MOBILITY & AIR SIMULATION

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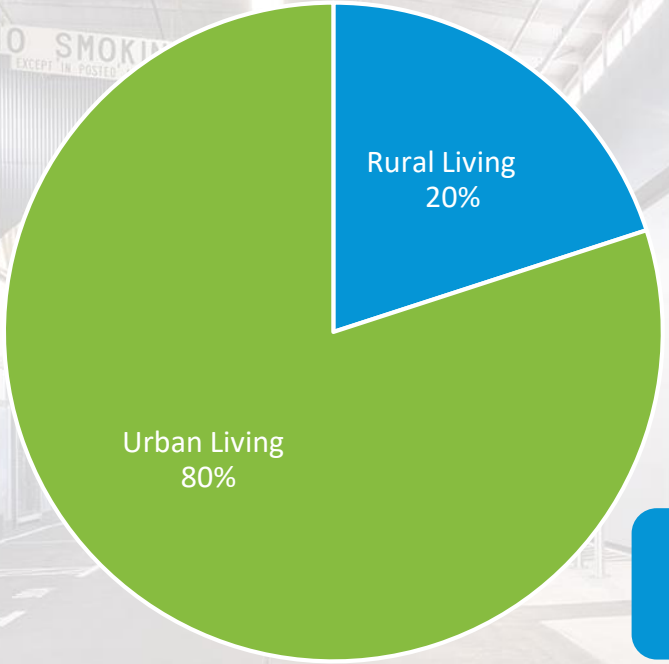
Why is Mobility Important?

Global Population: 80% predicted to reside in an urban environment by 2050



"Ensuring urban areas are fluid and mobile is fundamental…"

Source: European Automobile Manufacturers Association. 2019.

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Why is Mobility Important?

Industry Trends

- Growing prosperity creating a growing demand for mobility
- Definite movement towards ‘multimodal’ services combining walking, cars, buses, cycles and trains
- Transit Oriented Developments becoming more relevant

Pain Points

- Cities are challenged by increasing problems caused by traffic and transportation
- Existing urban infrastructure cannot support the predicted increase in vehicles on the road.
- Growing cost of congestion problems
- WHO estimated 7 million premature deaths attributable to air pollution and urban transit

Who?

1. **Crowd Simulation and Evacuation Modeling**
    a) Local Authorities
    b) Any ‘Campus’
        i. Ports
        ii. Airports
        iii. Universities
        iv. Commercial Businesses
    c) ESPs / Specialists

2. **Traffic Systems**
    a) Local Authorities
        i. Traffic Engineers
        ii. Transportation Analysts
    b) ESPs / Specialists

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Why Now?

1. **Urban mobility is becoming more important to cities**
   a) Congestion close to unbearable in some cities, costing as much as 4% of national GDP
   b) Lost time, wasted fuel, increased cost of doing business

2. **Cities looking for sustainable transportation solutions**
   a) Cities targeted on environmental factors relating to transportation
   b) Transit Oriented Developments
   c) Electric vehicles

3. **COVID-19**
   a) Governments need containment of the virus
   b) Companies need to provide a safe working environment for their workers

Mobility Simulation

COVID-19 Considerations and Application

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COVID-19 Considerations and Application

- Features, settings and parameters useful in modelling simulation specific to COVID-19 planning

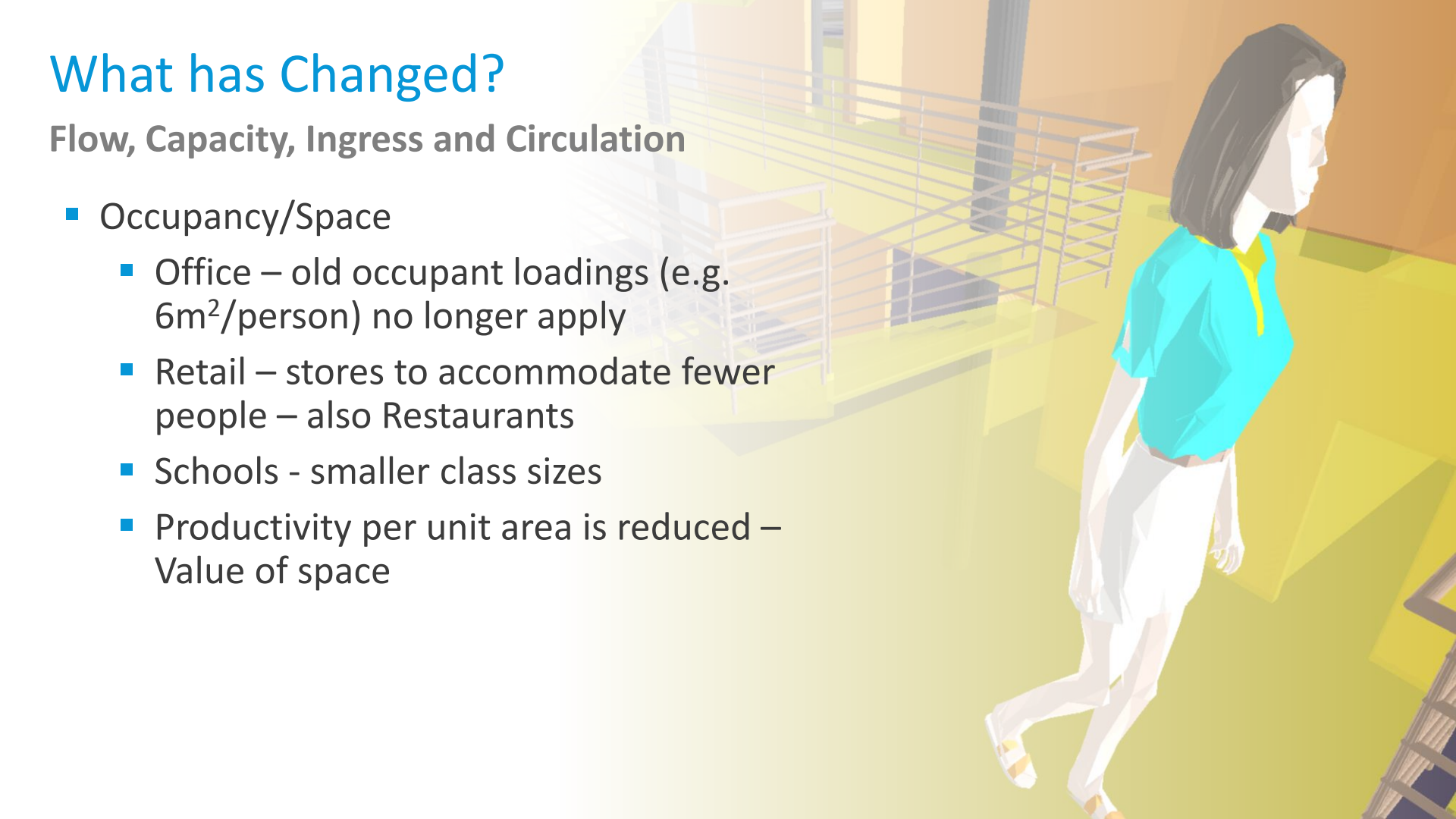
- General Considerations

- Technical Implementation
  - People Parameters
    - Spacing
    - Queuing

What has Changed?

Flow, Capacity, Ingress and Circulation

- Occupancy/Space
  - Office – old occupant loadings (e.g. $6m^2$/person) no longer apply
  - Retail – stores to accommodate fewer people – also Restaurants
  - Schools - smaller class sizes
  - Productivity per unit area is reduced – Value of space



What has Changed?

Flow, Capacity, Ingress and Circulation

- Route planning
  - The extra spacing:
    Door & Passage capacity
  - Understanding and measurements of one-way flow needs to be further developed
  - A reduction of crossing flows
  - Partitions must be considered

What has Changed?

Flow, Capacity, Ingress and Circulation

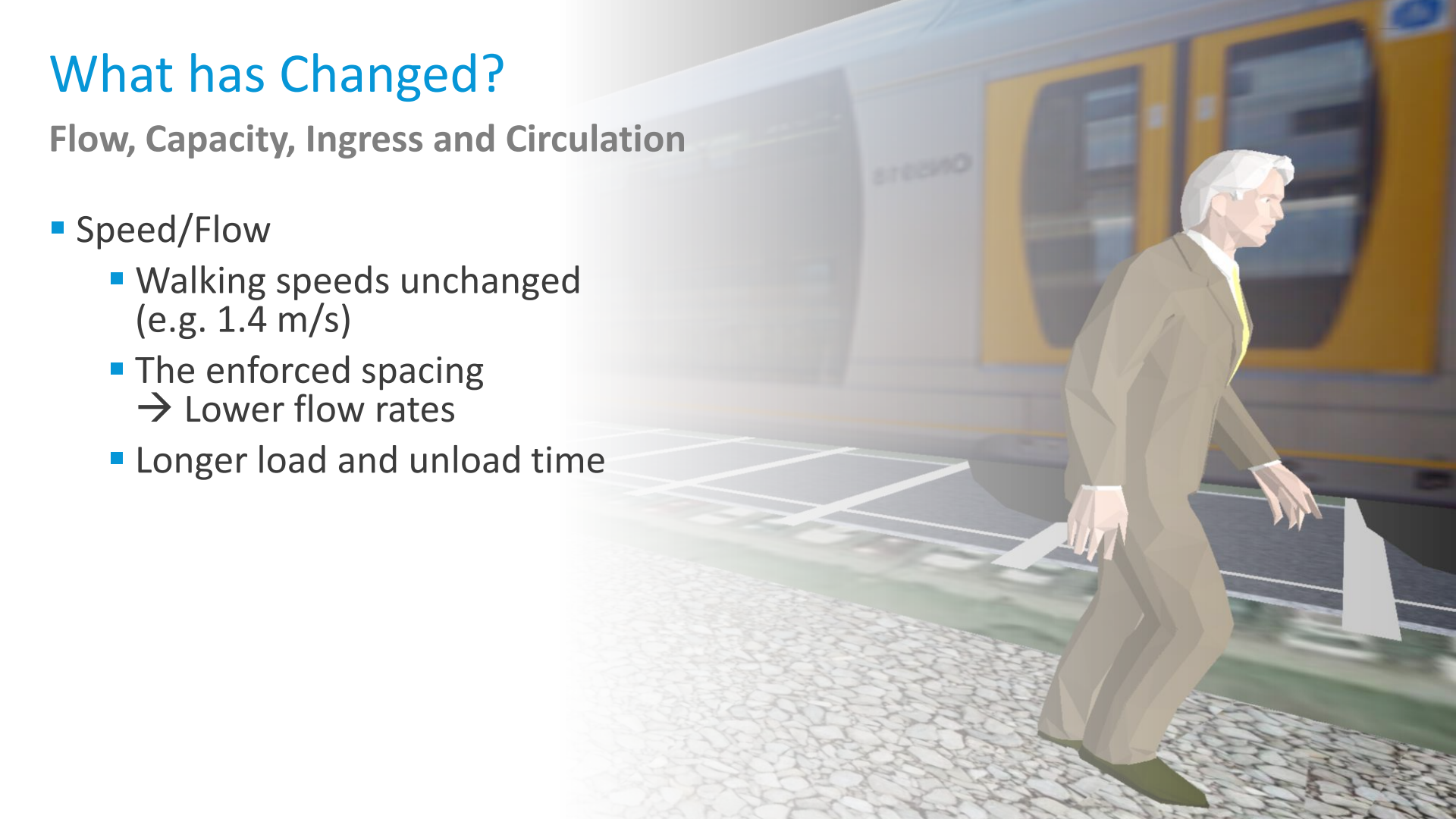
- “Risk”
  - Life safety, fire protection and evacuation
    → Infection and Transmission

- This might rebalance over time

What has Changed?

Flow, Capacity, Ingress and Circulation

- Speed/Flow
  - Walking speeds unchanged (e.g. 1.4 m/s)
  - The enforced spacing → Lower flow rates
  - Longer load and unload time



General Measures

COVID-19 Mitigation

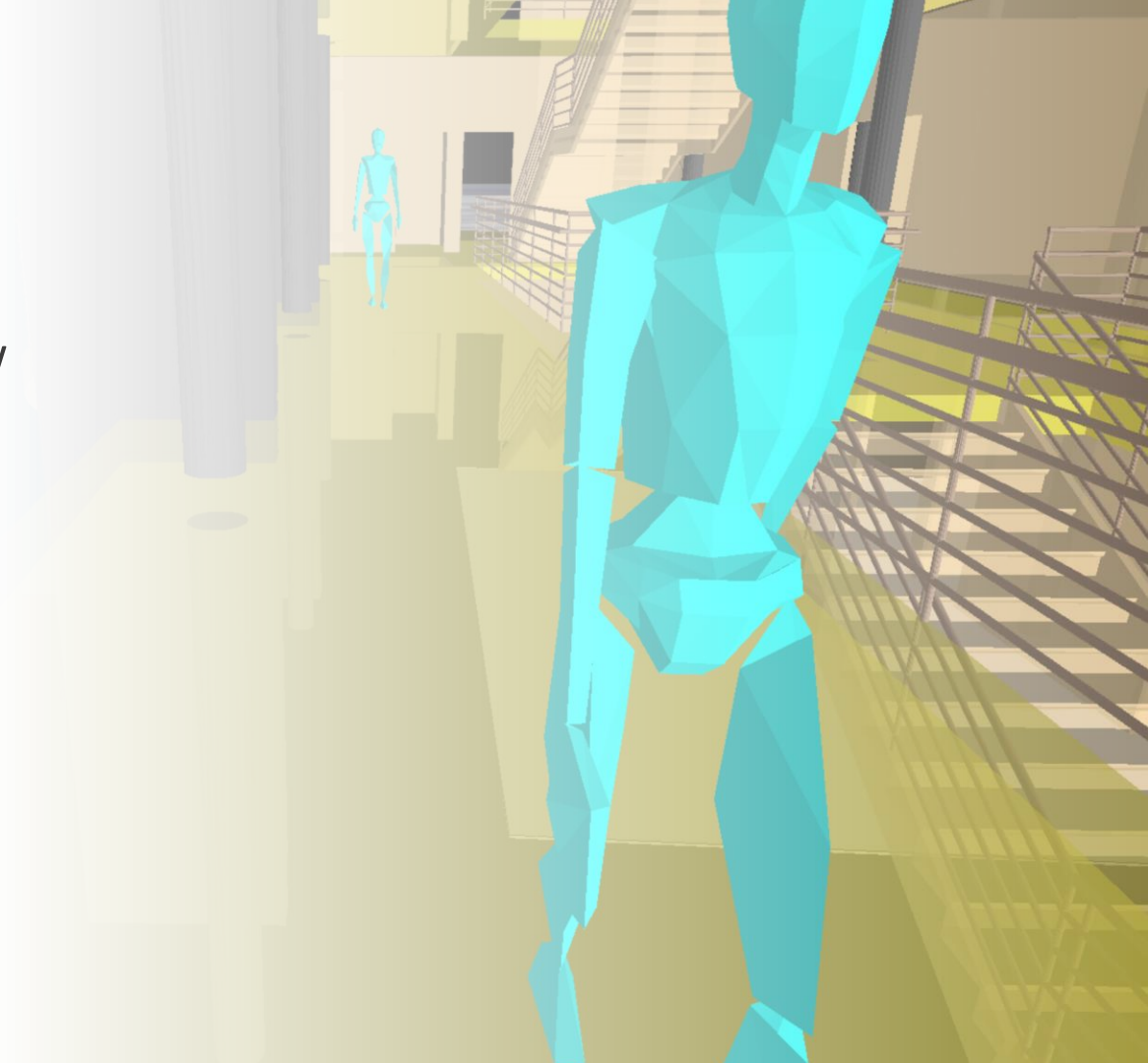
- Physical Distancing
- Uni-direction Flow
- Dedicated Parking
- Assigned Entrance / Exit
- Staggered Arrival / Departure Times

Mobility Simulation

Network Design

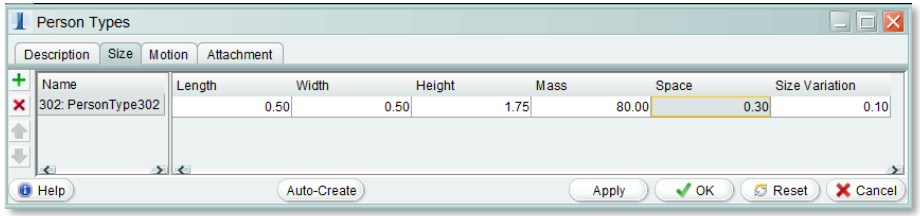
- Network Layout
  - Uni-direction Person Flow
  - Parking
  - Entrance / Exit

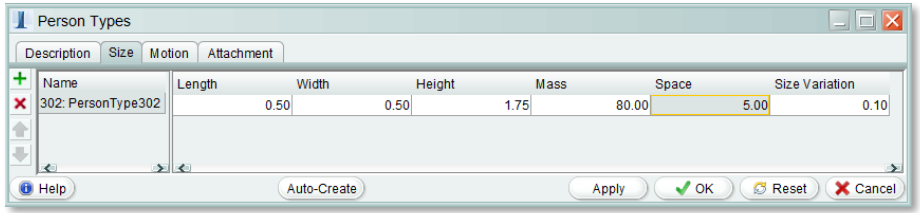
- People Parameters
  - Physical Distancing
- Walkway Parameters
  - Physical Distancing

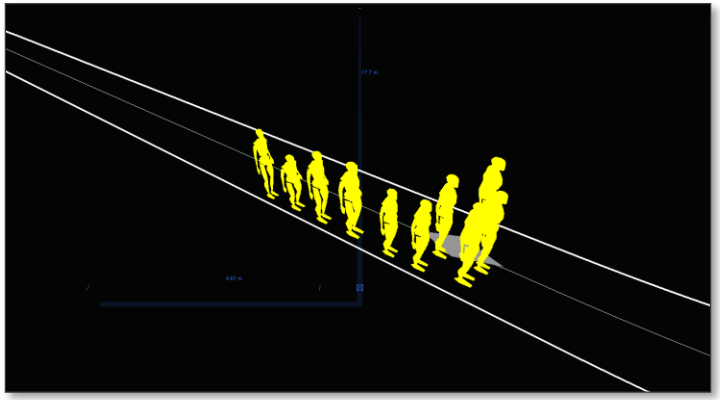


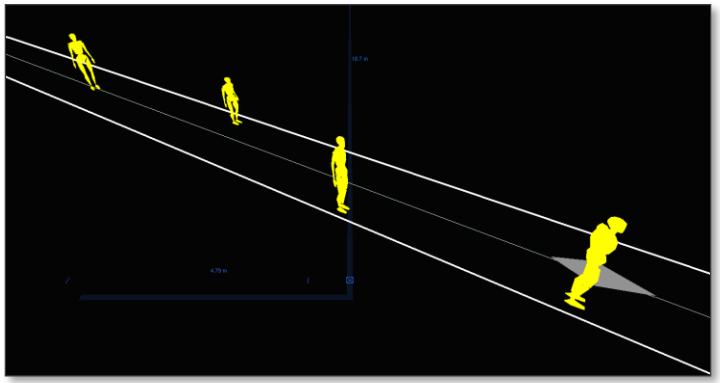
Mobility Simulation

Person Parameters









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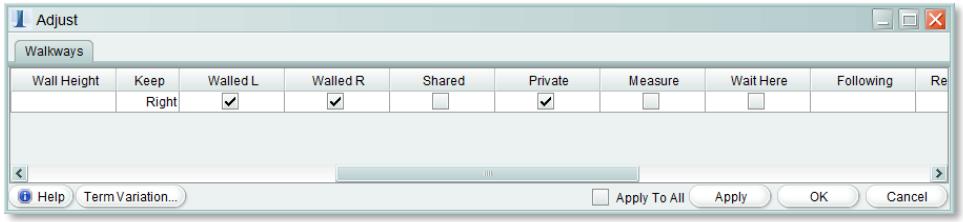
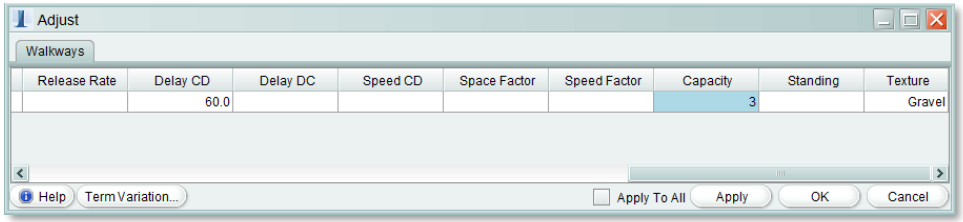
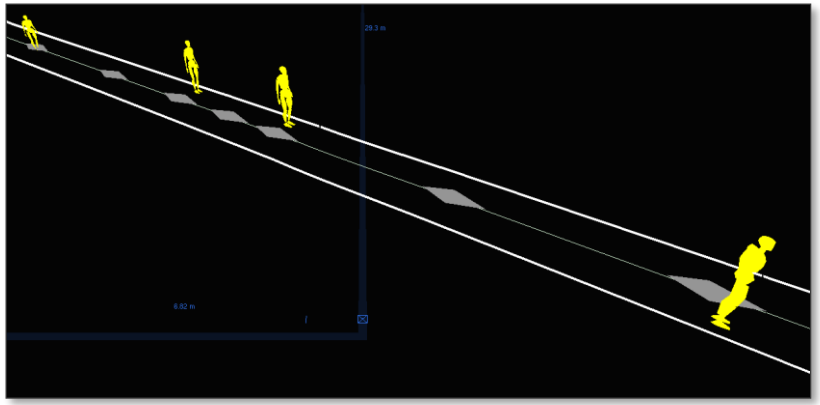
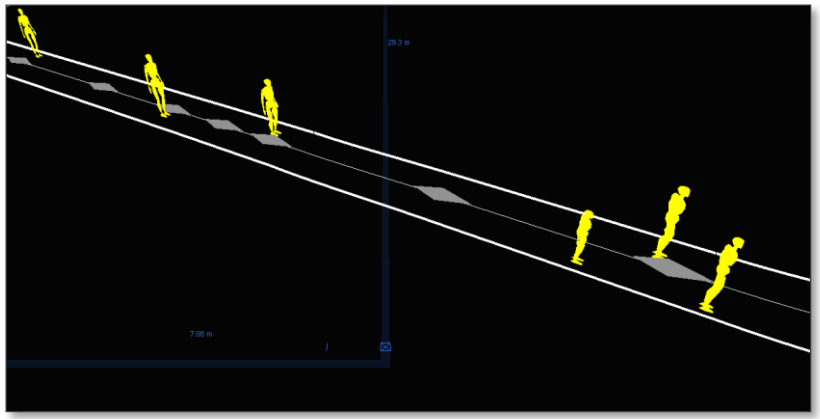
Mobility Simulation

Walkway Properties









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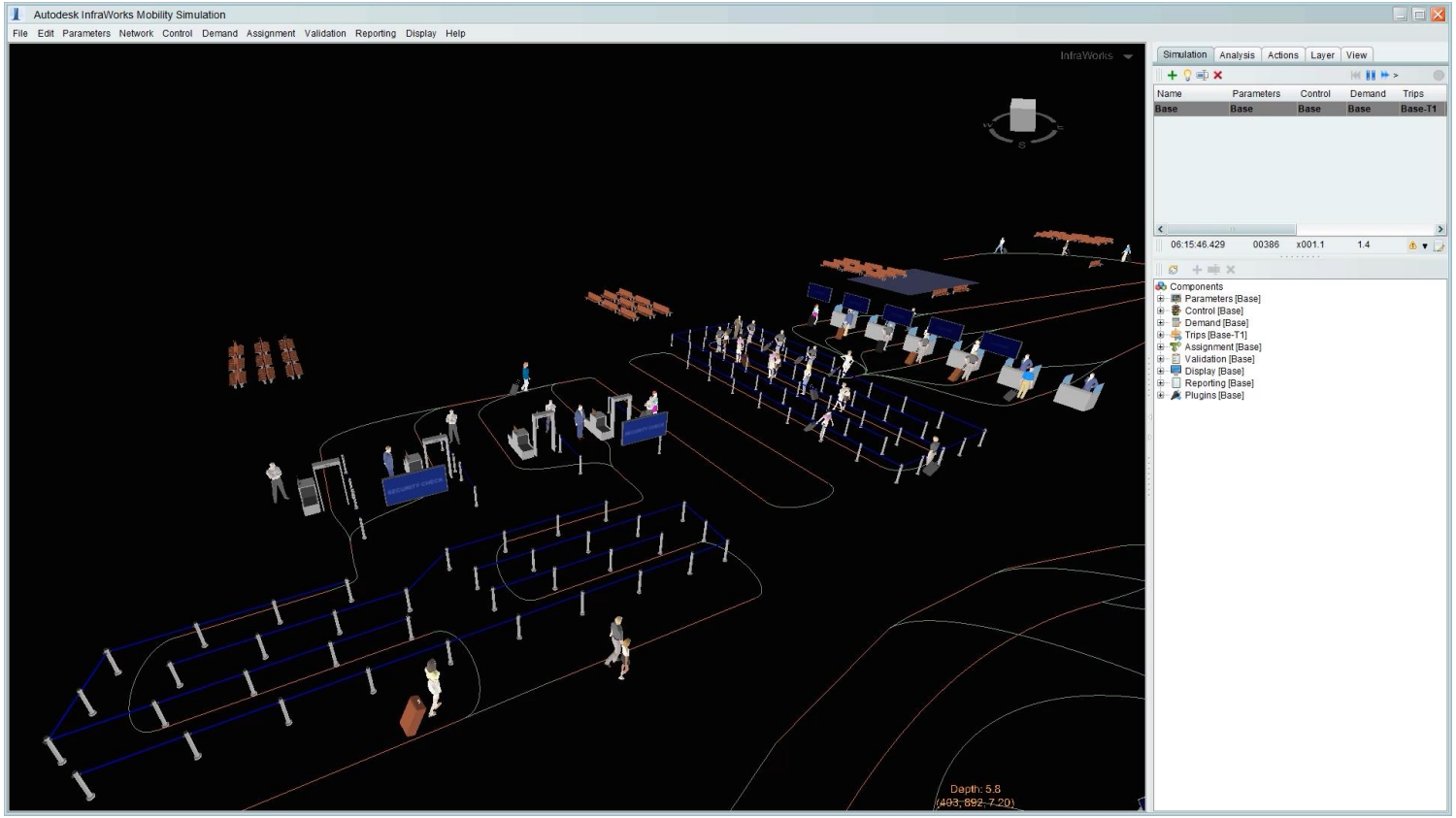
Airport Example – COVID-19

- Consider 3 Conditions
  - Normal ‘Pre-COVID’ Conditions
  - Physical Distancing Implemented
  - Physical Distancing PLUS Infrastructure Changes

Airport



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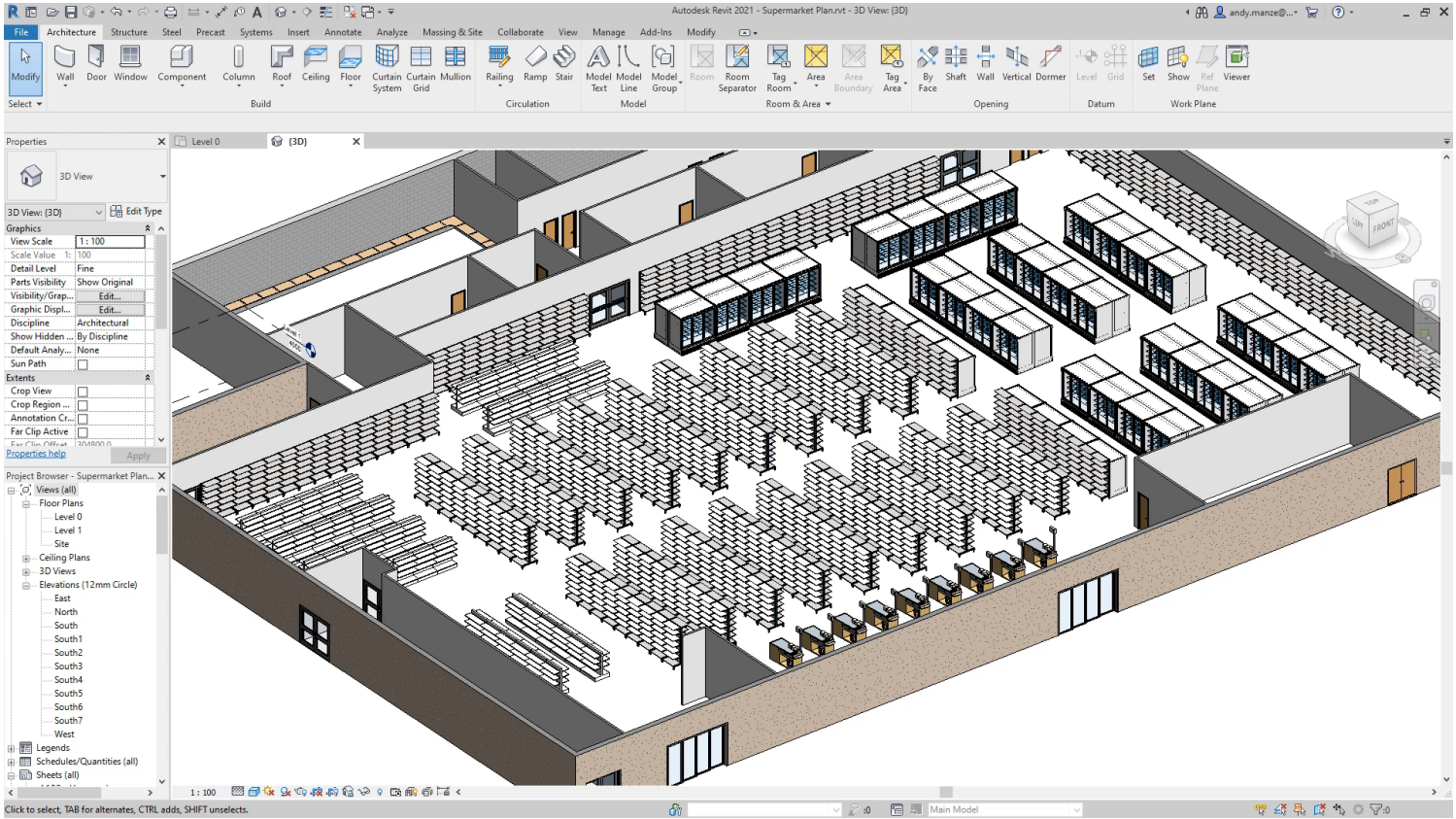
Mobility Simulation

Retail Example – COVID-19

- Consider 3 Conditions
  - Normal ‘Pre-COVID’ Conditions
  - Physical Distancing Implemented
  - Physical Distancing PLUS Infrastructure Changes
    - Unidirectional Flow

Retail



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CFD Air Simulations

For better and safer indoor air quality

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Air Simulation

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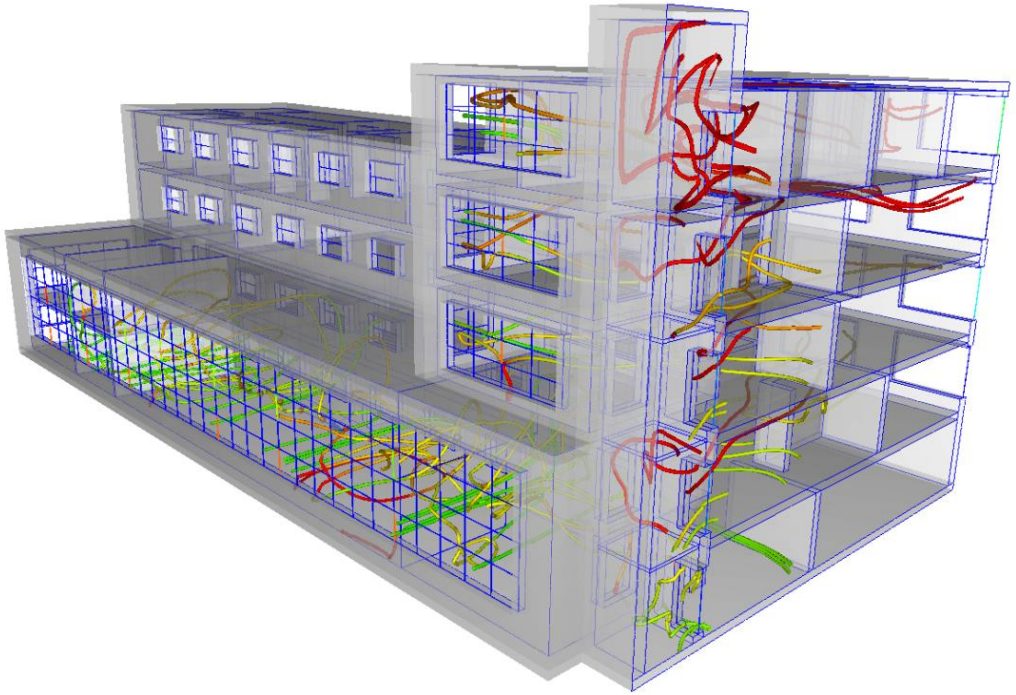
CFD for Natural Ventilation



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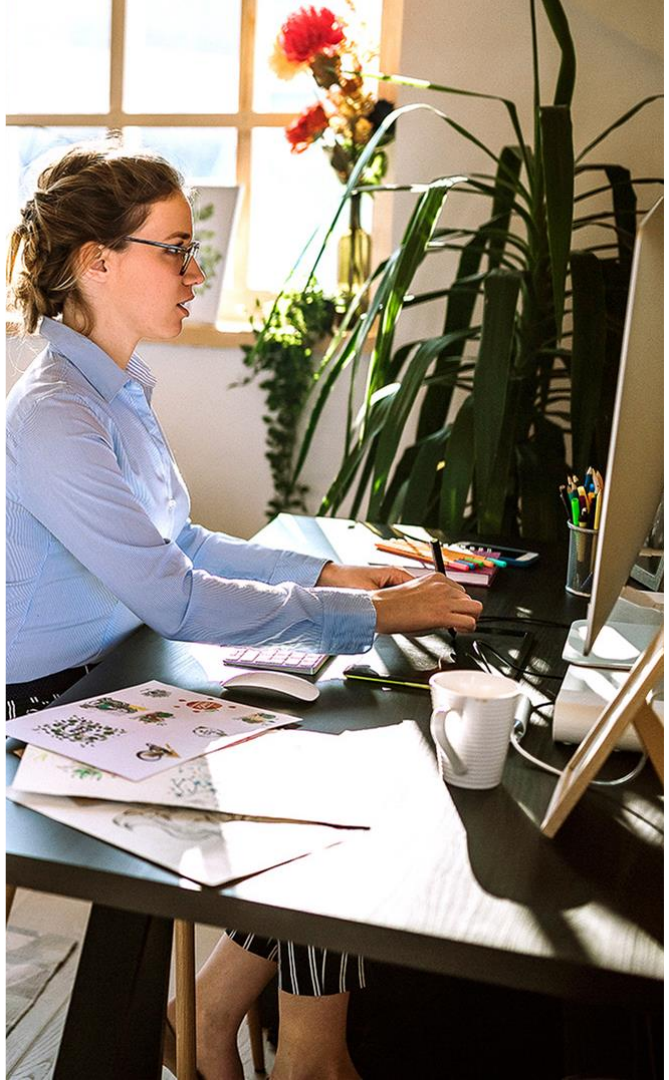

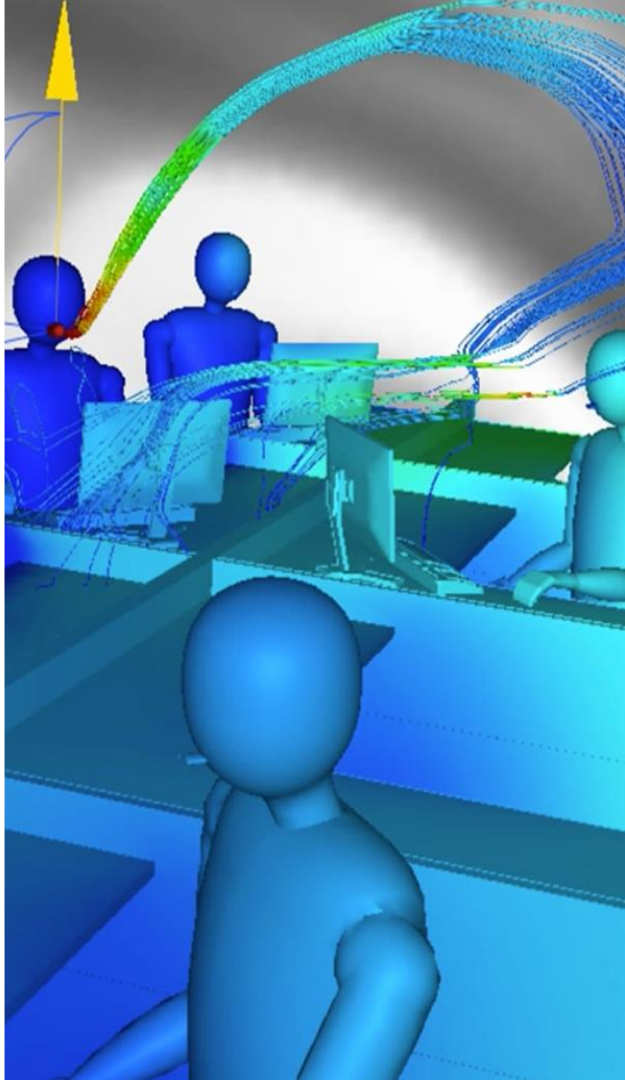

“Facts are better than dreams”

- Winston Churchill -

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