

Pros & Cons of TMP Strategies

Traffic Control Strategies							
Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration	Potential Pros	Potential Challenges	Other Considerations
Control Strategies							
Construction phasing/staging	✓			<ul style="list-style-type: none"> Long project duration 	<ul style="list-style-type: none"> Less traffic impacts at each construction phase 	<ul style="list-style-type: none"> Longer project duration 	<ul style="list-style-type: none"> Adequate work areas Extended periods of lane/ramp closures expected When schedule allows
Full roadway closures							
Continuous (for a project phase or the entire project)			✓	<ul style="list-style-type: none"> Detour routes available Project needs to be completed in a compressed timeframe Traffic volume through the project can be accommodated on detour route(s) Highway facilities Short project length 	<ul style="list-style-type: none"> Faster construction Easier, more efficient construction – larger workspace with more flexibility No traffic distractions Safer for workers Better construction (e.g., smoother ride) Public feedback often positive Reduces need to set up and take down traffic control 	<ul style="list-style-type: none"> May increase cost to motorists (time and fuel) Accessibility to businesses and residences Motorists may get lost May significantly impact local roadways used for detours 	<ul style="list-style-type: none"> Public information necessary Signage and/or capacity improvements to detour route(s) may be necessary Need enough labor and materials available for accelerated work
Off-peak/night/weekend	✓		✓	<ul style="list-style-type: none"> Detour routes available High traffic volumes Low traffic volumes during work time period 	<ul style="list-style-type: none"> Faster construction Less traffic impacts Safer for workers 	<ul style="list-style-type: none"> Motorists may get lost 	<ul style="list-style-type: none"> Public information necessary Signage and/or capacity improvements to detour route(s) may be necessary Need to schedule around special events

Intermittent		✓	✓	<ul style="list-style-type: none"> ▪ Short project length ▪ Short project duration ▪ When work can be accomplished in short periods of time ▪ Low traffic volumes ▪ Rural areas 	<ul style="list-style-type: none"> ▪ Can close as necessary for construction purposes 	<ul style="list-style-type: none"> ▪ Can result in large delays 	<ul style="list-style-type: none"> ▪ Public information necessary ▪ Detour route(s), with signage, may be needed
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Lane shifts or closures

Reduced lane widths to maintain number of lanes (constriction)	✓			<ul style="list-style-type: none"> ▪ Long project duration ▪ High traffic volumes 	<ul style="list-style-type: none"> ▪ Can maintain existing number of lanes ▪ Easier design ▪ Detour route may not be necessary ▪ Ramps can remain open 	<ul style="list-style-type: none"> ▪ Can reduce traffic capacity ▪ May interfere with contractor access ▪ Narrow lanes (may affect motorist safety) ▪ May take longer to construct ▪ Barrier could still be required for some drop-offs 	<ul style="list-style-type: none"> ▪ Less width reductions may be needed if the shoulder has adequate width and structural adequacy ▪ May not be feasible where traffic volumes already approach or exceed the capacity of the roadway ▪ Sometimes difficult to obtain minimum lane widths ▪ Potential conflicts between width of roadway and width needed for work
Lane closures to provide worker safety			✓	<ul style="list-style-type: none"> ▪ When the remaining lanes provide adequate capacity to handle the traffic demand ▪ Minor work with short duration 	<ul style="list-style-type: none"> ▪ Safer for workers ▪ Can provide more work space 	<ul style="list-style-type: none"> ▪ May interfere with contractor access ▪ May sacrifice project quality ▪ May cause delays 	<ul style="list-style-type: none"> ▪ In conjunction with lane shift to shoulder or median
Reduced shoulder width to maintain number of lanes	✓			<ul style="list-style-type: none"> ▪ Enough shoulder space available ▪ Minor work with short duration 	<ul style="list-style-type: none"> ▪ Traffic remains on routes 	<ul style="list-style-type: none"> ▪ May interfere with contractor access ▪ May compromise safety 	<ul style="list-style-type: none"> ▪ In conjunction with lane shift to shoulder or median

Shoulder closure to provide worker safety			✓	<ul style="list-style-type: none"> ▪ Enough shoulder space available ▪ Minor work with short duration 	<ul style="list-style-type: none"> ▪ Traffic remains on routes 	<ul style="list-style-type: none"> ▪ May interfere with contractor access ▪ May affect motorist safety ▪ No room for breakdowns 	<ul style="list-style-type: none"> ▪ Avoid in high incident areas
Lane shift to shoulder/median to maintain number of lanes	✓			<ul style="list-style-type: none"> ▪ High traffic volume ▪ Enough shoulder space available ▪ Where bridges can accommodate use 	<ul style="list-style-type: none"> ▪ Traffic remains on routes ▪ Low cost ▪ Allows wider work area or maintains capacity 	<ul style="list-style-type: none"> ▪ May interfere with contractor access ▪ May compromise safety ▪ No room for breakdowns ▪ May damage the shoulder/median 	<ul style="list-style-type: none"> ▪ May need to upgrade shoulder/median ▪ Adequate structural capacity to carry traffic mix (including heavy trucks) is necessary
One-lane, two-way operation				<ul style="list-style-type: none"> ▪ Highway type facilities ▪ Rural areas ▪ Short-term project covering a short distance ▪ Traffic volume through the project is not high 	<ul style="list-style-type: none"> ▪ Easy to set-up 	<ul style="list-style-type: none"> ▪ May result in long delays 	<ul style="list-style-type: none"> ▪ Flaggers or temporary/portable traffic signals are typically used to control traffic ▪ May be necessary to perform the work
Two-way traffic on one side of divided facility (crossover)			✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ Projects with multiple construction stages/phasing ▪ Concerns for worker safety ▪ When detour routes and/or median or shoulder is not available 	<ul style="list-style-type: none"> ▪ Provides a more efficient work space ▪ Can reduce construction period ▪ Safer for workers 	<ul style="list-style-type: none"> ▪ Additional cost to construct crossovers and separations between opposing traffic ▪ Difficulty handling ramps 	<ul style="list-style-type: none"> ▪ Shoulders and/or lane width reductions may be used to maintain an adequate number of lanes ▪ Positive separations are required ▪ Where roadway geometry makes the construction of crossovers practical

Reversible lanes	✓			<ul style="list-style-type: none"> ▪ Where there are capacity limitations and no alternate routes ▪ Significant directional peaking of traffic ▪ Long project duration 	<ul style="list-style-type: none"> ▪ Accommodates peak traffic flow 	<ul style="list-style-type: none"> ▪ May be labor intensive ▪ Confusing to motorists ▪ Cost of positive separation 	<ul style="list-style-type: none"> ▪ Best serves commuter traffic ▪ For high speed roadways, a movable barrier system or other form of positive separation is typically used to separate and direct traffic
Ramp closures/relocation	✓	✓		<ul style="list-style-type: none"> ▪ Alternative ramps/routes available ▪ Shorter construction period required ▪ High traffic volumes 	<ul style="list-style-type: none"> ▪ Faster construction ▪ Reduces mainline and cross road traffic congestion ▪ May simplify the work zone 	<ul style="list-style-type: none"> ▪ Diverts congestion elsewhere ▪ Increases cost to motorists (time and fuel) ▪ Motorists may get lost 	<ul style="list-style-type: none"> ▪ Public information necessary
Freeway-to- freeway interchange closures		✓		<ul style="list-style-type: none"> ▪ Alternative routes available 	<ul style="list-style-type: none"> ▪ Construction duration can be reduced ▪ May simplify the work zone 	<ul style="list-style-type: none"> ▪ May significantly affect facility capacity ▪ Additional signage to route motorists 	<ul style="list-style-type: none"> ▪ In conjunction with accelerated construction/ contracting techniques ▪ Public information necessary
Night work	✓			<ul style="list-style-type: none"> ▪ Urban area ▪ High traffic volume 	<ul style="list-style-type: none"> ▪ Maintains normal capacity during the day ▪ Fewer delays 	<ul style="list-style-type: none"> ▪ May be less safe due to lighting distractions, higher speeds, and increased driver impairment ▪ Costly for labor ▪ Possible reduced quality of work ▪ May extend project duration 	<ul style="list-style-type: none"> ▪ Where feasible to carry out work in nightly increments ▪ Where traffic controls can be reconfigured on a nightly basis ▪ Urban noise ordinances ▪ Need enough resources and laborers available for night work
Weekend work	✓			<ul style="list-style-type: none"> ▪ High traffic volume ▪ Commuter traffic is significant 	<ul style="list-style-type: none"> ▪ Maintains normal capacity during weekdays ▪ Fewer delays 	<ul style="list-style-type: none"> ▪ May extend project duration 	<ul style="list-style-type: none"> ▪ Need to consider special events when scheduling ▪ Need enough resources and laborers available for weekend work

Work hour restrictions for peak travel	✓			<ul style="list-style-type: none"> ▪ Urban areas ▪ High traffic volume ▪ Significant peaking of traffic ▪ Where significant capacity reductions are necessary 	<ul style="list-style-type: none"> ▪ Maintains normal capacity during traffic peak times ▪ Fewer delays 	<ul style="list-style-type: none"> ▪ May extend project duration 	<ul style="list-style-type: none"> ▪ Duration of work restrictions will vary by location
Pedestrian/ bicycle access improvements	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ Significant pedestrian/ bicyclist activities ▪ Existing sidewalks traverse the work zone ▪ A school route traverses the work zone 	<ul style="list-style-type: none"> ▪ Safer for pedestrians and bicyclists 	<ul style="list-style-type: none"> ▪ Additional cost to build alternate paths for pedestrians/ bicyclists 	
Business access improvements	✓			<ul style="list-style-type: none"> ▪ Long project duration ▪ Where access to businesses may be reduced ▪ Anticipated impacts to businesses 	<ul style="list-style-type: none"> ▪ Accessibility to businesses ▪ Positive community relations 	<ul style="list-style-type: none"> ▪ Additional cost 	

Off-site detours/Use of alternate routes	✓	✓		<ul style="list-style-type: none"> Where significant reduction in capacity is necessary in one or both directions When a full road closure is being used to perform the roadwork Long project duration High traffic volume Detour routes with capacity available 	<ul style="list-style-type: none"> More efficient utilization of existing transportation facilities May reduce motorist delays 	<ul style="list-style-type: none"> May require additional cost May significantly impact roadways used for detours Motorists may get lost 	<ul style="list-style-type: none"> Need local jurisdiction support Improvements to the detour route may be needed to accommodate the diverted traffic including capacity and geometric improvements, signal retiming and coordination, signing and pavement markings, parking restrictions, and CMS to provide detour information
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Traffic Control Devices

Temporary signs

Warning	✓	✓	✓	<ul style="list-style-type: none"> In a situation that may not be readily apparent (e.g., speed reductions, road or lane narrows, etc.) 	<ul style="list-style-type: none"> Reduces potential for incidents 	<ul style="list-style-type: none"> May be ignored or missed by motorists when much signage is present 	
Regulatory	✓	✓	✓	<ul style="list-style-type: none"> When necessary to inform road users of traffic laws or regulations 	<ul style="list-style-type: none"> Encourages reduced speeds Reduces incident potential 	<ul style="list-style-type: none"> May be ignored or missed by motorists when much signage is present 	
Guide/information	✓	✓		<ul style="list-style-type: none"> When off-site detours are being used When advanced notice is necessary for road users to choose an alternate route 	<ul style="list-style-type: none"> Provides alternate route and work zone information to road users 	<ul style="list-style-type: none"> May be ignored or missed by motorists when much signage is present 	

Changeable message signs (CMS)	✓	✓		<ul style="list-style-type: none"> When work zone information is subject to frequent changes Projects with multiple construction stages/phasing Detour routes with capacity available 	<ul style="list-style-type: none"> Effective way to communicate real-time information to road users Allows road users to adjust travel plans based on information Draws special attention to key information 	<ul style="list-style-type: none"> May be ignored or missed by motorists when much signage is present Additional cost 	<ul style="list-style-type: none"> Used to supplement normal static work zone signs Needs a means of controlling/updating signs, such as a TMC
Arrow panels	✓	✓	✓	<ul style="list-style-type: none"> Lane closures, particularly on high-speed roadways 	<ul style="list-style-type: none"> Assists motorists in navigating and merging through and around the work zone Effective method to alert motorists of lane closures Highly visible Encourages smooth merging behavior 	<ul style="list-style-type: none"> Additional cost 	<ul style="list-style-type: none"> Used to supplement conventional traffic control devices
Channelizing devices	✓	✓	✓	<ul style="list-style-type: none"> All work zone types When changes to the road configuration or potential hazards necessitate their use 	<ul style="list-style-type: none"> Helps to direct road users through the work zone Delineates potential work zone hazards Easy to set-up 	<ul style="list-style-type: none"> Errant vehicles are not prevented for intruding beyond these devices 	
Temporary pavement markings	✓	✓	✓	<ul style="list-style-type: none"> Long project duration When additional markings are necessary to guide road users through the work zone 	<ul style="list-style-type: none"> Provides guidance and information for road users through the work zone 	<ul style="list-style-type: none"> Visibility of the markings may be limited by weather conditions and debris 	<ul style="list-style-type: none"> Need to obliterate obsolete markings to minimize possibility of misleading road users
Flaggers and uniformed traffic control officers		✓		<ul style="list-style-type: none"> Low traffic volume projects Rural areas One-lane, two-way operations 	<ul style="list-style-type: none"> Helps to alert road users to the presence of work operations 	<ul style="list-style-type: none"> Reduces safety for road workers 	<ul style="list-style-type: none"> In conjunction with intermittent closure

Temporary traffic signals	✓	✓	✓	<ul style="list-style-type: none"> Where the work zone operations disrupt normal traffic patterns One-lane, two-way operations For longer-term projects When additional capacity is needed 	<ul style="list-style-type: none"> Helps improve ramp and/or detour capacity Improves traffic flow through and near the work zone Improves safety 	<ul style="list-style-type: none"> Changes traffic patterns on the cross road Cost 	<ul style="list-style-type: none"> Signal installation should be warranted
Lighting devices		✓	✓	<ul style="list-style-type: none"> When night work is being conducted Long project duration High traffic volume 	<ul style="list-style-type: none"> Enhances visibility of devices and delineations in the work zone Improves worker safety Guides road users through the work zone particularly during night and under adverse conditions 	<ul style="list-style-type: none"> May be distracting to motorists 	

Project Coordination, Contracting and Innovative Construction Strategies

Project coordination

Coordination with other projects	✓			<ul style="list-style-type: none"> May be beneficial to any project 	<ul style="list-style-type: none"> Reduces motorist delay Minimizes impacts to potentially affected businesses and communities Reduces exposure time to road work May increase efficiencies 	<ul style="list-style-type: none"> May be difficult to identify potential projects to coordinate with 	<ul style="list-style-type: none"> Routine agency meetings may address coordination at the project level, corridor level, district region level, and at the State level
Utilities coordination	✓			<ul style="list-style-type: none"> May be beneficial to any project 	<ul style="list-style-type: none"> Reduces construction duration and delay May reduce number of work zones and exposure to road work 	<ul style="list-style-type: none"> May be difficult to identify potential projects to coordinate with 	<ul style="list-style-type: none"> Development of training, education, and auditing standards for utility work can further minimize traffic impacts

Right-of-way coordination	✓			<ul style="list-style-type: none"> May be beneficial to any project 	<ul style="list-style-type: none"> Reduces construction duration and delay 	<ul style="list-style-type: none"> May be difficult to identify coordination opportunities 	<ul style="list-style-type: none"> Considering right-of-way issues early in project development can minimize traffic impacts
Coordination with other transportation infrastructure	✓			<ul style="list-style-type: none"> May be beneficial to any project 	<ul style="list-style-type: none"> Minimizes potential impacts on other transportation facilities 	<ul style="list-style-type: none"> May be difficult to identify coordination opportunities 	
Contracting strategies							
Design-build	✓			<ul style="list-style-type: none"> High traffic volume When project acceleration is desirable 	<ul style="list-style-type: none"> Shorter project duration Less traffic impacts May reduce administrative costs Provides a single point of contact for design and construction issues Allows for flexibility for innovative designs, materials, and construction techniques 	<ul style="list-style-type: none"> May pay more for the actual construction 	
A+B bidding	✓			<ul style="list-style-type: none"> High traffic volume Where significant reduction in capacity is anticipated Projects with significant impacts to traffic flow, businesses, and/or the community 	<ul style="list-style-type: none"> Reduces construction time Less traffic impacts 	<ul style="list-style-type: none"> May pay more for the work Potential for disagreements Issues must be resolved quickly 	<ul style="list-style-type: none"> If a project has significant issues with utilities, time-based bidding may be difficult; it may be possible to separate that portion of the project

Incentive/ disincentive clauses	✓			<ul style="list-style-type: none"> ▪ High traffic volume ▪ Where significant reduction in capacity is anticipated ▪ Projects with significant impacts to traffic flow, businesses, and/or the community ▪ When an out-of-service facility needs to be replaced ▪ No good alternate routes available 	<ul style="list-style-type: none"> ▪ Reduces construction time ▪ Less traffic impacts ▪ Early project completion may result in significant cost savings 	<ul style="list-style-type: none"> ▪ Potential arguments for time extensions ▪ Issues must be resolved quickly 	<ul style="list-style-type: none"> ▪ If a project has significant issues with utilities, time-based bidding may be difficult; it may be possible to separate that portion of the project
Lane rental	✓			<ul style="list-style-type: none"> ▪ Urban area ▪ High traffic volume ▪ For paving freeways ▪ No good alternate routes available 	<ul style="list-style-type: none"> ▪ Less traffic impacts ▪ Lanes only closed for short periods, when truly needed 	<ul style="list-style-type: none"> ▪ Requires careful timekeeping ▪ Potential for disagreements 	
ACC Innovative construction techniques (precast members, rapid cure materials)	✓			<ul style="list-style-type: none"> ▪ High traffic volume ▪ Where traffic restrictions need to be minimized ▪ When work activities need to be completed during night or weekend periods 	<ul style="list-style-type: none"> ▪ Reduces construction time ▪ Less traffic impacts 		

Public Information & Outreach Strategies

Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration	Potential Pros	Potential Challenges	Other Considerations
Public Awareness Strategies							
Brochures and mailers	✓	✓	✓	<ul style="list-style-type: none"> ▪ Urban area ▪ Long project duration ▪ Alternate travel modes available ▪ High public exposure ▪ Significant business impacts ▪ Significant residential impacts 	<ul style="list-style-type: none"> ▪ Condensed format of brochures lends itself to brief, high-impact messages ▪ Brochures have a relatively long shelf life, which is useful for projects of long duration ▪ Low cost ▪ Easy to distribute 	<ul style="list-style-type: none"> ▪ Information (e.g., dates of road closures) may change and not be reflected in the printed materials ▪ Often targets local motorists only 	<ul style="list-style-type: none"> ▪ Used in conjunction with other elements in the TMP ▪ Most useful if it gives people an alternative to driving alone through the work zone – transit, ridesharing, alternate route
Press releases/media alerts	✓	✓	✓	<ul style="list-style-type: none"> ▪ Large projects ▪ Projects with multiple phases/ construction stages ▪ High public exposure ▪ Significant business impacts ▪ Significant residential impacts 	<ul style="list-style-type: none"> ▪ Cost effective if it uses free publicity to inform 	<ul style="list-style-type: none"> ▪ Often targets local motorists only 	<ul style="list-style-type: none"> ▪ For larger projects, announcements may include project start ups, periodic progress reports, and major traffic pattern changes
Paid advertisements	✓	✓	✓	<ul style="list-style-type: none"> ▪ Alternate routes available ▪ High public exposure ▪ Significant business impacts ▪ Significant 	<ul style="list-style-type: none"> ▪ Gives travelers advanced warning to plan for delays or alternate routes ▪ Covers a large or multi-jurisdictional area 	<ul style="list-style-type: none"> ▪ Requires advanced planning ▪ Additional cost ▪ May only target local motorists ▪ Newspaper 	<ul style="list-style-type: none"> ▪ Advance planning prior to the start of construction is essential to develop and schedule the needed advertisements

				residential impacts	<ul style="list-style-type: none"> Reinforces public awareness of the project Can reach many people at one time 	readers may skip over ads	
Public information center	✓	✓	✓	<ul style="list-style-type: none"> Urban area Long project duration Projects with multiple phases/ construction stages High public exposure Significant business impacts Significant residential impacts 	<ul style="list-style-type: none"> Single, centralized access point to information about project Provides direct access to information and people to talk to about the project 	<ul style="list-style-type: none"> Additional cost of staffing and leasing office space and equipment 	<ul style="list-style-type: none"> Project is localized Construction zone is near major activity centers Plan to have an information hotline Center located near construction
Telephone hotline	✓	✓	✓	<ul style="list-style-type: none"> Urban area Long project duration Projects with multiple phases/ construction stages Detour routes available Alternate travel modes available High public exposure If frequent lane and/or ramp closures are expected 	<ul style="list-style-type: none"> Provides commuters with up-to-date traffic/ construction information and demand management information Information can be accessed whenever it is needed May be easy to update 	<ul style="list-style-type: none"> Pre-recorded messages may not contain all the information that travelers need Needs to be accurate information, otherwise the information is not credible 	<ul style="list-style-type: none"> Part of incident management Can include prerecorded messages and/or real time interactive response information
Planned lane closure web site	✓	✓	✓	<ul style="list-style-type: none"> Long project duration 	<ul style="list-style-type: none"> Information can be posted for the 	<ul style="list-style-type: none"> The web site would need to be publicized for 	<ul style="list-style-type: none"> This web site is usually done for the

				<ul style="list-style-type: none"> ▪ Projects with multiple phases/ construction stages ▪ Detour routes available ▪ High public exposure ▪ Project includes lane closures 	construction season	people to use	entire region or State
Project web site	✓	✓	✓	<ul style="list-style-type: none"> ▪ Urban area ▪ Long project duration ▪ High public exposure ▪ Project and traffic information changes frequently 	<ul style="list-style-type: none"> ▪ Single access point to find out all the information for a particular project ▪ May be easy to update 	<ul style="list-style-type: none"> ▪ Web site would need to be maintained for effectiveness 	<ul style="list-style-type: none"> ▪ Includes both static and/or real-time interactive information ▪ Audience needs to be made aware of the web site ▪ Cost will vary based on the complexity of the site
Public meetings/hearings	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High public exposure ▪ Significant business impacts ▪ Significant residential impacts 	<ul style="list-style-type: none"> ▪ Community and stakeholders can feel informed and involved in the project ▪ Opportunity to find out the information that stakeholders need 	<ul style="list-style-type: none"> ▪ Stakeholder may feel frustrated if they feel that their inputs were not considered 	<ul style="list-style-type: none"> ▪ Need to be wary of making "empty promises"
Community task forces	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High public exposure ▪ Significant business impacts ▪ Significant residential impacts 	<ul style="list-style-type: none"> ▪ Gets buy-in from different stakeholders 	<ul style="list-style-type: none"> ▪ Requires coordination beforehand ▪ May not be cost effective 	<ul style="list-style-type: none"> ▪ Best if developed early in planning for the project and continue meeting through design, construction, and project assessment
Coordination with	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project 	<ul style="list-style-type: none"> ▪ Travelers at major 		<ul style="list-style-type: none"> ▪ Requires advanced

media/schools/ businesses/ emergency services				<ul style="list-style-type: none"> ▪ duration ▪ High crash rate ▪ High public exposure ▪ Significant business impact ▪ Significant residential impacts 	activity centers can plan in advance to take alternate routes		<ul style="list-style-type: none"> ▪ planning and coordination with these activity centers ▪ Proximity to schools
Work zone education and safety campaigns	✓	✓	✓	<ul style="list-style-type: none"> ▪ High traffic volume ▪ Long project duration ▪ Projects with multiple phases/ construction stages ▪ High crash rate 	<ul style="list-style-type: none"> ▪ May reduce the number of fatalities and injuries in work zones ▪ Encourages general safety when driving around work zones ▪ Help travelers know what signs mean and what resources there are for advanced planning 	<ul style="list-style-type: none"> ▪ Results are harder to quantify 	
Work zone safety highway signs		✓	✓	<ul style="list-style-type: none"> ▪ High traffic volume ▪ Long project duration ▪ Projects with multiple phases/ construction stages ▪ High crash rate 	<ul style="list-style-type: none"> ▪ Increases driver awareness to work zone safety concerns ▪ May encourage speed reduction 	<ul style="list-style-type: none"> ▪ Highway signs should be maintained – if there is no work zone, signs should be taken down 	
Rideshare promotions	✓			<ul style="list-style-type: none"> ▪ Urban area ▪ Long project duration ▪ High expectation of delay ▪ Where advantages to carpools exist 	<ul style="list-style-type: none"> ▪ May reduce the number of vehicles traveling through the work zone ▪ Access to HOV lanes (if that exists) ▪ May reduce delays 	<ul style="list-style-type: none"> ▪ Cost of promotion and initial coordination effort ▪ Need enough participation in order to make a 	<ul style="list-style-type: none"> ▪ Works with large employment centers

				(parking cost reductions, HOV lanes, HOV bypass lanes)		difference	
Visual information (videos, slides, presentations) for meetings and web	✓	✓	✓	<ul style="list-style-type: none"> ▪ Projects with multiple phases/ construction stages ▪ High public exposure ▪ Significant impact on businesses ▪ Significant residential impacts 	<ul style="list-style-type: none"> ▪ Increases community awareness and understanding of the project 	<ul style="list-style-type: none"> ▪ Publicity needed for travelers to visit the web site and view the visual information ▪ May be expensive to produce 	<ul style="list-style-type: none"> ▪ Supports public meetings, information center, or press releases ▪ In conjunction with project or agency web site ▪ Requires preparation, up front planning

Motorist Information Strategies

Traffic radio	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ Projects with multiple phases/ construction stages ▪ Detour routes available ▪ Alternate travel modes available ▪ High public exposure 	<ul style="list-style-type: none"> ▪ Can reach many commuters over a wide area ▪ Little to no cost ▪ Targets people who are likely to use the information 	<ul style="list-style-type: none"> ▪ "Old" information is no longer useful 	<ul style="list-style-type: none"> ▪ Coverage more likely for major projects
Changeable message signs (CMS)	✓	✓	✓	<ul style="list-style-type: none"> ▪ Projects with multiple phases/ construction stages ▪ Alternate routes available ▪ When work zone conditions are subject to frequent or on- 	<ul style="list-style-type: none"> ▪ Provides real time information to motorists ▪ Gives public advance warning to make decisions ▪ Provides information to motorists directly affected by the 	<ul style="list-style-type: none"> ▪ Needs to be accurate information, otherwise the information is not credible 	<ul style="list-style-type: none"> ▪ Needs means of controlling/updating messages, such as a TMC ▪ Supports incident management ▪ Need to keep information up to date and useful

				going changes (e.g., lane and/or ramp closures expected)	project		
Temporary motorist information signs	✓	✓	✓	<ul style="list-style-type: none"> All situations – Advanced warning/public information and signage is generally always beneficial 	<ul style="list-style-type: none"> Provides information to motorists Warns motorists of potential hazards 	<ul style="list-style-type: none"> If project is delayed, sign is wrong 	<ul style="list-style-type: none"> Need to keep information up to date
Dynamic speed message sign		✓	✓	<ul style="list-style-type: none"> High crash rate 	<ul style="list-style-type: none"> Enhances safety by reducing speeding and speed variability 		<ul style="list-style-type: none"> May not be effective without enforcement May not be effective over a long work zone length and duration
Highway advisory radio (HAR)	✓	✓		<ul style="list-style-type: none"> When longer, more detailed messages than can be provided using signage are necessary Alternate routes available Long project duration Projects with multiple phases/ construction stages Frequent lane and/or ramp closures expected 	<ul style="list-style-type: none"> Provides current information directly to motorists Allows for longer, more detailed messages regarding a work zone incident Promotes diversion of traffic to alternate routes when appropriate Traffic patterns may resume to normal patterns more quickly Easy to access 	<ul style="list-style-type: none"> Limited range Typically low utilization rates 	<ul style="list-style-type: none"> Signs are used to inform road users of the HAR radio Information needs to be current/real-time Newer technologies based on in-vehicle navigation systems and cell phones are replacing HAR usage Motorists may not be aware of the HAR
Highway information network (web-based)	✓		✓	<ul style="list-style-type: none"> Urban area Long project duration 	<ul style="list-style-type: none"> Provides helpful information to motorists in one place Convenient way to share information 	<ul style="list-style-type: none"> Requires advanced planning 	<ul style="list-style-type: none"> Information should be up-to-date

					among stakeholders		
511 traveler information systems (wireless, handhelds)	✓	✓	✓	<ul style="list-style-type: none"> ▪ Urban area ▪ Long project duration ▪ Detour routes available ▪ Alternate travel modes available 	<ul style="list-style-type: none"> ▪ Provides motorists with current information ▪ Information can be accessed whenever it is needed ▪ May be easy to update 	<ul style="list-style-type: none"> ▪ Can be distracting to the driver if used on the road ▪ Road users must have these personal devices 	<ul style="list-style-type: none"> ▪ General public awareness of 511 is needed
Freight travel information	✓	✓	✓	<ul style="list-style-type: none"> ▪ Urban area ▪ Long project duration ▪ Moderate to high percentage of trucks traveling through the work zone 	<ul style="list-style-type: none"> ▪ Provides useful information to freight stakeholders ▪ May improve safety (e.g., reduce rear end collisions) by raising awareness before a work zone 	<ul style="list-style-type: none"> ▪ Additional cost of coordination and disseminating information to select group 	<ul style="list-style-type: none"> ▪ Work with the freight community to find out what information would be helpful ▪ Can be provided to a central location (e.g., trucking company) or to truckers approaching work zone via CB radio
Transportation management center (TMC)	✓	✓	✓	<ul style="list-style-type: none"> ▪ Project located on a freeway in an urban area ▪ Long project duration ▪ Projects with multiple phases/ construction stages ▪ Delay highly expected for the project ▪ High public exposure 	<ul style="list-style-type: none"> ▪ Have access to real-time information on traffic and incidents and relay that to the traveling public through different media outlets 	<ul style="list-style-type: none"> ▪ Costly to build and operate ▪ Detectors may be difficult to maintain while the work zone is taking place 	

Transportation Operations Strategies

Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration	Potential Pros	Potential Challenges	Other Considerations
Demand Management Strategies							
Transit service improvements	✓			<ul style="list-style-type: none"> Transit exists with capacity and frequency Where transit use is likely to be adequate to make the improvements worthwhile 	<ul style="list-style-type: none"> Shifts some demand from highway while it is under construction 	<ul style="list-style-type: none"> Requires advance planning and coordination 	<ul style="list-style-type: none"> In conjunction with transit incentives
Transit incentives	✓			<ul style="list-style-type: none"> Where adequate transit routes and frequencies exist that serve major origins and destinations for motorists that would normally drive through the work zone if transit options were not available 	<ul style="list-style-type: none"> Shifts some demand from highway while it is under construction 	<ul style="list-style-type: none"> Requires advance planning and coordination 	<ul style="list-style-type: none"> In conjunction with transit service improvements
Shuttle services	✓			<ul style="list-style-type: none"> Long project duration, High expectation for delay, Large amounts of similar origins and destinations 	<ul style="list-style-type: none"> Reduces vehicle trips and traffic in the work zone 	<ul style="list-style-type: none"> Can be costly 	<ul style="list-style-type: none"> Service would need to provide a benefit in terms of reduced travel time, travel and parking costs, etc. to attract users, Providing express shuttles from a few key locations may increase use
Ridesharing/ carpooling incentives	✓			<ul style="list-style-type: none"> Long project duration, High expectation for delay, Few or no alternate routes, Where ridesharing has the potential to reduce travel volumes , Commuter traffic is significant 	<ul style="list-style-type: none"> May reduce vehicle trips and traffic 	<ul style="list-style-type: none"> Need many people participating in order for it to be cost effective 	<ul style="list-style-type: none"> In conjunction with HOV lanes and/or parking management, Major activity and employment centers exist and can be targeted

Park-and-ride promotion	✓			<ul style="list-style-type: none"> Long project duration, High expectation for delay, Alternative travel modes are available, Good parking sites are available, Commuter traffic is significant 	<ul style="list-style-type: none"> Can be very cost-effective to commuters, May reduce the number of vehicles traveling through the work zone 		<ul style="list-style-type: none"> In conjunction with rideshare programs, transit service available at lot, HOV lanes, and/or parking management, Good promotion of program is needed
High-occupancy vehicle (HOV) lanes	✓			<ul style="list-style-type: none"> Urban area, Long project duration, High traffic volume, High expectation for delay, Alternative travel modes are available 	<ul style="list-style-type: none"> Better roadway efficiency (move more people per lane) 	<ul style="list-style-type: none"> Needs a high amount of similar origins and destinations and/or incentives, Taking a lane for HOV is likely to be controversial 	<ul style="list-style-type: none"> In conjunction with HOV bypass and ramp metering, express transit, park and ride, and other demand management strategies, Enforcement needed
Toll/congestion pricing	✓			<ul style="list-style-type: none"> Project is on a freeway, High traffic volume, Long project duration, Significant reductions in capacity are anticipated 	<ul style="list-style-type: none"> Reduces peak-period vehicle trips 	<ul style="list-style-type: none"> Lane(s) will need to be temporarily set aside 	<ul style="list-style-type: none"> Enforcement needed
Ramp metering	✓	✓		<ul style="list-style-type: none"> Long project duration Project is on a freeway There are a number of entrance ramps near the work zone 	<ul style="list-style-type: none"> Maintains safe and smooth freeway operations Controls entrance of vehicles to the roadway 	<ul style="list-style-type: none"> May cause vehicles to idle too long May result in ramp queues on local streets Cost 	<ul style="list-style-type: none"> Queues onto local streets may cause a problem depending on their extent Can be used during peak periods or continuously Secondary effect of diverting traffic to alternate routes
Parking supply management	✓			<ul style="list-style-type: none"> Urban area Long project duration Alternate travel modes are available Limited supply of on-site and off-site parking lots 	<ul style="list-style-type: none"> Cost-effective Decreases single occupancy vehicle use when implemented in conjunction with other elements and incentives 	<ul style="list-style-type: none"> Difficult to implement unless the responsible agency owns the lot and/or parking supply is limited 	<ul style="list-style-type: none"> In conjunction with other demand management strategies

Variable work hours	✓			<ul style="list-style-type: none"> ▪ Long project duration ▪ High traffic volume ▪ Employment and activity center along corridor and alternate routes ▪ Commuter traffic is significant ▪ Significant traffic increases during peak hours 	<ul style="list-style-type: none"> ▪ Distributes peak hour commuting over longer time period, thereby reducing travel demand during the peak periods 	<ul style="list-style-type: none"> ▪ Effort to convince employers of the benefits 	<ul style="list-style-type: none"> ▪ Needs to be supported by businesses and community
Telecommuting	✓			<ul style="list-style-type: none"> ▪ Urban area ▪ High traffic volume ▪ Long project duration ▪ High expectation for delay ▪ When significant reduction in capacity anticipated 	<ul style="list-style-type: none"> ▪ Reduces vehicle trips 	<ul style="list-style-type: none"> ▪ Effort to convince employers of the benefits ▪ May effect businesses, such as restaurants that are near employment centers 	<ul style="list-style-type: none"> ▪ Needs to be supported by businesses and community
Corridor/Network Management Strategies							
Signal timing/coordination improvements	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ High traffic volume ▪ When additional capacity is needed through the intersection in the work zone or on nearby roadways during construction 	<ul style="list-style-type: none"> ▪ Increases throughput of the roadway ▪ Improves traffic flow ▪ Optimizes intersection capacity ▪ Reduces frequent stops ▪ Improves driver safety by smoothing the flow through work zone bottlenecks 	<ul style="list-style-type: none"> ▪ Cost of estimating new saturation flow rates and demand 	<ul style="list-style-type: none"> ▪ Estimating both potential demand and capacity constrained volumes for obtaining the optimal coordination

Temporary traffic signals	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High traffic volume ▪ High expectation for delay ▪ When safety needs to be improved for new (temporary) turning movements through the work zone ▪ When additional capacity is needed 	<ul style="list-style-type: none"> ▪ Improves traffic flow through and near the work zone ▪ Helps achieve re-routing of traffic from project location ▪ Improves driver safety by separating conflicting movements ▪ Improves worker safety 	<ul style="list-style-type: none"> ▪ Cost of signal design, placement, and operation ▪ Changes traffic patterns on cross-roads 	<ul style="list-style-type: none"> ▪ Signals should be warranted as per the agency's signal warrant requirements
Street/ intersection improvements	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ High expectation for delay ▪ When work zone results in major congestion that can be alleviated by street/ intersection improvements 	<ul style="list-style-type: none"> ▪ Provides increased capacity ▪ Improves motorist safety 	<ul style="list-style-type: none"> ▪ Cost ▪ Time to design and construct 	<ul style="list-style-type: none"> ▪ Need to plan ahead to complete these before the main roadwork
Bus turnouts	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ High occurrence of bus traffic and stops 	<ul style="list-style-type: none"> ▪ Improves traffic flow and safety by minimizing traffic conflicts 	<ul style="list-style-type: none"> ▪ Cost ▪ Time to design and construct 	<ul style="list-style-type: none"> ▪ Provision of gaps and sight distance for the buses to re-enter the traffic stream
Turn restrictions	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ High expectation for delay ▪ When turning vehicles are causing unreasonable delays or crash potential in the work zone ▪ When the geometric design or the available sight distance at the intersection does not adequately provide for a safe turning movement 	<ul style="list-style-type: none"> ▪ Simple, cost-effective ▪ Increases roadway capacity ▪ Reduces potential congestion and delays ▪ Improves safety 	<ul style="list-style-type: none"> ▪ Additional delays for turning vehicles ▪ Turning vehicles need to re-route 	

Parking restrictions	✓			<ul style="list-style-type: none"> ▪ Long project duration ▪ When significant reduction in capacity anticipated ▪ When traffic demand at the location can be reduced by parking restrictions ▪ When parking spots can be converted to an additional travel lane ▪ When restricting parking spots can improve work zone access and quicken work zone activity 	<ul style="list-style-type: none"> ▪ Simple, cost-effective solution ▪ Increases roadway capacity ▪ Reduces traffic conflicts ▪ Quickens work zone activity by improving access ▪ Reduces duration of the work zone 	<ul style="list-style-type: none"> ▪ Affects local parking ▪ Will need flaggers if parking is converted to travel lane ▪ Will need barricades if parking is closed, requiring additional setup time and cost 	<ul style="list-style-type: none"> ▪ Impact to local businesses must be considered ▪ May need to improve intersection geometrics to accommodate additional or relocated lanes ▪ Can limit use to peak travel periods
Truck/heavy vehicle restrictions	✓	✓		<ul style="list-style-type: none"> ▪ Projects with high truck volume ▪ When significant reduction in capacity anticipated ▪ When the location has heavy truck traffic but also has potential alternate truck routes ▪ When capacity/safety concerns exist for truck movements through work zone ▪ Passenger cars are expected to be significantly delayed due to truck traffic 	<ul style="list-style-type: none"> ▪ Improves passenger car flow through the work zone by removing trucks from the traffic stream 	<ul style="list-style-type: none"> ▪ Provision of an alternate truck route may adversely affect other traffic or roads ▪ Requires additional signage/personnel to enforce truck restrictions 	<ul style="list-style-type: none"> ▪ Availability and sustainability of alternate routes for the trucks must be considered ▪ Federal, State, and/or local ordinances that govern truck traffic access must be considered ▪ Appropriate design and geometric concerns related to trucks would need to be addressed ▪ Noise and business impacts from use of detour route may need to be considered

Separate truck lanes	✓	✓		<ul style="list-style-type: none"> ▪ Long-duration projects with high truck volume ▪ High expectation for delay ▪ When significant reduction in capacity anticipated ▪ When capacity/safety concerns exist for truck movements through work zone ▪ Passenger cars are expected to be significantly delayed due to the trucks (e.g., areas with major inclines) 	<ul style="list-style-type: none"> ▪ Can increase capacity of the roadway 	<ul style="list-style-type: none"> ▪ Requires additional signage/personnel to enforce separate truck lane 	<ul style="list-style-type: none"> ▪ Design of the dedicated truck route ▪ State and/or local ordinances that govern truck traffic need to be considered ▪ If shoulder is used, may need to improve it first
Reversible lanes	✓			<ul style="list-style-type: none"> ▪ Where there are capacity limitations in the direction of travel and no alternate routes ▪ Long project duration ▪ Significant peaking of traffic ▪ Commuter traffic is significant 	<ul style="list-style-type: none"> ▪ Accommodates peak traffic flow 	<ul style="list-style-type: none"> ▪ Safety concerns ▪ Cost of positive separation and/or additional pavement markings and signs ▪ Confusing to infrequent road user 	<ul style="list-style-type: none"> ▪ Works well with commuter traffic ▪ For high speed roadways, a movable barrier system or other form of positive separation is typically used to separate and direct traffic
Dynamic lane closure system	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ Projects with multiple construction stages/phasing ▪ Moderate traffic volume and congestion ▪ When needed capacity can be gained ▪ When frequent lane closures are anticipated 	<ul style="list-style-type: none"> ▪ Enhances mobility and safety ▪ Controls vehicle merging at the approach ▪ Reduces vehicle conflicts ▪ Construction time can be reduced with additional contractor area 	<ul style="list-style-type: none"> ▪ Cost of dynamic message signs or other messaging devices is not available in-house 	<ul style="list-style-type: none"> ▪ Can be used in conjunction with reversible lane

Ramp metering	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ During mainline paving of basic freeway lanes where freeway demand needs to be metered to control congestion ▪ Project is on a freeway ▪ There are a number of entrance ramps near the work zone 	<ul style="list-style-type: none"> ▪ Maintains safe and smooth freeway operations ▪ Controls entry of vehicles to the roadway ▪ Improves safety by matching gaps between freeway and on-ramp vehicles ▪ May help spread traffic to other roads 	<ul style="list-style-type: none"> ▪ May result in ramp queues backing onto local streets ▪ Cost 	<ul style="list-style-type: none"> ▪ Potential impacts on local streets need to be considered before introducing ramp metering ▪ Various ramp metering strategies should be considered ▪ Can be used during peak periods or continuously
Temporary suspension of ramp metering	✓			<ul style="list-style-type: none"> ▪ At the end of a detour where it is advantageous to get traffic onto the freeway quickly 	<ul style="list-style-type: none"> ▪ Simple, cost-effective solution for improving traffic flow through the detour 	<ul style="list-style-type: none"> ▪ Can lead to a potential downstream freeway bottleneck 	<ul style="list-style-type: none"> ▪ Downstream freeway volumes must be evaluated before suspending ramp metering
Ramp closures	✓	✓	✓	<ul style="list-style-type: none"> ▪ High traffic volume ▪ If accelerated construction at the ramps is required ▪ Where work zone activity requires work space associated with the ramps ▪ Where freeway volumes at the ramp location have to be controlled ▪ When alternate ramps/routes are available close by 	<ul style="list-style-type: none"> ▪ Cost-effective ▪ Can pave/repair the full width of the ramp ▪ Better, faster construction ▪ Can provide work access within the work zone ▪ May improve traffic flow on the mainline ▪ Reduces crossroad congestion ▪ Easy to sign in rural areas 	<ul style="list-style-type: none"> ▪ Potential impact to business and community access ▪ Blocks traffic pattern and forces new traffic pattern ▪ Moves congestion elsewhere ▪ May have negative impact on local streets in high density locations 	<ul style="list-style-type: none"> ▪ It might affect motorist mobility adversely ▪ Impact to local businesses should be considered ▪ The strategy is inexpensive if only signs are used but will cost more if alternate route modifications are required ▪ Adequate driver information signs and clearly marked detour routes need to be provided
Railroad crossings controls		✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ When work zone stops and delays have potential of forcing vehicles to stop on railroad tracks 	<ul style="list-style-type: none"> ▪ Enhances motorist safety ▪ Enhances rail safety 	<ul style="list-style-type: none"> ▪ Cost 	<ul style="list-style-type: none"> ▪ Requires understanding on the traffic dynamics of the specific location ▪ State and/or local ordinances that govern railroad traffic control

Coordination with adjacent construction site(s)	✓			<ul style="list-style-type: none"> ▪ Whenever multiple work zone projects are in close proximity of each other or impact the same region 	<ul style="list-style-type: none"> ▪ Minimizes the combined impacts on road users ▪ Potential for cost savings to road users, community, and agency ▪ Addresses the need to maintain adequate capacity in the system ▪ Evaluates the complete city-wide street network for capacity needs rather than individual work zones ▪ Maintains system-wide mobility 	<ul style="list-style-type: none"> ▪ Complexity of coordinating adjacent work zones ▪ Cost 	<ul style="list-style-type: none"> ▪ Accommodate anticipated travel demand by not implementing work zones on parallel highways or complementary or alternate routes ▪ Requires good communication within and across various agencies ▪ Some work, such as utility work, may be done by other agencies
Work Zone Safety Management Strategies							
Speed limit reduction/ variable speed limits		✓	✓	<ul style="list-style-type: none"> ▪ Where significant reduction in capacity is anticipated ▪ When turning/merging conflicts exist that cannot be otherwise resolved ▪ When there are lane or shoulder closures, traffic shifts, or other changes in geometry ▪ On detours where traffic volumes and conflicts are increased ▪ When work is adjacent to the traffic lane 	<ul style="list-style-type: none"> ▪ Enhances motorist and worker safety 	<ul style="list-style-type: none"> ▪ Traffic mobility ▪ Compliance with speed limit reductions is often poor 	<ul style="list-style-type: none"> ▪ Additional enforcement and/or increased penalties might be needed for motorist compliance with the reduced speed limits ▪ Can be continuous, or intermittent (e.g., only when workers are present)

Temporary traffic signals	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High traffic volume ▪ When safety needs to be improved (e.g., for temporary turning movements) ▪ When additional capacity is needed on a temporary basis during construction ▪ When high delays are expected on ramps/detour routes ▪ One-lane, two-way operations 	<ul style="list-style-type: none"> ▪ Improves worker safety by replacing flaggers with temporary signals ▪ Improves driver safety by separating conflicting movements ▪ May increase capacity 	<ul style="list-style-type: none"> ▪ Cost of signal design, placement, and operation ▪ Changes traffic patterns on cross-roads 	<ul style="list-style-type: none"> ▪ Signals should be warranted as per the agency's signal warrant requirements ▪ May lead to re-routing of traffic from project location
Temporary traffic barrier		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ When long-term work zone activity is next to the travel lanes ▪ When high-speed opposing travel lanes are present 	<ul style="list-style-type: none"> ▪ Enhances safety to workers by the physical separation of the motorists from work zone ▪ Enhances motorist safety by physically separating traffic traveling in opposite directions 	<ul style="list-style-type: none"> ▪ Barrier system reduces saturation flow rates of travel lanes 	<ul style="list-style-type: none"> ▪ Temporary barrier usage should be based on length of the work zone project, volume and speeds in the location, and agency practices ▪ Screens may be mounted on the top of temporary traffic barriers to discourage gawking and reduce headlight glare
Movable traffic barrier systems	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ Projects with multiple construction stages/phasing ▪ High traffic volume ▪ When roadway capacity can be gained ▪ Roadways with capacity limitations in the direction of travel and no alternate routes ▪ When repeated barrier shifts are needed ▪ When frequent lane closures are anticipated ▪ When reversible lanes are used 	<ul style="list-style-type: none"> ▪ Rapid and safe reconfiguration of the traffic barrier system ▪ Can provide additional space for the contractor to work ▪ Enhances motorist safety by clearly delineating direction of travel 	<ul style="list-style-type: none"> ▪ Cost ▪ Labor for movement of barrier 	<ul style="list-style-type: none"> ▪ More effective when there is a majority commuter traffic and/or fluctuating demand on the roadway ▪ Shift distance must be constant

Crash-cushions		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High traffic volume ▪ High crash rate ▪ When temporary hazards (e.g., work zone vehicles and other work zone-related barriers) are in close proximity to motorists 	<ul style="list-style-type: none"> ▪ Protects a temporary hazard ▪ Prevents vehicle intrusion into the work space ▪ Significantly enhances safety of both motorist and worker 	<ul style="list-style-type: none"> ▪ Cost ▪ Space and labor for placement 	<ul style="list-style-type: none"> ▪ If cushion is struck frequently, replacement and repair costs may be significant
Temporary rumble strips		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High crash rate ▪ When the work zone occurs on an open stretch of highway where drivers may tend to lose alertness ▪ Where the traffic pattern has been changed ▪ Where there is alternating one-way traffic with a temporary traffic signal 	<ul style="list-style-type: none"> ▪ Alerts motorists about the presence of work zone ▪ Alerts motorists to change in traffic pattern 	<ul style="list-style-type: none"> ▪ Cost ▪ Rumble strips are not as effective in urban settings and are not appropriate for residential areas because of the noise 	<ul style="list-style-type: none"> ▪ Pavement needs to be prepared for laying rumble strips ▪ Implementation of rumble strips must be evaluated on a project-to-project basis
Intrusion alarms		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High crash rate ▪ In locations where worker safety is of particular concern ▪ Areas where sight distance is limited (e.g., after curves) 	<ul style="list-style-type: none"> ▪ Wakens dozing or un alert drivers, who are a cause of roadway and work zone crashes ▪ Provides workers with critical reaction time needed to move out of harms way 	<ul style="list-style-type: none"> ▪ Cost ▪ Can startle the errant motorist and also other adjacent vehicles 	<ul style="list-style-type: none"> ▪ Unreliable and/or frequent false alarms may cause workers to ignore the warning sounds
Warning lights		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High crash rate ▪ Where attention needs to be drawn to critical information that can lead to potentially severe consequences if missed 	<ul style="list-style-type: none"> ▪ Alerts motorists to critical information that can increase both motorist and worker safety 	<ul style="list-style-type: none"> ▪ Cost ▪ Space and labor for placement 	<ul style="list-style-type: none"> ▪ Must be used smartly so that motorists will not ignore the lights ▪ State and/or local ordinances that govern signage must be considered

Automated Flagger Assistance Devices (AFADs)			✓	<ul style="list-style-type: none"> ▪ High crash rate ▪ Where flaggers are needed ▪ Short-term lane closures 	<ul style="list-style-type: none"> ▪ Improves worker safety by removing worker from the roadway 	<ul style="list-style-type: none"> ▪ Cost 	
Project task force/committee		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High public exposure/traffic volume ▪ High business impacts ▪ High residential impacts ▪ In locations where worker and motorist safety are of particular concern 	<ul style="list-style-type: none"> ▪ Develops solutions to safety and traffic flow issues ▪ Improves worker and motorist safety due to trained and responsible persons in-charge 	<ul style="list-style-type: none"> ▪ Cost of training ▪ Team dynamics where no one takes responsibility for a particular job 	<ul style="list-style-type: none"> ▪ Team members must be assigned specific tasks with specific objectives to achieve overall safety during the project
Construction safety supervisors/inspectors		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ In locations where worker and motorist safety are of particular concern ▪ May be applicable to any work zone 	<ul style="list-style-type: none"> ▪ Improves worker and motorist safety due to trained and responsible person in-charge 	<ul style="list-style-type: none"> ▪ Cost of training 	<ul style="list-style-type: none"> ▪ In larger projects more than one person might be needed, while in smaller projects the safety supervisor may have other responsibilities
Road safety audits		✓	✓	<ul style="list-style-type: none"> ▪ May be performed during any or all stages of a project and on existing roads 	<ul style="list-style-type: none"> ▪ Improves worker and motorist safety due to upfront identification of potential safety hazards for remediation 	<ul style="list-style-type: none"> ▪ Cost and time to perform audit 	
TMP monitor/inspection team	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ Projects with multiple construction stages/phasing ▪ When congestion is a concern ▪ In locations where worker and motorist safety are of particular concern 	<ul style="list-style-type: none"> ▪ Improves worker and motorist safety due to trained and responsible person in-charge ▪ Aids in identifying whether the TMP is effective and if changes are needed to improve safety and mobility ▪ Provides useful data for improving future TMPs 	<ul style="list-style-type: none"> ▪ Cost of training 	

Team meetings		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ Where large projects with complex traffic conditions are present 	<ul style="list-style-type: none"> ▪ Improves worker and motorist safety 	<ul style="list-style-type: none"> ▪ Cost and time involved 	<ul style="list-style-type: none"> ▪ Team dynamics may be challenging ▪ Meetings should be regularly held to be effective
Project on-site safety training			✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ In locations where worker and motorist safety are of particular concern 	<ul style="list-style-type: none"> ▪ Improves worker safety due to the clear understanding on safety procedures and specific risks associated with the project by all workers 	<ul style="list-style-type: none"> ▪ Cost of safety training for all personnel 	<ul style="list-style-type: none"> ▪ Such trainings must be conducted periodically during the project life
Safety awards/incentives		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ In locations where worker and motorist safety are of particular concern 	<ul style="list-style-type: none"> ▪ Provides an alert work force that is proactively weeding out safety problems 	<ul style="list-style-type: none"> ▪ Dissention among workers due to not receiving awards 	<ul style="list-style-type: none"> ▪ Incentives and awards must be judged in an acceptable, non-partial way
Windshield surveys	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ In locations where worker and motorist safety are of particular concern 	<ul style="list-style-type: none"> ▪ Identifies and addresses potential safety deficiencies ▪ Improves worker and motorist safety due to the proactive approach of identifying potential safety concerns ▪ May lead to improved traffic flow 	<ul style="list-style-type: none"> ▪ Cost and time to perform surveys 	<ul style="list-style-type: none"> ▪ Such inspections are typically conducted by designated agency staff in cooperation with project staff

Incident Management Strategies

ITS for traffic monitoring/management	✓	✓	✓	<ul style="list-style-type: none"> ▪ Can be applicable to all situations – to convey messages that communicate accurate, timely, and pertinent information to motorists about prevailing and anticipated traffic conditions ▪ Long project duration ▪ Presence of permanent ITS deployment and/or TMC ▪ High expected delay ▪ Projects with multiple construction stages/phasing ▪ Available detour routes exist ▪ Frequent lane and/or ramp closures expected ▪ Existing and potential high incident locations 	<ul style="list-style-type: none"> ▪ Provides real-time information to motorists ▪ Enables agency to manage the transportation system in and around the work zone in real-time ▪ Provides road users with information to divert or take other appropriate measures in response to an incident ▪ Informs drivers of speed limit reductions and enforcement activities ▪ Allows motorists to avoid hazards and delays, and respond properly to changing roadway conditions ▪ Improves driver guidance and creates safer operations 	<ul style="list-style-type: none"> ▪ Cost ▪ Needs accurate and reliable information that is dependable 	<ul style="list-style-type: none"> ▪ Needs means of communication to transmit data; communication options may be limited by geography or existing infrastructure ▪ Needs an existing or planned TMC or the establishment of one – TMC can be virtual/remote ▪ Supports incident management ▪ May reduce the impact on businesses created by construction activities and detours
Transportation management center (TMC)	✓	✓		<ul style="list-style-type: none"> ▪ Urban area ▪ Long project duration ▪ Projects with multiple construction stages/phasing ▪ High expected delay ▪ High public exposure/traffic volume 	<ul style="list-style-type: none"> ▪ Provides centralized coordination and management of incidents ▪ Enhances safety and mobility by the use of centralized approach to manage traffic 	<ul style="list-style-type: none"> ▪ Cost 	<ul style="list-style-type: none"> ▪ Existing TMC is usually used and is staffed by either contract staff and/or agency personnel

Surveillance [Closed-Circuit Television (CCTV), loop detectors, lasers, probe vehicles]	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ All situations - advanced warning/public information and signage is generally always beneficial 	<ul style="list-style-type: none"> ▪ Verifies the presence of traffic problems and incidents ▪ Helps to determine appropriate response to address an incident ▪ Contributes to saving both motorist and worker lives by aiding quick, appropriate response from local incident response agencies 	<ul style="list-style-type: none"> ▪ If project is delayed, sign is wrong 	<ul style="list-style-type: none"> ▪ Supports incident management ▪ Needs existing, planned, or virtual TMC ▪ Requires reliable and timely data ▪ Used to provide road user information
Helicopter for aerial surveillance	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ Projects with multiple construction stages/phasing ▪ Large, complex work zone project 	<ul style="list-style-type: none"> ▪ Aids in quick identification of traffic problems and incidents and quick response ▪ Enables excellent coverage of a wide area 	<ul style="list-style-type: none"> ▪ Cost ▪ More often the helicopter is media controlled rather than controlled by the project or incident agency 	<ul style="list-style-type: none"> ▪ Supports incident management ▪ Mostly achieved by cooperation and cost sharing with local media
Traffic Screens	✓	✓	✓	<ul style="list-style-type: none"> ▪ High traffic volumes ▪ When crash rate is high ▪ When headlight glare needs to be reduced ▪ When construction is immediately adjacent to traffic 	<ul style="list-style-type: none"> ▪ Reduces driver distraction ▪ Reduces rubbernecking, which can prevent congestion ▪ Reduces headlight glare 	<ul style="list-style-type: none"> ▪ Additional cost to set up and maintain screens 	

Mile-post markers		✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ May be applicable to any work zone 	<ul style="list-style-type: none"> ▪ Provides the motorist with the location information critical for getting quick help ▪ Aids in responding to incidents or breakdowns ▪ Helpful in managing traffic records and subsequent analysis 		<ul style="list-style-type: none"> ▪ With the E911 mandate and increasing use of cell phones this might not be necessary in the future for pin-pointing incident locations for 911 dispatchers ▪ May also be called location reference markers ▪ The spacing of the markers is important. Placing markers a tenth of a mile apart rather than a mile apart enables motorists to more easily reference their location. ▪ Location markers can be helpful in areas where people may become easily confused, such as at a complicated intersection.
Tow/freeway service patrol	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ High public exposure/traffic volume ▪ Where incidents can create significant delays ▪ Where shoulder width reductions or closures are expected ▪ Existing and potential high incident locations 	<ul style="list-style-type: none"> ▪ Reduces the time required to remove the incident from the roadway 	<ul style="list-style-type: none"> ▪ Cost of maintaining dedicated towing equipment and crew 	<ul style="list-style-type: none"> ▪ Parking areas and turnaround locations are needed for the tow trucks to ensure quick response times ▪ Towing services are generally contracted, while freeway service patrols are more likely to be publicly operated

Coordination with media	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ High public exposure/traffic volumes 	<ul style="list-style-type: none"> ▪ Procedures to be followed in the event of an incident or major traffic delay are established in advance ▪ Helps to ensure the news media is able to convey factual information concerning incidents and traffic delays ▪ Provides advance guidance to motorists on major traffic delays and incidents 	Requires time to develop good relationships and procedures	<ul style="list-style-type: none"> ▪ Personnel turnover or extended time between occurrences may mean procedures need to be refreshed
Local detour routes	✓			<ul style="list-style-type: none"> ▪ Long project duration ▪ High traffic volume ▪ High crash rate ▪ Where detour routes are available 	<ul style="list-style-type: none"> ▪ Proactive approach helps in having a readily available, well-thought out plan for detours when incidents and major traffic delays happen 	Cost	<ul style="list-style-type: none"> ▪ Requires advance approval or authorization from the local agency for the use of the detour route in the event of an incident ▪ Need a means to communicate the alternate routes to travelers when appropriate
Contract support for incident management	✓	✓		<ul style="list-style-type: none"> ▪ Long project duration ▪ High crash rate ▪ In large urban areas with large and frequent work zone projects 	<ul style="list-style-type: none"> ▪ Provides additional, dedicated personnel for incident management 	Cost	<ul style="list-style-type: none"> ▪ During road projects, it is important to have people available on call who can quickly get to an incident when needed ▪ Need to establish means of coordinating with existing/other incident response
Incident/emergency management coordinator	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ Large complex project where on-going incident management is necessary ▪ High public exposure/traffic volume 	<ul style="list-style-type: none"> ▪ Provides a dedicated, responsible person for managing incidents and ensuring that traffic safety and mobility goals are met 	Cost	

Incident/emergency response plan	✓	✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ Major/complex work zone projects where there is potential for recurring significant incidents ▪ High public exposure/traffic volume 	<ul style="list-style-type: none"> ▪ Prompt and appropriate response and clearance of incidents 	<ul style="list-style-type: none"> ▪ Cost ▪ Predicting and planning for potential incidents 	<ul style="list-style-type: none"> ▪ Multi-agency coordinated effort is needed for identifying potential incidents and planning for them
Dedicated (paid) police enforcement		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High crash rate ▪ In large and complex work zone locations where enforcement is an issue or incident support is desired 	<ul style="list-style-type: none"> ▪ Enhances safety of motorists and workers ▪ Supports incident management ▪ Promotes orderly traffic flow 	<ul style="list-style-type: none"> ▪ Cost 	<ul style="list-style-type: none"> ▪ Police should be adequately trained to perform their duties safely
Cooperative police enforcement		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ High crash rate ▪ In complex work zone locations where enforcement is an issue ▪ May be applicable in any work zone 	<ul style="list-style-type: none"> ▪ Enhances safety of motorists and workers ▪ Supports incident management ▪ Promotes orderly traffic flow 	<ul style="list-style-type: none"> ▪ Enforcement is provided on an as-available basis as reimbursement of enforcement costs is generally not provided 	<ul style="list-style-type: none"> ▪ Similar to dedicated (paid) police enforcement except for the cost ▪ Police should be adequately trained to perform their duties safely
Automated enforcement		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ Long project length ▪ High crash rate ▪ Where inadequate off-road space and/or no shoulders are available 	<ul style="list-style-type: none"> ▪ May cost less than police ▪ Promotes compliance with speed limits and other traffic regulations without the presence of police 	<ul style="list-style-type: none"> ▪ Political and legal privacy issues limit use of this strategy ▪ Cost 	<ul style="list-style-type: none"> ▪ To effectively provide automated enforcement, a TMC should be present that can centrally coordinate the various technologies available to the agency
Increased penalties for work zone violations		✓	✓	<ul style="list-style-type: none"> ▪ Long project duration ▪ May be applicable in any work zone 	<ul style="list-style-type: none"> ▪ Improves safety by promoting compliance with work zone regulations 		<ul style="list-style-type: none"> ▪ Requires enforcement to be effective

This table adopted from “Developing and implementing Transportation Management Plans in Work Zones”, FHWA. December 2005

Table 1. TMP Strategy Matrix – Mobility/Safety Improvement and Considerations for Implementation

