

Guidebook on Incident Management Planning in Work Zones

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Prepared for the Midwest Smart Work Zone Deployment Initiative

September 1, 2005

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I Introduction, Regulations, Laws and Guidelines

Interest in improving public perception of work zones has recently prompted a greater emphasis in work zone traffic management planning in general, and an associated interest in managing work zone incidents. Incidents are difficult to predict in time, location and severity because the mitigation of impacts of incidents in work zones requires considerable advanced planning and preparedness. This guidebook is intended as a resource for engineers and construction managers who are interested in developing sound incident management plans for work zones. Because of the huge variety of work zones and their environments, this guidebook emphasizes flexibility of approach. Although there are a few fundamental principles that must be adhered to, the applications of these principles should be customized to each situation. This guidebook draws from experiences of traffic engineers who have developed incident management plans for work zones and has adapted techniques developed for normal highways.

An incident is any event that may disrupt traffic flow on a highway. *The Manual on Uniform Traffic Control Devices* more fully defines an incident as “an emergency road user occurrence, a natural disaster, or other unplanned event that affects or impedes the normal flow of traffic.” (1) The impacts of incidents on traffic flows and demand are illustrated in Figure 1-1. (2) When an incident occurs, traffic flow is interrupted and vehicles depart at a lower rate (Incident Flow) than they arrive (Normal Demand Flow), so vehicles are queued and delays are generated. Once the incident is cleared, cumulative vehicles are released at the maximum rate (Getaway Flow or Capacity Flow) until the traffic has fully recovered to its normal condition. The total delay generated is the area between the Demand Flow, the Incident Flow, and the Getaway Flow. When the drivers are informed about the incident, they will reroute to avoid the congestion. That causes a reduced traffic demand, and then in return less delay (the shaded area in the figure). If drivers are not aware of the congestion, or they are unable to reroute, additional delay is produced, which is shown as the double shaded area in the figure.

An incident may be a physical impediment to traffic, such as a disabled vehicle in a traffic lane, or a psychological impediment, such as a distracting event on the shoulder. Incidents can range greatly in severity and duration, but any incident has the potential to delay traffic and increase the risk of a crash. Highway agencies and their stakeholders have adopted incident management plans that enable incidents to be cleared quickly and safely, with the intention of getting traffic back to normal in the shortest possible amount of time.

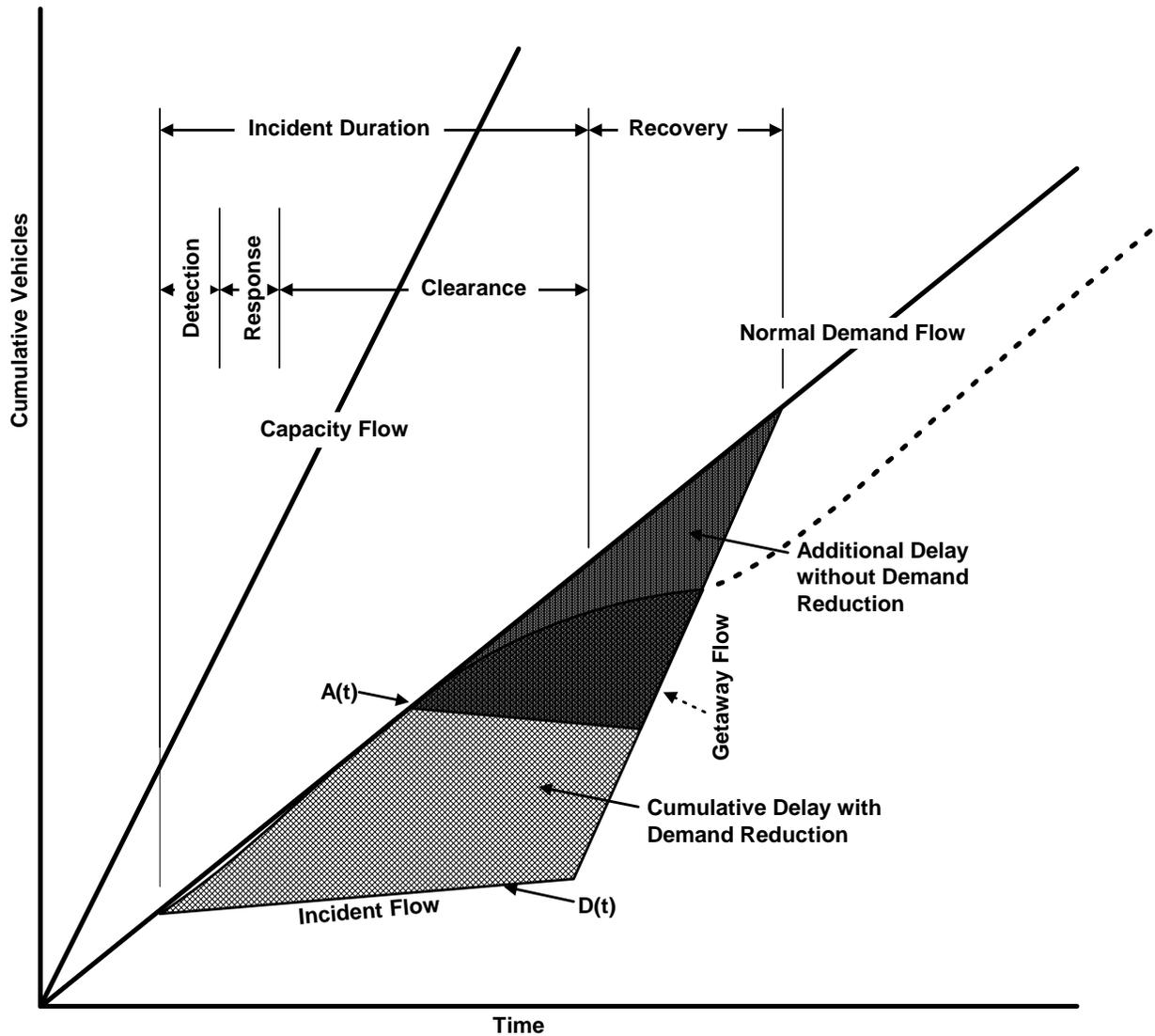


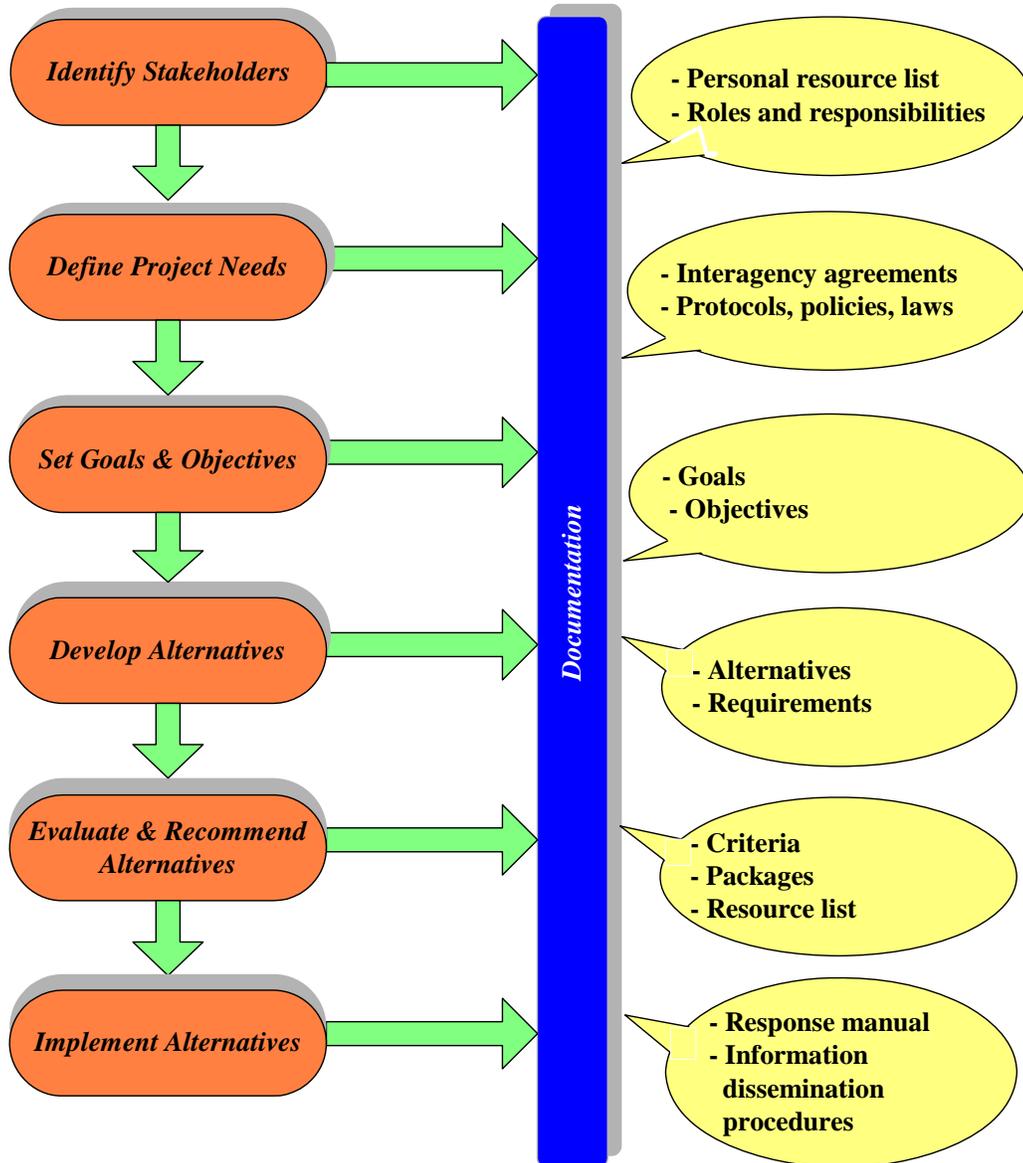
Figure 1-1 Traffic demand reduction during an incident. (2)

The Manual on Uniform Traffic Control Devices and Federal regulations describe a work zone as already being similar to an incident. Thus, an incident within a work zone compounds two possible traffic disruptions and this compounding leads to a greater likelihood of severe consequences. From a planning perspective an “incident within a work zone” would logically exclude normal construction or maintenance activities that might have an effect on traffic.

Many urban areas have adopted incident management plans, procedures, guidelines, agreements and hardware for general operations of their highway systems. Some of these same urban areas that are undergoing large highway projects have found it necessary to enhance their incident management capabilities to accommodate those projects. In addition work zones that fall outside of such urban areas need their own specialized incident management plans and procedures. The new Federal regulations for work zone mobility and safety (23 CFR Part 630) provide an opportunity to include incident management planning as part of a work zone design.

<p>Iowa</p>	<p>1. The operator of a motor vehicle approaching a stationary authorized emergency vehicle that is displaying flashing yellow, amber, white, red, or red and blue lights shall approach the authorized emergency vehicle with due caution and shall proceed in one of the following manners, absent any other direction by a peace officer:</p> <p><i>a.</i> Make a lane change into a lane not adjacent to the authorized emergency vehicle if possible in the existing safety and traffic conditions.</p> <p><i>b.</i> If a lane change under paragraph "a" would be impossible, prohibited by law, or unsafe, reduce the speed of the motor vehicle to a reasonable and proper speed for the existing road and traffic conditions, which speed shall be less than the posted speed limit, and be prepared to stop.</p> <p>2. The operator of a motor vehicle approaching a stationary towing or recovery vehicle, or a stationary highway maintenance vehicle, that is displaying flashing yellow, amber, or red lights shall approach the vehicle with due caution and shall proceed in one of the following manners, absent any other direction by a peace officer:</p> <p><i>a.</i> Make a lane change into a lane not adjacent to the towing, recovery, or highway maintenance vehicle if possible in the existing safety and traffic conditions.</p> <p><i>b.</i> If a lane change under paragraph "a" would be impossible, prohibited by law, or unsafe, reduce the speed of the motor vehicle to a reasonable and proper speed for the existing road and traffic conditions, which speed shall be less than the posted speed limit, and be prepared to stop.</p>
<p>Kansas</p>	<p>8-1530. Duty of driver upon approach of authorized emergency vehicle. (a) Upon the immediate approach of an authorized emergency vehicle making use of an audible signal meeting the requirements of subsection (d) of K.S.A. 8-1738, and amendments thereto, and visual signals meeting the requirements of K.S.A. 8-1720, and amendments thereto, or of a police vehicle properly and lawfully making use of an audible signal only, the driver of every other vehicle shall do the following unless otherwise directed by a police officer:</p> <p>(1) Yield the right-of-way;</p> <p>(2) immediately drive to a position parallel to and as close as possible to the right-hand edge or curb of the roadway clear of any intersection; and</p> <p>(3) Stop and remain in such position until the authorized emergency vehicle has passed.</p> <p>(b) The driver of a motor vehicle upon approaching a stationary authorized emergency vehicle, when the authorized emergency vehicle is making use of visual signals meeting the requirements of K.S.A. 8-1720, and amendments thereto, or subsection (d) of K.S.A. 8-1722, and amendments thereto, shall do either of the following:</p> <p>(1) If the driver of the motor vehicle is traveling on a highway that consists of at least two lanes that carry traffic in the same direction of travel as that of the driver's motor vehicle, the driver shall proceed with due caution and, if possible and with due regard to the road, weather and traffic conditions, shall change lanes into a lane that is not adjacent to that of the stationary authorized emergency vehicle; or</p> <p>(2) if the driver is not traveling on a highway of a type described in paragraph (1), or if the driver is traveling on a highway of that type but it is not possible to change lanes or if to do so would be unsafe, the driver shall proceed with due caution, reduce the speed of the motor vehicle and maintain a safe speed for the road, weather and traffic conditions.</p> <p>(c) From and after the effective date of this act and prior to July 1, 2001, a law enforcement officer shall issue a warning citation to anyone violating the provisions of subsection (b).</p> <p>(d) This section shall not operate to relieve the driver of an authorized emergency vehicle from the duty to drive with due regard for the safety of all persons using the highway.</p>
<p>Wisconsin</p>	<p>346.072 Passing stopped emergency vehicles, tow trucks and highway machinery equipment.</p> <p>346.072(1) If an authorized emergency vehicle giving visual signal, a tow truck flashing red lamps, as required by s. 347.26(6)(b), or any road machinery or motor vehicle used in highway construction or maintenance displaying the lights specified in s. 347.23(1)(a) or (b), with respect to a motor vehicle, displaying the lights specified in s. 347.26(7), is parked or standing on or within 12 feet of a roadway, the operator of a motor vehicle approaching such vehicle or machinery shall proceed with due regard for all other traffic and shall do either of the following:</p> <p>346.072(1)(a) Move the motor vehicle into a lane that is not the lane nearest the parked or standing vehicle or machinery and continue traveling in that lane until safely clear of the vehicle</p>

Pre-planning Processes for Work Zone Incident Management Programs



Example

US 36 Boulder Turnpike Incident Management Plan (2001): Agency Roles (4)

First Responder

- ✓ Determine severity of incident and condition of persons involved and relay to dispatch
- ✓ Identify if hazardous materials are involved
- ✓ Act as incident command leader until relieved

Law Enforcement

- ✓ Isolate and protect the scene
- ✓ Provide traffic control and implement alternate routes as needed
- ✓ Investigate the incident
- ✓ Release information related to activities at the scene

Fire/EMS

- ✓ Respond to fire and Contain the incident
- ✓ Rescue, remove and treat injured persons
- ✓ Request containment or clean-up resources
- ✓ Release information related to activities at the scene

CDOT

- ✓ Provide and place all required traffic control
- ✓ Provide sand or special equipment as requested
- ✓ Notify all agencies of incident as required
- ✓ Investigate and repair damages to roadway
- ✓ Release information related to activities at the scene

Local Jurisdiction

- ✓ Release information related to activities at the scene
- ✓ Assist with detour management

Coroner

- ✓ On scene investigation
- ✓ Release information related to activities at the scene

Towing/Recovery

- ✓ Respond quickly to incident when called
- ✓ Remove vehicle(s) in a safe manner

Another concerned agency in an incident management program is the medical examiner's office. In case of incidents involving fatalities or severe injuries, the medical examiner should be informed immediately, and usually the bodies and involved vehicles should not be moved from the scene until the medical examiner or the coroner has completed the investigation. However, waiting for the arrival of medical examiners can greatly delay the clearing of an incident, especially in rural work zones. Some states have implemented policies "giving medical examiners the power to delegate to responder agencies the authority to move fatal victims from the roadway when their presence endangers others, and to provide liability protection for personnel who perform these actions." (3)

Table 2-1 Typical Capacity during Work Zone Activities (10)

Normal Number of Lanes	Number of Lanes Closed	Average Capacity (vph)	Reduction in Roadway Space (%)	Capacity Reduction (%) ^a
2	1	1340	50	63
3	1	2980	33	45
3	2	1170	67	81
4	1	4560	25	37
4	2	2960	50	59
5	3	2740	60	70

^a Percent reduction based on an assumed normal vehicle capacity of 1800 vehicles/hour/lane
vph = vehicles per hour

The Ohio Department of Transportation approved a policy regarding traffic management in work zones in 2000 (11). It says “the criteria used to determine the impact of proposed work zones shall be queue length”. A set of thresholds used to determine work zone queue lengths is also given.

Example

Thresholds Shall be Used for the Evaluation of Project Queue Lengths as Determined by the Computer Model (Ohio DOT) (11):

- ✓ For queues less than 0.75 miles, the work zone impacts are acceptable.
- ✓ For queues greater than 0.75 miles and less than 1.5 miles, the work zone impacts are acceptable if the queue exceeds 0.75 miles for two hours or less. Where queues are expected to exceed 0.75 miles for any period of time, additional advanced work zone warning signing should be specified.
- ✓ For queues longer than 0.75 miles for more than two hours or longer than 1.5 miles for any period of time, the work zone impacts are unacceptable. Alternate strategies shall be considered per the provisions of this policy.
- ✓ A vehicle will be considered part of a queue if its average operating speed is approximately 10 mph or less. Discretion is required by the District personnel during both the analysis portion and field evaluation of the implemented work zone in determining what constitutes a queue. In general a condition that causes driver frustration due to stop and go operations should be considered a queue.



Response: an inter-jurisdictional, cross-functional, and multidisciplinary effort for the safe and rapid deployment of appropriate personnel, equipment, and communication links necessary to address life-safety issues as well as manage the traffic and subsequent clearance.



Site management: it includes assessing incidents, notifying, coordinating, and maintaining communication links among response agencies. It also involves the deployment of proper traffic control plans to manage the affected flow until full capacity is restored. Effective site management minimizes traffic disruption while maintaining a safe workplace for responders and reducing the probability of secondary incidents.



Clearance: it is the process of clearing the incident (of vehicles, wreckage, debris, spilled material) from the roadway and the immediate area to return the traffic to normal conditions.



Information dissemination: this procedure uses a variety of communications media to relay traffic incident conditions to travelers, so that they can avoid delays or congestion by making/changing travel plans accordingly. Motorists who are informed of an incident can use that information to make changes to their travel plans are less frustrated and less likely to become caught in the resulting delay.

Training / Education: multi-agency training for response personnel can enhance understanding of each agency's responsibility, improve inter-agency cooperation, and improve safety and program quality.

Documentation / Evaluation: formal documentation and regular evaluation allows for periodic review of the incident management programs on a quantified basis. This can help to effectively identify areas that require improvements and confirm the value of effective practices.

Generic objectives are categorized under each of the five goals and associated with the specific incident management phases. Major sources of the generic objectives are this report, Washington report *Framework for Developing Incident Management systems* (5), Colorado report *Guidelines for Developing Traffic Incident Management Plans for Work Zones* (4), and FHWA *Traffic Incident Management Handbook* (10).

Project goals and objectives should be determined by consensus of all responding agencies, in light of the complexity and needs of the project. It is not necessary to select all the possibilities from the generic lists. Each selected objective may be customized to the situation.

Generic Objectives for Work Zone Incident Management Programs

Goal 1

Improve work zone mobility



Minimize detection and verification times



Minimize notification times among response agencies



Minimize the time needed to transport equipment to an incident location.



Minimize incident investigation time



Minimize number of closed lanes



Minimize the length of exposure



Minimize road and lane closure times



Minimize motorist delay



Minimize traffic demand at and approaching the scene without causing severe impacts on surrounding streets



Provide data for automated incident detection



Provide temporary surveillance system for high incident locations



Improve coordination with the diversion route's traffic control system to carry the increased traffic volume

Goal 2

Improve work zone safety



Minimize the response time of emergency medical services



Minimize the time necessary to identify the character of the hazard material cargo



Minimize the traffic hazards near the incident location



Maximize the safety of responders and travelers



Exercising proper and safe on-scene management of personnel and equipment

Improve personnel training for site response

Improve personnel training for response to hazards material incidents

Goal 3

Efficiently and effectively use resources

Minimize the personnel cost associated with incident management

Minimize the cost to motorists of incident related delay

Maximize the use of existing communication resources



Protect the roadway and private property from unnecessary damage during the removal process

- Develop resource sharing agreements

Goal 4

Improve inter-agency cooperation

Maximize understanding of agency perspectives and responsibilities

Maximize information sharing among agencies

Maximize coordination between response and transportation agencies



Establish inter-agency field communications



Employ advanced communication technologies among agencies

Develop administrative coordination among agencies

Form consensus among agencies

Goal 5

Improve public perception



Educate drivers to improve their reactions to traffic incidents



Providing timely, accurate information to the public that enables them to make informed choices



Provide motorists with information about the cause of their delay to minimize their level of frustration with the road system



Adequately informing motorists of the incident location and the scope of the incident



Improve the public image of the response agencies

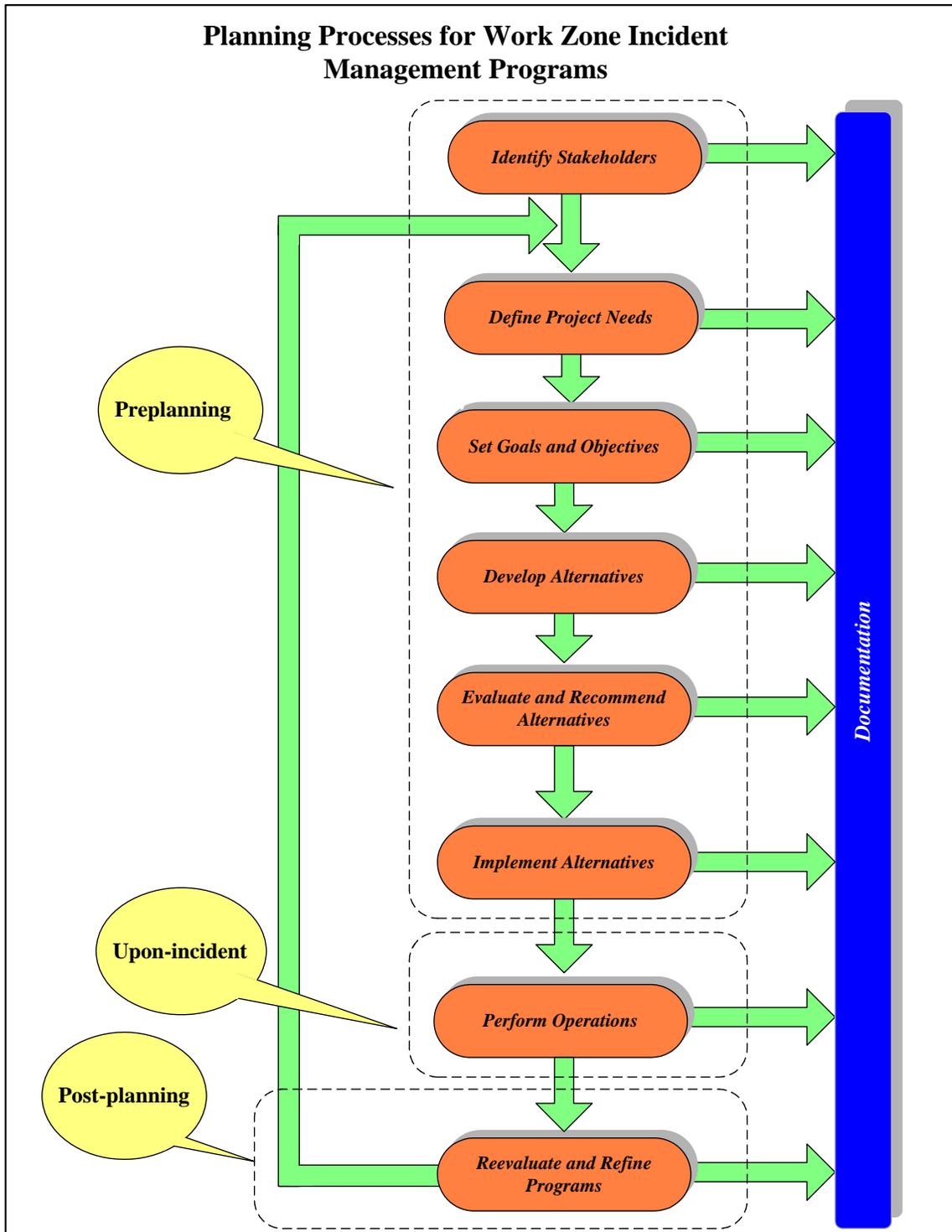


Foster wide dissemination of real-time traffic information

Example

An example of incident Levels and associated actions from T-REX Traffic Incident Management Program (4)

Level	Impact to Roadway	Actions to be Taken
1	Impact to traveled roadway estimated to be less than 30 minutes with no lane blockage. --Or-- Impact to traveled roadway is estimated to be less than 30 minutes with lane blockages.	Follow agency protocols Contact the CDOT Traffic Operation Center (TOC) <i>The CDOT TOC will:</i> > Contact COT Region 6 Maintenance Supervisors
2	Impact to traveled roadway estimated to be greater than 30 minutes, but less than 2 hours with lane blockages, but not a full closure of the roadway.	Establish Incident Command Consider designating staging areas <i>The CDOT TOC will:</i> > Consider implementing alternate routes > Update CDOT and T-REX web sites > Activate Highway Advisory Radio (HAR) & signs > Place messages on dynamic message signs (DMS) > Fax out advisories to Level 2 contacts > Contact: > CDOT Region 1 and 6 Maint. Supervisors > CSP and local communication centers > E-470 Command Center > CDOT Public Information Officer (PIO) > SECC Public Information Officer
3	Congestive impact to traveled roadway is estimated to be greater than 2 hours or roadway is fully closed in any single direction.	Establish Command Center or Post Coordinate with CDOT to implement alternate routes Consider designating staging areas Contact the CDOT Traffic Operation Center (TOC) <i>The CDOT will:</i> > Update CDOT and T-REX web sites > Activate Highway Advisory Radio (HAR) & signs > Place messages on Dynamic Message Signs (DMS) > Fax out advisories to Level 2 and Level 3 contacts > Contact: > CDOT Region 1 and 6 Maint. Supervisors > CSP and local communication centers (303-239-4501) > E-470 Command Center > CDOT Public Information Officer (PIO) > SECC Public Information Officer > Denver OEM (303-640-9999) > Aurora OEM > Arapahoe County OEM > Douglas County Emergency Management > Signal jurisdictions on alternate route > Request METS broadcast notification > Request update to emsystem.com



Potential techniques that can be used in work zone incident management are listed and summarized in Section III of this report. Each option is given a short description, and the most selected items (from our expert panel) are further investigated.

- over long distances. (transport agencies or all)
13. **Emergency Motorist Aid Call Boxes/Telephones:** Appropriate in isolated or limited access area where detection times are lengthy. Requires utility work. (transport or police agencies)
 14. **FM Position Location Systems:** Signals transmitted from commercial FM radio stations are used to compute the location of vehicles. (transport agencies)
 15. **Incident Phone Lines:** Similar to 911; allows the public to call one number for emergency response. Requires informing the public of the number and continued cooperation with media agencies. (transport or police and media agencies)
 16. **Inductive Loop Detectors:** Traffic flow provides information that can be sent via a communications link from the loop amplifiers to a central observation station. A computer equipped with incident detection software can indicate any incident occurrence. (transport agencies)
 17. **Global Positioning Systems:** A satellite-based navigation system. With a commercial receiver, GPS can be used to determine the position of a user within 100 meters. Since the satellite network is maintained by the US Government, the only direct cost to the user is the cost of the commercial GPS receiver.
 18. **Local/state Police Dispatch:** Sends response vehicles and necessary equipment to incident sites efficiently and quickly. (transport or police agencies)
 19. **Location Monitoring Services:** Authorized to operate within a certain band of frequencies, uses spread spectrum transmissions to network base stations and compute location at a control center using time difference of arrival measurements. (transport or police agencies)
 20. **Long Range Area Navigation:** Originally designed 30 years ago to be used for ships at sea. LORAN is a land-based radio navigation system which uses low-frequency waves to provide signal coverage. It determines location based on the reception of transmissions and associated timing. (transport or police agencies)
 21. **Microwave Radar Detectors:** The radar antenna emits microwaves and the reflected waves are received and processed to detect the presence of vehicles and the speeds. (transport or police agencies)
 22. **Motorist Cellular Call-ins:** Uses cellular phone systems to report incidents and allows drivers to directly contact the dispatch office. Information on the correct procedures for reporting accidents (incident type, location, direction) should be distributed to cellular phone users. (transport or police and media agencies)
 23. **Multi-sensor Surveillance Aircraft:** Multi-sensor operator work station is placed within an aircraft for traffic surveillance. (transport or police and media agencies)
 24. **Networking (Enhance 911):** Provides call routing to the appropriate Public Safety Answering Point (PSAP) along with display of the calling number, address, and in most cases, the name of the subscriber at the calling number. (police agencies)
 25. **Odometer Dead Reckoning:** Odometers and heading sensors such as compasses are used to determine a vehicle's direction of travel, and magnetic wheel motion sensors are used to determine its instantaneous speed. These continuous measurements are computer-processed to determine the vehicle's current location. (transport or police agencies)
 26. **Peak Period Motorcycle Patrols:** Operate in congested areas during peak hours or in areas that suffer from high incident rates. Provide added surveillance, reduce response time, reach and assess the incident site quickly, and allow traffic control procedures to begin early. (police agency)
 27. **Probe-based Traffic Surveillance Systems:** Use vehicles that have been outfitted with

4. **Central Information Processing and Control Site:** (See 3.1.1.8.)
5. **Closely Spaced Milepost Markers:** Allows for more accurate location of accidents by incident response personnel and citizens reporting incidents. (police agencies)
6. **Computer Aided Dispatch System:** Use GIS or GPS systems to facilitate more accurate dispatch. (police or private agencies)
7. **Dedicated Freeway/Service Patrol:** (See 3.1.1.11.)
8. **Emergency Vehicle Access:** In areas with limited access, movable barriers and U-turns at key locations can reduce response times. All responding agencies must then be informed of the existence and usage of these access routes. (transport agencies)
9. **Equipment and Materials Resource List:** A comprehensive list of available equipment or materials. Information includes locations and operators (radio channels and/or cell phone numbers and/or off-hour phone numbers) of equipment. (all agencies)
10. **Equipment Storage Sites:** Equipment and materials could be stored at key locations near areas that experience high incident rates. (all agencies)
11. **Geographic Information System:** Allows detailed mapping of an area, including its infrastructure, resources, and utilities. GIS could also be combined with automatic vehicle location, allowing dispatchers to exactly locate and dispatch the nearest vehicle.
12. **Improved Interagency Radio Communication:** Each respondent vehicle can communicate with any other respondent vehicle and all can understand and use a common radio language or lingo. May require the purchase of compatible two-way radio systems or installation of cell phone systems. (all agencies)
13. **Incident Response Database:** Provides consistent and comprehensive incident information for improved resource allocation and cost recovery. (transport or police or fire and rescue agencies)
14. **Incident Response Manual:** Predetermined chain of command and responses that can facilitate decision-making, communications and site management. Must be written as a cooperative effort by all responding agencies.
15. **Motorist Assistance Patrols:** Operate through the construction area and provide assistance where needed. Usually use specially equipped vehicles and deal with minor disablements and repairs. (transport or police or private agencies)
16. **Ordinances Governing Travel on Shoulders:** Minimum shoulder width ordinance. (transport agencies)
17. **Peak Period Motorcycle Patrols:** (See 3.1.1.26.)
18. **Personnel Resource List:** A comprehensive list of available personnel from each of the responding agencies, including transportation, police, fire and rescue, private and media agencies. Information includes geographic or jurisdictional responding area, radio channel or cell phone number. Need to be frequently updated. (all agencies)
19. **Personnel Training Programs:** Personnel are trained about each responding agency's needs and requirements. (all agencies)
20. **Public Education Program:** Inform the public regarding disabled vehicle removal policies, and could be part of a larger public information program. (all agencies)
21. **Tow Truck/Removal Crane Contracts:** Contracts may be established with private agencies to allow immediate use of necessary equipment without prior collection of a permit. (transport and private agencies)

- ✓ *Incident Management and Assistance Patrols: Assessment of Investment Benefits and Costs*, NCDOT Research Project 2003-06
<http://www.ncdot.org/planning/development/research/2003-06.html>
- ✓ Freeway service patrols
http://www.calccit.org/itsdecision/serv_and_tech/Freeway_servpat/freewayser_rep_print.htm
- ✓ *Incident Management : Detection, Response, and Operations State-of-the-Practice Report for I-95 Corridor Coalition agencies*
<http://144.202.240.28/pman/projectmanagement/Upfiles/reports/full10.pdf>
- ✓ *Guidelines for Developing Traffic Incident Management Plans for Work Zones*
http://trafficincident.org/papers/2003/incident_management_guidelines_20030919.pdf

Guidelines for Courtesy Patrol from T-REX Traffic Incident Management Response Manual (2001)

- Patrol corridor for disabled vehicles or other traffic impediments.
- Assess project area for traffic conditions and notify CDOT TOC of conditions
- Inform motorists of the services performed by the courtesy patrol.
- During Accident Alerts, provide information motorists involved in minor accidents of responsibilities for moving and reporting the accident.
- Courtesy Patrol Operator will maintain the response log, which will be turned into Segment Supervisor at the end of each shift (see attached).
- Level 1 Incidents:
 - Notify CDOT TOC dispatch
 - Incident to be cleared within 10 minutes of arrival.
 - If non-injury incident (e.g. flat tire, out of gas, stall, debris), get the vehicle moving or push/tow to a drop site.
 - If minor accident and Colorado State Statute 42-4-1602 applies, take picture, inform motorists of "Move It" law requirements, and encourage that the scene be cleared immediately.
- Level 2 and Level 3 Incidents:
 - Notify CDOT and TOC dispatch
 - Remain on the scene until scene commander arrived (law enforcement, fire/rescue personnel or jurisdictional representative).
 - Provide assistance to scene commander as requested.
 - Monitor and pick up light debris on roadway.

T-REX Incident Management Channel Access from T-REX TIM Response Manual

Channel	Agency																				
	Arap.Cty.Road & Bridge	Arap.Cty. Sheriff	Aurora Fire	Aurora Police	Aurora Public Works	Castle Rock Fire	CDOT TOC	CDOT Region 6	CSP	Cunningham Fire	Denver Fire	Denver Paramedics	Denver Police	Denver Public Works	Doug.Cty. Road & Bridge	Doug.Cty. Sheriff	Greenwood Village Police	Parker Fire	Skyline Fire	South Metro Fire	
ACSO 1	X	X							X	X										X	X
ACSO EOC	X	X							X	X										X	X
CSP 1									X							X					
CSP 2									X							X					
CDOT TRAFFIC 1		X	X	X			X	X	X	X	X		X			X	X				X
CDOT TRAFFIC 2		X	X	X			X	X	X	X	X		X			X	X				X
CLEER		X	X	X						X	X		X				X				
DCSO A									X							X	X				
DCSO B									X							X	X	X			
DCSO C																X	X	X			
DEC		X				X			X	X					X	X	X	X	X	X	X
DISP 1		X				X				X						X	X	X	X	X	X
FERN		X	X	X		X			X	X	X	X				X	X	X	X	X	X
GVPD 1		X								X							X				X
ICALL	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
ITAC 1	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
ITAC 2	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
ITAC 3	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
ITAC 4	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
MAC 1		X				X		X	X	X	X		X	X	X	X	X	X	X	X	X
MAC 2		X				X		X	X	X	X		X	X	X	X	X	X	X	X	X
MAC3		X				X		X	X	X	X		X	X	X	X	X	X	X	X	X
SNOW			X	X	X																
STAC 5	X	X				X			X	X					X	X	X	X	X	X	X

All traffic control during incidents should be coordinated on CDOT Traffic 1
RX frequency 822.2625, TX frequency 867.2625
Courtesy Patrol operates on CDOT Traffic 2
RX frequency 809.4625, TX frequency 854.4625

- ✓ *Module 8 Incident Management* (Freeway Management Handbook)
http://ops.fhwa.dot.gov/Travel/traffic/freeway_management_handbook/mod8cd.pdf

Type of information included in response manual			
Police		Fire/Rescue	
State	City	State	City
Park	Tollway	Airport	County
County (including sheriffs)	Military	Industrial	Military
News Media		Local and State Agencies	
Radio stations	Newspapers	Health	Pollution control
Television stations		Agriculture	Air control
Traffic reporting services (Metro, Shadow, Smartroutes, etc.)			
Highway Department		Emergency Medical Services	
Engineering	Maintenance	Coroner	Red Cross
Cleanup		Funeral homes	Helicopters
Traffic Management Center		Special medical vehicles	Ambulance
Tollway or turnpike authority		Hospital emergency rooms	
Traffic Management Team		Rescue squads-extrication	
Special Vehicle and Equipment		Towing and Road Service	
Cranes	Oversize wreckers	Auto clubs	
Tanker trucks	Trucking companies	Franchised tow truck operators	
Local transit service	Livestock trailers	Private-gas stations, garages, junkyards	
Earthmoving equipment		Public-police, hwy authority, service patrol	
Special Hazard Teams		Utilities	
Chemical	Electrical	Telephone	Electric
Mechanical	Biological	Gas	Water
Radioactive	Ordinance disposal	Sewer	Cable
Federal Agencies		Other	
Department of Energy		National Guard and Reserve	
Energy Resources Development Administration		Accident investigation teams	
Federal Aviation Administration		Vehicle rental companies	
Department of Defense		Institutions	
U.S. Public Health Service		Humane society	
Defense Civil Preparedness Agency		Game warden	
Office of Emergency Transportation		Military personnel	
Environment Protection Agency		Railroads	
Department of Agriculture		Weather bureau	
Postal Service		Pipeline companies	
Federal Emergency Management Agency		Water authorities	
		Scuba divers	
		Transportation services	



Equipment and Materials Resource List

All response agencies should have a comprehensive list of available equipment or materials. Information may include locations and operators (radio channels and/or cell phone numbers and/or off-hour phone numbers) for large or special equipments or materials.

- **Functions**
 - ✓ Save time in locating equipment or materials
 - ✓ Allow response agencies to know each other's responsibilities and limitations

- **Requirements**
 - ✓ Technical considerations
 - ✓ Need frequent update to ensure accuracy

- **Involved agencies**
 - ✓ Local transportation authorities
 - ✓ Towing and recovery
 - ✓ Police agency
 - ✓ Fire/rescue
 - ✓ Hazardous materials
 - ✓ Others

- **Examples/experiences/resources**
 - ✓ *Incident Management Successful Practices—Improving Mobility and Saving Lives* http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/8V001!.PDF

Incident Response Resources

- Computer-Aided Dispatch (CAD)
- Service Patrol Fleets
- Towing and Recovery Vehicles
- Law Enforcement Fleets
- Fire Engines
- Rescue Units/Ambulances
- Major Incident Response Teams
- Changeable Message Signs (CMS)
- HAZMAT Response Units
- Arterial Signal Control

Guidelines for lane closures and openings from the I-70 Mountain Corridor Incident Response Manual (2000)

- The Incident Commander is responsible for lane closure or opening decisions.
- Next to care for the injured and protection of emergency personnel, clearance of the traffic lanes should be a priority.
- Prior to any lane closure or opening, consider the safety of responders, patients, and the traveling public, and the ability to preserve evidence.
- Any change in the status of the roadway with regard to opening or closing.

Data elements that are entered into the WSDOT incident response database

CATEGORY	INFORMATION
Location (City and County)	<ul style="list-style-type: none"> • Nearest city • County in which the incident occurred, by code
General Information	<ul style="list-style-type: none"> • Name of person preparing the report • Date of the report • Date of the incident • Time of the incident • Time the IRT received the call to respond to the incident • Time the first IRT member arrived at the scene • Date and time incident ended • Time last IRT member left the scene • Repair notes
WSDOT Personnel	<ul style="list-style-type: none"> • Number of WSDOT employees involved • Number of hours each was at the incident site
Location (WSDOT Region and Maintenance Area)	<ul style="list-style-type: none"> • WSDOT Region and Maintenance Area in which the incident occurred • Regional Maintenance Area number
Highway/Route Information	<ul style="list-style-type: none"> • State route number and nearest milepost number • Description of the intersection state route and milepost number not available • Travel direction of affected lanes • Lanes closed (i.e. Ramp, single lane, multiple lanes, all lanes in one direction, or all lanes in both directions) • Roadway surface • Reason for road closure (i.e., single-vehicle accidents, multiple-vehicle accidents, fatal accidents, hazardous and non-hazardous material spills)
Travel Conditions	<ul style="list-style-type: none"> • Weather conditions (i.e., rain, snow, fog, wind, calm and clear) • Road conditions (i.e., dry, wet, ice-covered, snow-covered) • Light conditions (i.e., day, dawn, dusk, or night—night with street lights on, night with street lights off, or night with no street lights at all)
Agency Participation	<ul style="list-style-type: none"> • Agencies present at the incident site (WSDOT, Washington State Patrol, Department of Ecology, County Emergency Services, Fire Department, County Police, City Police, or other)
Equipment	<ul style="list-style-type: none"> • WSDOT equipment used • Incident Response Team equipment used • Non-WSDOT equipment used
Materials and Maintenance	<ul style="list-style-type: none"> • IRT vehicle materials used • Follow-up maintenance

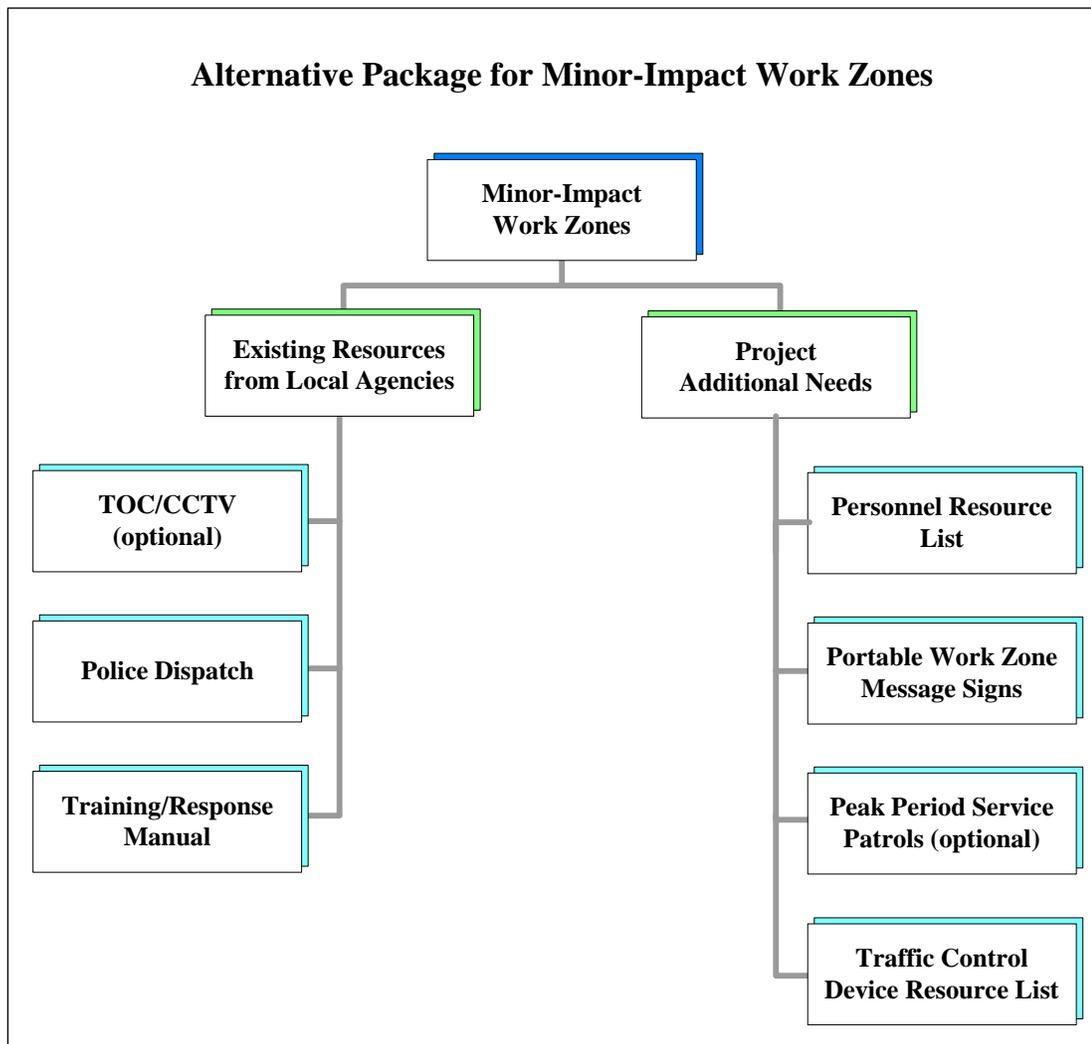
Data elements that are entered into the WSDOT incident response database (cont'd)

Clean-up	<ul style="list-style-type: none"> • Delayed cleanup until off-peak time • Conditions at the incident scene (i.e., presence of hazardous materials, non-hazardous materials, fuel spillage, fire, flammable liquid, corrosive material, explosive material, radioactive material, or toxic materials) • Agency responsible for cleanup
Traffic Control	<ul style="list-style-type: none"> • Lane where the incident originated • Detour route, if applicable • Occurrence of incident in construction zone • When lanes opened
Investigation	<ul style="list-style-type: none"> • Method of Washington State Patrol investigation (i.e., tape, total station equipment) • WSP accident and case number (if applicable) • Lead investigating agency (WSP, county, city) • Number of vehicles involved in the incident • Number of injuries, • Number of fatalities
Number of Vehicles	<ul style="list-style-type: none"> • Number of vehicles by type (e.g., one bus, two passenger cars, and a taxi)
Causing Party's Vehicle Type	<ul style="list-style-type: none"> • Type of vehicle the causing party was driving
Driver and Vehicle Identification	<ul style="list-style-type: none"> • Driver's last name, first name and middle initial • Driver's license number • State or province in which the license was issued • Vehicle license number of the party at fault • Vehicle year, make, model, and vehicle identification number • State or province that issued the vehicle license of the party at fault • Insurance of the party at fault • Insurance company
Comments	<ul style="list-style-type: none"> • Description of cargo that was cleared from incident, how it was disposed of, or whether it was stored, etc. • Or other information/comments

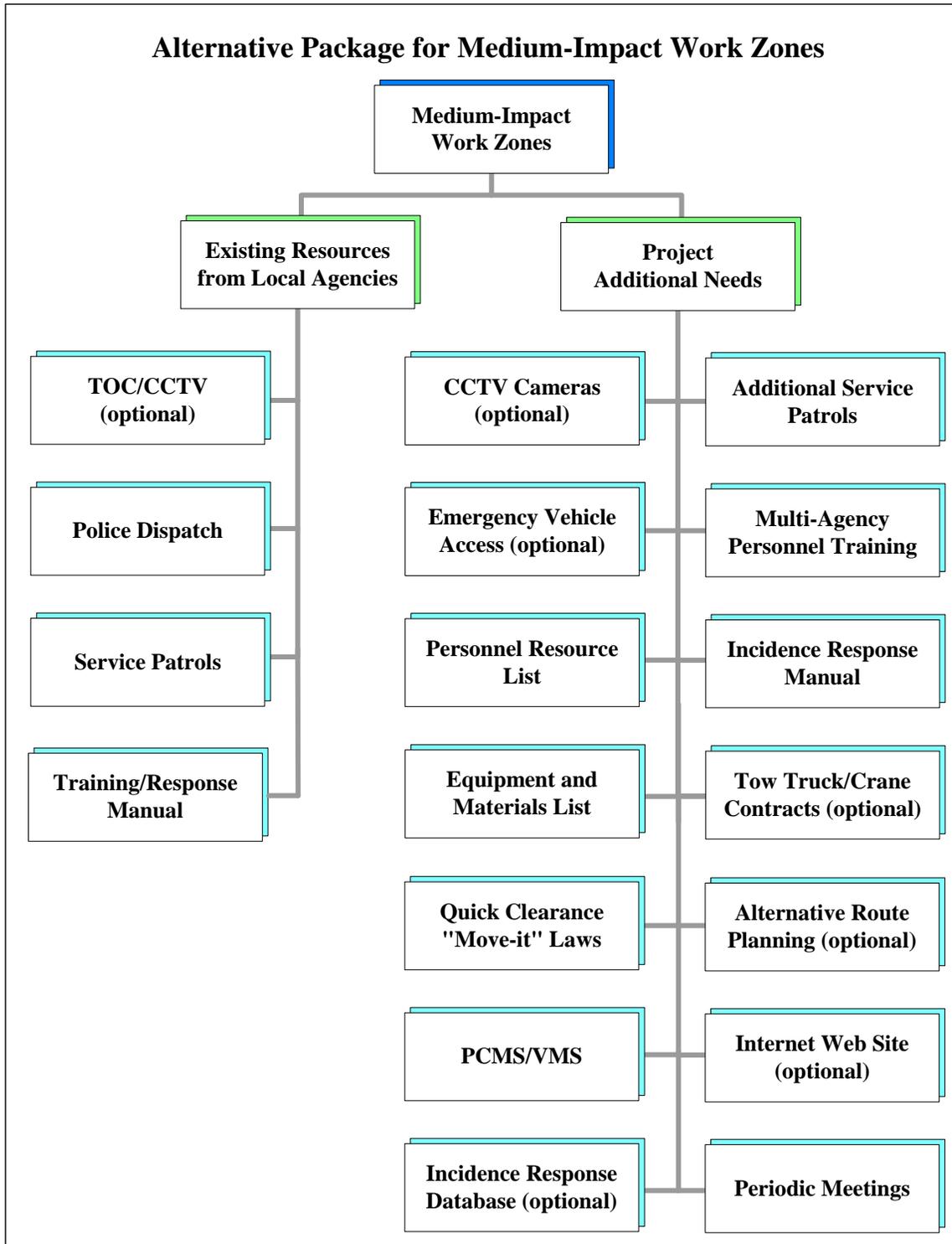
3.4 Alternative Packages

Incidents are unpredictable. Work zone incident management programs should be prepared for any kind of incident. However, work zone projects are pre-designed activities. Program requirements differ by work zone intensities. For example, a small, minor work zone project may only need an agreement with the local response agencies specifying responsibilities and procedures, while a large, complex project requires more formal and intense coordination and communication among all affected agencies.

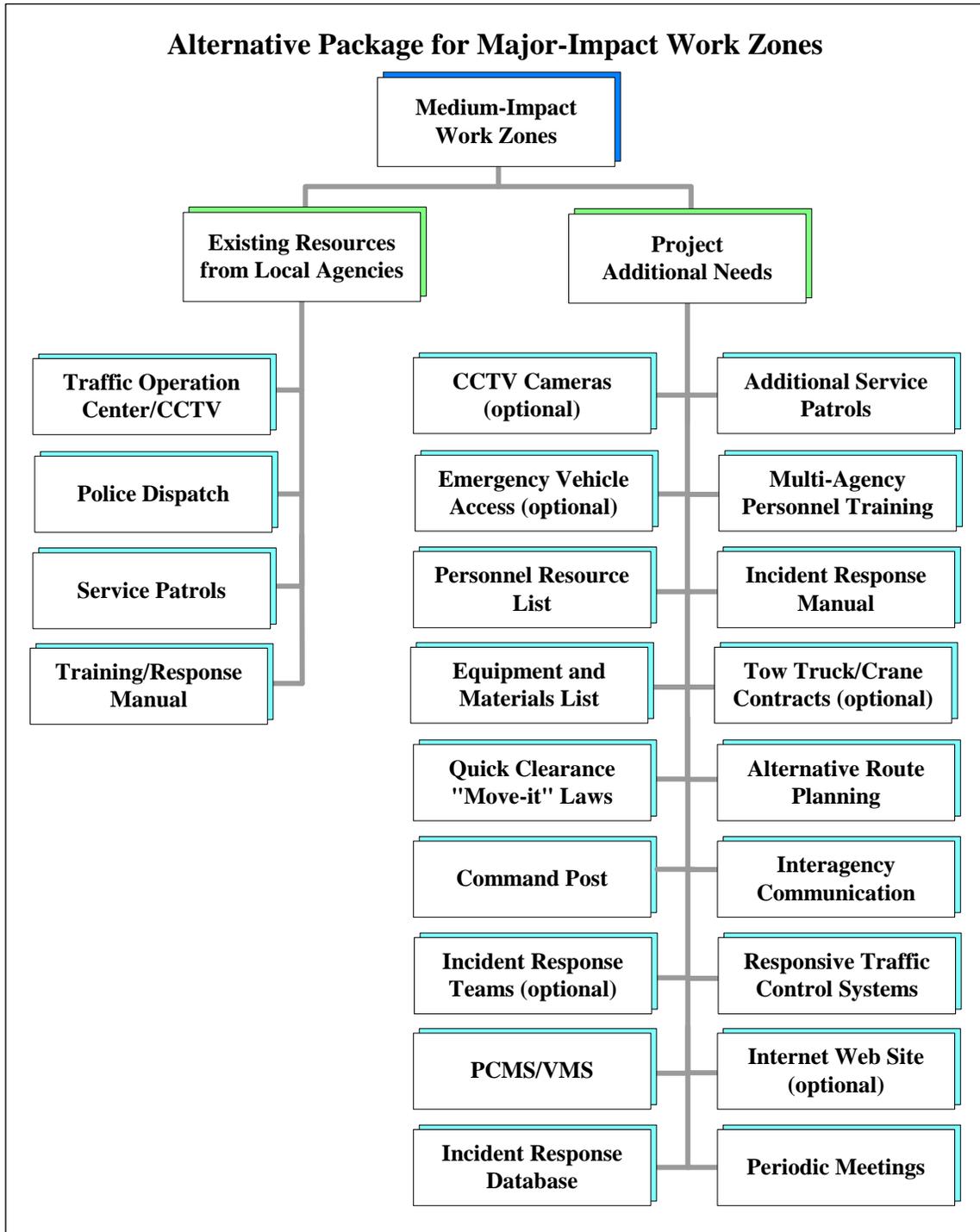
For **minor-impact work zone** projects, the work zone traffic planners should contact local transportation agencies, determine whether there is an incident management program covering the project area, identify additional needs, and develop agreements specifying responsibilities and procedures. The chart below indicates techniques that could be used to improve incident management performance in small work zones. Existing resources from local response agencies or corridor/regional incident management programs can be integrated through agreements or contracts. The work zone traffic planners also need to consider project specific needs, including personnel resource list and contact information.



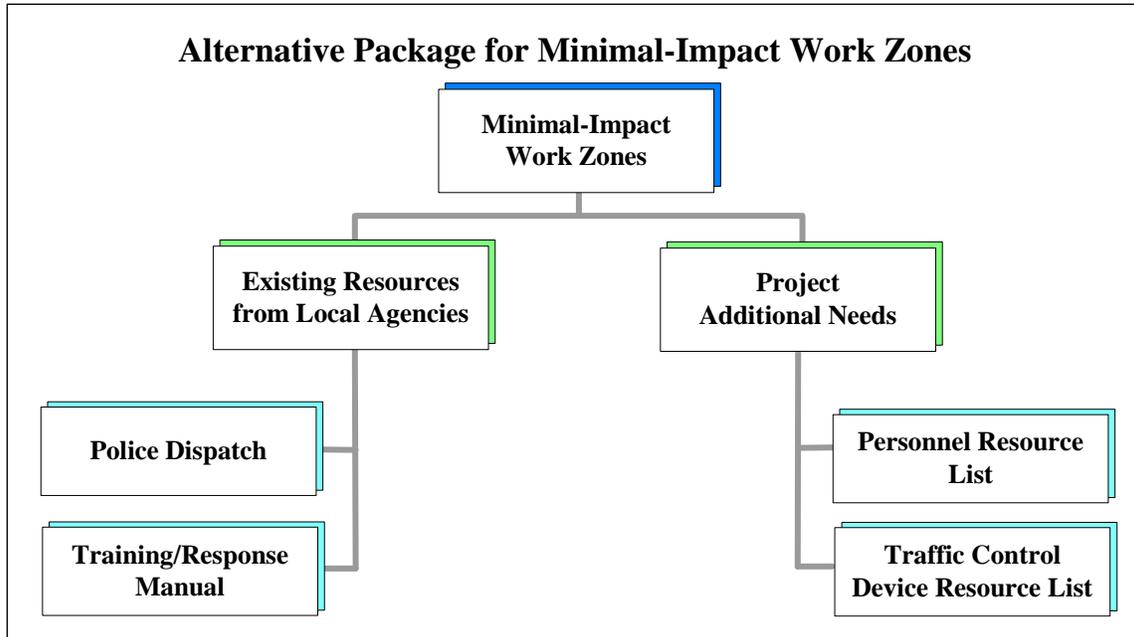
Medium-impact work zones require more efforts from the work zone traffic planner than minor work zone projects. Alternatives should be selected based on the project needs, budgets, and the benefit/cost of the alternatives, as indicated as “optional” in the chart below. Some permanent ITS applications for highway management such as CCTV cameras can be deployed early in the project.



Options for **Major-impact work zone** projects are indicated in the chart below. Other options that are not listed should also be considered provided they better satisfy the project goals and objectives.



In many cases, the impact of the work zone is very small, such as a four-hour maintenance activity on a local street. There is no need to dedicate a huge effort or waste limited resources over-preparing for the incident management. However, to be prepared for the unpredictable, there are still minimal requirements, as indicated in the chart below.



- There are three types of AIS: U-turn, frontage road, and side streets.
 - Use refuge areas when right shoulders do not allow refuge
 - Locate the sites adjacent to or near the freeway lanes
 - Include a median to provide a separation distance for horizontal clearance
 - Provide telephone access, sufficient overhead lighting, separate entrance and exits, and advance signing
 - Provide for acceleration/deceleration if no shoulders
 - Make the area large enough for response vehicles easy movement, normal size is 45 by 150 feet.
- **Temporary Shoulder Lanes:** Can be used as refuge areas and for emergency response (experience from Houston, Las Vegas, and I-66 between D.C.-Virginia)/
 - Appropriate for use in a short period when directed by on-site officers
 - Not recommend for use on a permanent or frequent basis.
- **Equipment Storage Sites:** Designate areas to store and stage response equipment and/or materials for high-incident or critical facilities (bridges, tunnels), because patrol cars and police cars typically do not have the necessary supplies when they first arrive at the sites (experience from Houston, Illinois, Nevada, and Virginia).
 - Not recommended under typical conditions. Their use is supplanted with courtesy trucks for light materials, and loading maintenance trucks/trailers for heavy materials.
 - May be useful in at least one location during a major roadway construction project.
- **Incident Location Techniques:**
 - California call boxes system
 - Dallas location or reference signs on overhead bridge structures
 - Maryland 0.1 mile marker spacing.
 - Kentucky system of standard reference markers for freeways and ramps
 - Texas wireless 911 calls service provides caller's number and location
- **Tall Concrete Barriers and Barriers with Glare Screens:** Forms a screen for median separation, glare reduction, prevention of slush and other objects being thrown into opposing lanes, and screening construction activities (experience from Nevada, Virginia, Maryland, and New Jersey).
 - Requires intensive maintenance.
 - Gaps must be considered. Barriers may prevent the view of responders from the opposite direction of the site and make it difficult for passing fire hoses or patients on stretchers from one side of the freeway to the other.
 - Tall concrete barriers need the least maintenance.

Appendix A Work Zone Incident Management Techniques Questionnaire

The purpose of this questionnaire is to help evaluate and identify work zone Incident Management techniques as part of the Midwest Smart Work Zone Deployment Initiative. The techniques listed here are identified from several reports as used in general Incident Management systems. The techniques are organized into different stages in Incident Management, and are to be evaluated by their applicability and effectiveness in the particular stages. If you have any questions or comments call (414) 229-6685 or email at horowitz@uwm.edu or xiajin@uwm.edu. Thank you for your participation.

0 represents not applicable/effective
4 represents highly applicable/effective

	Applicability					Effectiveness				
	0	1	2	3	4	0	1	2	3	4
Surveillance & Detection										
Aerostat Traffic Surveillance	<input type="checkbox"/>									
Advanced Vehicle Control	<input type="checkbox"/>									
Aircraft Patrol	<input type="checkbox"/>									
Automatic Crash or Deceleration Detection (video, aircraft, speed adaptation)	<input type="checkbox"/>									
Automatic Vehicle Identification	<input type="checkbox"/>									
Broadband Wireless Communications	<input type="checkbox"/>									
Cellular Communications	<input type="checkbox"/>									
Cellular Geolocation Systems	<input type="checkbox"/>									
Central Information Processing and Control Site	<input type="checkbox"/>									
Closed Circuit Television (CCTV) cameras	<input type="checkbox"/>									
Directional Antennas	<input type="checkbox"/>									
Emergency Motorist Aid Call Box	<input type="checkbox"/>									
FM position location systems	<input type="checkbox"/>									
Freeway Service Patrols	<input type="checkbox"/>									

	Applicability					Effectiveness				
	0	1	2	3	4	0	1	2	3	4
Global Positioning Systems (GPS)	<input type="checkbox"/>									
Incident Phone Lines	<input type="checkbox"/>									
Incident Response Database	<input type="checkbox"/>									
Inductive Loop Detectors	<input type="checkbox"/>									
Inertial Navigation Systems	<input type="checkbox"/>									
Land-based Radar Sensor	<input type="checkbox"/>									
Local/State Police dispatch	<input type="checkbox"/>									
Location Monitoring Service (LMS)	<input type="checkbox"/>									
Long Range Area Navigation (LORAN)	<input type="checkbox"/>									
Networking (Enhanced-911)	<input type="checkbox"/>									
Microwave Radar Detectors	<input type="checkbox"/>									
Motorist cellular call-ins	<input type="checkbox"/>									
Multi-Sensor Surveillance Aircraft	<input type="checkbox"/>									
Odometer Dead Reckoning	<input type="checkbox"/>									
Probe-based Traffic Monitoring Systems	<input type="checkbox"/>									
Peak Period Motorcycle Patrols	<input type="checkbox"/>									
Satellite Communications	<input type="checkbox"/>									
Satellite Positioning Systems	<input type="checkbox"/>									
Signpost Navigation	<input type="checkbox"/>									
Terrestrial Radio Frequency Networks	<input type="checkbox"/>									
Ties with Transit/Taxi Companies	<input type="checkbox"/>									
True Presence Radar Detectors (Frequency Modulated Continuous Wave)	<input type="checkbox"/>									
Video Image Processing	<input type="checkbox"/>									
Volunteer Watch	<input type="checkbox"/>									

	Applicability					Effectiveness				
	0	1	2	3	4	0	1	2	3	4
Response & Site Management										
Administrative Traffic Management Teams	<input type="checkbox"/>									
Adaptive Signal Control	<input type="checkbox"/>									
Alternative Route Planning	<input type="checkbox"/>									
Automatic Cargo Identification	<input type="checkbox"/>									
Automatic Vehicle Location	<input type="checkbox"/>									
Central Information Processing and Control Site	<input type="checkbox"/>									
Closely Spaced Milepost Markers	<input type="checkbox"/>									
Command Post	<input type="checkbox"/>									
Computer Aided-Dispatch (CAD) system	<input type="checkbox"/>									
Dedicated Freeway/Service Patrols	<input type="checkbox"/>									
Emergency Vehicle Access	<input type="checkbox"/>									
Equipment and Materials Resource List	<input type="checkbox"/>									
Equipment Storage Sites	<input type="checkbox"/>									
Flashing Lights Policy	<input type="checkbox"/>									
Geographic Information Systems	<input type="checkbox"/>									
Identification Arm Bands	<input type="checkbox"/>									
Improved Interagency Radio Communication	<input type="checkbox"/>									
Incident Response Database	<input type="checkbox"/>									
Incident Response Manual	<input type="checkbox"/>									
Incident Response Teams	<input type="checkbox"/>									
Motorist Assistance Patrols	<input type="checkbox"/>									
"Move-it" Law	<input type="checkbox"/>									
On-Site Courtesy Patrols	<input type="checkbox"/>									
Ordinances Governing Travel on Shoulder	<input type="checkbox"/>									
Peak Period Motorcycle Patrols	<input type="checkbox"/>									
Personnel Resource List	<input type="checkbox"/>									

	Applicability					Effectiveness				
	0	1	2	3	4	0	1	2	3	4
Personnel Training Programs	<input type="checkbox"/>									
Properly Defined Parking for Response Vehicles	<input type="checkbox"/>									
Properly Defined Traffic Control Techniques	<input type="checkbox"/>									
Public Education Programs	<input type="checkbox"/>									
Quick Clearance Policies	<input type="checkbox"/>									
Tow Truck/Removal Crane Contracts	<input type="checkbox"/>									
Information Dissemination										
Central Information Processing and Control Site	<input type="checkbox"/>									
Construction Information Hotline	<input type="checkbox"/>									
Externally Linked Route Guidance (ELRG) Systems	<input type="checkbox"/>									
Highway Advisory Radio (HAR)	<input type="checkbox"/>									
Improved Media Ties	<input type="checkbox"/>									
Internet Web Sites	<input type="checkbox"/>									
In-Vehicle Navigation Device	<input type="checkbox"/>									
LifeLink Telemedicine	<input type="checkbox"/>									
Portable Changeable Message Signs (CMS)	<input type="checkbox"/>									
Radio Data Systems	<input type="checkbox"/>									
Traffic Channel on Cable TV	<input type="checkbox"/>									
Traffic Telephone Information Line	<input type="checkbox"/>									
Travel data server	<input type="checkbox"/>									
VMS	<input type="checkbox"/>									
Wizard CB Alert System	<input type="checkbox"/>									
Clearance & Recovery										
Accident Investigation Sites	<input type="checkbox"/>									
Administrative Traffic Management Teams	<input type="checkbox"/>									
Advanced Vehicle Control	<input type="checkbox"/>									

