Incheon International Airport
A baggage handling system for Asia’s new hub

A success story –
high tech in the Land of Morning Calm

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"An emerging tiger economy in South-east Asia sharpening its claws" is a good way to describe South Korea’s current economic situation. To accommodate the country’s economic growth, infrastructure measures are taking on increasing importance. A good example of this is Younggeong, an artificial island 52 kilometers to the west of Seoul and the site of Incheon International Airport, the most important airport in South Korea. Airport operator Incheon International Airport Corporation (IIAC) is in the middle of a multiphase expansion that will make Incheon the largest hub in the region. Because Siemens has a long-existing business relationship with IIAC and we completed Phase I of the expansion project to their utter satisfaction, we were able to qualify as the perfect partner for the now-completed Phase II.
The challenge: expanding and renovating during live operation

As South Korea’s largest airport, Incheon was originally designed to handle 30 million passengers. However, growth forecasts were rapidly exceeded, largely due to the Olympic Games in Beijing. Based on a master plan developed in the 1990’s, the airport is now being expanded in several phases to make it the largest hub in Southeast Asia with an annual capacity of 100 million passengers. Phase II (now completed) included expanding the capacity of the existing Terminal 1 to 330 check-in counters, as well as building the first Concourse A. These measures increased overall capacity to 40 million passengers per year. Continuous growth in the number of transfers – solid evidence of Incheon’s attractiveness – required a massive expansion of the early bag storage system by 3,700 additional bags, for a total capacity of 4,700.

Wide-ranging tasks
Incheon International Airport’s Concourse A is separated from the Main Terminal by a distance of one kilometer. That’s a lot of ground to cover, both for passengers and for their baggage. But connecting times are what determine a hub’s competitiveness, so short transfer times to connecting flights had to be guaranteed despite this long distance. Incheon Airport is relying on two basic factors to ensure a minimum connecting time (MCT) of 25 minutes: the most efficient baggage handling possible, and installation of a Siemens high-speed tray system with transport speeds of up to 10 meters per second.

Other complex challenges included the combined transport of normal and oversize bags on one conveyor line, and replacement of the entire IT system in a “live system.” In the latter case, Siemens replaced the old system while the baggage handling system was in live operation. Baggage Base IT had already been thoroughly pretested at the Siemens Airport Center and could therefore be installed with no problems. At the same time, we helped our customer with the scheduled handover of the early operated areas two years before the Concourse A. This helped to quickly eliminate bottlenecks in the check-in area.
Our solution: over 56,000 pieces of luggage per hour sorted and delivered to their destination

The scope of the project quickly becomes clear when we consider the areas of the airport that were affected. The new Concourse A had to be connected to the expanded Main Terminal via a tunnel. This meant that additional transport facilities within the terminal also had to be built, and the one-kilometer-long connecting route had to be equipped with high-speed technology. For the three different processes of departure, transfer, and arrival, a total of 70 kilometers of Siemens belt and tray technology was installed, 20 kilometers of which were in the tunnel.
The scope of the new baggage handling system is apparent just from the number of devices and components installed. Despite – or perhaps because of – the extreme complexity of the project, rapid transport within the airport and to connecting flights is possible even under difficult conditions, such as inclement weather. When flights are delayed due to snow or high winds, for example, baggage can still be forwarded quickly and reliably to connecting flights and baggage claim areas even during the consequential peak times thanks to the flexibility of the baggage handling system.

The new baggage handling system sorts very reliably, as confirmed by the low percentage of baggage not delivered on time. With a left-behind index (LBI) of only 0.005 percent, Incheon is one of the very best.

### Key figures at a glance

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conveyor belt system:</strong></td>
<td>52,000 m</td>
</tr>
<tr>
<td><strong>High-speed system:</strong></td>
<td>36,000 m</td>
</tr>
<tr>
<td><strong>Early baggage storage capacity:</strong></td>
<td>4,700 pieces</td>
</tr>
<tr>
<td><strong>Sorting points:</strong></td>
<td>144</td>
</tr>
<tr>
<td><strong>Baggage claim carousels:</strong></td>
<td>23</td>
</tr>
<tr>
<td><strong>Baggage X-ray system and security screening:</strong></td>
<td>112</td>
</tr>
<tr>
<td><strong>Video monitors:</strong></td>
<td>299</td>
</tr>
<tr>
<td><strong>Drives for baggage handling:</strong></td>
<td>11,772</td>
</tr>
<tr>
<td><strong>Baggage identification sensors:</strong></td>
<td>25,000</td>
</tr>
</tbody>
</table>
Check-in counters: 332

Programmable controllers: 182 modules

Sorting capacity per hour: 56,520 pieces
Perfectly synchronized components

Before a piece of luggage from an arriving plane is claimed by its owner, it passes through one of the most modern baggage handling systems in the world. A total of 11,772 drives keep the overall system reliably in motion, and 27,500 meters of conveyor belts and 39,000 meters of tray conveyors deliver the luggage to its proper destination at a speed of up to 10 meters per second. Structural safety is provided by 10,000 tons of steel. Precise system monitoring and control are handled by 160 PLC groups, 30,000 sensors, and around 120 servers, workstations and network computers.

Thanks to the perfect interplay of all components, it takes a maximum of 18 minutes for a piece of luggage unloaded from a plane to be ejected onto the carousel. Even if passengers travel the entire distance on a people mover system, their bags will normally get there faster – an extremely pleasant situation for passengers, who are spared having to anxiously await their bags at the baggage claim carousel.

IT upgrade during airport operation

One of the major challenges of this project was renovating the heart of the baggage handling system. The entire existing IT system was replaced during running operations. This meant upgrading all the computers to state-of-the-art technology and integrating them into the higher-level automation architecture. Thanks to Baggage Base IT the system is characterized by a high level of flexibility, fault tolerance, and user-friendly configurability, allowing it to meet the demanding process requirements for MCT and security.

Successful project management achieved early handover

Siemens was able to complete the “Incheon Phase 2” project – from designing the system to handing it over to the customer – in less than three and a half years.

Despite the difficulties caused by the system being in operation, which meant that commissioning and testing could be performed only at night, the project was completed before the agreed-upon handover date.

From the conveyor technology to the carefully coordinated drive technology and IT software, a multicultural team comprising Siemens employees and local consortium partners made sure that all the components were perfectly harmonized.
The goal is reached: Incheon is ready for the future

Our solution offers a high degree of system reliability thanks to Baggage Base IT, the combined handling of over-size and normal bags in a single system, a sophisticated security concept, and early operated areas – with everything operating at top transport speeds.
A high degree of reliability thanks to Baggage Base IT

Thanks to the use of Baggage Base IT, all equipment operates with very high reliability. The entire system is designed to be fully redundant, meaning that systems will continue to function correctly in the highly unlikely event of a component failure.

During the sorting process, Baggage Base IT determines the shortest route and directs the containers accordingly. Depending on the need, empty containers are either routed directly to the next loading operation or diverted to a decentralized storage area for empty containers.

Baggage Base IT’s modular structure means that individual functions can be flexibly adapted or even expanded at any time – a solid investment in the future, as well as another important advantage for Incheon’s future development.

Security concept

The baggage handling system uses state-of-the-art five-level security screening. Suspicious bags are immediately separated out and forwarded to a level downstream. The Siemens screening concept ensures that only “clean” bags are loaded on planes. Safety first, with no exceptions!

Combined handling of oversize baggage

The Siemens baggage handling system can simultaneously sort normal and oversize bags in a single system. Although this makes the overall sorting system extremely complex, it also reduces the additional, manual handling of OOG (out-of-gauge) baggage within the system.

Early operated areas

Thanks to the early handover of 108 new check-in counters with linking to the existing Phase 1 system, check-in delays were soon a thing of the past at Incheon. Although implementation of provisional functions increased the costs for programming the control technology, the resulting passenger satisfaction justified the expense.

That’s why Incheon Airport always achieves first place in leading passenger satisfaction surveys.

Speed

The Main Terminal is connected to the satellite building by a one-kilometer-long tunnel. Because of the long distance and an MCT of only 25 minutes, Siemens integrated a high-speed tray system with the unique capability of transporting baggage at 10 meters per second.
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