

Performance Measures for RIDOT's Traffic Management Center

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Presentation Outline



- **Rhode Island Department of Transportation**
TMC vision, mission statement and goals
- **Performance Measures**
Metrics, data sources, conclusions and internal presentation
- **Online Reporting**
Developing traveler tools online for commuters and special events
- **Lessons Learned**
Sensor placement and operator training



Rhode Island Traffic Management Center

TMC Mission

To maintain and provide a safe, efficient, environmentally, aesthetically and culturally sensitive intermodal transportation network that offers a variety of convenient, cost effective mobility opportunities for people and the movement of goods to support economic development and an improved quality of life.



 Traffic Cams  Congestion Mapping  511  1630AM

Performance Measure Selection Criteria

- Follow FHWA/AASHTO recommendations
- Support the TMC's mission statement
- Ability to compute periodically
- Help improve safety and traffic operations
- Demonstrate the benefits derived from ITS
- Data must be
 - Reliable
 - Readily Available

LIST OF PERFORMANCE MEASURES

Initial
Future

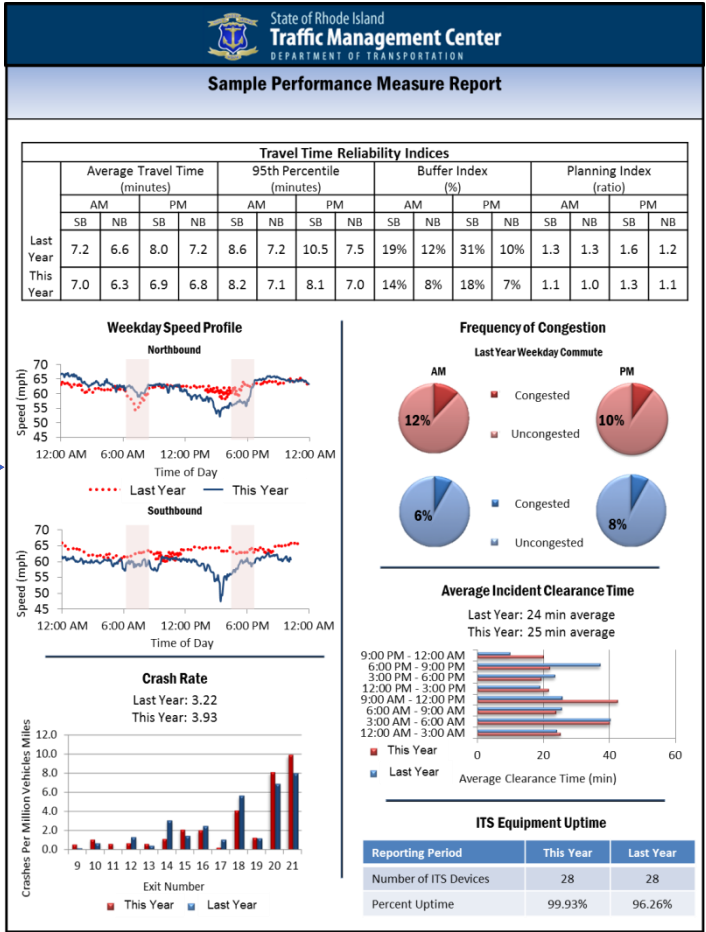
| Performance Measure | Definition | Units | Reporting Frequency | Data Source | Remarks |
|--|---|----------|---------------------|--|---|
| Incident Management (Reported for each highway segment) | | | | | |
| Incident Clearance Time (for all incidents) | Time from when incident is verified (reported) to the time the responders leave the scene and/or incident is declared as cleared. | Minutes | Monthly | RIDOT TMC Database - Incidents | FHWA Focus States Initiative TIM Final Report |
| Roadway Clearance Time (for incidents with lane closure) | Time from when incident is verified (reported) to the time when lanes are available to traffic | Minutes | Monthly | RIDOT TMC Database - Incidents | FHWA Focus States Initiative TIM Final Report |
| Number of secondary crashes | Number of crashes from time when primary incident is verified (reported) to the time when incident is declared as cleared, either at scene or in the queued section of highway in both directions | None | Yearly | RIDOT TMC Database - Incidents & RIDOT EARS Crash Database | FHWA Focus States Initiative TIM Final Report. Crash Database late by one year. |
| Incident Dispatch Time | Time from when incident is verified (reported) to time when TMC personnel are dispatched to the scene | Minutes | Monthly | RIDOT TMC Database – Dispatch | Will show how soon the TMC responded |
| Incident Response Time | Time from when incident is verified (reported) to time when first responders arrive on scene | Minutes | Monthly | RIDOT TMC Database – Incidents | Will show how soon the responders arrived on scene |
| Incident Recovery Time | Time from when incident is declared to be cleared to the time when average speeds return to 95% of historic levels | Minutes | Monthly | RIDOT TMC Database - Incidents & CMD DataCollector | Shows the level of impact from an incident |
| Incident Notification Time | Time from when incident is verified (reported) to the time when motorists are notified either via DMS/VMS or via 511 | Minutes | Monthly | RIDOT TMC Database - Incidents & Daktronix Vanguard Database & CARS 511 Database | Shows the level of response of the TMC |
| Number of Incidents | Total number of incidents by type reported | None | Monthly | RIDOT TMC Database – Incidents | Surrogate measure for overall safety of the highway segment |
| Travel Time Reliability (Reported for each highway segment for Weekday AM Period (6:00-900 AM), Weekday PM Period (3:00-7:00 PM)) | | | | | |
| 95 th ile travel time | 95 th percentile travel time | Minutes | Monthly | CMD DataCollector/CMD DataViewer | FHWA Travel Time Reliability |
| Planning Time Index | Ratio of 95 th percentile travel time to free flow travel time | None | Monthly | CMD DataCollector/CMD DataViewer | FHWA Travel Time Reliability |
| Buffer Index | Ratio of difference between 95 th percentile travel time and average travel time to average travel time | None | Monthly | CMD DataCollector/CMD DataViewer | FHWA Travel Time Reliability |
| Frequency of Congestion | Percent of time when sensor occupancy greater than 30-40% | None | Monthly | CMD DataCollector/CMD DataViewer | FHWA Travel Time Reliability |
| Customer Satisfaction | Level of customer satisfaction with the RIDOTs traveler information system including DMS and 511 | % | Annually | User survey results collected through the TMC website | Level of satisfaction and effectiveness of traveler information |
| Safety Management (Reported for each highway segment) | | | | | |
| Crash Rate | Total annual crashes per 100 million vehicle-miles | #/100MMV | Annually | RIDOT EARS Crash Database & RIDOT HPMS Database | AASHTO Recommended; But ADT and Crash data will be 1 year old |
| Work Zone Monitoring | Percent of total number of construction projects with ITS monitoring | % | Annually | ????? | Level of ITS monitoring of work zones |
| Work Zone Travel Time Reliability Indices | Travel Time Reliability Indices as listed above | None | Annually | RIDOT Construction Projects & CMD DataCollector & CMD DataViewer | Delay impacts of work zones |
| Traveler Information (Reported Statewide) | | | | | |
| Number of 511 Calls | Number of calls received by RI 511 | # | Monthly | RIDOT 511 | Usage level |
| Number of 511 Website Hits | Number of visits to the 511 website | # | Monthly | CARS ???? | Usage level |
| Number of TMC Website Hits | Number of visits to the TMC Website | # | Monthly | TMC Website | Usage level |
| System Performance & Maintenance (Reported Statewide) | | | | | |
| Percent CL Miles of Highway Network Covered | Percent of total centerline miles of the highway network the is covered | % | Annually | RIDOT GIS Database | Coverage of ITS devices and services |
| ITS Device Percent Uptime | Ratio of amount of time an ITS device is operational, not including planned or preventative maintenance and upgrade to total time in the reporting period | % | Quarterly | RIDOT TMC Database – Devices | Reliability of ITS devices |
| TMC System Availability | Percent of time when the systems at the TMC was operational and available for use by the operators | % | Annually | ????? | Reliability of the systems in the TMC |
| Mean Time Between Failures | Average of time between failures of ITS devices | Days | Annually | RIDOT TMC Database – Devices | Reliability of ITS devices |

RIDOT Data Sources

TMC

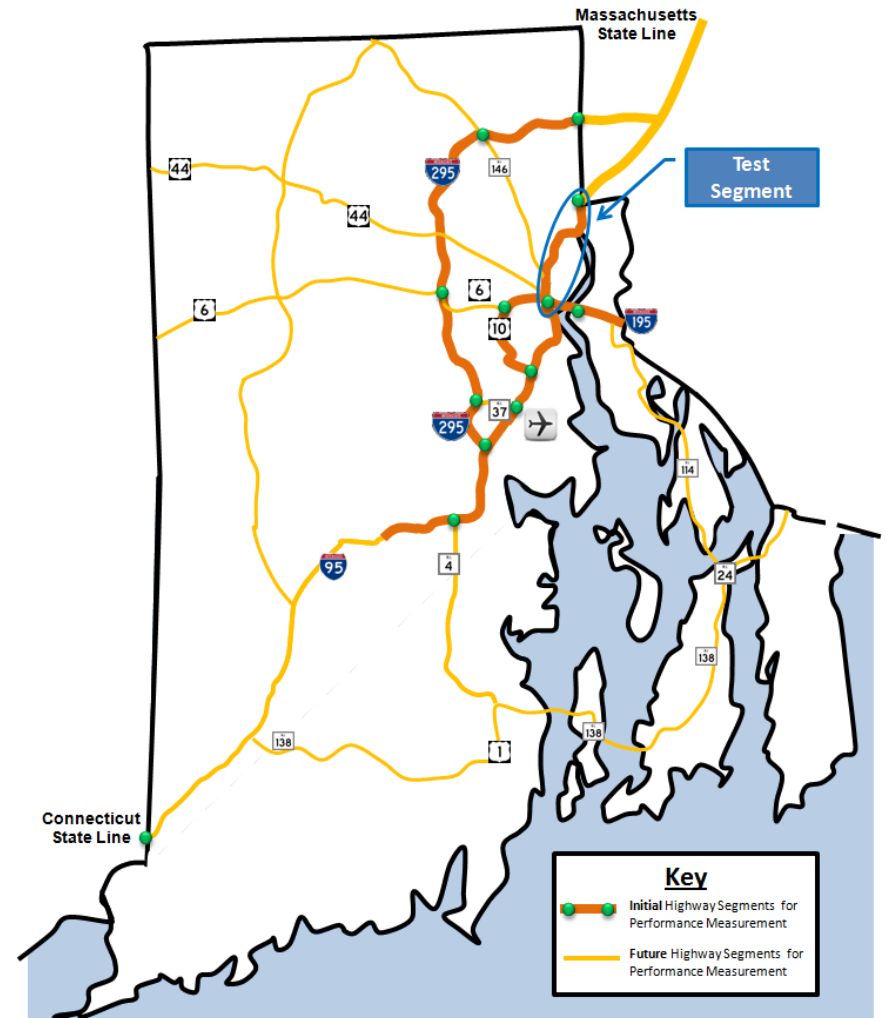


External



Metrics and Geographic Scope

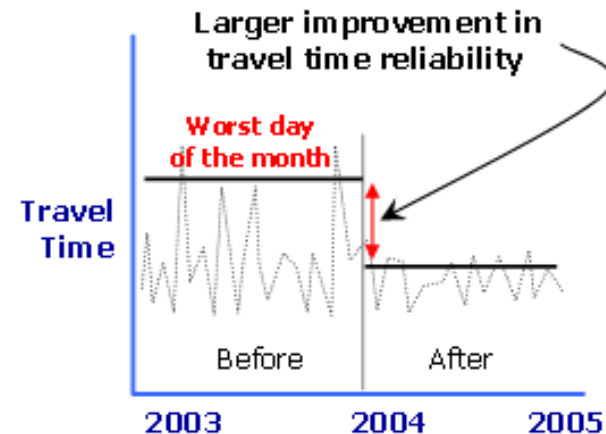
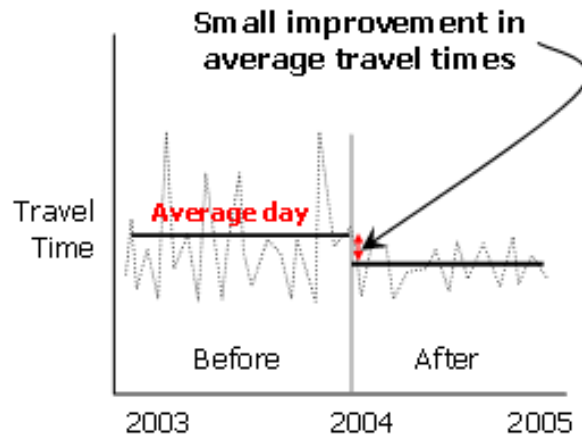
- Travel Time Reliability Measures
 - Average Travel Time
 - 95thtile Travel Time
 - Planning Index
 - Buffer Index
 - Congestion Frequency
- Incident Clearance Time
- Crash Rate
- ITS Equipment Uptime



Travel Time Reliability Indices

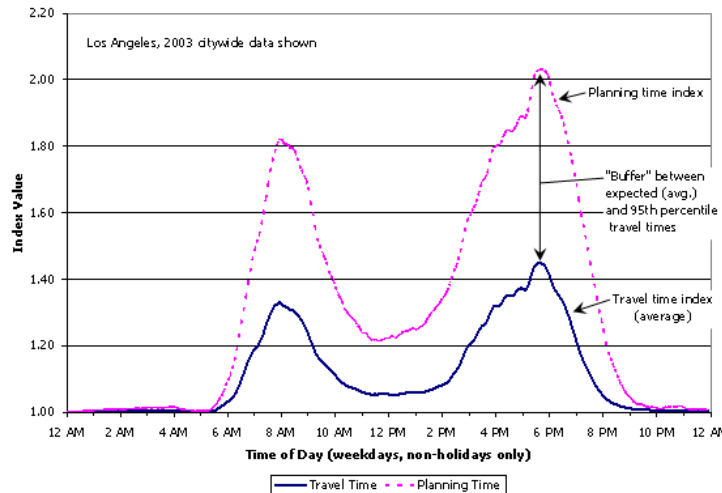
FHWA encourages travel time reliability indices be included as part of an overall performance program:

- Currently used measures of congestion are inadequate for determining the true impact of the congestion that clogs up the transportation system from a user's perspective.
- And that they are not able to adequately measure the impacts of congestion mitigation strategies.



Travel Time Reliability Indices

- 95%ile Travel Time-How much delay will be on the heaviest travel days.
- Travel time Index-Average time it takes to travel during peak hours compared to free flow conditions.
- Buffer Index- Represents the extra buffer time (or time cushion) that most travelers add to their average travel time when planning trips to ensure on-time arrival.
- Planning Time Index-Represents the total travel time that should be planned when an adequate buffer time is included.



Travel Time Reliability Indices

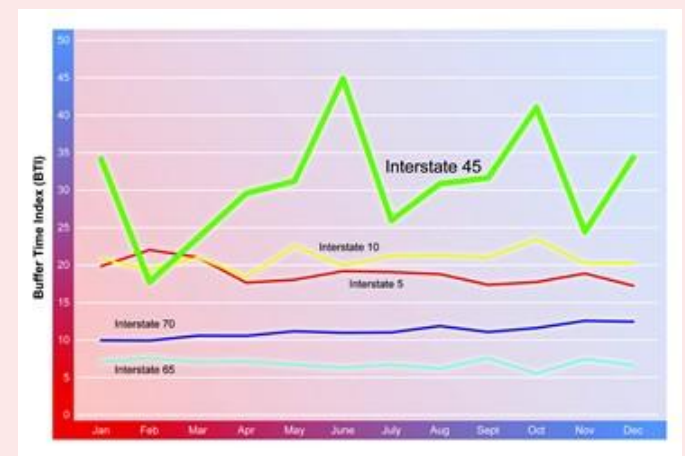
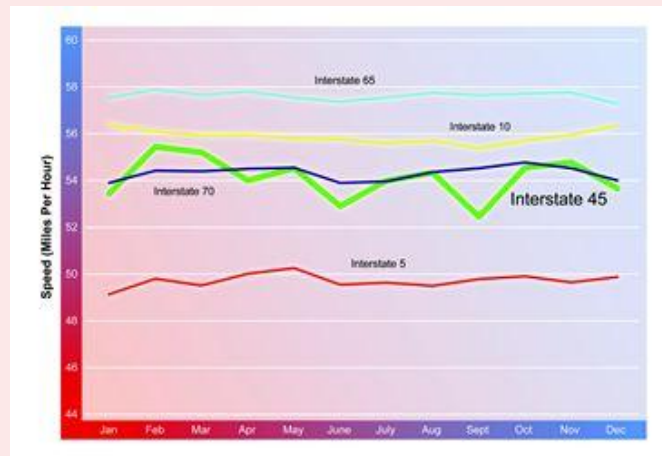
For a specific route/trip and time period :

$$\text{Buffer index (\%)} = \frac{95^{\text{th}} \text{ percentile travel time (minutes)} - \text{average travel time (minutes)}}{\text{average travel time (minutes)}}$$

For a specific route/trip and time period :

$$\text{Planning time index (no units)} = \frac{95^{\text{th}} \text{ percentile travel time}}{\text{free-flow travel time}}$$

FHWA Example of Speed Profile vs. Buffer Index Profile



Peak Periods

Reviewed Reports

Sensor Speed Profiles

INRIX National Traffic Scorecard 2009 Annual Report

#47 Providence Metropolitan Area

Urban Congestion Report (UCR)
A Snapshot of Congestion Trends in the U.S. for October 2009 through December 2009

Performance Monitoring Report Providence, RI
November 2009 – January 2010
Metropolitan Area Executive Summary

| YEAR | Congested Hours | | | Travel Time Index | | | Planning Time Index | | | Data Quality | Contributing Factors (Peak Period) | | | | | |
|------|-----------------|-------|------|-------------------|-------------|-------------|---------------------|-------------|-------------|--------------|------------------------------------|---------------|------------|-----|-----|--------|
| | Weekly | 25.0% | 0.0% | Weekly Peak | Weekly Peak | Weekly Peak | Weekly Peak | Weekly Peak | Weather [1] | | Work Zone [2] | Incidents [3] | Demand [4] | | | |
| 2010 | 128 | 0.3 | 0.9 | 0.5 | 1.15 | 1.1 | 1.2 | 1.377 | 1.3 | 1.4 | 98% | 92 of 92 | 21% | N/A | 115 | 16,419 |
| 2009 | 170 | 0.5 | 1.2 | 1.0 | 1.16 | 1.1 | 1.2 | 1.463 | 1.4 | 1.6 | 99% | 92 of 92 | 19% | N/A | 123 | 16,594 |
| | | | | | | | | | | | | | | | | |

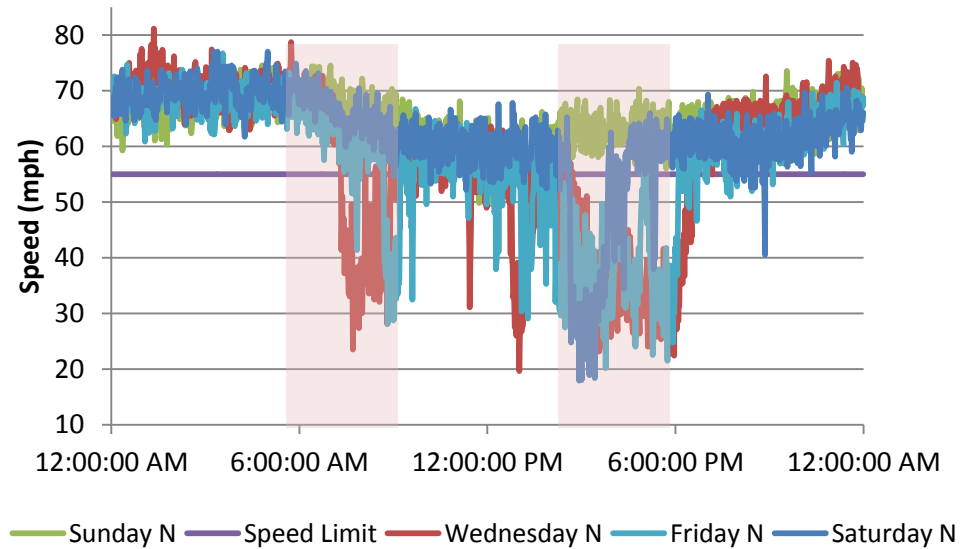
Area-Wide Congestion Trends Since June 2005

Top 10 Congested Corridors

| Rank | SR | SR | Description | Miles | Weekly Peak | Weekly All Day | Weekly Peak | Weekly All Day |
|------|-----|--------|---|-------|-------------|----------------|-------------|----------------|
| 1 | 1 | SR-146 | SR-146 SB: Route 6 (Mineral Spring Ave) to Admiral Street | 3.2 | 51 | 51 | 2,305 | 1,316 |
| 2 | 2 | SR-10 | SR-10 SB: Route 2 (Reservoir Ave) to Broadway | 4.3 | 50 | 53 | 2,305 | 1,394 |
| 3 | 3 | I-95 | I-95 SB: Central Ave to I-95 Interchange | 6.1 | 51 | 55 | 4,422 | 2,618 |
| 4 | 4 | SR-10 | SR-10 SB: Broadway to Route 2 (Reservoir Ave) | 4.3 | 54 | 55 | 2,361 | 1,307 |
| 5 | 5 | US-6 | US-6 SB: Route 5 (Ahwood Ave) to Kiltingly Street | 4.0 | 56 | 56 | 1,979 | 1,034 |
| 6 | 6 | I-95 | I-95 NB: I-95 Interchange to Central Ave | 6.8 | 56 | 55 | 4,411 | 2,300 |
| 7 | 7 | I-295 | I-295 SB: US-44 to I-95/Route 2 (Baldwin Road) | 13.0 | 59 | 59 | 2,310 | 1,167 |
| 8 | 8 | SR-146 | SR-146 NB: Admiral Street to Route 6 (Mineral Spring Ave) | 3.2 | 50 | 50 | 2,313 | 1,334 |
| 9 | 9 | US-6 | US-6 WB: Kiltingly Street to Route 5 (Ahwood Ave) | 4.0 | 51 | 51 | 1,625 | 929 |
| 10 | N/A | I-95 | I-95 SB: I-95 Interchange to Compton Road | 13.0 | 52 | 54 | 4,237 | 2,454 |

Congested Hours and Planning Time Index show an improvement over the previous year.

Speed Profile, April 24-28, 2010
Northbound (.3 mi N of DT Providence)



Morning 6:30 AM to 9:30 AM Evening 3:30 PM to 6:30 PM
Weekend 11AM to 6 PM

Sample Reliability Indices

| Travel Time Reliability Indices | | | | | | | | | | | | | | | | |
|---------------------------------|---------------------|-----|------|-----|-----------------|------|------|------|--------------|-----|-----|-----|----------------|-----|-----|-----|
| | Average Travel Time | | | | 95th Percentile | | | | Buffer Index | | | | Planning Index | | | |
| | SB | | NB | | SB | | NB | | SB | | NB | | SB | | NB | |
| | AM | | PM | | AM | | PM | | AM | | PM | | AM | | PM | |
| | Weekday | 7.2 | 6.3 | 8.3 | 7.2 | 11.8 | 7.6 | 12.4 | 8.4 | 52% | 16% | 43% | 13% | 1.9 | 1.3 | 2.0 |
| Friday | 6.2 | 6.2 | 11.0 | 7.0 | 6.8 | 7.0 | 23.2 | 8.6 | 10% | 12% | 97% | 19% | 1.1 | 1.2 | 2.8 | 1.5 |

Interpreting the Results

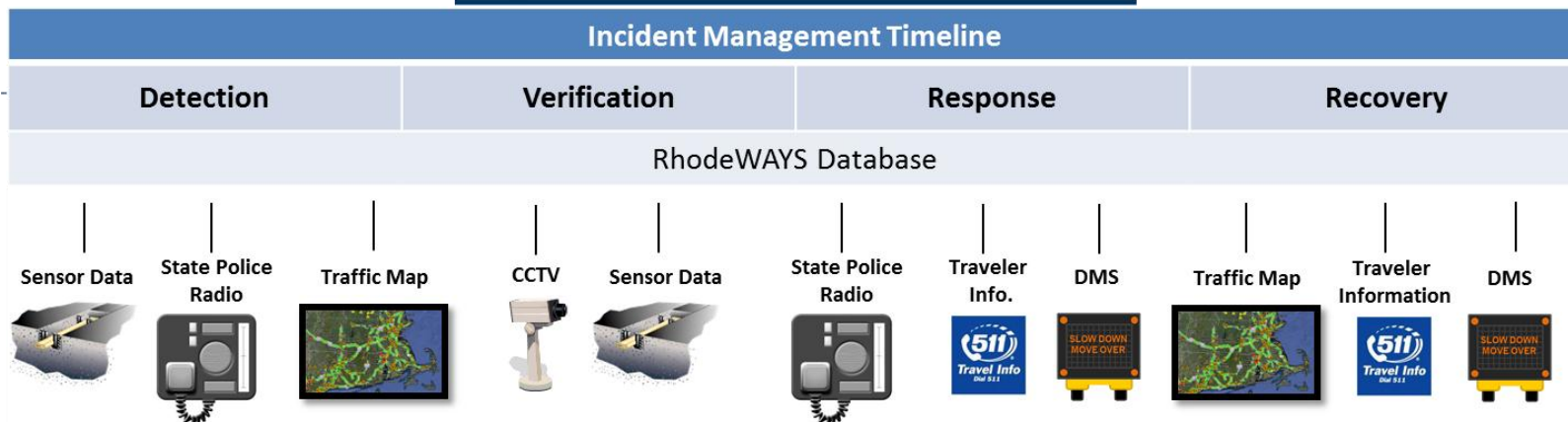
- Buffer Index - Drivers should allow for an extra 4 minutes on a weekday southbound in the morning and an extra 11 minutes on Fridays in the evening.
- Planning Index-Drivers should allow for a total trip time of 14 minutes on morning southbound commutes and total trip time of almost 30 minutes southbound in the evening on Fridays.

Incident Management

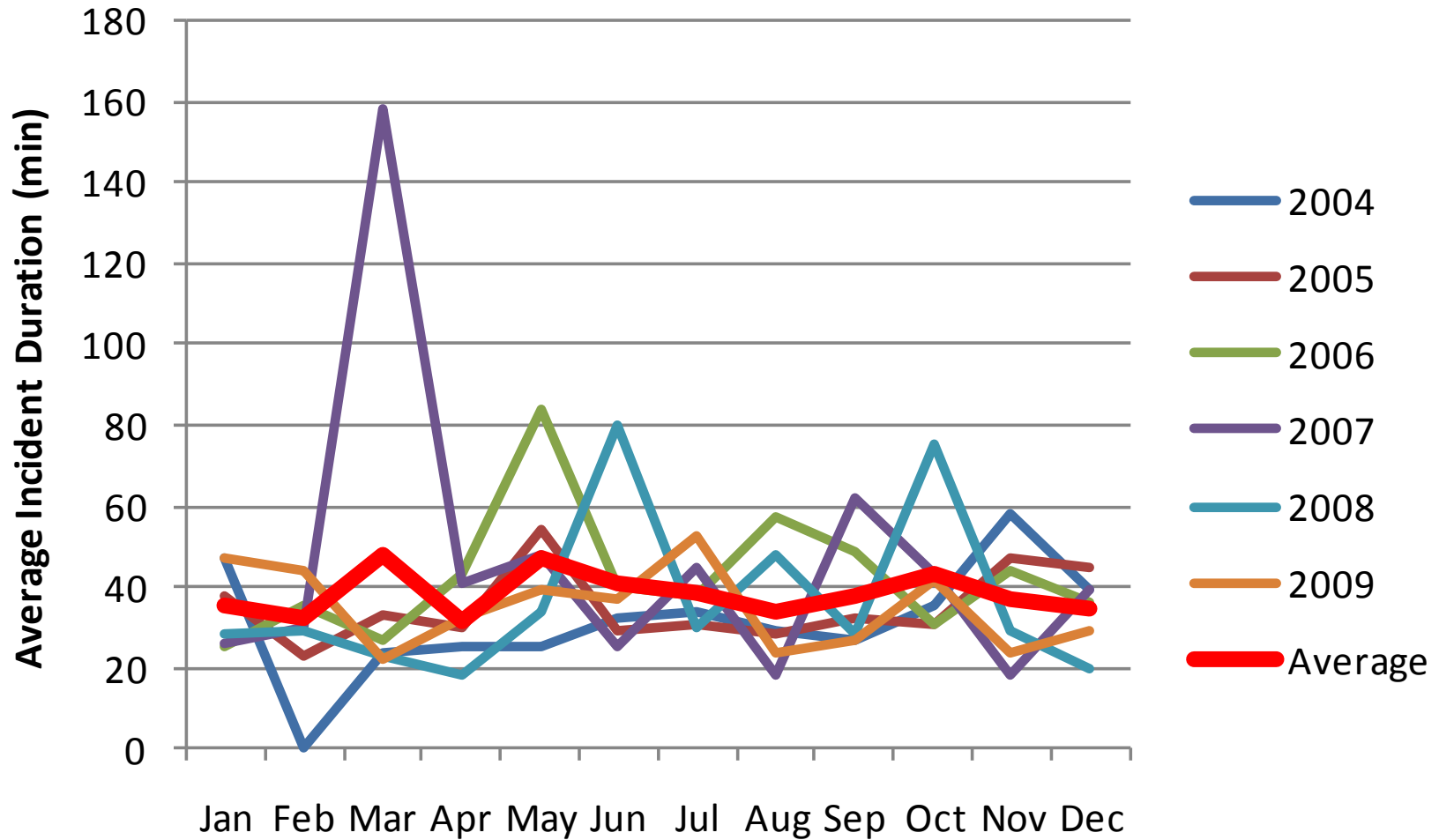
➤ Performance Measures

- Incident Clearance Time: Time from when the incident is verified to the time when the responders leave the scene – *currently implemented*
- Roadway Clearance Time: Time from when the incident is verified to the time when the lane is opened to traffic (applicable only if incident involved lane closure) – *for future implementation*

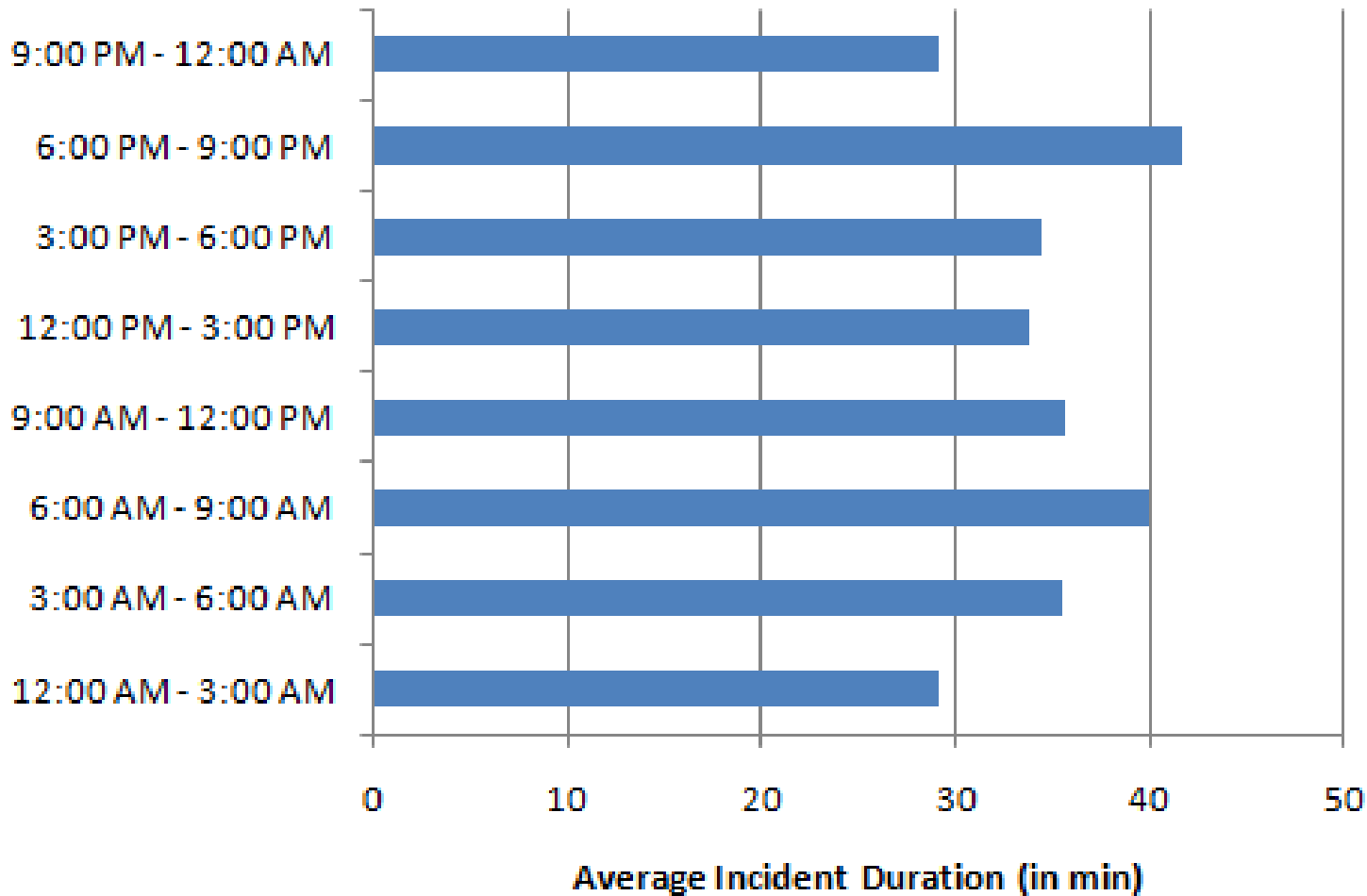
➤ Data extracted from the TMC Database for 2004 through 2011



Incident Clearance Time



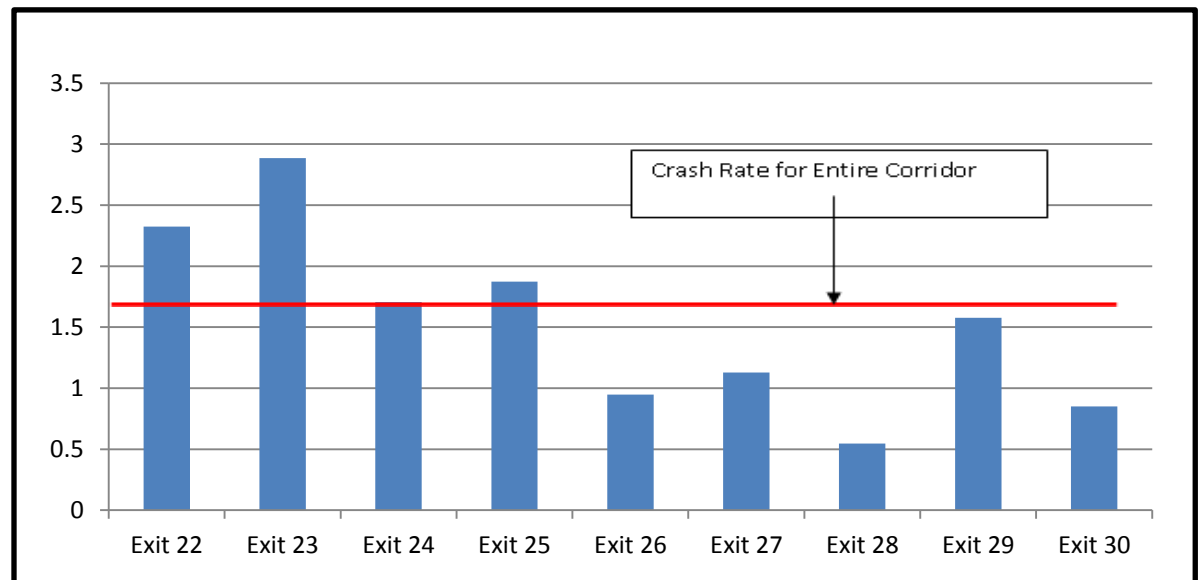
Incident Clearance Time



Safety & Crash Data

- Performance Measure
 - Crash Rate: Total number of crashes in a year divided by total annual vehicle miles traveled times 100 million
 - Crash records from RIDOT's Electronic Accident Reporting System (EARS)
- Utilized Average Daily Traffic (ADT) from sensor data

Sample Crash Rate
along Test Segment



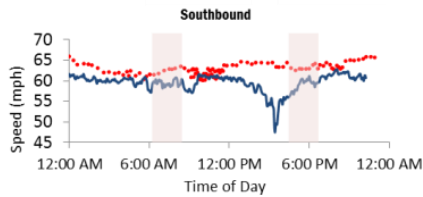
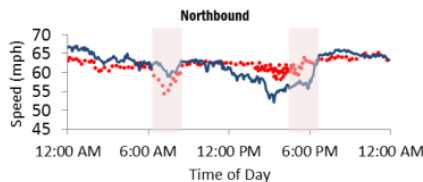


Sample Performance Measure Report

Travel Time Reliability Indices

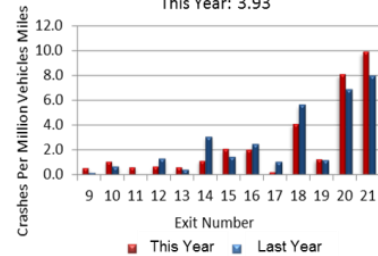
| | Average Travel Time (minutes) | | | | 95th Percentile (minutes) | | | | Buffer Index (%) | | | | Planning Index (ratio) | | | |
|-----------|-------------------------------|-----|-----|-----|---------------------------|-----|------|-----|------------------|-----|-----|-----|------------------------|-----|-----|-----|
| | AM | | PM | | AM | | PM | | AM | | PM | | AM | | PM | |
| | SB | NB | SB | NB | SB | NB | SB | NB | SB | NB | SB | NB | SB | NB | SB | NB |
| Last Year | 7.2 | 6.6 | 8.0 | 7.2 | 8.6 | 7.2 | 10.5 | 7.5 | 19% | 12% | 31% | 10% | 1.3 | 1.3 | 1.6 | 1.2 |
| This Year | 7.0 | 6.3 | 6.9 | 6.8 | 8.2 | 7.1 | 8.1 | 7.0 | 14% | 8% | 18% | 7% | 1.1 | 1.0 | 1.3 | 1.1 |

Weekday Speed Profile



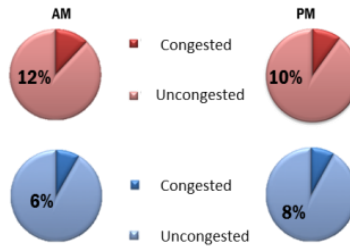
Crash Rate

Last Year: 3.22
 This Year: 3.93



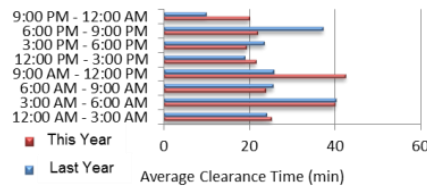
Frequency of Congestion

Last Year Weekday Commute



Average Incident Clearance Time

Last Year: 24 min average
 This Year: 25 min average



ITS Equipment Uptime

| Reporting Period | This Year | Last Year |
|-----------------------|-----------|-----------|
| Number of ITS Devices | 28 | 28 |
| Percent Uptime | 99.93% | 96.26% |

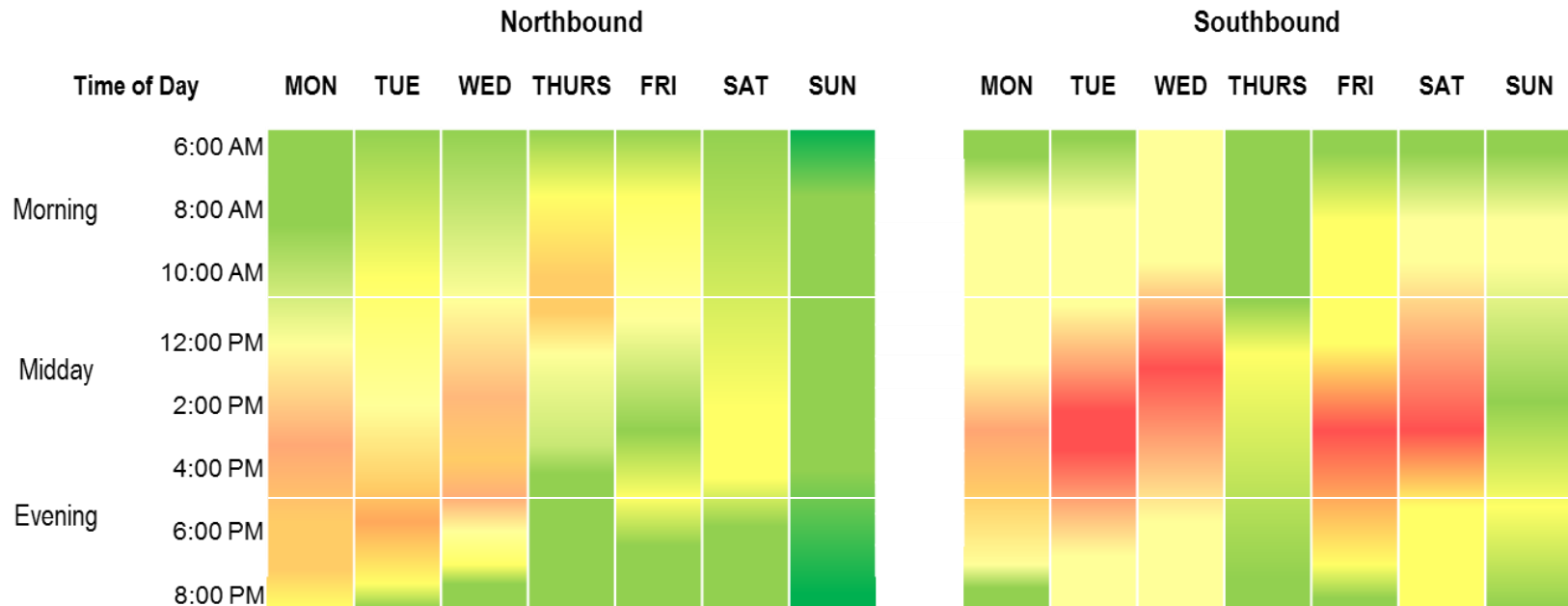
Report

- Internal RIDOT use
- For each major segment including I-95, I-295, I-195, Route 10/6





Public Outreach

Best Time to Travel During Thanksgiving I-95 From Massachusetts State Line to Downtown Providence



Key

 Less Congestion
 More Congestion

* Data from November 22, 2010 to November 28, 2010. True congestion may vary

Lessons Learned

- Sensor Location
 - Can affect travel time reliability measures
- Consistency of data from multiple sources
 - Sensor data: May need calibration of sensors
 - Crash and incident data: Needs coordination between TMC operator and Police
- Operator training
 - Understanding of data definitions

Thank You

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