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JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

SCIENCE AND TECHNOLOGY COMMISSION OF
SHANGHAI MUNICIPAL PEOPLE'S GOVERNMENT,
PEOPLE'S REPUBLIC OF CHINA

# DETAILED DESIGN OF SHANGHAI PUDONG INTERNATIONAL AIRPORT FINAL REPORT

## VOLUME I
## MAIN REPORT



SEPTEMBER 1997

**NIPPON KOEI CO., LTD.**
**NIKKEN SEKKEI LTD.**

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

SCIENCE AND TECHNOLOGY COMMISSION OF
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EXCHANGE RATE (1997.9.1)

1 RMB= 14.77 Yen

100 Yen= 6.77 RMB

# PREFACE

In response to a request from the Government of the People's Republic of China, the Government of Japan decided to conduct a Detailed Design Study on the Shanghai Pudong International Airport Construction Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to China a study team headed by Mr. Toshio Saeki, Nippon Koei Co.,Ltd. twice between May 1996 and September 1997.

The team held discussions with the officials concerned of the Government of China, and conducted field investigations at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the People's Republic of China for their close cooperation extended to the team.

September. 1997

Kimio Fujita

President

Japan International Cooperation Agency

# LETTER OF TRANSMITTAL

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Kimio Fujita

We are pleased to submit to you the Detailed Design Study report of Shanghai Pudong International Airport.

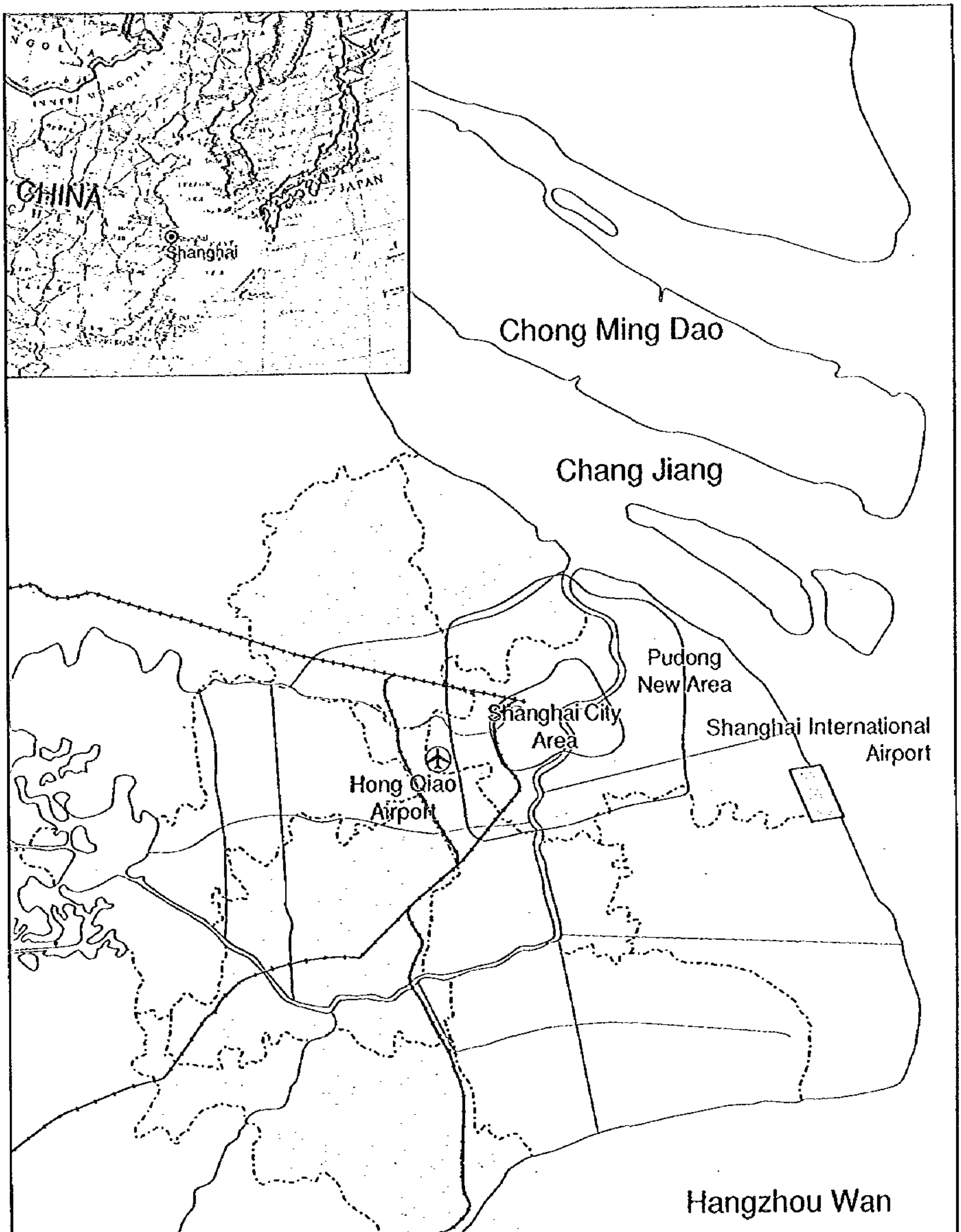
This study was conducted by Nippon Koei Co.,Ltd. and Nikken Sekkei Ltd.,under a contract to JICA, during the period from May, 1996 to September, 1997.
In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of the People's Republic of China and formulated the most appropriate Detailed Design for the project .

Finally, we hope that this report will contribute to further promotion of the project.

September. 1997

Very truly yours,

Toshio Saeki
Project manager,
Detailed Design study team on
Shanghai PudongInternational Airport




# Location Map

# DETAILED DESIGN
# OF
# SHANGHAI PUDONG INTERNATIONAL AIRPORT PROJECT
# FINAL REPORT
# VOLUME I MAIN REPORT

PART I MASTER PLANNING

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# DETAILED DESIGN
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# SUMMARY

# 1. Summary of the Study

Shanghai is situated on the south bank at the mouth of the Yangzhou (Changang) River. It is one of the largest cities in China, with a population of 13,000,000. In recent years, it has been plagued by over-concentration of population and insufficient infrastructure, causing it to lose economical position compared with the growth of other seaside cities.

Under these circumstances, The City Government of Shanghai adopted the "Pudong Development Plan" to revitalize the city. In the Plan, emphasis has been placed on development of the transportation and energy infrastructure with extremely high priority given to construction of a new airport.

Under this policy, The City Government decided to construct the new airport in the Pudong New Area, located in the suburbs of Shanghai about 32 ㎞ southeast of the city center. In December 1992, the City Government requested the Japanese Government for aid in preparation of the Master Plan for construction and the Feasibility Study (hereinafter called F/S Study) for selected high-priority projects. In response to the request, the Japanese Government resolved to undertake the Study. The F/S Study was conducted by the Japanese International Cooperation Agency ( hereinafter called JICA) from June, 1994 to August of the next year.

The Study formulated the Master Plan under which it was proposed for construction in three phases, namely Phase 1 (1 runway and related facilities to meet demand up to the year 2005 and to be completed by the year 2000), Phase 2 (a second open - parallel runway and related facilities to meet demand up to the year 2020 and to be completed by the year 2010) and Future Plan (A third and fourth close-parallel runways to be constructed to the exterior of the two open-parallel runways.).

Based on this Proposal, the Chinese Government requested the Japanese Government in August, 1995, for technical assistance in conducting the Detail Design for the construction of the Flight Area, International Terminal and other related facilities , in order to expedite the realization of Phase 1. In response, JICA conducted a Preliminary Study in January, 1996, and agreed with the Chinese Side on the Scope of the Study. The Scope included the Master Plan for the entire airport and the Detail Design for the Flight Area of Phase 1. In February, 1996, a Supplementary Study was conducted to resolve the differences between the Design and Construction Schedule proposed by the

City Government and in the F/S Study.

In March, 1996, based on the results of these Preliminary and Supplementary Studies, JICA sent an advance Study Team to discuss and sign the Particulars of the Detail Design and formally committed itself to conduct the Detail Design.

Co-ordination of the various agencies on the Chinese side responsible for the Project and cooperation with the Study Team dispatched by JICA for smooth implementation of the Project became the responsibility of the Science and Technology Commission of Shanghai Municipal People's Government.

## 2. Objectives and Scope of the Study, the Organization of the Study Team

### 2.1 Objectives of the Study

The objectives of the Study are formulation of ;

(1) The Master Plan for the Entire Shanghai Pudong International Airport Project

(2) The Basic and Detail Design for the Facilities of the Phase 1 Flight Area 【Runway Area (Civil Works, Airfield Lighting System), Fire Fighting & Rescue Facilities, Fuel Supply System】

in response to the request of the Peoples Republic of China, and based on the results of the F/S Study for the Shanghai Pudong International Airport. Furthermore, technology transfer through on-site Study activities to the Chinese Experts who take part in the Study is also an important objective of the Study.

### 2.2 Scope of the Study

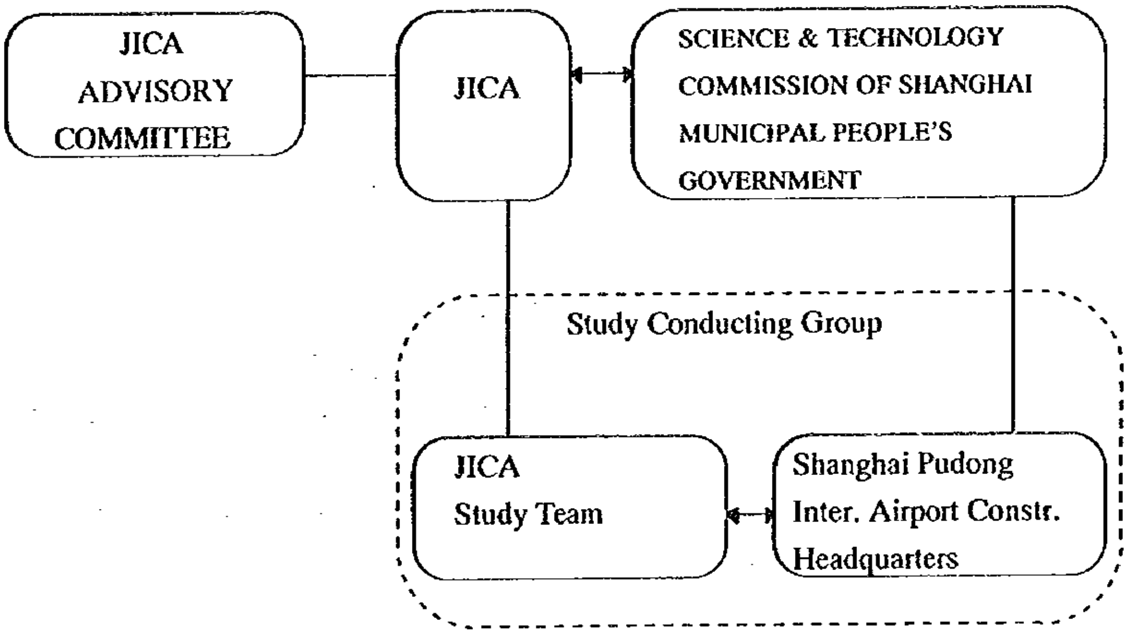
Based on the Subsidiary Note of Enforcement signed on the 6th of March, 1996, the Study will perform the Master Plan for the entire airport construction project, the Basic and Detail Design for the Flight Area of Phase 1 Project Site. In the course of conducting the Study, the prescribed Reports are to be prepared and thoroughly explained and discussed with the Chinese Side.

## 2.3 The Organization of the Study Team

The Study was conducted by the cooperation of the JICA Study Team and the Shanghai Pudong International Airport Construction Headquarters , based on the Agreement between JICA and the responsible agency on the Chinese side, the Science and Technology Commission of Shanghai Municipal People's Government.

JICA established the Advisory Committee for the Study as an advisory body to the Director of JICA.

The Organization of the Study is shown below;




The JICA Advisory Committe was composed of the following members;

| | |
|---|---|
| Chairman : Kanda Katsumi | Executive Director<br>The Services Center of Port Engineering |
| Airport Facilities : Nishimura Taku<br>(Specifications, Cost Estimation, Tendering) | Chief of 2nd Planning Section<br>Kansai International Airport Division<br>Airdrome Department<br>Civil Aviation Bureau<br>Ministry of Transport |

| | |
|---|---|
| Airport Facilities : Kimura Masakazu (Civil Works) | Deputy Manager<br>1st Civil Engineering Division<br>New Tokyo International Airport Authority |
| Airport Facilities : Yamada Toru (Airfield Lighting System) | Special Assistant to The Director<br>Air Traffic Services System Planning Division<br>Air Traffic Services Department<br>Civil Aviation Bureau<br>Ministry of Transport |
| Airport Facilities: Nagawa Yoshiharu (Fuel Supply, Fire Fighting & Rescue Facilities) | Deputy Director<br>Construction Division<br>Airdrome Department<br>Civil Aviation Bureau<br>Ministry of Transport |
| Project Evaluation: Morita Kunihiro | Deputy Director<br>1st Division Operations Department II<br>The Overseas Economic Cooperation Fund |

The members of the Science and Technology Commission of Shanghai Municipality in charge of the Project are shown below;

| | |
|---|---|
| Hua Yu Bian | Chairman<br>Science and Technology Commission of Shanghai Municipality |
| Xu Guan Hua | Vice Chairman<br>Science and Technology Commission of Shanghai Municipality |
| Hu Jia Lun | Department of Development Director<br>Science and Technology Commission of Shanghai Municipality |
| Yang Qing | Department of International Cooperation Director<br>Science and Technology Commission of Shanghai Municipality |

The members of the JICA Study Team and the Shanghai International Airport Construction Headquarters are shown below;

(1) JICA Study Team : Study Team of Shanghai Pudong International Airport Design

Joint Venture of Nippon Koei Co., Ltd and Nikken Sekkei Ltd

(2) Shanghai Pudong International Airport Construction Headquarters:

The Chinese Consultant, China Airport Construction Corporation of CAAC worked under the Study Team.

(Principal in Charge: Wei Qi Hua, Zhu Jing Yuan)

# 3 Results of the Study

## 3.1 Requirement of the Project and Summary of the Facilities

Requirement of the Project and Summary of the Facilities based on the Requirement of the Project are shown in Table-1.

Table-1 Summary of Facilities for Shanghai Pudong International Airport

| | Item | Phase One Plan (2005 year) | Future Plan |
|---|---|---|---|
| Requirement of the Project | 1. Annual Pax.( thousand ) | 20,000 [ Domestic : 14,400<br>International : 5,600 | 70,000 [ Domestic : 39,500<br>International : 30,500 |
| | 2. Annual Aircraft Movements | 126,000 | 320,000 |
| | 3. Annual Cargo (thousand tons) | 500 [ Domestic : 150<br>International : 350 | 4,100 [ Domestic : 1,700<br>International : 2,400 |
| Summary of the Facilities | 1.Basic Facilities | | |
| | Runway | 4,000m × 1 | 4,000m × 4 |
| | Taxiway | 1 set | 1 set |
| | Passenger Terminal Area Apron(spots) | 39 | 155 |
| | Cargo Apron(spots) | 8 | 27 |
| | Maintenance Apron(spots) | 18 | 47 |
| | 2.Terminal Facilities | | |
| | Passenger Terminal (m²) | 200,000 | 800,000 |
| | Cargo Terminal (m²) | 65,000 | 520,000 |
| | 3. Airfield Lighting System | 1 set | 1 set |

## 3.2 Summary of Design

### (1) Airside Civil Works

1) Site Preparation And Earth Work Plan

- Actual measurement values (August, 1996) for a 40m mesh were used to calculate Earth Works Design for the Phase 1 Site Airside (Basic Facilities Area). The results showed Cutting volume of roughly 1,600,000 ㎥ and a required embankment volume of roughly 2,400,000 ㎥. The deficit 800,000 ㎥ of embankment soil will be carried from out side of Airside.
- Ram-Drop Compaction Method was chosen for improvement of soft ground for the Basic Facilities such as the runway. The area requiring improvement of soft ground in the Phase 1 Area is roughly 2,000,000 ㎡.

2) Drainage Design

- Drainage within the Airport Area will be a inside drainage system composed of self-regulating gates, large scale pumping stations and regulating reservoirs. An integrated control system encompassing pumps installed in the other Terminal Area and Related Facilities Area was recommended to the Chinese Side for control of drainage pumps.
- The Drainage Facilities are designed for 5-year-frequency rainfall with additional considerations to allow safe flight operations even at peak flood levels under 50-year-frequency rainfall.

3) Pavement Design

- The Design Aircraft for Runway and Taxiway is the NLA (Expanded B747-400). The fillet design at each crossing point is designed for the B777-300 which has larger dimensions for both Wheel Base and space of outer wheel rims of the main legs.
- Cement concrete pavement was selected after considering past construction records, economical factors, durability and maintenance technology in China.

4) Design of Ancillary Facilities

- Perimeter Roads and Security Roads were provided for maintenance and periodical inspection of airport facilities.

- Perimeter Fencing and Gates are provided to prevent unauthorized entry into the Airside.
- Concrete Blast Fences are provided to protect Landside passerby and passing vehicles from the jet blast of aircraft near the Terminal Building.

(2) Airfield Lighting System

1) The Airfield Lighting System for the Project is designed to allow development for Advanced Surface Movement Guidance and Control System (A-SMGCS) with the following 4 features;

- Burnt-out Lamp Position Detection
- Stop Bars
- Visual Docking Guidance System
- Dual Circuit Power Supply

2) The Operation Category is designed to allow Category Ⅱ operations while assuming future transition to Category Ⅲ operations.

(3) Fuel Supply System

1) The design for the Fuel Supply Facilities followed Japanese and International Standards to provide International Level Fuel Supply Facilities.

2) The design for the Fuel Supply Facilities is compatible with other Chinese Fuel supply facilities and observance of Chinese customary operation procedures.

3)Fuel Supply System is based on Hydrant System, set up Storage Tank 10,000 $m^3 \times 6$ units . The Annual Fueling Capacity is 756,000 ton.

(4) Fire Fighting and Rescue Facilities

1)The Fire Fighting and Rescue facilities are based on ICAO regulations and standards of the CAAC as well as design policies described in the Chinese Feasibility Studies.

2) The system was one in which a large emergency ambulance vehicle backed up by emergency medical facilities to be situated in the surrounding area will be provided.

3) The Fire Fighting and Rescue Facilities have Main Fire Station , Sub Fire Station , Ambulance Garage , Fire Pump Room and so on.

## 3.3 Cost Estimation

The Cost Estimation is shown in the Table-2 on the next page.

## Table-2 Summary of Construction Cost

(unit : mil・RMB)

| | Basic Design | | Detail Design | |
|---|---|---|---|---|
| | Construction Cost | Foreign Curvency Portion | Construction Cost | Foreign Curvency Portion |
| Civil Works | | | | |
| 1)Land Grading | 427 | 0 | 248 | 0 |
| 2)Pavement Works | 547 | 0 | 490 | 0 |
| 3)Drainage Works | 139 | 0 | 89 | 0 |
| 4)Regulating Pond and Pump Station | 106 | 0 | 25 | 0 |
| 5)Appurtenant Works | 26 | 0 | 45 | 0 |
| Sub Total | 1,245 | 0 | 897 | 0 |
| Airfield Lighting System | | | | |
| 1)Direct Construction Costs | 674 | 478 | | |
| a)Lighting | — | — | 331 | 170 |
| b)Power Supply | — | — | 89 | 86 |
| c)Transportation and Packing | — | — | 42 | 42 |
| 2)Indirect Costs | 156 | 156 | 60 | 60 |
| 3)AFL Sub-Station | 20 | 0 | 7 | 0 |
| Sub Total | 850 | 634 | 529 | 358 |
| Fuel Supply System | | | | |
| 1)Fuel Supply Facilities | 548 | 272 | | |
| a)Fuel Storage Depot | — | — | 145 | 55 |
| b)Fuel Supply Depot | — | — | 67 | 82 |
| c)Fuel Hydrant Piping | — | — | 83 | 36 |
| Sub Total | 548 | 272 | 295 | 173 |
| Fire Fighting and Rescue Facilities | | | | |
| 1)Architectural Facilities | 18 | 0 | 13 | 0 |
| 2)Fire Hydrant System | 16 | 0 | 13 | 0 |
| 3)Fire Fighting Vehicles,etc | 47～56 | 35～40 | 46 | 42 |
| Sub Total | 81～90 | 35～40 | 72 | 42 |
| Total | 2,724～2,733 | 941～946 | 1,793 | 573 |

Exchange Rate

1 RMB ＝13 Yen (B/D) 、1 RMB ＝12.66 Yen (D/D)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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# DETAILED DESIGN
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# FINAL REPORT

## VOLUME I
## MAIN REPORT

### PART I
### MASTER PLANNING

SEPTEMBER 1997

**NIPPON KOEI CO., LTD.**
**NIKKEN SEKKEI LTD.**

# CHAPTER 1 REQUIREMENT OF THE PROJECT

## 1.1 Master Plan of Shanghai Pudong International Airport

In the Master Plan, the total air demand for Shanghai has been estimated for several cases as shown below, and also a forecast of the share of Hongqiao and Pudong airport based on division of function has been carried out.

### 1.1.1 Forecast of Air Traffic Demand

(1) Method of Forecast

Two different approaches have been considered by the Japanese team and the Chinese team in this study. The Chinese team made forcasts of total air traffic demand for Shanghai based on the socio-economic indicators. Forcasts were made for demand by route for both international and domestic routes taking future trends into consideration.

However, in the Japanese study air traffic demand is forecasted using the "gravity model" because of the lack of historical data.

(2) Premises of Forecast

1) GNP Growth Rate

The respective GNP growth rate given in the Chinese study and the Japanese study are shown in TableI-1.1.1.

**TableI-1.1.1 Assumption of GNP Growth Rate**

| Year | Chinese study | Japanese study |
|---|---|---|
| 2000 | 9.0 | International 10.0<br>Domestic 8.0 |
| 2010 | 7.5 | 5.0 |
| 2015 | 8.2 | 3.0 |
| 2020 | 4.5 | 3.0 |

2) Air Route Plan

Domestic routes: Guangzhou, Beijing, Xiamen, Shenzhen, Fuzhou, Xi'an, Guilin, Chengdu, Shantou, Dalian, Shenyang, Wuhan, Kunming, Haikou, Ha'erbin, Chongqing, Wulumuqi, etc.

International routes: Japan, America, Canada, Korea, Hongkong, Philipine, Thailand, Singapore, France, Russia, Germany, etc.

(3) Air Traffic Demand of Shanghai

The results of demand forecast given in the Chinese study are shown in TableI-1.1.2, and the results given in the Japanese study are shown in TableI-1.1.3.

**TableI-1.1.2 Forecast Results of Master Plan ( Chinese study )**

| Year | | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|
| Passenger ( thousand ) | International | 4,500 | 6,500 | 12,000 | 16,800 | 26,200 |
| | Domestic | 13,500 | 19,500 | 28,000 | 39,200 | 48,880 |
| Cargo ( thousand tons ) | International | 141 | 241 | 329 | 496 | 711 |
| | Domestic | 329 | 449 | 611 | 744 | 869 |
| Aircraft Movements | International | 27,480 | 37,790 | 69,740 | 84,045 | 131,043 |
| | Domestic | 75,826 | 105,503 | 151,213 | 206,322 | 256,584 |

Note: The results are the total for Shanghai

**TableI-1.1.3 Forecast Results of Master Plan (Japanese study )**

| Year | | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|
| Passenger ( thousand ) | International | 7,191 | 9,497 | 13,073 | 14,594 | 16,333 |
| | Domestic | 15,015 | 20,272 | 27,467 | 33,135 | 39,840 |
| Cargo ( thousand tons ) | International | 693 | 1,041 | 1,566 | 2,008 | 2,575 |
| | Domestic | 428 | 644 | 968 | 1,241 | 1,591 |
| Aircraft Movements | International | 38,985 | 51,563 | 70,887 | 78,752 | 88,055 |
| | Domestic | 99,151 | 124,529 | 146,989 | 164,983 | 187,298 |

Note: The results are the total for Shanghai.

(4) Air Traffic Demand of Pudong International Airport

The demand forecast results which were used to determine the airport facility requirements in the Master Plan are shown in TableI-1.1.4. The air passenger traffic demand used data from the Chinese study and the air cargo traffic demand used data from the Janpanese study.

Pudong International Airport will take all the international routes. Domestic routes including major routes like Beijing and Guangzhou will be shared by the two airports of Pudong and Hongqiao. The details of the division are shown in TableI-1.1.4.

**TableI-1.1.4 Demand Used in the Master Plan**

| Year | | 2000 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|
| Passenger ( thousand ) | International | 6,500 | 12,000 | 16,800 | 26,200 |
| | Domestic | 9,500 | 13,800 | 19,100 | 23,700 |
| Cargo ( thousand tons ) | International | 1,041 | 1,566 | 2,008 | 2,575 |
| | Domestic | 303 | | | 748 |
| Aircraft Movements | International | 32,260 | 57,690 | 78,320 | 118,550 |
| | Domestic | 58,460 | 79,190 | 106,850 | 127,930 |

Note: Demand of Pudong Airport is described here.

### 1.1.2 Forecast Results

The forecast results of the Master Plan are summarized in TableI-1.1.5.

**TableI-1.1.5 Facility Requirements Coresponding to the Annual Air Demand**

| Year | | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|
| Domestic | Annual Pax. (thousand ) | 9,500 | 13,800 | 19,100 | 23,700 |
| | Annual Aircraft Movements | 58,460 | 79,190 | 106,850 | 127,930 |
| | Peak-Hour Arr. Flights | 11 | 14 | 16 | 18 |
| | Peak-Hour Arr. Pax. | 2,338 | 3,156 | 3,740 | 4,603 |
| | Required Spot Number | 17 | 21 | 24 | 27 |
| | Average Available Seat | 250 | 265 | 275 | 285 |
| | Peak-Hour Ratio (%) | 12.5 | 11.5 | 10.5 | 10 |
| International | Annual Pax. (thousand ) | 6,500 | 12,000 | 16,800 | 26,200 |
| | Annual Aircraft Movements | 32,260 | 57,690 | 78,320 | 118,550 |
| | Peak-Hour Arr. Flights | 7 | 12 | 16 | 23 |
| | Peak-Hour Arr. Pax. | 1,845 | 3,264 | 4,488 | 6,647 |
| | Required Spot Number | 24 | 40 | 53 | 76 |
| | Average Available Seat | 310 | 320 | 330 | 340 |
| | Peak-Hour Ratio (%) | 15 | 14 | 13.5 | 13 |
| | Total Aircraft Movements | 90,720 | 136,880 | 185,170 | 246,480 |

## 1.2 Appraisal of the Forecast Results

In this section, a comparision is made with the forecast results of the Chinese Feasibility Study and the results of the Japanese study which are based on the statistical air traffic data of the Hongqiao Airport.

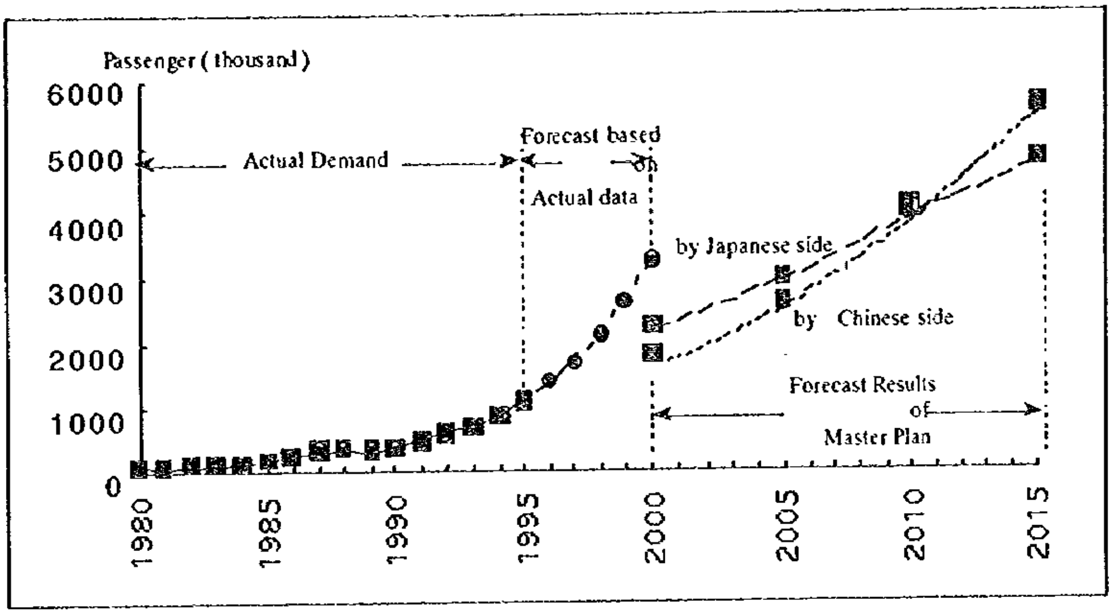
### 1.2.1 Actual Air Demand of the Hongqiao Airport

The rapid economic growth of China in recent years is noteworthy, especially in Shanghai. The air traffic demand of Shanghai has continued to increase after the master plan study. Therefore the plan needs to be reconsidered from the latest data. The difference between the forecast results of the master plan and the present actual demand data is shown in TableI-1.2.1 and FigureI-1.2.1.

It is also noted in the design policy of the Chinese study who will be in charge of the airport construction and the French designers of the terminal area facilities that it is important to adjust to the forecasted air traffic demand as the actual data changes in the future and to adopt the latest technology available at each phase of the construction.

**TableI-1.2.1 Recent Air Traffic Demand of Hongqiao Airport**

| | | Domestic | Intl. | others | total | indicator |
|---|---|---|---|---|---|---|
| 1993 | Passenger ( thousand ) | 5,759.4 | 949.6 | 885.8 | 7,594.8 | 100.0 |
| | Cargo ( thousand tons ) | 111.8 | 87.5 | 36.3 | 235.6 | 100.0 |
| | Aircraft Movements | 46,019 | 7,790 | 5,445 | 59,254 | 100.0 |
| 1994 | Passenger ( thousand ) | 6,709.4 | 1,114.1 | 895 | 8,718.5 | 114.8 |
| | Cargo ( thousand tons ) | 132.6 | 102.5 | 35.1 | 270.2 | 114.7 |
| | Aircraft Movements | 55,605 | 10,768 | 5,416 | 71,789 | 121.2 |
| 1995 | Passenger ( thousand ) | 8,443 | 1,681 | 952 | 11,076 | 127.0 |
| | Cargo ( thousand tons ) | 175.6 | 151.7 | 39 | 366.3 | 135.6 |
| | Aircraft Movements | 66835 | 13229 | 5606 | 85670 | 119.3 |




**FigureI-1.2.1 Comparison of Forecast Results and Actual Demand**

## 1.2.2 Preliminary Feasibility Study by Chinese Side

The results of the forecast made in the Chinese study based on the master plan are shown in TableI-1.2.2.

**TableI-1.2.2 Results of Preliminary Feasibility Study**

| Year | | 2000 | 2005 | 2010 | 2015 | 2020 |
|---|---|---|---|---|---|---|
| Passenger ( thousand ) | International | 2,600 | 5,600 | 11,800 | | 30,500 |
| | Domestic | 4,400 | 14,400 | 28,200 | | 39,500 |
| Cargo ( thousand tons ) | International | 180 | 470 | 1,020 | | 3,100 |
| | Domestic | 80 | 290 | 540 | | 1,400 |

Note: Demand of Pudong Airport is described here.

### 1.2.3 Feasibility Study

The air traffic demands of the airport facilities are summarized below.

(1) Air Passenger Traffic Demand

The air passenger traffic demand as forecasted in the Chinese study is shown in TableI-1.2.3.

**TableI-1.2.3 Air Passenger Traffic Demand in Feasibility Study**

| Year | Shanghai City (thousand) | Passenger (thousand) | | Intl. / Dom. (thousand) | |
|---|---|---|---|---|---|
| 2000 | 20,000 | Hongqiao Airport | 13,000 | Domestic | 11,000 |
| | | | | Intl. | 2,000 |
| | | Pudong Airport | 7,000 | Domestic | 4,400 |
| | | | | Intl. | 2,600 |
| 2005 | 33,000 | Hongqiao Airport | 13,000 | Domestic | 11,000 |
| | | | | Intl. | 2,000 |
| | | Pudong Airport | 20,000 | Domestic | 14,400 |
| | | | | Intl. | 5,600 |
| 2010 | 53,000 | Hongqiao Airport | 13,000 | Domestic | 11,000 |
| | | | | Intl. | 2,000 |
| | | Pudong Airport | 40,000 | Domestic | 28,200 |
| | | | | Intl. | 11,800 |
| 2015 | 100,000 | Hongqiao Airport | 30,000 | Domestic | 25,500 |
| | | | | Intl. | 4,500 |
| | | Pudong Airport | 70,000 | Domestic | 39,500 |
| | | | | Intl. | 30,500 |

(2) Air Cargo Traffic Demand

The forecast of the air cargo traffic demand of Pudong International Airport is shown in TableI-1.2.4.

**TableI-1.2.4 Forecast Results of Air Cargo Demand in Feasibility Study**

| Year | Shanghai City (thousand tons) | Pudong Airport (thousand tons) | Hongqiao Airport (thousand tons) |
|---|---|---|---|
| 2000 | 700 | 250 | 450 |
| 2005 | 1,200 | 750 | 450 |
| 2010 | 2,000 | 1,550 | 450 |
| 2015 | 6,000 | 4,500 | 1,500 |

However, because the demand of luggage is included in the air cargo demand according to the Chinese study, it is necessary to make clear the respective share of true air cargo and luggage. The details of the allocation are shown in TableI-1.2.5.

**TableI-1.2.5 Details of Forecasted Air Cargo Traffic Demand**

| Year of 2005 | | | Cargo | | luggage |
|---|---|---|---|---|---|
| 1,200 | Pudong Airport 750 | Intl. 500 | 350 | } total 500 | 150 |
| | | Dom. 250 | 150 | | 100 |
| (1000 tons) | Hongqiao A. 450 | | | | |

| Year of 2020 | | | Cargo | | luggage |
|---|---|---|---|---|---|
| 6,000 | Pudong Airport 5,000 | Intl. 3,000 | 2,400 | }total 4,100 | 600 |
| | | Dom. 2,000 | 1,700 | | 300 |
| (1000 tons) | Hongqiao A. 1,000 | | | | |

## 1.3 Facility Requirements

(1) Facility Requirements

The forecast results in the Feasibility Study made with consideration for recent air passenger traffic demand and National Development Plan of China and the City Development Plan of Shanghai is regarded as the most reasonable to determine the facility requirements for the first phase construction. The results are shown in TableI-1.3.1.

**TableI-1.3.1 Facility Requirements in Feasibility Study**

| | 2005 | future |
|---|---|---|
| Domestic Annual Pax. (thousand) | 1440 | 3950 |
| International Annual Pax. (10 thousand) | 560 | 3050 |
| Total Annual Pax. (10 thousand) | 2000 | 7000 |
| Annual Aircraft Movements | 126,000 | 320,000 |
| Peak-Day Passenger traffic | 67,000 | 240,000 |
| Peak-Hour Passenger traffic | 7,120 | 20,000 |
| Peak-Hour Flights | 35 | 84 |
| Apron Spot number | 34 | 140 |
| Average Available Seat | 250 | 365 |
| Peak-Hour concentrate rate (%) | 10.6 | |
| Domestic Annual Cargo (ton) | 150,000 | 1,700,000 |
| International Annual Cargo (ton) | 350,000 | 2,400,000 |
| Total Annual Cargo (ton) | 500,000 | 4,100,000 |
| Spot number for Cargo Freighter | 3 | 25 |

(2) Method of Analysis

Facility Requirement in the Feasibility Study has been made with due consideration of the need to create an identity for Pudong International Airport, the role of Pudong airport in the domestic air network, the trend towards NLA, phased construction, the relationship to other development plans in the surrounding area, economical development trends of recent years, and the environmental aspects,etc. Discussions between the Chinese team and the Japanese team introduced the Japanese methodology in planning and executing an airport project of this scale which has been reflected in this feasibility study.

The criterion of aircraft and number of seats for the NLA is described in TableI-1.3.2 .

**TableI-1.3.2 Required Aircraft Types and Number of Seats**

| Assumption in master plan (Chinese study) | | Assumption in Feasibility Study | | ( ratio for each type ) | | |
|---|---|---|---|---|---|---|
| Aircraft Type | Seater | Aircraft Type | Seat Number | Year 2005 | Year 2020 | ( Japanese study) |
| A | 150 | I | 150 | 40 | 10 | 54 |
| B | 200 | | | | | |
| C | 250 | II | 250 | 30 | 30 | 44 |
| D | 300 | | | | | |
| E | 350 | III | 350 | 20 | 30 | 2 |
| F | 400 | IV | 450 | 10 | 20 | |
| | | V | 800 | | 10 | |

B747F and MD11F will be used mainly as cargo freighter, and a small percentage of C130, B707 will also be used.

The passenger load factor is assumed to be 65%, and that of air cargo is assumed to be 60%. The takeoff weight of the cargo freighter is assumed to be 60 tons based on the maximum takeoff weight of B747F and MD11F.

The forecast results of the Chinese feasibility study was adopted for the final overall estimation. The route division between Pudong and Hongqiao airports in Shanghai area and the total balance of the national air network in this study reflect the Chinese goverment air policy. Futhermore, this study reflects the City policy of Shanghai concerning route division and aircraft movements which will be under the management and administration of the City Goverment.

# CHAPTER 2 GENERAL LAYOUT PLAN

## 2.1 Aim of General Layout Plan

FigureI-2.1.1 shows the process for development of the General Layout Plan by Shanghai City, based on the layout plan contained in the JICA feasibility study and including certain provisions from the results of the design competition for the terminal building.

(1) The Major Points of Difference between the General Layout Plan of JICA F/S and that of Chimese F/S.

The major points of difference between the General Layout Plan proposed by the JICA feasibility study and that of the Chinese Feasibility Study (Shanghai City) are described in the following section.

1) Shape of the Terminal Building

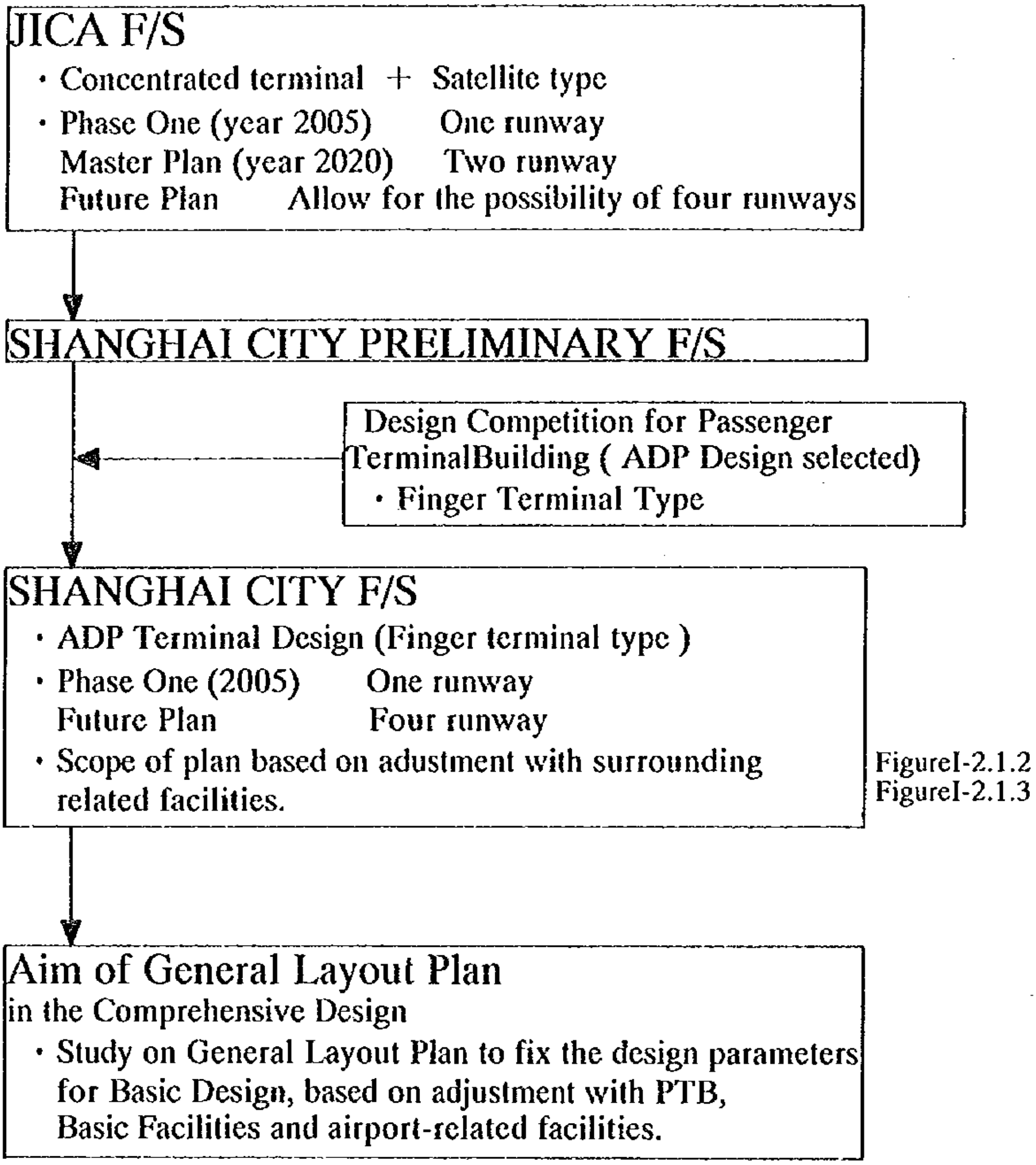
In the Shanghai City Feasibility Study, the general layout plan has been executed based on the Passenger Terminal Building plan selected in the design competition. The design competition winner (finger terminal type) and the JICA recommendation (satellite terminal type) differ widely. Therefore the overall layout plan will change.

2) Phase One Design, Runway Location

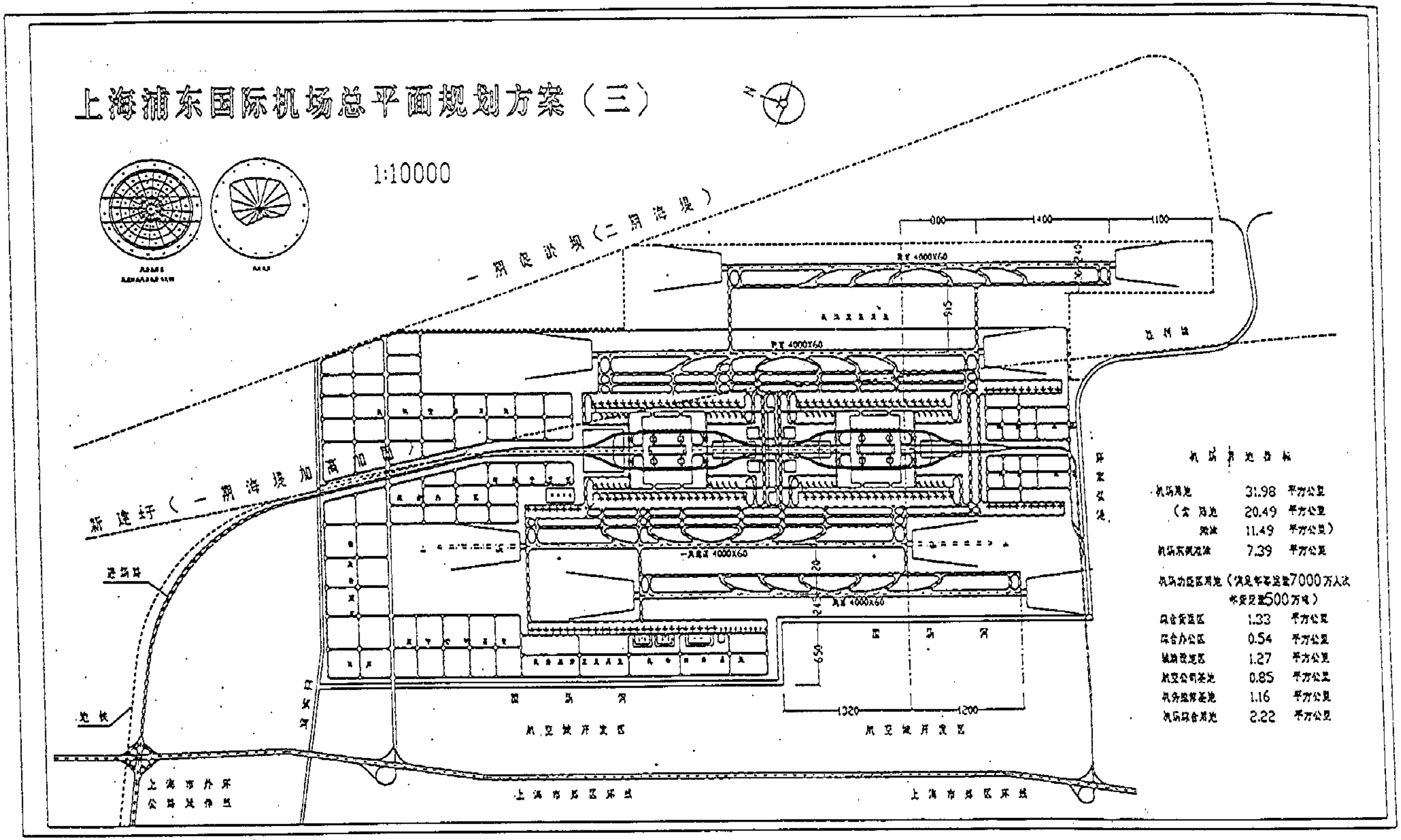
After the JICA Feasibility Study, Shanghai City has relocated the whole site of the Airport eastwards by 700 meters. This change is based on the readjustment with the plans including the outside embankment construction plan, the west side land development plan, etc. Consequently, the Phase One Runway in the Chinese F/S has been relocated to a position 700 meters east of its original location in the JICA F/S.

3) Runway Spacing

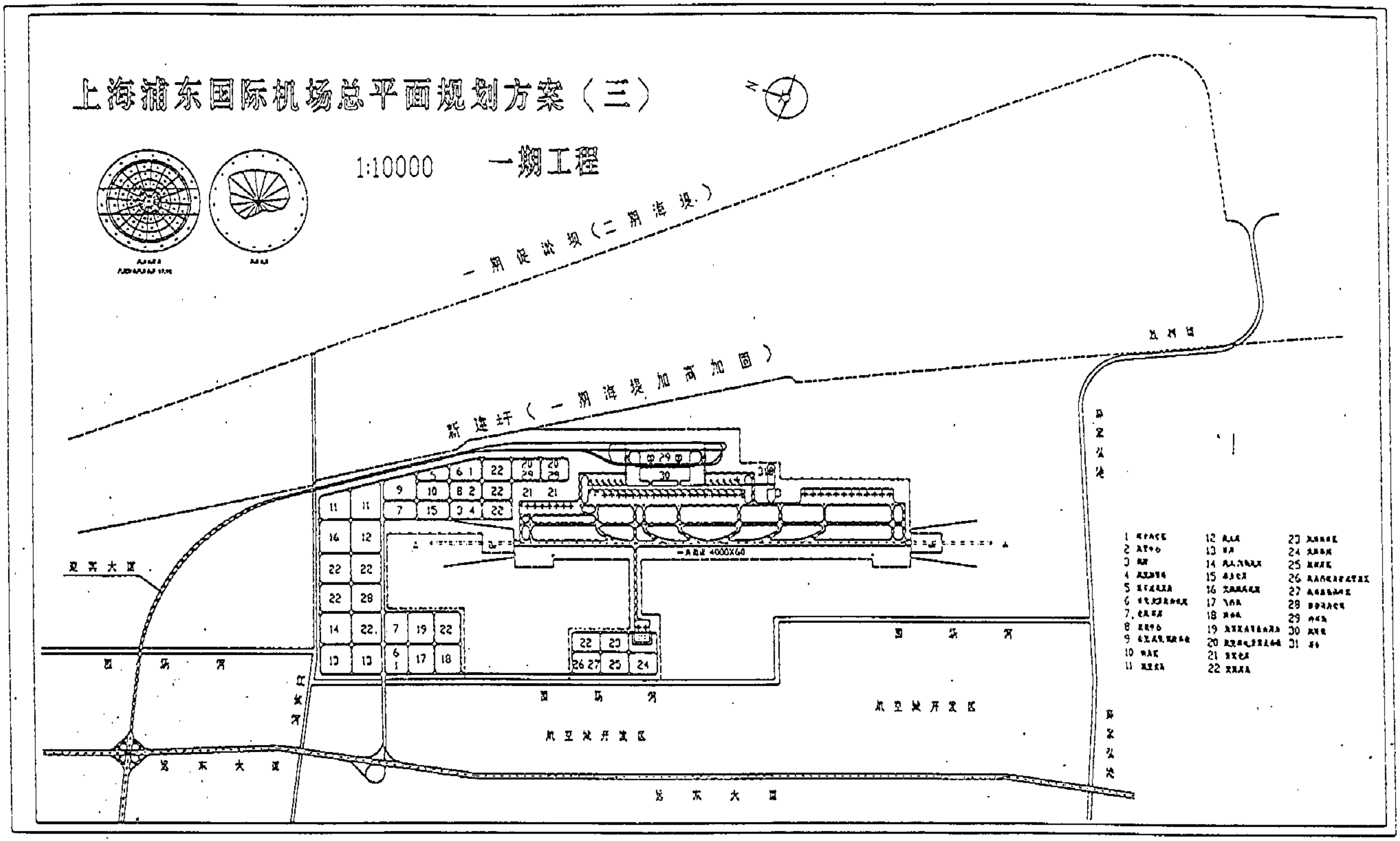
The spacing between the four runways, and the locations of the runway thresholds have been revised. This revision is based on the operational mode of each runway and the shape of the site (the coastline moves inward towards the north of the site and has a corespondingly smaller width in the northern sector).




**FigureI-2.1.1 Process of Study on General Layout Plan**




FigureI-2.1.2 General Layout Plan (Chinese F/S)




FigureI-2.1.3 Phase One Layout Plan (Chinese F/S)

(2) Principles of the General Layout Plan in the Comprehensive Plan

Based on the changes described above, the general layout plan in the Comprehensive Plan will be revised based on the following principles.

1) The principles items of the layout plan will be based on the general layout plan of the Shanghai City Feasibility Study (called the Chinese Plan hereafter). However, as to the matters which are not taken into consideration in ADP design, such as securing open aprons and location of the Maintenance Zone, further study is required.
The principle items are:

- length, direction and approximate layout of runways,
- form and approximate layout of the PTB (passenger terminal building),
- approximate location of cargo, aircraft maintenance and utility zones, and
- the total size of the airport site.

2) Based on the required dimensions, areas, etc., which have been defined by the investigations carried out for each airport facility, the necessary revisions will be made to the Chinese Plan.

3) Following revisions to the general layout plan, the relationship among various facilities will be fully reconsidered. Of particular importance is the adjustment made between the Basic Facilities (air side) and the land side facilities (PTB, access roads, railways).

## 2.2 Design Conditions of the General Layout Plan

The design conditions of the General Layout Plan are based on the Chinese F/S Report. The main conditions are as follows.

(1) Design Parameters

The number of passengers, volume of cargo and number of necessary spots shall be as indicated in the tables below based on Chinese F/S.

**TableI-2.2.1 Passenger Volume**

| No. of Passengers | Phase One (2005) million pax. annual | Future million pax. annual |
|---|---|---|
| Total | 20 | 70 |
| International | 5.6 | 30.5 |
| Domestic | 14.4 | 39.5 |

**TableI-2.2.2 Cargo Volume**

| Vol. of Cargo | Phase One (2005) kilo tons annual | Future kilo tons annual |
|---|---|---|
| Total | 500 | 4100 |
| International | 350 | 2400 |
| Domestic | 150 | 1700 |

**TableI-2.2.3 Necessary Spot Number**

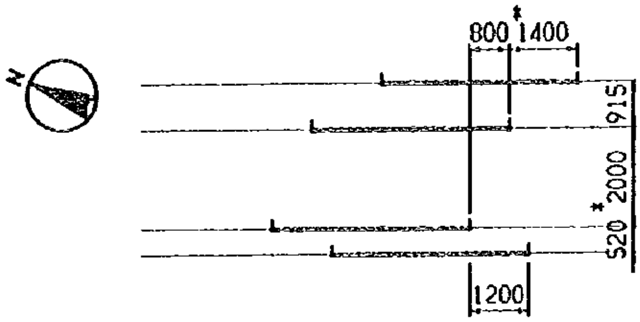
| | Phase One (2005) | Future |
|---|---|---|
| For passengers | 34 spots (3C,10D,21E) | 140 spots |
| For cargo | 3 spots | 25 spots |

(2) Site Conditions

The site is surrounded by Jiang Zhen Canal to the north, Xue Jia Hong Canal to the south, Perimeter Canal to the west, and the Outer Dike to the east. Future plans call for constructing a new Outer Dike in order to create additional land space for the airport.

(3) Runway Layout Conditions

The four runways shall be of 4000 meter length class, and the relative position of the runways is as shown in the figure below. The direction is 162 ° (due north).




However, the space of 2000 m between the two central runways and the staggering of 1400 m of the two eastern runways shall be decided after adjusting with the Passenger Terminal Building Design.

(4) Facility Zoning

The zoning concept of each area which constitutes the airport will be as follows.

1) Passenger Terminal Building (PTB) Zone, Access Roads, etc.

The plan for the PTB zone shall be based on the ADP concept. PTB, access roads, etc. will be located between the two central runways.

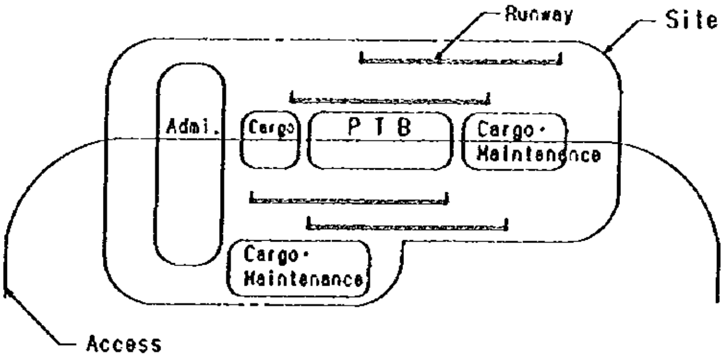
2) Cargo Zone, Maintenance Zone

Both in Phase One and the future plan, the cargo zone and the maintenance zone will be located on the north and south sides of PTB between the two central runways as long as it is possible. This aims to make the movement of aircraft, equipment and cargo easy.

However, because of the characteristics of the Pudong Airport, the demand for the Cargo zone could possibly exceed the future estimation. Therefore, a future site for a Cargo zone shall be prepared to the west of the runways.

3) Administrative Zone

The administrative zones are located on the east and west sides of the access road to the airport north of the PTB zone.




(5) Required Floor Area for Phase One Plan Facilities

The estimated required floor areas for all facilities in Phase One are shown in TableI-2.2.4, based on the Shanghai City Feasibility Study. The required floor area in the General Layout Plan will be in accord with this area.

**TableI-2.2.4 Floor Area of Facilities for Shanghai Pudong International Airport in 2005**

unit $m^2$

| | |
|---|---|
| 1. PTB Zone | |
| Passenger Terminal Building | 200,000 |
| Parking lot | 130,000 |
| 2. Cargo Zone | |
| Cargo storehouse | 65,000 |
| Parking lot | 12,500 |
| 3. Maintenance Zone | |
| Equipment Storehouse | 8,000 |
| (Eastern Airline) | (105,000) |
| 4. Air Traffic Control | |
| Control Tower | 5,000 |
| 5. Air Communication | |
| Communication Building | 3,000 |
| 6. Air Traffic Control Center | 9,000 |

| | |
|---|---|
| 7. Fire Fighting and Rescue Facilities | |
| Fire Station | 4,600 |
| Medical Emergency Center | 3,000 |
| 8. Oil Supply Facilities | |
| Oil Station for aircrafts | 4,700 |
| Oil Station for cars | 1,200 |
| 9. Communication Facilities | |
| Airport Telephone Center | 3,000 |
| 10. Auxiliary Facilities | |
| Passenger Lodging Facilities | 60,000 |
| Public Security & Inspection | 18,000 |
| Catering Facilities | 66,000 |
| Ticket Office | 6,000 |
| 11. Administrative and Living Facilities | |
| Office building | 6,000 |
| Accommodation | 8,600 |
| Amenity Facilities | 3,000 |
| Dining room | 2,000 |
| Apartment | 60,000 |
| 12. General Airport Facilities | |
| General Storehouse | 3,000 |
| General Garage | 3,000 |
| Power Maintenance | 10,000 |
| Service Department | 10,200 |
| ( 13. Bases for Airline Companies) | (83,300) |

## 2.3 General Layout Plan

### 2.3.1 Contents of General Layout Plan

As the result of the study on the General Layout Plan, the Chinese Plan will be altered on the following points (main points).

• Open spots are placed in front of the fixed gate which faces the runways. The space between the two central runways will corespondengly be widend from 2000m to 2260m. Furthermore, the easternmost runway is shifted southwards by 200m.

• The PTB Zone which is very long north-south-wisein the ADP Design is shortened by approximately 600m by cutting off the south side. The cut area will be used for the Cargo Zone and the Maintenance Zone.

• The Cargo Zone is located to the north of the PTB Zone, divided into the eastern zone western zone, with an access road between them. Also, another cargo zone is designed on the south side of the PTB Zone facing the east runway.

• A Maintenance Zone is located on the south side of PTB. The Maintenance Zone on the west side of the runway is narrower gecause of site constraints.

• The access roads and the railway shall be connected to the airport site by viaduct. An additional GSE passage to connect the east and west runways is placed at the south of the PTB Zone

(1) Runway, Taxiway System

1) Runways

The four runways are laid out for independent operations of each pair of runways on the eastern and western sides. As the spacing between the two runways in the east is 915m, alternating takeoffs and landings are possible. However, as the spacing between the two runways in the west is only about 760m, it is needed to operate them separately, using the one whose threshold is closer to the approach direction for landing, and the other for taking off.

The capacity of each runway in the east and the west per hour under Cat-I condition, not taking aerial areas into consideration, are as shown in the TablesI-2.3.1 through 2.3.3 when computed as a model under the following conditions. When approach is from the north, runway capacity will be reduced due to take-off aircraft crossing the runway.

Interval of landings on the landing runway 2.4 minutes (25times)
Interval of takeoffs on the takeoff runway 2.0 minutes (30times)
Interval of landings or takeoffs in the case of
alternate landings and takeoffs 3.7 minutes (32times)
( ) means the repeating times in an hour.

### TableI-2.3.1 East Runway (2-runway set)

| | | | |
|---|---|---|---|
| Landing only | | 25 times + $\alpha$ | Does not have double capacity because it is not possible to set independent final approach course |
| Mixture of landing & takeoff | Landing | 25 times | Use the runway with threshold closer to approach direction for landing, the other for takeoff. |
| | Takeoff | 30 times | |
| Takeoff only | | 30 times × 2 | Both runways only for takeoff |

### TableI-2.3.2 West Runway (2-runway set)

| | | | |
|---|---|---|---|
| Mixture of landing & takeoff | Landing | 25 times | Use the runway with threshold closer to approach direction for landing, the other for takeoff. |
| | Takeoff | 30 times | |
| Takeoff only | | 30 times × 2 | Both runways only for takeoff |

### TableI-2.3.3 One Runway (Phase One Plan)

| | | | |
|---|---|---|---|
| Alternate landing & takeoff | Landing | 16 times | |
| | Takeoff | 16 times | |

2) Rapid Exit Taxiway Locations

Considering that both large and medium size aircraft will use the airport, the rapid exit taxiway locations will be placed at approximately 1,700, 2,100, and 2,500 meters from the runway threshold. In addition, since the distance between the 2,500m rapid exit taxiway and the runway threshold is long(1,500m ) a taxiway is placed in the space.

3) Parallel Taxiways, Apron Taxiways, Apron Dimensions

The parallel taxiways, apron taxiways, and apron dimensions will be established according to both ICAO and Chinese standards. The Cargo Zone and Maintenance Zone will be determined in the same way. Dimensions are explained in 2.3.2.

4) Taxiways

Taxiways will be laid out taking into consideration safe and smooth aircraft operations.

• The east and west runways, with the PTB zone between them, shall be connected by east-west taxiways at two places.

• The number of taxiways to connect to the outside runway shall be 3 each for operational efficiency.

• Because there is only one extended taxiway in the Chinese Plan at the entrance to the apron behind the PTB concourse, there arises the potential for an obstruction to aircraft operations. Therefore 2 taxiways shall be provided for each where possible.

5) The hypothetical aircraft for runways and taxiways is to be NLA.

(2) Passenger Terminal Apron

1) Spots of Passenger Terminal Apron

In front of the passenger terminal apron, 18 spots for E-type aircraft shall be placed. At the back of the PTB, 10 spots for D-type aircraft(bi-engine,B767-300) shall be placed.

2) Open Spots

Open spots shall be laid out for E, D, C-type aircrafts according to the sizes of the aprons. Open spots for Phase One will be 3 spots for C-type and 8 spots for E-type. However, the north spot for E type will be available for use by D type .

(3) Cargo Zone

The Cargo Zone shall be located, both to the north and south of the PTB zone as mentioned above. The vehicles bound for the Cargo Zone will approach from Shanghai Suburb Main Road on the north side and again from the Shanghai Suburb Main Road via the south side of the Airport area. The number of spots in the Cargo Zone is 8 spots in Phase One, and 27 in the future plan.

The Cargo Zone in the southern sector can be changed to a Maintenance Zone depending on the future maintenance demand. In this case, it is considered that the Cargo zone shall be relocated to an area to the west area of the runways by an underpass road.

(4) Maintenance Zone

The Maintenance Zone will be located to the south of the PTB zone and to the west of the runways. In the Maintenance zone, night-stay aprons will be heavily concentrated.
In the apron, 44 aircrafts (E-type) can be parked in total (15 in Phase One).
Also, 3 spots for engine test shall be prepared separately.
It is possible to build 11 hangers within an area of 200m × 150m. (3 facilities in Phase One).

**TableI-2.3.4 Spot Number**

| | Type | Phase One (2005) | Future |
|---|---|---|---|
| Passenger Terminal apron | Fixed Spot | 18E<br>10D | 72E<br>40D |
| | Open Spot | 8E<br>3C | 25E<br>15D<br>3C |
| | Sub-total | 39spots | 155spots |
| Cargo zone | — | 8 spots | 27 spots |
| Maintenance zone | — | 15 spots | 44 spots |
| | Engine test | 3 spots | 3 spots |
| | Sub-total | 18 spots | 47 spots |
| Total | | 65spots | 229spots |

(5) Other Air Side Facilities

1) Control Tower

The control tower shall be located based on ADP plan.

2) Fire Fighting, Relief Facilities

Based on ICAO regulations, the main fire station has been located to secure a response time of less than 3 min. and, if possible, less than 2 min. The layout shall be planned so as to optimize the location in both the Phase One Plan and the Overall Plan, with the amount of land used in Phase One minimized so that land utilization will be efficient. Because the main fire station is required by Chinese regulation to service buildings inside the airport perimeter, the facility is located near the apron side of the administrative zone. Fire substations are located at the approximate centers of each runway, where they will shorten planned response time in emergency situations.

3) GSE Passage System

GSE passages shall be laid out with four classes of width indicated in TableI-2.3.5.

**TableI-2.3.5 GSE Passage Width**

| Width | Location |
|---|---|
| 15m | ① East-West connecting passage |
| 12m | ② Behind the aircrafts of fixed spots (front) |
| 10m | ③ Along the PTB<br>④ Behind the aircrafts of open spots<br>⑤ Passages to connect ② and ③, Others |
| 7.5m | ⑥ Between aircraft on open spots |
| 6m | ⑦ Behind the aircrafts of fixed spots (back) |
| 3.5m | ⑧ Between aircraft on open spots |

(6) Access System, Roads

1) Access System

The access system to the airport are an express highway and a railway. Within the premises of the airport, both of them will be elevated.

2) Roads

Classification and width of the roads are indicated inTableI-2.3.6.

**TableI-2.3.6 Width of roads**

| Roads on the premises | |
|---|---|
| Arterial road | 60m (4 lanes. 6 lanes in the future) |
| Sub arterial road | 40m (4 lanes) |
| Collector road | 30m (4 lanes) |
| Service road | 20m (2 lanes) |

(7) Administrative Zone

1) Administrative Facility Zone

Administrative facilities shall be gathered in a zone to the north of the PTB zone.

2) Utility Zone (including utility route plan)

Utility facilities shall be gathered in the northern sector of the site. Each utility comes into the site along the access road or arterial road and reaches the Administrative Zone, PTB Zone, Cargo Zone, Maintenance Zone and Flight Zone via the Utility Zone.

The sanitary sewage shall flow the route in reverse, and be treated in the Utility Zone and discharged.

A summary of each Utility Facility is given below :

① Water Supply

(Future Plan)

• Water supply system will use pump system as described in the Chinese F/S.

• The water supply network will comprise of the following three networks. A circular flow network will be arranged where possible from sanitary considerations.

a, West Terminal Network (West Terminal, South Maint. Zone, Administrative Zone)

b, East Terminal Network (East Terminal, South Cargo Zone, Administrative Zone)

c, Utility Facility Zone Network ( Utility Facility Zone, Aircraft Co. Zone, West Maint. Zone

• Fire fighting water will be taken from each network and supplied to the storage pit in each fire station.

• Water pipes will be placed underground in the road right of way area in principle. In the PTB Zone, the route must be determinedafter cordination with Terminal building design.

( Phase One Plan)

• The West Terminal Network and a Part of the Utility Facility Zone Network will be constructed in Phase One.

• The pipe network will allow each site to receive water from at least two directions.

• The piping leading from the PTB to the Maintenance Zone will be replaced in the future when the South Terminal is constructed.

② Waste Water Drainage

( Future Plan)

• Waste water will be collected at the waste water treatment plant In the Utility Facility Zone and will be discharged to the public sewage after treatment.

• Waste Water Drainage Network will be comprised of the following three systems.

a, West Terminal Network

b, East Terminal Network

c, West Maintenance Zone Network

• The flow will be by Gravity Flow. However, as the distance is long, pump houses will be constructed at several points to permit pumping up of the sewage.
• The routes of the pipe network will be roughly similar to that for Water Supply Network.

(Phase One Plan)
• The West Terminal Network and the West Maintenance Zone Network will be constructed in Phase One.
• The networks will be designed to allow discharge to one or two directions from each site.
• The piping leading from the PTB to the Maintenance Zone will be replaced in the future when the South Terminal is constructed. During the interim the pipe work will be temporary construction. As the distances are long provisions for pumped discharge will be made.

③ Thermal Energy Plant
( Future Plan )
• Hot and cold water for heating and cooling of each facility will be supplied from a central Thermal Energy Plant.
• The Thermal Energy Network will be comprised of the following three networks;
a, North Terminal Network
b, South Terminal Network
c, West Maintenance Zone Network
• The reason, unlike the Water Supply Network and the Waste Water Drainage Network, the North Terminal Network and the South Terminal Network were separated was to make each route as short as possible to reduce heat loss. The Thermal Energy Plant will be constructed in a section of the South Maintenance Zone.
( Phase One Plan )
• Parts of the above three networks will be constructed.
• The network will be designed to allow supply from at least one direction for each site. However, areas such as the Utility Facility Zone where expected demand is low will be omitted. It will be necessary to determine the necessity for themal energy supply as the plans for each site are developedin the future.

④ Power Supply
(Future Plan )
• The Power Supply Network will be comprised of the following three systems.
a, North Terminal Network( North Terminal, Control Tower Zone)
b, South Terminal Network (South Terminal, Maintenance, Cargo Zone)

c, West Maintenance Zone Network (Utility Facility Zone, West Main. Zone)

However, the North Terminal Network may require to be divided into the Terminal Zone Network and the Control Tower Network depending on the power demand .

( Phase One Plan )

• Parts of the above three networks will be constructed.

• The networks will be designed to allow supply from at least two directions for each site.

⑤ Matters requiring further study

• There are the following two approaches concerning implementation during Phase One period.

a, To construct the facilities with sufficient capacity for future growth in demand ( increase pipe size, etc.).

b, To construct facilities in accord with demand for Phase One facilties and allow for future demand in design. ( Design pipe sizes for Phase One demand , but keep space for additional pipes in the future.)

It is not considered wise to construct the facilities on the basis of estimated future demand , as the initial cost will be large and the estimates of future demand and facilties layout have a large element of uncertainty. It will be necessary at the time of the design of each facility to make a study on the alternatives.

• Pipe sizes, number of pipes and depth of placement, etc. will be determined after the system design based on demand study for each site has been conducted. Furthermore the routes should be adjusted based on actual demand.

• Regarding the Water Supply and Waste Water Sewage Facilities, it is possible to construct water supply and sewage treatment facilities on the southern portion of the site. The Pipe network in Phase One is designed to be temporary construction due to insufficient demand.

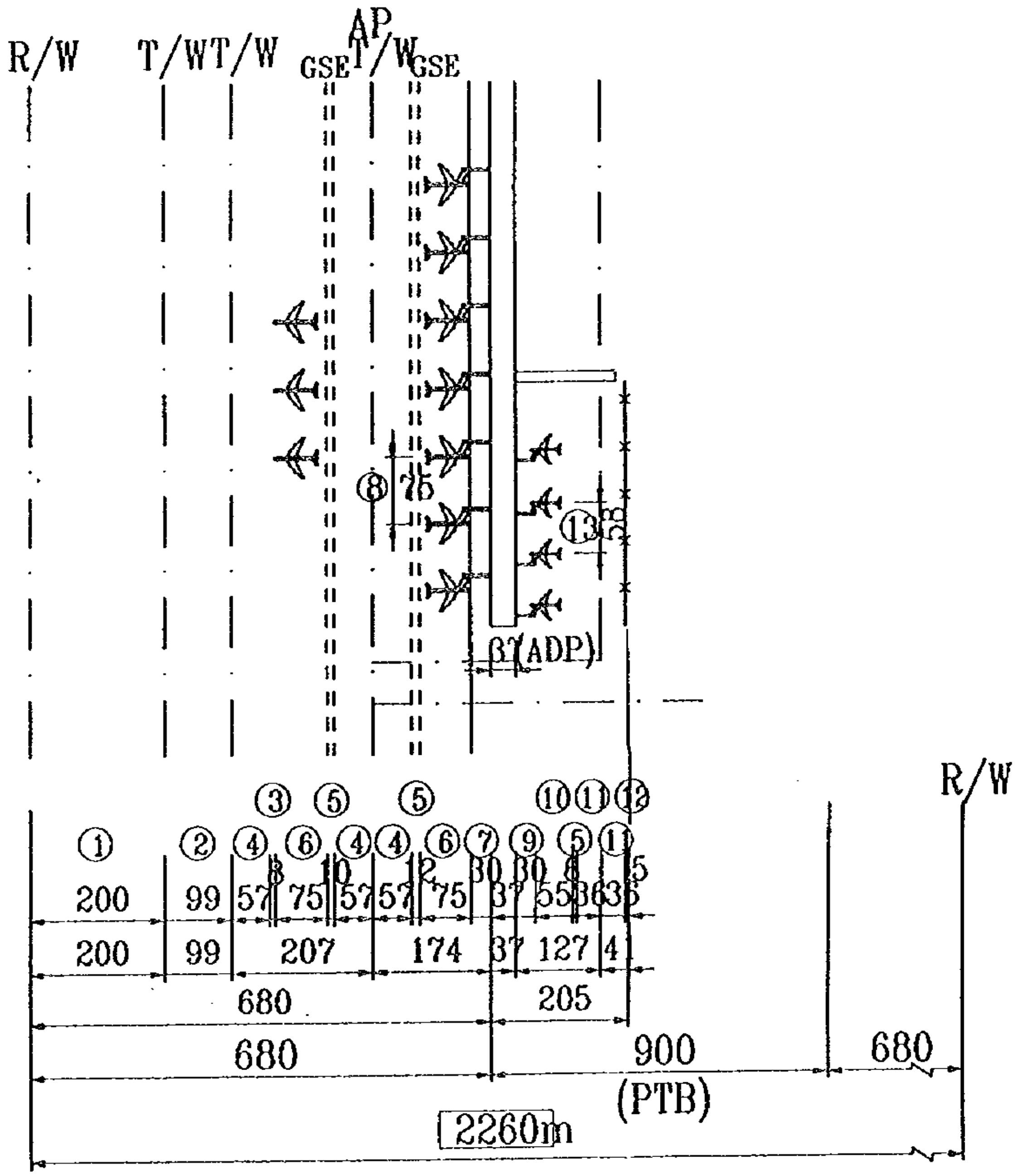
• Piping and wiring space in the Terminal Zone are severely constricted by the pond at the north of the terminal . The design for these facilities mest be adjusted in step with the progress of the Terminal Building.

3) Airline Company Zone

Airline companies shall be located in the western sector of the site in an single zone.

## 2.3.2 Dimensions Used in General Layout Plan

(1) Layout of R/W-T/W-Apron



The respective bases for dimensions in ① through ⑬ are as described below.

①R/W - T/W (ICAO standard) NLA assumed dimensions are L=84m, W=84m

RS/2+Ws/2=300/2+84/2=192m ⇒⇒⇒ to be 200m with margin

②T/W～T/W(ICAO standard) NLA assumed dimensions are L=84m,W=84m

Ws+C+Z=84+4.5+10.5=99m ⇒⇒⇒ to be 99m

③Allow 8m for the push-back space by towing tractor.

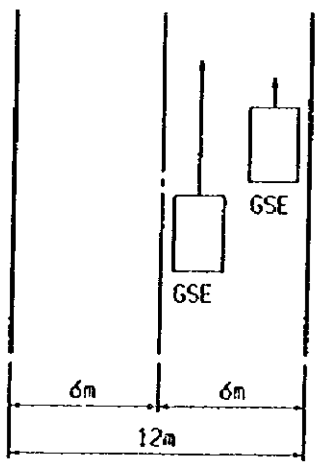
④T/W～object (ICAO standard) NLA L=84m,W=84m

Ws/2+C+Z=84/2+4.5+10.5=57m ⇒⇒⇒ to be 57m

⑤GSE width behind aircrafts

The width of the GSE passages along the fixed spots behind the aircraft will be 12m to allow taking over by GSEs because of the following reasons.

- Traffic to the Cargo Zone to the north is expected to be heavy.
- Large vehicles such as catering cars which approach from the landside will mainly use this passage, causing vehicles with different speed to mix.



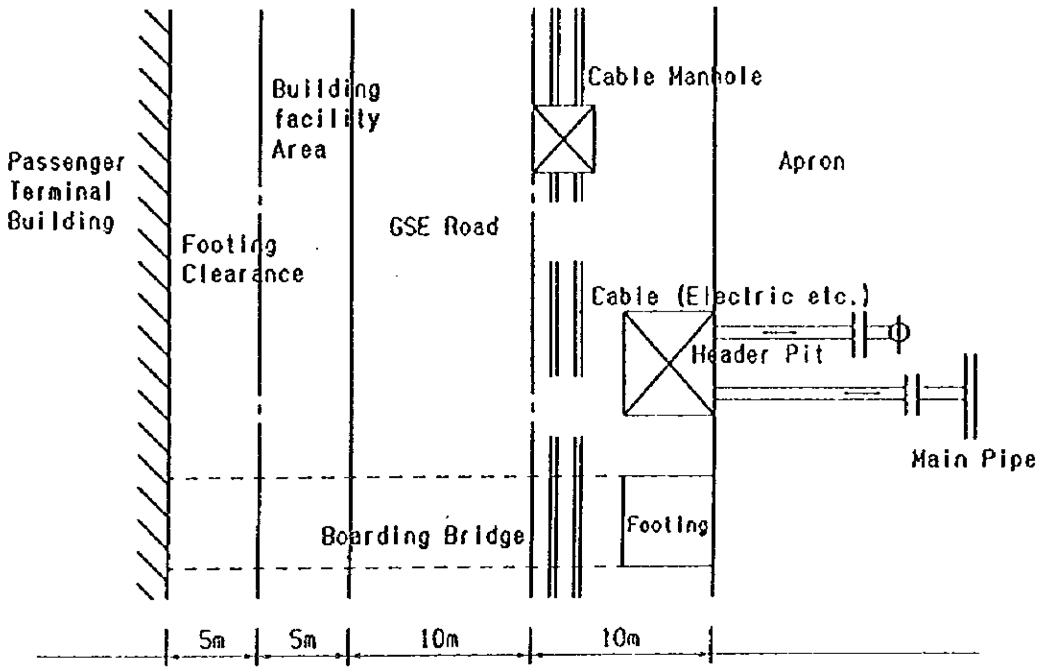

⑥Hypothetical aircraft

B777-300 L=73.8 ⇒⇒⇒ to be 75m
(reference : B747-600 L=84m)

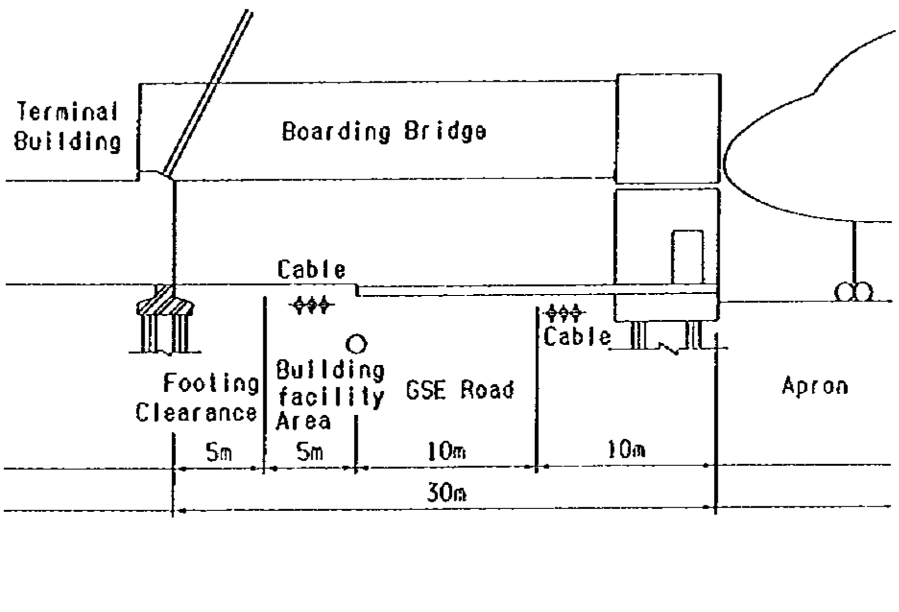
For the parking of NLA at the fixed spots, there are two methods; one is that the spots at both ends will have inclined parking position and the other is allow parking at right angles by closing a part of GSE passage behind the aircrafts.

⑦Spacing between aircraft nose and buildings.

PLAN




SECTION



⑧Hypothetical aircraft

B747-400 W=65.1 ⇒⇒⇒ to be 65.1m +10m=75m (Chinese standard)

⑨=⑦

⑩Hypothetical aircraft models

Assumed dimensions of B767-300ER, L=55m

| Type | Models | L | W |
|---|---|---|---|
| Narrow body (reference) | B737-700 | 33.63 | 34.31 |
| | MD-90 | 46.9 | 32.87 |
| | MD-95 | 37.34 | 32.86 |
| | A-320 | 33.91 | 37.57 |
| | B757-200 | 47.32 | 38.05 |
| Wide body Bi-engine | B767-300ER | 54.94* | 47.57* |
| | B767-200 | 48.51 | 47.57* |
| | A310-300 | 46.7 | 43.9 |
| | A300 | 54.1 | 44.8 |
| (reference) | A-330 | 63.7 | 60.3 |
| Tri-engine (reference) | MD-11 | 61.2 | 51.7 |

⑪T/L - object (ICAO standard)

B767-300ER , W=48 ⇒⇒⇒ to be 48/2 + 10 = 34 m

⑫Blast fence

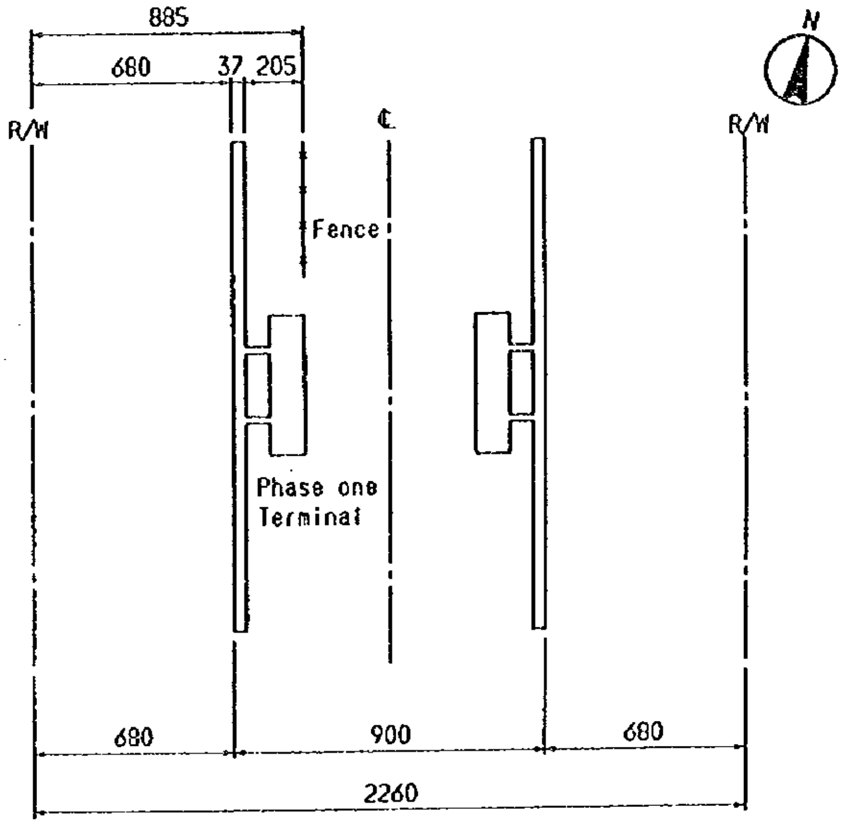
Allow 5m for blast fence.

⑬Hypothetical aircraft

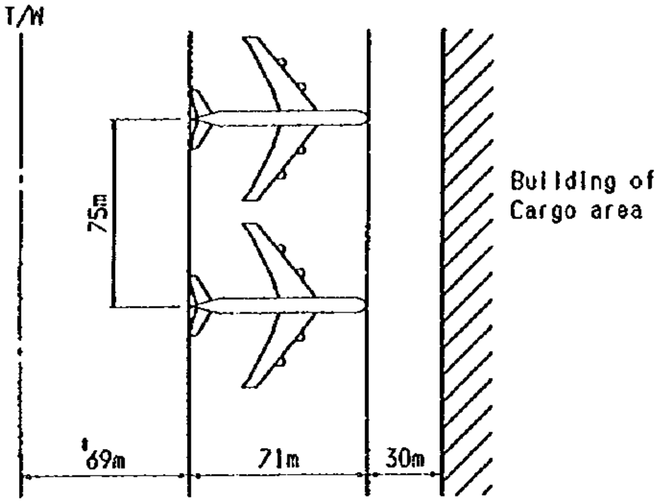
B767-300ER W=48m ⇒⇒⇒ 48m+10m=58m

(2) Relation between Terminal Area and Flight Operation Zone

The relation between the terminal area and the flight operation zone is as indicated below, taking into consideration the result of (1).

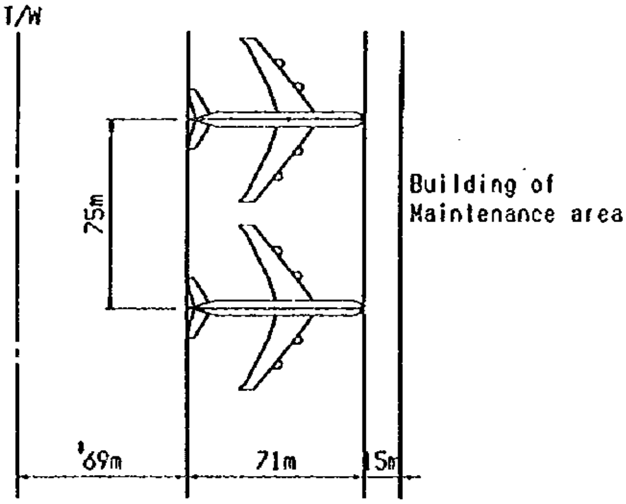


(3) Dimensions of Cargo Zone



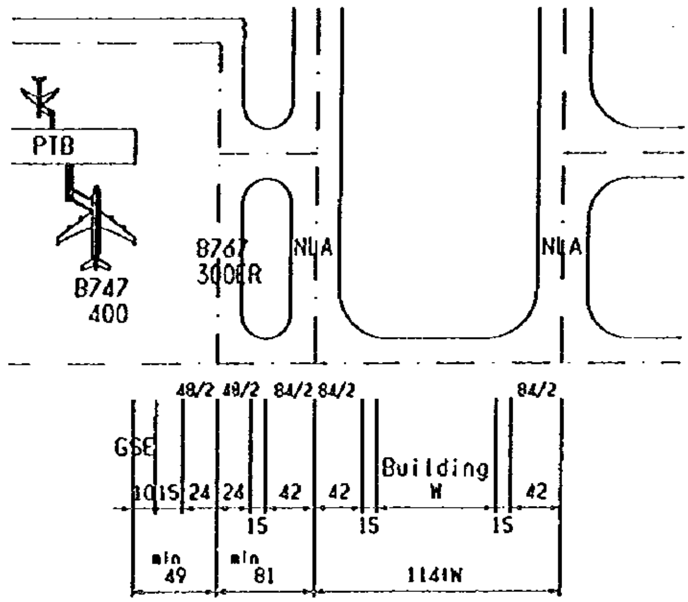

B747-400
* Hypothetical aircraft is NLA

(4) Dimensions of Maintenance Zone



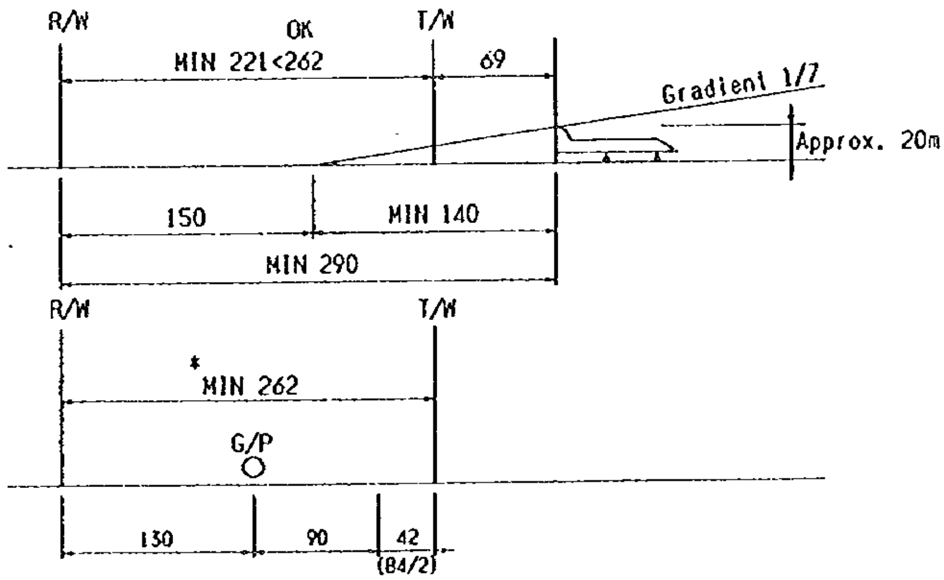

B747-400
* Hypothetical aircraft is NLA

(5) Spacing of the PTB concourse edge taxiways




(6) Control surface check

The control surface will be checked against the aircraft parked in the Maintenance Zone.



### 2.3.3 General Layout Plan

The General Layout Plan compiled from the investigation is shown in the two figures - FigureI-2.3.1 Future Plan and FigureI-2.3.2 Phase One Plan.

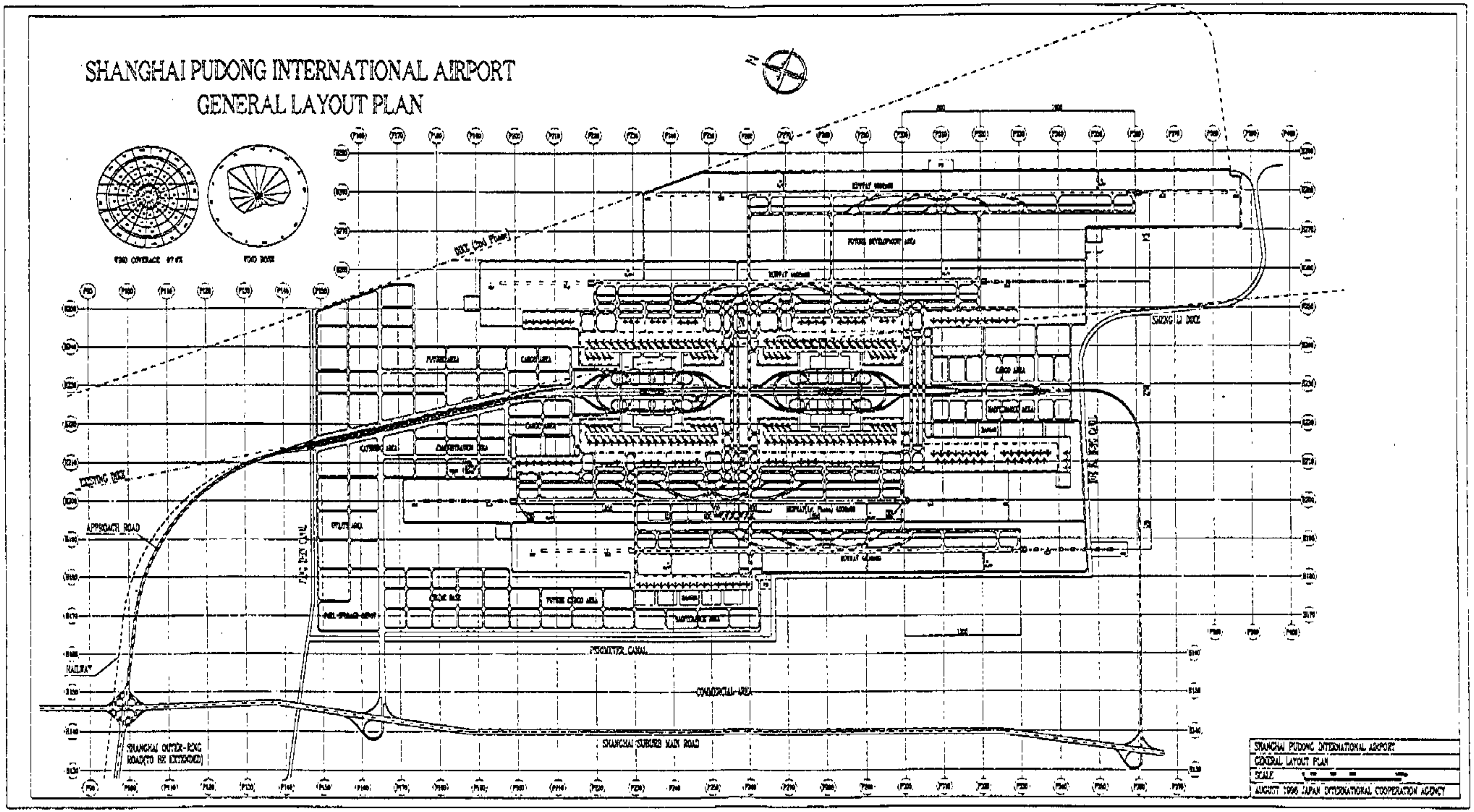
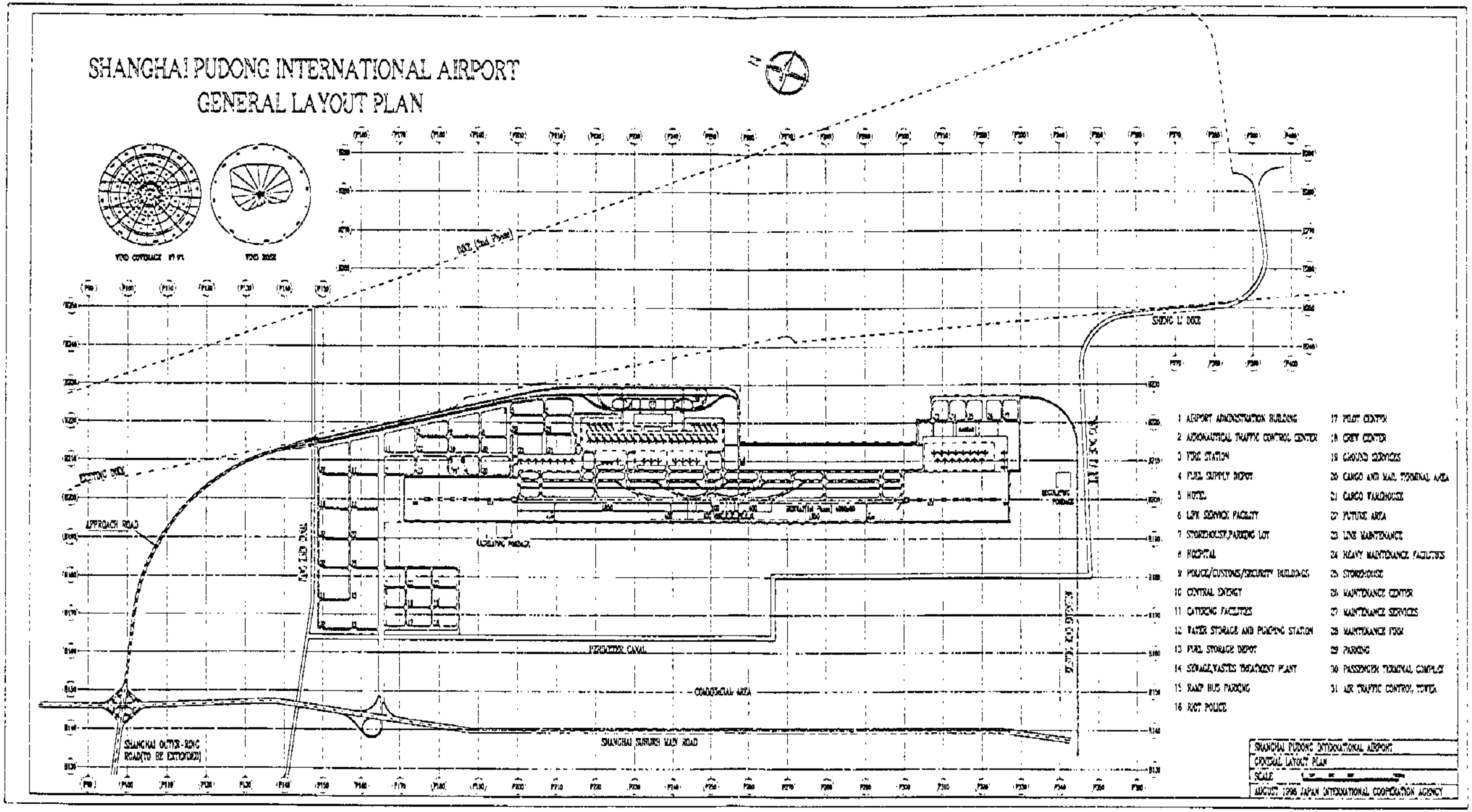



Figure I-2.3.1 Future Plan Layout




FigureI-2.3.2 1st Phase General Layout Plan