Oasys
YOUR IDEAS BROUGHT TO LIFE

ARUP

# Pedestrian Modelling and crowd simulation with MassMotion

# Who is Oasys?

- **The Software House of Arup and wholly owned by Arup**
- **Formed in 1976 to develop software for in-house and external use**
- **Offices in various countries including UK, US, Australia and India**
- **Network of partners and resellers in more than 30 countries**

# Products/Services

- **Crowd Simulation, Structural Analysis, Geotechnical Analysis and Document Management Software**
- **Training and consulting**


مركز التميز البحثي في النقل وادارة الحشود
Transportation and Crowd Management Center of Research Excellence

DANISH TECHNOLOGICAL INSTITUTE

POLITECNICO DI TORINO 1859 1906

YÜKSEL PROJE

nikken.jp

nbbj

Foster + Partners

Royal HaskoningDHV
Enhancing Society Together

SERECA
Global Leaders in Fire Engineering

SWECO
Sustainable engineering and design

ARUP

UNIVERSITY OF TORONTO

CISDI 中冶赛迪工程技术股份有限公司 CISDI ENGINEERING CO., LTD.

SMRT

SECOM

Beca

AECOM

L&B
Aviation Planning at the Leading Edge

crowd dynamics

KPF

WOODS BAGOT

smart infrastructure facility
UNIVERSITY OF WOLLONGONG

UNIVERSITY OF CAMBRIDGE

CYBERCUBE

TU Delft

# The Problem


HALIFAX
SALE
ANGEL
ANGEL
ANGEL
© Anita Maric/newsteam – NTI

# What is MassMotion?

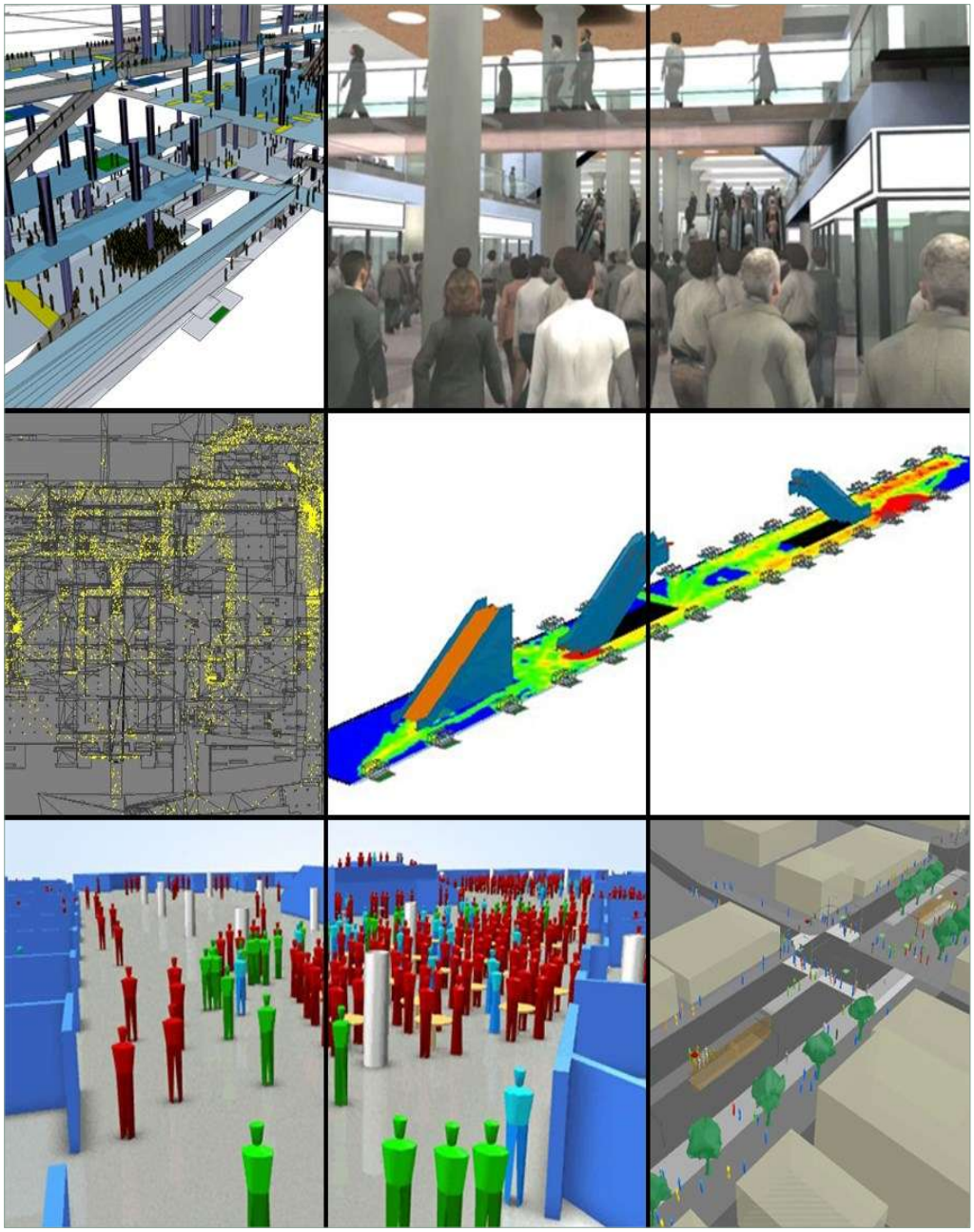
MassMotion is the next generation of advanced pedestrian simulation and crowd analysis software.

It was developed by Arup to address deficiencies in commercially available software.

MassMotion is an autonomous agent system that predicts how people will interact with the built environment.

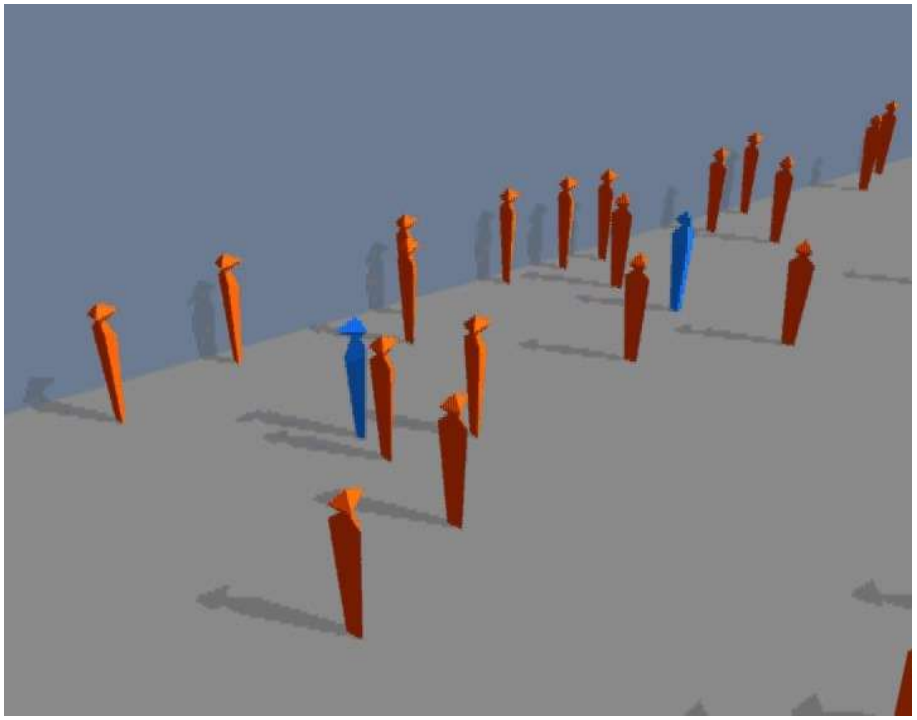
It is a powerful design and communication tool for a broad range of planning, architectural, and engineering applications.

ISO 9001:2008 & TickIT Certified



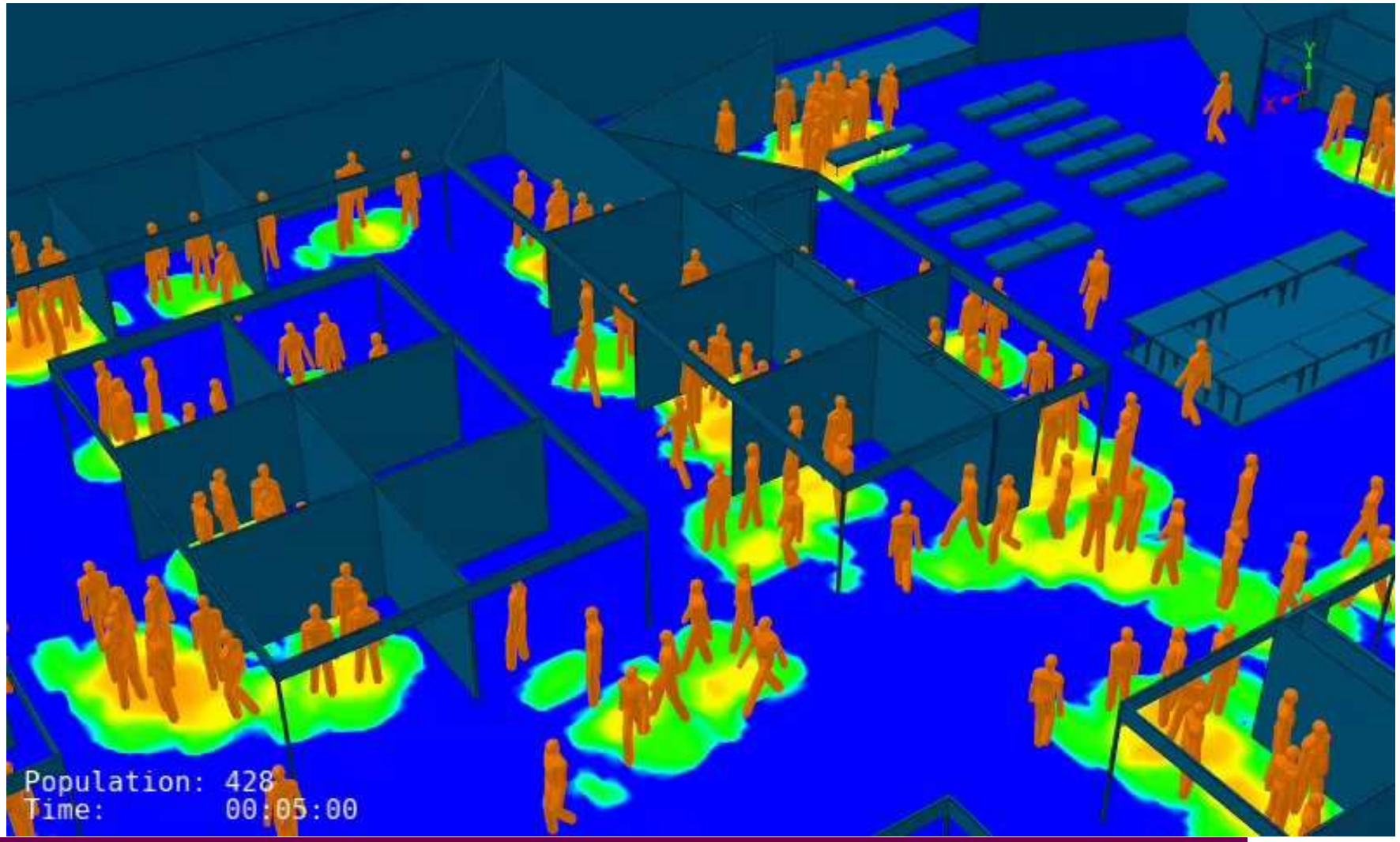
# Why is it different?

- All calculations are based on continuous three dimensional model spaces
- BIM Integration
- Much higher performance in terms of crowd size and speed of execution (tested to 1,000,000 agents)
- True way-finding through large and complex multi-level environments - Automatic dynamic agent route choice
- Much easier to produce 3D videos and images for presentation
- Powerful statistical analysis and discrete event process modelling built in



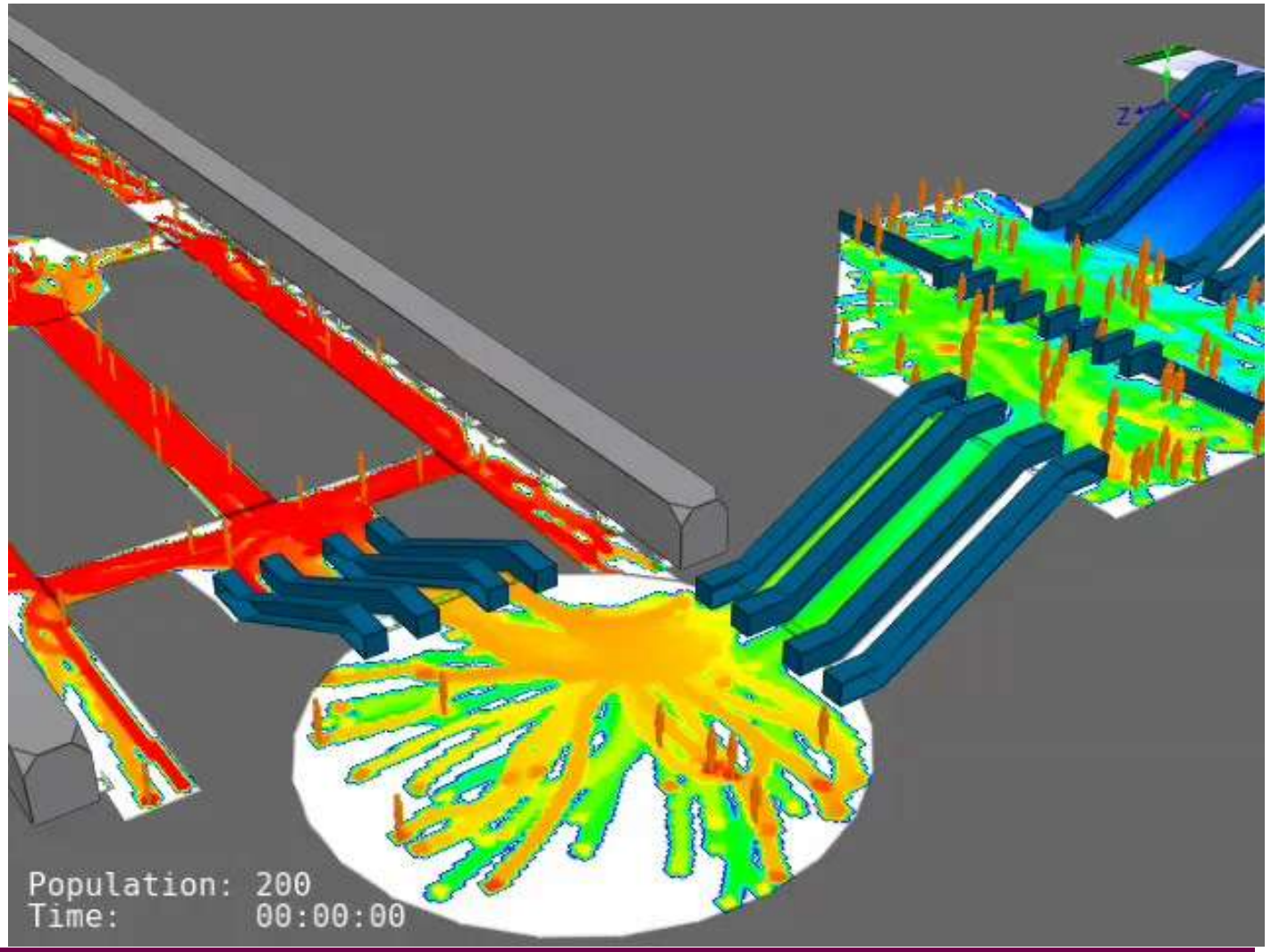
# MassMotion Applications

- **Flow and circulation analysis:** supporting design development: access, lobby, open spaces, sport venues, major events, parks, terminals etc.



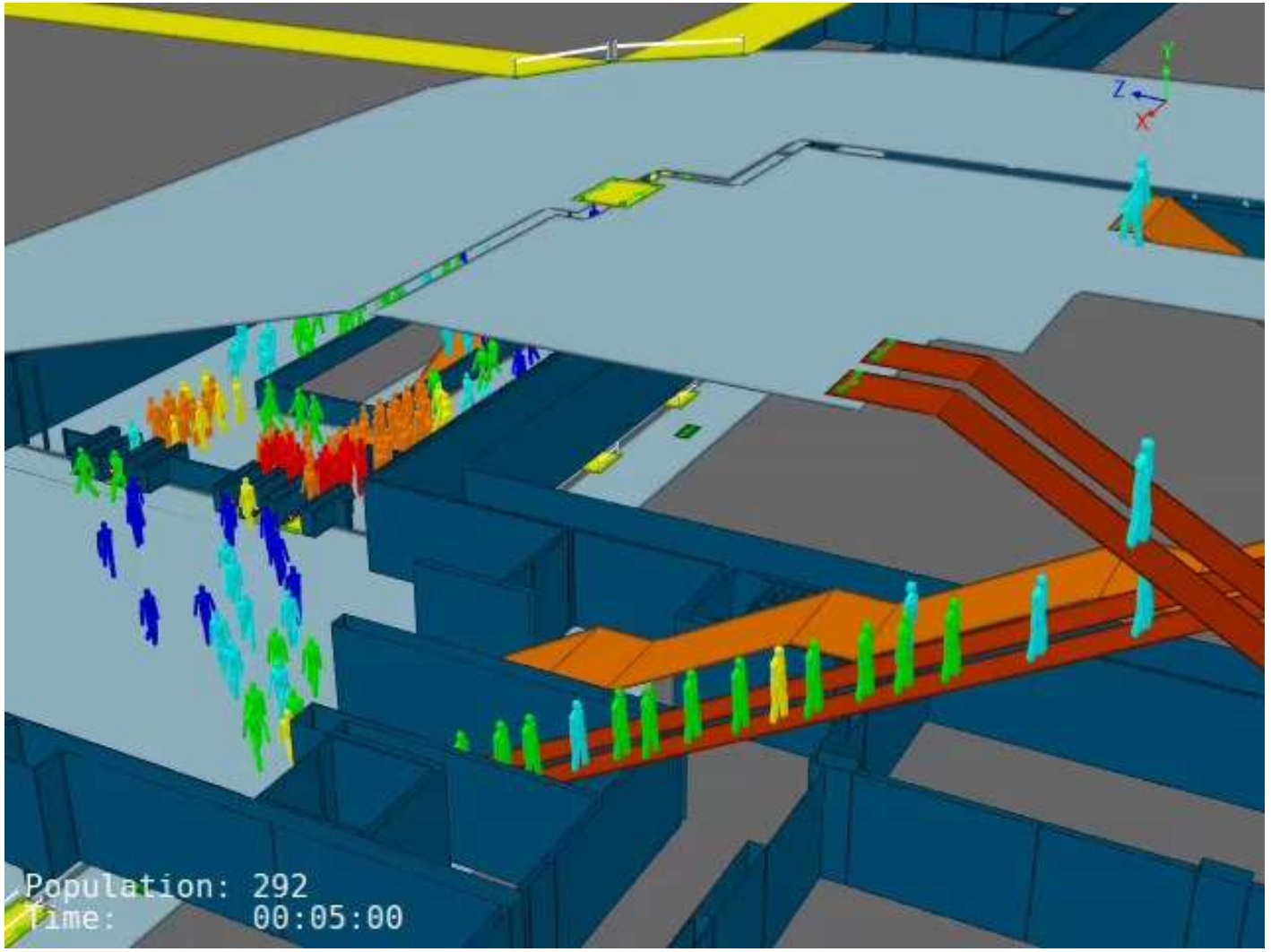
# MassMotion Applications

- **Egress analysis** for stadia, transit stations, offices, etc.



# MassMotion Applications

- **Vehicle passengers** for transit stations, terminals etc.

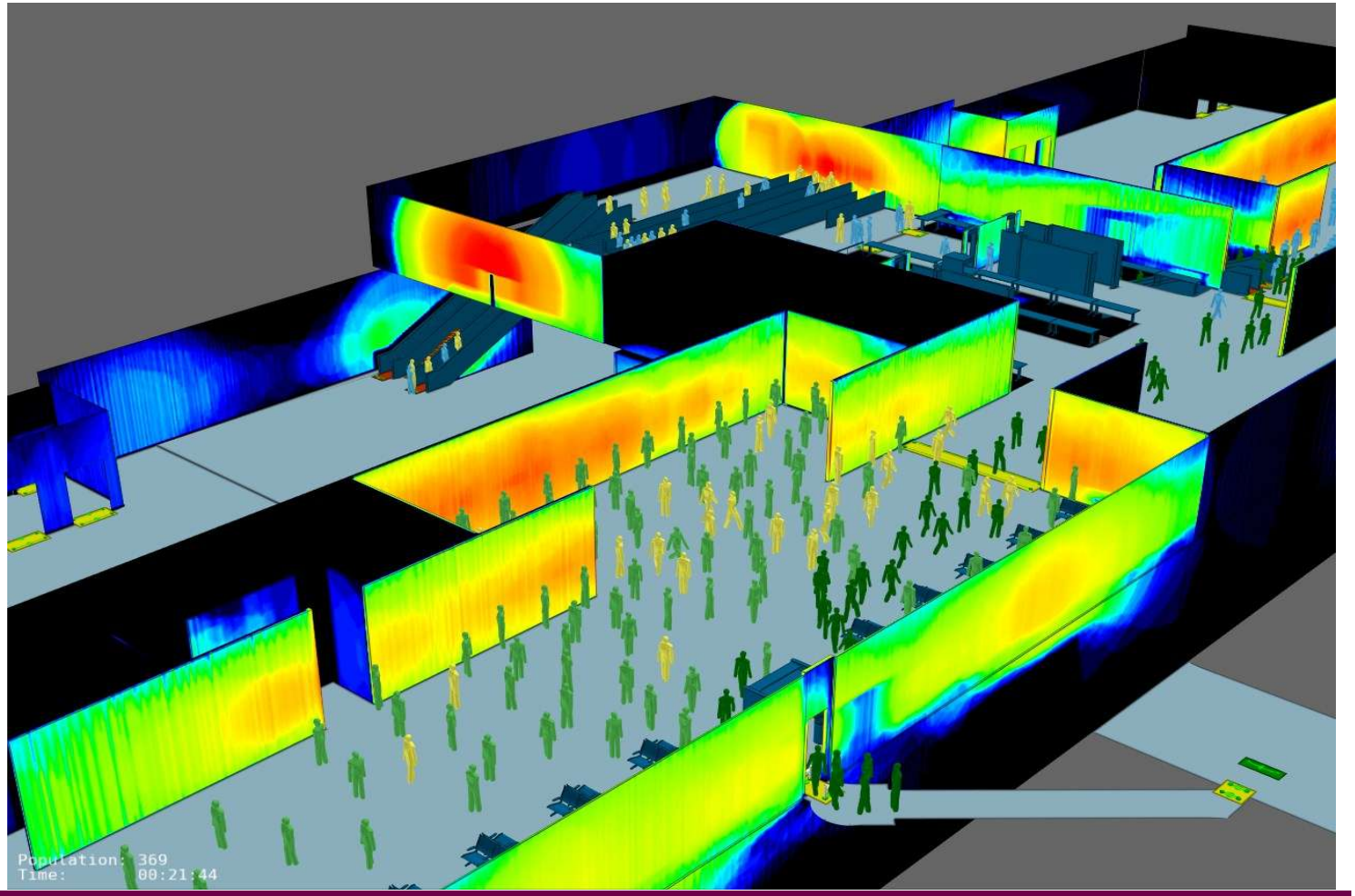


# MassMotion Applications

- **Operational analysis –** services, queues, ticketing, security

# MassMotion Applications

- **Marketing analysis –** pedestrian spaces including shopping malls, concourses etc. as well as vision maps for advertisement and signage



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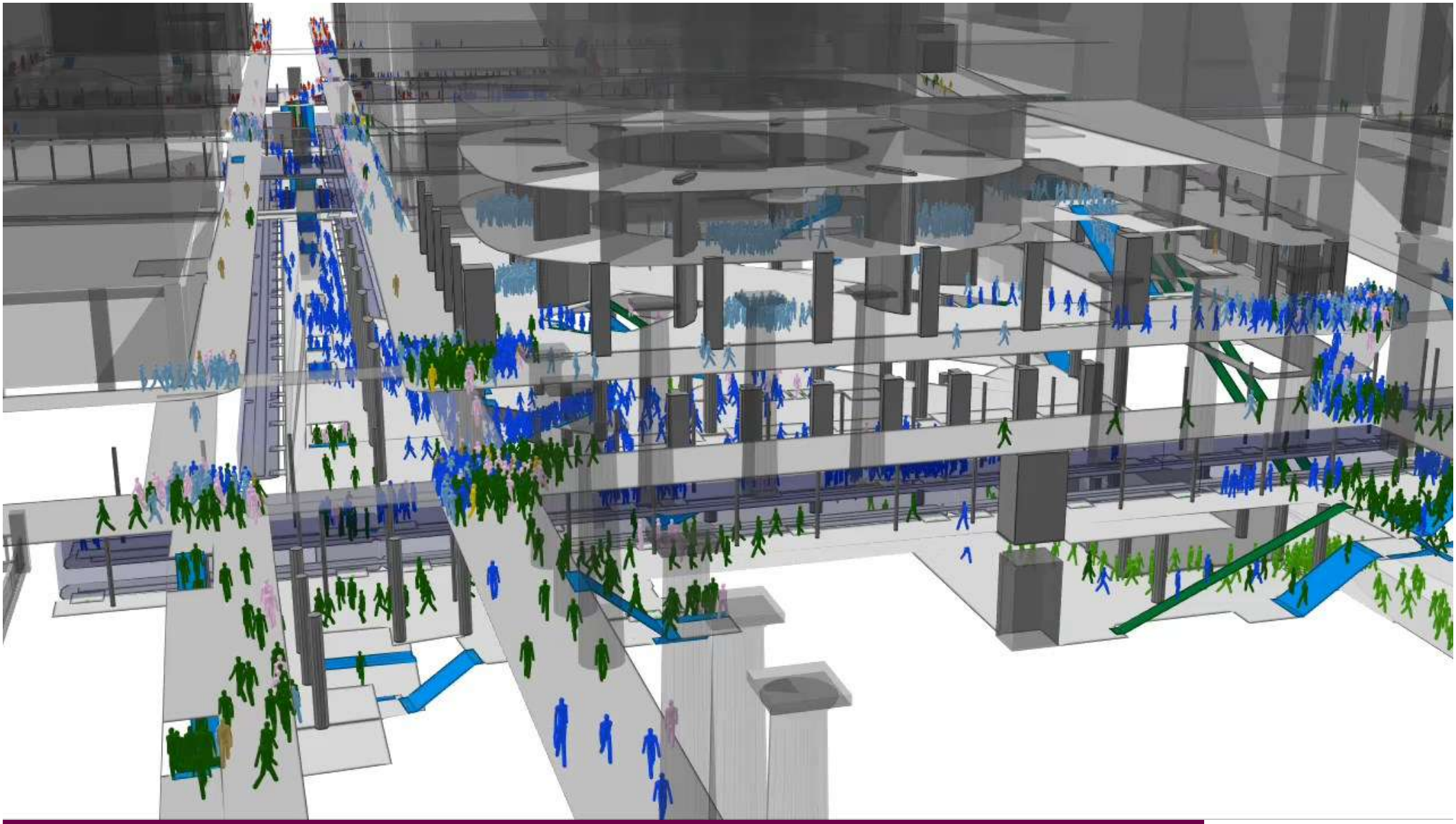
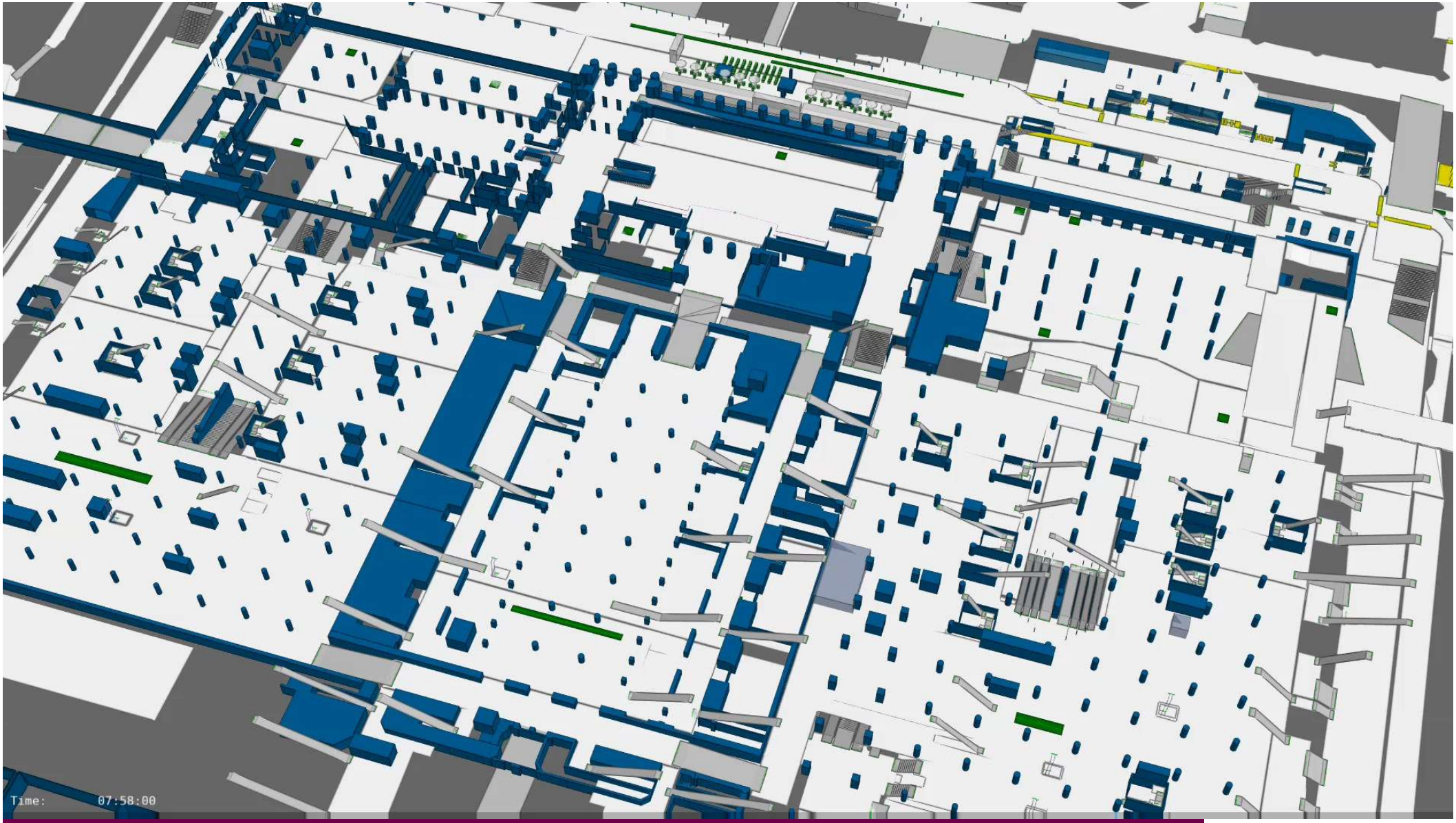
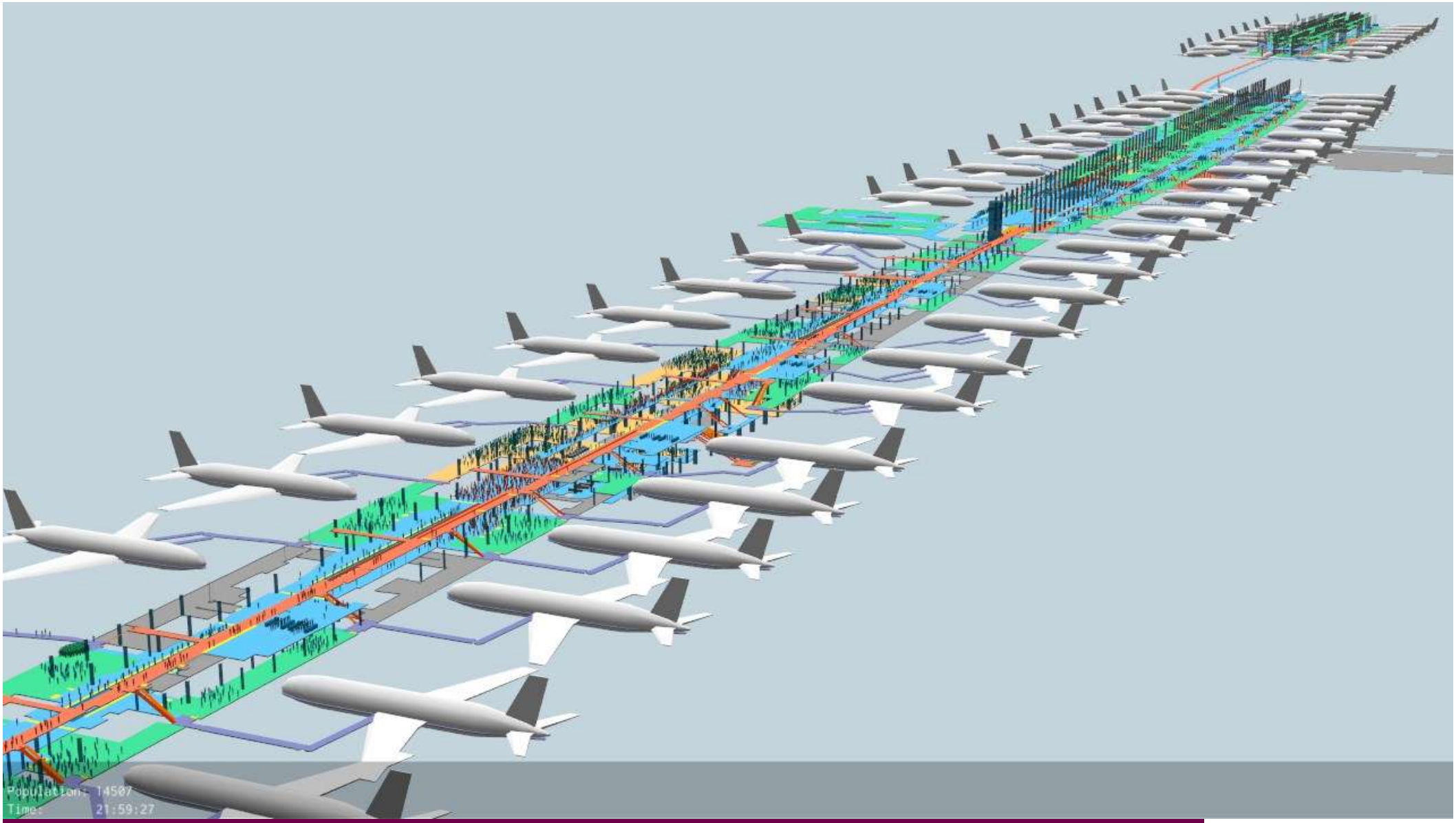


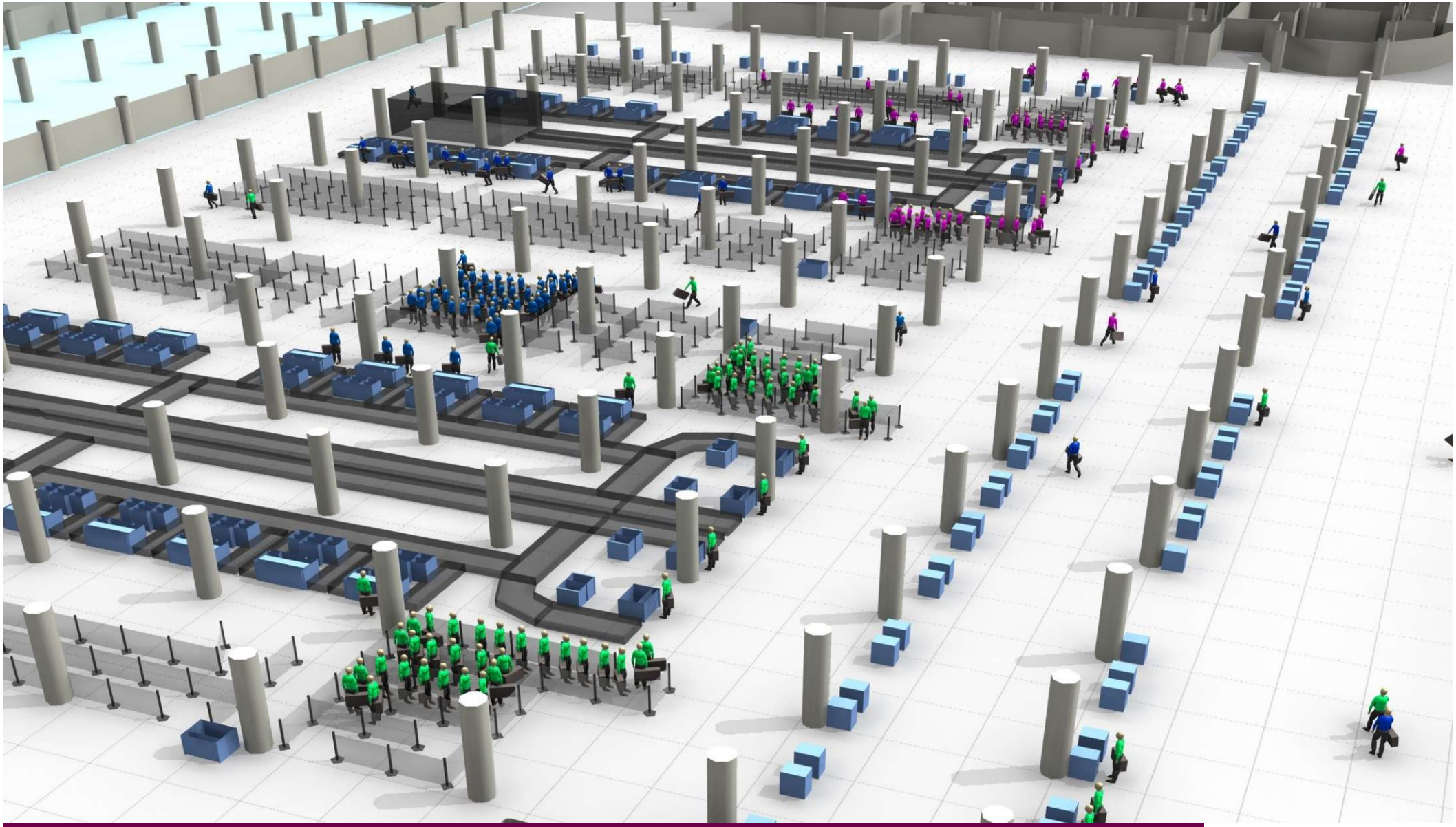
# Union Station, Toronto



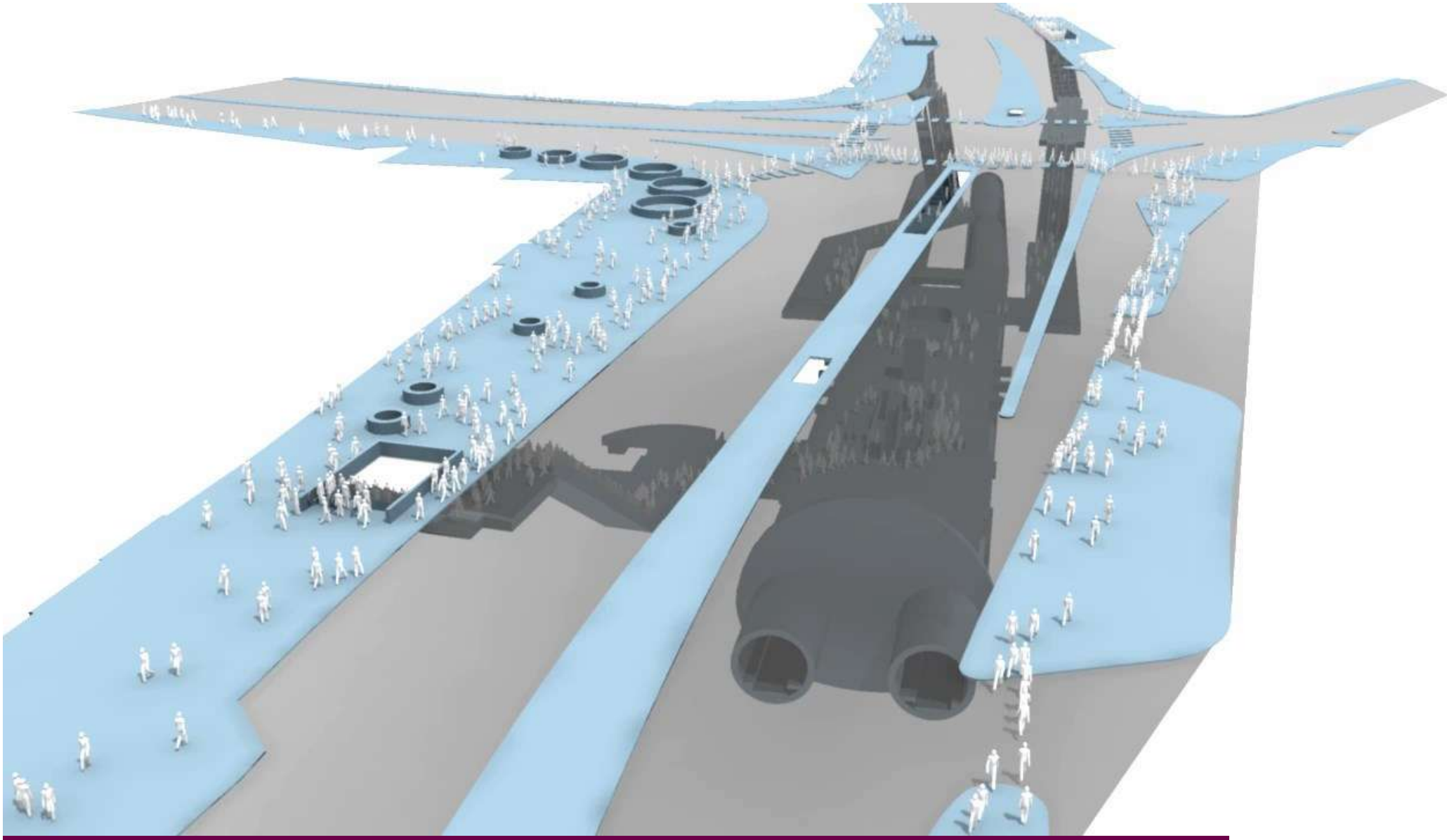
# Dubai Airport – MM Dynamics



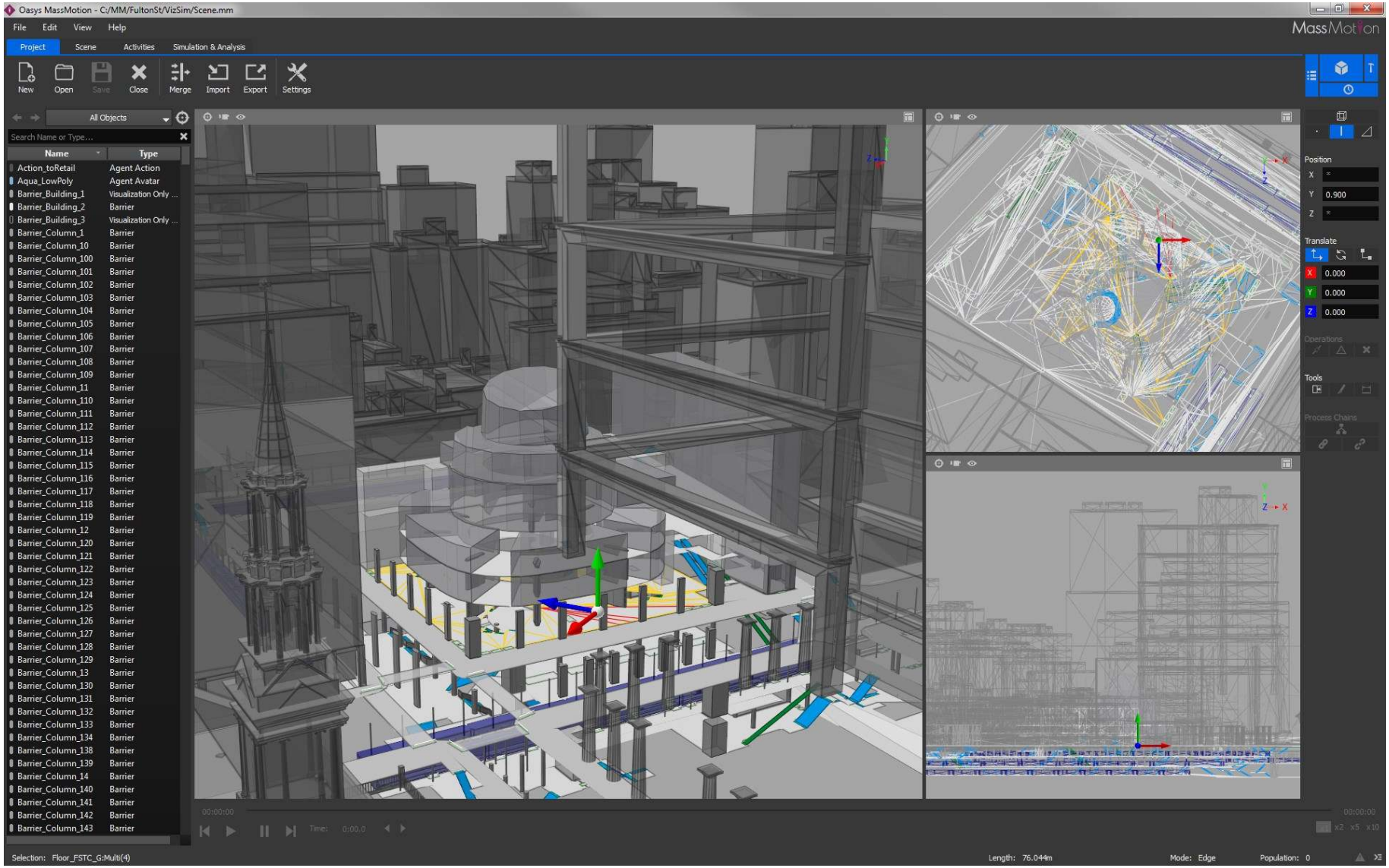
# Montreal Trudeau – MM Dynamics



# Underground Metro Station

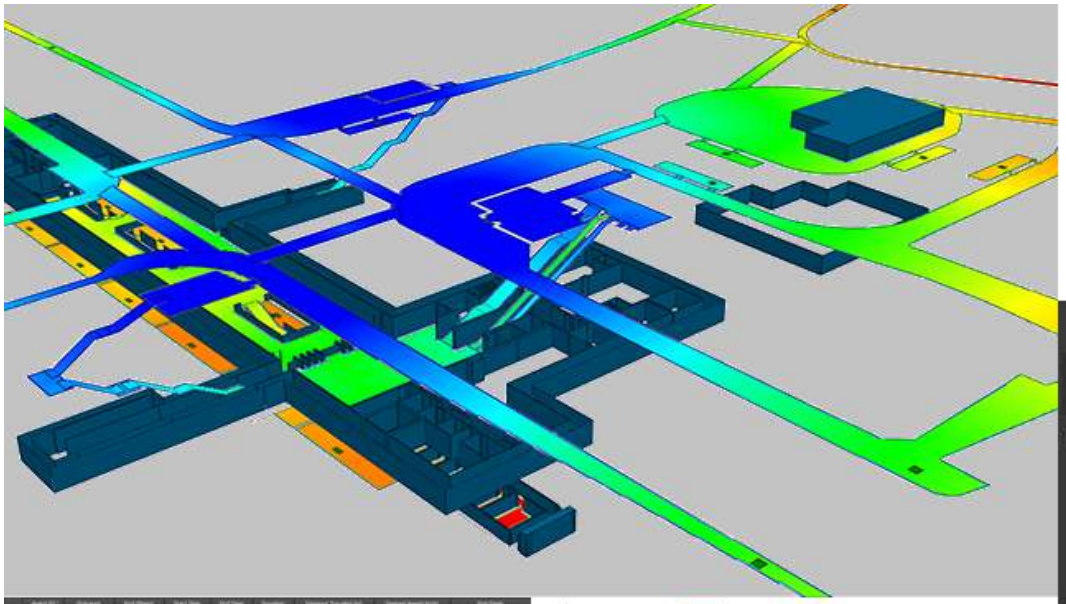


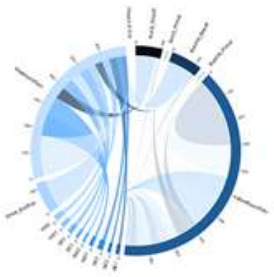
# Intuitive 3D Modelling

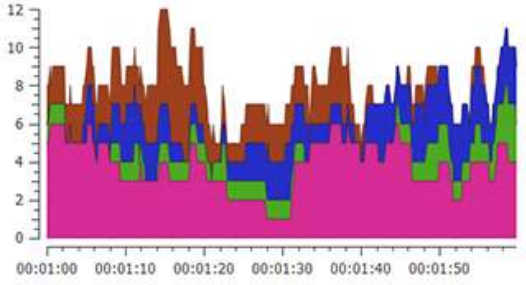


# Communication

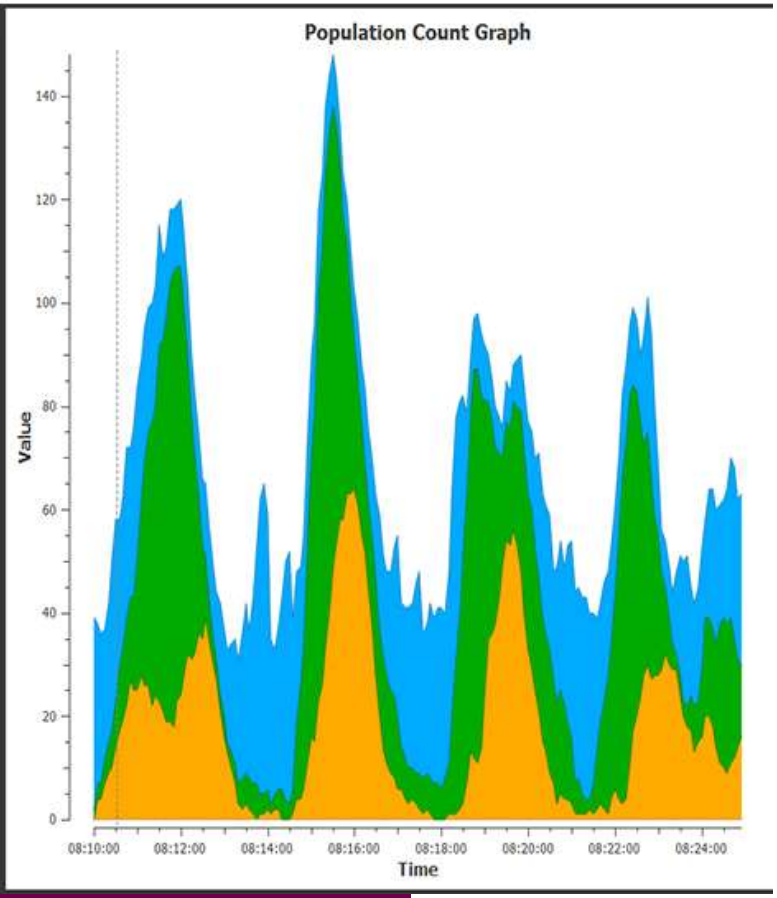
# Statistical & Spatial Analysis

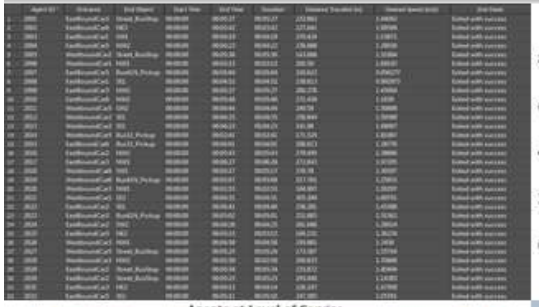


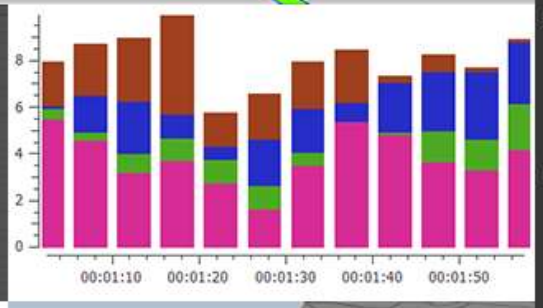


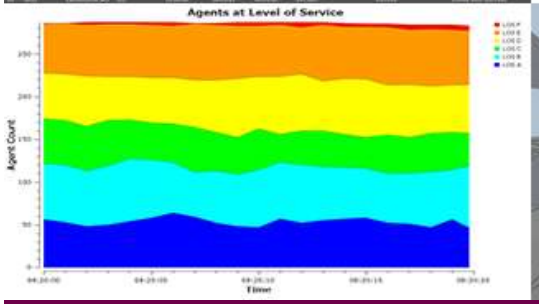


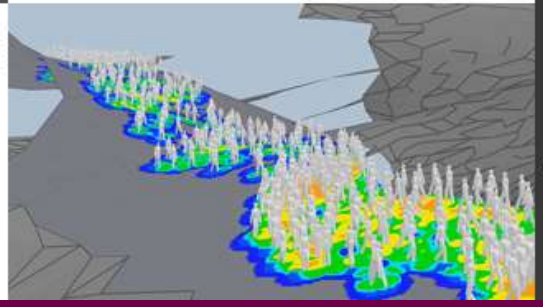




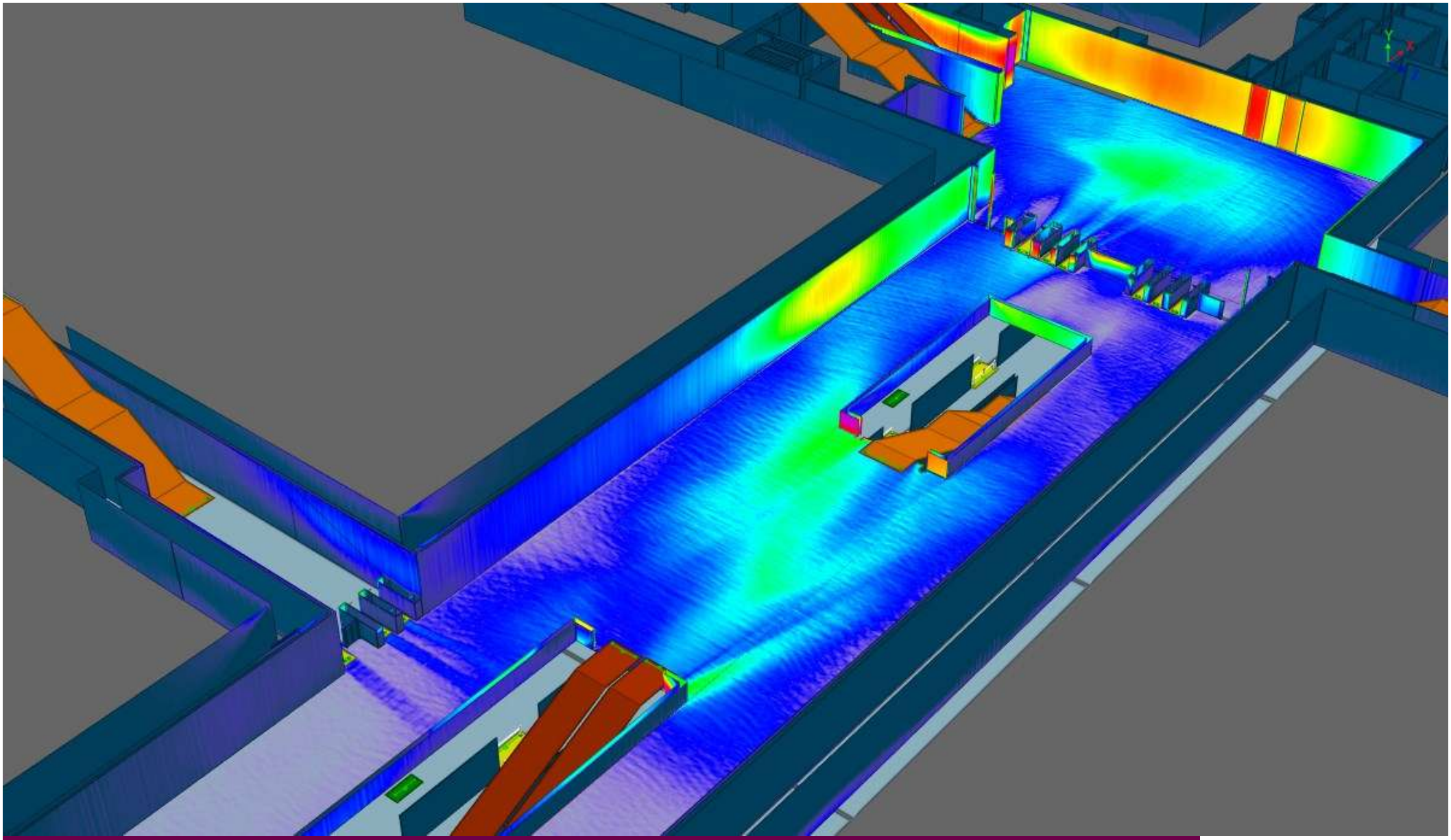





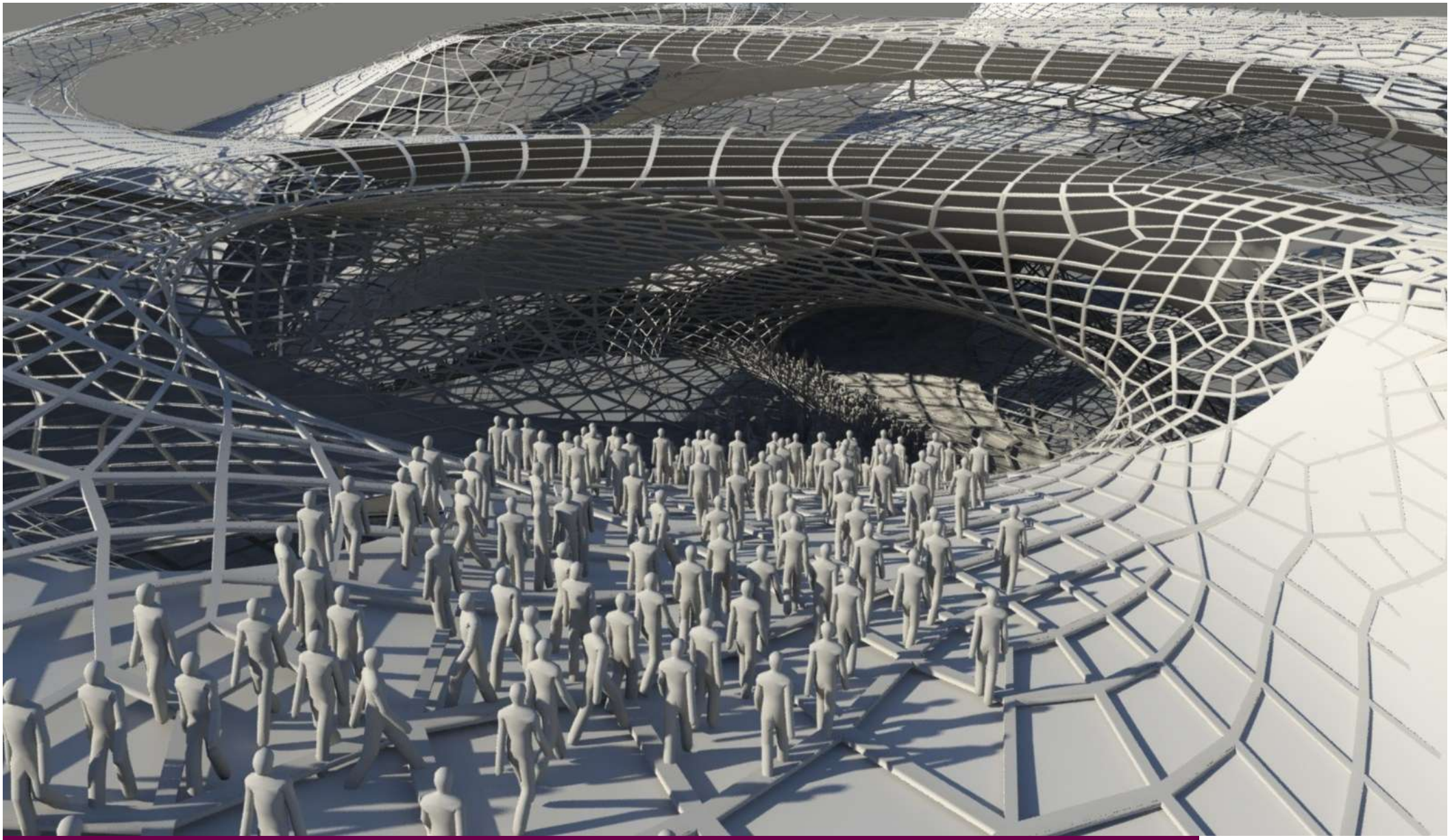



# 3D Analysis



# Visualization



# Animation

ARUP

# Model creation

**3D Geometry Creation**

- CAD
- Modelling

**Scenario Preparation**

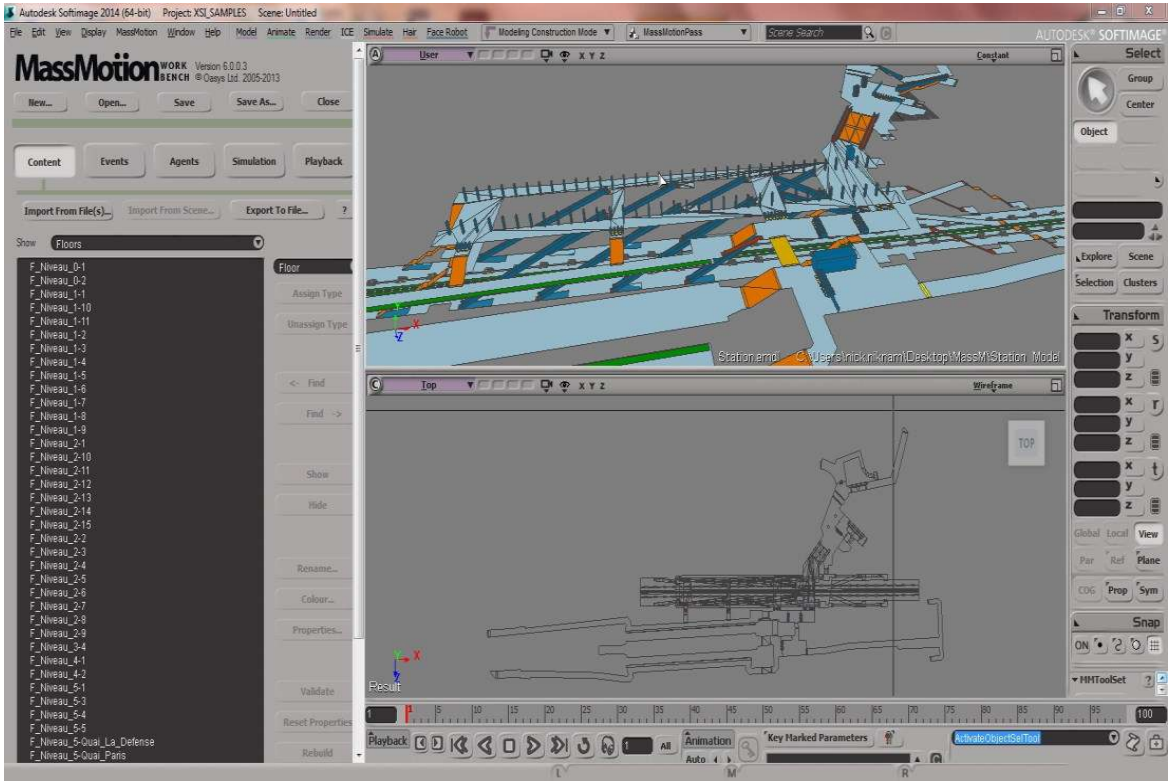
- Geometry Classification
- Agent Events

**Validation and Simulation**

- Calculation
- Results Logging

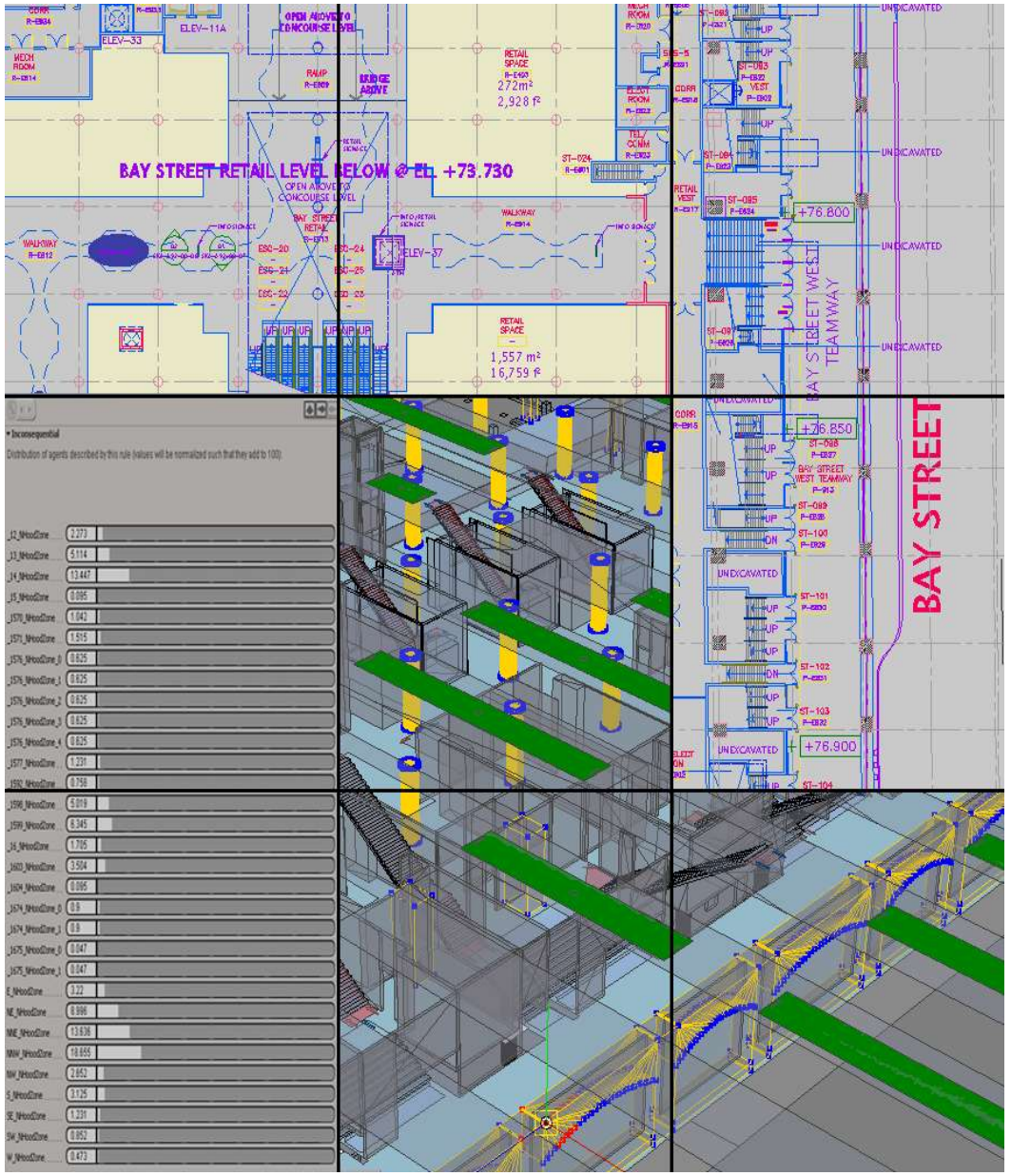
**Results and Analysis**

- Visual Verification
- Statistics
- Reporting

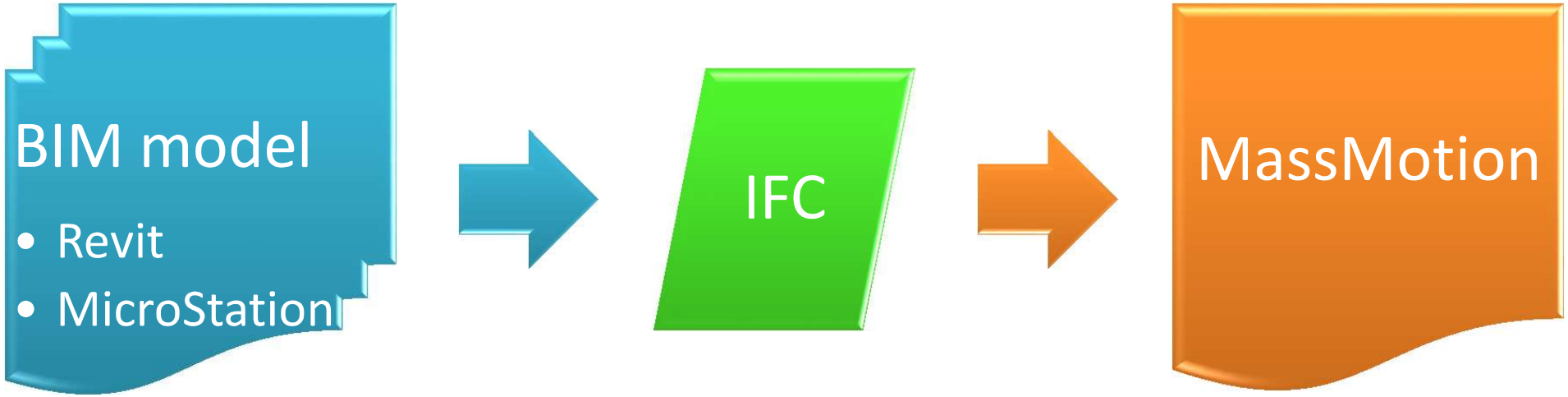


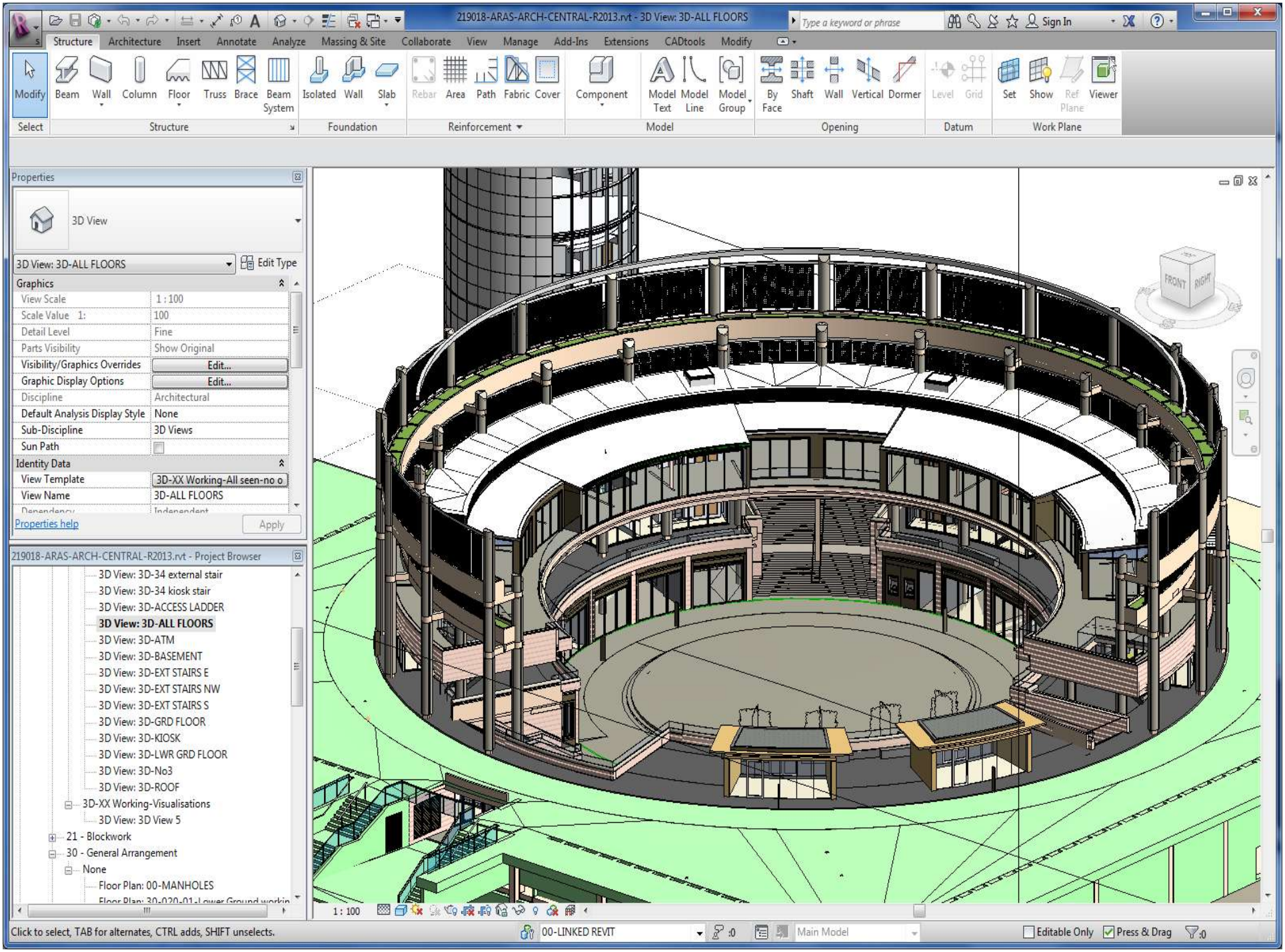
# Modelling

- Models can be developed from CAD drawings or built from scratch
- Translation tools enable import of 3D geometry from Revit, AutoCAD, Micro-Station, SketchUp, and Rhino
- Geometry is classified as floors, links, barriers, and portals
- Geometric design changes are automatically incorporated through scene parsing algorithms
- Pre-flight model validation ensures that setup problems are identified prior to simulation



# BIM integration




219018-ARAS-ARCH-CENTRAL-R2013.rvt - 3D View: 3D-ALL FLOORS
Structure
Architecture
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Extensions
CADtools
Modify
Modify
Beam
Wall
Column
Floor
Truss
Brace
Beam System
Isolated
Wall
Slab
Rebar
Area
Path
Fabric
Cover
Component
Model Text
Model Line
Model Group
By Face
Shaft
Wall
Vertical
Dormer
Level
Grid
Set
Show
Ref Plane
Viewer
Select
Structure
Foundation
Reinforcement
Model
Opening
Datum
Work Plane
Properties
3D View
3D View: 3D-ALL FLOORS
Edit Type
Graphics
View Scale 1 : 100
Scale Value 1: 100
Detail Level Fine
Parts Visibility Show Original
Visibility/Graphics Overrides Edit...
Graphic Display Options Edit...
Discipline Architectural
Default Analysis Display Style None
Sub-Discipline 3D Views
Sun Path
Identity Data
View Template 3D-XX Working-All seen-no o
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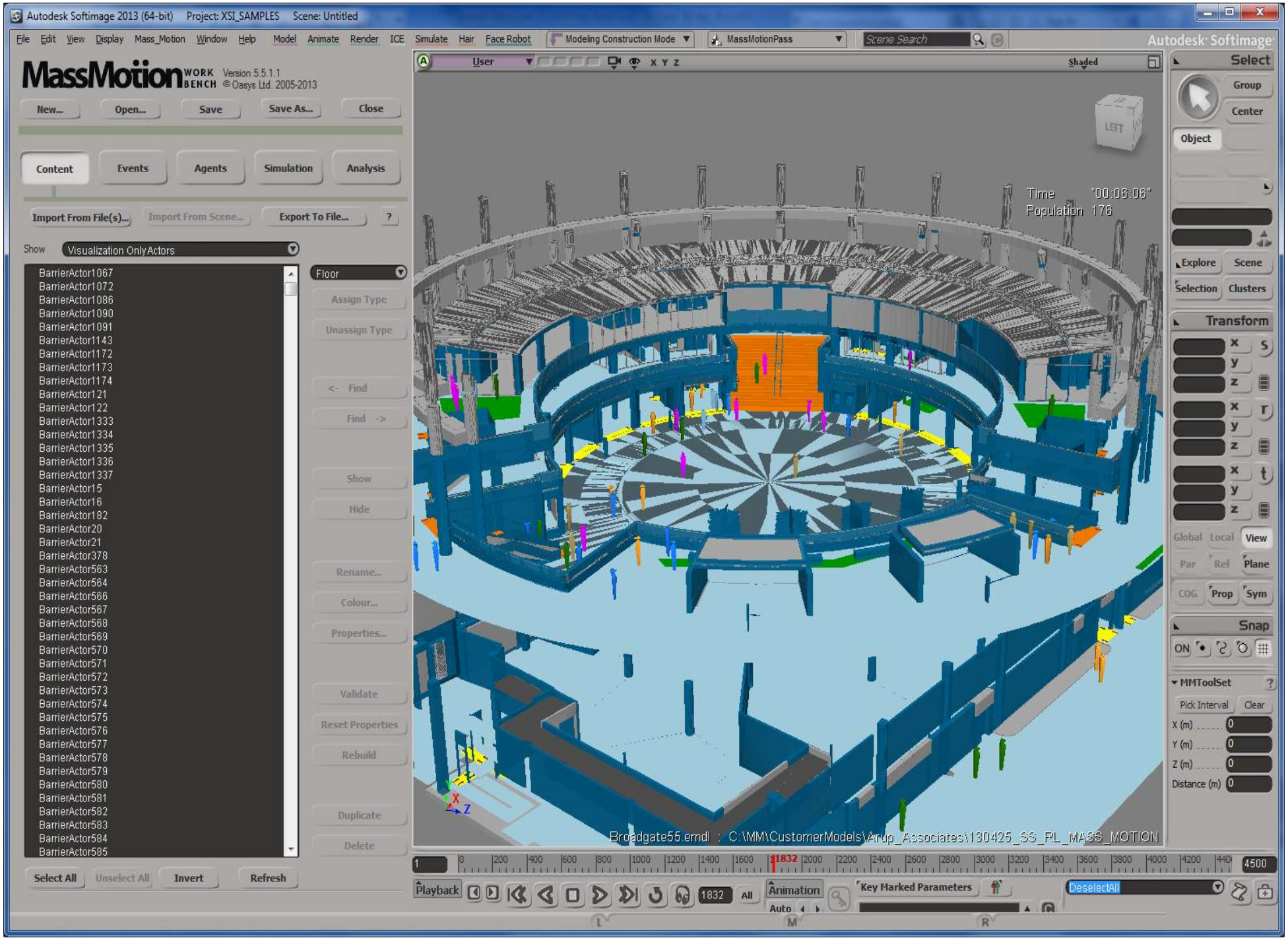
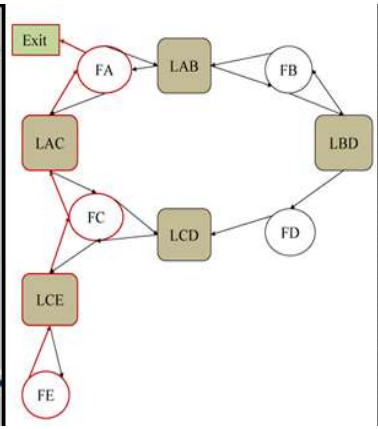
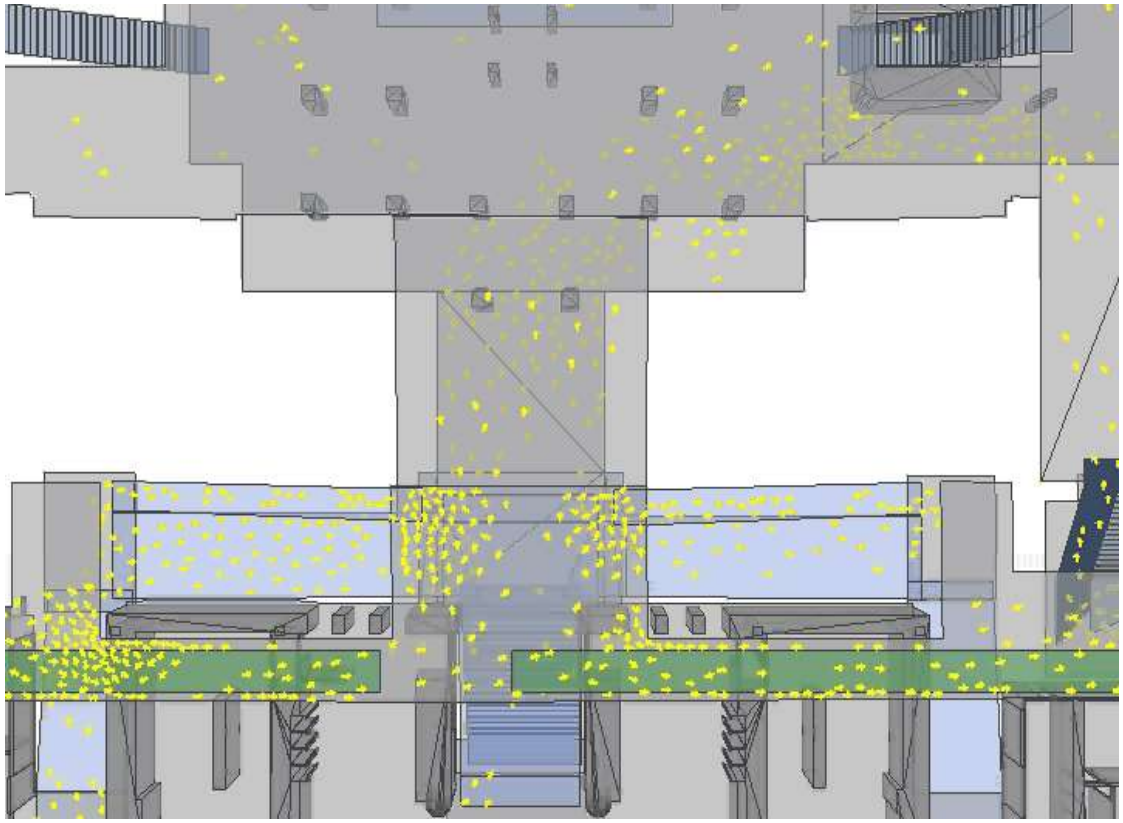
Properties help
Apply
219018-ARAS-ARCH-CENTRAL-R2013.rvt - Project Browser
3D View: 3D-34 external stair
3D View: 3D-34 kiosk stair
3D View: 3D-ACCESS LADDER
3D View: 3D-ALL FLOORS
3D View: 3D-ATM
3D View: 3D-BASEMENT
3D View: 3D-EXT STAIRS E
3D View: 3D-EXT STAIRS NW
3D View: 3D-EXT STAIRS S
3D View: 3D-GRD FLOOR
3D View: 3D-KIOSK
3D View: 3D-LWR GRD FLOOR
3D View: 3D-No3
3D View: 3D-ROOF
3D-XX Working-Visualisations
3D View: 3D View 5
21 - Blockwork
30 - General Arrangement
None
Floor Plan: 00-MANHOLES
FRONT
RIGHT
1 : 100
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
00-LINKED REVIT
Main Model
Editable Only
Press & Drag

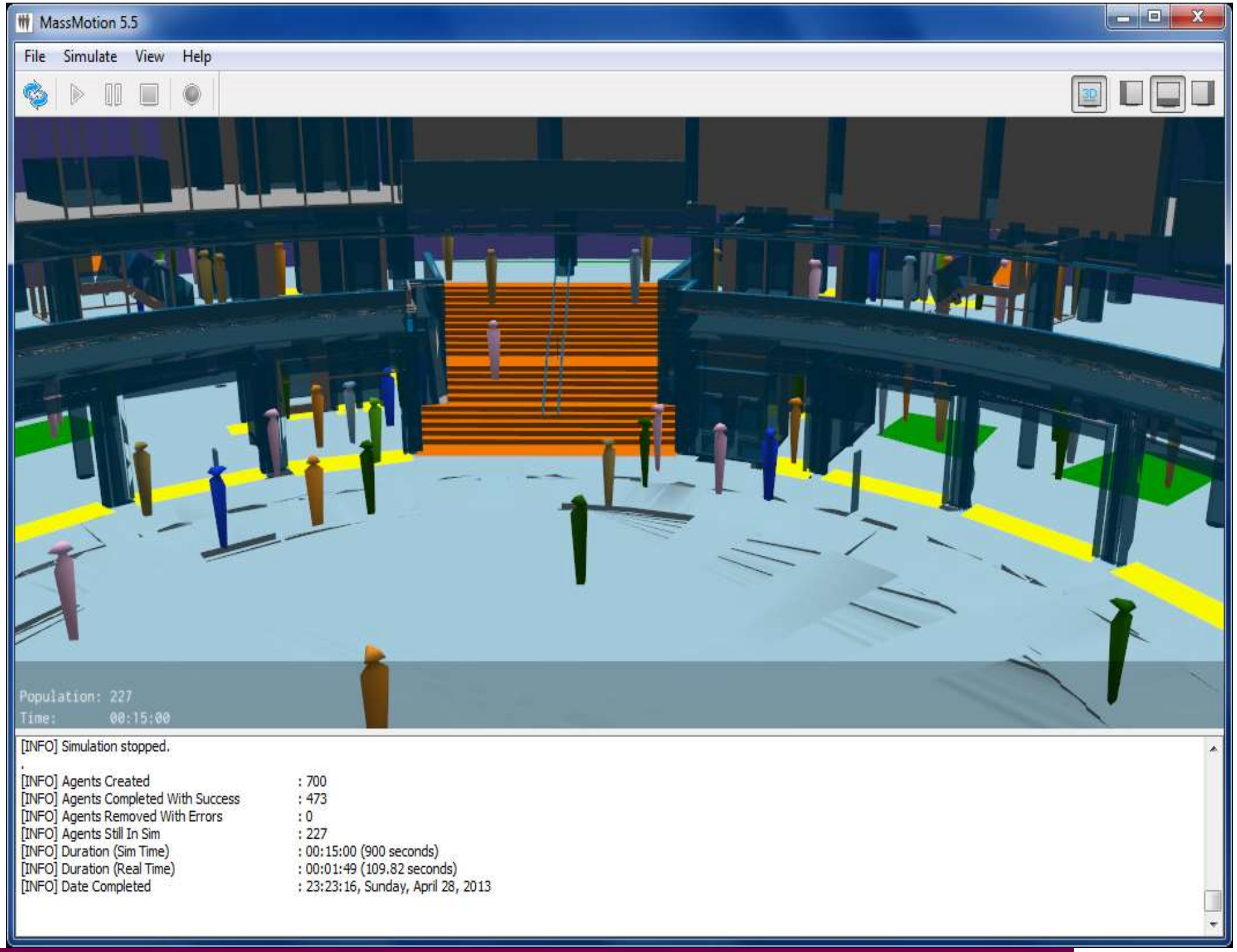

Autodesk Softimage 2013 (64-bit) Project: XSI_SAMPLES Scene: Untitled
MassMotion WORK BENCH Version 5.5.1.1
© Oasys Ltd. 2005-2013
Time "00:06:06"
Population 178
Broadgate55.emdl : C:\MM\CustomerModels\Arup_Associates\130425_SS_RL_MASS_MOTION

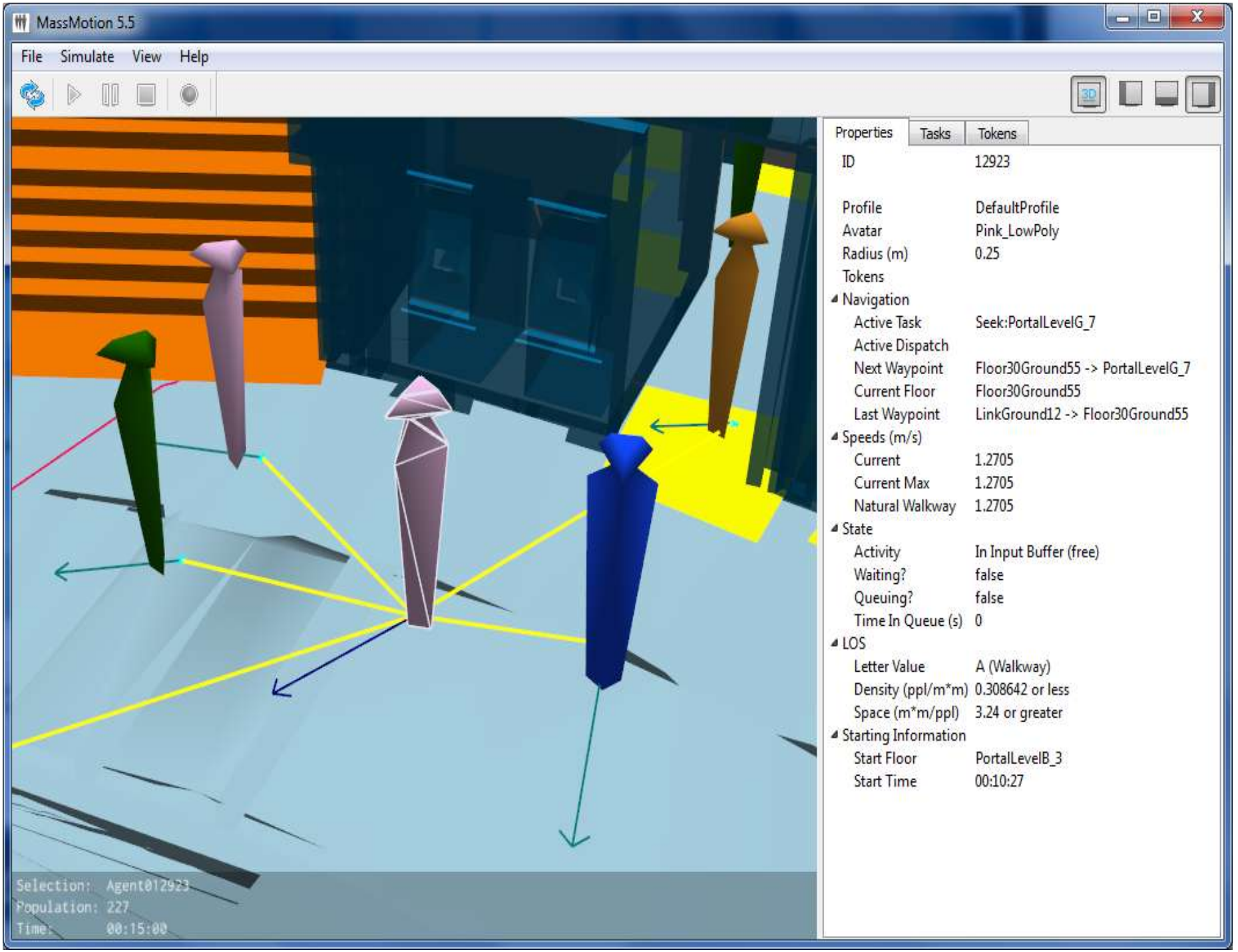
# Simulation

- 3D environment is parsed to develop physical relationships between geometric objects
- Routes between origins and destinations are mapped
- Agents navigate their way through the environment to their individual destinations
- Data is collected and exported for analysis



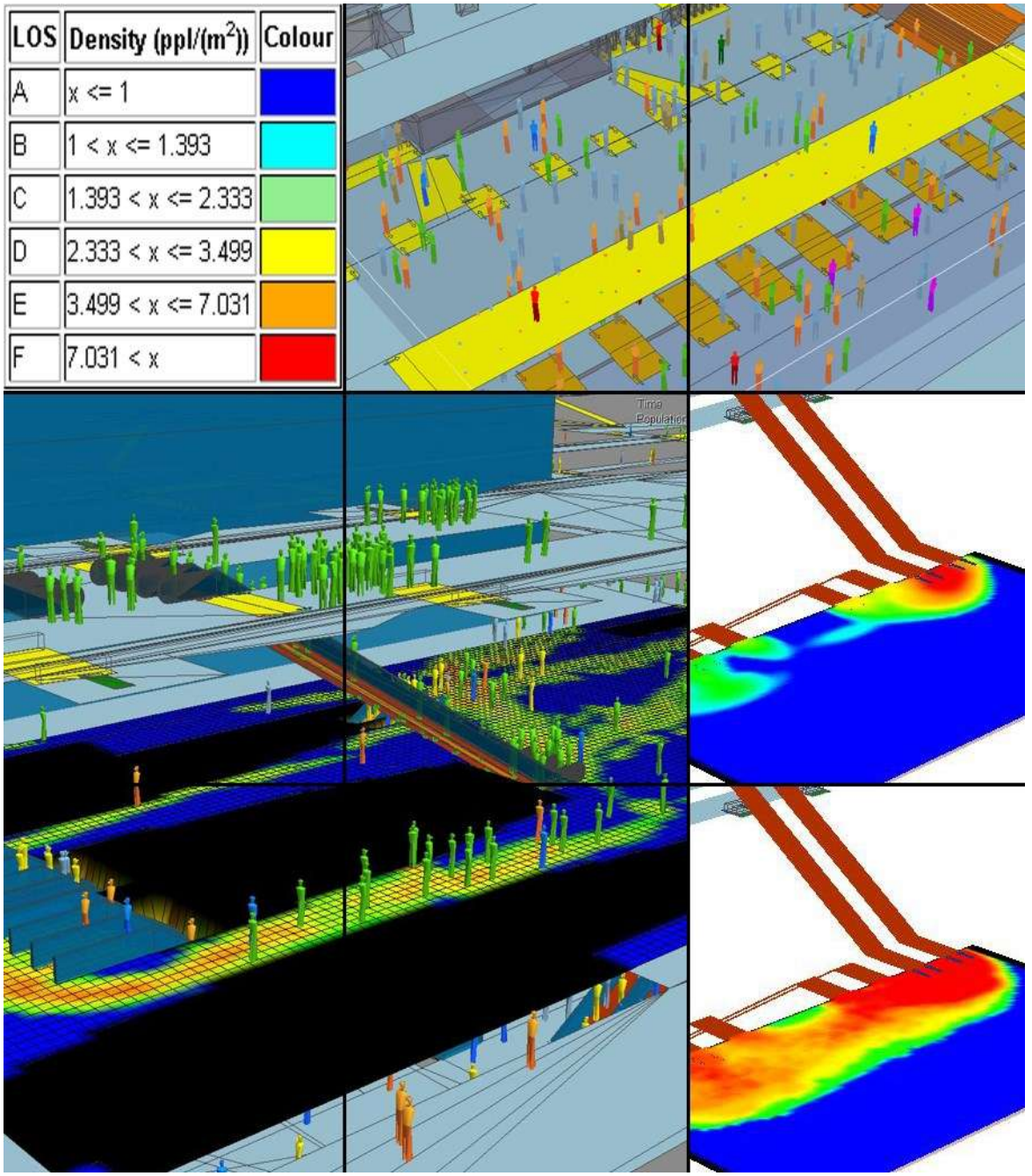



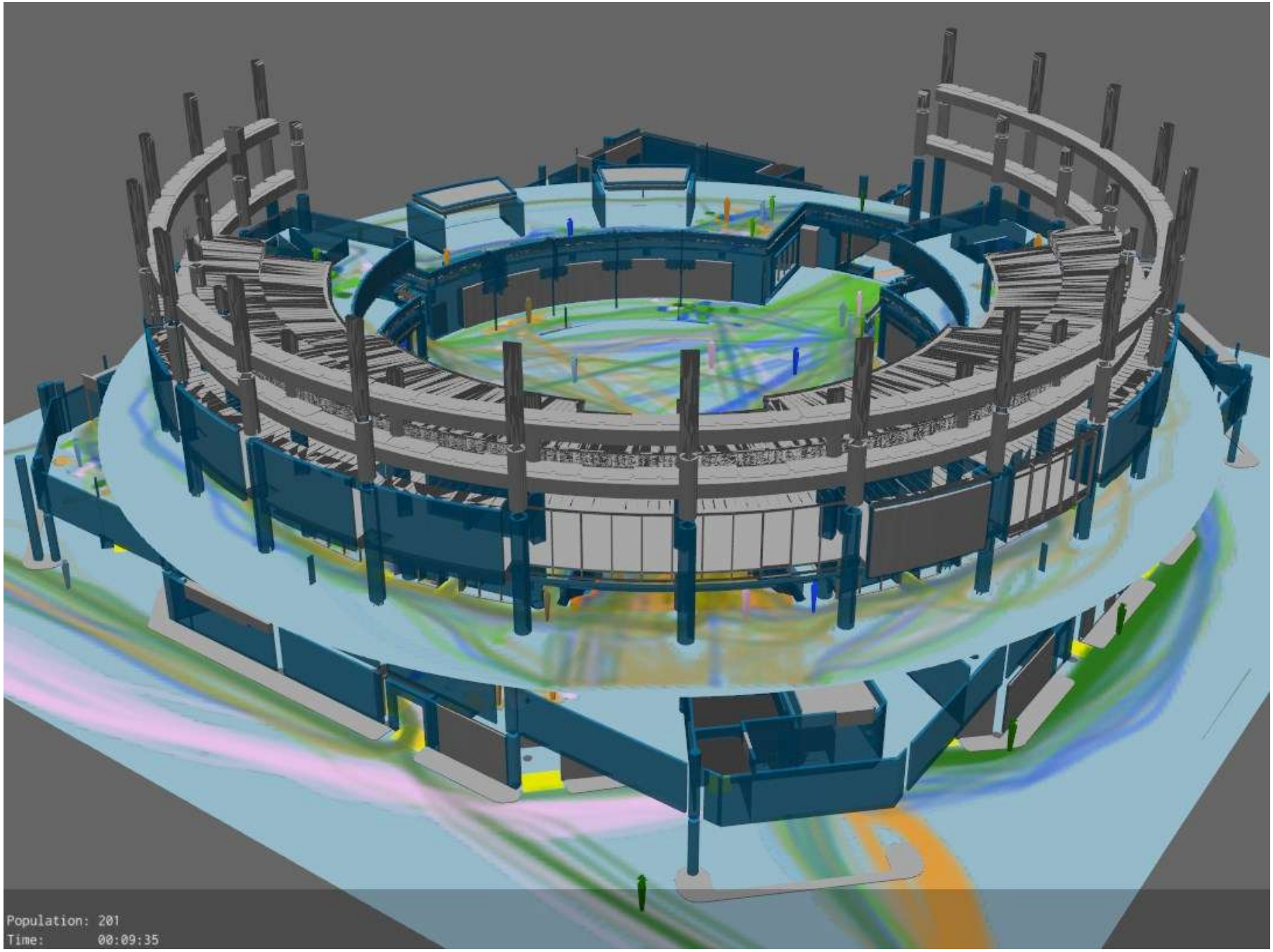

MassMotion 5.5
File Simulate View Help
Population: 227
Time: 00:15:00
[INFO] Simulation stopped.
.
[INFO] Agents Created : 700
[INFO] Agents Completed With Success : 473
[INFO] Agents Removed With Errors : 0
[INFO] Agents Still In Sim : 227
[INFO] Duration (Sim Time) : 00:15:00 (900 seconds)
[INFO] Duration (Real Time) : 00:01:49 (109.82 seconds)
[INFO] Date Completed : 23:23:16, Sunday, April 28, 2013


MassMotion 5.5
File
Simulate
View
Help
Properties
Tasks
Tokens
ID 12923
Profile DefaultProfile
Avatar Pink_LowPoly
Radius (m) 0.25
Tokens
Navigation
Active Task Seek:PortalLevelG_7
Active Dispatch
Next Waypoint Floor30Ground55 -> PortalLevelG_7
Current Floor Floor30Ground55
Last Waypoint LinkGround12 -> Floor30Ground55
Speeds (m/s)
Current 1.2705
Current Max 1.2705
Natural Walkway 1.2705
State
Activity In Input Buffer (free)
Waiting? false
Queuing? false
Time In Queue (s) 0
LOS
Letter Value A (Walkway)
Density (ppl/m*m) 0.308642 or less
Space (m*m/ppl) 3.24 or greater
Starting Information
Start Floor PortalLevelB_3
Start Time 00:10:27
Selection: Agent012923
Population: 227
Time: 00:15:00

# Analysis

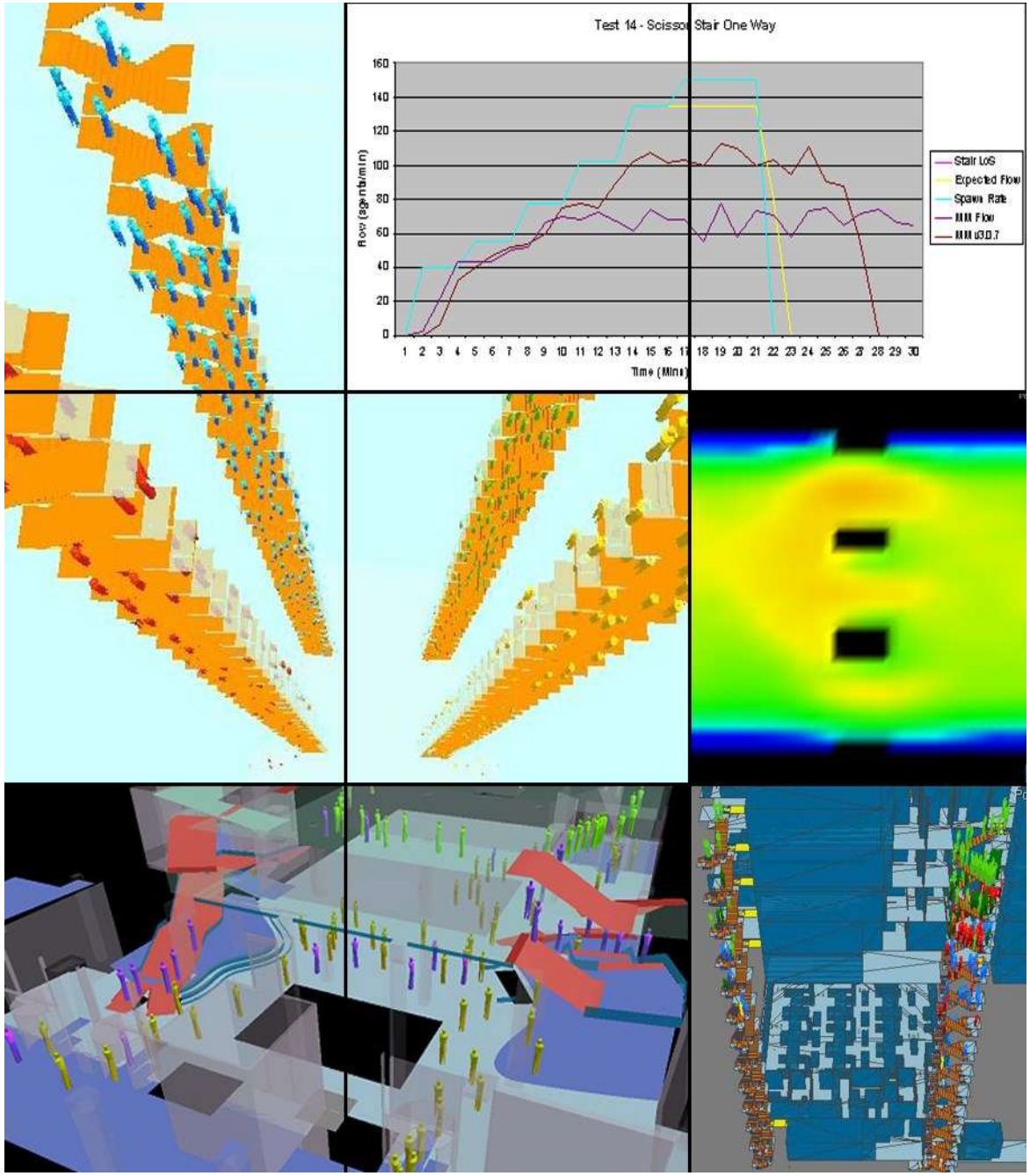
- Journey times between origins and destinations or across specific areas for individuals or groups
- Flow rates for doors, stairs, escalators, or arbitrary user defined cordons
- Queue lengths for thresholds or accumulations by user defined volumes
- Density plots for Level of Service including average, experiential, and maximum values
- Visual review of 3D recording




Population: 201
Time: 00:09:35

# Calibration & Validation

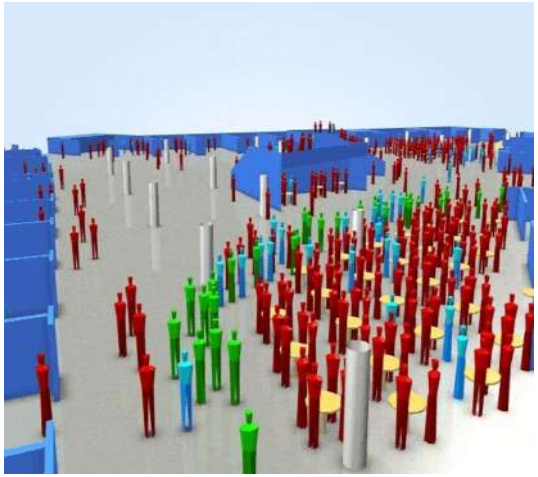
- Rigorous testing using a suite of case studies based on Fruin's industry standard pedestrian planning and design standards
- Extensive comparison with surveys of commuter behaviour and route choice patterns
- Comparative testing with other simulation tools
- Comparison with real world evacuation scenarios




UNION STATION
FUTURE EVENING PEAK

# Where has it been applied?

## Heathrow Airport



## Union Station

## London Olympics

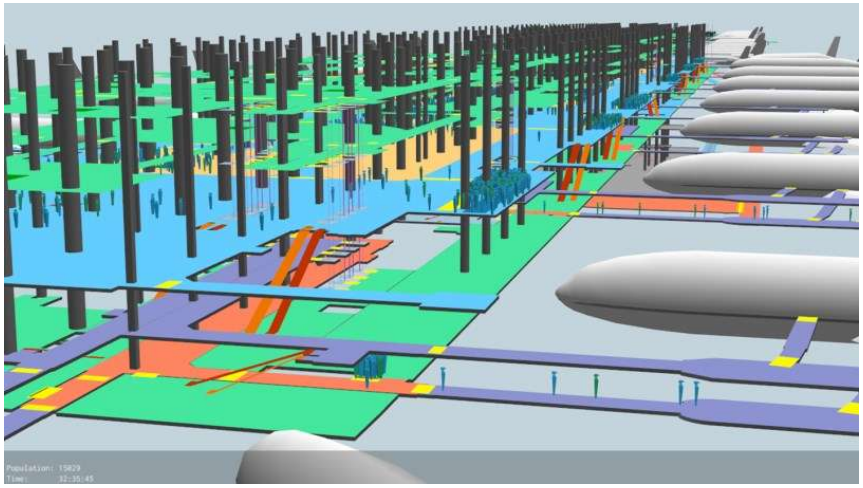
## The San Francisco Museum of Modern Art

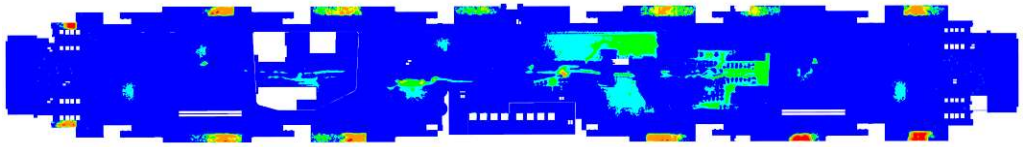
## International Airshow

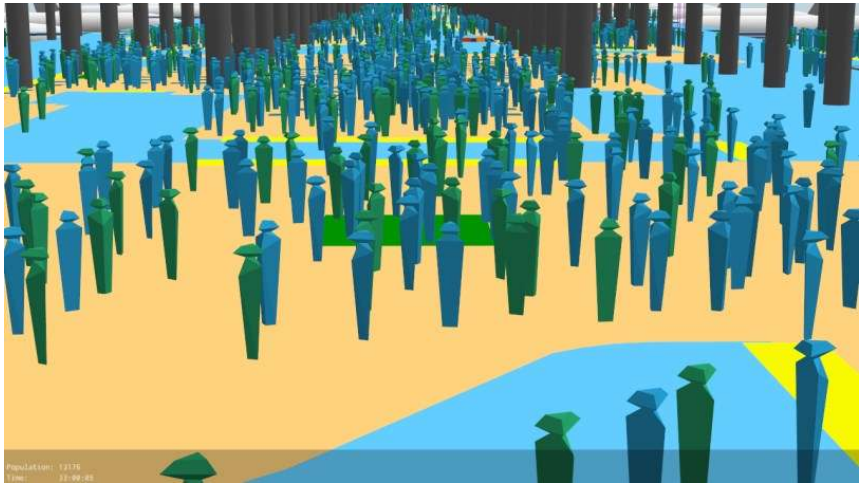
## Fastfood chain!

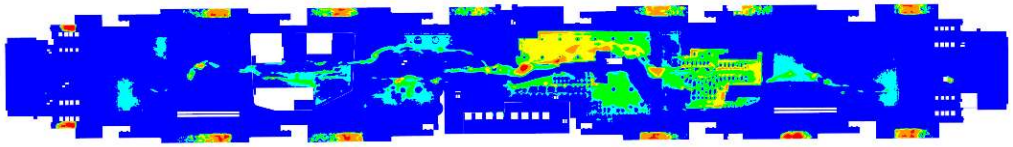
# Dubai Airport

- Investigation of pedestrian congestion in the concourses of DXB 2013 Baseline model and 2020 comparison model
- Comparative results to demonstrate the performance of existing infrastructure with projected increase in demand



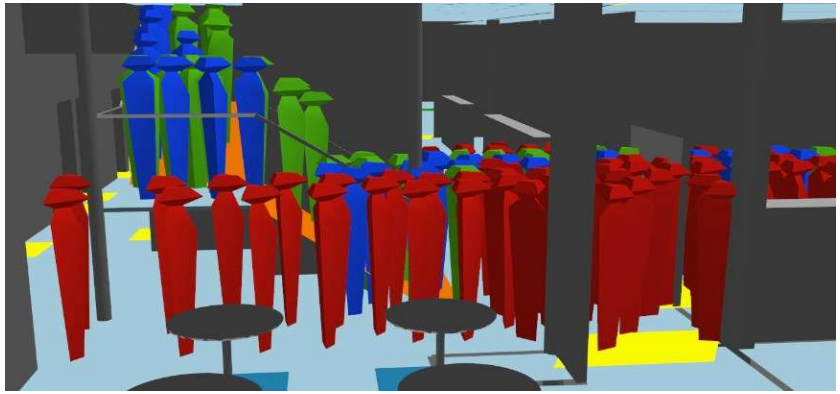


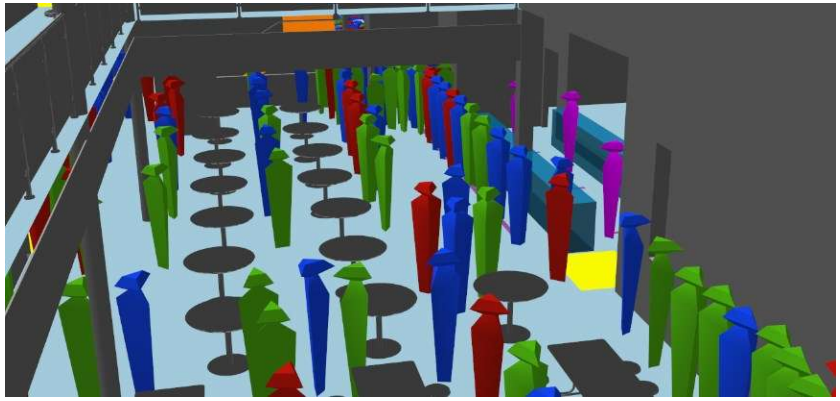


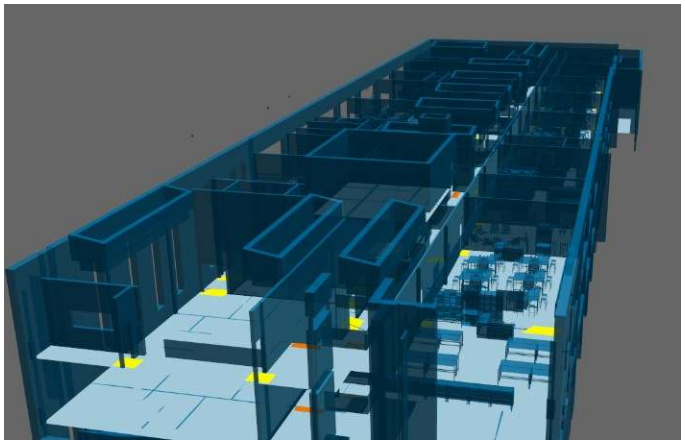


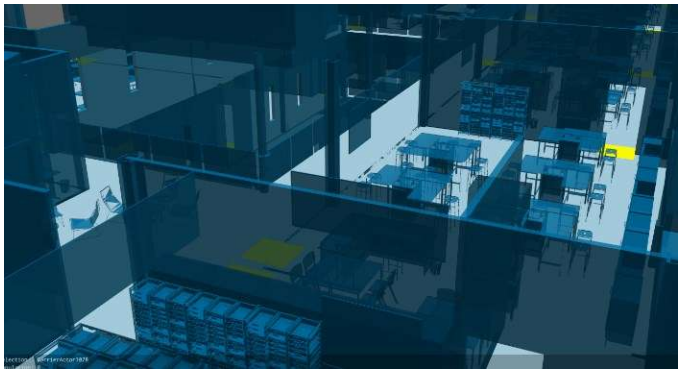
# Schools

- High level presentation regarding performance of the space for various student movements – Lunchtime movement, Sports hall egress, class egress etc.









# Value

- Predictive crowd modeling reduces **risk** in the planning and design of high occupancy facilities
- MassMotion 3D environments permit rapid iteration and testing of **design concepts**
- Diverse range of statistical and graphic output enables clear **communication** to design team, stakeholders, and the public
- Integrates well with design tools and processes including **BIM**

# Next Step

- MassMotion webpage http://www.oasys-software.com/products/engineering/massmotion.html
- Free 30 day trial from Oasys Website
- Oasys YouTube Channel http://www.youtube.com/user/TheOasysSoftware
- Oasys recorded webinars http://www.oasys-software.com/support/webinars.html
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