



**INDUSTRY**

Crowd Simulation & Infrastructures

**APPLICATION AREA**

Public Transport Terminals

**COUNTRY**

The Netherlands

**OBJECTIVE**

Create a modern, convenient and comfortable traffic hub.

**RESULTS**

- Supported by the simulation models CSE determines whether planned building activities will result in transfer bottlenecks and which measures can or must be made to improve the transfer.
- This way it is for instance determined that the bus terminal at the IJ side can be put into use some time before the delivery of the new station is completed. The consequence is that other building activities can be accelerated and simplified.
- It would not have been decided to take the measure if not the simulation model had provided insight in its effects.

**The Stations Island is one of three major transfer hubs in the Netherlands and connects railways, subways, trams, busses, ferries, cars, bikers and pedestrians. Simulation software was used to create a comfortable traffic hub.**

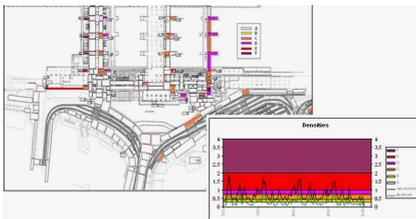
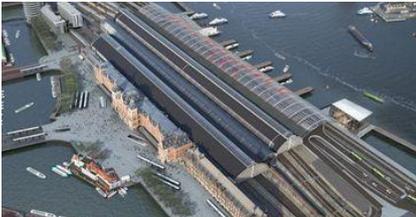
**NEW SUBWAY TRACK AND RENOVATION STATION**

The decision to build a new subway track was the immediate cause to start a large-scale renovation of the station area. For all means of transport the capacity had to be extended in order to be able to deal with the increasing numbers of passengers. Furthermore the station is intended to be more attractive for pedestrians as main entrance of the city. The Master plan Stations Island, stipulated in 2005, formulates the ambition to create a modern, convenient and comfortable traffic hub.

Besides building the new subway track and station several large-scale building projects are initiated. As these projects must be realized while the station is operational, it is essential to supervise the different sub-projects and balance the interests of projects and passengers. Therefore Coordination Stations Island (CSE) has been founded. Its main tasks are to guarantee

that the station area is accessible, enduring and safe while the projects can be carried out.

Building under, in and around the monumental station is not only very complex and time-consuming, but influences the daily transfer of around 250,000 passengers in a large degree. The various building phases lead to alterations in transfer routes on a regular basis and in order to guarantee traffic of the different means of transport the tracks and stops of busses and trams will be relocated regularly. This requires a careful consideration of all interests. CSE takes care of this process and communicates all measures and alterations.



**SIMULATION SOLUTION**

CSE developed plans to maintain and improve the accessibility and safety for everyone at the Stations Island during all building phases. One of the means to evaluate measures and their effectiveness is simulation. Since 2005 Pedestrian Dynamics® simulation models of the Stations Island, built by INCONTROL, are used. They determine the quality of transfer areas at the island and inside the train station during the several building phases and under different circumstances.

The models represent the complete infrastructure and the traffic flows of the public transfer and pedestrian movements at the Stations Island, both inside and outside the buildings. Therefore the timetables of the different means of transport (trains, subway and tram), the occupancy of the vehicles and the transfer relations are incorporated in the models in detail. Passengers are modeled as individual entities that move through the model, from the assigned origin to the destination at the Stations Island. Every passenger has its own preferred walking speed and route to reach the destination, but several factors can affect the characteristics of the transfer, such as:

- In the train station resources with limited capacities, such as doors, elevators, stairs, but also commercial services like desks, ticket automates and shops are part of the routes.
- Outside the building the pedestrians have to deal with traveling trams and busses, tram and bus stops, crossings and traffic lights.
- The walking speeds and choice of routes are influenced by the crowdedness in walking areas and tunnels and on elevators, stairs and platforms.

**ACTUALIZATION OF THE MODELS**

The effect of these constraints in the transfer is that pedestrians experience waiting times and have to reduce their speed. So the required transfer times will fluctuate dynamically. As every stage in the building process requires the closing of other entrances, tunnels or stairs and the introduction of new work areas, new situations appear frequently. Furthermore timetables change and numbers of passengers increase over the years. These new circumstances are reasons for actualization of the models so that future scenarios for estimation the transfer performance of the Stations Island can be simulated with a correct model. For every scenario the performances are expressed in many performance indicators. The most important are:

- Throughput times between origins to destinations.
- Waiting time distributions at different facilities.
- Flow intensities (throughput per time unit) on specific screen lines.
- Densities (occupation of areas) and accompanying levels.

For the purpose of estimating the densities the complete floor plan, inside the building as well as outside, is divided into smaller areas. It is registered continuously how many pedestrians are in each area. That way density of areas can be calculated and used in calculating the effective walking seeds of pedestrians in each area. The building activities are expected to be completed around the year 2013. Until this date the dynamic pedestrian simulation models will be used to study and evaluate the future stages.