Session 3: Performance Measurement/Management

- Which of the following automated technologies does your agency currently use for collecting data on the operational performance?
  - Probe vehicle data (e.g., INRIX, HERE) - Not for operations, planning
  - Vehicle re-identification (e.g., Bluetooth readers) – No, research projects
  - Other fixed ITS deployments
  - Vehicle detector data (aggregate counts)
    - Freeway – 5000 loop detectors & 200 WaveTronix (Metro) - ½ miles spacing
    - Arterial - 800 intersections loop detector data (State-wide)
  - Vehicle detector data (high-resolution)
    - Signals – 100 signal collecting high-res data (Metro)
- Are the measures used by your agency to track system performance currently available to the general public? If so, is this via a web-accessible interface?
  - Freeway – Annual Congestion Report
    - http://www.dot.state.mn.us/rtmc/reports/congestionreport2015.pdf
  - Arterials - no
- Does your agency currently utilize any performance measures or management tools that consider multiple modes of transportation? If so, which modes are considered? No, general traffic

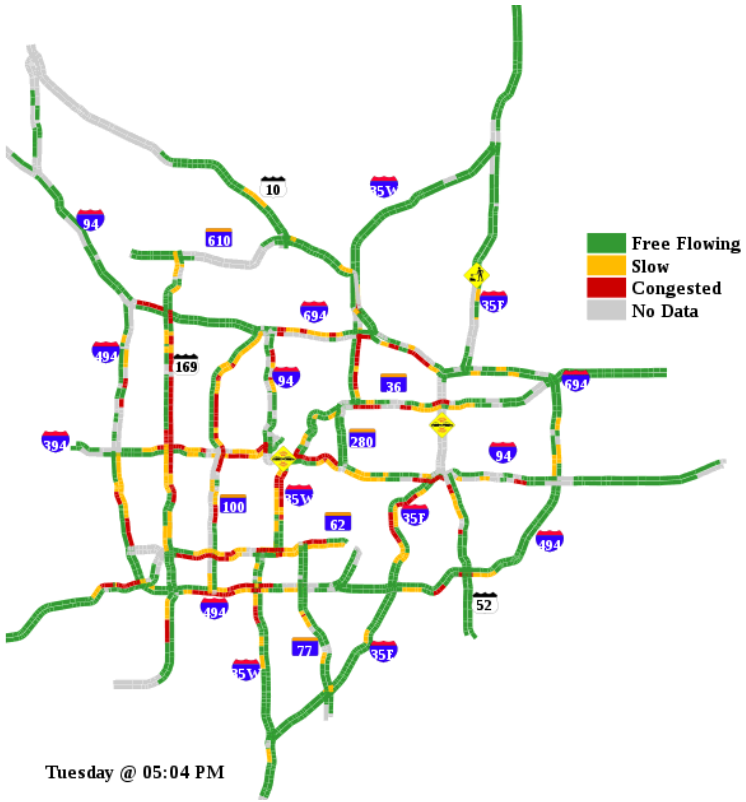
Session 3: Performance Measurement/Management

- Do you have any formal agreements with surrounding states on sharing performance measures or data? No
- Which of the following performance areas does your agency currently measure? Which specific measure(s) are utilized for each area?
  - Travel time reliability (TTR) on Interstate segments No
  - TTR on non-Interstate NHS segments No
  - Peak-hour travel times on Interstate and non-Interstate NHS segments No
  - Truck [commercial vehicle] TTR (TTTR) - No
  - Levels of congestion on Interstate segments for general purpose and truck traffic Yes – live congestion map
  - Excessive user delay No

MnDOT Detection – Freeway

- Detector stations
  - ½ mile spacing (Metro)
  - 1–5 miles spacing (outstate)
- 30 second bins
  - Volume
  - Occupancy
- Data Tools
- Historical data going back mid-1980's

Live Congestion Map

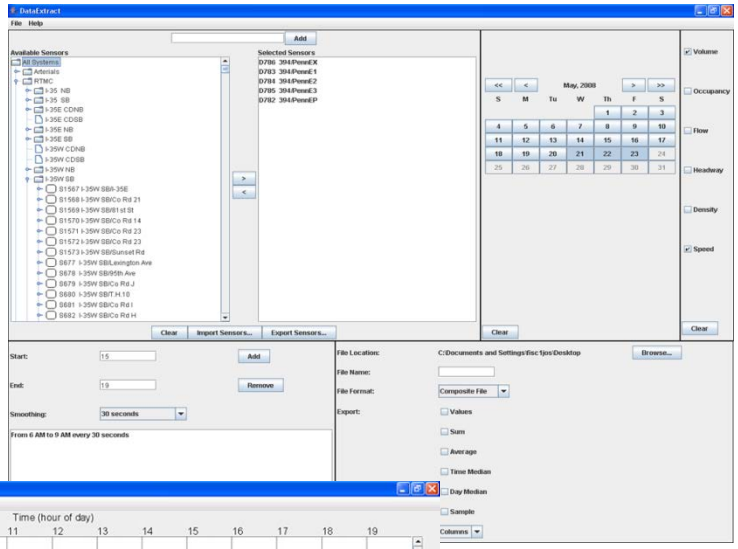


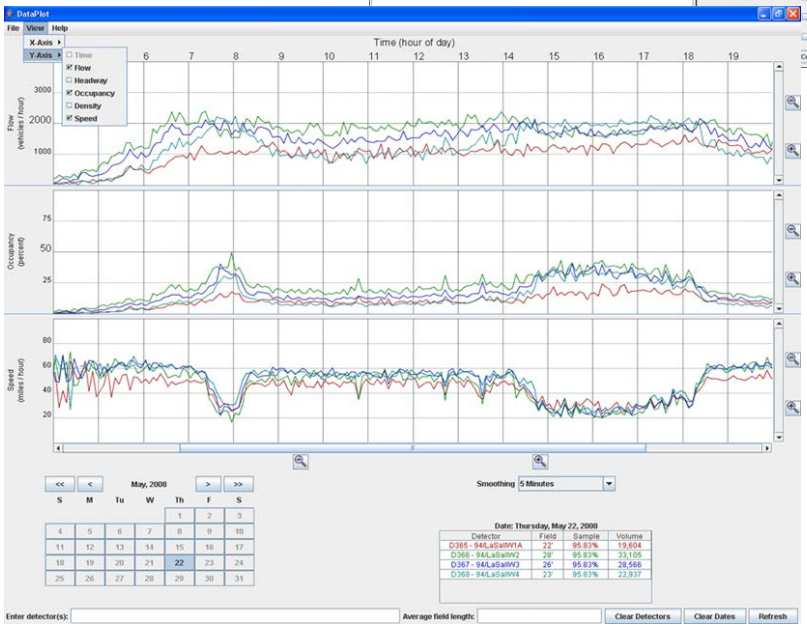
- Live html stream of freeway data
- Local news used data for Traffic Map
  - INRIX

Data Tools

Data Extract & Data Plot

- Developed and maintained by internal staff.
- Access to RTMC detector data.
- Allows for export to CSV file for basic performance measures
  - Volume
  - Occupancy
  - Speed
  - Headways
  - Vehicle Density





PeMS

- Performance Measurement System (PeMS)
- Developed for Caltrans by UC Berkley
- Provided by Iteris
- MnDOT has been using PeMS since 2012.
- Accesses RTMC detector data

ITERIS PeMS

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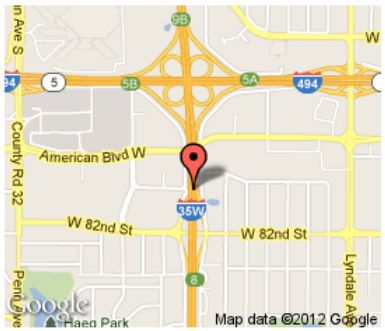
Mainline Station 55000043 - 82nd St

Performance | Data Quality | Configuration

Performance > Aggregates > Time Series

ABOUT THIS REPORT

Current Location



Maps: Real-Time | Performance | Inventory

I35W-N @ State PM 8.378068 (Abs PM 8.7)
District 5, Hennepin County

Station Details

Aliases	*None*
Controller	100025
Owner	*None*
Assoc. TMG Station	*None*
Speeds	Estimated
Max Cap.	96.2 Veh/Min (04/01/2012)
Vehicle Classification	*N/A*

Lane Detection

Lane	Slot	ID	Type
1		729	Mainline
2		282	Mainline
3		281	Mainline
4		6818	Mainline

Diagnostics

Threshold Set	Urban
Flow = 0, Occ > 0 (Intermittent)	2%
High Flow Threshold	20
High Occ Threshold	.7
High Occupancy (High Val)	20%

From: Oct 1 2012 0 — To: Oct 12 2012 15

Time of Day: All / 00:00 to 00:59

Include Days: Su Mo Tu We Th Fr Sa Holidays

Quantity: Flow

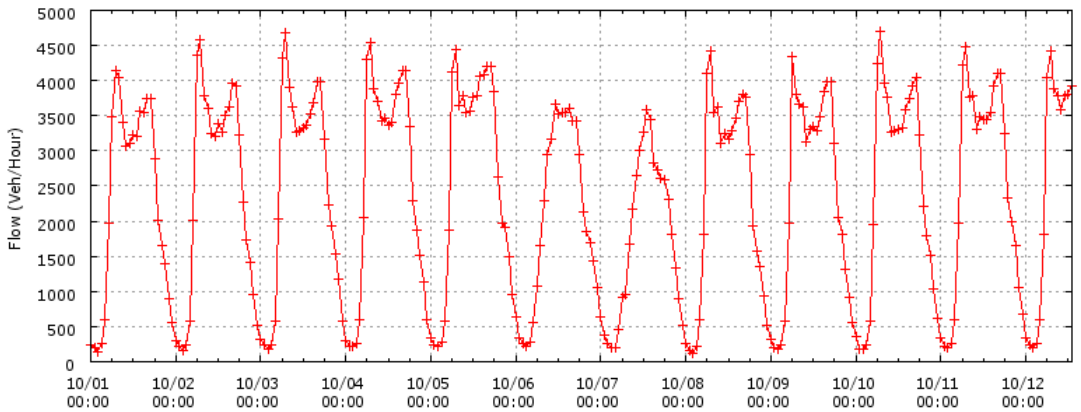
Granularity: Hour

Lanes: Agg 1 2 3 4

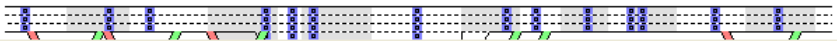
Second Quantity: -- None --

DRAW PLOT | VIEW TABLE | EXPORT TEXT | EXPORT to .XLS

Flow (Veh/Hour)
13,344 Lane Points (100% Observed)
Mainline Station 55000043 - 82nd St - I35W-N
Mon 10/01/2012 00:00:00 to Fri 10/12/2012 15:59:59



Y-Scale: Auto / Min Max — Lines Points Grid



Mainline Station 55000043 - 82nd St

Current Location

Maps: Real-Time | Performance | Inventory

I35W-N @ State PM 8.378068 (Abs PM 8.7)
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High Flow Threshold	20
High Occ Threshold	.7
High Occupancy (High Val)	20%

Performance | Data Quality | Configuration

Performance > Aggregates > Time of Day

ABOUT THIS REPORT

From: Oct 1 2012
*Min Range:*2 days

To: Oct 12 2012

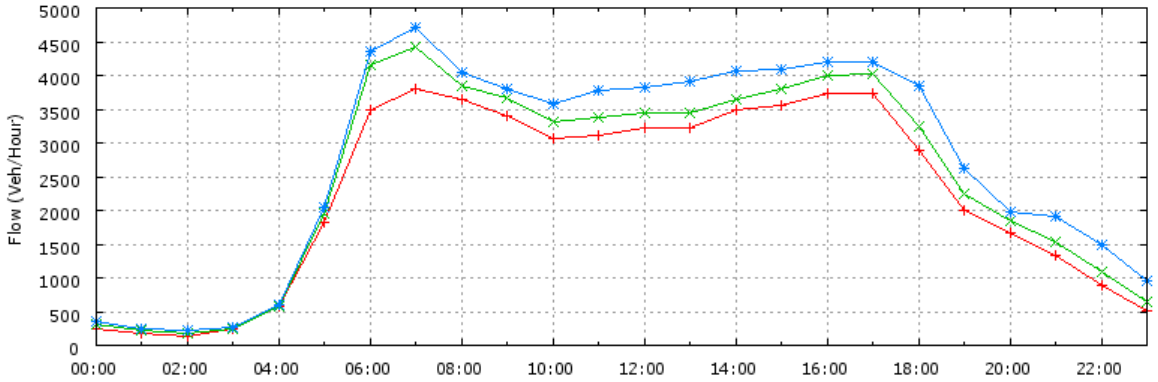
Include Days: ☐ Su ☑ Mo ☑ Tu ☑ We ☑ Th ☑ Fr ☐ Sa ☐ Holidays

Quantity: Flow

Statistics:
- ◉ Mean, Min, Max
- ○ Mean, Mean+σ,Mean-σ
- ○ Median, 25 %, 75 %
- ○ Discrete Days

DRAW PLOT | VIEW TABLE | EXPORT TEXT | EXPORT to XLS

Flow (Veh/Hour)
9,848 Lane Points (100% Observed)
Mainline Station 55000043 - 82nd St - I35W-N
Mon 10/01/2012 00:00:00 to Fri 10/12/2012 23:59:59 (Days=Mo,Tu,We,Th,Fr)



Minimum | Mean | Maximum

Y-Scale: ◉ Auto ○ Min Max ☑ Lines ☑ Points ☑ Grid

ITERIS PeMS

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Corridor I-35W: I-35 South to Chicago Ave

Current Location

Maps: Real-Time | Performance | Inventory

District 5: District 5

Active Corridor

I-35W: I-35 South to Chicago Ave

Detail | Overview

Jul 18, 2012 (Wed)

Day of Week

- (•) Single Day
- ( ) Monthly Averages

Direction of Travel

- (•) I35W-N
- ( ) I35W-S

Show

- [x] Speeds
- [x] Bottlenecks
- [x] Incidents
- [x] Grid
- [x] Stations

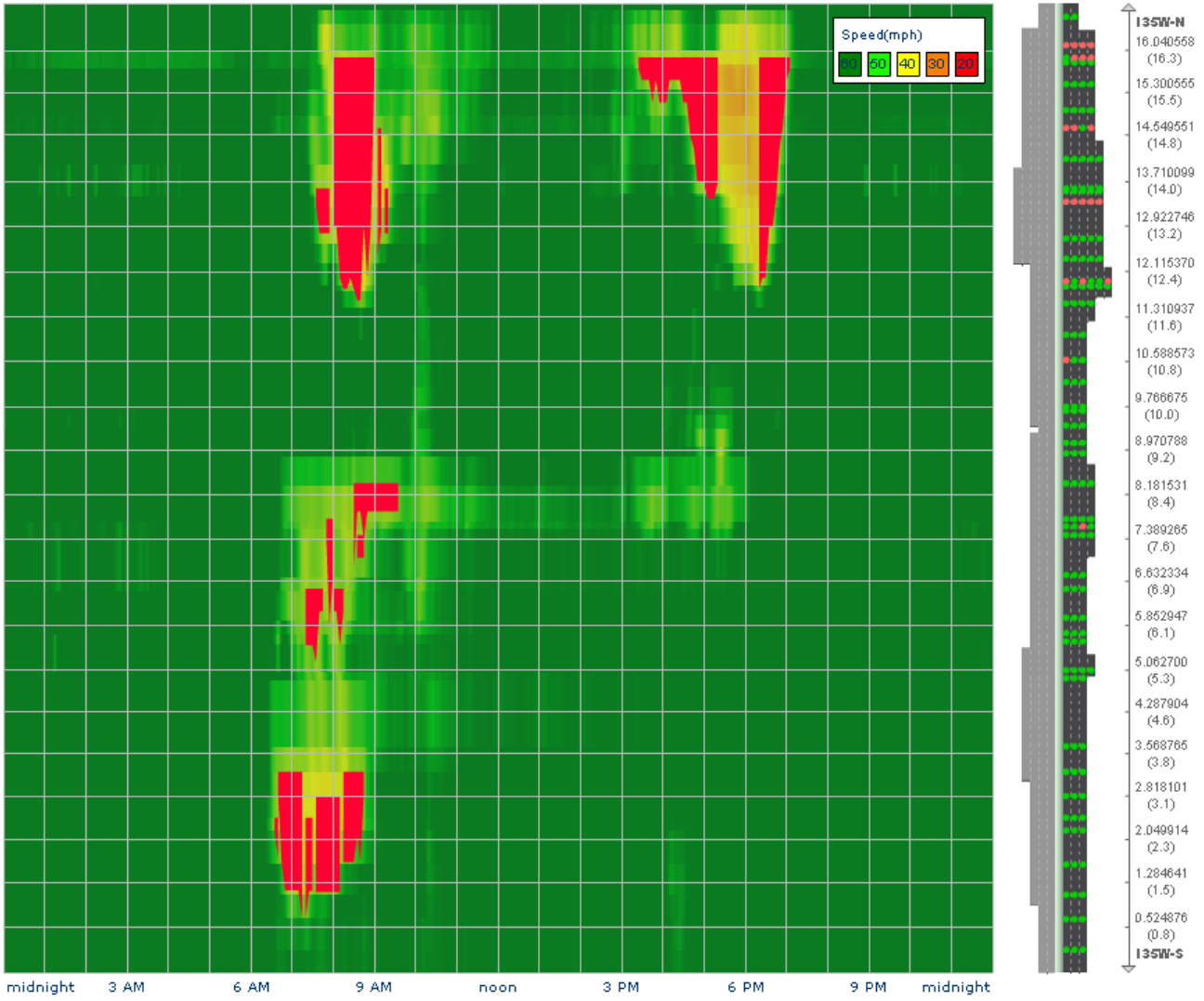
Tools

Holidays
System Administration

Map | Animation | Congestion | Travel Times | Detector Health | Download

Congestion: Detail

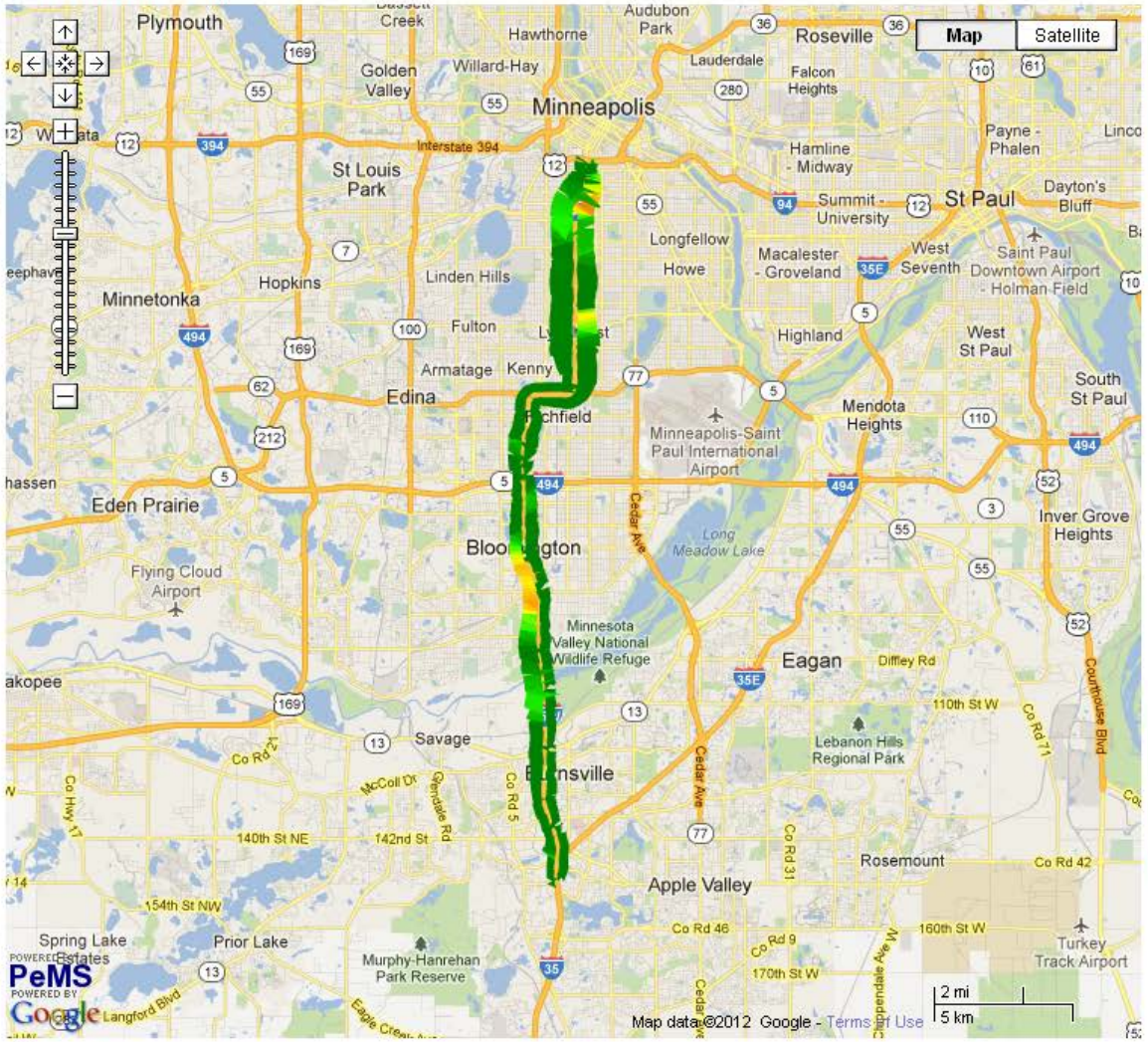
ABOUT THIS REPORT



Corridor I-35W: I-35 South to Chicago Ave

Animation: Daily

ABOUT THIS REPORT



Current Location

Maps: Real-Time | Performance | Inventory

District 5: District 5

Active Corridor

I-35W: I-35 South to Chicago Ave

Daily | Monthly

Oct 12, 2011 (Wed)

Start Time	End Time
03:00 PM	06:00 PM

Direction of Travel

- [x] I35W-N
- [x] I35W-S

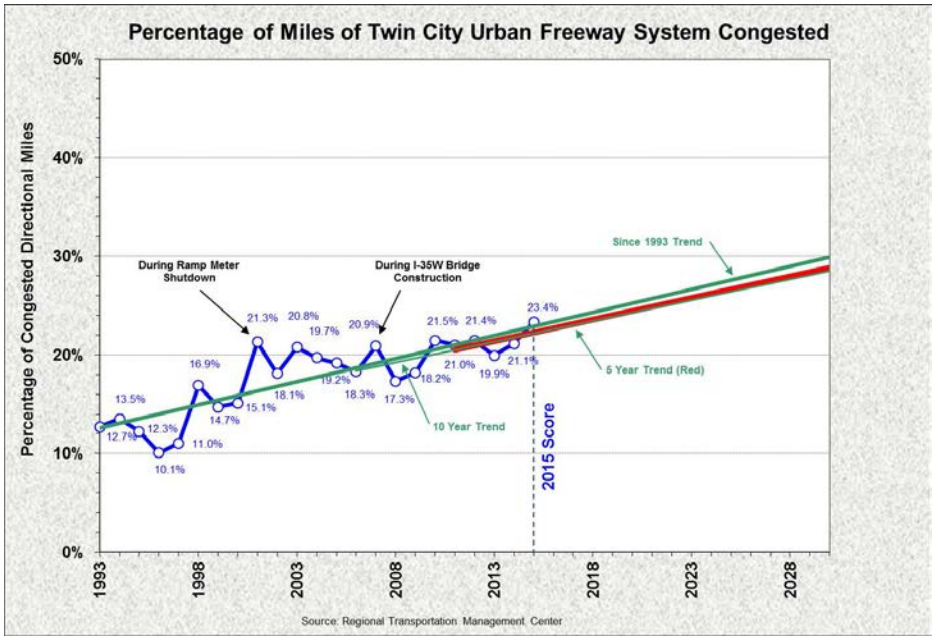
Show

- [x] Speeds
- [ ] Bottlenecks
- [x] Incidents
- [x] Volumes
- [ ] Stations

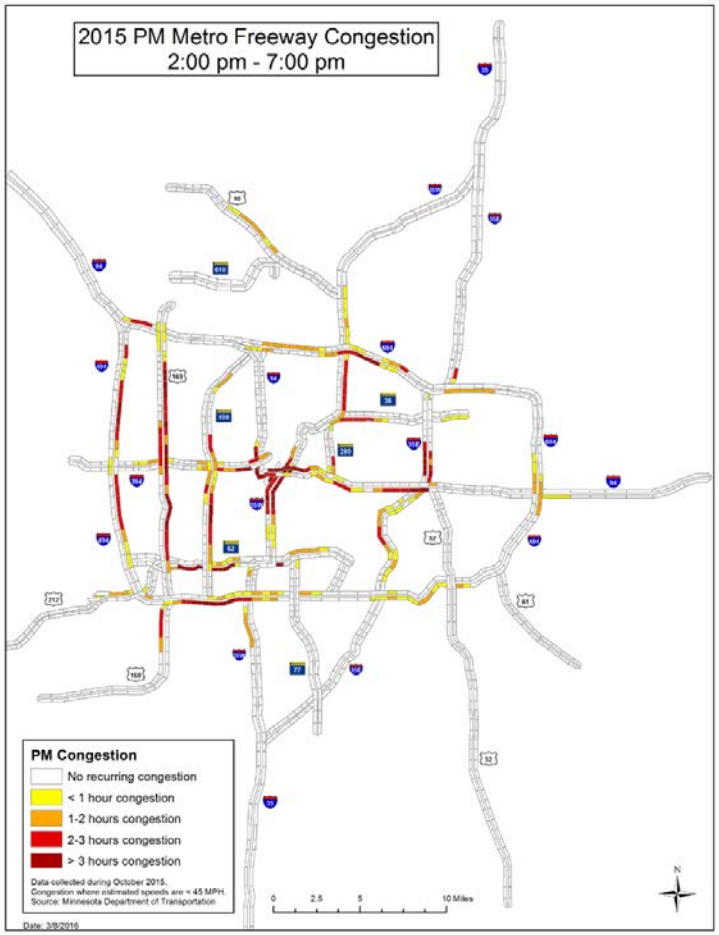
Tools

Holidays
System Administration

Metro Freeway Congestion Report



http://www.dot.state.mn.us/rtmc/reports/congestionreport2015.pdf



MnDOT Detection – Arterials

Detection – 6’ x 6’ inductive loop

- Lane by lane

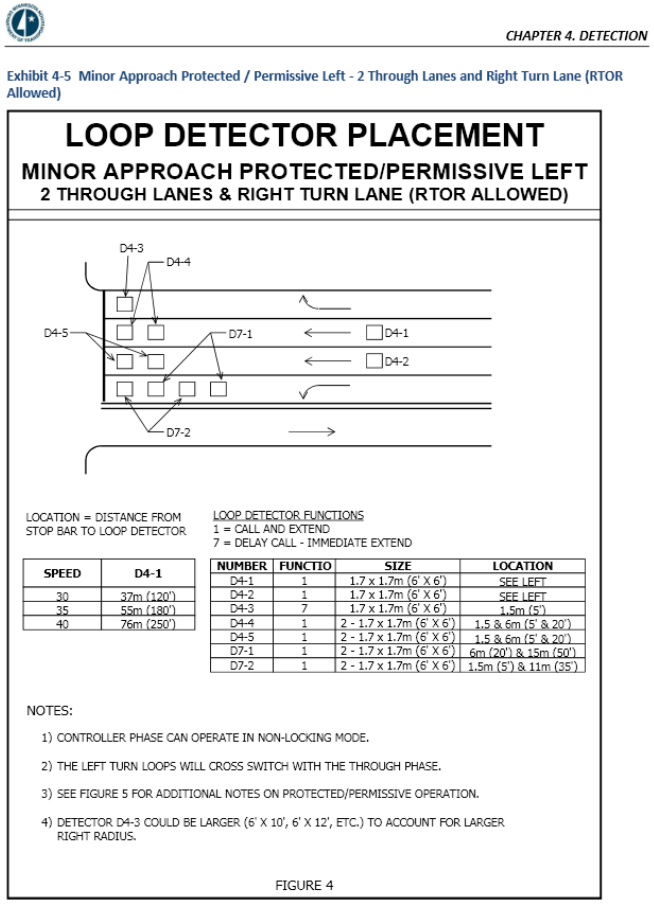
- http://www.dot.state.mn.us/trafficeng/signals/manual.html
  - Signal Design Manual, 2014
  - Signal Timing and Coordination Manual, 2015

High resolution data

- SMART SIGNAL – 2008
  - University of MN & MnDOT partnership
- 100 intersections with SPM

http://dotapp7.dot.state.mn.us/smartsignal/

- Utah SPM – IT issue
- Intelight imbedded SPM



CHAPTER 4. DETECTION

Exhibit 4-5 Minor Approach Protected / Permissive Left - 2 Through Lanes and Right Turn Lane (RTOR Allowed)

LOOP DETECTOR PLACEMENT

MINOR APPROACH PROTECTED/PERMISSIVE LEFT

2 THROUGH LANES & RIGHT TURN LANE (RTOR ALLOWED)

LOCATION = DISTANCE FROM STOP BAR TO LOOP DETECTOR

SPEED	D4-1
30	37m (120')
35	55m (180')
40	76m (250')

LOOP DETECTOR FUNCTIONS
1 = CALL AND EXTEND
7 = DELAY CALL - IMMEDIATE EXTEND

NUMBER	FUNCTIO	SIZE	LOCATION
D4-1	1	1.7 x 1.7m (6' X 6')	SEE LEFT
D4-2	1	1.7 x 1.7m (6' X 6')	SEE LEFT
D4-3	7	1.7 x 1.7m (6' X 6')	1.5m (5')
D4-4	1	2 - 1.7 x 1.7m (6' X 6')	1.5 & 6m (5' & 20')
D4-5	1	2 - 1.7 x 1.7m (6' X 6')	1.5 & 6m (5' & 20')
D7-1	1	2 - 1.7 x 1.7m (6' X 6')	6m (20') & 15m (50')
D7-2	1	2 - 1.7 x 1.7m (6' X 6')	1.5m (5') & 11m (35')

NOTES:

1) CONTROLLER PHASE CAN OPERATE IN NON-LOCKING MODE.

2) THE LEFT TURN LOOPS WILL CROSS SWITCH WITH THE THROUGH PHASE.

3) SEE FIGURE 5 FOR ADDITIONAL NOTES ON PROTECTED/PERMISSIVE OPERATION.

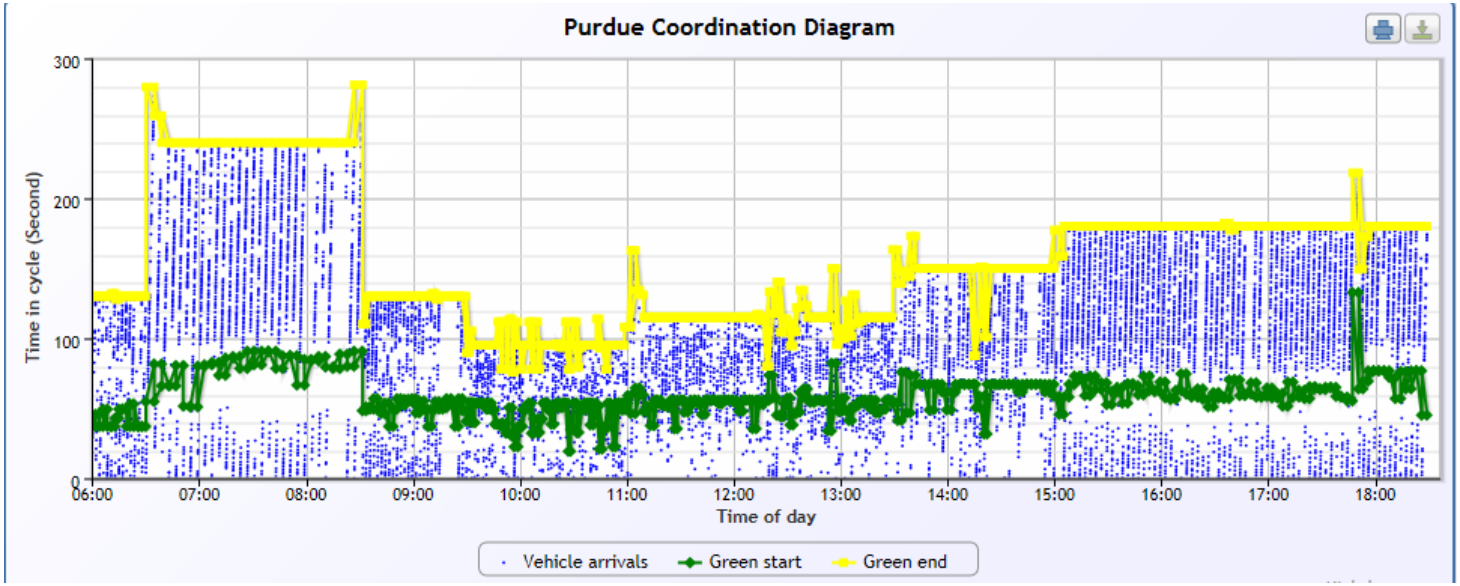
4) DETECTOR D4-3 COULD BE LARGER (6' X 10', 6' X 12', ETC.) TO ACCOUNT FOR LARGER RIGHT RADIUS.

FIGURE 4

MnDOT Traffic Control Signal Design Manual 4-30 June 2014

Performance Measurement

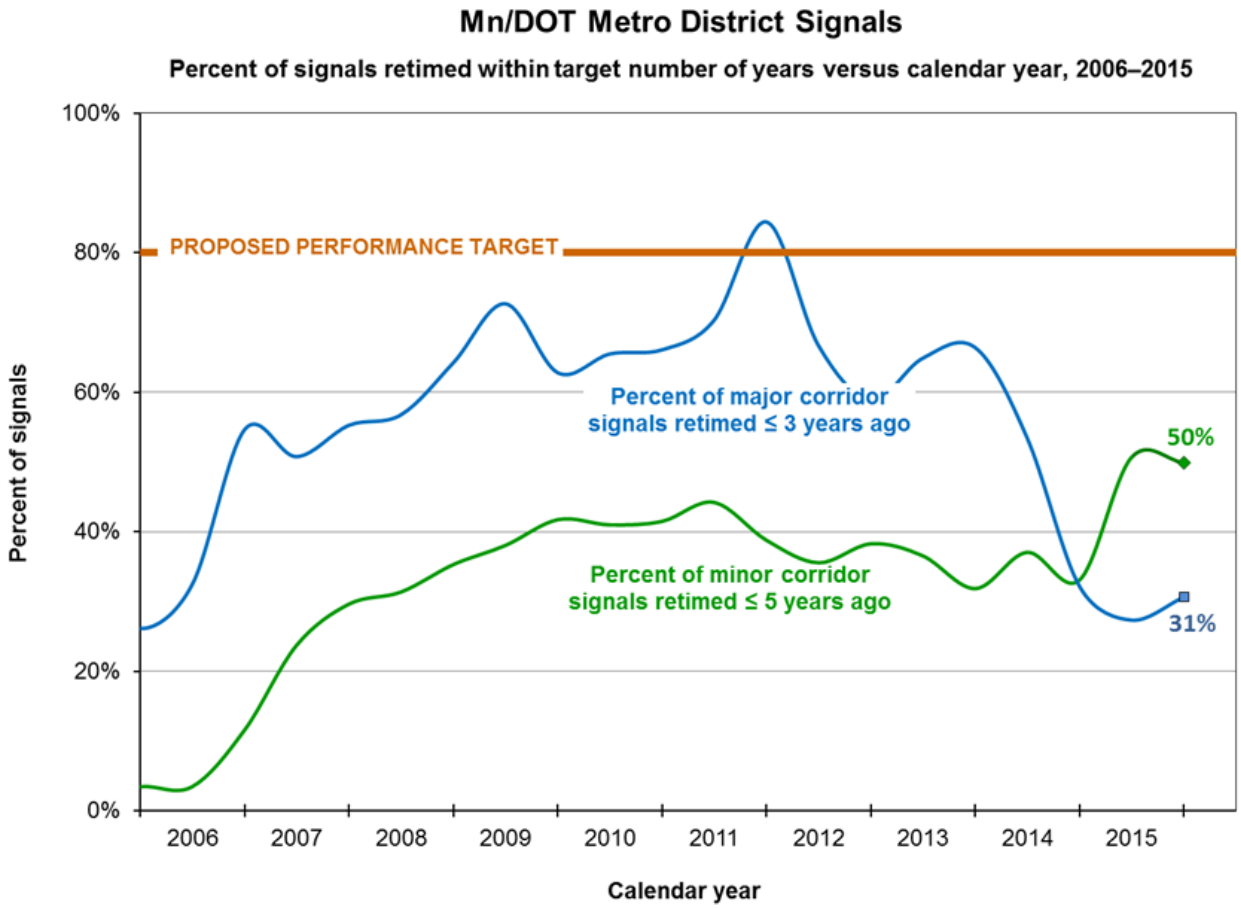
- Signal Performance Measures
  - SmartSignal
  - Utah DOT & Purdue
  - Intelight MaxView (new central system)



Performance Measurement
Signal Retiming – Metro

- Official Measure (2)
  - Retime signals on major corridors every 3 years
  - Retime signals on minor corridors every 5 years
- Temporary modification of the "Measure"
  - Upgrade of timing in all 726 signals
    - Pedestrian crossing times
    - Clearances
    - Operational consistencies
- Using SPM to determine when to retime & what adjustments to make.

Performance Measurement



January 13, 2015

Annual Performance Report

- Transportation Performance Report 2014
  - Http://www.dot.state.mn.us/measures/
  - Interregional Corridor Travel Time
    - Travel Time Reliability – Design/Planning
  - Twin Cities Freeway Congestion
    - Percent of freeways below 45 mph

Moving Forward

- Asset Management – TAMS implementing now
  - All ITS components, Signals & Lighting Components
- Central Signal System – Intelight MaxView
  - Statewide Procurement
    - All can purchase
    - Connected systems – Center to Center
- Signal Performance Measures
  - Determining baseline, tracking overtime
  - Expand the signals with SPM
  - Transitioning from retiming based on calendar (every 3-4 yrs) and more on actual need based on Performance Measure