Speed Management Action Plan

Oregon Department of Transportation

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U.S. Department of Transportation
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Contents

Chapter 1: Introduction

In 2014, Oregon reported 105 speeding-related fatalities, accounting for 29 percent of the total traffic fatalities in the State.[1] Speeding-related fatal (F) and serious injury (level A on the KABCO scale[2]) crashes account for *27 percent* of all F&A crashes in Oregon. Speeding is a complex issue for transportation agencies to address because it can involve multiple safety areas. Speeding is impacted by public attitudes, roadway design, establishing appropriate speed limits, traffic calming, and enforcement strategies, to name a few.

FHWA and most States have identified roadway departure, intersection, and pedestrian and bicycle crashes as the three safety focus areas with the greatest potential for reducing fatalities. Speeding-related crashes occur in all three of these focus areas, and many of the countermeasures applicable to crashes within these focus areas also apply to speed-related crashes. With speed as a crosscutting issue, FHWA encourages agencies to take a broad look at their speeding related policies, safety plans, and programs to identify opportunities for integrating speed management throughout.

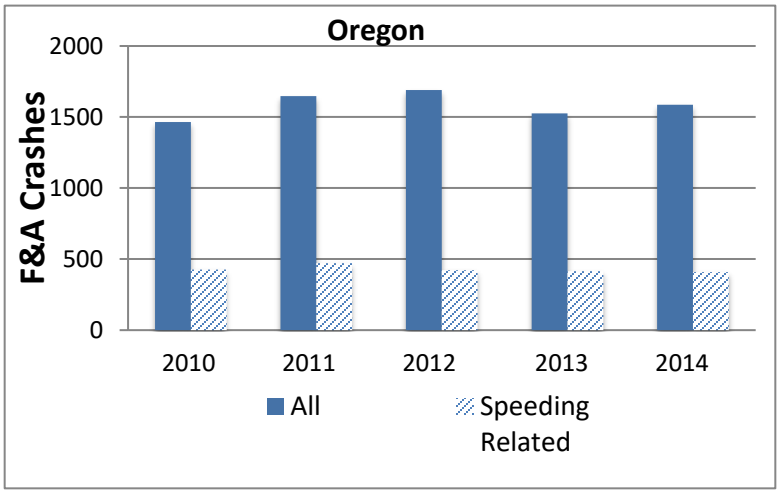

Figure 1 - Oregon's F&A Crashes, All and Speeding-related

This concept of integrating speed management within the three focus areas of roadway departure, intersection, and pedestrian and bicyclist, as well as within agency's existing policies, plans and programs is the foundation for Oregon's Speed Management Action Plan. The general outline of this plan is as follows:

- **Chapter 2** describes the approach that the project team used to develop the plan.
- **Chapter 3** identifies some key data analysis findings and presents speed management strategies that could be integrated into Oregon's roadway departure, intersection, and pedestrian and bicyclist plans.
- **Chapter 4** then lists some of the broader themes relating to speeding management in Oregon and potential strategies to overcome them.
- **Chapter 5** outlines opportunities to enhance or include information regarding speed-related concepts and speed management techniques into other agency plans, guidance, and manuals.

[1] National Center for Statistics and Analysis. (2016, April) Speeding: 2014 data (Traffic Safety Facts. Report No. DOT HS 812 265). Washington, DC; National Highway Traffic Safety Administration.

[1] The KABCO scale is a five point indexing system that consists of: fatal injury (K), incapacitating injury (A), non-incapacitating injury (B), possible injury (C), and no injury/property damage only (O).

- **Chapter 6** highlights the next steps, including considerations for future research needs relating to speed management and potential partners for success.

Reducing fatalities and severe injuries on the transportation system is directly impacted by an agency's efforts to manage roadway speeds and to implement effective speed management strategies. This speed management plan will assist Oregon in reaching their safety goals.

Chapter 2: Approach

The project team developed this plan based on a three-pronged approach that included a review of relevant Oregon transportation literature, data analysis to identify factors and trends that contribute to speeding-related crashes, and an interactive workshop with Oregon's key safety and speed management stakeholders.

Literature Review

The project team completed a literature review of ODOT's current state of practice, speed-related policies and guidance, and other safety plans to learn how Oregon is integrating speed management currently. Areas of improvement identified while reviewing these documents helped to shape the recommendations and strategies presented in this plan.

The project team reviewed the following resources:

- *Oregon Traffic Safety Performance Plan* (ODOT Transportation Safety Division, FY 2014)
- *Oregon Transportation Safety Action Plan* (SHSP) (ODOT, 2011)
- *Oregon Roadway Departure Safety Implementation Plan* (FHWA Office of Safety, 2010)
- *Oregon Intersection Safety Implementation Plan* (FHWA Office of Safety, 2012)
- *Oregon Bicycle and Pedestrian Safety Plan, Draft Plan for Review* (ODOT, November 2015)
- *Oregon Bicycle and Pedestrian Design Guide* (ODOT, 2011)
- *Oregon Statewide ITS Architecture and Operational Concept Plan* (ODOT, May 2012)
- *Traffic Manual 2015 Edition* (ODOT, June 2015)
- *Speed Zone Manual* (ODOT – Traffic Roadway Section, January 2014)
- *Traffic Signal Design Manual* (ODOT, 2014)
- *Highway Design Manual* (ODOT, 2012)
- *Setting Speeds* flier (ODOT, 2010)
- *The State of Pedestrian Safety, Oregon 2015* (Oregon Walks, 2015)
- House Bill 3402 (passed July 2015)
- State Automated Enforcement Laws (Insurance Institute for Highway Safety, November 2015)

Data Analysis

The project team analyzed Oregon State crash data to explore the characteristics of speeding-related crashes within roadway departure, intersection, and pedestrian and bicyclist safety focus areas. ODOT provided five years (2010-2014) of crash data from the State database for analysis. This set of data included information about all crashes on all roads. It should be noted that Oregon is a self-reporting State (i.e., a person involved in a crash may or may not choose to notify law enforcement when a crash occurs), so it is likely there are additional low severity crashes or property damage only crashes occurring that are unreported.

The project team examined fatal and serious injury (level A on the KABCO scale[3]) crash trends and causes within three categories:

- Roadway departure crashes involving speeding,
- Intersection crashes involving speeding, and
- Pedestrian and Bicycle crashes involving speeding.

Speed-related crash findings in each category were compared to overall (both speeding and non-speeding) crashes within that category in order to identify potential anomalies in speed-related crash trends and factors that may contribute to speed-related crashes. This section describes how the project team defined and queried each of these categories within the Oregon State crash database. The data analysis summary is included in Appendix B.

Defining Speeding-Related Crashes

The project team defined speed-related crashes by using the crash database field: [CRASH_SPEED_INVLV_FLG]. A "Yes" in this field indicated a speeding-related crash, and a "No" indicated a non-speed related crash.

Defining Roadway Departure Crashes

The project team defined roadway departure crashes as those in the crash database that meet the following criteria:

- All single vehicle, non-pedestrian, non-bicycle crashes.
    - Does not include intersection crashes.
    - Does not include any other pedestrian or pedcycle-related crashes.

- Head-On crashes and Sideswipe crashes where 1 vehicle was traveling East and one West or 1 vehicle was traveling North and one South.
    - Does not include intersection crashes.
    - Does not include any other pedestrian or pedcycle-related crashes.

- All other multi-vehicle crashes in where Crash Event 1-3 was a fixed object.
    - Does not include intersection crashes.
    - Does not include any other pedestrian or pedcycle-related crashes.

The project team combined this query criteria with that described under *Defining Speeding-Related Crashes* to generate all roadway departure crashes involving speeding.

[1] The KABCO scale is a five point indexing system that consists of: fatal injury (K), incapacitating injury (A), non-incapacitating injury (B), possible injury (C), and no injury/property damage only (O).

Defining Intersection Crashes

The project team defined intersection related crashes using two different fields within the crash database. The Field [RD_CHAR_SHORT_DESC] needed to be "inter" to denote that the crash was at an intersection, OR the field [ISECT_REL_FLG] needed to be true.

The project team combined this query criteria with that described under *Defining Speeding-Related Crashes* to generate all intersection crashes involving speeding.

Defining Pedestrian and Bicycle crashes

The project team defined pedestrian and bicycle (or pedcycle) crashes as any crash that involved a pedestrian or pedcycle. Fields [TOT_PED_CNT] and [TOT_PEDCYCL_CNT] were used to check the bike and pedestrian counts for each crash.

The project team combined this query criteria with that described under *Defining Speeding-Related Crashes* to generate all pedestrian and bicycle crashes involving speeding.

Workshop

FHWA's team and Oregon's safety stakeholders participated in a speed management workshop on April 5-6, 2016, at the Oregon Department of Transportation in Salem. Participants specializing in a variety of disciplines attended from ODOT, local agencies, and enforcement.

The workshop agenda included discussions around the following topics:

- Data analysis
- High crash locations vs. systemic approach
- Oregon's existing policies, guidance, and plans
- Speed management countermeasures for each focus area
- Importance of measuring performance

The attendee list and workshop agenda can be found in Appendix A.

During the workshop, attendees shared practices related to various aspects of speed management such as: speed limit setting practices, policies and guidance, collaboration between agencies and disciplines, speed limit enforcement, countermeasures, and data analysis. Throughout the workshop, key themes surfaced during stakeholder discussions that were deemed important to the development of and inclusion in Oregon's speed management action plan, and are listed below:

- Integrating with Focus Area Plans (roadway departure, intersection, and pedestrian and bicyclists)
- Appropriate Speed Limits
- Enforcement, Adjudication, and Penalties
- Challenges with High Speed to Low Speed Transitions
- Achieving Balance between Mobility and Safety
- Effective Education and Outreach

- Fostering Relationships
- Link between Engineering and Behavioral Countermeasures
- Data and Performance Measurement
- Enhancing Other Plans and Guidance

The discussions had, feedback shared, and information gained during the workshop were integral to shaping this speed management plan.

Chapter 3: Integrating Speed Management with Focus Area Plans

With roadway departure, intersections, and pedestrian and bicycle crashes accounting for approximately 90 percent of the traffic fatalities in the United States, these key focus areas are a vital link in managing speed and targeting speed-related crashes. Each of these areas combined contributes significantly to Oregon's total speeding-related fatality and serious injury levels.

Figure 2 breaks down F&A speeding-related crashes by focus area. Overwhelmingly, the majority of fatal and serious injury speed-related crashes are considered roadway departure crashes, but intersection and pedestrian and bicycle speed-related crashes are still significant contributors to the overall crash rate.

Note: A single crash may be attributed to multiple focus areas (e.g., an intersection crash may also be a pedestrian/bicycle crash).

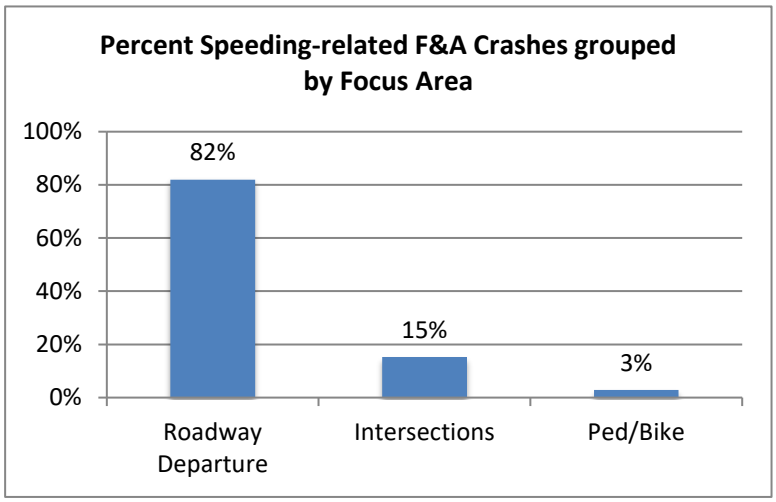

Figure 2 - Oregon's Speeding-related F&A Crashes by Focus Area

One of the most effective ways to ensure implementation of speed management practices is to identify opportunities to integrate speed management into existing plans. This leverages existing resources rather than attempting to identify new resources – human and fiscal – to focus specifically on speed management. The following subsections identify some key data analysis findings and present speed management countermeasures that could be integrated into Oregon's roadway departure, intersection, and pedestrian and bicyclist plans.

While not all strategies reduce overall speeds, all strategies help reduce crashes, both speeding and non-speeding related. Speed reductions listed within each strategy's description are sourced from FHWA's *A Desktop Reference of Potential Effectiveness in Reducing Speed*[4], unless otherwise noted.

Roadway Departure

ODOT has a *2010 Roadway Departure Safety Implementation Plan*, which analyzed crash data from 2002 to 2008. If this plan is still being used, consider conducting an update of the analysis with more recent data. It included strategies such as enhanced corridor enforcement, traffic calming measures, enhanced signing and marking.

Some potential issues that the project team identified during data analysis are:

- 75 percent of speed-related F&A roadway departure crashes occur in rural areas.
- Nearly half of all speeding related F&A roadway departure crashes occurred at curves.

[4] Resource can be found at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/eng_count/2014/reducing_speed.cfm

- When speed limit is known, nearly 60 percent of speed-related F&A roadway departure crashes occurred on roadways posted at 55 mph.
- 19 percent of F&A roadway departure speed-related crashes involve motorcycles.

Strategies and Countermeasures

Enhanced curve signing and delineation. Install oversized signs, florescent sheeting, full post delineation, center and edge line striping at curves with high speeding-related roadway departure crashes.

Sequential dynamic curve warning system. This measure is a series of blinking chevron signs installed throughout a curve that flashes sequentially through the curve to warn speeding drivers. Consider this strategy if enhanced curve signing and delineation has been previously installed and the area is still experiencing high speeding-related crashes.

Rural ITS solutions. Install speed feedback signs, speed activated warning or speed limit reminder signs. Research shows these types of signs have been effective at reducing speeds by 5 mph.

Transverse or optical speed bars. This pavement measure creates a visual effect that encourages motorists to slow down. Bar placement can be designed to minimize wear from wheel tracking. Studies have shown reductions in 85th percentile speeds up to 5 mph. It is used when there is a need for sudden decrease in speed (e.g., at sharp curves or short ramps).

Remove or delineate fixed objects within curves. Remove trees, brush, and other obstacles within designated distance from the edge of travel way along the outside of curves as appropriate. Delineate any fixed objects that cannot feasibly be removed along the outside of curves; all fixed objects including trees, utility poles, culverts/bridge abutments, mailboxes, and guardrail should be considered.

Bicycle-friendly rumble strips. Install center and/or edge line rumble strips with bicycle gaps.

High friction surface treatments (HFST). HFST places a thin layer of specially engineered, durable high friction aggregates as a topping on resins or polymers – usually urethane, silicon, or epoxy – with a binder. These aggregate systems have long lasting skid resistance, while also making the overlay much more resistant to wear and polishing. The increased friction enables shorter stopping distances and allows speeding drivers to recover more quickly from their mistakes.

Targeted enforcement, outreach, and education. Determine specific corridors with a high speeding-related roadway departure crash history and conduct high visibility enforcement and education efforts. Data shows males are more likely to be involved in speeding-related crashes. Motorcyclists are also a group that is at high risk of involvement in this type of crash.

Intersections

ODOT's *Intersection Safety Implementation Plan* was completed in 2012 and may soon be in need of an update. It included a speeding-related analysis and countermeasures such as traffic calming improvements, j-turn modifications, advanced signing, and signal coordination.

Some potential issues that the project team identified during data analysis are:

- 64 percent of speeding-related F&A Intersection crashes occur in rural areas
- In all age groups, males involved in F&A intersection crashes were coded as speeding-related with a higher percentage than females
- 21 percent of F&A intersection speed-related crashes involve motorcycles
- 43 percent of F&A intersection speed-related crashes were non-vehicle collisions (fixed object).

Strategies and Countermeasures

Improve visibility or conspicuity of intersections. Ensure sight distance is adequate, clear sight distance triangles, install advance signing, or enhance striping.

Appropriate speed limits. Ensure speed limits are set appropriately. Large variances between the actual operating speeds and the speed limit can affect signal timing, available stopping sight distances, etc.

Review signal timing. Create a plan to systematically review signal timings to ensure yellow and all-red clearance intervals are appropriate for the speed limit and the intersection geometry. Coordinate signals on arterials to promote progression and uniform speed.

Install dilemma zone protection measures. On high-speed roads with signals, install advance detection sensor equipment that adjusts the start time of the yellow-signal either earlier or later based on observed vehicle locations and speeds.

Rural ITS solutions. Install speed feedback signs, speed activated warning or speed limit reminder signs, or other signs/beacons that notify the side street or major street vehicle of an approaching vehicle. Research shows these types of signs have been effective at reducing speeds by 5 mph.

Reduction of lane width markings. For intersections located on high-speed roadways, narrow the lanes leading up to the intersection using pavement markings, rumble strips and pavement markings, or median, to create visual cues to drivers the roadway is changing and there is a need to slow down.

Transverse rumble strips. Following ODOT's Traffic Manual 2016 Edition, Sec 6.28.3 Transverse Rumble Strips, install transverse rumble strips to notify drivers of upcoming intersection.

Targeted enforcement, outreach, and education. Determine specific arterial corridors with a high speeding-related intersection crash history and conduct high visibility enforcement and education efforts. Data shows males are more likely to be involved in speeding-related intersection crashes. Motorcyclists are also a group that is at high risk of involvement in this type of crash.

Roundabouts. Roundabouts eliminate crossing conflicts and can have significant traffic calming effects. Studies have shown roundabouts can lower speeds by as much as 15 to 20 mph. According to the *AASHTO Highway Safety Manual*, roundabouts reduce the types of crashes where people are seriously hurt or killed by approximately 80 percent when compared to conventional stop-controlled and signalized intersections.

Pedestrians and Bicycles

ODOT is drafting a new *Bicycle and Pedestrian Safety Plan*, to be finalized in 2016. Strategies include information on the consideration of vehicle speeds and traffic calming measures, such as features that create visual friction, and the importance of balancing multimodal needs when setting speed limits. Education and outreach is also included.

While the percentage of Oregon's F&A pedestrian/bicycle speeding-related crashes is much lower than other focus areas, pedestrians and bicyclists are a very vulnerable group. Small increases in speed during a pedestrian or bicycle crash can greatly increase the likelihood of the crash resulting in a fatality or serious injury. Therefore, speed management is very important around areas that have heavy pedestrian and bicyclist traffic.

Furthermore, while the frequency of crashes involving pedestrians and bicyclists may be relatively low, crash severity is a concern because the risk of the pedestrian's and bicyclist's receiving fatal or serious injuries is high if involved in a crash. The lack of pedestrian and bicycle volume data makes it difficult to gauge overall pedestrian and bicycle crash risk, but it is likely that when looking at overall exposure to fatalities and serious injuries, walking and biking safety risks are relatively high.

Some potential issues that the project team identified during data analysis are:

- 73 percent of speeding-related F&A pedestrian/bicycle crashes occur in urban areas.
- 71 percent of speeding-related F&A pedestrian/bicycle crashes occurred at non-intersection locations
- 11 percent of speeding-related F&A pedestrian/bicycle crashes occurred on the interstates/freeways

Strategies and Countermeasures

Road Diets. Review existing 4-lane undivided roadways to determine candidate roads for reconfiguring the lanes. Studies show that Road Diets, when implemented in appropriate contexts, can lower speeds and greatly reduce the number of motorists speeding excessively, improving the overall safety of pedestrians and bicyclists. Additional space created can be used to build sidewalks, pedestrian refuge islands, bicycle lanes, landscaping, etc.

Evaluate sidewalk/bicycle lane gaps. Since pedestrian and bicycle crash data is limited, gauge crash risk to these vulnerable users by inventorying sidewalk or bicycle lane gaps. Having this framework, comparing it to crash data, traffic counts, etc., can be a starting point to then prioritize pedestrian and bicycle safety projects.

Design treatments. Consider intersection geometrics, lane widths, on-street parking, street trees, sidewalks, bicycle facilities, planter strips, and other street elements to create visual friction without introducing new crash types (such as fixed objects).

Appropriate speed limits. Examine ways to include implications on bicyclists and pedestrians for different locations and facilities within setting of speeds. Balance multimodal interests within the context of the facility, considering the different users and uses.

Collaborate with transit partners. Work together with transit agencies to evaluate existing transit stops and compare with pedestrian crashes nearby. Collaborate to improve safety at existing locations (e.g., additional safety features, moving the stop to a more suitable or safe area), as well as collaborating with new transit stops that are in the planning stages.

Pedestrian refuge islands and curb extensions. Pedestrian refuge islands allow pedestrians to cross in two stages, simplifying the crossing task. Refuge islands or median islands also provide visual friction to reduce the speed of motorists. Curb extensions also provide safety benefits to pedestrians by reducing their crossing distance and improving the visibility of pedestrians by aligning them with the parking lane.

Speed feedback signs. In areas of high pedestrian and bicycle activity, where speeding is a concern, install speed feedback signs, which display a driver's current speed. Research shows that these types of signs have been effective at reducing speeds by 5 mph.

Rectangular rapid flash beacons (RRFB). Install RRFBs at unsignalized or mid-block locations where pedestrian crossings are frequent. RRFBs increase driver yielding behavior at crosswalks when supplementing standard pedestrian crossing warning signs and markings.

In-street pedestrian crosswalk signs. Employ in-street signs in low-volume, low-speed areas to lower speeds in areas such as school zones or other locations that have high pedestrian activity.

Targeted enforcement, education and outreach. Enforce speed limits along high speeding-related crash locations where there is increased risk of pedestrian or bicyclist involvement, such as schools, busy urban areas, etc. Conduct education and outreach on pedestrian and bicyclist safety, from all viewpoints, i.e., teaching the pedestrian, bicyclist, and driver important safety tips and rules.

Chapter 4: Key Themes and Strategies

This section presents key themes, challenges, and strategies to overcome these challenges, all of which were synthesized from information and feedback gained through the literature review, data analysis, and the workshop. Each theme begins with a discussion of the associated challenges. Then, the plan presents several strategies to help Oregon overcome these challenges.

Appropriate Speed Limits

ODOT's Speed Zone Manual guidelines state that an engineering study should be conducted whenever there is a change in the roadway that affects the prevailing speed, such as roadway reconstruction, changes in roadside development, or significant changes in traffic volumes. The manual provides very detailed procedures for conducting a speed zone engineering study, but the preliminary requirement is that before a speed zone investigation can begin, there must be a written request from all road jurisdictions involved in ownership, maintenance, and enforcement in the section of road to be investigated. The engineering study considers factors such 85th percentile speed, geometric features, pedestrian and bicyclist activity, adjacent land use, enforcement input, crash history, public testimony, traffic volumes, and access.

If ODOT and the local road authority cannot reach agreement for speed zone setting, the request is reviewed by a Speed Zone Review Panel.

ODOT and the City of Portland are working towards an alternative process for recommending speed zones on collector streets that involves using additional factors besides 85th percentile speed such as context of the surrounding area, crash risk, and characteristics of the roadway.

Although ODOT's overall speed limit setting process is documented well, some challenges relating to appropriate speed limits are listed below:

- ODOT does not have a plan to systematically review speed limits. A method or procedure is needed to determine priority or risk areas for reviewing speed limits.
- Local jurisdictions often classify a road incorrectly related to assigning a statutory speed limit. For example, a street is classified as an arterial, but the local jurisdiction has posted the statutory speed limit according to a residential classification, because there are houses located along the street. These houses are not serviced by the street in question but by connector roads.
- In order for ODOT to complete a speed zone review on local roads, the local agencies or the public must request a speed zone review. Therefore, some existing speed limits may not be appropriate.
- It can be challenging for designers and planners to determine appropriate speed limits for designing or rebuilding a road, in addition to considerations of new developments along the road.

Recommended Strategies:

Develop a plan for reviewing speed limits. ODOT should form a small team to develop an alternative process to identify higher risk roads in order to conduct a screening process for reviewing the existing

speed limits. Considering budget and time constraints, the team should develop a plan to realistically review a number of existing speed limits per year on roadways. Crash data analysis or feedback from the enforcement community may be used to determine priority. This screening process may include fewer requirements than detailed in the Speed Zoning Manual, but by being proactive and identifying potential corridors, ODOT can then determine if speed management countermeasures should be considered or whether an official speed zoning evaluation should be conducted. Once the plan is established, consider using performance measures to track screening progress, as well as identifying the number of roadways with speed limits that have inappropriate speed limits.

Use USLMITS2 to complement the engineering speed study, particularly on high-profile or controversial speed limit adjustments. USLIMITS2 is a web-based program that can assist agencies with speed limit setting decisions. Often used as a complement to the comprehensive engineering speed study, it provides a fair and unbiased result that supports the credibility of an agency's speed studies. This tool may also be beneficial when providing information to lawmakers for making informed decisions on statutory speed limits.

Outreach/education to lawmakers. Setting appropriate speed limits is important for the safety and mobility of all users. Practitioners consider many factors to determine speed limits for a roadway. The process for setting speed limits and many speed concepts are not easily understood, especially with technical engineering terminology that is not familiar to many people. Develop outreach and education materials tailored towards lawmakers or officials to help them make informed decisions on statutory speed limits.[5] Since they are responsible for ultimately making laws for setting statutory speed limits, it is important that they understand the concepts, processes, and importance of setting appropriate speed limits.

Outreach/education to local agencies. During the workshop, stakeholders indicated that smaller local agencies often lack engineering resources for choosing traffic calming measures. There have been instances where the statutory speed limits according to functional class have been misinterpreted, and local streets have been assigned an incorrect speed limit. Develop an outreach plan for local agencies to educate them on the application of statutory speed limits to various functional roadway classifications. This could include a fact sheet explaining the information or possible participation in a local agency meeting with a short presentation on the importance of understanding functional classification and the corresponding speed limits, along with how to identify and incorporate speed management/traffic calming countermeasures.

Internal staff training on speed and speed management concepts. It can often be challenging for designers and planners to determine appropriate speed limits and design speed for planning a roadway or in consideration of new developments along a roadway. Conduct a training workshop for internal planning, design, and traffic staff (and others as appropriate) devoted to speed and speed management, including functional classification, choosing design speed, measuring operating speeds, setting speed

[5] FHWA Office of Safety – Speed Management is developing outreach materials for non-technical audiences and it should be available soon.

limits, and choosing speed management countermeasures. Also, consider complementing this type of course with a context sensitive solutions training workshop. FHWA is a possible resource for identifying appropriate training courses that may already be available.

Enforcement, Adjudication, and Penalties

Stakeholders indicated that the level of enforcement available is extremely limited and that Oregon has a much lower number of enforcement per capita than other States. They reported they are losing 30 troopers a month due to both attrition and funding issues. Because of this shortage, officers are frequently targeting the most aggressive speed limit violators. This often leads to situations where motorists are not pulled over even though they are obviously disobeying the speed limit, which gives impression of "speeding tolerance."

In addition, speeding violations are not always upheld in court. Judges may allow the motorists to attend a traffic safety diversion program. This program allows drivers to keep the points from traffic citations off of their driving record. Many times, this program involves online courses.

Recommended Strategies:

Collaborate with law enforcement, advocacy groups, and legislature. Provide supporting information and data on the risks of speeding, corridors with a high amount of speeding related crashes, etc. This information can then be used by appropriate advocacy or special interest groups to support their efforts in statewide budget appropriation for law enforcement.

Support public reporting of speeding and aggressive driving. Many States have a specific phone number that motorists can call to report crashes, reckless driving, etc., but the public may not be aware of this. Develop a campaign to support this option, with messages such as, "safety is everyone's responsibility", "we should watch out for each other", or similar messages.

Review data pertaining to adjudication and traffic safety diversion program. Because identifying speeding-related issues is complex, use this data to complement speeding-related crash data.

Challenges with High to Low Speed Transitions

Transition zones can be challenging for setting speed limits. Simply lowering the speed limit does not guarantee that motorists will drive slower; speed management countermeasures may have to be implemented along the roadway. During the workshop, stakeholders mentioned that they have difficulty managing speeds and choosing effective countermeasures in areas where the roadway transitions from higher speeds to lower speeds within the city limits. They also mentioned circumstances where two major roads came together at a rural intersection.

Recommended Strategies:

Review existing speed limits and locations of speed limit signs. As a first step in evaluating transition zones, ensure that the speed limit is appropriate and that signs are placed in correct locations. Consider using USLIMITS2 to support speed limit evaluations in transition zones.

Median or roadway changes. Incorporating features to give drivers' visual cues that the roadway environment and speeds are changing is important. Consider median changes, such as raised islands or landscaped medians, or apply lane narrowing techniques using striping or a combination of striping and rumble strips.

Signing or dynamic signing. Install larger or more reflective signing, or choose dynamic/ITS signing solutions, such as speed feedback signs, speed activated warning signs, or speed limit reminder signs.

Roundabouts. Consider a roundabout which is an effective intersection control design that can be used to help transition from higher speed to lower speed roadways. With the center island design and the median changes leading up to it, roundabouts gives drivers visual cues to slow down.

Internal staff training on speed and speed management concepts. High to low speed transition locations can be difficult to design and plan for. Conduct a training workshop for internal planning, design, and traffic staff (and others as appropriate) devoted to speed and speed management, including choosing design speed, measuring operating speeds, setting speed limits, and choosing speed management countermeasures. Also, consider complementing this type of course with a context sensitive solutions training workshop. FHWA is a resource for identifying appropriate training courses.

Enhance design manual guidance. Review existing guidance in ODOT's design manual to determine if there needs to be additional information included on addressing, planning, and designing high to low speed transition areas.

Achieving Balance between Mobility and Safety

Oregon is striving to achieve a balance between mobility and safety. There were several different aspects to this roundtable discussion.

Oregon is strongly focused on freight movement, so cooperation and coordination with freight is vital. But, many successful speed management countermeasures, such as roundabouts and road diets, may limit freight mobility. ODOT indicated that roundabouts have been installed, but mainly on the local system. They have a desire to install more roundabouts but have to be cognizant of the freight industry needs in designing and planning projects. Similar expectations apply to road diets. Wide-spread installations of these speed management countermeasures have been slow.

Achieving a balance between mobility and safety in urban areas is important to Oregonians. Managing these types of roadways involves not only considering the motorists, but also pedestrians and bicyclists that are using the roadway and surrounding areas. At times, focus on driver mobility may need to be deemphasized to promote the safety of the other users.

Recommended Strategies:

Collaboration with freight industry. ODOT current works closely with freight partners and will continue to do so.

Education and outreach for road diets and roundabouts. Road diets and roundabouts are effective treatments to improve safety and lower speeds. Workshop attendees indicated that the freight industry

has concerns with these treatments as they might limit mobility. Continue education on the benefits of these countermeasures and how they can often be designed to accommodate freights' needs.

Enhance design manual guidance. Review existing guidance in ODOT's design manual to determine if there needs to be additional information included regarding design aspects of roundabouts and road diets to ensure freight movements are considered.

Consideration of all road users in projects. Apply context sensitive design principles to consider all stakeholders and road users during project development.

Effective Education and Outreach

Some workshop discussions centered on the overall need for education and outreach for speed and speed management concepts to various groups, including public and politicians, ODOT staff, and external partner agencies or groups. There is not a one-size-fits-all education and outreach program. For example, non-technical outreach materials need to be developed for the public and politicians. In the 2017 legislative session, attendees expect adjustments to the statutory speed limits, especially in rural communities. While ODOT provides recommendations, lawmakers are making the final decisions on Oregon's statutory speed limits, so it is vital for them to fully understand speed concepts, basic process of choosing an appropriate speed limit, and the importance of speed management countermeasures.

The public needs education on the risks of speeding and the importance of speed limits. Education for drivers, pedestrians, and bicyclists is needed to promote a better understanding of the risks of being in a speeding-related crash. In addition to motorists understanding the importance of obeying speed limits, education on being a safe and cautious pedestrian and bicyclist along-side fast-moving vehicles is important, especially in Oregon that has high numbers of these vulnerable users. It is common for pedestrians to be walking along higher speed Interstates and freeways, and there are no laws restricting this activity. Attendees said that since these roads are the major roads between communities, this is often the path they travel. Pedestrian and bicyclist crash data supported this statement.

There is a need to educate internal staff on speed and speed management topics. This type of training could focus on promoting a better understanding of speed definitions and concepts, setting speed limits, choosing design speed, and selecting appropriate speed management countermeasures.

There are many opportunities for education and outreach programs that support speed management safety. Below is a list of potential education and outreach target audiences.

Recommended Strategies:

Prioritize education and outreach initiatives. Use data and team collaboration to prioritize outreach and education initiatives. Below are some key points to consider when determining education and outreach priorities:

- Policy and law makers are responsible for ultimately determining statutory speed limits, it is important they understand the concepts, processes, and importance of setting appropriate speed limits.
- The data analysis completed as part of the preparation for this speed management plan indicated that males and young drivers have a very high involvement in speeding-related crashes.
- The percentage of speeding-related crashes involving motorcyclists is higher in Oregon than the nationwide average.
- It is common for pedestrians to be walking along higher speed Interstates and freeways in Oregon, and there are no laws restricting this activity. Since these roads are the major roads between communities, this is often the path they travel. Pedestrian and bicyclist crash data supports this statement.
- Freight and commercial trucking is important to Oregon's economy, so collaboration and education is needed to balance safety and mobility, especially in relation to common speed management or traffic calming measures.
- It can be challenging for ODOT staff and local agencies to determine appropriate speed limits and design speed for planning a roadway or in consideration of new developments along a roadway.

Combine education and outreach with enforcement efforts. When planning education and outreach efforts, combine them with enforcement. Consider a combination of focuses, such as speeding and alcohol involvement or speeding and distraction.

Consider diverse audiences. During outreach and education development, tailor messages for target audiences, consider cultural sensitivities, use preferred languages, and spread messages through appropriate outlets.

Fostering Relationships

ODOT strives to have good collaboration and relationships with partners such as local agencies, law enforcement, bicyclist advocacy groups, the freight industry, and transit agencies.

Portland and ODOT have been working together to implement the proposed pilot program for setting speed zones on certain roadways in Portland.

Often, smaller local jurisdictions do not have engineering staff or knowledge, so they rely heavily on ODOT for expertise.

Since practitioners rely on accuracy of crash reports to help guide decisions on projects and choosing countermeasures, the relationships of transportation agencies and enforcement is important. During the workshop, the reporting or coding of a speeding-related crash was discussed. It was generally decided that it is difficult to consistently report a speeding-related crash, and it is subjective for an officer. There are numerous facts or contributing factors to consider in a crash.

Attendees reported that transit/bus stop locations could be contributing to the number of pedestrian crashes, and expressed a need to improve the collaboration with transit partners.

Recommended Strategies:

Continue collaboration with local agencies. Continue to foster relationships with local agencies and reach out to those that may need more engineering support.

Support relationships with law enforcement. The roles of law enforcement in speed-related topics are vital. They are responsible for enforcing speed limits and can provide valuable knowledge on the appropriateness of a speed limit as well as the roads that have the highest number of speed limit or speeding-related infractions. Officers are responsible for detailing a crash report, indicating whether a crash was speed-related. Collaborate with the law enforcement officials to review coding practices for speed-related crashes.

Reach out to transit partners. Collaborate with transit agencies to evaluate existing transit stops and compare with pedestrian crashes nearby. Work together to improve safety on existing locations (e.g., additional safety features, moving the stop to a more suitable or safe area), as well collaborating with new transit stops that are in the planning stages.

Link between Engineering and Behavior

Oregon is one of the leading States in seat belt usage at 98 percent. While this is a great accomplishment and certainly helps with speeding-related crash outcomes, Oregon is still struggling with distracted driving and driving under the influence (alcohol and marijuana).

Enforcement is very effective in lowering speeds, but as mentioned earlier, Oregon's level of enforcement has been decreasing. They indicated they typically do some high visibility enforcement campaigns around the holidays and along Safety Corridors. ODOT uses data to inform the troopers on where and when to enforce. Stakeholders also indicated they hold impaired driving and distracted driving campaigns. There was a consensus that distracted driving is under-reported because it is difficult to prove someone was distracted and the level of distraction. It was also mentioned that there was a need for a better definition of "distracted" driving. Currently, there is a field on the crash report that allows for reporting "inattentive" and "on cell phone".

One new situation that safety practitioners and enforcement are dealing with in Oregon is legalized marijuana. People under the influence of marijuana are more difficult to recognize in a field sobriety check than alcohol impaired drivers. Being able to recognize this is important because they have been getting crash reports where marijuana impaired drivers are going 100 mph or more. This is contrary to popular beliefs that motorists who are using marijuana drive slower. Enforcement has begun training on identifying marijuana impaired drivers.

Recommended Strategies:

Integrate speed management into focused education programs. Incorporate speed management into education programs that combat impaired driving and into safety initiatives targeted at youths, motorcyclists, and commercial vehicle operators.

Review and evaluate current communication/outreach strategies. Review existing strategies to ensure speed management is represented.

Collaboration with other States. With recent legalization of marijuana, ODOT should collaborate with other States that have similar laws to gain insight into potential strategies to address speeding-related crashes that involved marijuana impaired drivers.

Data and Measurement

Data-driven analyses helps to better inform decision-making and optimize budgets, while establishing performance measures can help an agency monitor progress or measure success. During the workshop, the team discussed ODOT's available data, hot spot versus systemic safety approaches, and the importance of performance measures. ODOT Regions use available data and crash history to optimize available resources to safety projects. Each year, ODOT submits annual performance measure reports to the Oregon Legislature to report progress towards meeting the mission and goals. Key Performance Measures are published online.[6]

Quality or Lack of Data

One challenge with speeding-related crash data is the subjectivity of the officer's determination of whether a crash is speed-related. ODOT data analyst indicated though they do not feel that "too fast for conditions" is a catchall, and they do have the opportunity to validate a crash report and determine whether a crash was too fast for conditions, but seldom happens.

While ODOT typically uses data to determine "best use" of money for safety projects, safety stakeholders indicated that the lack of speeding-related crash data for pedestrians and bicyclists is a challenge. The safety of all users is important to Oregonians, so additional risk factors need to be identified to help prioritize pedestrian and bicycle safety projects.

Attendees said that lack of local road data is a roadblock to systemic implementations.

Recommended Strategies:

Collaborate with law enforcement and judicial system. Review Oregon's crash coding manual and work with law enforcement to learn if there is a need or ways to better define whether a crash is speed-related. Also collaborate with the courts/judicial system to gain information on adjudication data.

Pedestrian and bicyclist data improvement plan. To improve information on the amount of pedestrians and bicyclists in a particular area, injuries, and excessive speeding violations, work together with law enforcement, emergency responders, and special interest groups. Also incorporate new technology to collect information on volumes of pedestrians and bicyclists.

Assess existing pedestrian and bicycle facilities. Assess existing pedestrian and bicycle facilities to identify potential problem areas where these users may be more vulnerable to speed-related crashes.

[6] Key Performance Measures information are found online at: http://www.oregon.gov/ODOT/CS/PERFORMANCE/Pages/index.aspx

Having an inventory of bicycle lanes and sidewalks may help identify risks. Research new priority methods and risk factors for pedestrians and bicyclists.

Broaden roadway characteristics database. Linking general roadway characteristic data (e.g. presence of an intersection, presence of a curve, roadway speed) can improve identification of crash cause, which in turn improves countermeasure selection. ODOT should consider adding intersection identifiers to the crash databases, developing a database that links roadways IDs to speed limits, creating a horizontal curve inventory, as well as other critical data identified by research as a risk factor.

Performance Measurement

Measuring the performance of speed management efforts can be difficult for several reasons.

- Speed management efforts are often cross-cutting so isolating the effectiveness of the speed-management component may be difficult. This is especially true when relying on fatality information since there are relatively few fatalities and many other potential factors.
- Data beyond fatality information may be difficult to collect, access, or analyze with the regularity necessary for meaningful performance measures.
- Speed management efforts are likely to rely heavily on engagement of local agencies as well as State agencies. Establishing speed management performance measures that can be applied across the board may be challenging.

Despite these potential challenges, it is critical that performance measures be established, targets set, and progress monitored regularly. This is especially true as federal programs are increasingly associated with an expectation for performance management.

Recommended Strategies:

***Identify meaningful performance measures*.** Rather than relying solely on measures that have been chosen because the data is readily available, identify what would actually be helpful for decision-makers and program managers. It may mean that performance measures have to be implemented with a phased in approach – first measure with available data while working toward acquisition and access to the desired measures.

Consider all potential data sources. While crashes, injuries, and citations issued are datasets most commonly associated with measuring the performance of speed management efforts, there are a suite of other data that may be useful. For example, adjudication data may provide and understanding of the outcome of speed citations and a public survey about attitudes toward speed management efforts may provide critical insight into public perception.

Engage partner agencies. Although one agency may be ultimately responsible for managing a statewide speed management program, it will rely heavily on participation by local and regional agencies as well. It is helpful to understand what they consider “success” in the performance measure setting process. They may also have access to data that is not available at the State level.

Assign responsibility and accountability and set a schedule. It is important to assign responsibility for collecting and reporting performance measures. It is equally important to assign accountability for the measures at the appropriate responsibility or management level. In addition, a schedule for performance reporting should be established. Annual performance measures are common but in some cases, a more frequent measure may help a program adjust direction if early indicators show a need for change from the original plan. Having a responsible party and an expected schedule prevents performance measurement from being set aside or forgotten as part of the speed management process. Accountability ensures that the efforts to improve are continuous.

Cumulative Strategies and Countermeasures

Table 1 below presents a list of all strategies mentioned in this plan, their related speed-management focus impact area, and its relative implementation time, cost, and impact. Table 2 details speed management countermeasures; associated impact area; relative cost, and crash modification factors.

See also a separate Excel spreadsheet (*SM Oregon ActionPlan Recommendations*), which shows how some strategies are applicable to more than one key theme (key themes surfaced during the stakeholder workshop and were deemed important to the development of and inclusion in Oregon's speed management action plan).

These tables and the separate spreadsheet serve as a resource for Oregon DOT and stakeholders to prioritize their next steps to improve their overall speed management program and reduce speeding related crashes, as they consider budget and staffing resources.

Table 1. Speed Management Strategies; Associated Impact Area; and Relative Implementation Time, Cost, and Impact.

Strategy	Impact Area			Relative Implementation Time			Relative Cost			Relative Impact		
	RwD	Intersections	Ped/Bike	Immediate	Short Term	Long Term	Low	Midrange	High	High	Midrange	Project Specific
Road Geometry												
Consider roundabouts to help transition from higher speed to lower speed roadways.		X	X			X		X				X
Review existing 4-lane undivided roadways to determine candidate roads for reconfiguring the lanes.			X		X		X					X
Consider intersection geometrics, lane widths, on-street parking, street trees, sidewalks, bicycle facilities, planter strips, and other street elements to create visual friction without introducing new crash types (such as fixed objects).		X	X		X			X				X
Assess existing pedestrian and bicycle facilities to identify areas where these users may be more vulnerable to speed-related crashes.			X			X		X			X	
Speed Setting Criteria												
Develop an alternative process to identify higher risk roads and conduct a screening process for reviewing existing speed limits on those roads.	X	X	X		X		X			X		
Determine an appropriate number of reviews on existing speed limits per year.	X	X	X		X		X			X		
Consider using performance measures to track screening progress, as well as identifying the number of roadways with speed limits that have inappropriate speed limits.	X	X	X			X	X			X		
Examine ways to include implications on bicyclists and pedestrians for different locations and facilities within setting of speeds. Balance multimodal interests within the context of the facility, considering the different users and uses.			X		X			X				X
Review locations that transition from higher speeds to lower speeds to evaluate the speed limits and the location of the speed limit signs.	X	X	X			X	X			X		
Traffic Signal Timings												
Develop a plan to systematically review all signal timings to ensure yellow and all-red clearance intervals are appropriate for the speed limit and the intersection geometry.		X		X				X			X	
Coordinate signals on arterials to promote progression and uniform speed.		X				X		X		X		
Transit Locations												
Partner with transit agencies to evaluate existing transit stop locations and safety deficiencies.			X		X			X			X	
Collaborate to improve safety on existing locations (e.g., additional safety features, moving the stop to a more suitable or safe area), as well collaborating with new transit stops that are in the planning stages.			X			X		X			X	
Targeted Enforcement												
Determine specific corridors with a high speeding-related roadway departure or intersections crash history and conduct high visibility enforcement and education efforts.	X	X				X			X	X		
Enforce speed limits along high speeding-related crash locations where there is increased risk of pedestrian or bicyclist involvement, such as schools, busy urban areas, etc.			X			X			X	X		

Strategy	Impact Area			Relative Implementation Time			Relative Cost			Relative Impact		
	RwD	Intersections	Ped/Bike	Immediate	Short Term	Long Term	Low	Midrange	High	High	Midrange	Project Specific
Internal Training												
Conduct a training workshop for internal planning, design, and traffic staff (and others as appropriate) devoted to speed and speed management, including functional classification, choosing design speed, measuring operating speeds, setting speed limits, choosing speed management countermeasures, and transitioning between high/low speed areas.	X	X	X		X		X				X	
Collaboration with External Partners												
Provide supporting information and data on the risks of speeding, corridors with a high amount of speeding related crashes, etc. to law enforcement, advocacy groups, and legislature.	X	X	X		X		X				X	
Review Oregon's crash coding manual and work with law enforcement to learn if there is a need or ways to better define whether a crash is speed-related.	X	X	X			X		X			X	
Collaborate with the courts/judicial system to gain information on adjudication data.	X	X	X			X		X			X	
To improve data on the amount of pedestrians and bicyclists in a particular area, injuries, and excessive speeding violations, work together with law enforcement, emergency responders, and special interest groups, including the freight industry, and incorporate new technology to collect information on volumes of pedestrians and bicyclists.			X			X				X		
Continue to foster relationships with local agencies and reach out to those that may need more engineering support on speed-related issues.	X	X	X	X			X			X		
With recent legalization of marijuana, ODOT should collaborate with other States that have similar laws to gain insight into potential strategies to address speeding-related crashes that involved marijuana impaired drivers.	X	X	X		X		X				X	
Policy and Guidance												
Review existing guidance in ODOT's design manual to determine if there needs to be additional information included on addressing, planning, and designing high to low speed transition areas and regarding design aspects of roundabouts and road diets to ensure freight movements are considered.	X	X	X			X	X			X		
Ensure that ODOT's design manual promotes context sensitive design principles to consider all stakeholders and road users during project development.			X	X			X				X	
Assign responsibility and accountability and set a schedule for reporting performance measures.	X	X	X			X	X			X		
Data												
Review data pertaining to adjudication and traffic safety diversion program, and use to complement speeding-related crash data.	X	X	X			X		X			X	
Consider adding intersection identifiers to the crash databases, developing a database that links roadways IDs to speed limits, and creating a horizontal curve inventory to further identify speed-related crash locations.	X	X	X			X	X			X		

Strategy	Impact Area			Relative Implementation Time			Relative Cost			Relative Impact		
	RwD	Intersections	Ped/Bike	Immediate	Short Term	Long Term	Low	Midrange	High	High	Midrange	Project Specific
Rather than relying solely on measures that have been chosen because the data is readily available, identify what would actually be helpful for decision-makers and program managers.	X	X	X			X	X			X		
Consider all potential data sources.	X	X	X			X	X			X		
Education and Outreach												
Support public reporting of speeding and aggressive driving. Develop a campaign to support this option, with messages such as, “safety is everyone’s responsibility” or “we should watch out for each other” or similar messages.	X	X	X		X			X			X	
Incorporate speed management into education programs that combat impaired driving and into safety initiatives targeted at youths, motorcyclists, and commercial vehicle operators.	X	X	X			X	X				X	
Combine education and outreach with enforcement efforts. Consider combination of focuses, such as speeding and alcohol involvement or speeding and distraction.	X	X	X			X	X				X	
Conduct education and outreach on pedestrian and bicyclist safety, from all viewpoints, i.e., teaching the pedestrian, bicyclist, and driver important safety tips and rules.			X			X	X				X	
Develop outreach and education materials tailored towards lawmakers or officials to help them make informed decisions on statutory speed limits.	X	X	X		X		X				X	
Develop an outreach plan for local agencies to educate them on application of statutory speed limits to various functional roadway classifications. This could include a fact sheet explaining the information or possible participation in a local agency meeting with a short presentation on the importance of understanding functional classification and the corresponding speed limits, along with how to identify and incorporate speed management/traffic calming countermeasures.	X	X	X			X		X			X	
Continue education on the benefits of road diets and roundabouts and how they can often be designed to accommodate freights’ needs.	X	X	X		X		X				X	

Table 2. Speed Management Countermeasures; Associated Impact Area; Relative Cost, and Crash Modification Factor (CMF)

Countermeasure	Impact Area			Relative Cost			CMF
	RwD	Intersections	Ped/Bike	Low	Mid	High	
Enhanced curve signing and delineation	X			X			0.671 – 0.741
Sequential dynamic curve warning system	X				X		0.438 – 0.627
Signing or dynamic signing addressing speed	X	X	X		X		0.87 – 0.95
Transverse or optical speed bars.	X			X			0.68
Remove or delineate fixed objects within curves	X			X			0.5 - 0.9
Center line or edge line rumble strips	X		X	X			0.6 – 0.85
High friction surface treatments (HFST)	X				X		0.522 – 0.607
Improve visibility or conspicuity of intersections		X		X			Unknown
Dilemma zone protection measures		X			X		0.6 - 0.8
Reduce lane widths		X		X			Unknown
Transverse rumble strips		X		X			0.36 – 1.4
Roundabouts		X	X			X	Varies by crash type
Lane reconfiguration (Road Diet)			X	X			0.59 – 1.0
Pedestrian refuge islands and curb extensions			X		X		0.54 – 1.94
Rectangular rapid flash beacons (RRFB)		X	X		X		Unknown
In-street signs to lower speeds in areas such as school zones or other locations that have high pedestrian activity			X	X			Unknown

Chapter 5: Enhancing Other Plans, Guidance, and Manuals

In addition to incorporating speed management within the roadway departure, intersection, and pedestrian and bicycle safety plans, there are opportunities to review other agency plans, guidance, and manuals to enhance or include information regarding speed-related concepts and speed management techniques.

Additional Plans

Oregon has four plans that present a prime opportunity for integrating speed management practices. Two are broad safety plans at the State level: The *Oregon Traffic Safety Performance Plan* is Oregon's NHTSA-mandated Highway Safety Plan, focused primarily on enforcement and education; and the *Oregon Transportation Safety Action Plan* is Oregon's Strategic Highway Safety Plan. This section also discusses integrating speed management practices into Local Transportation Safety Plans and Oregon's Statewide ITS Architecture and Operational Concept Plan.

Oregon Traffic Safety Performance Plan

The Oregon Traffic Safety Performance Plan, prepared by the ODOT Transportation Safety Division for FY14, includes multiple references to speed management efforts.[7]

One of the performance goals is speeding-related fatalities. These are being tracked at the higher decision-making levels. However, relying on fatality data alone for crash outcomes has its challenges. Fatality data may be several years old by the time a full year is available for analysis, especially if relying on national data such as the Fatality Analysis Reporting System (FARS). In addition, using only the number of speeding-related fatalities (as opposed to including severe injury crashes) makes robust analysis difficult. Speed management questions for consideration in future updates of this plan may include the following:

- While there may be some requirement that Oregon include speeding-related fatalities, are there other measures that may be more timely?
- Can fatality data be derived more quickly from State databases?
- Can other measures such as speeding-related serious injuries be used to allow for a larger set of incidents for analysis?
- Currently, the plan uses a five-year rolling average. Should this be adjusted to a three-year rolling average to align with FHWA-mandated safety performance measures? Though the mandated measures are not specifically speed-related, aligning with the analysis framework may make it easier to consider the relationship between speed-management efforts and overall safety success.

[7] Oregon Traffic Safety Performance Plans, Fiscal Year 2014. Oregon Department of Transportation, Transportation Safety. http://www.oregon.gov/ODOT/TS/docs/!FINAL%20(without%20405%20app)%202014%20Federal%20Version.pdf (Accessed May 4, 2016).

This plan also includes a performance goal for speeding citations issued during grant funded enforcement. While this is helpful for considering the potential reach of these enforcement efforts, it is difficult to tie those increased enforcement efforts to overall improvements in speed-related safety. Speed-management measures related to enforcement may consider the following questions:

- Should a measure focus around speeding conviction/adjudication as well as citation data to monitor the outcomes of speed enforcement efforts.
- Should speed enforcement data be considered in relation to speed-related crash data?

The question around outcomes related to speed enforcement is especially important given the public opinion survey data included in the plan that indicates that while most people said they do not speed, the vast majority (more than 60 percent) believed they would not be ticketed if they did speed.

This plan also points out the connection between speed-related fatal crashes and behavioral factors. Of the 132 fatal crashes where speed was a factor, less than half were speed only. The other two major contributing factors were alcohol impairment and lack of belt use. This highlights the clear need for a speed-management program that closely integrates engineer, enforcement, and education efforts.

Several action items in this plan's focus are speed-management related.

Police Traffic Services Link to Transportation Safety Action Plan, Action #35: Speed is the first issue identified as part of the Traffic Law Enforcement Strategic Plan, to include enforcement, laws, legislative needs, equipment, public information and education. The number of speed-related convictions is included in the Police Traffic Services data table, down 18 percent from 2008 to 2011. The number of speed e-citations issued is up 938.5 percent from 2008 to 2011. Another question to consider for this data analysis might be the following:

- Should adjudication data be reported in addition to citation data? This will provide a better understanding of the actual consequences associated with speed-related citations.

Speed management efforts are also mentioned in relation to several other action items:

- Safe Routes to School: Speed is a challenge for allowing children within a half-mile to walk to school;
- Work Zone Safety: Speed is a compounding factor in work zone safety; and
- Youth Transportation Safety: Speed and alcohol are cited as two major issues with youth related crashes.

Recommended Strategy:

Considerations for future updates. During the next update, the stakeholder team should collaborate and brainstorm options to improve on or enhance the plan, such as:

- Exploring alternatives for analyzing Oregon's speeding related data
- Identifying ways to derive necessary data more quickly or efficiently
- Determining whether speeding-related serious injuries can be used for analysis

- Considering the length of rolling average reported in the plan and whether there is a benefit in aligning with FHWA-mandated safety performance measures.
- Including additional speed-related performance measures or action items, as necessary.
- Referencing other ODOT speed management efforts and plans.

Oregon Transportation Safety Action Plan

The Oregon Transportation Safety Action Plan is prepared by the Oregon Department of Transportation as the State's Strategic Highway Safety Plan.[8] This plan was last published in 2011, with an update currently underway. This timing presents a prime opportunity to ensure speed management practices are incorporated into the plan. According to the data in this plan, speed contributed to nearly 42 percent of fatal crashes in Oregon in 2009. It was identified as a significant related to a number of areas:

- Pedestrian and bike crashes;
- Intersection crashes;
- Roadway departure crashes;
- Construction/repair decision-making;
- Significant factor in fatal crashes for the importance of developing law enforcement communication strategy;
- Significant factor in fatal crashes for the importance of training enforcement personnel, attorneys, judges, and DMV; and
- Speed enforcement using decoy vehicles, variable message speed monitors, and targeted enforcement on youth speed and alcohol involved crashes.

It is clear from this list that speed is perceived as a cross-cutting issue. Based on initial feedback from the current update process, speed management will continue as a cross-cutting theme in the forthcoming report.

Recommended Strategy:

Incorporate speed management practices into relevant areas. With an update currently underway, look at ways to incorporate speed management strategies and countermeasures in applicable focus areas. Ensure the strategies are specific enough to be measurable and not overshadowed by other components of the report.

Local Transportation Safety Plans

Local transportation safety plans are also a prime opportunity to integrate speed management efforts into broader safety programs.[9] For example, the Portland Bureau of Transportation has speed management related practices in the currently published-for-comment draft of updates to their Transportation System Plan. One of the TSP objectives is "Reduce traffic speeds through enforcement

[8] Transportation Safety Action Plan: An Element of the Oregon Transportation Plan, October 2011. Oregon Department of Transportation. https://www.oregon.gov/ODOT/TS/docs/tsap_revised_03-20-12.pdf (Accessed May 4, 2016).

[9] Transportation System Plan. Portland Bureau of Transportation. file:///C:/Users/hrothenberg/Desktop/TSP%20PD_Assembled_FINAL.pdf (Accessed May 4, 2016)

and design in high density main streets, Centers and Corridors, to levels that are safe and comfortable for bicyclist and pedestrians. It references traffic calming to "maintain…speeds below established thresholds", specifically for pedestrian and bike safety.

Recommended Strategy:

Support and collaborate with local agencies. Assist local agencies by providing data analysis support and educational, technical, and behavioral information relative to speed management for inclusion in local plans.

Oregon Statewide ITS Architecture and Operational Concept Plan

Oregon Statewide ITS Architecture and Operational Concept Plan *(Oregon Department of Transportation, 2012).*[10] The Transportation Operations Center System (TOCS) functions include providing control interface with variable speed limit signs, archiving the date and time of speed zone changes, and notifying enforcement agencies of speed limit changes. Future plans may include weather based variable speed limits.

Recommended Strategy:

Considerations for future updates. When this plan is updated, the team should look for opportunities to enhance or include additional information related to speed limits, speeding, and speed management countermeasures for inclusion within the plan.

Guidance and Manuals

Below is a summary of Oregon documents where speed-management efforts are referenced and may be further enhanced or incorporated.

Oregon Bicycle and Pedestrian Design Guide

Oregon Bicycle and Pedestrian Design Guide[11] mentions high speeds as being intimidating to pedestrians and bicyclists, noting that over design may encourage speeding by vehicles on the adjacent roadway.

- The guide provides tables and graphs to help with decision-making on type of bicycle facility to consider given posted speed (ideally 85th percentile speed) and vehicle average daily traffic.
- There is a separation context matrix that uses the context of traffic speeds/volume indicators to identify need for separation between pedestrian/bicycle facilities and adjacent vehicle lanes.
- There are a variety of specific design attributes that should be considered when designing pedestrian and bicycle facilities. These include the vehicle travel speed and the relationship between the pedestrian and bicyclist facilities and the roadway.

[10] Oregon Statewide ITS Architecture and Operational Concept Plan. Oregon Department of Transportation, 2012. http://www.oregon.gov/ODOT/HWY/ITS/Documents/Oregon%20ITS%20Architecture%20Report%202012.pdf (Accessed May 4, 2016).

[11] Oregon Bicycle and Pedestrian Design Guide. Oregon Department of Transportation, 2011. ftp://ftp.odot.state.or.us/techserv/roadway/web_drawings/HDM/2011%20HDM%20Rewrite/2012%20Appendix%20L%20Bike%20Ped%20Design%20Guide.pdf (Accessed May 4, 2016).

Traffic Manual 2016 Edition

Traffic Manual 2016 Edition[12] includes a section to outline the process associated with variable speed zones. There is a focus on the use of traffic control devices and design to maintained appropriate speeds given context. Speed is also noted as a factor for a variety of other traffic considerations:

- Active warning signs at bridges and tunnels;
- Marked crosswalks on State highways (specifically mid-block locations);
- In-Street Pedestrian Crossing Signs;
- Marking Crosswalks Across Channelized Right Turn Lanes;
- Pedestrian Crossing Strategy determination;
- Pedestrian Activated Warning Lights;
- Illumination;
- Intersection Traffic Control;
- Roundabout Design;
- Shoulder/Centerline/Transverse Rumble Strips;
- Safe Speed on Curves;
- Variable Message Signs (Variable Speed Zones); and
- Speed Zones.

This manual also addresses the issue of photo radar enforcement changes to those regulations made by the Oregon Legislative Assembly. It specifically refers readers to ORS 810.438 through 810.439 for the most recent legal requirements regarding photo radar speed enforcement.

Traffic Signal Design Manual

Traffic Signal Design Manual[13] references to speed management in this document include the use of Speed Limit Sign Beacons (on State highway system for school speed zones only) and the consideration of posted speed limits for installation of the pedestrian hybrid beacon. This manual also gives guidance on using approach speed to calculate yellow change and red clearance intervals.

Highway Design Manual

Highway Design Manual[14] mentions speed throughout the manual, for example as one of the consideration factors in project scoping, relationship to sight distance, roadway design elements, pedestrian and bicycle facilities, etc. The manual includes a comfort speed chart, which doesn't represent a standard, but may be useful to evaluate existing or proposed sections for safety and

[12] Traffic Manual 2016 Edition. Oregon Department of Transportation, 2016. https://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/pages/traffic_manual.aspx (Accessed May 10, 2016).
[13] *Traffic Signal Design Manual.* Oregon Department of Transportation, 2014. http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/docs/pdf/SignalDesignManual/SignalDesignManual_Oct2014.pdf (Accessed May 4, 2016).
[14] Highway Design Manual. Oregon Department of Transportation, 2012. https://www.oregon.gov/ODOT/HWY/ENGSERVICES/Pages/hwy_manuals.aspx (Accessed May 6, 2016).

operation. Chapter 2 includes information on choosing design speed. Selecting appropriate design speeds for projects is an important first step in speed management.

There may be opportunities to review this design manual to determine if there are opportunities to update or enhance information relating to speed guidance, including speed management countermeasures. For example, one tool that designers can use to determine where operating speeds may exceed the design speed on rural two-lane highways is the Design Consistency Module of the Interactive Highway Safety Design Model (IHSDM). Speed management strategies can them be applied to the locations where operating speed and design speed greatly differ.

Recommended Strategy:

Review manuals for potential updates. Form a speed management focused team to review existing manuals and guidance to determine if there are opportunities to update or enhance information relative to speed guidance, speed concepts/definitions, speed management countermeasures, effects or risks of speeding, etc. (depending on the focus of the manual).

Chapter 6: Conclusion and Next Steps

Summary

Over the past decade, Oregon has made great strides in reducing roadway fatalities. While the reduction in fatalities is significant and to be commended, additional focus on speed management is needed to continue the trend. Since roadway departure, intersection, and pedestrian and bicycle crashes have been identified by the Federal Highway Administration (FHWA) and Oregon as the three areas with great potential to reduce fatalities, this plan encourages Oregon to integrate speed management into these three safety focus areas by provided strategies and countermeasures for improving safety in each of these focus areas.

Oregon's State and local agencies are also encouraged to take a broad look at the existing policies and programs to identify opportunities for fully integrating speed management throughout their organization. This document recommends strategies for incorporating speed management into these broader plans as well as within design guidance and manuals.

Lastly, information gained from the workshop indicated that Oregon has encountered numerous challenges implementing effective speed management. In response, this plan recommended strategies for tackling some of Oregon's main speed management related challenges.

Future Research Needs

While this report proposed numerous strategies for tackling speed management challenges encountered by Oregon's transportation agencies, there are always opportunities to improve speed management solutions. The project team recommends ODOT, either independently or through an associated university, conduct additional speed management related research and investigation related to:

Relationship of clear zone and speed. Visual friction (e.g., trees, parking, buildings) and the surrounding environment has an effect on the speed people choose to drive, but at what point does the risk of a fixed object crash outweigh the benefit of slowing driver speeds?

Implications of establishing speed limits lower-than-recommended using standard practices to improve safety of vulnerable road users. It is understood that simply lowering speed limits won't actually lower the speeds of drivers, but what are the tradeoffs and mitigating factors that may help to balance higher operational speeds with reduced bicycle and pedestrian crash severities?

Partners for Success

This plan's success depends not only on efforts put forth by Oregon DOT, but also local jurisdictions throughout Oregon and other safety partners:

- AAA Foundation for Traffic Safety
- Associated General Contractors
- Association of Oregon Counties and League of Oregon Counties (AOC/LOC)
- Bicycle and pedestrian advocacy groups
- Construction industry
- Emergency services
- Oregon Association Chiefs of Police
- Oregon Department of Education
- Oregon Department of Motor Vehicles
- Oregon Health Authority
- Oregon Metropolitan Planning Organization (MPO) Consortium
- Oregon Motor Carrier Division
- Oregon State Police and local enforcement agencies
- Oregon State Sheriffs' Association
- Oregon Transit Association
- Oregon Trucking Association
- TEAM Oregon – Motorcycle Safety Program
- Work Zone Safety Industry/Groups
- Universities and schools

Appendix A – Workshop Agenda and Attendee List

Tuesday, April 5th

9:00-9:30	**Welcome and Introductions** Includes a review of workshop goals, objectives and outcomes
9:30-10:30	**Problem Identification** Data Analysis Results High Crash Locations vs. Systemic Approach
10:30-10:45	**Break**
10:45-11:30	**Oregon Speed Management Policies** Speed Limit Setting Existing Plans
11:30-12:00	**Roadway Departure Crashes** Engineering Countermeasures Behavioral Countermeasures
12:00-1:00	**Lunch**
1:00-1:30	**Roadway Departure Crashes (continued)** Engineering Countermeasures Behavioral Countermeasures
1:30-2:30	**Intersection Crashes** Engineering Countermeasures Behavioral Countermeasures
2:30-2:45	**Break**
2:45-3:45	**Pedestrian and Bicyclist Crashes** Engineering Countermeasures & Behavioral Countermeasures
3:45-4:00	**Wrap Up/Prep for Day 2**

Wednesday, April 6th

9:00-9:30	**Key Themes from Previous Day**
9:30-10:30	**Measuring Performance**
10:30-10:45	**Break**
10:45-11:30	**Next Steps**
11:30-1:00	**Lunch**
1:00-2:30	**Follow-up with management**

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FOLLOW-UP MEETING WITH MANAGEMENT				
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Appendix B – Data Analysis Summary

The Oregon data analysis includes crash data sets from 2010 to 2014, sourced from Oregon DOT.

Fatal and serious injury speed-related crashes are holding steady in Oregon, as all fatal and serious injury crashes slightly fluctuate.

Speeding-related fatal (F) and serious injury (injury severity A on the crash report) crashes account for *27 percent* of all F&A crashes in Oregon.

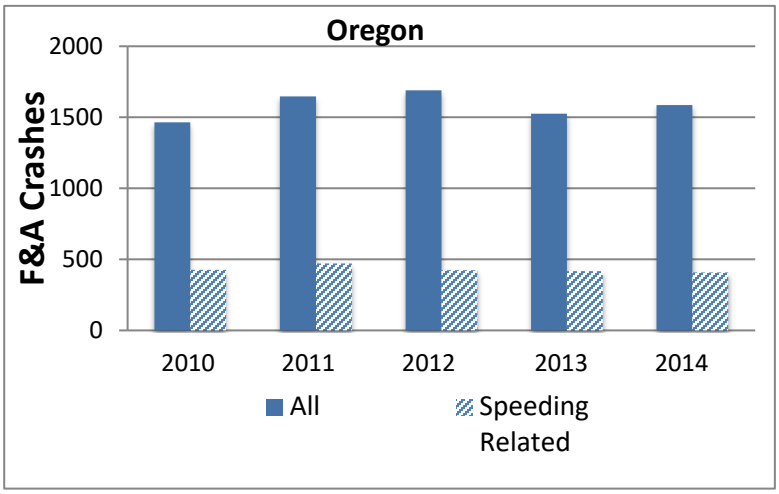

Figure 3 - Oregon's F&A Crashes, All and Speeding-related

Three Focus Areas Overview

Overwhelmingly, the majority of fatal and serious injury speed-related crashes are considered roadway departure crashes.

- Eighty-two percent of Oregon's speeding-related F&A crashes are considered roadway departure crashes.
- Fifteen percent of Oregon's speeding-related F&A crashes are considered intersection crashes.
- Three percent are pedestrian/bicycle crashes.

A single crash may be attributed to multiple focus areas (e.g., an intersection crash may also be a pedestrian/bicycle crash).

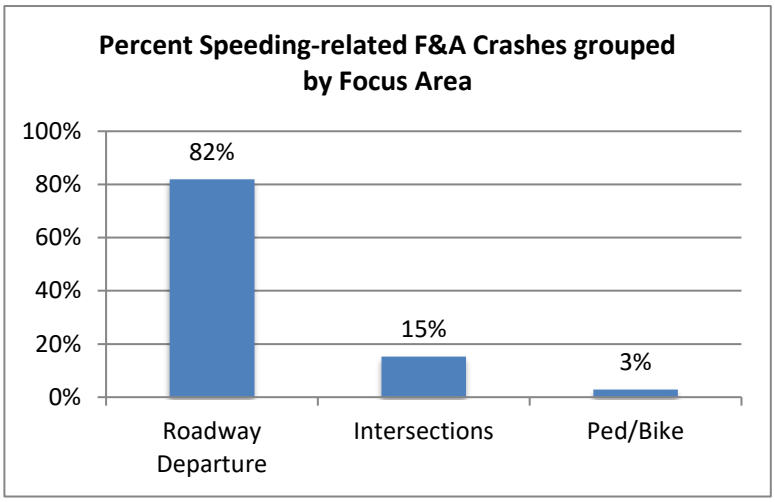

Figure 4 - Oregon's Speeding-related F&A Crashes by Focus Area

Data analysis and a comparison of speed-related crashes in the three focus areas to Oregon's functional classification system mileage shows that focus area F&A crashes are overrepresented within the following road systems:

- Interstates – Roadway Departure, Intersections, and Pedestrian/Bicycles
- Principal Arterials – Roadway Departure, Intersections, and Pedestrian/Bicycles
- Minor Arterials – Roadway Departure, Intersections, and Pedestrian/Bicycles

- Collectors – Roadway Departure
- Local Roads – none

Table 3 - Speeding-related F&A Crashes Compared to Functional Classification Mileage

Oregon				
Functional Classification	% of miles of Rural + Urban Roads	% Speeding Related F&A		
		Roadway Departure	Intersection	Pedestrian/ Bicycles
Interstate/Freeway	1	8	3	11
Principal Arterial	5	25	31	35
Minor Arterial	5	19	28	27
Collector	26	34	24	20
Local	63	14	14	8

Roadway Departure

This section includes a summary of the data analysis completed on roadway departure speeding-related F&A crashes in Oregon.

Quick Facts:

- Eighty-two percent of Oregon's speeding-related F&A crashes are considered roadway departure crashes.
- Over half of all F&A roadway departure crashes are speed-related.
- While 70 percent of all F&A roadway departure crashes occur in rural areas, 75 percent of speed-related F&A roadway departure crashes occur in rural areas.

By Roadway Type

Table 4. Percent of Speed-related F&A Roadway Departure Crashes (by Roadway Type and Ownership)

Percent of Speed-related F&A Roadway Departure Crashes (by Roadway Type and Ownership)	Oregon's Percent of Miles of System by Roadway Type	Crashes per System Miles
Interstate/freeway – 8 percent	Interstate/Freeway – 1 percent	Overrepresented
Principal arterial – 25 percent ○ ***State – 90 percent*** ○ ***City – 9 percent*** ○ ***County – 1 percent***	Principal arterial – 5 percent	Overrepresented
Minor arterial – 19 percent ○ ***State – 47 percent*** ○ ***City – 29 percent*** ○ ***County – 23 percent***	Minor arterial – 5 percent	Overrepresented
Local – 14 percent	Local – 63 percent	Underrepresented

Percent of Speed-related F&A Roadway Departure Crashes (by Roadway Type and Ownership)	Oregon's Percent of Miles of System by Roadway Type	Crashes per System Miles
○ ***State – 5 percent*** ○ ***City – 18 percent*** ○ ***County – 76 percent***		
Collector – 34 percent ○ ***State – 12 percent*** ○ ***City – 10 percent*** ○ ***County – 78 percent***	Collector – 26 percent	Overrepresented

By Speed Limit

- Speed-related F&A RwD crashes where speed limit is known:
  - 34 percent occurred on roadways posted less than 50 mph.
  - 59 percent occurred on roadways posted at 55 mph.

By Horizontal Alignment

- Nearly half of all speeding related F&A RwD crashes occurred at curves.

By Driver Characteristics

- 72 percent of all F&A RwD speed-related crashes are male drivers.
- The age group of 21-24 had the highest rate of involvement in speeding-related F&A roadway departure crashes (48 percent for females and 55 percent for males).
- Only age group that females had the higher percentage than males was age 45-54.

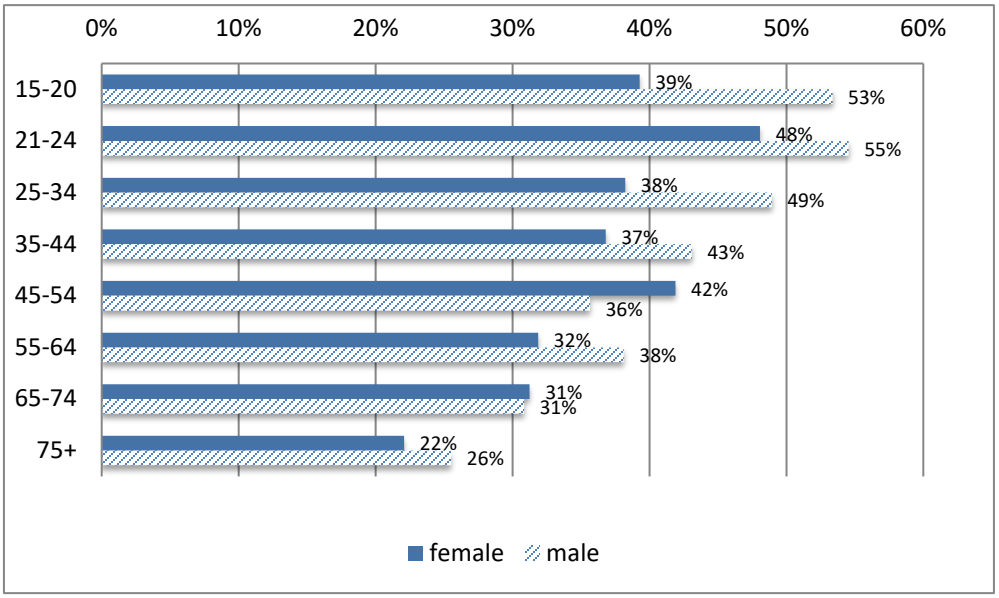

Figure 5 - Percentage of Drivers by Age and Gender Involved in Speeding-related F&A Roadway Departure Crashes

By Vehicle Type

- 19 percent of F&A roadway departure speed-related crashes involve motorcycles, compared to 13 percent nationally.

By Roadway Departure Crash Type

Rollover/Overturn Crashes

- 33 percent of rollover/overturn F&A speed-related crashes involve motorcycles.
- 28 percent of rollover/overturn F&A speed-related crashes occur on roadways posted less than 50 mph.
- 61 percent of rollover/overturn F&A speed-related crashes occur on roadways posted at 55 mph.

Opposing Direction Crashes

- 80 percent of opposing direction F&A speed-related crashes occur in rural areas.
- 28 percent of opposing direction F&A speed-related crashes occur on roadways posted 45 mph or below.
- 71 percent of opposing direction F&A speed-related crashes occur on roadways posted at 55 mph.
- 92 percent opposing direction F&A speed-related crashes involve passenger cars.

Tree Crashes

- 71 percent of tree F&A speed-related crashes occur in rural areas.
- 41 percent of tree F&A speed-related crashes occur on roadways posted 45 mph or below.
- 59 percent of tree F&A speed-related crashes occur on roadways posted at 55 mph.

Corridors with Highest F&A Speed-related Roadway Departure Crashes

Note: the corridor information below does not account for vehicle miles traveled (VMT) or the length of corridors.

Table 5 - Statewide Corridors with Highest F&A Speed-related Roadway Departure Crashes

Route	Number of F&A Crashes (2010 – 2014)
I-5	69
I-84	56
US 26	56
US 20	54
US 101	39
126	39
US 97	35
140	25
OR 22	24
OR 42	20

Table 6 - Corridors with Highest F&A Speed-related Roadway Departure Crashes by County

County	Route	Number of F&A Crashes (2010 – 2014)
Lane	126	29
Baker	I-84	16
Jackson	I-5	15
Umatilla	I-84	14
Multnomah	I-5	13
Coos	OR 42	13
Deschutes	US 97	13
Douglas	138	13
Douglas	I-5	13
Tillamook	US 101	13

Intersections

This section includes a summary of the data analysis completed on intersection speeding-related F&A crashes in Oregon.

Quick Facts:

- 15 percent of Oregon's speeding-related F&A crashes are considered intersection crashes.
- 64 percent of speeding-related F&A Intersection crashes occur in rural areas.
- Where traffic control was identified[15], speed-related F&A intersection crashes occurred at the following intersection types:
    - Stop-control – 49 percent
    - Signalized – 26 percent
    - None – 18 percent
- Three most common speed-related F&A intersection crash types in Oregon:
    - 13 percent – angle
    - 43 percent – non-vehicle collision
    - 15 percent – front-to-rear (rear end)

[15] 26 percent of speed-related F&A intersection crashes were identified as having "unknown" traffic control.

By Roadway Type

Table 7. Percent of Speed-related F&A Intersection Crashes (by Roadway Type and Ownership)

Percent of Speed-related F&A Intersection Crashes (by Roadway Type and Ownership)	Oregon's Percent of Miles of System by Roadway Type	Crashes per System Miles
Interstate/freeway – 3 percent	Interstate/Freeway – 1 percent	Overrepresented
Principal arterial – 31 percent ○ **State – 71 percent** ○ **City – 25 percent** ○ **County – 4 percent**	Principal arterial – 5 percent	Overrepresented
Minor arterial – 28 percent ○ **State – 20 percent** ○ **City – 66 percent** ○ **County – 14 percent**	Minor arterial – 5 percent	Overrepresented
Collector – 24 percent ○ **State – 8 percent** ○ **City – 31 percent** ○ **County – 61 percent**	Collector – 26 percent	N/A
Local – 14 percent ○ **State – 3 percent** ○ **City – 65 percent** ○ **County – 33 percent**	Local – 63 percent	Underrepresented

By Speed Limit

Speed-related F&A intersection crashes where speed limit is known:

- 20 percent on roads signed at 25 mph or less.
- 26 percent on roads signed 30-35 mph.
- 23 percent on roads signed at 40-45 mph.
- 31 percent on roads signed at 50-55 mph.
- 1 percent on roads signed at 60 mph or greater.

By Driver Characteristics

- 69 percent of F&A intersection speed related crashes are male.
- In all age groups, males involved in F&A intersection crashes were coded as speeding-related with a higher percentage than females.

By Vehicle Type

- 21 percent of F&A intersection speed-related crashes involve motorcycles, compared to 17 percent nationally.

By Intersection Collision and Crash Type

- 13 percent of F&A intersection speed-related crashes were angle crashes.
- 43 percent of F&A intersection speed-related crashes were non-vehicle collisions (fixed object).
- 15 percent of F&A intersection speed-related crashes were front-to-rear (rear end) crashes.
- 4 percent of F&A intersection speed-related crashes involved pedestrians.
- 1 percent of F&A intersection speed-related crashes involved pedacyclists.

Angle Crashes

- Of speed-related F&A intersection angle crashes where speed limit is known:
  - 19 percent on roads signed at 25 mph or less.
  - 33 percent on roads signed 30-35 mph.
  - 14 percent on roads signed at 40-45 mph.
  - 33 percent on roads signed at 50-55 mph.
  - None on roads signed at 60 mph or greater.

Non-vehicle Collision (Fixed Object) Crashes

- 42 percent of F&A intersection fixed object speed-related crashes are rural; 58 percent are urban.

- Of speed-related F&A intersection fixed object crashes where speed limit is known:
  - 23 percent on roads signed at 25 mph or less.
  - 24 percent on roads signed 30-35 mph.
  - 19 percent on roads signed at 40-45 mph.
  - 33 percent on roads signed at 50-55 mph.
  - One crash on roads signed at 60 mph or greater.

Front-to-Rear Crashes

- 76 percent of F&A intersection front-to-rear speed-related crashes are urban; 24 percent are rural.

- Of speed-related F&A intersection front-to-rear crashes where speed limit is known:
  - 1 crash on roads signed at 25 mph or less.
  - 20 percent on roads signed 30-35 mph.
  - 21 percent on roads signed at 40-45 mph.
  - 11 percent on roads signed at 50-55 mph.
  - None on roads signed at 60 mph or greater.

Corridors with Highest F&A Intersection Speed-related Crashes

Note: the corridor information below does not account for vehicle miles traveled (VMT) or the length of corridors.

Table 8. Statewide Corridors with Highest F&A Intersection Speed Related Crashes

Route	Number of F&A Crashes (2010 – 2014)
US 26	10
OR 99W	9
US 101	7
126	5
213	4
US 30	4
US 20	4
OR 22	4
OR 47	4

Table 9. Corridors with Highest F&A Intersection Speed Related Crashes by County

County	Route	Number of F&A Crashes (2010 – 2014)
Multnomah	US 26	5
Polk	OR 22	4
Washington	OR 99W	4
Lincoln	US 101	4
Multnomah	I-5	3
Polk	223	3
Clackamas	US 26	3
Tillamook	US 101	3
Josephine	US 199	2
Multnomah	OR 43	2
Multnomah	213	2
Yamhill	OR 99W	2
Linn	OR 34	2
Lane	OR569	2
Lane	126	2
Josephine	OR 199	2
Jackson	238	2
Deschutes	US 20	2
Crook	126	2
Columbia	US 30	2
Clackamas	213	2
Clackamas	211	2
Benton	OR 99W	2
Lane	OR 99	2
Multnomah	US 30BY	2
Umatilla	US 395	2
Washington	OR 47	2

Pedestrians and Bicycles

Although the overall percentage of pedestrian fatalities that are speeding-related is surprisingly low, the travel speed at impact directly influences the severity of pedestrian crashes, as the figure shows.

Quick Facts:

- 3 percent of Oregon's speed-related F&A crashes are considered pedestrian/bicycle crashes.
- 73 percent of speeding-related F&A pedestrian/bicycle crashes occur in urban areas.
- 71 percent of F&A pedestrian/bicycle speed-related crashes occurred at non-intersection locations.

By Roadway Type

Table 10. Percent of Speed-related F&A Ped/Bike Crashes (by Roadway Type and Ownership)

Percent of Speed-related F&A Ped/Bike Crashes (by Roadway Type and Ownership)	Oregon's Percent of Miles of System by Roadway Type	Crashes per System Miles
Interstate/freeway – 11 percent	Interstate/Freeway – 1 percent	Overrepresented
Principal arterials – 35 percent ○ ***State – 59 percent*** ○ ***City – 41 percent*** ○ ***County – 0 percent***	Principal arterial – 5 percent	Overrepresented
Minor arterial – 27 ○ ***State – 24 percent*** ○ ***City – 76 percent*** ○ ***County – 0 percent***	Minor arterial – 5 percent	Overrepresented
Collectors – 20 ○ ***State – 8 percent*** ○ ***City – 38 percent*** ○ ***County – 54 percent***	Collector – 26 percent	Underrepresented
Local – 8 ○ ***State – 0 percent*** ○ ***City – 80 percent*** ○ ***County – 10 percent***	Local – 63 percent	Underrepresented

By Speed Limit

Speed-related F&A pedestrian/bicycle speed-related crashes where speed limit is known:

- 30 percent on roads signed at 25 mph or less.
- 32 percent on roads signed 30-35 mph.
- 11 percent on roads signed at 40-45 mph.
- 19 percent on roads signed at 50-55 mph.
- 9 percent on roads signed at 60 mph or greater.

By Driver Characteristics

- 70 percent of all F&A pedestrian/bicycle speed-related crashes are male drivers.
- Male drivers aged 25-34 accounted for the highest number of F&A pedestrian/bicycle speed-related crashes (19 percent) followed by females aged 35-44 (10 percent).

Corridors with Highest F&A Pedestrian/Bicycle Speed Related Crashes

Note: the corridor information below does not account for vehicle miles traveled (VMT) or the length of corridors.

Table 11. Statewide Corridors with Highest F&A Pedestrian/Bicycle Speed Related Crashes

Route	Number of F&A Crashes (2010 – 2014)
US 26	4
US 30	3
I-5	3
OR 10	2
IS 405	2
211	1
I-82	1
I-84	1
126	1
OR 66	1
US 395	1
OR 82	1
OR 99	1
US 101	1
US 101B	1
OR 18	1

Table 12. Corridors with Highest F&A Pedestrian/Bicycle Speed Related Crashes by County

County	Route	Number of F&A Crashes (2010 – 2014)
Clackamas	US 26	2
Columbia	US 30	2
Multnomah	IS 405	2
Lincoln	US 101	1
Clackamas	211	1
Clatsop	US 101B	1
Clatsop	US 30	1
Jackson	I-5	1
Klamath	OR 66	1
Lane	126	1
Baker	I-84	1
Lane	OR 99	1
Washington	OR 10	1
Marion	I-5	1
Multnomah	OR 10	1
Multnomah	US 26	1
Polk	OR 18	1
Tillamook	US 26	1
Umatilla	I-82	1
Umatilla	OR 82	1
Umatilla	US 395	1
Lane	I-5	1

The team used the data variables listed below to identify crash trends.

Table 13. Data Variables Used in Analysis

CRASH TABLE				
HWY_NO	RD_CON_NO	ISECT_TYP_SHORT_DESC	INVSTG_AGY_SHORT_DESC	RTE_NM
SER_NO	LRS_VAL	ISECT_REL_FLG	CRASH_EVNT_1_CD	CRASH_LAST_UD_DT
CRASH_DT	LAT_DEG_NO	RNDABT_FLG	CRASH_EVNT_1_SHORT_DESC	TOT_VHCL_CNT
CRASH_MO_NO	LAT_MINUTE_NO	DRVWY_REL_FLG	CRASH_EVNT_2_CD	TOT_FATAL_CNT
CRASH_DAY_NO	LAT_SEC_NO	LN_QTY	CRASH_EVNT_2_SHORT_DESC	TOT_INJ_LVL_A_CNT
CRASH_YR_NO	LONGTD_DEG_NO	TURNG_LEG_QTY	CRASH_EVNT_3_CD	TOT_INJ_LVL_B_CNT
CRASH_WK_DAY_CD	LONGTD_MINUTE_NO	MEDN_TYP_CD	CRASH_EVNT_3_SHORT_DESC	TOT_INJ_LVL_C_CNT
CRASH_HR_NO	LONGTD_SEC_NO	MEDN_TYP_SHORT_DESC	CRASH_CAUSE_1_CD	TOT_INJ_CNT
CRASH_HR_SHORT_DESC	SPECL_JRSDCT_ID	IMPCT_LOC_CD	CRASH_CAUSE_1_SHORT_DESC	TOT_UNINJD_AGE00_04_CNT
CNTY_ID	SPECL_JRSDCT_SHORT_DESC	CRASH_TYP_CD	CRASH_CAUSE_2_CD	TOT_UNINJD_PER_CNT
CNTY_NM	JRSDCT_GRP_CD	CRASH_TYP_SHORT_DESC	CRASH_CAUSE_2_SHORT_DESC	TOT_PED_CNT
CITY_SECT_ID	AGY_ST_NO	COLLIS_TYP_CD	CRASH_CAUSE_3_CD	TOT_PED_FATAL_CNT
CITY_SECT_NM	ST_FULL_NM	COLLIS_TYP_SHORT_DESC	CRASH_CAUSE_3_SHORT_DESC	TOT_PED_INJ_CNT
URB_AREA_CD	RECRE_RD_NM	CRASH_SVRTY_CD	SCHL_ZONE_IND	TOT_PEDCYCL_CNT
URB_AREA_SHORT_NM	ISECT_AGY_ST_NO	CRASH_SVRTY_SHORT_DESC	WRK_ZONE_IND	TOT_PEDCYCL_FATAL_CNT
FC_CD	ISECT_ST_FULL_NM	WTHR_COND_CD	ALCHL_INVLV_FLG	TOT_PEDCYCL_INJ_CNT
FC_SHORT_DESC	ISECT_RECRE_RD_NM	WTHR_COND_SHORT_DESC	DRUG_INVLV_FLG	TOT_UNKNWN_CNT
NHS_FLG	FROM_ISECT_DSTNC_QTY	RD_SURF_COND_CD	CRASH_SPEED_INVLV_FLG	TOT_UNKNWN_FATAL_CNT
HWY_SFX_NO	CMPSS_DIR_CD	RD_SURF_SHORT_DESC	CRASH_HIT_RUN_FLG	TOT_UNKNWN_INJ_CNT
HWY_MED_NM	MP_NO	LGT_COND_CD	POP_RNG_CD	TOT_OCCUP_CNT
RDWY_NO	POST_SPEED_LMT_VAL	LGT_COND_SHORT_DESC	POP_RNG_MED_DESC	TOT_PER_INVLV_CNT
HWY_COMPNT_CD	RD_CHAR_CD	TRAF_CNTL_DEVICE_CD	RD_CNTL_CD	TOT_SFTY_EQUIP_USED_QTY
HWY_COMPNT_SHORT_DESC	RD_CHAR_SHORT_DESC	TRAF_CNTL_DEVICE_SHORT_DESC	RD_CNTL_MED_DESC	TOT_SFTY_EQUIP_UNUSED_QTY
MLGE_TYP_CD	OFF_RDWY_FLG	TRAF_CNTL_FUNC_FLG	RTE_TYP_CD	TOT_SFTY_EQUIP_USE_UNKNOWN_QTY
MLGE_TYP_SHORT_DESC	ISECT_TYP_CD	INVSTG_AGY_CD	RTE_ID	

PARTIC	VHCL
Age.[1]	Veh Type
Age.[2]	License
Age.[3]	
Age.[4]	
Age.[5]	
Restraint	

Appendix C – Speed Management Countermeasures List

This spreadsheet of potential countermeasures was provided to Oregon DOT. Representatives from ODOT contributed information in the last two columns for purposes of providing initial feedback to FHWA on ODOT's use of speed management countermeasures.

Table 14. Speed Management Countermeasures

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
STATIC SIGNING						
One direction large arrow sign (W1-6)		Roadway Departure	Rural	Curves	4	This would be limited to small radius curves where one arrow would be suitable to replace one or two chevrons
Add flashers to existing curve warning signs		Roadway Departure	Rural	Curves	2	
Add flags to existing curve warning signs		Roadway Departure	Rural	Curves	1	not sure flags do much
Curve Treatment Level 1: Basic Curve Signing (advanced warning, chevrons, speed plates)	Installing basic curve signing to meet MUTCD minimum	Roadway Departure	Rural	Curves	5	

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
Curve Treatment Level 2: Enhanced signing/delineation	Installing enhanced signing/delineation (oversized signs, florescent sheeting, full post delineation, etc.)	Roadway Departure	Rural	Curves	4	
DYNAMIC SIGNING (there is a variety of dynamic signing & messages that could be displayed, not all are shown below)						
Sequential Dynamic Curve Warning System	Series of blinking chevron signs installed throughout a curve, flashes sequentially through the curve to warn speeding drivers	Roadway Departure	Urban, Rural	Curves	3	
Speed feedback signs	Sign that dynamically displays speed of passing vehicles with the message, "YOUR SPEED XX"	Roadway Departure	Rural, Urban	Any roads; school zones, advance of signalized intersection; work zones	3	limit it mostly to urban and a few rural communities
Speed activated warning sign	Sign that displays warning messages to speeding drivers	Roadway Departure	Rural, Urban	Any roads; work zones; curves	3	We have been using these in work zones and they are very useful

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
Speed activated speed limit reminder sign	Displays speed limit to speeding drivers	Roadway Departure	Rural, Urban	Any roads	3	We have been using these in work zones and they are very useful
Variable speed limit sign	Signs that allow speed limit to change according to conditions	Roadway Departure	Urban	Principal arterial, interstate	2	pretty expensive only use for situations with reoccurring conditions that can be treated by VS
Speed Limit Sign with LED	Speed limit sign enhanced with LED lights	Pedestrian	Rural	Community entrance	2	
SURFACE TREATMENTS AND MARKINGS						
Transverse rumble strips	Raised or grooved patterns installed on the roadway travel lane or shoulder pavements, perpendicular to the direction of travel	Roadway Departure	Urban, Suburban, Rural	Local; stop-controlled approaches, major	1	Only likely use these for stop approaches to rural stop signs

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
Converging chevron marking pattern	Type of transverse pavement markings forming chevron shape to create the illusion of travelling faster as well as the impression of narrower lanes	Roadway Departure	Rural, Urban	Local street, collector, arterial; exit ramps; curves on directional interchange ramps	2	
Transverse markings	Series of white lines placed across the center of the lane and spaced progressively closer to create the illusion of travelling faster	Roadway Departure	Rural	Horizontal curves; Work zone	1	Probably would rather use optical speed bars

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
Optical Speed Bars	Series of white rectangular markings typically 1 foot wide placed just inside both edges of the lane and spaced progressively closer to create the illusion of travelling faster as well as the impression of narrower lane.	Roadway Departure	Rural	Local street, collector, arterial; curves	2	We have used this at a couple of locations- one at a rural curve and the other at an urban intersection.
Add shoulder markings to narrow lane			Rural, Urban	2 lane road through small town; exit ramp	2	
Speed Limit XX Pavement Legend	Speed limit painted on roadway	Pedestrian	Rural, Urban	Any roads	2	Have tried this
"Slow" pavement legend	Slow painted on roadway	Pedestrian, Roadway Departure	Rural, Urban	Local roads, collector, arterial; curves	2	Have tried this
"XX MPH" + Curve Symbol	Painted on roadway prior to curve	Roadway Departure			2	Have tried this

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
In-Roadway Warning Lights	Flashing lights installed in the roadway to warn users that they are approaching a condition on or adjacent to the roadway that might not be apparent and require the driver to slow down		Rural, Urban	Any roads; pedestrian crossing; school zones, curves	0	Probably not these
Internally illuminated raised pavement markers	Steadily illuminated lights installed in the roadway surface		Rural, Urban	Any roads; pedestrian crossing; school zones, curves	0	Probably not these
Alignment delineation			Urban, Rural	Any roads		not sure what is meant we have delineators and pavement marker elsewhere
High friction surface treatment		Roadway Departure			2	
INTERSECTION TREATMENTS						

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
Roundabout		Intersections	Urban, Rural	Local street, collector, arterial; ramp terminals	4	
VERTICAL CHANGES WITHIN THE ROADWAY						
Speed Hump	Rounded raised area across the road, typically 12-14 feet in length and 3-4 inches high	Pedestrian	Urban, Suburban	Local street	2	Hard to determine for locals, they use them but on mostly residential roads
Speed Cushion	Speed hump typically 6-7 feet wide that allows most emergency vehicles to straddle the hump	Pedestrian	Urban	Local street	2	More difficult than speed bump
Speed Table	Long speed hump typically 22 feet in length with a flat section in the middle and ramps on the ends	Pedestrian	Urban	Local street	2	More difficult than speed bump
Raised Intersection	Raised plateau, with ramps on all approaches, where roads intersect	Pedestrian	Urban	Local street	2	There may one or two of these out there but leave in as option

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
HORIZONTAL CHANGES WITHIN THE ROADWAY						
Road diet or road rechannelization	Restripe road to reduce the number of lanes from 2 lanes in each direction to 1 lane in each direction with a center turn lane	Pedestrian	Urban	Arterial and collectors road	4	We would like to incorporate more of these but find them politically difficult sometimes, maybe rename to roadway reconfiguration road diets has a bad connotation
Choker	Mid-block curb extensions that narrow a road by extending the sidewalk or widening the planting strip	Pedestrian	Urban	Local street		hard to say for locals for these maybe only residential local streets
Neckdown	Intersection curb extensions that narrow a road by extending the width of a sidewalk	Pedestrian	Urban	Local street		hard to say for locals
Chicane	Curb extensions that alternate from one side of the street to the other, forming S-shaped curves	Pedestrian	Urban	Local street		hard to say for locals

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
Lateral Shift	Curb extensions that shifts travel lanes to one side of road for extended distance and then back to the other side		Urban	Local street		hard to say for locals
Center Island	Raised island along the centerline of a street that narrows the travel lanes	Pedestrian	Urban	Local, collector, arterial	4	yes should use more
Tubular channelizers	Tubes used to create island in center of roadway	Pedestrian	Rural, Urban	Local, collector, arterial	3	use only on lower volume roads
VERTICAL DELINEATION						
Delineator Post		Roadway Departure	Rural, Urban	Any roads; curves	4	yes should use more
Landscaping	Roadside plantings used to create vertical friction	Roadway Departure	Urban	Collector	3	more local issue

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
(See also the sections on STATIC SIGNING and DYNAMIC SIGNING for potential options related to vertical delineation)						
GATEWAY ENTRANCE TREATMENTS						
Gateway Treatment	Placed at community entrance to remind drivers of changing roadway character	Pedestrian	Rural	Community entrance	2	
ENFORCEMENT AND/OR EDUCATION RELATED						
Corridor Enforcement and Education			Urban, rural	Any road	4	
Corridor 3-E Initiative (engineering, education, enforcement)			Urban, Rural	Any road	4	

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
"Radar Enforced" signs	Sign to remind drivers that a corridor is being monitored for speed on an unannounced basis.		Urban, Rural		1	we have many of these at community entrances already, they are limited to those cities that can do this by statute
Automated Enforcement	Use of cameras to enforce speed limits		Urban, Rural	Any road	4	limited to certain cities
Red signal enforcement lights (tattletale lights)	Auxillary lights connected to a traffic signal to help law enforcement officers more efficiently and safely issue citations for drivers who violate the red phase of the signal.	Intersections	Urban		4	limited to certain cities
OTHER COUNTERMEASURES THAT MAY HAVE AN EFFECT ON SPEEDS						
Centerline rumble strips	Traditional milled-in rumble strips	Roadway Departure	Rural		5	yes should use more
Raised thermoplastic centerline rumble strips		Roadway Departure	Urban?, Rural		5	yes should use more

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
Edge line or shoulder rumble strips	Traditional milled-in rumble strips	Roadway Departure			5	yes should use more
Raised thermoplastic edge line/shoulder rumble strips		Roadway Departure	Urban?, Rural		5	yes should use more
Sinusoidal/mumble strips	Type of rumble strip that has a sine wave pattern milled into the pavement; has a lower level of exterior noise while still providing an interior noise/vibration. Can be used on centerline or edgeline.	Roadway Departure	Urban, Rural	Any roads, where noise is a concern	5	yes should use more
Wider centerline pavement markings		Roadway Departure	Urban, Rural		1	not sure about wider lines yet right now wider edgeline means bike lane. Pavement marking crew is not onboard with this countermeasure.

Countermeasure	Description	Safety Focus	Urban/Rural Applicability	Roadway environment	Likelihood of consideration? (scale of 1-5) 1 - low; 5 - high	ODOT Comments
Wider edge lines		Roadway Departure	Urban, Rural		1	not sure about wider lines yet right now wider edgeline means bike lane. Pavement marking crew is not onboard with this countermeasure.
Add center and edge pavement markings		Roadway Departure	Rural, Urban	Any roads	3	most of these are going to be a local issue of paying for maintaining the striping, not sure if striping would help with speed maybe curves
OTHERS YOU WOULD LIKE TO CONSIDER/LOOK INTO?						
Raised or recessed pavement markers		Roadway departure	Rural	curves		