

SAFETY AND SECURITY BRAZIL

The growing recognition and importance of simulation modelling to optimise crowd management and safety decisions during sports venue design-build and reconstruction phases was recently illustrated by INCONTROL at the Arena do Grêmio stadium in Brazil.



Crowd flow simulation experts of INCONTROL were brought in by the global engineering and construction company OAS Arenas to develop a 3D crowd flow simulation model of this stadium to help ensure fan experience and compliance with the rigorous safety regulations and standards, including the 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 Pedestrian Dynamics model allowed OAS Arenas to simulate various 'what if' scenarios to analyse and compile vital statistics and reports for this stadium with capacity of 60,000 visitors.

The primary objective of the project was to identify potential problem areas, and propose recommended mitigations and/or operational solutions and measures to comply with the FIFA requirements.

The following two scenarios were performed and analysed according to the required key performance indicators (KPI):

Scenario 1: Emergency evacuation of spectators from the stadium. The KPIs 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 under normal conditions. In addition to the venue ingress flow analysis, the city transport operation was also taken into account to define the ingress arrival rates. The KPIs for this scenario were: visitor journey times, visitor queuing times at gates and determine appropriate queue lengths.

Based on the AutoCAD drawings provided by the OAS Arenas, INCONTROL team developed a detailed 3D crowd flow simulation model of the stadium. Based on these multi-layered drawings, all relevant walking spaces and entities (e.g. tribune stands, doors, stairs, ramps, turnstiles, and security space) were defined and simulated. Even elevators and escalators were included and all entities had variable process parameters that can be tweaked on-the-fly during simulation.

By monitoring both the walking areas and the visitors flow within the virtual 3D environment, the following output results were created:

- ▶ Densities of the areas measured in persons/m² (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 these results, OAS Arenas could make validated data-driven decisions regarding crowd management to ensure venue and fan safety and experience. Due to the realistic 2D / 3D visualization of the scenarios in combination with a structured and validated reports, all stakeholders were convinced that the recommendations and solutions provided by the OAS Arenas and INCONTROL were the optimum way-forward approach to progress with the project plans.

Carel Breen, Director Amsterdam ArenA International / ArenA do Brasil says:

"The simulation model offers us a tool to test drive operational solutions and to optimise these before going to live trials. 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". ■