

Fitting Simulation
to
DOT Business Processes

Organizational Process Issues

- **Simulation**
- **Work Zone Mobility**
- **Project Management – P/PMS Tasks / Flows**

Organizational Process Issues

- **P/PMS Tasks / Flows**
 - New federal requirements for mega projects
 - Unique process requirements for I-94 and I-75
 - Construction Staging; Constructability; Work Zone Mob.
- **Work Zone Mobility and Project Selection**
 - Programs (R&R, CE, CPT)
 - Decentralized program – coordination challenge
 - New federal rules
 - Network effects / requirements
- **Simulation**
 - Radically new technology
 - Old “Model” paradigms don’t apply
 - Organizational alignment challenge

Simulation - a New Technology

Requires Re-alignment:

- **Organizational Structure**
- **Culture**
- **Processes**
- **Paradigms**

Regional Planning Model

Project Traffic

Operational Analysis



count data

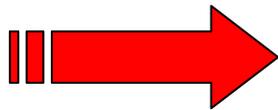


The Old Days

Organizational Structure Shift

Old Days:

- Traffic modeling was a planning task
- Operational analysis was performed by traffic engineers
- Design was performed by design engineers

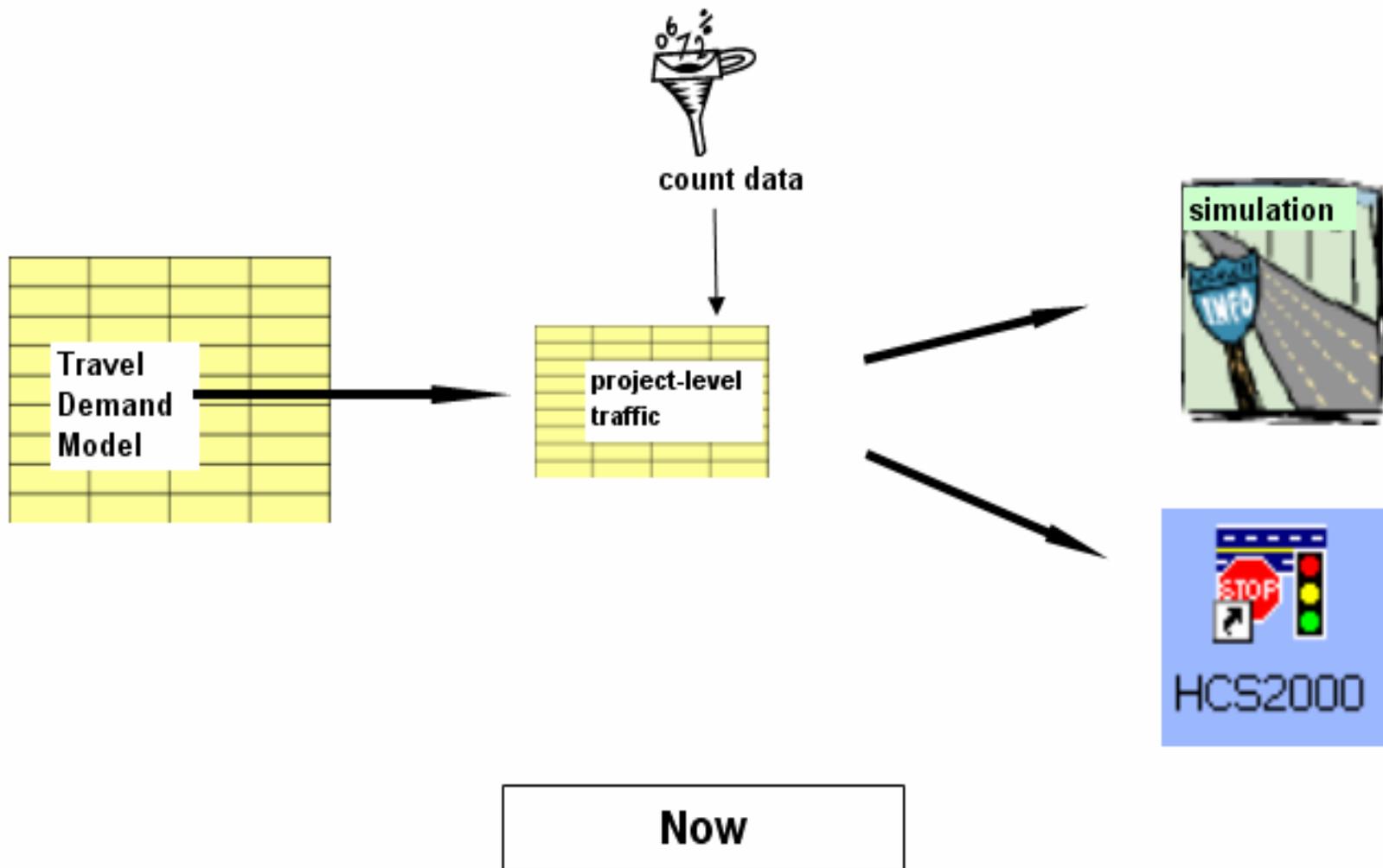


- » **Disconnect between Planning and Engineering**
- » **Disconnect between Traffic and Design**
- » **Disconnect between Traffic and Operations**
- » **Decision Quality suffered!**

Regional Planning Model

Project Traffic

Operational Analysis



Organizational Structure Shift

Now:

- **Traffic modeling will be done by traffic engineers**
- **The Planning Model may perceive a loss relative stature**
- **The middle step--“project level traffic”-- will be integrated with traffic modeling.**
- **Traffic analysis & modeling will be integrated with the Operational analysis**
- **Traffic and Design will need to be more integrated**
- **Design engineers will need to know a lot more about traffic operations.**
- **The Organization must become more traffic engineering literate**

New Generation Simulation -- Alignment Issues

Organizational Structure:

Where

Who

Control

May need to be incubated outside of existing structures

Culture:

Traffic engineering vs. planning

Traffic engineering vs. design

Top-down vs. bottom-up

A simulation model cannot be “owned”

Processes:

Data, GIS, Graphic

Paradigms:

Flexibility

Model vs. Open Platform

Making MDOT Simulation Friendly

Data Processes:

- **All data from all sources must be put on one platform**
- **All data must be formatted and stored electronically**
- **The Michigan Framework**
- **Traffic data tools developed by the METSIM will have independent utility—e.g., the “BALT”**

Challenge

- Build a system model, incrementally, from the bottom up
- Maintain flexibility
- Minimize Model development costs
- Minimize maintenance costs

Incremental Approach

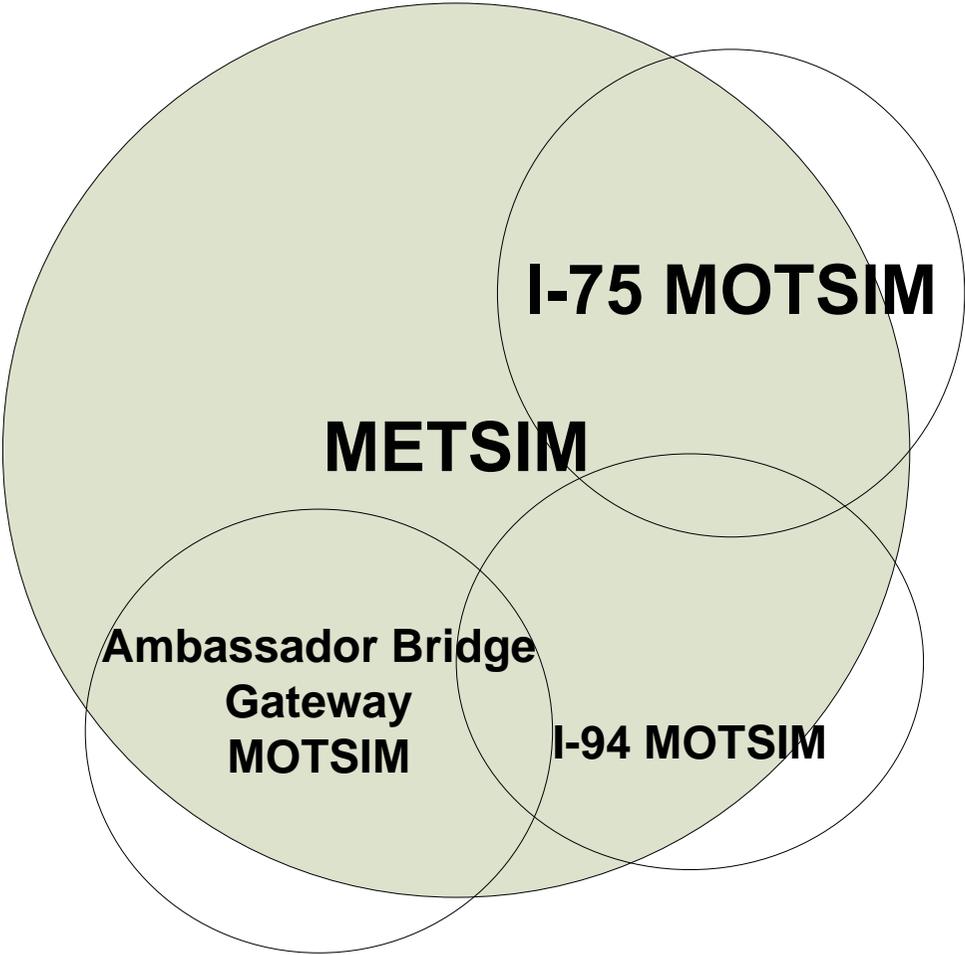
As each baby model is broken off, it is:

- **Developed to be uniform with all the other models**
- **Brought up to the new base year**

As two or more baby models are combined for the next project:

- **Their traffic is updated to the new base year**
- **They are joined and new matrices developed**

Approach



New Model Development

**25%
Network
Development**

**25%
Traffic
Development**

**50%
Simulation
And
Calibration**

Total Effort 100%

Combining Existing Models

**Salvage / New
% of Original Effort**

**20% / 5%
Network
Development**

**15% / 10%
Traffic
Development**

**10% / 40%
Simulation
And
Calibration**

**Salvage / New Effort
45% / 55%**

Work Zone Mobility

- Decentralized Organization
 - MDOT
 - Region
 - Transportation Service Centers
- Many chimneys:
 - Capacity Expand,
 - Preventative Maintenance
 - Rehab and Reconstruct
 - Safety



Fragmented program

Fragmented decision making

Work Zone Mobility—New Rules

Effects of new rules for work zone mobility :

- WZ will need to go upstream in the process,
 - » e.g., the early environmental process
- Require more functional integration in the Department
 - » e.g., among design, planning, operations
- Earlier consideration of staging and constructability
- On projects involving systemic (interstate) impacts, WZ mobility will
 - » require a network approach
 - » consider the interactive effects between closures
 - » probably require network simulation



» **Organization Process Challenge**

Work Zone Mobility

Needed:

- A focus on Operations
- An integrated approach
- Technological assist
- Organizational alignment

Metro Region's Response

A multi-pronged approach:

- Process Improvement
- Staff
- Data
- Network Simulation

Metro Region's Response

Process Improvement:

- **Intervention by MDOT's Performance Excellence Division (PED) – concept stage**
- **Top to bottom, Department-wide process improvement – concept stage**
- **Rationalize project selection and scheduling**
- **Reconcile bottom-up decision making with the need for a systematic approach**
- **Integrate Processes: Planning, Operations, and Design**

Metro Region's Response

Process Improvement

- **Requires support from other Stakeholders.**
- **For example, from Planning**
- **A shared understanding is needed.**
- **Dialogue among Stakeholders is the first step**

Metro Region's Response

Staff:

- **Reorganization of existing resources**
- **A centralized team to oversee traffic modeling and work zone mobility across the region**

Data:

- **Processes**
- **Collection**
- **GIS based – the Michigan Framework**

Metro Region's Response

Network Simulation:

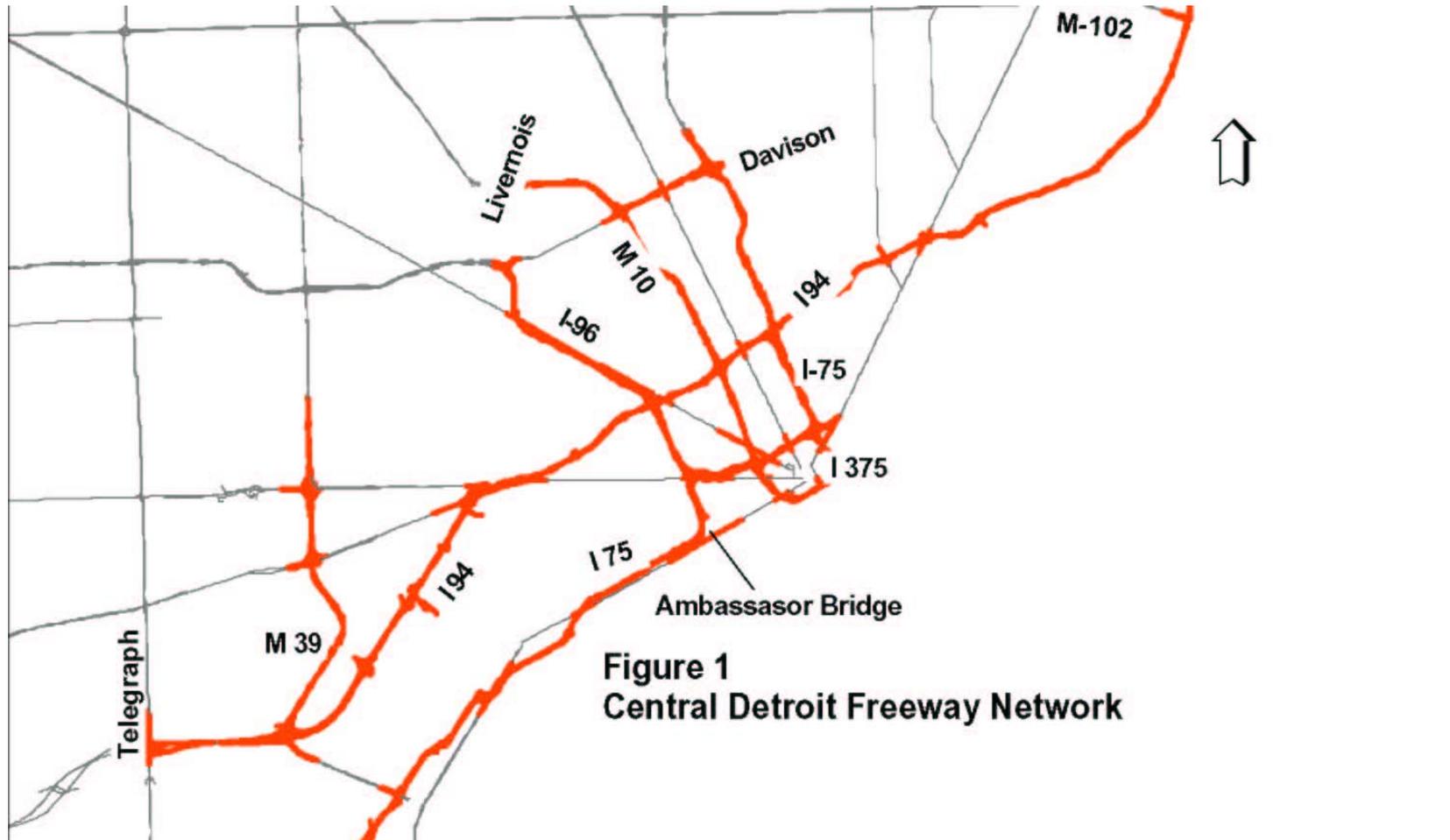
- **The various projects need to be tested on one platform—model—since their impact areas overlap**
- **How to build a large network, and re-use it for other projects**
- **How to do this without creating a new bureaucracy parallel to the Travel Demand bureaucracy**
- **In-house or by consultants?**
- **The goal is to have uniformity of the model across the system**
- **If multiple consultants, will there be too many cooks working on 'the model'?**

Metro Region's Approach

- Two years ago, Planning initiated the development of a network-wide freeway simulation, the “METSIM”
- METSIM consisted of the Central Detroit Freeway Network and the I-75 corridor, extending out to Pontiac Michigan.
- The METSIM is now being used to develop work zone mobility plans for three other projects (MOTSIM's):
 - **Ambassador Bridge Gateway – Construction**
 - **I-94 Rehabilitation – the Engineering Report**
 - **I-75 Trade Corridor – the Engineering Report**

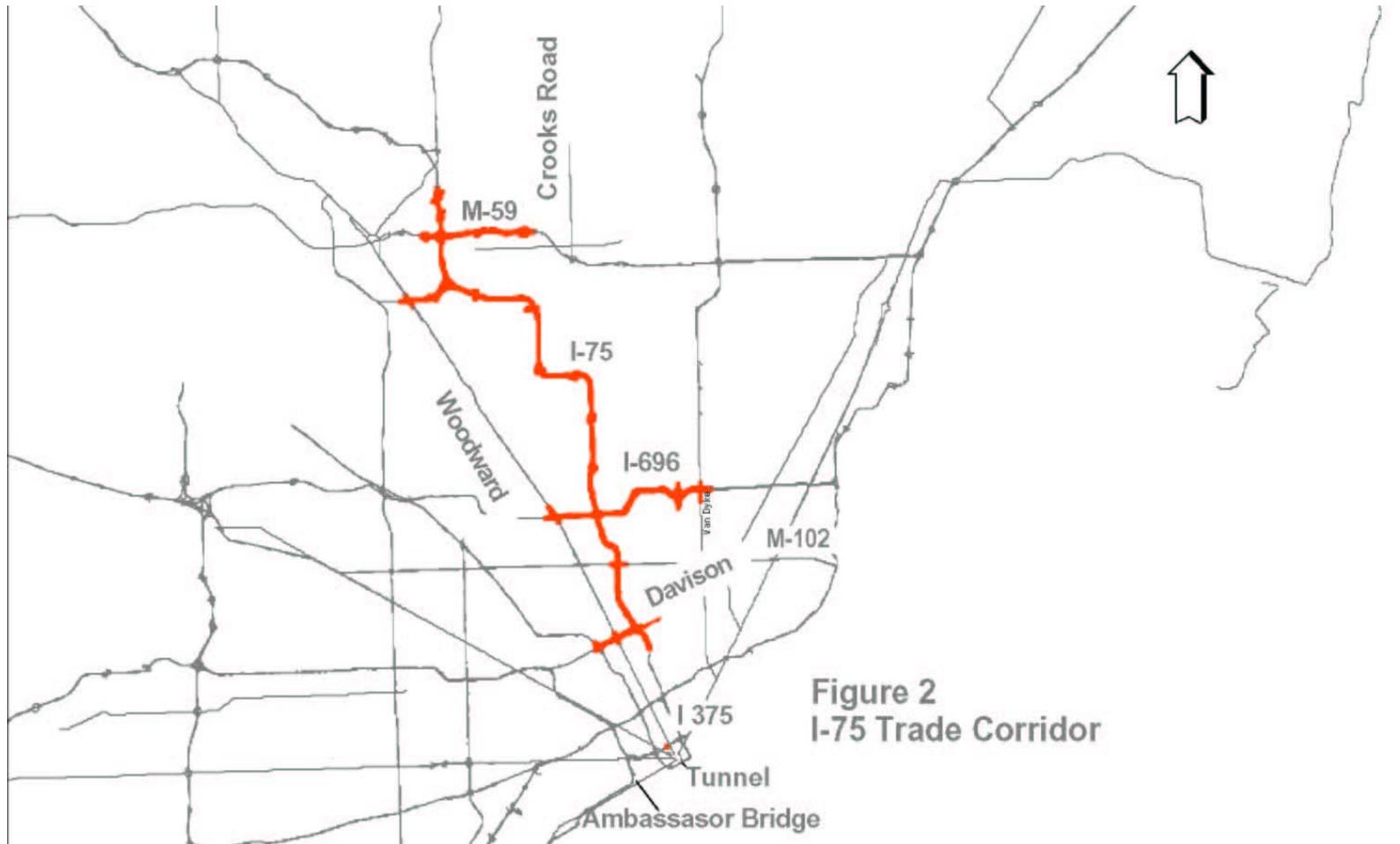
METSIM

Central Detroit Freeway Network-CDFN

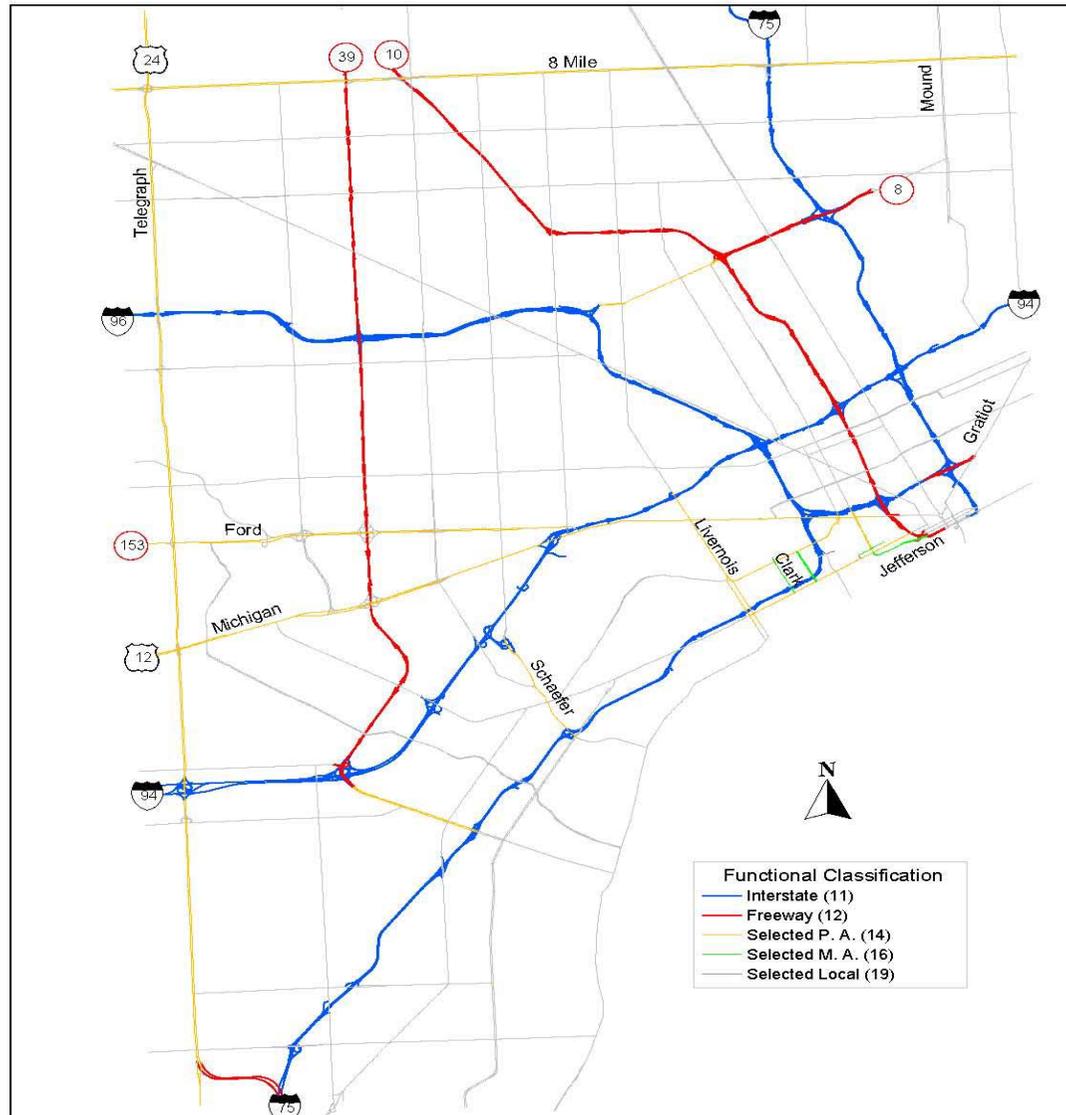


METSIM

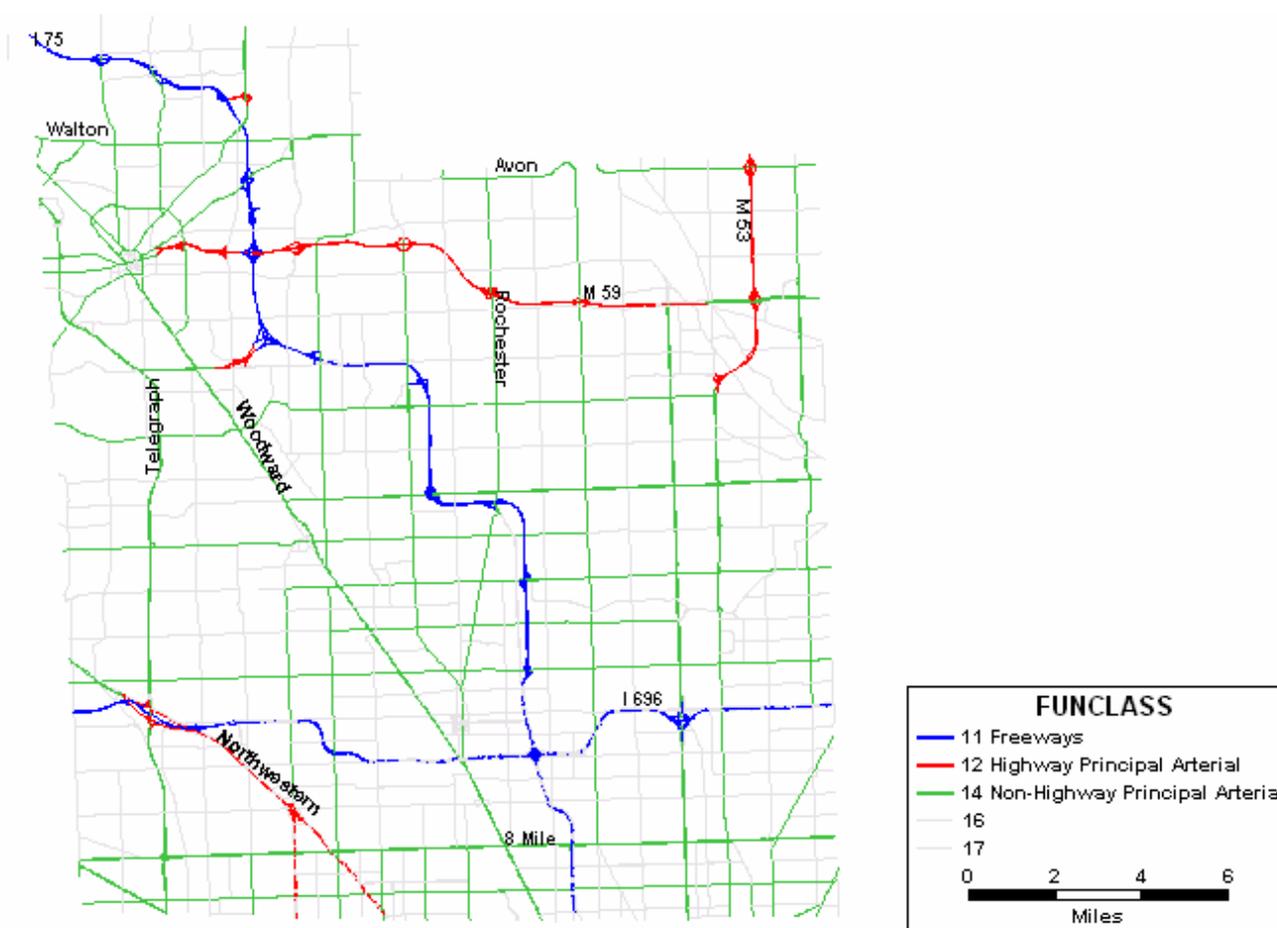
I-75 Trade Corridor (I-75 TC)



The Ambassador Bridge Gateway Motsim



I-75 TC MOTSIM



I-94 Motsim

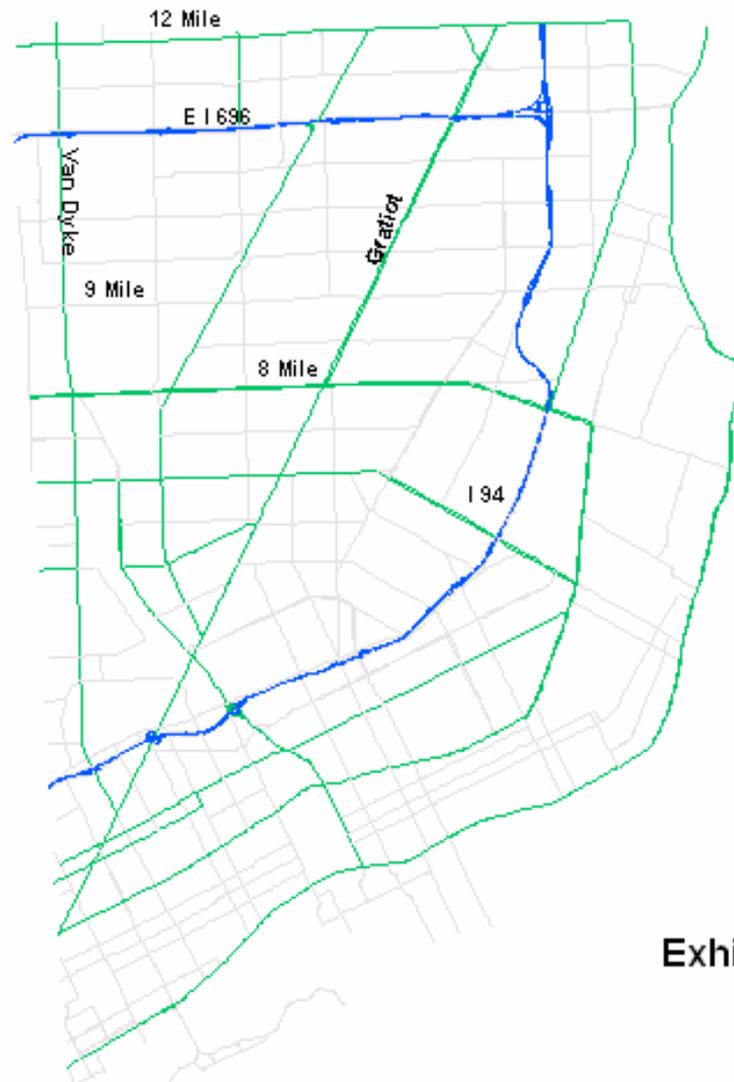
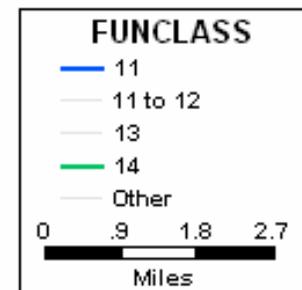


Exhibit 3



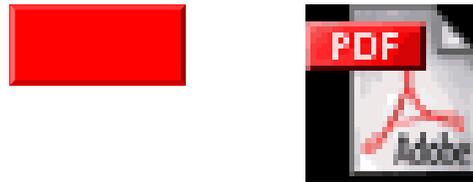
Project Management– P/PMS Tasks / Flows

- **New federal requirements for mega projects**
- **Construction Staging; Constructability; Work Zone Mobility.**
- **Unique process requirements for I-94 and I-75**

Project Management Plans (PMP's)

- **New federal requirements: Mega projects will require PMP's, starting at the Engineering Report Stage, or shortly after the ROD.**
- **We will need to develop a year by year plan of how the project is to be constructed.**
- **This presupposes that the Financial Plan is in place at this early stage of Design.**
- **This will require earlier and better construction staging, constructability, and work zone mobility analysis.**

MDOT's Process---P/PMS



Acrobat Document

MDOT's Process---P/PMS

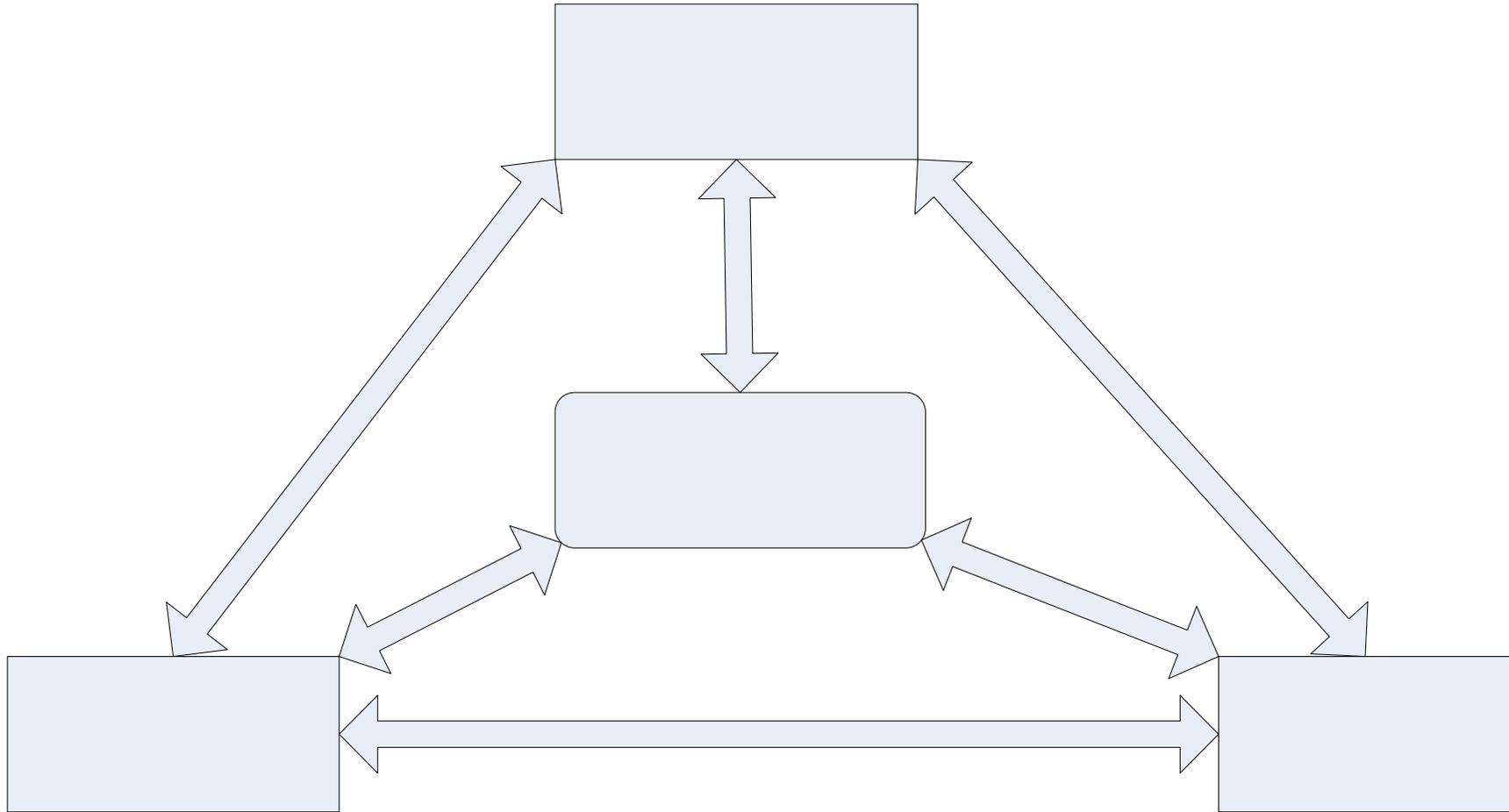
Problem:

- We need to start earlier doing Constructability , Construction Staging (CS), and Work Zone Mobility (WZ)
- On large “system” projects, we will need network simulation to perform these tasks
- We need to capture the dynamic relationships between these processes
- Conceived this way—these are essentially new processes
- MDOT doesn't have an institutional memory
- Neither do most of the Consultant Teams

Project Management

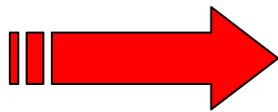
- **Project Management Plan Guidance for Mega Projects (and over \$100 million)**
- **Effort to build predictability into projects**
- **Effort to move federal oversight further upstream—before construction**
- **AASHTO found that the cost variances in large projects is larger in the pre-construction phase than at any other time.**
- **Improving pre-construction processes and building in predictability can have a huge potential pay-off.**
- **traffic simulation—construction staging– constructability – work zone mobility processes – can play a key role**

The Challenge



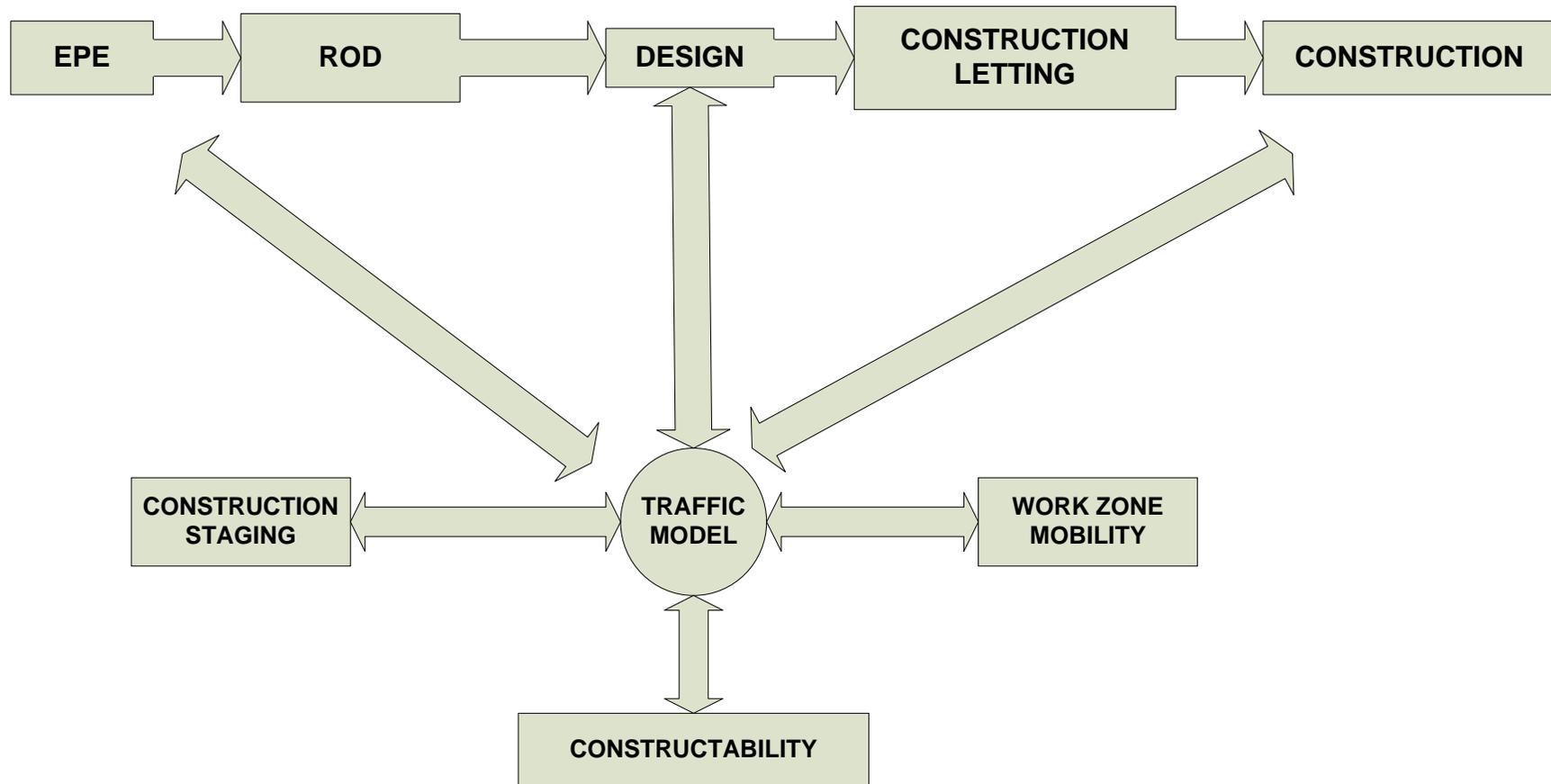
Challenge: A Toyota Production System

- The right information
- At the right time
- To the right process



- » **Shorter feedback loops**
- » **Shorter production runs**
- » **Higher Turnover**

The Challenge



Metro Region's Response

Goals:

- Develop an institutional memory
- Capture the Consultant's processes
- Rationalize and Develop the new process

Metro Region

Actions:

- **Scopes of work for I-94 and I-75—provide a basis for the new process**
- **Laying the groundwork for internal consensus (Planning, Operations)**
- **Initiated contact with MDOT's Performance Excellence Division**
- **Pursuing funding to hire a supply chain expert**
- **The supply chain expert will be “fly on the wall” on these projects.**
- **This will give MDOT a tool to rationalize the process.**

I-94 and I-75 Tasks

The network simulation models shall support:

- **Base Plans**
- **Constructability**
- **Construction Staging**
- **Structures**
- **Maintenance of Traffic**
- **Cost Estimates**
- **Financial Plan**
- **Horizontal and Vertical Alignments**
- **ROW Plans**

Interdependence

Work Zone Mobility, Simulation, and Project Management pose similar challenges

They are tied to inter-connected processes

A holistic, systematic approach to process improvement is needed.

To reap the full potential of Simulation