



INDUSTRY

Crowd Simulation

APPLICATION AREA

Stadiums & Arenas

COUNTRY

The Netherlands

CHALLENGE

PSV Eindhoven requested INCONTROL to develop a customized simulation tool. With this tool PSV itself is able to create and analyze different scenarios.

SOLUTION

With the use of graphical user interfaces (GUI) INCONTROL made the tool a user-friendly device that can be used by non-simulation experts. The user can apply and save his/her own settings, and hereby create different models for different situations.

RESULT

Crowd simulation offers PSV the possibility to deal with all challenges concerning crowd management and efficient usage of the soccer stadium.

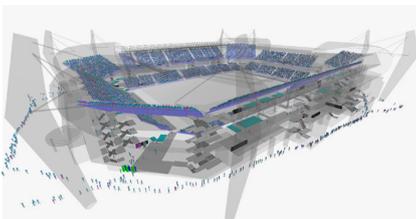
PSV has become Dutch Soccer League Champion for 6 times in the last 10 years. They used Pedestrian Dynamics® to ensure the safety of their 35.000 supporters.

PSV STADIUM

One could say that PSV Eindhoven is currently one of the most successful soccer teams in the Netherlands. Their soccer stadium has a capacity of 35,000 seats, located in an upper and a lower ring. Every soccer game PSV seeks the optimization of the pedestrian flows by managing the different activities that people undergo during their stay. These activities include for example, ticket sale, security check-in and the sale of food and beverages. Next to this, PSV wants to create insight into evacuation scenarios. Since doing an evacuation drill with 35,000 people is quite a complex matter, PSV is always searching for other methods that can help them in analyzing different evacuation solutions. The last years the stadium is also used for other purposes like pop concerts. The infrastructure was initially not created for these other commercial purposes. Therefore PSV also seeks for optimization of the pedestrian flows during these events.

GOAL

PSV Eindhoven requested INCONTROL to develop a customized simulation tool. With this tool PSV itself is able to create and analyze different scenarios. The tool is developed in two phases. The first phase contained the development of the soccer game scenario. And afterwards, in the second phase, also the event scenario is created. With the use of graphical user interfaces (GUI) INCONTROL made the tool a user-friendly device that can be used by non-simulation experts. The user can apply and save his/her own settings, and hereby create different models for different situations. The user does his/her experiments, after which the result is displayed in excel-sheets. Next to an overall view of the pedestrian flow through the different layers and activities of the stadium also quantitative output is created in order to do a proper analysis of the designed situation.



THE MODEL

Pedestrian Dynamics® is designed for the simulation of large amounts of pedestrians in various environments and contains targeted user-friendly simulation objects such as turnstiles, toilets, bars, coin sale machines and emergency exits. Each of these objects has parameters, which can be set to create a realistic situation. A 2D and 3D visualization is available to create a realistic representation.

The tool's infrastructure is built in different layers, which can be turned off individually to enable the different layers and sections of the stadium to be analyzed on a detailed level. With the use of entrances, exits and passages the different sections and areas in the stadium are connected. A pedestrian will create a realistic route through the possible connections to reach his destination. Within a soccer stadium the destination is set to be the tribune area which is assigned to the pedestrian (based on ticket sale). Based on the settings concerning toilet usage, coin sale and food and beverage, the pedestrian will adapt his route to use any of the assigned activities.

In the model it is possible to analyze the effects of different arrival intensities of the visitors; the amount of pedestrians; tribune destination and arrival times of the visitors.

EVACUATION

The user can create a total evacuation on a pre-defined moment during the simulation run. Visitors will adapt their behavior, for example increase their walking speed. Also the visitors will individually choose an evacuation route based on the available emergency exits

and passages. By closing or opening passages and exits during an evacuation the user is able to create its own "What if" situation. By analyzing the model visualization and quantitative output, the user can define and resolve bottlenecks. In this way current and proposed evacuation plans can be validated.

EVENTS

Since the stadium was initially not designed for other commercial events than the soccer games, temporary infrastructure is used to optimize the pedestrian flows during these events, for example female toilets, bars and ticket checkpoints. In this event scenario the field is also used to accommodate the visitors ($\pm 14,000$) during the event. Due to this different use of the infrastructure and the facilities of the soccer stadium there was decided to develop a second scenario focused on events. This scenario is created based on the design of a major event in 2011. The entire temporary infrastructure is developed in such a way that the capacity of these facilities is adapted in the simulation tool. By doing so, well thought-out decisions, concerning the temporary infrastructure, can be made during the design-phase.

FINALLY

Crowd simulation offers PSV the possibility to deal with all challenges concerning crowd management and efficient usage of the soccer stadium. This concerns challenges during soccer matches and other commercial usage of the stadium. In the future, every important decision that is made is supported by the simulation tool.