5.3 Alternative Airport Master Plans

Six alternative terminal area layout plans have been prepared as shown in Figures 5.3.1 through 6.

(1) Alternative Airport Master Plan - TA1

This conceptual plan utilizes the existing major terminal facilities i.e., passenger terminal building, apron and taxiway as much as possible.

(2) Alternative Airport Master Plan - TB1

The passenger terminal building and passenger terminal apron will be constructed new in this plan. The existing terminal building and the apron will be used for cargo facilities. The existing taxiway will also be utilized to the maximum extent possible.

(3) Alternative Airport Master Plan - TB2

This plan is a variation of Alternative-TB1. Both the new passenger and cargo terminal buildings will be constructed new, and the existing terminal building will be converted to be used as an office/storage building.

(4) Alternative Airport Master Plan - TC1

In this plan, the passenger terminal building, apron and taxiway will be new construction. The existing terminal facilities including taxiways will be demolished except for the runway. The passenger terminal building will be located in the area near the east end of the runway which will minimize the taxiing distance required for aircraft based on preferential runway operation.

(5) Alternative Airport Master Plan - TC2

The major terminal facilities will be upgraded in this plan, the same as for Alternative-TC1. The passenger terminal will be located to avoid conflict with the existing passenger terminal building because in Alternative-TC1 the new passenger terminal building will be constructed at the same location as the existing building and this construction will require a temporary passenger terminal building in order to handle the passengers during construction.

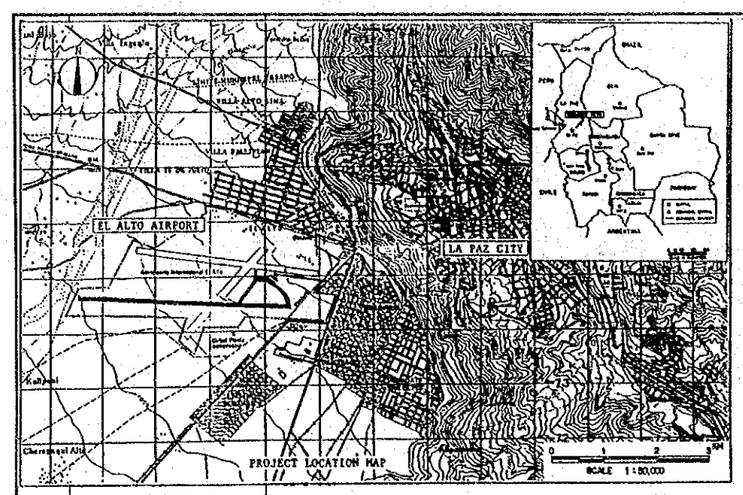
(6) Alternative Airport Master Plan - TC3

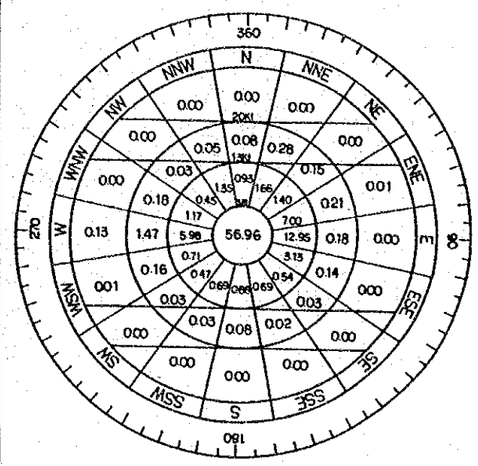
In the longer term after the year 2005, it is considered desirable that the passenger terminal be expanded to the east as much as possible taking into account efficient aircraft operations. Considering these points, Alternative-TC3 upgrading TC2 has been planned.

In this plan, the passenger terminal will first be developed at the same location considered for Alternative-TC2, and in the longer term it will be expanded to a location where the passenger terminal is planned in Alternative-TC1.

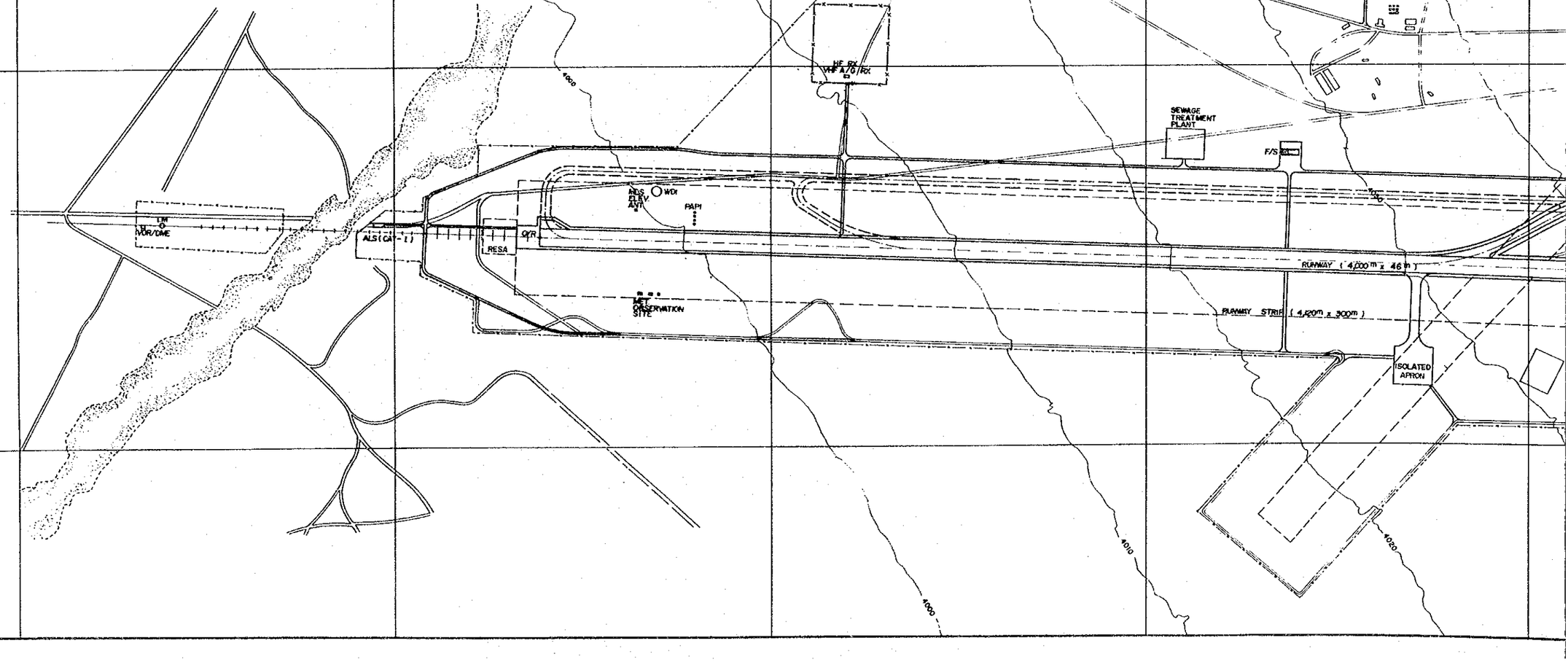
The cargo terminal will be located west of the passenger terminal area the same as for Alternative-TC1 in order not to limit the expansion potential for the passenger terminal, and to maintain an adequate area for expansion.

In this Alternative-TC3, however, the existing passenger terminal building can be maintained at its present location and used for the office building etc.





Location	El Alto Airport
Period	1984-1986
RWY Direction	N 92° E
Wind Coverage	99.44 % (Cross-wind 13 kt)
	99.996 % (Cross-wind 20 kt)



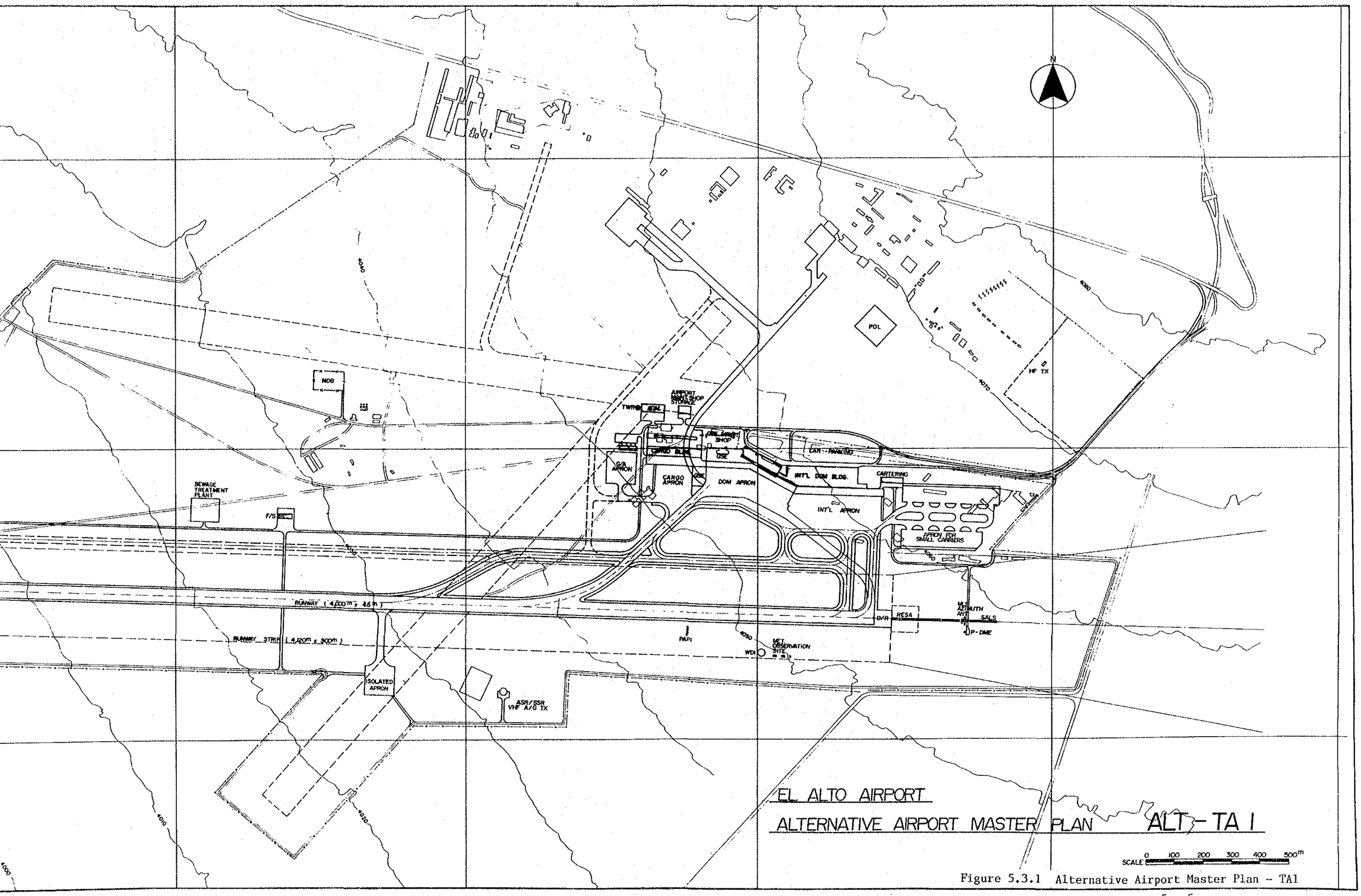
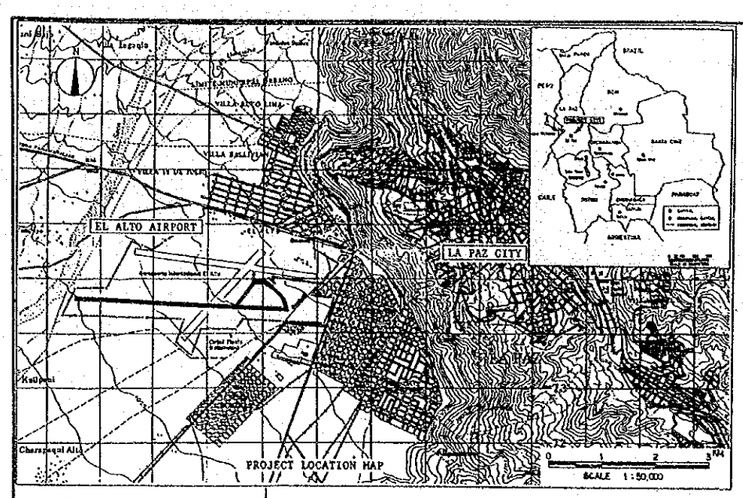
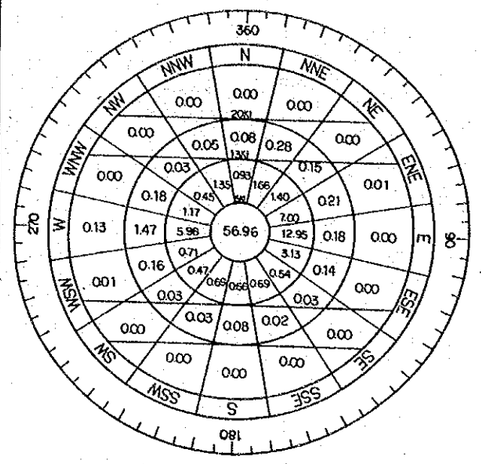
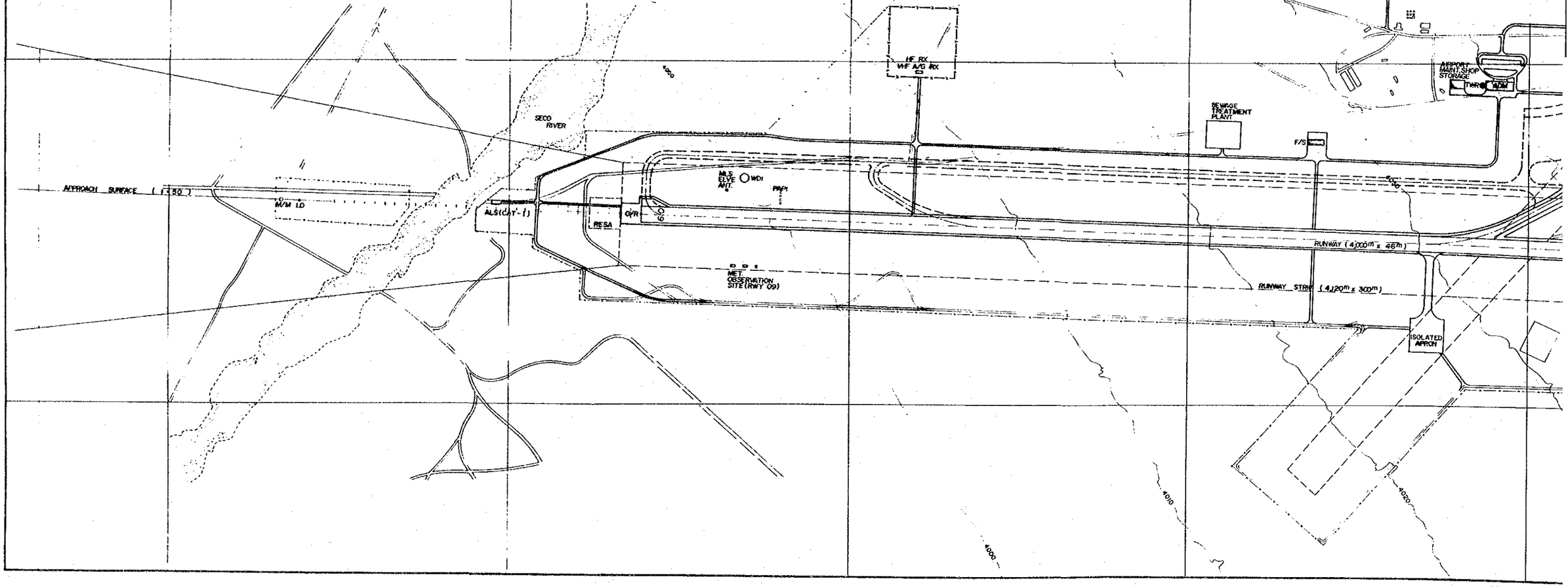


Figure 5.3.1 Alternative Airport Master Plan - TA1





Location	El Alto Airport
Period	1984-1986
RWY Direction	N 92° E
Wind Coverage	99.64 % (Cross-wind 13 kt)
	99.996 % (Cross-wind 20 kt)



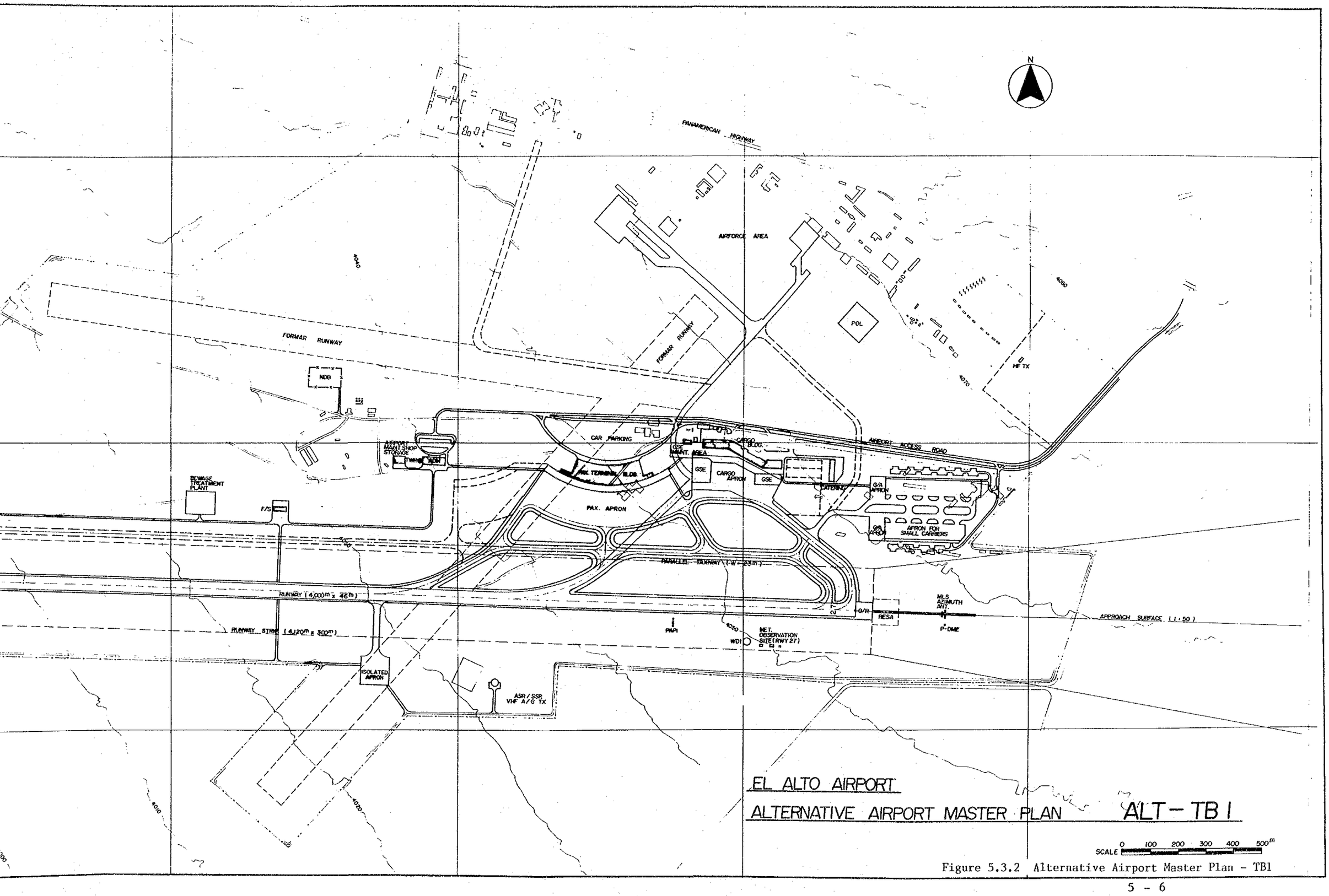
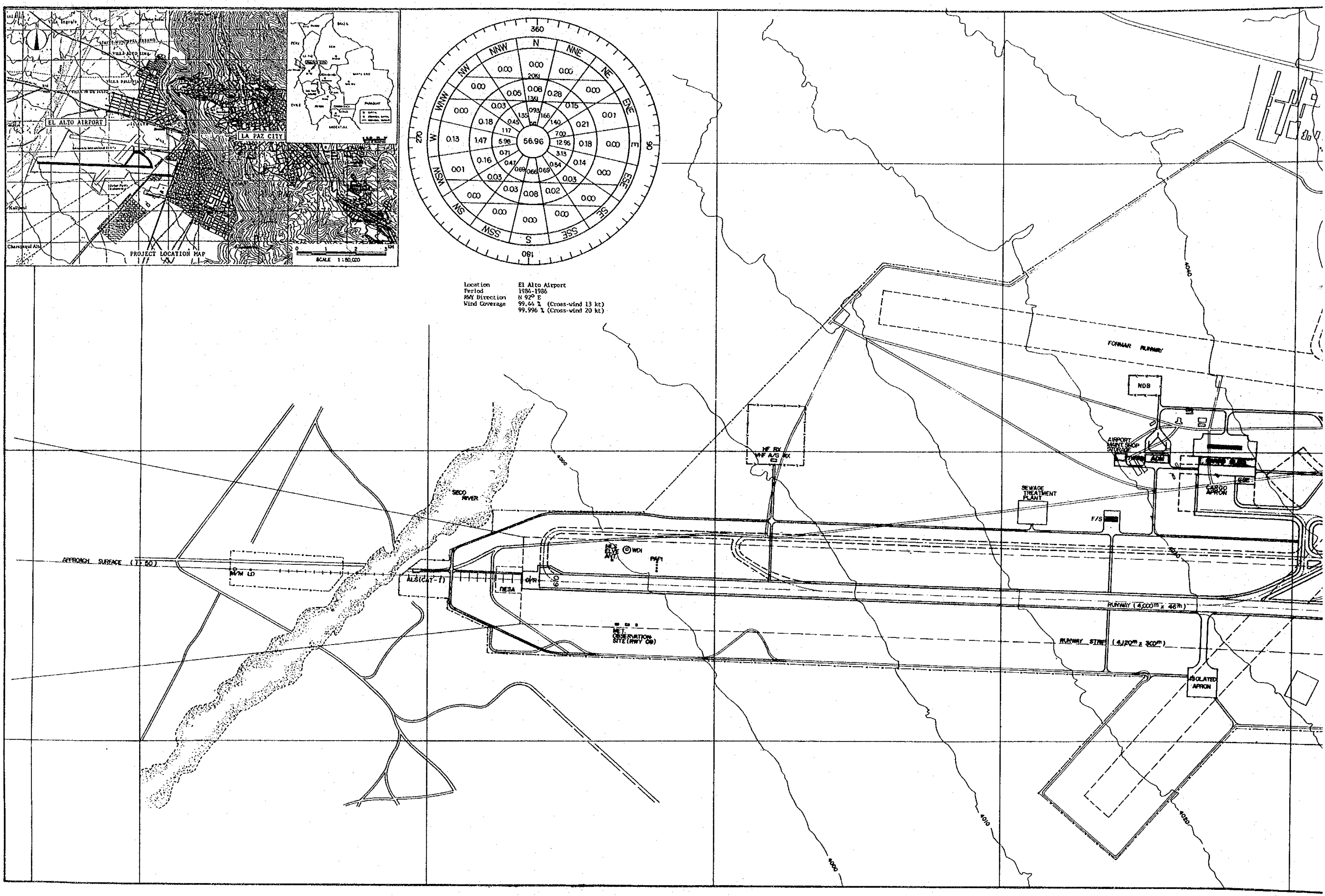


Figure 5.3.2 Alternative Airport Master Plan - TB1



EL ALTO AIRPORT
LA PAZ CITY
PROJECT LOCATION MAP
SCALE 1:50,000
Location El Alto Airport
Period 1984-1986
RWY Direction N 92° E
Wind Coverage 99.44 % (Cross-wind 13 kt)
99.996 % (Cross-wind 20 kt)
FORMAR RUNWAY
NDB
AIRPORT MAINT SHOP STORAGE
HF RX
VHF A/G RX
SEWAGE TREATMENT PLANT
CARGO APRON
F/S
SECO RIVER
APPROACH SURFACE (1:50)
ALS(CAT-I)
RESA
RUNWAY (4,000m x 46m)
RUNWAY STRIP (4,120m x 300m)
MET. OBSERVATION SITE (RWY 09)
ISOLATED APRON
4000
4010
4020
4040

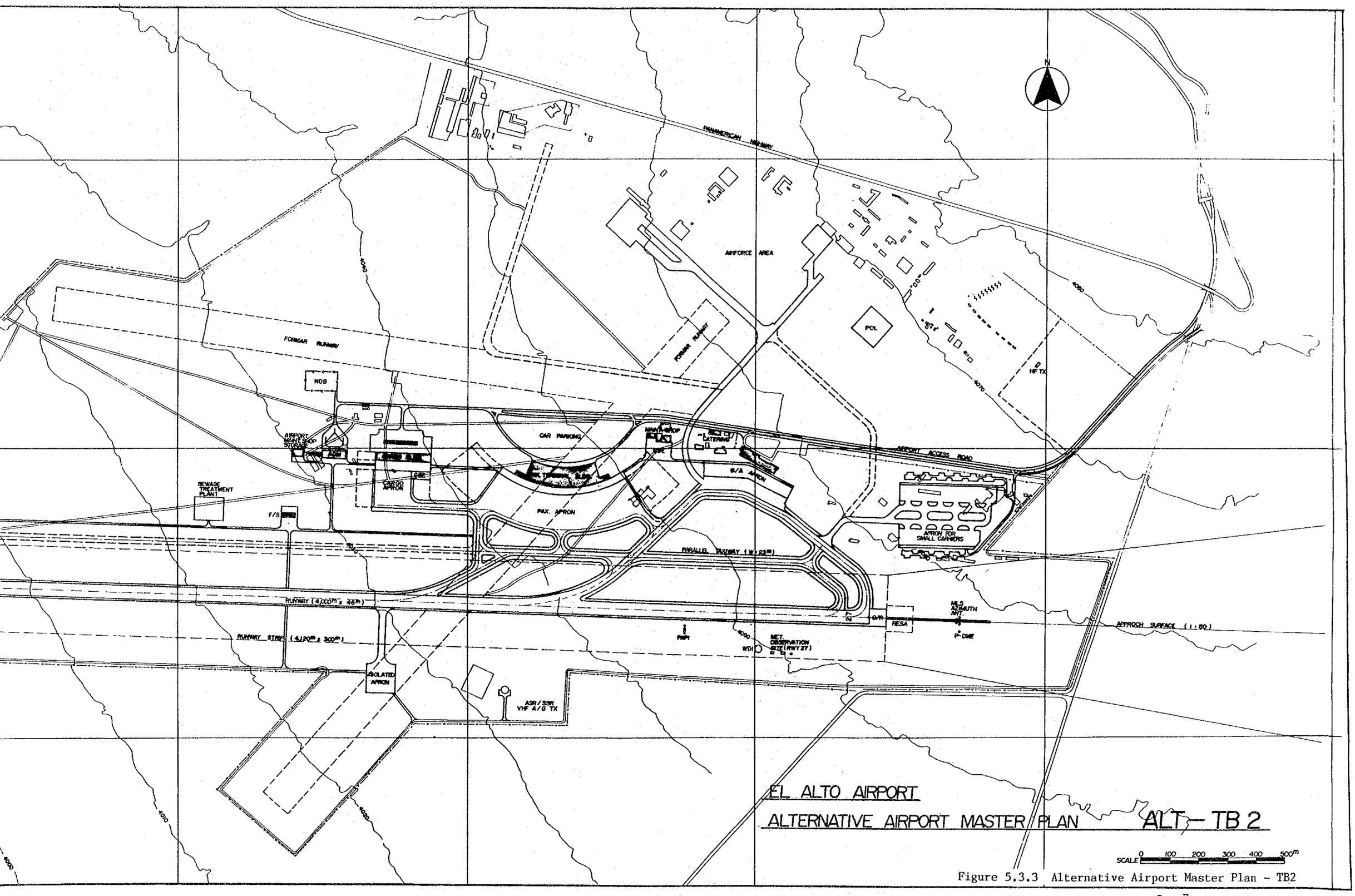
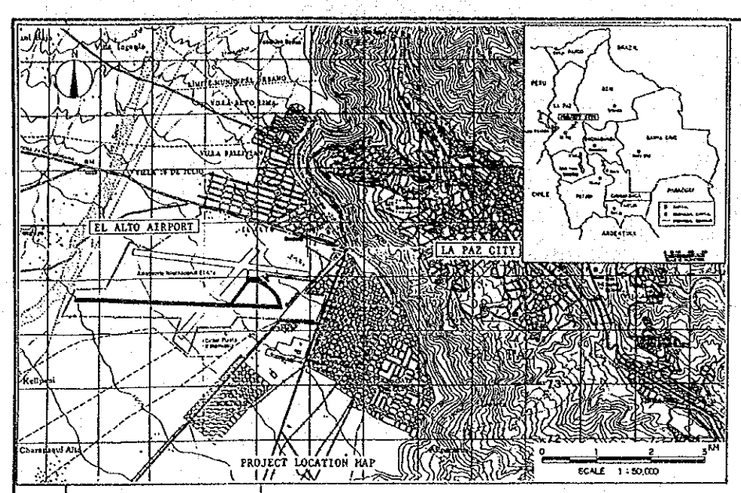
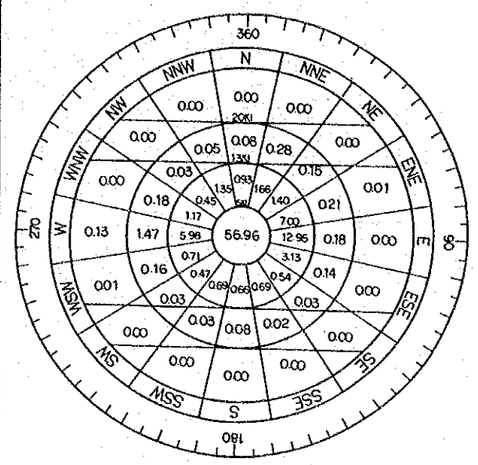
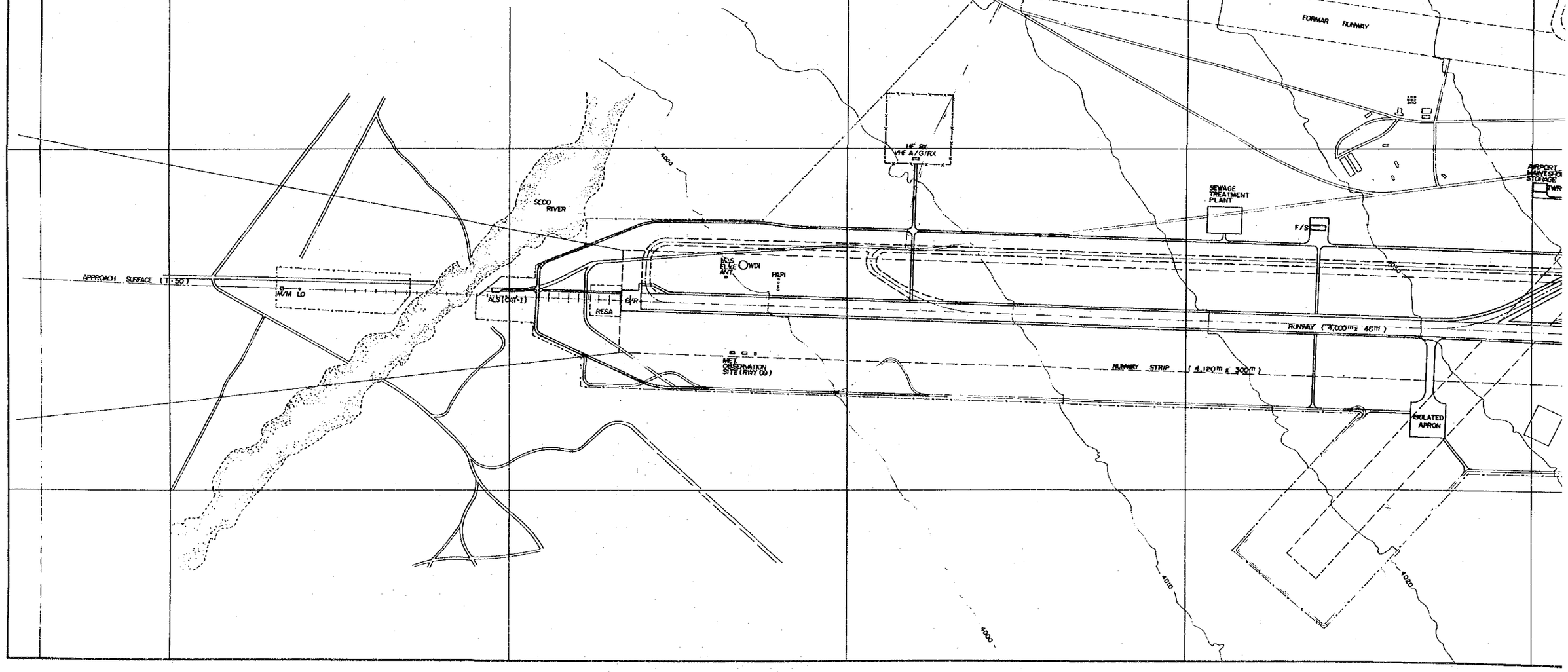


Figure 5.3.3 Alternative Airport Master Plan - TB2





Location	El Alto Airport
Period	1984-1986
RWY Direction	N 92° E
Wind Coverage	99.44 % (Cross-wind 13 kt)
	99.996 % (Cross-wind 20 kt)



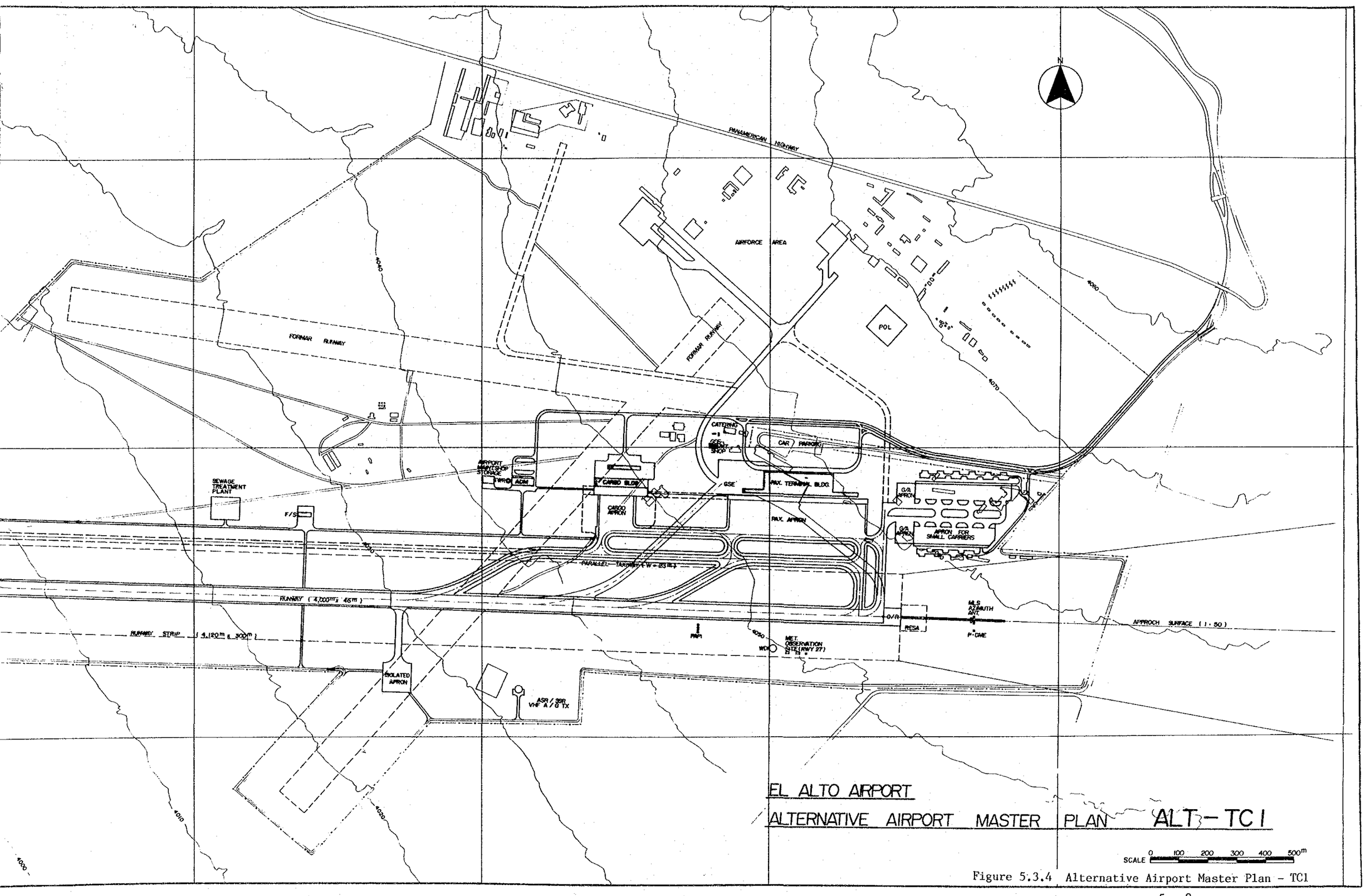
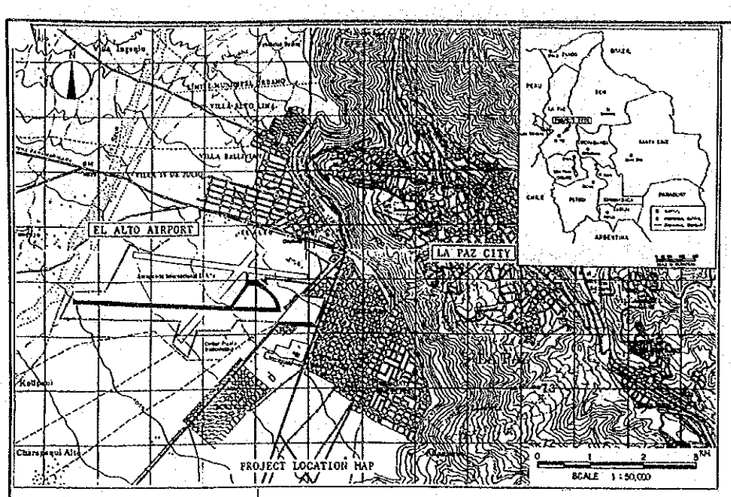
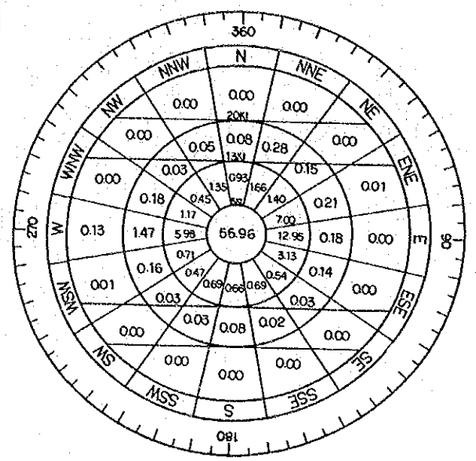
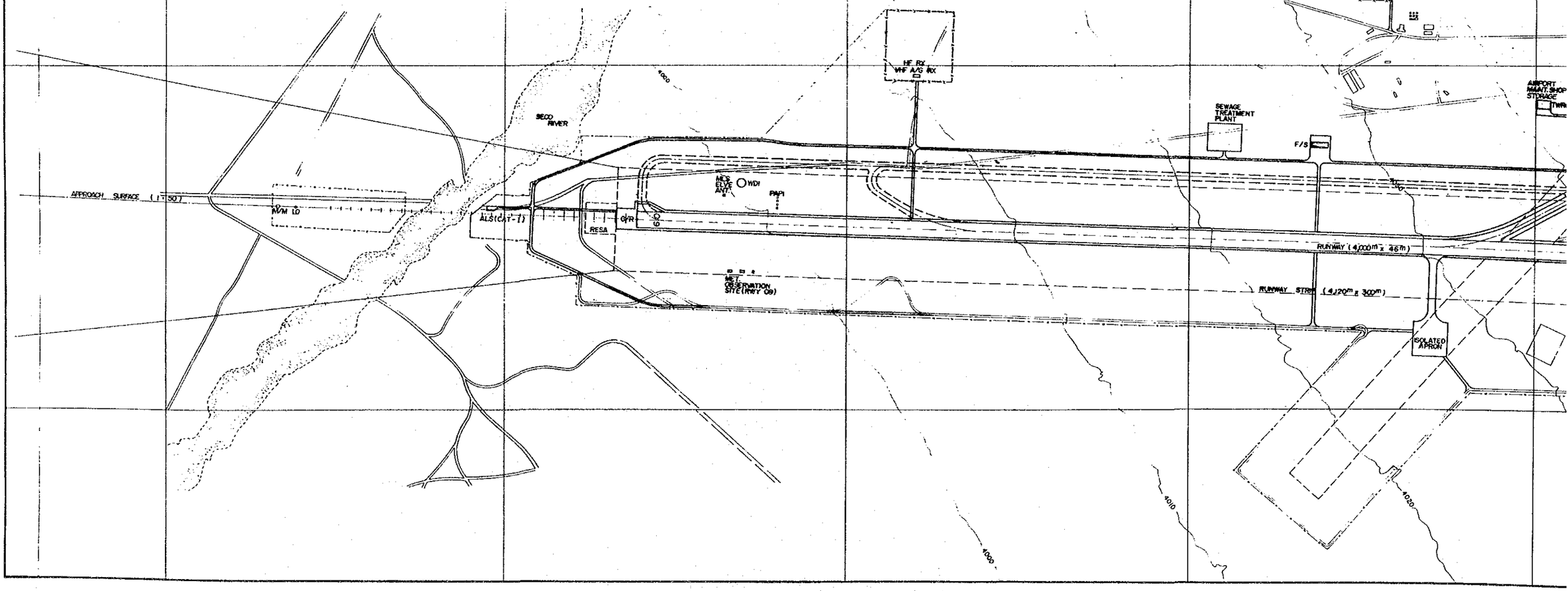


Figure 5.3.4 Alternative Airport Master Plan - TC1





Location El Alto Airport
Period 1984-1986
RW Direction N 92° E
Wind Coverage 99.44 % (Cross-wind 13 kt)
99.996 % (Cross-wind 20 kt)



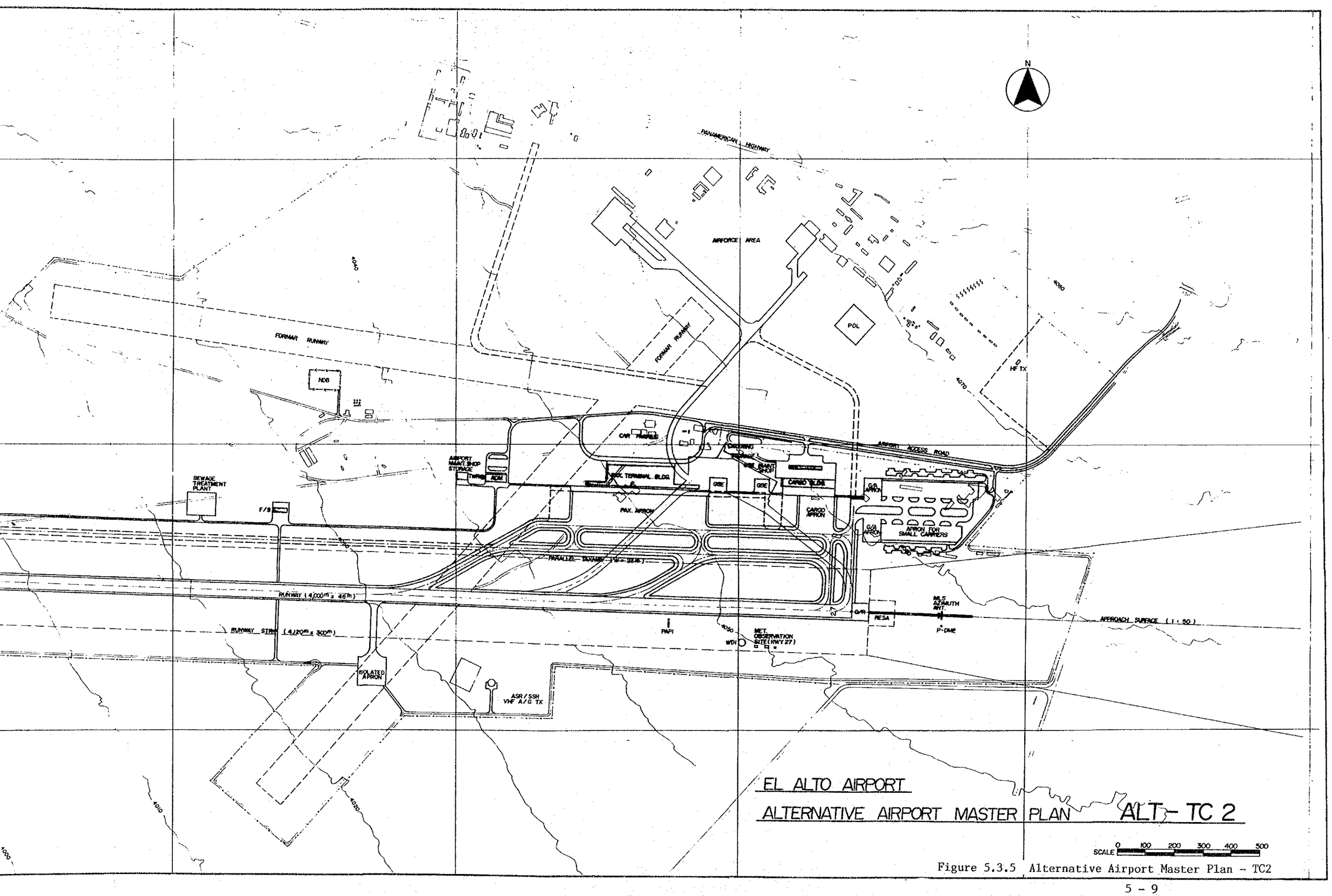
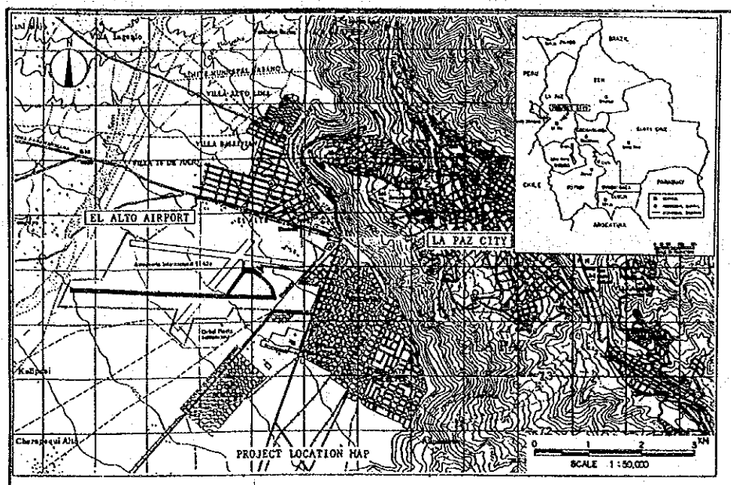
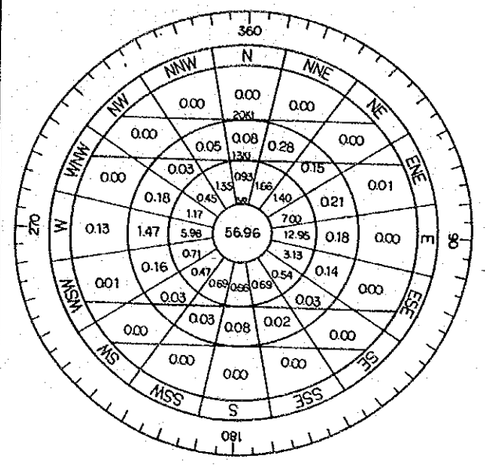
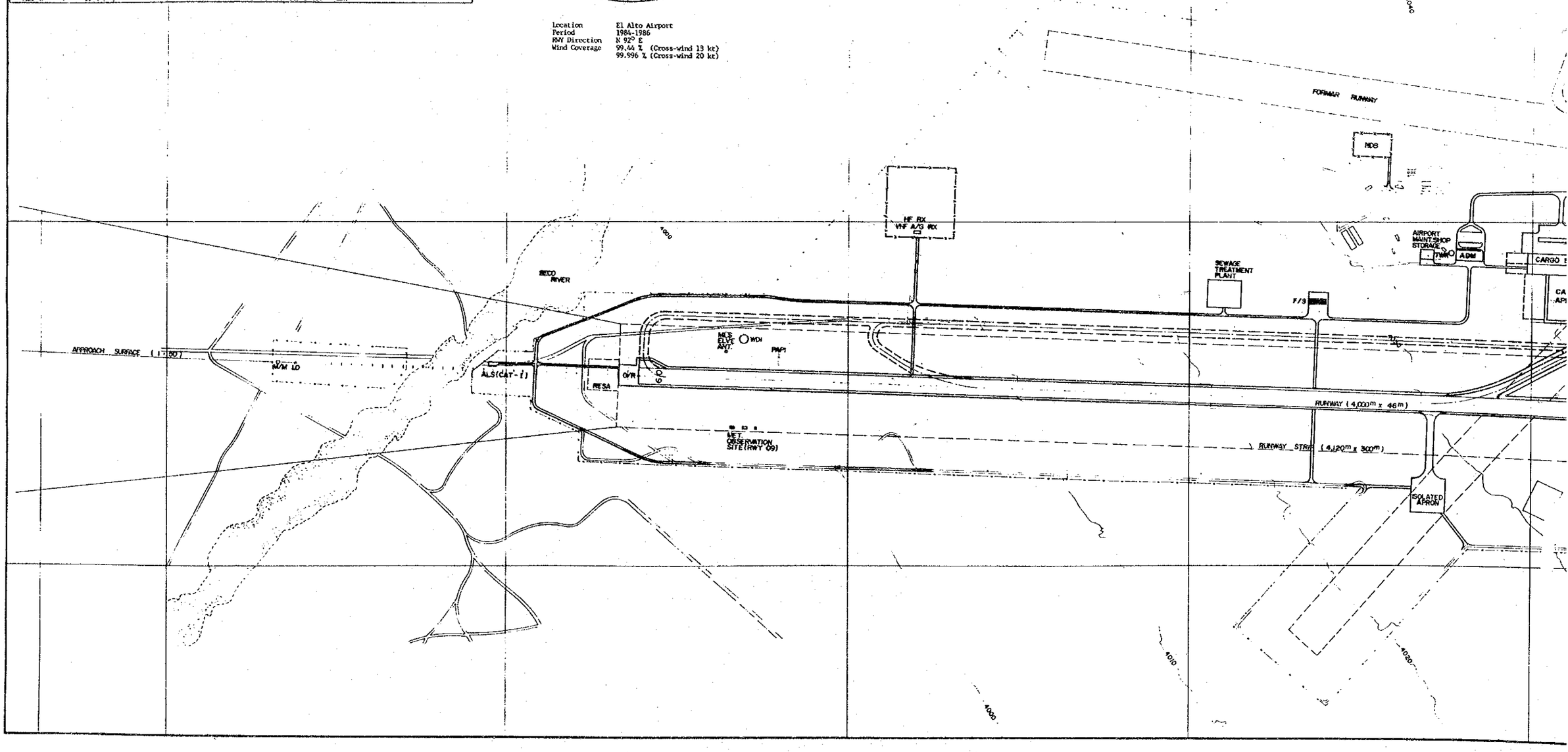


Figure 5.3.5 Alternative Airport Master Plan - TC2





Location El Alto Airport
Period 1984-1986
RWY Direction N 92° E
Wind Coverage 99.44 % (Cross-wind 13 kt)
99.996 % (Cross-wind 20 kt)



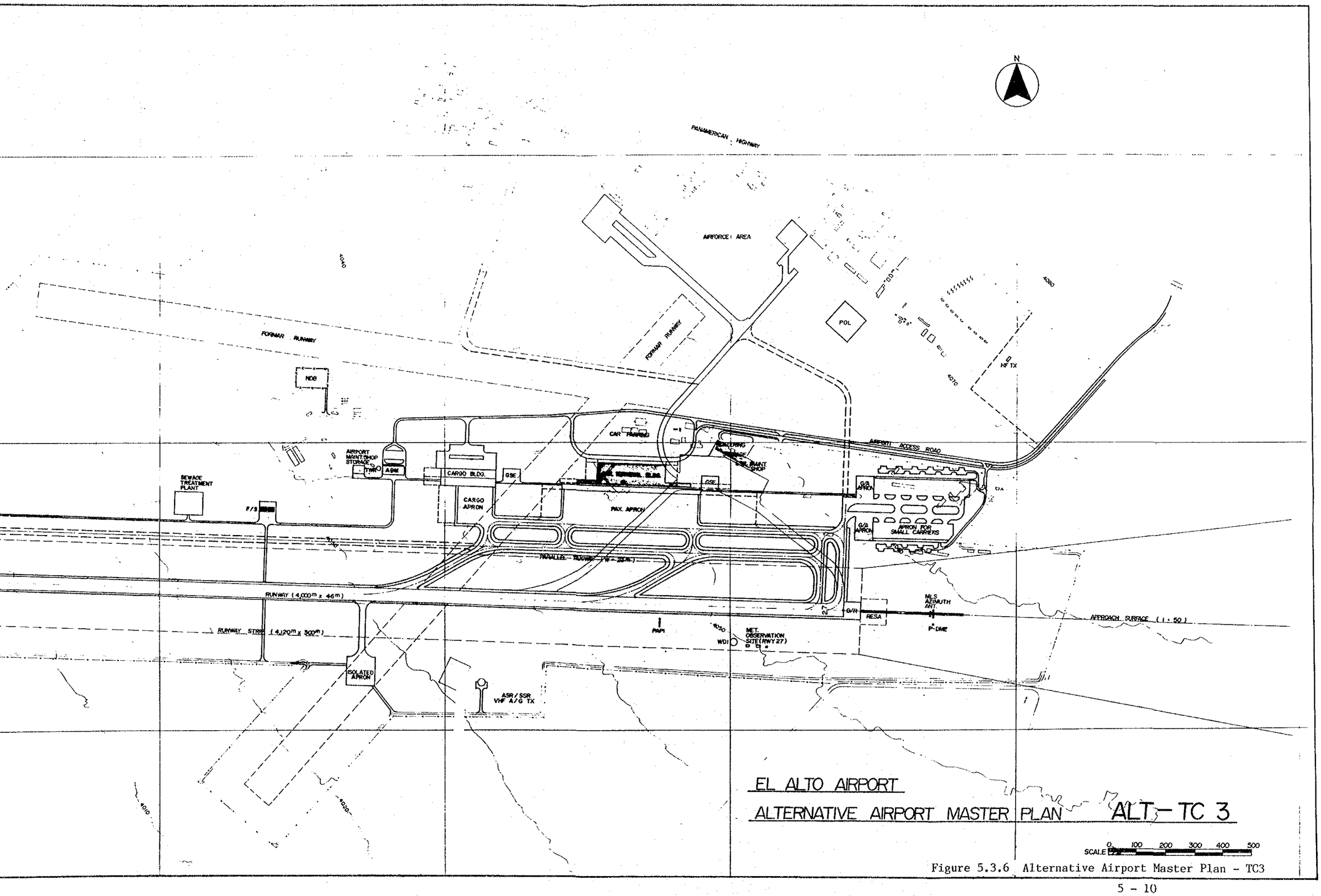


Figure 5.3.6 Alternative Airport Master Plan - TC3

CHAPTER 6 EVALUATION COMPARISON FOR ALTERNATIVE AIRPORT MASTER PLANS

CHAPTER 6 EVALUATION COMPARISON FOR ALTERNATIVE AIRPORT MASTER PLANS

6.1 General

The six alternative airport master plans defined in Section 5.3 have been assessed and evaluated analytically based on various considerations in order to determine the most suitable plan for the future development of El Alto airport.

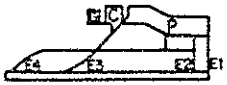
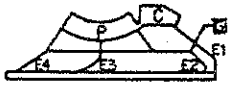
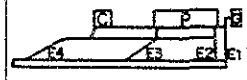
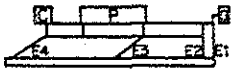
The result of this evaluation is that Alternative-TC3 is recommended to be adopted for the airport master plan.

6.2 Evaluation Comparison

Six alternative airport master plans were evaluated as shown in Table 6.2.1. In this table, "x" indicates greater disadvantage or poorer performance.

Note: The cost of TC-3, which is selected as the most suitable master plan, shown in Table 6.2.1 is revised in Chapter 12 based on the preliminary design for Phase I development. The cost of Phase I development is finally estimated to be 138 million US dollars based on 1987 prices as shown in Table 12.3.1.

Table 6.2.1 Comparison Table of Alternative Airport Master Plans

Item \ Plan	ALT-TA1	ALT-TB1	ALT-TB2	ALT-TC1	ALT-TC2	ALT-TC3
Illustration						
A. Convenience for Airport Users						
A.1 Passenger Convenience						
1) Use of Boarding Bridges	x Impossible for domestic passengers. Boarding bridge for existing building will not be provided.	Possible for all passengers. Complete terminal building will be new constructed.	Same as ALT-TB1	Same as ALT-TB1	Same as ALT-TB1	Same as ALT-TB1
A.2 Efficiency of Airlines' Operation						
1) Taxiing Distance of Passenger Aircraft (Preferential Operation)	JJM, LJ : L/D E2 TWY, T/O E1 TWY 1,250 m NJ, SJ : L/D E4 TWY, T/O E1 TWY 2,170 m Ave. 1,710 m x	JJM, LJ : L/D E2 TWY, T/O E1 TWY 2,230 m NJ, SJ : L/D E4 TWY, T/O E1 TWY 2,070 m Ave. 2,150 m x	JJM, LJ : L/D E2 TWY, T/O E1 TWY 2,610 m NJ, SJ : L/D E4 TWY, T/O E1 TWY 2,240 m x Ave. 2,430 m x	JJM, LJ : L/D E3 TWY, T/O E1 TWY 1,370 m NJ, SJ : L/D E4 TWY, T/O E1 TWY 2,110 m Ave. 1,740 m x	JJM, LJ : L/D E3 TWY, T/O E1 TWY 2,160 m NJ, SJ : L/D E4 TWY, T/O E1 TWY 2,060 m Ave. 2,110 m x	Same as ALT-TC2
2) Taxiing Distance of Freighter (Preferential Operation)	JJ, LJ : L/D E2 TWY, T/O E1 TWY 2,180 m NJ : L/D E4 TWY, T/O E1 TWY 2,200 m Ave. 2,190 m	JJ, LJ : L/D E2 TWY, T/O E1 TWY 2,230 m NJ : L/D E4 TWY, T/O E1 TWY 2,100 m Ave. 2,170 m x	JJ, LJ : L/D E2 TWY, T/O E1 TWY 3,950 m NJ : L/D E4 TWY, T/O E1 TWY 2,850 m Ave. 3,400 m x	JJ, LJ : L/D E3 TWY, T/O E1 TWY 2,180 m NJ : L/D E4 TWY, T/O E1 TWY 2,060 m Ave. 2,120 m	JJ, LJ : L/D E3 TWY, T/O E1 TWY 1,360 m NJ : L/D E4 TWY, T/O E1 TWY 2,060 m Ave. 1,710 m	JJ, LJ : L/D E3 TWY, T/O E1 TWY 2,750 m NJ : L/D E4 TWY, T/O E1 TWY 2,200 m Ave. 2,480 m
3) Taxiing Distance of General Aviation Aircraft (Preferential Operation)	P : L/D E4 TWY, T/O E1 TWY 2,640 m	P : L/D E4 TWY, T/O E1 TWY 2,000 m	P : L/D E3 TWY, T/O E1 TWY 1,540 m	P : L/D E4 TWY, T/O T1 TWY 2,320 m	Same as ALT-TC1	Same as ALT-TC1
4) Aircraft's Taxi Flow	x Not simple nor efficient	x Same as ALT-TA1	x Same as ALT-TA1	Simple and efficient	Simple and efficient	Simple and efficient

Note: "x" indicates greater disadvantage or poorer performance.

Table 6.2.1 (Cont.)

Item \ Plan	ALT-TA1	ALT-TB1	ALT-TB2	ALT-TC1	ALT-TC2	ALT-TC3
A.3 Efficiency of Airport Operation						
1) Communications among the Terminal Facilities	Good, Compact Layout	Acceptable	x Poor Facilities will not be located closely to each other.	Acceptable	Same as ALT-TC1	Slightly poor
B. Expansion Potential for Future Airport Development						
B.1 Passenger Terminal Area	x Poor	Good	Good	Good	Good	Good
B.2 Cargo Terminal Area	x Poor	Good	Good	Good	Good	Good
C. Constructional Considerations						
C.1 Quantity of Night Works (Excluding night works on runway)	x More x Night work will be required for taxiway overlay and apron expansion.	x Less No night work will be required for other than taxiway overlay.	x Same as ALT-TB1	Less than other alternatives	Same as ALT-TC1	Same as ALT-TC1
C.2 Special Measures to be Taken				x Temporary passenger terminal building will be required in Phase I development work.		
C.3 Construction Period				x Additional one year for temporary building construction will be required in Phase I development work.		
D. Preliminary Project Cost (Mil. US$)						
Phase I	159	x 167	x 167	x 169	163	163
Phase II	52	52	53	54	52	53
Total	211	219	220	223	215	216

Note: "x" indicates greater disadvantage or poorer performance.

Table 6.2.1 (Cont.)

Item \ Plan		ALT-TA1		ALT-TB1		ALT-TB2		ALT-TC1		ALT-TC2		ALT-TC3
E. Other Considerations E.1 Simple Layout of Terminal Facilities and/or Comfortable Atmosphere	x	Poor		Slightly poor		Good		Same as ALT-TB2		Same as ALT-TB2		Same as ALT-TB2
Main Disadvantages		Not recommended				Not recommended				Recommended		Recommended
	x	- Poor expansibility	x	- Aircraft taxiing flow is not simple and taxiing distance is slightly long.	x	- Taxiing distance is long particularly for freighter.	x	- Taxiing distance from/to cargo terminal apron is long.	x	- Taxiing distance from/to passenger terminal apron is long.	x	- Taxiing distance from/to passenger terminal apron and from/to cargo terminal apron is long.
	x	- Much night work	x		x		x	- Project cost is high and construction period is long due to temporary terminal facilities.		- Expansibility of cargo terminal area is slightly poor.		
	x	- Taxiway is not simple	x		x		x					
	x	- Project cost is not low in spite of utilization of existing facilities.			x							
	x				x							
	x				x							

Note: "x" indicates greater disadvantage or poorer performance.

The superiority of Alternative-TC3 is explained as follows:

The six alternatives have been broadly divided into the following two groups.

Group AB: Alternatives-TA1, TB1 and TB2, namely, the plans in which the existing facilities will be utilized, as much as possible.

Group C : Alternatives-TC1, TC2 and TC3, namely, the plans in which all airport facilities except for the runway will be constructed new.

Although the plans of Group AB will use the existing passenger terminal building, apron and taxiway effectively, these plans are not considered better than those of Group C for the following reasons:

- The cost required for the plans of Group AB is not much less than that for Group C due to the extensive night work required and the conspicuous obsolecence of the existing facilities.

- The taxi flow of aircraft in Group AB is not as convenient for the airlines as that in Group C because it is not as simple.

Although Group AB on a comprehensive basis is considered inferior to Group C, Alternative-TB1 is the most favorable among the plans in Group AB for the following reasons:

- Alternative-TA1 has a notable disadvantage, namely that its potential for expansion is poor in addition to the disadvantages mentioned above.

- Alternative-TB2 has more disadvantage than Alternative-TB1 as shown in Table 6.2.1.

Group C is divided again into the following two groups in terms of the facilities layout.

Group C1: Alternative-TC1, namely, new passenger terminal building will be developed at the same location as the existing passenger terminal building.

Group C2: Alternatives-TC2 and TC3, in which a new passenger terminal building will be developed on the west side of the existing passenger terminal building, which will be used for other purposes until the year 2005.

Although Group C1, i.e. Alternative-TC1 is excellent for the airlines due to the short taxiing distance required, it has more disadvantage due to the fact that it will require additional cost and a longer construction period for the temporary passenger terminal facilities prior to the construction of the new passenger terminal facilities. The development of El Alto airport, however, is considered an urgent matter as described in Chapter 4. Group C1 is therefore not considered applicable to this project.

With regard to the remaining Group C2 i.e. Alternatives-TC2 and TC3, there is scarcely any difference in terms of the evaluation comparison between these two alternatives. Alternative-TC3, however, is considered to be better than Alternative-TC2 because in Alternative-TC3 it is possible for the passenger terminal building to be expanded to the east without restricting the cargo terminal area in the long term development.

The most suitable airport master plan has been selected between Alternative-TB1 in Group AB and Alternative-TC3 in Group C. Alternative-TC3 is considered to be the best airport master plan for the following reasons:

- The cost required for Alternative-TC3 is less than Alternative-TB1 in which the existing passenger terminal building will be used for the cargo terminal facilities. The cargo terminal facilities in Alternative-TC3 will be constructed new.

- In Alternative-TC3 the existing passenger terminal building can be used as the head office for AASANA. AASANA can then save the rent being paid at the head office at the present time.

- The easterly direction is considered favorable for the expansion of the passenger terminal building. In Alternative-TC3, expansion toward the east is possible without any restriction in the future long term.

PART V PRELIMINARY DESIGN FOR PHASE I DEVELOPMENT

CHAPTER 7 SCOPE OF THE PHASE I DEVELOPMENT PROJECT

CHAPTER 7 SCOPE OF THE PHASE I DEVELOPMENT PROJECT

7.1 General

Alternative-TC3 has been selected as the most suitable master plan for El Alto airport based on an overall comparative evaluation as discussed in Chapter 6. In this chapter, the construction items for phased development, i.e. scope of the Phase I development project is clarified.

7.2 Project Phases

The airport master plan will be implemented utilizing the basic concept of phased development as mentioned below, for the purpose of economical and cost-effective investment.

a. Immediate improvement:

   To be carried out so that El Alto airport can cope with the passenger demand forecast until the Phase I development work has been completed.

b. Phase I development:

   To be planned in order to meet the demand anticipated for the year 1997 based on a consideration that major work will not be required for at least 4 years after the completion of the construction.

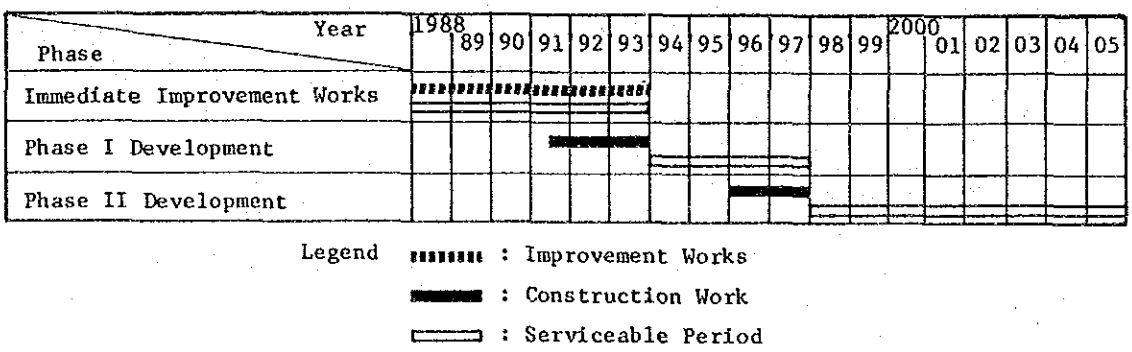
c. Phase II development:

   To be planned to meet the demand anticipated in the year 2005 so that the demand for eight years after the service period of Phase I development can be accommodated.

Accordingly, the phases of the airport development are summarized below and are shown in Table 7.2.1.

Phase	Design Year	Service Period
Immediate improvement		-1993
Phase I development	1997	1994-1997
Phase II development	2005	1998-2005

Table 7.2.1 Phases of Airport Development



7.3 Air Traffic Demand and Facility Requirements for Phases I and II

The air traffic demand and facility requirements for Phases I and II are summarized in Tables 7.3.1 and 2 based on the study discussed in Chapters 2 and 3.

Table 7.3.1 Traffic Demand for Phases I and II

Item \ Phase / Design Year		Present Conditions	Phase I	Phase II
		(as of 1987)	1997	2005
1. Annual Number of Passengers*a	Domestic	413,000(1985)	1,030,000	1,700,000
	International	133,000(1985)	280,000	440,000
	Total	546,000(1985)	1,310,000	2,140,000
2. Annual Cargo (ton)*b	Domestic	6,700(1985)	15,400	26,900
	International	5,800(1985)	15,600	25,700
	Total	12,500(1985)	31,000	52,600
3. Annual Aircraft Movements*a	Domestic	17,970(1985)	22,530	24,470
	International	2,640(1985)	5,310	6,550
	Total	20,610(1985)	27,840	31,020
4. Peak Hour Passengers*c	Domestic	290*f(1987)	680	1,120
	International*d	110*f(1987)	240	310
	Total*e	290*f(1987)	800	1,370
5. Peak Hour Aircraft Movements	Domestic*c	3(1987)	4	5
	International*c	3(1987)	3	3
	Domestic and International*c*e	4(1987)	6	7
	Total Airport*a	11(1986)	13	13

Note *a: Including non-scheduled *b: Excluding meat cargo
*c: Excluding non-scheduled *d: Excluding transit
*e: Not a mathematical summation of domestic and international, but an overall figure for the total airport
*f: Estimated figure

Table 7.3.2 Airport Facility Requirements for Phases I and II

No.	Facility	Phase / Design Year / Unit	Present Conditions (as of 1987)	Phase I 1997	Phase II 2005
1	Runway	meter	RWY 09R/27L 4,000 x 46 RWY 09L/27R 2,280 x 30 RWY 04/22 1,940 x 30	RWY 09R/27L 4,000 x 46	RWY 09R/27L 4,000 x 46
2	Runway Strip	meter	RWY 09R/27L 4,090 x 300 RWY 09L/27R 2,280 x 100 RWY 04/22 2,060 x 300	RWY 09R/27L 4,120 x 300	RWY 09R/27L 4,120 x 300
3	Taxiway	meter	Exit Taxiway 1,250 x 22.9	Partial Parallel Taxiway	
4	Passenger Terminal Apron	gate position	B-747 Class:1 B-727 Class:2 Total 3	International B-747 Class:2 International B-757 Class:1 Domestic B-757 Class:3 Total 6	International B-747 Class:2 International B-757 Class:2 Domestic B-747 Class:1 Domestic B-757 Class:2 Total 7
5	Cargo Terminal Apron	gate position	Nil	B-707 Class:2	B-747 Class:2
6	Cargo Apron for Small Carriers	gate position	C-54 Class:16	13	11
7	General Aviation Apron	gate position	COMMANDER-690 Class:9	13	19
8	Passenger Terminal Building — Domestic	sq. meter		10,200	16,800
	Passenger Terminal Building — International	sq. meter		7,200	9,300
	Passenger Terminal Building — Total *a	sq. meter	4,800 (Combined)	16,500	24,800
9	Cargo Terminal Building	sq. meter	1,300	5,160	8,670
10	Administration Building	sq. meter	2,819	4,000	4,000
11	Air Navigation Systems		Precision Approach Category-I	Precision Approach Category-I (ILS/MLS)	(MLS)
12	Car Park	cars	100	560	960
		sq. meter	4,600	20,000	34,000
13	Access Road		1 lane for each direction	1 lane for each direction	2 lanes for each direction
14	Fuel Supply (Jet. A-1)	Kl *b	2,056	2,500	4,000
		sq. meter	2,500	8,500	8,500
15	Rescue and Fire-Fighting	Category	7	7	8
		cars	3	4	4 or 5
		sq. meter	450	450	550
16	Utilities				
	Power Supply System	KVA	320 (270kw)	2,000	3,200
	Water Supply System	ton/month	6,900	12,000	20,400
	Sewerage System	ton/month	6,900	12,000	20,400
	Solid Waste Disposal System	ton/month	30	60	110

Note, *a: Not a mathematical summation of domestic and international, but an overall figure for the total airport

*b: Tank capacity

7.4 Construction Requirements for the Phased Development

The construction items to be included in the three phases described in Section 7.2 are tabulated in Table 7.4.1 in order to clarify the scope of the Phase I development project.
In Table 7.4.1, the mark "x" indicates the phase in which each construction item should be implemented.

The following sub-sections discuss the various considerations to be made in order to establish the construction items which are shown in Table 7.4.1.

Table 7.4.1 Construction Items in Phases

Construction Item	Immediate Improvement	Phase I	Phase II
A. Civil Works			
1) Improvement of the runway pavement	x		
2) Construction of runway shoulders and blast pads	x		
3) Construction of turning pads		x	
4) Runway pavement overlay		x	x
5) Construction of taxiways		x	
6) Construction of a passenger terminal apron		x	x
7) Construction of a cargo terminal apron		x	x
8) Construction of a general aviation apron		x	x
9) Construction of a cargo apron for small carriers		x	
10) Construction of an isolated apron with connecting taxiway		x	

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
11) Construction of internal roads and car parks		x	x
12) Construction of a storm water drainage system		x	
13) Construction of a new security fence		x	
14) Construction of perimeter roads		x	x
B. Architectural Works			
1) Remodeling the existing passenger terminal building	x		
2) Construction of a new passenger terminal building including flight information system and airport security system		x	x
3) Construction of a new cargo terminal building		x	x
4) Construction of a new administration building and control tower		x	

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
5) Construction of a Meteorological Observation building		x	
6) Construction of a new fire station		x	x
7) Construction of an airport maintenance shop and storage		x	
C. Air Navigation Systems			
C.1 Radio Navigation Aids			
1) Replacement of VOR/DME for terminal use		x	x
2) Replacement of NDB			x
3) Replacement of locator		x	x
4) Installation of telecommunications cable lines for navaids		x	
5) Installation of external power supply cables and construction of a substation for navaids		x	

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
6) Provision of spare parts and maintenance tools		x	x
7) Provision of measurement and test equipment		x	x
8) Installation of MLS		x	
C.2 Air Traffic Control and Aeronautical Telecommunications			
1) Replacement of VHF air-ground transmitter		x	x
2) Replacement of VHF air-ground receiver		x	x
3) Replacement of VHF multi-channel transceiver		x	x
4) Installation of VHF FM transceiver for vehicle control		x	x
5) Replacement of VHF links by UHF links		x	x
6) Replacement of HF/ SSB/ISB transmitter		x	x
7) Replacement of HF/ SSB/ISB receiver		x	x

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
8) Relocation of the receiver building		x	
9) Replacement of control consoles for the aerodrome control tower and communications control unit		x	x
10) Replacement of control consoles for ACC/FIC		x	
11) Installation of an automatic terminal information service (ATIS)		x	x
12) Replacement of the magnetic tape recorder		x	x
13) Replacement of air traffic light gun		x	
14) Provision of spare parts and maintenance tools		x	x
15) Provision of measurement and testing equipment		x	x

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
C.3 ATC Radar System			
1) Relocation of the SSR		x	
2) Replacement of SSR (under construction) by ASR/SSR and radar data processing system			x
C.4 Aeronautical Ground Lights			
1) Installation of a simple approach lighting system		x	
2) Replacement of runway edge lights		x	
3) Replacement of runway threshold and end lights/cat-I for both thresholds and ends		x	
4) Replacement of runway wing bar lights/ precision side only		x	
5) Installation of taxiway edge lights		x	
6) Installation of a taxiing guidance system		x	

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
7) Installation of apron floodlights		x	
8) Replacement of the illuminated wind direction indicator lights		x	
9) Installation of an aerodrome beacon		x	
10) Installation of a power distribution and control system for the ground lights		x	
11) Construction of ducts, manholes, and main conduits		x	
12) Construction of a power substation for the ground lights		x	
13) Provision of spare parts and maintenance tools		x	x
14) Provision of measurement and test equipment		x	x
15) Installation of runway centerline lights		x	

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
16) Replacement of Precision approach category-I lighting system			x
17) Replacement of PAPI			x
18) Replacement of emergency generator			x
C.5 Meteorological System			
1) Installation of field weather equipment, central data collection equipment, a weather report desk (console), branch display and branch video display		x	x
2) Replacement of the HF receiver, facsimile equipment and tele-typewriters		x	x
3) Replacement of the radiosonde receiver		x	x
4) Provision of spare parts and maintenance tools		x	x
5) Provision of measurement and testing equipment		x	x

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
6) Provision of consumables		x	x
7) Replacement of the weather satellite receiver		x	
8) Installation of a hydrogen generator		x	
9) Installation of radiosonde and transmitters for 2 years operation		x	x
C.6 Others			
1) Factory training, site training and ground assistance for flight calibration test		x	x
D. Airport Utilities			
1) Expansion of the power supply system and replacement of existing power supply equipment with new equipment		x	x
2) Expansion of the water supply system and increase of the capacity		x	

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
3) Construction of a new sewage system		x	x
4) Installation of an incinerator		x	x
5) Expansion of public tele-communications		x	x
E. General Services			
1) Provision of an ambulance		x	
2) Replacement of existing major vehicles with new vehicles to meet ICAO vehicle performance requirements		x	
3) Provision of rescue and protection equipment including oxygen masks		x	
4) Provision of major vehicles			x

Table 7.4.1 (Cont.)

Construction Item	Immediate Improvement	Phase I	Phase II
F. Other Facilities			
1) Installation of boarding bridges		x	x
2) Installation of lighting for car parking and service and access roads		x	x

7.4.1 Construction Items for Immediate Improvement

Most of the existing airport facilities are already obsolete and their capacities are also saturated due to the present air traffic demand as evaluated in Chapter 4. They require immediate improvement. Considering the finances to be arranged immediately by MDA/AASANA, however, immediate improvement is planned to cover the minimum items which are considered very urgent and can possibly be carried out within the present budget of MDA/AASANA.

These minimum items are listed as follows:

(1) Improvement of runway pavement

(2) Construction of a runway shoulder and blast pads at the runway threshold

(3) Renovation of the existing passenger terminal buidling

7.4.2 Construction Items of Phases I and II Development

The construction items required for Phases I and II development are planned as shown in Table 7.4.1 based on the facility requirements discussed in Section 7.3.

7.4.3 Construction Items which are Not Included in the Project

The project will not include the following facilities which will be constructed and/or supplied under other contracts.

- Fuel yard and fuel hydrant system, which will be constructed by YPFB.

- Catering, which will be implemented by the airlines or a private company.

- Storage facilities, which will be constructed by the airlines.

- Office for airlines' staff will be located outside the passenger terminal building, which will be constructed by the airlines.

- Maintenance shop and gasoline station for airlines' ground service equipment, which will be constructed by the airlines or YPFB.

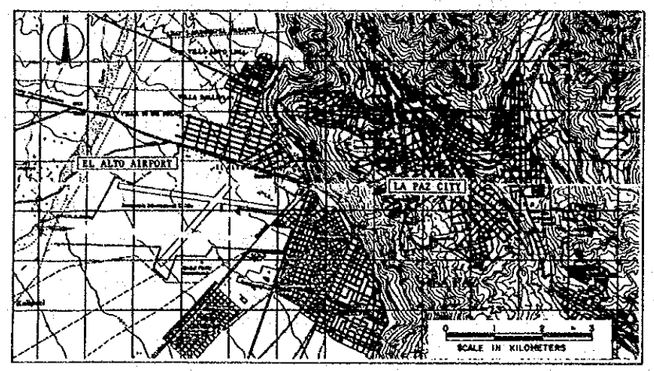
The area required for these facilities will be provided in the project.

CHAPTER 8 PRELIMINARY DESIGN FOR AIRPORT FACILITIES

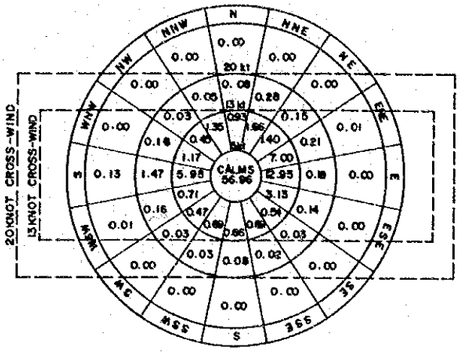
CHAPTER 8 PRELIMINARY DESIGN FOR AIRPORT FACILITIES

8.1 GENERAL

The preliminary design for the major airport facilities is described in this chapter. A layout plan of the El Alto airport Phase I development, which will meet the demand anticipated in the year 1997 and the terminal area layout plan are shown in Figures 8.1.1 and 2, respectively. An outline of the El Alto airport development in Phase I is also summarized in Table 8.1.1.

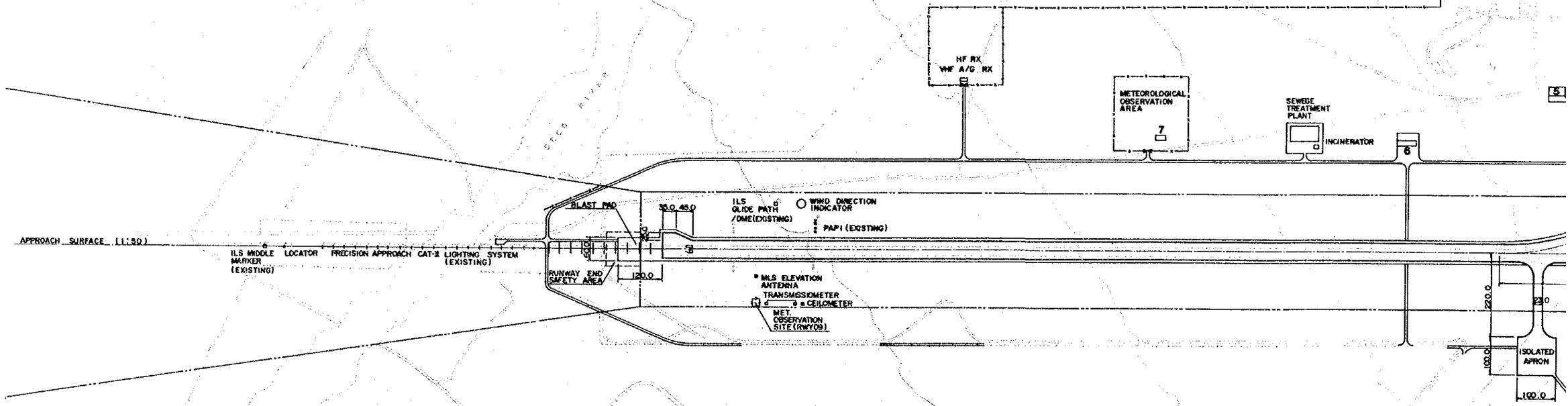


LOCATION MAP



WIND ROSE

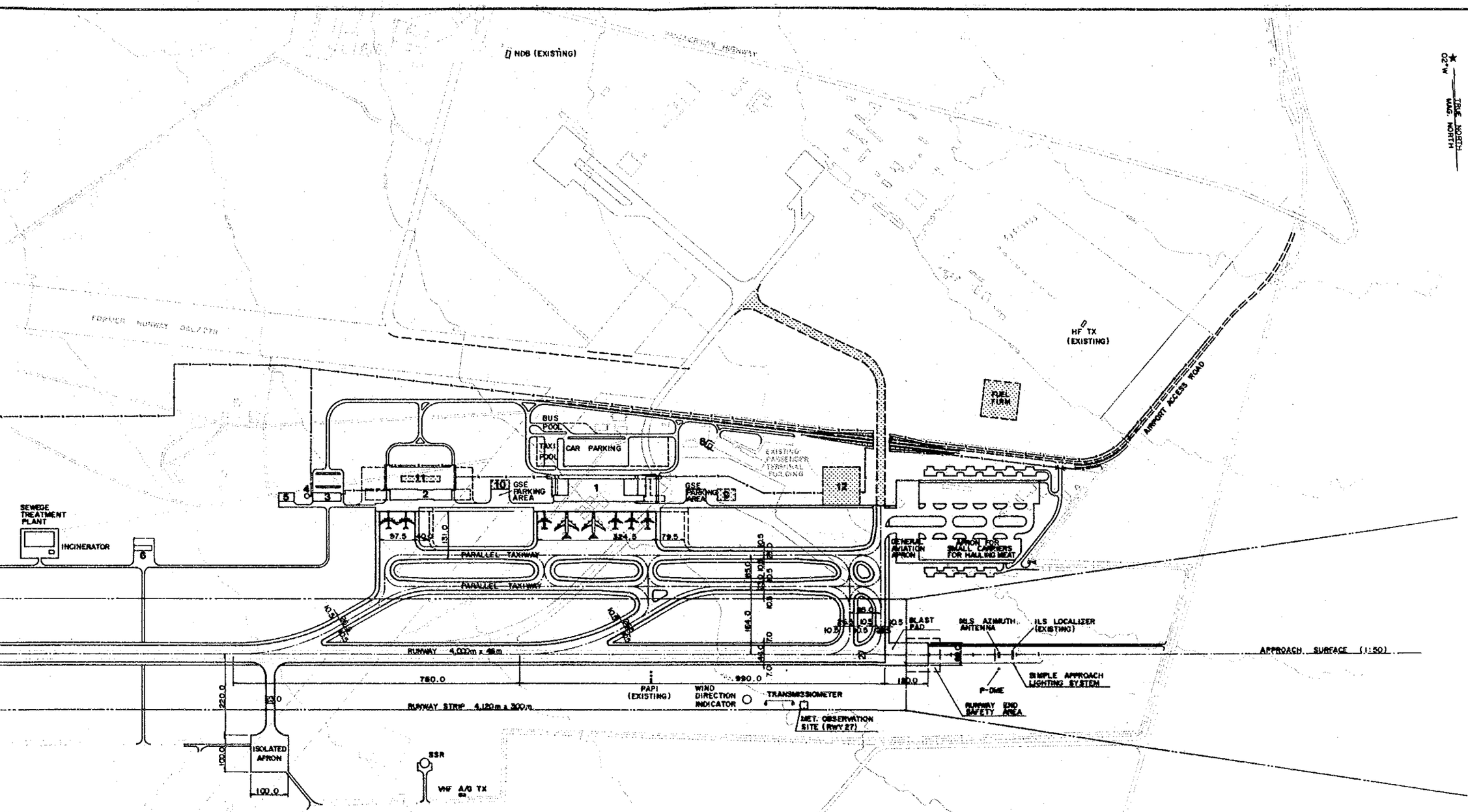
LOCATION	:	EL ALTO AIRPORT
PERIOD	:	1984 – 1986
RUNWAY DIRECTION	:	N92°E (MAG.)
13 KNOT CROSS-WIND COVERAGE	:	98.44%
20 KNOT CROSS-WIND COVERAGE	:	100.00%



BUILDINGS	
1	PASSENGER TERMINAL BUILDING
2	CARGO TERMINAL BUILDING
3	ADMINISTRATION BUILDING
4	CONTROL TOWER
5	AIRPORT MAINTENANCE SHOP AND STORAGE
6	FIRE STATION
7	METEOROLOGICAL OBSERVATION BUILDING
8	SWITCHING AND GENERATOR STATION
9	RESERVED AREA FOR STORAGE
10	RESERVED AREA FOR GSE MAINTENANCE SHOP
11	RESERVED AREA FOR CARGO AGENTS BUILDING
12	RESERVED AREA FOR CATERING BUILDING

RUNWAY DATA	
ITEMS	RUNWAY 09/27
EFFECTIVE GRADIENT %	1.55
PERCENTAGE WIND COVERAGE	20KNOT 100.00%
	13KNOT 99.44%
INSTRUMENT RUNWAY	✓
PAVEMENT STRENGTH	PCN52/F,A,X,T,
APPROACH SURFACES	1/50
RUNWAY LIGHTING	HIRL/RWCL
RUNWAY MARKING	PRECISION
LANDING AIDS	MLS/DME, PAPI, ILS/DME ALS(CAT-I), SALS

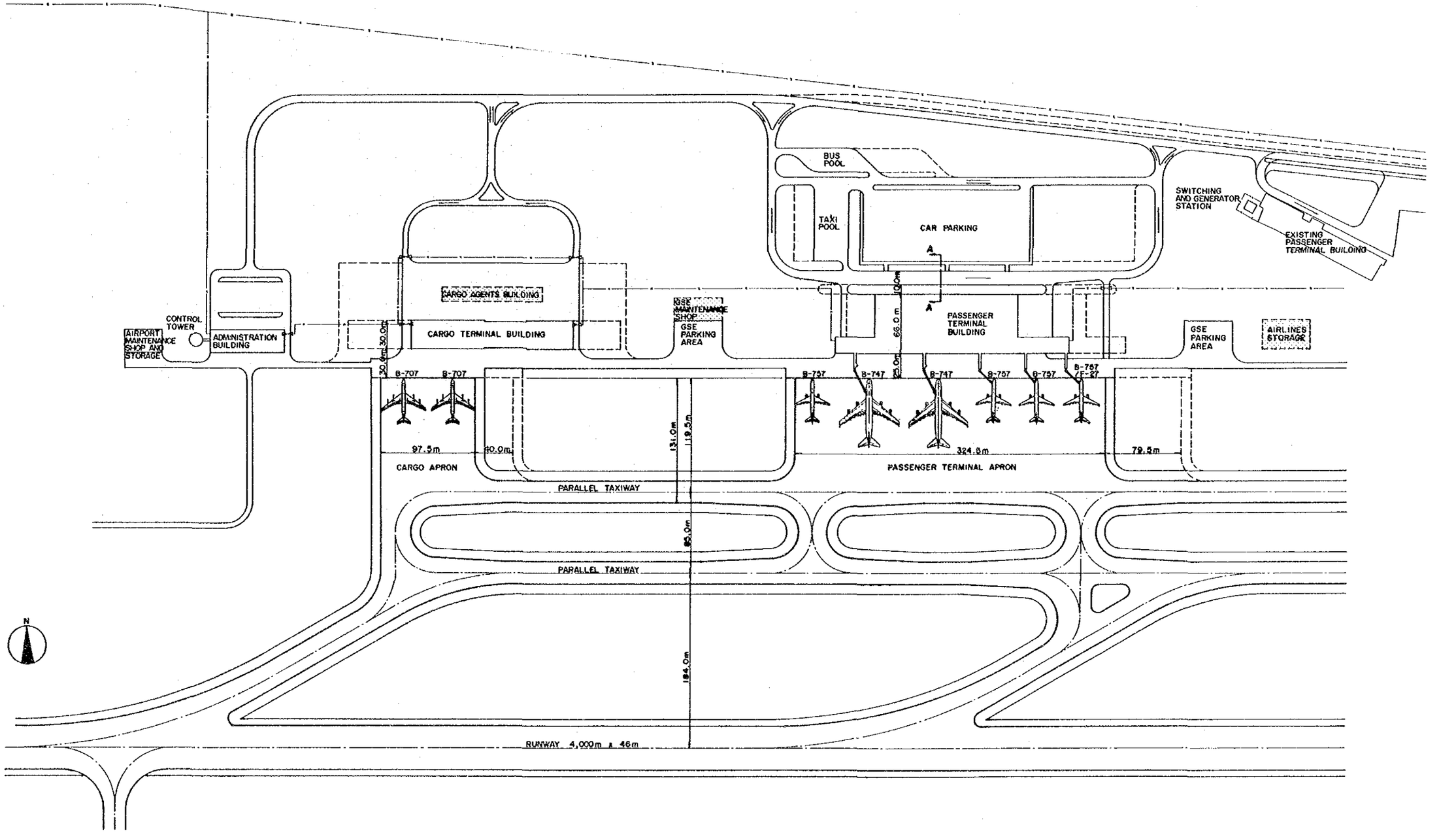
AIRPORT DATA	
ITEMS	
AIRPORT ELEVATION	4,058 M
AIRPORT REFERENCE POINT	LAT 16°30'36" S
(ARP) COORDINATES	LNG. 68°10'52" W
AIRPORT REFERENCE TEMPERATURE	16° C
AIRPORT AND TERMINAL NAVAIDS, AND TERMINAL RADAR	VOR/DME, NDB, LOC SSR
MAGNETIC VARIATIONS	02°W (1986)
CRASH PROTECTION PROVIDED	CAT-7



LEGEND	
——•——•——	SECURITY FENCE
~4000~	GROUND CONTOURS (IN METERS)
	PHASE I DEVELOPMENT (DESIGN YEAR : 1997)
	PROJECT BY OTHER ORGANIZATIONS
	PHASE II DEVELOPMENT (DESIGN YEAR : 2005)

FIGURE 8.1.1 EL ALTO AIRPORT PHASE I DEVELOPMENT LAYOUT PLAN (YEAR 1997)

0 100 200 300 400 500
SCALE IN METERS



LEGEND	
	SECURITY FENCE
	PHASE I DEVELOPMENT (DESIGN YEAR : 1997)
	PROJECT BY OTHER ORGANIZATIONS
	PHASE II DEVELOPMENT (DESIGN YEAR : 2005)

CROSS SECTION A – A

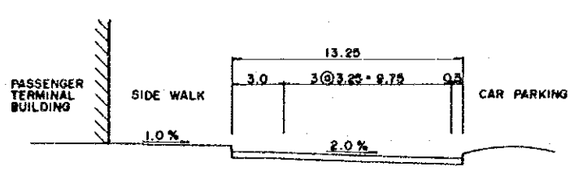


FIGURE 8.1.2 TERMINAL AREA LAYOUT PLAN

0 50 100 200
SCALE IN METERS

Table 8.1.1 Outline of El Alto Airport to be Developed in Phase I

"YES" indicates "Provided or available"
"NO" indicates "Not provided or not available"

Country	Name of Airport	INTL/DOM / ICAO CODE	Commencement of Services	Total Area of Airport	Aerodrome Ref. Point	Airport Elevation	Runway Orientation	Aerodrome Ref. Temperature	Operation Hour	Seasonal Availability	Administrative Agency:
Republic of Bolivia	John F. Kennedy	INTL/DOM: 4E	1966	850 ha	S 16°30'36" / W 68°10'52"	4,058 m (13,313 ft)	RWY09/27 N92°E(Mag.)	16 °C	24 hours	All Seasons	AASANA

City/Town			Transportation			Wind Coverage	Minimum Meteoro-logical Conditions
Name	Population	Distance to Airport	Railway	Taxi	Bus		
La Paz	Approximately 993,000 (1985)	14.5 km	NO	YES	YES	RWY 09/27 99.4%(13kt) 100%(20kt)	

Runway	Approach Procedure		Straight - in				Circling			
	Category of Aircraft		CAT-A	CAT-B	CAT-C	CAT-D	CAT-A	CAT-B	CAT-C	CAT-D
09	ILS/DME	OCA/H	13341/185	13355/199	13365/209	13378/222	14081/768	14081/768	14180/867	14180/867
		Visibility	-	-	-	-	1.6 Km	2.0 km	4.0 km	4.4 km
	VOR/DME	OCA/H	13900/744	13900/744	13900/744	13900/744	14081/768	14081/768	14180/867	14180/867
		Visibility	1.6 km	1.6 km	3.2 km	3.6 km	1.6 km	2.0 km	4.0 km	4.4 km
	NDB/LM	OCA/H	13900/744	13900/744	13900/744	13900/744	14081/768	14081/768	14180/867	14180/867
		Visibility	1.6 km	1.6 km	3.2 km	3.6 km	1.6 km	2.0 km	4.0 km	4.4 km

Air Navigation Systems

Radio	NDB	LO	VOR	DME	TACAN	ILS/MLS	ASR	PAR	SSR	ARTS	ASDE	HF	VHF	UHF	ATIS	DF	ITV	TTY	AFTN
Existing	YES	YES	YES	YES	NO	ILS	NO	NO	NO	NO	NO	YES	YES	YES	NO	NO	NO	YES	YES
Plan	YES	YES	YES	YES	NO	ILS/MLS	NO	NO	YES	NO	NO	YES	YES	YES	YES	NO	NO	YES	YES

Lightings	ALS	SFL	SALS	ALB	AGL	CGL	REIL	VASIS	PAPI	RWL	RWTL
Existing	YES	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Plan	YES	NO	YES	NO	NO	NO	NO	NO	YES	YES	YES
	RWCL	TDZL	STWL	DML	TWL	TWCL	TGS	ABN	WDIL	AFL	
Existing	NO	NO	NO	NO	YES	NO	NO	NO	YES	YES	
Plan	YES	NO	NO	NO	YES	NO	YES	YES	YES	YES	

Meteorological Facilities	
Runway Surface Sensors	YES
Weather Facsimile	YES
APT Receiver	YES
Radiosonde	YES
Weather Radar	NO
VOLMET Broadcast	YES

Basic Facilities

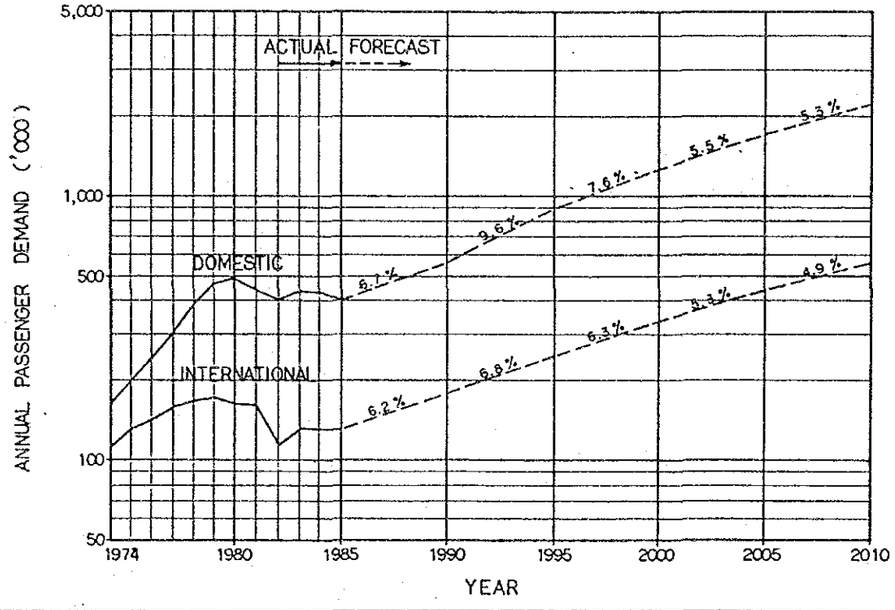
	Size	Pavement	Note
Runway	4,000m x 46m	Asphalt	PCN52/F.A.X.T.
Taxiway	Dual/Partial Parallel Taxiways with 2 Right Angle and 2 High Speed Exits W = 23m		

Apron	Design Aircraft	No. of Stands	Pavement	Area	Parking Configuration
	B-747	2	PCC	Passenger	Nose-in
	B-757	4			Nose-in
	B-707	2	PCC	Cargo	Nose-in
	C-54	13	Asphalt	Meat Cargo	Angle-out
	COM690	13	Asphalt	General Aviation	Angle-out

Other Facilities

	Size	Structure	Note
Car Parking	560 lots	Asphalt	
Pax. T. Building	16,500 m^2	RC	
Cargo T. Building	5,160 m^2	Steel	
Adm. Building	4,000 m^2	RC	
Control Tower	Cab: 60 m^2	RC	Height 29m
Fire Station (Level of Protection)	450 m^2	RC	4 cars
	Category-7		
Fuel Supply	Hydrant Supply System		
	Jet A-1 : 2,500 kl		
	Avigas : 1,662 kl		

Air Traffic Demand Forecasts



Note:
Completion of Phase I Development at the End of 1993

Items	1985	1997 (Phase I)	2005 (Phase II)
Annual Domestic Passengers ('000)	413	1,030	1,700
Annual International Passengers ('000)	133	280	440
Annual Domestic Cargo (ton)	6,700	15,400	26,900
Annual International Cargo (ton)	5,800	15,600	25,700
Annual Domestic Aircraft Movements	17,970	22,530	24,470
Annual International Aircraft Movements	2,640	5,310	6,550

Prepared by JICA as of 1987

8.2 Runway, Taxiways and Apron

8.2.1 Runway

The existing runway pavement will be overlaid with asphalt concrete. The required overlay thickness is calculated to be 14cm and the profile of the runway is shown in Figure 8.2.1.

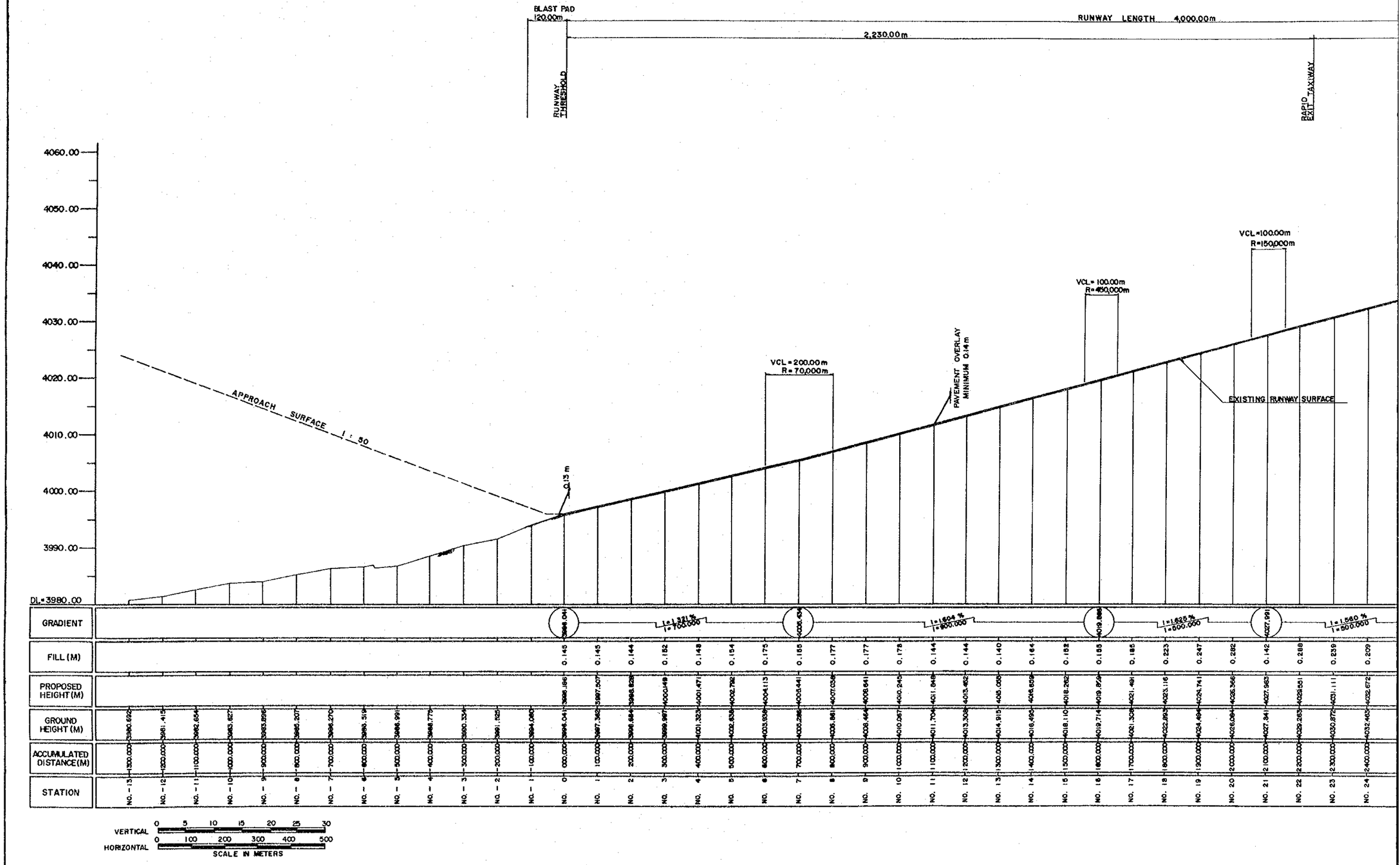
The existing runway will be provided with a turning pad for B-747 aircraft at the threshold of runway 09.

8.2.2 Taxiways

Dual/partial parallel taxiways are planned as discussed in Section 5.2. Separations between the centerlines of the runway and parallel taxiway and between the centerlines of the parallel taxiways are planned to be 184m and 85m respectively. These separations are determined by adding a margin to the ICAO minimum separation for the present B-747 in order to accommodate B-747-400 in the future. These figures are also the same as those specified in standard of JCAB (Japan Civil Aviation Bureau).

Rapid exit taxiways are provided at a distance of 2,230m and 3,010m from runway 09 threshold.

The taxiway is basically 23m wide and is provided with a 10.5m shoulder on each side.


BLAST PAD
120.00m
RUNWAY LENGTH 4,000.00m
2,230.00m
RUNWAY THRESHOLD
RAPID EXIT TAXIWAY
4060.00
4050.00
4040.00
4030.00
4020.00
4010.00
4000.00
3990.00
DL=3980.00
APPROACH SURFACE 1 : 50
0.13 m
VCL=200.00m
R=70,000m
PAVEMENT OVERLAY
MINIMUM 0.14m
VCL=100.00m
R=450,000m
VCL=100.00m
R=150,000m
EXISTING RUNWAY SURFACE
GRADIENT
I=1.321 %
I=700.000
I=1.604 %
I=800.000
I=1.625 %
I=600.000
I=1.560 %
I=500.000
FILL (M)
PROPOSED HEIGHT (M)
GROUND HEIGHT (M)
ACCUMULATED DISTANCE (M)
STATION
VERTICAL 0 5 10 15 20 25 30
HORIZONTAL 0 100 200 300 400 500
SCALE IN METERS

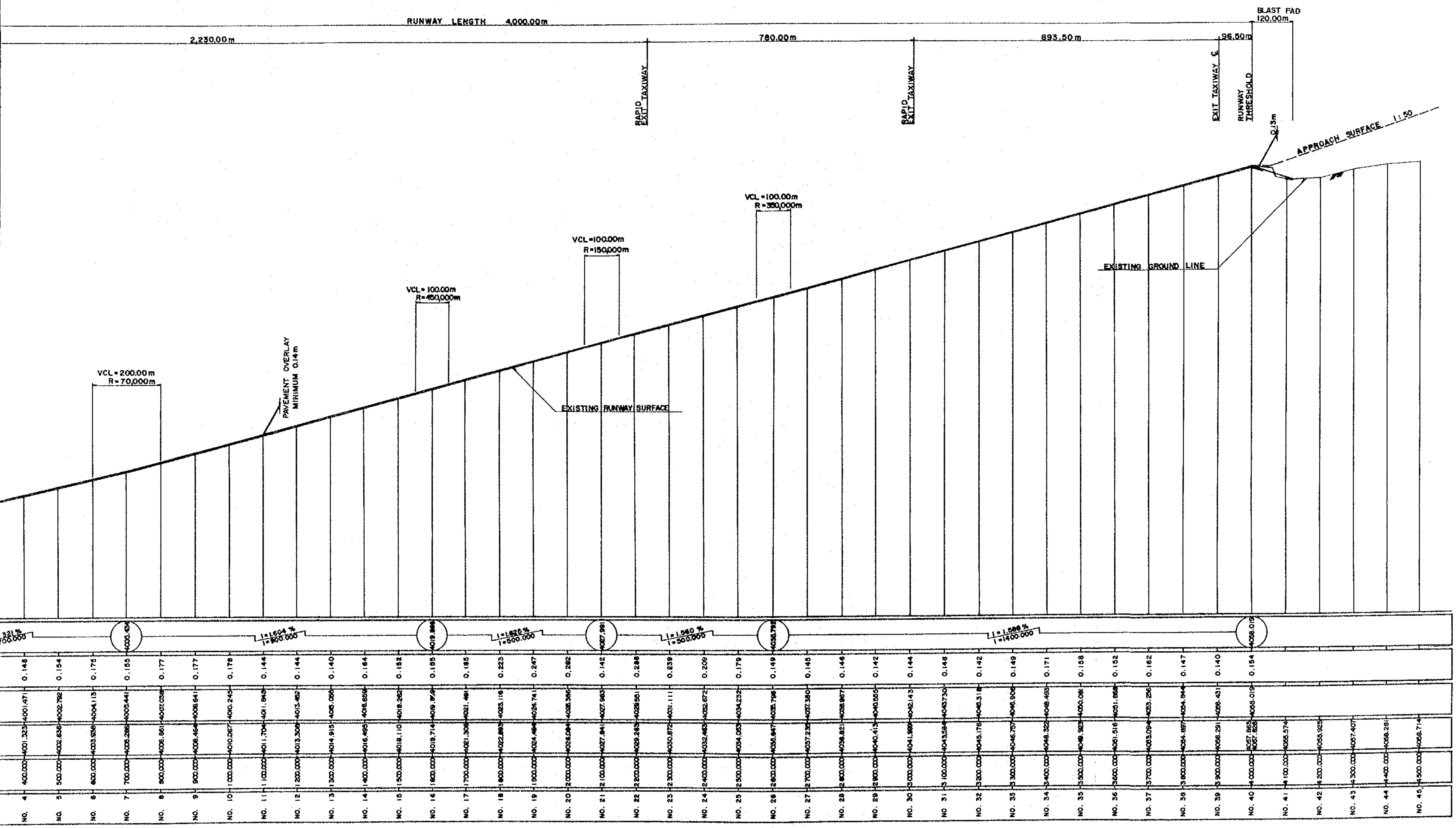


FIGURE 8. 2. 1 RUNWAY PROFILE

8.2.3 Apron

A 324.5m wide and 131m deep passenger terminal apron is planned in order to accommodate two B-747 class aircraft and four B-757 class aircraft. It will be expanded by 79.5m to the east in order to accommodate additional B-747 aircraft in the Phase II development.

A cargo apron with a width of 97.5m and the depth of 131m will be located to the west of and separated from the passenger terminal apron. This apron will accommodate two B-707 class freighter aircraft. Expansion in the Phase II development will be 40m to the east to accommodate two B-747 class aircraft.

An isolated parking apron for B-747 class aircraft and apron for meat carriers and general aviation aircraft are also planned as shown in Figure 8.1.1.

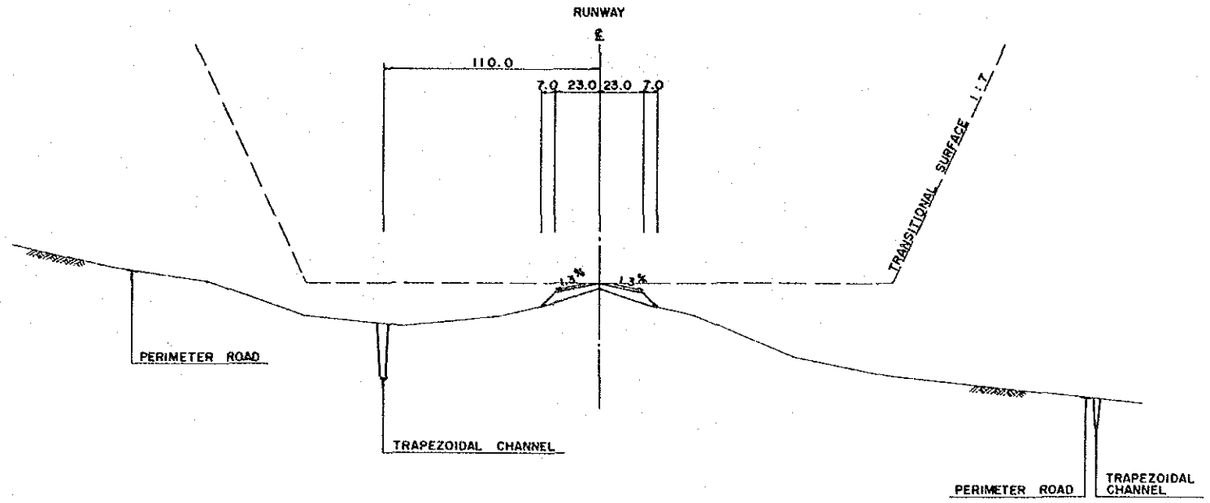
8.2.4 Airfield Road

Airfield roads consisting of perimeter roads and maintenance roads are planned for security patrol and maintenance of facilities.

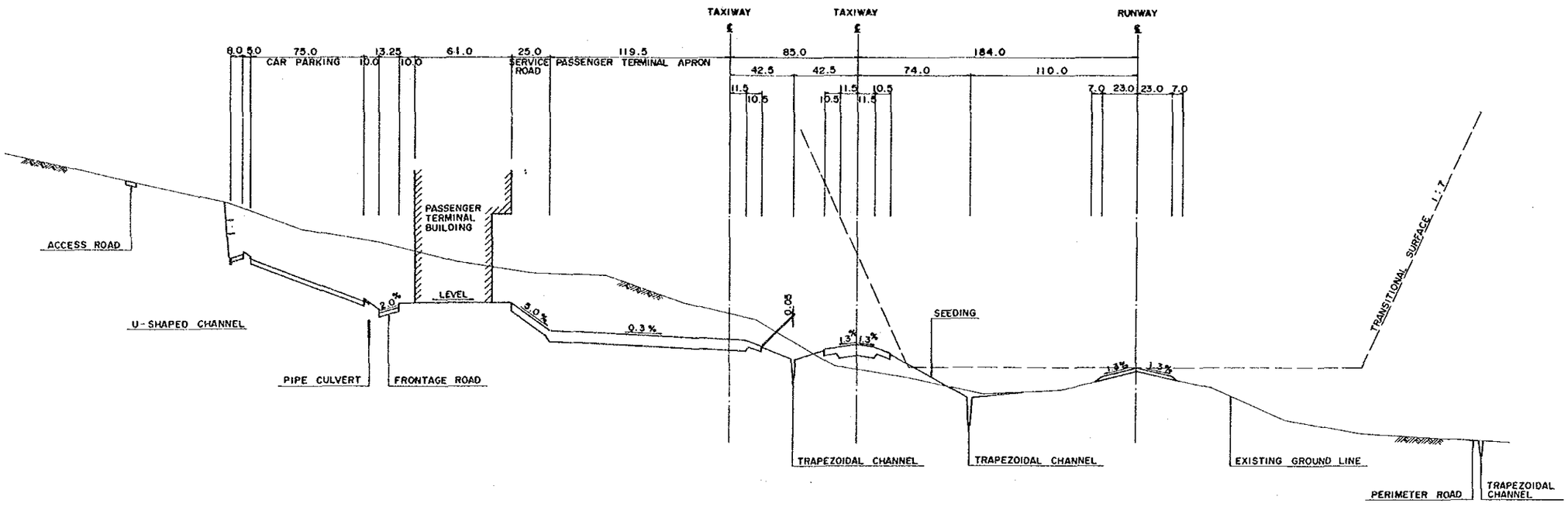
8.2.5 Grading Plan

Since the existing runway slope is more than 1.5% which exceeds ICAO recommendation, it is impractical to determine the elevations of other facilities fully in compliance with the ICAO requirements based on economic considerations.

An elevation plan is determined by using design criteria which are based on the existing condition of the facilities so that the earthwork volume may be reduced. Typical cross sections are shown in Figure 8.2.2.



RUNWAY STRIP



RUNWAY STRIP , TAXIWAYS , APRON AND PASSENGER TERMINAL AREA

VERTICAL 0 1 2 3 4 5 10

HOLIZONTAL 0 10 50 100 150

SCALE IN METERS

FIGURE 8.2.2 TYPICAL CROSS SECTIONS

8.2.6 Storm Water Drainage Plan

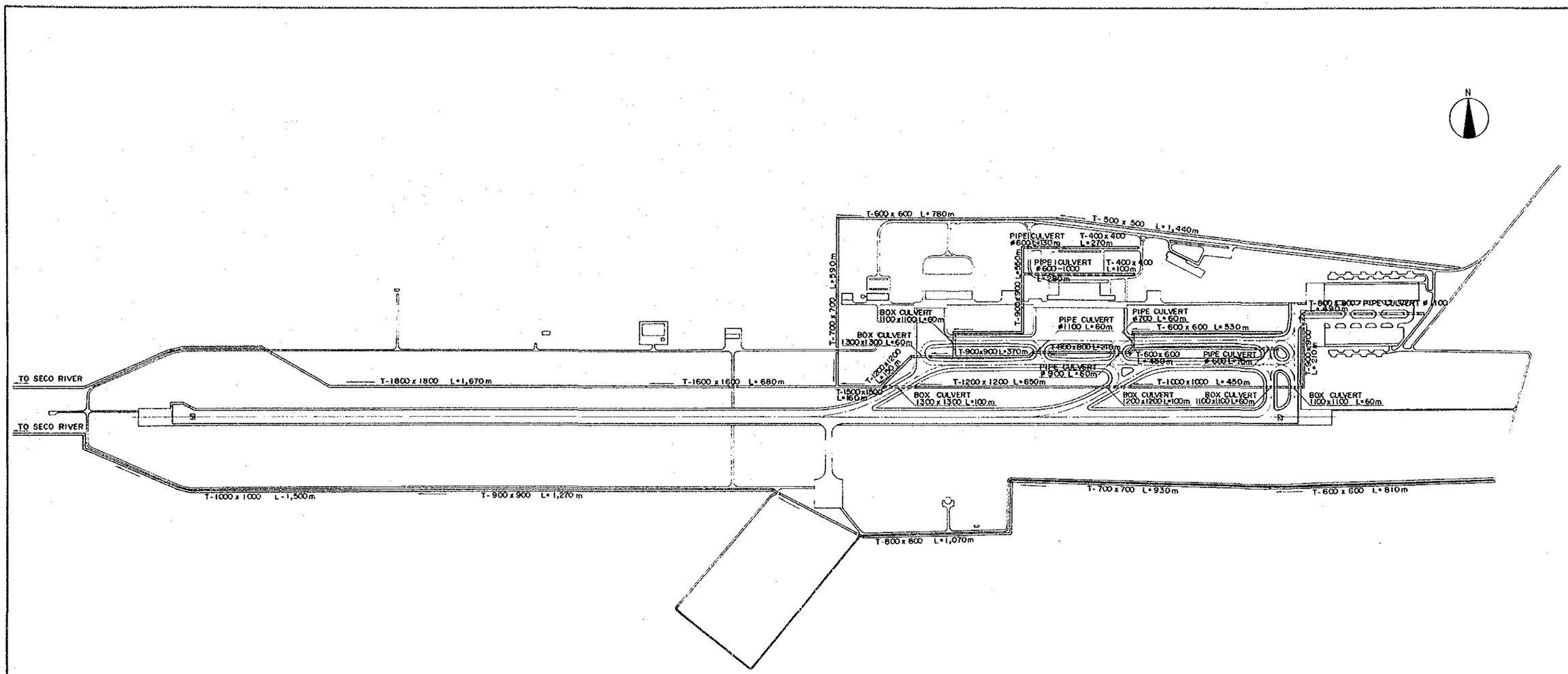
Storm water on the north side of the airport area from the runway centerline will be collected in a main drainage channel located 110m north of and in parallel with the runway centerline and will be discharged to the Seco River running on the west side of the airport property. Another main drainage channel located along the perimeter road beside the southern airport property line will collect the surface water on the south side of the airport area from the runway centerline and will also discharge storm water to the Seco River.

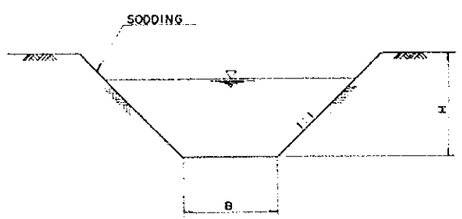
A storm water drainage plan is shown in Figure 8.2.3 together with an outline of the drainage facilities.

8.2.7 Pavement Plan

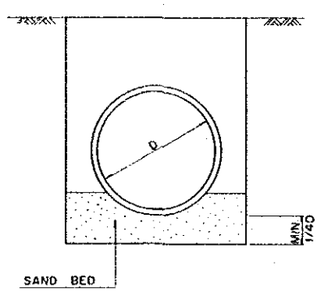
Asphalt concrete pavements will be adopted for the runway overlay, taxiways, isolated apron, meat carriers' apron and general aviation apron. Cement concrete pavements will be adopted for the passenger terminal apron and cargo terminal apron in order to avoid rutting from the heavy landing (wheel loads) gear of the jet aircraft and also taking the oil proof character into account.

The pavement plan and respective structures are shown in Figure 8.2.4.

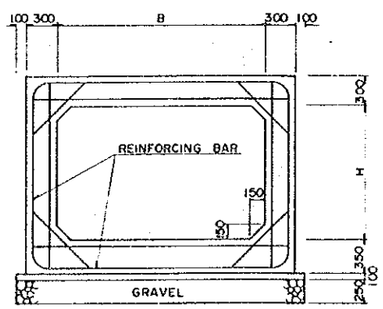




TRAPEZOIDAL CHANNEL
T- (B) x (H)



PIPE CULVERT
ø (D)



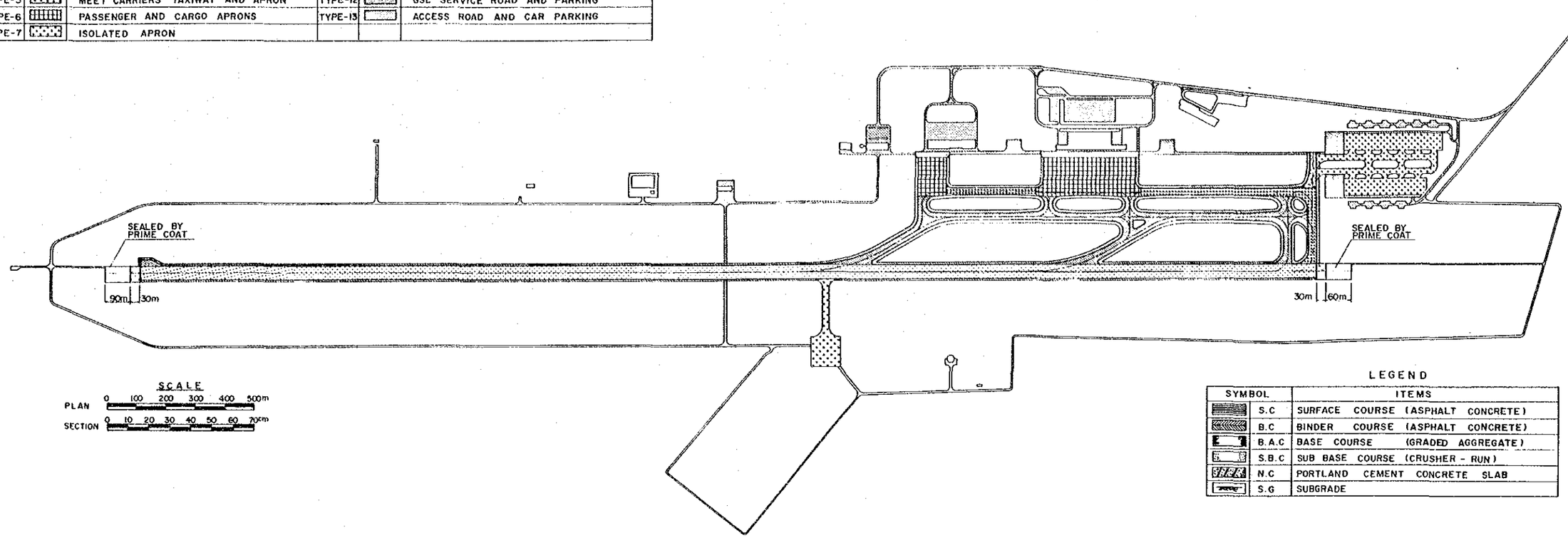
BOX CULVERT
(B) x (H)

FIGURE 8.2.3 STORM WATER DRAINAGE PLAN

0 100 200 300 400 500
SCALE IN METERS

PAVEMENT TYPES

	SYMBOL	PLACE		SYMBOL	PLACE
TYPE-1		RUNWAY OVERLAY	TYPE-8		GENERAL AVIATION APRON
TYPE-2		TAXIWAY	TYPE-9		SHOULDERS
TYPE-3		TAXIWAY	TYPE-10		BLAST PAD
TYPE-4		TAXIWAY	TYPE-11		GSE SERVICE ROAD
TYPE-5		MEET CARRIERS TAXIWAY AND APRON	TYPE-12		GSE SERVICE ROAD AND PARKING
TYPE-6		PASSENGER AND CARGO APRONS	TYPE-13		ACCESS ROAD AND CAR PARKING
TYPE-7		ISOLATED APRON			



SCALE

PLAN 0 100 200 300 400 500m

SECTION 0 10 20 30 40 50 60 70cm

LEGEND

SYMBOL		ITEMS
	S.C	SURFACE COURSE (ASPHALT CONCRETE)
	B.C	BINDER COURSE (ASPHALT CONCRETE)
	B.A.C	BASE COURSE (GRADED AGGREGATE)
	S.B.C	SUB BASE COURSE (CRUSHER - RUN)
	N.C	PORTLAND CEMENT CONCRETE SLAB
	S.G	SUBGRADE

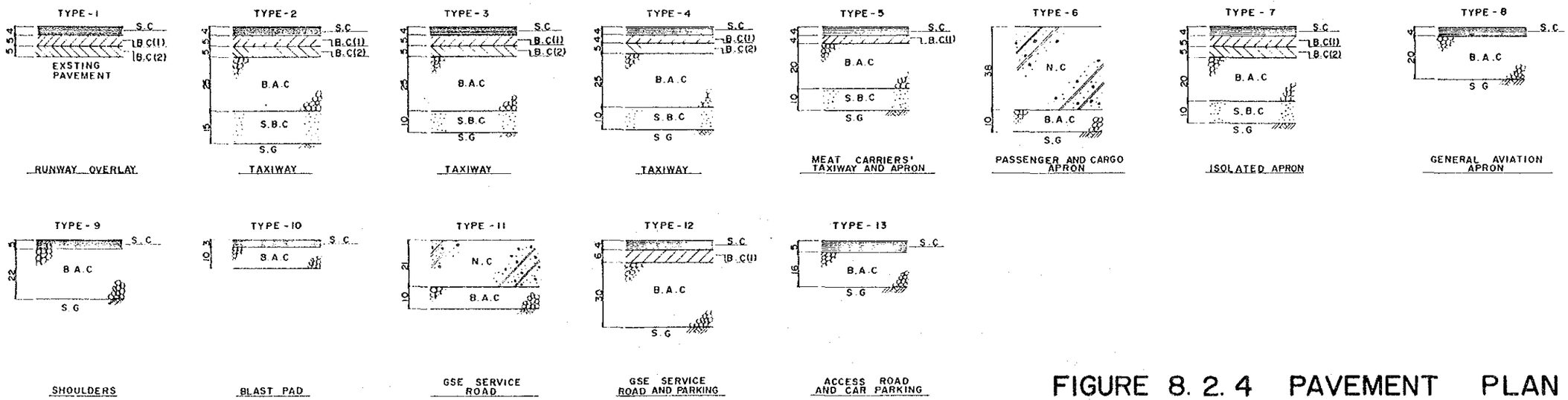


FIGURE 8. 2. 4 PAVEMENT PLAN

8.3 Passenger Terminal Building

The passenger terminal building with a total floor area of approximately 16,500 sq.m is planned for the Phase I development as shown in Figures 8.3.1 through 4. A linear type concept with one and half floor levels will be employed for the passenger terminal building based on a consideration of the number of aircraft stands and the number of passengers to be served.

The west side of the building will be used for departing passengers and the east side for arriving passengers. International passenger facilities are laid out at the central portion of the ground floor, and domestic passenger facilities on both sides taking into consideration the potential expansion of the building.

Simple passenger and baggage flows are considered for the design of terminal building, and a complete separation of departing and arriving passengers is planned considering security.

Requirements for the accommodation of mixed flight passengers are also satisfied in the design. Arriving international and domestic passengers from mixed flights will be segregated at the airside corridor where movements of passengers can be relatively controlled. Domestic passengers departing by a mixed flight will be accommodated in a gate lounge separately provided for international passengers in order to avoid the mixture of international and domestic passengers before boarding.

Five boarding bridges will be installed for the safety and convenience of passengers. A flight information system and airport security system are also be considered necessary.

The building will be a reinforced concrete structure with 7.5m x 7.5m standard spans for economical construction.

Note: This drawing does not bind the final concept of the building

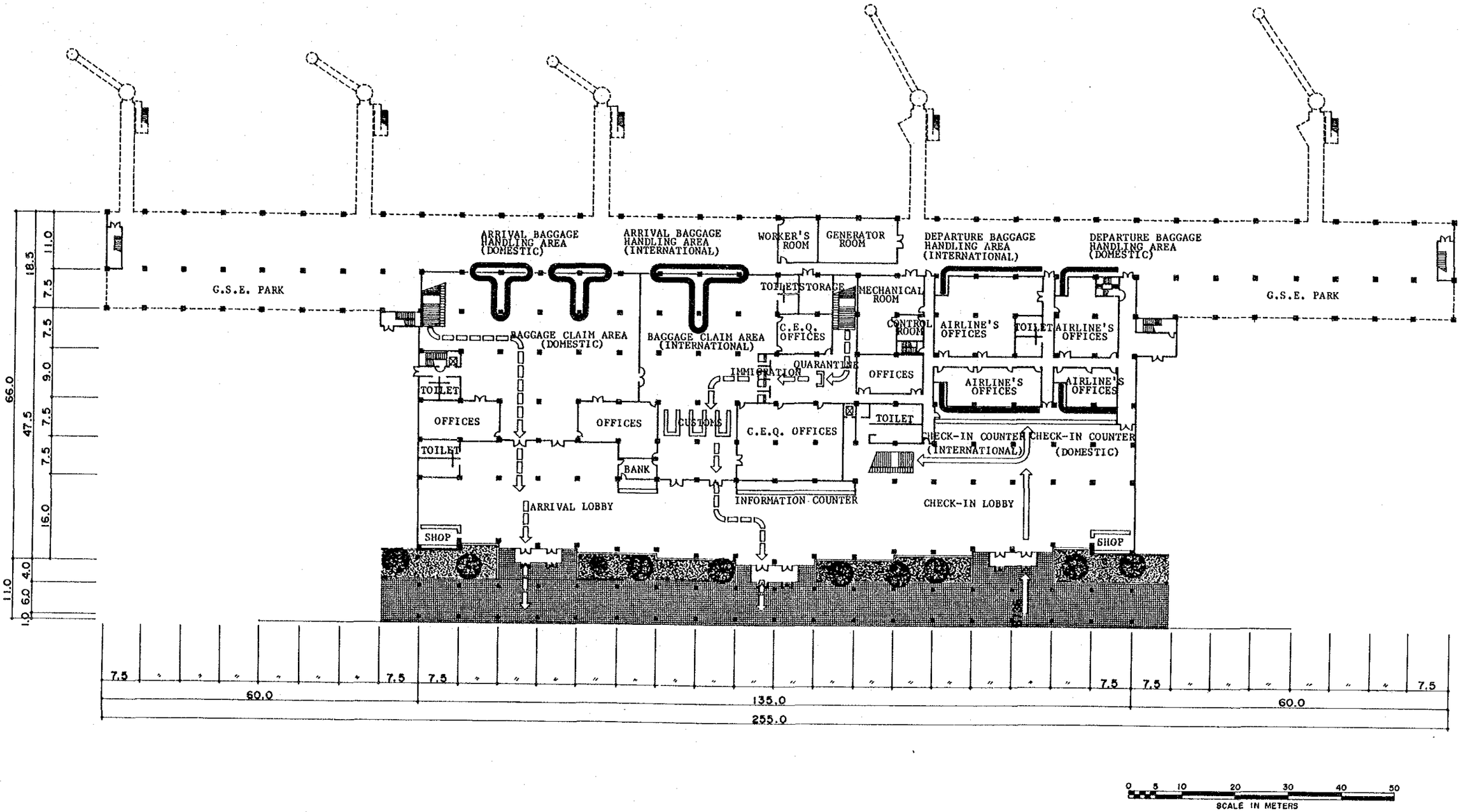


Figure 8.3.1 Passenger Terminal Building Ground Floor Plan

Note: This drawing dose not bind the
final concept of the building

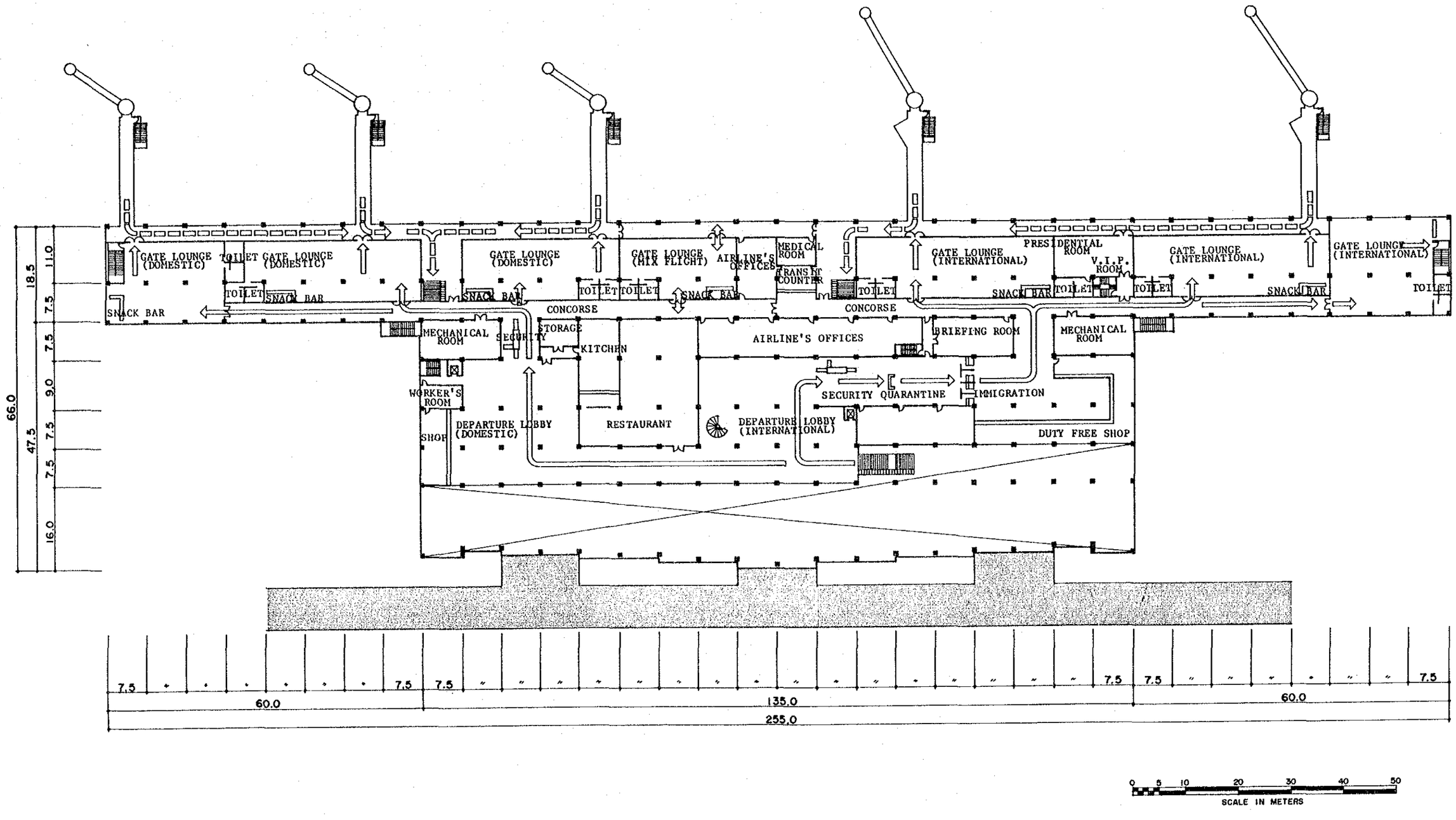


Figure 8.3.2 Passenger Terminal Building First Floor Plan

Note: This drawing does not bind the final concept of the building

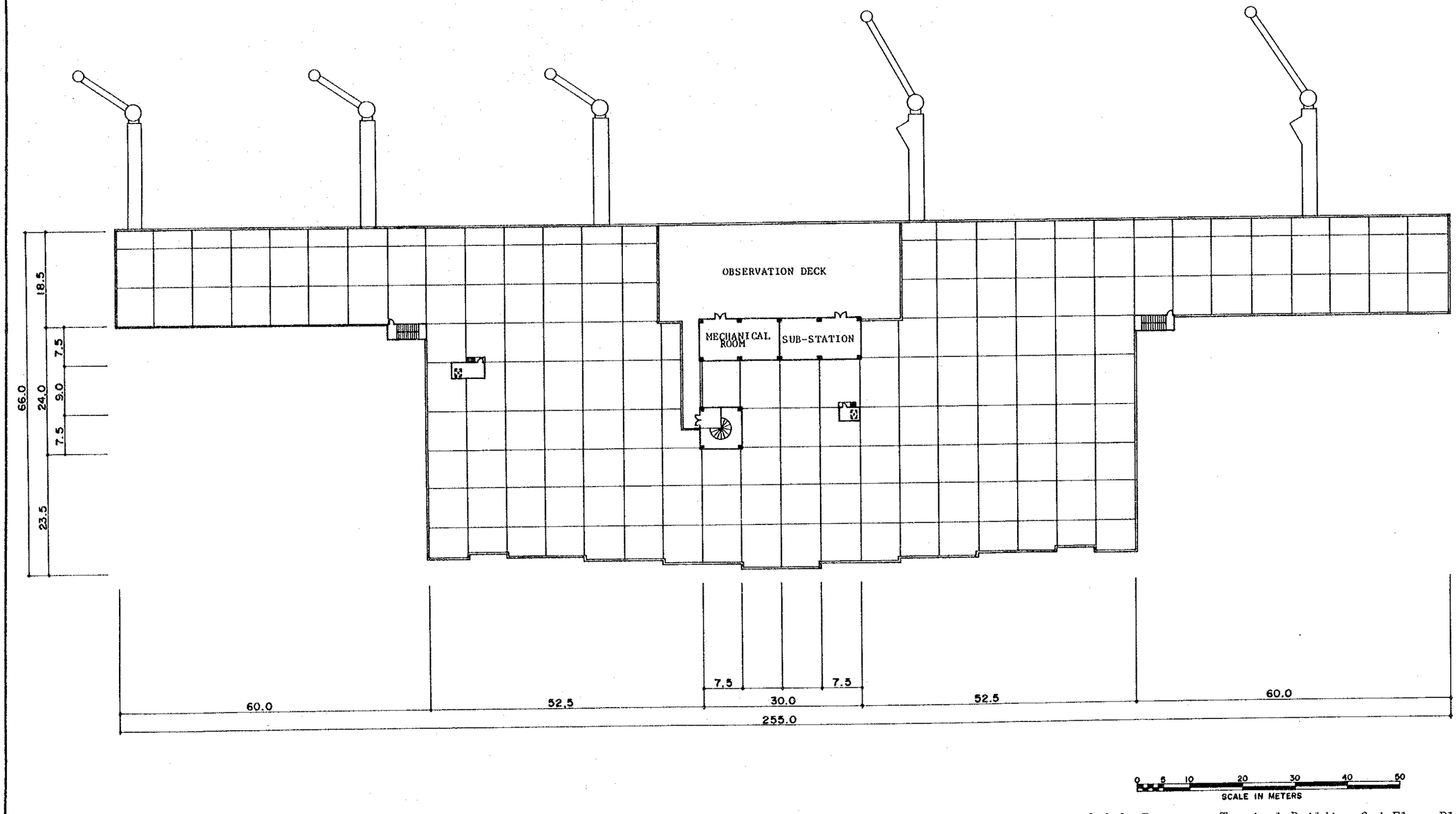
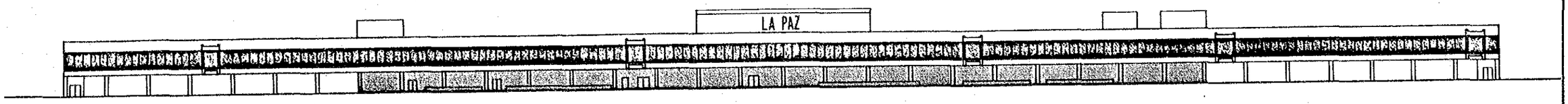
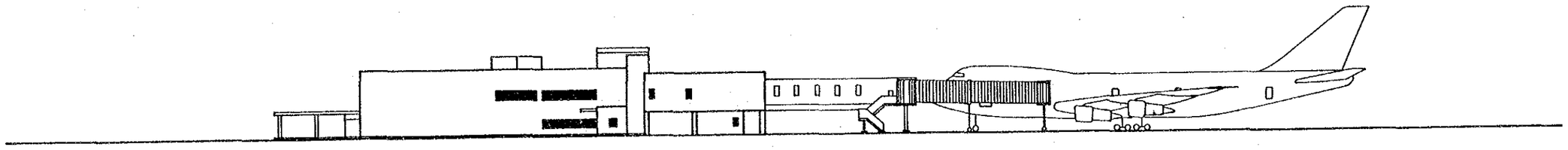


Figure 8.3.3 Passenger Terminal Building 2nd Floor Plan

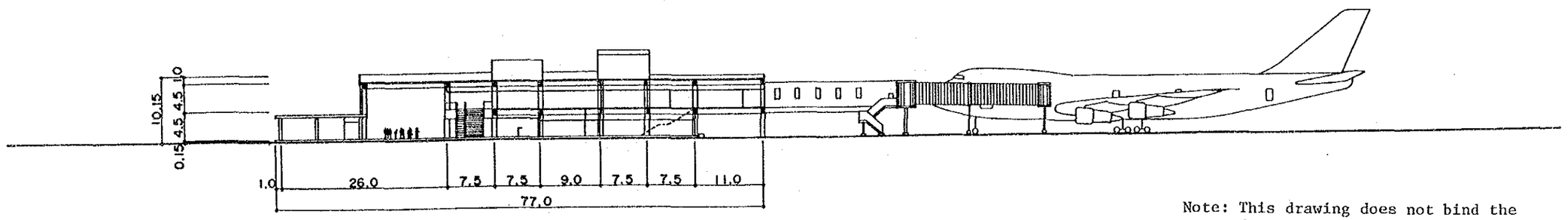
NORTH ELEVATION



SOUTH ELEVATION



WEST ELEVATION



SECTION

Note: This drawing does not bind the final concept of the building

Figure 8.3.4 Passenger Terminal Building Elevation and Sections

8.4 Other Buildings

8.4.1 Cargo Terminal Building

A cargo terminal building with a total floor area of approximately 5,000 sq.m is planned for the Phase I development as shown in Figure 8.4.1.

The east side of the building will be a domestic cargo terminal, and international facilities are planned for the west side facing the cargo apron. Offices are located between the domestic and international facilities.

The cargo storage area will be a single storey steel frame structure with a high ceiling to permit easy cargo handling, and to be flexible for internal rearrangement and possible future mechanization. The office portion will be a single storey reinforced concrete structure.

8.4.2 Administration Building and Control Tower

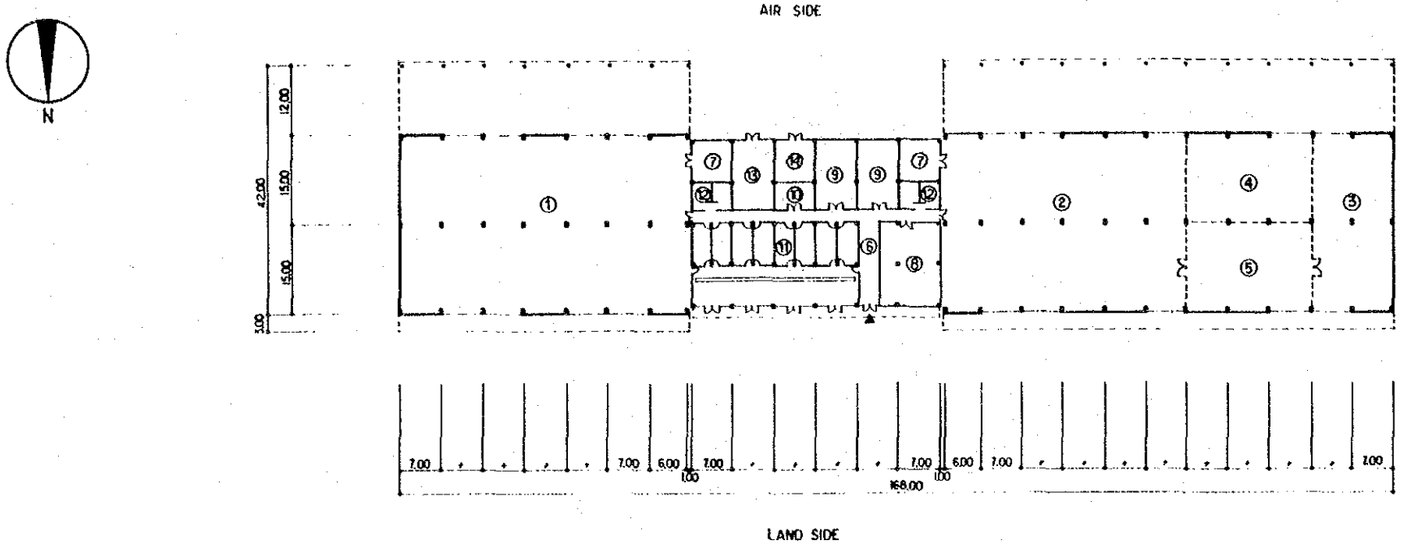
The administration building and control tower are planned as shown in Figure 8.4.2.

The administration building is planned to have about 4,000 sq.m in total floor area to meet the requirements for the Phase I development. The building will be a two storey reinforced concrete structure.

The height of the control tower is planned to be 29m (eye level 27m) above ground level in compliance with FAA standards. This height was determined so that the runway thresholds may be visible from the VFR room. The control tower is designed as a reinforced concrete structure.

8.4.3 Fire Station

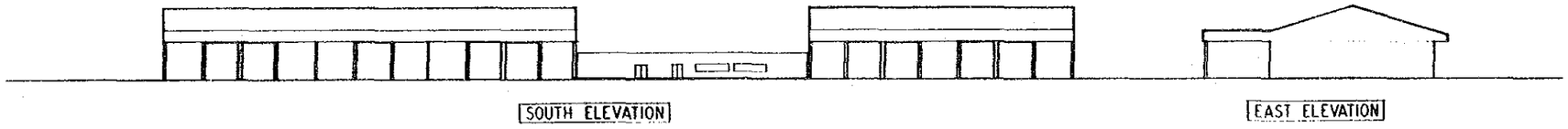
The fire station is planned to have a floor area of approximately 450 sq.m to meet the facility requirements. The fire station will be a one storey reinforced concrete structure. The floor and elevation plan is shown in Figure 8.4.3.



GROUND FLOOR PLAN

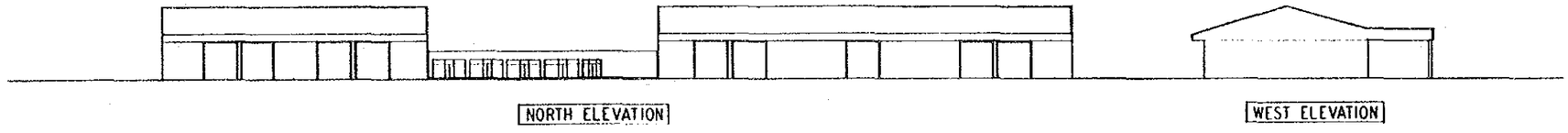
LEGEND

①	STORAGE (DOME)
②	↓ (IN-BOUND)
③	↑ (OUT-BOUND)
④	TRANSIT STORAGE
⑤	BONDED STORAGE
⑥	CORRIDOR
⑦	FREEZER COLD STORAGE
⑧	CUSTOM STORAGE
⑨	OFFICE
⑩	MECHANICAL ROOM
⑪	AIRLINE OFFICE
⑫	TOILETS
⑬	SUB-STATION
⑭	STORAGE



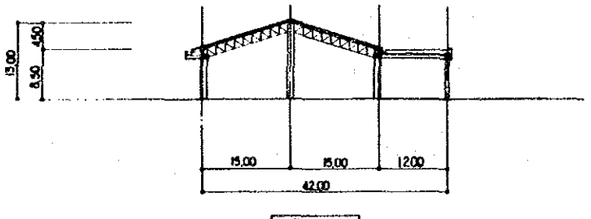
SOUTH ELEVATION

EAST ELEVATION



NORTH ELEVATION

WEST ELEVATION

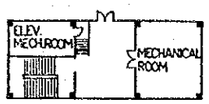


SECTION

Note: This drawing does not bind the final concept of the building

FIGURE 8.4.1
CARGO TERMINAL BUILDING PLAN, ELEVATIONS AND SECTION

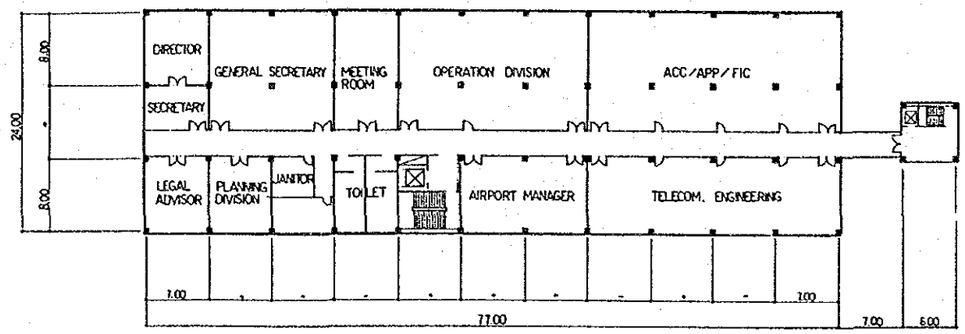
0 5 10 15 20M



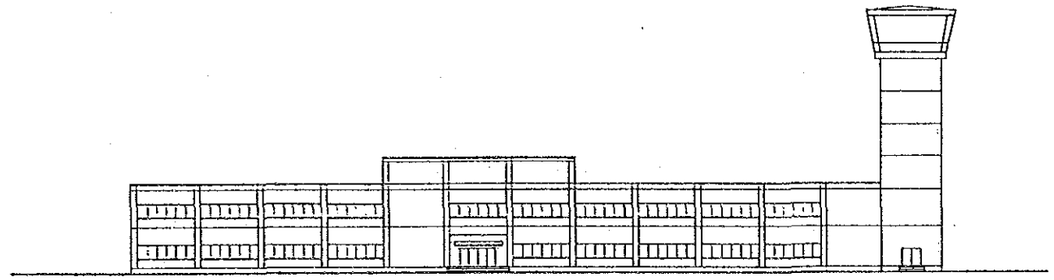
2ND FLOOR PLAN

CONTROL TOWER FLOOR PLAN

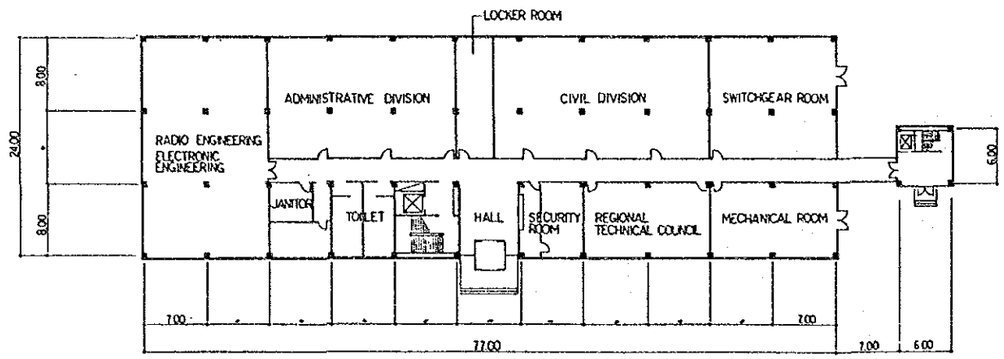
Note: This drawing does not bind the final concept of the building



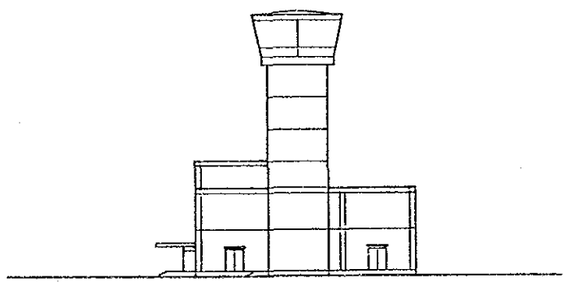
1ST FLOOR PLAN



NORTH ELEVATION



GROUND FLOOR PLAN



WEST ELEVATION

AREA SCHEDULE	M²
GROUND FLOOR	1.905
1ST	1.905
2ND	204
3RD	36
4TH	50
TOTAL	4 100

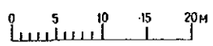
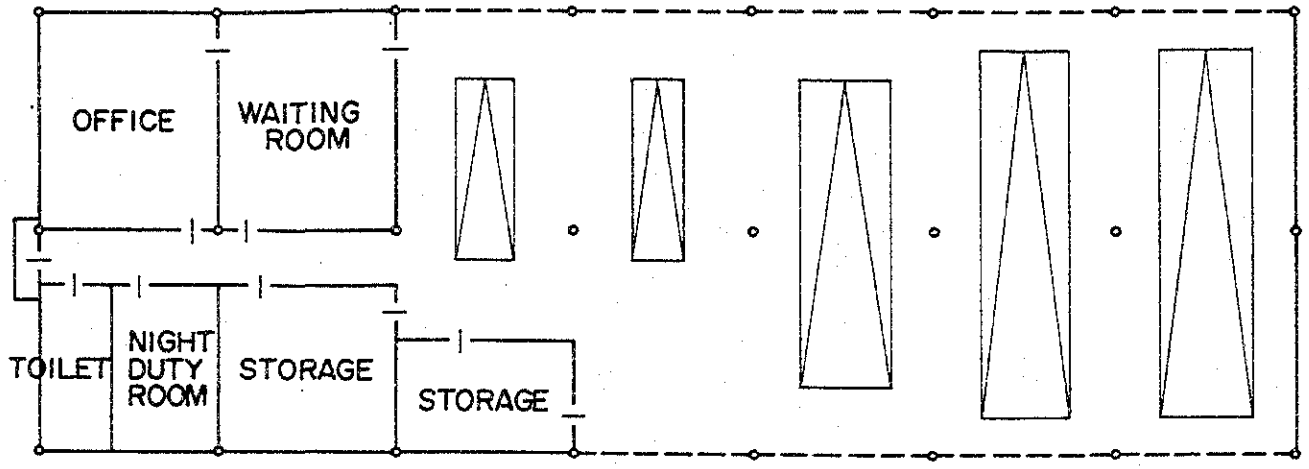
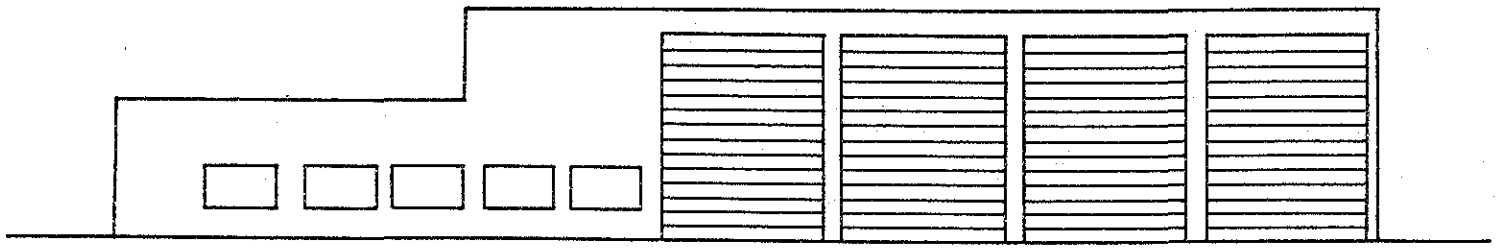


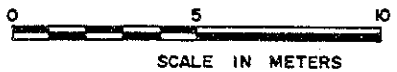
FIGURE 8.4.2 ADMINISTRATION BUILDING AND CONTROL TOWER PLAN



GROUND FLOOR PLAN



ELEVATION



Note: This drawing does not bind the final concept of the building

FIGURE 8.4.3 FIRE STATION PLAN AND ELEVATION