



## BAGGAGE HANDLING SIMULATION FOR OVERALL CAPACITY PLANNING



### INDUSTRY

Airport

### APPLICATION AREA

Baggage handling

### COUNTRY

The Netherlands

### CHALLENGE

Provide insight in the capacity of the baggage handling system under all circumstances.

### RESULT

Investigate system capacity constraints / efficiency during maintenance or (re-) construction operations.  
Create support for (future) business cases and investments.

### KEY TO SUCCESS

Baggage handling is executed by a very complex system in which investigations cannot be performed within the live operation. A simulation model creates an environment in which numerous efficiency measures can be executed without any risk.

Simulation has become part of the baggage operation at Amsterdam Airport Schiphol “No structural modifications are done without using simulation”.

### AMSTERDAM AIRPORT SCHIPHOL

Amsterdam Airport Schiphol is one of the largest European airport hubs. Currently, it handles over 55 million passengers annually of which about 40 percent is transferring. Within the airport infrastructure the baggage handling system is an important part. The system transports, screens and sorts the bags of all passengers. The available time is limited: all bags have to be ready 10–15 minutes before flights are departing. For the next years, the airport foresees a further increase in traffic. To accommodate this traffic, and to deal with new, more strict, EU baggage screening regulation, the baggage handling system needs to be expanded. The goal is to handle 70 million bags per year around 2020.

### BAGGAGE HANDLING SIMULATION

More than a decade ago, simulation projects for baggage handling at Schiphol were initiated to evaluate capacity requirements of a system part. A simulation model was developed for this specific part, and some simulation experiments were performed. After the results were reported, the project ended and the model was not used anymore.

A few years later, most of the baggage handling system was available as independent models. The capacity of the systems was reaching its limits due to a large increase in baggage flow. Simulation was used to find short term and long term solutions to increase and optimize the capacity and performance of the systems. Optimizing separate subsystems was not an option, because this could result in bottlenecks in other subsystems. Therefore, the existing models were all connected together. This overall model SIMBAX reflects the current situation of the baggage handling system in detail.



Simulation has proven to be successful. At Schiphol SIMBAX is being used to gain insight in the overall performance of the system and in the flows for the upcoming season. Further, to decrease in system times by reducing bottlenecks, to optimize the available capacity, to improve the redundancy of the system, and to validate future capacity requirements. This results in a better performing baggage handling system and allows the capacity managers at Schiphol to anticipate on future situations.

Simulation has also become a design supporting tool. When developing costly and complex systems it is important to validate and improve the design as soon as possible so management can be convinced that the system will meet the requirements. Simulation is also used to test new ideas and to assist in operational management. Simulation has become part of Baggage operation "No structural modifications are done without using simulation".

### OUTPUT

The output is presented in Excel, making it easily accessible, using the same subdivision as in the model. So, the performance of the overall system and performance of the different sub-systems are presented in different sheets. Within ED bags can be individually approached, which allows to store information about individual bags. This is the bases for the output. Bags are logged when they pass a specified location. Using this information in combination with the bag properties (e.g. outbound / inbound flight number, routing destinations, etc.), most of the desired output can be extracted.

Examples are:

- Flows
- Transportation times on certain routes
- Transportation times on certain routes for specific groups
- Buffer occupancy
- Totals over the day
- Routes of single bags

Additional required output is logged separately. All data is stored in a database and is extracted in Excel by using SQL queries, keeping the excel sheets clean from excessive data. This flexible method gives detailed information about the system and also turned out to be extremely useful when addition output is required when investigating odd behavior without re-running the simulation.

