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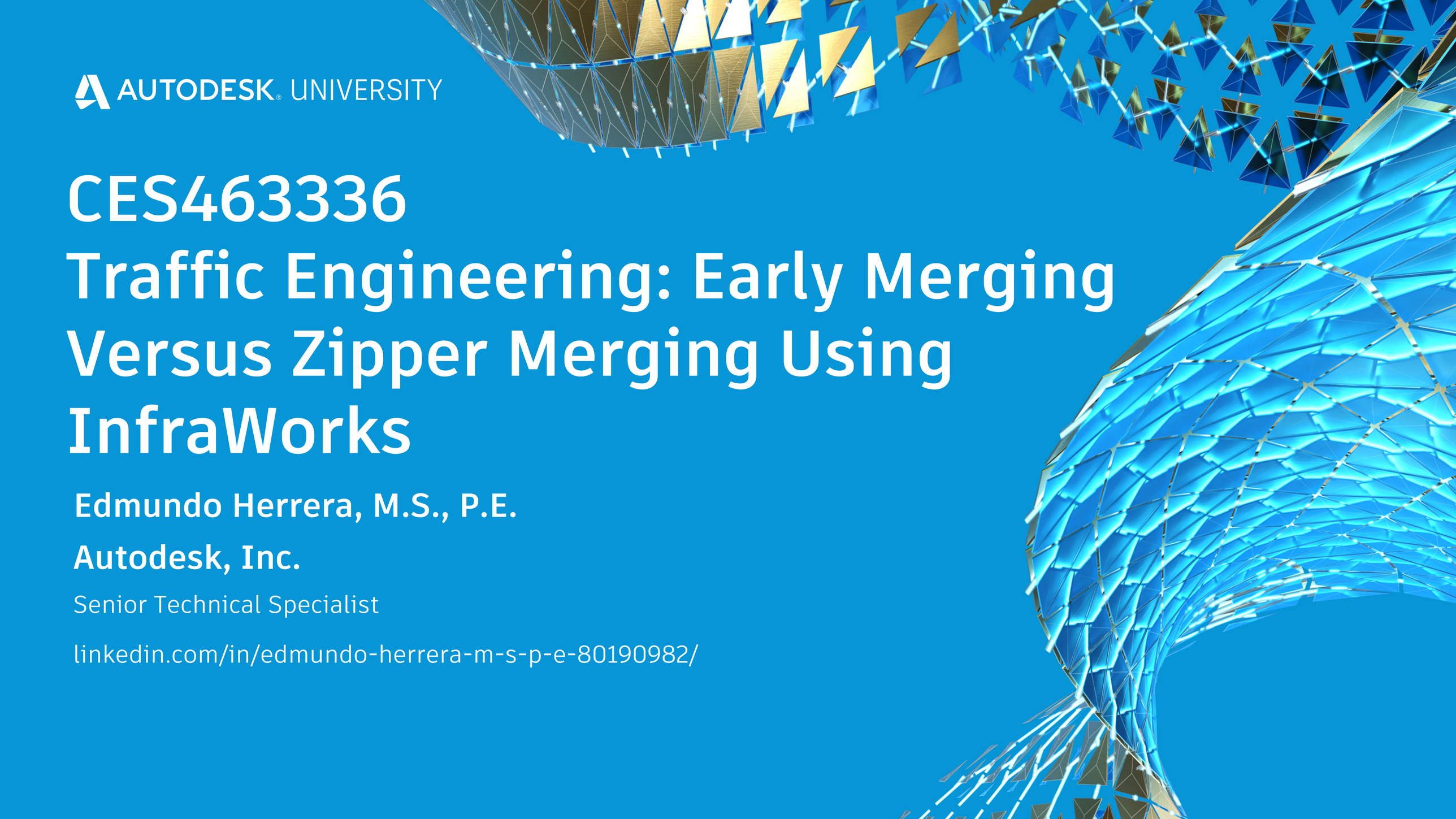
Traffic Engineering: Early Merging Versus Zipper Merging Using InfraWorks

Edmundo Herrera, M.S., P.E.

Autodesk, Inc.

Senior Technical Specialist

linkedin.com/in/edmundo-herrera-m-s-p-e-80190982/



About the Speaker

Edmundo Herrera, M.S., P.E.

Civil Engineer registered as a Professional Engineer in the State of Florida, with a master's degree in Structural Engineering and holding graduate studies at the Massachusetts Institute of Technology related to Transportation Networks and Smart Mobility.

Has more than twenty years of experience with civil engineering projects including software implementations, support, consulting, training and deployment for customers all over the world.

Works for Autodesk, Inc. as a Senior Technical Specialist using Autodesk's AEC Collection presenting, along with sales teams, specialized workflows and sales strategies in roadway, bridge and traffic engineering for Autodesk's Mid-Market, Named and Federal Accounts.

“Failing to Plan is Planning to Fail”

Benjamin Franklin

Terms and Definitions

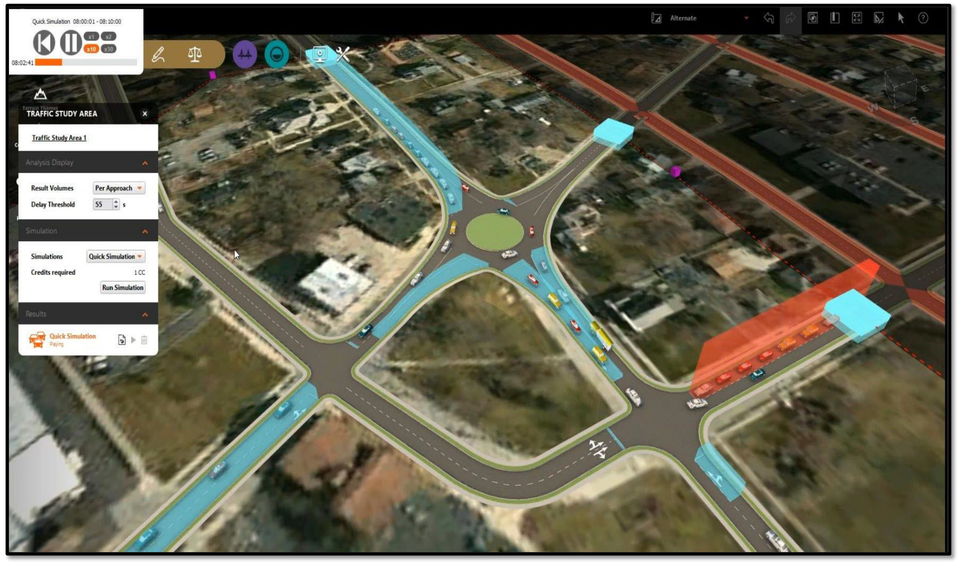
Traffic Simulation

- Is the mathematical model of transportation systems (i.e. freeways junctions, arterial routes, roundabouts, downtown grid systems, etc.) through the application of computer software to better help, plan, design and operate transportation systems
- Simulation of Transportation Systems started over 40 years ago and it is an important area of discipline in Traffic Engineering and Transportation Planning
- Simulation in Transportation is important because it can study models too complicated for analytical or numerical treatment, can be used for experimental studies, can study detail relations that might be lost in analytical or numerical treatment and can produce attractive visual demonstrations of present and future scenarios

Traffic Analysis/Mobility Analysis

- In Civil Engineering, it is the study of interactions between vehicles, drivers, pedestrians, cyclists, other travelers and infrastructure (including highways, signage and traffic control devices), with the aim of understanding and developing an optimal road network with efficient movement of traffic and minimal congestion problems

Introduction to Traffic Simulation



Traffic Simulation is used in Infrastructure Projects:

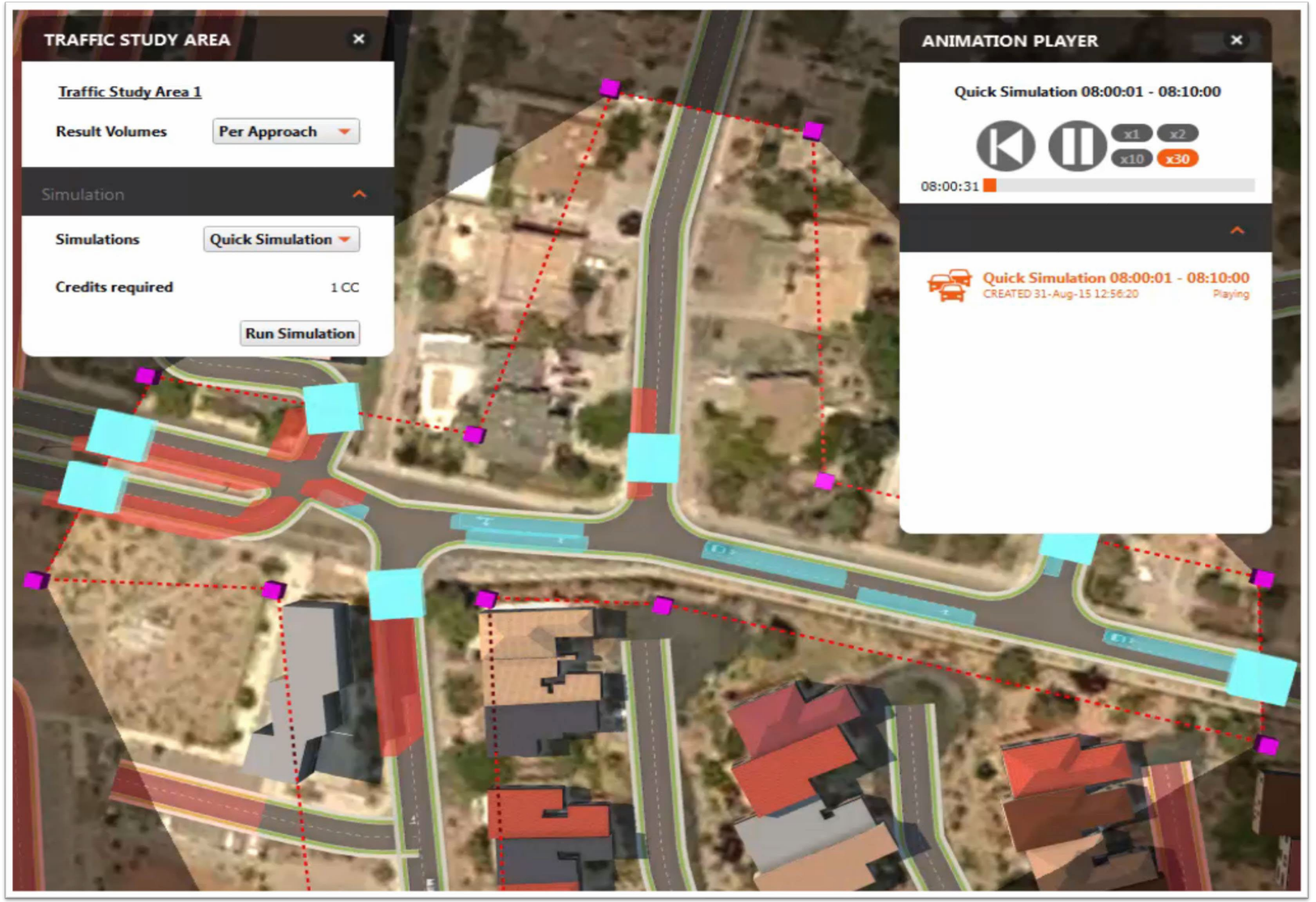
- Pre-construction, in the “Planning and Design” Phases
- Post-construction, in the “Operation and Maintenance” Phases

Traffic Simulation is used for:

- Visualization and Communication of a Design
- Analysis of the Economic Benefit of a Design
- Analysis of operational effectiveness under changing conditions
- Model a network of interacting bottlenecks
- Provide visual feedback through animation
- Provide numerical results for reporting

InfraWorks Traffic Simulation

- Simulates and analyzes traffic flow for complex road systems
- Identify problem areas, re-design and re-analyze
- Easy approach yet robust and sophisticated
- Visual results are easy to understand and explain



Transport Modeling Levels

- Regional Model
- City Model
- Neighborhood Model
- Intersection Model

2.3 Transport Modelling Hierarchy

Transport modelling operates at various levels of detail and scale, covering regions all the way down to single junctions. The hierarchy of modelling is illustrated below in Figure 1. The diagram indicates that data exchange should operate between different levels of modelling to promote analytical consistency.

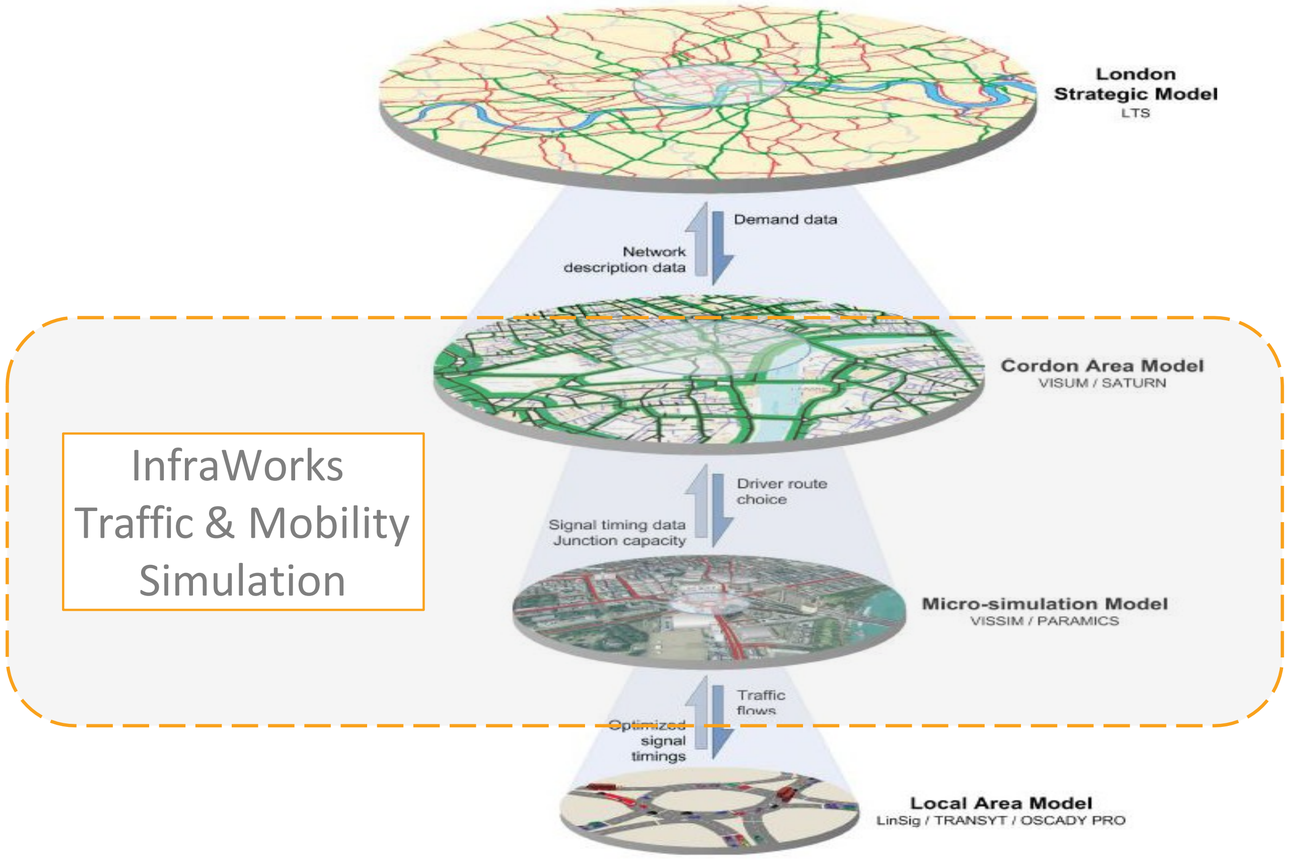


Figure 1: Transport modelling hierarchy.

Analytics for Infrastructure: “Calculating Benefit”

A: Time Saved

Quicker

Lower Travel Time = Higher Productivity
= Lower Emissions

$A

B: Distance Saved

Shorter

Shorter Distance = Less Fuel, Less Maintenance
= Lower Emissions

$B

C: Stops Saved

Smoother

Fewer Stops = Less Fuel, Less Maintenance
= Lower Emissions

$C

Greener

+

Benefit = $ (A + B + C)

User Need: Transport Modeling

When designing a transport system, the engineer's tasks are to:

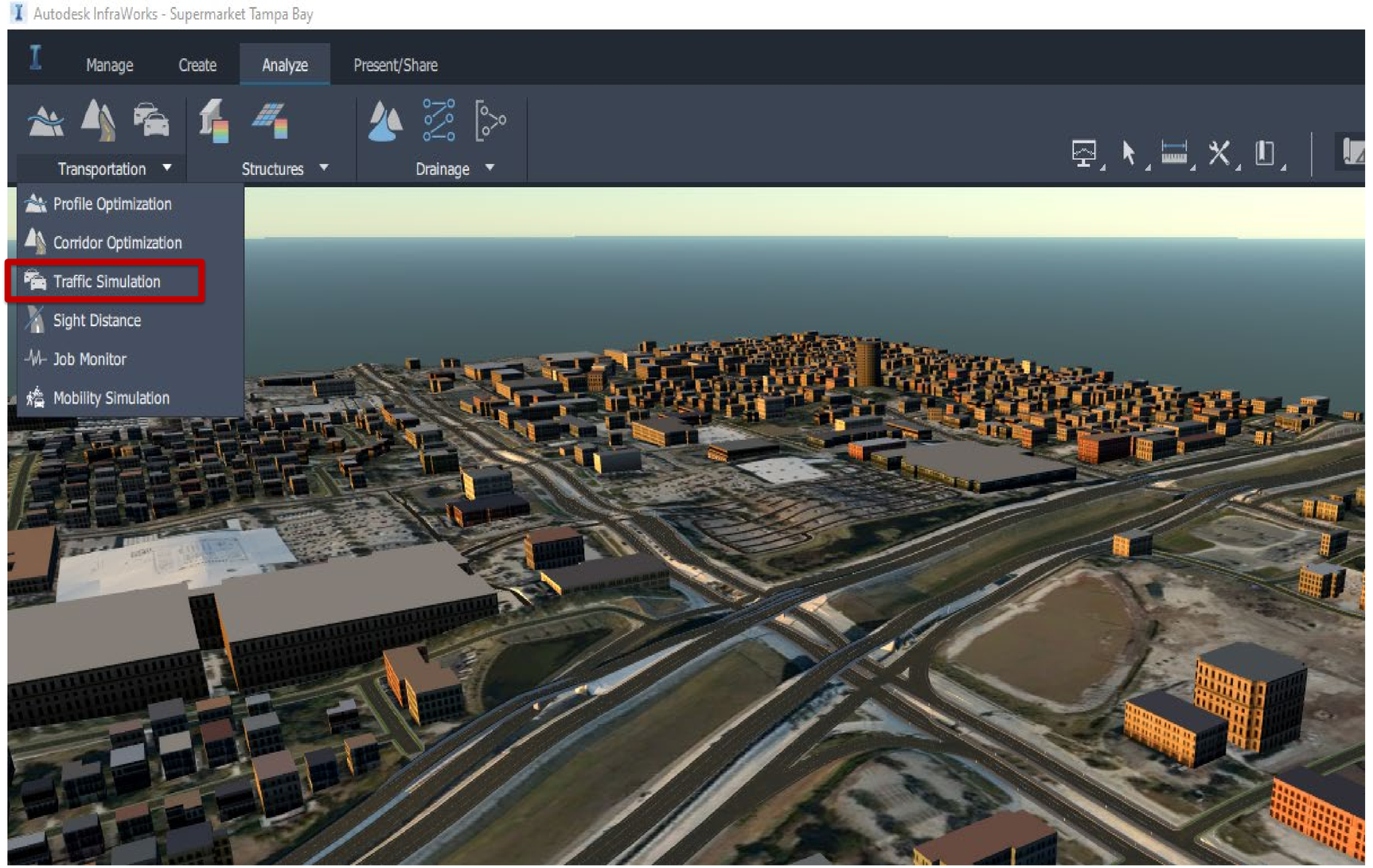
- **Maximize the benefit of design**
- **Minimize the cost of construction**

Transport modeling is the process of "estimating" the benefit measured by delay, flow, stops, queue length, fuel use, or a combination of many factors.

Traffic Modeling: Stochastic methods

- Traffic Simulation is a Stochastic Method
- Takes a range of inputs, delivers a range of results
- Uses simple mathematics and a set of rules to approximate a complex system
- Moves vehicles through a network, adhering to a car=following and gap acceptance model

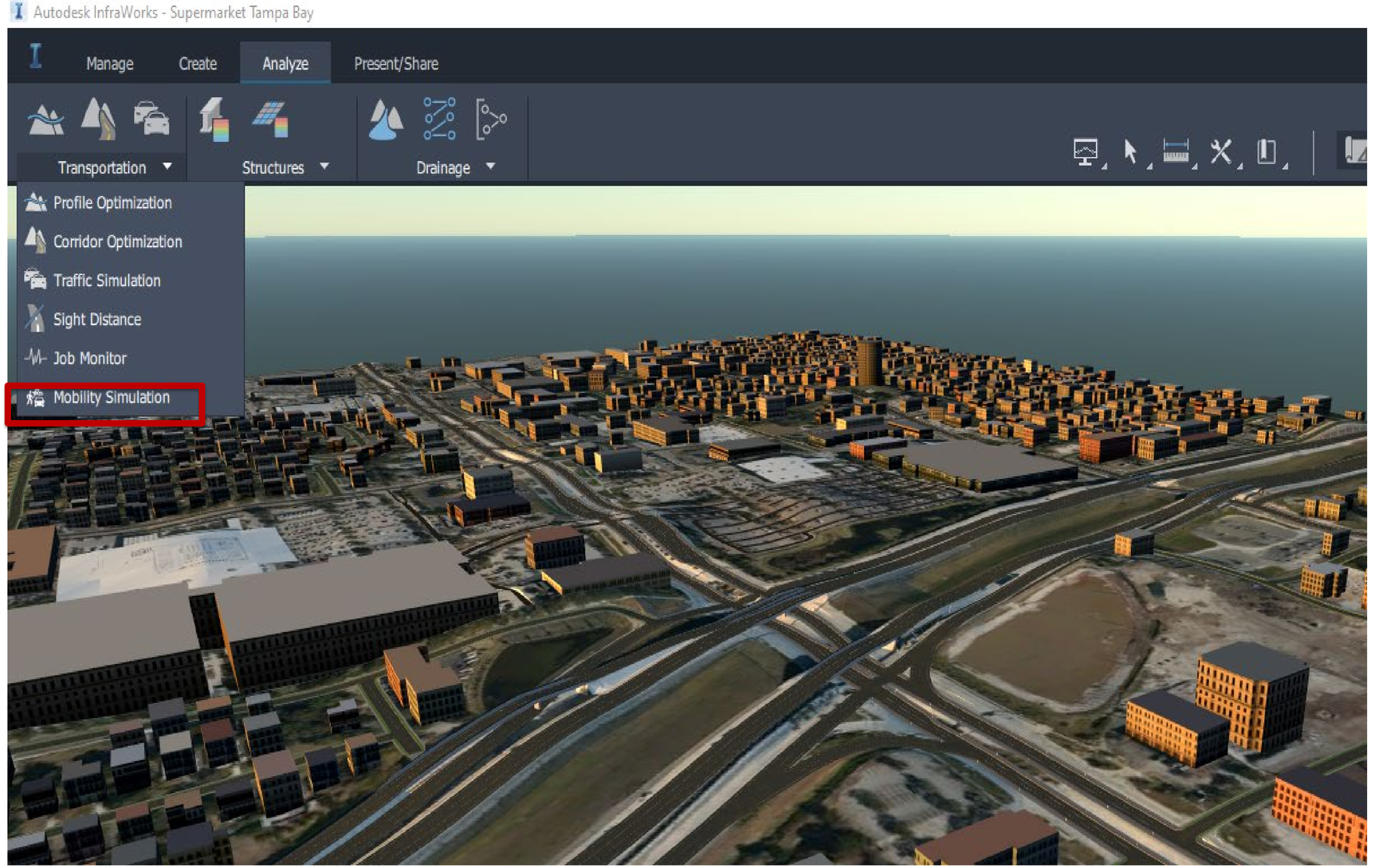
Traffic and Mobility Simulation in InfraWorks



Traffic Simulation

- Private Vehicles only (cars and trucks)
- Animation in InfraWorks canvas
- Delay and queue results in InfraWorks canvas

Traffic and Mobility Simulation in InfraWorks



Mobility Simulation

- All vehicles: Cars, Trucks, Buses, Trains, Taxis
- Pedestrian and cyclists
- Mobility Simulation is launched from InfraWorks but does not send results back to InfraWorks

Traffic & Mobility Simulation in InfraWorks

	Traffic Simulation	Mobility Simulation
Vehicles	Private Vehicles only (cars and trucks) + crosswalks	All Vehicles (cars, trucks, busses, trains, taxis) + Pedestrians and Cyclists…
Level of Analysis	Neighborhood to City	Neighborhood to City
Animation	In the main InfraWorks model	In the separate mobility tool (cannot be shown in the InfraWorks model)
Reporting	Extract traffic numbers in CSV & XLS file	Reporting on many aspects of the animation (detailed also as CSV, XLS, JSON)
Visual results	Delay and queue results in InfraWorks model	No results sent back to InfraWorks but shown in the tool
Roads	Component	Component
Publish Model	Yes	Yes

“Early Merging vs Zipper Merging using Autodesk InfraWorks”
https://www.youtube.com/watch?v=LsSwISwgNI0

This video covers an innovative workflow where true GIS data residing on a public or private portal is read to simulate, analyze and visually understand traffic congestion when lane closures are generated during resurfacing/repair operations helping city-traffic engineers and planners resolve the complexity of computing maximum vehicle queue lengths and delays at peak hours to properly schedule maintenance crews and closure times by minimizing impact, costs and providing the best possible Level of Service during operations.