

# Mega Events and Crowd Evacuation at Tourist Attractions: A Case Study of Souq Waqif Using Pedestride® Crowd Simulation Tool

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## Problem statement

- Large crowds are expected at tourist attractions, e.g., **Souq Waqif**, during special events such as the FIFA World Cup 2022.
- Understanding crowd dynamics is necessary to ensure **safety** and **efficiency** of crowds' flow.

## Objectives

- To evaluate safety and efficiency of crowd flows at Souq Waqif under normal and emergency situations.
- To highlight any required design modifications and to recommend and verify crowd management strategies in order to mitigate any unfavorable situations, such as stampeding during any emergency.



Main street in Souq Waqif (The Peninsula, local news agency),

## INTRODUCTION

## Main findings and recommendations

- During **normal evacuation**, crowds can safely exit the Souq due to the availability of many exit routes.
- During **emergency evacuation** and due to herding effect, crowds tend to take the same route what leads to stampeding and increased crowd density.
- **Dynamic exit signage** should be implemented to direct the crowds to clear exit routes, even at normal evacuation.

## Research limitations

- This is an initial study and the results obtained give an overview of the issue and suggest primary solutions to it.
- The collection of Souq Waqif layout and visitor demands was not possible.
- Model calibration and validation for the base models, i.e., the force-based behavior model and the exit choice model, required for local/Qatari conditions.

## CONCLUSION



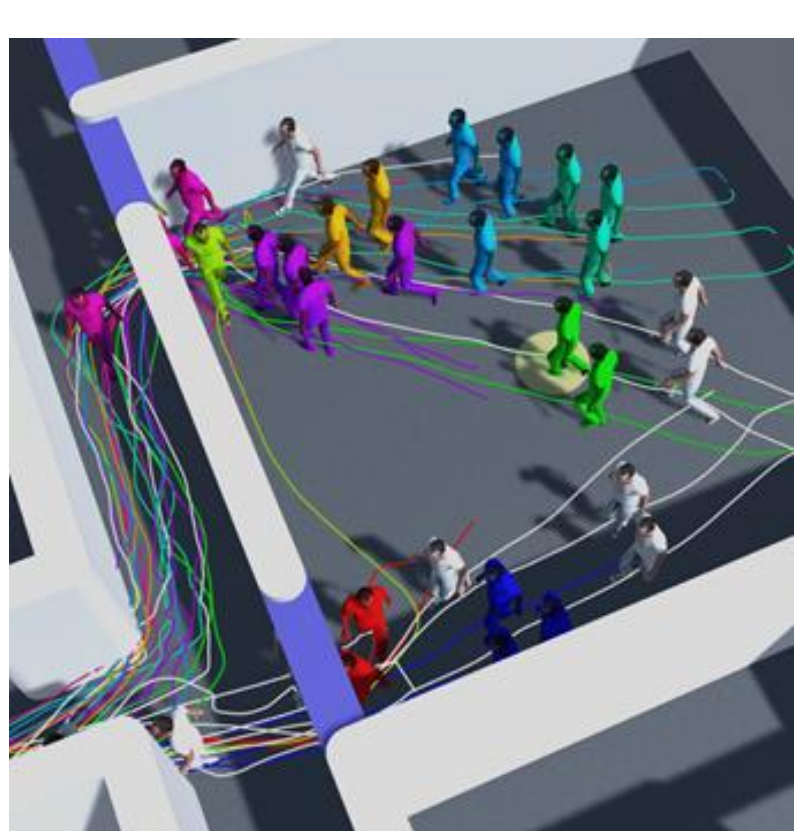
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## METHODOLOGY

### Case studies

- Pedestride® software was used to understand Souq visitors' behavior during an evacuation process.
- Simulation model has been calibrated and validated using empirical data collected through controlled experiments and real-world observations.
- **1<sup>st</sup> case study**: 500 agents over an area of 2260 m<sup>2</sup> or pedestrian density of **0.22 p/m<sup>2</sup>**.
- **2<sup>nd</sup> case study**: The density was almost doubled (**0.45 p/m<sup>2</sup>**) in the second case study by reducing the simulated area to 1109 m<sup>2</sup>.



Screenshot from Pedestrian® software

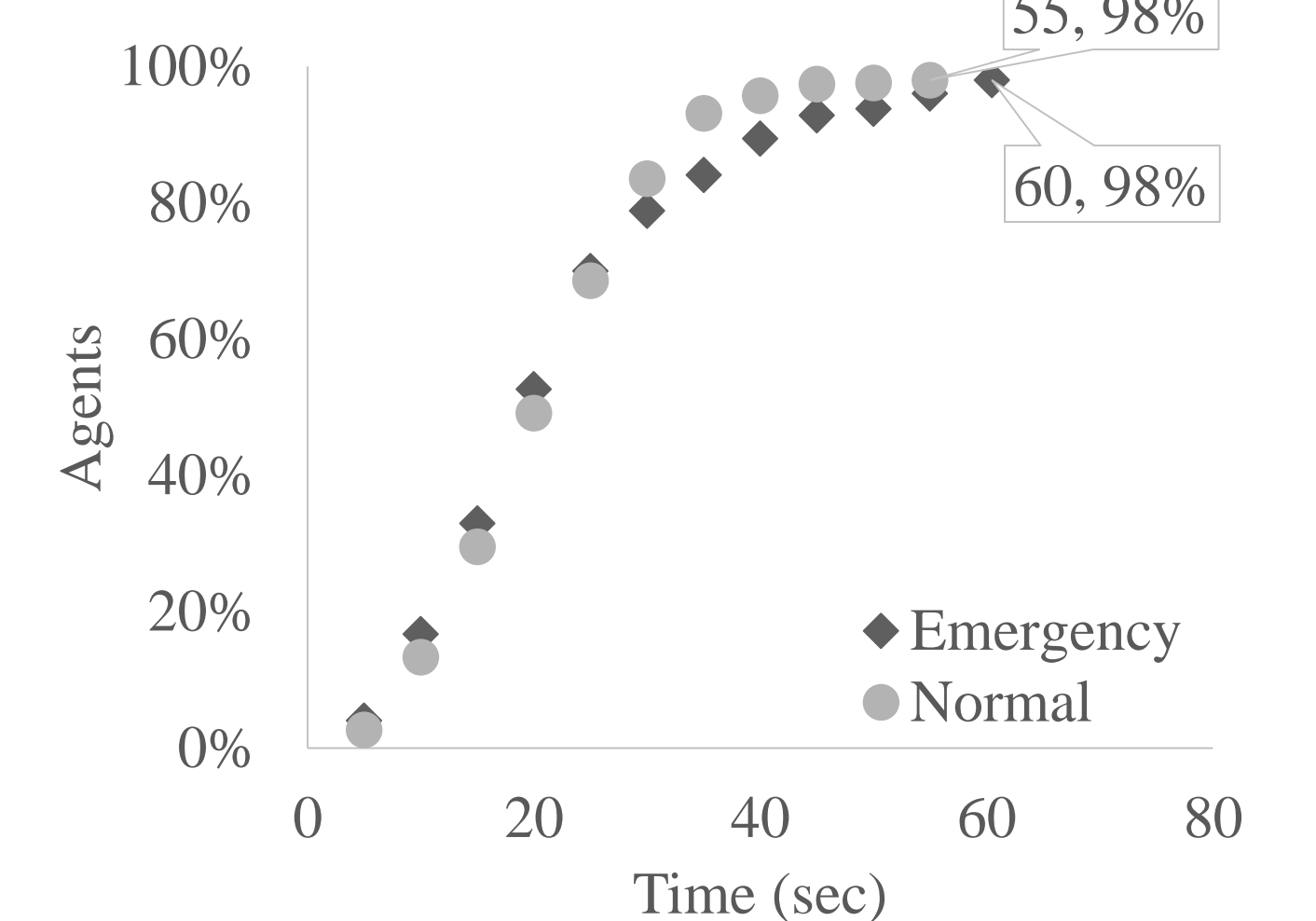


Area simulated (1<sup>st</sup> case study area ----, 2<sup>nd</sup> case study area ----).

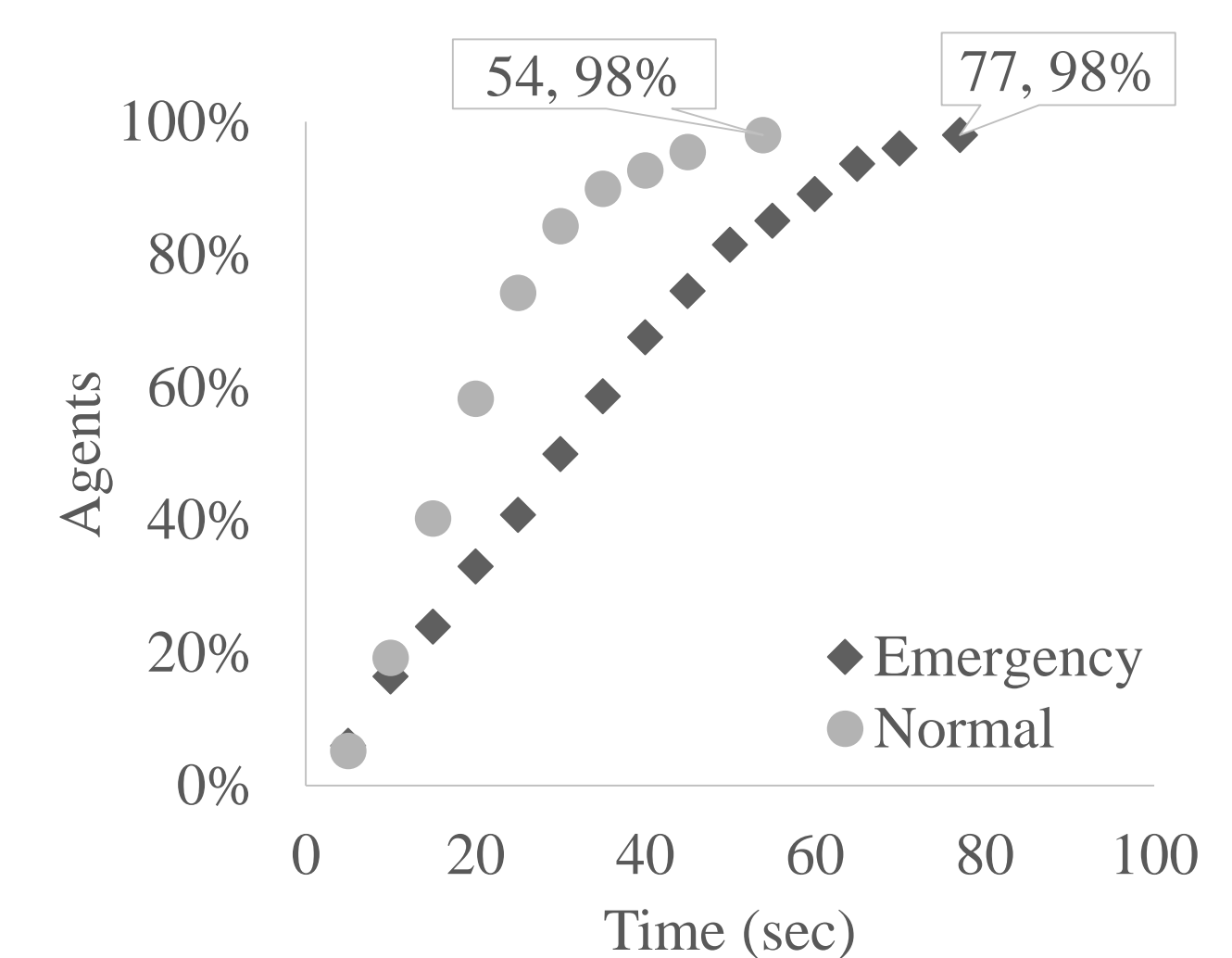
## RESULTS

### Evacuation time

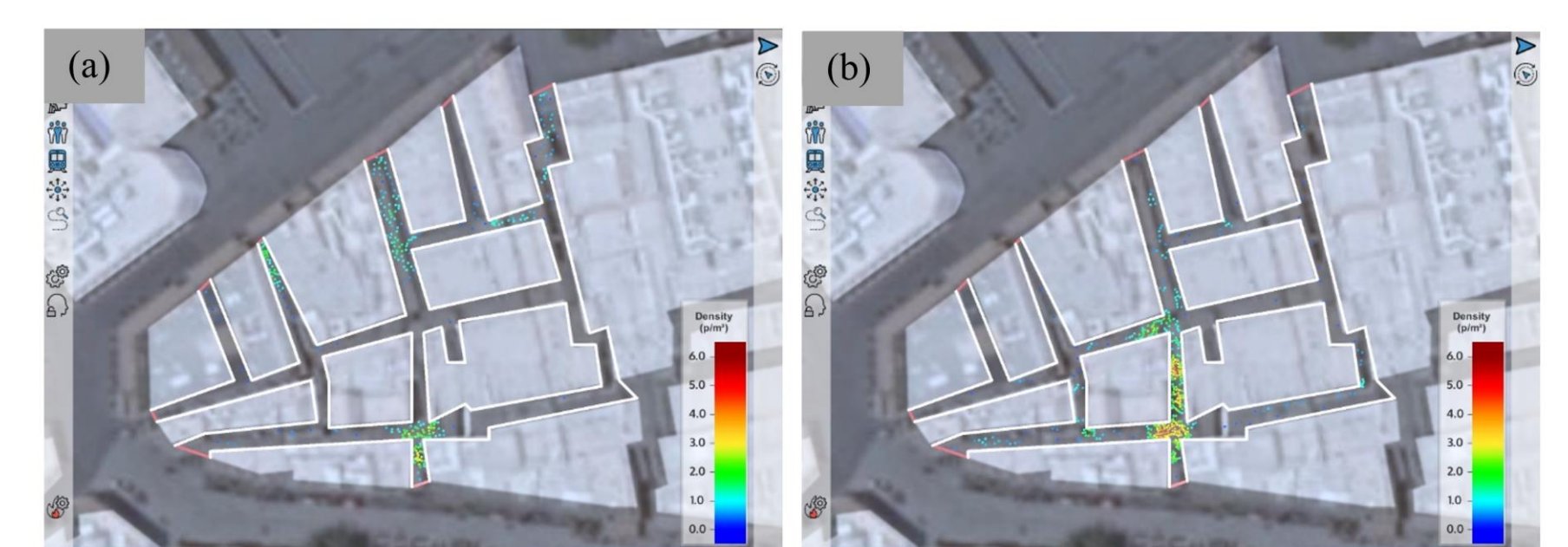
- When the crowd density was increased in the second case study, a change in the trend between normal and emergency evacuation was observed.



Percentage evacuated over time – 0.22 p/m<sup>2</sup> density



Percentage evacuated over time – 0.45 p/m<sup>2</sup> density



2<sup>nd</sup> Case study (0.45 p/m<sup>2</sup>) - Evacuation at 20 seconds: (a) Normal and (b) emergency