# PART III PRELIMINARY STUDY OF NEW POKHARA AIRPORT

## CHAPTER 18 PRELIMINARY STUDY OF NEW POKHARA AIRPORT

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### 18.1 General

The construction of New Pokhara Airport is desirable because of the faults of the existing airport and important in terms of contribution to tourism development as described before.

From this reason, the development is urgent and minimum facilities to start the operation should be provided in Phase I.

Phase I development aims to serve HS-748 class aircraft and includes the runway of 1900 m x 30 m, runway strip of 2020 m x 150 m, apron of three spots, terminal building and others.

Phase II development is for B-757 class jet aircraft as described in Chapter 10, and it includes extension of the runway to 2500 m x 45 m, expansion of runway strip to 2620 m x 300 m and others.

In this chapter, the preliminary study for major facilities for Phase I is made based on master plan prepared in Chapter 10.

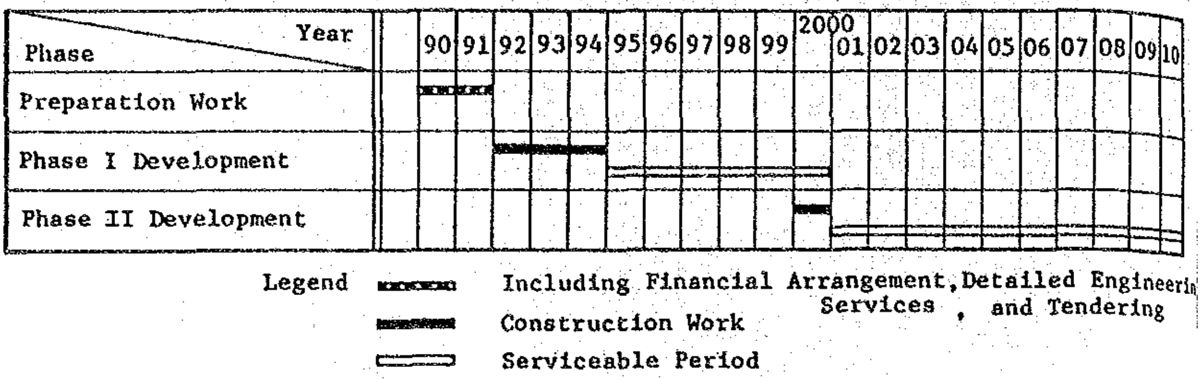
A layout plan of New Pokhara Airport, which will meet the demand anticipated in the year 2000 is shown in Fig. 10.4.2.

### 18.2 Project Phases

The Phases of the airport development are summarized below and are shown in Table 18.2.1.

| Phase | Design Year | Service Period |
|---|---|---|
| Phase I development | 2000 | 1995 - 2000 |
| Phase II development | 2010 | 2001 - 2010 |

Table 18.2.1 Phases of Airport Development




## 18.3 Air Traffic Demand and Facility Requirements for Phases I and II

The air traffic demand and the facility requirements for Phases I and II are tabulated in Table 18.3.1 based on the study discussed in Chapter 10.

Table 18.3.1 Air Traffic Demand vs. Airport Facility Requirements of New Pokhara Airport

| | Item \ Year | | Present Condition (as of 1987) | Phase I 2000 | Phase II 2010 |
|---|---|---|---|---|---|
| Air Traffic Forecast | 1.Annual Passenger | | 46,500 | 79,900 | 107,600 |
| | 2.Annual Cargo (ton) | | 195 | 330 | 440 |
| | 3.Annual Aircraft Movement (operation) | | N.A | 2,900 | 3,900 |
| | 4.Peak Hour Passenger | | N.A | 100 | 120 |
| | 5.Peak Hour Aircraft Movement (operation) | | 4.0 | 3.8 | 4.0 |
| | 6.Largest Aircraft | | HS-748 | do | B-757 class |
| Facility Requirements | 7.Runway (m x m) | | 1433 X 30 | 1900 X 30 | 2500 x 45 |
| | 8.Runway Strip (m x m) | | 1570 X 150 | 2020 X 150 | 2620 x 300 |
| | 9.Taxiway (m x m) | | - | 179 X 15 | 165 x 18 |
| | 10.Passenger Terminal Apron (gate position) | | HS-748 X 1<br>DHC-6 X 1 | HS 2<br>DH 1 | B757 1<br>HS 1<br>DH 1 |
| | 11.Passenger Terminal Building (sq.meter) | | | 800 | 1,000 |
| | 12.Cargo Terminal Building (sq.meter) | | - | 30 | 40 |
| | 13.Administration Building (sq.meter) | | - | 200 | 200 |
| | 14.Air Navigation Systems | | Non Precision, Instrument | Non Precision, Instrument | |
| | 15.Car Parks (cars)<br>(sq.meter) | | - | 30<br>1,400 | 50<br>1,800 |
| | 16.Access Road (lane) | | 1 | 2 | 2 |
| | 17.Fuel Supply (Fuel Tank)<br>(Kl/Week) | | - | 30 Kl<br>21 Kl | 50 Kl<br>29 Kl |
| | 18.Rescue and Fire-Fighting (Category)<br>(Cars)<br>(Fire Station,sq.m) | | - | 3<br>2<br>300 | 4<br>3<br>400 |
| | 19.Utilities | Electricity (KVA) | N.A | 80 | 90 |
| | | Water (Ton/Month) | N.A | 420 | 500 |
| | | Waste Deposit (Ton/Month) | N.A | 2.1 | 2.7 |
| | | Sewage (Ton/Month) | N.A | 310 | 370 |

## 18.4 Runway, Taxiway and Apron

### 18.4.1 Runway and Runway Strip

The profile of the runway is planned as shown in Fig.18.4.1 taking into consideration of earth work volume, clearance to the obstacle limitation surfaces and easiness of draining. The cross sections of the runway strip are also designed as Fig. 18.4.2 in accordance with the same reasons as the runway profile.

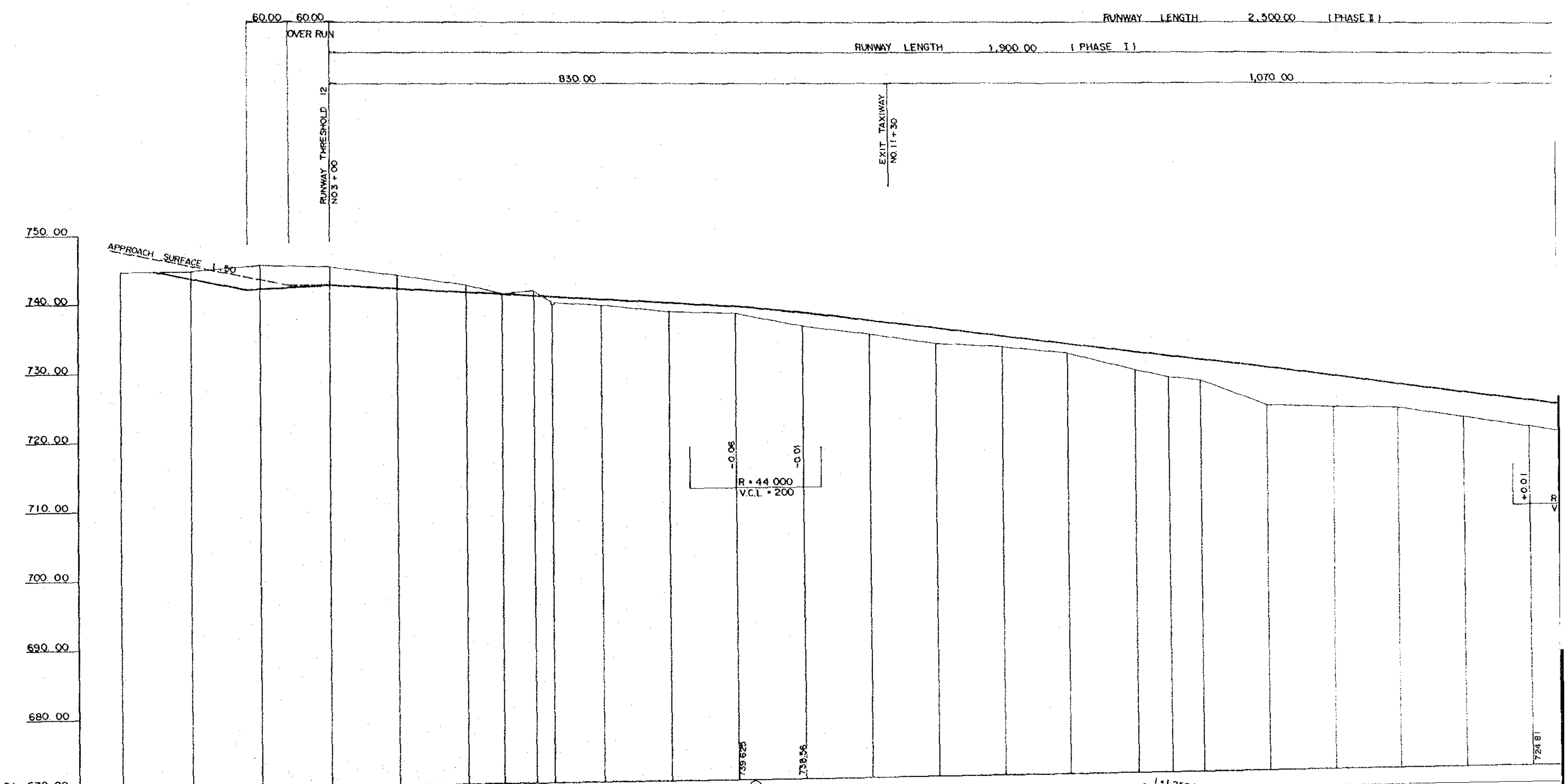
In order to minimize the initial investment cost, it is desirable to execute widening of the runway and runway strip in the Phase II development. Usually, runway widening works are executed in the hours except operation hours.

### 18.4.2 Taxiway

A taxiway connecting between the runway and apron, which can accommodate future traffic, is situated at the center of the apron. The taxiway is basically 15 m wide and is provided with a 5 m shoulder on each side.

### 18.4.3 Apron

A 135 m wide and 70 m deep passenger terminal apron is determined in order to accommodate, two HS-748 class aircraft and one DHC-6 class aircraft.




| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CUT & BANK | | | -3.64 | -2.77 | -1.96 | -0.96 | 0.13 | -0.72 | 1.19 |
| PROPOSED HEIGHT | | | 742.08 | 742.63 | 742.13 | 741.63 | 741.37 | 741.13 | 740.99 |
| GROUND HEIGHT | 744.65 | 744.76 | 745.72 | 745.40 | 744.09 | 742.59 | 741.24 | 741.85 | 739.80 |
| ACCUMULATED DISTANSE | -300 | -200 | -100 | 0 | 100 | 200 | 251 | 300 | 327 |
| DISTANCE | -100 | -100 | -100 | 0 | +100 | +100 | + 51 | + 49 | + 27 |
| STATION | NO.0 | NO.1 | NO.2 | NO.3 | NO.4 | NO.5 | | NO.6 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CUT & BANK | 1.17 | 1.68 | 1.38 | 1.66 | 2.36 | 2.35 | 2.40 | 2.49 | 1.91 |
| PROPOSED HEIGHT | 740.63 | 740.13 | 739.52 | 739.31 | 738.55 | 737.31 | 736.94 | 736.06 | 734.81 |
| GROUND HEIGHT | 739.46 | 738.45 | 738.14 | 737.65 | 736.19 | 734.96 | 734.54 | 733.57 | 732.90 |
| ACCUMULATED DISTANSE | 400 | 500 | 600 | 625 | 700 | 800 | 830 | 900 | 1000 |
| DISTANCE | + 73 | +100 | +100 | + 25 | + 75 | +100 | + 30 | + 70 | +100 |
| STATION | NO.7 | NO.8 | NO.9 | | NO.10 | NO.11 | | NO.12 | NO.13 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CUT & BANK | 1.72 | 3.06 | 3.47 | 3.36 | 5.91 | 4.86 | 3.91 | 3.98 | 4.08 |
| PROPOSED HEIGHT | 733.56 | 732.31 | 731.67 | 731.06 | 729.81 | 728.56 | 727.31 | 726.06 | 724.82 |
| GROUND HEIGHT | 731.84 | 729.25 | 728.20 | 727.70 | 723.90 | 723.70 | 723.40 | 722.08 | 720.74 |
| ACCUMULATED DISTANSE | 1100 | 1200 | 125 | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 |
| DISTANCE | +100 | +100 | + 51 | + 49 | +100 | +100 | +100 | +100 | +100 |
| STATION | NO.14 | NO.15 | | NO.16 | NO.17 | NO.18 | NO.19 | NO.20 | NO.21 |

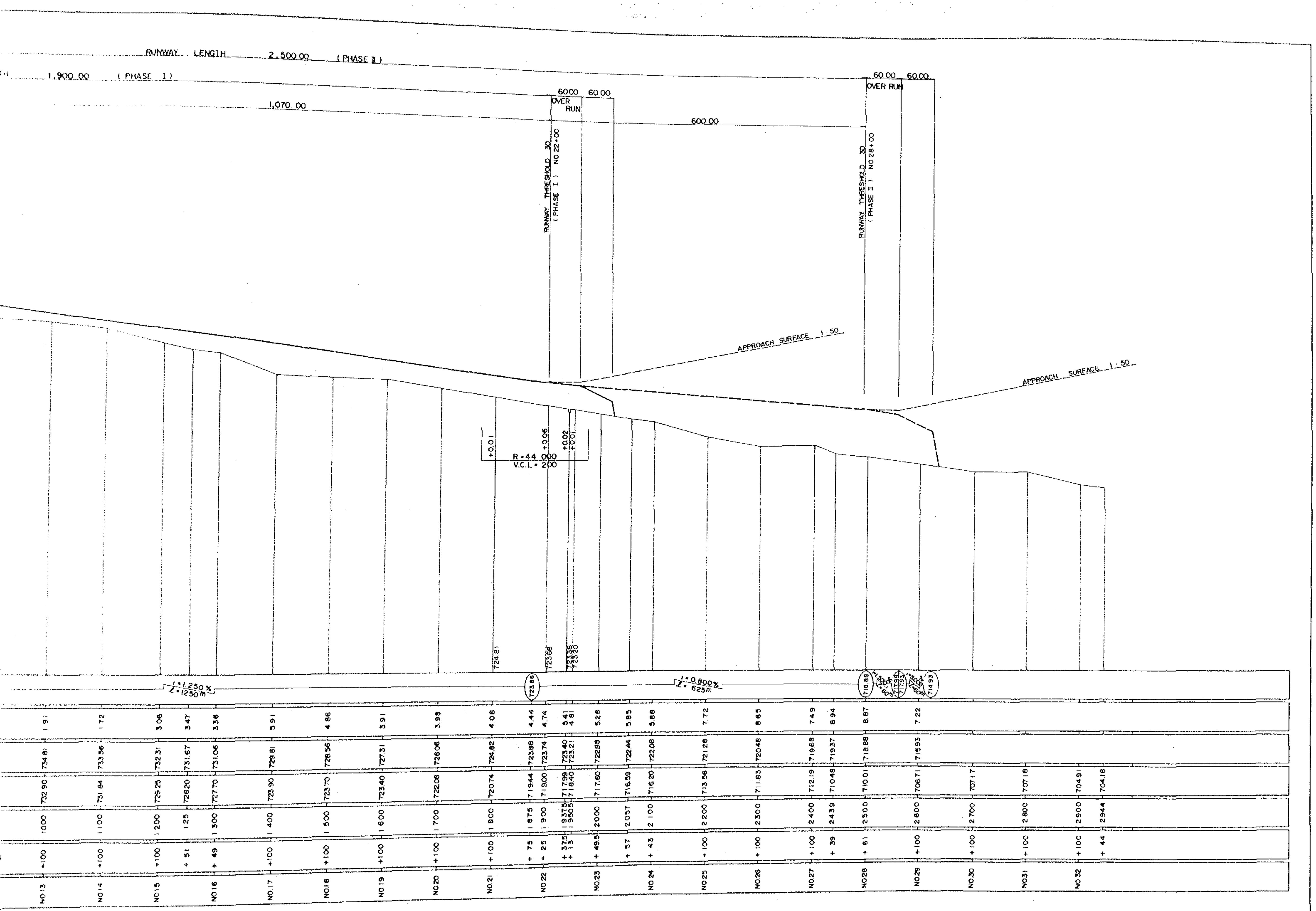



Fig. 18.4.1 Profile of Runway

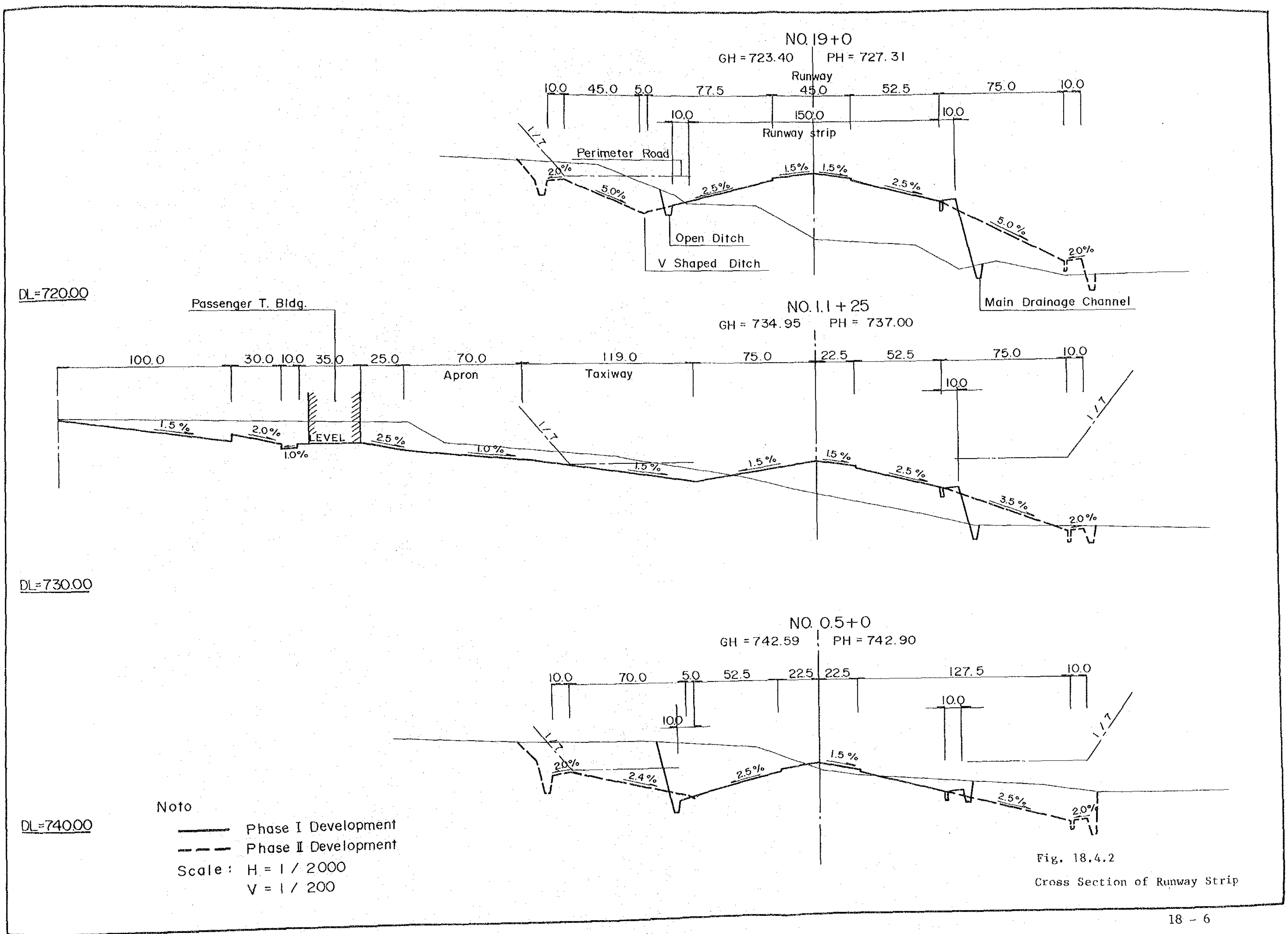
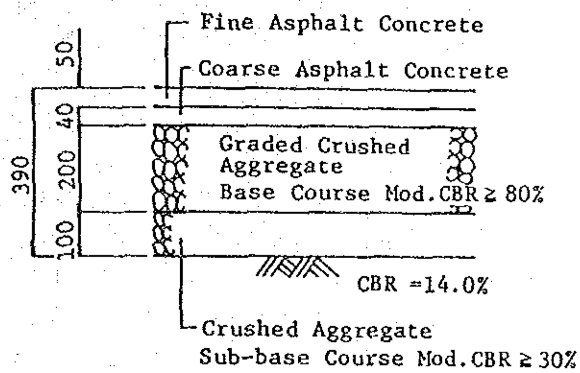



Fig. 18.4.2

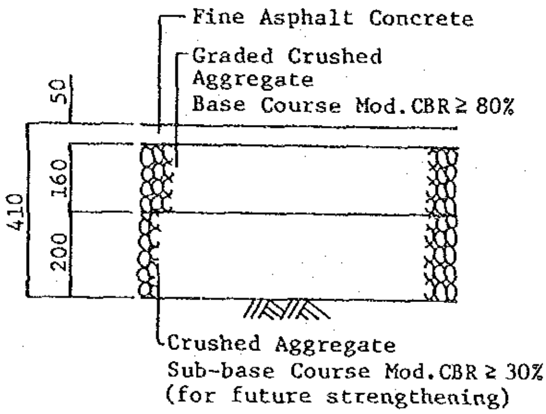
Cross Section of Runway Strip

### 18.4.4 Pavement Plan

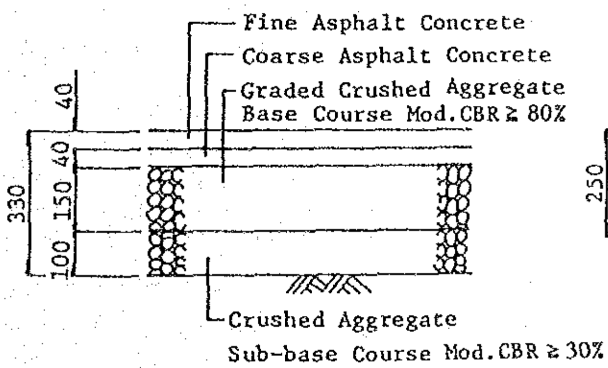
Asphalt concrete pavement will be adopted for the runway, taxiway, apron, and others. Assuming the strength of subgrade is CBR 14% according to "FEASIBILITY STUDY REPORT ON POKHARA AIRPORT" DCA 1984, the typical pavement structures are planned as Fig. 18.4.3. The design aircraft for Phase I is HS-748. The runway shoulder pavement is designed as a structure containing the extra sub-base course necessary for the runway pavement taking into consideration the easy conversion of runway shoulder into runway for widening in Phase II.



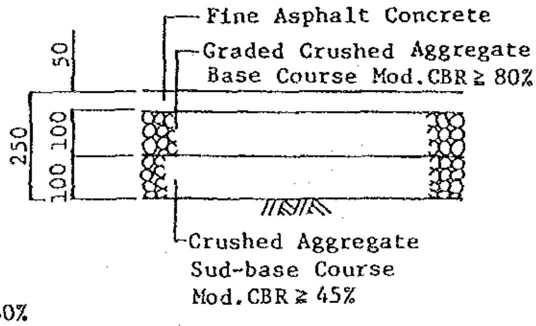

Flexible Pavement
(Runway,Taxiway and Apron)




Flexible Pavement
(Shoulder)




Apron Service Road,
Access Road & Car-park




Airport Perimeter Road

Fig. 18.4.3 Typical Pavement Structure

### 18.4.5 Storm Water Drainage Plan

Storm water on the north side from the runway will be collected in a V-shaped stone lining drainage located in the middle of the runway strip and in parallel with the runway in Phase II. But in Phase I storm water will be lead to a main drainage channel (open ditch) located along with the airport perimeter road and will be discharged to the Seti River crossing the east end of the runway.

Another main drainage channel is located along the perimeter road beside the southern airport property line. It will collect the surface water on the south side of the runway and distribute storm water to the existing channel and the Seti River.

The two existing irrigation channels which cross the runway strip will be replaced by pipe culverts to keep the function as present.

### 18.4.6 Grading Plan

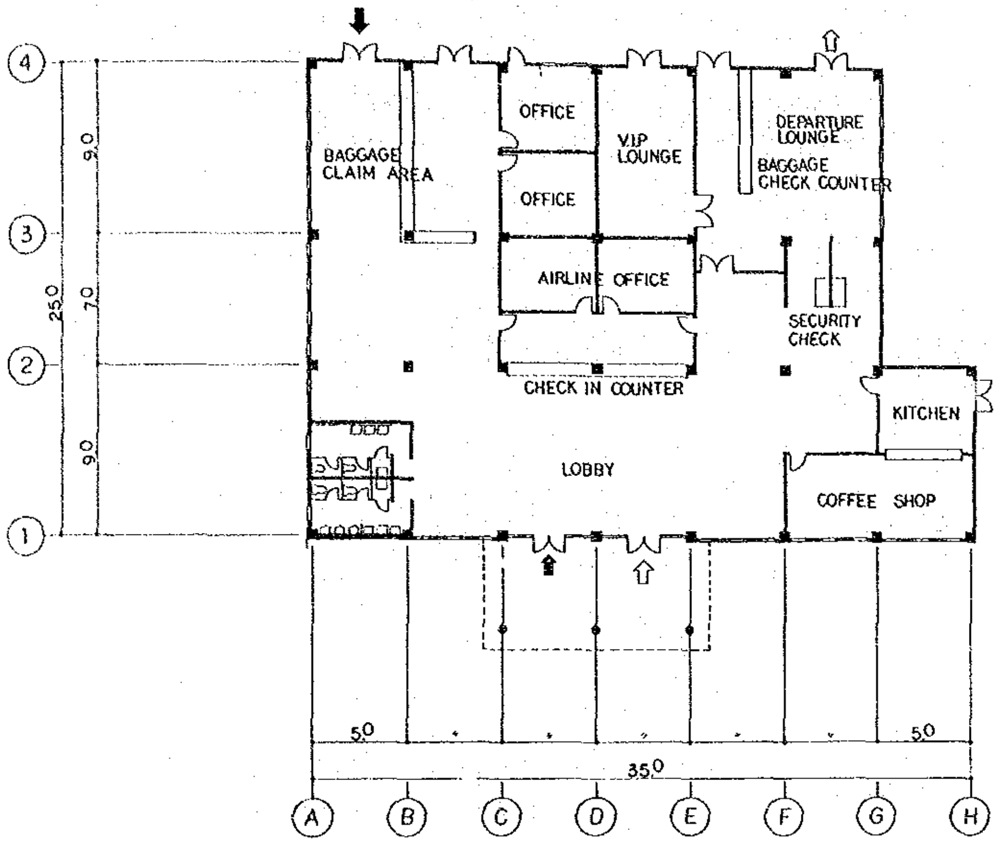
The terrain is inclined from north to south and its gradient is more than 1.5% which exceeds ICAO recommendation relating runway profile. Therefore, present ground of the runway 12 (west end) is cut in order to ensure approach surface and transitional surface. While the runway 30 (east end) is embanked by 5 m approximately in compliance with ICAO requirements on grading and in considering the balance of earth volume of cut/bank. A typical cross sections of the runway strip are shown as Fig. 18.4.2.

The hill, where situated in 2.1 km ahead of the runway 30 (east end), is planned to be cut because of an obstruction to approach surface and the excavated soil is diverted to embankment of the airport construction.

## 18.5 Passenger Terminal Building

The passenger terminal building is planned as shown in Fig. 18.5.1. One floor level concept is adopted corresponding to the number of passengers to be served. A total design floor area will be about 800 sq.m for Phase I development in order to handle 80,000 annual passengers in the year 2000.

The building will be made of reinforced concrete structure. It will be expanded by 1000 sq.m in Phase II.

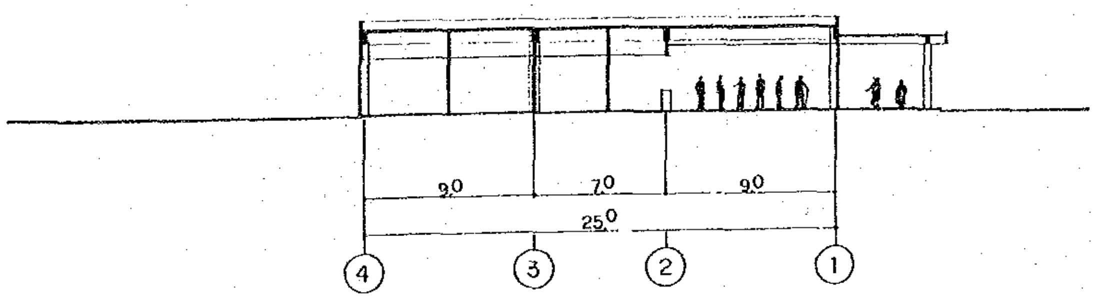




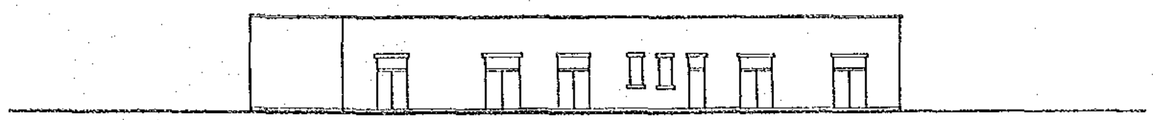
GROUND FLOOR PLAN

DEPARTING PASSENGERS

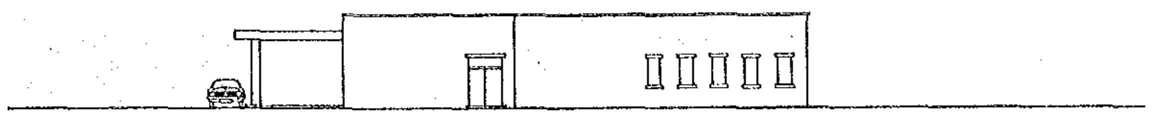
ARRIVING PASSENGERS



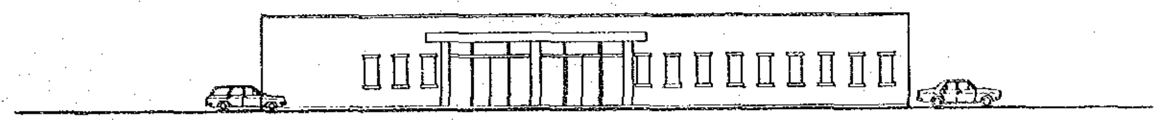

SECTION



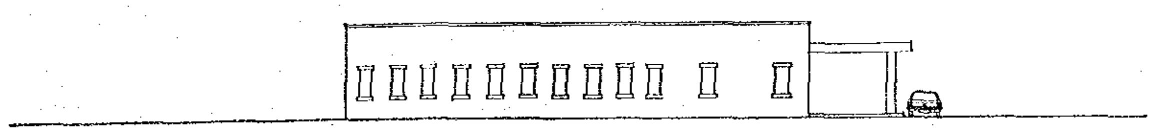
ELEVATION 1



ELEVATION 2



ELEVATION 3



ELEVATION 4

0 5 10 15 20m

Fig. 18.5.1
Passenger Terminal Building
for New Pokhara Airport

## 18.6 Air Navigation Systems

The operation category of New Pokhara Airport is classified to be "instrument, non-precision". Based on this operational category, the minimum air navigation systems have been planned as follows:

<u>Air Navigation System Plan in Phase I</u>

All equipment should be newly installed for the new airport.

(NAVAIDS)

| | | |
|---|---|---|
| (1) Doppler VOR/DME, dual | : | 1 set |
| (2) NDB (en-route and airport use, dual: 50-100 w) | : | 1 set |

(ATC/COM)

| | | |
|---|---|---|
| (1) VHF air-ground radio, dual<br>a) Control tower (TWR)<br>b) Emergency (Distress) | : | 2 sets |
| (2) VHF air-ground transceiver | : | 1 set |
| (3) HF air-ground transceiver | : | 1 set |
| (4) Domestic AFTN teletypewriters and Point to Point voice communication facility | : | 2 sets |
| (5) Domestic HF ground-ground transceiver for ATS Direct speech circuit | : | 1 set |
| (6) Aerodrome control console complete with clock, altimeter, interphone and others | : | 1 set |
| (7) ATC tape recorder | : | 1 set |

(LIGHTS)

(1) Simple approach lighting system (RWY 30)
(2) Runway threshold identification lights (RWY 12)
(3) PAPI (RWY 12/30)
(4) Runway edge lights
(5) Runway threshold and end lights
(6) Stopway lights
(7) Taxiway lights
(8) Aerodrome beacon
(9) Wind direction indicator
(10) Apron floodlights
(11) Substation for lights and associated control, power supply equipment.

(METEOROLOGICAL SYSTEM)

(1) Manual observation sensors including the following:

- Wind sensor : 1 set
- Thermometer : 1 set
- Hygrometer : 1 set
- Precipitation gauge : 1 set
- Barometer : 1 set
- Altimeter : 1 set

# CHAPTER 19   AIRSPACE USE OF NEW POKHARA AIRPORT

## CHAPTER 19 AIRSPACE USE OF NEW POKHARA AIRPORT

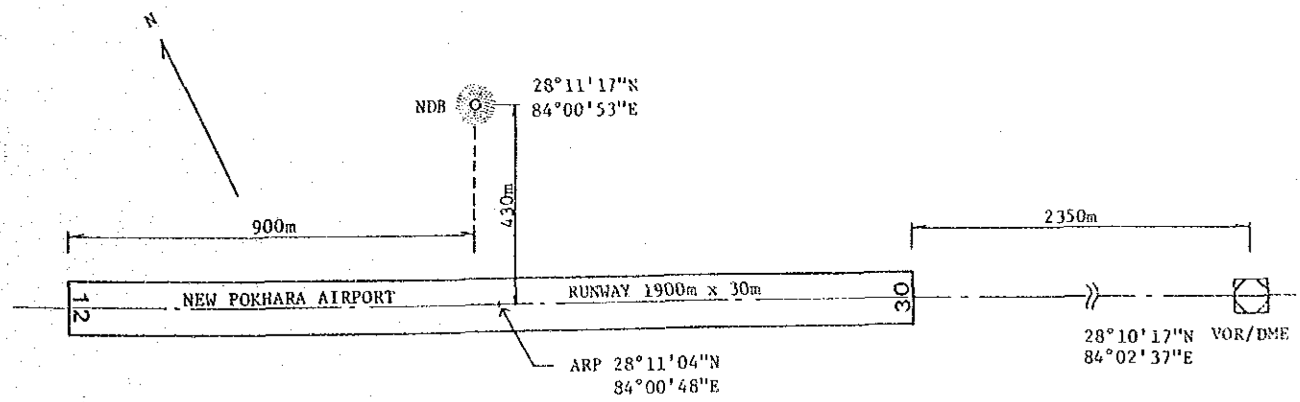
### 19.1 General

This chapter discusses airspace use for new Pokhara Airport which is planned at point 2 NM SE of the existing Pokhara Airport.

### 19.2 Basic Assumptions

The airspace use for new Pokhara Airport is studied in accordance with the assumptions and conditions described below:

| | |
|---|---|
| (1) Aerodrome Reference Point | 28°11'04"N / 84°00'48"E (Phase I) |
| | 28°11'00"N / 84°00'58"E (Phase II) |
| (2) Airport Elevation | 794 m (2604 feet) (Phase I) |
| | 790 m (2592 feet) (Phase II) |
| (3) Runway Orientation | 116°10'07"/296°10'07"T (12/30) |
| (4) Runway Length | 1900 m x 30 m (Phase I) |
| | 2500 m x 45 m (Phase II) |
| (5) Runway Strip | 2020 m x 150 m (Phase I) |
| | 2620 m x 300 m (Phase II) |
| (6) Magnetic Variation | 1.0° west |
| (7) Location of VOR/DME and NDB | |




The coordinates of VOR/DME and NDB are calculated based on the coordinates of ARP.

## 19.3 Obstacle Limitation Surfaces

Obstacle Limitation Surfaces for Phase I and Phase II development plan of new Pokhara Airport are shown in Figs. 10.3.1 and 19.3.1 respectively. They are studied based on the ICAO requirements for non-precision approach runway for aerodrome reference code 3C for Phase I and 4D for Phase II.

New Pokhara Airport is planned on the basin which is located approximately 7 km SE of Phewa Tal. Accordingly, hills surrounding the new airport project through the inner horizontal, extended approach and conical surfaces. In particular, a hill, 2800-foot-high, located on the approach area for runway 30 is projected through the approach surface. The portion of this hill which is projected through the approach surface should be cut off to ensure the safety of aircraft operations.

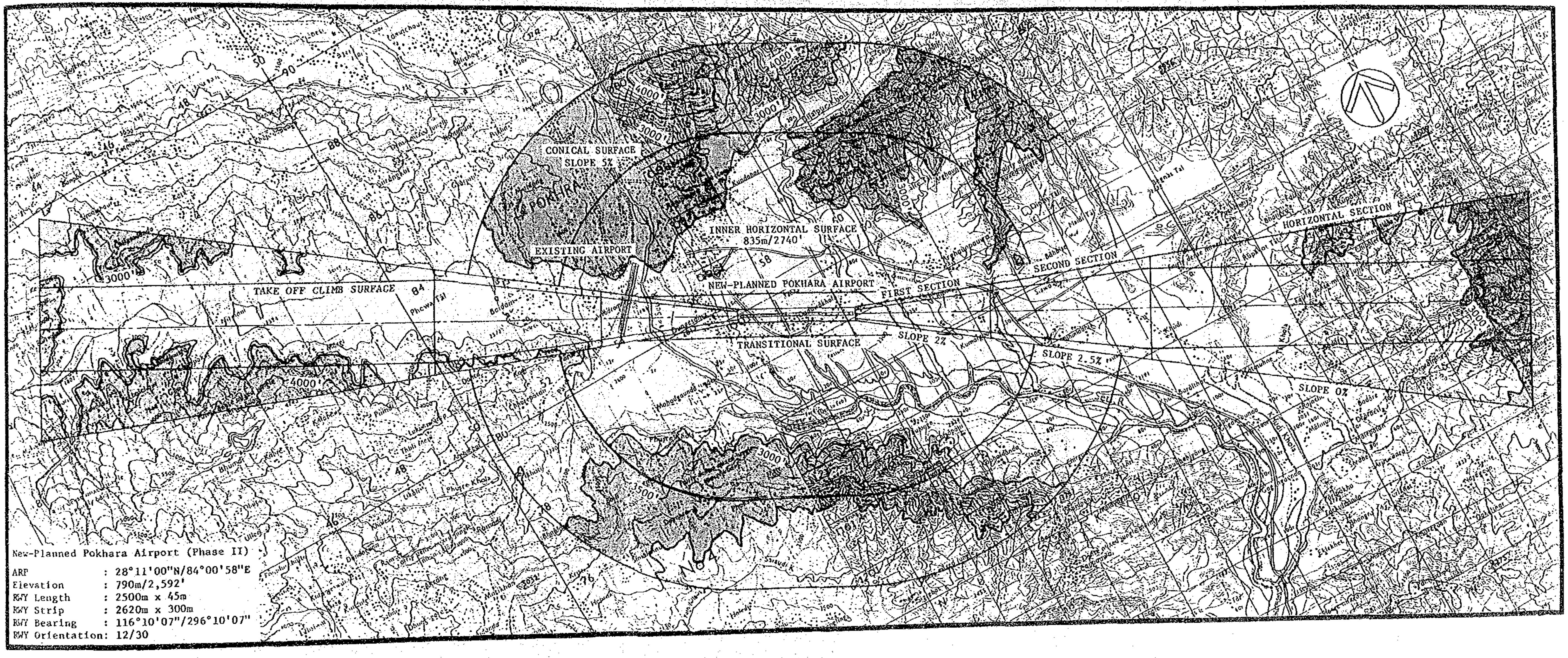



Fig. 19.3.1 Obstacle Limitation Surfaces of New-Planned Pokhara Airport (Phase II)

## 19.4 Controlled Airspaces

To maintain orderly air traffic flow and to provide sufficient airspace for air traffic control, controlled airspaces are proposed for new Pokhara Airport as shown in Fig. 19.4.1 and Tables 19.4.1 - 2.

Table 19.4.1 Proposed Aerodrome Traffic Zone

| Aerodrome | Dimension of Aerodrome Traffic Zone | |
|---|---|---|
| | Lateral Limit | Vertical Limit |
| New Pokhara Airport | An area of a circle of 5 NM radius centered at aerodrome reference point | From ground level up to 2000 feet |

Table 19.4.2 Proposed Controlled Airspace

| Tower | Controlled Airspace and Lateral Limits | Upper Limit / Lower Limit | Language |
|---|---|---|---|
| Pokhara Tower | CTR, a circle with a radius of 20 NM centered at Pokhara VOR/DME, excluding the portion of area which is overlapped with airway W-17 | 10500' / GND | English |

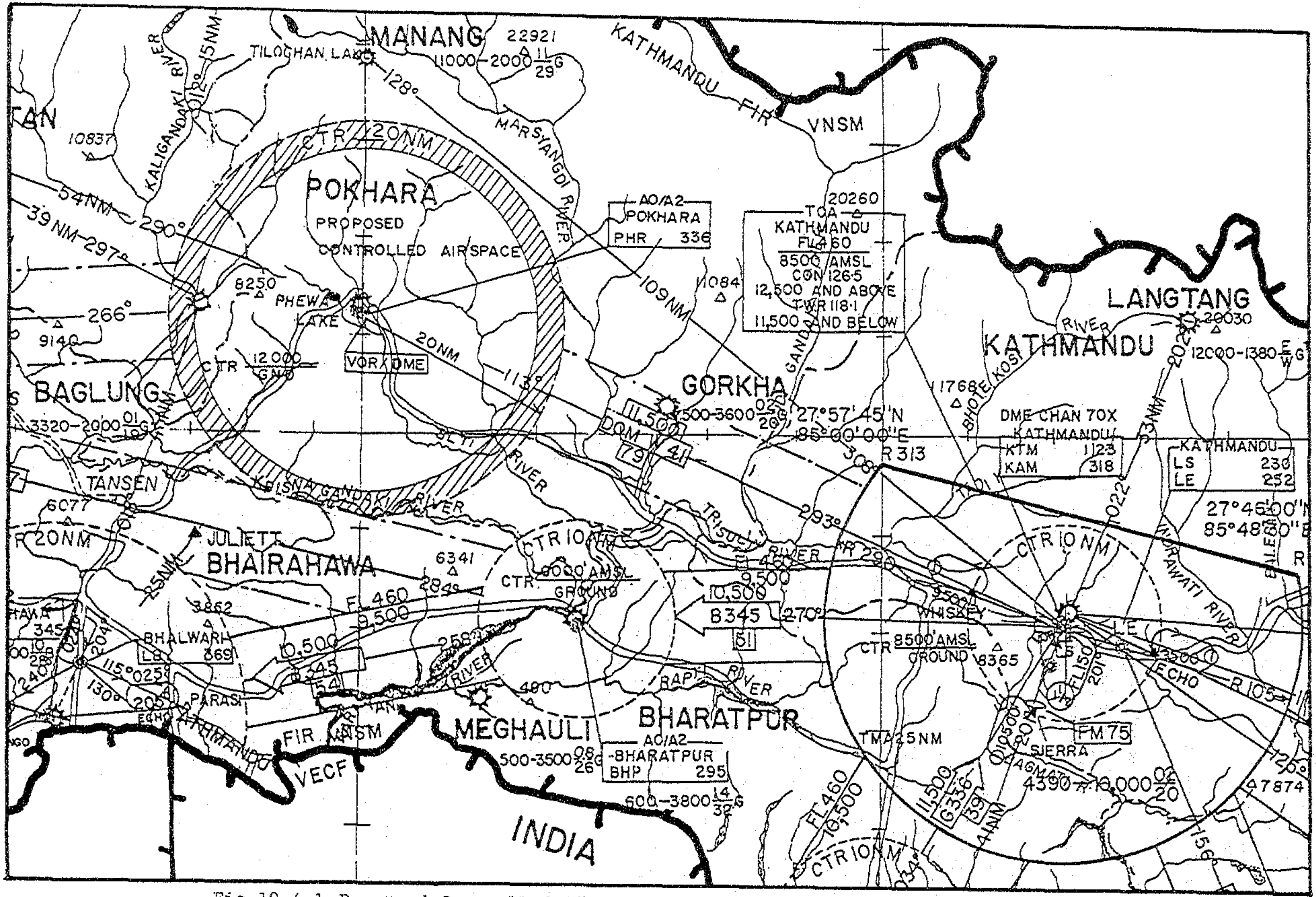


Fig.19.4.1 Proposed Controlled Airspaces for New-Planned Pokhara Airport

## 19.5 Instrument Approach and Departure Procedures

Instrument Approach/Departure Procedures are examined based on the ICAO DOC; 8168-OPS/611, Volume I and II, Procedures for Air Navigation Services, Aircraft Operations and Japanese Criteria for Establishment of Instrument Approach Procedure, Instrument Departure Route and Weather Minima.

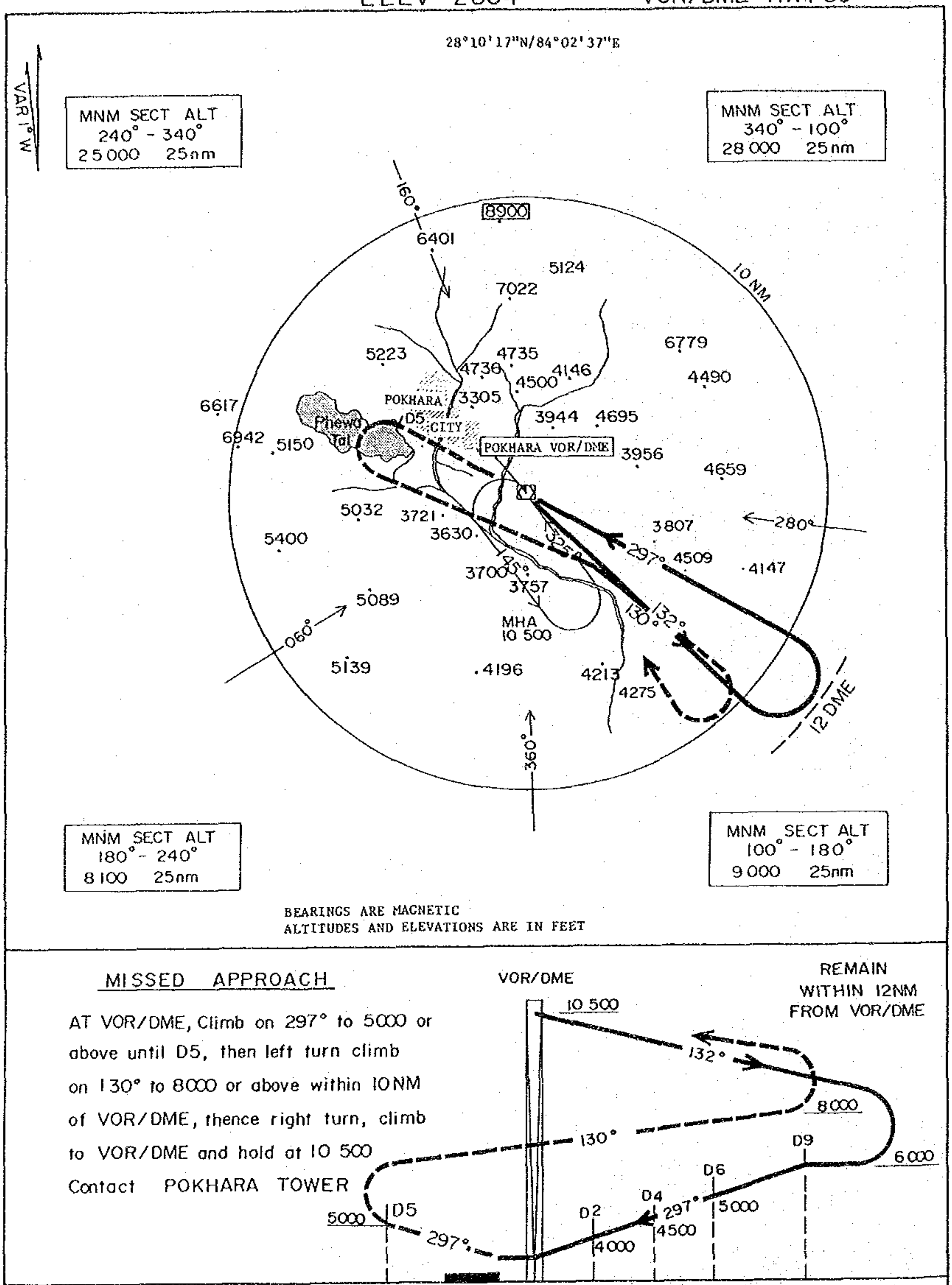
### 19.5.1 Instrument Approach Procedure

After examination of obstacles on the approach and missed approach areas for Runway 12 and 30, it is considered that establishment of procedures for a straight-in approach to Runway 30 is more safe for aircraft operations than those of Runway 12.

Fig. 19.5.1 is draft of straight-in approach procedure based on the Phase I development plan.

ELEV 2604'

NEW POKHARA AIRPORT
VOR/DME RWY 30




| STA TO RWY 30 | MDA 3 320' | | | |
|---|---|---|---|---|
| | ALS AVBL | | ALS OUT | |
| A | VIS | 1600 m | VIS | 2000 m |
| B | | 2000 m | | 2400 m |
| C | | 2400 m | | 2800 m |
| D | | 3600 m | | 4000 m |

| CIRCLING | MDA - VIS |
|---|---|
| A | 3 320' - 1 600 m (2000 m)* |
| B | 3 420' - 2 000 m (2400 m)* |
| C | 4 080' - 2 400m (2800 m)* |
| D | 4 280' - 3 600m (4 000 m)* |

* When Apch Lights is out.

Fig. 19.5.1 Proposed Instrument Approach Procedure, Pokhara VOR/DME RWY 30

### 19.5.2 Circling Area

Fig. 19.5.2 shows the circling area for each aircraft category. The highest obstacle which is one of the element for decision of minimum descent altitude (MDA) of each area is shown in Table 19.5.1.

In case of Phase I and Phase II development plan, significant obstacles on the circling area for each aircraft category are almost same.

Table 19.5.1 The Highest Obstacle on the Each Circling Area Corresponding to Aircraft Category

| Circling Area | Highest Obstacle | Location from ARP |
|---|---|---|
| Cat A | 850 m/2789' | 110°T/1.7 NM |
| Cat B | 920 m/3018' | 035°T/1.5 NM |
| Cat C | 1120 m/3675' | 215°T/2.0 NM |
| Cat D | 1180 m/3871' | 237°T/2.6 NM |


CAT. D
CAT. C
CAT. B
CAT. A
3018'
AP Elev.
2,604'
2789'
1.3nm
1.5nm
2.0nm
2.5nm
3675'
3871'

19.5.3 Standard Instrument Departures

Fig. 19.5.3 shows drafts of Standard Instrument Departures for new Pokhara Airport.

Take off Runway 30 : Straight climb out is not possible due to terrain, accordingly, turning departure is studied with restriction of turning area.

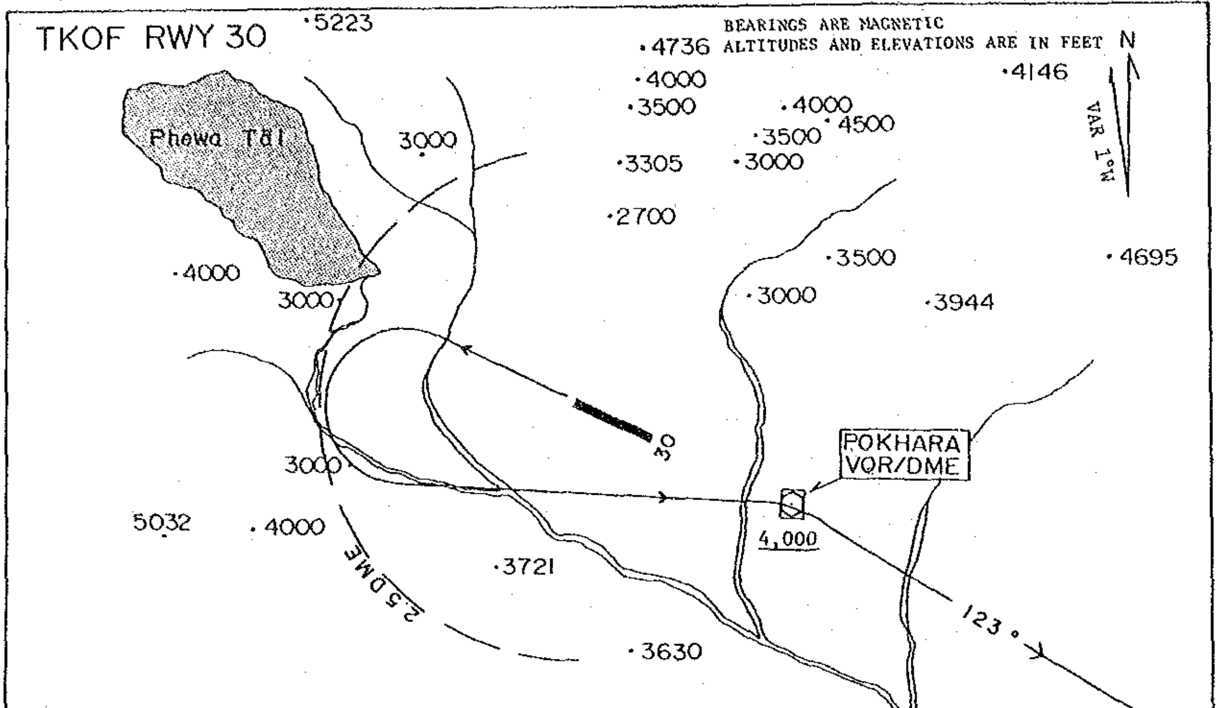
Take off Runway 12 : Almost of take off area is cleared; but some obstacles which are projected through the surface of 1/30 are scattered on the take off area.

Thus, following climb rate should be designated until reaching 4000 feet within R-123/4.5DME of VOR/DME.

| Speed (Knots) | 60 | 90 | 120 | 150 | 180 | 210 |
|---|---|---|---|---|---|---|
| Climb Rate (feet/minute) | 300 | 450 | 600 | 750 | 900 | 1050 |

| STANDARD INSTRUMENT DEPARTURES | ATIS<br>TWR<br>GND | AP. ELEV: 2,604'<br>TRANS LEVEL: FL 150<br>TRANS ALT: | NEW POKHARA AIRPORT |
| --- | --- | --- | --- |

## TKOF RWY 30

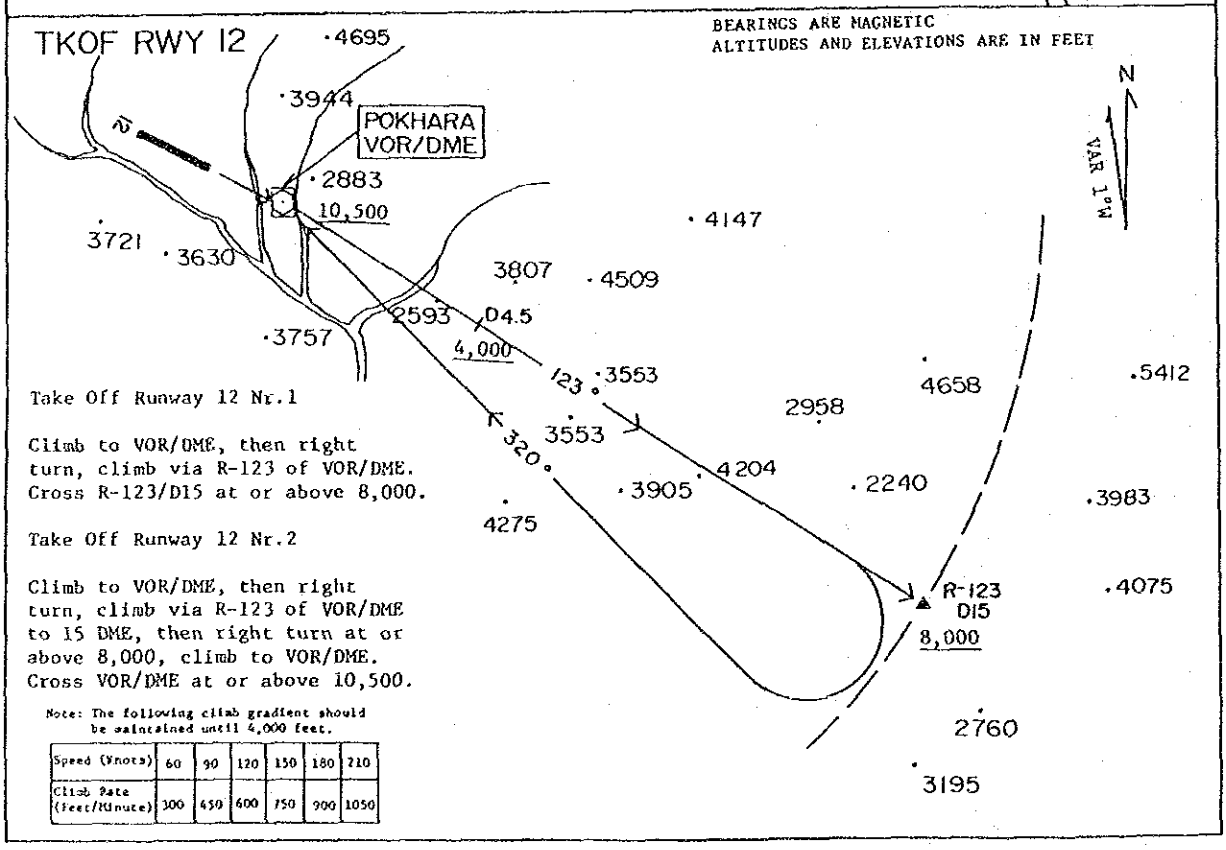



Take Off Runway 30

Complete left turn within 2.5nm, climb to VOR/DME, cross VOR/DME at or above 4,000, then right turn climb via R-123 of VOR/DME. Cross R-123/D15 at or above 8,000.

DME facility is required near the threshold 12.

## TKOF RWY 12




Take Off Runway 12 Nr.1

Climb to VOR/DME, then right turn, climb via R-123 of VOR/DME. Cross R-123/D15 at or above 8,000.

Take Off Runway 12 Nr.2

Climb to VOR/DME, then right turn, climb via R-123 of VOR/DME to 15 DME, then right turn at or above 8,000, climb to VOR/DME. Cross VOR/DME at or above 10,500.

Note: The following climb gradient should be maintained until 4,000 feet.

| Speed (Knots) | 60 | 90 | 120 | 150 | 180 | 210 |
| --- | --- | --- | --- | --- | --- | --- |
| Climb Rate (Feet/Minute) | 300 | 450 | 600 | 750 | 900 | 1050 |

Fig. 19.5.3 Proposed Standard Instrument Departures at New-Planned Pokhara Airport

## 19.6 ATS Routes

Fig. 19.6.1 and 2 show the ATS routes from new Pokhara VOR/DME and NDB to other airports. In these figures only calculated magnetic bearing and distance are shown, precise MEA (Minimum IFR Enroute Altitude) will be decided by flight check.

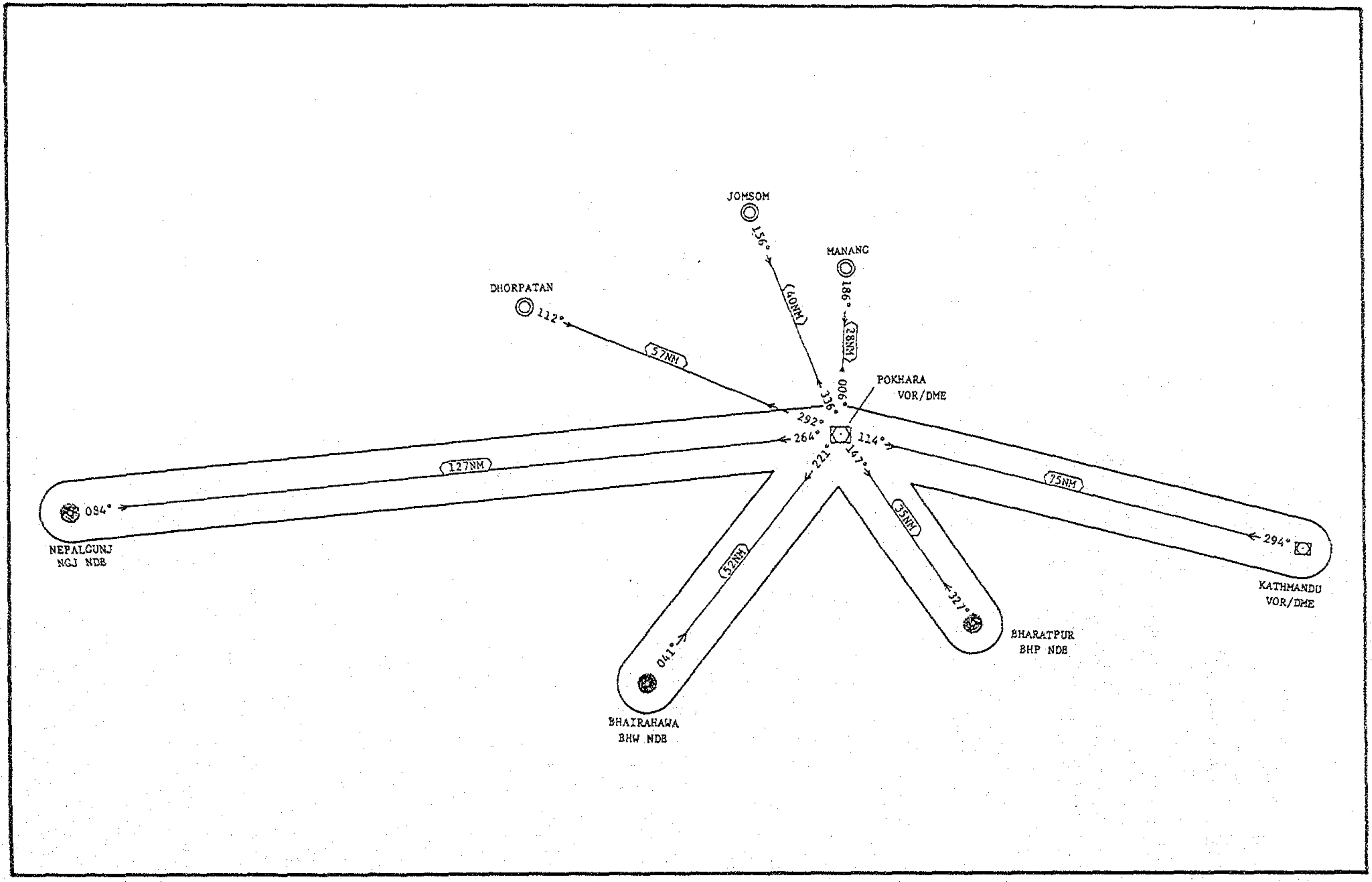



Fig. 19.6.1 Proposed ATS Routes from New Pokhara VOR/DME to Other Airports

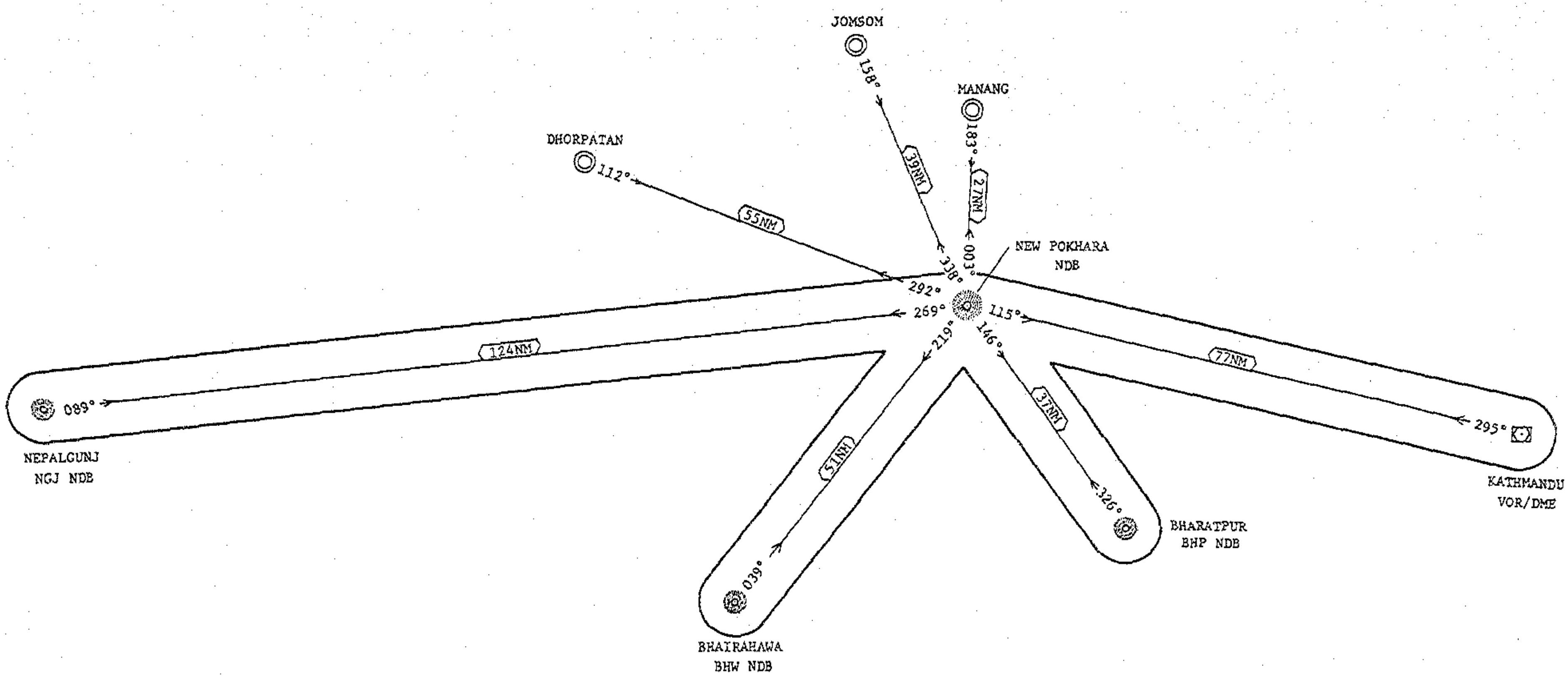



Fig. 19.6.2 Proposed ATS Routes from New Pokhara NDB to Other Airports

# CHAPTER 20 PROJECT IMPLEMENTATION SCHEDULE AND COST ESTIMATES OF NEW POKHARA AIRPORT

# CHAPTER 20 PROJECT IMPLEMENTATION SCHEDULE AND COST ESTIMATES OF NEW POKHARA AIRPORT

## 20.1 General

This chapter explains the project implementation schedule and cost estimates for New Pokhara Airport based on the preliminary study for the Phase I development as described in Chapter 18.

The project cost necessary for the Phase I and II development are estimated to be 40 million US dollars and 45 million US dollars respectivelly at 1988 base price.

## 20.2 Project Implementation Schedule

The construction schedule for the project is indicated in Table 20.2.1.

## 20.3 Project Cost Estimates

The project cost required for the Phase I development is estimated to be 40 million US dollars based on 1988 prices as shown in Table 20.3.1. This cost has been estimated primarily for the economic analysis which will be evaluated considering the national economy.

This cost includes soil investigation and topographical survey, construction supervision, engineering services and physical contingencies. The exchange rate used has been established at US$1.00 = Rs. 25.0 = Yen125. The contingency is estimated at about 10% of the sum of the total cost of construction works, soil investigation and topographical survey, engineering services cost and construction supervision.

The haul distance of borrowed soil is assumed to be about 10 km. It is, however, to be reviewed based on the field investigation before the implementation of the project. If the runway and runway strip are constructed in Phase I to be the same width as specified in Phase II, project cost for Phase I will increase to 46 million US dollars.

The estimated project cost for Phase II is shown in Appendix 20.3.

Table 20.2.1 Construction Schedule of New Pokhara Airport

| ITEM | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|
| Soil Investigation and Topo Survey | ── | | | | |
| Basic Design | ──── | | | | |
| Detailed Design and Tender documentation | | ──── | | | |
| Construction | | | ──── | ──── | ──── |
| (Construction Supervision) | | | ──── | ──── | ──── |
| Land Acquisition | ──── | | | | |

Table 20.3.1 Estimated Project Cost for Phase I Development

Exchange rate: US$1.00=NRs25.00
Cost estimate based on 1988 price
(Unit=US$1,000)

| Item | Nepal Portion | Foreign Portion | Total |
|---|---|---|---|
| A. Land Acquisition Cost | 279 | 0 | 279 |
| B. Construction Cost | | | |
| 1. Civil Works | 7,482 | 12,332 | 19,814 |
| 2. Architectural Works | 435 | 2,600 | 3,035 |
| 3. Air Navigation Systems | 710 | 6,621 | 7,331 |
| 4. Utilities | 62 | 512 | 574 |
| 5. Rescue & Fire Fighting Vehicles | 0 | 328 | 328 |
| 6. Lighting for Car Parks & Road | 8 | 152 | 160 |
| Total of B | 8,697 | 22,545 | 31,242 |
| C. Engineering Services Cost | 310 | 4,219 | 4,529 |
| A+B+C | 9,286 | 26,764 | 36,050 |
| Contingency (approx. 10%) | 929 | 2,676 | 3,605 |
| Total of Project Cost | 10,215 | 29,440 | 39,655 |