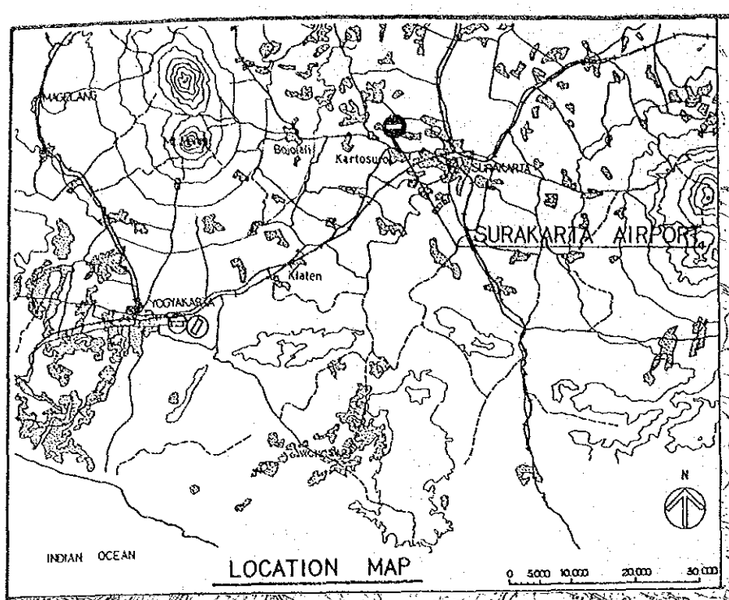
CHAPTER 3 AIRPORT MASTER PLAN

CHAPTER 3 AIRPORT MASTER PLAN

3.1 General

The facility layout plan and facility planning are described in this chapter based on the airport facility requirements for Phases I and II which were established in Chapter 2. The airport layout plan is shown in Fig. 3.1.1. and the proposed facilities required in Phase I are outlined in Table 3.1.1.



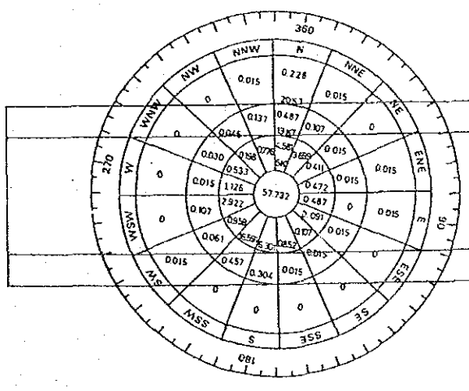
LOCATION MAP

BASIC DATA TABLE	
RUNWAY DATA	
EFFECTIVE RUNWAY GRADIENT	0.470 %
WIND COVERAGE	20 KNOT 99.7 % 13 KNOT 98.4 %
INSTRUMENT RUNWAY	YES
PAVEMENT STRENGTH	PCN 48
APPROACH SURFACE	1/50
RUNWAY LIGHTING	HIRL
RUNWAY MARKING	ALL WEATHER
NAVIGATIONAL AIDS	ILS, ALS, PAPI

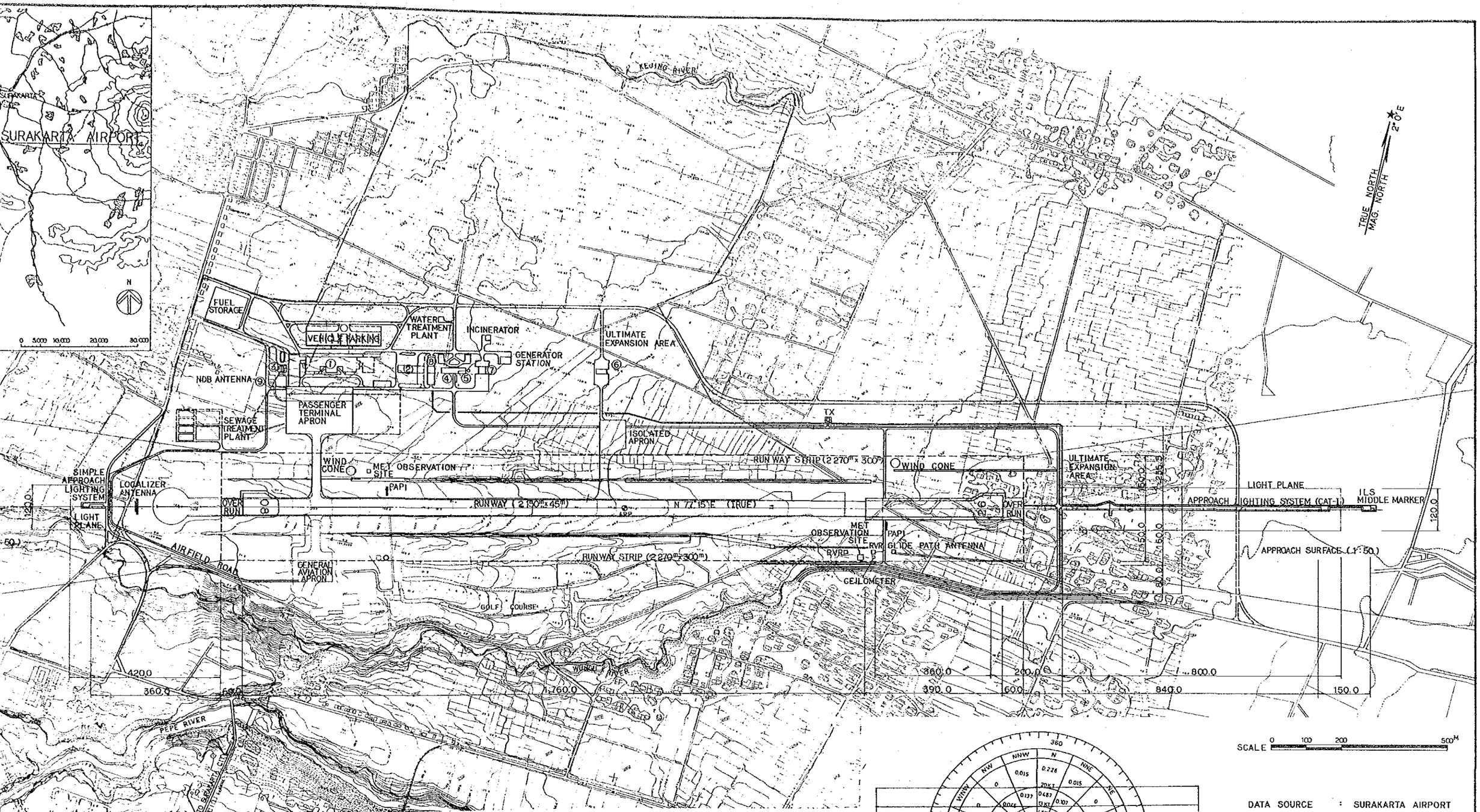
BASIC DATA TABLE	
AIRPORT DATA	
AIRPORT ELEVATION	118.6 m
AIRPORT REFERENCE POINT (ARP) COORDINATES	LAT 7°31'S LNG 110°45'E
AIRPORT AND TERMINAL NAVAIDS	VOR/DME NDB
AIRPORT REFERENCE TEMPERATURE	34.7°C

LEGEND	
	BUILDING / HOUSE
	PLANT BOARDER
	RICE FIELD
	FIELD
	TREES
	GRASS
	RIVER
	GROUND CONTOURS (0.5m PITCH)
	SECURITY FENCE
	AIRPORT BOUNDARY

BUILDINGS	
①	PASSENGER TERMINAL BUILDING
②	CARGO TERMINAL BUILDING
③	V.I.P. TERMINAL BUILDING
④	ADMINISTRATION BUILDING
⑤	CONTROL TOWER
⑥	FIRE STATION
⑦	GSE MAINTENANCE SHOP
⑧	AIRPORT MAINTENANCE BUILDING
⑨	TERMINAL BUILDING FOR TRANSMIGRATION



WIND ROSE



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	PLANT BOARDER
	RICE FIELD
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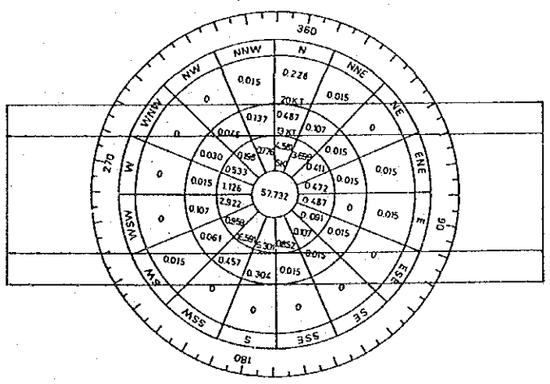


WIND ROSE

DATA SOURCE	:	SURAKARTA AIRPORT
PERIOD	:	1982 - 1984
RUNWAY DIRECTION	:	N 77° 15' E
WIND COVERAGE	:	99.7% (CROSS WIND 20KT)
		98.4% (CROSS WIND 13KT)

Fig. 3.1.1 Airport Layout Plan

Table 3.1.1 Outline of Surakarta Airport in Phase I

"X" indicates services available

Country	Name of Airport	INTL/DOM. ICAO CODE	Commencement of Services	Airport Total Area	Aerodrome Ref. Point	Airport Elevation	Runway Orientation	Aerodrome Ref. Temp.	Operation Hours	Seasonal Availability	Note: Control Agency; DGAC
Republic of Indonesia	Surakarta (Adi Sumarmo)	Dom. 4C	1978	251 ha	7°31'3"S 110°45'19"E	118.6 m (389.1 ft)	N 77°15'6"E (True)	34.7°C		All Seasons	

City/Town		Transportation			Wind Coverage	Operating Minimum					Note: Approach Category; Instrument, Precision Approach
Name	Population	Distance to Airport	Railway	Taxi	Bus		Runway	Procedure	DH/MDA	vis	
Surakarta	0.5 Million (1983)	14 KM by Road	N.A.	X	X	98.4% (13kt) 99.7% (20kt)	Apch to 08	ILS	-	-	
								VOR	-	-	
							Apch to 26	ILS	587'	800 m	
								VOR	760'	1,200 m	

Air Navigation Systems

Navaids																					
NDB		VOR		DME		TACAN		ILS		LOCATOR		VHF D.F.									
X		X		X		-		X		X		-									
ATC/COM																					
ASR		SSR		PAR		ASDE		ARTS		VHF A/G		AFS		TTY		MICROWAVE		ATIS			
-		-		-		-		-		X		X		X		X		-			
Lights																					
ALS	SFL	SALS	ALB	CGL	RWL	RWCL	RWTL	ORL	TDZL	REIL	DML	PAPI	TWL	TWCL	TGS	ABN	IWDI	AFL	O.L.		
X	-	X	-	-	X	-	X	X	-	-	-	X	X	-	X	X	X	X	X		
MET																					
RWY Surface Sensors		RVR		Ceilometer		WX-FAX		APT-RX		Radiosonde		WX Radar		WX-TTY							
X		X		X		X		-		-		-		X							

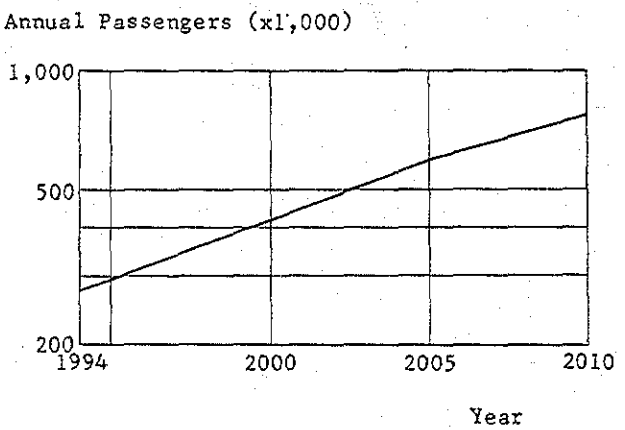
Basic Facilities

	Size	Pavement	Note
Runway Strip	2,270 m x 300 m	-	
Runway	2,150 m x 45 m	Asphalt	
Taxiway	285 m x 23 m	Asphalt	

Loading Apron	Design Aircraft	Nr. of Stands	Pavement	Area	Parking Configuration
	A320 class	3	Concrete/ Asphalt	20,460 m²	Self-maneuvering
	F-28 class	1			
Isolated Apron	B-767 class	1	Asphalt	5,760 m²	Self-maneuvering

Other Facilities

	Size	Structure	Note
Passenger Bldg.	7,700 m²	RC	
Cargo Building	800 m²	RC	
Administration Bldg.	1,200 m²	RC	
Control Tower	60 m²	RC	Height 23 m
Fire Station	400 m²	2 Air Crash Tenders 2 Fire Engines	CAT-7
Fuel Supply System	(Jet A1 520 kl)		PERTAMINA
Hangar	-		
Vehicle Parking Spaces	190 cars	Asphalt	
Access Road	2 lanes	Asphalt	



Traffic Demand

LDG AND TOF	3,388	3,900	4,500	5,500	6,400
Annual Freight (ton)	618	1,740	2,570	3,530	4,850
Annual Passengers	92,745	299,000	408,000	592,000	776,000
Year	1983	1995	2000	2005	2010

Note.
Completion of Phase I development:
End of 1993

Drawn by JICA
As of 1986

3.2 Airport Layout Planning

3.2.1 Airport Site

The existing airport is located in the agricultural district where villages are scattered as shown in Fig. 3.2.1. In the northern area of the airport site, a flat terrain which has been cultivated for agricultural use (rice fields) exists.

East of the runway, a number of housing areas has been developed. As the Wungu River which is utilized for agricultural irrigation flows next to the runway in the proposed runway extension area, it will be required to divert the river in order to extend the runway.

The site is very flat, and the only obstacles in extending the runway are the trees.

3.2.2 Layout Plan of the Airport

(1) Runway Extension

The existing runway will be extended up to 2,150 m. In detail, the threshold of Runway 08 will be relocated 250 m to the east and Runway 26 will be extended by 390 m to the east. The reason why the localizer (LLZ) area is to be installed within the existing area of Runway 08 based on the main approach direction is stated in Paragraph (2).

The reasons why the new LLZ area is not planned for installation in the west side of the existing runway and the portion of the existing runway is utilized are as follows:

- If the new LLZ area is planned outside the existing airport property, land acquisition of 5 ha. will be required and the volume of earthwork will be 250,000 cu.m to fill up that portion of the Wungu River.

- The Wungu River is required to be diverted by 400 m. For this diversion work, excavation of about 200,000 cu.m is required due to the river depth being about 10 m.

- A diversion of 1.5 km for the existing road and a new bridge are also required.

Fig.3.2.1 Existing Surakarta Airport Layout Plan

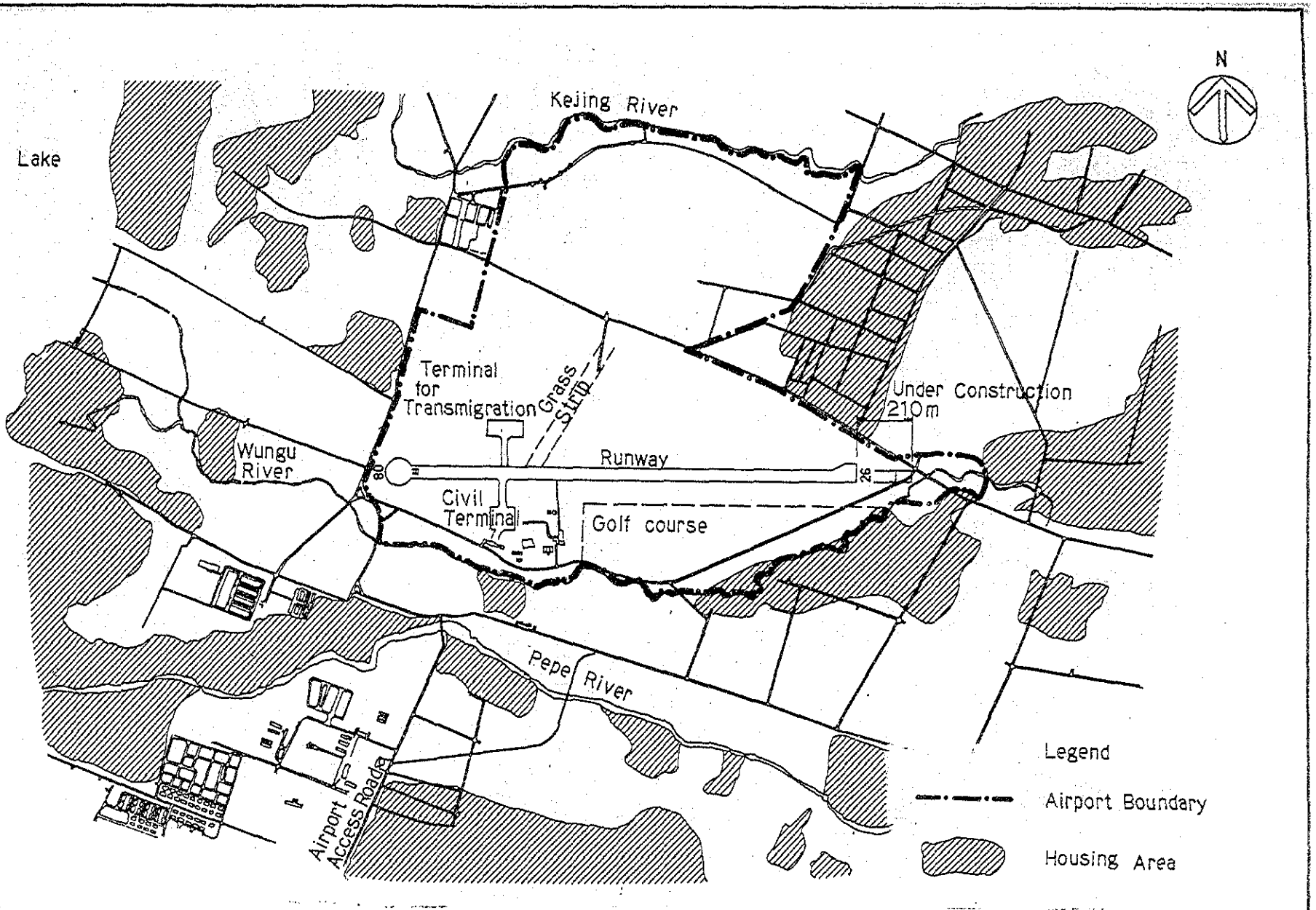


Fig.3.2.1 Existing Surakarta Airport Layout Plan

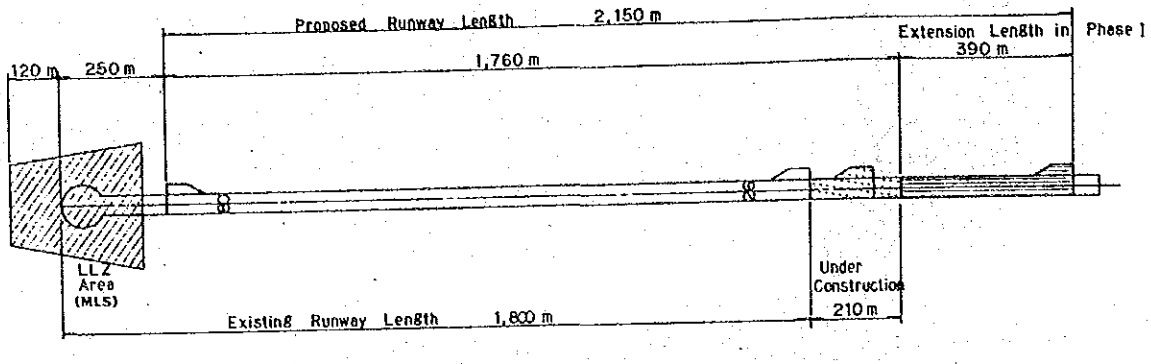


Fig. 3.2.2 Proposed Runway Location

(2) Main Approach Direction

The main approach direction has been determined to be Runway 26 where the highest approach ratio is indicated as studied in Part I. This plan also includes avoiding airspace establishment for the main approach near Mt. Merapi. Accordingly, Instrumental Landing System (ILS), Approach Lighting System (ALS), etc., for precision approach Category-I are planned for the approach to Runway 26.

(3) Location of the Terminal Area

The future terminal area requires a much wider area. Since the existing terminal is located south, a south expansion scheme is considered; however, it is impossible because the Wungu River forms deep valley outside the southern border of the existing terminal. In addition, DGAC has a plan in which the new terminal will be expanded north of the runway and based on the plan, the new apron with an area of 90 m x 186 m has been already completed. The new terminal, therefore, is planned to be set up in the north so as to coincide with this new apron.

(4) Configuration of Taxiway and Apron

A parallel taxiway is not required to be constructed at Surakarta airport in both Phases I and II. Therefore, only rectangular exit taxiways are planned.

Since a rectangular exit taxiway has been already constructed between the runway and the new north apron, this taxiway will be utilized as it presently exists.

(5) Aerodrome Location

The location of the airport has been planned in Part I as follows:

Runway Orientation	:	N 77° 15' E (True)
Aerodrome Reference Point	:	7° 31' 3" S 110° 45' 19" E
Airport Elevation	:	118.6 m

(6) Airport Property Area

The airport property area should be fixed so as to be compatible with the future development inside and outside the airport. If the airport property area is planned with not enough leeway provided for future expansion, it will be unable to expand to cope with increases in air traffic demand due to an escalation of social and economic factors.

Hence, the airport property area will be provided an ultimate expansion area such as an area for a complete parallel taxiway which is not required in Phases I and II, an area for extending the runway up to 2,500 m, etc., in addition to an area required for the Airport Master Plan to deal with the prospects of further expansion in the future..

The airport property area will be 251 ha including expansion area 11 ha for this project. The area for ultimate expansion is 18 ha.

3.2.3 Terminal Area Layout

The terminal area consists of the apron, passenger terminal building, cargo terminal building, control tower, administration building, vehicle parking and other facilities necessary for civil air transport.

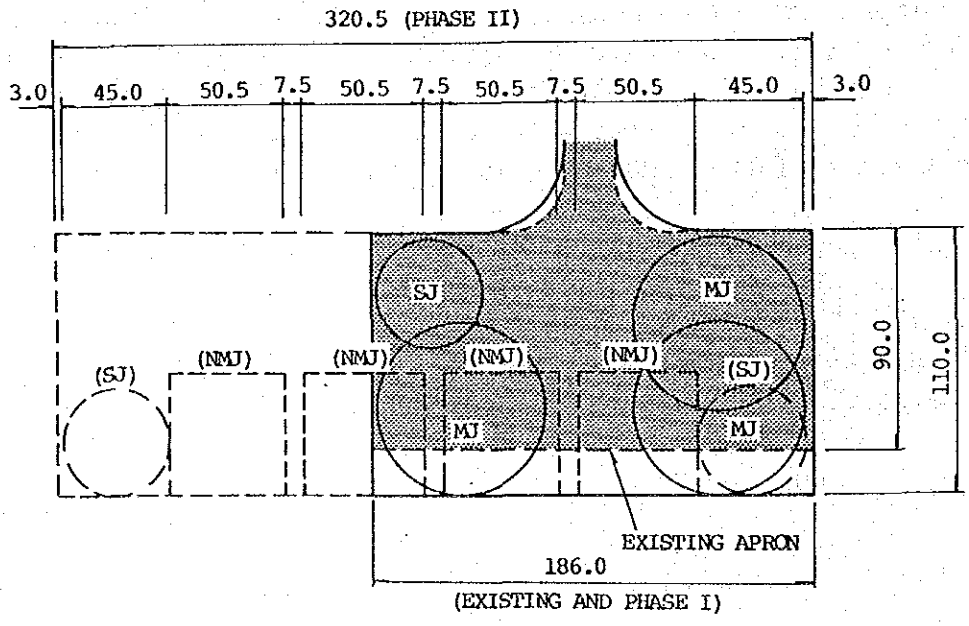
The layout of the new terminal area is designed based on a linear concept in which passenger and cargo terminal buildings, administration building, etc., are in a line facing the apron, as shown in Fig. 3.2.4.

The basic considerations for the terminal facilities are as follows:

(1) Passenger Terminal Apron

The location of the passenger terminal apron is as described in "Configuration of Taxiway and Apron" of Section 3.2.2. (4).

The required apron area in Phase I is planned by expanding the existing north apron as shown in Fig. 3.2.3. In Phase II, the apron will be, furthermore, expanded east so that it will be located in the center of the airport.



(NOTE) MJ, SJ : Self Maneuvering

Fig. 3.2.3 Apron Arrangement for New Terminal

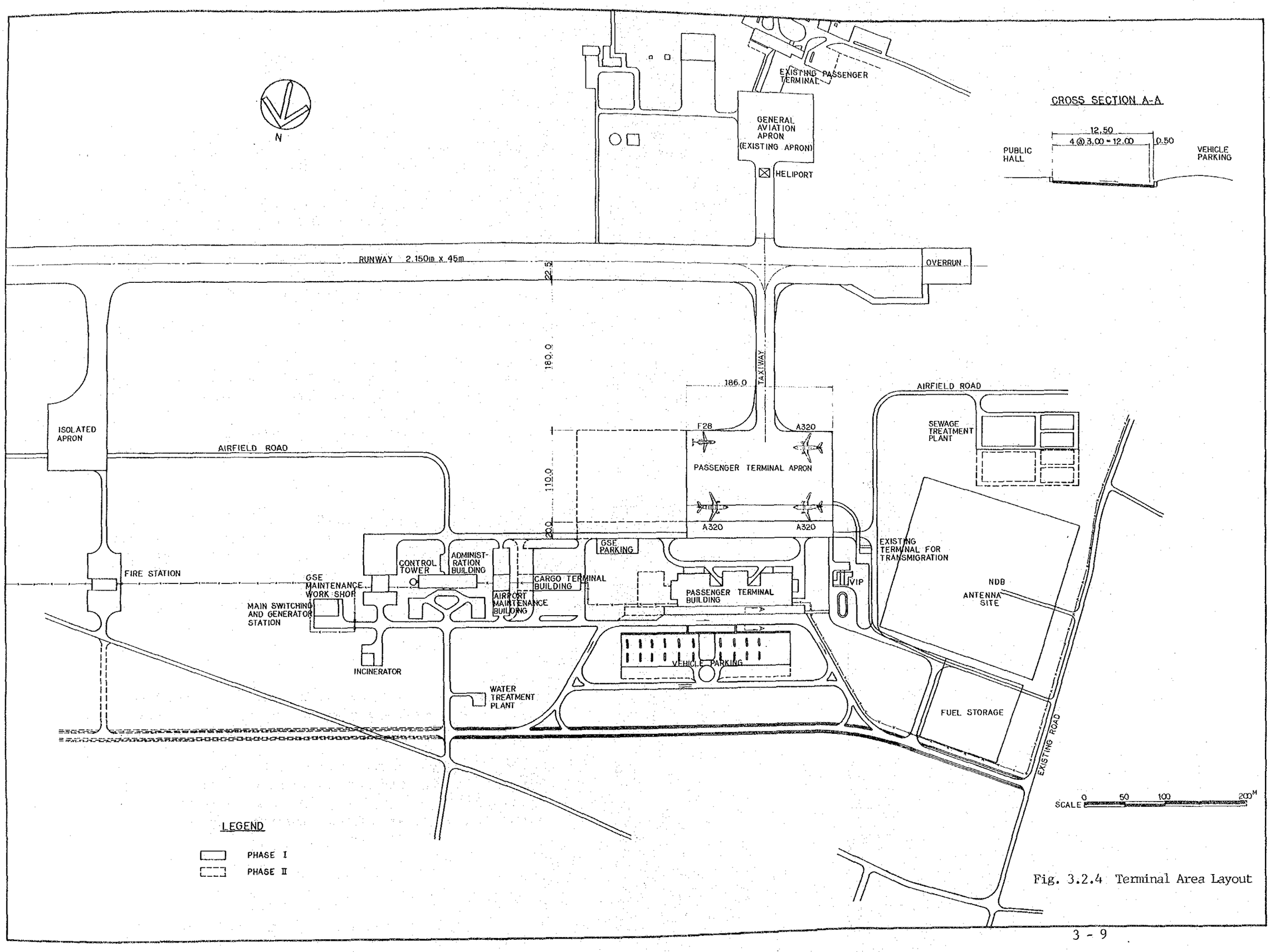


Fig. 3.2.4 Terminal Area Layout

(2) Passenger Terminal Building

The passenger terminal building is planned so as to face the apron based on consideration of the shortest and easiest access of passengers and baggage from/to the aircraft stands. The location of the passenger terminal building is planned to be 67.5 m away from the edge of the apron pavement in order to accomodate B-747 class aircraft in future.

The passenger terminal building in Phase II is planned to expand east the same as the apron; therefore, it is indispensable in the terminal area layout to ensure a sufficiently wide area for the proposed expansion.

(3) Cargo Terminal Building

The cargo terminal building is planned to be located at the east side of the passenger terminal building. Sufficiently wide space for future expansion will remain between both the cargo and airport maintenance building. The cargo terminal building is located close enough to the proposed apron including the allowance for future apron expansion that this layout will make cargo handling very efficient.

(4) Administration Building and Control Tower

It is desirable that the administration building and control tower are to be located next to each other in order to facilitate security control and maintain adequate functions.

The administration building and control tower are planned to be located east of the cargo terminal building. This location meets the necessary siting criteria for the control tower.

(5) Fire Station

This station is planned to be located adjacent to the proposed runway to achieve response times of two minutes, not exceeding three minutes, to the ends of the runway in accordance with the ICAO recommendations.

The location of the building is planned so as not to protrude upon the obstacle limitation surfaces and clearance is to be maintained with the taxiway even though a parallel taxiway, which is not required as far as this study based on the present conditions, would be constructed in future.

(6) VIP Building

Independent building, vehicle parking and an internal road for VIP (very important persons) are planned to be located separately from the public area surrounded by a security fence and to be located west of the passenger terminal building. This location is considered best because of easy access from the apron and an independent access road from the public road.

(7) Vehicle Parking and Internal Road

The public vehicle parking area is planned to be located in front of the passenger terminal building to minimize the walking distance between the terminal building and vehicle parking for convenience of passengers and visitors. Staff parking is also provided near each building.

The internal road is planned to be basically regulated for traffic in a one-way - clockwise direction - so as to provide orderly vehicular movement and easy pedestrian crossing.

(8) Parking for Ground Service Equipment

Although ground service equipment (hereinafter referred to as "GSE") such as towing tractors, passenger stair cars, etc., will be supplied by the airlines, the areas for parking, maintenance workshop and fuel station for GSE are reserved in this Airport Master Plan. The GSE parking area is planned to be located at the east side of the passenger terminal building, adjacent to both the apron and the passenger and cargo terminal buildings. The maintenance workshop and fuel station for the GSE are planned to be located next to the administration building.

(9) Isolated Apron

An isolated apron is located at the maximum distance possible from the passenger terminal apron, buildings, public areas, the airport fence, but should not be nearer than 100 m.

(10) General Aviation Apron and Heliport

The existing civil apron will be utilized as a general aviation apron without any improvement and a heliport is planned to be located on the existing taxiway between the existing civil apron and runway.

(11) Airport Utilities

The airport utilities such as power supply, water supply and an incinerator are planned in the vicinity of the load center and the airport administration area to minimize the length of cables and pipes required and to permit easy operation and maintenance.

Sewage treatment is planned to be located south of the NDB to discharge treated effluent into the Wungu River. Major facilities for both power and water supply will be located within an area isolated from the public access area in order to enhance security.

(12) Fuel Storage

The facilities for fuel storage will be constructed by PERTAMINA. Hence, the areas for fuel storage are reserved at the west side of the terminal area to allow easy access to/from airside and landside.

3.3 Airport Facilities Plan

3.3.1 Site Preparation

(1) Grading Plan

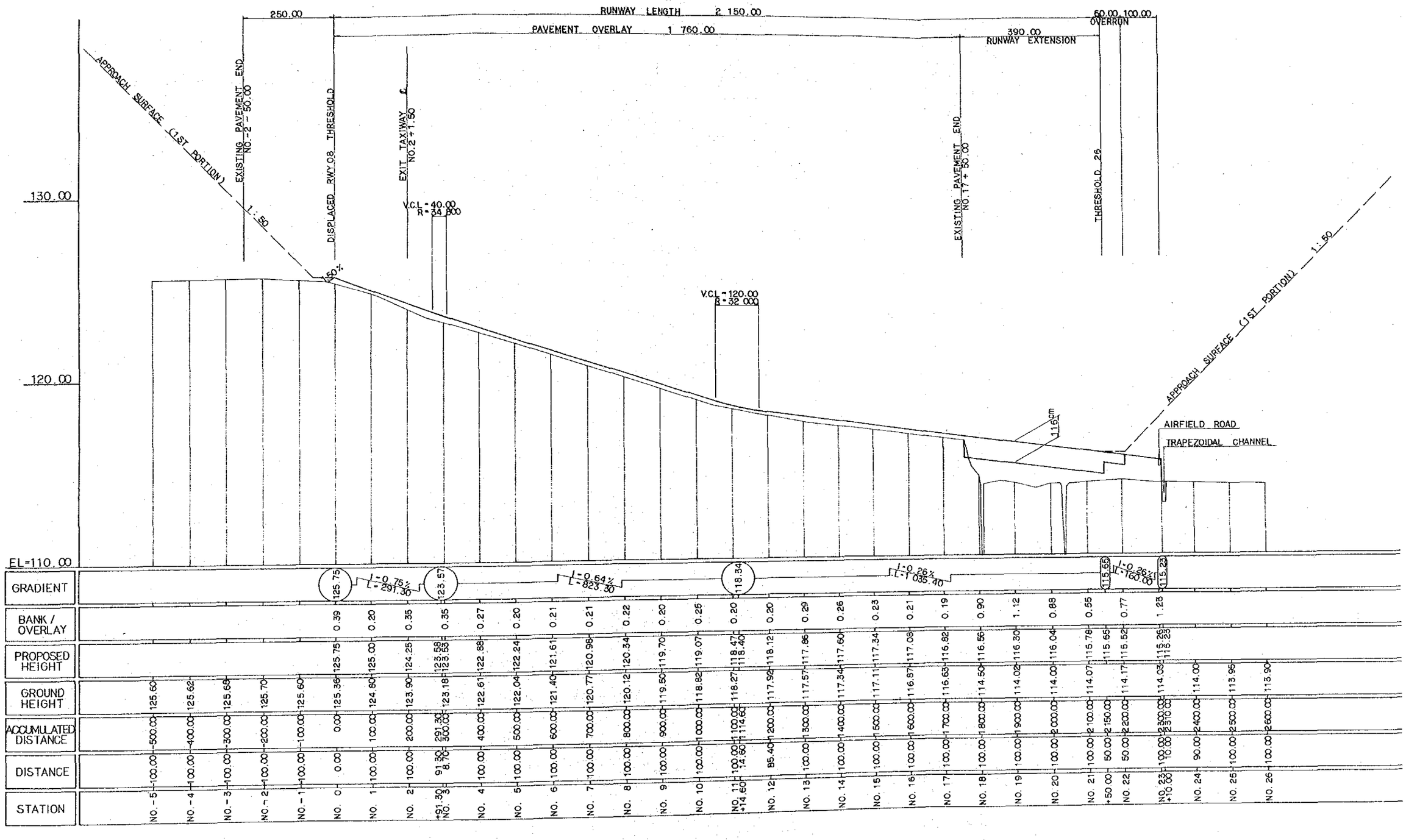
a) Runway profile

The runway construction work for the Surakarta airport development consists of a pavement overlay on the existing runway and a runway extension.

The runway profile of the pavement overlay portion is generally designed considering three factors; existing runway profile, transverse slope and required overlay thickness, and so as to minimize the quantity of bituminous materials.

As described in Section 3.3.2 , (4), "Pavement", the required overlay thicknesses for the existing runway, vary with the construction history and thickness of the existing pavement. The original portion requires an 8 cm overlay, and 11 cm is required where the runway was extended in 1974, and 15.5 cm for the runway extension now being carried out.

Taking into account these minimum overlay thicknesses and the transverse slope of the existing runway (as the basis for the master planning, it is assumed that 0.5 % for the original portion and 1.0 % slope for the extension portion), the runway profile is planned in compliance with ANNEX-14, ICAO as indicated in Fig. 3.3.1.



SCALE VERTICAL 0 1 5 10 M

HORIZONTAL 0 50 100 200 500 M

Fig. 3.3.1 Runway Profile

b) Grading of runway strip and terminal area

The typical cross sections for Surakarta airport are planned and are indicated in Fig. 3.3.2. These sections are based on the results of trial studies on vertical alignments in terms of economy of earthwork and adequate storm water drainage.

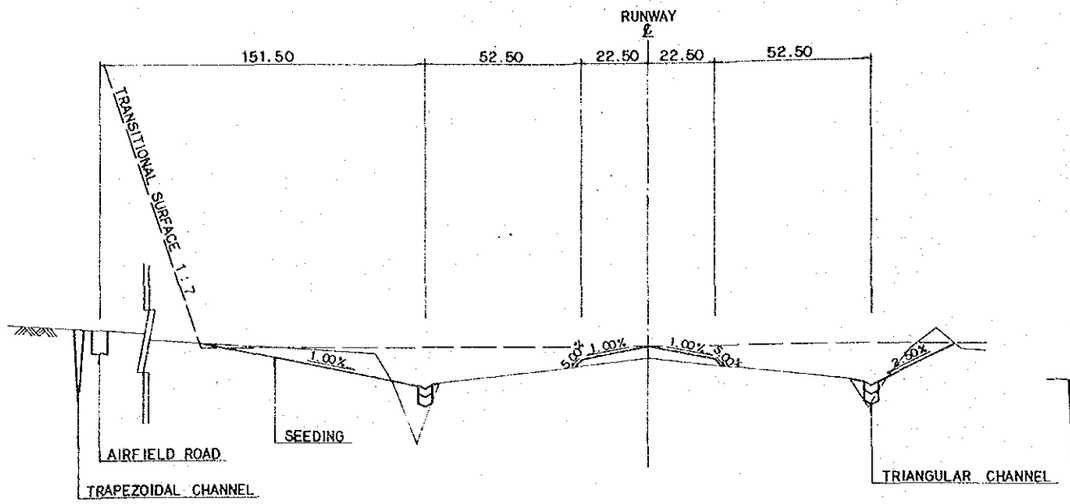
The total earthwork volume in Phase I is estimated to be about 190,000 cu.m for cut and about 110,000 cu.m for fill.

The major considerations for grading plan are summarized below:

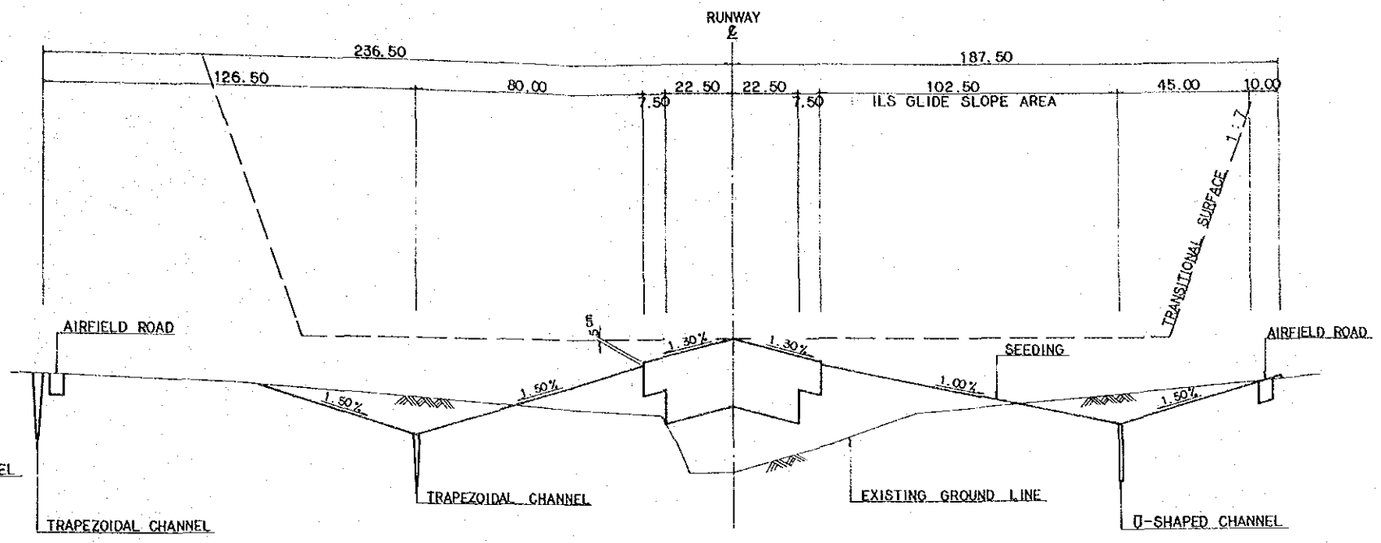
The Surakarta airport development requires a runway strip with 300 m width for a precision approach runway Category-I instead of the existing strip with a 150 m width at present. The transverse slopes for the existing runway strip conform with the stipulation in ANNEX-14, ICAO; hence, grading of this area is considered unnecessary. The portion of the strip beyond 75 m away from the center line of the runway will be graded up to at least 110 m in compliance with ICAO recommendations so as to balance the cut and fill volume of the earthwork.

Almost the whole area of the southern half of the runway strip to be extended is within the ILS glide slope area. Grading of this area is planned in accordance with standards and recommendations of ICAO and FAA considering the water level of the river to which the storm water of the airport is discharged.

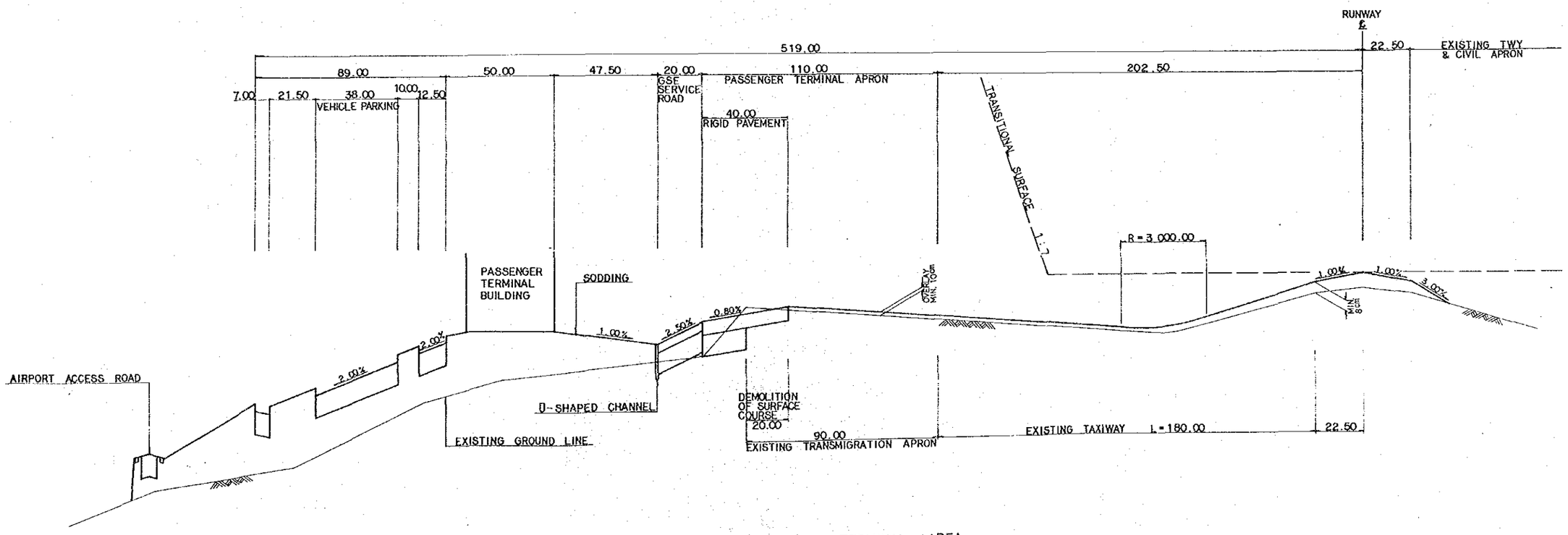
The elevations in the terminal area are planned to be closely related to those of the existing transmigration apron because the apron will be utilized as the passenger terminal apron with a 10 cm thick overlay. The elevation of the terminal building is planned taking the earthwork volume into account, to smooth to the apron with an adequate slope for storm water drainage and in order to cope with the introduction of unexpected large jet aircraft like B-747 even after the apron will have been expanded toward the passenger terminal building.



RUNWAY OVERLAY AND RUNWAY STRIP



RUNWAY EXTENSION AND ILS GLIDE SLOPE AREA



TAXIWAY, APRON AND TERMINAL AREA

SCALE VERTICAL 0 0.5 1 2 5 M

HORIZONTAL 0 10 50 100 M

Fig. 3.3.2 Typical Cross Sections

(2) Storm Water Drainage Plan

The airport drainage system is planned to basically discharge storm water into the Wungu River which flows south of the airport and to be diverted due to the runway extension.

Triangular channels with a transverse slope of 2.5 % are planned in the grading area of the runway strip. In other areas where the triangular channels are not required, trapezoidal channels are adopted for economical reasons.

The overall storm water drainage system and the outline of the drainage facilities are indicated in Fig. 3.3.3.

The criteria employed for drainage facilities planning are summarized as follows:

a) Runoff

The rational formula is used to estimate run off.

$$Q = \frac{1}{360} CIA$$

Where, Q: Runoff (cu.m/sec)

C: Runoff coefficient

I: Rainfall intensity (mm/hr)

A: Catchment area (ha)

b) Runoff coefficient

Pavement area : 0.95

Building area : 0.90

Turf area : 0.30 (slightly pervious soil)

c) Rainfall intensity

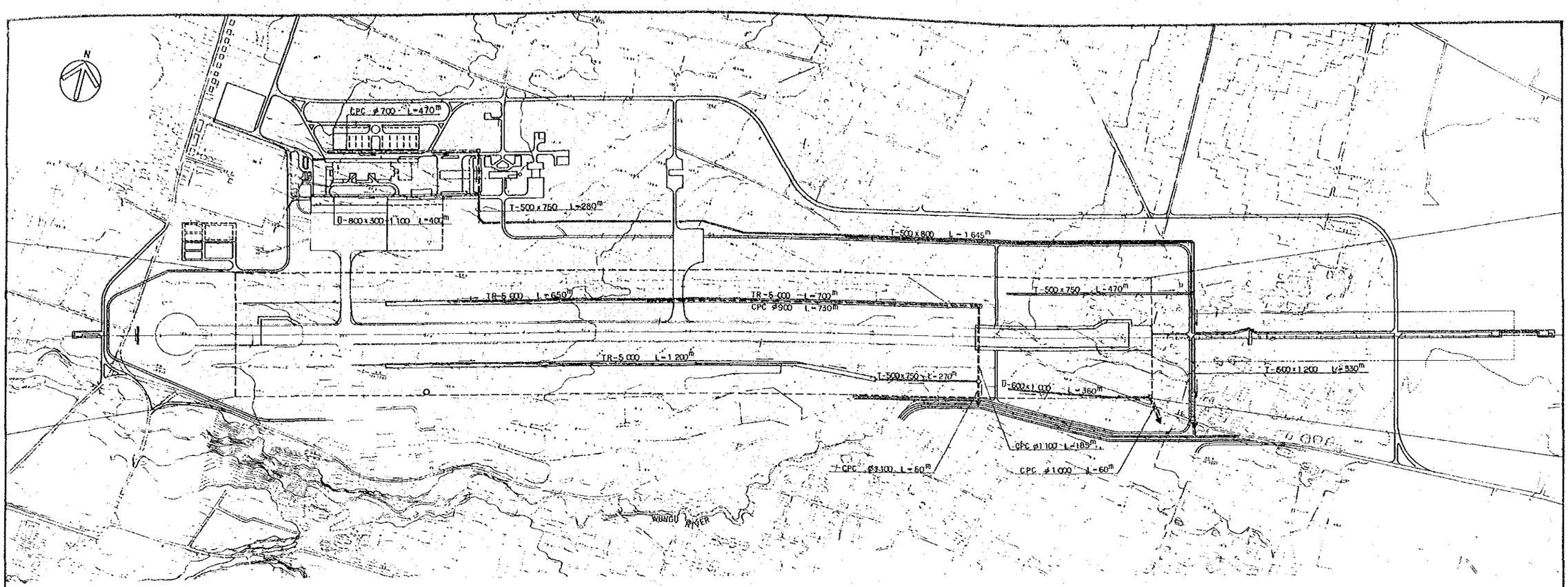
Due to the lack of hourly rainfall records, the rainfall intensity for Yogyakarta is substituted for the Surakarta region.

$$It = \frac{R24}{24}\left(\frac{24}{t}\right)^{2/3}$$

Where, It : Rainfall intensity for "t" time period (mm/hr)

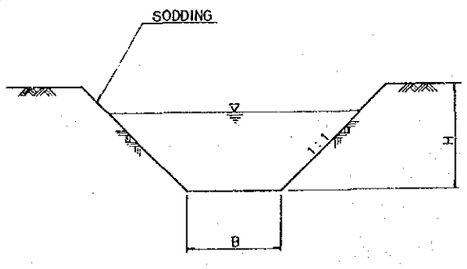
R24 : 135 mm/day for 5 year return period

t : Inlet time (hr)

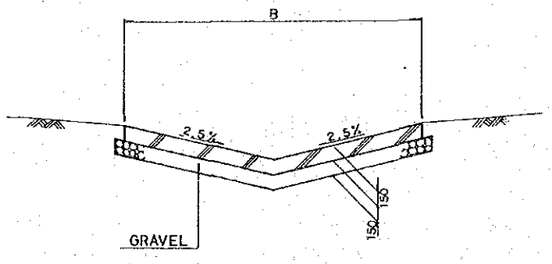


PLAN

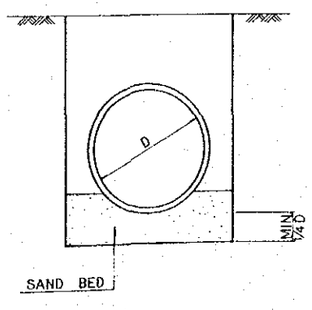
SCALE: 0 50 100 200 500 M



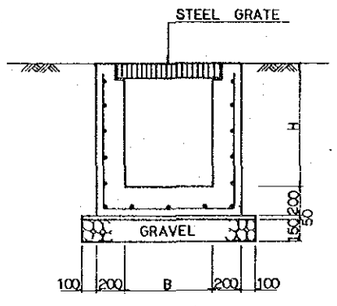
TRAPEZOIDAL CHANNEL
T - (B) × (H)



TRIANGULAR CHANNEL
TR - (B)



REINFORCED CONCRETE PIPE
CPC ⌀(D)



U-SHAPED CHANNEL
U - (B) × (H)

Fig. 3.3.3 Storm Water Drainage Plan and Typical Cross Sections

3.3.2 Runway, Taxiway and Apron

(1) Runway

The 2,150 m long and 45 m wide runway with 7.5 m wide shoulders is planned for Phase I, and no extension will be required in Phase II.

Since a complete parallel taxiway is not planned up to the year 2010, turning areas for the largest aircraft, MD-82/A320, are required in Phase I at both ends of the runway.

The new runway construction is 390 m long. The existing runway (1,760 m long) must have its pavement strength increased by an overlay.

(2) Taxiway

The existing taxiway elongating north from the runway is utilized as an exit taxiway in this plan. However, the existing taxiway is required to be increased in pavement strength by an overlay and fillets at the junction part of the taxiway connecting to the runway and apron are required to be widened in order to ensure smooth traffic for the MD-82 and A320 class aircraft.

(3) Apron

The new apron is designed to accommodate three MD-82/A320 class and one F-27 class aircraft adopting parallel parking configuration in Phase I.

The existing new north apron will be expanded 20 m toward the new passenger terminal building and the existing pavement will be strengthened by an overlay.

The space where aircraft stand in Phase II is required to be paved with cement concrete after removal of the existing asphalt concrete pavement.

Extension of the apron will be, furthermore, required in Phase II in order to accommodate four B-767/A310 class adopting nose-in parking configuration and two F-28 class aircraft adopting 45 degree nose-out parking configuration.

(4) Pavement

a) Types of Pavement

Two types of pavement are designed; flexible pavement (asphalt concrete pavement) and rigid pavement (cement concrete pavement).

Cement-concrete pavement is applied to the apron extension area. Asphalt concrete pavement is applied to the runway extension area. The asphalt concrete overlay on the existing runway, taxiway and apron is planned to strengthen the pavement so as to accommodate larger aircraft.

b) Design Load and Coverage

Design Load	MD-82, A320 class
Design Coverage	3,000

c) Subgrade Condition

According to the soil investigation for the 150 m extension work of the runway (under construction), the CBR value for compacted subgrade is 9 %.

The design CBR of the existing runway is unknown, however, judging from the existing pavement structure, it can be assumed to be 4.5 to 7 %. (Thickness of pavement is between 37.5 and 80 cm.)

Taking the above factors into consideration, the design CBR value is set at 5 % for safety, which is equivalent to a K-value of 3.7 kg/cu.cm.

d) Structure of Pavement

The pavement structure is designed on the basis of the JCAB method, and is summarized in Fig. 3.3.4.

The standard thickness of asphalt-concrete pavement is determined based on the design load, design coverage and design CBR of subgrade and the thickness for each categorized area such as the end and intermediate portions of the runways, taxiway shoulders, etc., is reduced in a certain proportion to the determined standard thickness.

The layer configuration of pavement is designed to be mechanically well balanced by using the tabulated standard thickness of surface course, binder course and base course which are determined based on the experiences and results of elasticity calculations. The remainder is given to subbase course.

Design of the thickness of cement concrete pavement is to be determined thickness of subbase course and cement concrete slab.

The thickness of subbase course is determined by using the authorized diagram showing the relationship between thickness of subbase course and ratio of coefficient of bearing capacity subbase course with subgrade.

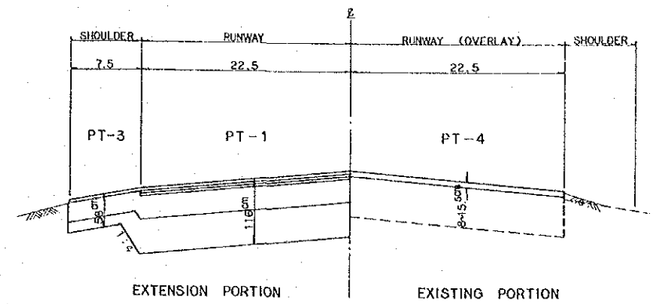
The coefficient of bearing capacity of subbase course is primarily standardized to be 7 kg/cu.m tested by a loading plate 75 cm in diameter.

The thickness of cement concrete slab is determined by using the standardized table calculated based on design load, design coverage and coefficient of bearing capacity of subbase course - 7 kg/cu.m -. For each categorized area, the thickness of pavement is reduced in the same manner as the layer configuration criteria of asphalt concrete pavement.

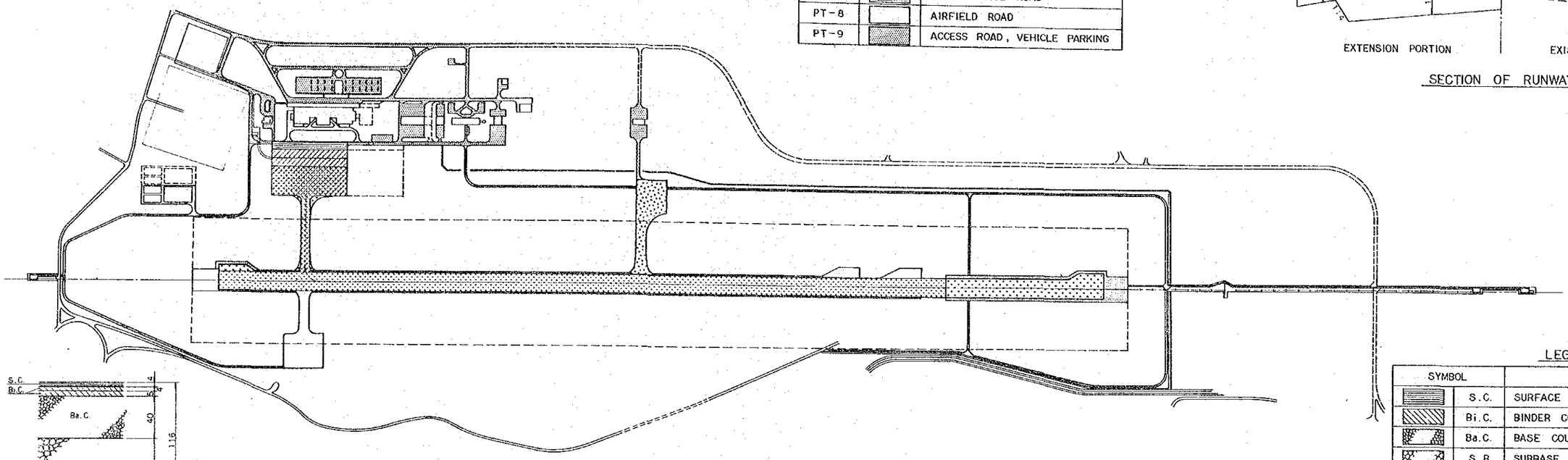
For the runway, the thickness of overlay varies between 8 and 15.5 cm on the existing pavement structure.

LEGEND

TYPE	SYMBOL	ITEMS
PT-1		RUNWAY, TAXIWAY
PT-2		TAXIWAY, APRON
PT-3		SHOULDER, OVERRUN
PT-4		RUNWAY OVERLAY
PT-5		APRON
PT-6		TAXIWAY AND APRON OVERLAY
PT-7		GSE SERVICE ROAD
PT-8		AIRFIELD ROAD
PT-9		ACCESS ROAD, VEHICLE PARKING



SECTION OF RUNWAY

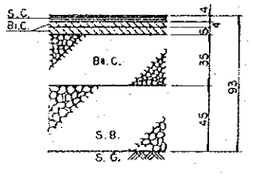


PLAN

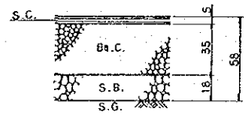
LEGEND

SYMBOL	ITEMS
S.C.	SURFACE COURSE (ASPHALT CONCR
Bi.C.	BINDER COURSE (ASPHALT CONCR
Ba.C.	BASE COURSE (GRADED AGGRE
S.B.	SUBBASE COURSE (CRUSHER RUN)
C.S.	PORTLAND CEMENT CONCRETE SLAB
S.G.	SUBGRADE

PT-1
RUNWAY AND TAXIWAY

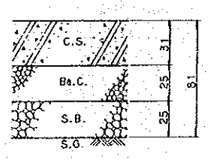


PT-2
TAXIWAY AND APRON



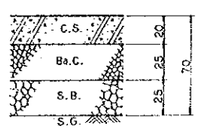
PT-3
SHOULDER AND OVERRUN

PT-4
RUNWAY OVERLAY

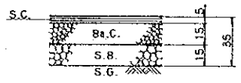


PT-5
APRON

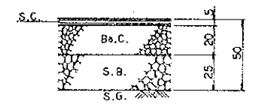
PT-6
TAXIWAY AND APRON OVERLAY



PT-7
GSE SERVICE ROAD



PT-8
AIRFIELD ROAD



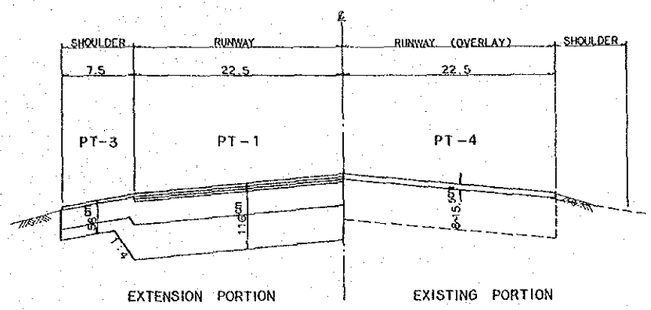
PT-9
ACCESS ROAD AND VEHICLE PARKING

SCALE 0 50 100 200 500 M

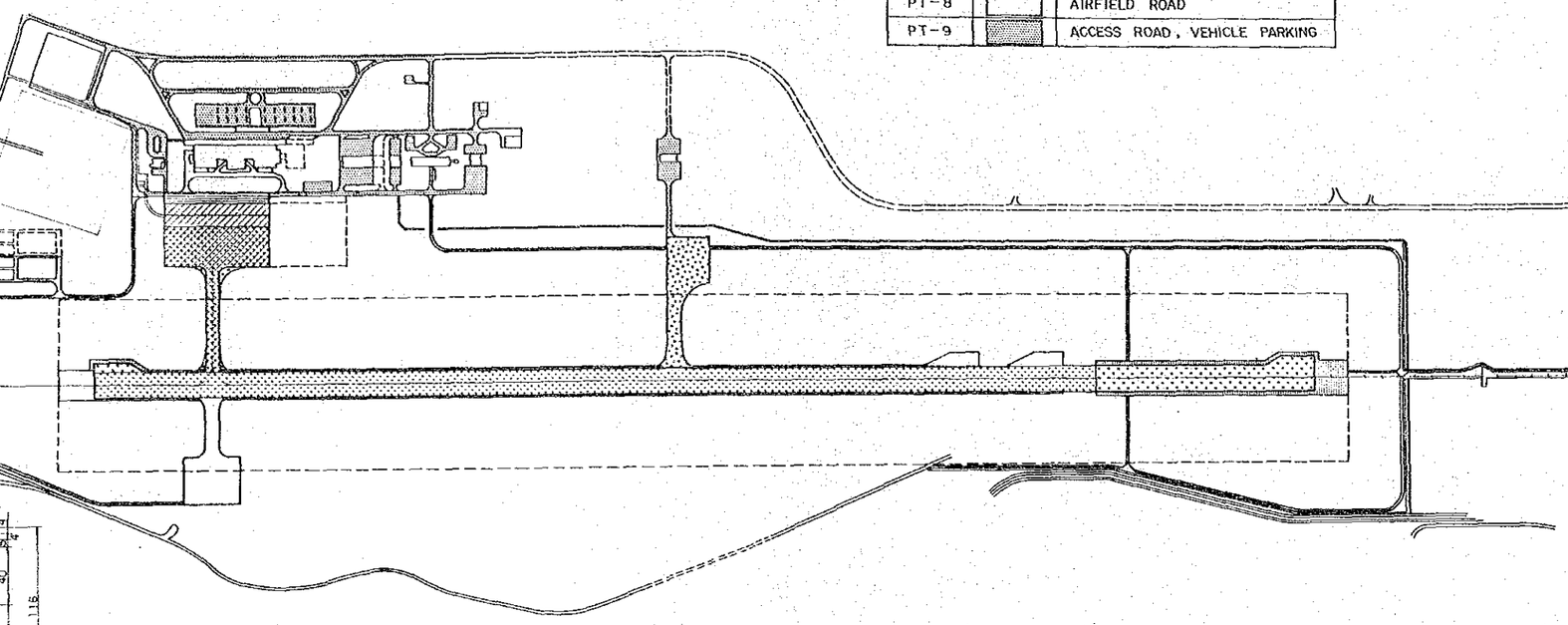
Fig. 3.3.4 Pavement Plan and Ty

LEGEND

TYPE	SYMBOL	ITEMS
PT-1		RUNWAY, TAXIWAY
PT-2		TAXIWAY, APRON
PT-3		SHOULDER, OVERRUN
PT-4		RUNWAY OVERLAY
PT-5		APRON
PT-6		TAXIWAY AND APRON OVERLAY
PT-7		GSE SERVICE ROAD
PT-8		AIRFIELD ROAD
PT-9		ACCESS ROAD, VEHICLE PARKING



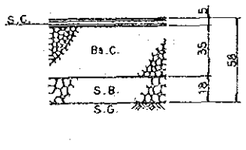
SECTION OF RUNWAY



PLAN

LEGEND

SYMBOL		ITEMS
	S.C.	SURFACE COURSE (ASPHALT CONCRETE)
	Bi.C.	BINDER COURSE (ASPHALT CONCRETE)
	Ba.C.	BASE COURSE (GRADED AGGREGATE)
	S.B.	SUBBASE COURSE (CRUSHER RUN)
	C.S.	PORTLAND CEMENT CONCRETE SLAB
	S.G.	SUBGRADE

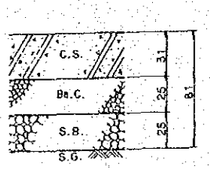


PT-3

SHOULDER AND OVERRUN

PT-4

RUNWAY OVERLAY

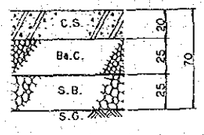


PT-5

APRON

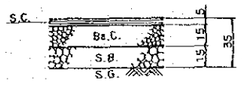
PT-6

TAXIWAY AND APRON OVERLAY



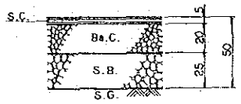
PT-7

GSE SERVICE ROAD



PT-8

AIRFIELD ROAD



PT-9

ACCESS ROAD AND VEHICLE PARKING

SCALE 0 50 100 200 500M

Fig. 3.3.4 Pavement Plan and Typical Sections

3.3.3 Passenger Terminal Building

(1) General Concept

The passenger terminal building is planned to be located 67.5 m away from the apron in both Phases I and II. The transportation between the terminal building and aircraft is either by bus or on foot. One floor level concept is adopted for the passenger terminal building corresponding to the number of passengers.

The aesthetic design should be a combination of Javanese traditional features and modern architecture.

(2) Planning

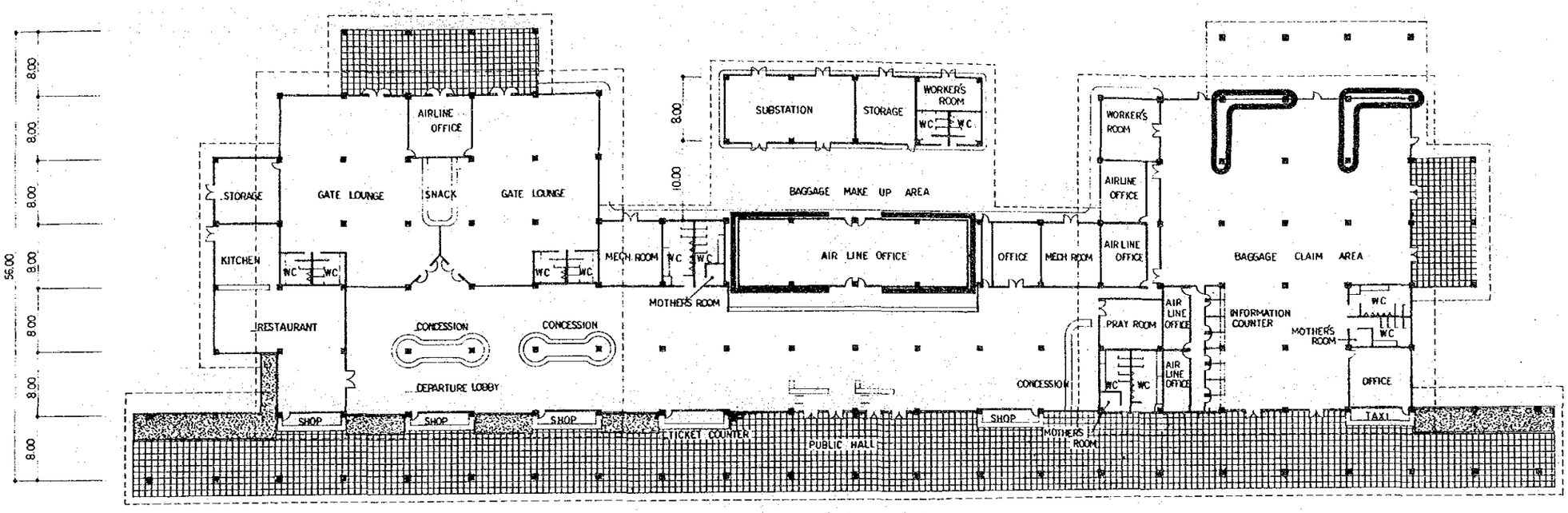
The plan for the terminal building with a total design floor area of 7,400 sq.m in Phase I as shown in Figs.3.3.5 and 3.3.6, does not dictate the final concept, and it is only used for cost estimates. In this building area, about 510 peak-hour passengers can be handled. A mother's room and prayer room are also planned in the terminal building for the convenience of passengers. The building will be made of a reinforced concrete structure with 8 m x 8 m spans for a more economical construction. The passenger terminal building will be expanded by 4,800 sq.m in Phase II.

3.3.4 Other Buildings

(1) Cargo Terminal Building

The cargo terminal building with a total floor area of approx. 800 sq.m consisting mainly of cargo storage and office areas is planned for the new terminal as shown in Fig. 3.3.7.

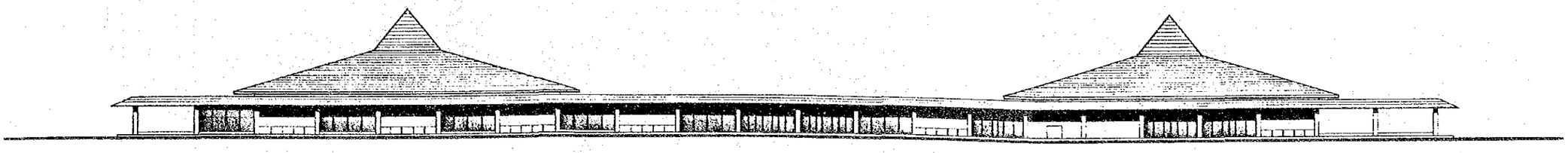
The cargo storage area is planned to be a single story concrete structure with high ceiling for free cargo handling, and to be flexibile for internal rearrangement and possible future mechanization.



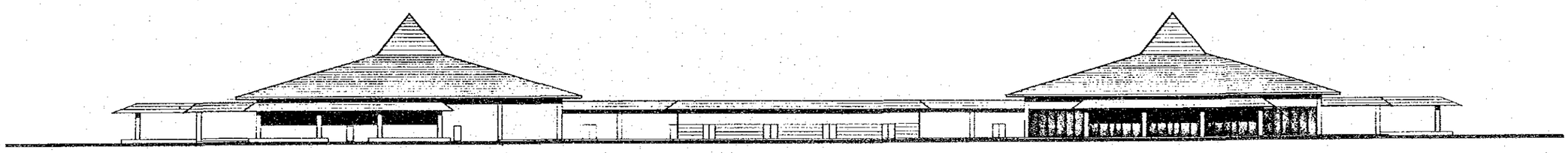
PLAN

Note: This drawing does not restrict the final concept for the building.

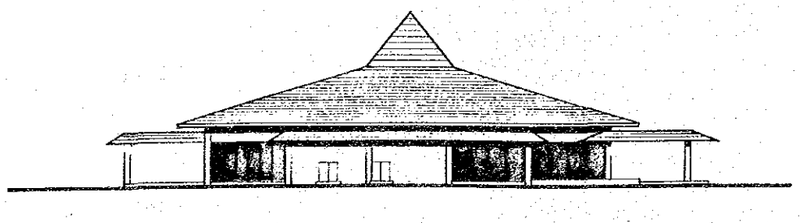
Fig. 3.3.5 Passenger Terminal Building Plan (Ground Floor Plan)



ELEVATION – LAND SIDE



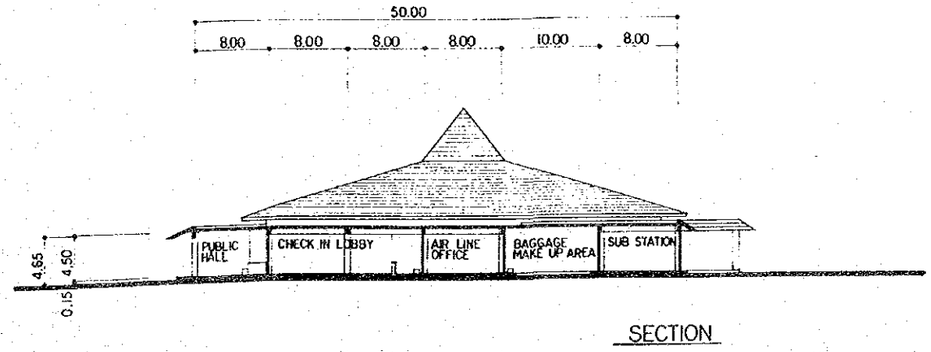
ELEVATION – AIR SIDE



ELEVATION

SCALE 0 10 20 30

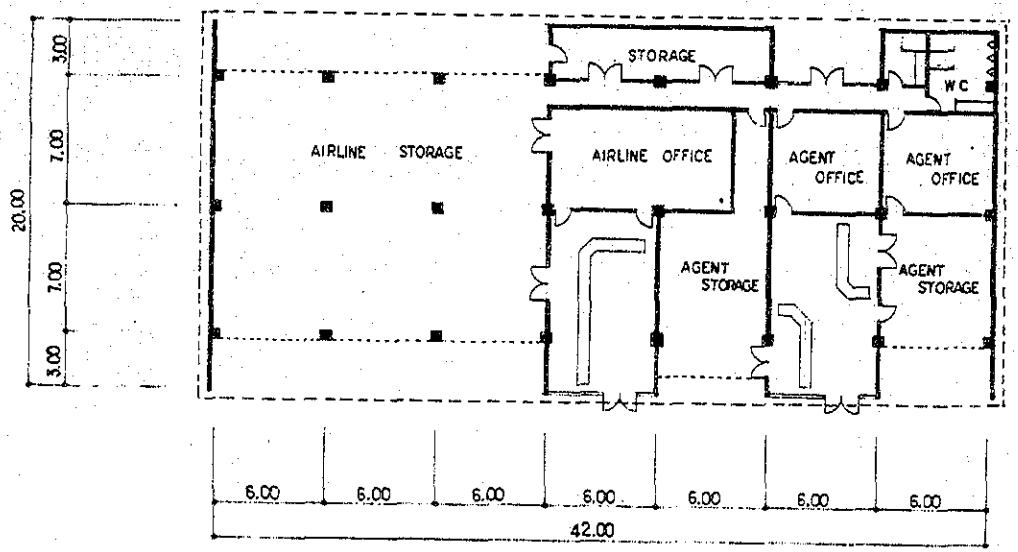
UNIT : METER



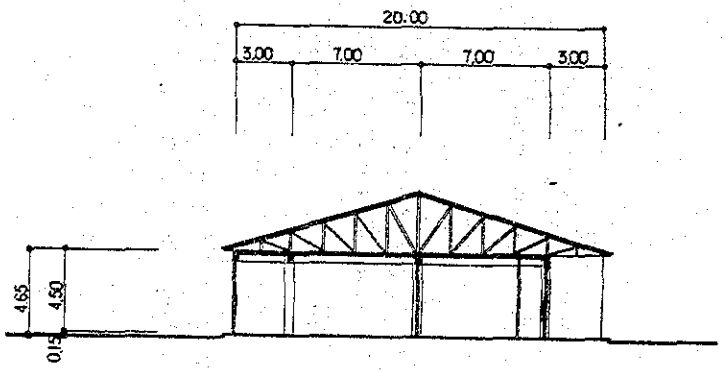
SECTION

Note: This drawing does not restrict the final concept for the building.

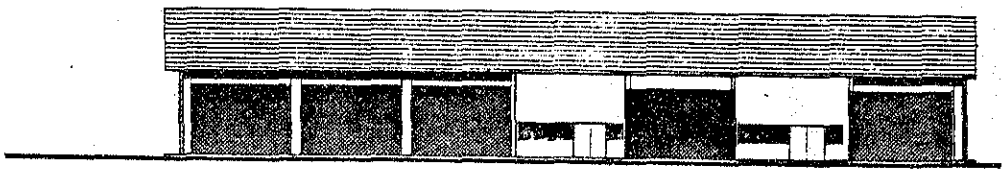
Fig. 3.3.6 Passenger Terminal Building Elevation and Section



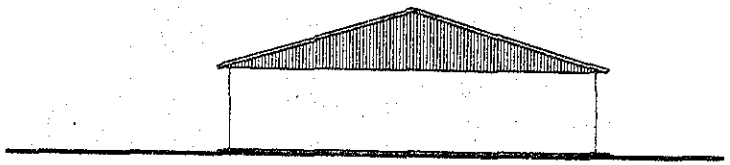
PLAN



SECTION



ELEVATION



ELEVATION

SCALE 0 10 20
UNIT: METER

Note: This drawing does not restrict the final concept for the building.

Fig. 3.3.7 Cargo Terminal Building Plan, Elevation and Section

(2) Administration Building and Control Tower

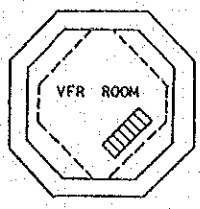
The administration building and control tower for the new terminal in Phase I are planned as shown in Fig. 3.3.8.

The administration building for the new terminal is planned to have about 1,200 sq.m in total floor area to meet the requirements for Phase I. The building comprises two stories and will be constructed of reinforced concrete.

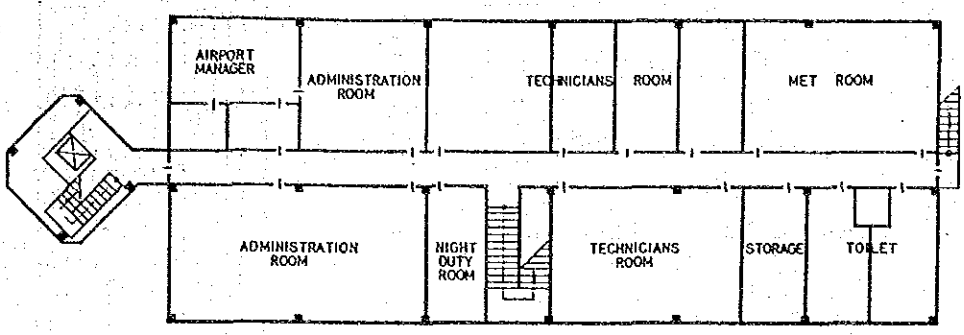
The height of the control tower is planned to be 23 m above ground level in compliance with the FAA standards. The control tower is designed to be of a reinforced-concrete structure.

(3) Fire Station

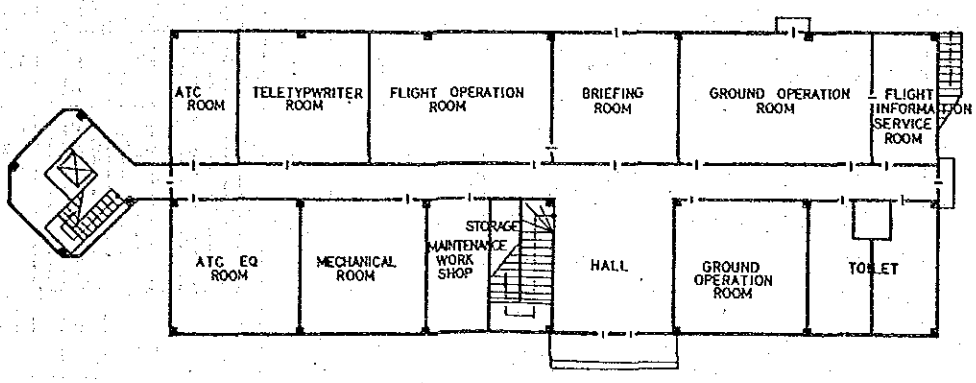
The fire station for the new terminal is planned to have a floor area of approx. 400 sq.m to meet the facility requirements. The fire station will be a one-story reinforced-concrete structure. The layout plan is shown in Fig. 3.3.9.



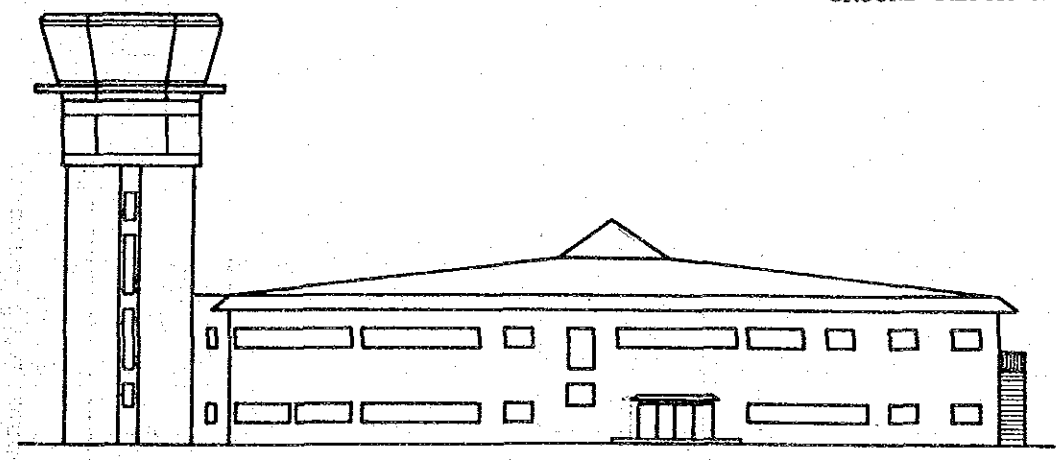
TOP FLOOR PLAN



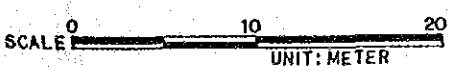
FIRST FLOOR PLAN



GROUND FLOOR PLAN

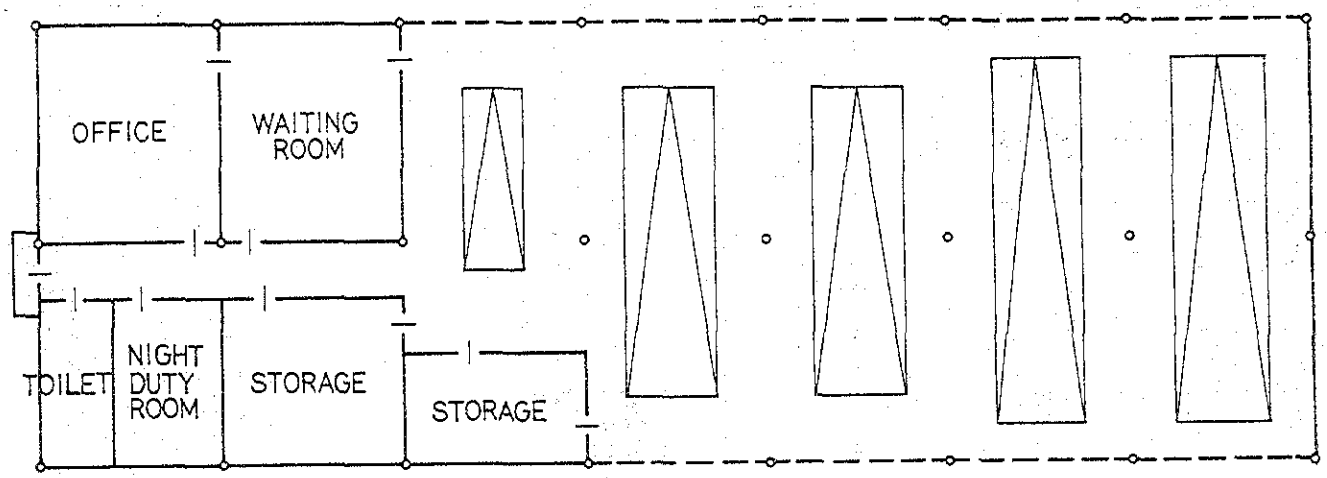


ELEVATION

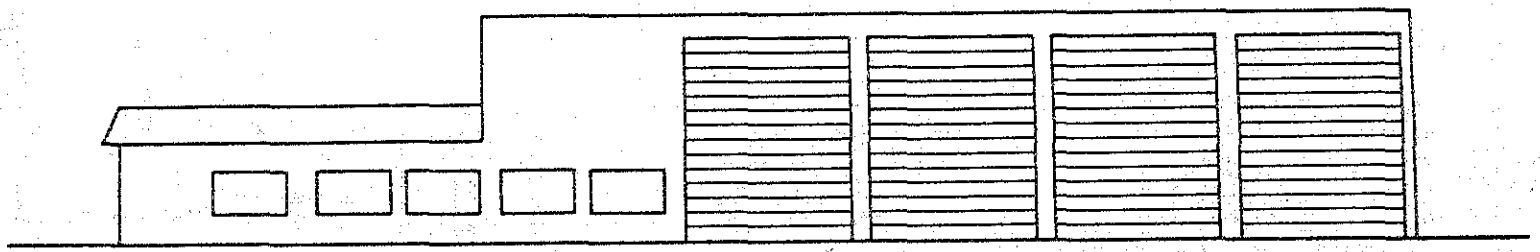


Note: This drawing does not restrict the final concept for the building.

Fig. 3.3.8 Administration Building and Control Tower Plan and Elevation



GROUND FLOOR PLAN



SCALE 0 5 10
UNIT: METER

ELEVATION

Note: This drawing does not restrict the final concept for the building.

Fig. 3.3.9 Fire Station Plan and Elevation

3.3.5 Access Road and Vehicle Parking Area

(1) Airport Access Road

The airport access road in Phase I is planned to be connected with the existing road passing on the west of the terminal area as shown in Fig.3.3.10, which is planned to be upgraded by Directorate General for Road Construction. In phase II, the access road is planned to approach from the east residential area of Surakarta. Since the existing road used as the access road is 4 m wide and non-paved, it should be widened. The width of the access road with one lane in each direction is designed to be7 m. The total length of the selected route is to be about 3.7 km.

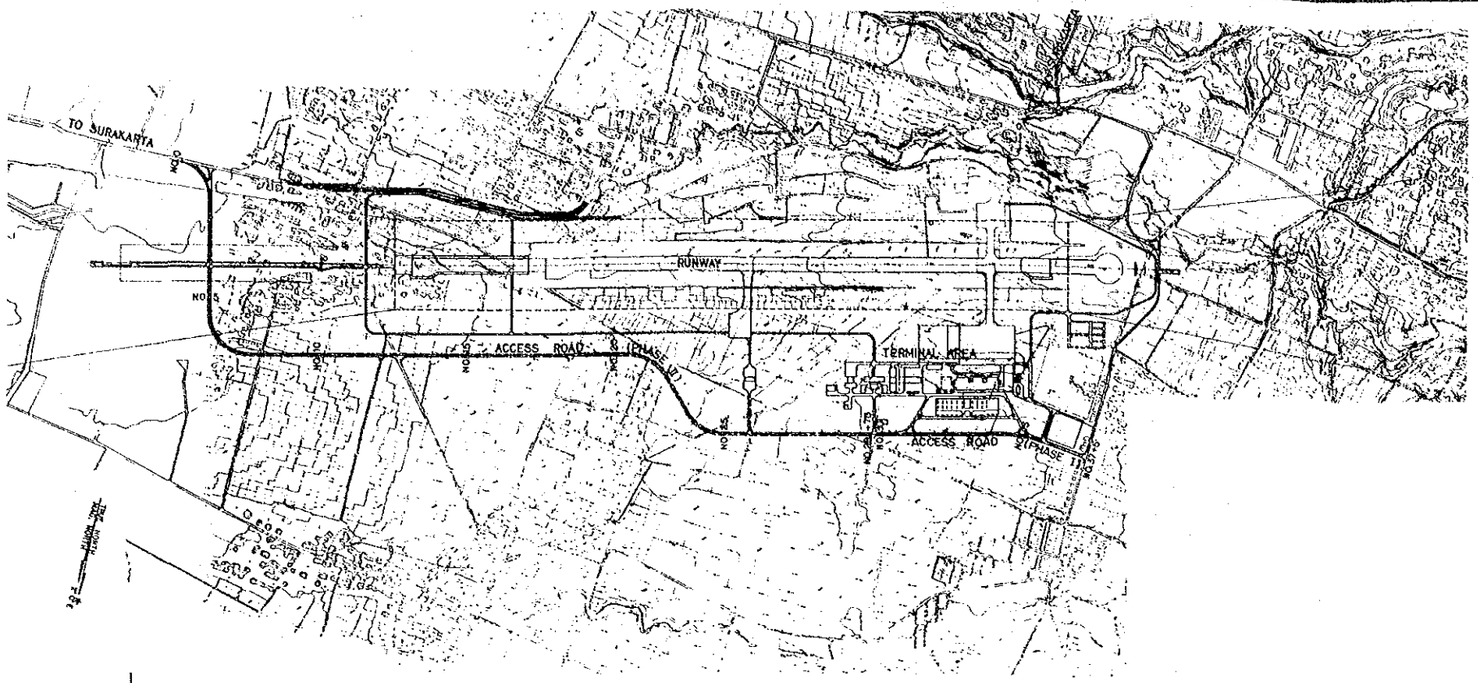
The pavement for the access road will be asphalt-concrete with a total thickness of 50 cm. This thickness will consist of a 5-cm surface, 20-cm base course and 25-cm subbase course. The thickness is designed based on the CBR design method, assuming 100 to 250 trucks daily with a 5-ton wheel load and 5 percent CBR value for the subgrade.

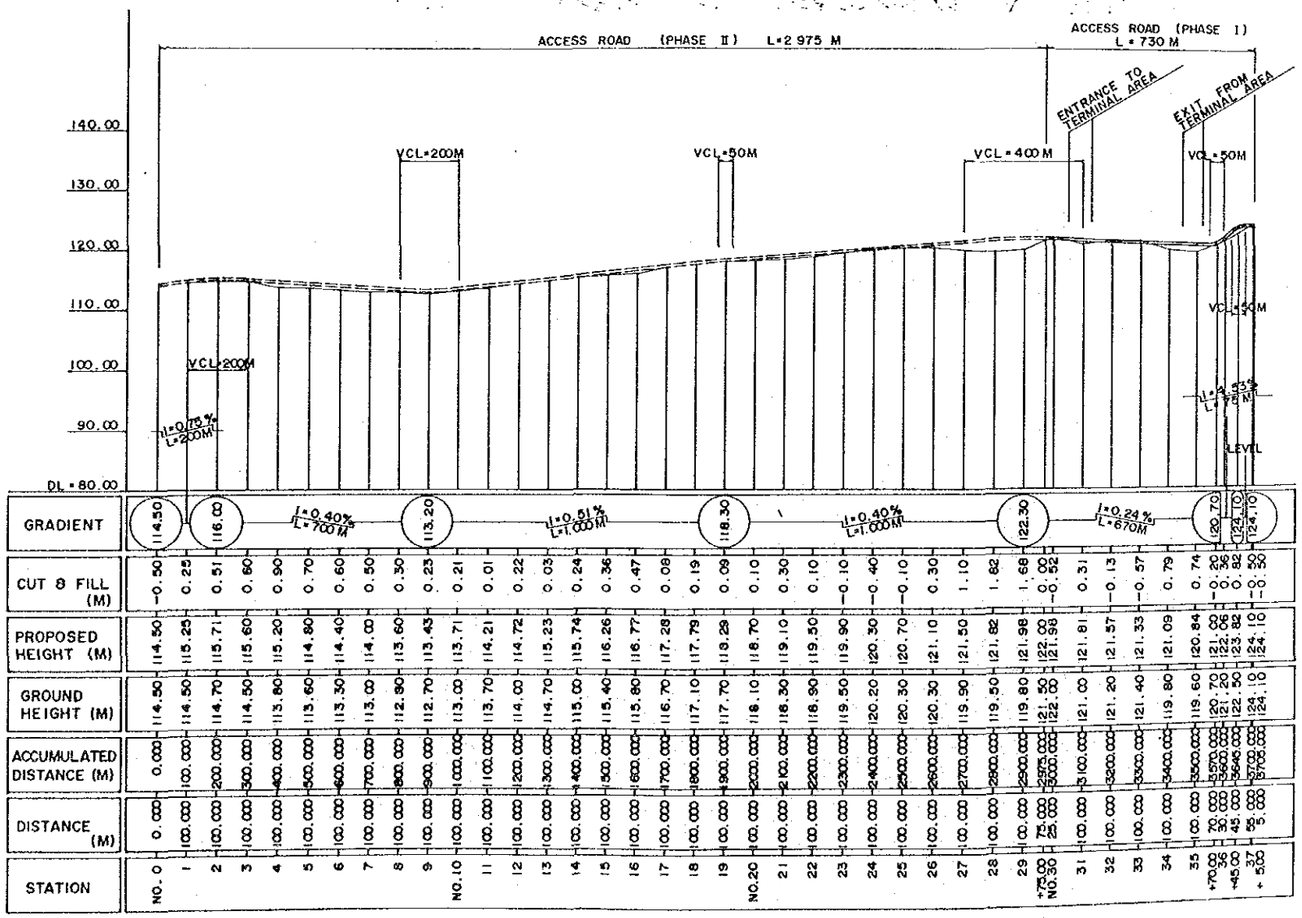
(2) Vehicle parking and Internal Road

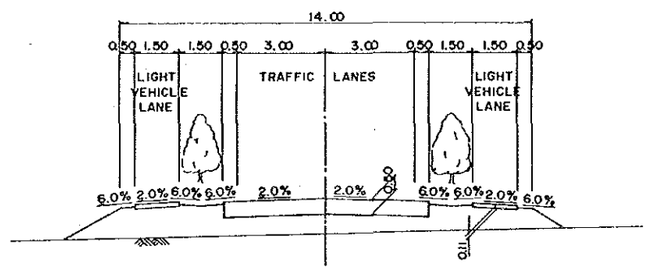
A public vehicle parking area with about 190 parking spaces at the new terminal is planned to cope with the Phase I requirements. Since it requires the smallest unit parking space, a 90^{o} parking configuration will be adopted for this plan. The dimensions of the unit parking space are 5 m x 2.5 m and the width of the aisle in the parking area is determined to be 6 m.

The width of the internal road with two lanes is designed to be 7 m except for the terminal frontage road. The terminal frontage road consists of two through traffic lanes, one weaving lane and one standing lane, hence the width is to total 12.5 m as shown in Fig. 3.2.4.

The vehicle parking and internal road will be paved with asphalt-concrete with the same 50-cm thickness as that of the access road.







TYPICAL CROSS SECTION

SCALE 0 0.5 1KM

PROFILE

Fig. 3.3.10 Airport Access Road Plan and Typical Cross Section

(3) Airfield Road

The airfield roads in the airport, consisting of a perimeter road and a security road, are planned for both airport maintenance and security patrol, as shown in Fig. 3.1.1.

The pavement thickness of the airfield roads is estimated to be 35 cm. This thickness consists of a 5-cm surface, 15-cm base course and 15-cm subbase course to satisfy the design conditions of low frequency for heavy loaded vehicles and a CBR value of 5 % for the subgrade.

3.3.6 Air Navigation Systems

(1) General

The air navigation systems at Surakarta airport, which include radio navigation aids, air traffic control system, aeronautical telecommunications system, meteorological system and aeronautical ground lights are planned to meet the aircraft operations category: precision approach Category-I.

The plan for the air navigation systems is shown in Fig 3.3.11 and the equipment required is listed in Table 3.3.1. The equipment which is intended to be installed in Phase I, will have to be replaced by new equipment in Phase II.

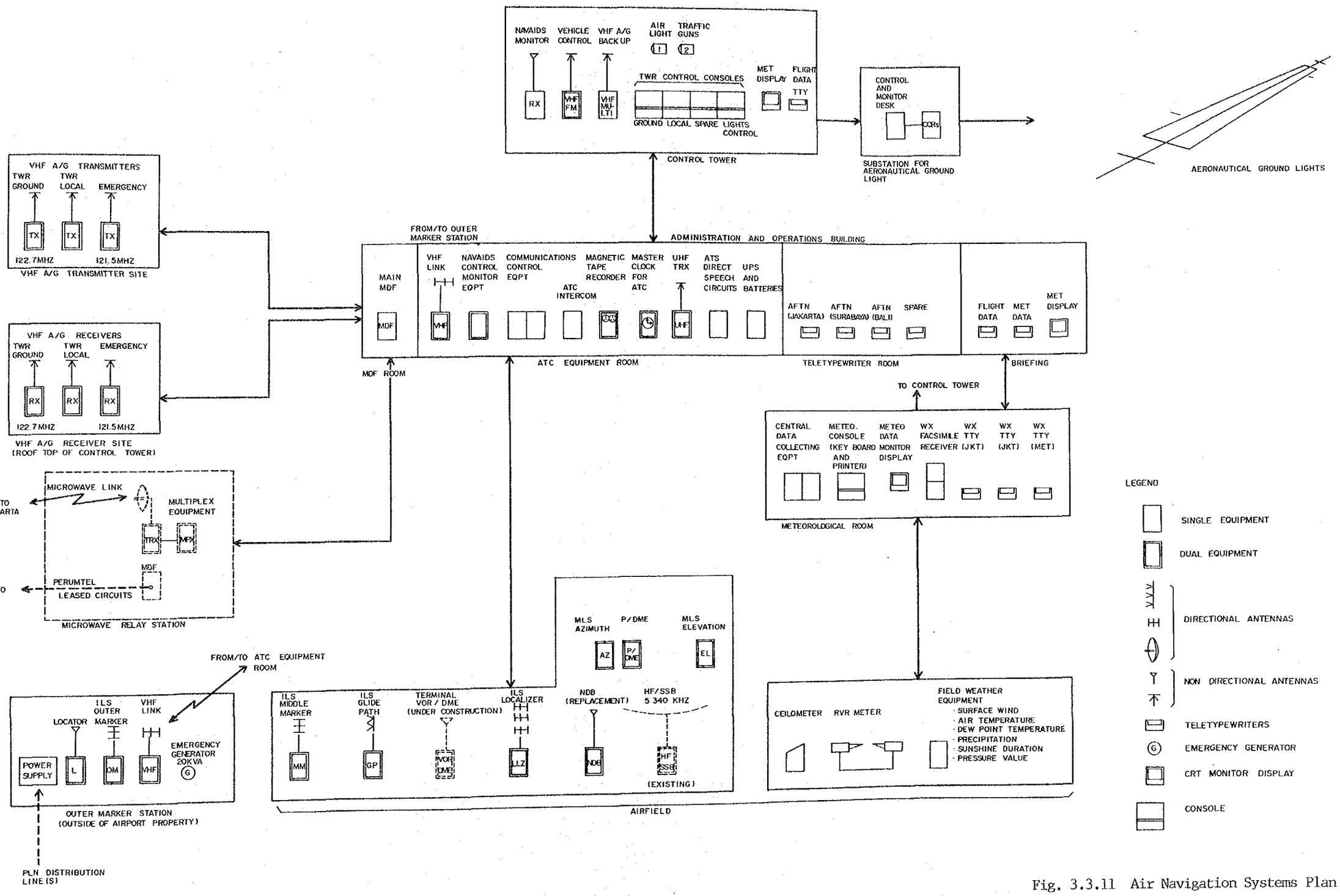


Fig. 3.3.11 Air Navigation Systems Plan

Table 3.3.1 Equipment List for Air Navigation Systems (Surakarta Airport)

Equipment	Outline of Equipment	Number	Remarks
Navaids			
. ILS LLZ, GP, MM, OM	Precision Approach Category I, RWY 26	1 set	
. VOR/DME	Under Construction by DGAC	-	
. NDB	Replacement of the existing NDB	1 set	
. Locater	Collocation with ILS/OM		
. MLS	Collocation with ILS in Phase I	1 set	
. Navaids control and monitor equipment	For ILS, VOR/DME and NDB	1 set	
ATC/COM			
. VHF air-ground radio	Dual equipment for Ground/Local/Emergency	3 sets	
. VHF air-ground transceiver	Back-up	1 set	
. VHF FM Radio	For Vehicle control	1 set	
. UHF air-ground radio	Multi Channel UHF transceiver	1 set	For coordination of training aircraft
. VHF link	Between airport and outer marker station	2 sets	

Equipment	Outline of Equipment	Number	Remarks
. Control consoles and communication control equipment	For control tower	1 set	
. AFTN Teletype-writers		6 sets	
. Magnetic Tape Recorder	ATC use	1 set	
. Master Clock and Interphone	ATC use	1 set	
. Air traffic light gun	In control tower	2 sets	
MET. System			
. Surface sensors, data collection equipment, branch display and consoles	Surface wind, dew point, air temperature, rain-fall, air pressure, humidity, sunshine duration.	1 set	
. Ceilometer		1 set	
. RVR meter			
. Weather facsimile		2 sets	
. Weather teletype-writers		4 sets	

Equipment	Outline of Equipment	Number	Remarks
Lights			
. Precision approach category I lighting system	RWY 26 approach	1 sum	
. Simple approach lighting system	RWY 08 approach	1 sum	
. Runway edge lights	Elevated type	1 sum	
. Runway centerline lights	Surface type	1 sum	
. Runway threshold and end lights	Surface type	1 sum	
. Runway wing bar lights	Elevated type	1 sum	
. Stopway lights	"	1 sum	
. PAPI	RWY 08/26	2 ea	
. Taxiway edge lights		1 sum	
. Apron floodlights		5 ea	
. Illuminated wind direction indicator	RWY 08/26	2 ea	
. Aerodrome beacon	On roof-top of control tower	1 set	
. Distribution and control system		1 sum	
. Control console	In control tower	1 set	
. Temporary lights	Runway edge lights, Runway threshold lights	1 sum	

Equipment	Outline of Equipment	Number	Remarks
. Demolition of the existing lights		1 sum	
Power Supply			
. UPS		1 set	
. DC Power Supply equipment		1 set	
Other			
. Spare parts and maintenance tools		1 sum	
. Measurement and testing equipment		1 sum	
. Flight check assistance and training		1 sum	

(2) Radio Navigation Aids

The following radio navigation aids (navaids) are required in Phase I as terminal navaids and also for precision approach Category-I.

- ILS Category-I
- MLS
- Doppler VOR/DME
- NDB

a) Microwave Landing System (MLS)

The ILS which is the ICAO standard primary landing system at present will be replaced by the MLS by the end of 1997 as shown in Table 3.3.2. Afterward, the MLS will be the sole ICAO standards. Accordingly, a MLS will be required to be installed by the end of 1997 and the cost necessary for the MLS is to be included in Phase I.

b) ILS and NDB

The conventional ILS will still be necessary before the transition to MLS in Phase I as a navaid for precision approach Category-I.

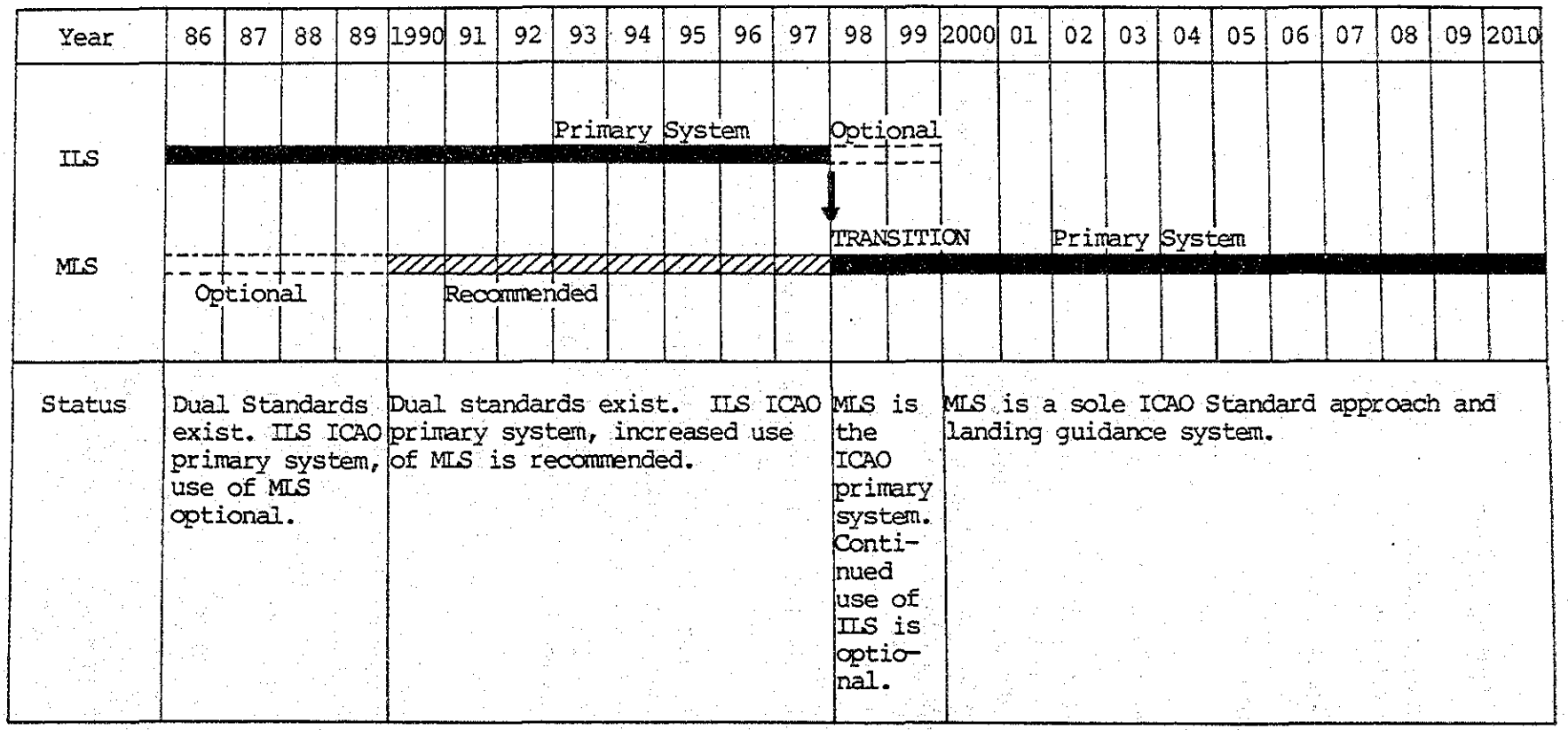
An ILS is planned for Runway 26 since the major aircraft operation will be on this runway due to meteorological conditions. The glide slope angle will be 3.0 degree based on international standards. The outer market of ILS must be located outside the airport and will be linked to the administration building by VHF radio.

Fig. 3.3.12 shows the layout plan for the navaids.

Installationof a D-VOR/DME at Surakarta airport is underway at present by DGAC. The D-VOR/DME is to be installed 3,500 m east of the existing runway 26's threshold and on the extended center line of the runway. The D-VOR/DME will be situated 3,050 m east of the new runway's threshold and on the extended center line in between the middle marker and the outer marker.

The existing NDB ("SO", 255 KHz) equipment and antenna will be replaced by a new one in Phase I, since the equipment will have reached the end of its service life in Phase I and the antenna mast infringes on the transitional surface for precision approach Category-I.

Table 3.3.2 ILS/MLS Transition Plan



(Source: Communications/Operations Division Meeting, 1985, ICAO)

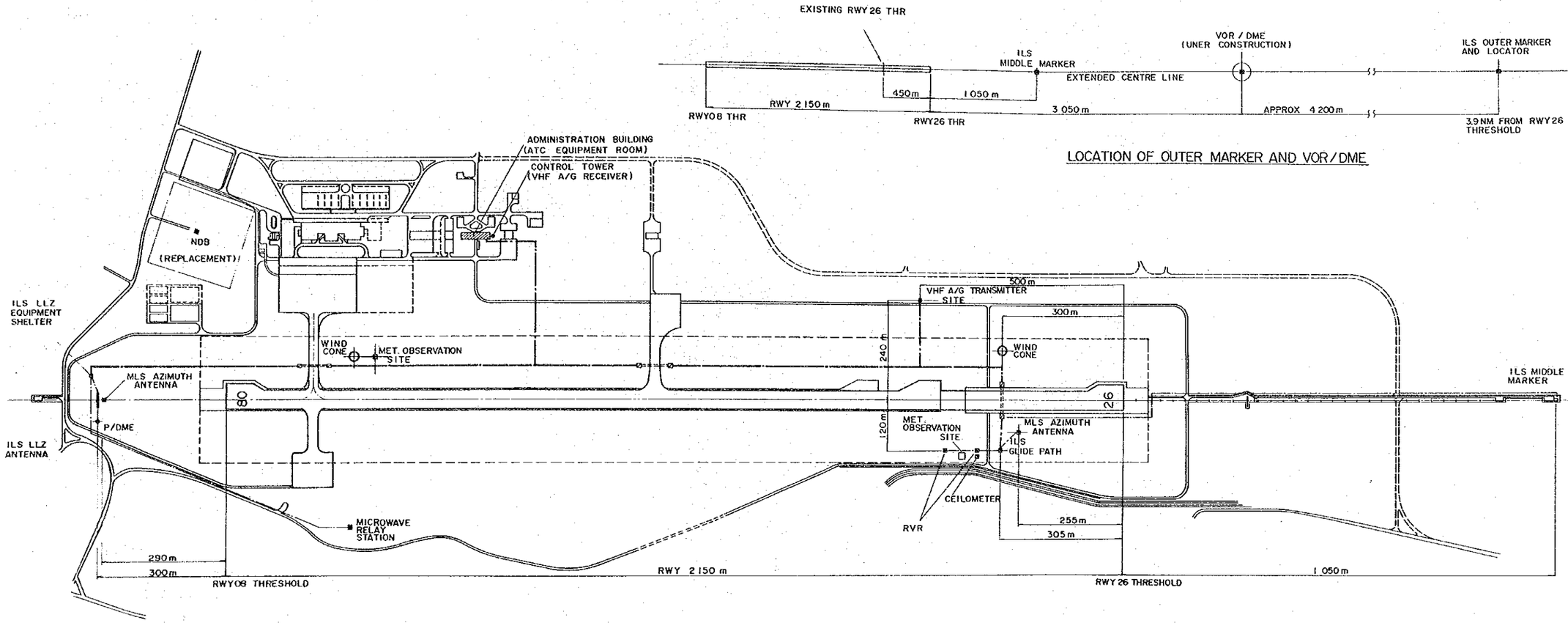


Fig. 3.3.12 Navaids Layout Plan

(3) Aeronautical Telecommunications and Air Traffic Control System

Only an aerodrome control is required for Surakarta, since the approach control is made by the Yogyakarta approach control utilizing PSR/SSR radars.

Two VHF radio frequencies and one distress frequency for aerodrome control are required. UHF radio is also planned in order to coordinate with the training aircraft in future.

Instead of planning a low reliable telecommunications link of HF/SSB circuits, a microwave link between airport and PERUMTEL office in Surakarta city is planned for aeronautical and meteorological telecommunications such as ATS direct speech circuits, AFTN teletypewriter circuits, etc.

(4) Meteorological System

The following meteorological data is required to be observed for precision approach Category-I:

- Runway visual range
- Cloud height
- Surface wind
- Air temperature
- Dew point temperature
- Precipitation
- Pressure value
- Sunshine duration

All the data observed will be collected automatically by central data collection equipment which will process, distribute and display the meteorological information to the control tower, briefing room, etc.

(5) Aeronautical Ground Lights

Aeronautical ground lights as listed in Table 3.3.1 are planned to meet the operational requirements: precision approach Category-I. Fig. 3.3.13 shows the layout of aeronautical ground lights. All the lights will be controlled by a lighting control desk in the control tower. Power supply and control equipment for the lights, such as a constant current regulator, logical control equipment, etc., will be located in the substation in the administration building.

The existing aeronautical ground lights as listed below will continue to operate up to the completion of the new aeronautical lights and will be removed thereafter. The demolition of the approach lighting system for Runway 26 and the temporary runway threshold lights will, however, be required for the extension work of the runway.

Existing Aeronautical Ground Lights:

- Runway edge lights
- Runway threshold lights
- Turning lights
- REIL
- VASIS
- Approach lighting system (RWY 26)
- Aerodrome beacon
- Landing tee
- Illuminated wind cone
- Apron Floodlights

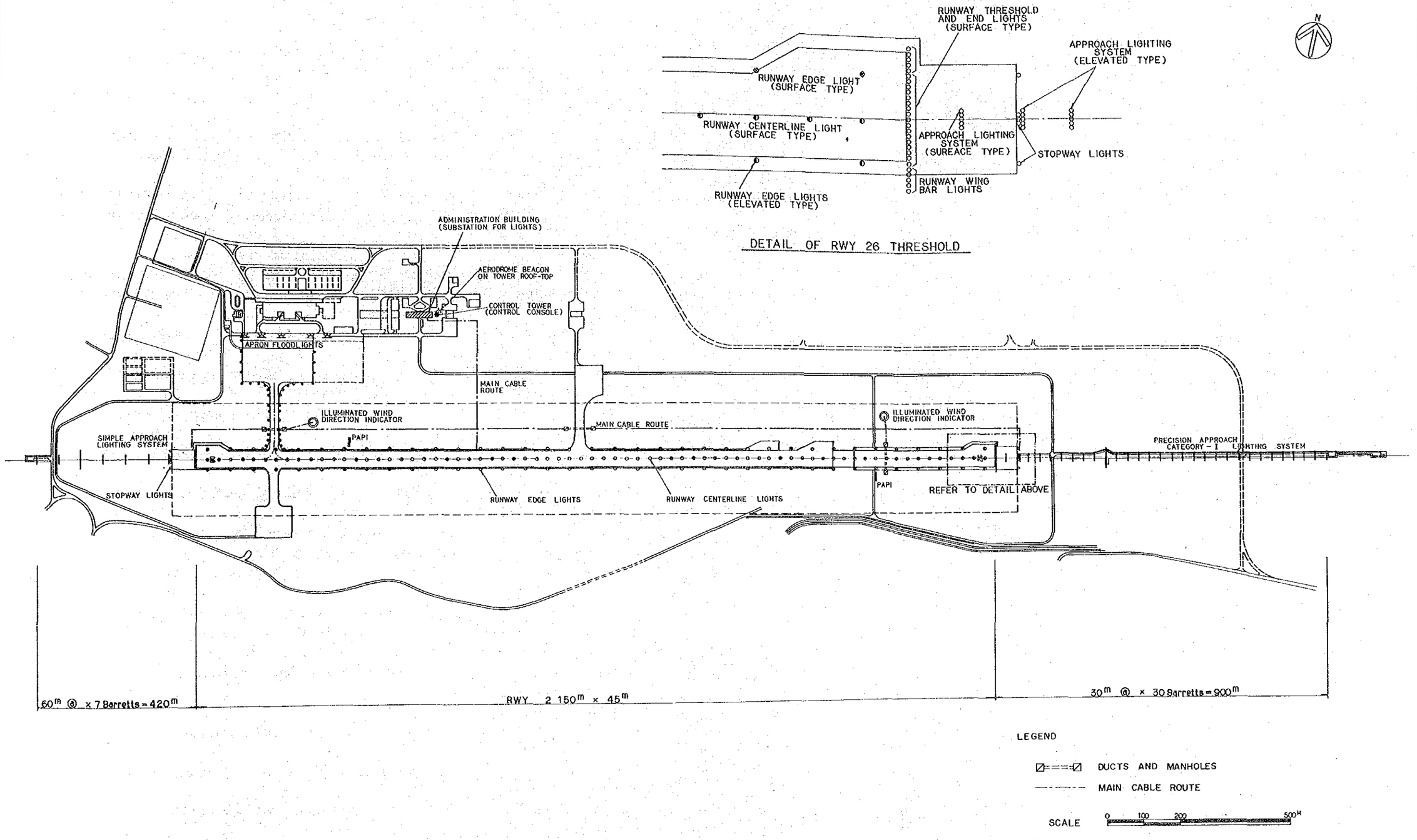


Fig. 3.3.13 Layout Plan of Aeronautical Ground Lights