Regional-Scale Multimodal Evacuation Planning and Analysis

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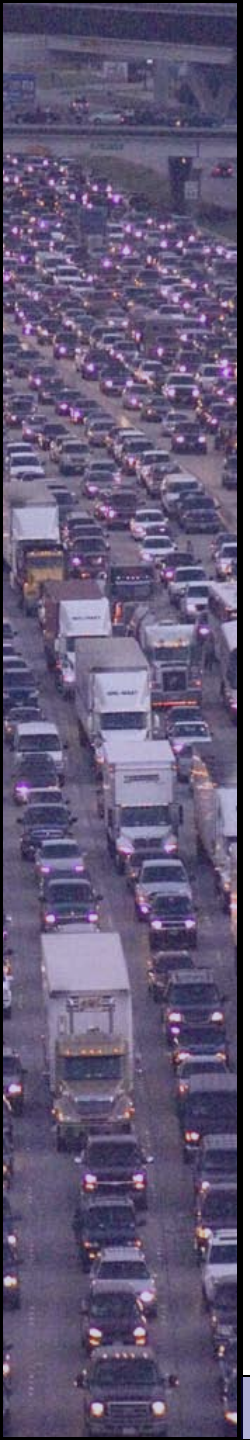
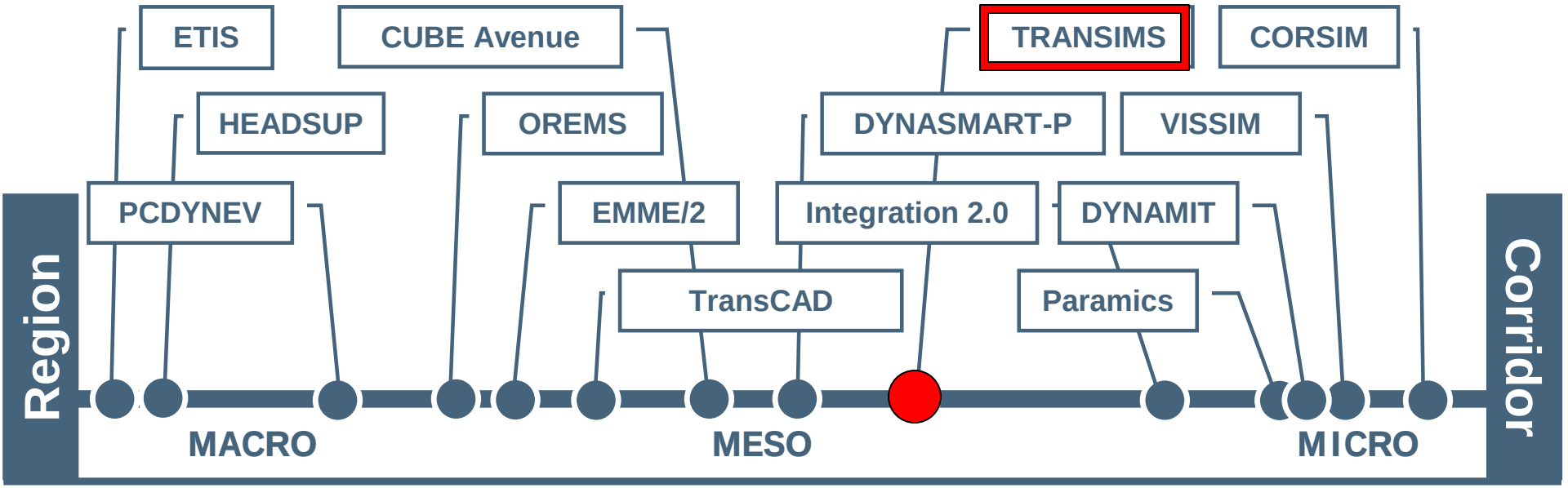
Louisiana State University



Evacuation Traffic Simulation

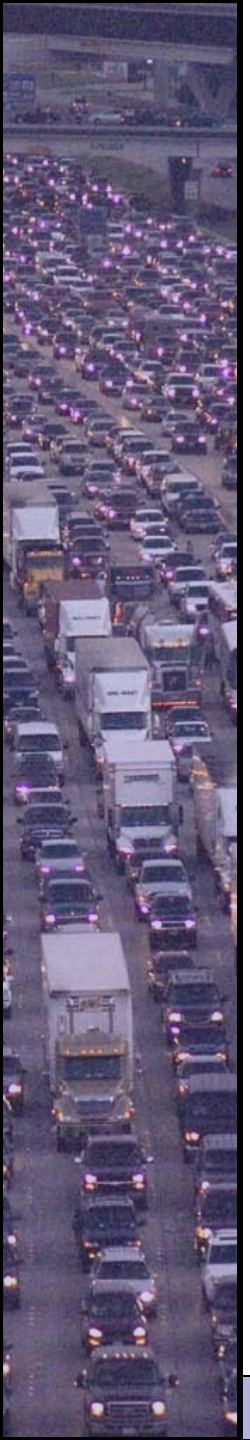
- *Has proven value*
- *Permits bottlenecks to be identified and potential solutions to be analyzed before they become problems*
- *Gives quantitative MOE results to decision-makers*
- *Allows effects of alternative strategies and adverse conditions to be assessed without consequence*

Evacuation Modeling Spectrum



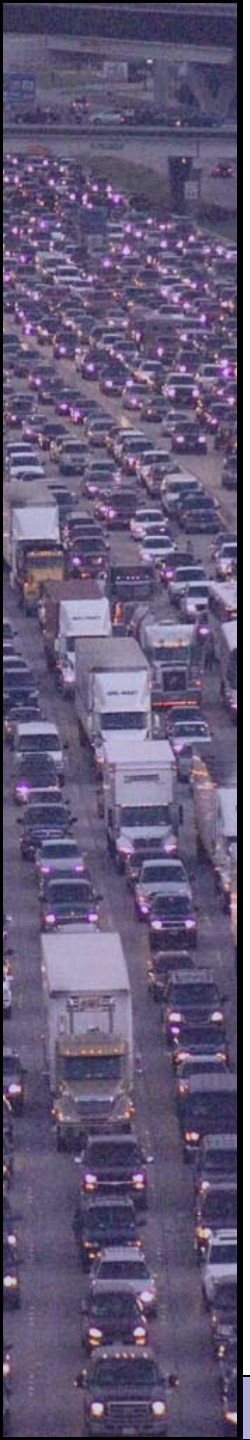
From: "Structuring Modeling and Simulation Analyses for Evacuation Planning and Operations"

By: Hardy, Wunderlich, Bunchand, and Smith



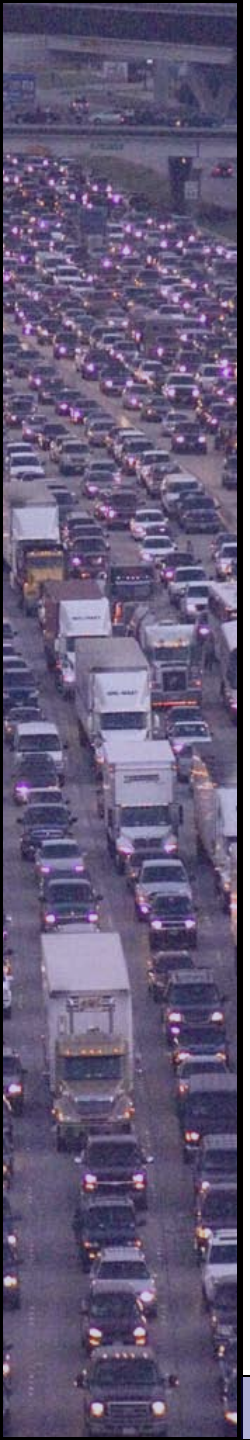
Recognized Limitations

- *Existing traffic/transportation simulation systems are not created to model evacuation conditions*
  - *Scale (e.g., number of vehicles)*
  - *Scope (e.g. duration, geographic area)*
- *Existing models do not permit the modeling and simulation of multiple modes of transportation simultaneously*
- *Most models are not able to give analysts the MOE's they'd like or decision-makers the answers to questions they pose*
- *Limited understanding and development of underlying behaviors of evacuation travel for different evacuee and mode types*



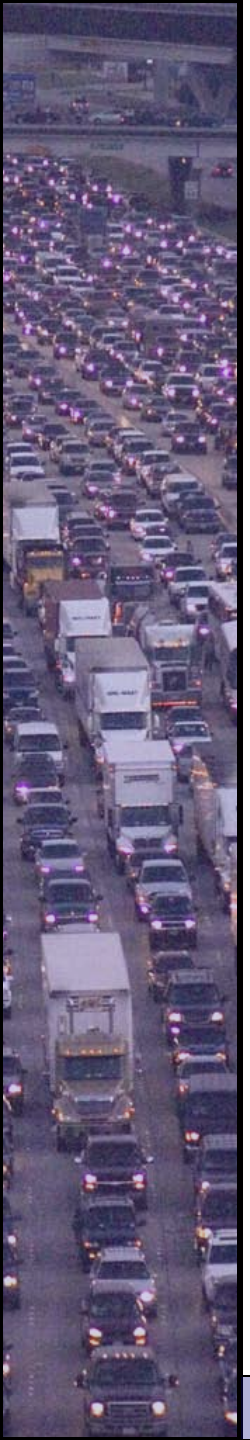
Assisted Evacuations

- *Evacuation planning has historically been targeted at persons with personal vehicles*
- *A substantial percentage of potential vulnerable populations do not have personal vehicles*
- *Plans to evacuate "carless" populations in many locations have been created relatively recently or are currently in development*
- *There have been few actual activations to gain knowledge and experience, nor tests, drills or simulations to evaluate potential weakness and needs*



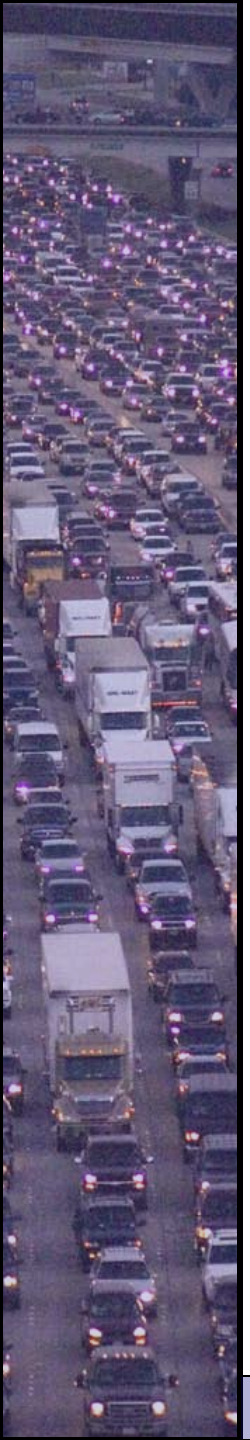
TRANSIMS System

- *Incorporates aspects of planning and operations*
- *Model large geographical regions and large numbers of travelers*
- *Model populations, travel activities, routing, and analyses it with a microsimulator*
- *Open source and available*
- *Effort and expertise required to code and run*
- *Issues of verification, validation, and calibration*
- *Hardware and software requirements*
- *History, experience, and acceptance within the professional transportation community*
- *Not developed for the purpose of evacuation*



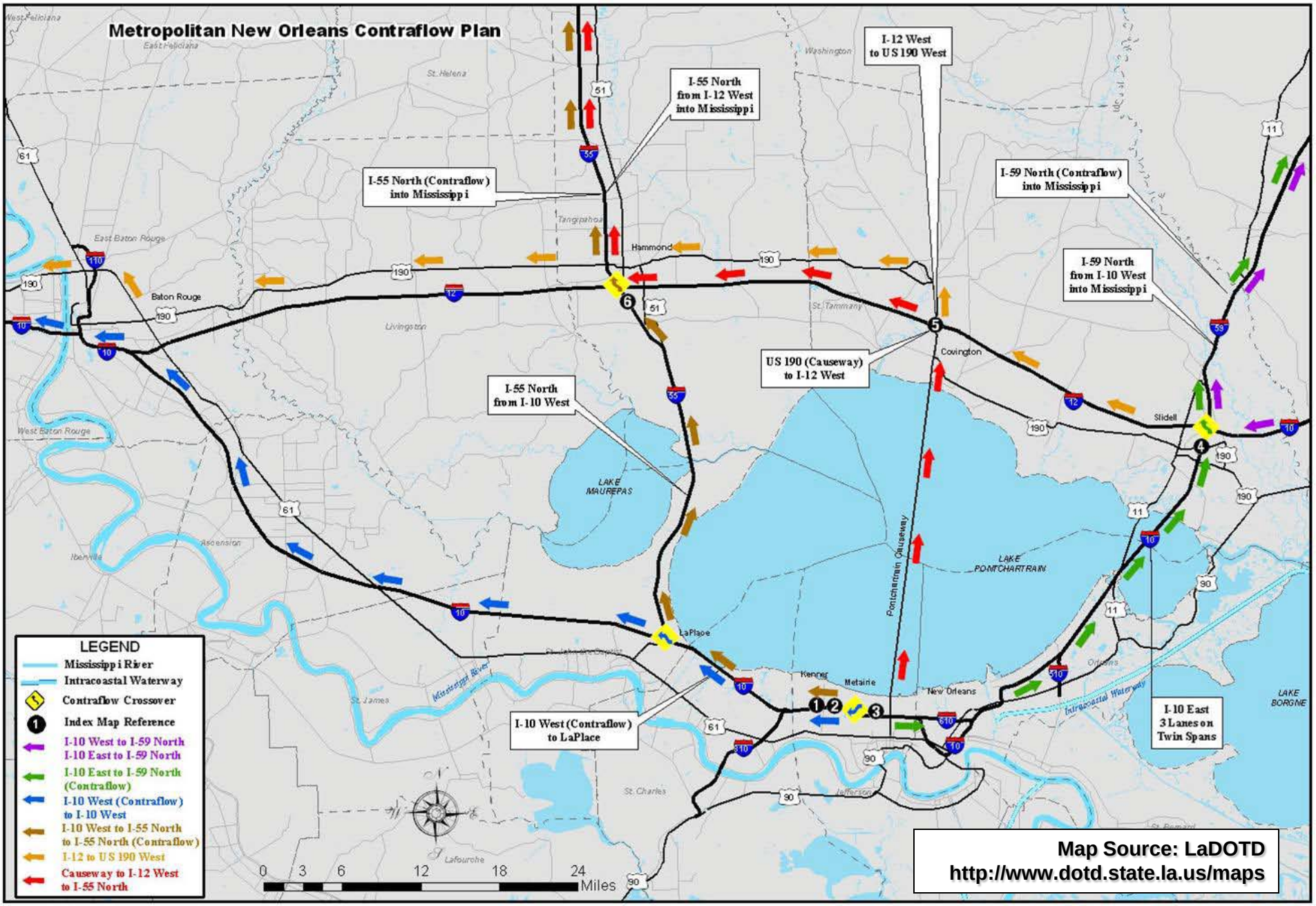
TRANSIMS Structure

- *Network Input*
  - *Structure and characteristics of the transportation network (control, capacity, etc.) and activity locations*
- *Population Synthesizer*
  - *Creates a disaggregate synthetic population based on aggregate census zonal information*
- *Activity Generator*
  - *Travel surveys or observation of past evacuations*
- *Router*
  - *Spatial and temporal travel behavior and route assignments*
- *Microsimulator*
  - *Tracks and compiles movements and statistics of each agent (vehciles & peds)*
- *Visualizer*
  - *3rd party developer Argonne National Labs , Balfour Technologies Inc., etc.*



LSU Study - Approach

- *Step 1 – Network development*
- *Step 2 - "Base Model" validation and calibration based on 2005 Katrina evacuation*
- *Step 3 - Code "New" New Orleans multimodal plan*
- *Step 4 - "Base Model" validation and calibration based on 2005 Katrina evacuation*
- *Step 5 - Code and test alternative plans and ideas in New Orleans and develop Houston models*


Metropolitan New Orleans Contraflow Plan
I-12 West to US 190 West
I-55 North from I-12 West into Mississippi
I-55 North (Contraflow) into Mississippi
I-59 North (Contraflow) into Mississippi
I-59 North from I-10 West into Mississippi
US 190 (Causeway) to I-12 West
I-55 North from I-10 West
I-10 West (Contraflow) to LaPlace
I-10 East 3 Lanes on Twin Spans
Hammond
Baton Rouge
Covington
Slidell
LaPlace
Kenner
Metairie
New Orleans
LAKE MAUREPAS
LAKE PONTCHARTRAIN
Pontchartrain Causeway
Intracoastal Waterway
LEGEND
Mississippi River
Intracoastal Waterway
Contraflow Crossover
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I-10 West to I-59 North
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I-12 to US 190 West
Causeway to I-12 West to I-55 North
0 3 6 12 18 24 Miles
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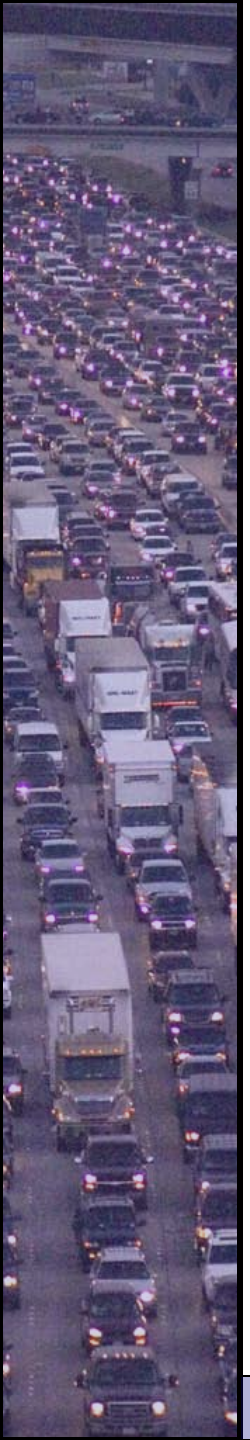
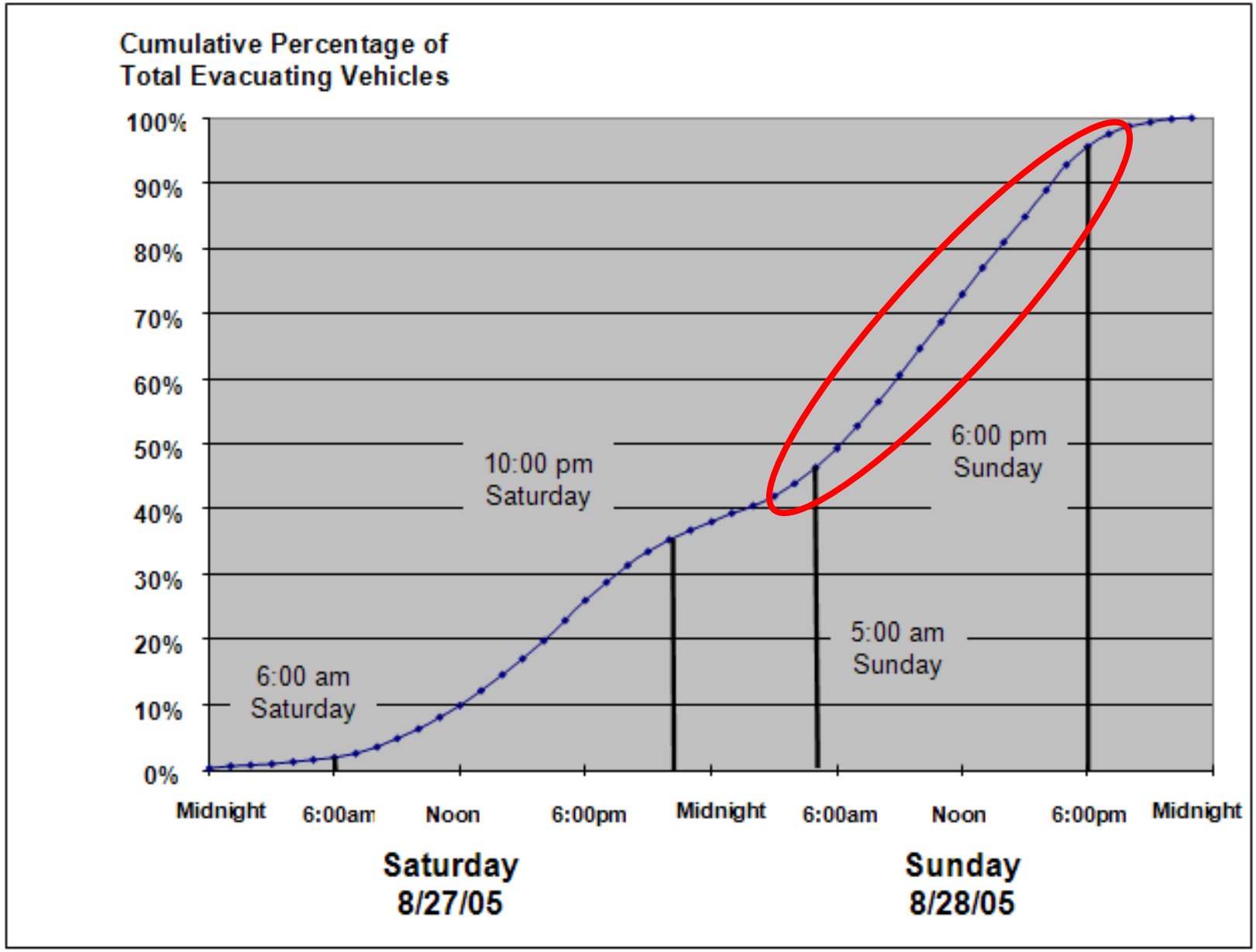
http://www.dotd.state.la.us/maps




Cumulative Percentage of
Total Evacuating Vehicles
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
6:00 am
Saturday
10:00 pm
Saturday
5:00 am
Sunday
6:00 pm
Sunday
Midnight
6:00am
Noon
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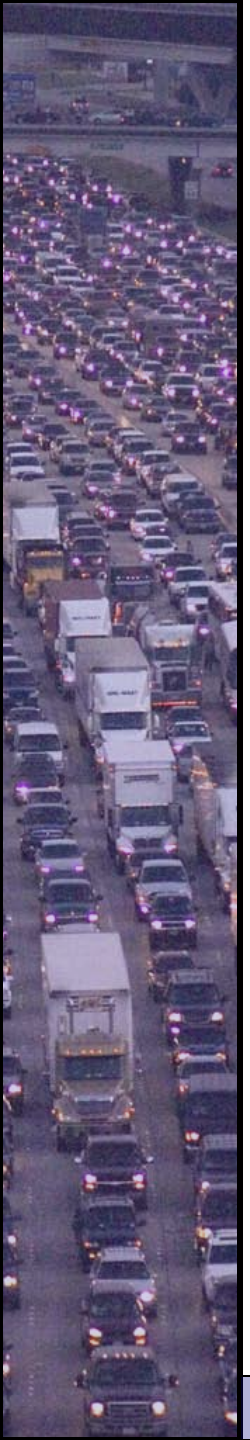
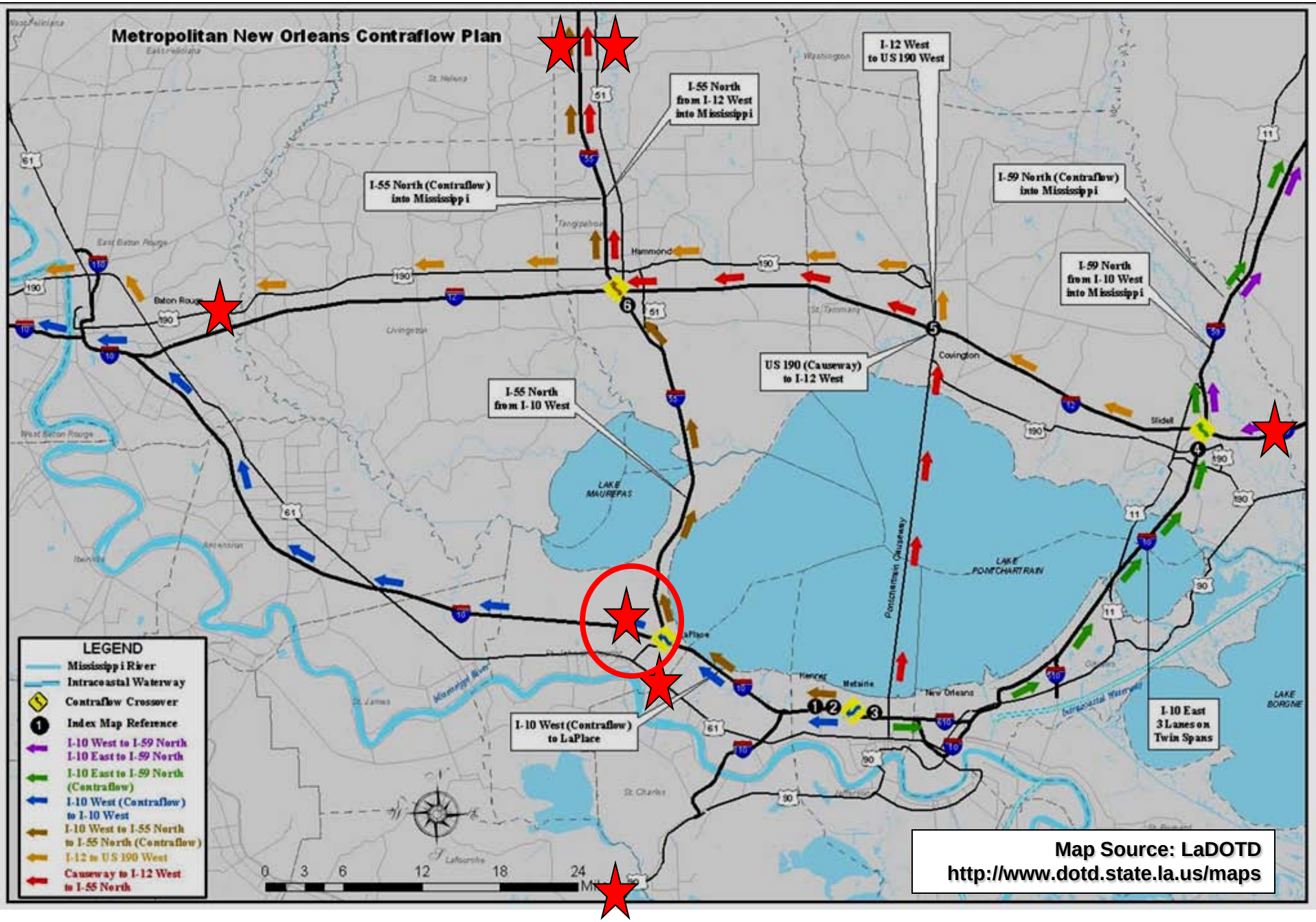
Saturday
8/27/05
Sunday
8/28/05



Study Questions

- ***Proof-of-Concept - Can TRANSIMS be used for evacuation analysis? Are its results reasonable?***
- ***Develop a variety and range of hazard-response scenarios***
- ***How many buses might be needed under various scenarios? What routes should they take?***
- ***Potential to estimate the number of location of evacuees***
- ***Examine the potential of alternate plans***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US 190 (Causeway) to I-12 West
I-55 North from I-10 West
I-10 West (Contraflow) to LaPlace
I-10 East 3 Lanes on Twin Spans
LAKE MAUREPAS
LAKE PONTCHARTRAIN
Pontchartrain Causeway
Intracoastal Waterway
LEGEND
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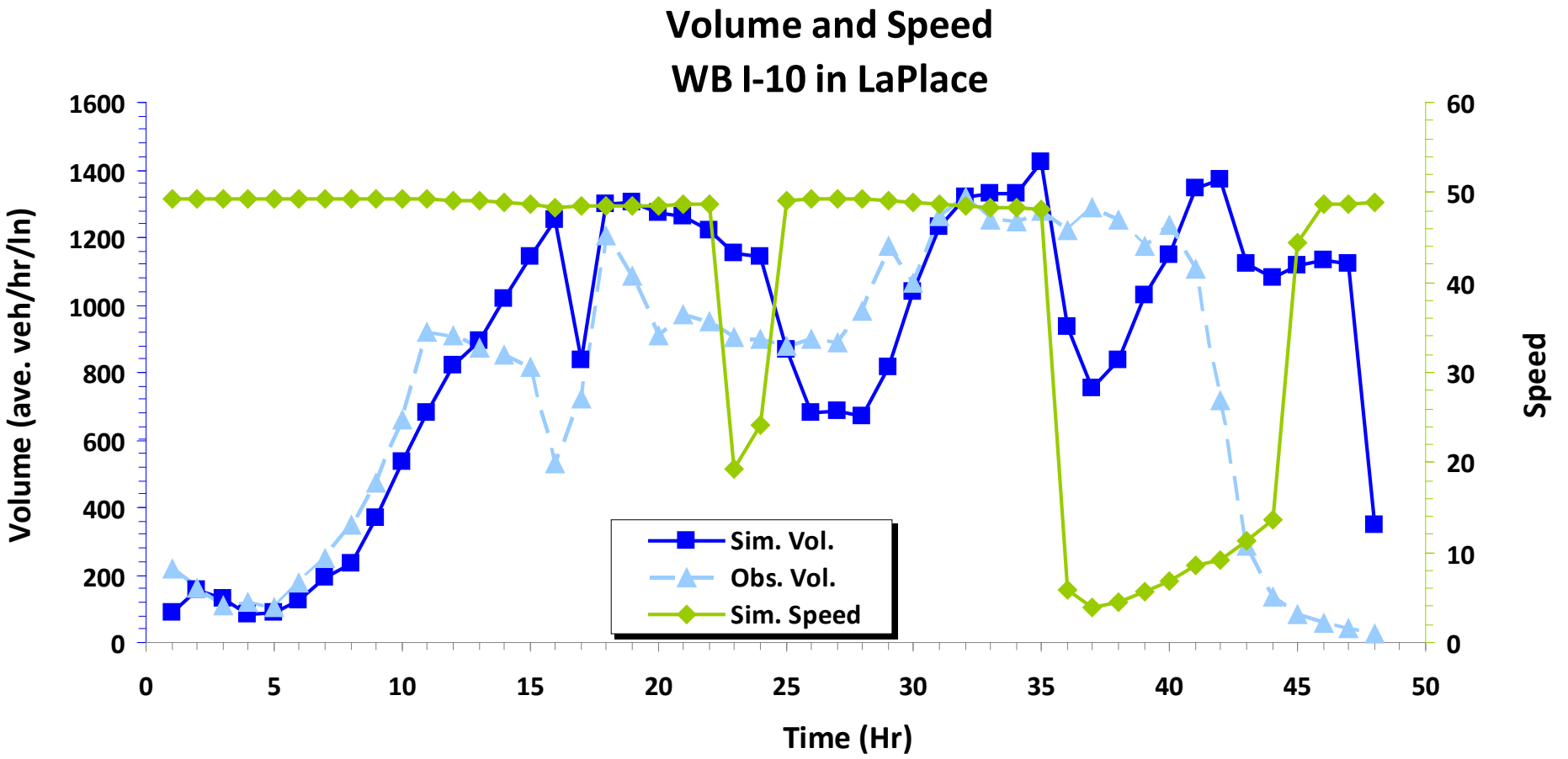
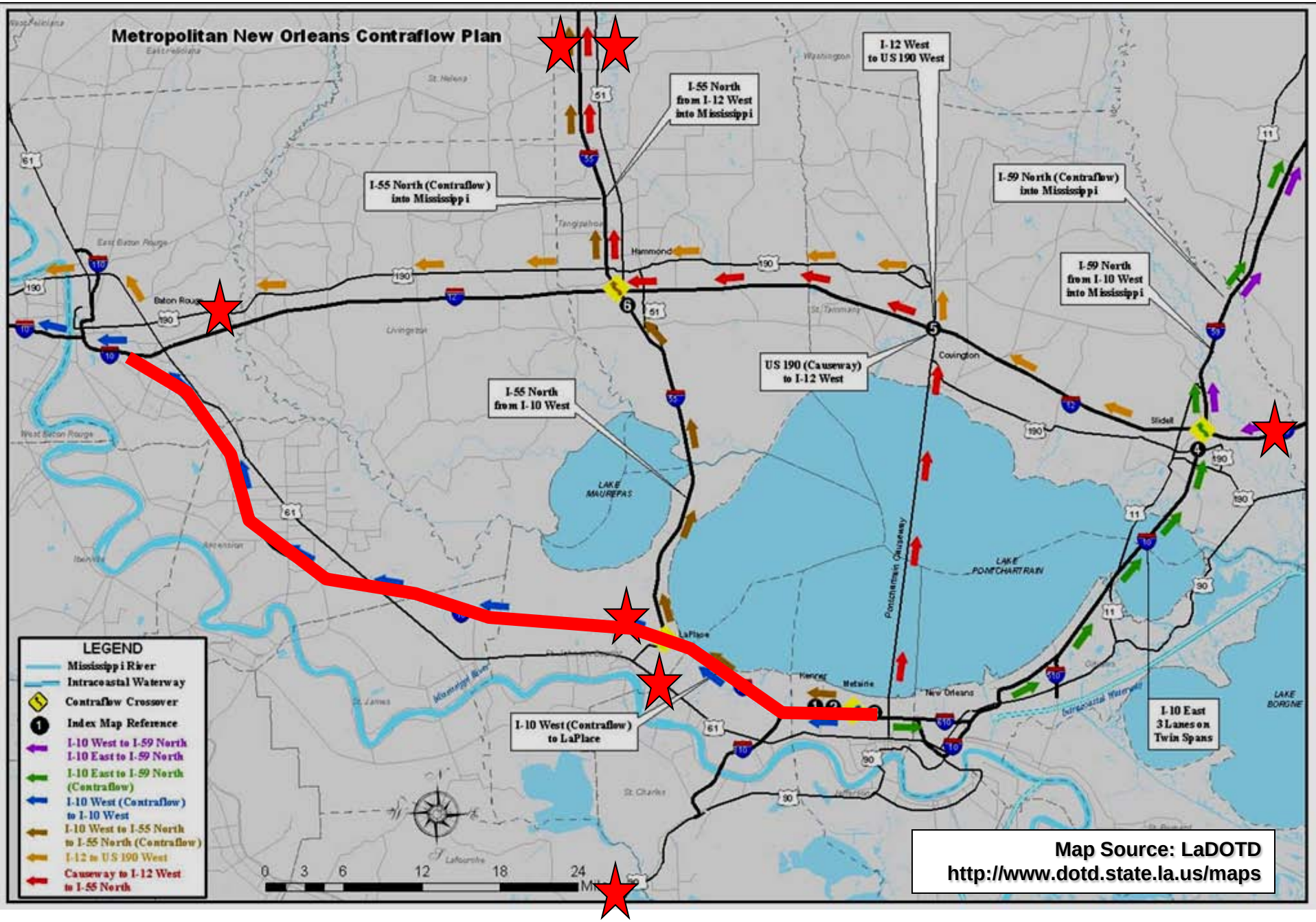


Network Link 58296 (DOTD Station 54 --2 miles W of US 51/I-55 Jct)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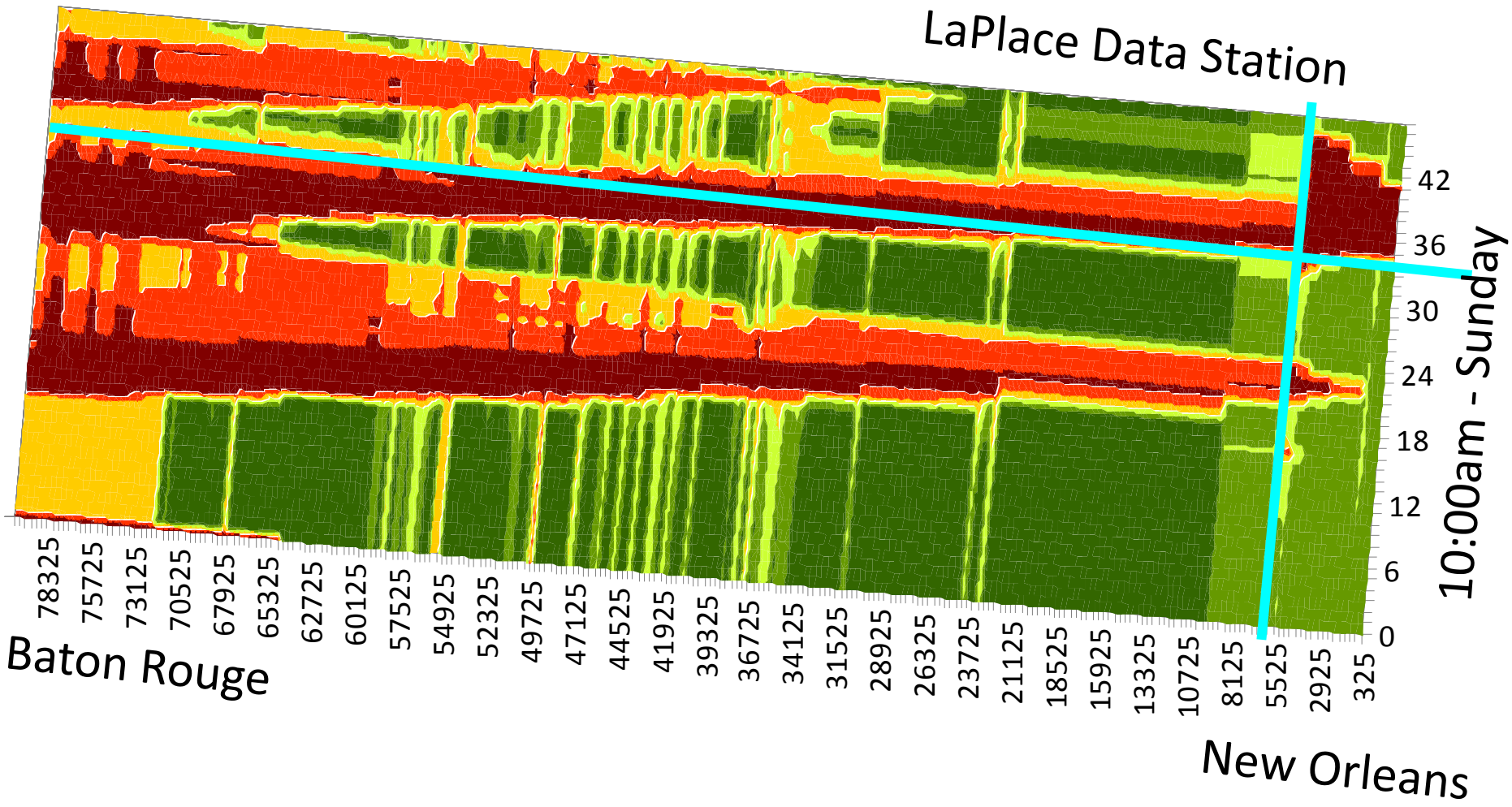
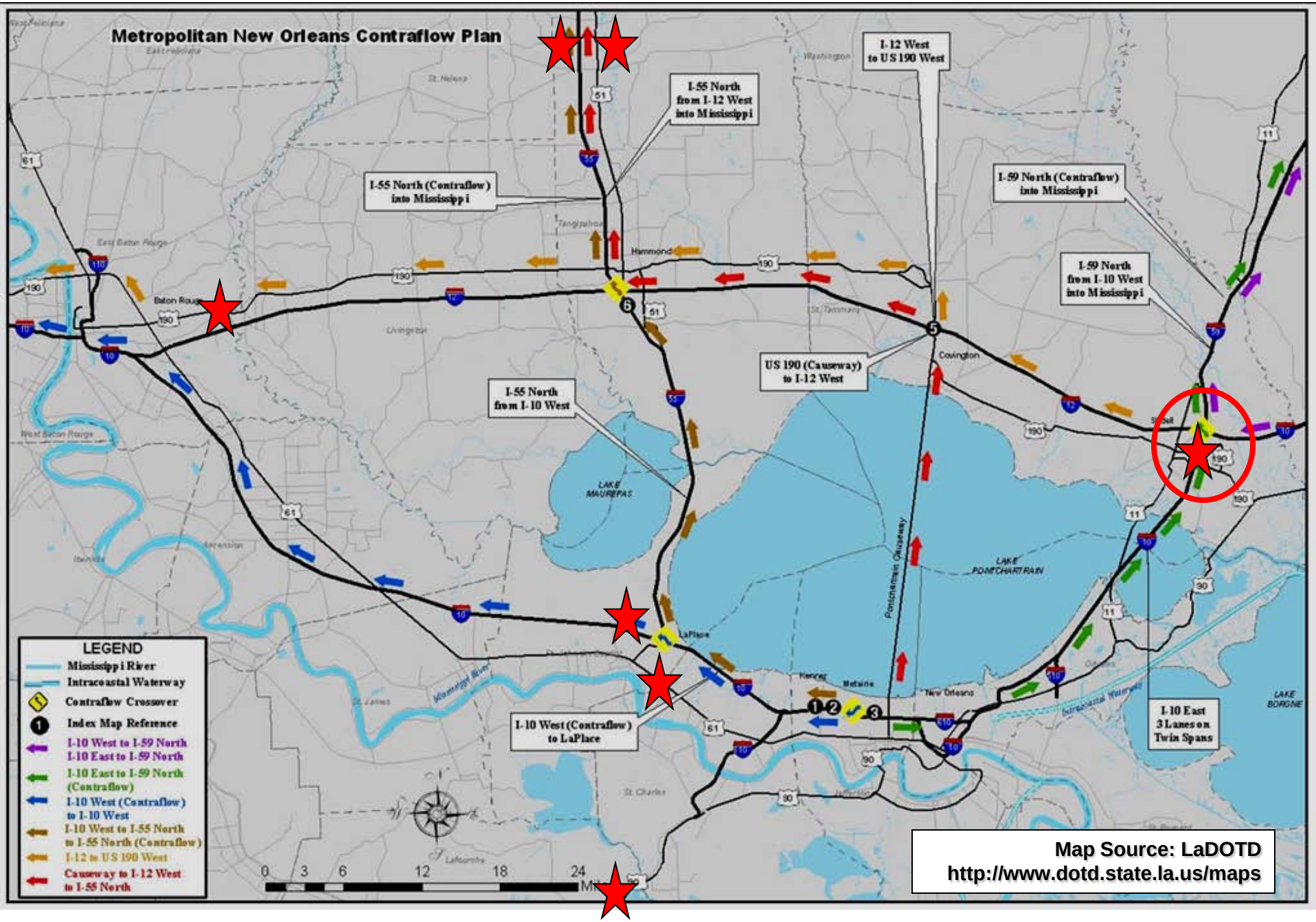


Westbound I-10 Traffic Speed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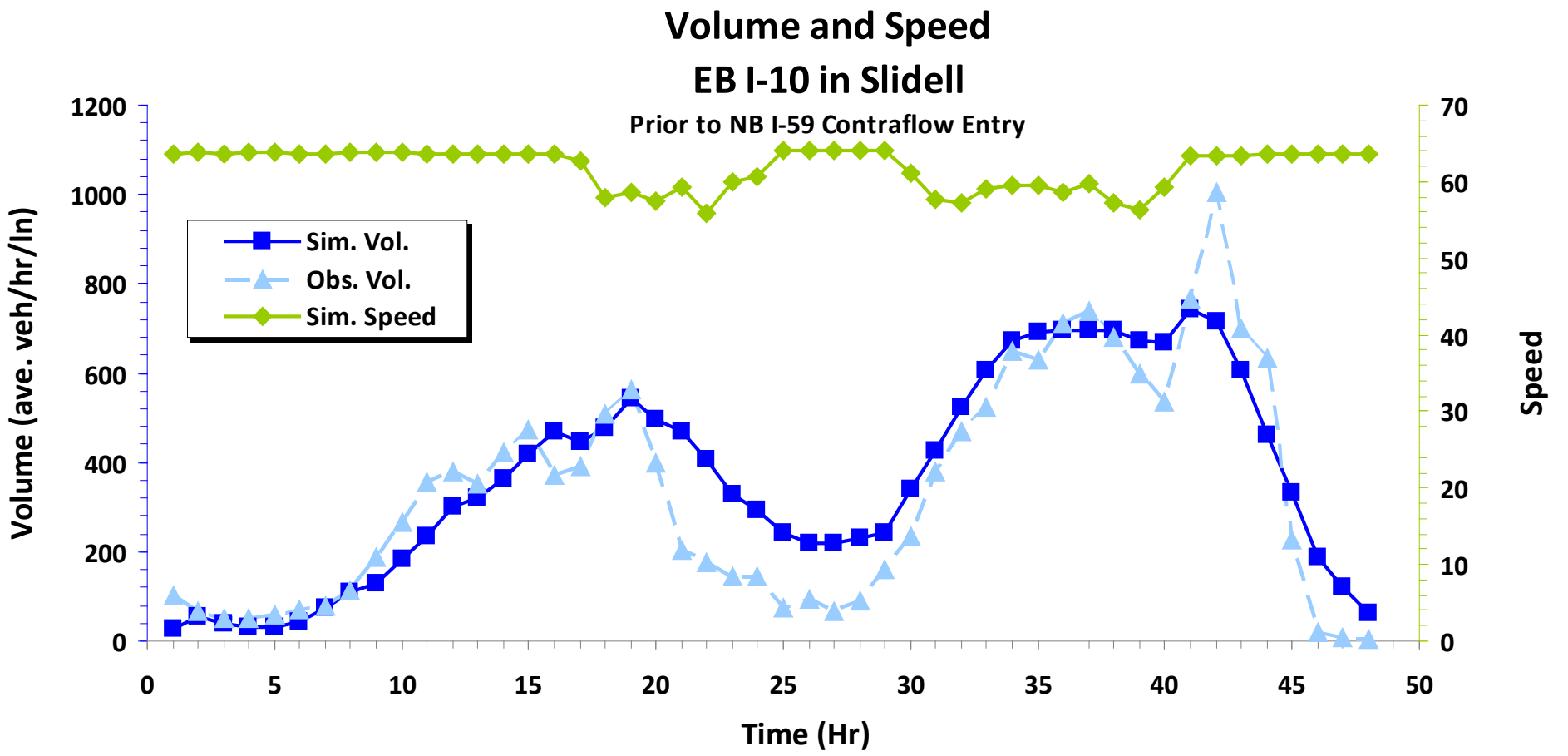
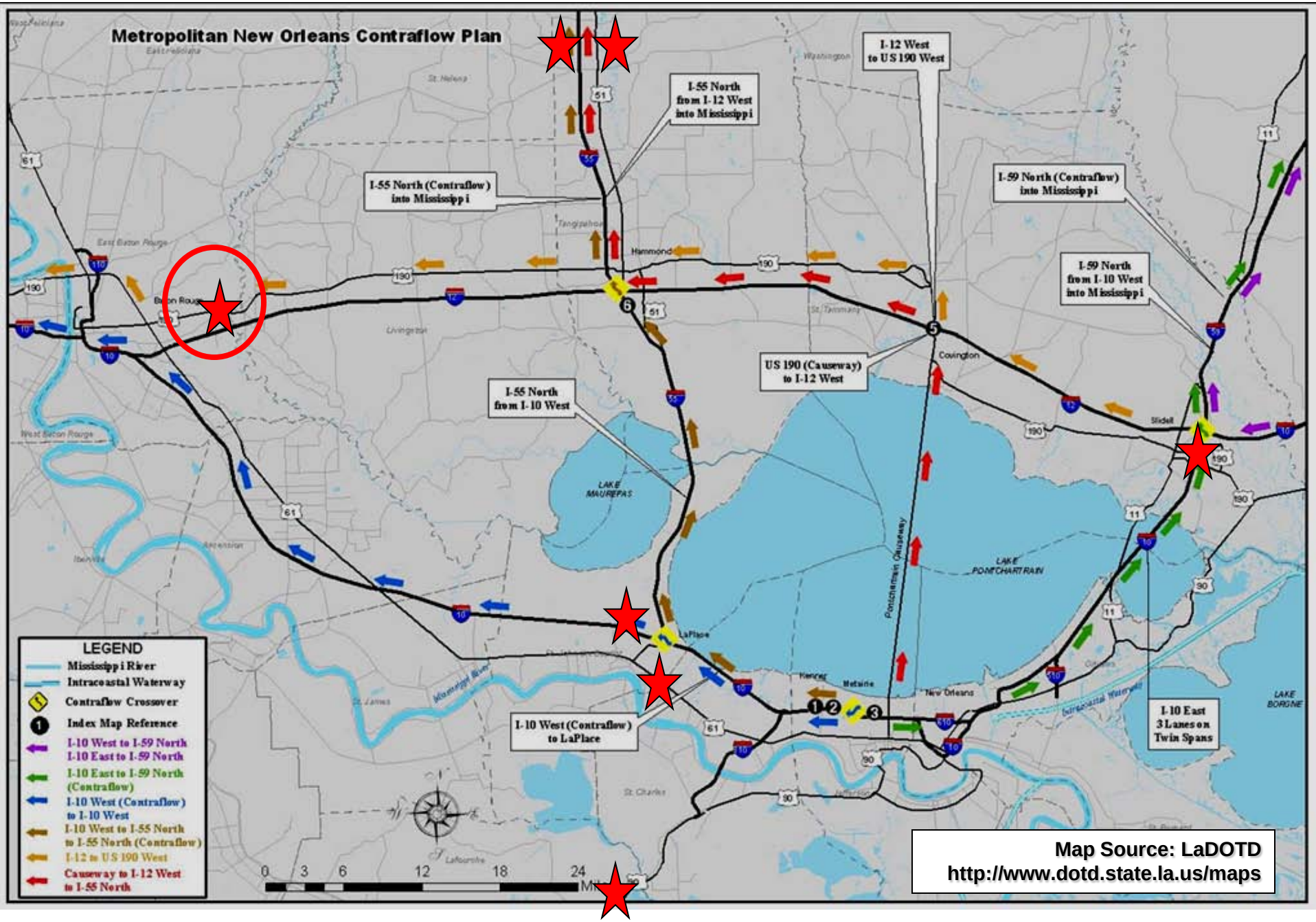


Network Link 56039 (Near DOTD Station 67 -- 1 mile S of I-12 , I-59 Jct)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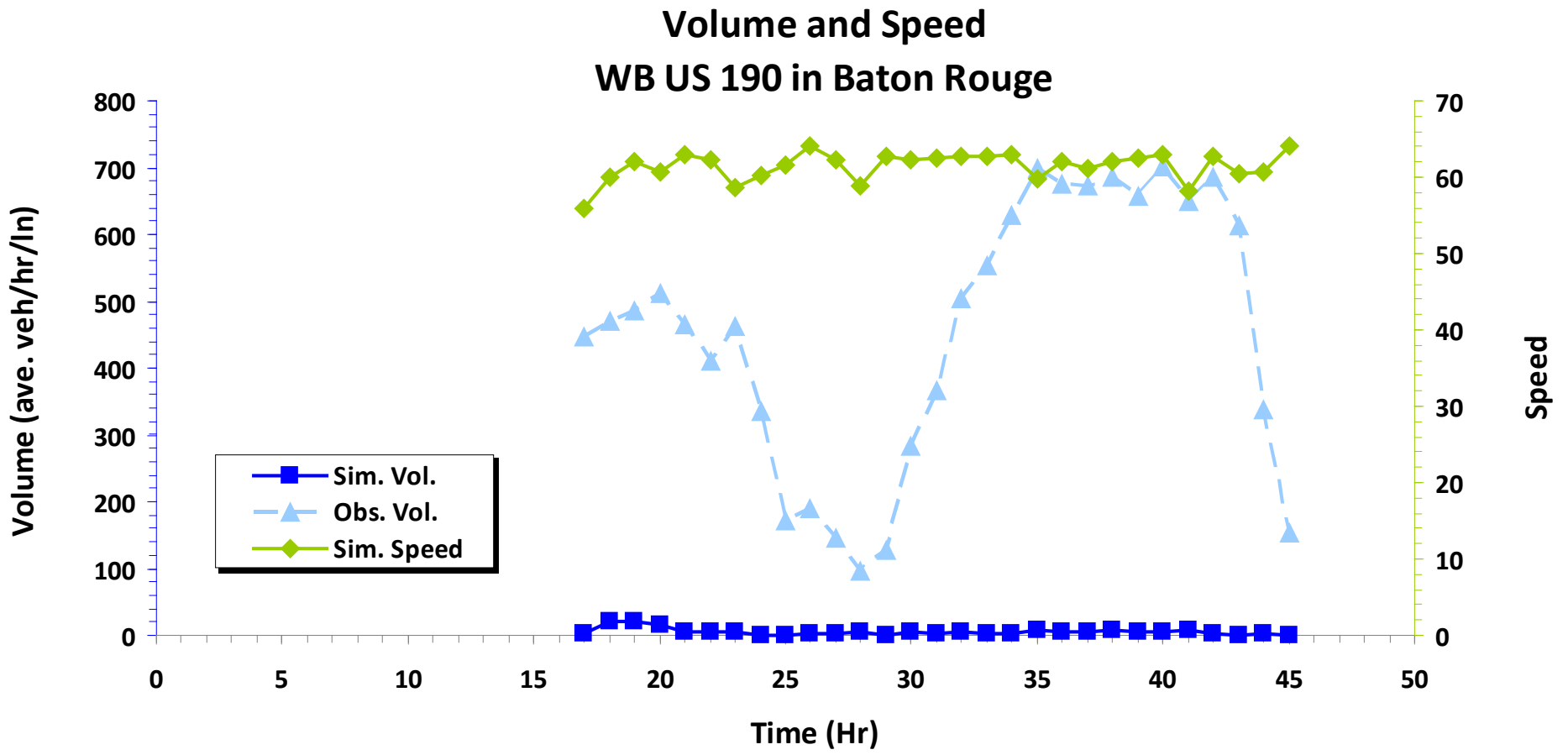
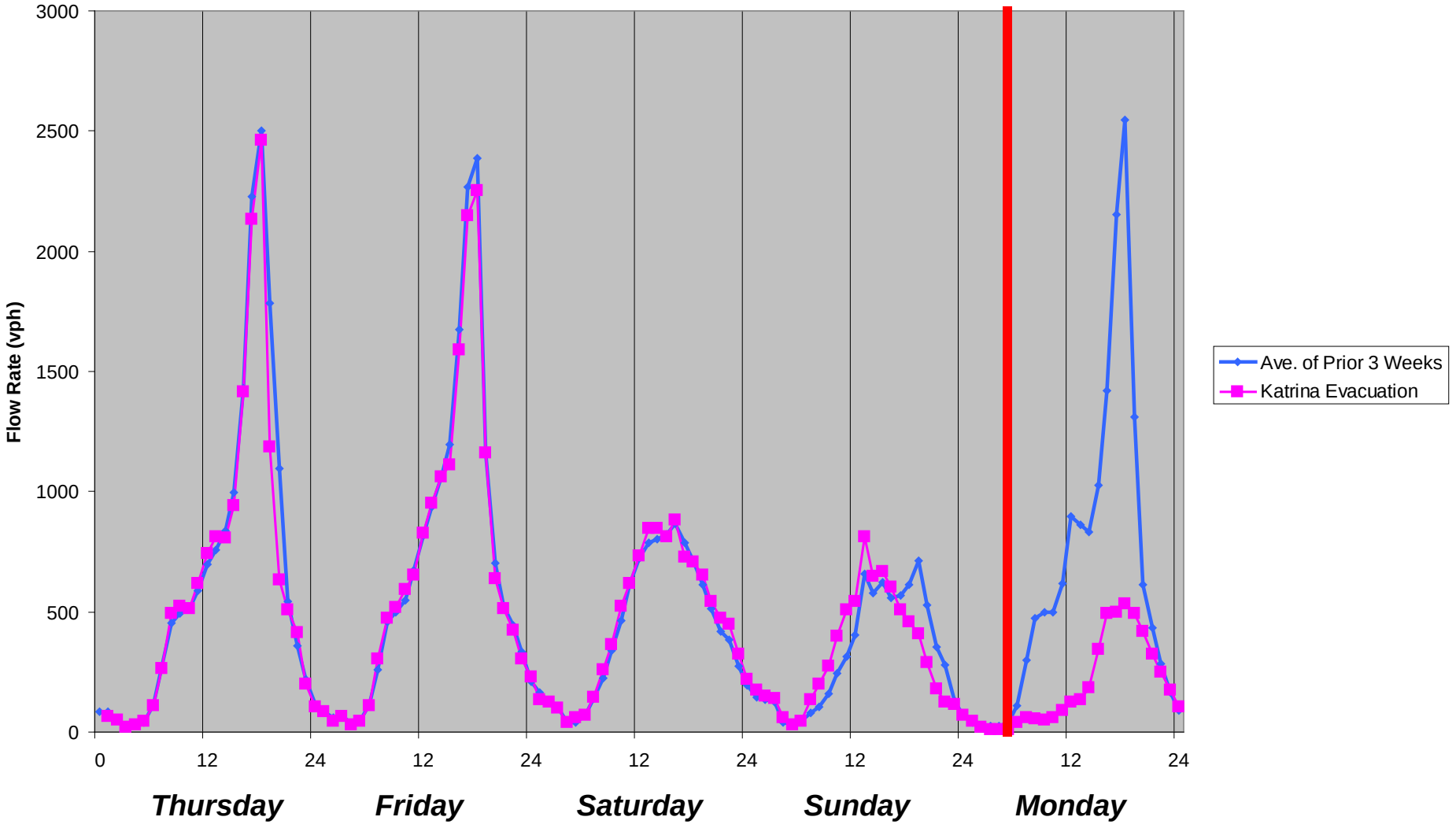
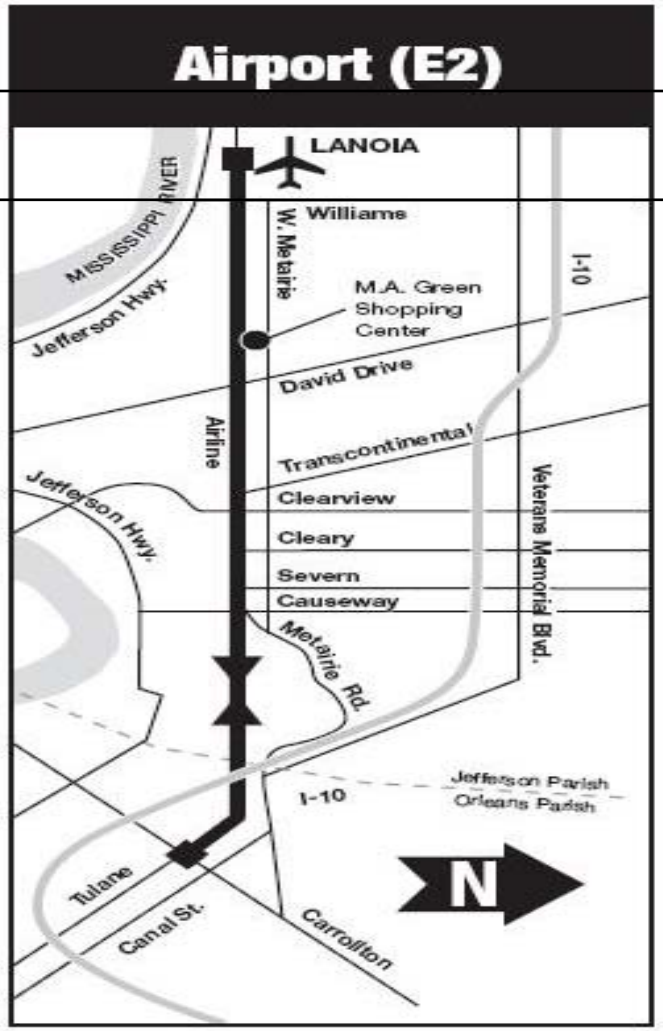


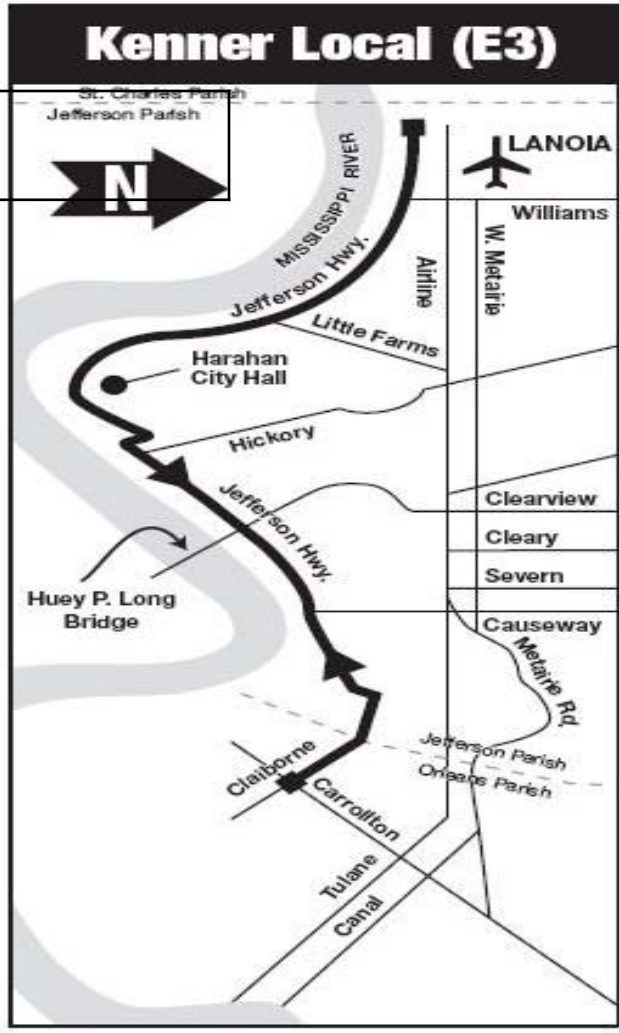
Network Link 57784 (DOTD Station 18 -- 1.1 miles E of O'Neal Ln Jct)

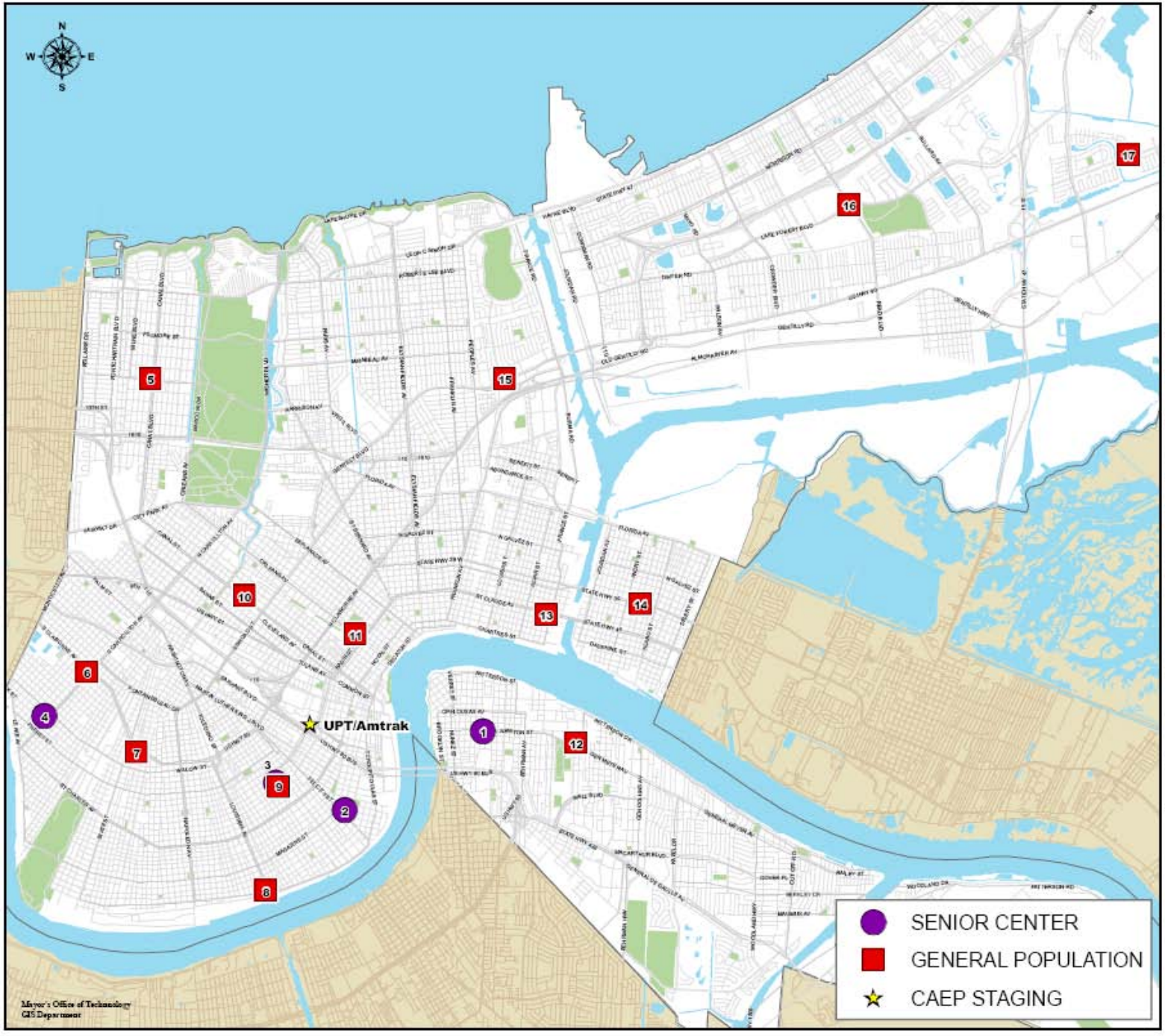
US 190 WESTBOUND
Denham Springs@Amite River Bridge



Jefferson Parish Bus Routes







Evacuation Pick-Up Locations

SENIOR CENTER LOCATIONS

1. Arthur Mondy Center
1111 Newton Avenue, Algiers

2. Kingsley House
1600 Constance Street,
Lower Garden District

3. Central City Senior Center
2020 Philip Street, Central City

4. Mater Dolorosa
1226 S. Carrollton Ave, Carrollton

GENERAL POPULATION

5. Smith Library Bus Stop
6300 Canal Blvd., Lakeview

6. Palmer Park
S. Claiborne and S. Carrollton,
West Carrollton

7. McMain High School
5712 S. Claiborne Ave, Broadmoor

8. Lyons Community Center
624 Louisiana Ave, Irish Channel

9. Dryades YMCA
1924 Philip Street, Central City

10. Warren Easton High School
3019 Canal Street, Treme

11. Municipal Auditorium
801 N. Rampart, 7th Ward

12. O. Perry Walker High School
2832 General Meyer, Algiers

13. Stallings Community Center
4300 St. Claude, Bywater

14. Sanchez Center
Caffin & N. Claiborne, Lower 9th Ward

15. Gentilly Mall Parking Lot
Chef Menteur & Press Dr., Gentilly

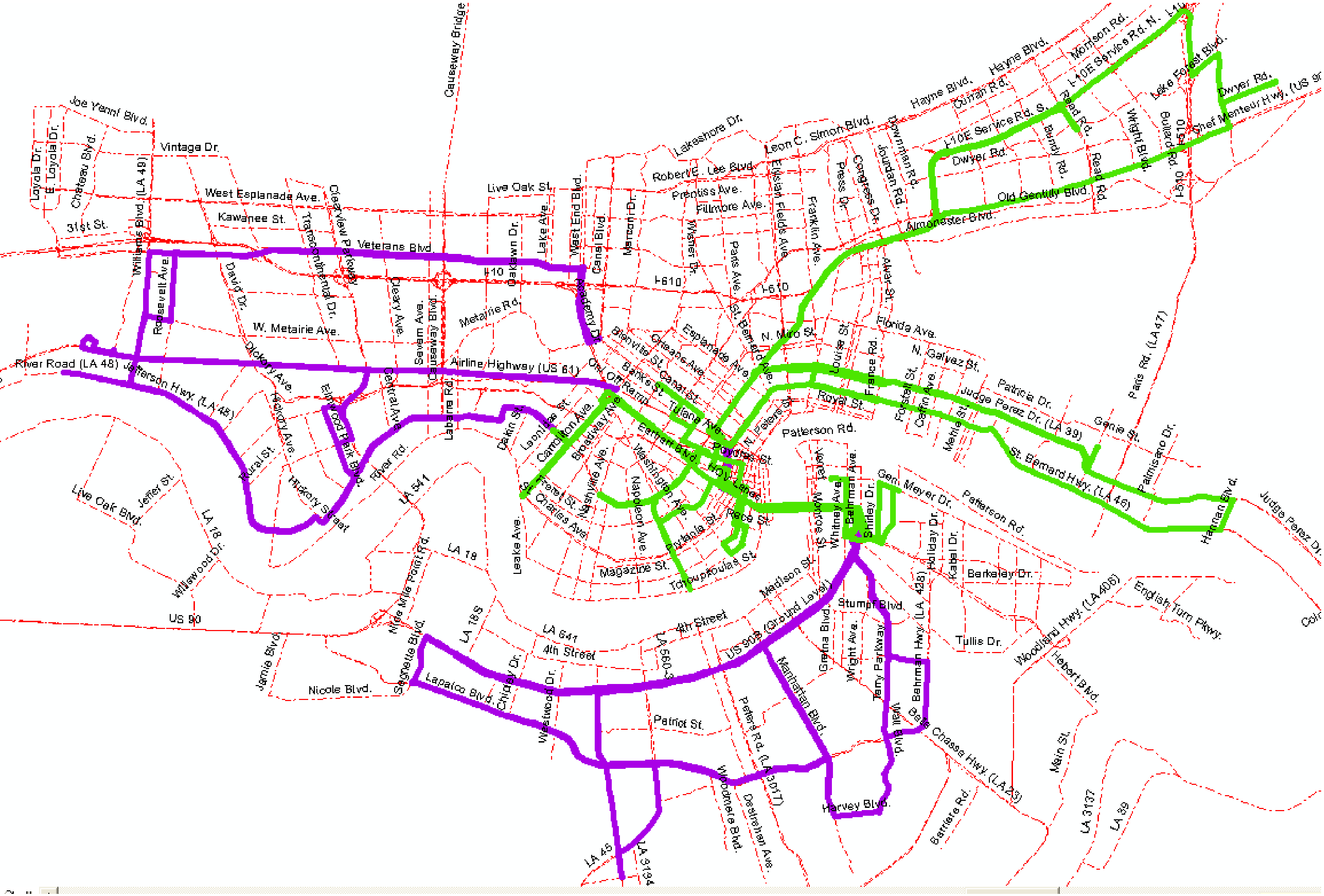
16. Walgreen's
Lake Forest & Read Blvd, NO East

17. Mary Queen of Vietnam
14001 Dwyer, New Orleans East

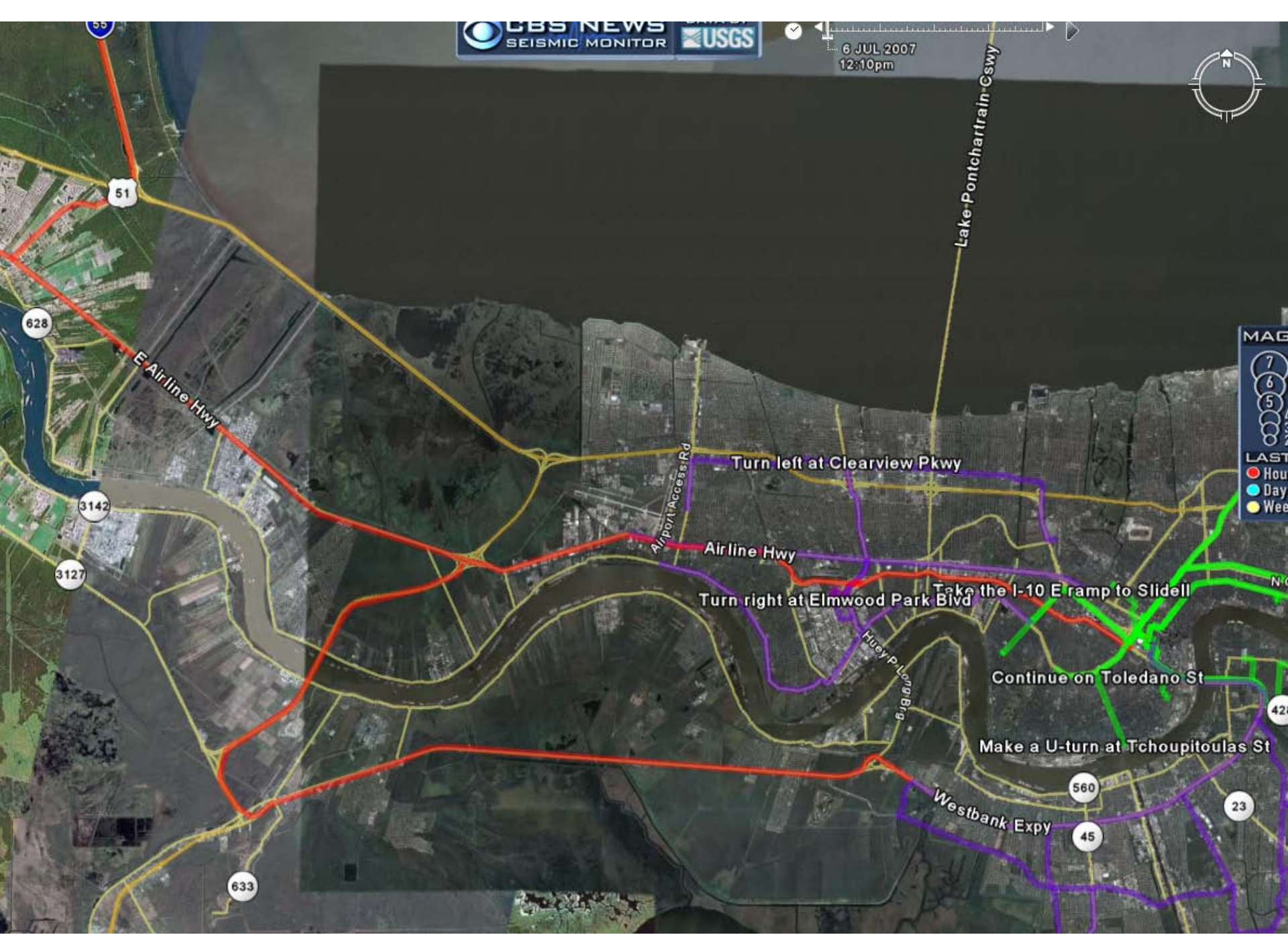
CITY OF NEW ORLEANS

City Assisted Evacuation Plan

0 0.45 0.9 1.8 Miles



Causeway Bridge
Joe Yenni Blvd.
Loyola Dr.
E. Loyola Dr.
Chateau Blvd.
Vintage Dr.
Williams Blvd. (LA 49)
West Esplanade Ave.
Kawanee St.
31st St.
Clearview Parkway
Transcontinental Dr.
Veterans Blvd.
Live Oak St.
Oakdown Dr.
Lake Ave.
West End Blvd.
Canal Blvd.
Marconi Dr.
Lakeshore Dr.
Robert E. Lee Blvd.
Prentiss Ave.
Fillmore Ave.
Leon C. Simon Blvd.
Elysian Fields Ave.
Franklin Ave.
Press Dr.
Congress Dr.
Downman Rd.
Jourdan Rd.
Hayne Blvd.
Curran Rd.
Morrison Rd.
I-10E Service Rd. N.
I-10E Service Rd. S.
Lake Forest Blvd.
Dwyer Rd.
Chef Menteur Hwy. (US 90)
Read Rd.
Bundy Rd.
Wright Blvd.
Bullard Rd.
I-510
Old Gentilly Blvd.
Almonaster Blvd.
Roosevelt Ave.
David Dr.
I-10
I-610
Cleary Ave.
Severn Ave.
Causeway Blvd.
Metairie Rd.
W. Metairie Ave.
Pontchartrain Expwy.
Airline Highway (US 61)
River Road (LA 48)
Jefferson Hwy. (LA 48)
Dickory Ave.
Central Ave.
Elmwood Park Blvd.
Labarre Rd.
Bienville St.
Orleans Ave.
Esplanade Ave.
St. Bernard Ave.
N. Miro St.
Paris Ave.
Alvar St.
Louisa St.
France Rd.
Florida Ave.
N. Galvez St.
Forstall St.
Caffin Ave.
Patricia Dr.
Judge Perez Dr. (LA 39)
Genie St.
Paris Rd. (LA 47)
Palmisano Dr.
St. Bernard Hwy. (LA 46)
Hannan Blvd.
Judge Perez Dr.
Banks St.
Canal St.
Tulane Ave.
Off Ramp
Royal St.
Poydras St.
St. Peters St.
Patterson Rd.
Earhart Blvd.
HOV Lanes
Washington Ave.
Carrollton Ave.
Broadway Ave.
Leonidas St.
Oakin St.
Hickory Ave.
Rural St.
Hickory St.
River Rd.
LA 541
Live Oak Blvd.
Jefferson St.
LA 18
Willswood Dr.
US 90
Nine Mile Point Rd.
Leake Ave.
Freret St.
St. Charles Ave.
Nashville Ave.
Napoleon Ave.
Prytania St.
Magazine St.
Tchoupitoulas St.
Reco St.
Verret St.
Whitney Ave.
Monroe St.
Behrman Ave.
Shirley Dr.
Gen. Meyer Dr.
Patterson Rd.
Holiday Dr.
Kabel Dr.
Berkeley Dr.
Madison St.
Stumpf Blvd.
Gretna Blvd.
Wright Ave.
Terry Parkway
Behrman Hwy. (LA 428)
Tullis Dr.
Woodland Hwy. (LA 406)
English Turn Pkwy.
Hebert Blvd.
4th Street
US 90B (Ground Level)
LA 641
LA 18S
Segnette Blvd.
Jamie Blvd.
Nicole Blvd.
Lapalco Blvd.
Chidsey Dr.
Westwood Dr.
LA 560-3
Patriot St.
Manhattan Blvd.
Peters Rd. (LA 3017)
Woodmere Blvd.
Destrehan Ave.
Harvey Blvd.
Wall Blvd.
Belle Chasse Hwy. (LA 23)
Barriere Rd.
Main St.
LA 3137
LA 39
LA 45
LA 3134


CBS NEWS
SEISMIC MONITOR
USGS
6 JUL 2007
12:10pm
Lake Pontchartrain Cswy
E Airline Hwy
Airport Access Rd
Turn left at Clearview Pkwy
Airline Hwy
Turn right at Elmwood Park Blvd
Take the I-10 E ramp to Slidell
Huey P Long Brg
Continue on Toledano St
Make a U-turn at Tchoupitoulas St
Westbank Expy
51
628
3142
3127
633
560
45
23

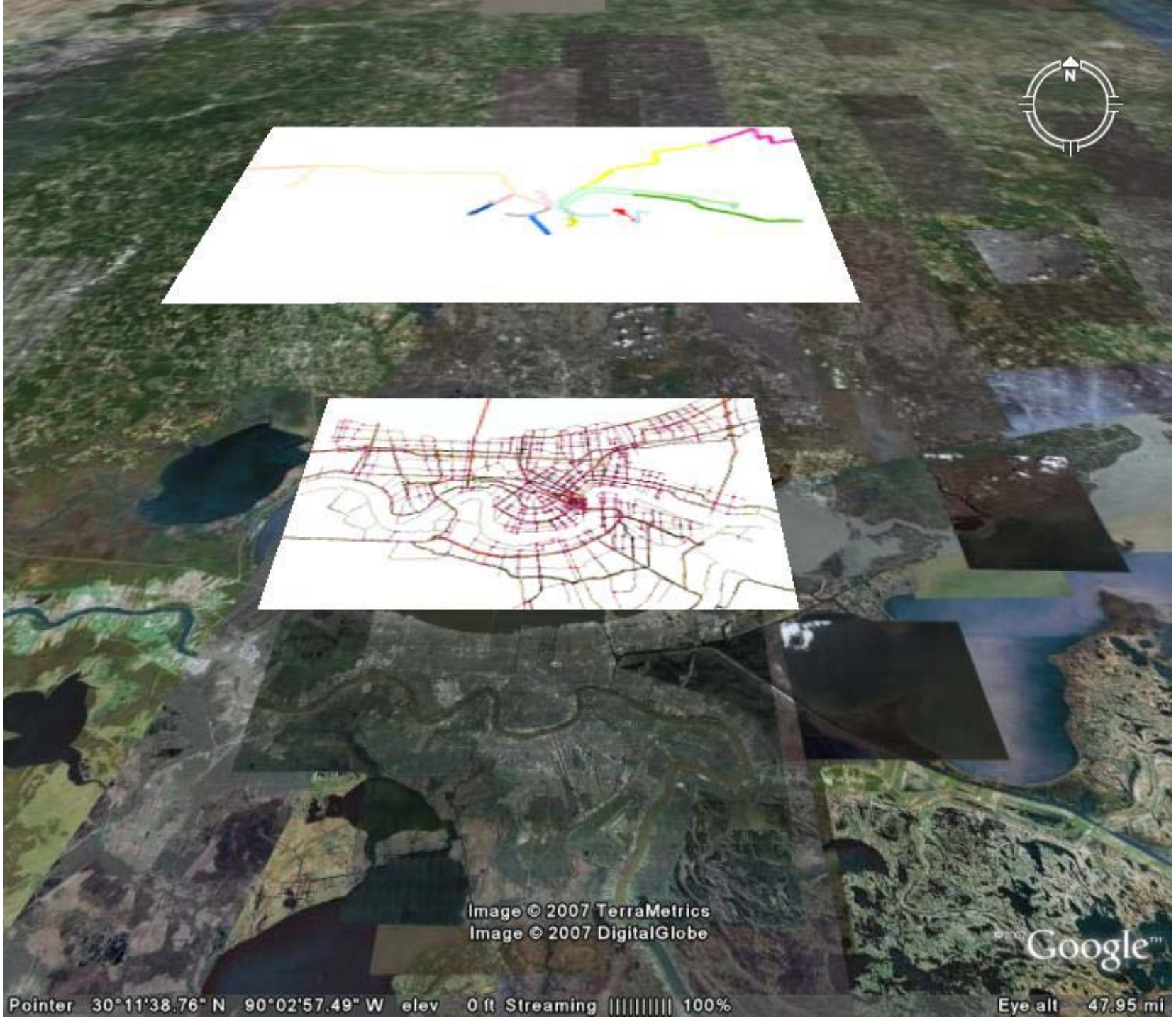

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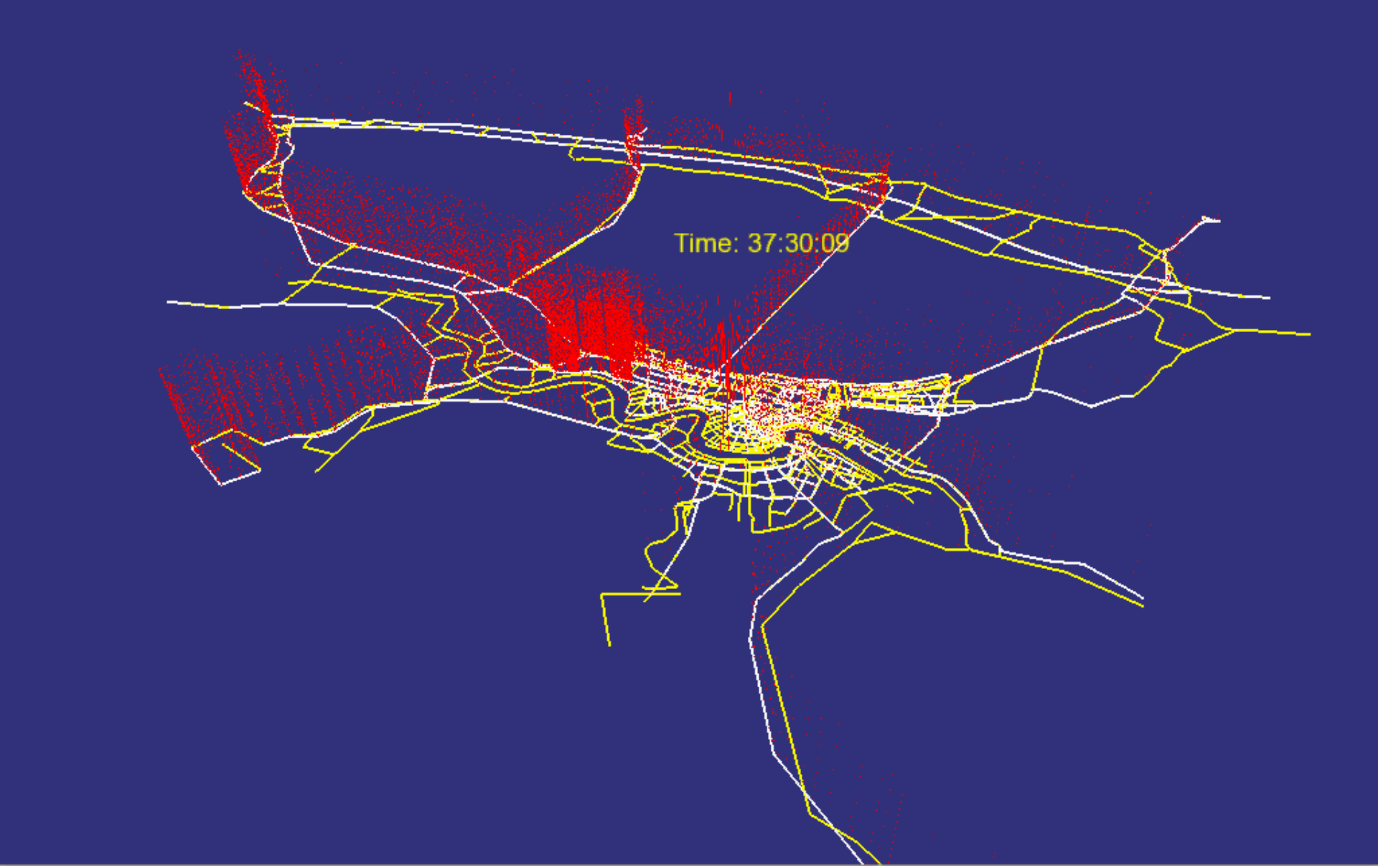
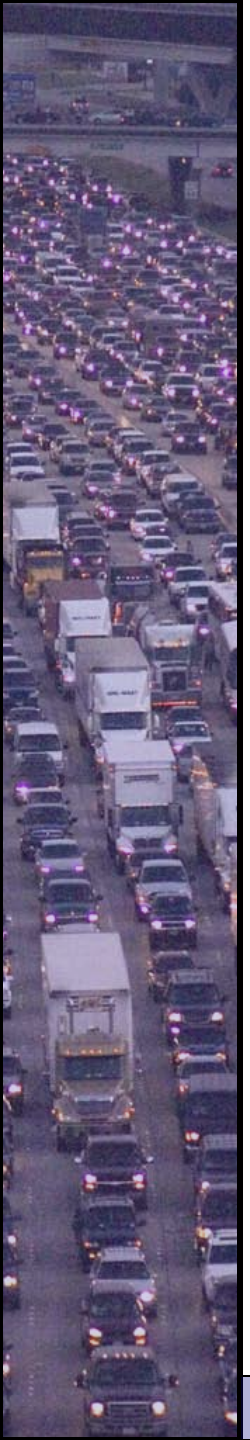
Image © 2007 TerraMetrics
Image © 2007 DigitalGlobe
Google™
Pointer 30°11'38.76" N 90°02'57.49" W elev 0 ft Streaming 100%
Eye alt 47.95 mi

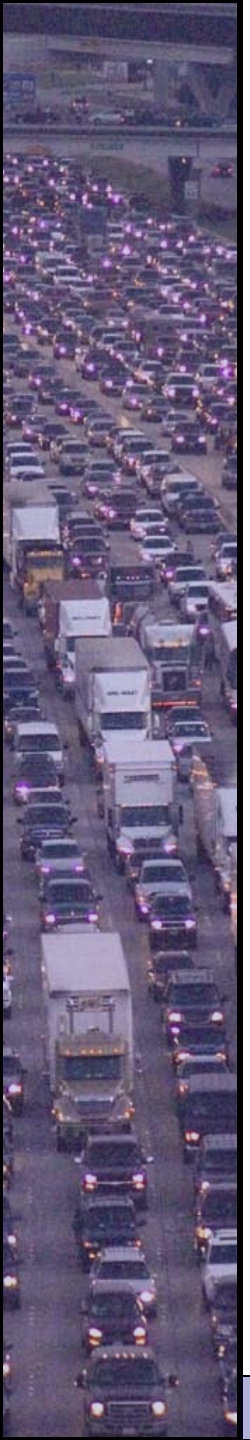


Demo Video



Conclusions and Contributions

- *Evidence that TRANSIMS can be an effective tool for regional multi-modal evacuation modeling and planning*
- *Constituent models can be useful in whole or when used separately (e.g., Wilmot predictive evacuation demand model)*
- *Development of new mathematical methods to calibrate models and analyze output data*
- *Current work focuses on analyses of alternative strategies that could be incorporated in future plans*



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