

Appendix 18A: Summary of TSMO Strategies

TSMO Strategy	Key Benefits	Order of Magnitude Cost	Geographic Application	Influencing Factors	Data Needs
Regional Traffic Control					
Transportation Operations Center (TOC) Coordinate and support traffic operations (often with other jurisdictions) and coordinate with police/emergency services and transit	<ul style="list-style-type: none"> • Supports coordination and collaboration • Resource sharing • Improved mobility 	Low (virtual TOC or workstation) – High (24/7 operations)	Agency based or Regionwide (urban or rural)	<ul style="list-style-type: none"> • Expense sharing opportunities • Center-to-field and often center-to-center communications needed 	<ul style="list-style-type: none"> • Varies based on functions carried out by TOC
Active traffic management Manage congested corridors with lane use control, reversible lanes, or variable speed limits (congestion or weather based)	<ul style="list-style-type: none"> • Improved safety • Improved mobility 	Low – High	Urban or rural corridors	<ul style="list-style-type: none"> • Multi-agency coordination • New technology capabilities and limitations 	<ul style="list-style-type: none"> • Vehicle volume, speed, and occupancy • Incident information • Air and road weather conditions
Special event management Automate traffic control using changeable lane assignment, reversible lanes, or enhanced signal operations for special events	<ul style="list-style-type: none"> • Improved mobility during high traffic demand • Supports local businesses 	Low – Medium	Urban or rural event centers	<ul style="list-style-type: none"> • Coordination with various event organizers • Order of magnitude varies by event 	<ul style="list-style-type: none"> • Vehicle volume, speed, and occupancy • Event times and information • Event related transit routes
Freeway/arterial integrated corridor management (ICM) Route/mode diversion to parallel facility, real-time information, and real-time adjustments (e.g. signals)	<ul style="list-style-type: none"> • Improved mobility • Supports incident management • Supports coordination and collaboration 	Medium	Urban freeway and adjacent arterials	<ul style="list-style-type: none"> • Interagency cooperation and implementation is key to success 	<ul style="list-style-type: none"> • Vehicle volume, speed, and occupancy • Incident information • Transit routes and travel times
Ramp metering Meter traffic flow on freeway on-ramps	<ul style="list-style-type: none"> • Improved mobility • Reduced vehicle conflicts 	Low – Medium	Urban freeway	<ul style="list-style-type: none"> • Public perception • Queue mitigation onto arterials 	<ul style="list-style-type: none"> • Vehicle volume, speed, and occupancy

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Enhanced traffic signal operations Improve existing signals through re-timing/optimization, adaptive systems, or better detection	<ul style="list-style-type: none"> Improved mobility Reduced fuel consumption and emissions 	Low – High	Urban or rural traffic signals	<ul style="list-style-type: none"> Understanding new technology, capabilities, and limitations 	<ul style="list-style-type: none"> Vehicle volume, speed, and occupancy
Bicycle and pedestrian operations and safety Crossing enhancements, bicycle detection, or signal timing for bicycles and pedestrians	<ul style="list-style-type: none"> Improved safety Improved mobility 	Low – Medium	Regionwide	<ul style="list-style-type: none"> Dependent on bicycle and pedestrian demand 	<ul style="list-style-type: none"> Vehicle, bicycle and pedestrian detection and volume
Traffic network surveillance Use video cameras or detection equipment to monitor key locations and assess real-time flow traffic conditions	<ul style="list-style-type: none"> Improved incident detection Broader traveler information Supports performance measurement 	Low – Medium	Regionwide; Urban networks and spot rural locations (e.g. weather or safety based)	<ul style="list-style-type: none"> Public perception Center-to-field communications infrastructure 	<ul style="list-style-type: none"> Vehicle volume, speed, and occupancy Camera coverage
Safety applications A variety of warning system applications activate warnings regarding queues, geometry (e.g. curves, over height/over width), intersections, and animals crossing	<ul style="list-style-type: none"> Improved safety 	Low	Primarily rural but also congested urban facilities (queue warning)	<ul style="list-style-type: none"> Crash history Analysis using the Crash Modifications Factors (CMF) Clearinghouse 	<ul style="list-style-type: none"> Vehicle volume, speed, and occupancy Vehicle size Animal migration activity
Traveler Information					
Regional traveler information Provide static and real-time traveler information (e.g. incidents, transit arrivals, construction, road weather) from all regional agencies from one central system	<ul style="list-style-type: none"> Improved mobility Increased attractiveness of alternate modes Increased traveler satisfaction 	Low – High (varies by amount of infrastructure needed)	Regionwide or statewide; Urban and rural	<ul style="list-style-type: none"> Multi-agency partnerships Commitment to keeping information up-to-date 	<ul style="list-style-type: none"> Varies by system As many data sources that are available
Roadside traveler information dissemination Add dynamic message signs (DMSs) on roadways or use highway advisory radio (HAR) to disseminate traveler information	<ul style="list-style-type: none"> Improved mobility Increased traveler satisfaction 	Medium – High	Urban or rural spot locations near alternate routes where events regularly impact route choice	<ul style="list-style-type: none"> Right-of-way often hard to obtain for urban arterials Power and communications not always nearby 	<ul style="list-style-type: none"> Direct communications to a TOC or leased cellular connection

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Predictive traveler information Develop models and tools that can predict travel conditions	<ul style="list-style-type: none"> Improved mobility Increased traveler satisfaction 	Low – Medium	Regionwide or statewide; Urban and rural	<ul style="list-style-type: none"> Availability of robust historic travel conditions information 	<ul style="list-style-type: none"> Vehicle volume, speed, and occupancy Regional travel demand model
Real-time transit arrival information Provide real-time transit arrival information by a variety of means such as wayside signs, in-vehicle systems, and interactive online/ personal device applications	<ul style="list-style-type: none"> Increased attractiveness of transit, bicycling, and walking Enhanced passenger convenience 	Medium – High	Regionwide; Any place with a transit system in operation	<ul style="list-style-type: none"> GPS location refreshing rate is critical Agency cooperation and integration between information systems 	<ul style="list-style-type: none"> Real-time transit vehicle location Vehicle volume, speed, and occupancy along transit route
Multi-modal trip planning website Develop a regional trip planning website that provides step-by-step planning directions and may include options related to quickest trip, shortest walk, and accessibility	<ul style="list-style-type: none"> Increased attractiveness of transit Enhanced passenger convenience Increased traveler satisfaction 	Low	Regionwide or statewide; Primarily urban	<ul style="list-style-type: none"> Consider different stakeholder interests Data requires regular updates Need server that can handle peak demand 	<ul style="list-style-type: none"> Transit routes and schedules Rideshare options Bicycle and pedestrian infrastructure location and quality
Parking availability information and guidance Provide real-time information about parking availability for high demand parking areas and for freight parking areas	<ul style="list-style-type: none"> Improved mobility Increased attractiveness of transit Improved freight routing 	Low – Medium	Urban or rural high demand parking facilities (e.g. park & rides, event centers, freight distribution centers)	<ul style="list-style-type: none"> Coordinate across jurisdictional boundaries when necessary 	<ul style="list-style-type: none"> Parking space occupancy
Maintenance and Construction					
Maintenance and construction activity coordination Track planned and ongoing maintenance and construction activities (by public agencies and private utilities) that impact travel	<ul style="list-style-type: none"> Enhanced operational efficiency Improved mobility Improved emergency vehicle and transit vehicle routing 	Low	Regionwide or statewide	<ul style="list-style-type: none"> Coordination with public agencies and private utilities Activities require regular updates 	<ul style="list-style-type: none"> Maintenance and construction activity schedules and travel impacts

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Asset management Streamline asset management with technology such as GPS or barcoding key assets	<ul style="list-style-type: none"> Enhanced operational efficiency 	Medium – High	Agency basis	<ul style="list-style-type: none"> Systems may get outdated quickly as technologies change Updating database as assets are added or replaced 	<ul style="list-style-type: none"> Device status and alerts
Fleet management Use systems to schedule routine vehicle maintenance and to track vehicles in the field	<ul style="list-style-type: none"> Enhanced operational efficiency, particularly during major emergencies 	Medium – High	Agency basis	<ul style="list-style-type: none"> On-board technology from fleet manufacturers may influence system 	<ul style="list-style-type: none"> Vehicle location Vehicle on-board maintenance records
Work zone management Use variable speed limits, automated enforcement, and traveler information for work zones that impact regional mobility and safety	<ul style="list-style-type: none"> Improved safety Improved mobility 	Low – Medium	Any work zone, particularly those that will be in place long-term	<ul style="list-style-type: none"> Public acceptance and understanding of technologies is needed for some strategies 	<ul style="list-style-type: none"> Varies by sub-strategy Work zone durations and travel impacts Vehicle speed and volume
Road Weather Operations					
Road weather information systems (RWISs) Monitor and predict roadway conditions to mitigate impacts of adverse conditions	<ul style="list-style-type: none"> Improved safety Improved mobility Improved resource allocation (e.g. staff and reduced anti-icing product usage) Reduced environmental impacts 	Low – Medium	Rural mountain passes, higher elevations in urban areas, locations with snow or ice	<ul style="list-style-type: none"> Power and communications not always nearby 	<ul style="list-style-type: none"> Air conditions (e.g. visibility, wind speed/direction) Road weather conditions (e.g. grip factor, surface temperature) Weather forecasts
Winter operations Various applications are available to improve winter safety and operations such as anti-icing systems, variable speed limits, and snow plow tracking	<ul style="list-style-type: none"> Improved safety Improved resource allocation 	Low – High	Regions with frequent snow and ice during winter	<ul style="list-style-type: none"> High crash locations related to winter weather Agencies with high winter operations budgets 	<ul style="list-style-type: none"> Varies by sub-strategy RWIS data Vehicle speed Snow plow location and schedule Weather forecasts

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Weather warning systems A variety of applications activate warnings regarding weather (e.g. roadway flooding, fog, snow, or ice) and some use automatic gates	<ul style="list-style-type: none"> Improved safety 	Low – Medium	Locations with frequent fog, snow, or ice; Low-water crossings	<ul style="list-style-type: none"> High crash/incident locations related to weather 	<ul style="list-style-type: none"> Air and road weather conditions
Incident Management					
Incident management (bi-state and regional) Coordinate responses to incidents that impact region or bi-state travel to and from Oregon; Includes many sub-strategies such as dedicated incident response program, incident response vehicles, and staged/dry run towing	<ul style="list-style-type: none"> Improved safety Improved mobility 	Low – Medium	Regionwide	<ul style="list-style-type: none"> Interagency coordination with transportation and emergency services/ first responders 	<ul style="list-style-type: none"> Vehicle volume, speed, and occupancy Camera coverage Incident reports
Computer aided dispatch (CAD) integration Enable traffic management and emergency management agency CAD systems to communicate with one another to support incident management	<ul style="list-style-type: none"> Improved safety Improved mobility Improved resource allocation 	Medium	TOCs, 911 Centers, Transit Operations Centers, and other Public Safety Answering Points with CAD systems	<ul style="list-style-type: none"> Interagency coordination Invest in same CAD system at multiple agencies or program a portal that interacts with all systems 	<ul style="list-style-type: none"> Incident reports and responses (only non-sensitive information)
Emergency Management					
Emergency Operations Center (EOC) and TOC Integration Integrate systems used at EOCs and TOCs or install TOC back-up systems at EOCs	<ul style="list-style-type: none"> Improved safety Improved mobility Improved coordination during major emergencies 	Medium	EOCs and TOCs	<ul style="list-style-type: none"> Interagency coordination Physical space available for servers Supporting communications 	<ul style="list-style-type: none"> Dependent on systems use at each EOC and TOC

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Public Transportation					
Advanced transit operations management Enhance transit operations and management through the use of computer aided dispatch (CAD), automated vehicle location (AVL), and automated passenger counting (APC)	<ul style="list-style-type: none"> Improved transit reliability and efficiency Increased traveler satisfaction 	Medium – High	Any transit system	<ul style="list-style-type: none"> System compatibility and future upgrade potential must be considered 	<ul style="list-style-type: none"> Vehicle location Vehicle route and schedule Passenger boardings
Transit signal priority (TSP) Use emergency vehicle preemption technology to provide extra green time at traffic signals for transit vehicles	<ul style="list-style-type: none"> Improved mobility Increased passenger throughput 	Low – Medium	Urban transit routes on arterials with closely spaced traffic signals	<ul style="list-style-type: none"> Willingness to prioritize transit over other modes Traffic signal infrastructure 	<ul style="list-style-type: none"> Transit vehicle location Transit schedule adherence (if required)
Electronic fare collection Use smart cards, magnetic stripe technologies, or smart phone applications to collect transit fares electronically	<ul style="list-style-type: none"> Enhanced passenger convenience Improved money handling efficiencies 	Medium – High	Any transit system	<ul style="list-style-type: none"> Security of financial transactions Interagency coordination if integrating with others 	<ul style="list-style-type: none"> Fare rates Fare transactions
Transit surveillance and security Provide video surveillance on transit vehicles or at transit facilities to deter unsafe behavior and monitor the system	<ul style="list-style-type: none"> Improved safety Increased traveler satisfaction 	Low – Medium	Any transit system	<ul style="list-style-type: none"> Need communications feed to transit operations center 	<ul style="list-style-type: none"> Camera coverage
Freight					
Roadside truck electronic screening/clearance Use truck-to-roadside communications at check stations to transfer regulatory data, payment, or weigh-in-motion	<ul style="list-style-type: none"> Improved freight mobility Reduced inspection time 	Medium – High	State or county ports of entry	<ul style="list-style-type: none"> Consider integration with ODOT's road user charging initiatives 	<ul style="list-style-type: none"> Vehicle weight Vehicle axle count Vehicle permits or regulatory requirements

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Truck traffic signal priority Detect heavy vehicles in the dilemma zone and provide extra green time at traffic signals	<ul style="list-style-type: none"> Improved safety Improved freight mobility 	Medium – High	Urban freight routes on arterials with closely spaced traffic signals	<ul style="list-style-type: none"> Willingness to prioritize freight over other modes Traffic signal infrastructure 	<ul style="list-style-type: none"> Vehicle volume, speed, occupancy, and classification Freight origin-destination data
Archived Data Management					
Data marts and data warehouses Collect and store data from multiple systems in a single repository with consistent formats and allow users to query basic data and reports	<ul style="list-style-type: none"> Supports regional operations and planning efforts 	Medium – High	Agency-based, Regionwide, or statewide	<ul style="list-style-type: none"> Critical to get data into consistent formats Data validation is also key 	<ul style="list-style-type: none"> Varies by end user needs and desired performance metrics
Performance measurement Develop comprehensive performance measures for all modes of travel to assess effectiveness of TSMO strategies	<ul style="list-style-type: none"> Better ability to target future policies and system improvements 	Medium – High	Agency-based, Regionwide, or statewide	<ul style="list-style-type: none"> Metrics should be consistent with federal, state, and local funding program requirements 	<ul style="list-style-type: none"> Varies by performance metric
Transportation Demand Management (TDM)					
Rideshare system Provide ride-matching services and programs that reduce commute trips (e.g. vanpool programs)	<ul style="list-style-type: none"> Reduced single occupancy vehicle trips Reduced emissions 	Medium – High	Within urban areas or to link urban areas	<ul style="list-style-type: none"> Clear incentives are needed to influence traveler behavior 	<ul style="list-style-type: none"> Rideshare options
Mass communication Use media, advertising, and marketing campaigns to increase awareness of transportation options	<ul style="list-style-type: none"> Improved mobility 	Medium – High	Regionwide or statewide	<ul style="list-style-type: none"> Multi-agency support and partnerships are required 	<ul style="list-style-type: none"> Travel options resources
Individualized marketing Reach out to individuals with personalized information and assistance with travel options	<ul style="list-style-type: none"> Improved safety Improved mobility 	Medium – High	Neighborhood or target audience	<ul style="list-style-type: none"> Staff resource allocation is critical for customer satisfaction 	<ul style="list-style-type: none"> Travel options resources

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<p>Traveler information marketing campaigns Market the information services available and build familiarity for checking information before embarking on a trip</p>	<ul style="list-style-type: none"> Improved mobility 	Low	Regionwide or statewide	<ul style="list-style-type: none"> Multiple travel options marketing efforts should link to one another Brand identity helps attract travelers 	<ul style="list-style-type: none"> Travel options resources
<p>Employer programs Assist employers in implementing an auto-trip reduction plan tailored to their work site and employees</p>	<ul style="list-style-type: none"> Improved safety Improved mobility 	Low	Large employment sites	<ul style="list-style-type: none"> Large employers (more than 100 employees) are affected by DEQ rules 	<ul style="list-style-type: none"> Employee origin-destination data
<p>Commuter incentives Reduce single-person vehicle trips made by commuters by offering time or cost savings and rewards</p>	<ul style="list-style-type: none"> Improved mobility 	Low	Urban areas	<ul style="list-style-type: none"> Large employers (more than 100 employees) are affected by DEQ rules 	<ul style="list-style-type: none"> Employee origin-destination data
<p>Telecommuting Encourage employers to allow employees to work from home or a satellite office on a regular basis</p>	<ul style="list-style-type: none"> Improved mobility 	Low	Large employment sites	<ul style="list-style-type: none"> Not all types of employment work well for telecommuting 	<ul style="list-style-type: none"> Employer data
<p>Urban centers, corridor, and industrial area investments Coordinate development of end-of-trip facilities, parking, carsharing, shared use mobility, and other strategies to complete areas or corridors</p>	<ul style="list-style-type: none"> Improved safety Improved mobility 	Low	Urban centers, corridors, and industrial areas	<ul style="list-style-type: none"> Often requires public-private partnerships Private entities will not risk locating beyond their market without revenue guarantee 	<ul style="list-style-type: none"> Travel demand model Development plans

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Complementary Strategies					
Shared communications network Share communications infrastructure between agencies to support the transportation and emergency management network	<ul style="list-style-type: none"> Enabled system integration and information sharing Cost-sharing benefits 	Low – High	Urban areas, key rural corridors	<ul style="list-style-type: none"> Interagency agreements help define the parameters 	<ul style="list-style-type: none"> Available and planned communications infrastructure Bandwidth
Bottleneck removal Small-scale capacity improvements that support TSMO include geometry improvements, new lanes (e.g. turn lanes), and temporary shoulder use	<ul style="list-style-type: none"> Improved safety Improved mobility 	Medium – High	Urban or rural facilities	<ul style="list-style-type: none"> Sufficient and accurate data collection is important for bottleneck analysis and mitigation 	<ul style="list-style-type: none"> Inputs for capacity analysis
Ramp closures Temporarily close freeway ramps to accommodate work zones, major events, or inclement weather conditions.	<ul style="list-style-type: none"> Improved safety Improved mobility 	Low	Congested urban freeways or rural freeways with winter weather	<ul style="list-style-type: none"> Public perception, particularly from nearby property owners Disruption and impacts to alternate routes 	<ul style="list-style-type: none"> Vehicle volume, speed, and occupancy Air and road weather conditions
Access management Includes many sub-strategies such as access closure, access restriction (medians, channelization), access sharing and consolidation, and street connectivity	<ul style="list-style-type: none"> Improved safety Improved mobility 	Low – High	Urban or rural facilities	<ul style="list-style-type: none"> Primarily addressed during the development review process 	<ul style="list-style-type: none"> Crash history Access spacing standards and actual field spacing
High performance transit Provide all day, two-way, reliable, and frequent service that offers competitive speeds to the private automobile and features improved amenities for passengers	<ul style="list-style-type: none"> Increased passenger throughput More efficient use of roadway capacity Increased traveler satisfaction 	High	Urban corridors	<ul style="list-style-type: none"> Public perception Requires multi-agency coordination, especially during the planning phases 	<ul style="list-style-type: none"> Inputs for capacity analysis

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Strategies that Require Political and Policy Changes					
Automated enforcement Automatically issue tickets for red light running or speeding at locations with compliance issues	<ul style="list-style-type: none"> Improved safety 	Medium	Urban or rural facilities	<ul style="list-style-type: none"> Public and political perception Need legal authority 	<ul style="list-style-type: none"> Camera coverage of infractions
Congestion pricing To manage demand on congested facilities a number of strategies may be used at all times or by time of day: variable priced lanes, variable tolls on entire roadways or roadway segments, cordon charging, or area-wide charging	<ul style="list-style-type: none"> Improved mobility during peak periods 	Medium – High	Urban facilities or urban areas	<ul style="list-style-type: none"> Public and political perception Need legal authority Requires integration with ODOT’s road user charging initiatives 	<ul style="list-style-type: none"> Vehicle volume, speed, and occupancy
Managed lanes High occupancy vehicle (HOV) lanes carry vehicles with a higher number of occupants; High occupancy toll (HOT) lanes allow single occupancy vehicles to use the HOV lanes for a toll; Lanes can be dedicated as transit only or trucks only	<ul style="list-style-type: none"> Improved mobility 	Low – High	Urban facilities	<ul style="list-style-type: none"> Public and political perception HOT lanes require integration with ODOT’s road user charging initiatives 	<ul style="list-style-type: none"> Vehicle volume, speed, and occupancy

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Emerging Strategies					
<p>Connected vehicles Connected vehicle applications provide connectivity between and among vehicles, infrastructure, and wireless devices. To date, a small percentage of the vehicle fleet has onboard connected vehicle technology. Some DOTs are providing connected vehicle technology for their fleet to help manage efficiency and provide mobile sources of data, especially weather data</p>	<ul style="list-style-type: none"> • Improved safety • Improved mobility • Reduced emissions 	High	Statewide	<ul style="list-style-type: none"> • Automotive industry is a key partner • Public agencies still determining future course of action • Many consumers not yet willing to pay 	<ul style="list-style-type: none"> • Varies by application (e.g. traffic signal data, geometric data)
<p>Autonomous vehicles Also known as uncrewed vehicles, driverless vehicles, self-driving vehicles, and robotic vehicles; they are capable of sensing their environment and navigating without human input.</p>	<ul style="list-style-type: none"> • Improved safety • Improved mobility • Reduced emissions 	High	Yet to be determined, may start with corridors	<ul style="list-style-type: none"> • More research still needed regarding safety • Current technology is still cost-prohibitive 	<ul style="list-style-type: none"> • Not yet known