Vehicle Infrastructure Integration: The Opportunity, The Challenges.

Gregory D. Krueger, P.E.
Statewide ITS Program Manager
Michigan Department of Transportation

In-Presentation Navigation

- Background
- The Challenges
  - (The VII Deadly Sins)
- The Status
- The Opportunity

In-Presentation Navigation

Background

The Driving Forces at a State DOT

- 42,000 People Die Every Year on Our Roadways
  - ***Leading Cause of Death Between Ages 4 – 33***
  - ***50% of the Deaths Occur from Intersection Collision and Roadway Departure***
- Traffic Crashes Cost the Economy $230B/Yr
- Traffic Congestion Costs Americans $63B/Yr
- Congestion Wastes Billions of Gallons of Fuel

DOT Focal Points

- Reduce and Eliminate Crashes
- Address Congestion
  - Recurrent vs. non-Recurrent
  - Manage / Maintain vs. Build-Out
- Economic Competitiveness and Development
  - National
  - International

Vehicle Infrastructure Integration

- VII is the new paradigm for transportation
- VII gives us new ways to address:
  - Congestion
  - Safety

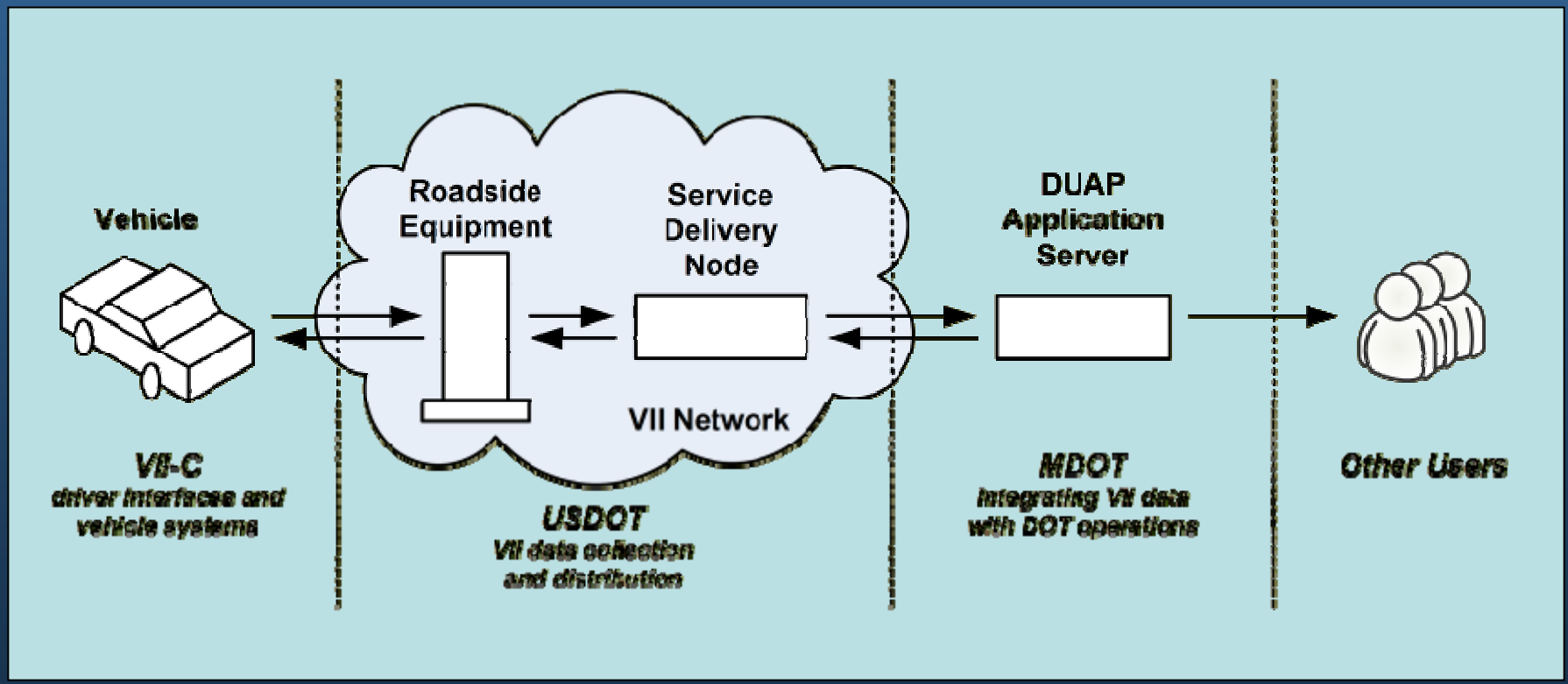
VII will happen – it's only a matter of when and how

It's the *"Internet on Wheels"*

Vehicle Infrastructure Integration Applications

- Passive Safety
  - Data Monitoring – the “Near Miss”
- Active Safety
  - Rear-End Collision Avoidance Systems
  - Intersection Collision Avoidance Systems
  - Road Departure Collision Avoidance Systems
- Post Crash Systems
  - Advanced Automated Crash Notification
- Congestion Avoidance Systems
- Weather Notification Systems
- Resource Management

VII Collaboration



The VII Deadly Sins

What Are the Hurdles?
How Do We Cross Them?

1. Over-Promise Benefits

- VII will result in NO delay on ANY street!
- VII will result in Zero crashes!

- Reality?
  - Volumes increase 50% in next 20 years with minimal new capacity!
    - Better route choice/guidance
    - Accurate travel times
    - In-vehicle pre-crash alerts
    - Fewer secondary crashes
  - Crashes are the result of driver **behavior**

2. Funding

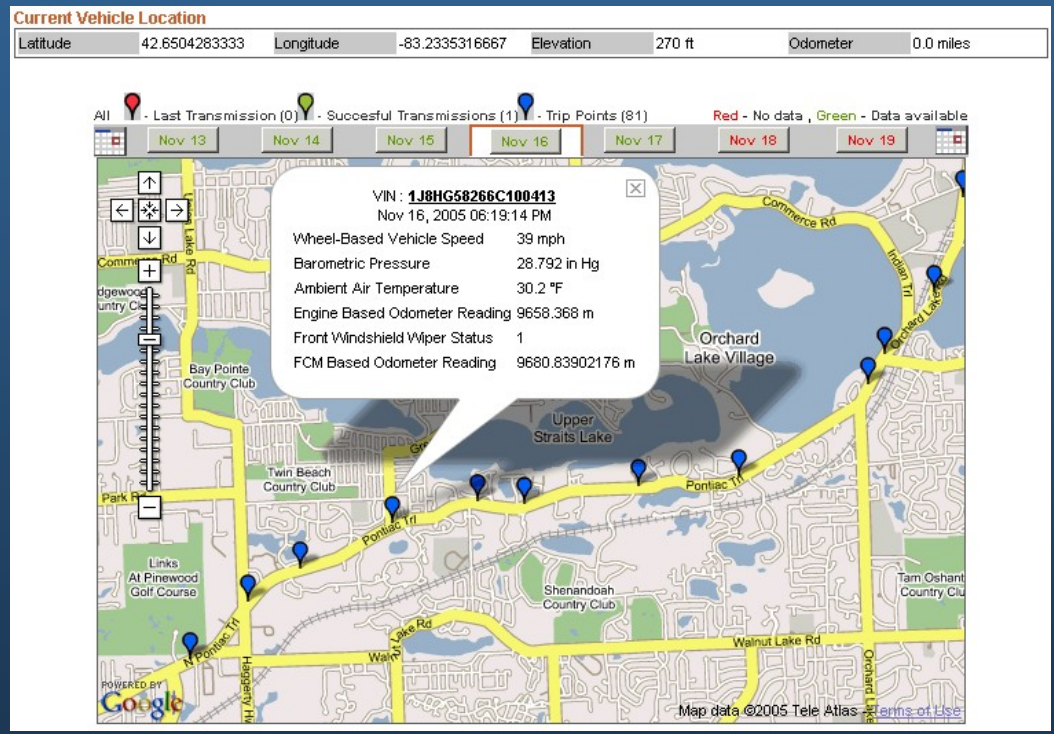
- Initial estimates range from $3-$7 Billion
  - May not include backhaul communications
  - Traffic Signal upgrades?
  - Operations?
  - Maintenance?
- Highway Trust Fund is exhausted in 2009
- Bridges likely the focus of the next Transportation spending bill

2. Funding (cont.)

- Solutions?
  - Innovative funding
    - Public-Private Partnerships (P/P/P)?
  - Phased deployment
  - Pay to play – sell data / bandwidth

3. Privacy

- There is a lot of personal / proprietary information available that must be protected!



3. Privacy (cont.)

- Personal privacy:
  - Minimize law enforcement activities
    - No day-to-day enforcement
    - “Warrant-only” access
  - New vehicle ID at every RSE
  - Opt-in for many services

3. Privacy (cont.)

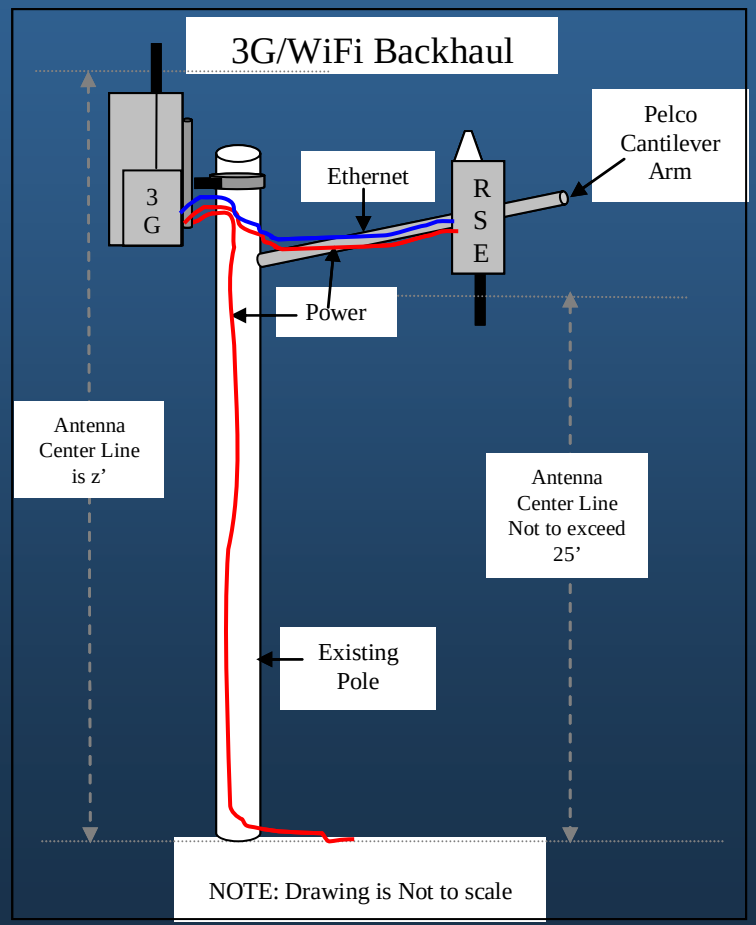
- Corporate privacy:
  - DSRC is inherently secure from outside hackers
  - Encryption of any / all data is possible and necessary

4. Installation

- Installing 250,000 RSE's in 2-years will require significant effort:
  - US DOT – led initiative, yet US DOT owns no infrastructure
  - State's only own about 10% of the national infrastructure
  - Local municipalities (cities, counties, etc.) are the key
  - Rural deployments compound these issues
    - Power & Communications

4. Installation (cont.)

- Partnerships amongst public-sector stakeholders will be critical to success
  - Education (what is VII?)
  - Make local agencies a stakeholder
  - Develop installation guidelines
  - Wireless communications to the RSE's
  - Is solar power an option?



5. Operational Structure

- The system has to be operated & maintained!
  - At 10% of capital cost per year - $300-$700M
- Multiple options for operations (each with advantages and disadvantages)
  - 100% Government
  - 100% Private
  - Quasi-public

6. Data Availability

- What data will ultimately be available for DOT's for improved operations?
  - Privacy concerns impact data available
    - Different vehicle id's at each RSE preclude O-D studies or turning movement counts
  - Who "owns" the data and will there be use limitations?
    - Traffic.com model has issues with data usage by DOT's

6. Data Availability (cont.)

- Need to clearly define objectives, data sources and data uses
- Show a benefit to all key parties of sharing data
  - Automakers can package and sell to customers
  - DOT's can more effectively manage traffic
  - Public gain reduced delay and fewer crashes

7. The Great Unknown

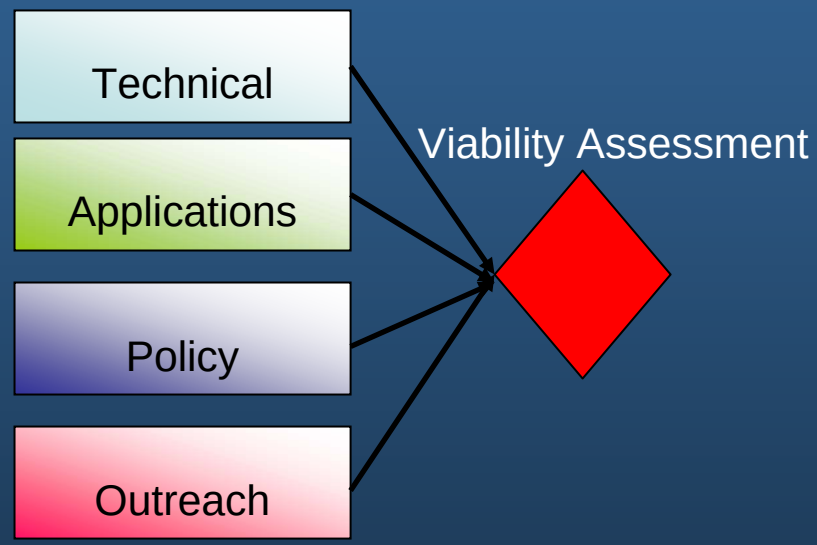
- What's not being considered at this point?
- Can we afford a system as reliable as we think we need?
  - 4-9's?
  - 5-9's?
- Can the Proof of Concept scale to a Field Operational Test? Full nationwide deployment?
- Schedule and market forces?
- What else…

In-Presentation Navigation

Status

Program Strategy: Viability Decision

- **Track 1: Technical**
  - Proof of Concept testing
  - Standards activities
- **Track 2: Applications**
  - Day 1 applications for POC
- **Track 3: Policy & Institutional**
  - Initiating policy research
- **Track 4: Outreach**
  - Public VII website

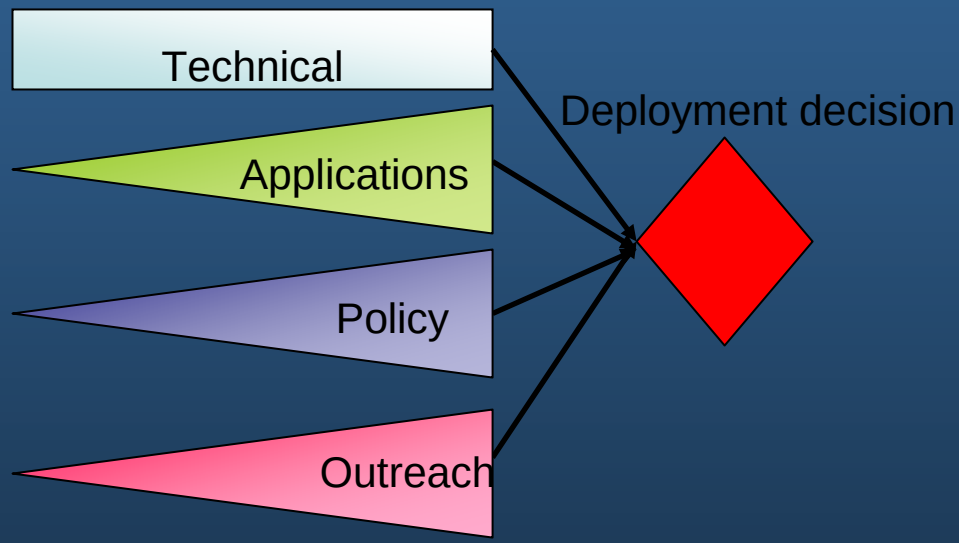


Viability Assessment - 2008

- Decision to move forward
- Cooperative decision among stakeholders
- *Criteria to be approved in November*

Program Strategy – Post Viability Assessment

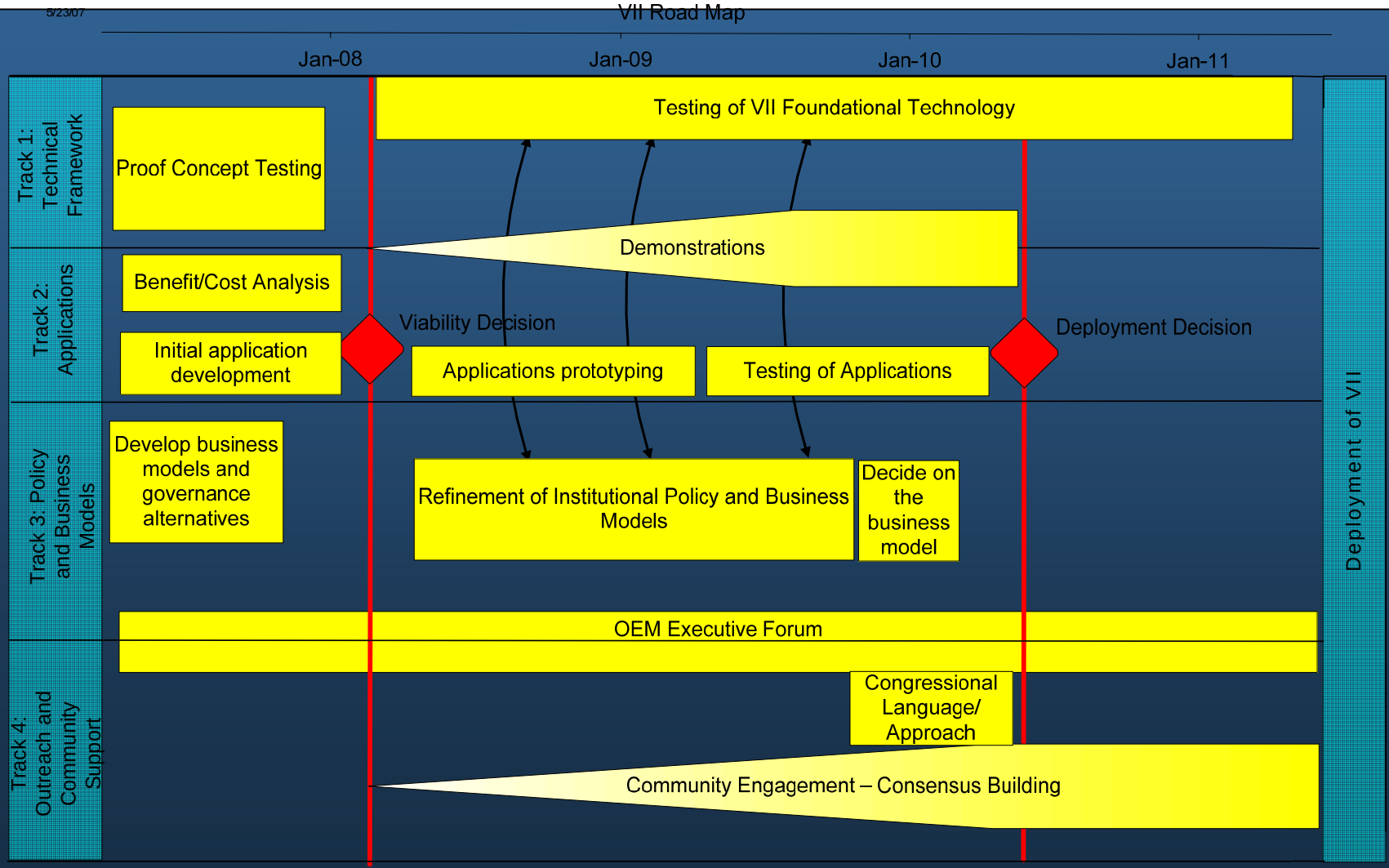
- **Track 1: Technical**
  - Sustain testbed
  - Address technical issues
- **Track 2: Applications**
  - Grow application functionality
- **Track 3: Policy**
  - Refine alternative(s)
- **Track 4: Outreach**
  - Broaden stakeholder engagement



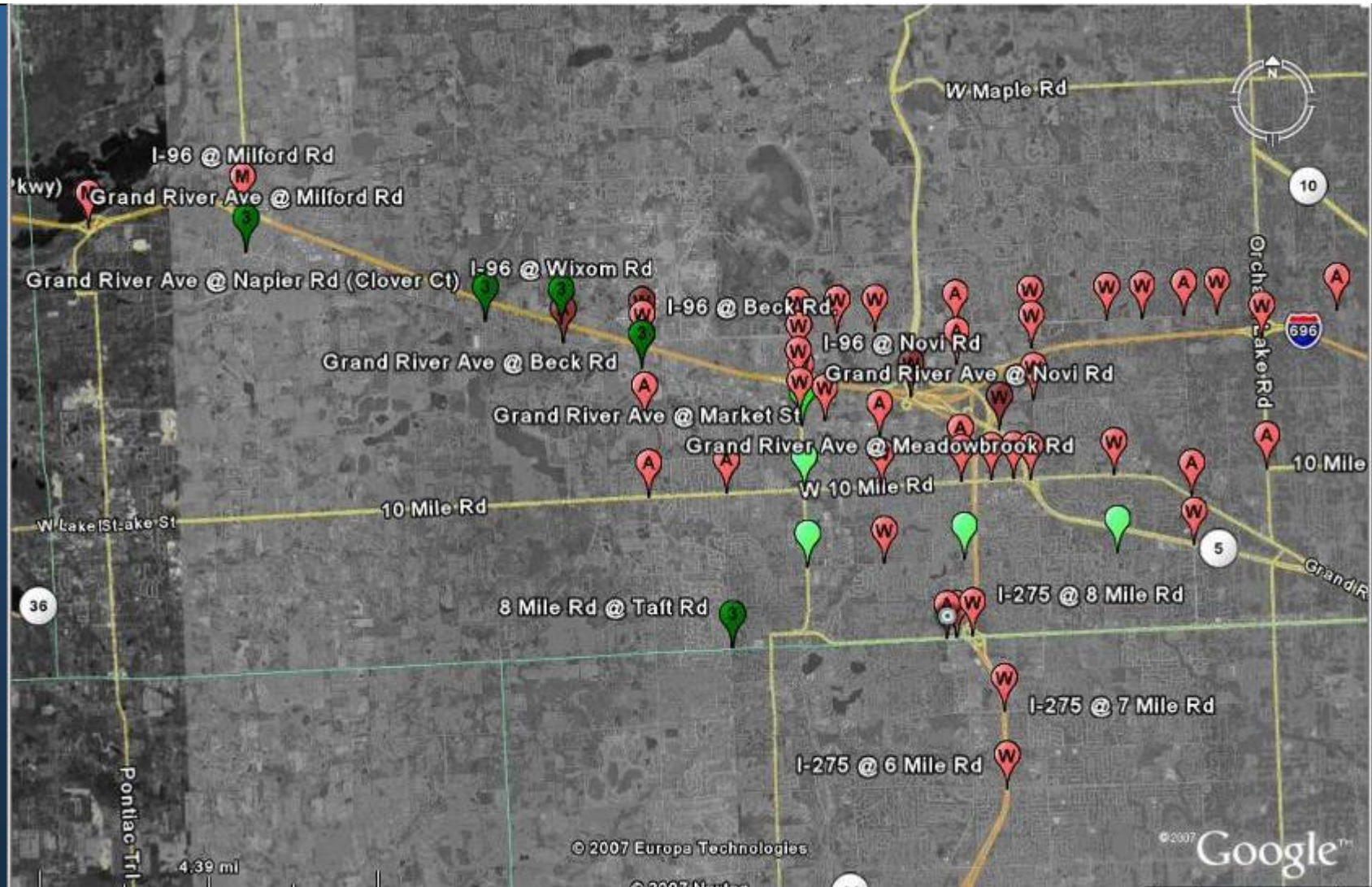
Deployment Decision:

2009-2010

FHWA Evaluation Schedule



Detroit Test Environment



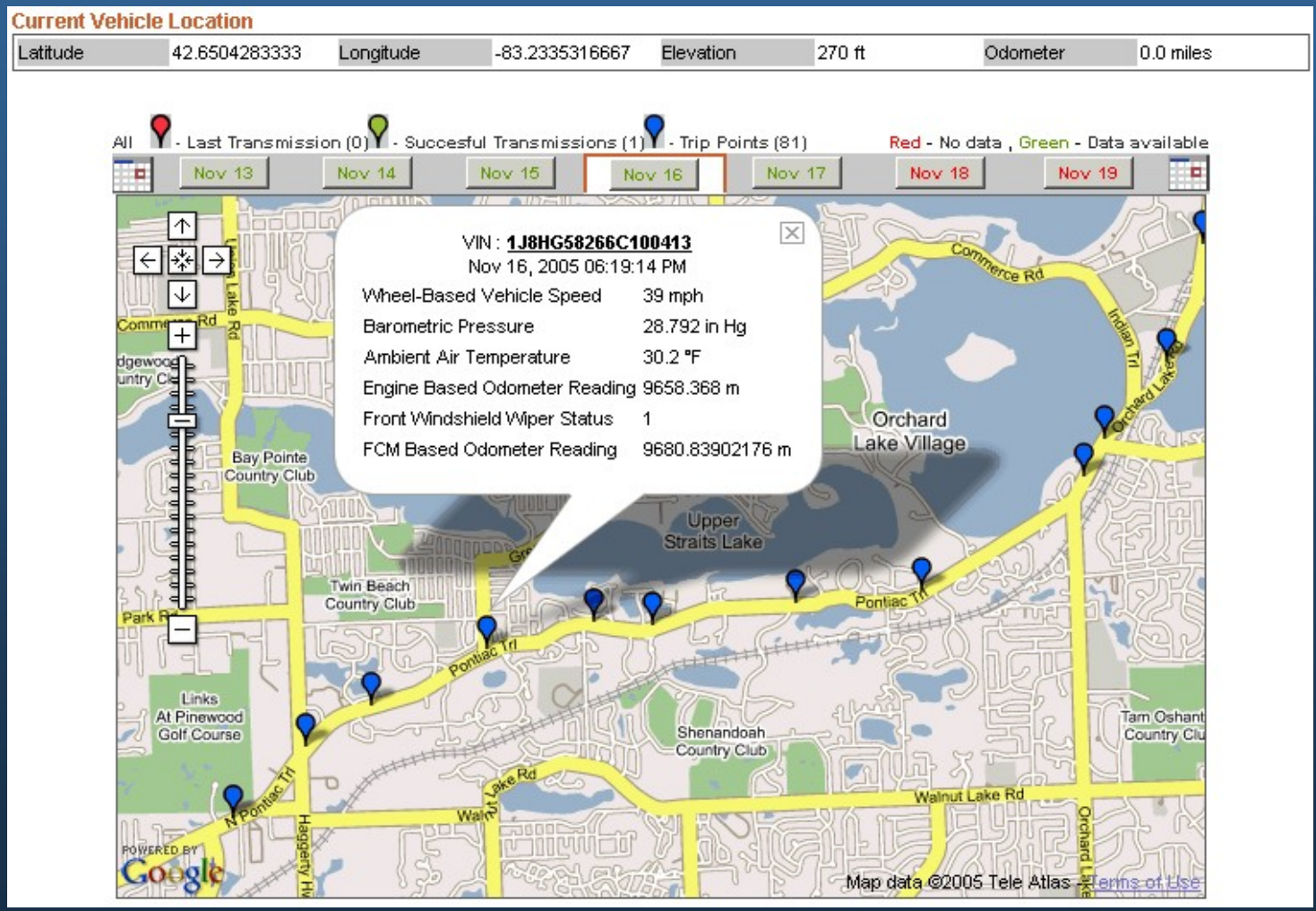
In-Presentation Navigation

The Opportunity

“Make no little plans;
they have no magic to stir men’s blood.”

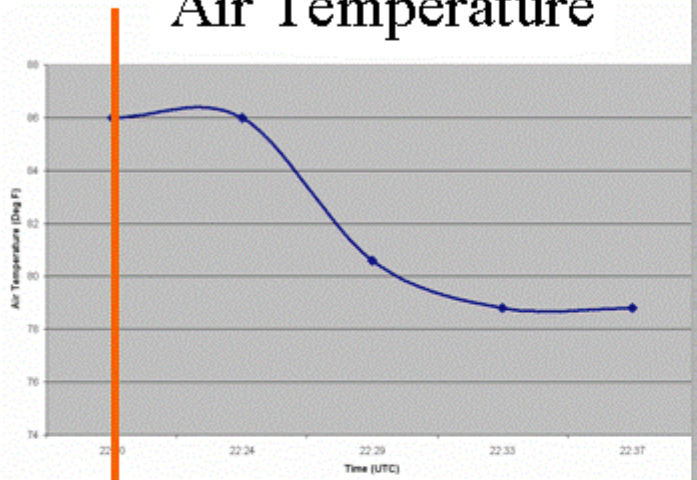
Daniel H. Burnham
Director of Works
World’s Columbian Exposition, 1893

Lessons Learned:
Road Weather Information

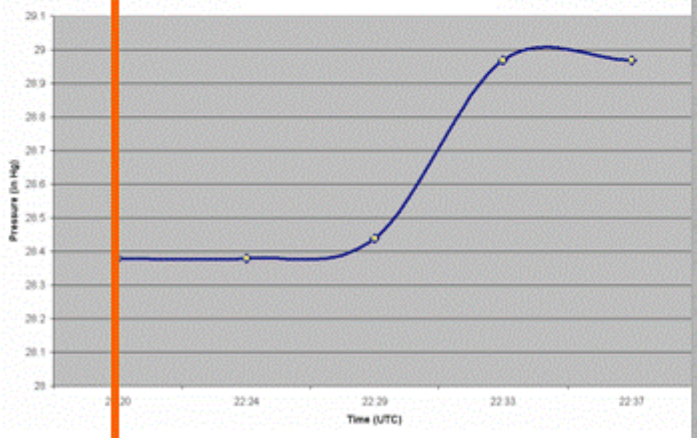


VII Test Bed – Detroit Metro

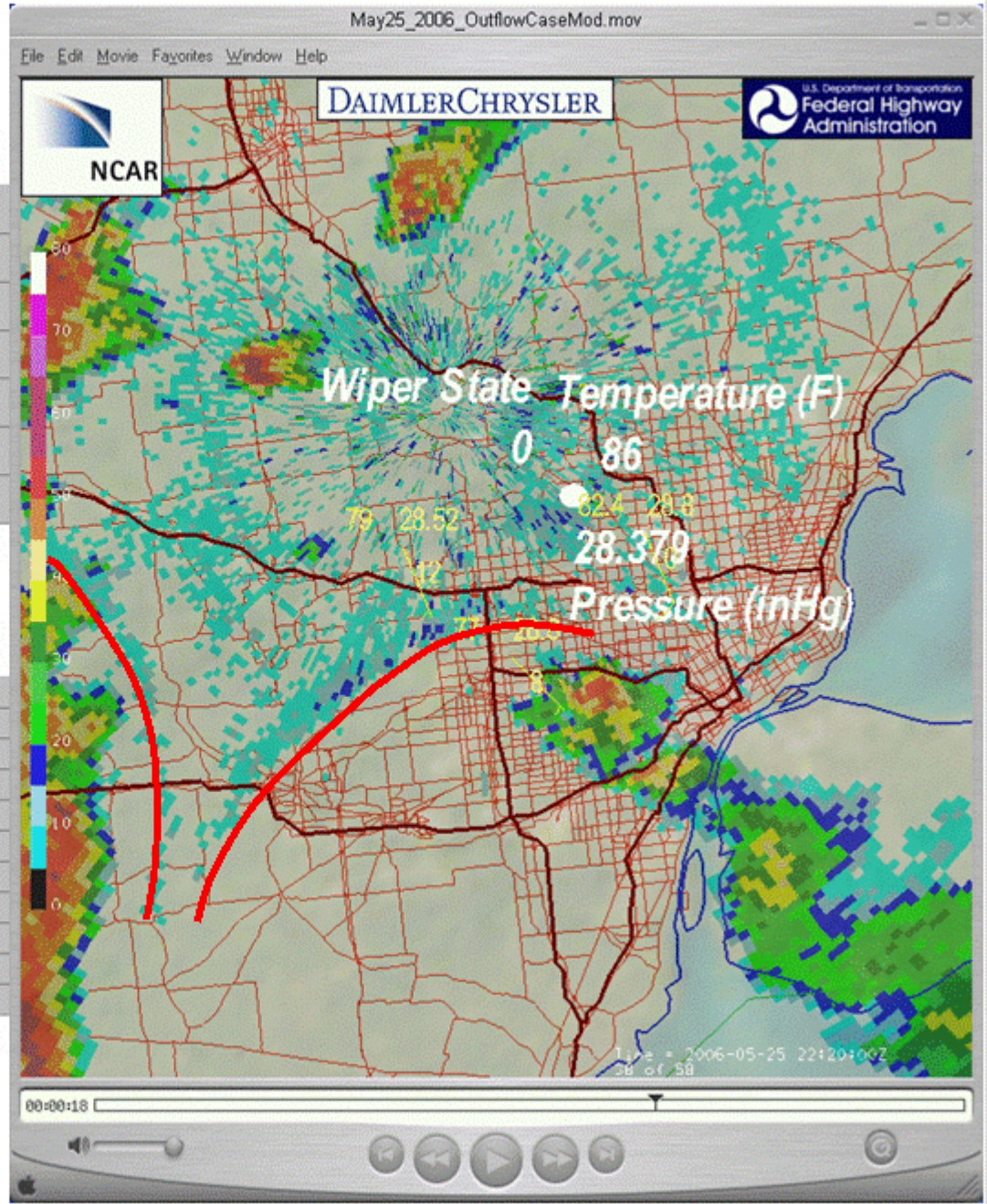
Air Temperature



Pressure

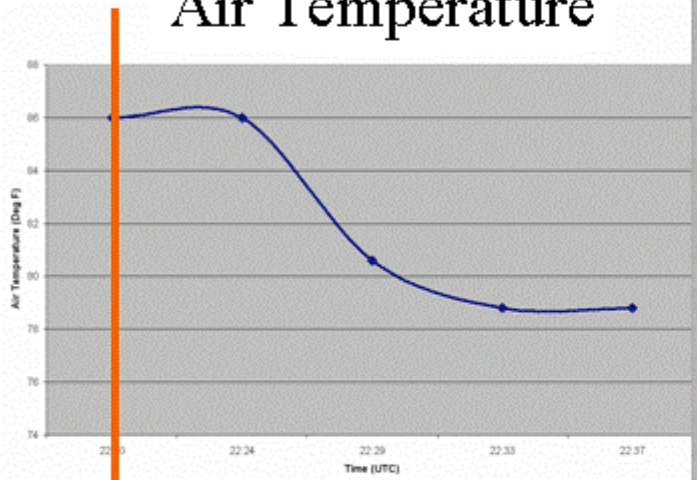


22:20 UTC

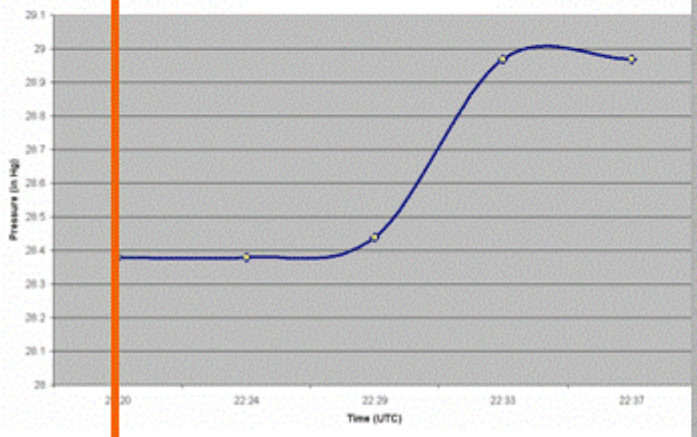


VII Test Bed – Detroit Metro

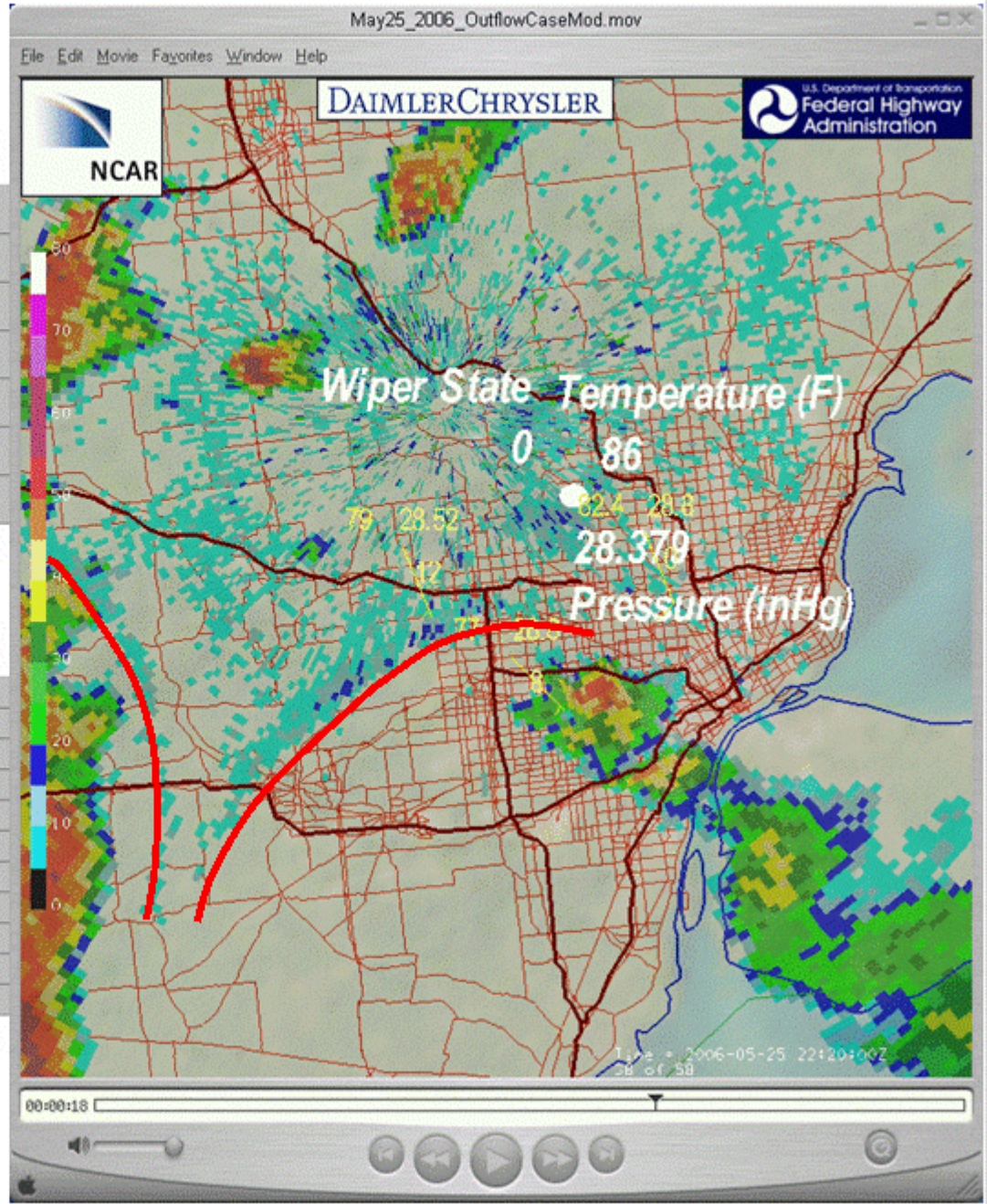
Air Temperature



Pressure



22:20 UTC



Flags

Same road under 3 different measurepoints

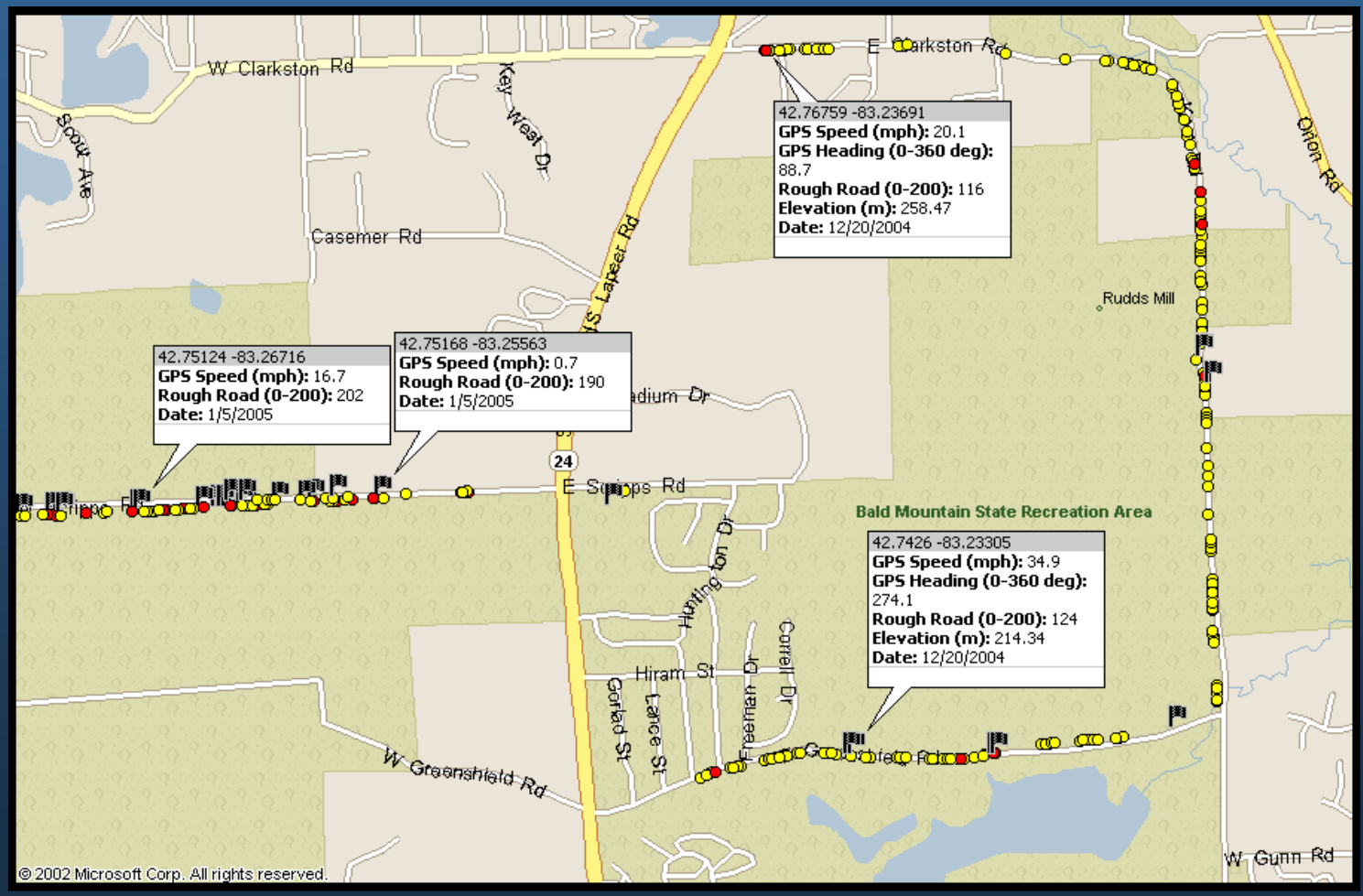
A: 16 flags (no maintenance): *very slippery*

B: 4 flags (salt, plowing): *slippery*

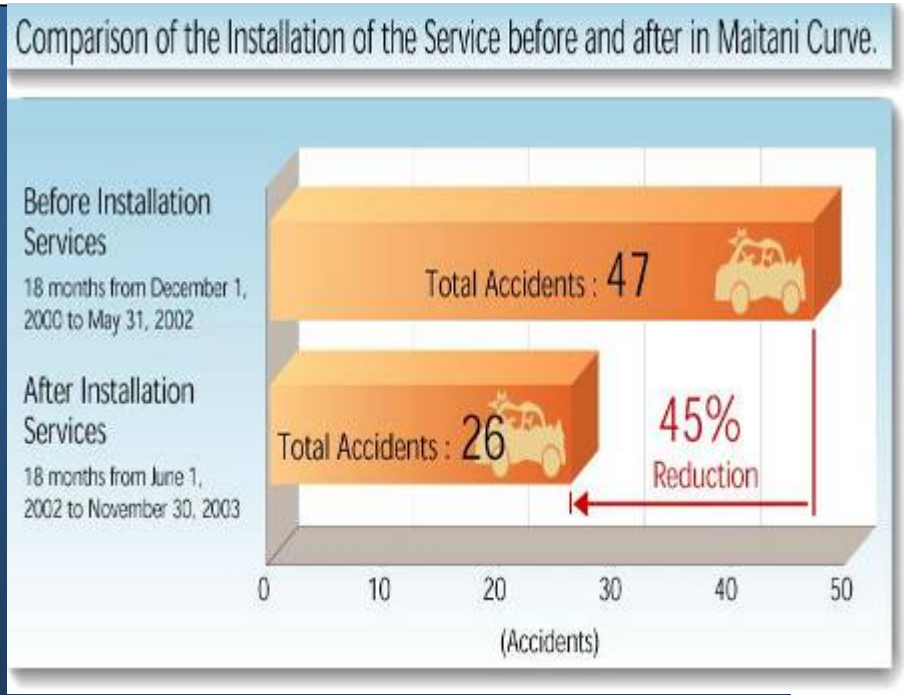
C: 0 flags (plus temp, rain): *no slippery*

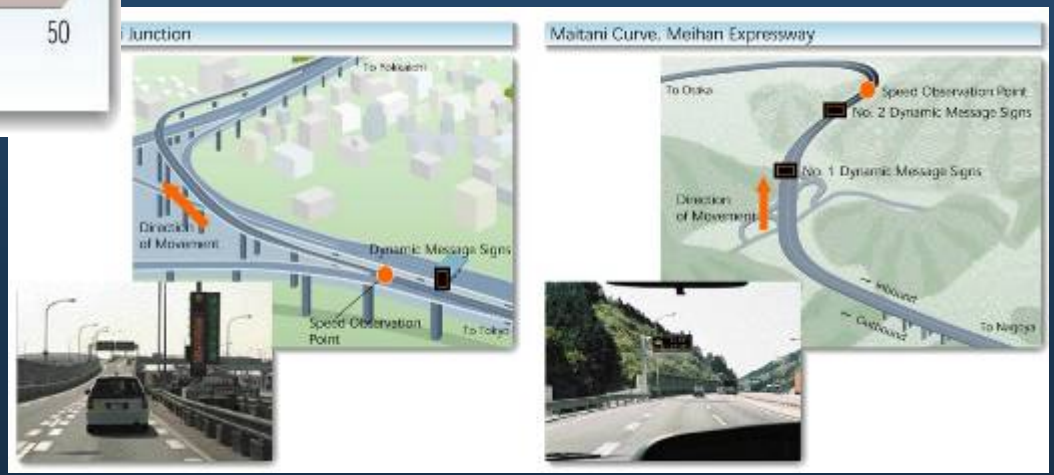
Information from SRA SRIS Program

Lessons Learned: Asset Management



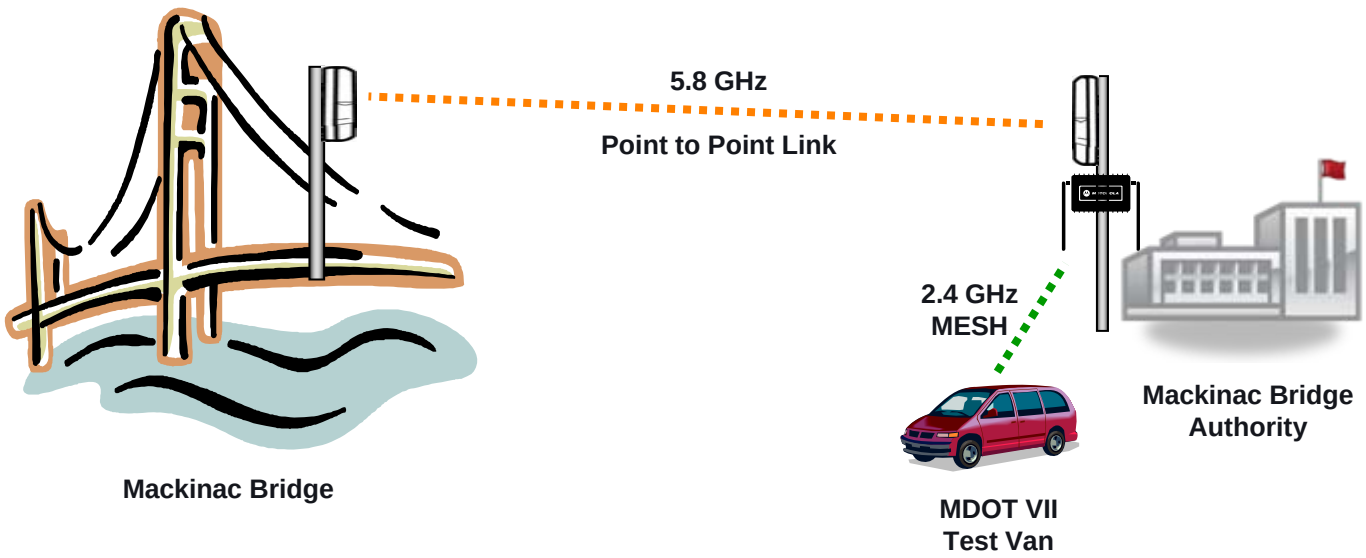
Lessons Learned: Crash Reduction





Information courtesy of ASHRA

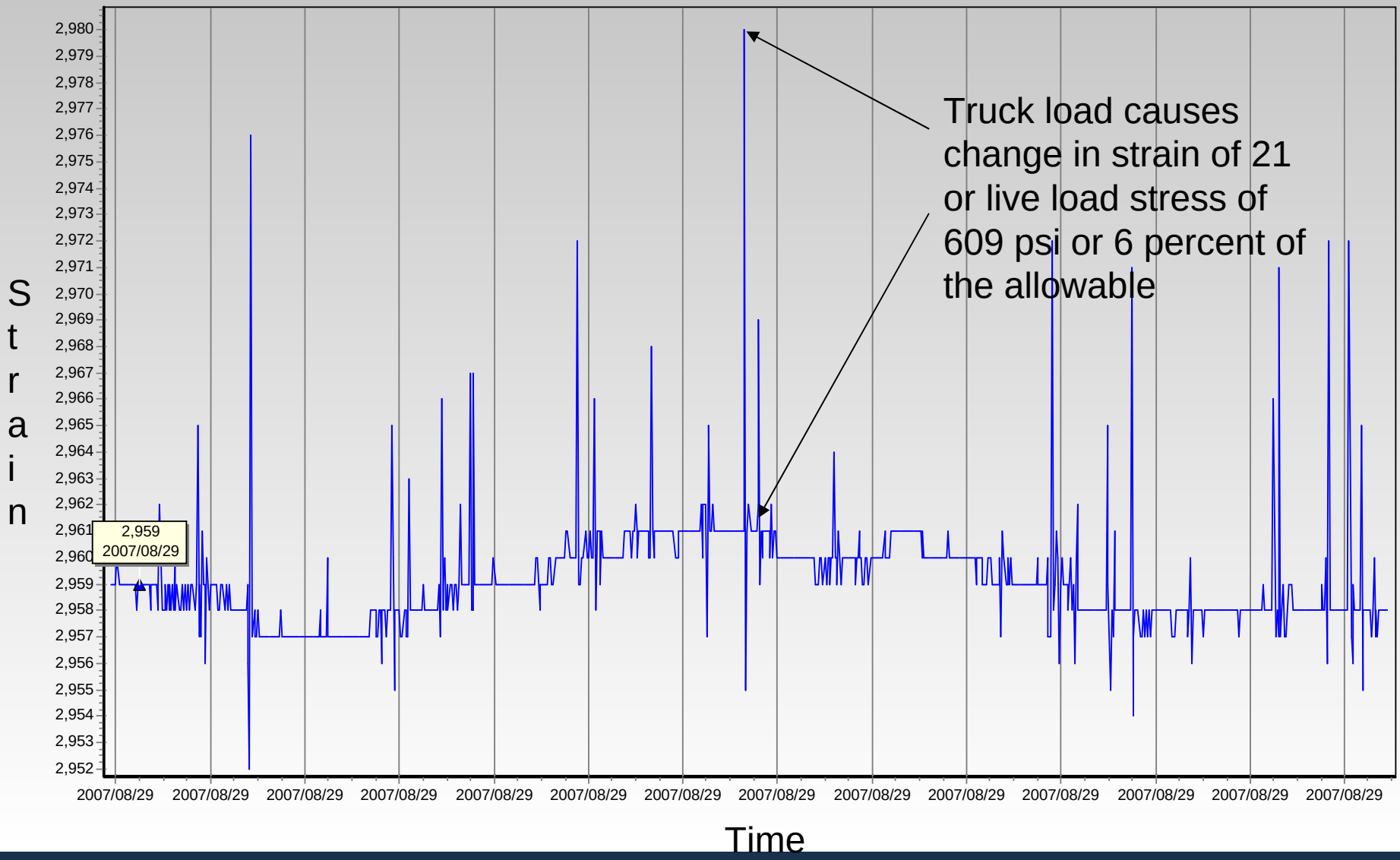
Mackinac Bridge Health Monitoring System



F:\CR10X_final_storage_1.dat

Array 115, Item 6

Allowable stress: 10,300 psi



Gage Reading at Truss Bottom Cord Mid-span East Side

Wireless VII Network Leverage – Utilizing Network to Support Existing Operations

- Possible Goals
  - Bridge Health Monitoring
  - Situation awareness to responding personnel
  - Expand wireless VII network on bridge
  - Allow on-bridge cameras to be viewed remotely in vehicles
  - Allow for Video Dispatch Center to view in-vehicle cameras

With the click of a button, the video can be sent to the Bridge Authority HQ, State Police HQ and other officers in the area, helping to ensure Bridge security and safety.

Video Dispatch Center

MOTOMESH Wireless Network

In-vehicle cameras can view an on-bridge incident that escalates.

Next Steps for MDOT

- Evaluate VII Data – How it impacts our day-to-day operations
- Support US DOT Proof of Concept efforts
  - Novi / Farmington Hills
  - VII-C
- Support Industry in independent VII testing
- Share information with our partners
  - www.michigan.gov/mdotvii

Thank You!

Greg Krueger, P.E.
Michigan Department of Transportation
kruegerg@michigan.gov
(517) 373-9479