



Knowledge FOR Resilient soCiEtY

2ND INTERNATIONAL SYMPOSIUM K-FORCE 2019

Tirana, September 9, 2019

SIMULATION ON BUILDING EVACUATION A CASE OF AN ELEMENTARY SCHOOL IN TIRANA

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Outline

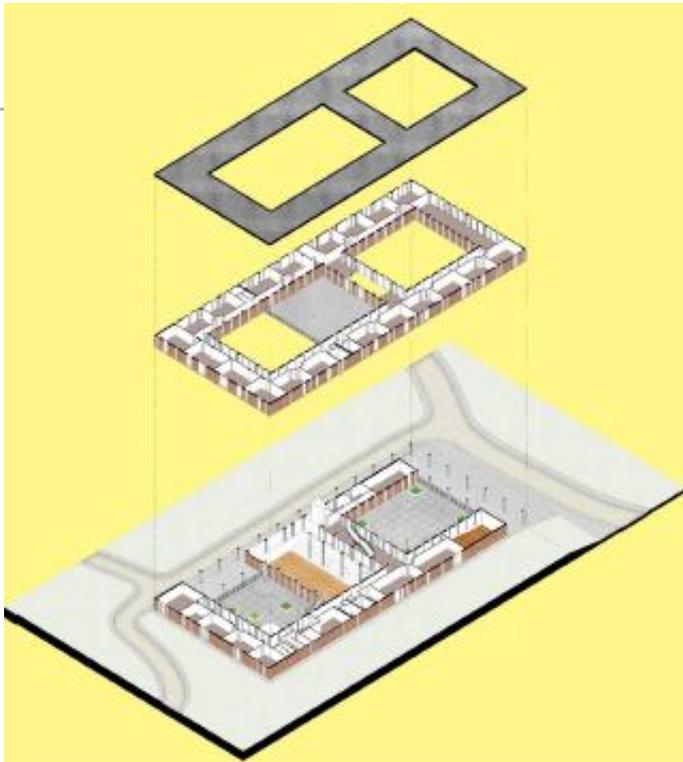
-  *Intro: A Case of an Elementary School Building in Tirana*
-  *Literature review*
-  *Methodology: Considerations*
-  *Methodology: Input Parameters for Evacuation Simulation*
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-  *Discussion*
-  *Conclusion*



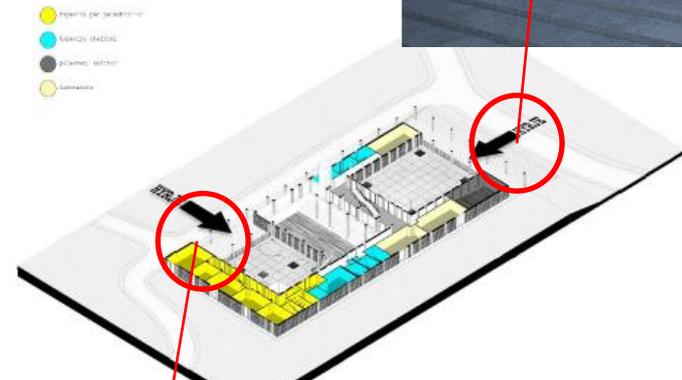
Intro: A Case of an Elementary School Building in Tirana

- *Location: Tirana, Albania*
- *3 floors: 1 underground floor (gym area) + 2 floors (classrooms, offices, labs, library, conference hall etc.)*
- *Total area of 3773 m²*
- *2 main entrances*
- *1 stair with a primary function of emergency exit*
- *2 other stairs with a primary function of access*
- *1 elevator*





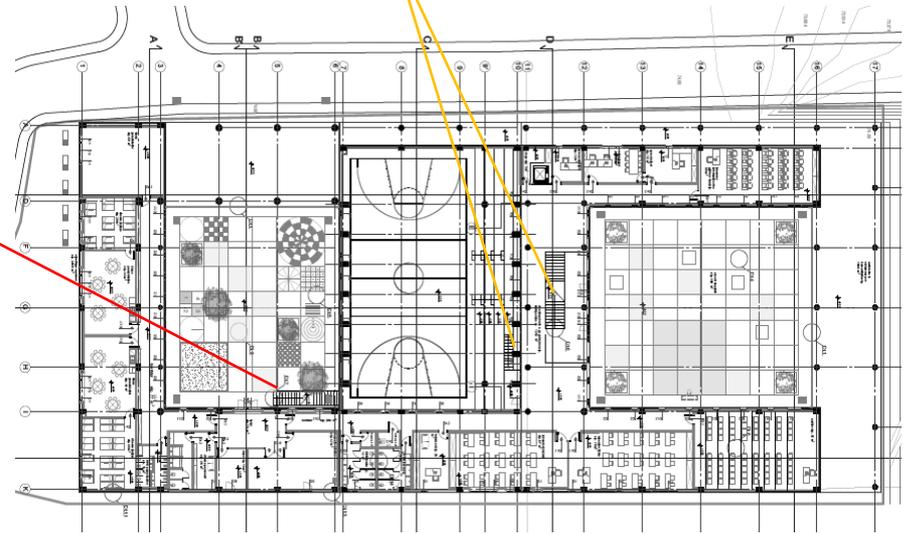
1st floor
0 floor
-1 floor



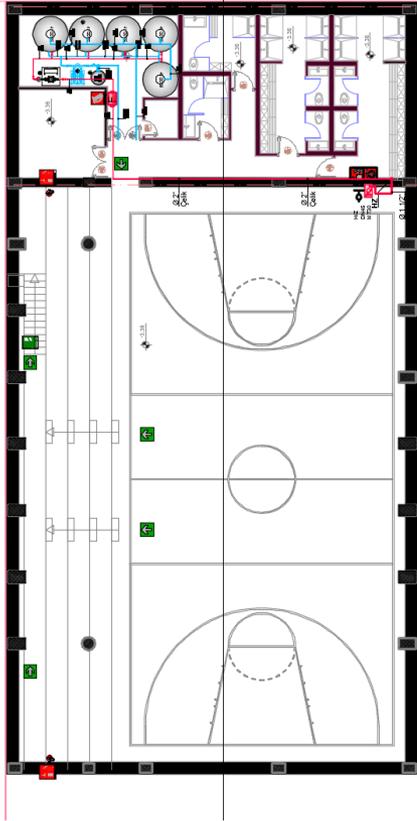
1 stair with a primary function of emergency exit



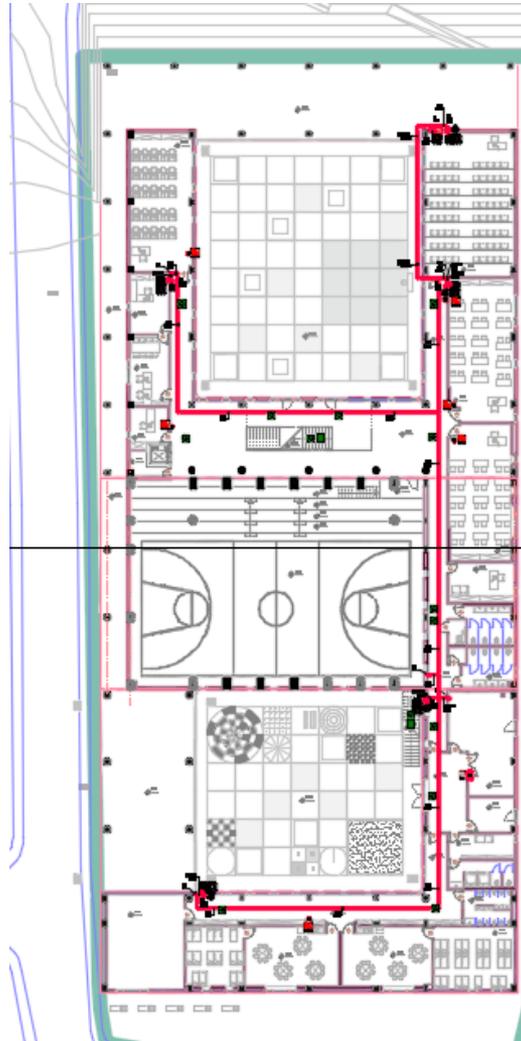
2 other stairs with a primary function of access



Current Fire Emergency Evacuation Plan



-1 floor



0 floor



1st floor

Current Fire Emergency Evacuation Plan

- 1. Passive and Active Fire Protection*
- 2. Action to be taken: "Go to any Exit!"*



Literature review: Evacuation of Children Focusing on daycare centers and elementary schools (Aldís Rún Lárusdóttir, 2013)

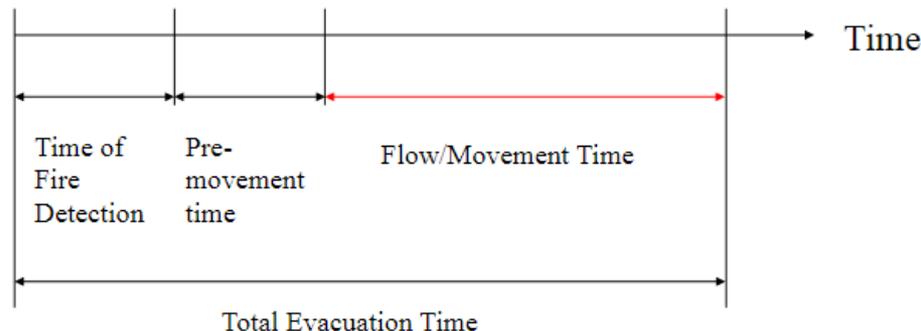
This project comprises evacuation experiments in daycares for children 0-6 years old and elementary schools for children aged 6-15 years.

Behavioral facts and main findings:

- Children are most comfortable with familiar people and routes.*
- Children could also be seen following the adults and children form their own group, throughout the evacuation where possible, indicating a preference.*
- Young children only evacuated when an adult came to get them.*
- Children tend to redirect to an other exit or stair due to congestion.*

Methodology: Considerations

- *Time delay to start an evacuation:*
 - *A good reference (SFPE Handbook of Fire Protection Engineering).*
- *An optimal time with respect to the daily routines must be chosen.*
- *A commonly used free travel speed in horizontal plane for children is 1.2-1.3 m/s.*
- *Pre-evacuation time: the time that passes from when the alarm is raised until leaving the current room*
- *Behavioral as* ^{Fire Occurs}



Methodology: Input Parameters for Evacuation Simulation

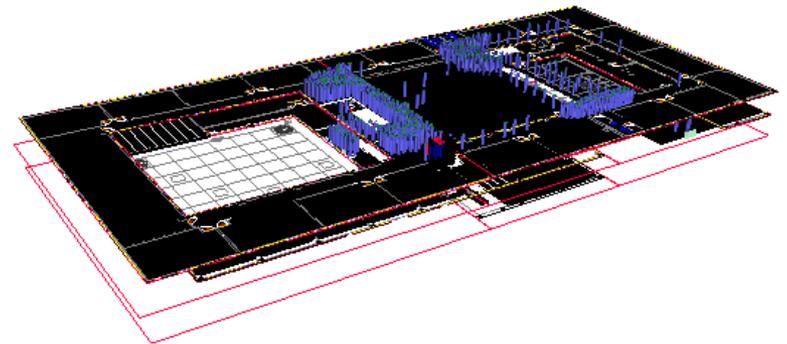
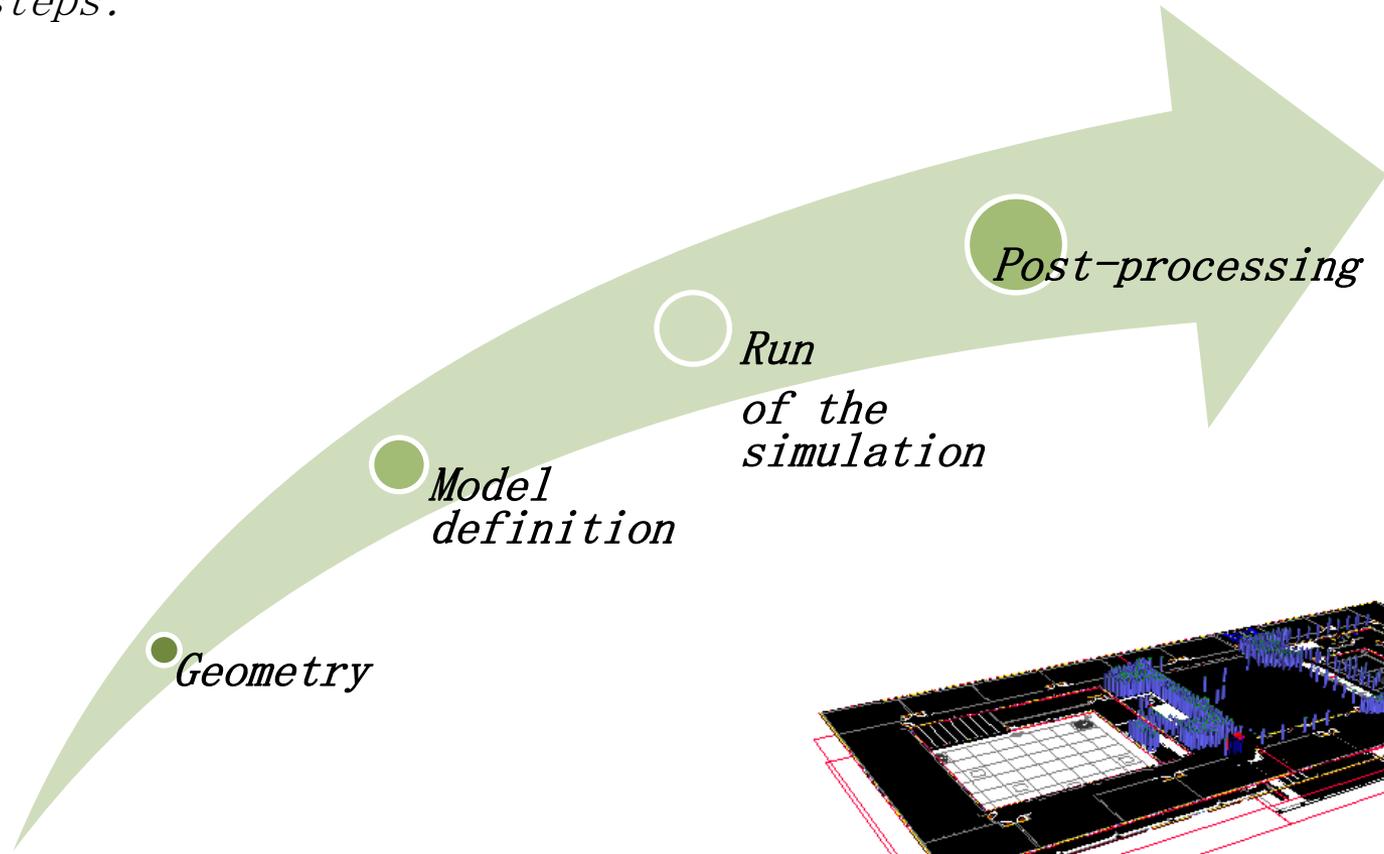
- *Time delay to start an evacuation:*
 - *For Schools = 240 s (Table 3-13.1, pg. 3.351, SFPE Handbook of Fire Protection Engineering).*
- *The simulation to be held around 10 am, at that time school almost all children are supposed to be in class with their teacher (859 occupants in total).*
- *A commonly used free travel speed in horizontal plane for children is 1.2-1.3 m/s.*
- *Behavioral aspects:*
 1. *"Go to any exit! (By default)" (Scenario 1, Current Fire Emergency Evacuation Plan),*
 2. *"Familiar routes" (Scenario 2, Main Entries of the school),*
 3. *"Follow the teacher!" (Scenario 3, Children preference).*



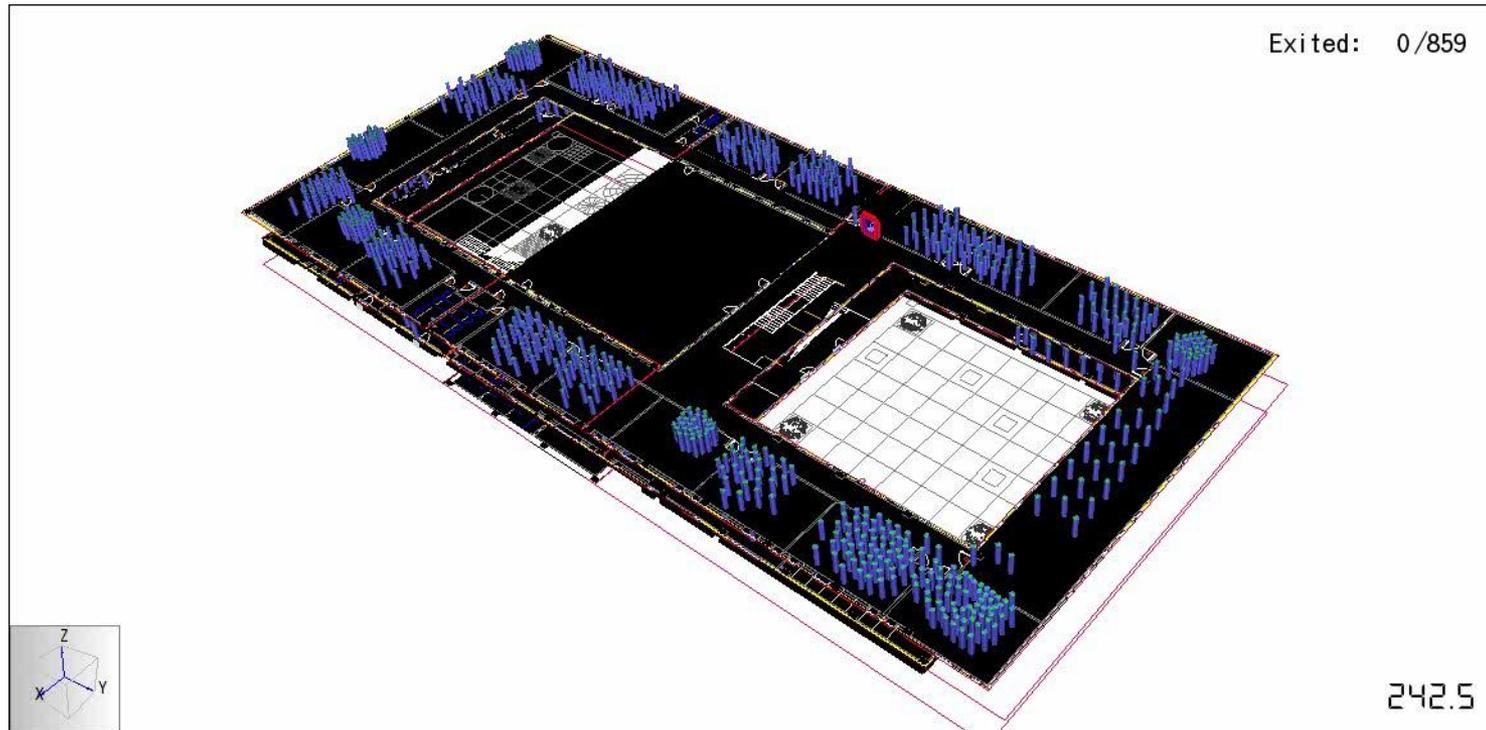
Simulation with Pathfinder



• *Main steps:*



Results: Simulation with Pathfinder

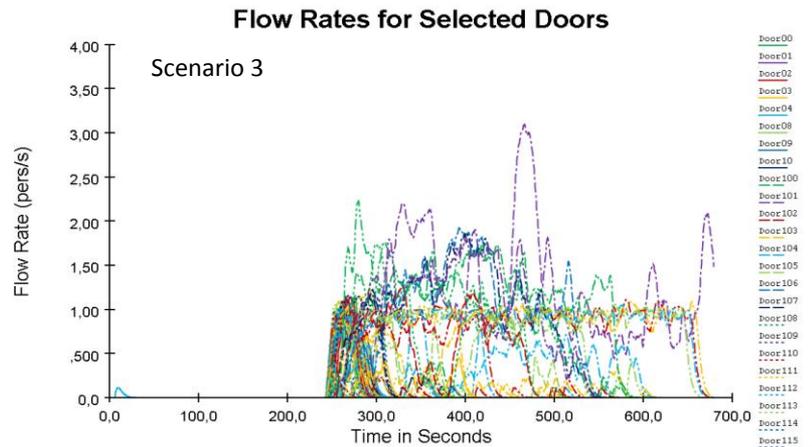
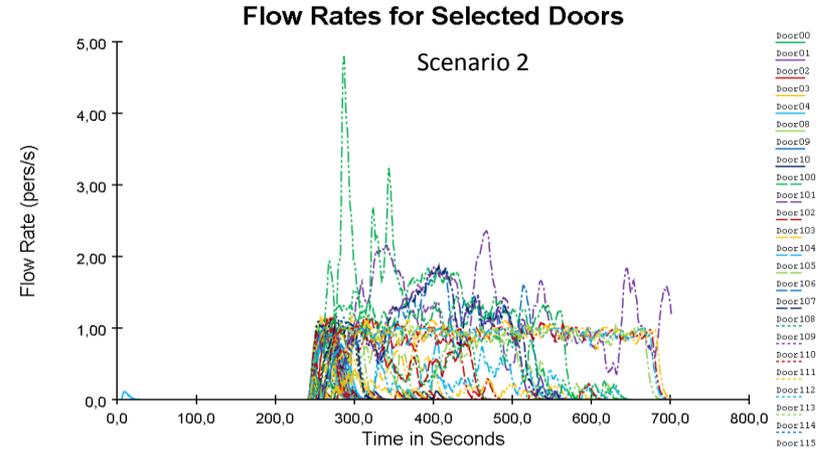
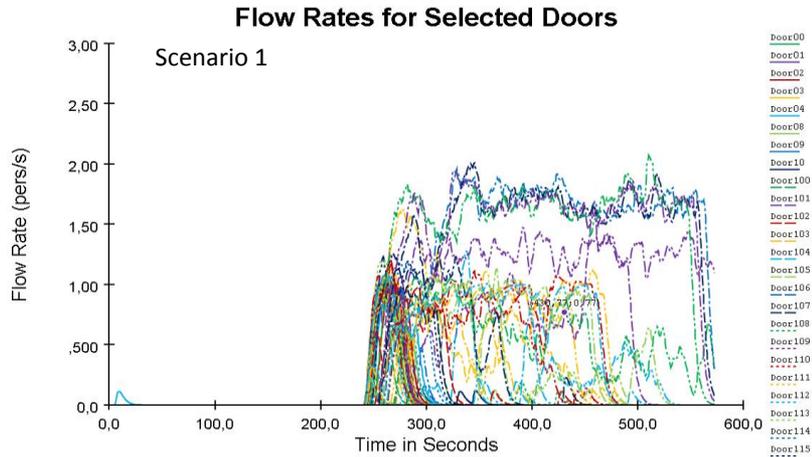


Results cont. :

Total Occupants	Behavior (scenario)	Max Completion time for all Occupants (s)	Traveled distance for all the Occupants (m)
859	Scenario 1: “Go to any exit!”	572.8	173.2
859	Scenario 2: “Familiar routes”	703.0	252.9
859	Scenario 3: “Follow the teacher!”	679.6	297.1

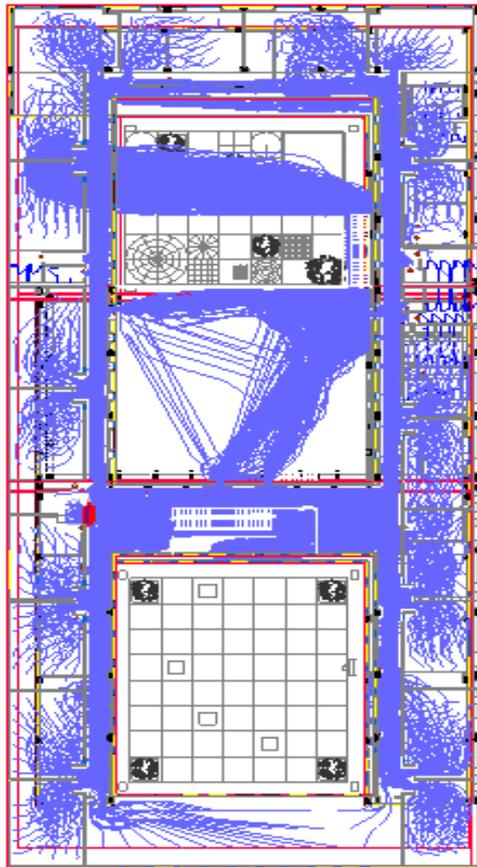
Results cont. :

The resulted plots for each of the scenario for the flowrates of all the doors of the school.

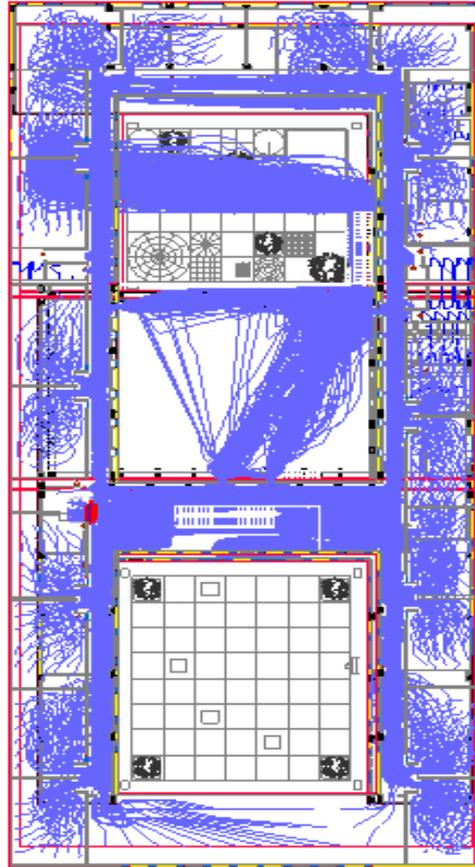


Results cont. :

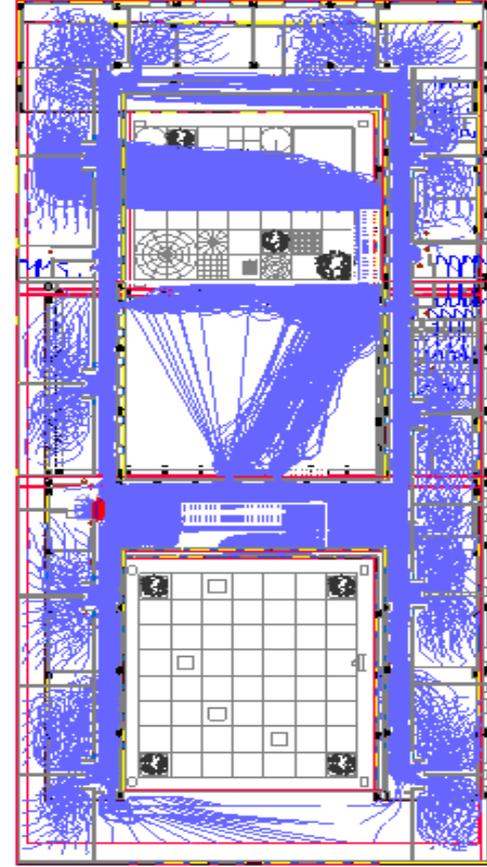
The resulted plots for each of the scenarios for the occupant's trajectory during the evacuation at floor 1.



Scenario 1



Scenario 2



Scenario 3

Discussion

- *Warning process : the warning process delays the evacuation.*
- *Reaction and decision making: conditional behavior for fire response.*
- *Doors and stairs are typical congestion points during evacuations.*
- *Bringing focus to the topic of evacuation of children and to provide new data and knowledge on children's evacuation in Albania.*



Conclusion

- *The main objective of this study is to bring focus to the topic of the evacuation of children and to provide new data and knowledge on children's evacuation in Albania.*
- *In this context, this work can serve as a guide for other specialists to consider while studying the safety of building with high occupancy like schools.*
- *The results indicate that Pathfinder can evaluate the efficiency of a school's evacuation and informing the school's administration about*





Co-funded by the
Erasmus+ Programme
of the European Union



Thank you
for your attention

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