VISSIM Microsimulation Modeling Overview

NCMUG

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Agenda

1 **What is VISSIM?**

2 **Modeling Process**

3 **Traffic Assignment in VISSIM**

4 **I-526 Corridor Study Example**

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What is VISSIM?

- **Microsimulation model developed by PTV**

- **Pros:**
  - Very flexible
  - Detailed results
  - High-quality videos with 3D objects

- **Cons**
  - Time-consuming
  - Costly (software and labor)
  - Tedious
  - OD Matrix requires separate platform

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What is VISSIM?

What is VISSIM?

What is VISSIM?

2

Modeling Process

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Modeling Process

Travel Demand Model
- TransCAD

Build Road Network
- VISSIM

OD Matrix Development
- VISUM

Load OD & Assign Traffic
- VISUM -> VISSIM

Run Model
- VISSIM

Modeling Process

Recommen-dations

Future Year Build

Network Deficiencies
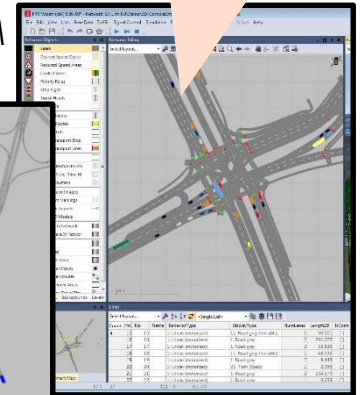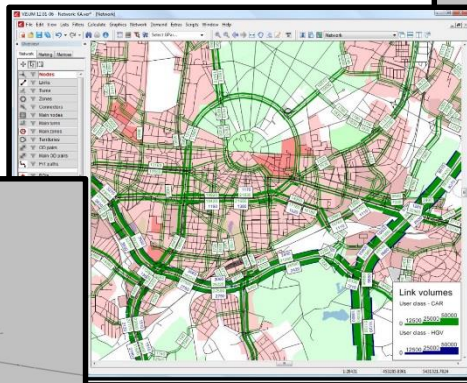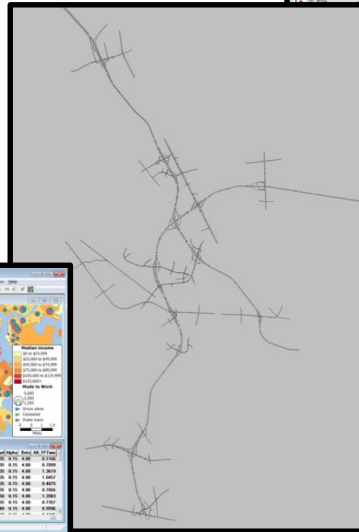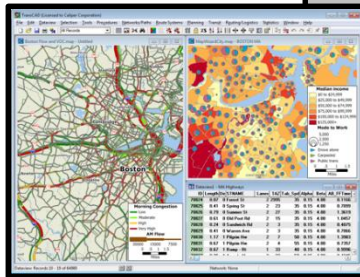
Future Year No Build

Calibration
- Volumes
- Speed
- Congestion
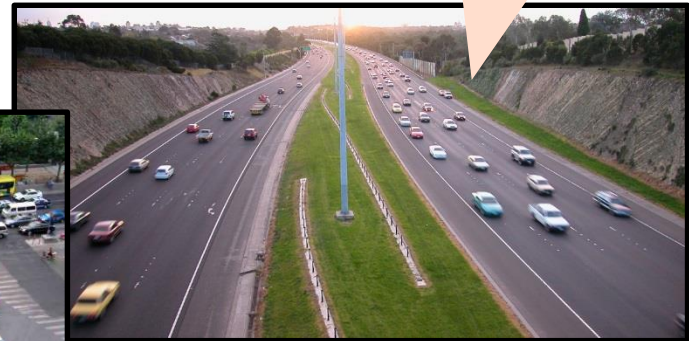
Travel Demand Model

TransCAD

- NC is a TransCAD state

- Regional model demonstrates the traffic movement on the regional level, but lacks the details needed by a simulation model.

- We use regional model to get:

  - Traffic patterns

  - Future year growth trend (Land Use related)

  - Build vs No-Build regional reactions

    - Corridor capacity change

    - Connectivity change

    - NOT interchange improvement

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Build Road Network

VISSIM

- Use aerial imagery or Bing Maps
- Add Network Elements
  - Links/connectors
  - Parking Lots (Zones)
  - Nodes
  - Signal heads
  - Reduced Speed Areas
  - Desired Speed Decisions
  - Conflict Areas
- Links/Connectors → VISUM

Network Objects

Links

Desired Speed Decisions
Reduced Speed Areas
Conflict Areas
Priority Rules
Stop Signs
Signal Heads
Detectors
Vehicle Inputs
Vehicle Routes
Parking Lots
Public Transport Stops
Public Transport Lines
Nodes
Data Collection Points
Vehicle Travel Times
Queue Counters
Sections
Background Images
Pavement Markings
3D Traffic Signals
Static 3D Models
Vehicles In Network
Pedestrians In Network
Areas
Obstacles
Ramps & Stairs
Pedestrian Inputs

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OD Matrix Development

VISUM (or other)

- VISSIM "stick" network imported into VISUM
- Base Year Demand Development
  - Traffic Pattern
    - Travel Demand Model
    - OD Survey Data: Bluetooth, Plates, Cellphone, etc
  - Turning Movement Counts & Link Volumes
  - Truck related information – Trucks play a big role in the simulation

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OD Matrix Development

VISUM (or other)

- Future Year Demand Development

  - Growth pattern from demand model

  - Traffic pattern change (if regionally significant) from demand model

  - Turning movements and link volume projections

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OD Matrix Development

	Sum	1	2	3	4	5	6	7	8	9	10	11	12	15	16	17	18	20	22	23	24	25	26	27	28	29	30	35	36	37	38	41
	Sum	854	1398	258	32	91	6	301	27	1	27	48	6	6	90	0	2	3	336	76	120	95	7	53	8	6	15	14	312	56	127	133
1	824	0	396	10	1	7	0	13	0	0	0	4	0	1	29	0	0	0	33	29	0	31	0	0	0	0	6	0	15	34	41	42
2	1156	488	0	36	1	13	0	59	19	0	10	35	6	1	11	0	0	1	178	11	25	16	1	10	1	0	0	11	104	0	25	20
3	259	38	71	0	21	6	2	94	1	0	1	2	0	0	0	0	0	0	5	0	2	1	0	1	0	0	0	0	7	0	2	2
4	40	3	7	20	0	0	0	8	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5	70	8	23	2	0	0	0	32	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0
6	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	313	22	83	132	6	47	2	0	1	0	1	3	0	0	1	0	0	0	5	0	1	1	0	0	0	0	0	1	2	0	2	0
8	38	2	0	7	1	1	1	10	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
9	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	11	0	6	1	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	294	18	123	47	2	16	1	76	2	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	1	0	1	1	1
12	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	8	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0
14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
15	11	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
16	169	24	26	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	106	0	1	0	0	0	0	0	0	0	1	4	0	1	1
17	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
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21	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	164	11	89	1	0	1	0	2	0	0	0	2	0	3	48	0	1	2	0	0	0	1	0	0	0	0	0	0	2	0	0	0
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25	74	17	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	15	25
26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
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28	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	7	0	0	0
29	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
30	25	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	10	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	11	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	4	0	0	0
36	459	47	239	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	52	1	3	19	3	3	0	0	0	0	0	1
37	44	0	42	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	75	3	24	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	8	16
39	6	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	1
40	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
41	20	3	4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	1	2	0
42	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Load OD and Assign Traffic

Parking Lots (Zones)

Nodes

OD Matrix

Dynamic Assignment
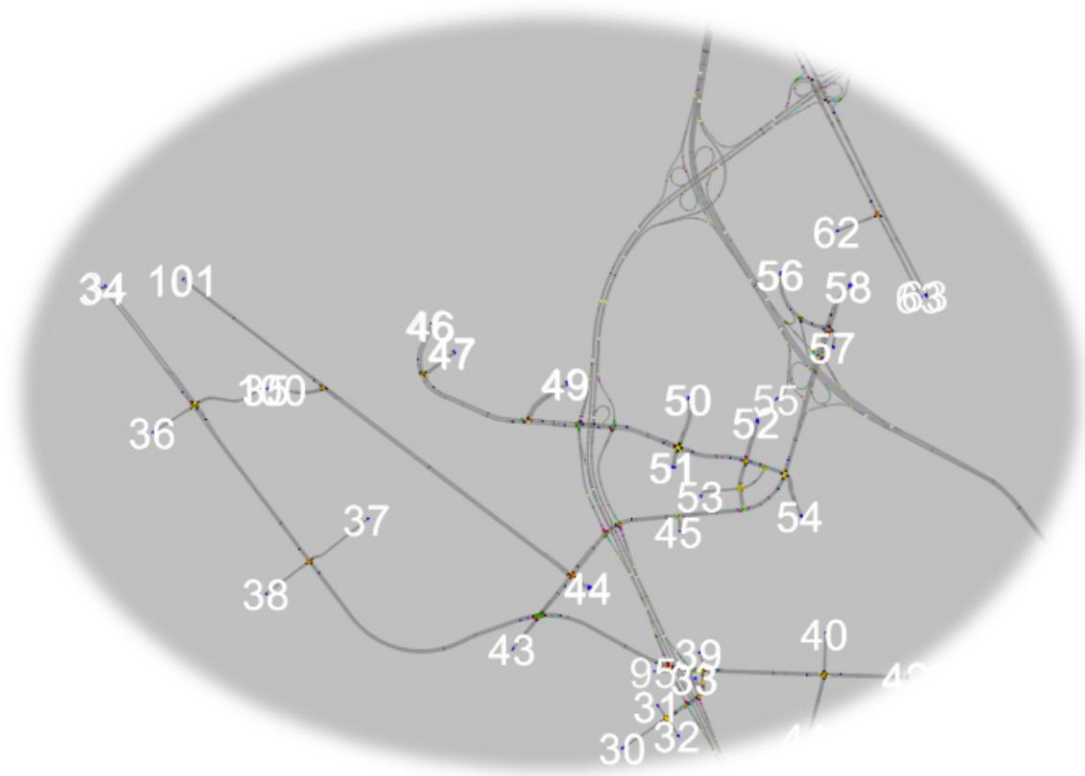
Two Options

**Dynamic Traffic Assignment (DTA)**

- Large networks
- Varying travel patterns
- Closely spaced intersections
- Travel Demand Model is available

Static Vehicle Assignment

- Smaller networks
- Less congested areas
- Defined travel patterns
- No closely spaced intersections

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Dynamic Traffic Assignment

- Allows vehicles to dynamically choose path
- Parallel routes, grid network
- Requires use of:
  - Parking lots
  - Nodes
  - OD Matrix
  - (Static Route Closures)
- Iterative process
- Easier to manipulate if OD changes
- Can convert to static routes once patterns are set

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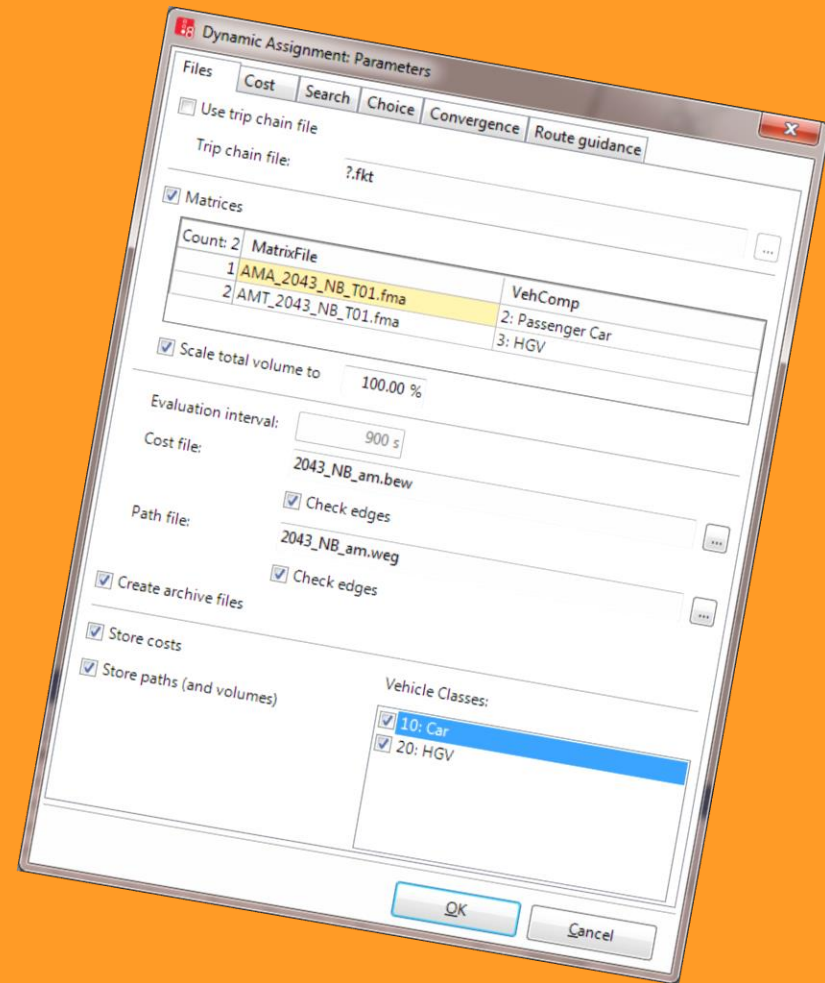
Static Vehicle Assignment

- Path manually chosen by user
- Requires use of:
  - Vehicle Inputs
  - Static Routing Decisions
  - Turning Movement Volumes (typically)
- Combine routes for closely spaced intersections
- Tedious for large networks

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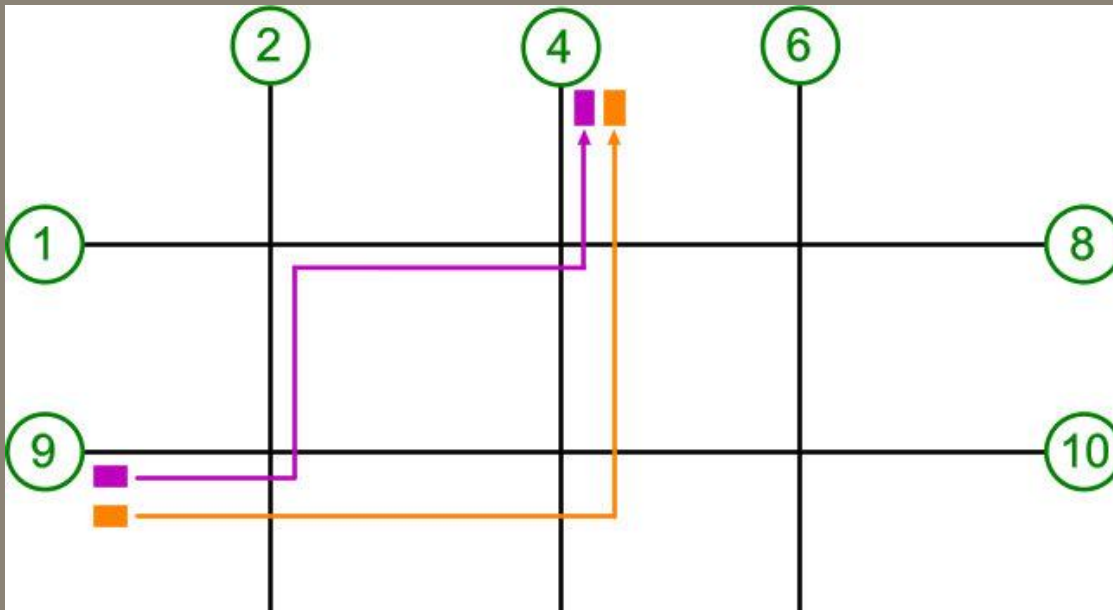
OD Matrix

	1	2	3	4	5	6	7	8	9
1	12	22	11	20	7	8	25	14	9
2	1	13	23	11	13	10	11	14	5
3	7	23	0	23	4	23	7	15	16
4	0	20	21	15	1	7	5	21	23
5	19	0	19	21	23	6	21	0	5
6	5	6	24	17	21	21	16	3	5
7	0	19	19	3	12	4	11	10	22
8	23	6	2	15	5	3	4	20	17
9	23	10	7	16	15	18	4	10	24

DYNAMIC ASSIGNMENT
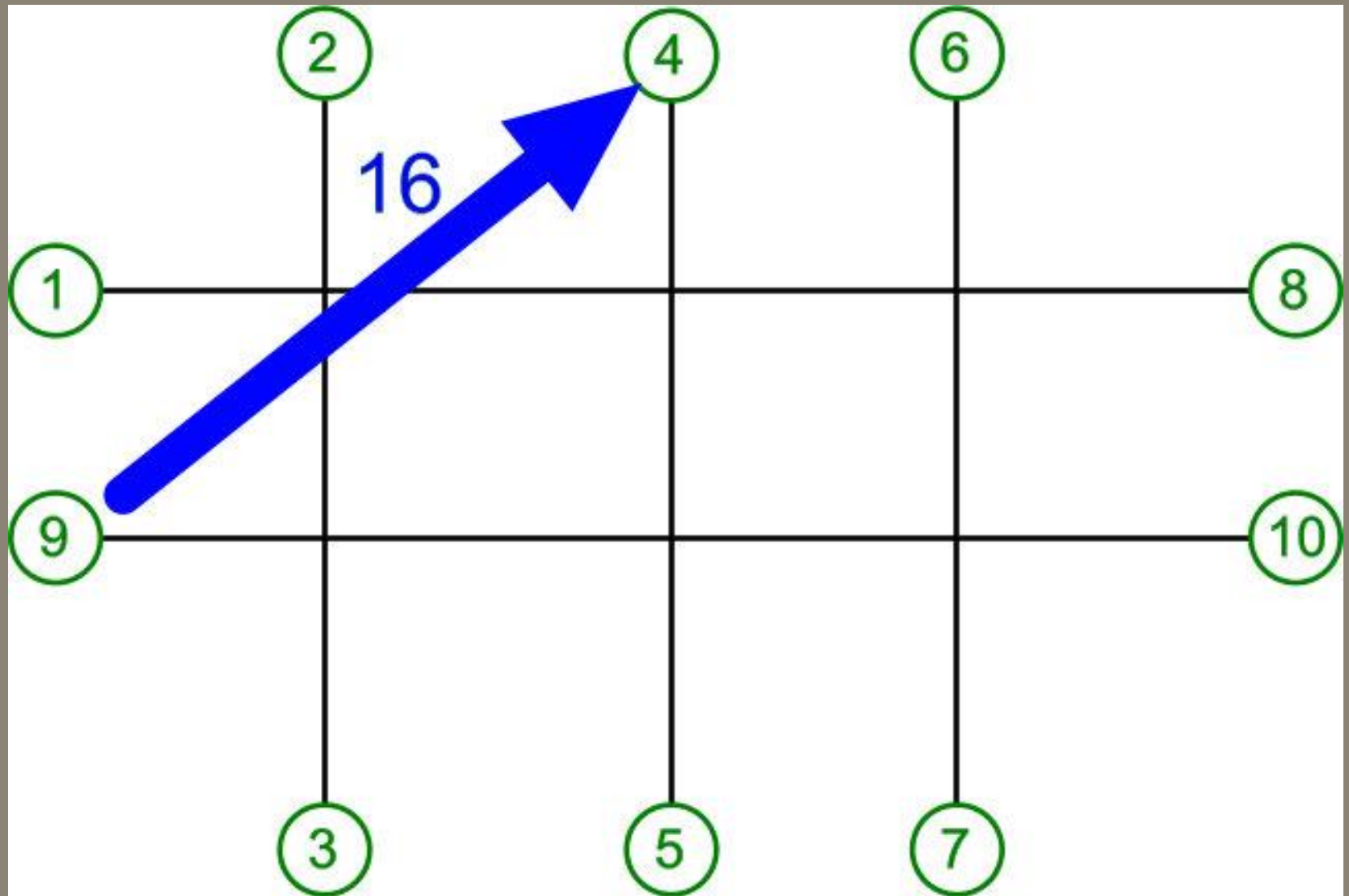
1 Introduction

Charleston, South Carolina

16+ miles of freeway
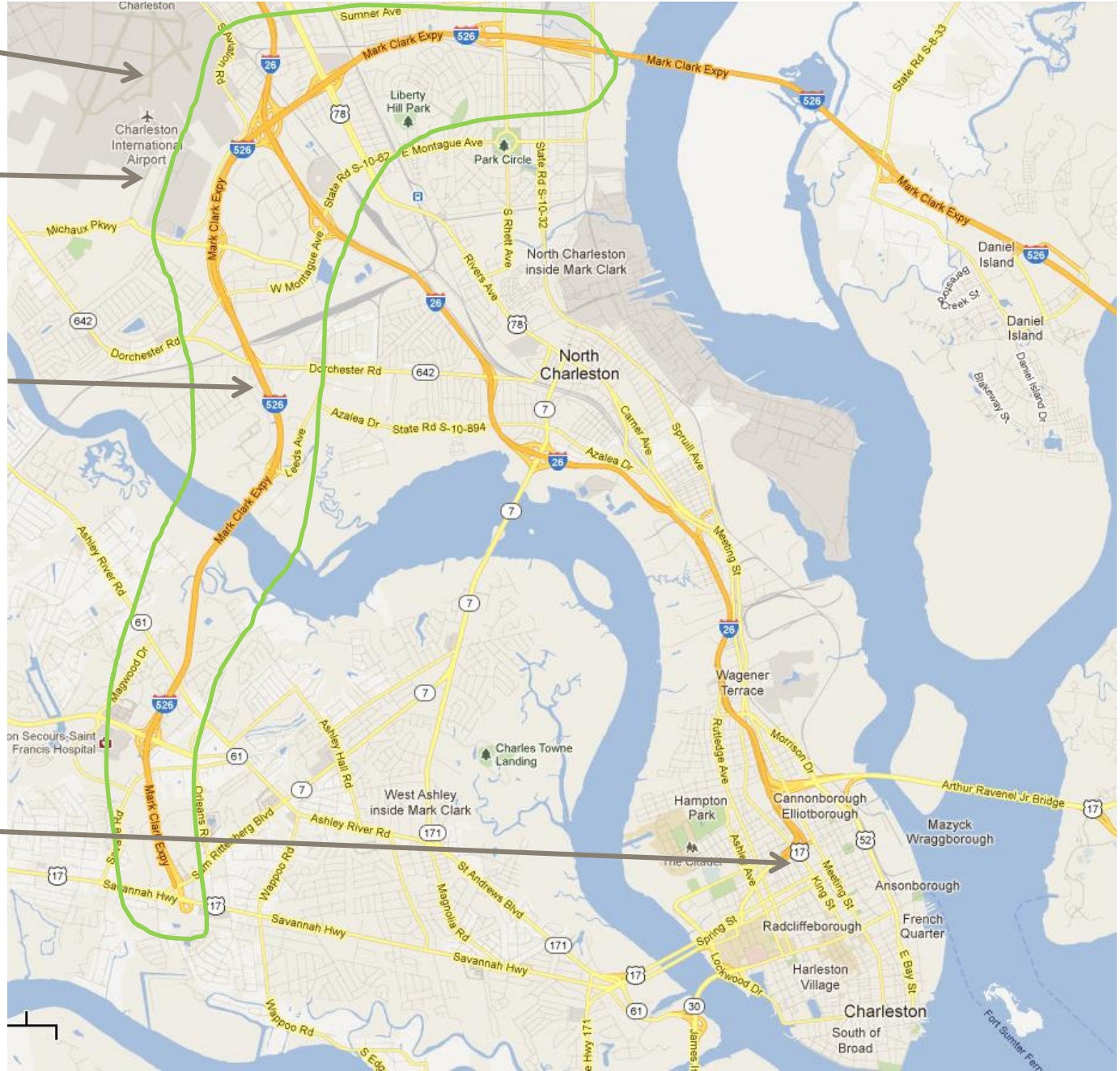
17 interchanges

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Where are we?

Suburbs

Airport

Boeing Plant

Tanger Outlets + Convention Center

Downtown Charleston

Project Background

- I-526 is one of the **most congested** corridors in South Carolina

- Designated as a "**Mega Project**" in the State Long-Range Interstate Plan

- Mega Projects = Construction costs for improvements **exceed the funding of the entire interstate program for South Carolina** for multiple years

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Daily Traffic Volumes – I-526
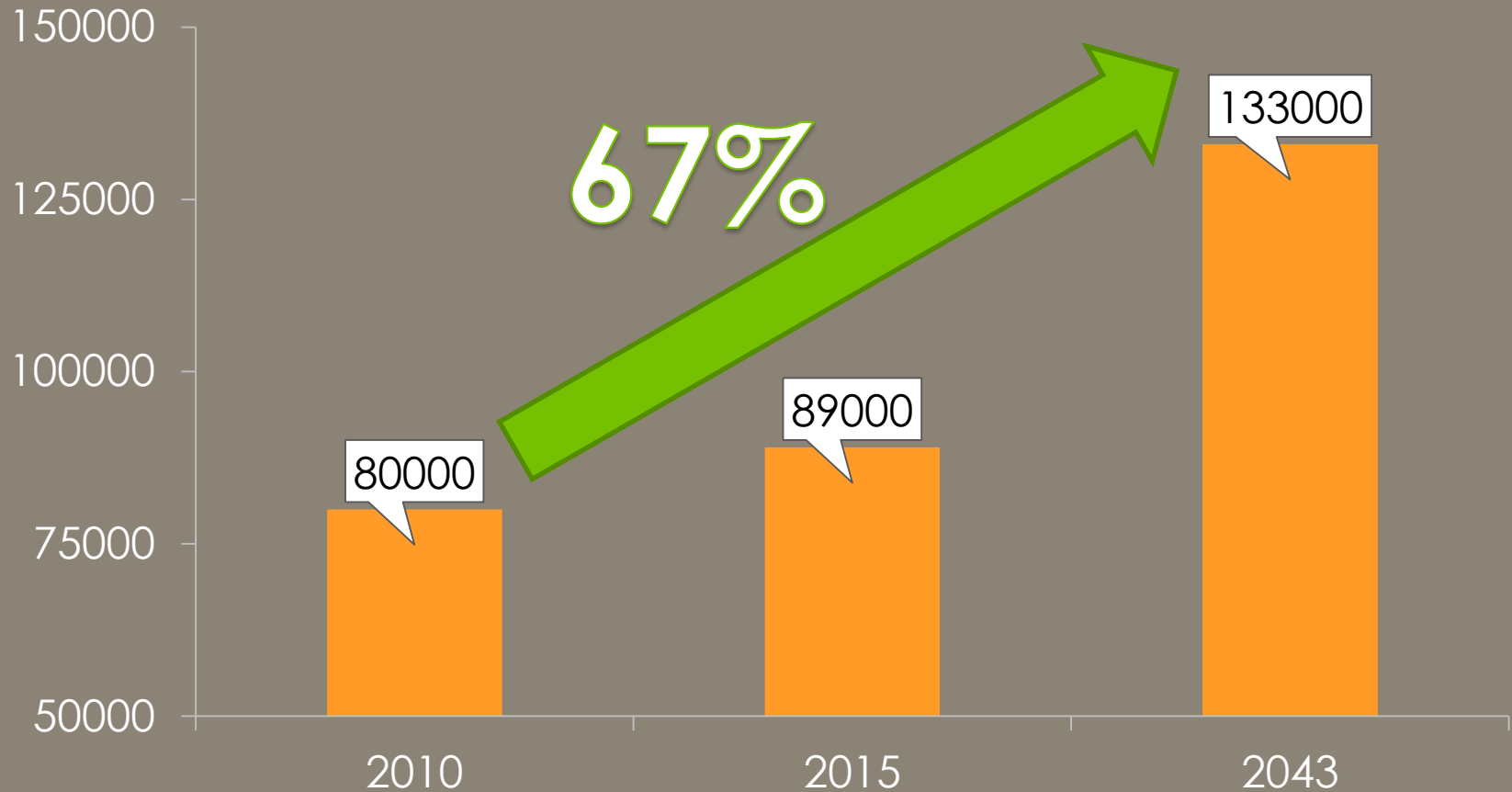
I-526 Work Effort

- Define existing corridor deficiencies

- Quantify future problem areas

- Identify potential improvement strategies

- Evaluate strategies for effectiveness – VISSIM

- Develop menu of recommendations

Begin Project at Rhett Avenue

End Project at US 17/Savannah Highway

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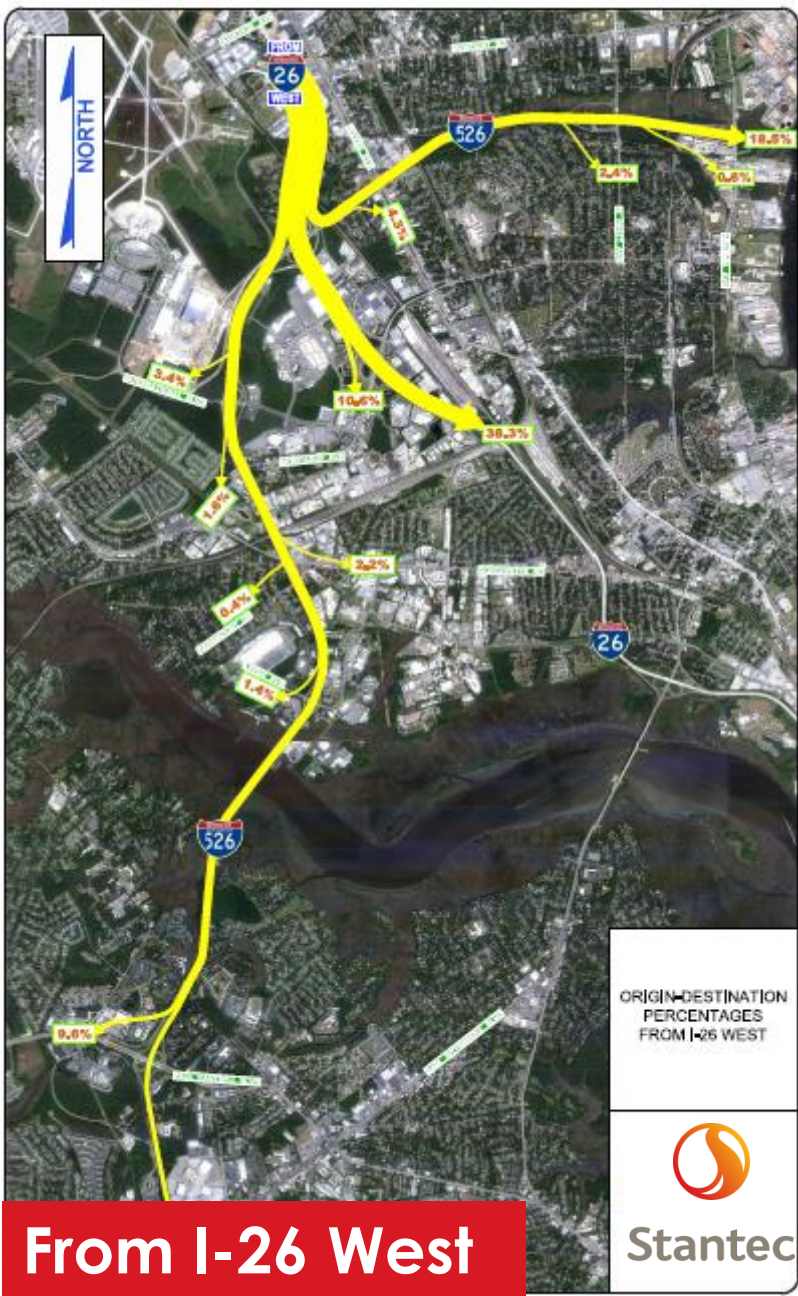# I-526 Potential Improvement Strategies

- **Evaluate the following strategies to reduce congestion:**
  - **Travel Demand Management (TDM)**
  - **Modal/Freight**
  - **Traffic Operations**
  - **Capacity Improvements**

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2   Data Collection

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Data Collection

- **Existing Traffic Counts**
- **Existing Signal Plans/Timings**
- **Regional Travel Demand Model**
  - Expected future development
  - Future travel patterns
- **Origin-Destination Data**
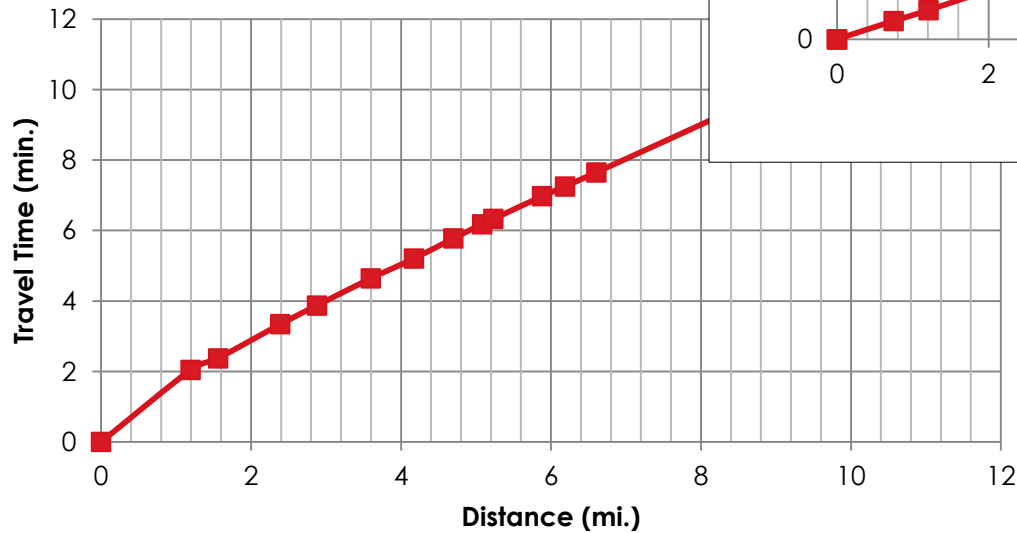- **Travel Times**
- **Field Observation**

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O-D Results

From I-26 West

From I-26 East

O-D Results

From I-526 East

From US 17

ORIGIN-DESTINATION PERCENTAGES FROM I-526 EAST

ORIGIN-DESTINATION PERCENTAGES FROM US 17
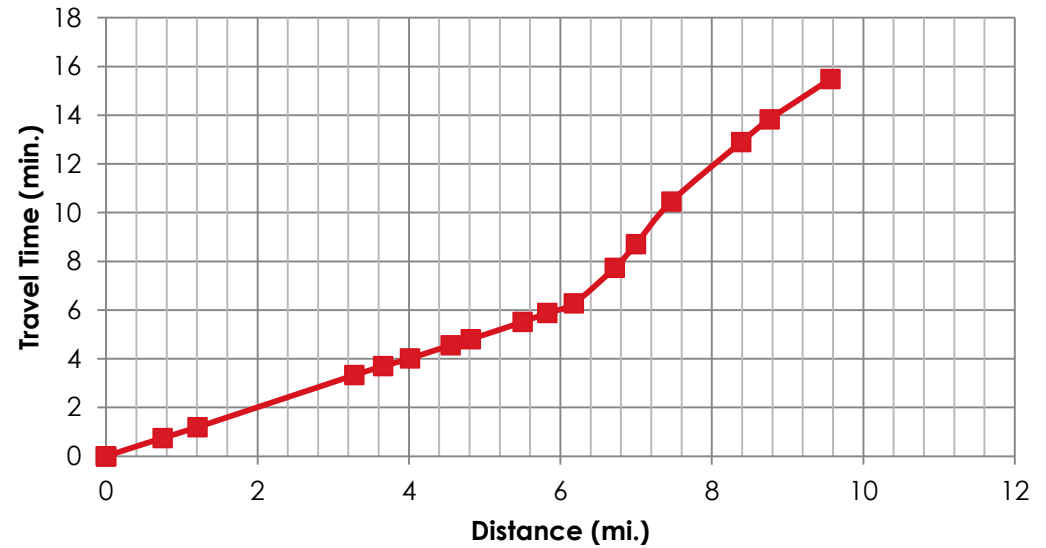
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Travel Time Results

Free Flow

~10 minutes

I-526 EB Travel Times
Existing AM Peak

I-526 WB Travel Time
Existing AM Peak

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2 VISSIM Model

Base Model Development

Determine MOE's

Calibration

Alternatives Analysis

Recommendations

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Base Model Development

- **Existing aerial photography**
- **Develop trip table using macro model (VISUM)**
  - **Blufax origin-destination data**
  - **CHATS model**
  - **Peak hour counts**
- **Dynamic traffic assignment**

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Measures of Effectiveness

- **Travel time**
- **Speed**
- **Delay**

- **Level of service (LOS)**
- **Density**
- **Queue length**

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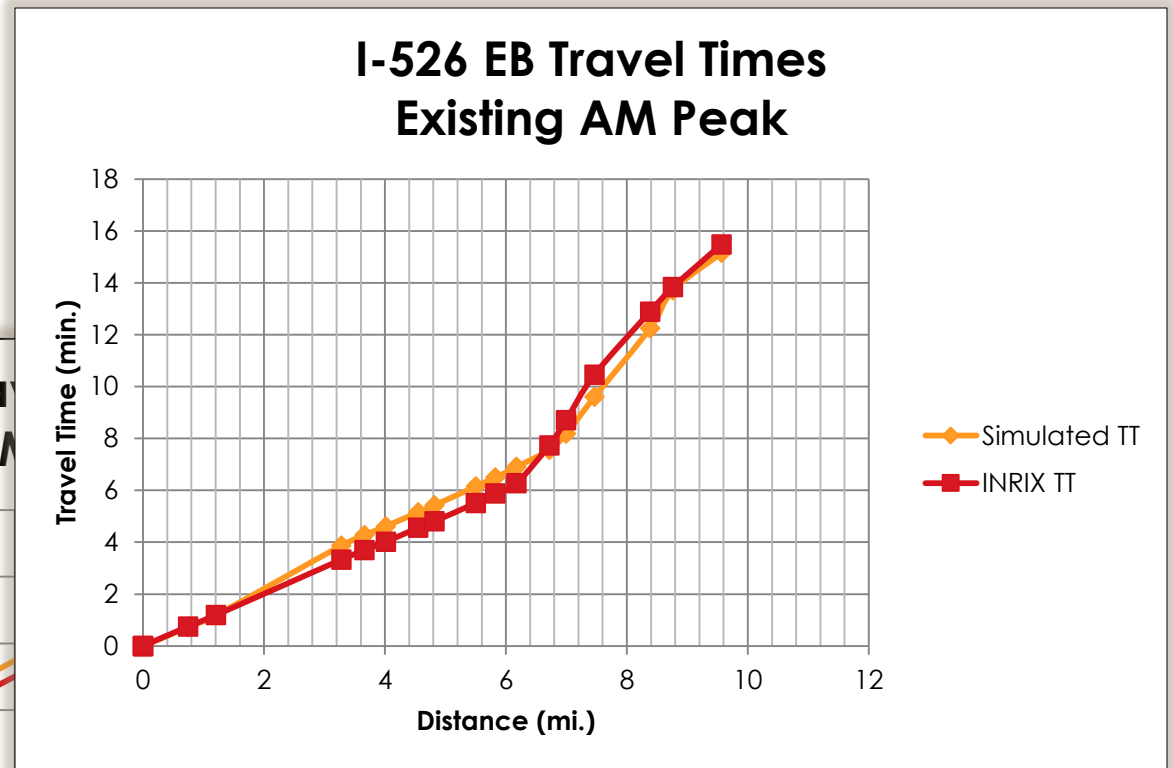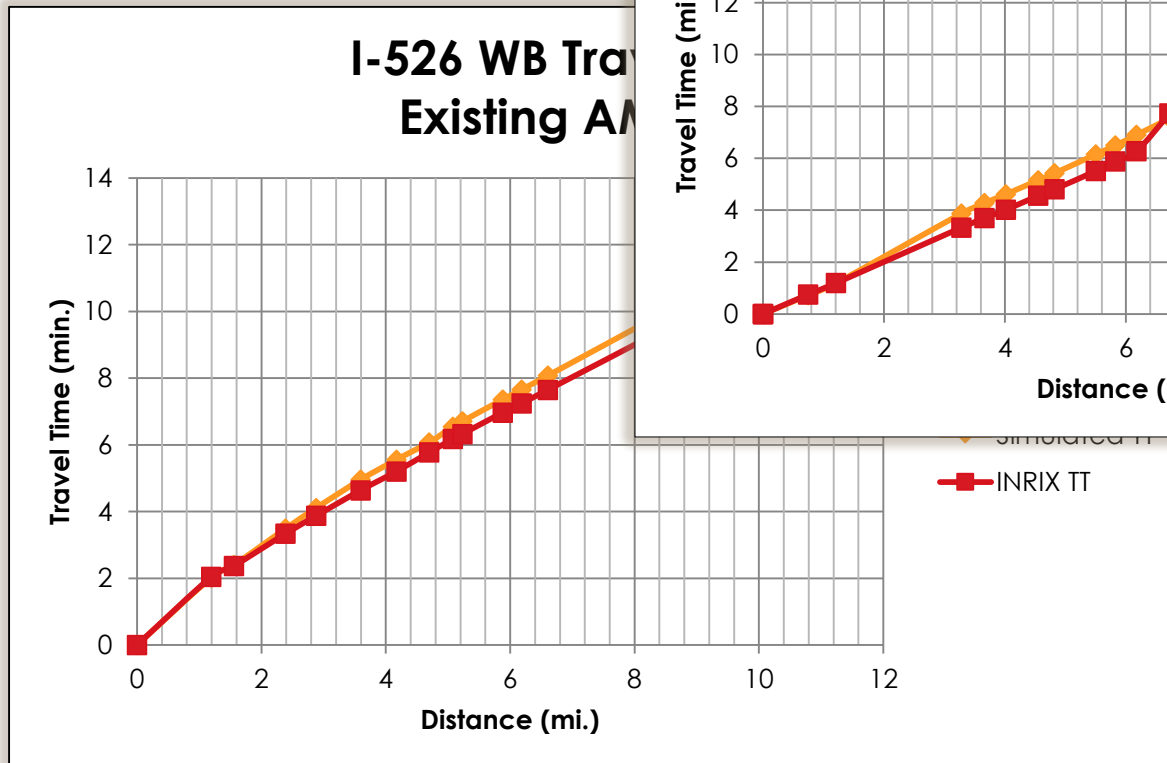# Calibration

Sim Vol	Counted Vol	Delta	% Delta	Descr	
3849	3736	113	3.0%	I-526 WB East of Rhett	
3320	3193	127	4.0%	I-526 WB East of Rivers	
3813	3746	67	1.8%	I-526 WB East of I-26	
3628	3506	122	3.5%	I-526 WB East of International	
3166	3096	70	2.3%	I-526 WB at Montague	
3535	3487	48	1.4%	I-526 WB East of Dorchester	
3475	3418	57	1.7%	I-526 WB East of Leeds	
2720	2668	52	1.9%	I-526 WB West of Leeds	
1445	1323	122	9.2%	I-526 WB West of Glen McConnell	I-526
4090	4466	376	8.4%	I-526 EB East of Rhett	
3146	3412	266	7.8%	I-526 EB East of Rivers	
2943	3054	111	3.6%	I-526 EB East of I-26	
3487	3438	49	1.4%	I-526 EB East of International	
2915	2968	53	1.8%	I-526 EB at Montague	
3528	3662	134	3.7%	I-526 EB East of Dorchester	
3365	3422	57	1.7%	I-526 EB East of Leeds	
3997	4132	135	3.3%	I-526 EB West of Leeds	
2058	1924	134	7.0%	I-526 EB West of Glen McConnell	
5687	5672	15	0.3%	I-26 EB North of US 52	
6909	7068	159	2.2%	I-26 EB South of US 52	
7971	8377	406	4.8%	I-26 EB South of Ashley Phosphate	
6579	6751	172	2.5%	I-26 EB South of Aviation	
7511	8101	590	7.3%	I-26 EB South of Remount	
5875	6439	564	8.8%	I-26 EB South of I-526	
5522	6146	624	10.2%	I-26 EB South of Montague	
5797	6385	588	9.2%	I-26 EB South of Dorchester	I-26
2819	2915	96	3.3%	I-26 WB North of US 52	
2258	2344	86	3.7%	I-26 WB South of US 52	
4253	4422	169	3.8%	I-26 WB South of Ashley Phosphate	
3893	3977	84	2.1%	I-26 WB South of Aviation	
5129	5205	76	1.5%	I-26 WB South of Remount	
2854	2920	66	2.3%	I-26 WB South of I-526	
2806	2787	19	0.7%	I-26 WB South of Montague	
3008	2964	44	1.5%	I-26 WB South of Dorchester	

Total Simulated Volume
137,351 vph

Total Counted Volume
141,124 vph

Calibration

Travel Times

I-526 EB Travel Times
Existing AM Peak

I-526 WB Travel Times
Existing AM Peak

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Calibration

Demand > Capacity

Field Observation showed this:

...but VISSIM was showing this

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Calibration

Future Year Models

- 2020 and 2043

- 1-2% Annual Growth

- Committed Improvements
  o Airport Connector Road

- Boeing Expansion
  o Growth by >200% from 2015 to 2043

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How do we fix it?

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Alternatives Analysis

- **Model Improvement Strategies:**
  - **Travel demand**
  - **Capacity improvements**
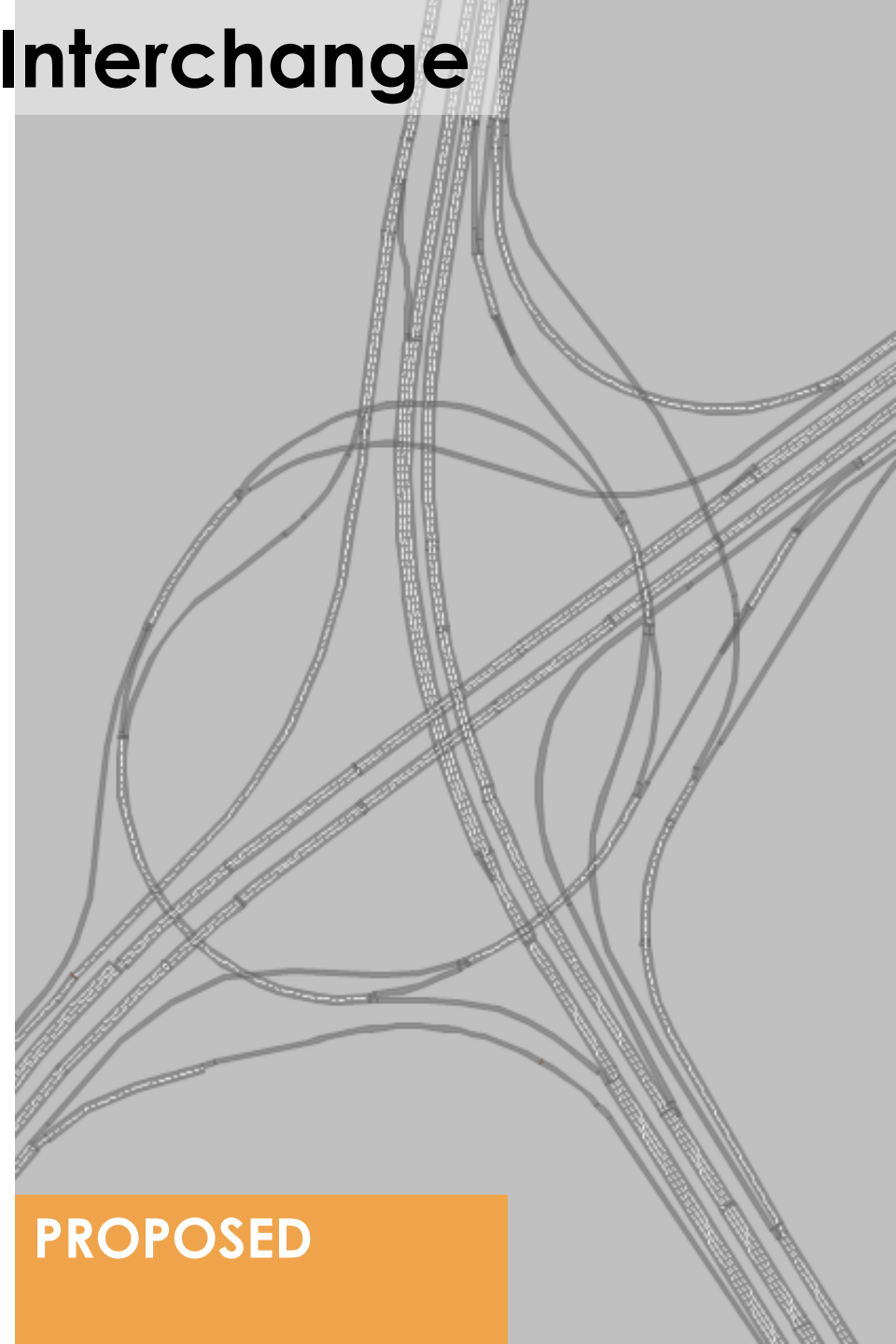 - **Volume adjustments**
- **Evaluate Results**
- **Make Recommendations**

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Improvements

Future Year Build Model

- **PROPOSED OPERATIONAL & CAPACITY IMPROVEMENTS**
  - Widening of I-526 to 6 lanes
  - "Turbo" Interchange at I-26 & I-526
  - Braided ramps
  - Diverging Diamond
  - Compressed Diamond
  - Bowtie Interchange

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I-526 at I-26 Interchange

EXISTING

PROPOSED

Braided Ramps

EXISTING

PROPOSED

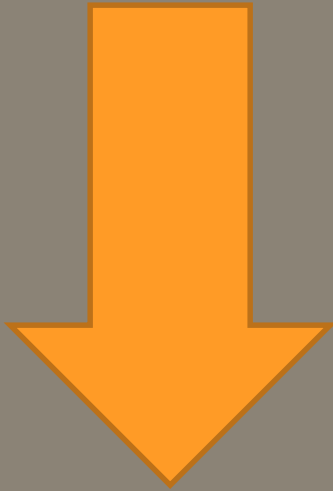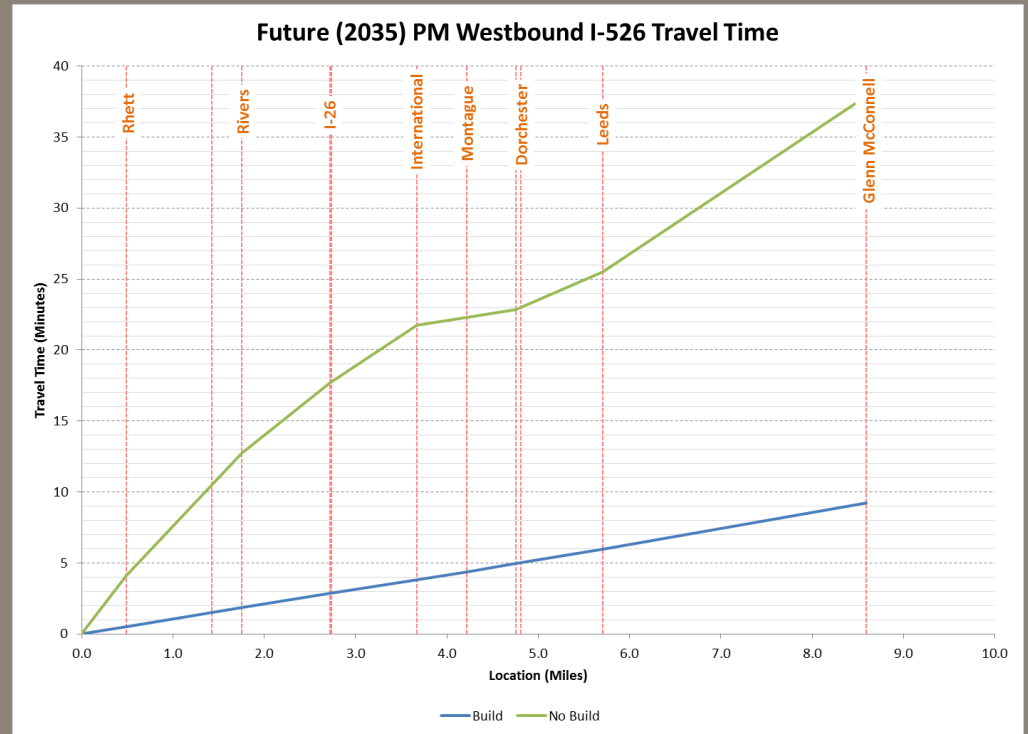# Montague Avenue Interchange

EXISTING

PROPOSED

Leeds Road Interchange

EXISTING

PROPOSED

Future Year Build

Future (2035) PM Westbound I-526 Travel Time

76%

Decrease in travel times

Questions