

# RWR 4015

# Traffic Simulation for Planning Applications

Dr. Ahmad Mohammadi

Week 10 | Lecture:  
3D Simulation in Planning I

Fall 2026

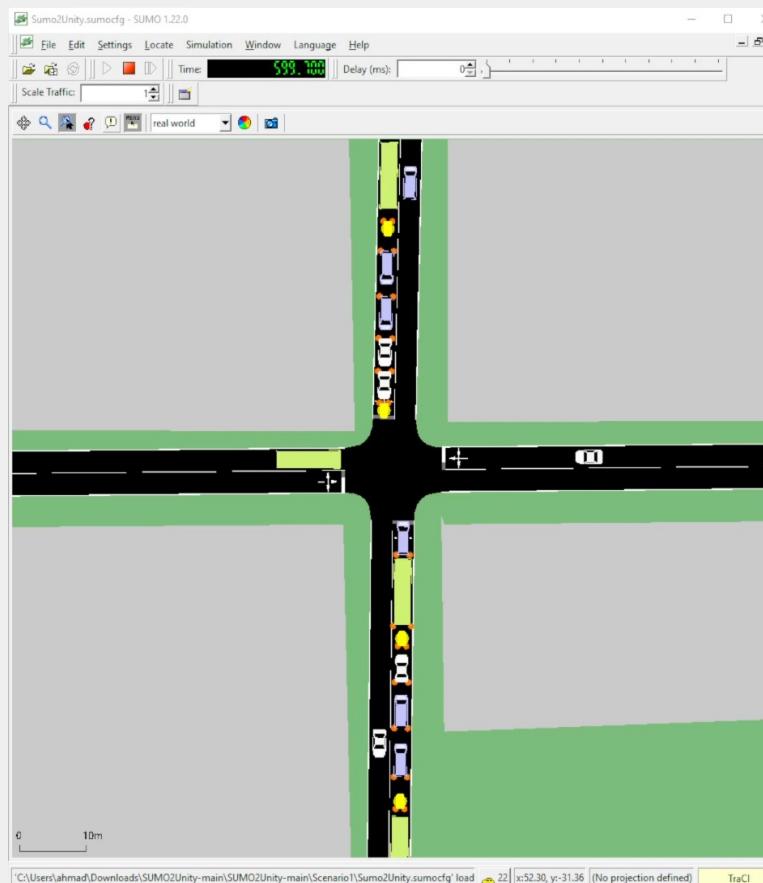
RoadwayVR



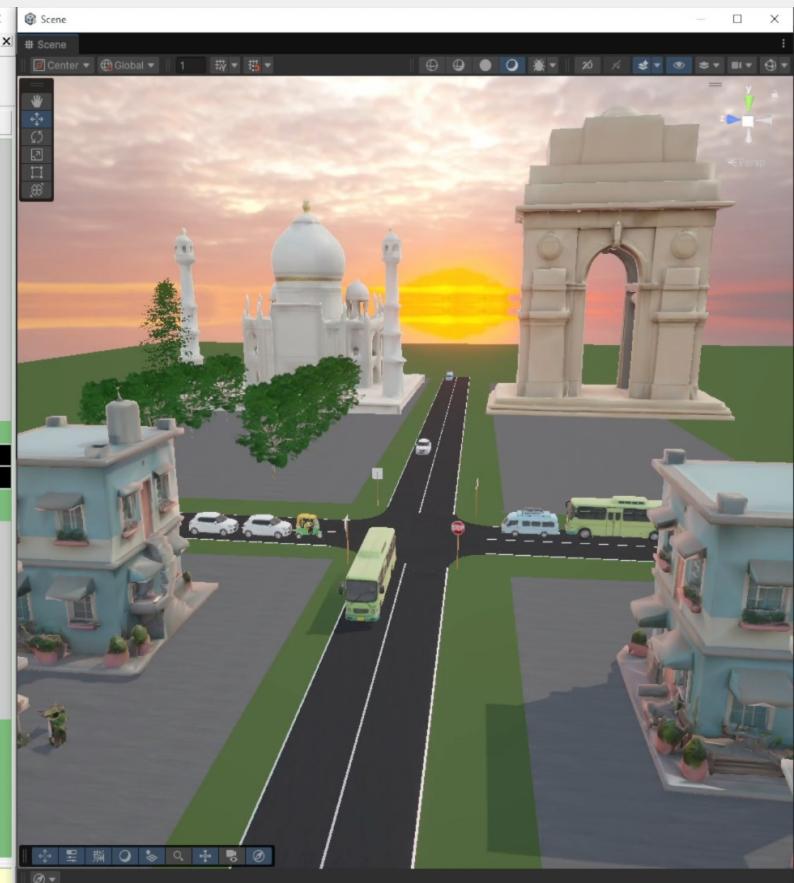
# Agenda

- 3D Visualization in Planning
- 3D Visualization Use Cases
- 3D Simulation with Existing Game Engines
- Unity Game Engine

Simulation of Urban Mobility (SUMO)



3D Visualization



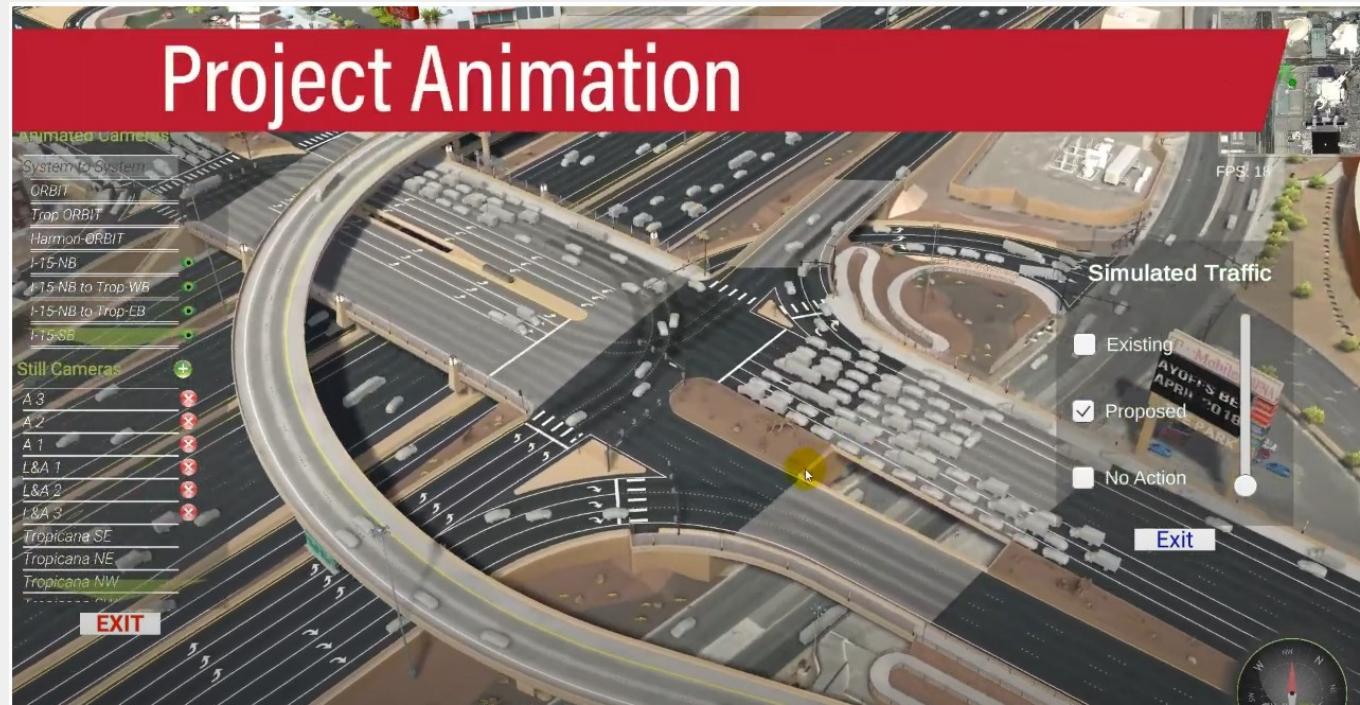
# 3D Visualization in Planning

- Public and Stakeholder Engagement
- Earlier design issue detection
- Faster “before vs. after” comparison.



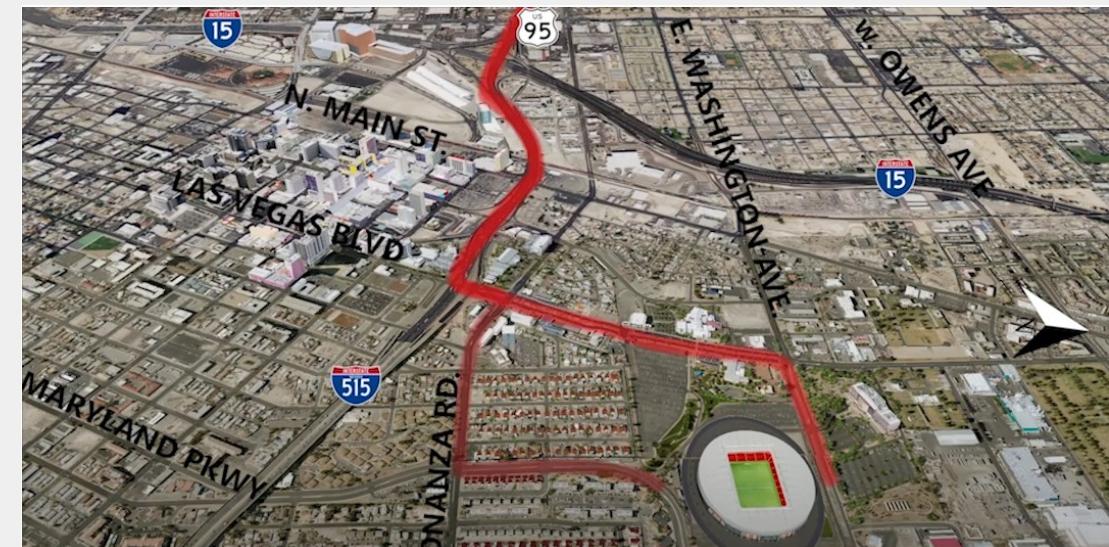
# 3D Visualization in Planning

- Public and Stakeholder Engagement
- Earlier design issue detection**
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# 3D Visualization in Planning

- Public and Stakeholder Engagement
- Earlier design issue detection
- Faster “before vs. after” comparison.



# 3D Visualization Use Cases

Company:  **McElhanney**

## Waterfront Centre

2017-2018 | Vancouver, BC

McElhanney was hired by Stantec for this planned renovation project to relocate multiple commercial retail units (CRU's) and modernize the food court. Record as-built drawings for this building were incomplete and deemed unreliable by the architects that needed a dependable model from which to base their design.

McElhanney provided:

- Laser scan survey of the full interior including plenum spaces. Survey of this space was conducted outside of mall hours and completed in 4 nights.
- LOD 300 Models, including all Architectural/Structural components and Mechanical/Electrical/Piping (MEP) Services.
- The scans and models were used to create a virtual reality experience.

**Link to the video:** <https://www.youtube.com/watch?v=thUKq06RJi8>

**Link to the project:** <https://www.mcelhanney.com/project/waterfront-centre/>

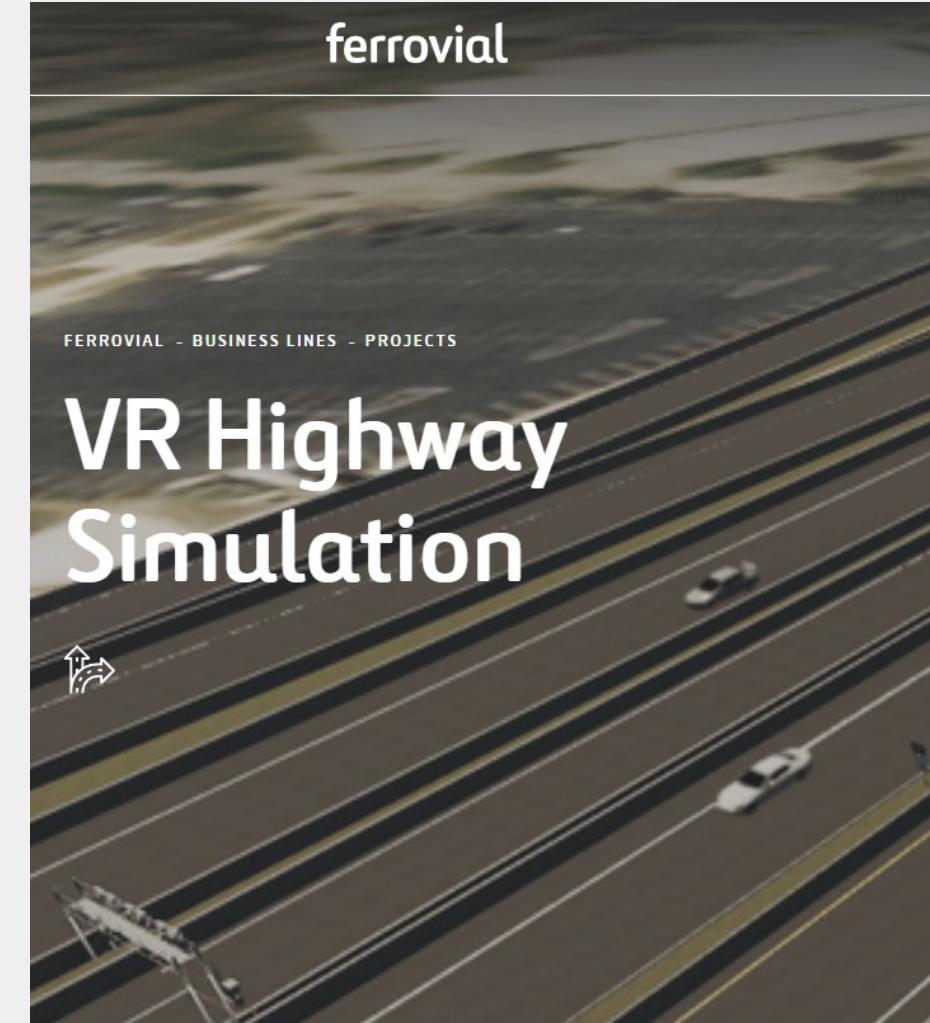


# 3D Visualization Use Cases

Company:

**ferrovial**

- Ferrovial has a VR Lab which developed a VR highway simulation as part of one of their projects for road safety.
- Goal: to generate different scenarios and conduct traffic analysis. No details about the analysis were provided.
- Method: VR glasses. They used Simulation of Urban Mobility (SUMO) software to generate the background traffic.



References :

<https://www.ferrovial.com/en-us/business/projects/vr-highway-simulation/>

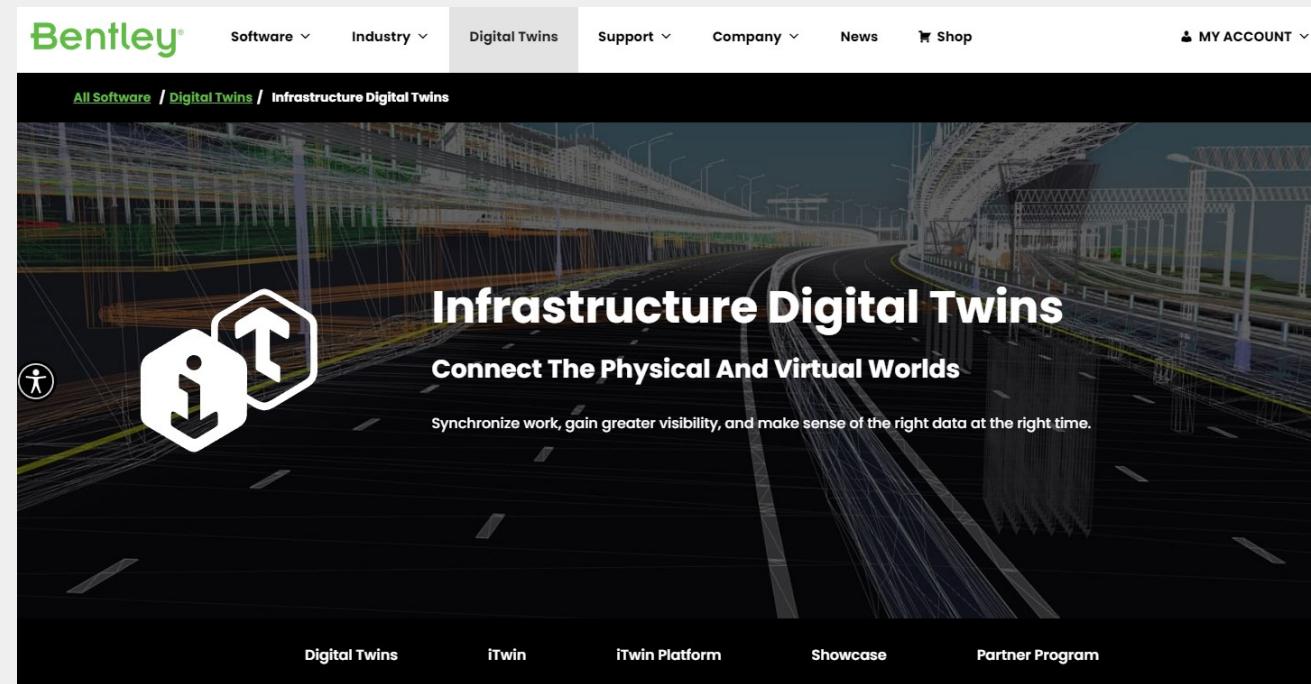
# 3D Visualization Use Cases

Company: **Bentley®**

- ❑ Most of transportation/construction companies have a section to create a digital (virtual) version of a new construction/design (e.g., digital twin section in Bentley).
- ❑ They can easily put a digital character into the digital environment and make a VR experience.
- ❑ However, rare materials exist about what types of human behavior analysis (e.g., safety analysis) they do and how they do the analysis.

References :

<https://www.bentley.com/software/infrastructure-digital-twins/>



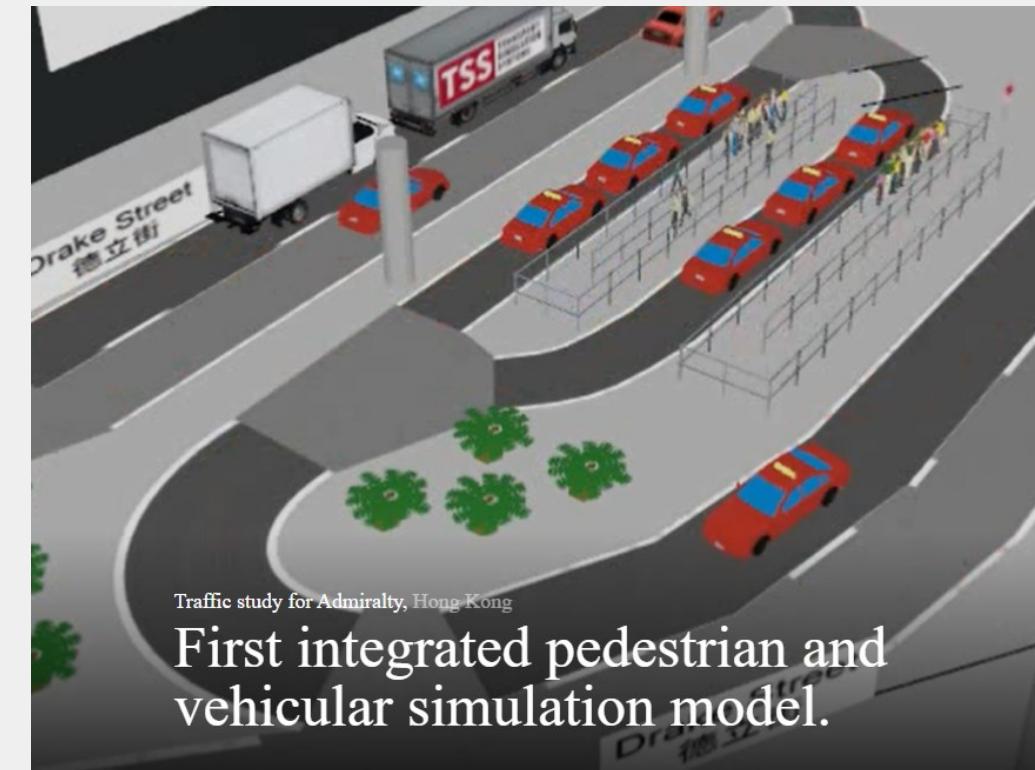
# 3D Visualization Use Cases

Company: **ARUP**

Hong Kong's busy central business district, Admiralty, is soon to get busier. It is now home to new government headquarters, the legislative council and two additional metro lines currently underway. The vehicular and pedestrian traffic issues have been a long-standing concern at the existing Admiralty public transport interchange, with over 29,000 passenger trips during peak hours on weekdays, and the number is set to increase further.

## Three-dimensional simulation

In preparation for the new developments, Arup was commissioned to conduct a large-scale assessment of potential traffic problems. Our study was the first to explore the interaction between pedestrian and vehicular traffic using a three-dimensional simulation model to help visualising the impact. The pedestrian and vehicular simulation model illustrated present and future traffic condition, highlighting congestion locations and points of conflict.



## References :

<https://www.arup.com/projects/traffic-study-for-admiralty-hk>

# 3D Visualization Use Cases

Company:

IBI GROUP

## Broadway Streetscape Urban Design and Master Plan

[Home](#) > [Projects](#) > [Broadway Streetscape Urban Design and Master Plan](#)

IBI Group worked with Melendrez Associates to develop a master plan for the redevelopment of the historic Broadway district in Downtown Los Angeles. IBI Group analyzed the famous street to determine how it would function with multimodal transportation uses, including streetcars, buses, automobiles, shuttles, bicycles and pedestrians, with regards to traffic impacts and street design.



# 3D Visualization Use Cases

Company:

IBI GROUP

## Bedrock 15-Minute Neighborhood Development Plan

[Home](#) > Projects > Bedrock 15-Minute Neighborhood Development Plan

Commercial real estate firm Bedrock Detroit retained IBI Group to create comprehensive, data-driven [urban design plans](#) for its holdings in Detroit and Cleveland. Our work focused on the goal of sustaining complete, pedestrian-oriented communities to help reawaken the urban cores of these American legacy cities.



# 3D Visualization Use Cases

Company:

IBI GROUP

## Curtner Station

[Home](#) > Projects > Curtner Station

IBI Group was appointed by the Santa Clara Valley Transportation Authority to design a mixed-use Transit Oriented Development for Curtner Station, an intermodal station site that includes light rail, bus, and active transportation connections in San Jose, California.





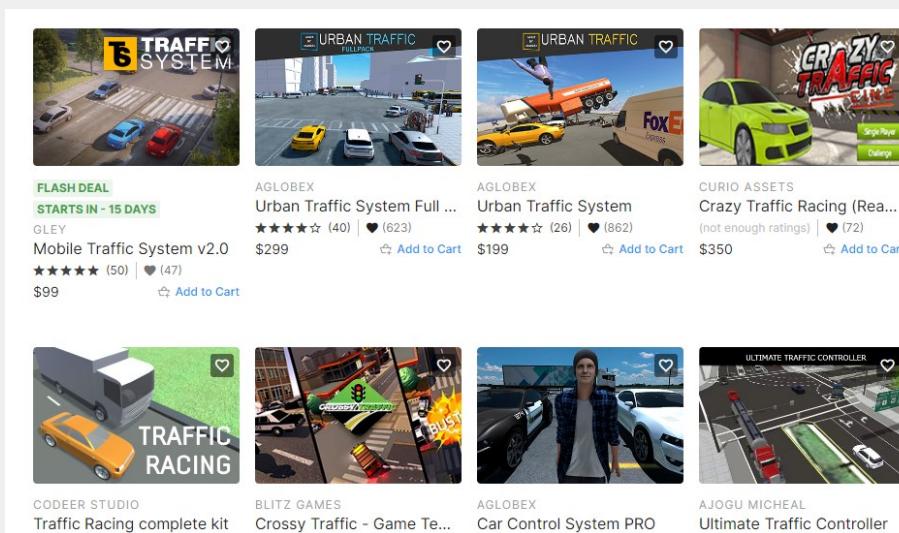
# 3D VR Interface Sample HWY 401 Corridor - 4 Km

See video:

[https://youtu.be/QxMKTjgDe\\_8](https://youtu.be/QxMKTjgDe_8)

<https://youtu.be/AIVpl8gZnaA>

# 3D Simulation with Existing Game Engines



# 3D Simulation with Existing Game Engines

Driver



Pedestrian



Wheelchair



E-Scooter



Bicycle



Motorcycle

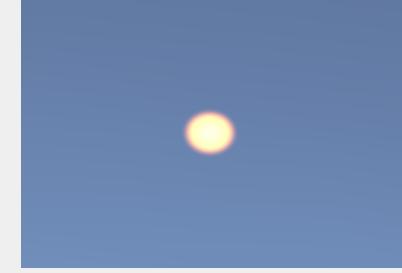
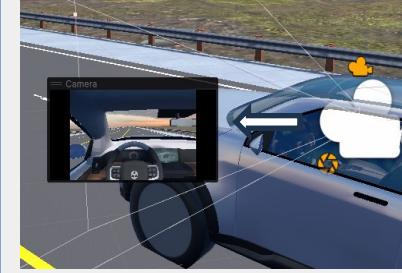


# Unity Game Engine

- Free to Everyone
- Designed Simulated Characteristics, Light, Location, Eye, Time, etc
- Designed Static Objects (Game Object, Mesh, Material and Textures)
- Designed Behaviors (Gravity, Wind, Collisions etc)



# Unity Fundamental: Light, Location, Eye, Time

Real World	Game Engine	Real World	Game Engine
Sunlight and Sky	Directional Light and Skybox	Eye	Driver Eye (Camera)
			
One Meter in Real World = One Meter in VR		One Second in Real World = One Second in VR	
Earth and (X,Y,Z) Coordinate	Plain and (X,Y,Z) Coordinate	Time	Simulation Time
			<pre>void FixedUpdate() { } Time: 26:44.844</pre>

# Unity Fundamental: Static Objects

Real World

Object (a Car)



Body



Color

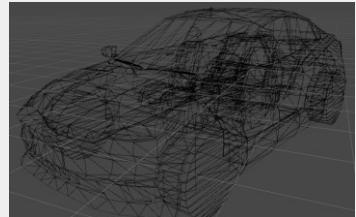


Game Engine

Game Object



Mesh



Material and Texture



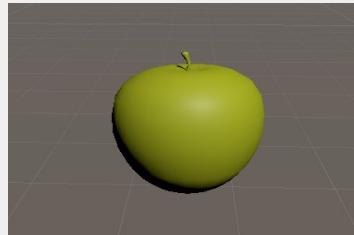
# Unity Fundamental: Behaviors

## Simple Behavior

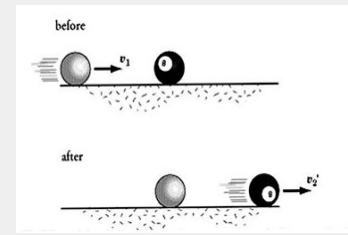
Physics Concept 1. Gravity



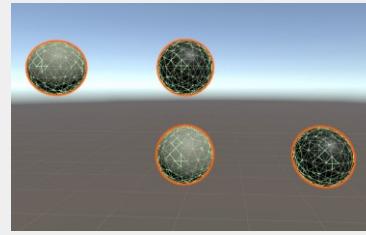
Physics Concept 1. Rigid Body



Physics Concept 2. Collision



Physics Concept 2. Collider

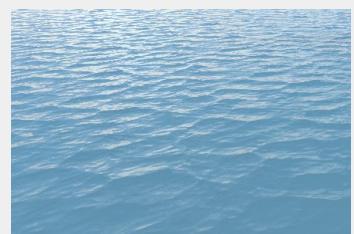


## Complex Behavior

Water



Water (Shader)



Fire



Fire (Shader and Particle System)



Wind



Animation



Wheel Rotation



Wheel Rotation (programming)



# Unity Optimization

1. Target Tris < 1 M

2. Target Verts < 3 M

3. FPS > 60 Frame Rate Per Second.

Headset with A Cable to a PC

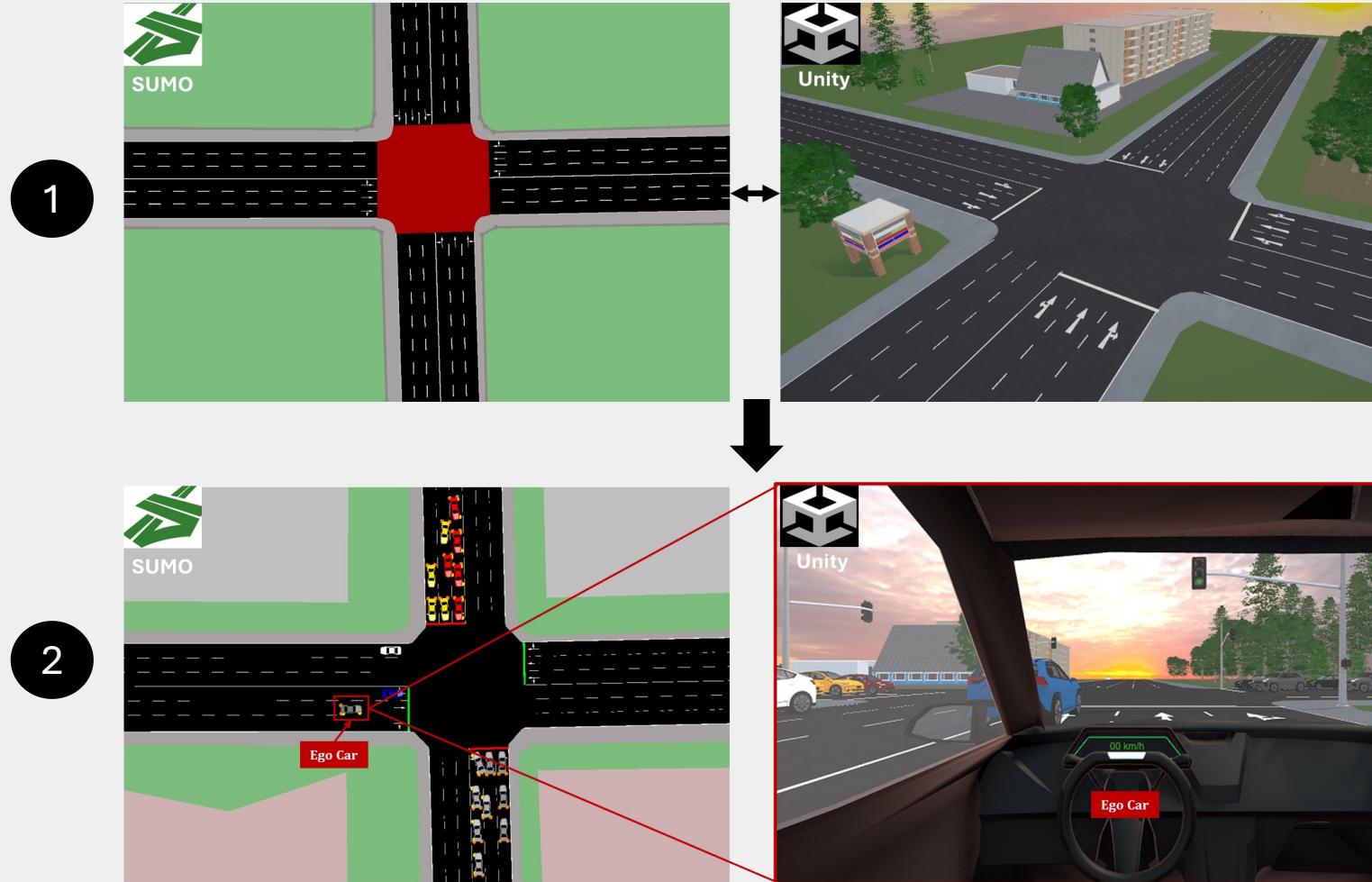
1. Target Tris < 6 M

2. Target Verts < 18 M

3. FPS > 60 Frame Rate Per Second



# Create 3D Visualization in Next Sessions



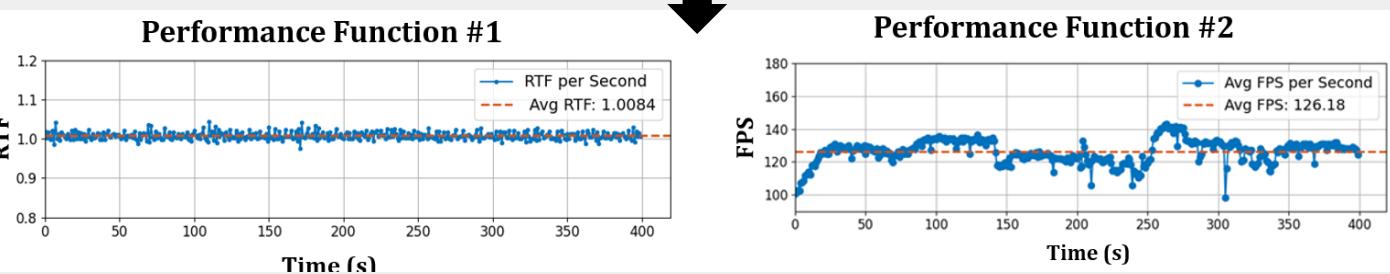
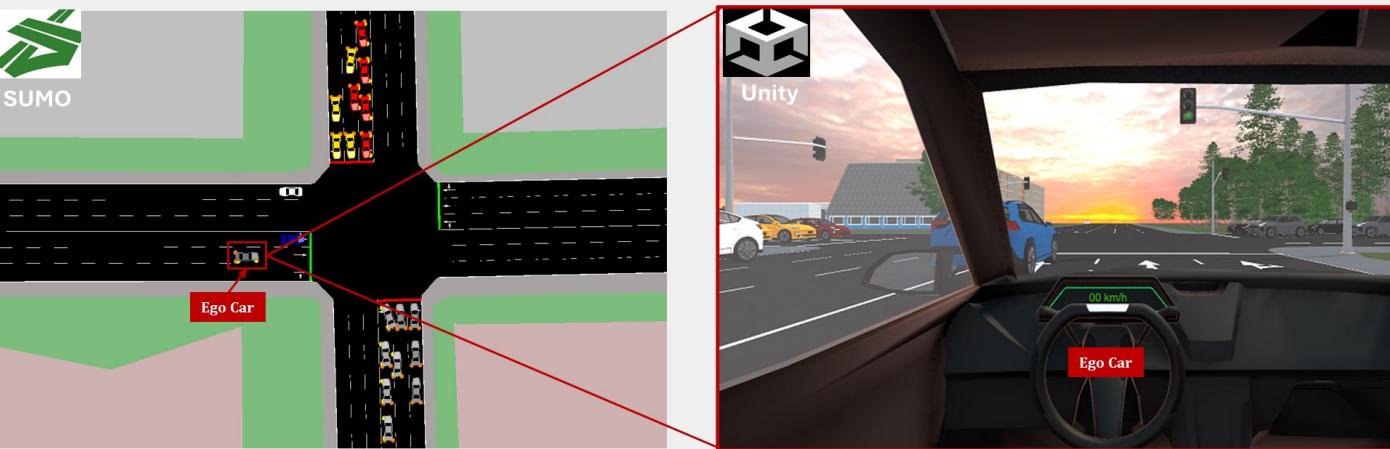
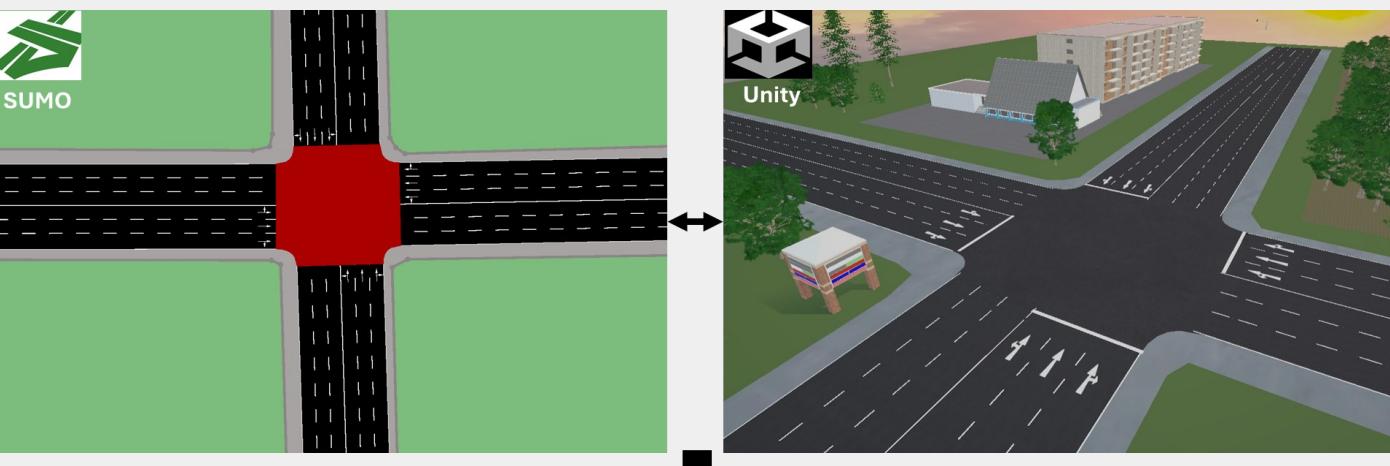
# Sumo2Unity Tool

- Download Sumo2Unity V2.0.0
- SUMO Installation and Quit Start
- Unity VR Installation
- Tutorials

# Sumo2Unity Tool

Generate:

- Complex Road Network
- Complex Traffic System
- Performance Functions (Analytics)



# SUMO Installation and Quick Start

1. Install SUMO (1.22 Recommended)

2. Set Up SUMO Environment Variables

3. Install Notepad ++

4. SUMO Tutorial



Watch:

**“SUMO Traffic Simulator Part1.1:  
Installation & Create a Simple Network”**



<https://youtu.be/lwsrNWIX9Ag>

To find previous SUMO versions:

<https://sourceforge.net/projects/sumo/files/sumo/>

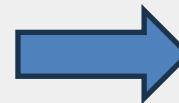
# Unity VR Installation

1. Install Unity HUB

2. Install Unity Editor (Version 6000.0.53f1)

3. Install Visual Studio

4. Install Visual Studio Dependencies



Watch:

“**Unity VR Tutorial Part 1.1. Install Unity HUB and Visual Studio**”



[https://youtu.be/ngccSGH3-\\_8](https://youtu.be/ngccSGH3-_8)