RWR 4015

Traffic Simulation for Planning Applications

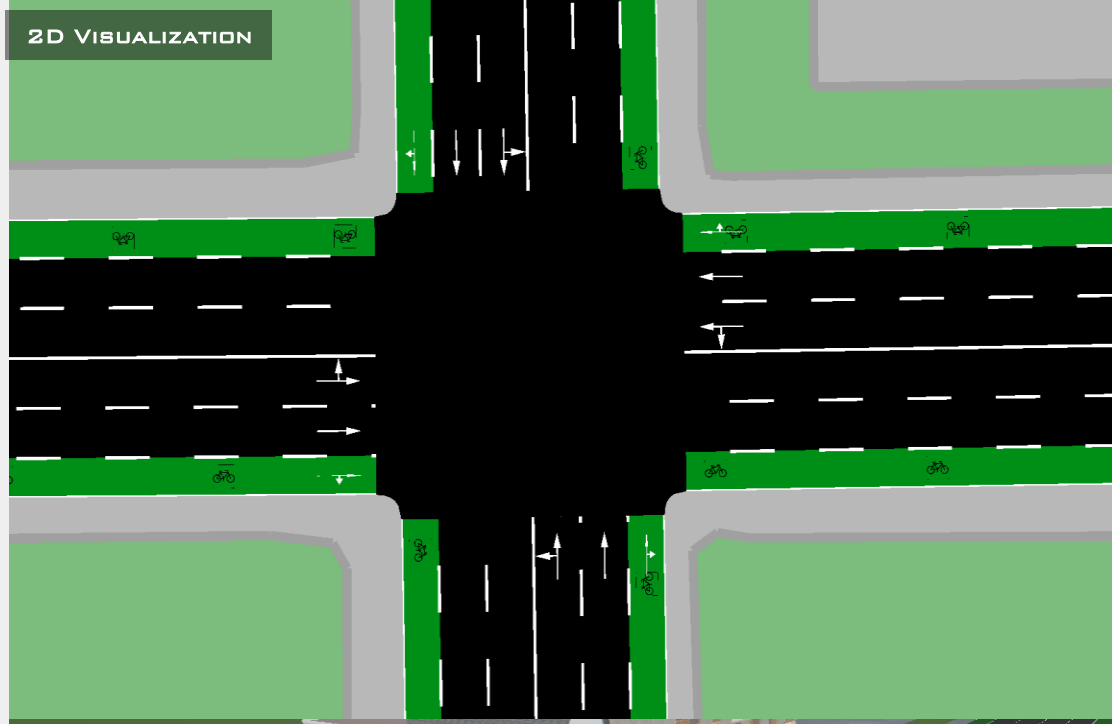
Dr. Ahmad Mohammadi

Week 10 | Lecture:
3D Simulation in Planning I

Fall 2026

RoadwayVR

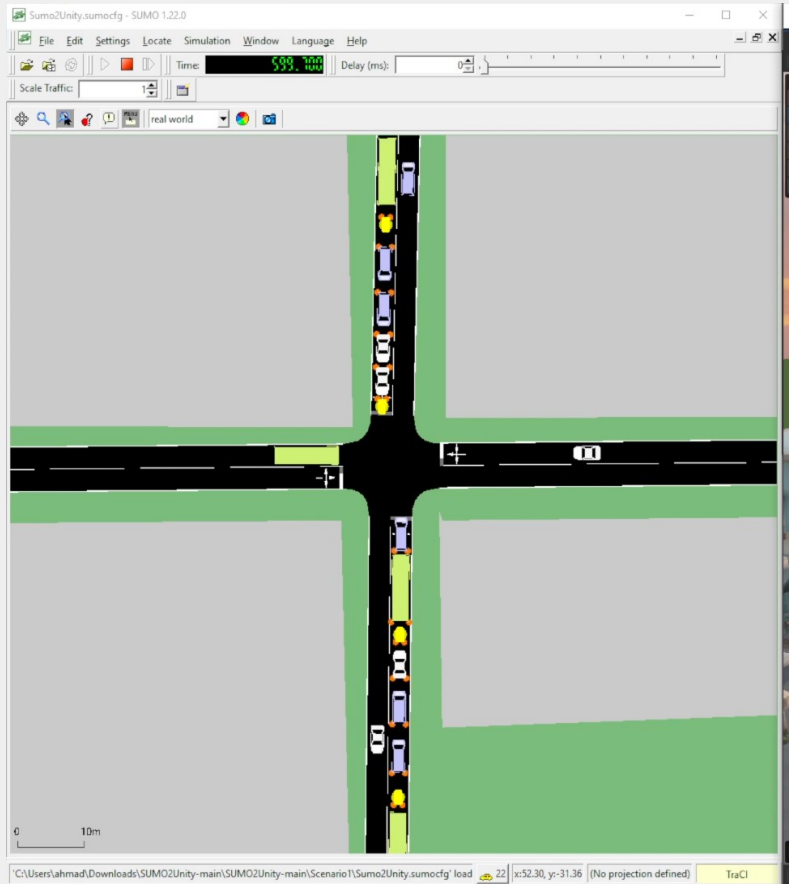
roadwayvr.github.io/TrafficSimulationforPlanningApplications



Agenda

- 3D Visualization in Planning
- 3D Visualization Case Studies
- 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.

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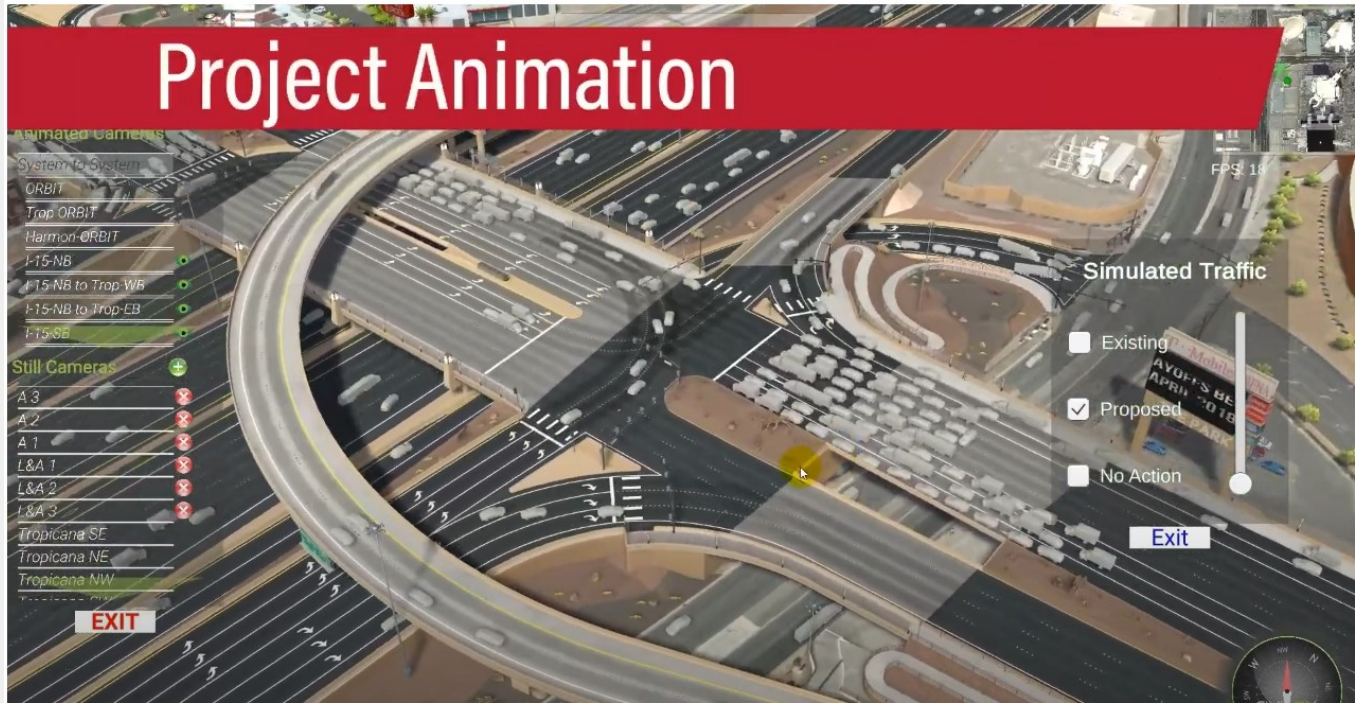

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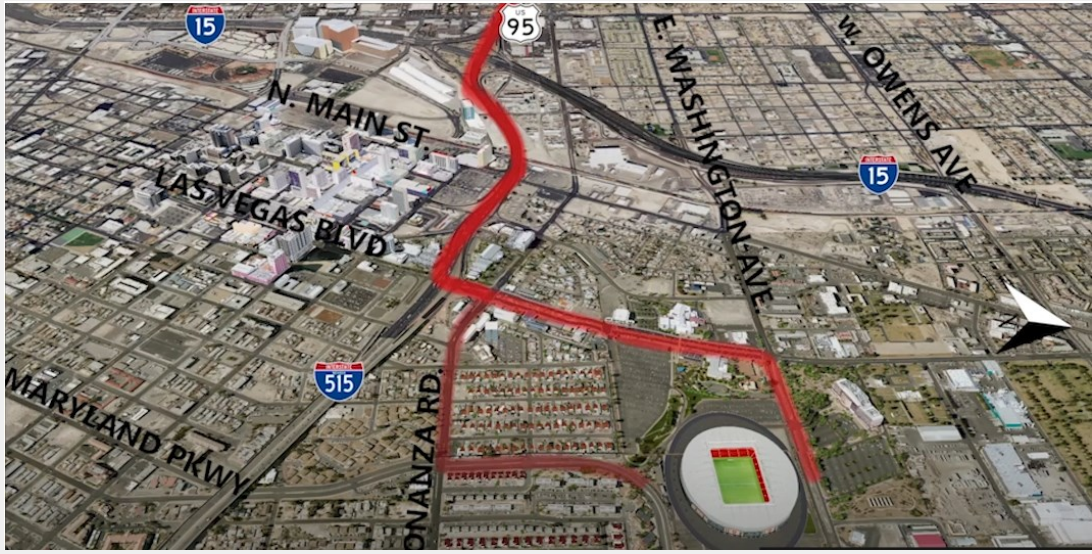


3D Visualization Case Studies

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.

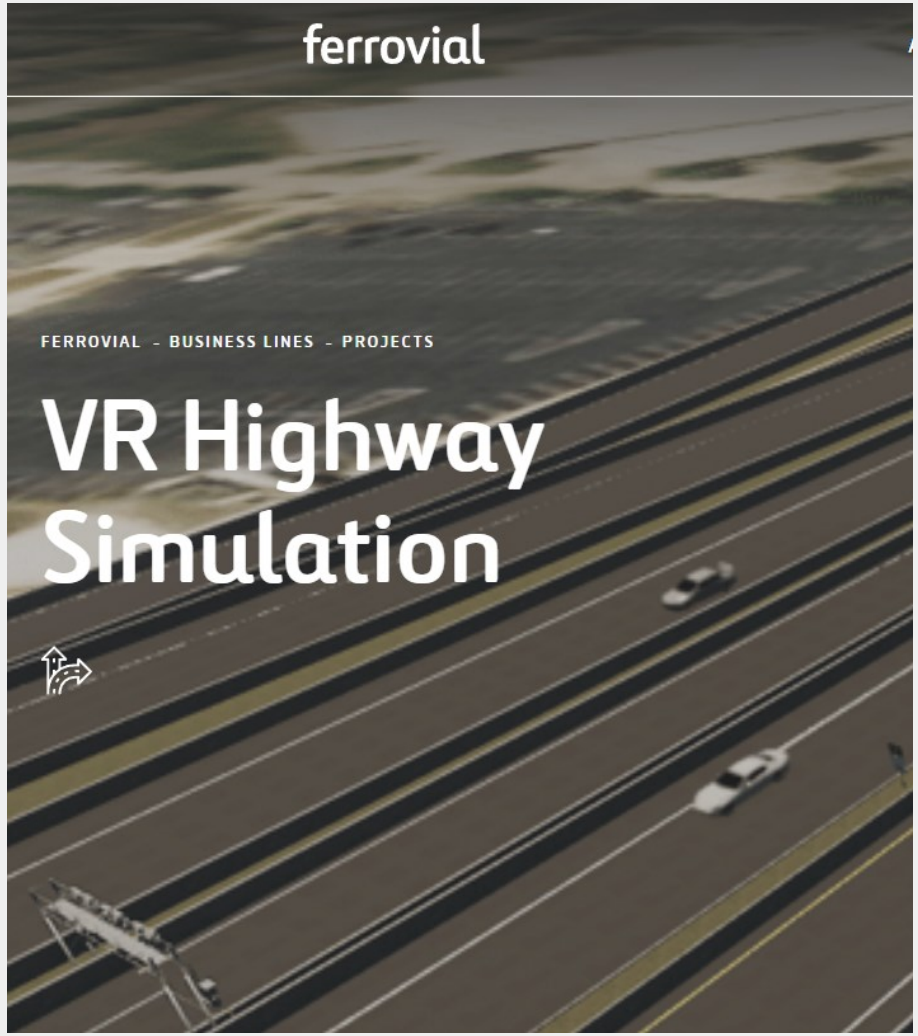
Link to the video: https://www.youtube.com/watch?v=thUKq06RJi8

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

3D Visualization Case Studies

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.



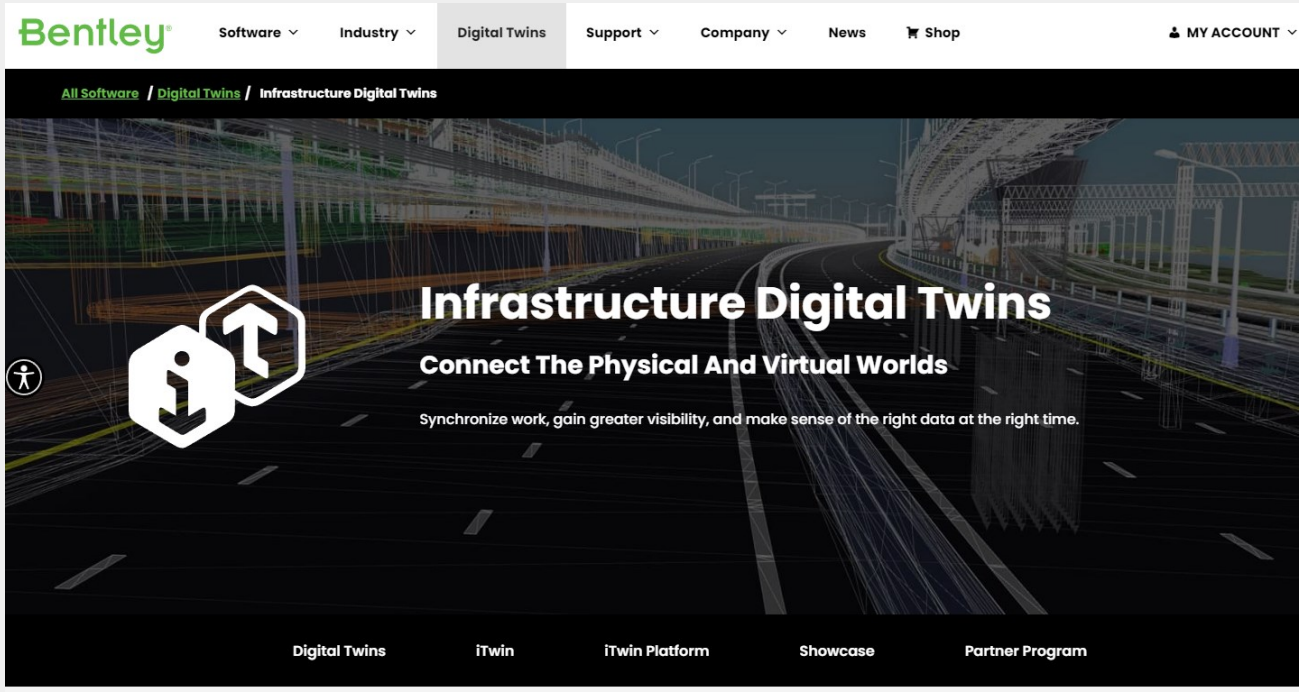
References :

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

3D Visualization Case Studies

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/

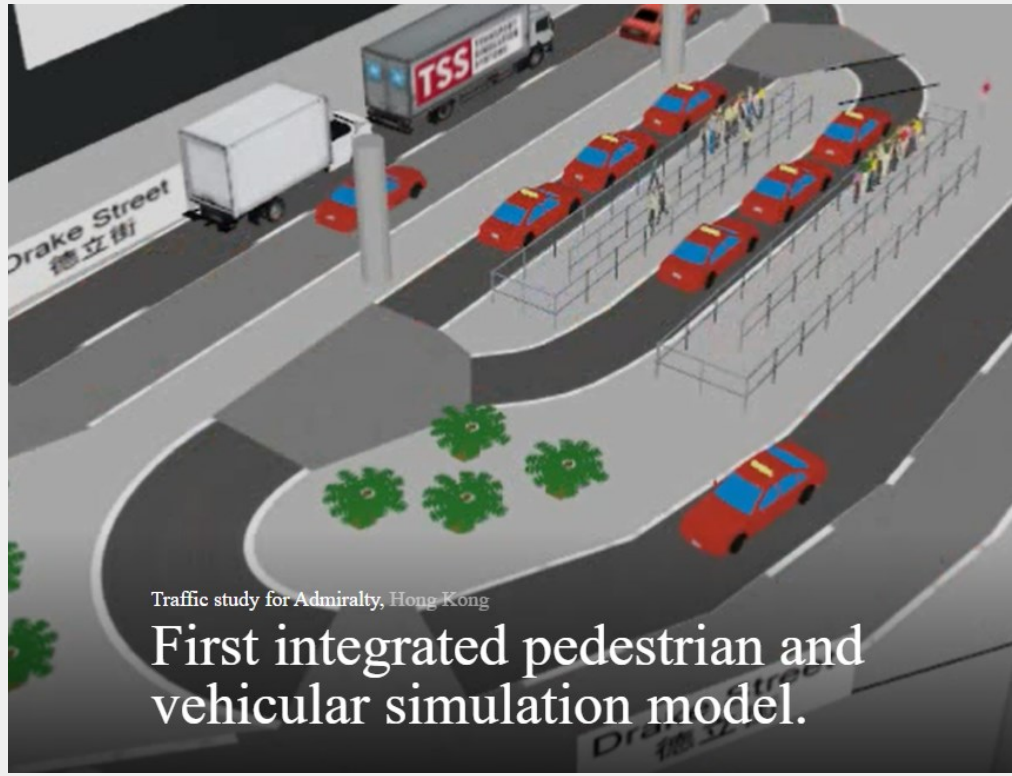
3D Visualization Case Studies

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 Case Studies

Company: IBI GROUP

Broadway Streetscape Urban Design and Master Plan

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.

Client

Melendrez Associates Community Redevelopment Agency of Los Angeles

Location

Los Angeles, CA

3D Visualization Case Studies

Company: IBI GROUP

Bedrock 15-Minute Neighbor Development Plan

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 Case Studies

Company: IBI GROUP

Curtner Station

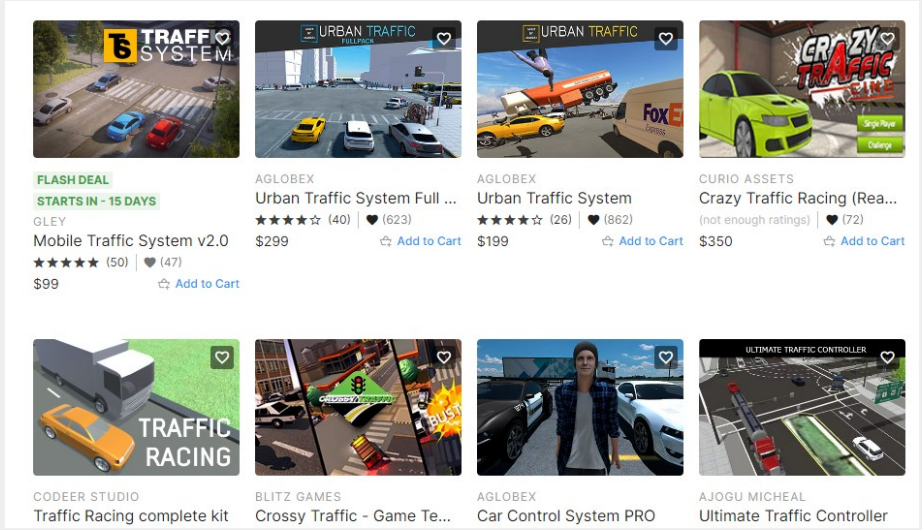
Projects > Curtner Station

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 Visualization Case Studies: HWY 401 Corridor - 4 Km

See video:
https://youtu.be/QxMKtjgDe_8
https://youtu.be/A1Vp18gZnaA

3D Simulation with Existing Game Engines



3D Simulation with Existing Game Engines

Driver

Pedestrian

Wheelchair

E-Scooter

Bicycle

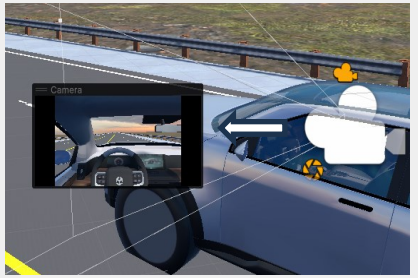
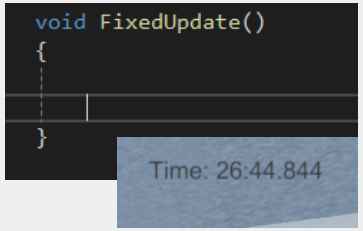
Motorcycle

Unity Game Engine

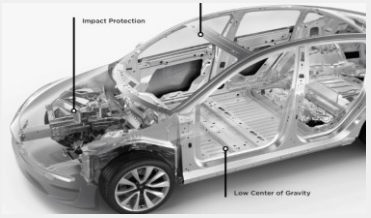
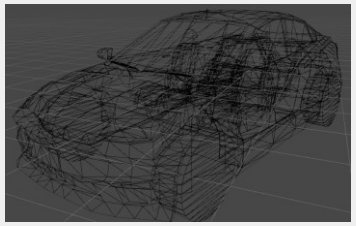
- ❑ Free to Everyone
- ❑ Designed Simulated Characteristics, Light, Location, Eye, Time, etc
- ❑ Designed Static Objects (Game Object, Mesh, Material and Textures)
- ❑ Designed Behaviors (Gravity, Wind, Collisions etc)

Unity Fundamental:
Light, Location, Eye, Time

Real World	Game Engine
Sunlight and Sky 	Directional Light and Skybox 
Earth and (X,Y,Z) Coordinate 	Plain and (X,Y,Z) Coordinate 
One Meter in Real World =	One Meter in VR

Real World	Game Engine
Eye 	Driver Eye (Camera) 
Time 	Simulation Time 
One Second in Real World =	One Second in VR

Unity Fundamental: Static Objects

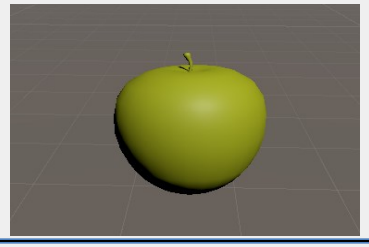
Real World	Game Engine
Object (a Car) 	Game Object 
Body 	Mesh 
Colo r 	Material and Texture 

Unity Fundamental: Behaviors

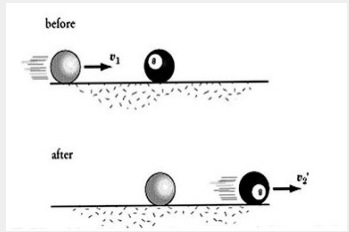
Simple Behavior

Physics Concept 1. Gravity

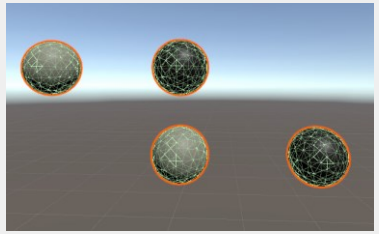
Physics Concept 1. Rigid Body



Physics Concept 2. Collision

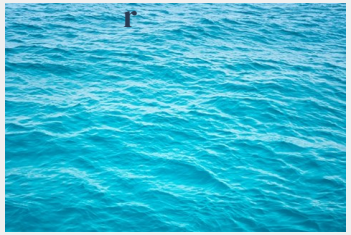


Physics Concept 2. Collider



Complex Behavior

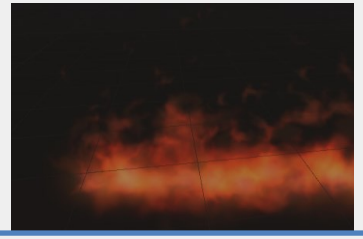
Wate r



Water (Shader)

Fire

Fire (Shader and Particle System)



Wind

Animation

Wheel Rotation

Wheel Rotation (programming)

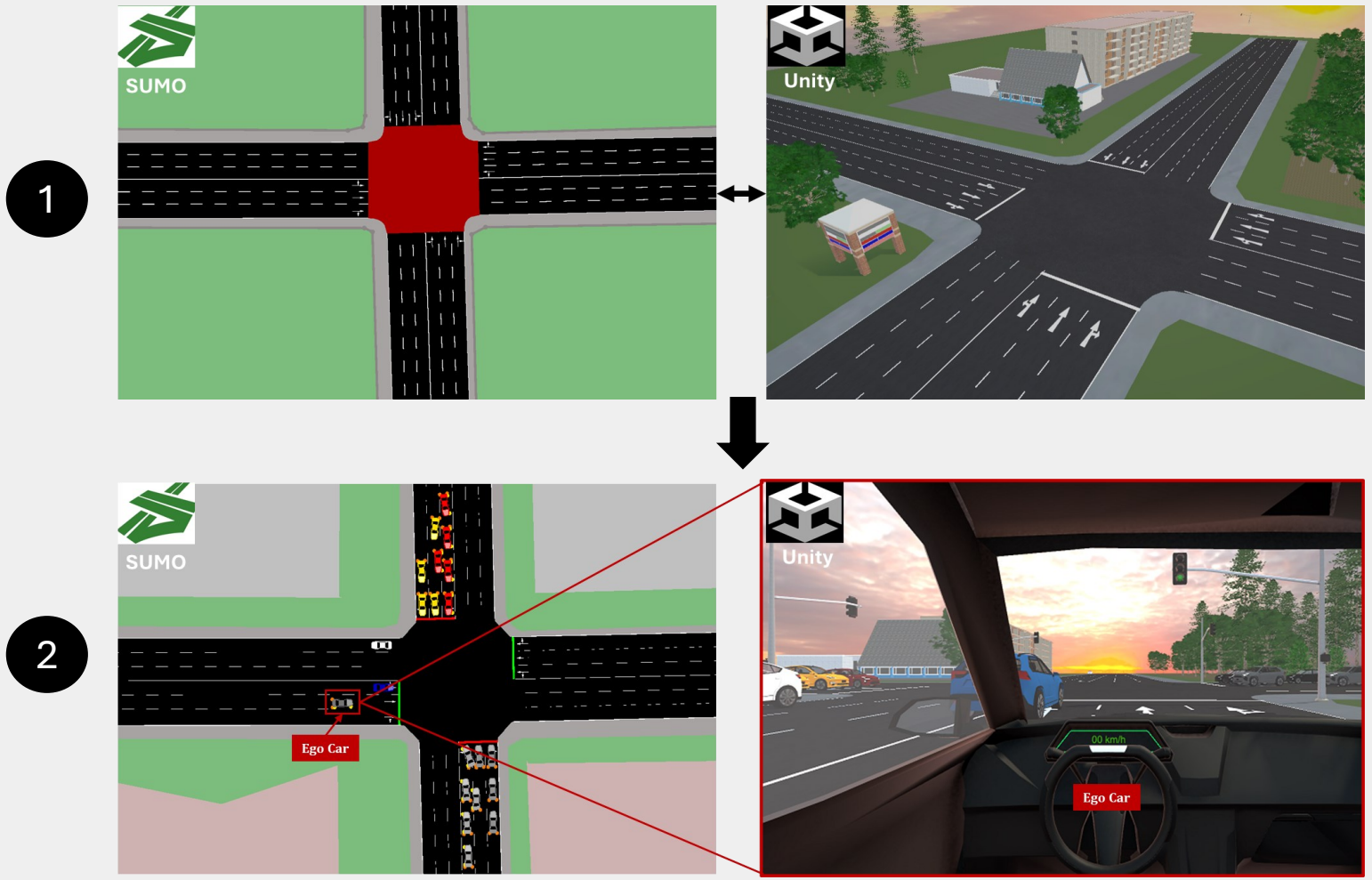
Unity Optimization

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

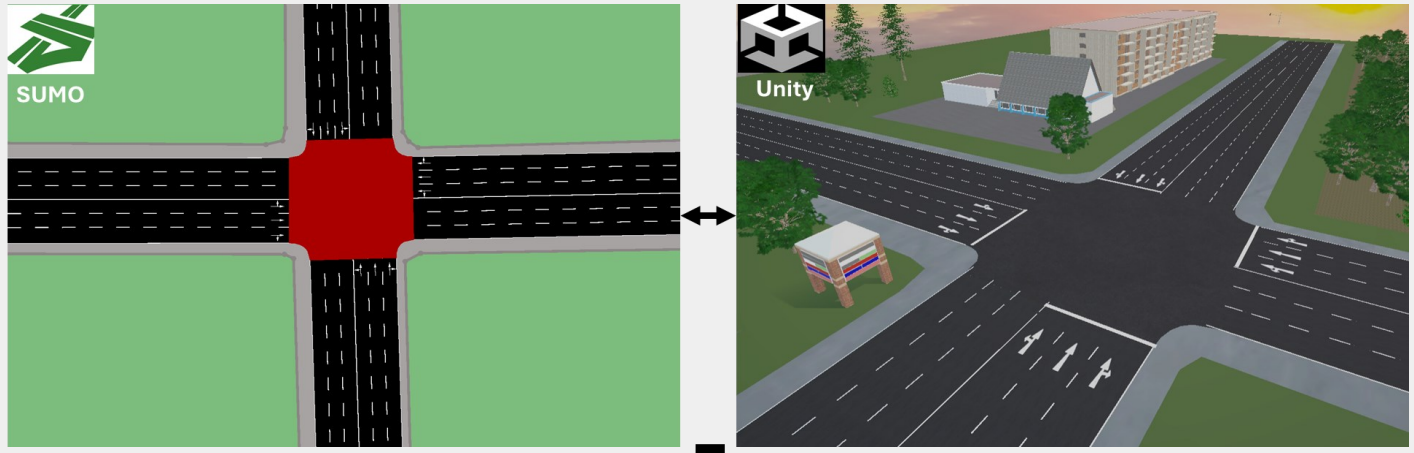
- ❑ Download Sumo2Unity V2.0.0
- ❑ SUMO Installation and Quit Start
- ❑ Unity VR Installation
- ❑ Tutorials

Sumo2Unity Tool

Generate:

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

1



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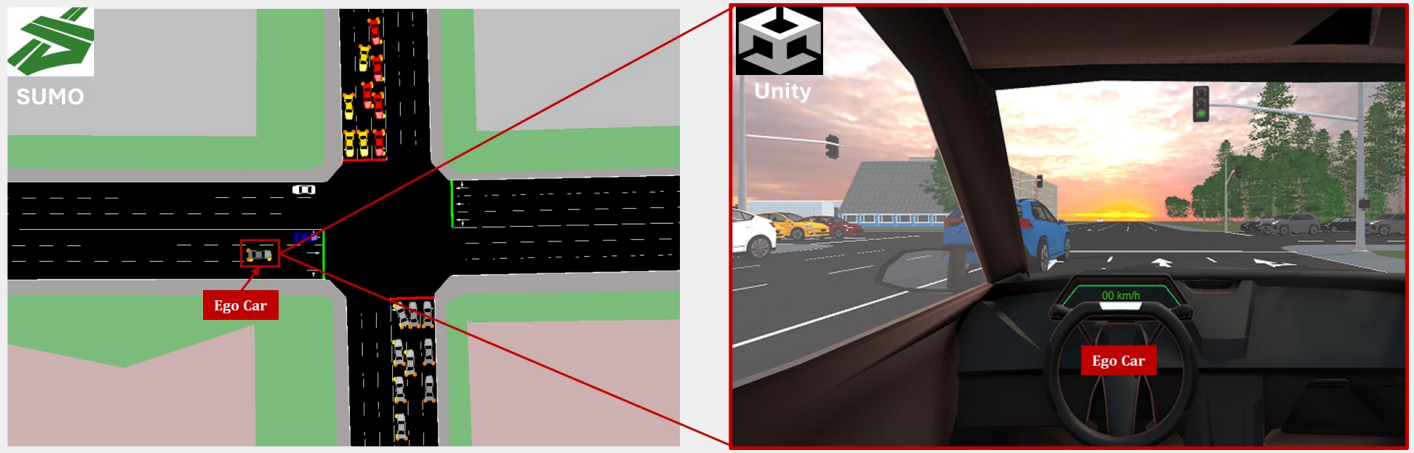

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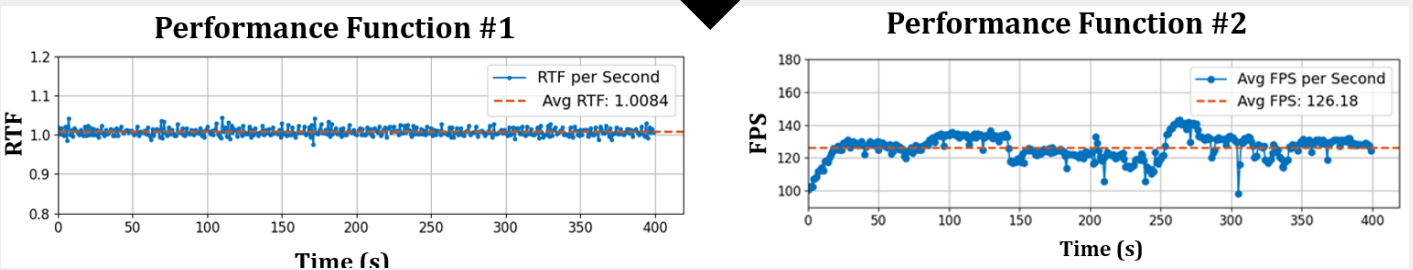
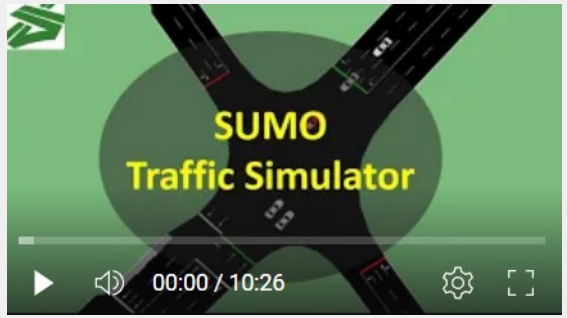


SUMO Installation and Quit Start

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/IwsrNWIX9Ag

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