasts.

c.FK28 type aircraft owned by Air Niugini alone account for 85% of the total passengers use of Tokua airport. Furthermore, the aircraft are used on a shuttle flight basis utilizing only one to two planes. The total fleet of FK-28 is 8 planes (of which 2 planes are for international flights). Therefore, the number of planes committed to Tokua airport is limited. Moreover, if maintenance or diversion to other airports of this limited stock occurs, the passenger numbers of Tokua airport fluctuate drastically.

3) Air Traffic Demand Forecast by ICAO (ICAO Circular 252)

a.The annual increase ratio is 5% for long term demand forecast, International flights increase by 6.5% while domestic increase is 4% annually.

b.The relation between flight numbers and passenger number

The forecast for 1992 to 2003 is 25% increase in flight numbers and 50% increase in passenger numbers. This can be assumed on the basis that of the passenger numbers increase, 25% can be attributed to the increase of flight numbers and 25% can be attributed to the increase of aircraft capacity.

c.Calculation of passengers increase factor for Tokua airport

Since Tokua airport handles only domestic flights, the passenger increase factor is 4% from a above. However, even after the proposed improvement, the runway length at Tokua airport will remain 1,720m in length, the same as at present which means that an increase by change to larger aircraft than FK-28 is not possible. Therefore, the annual increase factor of Tokua airport passenger numbers can be calculated as follows :

$$4\% - (4\% * 25\%) = 3\%$$

4) Results of demand forecast

From the above analysis, the demand forecast value for this project will be determined to be 3% per annum.

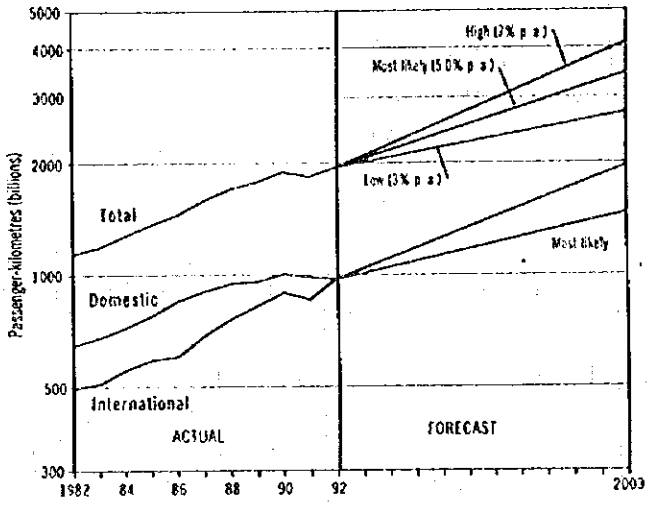



**Fig 2.2.1 Trends in world scheduled passenger Traffic (ICAO Contracting States)**

**Table 2.2.1 Actual Passengers of Rabaul Airport & GDP**

| | | | | | | |
|---|---|---|---|---|---|---|
| Actual Passengers | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
| | 116,330 | 112,759 | 106,298 | 101,705 | 111,182 | 132,823 |
| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
| | 146,255 | 109,304 | 103,512 | 111,577 | 124,474 | - |
| Real GDP | 2,317 | | | 2,878 | 3,366 | 3,546 |
| | | | | (124%) | 116% | 105% |

**Table 2.2.2 Forecast of Tokua Airport (3%)**

| Year | | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|
| Passengers | No | 132,000 | 135,000 | 140,000 | 144,000 | 148,000 | 153,000 | 157,000 | 162,000 | 167,000 |
| Cargo | t | (1,455) | 1,498 | 1,543 | 1,590 | 1,637 | 1,686 | 1,737 | 1,789 | 1,870 |
| Traffics | No | (17,854) | 18,389 | 18,930 | 19,500 | 20,083 | 20,685 | 21,306 | 21,945 | 22,700 |

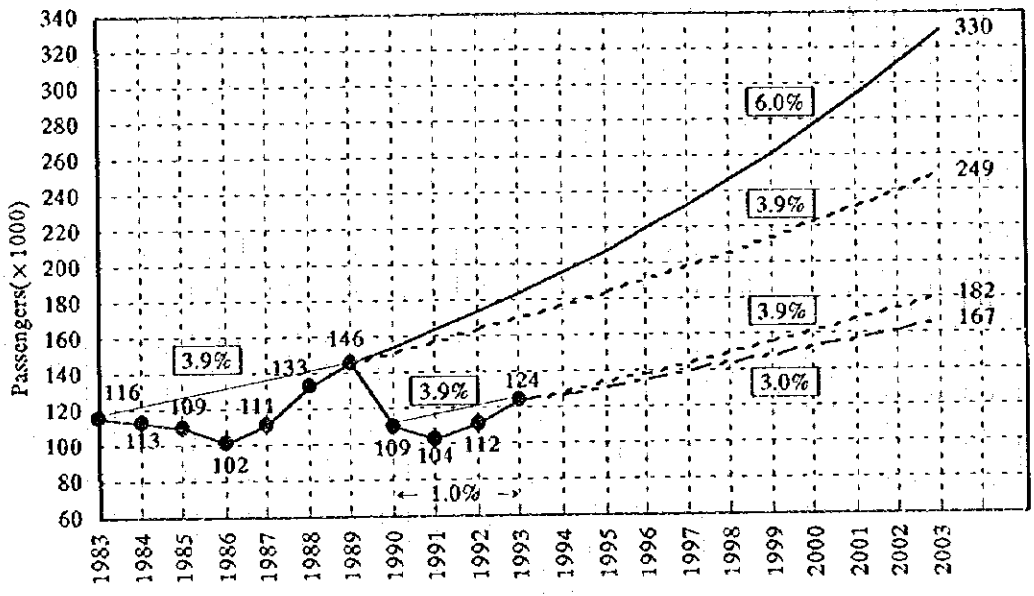



**Figure 2.2.1 Air Passenger Demand Forecast**

(3) Implementation Grades of Facilities and Equipment.

The criterion and capacity of respective Facility and Equipment are stated in the following items concerned.
ICAO standards are fundamentally adopted with the consideration to PNG standard level.

## 2-3 Basic Design

### 2-3-1 Design Concept

1. Basic Conditions

In designing the Airport Civil Engineering, Architectural Facilities and Operational Equipment for the Project, the following natural conditions must be taken into consideration.

(1) Natural Conditions

1) Since the site area is tropical and divided into the dry and the wet seasons, meteorological conditions in the wet season should be taken into account in order to design highly safe airport operations.
2) Since Tokua Airport is located 40km from the volcanic eruptions around Rabaul city, building design shall conform with the PNG's seismic standards.
3) Taking into account that the Airport field elevation is 5m to 15m and the distance to the sea shore is 1km to 1.5km, environmental impact to the sea and the surroundings caused by the development of the Airport shall be limited to the minimum extent.
4) The Airport is surrounded by groves of coconut and cocoa trees in the adjacent plantation area. Due consideration to preserve this scenic condition shall be taken in the implementation scheme.

(2) Social Condition

1) Since Tokua Airport has been designated as the alternate airport of the old Rabaul Airport and it will presumably be developed to international standards in the future, the design of airport facilities should be characteristic of PNG. Especially, the buildings such as the terminal building should be designed to reflect the traditional architectural culture of PNG.
2) East New Britain where Tokua Airport exists is not yet modernized compared to the capital Port Moresby, and the traditional living style is still being retained, except for some townships. Since Tokua Airport will be the key traffic interconnection point with the Capital as well as other cities, the development shall be implemented in conformity with the PNG's opinions as much as possible.

(3) Construction Situation

In the Province of East New Britain, where Rabaul is located, there are no contractors capable of undertaking projects of the magnitude of the project. Most large contractors are concentrated in the capital city of PNG, Port Moresby and the second largest city, Lae.

Construction in PNG is at a very high level considering that it incorporates the latest construction techniques from neighboring Australia and also based on the record of completed JICA grant-aid projects. Therefore local construction materials shall be used as much as possible.
Also, the Basic Design for the civil engineering, architecture and equipment are designed based on pertinent laws and regulations of PNG. The Procedures for Approval of Building and related matters will be done under the regulations of PNG.

1) Administrative Organization and Procedures
Procedures for Approval of Building is done by submitting an application to the respective provincial building board which has jurisdiction for the area of the project.

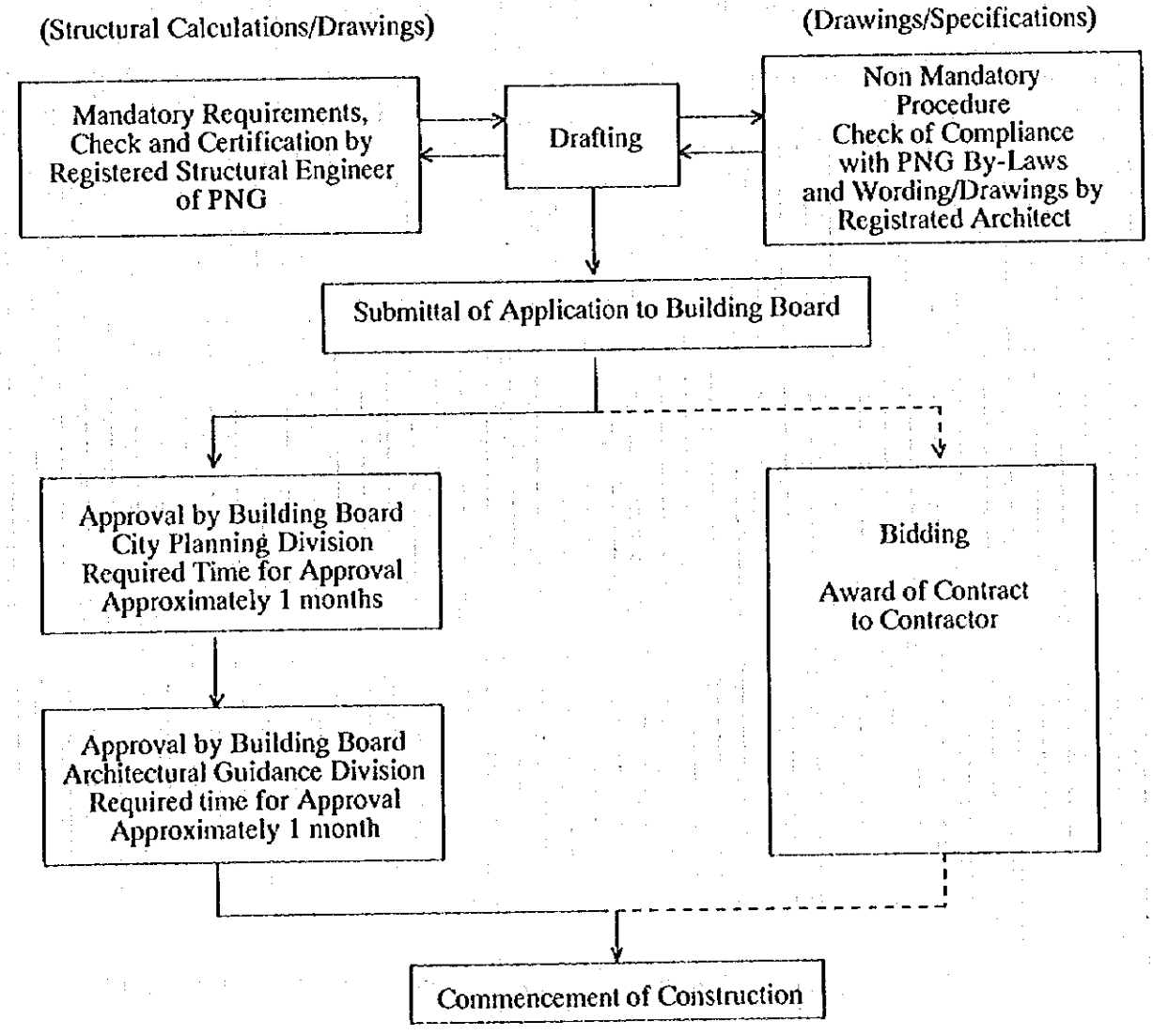



**Figure 2.3.1 Flow Chart of Approval for Building in PNG**

2) Construction Labor

The technical competence of skilled labor is substandard compared to advanced countries. Finish carpenters and the like are of high technical level, but are few in number. Generally, skilled labor is scarce is PNG, while semi-skilled and common labor is plentiful in all categories. However, the semi-skilled labor will need technical training.

3) Labor Conditions

In Papua New Guinea, as in Australia, the labor union system, the minimum wage system and the labor arbitration system are well developed. Minimum wages are minutely set out according to urban/rural and employment category. The minimum wages are revised annually based on the Consumer Price Index.

General labor conditions are based on Common Rules, and set out conditions for working hours, rest leave, sick leave, and overtime compensation. Furthermore, there is a National Provident Fund system under which the employer must set aside 7% and the workers 5% of income. The minimum wages set out by Common Rules is as follows.

| | Alotau, Arawa, Goroka, Kavieng, Kieta, Lae, Madang, Mount Hagen, Popondetta, Port Moresby, Rabaul, Wewak. | | Bulolo, Bwagaoia, Daru Kainantu, Kerema, Lorengau, Samarai, Vanimo, Wau, Mendi, Kimbe, Kundiawa, Wabag. | |
|---|---|---|---|---|
| Classifications | Minimum Weekly Rates (K) | Minimum Fortnightly Rates (K) | Minimum Weekly Rates (K) | Minimum Fortnightly Rates (K) |
| Youth under 22 years of age | 31.40 | 62.80 | 26.51 | 53.02 |
| General Laborers & Married Youths | 62.83 | 125.66 | 53.02 | 106.04 |
| Class 1 | 66.68 | 133.36 | 57.00 | 114.00 |
| Class 2 | 71.04 | 142.08 | 61.52 | 123.02 |
| Class 3 | 76.63 | 153.26 | 67.18 | 134.36 |
| Class 4 | 83.34 | 166.68 | 83.34 | 166.68 |
| Class 5 Qualified Tradesman (B1 and B2) | 90.05 | 180.10 | 90.05 | 180.10 |
| Class 6 Qualified Tradesman (A) | 96.79 | 193.58 | 96.79 | 193.58 |

**Table -2.3.1 Minimum Wages Set By Common Rules**

4) Construction Materials

Construction materials manufactured in Papua New Guinea are aggregate, concrete blocks, wood, plywood, paints and PVC pipes. Other major construction materials such as cement, steel reinforcing bars, metal windows and doors are imported from foreign countries such as Australia, New Zealand, Japan, etc. The standards for manufactured goods are based mainly on Australian standards.

(4) Local Contractors

There are 4 local contractors in PNG capable of carrying out large scale construction projects, all of which have their head office in Australia or New Zealand. There are 10 local contractors capable of medium to small scale construction work. When these local contractors take on large scale construction works, they employ expatriate experts as required. Almost all construction companies and subcontractors employ Australian, New Zealand or Philippine nationals at the administrative and foreman level, under whom the local PNG people work as common laborers. The main contractors are listed below.

AUHARAI CONSTRUCTIONS PTY LTD.
BARCLAY BROS (PNG) PTY LTD.
CLOUGH NIUGINI PTY LTD.
* CURTAIN BROTHERS PAPUA NEW GUINEA PTY LTD.
* DOWNER CONSTRUCTION PNG PTY LTD.
* FLETCHER MOROBE CONSTRUCTION PTY LTD.
* HEBOU CONSTRUCTIONS (P.N.G.) PTY LTD.
PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY
SHORNLIFFE (PNG) PTY LTD.
SIGMA CONSTRUCTION PTY LTD.
STABILISERS NIUGINI PTY LTD.
STARWEST CONSTRUCTIONS PTY LTD.
UNITECH DEVELOPMENT & CONSULTANCY PTY LTD.
W.P. CONSTRUCTIONS PTY LTD.

Note) * indicate large contractors

(5) Implementing Agency and Maintenance • Administrative Ability

The implementing agency for this project is Papua New Guinea, Development of Transportation, Office of Civil Aviation (DOT. OCA). During the basic design and details design plan it is sufficient for the OCA staff to be the implementing agency.

At present the administrative personnel of Tokua Airport is the Airport Manager and several others. In the future when the project enters the construction phase, inevitably there will be need for liaison work with the Japanese construction group. Therefore with the present limited staff it will be impossible to carry out necessary construction supervision and it will be necessary to organize a new supervision system. From the point of maintenance and administration, the present Tokua airport operations lack air control facilities and pilots conduct radio transmissions between themselves for each landing and takeoff.

For this project, the item with highest priority among the requested items of the Government of Papua New Guinea is the procurement and emplacement of air navigation related facilities. Therefore it is requisite that the staff who will undertake these operations be trained before the project facilities are commissioned.

(6) Scope of Facilities and Equipment.

1) Scope
   1 Basic scope for facilities and equipment will be to allow unlimited operation of FK28-4000, the critical aircraft.
   2 Facilities used primarily by commercial enterprises such as airline companies shall not be within the scope of the project except for structurally integral parts of the terminal building.
   3 Since the Project is to be urgently implemented, facilities and equipment which exceed the scope originally provided at Rabaul Airport shall be carefully studied.
2) Grade
   Though the adoption of the international standards is the principle, the grade of facilities and equipment will be decided taking into account the fund ceiling and the existing standard in PNG. In the case of facilities and equipment already existing in PNG, the grade will be set to provide quality and functionability equivalent with the existing.

(7) Basic Construction

1) The construction period will be set to meet Japan's budgetary system.
2) The implementation schedule will be divided into stages so that construction is implemented smoothly.
3) The contents of works implemented in each stage will be described in detail in Chapter 3. A realistic schedule will be made for each work stage taking into consideration the rainy season and the status of transportation and labour, etc.

## 2. Basic Engineering Concept

In addition to the Physical factors mentioned in the preceding sector, the basic concept planning of overall layout considering airport functions shall be as follows;

### (1) Civil Engineering

1) The reference standards of basic facilities shall be the following ICAO standards ;
   a. ICAO Annex 14, Aerodrome
   b. Airport Design Manual Part 1, Runway
   c. Airport Design Manual Part 2, Apron and Holding Bay
2) The design will be basically an urgent development for improving safety of aircraft operations.
3) FK28-4000 shall be the standard type which will be the critical aircraft for the year 2003.
4) The Value derived from the demand forecast for determining the scale of facilities will be the values shown in section 2.2.(2).
5) The existing facilities will be utilized to the full extent, and the airport development will be implemented while maintaining airport operations.
6) The topographical configuration for the design will basically use the measured results described in "Master Plan and Feasibility Study for Tokua Airport, JICA in 1991". However, the latest conditions have been changed due to the development of the runway, the taxiway, the apron and the terminal area carried out under the Tokua Airport Temporary Development by the Government of PNG after the volcanic eruption at Rabaul in 1994. The original topographical maps will be partially modified based on our site survey and the data received from the Government of PNG.

Based on the basic concept mentioned above, the basic configuration of the main facilities and GSE lane will be as follows ;

1) Runway : Length : 1,720m, Width : 30m, Overlay by asphalt
   Shoulder : 7.5m on both sides of the runway (Light-load pavement)
   The orientation shall remain the same as existing.

2) Over-run : Length : 60m, Width : 30m, New pavement by asphalt
   Shoulder : 7.5m on both sides of the over-run (Light-load pavement)

3) Taxiway : Length : 222.5m, Width : 15m, Overlay by asphalt
   Shoulder : 7.5m on both sides of the taxiway (Light-load pavement)

4) Apron : Width : 350m, Depth : 85m, Overlay by asphalt
Shoulder : 5m on both sides of the apron (Light-load pavement)

5) GSE Lane : Length : 350m, Width : 20m in the Airport compound (Light-load pavement)

(2) Architecture

The design criteria for determining facility area, size and contents of each facility will be determined based on the following criteria ;

a. Total scope of the project will be determined based on similar projects in Japan, the facilities at the old Rabaul airport and the proposed facilities development ongoing at the Jackson Airport.
b. Architecture Design Reference Manual (Japan)
c. Architecture Outline (Japan)
d. Architecture Equipment Standards of PNG
e. Layout Drawings for Security and Safety Equipment
f. Air Traffic Law and Regulation (Japan)
g. Air Traffic Control Tower (Standards and Criteria of Japan and U.S.A.)

1) Design Concept

The following Design Concepts will be followed during the preparation of the basic design.

1 Special conditions of the proposed site such as climate, lifestyle, architectural style, security, etc., will be fully considered and incorporated into the design.

2 The basic design will utilize natural ventilation, natural lighting and sunshine with the intention of lowering maintenance and administrative costs.

3 Full consideration of the construction capabilities and the local labor conditions will be taken and the facilities will be designed for ease of construction and economy.

4 The passenger terminal building will be designed to reflect its role as the main gateway for the province of East New Britain. Other facilities will not be specially designed but will be designed to harmonize with the surroundings.

5 Facility layout, floor plan, structural design and building utilities will be designed taking into account for future expansion.

1)-1 Basic natural condition factors.

1 Mean temperature for the Rabaul project site is considered to be 28.4°C (Dec. 1994).

2 Maximum daily rainfall is 151.2mm (1993)

3 Mean humidity is 77% (Dec. 1994)

4 There are no typhoons in PNG. Wind velocity will be 2 ~ 9m/s for ventilation calculations.

5 The seismic zone designation is Zone 1 and the seismic co-efficient is 0.2.

6 The projected height of the control tower is over 20m, so the designs will require a lightning conductor.

Based on the above conditions, the project designs will follow the following guidelines.

a. Rooms facing to the north will be protected by overhanging eaves against the strong sun.
b. Rooms with machinery requiring protection and the office room will be air-conditioned. Other rooms will be provided with natural ventilation.
c. Due to the heavy rainfall, gutters and downspouts will be provided and the runoff guided to ground gutters.
d. The ground floor slabs of the administration office and control tower will be designed to be 1 m above the planned ground level.

1)-2 Basic policy for social conditions

1 As security is not good at the proposed project site, all glass windows on the ground floor will be equipped with steel grilles to prevent entry of unauthorized persons.

1)-3 Basic policy concerning by-laws and design standards

1 Design of architectural facilities will be based on the PNG Building Act and Regulations (Chapter 301).

2 As in Japan, it is required to gain approval of building plans and specifications from the relevant provincial building board, building plans, specifications, structural calculations and drawings and fire protection systems will be certified by a local architectural firm registered in PNG.

1)-4 Basic policy concerning natural conditions

1 Priority will be given to materials and equipment locally available for easy servicing and maintenance.

2 Taking into consideration the scarcity of skilled labor, construct methods requiring highly skilled labor will be avoided.

3 Technical guidance and instruction is a high priority and the Japanese construction staff will endeavor to accomplish technical transfer throughout the construction period.

2) Determination of Design Area

The design dimensions of Tokua airport will be calculated on the basis that there will be a maximum of 12 daily flights, using aircraft such as FK28-4000 (85 passengers), FK28-1000, etc., and that airport maintenance and administration personnel of 50 persons will be necessary by the year 2003.

The airport facilities will be as follows and compiled in Table 2.3.2.

Facilities

1 Passenger Terminal Building
Check-in lobby, departure lobby, arrival lobby, information counter, restaurant, baggage storage, airline office, check-in counter, toilets (6 rooms), VIP room, baggage claim area, departure baggage handling area (outdoors), arrival baggage handling area (outdoors)

2 Administration Office/Control Tower
Meeting room, manager office, assistant-manager/guest room, staff room, rest room, toilets (2 rooms), kitchen, AFTN system, meteorological room, power room, maintenance room, diesel engine generator room, equipment room and aerodrome control cabin.

3 C.F.R. and Workshop Building
Garage, maintenance bay, office room, tool storage, toilet-shower room, locker room, kitchen, battery charger room, watching room, lecture and training room

**Table 2.3.2 Facility Areas and General Description**

| Facility | Floor area ($m^2$) | | Description |
|---|---|---|---|
| 1) Passenger Terminal Bldg. | | 1,300.0 | Single story reinforced concrete |
| 2) Administration/Control Tower | 1F | 630.0 | Five story reinforced concrete |
| | 2F | 37.5 | |
| | 3F | 37.5 | |
| | 4F | 37.5 | |
| | 5F | 37.8 | |
| | Total | 780.3 | |
| 3) C.F.R. and Workshop Building | 1F | 403.2 | Two story reinforced concrete |
| | 2F | 59.0 | |
| | Total | 403.2 | |
| Total | | 2,542.5 | |

## 2-3-2 Basic Design

### 1.Facility Layout Plan

The major facilities in the Project are Airport Civil Facilities (runway, taxiway, apron, landing strip) ,Architectural facilities, and Operational Equipment Facilities. Futhermore, there are certain project components to be borne by PNG as mentioned in 4-2 hereafter. These consist mainly of internal roads and parking in the terminal area, and these are also considered in the facility layout plan.

(1) Basic conditions

General layout plan for all facilities of the project will consider the functional operation of the airport based on the following conditions;

1) This project will be an emergency development to upgrade airport operation safety.

2) The basic dimensions of the facilities will be based on the following International Civil Aviation Organization (ICAO) standards;

a) International Civil Aviation Treaty Appendix 14

b) Airport Design Manual Part 1 Runway

c) Airport Design Manual Part 2 Taxiway, Apron, and Holding Bay

3) The critical aircraft will be FK28-4000 as the largest operational aircraft for the target year 2003.

4) The demand forecast values for determination of facility scale will be the values described in 2-2 (2).

5 Existing facilities will be effectively utilized and maintained in operation during development

(2) Criteria on scale of facilities

1) Runway

The existing unpaved runway is 1,720m in length and 30m in width without shoulder.

Present maximum operational aircraft is FK28-1000. The specifications are shown in Table 2.3.3 comparing with FK28-4000 which will be the critical aircraft of the design.

**Table 2.3.3 Specifications of FK28**

| | | F28-1000 | F28-4000 |
|---|---|---|---|
| Maximum Take-off Weight | ton | 29.48 | 33.11 |
| Maximum Landing Weight | ton | 26.76 | 29.03 |
| Full Length | m | 27.40 | 29.61 |
| Full Width | m | 23.58 | 25.07 |
| Height | m | 8.35 | 8.60 |
| Wheel Base | m | 8.90 | 10.35 |
| Wheel Track | m | 5.04 | 5.04 |
| No. of Seat | | 60 | 85 |
| Code Number/ Letter | | 3B | 3C |
| Standard Length of Runway | m | 1,645 | 1,640 |
| Minimum Width of Runway | m | 30 | 30 |
| Minimum Width of Runway Shoulder | m | 3 | 3 |
| Minimum Width of Taxiway | m | 10.5 | 15 |
| Minimum Width of Taxiway Shoulder | m | 5 | 5 |

Both aircraft are basically the same kind of aircraft, and the necessary runway length is the same in spite of F28-4000 being slightly bigger. Therefore design runway length and width shall be the as the same as the existing runway. Turning pads will be designed as same as the existing which is 60m in length and 15m in width. Runway shoulders will be newly constructed with a width of 7.5m.

Runway orientation will remain the same as existing. The wind coverage for the present orientation is 98.8% for a cross wind limit of 15knots and 100% for a limit of 20knots.

2) Over run

No over-run presently exists. For safe operation, new over-run shall be constructed at both ends of the runway.

Over-run : length 60m, width 30m, width of shoulder 7.5m

3) Landing strip

Existing landing strip has a width of 90m. For the design, the landing strip will be for instrument landing (non-precision) following the adoption of instrument landing procedure (non-precision).

Landing strip: length 1,840m, width 150m

4) Taxiway

Existing taxiways are two unpaved access taxiways. For the design, the length of taxiway shall be suitable for a middle-class jet aircraft to be introduced in the future. The number of the taxiway designed will be one access taxiway due to the number of operations. The new taxiway will be overlapped on the existing west taxiway considering effective usage of the existing taxiway and proper positioning when the runway is extended to the west in future expansion.

Taxiway : length 222.5m, width 15m, width of shoulder 5m

5) Apron

The existing apron is 350m in width by 70m in depth and unpaved. It is used by F28-1000, small aircrafts and helicopters with roughly assigned position for each type. Following will be the design of the apron;

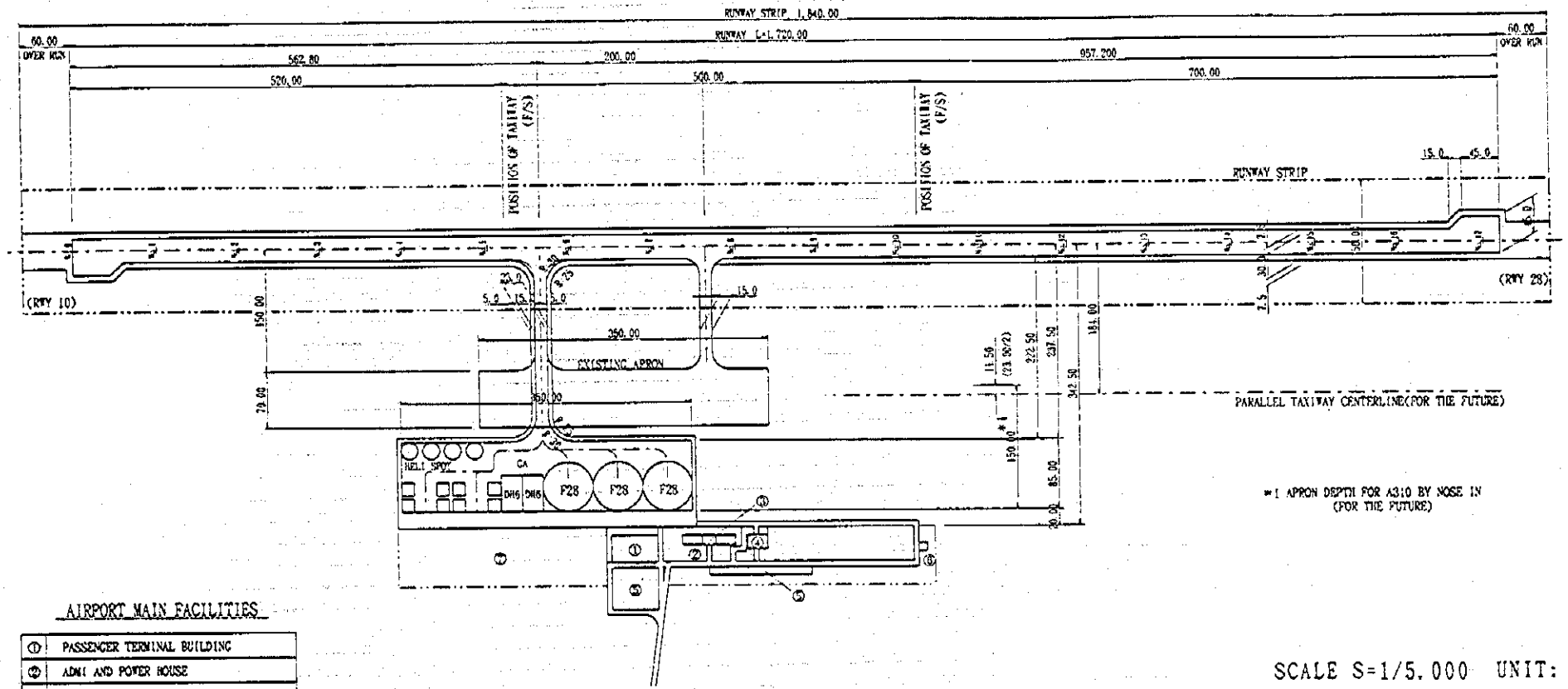
Apron width: 350m, depth 85m
Parking spot for F28: 3 (including one spare spot)
Parking spot for small aircraft: 10
Parking spot for helicopter: 4

Location of new apron will be laid out so as not to encroach upon the existing temporary terminal buildings.

6) GSE path

Between the apron and the terminal area, 20m width GSE path for GSE traffic and parking space will be newly constructed.

Overall facility layout is shown in Figure-2.3.1.



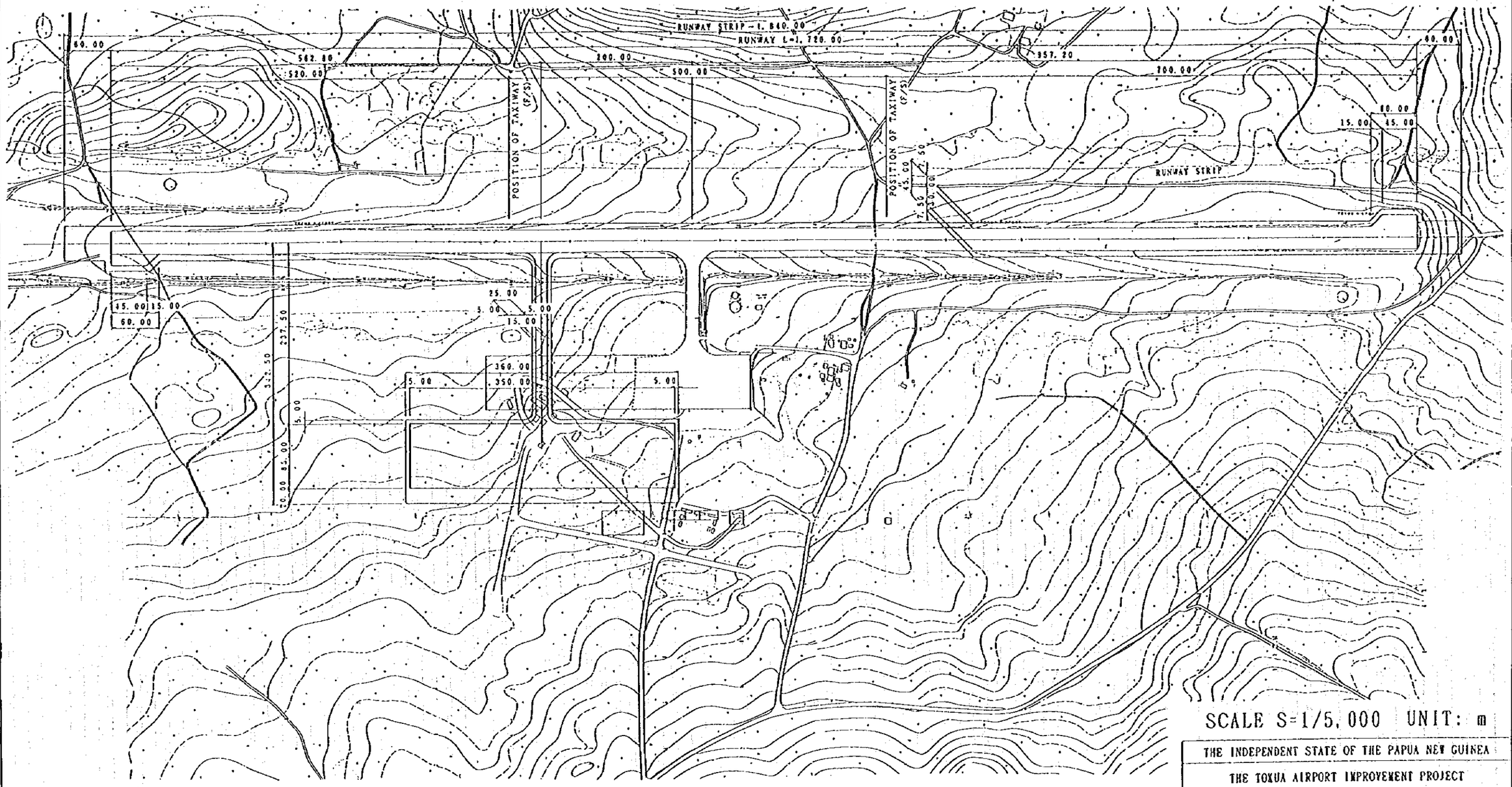

AIRPORT MAIN FACILITIES

| | |
|---|---|
| ① | PASSENGER TERMINAL BUILDING |
| ② | ADMI AND POWER HOUSE |
| ③ | CONTROL TOWER(ATC) |
| ④ | CFR BUILDING |
| ⑤ | CAR PARKING AREA |
| ⑥ | FUEL TANK |
| ⑦ | SERVICE AREA |

SCALE S=1/5,000 UNIT: m

| | |
|---|---|
| THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA | |
| THE TOKUA AIRPORT IMPROVEMENT PROJECT | |
| TITLE OF DRAWINGS: PLOT PLAN | |
| Date | Drawing No. |
| JAPAN INTERNATIONAL COOPERATION AGENCY<br>NIPPON KOEI Co., LTD. | |

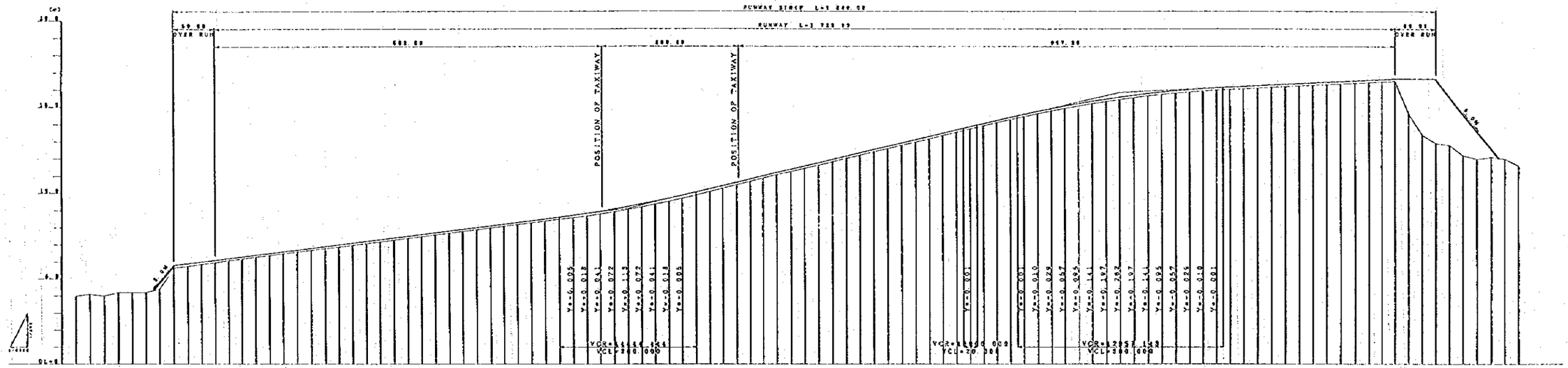
**Figure 2. 3. 2**




SCALE S=1/5,000 UNIT: m

| | |
|---|---|
| THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA | |
| THE TOKUA AIRPORT IMPROVEMENT PROJECT | |
| TITLE OF DRAWINGS | |
| PLAN | |
| Date | Drawing No |
| JAPAN INTERNATIONAL COOPERATION AGENCY<br>NIPPON KOEI Co., LTD. | |

**Figure 2. 3. 3**




UNIT: m

| | |
|---|---|
| THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA | |
| THE TOKUA AIRPORT IMPROVEMENT PROJECT | |
| TITLE OF DRAWINGS: LONGITUDINAL SECTION | |
| Date | Drawing No. 3 |
| JAPAN INTERNATIONAL COOPERATION AGENCY<br>NIPPON KOEI Co., LTD. | |

**Figure 2. 3. 4**

2. Civil Engineering

(1) Design of planning elevation

1) Runway and landing strip

The existing topographics in the Tokua airport is higher in the east (RWY 28), sloping gently lower to the west. The level on the runway is approximately 5m ~ 15m.See Figure-2.3.3. and Figure-2.3.4.

The present runway was overlaid with 30cm of coral materials in 1991. Further 17cm overlaying will be expected by the temporary pavement work loaned by World Bank. Considering these conditions, design work shall be carried out based on ICAO standards.

Transverse section is 1.5% gradient on the runway part and 2.5% gradient on the shoulder part. Overlaid level gaps of landing strip will be smoothed by maximum 5% transverse gradient. See Figure-2.3.5.

Overrun part of RWY 28 side shall be built up by compacted soil for several meters.

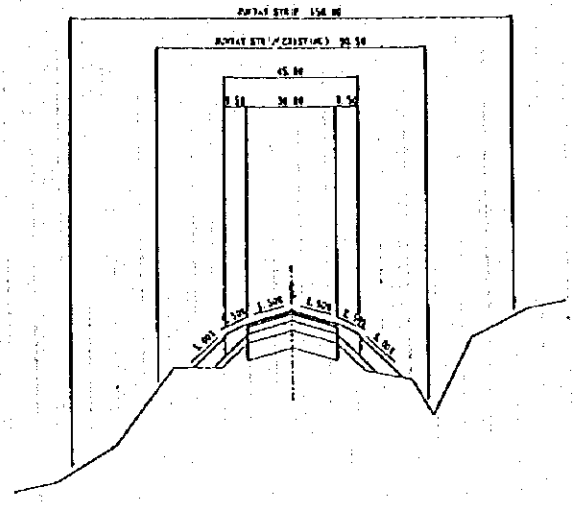


**Figure 2.3.5 Typical Cross Section, Runway**

2) Taxiway and apron

Planning height of the taxiway and apron will be the same as the existing height of taxiway and apron because the new taxiway is overlapped in plan on the existing taxiway. Also, since the new apron is located west of the existing terminal area, it will be necessary to design as equal as possible with the existing level in the terminal area. See Figure-2.3.6.

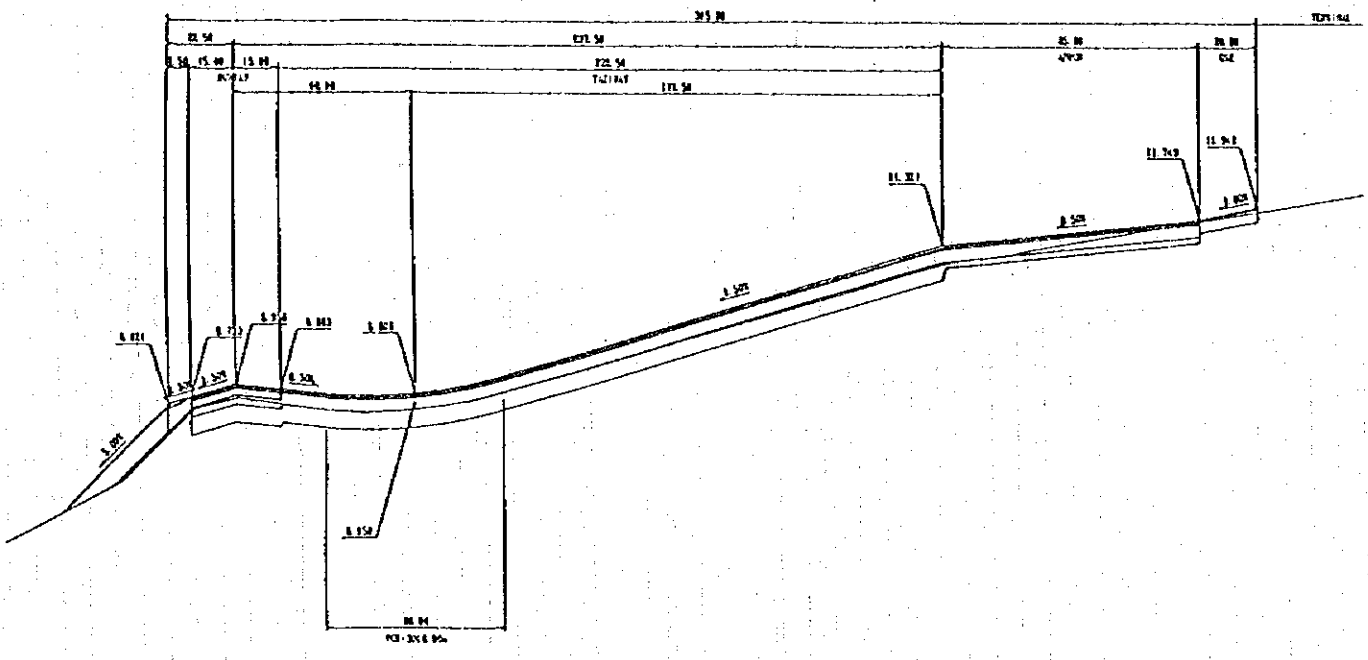


**Figure 2.3.6 Longitudinal Section, Taxiway & Apron**

(2) Drainage plan

Under this plan, the width of the landing strip will be increased from the present 90m to 150m for instrument landing (non-precision). The present landing strip has been leveled at 90m width with an open ditch gutter on its exterior. The drainage system for the airport using this gutter slopes to drain storm water out of the airport compound to the west. The maximum transverse gradient for the landing area is required to be less than 2.5%. To allow for the widening of the landing strip according to the improvement design, the present ditch should be filled in and leveled and a new gutter should be excavated on the outer side of the planned landing zone. Furthermore, following the moving of the drainage system, the present drains embedded under the existing taxiways must also be newly reinstalled.

This landscaping will require movement of several hundred thousand cubic meters of soil and also require a detail design that takes due consideration of the future expansion plans. Therefore, as this improvement plan is an emergency measure with limits to both construction time and money, large scale improvements including review of the drainage system will not be included in this project.

(3) Pavement plan

1) Existing pavement

The pavement included in this project includes the landing strip, taxiway and apron facilities. These existing pavements all consist of local coronous laid out about 30cm thick and rolled to compaction. Due to the physical characteristics of the coronous, it has a rather high compaction strength enabling take-off and landing of FK28. However, due to damage to the surface from repeated landings and take-offs and also because of loss of compaction strength caused by rainfall, immediate rehabilitation is required to insure aircraft safety.

2) Improvement method of pavement

The improvement method of the pavement consists of using the existing coral as the lower base course for the new pavement. The surface course can be either asphalt concrete or cement concrete, but considering the factors below, the use of asphalt concrete for all facilities has been decided.

a. There is no previous use of cement concrete pavement for airport facilities in PNG except for the capital Jackson airport apron pavement.

b. Construction time for cement concrete pavements is longer than that for asphalt concrete pavements. Furthermore, it requires more kinds of construction type using more kinds of construction equipment which, if assumed to be imported from a third country, are uneconomical.

c. In the future when medium size jet aircraft flights are inaugurated, the apron must be paved in cement concrete in order to avoid rutting. However, this project is designed to deal with FK28. The pavement thickness is correspondingly less and when it is required in the future to increase thickness, there will be technical difficulties in accomplishing this with a cement concrete pavement.

3) Pavement construction

Thickness of asphalt concrete pavement will be designed utilizing a flexible pavement design curve for the FK28 based on the US Corps of Engineer method.

a. Design Conditions

Design conditions for determination of pavement thickness are as follows;

(a) Design CBR

The native soil of the proposed facilities consists mainly of coronous according to a 1991 soil investigation. Although there are some discrepancies, a CBR of 10% or more can be expected.
Therefore, the design CBR is set at 10%.

(b) Design coverage

By setting daily traffic load at 12 flights per day and design life to be 5 years, design coverage can be calculated to be 3000 by the following formula.

$$n = 12_{\text{flights}} \times 365_{\text{days}} \times 5_{\text{years}} \times 4_{\text{wheels}} \times 0.03 = 2{,}628 \text{ coverages}$$
$$\rightarrow 3{,}000 \text{ coverages}$$

b. Flexible pavement design curve

Based on the following parameters the flexible pavement design curve for FK28-4000 can be calculated with the following formula. The results are shown in Table-1.3.7.

| | | |
|---|---|---|
| Type of aircraft | : | FK28-4000 |
| Maximum take-off mass (kgs) | : | 33,110 |
| Wheel layout | : | Tricycle dual wheel |
| Area of contact of one wheel ($cm^2$) | : | A = 1,073 |
| Radius of equivalent circle of tire contact area (cm) | : | r = 18.5 |
| Lateral distance between dual tire centers (cm) | : | S = 58 cm = 3.14r |
| Load on main gear (kgf) | : | 15,231 |

where ; t = Pavement thickness
A = Area of contact of one wheel
p = Contact pressure

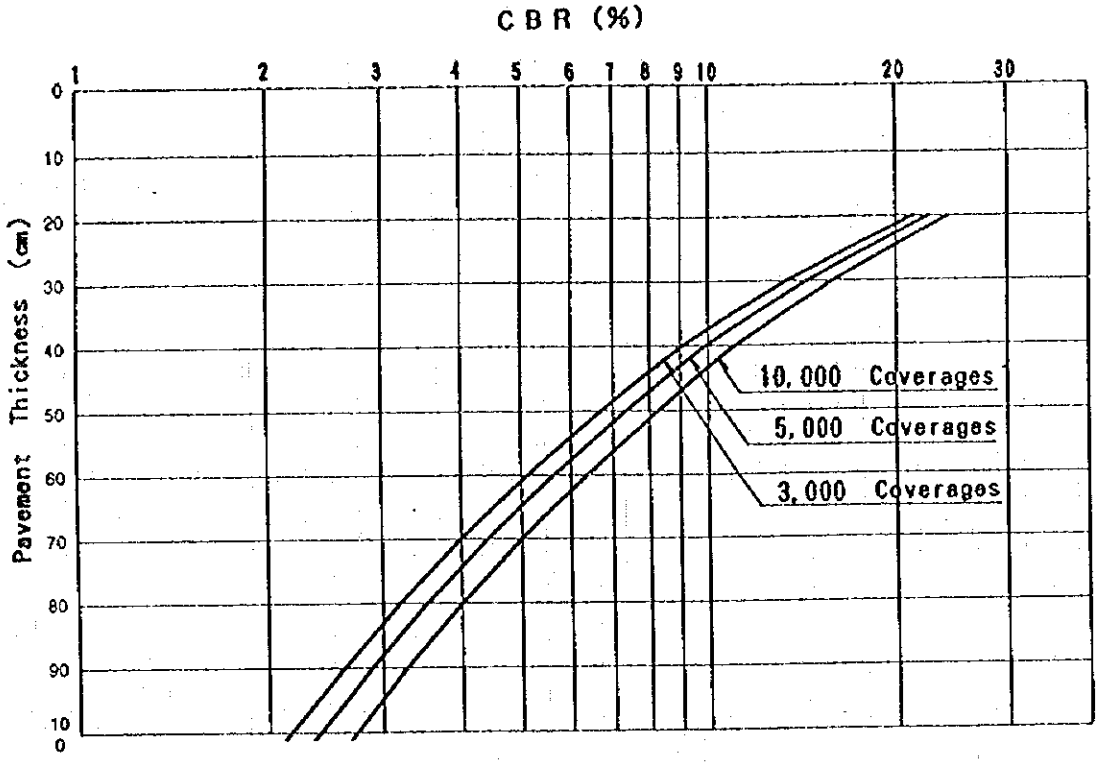



**Figure 1.3.7 Flexible Pavement Design Curve**

c. Pavement Design Profiles

From the flexible pavement design curve the value for t = 38 cm is derived. Based on this thickness, the design profile of the new pavement is set out below.

| | | |
|---|---|---|
| Surface course | $t_1$ = | 4 cm |
| Binder course | $t_2$ = | 4 cm |
| Upper base course | $t_3$ = | 20 cm |
| Lower base course | $t_4$ = | 10 cm |

($t_4 = t - (t_1 + t_2 + t_3) = 8$ cm but will be evened out to 10 cm as minimum construction thickness).

For the landing strip there is a projected chip-seal surfacing slated under the World Bank loans on the top of the existing 30cm coronous course. Therefore, the top layers are designed to be 8cm thick. However, laying the top course directly on the chip-seal layer will cause levelness problems. Therefore, a bituminous stabilization course 4cm thick will be provided over the chip-seal course as a leveling course.

For the taxiways, the existing coronous course 30cm thick will be considered as the lower base course and the courses above the upper base course will be constructed under this project.

d. Shoulder pavement

The thickness of shoulder pavement is 50% of standard thickness, which will require t = 19cm. Normally, the surface course will be 5cm with the remaining 14cm as base course for shoulder pavement. However, considering future expansion of the landing strip to 45m width, a base course 20cm thick will be provided. The surface course will be considered to be surface treatment only and a chip seal course 17mm thick only will be provided.

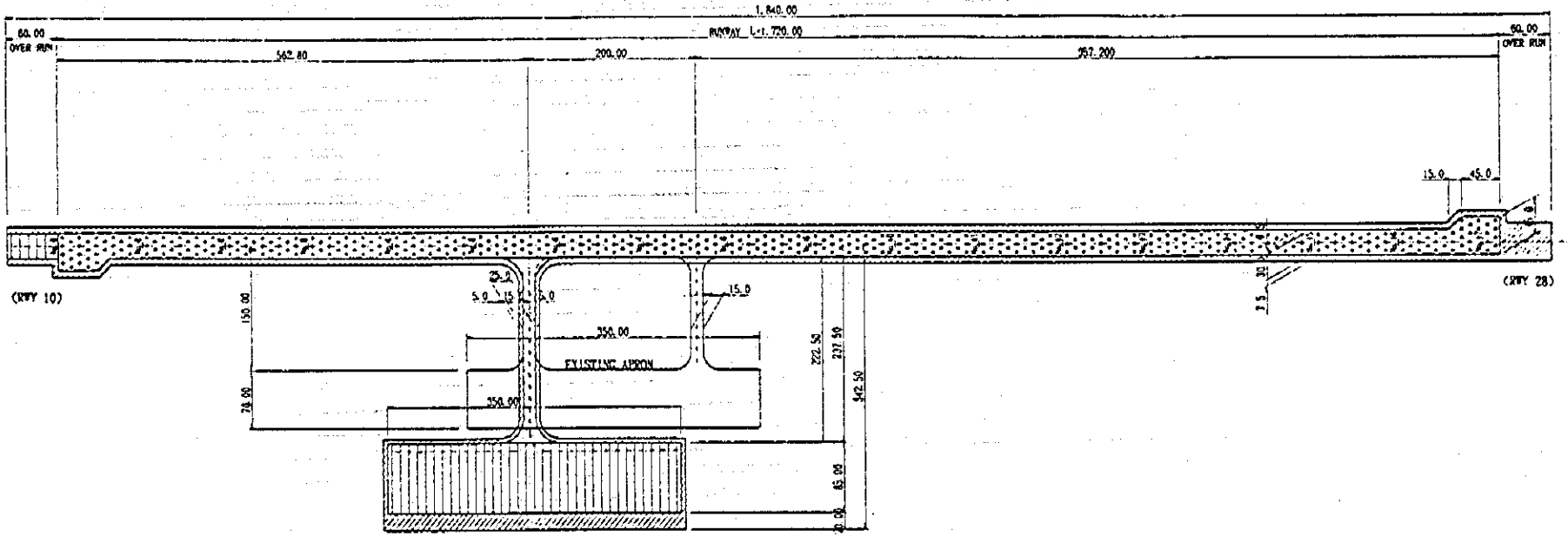
The above design profiles are shown in Figure-2.3.8 to Figure-2.3.9.

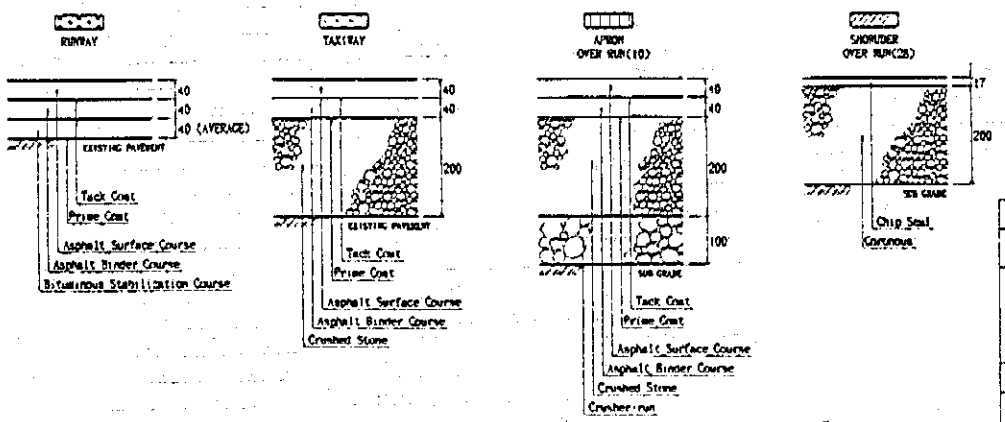
(4) Pavement Markings Design

Pavement Markings as shown in Figure-2.3.10 will be provided as required by the aircraft operation.

# CIVIL PROJECT LIST

| FACILITIES | SCALE | AREA | CONSTRUCTION ITEMS | REMARKS |
|---|---|---|---|---|
| 1 RUNWAY | | | | |
| 1) Runway | Length 1,720 m, Width 30 m | 53,175 m² | Asphalt pavement | Inlcude turning pads |
| | | | Surface course: 4 cm, Binder course: 4 cm, Leveling course: Average 4 cm | Use bituminous stablization for leveling course |
| 2) Over Run | Length 60 m, Width 30 m | 3,600 m² | Asphalt pavement and bituminous surfacing | |
| | RWY 10 and RWY 28 | | RWY 10 Surface course: 4 cm, Binder course: 4 cm, Base course: 20 cm, Sub base: 10 cm | Use gravel or crushed stone for base course and sub base |
| | | | RWY 28 Chip seal: 1.7 cm, Base course: 20 cm | Use coronous for base course |
| 3) Shoulder | Width 7.5 m | 27,356 m² | Bituminous surfacing | |
| | | | Chip seal: 1.7 cm, Base course: 20 cm | Use coronous for base course |
| 4) Ramway Markings | | 1 lot | Runway centerline marking, Runway side strip marking, Fixed distance marking, | |
| | | | Touchdown zone marking, Designation marking, Runway threshold marking, | |
| | | | Runway middle marking, Over run marking | |
| | | | | |
| 2 TAXIWAY | | | | |
| 1) Taxiway | Length 222.5 m, Width 15 m | 4,110 m² | Asphalt pavement | |
| | | | Surface course: 4 cm, Binder course: 4 cm, Base course: 20 cm | Use gravel or crushed stone for base course |
| 2) Shoulder | Width 5 m | 2,614 m² | Bituminous surfacing | |
| | | | Chip seal: 1.7 cm, Base course: 20 cm | Use coronous for base course |
| 3) Taxiway Markings | | 1 lot | Taxiway centerline marking, Taxiway side strip marking, Taxiway holding position marking | |
| | | | | |
| 3 APRON | | | | |
| 1) Apron | Depth 85 m, Width 350 m | 29,750 m² | Asphalt pavement | |
| | Numbers of Parking Spot F28: 3, DH6: 2, GA: 8 | | Surface course: 4 cm, Binder course: 4 cm, Base course: 20 cm, Sub base: 10 cm | |
| | Hilcopter: 4 | | | |
| 2) Shoulder | Width 5 m | 2,275 m² | | |
| 3) GSE Road | Width 20 m | 7,200 m² | Bituminous surfacing | |
| | | | Surface course: 1.7 cm, Base course: 20 cm | Use coronous for base course |
| 4) Apron Markings | | | | Obligation of PNG Government and airlines |
| | | | | |
| 4 GRADING WORK | | | | |
| 1) Beside Runway | Fill | 1 lot | | |
| 2) Over Run | Fill | 1 lot | | |
| 3) Apron | Cut and Fill | 1 lot | | |
| 4) Area at VOR/DME | Cut | 1 lot | | |
| | | | | |
| 5 PLUMBING WORK | | 1 lot | Steel pipe plumbing for the cable with aeronautical ground light, power supply, | |
| | | | telephone and others | |
| | | | | |

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THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA

THE TOKUA AIRPORT IMPROVEMENT PROJECT

TITLE OF DRAWINGS

PAVEMENT PLAN

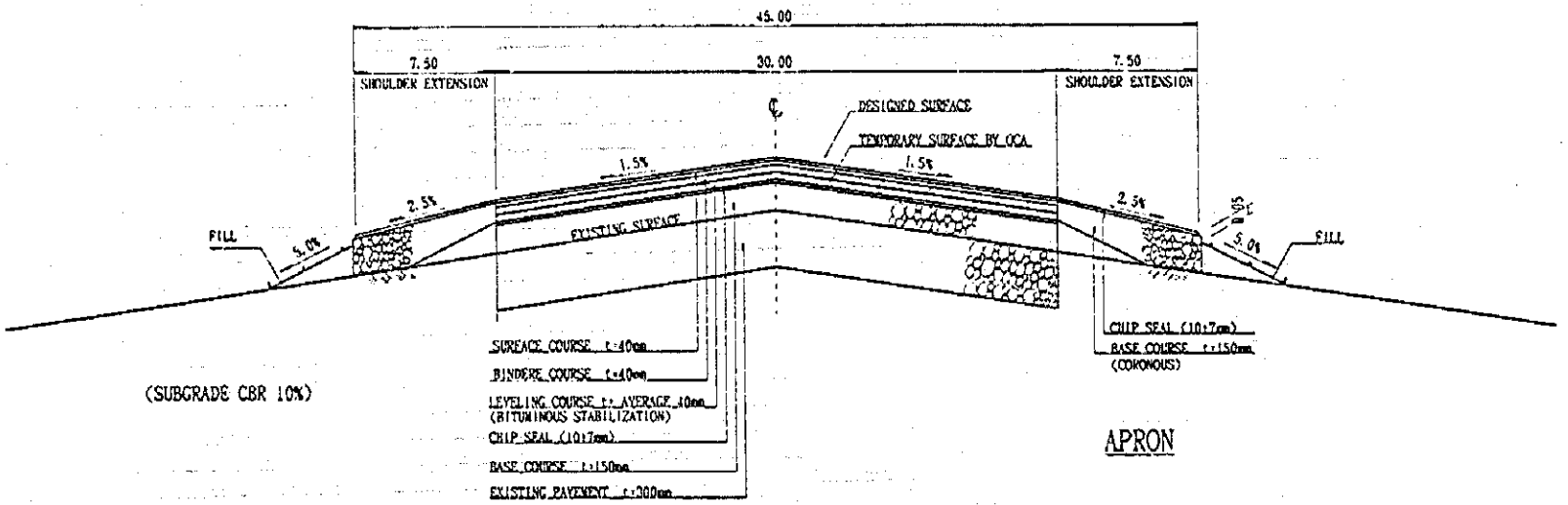
Date | Drawing No

JAPAN INTERNATIONAL COOPERATION AGENCY

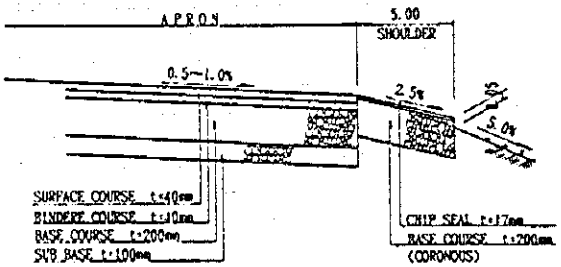
NIPPON KOEI Co., LTD.

**Figure 2. 3. 8**

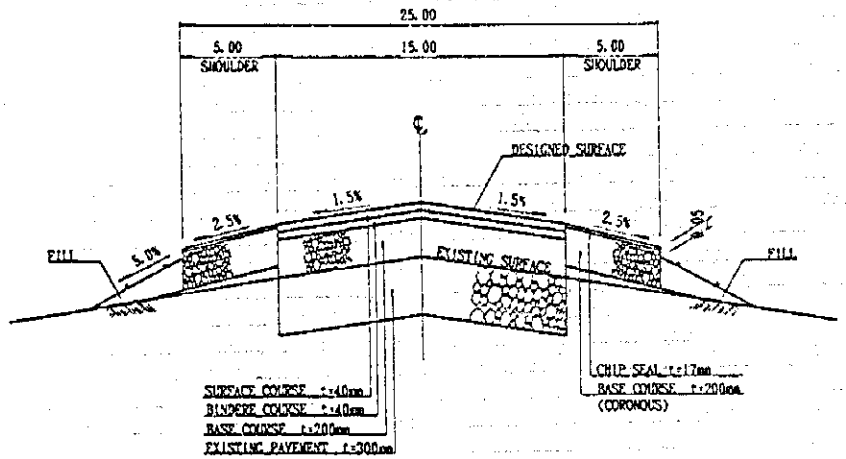
## RUNWAY




## APRON




## TAXIWAY

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| THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA | |
| THE TOKUA AIRPORT IMPROVEMENT PROJECT | |
| TITLE OF DRAWINGS: PAVEMENT TYPICAL CROSS-SECTION | |
| Date | Drawing No. 6 |
| JAPAN INTERNATIONAL COOPERATION AGENCY<br>NIPPON KOEI Co., LTD. | |

**Figure 2. 3. 9**

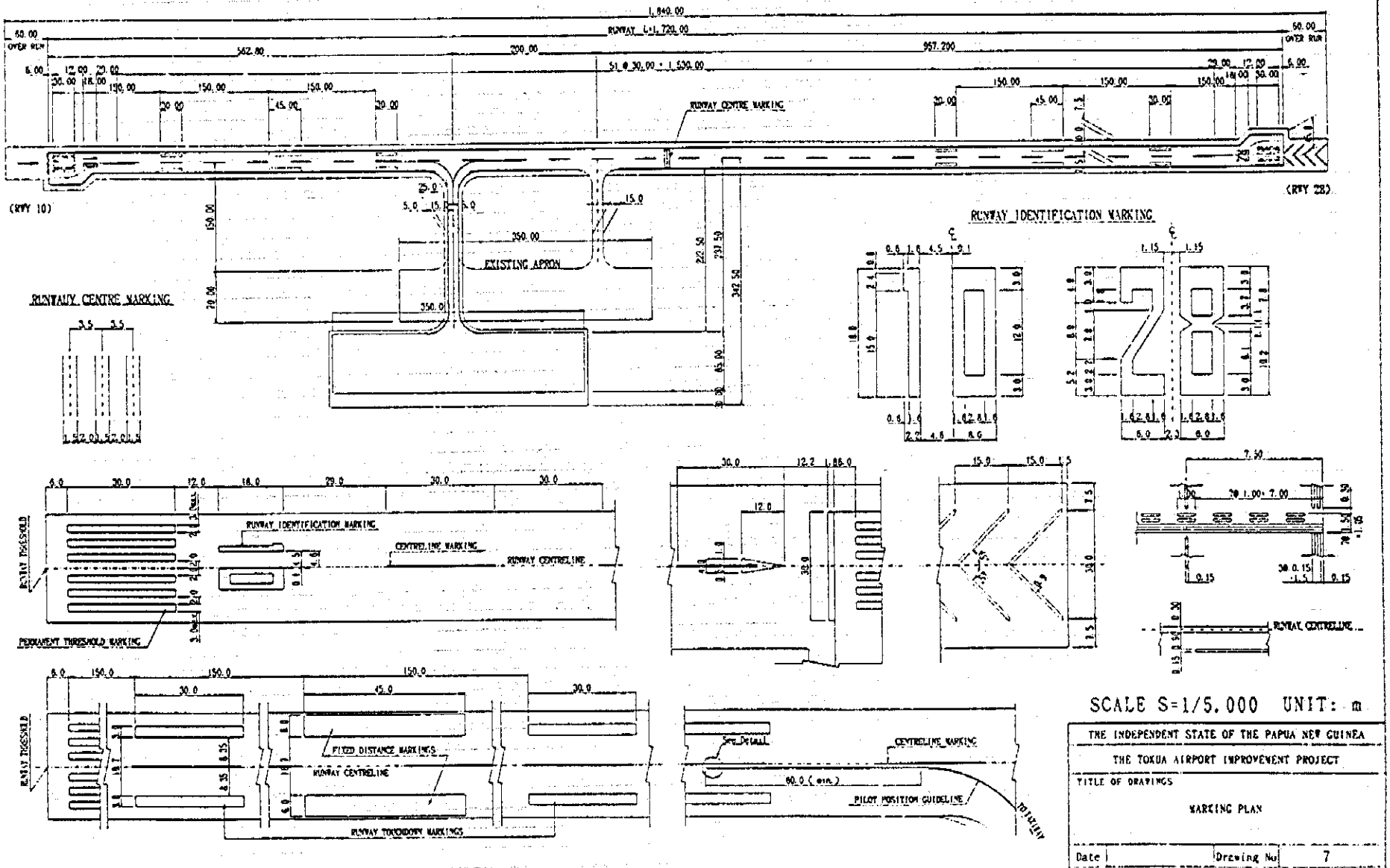

RUNWAY CENTRE MARKING
RUNWAY IDENTIFICATION MARKING
EXISTING APRON
RUNWAY IDENTIFICATION MARKING
CENTRELINE MARKING
RUNWAY CENTRELINE
PERMANENT THRESHOLD MARKING
FIXED DISTANCE MARKING
RUNWAY TOUCHDOWN MARKING
PILOT POSITION GUIDELINE
SCALE S=1/5,000 UNIT: m
THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA
THE TOKUA AIRPORT IMPROVEMENT PROJECT
TITLE OF DRAWINGS
MARKING PLAN
Date
Drawing No 7
JAPAN INTERNATIONAL COOPERATION AGENCY
NIPPON KOEI Co., LTD.

**Figure 2. 3. 10**

3. Architecture

(1) Architectural Facilities Layout Plan

Facility layout will be planned as below taking into consideration the approach road to the present Tokua Airport, placement of the aircraft apron area, site access routes and the function of each facility.

1) The passenger terminal building will be located nearest the approach road and apron area. For the benefit of facility users, a parking space will be arranged in front of the building. Furthermore, in consideration for ease of enlargement of the terminal building to meet future increase in passenger demand, the area to the west of the facility will be reserved as an open area and be used for the time being as a service area private commercial use.

2) Administration/Control Tower

The Control Tower must be able to command a good view of the surface movement area as well as aircraft movement in the air. As the administration office should be near the passenger terminal and also be located centrally among the various facilities, it shall be placed next to the passenger terminal.

3) C.F.R. and Workshop Building

It should be located nearest the aircraft apron and landing strip, so as to meet the requirement that response time for aircraft accidents and incidents is 2 minutes, and does not exceed 3 minutes to the ends of runways in optimum conditions of visibility and surface conditions. However, considering higher level priorities of the various buildings, it will be placed next to the Administration/Control Tower.

Furthermore, the spacing between various facilities will take into account future expansion needs and be laid out accordingly.

(2) Facility Planning

1) Layout Plan

a. Plan

a) Passenger Terminal Building

Determination of the required scale of the terminal will be based on the following guidelines;

- Spaces where passengers will accumulate will be estimated based on peak hour passengers and processing time.
- Baggage claim, security check area and baggage handling areas will be determined by setting out required dimensions of equipment.
- Offices and VIP room will be determined by referring to other airports of similar capacity.
- Concession areas, common areas and other spaces will be determined by proportional ratio to total area of facilities.

The basic data will be adapted from those described in Chapter 1.

b) Determination of Peak Hour Passengers

When normally determining peak hour passenger numbers, observed data such as peak hour ratio, etc. are used in the calculations. However due to the closure of scheduled flights to Rabaul airport, the required operational data are not available. Moreover, due to the improvised operations now being carried out, it is difficult to estimate reliable data for the calculations.
Therefore the peak loads were estimated from the present operating schedule. According to the present flight schedule, two FK28, the largest planned aircraft, utilize Tokua airport between 12:00 to 13:00 on Saturdays.

Considering the present aircraft fleet of PNG domestic airlines and the intention of the authorities to inaugurate FK28-4000 aircraft and the premise that there is a high possibility that the present flight schedule will be continued after the airport improvement, the peak hour passenger load should considered to be as follows,

| | |
|---|---|
| FK28-4000 | 85 passengers capacity |
| FK28-1000 | 60 passengers capacity |
| Total two aircrafts | 145 passenger/hour |

However, there is some uncertainty due to the presence of other smaller aircraft and transit passengers, which have been assumed to be included in the load factor calculation.

Following the above considerations, it will be determined that the peak handling capacity of the passengers terminal and other facilities should be as follows.

145 p/hour x 70% x 2 (arrival + departure ) ≒ 204 passengers

For reference, the estimated peak hour passengers based on peak hour ratio for the year 2003 is as follows.

a) Estimated annual passenger for 2003 167,000 passengers
b) Peak day passenger 618 p. (167,000 p. x 1/270 *1)
c) Passenger carrying ratio for largest aircraft (FK28)

$$\frac{12 \text{ flights} \times 60 \text{ p.}}{12 \text{ flights} \times 60 \text{ p} + 30 \text{ flights} \times 10 \text{ p.}^{*2}} = 0.7$$

therefore, the peak day passengers carried by FK28 is,

618 p. x 0.7 = 432 passengers

Furthermore, the peak hour ratio for FK28 aircraft can be set at 0.33 (4 flights out of 12 scheduled flights. 12÷4=0.33 ).
From this it is calculated that the peak hour passengers using the FK28 is 142 passengers (432 p x 0.33).
Since this number is 70% of total passengers,
peak hour passengers are 202 p. (142 p. / 0.7).

Notes *1. Peak day ratio for year 2000 A.D (from Tokua Airport Feasibility study Report prepared by JICA)
*2. Average seating capacity for small aircraft other than FK28.

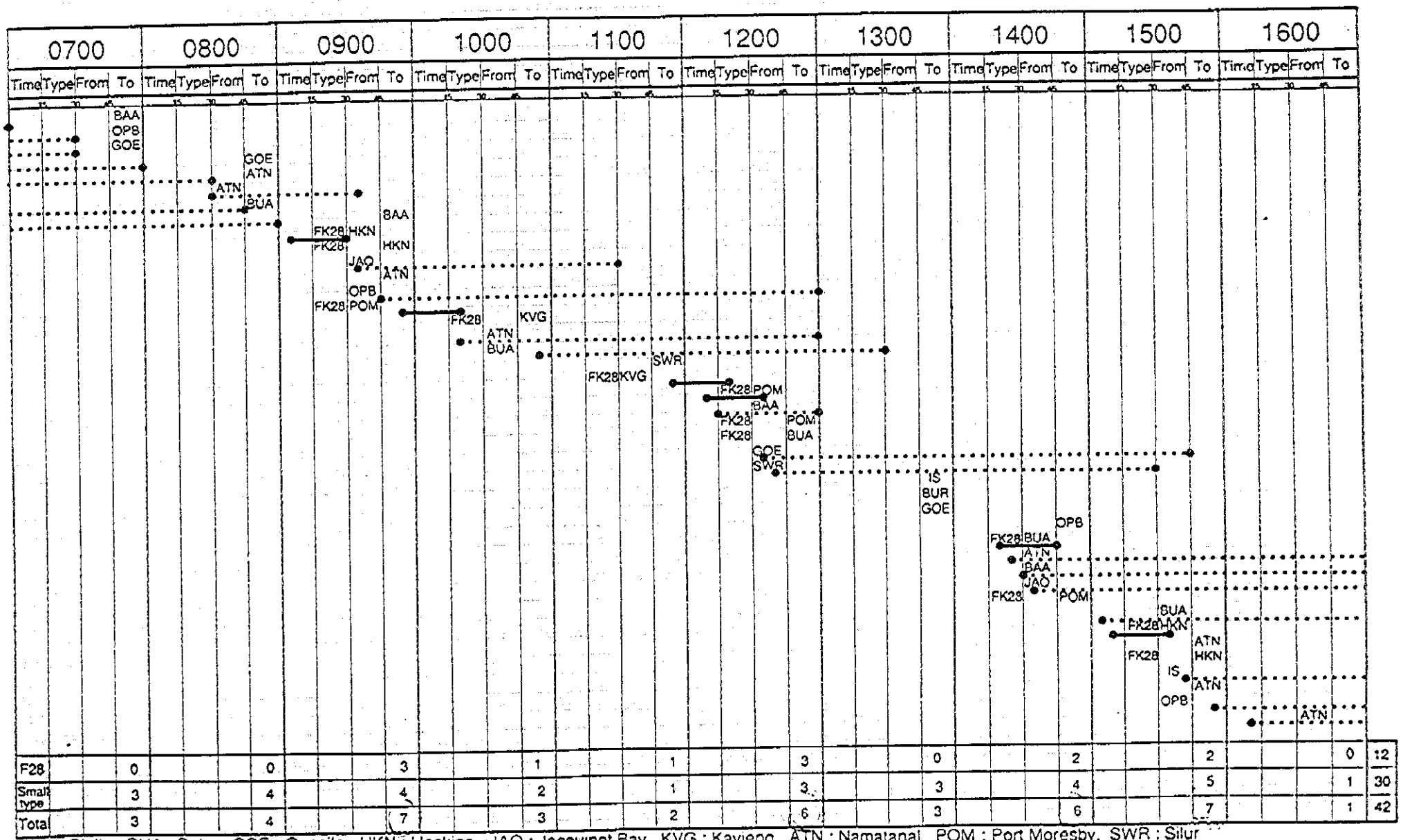
c) Passenger Terminal Building Allocation of Space
The summary table for allocation of space according to usage based on calculations, etc. are given below;

| Use | Estimated floor area ($m^2$) | Area ratio (%) | Planned floor area ($m^2$) | Notes |
|---|---|---|---|---|
| Check-in counter | 26 | 2.2 | 35 | 10.4m |
| Check-in lobby | 83 | 6.9 | 105 | |
| Departure lobby | 110 | 9.1 | 21 | |
| Holding lounge | 122 | 10.0 | 232.5 | |
| Baggage claim area | 180 | 12.6 | 180 | |
| Arrival lobby | 47 | 3.9 | 60 | |
| Air line offices | 133 | 9.3 | 140.3 | |
| Administration office | 49 | 3.4 | 52 | |
| VIP room | 30 | 2.1 | 37.5 | |
| Departure baggage handling area | 56 | 3.9 | (outdoor) | |
| Arrival baggage handling area | 56 | 3.9 | (outdoor) | |
| Total | 892 | 70.0 | 1,052.3 | |
| Concession areas | 127 | 10.0 | 127.9 | |
| Common, equipment room | 255 | 20.0 | 119.8 | |
| Grand Total | 1,274 | 100.0 | 1,300 | |

Notes) baggage claim area = handing over of baggage
concessions area = restaurants, cafeteria, shops, information, etc.
common, equipment room = toilets, corridors, etc.

# AIR TRAFFIC QUANTITY FOR EACH HOURS ON SATURDAY

Note: ●——● :FK28
●·····● :Small air craft




BAA : Bialla, BUA : Buka, GOE : Gonaile, HKN : Hoskins, JAQ : Jacquinot Bay, KVG : Kavieng, ATN : Namatanai, POM : Port Moresby, SWR : Silur

d) Calculations for Estimation of Passenger Terminal Building Areas

- Ticket Counter

  d)-1 Ticket Sales - Reservations Counter

  - unit nos. = Peak Hour Departure Passengers (102 p.) x peak factor (0.9) x sales ratio (0.3) x time per sales (1.5min.) ÷ peak passenger time (40min.) = 1.03 → 1
  - counter length = unit nos. (2) x 1.8m/unit = 3.6m

  d)-2 Check-in Counter

  - unit nos. = seat nos. per flight (85 seats) x load factor (80%) x peak factor (0.9) x handling time per person (0.34min.) ÷ passenger peak time (40min.) = 0.52 → 1
  - counter length = unit nos. (1) x peak departure flight nos. (2) x 1.2m/unit = 2.4m

  d)-3 Baggage Counter

  - unit nos. = peak hour passengers (102) x peak factor (0.9) x receiving ratio (0.8) x handling time (0.5 min.) ÷ passenger peak time (40 min.)= 0.918 → 1
  - counter length = unit nos. (1) x 2.0m/unit = 2.0m

  d)-4 Information Counter

  - unit nos. = ( d)-1+d)-2+d)-3 ) x 20% = 1.6 → 2
  - counter length = unit nos. (2) x 1.2m/unit = 2.4m

  d)-5 Total Counter Length, Area

  - total counter length = d)-1+d)-2+d)-3+d)-4 = 10.4m
  - counter length = total counter length (10.4) x 3.0m = 31m$^2$

- Check-in Lobby
  - lobby area = peak hour passengers (102) x (1+ well wisher ratio 0.3) x average stay time (15/60) x area per person (2.5 m$^2$/p) ≒ 83m$^2$

- Departure Lobby
  - lobby area = peak hour passengers (102) x (1+ well-wisher ratio 0.3) x average hold time (20/60) x area per person (2.5 m$^2$/p) ≒ 110 m$^2$

- Security Area
  - gate nos. = peak hour passengers (102) x average check time (0.1/60) = 0.17 → 1
  - floor area = gate nos. (1) x 35 m$^2$/gate (cf.fig. ) = 35 m$^2$

- Holding Lounge
  - holding lounge area = peak hour passengers (102) x average hold time (40/60) x {standing ratio (25%) x standing space ($1m^2/p$) + seating ratio (75%) x seat space ($1.5m^2/p$)} x auxiliary space ratio (1.3) $\fallingdotseq 122m^2$

- Baggage Claim Area
  - belt conveyer nos. = peak flight arrival nos. (2) x processing time per flight (20 min.) x 1/60 min.= $0.6 \rightarrow 1$
  - floor area = belt conveyer nos. (1) x space per unit ($180m^2$) = $180m^2$

- Arrival Lobby
  - lobby area = peak hour passengers (102p) x average hold time (5/60) x space per person ($2.5m^2/p$) + peak hour passengers (102p) x well-wisher ratio (0.3) x average hold time (20/60) x space per person ($2.5m^2/p$) $\fallingdotseq 47m^2$

- Airline Offices (based on comparison with airport of similar capacity)
  - floor area = estimated workers (7p) x space per person ($7m^2/p$) x nos. of company(1) + estimated workers (4p) x space per person ($7m^2/p$) x nos. of companies (3) = $133m^2$

- Administration Office (based on comparison with airport of similar capacity)
  - floor area = estimated workers (7p) x space per person ($7m^2/p$) = $49m^2$

- VIP Room (based on comparison with airport of similar capacity)
  -

- Departure Baggage Handling Area
  - floor area = departure baggage belt conveyor nos. (1) x $56m^2$ = $56m^2$

- Arrival Baggage Handling Area
  - floor area = arrival baggage belt conveyor nos. (1) x $56m^2$ = $56\ m^2$

- Concessions Area
  - 10% of total floor area

- Common, Equipment Room
  - 20% of total floor area

# ARCHITECTURE PROJECT LIST (1)

| BUILDING AND ROOM'S NAME | SCALE | FUNCTION AND PURPOSE | PLANNED PERSON'S NUMBER | FACILITIES | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CLOCK | TEL. | FAX. | AIRCON. | CEILING FAN | VENTI. | PLUM. | |
| 1 PASSENGER TERMINAL BUILDING | | | | | | | | | | | |
| Check-in Counter | 35.00 | Check-in space for four (4) Airline co.. | 42 persons (2.5 m²/) | | 2 | | | ○ | | | Weight counter provided by Airline co.. |
| Check-in Lobby | 105.00 | Ditto | 84 persons (2.5 m²/) | 1 | 1 | 4 | | ○ | | | incl. fixed chairs |
| Departure Lobby | 210.00 | Passenger waiting space | 24 persons (2.5 m²/) | 1 | 1 | | | ○ | | | |
| Arrival Lobby | 60.00 | Ditto | | 1 | 2 | | | ○ | | | |
| Restaurant (1), (2) | 69.80 | Snack and kiosk | | | 2 | | | | ○ | ○ | Counter construction shall include this project. Tenant scope is interior finishing works and kitchen set installation. shelf |
| Baggage Storage | 26.30 | Holding baggage space | | | | | | | ○ | | |
| Air-line Office (1), (2), (3), (4) | 140.30 | Four (4) private Airline co., space | 20 persons (7 m²/) | | 10 | 8 | ○ | | | | Airline co., scope is interior finishing works and kitchen set installation. |
| Information Counter | 19.50 | Reservation hotel, taxi and rental car | | | 2 | 2 | | | | | incl. counter construction |
| Toilet (1) | 10.20 | For VIP, Airline co. and management staffs | | | | | | | ○ | ○ | Closet (1), urinal (2), sink (2) |
| Kitchen | 6.00 | For Airline co. and management staffs | | | | | | | ○ | ○ | Kitchen set, hanger shelf, hot plate |
| Toilet (2) | 10.20 | For VIP, Airline co. and management staffs | | | | | | | ○ | ○ | Closet (2), sink (2) |
| VIP Room | 37.00 | Waiting for VIP (Very Important Person) | 7 persons (7 m²/) | 1 | 1 | 1 | ○ | | | ○ | Counter construction shall include this project Tenant scope is interior finishing works and kitchen set installation. |
| Administration Office | 52.20 | Management staffs for Airport | 7 persons (7 m²/) | 1 | 2 | | ○ | | | | |
| Police Office | 12.30 | Guardman room for Airport especially | | | 1 | | ○ | | | | |
| Holding Lounge | 232.50 | Waiting space | 160~180 persons | 2 | 2 | | | ○ | | ○ | Counter construction and fixed chairs shall include this project. Tenant scope is interior finishing works and kitchen set installation. |
| Toilet (3) | 14.00 | For passenger | | | | | | | ○ | ○ | Closet (2), sink (3) |
| Toilet (4) | 14.00 | Ditto | | | | | | | ○ | ○ | Closet (2), urinal (2), sink (2) |
| Toilet (5) | 14.00 | Ditto | | | | | | | ○ | ○ | Closet (2), urinal (2), sink (2) |
| Toilet (6) | 14.00 | Ditto | | | | | | | ○ | ○ | Closet (2), sink (2) |
| Baggage Claim | 180.00 | Baggage reciving space | | 1 | 2 | | | ○ | | | |
| Corridor/Others | 37.70 | | | | | | | ○ | | | |
| Baggage Handling (Depa.) | – | | | | | | | | | | |
| Baggage Handling (Arrival) | – | | | | | | | | | | |
| Pedestrian Way | – | Walkway | | 2 | | | | | | | |
| Sub-Total | 1,300.00 | | | 10 | 28 | 15 | | | | | |
| | | | | | | | | | | | |
| 2 ADMINISTRATIVE OFFICE AND CONTROL TOWER | | | | | | | | | | | |
| 1F Meeting Room | 63.00 | For meeting | 50 persons (1.2 m²/) | 1 | 1 | | ○ | | | | |
| Manager Room | 27.00 | incl. meeting purpose | 1 person | 1 | 1 | 1 | ○ | | | | |
| Assistant Manager and Guest Room | 20.30 | Ditto | 1 person | 1 | 1 | 1 | ○ | | | | |
| Staff Room | 72.00 | Office work space | 10 persons (7 m²/) | | 1 | | ○ | | | | |
| Rest Room | 20.00 | Night stay possible | | | | | | ○ | | | |
| Toilet (M) | 12.00 | For staff | | | | | | | ○ | ○ | Closet (2), urinal (2), sink (2) |
| Kitchen | 5.00 | Ditto | | | | | | | ○ | ○ | kitchen set, hanger shelf, hot plate |
| Toilet (F) | 7.50 | Ditto | | | | | | | ○ | ○ | Closet (2), sink (2) |

# ARCHITECTURE PROJECT LIST (2)

| BUILDING AND ROOM'S NAME | SCALE | FUNCTION AND PURPOSE | PLANNED PERSON'S NUMBER | FACILITIES | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CLOCK | TEL. | FAX. | AIRCON. | CEILING FAN | VENTI. | PLUM. | |
| AFTN and Meteorological Room | 71.50 | For meteorological data and flight planning space | 3 persons | | 1 | 1 | O | | | | |
| Maintenance Room | 45.00 | For repairing equipments | | | | | | | O | | |
| Power Room | 204.80 | Low voltage transformer and power board space | | | 1 | | | | O | | |
| D.E.G. Room | 47.30 | Emergency diesel engine generator and power board space | | | 1 | | | | O | | |
| Staircase, Corridor | 34.60 | | | | | | | | O | | |
| 2F Equipment Room | 25.00 | For repairing equipments | | | 1 | | | | O | | |
| Staircase | 12.50 | | | | | | | | | | |
| 3F Equipment Room | 25.00 | Related flight communication equipments space | 2 persons | | 1 | | O | | | | |
| Staircase | 12.50 | | | | | | | | | | |
| 4F Rest Room | 25.00 | Relaxation for flight controller | | 1 | 1 | | O | | O | O | Closet (1), urinal (1) kitchen set, hanger shelf, hot plate |
| Staircase | 12.50 | | | | | | | | | | |
| 5F Control Cab | 37.80 | Flight control space | 3 persons | 1 | 2 | 2 | O | | O | | The floor shall make a double floor (H=300) for cabling and wiring, double glazing window Lighting shall be adjustable. |
| Sub-Total | 780.30 | | | 5 | 12 | 5 | | | | | |
| | | | | | | | | | | | |
| 3 C.F.R - WORKSHOP BUILDING | | | | | | | | | | | |
| 1F Garage - Maintenance Bay | 237.80 | Garage for a fire engine and equipment repairing space | | | 1 | | | O | | | Greasing pit |
| Office | 19.20 | General administration space | 4 persons (5 m²/) | 1 | 2 | 1 | O | | | O | |
| Workshop | 53.60 | Equipment repairing space | | | | | | | O | | Shelf |
| Tool Storage | 44.10 | | | | | | | | O | | Shelf |
| Battery Chager Room | 11.30 | Related battery charging space | | | | | | | O | | |
| Toilet - Shower Room | 9.60 | For staffs | | | | | | | O | O | Closet (1), urinal (2), sink (2), shower booth |
| Locker Room | 7.70 | Ditto | | | | | | | O | | |
| Kitchen | 9.60 | Ditto | | | | | | | O | O | Kitchen set, hanger shelf, hot plate |
| Staircase | 10.30 | | | | | | | | | | |
| 2F Watching Room | 19.20 | Observating runway in airport | 1 person | 1 | 2 | 1 | O | | | | |
| Lecture and Training Room | 29.50 | | 24 persons (1.2 m²/) | 1 | 1 | | O | | | | |
| Staircase | 10.30 | | | | | | | | | | |
| Sub-Total | 462.20 | | | 3 | 6 | 2 | | | | | |
| | | | | | | | | | | | |
| Total | 2,542.50 | | | 18 | 46 | 22 | | | | | |

Summary of space requirements for rooms and equipment for administration building/control tower, C.F.R./Workshop building are given in the following List (cf. Architecture Project List 1,2 ).

2) Elevation and Section Design

The facade and section of architectural facilities will be designed on the following guidelines.

(a) Columns, girders and floor slab will be made of reinforced concrete. Exterior fill-in walls and interior partitioning walls will be made of reinforced masonry.

(b) Roofs will have structural trusses either of steel or wood and finished externally with locally available profiled steel sheets. To protect against radiated heat, the underside of the roofs will be insulated.

(c) Large roof overhangs (minimum 1.5 m) will be provided as protection from the strong sun rays.

(d) Natural ventilation will be provided for rooms without air conditioning. This will be arranged by using openwork concrete block wainscoting along with adjustable jalousie windows for the upper window sashes.

3) Finishing Design

Exterior and interior finishing will be chosen based on cost, general use in public buildings in PNG and ease and cheapness of maintenance. The finish schedule will be designed based on the following list. However, the interior finishing of the airline offices and the restaurant in the passenger terminal building are not included in the scope of works.

| | | |
|---|---|---|
| Exterior finish: | Roof; | Profiled galvanized steel sheets |
| | Wall; | Paint finish on reinforced masonry |
| Interior finish: | Floor; | Vinyl floor sheeting on concrete slab on grade |
| | Wall; | Paint finish on reinforced masonry |
| | Ceiling; | Paint finish on gypsum board |

4) Structural Design

a. Foundation Design

Based on the Soil Investigation Report prepared by JICA 1991, foundation will all be independent direct footing type foundations. For economy, ground floor slabs will be slab on grade, but the upper 30 ~ 40cm of topsoil will be removed and replaced with good bearing soil. However, as the ground floor slab of the Administration Building/Control Tower is designed to be 1 m above planned ground level, it will be a suspended slab.

Allowable ground bearing weight is assumed to be fc = 15.0t/m$^2$ for the silty clay layer at GL - 2.0 ~ 2.5m.

b. Loading

Live load (to be used only for suspended slabs).

| Room | Live load (Kpa) |
|---|---|
| Office rooms | 3.0 |
| Storage rooms | 5.0 |
| Equipment and plant rooms | 5.0 |
| Roof | 0.25 |

c. Earthquake Loadings

Earthquake loading will be calculated from the following formula.

$$V = C \cdot I \cdot K \cdot W$$

where, V: total horizontal seismic base shear
C: base seismic coefficient
I: importance factor of building
K: structural type factor

The following numerical values will be used in the structural design for this project.

C = 0.2 (seismic zone 1)
I = 1.25 (public buildings)
K = 1.0 (simple frame type structure)
K = 2.0 (cantilevered column type structure).

d. Wind Loads

Wind velocity of 28 m/sec (50 year return period) will be adopted for wind load calculations.

e. Basic Structural Materials

| Material | Specifications |
|---|---|
| Concrete | Over 20 Mpa (28 day compression strength) |
| Concrete block | Over 12 Mpa ( same as above ) |
| Steel bars | |
| Round bars | type AS1310, material 230R |
| Deformed bars | type AS1302, material 410Y |
| Structural steel | type JIS G3101 or equivalent, material SS400 |

5) Building Facilities Design

Lighting, electric outlets, telephones, plumbing, kitchen equipment for restaurants, ventilation and air conditioning equipment for airline offices and restaurants in the passenger terminal are not included in the scope of this project.

a. Electrical Facilities

a-1 Electric Power Reception Equipment

High-tension (22kV) cable will be laid by Elcom up to the airport boundary. Connection by underground conduit and cable to the Administration Building/Control Tower will be included in the "Operational Equipment Works"

a-2 Emergency Diesel Generator Facilities

This equipment will be included in "Operational Equipment Works"

a-3 Electric Power Mains Facilities

The connection by underground conduits from the low-tension distribution panel in the Power Room to the distribution panels in each building will be included in the architectural works and the laying of cables will be included in "Operational Equipment Works".

a-4 Lighting and Outlet Facilities

Taking into consideration economy and ease of maintenance, lighting will use fluorescent lighting. Luminous intensity of major rooms is as follows;

| Room | Intensity (lx) |
|---|---|
| VFR room | 500 (adjustable) |
| Office rooms, meeting room, airport manager room, assistant airport manager/guest room, training/lecture room, watching room | 500 |
| Guardmen room, information area | 500 |
| VIP room, lobbies, holding lounge, baggage claim area, air traffic control equipment rooms, repair bay | 300 |
| Equipment rooms, battery charger room, storage rooms, tool storage | 200 |
| Toilets, restrooms, locker rooms, corridors, staircases | 150 |
| Pedestrian ways | 50 |

a-5 Telephone • Facsimile Facilities

PABX equipment installation, laying of cable and conduits up to PABX is to be done by the government of PNG. The PABX equipment will be placed in the administration office from where conduits will be laid to each building. Airline offices and restaurants will be equipped only with outlet boxes.

a-6 Public Announcement Facilities

The public announcement amplifier will be placed in the administration office in the passenger terminal. It will be equipped with three channels for departure, arrival and controlled area announcements. Outlets for airlines shall be equipped only with connection boxes.

a-7 Automatic Fire Warning System

Based on the Building Regulations of PNG, the proposed building areas are less than the minimum requiring automatic fire warning systems and are therefore not needed.

a-8 Grounding System for Parked Aircraft

4 sets of grounding system for parked aircraft will be provided in the apron area.

b. Plumbing Facilities

b-1 Water Supply System

The provision of a water supply source with sufficient quantity and pressure to meet all the needs for potable, sanitary and fire extinguishing system of the airport facilities will be provided by the government of PNG up to the boundary line of the airport. From this point the water will be distributed to all toilets, kitchen and other places requiring water under the scope of this project. However, water supply for restaurants will be only to valve set in the floor of the area.

b-2 Hot Water Supply System

Ordinary toilets will not be provided which hot water.

b-3 Waste Water Discharge System

Waste water and soil water discharged from each facility will be received by a septic tank built in the airport area where it will be treated. The treated water will be discharged into a seepage tank and allowed to spread into the ground.

b-4 Rain Water Discharge System

Buildings will be provided with roof gutters, standpipes, etc. which will route the rain water discharge into gutters around each building. The gutters will connect to a gutter main which will discharge the water off site.

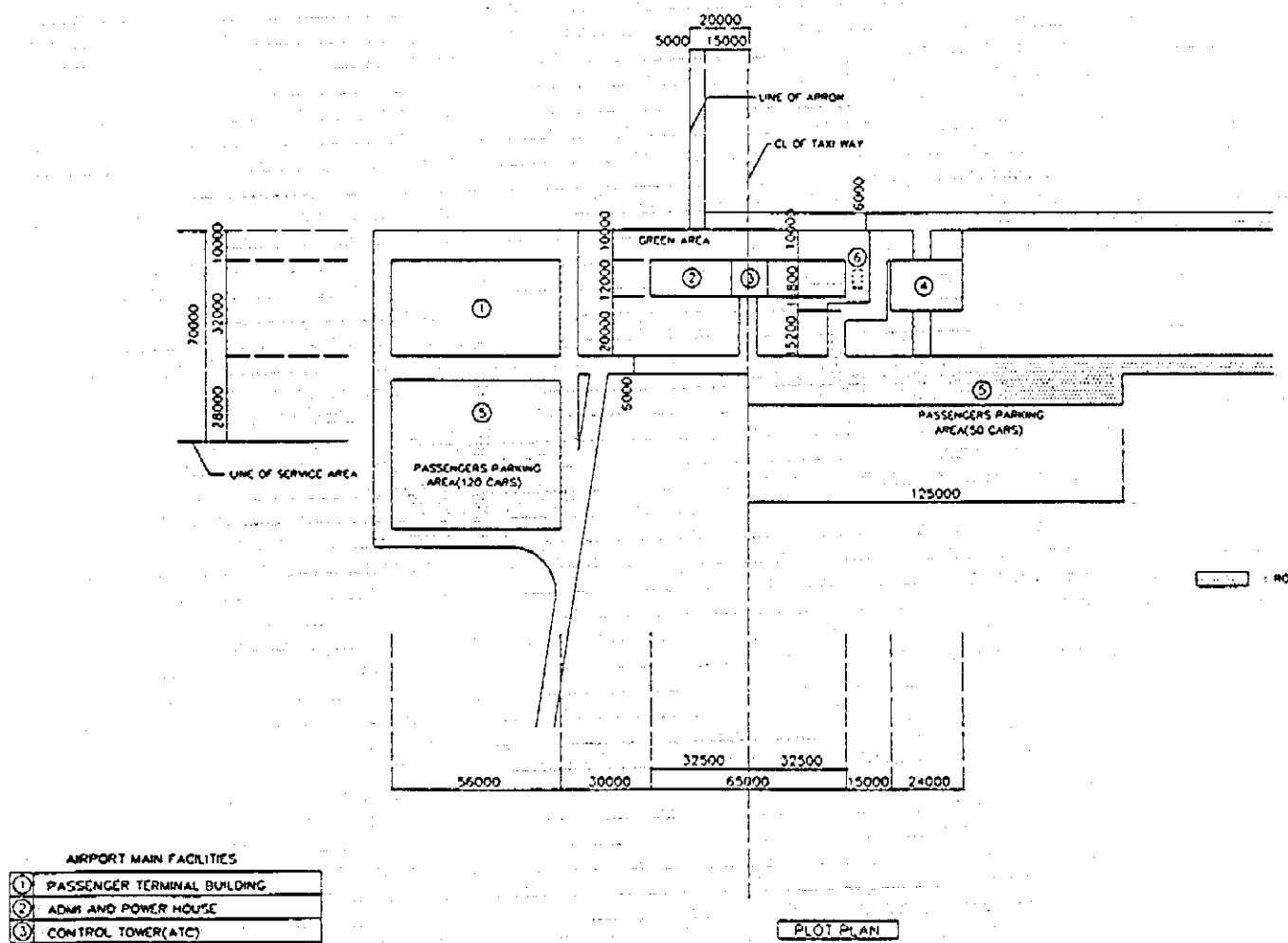
b-5 Fire Extinguishing System

Fire hose reels and halls will be provided as required by the Building Regulation of PNG.

c. Air Conditioning and Ventilation System

Air conditioning will be an air cooled cooler system with ceiling cassette type cooling units. The cooling system will not include the airline office and restaurant areas. Areas with ceiling cooling units are listed below. All other rooms will be provided with ceiling fans and ordinary ventilation fans.

| Building | Room |
|---|---|
| Passenger Terminal | Administration office, VIP room, police office |
| Administration/Control Tower | Meeting room, airport manager room, assistant airport manager/guest room, staff room, restroom, AFTN and meteorological room, control cab |
| C.F.R. and Workshop Building | Office, training/lecture room, watching room |




AIRPORT MAIN FACILITIES

| | |
|---|---|
| ① | PASSENGER TERMINAL BUILDING |
| ② | ADMI AND POWER HOUSE |
| ③ | CONTROL TOWER(ATC) |
| ④ | CFR AND MAINTENANCE WORKSHOP |
| ⑤ | CAR PARKING AREA |
| ⑥ | OIL TANK(UNDERGROUND) |

0 10 50 100

THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA

THE TOKUA AIRPORT IMPROVEMENT PROJECT

TITLE OF DRAWINGS

PLOT PLAN

Date | Drawing No

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI Co.,LTD

**Figure 2. 3. 11**

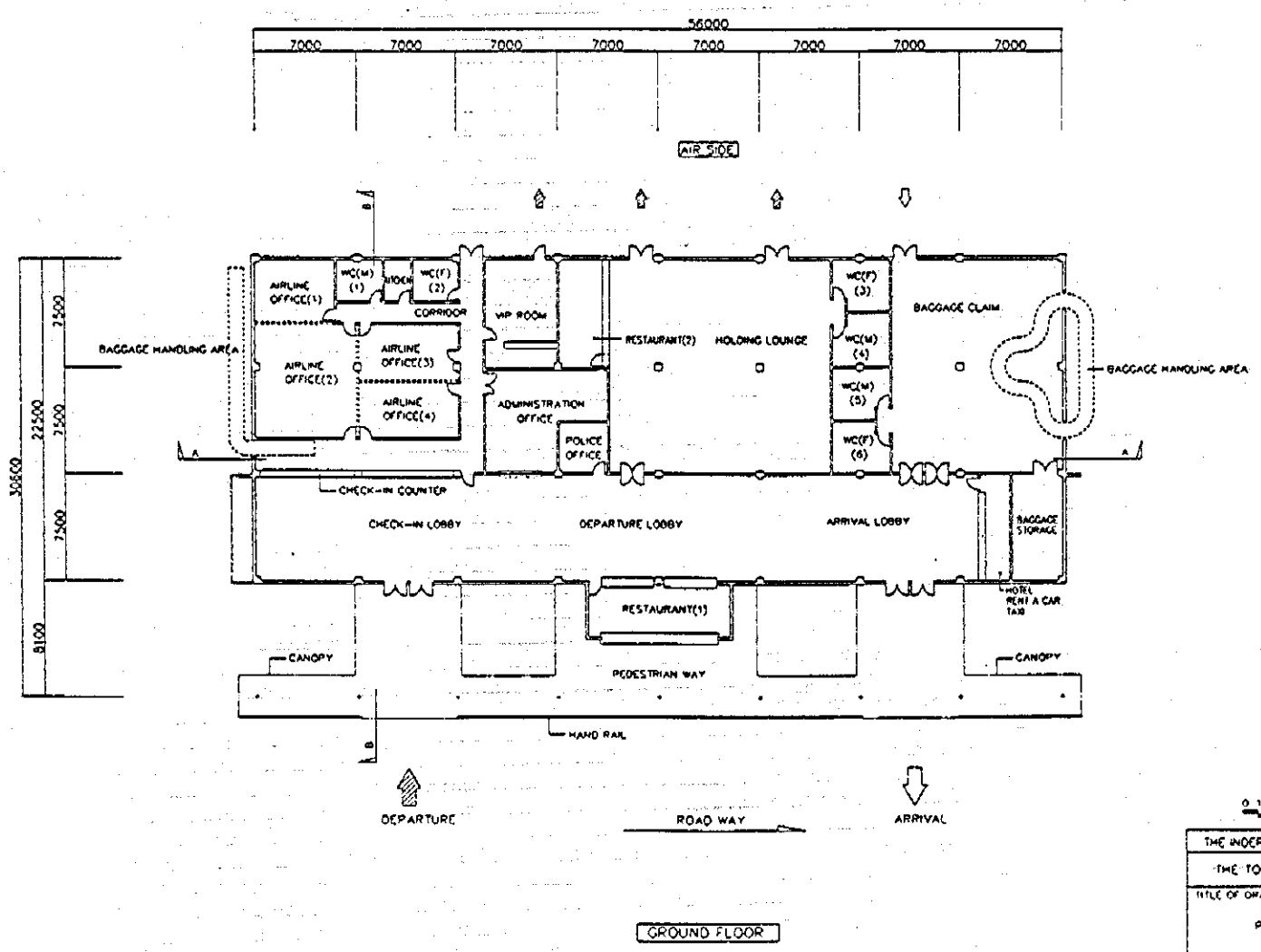
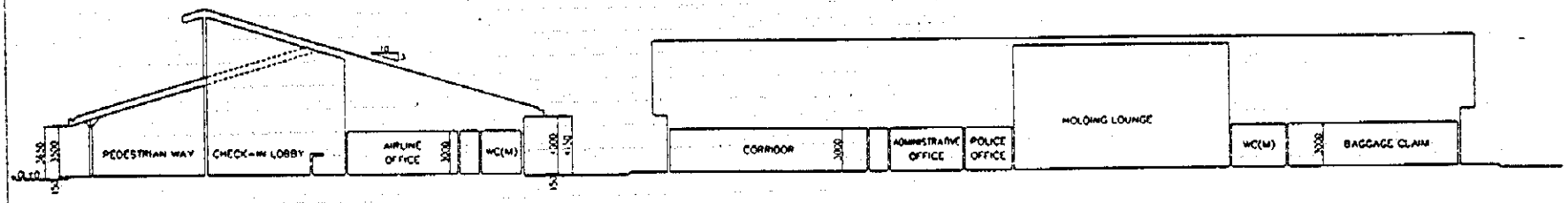
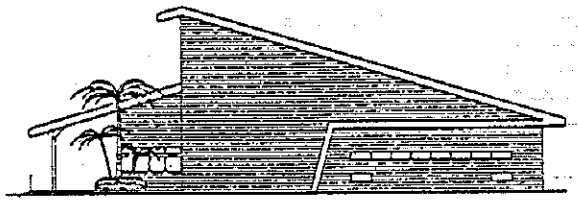

56000
7000
7000
7000
7000
7000
7000
7000
7000
AIR SIDE
AIRLINE OFFICE(1)
WC(M) (1)
STOCK
WC(F) (2)
CORRIDOR
VIP ROOM
RESTAURANT(2)
HOLDING LOUNGE
WC(F) (3)
WC(M) (4)
WC(M) (5)
WC(F) (6)
BAGGAGE CLAIM
BAGGAGE HANDLING AREA
BAGGAGE HANDLING AREA
AIRLINE OFFICE(2)
AIRLINE OFFICE(3)
AIRLINE OFFICE(4)
ADMINISTRATION OFFICE
POLICE OFFICE
CHECK-IN COUNTER
CHECK-IN LOBBY
DEPARTURE LOBBY
ARRIVAL LOBBY
BAGGAGE STORAGE
HOTEL
RENT A CAR
TAXI
RESTAURANT(1)
CANOPY
CANOPY
PEDESTRIAN WAY
HAND RAIL
2500
22500
2500
2500
9100
35600
DEPARTURE
ROAD WAY
ARRIVAL
GROUND FLOOR
0 1 5 10 15
THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA
THE TOKUA AIRPORT IMPROVEMENT PROJECT
TITLE OF DRAWINGS
PASSENGER TERMINAL BUILDING
PLAN
Date
Drawing No
JAPAN INTERNATIONAL COOPERATION AGENCY
NIPPON KOEI Co.,LTD.

**Figure 2. 3. 12**

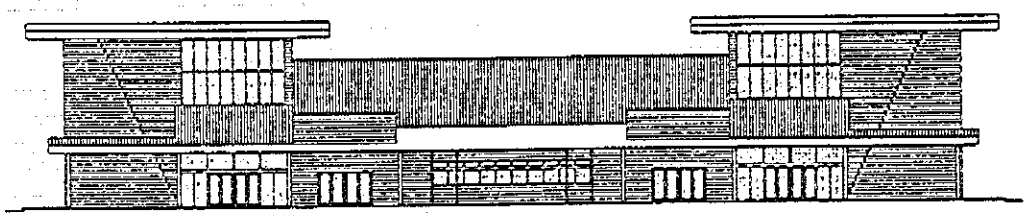



A-A SECTION

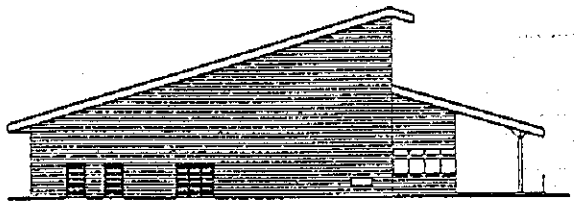
B-B SECTION



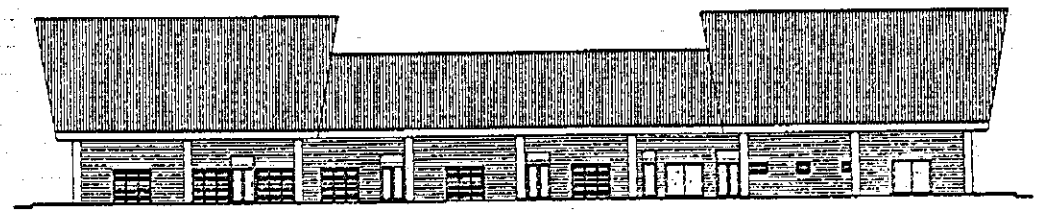
SIDE ELEVATION (1)



FRONT ELEVATION



SIDE ELEVATION (2)

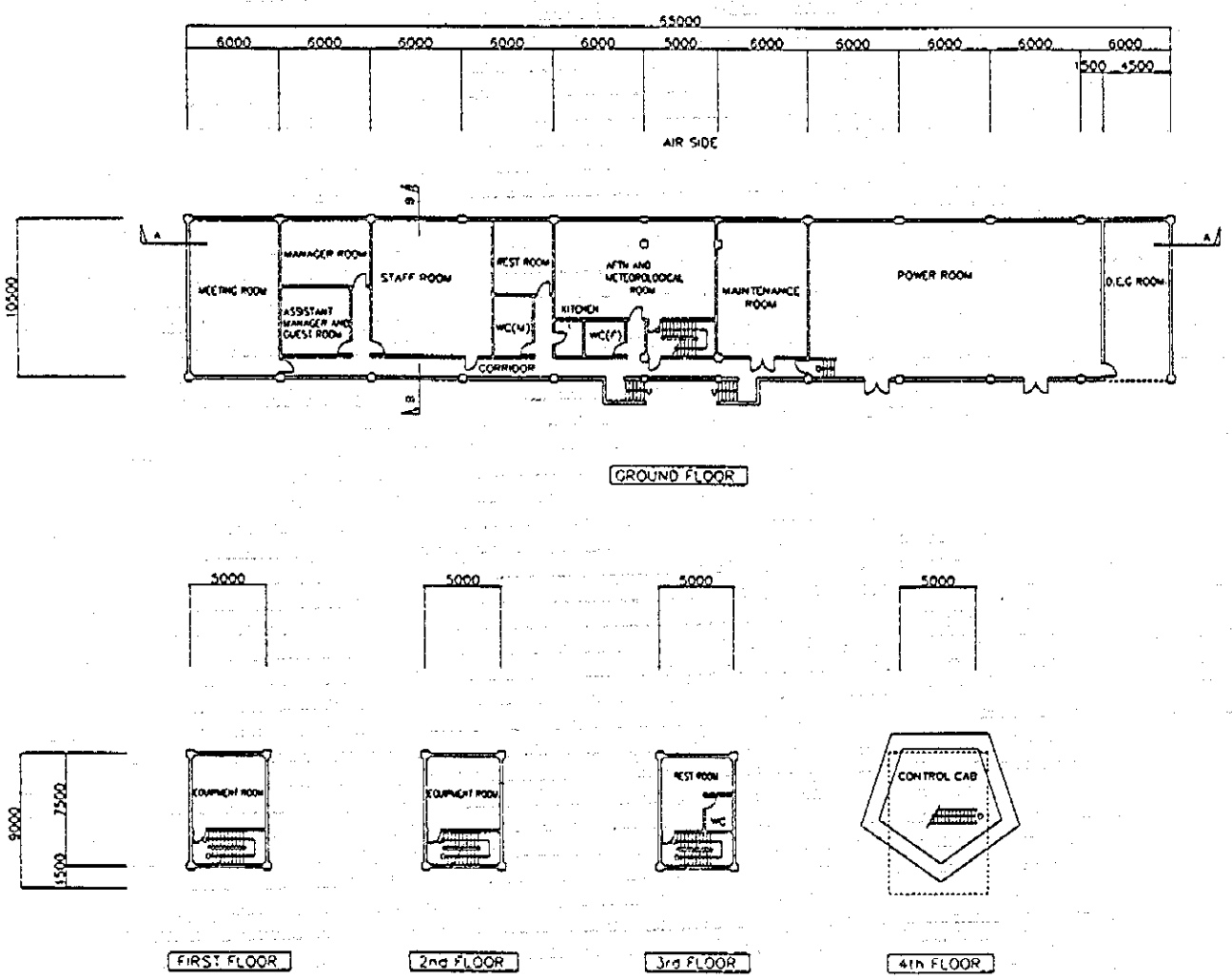


REAR ELEVATION

0 1 5 10 15

| | |
|---|---|
| THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA | |
| THE TOKUA AIRPORT IMPROVEMENT PROJECT | |
| TITLE OF DRAWINGS: PASSENGER TERMINAL BUILDING ELEVATIONS AND SECTIONS | |
| Date | Drawing No. |
| JAPAN INTERNATIONAL COOPERATION AGENCY<br>NIPPON KOEI Co.,LTD. | |

**Figure 2. 3. 13**




THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA

THE TOKUA AIRPORT IMPROVEMENT PROJECT

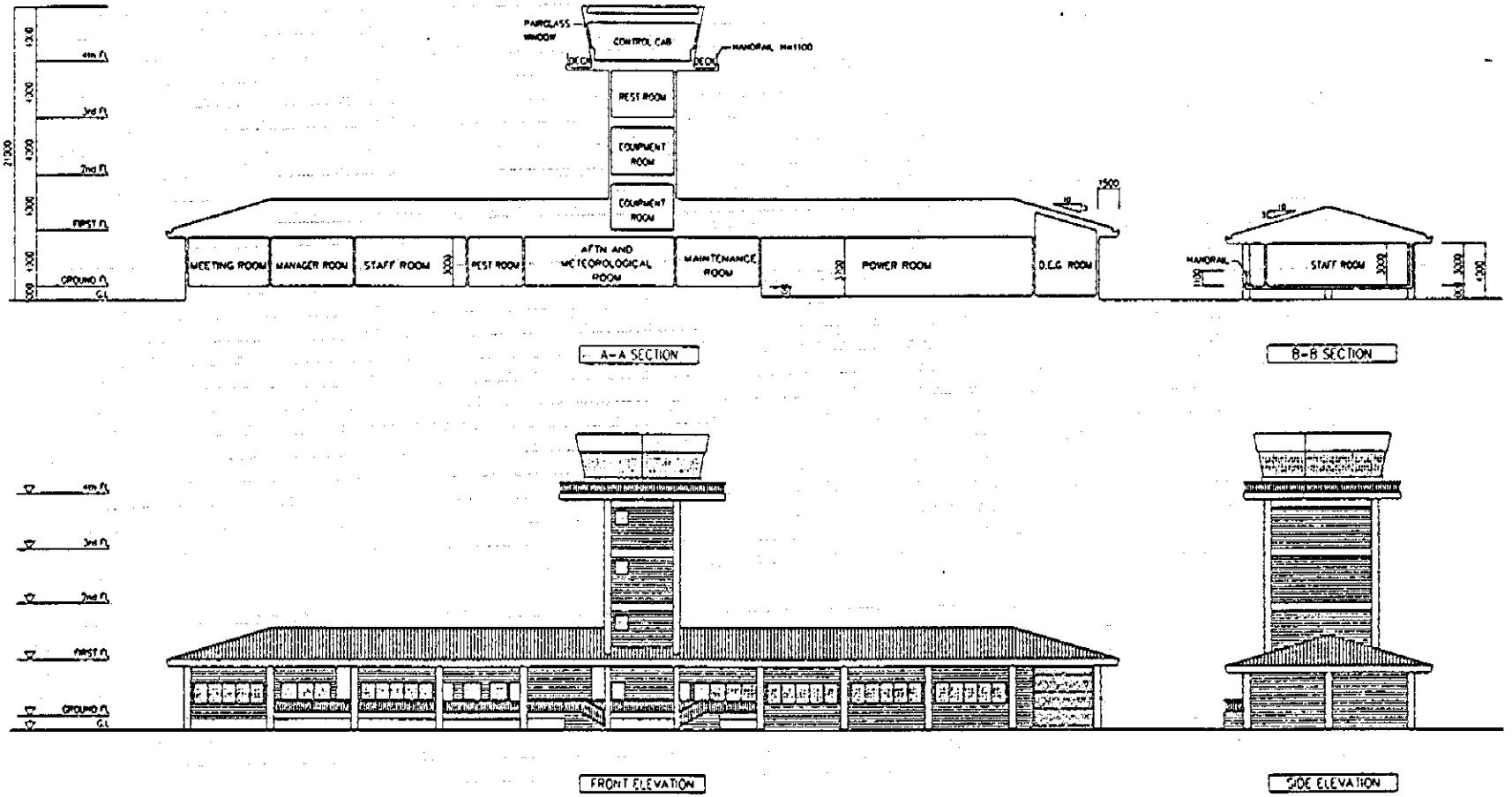
TITLE OF DRAWINGS

ADMINISTRATIVE OFFICE AND CONTROL TOWER PLANS

Date | Drawing No

JAPAN INTERNATIONAL COOPERATION AGENCY
NIPPON KOEI Co.,LTD

**Figure 2. 3. 14**




THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA

THE TOKUA AIRPORT IMPROVEMENT PROJECT

TITLE OF DRAWINGS

ADMINISTRATIVE OFFICE AND CONTROL TOWER ELEVATIONS AND SECTIONS

Date | Drawing No.

JAPAN INTERNATIONAL COOPERATION AGENCY
NIPPON KOEI Co.,LTD.

**Figure 2. 3. 15**

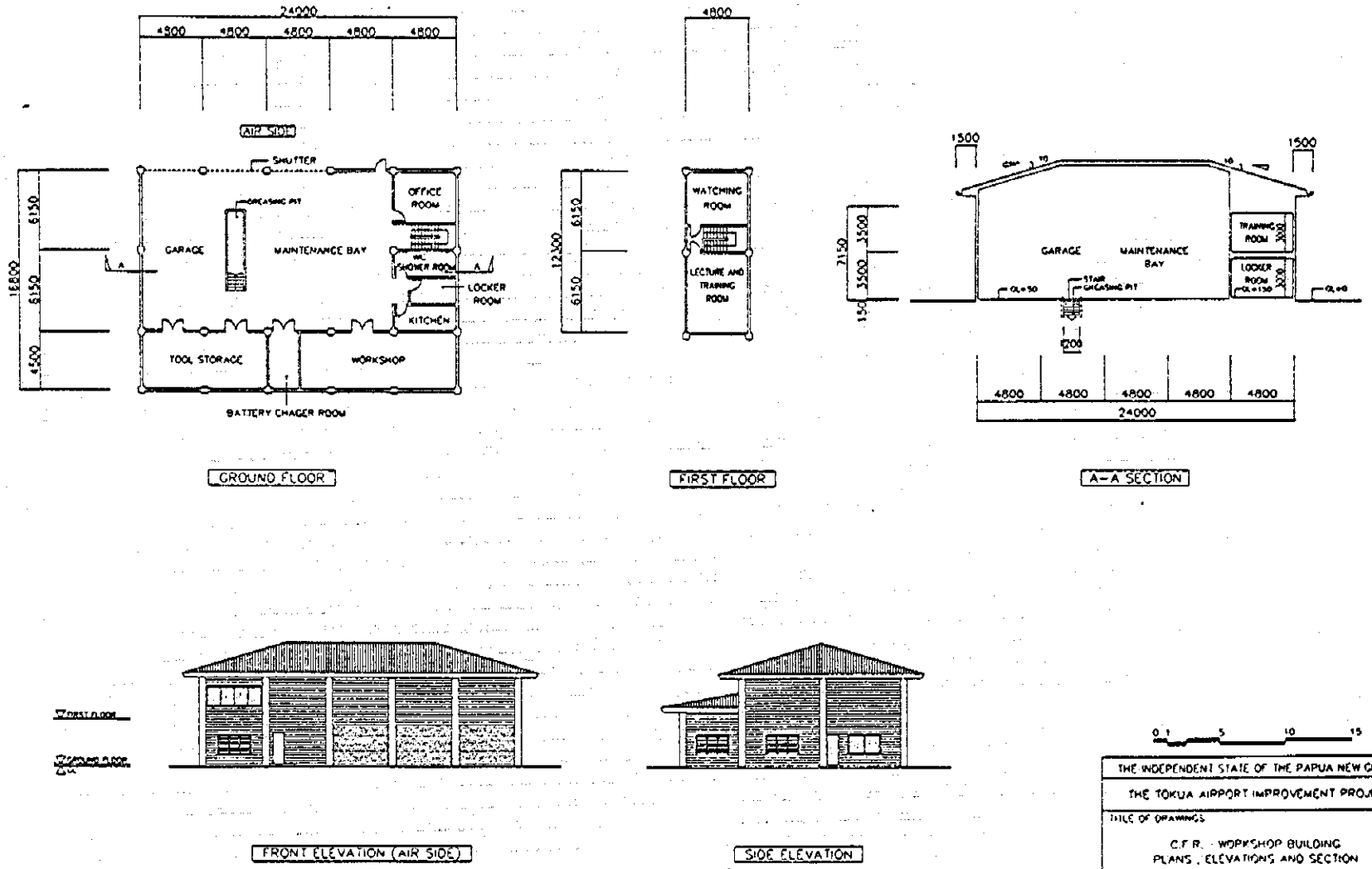
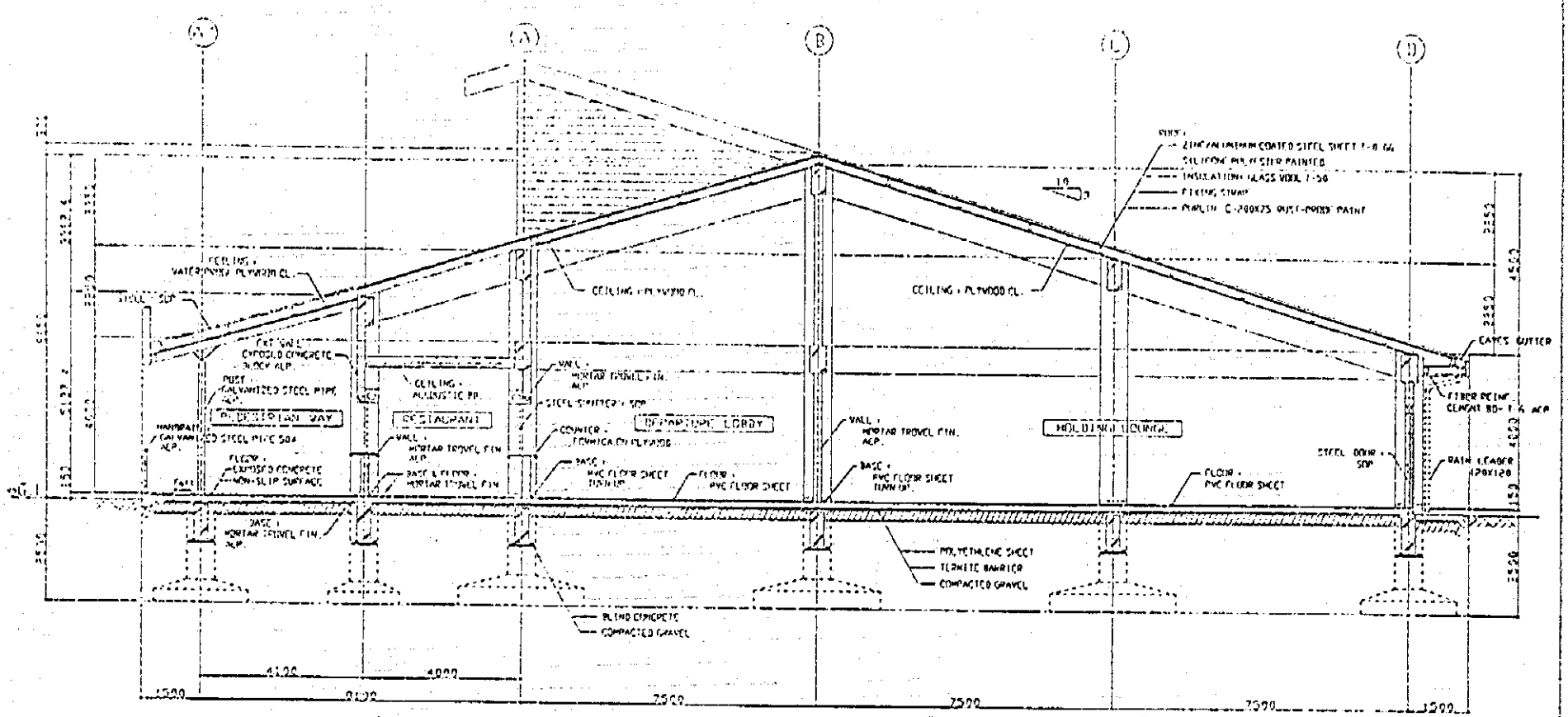

24000
4800 4800 4800 4800 4800
AIR SIDE
SHUTTER
GREASING PIT
OFFICE ROOM
GARAGE
MAINTENANCE BAY
WC
SHOWER ROOM
LOCKER ROOM
KITCHEN
TOOL STORAGE
WORKSHOP
BATTERY CHAGER ROOM
16800
6150
6150
4500
GROUND FLOOR
4800
12300
6150
6150
WATCHING ROOM
LECTURE AND TRAINING ROOM
FIRST FLOOR
1500
1500
7150
3500
3500
150
GARAGE
MAINTENANCE BAY
TRAINING ROOM
LOCKER ROOM
STAIR GREASING PIT
4800 4800 4800 4800 4800
24000
A-A SECTION
FIRST FLOOR
GROUND FLOOR
FRONT ELEVATION (AIR SIDE)
SIDE ELEVATION
0 1 5 10 15
THE INDEPENDENT STATE OF THE PAPUA NEW GUINEA
THE TOKUA AIRPORT IMPROVEMENT PROJECT
TITLE OF DRAWINGS
C.F.R. - WORKSHOP BUILDING
PLANS , ELEVATIONS AND SECTION
Date
Drawing no
JAPAN INTERNATIONAL COOPERATION AGENCY
NIPPON KOEI Co.,LTD

**Figure 2. 3. 16**




SECTION DETAIL

THE INDEPENDENT STATE OF PAPUA NEW GUINEA

DAUNDABURA AIRPORT IMPROVEMENT PROJECT

TITLE OF DRAWINGS

PASSENGER TERMINAL BUILDING

SECTION DETAIL

Date

Drawing No.

JAPAN INTERNATIONAL COOPERATION AGENCY

**Figure 2. 3. 17**