

Active Traffic Management Report

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I-5, SR 520, and I-90 Active Traffic Management Report

Executive Summary

This report is in response to direction given in the ESHB 2190, the 2012 Supplemental Transportation Appropriations Act, Section 215 stating “the department shall track costs associated with active traffic management systems on a corridor basis and report to the transportation committees of the legislature on the cost and benefits of the systems by December 1, 2012.”

Active Traffic Management (ATM) is a system that use overhead lane signing to provide advance notice of conditions causing congestion, and incrementally direct drivers to reduce speeds and change lanes as necessary to ease congestion. ATM helps drivers avoid last-second avoidance maneuvers and panic braking, primary factors contributing to collisions. ATM technology is an element of the Washington State Department of Transportation’s (WSDOT) *Moving Washington* strategy which emphasizes efficient operations of existing highways through applications that reduce collisions and maximize roadway movement.

WSDOT deployed ATM in the Seattle on segments of three highways. The first was about 2.5 years ago on NB I-5 near Boeing Field and later on sections of the I-90, and SR 520 cross lake bridges. Although 3 to 5 years of data is needed to prove its benefits, initial observations show that ATM is improving traffic flow. There have been approximately 12% fewer collisions during the 2.5 years after implementing ATM than the 2 years prior.

WSDOT’s Traffic Management Center operators, emergency responders, maintenance crews and contractors have observed that drivers comply with ATM “lane blocked/lane closed” symbols and speed limit reductions when activated on the ATM signs. Drivers have become more aware of lane blockages, and get out of impacted lanes sooner, giving highway workers more room to safely do their work. Emergency responders report being able to reach and clear incidents more quickly and Washington State Patrol (WSP) Troopers report an increase in safety when attending traffic incidents.

The SR 520 ATM system was added prior to construction of the new SR 520 Bridge to better manage construction activities as the bridge and its approaches are being constructed. The SR 520 ATM is getting significant use supporting construction closures with speed limits adjusted several times daily and closures for incidents and construction occurring about 93 times per month.

The I-90 ATM system was deployed in part to better manage the Interstate when HOV lanes are added on the shoulders and is also supporting construction closures.

The Maintenance and Traffic Operations Program budgets for ATM are \$317,000 per year and \$92,000 per year respectively. To date maintenance expenditures are consistent with the amount of budgeted funding. However, Traffic Operations expenditures (Q Program) have exceeded the budget, with \$184,000 in expenditures. Additional Q Program costs have been managed by reassigning duties, reprioritizing activities, and delaying other ITS support efforts.

ATM strategies in the Seattle area continue to evolve. WSDOT continues to refine ATM control strategies and messaging plans to better address evolving traffic patterns. WSDOT expects refinements to show additional benefits over time.

Introduction

This report is in response to direction given in ESHB 2190, the 2012 Supplemental Transportation Appropriations Act, Section 215 stating “the department shall track costs associated with active traffic management systems on a corridor basis and report to the transportation committees of the legislature on the cost and benefits of the systems by December 1, 2012.”

WSDOT is using ATM as a strategy to reduce collisions associated with congestion and lane blockages by dynamically re-directing traffic. About 50% of traffic congestion is caused by non-recurring events like traffic collisions and vehicle breakdowns. Using ATM reduces overall congestion by managing traffic issues.

ATM’s uses a system of overhead-lane signs to provide advance notice of incidents and adverse conditions that cause congestion. It then incrementally directs drivers to reduce speeds and change lanes as necessary to ease congestion. ATM helps drivers avoid last-second avoidance maneuvers and panic braking, the primary factors contributing to collisions. ATM technology is an element of the WSDOT’s *Moving Washington* strategy which emphasizes efficient operations of existing highways by deploying applications that reduce collisions and maximize roadway movement.

In Washington, ATM is being used to mitigate high collision rates in chronically congested urban corridors, and reduce the effects of high impact construction projects on portions of I-5, I-90, and SR 520. The following link describes Washington’s ATM systems: <http://www.wsdot.wa.gov/operations/traffic/activetrafficmanagement/>

ATM Projects

Northbound I-5 - Boeing Access Road to I-90

The first ATM system to be activated was a seven mile corridor along NB I-5 adjacent to the Boeing Access Road from the Duwamish curve to I-90. The system was activated on August 10, 2010 at a cost of approximately \$23 million dollars, as a construction traffic mitigation strategy for the Alaskan Way Viaduct Replacement project. This corridor has significant congestion and a high number of traffic collisions worsened by multiple lane reduction and weave areas, which in turn force lane changing and speed variation. Prior to implementing ATM there were approximately 430 collisions a year, 300 of which were congestion-related. Since

ATM implementation that number has dropped to about 380 per year, 280 of which are congested related.



NB Only I-5 ATM

I-90 and SR 520 cross lake corridors from Bellevue to Seattle.

Two factors spurred WSDOT's decision to implement ATM on the cross lake routes of I-90 and SR 520; the SR 520 bridge replacement project, and traffic mitigation needs for the Sound Transit light rail expansion on the I-90 Bridge.

ATM on I-90 and SR 520 was funded as part of a Federal Highway Administration Urban Partnership Agreement (UPA) grant. Because this work is part of a federal demonstration project, FHWA is funding an independent evaluation of the systems focusing on how ATM, tolling, transit and telecommuting techniques can improve travel within the corridors.

Before ATM, the I-90 Bridge averaged about 330 collisions per year, and the SR 520 Bridge averaged about 380. About 60% of collisions on both routes were congestion related. The cost to construct ATM on SR 520 was \$12,970,000 and the cost to construct ATM on I-90 was \$28,730,000. Because of the complexity and staggered manner of ATM implementation on SR 520 and I-90, "after" collision figures are not yet available.

Across Lake Washington, ATM implementation had to be carefully considered and implemented in a staged manner;

ATM began on SR 520 in both the eastbound and westbound directions from Bellevue to Seattle in November, 2010. Construction on the I-90 Eastside Transit and HOV Project began in early 2011, resulting in construction zones and lane shifting. ATM on I-90 was implemented in the westbound direction and approximately half the eastbound direction in June, 2011. The remaining portion of eastbound I-90 was activated in May, 2012. The delay was necessary to coordinate with the HOV lane construction project.

Adding to the issues on the cross lake corridor projects was the December 2011 introduction of tolling on the SR 520 Bridge which changed traffic patterns by decreasing traffic on SR 520 and increasing traffic on I-90. In addition work zones typically experience increased congestion resulting in additional collisions.



**SR 520 and I-90 ATM
Eastbound and Westbound Directions**

Report Findings

Observational studies of the ATM projects have identified changes over the 2.5 years ATM has been online. This report focuses on observations and data that is presently available.

ATM helps WSDOT communicate with motorists primarily through messaging about speed reductions, and alerts for drivers warning of incidents and construction. On I-5 WSDOT activates approximately 58 times a month for construction or incidents. On SR 520 WSDOT activates approximately 93 times a month for construction or incidents, the majority of which are for construction. On I-90 WSDOT activates approximately 44 times a month for construction or incidents.

ATM strategies in the Seattle area continue to evolve. WSDOT continues to refine ATM control strategies and messaging plans to better address evolving traffic patterns. WSDOT expects refinements to show additional benefits over time.

Observational Benefits - During 2.5 years of operation, WSDOT has observed the following:

- WSDOT's Traffic Management Center operators, Incident responders, maintenance crews and contractors have observed that drivers are consistently complying with ATM "lane blocked/lane closed" symbols and reduced speed limits posted on the signs
- Drivers have become more aware of lane blockages, and get out of the lane sooner, giving highway workers more room to safely do their work. Emergency responders report being able to reach and clear incidents more quickly and WSP Troopers report increased safety when attending traffic incidents
- The I-5 ATM system was used extensively during the SR 99 Viaduct closure for 8 days in October 2011 when West Seattle drivers were detoured to the Spokane Street Bridge and onto I-5. WSDOT used ATM to:
 - Notify drivers of the heavy on ramp traffic
 - Give drivers information on alternate routes around the construction enabling drivers to get to faster routes
 - Advise drivers in the lane where ramp traffic was merging to use caution (Many drivers moved out of the lane to provide gaps for merging traffic)

The improved merge action aided in the overall management of SR 99 construction congestion. Traffic management during the closure was successful and while congestion increased somewhat, it was not as severe as forecast. There were also no major collisions and the public, local agencies and media were generally satisfied with the results.

- The SR 520 ATM system is getting significant use, and has allowed WSDOT to better manage construction. Construction activities typically increase collisions between 25% and 50%. After ATM deployment collisions on SR 520 have gone up only about 10% and collisions on I-90 have risen by 30%

- WSDOT is required to evaluate public recognition and compliance with the yellow merge arrow and red X message. Observations show good compliance with traffic merging before the collision location, making overall traffic flow smoother and safer.
- ATM is also used to lower the regulatory speed limit when there is congestion ahead. Speed limits are lowered before the traffic becomes congested. Video observations indicate that traffic responds to the speed reduction signing.

Verifiable Benefits

Collision Data Analyses

WSDOT analyzes collision data over time to verify the benefits of the ATM systems. Analysts consider two important factors when studying collision data: Number of collisions in a period of time (i.e. from one year to the next or one quarter to the next), and regional trends in the collision data (i.e. increases, decreases, or no change over time). A change in the trend indicates a change as a result of a project. Although it has been noted that 3-5 years of data is needed for conclusive results, preliminary data is the graphs below:

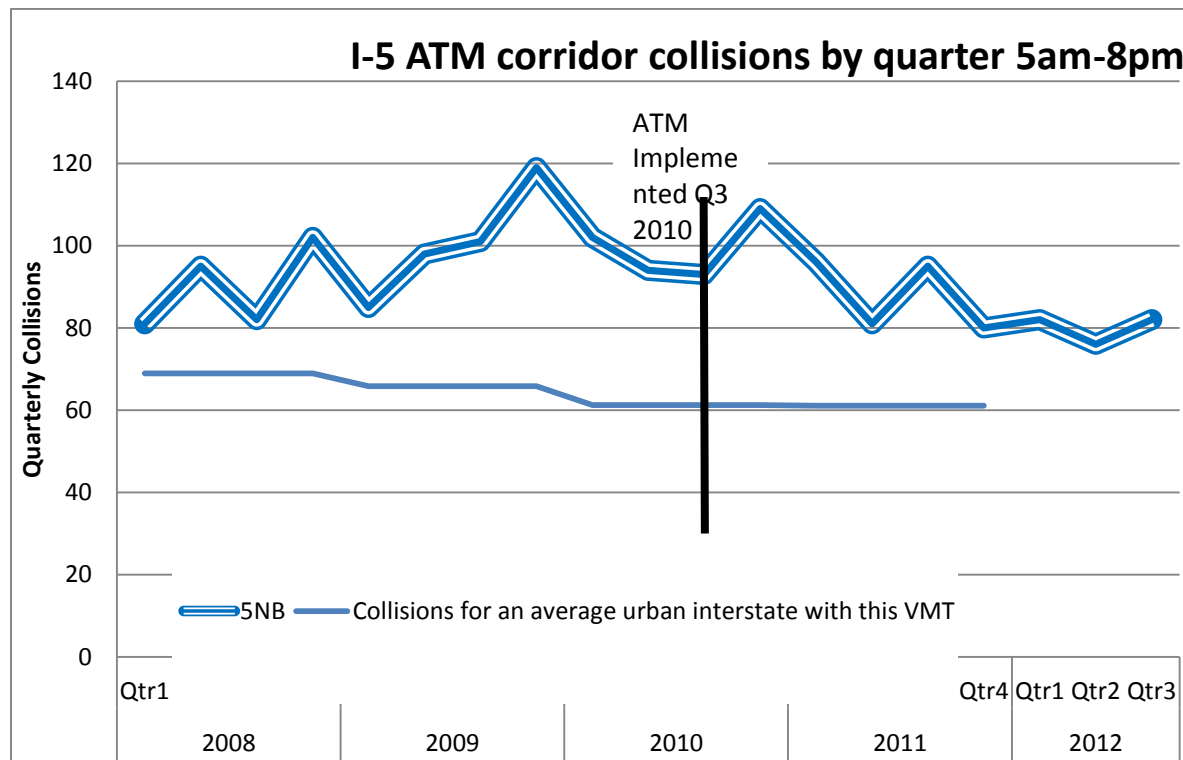


Figure 1, I-5 ATM Corridor Collisions 5am-8pm

In Figure 1 above, the vertical line in Q3, 2010 marks the beginning of ATM. The thick blue horizontal line shows collisions in the I-5 ATM corridor were trending upward prior to ATM activation with seasonal and annual variance). This upward trend was occurring at the same time average numbers of collisions on interstates was trending down (represented by the thin blue line). Collisions on I-5 are lower compared to 2008-09 (Collisions in Q4 2010 increased as is normal for weather and light conditions in Q4). The lower collision rate has stayed constant through Q3, 2012.

Figure 2 below shows the number of collision in the SR 520 ATM corridor by collision severity. The horizontal lines indicate the average for the before and after conditions.

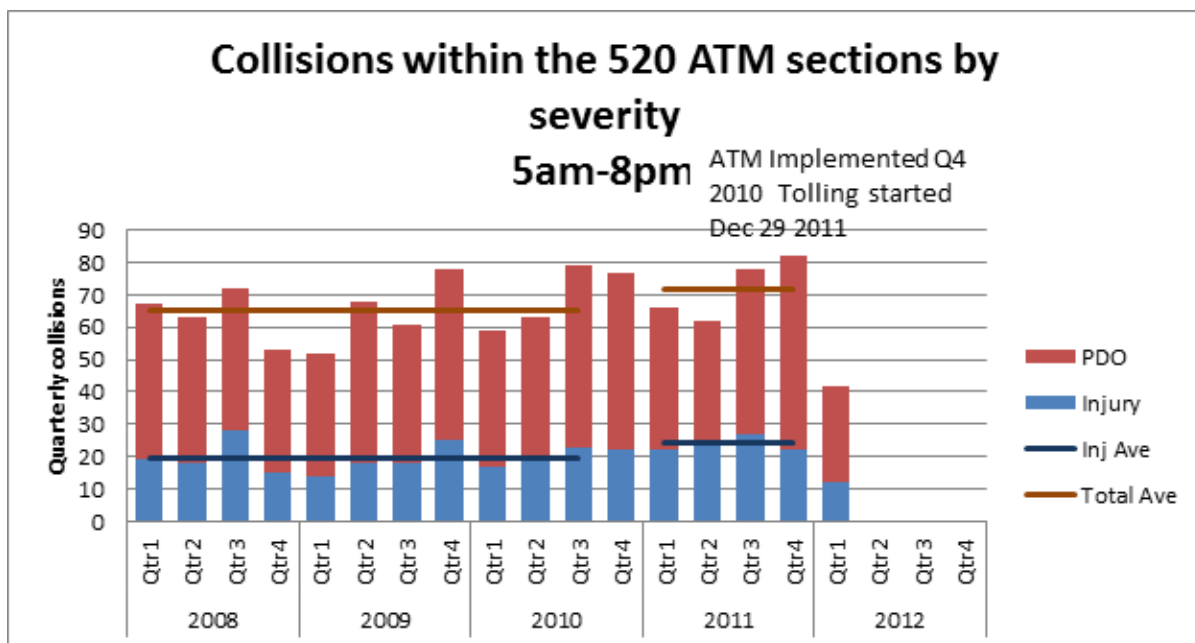


Figure 2, SR 520 ATM Corridor Collision Severity 5am-8pm

Figure 2 shows the significant changes that SR 520 has undergone since activation of ATM. Although the number of collisions in freeway work zones typically increases, the amount can be extremely variable with increases ranging from 25% to 50%. Collisions have gone up in the SR 520 corridor but only at a rate of about 10%. Bridge tolling which started at the end of 2011, added another variable to the rate of collisions. Q1 of 2012 has a very low number of collisions which could be a result of the fewer number of vehicles driving the bridge during the first 3 months of tolling. Not enough data is currently available to make conclusions on the benefits of ATM.

Figure 3 shows the number of collision in the I-90 ATM corridor by collision severity. The horizontal lines indicate the average for the before and after conditions.

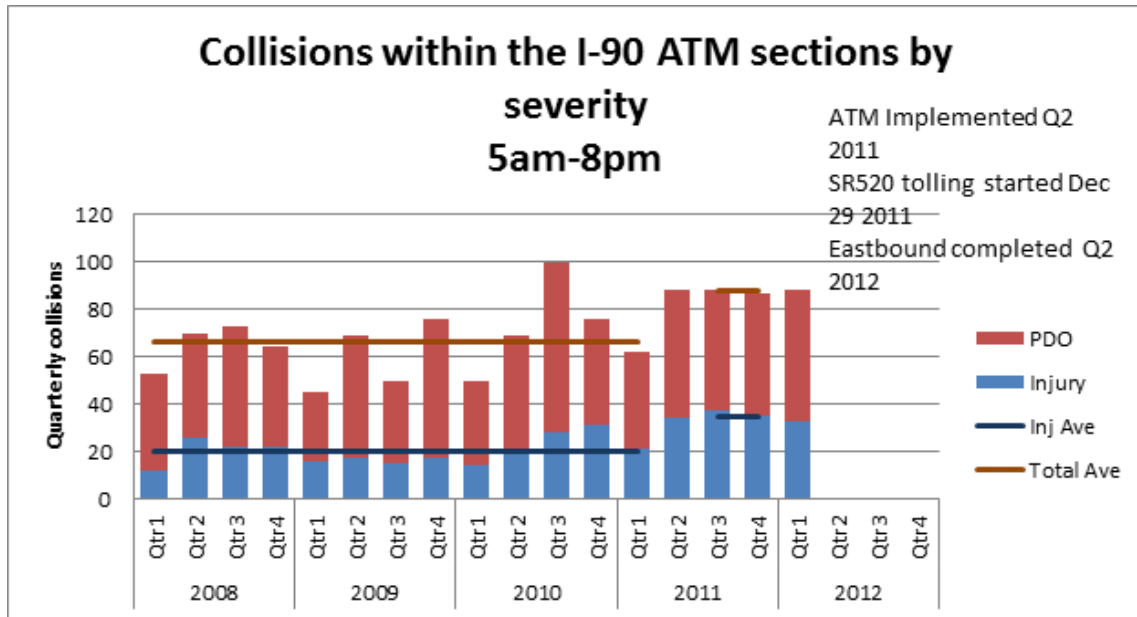


Figure 3, SR 520 ATM Corridor Collision Severity 5am-8pm

Figure 3 shows I-90 also undergoing significant changes since the activation of ATM. As with the SR 520 corridor, there is an increase of 25% to 50% in collisions related to this work zone. In the I-90 ATM corridor the number of collisions has gone up about 30%. The tolling of the SR 520 Bridge at the end of 2011 increased traffic on I-90. It is also too early to draw conclusions on the benefits of ATM on I-90.

University of Washington Collision Analysis

The University of Washington Transportation Center (TraC) performed an independent analysis of the I-5 ATM corridor. Preliminary analysis indicates that the ATM system on I-5 has reduced collisions, but TraC needs more data to make a definitive statement on the benefits. TraC also examined lane-blocking incidents through an eleven month period and early results show a positive trend.

Congestion Benefits

There is not enough data to adequately estimate congestion reduction due to ATM at this time. Congestion, like collisions, can vary greatly from year to year. Several years of travel time data is needed to measure a reduction in congestion.

ATM Program Costs

Maintenance

The legislature supplemented the M Program budget in 2010 with \$317,000 to support all three ATM corridors Maintenance costs. Maintenance work on ATM involves annual visits to clean test, and replace parts. Maintenance also repairs malfunctioning signs, maintains communications networks, and pays electricity costs. Program managers project future budgets to stay within the \$317,000 supplement.

Figure 4 compares maintenance expenditures from the time of activation of each ATM corridor.

| Corridor | Activation | Costs from Activation through March, 2012 | Costs from Activation through September, 2012 |
|----------|--------------|---|---|
| I-5 | Aug 10, 2010 | - | \$312,000 |
| SR 520 | Nov 16, 2010 | \$96,000 | - |
| I-90 | June 8, 2011 | \$328,000 | - |

Figure 4

Traffic Operations

Traffic Operations activities include monitoring and controlling ATM devices, reviewing and analyzing system operations to identify and implement refinements, and developing and testing software modifications. Other activities include training operators, planning special events, and coordinating operations with local agencies.

With almost 2.5 years of operations experience and a better understanding of the efforts required to fully utilize the system, ATM operations are anticipated to be \$184,000 a year, about twice the amount granted by the Legislature. Additional Traffic Operational expenses are presently being absorbed by the Q program by reassigning duties, reprioritizing activities, and delaying other ITS capital expenditures.

Figure 5 below provides a breakdown of funds provided and anticipated expenditures for both ATM maintenance and operations.

| Organization | Supplemental Funds (per year) | Anticipated Expenditure (per year) |
|-----------------|-------------------------------|------------------------------------|
| Maintenance (M) | \$317,000 | \$317,000 |
| Operations (Q) | \$92,000 | \$184,000 |

Figure 5

Conclusion

Moving Washington provides a new framework for WSDOT to reduce collisions, fight congestion, and efficiently operate the freeway. Although ATM is new and a work in progress, it is changing the way WSDOT operates its roadway systems. ATM gives WSDOT the ability to better inform drivers in actively managing congestion. Lessons learned from initial ATM implementation will improve the operations of the existing system and identify key operating parameters for expanding to new corridors.

Early analysis indicates several benefits from the systems: better congestion management; improved highway operations for major construction and incident management, and safer emergency response. Collision analysis conducted by both WSDOT and the University of Washington, show consistent and promising results. Benefits have been observed for the SR 99 Viaduct Tunnel Project. ATM on SR 520 and I-90 are used heavily to support construction activities and reduce collisions in constrained work zones. Changes in traffic patterns due to light rail construction on I-90 and tolling on the SR 520 bridge will delay quantifying collision reduction benefits.

ATM strategies in the Seattle area continue to evolve. WSDOT continues to refine ATM control strategies and messaging plans to better address evolving traffic patterns. WSDOT expects refinements to show additional benefits over time.

Maintenance of the system is adequately funded, but as the system, ages maintenance needs may grow. Ongoing maintenance efforts will continue to be tracked. However Traffic Operations is spending approximately double what is needed to conduct operations. WSDOT now has a better understanding of what staffing resources are needed to conduct operations.

Next steps:

- Continue to collect and study collision data to refine operations.
- Work with FHWA on standards for deployment and operation of ATM systems.
- Confer with other states to develop a larger pool of ATM knowledge.
- Continue working with local agencies to enhance dynamic re-routing of traffic to urban destinations.
- Develop predictive approaches to better operate the system during weather events such as rain and fog.
- Continue to work with the WSP to coordinate incident management and operations.
- Develop and publicize messages to educate drivers on how to use the system.