

SHRP 2 Reliability Project L17

# **Gap Filling Project 1: CEO Briefing Book on Effective Operations Improvement Strategies**

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**Gap Filling Project 1:  
CEO Briefing Book  
on Effective  
Operations  
Improvement  
Strategies**

**TRANSPORTATION RESEARCH BOARD**

Washington, D.C.

2014

[www.TRB.org](http://www.TRB.org)

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## TSM&O Category: [Automated Traveler Information Systems \(ATIS\)](#)

**Problem:** The traveling public lacks a comprehensive, reliable, and single location of traffic, transit, and emergency notifications to make informed trip decisions.

**Solution:** Develop a useful, high quality, and readily available 511 information system with a customizable platform of web, phone and mobile applications to access the information in real-time.

### Project Description:

- 511NY covers the transportation system and services throughout New York State
- Information is available about traffic and transit conditions, including incidents and construction, paratransit, major crossings such as bridges and tunnels, weather, transit trip-planning, carpools, airports, tolling, and commercial vehicle information
- My511NY is a free, personalized service on the phone, web, and app that allows a user to customize 511 based on their preferences
- 511NY provides mobile apps for Blackberry, iPhone and Android devices
- 511NY Transit Trip Planner allows a user to plan a trip across multiple transit services, agencies, operators, and states

### Results:

- 511NY has seen growth in usage across all elements of the program: landline, mobile app downloads, and social media
- Positive results have encouraged expansion of the system to include an updated rideshare page with a ridematching app and border crossing information
- Public feedback has been generally positive

**Cost:** The NY State Transportation Improvement Program (STIP) has a four-year (2011–14) program operational cost of \$27 million provided by Congestion Mitigation and Air Quality (CMAQ) funds.

### What's in it for me?

- 511 data and dynamic message signs reduced traffic queues 50% during Thanksgiving 2009
- Benefit-cost ratios for ATIS projects can exceed 16:1 during a major incident through traffic diversion
- 511 can reduce work zone travel time delay by 50%

**Contact:** Todd Westhuis, NYSDOT Project Director, [twesthuis@dot.state.ny.us](mailto:twesthuis@dot.state.ny.us) 518-457-7962  
Mary Harding, NYSDOT Outreach Coordinator, [mharding@dot.state.ny.us](mailto:mharding@dot.state.ny.us)

**Keywords:** 511, traffic, transit, information, weather, incidents, trip-planning, web, mobile, ATIS, ITS

**Project Team:** NYDOT and dozens of other New York state transportation and police agencies provide information to 511NY. 511NY also incorporates data from surrounding states and Canada.

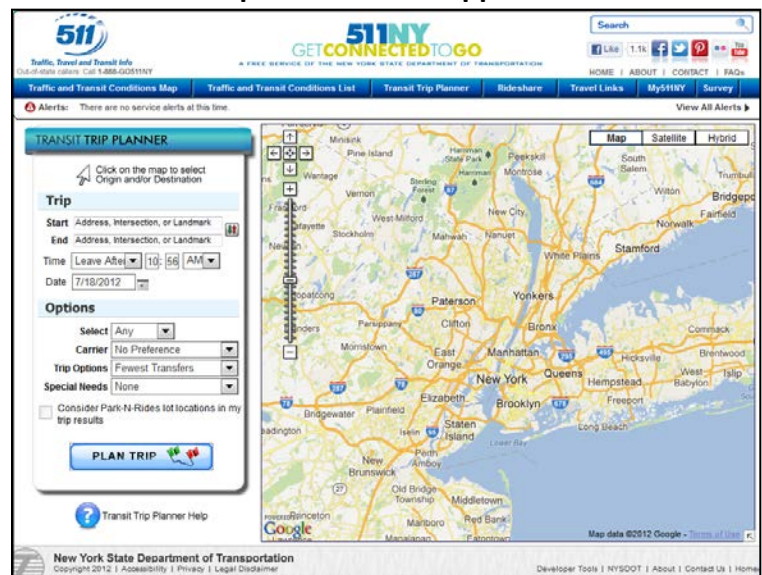
**Quote:** “511 has proven to be an invaluable information resource for highway traffic conditions. . . . All people have to do is call 511 or visit the website at 511NY.org and the service is available 24 hours a day, seven days a week.”

Joan McDonald, NYSDOT Commissioner

### Multimedia:

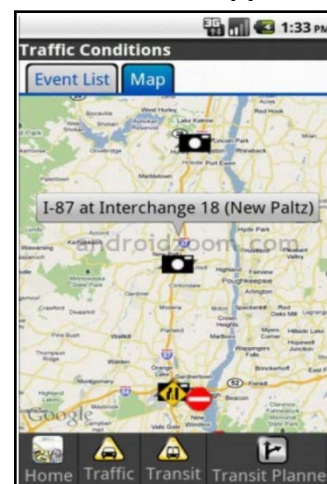
[511NY.org: Traffic, Travel and Transit Information](http://511NY.org: Traffic, Travel and Transit Information)  
[Sample of My511NY Customized Trip Information by Phone](#)

### 511NY Transit Trip Planner Web Application



Source: 511NY

### 511NY Mobile Apps for Android and iPhone



Source: 511NY



# Dallas Integrated Corridor Management

Dallas, TX

## TSM&O Category: [Integrated Corridor Management](#)

**Problem:** The congested US-75 project corridor plays a critical role in moving people through a region with rapid population growth and major employment centers. Road expansion is not an option.

**Solution:** Operate the US-75 corridor to incorporate multiple solutions involving ITS applications, travel demand management, enhanced transit options, special use lanes, and pricing strategies.

### Project Description:

The Dallas ICM project will be implemented in 2013 and will include the following assets and strategies:

- ITS infrastructure including surveillance cameras, dynamic message signs on arterials and US-75, traffic sensors and vehicle detection, responsive traffic signals, transit signal priority, and data archive
- Transportation Management Center that combines TxDOT, DART and Dallas County Sheriff Department
- HOV/HOT lanes
- Route and mode diversion strategies for incident and crash/mobility assistance patrols
- Smart parking systems at light rail stations
- Expanded traveler, weather, and 511 systems

### Results:

These results are taken from the Analysis, Modeling, and Simulation Phase of the project:

- Annual travel time savings are approximately 740,000 person-hours
- 3% improvement in travel time reliability
- Nearly 1 million gallons of fuel saved annually
- 9,400 tons of mobile emissions reduced
- Benefit-Cost ratio approximately 20:1

**Cost:** The ICM program will cost \$13.6 million over a 10-year period with funding from the USDOT, local share, DART, and other federal funds

### What's in it for me?

- Improved mobility and travel time reliability
- Reduced fuel consumption and mobile emissions
- ICM benefits accrue faster at higher levels of travel demand and during non-recurrent congestion
- Simulation work has resulted in improvements to analysis tools and modeling methodologies

**Contact:** Koorosh Olyai, ICM Program Manager, Dallas Area Rapid Transit, [olyai@dart.org](mailto:olyai@dart.org), 214-749-2866

**Keywords:** ICM, corridor, ITS, HOT, HOV, AMS, transit, signal priority, multimodal, modeling, operations

**Project Team:** Dallas Area Rapid Transit (DART), Cities of Dallas, Highland Park, Richardson, Plano, and University Park, North Central Texas Council of Governments, North Texas Tollway Authority, TxDOT

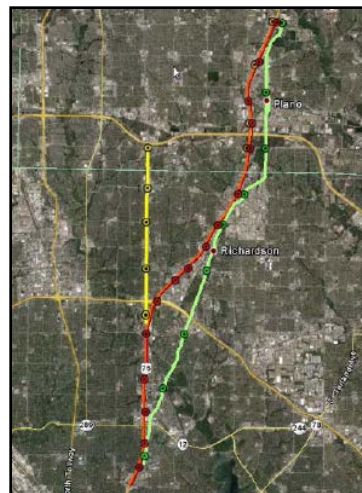
**Quote:** "The ability of the parallel arterials to handle traffic was confirmed during the analysis, modeling and simulation phase of the ICM project. The modeling assessment showed as much as a 20:1 benefit to cost could be achieved by implementing alternative diversion routes and shifts to transit."

Koorosh Olyai, Dallas Area Rapid Transit

### Multimedia:

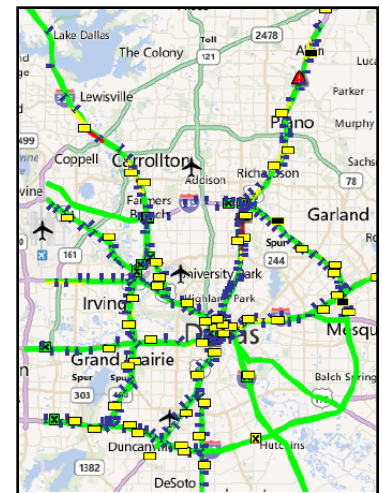
[Dallas ICM Initiative Presentation from ITS America 2012](#)

### Arterial Street Monitoring



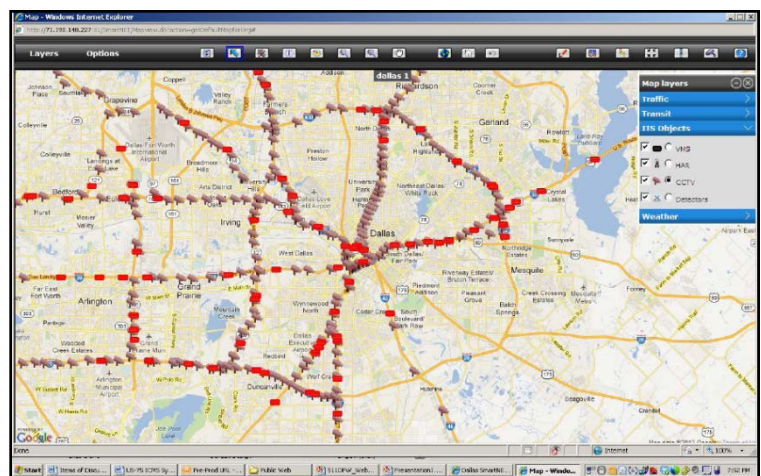
Source: DART

### Incident Diversion



Source: DART

### SmartNET ITS Device Map



Source: DART

# Freeway and Arterial System of Transportation (FAST) Las Vegas, NV

TSM&O Category: [Agency Management and Coordination](#)

**Project Team:** RTC (Las Vegas MPO), Clark County, NDOT, Cities of Las Vegas, North Las Vegas and Henderson

**Problem:** Metro areas lack unified system management and operations coordination across multiple jurisdictions.

- Need for consistent TSM&O program implementation
- Competition for TSM&O and ITS funding
- Increased jurisdictional coordination would improve management of regional transportation systems

**Solution:** Form a cross-agency partnership with strong leadership to make system-wide transportation decisions.

**Project Description:** The Regional Transportation Commission (RTC) formed FAST to manage the Southern Nevada transportation network.

- FAST is an integrated ITS organization with involvement from all local jurisdictional partners.
- Responsible for both the regional freeway and arterial network.
- FAST monitors traffic through extensive video imaging, CCTV, and inductive loop detection.
- FAST controls traffic through signal systems, ramp meters, DMS and lane use control signs.

## Results:

- Coordinated decision-making among jurisdictional partners.
- Rapid build-out of ITS infrastructure throughout the Las Vegas region.
- Decrease in non-recurrent delay.
- Improved incident management.
- Better informed public on traffic conditions.

**Cost:** Major costs are system-wide ITS infrastructure, TOC development, with minor costs associated with intra-agency coordination efforts, and performance evaluation work. However, collaboration created efficiencies and reduces duplicative efforts.

## What's in it for me?

- Coordinated signals can reduce traffic delay from 15–40% and travel time by up to 25%
- Ramp meters can reduce peak period collisions from 15–50% and increase travel speed (8–16%)
- Traffic incident management through CCTV cameras and video imaging can reduce effects of roadway lane closures from 14–28% and incident clearance times from 37–51%

**Contact:** Mary Martini, District 1 Engineer, Nevada DOT, [mmartini@dot.state.nv.us](mailto:mmartini@dot.state.nv.us)

**Keywords:** management, coordination, ITS, freeways, arterials, ramp meters, signals, operations

**Quote:** “FAST is rooted in a history of collaboration between NDOT and the cities and county in Southern Nevada. From the perspective of the motoring public, they enjoy a seamless delivery of services and the efficiencies of shared resources.”

- Mary Martini, NDOT District 1 Engineer

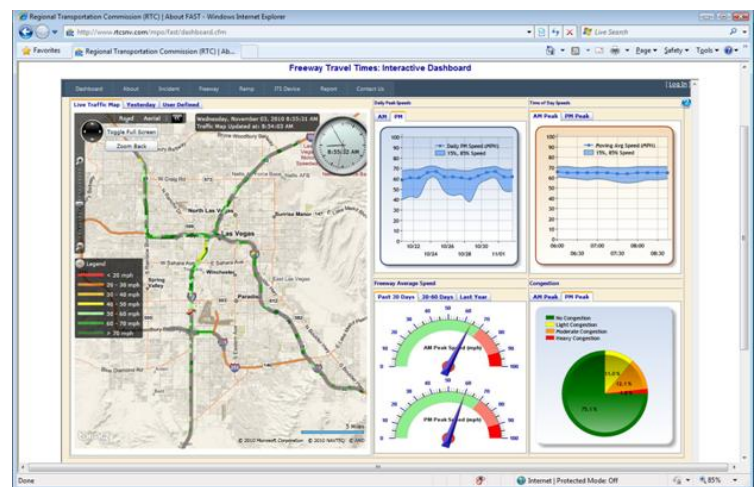
## Multimedia:

[FAST website](#)

[Daily PM commute traffic update](#)

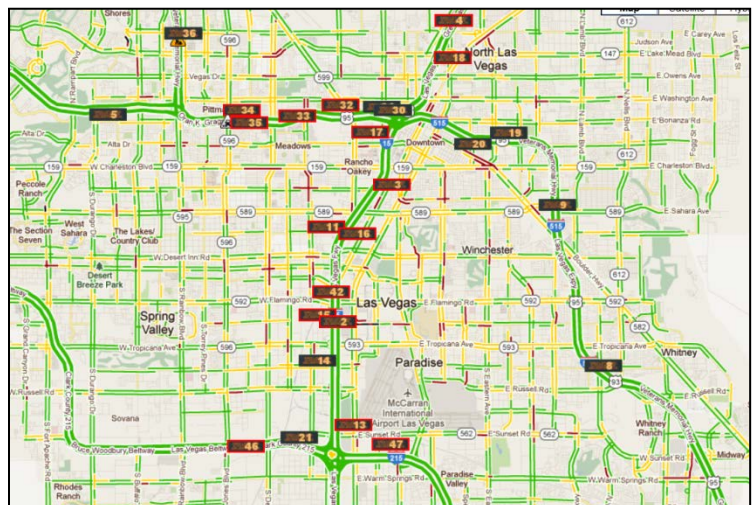
[FAST Frequently Asked Questions](#)

## Performance Monitoring and Measuring System Dashboard



Source: Nevada Department of Transportation

## Interactive DMS Map



Source: Nevada Department of Transportation



# Coordinated Work Zone Management Program

I-94, Michigan

## TSM&O: Work Zone Management

**Project Team:** MDOT: 3 Regions, 8 Transportation Service Centers, Operations Field Services Division

**Problem:** Non-recurrent work zone congestion caused by construction/maintenance during peak travel hours, traffic incidents, and bad weather results in reduced travel time reliability. In addition:

- Work zones were not managed on a corridor level.
- Work zones lacked standardized implementation.
- Greater communication needed between DOT, contractors, and emergency responders.

**Solution:** Measuring and reducing user delay costs creates the motivation to improve work zone congestion thereby increasing travel time reliability.

**Project Description:** Michigan DOT formed an I-94 partnership to implement the following:

- Set travel-time goals, measures, and strategies to account for work zone performance.
- Increase collaborative effort with contractors and emergency responders.
- Use traffic data and performance management software to measure program results.
- Increase communication clarity, consistency, and frequency to public.

### Results:

- User delay costs incurred from work zones, incidents, and weather events reduced 25% between 2010 and 2011 for the first segment under study.
- Bi-weekly meetings, corridor construction meetings and communication efforts have increased collaboration among partners.
- Work zones in corridor are coordinated and procedures have been standardized.
- Travel time and other performance metrics are measured and analyzed using accountability and reporting software.

**Cost:** Traffic data, performance management software, and staff time are the primary costs of this program. The measured savings in user delay costs far exceeds the capital and labor outlays.

### What's in it for me?

- Public experiences less unexpected delay and smoother travel through work zones and increases support for programs that produce results
- Another state DOT used automated speed detectors and message signs to shift traffic to an alternate road. This reduced ADT 16–19% and delay by 50% in the work zone.

**Contact:** Jason Firman, Congestion and Mobility Engineer, Michigan DOT, firmanJ@michigan.gov

**Keywords:** work zone management, performance measures, delay, safety, emergency responders, corridors

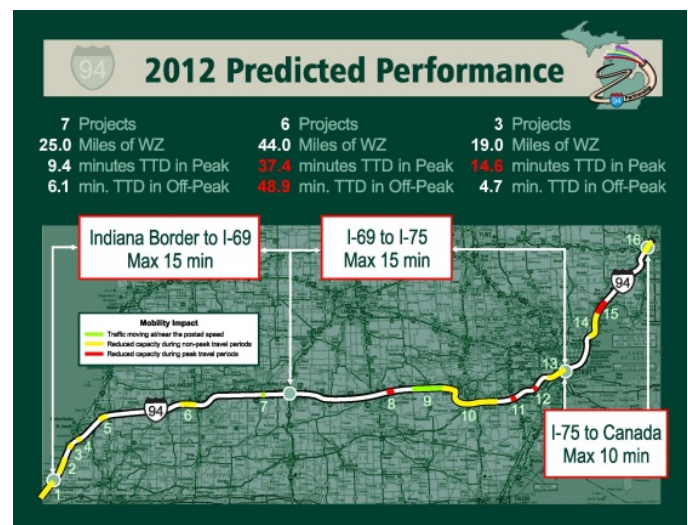
**Quote:** "Coordination across work zones, increased communication and collaboration between partners and investments in performance management tools have reduced unexpected delay."

Jason Firman - Congestion and Mobility Engineer

### Multimedia

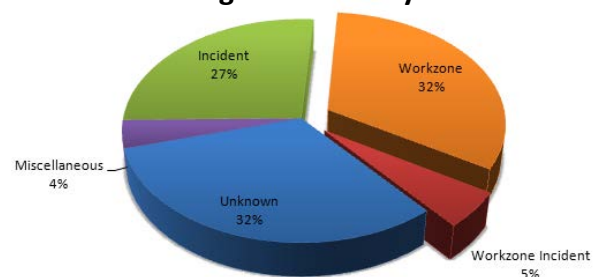
- [MDOT's Work Zone Safety Message - \(MP3 Audio File\)](#)
- [Mi Drive](#)

### I-94 Corridor



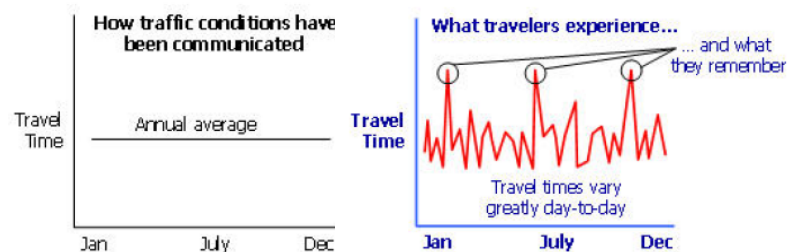
Source: Michigan Department of Transportation

### 2011 Causes of Significant Delay



Source: Michigan Department of Transportation

### Travel Condition Communication vs. Traveler Experience



Source: Federal Highway Administration



# 95 Express

## Florida

### TSM&O Category: [Managed Lanes](#)

**Problem:** Managing congestion through construction of new travel lanes along heavily traveled corridors is no longer effective or financially feasible for several reasons, which include

- Limited availability of federal and state funds
- High construction, ROW and environmental costs
- Public and legislative opposition to roadway widening

**Solution:** Use the existing system more efficiently by implementing pricing mechanisms, transit and TDM strategies.

**Project Description:** The 2-phase project covers 22 miles of Interstate 95 (I-95) from Miami to Ft. Lauderdale and includes

- Physically separated express lanes (2 per direction)
- Dynamically priced tolls
- Bus Rapid Transit Service
- No tolls for 3+ carpools, vanpools and hybrid vehicles
- Police enforcement of HOT lane compliance
- Incident management resources
- Dynamic message signs and 511 service
- Ramp metering

#### Results:

- Survey data says that 80% of regular users agree that 95 Express provides a more reliable trip
- Traffic volumes and revenue exceed projections
- 95 Express Bus ridership more than doubled compared to pre-95 Express conditions.
- Increased travel time reliability
- Increased travel speeds in both Express and General Purpose lanes
- All major goals for the project were met or exceeded.

**Cost:** Phase 1A and 1B constructions costs were \$132 million. Operations and maintenance costs were approximately \$8.2 million in FY 2011, not including transit costs.

#### What's in it for me?

- General purpose lanes travel speeds more than doubled during the AM and PM peaks
- Vehicle volumes on I-95 increased 70% during the AM peak period and 20% during the PM peak period.
- Project is an example of efficient forward-thinking free-market approach to transportation.

**Contact:** Rory Santana, ITS Manager, FDOT District 6, [Rory.Santana@dot.state.fl.us](mailto:Rory.Santana@dot.state.fl.us)

**Keywords:** tolling, bus rapid transit, HOT lanes, carpools, pricing, corridors, managed lanes

**Project Team:** FDOT, Broward County, Miami-Dade County, South Florida Commuter Services, USDOT, MDX, Florida's Turnpike Enterprise

**Quote:** "The use of managed lanes in this congested corridor has provided travel time and reliability benefits that have exceeded the cost of constructing and maintaining the managed lanes."

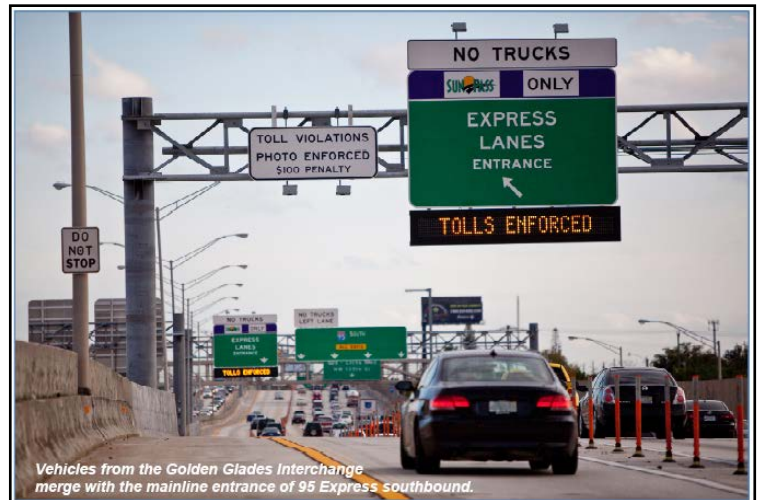
#### Multimedia

Rory Santana, ITS Manager, FDOT

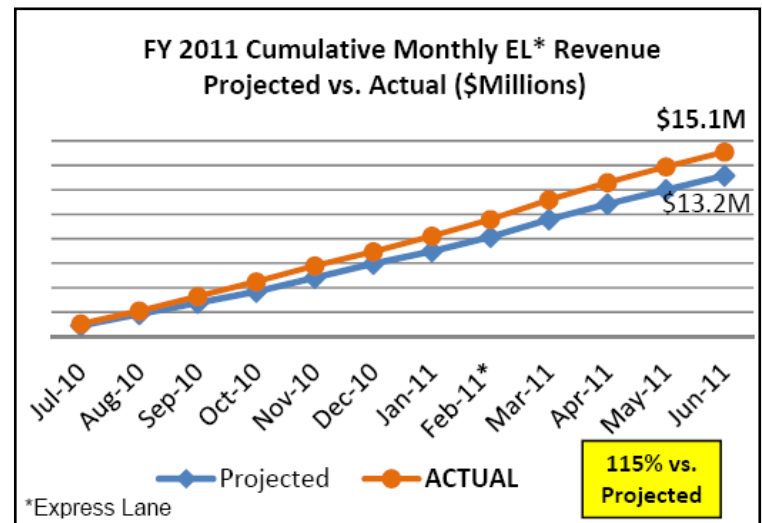
[About 95 Express](#)

[95 Express Project Operations and Benefits](#)

[FY2011 95 Express Annual Report](#)

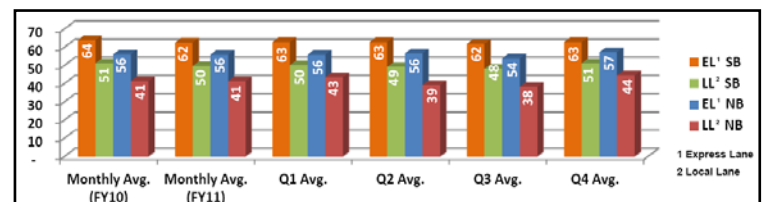


Source: Florida Department of Transportation



Source: Florida Department of Transportation

#### Peak Period Speed (mph)



Source: Florida Department of Transportation

## TSM&O Category: [Regional Traffic Management](#)

**Problem:** The highway system in the Kansas City metropolitan area operates at capacity during the peak periods. Recurrent and non-recurrent congestion creates unnecessary delay. Inadequate funding, environmental concerns, and construction costs make increasing capacity expensive and challenging.

**Solution:** Design, implement, and manage an integrated traffic management system using ITS technologies to make regional transportation safer and quicker.

**Project Description:** KDOT and MoDOT partnered to create a traffic management system, KC Scout, which covers more than 125 miles of freeway in greater Kansas City.

- About 300 cameras monitor highway conditions
- Imbedded sensors measure and gauge traffic flow
- Electronic message boards update travelers along the freeways and suggest re-route guidance
- Motorists can access a Highway Advisory Radio system or monitor traffic on the KC Scout website
- Ramp meters regulate the rate vehicles enter the freeways from on-ramps
- Comprehensive Bi-State Incident Management Program

### Results:

- The public experiences less delay and smoother travel
- The public supports DOT for effectively using tax dollars and improving traffic conditions
- Travel time savings, and reduced crashes, fuel consumption, and emissions provide benefits to system users and the general public

**Cost:** The project's initial cost was \$43 million, with the majority of the funding (80–90%) coming from FHWA and the remainder paid for by KDOT and MoDOT.

### What's in it for me?

- Ramp metering has decreased freeway merging crashes on I-435 by 64%
- KC Scout produced a benefit-cost ratio of 8:1 to system users and management agencies
- There was a decrease in the travel time index, which indicates an increase in system reliability
- Incidents affecting traffic for more than 90 minutes have been reduced

**Contact:** Gina Myles, Community Relations Coordinator, [Gina.Myles@modot.mo.gov](mailto:Gina.Myles@modot.mo.gov)

**Keywords:** ramp metering, incident management, freeways, delay, ITS, capacity, traveler information

**Project Team:** KDOT and MoDOT

**Quote:** "Utilizing Intelligent Transportation Systems like Scout is paramount to increasing safety, relieving congestion and adding capacity in times where adding additional lanes and building high cost highway construction projects are just unfeasible."

- E. Jason Sims, Manager, Kansas City Scout

### Multimedia:

[KCScout.net website](http://KCScout.net)

[@KansasCityScout Twitter Timeline](#)

[2011 Ramp Metering Evaluation Report](#)

[Kansas City Scout Commercial](#)

### Real-time Camera Snapshots available on KCScout Website



Source: Kansas and Missouri Departments of Transportation

### Segment Travel Time Reductions on I-435



Morning



Afternoon

Source: Kansas and Missouri Departments of Transportation

→ Travel time decrease  
→ Travel time increase

## TSM&O Category: [Parking Management](#)

**Problem:** Difficulty in finding street parking creates traffic congestion, pollution and wastes drivers' time.

**Solution:** Use a combination of technologies (sensors, new parking meters and real-time parking data) to price parking on a demand-responsive basis with the goal that at least one space on every block with meters is open at all times.

**Project Description:** The following project elements are part of the SFpark program.

- Sensors in on-street parking and City-owned garages track when and where parking is available
- Parking data is made available to the public via SFpark.org, smartphone applications, and 511.
- Adjust meter and garage pricing up and down to match parking demand
- Longer time limits at parking meters
- Garage facility upgrades to make them more convenient
- The goal of the pricing adjustments is to have at least one parking space on every block.
- New meters are provided to make it easier to pay with a variety of methods.

**Results:** SFpark is currently being evaluated by SFMTA and the US Department of Transportation (USDOT). Areas for evaluation will include

- Change in parking availability
- Ability of the program to reduce congestion caused from circling and double parking
- Effect on greenhouse gas emissions
- Improvement in public transit performance
- Effect on commercial viability in study area

**Cost:** Funding for the SFpark project comes primarily from a \$19.8 million grant from the USDOT's Urban Partnership Program

### What's in it for me?

- Managing residential and business parking can result in increased take-home pay for workers, increased profit for businesses, reduced monthly apartment or commercial rents, and the ability for property owners to sell or lease surplus spaces.

**Contact:** Jay Primus, Program Manager, SFMTA, [jay.primus@sfmta.com](mailto:jay.primus@sfmta.com)

**Keywords:** parking, pricing, revenue, ITS, safety, operations, data, transit, real-time, data, greenhouse gas emissions

**Project Team:** USDOT, FHWA, San Francisco Municipal Transportation Agency (SFMTA)

**Quote:** "We're counting on the fact that people are expert when it comes to parking. We only need a few people to see there is a price difference and choose to park in a different location to open up just a few spaces here and there."

Jay Primus, Program Manager (SFMTA)

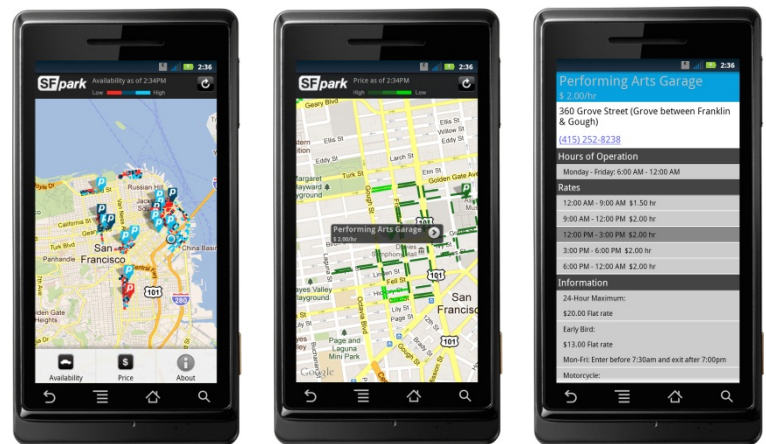
### Multimedia:

[SFpark Overview Video](#)

[SFpark Launch Event Video](#)

[Making the Streets of San Francisco Easier to Park On](#)

### SFpark Android App Screenshots



Source: SFpark

### SFpark Pilot and Control Areas



Source: SFpark



# Tow Truck Response Strategy Evaluation

Portland, OR

TSM&O Category: **Incident Management**

**Project Team:** ODOT Incident Responder, City of Portland Tow Desk, tow truck operators

**Problem:** Roadway incidents are estimated to contribute to 25% of total congestion.

- Incidents reduce freeway capacity (see table)
- Non-recurrent congestion cannot be mitigated by capacity improvements
- Incidents decrease travel time reliability

**Solution:** Reduce the time it takes to remove vehicles after an incident has occurred.

**Project Description:** A comparative evaluation of three different towing strategies on the I-5/I-405 loop in downtown Portland. The three strategies are

- Typical: Tow trucks are dispatched after on-site verification from ODOT Incident Response
- Staged: Tow trucks standing by at a strategic location are dispatched by Incident Response
- Instant: Tow trucks are dispatched by the TMOC after an incident is reported.

## Results:

- Staged and instant dispatch strategies reduced tow truck arrival times.
- Instant dispatch was 50 times cheaper than staged dispatch
- Incident management staff recommended dispatching tow trucks as soon as an incident was determined to have operational or safety impacts

**Cost:** An instant dispatch towing strategy is a low-cost solution to reducing the effects of incident-related congestion. Dispatching tow trucks before verification risks tow cancellation fees, but the value in decreasing incident-related delay far exceeds the additional cost expenditures.

## What's in it for me?

- A one-minute reduction in clearing a primary crash reduces the likelihood of a secondary crash by 2.8% and improves travel time in the affected area by four minutes
- Improved traffic incident management can reduce average incident duration by about 25%.

**Contact:** Eric Hathaway, Kittelson & Associates, ehathaway@kittelson.com

**Keywords:** incident management, towing, freeways, safety, crashes

**Quote:** "Implementing the instant dispatch system has increased capacity on our most congested corridor by decreasing towing response times 30% at an annual cost of under \$2,000."

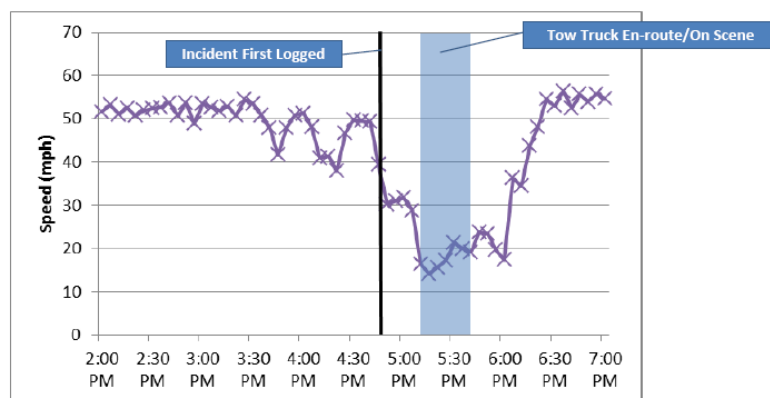
- Dennis Mitchell, ODOT Regional Traffic Engineer



Proportion of Segment Capacity Available under Incident Conditions (2010 HCM Exhibit 10-17)

Number of Lanes	Shoulder Disablement	Shoulder Crash	One Lane Blocked	Two Lanes Blocked	Three Lanes Blocked
2	0.95	0.81	0.35	0.00	-
3	0.99	0.83	0.49	0.17	0.00

## Stall Blocking One Lane Speed Profile



Source: Incident Management Evaluation Report (November 2011)



# UDOT Weather Management System

Utah

TSM&O Category: [Weather](#)

Project Team: UDOT

**Problem:** Weather events can cause non-recurrent congestion, crashes, and decrease travel time reliability. Automated weather information systems may produce unreliable forecasts, are expensive to implement, and can be slow to adapt to quickly changing conditions.

**Solution:** Develop a customized road weather information system (RWIS) and supporting infrastructure that relies on human forecasters.

**Project Description:** UDOT's RWIS program includes

- A customized system with non-proprietary weather data that is developed, built, & operated by UDOT
- Weather forecasters in the Traffic Operations Center (TOC) that produce twice-daily forecasts and are available 24/7 to field maintenance personnel
- A traveler information weather program available at the UDOT Traffic website, via mobile phone apps and the Utah 511 service
- Collaboration with the National Weather Service on weather advisories and traffic impacts
- Road surface forecasts for maintenance crews
- Archived data, forecasts and traveler information for review and future projects and research

## Results:

- More accurate and timely weather forecasts
- Personal interactions between forecasters, engineers, and field personnel result in improved operations and responses to weather events
- Reduced costs to install and maintain weather equipment
- Cost savings from in-house operations, program management, and preventative maintenance

**Cost:** An evaluation by the Western Transportation Institute determined that, on average, the UDOT RWIS program saves \$2.2 million per year for snow and ice control activities. These savings generate a benefit/cost ratio that exceeds 10:1.

## What's in it for me?

- Better weather forecasts and traveler data
- Faster responses to weather events
- Lower costs from in-house data management
- A DOT wet pavement detection and advisory system reduced crashes by 39%.

**Contact:** Leigh Sturges, UDOT Weather Operations Manager, [leighsturges@utah.gov](mailto:leighsturges@utah.gov)

Lisa Miller, Traveler Information Manager/PIO, [lisamiller@utah.gov](mailto:lisamiller@utah.gov)

**Keywords:** weather, RWIS, operations, maintenance, non-recurrent congestion, safety, reliability, traveler information

**Quote:** "Having meteorologists on site at the Traffic Operations Center and developing our own Road Weather Information System has consistently produced better data and better outcomes for UDOT maintenance projects while doing so at a fraction of the cost of automated systems used in other states."

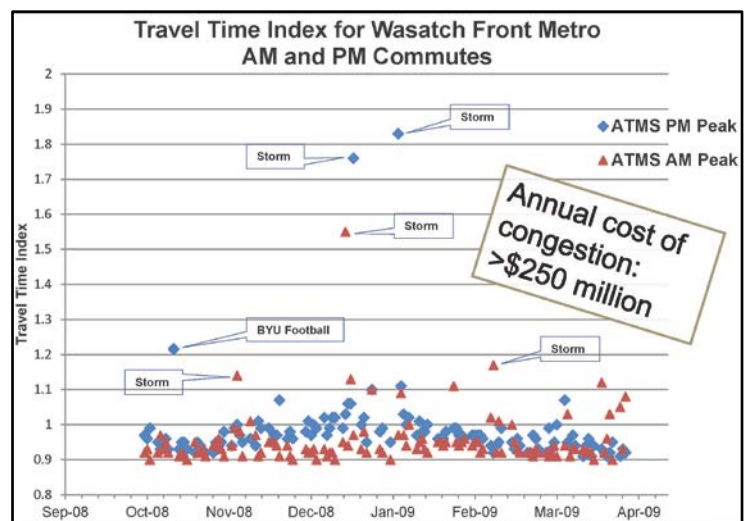
Leigh Sturges – UDOT Weather Operations Manager

## Multimedia:

[UDOT Traffic – Road Weather page](#)

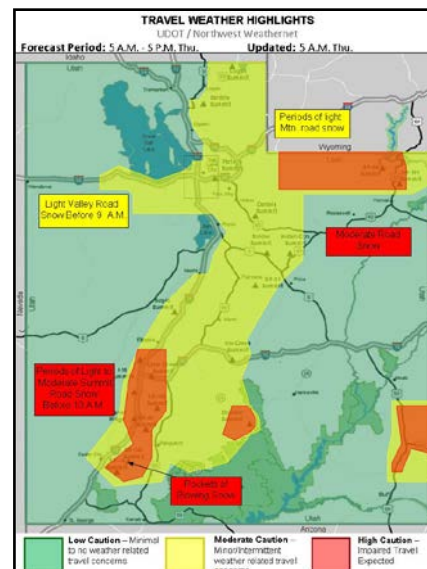
UDOT Traffic App for: [iPhone](#) | [Android](#)

[UDOT Transportation Blog](#)



Source: Utah Department of Transportation

## Traveler Information Forecast



Source: Utah Department of Transportation

## Android Road Conditions App



# I-5 Variable Speed Limits and Lane Control

Washington State

TSM&O Category: [Active Traffic Management](#)

Project Team: Washington State DOT

**Problem:** Growth in travel in congested freeway corridors exceeds transportation agencies' ability to provide sufficient roadway capacity.

**Solution:** Variable speed limit and lane control signs dynamically adapt to changing highway conditions to smooth traffic flow, manage demand and reduce congestion-related crashes.

**Project Description:** The project covers a 7-mile long section of I-5 northbound in Seattle and was activated August 10, 2010.

- 15 overhead gantries, spaced approximately ½ mile apart through the 7-mile project area.
- Gantries display dynamic speed limits, lane closures, merge arrows, warning information and variable messages.
- Speed adjustments are automated and based on measured changes from imbedded sensors.
- Lane control changes are human-initiated, but software automates the process of updating the signage and messages.
- Variable speed limit signs show a minimum of 40 mph, even if traffic is moving more slowly.
- Project has potential to improve congestion and safety

## Results:

- Positive public perception of the project.
- Well-covered on local news.
- A project performance report expected to be released within the next couple of months.

**Cost:** \$23.8 million for preliminary engineering and construction costs.

## What's in it for me?

- Lane control and speed harmonization may reduce fatality and injury crashes by 30%
- Speed harmonization effects may increase roadway capacities by approximately 5%
- Information displayed on roadway gantries can reduce corridor travel times up to 20%

**Quote:** "Paying attention and responding to the signs makes the road safer for drivers and emergency responders. We are seeing drivers move out of the closed lanes, and that creates a safer buffer."

- Washington State Patrol Capt. Steve Burns

## Multimedia:

[Smarter Highways Video Simulation](#)

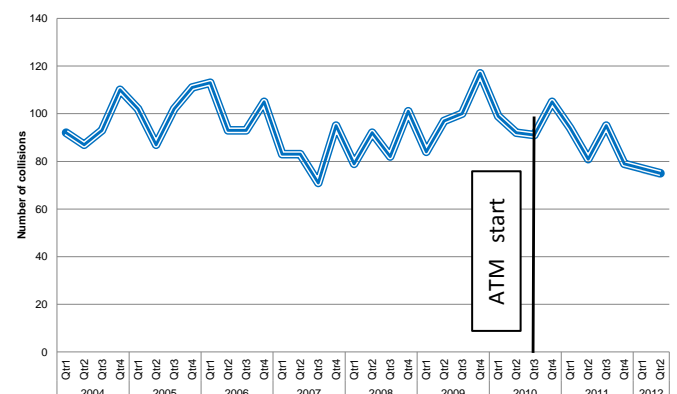
[I-5 Smarter Highways in Use with Disabled Semi-trailer](#)

[WSDOT Blog: Smarter Highways](#)



Source: Washington State Department of Transportation

## I-5 Smarter Highways: Preliminary Collision Data



Source: Washington State Department of Transportation

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**Keywords:** active traffic management, variable speed limits, congestion, safety, capacity