3.3.2 Considerations on Airspace Allocation

(1) Types of Service and Airspace Allocation

The types of ATC service to be offered at Wuhan/Tianhe Airport consist of area control, approach control and airport traffic control in accordance with the ICAO Recommendations, and the appropriate portions of national airspace should be designated and assigned to each facility as follows:

a. Wuhan Area Control Center(ACC)

This is responsible for en route air traffic control service and flight information service for aircraft flying in Wuhan Control Area.

b. Wuhan/Tianhe Approach Control Facility

The facility is responsible for approach control service for aircraft arriving at and/or departing from Wuhan/Tianhe Airport within the service area which is within a radius of 111.1km (60nm) from Tianhe VOR/DME as shown in Fig. 3-8.
As Airport Surveillance Radar to be installed at the Airport is to cover airspace within a radius of approximately 130km (70nm), the radar approach controller will be able to observe radar targets passing over release points,i.e. Hèkou,Xishui, Longkou and Tianmen and be ready to serve arriving IFR aircraft when released to him by Wuhan ACC.

Also, if Wuhan ACC releases an arriving aircraft at an altitude of 4,500m (15,000ft), the aircraft will be able to descend on the best descending rates of 50m/km (300ft/nm) or less. The optimum upper limit of Tianhe Approach Control Area should be at the altitudes of 4,500m to 4,800m.

c. Tianhe Control Tower

Tianhe Control Tower is responsible for air traffic control service for flights within Tianhe Control Zone which is within a radius of 9km (5nm) from Airport Reference Point.

(2) Flight Procedures in Terminal Airspace

The flight procedures in Tianhe Approach Control Area prepared by CAAC are considered to be appropriate as shown in Fig.3-8 and the instrument approach procedure plans are shown in Appendix 3-1.

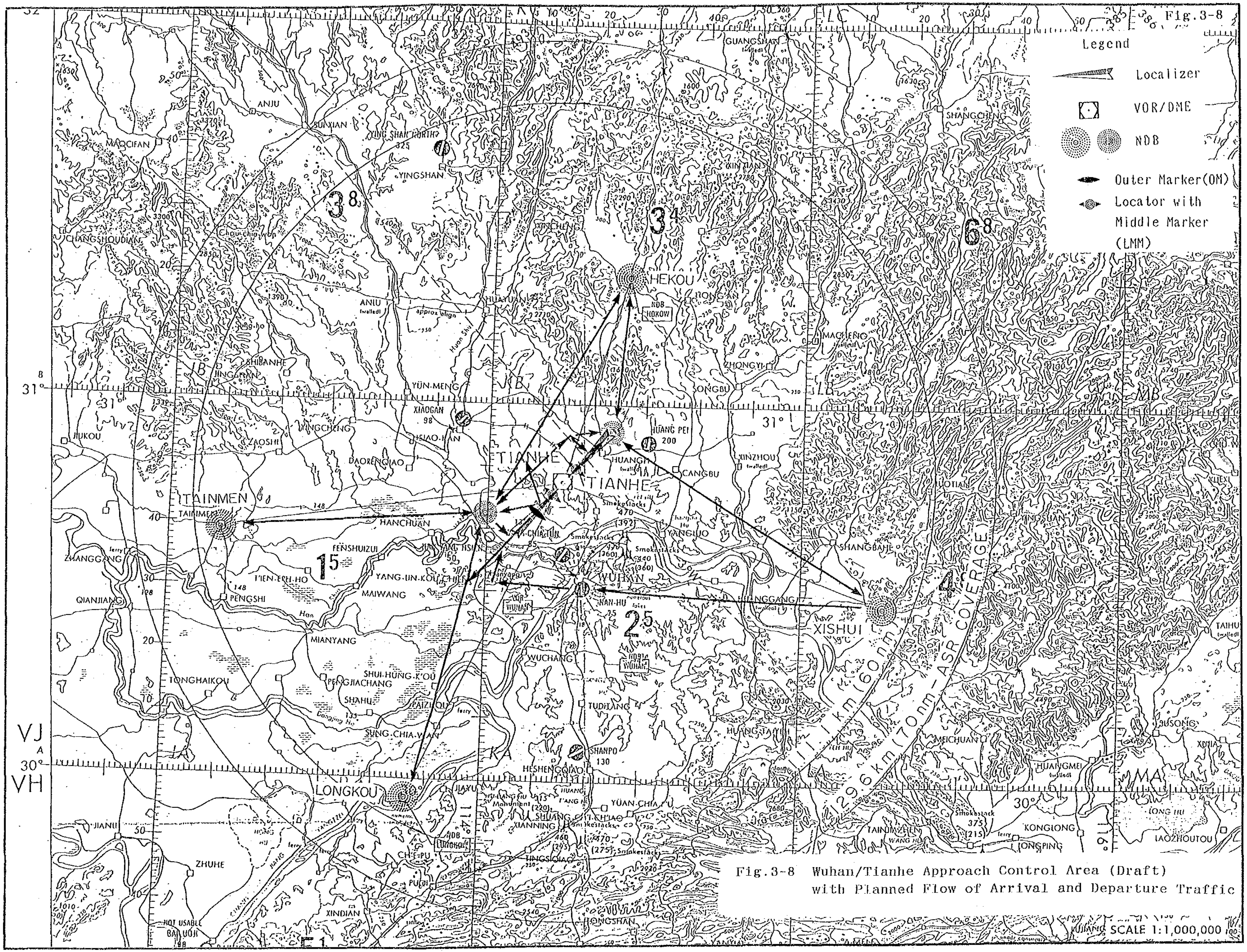


Fig.3-8 Wuhan/Tianhe Approach Control Area (Draft) with Planned Flow of Arrival and Departure Traffic

CHAPTER 4 FORECAST OF AIR TRANSPORT DEMAND

CHAPTER 4 FORECAST OF AIR TRANSPORT DEMAND

4.1 Review of Air Transport Demand

4.1.1 Air Passenger Transport Demand

(1) Air Passenger Transport Demand in China

Air passenger transport demand in China increased vigorously with a high annual growth rate of 27% during the period of 18 years from 1970 to 1987, amounting to 13,100 thousand in 1987 as shown in Fig.4-1 (Refer to Appendix 4-1). However, the number of trips by air is still at a low level of 12 per one thousand population in 1987, as compared with the figures of 568 and 1,000, in Japan and the United States respectively (Refer to Appendix 4-3).

The population and gross social product of China also developed steadily with annual growth rates of 1.3% and 9.3% respectively, during the same period as shown in Figs.4-2 and 4-3 (Refer to Appendix 4-2).

In 1983, however, there was a sudden decline of air passengers because CAAC imposed severe restrictions on the issuance of air tickets due to the hijack accident of CAAC aircraft in South Korea in May. And certification by local governments or places of employment is still required when people want to buy air tickets, but the Government is now considering to loosen this measurement.

In the long run, it can be said that there exists tremendous potentiality in the development of air transport in China, taking into consideration the vast land area, the huge population size and the abundant natural resources for economic development.

(2) Air Passenger Transport Demand at Wuhan/Nanhu Airport

Arriving and departing passengers at Wuhan/Nanhu Airport increased steadily with an annual growth rate of 22% during the period of 13 years from 1970 to 1982. After a big drop of air passengers in 1983 due to the above-mentioned reason, they grew abruptly about 5 (five) times during the five-year period from 1983 to 1987 as shown in Fig.4-4 (Refer to Appendix 4-1).

The number of air passengers at the Airport amounted to 492 thousand in 1987, accounting for 3.8% in the total air passenger transport in China. The number of trips by air per one thousand population of Wuhan City recorded 78 in 1987, much higher than the national average as mentioned above (Refer to Appendix 4-3).

The population and gross social product of Wuhan City also developed steadily with annual growth rates of 1.6% and 9.2%, respectively, during the period of 18 years from 1970 to 1987 as shown in Figs.4-5 and 4-6 (Refer to Appendix 4-2).

The average passenger load factor by route at Wuhan/Nanhu Airport recorded 79% in 1987, which was weighted by the number of seating capacity. Thus, it is estimated that there would be at least 20% of overflowed (potential) air passenger demand at the Airport, according to the theoretical study (Refer to Appendix 4-4).

(3) Results of Passenger Survey at Wuhan/Nanhu Airport

In order to grasp the characteristics of air passengers at Wuhan/Nanhu Airport, the questionnaire survey was conducted with the assistance of CAAC as follows:

a. Subjects: All the departing passengers at Wuhan/Nanhu Airport
b. Survey period: 7 days from December 22 to 28, 1988
c. Survey method: By distributing questionnaires to passengers at the waiting lobby and collecting them at the boarding gate.
d. Survey items : Sex, age, profession, present address, destination, purpose of trip, etc.
e. Number of distributed questionnaires: 3,000
f. Number of effective questionnaires collected: 2,139
h. Rate of collection: 71.3%

The results are summarized as follows (Refer to Appendix 4-5 for the details):

	Question	Answer
Sex	Male:	81.0%
	Female:	18.8%
Profession	Commerce & service:	31.0%
	Public officials:	26.8%
	Manufacturing:	18.5%
	Agriculture, forestry and fishery:	2.6%
	Without occupation:	2.4%
Present address	Wuhan City:	32.3%
	Guangdong Province:	14.8%
	Hubei Province:	10.3%
	Beijing City:	6.2%
	Shanghai City:	6.1%
Destination	Guangzhou:	35.2%
	Beijing:	16.6%
	Shanghai:	14.0%
	Fuzhou:	5.7%
	Xian:	4.9%
Purpose of trip	Business:	82.8%
	Leisure:	7.4%
	Private:	6.1%

In short, it can be said that most air passengers using Wuhan/Nanhu Airport come from Hubei Province including Wuhan City (42.6%) to visit three major cities of Guangzhou, Beijing and Shanghai (65.8%) for business purposes (82.8%).

According to the interviews with the air passengers at the Airport, it was made clear that they highly appreciate the time value of the time savings obtained by using air transport although dissatisfied with the service levels of current air carriers.

It is estimated from the above results that elasticity of air fare to passenger transport demand would be less significant at the Airport since most of the people do not buy air tickets from their own disposal incomes.

Fig. 4-1 Total Passenger Demand

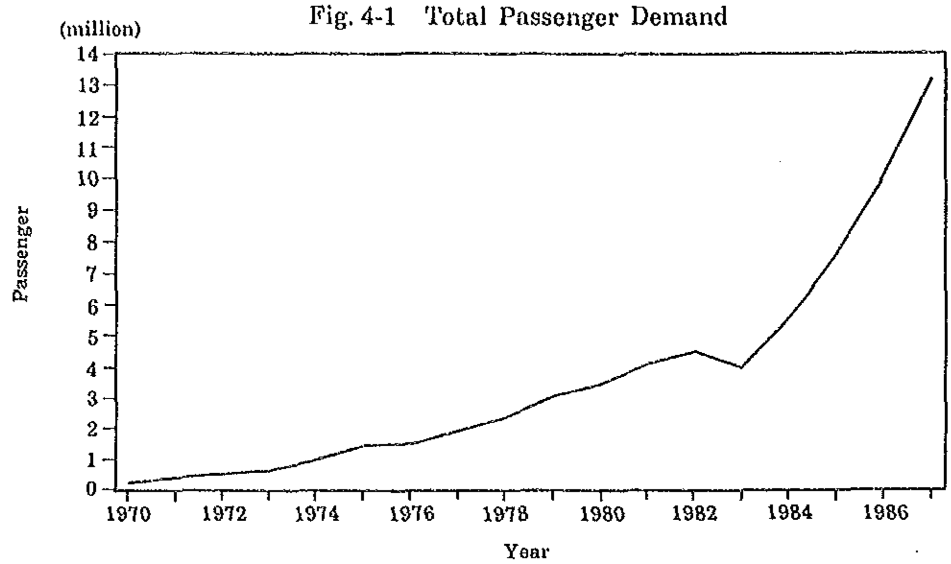


Fig. 4-2 China Population

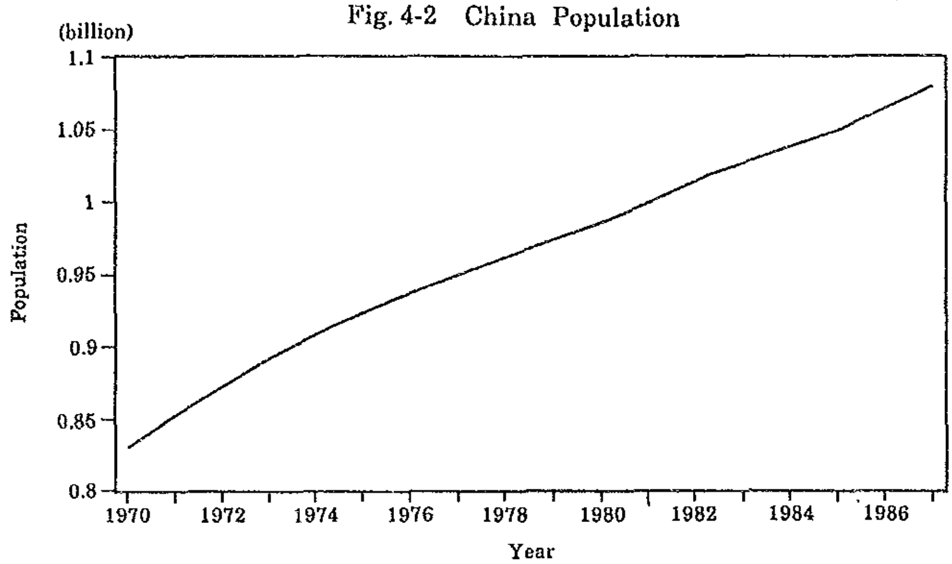


Fig. 4-3 China Social Product

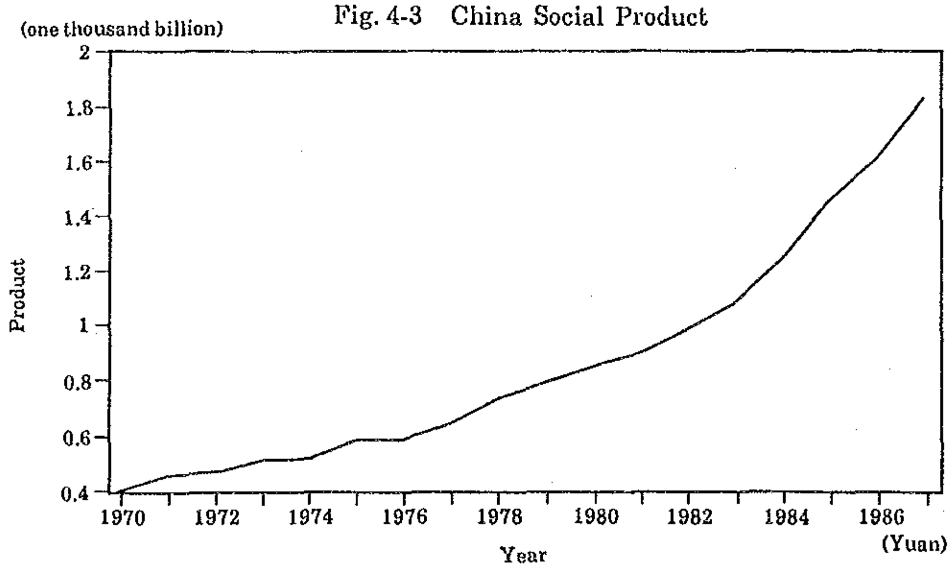


Fig. 4-4 Wuhan Airport Passenger

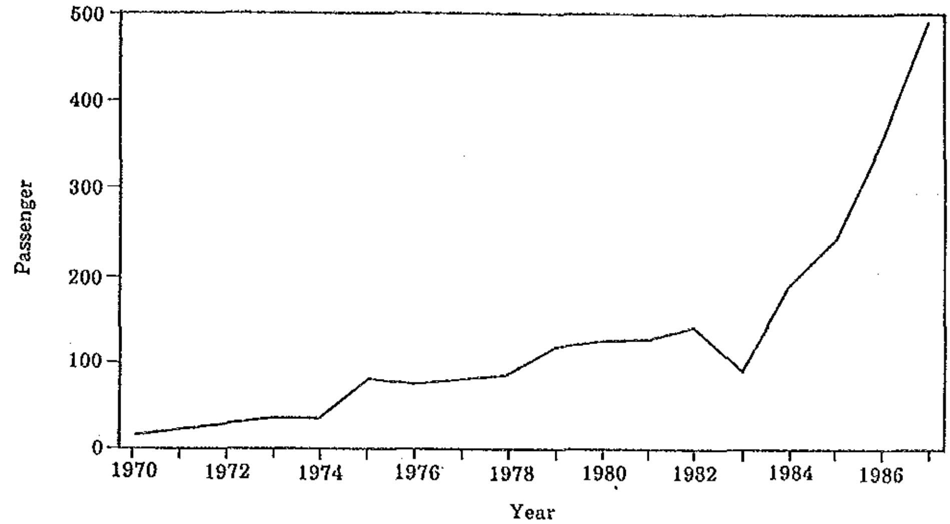


Fig. 4-5 Wuhan Population

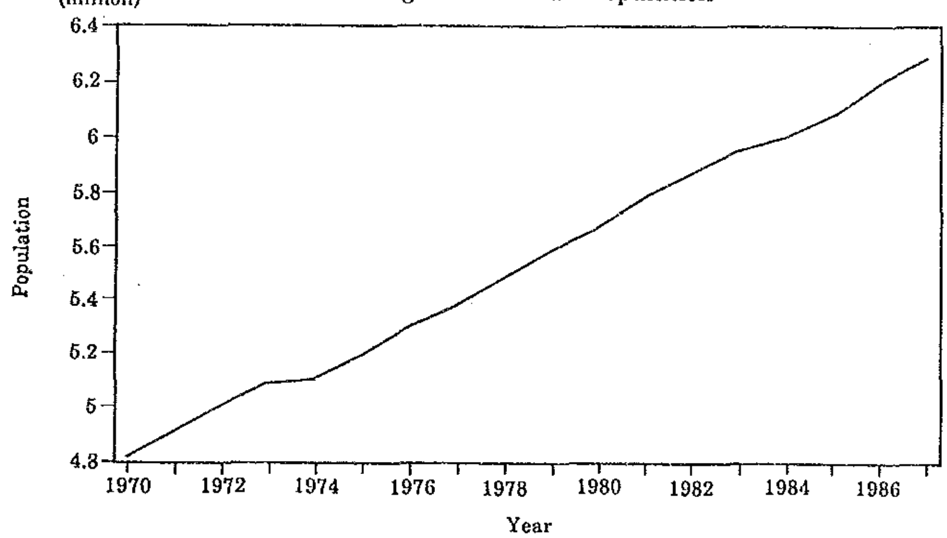
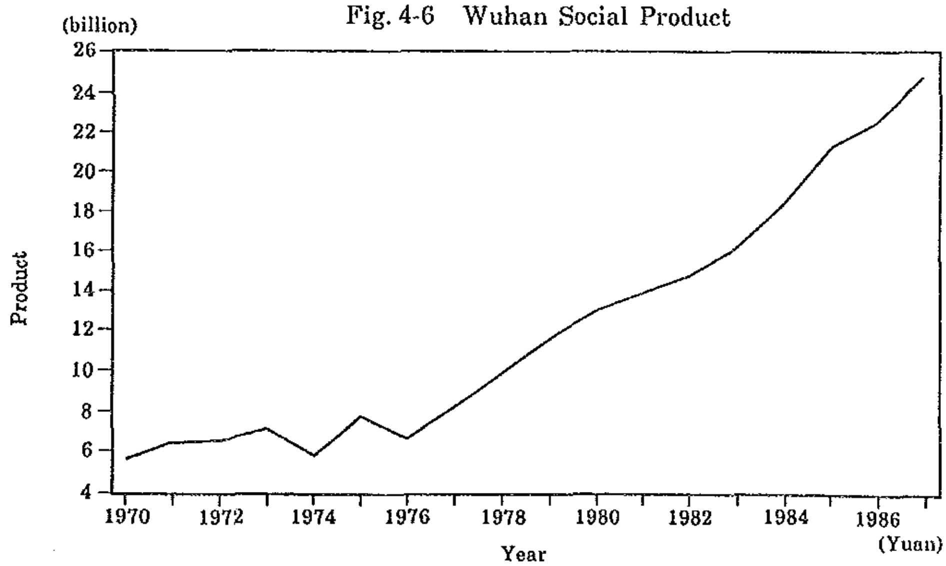


Fig. 4-6 Wuhan Social Product



4.1.2 Air Cargo Transport Demand

(1) Air Cargo Transport Demand in China

Air cargo transport demand in China increased remarkably with an annual growth rate of 18% during the period of 15 years from 1973 to 1987, amounting to 299 thousand tons in 1987, along with the development of the population and gross social product of China during the same period, as shown in Fig.4-7 (Refer to Appendix 4-1).

(2) Air Cargo Transport Demand at Wuhan/Nanhu Airport

Loaded and unloaded cargo at Wuhan/Nanhu Airport showed a fluctuating but upward trend from 1970 to 1979, and, after the stagnant period from 1979 to 1983, it recorded a tremendous increase since 1983 to 1987 with an annual growth rate of 35%, amounting to 9.0 thousand tons and accounting for 3% in the total air cargo transport demand in China, as shown in Fig.4-8 (Refer to Appendices 4-1 to 4-3).

Statistical data on commodities transported by air are not available at the Airport but the following items are said to be included:

a. Loaded cargo : fresh fishery products, electronics, clothes, machine parts, miscellaneous goods, etc.

b. Unloaded cargo : almost the same as loaded cargo, except fresh fishery products.

Fig. 4-7 Total Cargo Demand

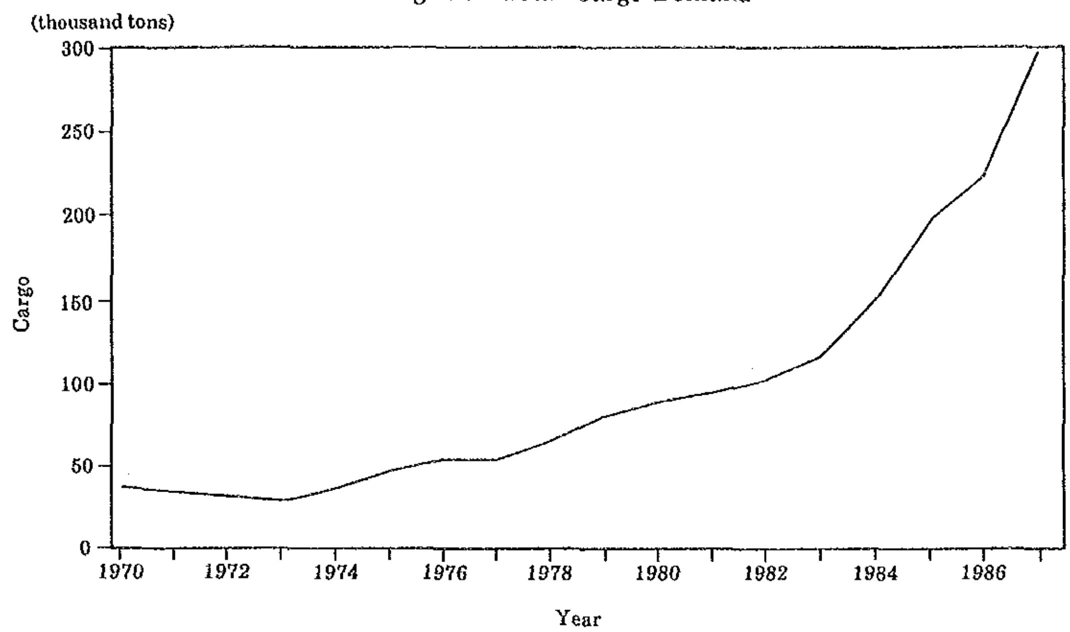
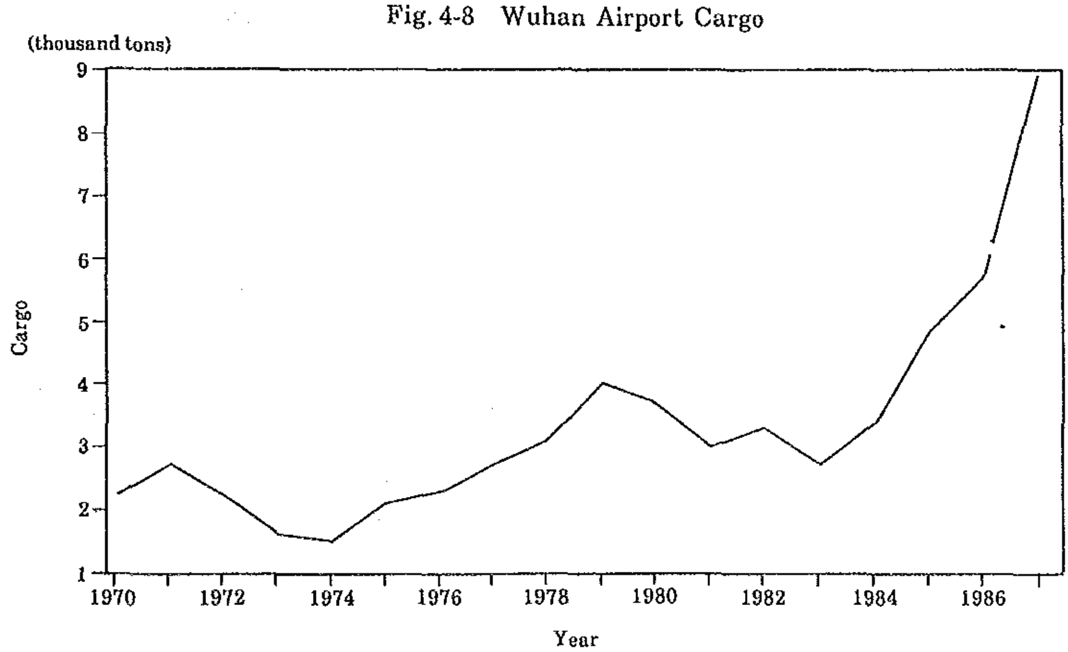


Fig. 4-8 Wuhan Airport Cargo



4.2 Method and Premises of Forecast

4.2.1 Method of Forecast

Forecast of air transport demand depends on the amount of available data and information and "a more reliable forecast may be obtained by employing more than one approach and consolidating differing results through judgement"*1.

In general, the forecasting methods can be divided into three broad categories*1: trend projection, econometrics approach, and market studies. The trend projection relies on the existence of historical data and on the continuation of historical trends. The econometrics approach further requires socio-economic indicators for the same period as historical transport data. The market studies rely heavily on judgement and experience, and are preferable in the situation where there is lack of historical data.

In this Study, statistical data on air transport and socio-economic indicators both for Wuhan City and China have been obtained for the period of 18 years from 1970 to 1987. Thus, the econometrics approach as defined in the said ICAO Manual is adopted as the method of forecasting air transport demand at Wuhan/Tianhe Airport.

Regression analyses are made on air passenger and cargo transport demand at Wuhan/Nanhu Airport by using such socio-economic factors as population and gross social product. Time variable is also included to see the future trend pattern of air transport. Then, forecast is made based on the selected equation showing the best goodness of fit in each regression analysis in terms of statistics. Different forecast results derived from different equations are consolidated into three cases; High Case, Middle Case and Low Case, in order to define the range of reliable forecast. The total air transport demand in China is also forecast for reference to check the forecast results for Wuhan/Tianhe Airport basically by the same method.

Air passenger demand by route is forecast by the share obtained from "gravity model" of which name is derived from the Newton's Law of Gravity,based on the present pattern of passenger distribution and the results of the air passenger survey.

Forecast is then made for aircraft movements by route and by aircraft type on the basis of the air passenger demand forecast by route. Peak hour traffic is also forecast by using a simulation model based on the present pattern of air traffic.

The general flow of the forecasting procedure is shown in Fig.4-9.

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*1 "Manual on Air Traffic Forecasting", ICAO Doc 8991-AT/722/2

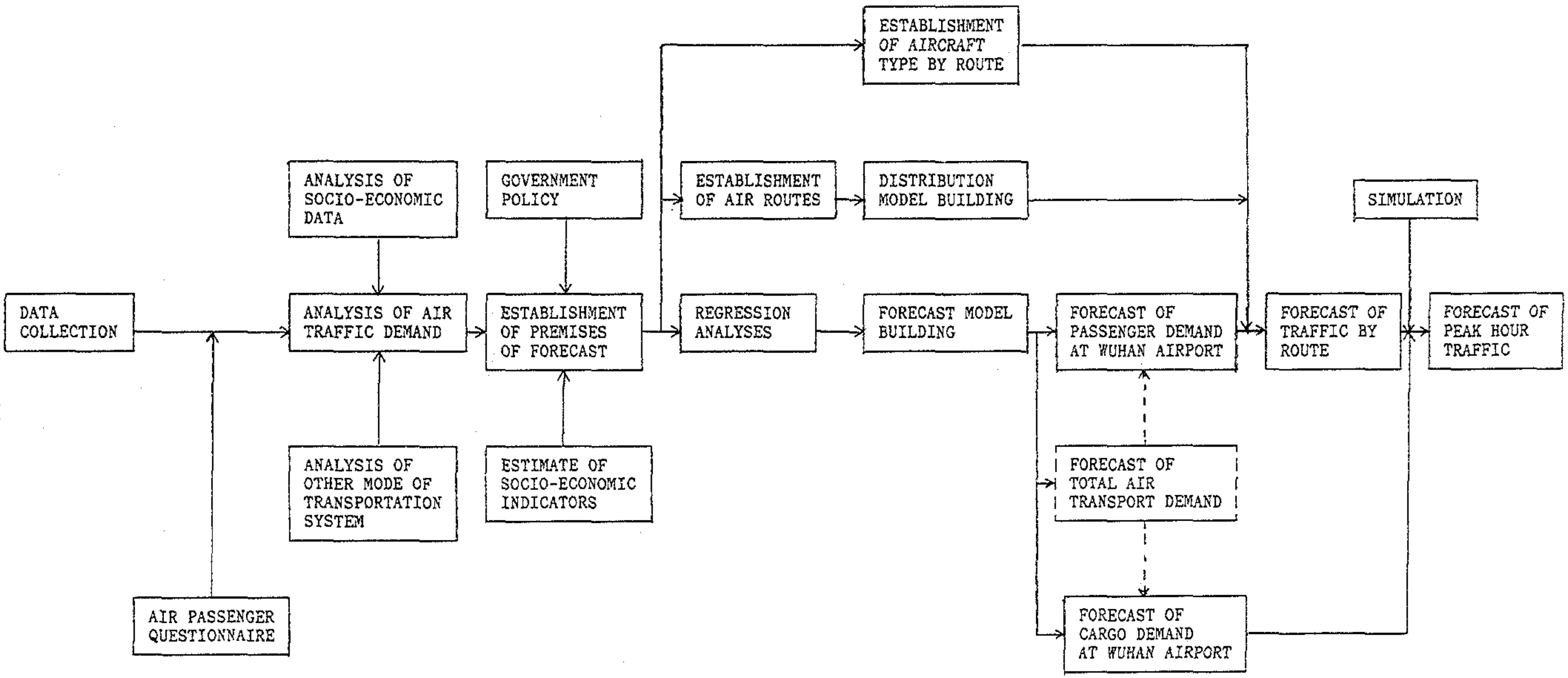


Fig. 4-9 GENERAL FLOW OF PROCEDURE OF AIR TRANSPORT DEMAND FORECAST AT WUHAN AIRPORT

4.2.2 Premises of Forecast

(1) Target Year

The target year of forecast is set at 2000, but forecast is also made for the years 1995 and 2010 as the short-term and long-term targets respectively.

(2) Roles of Wuhan/Nanhu Airport and Wuhan/Tianhe Airport

Wuhan/Nanhu Airport is to be used for small aircraft operation even after the construction of Wuhan/Tianhe Airport. However, the share of aircraft operation between Nanhu and Tianhe is not decided yet by CAAC. It is, therefore, supposed that all the scheduled aircraft operation be handled at Wuhan/Tianhe Airport in the Study.

(3) Socio-economic Framework

The future socio-economic framework of China and Wuhan City are given by the Chinese side as shown below.

1) Total Population of China

The Year 2000 (million)	Average Annual Growth Rate(%)	Period
1,250	1.126	1987 - 2000

Source: Civil Aviation Administration of China

2) Gross Social Product of China

The Year 2000 (billion Yuan in 1980 price)	Average Annual Growth Rate(%)	Period
(High case) 4,028	6.2	1987 - 2000
(Low case) 3,674	5.45	1987 - 2000

Source: Civil Aviation Administration of China

3) Total Population of Wuhan City

The Year 2000 (thousand)	Average Annual Growth Rate(%)	Period
7,482	1.34	1987 - 2000

Source: the People's Government of Wuhan City

4) Gross Social Product of Wuhan City

The Year 2000 (million Yuan in 1980 price)	Average Annual Growth Rate(%)	Period
79,170	9.286	1987 - 2000

Source: the People's Government of Wuhan City

(4) Supply Side Conditions on Air Transport

The supply side conditions on air transport in China are given by the Chinese side as shown below.

1) National Airport Development Plan

The national airport development plan in China relating to the Project is as shown in Table 4-1.

2) Aircraft Purchasing Plan

The aircraft purchasing plan by CAAC only up to 1990 is given as shown in Table 4-2. However, much more aircraft are expected to be required in the year 2000 to meet the air transport demand.

3) Air Route Plan

All of the given destination points are planned to be connected directly to and from Wuhan/Tianhe Airport as shown in Fig.4-10.

4) Training Programme of Pilots and Air Navigation Specialists

No concrete training programmes of airline pilots and air navigation specialists including air traffic controllers are available at the time of the Field Survey of the Study.

(5) Comments on Premises

There exist some uncertainties as to whether the above premises could be fulfilled to meet the development of air transport demand. For example, if the air passenger demand is forecast to increase five times of the current level, aircraft fleet must be increased procured proportionately, imposing financial burdens on the Government.

Thus, the air transport demand forecast hereinafter should be regarded as a potential in that if all the above premises are not fulfilled, the demand will not develop as forecast.

Table 4-1 Airport Development Plan

Airport	City	Runway	Terminal Build	Development Plan	Critical Aircraft
(1) 北　京	北 京 市	3800×60 3200×50	60000m^2	Completion of F/S	B-747
(2) 廣　州	廣 東 省	3380×60	20000m^2	New Terminal Building	B-747
(3) 上　海	上 海 市	3200×58	19000m^2	- ditto -	B-747
(4) 成　都	四 川 省	2600×60	5000m^2	5xpanscon of Terminal Building	MD-82
(5) 重　慶	四 川 省	2800×45		Under Construction	MD-82
(6) 西　安	陝 西 省	2200×45	5000m^2		B-737
(7) 西安/咸陽	陝 西 省	3000×45		Under Construction	MD-82, B-747
(8) 桂　林	江 西 省	2200×45 2800×45	4000m^2 15000m^2	Plan for Parallel Runway and New Terminal	MD-82
(9) 武漢/南湖	湖 北 省	1800×60	4000m^2		B-737
(10) 武漢/天河	〃	3000×45		F/S for New Airport under way	B-747
(11) 南　京	江 蘇 省	2200×60 2800×45	4000m^2	- ditto -	TRD MD-82
(12) 昆　明	雲 南 省	3000×60 3400×50	3000m^2	Under Construction for New Terminal	B-737, TRD, (after construction)B-747
(13) 瀋　陽	遼 寧 省	2020×80 3000×45	5000m^2 1500m^2	Under Construction	B-737 MD-82, B-747
(14) 大　連	遼 寧 省	3200×50	4000m^2		B-747
(15) 烏魯木斉	新疆维吾爾自治区	3200×50	8000m^2		MD-82, B-747 (alternate)
(16) 蘭　州	甘 粛 省	3400×45	3000m^2	5xpansion of Terminal	MD-82
(17) 哈爾濱	黒 竜 江 省	3200×45	8000m^2		B-747
(18) 鄭　州	河 南 省	2200×50	3000m^2	Under Construction for Pavement improvement	(after construction)MD-82
(19) 杭　州	浙 江 省	3200×60	4000m^2		B-747
(20) 長　沙	湖 南 省	2200×60 2600×45	3000m^2 8000m^2	Under Construction	An-24 MD-82
(21) 南　昌	江 西 省	2200×50	4000m^2		B-737
(22) 厦　門	福 建 省	2500×45	6000m^2		MD-82
(23) 福　州	福 建 省	2200×60	4000m^2		TRD
(24) 天　津	天 津 市	3200×50	5000m^2		B-747
(25) 合　肥	安 徽 省	3000×50	4000m^2		B-747
(26) 南　寧	広西壮族自治区	2400×60	4000m^2		B-737
(27) 青　島	山 東 省	2600×50	8000m^2		MD-82
(28) 煙　台	山　京	2600×50	6000m^2	Under Construction	MD-82
(29) 海　口	広 東 省	2500×50	4000m^2		MD-82
(30) 貴　陽	貴 州 省	2200×50	4000m^2		B-737
(31) 済　南	山 東 省	2200×60 2600×45	3000m^2 6000m^2	New Airport Plan	An-24 MD-82
(32) 深　圳	広 東 省	3400×50		- ditto -	B-747
(33) 西　寧	青 海 省	3000×45	4000m^2	Under Construction	MD-82
(34) 三　亜	海 南 島	2600×45		New Airport Plan	MD-82
(35) 太　原	山 西 省	2500×45	1400m^2		
(36) 恩　施	湖 北 省	1700×30	1500m^2		
(37) 沙　市	〃	1500×40	2500m^2		
(38) 宜　昌	〃	1700×50	1000m^2		
(39) 襄　樊	〃	1800×45	3700m^2		

Table 4-2 Aircraft Purchasing Plan by CAAC

	Current No. of Aircraft as of February 1989	Purchasing (Retirement) up to 1990	No. of Aircraft in 1990
B747-400	0	3	3
B747-200B	3	-	3
B747SP	4	-	4
IL-62	4	-	4
B767-200ER	4	2	6
B707-300	10	-	10
A310-300	2	-	2
A310-200	3	-	3
B757-200	3	-	3
Tu-154M	11	13	24
Md-82	7	23	30
B737300	8	-	8
B737-200	15	1	16
Trident	19	(19)	0
IL-18	2	(2)	0
BAe146-100	10	-	10
An-24	26	(26)	0
Shorts360	7	-	7
Y-7-100	25	20	45
MD11	-	2	2
Total	163	64 (47)	180

Source: Planning Division, CAAC

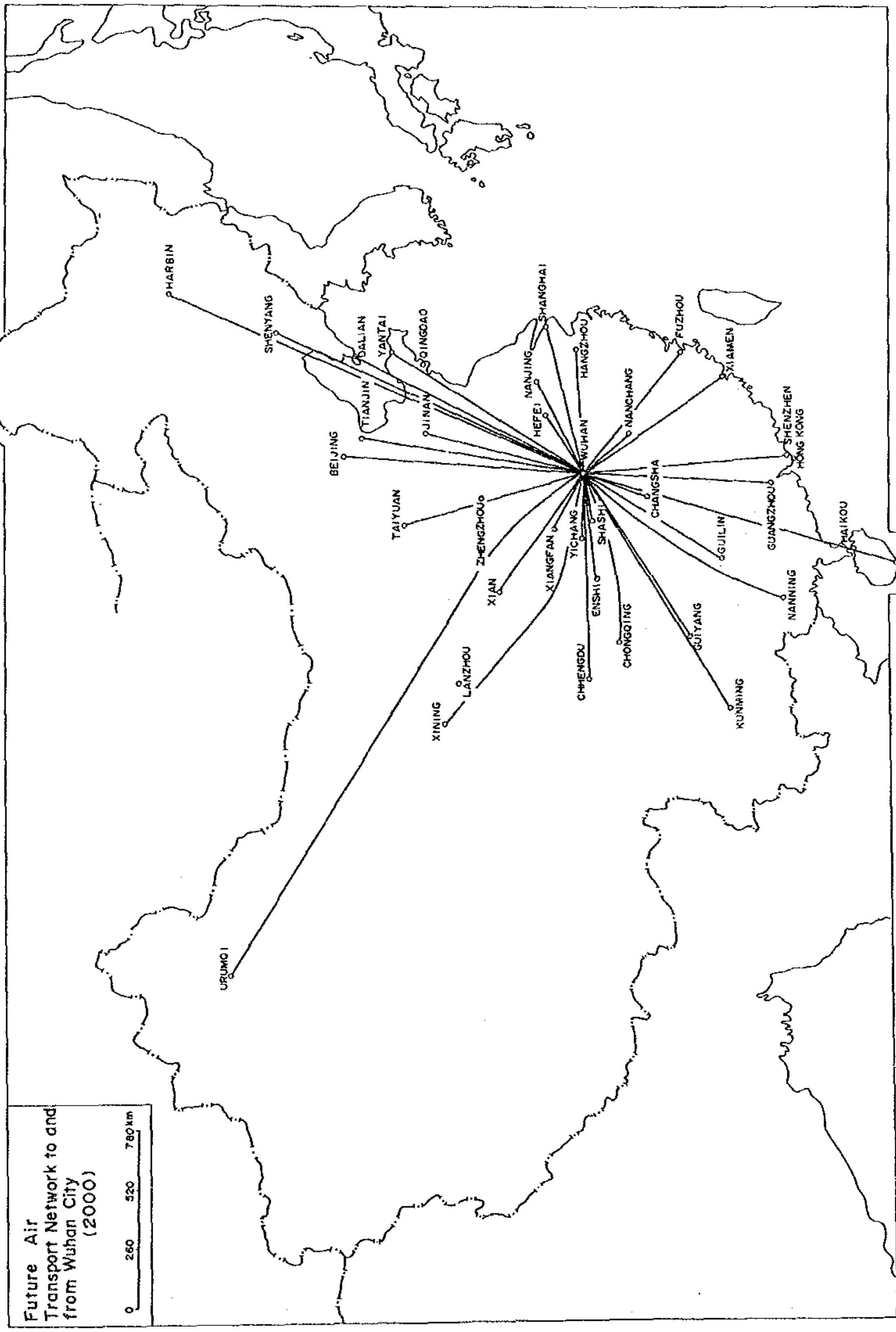


Fig.4-10 Air Route Plan

4.3 Forecast Results

4.3.1 Forecast of Air Passenger Transport Demand

(1) Forecast of Arriving and Departing Passengers at Wuhan/Tianhe Airport

Regression analyses were made on the statistical data of arriving and departing passengers at Wuhan/Nanhu Airport using the total population and gross social product of Wuhan City and time (year) as the explanatory variables for different data periods as shown in Appendices 4-6 to 4-9. The evaluation of the results to select the equation showing the best goodness of fit in each Analysis is as follows:

1) Analysis 1: Regression with Total Population in Wuhan City as explanatory variable

The equation (1) shows the best goodness of fit in terms of correlation coefficient and value as shown in Appendix 4-6.

2) Analysis 2: Regression with Gross Social Product of Wuhan City as explanatory variable

The equation (4) is considered to be of the best goodness of fit in terms of correlation coefficient, t value and data period as shown in Appendix 4-7.

3) Analysis 4: Regression with time (year) as explanatory variable

The equation (10) shows the best goodness of fit in terms of correlation coefficient as shown in Appendix 4-9.

There exists no significant difference among the equations thus selected in terms of correlation coefficient. Therefore, forecast is made on the arriving and departing passengers at Wuhan/Tianhe Airport based on the equations thus obtained, and the results are consolidated into three cases; High Case, Middle Case and Low Case, as shown in Table 4-3 and Fig 4-11.

The High Case can be interpreted as showing the future trend of air passenger demand up to the year 2000 on condition that the factors which determined the historical trend will not change in the future.

The Middle Case can be interpreted as having the close relationship with the level of economic activities of Wuhan City in the year 2000, thus regarded as the most plausible one.

The Low Case can be interpreted as showing the demand level correlated with the total population of Wuhan City in the year 2000 without regard to economic activities of the City.

Table 4-3 Forecast of Arriving and Departing Passengers at Wuhan/Tianhe Airport

Case	Forecast for Year 2000 (thousand)	Annual Average Growth Rate (%) (1987 - 2000)	Regression Equation
High Case	5,000	20	Equation (10) in Appendix 4-9
Middle Case	4,100	18	Equation (4) in Appendix 4-7
Low Case	3,400	16	Equation (1) in Appendix 4-6

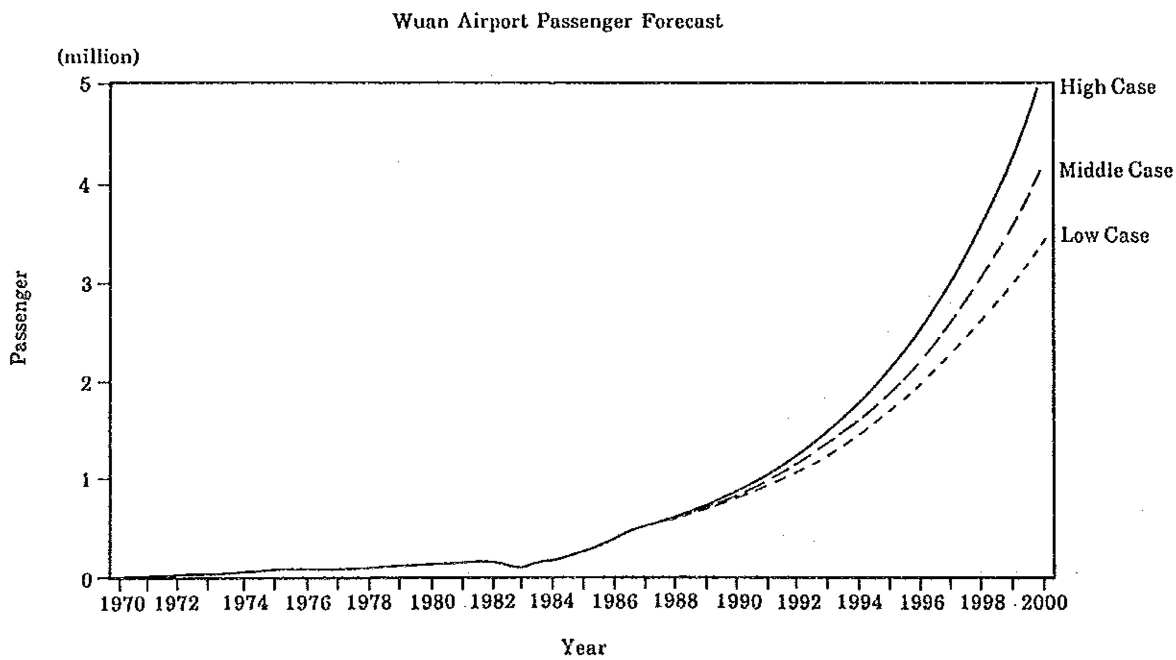


Fig.4-11 Forecast of Arriving and Departing Passengers at Wuhan/Tianhe Airport

(2) Checkup of Forecast Results

In order to check the forecast results from different angles, estimates are made both on the share of passengers arriving at and departing from Wuhan/Tianhe Airport in the total air passenger transport demand in China forecast as shown in Appendix 4-14, with the details as shown in Appendices 4-10 to 4-13, and on the number of trips by air per one thousand population of Wuhan City in the year 2000, as follows:

Forecast Results for Wuhan/ Tianhe Airport	Share in Total Passenger Demand Forecast in China(%)				Number of Trips by Air of Wuhan City (person/one thousand)	
	High Case (*1)	Middle Case (*2)	Low Case (*3)	(Present)		
High Case	4.5	6.3	10.0	(3.8)	668	(78)
Middle Case	3.7	5.1	8.2	(3.8)	548	(78)
Low Case	3.1	4.3	6.8	(3.8)	454	(78)

Note : Figures in parentheses show those of 1987.
*1 : 110 thousand in 2000
*2 : 80 thousand in 2000
*3 : 50 thousand in 2000

According to the above Table, it can be said that the forecast results in the year 2000 at Wuhan/Tianhe Airport as compared with the present level of air transport demand are regarded neither as overestimated nor underestimated, considering the economic potentialities of Wuhan City and the socio-economic position of the City in China. It must be noted, however, that if the Low Case of the total passenger demand forecast in China should be realized, then the Low Case forecast of the air passenger demand at Wuhan/Tianhe Airport would be revealed accordingly due to their close relationships.

4.3.2 Forecast of Air Cargo Transport Demand

(1) Forecast of Loaded and Unloaded Cargo at Wuhan/Tianhe Airport

Regression analyses were made on the statistical data of loaded and unloaded cargo at Wuhan/Nanhu Airport by using the total population and gross social product of Wuhan City and time (year) as the explanatory variables for different data periods, as shown in Appendices 4-15 to 4-18. The evaluation of the results to select the equation showing the best goodness of fit in each Analysis is as follows:

1) Analysis 9: Regression with Total Population in Wuhan City as explanatory variable

The equation (27) shows the best goodness of fit in terms of correlation coefficient and t value as shown in Appendix 4-15.

2) Analysis 10: Regression with Gross Social Product of Wuhan City as explanatory variable

The equation (30) shows the best goodness of fit in terms of correlation coefficient and t value as shown in Appendix 4-16.

3) Analysis 12: Regression with time (year) as explanatory variable

The equation (35) shows the best goodness of fit in terms of correlation coefficient as shown in Appendix 4-18.

There exists no significant difference among the equations thus selected in terms of correlation coefficient. Therefore, forecast is made on the loaded and unloaded cargo at Wuhan/Tianhe Airport based on the equations thus obtained, and the results are consolidated into three cases; High Case, Middle Case and Low Case, as shown in Table 4-4 and Fig.4-12.

The High Case can be interpreted as showing the demand level correlated with the total population of Wuhan City in the year 2000 without regard to economic activities of the City.

The Middle Case can be interpreted as having the close relationship with the level of economic activities of Wuhan City in the year 2000, thus regarded as the most plausible one.

The Low Case can be interpreted as showing the future trend of air cargo demand up to the year 2000 on condition that the factors which determined the historical trend will not change in the future.

Table 4-4 Forecast of Loaded and Unloaded Cargo at Wuhan/Tianhe Airport

Case	Forecast for Year 2000 (thousand tons)	Annual Average Growth Rate (%) (1987 - 2000)	Regression Equation
High Case	60	16	Equation (27) in Appendix 4-15
Middle Case	45	13	Equation (30) in Appendix 4-16
Low Case	25	8	Equation (35) in Appendix 4-18

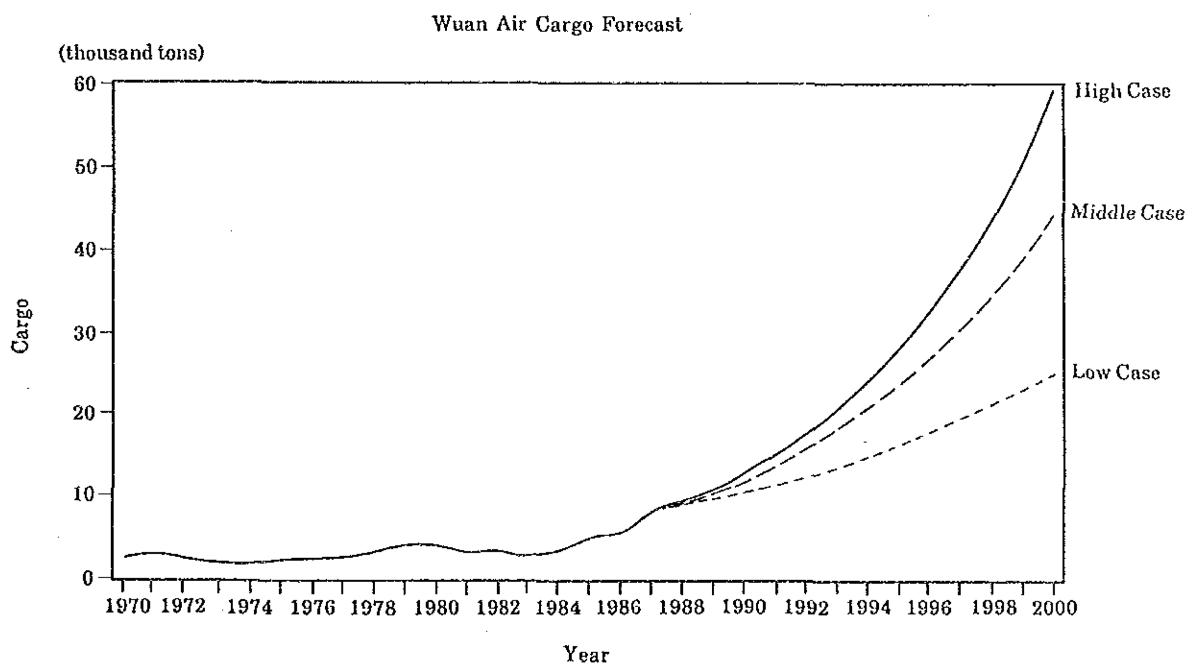


Fig.4-12 Forecast of Loaded and Unloaded Cargo at Wuhan/Tianhe Airport

(2) Checkup of Forecast Results

In order to check the forecast results from a different angle, the following estimate is made on the share of the loaded and unloaded cargo at Wuhan/Tianhe Airport in the total air cargo transport demand in China in the year 2000 forecast as shown in the Appendix 4-23, with details as shown in Appendices 4-19 to 4-22.

Forecast Results for Wuhan/ Tianhe Airport	Share in Total Cargo Demand Forecast in China (%)			
	High Case (*1)	Middle Case (*2)	Low Case (*3)	(Present)
High Case	4.3	5.0	6.7	(3.0)
Middle Case	3.2	3.8	5.0	(3.0)
Low Case	1.8	2.1	2.8	(3.0)

Note: Figures in parentheses show those of 1987.
*1: 1,400 thousand tons in 2000
*2: 1,200 thousand tons in 2000
*3: 900 thousand tons in 2000

According to the above table, it can be said that the forecast results as compared with the present level of air transport demand are regarded neither as overestimated nor underestimated, considering the economic potentialities of Wuhan City and the socio-economic position and the geographical situation of the City in China.

4.3.3 Forecast of Air Transport Demand by Route

(1) Forecast of Air Passengers by Route

A "gravity model", the name of which is derived from the Newton's Law of Gravity, is built based on present origin-destination flows of air passengers, population of each city, distance between each pair of cities, and characteristics of each route as shown in Appendix 4-24.

Forecast is made of air passengers by route to and from Wuhan/Tianhe Airport on the basis of the share by route thus obtained, which is adjusted by the present pattern of distribution and the air passenger survey results as shown in Table 4-8 hereinafter.

(2) Forecast of Aircraft Movements by Route

Aircraft types planned for Wuhan/Tianhe Airport by CAAC are shown in Table 4-5.

Table 4-5 Aircraft Types Planned for Wuhan/Tianhe Airport

Type	Number of Seats	Maximum Cruising Distance (km)	Minimum Required Runway Length for Take-off (m)
B767	212	5,130	1,590
B757	200	4,520	1,860
TU154	167	3,200	2,100
MD82	146	3,790	2,280
B737	126	2,450	1,800
BAe146	100	2,180	1,510
YN7	48	2,500	600
SH6	36	982	1,280

The criterion of aircraft types to be operated by route is established based on Table 4-5 and the number of forecast annual air passengers by route taking into consideration the Chinese aviation circumstances as shown in Table 4-6.

Table 4-6 Criterion of Aircraft Types to be Operated

Seater	Type	Cruising Distance (km)	Required Runway Length for Take-off (m)	Number of Base Air Passengers
200	B767 B757	below 5,000	over 1,900	over 500 thousand*1
150	MD82 TU154	below 3,200	over 2,300	over 50 thousand *2 and below 500 thousand
100	B737 BAe146	below 2,200	over 1,800	below 50 thousand
50	YN7 SH6	below 500	over 1,300	(within Hubei Province)

Notes : *1 : $200^{S} x 0.8^{L.F.} x 8^{F} x 365^{D} = 467,200$
*2 : $150^{S} x 0.8^{L.F.} x 4^{F} x 52^{W} = 49,920$
S : Number of seats
L.F.: Load factor
F : Number of flights
D : Days
W : Weeks

Forecast is made of aircraft movements by route based on the above-mentioned criterion, by using the following formula, the result being as shown in Table 4-8 hereinafter:

$$\text{Number of Aircraft Movements by route} = \frac{\text{Number of passengers by route}}{\text{Number of Seats x Load Factor}}$$

where: Load Factor is assumed to be 80%.

(3) Forecast of Annual Aircraft Movements

Annual aircraft movements at Wuhan/Tianhe Airport are forecast based on the result of Table 4-8 hereinafter, as shown in Table 4-7.

Table 4-7 Forecast of Annual Aircraft Movements at Wuhan/Tianhe Airport

Aircraft Type	Annual Aircraft Movements	Share(%)
50 Seater	3,404	10.7
100 Seater	2,814	8.9
150 Seater	10,634	33.6
200 Seater	14,812	46.8
Total	31,664	100.0

Table 4−8 Forecast by route

	Destination		Passenger (person, 1987)	City Population (thousand, 1987)	Distance (km)	Runway (m)	Share (%)			Forecast of		
							Records	Survey	Gravity Model	Passenger (thousand)	Air-craft	Flight
省外	1	広州	74,749	3,420	850	3,380	29.8	35.2	24.03	985.2	200S	6,158
〃	2	上海	50,771	7,220	745	3,200	20.2	14.0	16.31	668.7	200S	4,180
〃	3	北京	38,766	6,710	1,068	3,800 3,200	15.4	16.6	12.45	510.5	200S	3,192
〃	4	福州	15,048	1,240	767	2,200	6.0	5.7	4.83	198.0	150S	818
〃	5	南京	13,591	2,390	493	2,200 2,800	5.4	3.1	4.36	178.8	150S	1,490
〃	6	杭州	7,964	1,290	781	3,200	3.2	3.3	2.57	105.4	150S	878
〃	7	合肥	7,063	930	349	3,000	2.8	1.8	2.27	93.1	150S	776
〃	8	西安	6,160	2,580	685	(3,000)	2.5	4.9	1.99	81.6	150S	680
〃	9	厦門	2,841	* 380	1,167	2,500	1.1	1.8	0.92	37.7	100S	472
〃	10	沈阳	2,506	4,370	1,671	2,020 3,000	1.0	1.9	1.25	51.3	150S	428
〃	11	成都	2,064	2,690	1,072	2,600	0.8	3.9	1.23	50.4	150S	420
〃	12	大連	2,017	2,280	1,433	3,200	0.8	2.5	0.8	33.2	150S	278
〃	13	桂林	1,567	* 370	710	2,200 2,800	0.6	−	1.34	54.9	150S	458
〃	14	重慶	1,360	2,890	773	2,800	0.5	1.6	1.77	72.6	150S	606
〃	15	南昌	1.185	1,260	348	2,200	0.5	0.7	1.74	71.3	150S	596
〃	16	済南	705	2,140	780	2,200 2,600	0.3	0.6	1.33	54.5	150S	456
〃	17	鄭州	281	1,580	477	2,200	0.1	0.3	1.60	65.6	150S	548
〃	18	天津	169	5,540	1,000	3,200	0.06	−	2,50	102.5	150S	856
〃	19	哈爾濱	76	2,710	2,137	3,200	0.02	−	0.66	27.1	150S	226
〃	20	長沙	49	1,230	334	2,200 2,600	0.02	−	1.77	81.6	150S	606
〃	21	太原	468	1,980	814	2,500	0.2	−	1.20	49.2	150S	410
省内	22	宜昌	8,673	430	261	1,700	3.5	1.2	0.86	35.3	50S	884
〃	23	沙市	809	300	194	1,500	0.3	0.2	0.82	33.6	50S	840
〃	24	恩施	−	700	458	1,700	−	−	0.80	32.8	50S	820
〃	25	襄樊	−	460	288	1,800	−	−	0.84	34.4	50S	860
新規	26	海口/三	−	* 210	1,368	2,500	−	−	0.44	18.0	100S	226
〃	27	昆明	−	1,550	1,336	3,000 3,400	−	−	0.61	25.0	100S	314
〃	28	蘭州	−	1,420	1,263	3,400	−	−	0.59	24.2	100S	304
〃	29	烏魯木斉	−	1,060	3,008	3,200	−	−	0.20	8.2	150S	104
〃	30	青島	−	1,300	1,153	2,600	−	−	0.60	24.6	100S	308
〃	31	南宇	−	1,000	1,071	2,400	−	−	0.50	20.5	100S	258
〃	32	深圳	−	* 200	967	(3,400)	−	−	0.58	23.8	100S	298
〃	33	西宇	−	620	1,426	3,000	−	−	0.25	10.3	100S	130
〃	34	烟台	−	* 103	1,313	2,600	−	−	0.24	9.8	100S	124
〃	35	貴阳	−	1,430	998	2,200	−	−	0.74	30.3	100S	380
地区	36	香港	12,182	•••	•••	•••	4.9	−	5.00	205.0	200S	1,282
			251,064				100.0	99.3	100.00	4,100.0		31,664

* 経済特区／観光地

4.3.4 Forecast of Peak-Hour Traffic

(1) Peak-Day Traffic

The following premises are established in order to estimate peak-day traffic based on the Middle Case of air transport demand forecast at Wuhan/Tianhe Airport in 2000 as a general practice:

a. Peak-day is defined as the average day of the second peak-month in annual traffic.

b. There exists no variation in daily traffic.

Thus, the formula to estimate peak-day traffic is shown as follows:

Peak-day traffic = Annual traffic/365 x C

where C = Coefficient of second peak-month derived from statistical data by:

$$\frac{\text{Second peak-month traffic}}{\text{Average monthly traffic}}$$

1) Peak-Day Passenger Traffic

According to the monthly passenger traffic statistics at Wuhan/Tianhe Airport as shown in Appendices 4-25 to 4-28, coefficients of the second peak-months for the past three years are estimated to be 1.120, 1.290 and 1.182 in 1985, 1986 and 1987 respectively, amounting to 1.2 on anaverage. Based on this figure, the peak-day passenger traffic at Wuhan/Tianhe Airport in 2000 is estimated as shown in Table 4-9, with an assumed ratio of 1:1 for departure and arrival.

Table 4-9 Peak-Day Passenger Traffic at Wuhan/Tianhe Airport in 2000

(person)

	Domestic Route	Regional Route	Total
Departure	6,400	340	6,740
Arrival	6,400	340	6,740
Total	12,800	680	13,480

2) Peak-Day Cargo Traffic

Similarly, according to the monthly cargo traffic statistics at Wuhan/Tianhe Airport as shown in Appendices 4-29 to 4-32, coefficients of the second peak-months for the past three years are estimated to be 1.173, 1.261 and 1.208 in 1985, 1986 and 1987 respectively, amounting to 1.2 on an average. Based on this figure, the peak-day cargo traffic at Wuhan/Tianhe Airport in 2000 is estimated as show in Table 4-10, with an assumed ratio of 1:1.3 for loaded and unloaded cargo.

Table 4-10 Peak-Day Cargo Traffic at Wuhan/Tianhe Airport in 2000

(ton)

	Domestic Route	Regional Route	Total
Loaded	61	4	65
Unloaded	79	4	83
Total	140	8	148

3) Peak-Day Aircraft Movements

The average coefficient of the second peak-months of aircraft movements for the past three years is estimated to be almost the same figure of 1.2 as the passenger and cargo traffic, according to the monthly cargo traffic statistics at Wuhan/Tianhe Airport as shown in Appendices 4-33 to 4-34. Based on this figure, the peak-day aircraft movements at Wuhan/Tianhe Airport in 2000 is estimated as shown in Table 4-11, with an assumed ratio of 1:1 for landings and take-offs.

Table 4-11 Peak Day-Aircraft Movements at Wuhan/Tianhe Airport in 2000

(number)

	Domestic Route	Regional Route	Total
Take-offs	50	2	52
Landings	50	2	52
Total	100	4	104

(2) Peak-Hour Traffic

The peak-hour traffic as the basis for the facility requirement analysis in the next chapter is estimated by simulating the future aircraft movement distribution based on the following assumptions:

a. The present pattern of distribution of aircraft movements will not basically change for the forecast period.

b. The present operating time of 17 hours from 6:00 to 23:00 for scheduled flights will not change at Wuhan/Tianhe Airport.

c. Aircraft originating from Guangzhou, Beijing and Shanghai airports will stay overnight at each origin airport but others at Wuhan/Tianhe Airport.

d. Peak-hour cargo traffic will not be significant for the facility requirements analysis.

Based on the present pattern of hourly aircraft movement distribution grouped into five routes; Guangzhou, Beijing, Shanghai, Hong Kong and others as shown in Appendices 4-35 to 4-46, the future aircraft movement distribution is simulated as shown in Appendices 4-47 to 4-52.

The peak-hour traffic is forecast based on the above-mentioned simulation as shown in Table 4-12.

Table 4-12 Forecast of Peak-Hour Traffic at Wuhan/Tianhe Airport in 2000

		Domestic Route	Regional Route	Compound Total
Aircraft Movement	Take-offs	6	1	6
	Landings	6	1	6
	Compound Total	9	1	10
Passenger	Departure	730	130	740
	Arrival	810	160	810
	Compound Total	1,530	240	1,550

4.3.5 Short-term and Long-term Demand Forecasts

Forecasts are also made of air passengers and air cargoes demand for the year 1995 as the short-term target and for the year 2010 as the long-term target, respectively, for reference.

(1) Short-term Demand Forecast

The short-term demand forecasts for the year 1995 are made by interpolation with the average growth rates between the years 1987 and 2000 as shown in Table 4-13, and Figs 4-13 and 4-14 for passengers and cargoes, respectively.

Table 4-13 Short-term Demand Forecast for the Year 1995

Case	Air Passengers		Air Cargoes	
	Number (thousand)	Average Growth Rate (%) (1987-1995)	Tonnage (thousand tons)	Average Growth Rate (%) (1987-1995)
High	2,000	20	30	16
Middle	1,800	18	25	13
Low	1,600	16	15	8

Notes: The figures are rounded.

(2) Long-term Demand Forecast

The long-term demand forecasts for the year 2010 are made by extrapolation with Gomperz Curves as shown in Appendix 4-53 with the results as shown Table 4-14, and Figs 4-13 and 4-14 for passengers and cargoes, respectively.

Table 4-14 Long-term Demand Forecast for the Year 2010

Case	Air Passengers		Air Cargoes	
	Number (thousand)	Average Growth Rate (%) (1987-1995)	Tonnage (thousand tons)	Average Growth Rate (%) (1987-1995)
High	12,000	20	150	9
Middle	10,000	10	100	9
Low	8,000	9	60	8

Notes: The figures are rounded.

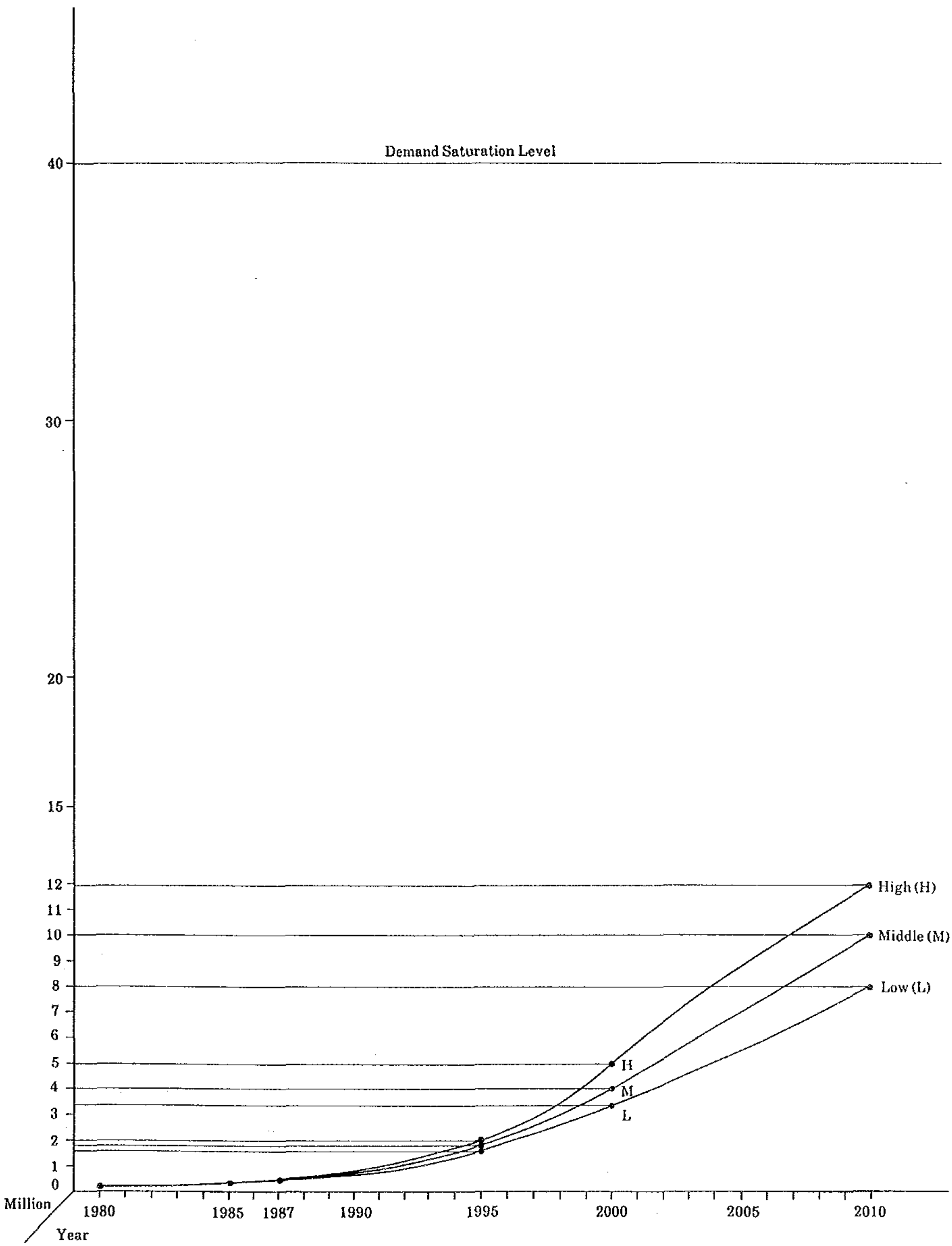


Fig. 4-13 Long-term Air Passenger Demand Forecast Wuhar/Tianhe Airport

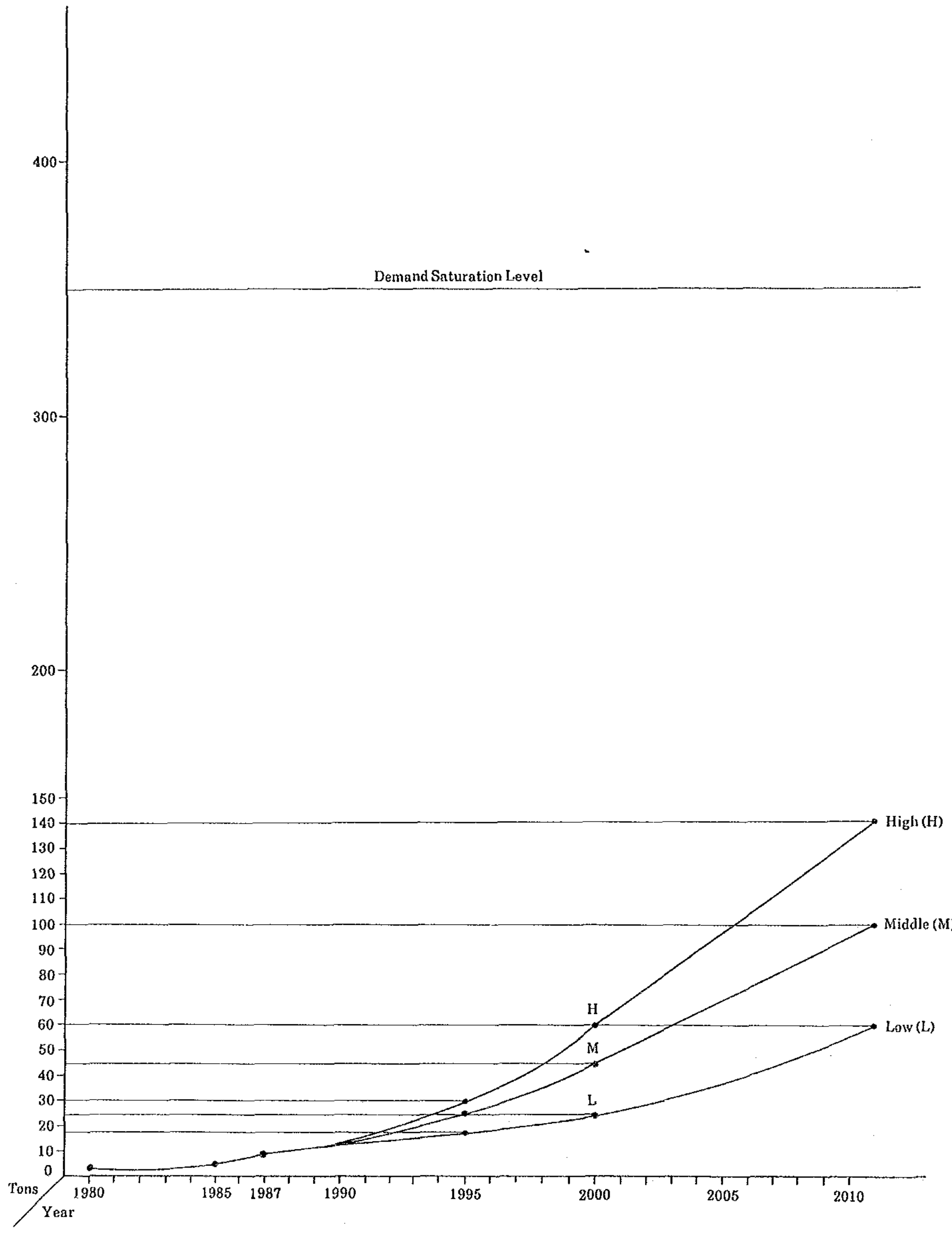


Fig. 4-14 Long-term Air Cargo Demand Forecast Wuhar/Tianhe Airport

CHAPTER 5 FACILITY REQUIREMENTS ANALYSIS

CHAPTER 5 FACILITY REQUIREMENT ANALYSIS

5.1 General

Facility requirements for the Wuhan/Tianhe Airport are determined based on the Middle Case of the air transport demand forecast for the design year of 2000 in conformity with the ICAO recommendations and the Chinese standards.

5.2 Airfield Facilities

5.2.1 Runway

(1) *Runway Length Requirement*

1) Aircraft

The following aircraft are considered in this Study:

200 Seater	B767	Longest route: Beijing(1,068km)
	B757	Longest route: Harbin (2,137km)
150 Seater	Tu154	Longest route: Urumqi (3,008km)
	MD82	
100 Seater	B737	Longest route: Xining (1,426km)
	BAe146	
50 Seater	YN7	Longest route: Enshi (458km)
	SH6	
B747 : Non-scheduled international flights Alternate for Beijing and Shanghai Airports		

2) Airport Reference Temperature

According to the 5-year records on monthly maximum mean temperature at Wuhan/Nanhu Airport, the Airport reference temperature is estimated to be 32.7°C as shown below:

(°C)

Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
7.4	8.6	13.9	21.3	26.7	29.6	32.7	32.1	27.4	21.5	16.2	9.5

3) Airport Elevation

Based on the lay of the site, the Airport elevation is assumed to be 35m from the sea level.

4) Runway Slope

Runway slope is assumed to be 0.2% based on the lay of the site.

5) Result of Calculation

The required length of the runway is calculated by aircraft type as shown in Table 5-1 with the details as shown in Appendix 5-1.

Table 5-1 Required Runway Length

Aircraft	Weight	Required Runway Length
TU154	Maximum Takeoff Weight	2,621m
MD82	- ditto -	2,754m
B757	- ditto -	2,796m
B767	- ditto -	2,367m
B747	Maximum Landing Weight	2,493m

Based on the above result, the required runway length of 2,800m is theoretically sufficient for all planned routes and aircraft types. However, in this Study, the required length of the runway for the Wuhan/Tianhe Airport is determined as 3,000m, taking into consideration the Chinese aviation circumstances that most major local airports in China are developed with the runway length of 3,000m as shown in Table 4-1 in Chapter 4.

(2) Runway Width

Runway width is determined to be 45m according to the recommendation of ICAO Annex 14.

(3) Runway Shoulders

Runway shoulders are extended symmetrically on both sides of the runway so as to secure the overall width of 60m including the runway width, i.e., with each runway shoulder width of 7.5m.

(4) Stopways

Stopways are extended at both ends of the runway with the length of 60m each.

(5) Runway Strip

The width of the runway strip is determined to be 150m each on both side from the runway centreline based on the aerodrome reference code of 4E according to the ICAO Annex 14. The runway strip must accord with the standard for a precision approach runway with the length of 60m each at both ends of the runway.

5.2.2 Taxiway

(1) Taxiway Configuration

Following taxiways are required according to the forecast peak-hour aircraft movements at the Airport:

a. Parallel taxiway
b. Entrance taxiways at each runway end
c. Right-angled exit taxiways at 450m to 600m intervals
d. Apron taxiway

Rapid exit taxiways are normally required at airports with peak hour aircraft movements of over 25 according to the ICAO Design Manual. However, at the Wuhan/Tianhe Airport, mixed traffic of large aircraft such as B767 and small aircraft such as SH6 will operate simultaneously at the peak hour. In this situation, rapid exit taxiways are very effective in terms of safety of operation. Thus, the following two cases are considered in this Study as shown in Fig.5-1.

a. Case 1: With only right-angled exit taxiways

b. Case 2: With right-angled exit taxiways and two rapid exit taxiways

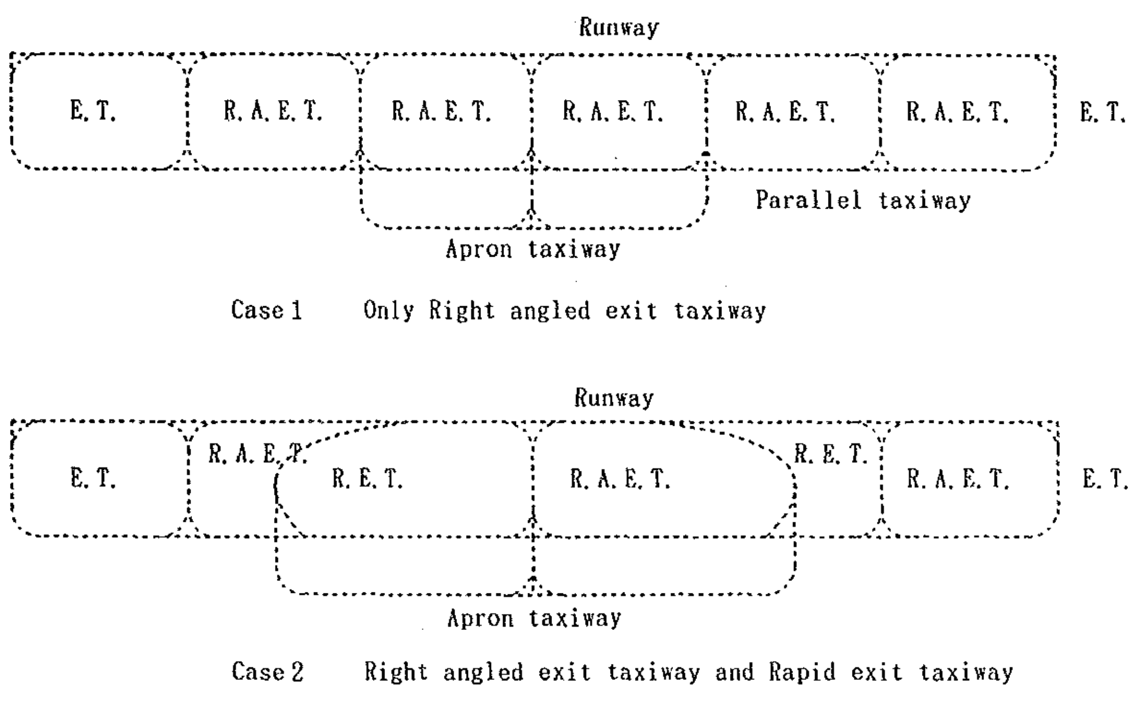


Fig.5-1 Taxiway Configuration

The difference in paved area between the two cases is about 3,200m^2 because the paved areas of a rapid exit taxiway and a right-angled exit taxiway are 7,100m^2 and 5,500m^2 respectively.

Since the total area of the runway and taxiways is estimated to be 274,000m^2 to 277,000m^2, the extra area required for two rapid exit taxiways accounts for only about 1.2% in the total paved area. Thus, the Case 2 is adopted in this Study from the viewpoint of operational safety.

(2) Location of Rapid Exit Taxiway

The location of rapid exit taxiways is determined at the point of 1,800m from each threshold of the runway according to the ICAO Aerodrome Design Manual, with the details as shown in Appendix 5-2.

(3) Taxiway Width

Taxiway width is determined to be 23m at straight portions according to the ICAO Annex 14.

(4) Taxiway Shoulders

Taxiway shoulders are extended symmetrically on both sides of the taxiway with the overall width of 44m including the taxiway width, i.e., with each taxiway shoulder width of 10.5m.

(5) Separation from Runway

The distance between the centre-lines of the runway and the parallel taxiway is determined to be 200m, considering the lineament of rapid exit taxiways.

5.2.3 Apron

(1) Number of Aircraft Stands

The number of aircraft stands is determined based on simulated flight schedule as shown in Table 5-2.

Table 5-2 Number of Required Aircraft Stands

Aircraft Type	Loading Apron		Night Stay Spot	Maintenance Spot	Total
	Loading Spot	Reserved Spot			
200 Seater	6	0	0 (2)	1	7
150 Seater 100 Seater	4	0	4 (7)	0	8
50 Seater	2	0	1 (2)	0	3
B747	0	1	0	0	1
Total	12	1	5 (11)	1	19

Note: Figures in parentheses show the number of night staying aircraft.

(2) Dimension of Aircraft Stand

The width of aircraft stand is determined as follows:

Aircraft Type	Width
200 Seater	56m
100 and 150 Seater	46m
50 Seater	40m
B747	72m

5.3 Terminal Facilities

5.3.1 Passenger Terminal Building

Facility requirements of passenger and baggage handling areas are determined on the basis of peak-hour passenger traffic derived from the simulated flight schedule as shown in Table 5-3.

Table 5-3 Required Area for Passenger Terminal Building

Facilities	Required Area (m^2)
Domestic Routes	
1. Departure Lobby	1,140
2. Ticket Lobby	480
3. Security Inspection	500
4. Gate Lounge(Holding Lounge)	3,380
5. Baggage Claim Area	800
6. Arrival Lobby	540
7. Departing Baggage Sorting Area	1,320
8. Arriving Baggage Sorting Area	360
9. VIP Area	200
10. Concessions	3,900
11. Airline Offices,etc.	10,090
Sub-total	22,710 (21,030)*
Regional Routes	
1. Departure Lobby	500
2. Departure Customs Area	35
3. Ticket Lobby	180
4. Departure Immigration Area	30
5. Security Inspection Area	100
6. Gate Lounge (Holding Lounge)	260
7. Arrival Quarantine Area	60
8. Arrival Immigration Area	280
9. Baggage Claim Area	400
10. Arrival Customs Area	30
11. Arrival Lobby	350
12. Departing Baggage Sorting Area	600
13. Arrival Baggage Sorting Area	180
14. VIP Area	100
15. Concessions	410
16. Airline Offices,etc.	2,810
Sub-total	6,325 (5,545)*
Grand Total	29,035 (26,575)*

* Excluding outdoor areas.

The number of required counters and booths are determined as shown in Table 5-4.

Table 5-4 Required Number of Counters and Booths

Counter/Booth/Conveyor	Number
<u>Domestic Routes</u>	
1. Check-in Counter	12
2. Reservation and Ticketing Counter	4
3. Security Inspection Booth	5
4. Baggage Claim Conveyer	2
<u>Regional Routes</u>	
1. Departure Customs Counter	1
2. Check-in Counter	5
3. Reservation and Ticketing Counter	1
4. Security Inspection Booth	1
5. Arrival Quarantine Counter	1
6. Arrival Immigration Counter	4
7. Baggage Claim Conveyer	1
8. Arrival Customs Counter	1
9. Departure Immigration Counter	3

5.3.2 Cargo Terminal Building

The cargo terminal building is to be located near the loading apron and be provided with adequate ventilation. The required area for each facility is shown in Table 5-5.

Table 5-5 Required Area for Cargo Terminal Building

Facility	Required Area (m^2) Domestic	Regional	Total Area(m^2)
Sorting Area	2,140	290	2,430
Airline Offices, etc.	800		800
Storage, Bonded store, etc.	800		800
Cargo Agents	850	20	870
Total			4,980

5.3.3 Aircraft Maintenance Facility

The C-check heavy maintenance is to be made for middle-sized jet aircraft at the Airport. Required areas for major maintenance facilities are shown in Table 5-6.

Table 5-6 Required Area for Aircraft Maintenance Facilities

Heavy Maintenance Hangar	:	4,200m^2(60m x 70m)
Repairing Plant	:	2,000m^2
Related Workshop	:	2,500m^2
Aircraft Parts Storage	:	4,500m^2
Ramp Service Workshop	:	800m^2
Total	:	14,000m^2

5.3.4 Ground Support Equipment and Facility

The list of typical ground support equipment (GSE) is as follows:

- Catering Truck
- Loader
- Conveyer Belt
- Passenger Steps
- Hydrant Dispenser
- Transfer Platform
- Tow Tug
- Toilet Service Vehicle
- Ground Power Unit
- Tanker
- Follow Me Car
- Ramp Bus

The required space for GSE parking lot is as follows:

Passenger Terminal Area	4,230m^2
Cargo Terminal Area	3,890m^2
Garage Floor Space	2,000m^2

5.3.5 Roads and Car Park

(1) Roads

1) Number of Visitors

The number of well-wishers per passenger is assumed to be 0.5 according to the the passenger questionnaire survey.

2) Access Transport Means

The share of each access transport means is assumed based on the passenger questionnaire survey as follows:

Taxi	30%
Bus	25%
Private cars	45%

3) Number of persons per car

The number of persons per car is assumed to be 2.5 and 3.4 for taxi and private car respectively, based on the passenger questionnaire survey.

4) Peak-Day Car Traffic

Based on the above conditions, peak-day car traffic is estimated as shown in Table 5-7.

Table 5-7 Peak-Day Car Traffic

Transport Means	Inflow	Outflow	Total
Taxi	1,703	1,703	3,406
Private Car	1,734	1,740	3,474
Bus	82	82	164
Truck	148	148	266
Total	3,667	3,673	7,340

Note: Air cargo volume per truck is estimated to be 0.5 ton.

The estimated number of persons and cars for inflow and outflow by time period is shown in Appendix 5-3.

5) Dimension of Road

The dimension of roads in the terminal area is determined as follows:

Width of lane	: 3.25m
Maximum traffic capacity per one lane	: 8,960 vehicles a day
Number of lanes:	2 (one for each direction)

The transversal section of the roads in the terminal area is shown in Fig.5-2.

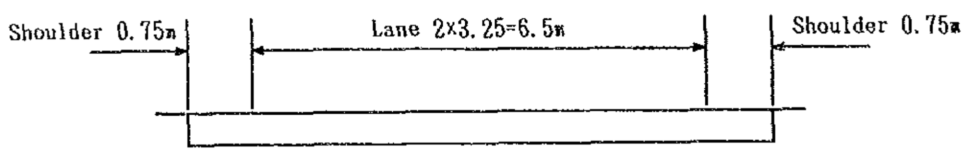


Fig.5-2 Transversal Section of Roads in Terminal Area

(2) Car Park

Based on the above conditions, the required area for car park is determined as shown in Table 5-8, the estimated inflow and outflow of staying cars by time period being as shown in Appendix 5-3.

Table 5-8 Required Area of Car Park

Transport Means	Number of Stands	Required Area per stand $(^{2})$	Total Area $(^{2})$
Taxi	160	15	2,400
Private Car	310	25	7,750
Bus	15	120	1,800
Total	485		15,600

5.4 Air Navigation Facilities

5.4.1 Radio Nav-Aids

(1) Instrument Landing System (ILS)

ILS is to be provided as precision approach aids to Runway 04 and Runway 22, consisting of Localizer (LLZ), Glide Path (GP), Middle Marker (MM), and Remote Control and Monitoring Unit. ILS should have an interlocking system so as not to be influenced by simultaneous operation at both sides.

(2) VHF Omnidirectional Radio Range/Distance Measuring Equipment (VOR/DME)

VOR/DME is to be provided for the Airport. The location and performance specification should be determined based on the air traffic control procedure and required coverage.

(3) Non-directional Radio Beacon (NDB)

NDB is to be provided for the Airport, with the location and performance specification determined based on the air traffic control procedure and required coverage.

5.4.2 Visual Aids

Runway 04 is to be provided with the Category II visual aid facilities, while Runway 22 with the Category I facilities, in accordance with the ICAO recommendations, as shown in Table 5-9.

Table 5-9 Facility Requirements for Visual Aids

Facility	To be installed
(1) Approach Lighting Systems	RWY 04:ALS (equipped with two side ro of lights extended at the distance of 270m from the threshold, and two cros bars, one at 150m and other at 30 respectively from the threshold.)
	RWY 22:ALS (equipped with a crossbar the distance of 300m from t threshold.)
	Each barrette is supplemented a capacitor discharge light except t portion at the distance of 30m from t threshold, and by a huan shi lig (omnidirectional light). Crossbars are supplemented by huan s lights except the portion at t distance of 60m from the threshold.
(2) Precision Approach Path Indicator	RWY 04 RWY 22
(3) Runway Edge Lights	at 60m intervals
(4) Runway Threshold Lights and Runway End Lights	RYW 04 RWY 02 (The threshold of RWY04 is supplemented by wing b lights.)
(5) Stopway Lights	RWY 04 RWY 22
(6) Runway Centre Line Lights	at 30m intervals
(7) Runway Touchdown Zone Lights	RWY 04 at 30m intervals
(8) Taxiway Edge Lights	taxiway and apron
(9) Taxiway Centre Line Lights	taxiway centrelines except apron taxiway
(10) Taxiing Guidance Signs	to be required
(11) Illuminated Wind Direction Indicator	RWY 04 RWY 22
(12) Apron Flood Lighting	apron

5.4.3 Air Traffic Control Facility

(1) Control Tower

Air Traffic Control Tower (Visual Control Room) is to be provided with consoles for supervisor, aerodrome control, ground control, flight data and airport lighting control. The eye-level of a controller in the control tower is to be not lower than 31m so as to be able to scan the whole aircraft movement area.

(2) Radar Approach Control

Radar Approach Control Room (IFR Room) is to be provided with consoles for supervisor, approach-control, departure control and coordinator.

(3) Airport Surveillance Radar

Airport Surveillance Radar (ASR), Secondary Surveillance Radar (SSR) and proper alfa/numeric system (terminal radar processing system) are to be installed for the execution of radar control in IFR Room. Bright Display system is to be provided at visual control room so as to monitor radar targets in bright conditions.

5.4.4 Aeronautical Telecommunications Facility

(1) Air to Ground Communications

Air to ground VHF/UHF communication equipment is to be provided as shown in Table 5-10.

Table 5-10 Required Equipment for Air to Ground Communications

Equipment	TX	RX
For Ground Control	1 set	1 set
For Aerodrome Control	1 set	1 set
For Approach Control	1 set	1 set
For Departure Control	1 set	1 set
For Distress/Emergency	1 set	1 set
For Common use	1 set	1 set

Each equipment should be of dual system. Transmitter site and Receiver site should be located separately.

(2) Fixed Telecommunications

Fixed Telecommunications system should consist of tele-typewriters for Aeronautical Fixed Telecommunication Network (AFTN) and apparatus for Direct Speech Circuits for communications with remote areas.

5.4.5 Meteorological Facility

The following meteorological equipment are to be installed in meteorological offices and airfield:

- Transmissometer
- Air and dew point temperature sensor
- Ceilometer.
- Automated data collection and recording unit
- Wind direction and speed indicator
- Anemometer and wind vane
- Barometer
- Rainfall gauge
- Mercury barometer
- MET facsimile equipment with HF receiver
- MET satellite receiving equipment (APT)
- MET radeo teletypewriters
- Weather radar

5.5 Airport-Related Facilities

5.5.1 Drainage Facility

Drainage facilities are planned in order to dispose of water from runway, taxiway, apron and terminal area as quickly as possible. Existing small channels within the airport boundary should be relocated, but modification of routes will not be studied in this Study although compensation costs are to be estimated.

5.5.2 Water Supply Facility

It is necessary to plan and construct a new water supply facility for the Airport because there is no existing water supply facility around the new airport site, which is outside of the service area of Wuhan City Water Supply Corporation.

Water intake facility is to be constructed at Yuanjiaju point of Houhu Lake side because natural water of good quality and stable quantity is expected to be obtained from Houhu Lake all the year round. Water treatment plant is to be constructed near the water intake point. The natural water will be treated in accordance with the "Sanitary Standard for Drinking Water of China", and the treated water will be transported to the airport water distribution system by water pipelines.

Water tower is to be constructed for stable distribution of water and for easy operation and maintenance. A schematic diagram of water supply system is shown in Fig. 5-3.

The following estimation is made on water consumption based on the required airport facilities as shown in Appendix 5-4:

Annual Water Consumption	690,000m^3
Mean Daily Water Consumption	2,000m^3

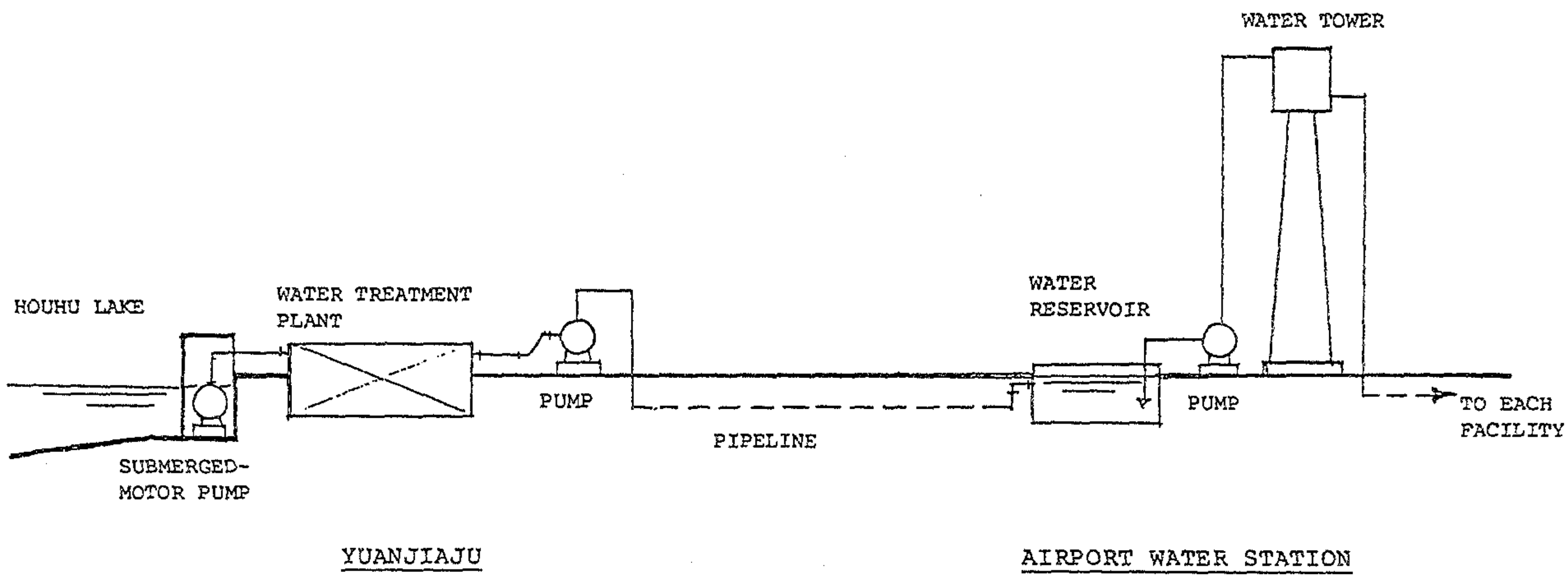


Fig.5-3 Schematic Diagram of Water Supply System

5.5.3 Sewage Disposal Facility

(1) Sewage Treatment Facility

A collective treatment system is considered to be appropriate for sewage from each facility of the Airport in terms of operation, maintenance and economy. Waste water from each facility will flow into the sewage disposal plant by sewer and be treated in conformity with the "Integrated Waste Water Discharge Standard of China" and then discharged to the Fuhe River.

Volume of waste water disposal is estimated to be 90% of total water consumption because of high interrelation between water supply quantity and waste water quantity. Estimate is made on waste water quantity as follows:

Annual Waste Water Quantity	621,000m^3
Mean Daily Waste Water Quantity	1,800m^3

(2) Trash Disposal Facility

Disposed trash in the Airport is considered to consist of wastepapers, empty bottles and garbage, etc., and can be grouped into three types of disposal, i.e. for recycling, incineration and burying. Disposal by incineration and burying is to be done inside the Airport, while that for recycling is to be dealt with by outside specialized corporations.

The following estimation is made on trash disposal quantity based on the required airport facilities as shown in Appendix 5-5:

Annual Trash Disposal Quantity	3,800 ton
Mean Daily Trash Disposal Quantity	11 ton

5.5.4 Electric Power Supply Facility

(1) Electric Power Supply to Airport

In China, a dual system by disintegrated routes is required to ensure a reliable power supply from independent substations. The required transmission lines from substations to the Airport is shown in Table 5-11 with a diagram as shown in Fig. 5-4:

Table 5-11 Required Transmission Lines

Route	Voltage	Distance
From Dai Jia Shan to Heng Dian Zhen	110KV	18km
From Heng Dian Zhen to Airport	35KV	8km
From Chen Jia Ji to Airport	35KV	25km
From Heng Dian Zhen to Oil Terminal	10kv	2km
From Airport to TX Site	10kv	3.5km
From Airport to RX Site	10kv	2km
From RX Site to Water Treatment Plant	10kv	4km

The required facilities for the substations to supply electric power to the Airport are shown in Table 5-12.

Table 5-12 Required Facilities for Subsations

Substation	Equipment
Dai Jia Shan	Breaker
Heng Dian Zhen	Breaker and Transformer (110kv/35kv/10kv 10MVA)
Chen Jia Ji	Breaker and Transformer (110kv/35kv 10MVA)

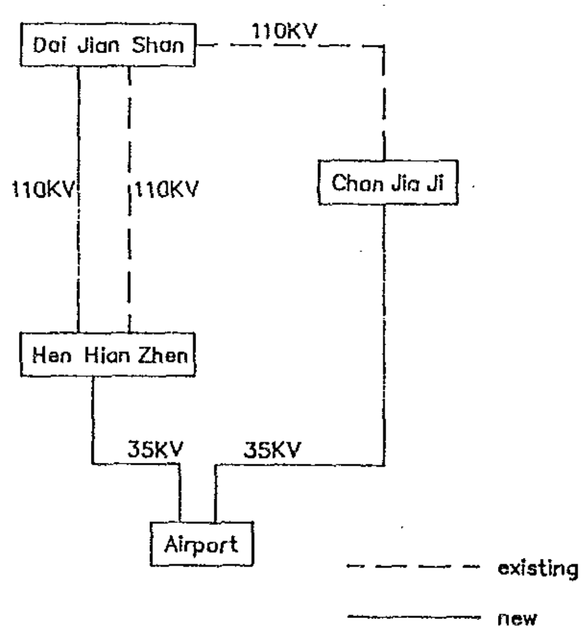


Fig. 5-4 Diagram for Electric Power Supply Transmission

(2) Electric Power Supply for Airport Facilities

The main substation is to be located in the terminal area. The voltage of the power supply for passenger terminal building, cargo building, administration building, hangar, air navigation facilities, etc. is estimated to be 10KV distributed through the main transformer of 35KV/10KV.

Electric power for air navigation facilities such as ILS and visual aids is to be supplied from substations located at each runway end. Stand-by generators are to be provided for important facilities of airport operation such as passenger terminal building, air navigation facilities, etc.

The total demand of the Airport facilities is estimated to be about 8,500KVA. As the electric power is required to be supplied by a dual system, two units of 10MVA transformers are to be provided in the main substation.

(3) Electric Power Supply for Off-Airport Facilities

Electric power supply for other facilities located outside the Airport is to be supplied from nearby substations as shown in Table 5-13.

Table 5-13 Required Electric Power Supply for Off-Airport Facilities

Facility	Transformer	Distribution Voltage
Yuan Jiaju Water Treatment Plant	200KVA	10KV
Heng Dian Oil Terminal	300KVA	10KV
RX Site	40KVA	10KV
TX Site	200KVA	10KV
RWY 04 Outer Marker	10KVA	10KV
North NDB	30KVA	10KV
South NDB	30KVA	10KV

(4) Telephone System

Trunk lines of the telephone system for the Airport are required to be installed between the telephone station in Wuhan City and that in the Airport. Requirements for the telephone system are shown below, with a diagram as shown in Fig.5-5:

Trunk Line : 300 channels of Optical fiber cable
60 channels of Microwave
Branch Line: 2,000 channels

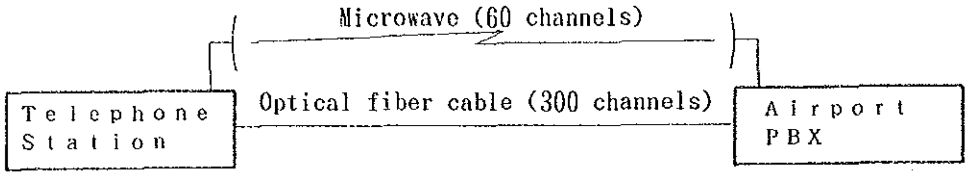


Fig.5-5 Diagram for Telephone System

5.5.5 Fuel Supply Facility

(1) Aircraft Fuel Facility

Available aviation fuel is limited to RP-2 according to the Chinese standard; however the following grades of fuel and oil are also required at the Airport:

a. Rh95/130: aviation gasoline
b. HH-20: lubricaing oil for reciprocating engines
c. HP-8: another grade of lubricating oil for reciprocating engines
d. No.180: engine cleaning agent
e. No. 0: diesel oil

All these grades of fuel and oil are to be transported to an oil terminal to be located near Heng Dian Station by railway tank cars from each oil refinery. In terms of reliability and safety, the distribution of RP-2 is made from the oil terminal to the Airport fuel depot by pipeline transfer system (Refer to Appendix 5-7).

Hydrant fueling system is provided for fuel supply from the Airport fuel depot to aircraft due to its many advantages in terms of quality control, safety and efficiency of refueling operation, etc. (Refer to Appendix 5-7). A fuel control centre is planned for the purpose of control of refueling operation to aircraft on the apron.

The schematic diagram of aircraft fueling system is shown in Fig. 5-6.

Estimate is made on fuel consumption based on the number of takeoff flights, average flight times, fuel consumption unit, etc. as shown in Appendix 5-8, with the result as shown below:

Annual Fuel Consumption	126,000kl
Mean Daily Fuel Consumption	350kl

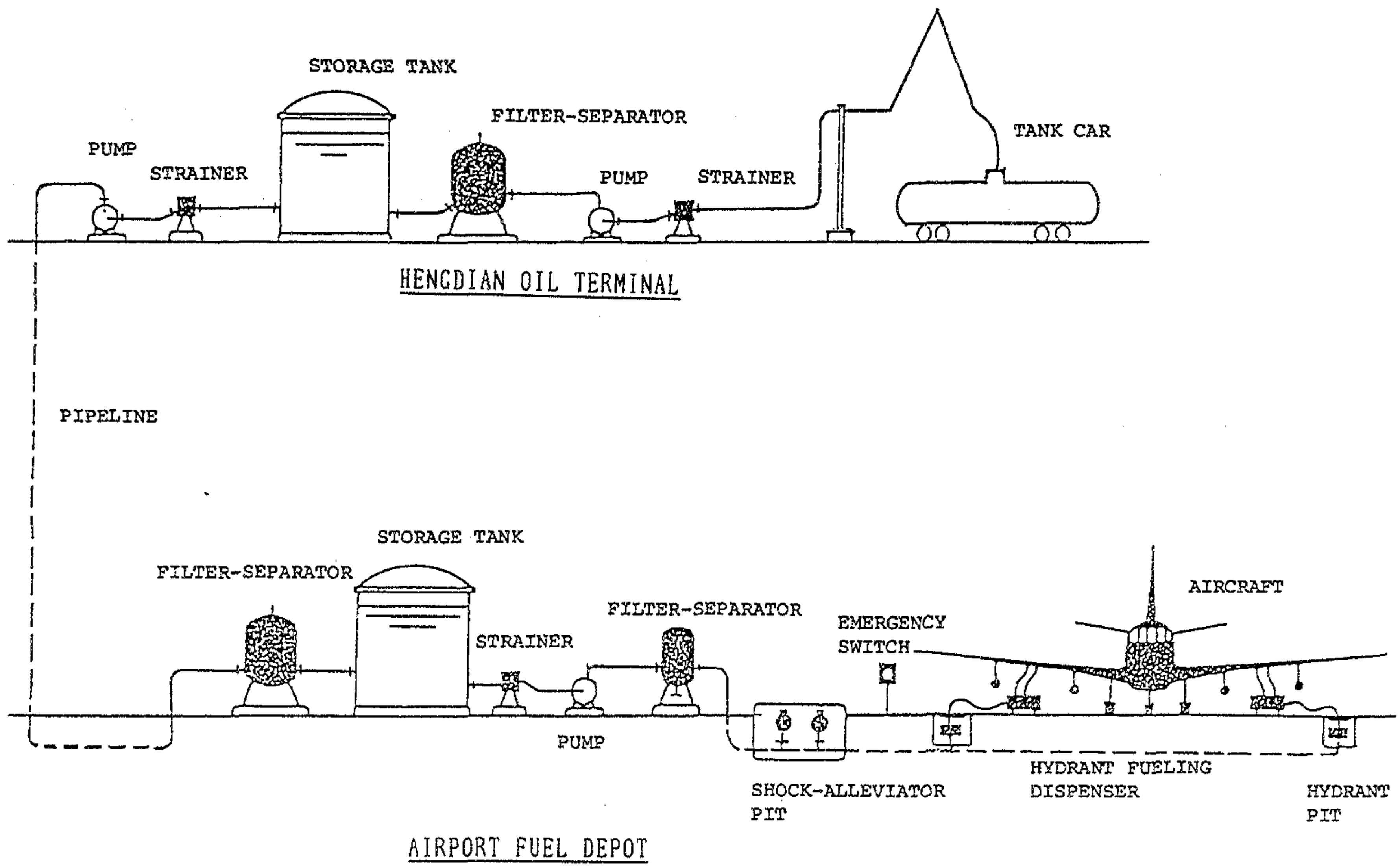


Fig 5-6 Schematic Diagram of Aircraft Fueling System

(2) Gas Supply Facility

LPG (Liquefied Petroleum Gas) is to be used for gas supply to the Airport because there is no city gas supply line or LPG supplier in the Tianhe area. Gas will be purchased directly at LPG refineries in Wuhan City and/or in other places and transported with tank lorries.

Estimate is made on LPG consumption based on the requirements as shown in Appendix 5-9, with the result as shown below:

Annual LPG Consumption	560,000 kg
Mean Daily LPG Consumption	1,600 kg

5.5.6 Air-conditioning Facility

As regards air-conditioning systems, individual system is adopted for cooling source, while central system for heating source, taking local Chinese situations into consideration.

Estimate is made on cooling and heating load capacities as shown below, with the details as shown in Appendices 5-10 and 5-11:

Cooling Load Capacity	6,700 Mcal/H
Heating Load Capacity	7,500 Mcal/H

5.5.7 Rescue and Fire-fighting Facility

The rescue and fire-fighting facility is to be equipped in accordance with Airport Category 8 Standard recommended by the ICAO Annex 14 as follows:

Rapid Intervention Vehicle	: 1
Major Vehicle	: 3
Fire Chief Commander Car	: 1
Ambulance	: 1
Total	: 6

The required area for the fire-fighting and rescue station is assumed to be about 1,500m^2.

5.5.8 Guard Facility

The required area for the guard facility is assumed to be 3,000 m^2 including the offices and canteens for security inspectors in the passenger terminal building and other buildings.

5.5.9 Related Buildings

Related buildings and facilities are required for the operation of the Airport by CAAC as shown in Table 5-14.

Table 5-14 Required Areas for Related Buildings

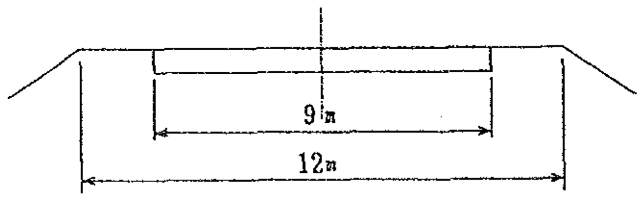
Related Buildings	Required Area(m^2)
1) Administration Building for Airport Authority	2,000
2) Administration Building for Airlines	2,000
3) Catering Facilities	2,000
4) Storage for Cabin Accessories	800
5) Common Storage	2,000
6) Airfield Staff Grooming Room	2,000
7) Storage for Building Materials	500
8) Pilot and Crew Room	3,000
9) Medical Check and Health Control Room	500
10) Staff Housing for Unmarried Persons of Airlines	1,500
11) Canteens for Airline Employees	1,500
12) Canteens for Airport Authority	1,500
13) Clinic/Medical Office	800
14) Staff Housing for Married Persons of Airport Authority	19,000
15) Welfare and Living Service Facilities 16) Electric Division of Service Facilities 17) Culture Centre 18) Public Baths	2,000
19) Public Nursery and Kindergarten	1,500
21) Staff Accommodations	1,500
22) Downtown Staff Housing	36,000
23) Downtown Ticketing Office	6,000
Total	86,100

5.5.10 Related Roads

(1) Airport Access Road

1) Road Section

The traffic volume of the airport access road is estimated to be 7,340 vehicles per day for both directions. According to the Road Standard of China, the width of the road is determined as follows:



Assuming the width of the lane of 3.5m, the lateral clearance including the 1m-wide shoulder is 2.5m on either side. The possible traffic capacity of the access road is estimated to be 2,250 vehicles per hour for both directions according to the formula. The maximum possible traffic capacity per day is estimated to be 13,200 vehicles in the year 2000. Thus, the access road section is considered to be sufficient for the estimated traffic volume.

2) Alternative Plans of Routes

The following three alternative route plans are studied including the original route plan prepared by Hubei Regional Office of CAAC as shown in Fig.5-7, with the longitudinal profiles as shown in Appendices 5-12 to 5-14:

Route-1 (the original plan) is planned to secure the shortest distance from Taoyuanji I.C. to the airport terminal.

Route-2 is planned to obtain the higher planning elevation of the road than anticipated flood level (M.H.W.L. = 27.9m).

Route-3 is planned to improve the curve element of Route-2.

The Table 5-15 shows the comparison of three routes.

To balance the volume of cuts and fills in earthwork, the planning elevation of Route-1 is calculated to be 26m, which is slightly lower than the flood level (H.H.W.L.). However, the planning elevation of some parts of the Dai Huang Road, closer to Wuhan City from Taoyuanji I.C., has been determined to be around 25m.

Therefore, the planned elevation of 25 m of Route-1 is considered to be tolerable. Moreover, the other planning conditions of Route-1, such as the distance, the number and length of concrete structures and the volume of earthwork, are more preferable as compared with Route-2 and Route-3.

In conclusion, Route-1 is recommended in this Study.

Table 5-15 Comparison of Routes for Access Roads

Item	Route-1	Route-2	Route-3
Route Length	9.7 km	11.4 km	12.5 km
Planning Elevation	25 m	27 to 32 m	28 to 35.5 m
Roughly Estimated Amount of Earth Work	Cut 294 thousand m^3 Fill 272 thousand m^3	Cut 275 thousand m^3 Fill 264 thousand m^3	Cut 279 thousand m^3 Fill 299 thousand m^3
Structure	Crossing the channel :4 locations Total length: 100 m	Crossing the channel :3 locations Crossing the reservoir :1 location Total length: 200 m	Crossing the channel :3 locations Crossing the road :2 locations Total length: 180 m
Number of Curves	1	7	5
Removal of Settlements	Nil	Nil	Nil
Maximum Height of Cuts	9.5 m	9.0 m	12.0 m
Maximum Height of Fills	6.0 m	7.0 m	7.0 m
Maximum Longitudinal Slope	0.45%	2 %	2.1 %
Total Evaluation	Fair	Good	Good

Fig.5-7 Alternative Plans of Access Road Routes

Fig.5-7

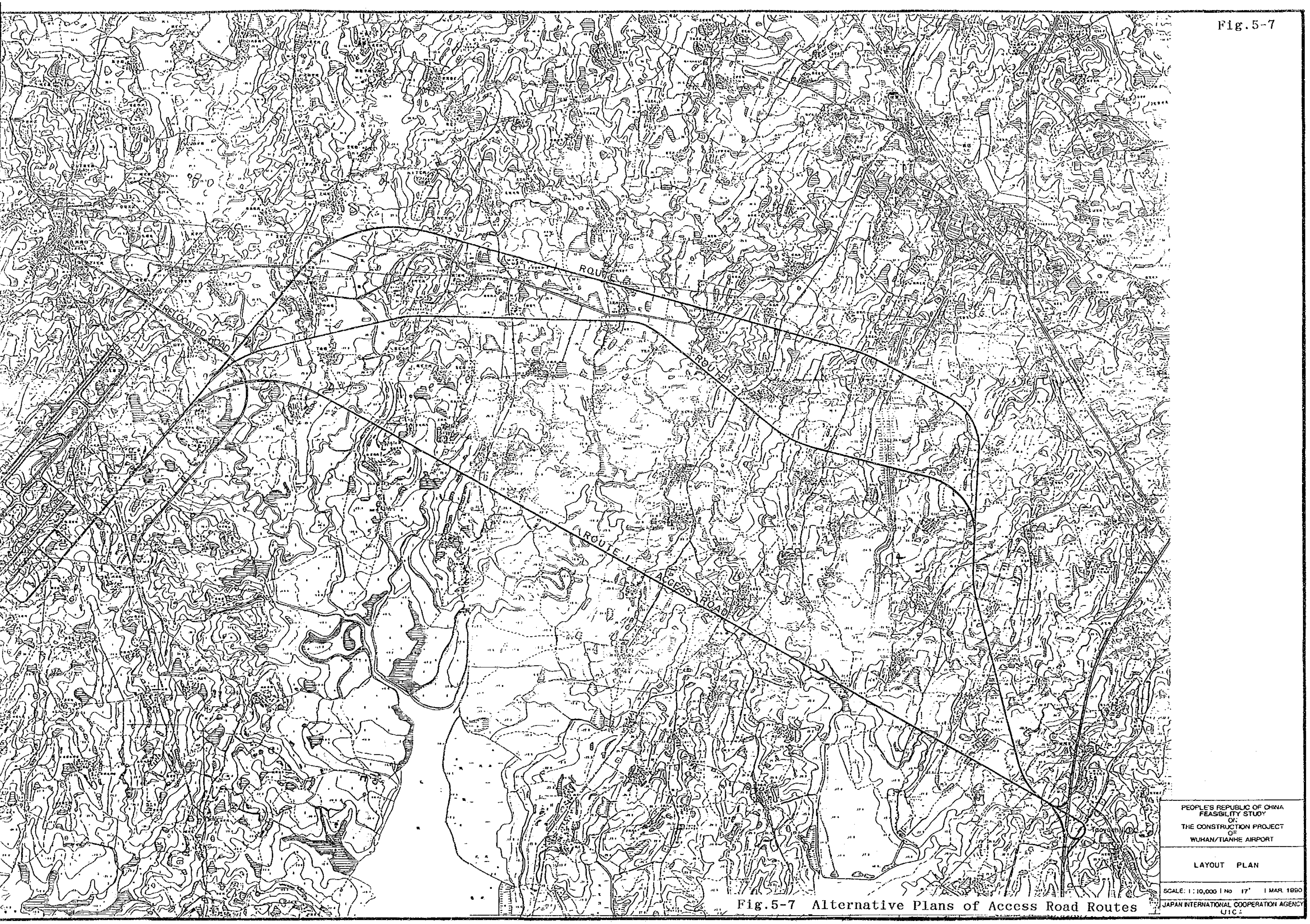


Fig.5-7 Alternative Plans of Access Road Routes

(2) Relocation of Existing Road

1) Objects of Relocation

The existing road connecting Tianhe to Wuhan City centre, which crosses the Airport site is to be relocated with the completely identical physical characteristics. Relocation of existing other small roads is not covered in this Study, but its cost is included in the land compensation costs.

2) Alternative Plans for Relocation

The following three alternative routes for relocation of the existing road are considered as shown in Fig.5-8:

Route-1 is planned along the boundary of the Airport, taking the second runway into consideration .

Route-2 is planned to cross the access road at the point where the ground elevation is relatively low.

Route-3 is planned to obtain a more direct path.

The Table 5-16 shows the comparison of three routes.

It is considered that Route-2 is the most recommendable plan from the viewpoint of the future expansion of the Airport because it will not affect the location of the second runway.

Table 5-16 Comparison of Routes for Relocated Roads

Item	Route-1	Route-2	Route-3
Route Length	4.3 km	4.3 km	4.5 km
Relation to Channels	No problem	No problem	3 intersections
Relation to Villages	No problem	No problem	No problem
Ground Elevation	The length of low portion (about 20m) is 150m.	The length of low portion is 300m.	The length of low portion is 1500m.
Number of Curves	7	8	4
Intersection to Access Road	Ground elevation is 30m ·The volume of excavation in constructing the underpass is large.	Ground elevation is 23m ·The construction of the underpass is easy.	Ground elevation is 20m ·The construction of the under pass is easy.
Total Evaluation	Fair	Best	Good

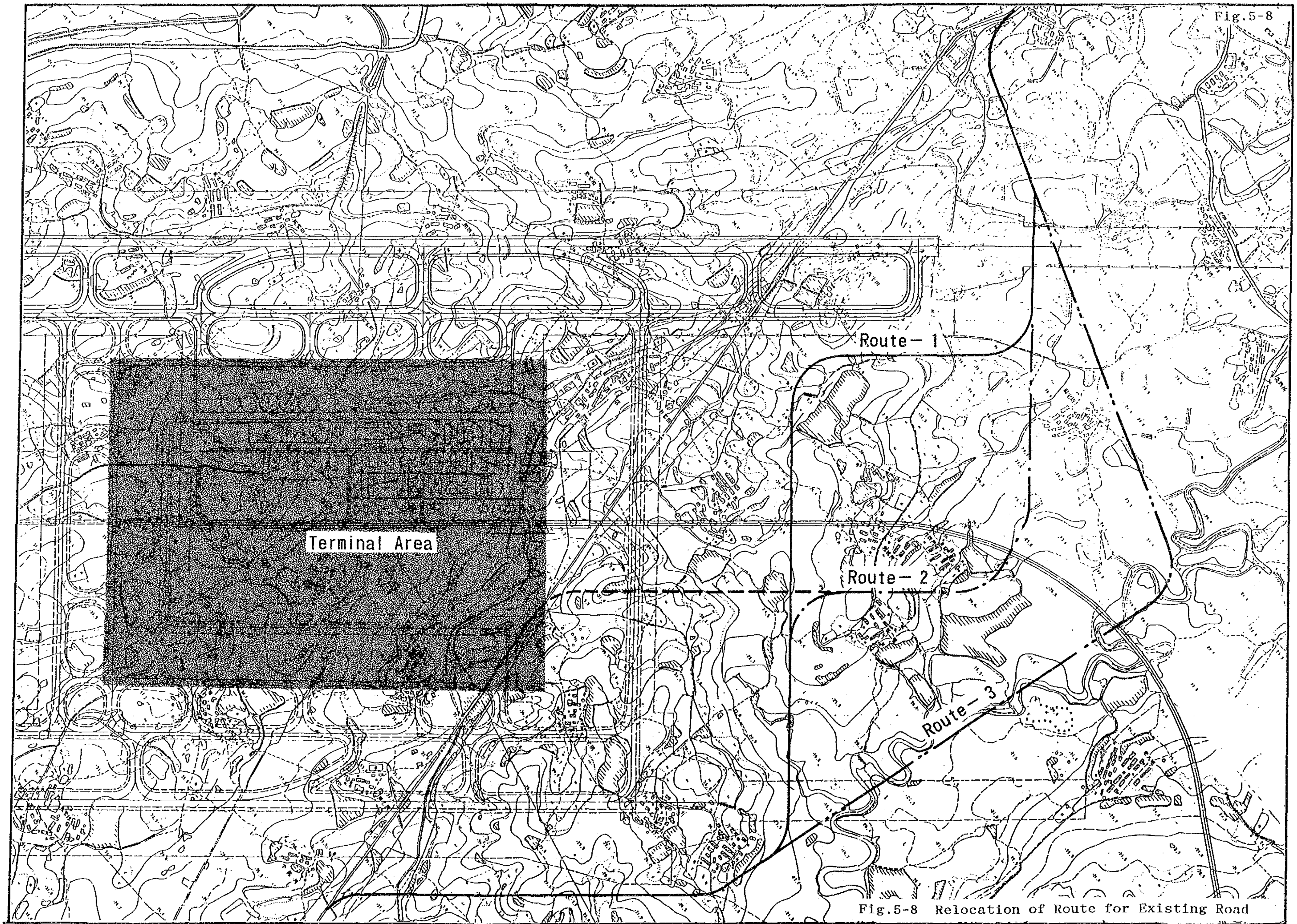


Fig.5-8 Relocation of Route for Existing Road

5.5.11 Exclusive Railway

(1) Transport of Aircraft Fuel by Railway

In China, aircraft fuel is generally transported by railway from oil refineries to airports. However, the volumes and intervals in transporting aircraft fuel from each oil refinery to each airport are not necessarily constant, depending on the facility capacity of the oil refineries and the transport capacity per one railway car in the transit sections. There are instances where the number of tank railcars ranges from several to some fifty at the time of arrival at a certain airport. In this situation, the constant transport of aircraft fuel cannot be expected.

For this reason, it is regulated by the Aircraft Fuel Service Act of CAAC that aircraft fuel be reserved at least for two or three times of the required fuel volume per month depending on airport traffic. At Wuhan/Tianhe Airport, it is requested that the required volumes of aircraft fuel for two months be reserved. Accordingly, planning is made in this Study for the exclusive railway facility to transport the said aircraft fuel volume from each fuel refinery.

(2) Site for Aircraft Fuel Terminal (Oil Terminal)

It is a common practice in China that aircraft fuel is transported to oil terminals located outside airport boundaries by railway, and from there to the airport fueling station by pipeline. Therefore, planning is made for aircraft fuel terminal facilities where aircraft fuel is unloaded from tank railcars, stored, and transported to the Airport by pipeline with pressure.

Wuhan/Tianhe Airport is planned to be constructed at a distance of about 10km to the south from Heng Dian Station, the nearest railway station of Jing Guang Railway Line.

Heng Dian Station is situated at about 45m above the sea level which is above the high-water level of 27.03m of the Chang Jiang River. It deals with local passengers and local freight of about 150 thousand tons annually, comprising mainly coal and fertilizer for unloading and agricultural products for loading.

The Station has the main up and down lines with the subsidiary tracks of the effective length of 850m each. It also has the freight unloading tracks at both sides of the main lines together with the private siding at the left side of the origination point, as shown in Fig.5-9.

Electrification works are now in progress between Wuchang and Zengzhou of Jing Guang Railway Line to reinforce pulling capacity from the current 3,200 tons to 4,000 tons. Accordingly, extension works of the effective length of the main track of the Station are under way.

Furthermore, additional works are now in progress for freight platform facilities by the Railway Department, considering the freight transport demand for the new Airport and the regional development plan of the area, as shown in Fig.5-10.

Thus, the Station is considered to be the most suitable one for the private siding of the Airport to be connected, and the aircraft fuel facility is planned to be constructed near the Station.

(3) Connection of Private Siding and Oil Terminal Site

It is almost impossible to branch out a private siding for aircraft fuel from the existing yard of Heng Dian Station due to operational difficulties, topographical conditions and surrounding facilities. Accordingly, a private siding is planned to be connected with the pulling-up line of additional freight platforms as shown in Fig.5-10 and Fig.5-11.

By the same token, the oil terminal is best to be sited along the extended pulling-up line for freight as shown in Fig. 5-10 and Fig.5-11 where the crowded areas around the Station are remote and the connecting road from the Airport access road to the oil terminal can be easily constructed.

Two alternative plans for the site of the oil terminal are considered as shown in Fig.5-12. However, there exist some problems in these plans that it is difficult to secure large area for the oil terminal and the operation of freight platforms will be disturbed.

(4) Private Siding

The private siding is to be installed almost in parallel with Jing Guang Railway Line and planned to secure the regulated distance with the oil terminal. The topographical conditions are such that the area is of a gentle slope downward on the right side of the main line with Jing Guang Line as the ridgeline, and comprises mostly farms with some small ponds scattered, being located from 35m to 45m above the sea level.

The rail level of the private siding is set at the height of 45.63m in accordance with that of the pulling-up line of freight platforms at Heng Dian Station. Although economically it is better to minimize the filling volumes by considering the downward slope of the area, the private siding is to be planned at a level so as to minimize impact on the oil terminal in case railcars should run mistakenly due to errors of workors on handling or maneuvering at the freight platforms.

The extension line capable of handling more than a half of one tank railcar train is planned at the middle point between the oil terminal and the freight platforms so as not to disturb the maneuvering at the freight station.

(5) Facilities of Oil Terminal

Presently in Jing Guang Railway Line, one exclusive train for aircraft fuel is formed with 48 (forty-eight) tank railcars, and in future it will be extended up to 60 (sixty) railcars on condition that upgrading of facilities at oil refineries and reinforcement of transport capacities at transit sections are made. Accordingly, in this Study, planning is made for facilities of the oil terminal so as to handle one exclusive train comprising 48 tank railcars together with a reserved area for extension to cater for a 60-railcar train in future.

The unloading line for aircraft fuel is to consist of double lines taking into consideration such points as to minimize installation works for tank railcars, to facilitate maneuvering of workmen for unloading, and to shorten the length of piping and extension of pipes for unloading of aircraft fuel. Furthermore, facilities for unloading fuel are to be installed between the lines.

A culvert box of 2m span is to be installed so as to let pipelines and workmen pass in the middle of the unloading line on the side of the oil terminal by utilizing the difference of the height of about 4m between the unloading lines and the oil terminal.

The oil terminal is to be installed with 2 (two) oil tanks of 2,000kl on the southern side of the unloading lines together with pump rooms, oil testing rooms and administration buildings distributed at certain intervals, as shown in Fig. 5-13.

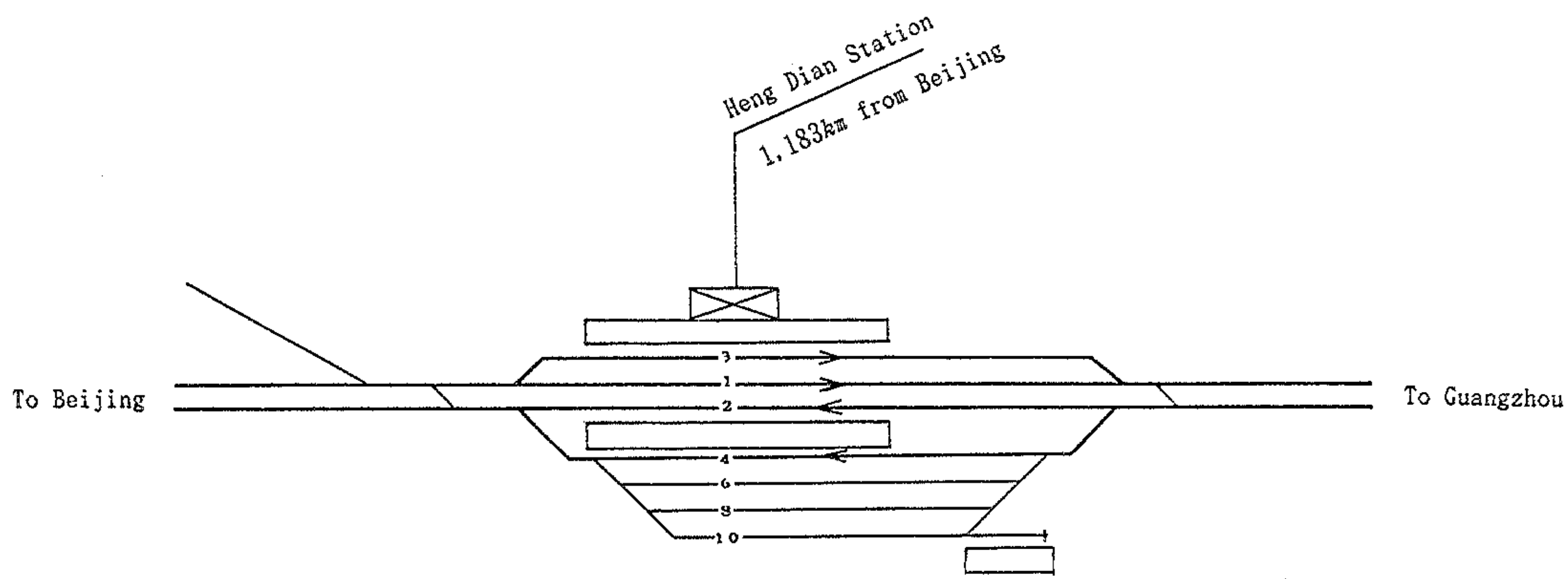


Fig. 5-9 Existing Layout Plan of Heng Dian Station

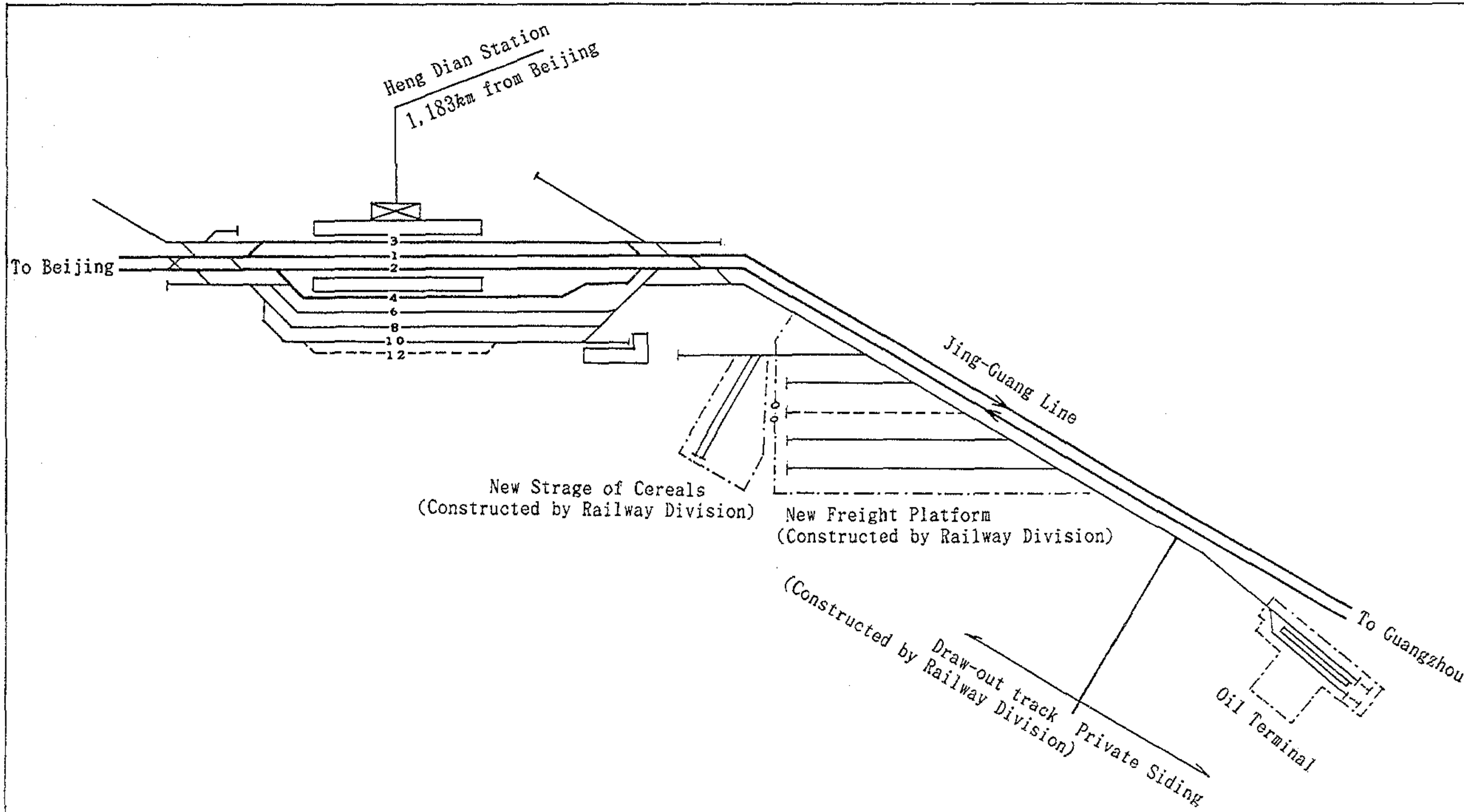


Fig. 5-10 Expansion Plan of Heng Dian Station

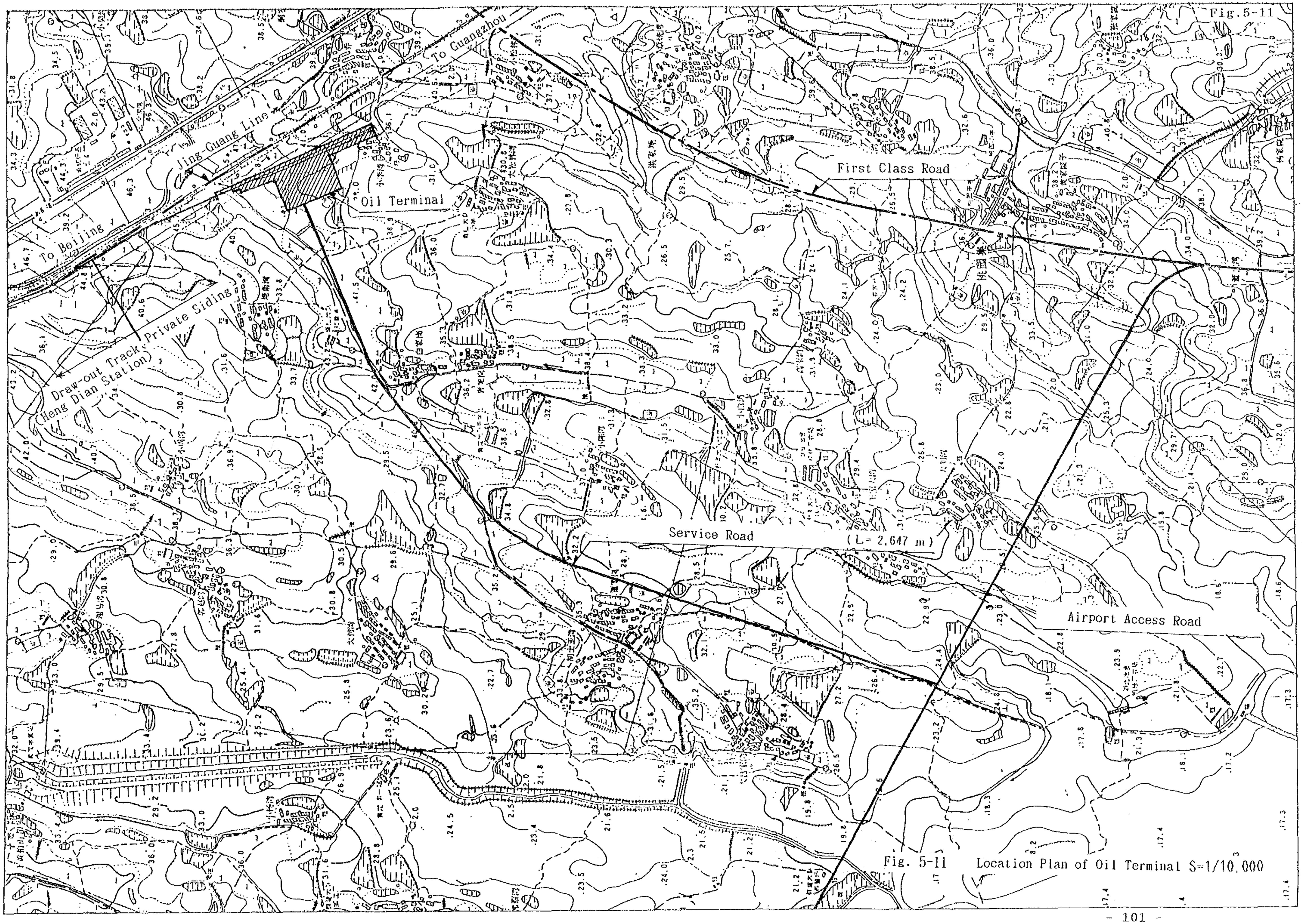


Fig. 5-11 Location Plan of Oil Terminal S=1/10,000

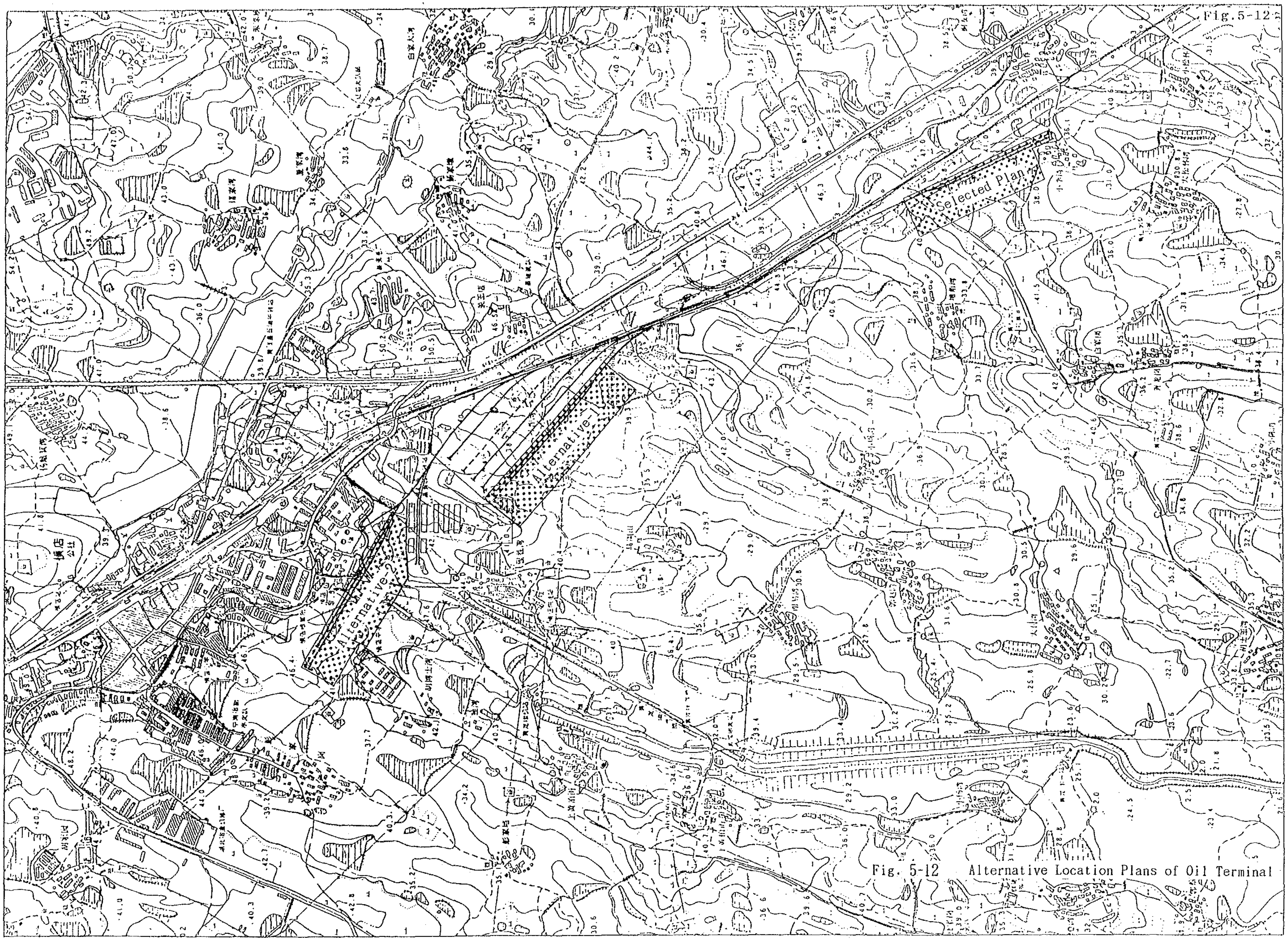


Fig. 5-12 Alternative Location Plans of Oil Terminal

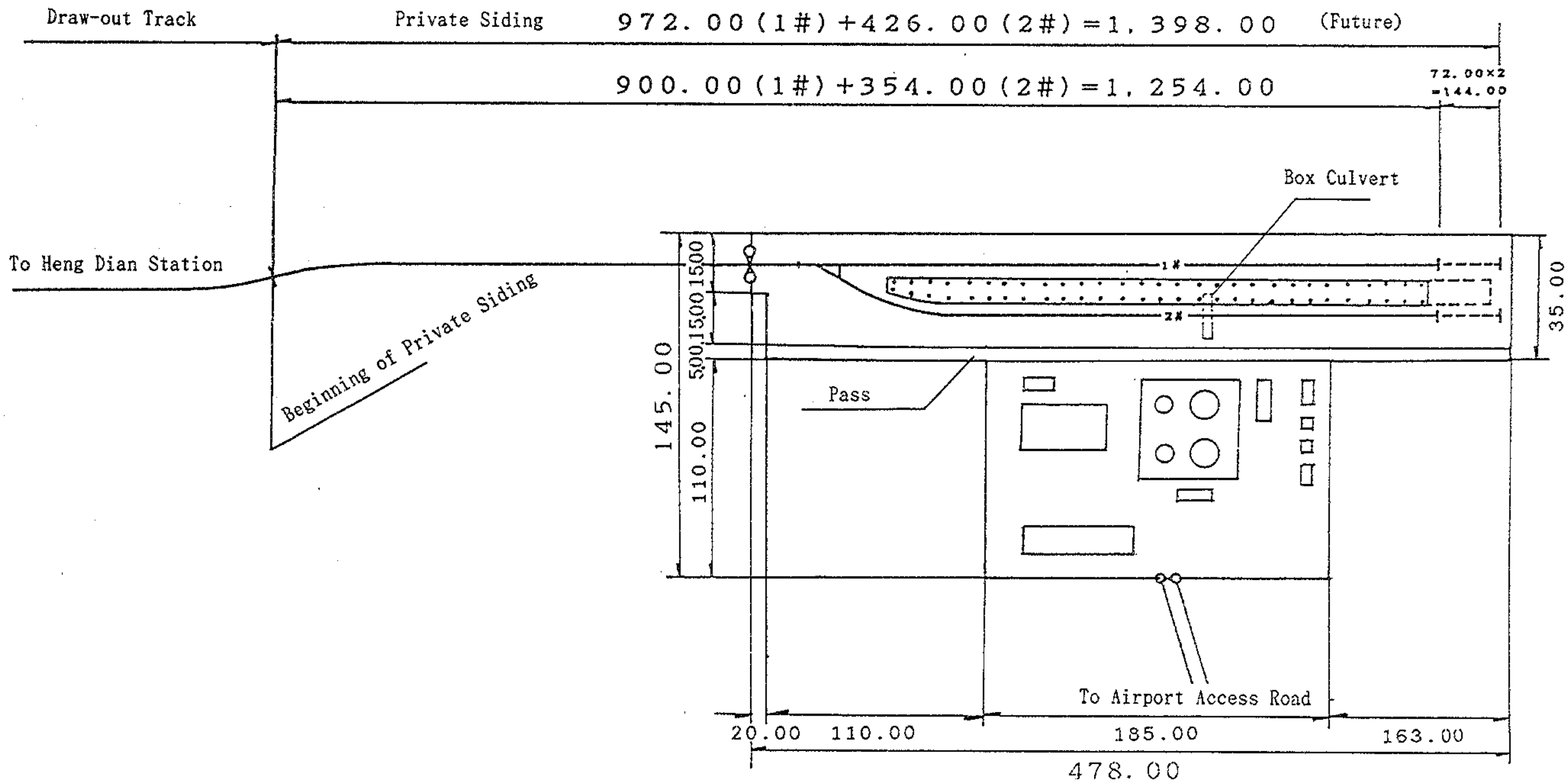


Fig. 5-13 Layout Plan of Exclusive Railway

CHAPTER 6 NEW AIRPORT MASTER PLAN

CHAPTER 6 NEW AIRPORT MASTER PLAN

6.1 Layout of Airport Facility

6.1.1 Location of Runway

(1) First Runway

The direction and location of the first runway for the design year of 2000 has been decided by the Chinese side as follows:

a. Direction : N43° 50'E(MN)

b. Airport Reference Point;
Latitude : 30° 47'01"N
Longitude : 114° 12'27"E

As mentioned in Chapter 3, there exists no problem on the runway direction. Moreover, it can be said that the location of the runway is best selected due to the following reasons:

a. The ground elevation at the southern portion of RWY 04 end of about 20m to 25m is considered to be relatively low and the northern portion of RWY 22 end also slopes downward. Therefore, it is not desirable to shift the runway end either to the south or to the north.

b. If the runway is moved to the west, the ground elevation becomes lower, requiring much more filling works. Furthermore, if the runway is shifted to the east, it will affect the second parallel runway planned in the future, requiring more filling works.

(2) Second Runway

The second runway is considered to be constructed parallel to the first runway in the long-term plan beyond the year 2000 by the Chinese side. In this Study, the planning considerations are made on the location of the second runway in order to clarify the whole airport boundary, as follows:

a. The distance between the centrelines of both runways is to be 1,650m so as to secure simultaneous operations.

b. The both runway ends are to be offset taking into consideration taxiing distances of aircraft.

c. The second runway is to be offset about 800m to the south from the end of the first runway, considering the layout of the taxiway attached to the first runway.

6.1.2 Location of Terminal Area

The following two alternative plans for the location of the terminal area are considered, as shown in Fig.6-1:

Location-1 is planned so as to locate the centre of the terminal area on the line of the middle point of the runway.

Location-2 is planned so as to locate the centre of the terminal area on the line of the gravity centre of the whole airport boundary including the second runway to be constructed in the long-term plan beyond the year 2000.

In this Study, the plan of Location-2 is selected for the following reasons:

a. The taxiing distance of take-off aircraft using the main runway (RWY 04) by the plan of Location-2 is shorter than that of Location-1.

b. The plan does not necessitate the relocation of Daodian village which will be the case for the plan of Location-1.

c. The plan has an advantage in expansibility for the long-term plan beyond the year 2000.

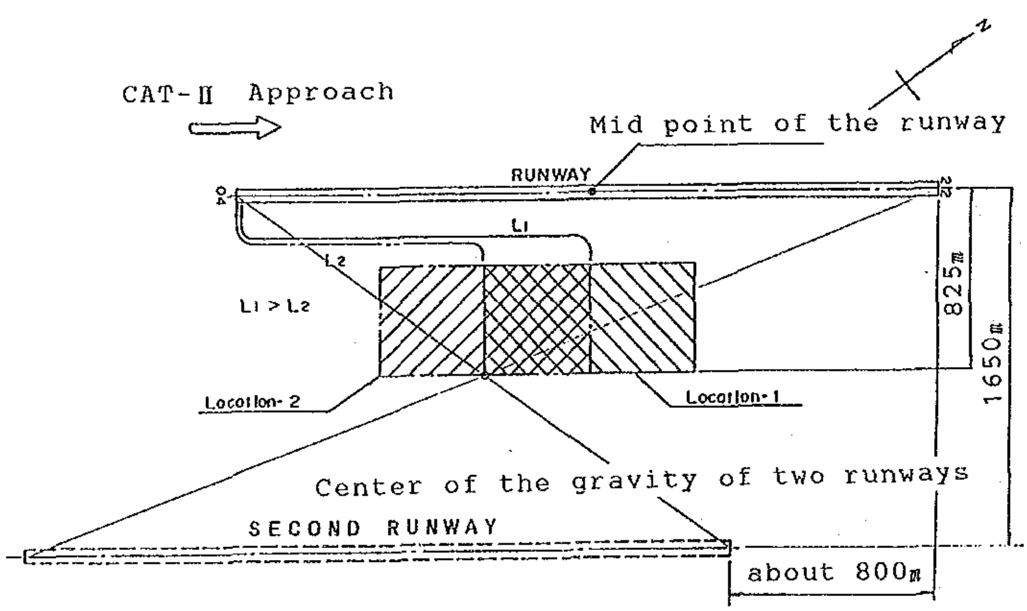


Fig. 6-1 Alternative Plans of Location of Terminal Area

6.1.3 Airport Boundary around Runway

The airport boundary around the first runway is planned as below.

(1) West Side Boundary

The boundary is set at the distance of 160m from the runway centre line, by adding 10m for the maintenance road to the width of the runway safety area.

(2) East Side Boundary

The boundary is set at the distance of 60m from the centre line of the parallel taxiway, by adding 10m for the maintenance road to the width of the taxiway safety area.

(3) ILS Antenna Site

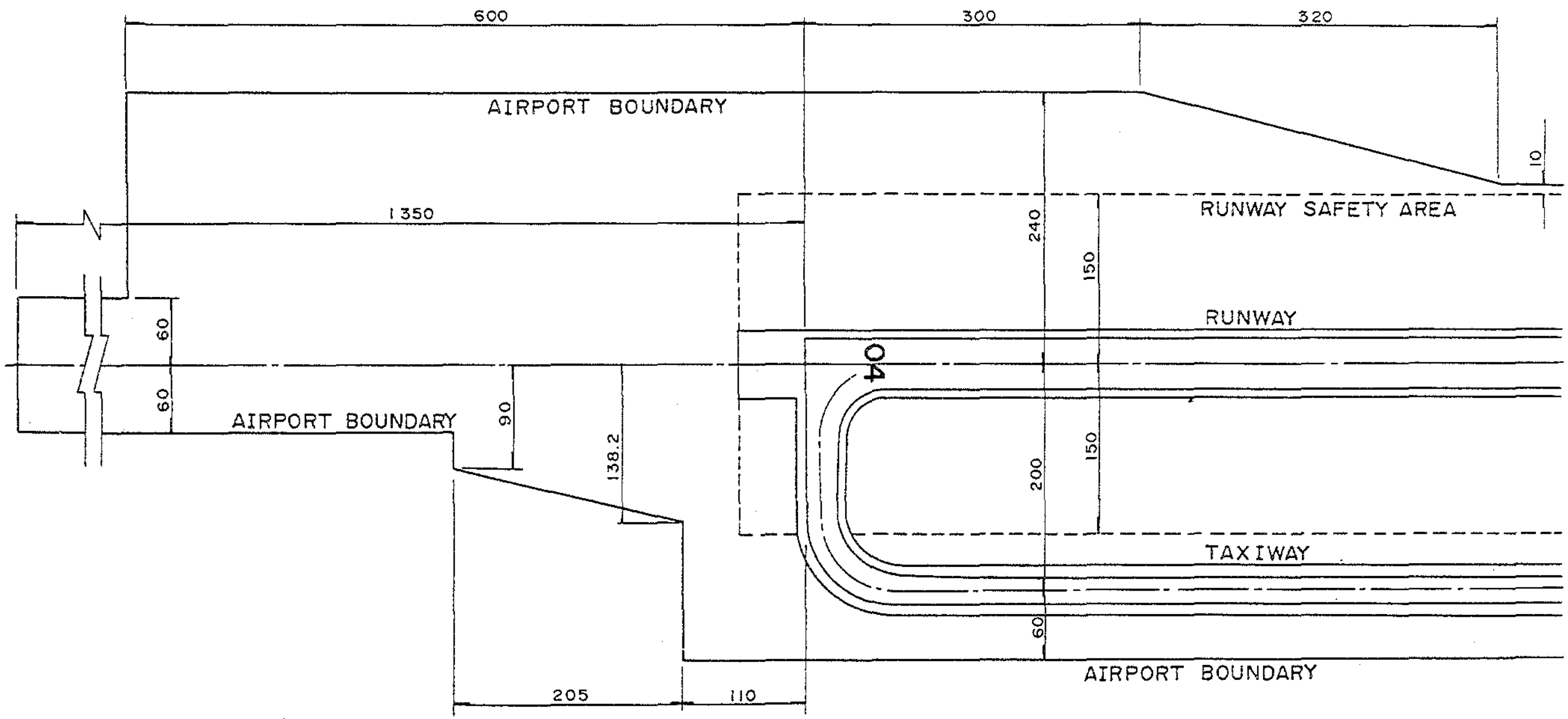
The grading area for ILS/LLZ and GS antenna site is planned with reference to the standards of ICAO, FAA and JCAB (Refer to Appendices 6-1 to 6-3).

The planned airport boundary around the runway is shown in Figs.6-2 and 6-3 for RWY 04 and RWY 22 respectively.

6.1.4 Runway Longitudinal Profile

The longitudinal profile of the runway is planned based on the estimated amount of earthworks to balance the filling and the cutting. In the case of the study prepared by the Chinese side (Refer to Appendix 6-4), it is estimated that the amount of cutting works greatly exceeds that of filling works. Thus, in this Study, the modified longitudinal profile is planned as shown in Appendix 6-5.

Fig. 6-2 Required Area Around Runway 04



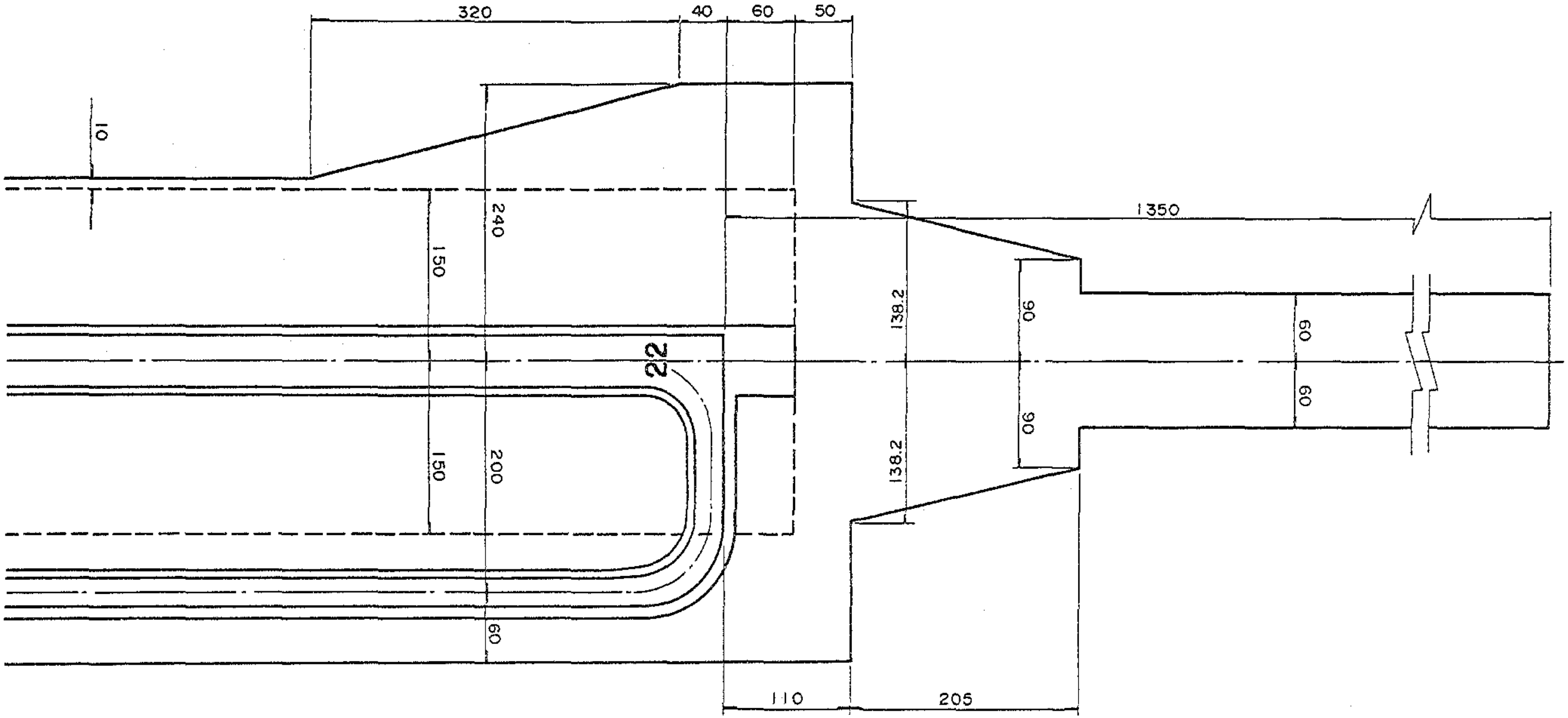


Fig. 6-3 Required Area Around Runway 22

6.2 Airport Layout Plans

6.2.1 Basic Concept for Apron and Terminal Building

The concepts on passenger terminal buildings are classified from various aspects as follows:

1) Classification in terms of terminal operation:
   a. Centralized concept
   b. Unit operation concept

2) Classification in terms of processing levels:
   a. One-level system
   b. One-and-a-half level system
   c. Two-level or multi-level system

3) Classification in terms of check-in procedure:
   a. Central check-in system
   b. Gate check-in system
   c. Split check-in system

4) Classification in terms of relation between buildings and loading spots:
   a. Frontal concept or Frontal linear concept
   b. Finger concept or Pier concept
   c. Satellite concept
   d. Open apron concept or Transporter concept
   e. Combination or Hybrid concept

There are merits and demerits in each concept and the combination of the above concepts are determined basically according to air traffic demand at the airport.

Considering the annual passenger demand and the peak hour traffic at Wuhan/Tianhe Airport, the following concepts are studied in this Study:

Concept A :
1) Centralized concept
2) One-and-a-half-level system
3) Central check-in system
4) Frontal or Frontal linear concept

Concept B :
1) Centralized concept
2) One-and-a-half-level system
3) Central check-in system
4) Finger or Pier concept

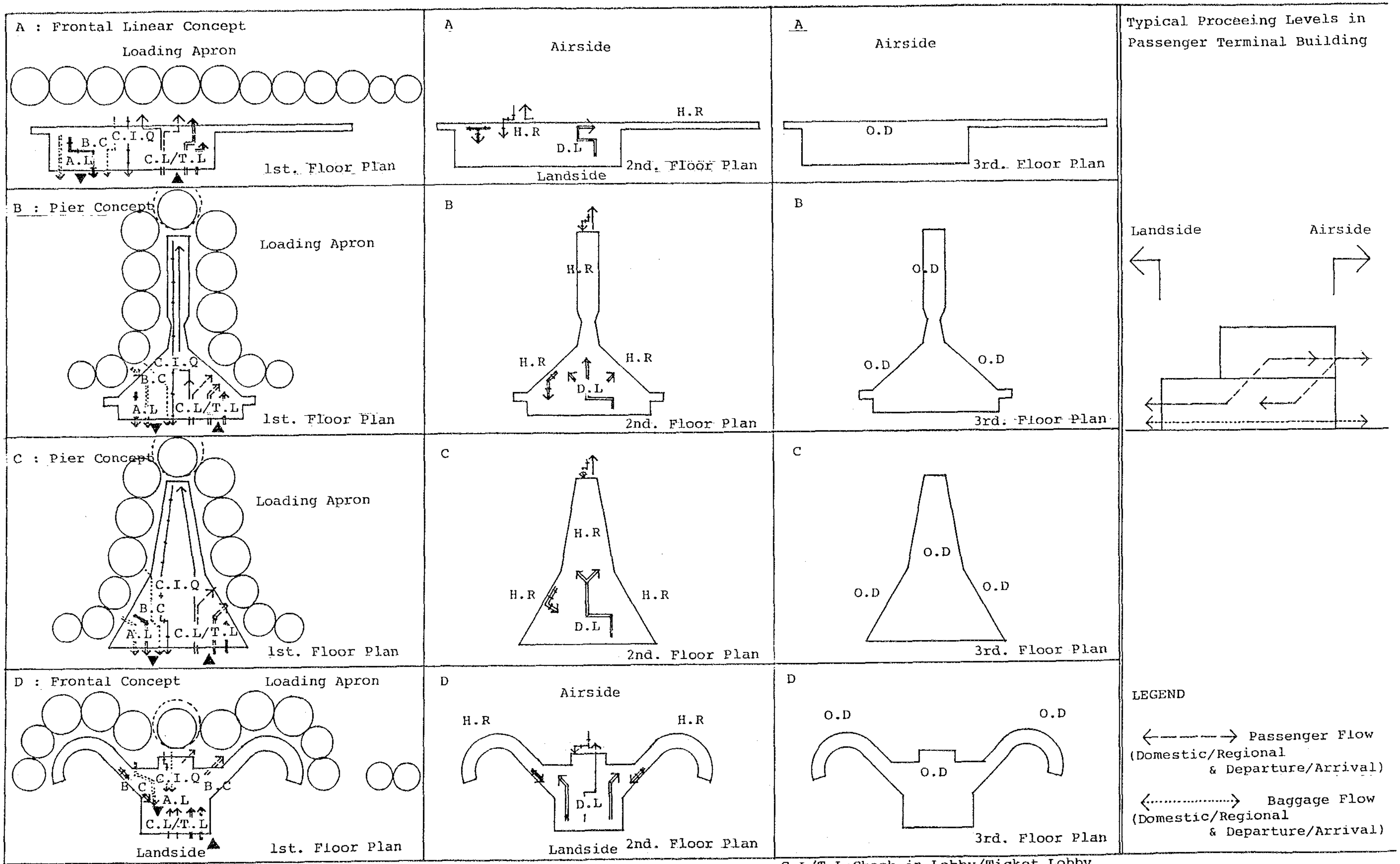
The comparisons of those concepts together with variations of Concept C and Concept D are shown in Table 6-1 and Fig.6-4, with the terminal floor layout plans as shown in Appendices 6-6 to 6-17.

Table 6-1 Comparison of Conceptual Passenger Terminal Building

Check Item	Concept A (Frontal Linear)	Concept B (Pier)	Concept C (Pier)	Concept D (Frontal)
(1) Check-in system Processing level	Centralized check-in system One & a half	ditto	ditto	ditto
(2) Floor area Length of outer wall	approx. 27,000 m^2 approx. 3,600 m	approx. 26,500 m^2 approx. 3,000 m	approx. 28,000 m^2 approx. 3,800 m	approx. 26,500 m^2 approx. 3,000 m
(3) Walking distance for passengers(pax.)	x	o	■	o
(4) Loading method and protection of pax.	o	o	o	o
(5) Separation of pax. and baggage flow	■	x	■	o
(6) Apron expansibility	o	x	x	■
(7) Flexibility of air-craft enlargement	o	x	x	■
(8) Convenience of tran-sit & transfer pax.	■	■	o	x
(9) Relationship between pax. terminal bldg. and car parking lot	■	o	o	■
(10) Activities of baggage handling	o	x	x	■
(11) Building expansibility	o	■	■	x
Overall evaluation (Score points)	13 points (Recom-mendable	8 points	9 points	10 points

Legend : o 2 points (Good)
■ 1 point (Fair)
x 0 point (Poor)

Fig. 6-4 Passengers and Baggages Flow in each Concept



LEGEND

- Departure Pax.(Domestic)
- Departure Pax.(Regional)
- Departure Baggage(Domestic)
- Departure Baggage(Regional)
- Arrival Pax.(Domestic)
- Arrival Pax. (Regonal)
- Arrival Baggage(Domestic)
- Arrival Baggage(Regional)

C.L/T.L:Check-in Lobby/Ticket Lobby
D.L:Departure Lobby
H.R:Holding Room
B.C:Baggage Claim Area
A.L:Arrival Lobby
C.I.Q:Customs,Immigration and Quarantine Inspection Area
O.D:Observations Deck