
Travel Demand Forecast Model Applications Workshop

Transportation Technical Committee
October 6, 2008
MDOT Secondary Center

Outline of Workshop

1. Deficiency Analysis
2. Alternative Testing – LRTP Process
3. Lunch
4. Project Impact Analysis

Outline of Workshop

1. **Deficiency Analysis**

- Define and Explain
- Process and Steps
- Case Studies: BCATS and Lansing

2. **Alternative Testing – LRTP Process**

- Define and Explain
- Process and Steps
- Case Studies: Kalamazoo and SEMCOG

3. **Project Impact Analysis**

- Selected Examples
- Work Zone Safety & Mobility Analysis

Deficiency Analysis

- What is “**Deficiency Analysis**”?
 - Analysis of capacity-related concerns within a study area using a tool which reflects current/future conditions on the system.
 - Tool = Travel Demand Forecast Model

- **Goal**

“Deficiency Analysis” results



State/MPO LRTP and Congestion Mgt. Process



Project Selection

Deficiency Analysis

- Where and When is “Deficiency Analysis” performed?
- Why is “Deficiency Analysis” performed?
- How and why is it important to decision makers?
- “Deficiency Analysis” has a strong impact on project selection, LRTPs, and measures of effectiveness.

Deficiency Analysis - Process

- **Timeframe of Deficiency Analysis within LRTP Process**
 - How long does it take?
 - What level of detail (complexity) needs to be applied for different areas?

Deficiency Analysis - Process

- A. Determine Level of Service Thresholds
- B. Estimate capacities along all road segments
- C. Run the Travel Demand Forecast Model
- D. Model results presented to MPOs
- E. Review Process – study and analyze deficiencies with technical team
- F. Review Deficiencies with Committees and receive feedback
- G. Study potential solution strategies
- H. Determine alternative solution strategies to address these deficiencies

Deficiency Analysis - Process

A. Determine Level of Service (LOS) Thresholds

- Level of Service – determined according to measures of effectiveness
 - Range from A to F
- Many MPOs in Michigan set a goal of maintaining a LOS D threshold
- A V/C ratio of **1.0** is where the volumes on the roads are equal to the allotted capacity
- Capacity - Definition

Deficiency Analysis - Process

A. Determine LOS Thresholds (cont.)

- Establish thresholds for Base and Future Year Deficiencies according to different levels of severity
- Example of an MPO deficiency breakdown
 - MPO has identified LOS D as their threshold for capacity
 - Low Deficiency ($V/C = 0.8-1.0$)
 - Moderate Deficiency ($V/C = 1.0-1.2$)
 - Severe/High Deficiency ($V/C > 1.2$)

Deficiency Analysis - Process

- B. Estimate capacities along all road segments**

- C. Run the Travel Demand Forecast Model (TDFM) for base year and future years analysis**
 - Calculate Volume to Capacity ratios (V/C)
 - Assist in estimating congestion levels

Deficiency Analysis - Process

- **What does the model explain?**
 - Capacities are assigned to all model roadway segments
 - User equilibrium assignment utilizing the capacities in the model
 - V/C ratios are calculated for all road segments
 - Deficiencies are identified based on those values

Deficiency Analysis - Process

- **How to determine and interpret results from the model.**
 - What does the model show?
 - Is this a Daily deficiency or a AM/PM peak deficiency?
 - Intersection/traffic signal delays?
 - Free-flow speed impacts?
 - Where are the principal loading points for the TAZs surrounding these areas?

Deficiency Analysis - Process

D. Model results presented to MPOs

E. Review Process – study and analyze the deficiencies with technical team

1. Discuss possible methodologies for reviewing deficiencies
 - Individual link-segment deficiencies
 - Corridor approach
2. Determine/interpret the results from the model

Deficiency Analysis - Process

- F. Review Deficiencies with Committees and receive feedback on the results**

- G. Discuss, identify and study potential solution strategies for addressing/minimizing the current and future deficiencies**

- H. Determine alternative solution strategies to address these deficiencies**
 - Use to model to perform alternative testing (next section)

Deficiency Analysis – Case Studies

- **Case Studies**

1. BCATS - Battle Creek
2. Tri-County - Lansing

BREAK

Congestion Management Process

- A systematic approach applied in a metropolitan region to identify congestion and its causes, propose mitigation strategies, and evaluate the effectiveness of implemented strategies.
- As an integral part of the planning process that influences decision-making, the CMP feeds projects and strategies directly into the Plan, TIP and STIP.

CMP – Essential Elements

- Monitoring and evaluating transportation system performance
- Identifying causes of congestion
- Identifying and evaluating alternative strategies
- Evaluating effectiveness of implemented strategies

CMP – Who/How to Integrate

- **Who has to integrate a CMP?**
 - A requirement for all TMAs
- **How to effectively integrate the CMP into the planning process**
 - A viable approach
 - Measure-able objectives
 - A systematic process that includes performance measures for developing and selecting management & operational strategies
 - Collaboration to create more effective management and operations

Alternative Testing – LRTP Process

- **What is “Alternative Testing”?**
 - Deficiencies → Alternative Testing → Solutions and Final Project List
 - Using model/other tools to analyze potential impacts to proposed solution strategies
 - Goal:
 - Complete list of project strategies and solutions to address deficiencies listed
 - Remaining financially constrained
 - Best “mix of fixes”

Alternative Testing – LRTP cont.

- “Alternative Testing” is an important step to the State/MPO Planning Process, Requirements and the CMP
 - Determine the best strategies (“mix of fixes”) to achieve the study area’s performance measures
 - LOS, accessibility, mobility, economic development, safety, quality of life, air quality, etc.
 - Get the most out of what is available

Alternative Testing – Why/Who?

- Why is “Alternative Testing” needed and why is it useful to Decision Makers?
 - Testing alternative solution strategies will assist in:
 - Answering Decision Makers’ questions
 - Evaluating/Prioritizing solution strategies
 - Finding a feasible, financially constraint solution strategy which can address the regional concerns
- Who should be involved?
 - MPO, its committees and partners should be involved throughout the process

Alternative Testing – When?

- When should “alternative testing” be performed?
 - After model is calibrated and deficiencies are evaluated
 - During project selection process
 - Before finalizing a preferred solution strategy and financial constraint plan
 - Before finalizing LRTP/TIP project list
 - TMA’s – use CMP as part of this process

Alternative Testing – Types

- Types of Alternative Testing

- Project-Specific Alternative Tests

- Based on individual network deficiencies, mixing and matching series of potential projects together in different ways to determine the best mix of fixes

- System-Wide Alternative Tests

- Taking different combinations of projects and solution strategies across the system and applying them to the future year model analysis

Alternative Testing – Model

- Model and Alternative Testing
 - Taking results of deficiencies and addressing potential project locations
 - Modeler will modify network attributes to account for potential projects and re-run the model to study the changes
 - Model Assumptions and approaches
 - What can the model do vs. what it can't.

Alternative Testing – Process

- A. Review and Analyze the deficiencies
- B. Prioritize/analyze a preliminary list of CI/NR deficiencies using the project selection criteria.
- C. Brainstorm potential ideas to address the deficiencies
- D. Prepare multiple alternative solution strategies
- E. Run the model and other tools implementing the different strategies
- F. Evaluate the preliminary analysis of the different strategies
- G. Evaluate the alternatives and begin developing a project selection list.

Alternative Testing – Process

- H. Determine a preferred alternative solution strategy
- I. Review preliminary project list and prepare a financially constrained and illustrative plan.
- J. Select and prepare a “recommended” project list
- K. Perform air quality analysis
- L. Review with committees and receive final approval
- M. Implement “final” project list into LRTP

Alternative Testing – Process

A. Review and Analyze the deficiencies

- Current and future conditions of the system

B. Prioritize/analyze a preliminary list of capacity-related deficiencies using the project selection criteria.

C. Brainstorm potential ideas to address the deficiencies

Alternative Testing – Process

D. Prepare multiple alternative solution strategies for addressing these deficiencies

- **Alternative Solution**
 - Where the deficiency could be resolved by operational improvements, signalization, transit etc.; or
 - The deficiency cannot be fixed due to political, environmental reasons.

Alternative Testing – Process

D. Prepare multiple alternative solution strategies for addressing these deficiencies cont.

- **Examples:**
 - No build (do nothing) strategy
 - Build-out strategy to resolve all concerns (if funding resources were not limited)
 - Mode strategies (highway, transit, etc.)
 - Develop different “mix of fix” strategies keeping in mind: financial constraint, performance measures, etc.

Alternative Testing – Process

- E. Run the model and other tools implementing the different strategies**
 - Goal: Determine if and how the model responds to each strategy
 - Modeler will modify network attributes to account for potential projects and re-run the model to study the changes
 - Model's Assumptions and Approaches will affect the types of strategies that can be tested

Alternative Testing – Process

F. Evaluate the preliminary analysis of the different strategies

- Ask the following questions:
 - Does this project/strategy resolve the problem identified?
 - Is this project/strategy feasible?
 - Can this project/strategy be implemented while remaining financially constrained?
 - Does this strategy introduce any new potential problems or concerns?
 - Is there any other way to address this problem?

- For TMAs, implement this into the CMP

Alternative Testing – Process

- G. Evaluate the alternatives and begin developing a project selection list.**
 - All deficiencies not addressed in the solution strategies become the preliminary list of potential CI/NR projects.

- H. Determine a preferred alternative solution strategy.**

- I. Review preliminary project list based on short-term and long-term investment strategies and prepare a financially constrained and illustrative plan.**

Alternative Testing – Process

- J. Select and prepare a “recommended” project list - best mix of fixes**

- K. Perform air quality analysis.**

- L. Review with committees and receive approval.**
 - “Recommended” becomes “Final” through approval process

- M. Implement “final” project list into the LRTP**

Alternative Testing vs. Scenario Planning

- Scenario Planning implements different growth strategies into the forecast years of LRTP
 - Provides an area with different possible outlooks on the future of their MPO area
- Different Scenarios can be applied according to:
 - Land use development
 - Rates of Growth
 - Where Growth occurs
 - Other special attractions which may affect the area
- Alternative Testing and the development of a project list is done based on **one** particular scenario

Alternative Testing vs. Scenario Planning

- The planning process and model runs are repeated with each scenario
 - Forecasting SE Data by TAZ
 - Running the Travel Demand Forecast Model
 - Determining future V/C estimates
 - Studying and analyzing future deficiencies
 - Determining possible solution strategies
 - Testing alternative strategies
 - Developing project list and selecting projects.

Alternative Testing – LRTP cont.

- Case Studies
 - KATS - Kalamazoo
 - SEMCOG – Southeast Michigan

LUNCH

Project Impact Analysis

- Impact Analysis can be performed using the model for projects outside of the LRTP
 - Detour Analysis
 - Illustrative Projects
 - Other Corridor/Sub-area Studies and Land Use Developments
 - Work Zone Safety & Mobility Analysis

Project Impact Analysis - Examples

- Examples:
 - M-63 (between I-94 and Hollywood Road)
 - US-31 Freeway Project (Napier Avenue to I-94 near Benton Harbor/St. Joseph)
 - Select Zone Semi-Conductor Expansion (Saginaw)
 - Select Link – M-46 (Thomas Twp, Saginaw)
 - Zilwaukee Bridge Closure Project
- Work Zone Safety & Mobility

M-63 (b/w I-94 and Hollywood Rd)

- **Situation:**

- Low deficient corridor in 2006 ($V/C = 0.86$)
- Projected over-capacity before 2035 ($V/C = 1.029$).
- Plans for commercial and light industrial development along Hollywood Road by 2015

- **Task:** Study impacts to area as a result of project for 2015 year

M-63 (b/w I-94 and Hollywood Rd)

■ Analysis:

- Select Link along road segment
- Alternative run for 2015 year (compare existing 2015 with project 2015 development)

■ Results:

- The select link
- Hollywood Road development impacts

Proposed US-31 Freeway Completion Project

- **Situation:** Proposed completion between Napier Avenue and I-94
- **Task:** Study travel characteristics in 2035 with and without the freeway
- **Analysis:** Study both the local impacts (using the TwinCATS Urban Model) and the regional/statewide impacts (using Statewide Model)

Select Zone Semi-Conductor Expansion in Saginaw

■ Situation

- What roads will be the most impacted by an expansion of the Semi-Conductor?
- Addition of 500 employees in 2010
- Addition of 1,000 employees in 2012

■ Task

- Perform new trip generation for the zone
- Distribute trips
- Assignment

Select Zone Semi-Conductor Expansion in Saginaw

- **Results**
 - Directional
 - Color and size theme

Select Link on M-46

Thomas Township Question

■ Situation

- Select Link on M-46
- How many trips that use this link begin or end in Thomas Township?

■ Task

- Select Link Assignment
- Selection set of connectors in Thomas Township

Select Link on M-46

Thomas Township Question

■ Results

- Map Color and size theme
- Summary

■ <u>Link</u>	<u>Total Volume</u>	<u>Thomas Twp</u>	<u>%</u>
East bound W of M-47	14083	8998	63.8%
West bound W of M47	13949	8902	63.9%
East bound E of M52	7379	4229	57.3%
■ West bound E of M52	7324	4324	59.0%

Detour Analysis

Zilwaukee Bridge Closure

■ Situation

- What happens if we close the Zilwaukee Bridge?

■ Task

- Create new network without bridge
- Assign trips to the new network

■ Results

- Maps with directional percent change
- Color and size theme
- Remember model assumptions

Work Zone Safety and Mobility

MDOT policy established, in accordance with federal regulation, to improve safety and mobility in work zones by reducing congestion and traffic incidents

All State Trunkline

- Projects
 - Construction and maintenance
 - Permitted projects starting in January 2009
- Development of Transportation Management Plan
- If at least one of these applies:
 - Last more than three days
 - If impacts are intolerable
 - Defined as potentially significant or critical by MDOT Region staff

Impact Intolerable If?

- Original **volume to capacity ratio** greater than 0.8
- **Travel time** delay is 10 minutes greater than normal travel
- If **level of service** is very low or changes substantially

Use of Travel Demand Model

- Determine diversion rate
 - Run model for construction year
 - Add construction project to model
 - Create percent change in model volumes by link
- Potential adjustments for diversion analysis
 - Speed reduction
 - Lane width reductions
 - Side restrictions

Modeling Capabilities

- Types of construction projects
 - Lane closures
 - Flagging
 - Prohibiting turns
- Time of construction
 - 24 hour
 - Evening work
 - Weekend work

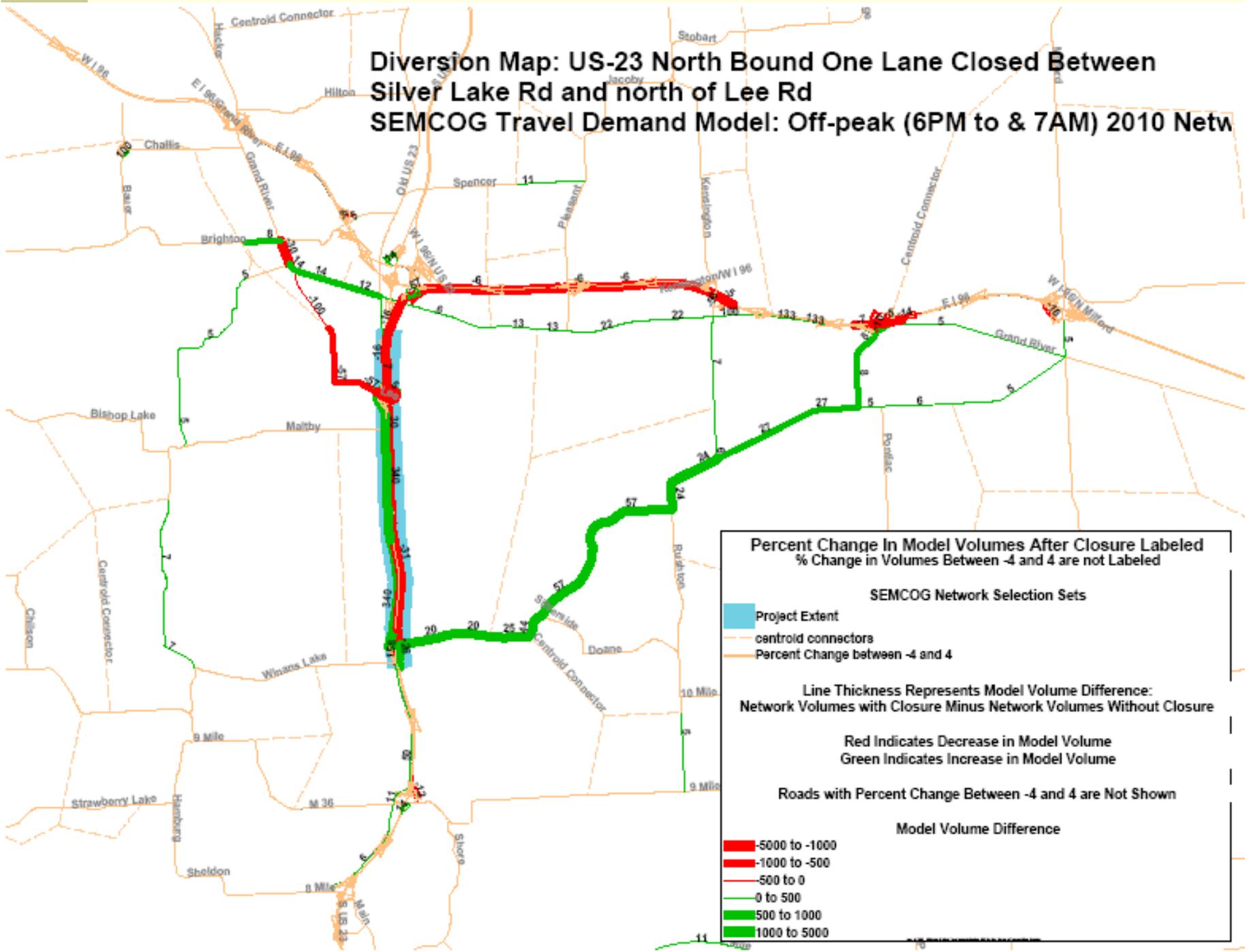
Diversion Map

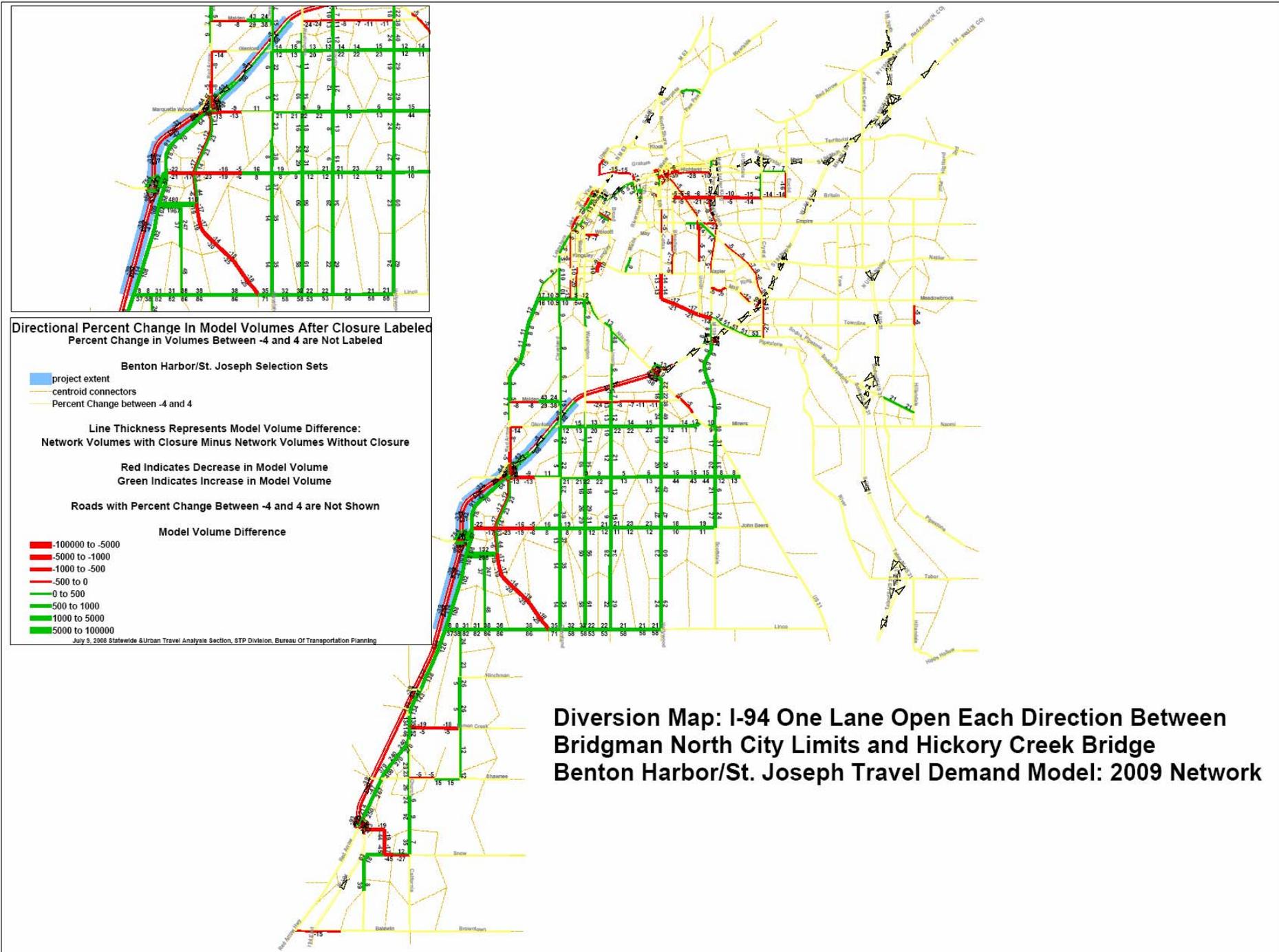
Examples

- US-23
 - Off-peak (evening work)
 - One lane closed north bound
- I- 94
 - Weekday work
 - One lane open each direction
 - Directional

Diversion Map: US-23 North Bound One Lane Closed Between Silver Lake Rd and north of Lee Rd

SEMCOG Travel Demand Model: Off-peak (6PM to 7AM) 2010 Netw





Directional Percent Change In Model Volumes After Closure Labeled
 Percent Change in Volumes Between -4 and 4 are Not Labeled

- Benton Harbor/St. Joseph Selection Sets**
- project extent
 - centroid connectors
 - Percent Change between -4 and 4
- Line Thickness Represents Model Volume Difference:
 Network Volumes with Closure Minus Network Volumes Without Closure
- Red Indicates Decrease in Model Volume
 Green Indicates Increase in Model Volume
- Roads with Percent Change Between -4 and 4 are Not Shown
- Model Volume Difference**
- 100000 to -5000
 - 5000 to -1000
 - 1000 to -500
 - 500 to 0
 - 0 to 500
 - 500 to 1000
 - 1000 to 5000
 - 5000 to 100000
- July 9, 2008 Statewide & Urban Travel Analysis Section, STP Division, Bureau Of Transportation Planning

**Diversion Map: I-94 One Lane Open Each Direction Between
 Bridgman North City Limits and Hickory Creek Bridge
 Benton Harbor/St. Joseph Travel Demand Model: 2009 Network**