



DMS Travel Time Pilot Project Evaluation

Executive Summary and Research Acknowledgements

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Any questions about the contents of the report should be directed to Lydia Warnick, ADOT Transportation Technology Group.

EXECUTIVE SUMMARY

History and Overview

The Arizona Department of Transportation (ADOT) has been actively developing freeway travel times for the last several years on Phoenix metropolitan area freeways. Travel times in the region were first developed by the AZTech™ partnerships. ADOT loop detector data was used and the travel time algorithm was tested and validated on I-17. In January 2008, ADOT initiated a pilot project to display freeway travel times on selected dynamic message signs (DMS) in the Phoenix metropolitan area. The Travel Time Pilot Project included travel time messages being displayed on 12 DMS (six inbound locations during the AM peak travel period, and six outbound locations in the PM peak travel). These sign locations were intended to be visible to the largest number of freeway weekday commuters on the most heavily traveled freeway corridors in the Phoenix metropolitan area.

An evaluation of the pilot project was conducted to identify if there were any impacts to freeway speed, mobility, or crash rates. An integral part of the evaluation also was to obtain user feedback on the Travel Time Pilot Program. Although difficult to quantify, the perceived value of the DMS travel times by regular users of the freeway network during peak travel hours will be an important justification for ADOT to continue and/or expand the DMS Travel Time Pilot Program.

The goals of the DMS Travel Time Pilot Program evaluation were to:

- Evaluate impacts to freeway operations and freeway mobility as a result of posting travel time messages on DMS during peak hour travel;
- Evaluate and document customer response to freeway travel time messages for use in development enhancements or recommended modifications to the DMS Travel Time Pilot Program; and
- Compare the accuracy of travel time messages being displayed with actual travel times.

Best Practices

Overall, positive public feedback has been commonly reported by cities that provide travel time messaging on DMS. However, a recurring notation is that there is a perceived slowdown during the initial stages of DMS travel time activation (made by either motorists or law-enforcement), and few studies were available that specifically addressed that claim. Based on the literature reviewed, a number of cities have indicated that a more focused and planned public outreach program on DMS travel times can help to reduce public concerns over slowdowns and information accuracy. Another lesson learned from other metropolitan areas that post DMS travel times is that travel times are not suitable for every DMS or for every hour of the day – a systematic approach is advisable before beginning to post travel times.

The best practices from other areas displaying travel times on their DMS was used to guide the deployment and recommendations for the ADOT Travel Time Pilot Program moving forward.

Factors Influencing the Evaluation

The following three factors, occurring during the evaluation period, may have influenced the evaluation outcomes:

Speed enforcement cameras on Phoenix area freeways. The presence and operation of speed enforcement cameras between September, 2008 and July, 2010 may have influenced some of the crash and mobility data, although positively, but it is difficult to isolate the travel time display impacts on speeds.

Overall reduction in traffic volumes over the last three years. Arizona DOT's Annual Average Daily Traffic (AADT)volumes showed declining numbers in several locations of the Travel Time Pilot Program. Exceptions to this are I-10 in the West and East Valley, and I-17 near downtown Phoenix.

Corridor widening project on Loop 202. Loop 202 from the I-10/SR-51 interchange to Loop 101 in Tempe was widened to include new eastbound HOV and auxiliary lanes. Construction began in December, 2008 and was completed in 2010. Loop 202 AADTs in the pilot program area dropped significantly between 2008 and 2010.

Outcomes

The evaluation of the Travel Time Pilot Program yielded very positive support from the traveling public, including several comments asking for more signs and travel times on more freeways. The majority of comments received via the website were positive. Similarly, the telephone surveys showed strong support for keeping the Travel Time Pilot Program moving forward. Other parameters that were evaluated during the Travel Time Pilot Program, including speed/mobility and safety, showed no adverse impact of the travel time displays.

The Travel Time Pilot Program's literature review and best practices evaluation revealed some conclusions and outcomes from other jurisdictions, which were used in part to establish research hypotheses for ADOT's program. The project was structured to confirm or refute these hypotheses, and the outcomes are summarized in the table below.

Hypotheses	Summary of Outcome
Minimal reductions to AM freeway speeds/mobility during travel time messages, due to already concentrated AM conditions on weekdays.	The speed assessment showed minimal impact to the freeway mobility upstream of the DMS with active travel times. Variability in the AM drive was higher than PM. I-10 and I-17 demonstrated the most variability.
More noticeable reduction in speed during PM travel periods due to distribution of PM traffic over time.	PM drive showed some degradation of speeds, but in a consistent pattern with the baseline for January 2008.
More noticeable reduction in travel speeds near DMS with two destinations than those with one destination.	There was no discernable correlation between speed reductions at DMS with one versus two destinations.
More positive public feedback is expected on the value of inbound travel time messaging than outbound (inbound travel is expected to have more time constraints than outbound)	Telephone surveys did not indicate a statistically significant difference in perceived accuracy of the information in inbound vs. outbound travel. Commuters who used the freeways primarily in the afternoon were more likely to feel the signs are accurate than those who use the freeways in the mornings or both mornings and afternoons.
Commuters will notice and/or complain about the slowdowns (perceived or real) near the DMS while messages are active.	Some respondents to the survey commented that drivers slow down near the signs (11 comments). These comments were more frequent during the first six weeks of operation.
There is not expected to be an impact on crash frequency as a result of deploying travel time messages on DMS	There were no negative impacts to crash rates near the DMS in the pilot program. In fact, several locations saw reduced crash rates. With other influences on the freeway network, including reduced volumes in many locations and speed cameras widely deployed, it cannot be concluded that the travel time messages were responsible for this reduction in crash rate.
The Travel Time Pilot Program and its associated outreach activities will increase the awareness of and usage of ADOT's 511 and AZ511.gov traveler information systems	Based on the data reviewed, there was not an increase not decrease in usage of the 511 systems as a result of the Travel Time Pilot Program.

Expansion Plan and Costs

The current Travel Time Pilot Program in the Phoenix metropolitan area includes a limited number of DMS on a limited number of corridors. Given the popularity of the program and the current and near-term Freeway Management System (FMS) infrastructure to support travel times, it is recommended that ADOT expand the program to include additional DMS and additional corridors and destinations only in AM and PM peak hours. In June 2010, ADOT proposed an expansion to the FMS program over the next six years to continue and incrementally expand the Travel Time Program, and this was unanimously approved by the MAG ITS Committee. Key recommendations from the expansion plan include:

Do not remove any signs from program – It is recommended to not significantly modify the current travel time DMS locations used and routes reported because they have established known routes to the public. Minor adjustments may be warranted based on major interchanges (such as Bell Rd, Shea Blvd, 83rd Ave, etc.) and new definition of FMS boundaries that do not limit reporting routes.

Add new signs to program – It is recommended to expand the Travel Time Pilot Program to other freeway corridors and DMS in AM and PM peak hours due to new phases of the FMS program being installed as well as the *potential* for private sector speed data to supplement ADOT's detection (for corridors where detection has not been deployed). ADOT proposed and the MAG ITS Committee meeting unanimously agreed to *plans* for introducing new DMS every year to the Travel Time Program prior to completing this final report with the phasing plan as discussed below.

All major corridors that have been instrumented with FMS or have planned FMS in the future have been included in the expansion of the Travel Time Pilot Program in AM and PM peak hours. The phasing plan is summarized as follows:

- **Existing (2010, 12 DMS)** – Travel time messages currently being displayed as part of the program.
- **Phase 1 (2011, 19 DMS)** – Minor modifications to current travel time messages and new travel time messages recommended due to the expansion of FMS and detection in the Valley that has occurred since the original launch of the Travel Time Pilot Program.
- **Phase 2 (2012, 23 DMS)** – Travel time message recommendations based on FMS expansion plans by 2012.
- **2013-2016 (23 DMS)** – Continue operating Phase 2 due to anticipated coverage of existing logical corridors.
- **Phase 3 (2017, 25 DMS)** – Travel time message recommendations based on FMS expansion plans by 2017.

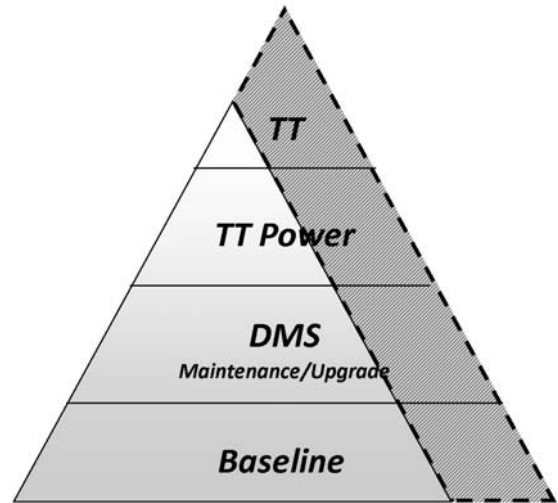
Costs of the Travel Time Pilot Program

The project management team was challenged with identifying the costs associated with the travel time expansion program. After much deliberation, the following costs were identified:

- Travel time algorithm development/support;
- Incremental weekday power costs associated with posting travel times on DMS during peak hours;
- Maintenance/upgrade costs for a set number of DMS regardless of the types of messages posted;
- Hardware, software, and licensing costs used to support the entire state ITS program, not just travel times on DMS;
- ADOT TOC facility costs used to support the entire state ITS program, not just travel times on DMS;
- ADOT TOC staff costs used to support the entire state ITS program, not just travel times on DMS; and
- DMS lifecycle costs.

The first two bullets are specific to travel times on DMS operations. If the travel time program was cut, this savings would be realized. Bullet three refers to the maintenance/upgrade of a set number of DMS regardless of the type of message posted. If the travel time program was cut, this cost would still be there because the DMS are used for posting other messages besides travel time and would still need to be maintained/updated. Bullets four, five, and six are baseline costs that support the entire state ITS program, not just travel times on DMS.

In the event there are changes to funding the program, the Travel Time Pilot Program will be proportionately affected. Funding shortfalls will significantly reduce the program capabilities and will thereby affect the travelers who have come to expect the information displayed on DMS along their route.



Maintenance/Upgrade Costs

Regular maintenance checks are required for ADOT DMS. These maintenance checks may incorporate bulb replacement costs or shutter costs for additional use of the DMS display, but these costs are estimated as insignificant when compared to the general maintenance costs of the DMS. New LED technology signs offer power and maintenance savings making for a more cost effective operations of DMS. This is important as ADOT is currently utilizing the new LED technology for new DMS locations as well as upgrading older signs to newer and more cost-effective LED sign technology. The LED technology has different operating characteristics than the fiber optic display systems previously used.

Lifecycle Costs

The LED light component of the panel that makes up the DMS display is the main component that is affected by continuous use. Panels on the DMS display can be maintained or replaced without a forklift replacement of the full DMS structure. To date, ADOT is on a 15-year replacement cycle for DMS. As technology improves and becomes more cost effective, it becomes more prudent to upgrade the technology in advance of failure. Many of ADOT's DMS, part of the initial phases of ADOT's FMS program, were installed in 1995 and are currently being upgraded to LED technology. To date, ADOT has not had to replace any LED panels on DMS that were deployed as part of Loop 101 and US-60 phases of FMS approximately five years ago. It can be assumed that an LED or LED panel should be replaced 20% faster due to travel time peak period posting; however, the LED mean time between failure of 11.5 years exceeds the timeframe for ADOT's standard replacement for LED panels. This means that even though the use of the DMS increases, the lifecycle costs remains the same if ADOT continues to replace DMS every ten years.