



**REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION**

Maintenance of Bridge Expansion Joints

Lot 1 & Lot 2

Tender Documents

TRAFFIC MANAGEMENT PLAN (TMP)

**Rev 1
January 2024**

INTRODUCTION

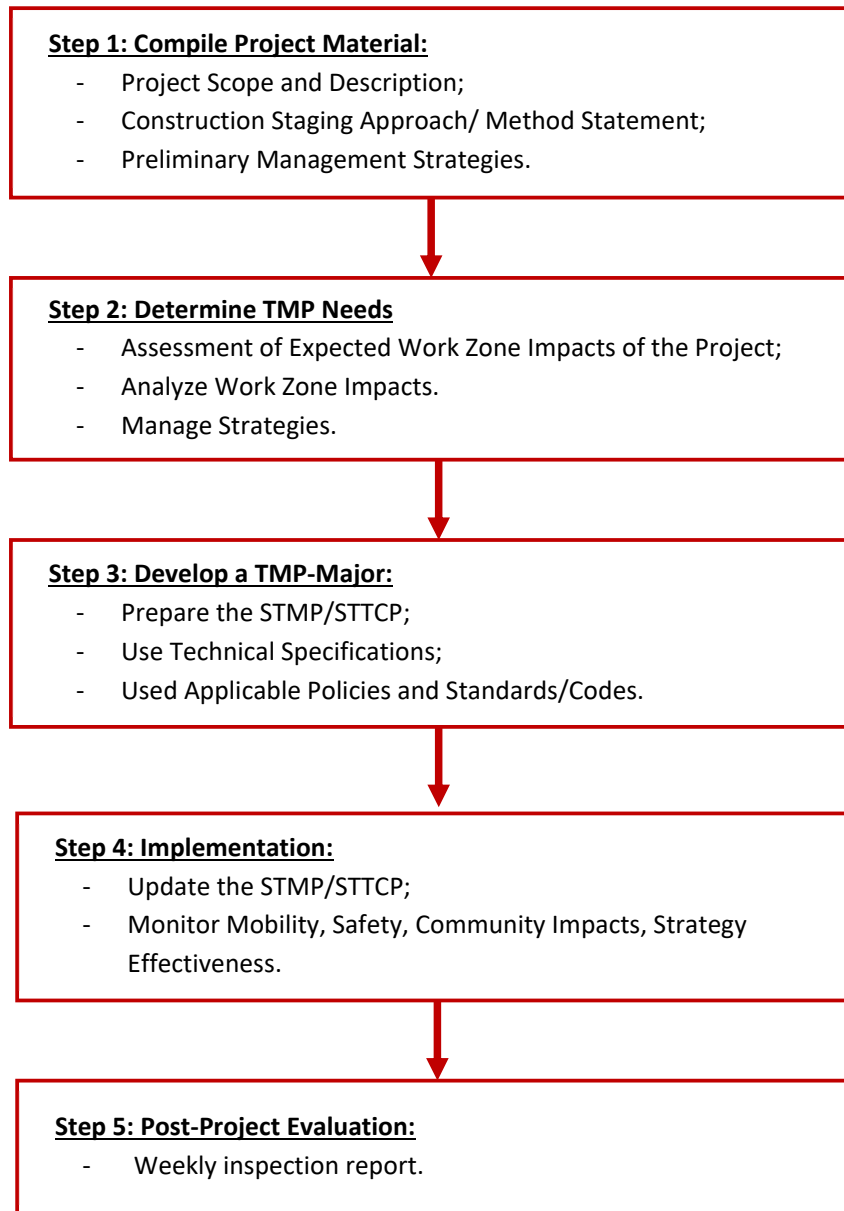
The purpose of this Traffic Management Plan (TMP) is to address construction related traffic impacts for the maintenance and rehabilitation of the damaged bridge's expansion joints on Highway (12 Bridges). It includes measures to protect workers and manage the risks from civilian traffic within close proximity to maintenance activities on the Highways.

The TMP will include the following:

- Part I- General Traffic Management Plan (GTMP): that focus on construction staging during different phases of maintenance/repair/construction, factors impacting traffic and constructing staging; project area characteristics of each bridge; work zone lane restrictions, traffic management and operation strategies; type of sign that shall be used during construction (as Diversion sign, Regulatory signs, Informative signs); Proposed working hours; potential mobility issues; incident management plan, etc...
- Part II-Specific Temporary Traffic Control/ Management Plans (STTCP/ STMP): including various traffic diversion plan layouts for various type of activities; Analysis of impacted roads; Risk Assessment; Protection of Work Zones and road users including pedestrians. Noting that these plans shall be refined and updated by the Contractor during construction phase and shall be approved by the Consultant prior the execution of work.

The General Traffic Management plan (GTMP) report will provide the details behind the development of the project's Specific Temporary Traffic Control Plan (STTCP/STMP) and other strategies that will be put in place for construction to minimize disruptions to motorists, pedestrians, and communities without compromising public or workers' safety, or the quality of the work being performed.

The Traffic Management Plan (TMP) development process which is illustrated in the diagram below may be used as a starting point for developing the TMP for the project.



Part I- General Traffic Management Plan (GTMP):

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1. PROJECT DESCRIPTION.

The Project of “Maintenance of Bridge Expansion Joints for Lot 1 and Lot 2” aims to perform the maintenance works for the expansion joints of selected bridges by replacement/ repair the damaged joints as specified in the project Tender Documents.

The main indicator for joint defect of the bridge is when it fails to provide the following functions: (1) withstand traffic loads and allow bridge movement, (2) afford a smooth riding surface and safe surface for vehicles, (3) minimize noise and vibration, and (4) prevent water from infiltrating and damaging other bridge components.

The bridges within the project scope listed in the following table are located on high-speed highway roads, serving high traffic volumes and presenting significant risk factors. In addition, the following tables show the classification of the bridges based on the assigned time for the execution of joints maintenance works, considering traffic service level constraints during execution.

Table 1a: List of Bridges Under Lot 1 Scope of Work

Lot No	Caza	Bridge Reference	Bridge Name	Fixed/ Optional	Group Assignment
Lot 1	Kesrouan	BR-I.1	Adma Interchange	Fixed	Group-I (Night time)
	El Meten	BR-I.2	Antelias Bridge	Fixed	Group-I (Night time)
	Jbeil	BR-I.3	Naher Brahim Bridge	Optional	Group-I (Night time)
	Batroun	BR-I.4	Batroun Interchange	Optional	Group-I (Night time)
	Baabda	BR-I.5	Al Hkmeh - City Center Bridge	Optional	Group-I (Night time)

Table 2b: List of Bridges Under Lot 2 Scope of Work

Lot No	Caza	Bridge Reference	Bridge Name	Fixed/ Optional	Group Assignment
Lot 2	Aley	BR-II.1	Soufar Bridge	Fixed	Group-II (Day time)
		BR-II.2	Khaldeh Bridge	Fixed	Group-I (Night time)
	Chouf	BR-II.3	Wadi Al Zayneh Bridge	Fixed	Group-II (Day time)
	Saida	BR-II.4	Al Zahrani Interchange	Optional	Group-II (Day time)
		BR-II.5	Al Aakbieh Bridge	Optional	Group-II (Day time)



Figure 1: Location of the bridges Under the Scope of Work.

The main indicator for joint defect of the bridge is when it fails to provide the following functions: (1) withstand traffic loads and allow bridge movement, (2) afford a smooth riding surface and safe surface for vehicles, (3) minimize noise and vibration, and (4) prevent water from infiltrating and damaging other bridge components.

The site photos, roadway geometric details and safety conditions (as lighting, road marking, etc...) related to the expansion joints of the above-mentioned bridges are shown below:

No.1-BR-I.1: Adma Interchange.



- Location: Kesrouan, on the Main Highway with high Traffic Volumes.
- Dual Carriageway Bridge, (4 Lanes divided structure), two lanes in each direction.
- Total Width=11m in each direction.
- No shoulders.
- Average Speed=100Km/h. running
- No lighting at night.
- Bad Conditions of Road Marking.
- Bad Visibility located on a curve.



No.2-BR-I.2: Antelias Bridge.



- Location: El Meten, on the Main Highway with high Traffic Volumes.
- Dual Carriageway Bridge 6 Lanes (divided structure), 3 lanes in each direction.
- Total Width=16m, in each direction.
- No shoulders.
- Average Speed=100Km/h. running
- No lighting at night.
- Bad Conditions of Road Marking.
- Bad Visibility located on a crest/sag of the bridge.



No.3-BR-I.3: Naher Brahim Bridge.



- Location: Jbeil, on the Main Highway with high Traffic Volumes.
- Dual Carriageway Bridge 6 Lanes (divided structure), 3 lanes in each direction.
- Total Width=16m, in each direction.
- Small shoulder in each direction.
- Average running Speed=100Km/h.
- No lighting at night.
- Bad Conditions of Road Marking.
- Good Visibility located on a Tangent.



No.4-BR-I.4: Batroun Interchange.



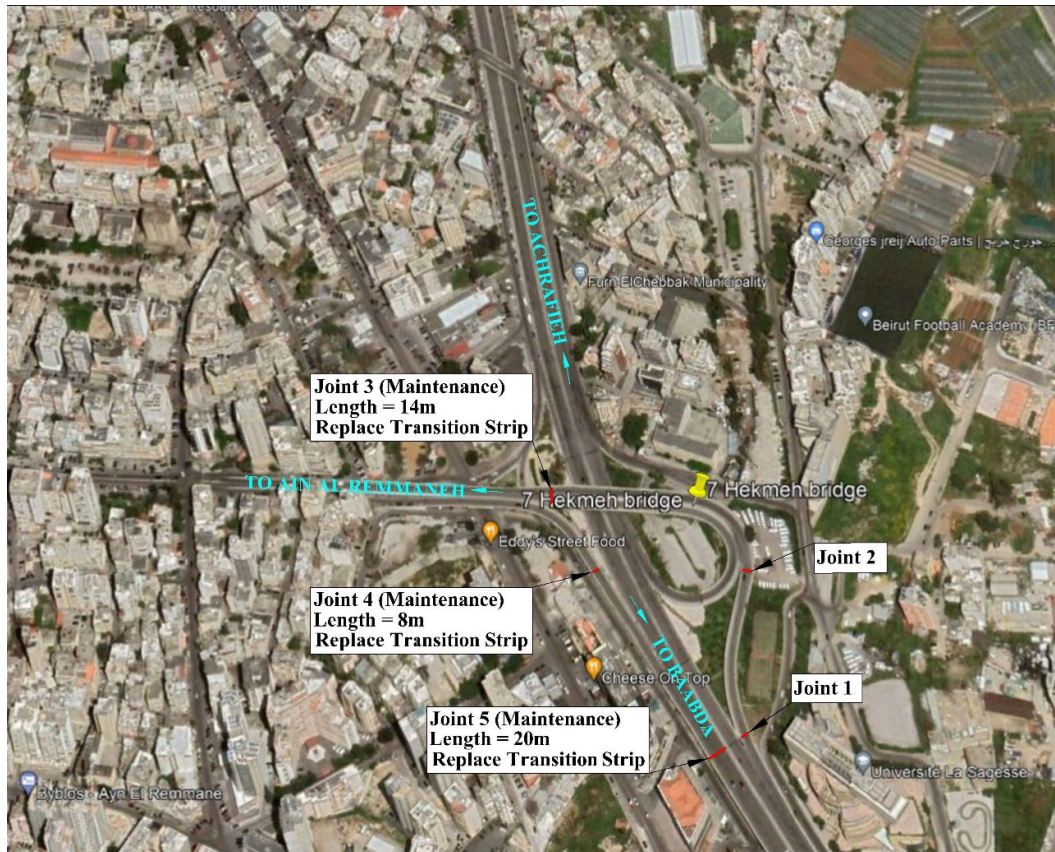
- Location: Batroun, on the Main Highway with high Traffic Volumes.
- Dual Carriageway Bridge 6 Lanes (divided structure), 3 lanes in each direction.
- Total Width=18m in each direction.
- One shoulder in each direction.
- Average running Speed=100Km/h.
- No lighting at night.
- Bad Conditions of Road Marking.
- Good Visibility located on a Tangent.



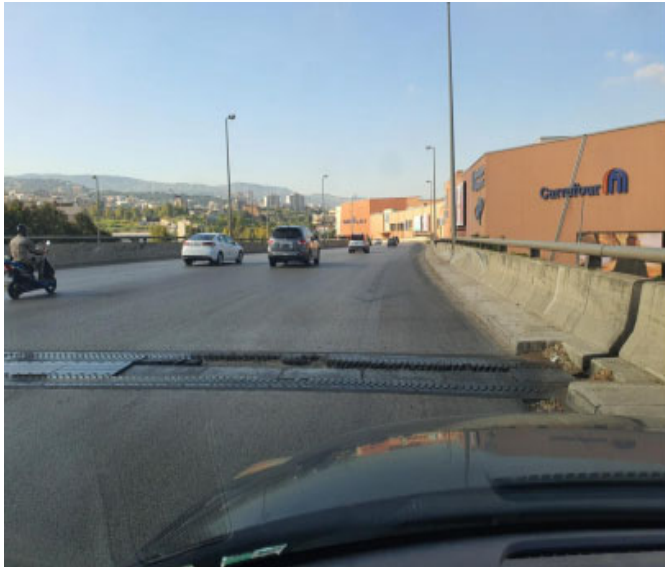
No.5-BR-I.5: Al Hkmeh – City Center Bridge.



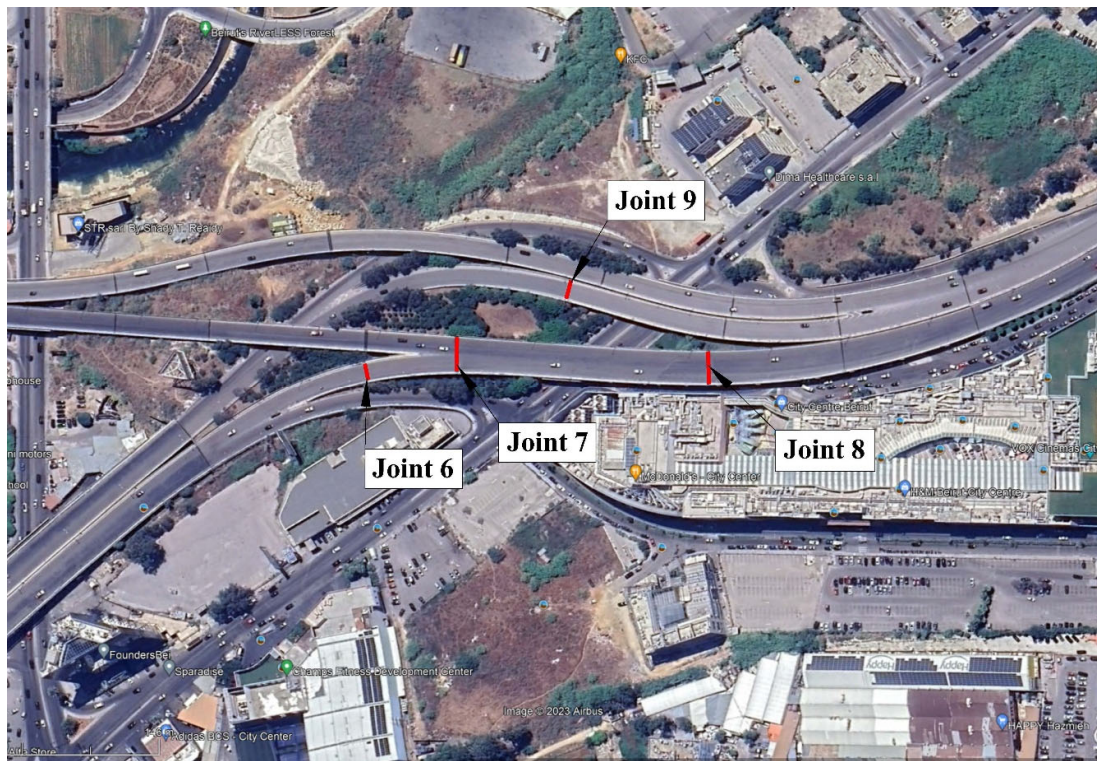
- Location: Baabda, on the loop of the overpass, with medium Traffic Volumes.
- 2 Lanes in each direction.
- Total Width=9m in each direction.
- No shoulders.
- Average Speed=100Km/h. running
- No lighting at night.
- Bad Conditions of Road Marking.
- Bad Visibility located on a curve.



BR-I.5 (Section 1)



- Location: Baabda, on the overpass, with high Traffic Volumes.
- Dual Carriageway Bridge 6 Lanes (divided structure), 3 lanes in each direction.
- Total Width=15m in each direction.
- No shoulders.
- Average running Speed=100Km/h.
- No lighting at night.
- Bad Conditions of Road Marking.
- Bad Visibility located on a crest/sag.



BR-I.5 (Section 2)

No.6-BR-II.1: Saoufar Bridge.



- Location: Aley, on the overpass, with high Traffic Volumes.
- 3 Lanes in each direction.
- Total Width=14m, in each direction.
- One shoulder in each direction.
- Average running Speed=100Km/h.
- No lighting at night.
- Bad Conditions of Road Marking.
- Good Visibility located on a wide curve.



No.7-BR-II.2: Khaldeh Bridge.



- Location: Aley, on the overpass, with high Traffic Volumes.
- Dual carriageway bridge 4 lanes (divided structure), 2 Lanes in each direction.
- Total Width= 8m, in each direction.
- No shoulders
- Average Speed=100Km/h. running
- No lighting at night.
- Bad Conditions of Road Marking.
- Good Visibility located at the start of the curve.



No.8-BR-II.3: Wadi Al Zayneh Bridge.



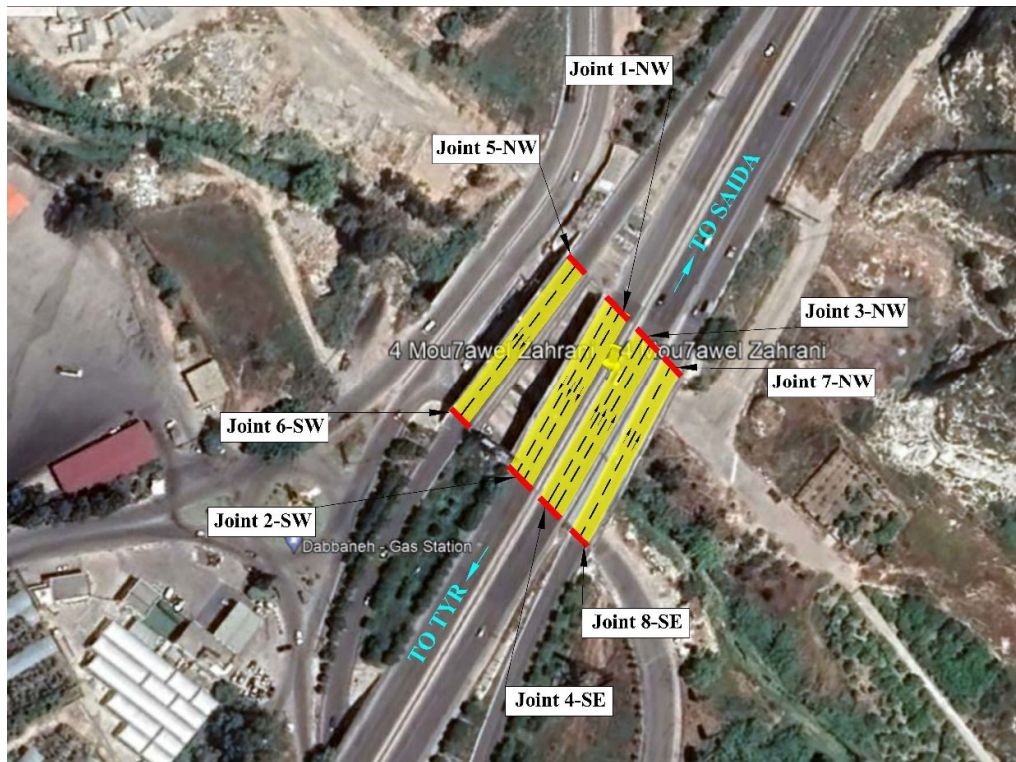
- Location: Chouf, on the overpass, with Medium Traffic Volumes.
- Dual carriageway bridge 6 lanes (divided structure), 3 Lanes in each direction.
- Total Width= 15m, in each direction.
- No shoulders.
- Average Speed=100Km/h. running
- No lighting at night.
- Bad Conditions of Road Marking.
- Good Visibility located on a tangent.



No.9-BR-II.4: Al Zahrani Interchange.



- Location: Saida, on the overpass, with High Traffic Volumes.
- Dual carriageway bridge 4 lanes (divided structure), 2 or 3 Lanes in each direction.
- Total Width= 10-15m, in each direction.
- No shoulders.
- Average Speed=100Km/h. running
- No lighting at night.
- Bad Conditions of Road Marking.
- Good Visibility located on a tangent.



No.10-BR-II.5: Al Aakbieh Bridge.



- Location: Saida, on the overpass, with High Traffic Volumes.
- Dual carriageway bridge 6 lanes (divided structure), 3 Lanes in each direction.
- Total Width= 14m, in each direction.
- No shoulders.
- Average running Speed=100Km/h.
- No lighting at night.
- Bad Conditions of Road Marking.
- Good Visibility located on a tangent.



2. PURPOSE AND OBJECTIVE OF THE TMP.

The key objective of the TMP is to ensure that traffic and transport impacts due to Construction activities of this project are minimized.

The TMP has been prepared to manage, mitigate, and monitor the effects of construction activities and construction traffic on other road users and the highway network. The objective of the TMP is to detail the best practicable option to avoid adverse safety and efficiency effects caused by construction and to mitigate any such effects should they occur. The TMP identifies how construction traffic will be managed to:

- Protect public safety;
- Minimize delays to road users;
- Minimize disruption to property access;
- Inform the public about any potential impacts on the road network.

To achieve this objective, the Contractor shall:

- Implement appropriate controls and procedures during construction activities to address potential traffic impacts along the project work zones;
- Minimize the overall impacts on road users;
- Maintain access for the local community, transport operators and businesses;
- Regularly inform road users and local communities in relation to changed traffic conditions or access;
- Ensure safe and continuous traffic movement for construction workers and the general Public;
- Maintain the capacity of existing roads where possible during construction in order to minimize road user delays;
- Undertake appropriate consultation with impacted residents and businesses and stakeholders;
- Implement traffic control operations to minimize delays to road users taking into consideration traffic volumes including peak times of the day and seasonal traffic;
- Avoid road occupancy where possible;
- Plan all construction vehicle movements to minimize disruption to traffic flow on roads within the project area and surrounds;
- Minimize impacts on, and complaints from, the community and stakeholders.

In preparing this TMP, information has been drawn from practical experience with the management of traffic from and around similar construction projects, as well as the following document: “*Manual on Uniform Traffic Control Device for Streets and Highways. U.S. Department of Transportation (MUTCD); and Federal Highway Administration. 2009 Edition*”.

This TMP (specifically the STTCP/STMP) is a live document that shall be reviewed and updated by the Contractor(s) during the course of the Project to reflect significant changes associated with construction techniques, communication, mitigation, or the natural environment, and shall be approved by the Supervision Consultant before execution.

3. PROPOSED METHOD STATEMENT FOR THE MAINTENANCE/REPAIR OF BRIDGES EXPANSION JOINTS

The maintenance/ repair of the existing highway expansion joint includes repair/ rehab of minor and major defects according to the following conditions:

- In case of minor defect: the repair of existing joints consists of replacing the damaged parts of joint and restoring/repairing the deteriorated parts of anchorage systems without full replacement of existing joints.
- In case of major defects: the rehabilitation of deck expansion joints includes mainly replacing the existing one by a similar type of joint according to the method statement.

The majority of the damaged expansion joints (listed in paragraph 1 “Project Description” above) are *Reinforced Elastomeric Joints* and the required maintenance works consist mainly of fully replacing the damaged joint with a new one having similar technical specifications (major defects).

The execution of required works can be classified as a simple construction activity that will be carried out with a limited number of laborers (between 5 & 8 workers for each joint bridge), light construction machine (pick-up truck, bobcat and others equipment as listed in table 4 below), and in a quick time (not to exceed two weeks or 14 working days for each bridge). It will include the following activities:

- Step 1: Install as necessary the temporary signing and channelizing devices for the traffic control plan in the working area.
- Step 2: Removing of the existing expansion joints, all related materials and accessories.
- Step 3: Milling the existing pavement from both sides of the expansion joint
- Step 4: Base joint preparation by cleaning and removal of the damaged parts by using an electrical hammer.
- Step 5: Installing of steel reinforcement where required (Utilization of Epoxy mortar for steel anchor).
- Step 6: Base releveled and pouring of deteriorated parts by using high strength and fast hardening micro-concrete (Sikacrrete or equivalent).
- Step 7: Joint installation including drill and fixation of anchor bolts by Epoxy resin.
- Step 8: Surface asphaltting from both sides of the expansion joint.
- Step 9: Clean and fill the transition strip on both sides of the expansion joints.
- Step 10: Dismantle the temporary signing and channelizing devices.

Noting that the Contractor shall dismantle the temporary signing and channelizing devices at the end of each working day/ night, and re-install all temporary devices again in the next working day/ Night. Accordingly, a temporary steel plate shall be used to cover the expansion joints and to insure a safe pass to vehicles during the whole period of construction.

In order to ensure a safe execution of the repair/ rehab bridge joints for road users and minimizing the impact of congestion, the Contract shall divide the construction activities on each bridge joints to 2 Stages as shown in table 2 below:

Table 3: Proposed Construction Stages and Activities:

Stage 1: Closing of half number of lanes from the right hand side of each right of way: It will include the following activities with the estimated duration to complete each activity in the closing part of the bridge:	
Day/Night 1:	<ul style="list-style-type: none"> ➤ <u>Activity 1:</u> Implementation of the Specific Traffic Control Plan (STCP). Maximum duration 1h to implement the required traffic control devices in both sides of the closed right of way for one bridge. ➤ <u>Activity 2:</u> Dismantling of the existing expansion Joints and all related materials and accessories and milling the existing pavement in both sides of the closed right of way for one bridge. (maximum duration of 8h) ➤ <u>Activity 3:</u> dismantle the temporary signing and channelizing devices, and install a temporary steel plate to cover the expansion joints in both sides of the closed right of way for one bridge. (maximum duration of 1h)
Days/Nights 2 & 3:	<ul style="list-style-type: none"> ➤ <u>Activity 1:</u> Implementation of the Specific Traffic Control Plan (STCP). Maximum duration 1h to implement the required traffic control devices in both sides of the closed right of way for one bridge. ➤ <u>Activity 2:</u> Cleaning of base Joints and removal of the damage parts in both sides of the closed right of way for one bridge, with maximum duration of 8h/day (this activity required 2 days to be done). ➤ <u>Activity 3:</u> dismantle the temporary signing and channelizing devices at the end of each working day/ night, and install a temporary steel plate to cover the expansion joints in both sides of the closed right of way for one bridge. (maximum duration of 1h).
Days/Nights 4, 5 & 6:	<ul style="list-style-type: none"> ➤ <u>Activity 1:</u> Implementation of the Specific Traffic Control Plan (STCP), maximum duration 1h to implement the required traffic control devices in both sides of the closed right of way for one bridge. ➤ <u>Activity 2:</u> Installation of steel reinforcement where required, pouring of deteriorated parts, and base leveling, in both sides of the closed right of way for one bridge, with maximum duration of 8h/day (this activity require 3 days to be done). ➤ <u>Activity 3:</u> dismantle the temporary signing and channelizing devices at the end of each working day/ night, and install a temporary steel plate to cover the expansion joints in both sides of the closed right of way for one bridge. (maximum duration of 1h).
Day/Night 7:	<ul style="list-style-type: none"> ➤ <u>Activity 1:</u> Implementation of the Specific Traffic Control Plan (STCP), maximum duration 1h to implement the required traffic control devices in both sides of the closed right of way for one bridge. ➤ <u>Activity 2:</u> Joint installation including drill and fixation of anchors bolts, in both sides of the closed right of way for one bridge. (maximum duration of 8h). ➤ <u>Activity 3:</u> Surface asphaltting from both sides of the expansion joint for one bridge. (maximum duration of 2h). ➤ <u>Activity 4:</u> dismantle the temporary signing and channelizing devices.
Stage 2: Closing of half number of lanes from the left hand side of each right of way: It will include the following activities with the estimated duration to complete each activity in the closing part of the bridge:	

Day/Night 1:	<p>➤ <u>Activity 1</u>: Implementation of the Specific Traffic Control Plan (STCP). Maximum duration 1h to implement the required traffic control devices in both sides of the closed right of way for one bridge.</p> <p>➤ <u>Activity 2</u>: Dismantling of the existing expansion Joints and all related materials and accessories and milling the existing pavement in both sides of the closed right of way for one bridge. (maximum duration of 8h)</p> <p><u>Activity 3</u>: dismantle the temporary signing and channelizing devices, and install a temporary steel plate to cover the expansion joints in both sides of the closed right of way for one bridge. (maximum duration of 1h)</p>
Days/Nights 2 & 3:	<p>➤ <u>Activity 1</u>: Implementation of the Specific Traffic Control Plan (STCP). Maximum duration 1h to implement the required traffic control devices in both sides of the closed right of way for one bridge.</p> <p>➤ <u>Activity 2</u>: Cleaning of base Joints and removal of the damage parts in both sides of the closed right of way for one bridge, with maximum duration of 8h/day (this activity required 2 days to be done).</p> <p><u>Activity 3</u>: dismantle the temporary signing and channelizing devices at the end of each working day/ night, and install a temporary steel plate to cover the expansion joints in both sides of the closed right of way for one bridge. (maximum duration of 1h).</p>
Days/Nights 4, 5 & 6:	<p>➤ <u>Activity 1</u>: Implementation of the Specific Traffic Control Plan (STCP), maximum duration 1h to implement the required traffic control devices in both sides of the closed right of way for one bridge.</p> <p>➤ <u>Activity 2</u>: Installation of steel reinforcement where required, pouring of deteriorated parts, and base leveling, in both sides of the closed right of way for one bridge, with maximum duration of 8h/day (this activity require 3 days to be done).</p> <p><u>Activity 3</u>: dismantle the temporary signing and channelizing devices at the end of each working day/ night, and install a temporary steel plate to cover the expansion joints in both sides of the closed right of way for one bridge. (maximum duration of 1h).</p>
Day/Night 7:	<p>➤ <u>Activity 1</u>: Implementation of the Specific Traffic Control Plan (STCP), maximum duration 1h to implement the required traffic control devices in both sides of the closed right of way for one bridge.</p> <p>➤ <u>Activity 2</u>: Joint installation including drill and fixation of anchors bolts, in both sides of the closed right of way for one bridge. (maximum duration of 8h).</p> <p>➤ <u>Activity 3</u>: Surface asphaltting from both sides of the expansion joint for one bridge. (maximum duration of 2h).</p> <p><u>Activity 4</u>: dismantle the temporary signing and channelizing devices.</p>

The following table 3 shows the classification of the bridges based on the proposed shift for the execution of joints maintenance works, considering traffic service level constraints during execution and area conditions:

- Bridge Group-I: Includes all bridges proposed to carry out the required joints maintenance works during Nighttime.

- Bridge Group-II: Includes all bridges proposed to carry out the required joints maintenance work during Daytime.














Table 4: Proposed Classification for Maintenance/Repair works for the damaged expansion joints.

No	Bridge ref:	Caza	Bridge Name	Group Assignment
01	BR-I.1	Kesrouan	Adma Interchange	Group I- Nighttime.
02	BR-I.2	El Meten	Antelias Bridge	Group I- Nighttime.
03	BR-I.3	Jbeil	Naher Brahim Bridge	Group I- Nighttime.
04	BR-I.4	Batroun	Batroun Interchange	Group I- Nighttime.
05	BR-I.5	Baabda	Al Hkmeh - City Center Bridge	Group I- Nighttime.
06	BR-II.1	Aley	Soufar Bridge.	Group I- Daytime.
07	BR-II.2		Khaldeh Bridge.	Group I- Nighttime.
08	BR-II.3	Chouf	Wadi Al Zayneh Bridge	Group II- Daytime.
09	BR-II.4	Saida	Al Zahrani Interchange	Group I- Daytime.
10	BR-II.5		Al AAkbieh Bridge	Group I- Daytime.

In general, the Maintenance of the Bridge Expansion Joints required the use of lightweight machinery (i.e. Bobcat machine, Pickup truck) in addition to the equipment illustrates in table 4 below with illustrative pictures:

Table 5: Typical type of Equipment Used in Bridge Joints Repair/ Rehab.

Surface Preparation for Concrete repair Work:	1.Surface preparation		
	Power disc grinder	Air gun	Wire brush
			
	High pressure water blasting	Electric wire brush	Electric cup wire brush
			
	Scraper	Bristle Blaster	
			
Removing damage concrete:	2.Removing damaged concrete		
	Electric pick hammer	Electric power chisel	Chisel
			
	Power disc cutter	Electric drill with U shape bit	Concrete breaker
			

	Concrete cutter		
			
	Hammer		
			
Painting:	3.Painting		
	Brush		
		Brush roller	
			
Mixing Repair material:	4.Mixing repair material		
	Hand mixer		
		Concrete mixer	
			
	Mortar mixer		
		Measure cup	
			

Setting repair material:	5.Setting repair material		
	Air compressor	Caulking gun	Squeeze pump
			
	Grout injection gun	Epoxy injection gun	Vibrator
			
	Hopper	Wet spraying machine	Dry spraying machine
			
Finishing:	7.Finishing		
	Steel trowel	Panel for repair material	
			
Others:	8.Others		
	Portable generator	High pressure water pump	Reinforcing steel cutter
			
	Curing sheet	Pail can	Tape
			

Noting that all machinery/ equipment shall be removed from the site during off-hours and placed in a land outside the right of way of the Highway.

4. TMP TEAM ROLES AND RESPONSIBILITIES

Defining roles and responsibilities from the initial stages of a project helps to coordinate all the activities related to TMP development, implementation, and monitoring. This section includes contact information, roles and responsibilities for key personnel involved in the project, such as:

a. Key Project Personnel.

1) Project Manager / Construction Manager (Contractor Staff):

The Project Manager / Construction Manager have the overall responsibility to ensure that all works are completed in a safe and efficient manner for the project. To meet these needs, the Project Manager/ Construction Manager shall:

- Provide the necessary resources for the development, implementation and monitoring of the Worksite Traffic Management Plans and strategies.
- Ensure any incidents are recorded and closed out and appropriate actions taken with minimal time frames.
- Ensure that all identified hazards are controlled.

2) Road Safety Expert (Contractor Staff):

The Road Safety Expert (RSE) is responsible for implementing the TMP in accordance with the requirements of international practices (FHWA, AUSTRROADS). To meet these needs, the RSE shall:

- Update the Specific Temporary Traffic Control/ Management Plans (TMP's/ TCP's) and obtain required approvals of all traffic management measures on site from the Consultant.
- Ensure that the approved traffic management measures are implemented and maintained in accordance with the approved plans.
- Ensure that employees or subcontractors have the required skills and training to conduct worksite traffic management activities.
- Regularly inspect the workplace, monitor the works and the traffic conditions, and take appropriate action where necessary.
- Amend and update the plans, as required, to ensure that they remain current as the work progresses.
- Identify situations where traffic congestion, or unsafe conditions for vehicles, pedestrians and workers, are occurring and provide recommendations for improvement.
- Maintain current copies of the Traffic Management Plan and Temporary Traffic Control Plans in the site offices.
- Liaise with concerned authorities when necessary.
- Regularly monitor the traffic flow and limit any probable delays.
- Update the Project monthly report on all traffic related measures (recording and reporting on all traffic accidents weekly report, delay and queue management).
- Consult on traffic matters with local businesses and residents.
- Arrange the design and certification of site entry and exit facilities.
- Undertake traffic-based risk assessments of the Works.

Frequent monitoring and inspections of all TTC Plans are the responsibility of a Road Safety Superintendent (Foreman/ Jr. Civil Engineer) to be nominated by the Project manager and trained by the RSE.

3) Resident Engineer (Consultant Staff):

The Resident Engineer is responsible for the daily work functions including planning and supervising and ensuring safe work practices are being complied with by all staff and subcontractors. The Resident Engineer has responsibility for the following:

- Implement the worksite TMP in accordance with the developed documentation.
- Document and investigate incidents or near-miss incidents relating to the worksite traffic management processes.
- To rectify safety matters raised by RSE within the work zones

4) Road Safety Expert (Consultant Staff):

The Road Safety Expert (RSE) is responsible for verifying the implementation of the approved TMP. The RSE has responsibility for the following:

- Approve the updated Specific Temporary Traffic Control/ Management Plans (TMP's/ TCP's).
- Ensure that the approved traffic management measures are implemented and maintained in accordance with the approved plans.
- Ensure that employees or subcontractors have the required skills and training to conduct worksite traffic management activities.
- Regularly inspect the workplace, monitor the works and the traffic conditions, and take appropriate action where necessary.
- Conduct a weekly road safety inspection and send it to the Contractor for improvement.
- Document and investigate incidents or near-miss incidents relating to the worksite traffic management processes.

b. Other Personnel Responsibilities

All other on-site personnel including but not limited to subcontractors, delivery drivers and visitors must:

- Comply with Traffic Control Plans.
- Bring any issues/deficiencies/improvement opportunities to the attention of the Resident Engineer /Road safety Superintendent as soon as identified.

5. COMMUNICATION

The Project key personnel in coordination with local authorities shall regularly consult with key stakeholders directly, and advise them of the works and any major changes in traffic conditions.

Furthermore, it is mandatory to get the permission from the concerned municipalities or Ministry of Public Work and Transport (MOPWT) and Internal Security Forces (ISF) prior to any implementation of traffic detours. The municipalities have primary responsibilities for traffic accommodation when undertaking work on municipal roads and MOPWT and ISF when on highway. The Internal Force Security (ISF) will provide security support to the implementation of the detour on highway.

The Project Team shall ensure all concerned authorities are regularly consulted about proposed changed traffic conditions. Below are the contact numbers of the emergency services.

Emergency Services	Phone Number
Civil Defense	125
Red Cross	140
ISF	112
General Georges Ghazali (Head of Roads & Traffic in the ISF)	+961-70-243850.
Ministry of Public work and Transport	+961-05-459980.

6. GENERAL RISK MANAGEMENT

As research shows:

- In 2% of accidents the principal contributory factor was the road environment;
- In 76% of accidents the principal contributory factor was the road user; and
- In 3% of accidents, the principal contributory factor was the vehicle.

However, it should be noted that the above does not account for all accidents as some are caused by a combination of two or all three of the above contributors.

Other findings indicate that:

- In 16% of accidents the principal contributory factors were the road environment and the road user;
- In 0.1% of accidents the principal contributory factors were the road environment and the vehicle;
- In 2% of accidents the principal contributory factors were the road user and the vehicle;
- In 0.3% of accidents, the principal contributory factors were all three possible contributors.

It is clear from this research that the road user is a contributor to some extent in 95% of crashes. Therefore, most investigations into road traffic accidents will conclude that driver error (or other road user error) is a significant causative factor. However, it is important to consider the weight of the other factors and interactions in the context of the accident scenario.

One problem with such a large number of crashes is that it tends to lead to the majority of them being simply “reported” rather than being “investigated” in any detail. However, there are many techniques at accident investigators' disposal to help them reconstruct the causes of an accident. While high speed is important, there are numerous other factors to be considered. For example, timings, witness accounts, vehicle specification/configuration and condition, weather, visibility, environment, road condition, signing and markings, heavy trucks, and drivers' behavior.

However, whilst the road environment may be found to be less than perfect (often with minor surface defects present, etc.), linking its condition to the causation of the accident is often tricky. Furthermore, even if the condition is causative, this may not necessarily be indicative of liability on the part of the highway authority.

Success in a safety management system requires the development of supportive organizational cultures. All management systems need the active involvement of Employees in the process; there must be also visible leadership by managers.

What is essential to using a safety management system is an understanding of the difference between hazards, risk situations, risks, harms, and losses.

- A hazard is anything that has the potential to cause harm or loss or damage to human health, property, or the environment.
- A risk situation occurs when a person comes into contact with a hazard.
- Risk is the likelihood that the hazard will cause harm or loss, together with the severity of that harm or loss.
- Harm is the adverse effect on an individual that may result from exposure to the hazard.
- Loss is the damage to equipment, property, or the environment that may result from exposure to the hazard.

a. General Principles of Prevention

- The avoidance of risks: Select a Temporary Traffic Management Plan that will remove the hazards that exist during the project;
- The evaluation of unavoidable risks: Selecting a Temporary Traffic Management Plan that removes all the hazards during the project will not always be possible; therefore, the unavoidable risk must be assessed so that control measures may be implemented to reduce the risk to an acceptable level;
- The combating of risks at source: It is better to design out or minimize risks where practicable rather than leave them to be dealt with on-site;
- The adaptation of work to the individual: This principle considers the ergonomic needs of the individual and is especially relevant to the design of a place of work, the choice of work equipment, and the systems of work selected; e.g., the Temporary Traffic Management Plan should consider manual handling when specifying the number, size and type of signs/cones that will be used for the traffic management arrangements.
- The adaptation of the place of work to technical progress: As technology progresses safety will improve; e.g., the use of vehicle-actuated temporary traffic lights, the use of two-way radios with a STOP/GO system, VMS signs, data loggers, speed limit signs, warning signs and plates, etc.
- The replacement of dangerous articles, substances, or systems of work: The replacement of these with safe or less dangerous articles, substances, or systems of work; e.g., the introduction of a safe system of work such as using a convoy system to control vehicle speed where the required lateral safety zone cannot be provided.
- The giving of priority to collective protective measures over individual protective measures; e.g., the provision of both lateral and longitudinal safety zones to collectively protect the entire workforce.

The following details the preliminary assessment of site hazards likely to be encountered, the level of risk associated with each, and the control proposed. Note that the risk level is the level of assessed risk without the controls in place. The controls listed have been determined as being appropriate in reducing the risk to an acceptable level.

The hierarchy of control has been utilized to ensure that the highest practicable level of protection and safety is selected:

- Elimination
- Substitution
- Isolation
- Engineering
- Administration
- Personal Protection Equipment

In evaluating the options, a key consideration is whether the option takes traffic around, over, or past the worksite.

b. Speed Control/ Temporary Speed Limits

Works should be designed to minimize the risks to road users and the workforce.

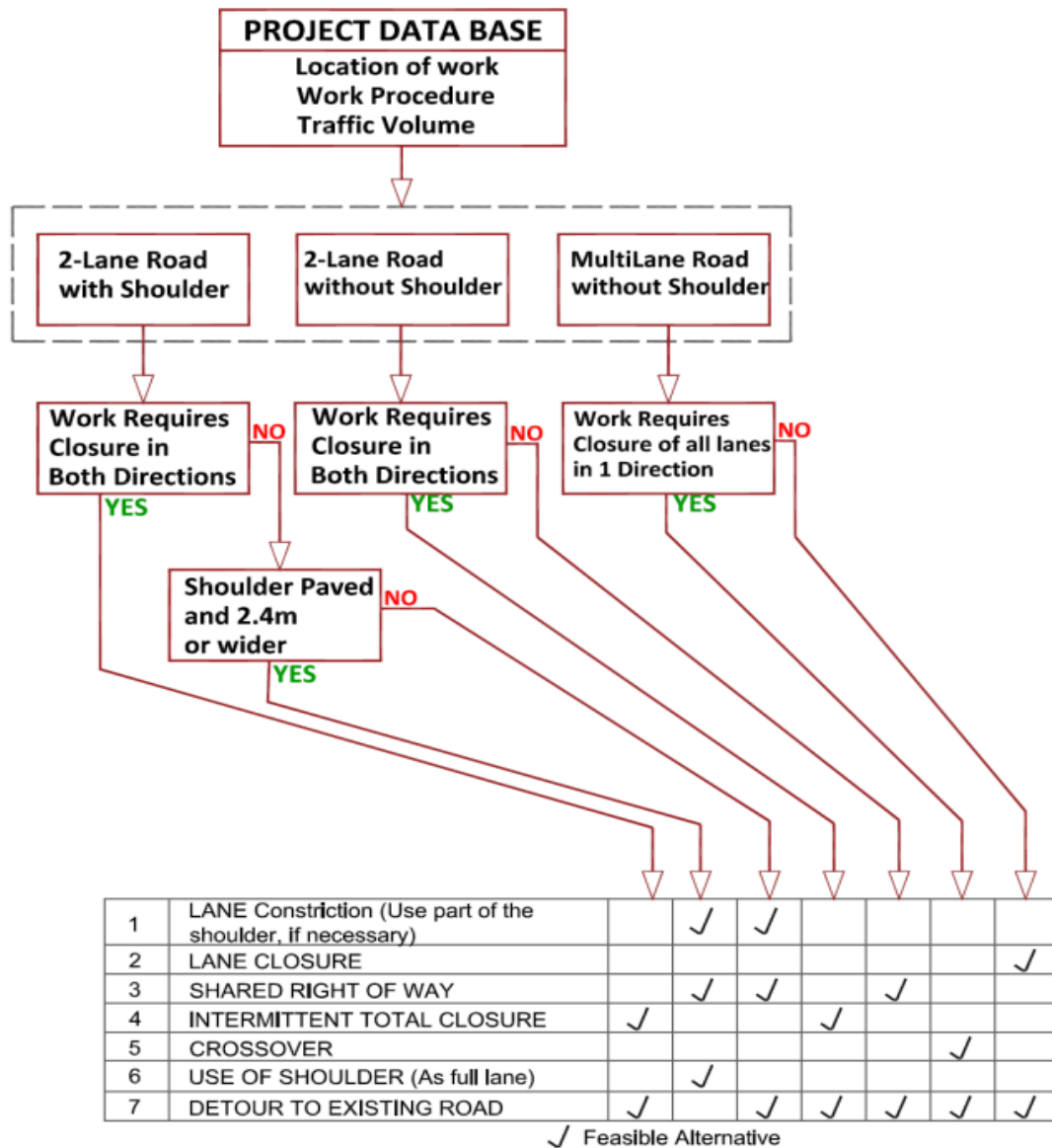
Having done so, the implementation of a temporary mandatory speed limit should be considered, especially where the workforce is required to operate on the carriageway or other vulnerable areas.

There may often be pressure for temporary speed limits, but their limitations as a protection to persons working on the site must be realized. Traffic speeds will inevitably be reduced where busy roads are severely obstructed, so a speed restriction may not be necessary. On dual carriageway roads, where works requiring protection are taking place within the central reservation or on the other carriageway, any protection necessary on the unobstructed carriageway should be given using channelizing devices rather than a speed limit according to the MUTCD.

7. WORK ZONE IMPACT ASSESSMENT

In order to meet safety and mobility needs during maintenance of bridge expansion joints on highway, and to meet the expectations of the travelling public, it is important to systematically assess the work zone impacts of projects and take appropriate action to manage these impacts.

Some international practices use decision-support tools which is beyond the scope of this rehabilitation project, we adopt and update the below flowchart based on the FHWA guidelines to assist in the decision-making process.



a. Basic Types of Work Zones

According to the project data base and the characteristics of the highways where is located the bridge expansion joints (number of lanes, existing of shoulder or not, width of paved shoulder whether enough or not), we define 7 basic types of Work Zones WZ:

1. Lane Constriction:
 - Lane widths are reduced to retain the number of lanes normally available to traffic.
 - Applicable only if the work area is mostly outside the normal traffic lanes.
 - May depend on the availability of shoulders.
 - Least disruptive of all work zone types.
2. Lane Closure:
 - Close of one or more normal traffic lanes.
 - May require capacity analysis to determine whether serious congestion will result.
 - Use of shoulder or median as a temporary lane may mitigate the capacity problems.
3. Shared Right of Way:
 - Uses the same right of way for both directions of traffic.
 - Traffic must be controlled and coordinated with the use of flaggers or traffic signals.
4. Intermittent Closure:
 - All traffic in both directions must be stopped for a short period of time to allow the work to proceed, after which, traffic is allowed to proceed.
 - Normally applicable only on very low-volume roadways.
5. Crossover, including Two-lane Two-way Operation:
 - The traffic in one direction is rerouted across the median to the opposite traffic lanes.
 - May also require the use of the shoulder and/or lane constrictions to maintain the same number of lanes.
 - Consideration must be given to separation devices, crossover design, and length before selecting this strategy. Long work zones can be a delay concern for drivers.
6. Use of Shoulder or Median:
 - The shoulder or median serves as a temporary lane.
 - Must determine if there are underpasses or other vertical clearance issues.
 - Must determine if shoulder or median will adequately support the expected traffic loads.
 - Must determine if the traffic can be transitioned safely to the temporary lane.
 - May be used in combination with other work zone types or as a separate technique.
 - Potential drainage and rollover concerns.
7. Detour:
 - Requires total road closure and rerouting of traffic to existing off-site facilities.
 - Particularly desirable when there is unused capacity on roads running parallel to the closed roadway.
 - May require improvements to existing roadway(s) to make it suitable to carry detoured traffic.

8. WORK ZONE IMPACT MANAGEMENT STRATEGIES

Work zone impact management strategies are intended to provide mobility and access in and/or around the construction area without compromising public safety. Depending upon the complexity, impact and public interest generated in the works, the Work Zone Traffic Management Plan (WZTMP) can comprise up to three components/strategies. The strategies are grouped according to the following four categories:

- Temporary Traffic Control (TTC);
- Temporary Traffic Control (TTC) and Traffic Operation Analysis (TOA);
- Transportation Operations Strategies (TOS);
- Public Information and Outreach (PI&O);

Below matrix should be used in order to determine which of these three WZTMP components are required. This is based upon consideration of both the Work Zone Impact Assessment carried out in the previous section (i.e. Not significant, Minor, Moderate, Major) and the overall duration of the works.

	< 24 Hours	> 24 Hours < 3 Days	> 3 Days
Not Significant	TTC		
Significant with Minor Impacts	TTC	TTC + TOA	
Significant with Moderate Impacts	TTC + TOA		TTC + TOS +PI
Significant with Major Impacts	TTC + TOS		

As per the proposed method statement for the maintenance/ repair of Bridge expansion joints (Section 3 of this report), the selected work zone alternative, and the above matrix it is clear that maintenance of Bridge joints will require Temporary Traffic Control (TTC), Transportation Operation Strategies (TOS) and Public Information and Outreach (PI).

The Temporary Traffic Control Plans (TTCP/STTCP/STMP) (Part II of this report) including various traffic diversion plan layouts for various type of activities; Analysis of impacted roads; Risk Assessment; Protection of Work Zones and road users including pedestrians. These plans shall be refined and updated by the Contractor during construction phase and shall be approved by the Consultant prior to the execution of work.

The Transportation Operation Strategies (TOS) shall be prepared by the Contractor and approved by the Consultant prior to the execution of work.

Public Information and Outreach (PI) shall be by implemented by the Contractor in the assistance of the Supervision Consultant prior to the execution of work.

9. TEMPORARY TRAFFIC CONTROL PLAN

The Temporary Traffic Control (TTC) Plan is required for all Work Zone Traffic Management Plan (WZTMP) WZTMPs (Not significant, Minor, Moderate, and Major). The TTC deals with management of traffic (road users) in and around the Work Zone. The TTC does not cover contractors' internal traffic management issues within the Work Zone/site boundaries, except at works accesses/works exits where works vehicles interact with road user traffic. The TTC describes the methods and approach to traffic control to be used in facilitating the safe passage of vehicular traffic through and around the Work Zone.

The detail of the TTC will be dependent upon a number of factors such as complexity of work, duration and location. Generic TTC standard drawings shall be accepted for routine works carried out repeatedly in the same location as given in this TMP.

Project specific details will address for each stage of traffic management (where applicable):

- Works setting out and detailed setting out information;
- Circulation and travel lanes;
- Temporary signing, road markings (where appropriate);
- Details of any cancelled traffic movements;
- Traffic signal staging plans (If applicable);
- Barricades and temporary detour routes;
- Maintenance of the temporary traffic management.

Specific details shall provide also the following information to supplement the TTCP:

- Scheme location plan.
- Definition of Work Zone limits.
- Selected Work Zone management.
- Typical traffic management layouts and details/specification.
- Specific traffic management layouts and details/specification.
- TCDs to be utilized.

a. Work Zone Components

A work zone is typically marked by temporary traffic control devices such as signs, channelizing devices, barriers, pavement markings, and/or work vehicles. It usually extends from the first to the last of the traffic control devices, and is generally the area between the first advance warning sign and a point beyond the work operations where traffic is no longer affected by temporary controls.

As shown in Figure 9-1 below, work zone can be divided into six components:

- Advance Information Zone (optional);
- Advance Warning Area;
- Transition Area (if a lane or shoulder is closed);
- Buffer Space;
- Work Activity Area;
- Termination Area;

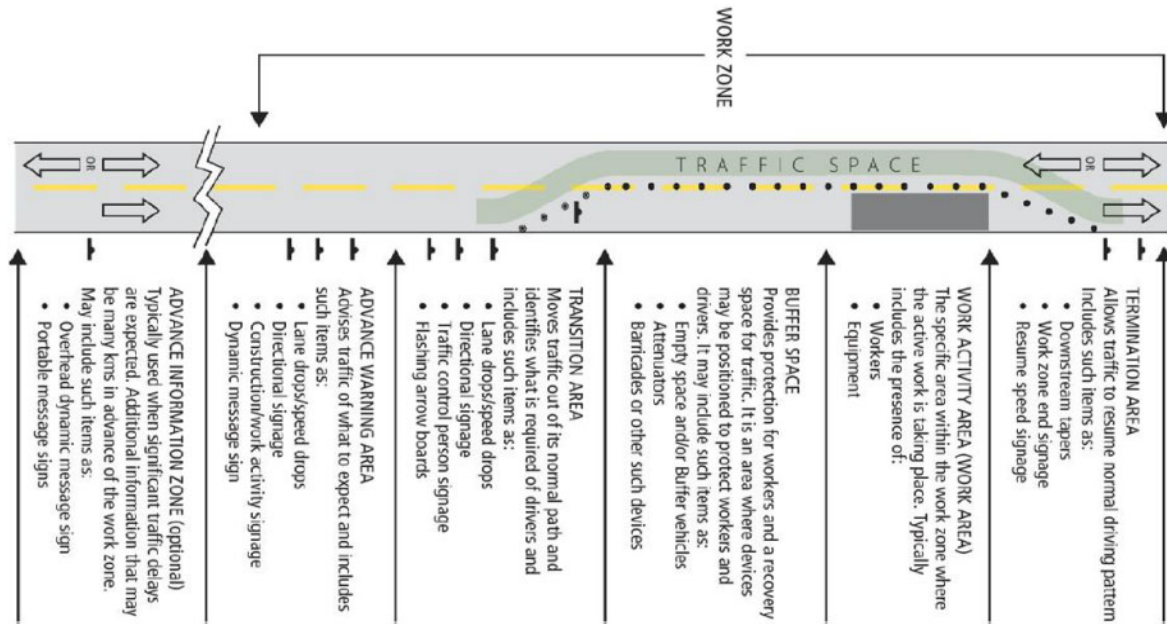


Figure 9-1- Work Zone Components

1. Advance Information Zone (optional)

This could be typically adopted when significant traffic delays are expected. Additional Portable message signs, that may be kms in advance of the work zone, can be utilized to provide greater information to travelers, particularly when there are significant impacts or delays.

2. Advance Warning Area

The advance warning area is the area where road users are informed of what to expect ahead. The length of the advance warning area from the first sign to the beginning of the transition area should provide drivers with enough time to adjust their driving patterns safely and appropriately.

If a temporary reduced speed limit applies in the Work Zone, signing for this is located in the Advance Warning Area.

The required length of the advance warning area increases with the roadway speed so that road users may more readily perceive and respond to the work condition ahead.

A typical example layout for an Advance Warning Area for a 2-lane road is shown in Figure 9-2 below.

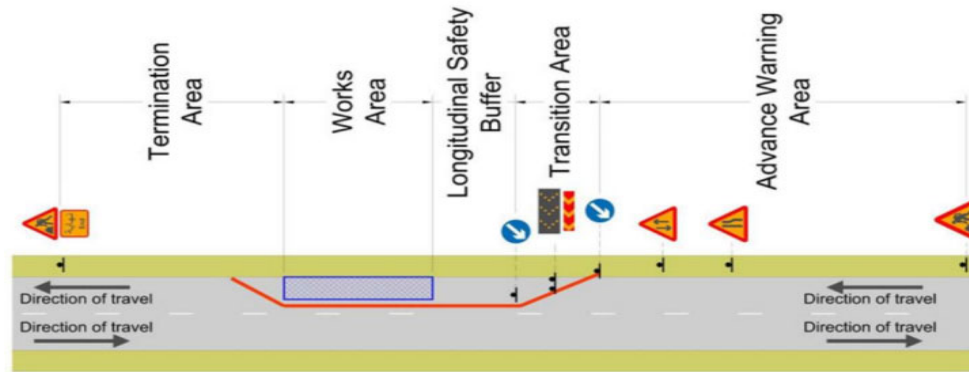


Figure 9-2- Typical example layout for an Advance Warning Area for a 2-lane road.

3. Transition Area (Taper)

The transition area is the area in which vehicles are channelized/ redirected from their normal path of travel into a new path in order to move around the work activity area. This movement of traffic is achieved by using channelizing devices and directional signs in the tapers that are used to close lanes.

The transition area should be obvious to road users, with the correct path clearly identified with pavement markings and/or channelizing devices so that drivers will not attempt to follow the normally travelled path.

For moving work operations, the transition area moves with the work activity area.

Tapers are used in both the transition and termination areas, and are created with a series of channelizing devices or pavement markings placed to move traffic out of—or back into—its normal path. Adjustments to standard taper lengths may be necessitated by the presence of access/egress points and other site constraints. Tapers should comply with the lengths given in Table 5 below.

Table 6: Taper Length

Permanent Posted Speed Limit (Km/h)	Preferred Taper Ratio	Preferred Taper Length for Single Lane Closure (m)	Minimum Length for Single Lane Closure (m)	Maximum Taper length for Single Lane Closure (m)
40	1:22	80	60	100
60	1:33	120	90	150
80	1:44	160	120	200
100	1:55	200	150	250
120	1:66	240	180	300
140	1:77	280	210	350
160	1:88	320	240	400

The above preferred taper ratios and distances are consistent with the preferred figures given in MUTCD which also permits a 25% shorter taper length in physically constrained sites and single carriageways and on congested roads with traffic speeds of 50km/h or less.

The termination of barriers or other channeling devices shall be flared out from the edge of the carriageway at the same alignment, or flare ratio, as is applicable for the taper and all barriers or devices shall be fitted with an approved end terminal, such that no part of the protection device constitutes an impact hazard to vehicles.

4. Buffer Space

The buffer space is the unoccupied space between the transition area and the work activity area. It improves safety for drivers and workers by providing recovery space for errant vehicles.

They should be included wherever possible.

Circumstances that may necessitate the implementation of a buffer space include:

- Poor sight distance in advance of the work activity area.
- High speeds and/or high traffic volumes on the roadway.

The length of the longitudinal safety buffer is determined by the permanent speed limit that applies to traffic approaching the work zone. Table 6 below provides the minimum lengths for the Longitudinal Safety Buffer for specific permanent speed limits.

Table 7: Minimum Lengths for The Longitudinal Safety Buffer

Permanent Posted Speed Limit (Km/h)	Preferred Safety Buffer Distance to Work Area (m)
40	10
60	25
80	40
100	60

5. Work Activity Area

The work activity area is the area where the work is taking place. It may be a fixed location or multiple locations as moving work progresses down the roadway.

The work activity area is closed to traffic, set aside for exclusive occupation by workers, equipment, and construction activities, and is delineated by channelizing devices.

Potential hazards increase in and around a work activity area when:

- The work activity area is close to the travel lanes.
- Traffic speeds and volumes increase.
- Work activities affect normal traffic operations (e.g., uneven pavements, vehicles loading or unloading).
- The change in travel path becomes more complex.

Minimizing hazards between traffic and the work activity area will be carried out by considering the following:

- Use of traffic control devices to make the travel path clearly visible to traffic. Avoid gaps that may falsely suggest to drivers that they have passed through the work zone.
- Place channelizing devices between the work activity area and the travel path. Devices placed on a tangent along the work activity area to keep traffic out of a closed lane should be spaced appropriately—for the extent and type of activity, the speed limit of the roadway, and the vertical and horizontal alignment—so that it is obvious that the

lane is closed. For urban streets and low-speed roadways, closer spacing may be required.

- Provide an unobstructed entrance and exit for work vehicles.
- Protect moving operations with adequate advance warning of the work and/or shadow vehicles

6. Termination Area

The termination area is a short distance through which traffic clears the work activity area and returns to the normal traffic path. It extends from the downstream end of the work activity area to the last temporary traffic control device and may include a downstream taper.

There are occasions where the termination area may include a transition area. For example, if a taper is used to shift traffic into an opposing lane of a multilane roadway, the termination area needs a taper to shift traffic back to its normal path.

A buffer space may be used between the end of the work activity area and the beginning of the downstream taper. A typical signing and layout arrangement of a Termination Area is shown in Figure 9-3 below.

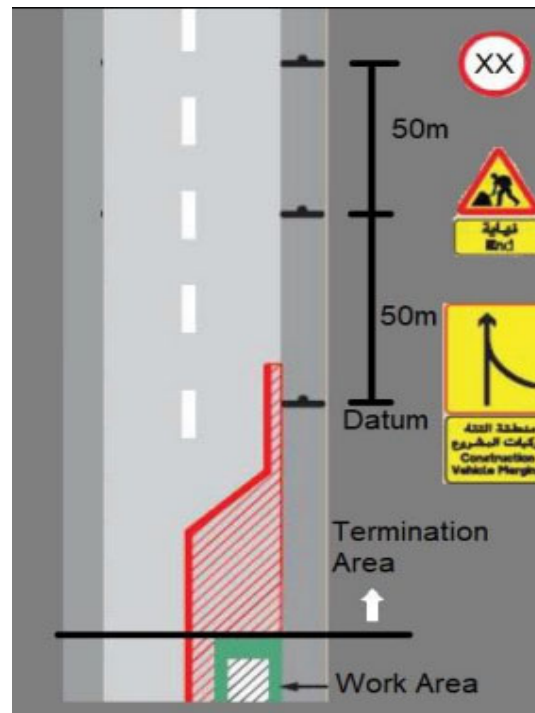


Figure 9-3: Typical Layout Arrangement of a Termination Area.

b. Lateral Work Zone Components

The lateral components of a work zone serve to fulfill the following:

- Define the work area and working space in which road workers should not leave unless they are a fully trained (such as Road Safety Superintendent) and are implementing, maintaining or decommissioning the TTCP.
- Define safety buffers, which are required to provide protection to both road users and road workers, as well as allowing safety barriers to function correctly.

- Define the area in which road users are permitted to travel through or around the work zone and should not leave under any circumstances.

1. Lateral Safety Buffer

There must be sufficient lateral distance between Work Areas and any live traffic lanes such that a lateral safety zone is established. The Lateral safety buffer can be delineated using various safety barriers and channeling devices, although this is dependent on the type of works being undertaken, the duration of the works and the operating speed limit of the road. The minimum widths of the traffic safety buffer and worker safety buffer are given in Table 7 below.

Table 8: Minimum Widths of Safety Buffer

Permanent Posted Speed Limit (Km/h)	Outer Barrier Formed by Concrete New Jersey Barriers (m)	Outer Barrier Formed by Plastic Temporary Devices (m)
40	0.8	1.5
60	1.0	3
80	1.5	Not Recommended
100	2.5	Not Recommended

The decision whether to provide temporary barriers, plastic temporary barricades or cones, shall consider the following factors:

- Time and means of installation, maintenance and removal of the devices.
- Implications arising from their use on works accesses and exits.
- Duration of works.
- The cost-benefit of the proposed use.
- Any special arrangements which may be necessary for safe installation and removal.

The contractor shall undertake a risk assessment of the situation in case the lateral safety buffer is smaller than the recommended values.

The various options for delineation devices at highway are shown in the photo 9-4 below:

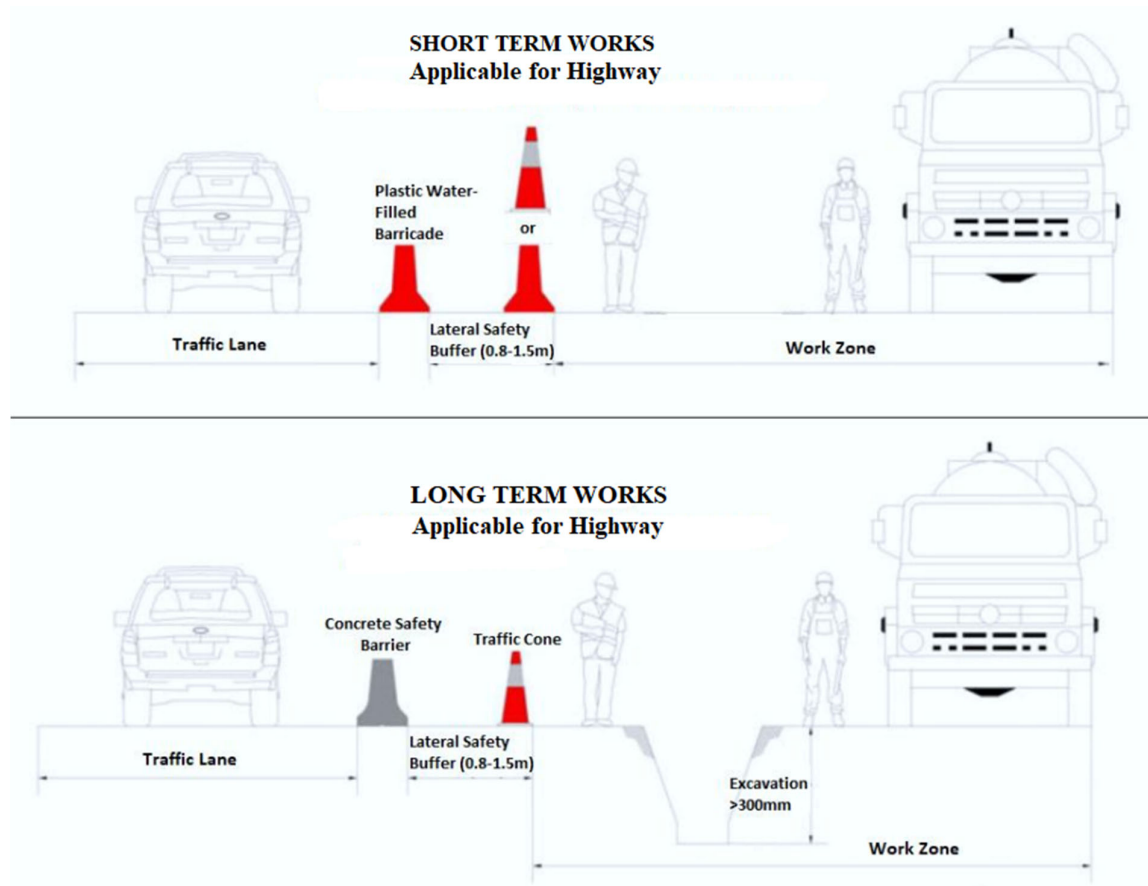


Figure 9-4: Delineation Devices Options.

2. Pedestrian Safety

Pedestrian safety is a high priority at all stages of the work zone process. Pedestrians must be protected from both works activity and from passing traffic. If the works involve closure of all or part of a footway, a safe alternative route shall be provided, which must include access to adjacent buildings, properties and public areas.

Safe routes should provide a minimum unobstructed width of 1m, increased where possible to 1.5m or more. However, a balanced risk assessment must be undertaken to ensure pedestrians are provided with the safest option. For example, a route of 1m width which uses the existing footway may be safer than a wider temporary pedestrian route located in the carriageway. Temporary pedestrian routes must be constructed of a firm, level pavement surface free from trip hazards, steps or discontinuities. Kerbs must be ramped and any steep ramps must be safe for wheelchairs or pushchairs to use without over turning.

In addition to this, suitable delineation devices such as barricades must be provided to safely separate pedestrians from hazards within the works area. Additionally, road safety barrier systems may be required to protect pedestrians from errant vehicles. Wherever possible, diverted pedestrian routes should be located away from the live carriageway.

However, when pedestrian routes have to be located in the carriageway, traffic signing and safety barriers must be put in place before the footway is blocked. An example of a footway diversion into the carriageway is shown in Figure 9-5.

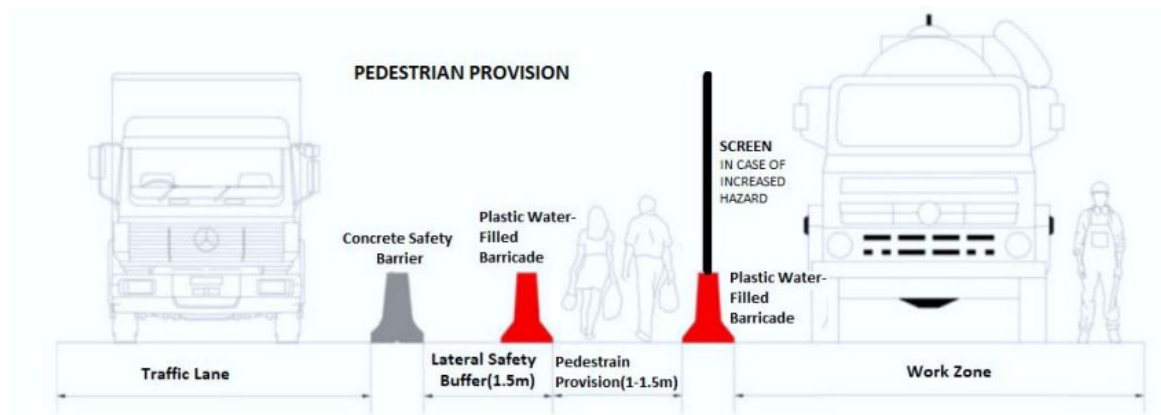


Figure 9-5: Footway Diversion.

c. Temporary Speed Limits

It is necessary to implement temporary speed limits through work zones, as work zones often result in the road environment being geometrically changed to a point where the operating speed limit of the road is no longer appropriate. Temporary speed limits increase safety for road users and road workers and also help to promote a suitable driving behavior throughout work zones.

Table 8 outlines the temporary speed limit options depending on work types, durations and existing operating speed limits.

Table 9: Temporary Speed Limit.

Duration / Type of Works	Operating Speed Limit (Km/h)	Temporary Speed Limit (Km/h)
Medium-Term (15min- 6 Hours)	> 80	80
	< 80	50*
Long-Term (>6 hours)	> 80	80
	< 80	50*

Where a temporary speed limit is introduced through a work zone, the reduction in speed shall be achieved within the Advance Warning Area as shown in Figure 9-6, such that the temporary speed limit commences before the start of the Transition Area.

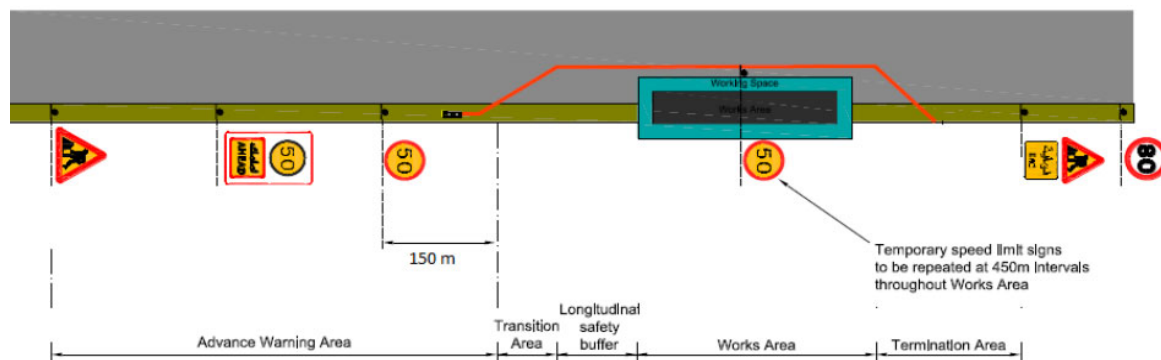


Figure 9-6: Temporary Speed Reduction Layout (Example).

d. Traffic Control Devices (TCDs)

The application of temporary traffic control devices in work zones should address the needs of all road users—drivers, and pedestrians, including those with disabilities.

The devices should meet the basic principles of signing to be effective with road users:

- They fulfill a need.
- They command attention and respect.
- They convey a clear, simple meaning.
- They provide adequate time for a proper response.

During works activities care must be taken that permanent traffic signs and road markings do not conflict with the temporary traffic signing and road markings. This can be addressed by temporarily covering or removing traffic signs and road markings to ensure that information is consistent with the temporary road layout, and with any temporary diversions or other changes in the surrounding road network

1. Standards and Sizes

All temporary signs associated with a Work Zone must be designed and manufactured to the same standards as permanent signs. The visibility of signs is extremely important, and all signs shall be reflectorized by the application of retro-reflective material. All temporary signs shall comply with LIBNOR requirements. Signs which have no equivalents as per LIBNOR shall comply with Manual of Uniform Traffic Control Devices (MUTCD) requirements after getting the Engineer approval.

Temporary signs associated with a Work Zone should have an identification number on the reverse, with both day and night time contact details of the Contractor, for use in case of an emergency.

Figure 9-7 below provides an overview of the various types of traffic sign. The ‘Permanent’ column illustrates the shape and color of each sign type when used in permanent circumstances. However, within work zones the background color is revised in most cases to provide a yellow ‘color theme’ through the work zone.
















Sign Type	Purpose	Appearance	Permanent	In Work Zone
Warning	Provide warning in advance of hazard	Triangular with a red border Rectangular		 
Mandatory	Instruction	Circular and usually blue		
Regulatory	Prohibition or limit	Circular with a red border, sometimes with a diagonal bar or cross bars	 	 
Informatory	Provides information	Rectangular, and vary in colour		
Direction	Provides route information	Rectangular or chevron and vary in colour	 	 

Figure 9-7: Types of Traffic Sign.

The size of a sign is determined by the speed of traffic approaching it. For signs associated with work zones, this speed shall be taken as the permanent speed limit for all signs within the advance warning and transition areas. If a temporary speed limit applies, sign sizes in the works and termination areas may be reduced by one level.

Table 9 below gives the minimum size of standard signs to be used for given speed limits. Worded signs are to be to the specified aleph- and x-heights. Other Supplementary plate sizes and x-heights shall be as specified in the MUTCD or as directed by the Engineer.

Table 10: Minimum Size of Standard Signs

Permanent Posted Speed limit or 85th Percentile Speed if Higher (Km/h)	Minimum Diameter/ Height Circular/ Triangular Signs (mm)	Minimum Forward Visibility (m)	Worded signs Aleph / x-height (mm)
40	600	60	130/75
60	750	75	170/100
80	900	100	225/150
100	1200	100	225/150

2. Signs for use in Work Zones

Whenever signs are referenced within the TTC plans, they should be referenced using the names and numbering detailed within this table. Any signs that are required within Work Zones that are not detailed hereby, should be developed in accordance with the MUTCD and approved for use by the Engineer.

- **Temporary Warning Signs:**











Sign Number	Name	Sign Shape
W001	Crossroads ahead	
W002	T-junction ahead	
W003	Side road ahead	
W004	Staggered junction ahead	
W005	Road to left (right) at junction ahead closed	
W006	Road ahead closed	
W007	Road merges from right or left ahead	
W008	Bend to right (left) ahead	
W009	Double bend ahead, first to the left (first to the right)	
W010	Roundabout ahead	

Figure 9-8: Temporary Warning Signs.












Sign Number	Name	Sign Shape
W011	Road narrows on Right (Left if reversed)	
W012	Road narrows both sides ahead	
W013	End of divided carriageway	
W014	Two-way traffic ahead	
W015	Traffic signals ahead	
W016	Pedestrian crossing ahead	
W017	School/ playground ahead	
W018	Slippery road surface ahead	
W019	Road humps ahead	
W020	Height restriction ahead	
W021	Distance to hazard (number varies)	

Figure 9-9: Temporary warning Signs





Sign Number	Name	Sign Shape
W022	Other hazard ahead	
W023	Work zone/roadworks	
W023-s	Supplementary plate 'To the Right' (Left if reversed)	
W024	Reduction in traffic lanes -3 lanes, one closed (Other combinations are possible to depict closures required)	
W025	Chevron board (variable numbers of chevrons and formats)	
W026/7	Merge left (right)	
W028	Traffic merging with the main line (from either side and multiple lanes possible)	

Figure 9-10: Temporary Warning Signs.

- **Temporary Regulatory Signs**

It may be necessary as part of the establishment of a Work Zone to erect temporary signs that limit or prohibit specific actions or vehicle types (i.e. signs that are normally prescribed for permanent situations), assuming that appropriate authority has been granted for such limits or prohibitions.










Sign Number	Name	Sign Shape
R001	Temporary Speed Limit (25, 40, 60, 80, 100 and 120 km/h respectively)	
R002	Keep left (right if reversed)	
R003	One way traffic	
R004	One way traffic	
R005	One way traffic	
R006-P	Stop	
R007-P	Give way	
R008-P	No entry	
R009	Go	

Figure 9-11: Temporary Regulatory Signs.

- **Prohibitory Traffic Movement Signs**

Prohibitory signs prohibit certain maneuvers and actions or classes of road user from Work Zones. Figure 9-12 below lists a number of regularly-used signs that are specifically for use within Work Zones. Refer to MUTCD for additional prohibitory signs if required.

Sign Number	Name	Sign Shape
P001	No left turn	
P002	No right turn	
P003	No U turn	
P004	No overtaking	
P005	No inflammable goods	
P006	No goods vehicles	
P007	No pedestrians	
P008	No cyclists	
P009	No horns	

Figure 9-12: Temporary Prohibitory Movement Signs.

- **Mandatory Signs**

The signs in this group shall have a yellow background and a black border and black arrow symbols.







Sign Number	Name	Sign Shape
M001	Ahead only	
M002	Turn right (left)	
M003	Turn right ahead only (left only)	
M004	Pass either side	
M005	Keep right (left)	
M006	Roundabout	

Figure 9-13: Temporary Mandatory Signs.

- **Information Signs**

Within a Work Zone, information signs may be required to advise road users of specific conditions. These types of signs are shown in Figure 9-14 below. Worded signs should be avoided whenever practicable due to the need for clarity and also consideration of the differing literacy levels of road users.

Sign Number	Name	Sign Shape
I001	On red stop here	
I002	Temporary surface	
I003	Works access	
I004	Works exit	
I005	Construction traffic only	
I006	Carriageway ahead closed	
I007	Carriageway closed	
I008	Traffic control ahead	
I009	Start of diversion route	

Figure 9-14: Temporary Information Signs.

3. Traffic Channeling Devices

Temporary safety barriers are designed to physically separate vehicles travelling through a work zone from road workers and any hazards such as excavations, construction equipment and

construction materials. The purpose of a temporary safety barrier is to redirect an impacting vehicle with minimal deflection in a way that minimizes injury to the vehicle occupants.

It is necessary to provide safe indication to road users passing through work zones of the path they must follow. When concrete or steel barriers are provided, these fulfill this role for vehicular traffic.

However, there are occasions where concrete or steel safety barriers may not be appropriate and traffic cones or water-filled plastic barricades may be required where a permanent speed limit of 50km/h or less applies to the road and where excavations are less than 300mm in depth.

- **Plastic Water-Filled Barricades:**

When using Plastic Water-filled Barricades they must be linked together in an approved manner in accordance with the manufacturers' guidance to form a continuous delineation boundary as shown in Figure 9-15 below. In most cases, Plastic Water-filled Barricades must only be used to delineate boundaries within the Work Zone and are generally not suitable to be deployed as safety barrier. However, depending on the duration of works (only for medium/short term work; a week or less), type of works, speed of traffic and the presence of excavations over 300mm in depth, these devices may be suitable for use in certain circumstances.

- Plastic Water-filled Barricades shall be manufactured from a durable material, able to endure impacts from passing vehicles without suffering damage or damaging the passing vehicle, or causing injury to pedestrians and road workers in the vicinity
- Alternate units in a system shall be colored red/orange and white.
- Plastic Water-filled Barricades must be highly visible to drivers. In areas with insufficient street lighting, flashing lamps or beacons (if applicable) must be used or can be replaced by Reflectors or reflective tapes attached to the barricades to improve visibility.
- Plastic Water-filled Barricades shall be designed to link together to form a cohesive system. The linking system shall be applied in accordance with the manufacturers' instructions. Delineators from different manufacturers shall not be used together unless the linking systems are compatible.
- Plastic Water-filled Barricades shall be filled with adequate levels of water in accordance with the manufacturers' specification, to prevent excessive displacement as vehicles pass by or from interference by pedestrians or members of the work force.



Figure 9-15: Plastic Water filled Barricades within Work Zone.

- **End Treatments**

The untreated end of a safety barrier is extremely hazardous if hit by an errant vehicle. The ends of temporary safety barriers must be appropriately treated either with a crashworthy end treatment, such as an energy absorbing attenuator (crash cushion), or if sufficient room is available by flaring the exposed end of the barrier away from approaching traffic so that it cannot be hit. The proposed treatment of barrier ends will be clearly stated within the TTCP outlining why the chosen treatment option has been chosen.



Figure 9-16: End Treatment Example.

- **Traffic Cones**

The purpose of traffic cones is to provide a visual indication to drivers that the carriageway ahead is realigned. Cones or other traffic barriers for guiding vehicles past/through construction Work Zones should be placed on the traffic side of any works/obstruction. Their height is dependent on the speed of the road and/or their purpose, however, to standardize their use it is recommended that a single size is used – 1000mm high with a base diameter of 500mm. They may be suitable for higher speed roads dependent on risk assessment although that assessment may indicate the need for vehicle restraint barrier in addition nearer to the work area to protect the workforce, and the road user from impact with any plant, excavation or high risk situation.

- All traffic cones shall be manufactured from a durable material, able to endure impacts from passing vehicles without suffering damage or damaging the passing vehicle, or causing injury to pedestrians and road workers in the vicinity
- Traffic cones shall be of a hollow, conical shape to enable them to be stacked one on top of another, when not in use.
- Traffic cones shall be orange/red fluorescent color, with a white high intensity retro-reflective band that covers the middle third of the cone so as to be visible during both hours of daylight and darkness.
- All traffic cones shall have an adequately weighted base, in order to withstand any minor collision or air turbulence from passing traffic.
- The position and spacing of traffic cones within a work zone is governed by the nature of work being undertaken and the environment in which they are to be used.

- **Screens and Hoardings**

Screens are used to reduce the level of distraction to drivers and other road users created by work zones. They can also be used to reduce the amount of dust being blown across the road.

Screens can be mounted on safety barriers or barricades, or be self-standing on concrete footings behind a safety barrier (outside of the Lateral Safety Buffer).

Screens should be used on long-term works greater than 1 month in duration to reduce the level of distraction to drivers and where there is a strong likelihood of substantial amounts of dust being blown across the road. Suitable screen details must be approved by the Engineer before implementation at work zones.

• Temporary Rumble Strips

Temporary rumble strips may be used to alert road users to a changing roadway environment that requires extraordinary caution. They may also be used as an audible vehicle detection system for workers adjacent to the roadway.

They are surface placed, raised strips, which are placed perpendicular to the direction of travel. When a vehicle passes over the strips, the noise and vibration draw the driver's attention to features such as signs, unexpected alignment changes, or potential stop conditions.

- Spacing between temporary rumble strips should be 3.0 m, and their width should extend across the travel lane. A sign warning drivers of the rumble strips should be placed in advance of the installation (see Figure 9-17: Layout of Temporary Rumble Strips).
- Temporary rumble strips may be white, yellow, black, or orange, and contrast the color of the roadway.
- Temporary rumble strips should be placed sufficiently in advance of the condition to allow road users to respond to the warning.
- Temporary rumble strips should not be placed:
 - within intersections;
 - through pedestrian crossings;
 - on sharp horizontal or vertical curves.

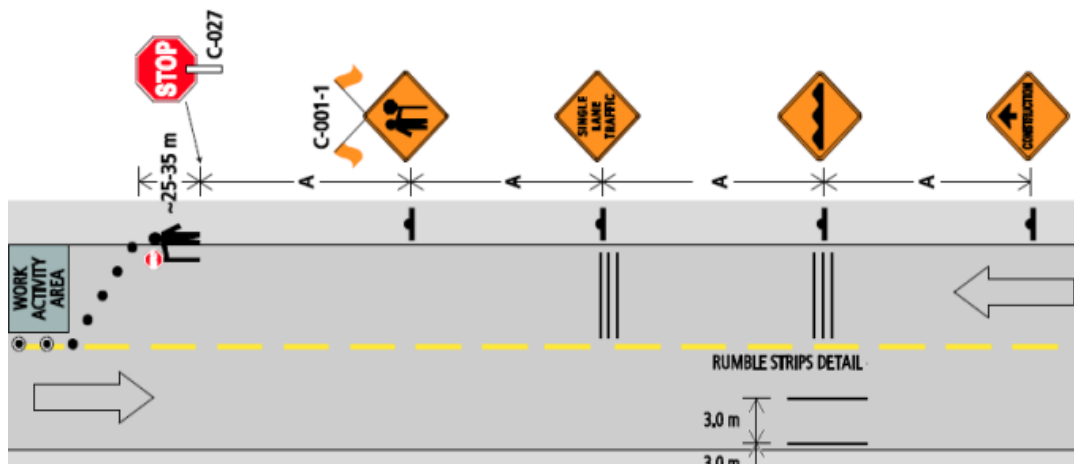


Figure 9-17: Layout of Temporary Rumble Strips (Example).

e. Work Zones During the Hours of Darkness

Traffic flows and other factors dictate that some traffic management activities are conducted during the hours of darkness. Such operations require additional pre-planning, resources and procedures to those needed for daytime activities. For example, some maintenance activities are executed at night-time to take advantage of low traffic volumes.

Although the risk of encountering high traffic flows are reduced by working during the night, other factors such as poor driver behavior, higher speeds, fatigue, difficulty in judging distances and limited vision will increase the risk of working during the night.

Throughout the hours of darkness, any traffic barriers, including coning, water filled plastic barriers and temporary concrete/steel barriers in addition to any signing shall be equipped with appropriate permanently **illuminated warning lights** or **high-intensity flashing beacons** to alert approaching drivers to the presence of a hazard.

In general, warning lights should be used to indicate to drivers the extent of an obstacle and high-intensity flashing beacons should be used to draw attention to a specific hazard. Over-use of flashing lights should be avoided as this can give a confusing effect to approaching drivers. Temporary lighting shall be positioned so as to not interfere with or dazzle road users. Light sources that produce glare shall not be used at road works.

Additional temporary lighting, over and above the existing public lighting, may be required for pedestrian detours, the works area, safety zones or manual traffic controllers. The Engineer shall approve the additional lighting implementation. These principles must be observed for any work zone that is in place during hours of darkness, even if works are not being carried out during those periods.

- **Nighttime Flagging**

Flagger stations shall be well illuminated with auxiliary lighting such as floodlights or balloon lighting except in emergency situations. If the emergency is expected to last an extended period, an attempt to illuminate the flagger station should be made. Auxiliary lighting shall not produce a disabling glare condition for approaching road users, flaggers, or workers. A flashlight with a red glow cone may be used to supplement the STOP/SLOW paddle. Retroreflective channelizing devices shall be used.

To stop traffic, the flagger shall hold the flashlight with glow cone in left hand with arm extended and pointed down toward the ground. To direct traffic to proceed, the flagger shall point the flashlight with glow cone at the first vehicle's bumper then slowly aim the flashlight toward the open lane, holding the flashlight in that position. To alert or slow traffic, the flagger shall point the flashlight with glow cone toward oncoming traffic and quickly wave the flashlight in a figure eight motion.

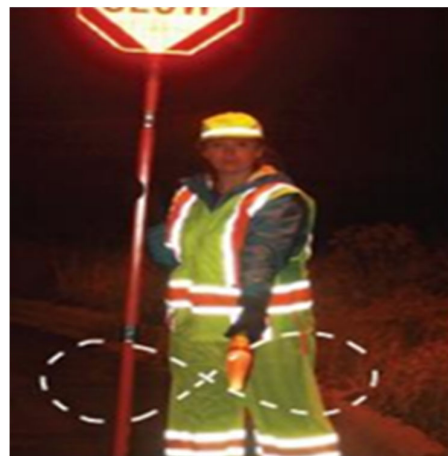


Figure 9-18: Nighttime Flagging with Glow Cone.

f. Traffic Control Persons (TCPs)

1. Traffic Control Supervisor

The Traffic Control Supervisor (Road Safety Superintendent) is responsible for the following:

- Overseeing traffic control operations, ensuring traffic control is executed in accordance with the Traffic Control Plan, and updated as necessary.
- Making sure that all required traffic control devices are in place.
- Signs are checked, maintained, and moved as required.
- Daily traffic control setups are documented, and changes are identified in the Traffic Control Plan or log book.
- Traffic concerns are reported to the Road Safety Expert (RSE) or The Resident Engineer (R.E).
- Each member of the traffic control crew wears the required personal protective clothing and equipment

The Traffic Control Supervisor shall also ensure that all TCPs are:

- Equipped with all necessary equipment, including radios, spare batteries, chargers, and red signaling wands.
- Performing traffic control duties competently and safely.
- Provided with rest break.

2. Traffic Control Persons (TCPs)

TCPs shall communicate instructions and directions to drivers effectively by using standard traffic control motions and signals that are precise and deliberate to be clearly understood by road users.

Among other requirements specified by MUTCD, TCPs and supervisors should ensure that:

- Traffic control arrangements and procedures for the work are made known to all personnel involved in the work.
- Required traffic control devices and procedures are in place before the work starts and are removed when they are no longer required.
- Any person assigned to be a TCP is adequately trained in an acceptable manner, and performs effectively in accordance with the traffic control arrangements and procedures for the work.

Traffic controllers must use the following equipment and personal protective gear:

- Hard hat.
- High Visibility Apparel (Vest, T-Shirt)
- 60 cm stop/slow paddle, Red flag (60x60 cm²). The paddle is the preferred device but the flag may be used at intersections where the stop/slow paddle would offer contradicting information to drivers traveling in opposite directions/legs of the intersection or during emergency situations.
- A red wand flashlight, if working at night, and portable lighting is unavailable.

- **Flagger**

A flagger may be necessary to alert traffic, or to stop traffic intermittently, as required by the progress of work in a work zone. The flagging operation provides protection for other workers and the public.

A flagger should be alert, neat appearing and act responsibly.

The flagger's only job is work zone protection and traffic control. The flagger must never assist the crew with work activities, or engage in any distraction, and must remain on duty until properly relieved. Use stop-slow paddles, where feasible. Flags may be used at intersections or where the back-side message is inappropriate for opposing traffic and where conditions such as high wind make the use of a paddle impractical.

Flaggers should be used in the following situations:

- One lane is alternately used for both directions of traffic.
- The roadway is closed for a brief period of time.
- Traffic speeds need to be substantially reduced.
- Inadequate sight distance advance warning.
- Information, such as changing conditions, needs to be conveyed to motorists.
- Opposing traffic needs to be controlled at an intersection.
- Installing and removing other traffic control devices.
- Where conditions require unusual precautions

No employee is to be utilized as a flagger until the employee has shown conclusively to their Supervisor that they realize fully the importance of the job, and understands the duties and responsibilities associated with it.

Flaggers must:

- Always face oncoming traffic.
- Never leave their position until relieved.
- Know where crew members and equipment are, be aware of changes, and never stand among workers and equipment.
- Be courteous, yet authoritative.
- Minimize conversations with motorist and pedestrians.
- Be positioned to compensate for limited sight distance, to provide maximum advance warning, and remain clearly visible to traffic at all times.
- Maintain continuous communication with any other flaggers.
- Try to maintain color contrast with background; consider sun glare on motorist.
- Establish eye contact with drivers to whom they must give direction. A flagger's activities bring them into continuous contact with the public.

The flagger's supervisor shall determine when flaggers are to be used, how many are needed, where they are to be stationed for a specific operation, and the methods of communication between multiple flaggers.

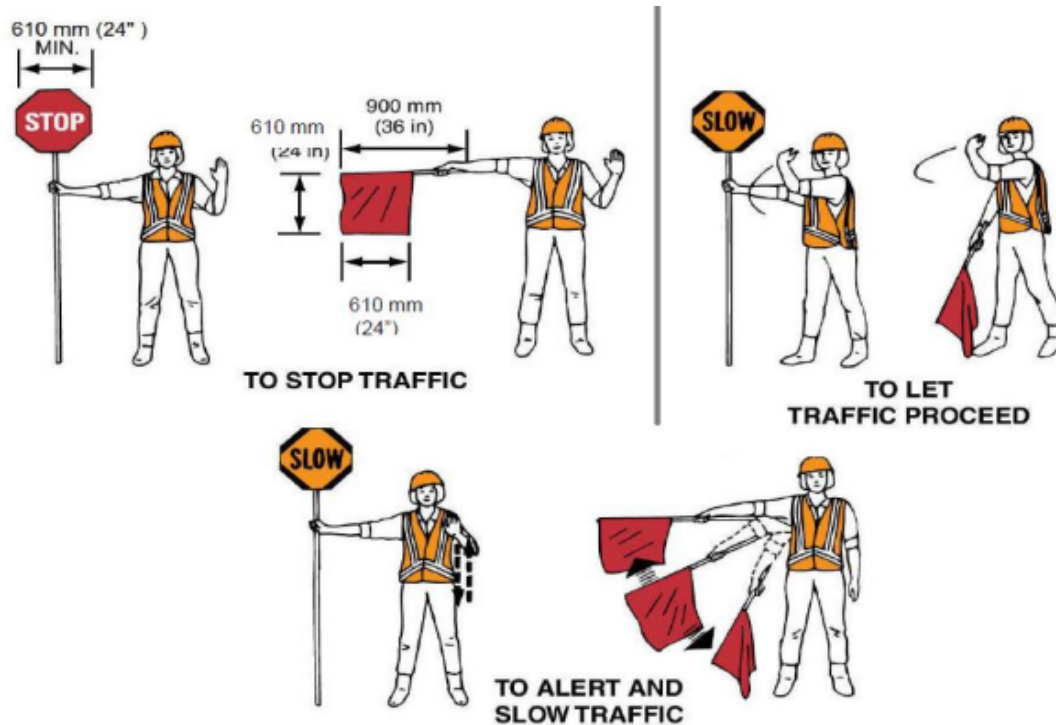


Figure 9-19: Flaggers Hand Signaling Devices.

- **Banksman/ Spotter**

A banksman/Spotter is a person with the same qualifications of the flagger. A banksman may be required to warn workers of errant vehicles, danger from traffic, or to assist drivers of work vehicles in entering or leaving work sites or in performing U-turns.

Where there are specific hazards, such as open excavations, then the movement of machines should be strictly controlled by competent banks person. The banks person must be excluded from the 'operational area' of the machine and a risk assessment will be required to determine the safe area and distance around the machine – if in any doubt, the plant should be segregated from the banks person and other workers.

To avoid high accident rate within the work zone, there should be use a banksman to direct all rig movement. The banksman is responsible for planning and coordinating the safe movement of vehicles in the workplace and to guide drivers with the use of hand signals. The banksman is in charge of the vehicle maneuvers in the workplace not the driver. Before any vehicle movements begin, the banksman and driver need to agree exactly what the requirement is and how it is to be conducted. Hand signals must be confirmed and agreed before any movement. Drivers must strictly adhere to the signals of the banksman and the banksman must be visible to the driver at all times. Only trained banksmen should assist reversing vehicles. The banksman should stand 5-10 m back and 1m out from the side of the vehicle, so that the driver can see them at all times. Banksmen should never stand directly behind the vehicle. Banksmen should never walk backwards while giving signals, they should be side on with situational awareness. If the driver loses sight of the banksman, they should stop the vehicle immediately.

The banksman and the driver must work as a team. The rig must never move without instruction from the banksman; but the driver must also take responsibility and should not move if there is

any danger to the banksman or any other person. Ideally, the same driver should always work with the same banksman so that they build up trust and understanding.

The authority and visibility of the banksman can be enhanced by providing him with a different colored high visibility vest.

g. Work Zone Apparel and Equipment

1. TCP Apparel and Equipment

Personal protective clothing and equipment for TCPs shall comply with international standards:

- **Basic Requirements**

TCPs shall have the following required material with them on the job at all times:

- STOP or SLOW Paddle;
- Safety Headgear/Hard hats;
- Safety Footwear;
- Safety Retroreflective Apparel: alternative to coveralls shown, TCPs may wear, at nighttime shift, a combination of a torso vest (or jacket) and bands encircling both arms and both legs.

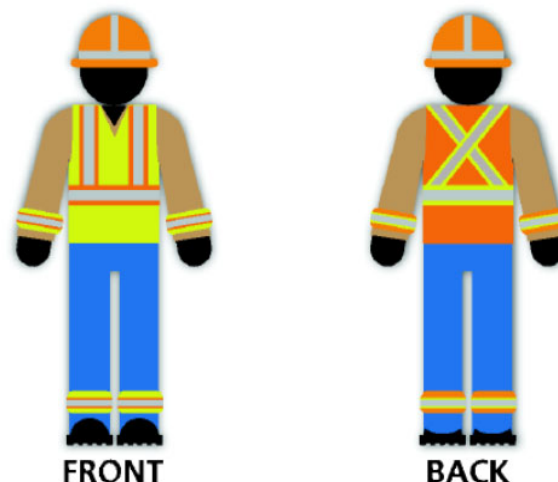


Figure 9-20: TCPs with Fluorescent Yellow-Green and Fluorescent Orange-Red Vests.

Additional Requirements for Night Operations

- Flashlight with red signaling wand;
- Spare batteries
- Two-way radios

- **Night Lighting**

TCP stations shall be illuminated at night. If street lighting is available, TCPs should stand below the light to maximize front-of-body illumination. If temporary overhead lighting is being used, it shall not subject approaching drivers to excessive glare.

2. Apparel Retro-reflectivity for TCPs.

TCPs shall wear Class 3 safety garments that comply with the international standards. At minimum, Class 3 high-visibility material shall fully cover the upper torso (front, back, sides, and over shoulders) and shall include bands encircling both arms and both legs.

Acceptable colors for background material on these high-visibility safety garments are fluorescent yellow-green and fluorescent orange-red (the orange-red is often labeled fluorescent orange).

These garments require a contrasting-color fluorescent stripe that is at least 100 mm wide.

Acceptable colors for the contrasting stripe are also fluorescent yellow-green and fluorescent orange-red. The retro-reflective bands used on these garments shall be at least 50 mm wide and in a color that contrasts with the background color.

Horizontal wrist and ankle stripes/bands shall be placed on the sleeves and pants, encircling both arms and legs. They shall be 100 mm wide and include a 50 mm retro-reflective band with two 25 mm contrasting color fluorescent stripes on each side of the retro-reflective band.

The stripes/bands shall be laid out in this pattern:

- Symmetric X on back of garment extending from shoulders to waist.
- Two vertical stripes/bands on front extending over shoulders and down to waist.
- Horizontal leg and arm stripes/bands encircling both arms and both legs.
- Waist-level, horizontal stripe/band extending entirely around the circumference of the torso from the back to the bottom of the vertical stripe/bands on the front, where they end at the front fastening mechanism (snap, zipper, etc.)
- Gaps in retro-reflective materials for front fastening cannot exceed 50 mm.

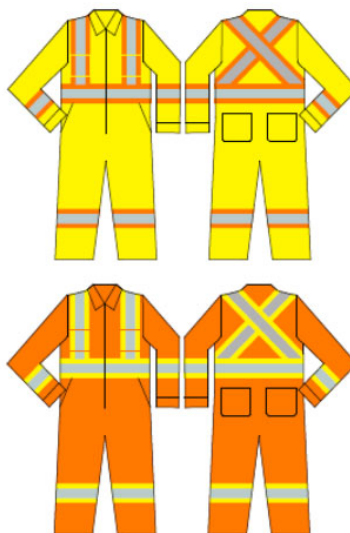


Figure 9-21: Coveralls with Contrasting Retro-Reflective Bands.

3. Apparel for Other Onsite Workers

Work zone workers who are not TCPs shall wear Class 2 safety garments that comply with standard requirements.

At minimum, Class 2 high-visibility material shall fully cover the upper torso (front, back, sides, and over the shoulders).

The following apparel components shall also comply with the retro-reflectivity requirements for TCPs:

- Fluorescent background material.
- Fluorescent 100 mm (4") contrasting stripe.
- 50 mm (2") retro-reflective bands of tape.



Figure 9-22: Workers Vests with Contrasting Retro-Reflective Bands.

h. TCP Communications

TCPs work together to regulate traffic through the work zone. This means that they need to communicate effectively with each other.

When the two TCPs are within sight of each other:

- They should use pre-arranged visual signals to communicate.
- One TCP should wait until signals are acknowledged by the other TCP before changing traffic flow.

When the two TCPs are not inter-visible, such as on curves or hills, they should either use two-way radios.

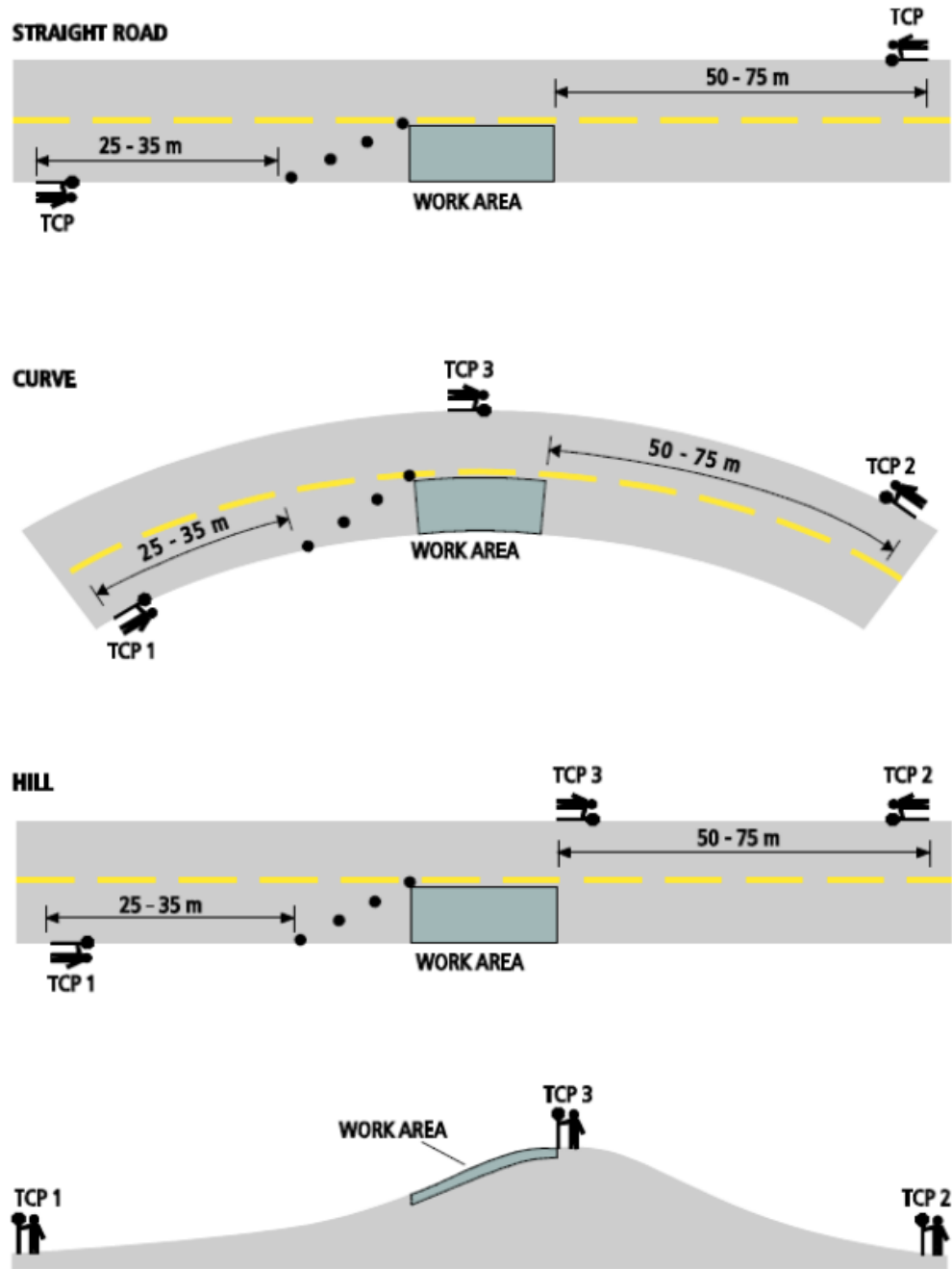


Figure 9-23: Positioning Requirements When Two TCPs are not Inter-Visible.

i. TCP Positioning and Signals

1. Hazard and Risk Assessment

When deciding on a position for the TCP and the traffic queue, it is important to identify and assess the potential risks associated with all site hazards.

If TCPs and traffic queues will be positioned such that the TCPs are at high risk from a hazard, appropriate steps should be taken to eliminate or minimize the risk. It may be necessary to remove the hazard or reposition the TCP.

- Tunnel entrances and exits.
- Heavy traffic congestion.
- Large commercial or business accesses.

Note: TCPs should be able to focus their attention on traffic and not be distracted by having to watch out for other hazards.

The distance between the Traffic Control Person Ahead sign and the TCP should not exceed 150 meters unless local site conditions (curves, hills, etc.) govern. If there is not an ideal location within this distance because of road features or conditions, an additional sign should be used in advance, such as a Flagger Ahead sign or a Prepare to Stop sign.

2. Positioning Rules for TCPs

Stand either on the shoulder adjacent to the traffic being controlled or in a lane that has been closed to traffic, on the same side of the roadway where you are controlling traffic.

Be aware that the closed lane is not the opposing lane, even when controlled by another TCP or device.

- Always plan an escape route from every position you assume—i.e., an uninhibited path for avoiding errant vehicles.
- After more than one vehicle has been stopped—and only if necessary—you may move into the lane under your control to assess queue length or to achieve a better view of approaching vehicles.
- Avoid entering a lane being used by opposing traffic.
- Return to your starting position before you release the stopped traffic queue.

Unless otherwise specified, stand 25 to 35 meters from the TCP taper and 50 to 75 meters from the downstream taper to avoid out-of-control vehicles and to provide maneuvering room for responding to vehicles that make unanticipated lane changes.

Face the center of the road, with your back to the road shoulder, scanning traffic approaching from both directions. Remain aware of what is happening in the stopped lane.

For intersection traffic control, it may be necessary to stand in the middle of the intersection, in which case it may not be possible to comply with the three rules above.

Stand where you can see equipment on the site and where you can see—and be seen by—approaching drivers. To the extent practicable, stand where the background will make you as conspicuous as possible.

To be visible to drivers, stand away from the other workers, and never stand in a group of people while stopping traffic.

Never use your body as a barrier for blocking errant vehicles.

Regardless of the rules listed above, TCP safety is paramount. Therefore, always stand where you can see and be seen by approaching drivers, in a position that is suitable for safely stopping traffic and/or directing traffic through the work activity area, and where there is an escape route.

3. Positioning Rules for TCPs in Intersections

TCP direction in intersections cannot conflict with the direction provided by any existing intersection control. Traffic signals shall be shut off or changed to flash mode. Stop signs shall be covered.

Traffic Control Persons must be visible to approaching traffic and not obscured by advance warning or other signage.

4. TCP Signals

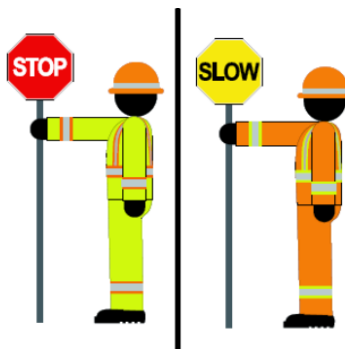
TCP signals shall comply with the specifications standard of Occupational Health and Safety Regulation:

- **Signal for Stopping Traffic**

- Position yourself in a safe position.
- Stand on the roadway shoulder, where you can see, and be seen, with toes pointing towards the center of the road, and hold the paddle out to stop the first vehicle.
Always display the paddle in a static manner, and hold the paddle so that it is visible to traffic.
- Once you have stopped the first vehicle, adjust your position so that you are standing in a position where you can see, and be seen by, approaching drivers from a sufficient distance to stop safely (at least 150 meters).

- **Signal for Slowing Traffic**

- Extend the traffic control paddle towards the lane of oncoming traffic.
- Wave the traffic forward with your other hand to avoid bringing traffic to a full stop.



j. **TCP Safety**

1. Ability to Make Evasive Maneuvers

- TCPs should be positioned so that they can make evasive maneuvers to avoid being struck by a vehicle.
- If an errant vehicle enters the work site, TCPs are responsible for using their escape routes.
- If it appears that the vehicle is not stopping, the TCP should notify personnel working on the site (via radio or audible device), and observe and document as many details as possible for subsequent follow-up.
- Although many TCPs use their vehicles as refuge, they should not position themselves in such a way that the presence of the vehicle or other equipment reduces their options for making evasive maneuvers. The same precautionary principle applies to working near equipment, barriers, or opposing traffic.

2. Management of Approaching Vehicle Speeds

- Speed Management Delineation: Centerline or edge line delineation can be used to reduce vehicle speed in advance of the TCP position.

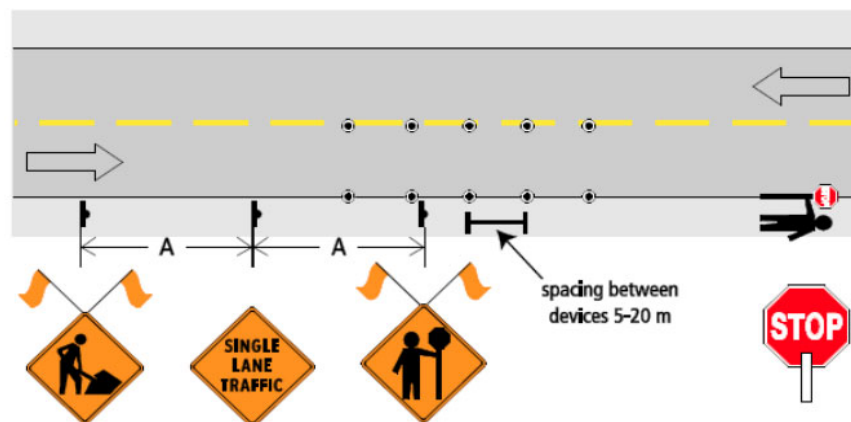


Figure 9-24: Centerline and Edge Line Delineation.

- Speed Management at Night: When TCPs are working during hours of darkness and are having difficulty getting traffic to stop, various traffic control options may assist with slowing and stopping traffic. Examples include, but are not limited to:
 - Increasing number of advance warning signs and devices.
 - Increasing sign sizes
 - Using an oversized STOP sign (75 cm x 75 cm) on a barricade across the closed lane
 - Where the TCP is positioned

3. Prohibitions for TCPs While Actively Controlling Traffic.

- Never stand near a vehicle or sit in a vehicle when actively controlling traffic.
- Never argue with a driver.
- Never stand in an open travelled portion of the roadway while traffic is moving.
- Never accept an assignment to carry out other onsite work, and never attempt to carry out any other onsite work.
- Never allow the TCP sign to be displayed when a TCP is not directing traffic.
- Never give direction that contradicts a traffic signal.
- Never converse with any person about anything that is not work-related, and ensure that all work-related conversation is both necessary and brief.
- Never sit when actively controlling traffic.
- Never lean on a post or other object.

- Never use a mobile device, tape, disk, MP3 player, TV, non-work radio, or any other device that impairs sight, hearing, or attention. Use cell phones only to communicate about onsite emergencies.
- Never stand near equipment.
- Never turn your back on approaching traffic.
- Never wear clothing or items that can obscure or reduce peripheral vision, such as hoodies, certain kinds of sunglasses, etc.
- Never become impatient or enraged.
- Never attempt to slow traffic by displaying the STOP sign rather than the SLOW sign.
- Never leave the control position without being replaced. Meal, coffee, toilet, and rest breaks should be pre-arranged before work starts.
- Never regulate traffic if your judgment is impaired in any way.
- Never regulate traffic if you have suffered a reduction in performance that could increase anyone's exposure to risk.

k. Emergency Procedures.

1. Passage of Emergency Vehicles and Personnel.

TCPs should review the Traffic Management Plan, which may specify how emergency vehicles and personnel are to be accommodated or taken through the work zone, and should discuss the process to be used in these situations with the RSE and Site Supervisor.

TCPs need to be aware of any instructions that should be communicated to the drivers of emergency vehicles.

2. Traffic Control at Emergency Scenes.

Members of emergency responder groups often have to control traffic around the site of an emergency or crash. Before implementing traffic control, responders and workers should ensure their own safety FIRST and then the safety of others.

Having assured the safety of themselves and other onsite personnel, emergency responders are expected to maintain traffic operations through the area impacted by the emergency by employing basic traffic control principles, and to be trained in:

- Basic traffic control techniques.
- Traffic control equipment setup, operation, and take-down.
- The traffic management principles outlined in this Manual.
- The use of a buffer vehicle to protect the workplace.
- The use of appropriate personal protective clothing and safety equipment.
- Other appropriate safe work procedures.

If the traffic control situation will persist for more than two hours, the emergency responders directing traffic are expected to be trained in an acceptable manner for high-risk traffic control or to be replaced by personnel who have this training.

10. SITE SAFETY

a. Traffic Risk Assessment

A traffic management risk assessment shall be conducted prior to the commencement of any traffic management works.

The purpose of the assessment was to identify and address the risks associated with the road safety and traffic management specific to the Construction site. The outcomes of the assessment are available below.

The identified risks will be managed through the implementation of TTC plans and other measures outlined in this TMP.

Table 11: Traffic Management Risk Assessment

Traffic Management Risk Assessment					
Activity	Risk/Hazard	Uncontrolled Risk Score	Mandatory Controls	Controlled Risk Score	Who is responsible
Construction Activity: Repair of Bridge Joints.	Traffic Collision with Traffic Barriers	Extreme	-Speed Reduction; -Ensure a safe advance warning zone and Taper. -Ensure exclusion zones behind barriers is maintained;	Moderate	Contractor
	Delay to traffic and excessive queueing	Moderate	-Do not stop traffic during peak times. -Ensure a safe advance warning zone and Taper.	Low	Contractor
	Changed Traffic Conditions confusing drivers.	High	-Community notification. -Prevent sign clutter	Low	Contractor

b. TMP Implementation, Monitoring and Measurement

Specific Typical Traffic Control Plans (STTCPs) have been prepared for the Project.

STTCPs shall be updated progressively throughout Construction by the Contractor to identify measures that will be installed to warn traffic and guide it around or past the Construction sites.

The Contractor Road Safety Expert (RSE) shall ensure that the traffic management measures are implemented in accordance with the approved site specific TTCPs.

STTCPs revised by the Contractor shall be submitted to the Supervision Consultant for approval at least three working days before the commencement of any activity which affects traffic conditions for a particular section of the Project.

The Contractor RSE/ R.E shall inspect and monitor traffic movements around the site in conjunction with the personnel who have erected the control measures.

The outcomes of the inspection will be documented for the information of the Project Team.

Inspections will be undertaken as required and at a minimum on the following occasions:

- Before the start of work activities;
- Closing down at the end of the shift period.

A daily record of inspections will be kept indicating:

- When traffic controls were erected.
- When changes to controls occurred and why the changes were undertaken.
- Any significant incidents or observations associated with the traffic controls and their impacts on road users or adjacent properties.

Where significant changes to the work or traffic environment or adverse impacts are observed, controls shall be measured as a matter of urgency. All variations to the STTCP, non-conformances, incidents and accidents will be recorded. Copies of completed records will be kept in the Traffic Management folder.

Regular site inspections will be undertaken no less than two times a day during normal working business hours or as often as required by the RSE.

All observations to be included in the daily inspection record will be:

- Conditions of signage: Signs will be monitored daily for conditions/suitability. Signs may need to be cleaned, repositioned, re-erected or replaced if damaged. The sign condition checks will be recorded daily in the site inspection records.
- Delineating devices will be checked and recorded for cleanliness and visibility to road users during all conditions including sunrise and sunset.

Weekly site inspections will be conducted by the Traffic Manager/RSE to ensure adequate inspection, monitoring and maintenance of traffic management arrangements and devices. The inspections will be carried out and recorded.

c. Monitoring and Inspections

The Project Team will conduct regular inspections of the temporary traffic controls during the Construction phase. These inspections will be carried out in accordance with Table 11 below.

The main types of inspections are:

- Pre-start and pre-closedown inspections: before works starts, regularly through the shift and prior to closing down.
- Night Inspection: On the day before the work begins and at every night for night work bridges.
- Intermittent inspections of long-term traffic control (including night inspections).
- Pre-opening inspections of temporary roads.

Table 12: Inspections and Monitoring Relevant to Traffic & Transport.

Inspection/ Monitoring	Frequency	Responsibility
Traffic control plan inspection: Ensure all traffic control signs and devices are functioning and implemented in the correct location.	Daily	Contractor RSE
Traffic management risk assessment	Upon Demand	Contractor RSE
Traffic control safety inspection: Ensure traffic control plans implemented are approved and Construction sites are operating safely.	As per the Engineer request	Contractor RSE/

d. Incident planning and response

A traffic incident represents an unplanned event creating a temporary reduction in road capacity that leads to an adverse impact on traffic flow. Incidents may result from vehicle disablements, impacts, spills, roadway debris, stranded vehicles, and secondary incidents through driver distraction, adverse weather conditions and maintenance activities.

Effective strategies and provision for incidents will reduce incident related delay and congestion, improve the safety of motorists and crash victims, incident responders.

To achieve these objectives, the Contractor will implement the following provisions; as per Table 12 below.

Table 13: Incident Management and Response.

Objective	How addressed
Nominated site contact to deal with issues of clearing the road when notified by ISF.	Responsible personnel identified and nominated. Nominated persons provided with contact list of local subcontractors / contacts with arrangements to provide required services e.g. Vehicle Recovery Services, Road Sweeping, Spill Response, Heavy Lifting Plant, Traffic Control etc.
Availability of supplementary Traffic Control Measures	Maintain a reserve supply of suitable traffic control devices e.g. traffic barriers, cones, signs and debris clearing tools.
Ensure the area is restored to the full and compliant safety level within a minimum amount of time. Arrange recovery of any Construction vehicle if in the event of breakdown that occurs en-route or within Construction sites or ancillary facilities.	Provide capacity on site for basic early traffic control that may be required at an incident, such as cones, signs, clearing debris. Keep suitable plant available on site during construction for moving temporary concrete safety barriers;
Keep records of communications with the concerned Authorities, and Keep records of all traffic incidents attended .	Traffic incidents and associated records / documentation will be entered into Contractor database. The RSE will prepare a report for each traffic related incident. The report will include photographs of the road approaches at 10 m

Objective	How addressed
	intervals starting from at least 200 m each side of the incident site, including photographing the location of all relevant safety devices and signs, and any recommended corrective actions to prevent further incidents

e. Reporting

During the Construction phase, the Project Manager will include a section on Traffic management within the progress report that is submitted to the Client.

The traffic management component of the report may include, but not be limited to, the following items:

- Current and upcoming critical issues, identified by the Engineer or other relevant stakeholders, and measures to address these issues are to be included.
- Reports on recent traffic incidents.
- The current status of TTC Plans development, approvals and implementation.
- Community and media feedback as they relate to road safety and traffic management issues.

The Contractor will maintain accurate records substantiating all Construction activities associated with the Project or relevant to the conditions of approval, including measures taken to implement this TMP. Records will be made available to the Client upon request, within the timeframe nominated in the request.

Part II- Specific Temporary Traffic Control/ Management Plans (STTCP/ STMP):