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ABSTRACT

To face with the increasing the air transportation in Korea, the construction of Inchon International Airport is underway in the bay of Inchon on the reclaimed land. The construction project has begun since the end of 1992, and will be completed by the end of year 2000. This paper presents the general plan of project, site development, soil improvement work, transportation system, and construction budget and fund.

KEYWORDS

Inchon International Airport, soil improvement, land reclamation.

INTRODUCTION

The Construction site of the Inchon International Airport(IIA) was chosen from the survey of 22 tentative sites around a 100km radius of Seoul. After reviewing of site condition, site location, air traffic, construction cost, and environmental effects, the present site, in Fig.1 Yongjong Island, was selected on June 14, 1990.

The construction work was implemented from November 12, 1992 and 17.28km long dikes were completed on October 29, 1994. It was constructed against 10,000 year period of sea storm. Land reclamation works for Phase I (1.174ha) were completed and site improvement works are almost done.

Currently, foundation works for passengers terminal, underground automated transit system, taxi way, and parking area are actively underway. So far total progress of construction works of the Phase I has been done about 45%. The airport will be opened in the year 2001 with 2 runways. Final Phase will be completed by the end of 2020 with four runways.

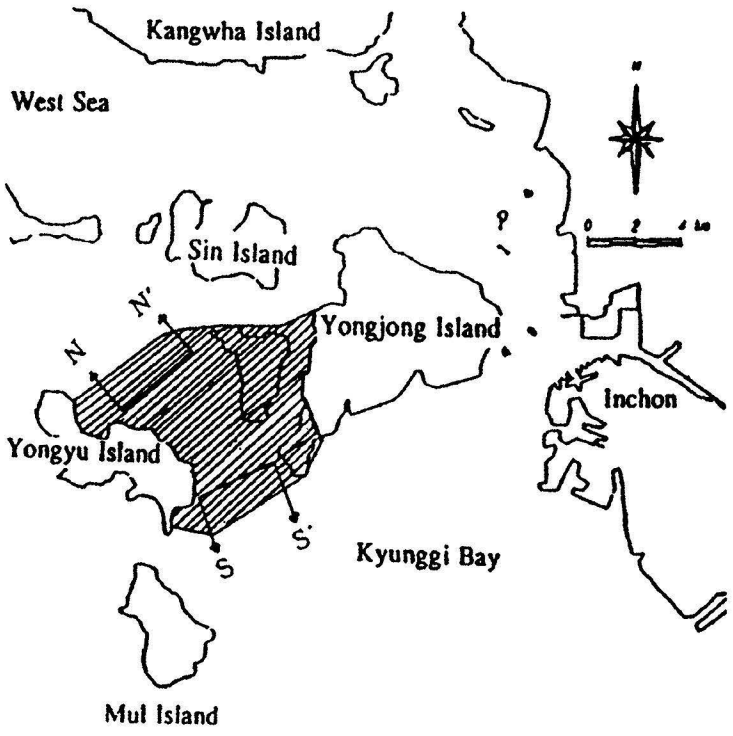

Figure 1. Construction Site of Inchon International Airport

GENERAL PLAN OF PROJECT AND SITE DEVELOPMENT

A number of new airports are planned and under construction in the Asia-Pacific region. The project of Inchon International Airport are compared with Kansai & Chek Lap Kok Airports in Table 1.

Table 1. Comparison Inchon International Airport with Chek Lab Kok & Kansai Airports

Classification	IIA	Kansai	Chek Lab Kok
Site(ha)	1,174 (4,744)	512 (1,300)	1,248 (1,250)
Runways	2(4)	1(3)	1(2)
Flights (100/year)	260(530)	160(260)	160(320)
Passengers (million/year)	35(100)	25(40)	27(87)
Const. period	'92~'00	'86~'94	'91~'97
Const. budget (million U$)	5,476	11,000	12,325
Distance(Km) from city	55	50	30

( ) Final phase

At the Inchon International Airport, two passenger terminals, four remote concourses and an apron capable of parking 153 aircraft simultaneously will be located between four runways. For the phase 1, the International Business Center will be built just south of the Passenger Terminal. For the phase of 2020, a vast support complex will be constructed on the east of the airport.

The cargo terminals will stand to the east of the runways, while aircraft maintenance hangars will be placed north of the runways. In-flight catering facilities, refueling facilities, and an intergrated transportation center with parking facilities and a train depot, will be designed and located for maximum efficiency for overall airport operations.

The airport site covers 5,615 hectares. It is made up of 4,743 hectared of reclaimed land between Yongjong and Yongyu Islands with 872hectares of existing land. The scope of construction project is described in Table 2.

Table 2. Scope of the Inchon International Airport Project

Classification		Phase I	Final stage
Airport facility	Area(ha)	1,174	4,744
	Runway (m)	3,750×60 (m, 2EA)	3,750~4,200 ×60 (m, 4EA)
	Passenger terminal (1000^2)	357	1.12
	NAVAID	CAT-IIIa	CAT-IIIB
Access transportation	Express-way	6~8 lanes 54.5km	8 lanes 54.5km
	Railway	Land acquisition	Double-track 66km
Support community(ha)		218	837

The two islands were connected as one by constructing 17.3㎞ long dike. The dike was bulit to block the sea. It will secure the new airport from constant waves within a period of 10,000years.

The 6.1㎞ southern dike is 8.3m in height, while 7.3 ㎞ northern dike is 9.4m in height, and the 3.9㎞ eastern dike is 7.5m in height. These dikes are 90-120m wide at the bottom and 20m wide at the top In order to reclaim 4,743 hectares, approximately 180million㎥ of earth will be dredged from the sea and the rest 20% of fill will be excavated from the mountains and hills in the area.

For land reclamation, it is estimated 3.8 ㎥ of soil per ㎡ will be required for fill. Because a lesser volume of fill is required, the airport construction cost will be lower than other airports. Therefore, the Inchon International Airport will provide lower landing fees. While the fill material required for reclamation of 1㎥ is 36㎥ for Kansai airport and 15 ㎥ for Hong Kong airport.

SITE IMPROVEMENT WORK

The subsoil condition of the airport construction site is consisted of clay, silt, sand, and formed in the 4th Alluvial. The metamorphic sedimentary rock from gneiss complex was formed in the pre-cambria period around the site. The thickness of soft soil ranges from 3m to 10m with an average thickness of 5m.

The typical soil properties of soft marine clay are tabulated in Table 3.

Table 3. Soil properties of soft marine clay

Natural Water Content(w_n)	25~40%
Liquid Limit(LL)	30~50%
Plastic Limit(PL)	10~23%
Initial Void Ratio(e_o)	0.7~1.1
Undrained Strength(c_u)	0.11~0.55kg/㎠
Specific Gravity(G_s)	2.67~2.71
NO.200 Passing(%)	72~99%

Soil improvement technique is required to stabilize the reclaimed land. Runways, taxiways, and apron areas are designed to withstand the maximum take-off weight of future aircraft over 450metric tons. Permissible levels of settlement consolidation for ground fill are shown in Table 4

Table 4. Permissible Levels of Subsidence for Various Structure

Structure	Permissible level of subsidence(cm)	Remarks
Runways	7.5	Including 5cm of lower sea layer
Apron, Taxiway, GSE road	10.0	
Landing spot	15.0	
Green area	20.0	

The SCP method was partly used in the construction of Kansai and Chek Lap Kok International Airport. PBD method was successfully implemented in the construction work of Changi and the 2nd Bankok International Airport. The geotechnical properties of Changi International Airport site is somewhat similar to those of the IIA site. The pilot tests were performed from October, 20, 1994 to December, 1995. The parameters of the individual soil improvement method is given in Table 5. The test results indicated that the degree of soil improvement by sand drain method is not much different from that of PBD, due to the predominant of sand seam. So, those two methods are currently used in the soil improvement work.

Table 5. Various Soil Improvement Methods with Degree of Consolidation

Method	Dia(cm)	$U_{100\%}$ spacing	$U_{90\%}$ spacing
SCP	50	1.9	2.4
	60	2.1	2.6
SD	30	1.6	2.1
	40	1.8	2.2
PD	12	2.4	2.8
PBD	10×0.3	1.0	1.5

TRANSPORTATION SYSTEMS

The 40.2km long Airport Expressway is being built with 8 lanes and will expand to 12~16 lanes from support complex to terminal. Also, airport railway will be linked to the terminal for easy and convenient accessibility to the airport.

To reduce traffic congestion at the terminal curbside, the third level will be specifically designed for departures and the first level for arrivals. Each level will facilitate efficient traffic flow for passengers, buses, taxis and private vehicles. The parking facilities will be designed for long-term and short-term parkings. At the Inchon International Airport, two parking facilities of short-term parkings will be located at south the terminal, capacity of total 11,000 cars. In the final phase, transportation hub will be built to the east of the passenger terminal and accommodate an additional 14,500 cars.

The Transportation Center, located between the Passenger Terminal 1 and Terminal 2, will be the primary intermodal facility for transportation systems. It will poised on 270,000m^2, 4 floors above the ground, 2 basement floors, and Apron Control Tower. Train station, IAT, BHS, and PMS facilities will be located at the Transportation Center.

Passengers will access the terminal and concourse by using IAT(Intra Airport Transit) System. The IAT system will run every 108 seconds and take 7 minutes to reach the farthest concourse. Capacity will be 14,000 passengers per hour. The PMS(People Mover System) will link passenger terminals 1 and 2 to the International Business Center with a capacity of 10,000 passengers per hour.

CONSTRUCTION BUDGET AND FUND

Most of the large construction projects were financed by a government budget. However, the IIA project is largely depended on the efforts of the construction authority to raise funds by land sale and private investment. This is partially due to limits on the government's capability to meet the social overhead capital requirements. Based on the intent of the Private Capital Enticement Promotion Act and its enforcement ordinance for the Social Overhead Capital Facilities, plans are being pursued for the maximum expansion of opportunities for private investment and active participation by the private sector on the IIA construction project. This government action will achieve the double benefit of allowing of private investments to create new business for profit and also help the national treasury finance large public projects.

Table 6. Total Required Budget and Fundraising plans for Phase I (Unit : million U$)

Investment		Fundraising	
Project	Budget	Sources	Amount
◦ Airport facility		Borrowing	2,446
-Compensation	573		
-Site development	789		
-Airfield facility	1,185		
-Architect facility	1.719	Government	2,037
◦ IBC	318	Grant	
◦ Supporting	153		
community		KAA	42
◦ Design & Super	318		
-vision cost			
Subtotal	5,055	Subtotal	4,525
◦ Access transportation	421	Fundraising private sector	951
Total	5,476	Total	5,476

The total required budget and fundraising plans for Phase I is tabulated in Table 6.

CONCLUSION

This paper described the construction of the Inchon International Airport project.

IIA will be fully-equipped airport as a 24 hours a day self-sustaining grobal village supported by Seoul and Inchon, and by the information superhighway linking it with the whole world. By year 2001, the airport will be capable handling annually 27million passengers, 170,000 flights, and 1.7 million ton of cargo.

The construction work has been progressed about 45% so far. By the year 2020, the airport will have a capacity to handle 530,000 flights, 100 million passengers, and 7 million tons of air cargo annually.

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