VISSIM Application for Special Use Lanes

Gold Coast ITE - Traffic Analysis Tools and Specialized Applications Workshop

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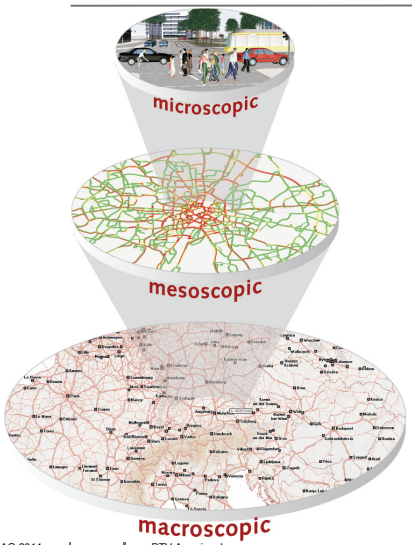
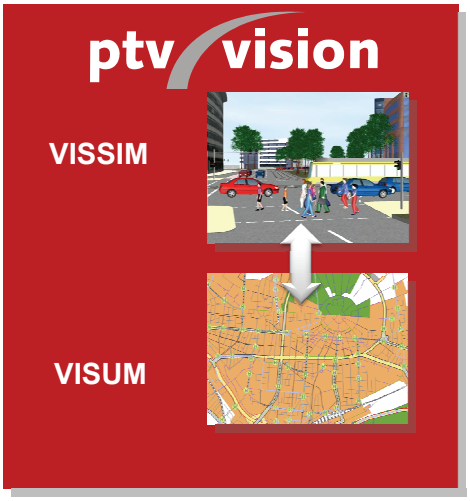
traffic mobility logistics.

VISSIM Example – Special Use/Managed Lanes

PTV Vision: Multi-Resolution Modeling





PTV Vision: Software Products

VISUM
- Macroscopic
- Regional Planning Platform
- Mesocopic
  - DynusT
  - VISTA
  - API

TRAFFIX
- Macroscopic / HCM Analysis
- Traffic Impact Analysis

VISSIM
- Microscopic
- Traffic, Transit, and Pedestrian Simulation

Special Use/Managed Lane Modeling

Understanding Demand Impacts

> Will improved travel times result in new traffic patterns?
> Trip temporal distribution
> Best Tool: Macroscopic

Understanding Supply Impacts

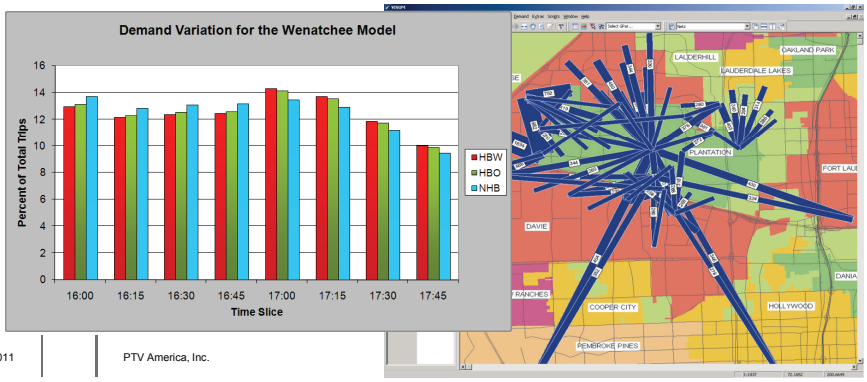
> Will modified capacity result in additional trips?
> Trip spatial distribution
> Best Tool: Macroscopic/Mesoscopic/Microscopic

Understanding Operations

> How will the facility respond to short-term demand?
> How will the user respond to dynamic pricing?
> Trip spatial decisions
> Best Tool: Microscopic

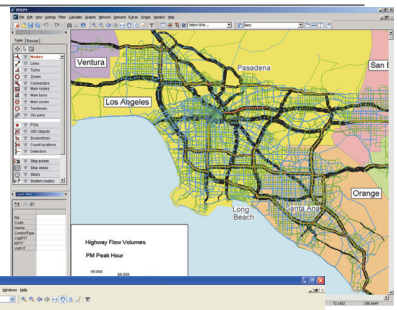
Special Use/Managed Lane – Demand Impacts

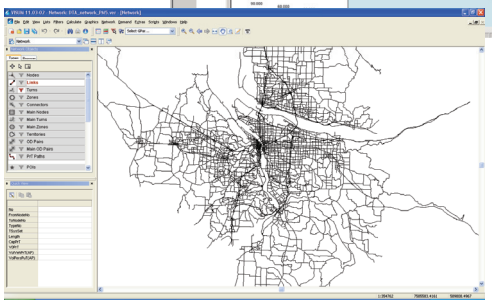
> Trip start times are modified
> Driver begins trip earlier / later because of travel time changes
> Application:
  > VISUM – Dynamic User Equilibrium



Special Use/Managed Lane – Supply Impacts

- Trip / path changes for O-D
- Driver takes a new path because of travel time changes
- Applications:
  - VISUM
  - DynusT
  - VISSIM Dynamic Traffic Assignment





Special Use/Managed Lane - Operations

- Smaller temporal and spatial decisions to use a managed lane facility
- Driver does not make decision to take unique trip based on immediate condition (toll)
- Applications:
  - VISSIM Managed Lanes Module
  - VISSIM COM
  - VISSIM VAP

Special Use/Managed Lanes Module Components

Managed Lane Facility

> Main lanes: no toll, no restrictions
> Managed lane: toll and/or occupancy restrictions

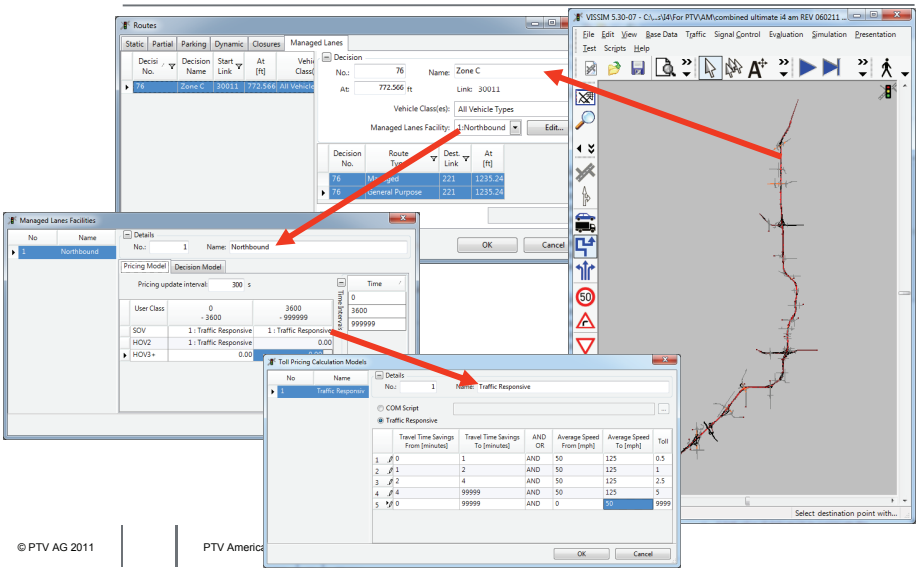
Pricing Model

> In reality, different pricing models exist
> Tolls typically depend dynamic traffic conditions
> Different pricing for different vehicle classes

Decision Model

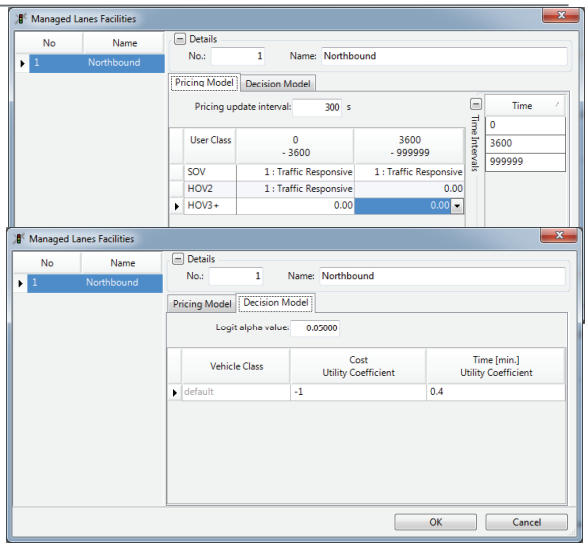
> Which drivers use the managed lane?
> Discrete choice model
  - utility of toll computed from travel time savings and current toll price
  - logit decision function: 50% on toll lane if utility = 0
> unique user classes react differently to same toll

VISSIM Special Use/Managed Lanes Workflow



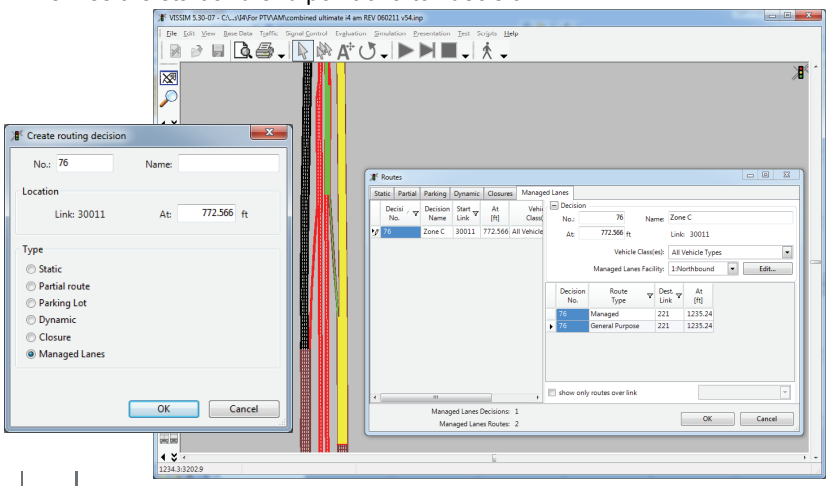
Managed Lanes Facilities

- Defines pricing update frequency
- Defines pricing model by User Class and Time
- Defines decision model by Vehicle Class



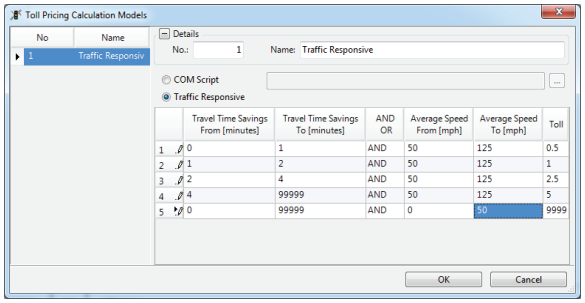
Routing Decisions

- Defines the start and end point of a toll decision

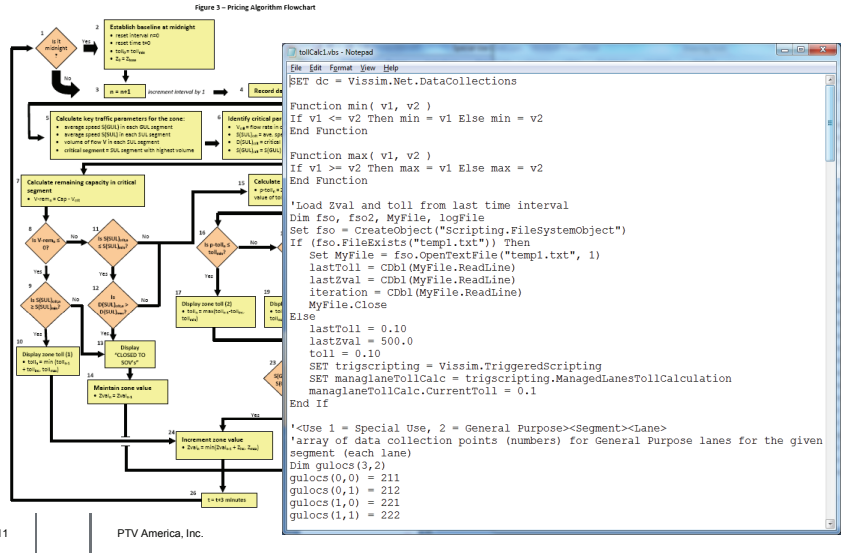


Toll Pricing Model

- Defines simple logic matrix of Travel Time Savings AND/OR Average Speed = Toll
- Defines nested COM script for all other advanced applications
- Technologies used in the field can be replicated as closely as possible



Example Nested COM Script

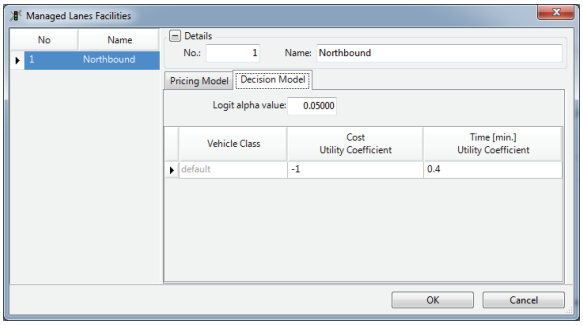


Decision Model

> Probability of vehicle class using the managed lanes facility based on a Logit model $P(Managed) = 1 - \frac{e^{\alpha * U_{Managed}}}{e^{\alpha * U_{Managed}} + e^{\alpha * U_{Unmanaged}}} = 1 - \frac{1}{1 + e^{\alpha * \Delta U}}$

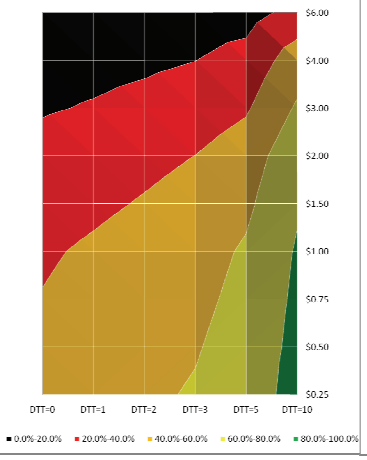
> Cost coefficients define a general utility function

$$\Delta Utility = CostCoefficient * \Delta Cost + TimeCoefficient * \Delta Time$$

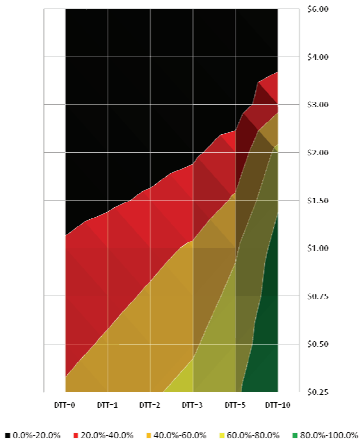


Decision Model Calibration

Probability Contours for Default Coefficients

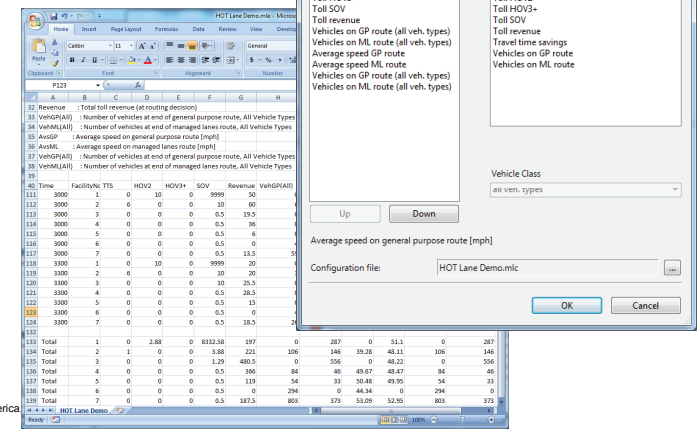


Probability Contours for Calibrated Coefficients



Evaluation

- User-defined evaluation
- Per vehicle class
- Per pricing update interval



Special Use/Managed Lanes Module Key Points

- All vehicles are assigned to general purpose lanes by static routing
- Origin-destination or decision area based
- Vehicle classes are assigned to the facility “dynamically”

- Pricing model built-in or user-defined

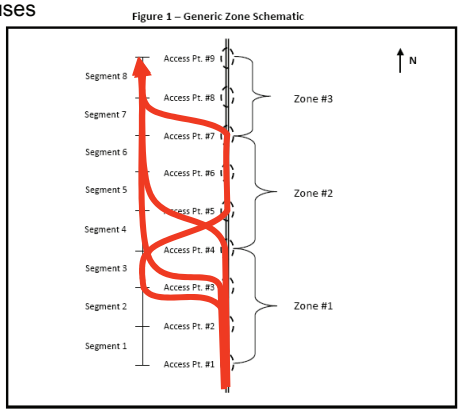
- Dynamic traffic assignment can be used in addition to the traffic assigned by the managed lanes module, but these vehicles will not respond to local dynamic routing

- Feedback to planning process is possible
- In theory, dynamic traffic assignment could be based on dynamic cost feedback and COM applications

Special Use/Managed Lanes Module Considerations

- Application must have limited ingress/egress points for total trip
- The current problem:
  - Facility has multiple pricing zones
  - User can enter/exit session
  - Total trip has multiple possible uses

Figure 1 – Generic Zone Schematic



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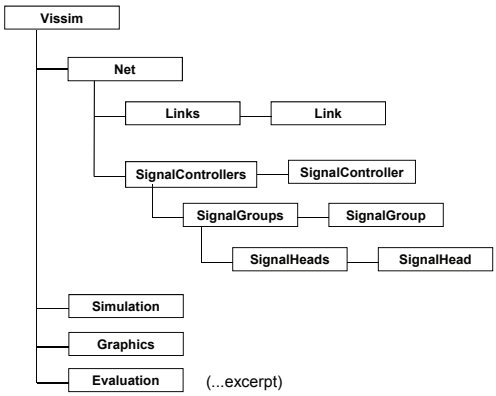
VISSIM COM

Scripting/programming via VB, VBA, JavaScript, Python

VISSIM object model externally accessible



(...excerpt)

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VISSIM COM

Object attributes are modified during simulation

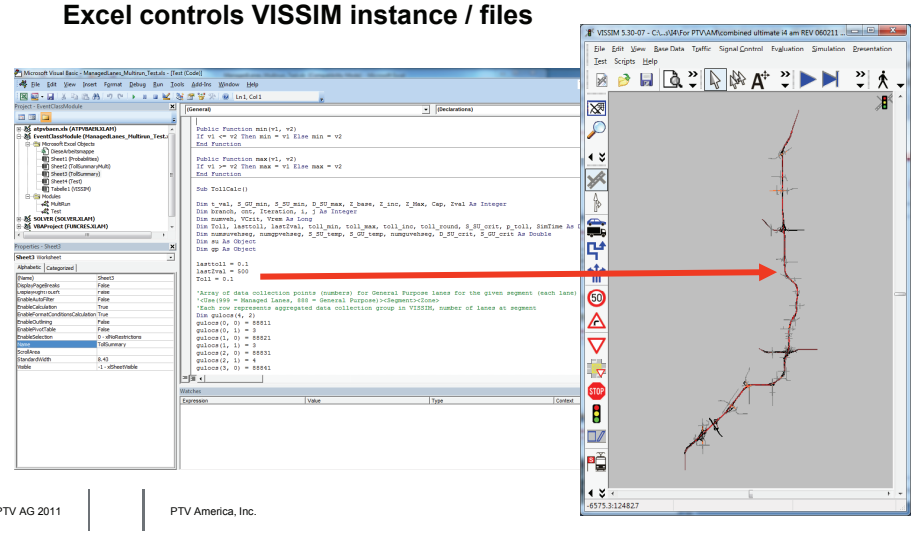
Example VBA script:

```
For p = 0 To 18
    If p = 0 Then
        Net.RoutingDecisions.GetRoutingDecisionByNumber(53).Routes.GetRouteByNumber(2).AttValue1("RelativeFlow", 1) = RI
        Net.RoutingDecisions.GetRoutingDecisionByNumber(53).Routes.GetRouteByNumber(1).AttValue1("RelativeFlow", 1) = RI
    End If
    If SB2Toll = 1000 Then
        Net.RoutingDecisions.GetRoutingDecisionByNumber(53).Routes.GetRouteByNumber(2).AttValue1("RelativeFlow", 1) = RI
        Net.RoutingDecisions.GetRoutingDecisionByNumber(53).Routes.GetRouteByNumber(1).AttValue1("RelativeFlow", 1) = RI
        Exit For
    ElseIf SB2Toll > tollthresSB53(p) Then
        Net.RoutingDecisions.GetRoutingDecisionByNumber(53).Routes.GetRouteByNumber(2).AttValue1("RelativeFlow", 1) = RI
        Net.RoutingDecisions.GetRoutingDecisionByNumber(53).Routes.GetRouteByNumber(1).AttValue1("RelativeFlow", 1) = RI
    Else
        Exit For
    End If
Next
```

- Example function: GetRouteByNumber()
- Example attribute: AttValue1(<"attribute">, <time period>)

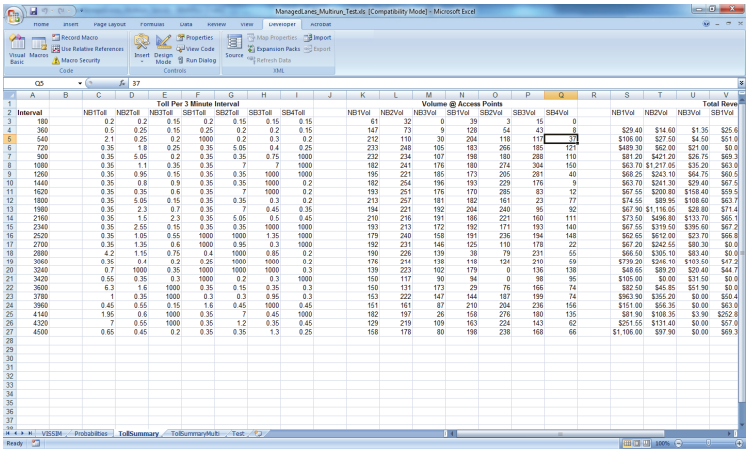
VISSIM COM - VBA

Excel controls VISSIM instance / files



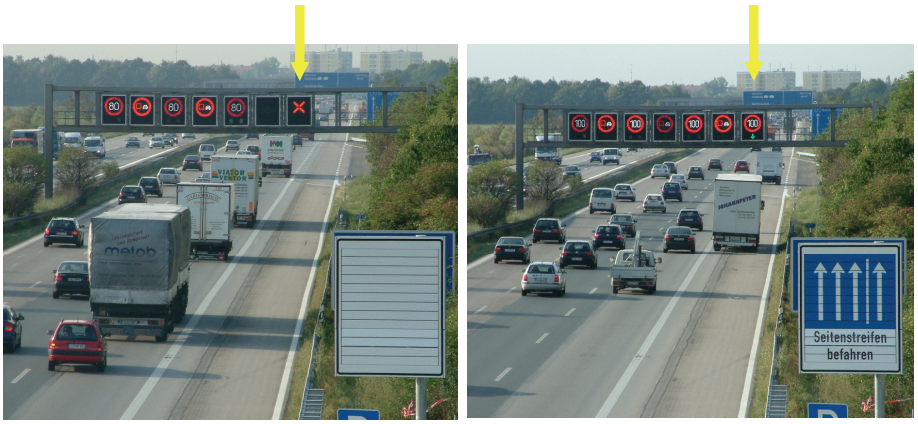
VISSIM COM - VBA

Feedback results to Excel

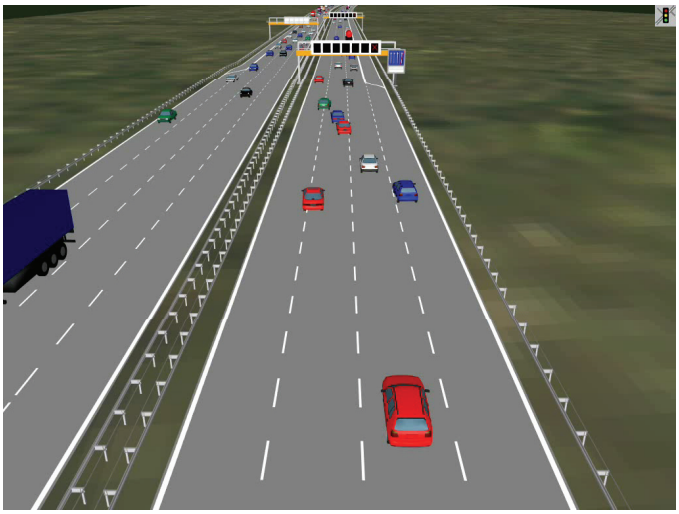


VISSIM COM Example – Managed Lanes

Shoulder use based on density:



VISSIM COM Example - Managed Lanes



VISSIM COM Example – Dynamic Speed Control

VISSIM COM Example – Ramp Metering

Thank you!

traffic mobility logistics.

Question & Answers