

STRUCTURAL DESIGN OF THE INCHEON INTERNATIONAL AIRPORT TERMINAL BUILDING



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1. Introduction

The Incheon international airport is designed to maintain Korea's position in the world wide air traffic market in competition with other giantic regional airports. The major potential of the airport to become an aviation hub lies in its geographic location. It is located in Northeast Asia at the intersection of the trunk routes between North America and China, and from the Pacific area to Europe. Thus, the main goal is to establish Incheon as an Asian transportation hub, and a center of leisure, distribution and manufacture for the first order.

By 2020, the airport will contain 2 passenger terminal buildings and 4 remote concourses. Thirteen projects will have been carried out, of which forty-seven buildings including two 3,750m runways, 173,678m² passenger terminal I, 250,000m² transportation center, control tower and airport integrated communications center are completed last year. The softly curved passenger terminal I for super multi-facilities has a length of 1,064m, a width of 149m and a height of 33m. This is as large as 60 soccer fields. The total floor space is 496,000m² with two basement levels of 12.5m and four levels of 33.09m above ground. The terminal is constructed of reinforced

concrete and steel reinforced concrete structure for basements and steel structure for super structure. The terminal accommodates the parking of 44 large aircrafts simultaneously. More than 15,000 steel piles, driven into the base rock to ensure a solid foundation after compaction, support the terminal of 173,678m².

The passenger terminal has two independent parallel runways able to handle 170,000 aircraft movements, 27 million passengers and 1.7 million tons of cargo a year. It takes over all international operations from Gimpo international airport, Seoul, which is ranked 9th for passengers and 6th for cargo in the world. While the total area of the airport is 1,392hectares in its first phase, the overall reclaimed land site is expected to be



Fig. 1 View of Incheon International Airport

5,617 hectares, 12 times larger than Kansai international airport and six times larger than the new airport in Hong Kong.

2. Design Philosophy

Incheon international passenger terminal is figured with Korea's rich cultural context and a feeling of kindness and

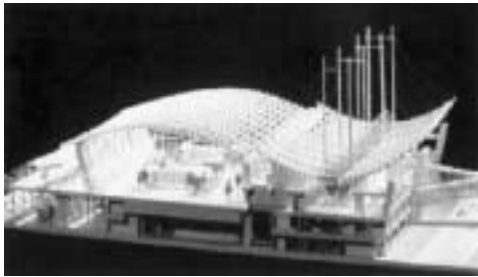


Fig. 2 Terminal of structural integrity and symbolic form

welcome. The passenger terminal building, as a heart of the airport, is realized in form and space with an architectural symbol of the nation and the globe. The strength and beauty of a manmade structure is symbolized in harmony with nature and culture (see Fig. 2). The concept of the terminal design is based on harmony with the surrounding environment and Korean traditional beauty. As it is the largest off-shore airport, the terminal design reflects its beautiful natural environment with lines that evoke the image of clouds and waves. External shapes emphasize the image of airport on sea and the mechanical flow of air and water. The masts stretched into the sky remind vessels docked at a harbor. The rhythm of rooflines symbolizes the curved shapes of wind and water. All these are based on Orientalism representative of the harmony of the negative and positive and the origin of lives. In addition, a module concept is also applied to the new airport for the formation of the systematic and organized space, and for the inter-connection among material, design and construction to produce the aesthetic system.

2.1 Elevation

While the lower part of the terminal is composed of Granite to emphasize a stable and comfortable impression, the upper part consists of the window and the sloped curtain wall. The roof, covered with window, is likely to bring in the same tension as passengers feel at the just beginning of flying. The boarding gate has 2 stone columns for the safety and the rhythm of elevation. According to each direction, windows have the different coating, insulation bar, tinting and fitting for the control of the solar heat and light as well as the reduction of heat loss. The masts and catenaries support system of the roof emulate the large anchored ships nearby Incheon Harbor. Clerestories and skylights bring enough daylight into the interior to allow the cultivation of traditional Korean gardens, which lend a peaceful and welcoming feel to the space. Both overt and subtle ways are adopted to make the Incheon terminal a memorable gateway and haven for weary travelers.

2.2 Roof



Fig. 3 Exteriors of the Incheon Passenger Terminal

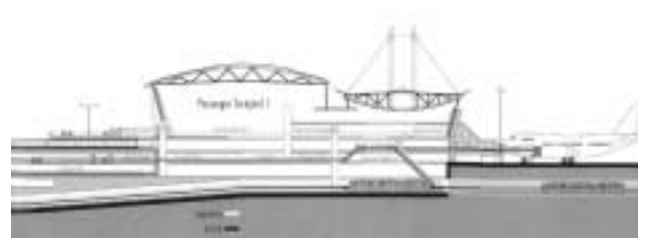


Fig. 4 Elevation of the Incheon Passenger Terminal

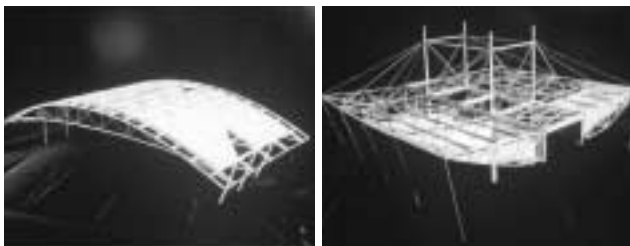
The roof shape contains the meanings of the Korean traditional architecture, the harmony of the negative and positive, the image of aviation and the movement of wind and water etc. These are configured in a welcoming arc, as its sweeping rooflines, modeled after the gentle roof arc of ancient Korean temples.

The huge roof covers the roofs of the terminal and the concourse, but the roof is designed to make up for the defect of each independent function. At each module, the terminal roof covers the region of Check in Island with an

82m span of independent shell structure, and roof windows are placed between the shells for inducing the natural light. The design of the concourse is changed from the pagoda roof to the flat roof for the disposal of water and the installation of ventilation facilities. The pagoda was the convex roof with 4 columns at the center of each module.



Modularized Plan



Modularized Entrance Hall Truss

Modularized Concourse Truss

Fig. 3 Exteriors of the Incheon Passenger Terminal

A brand new construction technique is employed for the building. The terminal buildings incorporate the latest techniques into architectural design. A specific truss-type of building structure, designed to secure the safety of all airport patrons, provides spacious and comfortable indoor areas. The exterior finishes employ artificial and natural materials for a symbolic expression of the harmony existing between nature and technology. The state-of-the-art construction method applied to the buildings, especially at the terminal building, includes a symphonic drainage system and lift-up method along the airport's rooftops.

The lift-up technique is adopted for the installation of roof truss with maximum 1,250tons of weight, which is assembled on the third floor. Ten hydraulic jacks are concurrently used to lift the roof truss onto the design level. This method brings to minimize on-site hazard at the high place and to reduce construction period as well as to keep high construction quality.

The symphonic drainage system increases the spacing of drainage pipe up to 10 times and decreases the diameter of the drainage pipe up to a quarter, when compared with the existing ones. Due to its drainage speed faster than that of the existing, the drainage system enables to remove the remains or substance inside the pipes. Furthermore, the electric heat system is attached to the drainage pipes to prevent the freezing of the pipes during the winter.

3. Passenger Terminal Structure