TEMPORARY TRAFFIC CONTROL MANUAL

CITY OF BRANDON

ENGINEERING DEPARTMENT

2006

GENERAL SECTION

FOREWORD

This manual makes reference to the standards specified in the most recent edition of the Manual of Uniform Traffic Control Devices for Canada (MUTCDC) published by the Transportation Association of Canada (TAC). The standards specified in the MUTCDC have been adopted by most Canadian municipalities, thereby providing a consistent traffic control system for work zones nation wide.

This manual is published by the City of Brandon Development Services Division, and is available at the City of Brandon Engineering Department located in City Hall on the second floor.

CONTACT INFORMATION

Department of Engineering / Traffic Section

Regular office hours (8:30 A.M. to 5:00 P.M.)

Phone: (204) 729-2214

After Hours Temporary Traffic Control Concerns

Phone: (204) 729-2285

COMMENTS

Your comments on this manual are welcome and may be directed to:

The City of Brandon
Development Services Division
Department of Engineering / Traffic Section
410 – 9th Street
Brandon, MB. R7A 6A2

Phone: (204) 729-2214
Fax: (204) 725-3235
Email: engineering@brandon.ca

Please contact the City of Brandon Engineering Department for advice or recommendations on dealing with traffic control situations not included in this manual. Where the guidelines in the manual fail to adequately control traffic or protect workers, immediate notification is required.

AMENDMENTS

Revisions and updates may be necessary from time to time and is the responsibility of manual holders to update accordingly. It is important that new or revised pages be placed in the Manual as soon as possible. Out of date pages should be removed and discarded at the same time to ensure the Manual is current. All manual holders will be responsible for the safe custody and maintenance of their manual.

Once amendments have been completed, it is the responsibility of manual holders to sign and date manuals for verification of receipt. This is accomplished by signing and dating the amendments table provided in this manual. Failure to do so will indicate the manual is not current, and subject to validity by City of Brandon Engineering Inspectors.

CORRIGENDA

Minor changes (i.e. phone numbers, typos) may be accommodated by "pen and ink" by manual holders as required. A record of these changes will be recorded in the corrigenda in the same format as the amendments.

RECORD OF AMENDMENTS

No.	Date of Issue	Date Entered	Entered By

CORRIGENDA

No.	Date of Issue	Date Entered	Entered By

TABLE OF CONTENTS

GENERAL SECTION
FOREWORD 2
CONTACT INFORMATION 2
COMMENTS 2
AMENDMENTS 3
CORRIGENDA 3
TABLE OF CONTENTS 4

PART I - INTRODUCTION
1.1 PURPOSE 9
1.2 SCOPE 9
1.3 AUTHORITY 10
1.4 DISCLAIMER 10
1.5 COMPLIANCE 10

PART II - TRAFFIC CONTROL PRINCIPLES
2.1 TRAFFIC CONTROL PLANS 12
2.2 DURATION OF WORK 12
2.2.1 Mobile 13
2.2.2 Very Short Duration 13
2.2.3 Short Duration 13
2.2.4 Long Duration 13
2.3 STREET CLASSIFICATIONS / NOTIFICATION TIMELINES 14
2.3.1 Arterial Streets 14
2.3.2 Collector Streets 15
2.3.3 Residential Streets & Lanes 15
2.4 EMERGENCIES 16
2.5 TRAFFIC SIGNALS 16
2.6 PEDESTRIAN SAFETY 16
2.7 SPEED LIMITS 17
2.8 IDENTIFICATION 17

PART III - WORK ZONE PRINCIPLES
3.1 WORK ZONE REQUIREMENTS 19
3.1.1 Design and Placement 19
3.1.2 Application 19
3.1.3 Maintenance 20
3.1.4 Uniformity 20
3.2 COMPONENTS OF A WORK ZONE 21
3.2.1 Advance Warning Area 22
3.2.2 Transition Area 22
3.2.3 Activity Area 23
Buffer Space (longitudinal) 23
Work Space 23
Buffer Space (lateral) 23
Traffic Space 24
3.2.4 Termination Area 24
3.3 TRAFFIC TAPERS 24
3.3.1 Suggested Taper Lengths 25
3.3.2 Shoulder Closure Taper 25
3.3.3 Downstream Taper 25

PART IV - TRAFFIC CONTROL DEVICES

4.1 SIGN TYPES 27
4.1.1 Regulatory Signs 27
4.1.2 Warning Signs 30
4.1.3 Information Signs 34
Detour Information Signs 34
4.2 INSTALLATION 34
4.3 SIGN MOUNTING HEIGHT 35
4.4 MAINTENANCE 35
4.5 SIGN REFELECTIVITY 36
4.6 RECORD KEEPING 37
4.7 PARKING SIGNS & PARKING METERS 37
4.8 TRAFFIC CONTROL PERSON'S (TCP's) 37
4.8.1 Responsibility 37
4.8.2 Qualifications 38
4.8.3 Positioning 38
4.8.4 Equipment 38

PART V - OTHER CONTROL DEVICES

5.1 DELINEATION DEVICES 40
5.1.1 Traffic Cones 40
5.1.2 Delineator Posts 41
5.1.3 Flexible Drums 41
5.2 BARRICADES 42
5.2.1 Light Barricades 43
5.2.2 Heavy Barricades 43
5.3 CONCRETE BARRIERS 44
5.4 IMPACT ATTENUATORS 45
5.5 VARIABLE MESSAGE BOARDS (VMB) 45
5.6 FLASHING ARROW BOARDS (FAB) 46
5.7 SHADOW VEHICLES 48
5.8 BUFFER VEHICLES 48
5.9 PAVEMENT MARKINGS 49
5.10 METAL PLATES 49

PART VI – STANDARD DRAWINGS

6.1 SYMBOL LEGEND 51
6.2 ROADSIDE WORK AND SHOULDER WORK
Right Shoulder Work *(Residential & Collector Street)* 52
6.3 ROADSIDE WORK AND SHOULDER WORK ON A TWO-LANE STREET – MOBILE OPERATIONS
Encroachment in Right Lane *(Residential & Collector Street)* 53
6.4 ROADSIDE WORK AND SHOULDER WORK ON A TWO-LANE ROAD
Encroachment in Right Lane *(Residential Street)* 54
6.5 ROADSIDE WORK AND SHOULDER WORK ON A TWO-LANE ROAD
Encroachment in Right Lane *(Collector Street)* 55
6.6 SINGLE LANE CLOSED / YIELD TO ONCOMING TRAFFIC
Two-Lane Road / Right Lane Closed *(Residential Street)* 56
6.7 SINGLE LANE CLOSED / TRAFFIC CONTROL PERSON'S
Two-Lane Road / Right Lane Closed *(Collector & Arterial Street)* 57

PART VI CONTINUED

6.8 ROADSIDE WORK AND SHOULDER WORK ON A MULTI-LANE ROAD – MOBILE OPERATIONS
Encroachment in Right Lane *(Collector & Arterial Street)* 58
6.9 ROADSIDE WORK AND SHOULDER WORK ON A MULTI-LANE ROAD
Encroachment in Right Lane *(Collector & Arterial Street)* 59
6.10 ROADSIDE WORK AND SHOULDER WORK ON A MULTI-LANE ROAD – LONG DURATION
Encroachment in Right Lane *(Collector & Arterial Street)* 60
6.11 SINGLE LANE CLOSED
Multi-Lane Road / Right Lane Closed *(Collector & Arterial Street)* 61
6.12 SINGLE LANE CLOSED FOR SHORT DURATION
Multi-Lane Road / Right Lane Closed *(Collector & Arterial Street)* 62
6.13 SINGLE LANE CLOSED FOR LONG DURATION
Multi-Lane Road / Right Lane Closed *(Collector & Arterial Streets)* 63
6.14 ROADSIDE WORK AND SHOULDER WORK ON A MULTI-LANE ROAD – MOBILE OPERATIONS
Work in the Median 64
6.15 ROADSIDE WORK AND SHOULDER WORK ON MULTI-LANE ROADS
Work in the Median 65
6.16 ROADSIDE WORK AND SHOULDER WORK ON MULTI-LANE ROADS
Work in the Median / One Direction Lane Closed 66
6.17 TRAVEL LANE CLOSED AT INTERSECTION ON TWO-LANE ROADS
Near Side Lane Closed *(Residential Street)* 67
6.18 TRAVEL LANE CLOSED AT INTERSECTION ON TWO-LANE ROADS
Near Side Lane Closed *(Collector & Arterial Streets)* 68
6.19 TRAVEL LANE CLOSED AT INTERSECTION ON TWO-LANE ROADS
Far Side Lane Closed *(Collector & Arterial Streets)* 69
6.20 INTERSECTION NEAR SIDE LANE CLOSED ON MULTI-LANE ROADS
Left Lane Closed *(Collector & Arterial Streets)* 70
6.21 INTERSECTION NEAR SIDE LANE CLOSED ON MULTI-LANE ROADS
Right Lane Closed *(Collector & Arterial Streets)* 71
6.22 INTERSECTION FAR SIDE LANE CLOSED ON MULTI-LANE ROADS
Left Lane Closed *(Collector & Arterial Streets)* 72
6.23 INTERSECTION FAR SIDE LANE CLOSED ON MULTI-LANE ROADS
Right Lane Closed *(Collector & Arterial Streets)* 73
6.24 INTERSECTION NEAR SIDE ALL LANES CLOSED ONE DIRECTION ON MULTI-LANE ROADS
One Direction Lane Closed *(Collector & Arterial Streets)* 74
6.25 INTERSECTION FAR SIDE LANE CLOSED ON MULTI-LANE ROADS
Left Lane Closed and Near Side Left Turn Lane Open 75
6.26 MEDIAN CROSSOVER ON MULTI-LANE ROADS
Mid-Block Location 76
6.27 DETOUR / ALL LANES CLOSED AT MID-BLOCK
Total Road Closure *(Residential Streets)* 77
6.28 DETOUR / ALL LANES CLOSED AT MID-BLOCK
Total Road Closure *(Collector & Arterial Streets)* 78
6.29 PEDESTRIAN CONSIDERATIONS FOR SIDEWALK DETOUR ONTO A ROAD
Mid-Block Location 79

APPENDIX SECTION

APPENDIX A
Glossary 81

APPENDIX B
Arterial Street Classifications 88

APPENDIX C
Collector Streets Classifications 90

APPENDIX D
Arterial Streets Map 92
Collector Streets Map 93

TEMPORARY TRAFFIC CONTROL MANUAL

PART I

INTRODUCTION

1.0 INTRODUCTION

1.1 PURPOSE

Traffic control is required when traffic must be moved through or around street construction, maintenance operations or utility work on or adjacent to a roadway. **This manual is intended to provide guidelines for the protection of road users and workers during temporary periods of street maintenance and construction, including utility and other operations.** This manual sets forth basic principles and provides standards for design, application, installation, and maintenance of the various types of traffic control through work zones. Traffic control systems which differ from standard practices have severe implications and endanger motorists as well as workers.

The standard plans detailed in this manual provide minimum standards based on a work area and street classification. In more complex situations, these plans will form the basis of more specific, detailed Traffic Control Plans. In some instances, the standards specified in this manual may need to be exceeded.

Motorists shall be guided in a clear and positive manner while approaching and traversing through a work area or detour, and under all circumstances, this positive guidance shall create a consistent visual image for motorists. This may be achieved by the use of signs, delineators, channelizers, barricades, pavement markings, lighting devices, or traffic control persons (TCPs), all used in a variety of combinations to achieve the safe movement of traffic around workers.

1.2 SCOPE

This manual is intended as a practical working reference to be used by private contractors, utility contractors, consultants and City personnel. Uniform standards and procedures are set out in this manual and shall be adhered to when working on or adjacent to roadways under jurisdiction of The City of Brandon.

All agencies and contractors shall observe and maintain these standards and procedures to ensure uniform standards for design and quality of traffic control devices within the City of Brandon. Minimum standards of application are prescribed in this manual for typical situations and for methods of controlling traffic through work zones. A number of typical situations have been illustrated to assist in the planning of traffic control through various scenarios that may arise in the City of Brandon.

This manual shall be used in conjunction with the Manitoba Occupational Health and Safety Act and Regulations, the Provincial Highways Traffic Act, and Associated Regulations including applicable bylaws and related contract documents.

1.3 AUTHORITY

All work performed on City owned Right-Of-Way's (ROW's), shall conform to the policies, standards, and procedures set out by The City of Brandon including this Temporary Traffic Control Manual. The City of Brandon Engineering Department is authorized to set regulations for traffic control devices for the purpose of controlling, warning, guiding, informing and directing traffic. This authority is granted under The City of Brandon Traffic Bylaw No. 5463/16/87, Section #10.1, *"Working In or Upon any Roadway"* [EN. B/L 5810/85/90]. Provincial Utilities or Agencies have authority to perform work in cooperation with the City to restore City infrastructure to its original condition.

No work shall commence on a public roadway without first obtaining a work permit providing approval by the City of Brandon Engineering Department. The City may grant continuing permits for specific routine operations.

Any work that occurs on private property where the activity encroaches on a street ROW is also regulated and approved by the City of Brandon Engineering Department.

1.4 DISCLAIMER

Since it is not practical to prescribe detailed application standards for all situations that may arise, it is emphasized that only minimum desirable standards for normal situations are presented in this manual. No one standard sequence of signs or control devices may be applied for all locations or conditions, due to the variety of conditions possible. When unusual or hazardous conditions prevail, traffic control procedures must be established by appropriate modification of existing examples and/or application of the general control principles set out in this manual. The City of Brandon Engineering Department must be consulted prior to changes in a Traffic Control Plan.

Where there may be a conflict between this manual and the regulations set forth in supplementary Provincial/Municipal Regulations and/or Acts, the most stringent requirements shall apply.

1.5 COMPLIANCE

Compliance with the guidelines contained in this manual is mandatory. City work crews, contractors & utilities must inspect the work zone regularly to ensure compliance with these standards. All parties must be aware of the consequences for not meeting the standards. Failure to comply with the standards may result in any or all of the following:

- Increased liability; (Criminal Liability: Bill C-45)
- Issuance of a cease work order;
- Work completion or repairs by others and cost incurred to the party involved.

TEMPORARY TRAFFIC CONTROL MANUAL

PART II

TRAFFIC CONTROL PRINCIPLES

2.0 TRAFFIC CONTROL PRICIPLES

2.1 TRAFFIC CONTROL PLANS

Planning for traffic control in work zones is essential. Traffic control plans shall be formulated by qualified personnel and plans shall be reviewed by the City of Brandon Engineering Department to determine optimum performance. The principles of pre-planning and review shall always apply, regardless of the project size.

The traffic control plan will vary in detail given the complexity of the project, and on the potential conflicts between traffic and the work zone. The plan shall include provisions for adequate separation of public traffic and work areas, the limitation of work periods, and for lane closures based on careful consideration of anticipated traffic volumes and minimum exposure of workers.

The plan for traffic control shall also include, but not be limited to, signing, application and/or removal of pavement markings, traffic control persons, roadway lighting, methods and devices for delineation, channelization, placement, and maintenance of all devices.

The decision to use a particular device or devices in a general situation shall be made on the basis of knowledge regarding the location. While this Manual provides guidelines for design and application of temporary traffic control devices, it is not a substitute for sound engineering judgment. It is the intent that the guidelines of this Manual be minimum recommended standards for traffic control.

Whenever possible, consideration shall be given to avoiding the scheduling of work zone activities during peak traffic hours, typically 07:00 to 09:00 and 16:00 to 18:00.

2.2 DURATION OF WORK

Urban traffic is typically characterized by relatively low speeds, wide ranges of traffic volume, narrower traffic lanes, frequent intersections and turning movements, significant pedestrian and cyclist traffic, and more roadside obstacles.

Work duration is a major factor in determining the methods along with the number and types of signs and devices to be used in temporary work zones. There are four categories of work duration used in this manual. They are as follows:

- Mobile
- Very Short Duration
- Short Duration
- Long Duration

2.2.1 Mobile

Mobile operations involve work that is done while moving continuously, usually at slow speeds, or intermittently, with periodic stops which do not exceed a few minutes in duration. The advance warning area moves with the activity area. For some continuously moving operations, such as street sweeping, where volume is light and visibility is good, a well marked and well signed vehicle may be sufficient. If volume and/or speed are higher, a buffer vehicle, preferably with a flashing arrow board, should follow the work vehicle. In addition, vehicles may be equipped with devices such as flashing vehicle lights, truck mounted attenuators, and appropriate signs.

Examples of mobile operations include longitudinal pavement marking, watering of boulevards or centre medians, and street sweeping.

2.2.2 Very Short Duration

Very short duration work occupies a fixed location for up to 30 minutes. The work site may be moved along the road and make frequent, short stops. The time required to set up and remove normal traffic control devices in these situations often exceeds the time required to perform the work itself. Consequently, the use of active devices such as flashers and flashing arrow boards, along with simplified set up and removal procedures, is advocated for very short duration work. The investment in these active devices ensures adequate traffic control, reduces worker time spent exposed to traffic hazards and yields more efficient, productive work operations.

Examples of very short duration operations include utility work, minor road maintenance, crack sealing, minor sign maintenance and signal light repairs.

2.2.3 Short Duration

Short duration work is stationary work that requires a separate work space that is continuously attended by workers for more than 30 minutes and less than 24 hours. It may include maintenance, construction or utility work. The work crew is present to monitor and maintain the temporary traffic control zone. The road is completely restored and returned to normal operation when the work is complete.

Examples of short duration operations include sidewalk/boulevard repair, asphalt patching, water-main repairs and road maintenance.

2.2.4 Long Duration

Long duration work is stationary work that requires a separate work space for longer than 24 hours. At long duration temporary work zones, there is ample time to install and to realize the benefits from the full range of traffic control devices and procedures that are available for use as outlined in this manual. Temporary roadways and barriers may be provided, and inappropriate pavement markings may be removed and replaced with temporary markings.

Examples of long duration operations include utility replacement, roadway reconstruction, sewer & water upgrades, and large paving projects.

2.3 STREET CLASSIFICATIONS & NOTIFICATION TIMELINES

Traffic conditions on urban streets are characterized by lower speeds, a wide range of traffic volumes, limited maneuvering space, frequent turns, and significant pedestrian movements. Before a traffic control plan is selected, the area required to do the work safely shall be determined.

The City of Brandon street classifications will assist in developing the appropriate traffic control plan. Arterial and Collector street classifications are those established in the most recent edition of the City of Brandon Consolidated Traffic Bylaw No. 5463/16/87, Section "A1", (Appendix B to this manual).

Whenever possible, two-way traffic set-ups are preferred over detouring traffic to another street. In situations where only one lane is available, it is preferred that it is utilized and only one direction of travel be detoured.

NOTIFICATION TIMELINES

2.3.1 Arterial Streets

The City of Brandon Engineering Department shall be notified in writing, complete with Temporary Traffic Control Plan drawings and specifications for any work proposed on these streets a minimum of 14 days in advance, except in an emergency situation. Special attention shall be given to those Arterial streets that are bus routes. The most recent edition of the Brandon Transit Ride Guide will assist in determining which streets are bus routes.

The City of Brandon Engineering Department shall review said drawings and/or specifications for all temporary traffic control plans on arterial streets. The temporary traffic control plans shall adhere to standards prescribed in this manual. Only upon approval by the City Engineer or designate, shall work commence as proposed on arterial streets.

The agency responsible for the work, shall notify all affected residents and/or merchants of the closure a minimum of 48 hours in advance of the scheduled work. A detailed notice, approved by the City of Brandon Engineering Department, shall be delivered by the agency responsible for the work.

For closures longer than one day, the general public shall be notified by newspaper advertisement and/or public service announcement. The City of Brandon Engineering Department shall prepare the advertisement, with the cost incurred by the contractor. Notice to merchants for extended road closures greater than three (3) business days shall be the responsibility of the agency responsible for the work.

Often it may be necessary that work occurs on a specific day of the week (Sunday) or period of the day (evening or early morning) to minimize the effect on traffic.

2.3.2 Collector Streets

The City of Brandon Engineering Department shall be notified in writing, complete with Temporary Traffic Control Plan drawings and specifications for any work on these streets a minimum of 7 days in advance, except in an emergency situation. Special attention shall be given to those Collector streets that are bus routes. The most recent edition of the Brandon Transit Ride Guide will assist in determining which streets are bus routes.

The City of Brandon Engineering Department shall review said drawings and/or specifications for all temporary traffic control plans on collector streets. The temporary traffic control plans shall adhere to standards prescribed in this manual. Only upon approval by the City Engineer or designate, shall work commence as proposed on collector streets.

The agency responsible for the work, shall notify all affected residents and/or merchants of the closure a minimum of 48 hours in advance of the scheduled work. A detailed notice, approved by the City of Brandon Engineering Department, shall be delivered by the agency responsible for the work.

Notice to merchants for extended road closures greater than three (3) business days shall be the responsibility of the agency responsible for the work.

Often it may be necessary that work occurs on a specific day of the week (Sunday) or period of the day (evening or early morning) to minimize the effect on traffic.

2.3.3 Residential Streets & Lanes

The agency responsible for the work may close or restrict a residential street or lane during the day by notifying the City of Brandon Engineering Department the day prior to the closure,

This is provided that any affected residents or businesses are notified two days in advance, and the street or lane is available to local traffic. The installation of traffic control devices shall adhere to standards prescribed in this manual.

Access to businesses to the maximum extent possible, shall be maintained at all times. This access may be via lanes or adjacent streets.

For closures overnight, the City of Brandon Engineering Department shall be notified two days in advance to ensure any additional safety precautions are undertaken if required.

2.4 EMERGENCIES

Where an emergency situation arises, temporary traffic control and public communication shall not be compromised. Minimum standards must be achieved as soon as possible. It is understood that in emergency situations it may not be possible to meet all the minimum standards mentioned in this manual.

All parties involved must prove due diligence to provide for both public and emergency personnel safety through adequate temporary traffic control in all emergency situations.

The Brandon Police Service will determine if an emergency situation exists and if police officers are required to provide temporary traffic control.

2.5 TRAFFIC SIGNALS

Whenever construction work takes place in close proximity to a signalized intersection, the Contractor shall notify the City of Brandon Engineering Department for City owned signals and the Manitoba Transportation and Government Services for Provincial Signals, so that any necessary changes in the signal timing are made.

Close communication shall continue until the signals are back to operating as they did prior to any operational adjustments that may have been made.

2.6 PEDESTRIAN SAFETY

Where pedestrians and/or cyclists are likely to be present in work zones, significant consideration shall be given to their safety requirements.

Although the contents of this manual deal mostly with the motoring public and worker safety, it must be recognized that providing for the safety of pedestrians is equally important. In situations where work is taking place in close proximity to pedestrian traffic, steps shall be taken to ensure their safety.

The following standards shall be maintained to ensure pedestrian safety:

- Pedestrian and vehicular traffic must be physically separated.
- Pedestrian traffic shall also be physically separated from workers and equipment in the work space. Accommodations shall be made for a safe passage through or around the work space.

Sidewalks and crosswalks may be closed to prevent pedestrian traffic through or around the work area, provided alternate means of detouring pedestrian traffic is available. When a sidewalk must be closed and it is not possible to direct pedestrians to the other sidewalk, a proper closure of the adjacent curb lane may be used to provide pedestrians with a temporary sidewalk. **A minimum width of 1.2 metres is required.**

In cases where it is not possible to detour pedestrian traffic, pedestrians shall be protected as they pass through the work area. This may require the use of barricades to separate the worksite from the pedestrian walkway. It may also be necessary to use bridges (complete with handrails) and sheltered walkways (hoarding and scaffolding).

In all cases, measures taken to protect pedestrians shall be to the satisfaction of the City of Brandon Engineering Department. Specifications used for bridges and hoarding, shall meet the requirements of the Manitoba Building Code, prior to commencement of work.

2.7 SPEED LIMITS

Construction speed limit signs may be legally enforceable, thus the installation and maintenance of these signs requires special attention.

The City of Brandon Engineering Department may have the authority to set construction zone speed limits, but only The Province of Manitoba has the authority to set permanent speed limits, commonly recognized as white regulatory signs.

Reduced speed limits in construction zones shall be approved by the City of Brandon Engineering Department prior to setting up traffic accommodation. The posted speed limits shall not exceed 60% of the normal posted speed limit as follows;

Posted Speed Limit (km/h)	100	80	70	60	50
Typical Work Zone Speed Limit (km/h)	60	50	45	40	30

It is mandatory that speed limit signs shall be covered or removed when the street is no longer considered a work zone.

2.8 IDENTIFICATION

Sign faces and/or supports, along with barricade rail faces, shall not bear any advertising, company name, or logo.

This information, including 24 hour emergency contact information (i.e. phone numbers) shall be prominently displayed on the reverse side of all temporary condition warning signs, delineation devices and barricades.

In the event that a sign is moved and/or damaged or in the case of an emergency after regular construction hours, the contact displayed in the information area will be phoned to rectify the temporary traffic control issue.

TEMPORARY TRAFFIC CONTROL MANUAL

PART III

WORK ZONE PRINCIPLES

3.0 WORK ZONE PRINCIPLES

3.1 WORK ZONE REQUIREMENTS

Basic principles are required for the design and use of traffic control devices in work zones. These principles are outlined throughout this manual, and pertain to specific devices or groups of devices. It is very important that these principles be given primary consideration in the selection and application of each device.

To be effective, all traffic control devices shall meet five basic requirements. These are to:

- Fulfill a need,
- Command attention,
- Convey a clear, simple meaning,
- Provide adequate time for a proper response,
- Command respect of road users.

Basic considerations such as design, placement, application, maintenance and uniformity are used to ensure that these requirements are achieved. These considerations are essential to be effective traffic control devices.

3.1.1 Design & Placement

The design, placement and sign messages shall be such that attention is drawn to them, that they are legible, their meaning is clear, and there is adequate time for response. In situations where messages are required other than those specified in this manual, the signs shall have the same shape, colour, dimensions and illumination as signs of the same classification. Symbols, wording, and lettering shall conform as closely as possible to signs of the same type.

3.1.2 Application

Consistent application shall ensure that the appropriate devices are installed in a standard fashion to meet the traffic control requirements at any given location. Devices shall be placed in a uniform and consistent manner to ensure that motorists can be expected to respond properly to the devices based on their previous exposure to similar traffic control situations.

3.1.3 Maintenance

Maintenance of devices shall be to a high standard both day and night, to ensure that the legibility of signs is retained, that the devices are visible and that they are only in place when needed. Clean, legible and properly mounted devices in good condition, command the respect and attention of motorists, cyclists and pedestrians. In addition to physical maintenance, functional maintenance is required to adjust needed traffic control devices to current conditions and to remove any which are unnecessary. The fact that a device is in good physical condition should not be a basis for retaining it if the message is inappropriate. Carelessly executed functional maintenance will destroy the value of a group of devices by throwing them out of balance. Replacement of a sign in a group or series of devices, by one that is disproportionately larger will provide such a response.

3.1.4 Uniformity

Uniformity in the design of traffic control devices simplifies the task of the road users by aiding in the recognition and understanding. It also provides economy in manufacturing these signs.

Uniformity also means always treating similar situations in the same way. The use of uniform traffic control devices does not, by itself, constitute uniformity. A standard device used where it is not required or appropriate, will result in disregard for this device by road users at other locations where it is needed.

3.2 COMPONENTS OF A WORK ZONE

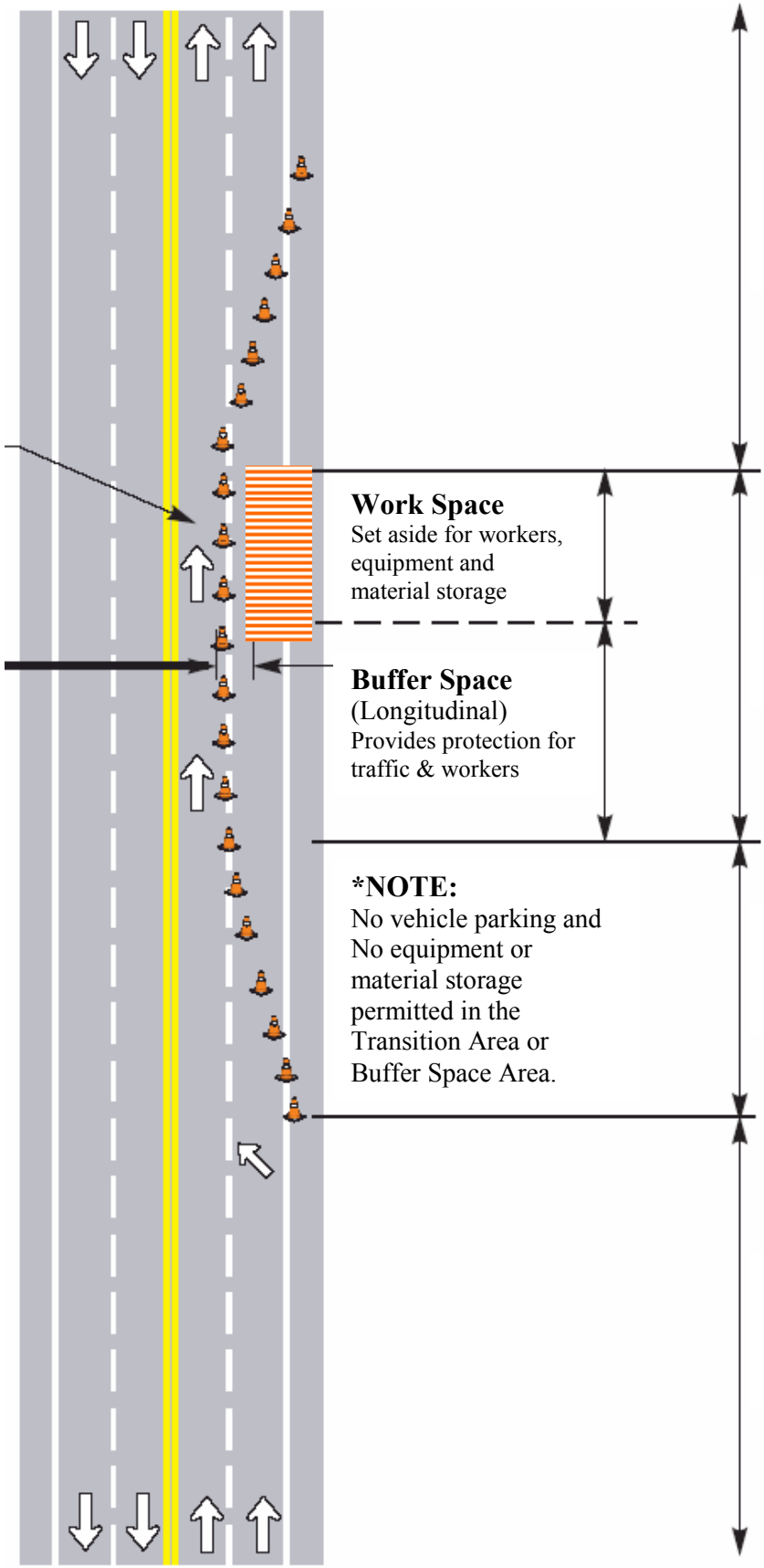
When traffic is affected by construction, maintenance, utility or similar operations, traffic control is needed to safely guide and protect road users and workers in a work zone. The work zone is the area between the first advance warning sign and a point beyond the work where road users are no longer affected.

Most work zones will consist of five distinct component areas, each playing a specific role in the work zone. They are commonly referred to as:

- Advance Warning Area
- Transition Area
- Buffer Space
- Work Area
- Termination Area

Refer to the following page for an illustration that best describes these areas.

Components of a Temporary Traffic Control Zone



Termination Area
Let's traffic resume normal driving

Traffic Space
Allows traffic to pass through the activity area (Min. 3.0 m.)

Work Space
Set aside for workers, equipment and material storage

Activity Area
Where the work takes place

Buffer Space
(Lateral)
Provides protection for traffic and workers

Buffer Space
(Longitudinal)
Provides protection for traffic & workers

***NOTE:**
No vehicle parking and No equipment or material storage permitted in the Transition Area or Buffer Space Area.

Transition Area
Moves traffic out of the normal path

Advance Warning Area
Informs motorists to expect work ahead & what action is required

If no lane or shoulder closure is involved, the transition area will not be used. In the following sections, each of these areas will be described for one direction of travel. If the work zone affects more than one direction of travel, the same principles apply to traffic in both directions.

3.2.1 Advance Warning Area

An advance warning area is required for all work zones in order to alert motorists of what to expect ahead. Before reaching the work zone, motorists shall have enough time to adjust their driving patterns. The advance warning area may vary from a series of signs starting in advance of the work area, to a single sign or flashing lights on a vehicle.

Advance warning signs are not needed when the work area is entirely off the roadway and shoulder, provided the work does not interfere with traffic. An advance warning sign(s) should be used when any problems or conflicts with the flow of traffic might possibly occur.

The advance warning area, from the first sign to the alert of the next area, shall be long enough to give motorists adequate time to respond to the road work ahead.

3.2.2 Transition Area

When work is performed within one or more travel lanes, a lane closure(s) is required. In the transition area, traffic is channelized from its normal lane(s) to another path in order to move traffic around the work zone. **It is imperative that no work material, vehicles, or equipment be stored or parked in the transition area.**

The transition area shall be delineated by channelizing devices, unless otherwise indicated by typical layouts in this manual. The transition area contains the tapers and parallel sections that are used to effectively close the lanes. The length of the taper and parallel section lengths are outlined further in this manual.

The transition area shall be made obvious to motorists. The intended path shall be clearly delineated with pavement markings and/or channelizing devices so motorists will not attempt to follow the original route. For long duration work zones, there may be a requirement to remove existing pavement markings when they conflict with the transition. Temporary pavement markings shall be used to identify a clear route where there could be confusion regarding the proper route.

With moving operations, the transition area moves with the work area. A shadow vehicle shall be used to warn traffic and/or guide it into the proper lane.

3.2.3 Activity Area

The activity area is where the work takes place. It includes longitudinal buffer space, work space, traffic space, and lateral buffer space.

Buffer Space (longitudinal)

The longitudinal buffer space is the open or unoccupied space which provides protection for traffic and workers between the end of the transition area and the work space. Where space permits and it is considered desirable, a buffer zone should be included even though it may not be indicated on the traffic control plan. With a moving operation, the buffer space is the space between the shadow vehicle, if one is used, and the work vehicle.

The buffer space provides a margin of safety for both traffic and workers. If a driver does not see the advance warning or fails to negotiate the transition, the buffer space provides room to stop before the work area. It is very important for the buffer space to be free of equipment, workers, materials, and vehicles at all times. The only exception may be if a buffer vehicle is required, in which case the vehicle would be parked upstream of the work zone.

Situations occur where opposing streams of traffic are moved over so one lane of traffic uses a lane that normally flows in the opposite direction. In these situations, a buffer space should be used to separate the two tapers for opposing directions of traffic to help prevent possible head on collisions.

Work Space

The work area is that portion of the roadway which contains the work activity and is closed to traffic and set aside for exclusively for workers, equipment, and construction materials. Work areas may remain in fixed locations or move as work progresses. The work area is usually delineated by barricades or other channelizing devices to exclude public traffic. Every practical effort shall be made to minimize hazards and distractions to motorists and workers.

Work spaces that remain overnight have greater need for delineation than day time operations. Every reasonable effort shall be made to minimize conflicts during evening hours.

Buffer Space (lateral)

The lateral buffer space provides for a separation between the work space and the adjacent traffic space.

Traffic Space

The traffic Space allows traffic to pass through the activity area. The traffic space should provide minimum lane widths of 3.0 m. Where the speed limit is 80 km/h or higher, it may be desirable to provide wider lane widths.

3.2.4 Termination Area

The termination area provides a short distance for traffic to clear the work space and to return to the normal traffic lane(s). The termination area extends from the downstream end of the work space to the point where traffic is able to resume normal driving.

There are occasions where the termination area could include a transition area. If a taper is used to shift traffic into an opposing lane of a multilane roadway, then the termination area should have a taper to shift traffic back to its normal path. This taper would then be the transition area for the opposing direction of traffic.

Avoid *"gaps"* in the traffic control plan that may falsely indicate to drivers that they have passed through the entire work zone. If the work areas include intermittent activity throughout a section of road, the drivers must be reminded periodically that they are still in the work zone.

3.3 TRAFFIC TAPERS

One of the most important elements of temporary traffic control is the traffic taper. A traffic taper gradually diverts traffic to an adjacent lane, thereby taking a lane out of service or deflecting traffic into a lane normally used for parking. Traffic tapers usually consist of chevron signs, delineator posts, barrels, or warning signs placed in a manner that gradually forces motorists to change lanes into the adjacent lane. An inadequate taper will almost always produce undesirable results such as lengthy traffic backups and unsafe conditions that may result in an accident. Therefore it is very important to provide adequate tapers based on speed limits and lane widths.

The length of a taper used to close a lane is determined by the speed of traffic and the width of the lane to be closed, (the lateral distance that traffic is shifted). Generally tapers should be lengthened, not shortened, to increase their effectiveness. Traffic should be observed to see if the taper is working correctly. Frequent use of brakes is an indication that either the taper is too short or the advance warning is inadequate.

If restricted sight distance is a problem, for example a sharp vertical or horizontal curve, the taper should begin well in advance of the sight restriction. The beginning of a taper should not be hidden downstream of curves.

Suggested taper lengths for a maximum vehicle speed are shown in the following chart. The number of devices in the taper length, and the spacing between channelizing devices is also included.

3.3.1 SUGGESTED TAPER LENGTHS					
Maximum Speed (km/h)	**Suggested Taper Lengths for Various Lane Widths (metres)**			****Number of Channelizing Devices for Taper**	**Spacing for Devices Along Taper (metres)**
	3.05	**3.35**	**3.66**		
30	21	23	24	5	6
40	32	35	38	6	8
50	46	50	55	7	9
60	82	90	98	9	12
70	137	151	165	13	14
80	152	168	183	13	15
90	168	184	201	13	17
100	185	200	220	13	18

** Based on a 3.66 metre or less traffic lane width

Situations may be encountered where the recommended values for taper lengths and the number of devices required cannot be achieved within the available space. Private access and closely spaced intersections may force taper lengths to be compromised on occasion. However, taper lengths should only be compromised as a last resort and with the approval of the City of Brandon Engineering Department.

3.3.2 Shoulder Closure Taper

When an improved shoulder is closed adjacent to a high speed roadway, it should be treated as a closure of a portion of the traveled roadway since motorists expect to be able to use the shoulder in the event of an emergency. The work space on the shoulder should be preceded by a taper, and if the shoulder is being used as a travel lane, either through practice or due to construction, a full lane closure taper should be placed on the shoulder.

3.3.3 Downstream Taper

A downstream taper is used at the far end of the work area to indicate to drivers that they are permitted to move back into the lane that was closed. It is placed in the termination area. While downstream tapers are optional, they may be useful in smoothing traffic flow.

Downstream tapers may not be advisable when work vehicles move into or leave the work area from the downstream end.

TEMPORARY TRAFFIC CONTROL MANUAL

PART IV

TRAFFIC CONTROL DEVICES

4.0 TRAFFIC CONTROL DEVICES

4.1 SIGN TYPES

Signs are an integral part of an effective traffic plan, and shall be used to provide advance warning and guidance through the construction area. The contractor shall ensure all existing signs in the area are covered to suit conditions of the work zone.

Signs are necessary whenever a motorist is required to change the path of travel or there is a need to warn motorists of construction activity beside the roadway. It is important that signs give clear and concise instructions. Traffic signs are classified into the following categories:

- Regulatory
- Warning *(including orange Temporary Condition Warning Signs)*
- Information

The most effective system of regulating, warning, and guiding motorists in work zones is provided through planned use of traffic control signs and devices that are placed properly and well maintained. All traffic control signs shall meet the minimum requirements in the ***Manual of Uniform Traffic Control Devices for Canada.***

4.1.1 Regulatory Signs

Regulatory signs indicate a traffic regulation that applies at a specific time or place on the road. These signs are essential to indicate the applicability of legal requirements that may not otherwise be apparent to the driver. All road users must abide by them and unlike warning and guide signs, they are enforceable. Existing regulatory signs within or adjacent to the work area shall be retained by the contractor. If existing signs are not appropriate for the traffic conditions in the work area, the City of Brandon Engineering Department shall be notified to determine if the signs should be covered, replaced, or relocated.

The following are some commonly used regulatory signs for temporary traffic control. For more details and examples of regulatory signs, please refer to the *Manual of Uniform Traffic Control Devices for Canada (Part A, Division 2).*

RA-1

Stop Sign (RA-1)

- This sign indicates to drivers that they must come to a complete stop and shall not proceed until safe to do so.
- 600 mm x 600 mm


RA-2

Yield Sign (RA-2)

- This sign indicates to drivers that they must yield the right-of-way, stopping if necessary and shall not proceed until safe to do so.
- 750 mm sides

RB-23

Entry Prohibited Sign (RB-23)

- This sign indicates to drivers that they are not permitted to enter the road at the location of the sign.
- 600 mm x 600 mm

RB-66

Pedestrians Prohibited Sign (RB-66)

- This sign indicates to drivers that pedestrians are prohibited in a specific area.
- 600 mm x 600 mm

RB-16

U-Turn Prohibited Sign (RB-16)

- This sign indicates to drivers that they are prohibited from executing U-turns at or near that location.
- 600 mm x 600 mm

RB-15

Turns Prohibited Sign (RB-15)

- This sign indicates to drivers that they are not permitted to turn left or right at this location. Traffic in all lanes must proceed straight ahead.
- 600 mm x 600 mm

RB-11L

RB-11R

Right (Left) Turn Prohibited Sign (RB-11)

- The Left Turn Prohibited sign (RB-11L) indicates to drivers that they are not permitted to turn left.
- The Right Turn Prohibited sign (RB-11R) indicates to drivers that they are not permitted to turn right.
- 600 mm x 600 mm

RB-51

Parking Prohibited Sign (RB-51)

- This sign indicates that parking is prohibited at all times on all days, in the direction(s) indicated by the arrows.
- 300 mm x 300 mm

RB-55

Stopping Prohibited Sign (RB-55)

- This sign indicates that stopping is prohibited at all times on all days, in the direction(s) indicated by the arrow(s).
- 300 mm x 300 mm

RB-41R

Right (Left) Turn Only Lane Sign (RB-41R and RB-41L)

- These signs indicate to drivers that they must turn from the designated lane at the intersection.
- 600 mm x 600 mm

RB-31

Passing Prohibited Sign (RB-31)

- This sign indicates to drivers that they shall not overtake another vehicle within a specified zone.

RB-32

Passing Permitted Sign (RB-32)

- This sign indicates to drivers that passing is permitted. It may only be used at the end of a no-passing zone where a Passing Prohibited sign was installed
- 600 mm x 600 mm

RB-25

Keep Right Sign (RB-25)

- This sign indicates that traffic is required to pass to the right of obstructions such as medians or islands.
- 600 mm x 750 mm

RB-61

Truck Route Sign (RB-61)

- This sign indicates that trucks, as prescribed by legislation, are permitted on this section of road.

RB-62

Trucks Prohibited Sign (RB-62)

- This sign indicates that trucks, as prescribed by legislation, are prohibited from traveling on this section of road.
- 600 mm x 600 mm

RB-24

Two Way Traffic Sign (RB-24)

- This sign indicates to drivers that this section of road is a two-way road, and that rules of the road for two-way operation apply.
- 600 mm x 750 mm

4.1.2 Temporary Condition Warning Signs

Temporary Condition signs shall be placed in advance of the work zone to permit the motorists time to understand the information and make the required response. Where a series of temporary condition warning signs are used, the signs nearest the work area shall be placed well in advance to give motorists time to react to a particular situation. Minimum dimensions shall be maintained using the following table as a guide.

Minimum Dimensions for Warning Signs Within a Work Zone

Posted Speed Limit Existing	Size of Sign In Advance Area	Size of Sign In Work Zone
100 km/h	1200 X 1200 mm	900 X 900 mm
70 km/h – 99 km/h	900 X 900 mm	750 X 750 mm
30 km/h – 69 km/h	750 X 750 mm	750 X 750 mm

Temporary condition signs are used for temporary traffic control and have an orange background with black symbol or text. The following are some commonly used warning signs. For more details and examples of temporary condition warning signs, please refer to the *Manual of Uniform Traffic Control Devices for Canada (Part D).*

TC-B1

Stop Ahead Sign (TC-B1)

- This sign indicates the presence of a Stop sign (RA-1) ahead.

TC-B2

Yield Ahead Sign (TC-B2)

- This sign indicates the presence of a Yield sign (RA-2) ahead.

TC-1

Construction Ahead Sign (TC-1)

- This sign indicates advanced warning of a major work zone and are generally used for long term construction projects.

TC-10

Detour Ahead Sign (TC-10)

- This sign indicates that traffic will be required to follow another route around a work zone.

TC-11

Detour Direction Markers (TC-11R and L)

- These signs are used to indicate an alternate route for traffic to follow where work zone activities require the total closure of a road.
- 600 mm x 600 mm


TC-2

Road Work Sign (TC-2)

- This sign indicates that work zone activities are in progress on or adjacent to the road, and that workers or equipment may be exposed to motorists.


TC-3

Survey Crew Sign (TC-3)

- This sign shall be used by survey crews at all times when surveying on or adjacent to roads. The signs must be taken down when the survey crew is no longer working.


TC-21

Traffic Control Person Ahead Sign (TC-21)

- This sign indicates an area where a traffic control person (TCP) is directing traffic through the use of a TC-65 Traffic Control Paddle. This sign shall be used at all times when a TCP is on duty.


TC-5

Temporary Lane Closed Ahead Sign (TC-5R and TC-5L)

- This sign indicates that a lane is temporarily closed ahead.


TC-24

Two Way Traffic Ahead Sign (TC-24)

- This sign indicates the approaching section of a road is a two-way street.


TC-51

Bump Sign (TC-51)

- This sign warns of approaching bump(s) in the road ahead. Motorists should take caution and reduce speed.

TC-49

Pavement Drop-Off Sign (TC-49)

- This sign indicates to drivers that they are approaching a section of road where either (or both) the adjacent lane or shoulder are higher or lower than the driver's traveled lane.

TC-55

Slippery Road Sign (TC-55)

- This sign warns drivers that slippery road conditions may exist. Drivers should take caution and reduce speed accordingly.

TC-47

Grooved Pavement Sign (TC-47)

- This sign warns of road surface conditions in work zones which require extra precaution and attention by motorcycle or bicycle operators.

TC-6R

Lane Closure Taper Sign (TC-6R and L)

- This sign indicates the beginning of a lane closure. The sign is repeated for successive lane closures.

TC-17S

Yield to Oncoming Traffic Sign (TC-17S)

- The Yield Sign (RA-2) with the Oncoming Traffic tab sign (TC-17S) is used to indicate which direction has the right of way where only one lane is available for two-way traffic.
- ***This shall only be used where traffic volumes are too low to warrant the use of a TCP.***

TC-7R

Lane Closure Arrow Sign (TC-7R and L)

- This sign indicates that traffic must pass to the left or right of a temporarily closed lane. In many situations, it may be more appropriate to use a flashing arrow board instead of this sign.
- 1200mm x 600mm
- ***The TC-7 sign shall not be used for detours.***

TC-54

Truck Entrance Sign (TC-54R and L)

- This sign indicates trucks entering the roadway from either the right or left hand side of the roadway.

TC-50

Pavement Ends Sign (TC-50)

- This sign indicates to motorists that the hard surface (pavement) road is about to end.

TC-31

Chevron Alignment Sign (TC-31)

- This sign indicates to motorists a change in the horizontal alignment of the road. Where used the signs shall be placed so that a minimum of two signs are always visible to the motorist while negotiating the change in alignment.
- 450mm x 600mm

TC-13L

Road Diversion Sign (TC-13L and TC-13R)

- This sign indicates a minor deviation from the normal road which is 200 metres or less in length.

TC-23

Temporary Maximum Speed Sign (TC-23)

- This sign indicates the Maximum Work Zone Speed Limit (km/h).
- *Refer to section 2.7 of this manual*

TC-30

Checkerboard Sign (TC-30)

- This sign indicates to motorists the termination of a road.

TC-34

Road Narrows Sign (TC-34)

- This sign indicates to motorists the narrowing of the road ahead.

TC-4

Construction Ends Sign (TC-4)

- This sign indicates to motorists the end of a work zone. This sign shall be placed at the end of the termination area of a work zone.

4.1.3 Information Signs

Information signs in work zones are used to indicate a suggested route for traffic to follow. Where work zone activities require a total closure of the road, the detour route shall include appropriate signs placed before all turns and on any straight portions along the route longer than two city blocks to confirm the correct detour route.

Detour Information Signs

Detour information signs shall be required for work on arterial streets. Detour information signs are necessary for controlling, warning or guiding traffic through or around a work area. Signs shall be mounted approximately at right angles to and facing the flow of traffic, contain as few words as possible and deliver a clear and concise message.

Signs are normally placed prior to an arterial street so that motorists use arterial streets rather than the local or collector street detour provided to bypass the work zone.

The following are some examples of information signs used for temporary traffic control.

MINOR ARTERIAL or COLLECTOR STREET 1200 mm x 1200 mm

MAJOR ARTERIAL CLOSURE 1200 mm x 2400 mm

Placement of these signs shall be determined on an individual basis in collaboration with the City of Brandon Engineering Department.

4.2 INSTALLATION

All devices shall be placed in a manner so as to not interfere with existing traffic control devices. It is important to survey the site before preparing a temporary traffic control plan. This will ensure that any conflicting signs be covered or removed, traffic signals adjusted, and road markings revised to reflect the work zone. All other signs identifying characteristics which are still relevant during the term of the work project shall be maintained.

Signs are generally placed within the work area to warn, regulate or guide anyone past a roadway construction or maintenance operation. Signs shall be installed before work is to commence and removed promptly to accommodate rush hour traffic whenever possible. The following considerations shall be used when deciding on sign installation:

- Traffic lanes may be narrowed to a minimum of 3.0 metres in width;
- A buffer of 3.0 metres minimum shall be provided beside any excavation greater than 1.0 metre in depth;
- Traffic may be shifted onto part of a shoulder, providing that portion may be used by any vehicle without pavement failure;
- Two-way traffic operations are always preferred over detouring traffic to another route;
- Traffic may be detoured, providing that the detour route is not already affected by another construction or maintenance project.

When work is carried out at night or under adverse weather conditions, certain signs may require supplementary flashing or steady lights for added visibility. On streets separated by a median wider than 1.0 metre, all signs shall be doubled by the provision of a second sign on the median or divider.

4.3 SIGN MOUNTING HEIGHT

Signs shall be placed at an angle of 90 degrees to the direction of oncoming traffic and be a minimum of 1.0 to 2.5 metres above the paved surface. Advance warning signs shall be located on the right hand side of traffic lanes and/or in the median area where there is sufficient space to accommodate doubling the signs.

4.4 MAINTENANCE

Sign maintenance plays an important role in traffic safety. All signs shall be kept clean, legible, and in proper position at all times. Damaged signs shall be repaired as soon as possible. Well maintained signs have more impact to motorists as traffic control devices if they are properly maintained. Damaged, defaced or dirty signs are less effective, and may increase exposure to litigation.

To ensure adequate maintenance, a suitable schedule for inspection, cleaning and replacement of signs shall be established, including inspection at night to determine the effectiveness of sign reflectivity. Special care shall be taken to remove debris such as construction materials, weeds, or snow which may obscure the sign face.

Signs shall also be covered or removed when the condition for which the sign is warning about no longer exists. Unnecessary signs create frustration and motorists lose respect for all traffic signs. When this occurs, hazards exist for both road users and work crews in the work zone. However if care is taken to ensure the signs in work zones are current and accurate, they will achieve the desired effect of warning, guiding and regulating traffic.

4.5 SIGN REFLECTIVITY

All signs and other devices used in low light or reduced visibility shall be designed and manufactured with a material that has a smooth, sealed surface, so as to display the same shape and colour by night as by day. This is normally achieved by using retroreflective sign materials. Specifications for retroreflective material have been established by the most recent edition of the Canadian General Standards Board (CGSB) Specification 62-GP-11M. Additional information on retroreflective sheeting is provided by the most recent edition of the American Society for Testing and Materials (ASTM) Specification D4956-04a.

Sign faces and/or supports shall not bear any advertising, company name, or logo. Lettering and background shall be according to the guidelines set in the *Manual of Uniform Traffic Control Devices for Canada (Part A, Division 1).*

Effective January 1st, 2010, only the following minimum standards of reflectivity will be permitted on all temporary traffic control devices for the City of Brandon work zones. The types of reflective materials to be used on various devices are as follows:

- All Regulatory Signs shall use 3M High Intensity sheeting or a proven equivalent, deemed as such by the City Engineer or designate.
- **All Temporary Condition Warning Signs for work zones shall use 3M Diamond Grade DG3 Fluorescent sheeting (4084), or proven equivalent, deemed as such by the City Engineer or designate.**
- For Information Signs including project signs and detour signs, Engineering Grade sheeting shall be the minimum level of reflectivity permitted for these signs, deemed as such by the City Engineer or designate.
- **All Barricade faces shall use 3M Diamond Grade Fluorescent Sheeting or proven equivalent, deemed as such by the City Engineer or designate.**

High Intensity material, defined as CGSB 62-GP-11M – Reflectivity Level I (ASTM D4956 Type III, Type IV, Type VI), shall be used for all other Temporary Condition Warning Signs prior to the aforementioned date of January 1st, 2010. This shall be effective January 1st, 2007, and shall include devices used for channelizing traffic such as flexible drums, cones, and delineator posts. **Non retroreflective material shall not be permitted for any temporary traffic control sign and/or device used in the City of Brandon.**

Consideration shall be given to the use of 3M Diamond Grade Fluorescent material on other signs and devices for emphasis and clarity where high levels of illumination, complex environments, roadside distractions or other features may compete for the motorist's attention.

4.6 RECORD KEEPING

Record keeping is an important component of temporary traffic control to document and ensure that the appropriate measures are in place at all times. The supervisor of the project is responsible for maintaining a record of all traffic control devices used on the project, and to ensure the necessary steps are taken to correct any deficiencies. For larger projects, it is recommended that a separate field book be maintained for this purpose.

The daily status and times of any signs changing location shall be recorded. As soon as possible after an incident/accident, the status of traffic control devices in the area concerned and the time of the inspection shall be recorded. Any necessary measurements or photographs shall also be taken at this time in regards to sign locations.

4.7 PARKING SIGNS & PARKING METERS

On Construction projects where it is necessary to utilize the curb lane, the contractor shall eliminate parking with appropriate signs or parking meter bags installed 24 hours before the restriction is required.

If construction work necessitates the removal of a parking meter or requires a parking meter to be taken out of service, the contractor shall make an application through the City of Brandon Licensing Department to remove or reserve the parking meter(s). All costs, including lost revenue, associated with this request shall be the responsibility of the contractor.

4.8 TRAFFIC CONTROL PERSONS (TCP's)

If traffic congestion warrants or if the City of Brandon Engineering Department determines it necessary, the contractor shall provide a Traffic Control Person (TCP). TCP's are used to regulate traffic to prevent conflicts between the movement of pedestrians, vehicles, workers, and work zone equipment. They may also be used to slow traffic passing close to workers or equipment. TCP's shall be used when all other methods of controlling traffic are considered inadequate to warn, direct, and regulate traffic.

Common applications for TCP's include when workers or equipment intermittently block a traffic lane and there is only one remaining lane for both directions of travel to use. More commonly, TCP's shall be used when a higher level of safety is deemed necessary.

TCP's are not generally required as part of the traffic control for a reduction in the number of lanes on multilane streets.

4.8.1 Responsibility

It is the responsibility of the traffic control person to effectively communicate with the traveling public by using traffic control motions and signals that are precise and deliberate so that the meaning of the signal can be clearly understood.

4.8.2 Qualifications & Training

TCP's shall be selected with care. They have a high level of contact with the public and shall therefore be thoroughly trained to ensure their safety. Contractors shall be responsible for ensuring TCP's receive the proper training for traffic control. TCP's shall possess the following characteristics:

- Intelligence and common sense;
- Alertness;
- Neat appearance;
- Good hearing & eyesight;
- A sense of responsibility for the safety of workers and the public;
- A courteous but firm manner.

4.8.3 Positioning

TCP's shall be stationed far enough from the work area to slow down traffic before they enter the work area. They shall stand outside the lane carrying moving traffic.

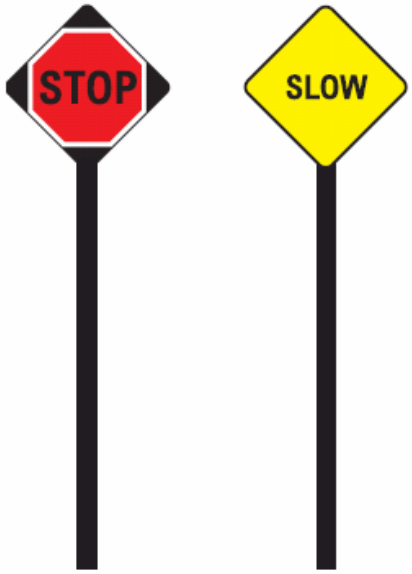
Where work is in progress adjacent to an intersection, it may be necessary to stand in the middle of the intersection in which case it may not be possible to always face the moving traffic.

4.8.4 Equipment

A TC-21 TCP Ahead sign shall be in place in advance of all Traffic Control Persons. The TC-65 Traffic Control (Stop and Slow) Paddle shall be used by TCP's, **no substitutes shall be permitted**. See the following illustrations for examples of the TC-65 paddles:

All TCP's shall wear the proper safety equipment at all times when directing traffic. Safety vests, hard hats and steel toe work boots are required at all job sites.

TCP's shall be provided with the proper communication equipment when TCP's are not visible to each other.



TC-65
450 mm x 450 mm x 1.750 m

TEMPORARY TRAFFIC CONTROL MANUAL

PART V

OTHER CONTROL DEVICES

5.0 OTHER CONTROL DEVICES

5.1 DELINEATION DEVICES

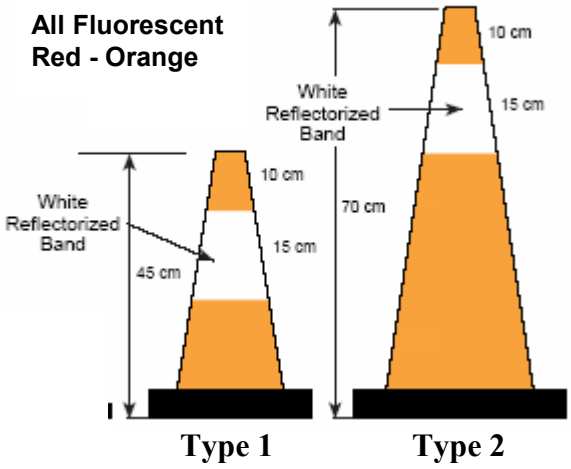
Delineation Devices are used to direct traffic away from, through or around a work area and may also be employed to separate traffic traveling in opposite directions.

Delineation devices include traffic cones, delineator posts, and flexible drums. Delineation devices shall be fluorescent orange and made of rubber or similar flexible material. In the case these devices are struck by errant vehicles, the devices themselves must be less hazardous than the hazards they mark. **Delineation devices do not include barricades, or concrete barriers.**

Since they are easily knocked down, displaced or blown over, some devices need extra weight to keep them in place. Sand bags may be used, but solid materials such as rock, concrete, etc., shall not be used for this purpose. Extra weights shall be placed at the base of devices to provide maximum stability and to avoid the weights becoming projectiles in the event of a collision. Extra weights should be placed in a way that does not reduce the effectiveness of the devices.

5.1.1 Traffic Cones (TC-61)

Traffic cones are lightweight, flexible delineation devices. They are used primarily for daylight operations, but may be used at night if equipped with reflectorized bands as illustrated. Traffic cones shall not be used for durations exceeding 24 hours. For durations exceeding 24 hours, delineator posts shall be used. Please refer to the next page for delineator posts.



Traffic Cones (TC-61)

Type 1 cones are the most commonly used cone in traffic control. They are used to delineate work areas and specific hazards in or adjacent to the travel path.

Type 2 cones may be substituted for type 1 cones in any application where the additional height would be advantageous, provided stability of the higher cones is reasonably assured.

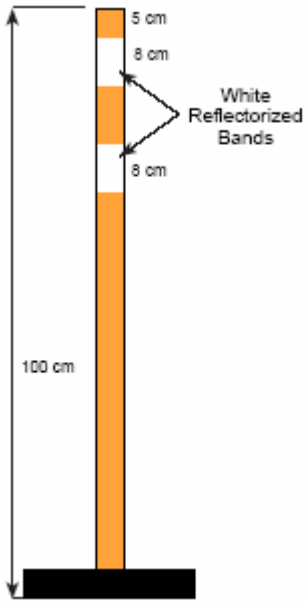
To increase cone stability, rubber or sand collars or specially designed weighted bases may be used. Excluding tubular markers, which are considered separately, cones are separated by size and usage.

As traffic cones cause little or no damage when hit, motorists tend not to respect them as much as other delineation devices. Consequently, even weighted cones will need to be checked more often for correct traffic control.

5.1.2 Delineator Posts

Delineator posts are similar to cones in that they are lightweight and easy to place and remove. They may be set in special weighted bases or fastened directly to the pavement. Due to their increased height and narrow width, delineator posts are particularly suited to delineating traffic lanes or separating two-way traffic for short duration. Because these devices are highly portable, they must also be inspected regularly to ensure they have not been knocked down, blown over, or unlawfully removed.

Delineator posts shall be a min. of 100 cm. in height. They are primarily daytime devices, but may be used at night if equipped with reflective bands as illustrated.



Delineator posts may replace Type1 or Type2 cones, provided stability of the delineator posts are reasonably assured.

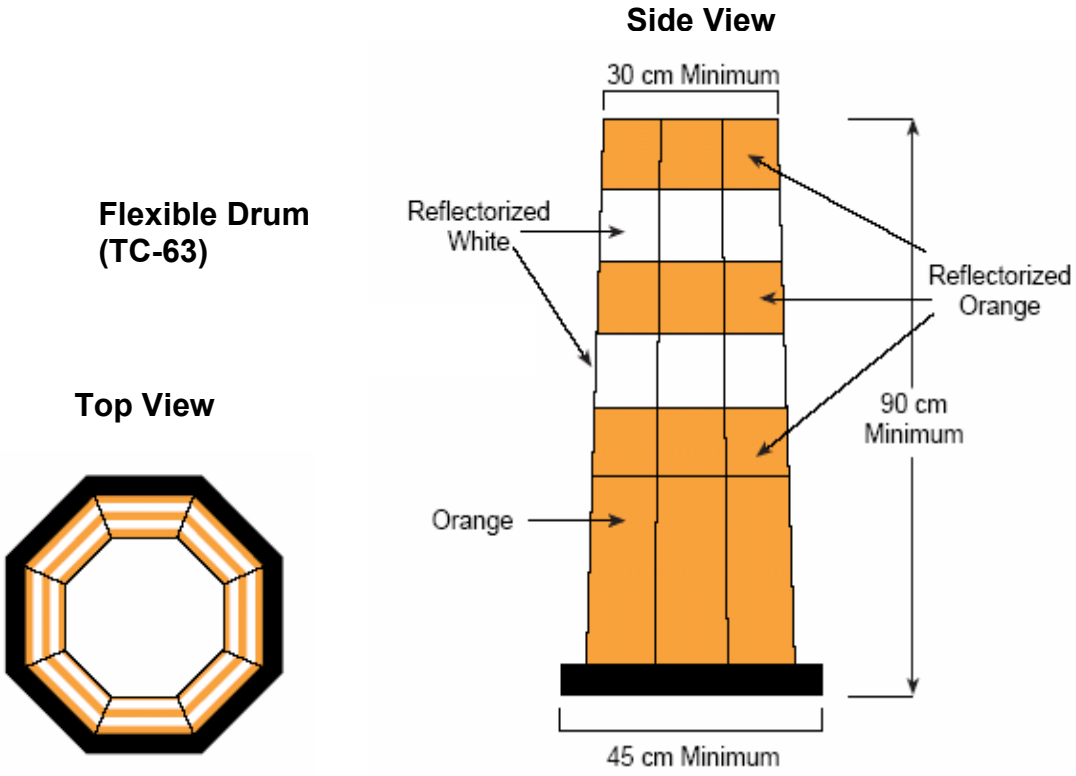
Larger or higher versions of the delineator posts may always be used in place of smaller ones provided the oversized applications are consistent with the specifications of this manual.

5.1.3 Flexible Drums (TC-63)

Flexible drums are also used as delineation devices. They are highly visible, and because they appear to be solid, they command the respect of motorists.

As shown on the next page, flexible drums are predominately orange. They are generally a minimum of 90 cm. in height, a minimum of 45 cm. in diameter at the base and a minimum of 30 cm. at the top.

For nighttime use, flexible drums are reflectorized by application of alternating horizontal orange and white bands. There shall be a minimum of two white and three orange bands, each a minimum of 10 cm. in width, spread between the top and bottom of the device.



The tapered design of the drums allows them to be stacked for easier transportation and storage. Many of the commercially available models have one or more flat sides to avoid rolling. If extra weights in the form of sand bags are required, they should be added at the base of the drums. **Always remember, the devices themselves must be less hazardous than the hazards they mark.**

5.2 BARRICADES (TC-64A, TC-64B, and TC-64C)

Barricades are highly visible, relatively frangible warning devices, which are used to mark areas into which most public traffic is not intended to proceed. They may be used to close streets at, or in advance of, the activity area. They may also be used to close individual lanes or shoulders at, or in advance of, the activity area. Care must be taken to ensure that barricades are not located within the buffer space of an activity area.

Markings for barricade panels shall adhere to all specifications of sign reflectivity as defined in Clause 4.4 of this manual. **No barricade rail face shall bear any commercial or company name. This information, including emergency contact information (i.e. phone numbers) shall be prominently displayed on the reverse side of all barricades.**

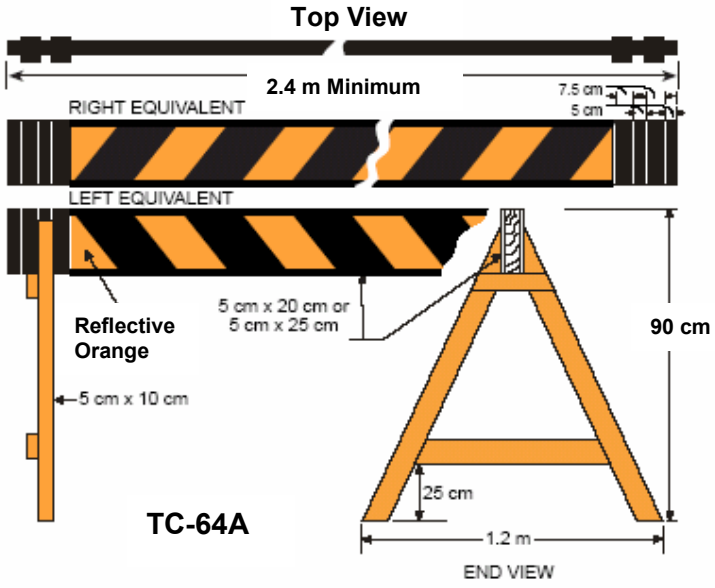
When barricades are used to close a street, they should be placed so there is no gap large enough for a vehicle to pass through, except when it is necessary to provide access for local traffic or emergency vehicles. Barricades act as a physical barrier between the road user and the activity area or the obstruction. They shall be placed at angles of approximately 90˚ to the direction of travel to present the largest possible target area to the motorist.

A single barricade is not enough to close a street, and more importantly, the barricade should not replace a sign, light, delineator, or traffic control person. **Barricades shall not be used as delineation devices in any circumstance.** When light barricades require to be stabilized due to weather conditions, sandbags may be placed on the lower portion of the frame. Under no circumstances shall a sandbag be placed over the rail of the barricade.

Typically, barricades are separated into two classes, light barricades and heavy barricades. Refer to the following sections for a brief description and an illustration of each class.

5.2.1 Light Barricades (TC-64A)

Light barricades may be used to provide the closure of a street, lane or shoulder for a short period of time. This type is particularly convenient for folding, stacking and transporting from one site to the next. Refer to the illustration below for an example of a light barricade.



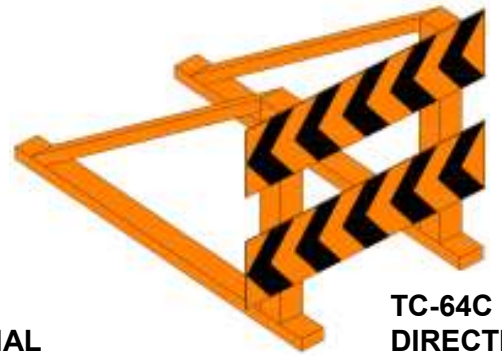
This type of barricade is not used to indicate direction. Light barricades shall comply with the minimum dimensions indicated in the Manual of Uniform Traffic Control Devices for Canada. They shall be a minimum of 2.4 metres in length and a minimum of 900 mm in height.

5.2.2 Heavy Barricades (TC-64B, TC-64C)

Heavy barricades are used to provide a complete closure of a street, lane or shoulder. The supports may consist of posts set in the ground or posts set on weighted bases. This type of barricade is less mobile in nature and shall be used in the larger construction projects where they are required to function in one location for an extended period of time.

Where no direction in travel is required to be indicated, the TC-64B barricade shall be used. Refer to the illustration for an example of a heavy barricade. It shall have a minimum of two rails with alternating orange and black vertical stripes. All stripes shall be 220 mm in width.

TC-64B
NON-DIRECTIONAL



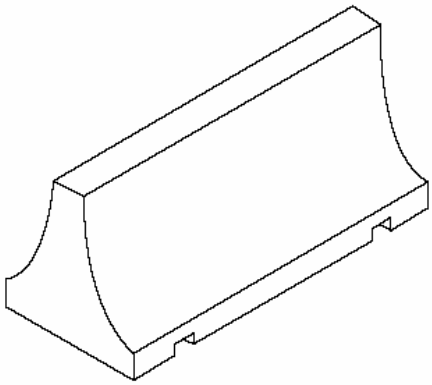
TC-64C
DIRECTIONAL

Where direction in travel is required to be indicated to motorists, the TC-64C barricade shall be used. It shall have a minimum of two rails with alternating orange and black stripes in a chevron pattern. All chevron stripes shall be 220 mm in width.

Heavy barricades shall comply with the minimum dimensions indicated in the Manual of Uniform Traffic Control Devices for Canada. They shall be a minimum of 2.4 metres in length and a minimum of 2 metres in height. Heavy barricades used to close narrow shoulders or lanes may have a reduced length.

5.3 CONCRETE BARRIERS

The term "barrier" and "barricade" are often confused. Barricades as previously discussed, are relatively frangible devices, normally placed at or near right angles to approaching traffic, which provide visual identification of hazardous locations or delineate travel paths and are relatively forgiving of errant vehicles. On the other hand, barriers are normally placed parallel or near parallel to approaching traffic. They are solid, continuous installations designed to deflect errant vehicles, at a small angle, that might otherwise enter a closed or hazardous area.



Individual, unconnected sections of barrier are generally not used due to the number of exposed ends and gaps through which vehicles could pass. Unlike barricades, barriers are not normally installed at or near right-angles in higher speed zones where they could be severely impacted by errant vehicles.

Where required, concrete barriers are most commonly used in long duration (but still temporary) work zones to:

- Protect workers;
- Separate motorists from potentially hazardous objects and areas in work zones;
- Separate opposing lanes of traffic where barricades or other delineation devices are not considered adequate.

If the exposed approach end of a barrier cannot be flared away from the intended travel path, it shall be protected with attenuation (crash cushion) devices. Connections to any existing barriers or guardrails should be smooth and shall not create weak points.

5.4 IMPACT ATTENUATORS

Impact attenuators (also known as crash cushions) are used to prevent an errant vehicle from impacting a fixed object by controlled deceleration. Impact attenuators in temporary traffic control zones protect the motorists from the exposed ends of barriers, fixed objects, and other hazards. For temporary traffic control there are typically two types of attenuators commonly used, stationary, and truck mounted (or mobile).

Stationary attenuators are recommended for long-term situations; while truck mounted attenuators (TMA's) are preferable for short term or mobile operations. Truck mounted attenuators are mounted on the rear of a truck and deforms on impact in a controlled manner

5.5 VARIABLE MESSAGE BOARDS

Variable message boards are used to relay information to motorists for upcoming or existing road construction. Typically these are used where road construction is expected to cause delays on high volume streets. They are used to advise motorists to expect delays or use alternative routes where possible. Variable message boards are more effective than static signs in capturing the attention of the road users. Variable message boards should be programmed so the motorists are able to read the message twice given the posted speed and shall be legible from all lanes at a minimum of 200 metres.

When placing variable message boards, the reflection of the sun shall be taken into account to ensure the message is legible and clearly visible to all road users. They shall always be placed on the same side of the street when two are used and spaced a minimum of 300 metres apart. When variable message boards are not in use, they shall be removed immediately.

5.6 FLASHING ARROW BOARDS

Flashing arrow boards (FABs) are traffic devices which can provide an illuminated flashing display of a left arrow, a right arrow or a bar which informs motorists either to change lanes or to proceed with caution. By providing a highly visible display, flashing arrow boards also provide site identification for the work zone. They are very effective when installed to perform these functions and are very effective both day and night. They may replace other devices when the visibility is clear and the work operation is of a short duration.

The minimum recommended sizes for arrow panels are given in the following table. For utilities and most City streets, a smaller version, 600 mm x 750 mm, is permitted.

Type	Minimum Dimensions	Speed Limit
A	900 mm x 450 mm	≤ 50 km/h
B	1200 mm x 600 mm	≤ 60 km/h
C	1500 mm x 750 mm	≥ 70 km/h

Where the speed limit is higher than 50 km/h, Type A may be used on larger utility vehicles where Type B or C cannot be physically accommodated, provided that the intention is for short duration work.

With smaller FABs special consideration shall be given to the light intensity and mounting height to ensure the FAB sign is conspicuous to approaching motorists and that the arrow shape is retained. This is especially important for lane closures, where the intended direction of travel is critical for the motorists.

The main purpose of FABs is to direct traffic from a closed lane to another available lane, using appropriate arrow indications. In this mode, they can be used for static or moving operations. An arrow board may also be used without directional indication, operating in a bar mode when a lane change is not necessary. This operation provides a highly visible warning display that work is in progress.

Arrow boards may be mounted on trucks, trailers, or other suitable supports for both stationary and moving operations.

As large arrow boards may be seen from 1 km. away, they are very effective in high volume or high speed areas, and for moving operations either on work or shadow vehicles. For night use, arrow boards should be equipped with both an automatic and manual dimming device, capable of 50 percent dimming. FABs that are used at night shall be checked to ensure the devices are properly dimmed.

Under low light level conditions, the sign shall automatically adjust to 50% dimming so as to meet the legibility requirements and not impair motorists vision.

It is recommended that FABs be displayed a minimum of 1.5 metres above the street surface.

There are two kinds of FABs; flashing and sequencing. Both kinds have the following basic operating modes:

- **Flashing Arrow:** is recommended for full closures with the option of directing traffic in any direction.

- **Sequential Flashing Arrow:** is recommended for full closures where a change of direction is required and/or a specific direction is desired.

- **Sequential Flashing Chevron:** is recommended for partial closures or restrictions where traffic is required to change lanes, but not direction of travel.

- **Caution:** is recommended for closures of the curb lane where work may intermittently present a hazard to motorists in adjacent driving lanes.

The flashing or sequencing arrow modes shall not be used under the following conditions:

- When the location of the work does not require any lanes to be closed.
- When all of the work is on or outside the shoulder and there is no interference which requires the adjacent traveled lane to be closed.
- When a traffic control person is controlling traffic on a normally two-lane, two-way road.

Use of the arrow modes in the previous conditions will lead to the loss of credibility when the arrow mode is correctly used for lane closures or moving operations on multilane streets.

The colour presented by the flashing bulb elements shall be yellow. The minimum element "on time" is 50% for the flashing mode. The flashing rate shall be between 25 and 40 flashes per minute.

5.7 SHADOW VEHICLES

Shadow vehicles may be required as mobile advance warning devices for continuously slow moving operations where a work vehicle blocks or encroaches into a traveled lane and that lane has not been closed to traffic. Such operations include pavement marking, sweeping, flushing, pavement milling and possibly mowing.

Factors involved in determining the need for a shadow vehicle include the exposure of workers to traffic, the speed of traffic relative to the speed of the work vehicle, traffic volumes, the type of street/or road, shoulder width alignment, sight distance and weather conditions.

A Shadow Vehicle or a Traffic Control Person shall be required at all times on streets with a minimum speed limit of 60 km/h, if a work vehicle may block or encroach into a traveled lane.

Unlike buffer vehicles, shadow vehicles are not used to block traveled lanes. As far as possible, they should be positioned on the shoulder and upstream of the work vehicle (or any vehicles held up behind the work vehicle). For horizontal and vertical curves, the advance distance should be adjusted accordingly so that the shadow vehicle is clearly visible to traffic approaching the curves.

Shadow vehicles shall be equipped with an appropriate rear facing sign (for example, SLOW VEHICLE AHEAD), and either a flashing arrow board (FAB) or a 360˚ flashing yellow light and 4-way flashers. If a FAB is used on a two-lane two-way roadway, it shall only show a non-directional warning display. **A FAB shall never display an arrow directing traffic into a lane which could be occupied by opposing traffic.**

The operators of the shadow vehicle and work vehicle shall be in radio contact.

5.8 BUFFER VEHICLES

Buffer vehicles are used when necessary to protect workers from errant vehicles in a closed off activity work area. A buffer vehicle may be parked in the work area and upstream of the workers.

Buffer vehicles shall be equipped with either a Flashing Arrow Board, or a 360˚ flashing yellow light and 4-way flashers. They may also be equipped with portable rear-mounted crash attenuators to reduce the effect of a collision.

5.9 PAVEMENT MARKINGS

Under certain circumstances, the use of pavement striping and raised pavement markers may be justified to supplement devices for delineation. On major construction projects where traffic is diverted for extended periods, pavement striping or markers shall be required to delineate traffic and minimize confusion.

Whenever temporary conditions pavement markings are applied to a surface, any conflicting pavement markings shall be removed to prevent confusion. The method used to remove the pavement markings shall be such that all permanent markings are effectively removed and produce no evidence of appearance under all driving conditions. Some pavement surfaces permanent markings which have been effectively removed for dry daylight conditions may under wet conditions still appear to be in place. If this condition is anticipated, or found to exist, use of raised pavement markers or special delineation shall be required.

Raised plastic devices such as reflective "L" shaped flexible reflectorized markers may be used to supplement or used in place of temporary pavement markings. Where used, raised markers shall be installed frequently enough so that a minimum of four individual markers are visible from any given point. In most circumstances, these devices are more effective than temporary marking tape and are highly visible in most adverse weather conditions.

Temporary pavement markings and raised markings shall be reflectorized and display the same colour by day as by night. They shall also be the same colour as the permanent markings which they replace.

Typical applications include two-way traffic situations on busy arterial streets where proper delineation is essential. All pavement markings shall be approved by the City of Brandon Engineering Department. All newly paved surfaces shall be completely marked or pre-marked before being opened to traffic.

5.10 METAL PLATES

Pavement cuts on arterial streets shall, whenever possible, be plated to accommodate rush hour traffic or when work is discontinued for the day. They are useful to accommodate traffic while concrete cures and surface repairs cannot be done immediately.

Metal plates shall be used to avoid closing a street or too many traffic lanes of a street and be sufficient strength to support traffic. Plating shall be provided to maintain street access to businesses when required.

Temporary bump signs shall be used for traffic in each direction. All metal plates shall be adequately pinned to the road surface to prevent plate movement.

TEMPORARY TRAFFIC CONTROL MANUAL

PART VI

STANDARD DRAWINGS