



**INDUSTRY**

Crowd Simulation

**APPLICATION AREA**

Stadiums & Arenas

**COUNTRY**

Brazil

**CHALLENGE**

Ensuring the compliance with the Green Guide

**SOLUTION**

INCONTROL developed a crowd simulation model with support of Amsterdam Arena International and performed scenario analysis

**RESULT**

With the results OAS Arenas could make absolute validated decisions regarding crowd management. The compliance with the Green Guide was validated.

“The simulation model offers us a tool to test drive operational solutions and to optimize these before going to live trials” Carel Breen, Amsterdam Arena International

**FIFA REQUIREMENTS**

The growing recognition and importance of simulation modelling to shape crowd management decisions during sports venue design and construction was recently illustrated on the Arena Porto Alegre stadium in Brazil.

INCONTROL was brought in by the stadium developers OAS Arenas to develop a simulation model of the stadium to help ensure compliance with rigorous safety regulations and standards, including complying with FIFA's World Cup 2014 standards as described by their Safety & Security Guide (“Green Guide”). During the project INCONTROL was supported by Amsterdam Arena International

INCONTROL's model allowed them to perform different crowd scenarios analysis and compile vital reports of the scenarios for the stadium which was earmarked for a capacity of 60,000 visitors.

“Besides investigating in- and outflow schemes we are able to improve the logistics around F&B outlets and merchandise stands, improving the revenue generating options in the stadium and on the large concourse outside the stadium”

Carel Breen, Director  
Amsterdam Arena  
International

#### OBJECTIVE

The objective of the project was to identify potential problem areas, propose recommended mitigations and or operational solutions and measure the design against FIFA Green Guide regulations.

Two scenarios were performed and analyzed according to the given performance indicators:

Scenario 1: Emergency evacuation of spectators from the stadium. The given performance indicators for this scenario were: evacuation times, maximum densities of pedestrian areas, duration of visitor immobility due to high densities in pedestrian areas and gate capacity performance.

Scenario 2: Spectators entering the stadium and arena under normal conditions. For the ingress flow, the city transport operation was taken into account to define the ingress arrival rates. The performance indicators were: visitor journey times, visitor queuing times at gates and determine appropriate queue lengths.

Based on the CAD drawings supplied by OAS Arenas, INCONTROL were able to develop a simulation model which included all layers (floors) of the stadium. Based on these drawings all relevant walking spaces and entities (e.g. tribune stands, doors, stairs, turnstiles, security areas ) were defined. Even elevators and escalators were included and all entities had variable process parameters.

#### RESULTS

By monitoring both the walking areas and the visitors, output was created to perform the analysis of the scenario.

The following output was created by the model:

- Densities of the areas measured in persons/m<sup>2</sup> (also over time)
- Durations of visitor immobility due to high densities
- Travel time of the visitors (between pre-defined locations)
- Evacuation time (per tribune stand/exit)
- Waiting times (per turnstile/process)
- Time to empty or fill a certain area (e.g. stands)
- Capacity of gates (per gates)

With the results OAS Arenas could make absolute validated decisions regarding crowd management. Due to the clear 2D and 3D visualization of the scenarios in combination with a structured and validated report, all stakeholders were convinced that the solution provided was the optimum way forward to progress with the project plans.

