CHAPTER 10 SCOPE OF PHASED DEVELOPMENT PLAN

CHAPTER 10 SCOPE OF PHASED DEVELOPMENT PLAN

On the basis of the best plan of the southern area development established in Chapter 9, the scope of the phased development plan is identified and outlined in Table 10.1.1. The development of the aircraft maintenance area is excluded from the project since it was assumed to be implemented by the Vietnam Airlines.

Table 10.1.1 Scope of the Phased Development Plan

Item	Before Mid Term	Medium Term	Long Term	Future
1. Civil Works				
1.1 Construction of western half of the parallel taxiway for the existing runway	X			
1.2 Expansion of apron A1	X			
1.3 Site preparation and earthworks of south area		X	X	
1.4 Construction of storm water drainage system of the south area		X	X	
1.5 Construction of the second runway and connecting taxiways		X		
1.6 Construction of new taxiways for the south area		X	X	
1.7 Construction of new international aprons		X		
1.8 Expansion of the international aprons			X	X
1.9 Construction of roads and car parks for the new international passenger and cargo terminals		X		
1.10 Construction of roads and car parks for the second international passenger terminal			X	
1.11 Expansion of the car parks for the second international passenger terminal				X
1.12 Construction of airside service roads in the south area		X		
1.13 Construction of boundary and security fence		X	X	
2. Building Works				
2.1 Construction of a new passenger terminal building T1	X			
2.2 Conversion of the existing passenger terminal building to a cargo terminal building	X			
2.3 Construction of a new control tower	X			

Table 10.1.1 Scope of the Phased Development Plan (Continued)

Item	Before Mid Term	Medium Term	Long Term	Future
2.4 Construction of a new international passenger terminal building		X		
2.5 Conversion of T1 to a domestic passenger terminal building		X		
2.6 Construction of a new international cargo terminal building		X		
2.7 Construction of a fire station for the southern area		X		
2.8 Construction of the second international passenger terminal building			X	
2.9 Construction of the second domestic cargo terminal building			X	
2.10 Expansion of the international cargo terminal building			X	X
2.11 Expansion of the second international passenger terminal				X
2.12 Expansion of the second domestic cargo terminal building				X
3. Air Navigation Systems				
3.1 Radio Navigation Aids				
3.1.1 Replacement of the existing ILS	X			
3.1.2 Replacement of the existing VOR/DME	X			
3.1.3 Replacement of the existing NDBs	X			
3.1.4 Installation of ILS Cat-II for the new runway		X		
3.2 ATC and Communication Systems				
3.2.1 Installation of ATC consoles and equipment for the new control tower	X			
3.2.2 Installation of ASR, SSR and PAR	X			
3.2.3 Installation of additional ATC consoles for the second runway		X		
3.2.4 Installation of ATIS, ARTS and Daylight Radar Display			X	
3.2.5 Installation of ASDE and an additional ATC console for Clearance Delivery				X

Table 10.1.1 Scope of the Phased Development Plan (Continued)

Item	Before Mid Term	Medium Term	Long Term	Future
3.3 Aeronautical Ground Lighting System				
3.3.1 Installation of SALS for the existing runway 29	X			
3.3.2 Installation of PAPI for the existing runway 29	X			
3.3.3 Installation of Aerodrome Beacon	X			
3.3.4 Installation of PALS Cat-II for the new runway 11R		X		
3.3.5 Installation of PAPI for the new runway 11R and 29L		X		
3.3.6 Installation of airfield lighting system for the south runway and taxiways		X		
3.4 Meteorological Observation System				
3.4.1 Installation of RVR and ceilometer for the existing runway	X			
3.4.2 Installation of RVR's for the new runway		X		
4. Airport Utilities				
4.1 Installation of a power supply system for the south area		X		
4.2 Installation of a telephone system for the south area		X		
4.3 Construction of a water supply system for the south area		X		
4.4 Construction of a new sewerage system		X		
4.5 Installation of a new incinerator		X		
4.6 Installation of an aircraft refuelling system for the south area		X		
5. Land Acquisition and Relocation				
5.1 Land acquisition and resettlement of households		X	X	
5.2 Relocation of National Road No. 2		X		
5.3 Relocation of Noi Bai Canal		X	X	
5.4 Relocation of irrigation channels		X		
5.5 Relocation of telephone lines		X		
5.5 Relocation of power transmission lines		X		

CHAPTER 11 PLANNING AND PRELIMINARY DESIGN OF THE PROJECT

CHAPTER 11 PLANNING AND PRELIMINARY DESIGN OF THE PROJECT

11.1 GENERAL

Facility planning and preliminary design for the Medium Term Development Project have been conducted based on the Long Term Development Plan established in Chapter 9 and Scope of Phased Development described in Chapter 10. The main purpose of the planning and design of the facilities is to describe the facilities sufficiently for cost estimation in a feasibility study.

This chapter consists of the following sections.

a) Civil Works
b) Building Works
c) Air Navigation Systems
d) Airport Utilities
e) Construction Plan

As a result of the preliminary design, the layout of the airport facilities for the Medium Term Development was adjusted as shown in Figures 11.1.1 and 11.1.2.

11.2 CIVIL WORKS

11.2.1 Runway, Taxiway and Apron

1) Runway

A new runway should be constructed in parallel with and 1,850 m south of the existing runway. The threshold of Runway 11R should be located at about 500 m from the expressway. The dimensions of the runway should be 3,600 m x 45 m with a 7.5 m shoulder on each side, in accordance with ICAO Annex 14. The slopes of the runway and its shoulders should conform to the recommendations of Annex 14, and the maximum transverse slopes used in the preliminary design are as follows:

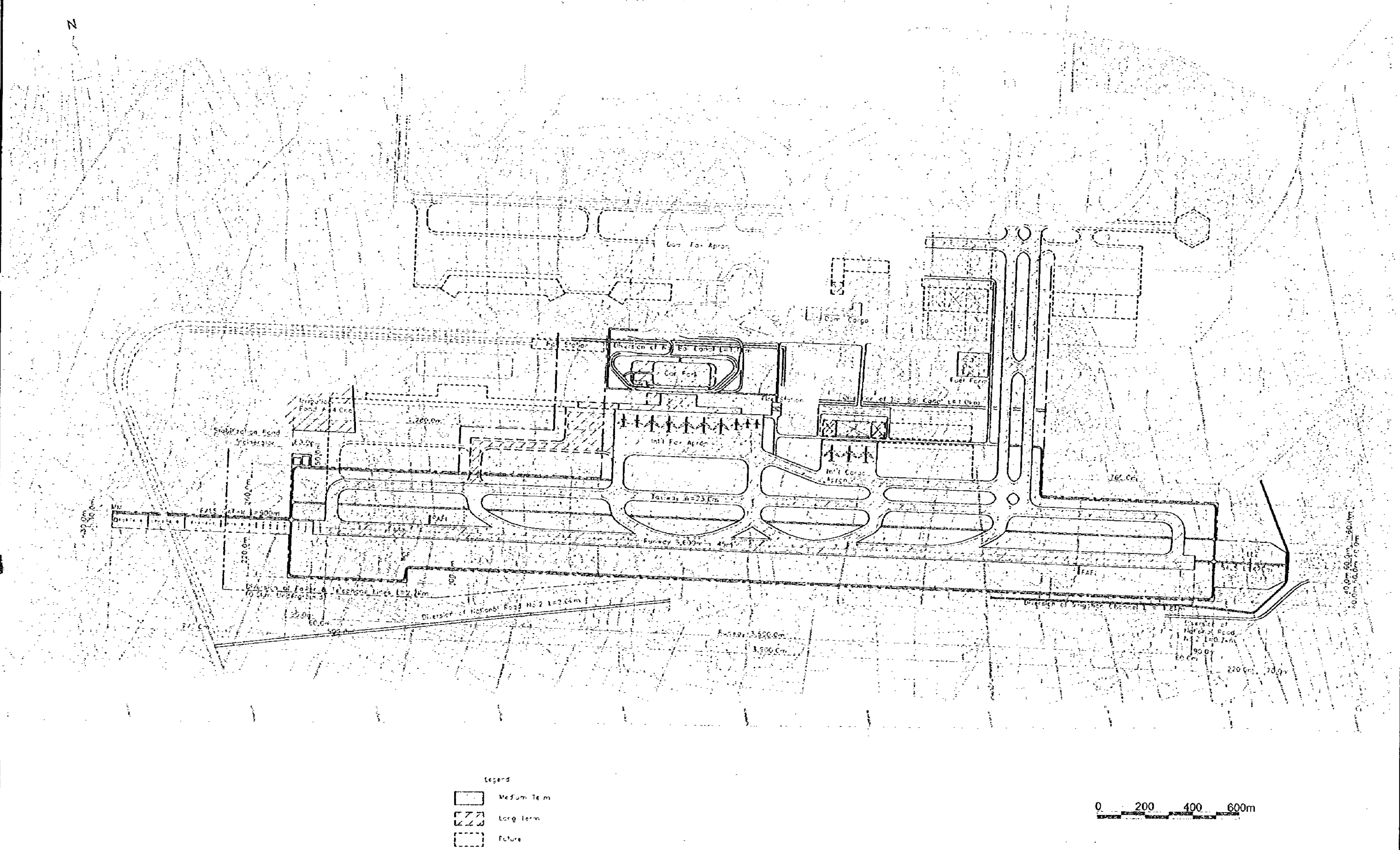


Figure 11.1.1 Medium Term Development Plan.

Note: CAAV's development plans for the existing airprt area are indicated as future developments for reference purposes.

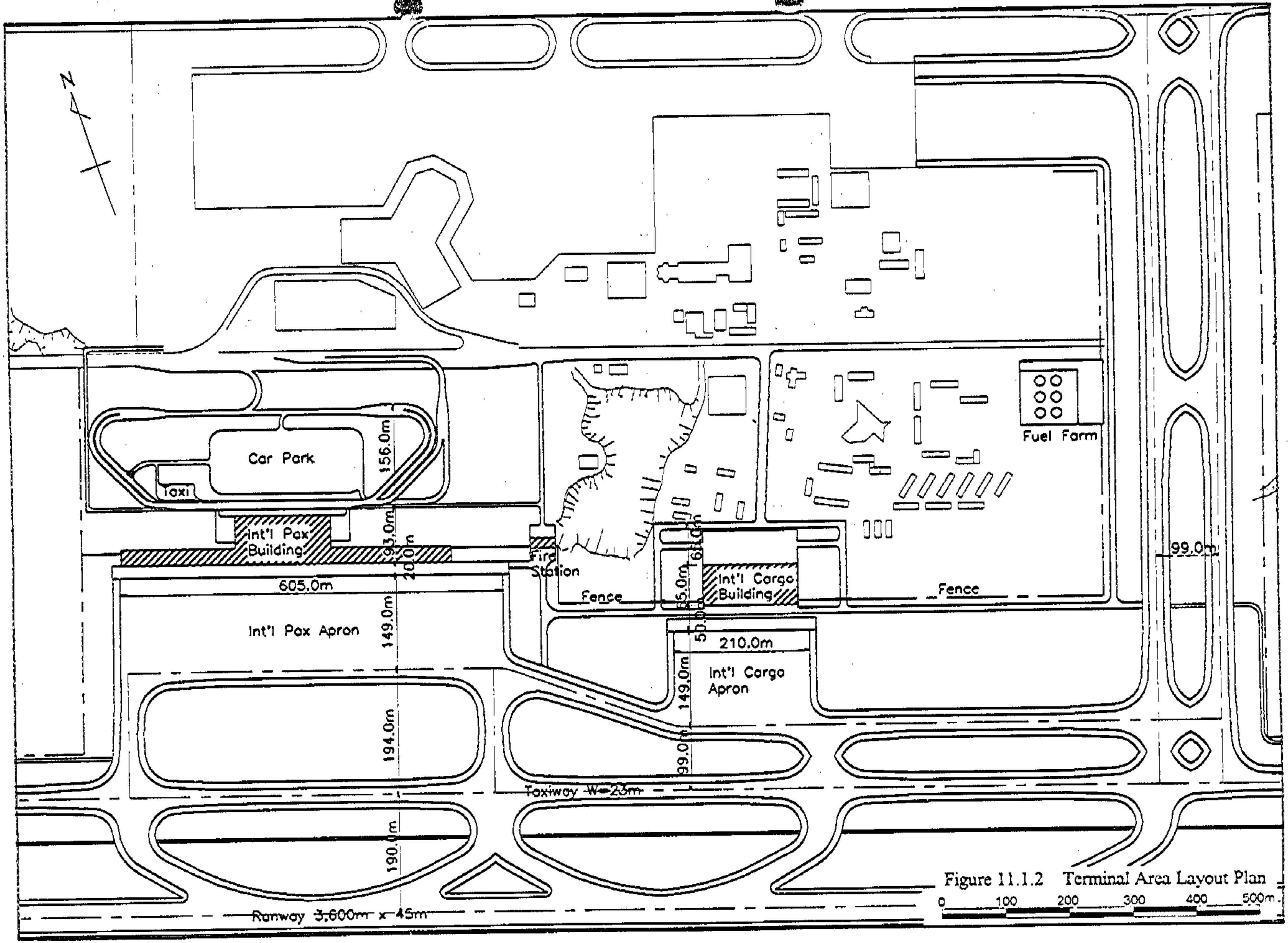


Figure 11.1.2 Terminal Area Layout Plan

a) Transverse Slope of Runway: 1.3%

b) Transverse Slope of Runway Shoulder: 2.5%

Figures 11.2.1 and 11.2.2 show the longitudinal profile and typical cross sections of the runway.

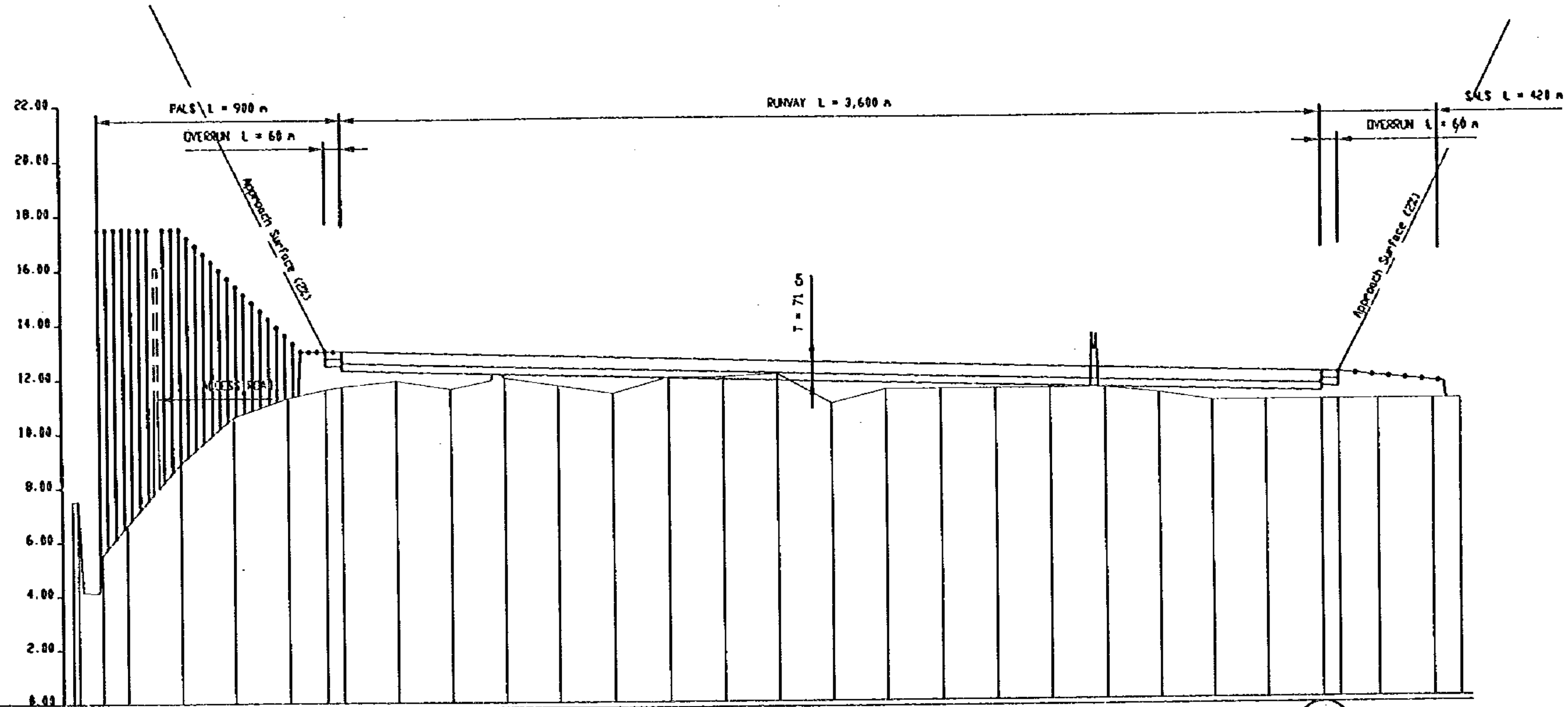
2) Taxiway

A full parallel taxiway and six (6) rapid exit taxiways should be provided for the new runway, and dual connecting taxiways should be constructed to provide access between the existing and new runways and terminals. In order to prepare for new large aircraft, the separation distance between the centrelines of the runway and the parallel taxiway should be 190 m, and that of the dual taxiways should be 99 m. The width of taxiways should be at least 23 m with a 10.5 m shoulder on each side in accordance with Annex 14. The slopes of the taxiways should conform to the recommendations of Annex 14, and the maximum transverse slopes used in the preliminary design are the same as those for the runway. Figures 11.2.2 and 11.2.3 show the typical cross sections and longitudinal profile of the parallel taxiway. Figure 11.2.4 shows the longitudinal profile of the connecting taxiway.

3) Apron

The dimensions of the new international passenger loading apron should be about 605 m x 160.5 m so as to accommodate four (4) B747's, two (2) DC-10's, one (1) B767, three (3) A320's and one (1) ATR72. The international cargo apron should be about 210 m x 160.5 m to accommodate three (3) B747's. The slopes of the apron should not exceed 1%, which is the recommended practice of Annex 14. Figure 11.2.2 shows the typical cross sections of the aprons.

A 20 m wide space for GSE parking and apron service traffic should be provided between the apron and passenger terminal building.



SLOPE: 13.00 — i = 0.028%, L = 3,600 m — 12.00

STATION	ACCUMULATED DISTANCE	GROUND HEIGHT	PROPOSED HEIGHT	CUT	FILL
NO. -10	-1,000.0	7.5			
NO. -8	-800.0	6.6			
NO. -6	-600.0	8.9			
NO. -4	-400.0	10.6			
NO. -2	-200.0	11.3	12.95		1.65
+60.0	-60.0	11.6	12.95		1.35
NO. 0	0.0	11.7	13.00		0.59
NO. 2	200.0	11.9	12.94		0.33
NO. 4	400.0	11.6	12.89		0.58
NO. 6	600.0	12.0	12.83		0.12
NO. 8	800.0	11.7	12.78		0.37
NO. 10	1,000.0	11.4	12.72		0.61
NO. 12	1,200.0	12.0	12.67	0.04	
NO. 14	1,400.0	12.0	12.61	0.10	
NO. 16	1,600.0	12.1	12.56	0.25	
NO. 18	1,800.0	11.0	12.50		0.79
NO. 20	2,000.0	11.5	12.44		0.23
NO. 22	2,200.0	11.5	12.39		0.18
NO. 24	2,400.0	11.5	12.33		0.12
NO. 26	2,600.0	11.5	12.28		0.07
NO. 28	2,800.0	11.5	12.22		0.01
NO. 30	3,000.0	11.3	12.17		0.16
NO. 32	3,200.0	11.0	12.11		0.40
NO. 34	3,400.0	11.0	12.06		0.35
NO. 36	3,600.0	11.0	12.00		0.29
+60.0	3,660.0	11.0	11.93		0.93
NO. 38	3,800.0	11.0	11.79		0.79
NO. 40	4,000.0	11.0	11.59		1.00
+50	4,100.0	11.0			

Figure 11.2.1 Runway Profile

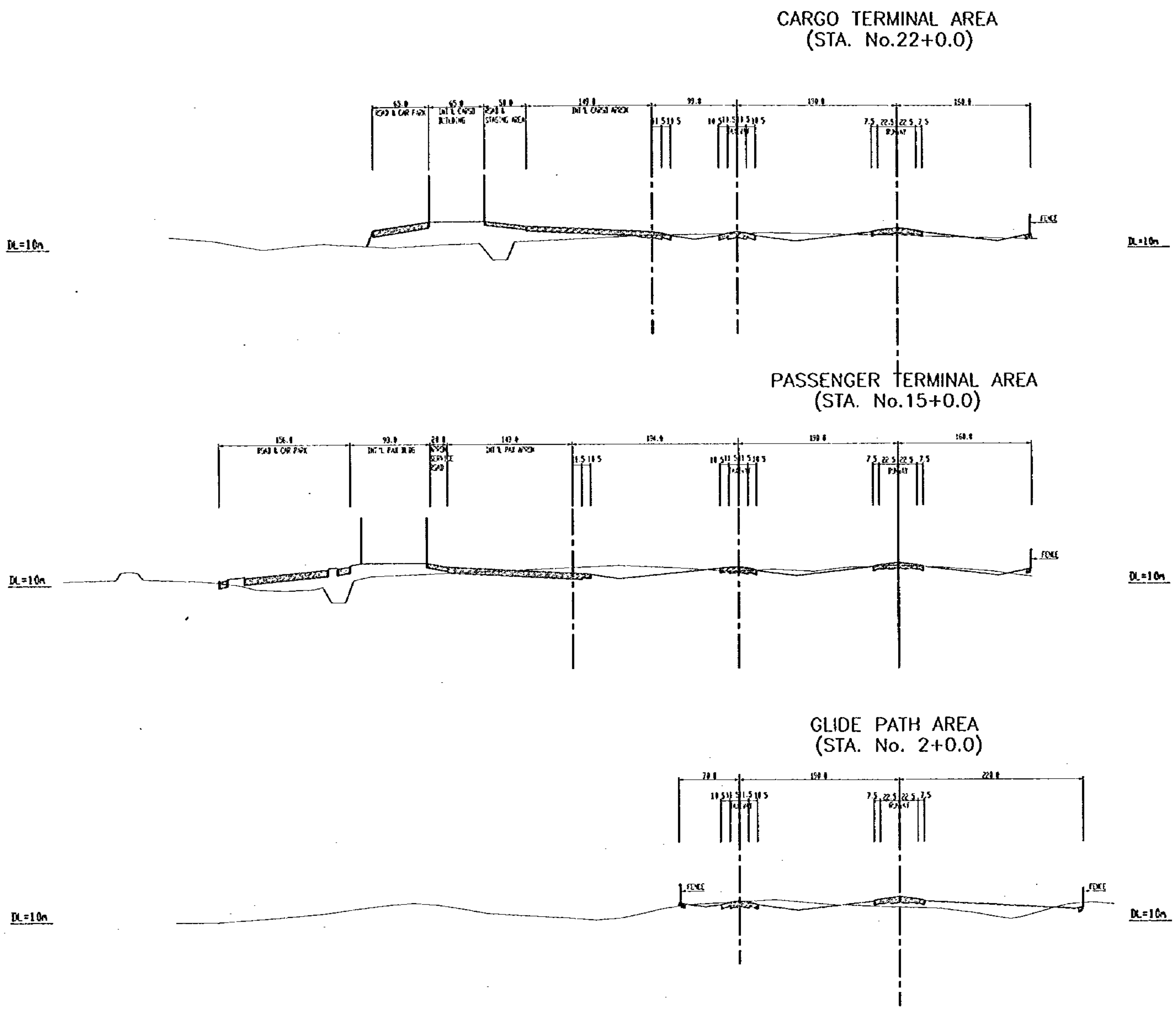
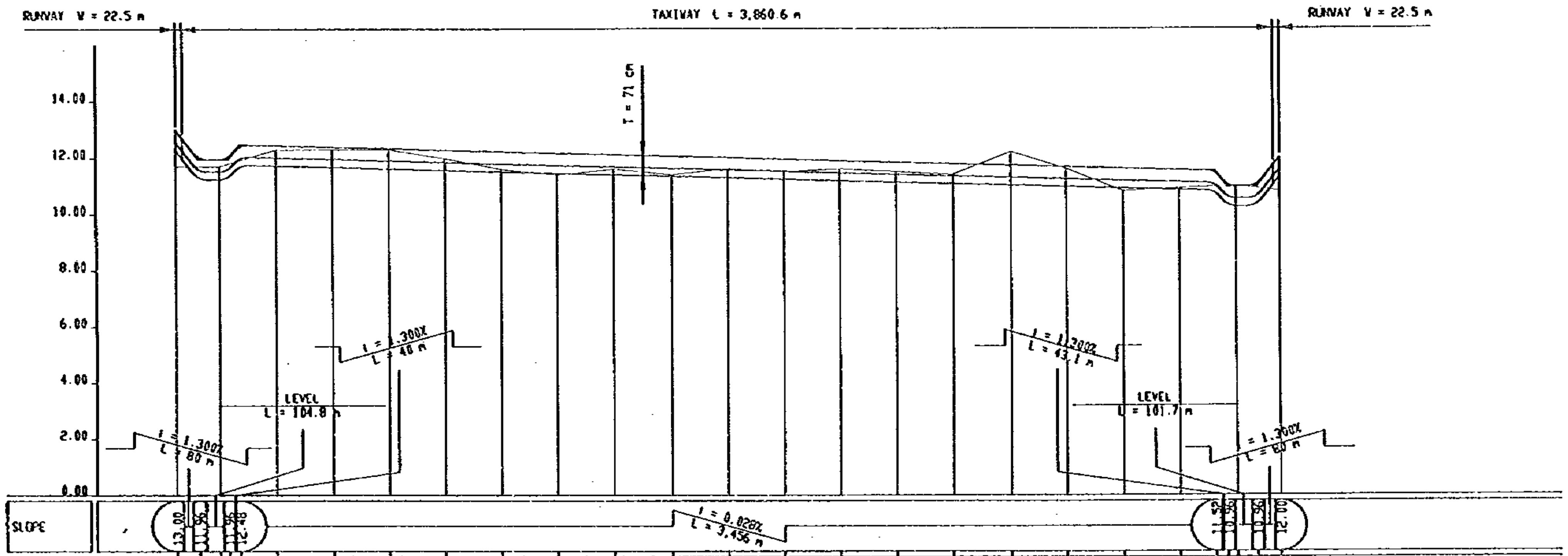


Figure 11.2.2 Typical Cross Sections



STATION	ACCUMULATED DISTANCE	GROUND HEIGHT	PROPOSED HEIGHT	CUT	FILL
-152.8	-152.8	11.7	13.00		0.59
-72.8	-72.8	11.7	12.01	0.40	
NO. 0	0.0	11.7	11.96	0.45	
+32.0	+32.0	11.8	12.07	0.55	
+72.0	+72.0	11.9	12.43	0.18	
NO. 2	200.0	12.3	12.44	0.57	
NO. 4	400.0	12.3	12.39	0.62	
NO. 6	600.0	12.3	12.33	0.68	
NO. 8	800.0	12.0	12.28	0.43	
NO. 10	1,000.0	11.6	12.22	0.09	
NO. 12	1,200.0	11.4	12.17		0.06
NO. 14	1,400.0	11.6	12.11	0.20	
NO. 16	1,600.0	11.4	12.06	0.05	
NO. 18	1,800.0	11.6	12.00	0.31	
NO. 20	2,000.0	11.5	11.94	0.27	
NO. 22	2,200.0	11.6	11.89	0.42	
NO. 24	2,400.0	11.5	11.83	0.38	
NO. 26	2,600.0	11.4	11.78	0.33	
NO. 28	2,800.0	12.0	11.72	0.99	
NO. 30	3,000.0	11.6	11.67	0.64	
NO. 32	3,200.0	10.8	11.61		0.70
NO. 34	3,400.0	10.9	11.56	0.05	
+128.0	3,528.0	11.0	11.47	0.24	
+171.1	3,571.1	11.8	11.02	0.70	
NO. 36	3,600.0	11.8	10.96	0.75	
+72.8	3,672.8	10.9	11.01	0.60	
+152.8	3,752.8	10.8	12.00		0.49

Figure 11.2.3 Profile of Parallel Taxiway

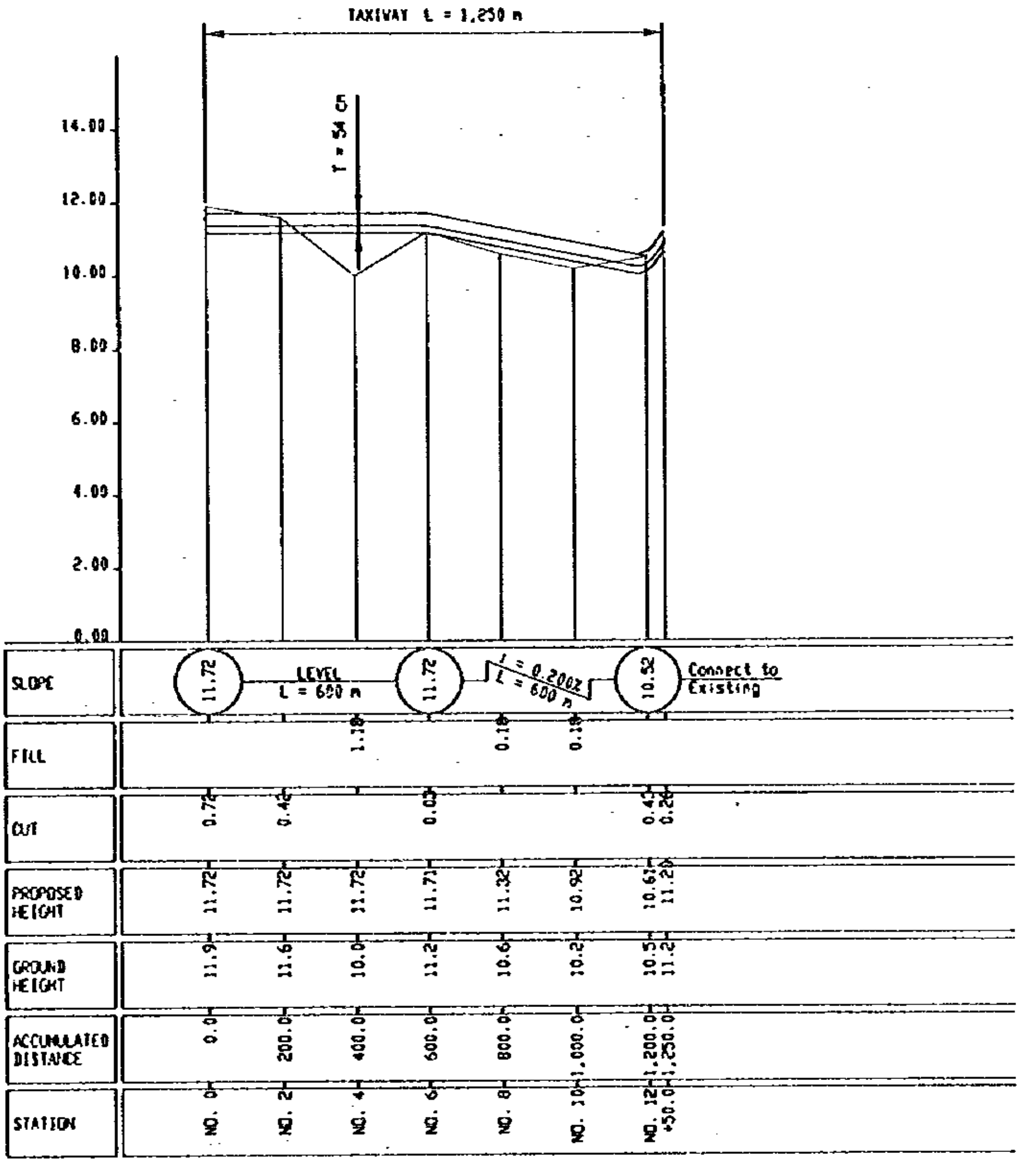


Figure 11.2.4 Profile of Connecting Taxiway

3) **Pavement Design**

The pavement of the runway, taxiways and aprons should have a strength rating of PCN 73 R/D/W/T or 88 F/D/W/T. The pavements for the new runway and its associated taxiways, and international passenger apron should be designed for international aircraft movements anticipated in the 20-year period.

For the preliminary design, it was assumed that the traffic in the year 2015 was equal to an average over the 20 years.

Figure 11.2.5 shows an example of pavement design (refer Appendix 11.2.1 for more details) based on the FAA's practices and the following design conditions:

a) Design CBR of Subgrade: 2.4%

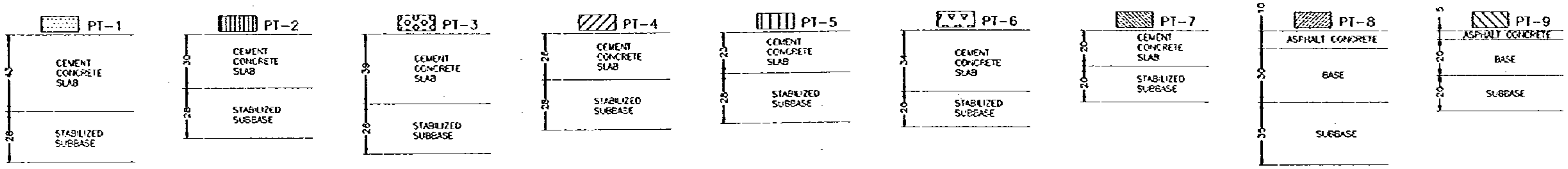
b) Design K-value of Subgrade: 2 kg/cm^3

c) Design Aircraft: B747-200

d) Equivalent Annual Departures: 16,000 (using int'l aircraft movements in 2015)

In this preliminary design, rigid pavements were used for the aircraft pavement because the thickness of rigid pavement is generally less than that of flexible pavements and suitable where the ground water level is high.

The pavement structure of the existing parallel taxiway was used for the connecting taxiways and international cargo apron, because the traffic on these taxiways and aprons will be far less than the traffic on the new runway.



TYPE	LOCATION
PT-1	RUNWAY CENTER PORTION, PARALEL TAXIWAY, INT'L PAX APRON
PT-2	RUNWAY EDGE PORTION
PT-3	RAPID EXIT TAXIWAYS
PT-4	OVERRUN, SHOULDER IN SOUTHERN AREA
PT-5	APRON SERVICE ROAD
PT-6	CONNECTING TAXIWAY, APRON & TAXIWAY IN NORTHERN AREA
PT-7	SHOULDER IN NORTHERN AREA
PT-8	TERMINAL ROAD, CAR PARK
PT-9	AIRSIDE SERVICE ROAD

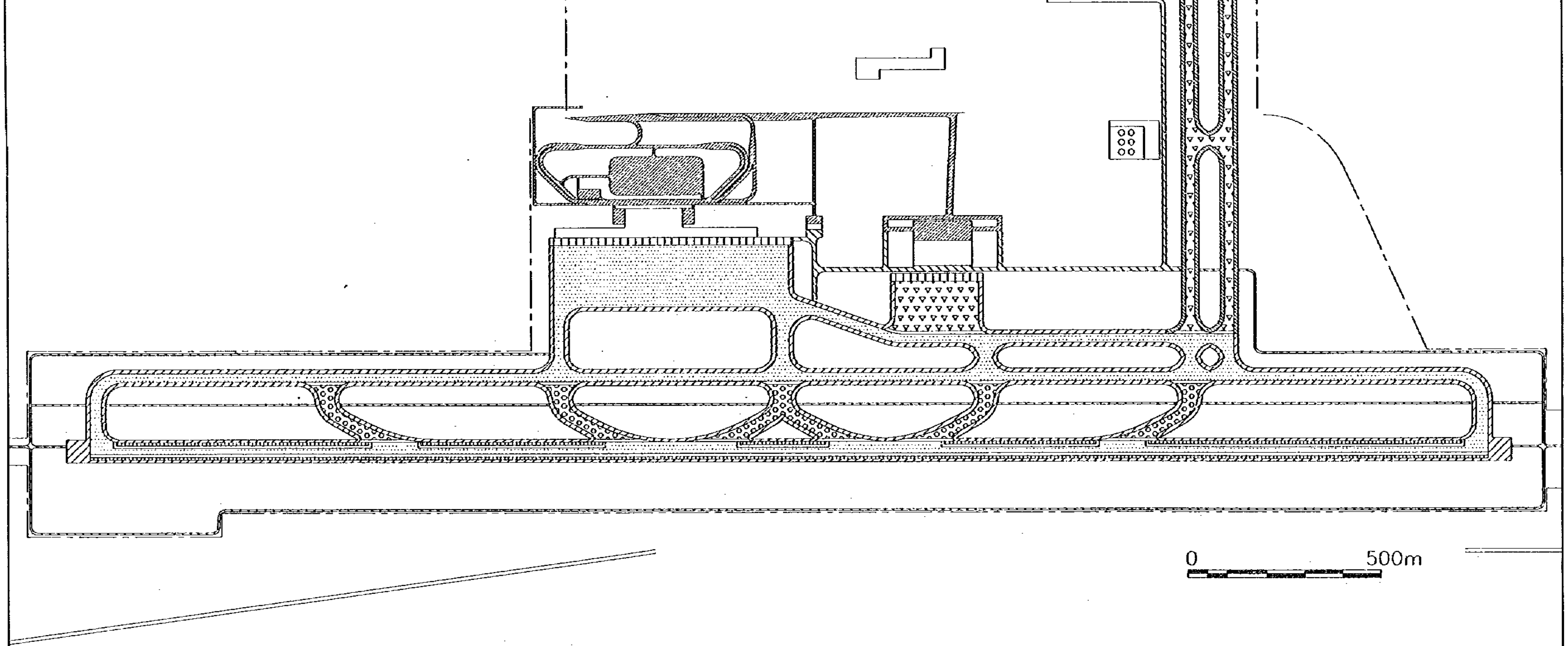


Figure 11.2.5 Pavement Plan

11.2.2 Roads and Car Parks

1) Access Road

As the existing 4-lane airport access road has enough capacity, no major changes are planned for the access road except for the intersections with the roads to/from the southern terminal.

Peak hour vehicle traffic on the access road at the terminal area in the year 2010 is estimated as shown in Figure 11.2.6.

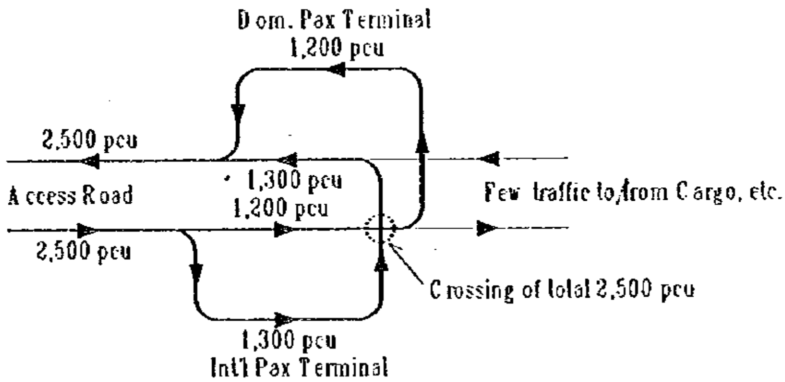


Figure 11.2.6 Peak Hour Vehicle Traffic at the Terminal Area

The volume of traffic at the intersection of outgoing traffic from the international passenger terminal and incoming traffic to the domestic terminal is estimated to be 2,500 pcu during the peak hours. In order to reduce the risk of traffic accident and to provide high levels of service to the air travellers, a flyover bridge is planned for outgoing traffic from the international passenger terminal, although it may be possible to use an intersection on grade with traffic lights.

2) National Road No. 2

Two sections of National Road No. 2, total length of 2.7 km, should be diverted to clear the site for southern area development. A new alignment of National Road No. 2 is planned so that the location of an existing school can remain unchanged and to clear the approach surface. The road is rated as be a standard 2-lane Grade 3 road.

This plan has only been made for the purposes of the feasibility study of the Airport (in order to estimate the cost of relocation of the road for clearing the airport development site). It should be noted that a feasibility study on the Highway No. 18 Improvement Project, which includes the section from Noi Bai to Bac Ninh along National Road No. 286, is being executed by JICA, and that close coordination between the airport development project and the road development project will be required to achieve the smooth and effective implementation of the both projects.

3) Terminal Road

There are various points of origin and destination within the passenger terminal. The major routes used by passenger related traffic are shown in Figure 11.2.7.

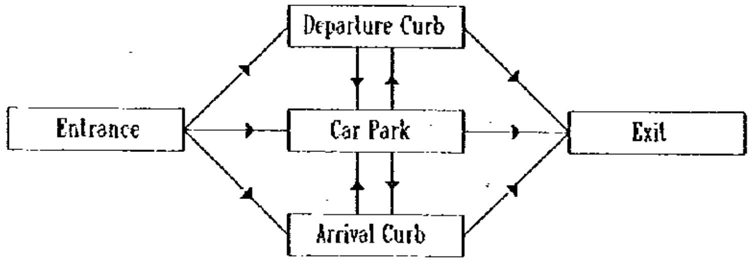


Figure 11.2.7 Major Traffic Routes within Passenger Terminal

In addition, there will be transfer passenger traffic between the international and domestic passenger terminals and staff traffic to/from all airport facilities. The road network in the terminal area has been planned as shown in Figure 11.2.8 taking into consideration the longitudinal slopes of ramps and separation distances between merging and diverging points.

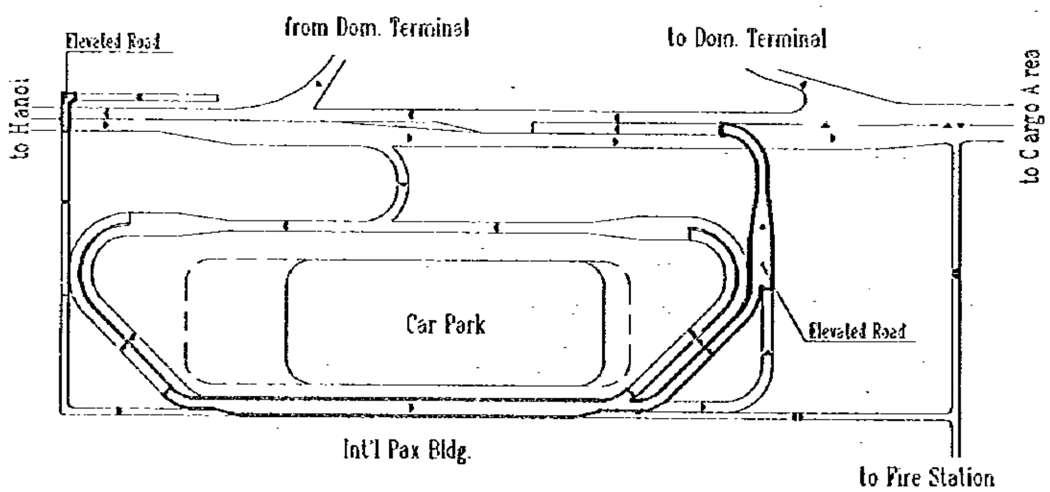


Figure 11.2.8 Terminal Road Network

4) Airside Service Road

Airside service roads should be provided along the perimeter of the southern area and approach lighting systems, and connected to the terminal areas. The service road will be 4 m wide and paved for all-weather service.

5) Car Park

The car park will be separated into two areas, one as a public car park and another as a taxi pool. All taxis waiting for passengers will be required to queue in the taxi pool and come to the curb of the terminal building when needed, so as to minimize curb congestion. Figure 11.2.9 shows the layout of the car park and taxi pool together with the locations of entrances and exits.

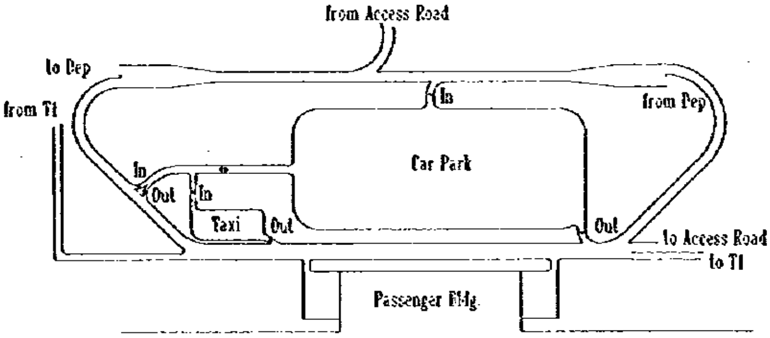


Figure 11.2.9 Layout of Car Park and Taxi Pool

6) Pavement Design

The pavements of the roads and car parks should be capable of withstanding anticipated traffic for 10 years from the inauguration date. The average daily traffic of large vehicles (buses and trucks) in the international terminal was estimated from the traffic survey results and the air traffic demand forecast for the year 2010 as follows:

a) Unit Demand of Large Vehicles: 0.05 large vehicle / pax

b) Design Day International Pax in 2010: 11,530 pax

c) Daily Traffic of Large Vehicles: 11,530 x 0.05 = 580

The average traffic level for large vehicles on the airside service road has been estimated at less than 100 per day. An example of the pavement design based on the Asphalt Pavement Manual of the Japan Road Association are shown in Figure 11.2.5.

11.2.3 Site Preparation and Storm Water Drainage

1) Grading Plan

(1) Runway Strip

A runway strip of 3,720 m x 300 m should be provided for the new runway. The runway strip should be graded so as to create a storm water drainage system. The maximum slopes of the runway strip should be in accordance with the recommendations in ICAO Annex 14. The minimum slope of 1.0% for surface drainage of the runway strip was used in the preliminary design.

(2) Taxiway Strip

Taking account of the new large aircraft, an area within 59 m from the taxiway centreline should be graded in accordance with the recommendations for taxiway strips in Annex 14.

(3) ILS Glide Path and Localizer Areas

The grading of the ILS Glide Path and Localizer critical areas has been designed within the following ranges of slope:

Glide Path Critical Area

Longitudinal Slope:	+1.5% to -1.5%
Transverse Slope:	0% to -1.5%

Localizer Critical Area

Longitudinal Slope:	0% to -1.5%
Transverse Slope:	+1% to -3%

(4) Terminal Area

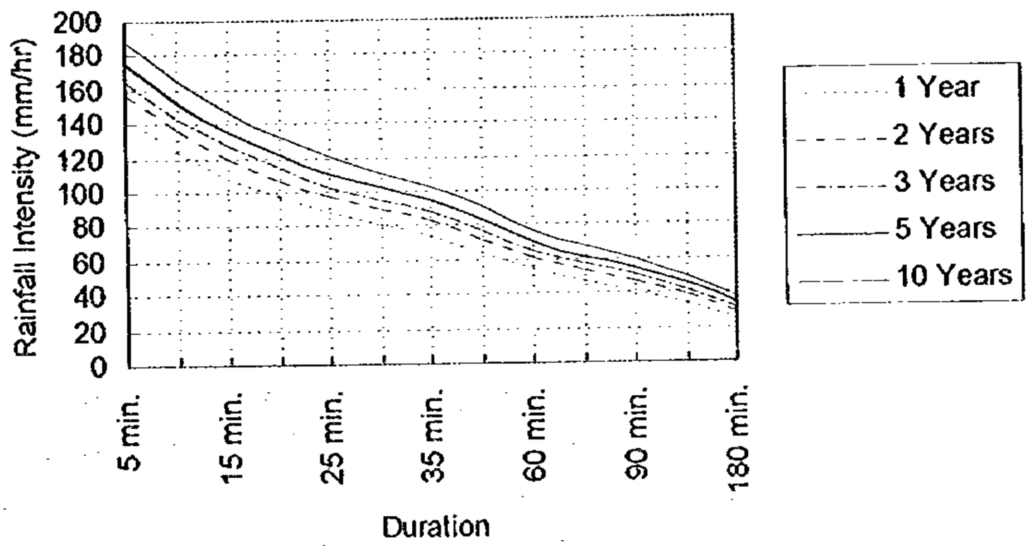
The slope of terminal area has been designed to have down slope in a general northerly direction. The slope of the car park will not exceed 2%.

2) Storm Water Drainage

(1) Design Conditions

The following parameters were used in the preliminary design:

a)	Return Period of Design Rainfall:	5 Years
b)	Rainfall Intensity Duration Curve:	As shown in Figure 11.2.10.
c)	Runoff:	$Q = 1/360 \times C \times I \times A$
		where, Q: Runoff (m^3/sec.)
		C: Runoff Coefficient
		I: Rainfall Intensity (mm/hr)
		A: Catchment Area (ha)
d)	Runoff Coefficient:	Pavement Area : 0.95
		Building Area : 0.90
		Turf Area : 0.50 (clayey soil)
e)	High Water Level of Noi Bai Canal:	upstream part: +10.0 m
		downstream part: +7.0 m



Source: The Study on Urban Drainage and Wastewater Disposal System in Hanoi City, JICA, Feb. 1995

Figure 11.2.10 Rainfall Intensity - Duration Curve

(2) Zoning of Catchment Area

The existing catchment areas of the Airport and its surroundings is illustrated in Figure 11.2.11 (top). The zoning of the catchment areas for the southern area development has been planned as shown in Figure 11.2.11 (bottom) taking account the following aspects requirements.

a) To maintain the reservoir function of Noi Bai Canal:
A new border has been planned so that the runoff into Noi Bai Canal catchment area will not decrease. The northern area of new parallel taxiways is included in the Noi Bai Canal catchment area.

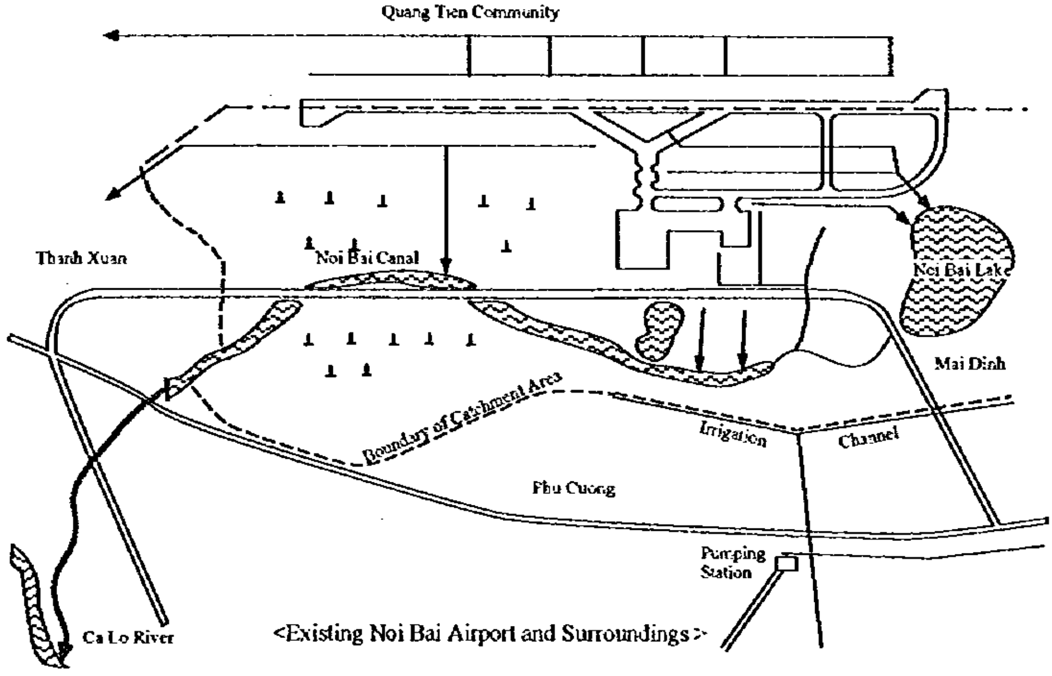
b) To avoid flooding caused by increased runoff into new development area:
The airside area of new runway is divided by two major catchment zones. In the western half of runway strip and loading apron area, rainwater is led westward by channels and culverts to flow into the Ca Lo River after joining the Noi Bai Canal. In the eastern half of runway strip and dual parallel taxiway area, rainwater is collected to the south and discharges into the Ca Lo River directly by a new trunk facility.

(3) Layout of Drainage Facilities

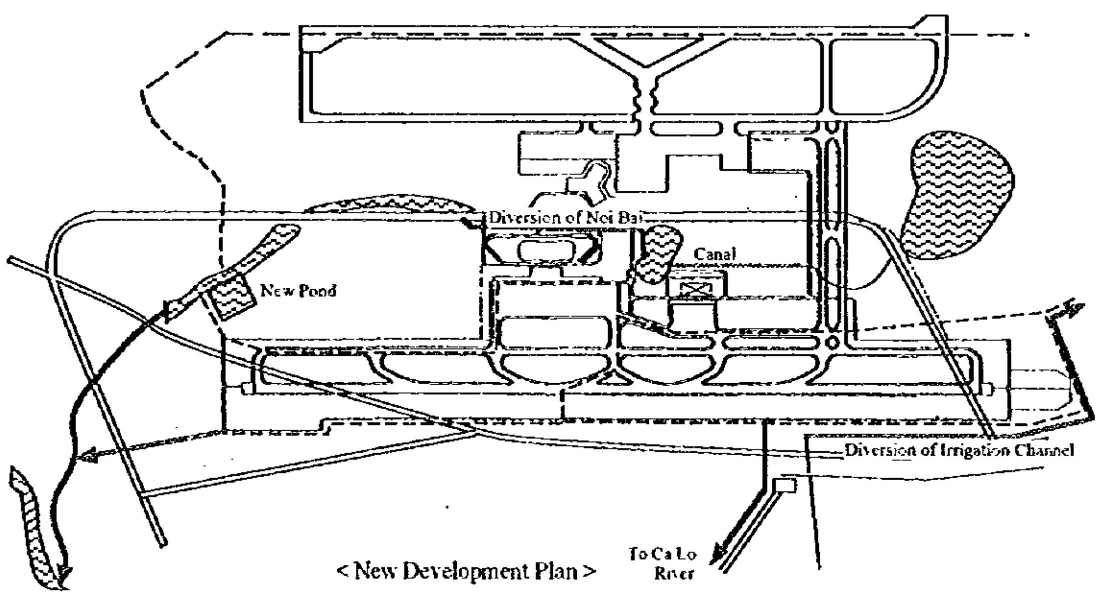
Trapezoidal channels are located along the airside grading area. Two to four 1,200 mm diameter pipe culverts will be laid under the ordinary and rapid exit taxiways. Box culverts are needed at the downstream part of the drain because of high runoff volumes. U-shaped channels have been adopted for the landside area. Figure 11.2.12 shows an outline of the storm water drainage facility layout. The size of drainage facilities is obtained from hydraulic calculations (included in Appendix 11.2.2.).

Noi Bai Canal functions as an irrigation pond. In order to compensate for the reduction in storage capacity due to the southern area development, a new pond will be constructed along the Noi Bai Canal. The area of new pond will be about 4 ha, and the depth will be about 2 m.

There is a irrigation network around the development area. Since the new runway strip conflict with the existing trunk channel, diversion of this channel is planned. It will connect the pumping station and the eastern channel to the community of Mai Dinh.



<Existing Noi Bai Airport and Surroundings>



< New Development Plan >

Figure 11.2.11 Catchment Areas

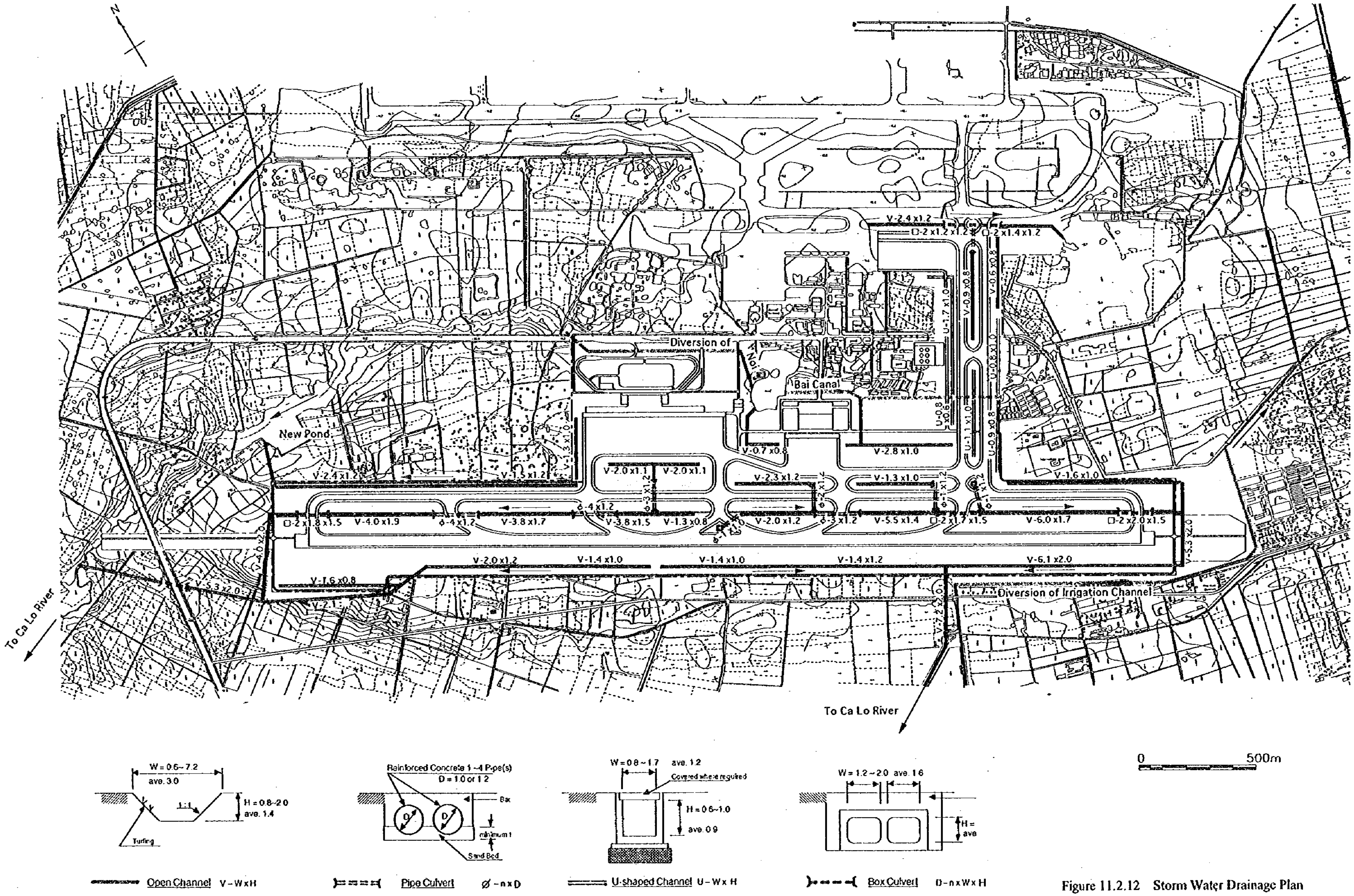


Figure 11.2.12 Storm Water Drainage Plan

11.2.4 Other Civil Works

Other civil works will include the following.

a) Fence and Gates:

A security fence should be installed along the airport perimeter and at the boundary of landside and airside in the terminal area. Gates should be provided where access between the landside and airside is required.

b) Landscaping:

Landscaping will be required in the terminal area to create pleasing impression for users. In addition, sodding and seeding will be required for surface protection of the grading areas.

c) Marking and Signs:

Marking will be required on the runway, taxiways, aprons, roads and car parks. Signs should also be provided along the roads and at the car parks.

11.3 BUILDING WORKS

11.3.1 International Passenger Terminal Building

1) General Concept

The basic concept for the international passenger terminal building is a combination of linear and transporter concepts, as described in Chapter 9. Regarding processing levels, the two level concept has adopted in the preliminary design for the following reasons.

a) Major passenger processing functions can be more centrally located with a two level concept than with a one-and-a-half level concept; therefore, the maximum walking distance can be reduced.

b) The two level concept is more convenient for passengers since it reduces number of level changes in the terminal building.

c) The two level concept reduces congestion at the curb by segregating departing and arriving passengers.

d) There is sufficient space to construct a road network, including ramps, in the terminal area.

The passenger and baggage flow used in the preliminary design of the international passenger terminal building is, in principle, based on the current practice at NBIA, although several changes in the passenger and baggage processing are recommended in Section 13.5. The continuation of these practices is unfavourable for the design of the building and the feasibility study, because these require more floor area and result in high costs. Figure 11.3.1 shows the flow diagram of passengers and baggage used in the preliminary design of the building.

2) Facility Requirements

the required number and sizes of major facilities were calculated based on: the number of peak hour passengers in the year 2010, the results of traffic survey at NBIA, and capacity calculation formulae in IATA's Airport Development Reference Manual, as shown in Table 11.3.1. Details of the calculation are shown in Appendix 11.3.1.

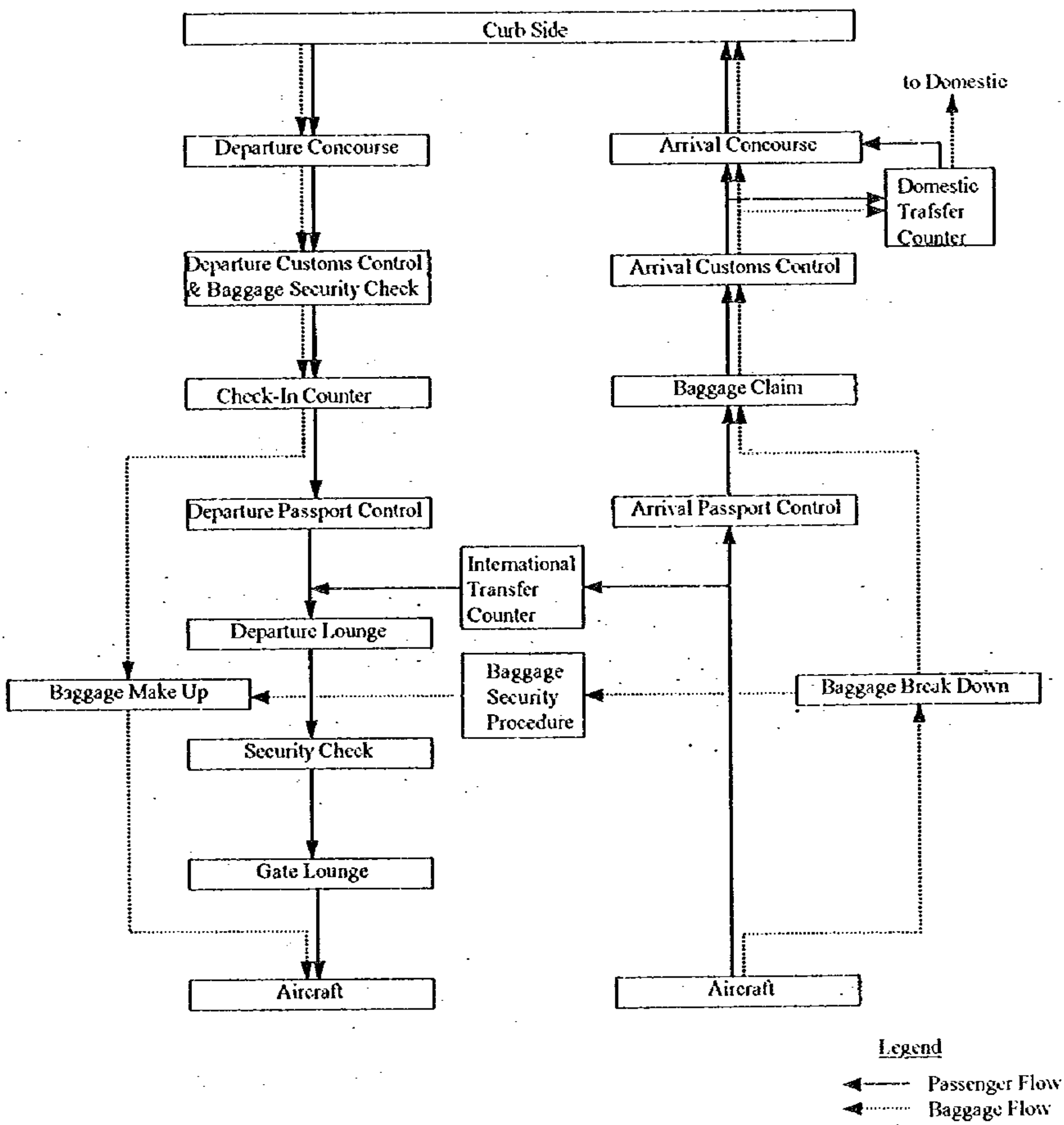


Figure 11.3.1 Flow of International Passengers and Baggage

Table 11.3.1 Requirements of Major Facilities

Facility	Requirement	Key Assumption
Departure Curb	103 m	
Departure Concourse	1,850 m^2	1.0 visitor per pax
Customs and Baggage Security Check	8 sets	0.33 min. per pax
Check-in Queuing Area	340 m^2	
Check-in Counter	34 nos.	1.5 min. per pax
Departure Passport Control Counter	57 nos.	2.5 min. per pax
Security Check (Gate Lounge)	2 sets per gate	500 pax
Departure Lounge	2,710 m^2	Ave. occupancy 60 min.
Gate Lounge	500 m^2	500 pax
Arrival Passport Control Queuing Area	310 m^2	
Arrival Passport Control Counter	68	3.0 min. per pax
Baggage Claim Device	4 nos.	70% pax from wide-body
Arrival Customs Queuing Area	340 m^2	100% pax checked
Arrival Customs Counter	6 nos.	0.25 min. per pax
Arrival Concourse	1,530 m^2	1.0 visitor per pax
Arrival Curb	103 m	

3) Zoning and Layout of Major Functions

Allowing for the basic concepts and passenger and baggage flows described previously, the following zoning principles were adopted for the preliminary design.

a) Most of the departing passenger processing facilities will be located on the second floor, and laid-out from landside to airside in the sequence of processing, so as to minimize any lateral movements of the passengers.

b) Most of the arriving passenger processing facilities will be located on the first floor and laid-out from airside to landside in the sequence of processing so as to minimize any lateral movements of the passengers.

c) Departing and arriving passengers will mix at the corridor on the mezzanine floor in the same way as happened at Singapore's Changi Airport. (If it is required to segregate the departing and arriving passengers, the second floor needs to be extended to the end of both wings to provide a corridor for the departing passengers. This arrangement will require an additional floor area of about 3,000 to 5,000 sq. m.)

d) Gate lounges and arrival passport controls will be located on the mezzanine floor where the passenger loading bridges will be connected.

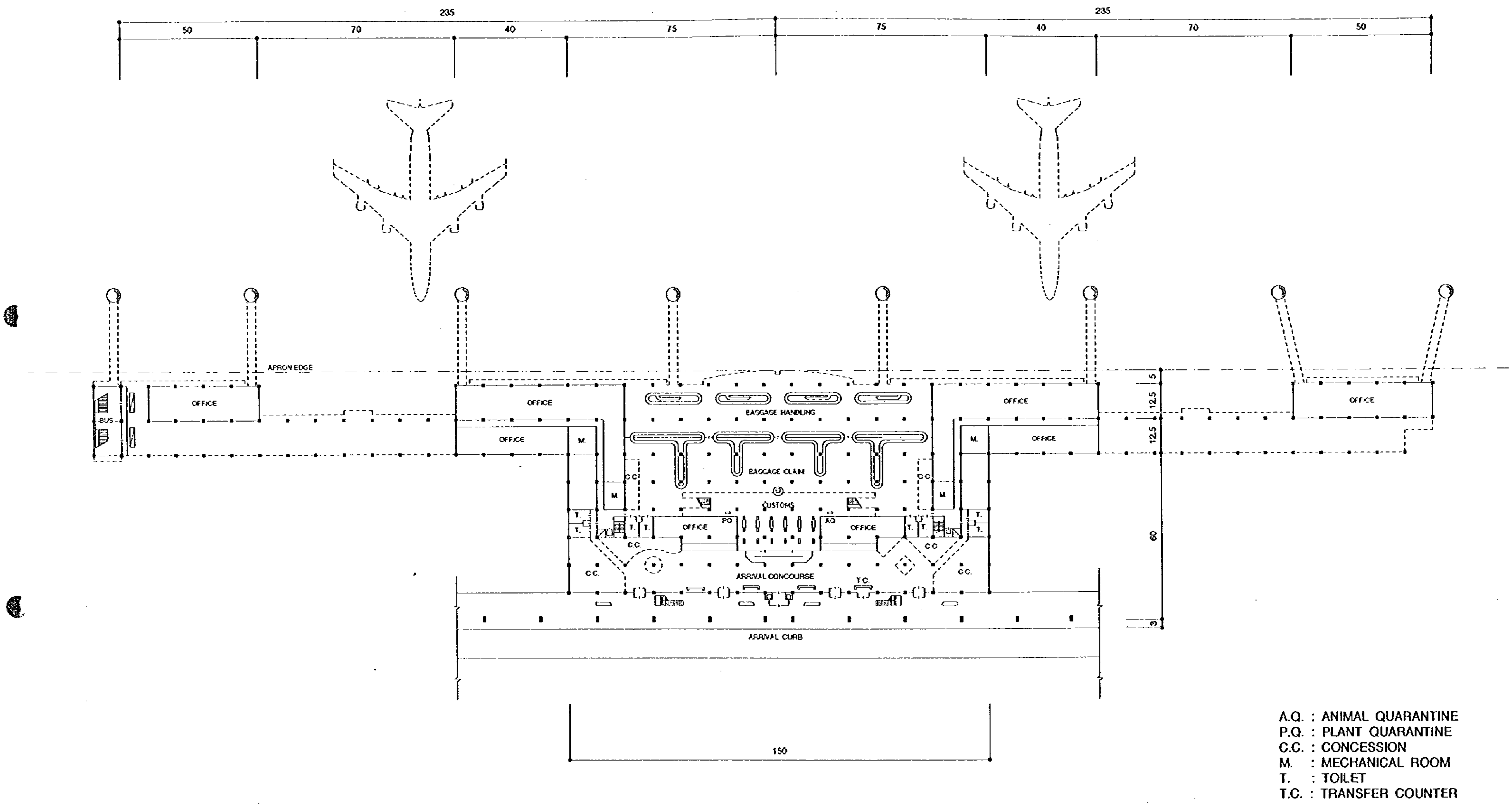
e) Baggage make-up and break-down area will be located on the first floor nearest to the apron.

Figures 11.3.2 through 11.3.4 show floor plans, and Figure 11.3.5 shows the elevations and section of the international passenger terminal building.

Departing passengers will usually arrive at the departure curb on the second floor and enter the terminal building. There is a departure concourse where passengers and their friends can stay together for a while before the passengers proceed to baggage screening. After baggage screening, the passengers proceed to the check-in counter and then to the departure passport control. There are CIP lounges and a restaurant at the airside of the second floor but most of the passengers will go downstairs to the mezzanine floor. On the mezzanine floor, the passengers will stay near the concessions or near the gate lounge until their boarding time. Before the boarding, the passengers proceed to the security check at the entrance of the gate lounges, and enter the aircraft through the passenger loading bridges. A bus gate for remote aircraft stands is located at the east corner of the main building on the first floor.

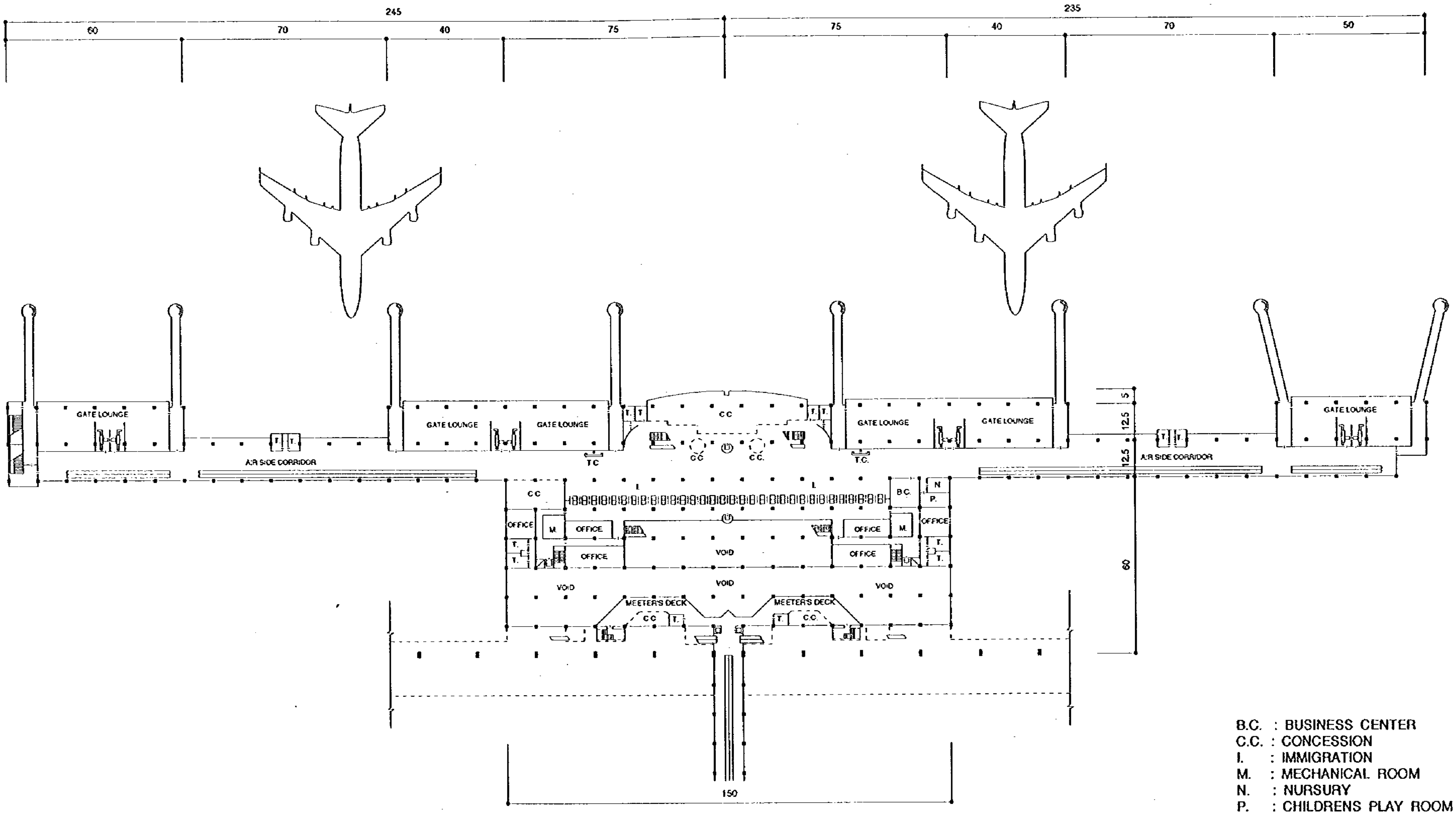
Arriving passengers will enter the terminal building on the mezzanine floor through the passenger loading bridges. The passengers will walk or use moving sidewalks, and come to the arrival passport control area. After clearing passport control, they will go down stairs to the baggage claim area on the first floor. After claiming their bags, the passengers will proceed to the customs check and then exit to the arrival concourse where concessions will be provided and welcomers may wait. From the arrival concourse, the passengers and welcomers will exit to the arrival curb.

A covered pedestrian bridge with moving sidewalks is planned at the central part of the terminal building on the mezzanine floor so as to provide access between the international passenger terminal building and the car park. The bridge may be extended to the domestic passenger terminal building across the access road. Vertical access between the mezzanine floor and the first and second floors will be provided at landside.



First Floor Plan S = 1 / 1,300

Figure 11.3.2 Floor Plan of International Passenger Terminal Building - First Floor

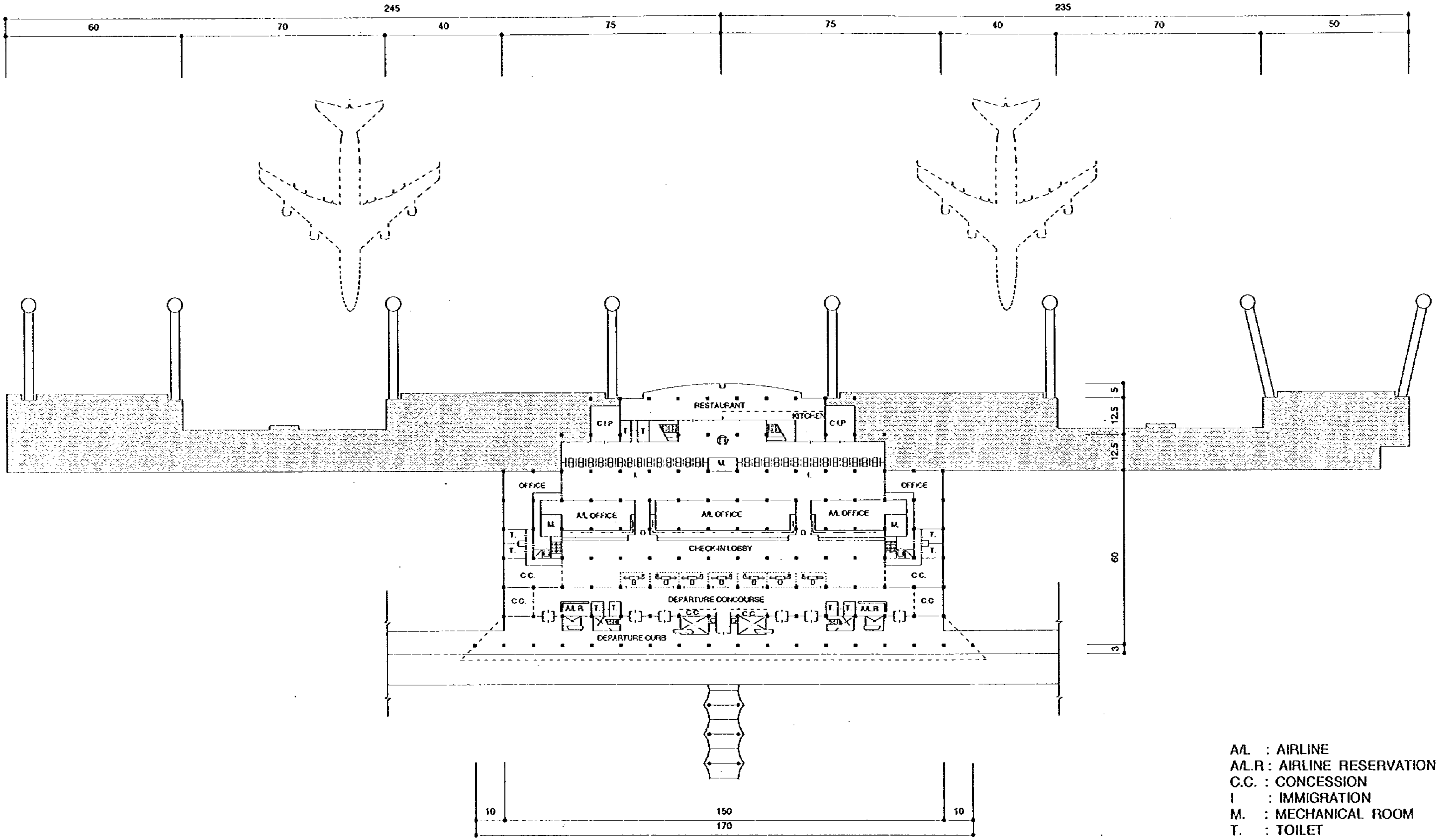


B.C. : BUSINESS CENTER
C.C. : CONCESSION
I. : IMMIGRATION
M. : MECHANICAL ROOM
N. : NURSURY
P. : CHILDRENS PLAY ROOM
T. : TOILET
T.C. : TRANSFER COUNTER

Mezzanine Plan **S = 1 / 1,300**

0 50 100m

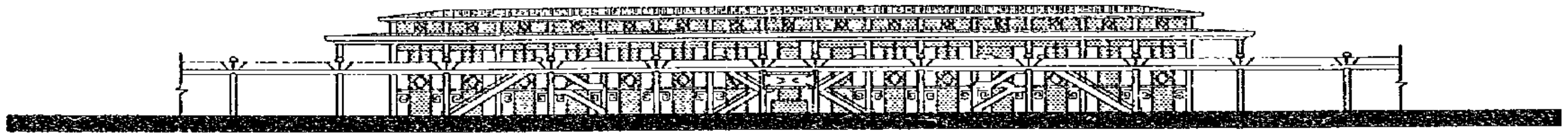
Figure 11.3.3 Floor Plan of International Passenger Terminal Building - Mezzanine Floor



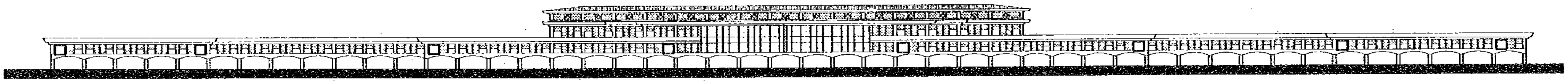
A/L : AIRLINE
A/L.R : AIRLINE RESERVATION
C.C. : CONCESSION
I : IMMIGRATION
M. : MECHANICAL ROOM
T. : TOILET

Second Floor Plan **S = 1 / 1,300**

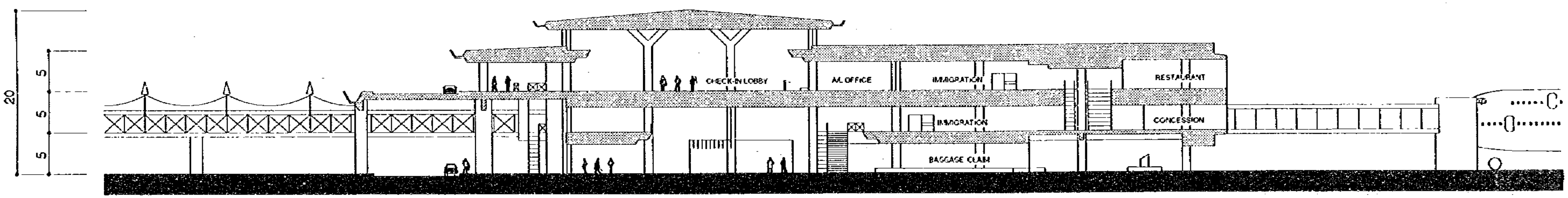
Figure 11.3.4 Floor Plan of International Passenger Terminal Building - Second Floor



Curb Side Elevation S = 1 / 1,300



Air Side Elevation S = 1 / 1,300



Section S = 1 / 500

Figure 11.3.5 Elevation and Section of International Passenger Terminal Building

Table 11.3.2 summarizes the floor areas of major parts of the terminal building.

Table 11.3.2 Schedule of Floor Area

Name of Area	Floor Area (m^2)	Remarks
First Floor		
Baggage Make Up and Break Down Area	2,090	
Baggage Claim Area	2,610	
Arrival Customs Area	680	
Arrival Concourse	1,650	
Office Area	3,750	
Concession Area	1,280	
Others	3,700	
Total	15,760	
Mezzanine Floor		
Gate Lounge	3,080	
Airside Corridor	4,510	
Arrival Passport Control Area	1,380	
Office Area	800	
Concession Area	1,020	
Others	4,450	
Total	15,240	
Second Floor		
Departure Passport Control Area	1,240	
Check-in Lobby	1,470	
Check-in Baggage Screening	350	
Departure Concourse	990	Exclude exteria public area of 1,500 m^2
Office Area	1,650	
Concession Area	1,920	
Others	2,530	
Total	10,150	
Grand Total	41,150	

4) **Outline of Structure**

Considering the scale and functions of the building, a 10m x 10m structural grid was used for the main part of the international passenger terminal building in the preliminary design. A 12.5m x 10m grid was used for the wing so as to provide enough space for the gate lounge, security screening, airside corridor and other needs. The second floor was planned to be 10m above the first floor so as to provide a mezzanine floor, to which passenger loading bridges and a pedestrian bridge to/from the car park will be connected. The highest part of the roof in the check-in lobby area has been planned to be 17.5m above the second floor. Based on these parameters, it was considered appropriate to adopt a steel-reinforced concrete (SRC) structure. Floor slabs will be of reinforced concrete, and the roof will also be a reinforced concrete slab. In order to support these upper structures, pile foundation will be required. The length of the piles will be about 30m in order to reach the basement rock layer.

5) Outline of Finishing

Exterior and interior finishing has been planned as shown in Table 11.3.3.

Table 11.3.3 Outline Finishing Schedule of International Passenger Terminal Building

Location	Part	Finishing Material
Exterior	Curb Walkway	Granite Flame Finish
	Columns and Beams	Painted on Fair Faced Concrete
	Windows and Doors	Anodized Aluminium Sash and Doors
	Glass	Heat Absorbing Glass Reflective Glass Tempered Glass
	Wall	Molded and Painted Pre-cast Concrete
	Roof	Gravel Top Built-Up Roofing
Interior		
Departure Concourse, Check-in, Passport, Baggage Claim, Bus Lounge, etc.	Floor	Vinyl Floor Sheet
	Wall	Emulsion Paint Finish Finished Faced Plywood
	Ceiling	Mineral Acoustical Tile
Airside Corridor and Gate Lounge	Floor	Tile Carpet
	Wall	Emulsion Paint Finish Finished Faced Plywood
	Ceiling	Aluminium Louver Mineral Acoustical Tile
Office Area	Floor	Vinyl Floor Sheet
	Wall	Emulsion Paint Finish
	Ceiling	Mineral Acoustical Tile

11.3.2 Domestic Passenger Terminal Building

The passenger terminal T1 will be converted to a domestic passenger terminal building after the completion of the new international passenger terminal building. Renovation work will mainly involve the removal of the government control facilities for international passengers, e.g. immigration and customs counters, partitions between international and domestic areas, and signage.

11.3.3 International Cargo Terminal Building

1) General Concept and Layout

The international cargo terminal building was planned as a one-story (partially two-story) building. Although it was assumed that the manual handling will be used in the international cargo terminal building, clearance height of the cargo handling area will allow higher mechanization in the future.

Total required floor area is 12,300 sq. m as described in Section 5.3.2, and it is divided into three areas as follows based on the experiences in the other airports.

Office Area:	2,460 sq. m (20%)
Import area:	4,920 sq. m (40%)
Export Area:	4,920 sq. m (40%, include Bonded Storage)

The internal layout of the international cargo terminal building was planned such that the cargo flow in the building can be as straight as possible from landside to airside or vice versa. The office area is located on the second floor of the landside. Figure 11.3.6 shows the floor plan, elevation and section of the international cargo terminal building.

In order to allow the free access of forklifts, the floor of the building was planned to be flat with airside and landside roads, and dock levellers will be provided for loading and unloading of cargo to and from various types of trucks at the landside.

2) Outline of Structure

In order to facilitate efficient working arrangements in the cargo handling area, a 50m x 10m and 15m x 10m grids were used for the cargo handling and office areas respectively. A steel frame structure has been chosen for the international cargo terminal building.

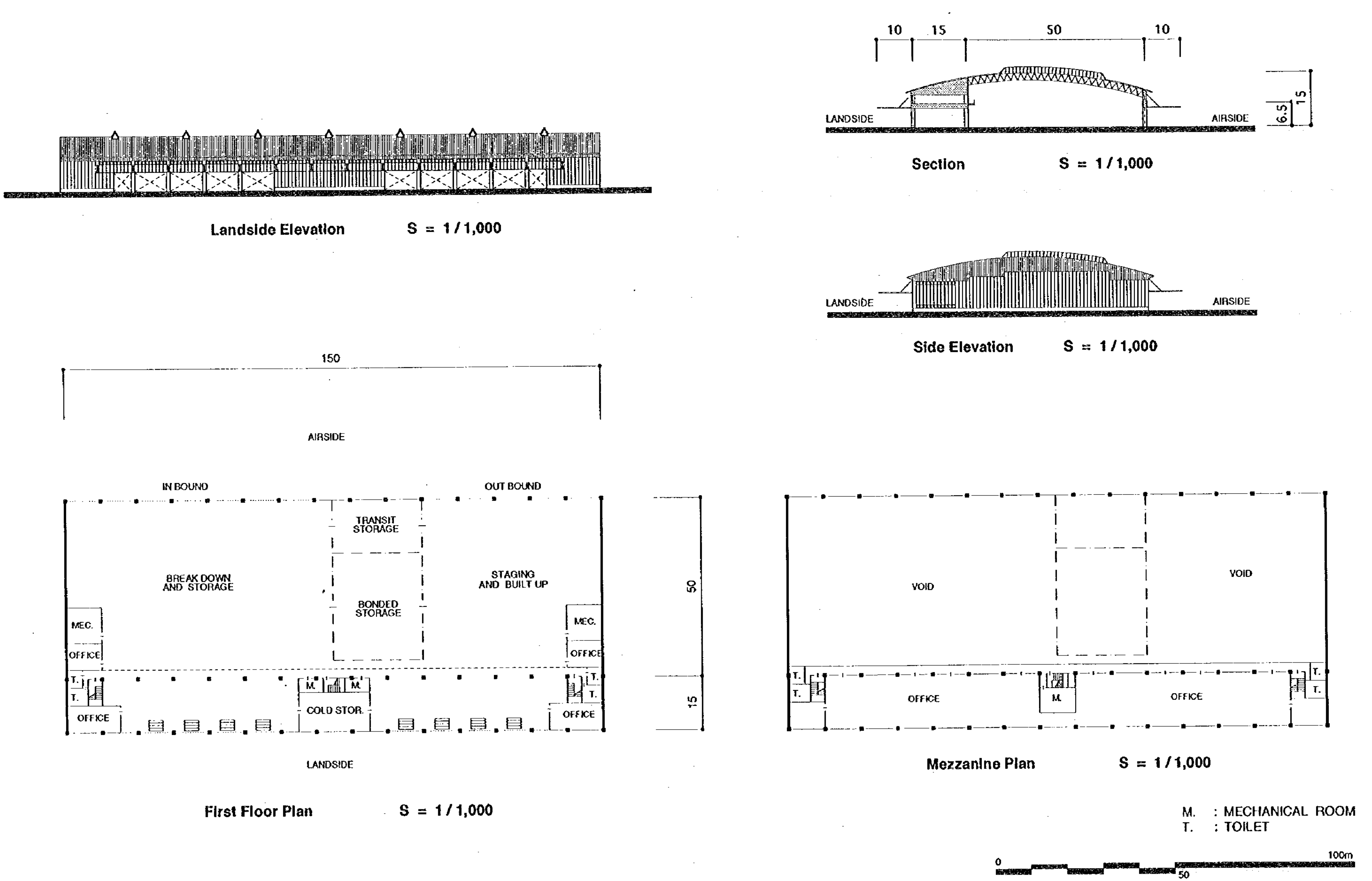


Figure 11.3.6 Floor Plan, Elevation and Section of International Cargo Terminal Building

3) Outline of Finishing

Table 11.3.4 describes the finishings for the international cargo terminal building.

Table 11.3.4 Outline Finishing Schedule of International Cargo Terminal Building

Location	Part	Finishing Material
Exterior	Wall	Extruded Cement-Asbestos Board
	Roof	Galvanized Steel Corrugated Roof
	Windows and Doors	Aluminium Sash Painted Steel Doors Steel Roll-Up Shutters
Interior		
Cargo Handling Area	Floor	Colored Concrete Hardener
	Wall	Extruded Cement-Asbestos Board
	Ceiling	Exposed Steel Frame Painted Painted Insulation Board
Office Area	Floor	Vinyl Floor Sheet
	Wall	Emulsion Paint Finish
	Ceiling	Mineral Acoustical Tile

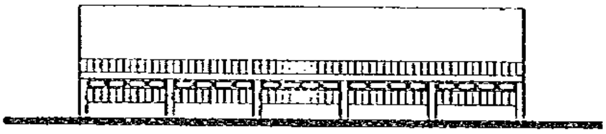
11.3.4 Fire Station

1) General Concept and Layout

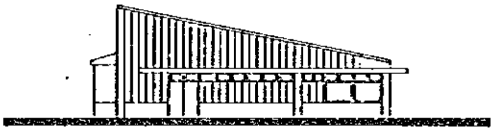
The fire station has been planned as a one-story building. It will house a self-contained fire fighting unit, including a: watchroom, garage, storage for extinguishing agents, lecture room, dormitory, locker room, etc. The garage and watchroom will face the airside, and the garage can accommodate three fire fighting vehicles and one ambulance. Other rooms will be located around the garage in an L-shape. Figure 11.3.7 shows the floor plan, elevation and section of the fire station.

2) Outline of Structure

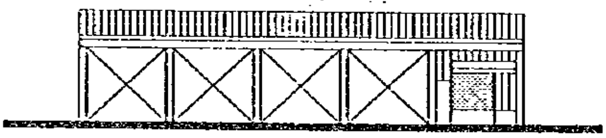
The structural grids of the fire station are 12m x 6m and 6m x 6m for garage and other areas respectively, and a steel frame structure has been chosen.



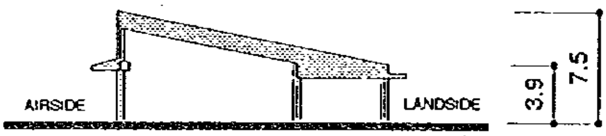
Landside Elevation S = 1 / 500



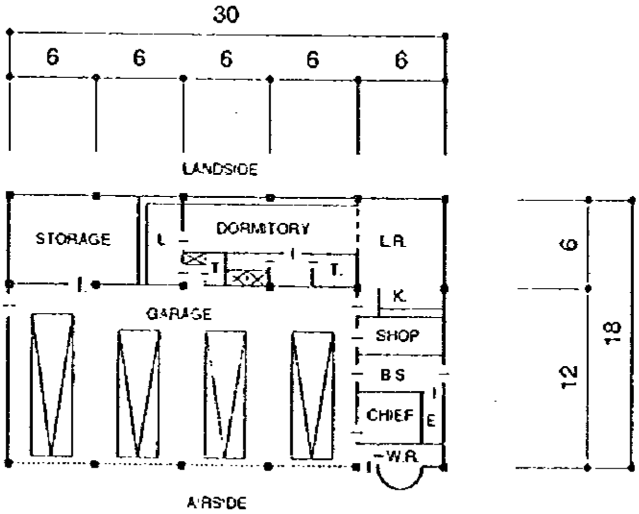
Side Elevation S = 1 / 500



Airside Elevation S = 1 / 500



Section S = 1 / 500



B.S. : Building Service
E. : Erectric Room
K. : Kitchen
L. : Locker Room
L.R. : Lecture Recreation
T. : Toilet
W.R. : Watch Room

First Floor Plan S = 1 / 500

0 30m

Figure 11.3.7 Floor Plan, Elevation and Section of Fire Station

3) **Outline of Finishing**

Table 11.3.5 describes finishings of the fire station.

Table 11.3.5 Outline Finishing Schedule of Fire Station

Location	Part	Finishing Material
Exterior	Wall	Extruded Cement-Asbestos Board
	Roof	Galvanized Steel Corrugated Roof
	Windows and Doors	Aluminium Sash Painted Steel Doors Steel Roll-Up Shutters
Interior		
Garage, Storage, Work Space	Floor	Colored Concrete Hardener
	Wall	Extruded Cement-Asbestos Board
	Ceiling	Exposed Steel Frame Painted Painted Insulation Board
Dormitory, Office Area	Floor	Tile Carpet, Vinyl Floor Sheet
	Wall	Wall Paper, Emulsion Paint Finish
	Ceiling	Mineral Acoustical Tile

11.4 AIR NAVIGATION SYSTEMS

11.4.1 Radio Navigation Aids

A Category II Instrument Landing System (or Microwave Landing System) should be installed for Runway 11R. The ILS will consist of the following components:

a)	Localizer:	on the extended center line and 300m from the threshold of Runway 29L
b)	Glide Path:	324m inside of Runway 11R threshold and 120m south of the runway center line
c)	Inner Marker:	on the extended center line and 450m from the threshold of Runway 11R
d)	Middle Marker:	on the extended center line and 910m from the threshold of Runway 11R
e)	Outer Marker:	on the extended center line and 10.9 km from the threshold of Runway 11R
f)	Locator:	on the extended center line and 18.5 km from the threshold of Runway 11R
g)	Distance Measuring Equipment: collocate with the GP	

Figure 11.4.1 shows the layout of radio navigation aids and meteorological observation systems in the NBIA.

The performance and installation of ILS should conform to standards and recommendations of ICAO Annex 10.

11.4.2 ATC and Communication Systems

Three additional ATC consoles for south runway operations should be installed in the ATC tower. Additional consoles with communication facilities will be used for the following functions.

a) Aerodrome Control (ADC)
b) Ground Control (GC)
c) Flight Data (FD)

For the ease of operation and maintenance the consoles should be compatible with the other consoles provided in the New Control Tower.

Abbreviations

CL	Ceilometer
DME	Distance Measuring Equipment
GP	Glide Path
IM	Inner Marker
LLZ	Localizer
MM	Middle Marker
RVR	Runway Visual Range
WDI	Window Direction Indicator

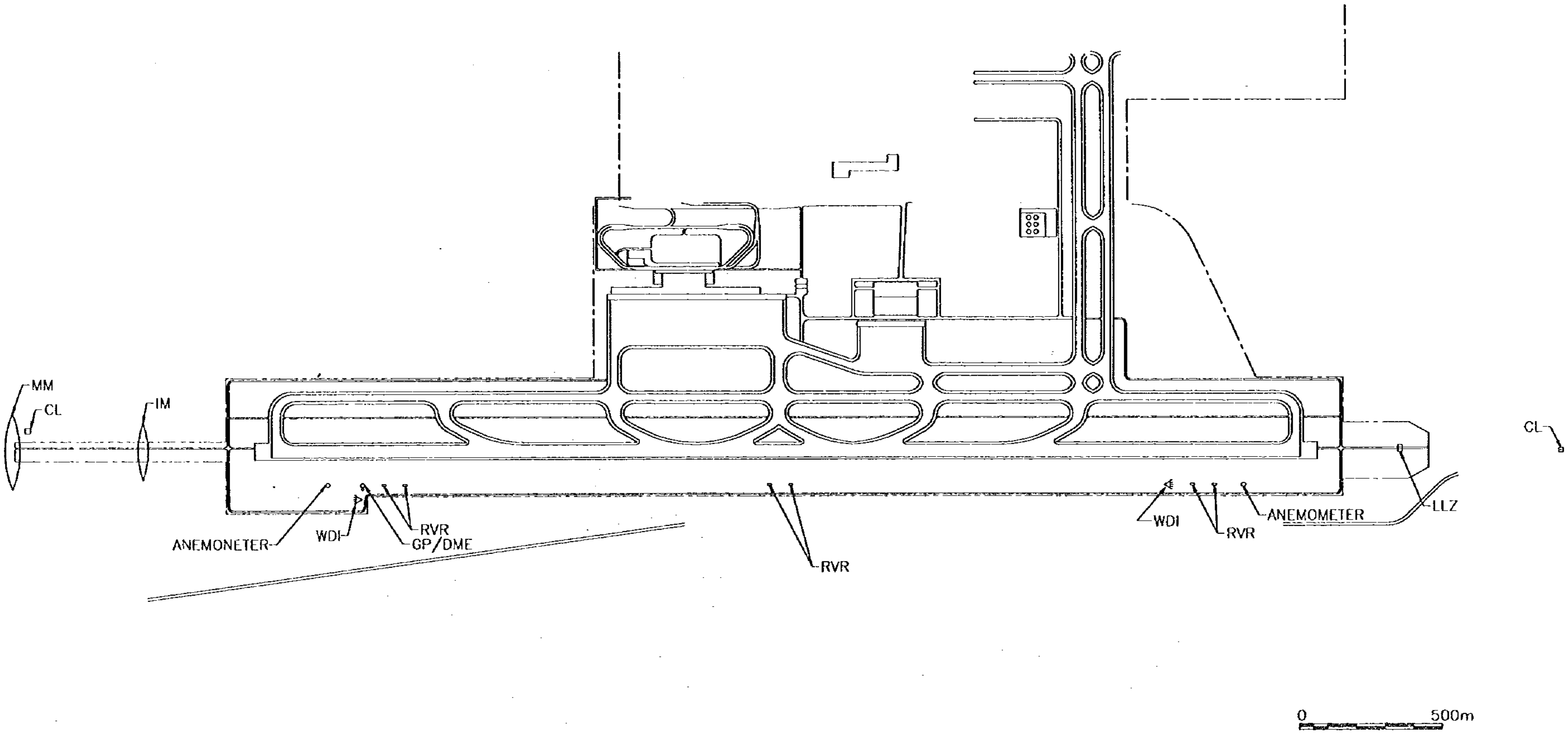


Figure 11.4.1 Layout of Radio Navigation Aids and Meteorological Observation Systems

11.4.3 Aeronautical Ground Lighting Systems

The following aeronautical ground lighting system should be installed for the new runway, taxiways and aprons:

a) Precision Approach Category II Lighting System (PALS Cat-II) for Runways 11R
b) Simple Approach Lighting System (SALS) for Runways 29L
d) Precision Approach Path Indicators (PAPI) for Runway 11R and 29L
e) Runway Edge Lights, Runway Threshold and Wing Bar Lights, Runway End Lights, Stopway Lights, Taxiway Edge Lights.
f) Runway Center Line Lights, Runway Touchdown Zone Lights, Taxiway Center Line Lights, Stop Bar Lights Taxi-holding Position Lights for Runway 11R and related taxiways.
g) Apron Flood Lights.
h) Aeronautical Ground Light Monitoring and Control System

Figure 11.4.2 shows the layout of the aeronautical ground lighting systems.

The performance and installation of lighting fittings should conform to standards and recommendations of ICAO Annex 14. Lighting controls, such as switching and illuminance control, should be located in the ATC tower cab. The electric power supply should be controlled by Constant Current Regulators (CCR), and supported by a secondary power supply system to conform with Annex 14.

11.4.4 Meteorological Observation Systems

Runway Visual Range (RVR) devices should be installed at about 300m from the thresholds of Runway 11R and 29L (near the touchdown points) and 120m south of the runway center line. In addition, another RVR should be installed for observations along the middle section of the runway. Anemometers and wind direction indicators should also be installed near the touchdown points. The layout of meteorological observation systems is shown in Figure 11.4.1.

The data to be collected by the RVRs should be transmitted automatically to the existing meteorological observation system. The performance and installation of the equipment should conform to the standards and recommendations of ICAO Annex 3.

Abbreviations

PALS	Precision Approach Lighting System
SALS	Simple Approach Lighting System
PAPI	Precision Approach Path Indicators
REDL	Runway Edge Lights
RTHL	Runway Threshold Lights
REDL	Runway End Lights
RWCL	Runway Center Line Lights
RTZL	Runway Touchdown Zone Lights
TWYL	Taxiway Edge Lights
TWCL	Taxiway Center Line Lights
STWL	Stopway Lights
WDIL	Wind Direction Indicator Lights
WBAR	Wing Bar Lights
FLO	Apron Flood Lights

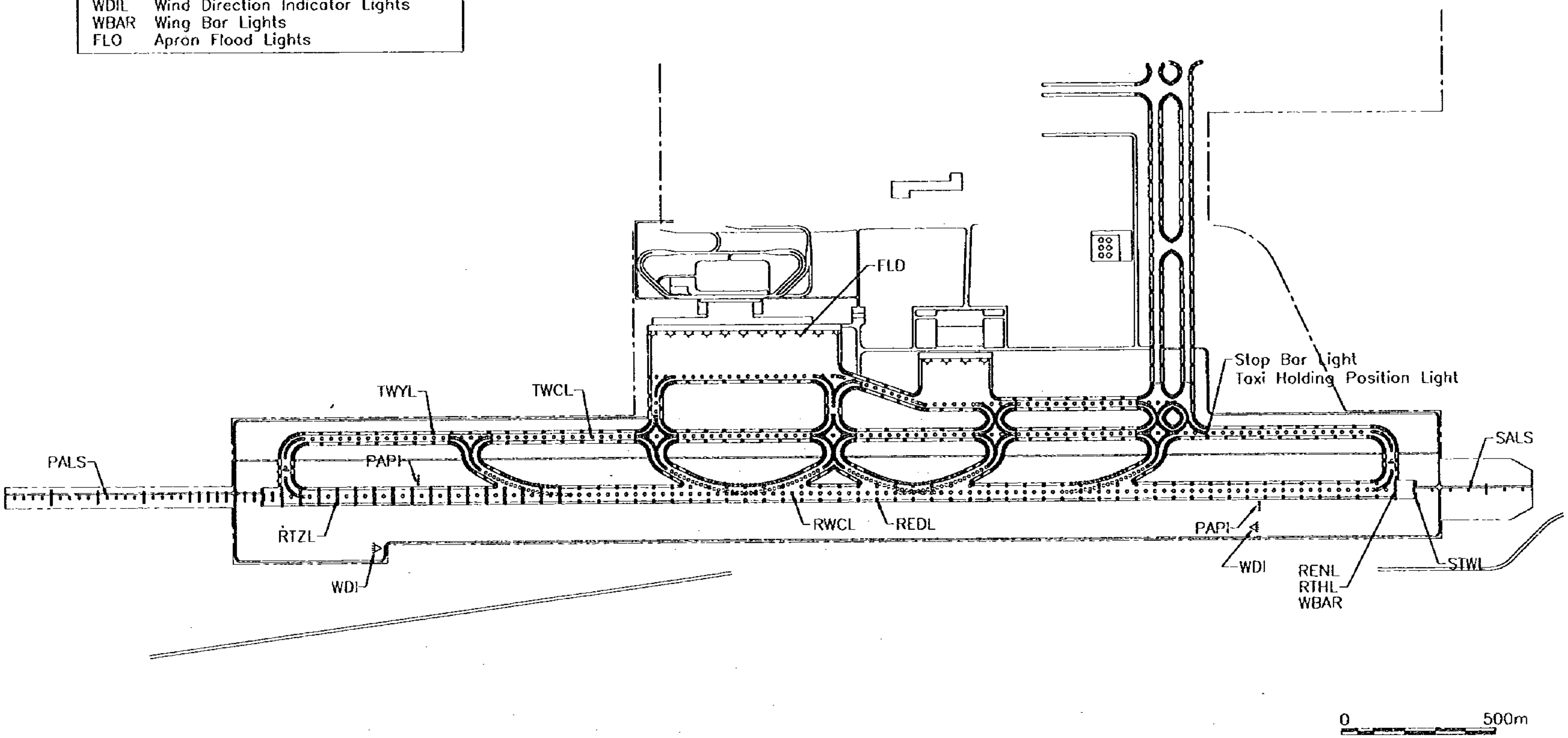


Figure 11.4.2 Layout of Aeronautical Ground Lighting Systems

11.5 AIRPORT UTILITIES

11.5.1 Power Supply System

Allowing for the location of the existing high voltage power supply network in the northern area, the location of the new facilities to be developed in the southern area, and electrical loads of the both areas, it is considered appropriate to provide a separate new high voltage power supply network for the southern area. This new power supply network was designed for 6.35 kV, the same voltage as the existing network, for ease of the maintenance.

The high voltage power supply cable diagram of both the new and existing high voltage power supply system is shown in Figure 11.5.1. Figure 11.5.2 shows the high voltage single line block diagram for the southern area.

As shown in Figures 11.5.1 and 11.5.2, the new power house will be connected to two 35 kV new incoming cables and accommodate 35 kV distribution equipment, step-down (from 35 kV to 6.35 kV) transformers, 6.35 kV distribution equipment, 380 V standby generator sets and step-up (from 380 V to 6.35 kV) transformers.

There will be three (3) groups of power distribution systems with one 2,000 kVA and two 2,500 kVA transformers in the southern area,. One group with a 2,000 kVA transformer will supply power to the air navigation facilities, international cargo building and new fire station. Two groups with 2,500 kVA transformers have been designed to supply power to the new international passenger building. Each system will have a standby generator system as a secondary power source for the 50 % of the demand so as to maintain the operations of essential facilities during commercial power failures.

In the AFL Station, additional secondary power supply systems which meet the maximum switch-over time specification for Precision Approach Category II operations, will be provided. The secondary power supply systems in the AFL station will consist of an Uninterruptible Power System (UPS) for the airfield lighting system, for operation at Precision Approach Category II. In order to reduce the load of the UPS, the runway edge lights and taxiway edge lights are not backed-up by the UPS, but by a standby generator system with a 15-second maximum switch-over time. Two transformers will be provided to keep the independent secondary power source for the air navigation equipment to be designed for Precision Approach Category II operation.

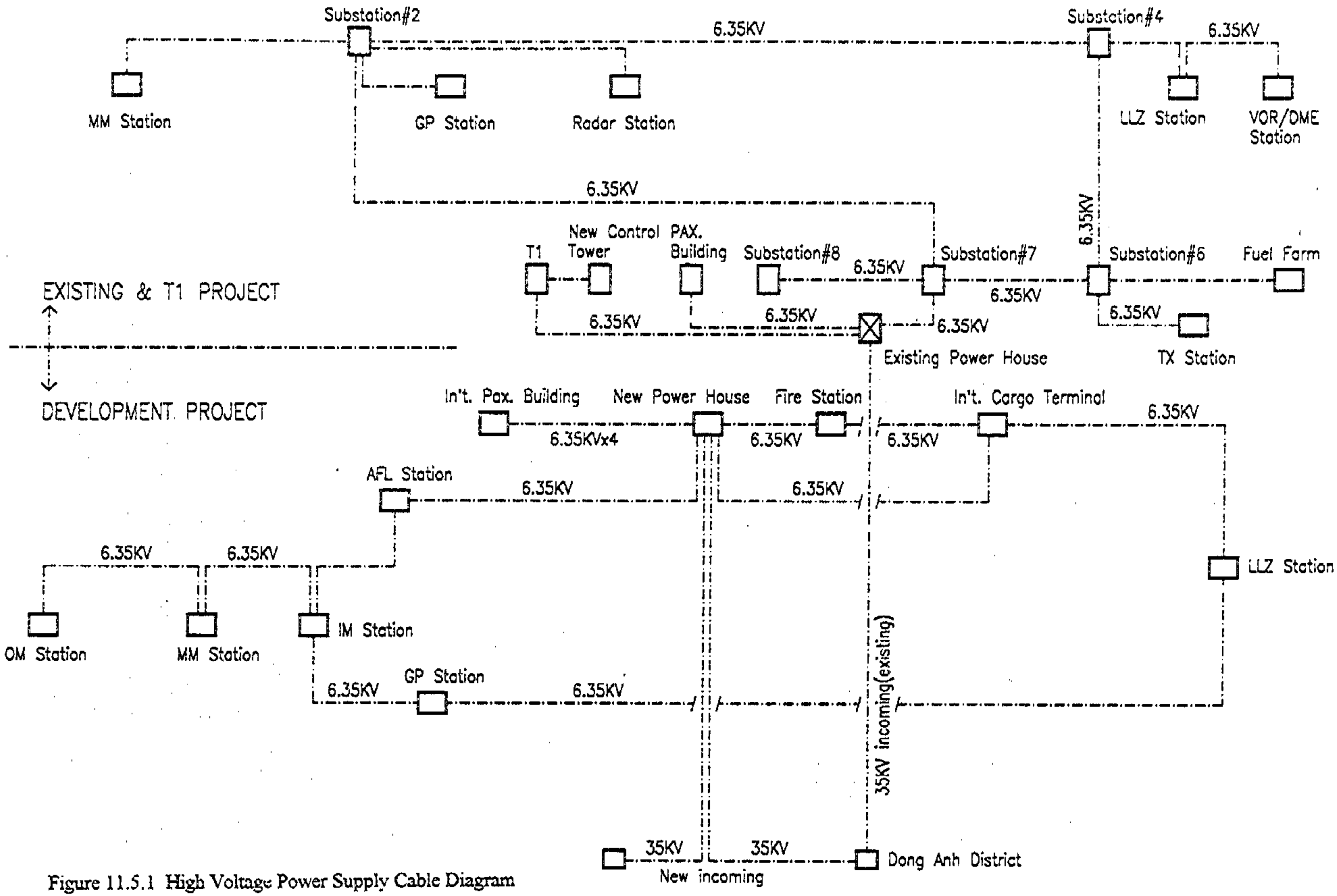


Figure 11.5.1 High Voltage Power Supply Cable Diagram

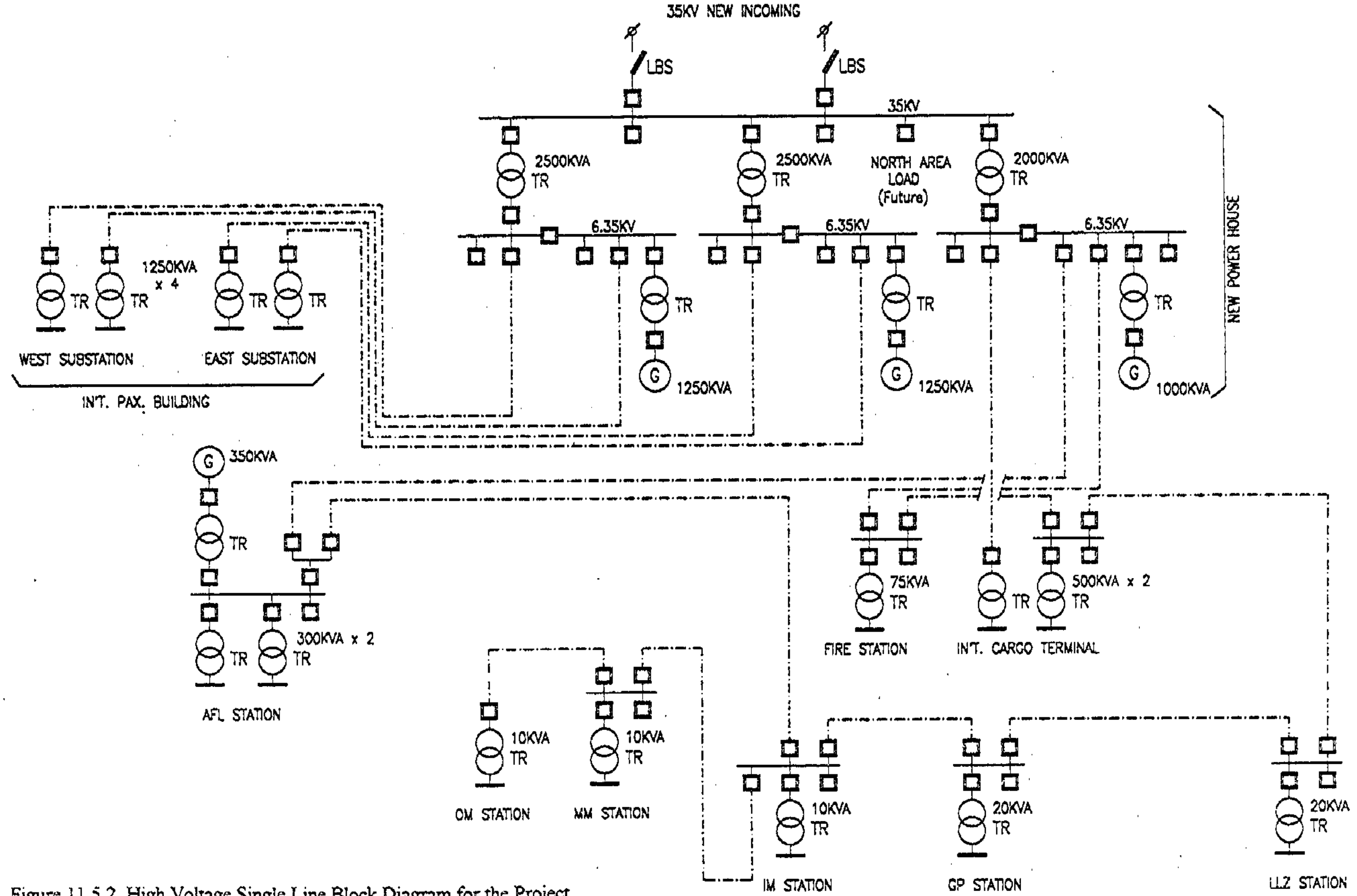


Figure 11.5.2 High Voltage Single Line Block Diagram for the Project

11.5.2 Telephone System

An automatic telephone exchange system (PABX), with a capacity of about 300 extension lines and 60 external lines, should be provided to meet the demand of the southern area. It will be connected with the existing PABX by internal trunk line cables from the new main distribution frame (MDF) so as to utilize the existing equipment and external trunk lines efficiently. The PABX and MDF will be installed in the international passenger terminal building.

11.5.3 Water Supply System

As described in Section 6.6.3, the existing water supply system has enough capacity to meet the anticipated demand for the Medium Term Development. Therefore, it was planned to construct a water distribution system for the southern area and connect it to the existing water supply system. The concept of the supply system is shown in Figure 11.5.3.

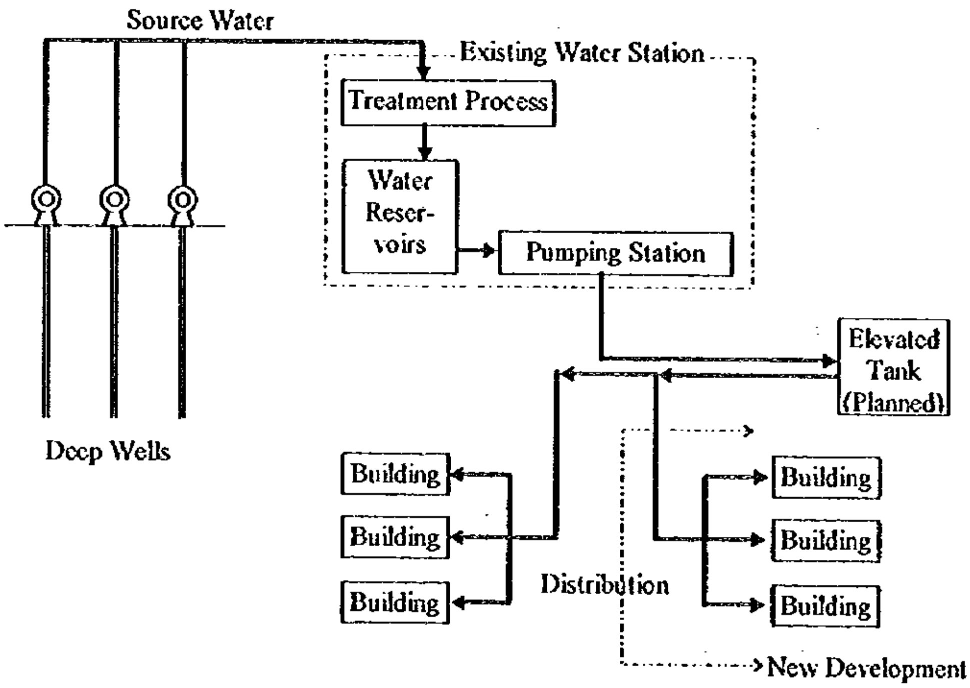


Figure 11.5.3 Concept of Water Supply System

Coal tar enamel painted steel distribution pipes, about 200 mm diameter, will supply about 120 tons of water to the southern area during peak hours, at 1.3 m/sec velocity.

11.5.4 Sewerage System

A sewerage system, with a capacity of 1,100 t/day (140 t/hr), should be constructed to collect and treat the waste water from the southern area facilities. If the facilities in the northern area are required to connect to the same system, the total capacity will be 2,000 t/day (250 t/hr). For the purposes of the preliminary design, the condition of the influent and effluent has been assumed as follows:

a)	Influent		
	BOD_5	200 mg/l	
	SS	250 mg/l	(Consultant's estimation)
b)	Effluent		
	BOD_5	80 mg/l	Source: "Provisional Environmental Criteria",
	SS	50 mg/l	Ministry for Science, Technology and Environment

There are many types of sewerage treatment methods as shown in Table 11.5.1.

Table 11.5.1 Comparison of Sewerage Treatment method

Method	Quality of Effluent	Stability against Load Change	Sludge Genera-tion	Required Area	Mainte-nance	Const-ruction Cost	Opera-tion Cost
Septic Tank Process	C } B	B	B	A	A	B	A
Stabilization Pond Process	C	A	B	B	A	A	A
Conventional Activated Sludge Process	A	B	C	A	C	C	C
Oxidation Ditch Process	A	B	B	A	C	C	B
Sequencing Batch Reactor Process	A	A	C	B	C	C	C
Oxidation Pond Process	B	A	A	C	A	A	A

Note: "A" Good; "B" Fair; "C" Poor

A septic tank with stabilization pond is recommended as a sewerage treatment system for the NBIA for the following reasons:

a) Septic tank process is the same as the existing system. The quality of effluent from septic tanks normally meets the Vietnam's standard when it is operated and maintained properly.

b) To prepare for occasional extra loads, the combined use of a stabilization pond has been planned. This also makes chlorination process unnecessary.

b) Less construction, operation and maintenance cost than other systems.

Waste water from each building is collected into a septic tank near to the building, and effluent from the septic tanks will be sent to a stabilization pond. A waste water collection system (separate for rain water collection system) has been planned for the southern terminal area. The concept of the treatment system is shown in Figure 11.5.4. A land area of about 1,000 sq. m is required for the stabilization pond.

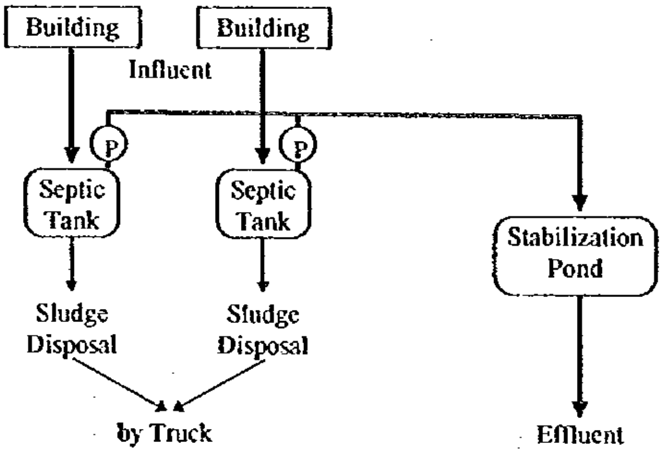


Figure 11.5.4 Concept of Sewerage Treatment Method

11.5.5 Solid Waste Disposal System

An incinerator should be provided at the airport so as to dispose of combustible solid waste collected from the airport. The incinerator should be able to incinerate 5 tons of waste from the southern area within about 8 hours. If the waste from the northern area is to be disposed of in the same incinerator, the capacity or hours of operation shall be increased to incinerate a total of 10 tons of waste per day.

11.6 OTHER FACILITIES

11.6.1 Aviation Fuel Supply System

A fuel hydrant system will be required so as to improve the safety of traffic on the apron and to maintain fuel quality. It has been assumed that a fuel hydrant system will be installed in the apron for T1 before the Project, and a hydrant system for the southern area can be connected to this system. It has also been assumed that fuel hydrant pumps will be installed in the existing fuel storage N-2 so as to minimize the construction period and investment before the Project.

During the Project, the existing fuel storage N-2 should be demolished so as to clear the site for the connecting taxiways; therefore, a new fuel farm needs to be constructed close to the Airport, in which fuel hydrant pumps, secondary storage tanks and other facilities will be installed. Potential site of the new fuel farm is on the east side of the connecting taxiways.

Figure 11.6.1 conceptually shows the fuel supply system before and after the Project. The new fuel storage tank will be connected to the existing fuel storage N-1 through the existing receiving pipe line. Fuel will be supplied to the hydrants in both northern and southern areas from the new fuel supply pumps.

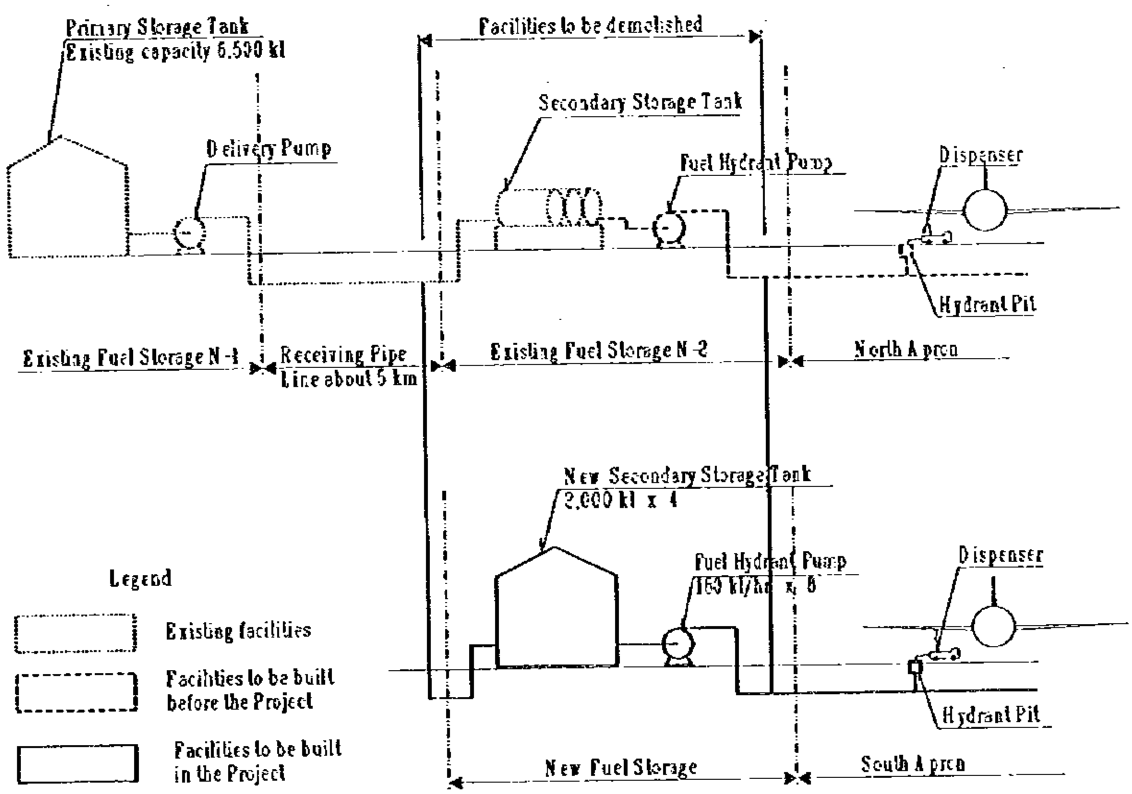


Figure 11.6.1 Conceptual Diagram of the Fuel Supply System

Based on the peak hour aircraft movements and allowing about 20 to 30 minutes for refueling time, it has been assumed that four (4) aircraft, i.e. one B747, two DC-10's and one B767, will need to be simultaneously refueled on the international passenger loading apron by the year 2010.

11.6.2 Rescue and Fire Fighting System

Three (3) fire fighting vehicles should be provided for the southern fire station so as to provide category 9 services for the southern area. The performance of the vehicles should conform to the following requirements and the recommendations of ICAO's Annex 14 and Airport Service Manual, Part 1.

Water Tank Capacity:	8,100 liter
Discharge Rate of Foam Solution:	3,000 liter/min
Complementary Agent:	150 kg of dry chemical powder

11.6.3 Airport Maintenance Equipment

In order to conduct periodic friction tests of the runway and to clean debris from the pavement surface, one pavement friction test device and one mechanical sweeper will be provided. Four disc type mowers, four hand mowers and one dump truck will be provided so that grass cutting of the runway strip and other areas (southern area only) can be conducted about once per month.

11.6 CONSTRUCTION PLAN

11.6.1 Site Conditions

The climate of Hanoi is subtropical with a mean annual rainfall of about 1,300 mm. Table 11.6.1 shows the monthly meteorological statistics for 1994.

Table 11.6.1 Monthly Meteorological Statistics for 1994

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Temperature (deg. C)												
Daily Maximum	20.9	22.0	21.3	28.8	32.1	32.3	32.2	32.3	30.8	28.7	27.4	23.1
Daily Minimum	15.6	17.3	16.4	23.4	25.1	26.4	26.1	25.8	25.1	21.5	20.5	17.6
Daily Mean	17.8	18.9	18.4	25.3	27.8	28.7	28.4	28.5	27.1	24.3	23.1	19.7
Average Humidity (%)	80	85	83	86	81	81	84	82	85	78	78	79
Monthly Rainfall (mm)	12	40	122	19	416	348	468	596	319	103	23	71

As it can be seen in Table 11.6.1, the hot and rainy season runs from May to September. During the rainy season, the number of working days for civil works will be reduced to about 50% due to the rainfall.

11.6.2 Major Temporary Works

Major temporary works will be as follows:

a) Cement Concrete Batching Plant
b) Asphalt Concrete Batching Plant
c) Stock Yard
d) Tower Crane
e) Contractor's Site Office and Camp

There will be sufficient space at the construction site for establishing plant, yards and the site office. The contractor's camp may be built near to the Airport and/or existing villages and towns. It may be worthwhile to consider the possibility of building a new residential area as a part of development of Soc Son District, and leasing the residences to the contractors.

The locations, numbers and sizes of construction roads, sedimentation ponds and other temporary works should be planned by the contractor, taking into account of environmental impact of the works, as these are closely related to the construction plan to be established by the contractor.

11.6.3 Construction Time Schedule

The outline construction time schedule is planned as shown in Table 11.6.2. The overall construction period is assumed at 4 years including time for mobilization and for facility preparation prior to hand over. Earthworks and pavement works is considered to be on the critical path.

Table 11.6.2 Construction Time Schedule