

1 SAUDI ARABIAN OIL COMPANY (Saudi Aramco) <b>GENERAL INSTRUCTION MANUAL</b>		G. I. Number Approved 1021.000
ISSUING ORG. * TRANSPORTATION DEPARTMENT		ISSUE DATE 03/17/2010
SUBJECT	STREET AND ROAD CLOSURE: EXCAVATION , REINSTATEMENT AND TRAFFIC CONTROLS	REPLACES 01/08/2005 APPROVAL PAGE NO. 1 of 12

## CONTENT:

This instruction outlines the procedures to be followed during Saudi Aramco road closures. Procedures cover the advisement of Saudi Aramco Departments and the Saudi Aramco Community, roadway excavation and reinstatement requirements and guidelines for the control of pedestrian and vehicular traffic.

### TEXT INCLUDES:

- 1 Definitions
- 2 Purpose
- 3 Scope
- 4 Responsibilities
- 5 General Requirements and Methods

## \*1.0 DEFINITIONS:

- 1.1 SAUDI ARAMCO ROADWAY. Any roadway whose operation and maintenance falls within Saudi Aramco's responsibility. Proponency for these roadways, for purposes of G.I. 1021.000, fall within four areas:
  - 1.1.1 Saudi Aramco Roads Network: These are normally roads outside of the responsibility / boundaries of the various Saudi Aramco plants and camps. Any closure of these roadways requires the approval of the Roads Division's Superintendent.
  - 1.1.2 Skid roads and other unpaved Saudi Aramco Roads: These roads are the responsibility of the Wellsites Division of Drilling & Workover Svcs Dept. Any closure must be approved by the Superintendent of Wellsites Division and Producing Operation Department.
  - 1.1.3 Saudi Aramco Plant Roads, Parking Areas, Plant Areas & Lay down Yards: These are roadways within the various Saudi Aramco plants, terminals, refineries, gas plants and other facilities. Any closure of these roadways must be approved by the Manager of the plant or his delegate.
  - 1.1.4 Camp Roads and Streets., parking areas, alleys and sidewalks and other pedestrian and vehicular facilities within the boundaries of a Saudi Aramco Camp are normally under the control of the Area Community, Office Services and Medical Departments.. In all cases, a letter of intent (see supplement # 1021.000-1) will be required and a work permit (if it is a restricted area) should be received from the appropriate Community Services -Operating Department/Division prior to any closure.
  - 1.1.5 Airstrips (A). Runways, Taxiways, Parking Areas & vehicular facilities within the boundaries of Saudi Aramco Aviation Facilities.
- 1.2 CLOSURE. A closure will be considered as any activity, which restricts the full use of a pedestrian or vehicular roadway.
- 1.3 SAUDI ARAMCO ROADWAY DEPARTMENT. The Saudi Aramco Organization that has operational or maintenance responsibility over the roadway that the closure will affect.

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- 1.4 SAUDI ARAMCO FACILITY DEPARTMENT. The Saudi Aramco Organization having operational or maintenance responsibility over non-roadway facilities. Normally, these would be organizations such as Pipelines Departments and the various Utility Departments. It would be possible for a Saudi Aramco Plant to fall into this category if they had an operation that requires closure of a roadway not under their authority. The case of a Saudi Aramco Plant closing a roadway under its control would fall under definition 1.3 and would, in most cases, utilize the exception under 5.3.1.
- 1.5 MAINTENANCE OR CONSTRUCTION AGENCY. Defined as the engineering agency/consultant or contractor responsible for accomplishing the work entailed in the closure. This agency may be a Saudi Aramco Organization or a non-Saudi Aramco consultant or contractor.

**2.0 PURPOSE:**

- 2.1 The purpose of this instruction is to establish guideline of the construction or maintenance work procedures associated with a closure of Saudi Aramco roadways that will:
- 2.1.1 Ensure safe and expeditious movement of pedestrians, vehicles and motorists.
  - 2.1.2 Ensure the safety of the work force performing the construction or maintenance activity.
  - 2.1.3 Ensure the restoration of the roadway structure to meet SAES-Q-006 (Asphalt Concrete Paving) and the procedures and the methods to be followed for installation of utilities and reinstating the roadway (see supplement # 1021.000-2). .
  - 2.1.4 Ensure the restoration of road marking, raised markers, signs & signals.
  - 2.1.5 Ensure all underground utilities are well protected and handwork should be carried out where underground utilities are expected.
  - 2.1.6 Ensure the restoration of manhole, trench cover, grating, cable marker, etc and to be elevated to match the road surface, which has to be sloped to the original slope.

**3.0 SCOPE:**

The scope of this G.I. is to set standards for the following

- 3.1 Circulation of a letter of intent to advise necessary Saudi Aramco Departments and gaining concurrence of controlling Saudi Aramco Departments.
- 3.2 Installation and maintenance of traffic control devices required for road closures.
- 3.3 Procedures and methods to be followed for installation of utilities and restoration of the roadway (see supplement # 1021.000-2).
- 3.4 Control damage/impact to underground utilities during construction.

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**4.0 RESPONSIBILITIES:**

- 4.1 It is the responsibility of the Saudi Aramco Department initiating the required closure or work activity to ensure that their maintenance or construction agency performs the following:
- 4.2 The Saudi Aramco Department initiating the closure will circulate a letter of intent and advertise the closure in the area highlights at least 10 days prior to the scheduled start of the closure. The letter of intent and advertisement will include the proposed method of construction, pedestrian and vehicular traffic control, plot plan detailing the location of the closure and the time schedule of the work. The purpose of the letter of intent is to obtain the approval of the proponent department, which has the authority over the paved area, and advise other Saudi Aramco Departments of the proposed closure in order to resolve conflicts in the closure operations prior to their concurrence. (See sample letter of intent Supplement 1021.000-1.)
- 4.3 Adhere to this G.I, the Saudi Aramco Construction Safety Manual and the requirement of SAES-Q-006 (Asphalt Concrete Paving).
- 4.4 Include a one-year warranty period to the required asphalt work in the project scope. Any pavement failure within the warranty period shall be the responsibility of the Saudi Aramco Department initiating the required closure and their maintenance or construction agency.
- 4.5 Comply with all necessary tests required by SAES-Q-006 and submit results to the Saudi Aramco Department, that is the proponent of the area affected by the closure for approval prior and after paving. The most important tests to be done are gradation test, atterberg limit, modified proctor test, California bearing ratio (CBR), extraction, bulk specific gravity, core thickness and density. Tests shall be done at an independent approved outside lab (consult Inspection Department to check on the current approved labs) and charged to the Saudi Aramco Department initiating the closure. The tests described herein are not necessary for relatively small jobs. The proponent department who approves the closure has to check mark and identify the necessity of those tests in the letter of the intent upon his approval.
- 4.6 Plain concrete as per SAES-Q-001 (Criteria for Design and Construction of Concrete Structures) could be used instead of selected material or crushed stone as a base for the asphalt pavement. Proponent approval must be obtained to use this option. Plain concrete specifications must meet SAES-Q-001.
- 4.7 It is the responsibility of the Saudi Aramco Department initiating the closure to hold the MCC or final completion letter until the proponent department, which has the authority over the paved area, accepts the paving work done by the maintenance or construction agency or include it in the exception items list of the MCC if the paving work was unsatisfactory. Should any failure occur in the asphalt pavement, the proponent department has the right to do the necessary repair and charge the Saudi Aramco Department initiating the closure.
- 4.8 After all work is completed; the Saudi Aramco Department initiating the closure must send a letter of clearance to obtain the concurrence of the controlling department approving the roadway reinstatement works.

**5.0 GENERAL REQUIREMENTS AND METHODS:**

\* CHANGE

\*\* ADDITION

NEW INSTRUCTION COMPLETE REVISION

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The following requirements are applicable to all road closures.

- 5.1 Any road closure or excavation works around emergency gates or security lighting system shall be approved in writing by the area industrial security operations department.
- 5.2 The Saudi Aramco Department initiating the closure will assure itself that the following Saudi Aramco Organizations operating in that area are advised by the letter of intent at least ten working days prior to commencement of work:
  - 5.2.1 Industrial Security
  - 5.2.2 Fire Protection
  - 5.2.3 Medical Organization (Ambulance Service)
  - 5.2.4 Loss Prevention
  - 5.2.5 Residential/Recreation & Environmental Department (if within a camp).
  - 5.2.6 Passenger Transportation (if any bus or taxi route is involved).
  - 5.2.7 Pipelines Department (if crossing or adjacent to petroleum pipelines).
  - 5.2.8 Community Utilities Department (if within a camp).
  - 5.2.9 Plant Utility Department (if within a plant)
  - 5.2.10 Computer and Communication Svcs. (above and below ground).
  - 5.2.11 Power Distribution (above and below ground).
  - 5.2.12 Exploration Operations.
  - 5.2.13 Other Saudi Aramco Departments that could have their operation affected because of the proximity of the work or changed access to their operation (terminals, gas plants, refineries, pipelines, local communities. etc.).
  - 5.2.14 In those cases where a closure will impact local communities such as on major Saudi Aramco public roads, the Area Government Affairs Office will be contacted and through them local Government entities will be advised.
  - \*5.2.15 For excavation work/closure outside Saudi Aramco communities it is essential that every excavation/closure be closely analyzed for any impact with Saudi Arabian Government Agencies such as SEC, Saudi Telecommunication Co, MOW, MOT, Saudi Railroad Organization (SRO) or Ministry of Municipality and Rural Affairs (MOMRA), etc. If there is any question about impacting Government Agencies, the initiator of the closure should contact the Area Government Affairs Office.

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- 5.2.16 All Saudi Aramco Departments once notified are responsible for notifying contractors working for them who could possibly be affected by any of the new construction

**5.3 EXCEPTION TO THE REQUIREMENT FOR A LETTER OF INTENT.**

- 5.3.1 The manager of a plant or otherwise self-contained operation (if the organization which initiate the closure is the same organization which has the authority over the area and will maintain and reinstate the paved area) may waive the requirements of the letter of intent if they have adequate safeguards built into their work permit procedures.

- 5.3.2 Emergency closure will be made as required; however, organizations listed under paragraph 5.2 will be notified by telephone as soon as possible (within 24 hours). If the emergency closure will remain in effect more than two days, a letter of intent will be transmitted by fax and circulated during the second day explaining action proposed as described under paragraph 5.1.

- 5.3.3 The affected Plant or Saudi Aramco Department manager has the authority to waive the letter of intent for routine minor maintenance work that will not have a significant impact on pedestrian or vehicle traffic.

- 5.3.4 A major BI project will normally have satisfied the requirements for a letter of intent since the project would have been processed through the local area planning committee. Changes in a BI should be routed through the concerned Saudi Aramco Organization. In addition, schedules should be advertised periodically in the local Highlights to keep interested organizations advised.

- 5.4 WORK PERMITS:** No part of this General Instruction will be construed as abbreviating or eliminating any portion of G.I. 2.100. Work permits are required in all restricted areas as well as in other areas designated by the manager or his delegate of Saudi Aramco Department who has the authority over the roadway or the paved area and concurring organizations in paragraph 5.2.

**5.5 LOCATION OF UTILITIES AND OTHER FIXED OBJECTS WITHIN OR ADJACENT TO THE ROADWAY CROSS SECTION**

- 5.5.1 Underground utilities, which must cross an existing roadway or paved area, should cross at right angles to the flow of traffic if design and construction make it technically feasible to do so. Thrust boring should be performed when utilities are installed outside the main camp or land area and where field conditions are suitable. In situations where thrust boring is not practical, the Saudi Aramco Utility Department may request approval from the Manager of the Saudi Aramco Department who has authority over the roadway or paved area to open cut for the utility installation. When open cut is allowed, the excavation must be performed according to the requirements stipulated in Supplement 1021-000-2 entitled "Excavation and Reinstatement of Utility Trenches". Any exception to Supplement 1021-000-2 must be approved by the Manager of the Saudi Aramco Department responsible for the roadway or the paved area. All spoils or other construction materials not incorporated in the utility crossing must be removed at once.

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- 5.5.2 Within Saudi Aramco camps, underground utilities may be located within the roadbed when approved by the Manager of Transportation Department and the Manager of Community Building and Office Services.
- 5.5.3 Utilities to be located within Plants will require approval of the manager of the affected Plant.
- 5.5.4 Fences, signs, power poles and other fixed objects to be located within 10 meters of the edge of a Saudi Aramco Road require approval of the Manager of the Saudi Aramco Department involved. All signs must comply with S.A. standards and "Manual On Uniform Traffic Control Devices" set by Ministry of Transport. Examples of the common signs specifications are placement, reflectivity, breakaway base, height, erection.... etc.
- 5.5.5 All required safety measures shall be put in place, and testing for underground utilities and any other fixed object locations shall be performed prior to thrust boring operation.
- 5.5.6 Failure to meet the above requirements mentioned under item 5.5, the proponent department has the right to remove the object and charge the Saudi Aramco Department initiating the closure. Prior notice is required before proceeding with removal and back charges.
- 5.6 TRAFFIC CONTROL DEVICES. All closures, construction and maintenance activities will be properly signed in accordance with Supplement 1021.000-3 cases I-A to XIII-B attached.
- 5.6.1 Sign layout drawings in Supplement 1021.000-3 show typical examples of construction signing on Saudi Aramco roads. The construction or maintenance agency should view these drawings as a guide to minimum standards in arriving at a detour and/or signing plan. Each site must be evaluated as to its particular conditions including, but not limited to, physical culture of the area, sight distance, traffic volumes, speed limit, duration of the closure, and anticipated weather conditions. From these considerations, the type of detour will be determined and the requirements for surfacing and/or illumination decided. The Saudi Aramco Road Division's Traffic Engineer will be available for advice in developing detour and signing plans.
- 5.6.2 Drawings in Supplement 1021.000-3 are based on current government standards. All signs should conform to this GI.
- 5.6.3 Spacing of signs may be reduced in areas of lower speeds (less than 60 KPH) or at areas where the required spacing could not be met.
- 5.6.4 Spacing of signs will be adjusted to fit community or plant street systems
- 5.6.5 Signs for short-term projects (less than one month or projects where the work area constantly changes) may be mounted on portable supports.
- 5.6.6 Signs for long-term projects (more than one month): will be post mounted in the ground using breakaway base.

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- 5.6.7 Signs will be maintained in a clean and legible condition. Illegible signs will be replaced at once.
- 5.6.8 Signs shall be made of reflective sheeting conforming to current Ministry of Transport and Saudi Aramco standards.
- \*5.6.9 Detours for long-term projects (30 days or more) should be paved with hot mix asphalt for heavy traffic volume, and / or stabilized with emulsion for low traffic volume.

## 5.7 GENERAL:

- 5.7.1 The maintenance or construction agency will complete the work as rapidly as possible to minimize the inconvenience to the road users and shall contact all other Saudi Aramco departments and their contractors who are working in the area for a pre-work risk assessment meeting. This meeting will coordinate planning among various parties and help avoid any other Saudi Aramco departmental delays in operation.
- \*5.7.2 Excavations will be barricaded or otherwise protected to ensure the safety of pedestrians especially children in camp areas. All road closures or jobs impacting traffic and/or pedestrian flow shall comply with drawing in supplement 1021.000-3 and or the Manual of Uniform Traffic Control Devices (MUTCD).
- 5.7.3 Upon completion of the closure activity, all excess materials, spoils; debris and traffic control signs will be removed from the area immediately. Shoulders, side slopes, ditches and back slopes will be re-graded, compacted & restored to meet S. Aramco standards.
- 5.7.4 Road Closure areas shall be illuminated during hours of darkness.
- 5.7.5 For work areas in the medical organization area, sufficient accessibility should be considered for handicapped, visitors and pedestrians paths in work areas in front of the health care facilities entrances and on the path ways to and from the parking areas
- 5.7.6 In the case that seismic operation are impacted by construction operation, then the maintenance or construction agency should make-every effort not to damage any seismic equipment that may be crossing the area of work. Pre-planning and good communication prior to commencement of work can avoid damage and delays for all departments.

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## 5.8 FAILURE TO FULFILL THE REQUIREMENTS OF G.I.1021.000.

Failure to meet all the requirements mentioned in this GI, the proponent department, which has the authority over the paved area, has the right to stop, remove or do the necessary repair, and charge the Saudi Aramco Department initiating the closure. Unless it is an emergency situation prior notice not less than 24 hours should be given.

Recommended By :  
Manager, Transportation Department: \_\_\_\_\_

**Approvals:****\*\*\*\*\* ENGINEERING & OPERATION SERVICES \*\*\*\*\***

Executive Director, Industrial Services                      Executive Director, Material Supply

Vice President, Engineering Services                      Vice President, Project Management

**\*\*\*\*\* REFINING SUPPLY & DISTRIBUTION \*\*\*\*\***

Executive Director, WR Ref. Supp &amp; Dist                      Vice President, ER Ref. Supp &amp; Dist

General Manager, CR Ref. Supp &amp; Dist

**\*\*\*\*\* EXPLORATION & PRODUCING \*\*\*\*\***

Vice President, Petroleum Eng'g &amp; Development                      Vice President, Exploration

Vice President, NA Oil Operation                      Executive Director, SA Oil Operation

Vice President, Abq Plants &amp; Pipelines

**\*\*\*\*\* GAS OPERATIONS \*\*\*\*\***

Vice President, NA Gas Operations                      Vice President, SA Gas Operations

**\*\*\*\*\* INDUSTRIAL RELATIONS \*\*\*\*\***

Executive Director, Community Bldg. &amp; Office Sev                      Executive Director, Safety &amp; Ind'l Security

Executive Director, Empl. Relations &amp; Training                      Vice President, Medical Services

**\*\*\*\*\* INFORMATION TECHNOLOGY \*\*\*\*\***

Vice President, Information Technology

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SUPPLEMENT # 1021.000-1

\*\*\*SAMPLE LETTER OF INTENT\*\*\*

**GAZLAN ROAD CLOSURE  
QATIF GOSP-1 FLOWLINES CROSSING**

PD&amp;C/CA-220-884

Superintendent, Roads Division (For Approval)  
 Superintendent, RT Loss Prevention Division (Advise)  
 Fire Marshal, N.A. Fire Protection Division (Advise)  
 Superintendent, Juaymah Security Operations (Advise)

We are intending to install new pipelines from Qatif Wells to Qatif GOSP-1 crossing Gaszlan Road. A plot Plan detailing the location of the closure and the detour is attached. The exact location of road crossing and schedule is as follows:

<u>Description</u>	<u>Location of Road Crossing</u>	<u>Schedule</u>
	Q W -19 20 cm. Flow line KM 4.65	(07:00-17:30 hrs)
	Q W -19 20 cm. Flow line KM 6.50	3/17/1983 (Thursday) 3/18/1983 (Friday)

In compliance with G. I. 1021.000, at each location a detour will be constructed to control traffic. Work will be completed and normal two-way traffic will be restored as per the above-mentioned dates. Moreover, according to item # 4.5 in G.I. 1021.000 you are kindly requested to highlight the required test(s) to be done on the Base / Asphalt layers (if any). Tests that are commonly performed are listed below in a priority order. Note that those test are not intended for small or handwork jobs.

TEST NAME	REQUIRED	NOT REQUIRED
Field Density (Base layer)		
California Bearing Ratio (Base layer)		
Gradation test. (Asphalt layer)		
Marshal test. (Asphalt layer)		
Consult R&HED for more tests or check SAES-Q-006 & G.I 1021.000		

The excavation and restoration will be done in accordance with applicable Saudi Aramco Engineering Standards. "Asphalt Concrete Paving" SAES-Q-006 and the Saudi Aramco Construction Safety Manual.

For further information please contact \_\_\_\_\_ NAME phone \_\_\_\_\_ NUMBER \_\_\_\_\_.  
 Please indicate your concurrence by signing below.

\_\_\_\_\_  
Proj. Mgr., Prod. & P/L Proj. Div.

Approved: \_\_\_\_\_  
 Superintendent, Roads Division

Attachment.

Distribution: Per 5.2

\* CHANGE

\*\* ADDITION

NEW INSTRUCTION COMPLETE REVISION

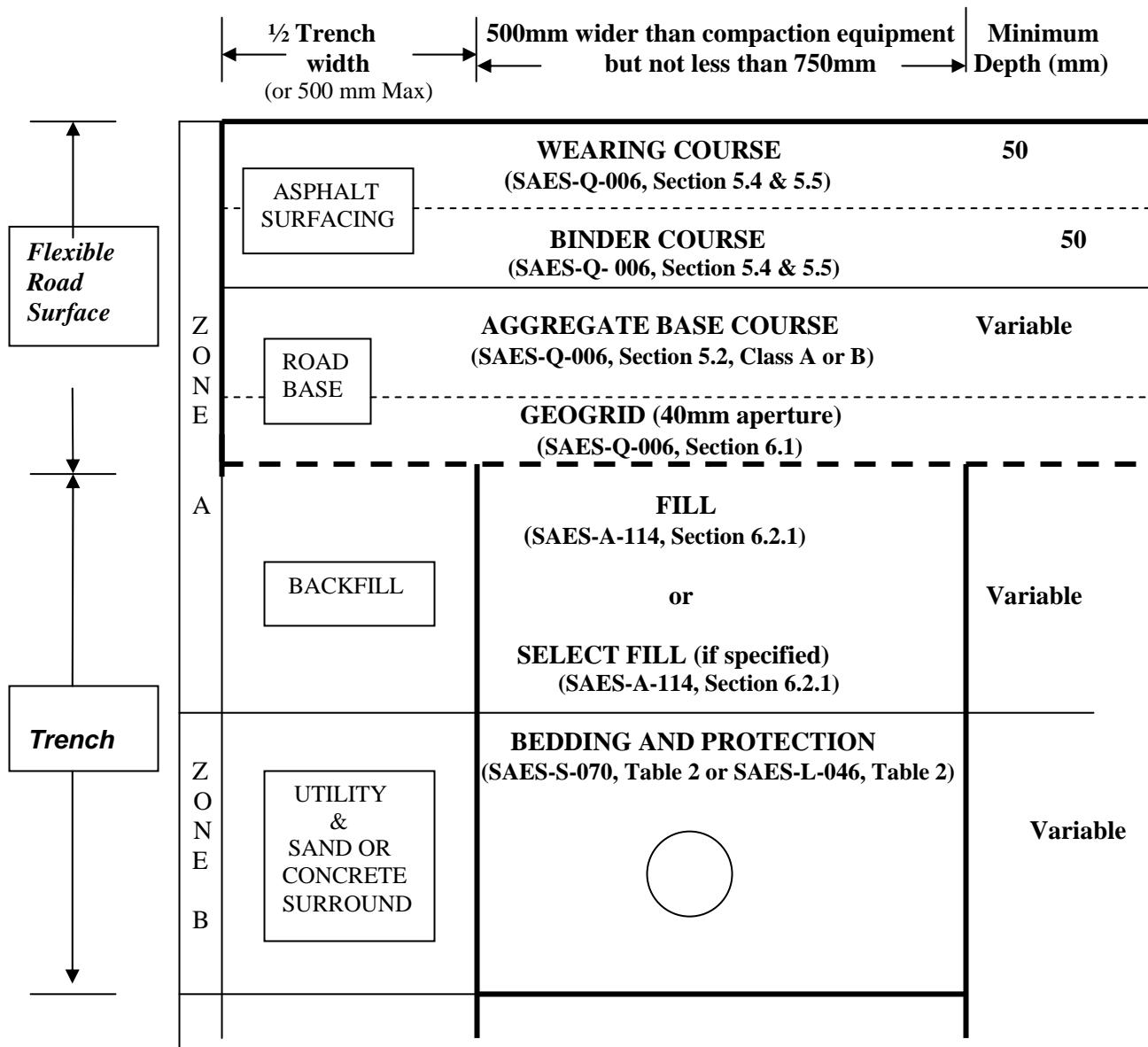
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Supplement 1021-000-2  
“EXCAVATION & REINSTATEMENT OF UTILITY TRENCHES”

**Typical Trench**

See construction notes in page 2 &amp; 3 of this supplement

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Supplement 1021-000-2

**CONSTRUCTION NOTES****EXCAVATION**

1. Initial pavement removal may be made by any means that does not disturb the pavement beyond the limits of the final repair.
2. The walls of the excavation shall be made vertical.
3. A clear space of at least 0.6 m (2 ft) shall be maintained on all sides of the trench. When any trench reaches a depth of 1.2 m (4 ft), shoring shall be installed or the sides shall be sloped or benched in accordance with the Saudi Aramco Construction Safety Manual. A safe means of entry and exit shall be provided for all excavations and trenches.
4. Width of the excavation shall be 500mm wider than the width of the compaction machine used, but in no case less than 750mm wide.
5. Depth of the trench shall provide for a minimum cover over the installed utility as defined in [SAES-L-046](#), [SAES-L-051](#), [SAES-P-104](#), [SAES-S-070](#), [SAES-T-624](#), [SAES-T-911](#) and [SAES-T-928](#).
6. Should it be impossible to achieve minimum cover, a reinforced concrete slab will be installed. The top of the slab will be located at the bottom of the asphalt pavement grade. The proponent of the roadway and the proponent of the utility will approve the slab design.
7. Pavement and base course shall be removed to a point one-half the width of the trench, or a maximum of 500 mm, beyond the edge of the trench. Excavation shall remove the base course to full depth. Pavement broken or disturbed by the construction activity shall also be removed. This removal will be made to saw lines.
8. A strip of pavement less than a 1000mm wide will not be left between the edge of the excavation and the edge of the pavement. Should over breakage result in less than 1000mm of pavement, the pavement will be replaced to the original line of the pavement, curb or gutter.

**BACKFILL REINSTATEMENT**

1. The appropriate Saudi Aramco Engineering Standard will cover the bedding, protection and backfill around the utility (Zone B). However, that portion of the backfill above the annulus materials (Zone A) must meet the following minimum requirements:
2. Backfill shall meet SAES-A-114 Fill Material or Select Fill Material requirements.
3. Backfill within 610mm of the bottom of the asphalt pavement should be crushed aggregate or select marl with a minimum CBR of 50.
4. Backfill materials shall be placed in lifts not exceeding 100 mm (4 in) in loose depth for hand-operated compaction.
5. Compaction shall be as defined in SAES-Q-006, Section 6.
6. In-place, density shall be measured by ASTM D2922 or ASTM 1556 or other approved methods. Testing shall be conducted at a rate of one test every 50 linear ft (15 m) of each lift.

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**BASE COURSE RECONSTRUCTION**

1. The base course shall be reconstructed consisting of Aggregate Base Course Class A or B material conforming to the requirements of SAES-Q-006, Tables 6, 7, and 8. The base course must have a minimum thickness as indicated in SAES-Q-006, Table 4 and must be at least as thick as the original aggregate base course
2. One layer of geogrid (Tenax LBO 330 or equivalent) shall be placed at the sub-base or natural soil/aggregate base course interface. The geogrid shall extend to a width of one-half the trench width, or a maximum of 500 mm, beyond both edges of the trench. Additional geogrid layers shall be placed after every 300mm of aggregate base course has been placed and compacted. Adjacent sheets of geogrid should include a 300mm overlap.
3. Aggregate base material shall be placed in layers of uniform thickness. Layer thickness shall not exceed 150 mm after compaction. In no case shall thin layers of fine materials be added to the top layer of the base course in order to meet the required elevation.
4. Aggregate base materials shall be compacted to 100% of the maximum laboratory dry density as determined by ASTM D1557, or AASHTO T180.
5. In-place, density shall be measured by ASTM D2922 or ASTM 1556 or other approved methods. Testing shall be conducted at a rate of one test every 50 linear ft (15 m) of each lift.

**ASPHALT CONCRETE PAVEMENT RECONSTRUCTION**

1. Exposed base will be re-compacted and free of unsuitable materials.
2. The base will be primed and the edges of existing asphalt tacked in accordance with SAES-Q-006.
3. Asphaltic concrete materials and mix design shall be in accordance with the requirements of SAES-Q-006.
4. Asphalt pavement shall be placed in two lifts or more to a thickness equivalent to the original pavement, but not less than 100mm in thickness. No lift shall be greater than 60mm or less than 25mm.
5. Asphalt pavement shall be compacted to 96% of the Marshall density per ASTM D1559. All compaction shall be completed before the temperature of the mixture drops below 90°C.
6. Concrete slabs on grade, curbs, gutters, sidewalks and walkways damaged during the construction shall be replaced to the requirements of SAES-Q-001.

## **5.08 Typical Methods of Traffic Control Through Work Areas**

Typical traffic control methods applied to varying conditions of need through work areas are illustrated in the following examples. Accompanying these illustrations are special notes (if

not covered in the general notes) which explain the application of these methods and the traffic control devices used.

### **Examples**

**Case I-A: Where Work is Clear of Roadway at Least 5.0 m from the Edge of Pavement**

**Case I-B: Where Work is Clear of Roadway at least 5.0 m from the Edge of Pavement (Expressway)**

**Case I-C: Where Work is Clear of Roadway and within 5.0 m of the Edge of Pavement**

**Case I-D: Where Work is Clear of Roadway and within 5.0 m of the Edge of Pavement (Expressway)**

**Case II: Encroachment in One Lane  
Two Lane, Two-Way Operation**

**Case III-A: Intermittent or Continuous Moving Operations in Close Proximity to the Pavement or Shoulder**

**Case III-B: Intermittent or Continuous Moving Operation on the Pavement or Shoulder**

**Case IV-A: Short-Time Operations with Some Work on the Pavement**

**Case IV-B: Short-Time Operations in Close Proximity to the Pavement or Shoulder**

**Case V: Activities Encroaching on One Lane of a Bridge Deck and When Traffic Signals are Required**

**Case VI: Closure of Both Lanes and Use of a Temporary Detour**

**Case VII-A and B: Encroachment on Pavement During Pavement Widening Procedures**

**Case VIII: When Activities Encroach on Any Portion of the Lane Immediately Adjacent to the Shoulder Within 0.5 m of the Edge of the Pavement**

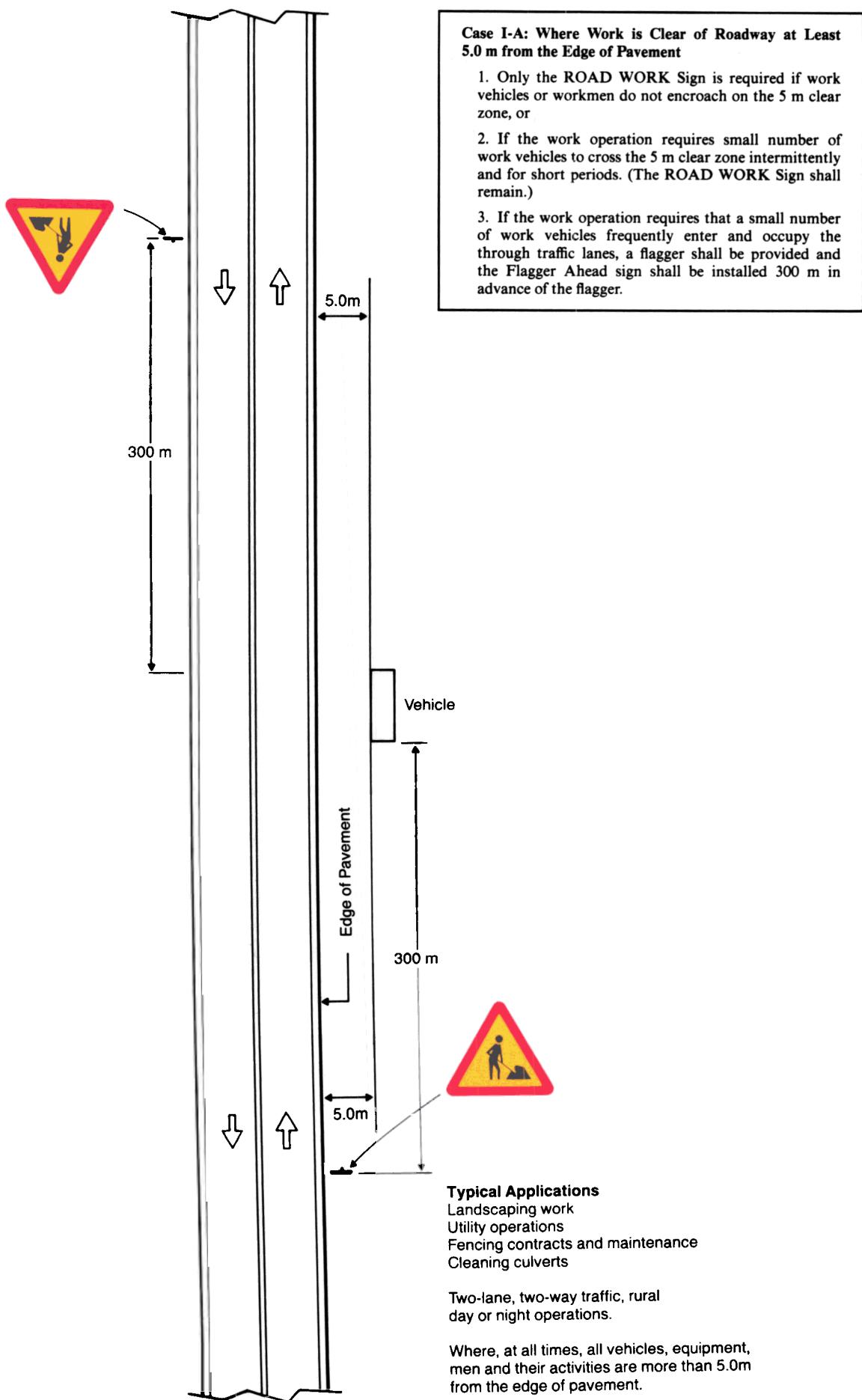
**Case IX: When Activities Require the Closure of Two Adjacent Lanes and a Temporary Crossover Is Provided by Making Use of One Lane Normally Used by Opposing Traffic**

**Case X: When Activities Require the Closure of Two Adjacent Lanes and a Temporary Detour Is Provided By Making Use of One Lane Normally Used By Opposing Traffic**

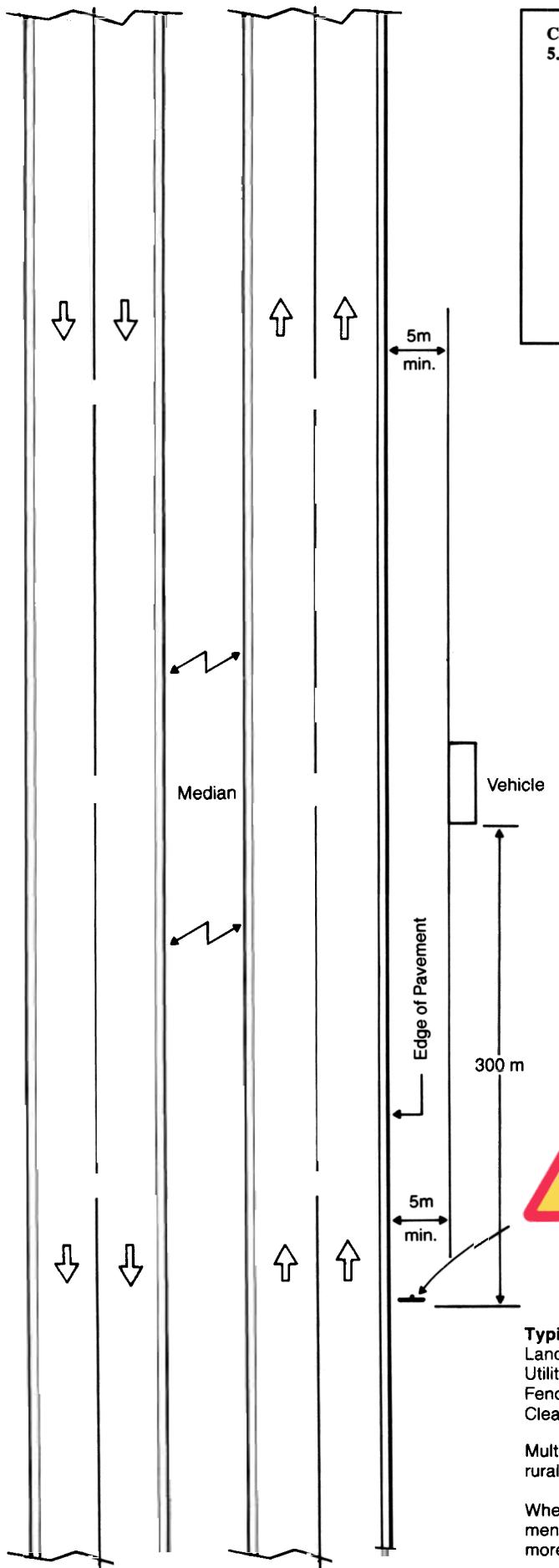
**Case XI: When Activities Require a Moving Operation When the Average Speed of Movement Is Greater Than 2 km/h But Less Than 20 km/h**

**Case XII: When Activities Encroach on the Pavement, Requiring Closure of One Traffic Lane in an Area Where Speeds Are in a Lower Range Posted Area**

**Case XIII-A and B: When Activities Encroach on the Pavement, Requiring the Closure of at Least One Traffic Lane in an Area Where the Posted Speed Is 60 km/h or Less**



**Case I-A**



**Case I-B: Where Work is Clear of Roadway at Least 5.0 m from the Edge of Pavement (Expressway)**

1. Only the ROAD WORK Sign is required if work vehicles or workmen do not encroach on the 5 m clear zone, or
2. If the work operation requires small number of work vehicles to cross the 5 m clear zone intermittently and for short periods. (The ROAD WORK Sign shall remain.)
3. If the work operation requires that a small number of work vehicles frequently enter and occupy the through traffic lanes, a flagger shall be provided and the Flagger Ahead sign shall be installed 300 m in advance of the flagger.

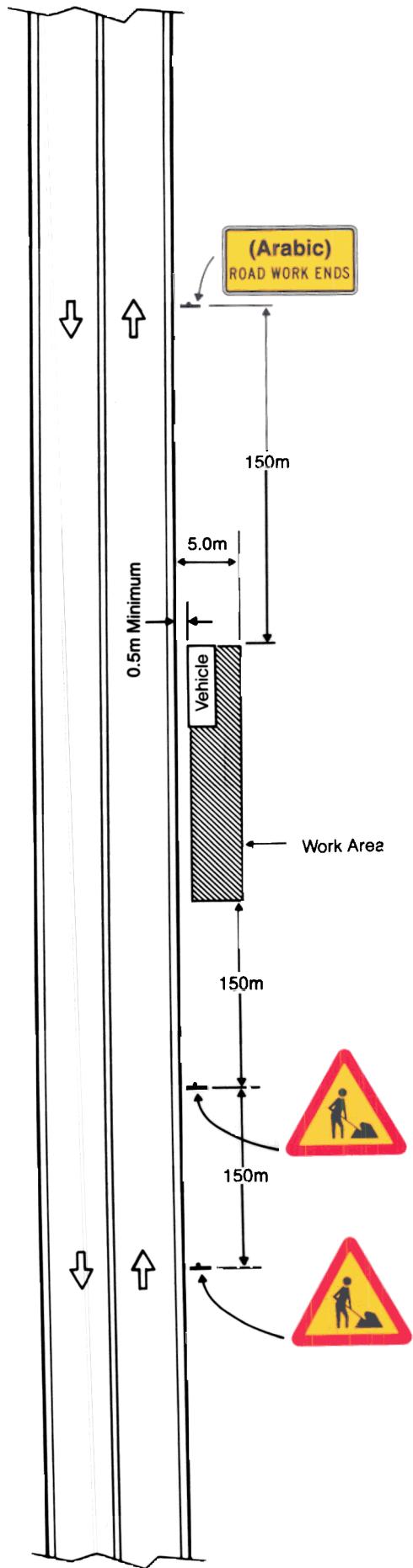
**Typical Applications**

Landscape work  
Utility work  
Fencing contracts and maintenance  
Cleaning culverts

Multi-lane, divided and undivided  
rural day or night operations

Where, at all times, all vehicles, equipment,  
men or their activities are at all times  
more than 5m from the edge of the pavement

**Case I-B**



**Case I-C: Where Work is Clear of Roadway and within 5.0 m of the Edge of Pavement**

1. The signing is required if work vehicles or workmen encroach on the 5 m clear zone, or
2. If the work operation requires small number of work vehicles to cross the 5 m clear zone intermittently and for short periods.
3. If the work operation requires that a small number of work vehicles frequently enter and occupy the through traffic lanes, a flagger shall be provided and the Flagger Ahead sign shall be installed 300 m in advance of the flagger.
4. The same series of signs shall be installed for the opposite direction of travel.

**Typical Applications**

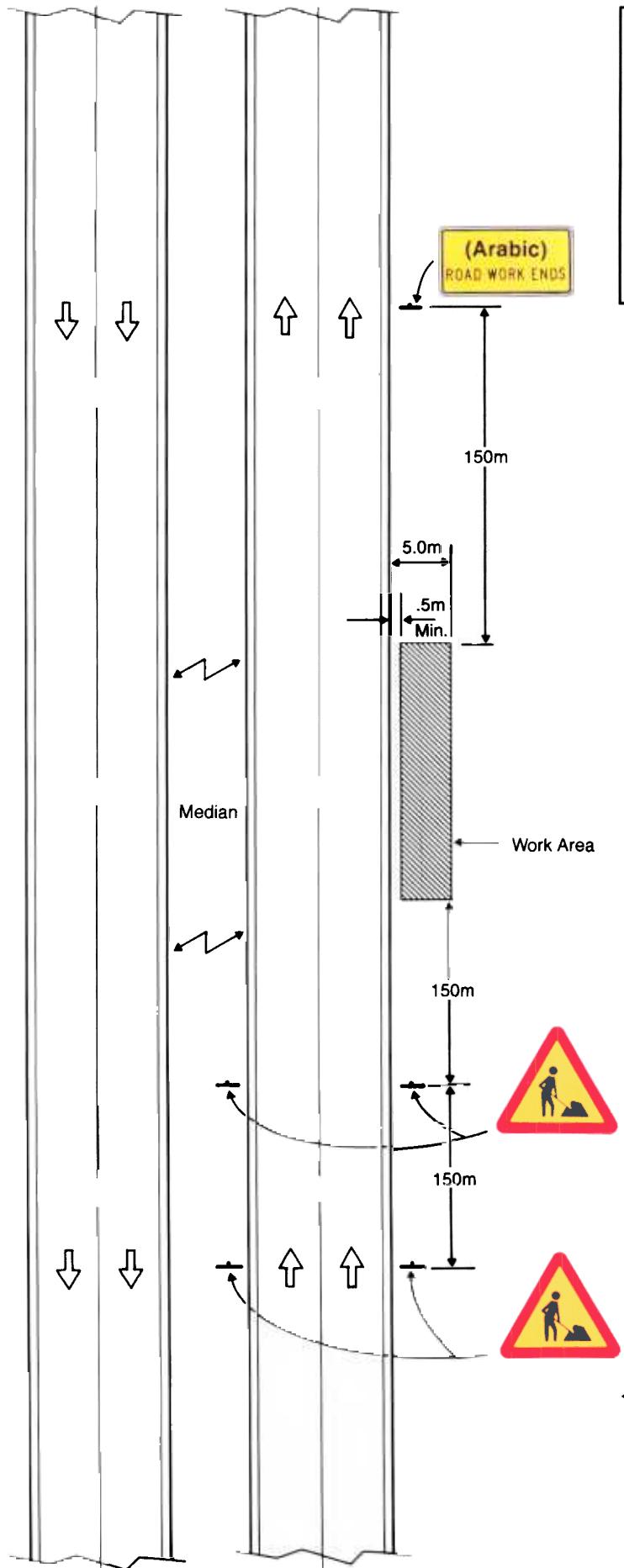
Culvert extensions  
Side slope change  
Guard rail installation and maintenance  
Delineator installation and maintenance  
Landscaping operations  
Cleaning ditches and drainage structures  
Sign installation and maintenance  
Shoulder repair

**Symbols**

→ Sign on portable or permanent support

Two-lane, two-way traffic  
rural day or night operations.

Where, at any time, any vehicle,  
equipment, men or their activities  
will encroach in the area closer  
than 5m but not closer than 0.5m  
to the edge of the pavement.



**Case I-D: Where Work is Clear of Roadway and within 5.0 m of the Edge of Pavement (Expressway)**

1. The signing is required if work vehicles or workmen encroach on the 5 m clear zone, or
2. If the work operation requires small number of work vehicles to cross the 5 m clear zone intermittently and for short periods.
3. If the work operation requires that a small number of work vehicles frequently enter and occupy the through traffic lanes, a flagger shall be provided and the Flagger Ahead sign shall be installed 300 m in advance of the flagger.

**Typical Applications**

Utility operations  
Culvert extensions  
Side slope changes  
Guard rail installation and maintenance  
Delineator installation and maintenance  
Sign installation and maintenance  
Cleaning ditches and drainage structures  
Shoulder repair

**Symbols**

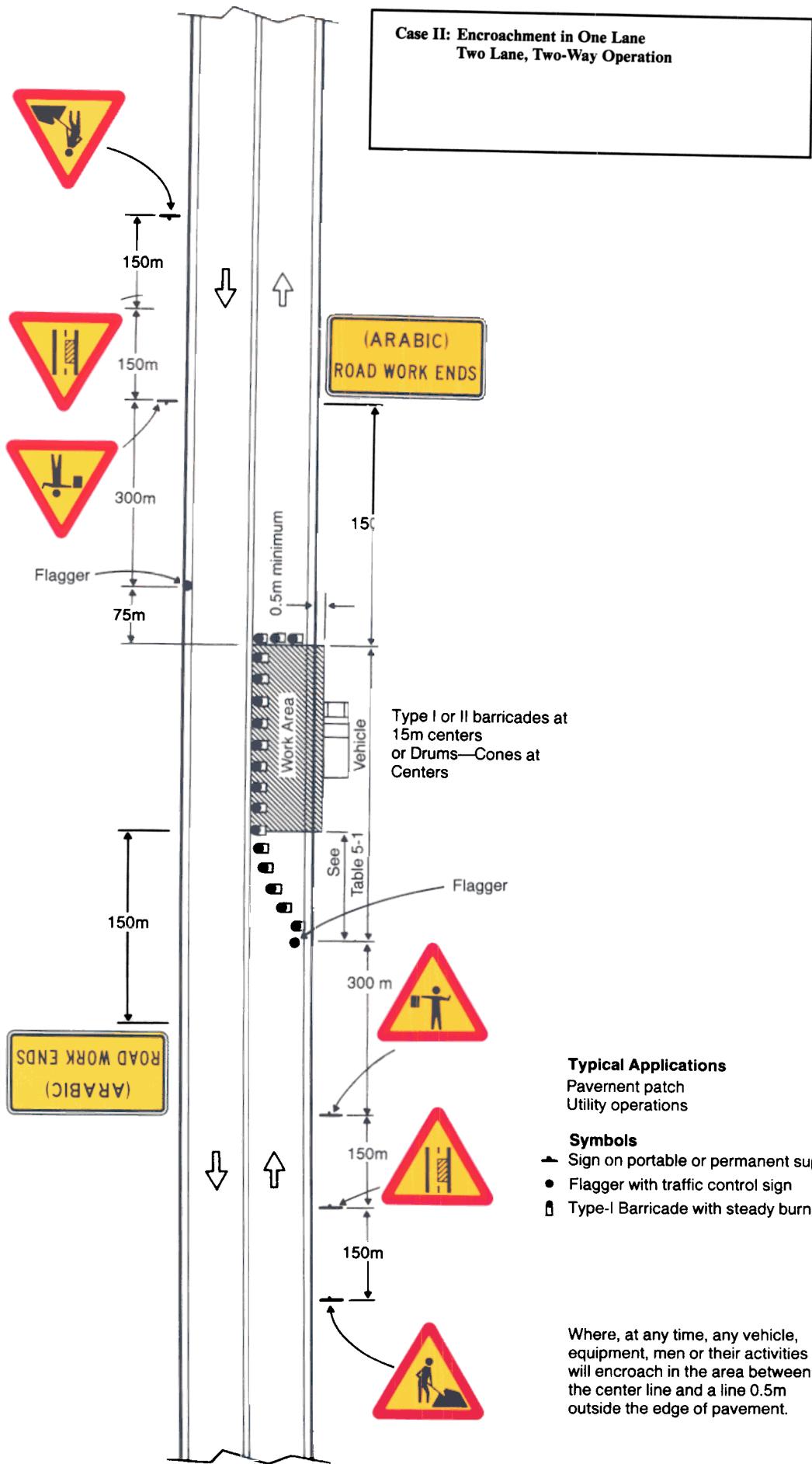
- Sign on portable or permanent support

Multi-lane, divided and undivided rural day or night operations

Where, at any time, any vehicle, equipment, men or their activities will encroach in the area closer than 5.0m but not closer than 0.5m to the edge of pavement

**Case I-D**

**Case II: Encroachment in One Lane  
Two Lane, Two-Way Operation**



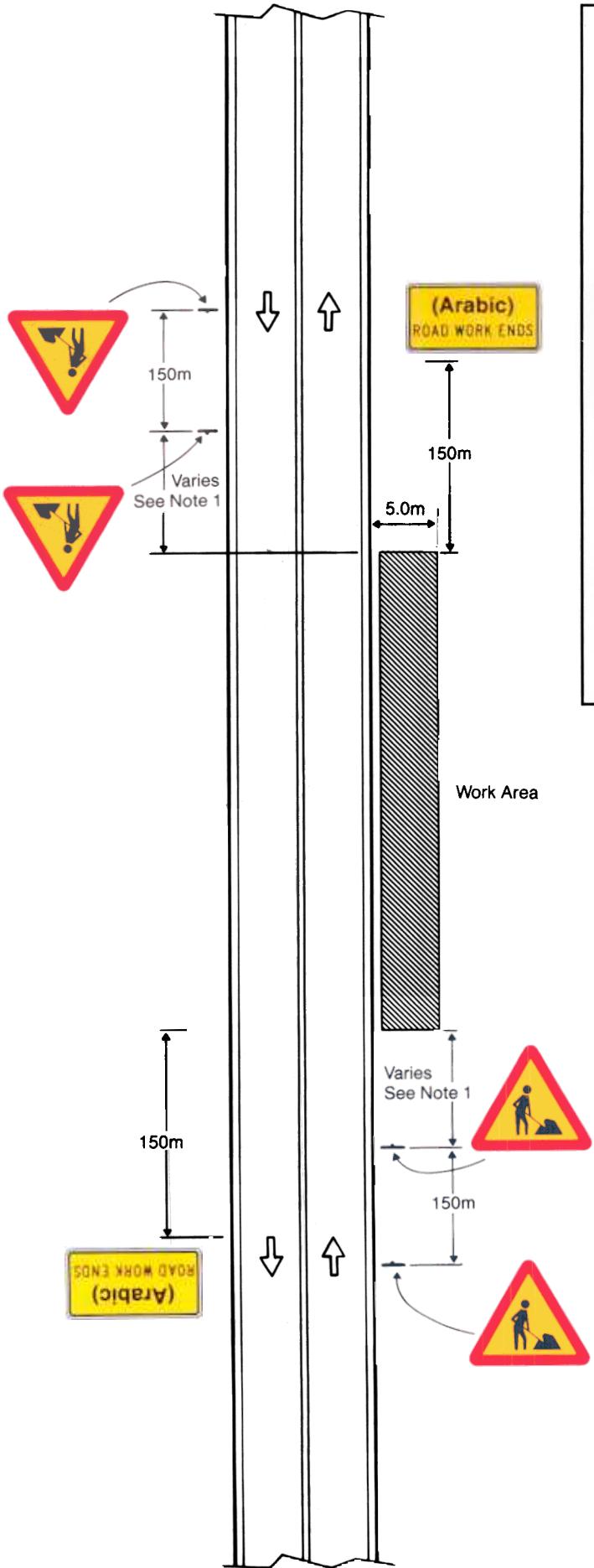
**Typical Applications**

Pavement patch  
Utility operations

**Symbols**

- ▲ Sign on portable or permanent support
- Flagger with traffic control sign
- Type-I Barricade with steady burning light

Where, at any time, any vehicle, equipment, men or their activities will encroach in the area between the center line and a line 0.5m outside the edge of pavement.



**Case III-A: Intermittent or Continuous Moving Operations in Close Proximity to the Pavement or Shoulder**

1. The minimum length of the work site activity is 60 m. The maximum distance between the Road Works signs shall be determined by the Engineer.
2. For divided roadways, the required Advance Warning signs shall be posted on both the right and left side of the roadway.
3. If the work operation requires vehicles or workmen to enter the through traffic lanes frequently, a flagger shall be provided. The Flagger Ahead sign shall be maintained approximately 300 m ahead of the actual work area and moved with the work as necessary.
4. On roadways having four or more lanes, the Advance Warning signs for traffic using lanes which are not closed, are omitted, and Right Lane Closed Ahead sign(s) shall be installed between the first and second sign of the Advance Warning sign series. A 150 m interval shall be maintained between all signs in that series.
5. This case also applies when work is being performed in lanes adjacent to the center lane of an undivided highway having four or more lanes or adjacent to the median on a divided highway. Under these conditions, Left Lane Closed Ahead sign(s) shall be substituted for Right Lane Closed Ahead sign(s).
6. Any obstacle or excavation in the work area shall be protected by Type I or Type II barricades with flashing lights.

**Typical Applications**

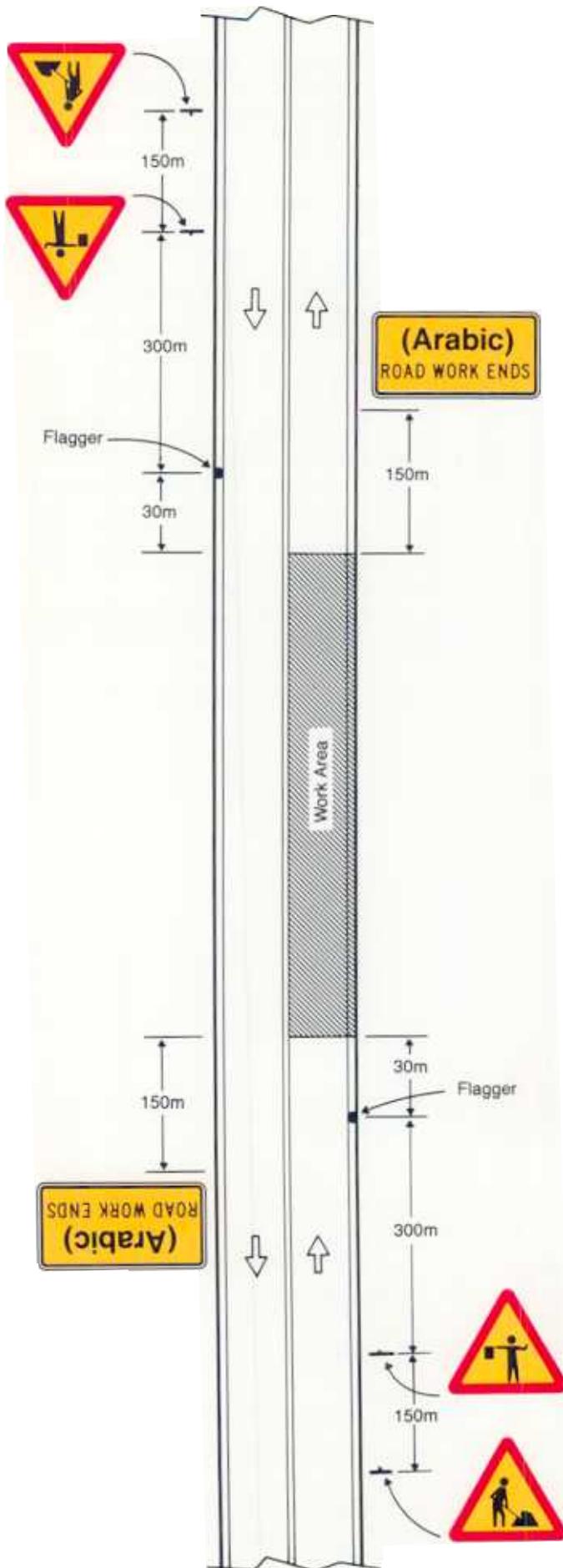
Shoulder work  
Mowing  
Utility operations

**Symbols**

- Sign on portable or permanent support

Rural moving operations, day operation only.

Where, at any time, any vehicle, equipment, men or their activities require an intermittent or continuous moving operations on the shoulder.



**Case III-B: Intermittent or Continuous Moving Operations on the Pavement or Shoulder**

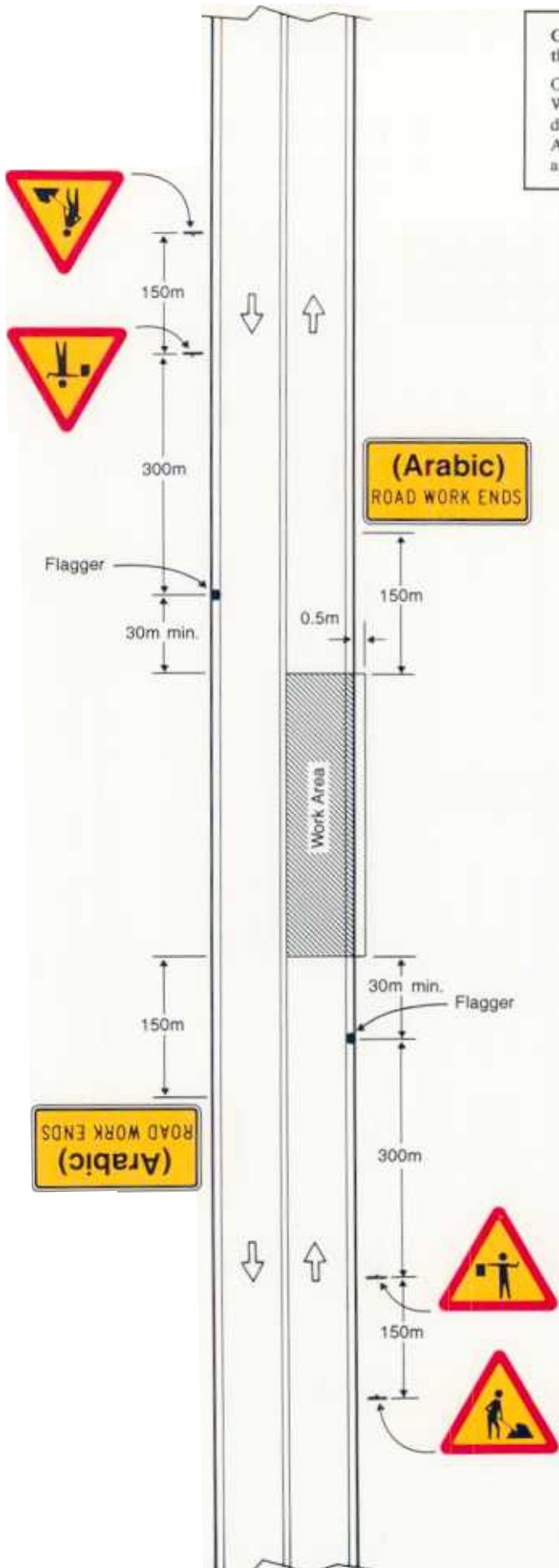
1. The minimum length of the work site activity is 60 m. The maximum distance between the Road Works signs shall be determined by the Engineer.
2. For divided roadways, the required Advance Warning signs shall be posted on both the right and left side of the roadway.
3. If the work operation requires vehicles or workmen to enter the through traffic lanes frequently, a flagger shall be provided. The Flagger Ahead sign shall be maintained approximately 300 m ahead of the actual work area and moved with the work as necessary.
4. For divided roadways, the required Advance Warning signs shall be posted on both the right and left side of the roadway.
5. On roadways having four or more lanes, the Advance Warning signs for traffic using lanes which are not closed, are omitted, and Right Lane Closed Ahead sign(s) shall be installed between the first and second sign of the Advance Warning sign series. A 150 m interval shall be maintained between all signs in that series.
6. This case also applies when work is being performed in lanes adjacent to the center lane of an undivided highway having four or more lanes or adjacent to the median on a divided highway. Under these conditions, Left Lane Closed Ahead sign(s) shall be substituted for Right Lane Closed Ahead sign(s).
7. Any obstacle or excavation in the work area shall be protected by Type I or Type II barricades with flashing lights.

**Typical Applications**  
Bituminous resurfacing  
Crack pouring  
Utility operations

**Symbols**

- Sign on portable or permanent support
  - Flagger with traffic control sign
- Rural moving operations  
Day operation only

Where, at any time, any vehicle, equipment, men or their activities require an intermittent or continuous moving operation on the pavement where the average speed of movement is less than 8 km/hr



**Case IV-A: Short-Time Operations with Some Work on the Pavement**

On roadways having four or more lanes, the Advance Warning signs for traffic approaching from the opposite direction are omitted. For divided roadways, the required Advance Warning signs shall be posted on both the right and left side of the roadway.

**Typical Applications**

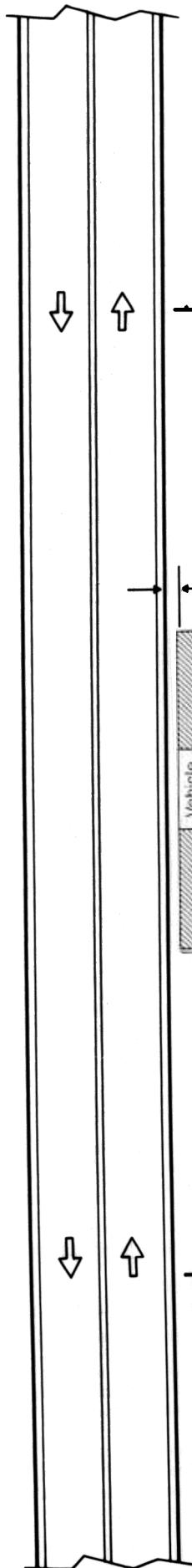
Marking patches  
Field survey  
String survey  
Utility operations  
Cleaning up debris on pavement

**Symbols**

- Sign on portable or permanent support
- Flagger with traffic control sign

Two-lane, two-way or multi-lane traffic, short time operations, day or night operations

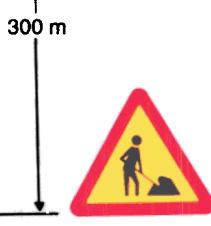
For any operation that encroaches in the area between the center line and a line .5m outside the edge of the pavement for a period in excess of 15 minutes but less than 60 minutes



**Case IV-B: Short-Time Operations in Close Proximity to the Pavement or Shoulder**

On roadways having four or more lanes, the Advance Warning signs for traffic approaching from the opposite direction are omitted. For divided roadways, the required Advance Warning signs shall be posted on both the right and left side of the roadway.

Vehicle with dual flashers  
or flashing amber dome light  
operating

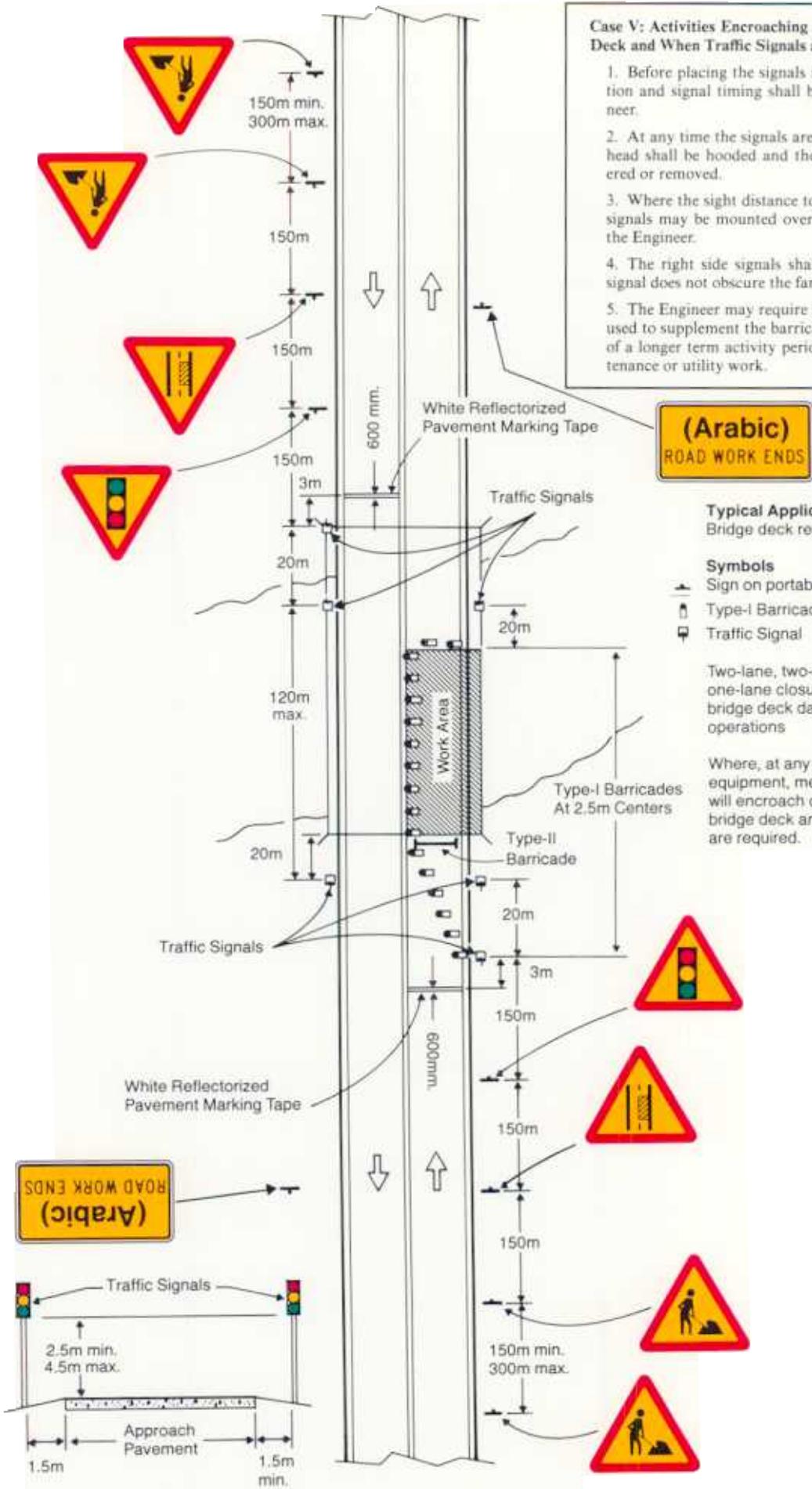


**Typical Applications**

Marking patches  
Field survey  
String survey  
Utility operations  
Cleaning up debris on pavement

Two-lane, two-way or multi-lane traffic, short time operations, day or night operations

For any operation that is more than .5m outside the edge of the pavement for a period of less than 60 minutes



**Case V: Activities Encroaching on One Lane of a Bridge Deck and When Traffic Signals are Required**

1. Before placing the signals in operation, the installation and signal timing shall be approved by the Engineer.
2. At any time the signals are not operating, the signal head shall be hooded and the Signal Ahead sign covered or removed.
3. Where the sight distance to the signal is limited, the signals may be mounted overhead at the discretion of the Engineer.
4. The right side signals shall be located so the near signal does not obscure the far signal.
5. The Engineer may require 210 liter steel drums to be used to supplement the barricades if the closure time is of a longer term activity period, over and above maintenance or utility work.

**(Arabic)**

**ROAD WORK ENDS**

**Typical Applications**  
Bridge deck repair

**Symbols**

- ▲ Sign on portable or permanent support
- Type-I Barricade with steady burning light
- Traffic Signal

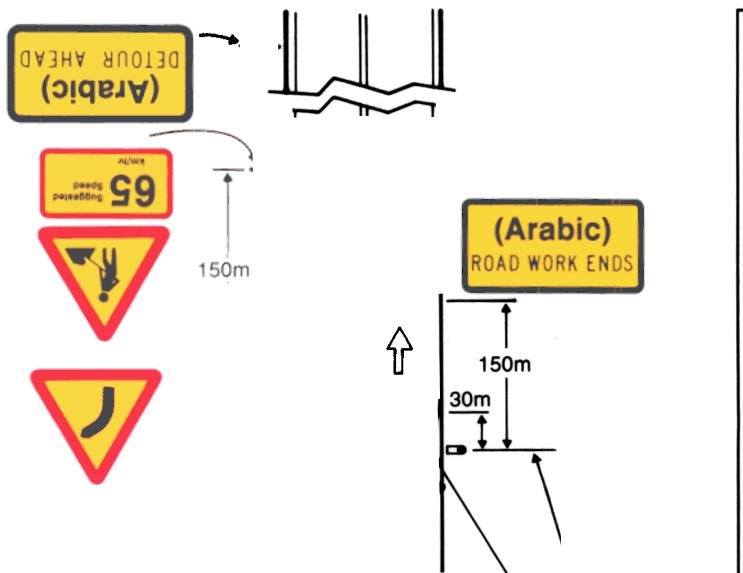
Two-lane, two-way, rural one-lane closure on a bridge deck day or night operations

Where, at any time, any vehicle equipment, men or their activities will encroach on one lane of a bridge deck and traffic signals are required.

(See Figure 4-20 for additional details.)

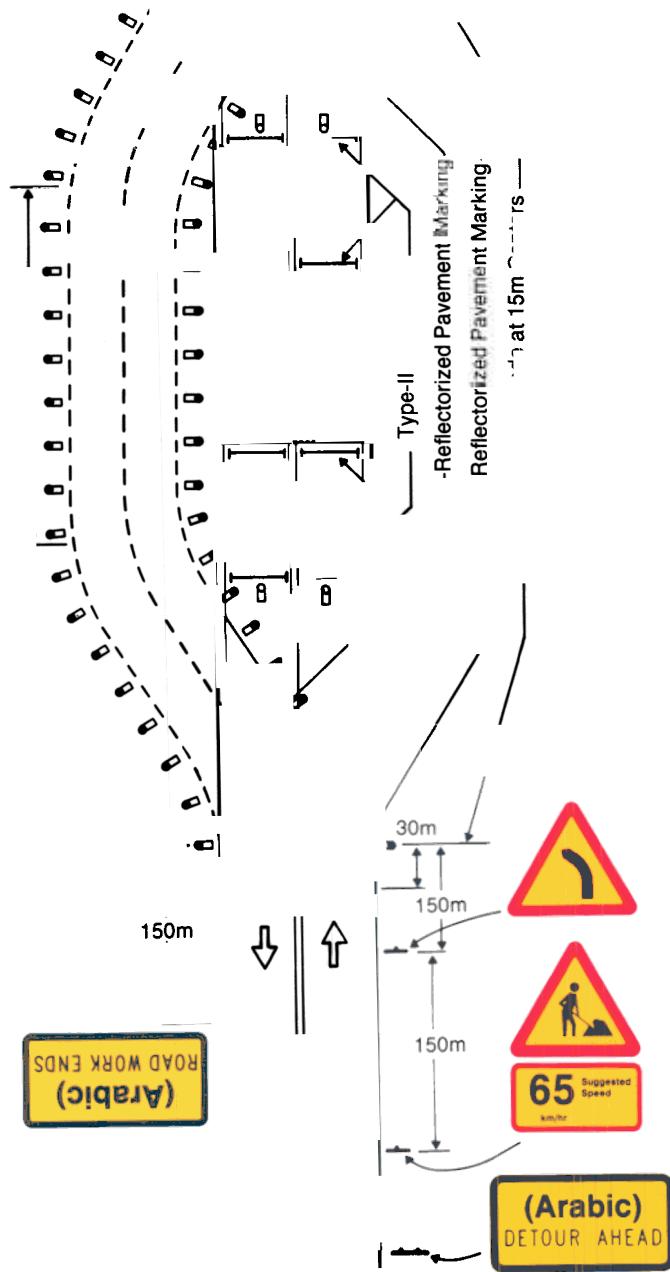
**Case V**





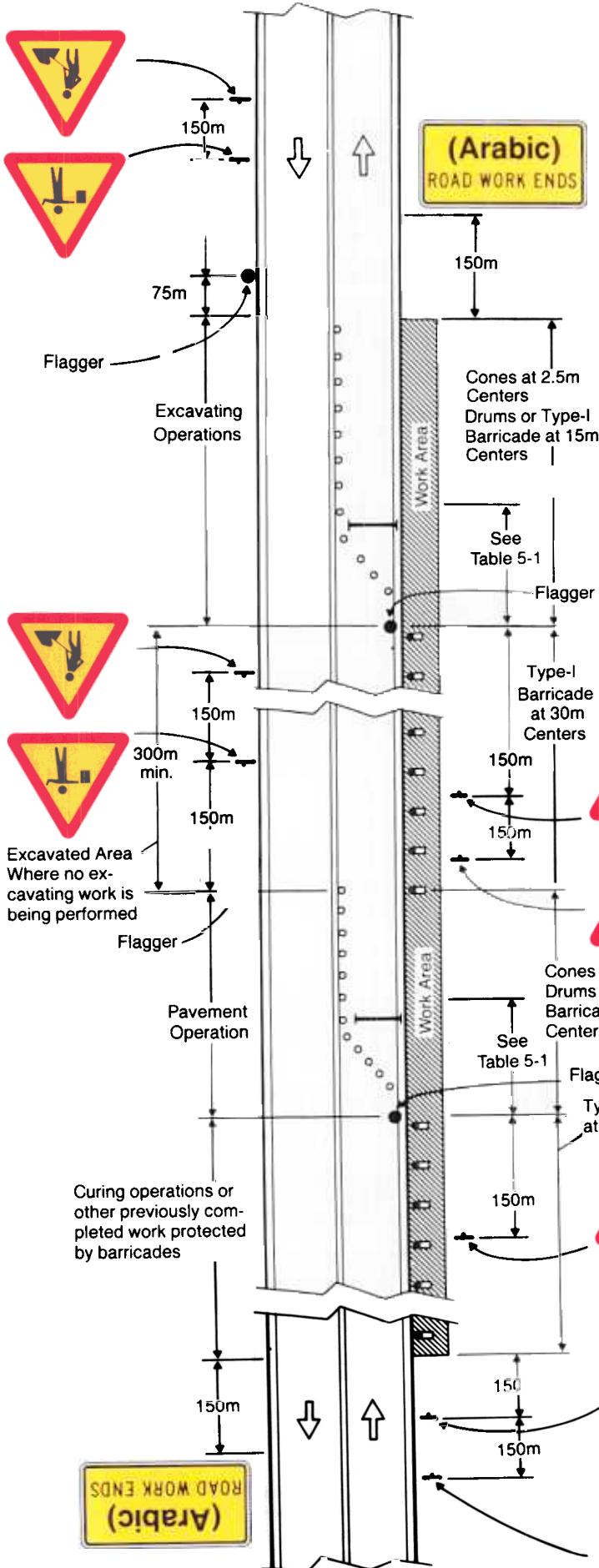
**Case VI: Closure of Both Lanes and Use of a Temporary Detour**

1. Pavement markers on paved detours shall be used when the closure time is of longer duration or when the normal posted speed outside the area of operations exceeds 80 km/h. Temporary pavement marking materials shall be used for marking new center lines and edge lines on the existing pavement. All existing markings conflicting with the revised traffic pattern shall be removed. Reflectorized pavement markings shall be used on paved detours.
2. Where the tangent distance ( $T$ ) on the temporary detour exceeds 180 m, spacing between barricades may be increased to 30 m within the limits of the tangent. Within these same limits, the white reflectorized marking used to indicate the center line of the traveled way may be a dashed pattern, if sight distance is adequate for passing.
3. The suggested safe speed to be shown below the Reverse Bend signs shall be determined at the site and approved by the Engineer.



**Typical Applications**  
Bridge construction  
Culvert construction

Where, at any time, any vehicle, equipment, men or their activities require the closure of both lanes and a temporary runaround is constructed.



**Case VII-A and Case VII-B: Encroachment on Pavement During Pavement Widening Procedures**

1. Where the distance between paving and excavating operations is less than 600 m, the entire operation will be considered as one work area for signing and traffic control purposes. When the distance between operations exceeds 600 m, additional Warning signs and taper as shown shall be installed. Under restricted sight distance conditions such additional Warning signs may also be required for distances less than 600 m at the discretion of the Engineer.

2. Two flaggers shall be required for each separate construction operation within the work area.

3. No paving or excavating operations shall be performed at night unless authorized by the Engineer. When these operations are suspended, all vehicles and equipment, including traffic control and protective devices, shall be removed from the pavement and the excavated area shall be protected by Type I or Type II barricades at 15 m centers. Road Works signs shall be installed as shown to protect the curing operations. Road Works signs shall be installed for traffic in the opposite direction.

4. Construction operations shall be confined to one traffic lane, leaving the opposite lane open to traffic. When the area where work is being performed reaches 400 m, the taper and the flagman shall be moved ahead and barricades placed at the edge of the pavement to protect the completed work. A complete traffic control plan must be approved if the operation exceeds this limit.

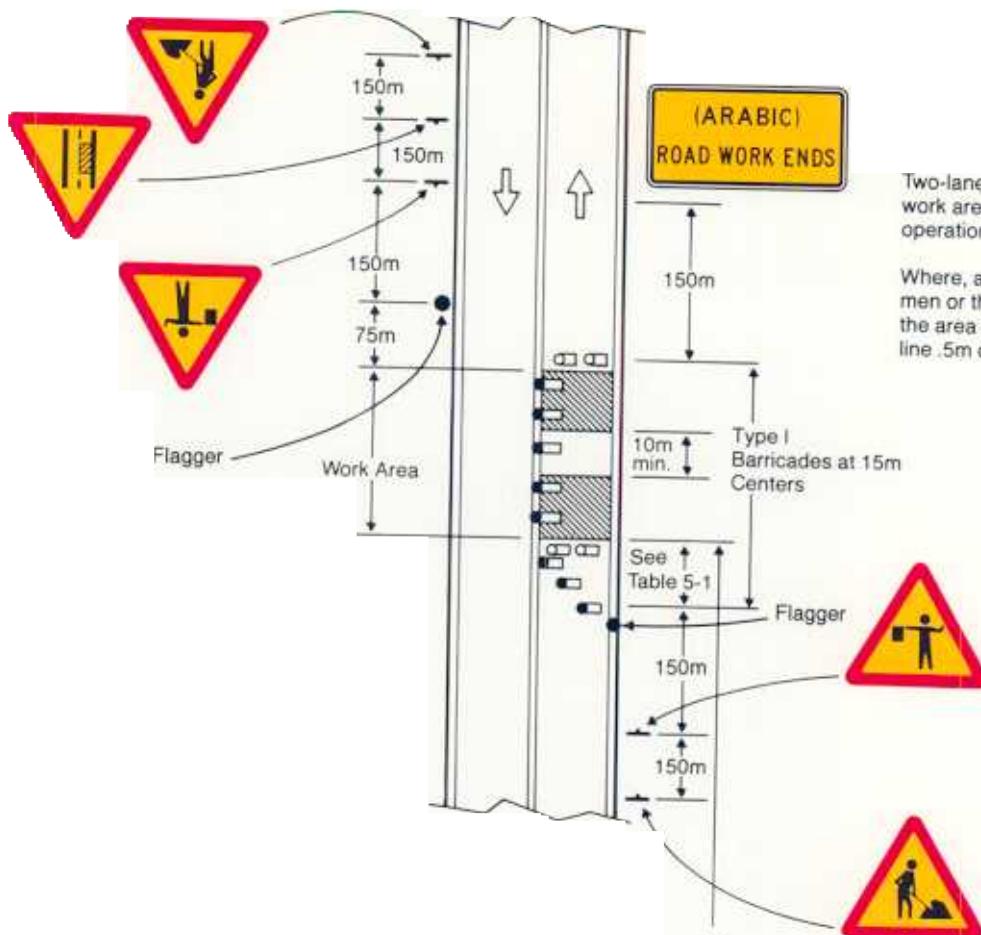
**Typical Applications**  
Pavement Widening

**Symbols**

- Sign on portable or permanent support
- Flagger with traffic control sign.
- Type-I Barricade with steady burning light.
- Cone, steel drum (210 liters) or Type-I Barricades.
- [ ] Type-I Barricades.

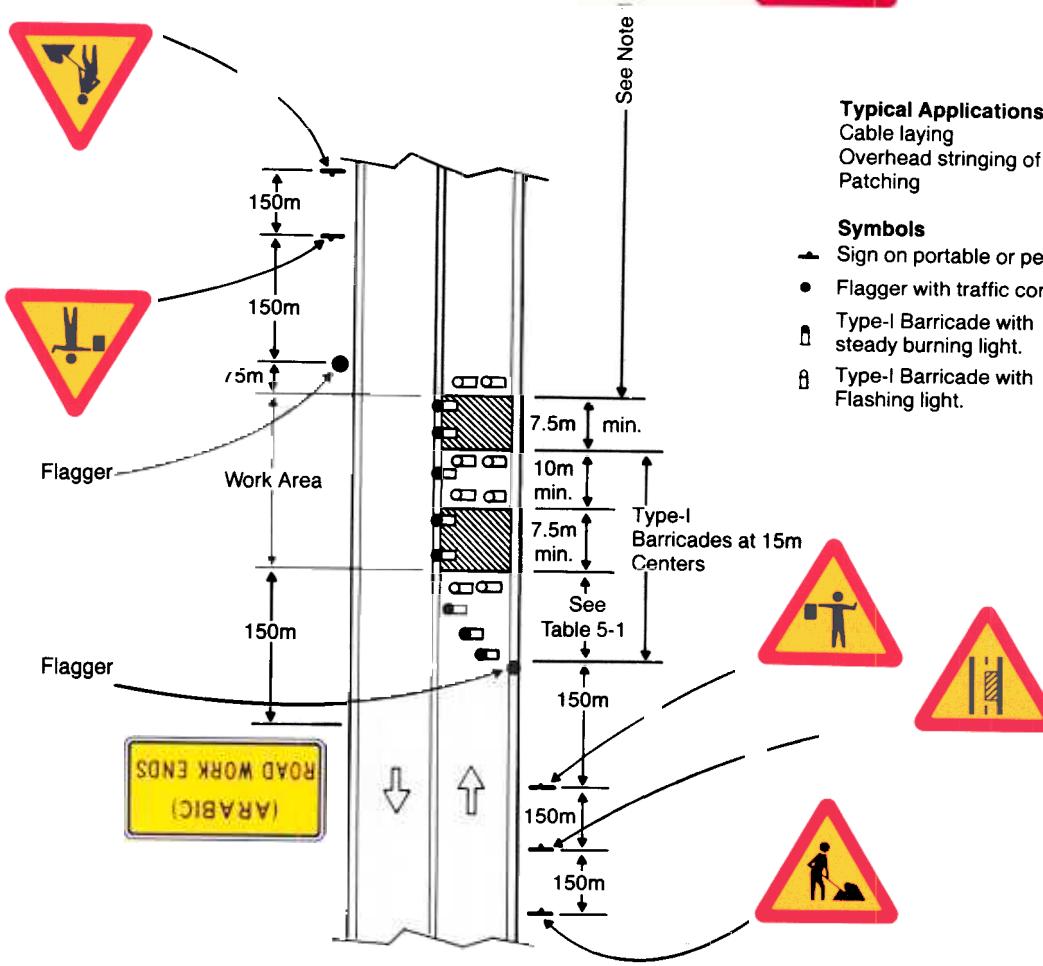
Two-lane, two-way traffic rural widening of pavement day or night operations

Where, at any time, any vehicle, equipment, men or their activities will encroach on the pavement during pavement widening operations.



Two-lane, two-way traffic rural work areas in series day or night operations.

Where, at any time, any vehicle, equipment men or their activities will encroach in the area between the center line and a line .5m outside the edge of pavement



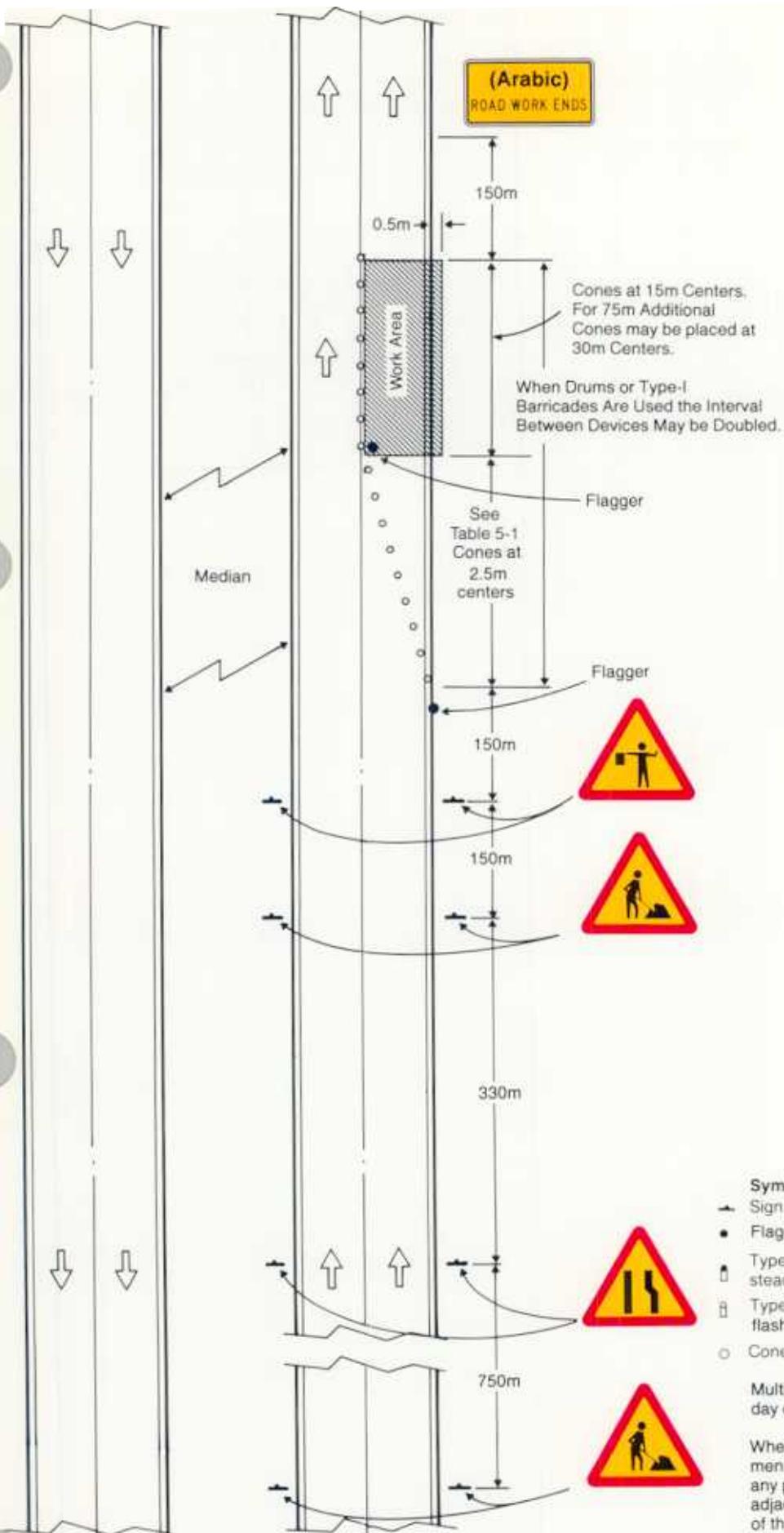
#### Typical Applications

Cable laying  
Overhead stringing of cable  
Patching

#### Symbols

- Sign on portable or permanent support.
- Flagger with traffic control sign.
- Type-I Barricade with steady burning light.
- Type-I Barricade with Flashing light.





Case VIII

**Case VIII: When Activities Encroach on Any Portion of the Lane Immediately Adjacent to the Shoulder Within 0.5 m of the Edge of the Pavement**

1. The "L" distance equals the lane width times the taper ratio as shown in Table 5-1.
2. Operations restricting vehicular movement, so traffic in both directions must use a single lane, shall only be allowed while flaggers are on duty or when a temporary traffic signal is installed to assign right-of-way.
3. This case also applies when work is being performed in the lane adjacent to the median on a divided highway. Under these conditions Left Lane Closed Ahead sign(s) shall be substituted for Right Lane Closed Ahead sign(s). Signs shall be added in the opposite direction and cones shall be placed along the center line throughout the taper and work area.
4. This case also applies when work is being performed in the lane adjacent to the center line on an undivided highway. Under these conditions Left Lane Closed Ahead sign(s) shall be substituted for Right Lane Closed Ahead sign(s). Signs shall be added in the opposite direction and cones shall be placed along the center line throughout the taper and work area.
5. This case does not apply when work is being performed in the middle lane(s) of a six or more lane highway. Special plans approved by the Engineer will be required.
6. This case also applies when work is being performed on a multi-lane undivided highway. Under these conditions the signs normally mounted in the median shall be omitted.

**Symbols**

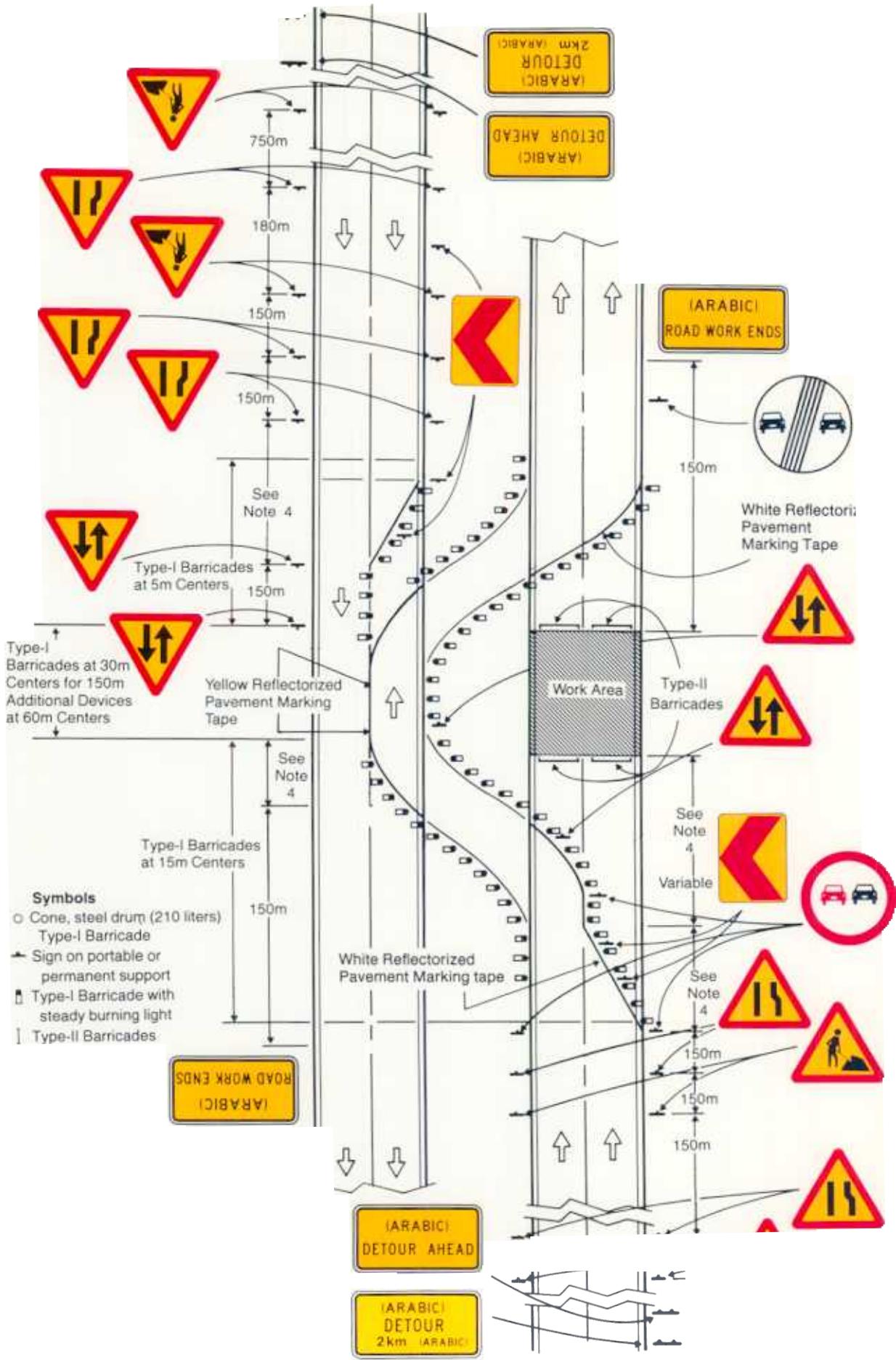
- Sign on portable or permanent support.
- Flagger with traffic control sign
- ▲ Type-I Barricade with steady burning light.
- Type-I Barricade with flashing light
- Cones

Multi-lane, divided and undivided rural day operations only.

Where, at any time, any vehicle, equipment men or their activities will encroach on any portion of the lane immediately adjacent to the shoulder within 0.5m of the edge of pavement.

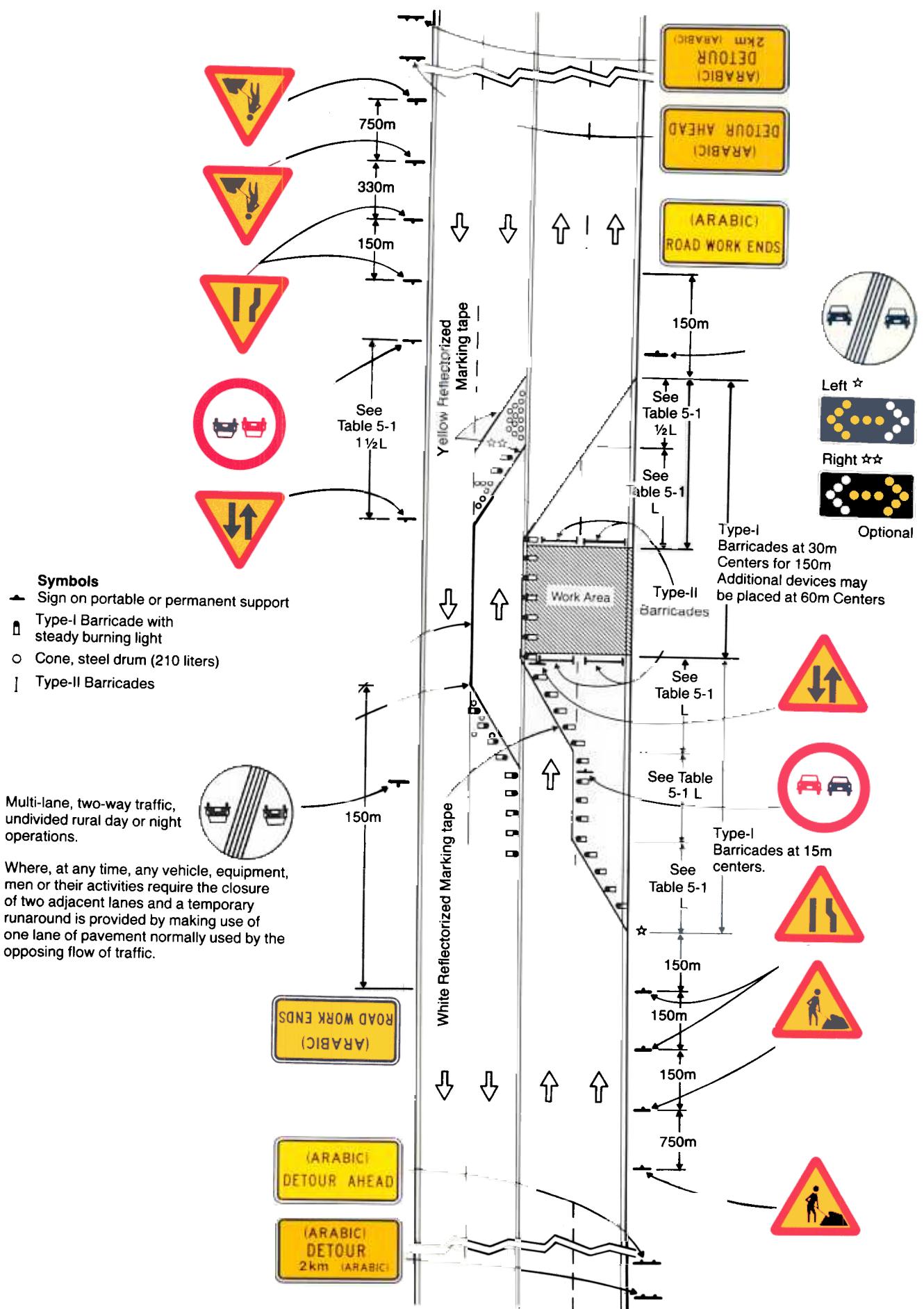
**Case IX: When Activities Require the Closure of Two Adjacent Lanes and a Temporary Crossover Is Provided by Making Use of One Lane Normally Used by Opposing Traffic**

1. On paved crossovers pavement markings shall always be used. Temporary pavement marking tape shall be used for marking a new center line and edge line on the existing pavement. All existing markings conflicting with the revised traffic pattern shall be removed.
2. Two-way Traffic sign(s) shall be repeated every 400 m in each direction through the tangent distance.
3. Where the tangent distance (T) on the temporary runaround exceeds 160 m, spacing between barricades may be increased to 60 m within the limits of the tangent. Within these same limits the white reflectorized dashed marking used to indicate the center line of the traveled way may be supplemented with continuous white reflectorized markings if a no passing sight distance restriction exists.
4. The "L" distance equals the lane width times the taper ratio as shown in Table 5-1.

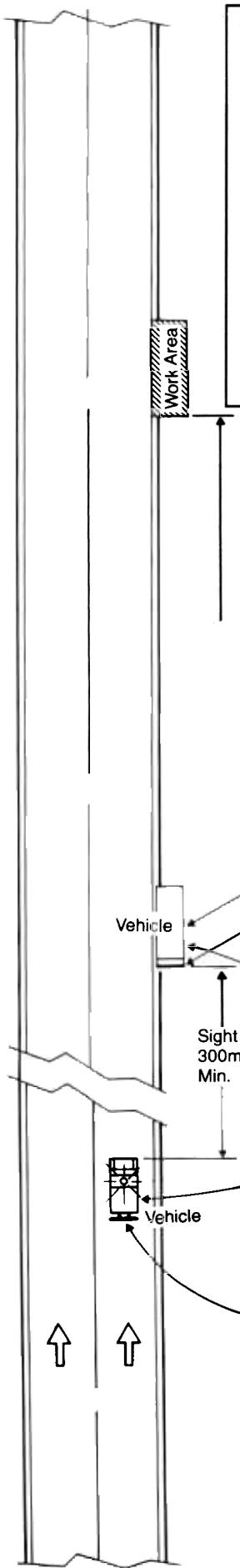
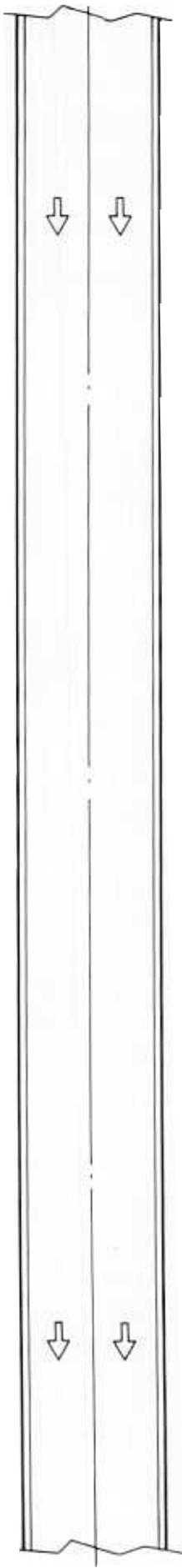


**Case X: When Activities Require the Closure of Two Adjacent Lanes and a Temporary Detour Is Provided By Making Use of One Lane Normally Used By Opposing Traffic**

1. Pavement markings shall always be used on paved crossovers. Temporary pavement marking tape shall be used to mark a new center line and edge line on the existing pavement. All existing markings conflicting with the revised traffic pattern shall be removed.
2. Two-way Traffic sign(s) shall be repeated every 400 m in each direction through the tangent distance (T).
3. This case does not apply when work is being performed in the middle lane(s) of a six or more lane highway. Special plans approved by the Engineer will be required.
4. Cones may be substituted for barricades during day operations.
5. The "L" distance equals the lane width times the taper ratio shown on Channelizing Device Placement Table 5-1.



## Case X

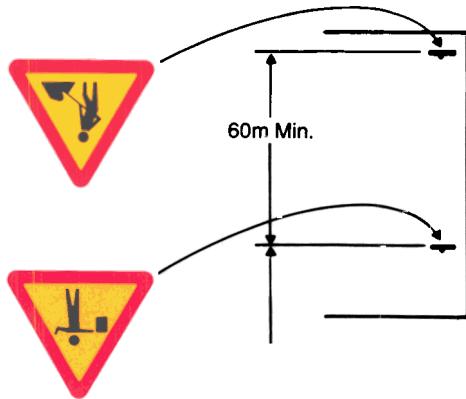


**Case XI: When Activities Require a Moving Operation  
When the Average Speed of Movement Is Greater Than 2 km/h But Less Than 20 km/h**

1. The work area shall be restricted to only one lane or portions of one lane.
2. All vehicles, equipment, men, and accompanying activities are restricted at all times to the protected lane unless otherwise authorized by the Engineer.
3. Light configurations on the Warning Arrow Panel sign shall be visible and discernible during daylight hours at a distance of 300 m under normal atmospheric conditions.
4. If the Warning Arrow Panel units are used at night, the intensity of the flashers shall be reduced to a level which does not interfere with the motorist's vision but is visible and discernible at a distance of 300 m under normal atmospheric conditions.

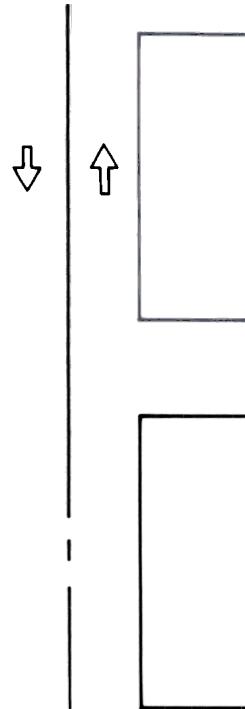
Urban or rural moving operations.  
Multi-lane operations only.

Where, at any time, any vehicle, equipment, men or their activities require a moving operation where the average speed of movement is greater than 2 km/hr but less than 20 km/hr



120m Min

One-way, one-lane  
operation  
Cones at 2.5m Centers or  
Type-I Barricades at 15m Centers



#### Case XII: When Activities Encroach on the Pavement, Requiring Closure of One Traffic Lane in an Area Where Speeds Are in a Lower Range Posted Zone

1. Type I or Type II barricades, drums, or vertical panels with steady burning lights shall be used.
2. For operations within 15 m of an intersection, traffic handling plans shall be approved by the Engineer.
3. Where the work area extends through the intersection, barricades and adequate Warning signs shall be erected on the cross street.
4. If the work area is in the parking lane and the parking exists during work hours, a Road Work sign shall be installed a minimum of 60 m in advance of the work area and the area protected with cones or barricades.
5. If the work operation is performed during off peak periods and is of short duration, signing shall be in conformance with Case VII.
6. Construction operations shall be confined to one traffic lane, leaving the opposite lane open to traffic.
7. The flaggers shall be in sight of each other or in direct communication at all times. When a travel lane is closed, the flagman will be present whether work is performed or not performed.

#### Symbols

- Cones, steel drum (210 liters) or Type-I Barricade.
- Flagger with traffic control sign
- Two-lane, two-way traffic, undivided urban day or night operations.

See Table 5-1

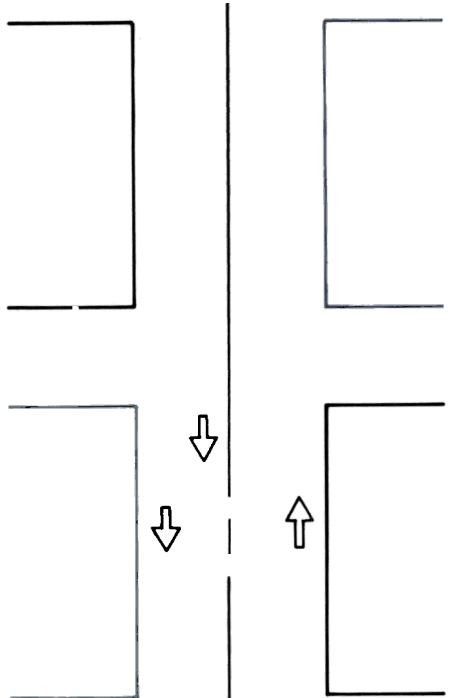
120m Min.



60m Min.

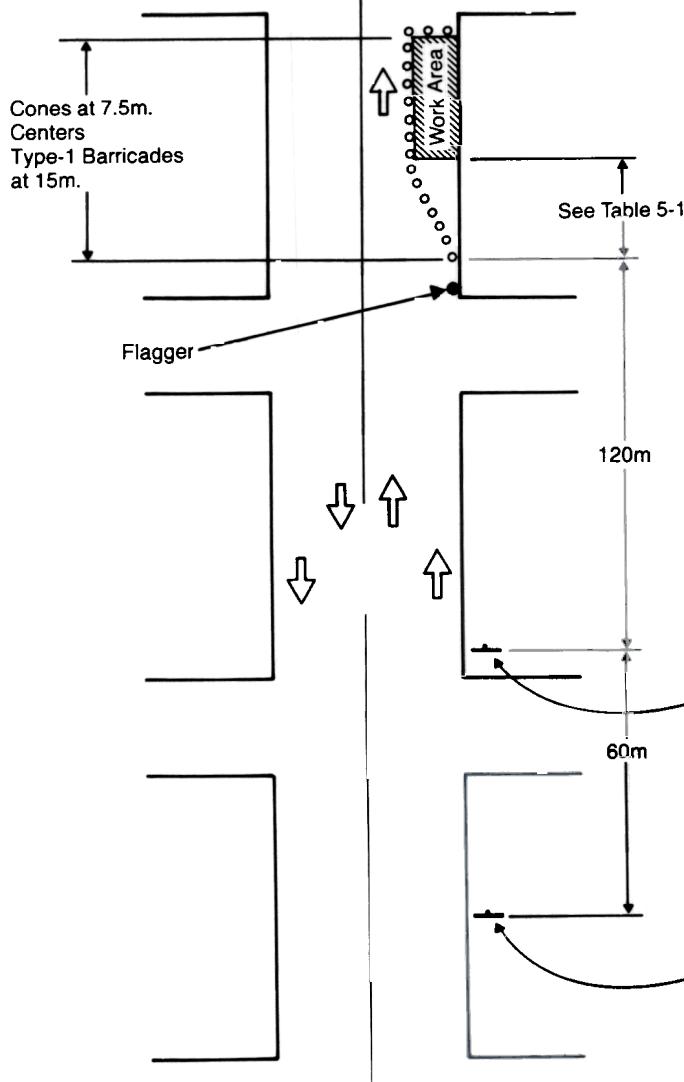


#### Case XII



**Case XIII-A and Case XIII-B: When Activities Encroach on the Pavement, Requiring the Closure of at Least One Traffic Lane in an Area Where the Posted Speed Is 60 km/h or Less**

1. Type I or Type II barricades with steady burning lights shall be used in lieu of cones or steel drums for night operations.
2. For operations within 15 m of an intersection, traffic handling plans shall be approved by the Engineer.
3. Where the work area extends through the intersection, barricades and adequate Warning signs shall be erected on the cross street.
4. If the work area is in the parking lane and the parking exists during work hours, a Road Works sign shall be installed 200 m in advance of the work area and the area protected with cones or barricades.
5. Operations restricting vehicular movement, so traffic in both directions must use a single lane, shall only be allowed while flaggers are on duty or when a temporary traffic signal is installed to assign right-of-way.
6. This case does not apply when work is being performed in the middle lane(s) of a six or more lane highway. Special plans approved by the Engineer will be required.
7. For night operations, flashing lights shall be installed above the first sign on each approach.
8. Distances shown are minimums.



**Symbols**

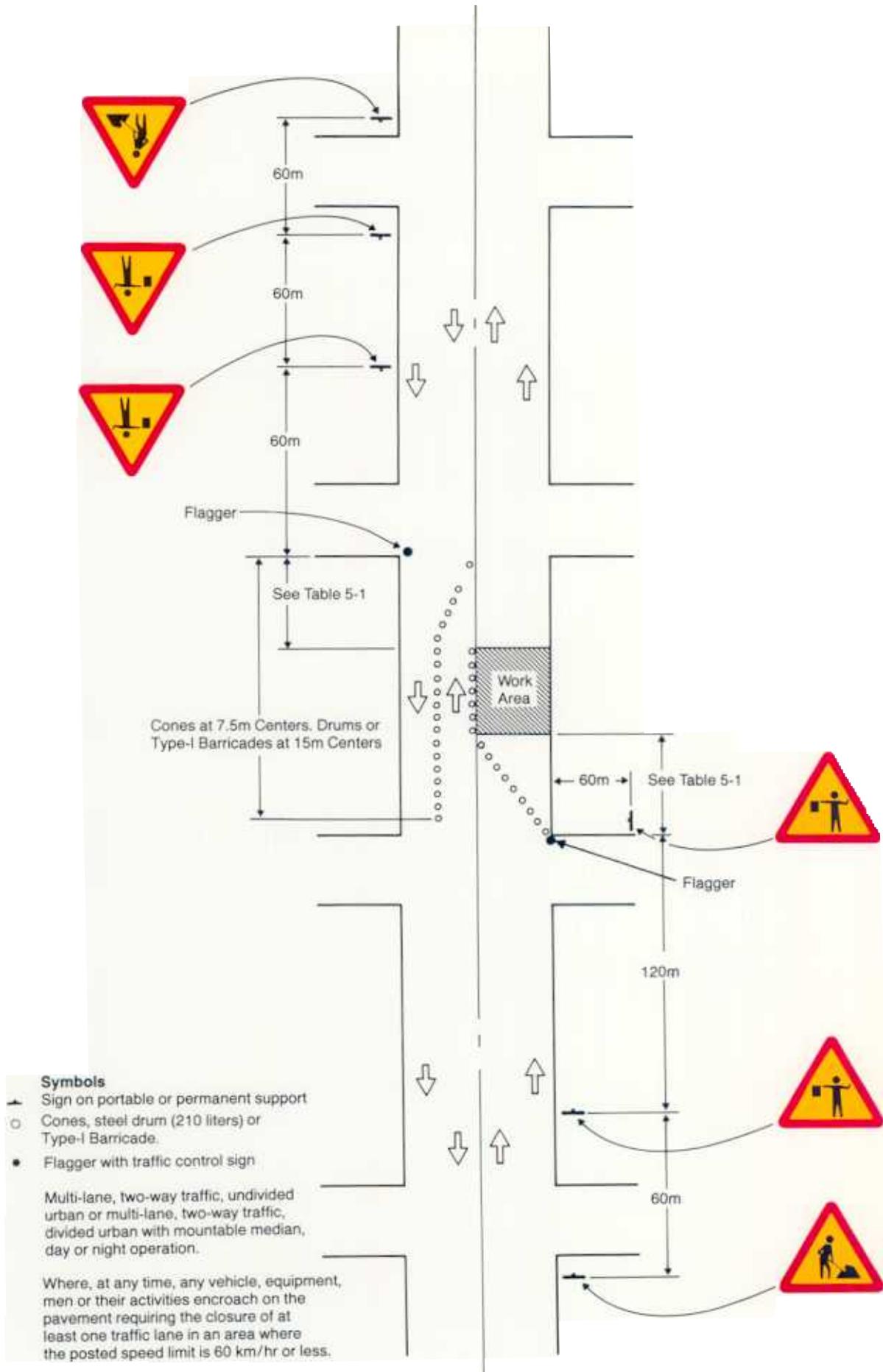
- Sign on portable or permanent support
- Cones, steel drum (210 liters) or Type-I Barricade.
- Flagger with traffic control sign

Multi-lane, two-way traffic, undivided urban or multi-lane, two-way traffic, divided urban with mountable median, day or night operation.

Where, at any time, any vehicle, equipment, men or their activities encroach on the pavement requiring the closure of at least one traffic lane in an area where the posted speed limit is 60 km/hr or less.



**Case XIII-A**



Case XIII-B