# MAG Systems Management and Operations (SMO) Plan

# Task 6 and 7 Report – Recommended Data Collection, Performance Measurement and Reporting Processes and Annual SMO Reporting Framework

## FINAL

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# 1 INTRODUCTION

The goals of Task 6 and 7 are to provide recommendations for implementing a review process at Maricopa Association of Governments (MAG) related to the System Management and Operations (SMO) Plan. The MAG SMO Plan has identified several priority focus areas, and will be important for MAG, and the region, to track performance of various aspects of the SMO strategy. This process will generate performance reports on SMO at the system level to demonstrate the effectiveness of SMO strategies, and help inform future funding and investment decisions related to system management and operations in the MAG region.

This document provides recommendations for MAG to support the implementation of an annual SMO performance management and reporting process. This new process will be separate from, but will complement, MAG's current performance reporting process. This document summarizes:

- The existing data and data sources related to SMO and the common uses of that data, as well as data gaps;
- The current reporting activities by MAG and its member agencies related to the operation and management of the transportation network;
- A set of recommended performance measures for each of the SMO Investment Categories that have been identified for MAG Regional SMO Plan; and
- Recommended annual reporting process for SMO.

This report also provides some reporting examples from other metropolitan areas and states to illustrate key concepts.

# 2 CURRENT SMO-RELATED DATA SOURCES

A key requirement for any effort to track and report on transportation system performance is relevant data. There are several existing SMO data sources that are currently used by MAG and other agencies for various functions, including performance reporting. Some of these data sources are local systems and are specific to the Phoenix metropolitan area, while others are nationally-available historical datasets that are made available by the Federal Highways Administration (FHWA) to public agencies, to support performance tracking and reporting. This section summarizes these data sources and their current uses in the MAG region.

## *2.1 ADOT Highway Condition Reporting System*

The ADOT Highway Condition Reporting System (HCRS) is a statewide database with closure and restriction information on both state-owned roadways and some key arterials in the Phoenix metropolitan area. The HCRS was implemented by ADOT in late 1990s and has been updated and expanded over time.

Data in the HCRS includes planned closures for work zones or maintenance activity, larger-scale planned special events, incidents, and advisories. The Regional Archived Data System (RADS) feeds some data into HCRS, including freeway and arterial travel times and roadway event information (construction and incidents) from Phoenix and Mesa Fire 911 Computer Aided Dispatch (CAD) systems, Mesa Police 911 CAD and participating local agency construction permitting systems. Operators at the ADOT Traffic Operations Center (TOC) are responsible for entering real-time information directly into the HCRS during incidents and events on the freeways. There is also automatic entry of filtered information from the Department of Public Safety (DPS) CAD on freeway incidents and events. The HCRS serves as the foundation for all freeway traveler information in the MAG region, and in many parts of the state. Data in HCRS is used to populate the AZ511 public website and the 5-1-1 phone system for traveler information.

## 2.2 Regional Archived Data System

The Regional Archive Data System (RADS) is an ITS database system, hosted at ADOT and at Maricopa County, that supports historical and real-time traffic data management in the Phoenix metropolitan area. RADS was originally developed in 2000 as a MAG-funded regional ITS project to establish a Regional Archived Data Server. The original concept, promoted at the time by the United States Department of Transportation (USDOT) and ITS America, was primarily for using archived data for evaluating ITS projects. RADS has been enhanced and expanded to support several real-time applications. It has undergone several MAG-funded expansions and enhancements to provide additional functionalities, such as estimating freeway and arterial travel times, providing roadway condition information (i.e. crashes and construction restrictions) to the AZ 511 system for the Phoenix metropolitan area, sharing arterial traffic signal timing information between agencies, and providing traffic incident notifications to local agency transportation management centers (TMCs) through the AZTech Regional Information System (ARIS).

The following data are available in RADS:

- Freeway detector data (volume, speed and occupancy) and ramp meter data (meter status and meter rate) from the region's freeways;
- Third party probe data (speeds) for travel times on limited arterial segments;
- Freeway event data captured from the ADOT HCRS;
- Arterial speed data generated by Anonymous Re-Identification (ARID), Bluetooth and Wi-fi devices currently installed on arterial streets by four local agencies;
- Traffic incident data from Phoenix Fire, Mesa Police and Mesa Fire CAD systems;
- Planned local agency construction permitting data from 10 agencies;
- Traffic signal timing data from nine local agencies in the region; and
- Traffic signal controller high resolution data for Maricopa County and City of Tempe traffic signals as part of an Advanced Traffic Signal Performance Measures (ATSPM) pilot program.

All the above data is stored in the RADS data warehouse built within computer servers physically located at the ADOT TOC (for freeway data) and through a virtualized environment hosted at the Maricopa County Department of Transportation (MCDOT) TMC (for arterial data). Data are archived to the ADOT FTP site monthly, with data provided at various intervals. One application of RADS' real-time travel information capabilities is using freeway detector data and probe data to calculate travel times for freeways, which are posted on dynamic message signs (DMS) and at the AZ511 website, mobile website and on the fat-screen display monitors at the Rental Car Center located at the Sky Harbor Airport. Another application is the use of public safety CAD and HCRS data, within the Arizona Road Information System (ARIS) to provide real-time incident notifications to traffic management staff at local agencies.

## 2.3 ADOT Accident Location Identification Surveillance System

Data related to crashes on all public roads in Arizona are stored in the Accident Location Identification Surveillance System (ALISS) database maintained by the ADOT Road Safety Group. ALISS contains data from the standard crash report forms filled out by law-enforcement officers for crashes that involve any injuries or crashes with property damages estimated at $1,000 or more. The ALISS database is used by ADOT to prepare the annual Arizona Motor Vehicle Crash Facts report that provides an overview of crashes involving motor vehicles in the state each year. The ALISS database is updated as crash reports are submitted to ADOT from law enforcement agencies throughout the state. Data from the ALISS database for crashes that occur in the MAG planning area are also archived at MAG. This archive contains crash data from 1999 through 2017 and is utilized in the MAG crash data analytics software named RTSIMS. This software is used by staff at MAG, ADOT and several local agencies (described in more detail in Section 3.2).

## 2.4 Arizona Department of Public Safety Traffic Incident Management Database

The Arizona DPS collects and generates a large amount of data related to Traffic Incident Management (TIM) on freeways in the State of Arizona, with a focus on the Phoenix metro area. In addition to traditional crash information that can be found in ALISS, DPS also collects data that allows the department to track key TIM performance metrics for freeway incidents, including secondary collisions, incident response time, roadway clearance time, incident clearance time and incident duration. In 2014, DPS worked with the Governor's Office of Highway Safety, and the ADOT Traffic Records Coordinating Committee to update the Traffic and Criminal Software (TraCS) electronic citation and collision program system used by field officers. Enhancements were made to this tracking system to provide more consistent information, automate some of the data collection functions, and it also provided DPS with the ability to modify some data fields to better track incident types[1]. DPS reports on statewide TIM performance measures to the USDOT on an annual basis and reports regularly on TIM performance to the AZTech TIM Coalition during their scheduled meetings.

## 2.5 Highway Performance Monitoring System

The Highway Performance Monitoring System (HPMS) is a national- highway information system where data is collected and used to assess highway system performance under the USDOT and FHWA's strategic planning and performance reporting process. The HPMS is the official federal source of data on the extent, condition, performance, use, and operating characteristics of the nation's highways. It includes certain data items such as length, lane miles, and travel; this reporting is required for all public roads that are eligible for federal-aid highway funds. As such, the focus of HPMS data for arterial volumes is largely limited to those identified as part of the National Highway System (NHS).

Each state department of transportation (DOT) is responsible for providing the data included in the HPMS for their respective networks. The annual delivery of HPMS data is completed by December 31st of year each and is a cooperative effort among State DOTs, local governments, and metropolitan planning organizations (MPOs) to collect, assemble, and report the necessary information. The following data collection guidelines are put forth by the FHWA for the HPMS data submissions[2]:

- A minimum of one-third of all NHS, Interstate, other freeways and expressways, other principal arterials, and HPMS sample sections shall be counted each year; all other monitoring should be on a minimum six-year cycle.
- Automatic Traffic Recorders are used to provide continuous traffic count coverage for every day of the year at a limited number of locations using automated procedures. Whenever possible, the state should have at least one continuous counter on each major principal arterial system (PAS)/NHS highway route and each continuous counter should have at least one full day of data for each day of the week for each month provided the State.
- Traffic counts are required on all federal-aid highways including ramps associated with grade-separated interchanges. Ramp counts are required at least once every six years and are important because many bottlenecks occur at major interchanges around the country and large amounts of federal funds are expended to address these congestion issues.
- Data reported in the HPMS should accurately report truck data, vehicle classification summaries, and develop seasonal and day of week vehicle class adjustment factors.

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[1] http://nchrptimpm.timnetwork.org/?page_id=73

[2] FHWA Office of Highway Policy Information, Chapter 5: Guidance on Special Topics; https://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/chapter5.cfm

- Estimates of daily vehicle miles of travel (DVMT) are calculated for all federal-aid highway systems by the HPMS software, which multiplies the section annual average daily traffic (AADT) by the section length and sums the result to the HPMS aggregation level desired (functional system, total rural, etc.).

### 2.6 National Performance Management Research Data Set

The National Performance Management Research Data Set (NPMRDS) provides vehicle probe-based travel time data for passenger autos and trucks on the NHS and 26 key Canadian and Mexican border crossings. The probe data is provided by INRIX, in partnership with the University of Maryland Center for Advanced Transportation Technology Laboratory and Texas A&M Transportation Institute (this capability previously was provided by the data vendor HERE). The real-time probe data is collected from a variety of sources including mobile devices, connected vehicles, portable navigation devices, and commercial fleets. The NPMRDS is updated each month, with new data becoming available within five business days after each month ends. The dataset is based on actual reported vehicle data, without any imputation and covers over 400,000 road segments, provided at 5-minute intervals, 24 hours per day. The complete NPMRDS dataset for the MAG region is available at MAG.

### 2.7 Agency Central Traffic Management Systems

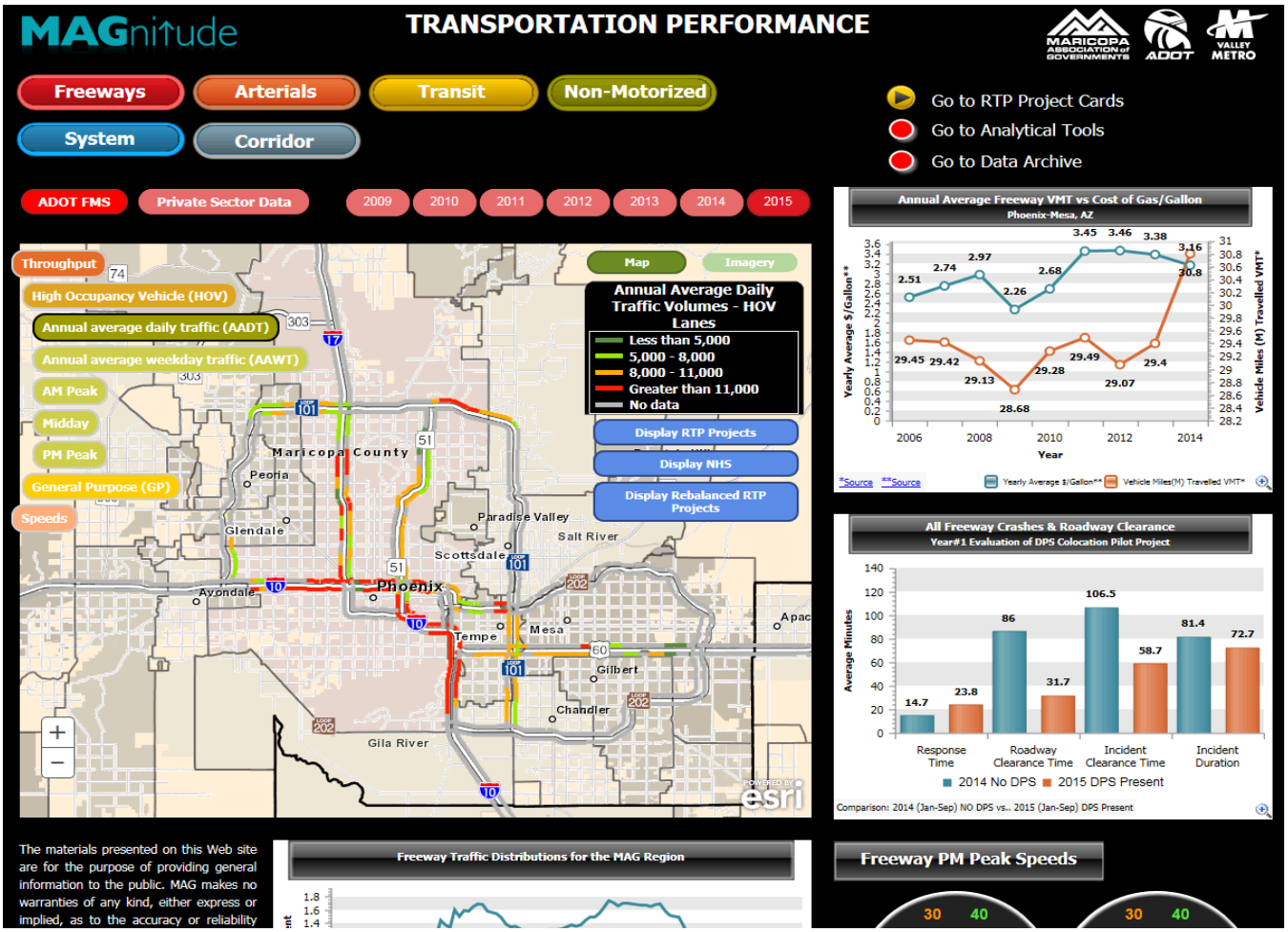
Many local agencies in the MAG region have a central traffic management system that collects and stores traffic data (for a limited time) from ITS devices and traffic signals, as well as other network performance details. For example, data that could be available in an agency central system includes communications status and uptime (i.e., is communications infrastructure working, and if it is not, how long has it not been online), traffic signal or ITS device status (i.e., signal phase, timestamp of when signal timing changes are made), and data related to ITS field devices (i.e., detector counts, volume counts, pedestrian push button activations, EVP calls received/served). Information about the agency ITS network status, the data available from agency ITS devices, and information about agency user activities are all available through the various central management systems at each operating agency in the region.

An additional local agency system that can provide data is the database from the MAG-funded East Valley Travel Time project, which warehouses data gathered from ARID devices that are deployed in Mesa, Tempe and Gilbert, in coordination with ADOT and MCDOT. The ARID data is being collected to provide arterial travel times for key local agency facilities on the AZ511 system. While this historical data will be available for download through the ADOT FTP site, it can also be made available to MAG directly from the project database that has been implemented.

## 3 CURRENT PERFORMANCE MEASURE REPORTING TOOLS

### 3.1 MAG Performance Website – MAGnitude

MAG developed its performance website, known as MAGnitude (screenshot shown in **Figure 1,** http://performance.azmag.gov/), in 2009 to support MAG staff with federal reporting requirements, state performance audits, and MAG planning, programming and decision making.



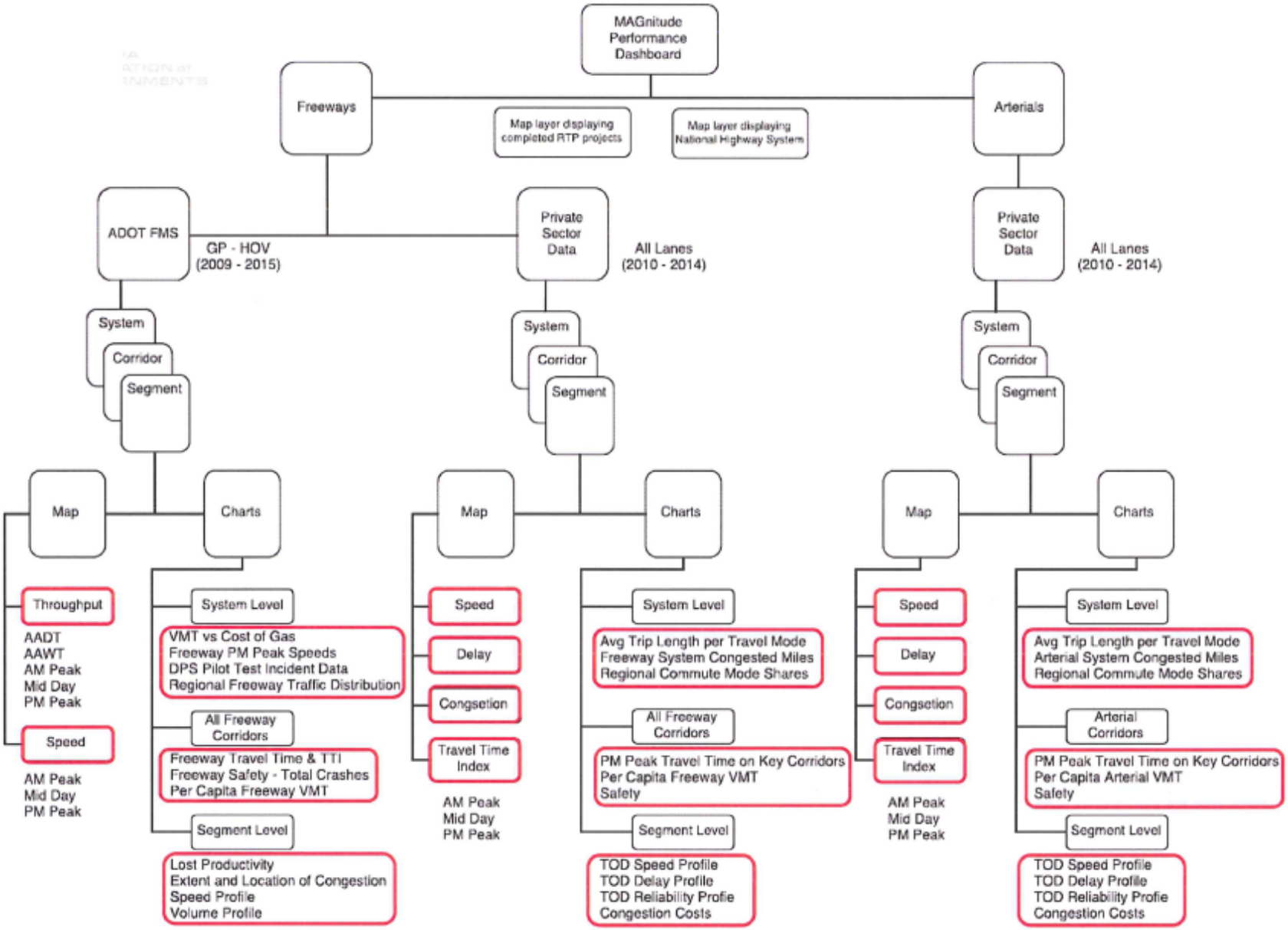

*Source: http://performance.azmag.gov/*

**Figure 1 – Screenshot of the MAGnitude Performance Website**

The website is an interactive and dynamic tool that provides a variety of data and information displays for the transportation network in the MAG region. The goal of the website is to help show the relationship between a MAG investment and the performance of the transportation network which can be used to assist in planning-level decision making at the regional level.

**Figure 2** identifies the data sources and data outputs that are available through the MAGnitude website as of December 2017.The information displayed on the website is derived from archived data from a variety of sources, including:

- ADOT Freeway Management System;
- Private sector speed data; and
- ADOT ALISS crash data for the MAG region.




*Source: MAG*

**Figure 2 – Data and Information in the MAGnitude Performance Website**

All data for the region is processed and analyzed by MAG staff, and MAG staff aggregates this checked data to provide an annual average of past years; there is no real-time data available on the MAGnitude website. It is important to note that transit or bicycle/pedestrian data have not been integrated into the interactive website. Bicycle/pedestrian data currently consists of maps that depict the bikeways in the region, as consistent and reliable bicycle and pedestrian data is not currently available. Transit data is made available via a direct link to the Valley Metro annual performance report on the Valley Metro website[3].

All the data analysis and reporting is currently performed by MAG staff, including data analysis, maintenance of the MAGnitude website, filing of federal or state reports, and the preparation of MAG performance reports. Future updates to the MAG Regional Transportation Plan (RTP) will include a stand-alone section on performance reporting that will address all reporting requirements at the regional and federal levels.

## 3.2 Regional Transportation Safety Information Management System

The Regional Transportation Safety Information Management System (RTSIMS) is a software tool developed by MAG to support crash data analyses for regional planning. Crash data in RTSIMS comes from the ALISS crash database, which is downloaded from the ADOT Safety Data Mart. As new crash data is released by ADOT, this data is incorporated into the MAG crash data archive. Updating the crash database for the previous year generally occurs mid-year.

RTSIMS allows users to search the MAG crash database and perform macro-level (i.e., region-wide, jurisdiction-wide) as well as micro-level (i.e., corridor and intersection-level) analyses. There are five basic report types that can be generated by RTSIMS, including:

- *Crash totals* – all vehicular crashes that have occurred within the boundary of the jurisdiction for the selected years (freeway and non-freeway).
- *Crash severity* – number of non-injury crashes, possible injury crashes, non-incapacitating injury crashes, incapacitating injury crashes, fatal crashes, unknown crashes and total crashed for the selected jurisdiction and years.
- *High crash intersections* – user-defined number of intersections with the most crashes within the identified jurisdiction.
- *Crashes by year by highway* – number of crashes that occur on the selected freeway for each year within the jurisdiction selected.
- *Freeway by milepost by direction* – number of crashes that occur at each milepost in a specific direction by injury severity.

The system also provides the ability to request Custom Reports using the following query options: 'by crashes', 'by persons' or 'by intersections). RTSIMS is frequently used to perform analyses to support safety projects and studies undertaken by MAG or by MAG member agencies. MAG encourages local agencies with no access to ALISS crash data to use data and information from RTSIMS when identifying projects to submit for funding through MAG. Online access to RTSIMS has been provided to staff at ADOT and 10 member agencies.

## 3.3 Agency-Driven Monitoring and Evaluations

While not part of a regional report or dashboard, many agencies in the region perform project- or event-specific performance monitoring and evaluation related to operations. For example, the City of Glendale monitors and tracks the ingress and egress durations for major sporting events at the University of Phoenix Stadium to track how well traffic signals and other operations functions are coordinated to minimize traveler delay related to such

[3] http://www.valleymetro.org/ publications_reports/ transit_performance_reports

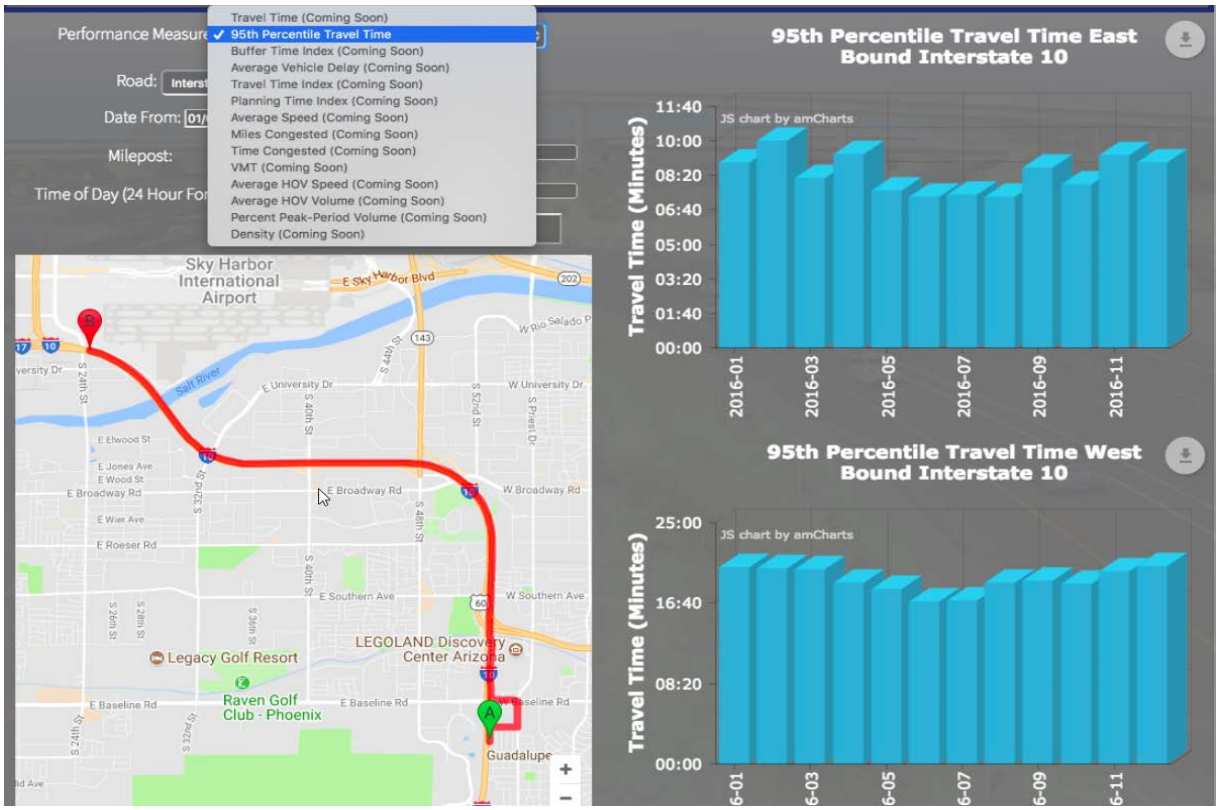
events. These statistics are shared internally at the City and with others reporting. Another example is related to signal timing optimization projects conducted for local agencies through the MAG Traffic Signal Optimization Program (TSOP). For at least three projects each cycle, before-and-after studies are performed to assess the outcome of each project. Typical benefit-cost ratios calculated for these projects range from 17:1 to 68:1.

For some MAG-funded pilot projects, evaluations are conducted to identify the impacts of the project over time. Most recently, MAG conducted an evaluation of the co-location of DPS officers at the ADOT TOC, which was a pilot project jointly funded by ADOT and MAG.

Project evaluations provide in-depth analysis of the costs and benefits of the projects to show the return on investment. These detailed project evaluations are not performed for every MAG project, but are often provided for those projects with high public or political interest, or those that are high-investment pilot projects undertaken by MAG and its partners. The data and the evaluation results are available through MAG for these projects.

## *3.4 ADOT Transportation System Management Performance Reporting*

The ADOT Transportation System Management and Operations (TSMO) Division is measuring and reporting on performance measures related to freeway management, traffic incident management, freight management and ITS device management, as part of an expanded performance management program. ADOT identified 14 measures that they will track and report on in a Performance Reporting Dashboard (currently in development; http://www.adotpm.org), shown in **Figure 3**. This initial dashboard is a proof-of-concept, and will likely evolve over time as specific performance measure analysis functions are developed. Some of the measures, such as average HOV speed/volume will only be reported for the Phoenix metropolitan area, where the FMS is deployed to provide the needed data. In other cases, the new ADOT private sector data procurement contract will help provide some of the data needed for performance metrics in the Phoenix metropolitan area and throughout the state.




*Source: http://www.adotpm.org/update1/main.php*

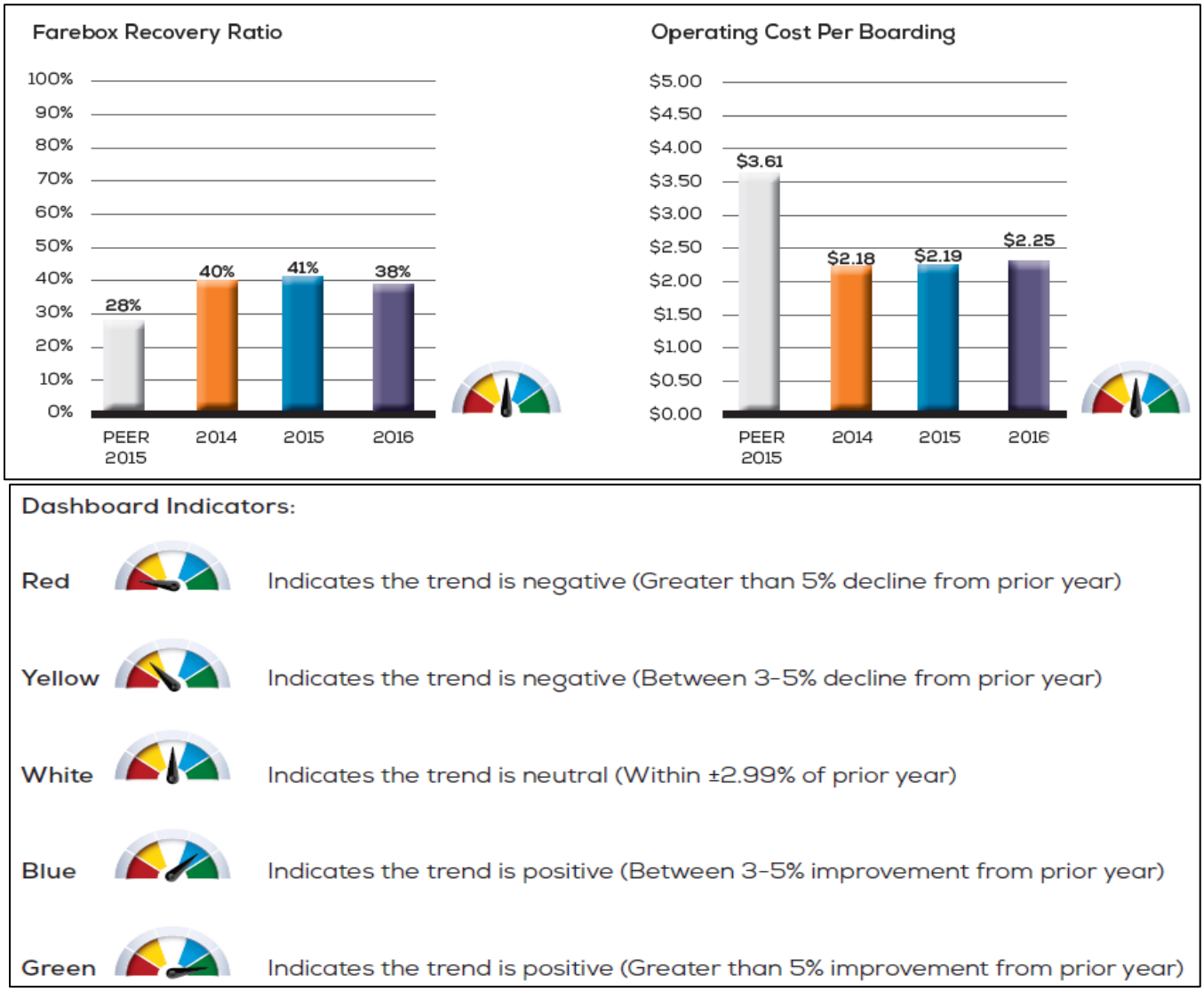
**Figure 3 – Example of the ADOT TSMO Performance Reporting Dashboard**

## 3.5 Valley Metro Transit Performance Report

Valley Metro produces an annual Transit Performance Report (TPR) to provide information concerning ridership, operating cost, fare revenue, and performance indicators for region-wide transit services including fixed route bus, light rail, paratransit and vanpool. The performance indicators that are reported on each year include:

- Total boardings;
- Percent of total boardings per mode;
- Vehicle revenue miles;
- Operating cost per revenue mile;
- Boardings per revenue mile;
- Average fare;
- Farebox recovery;
- Operating cost per boarding; and
- Subsidy per boarding.

In addition to the numeric reporting for these measures, the annual TPR includes a dashboard that shows performance of each indicator for each mode compared to the previous years. An example from the 2016 report on the Light Rail is shown in **Figure 4**.




*Source: http://www.valleymetro.org/images/uploads/projects/FY16_Transit_Performance_Report_022117.pdf*

**Figure 4 – Example of Valley Metro Transit Performance Report Dashboard**

In addition to the TPR, Valley Metro established Transit Standards and Performance Measures (TSPM) to be consistent with federal and state requirements. This includes five transit service performance measures with corresponding thresholds. Routes or services that are funded, in part, by regional transit funds that are within the top or bottom 25% (by service type) of any two performance measures are further evaluated, and potential performance improvement actions are identified. An example of the TSMP for 2016 is shown in **Figure 5**.

| | Service Type | Quartile: On-Time Performance | Quartile: Weekday Boardings per Revenue Hour | Quartile: Weekday Boardings per Revenue Mile | Quartile: Weekday Farebox Recovery Rate (%) | Quartile: Weekday boardings per TRIP |
|---|---|---|---|---|---|---|
| Bottom[1] | Local Routes | 92% | 14.3 | 1.0 | 10% | N/A |
| | Key Local Routes | 89% | 30.1 | 2.0 | 20% | N/A |
| | Commuter Express | 87% | 15.5 | N/A | 16% | 13.4 |
| Top[2] | Local Routes | 94% | 26.7 | 2.0 | 21% | N/A |
| | Key Local Routes | 92% | 37.9 | 2.8 | 25% | N/A |
| | Commuter Express | 94% | 32.8 | N/A | 23% | 26.7 |

*Source: http://www.valleymetro.org/images/uploads/projects/FY16_Transit_Performance_Report_022117.pdf*

**Figure 5 – Example of Valley Metro Transit Standards and Performance Measures**

## 3.6 Summary of Available Data and Reporting Related to SMO

**Table 1** provides a summary of applications on how data related to systems management and operations are currently used in the MAG region.

**Table 1 – Summary of Available SMO-Related Data in the MAG Region**

| Data | Application/Use for Data | Database/Source |
|---|---|---|
| Freeway vehicle speeds, volumes and occupancy | Real-time point-to-point travel times posted on Dynamic Message Signs on freeways | ADOT FMS/RADS* |
| Freeway vehicle speeds and volumes | MAGnitude website metrics | ADOT FMS |
| Third party probe data (speeds) | MAGnitude website metrics | MAG database |
| Freeway event/incident data | Posting on 511; ADOT incident/event reporting | HCRS |
| Real-time freeway travel times | Posting on DMS and 511 | RADS (freeway loops) |
| Historical freeway travel times (including truck travel times) | MAGnitude website metrics on travel time, travel time index | HERE |
| Historical arterial travel times | MAGnitude website metrics on travel time and travel time index | HERE |
| Freeway incident/crash data that impact operations (injury crashes or crashes with property damage greater than $1000) | Crash reporting | ALISS |
| Average annual daily traffic/volumes | Federal reporting requirements | ADOT HPMS |
| Boardings and ridership per transit route | Federal and state reporting | Valley Metro annual performance report |
| Transit on-time performance per transit route | Federal and state reporting | Valley Metro annual performance report |
| TIM performance data (incident response/clearance times, secondary crashes) | TIM performance measures and reporting, resource allocation, trend analysis | DPS aggregates from DPS sources |
| Local TMC activity (number of device activations, signal timing changes made) | Reporting on real-time management activities being conducted by TMCs | Local agency systems |
| Local agency communications status | Reporting on communications reliability and health | Local agency systems |

**All data from RADS is archived and available as historical data via the ADOT FTP site.*

# 4 RECOMMENDED PERFORMANCE MEASURE STRATEGY FOR SMO

## 4.1 Key Performance Metrics for SMO

This section identifies the recommended set of performance measures and performance indicators that should be tracked by MAG related to systems management and operations. The focus of the MAG SMO performance reporting is on performance of the system in the previous year using historical data. There is a need for real-time data collection and reporting to inform operations, but this type of data analysis and reporting is separate from the

SMO annual reporting. The measures identified account for both federal reporting requirements as well as measures that can help show the impacts of the SMO investments that are recommended in this SMO Plan.

### 4.1.1 Federal Requirements

On May 20, 2017, a Final Rule became effective for system performance measures as part of the Fixing America's Surface Transportation (FAST) Act. **Table 2** summarizes the performance measure area and specific metrics that are included in the Final Rule for System Performance and Freight.

**Table 2 – Summary of Federal Reporting Requirements Related to Operations**

| Measure Area | Performance Measures | Metric |
|---|---|---|
| Performance of the National Highway System | Interstate travel time reliability measure | Percent of person-miles traveled on the Interstate that are reliable |
| | Non-interstate travel time reliability measure | Percent of person-miles traveled on the non-interstate NHS that are reliable |
| Freight movement on the Interstate system | Freight reliability measures | Truck Travel Time Reliability (TTTR) Index |
| Measures to assess the CMAQ Program – Traffic Congestion | Peak hour excessive delay (PHED) measure | Annual hours of peak hour excessive delay per capita |
| | Non-single occupancy vehicle (SOV) travel measure | Percent of non-single occupancy vehicle travel |
| Measure to assess the CMAQ Program – On-road mobile source emissions* | Emissions measure | Total emissions reduction |

**A second portion of the rule pertaining to greenhouse gases has been delayed indefinitely.*

Under this Final Rule, the following responsibilities are assigned to MPOs:

- Establish 4-year targets by supporting the state DOT target or establishing a quantifiable target for Travel Time Reliability and Freight Reliability measures.
- For MPOs with planning areas in nonattainment or maintenance area for emissions (including MAG), establish quantifiable 2-year and 4-year targets.
- Establish a single, unified target (both 2- and 4-year) for entire urbanized area for peak hour excessive delay per capita and non-single occupancy vehicle (SOV) travel measures.

Additionally, MPOs have the following responsibilities for reporting on performance measures:

- Report on targets to respective state DOT in a manner that is documented and mutually agreed upon.
- Report on baseline level performance and progress towards targets.
- Develop CMAQ Performance Report in state Biennial Performance Reports.

Both MAG and ADOT are currently in the process of identifying the relevant targets for each of the required performance metrics, with ADOT setting the statewide targets and MAG supporting the identification of targets for the MAG planning area based on the ADOT targets. During reporting, MAG will support ADOT in statewide reporting by providing the reporting needs for the MAG planning area. MAG will also be responsible for the required reporting from the MPO level.

Reporting related to emissions and air quality for the MAG region will not be part of the SMO performance measure process, although the SMO program may support this reporting at a higher level, and air quality will continue to be a scoring criteria as part of future SMO project programming. MAG has a dedicated team to support the data collection and reporting for these measures, which goes far beyond the SMO program.

### 4.1.2 Recommended Metrics for MAG SMO

The goal of the SMO program is to create substantial improvements to the operations and management of the region's transportation network through investment in four categories – integrated corridor management, regional priority arterials, local priority arterials and regional operations priorities. While the strategies within each of these investment categories will collectively improve SMO in the region, the recommended performance measures are broken down by investment category to make sure that there are meaningful measures related to each.

**Integrated Corridor Management Category**

The goal of implementing Integrated Corridor Management (ICM) along a corridor is to improve the reliability, throughput and safety of corridor operations, improve freeway/arterial coordination, and multimodal operations. ICM corridors will be somewhat complex to measure, and will require that MAG aggregate data across multiple facilities (freeway, arterial and transit) to arrive at measures that represent overall ICM corridor mobility, throughput and safety. **Table 3** identifies the performance measures that are recommended for ICM investments.

**Table 3 – Recommended Performance Measures for the ICM Category**

| Performance Measure Area | Performance Metrics | Description | Data Needs |
|---|---|---|---|
| Incident Management | Freeway crash clearance time | Time from when crash is reported to when all lanes are open on the freeway | Crash report data |
| | Annual number of secondary crashes | Back of queue crashes and crashes in the opposite direction near a crash on the freeway | Crash report data |
| Travel Time Reliability* | 95% planning time index | How much total time traveler should allow to ensure on-time arrival 95% of the time | Average and max travel time |
| | Truck Travel Time Reliability (TTTR) Index | 95$^{th}$ percentile time divided by the normal time (50$^{th}$ percentile) | Average and max truck travel times |
| | Vehicle miles traveled (VMT)/yr | Total miles traveled by vehicles along a specified facility | Traffic counts |
| Corridor Throughput* | Person throughput/yr | Number of persons traveling through a corridor regardless of the mode | Average vehicle occupancy, traffic counts and VMT |
| | Transit route on-time performance | Percent of transit vehicles arriving at their scheduled stop on-time | Valley Metro Transit Standards and Performance Measures report |
| Safety | Total fatal and injury crashes/yr | Total fatal and injury crashes reported on a facility | Total fatal and injury crashes |
| | Annual crash rate | Number of crashes per VMT for a facility | Total crashes and VMT |

**ICM is envisioned to initially be implemented for non-recurring events, such as freeway incidents, as opposed to recurrent congestion. As such, to understand the impacts of ICM investments, measures for travel time reliability and corridor throughput should be measured on a per-event basis, with data being collected during the freeway event and compared to regularly collected data during non-event (typical) conditions.*

**Regional Priority Arterials Category**

In this SMO Plan, regional priority arterials are those that are considered critical to support regional movement and people and goods. They were identified through a data-driven process that considered three factors: crashes per mile per year, maximum travel time index, and average VMT per mile. **Table 4** identifies the performance measures recommended to measure the impact of investments on regional priority arterials. There could be a variety of different technology or operations strategies implementation on priority arterials; some might require upgrades to traffic signal equipment or monitoring capabilities, others might require telecommunications infrastructure to link traffic signals and operations centers. The investment level and the specific technologies to be implemented will vary, but it will be important for MAG to establish some common operations performance expectations for this group of key corridors in the region. It is important to note that individual agencies might elect to do additional performance tracking and reporting as part of their operational processes.

**Table 4 – Recommended Performance Measures for the Regional Priority Arterials Category**

| Performance Measure Area | Performance Metrics | Description | Data Needs |
|---|---|---|---|
| Travel Time Reliability | 95% planning time index | How much total time traveler should allow to ensure on-time arrival 95% of the time | Average and max travel time |
| Corridor Throughput | Vehicle miles traveled (VMT)/Yr | Total miles traveled by vehicles along a specified facility (this will be used for context to other measures) | Traffic counts |
| | Person throughput | Number of persons traveling through a priority corridor per year regardless of mode | Average vehicle occupancy and VMT |
| Safety | Total fatal and injury crashes/Yr | Total fatal and injury crashes reported within a corridor | Total fatal and injury crashes |
| | Annual crash rate | Number of crashes per VMT for a facility | Total crashes and VMT |
| Transit Mobility | Transit route on-time performance | Percent of transit vehicles on a priority arterial arriving to their scheduled stop on-time | Valley Metro Transit Standards and Performance Measures report |
| | Transit ridership | Ridership of transit routes located on a regional priority arterial | Valley Metro Ridership Report |

**Local Priority Arterials**

The SMO Plan does not make recommendations for performance measures for local priority arterials, as the project scopes and locations are fully defined by local agencies and are not necessarily influenced by this SMO Plan. However, some of the regional data sets and performance measures recommended for Regional Priority Arterials may also be applicable to local priority arterials and could be utilized accordingly by local agencies.

**Regional Operations Priorities**

The Regional Operations Priorities were identified as activities that should be undertaken at the regional level to support regional transportation operations. Many of these operations strategies are not one-time projects but rather represent ongoing programs on a larger scale that will require annual investment.

It will be important to track the use and progress of these programs to show return on investment. An example of the benefit of performance tracking for operations is the evaluation results from the pilot project to co-locate DPS

officers at the ADOT TOC. Because this pilot required annual investment, it was critical to show the impacts of the regional investment on safety and efficiency. The ability to show immense benefits through a project evaluation helped justify continuing the co-location program and demonstrated that MAG and its partners are good stewards of public funds.

Quantifying meaningful outcomes from investment in Regional Operations strategies, as demonstrated for the DPS colocation pilot, will require a comprehensive look at many factors to arrive at overall benefit of regional operations investments. Multiple data points will be needed to tell the full story about the impacts of making the recommended investments in operations strategies, including some of the measures that are recommended in Tables 3 and 4 related to operations of key facilities. As such, **Table 5** identifies initial *output* measures for the Regional Operations Priorities category that, when use in context with some of the other recommended measures, can support the quantification of *outcomes* of SMO investments.

**Table 5 – Recommended Performance Outputs for the Regional Operations Priorities Category**

| Performance Measure Area | Performance Metrics | Description | Data Needs |
|---|---|---|---|
| After-Hours TMC Operations | Frequency of response to after-hours traffic incidents | Number of times a sub-regional TMCs is activated in response to an alert for a major incident on a freeway or an arterial | Number of incident alerts; number of sub-regional TMC activations |
| Freeway Service Patrol | Number of assists per year | Number of motorist assists provided by FSP vehicles per year | DPS data on FSP assists |
| Traveler Information and Alerts | Travel time coverage (miles) | Percent of miles of major arterials and freeways in the region where real-time estimated travel times are calculated and provided | Travel time engine data, private sector arterial data |
| | Regional mobile application subscribers | Growth in number of subscribers for a traveler information app developed for the region | Mobile application database |

It is recommended that project/program evaluations be conducted for some Regional Operations Priorities projects to demonstrate the value of the investment, such as what was done for the DPS at the ADOT TOC co-location pilot project. MAG should plan for an evaluation of the performance of the sub-regional TMCs for after-hours support. Because the strategy anticipates using regional funds for staff time and extended licenses that are usually local agency expenses, it will be important to make sure that there are benefits to the region as a whole because of the investment.

The Regional Operations Priorities category is a diverse range of SMO strategies, some being project or program related, others being more service oriented (such as procuring private sector data for arterials). It is important to note that several of these performance measures will require aggregating data from multiple sources and potentially multiple facilities to be able to adequately tell the story of the impact of regional operations investments. MAG will consider a phased approach to evaluating these operations strategies due to the effort that will be involved.

## *4.2 Data Needs, Sources and Gaps*

The section above identified the types of data that will be needed to support measurement and reporting on each of the recommended performance measures. Currently, all the data required for the recommended performance measures is available to MAG or can be made available as part of new SMO projects. **Table 6** summarizes the data needs and data sources based on existing databases, as described in Sections 2 and 3.

**Table 6 – Summary of Data Needs and Data Sources**

| Data Needed | Source |
|---|---|
| Time crash was reported | HCRS from DPS CAD; ALISS |
| Time when all lanes are open after a crash | HCRS from DPS CAD |
| # of crashes on the same facility within 2 miles of first crash | HCRS from DPS CAD |
| Speed and location | RADS from freeway and arterial detectors/ARID |
| Travel time | RADS from freeway and arterial detectors/ARID |
| Traffic Counts | HPMS; RADS from specific detection |
| Transit ridership | Valley Metro central system |
| Freight travel time | NPMRDS; ADOT third party data |
| Transit on-time performance | Valley Metro central system |
| Number of times a sub-regional TMCs is activated in response to an incident alert | Sub-regional TMC central system database |
| # of miles with travel time data | RADS |
| Number of regional mobile app subscribers | Mobile app database |

### 4.2.1 Data Collection Needs

Much of the data needed for the recommended performance measures is currently available and used by MAG or other agencies in the region who report on performance. There will be some efforts required to make sure that the data is available for the entire MAG region. For example, RADS is a source for speed and occupancy data for local arterials, but data is only available for those agencies who have adequate detection that can provide the data. To get data for the whole region, additional detection on key arterials will be needed; however, it should be noted that deploying the infrastructure that will also provide this data is part of the goal put forth by the Base ICM and Level 1 Regional Priority Arterial implementation strategies.

There are also some needed data points that can be acquired from existing sources that are not currently used for performance reporting, such as information related to use of central systems. There is the ability to get information about user statistics and timestamps of activation; however, this will be a new type of data that is collected. Processes to identify and extract the data will need to be established and may involve development of formalized agreements or intergovernmental agreements (IGAs) between agencies.

Finally, there are some data needs identified for the SMO Plan that require sharing of data that is not currently shared between agencies. One example of data that will need to be shared are the transit data points that are archived and reported by transit. While this data is currently collected by Valley Metro, it will need to be shared with MAG so that it can be included in the MAG database that is used for calculating the recommended performance metrics.

### 4.2.2 Data Analysis Needs

The successful implementation of the recommended performance measurement program is not only reliant on the availability of the necessary data, but it also requires the staff time and skill sets to aggregate, review, validate and analyze the data. MAG currently has a two-person team for data review, analysis and reporting via the MAGnitude website, and many of the recommended performance metrics are already part of the reporting processes that this team conducts annually for the dashboard. However, there are many new data sources which will require additional time to aggregate, sort and validate. There are also new metrics that will require different analysis than is currently being performed.

For example, some of the ICM performance measures require data from a freeway, a set of arterials and associated transit routes which make up the ICM corridor. Because the data for each of these facilities is collected and provided independently, it will initially require manual collection and processing of each of these data sets to aggregate the ICM performance metrics. This is also the case for some of the recommended throughput measures, which would require aggregation of occupancy data for automobiles, bicycles, pedestrians and transit within a corridor.

MAG will need to make sure that there is sufficient staff time available and knowledge in data analysis to undertake the recommended performance program for SMO.

# 5 FRAMEWORK FOR ANNUAL SMO REPORTING

This section provides recommendations for the structure of the SMO Annual Report, including identification of key system performance outputs for reporting, a sample reporting format and recommendations for developing a process for establishing key performance targets and demonstrating the return on investment related to SMO strategies. It is challenging to isolate the benefits of individual SMO strategies to derive specific performance impacts. Many of the implementation strategies are a combination of different technologies and strategies. For example, the Integrated Corridor Management category includes various potential freeway and arterial operations enhancements, operational integration and multimodal operations. Similarly, the implementing the priority corridors will require a combination of traffic signal enhancements, coordination, telecommunications, monitoring capabilities and potentially other infrastructure, in addition to multimodal performance information. The annual SMO reporting will seek to capture the performance outcomes on a corridor basis for ICM and Priority Arterials, and will seek to aggregate information at the regional level for specific regional operations strategies.

It should be noted that the SMO Annual Report is separate from, although should in alignment with, the annual reporting that is already conducted by MAG per state and federal requirements. The production of an SMO Annual Report is not required but is recommended for some key reasons:

- To create accountability for the safe and efficient operation of the regional transportation system; and
- To help justify the continuation or discontinuation of the use regional funding for SMO investments, as outlined in the SMO Plan.

The remaining sections of this report will take the recommendations from Section 4 on specific performance measures to report on and provide guidance on ways to effectively compile, display and disseminate them.

## *5.1 Recommended Performance Report Format*

MAG's SMO Annual Report should be designed with a focus on effective communication about system performance and the role of SMO investments and activities. MAG should build on the effective practices in performance reporting already conducted at MAG as well as some best practices in performance reporting from around the country. MAG's Annual SMO report should specifically communicate information on:

- Annual system-level and corridor-level performance indicators, including changes in performance over time using data that is collected on an on-going basis (currently done for freeway instrumented corridors);
- Explanations or context to explain the reasons for changes in performance; and
- Data and "stories" about how SMO programs and investments are contributing to transportation benefits, based on evaluations of implementation activities.

While activities around performance measurement are largely data-driven, performance reporting is more than providing data; it is about converting data into useful information to share with the public and decision makers. Effective communication is an important element of performance reporting. The SMO Annual Report needs a format to present results in a way that is easy to understand even by non-technical audiences. Simplicity and clarity

of design is key when data are presented to a wide audience. The use of charts, tables, and infographics in reports are effective ways to present complex data to diverse audiences. In addition, tools such as dashboards allow the performance data to be understood at a glance, making use of easy-to-read graphics that can give insights into the performance of key parameters and allow identification of trends and patterns. Finally, "story telling" and making information come alive through real-world examples is important.

The MAG SMO Annual Report should provide an annual update on operational performance of the regional transportation system and explore the correlation between SMO investments and resulting impacts to the region's transportation system in relation to key regionally-accepted performance measures. The document can incorporate, by referencing to other relevant MAG performance reports, national performance measures that MAG (as well as other MPOs and State DOTs) is required to report upon that are related to SMO (as identified in Table 2, Section 4.1.1).

A clear explanation of these required measures, as well as the targets set by MAG for each and trends over time in relation to targets, will help decision makers and the public to gain a clearer understanding of these performance indicators. The information also can provide a basis for or serve as a reporting mechanism for the MAG Congestion Management Process (CMP) and feed into the System Performance Report that must be integrated into the Regional Transportation Plan (RTP).

Beyond the national measures and targets, the SMO Annual Report should provide performance of the transportation system in relation to the SMO investment categories - Integrated Corridor Management; Regional Priority Arterials; and Regional Operations Priorities. Each of these categories include multiple individual strategies. The intent of SMO reporting is not to measure and report on the impact of individual strategies, but rather report on the impacts of overall implementation on a corridor. For example, the SMO reporting recommendations will focus on overall corridor operational performance outcomes as a result of SMO investments.

By presenting performance indicators (described in 5.1.2) in relation to these SMO investment categories and in the context of corridors or corridor facilities (such as ICM), the report will help MAG anecdotally link transportation operations performance to its SMO investments and investment prioritization processes and help "tell the story" about the benefits of its investments. This information can help to set up a framework for ongoing monitoring and refining of targets related to SMO.

The MAG SMO Annual Report can be instrumental to not only communicate about system performance but also about the current state of the region's SMO investments to the decision makers at MAG, stakeholders and the public.

The recommended SMO Annual Report should include the following sections, which are described in more detail below:

- An Introductory Dashboard focused on MAG SMO Performance Measures, which would be different than the current MAGnitude web site, but could be linked from the main MAGnitude site;
- Regional Performance Indicators (see 5.1.2), including a more in-depth discussion of monitored system performance in the region;
- Sections on Investment Priority Topic Areas, including information on performance at a more spatial scale, as well as supporting information on related SMO investments and evaluations of effectiveness, organized around major topics; and
- Moving Forward, which would include some concluding thoughts, such as how MAG will address any notable changes in SMO investment performance, as well as any additional future focus areas.

### 5.1.1 Introductory Dashboard

Dashboards are helpful in communicating information in ways that the public and stakeholders can understand. Dashboards typically include a limited set of the key performance measures that communicate system-level performance and provide an easy "at a glance" view of system performance and performance trends. To avoid misinterpretation of some of the results presented in a dashboard, it is recommended that a brief context also be provided, including comments. An example of the overall dashboard concept from Washington State DOT's Gray Notebook is shown in **Figure 6**. This dashboard was developed as part of a department-wide performance monitoring program, and is updated quarterly. WSDOT has made some significant resource investments to be able to do this level of reporting; this example is merely illustrative of a dashboard concept.

**65 Statewide Transportation Policy Goals**

| Statewide policy goal/ WSDOT performance measure | Previous period | Current period | Goal | Goal met | Five-year trend *(unless noted)* | Desired trend |
|---|---|---|---|---|---|---|
| **Safety** | | | | | | |
| Rate of **traffic fatalities** per 100 million vehicle miles traveled statewide (Annual measure: calendar years 2014 & 2015) | 0.80 | 0.95[1] | <1.00 | ✓ | | ↓ |
| Rate of **recordable incidents** for every 100 full-time WSDOT workers (Annual measure: calendar years 2015 & 2016) | 4.3 | 4.6 | <5.0 | ✓ | | ↓ |
| **Preservation** | | | | | | |
| Percentage of state **highway pavement** in fair or better condition by vehicle miles traveled (Annual measure: calendar years 2014 & 2015) | 93.3% | 93.0% | ≥ 90.0% | ✓ | | ↑ |
| Percentage of **state bridges** in fair or better condition by bridge deck area (Annual measure: fiscal years 2015 & 2016) | 92.1% | 91.2% | ≥ 90.0% | ✓ | | ↑ |
| **Mobility (Congestion Relief)** | | | | | | |
| **Highways**: Annual (weekday) vehicle **hours of delay** statewide relative to **maximum throughput speeds**[2] (Annual measure: calendar years 2014 & 2015) | 32.3 million | N/A | N/A | N/A | (Four-year trend) | ↓ |
| **Highways**: Average **incident clearance times** for all Incident Response program responses (Calendar quarterly measure: Q4 2016 & Q1 2017) | 12.6 minutes | 12.0 minutes | N/A | N/A | (Five-quarter trend) | ↓ |
| **Ferries**: Percentage of trips departing on time[3] (Fiscal quarterly measure: year to year Q3 FY2016 & Q3 FY2017) | 96.3% | 96.2% | ≥ 95% | ✓ | | ↑ |
| **Rail**: Amtrak Cascades on-time performance[4] (Annual measure: fiscal years 2015 & 2016) | 72.1% | 74.8% | ≥ 80% | — | | ↑ |
| **Environment** | | | | | | |
| Number of WSDOT **stormwater management facilities** constructed (Annual measure: fiscal years 2015 & 2016) | 130 | 151 | N/A | N/A | | Not applicable |
| Cumulative number of WSDOT **fish passage improvement projects** constructed (Annual measure: calendar years 2014 & 2015) | 291 | 301 | N/A | N/A | | ↑ |

**Figure 6 – Example Dashboard from Washington DOT Gray Notebook**

### 5.1.2 Regional Performance Indicators

Following the dashboard, the performance report would address system-level operational performance, including a summary of both performance at the regional-level and at the corridor-level. This section of the report would focus on reporting on performance in relation to national performance measures and related topics. An organizing

structure of the report would include a single or multiple page fact sheet style summaries, addressing the topics of: Congestion; Reliability; and Freight Movement (to be compatible with MAG federally required reporting). Each of the topics and measures would be defined and described in simple terms, along with trends, and factors affecting performance. A good example of the information that is recommended for this section of the report is the Wisconsin DOT (WisDOT) Travel Time Reliability and Delay Report, shown in **Figure 7**. In this report, WisDOT reports travel time reliability and delay at both the system-level and corridor-level. It uses graphics to provide a high-level description of the measures with information about how the measure is calculated, which is important given the complexity of some of the measures, such as the planning time index used to assess travel time reliability.

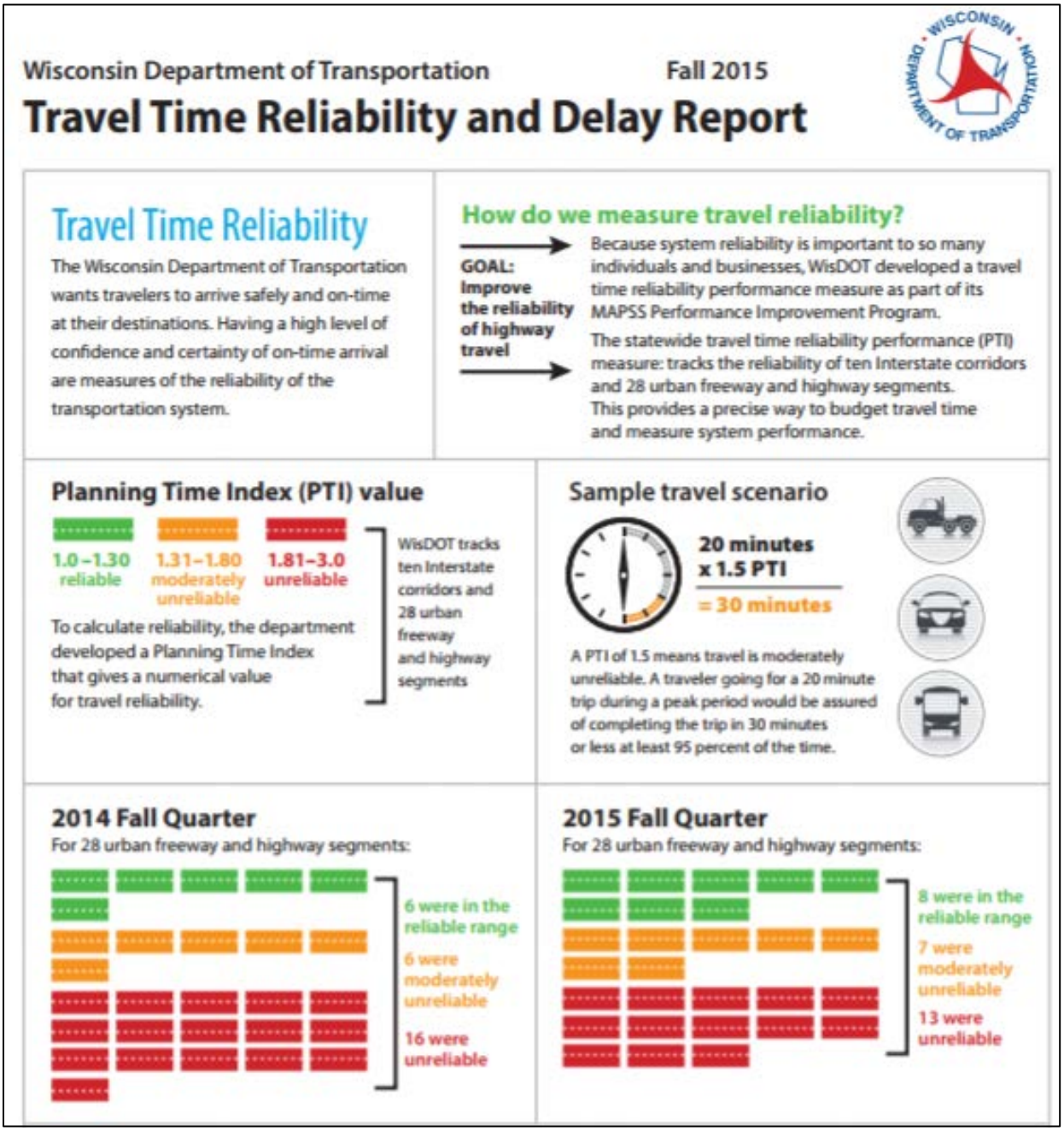



**Figure 7 – Wisconsin DOT's Travel Time Reliability and Delay Report**

In addition, other relevant regional figures can be provided, such as regional statistics (national rankings of congestion) for the Phoenix area from the TTI Urban Mobility Scorecard[4] to help convey how the Phoenix region is performing compared to the rest of the country.

### 5.1.3 Investment Priority Areas

Next, the report would get more detailed in addressing specific investment priority topics related to parts of the transportation system and provide more detailed information on the performance of specific elements of the transportation system. This section could be also organized with simple fact sheet style summaries addressing:

- **ICM/Freeway Management** – This section would discuss performance of the freeway system, and include maps that display key freeway traffic congestion and reliability indicators. The discussion should address changes in performance, as well as examples of projects implemented to address traffic using freeway management systems components (e.g., detection systems, ramp meters, dynamic message signs, and cameras). It could also highlight efforts to integrate and improve interagency coordination across a corridor during recurring and non-recurring events.
- **Arterial Management (Regional Priority Arterials)** – This section would present performance of the priority arterial network and address the management of traffic and incidents at intersections and along these priority arterials. It would include maps that display key traffic congestion and reliability indicators along regional priority arterials. As with the section on ICM/Freeway Management, this section would address changes in performance, as well as examples of projects implemented to address arterials, including evaluations of signal improvements and other coordinated projects.
- **Traffic Incident Management** – While incident management relates closely to ICM and freeway management, and performance measures for incident management relate to both, there is enough data and a story to tell about incident management to have a section of its own. Incident management measures tend to be regional rather than geographically-based. This section would discuss key indicators related to incident detection and clearance times, coordination with law enforcement and other activities. It would also highlight regional activities associated with sub-regional traffic management centers (TMCs) and highlight the benefits of investments. An example of an incident management performance tracking effort is shown in **Figure 8**, which shows results from the evaluation of the DPS co-location pilot project.

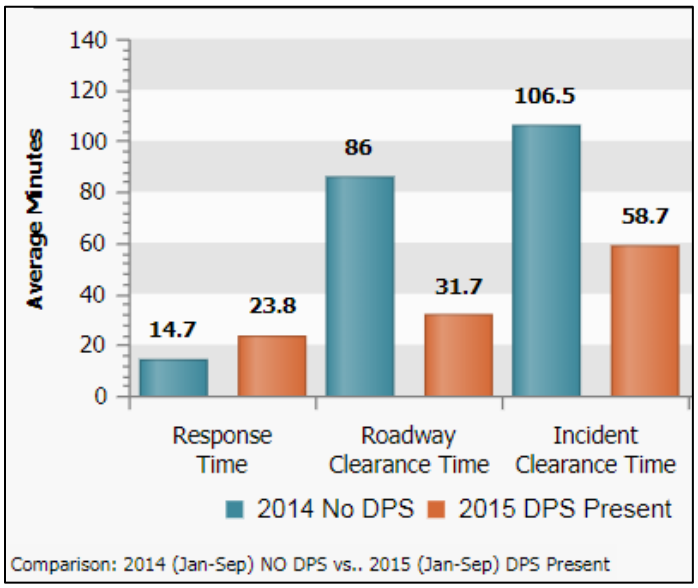



**Figure 8 – Outcomes from Year #1 Evaluation of DPS Colocation Pilot Project**

[4] TTI Urban Mobility Scorecard; https://mobility.tamu.edu/ums/

While a key focus of the report is to provide a performance update on the system, each of these sections would ideally bring in short examples or case studies of projects being implemented to make the connection between investments and performance indicators.

### 5.1.4 Moving Forward

Finally, the report would conclude with some perspectives either on priorities moving forward, or another discussion that links the performance information in the report into other activities and priorities being undertaken by MAG, such as updates to the Congestion Management Process, RTP, or TIP. This section also could include any information about strategic changes MAG plans to implement as a result of system performance or performance outcomes.

# 6 PROCESS FOR CONDUCTING ANNUAL REPORTING

The process that MAG uses for developing the annual report will involve several steps, as described below, including first deciding on the key performance measures to incorporate into the report, followed by consideration of setting targets, collecting and compiling monitored data, conducting evaluation studies, and finally interpreting, synthesizing, and laying out the document. Setting targets should be done with much caution so as to not contradict the federally required 17 targets reported elsewhere. Each of the recommended steps are discussed briefly below.

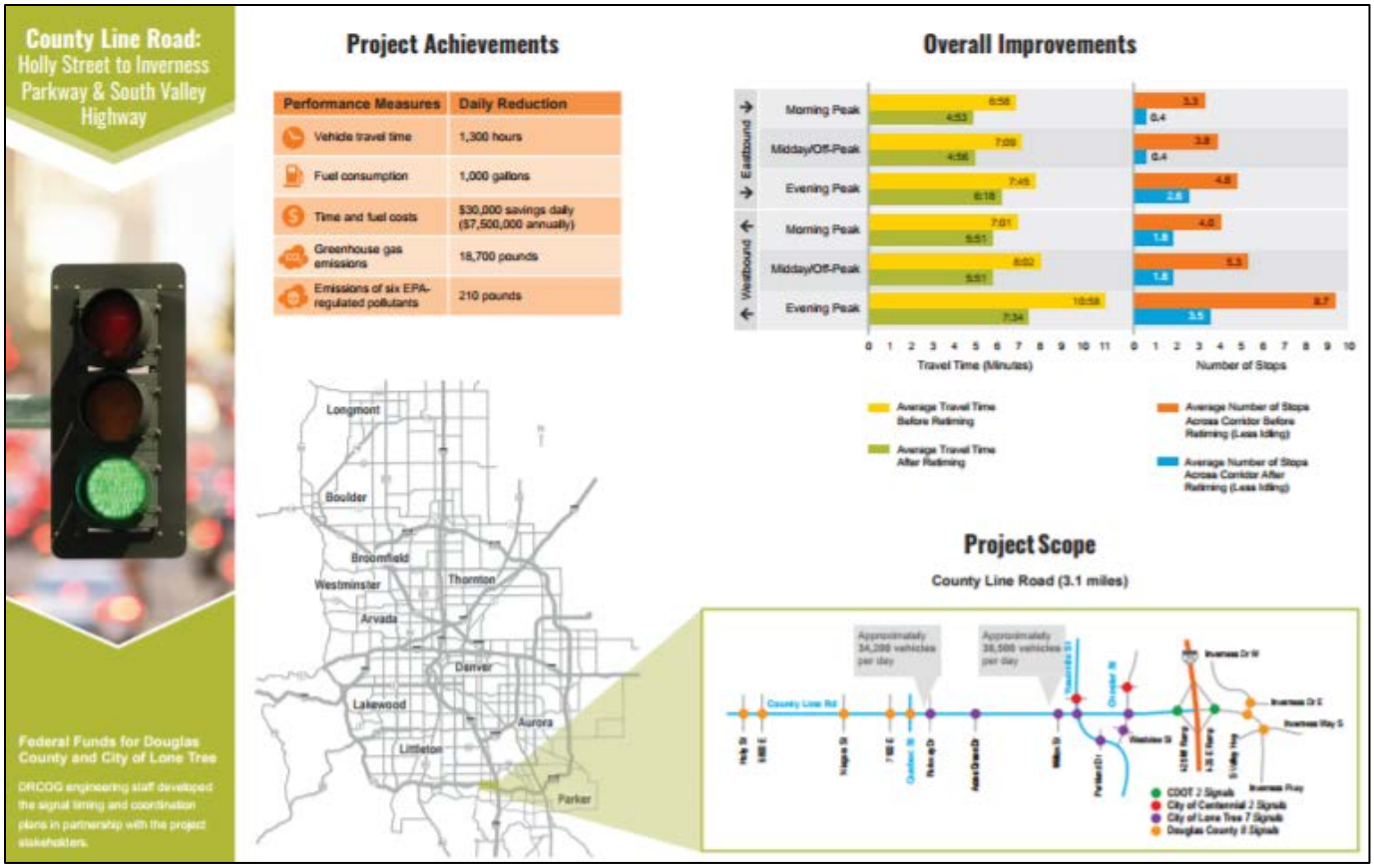
## *6.1 Collecting Data for Key SMO Performance Measures*

While some regions have developed and track dozens of performance measures, MAG should look to report on a narrow list of measures to effectively communicate operations performance and support investment decision making. The MAGnitude website provides an array of detailed information at various spatial scales that can be used to make comparisons; the SMO Annual Report will focus on drawing out a subset of the most relevant information to tell the story about performance changes and as importantly, make the connection to investment priorities.

The SMO Annual Report will depend on the availability of monitored data to continue to assess and track performance over time. The MAG region already has a wealth of data from multiple sources, including the ADOT HCRS, RADS, the ADOT ALISS and the NPMRDS, among others. The MAGnitude performance website already accesses most of these data sources and presents many of these figures in a dynamic tool on the website.

## *6.2 Evaluating the Effectiveness of Investments*

To evaluate the impacts of SMO projects, it will be important for MAG to conduct some evaluation studies of the impacts of investments or programs. Locally, MAG is already starting to do these kinds of before and after assessments as part of signal timing optimization projects through the MAG TSOP program (for a limited number of projects each year) as well as project evaluations, such as the evaluation undertaken for the DPS co-location project that has been described previously. Nationally, the Denver Regional Council of Governments' (DRCOG) Traffic Signal System Improvement Program (**Figure 9**) is regarded as a good example of project evaluation reporting. DRCOG tracks and publishes an Annual Benefits Summary of Projects as well as Annual Signal Timing Briefs to track the benefits of the projects. These documents clearly illustrate the benefits of implementing traffic improvement projects.




*Source:* https://drcog.org/programs/transportation-planning/traffic-operations-program

**Figure 9 – DRCOCG's Annual Signal Timing Brief for Individual Project**

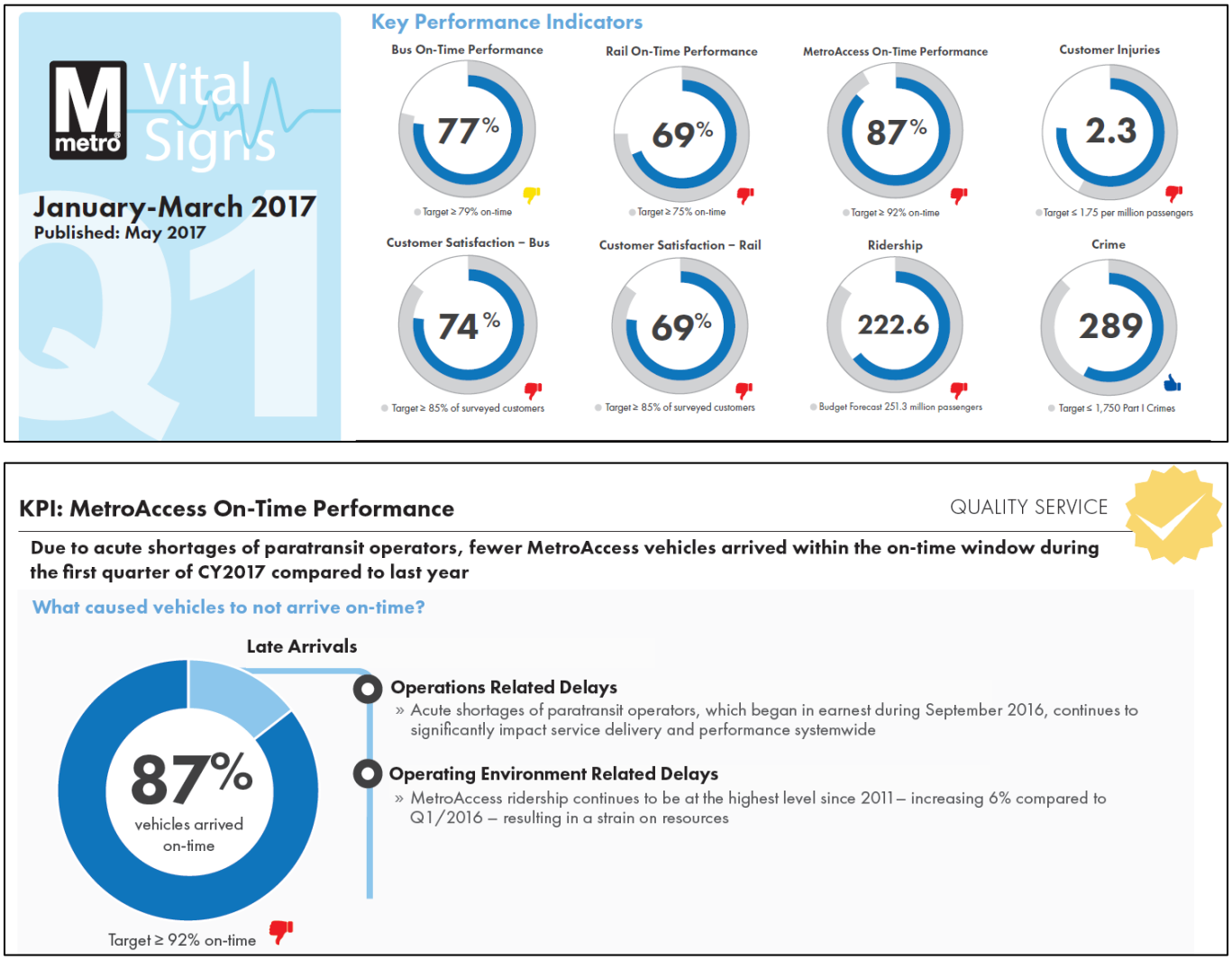
It will be valuable to highlight on-going efforts to assess the impacts of SMO projects using before and after evaluation on corridors. The corridor level evaluation of SMO projects when accompanied by a benefit/cost analysis can help to justify the investment cost. Corridor level evaluation also can help shape future investment prioritization and decision making. These studies typically will need to be funded as part of the program development efforts, since simply using monitored traffic and related data may not be sufficient to conduct an adequate evaluation.

## *6.3 Interpreting and Synthesizing Results and Preparing the Report*

Finally, the most complex and perhaps important component of developing the Annual Report will be working to present the information in a clear and compelling way. This process of "turning data into information" takes time and effort to interpret results and synthesize information in ways that tell a story. This process would likely be supported through partnership among MAG staff with ADOT and perhaps other agencies in the region to help "tell the story" of system performance and SMO activities.

In addition to reporting on the identified operations performance metrics, the SMO Annual Report can link performance measures to tell a bigger picture story about the contributions of investment strategies, as well as other factors. For example, reliability of freeway corridors is greatly affected by the number of incidents and the incident clearance time, among other factors. Consequently, a discussion of reliability and presentation of reliability measure should link to information about incident clearance time changes to tell a compelling story. The narrative discussion also can address other factors to explain the direction of impacts, such as changes in VMT, to tell a compelling story.

This final step of the reporting effort will require development of effective graphics, an easy-to-read layout of information, and writing that explains often complex data in ways that the public and decision makers can understand. An example of effective performance story is the Washington Metropolitan Area Transit Authority's (WMATA) Annual Vital Signs report and Scoreboard (**Figure 10**), where WMATA tells its story on why the performance improved or worsened during the period. In cases where there is reported improvement in performance, the report also explains the actions that could have led to the improvement. Similarly, for measures showing declined performance, WMATA explains the actions it is taking to improve the outcome of the measurers.




*Source: https://www.wmata.com/about/board/meetings/board-pdfs/upload/4A-Vital-Signs-Q1-CY2017-TO-POST.pdf*

**Figure 10 – WMATA Vital Sign Report Dashboard and Detailed Performance Explanation**

# 7 ANNUAL REPORT OUTREACH STRATEGIES/DISTRIBUTION

MAG can distribute the Annual Report using various mechanisms. The Annual SMO performance report can be published both on the MAG website (electronic format) as well as a PDF version which can be printed annually and can be archived and made available for a period of years. The report likely should be a link accessible from the MAG Transportation Performance Management page (http://azmag.gov/Programs/Transportation/Transportation-Performance-Management) and from other key web pages, such as MAGnitude.

It is also recommended that MAG compile a brief performance summary presentation that can be shared with MAG committees and councils to update these key groups on SMO performance, trends and outcomes. These groups are a primary audience for reporting on the performance of SMO investments and will play an important role in prioritizing SMO for regional funding. MAG partner agencies will also want a brief document (or web resource) that can be shared with management and decision-makers at their agencies. The SMO performance summary should focus on outcomes across several key investment areas. For example:

- ICM: What has been the benefit of ICM? How has it helped agencies better manage incident response, traffic re-routing and network recovery? What have travelers gained because of ICM?
- Priority Arterial Investments: Have travel times improved on key corridors because of SMO investments? How many more people are we able to move during peak periods on key corridors? How much time are travelers saving? What does this translate to in terms of fiscal benefits?
- Regional Operations Investments: How has the investment in after-hours arterial operations benefitted agencies and travelers? How have these investments enabled agencies to better manage after-hours impacts? What have been the improvements seen because of expanded traveler information capabilities?

Supplemental information sheets can be made available online to give additional information on the individual performance measures. These supplemental information sheets can provide detailed information on the data sources and the process of computation of the performance measure for those who are interested to understand the analysis.

In addition to the full annual report a summary fact sheet of the report (about two page long) can be made available allowing the audience to get an overview of the performance of the system and key corridors.

# 8 ADDITIONAL REPORTING BEST PRACTICE EXAMPLES

Many transportation agencies develop annual or periodic (e.g., monthly, quarterly, or biennial) performance reports, which provide models or lessons about effective practices that can be incorporated into the MAG SMO Annual Report. This section provides an overview of several examples of performance reports, and highlights particularly valuable features of these reports.

First, a summary is provided of several reports that discuss system-level performance, including both reports focused on SMO and agency-level performance reports that address a full array of goal areas. Second, examples of reports that document the benefits or return on investment from SMO investments are highlighted. It is anticipated that the MAG SMO Annual Report would include a combination of both types of reporting information.

## *8.1 System-Level Performance*

System-level performance reports generally highlight overall system (i.e., statewide, regional, or agency-wide) performance in relation to defined system-level goals and performance measures. They also can provide corridor-level or roadway-level performance information across a broad region.

Under the transportation planning rule published in May 2016 supporting requirements under the Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Fixing America's Surface Transportation (FAST) Act, all statewide and metropolitan transportation plans are now required to include a system performance report and subsequent updates evaluating the condition and performance of the transportation system with respect to performance targets (including progress achieved in meeting the performance targets in comparison with system performance recorded in previous reports). As a result, MAG will need to develop a region-wide system performance report addressing all the national performance measures and its established targets (and could include other performance measures as well); and parts of the SMO Annual Report could be utilized within the overall system performance report. MPOs and State DOTs are beginning to develop such reports, and some areas have developed reports focused more specifically on operational performance. Based on existing/previous experience, examples of effective practices that provide some potential insights for the MAG SMO Annual Report include the following:

- Mid America Regional Council's (MARC) annual performance measurement progress report and Annual Safety Report
- Washington Metropolitan Area Transit Authority's (WMATA) Vital Signs Report
- Wisconsin DOT's Travel Time Reliability and Delay Report

Each of these reports is briefly described below, highlighting attributes that may be a model for MAG to consider in its SMO Annual Report.

### 8.1.1 Mid America Regional Council (MARC) Annual Performance Measurement Progress Report and Annual Safety Report

MARC publishes an annual performance measurement progress report and Annual Safety Report. The performance measures progress report provides historical data and analysis for selected performance measures (example shown in **Figure 11**). Each performance measure corresponds to at least one goal in the adopted long range plan.

## Kansas City Regional Performance Measures

| | Factor | Measure | Data | Goal | Actual | Change |
|---|---|---|---|---|---|---|
| Vibrant | **Equity** | | | | | |
| | Travel time to work | Ratio of transit travel time to auto travel time | 2015: 1.7 times longer by transit<br>2016: 2 times longer by transit | ↓ | — | Not significant* |
| | **Placemaking** | | | | | |
| | Multimodal options | Percent of work trips using alternative modes (transit, bicycling, walking, etc.) | 2015: 16.5 percent<br>2016: 16.1 percent | ↑ | — | Not significant* |
| | Walkability index – employment | Change in employment within a quarter mile of walkable area | 2013-2014: 2,668 more jobs<br>2014-2015: 11,632 more jobs | ↑ | ↑ | Net positive |
| | Walkability index – housing permits | Percent of regional permits for new housing units within walkable area | 2015: 14.5 percent<br>2016: 17.8 percent | ↑ | ↑ | 3.3 percentage points |
| | **Transportation choices** | | | | | |
| | Transit service usage | Average transit boarding per revenue service hour | 2014: 18.9 boardings<br>2015: 17.8 boardings | ↑ | ↓ | -5.9% |
| Connected | **Safety & security** | | | | | |
| | Crash fatalities | 5-year average of crash fatalities | 2015: 171.6 fatalities<br>2016: 178.4 fatalities | ↓ | ↑ | 4% |
| | Rate of crash fatalities | 5-year average rate of fatalities per 100 million vehicle miles traveled | 2015: 0.87 fatalities/100 VMT<br>2016: 0.89 fatalities/100 VMT | ↓ | ↑ | 1.9% |
| | Serious injuries | 5-year average of serious injuries | 2015: 1,233.8 serious injuries<br>2016: 1,155.6 serious injuries | ↓ | ↓ | -6.3% |
| | Rate of serious injuries | Rate of serious injuries per 100 million vehicle miles traveled | 2015: 6.3 serious injuries<br>2016: 5.8 serious injuries | ↓ | ↓ | -7.9% |
| | Non-motorized fatalities and injuries | 5-year average of non-motorized fatalities and non-motorized serious injuries | 2015: 121 fatalities and serious injuries<br>2016: 114 fatalities and serious injuries | ↓ | ↓ | -9.2% |
| | **System performance** | | | | | |
| | On-time transit performance | Regional on-time transit performance | 2014: 87.4 percent<br>2015: 88.8 percent | ↑ | ↑ | 1.4 percentage points |
| | Reliable truck travel times | Truck Travel Time Reliability Index | 2015: 1.90<br>2016: 1.86 | ↑ | ↓ | -2.1% |
| | Reliable travel times | Percent of miles traveled on Interstate highways that are reliable | 2015: 87.9 percent<br>2016: 88.6 percent | ↑ | ↑ | 0.7 percentage points |
| | | Percent of miles traveled on non-Interstate highways that are reliable. | 2015: 70.4 percent<br>2016: 71.5 percent | ↑ | ↑ | 1.1 percentage points |

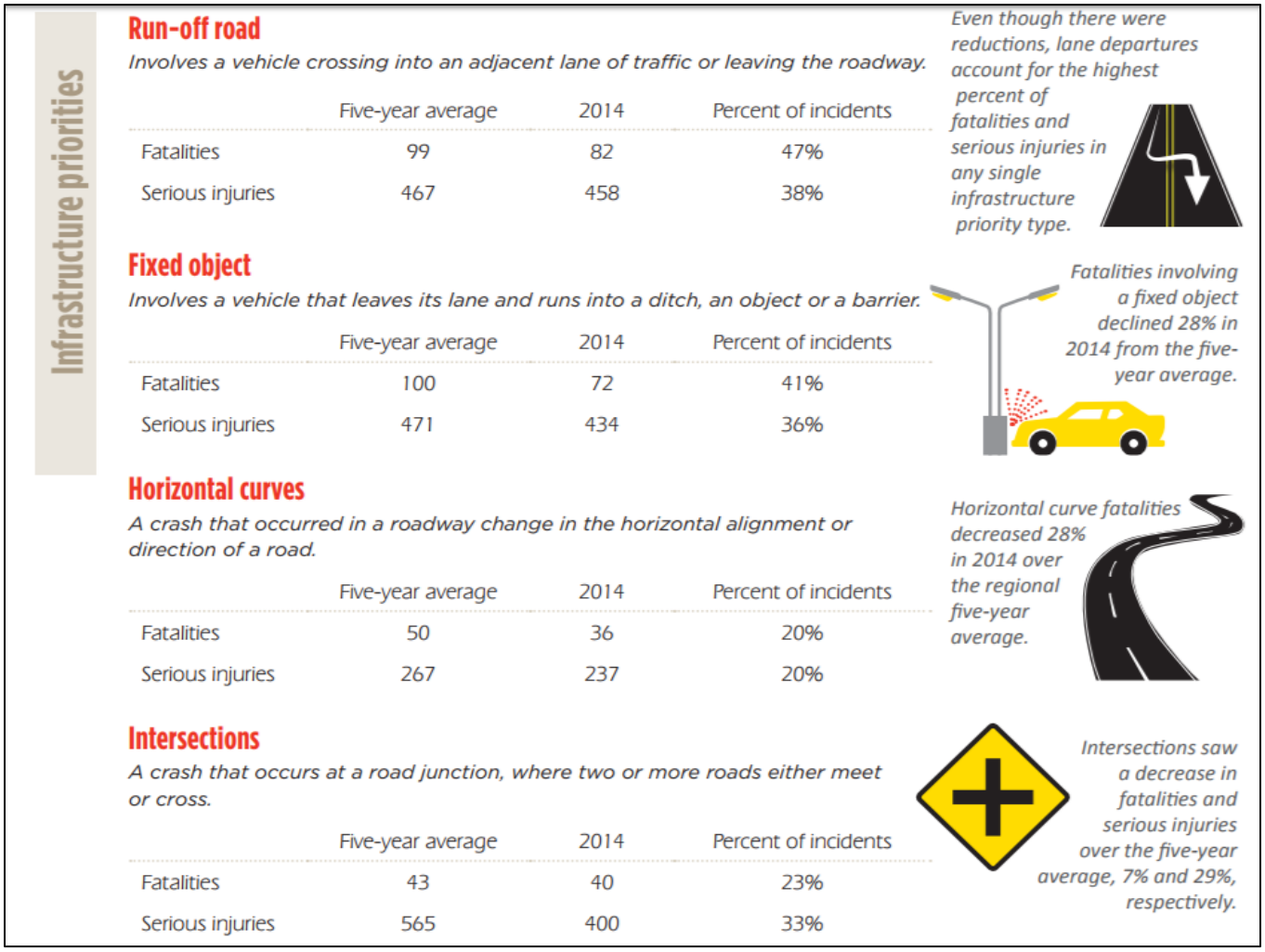
*Source: http://www.to2040.org/assets/Performance-measures-report_20171016.pdf*

**Figure 11 – Mid- America Regional Council's Dashboard Summary**

The progress report serves as an annual snapshot of the region, which helps MARC and its planning partners better understand the state of the transportation infrastructure and if they are moving towards achieving the goals stated in the long-range plan. Resulting performance measure trends displayed in this report help inform decisions, alternative strategies, and investment priorities for the region's transportation network. As shown in Figure 5, the recent year's summary includes some MAP-21 measures that will become reporting requirements for all MPOs across the country. The MARC performance measures dashboard utilizes "Goal", "Actual" and "Change" column to clearly identify whether the trend is in or the opposite direction of the desired goal. The "Change" Column

effectively uses red, green and gray colors with text to illustrate how significant the performance measure changes from the last reporting period.

A separate report, MARC's Annual Safety Report (**Figure 12**) provides an example of presenting data in an aesthetically pleasing report. This report includes not only data but brief explanations or "factoids" that help to communicate key points to the reader.



Infrastructure priorities

**Run-off road**

*Involves a vehicle crossing into an adjacent lane of traffic or leaving the roadway.*

| | Five-year average | 2014 | Percent of incidents |
|---|---|---|---|
| Fatalities | 99 | 82 | 47% |
| Serious injuries | 467 | 458 | 38% |

*Even though there were reductions, lane departures account for the highest percent of fatalities and serious injuries in any single infrastructure priority type.*

**Fixed object**

*Involves a vehicle that leaves its lane and runs into a ditch, an object or a barrier.*

| | Five-year average | 2014 | Percent of incidents |
|---|---|---|---|
| Fatalities | 100 | 72 | 41% |
| Serious injuries | 471 | 434 | 36% |

*Fatalities involving a fixed object declined 28% in 2014 from the five-year average.*

**Horizontal curves**

*A crash that occurred in a roadway change in the horizontal alignment or direction of a road.*

| | Five-year average | 2014 | Percent of incidents |
|---|---|---|---|
| Fatalities | 50 | 36 | 20% |
| Serious injuries | 267 | 237 | 20% |

*Horizontal curve fatalities decreased 28% in 2014 over the regional five-year average.*

**Intersections**

*A crash that occurs at a road junction, where two or more roads either meet or cross.*

| | Five-year average | 2014 | Percent of incidents |
|---|---|---|---|
| Fatalities | 43 | 40 | 23% |
| Serious injuries | 565 | 400 | 33% |

*Intersections saw a decrease in fatalities and serious injuries over the five-year average, 7% and 29%, respectively.*

**Figure 12 – Mid- America Regional Council's Annual Safety Report**

### 8.1.2 Wisconsin DOT Travel Time Reliability and Delay Report

The Wisconsin DOT's (WisDOT) performance improvement program focuses on core goal areas of mobility, accountability, preservation, safety and service (MAPSS). The progress of the performance measures is published in a two-page scorecard in the body of the MAPPS report. As with other performance reports, the scorecard provides both data and quick visuals to help the reader assess whether the target (goal) has been met and the direction of the trend. The scorecard also helps to communicate the trend and provides other relevant factors to consider through comments (**Figure 13**).

October 2017

Wisconsin Department of Transportation

**MAPSS Performance Scorecard**

✓ Goal has been met ↑ Performance is trending in a favorable direction ↔ Trend is holding ↓ Performance is trending in an unfavorable direction

| Performance measure | How we measure it | Current report period | Goal | Goal met | Trend | Comments |
|---|---|---|---|---|---|---|
| **Mobility:** Delivering transportation choices that result in efficient trips and no unexpected delays. | | | | | | |
| Delay (Hours of Vehicle Delay) Seasonal quarter Fall 2016 | Number of hours spent in Interstate traffic below posted speed | 3,959,120 hrs | 4,712,207 hrs | ✓ | ↑ | Vehicle delay decreased compared to fall 2015. Only one of the 10 Interstate corridors had increased delay (a lower number is better). |
| Reliability (Planning Time Index) Seasonal quarter Fall 2016 | Index based on extreme travel time in a period | 1.15 | 1.17 | ✓ | ↑ | The planning time index (PTI) decreased compared to fall 2015. All corridors had decreased PTI with the exception of the I-39/90 corridor between Madison and the Illinois State line (a lower number is better). |
| Transit Availability Calendar year 2016 | Percent of population served by transit | 56.0 | 55.0 | ✓ | ↑ | There was a three percent increase from 2015 to 2016. This increase was largely driven by increased access in several rural counties. |
| Bicycling Conditions on Rural Highways Calendar year 2016 | Percent of rural highway miles with favorable bicycling conditions | State hwys: 66.1; County roads: 91.4 | 100 percent on roads where bicycles are not prohibited | | ↔ | Overall, the number of miles rated as favorable for bicycling increased on county highways but decreased on state highways. |
| Incident Response Calendar year 2016 | Percent of incidents cleared within a specific timeframe | Inter-mediate incidents: 91.4; Major incidents 86.4 | Intermediate incidents: 90.0; Major incidents: 80.0 | ✓ | ↑ | The department's coordination in this area continues to improve and both the intermediate and major incident clearance goals were met. The average clearance time of 78 minutes achieved in 2016 is one of the lowest in the last six years. |
| Winter Response State fiscal year 2017 | Percent to bare-wet within a specific time period after a storm | 75 for 24-hr roads | 70.0 within specified time | ✓ | ↓ | The department continues to develop and implement best practices for effective and efficient winter response. One of such is the expanded use of salt brines in lieu of rock salt. |

*Source:* http://wisconsindot.gov/Documents/about-wisdot/performance/mapss/perf-report.pdf

**Figure 13 – Component of Summary Scorecard within WisDOT MAPSS Report**

In addition, Wisconsin DOT has also published a Travel Time Reliability and Delay Report, which was a featured report as part of the MAPSS Performance Improvement Program.

In addition to reporting on system-wide performance, the Travel Time Reliability and Delay Report also includes corridor-level information, showing performance measures mapped out to communicate information for individual freeway links. The maps and tables for the Milwaukee area are shown in **Figure 14**.

# Milwaukee Area Travel Time Reliabilty

## Milwaukee Freeway Peak Travel Times: 2014 Spring Quarter

| Map Link | Planning Time Index (PTI) | Highway | From | To | Distance Miles | Normal Travel Time Minutes | Worst Peak Travel Time Minutes | Worst Peak |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.18 | I-94 EB | WIS 67 | US 18 | 15.3 | 14.2 | 16.7 | AM |
| 2 | 1.20 | I-94 WB | US 18 | WIS 67 | 15.4 | 14.2 | 17.1 | PM |
| 3 | 2.36 | I-94 EB | US 18 | Zoo interchange | 7.4 | 8.0 | 18.9 | PM |
| 4 | 1.26 | I-94 WB | Zoo interchange | US 18 | 7.4 | 7.5 | 9.4 | PM |
| 5 | 2.45 | I-894 WB | Hale interchange | Zoo interchange | 6.2 | 6.8 | 16.7 | AM |
| 6 | 1.75 | I-894 EB | Zoo interchange | Hale interchange | 5.5 | 6.0 | 10.5 | PM |
| 7 | 1.39 | I-43NB/894EB | Waukesha County Line | Mitchell interchange | 9.1 | 9.9 | 13.8 | AM |
| 8 | 1.41 | I-43SB/894WB | Mitchell interchange | Waukesha County Line | 7.5 | 8.2 | 11.5 | PM |
| 9 | 2.19 | I-94 EB | Zoo interchange | Marquette interchange | 5.2 | 6.0 | 13.1 | AM |
| 10 | 2.14 | I-94 WB | Marquette interchange | Zoo interchange | 5.9 | 6.7 | 14.4 | PM |
| 11 | 1.49 | US 45 NB | Zoo interchange | Waukesha County Line | 8.3 | 9.1 | 13.5 | PM |
| 12 | 2.38 | US 45 SB | Waukesha County Line | Zoo interchange | 8.5 | 9.2 | 22.0 | PM |
| 13 | 1.36 | I-94 WB | Racine County Line | Mitchell interchange | 8.9 | 8.8 | 11.9 | AM |
| 14 | 1.11 | I94 EB | Mitchell interchange | Racine County Line | 9.3 | 9.1 | 10.1 | PM |
| 15 | 2.00 | I-94 WB | Mitchell interchange | Marquette interchange | 5.5 | 6.0 | 12.1 | AM |
| 16 | 1.82 | I-94 EB | Marquette interchange | Mitchell interchange | 6.3 | 6.9 | 12.6 | PM |
| 17 | 1.57 | I-794 WB | Carferry Dr | Marquette interchange | 3.7 | 4.4 | 7.0 | AM |
| 18 | 1.34 | I-794 EB | Marquette interchange | Carferry Dr | 3.7 | 4.4 | 5.9 | AM |
| 19 | 1.71 | I-43 NB | Marquette interchange | Ozaukee County Line | 11.1 | 12.3 | 21.0 | PM |
| 20 | 1.92 | I-43 SB | Ozaukee County Line | Marquette interchange | 10.8 | 12.1 | 23.2 | PM |

*Source:* http://wisconsindot.gov/Documents/about-wisdot/performance/mapss/travel-time-report-fall-2015.pdf

**Figure 14 – Wisconsin DOT's Travel Time Reliability for Corridors in Milwaukee Area**

## 8.2 Program and Project Evaluation

In addition to reporting on system-level or corridor-level performance, some agencies include information from evaluation studies to highlight the benefits of program-, corridor-, or project-level investments. For instance, in its Gray Notebook, WSDOT not only reports on performance but provides highlights of successful practices being undertaken to support positive outcomes. For instance, in the report for Q2 of 2017, the discussion of safety performance includes information on WSDOT's review of safety performance at more than 350 roundabouts showing the improvements achieved and high 59:1 benefit to cost ratio. The document also highlights WSDOT's data driven approach for selecting safety projects to help tell the story about the contributions of WSDOT to system performance.

This type of evaluation of SMO investments and "story telling" about implementation of SMO projects helps to demonstrate the value of investments. These types of stories of implementation success can be important in explaining the contribution of investments toward positive performance outcomes, particularly since overall system performance levels are generally affected by many different factors beyond the control of transportation agencies. For instance, population growth, land use development, fuel prices, and many other factors affect vehicle travel, congestion, and other indicators of mobility and reliability, and as a result, regional performance may worsen even with the implementation of effective programs. Consequently, providing an evaluation of investments to show before-and-after data or estimates of the benefits of implementation compared to no implementation can help to communicate how the SMO program is providing benefits. Examples of reports providing this type of information include evaluation reports conducted for the following programs:

- North Central Texas Council of Governments' (NCTCOG) Thoroughfare Assessment Program/Traffic Signal Integration and Monitoring Program; and
- Denver Regional Council of Governments' (DRCOG) Traffic Signal System Improvement Program.

### 8.2.1 North Central Texas Council of Governments (NCTCOG) Thoroughfare Assessment Program/Traffic Signal Integration and Monitoring Program

NCTCOG, the MPO for the Dallas-Ft. Worth metropolitan area, has maintained a long-standing program designed to improve traffic flow and enhance the capacity of existing arterial systems by implementing new signal timing and low-cost operational improvements along selected corridors. Initially called the Thoroughfare Assessment Program (TAP), and now known at the Traffic Signal Integration and Monitoring Program, the effort has implemented new projects in several phases, with evaluation studies conducted for each one to assess benefits. This effort involves analyzing the performance on the arterials that are part of the program by comparing observed travel time runs before and after project implementation. In addition, modeling has been conducted using Synchro models to develop new traffic signal timing plans and estimate measures of effectiveness, including total signal delay, fuel usage, and emissions.[5]

An example of the series of corridors analyzed in show in **Figure 15**. For each corridor, data are provided in tables showing the estimated benefits across the measures of effectiveness.

[5] http://www.nctcog.org/trans/tsm/index.asp

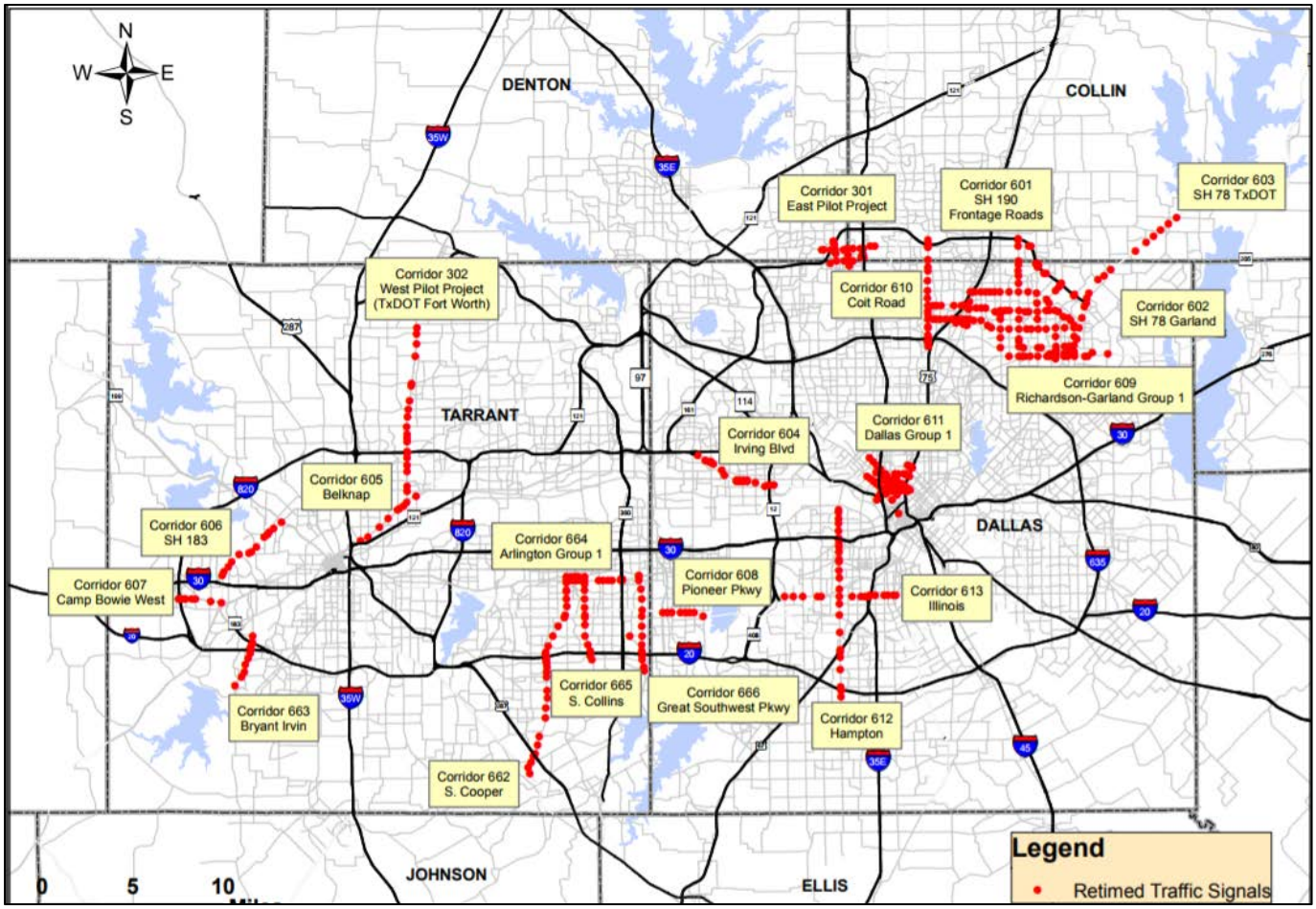



**Figure 15 – NCTCOG's Thoroughfare Assessment Program**