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From: Kittelson & Associates, Inc.

RE: Transportation Safety Action Plan Update: Revised Draft Performance Measures

INTRODUCTION

This memorandum summarizes the revised draft performance measures identified to track how well the City and its partners are implementing the Transportation Safety Action Plan (TSAP) and how effective this implementation is. Performance measures align with the City's transportation safety vision to "strive toward zero serious injuries and deaths related to transportation crashes by 2035."

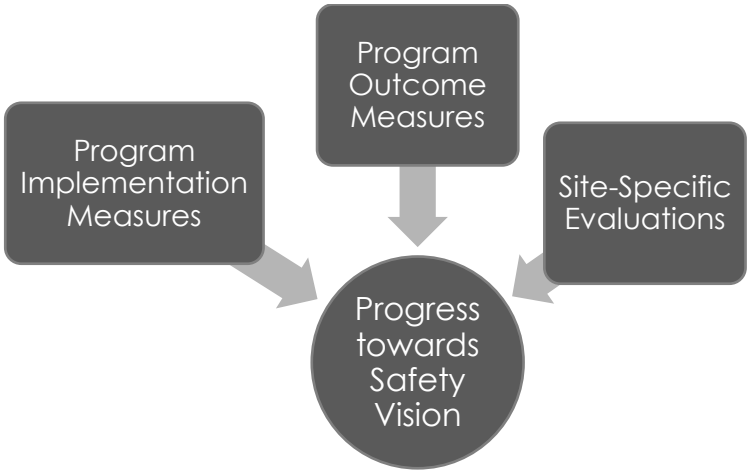
Based on performance tracking, the City should evaluate the TSAP approximately every 5 years to identify whether any adjustments need to be made to the program.

PERFORMANCE MEASURES

Performance measures provide the information needed to evaluate safety implementation and identify the need for changes to the TSAP as progress is tracked. Using performance measures to track progress can also help focus additional resources towards strategies related to specific emphasis areas.

Performance measures are separated into three categories: Program Implementation Measures, Program Outcome Measures, and Site-Specific Evaluations. The Program Implementation Measures and Program Outcome Measures track overall progress towards implementing the TSAP and achieving the City's safety vision. The Site-Specific Evaluations assess the effectiveness of a specific infrastructure safety project.

Each of these is discussed in the following sections of this memorandum.



Program Implementation Measures

Program Implementation Measures track the progress of carrying out the TSAP strategies and recommendations. Program Implementation Measures should be tracked annually. These measures track actions and outreach. Table 1 summarizes the Program Implementation Measures for the TSAP. As part of tracking implementation, the City will communicate with partners and the community to identify any challenges or barriers to implementing the TSAP.

Table 1. Program Implementation Measures

Implementation Category	Performance Measures
Actions	– Number of strategies/actions implemented[1] o Total o By emphasis area o By Safe System focus area (e.g. Safer Roads, Safer People, Safer Speeds, Safer Vehicles, and Post-Crash Care) o In priority locations (e.g. Top 40% Pedestrian and Bicycle Risk Factor Sites, sites with relatively high crash severity scores according to the Equivalent Property Damage Only (EPDO) screening, and in high and medium high social equity index zones) – Number of site-specific safety projects completed – Number of partners leading or engaged with implementing strategies/actions
Outreach	– Number of outreach or education events – Number of outreach events in HMC – Number of safety comments submitted through the Engage site – Number of visitors to the Engage site

In the future, the City can consider tracking funding through measures like dollars spent on safety projects or on safety elements of projects. This would require the City to establish a methodology for categorizing projects and tracking overall spending on those projects.

[1] In many cases, strategies and actions require ongoing implementation. For example, education programs can be tracked by number of classes or students taught over a year.

Program Outcome Measures

Program Outcome Measures evaluate the success of the TSAP's implementation in achieving its goal of zero fatal and serious injuries. Table 2 documents the recommended Program Outcome Measures by emphasis area. The City can track these metrics using the most recent year of available crash data, U.S. Census data, Oregon Department of Transportation (ODOT)'s Social Equity Index[2], and emerging technologies for tracking safety performance. Program Outcome Measures should be tracked annually.

The City's vision is to achieve zero serious injuries and fatalities related to transportation crashes by 2035. Therefore, the total number of fatal and serious injury crashes is the most important outcome measure to track to assess progress towards the City's vision.

Table 2. Program Outcome Measures

Emphasis Area	Performance Measure

Comprehensive (Total Crash History)	– # of fatal and serious injury crashes
	  o Total
	  o Per capita
	  o By crash type
	  o By social equity index category of crash location
	  o By roadway ownership
	– Crash severity ratio (# of fatal and serious injury crashes relative to total # of crashes)

Pedestrian and Bicycle Crashes	– # of pedestrian crashes – # of bicycle crashes – # of fatal and serious injury pedestrian crashes – # of fatal and serious injury bicycle crashes

Aggressive Driving (Failure to Yield Right-of-Way, Speed, and Following too Closely)	– # of crashes involving aggressive driving behaviors
	– # of fatal and serious injury crashes involving aggressive driving behaviors
	– Behavioral data, pending data availability, such as:
	  o Hard Braking Risk Score[3]
	  o Speed Risk Score[3]
	  o Vehicles exceeding speed limit +10 mph[3]

Impaired Driving	– # of crashes involving impaired driving – # of fatal and serious injury crashes involving impaired driving
Intersection Crashes[4]	– # of intersection crashes – # of intersection crashes by intersection control type, pending data availability – # of fatal and serious injury crashes at intersections
Turning Movement and Rear End (on 40+ MPH roadways) Crashes	– # of fatal and serious injury turning movement/rear end crashes
Vulnerable Aging Users[5]	– # of crashes involving aging road users per capita – # of fatal and serious injury crashes involving aging road users per capita

[2] https://geo.maps.arcgis.com/apps/View/index.html?appid=bbd3d9861fcd40ffa4085d457e4361a7%20
[3] Data provided by Safety View by INRIX and General Motors (GM).
[4] Intersection crashes are defined within ODOT's crash data set.
[5] Aging road users is defined as those aged 65 and over.

Site-Specific Evaluations

A common means for evaluating the effectiveness of a project is to analyze crashes before and after countermeasure implementation. For a project at a single location, this may be completed for just the single site. For systemic projects, where the same treatment is deployed across multiple locations, the data across all sites needs to be grouped together for the evaluation. Site-Specific Evaluations should be tracked annually: data from the year of construction should be excluded from calculations and each site (or grouping of sites) can be evaluated approximately three years after implementation if using crash data and approximately a year after implementation if using emerging technologies as described in the following section.

While before and after performance tracking has its benefits, the following limitations are worth consideration:

- It does not account for randomness in crash data, which can be especially marked in lower volume locations and low-occurring crash types, such as fatal and serious injury crashes or when evaluating only a single site.
- It takes several years to review crash data, which delays the amount of time between when an agency implements a project and when the agency can evaluate how the new solution is impacting behavior.

Where a simple before-after study is applied, using advanced statistical methods and/or grouping multiple sites together for evaluation can help limit the impact of variability (e.g., regression-to-mean) on performance evaluations and create more reliable datasets for low-occurring crash types.

According to the *Highway Safety Manual*, one method to provide a better statistical estimate of the effect of a treatment is to use safety performance functions (SPFs, mathematical models that predict long-term average crash frequency) in conjunction with observed crash data. ODOT has calibrated SPFs for many intersection types to Oregon conditions, allowing them to potentially be used in these analyses. When possible, these SPFs should be used in performing project evaluations.

Additionally, alternative data sources can be leveraged to get faster results and track driver behaviors. Examples of behaviors that are insightful to track include: near-miss detection, risky maneuvers (e.g. hard braking, hard acceleration, and hard cornering), and speeding. More details about emerging technologies for tracking safety performance are provided in the following section.

EMERGING TECHNOLOGIES FOR TRACKING SAFETY PERFORMANCE

The City should continue monitoring the development of new and emerging technologies that can be useful for tracking safety and behavior characteristics of roadway users. Similarly, the City may choose to monitor how changes in sampling methods/size and calculation may influence scoring of individual technologies.

The TSAP Update has leveraged resources and data provided by Safety View by INRIX and General Motors (GM). This tool has been valuable in identifying behavioral characteristics at site specific locations including

but not limited to hard braking risk scores, speed risk scores, and vehicles exceeding speed limit +10 mph[6]. This tool also provides data on near-miss detection and risky maneuvers for some GM vehicles. As recommendations and strategies are implemented, the City can track before and after data to evaluate the performance of site specific and systemic recommendation implementation. INRIX and GM Safety View is continuing to add features and update capabilities.

Another emerging technology to consider is video analytics that track individual users as they travel through an intersection. These video analytics provide information on the user, such as user type (i.e., pedestrian, bicyclist, or motor vehicle), speed, turning/crossing movement, and signal compliance, as well as their interactions with other users in the intersection. Video analytics can provide a large sample size in a short amount of time at a specific location.

Emerging technologies such as video analytics and Safety View (once longer periods of data become available) allow an agency to evaluate how a new solution is impacting behavior without having to wait 3-5 years (or longer) to review crash data.

NEXT STEPS

This memorandum documents the recommended performance measures identified to monitor how well the TSAP is being implemented and how effective this implementation is at reducing fatal and serious injury crashes. The project team is actively preparing the TSAP update based on the work completed to date and the City's continuous efforts to implement strategies that reduce risk of fatal and serious injury crashes.

[6] Road segment risk scores are calculated using aggregated and anonymized connected vehicle data to provide insight into the level of risk present on a particular road segment. These scores are updated on a quarterly basis, so users have more current data to explore impacts of implemented safety measures.