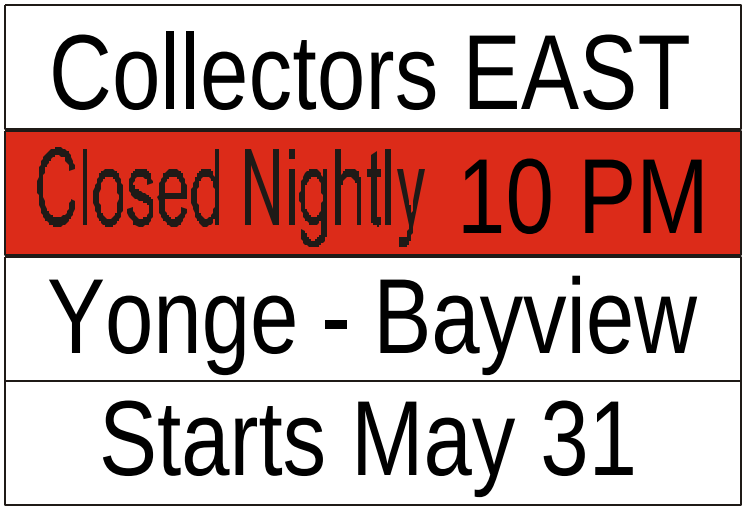
Temporary Conditions Traffic Management:

Advance Notification, Advance Warning, and Alternative Route Signing



For use on Provincial Highways and other roadways in MTO's Central Region

Ontario Ministry of Transportation
Central Region Traffic Office

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Temporary Conditions Traffic Management: Advance Notification, Advance Warning and Alternative Route Signing for Provincial Highways

Foreword

The purpose of this Manual is to provide information and guidance for transportation practitioners and others, and to promote uniformity of treatment in the design, selection, application and operation of temporary conditions traffic management systems on provincial highways within the Ministry of Transportation's Central Region. It is intended both as a statement of policy and intent, and as a working reference. It contains the following:

- guiding principles;
- overarching policy;
- standards;
- general and specific direction;
- guidance in the selection of best practices;
- guidance in the application of sound judgement; and
- worked examples.

The information provided will be of interest to anyone with responsibility for the planning, design, installation, management, supervision or enforcement of work zone traffic management and control measures.

The primary aim of the Manual is to promote the safe and efficient conduct of road users through work zones, by the provision of adequate and explicit forewarning of conditions that will be encountered, and through the clear delineation of alternative routings to avoid those conditions, where appropriate.

The Manual is not a comprehensive reference on the subject of temporary conditions traffic control. It is to be read in conjunction with the *Ontario Manual of Uniform Traffic Control Devices*, in particular Part A, Division 5, Temporary Conditions, until such time as that reference is superceded. A superceding reference, the *Ontario Traffic Manual*, in particular Book 7 entitled *Temporary Conditions*, is in development. When it becomes available, this Manual is to be read in conjunction with that reference.

The interpretations, recommendations and guidelines in this Manual are intended to provide an understanding of temporary conditions traffic operations. They cover a broad range of traffic situations encountered in practice. They are based on many factors that may determine the specific design and operational effectiveness of traffic control systems. They are necessarily general because they cannot cover all on-site conditions and ambiguities. No manual can cover all contingencies or all cases encountered in the field. Therefore, field experience and knowledge of application are essential in deciding what to do in the absence of specific direction from the Manual itself and in over-riding any of the recommendations of this Manual.

The traffic practitioner's fundamental responsibility is to exercise professional engineering judgement on technical matters in the best interests of the public. These matters include safety, efficiency, environmental sustainability and cost-effectiveness. Standards are

available to assist in making those judgements but should not be used as a substitute for judgement.

The Manual reflects current, best practices in the provision of temporary conditions traffic management signing in Ontario. Its fundamental approach is both human-centered and systems oriented.

The Manual strives to consider and accommodate the physical and mental capabilities and limitations of drivers in its design, installation and operational guidance. It considers the driver, the vehicle and the roadway environment as principle elements in a single, complex and interactive system. The driver is recognized as the dynamic, controlling influence within that system. In understanding and applying the guidance contained in the Manual to achieve a desired result, the reader is encouraged to consider how drivers perceive, interpret and interact with the roadway environment, and to take into consideration the motivations, mindset and expectations created by that environment, along with those ingrained through experience.

In some designs or operational features, the practitioner's judgement is to meet or exceed a standard. In others, a standard might not be met for sound reasons such as cost-effectiveness or environmental protection, yet still produce a design that may be judged to be adequate to the prevailing conditions. In such situations, every effort should be made to stay as close to the guidelines provided as possible, and to thoroughly document the rationale for such departures.

While objectives such as efficiency can be quantified in absolute terms, via measures such as traffic through-put and volume-to-capacity ratios, safety is a relative measure. By the very nature of the activities that occur on and around a highway, no highway, whether it is the subject of temporary conditions activities or not, can be made completely safe. The operation of a completely safe highway implies that no collisions have occurred, or are ever going to occur, on that facility. This expectation is unrealistic. Safety can be improved in most circumstances, but improvement may come only through the expenditure of resources, or at the expense of efficiency or of the environment. These constraints and competing objectives must be balanced to assure an optimized solution - that a particular circumstance is *as safe as is possible* under the prevailing conditions and constraints.

This Manual is not intended as a tool to measure engineering quality and is not suitable for that purpose. Engineering quality assessments are best made by practitioners with experience in that field of engineering, and with the benefit of knowledge of the circumstances and the basis of decisions.

Although this Manual is intended primarily as a practical guide to traffic practitioners, users should be aware that it may be used as a benchmark reference by the courts in their determination of whether reasonable efforts have been made to provide safe road transportation.

Because of the essential need to apply design, operational standards and procedures with judicious care and proper consideration of prevailing circumstances, this Manual is not suitable for adoption as a code in a regulatory sense.

Custodial Office

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Map Graphics

Map graphics are excerpted solely for the purposes of illustrating temporary conditions traffic control concepts and applications. This does not constitute a use of proprietary map graphics for the purposes of wayfinding in a document intended for resale.

Obtaining Copies

Inquiries regarding the purchase and distribution of the Manual may be directed

CHAPTER 1

INTRODUCTION TO THE MANUAL

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1.1 Introduction

One of the greatest operational challenges for road authorities and contractors is keeping an existing, busy highway corridor open to traffic during maintenance, rehabilitation, reconstruction or expansion activities.

- New and unexpected situations are created for local drivers and commuters.
- Non-local drivers must overcome both the challenges of navigating an unfamiliar route, and the additional trials imposed by the work zone.
- The need to service traffic impedes the staging of construction, the movement of materials, and overall operations.
- Portions of the highway must be taken out of service, leaving less usable space for traffic.
- Traffic must be separated from the work zone, protected from hazards, and guided through the zone.
- By necessity, new hazards are introduced and distractions are created within the corridor.
- Workers are placed in close proximity to open traffic lanes, and work vehicles are forced to intermix with general traffic.

The issues and concerns associated with normal highway operations, including congestion, speed, incidents, enforcement opportunities, driver inattentiveness, frustration and aggression are magnified, along with the associated risks.

Faced with the competing objectives of safety, mobility, environmental sensitivity and cost-effectiveness, road authorities must strive to find an acceptable balance between risk, delay, impacts on the environment and project costs.

Most recently, the application of human factors knowledge and positive guidance technique to work zone safety and efficiency issues has highlighted the substantial benefits of providing adequate advance warning and directional guidance to drivers approaching work zones.

Advance notification of planned work operations raises the awareness of recurring road users, allowing them to adjust their travel schedules or to seek alternative routes in anticipation of future delays. Forewarning upstream of a work zone raises the awareness of the non-local driver and allows drivers with local knowledge and commuters to select alternative routes to by-pass the resulting congestion. Where alternative routes are available, comprehensive alternative route signing allows drivers on the route to bypass the work zone, and diverts drivers that might otherwise have chosen to travel the affected route.

On Ontario's provincial highway network, an enhanced, adaptive system of temporary conditions advance warning, encompassing advance notification, advance warning and alternative route signing, is normally employed in conjunction with large, long-duration or otherwise intrusive projects. Under this scheme, the provision of temporary conditions advance warning has grown from simple "Construction Ahead" signing to a complex system of static and dynamic message signing on the affected

roadway, and on intersecting roads and parallel routes.

What has also been evolving over time, are comprehensive, uniform operational guidelines, and criteria for use.

Experience has shown that commuter routes benefit substantially from advance notification. Similarly, drivers exposed to credible, legible and timely advance warning information arrive at the work zone with expectations more consistent with the prevailing conditions. They are less likely to be surprised by what they encounter, and are more likely to negotiate the zone in an appropriate, error-free fashion. Even when delayed or detoured, drivers who have received adequate advance warning of prevailing conditions, and have been provided an opportunity to divert to another route, are thought less likely to become frustrated, aggressive or careless in their conduct.

1.2 Purpose of the Manual

This Manual is intended to provide information and guidance on uniform requirements for the provision of temporary conditions advance notification, advance warning and alternative route signing on provincial highways, intersecting roadways and parallel routes within the Ontario Ministry of Transportation's Central Region. It has been written to consolidate the assembled guiding principles, applicable policies, criteria for use, uniform standards, best practices guidance and worked examples associated with their provision into a single, easily-accessed reference.

The Manual must be used by all entities and persons responsible for the planning, design, approval, fabrication, installation, inspection, maintenance and revision of temporary conditions advance warning and alternative route signing within Central Region. This is contemplated to include MTO personnel, planning and design consultants, officials representing municipal road authorities, sign fabricators, traffic control and sign installation contractors, staff responsible for construction and maintenance supervision and inspection, sign maintenance staff, and others.

1.3 Scope of the Manual:

This Manual contains guiding principles, overarching policy, standards, general and specific direction, best practices guidance, guidance in the application of sound judgement, and worked examples, relating to the provision of temporary conditions traffic management signing. Although the principles, policies, standards, guidelines and practices contained within are generally applicable to all temporary conditions where advance warning, advance notification and alternative route signing are required, this Manual has been specifically developed for use as follows:

- within the Ministry of Transportation's Central Region;
- on provincial highways, intersecting roadways and parallel routes; and
- within the advance warning area of work zones deemed to require temporary conditions advance notification, advance warning and alternative route signing.

The Manual is not a standalone reference on the subject of temporary conditions traffic control and devices. It is limited in scope to discussions of the provision of advance notification, advance warning and alternative route signing within what is known as the advance warning area of the work zone.

The contents of the Manual are supplementary to, and are to be read in conjunction with, the following references:

- The Ontario Manual of Uniform Traffic Control Devices (until superceded by the Ontario Traffic Manual);
- The Traffic Control Manual for Roadway Work Operations;
- The Ontario Traffic Manual (when available);
- The King's Highway Guide Signing Policy Manual (MTO);
- The Sign Support Manual (MTO); and
- The Roadside Safety Manual (MTO).

1.4 Manual Organization

The Manual is organized into six Chapters, each of which is divided into multiple Sections. Tables and Figures are referenced individually.

Chapter 1 introduces the scope and purpose of the Manual. It describes how the manual is organized, provides definitions relating to application guidance and roadway classification, sets out policy on bilingual signing and provides guidance in the use of the Manual.

Chapter 2 provides an overview of Temporary Conditions Traffic Control and introduces the concept of Temporary Conditions Traffic Management, defining the scope, goals and objectives of each. Three key traffic management strategies, relating to the management of driver expectations and traffic demand, are introduced. They are:

- Advance Notification;
- Advance Warning; and
- Alternative Routing.

Methods of quantifying the impact of temporary conditions work zones on traffic operations are explored, through an examination of the navigational and critical capacity restrictions that are imposed.

To be effective, traffic management strategies must impart information to drivers and, in most cases, elicit some form of desired behaviour. Within this Chapter, relationships between traffic management objectives, driver information needs and the behaviour desired of drivers are related in a cause-and-effect manner.

Finally the human factors considerations around the driving task are briefly explored, along with their implications on the implementation for temporary conditions traffic management strategies in the field.

Chapter 3 addresses the general aspects of advance notification, advance warning and alternative route signing. It sets out definitive criteria for the use of these strategies. The physical elements required to enact these strategies are defined, as are their

necessary attributes. This relates primarily to the temporary signing installed, and amendments to the existing, permanent information presentations within the corridor.

The information content and organization of individual signs is outlined, being careful to remain true to the human factors considerations identified in Chapter 2. A standard lexicon of terms, with French equivalents, is provided. All of the significant aspects of the design and fabrication of the signs are specified. Guidance in the selection and design of sign supports is provided. Direction regarding the installation of signs in the field, and the periodic updating of their messages to match changing conditions – a key aspect in the credibility and effectiveness of all three of the traffic management strategies – is discussed. Standards for the maintenance of signs, and guidance in determining when they should be removed, are addressed.

A section on bilingualism issues provides specific guidance where traffic management strategies must be implemented in English and French.

Guidance in the amendment of existing, permanent guide and information signing, to reflect reality under temporary conditions, is also provided.

Finally, integrating the static signing for temporary conditions traffic management, and the amended guide and information signing, with messages displayed on permanent Variable Message Signs (VMS) - (i.e. COMPASS), and on Portable Variable Message Signs (PVMS) is discussed.

Chapter 4 provides application guidance in implementing traffic control strategies, in response to various types of work zones, in common circumstances. Not unlike the typical figures contained in the Traffic Control Manual for Roadway Work Operations, the narratives and layouts contained within this Chapter serve to demonstrate the principles applied, and to illustrate typical, minimum standards for treatment.

This Chapter is broken into Freeway (Complex and Simple Freeway) and Non-freeway applications, and is further partitioned based on the type of work zone being treated. For freeways, the categories include the following:

- Closure of Express Lanes;
- Closure of Collector Lanes;
- Lane Closures;
- Transfer Lane Closures;
- On-ramp Closures;
- Off-ramp Closures; and
- Narrowed Lanes and Shoulders.

The non-freeway scenarios include the following:

- Road Closures;
- Single Lane Operation – Two Lane Roads;
- Lane Closures – Multi-Lane Roads;
- Work in Intersections;
- Road Side Diversions;
- Narrowed Lanes and Shoulders; and
- Alternative Routes and Detours.

Typical approaches to amending permanent guide and information signing are discussed.

Alternative route signing is also illustrated:

- as mitigation for navigational constraints imposed by the work (i.e. Road Closures)
- as a method of diverting traffic from the affected route, and
- as a tool to "intercept" traffic destined for the affected facility and re-route it.

Chapter 5 provides worked examples, using actual field scenarios and real highway corridors. Along with the narrative provided, it illustrates the practical application of the typical standards outlined in Chapter 4.

Chapter 6 provides a discussion of the standardized documents to be inserted into a contract where the deployment of a traffic management strategy is a requirement.

Appendix A provides definitions of all uncommon terms used in the text.

Appendix B identifies referenced documents and other references used in its preparation.

A comprehensive Index is located at the back of the Manual.

1.5 Application Guidance

The standards, guidelines and criteria outlined in this manual generally provide MINIMUM TYPICAL STANDARDS for frequently occurring and recurring circumstances. It is the practitioner's fundamental responsibility to exercise professional engineering judgement on technical matters in the best interests of the public, including safety and cost-effectiveness. However, all installations must conform to the general principles presented in this manual.

The following standard terminology will provide the user of this Manual with guidance on what practices are recommended and when judgement can be applied:

Must indicates a mandatory condition. Where 'must' is used to describe the design or application of the device, it is mandatory that these conditions be met in order to promote uniformity. ("Must" replaces the expression "shall" in previous versions of the Ontario MUTCD.)

Should indicates an advisory condition. Where the word "should" is used, the action is recommended but is not mandatory. "Should" is meant to suggest good practice in most situations and to recognize that there may be valid reasons not to take the recommended action. Where such valid reasons lead to a deviation, it should be thoroughly documented.

May indicates a permissive condition. No requirement for design or application is intended. However, once a specific option is chosen, mandatory requirements might apply.

1.6 Roadway Classification

Simple Freeway

A simple freeway is defined as a fully access-controlled expressway with interchanges in place of at-grade intersections. This includes all 400

series highways, the Queen Elizabeth Way, Toll Highways and other facilities built to a freeway configuration and operating in the manner of a freeway.

- **Urban** typically includes:
  - adjacent development
  - main roadways with two or more lanes per direction;
  - high traffic volumes;
  - closely spaced interchanges;
  - roadway and interchange lighting;
  - overhead signing;
  - three or more interchanges serving a major city.

- **Rural** typically includes:
  - longer interchange spacing;
  - high speed traffic;
  - ground-mounted signing placed for maximum conspicuity.

Complex Freeway

Complex freeways are divided into an express roadway and a collector roadway for each direction of travel. They are generally found in urban areas and are similar in character to simple freeways, except that access to crossing roadways from the express roadway is limited, allowing it to function as a by-pass. Crossing roadways are accessed from the collectors via interchanges. Access to and from the express lanes is generally from the collectors, via transfer lanes.

Non-freeway

Roadways with at-grade intersections for roadways and private points of access. This includes all King's highways, Regional and Municipal roads.

- **Urban** typically includes:
  - multi-lane expressways with at-grade intersections;
  - major urban roads and streets;
  - local streets.

- **Rural** typically includes:
  - non-freeway King's Highways;
  - rural regional roads;
  - rural country roads;
  - rural local roads.

1.7 Bilingual Signing Policy

The French Language Services Act, 1986, requires bilingual signs to be installed on Provincial highways located in designated areas. For the purposes of uniformity and consistency, bilingual signs are installed along additional lengths of some Provincial highway routes.

The obligations of government agencies under the Act are subject to such limits as circumstances make reasonable and necessary. Confirmation regarding the necessity of providing bilingual temporary conditions signing should be sought during the planning stages of all projects.

This Manual provides guidance in the provision of bilingual temporary conditions traffic management signing as it relates to advance notification, advance warning, alternative route information and the amendment of existing, permanent signing. In general, the text-based nature and format of this signing requires that all English signing be duplicated, separately and in its entirety, in French. Refer to Chapter 3, Section 4 for a lexicon of French translations of English terminology used throughout the Manual. Guidance in locating bilingual signing can be found in Chapter 3, Section 11.

Provincial highways identified as requiring bilingual signing are listed in Chapter 3, Section 11.

Information is available through the Traffic Office on bilingual sign patterns for standard signs not detailed in this Manual.

1.8 Policy Regarding Use

This Manual must be consulted during preparations for all construction and maintenance activities, intended to occur on provincial highways within Central Region, that may impact normal traffic operations. Included are any activities that encroach onto or over a traffic lane or shoulder of a roadway, transfer lane or ramp.

The expected location, extent, duration, and influence on traffic operations of the activity is to be assessed in accordance with the criteria for use contained in this Manual.

Where the criteria for use for the provision of temporary conditions traffic management signing are met, the requirements of the Manual must be integrated into the planning process and satisfied as an integral part of the overall accomplishment of the activity.

Where multiple activities warranting signing will occur within a corridor, and an overlap in time and/or in location is anticipated, coordination must occur between those entities and individuals responsible for the work, to ensure that clear and explicit information is provided to drivers at all times.

CHAPTER 2

INTRODUCTION TO TEMPORARY CONDITIONS TRAFFIC CONTROL AND TRAFFIC MANAGEMENT

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2.1 Temporary Conditions Traffic Control

Within any highway work zone where the roadway remains open to traffic, two incompatible activities are taking place at the same time. Workers are exposed to traffic while trying to maintain or improve the roadway, and drivers are exposed to unexpected situations, distractions and hazards while trying to reach their destination. The only way this can occur in relative safety is if order is maintained, and the two activities remain physically separated. The element that provides this physical separation is temporary conditions traffic control.

The twin goals of temporary conditions traffic control are usually at odds. They are:

- to facilitate the conduct of the work; and
- to maintain the flow of traffic.

Often however, achievement in one area can only occur at the expense of the other. An expansive work zone covering several traffic lanes facilitates the staging and the conduct of the work but impedes traffic flow. A constrained work zone, and complex staging of the work, maintains traffic flow, but impedes project progress. Balancing the needs of each, while maximizing safety and optimizing efficiency, is the objective of work zone traffic control.

Work zone traffic control is first and foremost about informing and guiding drivers through work zones. Understanding the information and guidance needs of drivers, along with their capabilities and limitations, allows us to do this more effectively. The study of such aspects human performance is known as ergonomics or human factors, and is discussed in more detail later in this Chapter.

The functional design of work zones has evolved over time, in keeping with our understanding of the needs of drivers. Specific information on the provision of work zone traffic control is beyond the scope of this manual, and is contained in the Ontario Manual of Uniform Traffic Control Devices, the Traffic Control Manual for Roadway Work Operations, and soon-to-be-released Ontario Traffic Manual – Book 7.

To place the role of advance notification, advance warning and alternative route signing in context however, it is necessary to discuss the layout of a typical work zone, the function of each of its component areas, and the limitations of the information and guidance provided.

Work zones typically consist of six major components. They are:

1. The Advance Warning Area, that informs drivers to expect work ahead;
2. The Approach Area, indicating what actions the driver is to take;
3. The Transition Area, where traffic is moved out of its normal path;
4. The Activity Area, which includes the following:
   - a Longitudinal Buffer Area and a Lateral Buffer to separate traffic and workers;
   - the Work Space, which is set aside exclusively for workers, equipment and material storage; and
5. the Traffic Space, which allows traffic to pass through the activity area; and finally
6. The Termination Area, which lets traffic resume normal driving.

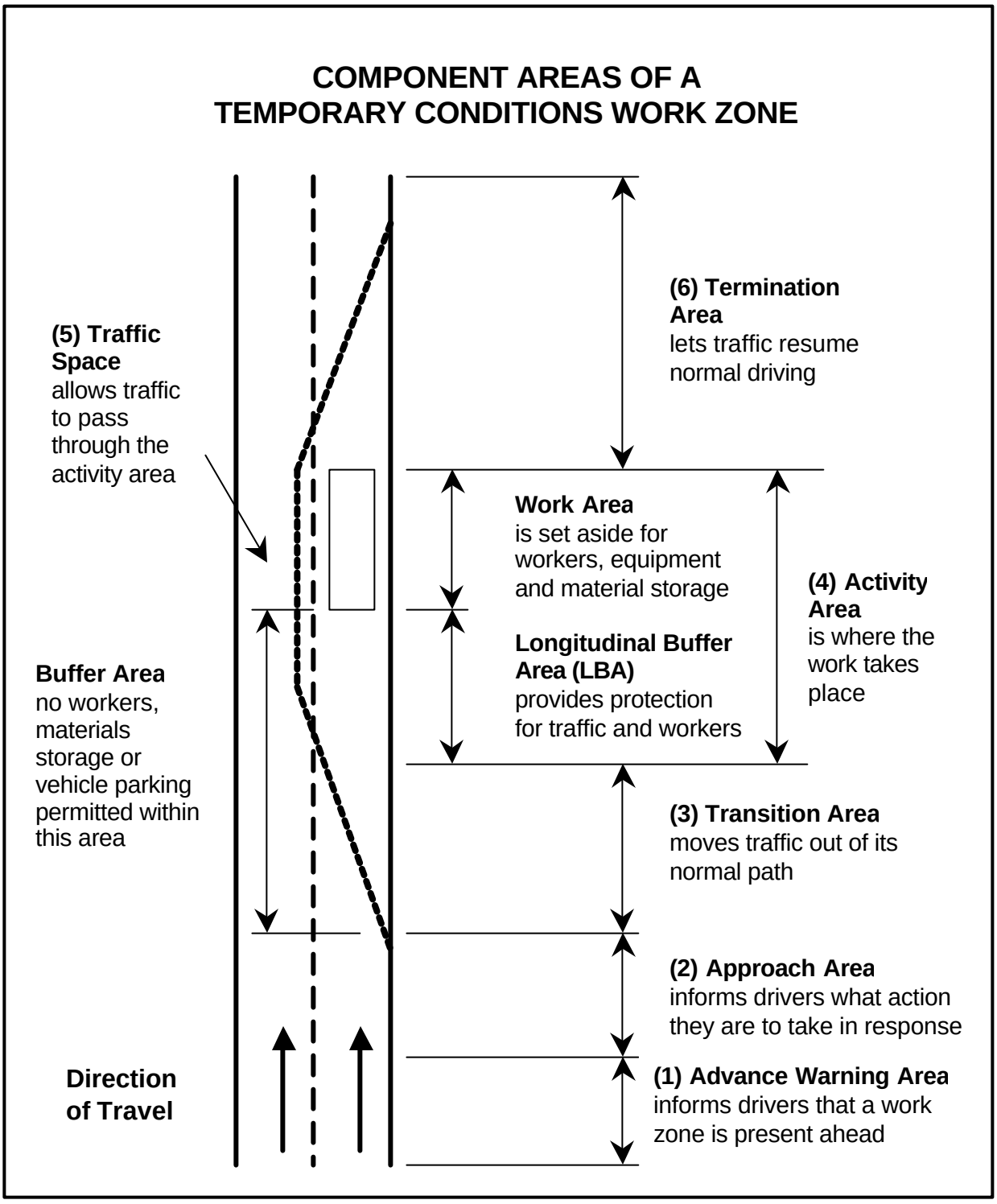
COMPONENT AREAS OF A
TEMPORARY CONDITIONS WORK ZONE
(6) Termination Area
lets traffic resume normal driving
(5) Traffic Space
allows traffic to pass through the activity area
Work Area
is set aside for workers, equipment and material storage
(4) Activity Area
is where the work takes place
Longitudinal Buffer Area (LBA)
provides protection for traffic and workers
Buffer Area
no workers, materials storage or vehicle parking permitted within this area
(3) Transition Area
moves traffic out of its normal path
(2) Approach Area
informs drivers what action they are to take in response
(1) Advance Warning Area
informs drivers that a work zone is present ahead
Direction of Travel

FIGURE 2.1

These five areas provide the information and guidance necessary in all work zones. In certain cases, two or more areas may overlap, or their functions may be combined into a single device or group of devices.

2.2 Temporary Conditions Traffic Management

In most cases, sufficient information and guidance is provided to drivers by devices contained within the component areas of a work zone, and safe and efficient operations result. In more demanding circumstances however, even the best traffic control plans can break down due to excessive traffic demand, compounded by the mobility expectations of drivers. Within the busy highway corridors of Southern Ontario, this can occur despite accommodations in the planning and scheduling of work. Such accommodations include confining the planned work to daytime off-peak periods, limiting lane closures, and working exclusively at night or on weekends.

Temporary conditions traffic control is essentially a reactive response to the needs of the work zone. The existing traffic volumes are accepted, and attempts are made to accommodate prevailing conditions. Where *traffic control* has proven insufficient in the past, proactive approaches, collectively termed within this Manual as *traffic management,* have been employed with success.

Traffic management takes a broader view of the problems of work zone safety and efficiency. Rather than simply attempting to control the situation, at the site and in the present, traffic management uses communications tools and demand management strategies to manage the expectations of drivers regarding their mobility, and the pressures placed on the traffic controls within the work zone.

The signing strategies that support traffic management objectives are intended to supplement other communication strategies employed by the ministry, which include toll-free telephone information services, advertisements in the print media, brochures, and radio spots.

2.3 Managing Driver Expectations and Traffic Demand

The pressing need to accomplish rehabilitation and expansion projects has made construction a year-round preoccupation on highways in Central Region. With more and more roadways operating at or above their intended capacity, the limitations of traffic control, and the need for traffic management, is becoming evermore acute.

Traffic management seeks to manage the following:

- driver expectations regarding mobility; and
- traffic demand through the work zone.

Managing Driver Mobility Expectations:

Drivers in Southern Ontario have come to expect a high degree of mobility. The time pressures of modern life dictate that, recurring congestion aside, drivers do not generally make provisions for delays in their travel planning. This accepts an element of risk, that a traffic incident or weather conditions may delay them, for example, but on the whole, drivers expect the highways to be open, and traffic to move.

This expectation comes into conflict with reality when traditional methods of traffic control are applied in busy corridors.

Temporary conditions traffic control devices are generally installed only once work is set to begin. Typically, drivers are provided with little or no forewarning that an activity is planned – it just appears on the roadway. Similarly, drivers approaching the Advance Warning Area of the work zone are often already committed to pass through it, having passed their last opportunity to exit before encountering any temporary conditions signing. This induces uncertainty, frustration, anger, and in some cases aggression in drivers.

"Why couldn't they tell me the road was going to be under construction – I would have left earlier / taken another route."

"500 metres sooner and I could have gotten off the highway – now its six kilometres to the next exit and traffic is stopped. I'm going to be late."

"There is the exit, but if I get off here, how do I get back to the highway?"

These quotes are representative of the thoughts of driver's when they encounter an unexpected work zone. The frustration can result in angry calls to the road authority or aggressive, impolite driving, placing workers and other road users at risk.

In such circumstances, the provision of information sources above and beyond those typically located within the work zone may prove beneficial.

Providing information to drivers prior to beginning the project, including its planned location, duration (both the overall project and any recurring activities), its extent along the roadway, and an indication of the severity of the anticipated impacts on operations, allows the recurring user to make informed choices.

Notifying daily commuters that work will begin on their route in a week's time, and will close one of the three lanes of the facility between two interchanges, allows them to plan for that eventuality. They can respond by selecting an alternative route or adjusting their schedules to accommodate the anticipated delay. Even if commuters continue to drive the route throughout the duration of the activity, the advance notification has permitted them to make informed choices regarding the impacts on their lives.

Advance notification can provide similar benefits in the movement of goods. Awareness amongst goods carriers that a key border crossing or commerce route will be impacted by construction can allow time-sensitive cargo to be expedited or re-routed.

Much of the work on provincial highways in Southern Ontario involves recurring full or partial closures during off-peak periods, along with some elements of continuous activity. One lane of a facility may be closed for the duration of a project, with additional lanes being closed on a nightly basis. Even during these "off-peak" times, the impacts of these activities on traffic operations can be significant.

Often pauses will occur in these recurring events. Planned closures will be postponed or extended as plans change, work progresses, and transient conditions such as weather intervene. Providing drivers with a daily status regarding these planned

events during the conduct of the project can allow them to amend their travel plans "on the fly".

Managing expectations through the provision of information has direct benefits in improved public relations and customer satisfaction. It may also reduce frustration and aggressiveness among drivers.

Expectation management, by its nature, offers a degree of demand management as well. Recurring users will alter their travel plans to avoid peak periods where possible, or may postpone discretionary trips. Drivers with local knowledge, who must travel during peak periods, will seek alternative routes around the work zone or will avoid that portion of the facility. These behaviors can be reinforced and enhanced through additional demand management strategies such as alternative route signing.

Finally, from the driver's perspective, *what* is occurring is of less importance than *what does it mean for me.* For example: it is irrelevant whether a lane is blocked by a collision, closed for maintenance purposes, or occupied by a long duration construction project when the driver is committed and approaching that point on the route. All that matters is that the lane is unavailable to traffic, and he or she and everyone else is going to have to make do with what is still open. Information indicating whether the condition is unique (i.e. a collision) recurring (i.e. nightly closures) or semi-permanent (i.e. a long duration activity) is beneficial only for future reference, and is of secondary importance at that moment.

Managing Traffic Demand:

Traffic demand in the work zone can be managed in one of three ways, as follows:

- trips can be encouraged to be eliminated or shifted to an alternative mode of travel;
- trips can be encouraged to occur at times different than they might otherwise have occurred; and
- trips can encouraged to occur on alternative facilities or routes.

Advance notification of planned work activities can induce drivers to postpone discretionary trips, shift their travel plans to off-peak periods, plan alternative travel routes or choose alternative travel modes.

Current, relevant and credible information on the status of work zones involving recurring partial and/or full closures during the conduct of the work, can allow drivers to make amendments to their travel plans and routes "on the fly", rerouting some trips already in progress.

Alternative route signing, depending on the degree to which it is provided, can assist in demand management by doing the following:

- prescribe a recommended alternative route for those on the affected facility;
- prescribe and trailblaze a recommended alternative route for those on the affected facility; and
- intercept and redirect those destined for the affected route via parallel or crossing routes, to an alternative route.

Expectation and demand management strategies are particularly effective under certain circumstances. These include the following:

- On routes with a high percentage of recurring users (i.e. commuters and/or

weekend recreational travelers), where there is a desire to forewarn of planned work prior to its commencement;
- On routes with a high percentage of recurring users, where frequent full or partial closures are necessary to facilitate the work, and there is a desire to communicate the status of the roadway on a daily basis;
- On routes where there is a desire to provide warning in advance of exits upstream of the work zone, allowing familiar drivers to seek alternative routes of their own choosing;
- On routes where detour signing is provided, allowing the unfamiliar driver to follow an alternative route; and
- On roadways parallel to, and crossing, the affected route, where it is desired to intercept drivers destined for the affected route before they reach it, and direct them onto alternative routes.

2.4 Concepts and Definitions - Traffic Management Strategies

Traffic management seeks to move beyond traffic control, managing both traffic demand and driver expectations through information. Information, in the highway environment, is usually presented by signing.

This information, in the form of advance notification, advance warning and alternative route signing, is generally located well outside of the highway work zone. It is on the affected facility, upstream of the work zone or, in the case of alternative route signing, on routes parallel to or crossing the affected route. It is considered an enhancement to the basic requirements for work zone traffic control, over and above the requirements outlined in the Ontario Manual of Uniform Traffic Control Devices (OMUTCD), the Traffic Control Manual for Roadway Work Operations and the Ontario Traffic Manual.

Each type of signing has a specific purpose in managing driver expectations and/or traffic demand.

Advance Notification Signing

Advance Notification Signing is temporal or time-oriented. It aims to create awareness of a future, planned work activity before it is scheduled to occur. Advance notification is primarily aimed at the recurring user – the daily commuter or the weekend recreational traveler. Its goal is to forewarn of future, scheduled events liable to impact traffic operations within the corridor. Its objective is to effectively communicate the time, duration, extent and potential impact of the planned activity, allowing recurring users to alter their future travel plans, their intended route, or both, to avoid being delayed by the activity when it occurs.

Advance Warning Signing

Advance Warning Signing is situational or location-oriented. It aims to create awareness of the location, extent, duration and degree of encroachment of an ongoing activity well before the driver reaches it.

Advance warning allows the familiar driver to exit the facility and seek an alternative route. In combination with Alternative Route Signing, it also allows the unfamiliar driver to bypass the affected location.

Properly positioned, Advance Warning Signing raises driver awareness well in advance of the tail of the queue when work is in progress, and can provide near "real-time" information regarding recurring activities such as lane closures.

Alternative Route Signing

An alternative route is only termed a "detour" if it is formally signed. Unsigned routes are simply alternative routes. To qualify as a detour, temporary trailblazer signing must be provided throughout the route.

Alternative route signing, depending on the degree to which it is applied, can serve multiple purposes. At its simplest, it can prescribe a viable but unsigned alternative route to the driver with local knowledge (Alternative Route Signing).

More formally, Detour Route Signing can be combined with Detour Trailblazer Signing to guide drivers exiting the affected facility along a detour route, returning them to their original route downstream of the work zone.

In its most comprehensive form, an alternative route signing scheme can also "intercept" drivers destined for the affected facility, (Intercept Alternative Route Signing) channeling them onto alternative routes. If these routes are signed, Intercept Detour Route Signing and Intercept Detour Trailblazer Signing is used, guiding drivers to a point downstream of the work zone.

2.5 Quantifying Work Zone Impacts on Traffic Operations

For ease of assessment, the effects of temporary conditions work zones on traffic operations can be classified as either *Capacity Impacts* or *Navigational Impacts*.

- *Capacity Impacts* occur when the ability of the roadway to carry traffic is compromised. This may result from one or more of the following:
  - the imposition of lateral constraints (narrow lanes, structures);
  - from a degradation of the roadway surface (removal of pavement from lanes open to traffic, traffic diverted onto shoulder);
  - through the closure of traffic lanes; or,
  - in the case of complex freeways, through the closure of an entire roadway (i.e. express or collector).

- *Navigational Impacts* occur when full or partial closures of intersections or interchanges prevent the free movement of traffic, imposing navigational restrictions on road users. This may result from one or more of the following:
  - closures of the collector lanes on a complex freeway, thus preventing access to interchanges;
  - individual ramp or transfer lane closures;
  - turn restrictions at intersections;
  - closures of channelizations at intersections.

Work zones may result in both capacity and navigational impacts. An example would be the closure of the collector roadway of a complex freeway between successive

transfers. Navigational impacts are imposed by the lack of access to interchanges with crossing roadways – drivers cannot exit at the interchange of their choosing. Capacity impacts are created by the loss of through lanes in the collectors – all through traffic must be accommodated in the express lanes.

Navigational impacts are generally definitive – free movement is either available or it is not available - and become obvious during the planning process. Capacity impacts are situational - they vary according to the circumstances - and analysis is generally required to quantify them.

For example, the effects of a work zone occupying one lane of a multi-lane facility may be negligible, if the facility is either lightly traveled during the planned period of the activity (i.e. at night) or if the roadway typically operates at a high level of service. In contrast however, even a minor intrusion on a route that is operating at or near capacity can have dramatic impacts on traffic operations.

The capacity and navigational impacts of a planned work zone are important considerations in developing a traffic management strategy to ensure safe and efficient operations.

Costs and Benefits

The costs associated with providing information and guidance to drivers in regards to temporary conditions work zones are not trivial. Signing must be planned for, designed, manufactured, installed, periodically updated, maintained and removed at the conclusion of the activity. Adequate coverage within complex or lengthy corridors may necessitate many installations, and require frequent updates throughout the duration of the project to ensure that the signed information matches actual conditions. Expenditures beyond those necessary to meet basic traffic control requirements must be justified. The benefits accrued through the presence of these enhancements must outweigh the costs and risks associated with placing and maintaining them throughout the activity.

The potential benefits of strategies for the employment of Advance Notification, Advance Warning and Alternative Route Signing may well be tangible (i.e. demand management resulting in improved operations, public relations and “customer” satisfaction). They are, however, highly project-specific, difficult to measure, and even more difficult to predict with any degree of certainty, at the outset.

Still other, less-quantifiable benefits may be accrued, such as a reduction in driver frustration and aggressiveness, along with heightened awareness of the potential for congested conditions ahead, resulting in fewer rules-of-the-road violations and collisions.

Thus, it is extremely difficult to generalize as to the benefits of traffic management strategies. It is also beyond the scope of this Manual to provide mechanisms for the prediction of the benefit-costs of traffic management strategies in more than a general fashion.

Determining when traffic management expenditures are justified requires that a number of factors be taken into consideration. The project specific costs anticipated, and the potential benefits to be accrued from the provision of enhanced information are heavily dependent on a

number of dynamic factors related to the attributes of the planned activity, and the corridor within which it is to occur.

These include, but are not limited to, the following:

- location of the activity (i.e. on a secondary route versus a critical link);
- duration of the activity (i.e. cumulative impact over several days versus weeks or months);
- extent of the activity (i.e. longitudinal impacts – confined to a single structure or encompassing many kilometres/multiple interchanges);
- degree of intrusiveness of the activity (i.e. off the traveled portion versus occupying one or more through lanes).
- traffic volumes within the corridor (i.e. number of users impacted, cumulative cost of delay)
- degree of saturation of the facility (i.e. spare capacity available or recurring congestion already occurring under unconstrained conditions);
- proportion of recurring users within the traffic mix (i.e. link between distant communities or heavily-traveled commuter route);
- degree of local knowledge among recurring users (i.e. able to determine their own alternative routes or in need of detour signing);
- availability of parallel or alternative routes (i.e. are there one or more viable alternatives nearby or is link particularly critical – 401 over Rouge River, QEW over 16 Mile Creek);
- function of the facility within the roadway network (i.e. normally draws traffic to it from surrounding area via crossing roadways and is preferred by users over parallel routes under normal circumstances).

In addition, it must be recognized that each of the three types of signing function most effectively under certain circumstances. They are as follows:

Advance Notification Signing:

- Heavily saturated corridor;
- recurring or on-going, intrusive work activity (i.e. repetitive partial closures) liable to significantly impact traffic operations when implemented; and
- high proportion of recurring users;

Advance Warning Signing:

- On-going, intrusive work activity significantly impacting traffic operations;
- recurring, intrusive work activity (i.e. repetitive partial closures) liable to significantly impact traffic operations when implemented;
- viable parallel or alternative routes available; and
- alternative route signing considered justified as a demand management strategy.

Alternative Route Signing On Affected Route:

- The presence of a navigational restriction;
- on-going, intrusive work activity significantly impacting traffic operations;
- recurring, intrusive work activity (i.e. repetitive partial closures) liable to significantly impact traffic operations when implemented;
- viable parallel or alternative routes available;

- recurring users with local knowledge; and
- traffic demand anticipated to exceed capacity of work zone.

Alternative Route Signing On Parallel and Crossing Routes:

- On-going, intrusive work activity significantly impacting traffic operations;
- Recurring, intrusive work activity (i.e. repetitive partial closures) liable to significantly impact traffic operations when implemented;
- Viable parallel or alternative routes available;
- Affected route draws traffic from surrounding network;
- Traffic demand anticipated to exceed the capacity of work zone.

Specific criteria for use regarding Advance Notification, Advance Warning and Alternative Route Signing are provided in Chapter 3, Section 2.

2.6 Relating Traffic Management Objectives to Driver Information Needs

This Manual discusses three types of traffic management strategies. They are:

- Advance Notification;
- Advance Warning; and
- Alternative Routing.

To be effective, each strategy requires that drivers be given certain information. This information, in turn, is intended to encourage certain lines of thought, decision-making and actions among drivers exposed to it. By considering what credible information can be provided that would induce a driver to make the desired decision, a communications strategy emerges.

The objectives of the traffic management strategy, and the information needs of drivers, will change once work begins, and may change frequently – even daily – as the project progresses. To remain effective in informing drivers and influencing their decision-making, information sources must remain conspicuous, legible, relevant, credible and consistent.

For example: To effectively notify drivers of a planned, future work activity, prepare them for the anticipated delays, and induce them to amend their future travel plans, it would be necessary to provide all of the information contained in Table 2.1 below.

Element of Information	Content	Relevance to Driver
Location	What highway What direction What stream	Initial determination of relevance Is it on my route? What are my alternatives to driving through that section during the time the activity is underway?
Extent	Where longitudinally along the highway the activity will occur Limits - from where to where - using terms likely to be familiar to drivers	Places activity in context, allows assessment of gravity, degree of personal impact Is it after my exit? Can I get off highway early?
Start date	When the activity is first expected to impact traffic, and how long will it continue (optional)	Sets deadline When do I have to have made decisions and taken action by?
Degree of intrusiveness	Planned impacts on capacity or navigational freedom, duration of those impacts if non-continuous	Allows for personal assessment/decision-making Leave early or take alternative route?

Table 2.1

Communications Strategy for Advance Notification

Similarly, during the conduct of the work, it may be considered necessary to forewarn drivers approaching the work zone of on-going activities and their impacts on traffic operations on a day-to-day basis.

The strategy may simply be to reduce driver uncertainty and frustration in anticipation of the resulting delay or, in more challenging circumstances, the objective may be to induce some drivers to exit the facility and seek alternative routes. See Table 2.2 below.

Element of Information	Content	Relevance to Driver
Location	What highway What direction What stream	Initial determination of relevance Is it on my route? What are my alternatives to driving through that section during the time the activity is underway?
Extent	Where longitudinally along the highway the activity will occur Limits - from where to where using terms likely to be familiar to drivers	Places activity in context, allows assessment of gravity, degree of personal impact Is it after my exit? Can I get off highway early?
Timing of occurrence	When the activity is first expected to impact traffic, and how long will it continue (optional)	Allows amendment of travel plans "on the fly" Will I be travelling during the impacted period? Can I modify my timing, route, etc. to avoid?
Degree of intrusiveness	Planned impacts on capacity or navigational freedom, duration of those impacts if non-continuous	Allows for personal assessment/decision-making Leave early or take alternative route?

Table 2.2

Communications Strategy for Advance Warning

Alternative Route Signing is required only where it is necessary to divert some proportion of the traffic to alternative routes. Navigational restrictions on the affected route make some form of alternative route strategy a necessity. Navigational restrictions on crossing roadways (i.e. unable to access affected route) also warrant the provision of an alternative route.

Where demand exceeds capacity on the affected route, it may be desirable to provide an alternative route around the affected area, to relieve congestion. Similarly, it may be desirable to "intercept" some portion of the traffic destined for the affected route, upstream of the work area, and re-route it to parallel routes.

In urban commuter areas, and in the presence of advance warning information

(i.e. “401 Collectors East Closed Tonight Avenue-Bayview”), drivers with local knowledge may divert regardless of the presence or absence of alternative route information. Others may be induced to detour along a well-known but unsigned alternative route if the suggestion is made (i.e.”401 EAST Via York Mills/Leslie”). Unfamiliar drivers will usually only detour if it appears from the first sign or two that the route will be well-signed (i.e. “Alternate Route Via D-1”).

In all cases, the credibility of the information provided, both in regard to the activities occurring on the affected route and in regard to the reliability of the alternative route guidance, is critical to success.

Note: Some of the elements of information that make alternative route information effective are conveyed by the Advance Warning elements of the system, which are generally located immediately upstream, and need not be repeated. See Table 2.3 on the following page.

Element of Information	Content	Relevance to Driver
Location	What highway What direction What stream	Initial determination of relevance Is it on my route? What are my alternatives to driving through that section during the time the activity is underway?
Extent	Where longitudinally along with highway the activity will occur Limits - from where to where using terms likely to be familiar to drivers	Places activity in context, allows assessment of gravity, degree of personal impact Is it after my exit? Can I get off highway early?
Timing of occurrence	When will this begin How long will it continue	Allows amendment of travel plans "on the fly" Will I be travelling during the impacted period? Can I modify my timing, route, etc. to avoid?
Alternative route	Directional instructions (1) on affected route - instruction to follow unsigned alternative route (2) on affected route - instruction to follow signed detour (3) on parallel routes and crossing roadways – instruction to follow either unsigned or signed alternative route	(1) Recommends unsigned alternative route to a driver with local knowledge With location, extent and "Follow X to Y" information, a driver with local knowledge can bypass activity. (2) Provides direction to signed detour route. Unfamiliar driver can also opt to bypass activity.
Degree of intrusiveness	Planned impacts on capacity or navigational freedom, duration of those impacts if non-continuous	Allows for personal assessment/decision-making Leave early or take alternative route?

Table 2.3

Communications Strategy for Signing Alternative Routes

2.7 Human Factors Considerations

Employing the various traffic management strategies discussed in the preceding sections involves communicating with drivers, primarily through the provision of text messages on temporary roadside signs or on overlays of existing signs. This presents a number of challenges. Understanding the capabilities, limitations and information needs of drivers, and how drivers seek out, process and act on the information they encounter within the highway environment, will allow this communications task to be accomplished more effectively.

Understanding Drivers:

Drivers, as humans, have a diverse range of physical and cognitive capabilities and limitations that define how fast, how accurately or how poorly they perform various tasks. The impacts of these human capabilities and limitations on performance are quantified through the study of ergonomics, or human factors. In assessing complex tasks such as driving, processes involving information gathering, information assessment, decision-making and action-taking are of particular interest and importance.

A Systems Approach:

Drivers, in vehicles, on a roadway, are constantly interacting with their surroundings. They take in information, and they use their knowledge and experience to rationalize the importance and meaning of that information, and make decisions accordingly. They then translate those decisions into actions. The complex interaction between the driver, the vehicle and the road can be thought of as a system, with the driver – the intelligence within the system – at its centre.

The Driving Task:

Driving tasks can be grouped into three levels, by order of importance, as follows:

- Control;
- Guidance; and
- Navigation.

Each level forms a foundation for more complex tasks to be built upon it. At the base is control, which involves managing the vehicle. Guidance primarily involves speed and path decision-making – staying on the road, responding to traffic controls, and avoiding conflicts with other vehicles. Navigation involves making choices at decision points and getting to a destination across a roadway network. The driver must be in control of the vehicle before guidance-level decisions can be exercised. Similarly, implementing navigation decisions requires both vehicle control and vehicle guidance (speed and path) to be well in hand.

Information Gathering and Decision-Making:

To carry out the various driving tasks, drivers continually collect information, most of it visually. They look at both formal information sources (i.e. highway signs, roadway alignment) and informal ones (i.e. pavement joints, tree lines and parallel features), drawing conclusions from each. On average, they make and implement several routine decisions every second, and address a major driving task decision every few seconds. They cope by juggling tasks, by continuously sampling the available

information to find what they need, and by making decisions based on what is most pressing at the moment.

Information Presentation:

When all the information a driver needs to make decisions and take actions is available, in a simple, legible and explicit format, with sufficient time to make decisions and take actions, performance is usually rapid and error free. When information is missing, misplaced, obscured, conflicting or confusing, the driving task gets more difficult. As driving tasks multiply, or become more complex, this further adds to the driver's workload. Too much information or too many tasks can overload the driver, resulting in missed information, delayed or flawed decisions, errors, and ultimately, collisions.

Often, when the available information is insufficient to support a clear decision, drivers will rely on their expectations. This is fine as long as everything turns out as they expect. When those expectations are violated however, the driver is surprised, and must collect new information, rethink what to do, and then take action. If the time available is insufficient, or if other tasks go undone as this process takes place, errors can again occur, leading to collisions.

Driver Expectation:

Drivers have a short and a long-term memory that allows them to build up a store of experiences. Drivers bring the benefit of their experiences to every situation, filling in the missing pieces and anticipating what will happen next based on recent observations, and past occurrences. This is known as expectation.

Driver Error:

Most collisions are attributable to driver error. Drivers make errors for many reasons, including inattention and impairment. However, many errors occur for reasons beyond the direct control of the driver. Errors in judgement on the part of the driver may stem from a lack of information, a lack of clarity in the information available, or insufficient time in which to respond appropriately. Drivers may also be surprised, and fail to respond appropriately, or at all, when confronted by unexpected conditions or events. Regardless of their cause, driver errors are viewed as system failures.

Driver errors may have little or no negative outcome, amounting to nothing more than a momentary traffic delay or a missed turn. These are considered to be low severity system failures. Occurrences where a driver's error substantially heightens risk (erratic maneuver, traffic conflict) or results in an actual collision, are treated as moderate and high severity system failures respectively.

In circumstances where the driver received deficient information, or was taken by surprise by a roadway feature, the roadway itself must share some responsibility for the occurrence. Viewed in this manner, system failures in which the roadway played some role represent opportunities to better understand and improve the roadway information system, thus preventing similar errors and occurrences in the future.

The Positive Guidance Approach:

The Positive Guidance approach treats the roadway, the vehicle and the driver as a single, integrated system. It recognizes drivers as the information

gatherers/decision makers within the system, and focuses attention on assuring that they get the information they need, when they need it, in a form they can understand, in time to make rapid, error-free decisions and to take appropriate actions. When this occurs, the system functions most effectively, and the driving task is successfully accomplished.

Creating and sustaining a supportive information environment on the roadway is the goal of Positive Guidance, and the objective of this Manual.

Aging Drivers:

North America is an aging society that continues to demand mobility. As drivers age, their vision generally deteriorates. Their ability to process information slows, as does their decision-making processes. Their actions and control inputs may also be slower and less precise.

The capabilities and limitations of aging drivers must be accommodated in the design of highway information systems. Providing larger signs and text, located so as to provide more time to perceive their message and react, benefits not only aging drivers, but all others as well.

Driver Vision:

Much of the information needed by drivers in performing the driving task is acquired visually. Not all drivers have perfect vision. Signs have to be designed so that they a readable by the majority of drivers under typical conditions. Using a conservative vision standard provides assurance that sign messages will be legible to a high percentage of drivers.

Reading and Comprehending Signs:

Not all drivers read English, or even read at all. Where symbolization or the presentation of messages in an alternative language is impractical, the use of standardized English terminology becomes even more crucial. When it is uniformly and consistently used, drivers become familiar with the meaning of standard terminology through association. Terminology should be simple, explicit and brief.

Reading Time:

Where drivers must share their time between reading signs and other driving tasks, a reading time of approximately 0.5 seconds for each major word or symbol should be assumed. The following message:

Collectors
To Be Closed
400 to Allen
Starts May 31

contains six (6) major words:

1. Collectors
2. Closed
3. 400
4. Allen
5. Starts
6. May 31

This message requires between 3.0 and 3.5 seconds reading time, depending on how the date is viewed. The font and letter height chosen to present this message must be readable by most drivers at a distance sufficient to allow them to read it all as they drive by.

Signs on highways are only readable until the driver is within roughly 15 metres of them. At 100 km/h, a driver is moving 27.8 metres per second towards

a fixed road side object such as a sign. To have 3.5 seconds of reading time before reaching a point 15 metres in advance of the sign, the sign must be readable from a distance of 113 metres.

Tests with drivers of various ages suggest that the legibility of a Highway Gothic E-modified font is 4.8 m/cm. This means that letters that are 20 cm high can be read from a distance of 96 m.

Decisions and Actions:

Drivers are constantly making decisions and taking actions while driving. Once drivers have read and understood a piece of information, they must decide what to do.

Depending on the complexity of the decision and the action to be taken, this can require several seconds. Complex maneuvers such as lane changes, which require searching for a gap as well as repositioning the vehicle, can take upwards of ten seconds to execute, more if in heavy traffic or if operating a large commercial vehicle.

2.8 Human Factors Implications

Sign Design and Content Implications:

To be effective, signs must possess the following characteristics:

- Conspicuity – they need to attract the driver's attention, ideally at a distance before they become legible;
- Legibility – they need to be easily read at a glance under all conditions;
- Brevity – must be able to be read in one or more glances, during the time available;
- Uniformity and Consistency – must use the same sign, with the same message, when conditions are similar;
- Comprehensibility – they need to be explicit and clearly understood;
- Relevance – they must communicate something of interest or importance to the driver; and
- Credibility – their communications must be trustworthy and believable.

Sign Location Implications:

To be safe and effective, signs must be located as follows:

- Where drivers expect to find them – i.e. on the right or over the roadway, supplemented by signing on the left on multi-lane facilities where necessary;
- Close enough to the roadway to be conspicuous and easily read;
- Outside of the hazard removal zone, or shielded or made breakaway so as not to pose a hazard;
- Adequately spaced from other information sources so as not to overload the driver;
- Away from decision points, so as not to pose a distraction from the driving task at a critical location;
- Far enough in advance of the feature being signed-for, thus providing sufficient time to react.

CHAPTER 3

GENERAL ASPECTS OF ADVANCE NOTIFICATION, ADVANCE WARNING AND ALTERNATIVE ROUTE SIGNING

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3.1 Overview

The previous chapter outlined the function and limitations of temporary conditions traffic *control*. It then introduced the concept of temporary conditions traffic *management* as a proactive, information-based approach to improving traffic operations within affected highway corridors. It set out a rationale for use and determined that the stated goal of improvement in operations, safety and public relations would require any strategy for its achievement to include the following objectives:

- Managing driver attitudes, expectations and mobility demands through information;
- Reducing traffic demand within the corridor, particularly on the affected route, during key periods; and
- Mitigating the navigational restrictions imposed by the work zone.

Accordingly, three information strategies were defined in keeping with those objectives. They were:

- Advance Notification;
- Advance Warning; and
- Alternative Routing.

To refine these strategies into applicable tools, the adverse impacts of temporary conditions work zones on capacity and navigational freedom were examined, along with driver perceptions, motivations and actions in relation to work zones. The information requirements of each strategy were defined according to what drivers needed to know, or what information was necessary to induce the desired response in drivers.

The human factors considerations involved in presenting information to drivers were reviewed, as were the specific implications of human factors in implementing the traffic management strategies proposed.

From this base information, the following chapter will define criteria for the use of traffic management strategies, and outline design and implementation guidelines.

3.2 Criteria for Use

General:

Each of the three traffic management strategies contained in this Manual has somewhat different goals and objectives in mitigating the impacts of work zone activities. Each is best suited to, and functions most effectively under, a specific set of circumstances. Accordingly, each strategy has a different set of criteria for use.

All of the criteria for use are triggered by operational impact. If a particular activity has no impact on traffic operations, then there are no effects to be mitigated, and a traffic management strategy is unnecessary.

The criteria are applicable to all classes of roadways, and are subjectively predicated on the following factors:

- the public relations benefits that accrue from informing drivers of planned activities that will disrupt their travel plans;

- the safety benefits that accure from drivers being forewarned and well-briefed as they enter a work zone;
- the safety benefits that accrue from reducing driver anxiety and frustration, achieved through the provision of information and options available at the discretion of the driver; and
- the self-evident operational benefits of demand management through the work zone.

Traffic management strategies centered around the deployment of static signs are not suited to all circumstances. When planned activities meet the following criteria:

- conducted outside of peak periods; and
- either mobile or of short duration (one day or less); and
- non-recurring (i.e. lane marking or a yearly, three-hour closure for luminaire relamping), or
- of longer duration but are exceptionally variable and unpredictable;

then their impacts should be managed through more flexible, responsive and adaptable methods. Such methods include media advisories, 1-800 numbers and changeable message sign displays, where they are available.

The incremental improvements in traffic operations that can be gained from the installation of static signing can be significant, but must accrue over longer periods or in more extreme circumstances to offset the effort and expenditure involved in their development and deployment. The criteria for use that follows will assist the user in determining when and whether such conditions exist.

- *Operational Impact* is the degree to which normal traffic operations are affected by the activity. These impacts are quantified as follows:
  - a critical reduction in capacity; or
  - a navigational freedom restriction.

Supporting the consideration of operational impact are the specific circumstances surrounding the activity, which include the following:

- *Location* – takes into consideration what type of route is being affected (degree of importance within the roadway network), and what elements of the route are impacted (i.e. a minor ramp or a critical link).
- *Duration* – considers both the amount of time the work activity will be present on the road and, in the case of intermittent or recurring intrusions, their timing and duration.
- *Extent* – considers whether the effects of a work zone are localized or widespread. A bridge rehabilitation may occupy less than a hundred metres longitudinally on the roadway (not including traffic control elements), while a resurfacing project may extend for many kilometres.

Implicit in the consideration of location, duration and extent is a measure of how many road users are impacted and, in commuting areas, the repetitive impacts on the same commuter. Taken together, it is these impacts that produce outcomes such as congestion, and result in driver frustration and anxiety.

Application Guidance:

While the criteria are definitive in that they inform the user when and where certain traffic management strategies must be used, this does not preclude their application to circumstances other than those contemplated and described within the text. Those responsible for temporary conditions traffic control and management should be encouraged to exercise judgement and initiative, to investigate unique circumstances, and to make recommendations for mitigating measures where, in their professional opinion, such mitigation is justified.

Definitions:

For the purposes of the criteria, the following definitions will apply:

Restriction on Navigational Freedom: Restrictions on navigational freedom include any of the following:

- the closure of a highway;
- the closure of a collector roadway (as on a complex freeway), a transfer lane, a ramp or a channelization; or
- the imposition of a temporary turn restriction at an intersection;

precluding the free movement of traffic along routes that are otherwise available.

Critical Capacity Reduction: A critical capacity reduction is one that reduces the Level of Service (LOS) on a facility to LOS E or below. For routes that operate below LOS E during the affected period, any intrusion onto or over the traveled lanes must automatically be considered to result in a critical capacity reduction. Any reduction in lane or shoulder width should be carefully investigated, to determine whether it will result in a critical capacity reduction.

Commuter Route: A commuter route is a route that displays weekday peaks in travel demand consistent with travel to and from places of employment. (Examples include 400 series highways within the Greater Toronto Area).

Commerce Route: A commerce route is a route critical to the movement of commercial goods by truck. (Examples Highway 401 and the QEW).

Recreational Route: A recreational route is a route that displays summer and/or winter weekend peaks in travel consistent with travel to and from recreational areas.

Criteria for Use - Advance Notification Signing

The benefits of Advance Notification Signing are strongly linked to the proportion of recurring users on the route. In areas with a high proportion of commuters or recurring recreational users, Advance Notification Signing benefits these users by forewarning of planned activities. On other routes, Advance Notification Signing can provide benefits, but they accrue over longer periods, in keeping with the lower proportion of recurring trips.

On commuter and recreational routes, in areas of recurring congestion, even minimal intrusions into the roadway can have significant impacts on operations. In such circumstances, the public relations benefits of advance notification often outstrip the operational benefits.

Advance Notification Signing should be used in the following circumstances:

a. The creation of a critical capacity reduction or a restriction to navigational freedom on a *commuter and commerce route* that will be imposed either:

    1. on a continuous basis for a period exceeding 48 hours; or
    2. on a part-time, recurring basis during the same period (i.e. nightly lane closures) twice or more over a span of 7 consecutive days.

b. The creation of a critical capacity reduction or a restriction to navigational freedom on a *recreational route* that will be imposed either:

    1. at any time during the peak travel periods of a holiday weekend;
    2. on a continuous basis for a period exceeding 7 days; or
    3. on a part-time, recurring basis (i.e. nightly weekend closures) on two or more consecutive weekends.

On other types of routes Advance Notification Signing has minimal benefits. Its use is at the discretion of the persons responsible for planning the traffic management and control.

Criteria for Use - Advance Warning Signing

The use of Advance Notification Signing prior to the commencement of work automatically warrants the continuation of a traffic management strategy using Advance Warning Signing once the project commences. Thus the warrants for Advance Warning Signing are the same as those of Advance Notification Signing on commuter, commerce and recreational routes.

On other types of routes, Advance Warning Signing is used to raise awareness of the impacts of continuous operations during their presence (i.e. Muskoka Road 32 Closed). It is also effective in communicating the daily status of a route subjected to recurring events (i.e. Closed Nightly – Closed Tonight). Advance Warning Signing can also serve as a lead-in to alternative route information.

Because it conveys information regarding the present, Advance Warning Signing is relevant to all users of the route, and is thus more broadly applicable than Advance Notification Signing. Advance Warning Signing should be used in the following circumstances:

a. Where there has been prior use of Advance Notification Signing.

b. where a critical capacity reduction or a restriction on navigational freedom that will be imposed either:

    1. on a continuous basis for a period exceeding 48 hours; or
    2. on a part-time, recurring basis during the same period (i.e. nightly lane closures) twice or more within 7 days.

Criteria for Use – Alternative Routing

Alternative routing as a traffic management strategy can be taken to different levels. Even without the provision of any information on alternative routes, Advance Warning Signing provides the opportunity for drivers with local knowledge to elect to follow an alternative route, where one is available. The identification of an unsigned alternative route (Use Keele to Wilson) provides drivers with local knowledge further inducement to detour. A signed detour route, leading from the affected route upstream of the work zone to a point beyond it, will also attract some proportion of unfamiliar drivers. Signing on parallel and crossing routes will "intercept" drivers destined for the affected route, reducing travel demand through the affected section. In extreme situations, where a route is closed completely, the provision of an alternative route becomes essential.

The decision whether or not to detour traffic is a complex one, with many considerations. They include the following:

- Is the capacity of the work zone insufficient?
- Is a detour necessary or desirable?
- Is there a viable alternative route?
- What is the shortest, most direct route?
- Does it have sufficient spare capacity?
- What are the implications for other road users and residents along the alternative route (i.e. cyclists, pedestrians, adjacent land users)?
- Will it accommodate all vehicle types (i.e. buses, semi-trailers, oversized loads)?
- Will drivers find it on their own?
- If not, is the route explicit and signable?
- Is the controlling road authority in agreement?
- What concessions does the controlling road authority expect in return?
- What are the operational implications at the point of departure from the affected route?
- What are the operational implications where the detour route rejoins the affected route?

Warrants for alternative route signing on all types of roadways are as follows:

a. Restrictions on Navigational Freedom:

   Alternative route or detour signing identifying an alternative route must be provided concurrent with any restriction on navigational freedom. Where alternative routes are unavailable, some measure of access must be maintained.

   Where alternative routes are straightforward and obvious, this warrant may be satisfied by directional information (Use Keele to Wilson) provided at the site of the restriction. In more complex situations, signing at decision-points along the detour route will be necessary.

b. Critical Capacity Reductions:

   Where critical capacity reductions are associated with either of the following:

   - a continuous activity with a duration exceeding 7 days; or
   - a part-time activity recurring four or more times during the same period (i.e. nightly lane closures) within 7 days;

an analysis is to be undertaken to assess the magnitude of the capacity shortfall.

Where the results of that analysis indicate that the volume-to-capacity ratio (V/C) will exceed 1.0, resulting in a Level of Service (LOS) of “F” during the period of the activity, and congestion is anticipated to result, the opportunities for relief through the signing of an alternative route should be examined.

Where analysis indicates that the anticipated proportion of traffic that will leave the affected route and follow the alternative route may be insufficient to achieve a V/C < 1.0, the need for intercept signing on parallel and crossing roadways should be considered.

Figure 3.1 (a) through (e) illustrates a decision tree for determining whether the application of various traffic management strategies is justified. It is intended as guide only, and site-specific situations should be given full consideration.

1. Assess the Nature of the Activity

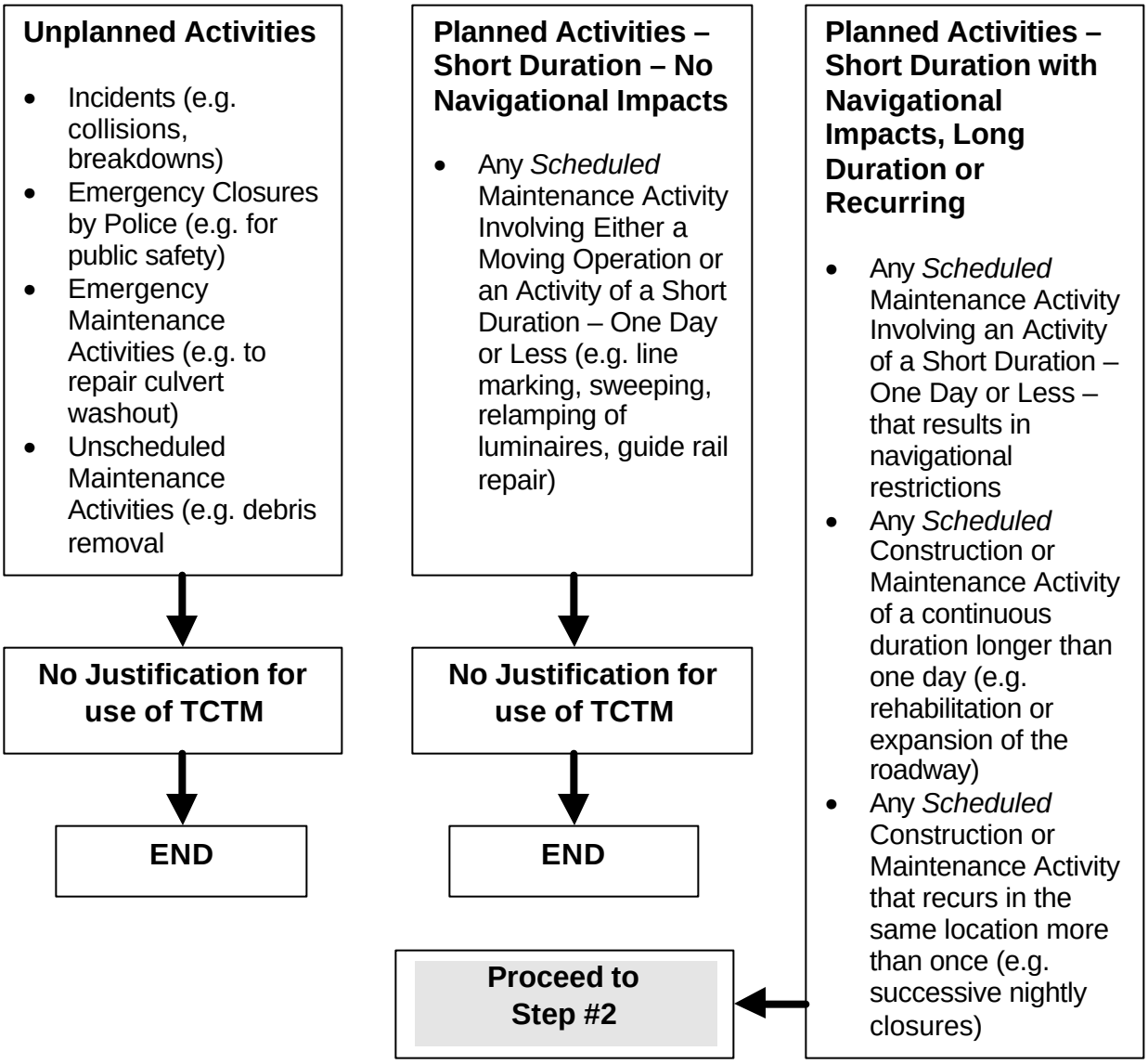


Figure 3-1(a) – Criteria for Use

2. Assess the Operational Impact of the Activity

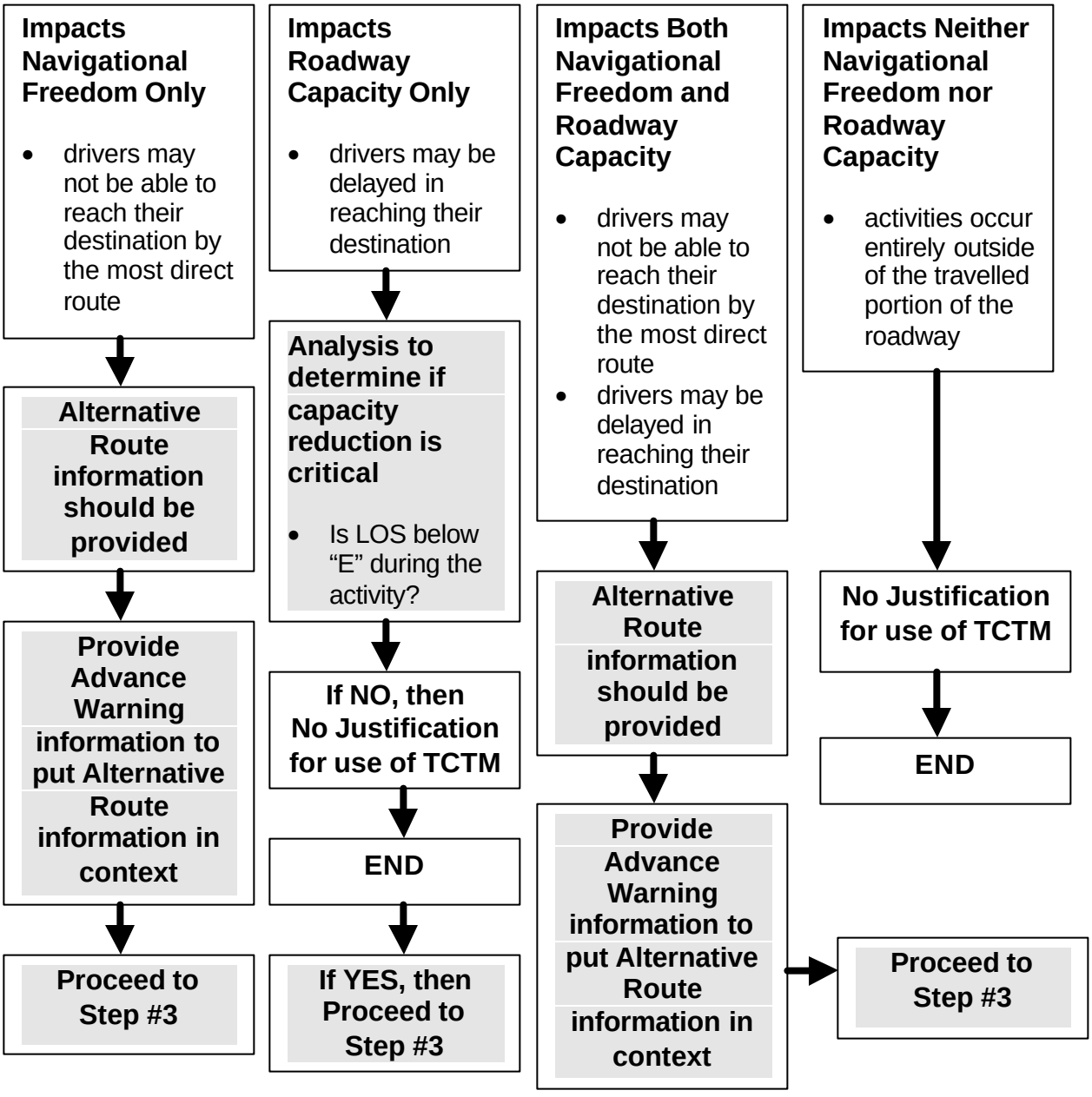


Figure 3-1(b) – Criteria for Use

3. Assess the Duration and Degree of Intrusiveness of the Activity

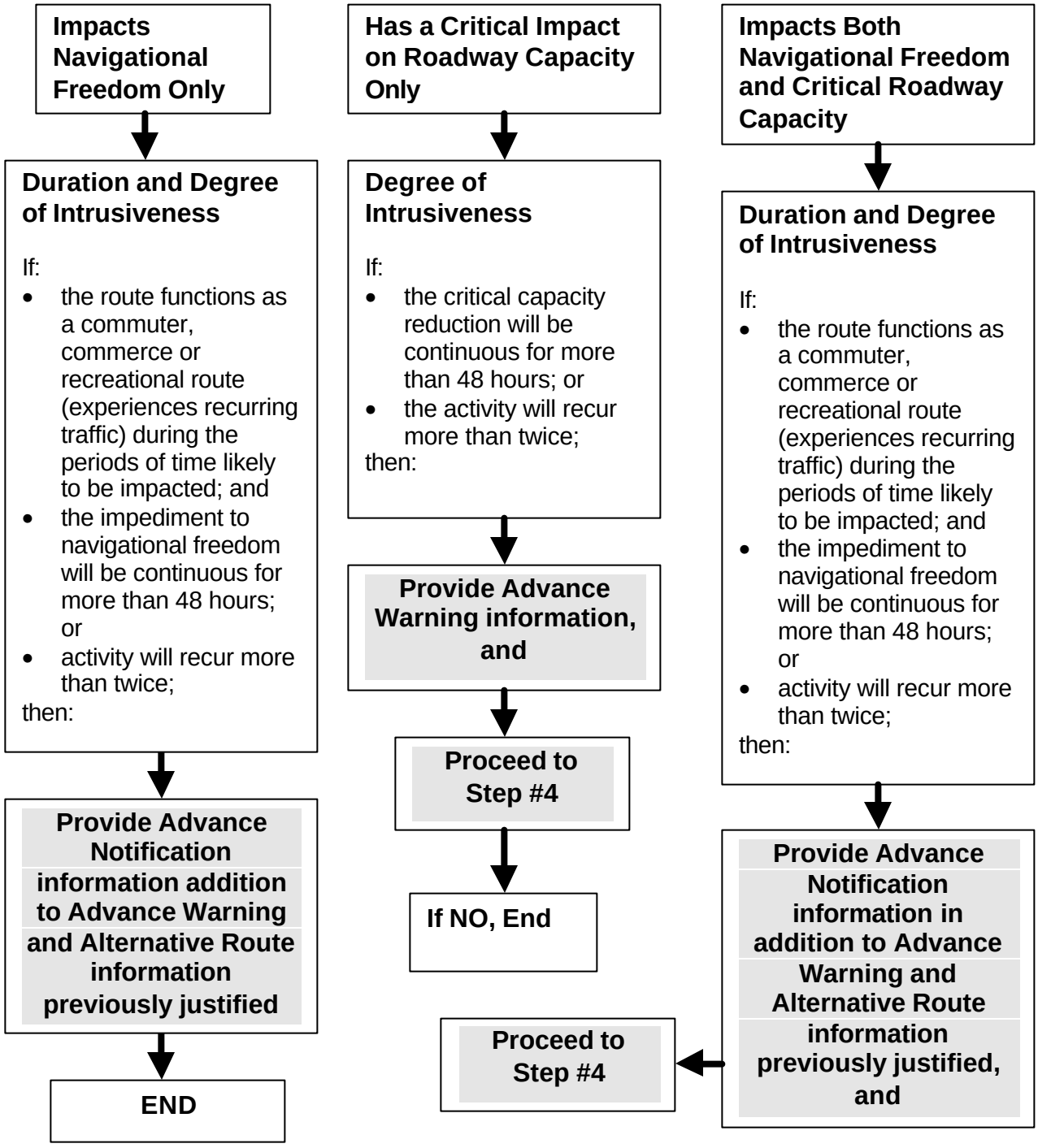


Figure 3-1(c) – Criteria for Use

4. Assess Need for Alternative Routes to Augment Capacity

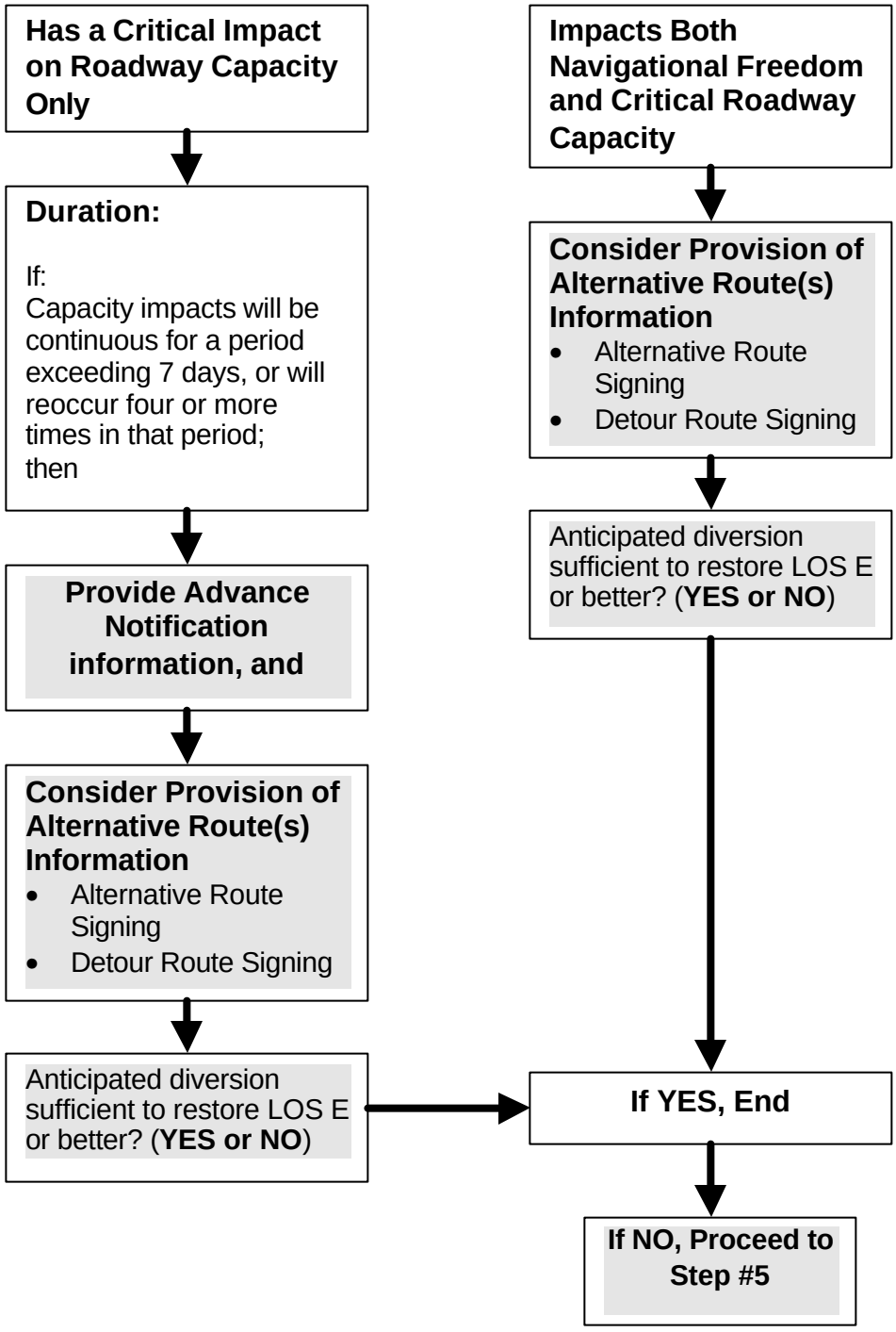


Figure 3-1(d) – Criteria for Use

5. Assess Need for Intercept Alternative Routes to Augment Capacity

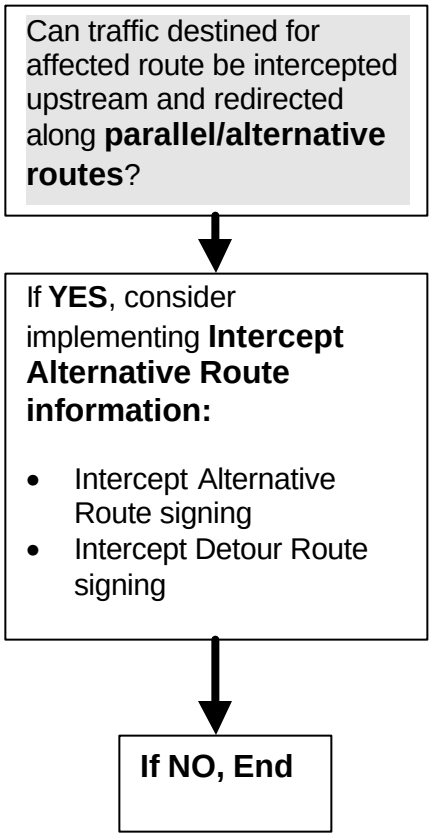


Figure 3-1(e) – Criteria for Use

3.3 Information Content and Organization

To be effective, signing placed in support of advance notification, advance warning and detour strategies must present their information in a manner consistent with the human factors considerations outlined in Chapter 2. The following section provides guidance in selecting information content appropriate to each strategy, and organizing it uniformly and consistently within a sign or series of signs in a uniform and consistent manner.

Principles:

- Must not exceed three lines of message, except during advance notification phase.
- Must not exceed six (6) major elements of information on one sign (a major information element is one key word, a number or a symbol).
- Modifiers to road names (i.e. Highway, Road, Street, Avenue, etc.) are not used.
- Messages regarding the limits of a closure identify the first and last point of access that are closed.
- Permanent signing must be amended to agree with temporary signing.
- Where space for signs is limited, or concerns exist regarding an overload of information presented to the driver, information on navigational restrictions must take precedence over information on capacity restrictions.
- Where space for signs is limited, temporary conditions traffic management signing takes precedence over contract identification and contractor advertising signing.
- Cardinal direction information is preferred for the purposes of orientation, except where such information may prove confusing. In such instances, destination-type information (e.g. QEW Toronto) may be substituted.

Advance Notification Signing (ANS) – Affected Route:

Each line of message is intended to respond to a specific driver information need. Read together, this information provides drivers with a clear indication of location, scope, extent and timing of the planned, future activity. In general, ANS will be organized as follows:

Presentation of Information – Advance Notification Period:

Line 1 – Where the event will occur
Line 2 – What the future operational impacts on traffic will be
Line 3 – What is the extent of the activity
Line 4 – When is it scheduled to start

For Example:

Collectors EAST
To Be Closed
Here - There
Starts May 31

or

Collectors EAST
Closed Nightly 10 PM
Here - There
Starts May 31

Messages referencing the extent of a closure must identify the first interchange or intersection closed and the last interchange or intersection closed.

Advance Notification Signing (ANS) – Crossing Roadways:

Crossing Roadway Signing, as the name implies, is intended to provide drivers on crossing roadways that intersect with the affected route within the limits of the work zone, and are thus impacted, forewarning of the coming activities.

Presentation of Information – Advance Notification Period:

Line 1 – Where the event will occur
Line 2 – What the future operational impacts on traffic will be
Line 3 – What is the extent of the activity
Line 4 – When is it scheduled to start

For Example:

Access to 401 EAST
To Be Closed
Here - There
Starts May 31

or

Access to 401 EAST
Closed Nightly
Here - There
Starts May 31

Advance Notification Signing (ANS) – Upstream Crossing Roadways:

Upstream Crossing Roadway Signing, is intended to forewarn drivers on crossing roadways that are immediately upstream of the planned activity area, of the pending activities. The purpose is to set the stage for "intercepting" and re-routing this traffic demand along parallel routes during the activity.

Presentation of Information – Advance Notification Period:

Line 1 – Where the event will occur
Line 2 – What the future operational impacts on traffic will be
Line 3 – What is the extent of the activity
Line 4 – When is it scheduled to start

For Example:

401 Collectors EAST
To Be Closed
Here - There
Starts May 31

or

401 Collectors EAST
Closed Nightly
Here - There
Starts May 31

The variation in the message is subtle, as these roadways will not be directly affected.

Advance Warning Signing (AWS) – Affected Route:

During the period while the work zone is impacting the route, drivers need information on the location, scope and

extent of the activity. This information is sufficient if the presence is continuous. Where the activity is a recurring one – a nightly closure for example - information on the status of the activity and the activity period is required.

In some instances, the scope of the activity cannot be presented on one line (i.e. 2 Left Lanes Closed). In such circumstances, information on the extent of the condition is dropped to provide additional space, and to limit the overall amount of information presented.

Presentation of Information – Advance Warning Period (Continuous Activity):

Line 1 – Where the event will occur
Line 2 – What are the current operational impacts on traffic
Line 3 – What is the extent of the activity

For example:

Collectors EAST
Closed
Here - There

Presentation of Information – Advance Warning Period (Recurring Activity When Activity is Planned):

Line 1 – Where the event will occur
Line 2 – What are the intended operational impacts on traffic
Line 3 – What is the extent of the activity

For example:

Collectors EAST
Closed Tonight 10 PM
Here - There

Presentation of Information – Advance Warning Period (Recurring Activity When Activity is NOT Planned):

Line 1 – Where the event will occur
Line 2 – What are the intended operational impacts on traffic
Line 3 – What is the extent of the activity

For example:

Collectors EAST
Open Tonight
<Blank>

Presentation of Information – Advance Warning Period (Recurring Activity When Activity is Planned, Extent Information Dropped):

Line 1 – Where the event will occur
Line 2 – What are the current operational impacts on traffic
Line 3 – What additional operational impacts on traffic are intended

For example:

Collectors EAST
2 Left Lanes
Closed

Whenever possible, messages should be accurate and specific. Where the number of lanes to be closed is variable, or cannot be predicted, the more general statement “Left Lanes Closed” or “Lanes Closed” may be used in place of “2 Left Lanes Closed”.

Where the timing of recurring closures is variable or unpredictable, the more general statement “Lane Closures“ may be used on

place of “Closed Nightly” or “Closed Weekends”.

Advance Warning Signing (AWS) – Crossing Roadways:

During the period while the work zone is impacting the route, drivers on crossing roadways impacted by navigational restrictions also need information on the location, scope and extent of the activity. This information is sufficient if the presence is continuous. Where the activity is a recurring one – a nightly closure for example - information on the status of the activity and the activity period is required.

Presentation of Information – Advance Warning Period (Continuous Activity):

Line 1 – Where the event will occur
Line 2 – What are the current operational impacts on traffic
Line 3 – What is the extent of the activity

For example:

Access to 401 EAST
Closed
Here - There

Presentation of Information – Advance Warning Period (Recurring Activity When Activity is Planned):

Line 1 – Where the event will occur
Line 2 – What are the intended operational impacts on traffic
Line 3 – What is the extent of the activity

For example:

Access to 401 EAST
Closed Tonight 10 PM
Here - There

Presentation of Information – Advance Warning Period (Recurring Activity When Activity is NOT Planned):

Line 1 – Where the event will occur
Line 2 – What are the intended operational impacts on traffic
Line 3 – What is the extent of the activity

For example:

Access to 401 EAST
Open Tonight
<Blank>

Where the timing of recurring closures is variable or unpredictable, the more general statement “Lane Closures“ may be used on place of “Closed Nightly” or “Closed Weekends”.

Advance Warning Signing (AWS) – Upstream Crossing Roadways:

During the period while the work zone is impacting the route, it may be desirable to re-route drivers on upstream crossing roadways away from the affected route, along parallel routes. As a precursor to presenting the alternative route information, these drivers need to be informed of conditions on the affected route.

Presentation of Information – Advance Warning Period (Continuous Activity):

Line 1 – Where the event will occur
Line 2 – What are the current operational impacts on traffic
Line 3 – What is the extent of the activity

For example:

401 Collectors EAST
Closed
Here - There

Presentation of Information – Advance Warning Period (Recurring Activity When Activity is Planned):

Line 1 – Where the event will occur
Line 2 – What are the intended operational impacts on traffic
Line 3 – What is the extent of the activity

For example:

401 Collectors EAST
Closed Tonight 10 PM
Here - There

Presentation of Information – Advance Warning Period (Recurring Activity When Activity is NOT Planned):

Line 1 – Where the event will occur
Line 2 – What are the intended operational impacts on traffic
Line 3 – What is the extent of the activity

For example:

401 Collectors EAST
Open Tonight
<Blank>

Where the timing of recurring closures is variable or unpredictable, the more general statement "Lane Closures" may be used on place of "Closed Nightly" or "Closed Weekends".

Alternative Route Signing (ARS) – Affected Route:

Two levels of alternative route information can be provided. Alternative Route Signing (ARS) allows the presentation of detailed information regarding an unsigned, alternative route. ARS requires the installation of a second sign on the affected route.

Information provided to drivers on the affected route includes a repetition of the navigational impact, and some form of direction to the alternative route.

Presentation of ARS Information – Advance Warning Period:

Line 1 – What routes are affected
Line 2 – "Via", indicating what follows is the alternative route to reach the affected links
Line 3 – The alternative route

For example:

Collectors EAST
Closed Tonight 10 PM
Yonge - Bayview

is followed by:

Yonge – Bayview
Via
Avenue Road

on a second sign. This information is followed up by additional directional guidance at the Avenue Road exit.

ARS functions effectively where local knowledge among drivers is strong, parallel routes are easily accessible, simple, and service the crossing roadways otherwise accessed via closed interchanges or intersections (i.e. a grid network of parallel and crossing roadways within the corridor of the affected route). Drivers must use local knowledge and permanent way finding references (i.e. street name signing) to navigate their route.

Alternative Route Signing (ARS) – Crossing Roadways:

Two levels of alternative route information can be provided. Alternative Route Signing (ARS) allows the presentation of detailed information regarding an unsigned, alternative route. ARS requires the installation of a second sign on the affected route.

Information provided to drivers on the affected route includes a repetition of the navigational impact, and some form of direction to the alternative route.

Presentation of ARS Information – Advance Warning Period:

Line 1 – What routes are affected
Line 2 – "Via", indicating what follows is the alternative route to reach the affected links
Line 3 – The alternative route

For example:

Access to 401 EAST
Closed Tonight 10 PM
Yonge - Bayview

is followed by:

401 EAST
Via
York Mills/Leslie

on a second sign.

ARS functions effectively where local knowledge among drivers is strong, parallel routes are easily accessible, simple, and service the crossing roadways otherwise accessed via closed interchanges or intersections (i.e. a grid network of parallel and crossing roadways within the corridor of the affected route). Drivers must use local knowledge and permanent way finding references (i.e. street name signing) to navigate their route.

Intercept Alternative Route Signing (ARS) – Upstream Crossing Roadways:

Provincial highways draw traffic from adjacent and crossing arterial roadways. Where it is desired to "intercept" the traffic on a parallel or crossing roadway that is destined for the affected route, and redirect them onto an alternative route, Intercept Alternative Route Signs (IARS) or Intercept Detour Route Signs (IDRS) are installed on these roadways. This signing informs drivers of the status of the affected route, and directs them to the alternative route.

Both IARS and IDRS are two-sign systems.

Depending on the degree of complexity involved, and the proportion of unfamiliar drivers, the intercept route may or may not require trailblazing. With IDRS, Intercept Detour Trailblazer Signs (IDTS) are required, to mark decision-points along the route.

Presentation of IARS Information – Advance Warning Period:

Line 1 – What routes are affected
Line 2 – "Via", indicating what follows is the alternative route to reach the affected links
Line 3 – The alternative route

For example:

401 Collectors EAST
Closed Tonight 10 PM
Yonge - Bayview

is followed by:

401 Collectors EAST
Via
York Mills/Leslie

on a second sign.

ARS functions effectively where local knowledge among drivers is strong, parallel routes are easily accessible, simple, and service the crossing roadways otherwise accessed via closed interchanges or intersections (i.e. a grid network of parallel and crossing roadways within the corridor of the affected route). Drivers must use local knowledge and permanent way finding references (i.e. street name signing) to navigate their route.

Detour Route Signing (DRS) – Affected Route:

Detour route signing is a further enhancement to the basic ARS concept. DRS allows the presentation of more detailed information regarding a signed, alternative route. DRS also requires the installation of a second sign on the affected route, and trailblazing on the alternative route.

Information provided to drivers on the affected route includes a repetition of the affected links, and instructions to follow detour trailblazing.

Presentation of DRS Information – Advance Warning Period:

Line 1 – What routes are affected
Line 2 – "Via", indicating what follows is the alternative route to reach the affected links
Line 3 –Which trailblazer route to follow (i.e. D-1).

For example, the main line signing consists of the following:

Collectors EAST
Closed Tonight 10 PM
Yonge - Bayview

This is followed by:

Yonge – Bayview
Via
Avenue Road

At the Avenue Road Exit, additional information is presented as follows:

Yonge – Bayview
Via
D-1

On the latter sign, a detour trapezoid symbol would be included in the last line of the message. Detour Trailblazer Signing (DTS) would then be placed at each subsequent decision point along the route.

At this point, drivers transition to following Detour Trailblazer Signing (DTS), rather than having to rely on permanent guide signing and/or local knowledge.

Detour Trailblazer Signing (DTS)

DTS takes the detour trapezoid and detour number and pairs it up with either a directional arrow (left, right or straight ahead) or with the word "Ends" to communicate directions to drivers at decision points along the route. This provides a route guidance tool to trailblaze the alternative route.

Detour Route Signing (DRS) – Crossing Roadways:

Detour route signing on crossing roadways leads drivers from affected roadway to an alternative point of access, via a signed detour route. The information provided includes the navigational restriction, and instructions to follow the detour trailblazing.

Presentation of DRS Information – Advance Warning Period:

Line 1 – What routes are affected
Line 2 – "Via", indicating what follows is the alternative route to reach the affected links
Line 3 –Which trailblazer route to follow (i.e. D-1).

For example, the crossing roadway signing consists of the following:

Access to 401 EAST
Closed Tonight 10 PM
Yonge - Bayview

This is followed by:

Yonge – Bayview
Via
D-1

On the latter sign, a detour trapezoid symbol would be included in the last line of the message. Detour Trailblazer Signing (DTS) would then be placed at each subsequent decision point along the route.

Drivers now transition to following Detour Trailblazer Signing (DTS), rather than having to rely on permanent guide signing and/or local knowledge.

Intercept Detour Route Signing (IDRS) – Upstream Crossing Roadways:

Detour route signing on upstream crossing roadways leads drivers that would otherwise have joined the affected route upstream of the work zone, across a signed detour route to a point downstream of the affected area. The information provided includes the

navigational restriction, and instructions to follow the detour trailblazing.

Presentation of DRS Information – Advance Warning Period:

Line 1 – What routes are affected
Line 2 – "Via", indicating what follows is the alternative route to reach the affected links
Line 3 –Which trailblazer route to follow (i.e. D-1).

For example, the crossing roadway signing consists of the following:

401 Collectors EAST
Closed Tonight 10 PM
Yonge - Bayview

This is followed by:

401 EAST
Via
D-1

On the latter sign, a detour trapezoid symbol would be included in the last line of the message. Detour Trailblazer Signing (DTS) would then be placed at each subsequent decision point along the route.

Drivers now transition to following Detour Trailblazer Signing (DTS), rather than having to rely on permanent guide signing and/or local knowledge.

Special Considerations - Message Presentation:

Delay:

The provision of redundant information such as "Expect Delays" should be avoided, as it provides no value-added. Factual information regarding the location, extent, duration and degree of intrusiveness of the activity will allow road users to draw their own conclusions regarding the potential for delay.

Cardinal Direction:

Where the cardinal direction taken by a highway route is not consistent (e.g. north-south or east-west), and the use of cardinal direction either provides insufficient orientation or may lead to confusion, destination-oriented messages may be substituted.

Where possible, these should be presented in a manner consistent with that used on permanent guide sign (e.g. QEW Hamilton, QEW Niagara, QEW Toronto).

3.4 Lexicon of Terms and French Equivalents

A standard lexicon of terms, with French equivalents, is provided.

English	French
Express	Express
Collectors	Collectrices
Transfer	Accès e.g. Transfer from express - - Accès à partir des express Transfer to collectors -- Accès aux collectrices
This Transfer	Cet accès
Next Transfer	Prochain accès
At This Transfer	À cet accès
At Next Transfer	Au prochain accès
Access	Accès
This Access	Cet accès
Access To	Accès à
No Access	Accès interdit
To (Road X)	Vers
At (Road X)	À
Lane	Voie
Lanes	Voies
All Lanes	Toutes voies
Lane Closures	Fermetures de voies
Reduced to 1 Lane	Réduction à 1 voie
1 Lane Nightly	1 voie la nuit
Left	Gauche
Right	Droite
On Left	À gauche
On Right	À droite
From Left	De la gauche
From Right	De la droite
Left Lane	Voie à la gauche
Right Lane	Voie à la droite
Centre Lane	Voie Médiane
No Left Turn	Virage à gauche interdit
No Right Turn	Virage à droite interdit
No Turns	Virages interdits
Open	Ouvert(e)(s) (will vary depending on whether noun preceding is feminine or masculine, singular or plural)

To Be Closed	Sera fermé(e)/ Seront fermés(es) (will vary depending on whether the noun preceding is feminine or masculine, singular or plural)
Closed	Fermé(e) (varies depending on whether the noun preceding is feminine or masculine)
Closed Nightly	Fermé(e) la nuit
Closed Weekends	Fermé(e) (s) en fins de semaines (will vary depending on whether the noun preceding is feminine or masculine, singular or plural).
Open Tonight	Ouvert(e)(s) ce soir (will vary depending on whether the noun preceding is feminine or masculine, singular or plural).
Closed Tonight	Fermé(e)(s) ce soir (will vary depending on whether the noun preceding is feminine or masculine, singular or plural).
All Traffic Exits	Sortie obligatoire
For (XX km)	Sur
Next (XX km)	Prochain
Starts	À compter
North	Nord
South	Sud
East	Est
West	Ouest
January	Janvier
February	Février
March	Mars
April	Avril
May	Mai
June	Juin
July	Juillet
August	Août
September	Septembre
October	Octobre
November	Novembre
December	Décembre
Via (Road X)	Via
Ends	Fin
Narrow Lane	Voie étroite
Narrow Lanes	Voies étroites
Trucks Use	Camions prenez
Be Prepared	Préparez-vous
To Stop	À arrêter
Ahead	À l'avant
Alternate Route	Voie facultative

Table 3-1 Bilingual Lexicon

3.5 Sign Design and Fabrication

Primary Signs:

For economy and efficiency in fabrication, temporary conditions traffic management signing is designed around standard (1.2 m x 2.4 m) plywood sheets. The resulting message area is partitioned into 0.4 m x 2.4 m elements. A 40 cm x 2.4 m message area is the basic building block of this signing system. This is illustrated in Figure 3.2.

The following provides guidance in regards to specific elements of the signs.

Auxiliary Signs:

Auxiliary signs are also designed to make economical use of substrate materials. Auxiliary signs (normally detour trailblazer signs) are 0.6 m x 1.2 m. This is illustrated in Figure 3.3.

Substrate:

- 1.2 m x 2.4 m plywood panels, a minimum of 12 mm in thickness, meeting the most recent iteration of Canadian Standards Association (CSA) specification 0121-M 1978 (Douglas Fir) or 0153-M (Poplar).
- All surfaces are to be filled, sealed and painted.
- The back of sign is to be painted gray.
- No messages are permitted on the back of the sign, other than barcodes, ownership stamps or similar markings unobtrusive to the driver.

Sheeting Material:

- All portions of the message side of the sign face must be covered in sheeting. All sign sheeting must be retroreflective, and meet the latest iteration of American Society for Testing and Materials (ASTM) specification 4956-90, for Type III material, commonly referred to as “Engineering Grade”. More highly retroreflective grades of sheeting materials may be specified, as conditions demand.

Background:

- The base message background must be white retroreflective.
- Where indicated, the background colour of the emphasized line of text must be orange retroreflective.

Border:

- Borders are not a requirement, but their consideration is recommended where messages must stand out against complex backgrounds.
- The use of a contrasting, highly retroreflective border may also assist in making the sign more conspicuous within its surroundings.
- When used, borders are to be of an edge-type (extending to the edge of the substrate, as opposed to being inset), retroflective orange, and equal in width to twice the stroke width of the text font appearing on the sign. The border must extend around the entire perimeter of the signed message, and must be replicated in a matching fashion on all temporary or permanent overlays used in conjunction with the sign.

Lettering:

- All lettering must be black vinyl.
- Highway Gothic Font, E – Series, modified is to be used for all text.
- Upper and lower case lettering is to be used for all text, with the exception of cardinal directions (NORTH, SOUTH, EAST & WEST).
- Letter height must be 20 cm unless noted otherwise.
- Where proposed messages exceed the horizontal dimension of the sign blank, it is permissible to force the letter *spacing*, and not the letter stroke or width, to 90% of its original value, in order to accommodate the message.
- Crowns containing the Highway number of the King's Highway may be used to denote the King's Highway on signs, provided this does not result in a compromise of the letter height of the highway number.

Symbols:

- All detour symbols must be orange retroflective.
- All arrows must be black vinyl (non-retroreflective).

Message Layout:

- Each line of message must be centered horizontally and equally spaced vertically.
- Symbols must be positioned as shown in the typical diagrams.

Sign Assembly:

Refer to Figures 3.2 for a graphical representation of a typical sign configuration.

- Sign messages must NOT be assembled from several individual panels each comprising a single line of text.

  Signs messages for the Advance Notification Phase and for continuous activities are to constructed of one sheet of plywood comprising the first three lines of message, with the fourth line appended as a tab. Tabs are to be butted tight to the primary sign message. No border or seam is to be visible between the main sign and the tab.

- During the Advance Notification Phase, a "Starts" tab will generally be in place, below the primary sign message.

- At the onset of the Advance Warning Phase, for continuous activities, the assembly is amended as follows:

  - The "Starts" tab is removed; and
  - Lines two and three of the sign are permanently overlaid with a single panel bearing the new two-line "activity" message (e.g. "Closed" and "Here – There").

- At the onset of the Advance Warning Phase, for recurring activities, the assembly is amended as follows:

  - The "Starts" tab is removed; and
  - Lines two and three of the sign are permanently overlaid with a single panel bearing the new two-line

"activity" message (e.g. "Closed Tonight" and "Here – There").
- A second, removable overlay panel, capable of covering lines two and three of the message, is assembled, bearing the "no activity" message (e.g. "Open Tonight" and a blank line).

- Auxiliary information signs, those with information regarding alternative routes, are entirely covered when their message is not in service. This covering is made to look like a blank sign and is retroreflective. This is to allow the sign to remain conspicuous at night, both to indicate to drivers that is a location where messages will be presented in the future, and to delineate the presence of the sign so that drivers may avoid colliding with it on the shoulder.

Sign Hardware:

Hardware used in constructing the signs must meet the following criteria:

- The mechanical fixtures allowing the sign to be temporarily overlaid must be robust, capable of withstanding the outdoor elements, and must not interfere with the presentation of the message (i.e. create a non-retroreflective area within the background at night or streak rust on the message).

- The hardware must be tamper-resistant and capable of being locked in either mode.

- Where desired, it is permissible to design the sign in such a way that the removable tab is capable of being stored on-site (e.g. mounted facing inwards on the back side of the sign) provided:

- the message is entirely obscured from view by road users; and

- the mounting is made tamper-resistant.

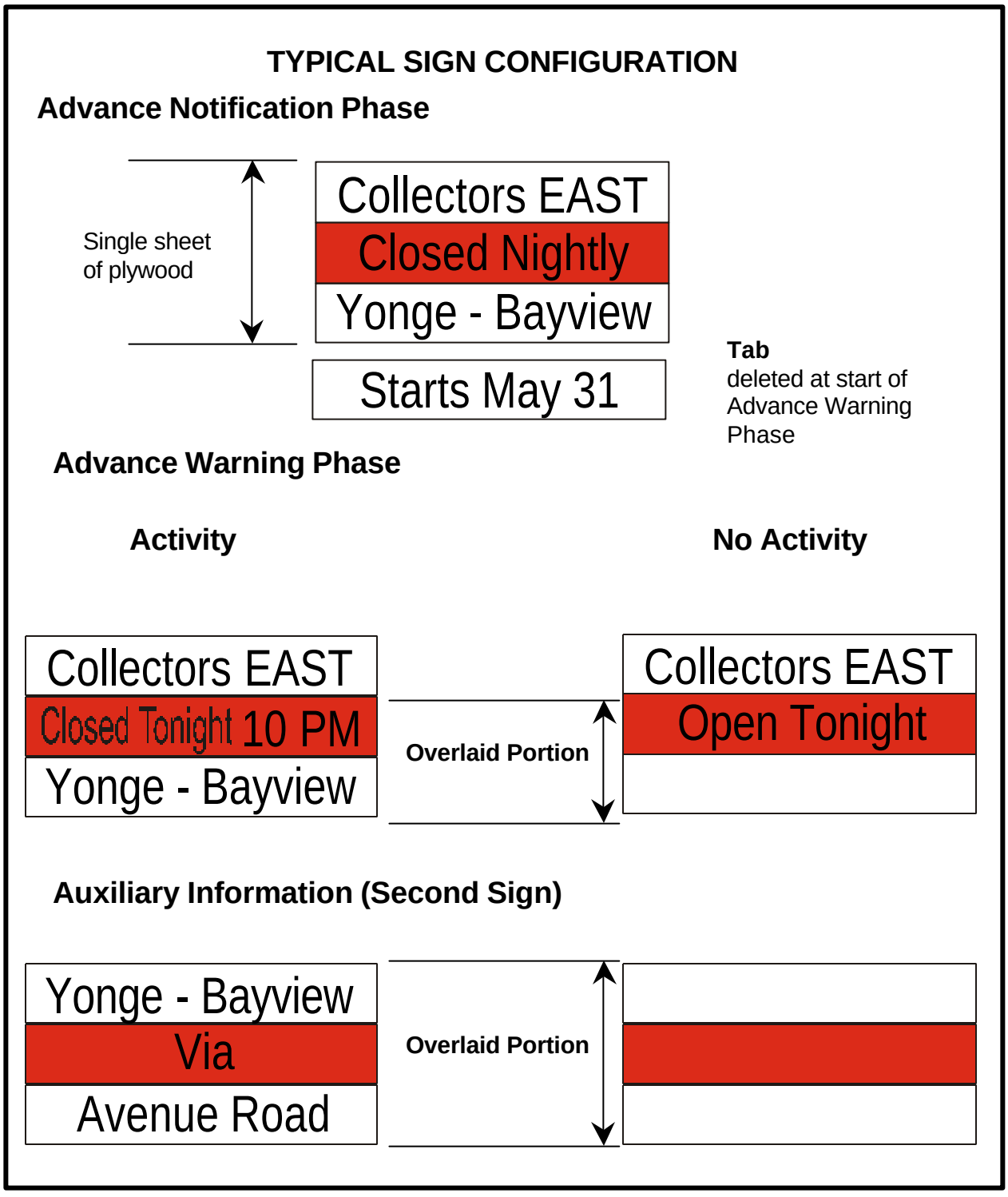


Figure 3.2 – Sign Configuration

Trailblazer Signs:

Refer to Figure 3.3.

Substrate:

- Plywood panels, a minimum of 12 mm in thickness, meeting the most recent iteration of Canadian Standards Association (CSA) specification 0121-M 1978 (Douglas Fir) or 0153-M (Poplar).
- All surfaces are to be filled, sealed and painted.
- The back of sign is to be painted gray.
- Alternatively, metal sign blanks may be used.
- No messages are permitted on the back of the sign, other than barcodes, ownership stamps or similar markings unobtrusive to the driver.

Sheeting Material:

- All portions of the message side of the sign face must be covered in sheeting. All sign sheeting must be retroreflective, and meet the latest iteration of American Society for Testing and Materials (ASTM) specification 4956-90, for Type III material, commonly referred to as "Engineering Grade". More highly retroreflective grades of sheeting materials may be specified, as conditions demand.

Background:

- The base message background must be white retroreflective.

Border:

- An inset black vinyl border (non-retroreflective), equal in width to the stroke width of the message text, and inset by one stroke width, is a requirement.

Lettering:

- All lettering must be black vinyl (non-retroreflective).
- Highway Gothic Font, E – Series, modified is to be used for all text.
- Letter height must be 20 cm unless noted otherwise.

Symbols:

- All detour symbols must be orange retroflective.
- All arrows must be black vinyl (non-retroreflective).

Message Layout:

- Symbols must be positioned as shown in the typical diagrams (see Figure 3.3).

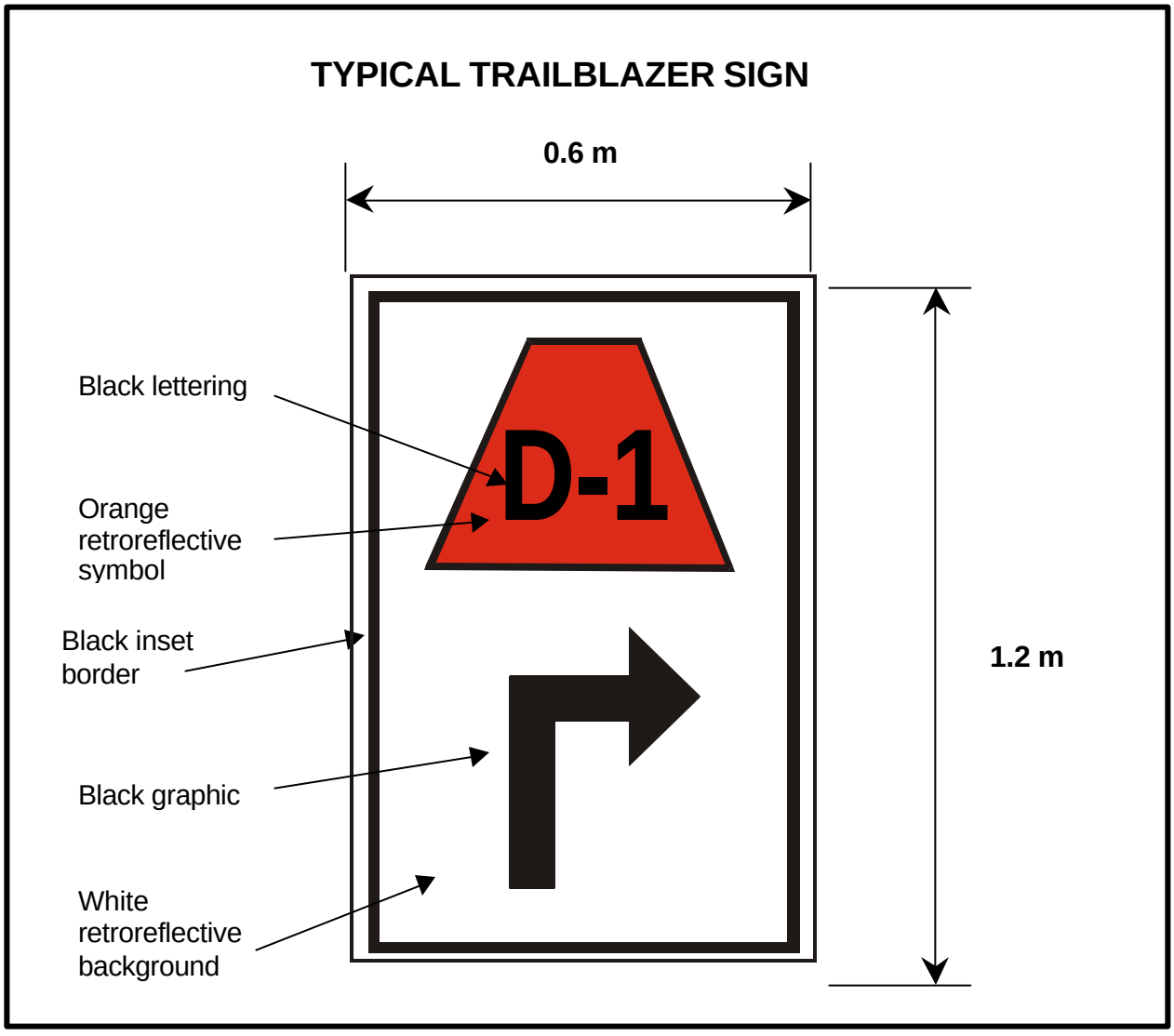


Figure 3.3 – Typical Trailblazer Sign

3.6 Sign Supports

Principles:

Sign supports hold the sign face at a proper height and orientation towards approaching traffic. Sign supports must be sufficiently strong so as to support the weight of the sign and to resist the overturning forces created by wind and passing vehicles, but must also yield in the event of an impact by an errant vehicle to avoid causing more serious damage or injury.

A general sign support configuration is provided in Figure 3.4.

To the extent possible, sign supports must be designed not to snag, ramp or vault an errant vehicle, or to penetrate its occupant cabin. When struck, signs should not create hazardous debris that could strike another vehicle, a pedestrian or a worker.

Support Materials:

- Sign supports must be made of wood.
- Dimensional lumber exceeding 100 mm in width or depth must not be used.

Support Configuration:

- To ensure lateral stability, "legs" of a temporary sign support should be adequately spaced horizontally, and be located near the outer edges of the sign panel.
- To ensure longitudinal stability, the length of the "feet" of a temporary sign support should be equal to the height of the sign
- Back-bracing must not be used (refer to Figure 3.5).
- Tension-bracing is permissible, with the tendons not to exceed 50 mm x 100 mm in width and depth. Where a sign straddles a median separating opposing traffic, care must be taken to ensure tension-bracing is correctly oriented.
- Gussets strengthening the "ankles" of a temporary sign support must not exceed 300 mm in height.

Auxiliary signs may be installed on existing supports, where they are available, or on a single 100 mm x 100 mm post, either direct-buried or supported on a temporary stand, as required.

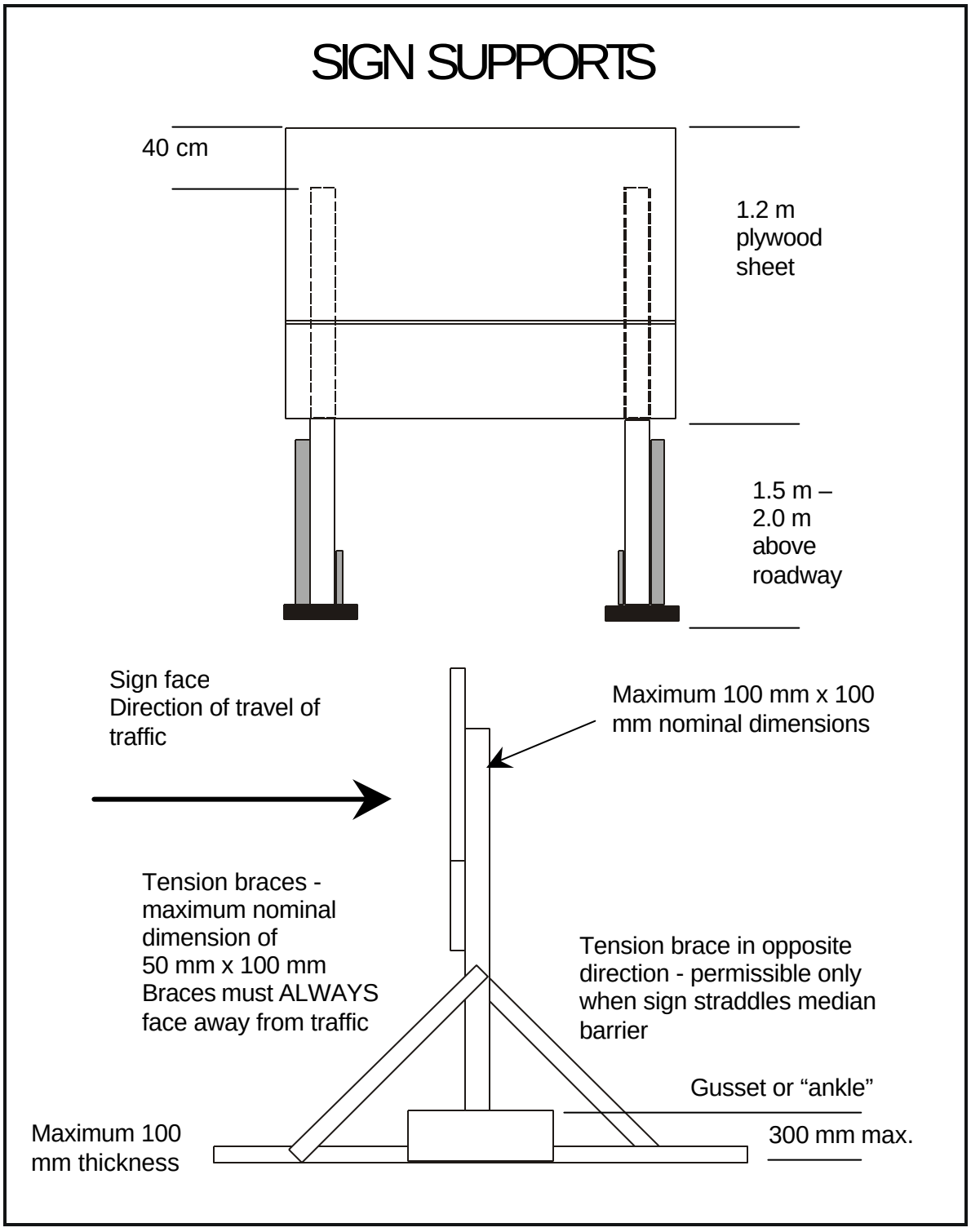


Figure 3.4 – Sign Supports

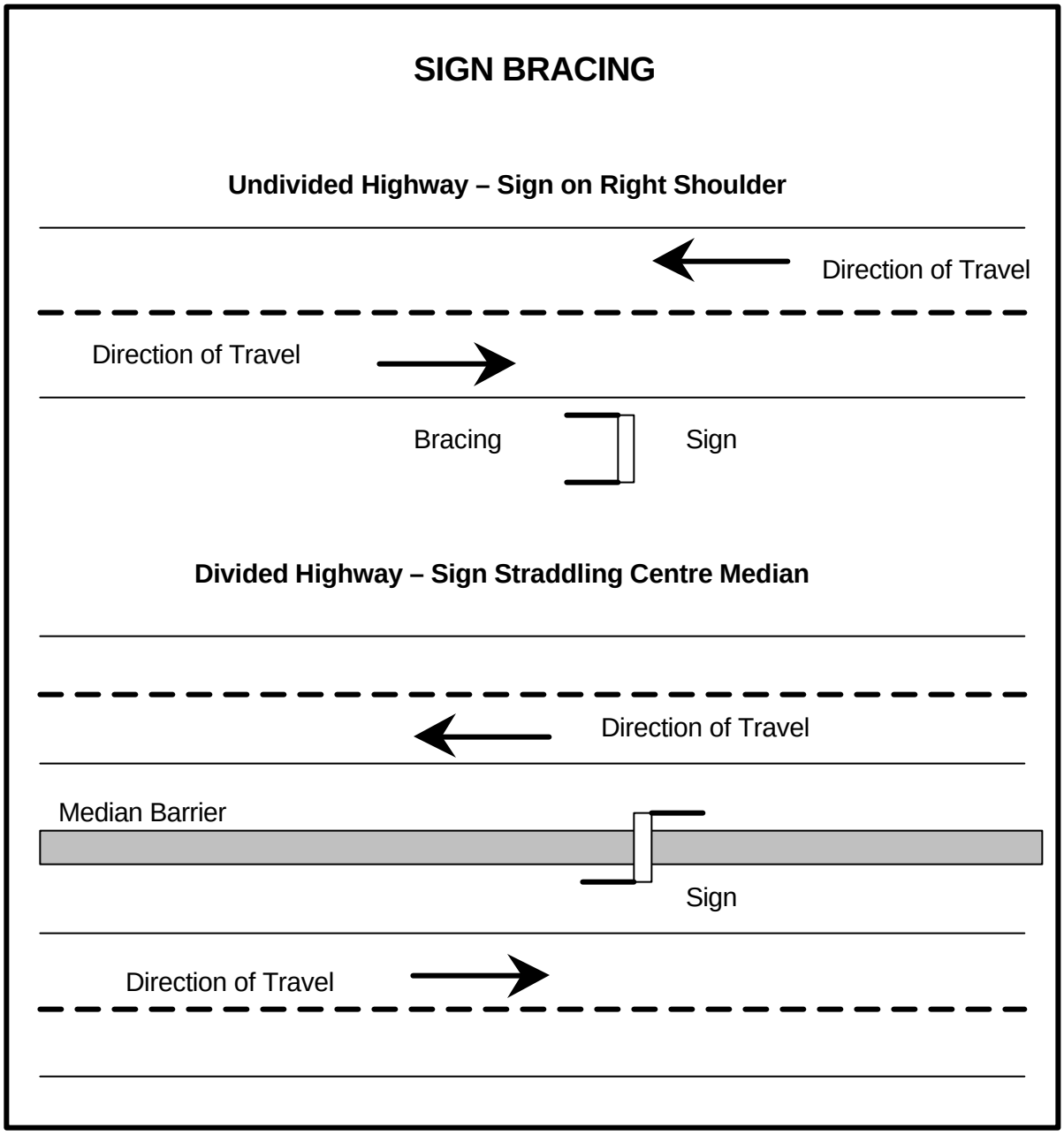


Figure 3.5 – Sign Bracing

Ballasting:

Despite the stability of their design, temporary sign supports that are not direct-buried or attached to some other fixed feature must be ballasted to prevent them "walking" due to wind action. Ballast must only be placed at the base of the sign, and not hung over or upon it. Preferably, it should be in the form of a bagged, dry-granular material, one that will disperse with the transfer of energy if struck. Sandbags are considered suitable.

Positioning of Sign Face:

The sign support must position the sign face as follows:

- a minimum 1.5 m and a maximum 2.0 m above the roadway, measured from the bottom of the sign (or tab, if so equipped) to the surface of the roadway; and
- angled slightly away from approaching traffic, so as not to reflect glare towards them.

Mounting of Signs to Existing Supports – Trailblazing Signs:

In urban areas, signs mounted on existing supports should be a minimum of 2.5 m above the roadway, measured from the bottom of the sign to the surface of the roadway. This is to avoid pedestrians striking their heads on the signs while walking under them, and to give the signs greater visibility over obstructions such as parked vehicles.

3.7 Sign Installation

Principles:

To be effective, signs must be located as follows:

- Where drivers expect to find them – i.e. on the right.
- On divided highways with six or more basic lanes, signs must be placed on both sides of the road, separated longitudinally by a distance of not less than 200 metres.
- Close enough to the roadway to be conspicuous and easily read, but not so close as to constitute a hazard to vehicles in adjacent lanes. Where possible signs should be located immediately beyond the roadway shoulder. Alternatively, they may be placed on the shoulder.
- Adequately spaced from other information sources so as not to overload the driver. Whenever possible and appropriate, temporary conditions traffic management signing should be located away from interchanges or intersections, and away from other, potentially competing information presentations.
- Far enough in advance of the feature being signed-for, thus providing sufficient time to react. This is addressed under Advance Posting.
- Far enough from other traffic signs so as not to obstruct the driver's view of them.
- In place early enough to reach their intended audience.

Staff responsible for installing signs must abide by the requirements of the Traffic Control Manual for Roadway Work Operations while on the roadway.

Timing of Placement - Advance Notification Signing:

Advance Notification Signing must be installed as follows:

- A minimum of seven (7) days before the commencement of work on a commuter and commerce route;
- A minimum of fourteen (14) days before the commencement of work on a recreational route; and
- A minimum of fourteen (14) days before the commencement of work on all other routes.

Longitudinal Placement on Affected Route:

In general, longitudinal placement of signs on the affected route must provide the following:

- A minimum of 30 seconds of travel time in advance of the signed-for decision point (i.e. the exit to an alternative route).
- In advance of a minimum of one opportunity to exit from the express lanes before encountering the signed-for condition.
- In advance of a minimum of two opportunities (i.e. two interchanges) to exit from the collector lanes before encountering the signed-for condition.
- In advance of a minimum of two major intersections on a non-freeway facility before encountering the signed-for condition.

Signing on alternative routes should be placed to provide sufficient time for a driver to perceive and react to the message, and to perform the maneuvers necessary to follow the instructions provided (i.e. make lane changes, access turn lanes, ramps, channelizations, etc.). Typically, 10 - 15 seconds of travel time in advance of the decision point will suffice.

Lateral Placement:

Signs on the affected route should ideally be placed immediately beyond the shoulder or, where this is impractical upon the shoulder itself. Signs must not encroach onto or over the traveled portion of the roadway. On non-freeway routes and municipal roads, particularly in urban areas, signs must not block driveways or accesses; pedestrian areas, walkways or sidewalks; fire hydrants; bus stop shelters or the visibility of other traffic control devices or signing.

Intercept Signing:

Signing deployed to intercept drivers destined for an affected route must reach both those destined for points of access within the sphere of influence of the activity (i.e. interchanges that are closed), and those destined for points immediately upstream. Intercept signing should be placed as follows:

- On all crossing routes that pass within the sphere of influence of the activity, and are thus directly impacted;

- on parallel arterial routes from which driver may choose to travel a crossing roadway within the sphere of influence; and
- on crossing roadways a minimum of two interchanges or intersections upstream of the beginning of the activity area.

3.8 Updating Sign Messages

Principles:

In order to remain relevant and credible, signs warning of a condition or need for action must reflect reality. This is the key to the effectiveness of temporary conditions traffic management. If the signing provided lacks relevance, or is judged to be incredible by drivers, the information it provides will not be trusted or acted upon, and the desired responses among drivers will not be elicited.

When Updating Must Occur:

Advance Notification Signing is removed when Advance Warning Signing is installed.

Advanced Warning Signing should be in place as follows:

- at the time work commences for continuous operations; and
- no less than twelve (12) hours prior to the commencement of work for recurring operations.

In this way, displayed messages such as “Closed” or “Closed Tonight” have relevance.

If a recurring activity will not be occurring on a particular day, then the signing must be updated to reflect this fact a minimum of eight (8) hours before the activity was originally scheduled to begin.

If a recurring activity is cancelled shortly before it was scheduled to occur, for reasons of weather for example, or is terminated four (4) or more hours prior its scheduled termination, then every effort to update the signing to reflect that reality should be made.

All signing should be updated sequentially, by route.

Staff responsible for updating signs must conform to the requirements of the Traffic Control Manual for Roadway Work Operations, or Ontario Traffic Manual Book 7, as appropriate, while on the roadway.

Planning for message updating must take into consideration any hours-of-work restrictions imposed on main line and/or alternative routes.

A typical example of sign updating requirements for a recurring night closure (10 PM start) operation follows:

- 14 days prior to the commencement of work, Advance Notification Signs are installed.

- Prior to the first night of planned operations, in the early morning hours and before the morning rush, Advance Notification Signs displaying “Starts” information are replaced with the message “Closed Tonight 10 PM”. It is intended that this information be read by morning and evening commuters, and others, throughout the day.

- The first recurring closure occurs that night.

- If the closure is planned to occur again on the next night, then, no subsequent alternation to the signing would be required. If however, the roadway will remain open, all sign messages should be updated to read "Open Tonight" in the early morning hours of the second day.

- This pattern would repeat itself throughout the project.

- At the conclusion of the project, all signing should be promptly removed.

3.9 Sign Maintenance

Principles:

Signs are only effective if they do the following:

- attract attention;
- fulfill a need;
- command respect;
- convey a relevant message; and
- provide sufficient time to react.

Temporary conditions signs function in a harsh environment. They are often designed to be inexpensive, for short-term use, and with obsolescence in mind. Nevertheless, temporary conditions signing is essential to safe and efficient highway operations during work zone activities, and must be maintained to the same high standard as permanent signing.

Requirements:

Signs that are missing, mis-aligned, dirty or defaced must be repaired or replaced, as is appropriate. Signs presenting inaccurate information or which are no longer relevant, must be updated or removed, as required.

Signs should be inspected on a daily basis, to ensure they are present, properly aligned, clean and legible, free from the effects of damage or vandalism, and are displaying current and correct information. Those responsible for overseeing the work of the contractor should ensure this is done, noting any discrepancies in the project log.

Where appropriate, incentives and dis-incentives based on performance should be imposed, to achieve the desired level of compliance.

3.10 Sign Removals

Principles:

Signed messages must be relevant and credible if they are to be accepted and followed. Signs that are no longer relevant or required must be removed promptly, to preserve the credibility of those that remain.

Requirements:

All signing, including main line, crossing roadway, upstream crossing roadway and alternative route signing, when used, must be kept current and credible through a planned program of message updating to reflect actual or planned conditions, and sign relocation or removals, as required.

Where conditions change, every effort should be made to update the information displayed to drivers.

Where used, Advance Notification Signing must be removed immediately prior to the commencement of work operations, and be replaced with Advance Warning Signing.

Sign messages that are no longer relevant should be covered immediately. When no longer required, sign supports should be removed within twenty-four (24) hours.

At the conclusion of a project, all temporary signing must be removed from all roadways.

3.11 Signing in Designated Bilingual Areas

Principles:

The Ontario Ministry of Transportation has policies on the provision of bilingual signing. They are to be followed in all cases, unless specific, written exemptions are provided.

The following is a list of municipalities in Central Region. Those shown in **bold** are designated bilingual areas.

Aurora
Brampton
Brock
Burlington
Caledon
Dundas
East Guillimbury
Etobicoke (City of Toronto)
Flamborough
Fort Erie
Georgina
Grimsby
Halton
Halton Hills
City of Hamilton
Regional Municipality of Hamilton-Wentworth
King
Lincoln
Markham
Milton
City of Mississauga
Newcastle
Newmarket
Regional Municipality of Niagara
City of Niagara Falls
Niagara on the Lake
North York (City of Toronto)
Oakville
Oshawa
Regional Municipality of Peel
Pelham
Pickering
City of Port Colborne
Richmond Hill
St. Catharines
Scarborough (City of Toronto)
Scugog
Stoney Creek
Thorold
City of Toronto
Regional Municipality of Toronto
Uxbridge
Vaughan
Wainfleet
City of Welland
West Lincoln
Whitby
Whitchurch-Stouffville
City of York
Regional Municipality of York

For the purposes of continuity, certain highway corridors outside of these municipalities require bilingual signing. Highways on which bilingual signing is required are depicted on Figure 3.6.

Since temporary conditions traffic management signing is almost exclusively text, translation and duplication are the only suitable means of meeting these requirements.

Requirements:

- All messages presented in English must also be presented in French.
- English and French messages must be presented on separate signs.
- English messages are presented first, with the French messages following immediately thereafter.
- A minimum of 150 metres must separate successive messages in English and French.
- Where messages on successive signs are intended to be read as a single message (e.g. an Advance Warning sign followed by an Alternative Route sign), these messages are to be kept together as English pairs, followed by the equivalent French message pairs.
- A minimum of 150 metres must separate successive pairs of messages, where multiple signs are used.
- English and French messages must be identical at the outset, and must be kept identical at all times, by being updated in unison.
- The human factors implications of changes in letter size, font, stroke width and compression are to be considered before changes are implemented to accommodate French text within the confines of standard sign blanks.

For additional guidance, contact the Traffic Office, Ministry of Transportation.

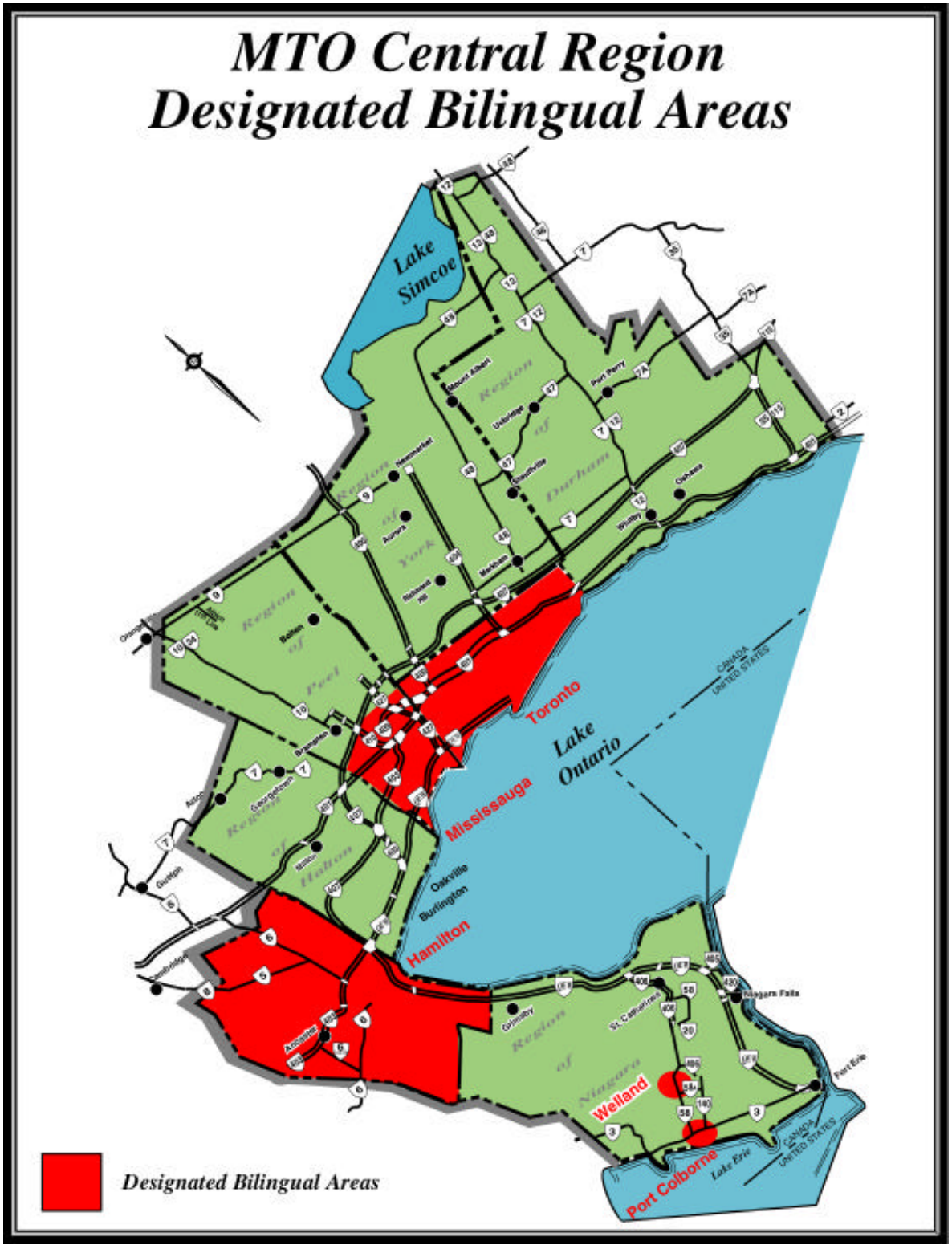


Figure 3.6 - MTO Central Region – Designated Bilingual Areas

3.12 Amending Existing, Permanent Signing

This Section deals with the amendment of Guide and Information Signing for the purposes of *Temporary Conditions Traffic Management (TCTM)*. Amendments to regulatory signing, warning signing, pavement markings and delineation for the purposes of *Temporary Conditions Traffic Control*, is covered by the Ontario MUTCD, the Traffic Control Manual for Roadway Work Operations (TCMRWO), or OTM Book 7 – Temporary Conditions, as applicable.

Principles

The information needs of drivers are not lessened by the presence of work activities on or adjacent to the roadway. On the contrary, the need for information sources that provide drivers with Positive Guidance is often increased in such circumstances.

In addition to the Regulatory and Warning information provided by permanent and temporary devices, drivers continue to require navigational, services and attractions information to complete their journeys.

Work zones often create new navigational tasks that must be communicated - even to familiar drivers. Work zones also introduce visual distractions, create or compound congestion, and interfere with the optimum placement of information sources.

Work zones that create navigational restrictions often render the information presented by permanent guide and information signs invalid. To properly guide and inform drivers in a credible manner, this information must be amended to reflect actual conditions.

Amended information must have high conspicuity, to draw driver attention. It must be credible, to invoke the desired response. It must be brief, legible and explicit, to ensure it is accurately conveyed and can be fully understood. Finally, it must provide sufficient time for decision and action.

The objective of TCTM in regards to permanent signing is to manage the information presentations in order to facilitate the work, while continuing to meet the information needs of drivers in a manner consistent with their capabilities and limitations. Abiding by the rules of Positive Guidance is the best way to accomplish this.

Permanent sources of information on routes, services and attraction are first assessed as to their relevance to conditions during work operations. Irrelevant or unnecessary information is eliminated. Low priority information is relocated to where the driving task is less demanding, or to where adequate roadside space is available.

Essential information is retained, although it may be relocated or conveyed through other, temporary sources. Often essential information is amended or revised, to reflect the realities of the situation during work activities.

Technical Considerations

Signs that are rendered irrelevant by the presence of work activities should be covered or removed, to lessen the information load on drivers and to avoid confusion. Coverings must be designed to

remain in place and be effective for as long as needed. They should be securely fastened to the sign, to avoid pre-mature exposure of the sign message or the covering becoming dislodged and constituting a hazard.

The covering should completely obscure the sign, or the unwanted portion of the sign message, from the view of all road users but should not cause damage to any portion of the sign.

Low priority information, that is location-insensitive, should be relocated to areas of lower relative driver workload. Information made incorrect by work activity-related changes should be revised, updated and, where necessary, relocated in order to be properly presented.

Information that is relocated or amended may be presented in one of two ways, as follows:

- existing, permanent signs may be removed and re-installed on temporary supports, with their messages amended as required; or
- existing signs may be covered or removed, and temporary signs constructed and installed to convey an identical or amended message.

Revised or relocated signing should abide by good practice in regards to uniformity, message presentation, location and position, to the extent possible.

Overlays that amend the information presented on ground-mounted or overhead guide signs must be presented as a black message on an orange retroreflective background.

Wherever possible, the same font, letter height and spacing standards used for permanent signs should be applied to overlays for those signs.

Temporary signs, installed to replace permanent signs at their original location, or at relocated positions may, out of necessity, have to be made smaller than the signs they replace. A smaller sign (with smaller text and graphics) affords the driver less reading time, at an equivalent speed. This factor should be taken into consideration when designing such signs. Mitigating measures should also be considered, such as the following:

- reducing the amount of information on the sign;
- splitting the message into two parts, presented on separate signs;
- repeating the message, to provide a second opportunity for it to be read; or
- redundantly presenting the message, through a different source (e.g. varaible message signs).

Down-arrows on overhead guide signs should be removed or overlaid when lane shifts render them incorrect. Overlays should match the background colour of the overhead sign.

Overlays to inform drivers of a navigational restriction – that access to Express-Collector Transfer, an Interchange, or a crossing roadway is “Closed” for example, should not obscure the name of the facility or crossing roadway. This information being obscured makes it more difficult for the driver to determine what, in fact, is closed, and the relevance of that information.

The use of temporary “Closed Nightly” tabs on permanent guide signs should be

avoided, as they cannot be amended on a daily basis, as changes occur in conditions. Their presence detracts from the credibility of other, more accurate messages.

Wind loading is a critical consideration in the design of large signs, as is vertical clearance beneath overhead signs that encroach over the traveled portion of the roadway. Accordingly, overlays must not extend beyond the boundaries of the existing sign face being overlaid, and thus increase its surface area in any dimension.

For guidance on attaching overlays to aluminum extruded signs, contact the MTO's Provincial Sign Shop.

Guide Signing

Route, Direction and Destination

Route, direction and destination signing is essential to the navigational component of the driving task. It provides information on route names and numbers, cardinal direction, and the major destination or destinations serviced by those routes – usually population centres, modal facilities (e.g. airports), or provincial/international border crossings. This information is usually presented well in advance of decision-points. It assists drivers in orienting themselves within the roadway network, in making route selection decisions, and in being prepared to take appropriate action when decision-points are reached.

Where such information must be relocated, or where traffic must follow a detour to reach the identified route or destination, it is essential that this new information be clearly, conspicuously, and explicitly provided, with adequate time for the driver to read, comprehend and respond to it.

Where new or revised routings are introduced, the use of pre-advance signing – message presentations providing additional explanation of the route and its destination (e.g. "Destination" via "Route" – Pearson International Airport via QEW/Hwy 427) - should be considered.

Location Identification

Location identification signing identifies the boundaries of population centres, along with downtown and business areas. It assists drivers in orienting themselves in regards to destinations, and the likely presence of services and attractions.

Whenever possible, location identification information should be retained.

Decision-points

Successful navigation involves choosing the correct route at decision-points, to reach a destination. A decision-point occurs whenever there is a choice of two or more routes. Express-Collector Transfers, Freeway Interchanges and Intersections are all decision-points, in that they present a route selection task that involves collecting information on the choices available, selecting the correct route, and maneuvering to it.

Work operations that encompass a decision-point make these tasks more difficult. Navigational restrictions may be imposed, necessitating the identification and use of alternative routes. Work zone intrusions may change the configuration of the decision-point, requiring amendments to information presentations in advance of the

location. Increased congestion, resulting from reductions in capacity imposed by the work activity, may interfere with maneuvering, making it more difficult to reach a particular route. In these circumstances, drivers become even more reliant on navigational information sources to make and implement route selection decisions.

Clear, explicit route guidance, that provides sufficient time for decision-making and maneuvering, facilitates less turbulent, more orderly traffic flow, by avoiding confusion and last-minute maneuvers. Attention paid to properly informing drivers of available routes, destinations, alternatives routes and correct lane choices upstream of the work zone can make traffic operations within the work zone safer and more efficient.

Drivers who arrive at a decision-point within the work zone with a clear understanding of their route choices, and with their route selection decisions behind them, are potentially at a lower level of workload, and more capable of attending to high-priority speed and path decisions.

Information Signing

Emergency/Modal Facilities and Services

Signing for emergency facilities such as police stations, hospitals, etc. and modal facilities such as bus and train stations may require relocation during work activities. The provision of appropriate temporary signing, or the accommodation of relocated permanent signing on temporary supports, must be considered. Where necessary, alternative routes to these facilities should be established, with appropriate consultation.

Service Centers

Signing for service centers may require relocation during work activities. If the center is to remain open, the provision of appropriate temporary signing, or the accommodation of relocated permanent signing on temporary supports, should be considered.

Where service centers are rendered inaccessible, signing should reflect that the facility is closed. Temporary signing that provides distance information to the next accessible facility should be considered.

Essential Motorist Services, Tourism Operations

Signing for essential motorist services or tourism operations may require relocation during work activities. These signs are owned and administered by a private sector delivery agent, who should be consulted in all such circumstances. The agreement between the delivery agent and the MTO requires reasonable efforts to accommodate the continued provision of essential motorist services and tourism operations signing during work activities.

If access to the service providers and/or tourism operations is to be maintained via an alternative route, the provision of appropriate temporary signing, or the accommodation of relocated permanent signing on temporary supports, should be considered.

Where essential motorist services or tourism operations are rendered inaccessible, signing should reflect that the facility is closed. Responsibility for such

provisions should be discussed with the delivery agent, and the operator.

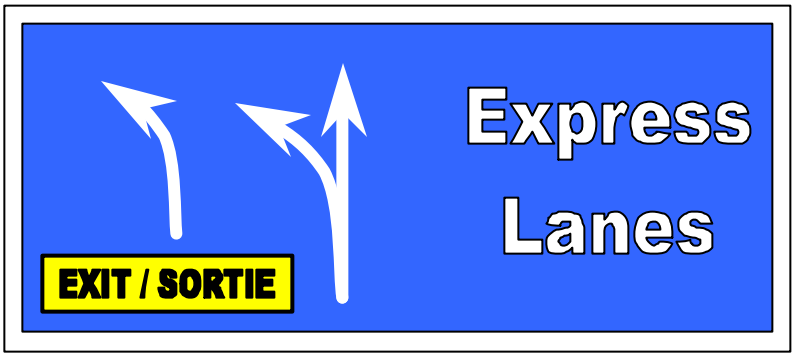
Examples of Amended Signs

Examples of typical amendments to route guidance and navigation signs are shown in Figure 3.7.

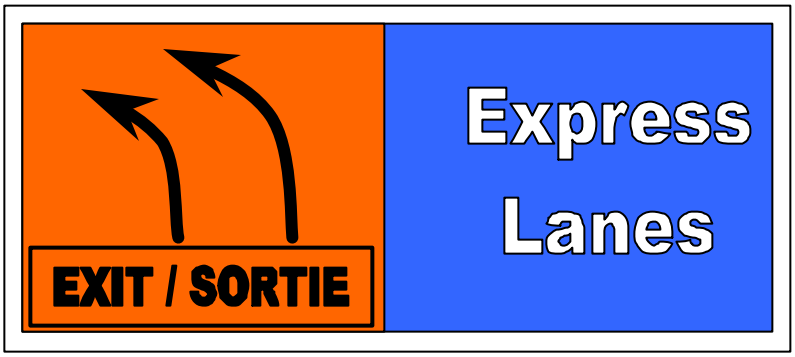
TYPICALS OF AMENDED SIGNS

a) Collector-to-Express Transfers

Permanent Overhead Sign



Amended Lane Arrangement



Transfer Closed

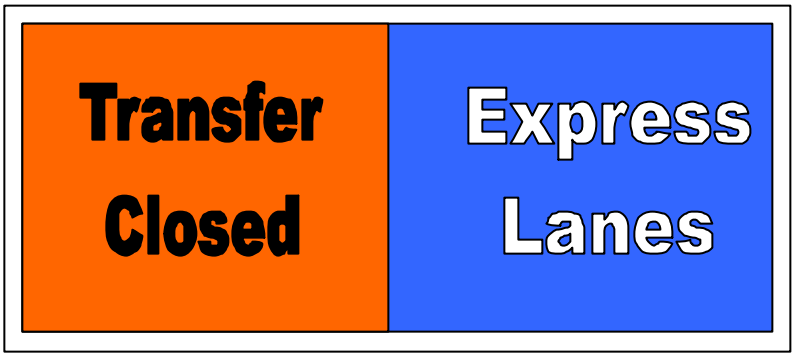


FIGURE 3.7(a) - Typicals of Amended Signs

b) Advance Signing in Express

Advance Sign in Express for Express-to-Collector Transfer

Identification of an Additional Interchange to be Served by Express-to-Collector Transfer

Turn-off Sign at Express-to-Collector Transfer With Additional Interchange Identified

FIGURE 3.7(b) - Typicals of Amended Signs

c) Signing in the Collectors

"Pull-Through" Sign in Collectors

Interchange Shown as Closed on Pull-Through Sign

Down-Arrows Covered Due to Lane Shift

FIGURE 3.7(c) - Typicals of Amended Signs

d) Interchange Signing - Overhead

Interchange Advance Signing

Advance Signing of Amended Lane Arrangement at Intersection

Advance Posting of Interchange Closure

FIGURE 3.7(d) - Typicals of Amended Signs

d) Interchange Signing – Overhead (Con't)

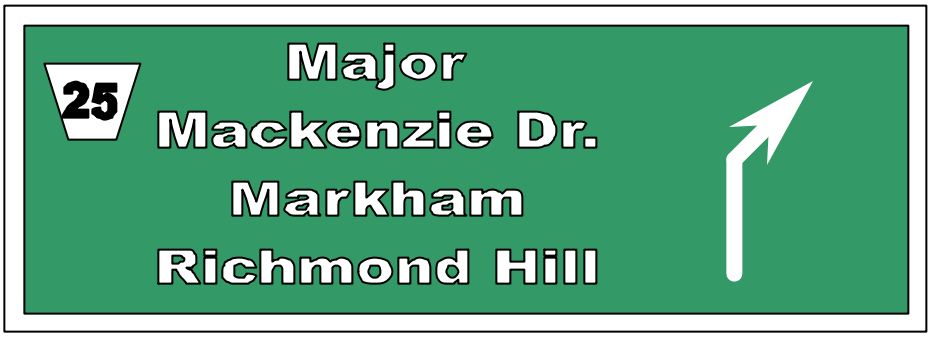
Interchange Turn-off Signing

Interchange Turn-off Signing – Interchange Closed

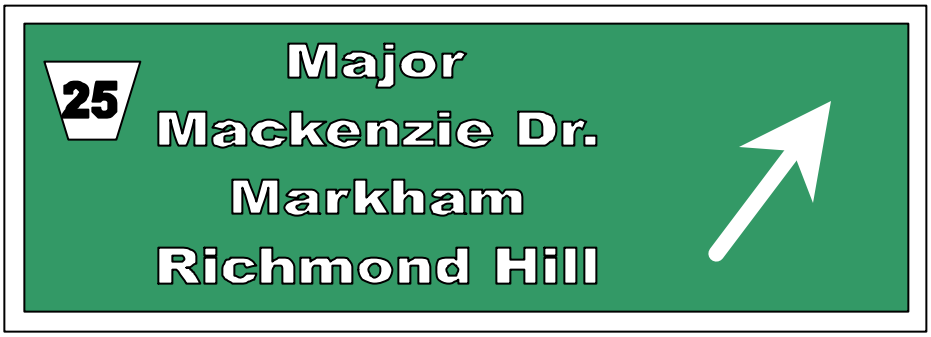
FIGURE 3.7(e) - Typicals of Amended Signs (Con't)

e) Interchange Signing – Ground-Mounted

Typical Advance Sign



Typical Turn-off Sign



Signing of Interchange Closures

FIGURE 3.7(f) - Typicals of Amended Signs

3.13 Integration with Variable Message Signing

This section addresses the integration of Variable Message Signs (VMS) and Portable Variable Message Signs (PVMS) into TCTM planning.

Large, overhead VMS are currently in use on selected corridors within Central Region. They are used to communicate information to drivers regarding recurring congestion (to balance demand between the Express and Collector streams of complex freeways, and between parallel routes), and to facilitate incident management. These activities take priority over all other uses. Accordingly, VMS messages may supplement TCTM information, but cannot be relied on as a conduit for its delivery.

In the last several years, Central Region has successfully employed what were PVMS, in long-term temporary installations upstream of major work zones. Placed strategically, highly conspicuous and capable of receiving message text downloaded remotely, they have proven effective in communicating relevant, up-to-the-minute information to drivers regarding conditions ahead.

Trailer-mounted, PVMS have been used in a similar fashion, on projects of shorter duration or with continuously shifting areas of activity (e.g. resurfacing projects).

PVMS offer a number of benefits over static signing. They are as follows:

- PVMS are highly conspicuous and command driver attention;
- PVMS are capable of presenting multi-part messages, of greater total content, than a single static sign;
- PVMS messages can be updated or terminated immediately;
- depending on the sophistication of the device, PVMS messages can be amended remotely;
- use of PVMS may lessen the need for static signing, reducing the overall information load imposed on drivers; and
- the presence of PVMS devices conveys a sense importance to the work zone, commanding driver respect.

PVMS also have a number of limitations, including the following:

- PVMS are relatively expensive to purchase or lease;
- like static signs, PVMS are vulnerable to tampering or vandalism, when either unattended or in use;
- PVMS require periodic maintenance and, depending on the technology employed, and may require periodic replenishment of their energy supply;
- PVMS pose a greater fixed object hazard than a static sign, and must be located with this consideration in mind;
- PVMS can be difficult to read under some lighting conditions;
- depending on their size and sophistication, the message presentation capabilities of PVMS may be limited;
- messages must be updated promptly, to retain their credibility;
- messages must use consistent terminology, and standard contractions, to remain comprehensible; and

- if they are too long or complex, messages may pose a distraction for drivers.

MTO has developed specifications as to what types of PVMS are permissible for use on provincial highways, along with standards detailing how they should be deployed, and guidelines for message development and presentation intended to promote uniformity. Current information is available from the Advanced Traffic Management Section of the Central Region Traffic Office.

CHAPTER 4

APPLICATION GUIDANCE

TABLE OF CONTENTS

4.1 Introduction

This section uses typical, generic examples to provide guidance in the application of signing elements described in the previous Chapter.

4.2 Complex Freeway – Recurring Closure of Express Lanes

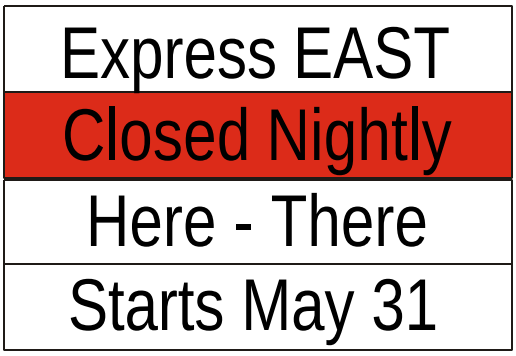
Most recurring closures involve night work. A recurring closure of the express lanes of a complex freeway can be initiated where the complex freeway begins, or at any express-to-collector transfer lane. By blocking subsequent collector-to-express transfers downstream, it can then be extended as necessary.

Since navigational freedom is not compromised (through traffic is accommodated by the collector lanes, and no interchanges are exclusively accessed from the express lanes), the key impacts from the driver's perspective will be capacity-related.

Message Signed During Advance Notification Phase

During the advance notification phase, drivers are informed of the direction and the stream to be impacted, the type of impact anticipated, the extent, and when activity will begin. This signing would be located as follows:

1. If closure is at the beginning of the complex freeway (Figure 4.1), and all traffic is being directed into the collectors:
   - at least two interchanges in advance of the upstream end of the closure; and
   - just in advance of the site of the closure.
2. If closure is at the site of an express-to-collector transfer within a section of complex freeway (Figure 4.1), and again all traffic is being directed into the collectors via the transfer lane:
   - in the collectors, upstream of the preceding collector-to-express transfer and a minimum of two interchanges in advance of the last open express-to-collector transfer;
   - in the express lanes upstream of the preceding express-to-collector transfer; and
   - in the express lanes, just in advance of the site of the closure.



Advance Notification Sign (ANS)

If the closure encompasses one or more collector-to-express transfers downstream, advance notification is provided at those locations also. Refer to Sections 4.4 and 4.5 on Transfer Closures.

ANS on the crossing roadways within the affected area and immediately

upstream of it may also be considered, as a prelude to providing IARS or IDRS on those routes as a congestion management measure. Refer to Section 4.22.

Message Signed During Advance Warning Phase

Once the activity is underway, drivers approaching the affected area are informed of the condition, along with its location and extent.

This signing would be located as follows:

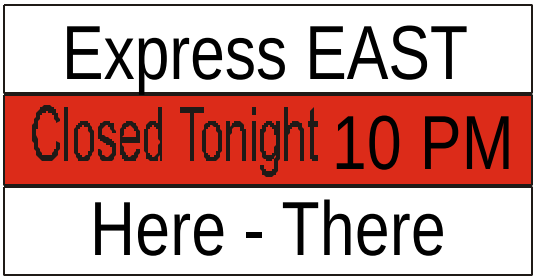
1. If closure is at the beginning of the complex freeway (Figure 4.1), and all traffic is being directed into the collectors:

    - at least two interchanges in advance of the upstream end of the closure; and
    - immediately before the express-collector split.

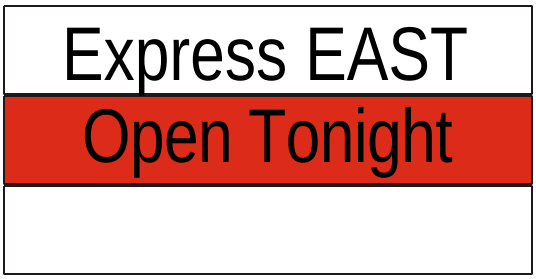
2. If closure is at the site of an express-to-collector transfer within a section of complex freeway (Figure 4.1), and again all traffic is being directed into the collectors via the transfer lane:

    - in the collectors, upstream of the preceding collector-to-express transfer and a minimum of two interchanges in advance of the last open express-to-collector transfer;
    - in the express lanes upstream of the preceding express-to-collector transfer; and
    - immediately before the express-to-collector transfer at the site of the closure.

During the Advance Warning Phase, Guide and Information signs referencing the closed section of the roadway will require amendment so as to provide correct and credible information (e.g. Closed Nightly appended to sign). Refer to Chapter 3, Section 3.12 for guidance in this regard.



Advance Warning Sign (AWS) – Work Activities Planned



Advance Warning Sign - Work Activities Not Planned

If the closure encompasses one or more collector-to-express transfers downstream, advance warning is provided at those locations also. Refer to Sections 4.4 and 4.5 on Transfer Closures.

Where it is desired to divert some portion of the demand in the collectors during the closure onto alternative, parallel routes, ARS or DRS signing may be used to delineate a bypass route. Refer to Section 4.22.

Temporary Conditions Traffic Management: Advance Notification, Advance Warning and Alternative Route Signing for Provincial Highways

If deemed necessary, IARS or IDRS signing may be provided on crossing roadways within the affected area and immediately upstream of it. This may be done as a congestion management strategy, to manage demand in the collectors during the closure, by directing traffic destined for the freeway facility onto alternative, parallel routes. Refer to Section 4.22.

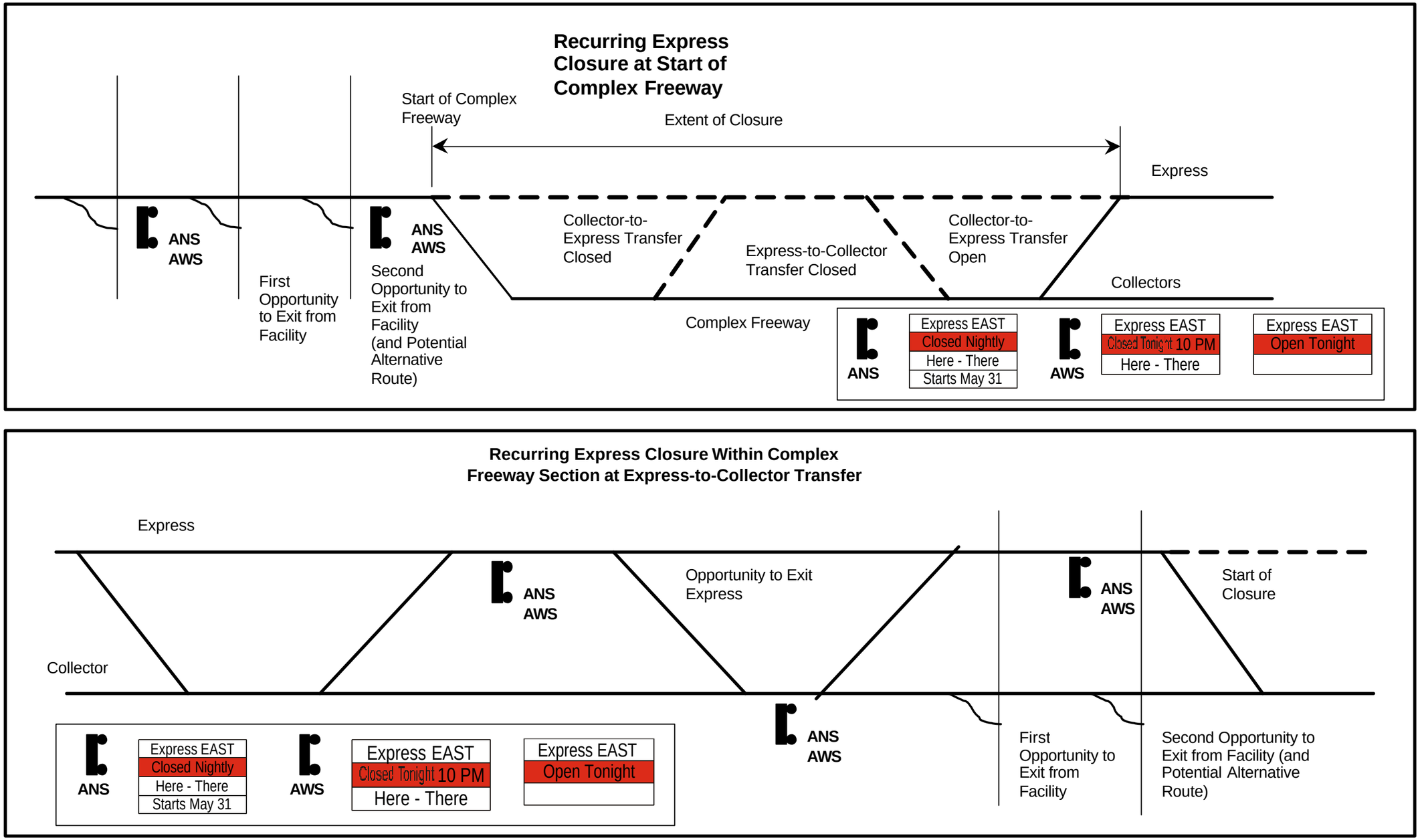


Figure 4.1 – Recurring Closure of Express Lanes – Complex Freeway

4.3 Complex Freeway – Recurring Closure of Collector Lanes

Most recurring closures involve night work. A nightly closure of the collector lanes of a complex freeway can be initiated where the complex freeway begins or at any collector-to-express transfer lane.

A closure of the collector lanes can be extended as necessary, by blocking subsequent express-to-collector transfers and interchange on-ramps downstream.

A closure of the collectors impacts the capacity of the facility. It also imposes significant navigational restrictions on drivers using the affected route, and those wishing to access it from parallel and crossing routes. Interchanges eclipsed by the closure are unavailable to traffic on the facility, and are closed to traffic wishing to enter. Navigational restrictions on the route must be fully communicated to drivers and mitigated through the provision of alternative routes. Other traffic drawn to the facility may also require information and redirection to avoid frustration and delay.

During the activity, two types of traffic on the affected route must be managed, as follows:

1. Through traffic. Through traffic must be reassured of the following:

    - that the express lanes are open; and
    - that they should remain in the express, or move into the express from the collectors, rather than exiting the facility.

2. Traffic destined locally. These are drivers whose path would otherwise have taken them through the collectors to one of the closed interchanges. They require the following information:

    - if they are in the express lanes, guidance in advance of an upstream express-to-collector transfer, to exit the express lanes early and move into the collectors;
    - in the collectors, downstream of the express-to-collector transfer noted above, guidance to a suitable interchange upstream of the closure, where an alternative route has been identified; and
    - depending on the circumstances, route guidance in the form of alternative route signing (ARS) or detour route signing (DRS), leading them to the crossing roadways otherwise serviced by the closed interchanges.

The provision of ARS or DRS to overcome the navigational restrictions imposed on drivers exiting the affected facility can be augmented with a return route back to the affected facility, downstream of the work zone, to provide a bypass route. This may be considered were appropriate as a congestion management strategy.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. ANS should be considered for these roadways, as a prelude to providing IARS or IDRS. By this means, drivers destined for interchanges within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream

of the affected area during the advance warning period. Refer to Section 4.22 for more information on implementing these strategies.

Message Signed During Advance Notification Phase:

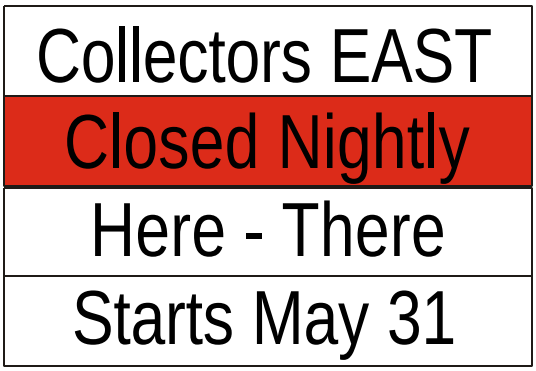
During the advance notification phase, drivers are informed of the direction and the stream to be impacted, the type of impact anticipated, the extent, and when activity will begin. This signing would be located as follows:

1. If closure is at the beginning of the complex freeway (Figure 4.2), and all traffic is being directed into the express:

    - at least two interchanges in advance of the upstream end of the closure; and
    - just in advance of the site of the closure.

2. If the closure is at the site of an collector-to-express transfer within a section of complex freeway (Figure 4.2), and again all traffic is being directed into the express via the transfer lanes:

    - In the express, upstream of the express-to-collector transfer preceding the interchange intended to access the alternative route,
    - in the collectors upstream of the preceding collector-to-express transfer and a minimum of two interchanges in advance of the closure; and
    - just in advance of the site of the closure.

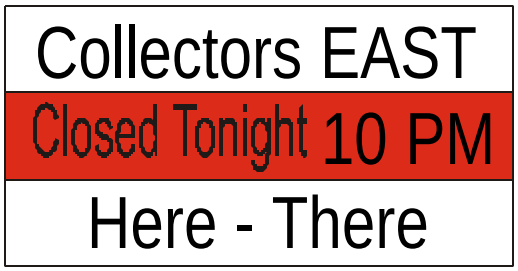


Advance Notification Sign (ANS)

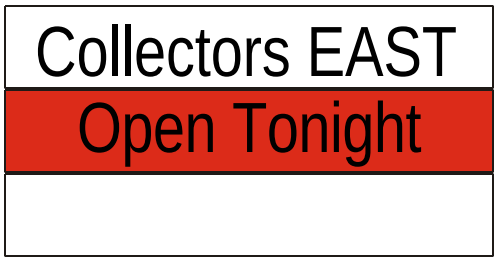
If the closure encompasses several express-to-collector transfers downstream, advance notification may be provided at those locations also. Refer to the Sections 4.4 and 4.5 on Transfer Closures.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require ANS information. During the closure, drivers destined for interchanges within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area. Refer to Section 4.22 for more information on implementing these strategies.

Message Signed During Advance Warning Phase



Advance Warning Sign (AWS) – Work Activities Planned



Advance Warning Sign (AWS) – Work Activities Not Planned

Once activity is underway, through traffic approaching the affected area is informed of the condition, its location and extent, and may optionally be provided assurance that the express lanes remain open.

1. If closure is at the beginning of the complex freeway (Figure 4.2), and all traffic is being directed into the express:

    - at least two interchanges in advance of the upstream end of the closure; and
    - immediately in advance of the express-collector split.

2. If the closure is at the site of an collector-to-express transfer within a section of complex freeway (Figure 4.2), and again all traffic is being directed into the express via the transfer lanes:

    - In the express, upstream of the express-to-collector transfer preceding the interchange intended to access the alternative route;
    - in the collectors upstream of the preceding collector-to-express transfer and a minimum of two interchanges in advance of the closure; and
    - immediately in advance of the collector-to-express transfer at the site of the closure.

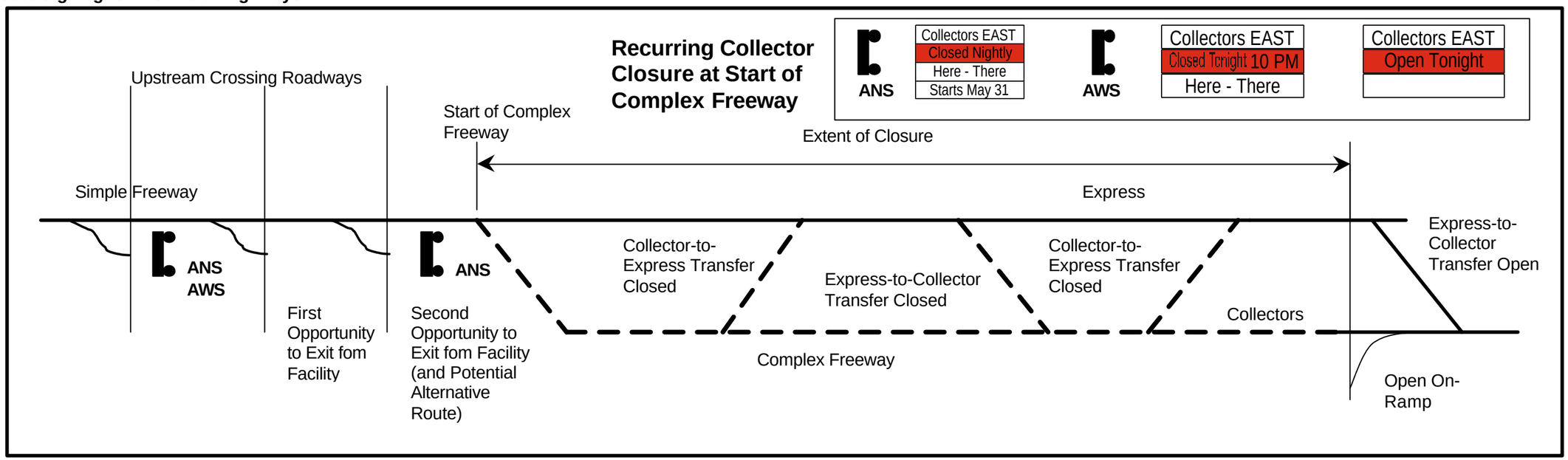
During the Advance Warning Phase, Guide and Information signs referencing the closed section of the roadway and affected points of access will require amendment so as to provide correct and credible information. Refer to Chapter 3, Section 3.12 for guidance in this regard.

If the closure encompasses one or more express-to-collector transfers downstream, advance notification is provided at those locations also. Refer to the Sections 4.4 and 4.5 on Transfer Closures.

Where it is desired to divert some portion of the demand in the express during the closure onto alternative, parallel routes, augmentations to ARS or DRS signing provided to overcome navigational restrictions may be used to delineate a bypass route. The route would rejoin the affected facility, downstream of the work zone. Refer to Section 4.22.

Temporary Conditions Traffic Management:
Advance Notification, Advance Warning and
Alternative Route Signing for Provincial Highways

IARS or IDRS signing should be provided on crossing roadways within the affected area and immediately upstream of it. This is necessary to overcome the navigational restrictions imposed by on-ramp closures and to avoid road users entering the affected facility immediately upstream of the work zone and thus becoming either caught in congestion or forced into the express and led past their intended exit. This strategy may also serve to manage demand in the express during the closure, by directing traffic destined for the freeway facility onto alternative, parallel routes. Refer to Section 4.22.



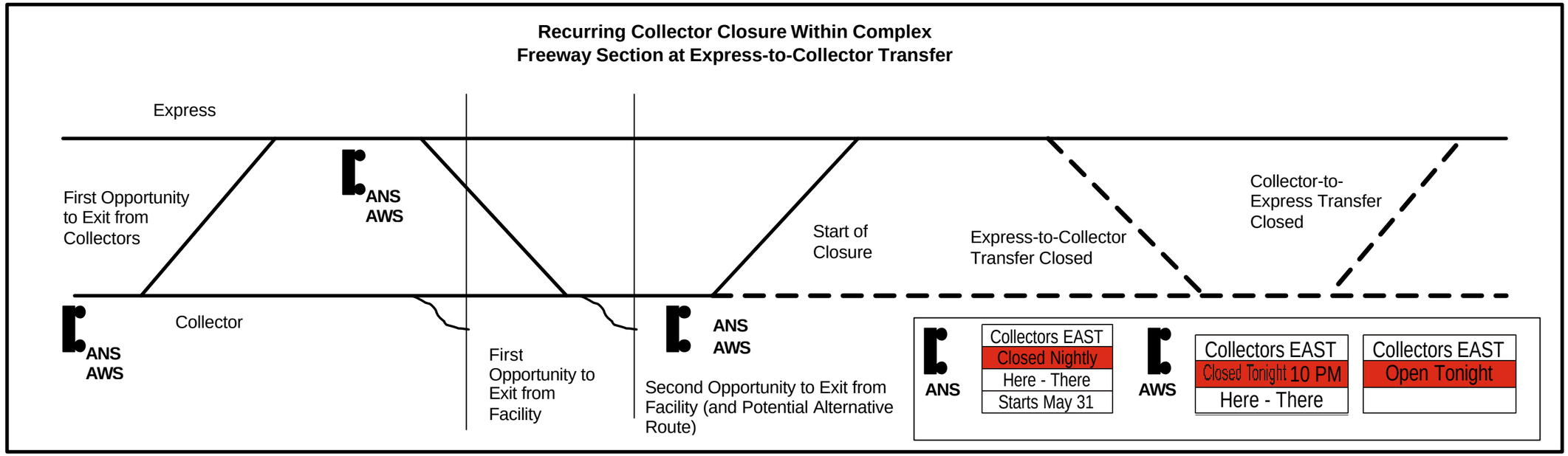


Figure 4.2 – Recurring Closure of Collector Lanes – Complex Freeway

4.4 Complex Freeway – Full Closure of Transfer Lanes

A full closure of a transfer lane on a complex freeway can effect either a collector-to-express transfer or an express-to-collector transfer. The implications on traffic operations of each are quite different. Transfer lane closures are normally associated with recurring closures of either the express or collector lanes, or with partial closures in either stream.

The closure of a collector-to-express transfer will result in some reductions in capacity brought about by imbalances in demand between the two traffic streams. Imbalances in capacity and demand are normally addressed by traffic moving between the collectors and the express lanes. No navigational restrictions are created however, as all interchanges remain fully accessible from the collector lanes. Advance notification and warning signing need only be considered in the context of public relations.

Closure of an express-to-collector transfer (Figure 4.3) is another matter. The provision of advance notification of such major closures is highly recommended.

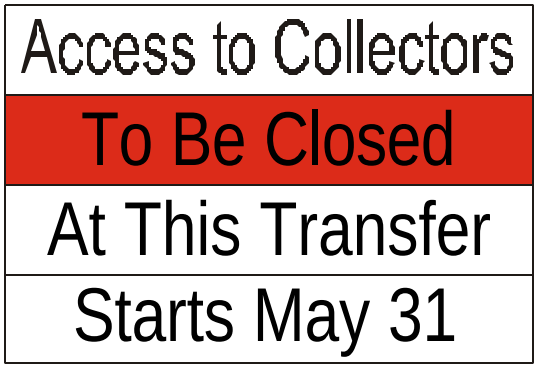
A closure of an express-to-collector transfer impacts the capacity of the facility. It also imposes significant navigational restrictions on drivers using the affected route. These navigational restrictions must be fully communicated to drivers and mitigated through the provision of alternative routes. Drivers in the express must be directed to depart the express lanes at an earlier express-to-collector transfer in order to access interchanges downstream of, and normally serviced by, the affected transfer. Drivers in the collector lanes must not be allowed to move into the express lanes, assuming they can return to the collectors via the next transfer, and thus become trapped in the express lanes by the closure, causing them to miss their exit.

The most effective way to accomplish this is to close transfers in pairs. Where an express-to-collector transfer is to be closed, the matching collector-to-express transfer immediately upstream is also closed. This prevents drivers from moving into the express and accidentally being "trapped" as they near their exit.

Message Signed During Advance Notification Phase:

During the advance notification phase, drivers in the express and the collector lanes are informed of the transfers to be impacted, the type of impact anticipated, and when activity will begin. This signing would be located as follows:

- In the express, upstream of the express-to-collector transfer targeted for closure; and
- In the collectors, upstream of the corresponding collector-to-express transfer located immediately upstream of the transfer targeted for closure.



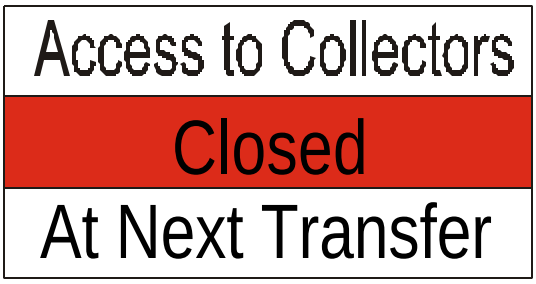
Advance Notification Sign (ANS)

Signed Message During Advance Warning Phase

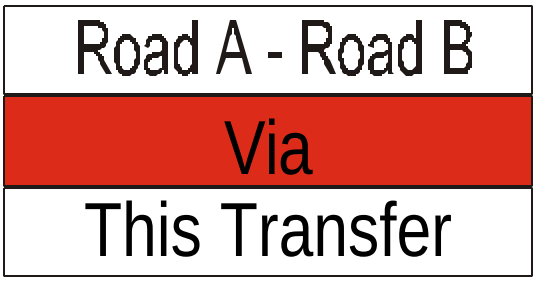
At the commencement of work, Advance Warning Signing (AWS) would be placed as follows:

- In the express, upstream of the express-to-collector transfer preceding one targeted for closure; and
- In the collectors, upstream of the corresponding collector-to-express transfer located immediately upstream of the transfer targeted for closure.

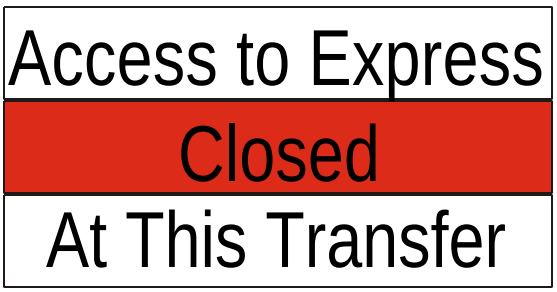
An additional sign, an Alternative Route Sign (ARS), conveying information regarding access to interchanges normally reach via the affected transfer, is added in the express lanes. Read together, the two messages direct drivers to exit the express at the upstream transfer. For additional details, refer to Figure 4.3.



Advance Warning Sign (Express)



Alternative Route Sign (Express)



Advance Warning Sign (Collectors)

During the Advance Warning Phase amendments to guide and information signing will be necessary to overcome the navigational restrictions imposed by the closure. Refer to Chapter 3, Section 3.12 for guidance in this regard.

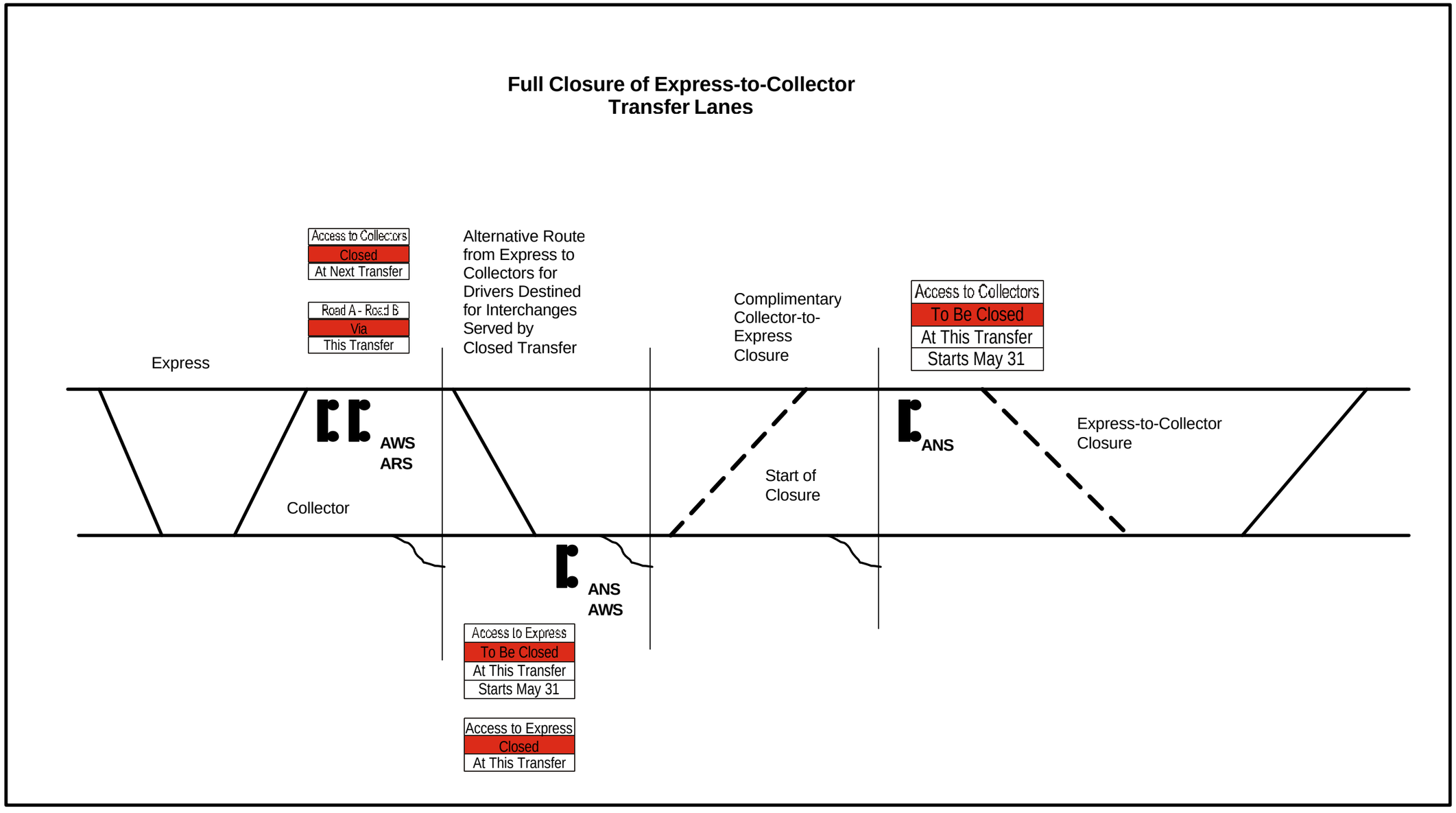


Figure 4.3 – Full Closure of Express-to-Collector Transfer Lanes – Complex Freeway

4.5 Complex Freeway – Recurring Closure of Transfer Lanes

A recurring closure of a transfer lane on a complex freeway can effect either a collector-to-express transfer or an express-to-collector transfer. The implications on traffic operations of each are quite different. Transfer lane closures are normally associated with partial closures (lane closures) in the express lanes, the collector lanes, or both.

The closure of a collector-to-express transfer will result in some reductions in capacity brought about by imbalances in demand between the two traffic streams. Imbalances in capacity and demand are normally addressed by traffic moving between the collectors and the express lanes. No navigational restrictions are created however, as all interchanges remain fully accessible from the collector lanes. Advance notification and warning signing need only be considered in the context of public relations.

Closure of an express-to-collector transfer is another matter. The provision of advance notification of such major closures is highly recommended.

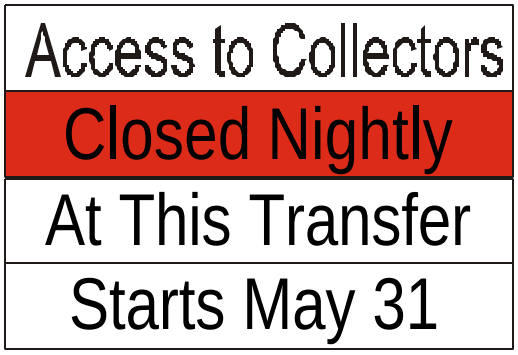
A closure of an express-to-collector transfer impacts the capacity of the facility. It also imposes significant navigational restrictions on drivers using the affected route. These navigational restrictions must be fully communicated to drivers and mitigated through the provision of alternative routes. Drivers in the express must be directed to depart the express lanes at an earlier express-to-collector transfer in order to access interchanges downstream of, and normally serviced by, the affected transfer. Drivers in the collector lanes must not be allowed to move into the express lanes, assuming they can return to the collectors via the next transfer, and thus become trapped in the express lanes by the closure, causing them to miss their exit.

The most effective way to accomplish this is to close transfers in pairs. Where an express-to-collector transfer is to be closed, the matching collector-to-express transfer immediately upstream is also closed. This prevents drivers from moving into the express and accidentally being "trapped" as they near their exit.

Message Signed During Advance Notification Phase:

During the advance notification phase, drivers in the express and the collector lanes are informed of the transfers to be impacted, the type of impact anticipated, and when activity will begin. This signing would be located as follows:

- In the express, upstream of the express-to-collector transfer targeted for closure; and
- In the collectors, upstream of the corresponding collector-to-express transfer located immediately upstream of the transfer targeted for closure.



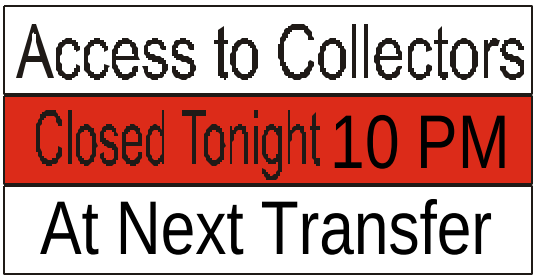
Advance Notification Sign (ANS)

Signed Message During Advance Warning Phase

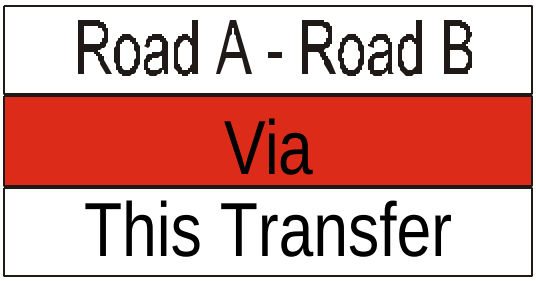
At the commencement of work, Advance Warning Signing (AWS) would be placed as follows:

- In the express, upstream of the express-to-collector transfer preceding one targeted for closure; and
- In the collectors, upstream of the corresponding collector-to-express transfer located immediately upstream of the transfer targeted for closure.

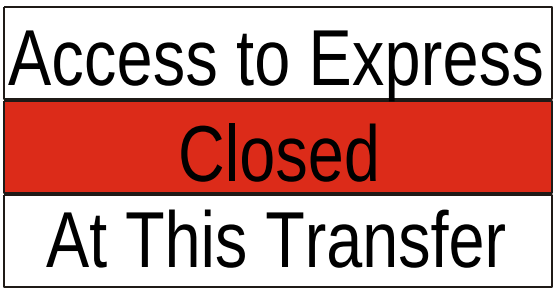
An additional sign, an Alternative Route Sign (ARS), conveying information regarding access to interchanges normally reach via the affected transfer, is added in the express lanes. Read together, the two messages direct drivers to exit the express at the upstream transfer. For additional details, refer to Figure 4.4.



Advance Warning Sign (Express)



Alternative Route Sign (Express)



Advance Warning Sign (Collectors)

During the Advance Warning Phase amendments to guide and information signing will be necessary to overcome the navigational restrictions imposed by the closure. Refer to Chapter 3, Section 3.12 for guidance in this regard.

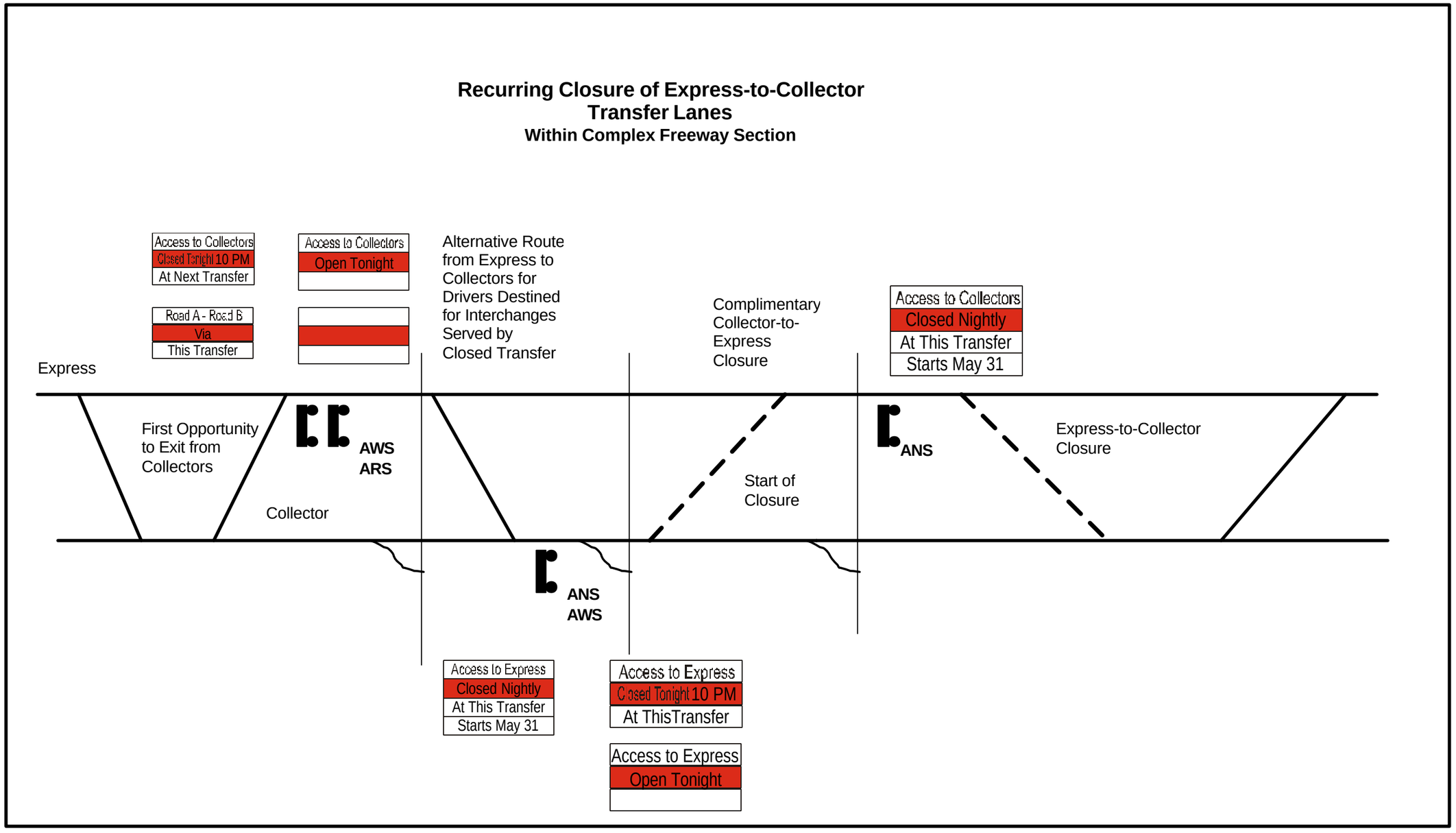


Figure 4.4 – Recurring Closure of Express-to-Collector Transfer – Complex Freeway

4.6 Complex Freeway - Interchange Ramp - Full Closure

A full closure of an interchange ramp may occur in isolation, to permit work to occur on the ramp itself, or it may be incidental to lane closures on the main roadway that prevent the maintenance of access at the ramp location. In either event, ramp closures result in restrictions to navigational freedom, requiring advance notification and advance warning in some instances, and the provision of an alternative route in all cases.

The following guidance applies to ramps on complex freeways. For guidance regarding ramps on simple freeways, see Sections 4.12 and 4.13. For guidance regarding ramps between express and collector lanes, see Transfer Lanes.

Interchange ramps may be classified as follows:

- freeway to crossing roadway ramps (off-ramps);
- crossing roadway to freeway ramps (on-ramps); and
- freeway-to-freeway connections.

The provision of advance notification of freeway-to-freeway ramp closures of any duration is highly recommended.

The closure of an off-ramp or freeway-to-freeway ramp imposes significant navigational restrictions on drivers using the affected route. The closure of an on-ramp places navigational restrictions on those wishing to access the affected route from parallel and crossing routes. Navigational restrictions on the route must be fully communicated to drivers and mitigated through the provision of alternative routes. Other traffic attempting to access the facility via affected ramps may also require information and redirection to alternative points of access to avoid frustration and delay.

Off-Ramps and Freeway-to-Freeway Connections

In circumstances impacting off-ramps and freeway-to-freeway connections, the primary concern is drivers whose planned route includes the affected link. In short-duration circumstances, it may be acceptable to sign the closure at the site, and to direct drivers downstream to the next interchange, with instructions on how to double back and return to their route. For long duration closures however, it is generally more efficient to intercept these drivers upstream of the affected link and direct them to exit at an earlier interchange that provides a suitable alternative route.

The importance of the affected link, the availability and simplicity of alternative routes, the adequacy of existing, permanent signing on the alternative route and the degree of local knowledge among users will determine whether signing is necessary on the alternative route, and to what level it must be provided. In some urban commuter corridors, with a dense grid network of crossing and parallel routes, it may be acceptable simply to inform drivers of the closure (e.g. Access Closed to Road X). If this is done at a point sufficiently in advance, drivers with local knowledge can select an earlier exit of their choosing – or go to the exit beyond and double back, and navigate across a parallel route to their destination. It may be necessary to provide both the advance warning and some minimal instructions to exit at an earlier interchange destination (e.g. Access

Closed to Road X NORTH). Finally, where alternative routes are less obvious or are complicated, it may be necessary to provide detour signing along the alternative route.

Message Signed During Advance Notification Phase:

During the advance notification phase, drivers are informed of the link or links to be impacted, the type of impact anticipated, the extent, and when activity will begin. This is done with signing located directly on the affected ramp(s). Once the closure is underway, signing would be relocated to a suitable point upstream of the alternative route. Refer to Figure 4.5.

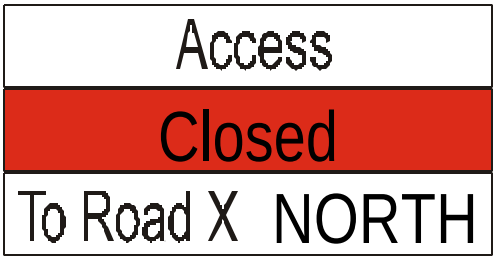
Advance Notification Sign (ANS)

Message Signed During Advance Warning Phase:

Once activity is underway, traffic approaching the affected area is informed of the condition, its location and extent, and of the alternative route (Figure 4.5). If the route involves exiting the affected route early, then signing is placed at a point in advance of the appropriate upstream interchange. If the most suitable alternative route involves by-passing the closed ramp and exiting downstream, the message is placed on the main line, in advance of the closure.

During the Advance Warning Phase, for closures of significant duration, Guide and Information signs referencing the closed ramp will require amendment so as to provide correct and credible information. Refer to Chapter 3, Section 3.12 for guidance in this regard.

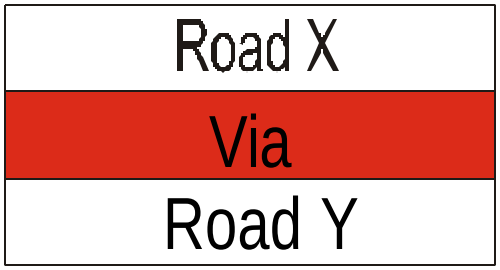
Advance Warning Sign (AWS)



Advance Warning Sign (AWS) - Directional

Alternative Route Signing on Affected Roadway (with unsigned alternative route):

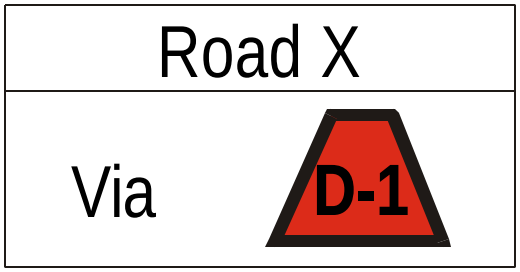
Where alternative routes are obvious and uncomplicated, it may not be necessary to provide detour signing along the alternative route. An Alternative Routes Sign (ARS) may be used to direct drivers to the unsigned, alternative route, where they must use permanent navigational references and local knowledge to reach their destination.



Alternative Route Sign (ARS)

Detour Route Signing on Affected Roadway (with signed alternative route)

Where alternative routes are less obvious or are complicated, it may be necessary to provide detour signing along the alternative route. An Alternative Route Sign is installed following the AWS, and a Detour Route Sign (DRS) is installed on the ramp exit leading to the alternative route. Detour Trailblazing Signs (DTS) are then installed at all decision points along the route. Refer to Section 4.22 for details.



Detour Route Sign (DRS)

On-Ramps to Freeways

Where access to a freeway facility is precluded by the closure of one or more ramps, it is desirable to:

- inform drivers of the planned closure in advance,;
- warn them of its existence during the closure period; and
- provide information on alternative routes to the facility.

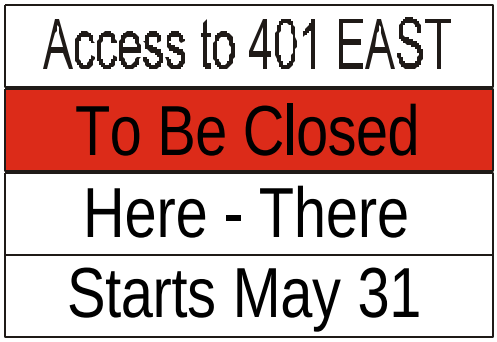
Refer to Chapter 3 Section 3.12 regarding the amendment of permanent signing. Refer to Section 4.22 regarding the provision of alternative route information.

Signing During Advance Notification Phase:

The simplest approach is to place the sign on the ramp itself. Refer to Figure 4.6.

Advance Notification Signing (ANS)

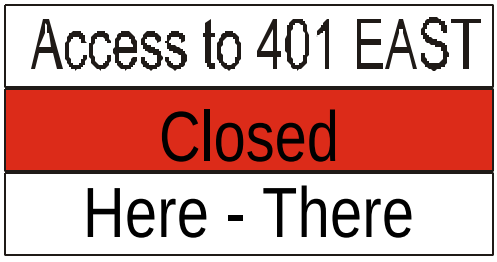
Where multiple ramps are to be closed (such as in conjunction with the closure of the collector lanes on a complex freeway), it is desirable to give additional information, as follows.



Advance Notification Sign (ANS)

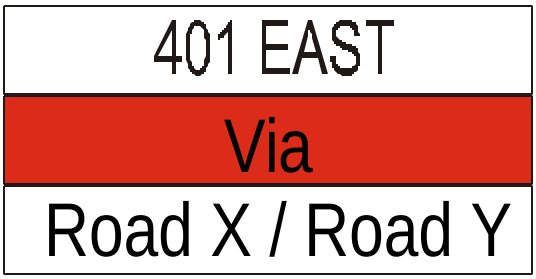
Signing During the Advance Warning Phase

During the Advance Warning Phase, it may be desirable to have drivers by-pass the closed access and proceed elsewhere, following either an unsigned alternative route familiar to drivers with local knowledge, or a more formal, signed detour route. In either case, information regarding the closure is a necessary preamble to any alternative route information.



Advance Warning Sign (AWS)

Logically, it then follows to provide either alternative route information, or a signed detour, should one be necessary.



Alternative Route Sign (ARS)

Detour Route Sign (DTS)

Figure 4.6 illustrates the use of On-Ramp Signing

4.7 Complex Freeway - Interchange Ramp - Recurring Closure

Most recurring closures involve night work. A night closure of an interchange ramp may occur in isolation, to permit work to occur on the ramp itself, or it may be incidental to lane closures on the main roadway that prevent the maintenance of access at the ramp location. In either event, ramp closures result in restrictions to navigational freedom, requiring specific advance notification and advance warning in some instances, and the provision of an alternative route in all cases.

The following guidance applies to ramps on complex freeways. For guidance regarding ramps on simple freeways, refer to Sections 4.12 and 4.13. For guidance regarding ramps between express and collector lanes, see Transfer Lanes.

Interchange ramps may be classified as follows:

- freeway to crossing roadway ramps (off-ramps);
- crossing roadway to freeway ramps (on-ramps); and
- freeway-to-freeway connections.

The provision of advance notification of freeway-to-freeway ramp closures is highly recommended.

The closure of an off-ramp or freeway-to-freeway ramp imposes significant navigational restrictions on drivers using the affected route. The closure of an on-ramp places navigational restrictions on those wishing to access the affected route from parallel and crossing routes. Navigational restrictions on the route must be fully communicated to drivers and mitigated through the provision of alternative routes. Other traffic attempting to access the facility via affected ramps may also require information and redirection to alternative points of access to avoid frustration and delay.

Off-Ramps and Freeway-to-Freeway Connections

In circumstances impacting off-ramps and freeway-to-freeway connections, the primary concern is drivers whose planned route includes the affected link. In short-duration circumstances, it may be acceptable to sign the closure at the site, and to direct drivers downstream to the next interchange, with instructions on how to double back and return to their route. For long duration closures however, it is generally more efficient to intercept these drivers upstream of the affected link and direct them to exit at an earlier interchange that provides a suitable alternative route.

The importance of the affected link, the availability and simplicity of alternative routes, the adequacy of existing, permanent signing on the alternative route and the degree of local knowledge among users will determine whether signing is necessary on the alternative route, and to what level it must be provided. In some urban commuter corridors, with a dense grid network of crossing and parallel routes, it may be acceptable simply to inform drivers of the closure (e.g. Access Closed to Road X). If this is done at a point sufficiently in advance, drivers with local knowledge can select an earlier exit of their choosing – or go to the exit beyond and double back, and navigate across a parallel route to their destination. It may be necessary to provide both the advance warning and some minimal instructions to exit at an earlier

interchange destination (e.g. Access Closed to Road X NORTH). Finally, where alternative routes are less obvious or are complicated, it may be necessary to provide detour signing along the alternative route.

Message Signed During Advance Notification Phase:

Refer to Figure 4.7. During the advance notification phase, drivers are informed of the link or links to be impacted, the type of impact anticipated, the extent, and when activity will begin. This is done with signing located directly on the affected ramp(s). Once the closure is underway, signing would be relocated to a suitable point upstream of the alternative route.

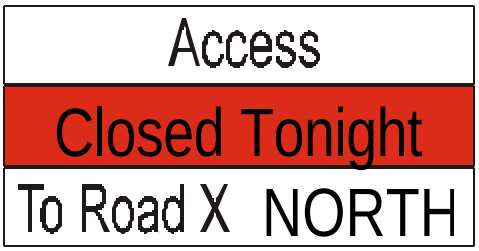
Advance Notification Sign (ANS)

Message Signed During the Advance Warning Phase:

Once activity is underway, traffic approaching the affected area is informed of the condition, its location and extent, and of the alternative route (Figure 4.7). If the route involves exiting the affected route early, then signing is placed at a point in advance of the appropriate upstream interchange. If the most suitable alternative route involves by-passing the closed ramp and exiting downstream, the message is placed on the main line, in advance of the closure.

During the Advance Warning Phase, for closures of significant duration, Guide and Information signs referencing the closed ramp will require amendment so as to provide correct and credible information. Refer to Chapter 3, Section 3.12 for guidance in this regard.

Advance Warning Sign (AWS)



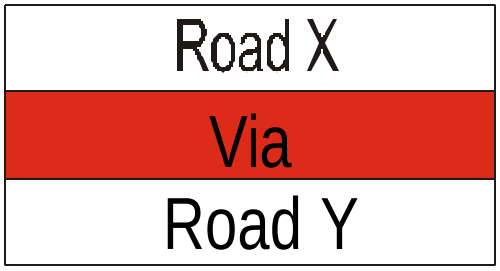
Advance Warning Sign (AWS) - Directional

Advance Warning Sign (AWS) – Closure Not Planned

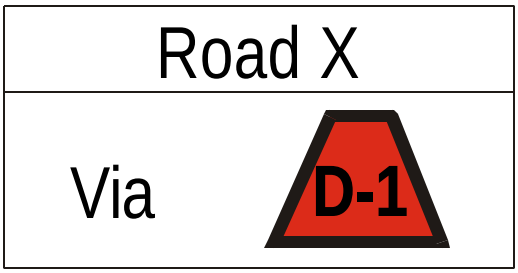
Alternative Route Signing on Affected Roadway (with unsigned alternative route)

Where alternative routes are obvious and uncomplicated, it may not be necessary to provide detour signing along the alternative route. An Alternative Routes Sign (ARS) may be used to direct drivers to the unsigned, alternative route, where they must use permanent navigational references and local knowledge to reach their destination.

This sign must be covered whenever the route is not in effect.



Alternative Route Sign (ARS)



Detour Route Sign (DRS)

Detour Route Signing on Affected Roadway (with signed alternative route)

Where alternative routes are less obvious or are complicated, it may be necessary to provide detour signing along the alternative route. An Alternative Route Sign is installed following the AWS, and a Detour Route Sign (DRS) is installed on the ramp exit leading to the alternative route. Detour Trailblazing Signs (DTS) are then installed at all decision points along the route. Refer to Section 4.22 for details.

This sign must be covered whenever the route is not in effect.

On-Ramps to Freeways

Where access to a freeway facility is precluded by the closure of one or more ramps, it is desirable to:

- inform drivers of the planned closure in advance,;
- warn them of its existence during the closure period; and
- provide information on alternative routes to the facility.

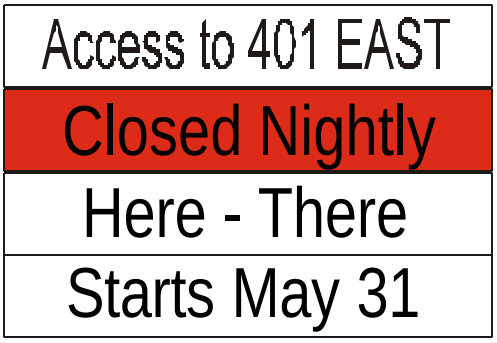
Refer to Chapter 3 Section 3.12 regarding the amendment of permanent signing. Refer to Section 4.22 regarding the provision of alternative route information.

Signing During the Advance Notification Phase:

Refer to Figure 4.8. The simplest approach is to place the sign on the ramp itself.

Advance Notification Signing (ANS)

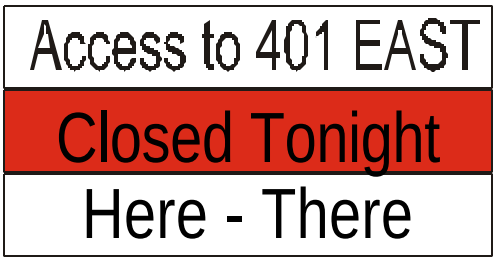
Where multiple ramps are to be closed (such as in conjunction with the closure of the collector lanes on a complex freeway), it is desirable to give additional information, as follows:



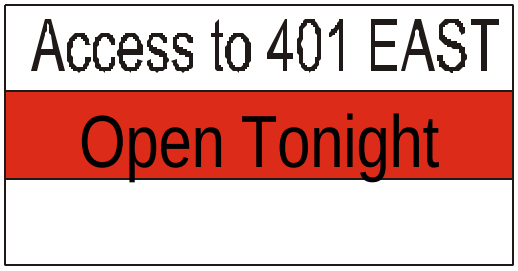
Advance Notification Sign (ANS)

Advance Warning Phase

During the Advance Warning Phase, it may be desirable to have drivers by-pass the closed access and proceed elsewhere, following either an unsigned alternative route familiar to drivers with local knowledge, or a more formal, signed detour route. In either case, information regarding the closure is a necessary preamble to any alternative route information.



Advance Warning Sign (AWS) – Work Activities Planned



**Advance Warning Sign (AWS) –
No Work Activities Planned**

Logically, it then follows to provide either alternative route information, or a signed detour, should one be necessary. These signs would be covered when the closure was not in effect.

Alternative Route Sign (ARS)

Detour Route Sign (DTS)

Figure 4.8 illustrates the use of On-Ramp Signing.

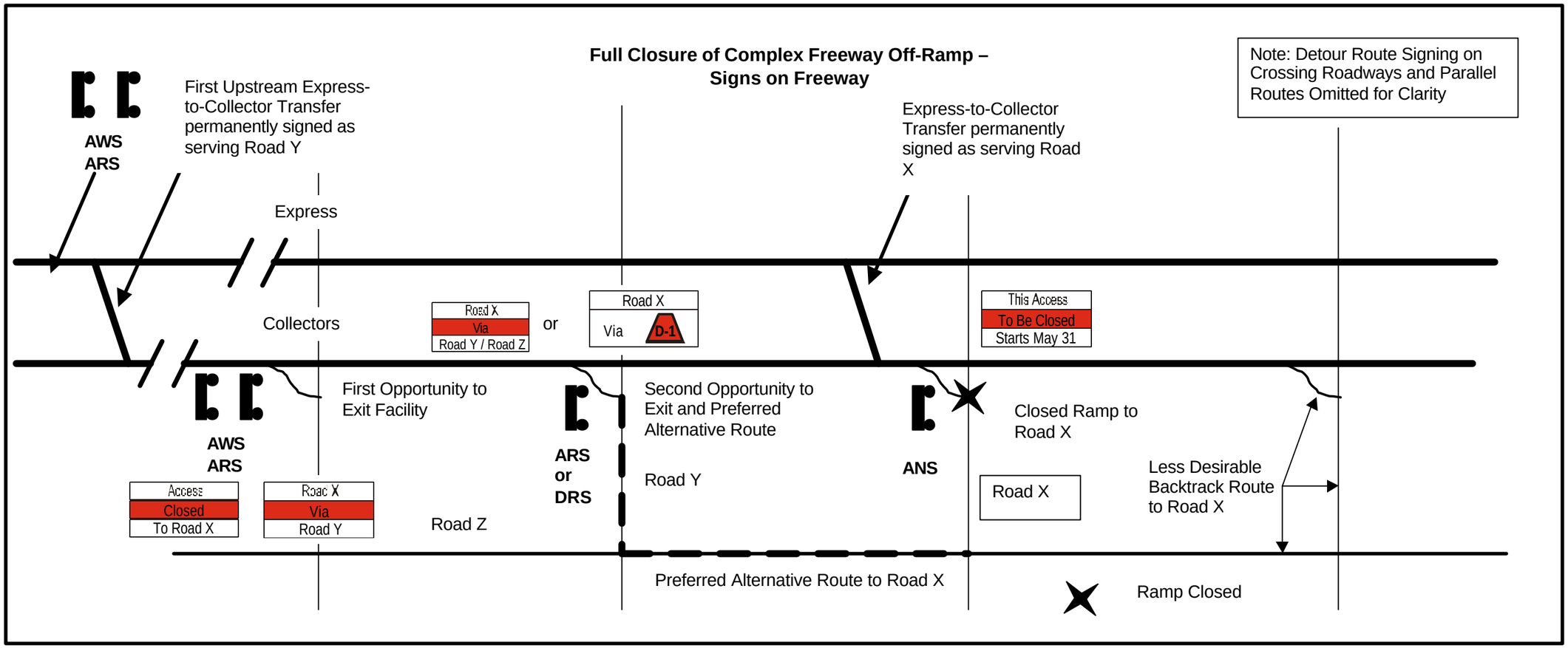
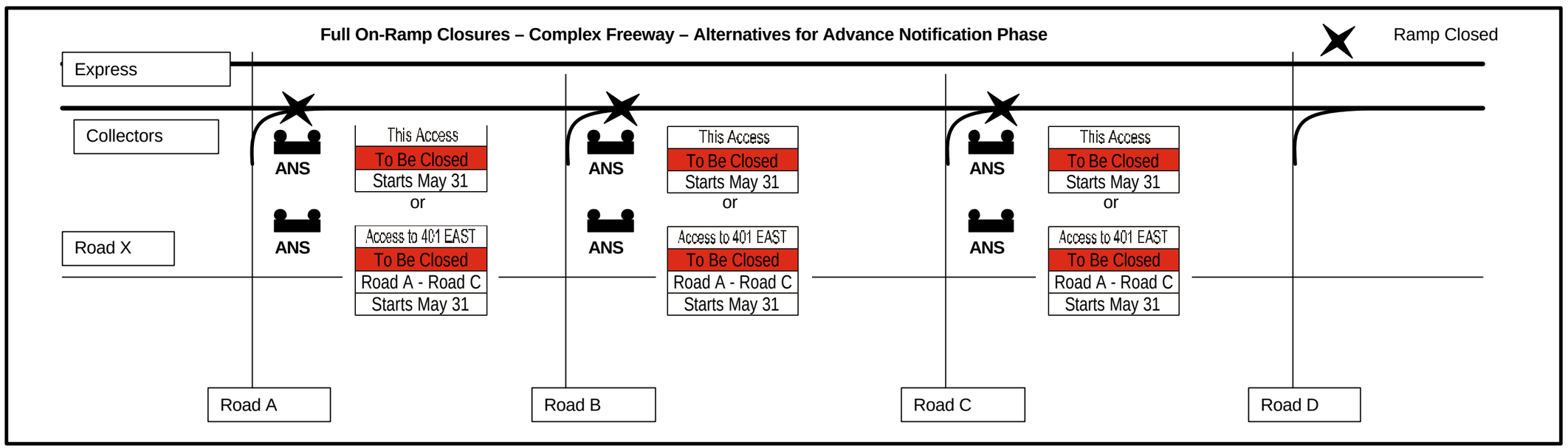


Figure 4.5 – Complex Freeway - Full Closure of Off-Ramps and Freeway-to-Freeway Connections



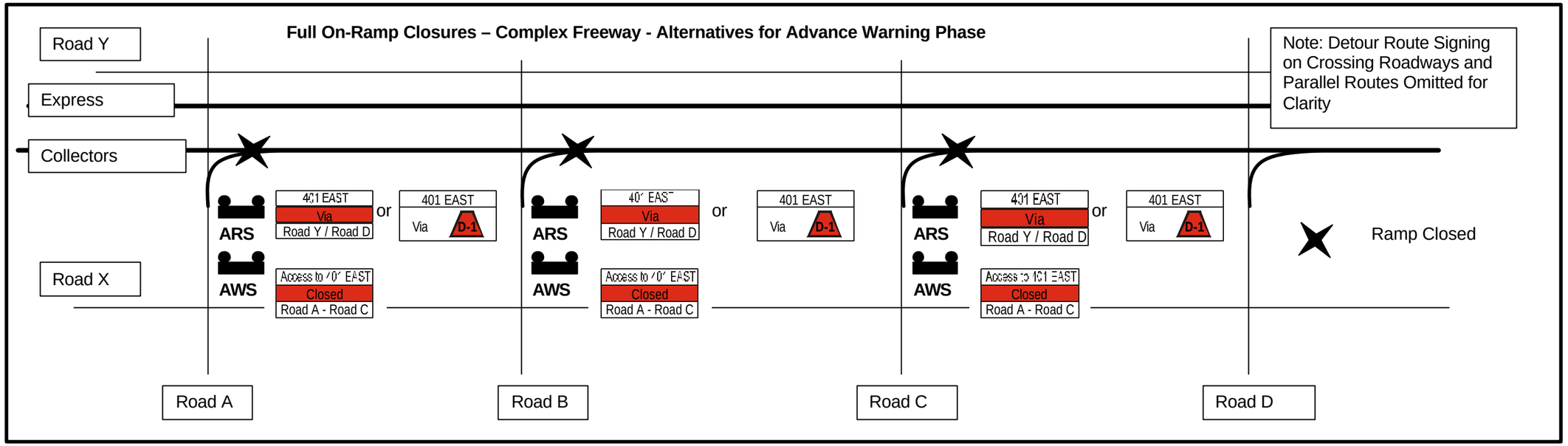


Figure 4.6 – Complex Freeway -Full Closure of Freeway On-Ramps

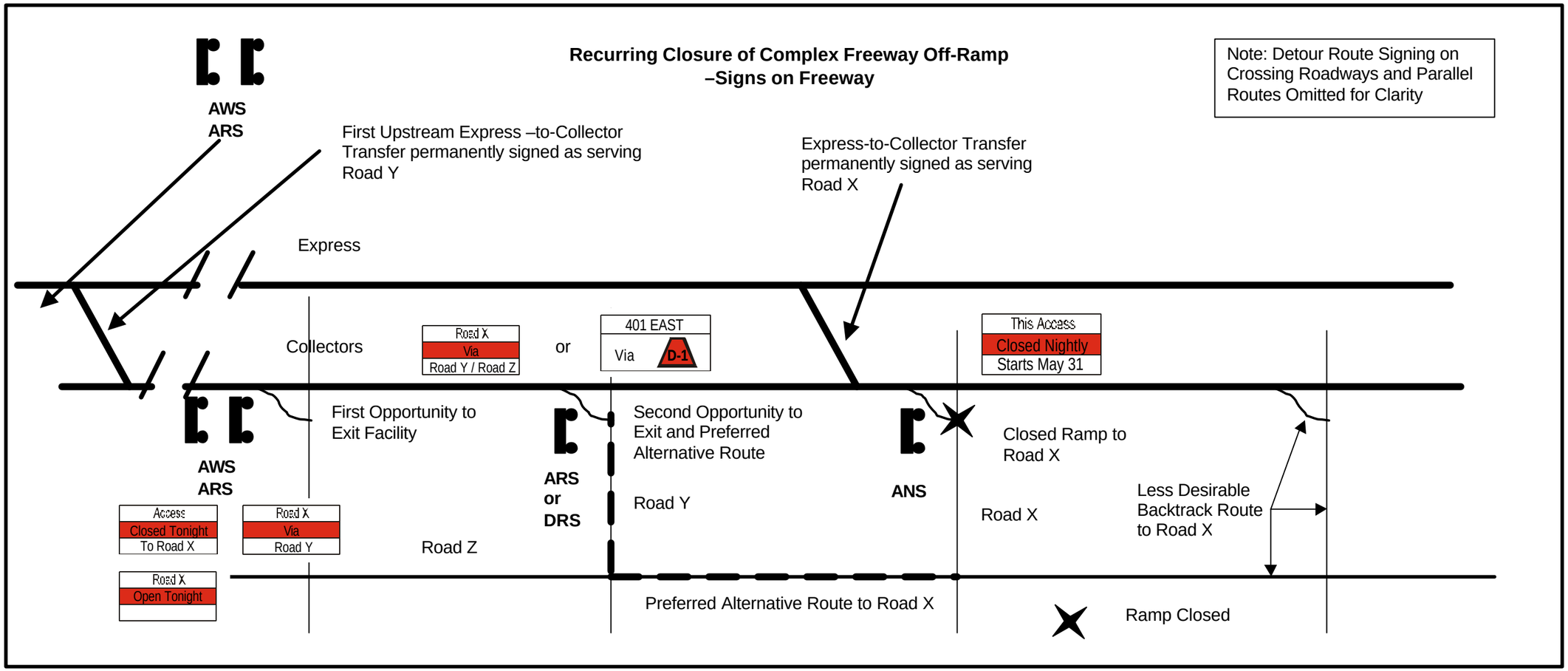
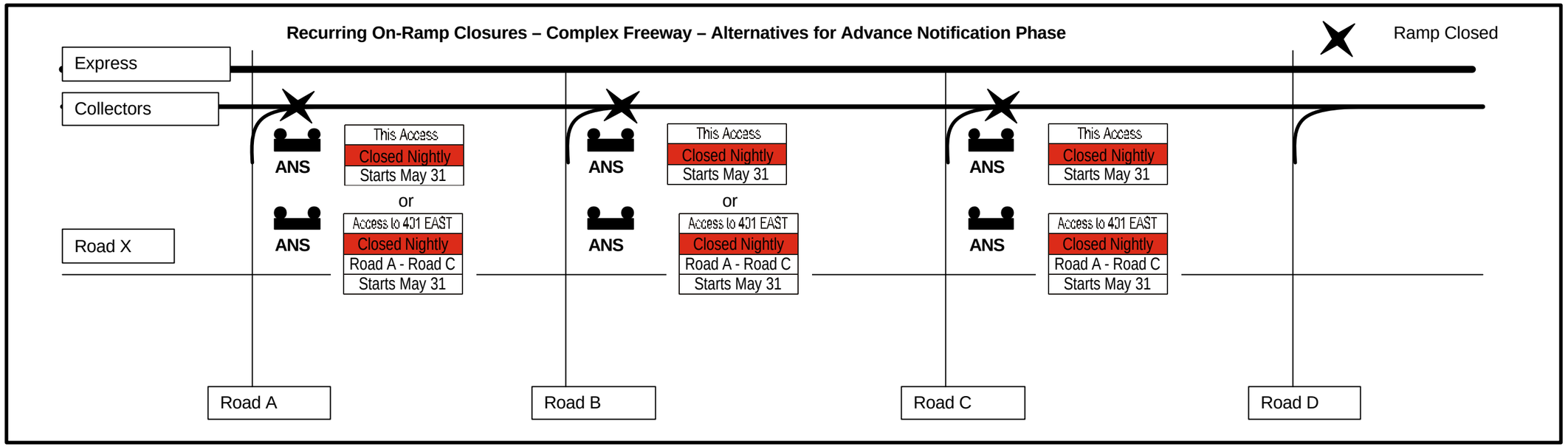


Figure 4.7– Complex Freeway - Recurring Closure of Off-Ramps and Freeway-to-Freeway Connections



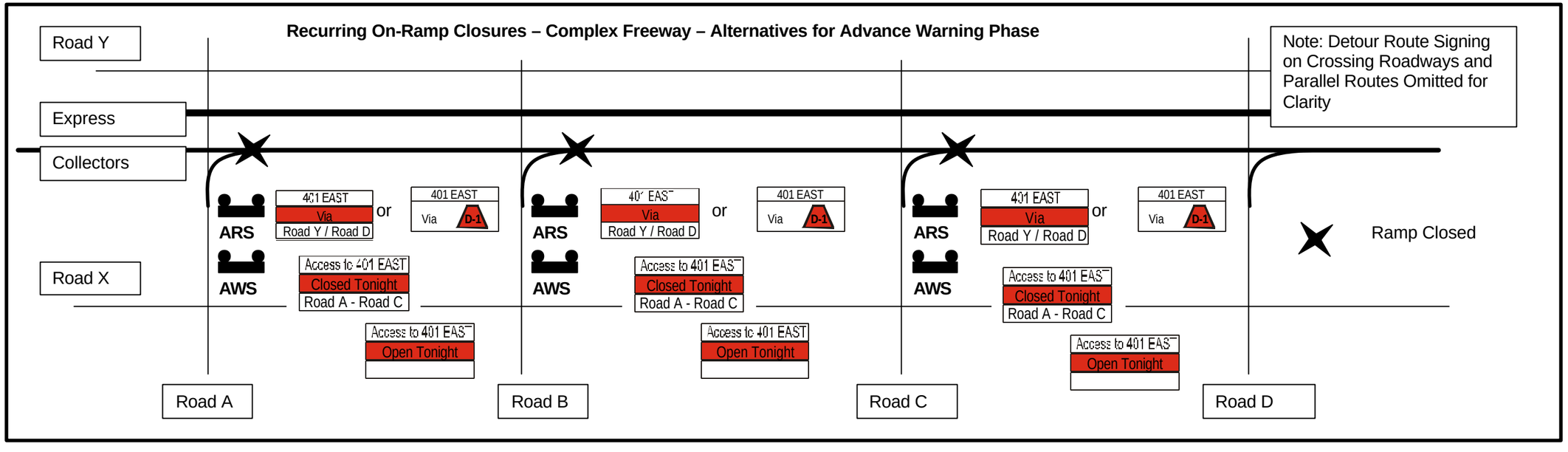


Figure 4.8 – Complex Freeway - Recurring Closure of Freeway On-Ramp

4.8 Complex Freeway - Continuous Lane Closures

The section addresses partial closures of complex freeways. For application guidance involving recurring closures of the entire express or collector lanes, refer to Express Lanes or Collector Lanes respectively. For closures that impact navigational freedom across links such as transfer lanes or interchange ramps, refer to Transfer Lanes and Ramps, accordingly.

Lanes closures on freeways may cause critical reductions in capacity, and result in congestion. Advance notification of planned lane closures provides drivers with an opportunity to adjust their travel plans. Providing advance warning of their presence makes drivers aware of the potential for congestion, allowing them to seek alternative routes or to be prepared to respond to changes in traffic flow. This awareness reduces uncertainty and frustration, in turn reducing the potential for aggressive and illegal acts.

If more specific information on the nature of the closure can be provided (i.e. left lane(s), right lane(s), etc.), it allows drivers to respond earlier to traffic controls, resulting in smoother traffic flow. This specific information is particularly beneficial to the operators of large commercial vehicles. Commercial vehicles require longer to execute lane changes, needing larger gaps and more maneuvering room than passenger vehicles.

Advance information can become part of a strategy for managing traffic demand within the work zone. Often the threat of congestion will reduce demand on busy commuter routes, as drivers with local knowledge amend their travel plans or seek alternative routes. When combined with ARS or DRS signing on suitable, alternative routes, advance warning of lane closures can induce a larger proportion of drivers to detour around the affected area. Refer to Section 4.22.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. Drivers destined for interchanges within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area using IARS or IDRS. Refer to Section 4.22.

Message Signed During Advance Notification Phase:

During the advance notification phase, drivers are informed of the direction and the stream to be impacted, the type of impact anticipated, the extent, and when activity will begin.

This signing would be located as follows:

1. If closure is in the collectors of a complex freeway:

    - in the collectors, upstream of the location of the planned closure, to allow drivers on affected route to see the message; and
    - in the express, upstream of the express-to-collector transfer preceding the site of the planned closure.

2. If the closure is in the express lanes of a complex freeway:

- in the express, upstream of the location of the planned closure, to allow drivers on affected route to see the message; and
- in the collectors, upstream of the collector-to-express transfer preceding the site of the planned closure.

The extent of the activity can be described in one of two ways: using boundary references (e.g. Here – There, Road X – Road Y), or by providing an indication of distance (e.g. for XX km). Boundary references are preferred.

On complex freeways the stream information and direction of travel is omitted on signing in the affected stream only. It is retained on signing in the concurrent stream.

Information regarding which lanes are closed can be presented in different levels of detail, as follows:

- Lane Closed

- Lane Closures

- Left Lane Closed
- Right Lane Closed

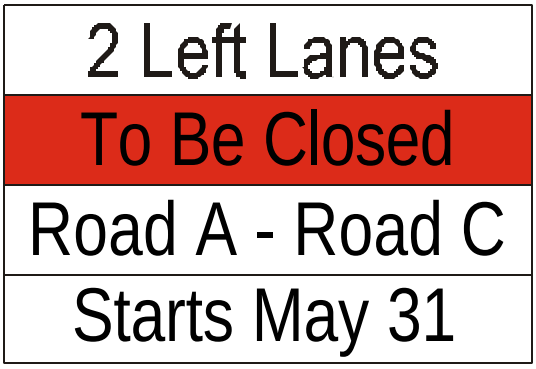
- Left Lanes Closed
- Right Lanes Closed

- 2 Left Lanes Closed
- 2 Right Lanes Closed

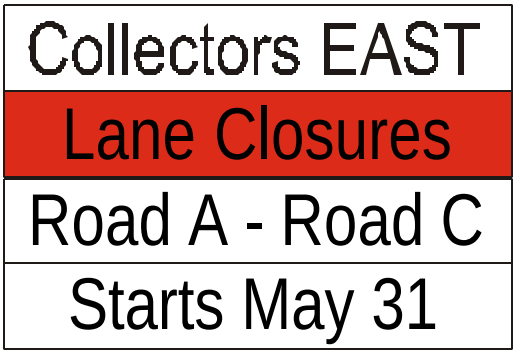
Where specific information is not known at the time signing is being prepared, or may vary frequently during the work and thus reduce the credibility of the signed message, it is preferable to employ the more generic message.

These concepts are illustrated in the examples that follow:

Lanes Closed in Collectors (see Figure 4.9):



**Advance Notification Signing (ANS)
in Collectors – Details Known**



**Advance Notification Signing (ANS)
in Express – Details Known**

Lanes Closed in Express (see Figure 4.10):

Advance Notification Signing (ANS) in Collectors – Extent Shown in Kilometres

Advance Notification Signing (ANS) in Express – Extent Shown in Kilometres

Messages Signed During Advance Warning Phase:

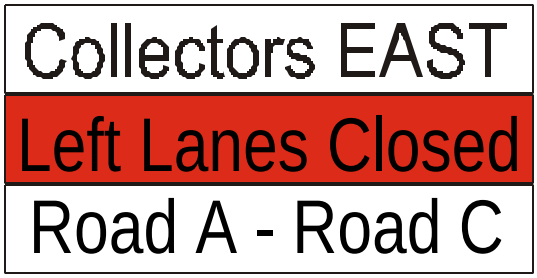
During the advance warning phase, more specific information is provided, where possible, sufficiently in advance to permit drivers to make decisions regarding alternative routes.

This signing would be located as follows:

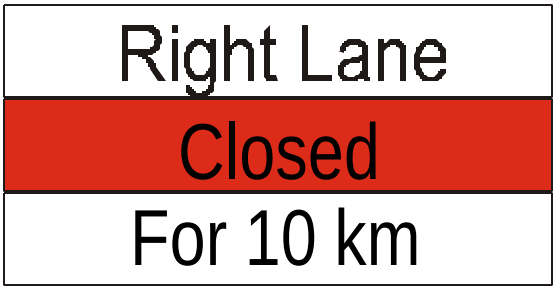
1. If closure is in the collectors of a complex freeway:
   - in the collectors, a minimum of two interchanges and one collector-to-express transfer upstream of the location of the planned closure, to allow drivers on affected route to exit the facility or to bypass the closure in the express lanes; and
   - in the express, upstream of the express-to-collector transfer preceding the site of the planned closure, allowing drivers to remain in the express lanes.
2. If the closure is in the express lanes of a complex freeway:
   - in the express, upstream of the express-to-collector transfer preceding the location of the planned closure, to allow drivers on affected route to move to the collectors and avoid the closure; and
   - in the collectors, upstream of the collector-to-express transfer preceding the site of the planned closure, allowing drivers to choose to remain in the collectors and bypass the closure.

In the Advance Warning Phase, drivers are given information regarding the location (route, direction, position and stream, where applicable), along with the specific impact anticipated, in various formats.

Lanes Closed in Collectors (see Figure 4.9)



Advance Warning Signs (AWS) in Express

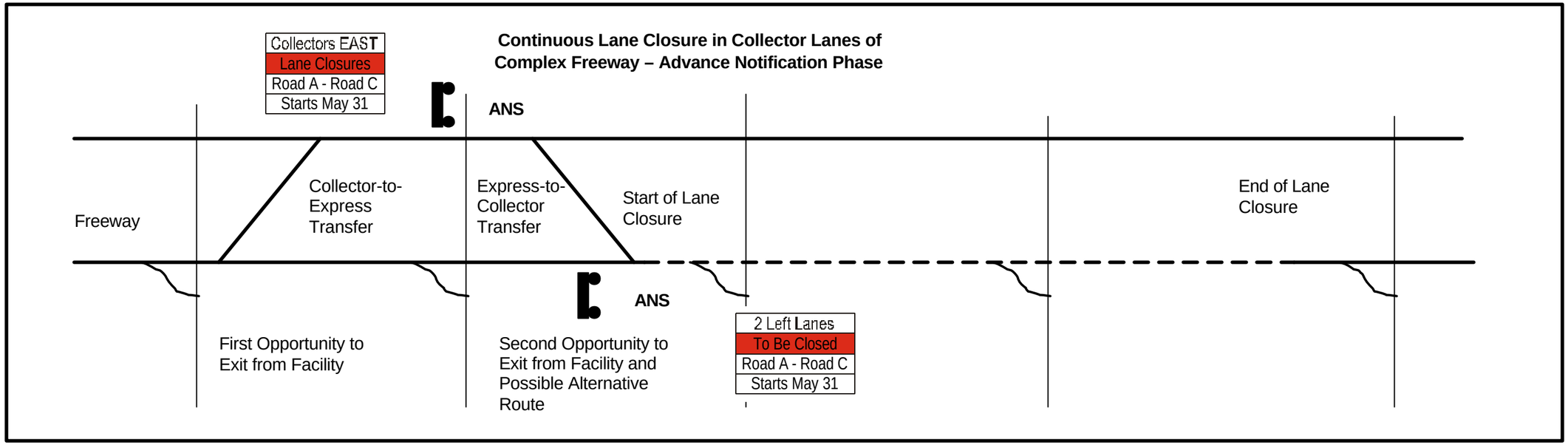


Advance Warning Signs (AWS) in Express

Advance Warning Signs (AWS) in Collectors

Lanes Closed in Express (see Figure 4.10)

Advance Warning Signs (AWS) in Collectors



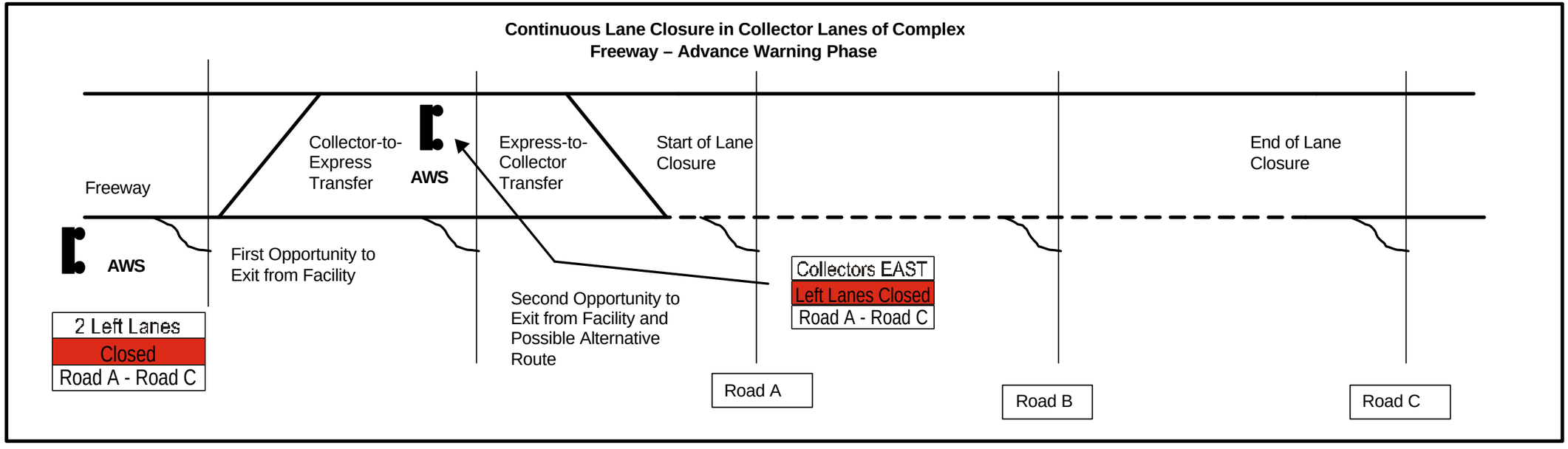


Figure 4.9 – Complex Freeway - Continuous Lane Closure – Collectors of Complex Freeway

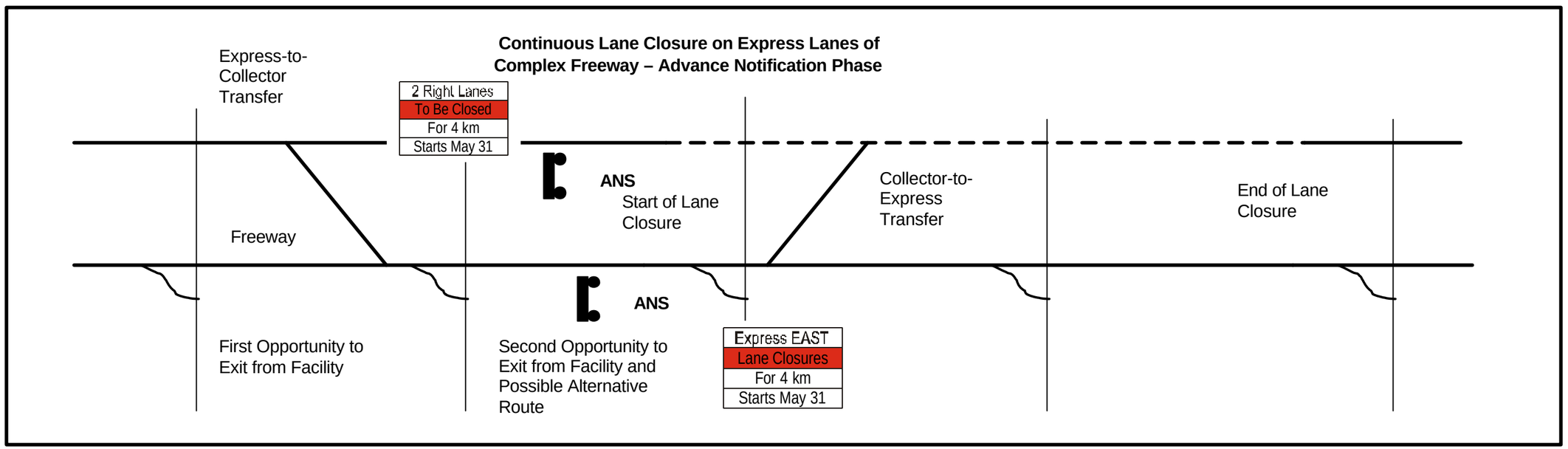


Figure 4.10 – Complex Freeway – Continuous Lane Closure – Express of Complex Freeway

4.9 Complex Freeway - Recurring Lane Closures

The section addresses partial closures of complex freeways that take place on a recurring basis. The most common type of recurring closures are night closures. For application guidance involving recurring closures of the entire express or collector lanes, refer to Express Lanes or Collector Lanes respectively. For closures that impact navigational freedom across links such as transfer lanes or interchange ramps, refer to Transfer Lanes and Ramps, accordingly.

Lanes closures on freeways may cause critical reductions in capacity, and result in congestion. Advance notification of planned lane closures provides drivers with an opportunity to adjust their travel plans. Providing advance warning of their presence makes drivers aware of the potential for congestion, allowing them to seek alternative routes or to be prepared to respond to changes in traffic flow. This awareness reduces uncertainty and frustration, in turn reducing the potential for aggressive and illegal acts.

If more specific information on the nature of the closure can be provided (i.e. left lane(s), right lane(s), etc.), it allows drivers to respond earlier to traffic controls, resulting in smoother traffic flow. This specific information is particularly beneficial to the operators of large commercial vehicles. Commercial vehicles require longer to execute lane changes, needing larger gaps and more maneuvering room than passenger vehicles.

Advance information can become part of a strategy for managing traffic demand within the work zone. Often the threat of congestion will reduce demand on busy commuter routes, as drivers with local knowledge amend their travel plans or seek alternative routes When combined with ARS or DRS signing on suitable, alternative routes, advance warning of lane closures can induce a larger proportion of drivers to detour around the affected area. Refer to Section 4.22.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. Drivers destined for interchanges within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area using IARS or IDRS. Refer to Section 4.22.

Message Signed During Advance Notification Phase:

During the advance notification phase, drivers are informed of the direction and the stream to be impacted, the type of impact anticipated, the extent, and when activity will begin.

This signing would be located as follows:

1. If closure is in the collectors of a complex freeway:

    - in the collectors, upstream of the location of the planned closure, to allow drivers on affected route to see the message; and
    - in the express, upstream of the express-to-collector transfer preceding the site of the planned closure.

2. If the closure is in the express lanes of a complex freeway:

    - in the express, upstream of the location of the planned closure, to allow drivers on affected route to see the message; and
    - in the collectors, upstream of the collector-to-express transfer preceding the site of the planned closure.

The extent of the activity can be described in one of two ways: using boundary references (e.g. Here – There, Road X – Road Y), or by providing an indication of distance (e.g. for XX km). Boundary references are preferred.

On complex freeways the stream information and direction of travel is omitted on signing in the affected stream only. It is retained on signing in the concurrent stream.

Information regarding which lanes are closed can be presented in different levels of detail, as follows:

- Lane Closed

- Lane Closures

- Left Lane Closed
- Right Lane Closed

- Left Lanes Closed
- Right Lanes Closed

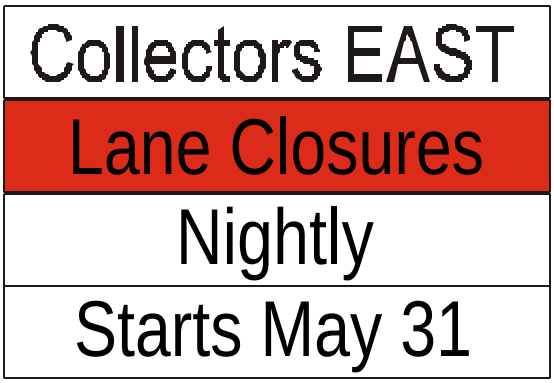
- 2 Left Lanes Closed
- 2 Right Lanes Closed

Where specific information is not known at the time signing is being prepared, or may vary frequently during the work and thus reduce the credibility of the signed message, it is preferable to employ the more generic message.

These concepts are illustrated in the examples that follow.

Lanes Closed in Collectors (see Figure 4.11)

**Advance Notification Signing (ANS)
in Collectors**



**Advance Notification Signing (ANS)
in Express**

Lanes Closed in Express (see Figure 4.12)

**Advance Notification Signing (ANS)
in Collectors**

**Advance Notification Signing (ANS)
in Express**

Messages Signed During Advance Warning Phase:

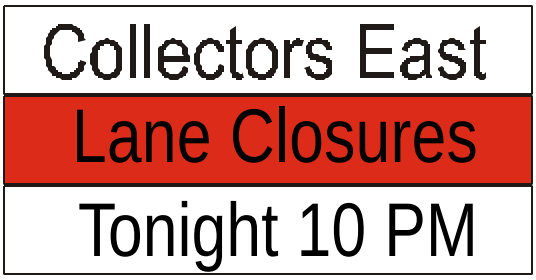
During the advance warning phase, more specific information is provided, where possible, sufficiently in advance to permit drivers to make decisions regarding alternative routes.

This signing would be located as follows:

1. If closure is in the collectors of a complex freeway:
   - in the collectors, a minimum of two interchanges and one collector-to-express transfer upstream of the location of the planned closure, to allow drivers on affected route to exit the facility or to bypass the closure in the express lanes; and
   - in the express, upstream of the express-to-collector transfer preceding the site of the planned closure, allowing drivers to remain in the express lanes.
2. If the closure is in the express lanes of a complex freeway:
   - in the express, upstream of the express-to-collector transfer preceding the location of the planned closure, to allow drivers on affected route to move to the collectors and avoid the closure; and
   - in the collectors, upstream of the collector-to-express transfer preceding the site of the planned closure, allowing drivers to choose to remain in the collectors and bypass the closure.

In the Advance Warning Phase, drivers are given information regarding the location (route, direction, position and stream, where applicable), along with the specific impact anticipated, in various formats.

Lanes Closed in Collectors (see Figure 4.11)

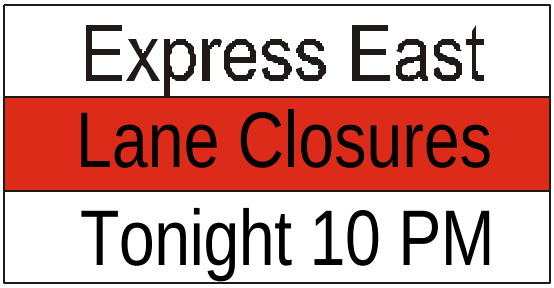


Advance Warning Signs (AWS) in Express – Work Activities Planned

Advance Warning Signs (AWS) in Collectors – Work Activities Planned

Advance Warning Signs (AWS) in Express and Collectors – Work Activities Not Planned

Lanes Closed in Express (see Figure 4.12)



Advance Warning Signs (AWS) in Collectors – Work Activities Planned

Advance Warning Signs (AWS) in Express – Work Activities Planned

Advance Warning Signs (AWS) in Express and Collectors – Work Activities Not Planned

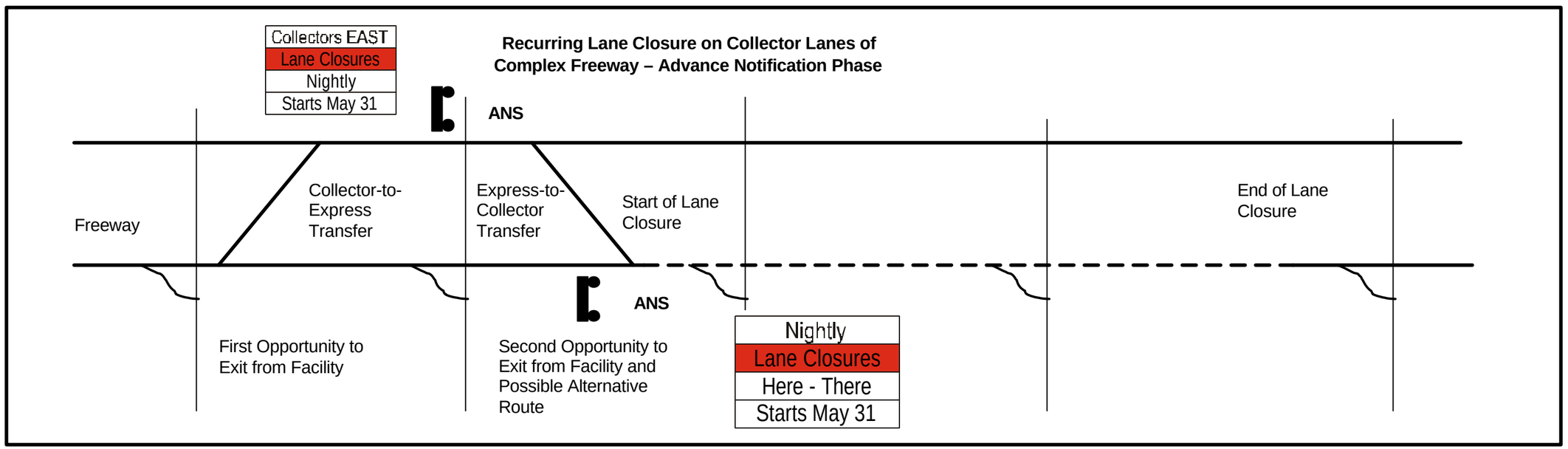


Figure 4.11 – Complex Freeway – Recurring Lane Closure Collectors of Complex Freeway

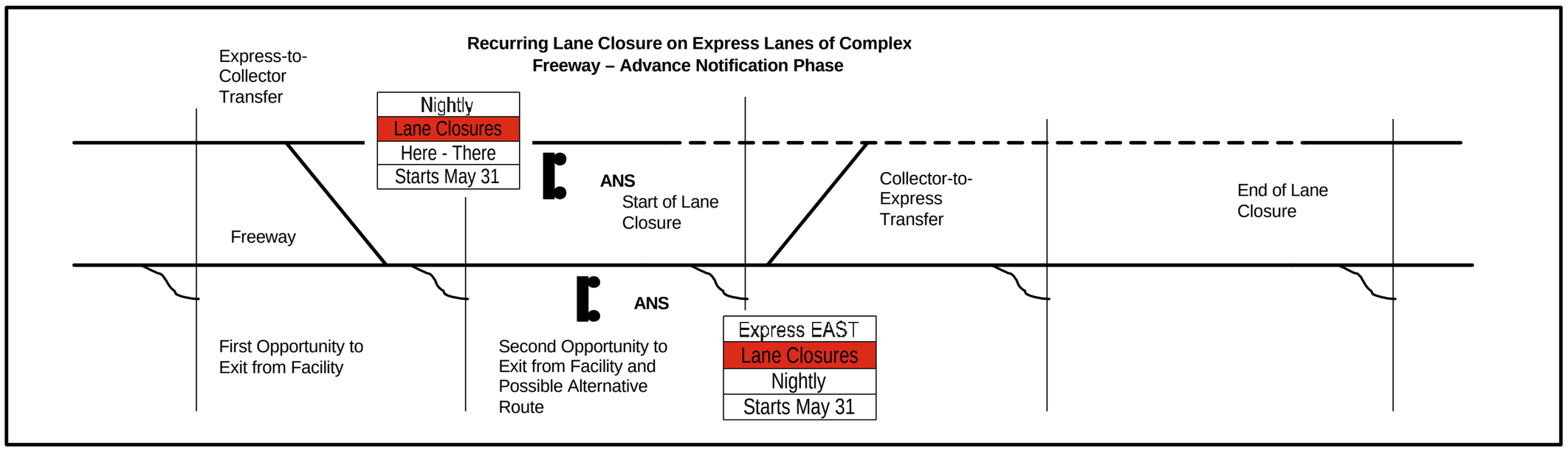


Figure 4.12 – Complex Freeway – Recurring Lane Closures Express of Complex Freeway

4.10 Simple Freeway - Continuous Lane Closures

The section addresses partial closures of simple freeways. For application guidance involving partial closures of the express or collector lanes of a complex freeway, refer to Sections 4.7 and 4.8. For application guidance involving closures that impact navigational freedom across links such as transfer lanes or interchange ramps, refer to Sections 4.4, 4.5 and 4.6, 4.7 respectively.

Lanes closures on freeways may cause critical reductions in capacity, and result in congestion. Advance notification of planned lane closures provides drivers with an opportunity to adjust their travel plans. Providing advance warning of their presence makes drivers aware of the potential for congestion, allowing them to seek alternative routes or to be prepared to respond to changes in traffic flow. This awareness reduces uncertainty and frustration, in turn reducing the potential for aggressive and illegal acts.

If more specific information on the nature of the closure can be provided (i.e. left lane(s), right lane(s), etc.), it allows drivers to respond earlier to traffic controls, resulting in smoother traffic flow. This specific information is particularly beneficial to the operators of large commercial vehicles. Commercial vehicles require longer to execute lane changes, needing larger gaps and more maneuvering room than passenger vehicles.

Advance information can become part of a strategy for managing traffic demand within the work zone. Often the threat of congestion will reduce demand on busy commuter routes, as drivers with local knowledge amend their travel plans or seek alternative routes. When combined with ARS or DRS signing on suitable, alternative routes, advance warning of lane closures can induce a larger proportion of drivers to detour around the affected area. Refer to Section 4.22.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. Drivers destined for interchanges within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area using IARS or IDRS. Refer to Section 4.22.

Message Signed During Advance Notification Phase:

During the advance notification phase, drivers are informed of the direction and the stream to be impacted, the type of impact anticipated, the extent, and when activity will begin.

This signing would be located upstream of the location of the planned closure, to allow drivers on affected route to see the message.

The extent of the activity can be described in one of two ways: using boundary references (e.g. Here – There, Road X – Road Y), or by providing an indication of distance (e.g. for XX km). Boundary references are preferred.

On simple freeways, the stream information (express or collector) is not applicable. The fact that the message applies to the facility on which the driver is travelling, and to the direction of travel viewing the message can be assumed (e.g. “Hwy EAST” is omitted). This

provides additional message space for more pertinent details.

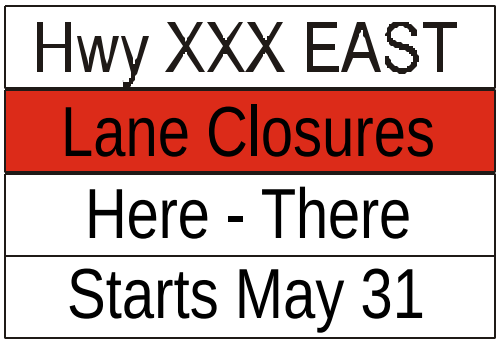
Information regarding which lanes are closed can be presented in different levels of detail, as follows:

- Lane Closed
- Lane Closures
- Left Lane Closed
- Right Lane Closed
- Left Lanes Closed
- Right Lanes Closed
- 2 Left Lanes Closed
- 2 Right Lanes Closed

Where specific information is not known at the time signing is being prepared, or may vary frequently during the work and thus reduce the credibility of the signed message, it is preferable to employ the more generic message.

These concepts are illustrated in the examples that follow:

Lanes Closed on Simple Freeway (see Figure 4.13):



Advance Notification Signing (ANS) – Simple Freeway – Limited Detail

Messages Signed During Advance Warning Phase:

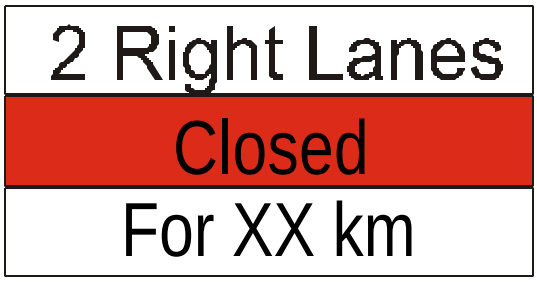
During the advance warning phase, more specific information is provided, where possible, sufficiently in advance to permit drivers to make decisions regarding alternative routes.

This signing would be located a minimum of two interchanges upstream of the location of the planned closure, to allow drivers on affected route choose to exit the facility.

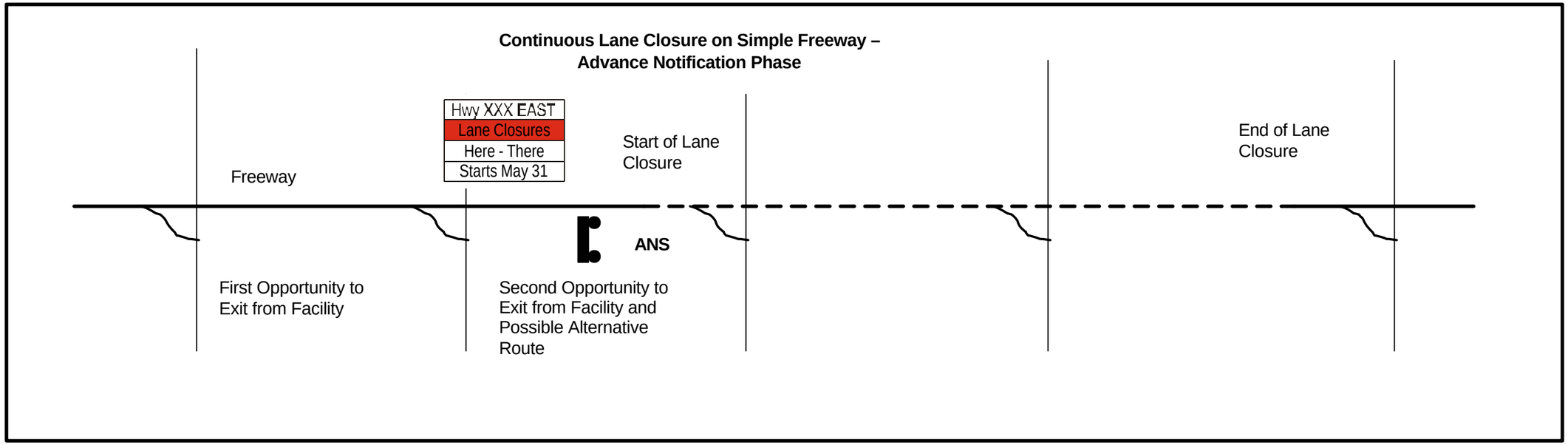
In the Advance Warning Phase, drivers are given information regarding the location (route, direction, position and stream, where applicable), along with the specific impact anticipated, in various formats.

Lanes Closed on Simple Freeway (see Figure 4.13):

Advance Warning Signs (AWS) – Simple Freeway – Extent Shown by Points of Reference



Advance Warning Signs (AWS) – Simple Freeway – Extent Shown by Distance



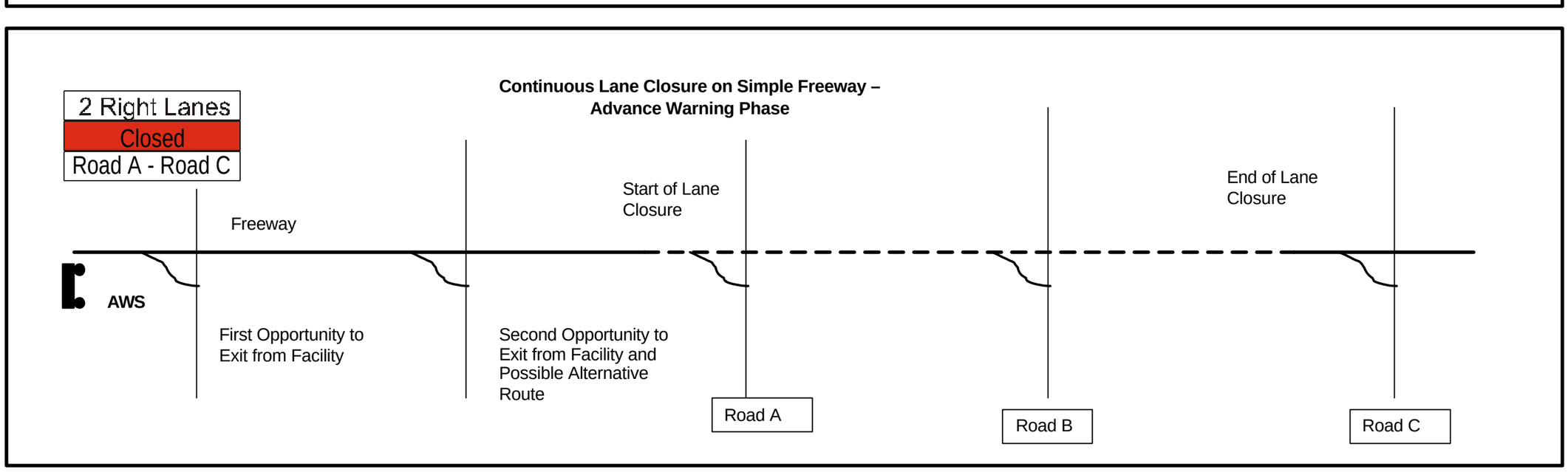


Figure 4.13 – Freeway - Continuous Lane Closure - Simple Freeway

4.11 Simple Freeway - Recurring Lane Closures

The section addresses partial closures of simple freeways. For application guidance involving partial closures of the express or collector lanes of a complex freeway, refer to Section 4.8 and 4.9. For application guidance involving closures that impact navigational freedom across links such as transfer lanes or interchange ramps, refer to Sections 4.4, 4.5 and 4.6, 4.7 respectively.

Lanes closures on freeways may cause critical reductions in capacity, and result in congestion. Advance notification of planned lane closures provides drivers with an opportunity to adjust their travel plans. Providing advance warning of their presence makes drivers aware of the potential for congestion, allowing them to seek alternative routes or to be prepared to respond to changes in traffic flow. This awareness reduces uncertainty and frustration, in turn reducing the potential for aggressive and illegal acts.

If more specific information on the nature of the closure can be provided (i.e. left lane(s), right lane(s), etc.), it allows drivers to respond earlier to traffic controls, resulting in smoother traffic flow. This specific information is particularly beneficial to the operators of large commercial vehicles. Commercial vehicles require longer to execute lane changes, needing larger gaps and more maneuvering room than passenger vehicles.

Advance information can become part of a strategy for managing traffic demand within the work zone. Often the threat of congestion will reduce demand on busy commuter routes, as drivers with local knowledge amend their travel plans or seek alternative routes. When combined with ARS or DRS signing on suitable, alternative routes, advance warning of lane closures can induce a larger proportion of drivers to detour around the affected area. Refer to Section 4.22.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. Drivers destined for interchanges within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area using IARS or IDRS. Refer to Section 4.22.

Message Signed During Advance Notification Phase:

During the advance notification phase, drivers are informed of the direction and the stream to be impacted, the type of impact anticipated, the extent, and when activity will begin.

This signing would be located upstream of the location of the planned closure, to allow drivers on affected route to see the message.

The extent of the activity can be described in one of two ways: using boundary references (e.g. Here – There, Road X – Road Y), or by providing an indication of distance (e.g. for XX km). Boundary references are preferred.

On simple freeways, the stream information (express or collector) is not applicable. The fact that the message applies to the facility on which the driver is travelling, and to the direction of travel viewing the message can be assumed (e.g. “Hwy EAST” is omitted). This

provides additional message space for more pertinent details.

Information regarding which lanes are closed can be presented in different levels of detail, as follows:

- Lane Closed
- Lane Closures
- Left Lane Closed
- Right Lane Closed
- Left Lanes Closed
- Right Lanes Closed
- 2 Left Lanes Closed
- 2 Right Lanes Closed

Where specific information is not known at the time signing is being prepared, or may vary frequently during the work and thus reduce the credibility of the signed message, it is preferable to employ the more generic message.

These concepts are illustrated in the examples that follow.

Lanes Closed on Simple Freeway (see Figure 4.14)

Advance Notification Signing (ANS) – Simple Freeway

Messages Signed During Advance Warning Phase:

During the advance warning phase, more specific information is provided, where possible, sufficiently in advance to permit drivers to make decisions regarding alternative routes.

This signing would be located a minimum of two interchanges upstream of the location of the planned closure, to allow drivers on affected route choose to exit the facility.

In the Advance Warning Phase, drivers are given information regarding the location (route, direction, position and stream, where applicable), along with the specific impact anticipated, in various formats.

Lanes Closed on Simple Freeway (see Figure 4.14)

Advance Warning Signs (AWS) – Simple Freeway – Work Activities Planned

**Advance Warning Signs (AWS) –
Simple Freeway – Work Activities Not
Planned**

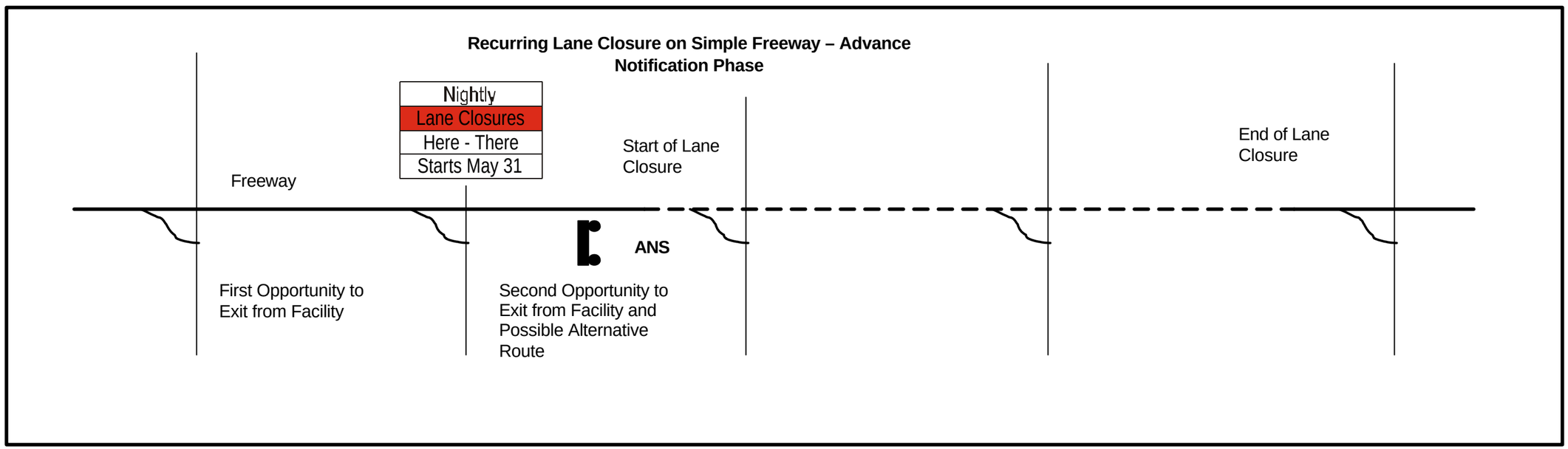


Figure 4.14 – Recurring Lane Closure - Simple Freeway

4.12 Simple Freeway - Interchange Ramp - Full Closure

A full closure of an interchange ramp may occur in isolation, to permit work to occur on the ramp itself, or it may be incidental to lane closures on the main roadway that prevent the maintenance of access at the ramp location. In either event, ramp closures result in restrictions to navigational freedom, requiring advance notification and advance warning in some instances, and the provision of an alternative route in all cases.

The following guidance applies to ramps on simple freeways. For Guidance regarding Ramps on complex freeways, refer to Section 4.6 and 4.7 For guidance regarding ramps between express and collector lanes, see Section 4.4 and 4.5 Transfer Lanes.

Interchange ramps may be classified as follows:

- freeway to crossing roadway ramps (off-ramps);
- crossing roadway to freeway ramps (on-ramps); and
- freeway-to-freeway connections.

The provision of advance notification of freeway-to-freeway ramp closures of any duration is highly recommended.

The closure of an off-ramp or freeway-to-freeway ramp imposes significant navigational restrictions on drivers using the affected route. The closure of an on-ramp places navigational restrictions on those wishing to access the affected route from parallel and crossing routes. Navigational restrictions on the route must be fully communicated to drivers and mitigated through the provision of alternative routes. Other traffic attempting to access the facility via affected ramps may also require information and redirection to alternative points of access to avoid frustration and delay.

Off-Ramps and Freeway-to-Freeway Connections

In circumstances impacting off-ramps and freeway-to-freeway connections, the primary concern is drivers whose planned route includes the affected link. In short-duration circumstances, it may be acceptable to sign the closure at the site, and to direct drivers downstream to the next interchange, with instructions on how to double back and return to their route. For long duration closures however, it is generally more efficient to intercept these drivers upstream of the affected link and direct them to exit at an earlier interchange that provides a suitable alternative route.

The importance of the affected link, the availability and simplicity of alternative routes, the adequacy of existing, permanent signing on the alternative route and the degree of local knowledge among users will determine whether signing is necessary on the alternative route, and to what level it must be provided. In some urban commuter corridors, with a dense grid network of crossing and parallel routes, it may be acceptable simply to inform drivers of the closure (e.g. Access Closed to Road X). If this is done at a point sufficiently in advance, drivers with local knowledge can select an earlier exit of their choosing – or go to the exit beyond and double back, and navigate across a parallel route to their destination. It may be necessary to provide both the advance warning and some minimal instructions to exit at an earlier interchange destination (e.g. Access

Closed to Road X NORTH). Finally, where alternative routes are less obvious or are complicated, it may be necessary to provide detour signing along the alternative route.

Message Signed During Advance Notification Phase:

During the advance notification phase, drivers are informed of the link or links to be impacted, the type of impact anticipated, the extent, and when activity will begin. This is done with signing located directly on the affected ramp(s). Once the closure is underway, signing would be relocated to a suitable point upstream of the alternative route. Refer to Figure 4.15.

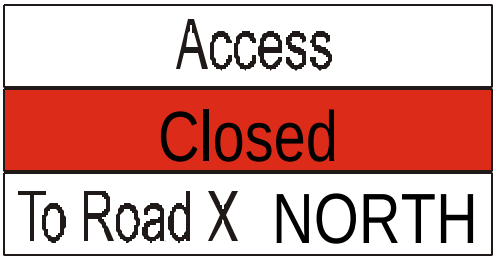
Advance Notification Sign (ANS)

Message Signed During Warning Phase:

Once activity is underway, traffic approaching the affected area is informed of the condition, its location and extent, and of the alternative route (Figure 4.15). If the route involves exiting the affected route early, then signing is placed at a point in advance of the appropriate upstream interchange. If the most suitable alternative route involves by-passing the closed ramp and exiting downstream, the message is placed on the main line, in advance of the closure.

During the Advance Warning Phase, for closures of significant duration, Guide and Information signs referencing the closed ramp will require amendment so as to provide correct and credible information. Refer to Chapter 3, Section 3.12 for guidance in this regard.

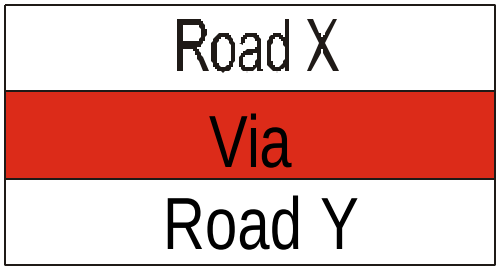
Advance Warning Sign (AWS)



Advance Warning Sign (AWS) - Directional

Alternative Route Signing on Affected Roadway (with unsigned alternative route):

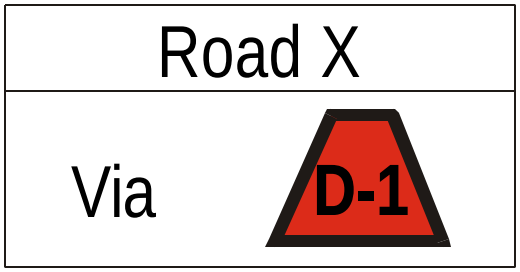
Where alternative routes are obvious and uncomplicated, it may not be necessary to provide detour signing along the alternative route. An Alternative Routes Sign (ARS) may be used to direct drivers to the unsigned, alternative route, where they must use permanent navigational references and local knowledge to reach their destination.



Alternative Route Sign (ARS)

Detour Route Signing on Affected Roadway (with signed alternative route)

Where alternative routes are less obvious or are complicated, it may be necessary to provide detour signing along the alternative route. An Alternative Route Sign is installed following the AWS, and a Detour Route Sign (DRS) is installed on the ramp exit leading to the alternative route. Detour Trailblazing Signs (DTS) are then installed at all decision points along the route. Refer to Section 4.22 for details.



Detour Route Sign (DRS)

On-Ramps to Freeways

Where access to a freeway facility is precluded by the closure of one or more ramps, it is desirable to:

- inform drivers of the planned closure in advance,;
- warn them of its existence during the closure period; and
- provide information on alternative routes to the facility.

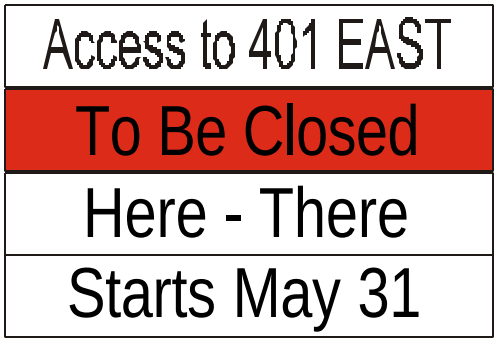
Refer to Chapter 3 Section 3.12 regarding the amendment of permanent signing. Refer to Section 4.22 regarding the provision of alternative route information.

Signing During Advance Notification Phase:

The simplest approach is to place the sign on the ramp itself.

Advance Notification Signing (ANS)

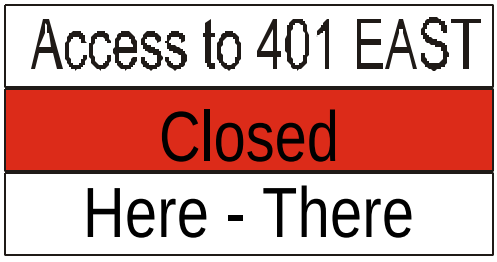
Where multiple ramps are to be closed (such as in conjunction with the closure of the collector lanes on a complex freeway), it is desirable to give additional information, as follows.



Advance Notification Sign (ANS)

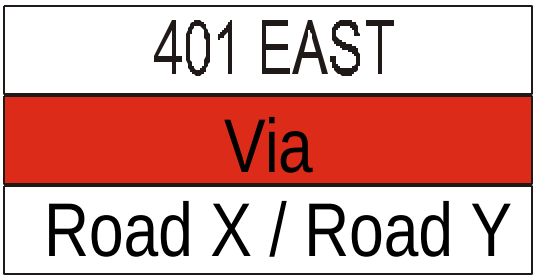
Signing During the Advance Warning Phase

During the Advance Warning Phase, it may be desirable to have drivers by-pass the closed access and proceed elsewhere, following either an unsigned alternative route familiar to drivers with local knowledge, or a more formal, signed detour route. In either case, information regarding the closure is a necessary preamble to any alternative route information.



Advance Warning Sign (AWS)

Logically, it then follows to provide either alternative route information, or a signed detour, should one be necessary.



Alternative Route Sign (ARS)

Detour Route Sign (DTS)

Section 4.16 illustrates the use of On-Ramp Signing

4.13 Simple Freeway - Interchange Ramp - Recurring Closure

Most recurring closures involve night work. A night closure of an interchange ramp may occur in isolation, to permit work to occur on the ramp itself, or it may be incidental to lane closures on the main roadway that prevent the maintenance of access at the ramp location. In either event, ramp closures result in restrictions to navigational freedom, requiring specific advance notification and advance warning in some instances, and the provision of an alternative route in all cases.

The following guidance applies to ramps on simple freeways. For Guidance regarding Ramps on complex freeways, refer to Sections 4.3 and 4.5. For guidance regarding ramps between express and collector lanes, see Transfer Lanes.

Interchange ramps may be classified as follows:

- freeway to crossing roadway ramps (off-ramps);
- crossing roadway to freeway ramps (on-ramps); and
- freeway-to-freeway connections.

The provision of advance notification of freeway-to-freeway ramp closures is highly recommended.

The closure of an off-ramp or freeway-to-freeway ramp imposes significant navigational restrictions on drivers using the affected route. The closure of an on-ramp places navigational restrictions on those wishing to access the affected route from parallel and crossing routes. Navigational restrictions on the route must be fully communicated to drivers and mitigated through the provision of alternative routes. Other traffic attempting to access the facility via affected ramps may also require information and redirection to alternative points of access to avoid frustration and delay.

Off-Ramps and Freeway-to-Freeway Connections

In circumstances impacting off-ramps and freeway-to-freeway connections, the primary concern is drivers whose planned route includes the affected link. In short-duration circumstances, it may be acceptable to sign the closure at the site, and to direct drivers downstream to the next interchange, with instructions on how to double back and return to their route. For long duration closures however, it is generally more efficient to intercept these drivers upstream of the affected link and direct them to exit at an earlier interchange that provides a suitable alternative route.

The importance of the affected link, the availability and simplicity of alternative routes, the adequacy of existing, permanent signing on the alternative route and the degree of local knowledge among users will determine whether signing is necessary on the alternative route, and to what level it must be provided. In some urban commuter corridors, with a dense grid network of crossing and parallel routes, it may be acceptable simply to inform drivers of the closure (e.g. Access Closed to Road X). If this is done at a point sufficiently in advance, drivers with local knowledge can select an earlier exit of their choosing – or go to the exit beyond and double back, and navigate across a parallel route to their destination. It may be necessary to provide both the advance warning and some minimal instructions to exit at an earlier

interchange destination (e.g. Access Closed to Road X NORTH). Finally, where alternative routes are less obvious or are complicated, it may be necessary to provide detour signing along the alternative route.

Message Signed During Advance Notification Phase:

During the advance notification phase, drivers are informed of the link or links to be impacted, the type of impact anticipated, the extent, and when activity will begin. This is done with signing located directly on the affected ramp(s). Once the closure is underway, signing would be relocated to a suitable point upstream of the alternative route.

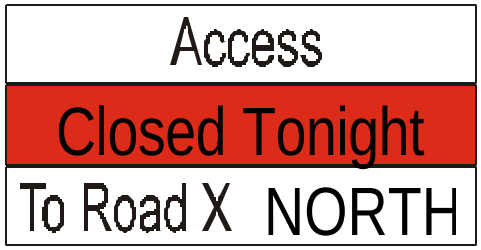
Advance Notification Sign (ANS)

Message Signed During Warning Phase:

Once activity is underway, traffic approaching the affected area is informed of the condition, its location and extent, and of the alternative route (Figure 4.15). If the route involves exiting the affected route early, then signing is placed at a point in advance of the appropriate upstream interchange. If the most suitable alternative route involves by-passing the closed ramp and exiting downstream, the message is placed on the main line, in advance of the closure.

During the Advance Warning Phase, for closures of significant duration, Guide and Information signs referencing the closed ramp will require amendment so as to provide correct and credible information. Refer to Chapter 3, Section 3.12 for guidance in this regard.

Advance Warning Sign (AWS)



Advance Warning Sign (AWS) - Directional

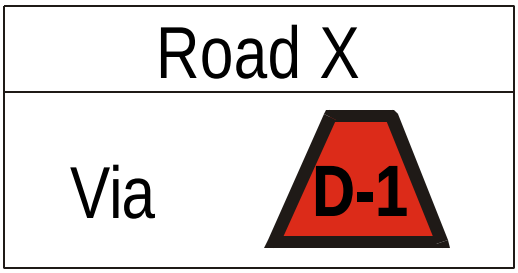
Advance Warning Sign (AWS) – Closure Not Planned

Alternative Route Signing on Affected Roadway (with unsigned alternative route)

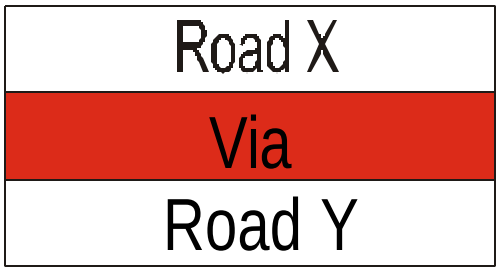
Temporary Conditions Traffic Management:
Advance Notification, Advance Warning and
Alternative Route Signing for Provincial Highways

Where alternative routes are obvious and uncomplicated, it may not be necessary to provide detour signing along the alternative route. An Alternative Routes Sign (ARS) may be used to direct drivers to the unsigned, alternative route, where they must use permanent navigational references and local knowledge to reach their destination.

This sign must be covered whenever the route is not in effect.



Detour Route Sign (DRS)



Alternative Route Sign (ARS)

Detour Route Signing on Affected Roadway (with signed alternative route)

Where alternative routes are less obvious or are complicated, it may be necessary to provide detour signing along the alternative route. An Alternative Route Sign is installed following the AWS, and a Detour Route Sign (DRS) is installed on the ramp exit leading to the alternative route. Detour Trailblazing Signs (DTS) are then installed at all decision points along the route. Refer to Section 4.22 for details.

This sign must be covered whenever the route is not in effect.

On-Ramps to Freeways

Where access to a freeway facility is precluded by the closure of one or more ramps, it is desirable to:

- inform drivers of the planned closure in advance,;
- warn them of its existence during the closure period; and
- provide information on alternative routes to the facility.

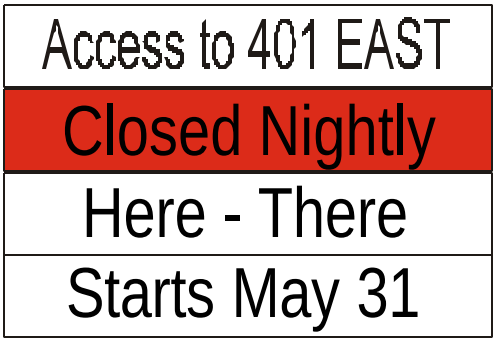
Refer to Chapter 3 Section 3.12 regarding the amendment of permanent signing. Refer to Section 4.22 regarding the provision of alternative route information.

Signing During the Advance Notification Phase:

The simplest approach is to place the sign on the ramp itself.

Advance Notification Signing (ANS)

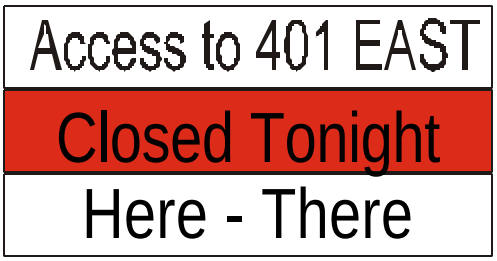
Where multiple ramps are to be closed (such as in conjunction with the closure of the collector lanes on a complex freeway), it is desirable to give additional information, as follows:



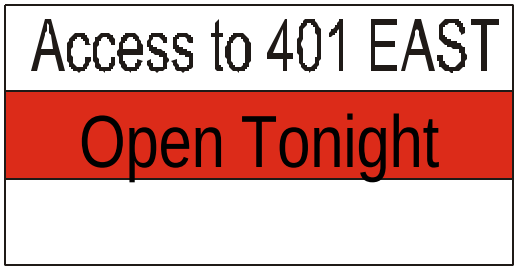
Advance Notification Sign (ANS)

Signing During the Advance Warning Phase

During the Advance Warning Phase, it may be desirable to have drivers by-pass the closed access and proceed elsewhere, following either an unsigned alternative route familiar to drivers with local knowledge, or a more formal, signed detour route. In either case, information regarding the closure is a necessary preamble to any alternative route information.



Advance Warning Sign (AWS) – Work Activities Planned



**Advance Warning Sign (AWS) –
No Work Activities Planned**

Logically, it then follows to provide either alternative route information, or a signed detour, should one be necessary. These signs would be covered when the closure was not in effect.

Alternative Route Sign (ARS)

Detour Route Sign (DTS)

Section 4.17 illustrates the use of On-Ramp Signing.

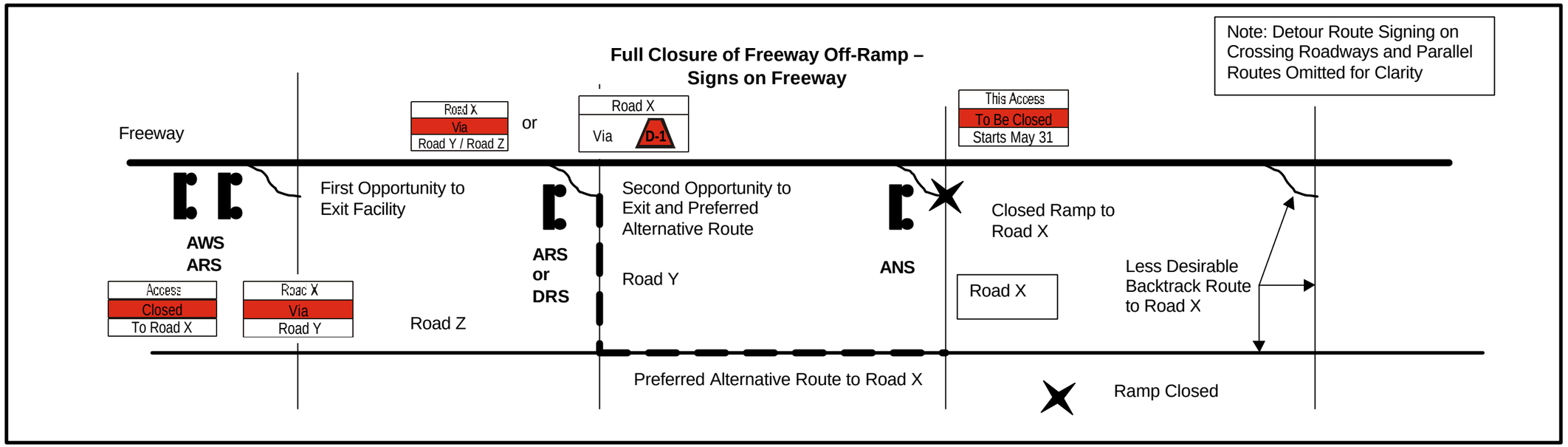
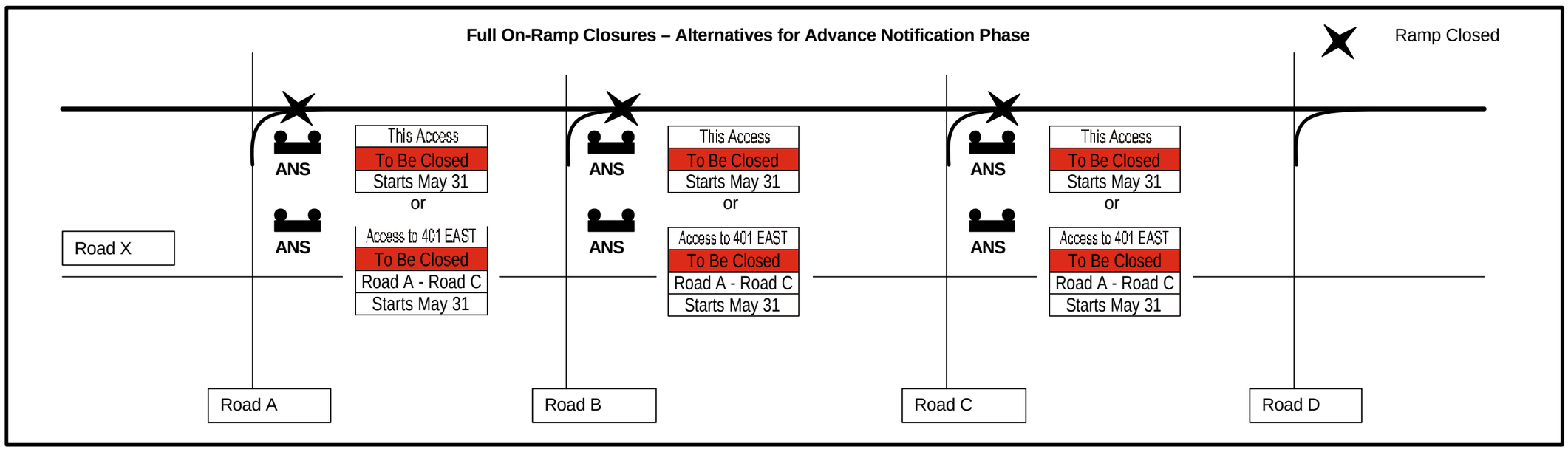


Figure 4.15 – Full and Recurring Closure of Off-Ramps and Freeway-to-Freeway Connections



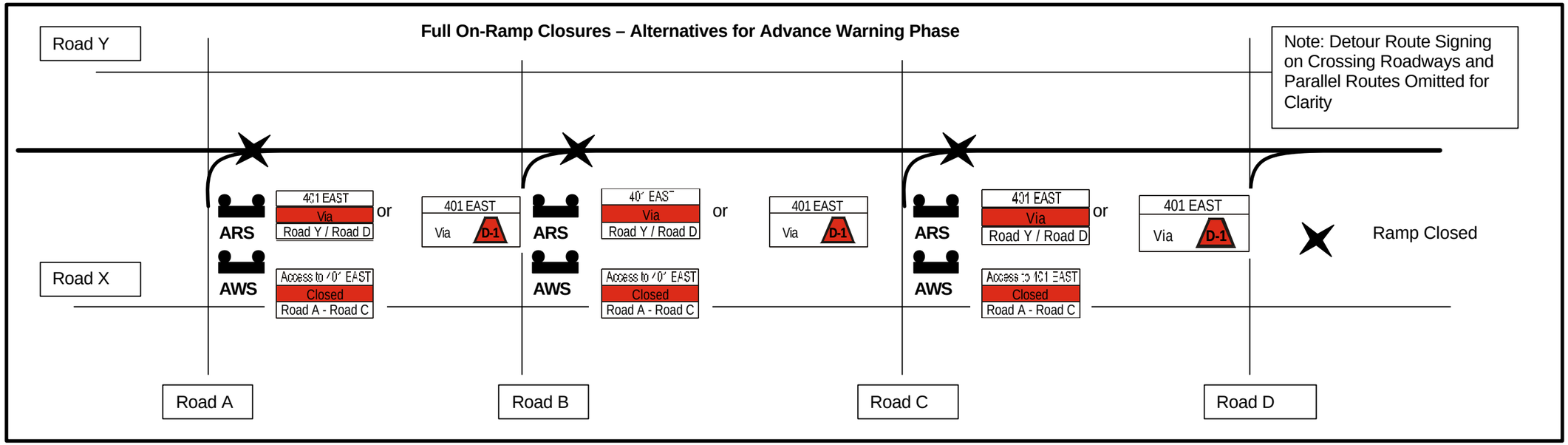


Figure 4.16 – Full Closure of Freeway On-Ramps

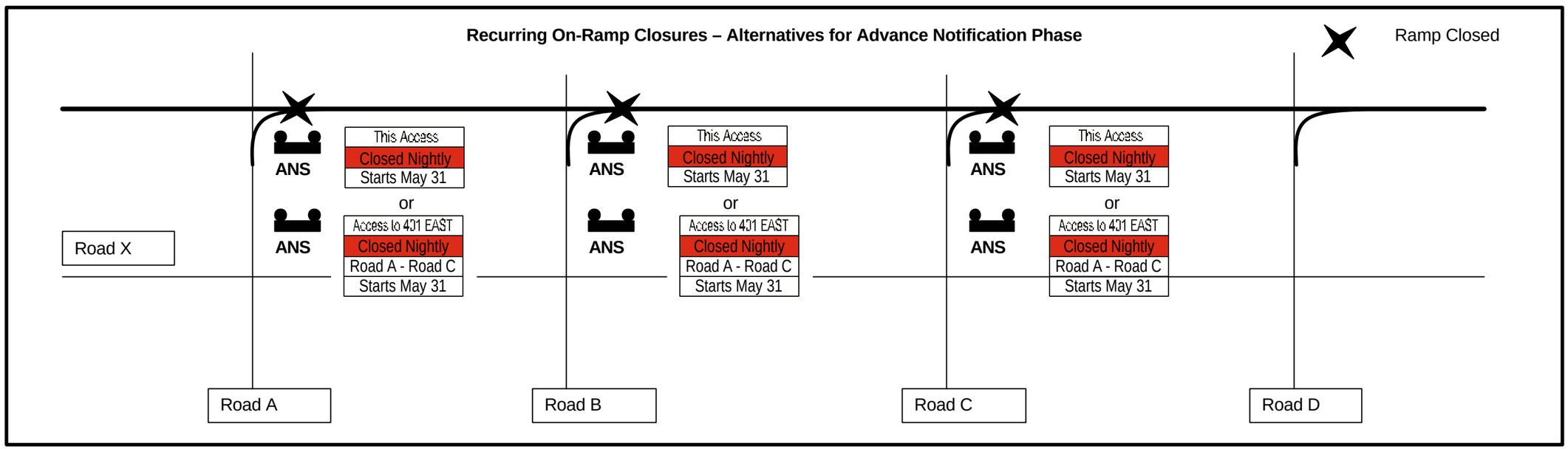


Figure 4.17– Recurring Closure of Freeway On-Ramp

4.14 Simple Freeway – Two Lane Two-Way Operation

Two lane two-way operation occurs on a freeway when the lanes for one direction of travel on a multi-lane, divided route are closed, and traffic is diverted onto what would otherwise have been the opposing lanes. Opposing traffic is generally separated, either by temporary delineation devices, or by temporary barriers.

When applied over long segments of freeway, two lane two-way operations can preclude access to intervening interchanges. This is addressed as either an on-ramp or an off-ramp closure, as the situation dictates. Refer to 4.12 and 4.13.

Traffic is guided off the affected route upstream of the closure and routed to the affected crossing roadways via an alternative route. Refer to Section 4.22.

Traffic wishing to access the facility is guided to an appropriate location downstream of the two-lane, two-way operation. Refer to Section 4.22.

Capacity restrictions stem from the closure of lanes to provide for opposing traffic, and are signed as lane closures. Refer to Section 4.11.

Where both navigational and capacity restrictions exist, and signing opportunities are limited, information regarding the navigational restrictions should take precedence.

Advance information can become part of a strategy for managing traffic demand within the work zone. Often the threat of congestion will reduce demand on busy commuter routes, as drivers with local knowledge amend their travel plans or seek alternative routes. When combined with ARS or DRS signing on suitable, alternative routes, advance warning of lane closures can induce a larger proportion of drivers to detour around the affected area. Refer to Section 4.22.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. Drivers destined for interchanges within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area using IARS or IDRS. Refer to Section 4.22.

Signing During the Advance Notification Phase:

During the advance notification phase, information is presented regarding any navigational restrictions that will occur (e.g. at on and off-ramps to be closed), and in regards to the anticipated critical reduction in capacity (e.g. notification of planned lane closures). Refer to Sections 4.12 and 4.10 respectively.

Signing During the Advance Warning Phase

Road users that have crossed over and are travelling in the opposing lanes are unable to access off-ramps at intersections within the closed section. These navigational impacts are signed in advance, in the same manner as a simple ramp closure, and alternative routes are provided.

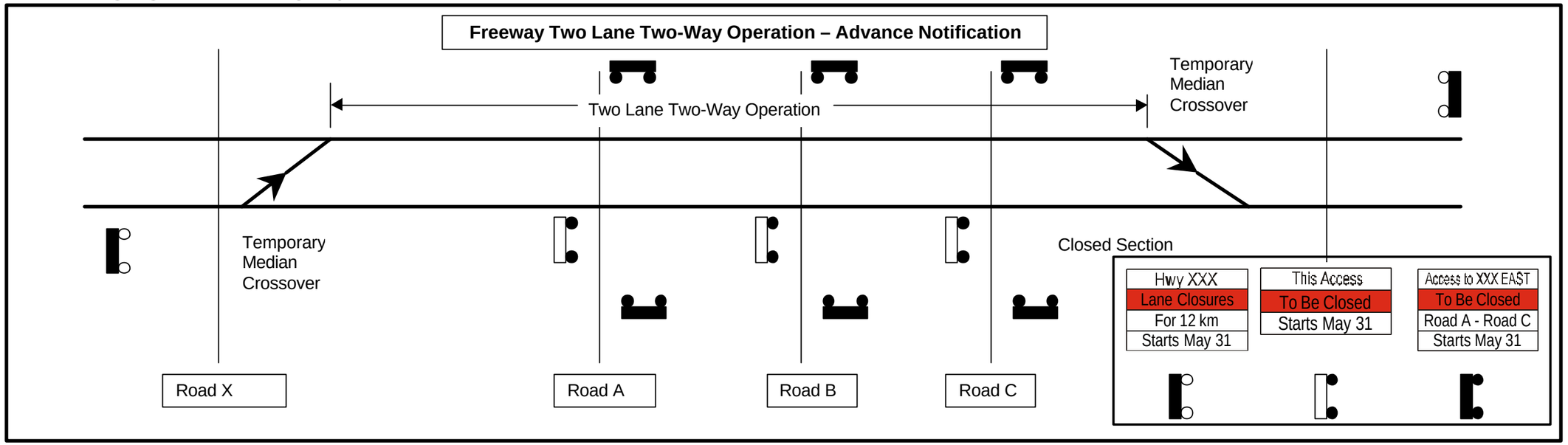
Road users on crossing roadways are also affected by the closure in that they are unable to access the freeway facility for one direction of travel. They also require information regarding the

closure. Alternative route signing to guide these road users to alternative points of access to the freeway may also be required.

Accommodating all traffic in lanes normally reserved for one direction of travel may result in critical reductions in capacity. Where they occur, they are signed in the same manner as a lane closure.

Where it is necessary to further manage demand on the facility, signing is provided on parallel and crossing routes upstream of the closure, traffic is intercepted and directed onto alternative, parallel routes. Refer to Section 4.22.

Information regarding the undivided two lane two-way operation itself (e.g. within the work zone) is best conveyed using standard signs found in the MUTCD and/or the Ontario Traffic Manual.



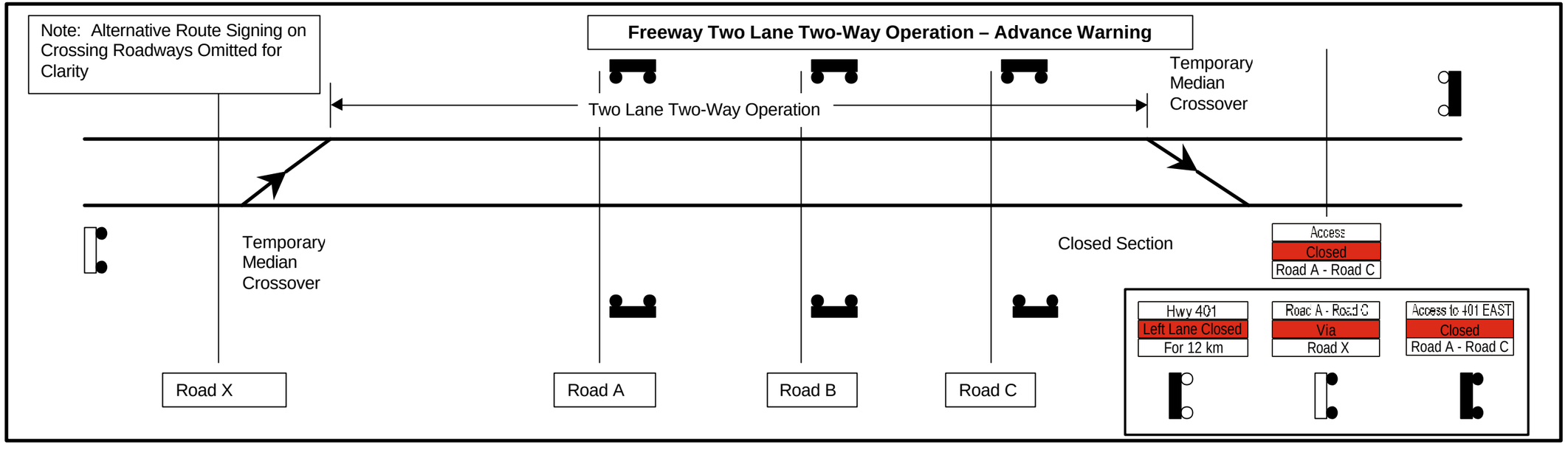


Figure 4.18 – Freeway Two-Lane, Two-Way Operation

4.15 Non-Freeway – Full Highway Closure

The closure of a segment of provincial highway creates a significant restriction on navigational freedom. It should only be considered where less restrictive alternatives have been evaluated, and proven deficient.

Drivers expect continuity on provincial highway routes, and when this continuity is broken, alternatives are required. An alternative route must be provided in all cases. In most instances, a signed route will be required.

When closing routes of regional, provincial or inter-provincial significance, relying on the local knowledge of drivers to navigate around the closure is not practical. Non-local road users must also be considered and accommodated.

Signing During the Advance Notification Phase:

During the advance notification phase, drivers are informed of the planned closure, including its extent, the type of impact expected and the planned duration.

Signing is placed immediately upstream of the site of the planned closure, and in advance of key decision-points where alternative routes on provincial facilities may be accessed.

Ideally, signing in the vicinity of the location of the planned closure should be located a minimum of two opportunities to exit the facility in advance, however this may not be practical where there is little or no suitable municipal road network to provide parallel, alternative routes.

Advance Notification Sign

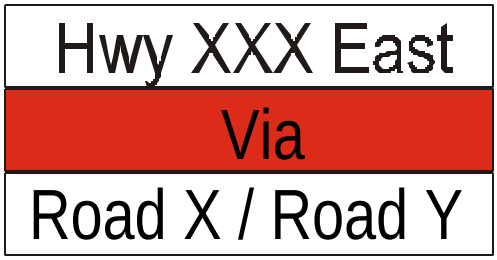
Signing During Advance Warning Phase:

Signing during the advance warning phase may be located upstream of the location of the closure, to facilitate the presentation of alternative route information using local roadways in the immediate area. It may also be located at more distant locations, where other provincial highways intersect with the affected route, to provide information regarding the closure and to set the context for alternative route information about routes that traverse provincial highways.

Advance Warning Signing

Alternative route signing accompanying this information may take several forms depending on the nature of the alternative route.

If the alternative route is simple, explicit, and well-signed, it may be possible to provide directional information sufficient to the needs of both local and non-local drivers, as follows:



Alternative Route Sign – Simple Route

Municipal roads, provincial highways, or a combination of the two may, form the route. However, no more than two concurrent roadways can be identified in the message.

For more complex routes, a signed detour is required, as follows:

Alternative Route Signing - Complex Route

These signs would be located immediately following the Advance Warning Sign, at either local or distant locations. Refer to Figure 4.19 for a diagram of the general arrangement, and to Section 4.22 regarding Alternative Route Signing.

4.16 Non-Freeway – Recurring Highway Closure

The recurring closure of a segment of provincial highway creates a significant restriction on navigational freedom. It should only be considered where less restrictive alternatives have been evaluated, and proven deficient.

Drivers expect continuity on provincial highway routes, and when this continuity is broken, alternatives are required. An alternative route must be provided in all cases. In most instances, a signed route will be required.

When closing routes of regional, provincial or inter-provincial significance, relying on the local knowledge of drivers to navigate around the closure is not practical. Non-local road users must also be considered and accommodated.

Signing During the Advance Notification Phase:

During the advance notification phase, drivers are informed of the planned closure, including its extent, the type of impact expected and the planned duration.

Signing is placed immediately upstream of the site of the planned closure, and in advance of key decision-points where alternative routes on provincial facilities may be accessed.

Ideally, signing in the vicinity of the location of the planned closure should be located a minimum of two opportunities to exit the facility in advance, however this may not be practical where there is little or no suitable municipal road network to provide parallel, alternative routes.

Advance Notification Sign

Signing During Advance Warning Phase:

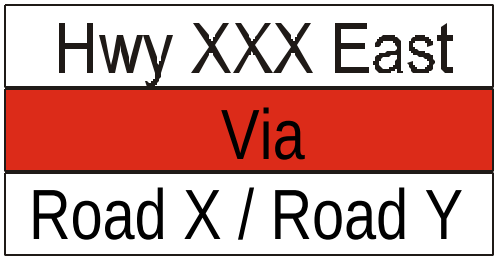
Signing during the advance warning phase may be located upstream of the location of the closure, to facilitate the presentation of alternative route information using local roadways in the immediate area. It may also be located at more distant locations, where other provincial highways intersect with the affected route, to provide information regarding the closure and to set the context for alternative route information about routes that traverse provincial highways.

Advance Warning Signing – Work Planned

Advance Warning Signing – Work Not Planned

Alternative route signing accompanying this information may take several forms depending on the nature of the alternative route.

If the alternative route is simple, explicit, and well-signed, it may be possible to provide directional information sufficient to the needs of both local and non-local drivers, as follows:



Alternative Route Sign – Simple Route

Municipal roads, provincial highways, or a combination of the two may form the route. However, no more than two roadways can be represented.

For more complex routes, a signed detour is required, as follows:

Alternative Route Signing - Complex Route

These signs would be located immediately following the Advance Warning Sign, at either local or distant locations. Refer to Figure 4.19 for a diagram of the general arrangement, and to Section 4.22 regarding Alternative Route Signing.

4.17 Non-Freeway – Continuous Single Lane Operation – Two Lane Highway

Single lane operation on two lane roads involves alternating the right-of-way between opposing traffic streams through one of the following means:

- yield to opposing traffic signing in one direction of travel;
- traffic control persons;
- temporary lane control signals; or
- temporary traffic signals

Navigational freedom is preserved, however the capacity restrictions imposed may result in congestion and delay. Advance notification and advance warning, alone or in combination with alternative route signing, can serve to divert some proportion of the traffic demand where alternative routes are available, and reduce driver frustration by communicating accurate information on conditions to be encountered.

Advance information can become part of a strategy for managing traffic demand within the work zone. Often the threat of congestion will reduce demand on busy commuter routes, as drivers with local knowledge amend their travel plans or seek alternative routes. When combined with ARS or DRS signing on suitable, alternative routes, advance warning of lane closures can induce a larger proportion of drivers to detour around the affected area. Refer to Section 4.22.

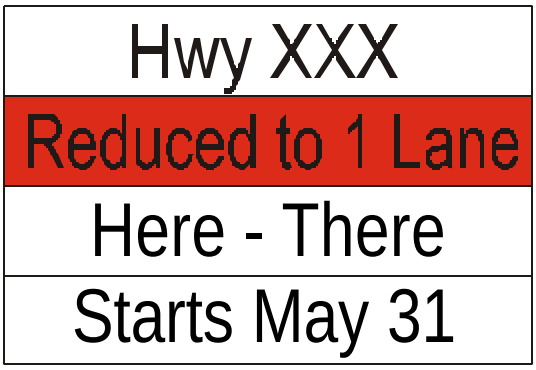
Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. Drivers destined for intersections within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area using IARS or IDRS. Refer to Section 4.22.

Message Signed During the Advance Notification Phase:

During the advance notification phase, drivers are informed of the planned closure, including its extent, the type of impact expected and the planned duration.

Signing is placed immediately upstream of the site of the planned closure, and in advance of key decision-points where alternative routes on provincial facilities may be accessed.

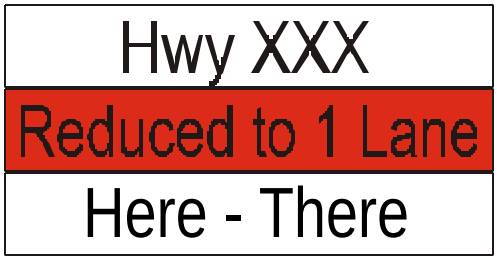
Ideally, signing in the vicinity of the location of the planned closure should be located a minimum of two opportunities to exit the facility in advance, however this may not be practical where there is little or no suitable municipal road network to provide parallel, alternative routes.



Advance Notification Sign

Signing During Advance Warning Phase:

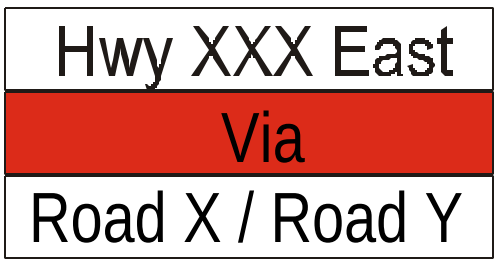
Signing during the advance warning phase may be located upstream of the location of the closure, to facilitate the presentation of alternative route information using local roadways in the immediate area. It may also be located at more distant locations, where other provincial highways intersect with the affected route, to provide information regarding the closure and to set the context for alternative route information about routes that traverse provincial highways.



Advance Warning Signing

Alternative route signing accompanying this information may take several forms depending on the nature of the alternative route.

If the alternative route is simple, explicit, and well-signed, it may be possible to provide directional information sufficient to the needs of both local and non-local drivers, as follows:



Alternative Route Sign – Simple Route

Municipal roads, provincial highways, or a combination of the two may form the route. However, no more than two roadways can be represented.

For more complex routes, a signed detour is required, as follows:

Detour Route Signing

These signs would be located immediately following the Advance Warning Sign, at either local or distant locations. Refer to Figure 4.19 for a diagram of the general arrangement, and to Section 4.22 regarding Alternative Route Signing.

4.18 Non-Freeway – Recurring Single Lane Operation – Two Lane Highway

A recurring single lane operation on two lane roads involves alternating the right-of-way between opposing traffic streams through one of the following means:

- yield to opposing traffic signing in one direction of travel;
- traffic control persons;
- temporary lane control signals; or
- temporary traffic signals

Navigational freedom is preserved, however the capacity restrictions imposed may result in congestion and delay. Advance notification and advance warning, alone or in combination with alternative route signing, can serve to divert some proportion of the traffic demand where alternative routes are available, and reduce driver frustration by communicating accurate information on conditions to be encountered.

Advance information can become part of a strategy for managing traffic demand within the work zone. Often the threat of congestion will reduce demand on busy commuter routes, as drivers with local knowledge amend their travel plans or seek alternative routes. When combined with ARS or DRS signing on suitable, alternative routes, advance warning of lane closures can induce a larger proportion of drivers to detour around the affected area. Refer to Section 4.22.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. Drivers destined for intersections within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area using IARS or IDRS. Refer to Section 4.22.

Message Signed During the Advance Notification Phase:

During the advance notification phase, drivers are informed of the planned closure, including its extent, the type of impact expected and the planned duration.

Signing is placed immediately upstream of the site of the planned closure, and in advance of key decision-points where alternative routes on provincial facilities may be accessed.

Ideally, signing in the vicinity of the location of the planned closure should be located a minimum of two opportunities to exit the facility in advance, however this may not be practical where there is little or no suitable municipal road network to provide parallel, alternative routes.

Advance Notification Sign

Signing During Advance Warning Phase:

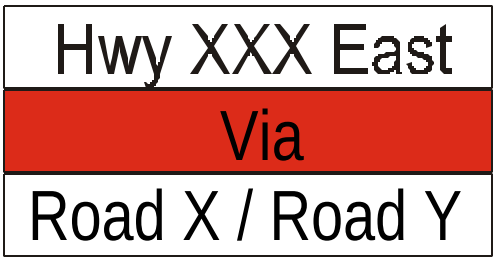
Signing during the advance warning phase may be located upstream of the location of the closure, to facilitate the presentation of alternative route information using local roadways in the immediate area. It may also be located at more distant locations, where other provincial highways intersect with the affected route, to provide information regarding the closure and to set the context for alternative route information about routes that traverse provincial highways.

Advance Warning Signing – Work Planned

Advance Warning Signing – Work Not Planned

Alternative route signing accompanying this information may take several forms depending on the nature of the alternative route.

If the alternative route is simple, explicit, and well-signed, it may be possible to provide directional information sufficient to the needs of both local and non-local drivers, as follows:



Alternative Route Sign – Simple Route

Municipal roads, provincial highways, or a combination of the two may form the route. However, no more than two roadways can be represented.

For more complex routes, a signed detour is required, as follows:

Detour Route Signing – Complex Route

These signs would be located immediately following the Advance Warning Sign, at either local or distant locations. Refer to Figure 4.19 for a diagram of the general arrangement, and to Section 4.22 regarding Alternative Route Signing.

4.19 Non-Freeway – Continuous Lane Closures – Multi-Lane Roads

The section addresses lane closures on highways. For application guidance involving full or recurring closures of an entire highway, refer to Non-Freeway – Continuous Highway Closures or Recurring Highway Closures respectively.

Lanes closures on highways may cause critical reductions in capacity, and result in congestion. Advance notification of planned lane closures provides drivers with an opportunity to adjust their travel plans. Providing advance warning of their presence makes drivers aware of the potential for congestion, allowing them to seek alternative routes or to be prepared to respond to changes in traffic flow. This awareness reduces uncertainty and frustration, in turn reducing the potential for aggressive and illegal acts.

If more specific information on the nature of the closure can be provided (i.e. left lane(s), right lane(s), etc.), it allows drivers to respond earlier to traffic controls, resulting in smoother traffic flow. This specific information is particularly beneficial to the operators of large commercial vehicles. Commercial vehicles require more time and distance to execute lane changes, needing larger gaps and more maneuvering room than passenger vehicles.

Advance information can become part of a strategy for managing traffic demand within the work zone. Often the threat of congestion will reduce demand on busy commuter routes, as drivers with local knowledge amend their travel plans or seek alternative routes. When combined with ARS or DRS signing on suitable, alternative routes, advance warning of lane closures can induce a larger proportion of drivers to detour around the affected area. Refer to Section 4.22.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. Drivers destined for intersections within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area using IARS or IDRS. Refer to Section 4.22.

Message Signed During Advance Notification Phase:

During the advance warning phase, drivers are informed of the planned closure, including its extent, the type of impact expected and the planned duration.

Signing is placed immediately upstream of the site of the planned closure, and in advance of key decision-points where alternative routes on provincial facilities may be accessed.

Ideally, signing in the vicinity of the location of the planned closure should be located a minimum of two opportunities to exit the facility in advance, however this may not be practical where there is little or no suitable municipal road network to provide parallel, alternative routes.

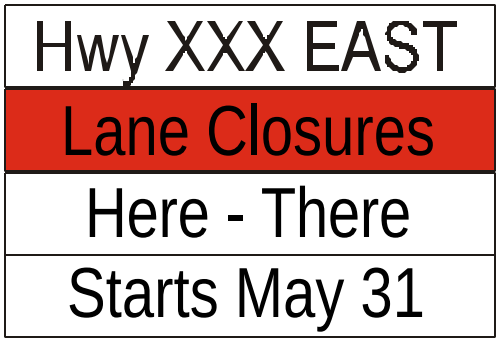
The extent of the activity can be described in one of two ways: using boundary references (e.g. Here – There, Road X – Road Y), or by providing an indication of distance (e.g. for XX km). Boundary references are preferred.

Information regarding which lanes are closed can be presented in different levels of detail, as follows:

- Lane Closed
- Lane Closures
- Left Lane Closed
- Right Lane Closed
- Left Lanes Closed
- Right Lanes Closed
- 2 Left Lanes Closed
- 2 Right Lanes Closed

Where specific information is not known at the time signing is being prepared, or may vary frequently during the work and thus reduce the credibility of the signed message, it is preferable to employ the more generic message.

These concepts are illustrated in the examples that follow.



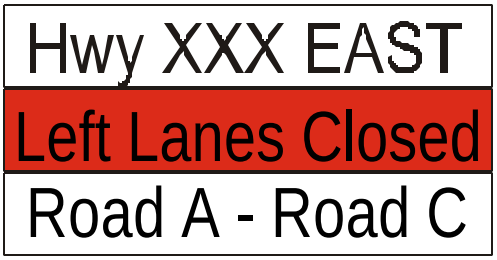
Advance Notification Signing (ANS)

Messages Signed During Advance Warning Phase:

During the advance warning phase, more specific information is provided, where possible, sufficiently in advance to permit drivers to make decisions regarding alternative routes.

Signing may be located upstream of the location of the closure, to facilitate the presentation of alternative route information using local roadways in the immediate area. It may also be located at more distant locations, where other provincial highways intersect with the affected route, to provide information regarding the closure and to set the context for alternative route information about routes that traverse provincial highways.

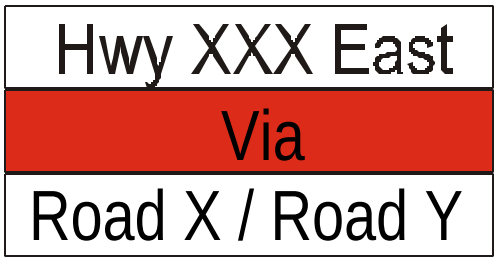
Advance Warning Sign (in the Immediate Vicinity of the Closure)



Advance Warning Sign (At More Distant Locations)

Alternative route signing accompanying this information may take several forms depending on the nature of the alternative route.

If the alternative route is simple, explicit, and well-signed, it may be possible to provide directional information sufficient to the needs of both local and non-local drivers, as follows:



Alternative Route Sign – Simple Route

Municipal roads, provincial highways, or a combination of the two may form the route. However, no more than two roadways can be represented.

For more complex routes, a signed detour is required, as follows:

Alternative Route Signing (Complex Route)

These signs would be located immediately following the Advance Warning Sign, at either local or distant locations. Refer to Figure 4.19 for a diagram of the general arrangement, and to Section 4.22 regarding Alternative Route Signing.

4.20 Non-Freeway – Recurring Lane Closures – Multi-Lane Roads

The section addresses recurring, partial closures of highways. For application guidance involving full or recurring closures of an entire highway, refer to Non-Freeway – Continuous Highway Closures or Recurring Highway Closures respectively.

Lanes closures on highways may cause critical reductions in capacity, and result in congestion. Advance notification of planned lane closures provides drivers with an opportunity to adjust their travel plans. Providing advance warning of their presence makes drivers aware of the potential for congestion, allowing them to seek alternative routes or to be prepared to respond to changes in traffic flow. This awareness reduces uncertainty and frustration, in turn reducing the potential for aggressive and illegal acts.

If more specific information on the nature of the closure can be provided (i.e. left lane(s), right lane(s), etc.), it allows drivers to respond earlier to traffic controls, resulting in smoother traffic flow. This specific information is particularly beneficial to the operators of large commercial vehicles. Commercial vehicles require longer to execute lane changes, needing larger gaps and more maneuvering room than passenger vehicles.

Advance information can become part of a strategy for managing traffic demand within the work zone. Often the threat of congestion will reduce demand on busy commuter routes, as drivers with local knowledge amend their travel plans or seek alternative routes. When combined with ARS or DRS signing on suitable, alternative routes, advance warning of lane closures can induce a larger proportion of drivers to detour around the affected area. Refer to Section 4.22.

Depending on the circumstances, drivers on crossing roadways and parallel routes in the vicinity of the closure may also require information and direction. Drivers destined for intersections within or immediately upstream of the closure could be intercepted and redirected along alternative routes to a point downstream of the affected area using IARS or IDRS. Refer to Section 4.22.

Message Signed During Advance Notification Phase:

During the advance warning phase, drivers are informed of the planned closure, including its extent, the type of impact expected and the planned duration.

Signing is placed immediately upstream of the site of the planned closure, and in advance of key decision-points where alternative routes on provincial facilities may be accessed.

Ideally, signing in the vicinity of the location of the planned closure should be located a minimum of two opportunities to exit the facility in advance, however this may not be practical where there is little or no suitable municipal road network to provide parallel, alternative routes.

The extent of the activity can be described in one of two ways: using boundary references (e.g. Here – There, Road X – Road Y), or by providing an indication of distance (e.g. for XX km). Boundary references are preferred.

Information regarding which lanes are closed can be presented in different levels of detail, as follows:

- Lane Closed

- Lane Closures

- Left Lane Closed
- Right Lane Closed

- Left Lanes Closed
- Right Lanes Closed

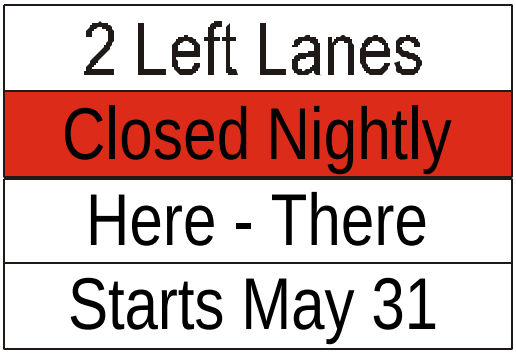
- 2 Left Lanes Closed
- 2 Right Lanes Closed

Where specific information is not known at the time signing is being prepared, or may vary frequently during the work and thus reduce the credibility of the signed message, it is preferable to employ the more generic message.

At more distant locations, it may preferable to provide less precise information on which lanes are to be closed, but to focus on the limits and timeframes. Signing adjacent to the location of the planned activity can provide more specific information.

These concepts are illustrated in the examples that follow.

Advance Notification Signing (ANS) – Distant Locations



Advance Notification Signing (ANS) – Locations in Vicinity of Closure

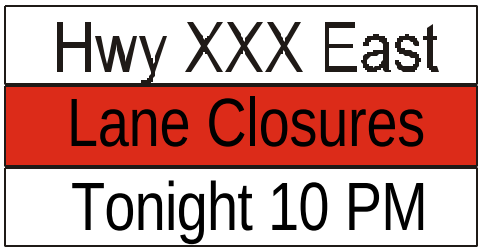
Messages Signed During Advance Warning Phase:

During the advance warning phase, more specific information is provided, where possible, sufficiently in advance to permit drivers to make decisions regarding alternative routes.

Signing may be located upstream of the location of the closure, to facilitate the presentation of alternative route information using local roadways in the immediate area. It may also be located at more distant locations, where other provincial highways intersect with the affected route, to provide information regarding the closure and to set the

context for alternative route information about routes that traverse provincial highways.

Advance Warning Sign (in the Immediate Vicinity of the Closure)



Advance Warning Sign (At More Distant Locations)

Advance Warning Sign (No Work Activities Planned)

Alternative route signing accompanying this information may take several forms depending on the nature of the alternative route.

If the alternative route is simple, explicit, and well-signed, it may be possible to provide directional information sufficient to the needs of both local and non-local drivers, as follows:

Alternative Route Sign – Simple Route

Municipal roads, provincial highways, or a combination of the two may form the route. However, no more than two roadways can be represented.

For more complex routes, a signed detour is required, as follows:

Alternative Route Signing - Complex Route

These signs would be located immediately following the Advance Warning Sign, at either local or distant locations. Refer to Figure 4.19 for a diagram of the general arrangement, and to Section 4.22 regarding Alternative Route Signing.

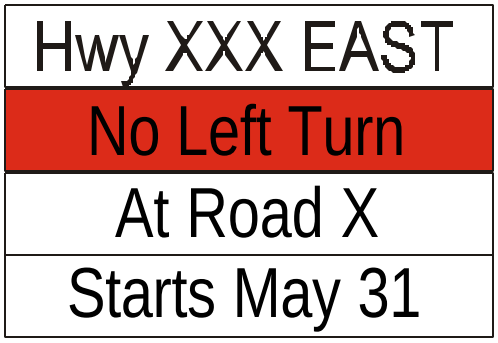
4.21 Non-Freeway – Continuous Work in Intersections

Work in intersections may result in capacity restrictions and in restrictions to navigational freedom. Where it is desired to provide advance notification, advance warning or alternative route information regarding these conditions, the following typical messages may be applied.

Signed Message During the Advance Notification Phase:

During the advance warning phase, drivers are informed of the planned closure, including its extent, the type of impact expected and the planned duration.

Signs are located in the immediate vicinity of the intersection, on the affected approach(es).



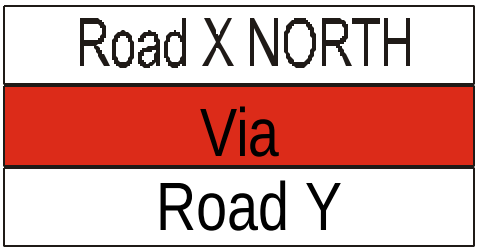
Advance Notification Sign (ANS)

Signed Messages During the Advance Warning Phase

During the advance warning phase, signed messages are installed sufficiently in advance to allow road users to select and access alternative routes. Messages set the context for alternative route or signed detour route information.

Examples include the following:

Advance Warning Sign (AWS)



Alternative Route Sign (ARS)

Detour Route Sign (DTS)

Refer to Figure 4.19 for a diagram of the general arrangement. For additional information on signing alternative routes, refer to Section 4.22.

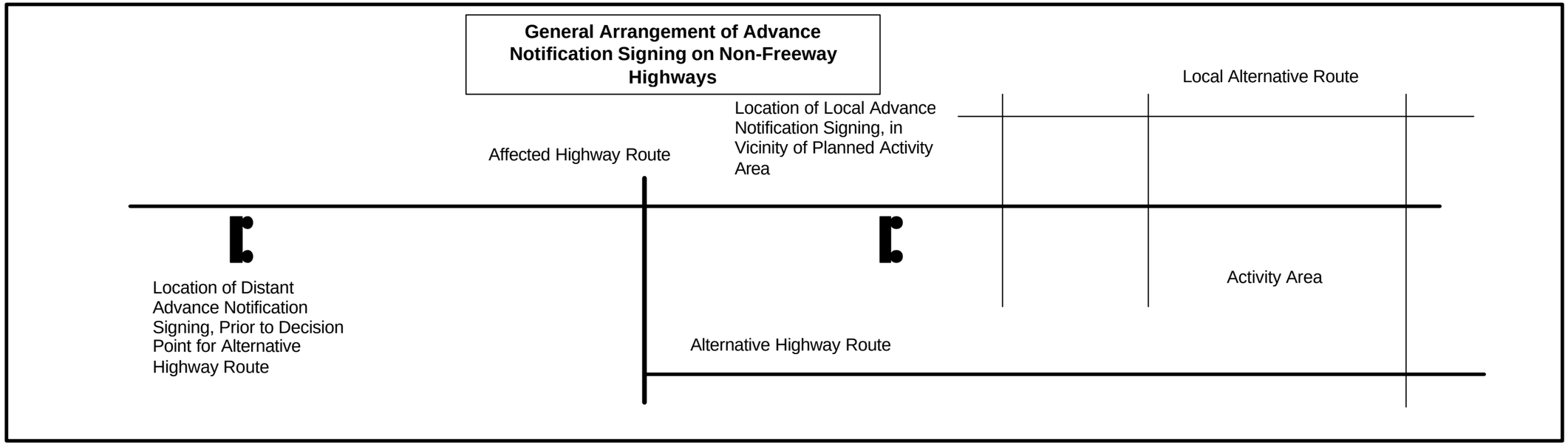


Figure 4.19 – Non-Freeway General Arrangement of Signs

4.22 Alternative Route Signing

The provision of alternative routes allows drivers to overcome navigational restrictions imposed by work activities, to by-pass areas of congestion, or both. The provision of an alternative route is optional in the case of a capacity restriction, but should be provided whenever navigational restrictions are imposed.

Alternative route signing is an umbrella term that covers any type of signing that directs drivers to an alternative route. It may be employed on the affected route itself, on crossing roadways that intersect with the affected route within the limits of the work area (and are thus directly affected), and on crossing roadways upstream of the activity area, to reduce traffic demand within the work area.

Alternative route signing works in concert with advance warning information. It is intended that the two messages be read together, in sequence, in order to convey complete and correct information to the driver. This is illustrated below. Alternative route signing must be covered when the route is not in use, as in the case of recurring work activities.

Generically, alternative route signing takes two forms.

In areas where alternative routes are simple, have explicit permanent signing, and a high proportion of drivers have good local knowledge, Alternative Route Signing may simply advocate an alternative route upstream of a key decision point. No trailblazing is provided along the route. The driver must use local knowledge and other, permanent wayfinding information to navigate to a destination, or to rejoin the impacted facility downstream of the work activity.

Alternative Route Signing (ARS) on Affected Roadway (unsigned alternative route):

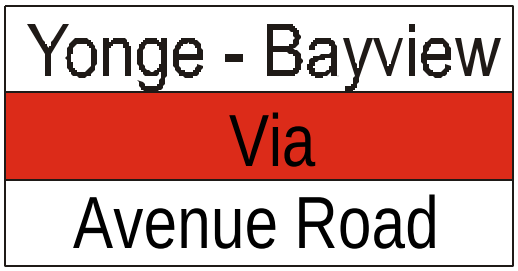
Explaining alternative route signing generically is apt to lead to confusion. Accordingly, a “real world” example is used throughout the remainder of this section.

In a theoretical recurring closure of the eastbound collector lanes of Highway 401 between Yonge Street and Bayview Avenue, a navigational restriction and a critical capacity reduction are created. Advance Notification Signing (ANS) would be installed prior to the planned closure, to forewarn recurring users of the facility. At the commencement of work, an Advance Warning Sign (AWS) would be located on Highway 401 eastbound with this message:

Collectors East
Closed Tonight 10 PM
Yonge – Bayview

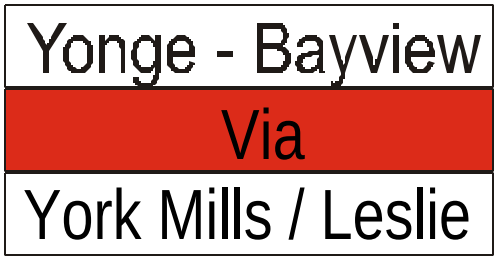
This message would then be followed by an Alternative Route Sign (ARS) advocating an alternative route, as follows:

Yonge – Bayview
Via
Avenue Road



Alternative Route Sign (ARS)

This information would then be supplemented, once the driver had exited at Avenue Road, with the following:



Alternative Route Sign (ARS)

If it is thought necessary to encourage some proportion of drivers in the collectors that are destined further to the east to use the Avenue Road, York Mills, Leslie alternative route, to ease congestion, messages in addition to those shown above would be required. The following depicts the complete sequence.

Collectors East
Closed Tonight 10 PM
Yonge – Bayview

would be posted in the express and collectors, followed by:

Yonge – Bayview
Via
Avenue Road

in turn, followed by (in the collectors only):

Alternate Route
Via
Avenue Road

At the Avenue Road ramp, the signing would indicate the following:

Yonge – Bayview
Via
Wilson / York Mills

followed by:

401 EAST
Via
York Mills / Leslie

With this information, a driver with local knowledge can:

- overcome the navigational restriction, and access the crossing roadways served by the closed interchanges; and
- bypass the congested area, rejoining the highway at a designated downstream location – in this case at Leslie Street.

Refer to Figure 4.20 and Figure 4.21 for additional details.

Detour Route Signing (DRS) on Affected Roadway (with signed alternative route):

Where the alternative route is more complex, the permanent signing is less explicit, or the proportion of drivers with local knowledge is low, a signed alternative route is needed. This is referred to as Detour Route Signing, and comprises an initial Detour Route Sign (DRS) at the upstream end of the route, and Detour Trailblazer Signs (DTS) in advance of decision points along the entire route.

Detour Routes have the advantage of being easily followed by drivers unfamiliar with the local roadway network. Their major drawback is the requirement for additional, temporary signs.

In the case of our collector closure scenario, the same AWS and ARS messages would be used on the main line to guide drivers to exit at Avenue Road. Then, instead of additional route instructions, drivers would be directed to follow a specific detour route (e.g. D-1).

Advance Notification Signing (ANS) would be installed prior to the planned closure, to forewarn recurring users of the facility. At the commencement of work, an Advance Warning Sign (AWS) would be located on Highway 401 eastbound with this message:

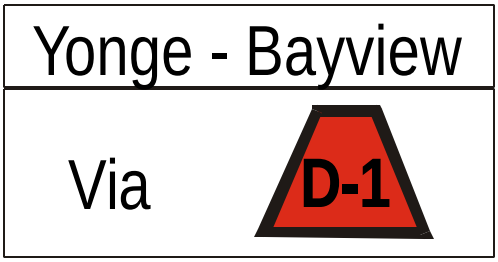
Collectors East
Closed Tonight 10 PM
Yonge – Bayview

This message would then be followed by an Alternative Route Sign (ARS) advocating an alternative route, as follows:

Yonge – Bayview
Via
Avenue Road

In advance of the ramp terminal, drivers are instructed to follow a signed detour route, by the following message:

Yonge – Bayview
Via
D-1



Detour Route Sign (DRS)

The D-1 icon would then be repeated on signing in advance of each decision-point, along with an appropriate directional arrow directing drivers along the route (refer to Detour Trailblazer Sign).

In less complex scenarios, such as an alternative route from a highway that begins at an at-grade intersection, the "Via D-1" message could be presented at the outset, and trailblazing provided throughout the route.

Where the alternative route is intended to by-pass areas of congestion on an affected route, and return diverted traffic to the affected route downstream of the work area, detour route signing is generally required. This is due to the

complexity of the route, which may include exiting at a crossing roadway, accessing a parallel route, following it to another crossing roadway, and returning to the affected route.

To encourage unfamiliar drivers to use the Avenue Road, York Mills, Leslie alternative route, to ease congestion, messages in addition to those shown above would be required. The following depicts the complete sequence.

Collectors East
Closed Tonight 10 PM
Yonge – Bayview

would be posted in the express and collectors, followed by:

Yonge – Bayview
Via
Avenue Road

in turn, followed by (in the collectors only):

Alternate Route
Via
Avenue Road

At the Avenue Road ramp, the signing would indicate the following:

Yonge – Bayview
Via
D-1

followed by:

401 EAST
Via
D-1

Refer to Figures 4.22 and 4.23.

Intercept Alternative Route Signing (IARS) on Crossing Roadways Intersecting Within the Activity Area (unsigned alternative route):

IARS can be applied in a number of scenarios. They may be used to address traffic on crossing roadways that intersect with the affected route within the activity area and are thus also affected. In this manner they redirect traffic destined for the affected route along parallel or by-pass routes, overcoming navigational restrictions (e.g. closed ramps) and capacity constraints.

For example, an AWS message on a crossing roadway that intersects the affected facility within the activity area might read as follows:

Access to 401 EAST
Closed Tonight 10 PM
Yonge – Bayview

The IARS sign that follows might then read:

Yonge – Bayview
Via
York Mills / Leslie

Refer to Figure 4.24 for additional details.

Intercept Detour Route Signing (IDRS) on Crossing Roadways Intersecting Within the Activity Area (with signed alternative route):

IDRS can be applied in a number of scenarios. They may also be used to address traffic on crossing roadways that intersect with the affected route within the activity area and are thus also affected. In this manner they redirect traffic destined for the affected route

along parallel or by-pass routes, overcoming navigational restrictions (e.g. closed ramps) and capacity constraints.

The same alternative route as previously described, identified using IDRS, would read as follows, starting with the AWS:

Access to 401 EAST
Closed Tonight 10 PM
Yonge – Bayview

The IDRS sign that follows would then read:

Yonge – Bayview
Via
D-1

Detour Trailblazer Signing (DTS) along York Mills to Leslie Street would lead drivers to the intervening crossing roadways and to Leslie Street, where they would rejoin Highway 401 EAST.

Refer to Figure 4.25 for additional details.

Intercept Alternative Route Signing on Crossing (IARS) Roadways Intersecting Upstream of the Activity Area (unsigned alternative route):

Intercepting traffic on crossing roadways that intersect with the affected route upstream of the activity area requires a slightly different message. Whenever possible, the same alternative route as is used for the traffic diverted from the crossing roadways within the activity area is used. This avoids the potential for confusion and reduces the amount of signing required.

Where capacity through the activity area is critical, IARS can be used on crossing roadways upstream of the activity area to "intercept" traffic destined for the affected facility and redirect it along parallel or by-pass routes. This treatment follows the same principles as ARS. It provides alternative route information by advocating describing route.

Using IARS, the message on an upstream crossing roadway would read as follows, starting with the AWS:

401 Collectors EAST
Closed Tonight 10 PM
Yonge – Bayview

followed by the IARS information

401 Collectors EAST
Via
York Mills / Leslie

Refer to Figure 4.26 for additional details.

Intercept Detour Route Signing (IDRS) on Crossing Roadways Intersecting Upstream of the Activity Area (with signed alternative route):

Intercepting traffic on crossing roadways that intersect with the affected route upstream of the activity area requires a slightly different message. Whenever possible, the same alternative route as is used for the traffic diverted from the crossing roadways within the activity area is used. This avoids the potential for confusion and reduces the amount of signing required.

Where capacity through the activity area is critical, IDRS can be used on crossing roadways upstream of the activity area to "intercept" traffic destined for the affected facility and redirect it along a signed parallel or by-pass route. IDRS

provides alternative route information by providing an initial Intercept DRS (IDRS) and trailblazing (referred to as Detour Trailblazing Signs - DTS) at decision-points along the route.

If IDRS were used, the message would read as follows, beginning with the AWS:

401 Collectors EAST
Closed Tonight 10 PM
Yonge – Bayview

followed by the IDRS information

401 Collectors EAST
Via
D-1

Detour Trailblazer Signing (DTS) along York Mills to Leslie Street would lead drivers past the intervening crossing roadways and to Leslie Street, where they would rejoin Highway 401 EAST.

Refer to Figure 4.27 for additional details.

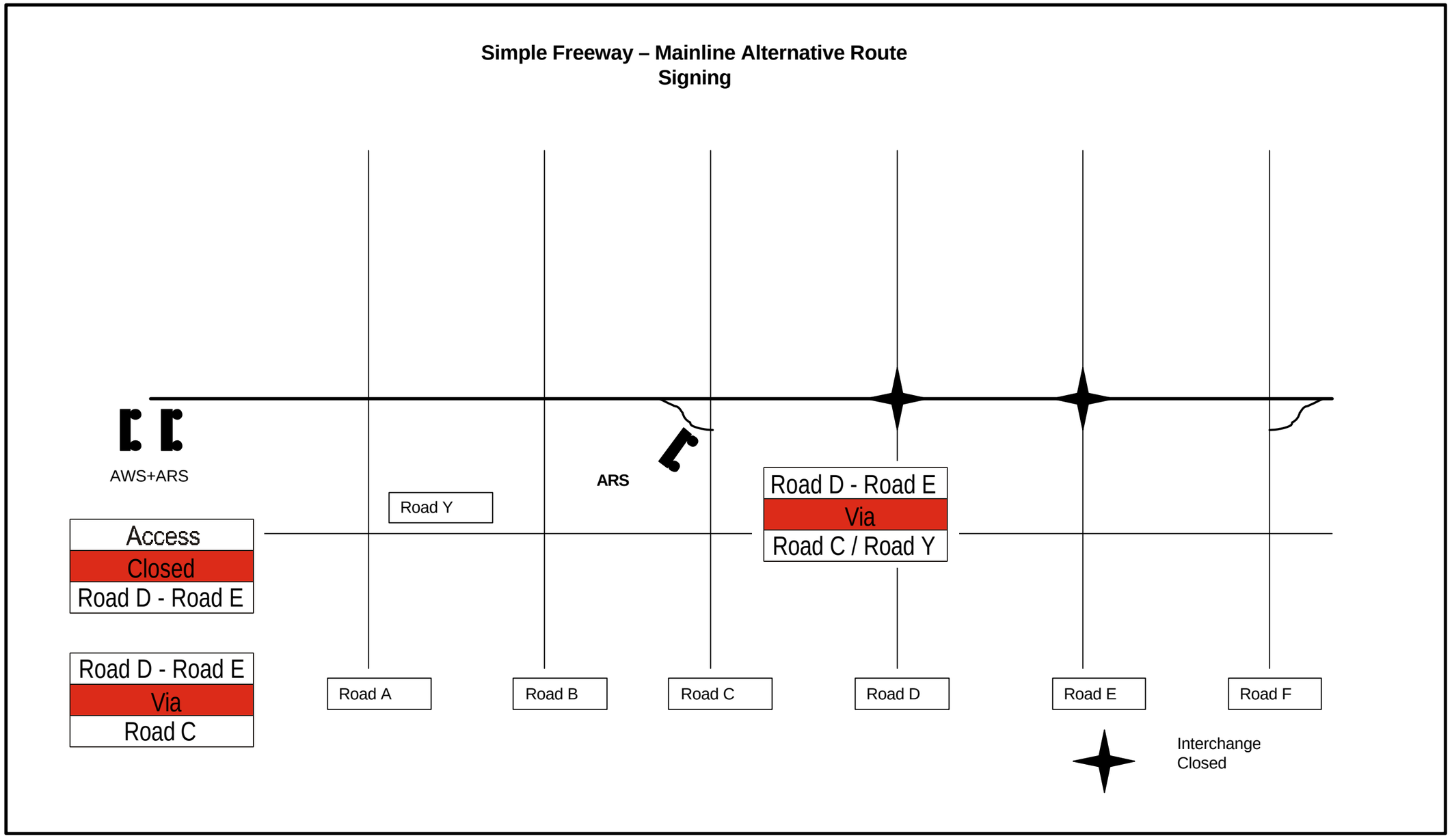


Figure 4.20 – Simple Freeway – Mainline Alternative Route Signing

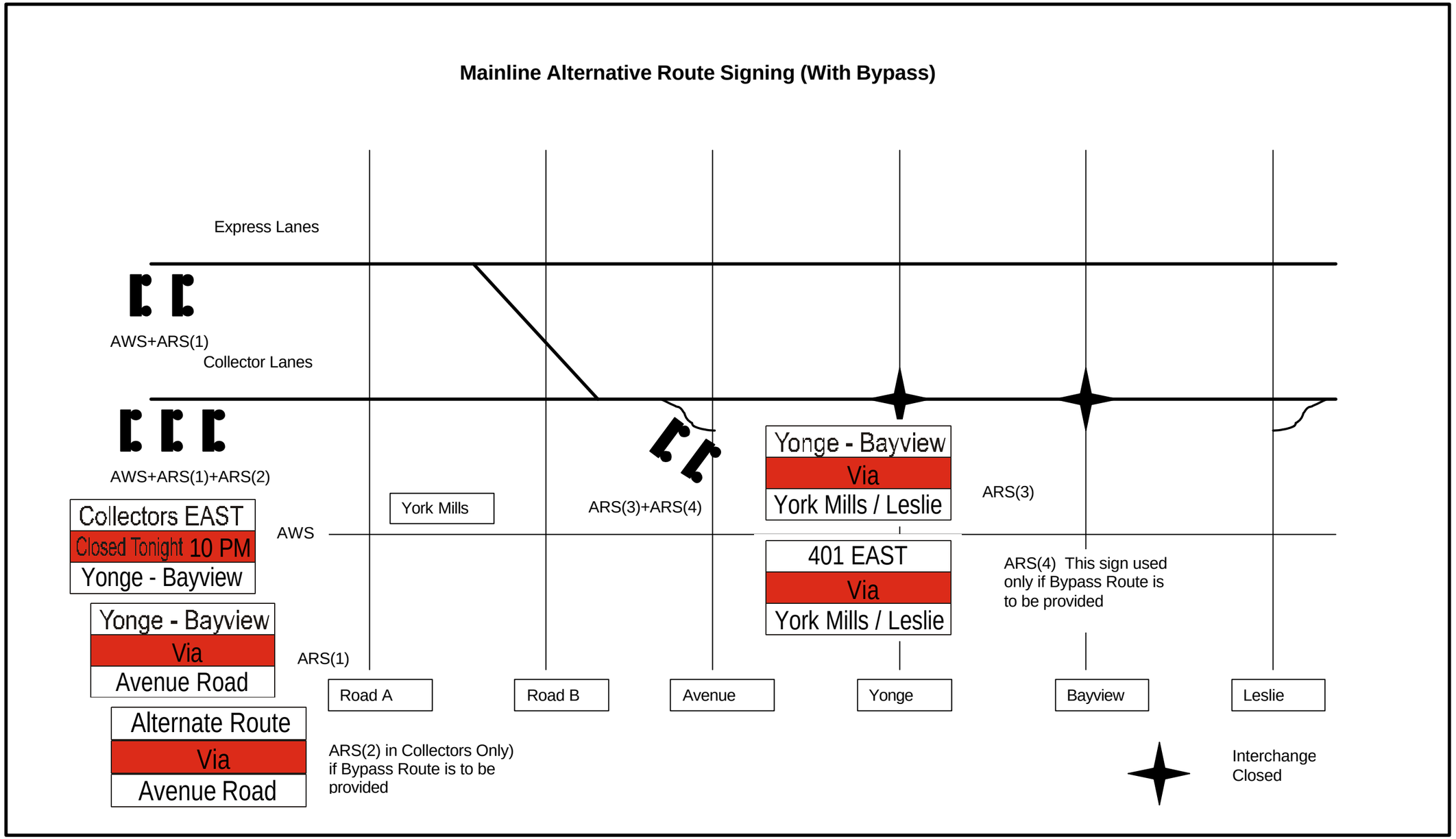


Figure 4.21 –Mainline Alternative Route Signing (With Bypass)

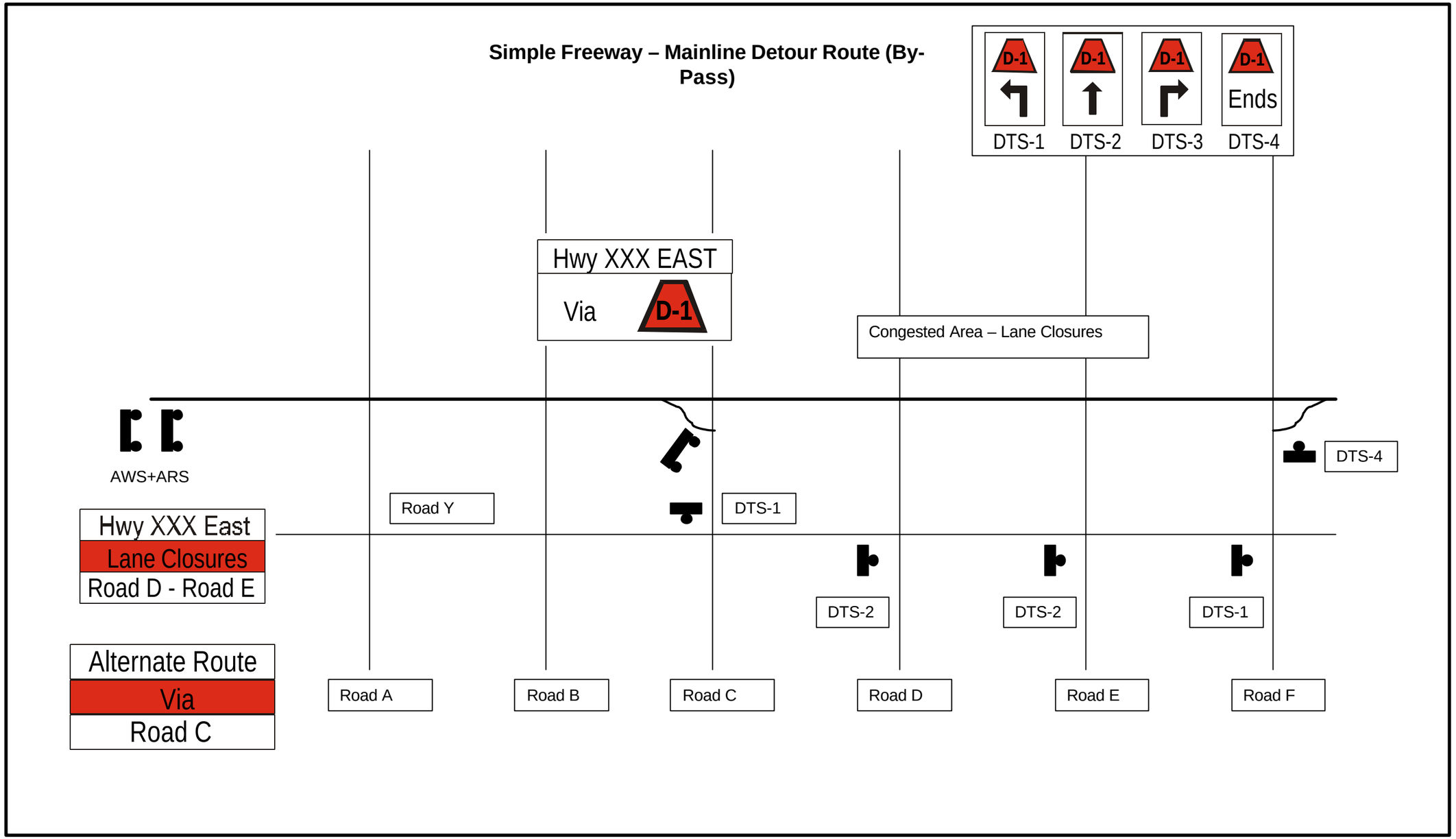


Figure 4.22 – Simple Freeway – Mainline Detour Route Signing (By Pass)

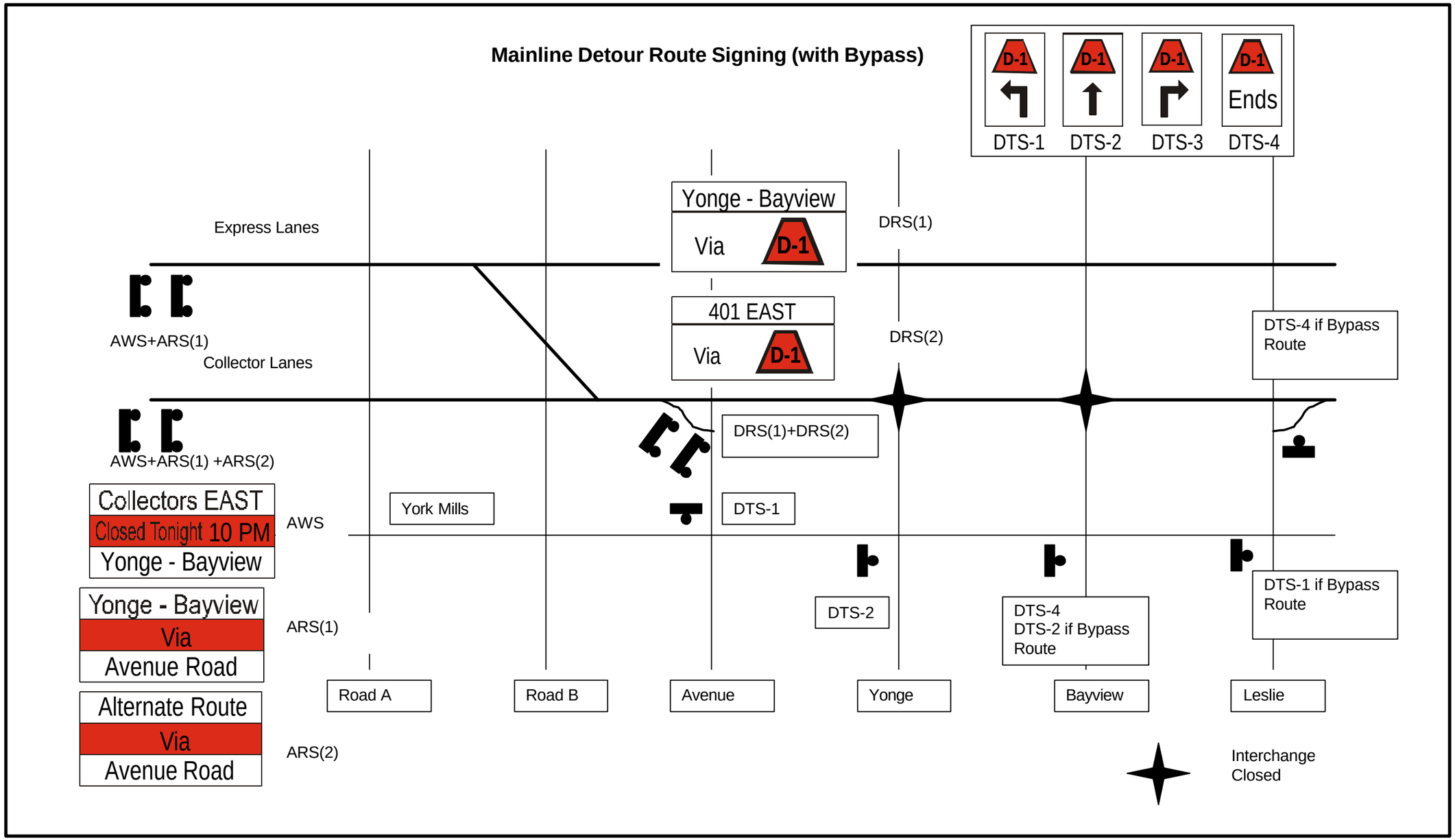


Figure 4.23 – Mainline Detour Route Signing (With Bypass)

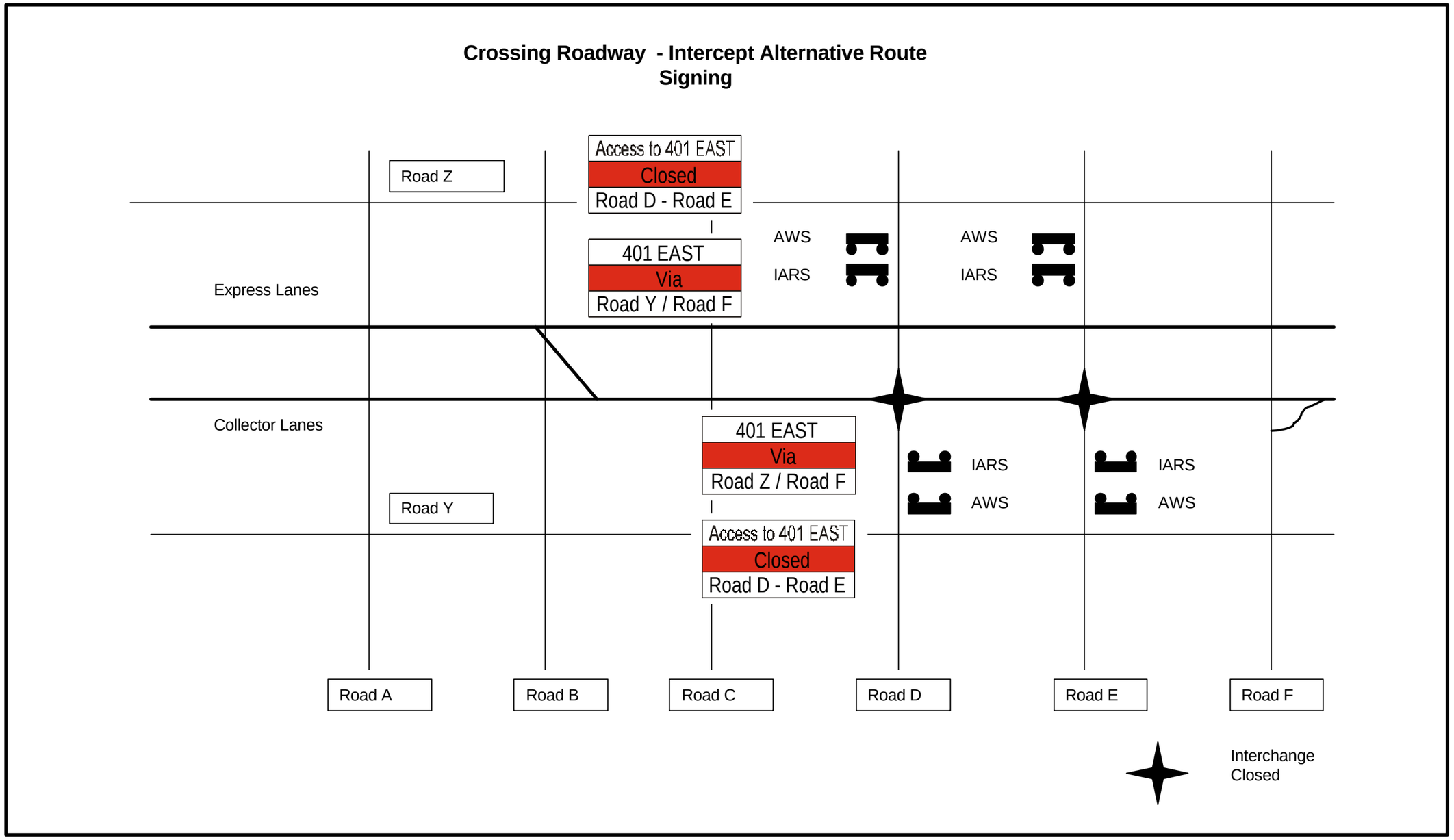


Figure 4.24 – Crossing Roadway – Intercept Alternative Route Signing

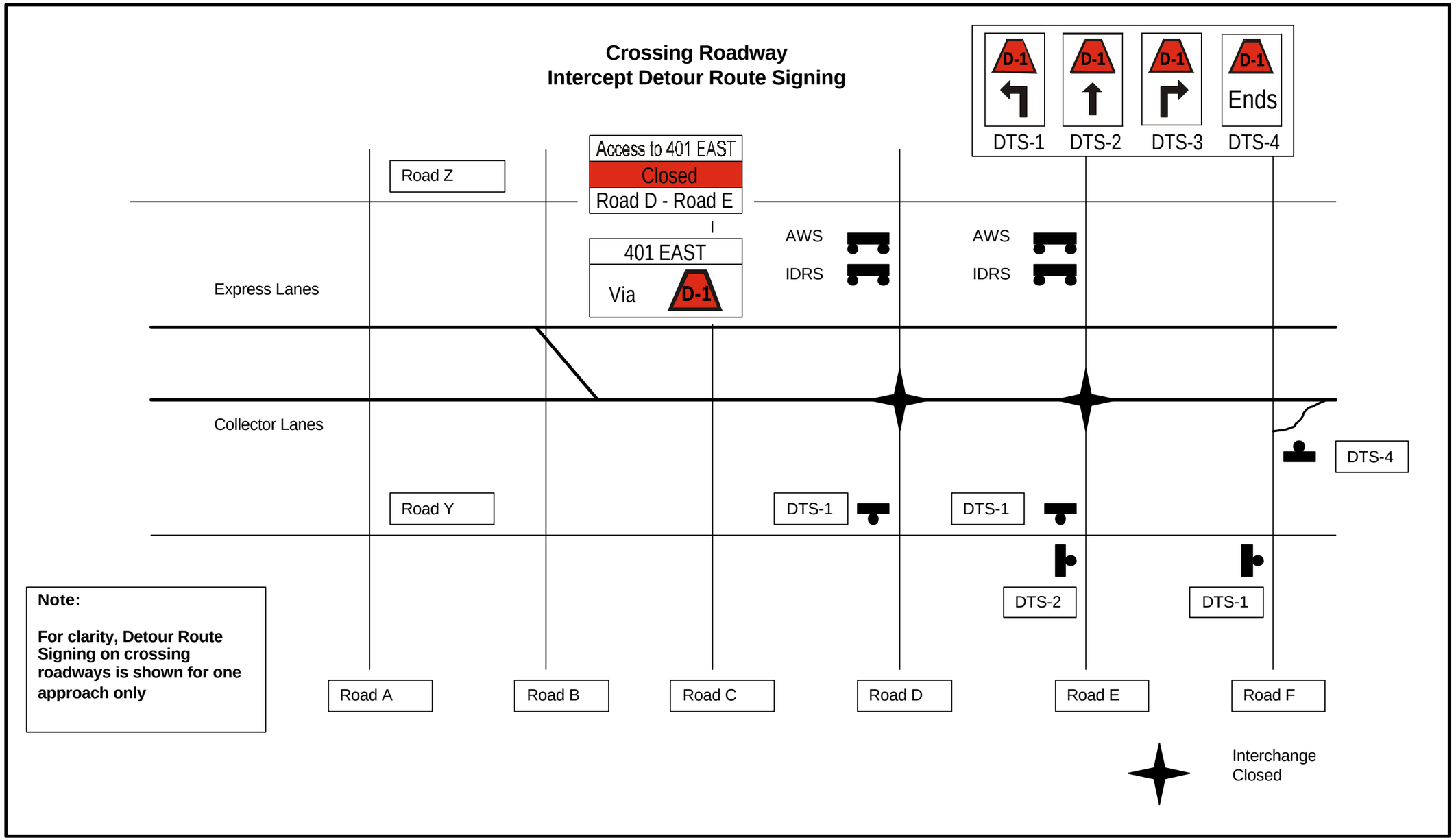


Figure 4.25 – Crossing Roadway – Intercept Detour Route Signing

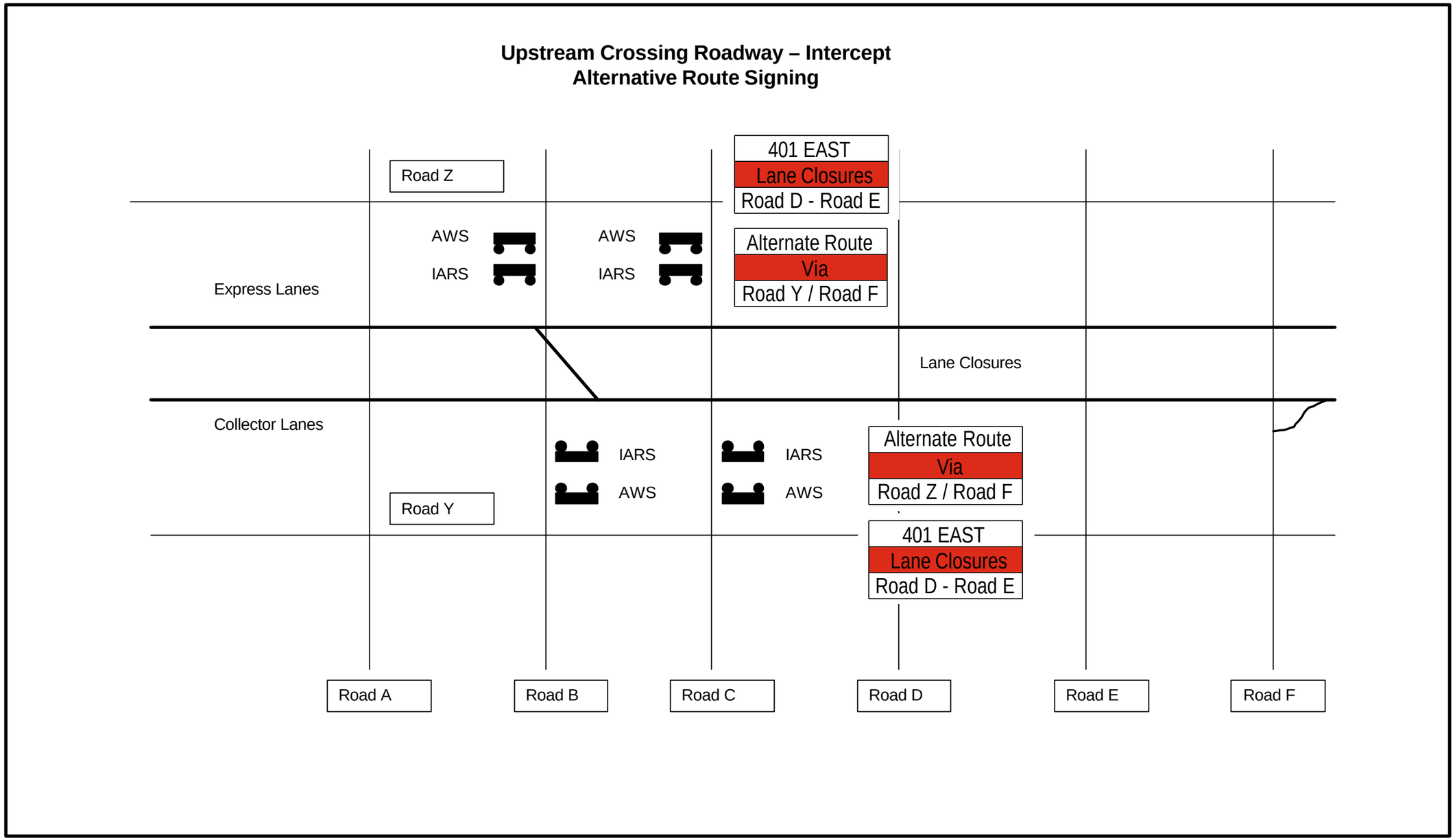


Figure 4.26 – Upstream Crossing Roadway – Intercept Alternative Route Signing (By-Pass)

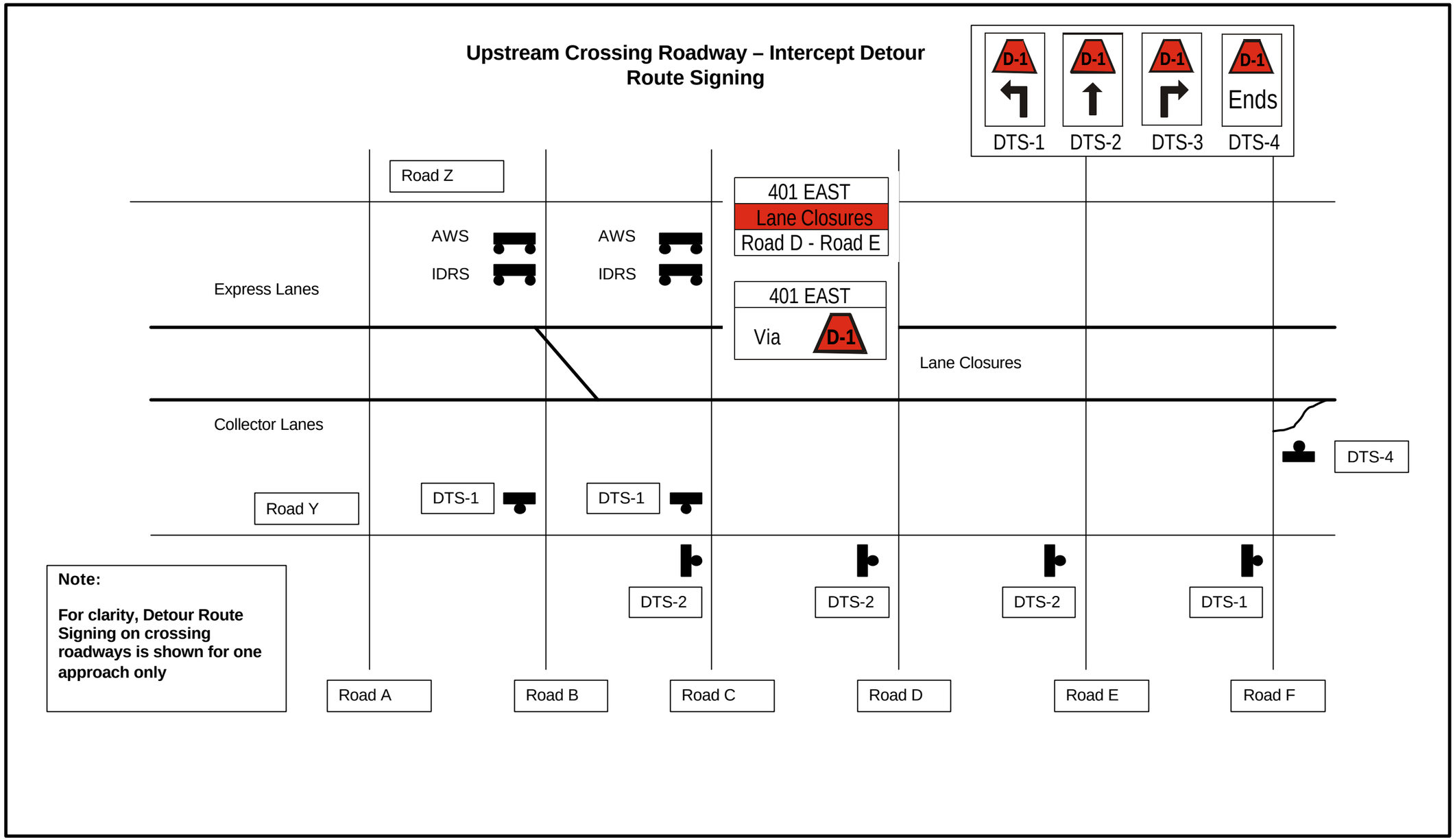


Figure 4.27 – Upstream Crossing Roadway – Intercept Detour Route Signing (By-Pass)

4.23 Signing for Miscellaneous Conditions

Temporary conditions traffic management signing can be used to sign for a broad range of miscellaneous conditions, while keeping with the principles outlined in this Manual.

Care should be taken not to overburden the driver with non-essential information and messages.

Narrow Lanes

Narrow lanes can have substantial impacts on the capacity of a route. Narrow lanes, particularly when used in concert with barriers placed immediately adjacent to traveled lanes, create operational challenges for large commercial and recreational vehicles. Where conditions are significantly constrained, transport trucks and buses will avoid operating in parallel, staggering their position in traffic, and further hampering capacity. This practice may also see these vehicles encroach into adjacent lanes, coming into conflict with smaller vehicles attempting to overtake them.

Where capacity constraints and/or operational challenges are anticipated, advance notification and warning may prove beneficial. This is particularly true of routes with higher proportion of commercial vehicles.

Narrow Lanes Signing

Narrow Lanes Signing

Lanes Designated for Commercial Vehicles:

Where narrow lanes and/or shoulders are severe, or a shoulder is being used as a temporary lane and is unsuitable for large commercial vehicles, specific direction can be given to commercial vehicle operators regarding choice of lane.

The illustrative signs that follow are intended to supplement those shown above.

Narrow Lanes Signing with Truck Advisory

Length of Queue Warning:

Where it is desired to raise the awareness of drivers regarding possible congestion, the following sign may be placed upstream of the anticipated tail of the traffic queue created by the capacity restriction.

Central Region Traffic Office will provide information of projected queue lengths based on anticipated volumes and capacity restrictions.

Queue Warning Sign

CHAPTER 5

WORKED EXAMPLES

TABLE OF CONTENTS

5.1 Introduction

Thus far in the Manual, we have discussed the application of various Temporary Conditions Traffic Management tools in the generic sense, or in isolation from one another. In this Chapter, we will take a number of realistic scenarios and, through demonstration, build up to applying the full range of TCTM tools to a single project.

This is not to imply that all of the tools demonstrated are always necessary. In each case, the road authority or their designee must evaluate the circumstances of the project and determine to what degree TCTM is required, if at all, and can be practically implemented.

Implementing the traffic management strategies outlined in this Chapter involves careful planning, and cooperation between roadway jurisdictions in the development and signing of alternative routes.

It also requires a concerted effort by the contractor to keep the information up-to-date and relevant. This cannot be overstated. Unless the information is relevant, is placed appropriately and is kept current, its credibility with road user will be lost, and the resources dedicated to TCTM will not achieve their desired benefit.

5.2 King's Highway Nighttime Recurring Lane Closure – No Alternative Route

Outline of the Scenario

Highway 9 west of Newmarket, between York Regional Road 36 and Dufferin Street, is to be reconstructed in the Summer of 2001. Work is set to begin on May 31, 2001.

Portions of the work (milling and resurfacing, culvert replacement) will require the roadway to be reduced to one lane during nighttime, off-peak periods, over short sections, with right-of-way alternated through the use of portable lane control signals and pilot vehicles. Two lane, two-way operations through the work zone will be restored daily. This phase of the work will last approximately six weeks.

Due to the nature of the location and the lack of suitable, parallel routes, no alternative routes will be provided. Signing will be provided on the provincial highway and, although optional, on major crossing roadways within the limits of the work zone. Police will control the intersections whenever they are straddled by the single lane operation.

Figure 5.1 provides an overview of the site.

Figure 5.2 illustrates the Advance Notification signing (ANS) proposed. This would be installed seven (7) to ten (10) days before the commencement of work. Note that providing ANS on the crossing roadways is optional.

Figure 5.3 illustrates the Advance Warning signing (AWS) in its two configurations – when work is planned for the upcoming evening, and when it is not. Again, signing on the crossing roadways is optional.

During the advance warning phase, updating of these signs would occur daily, before 05:30 AM, to reflect the planned events for that evening (1 Lane Tonight or Open Tonight).

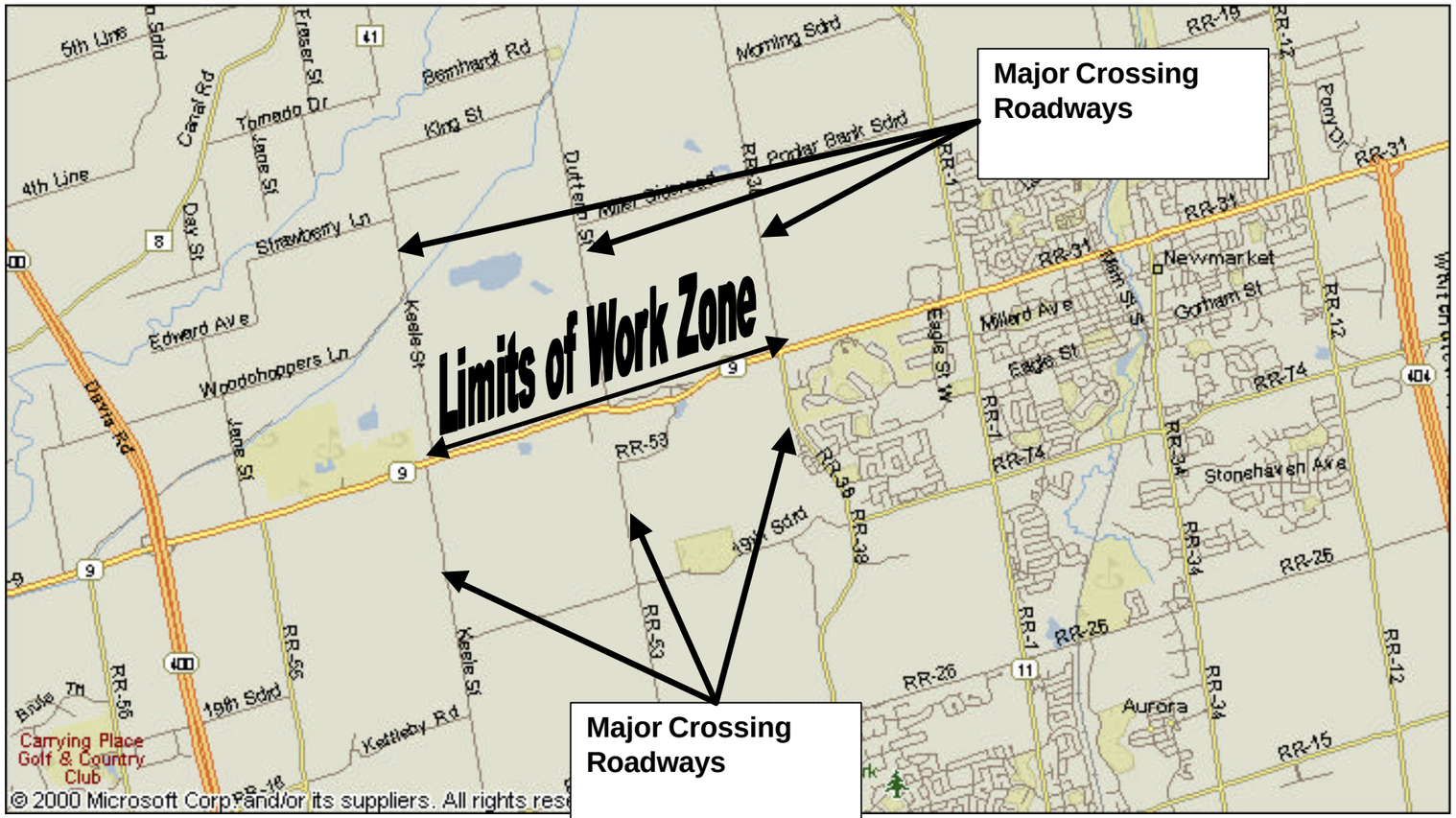


Figure 5.1 – Highway 9 Reconstruction – Overview

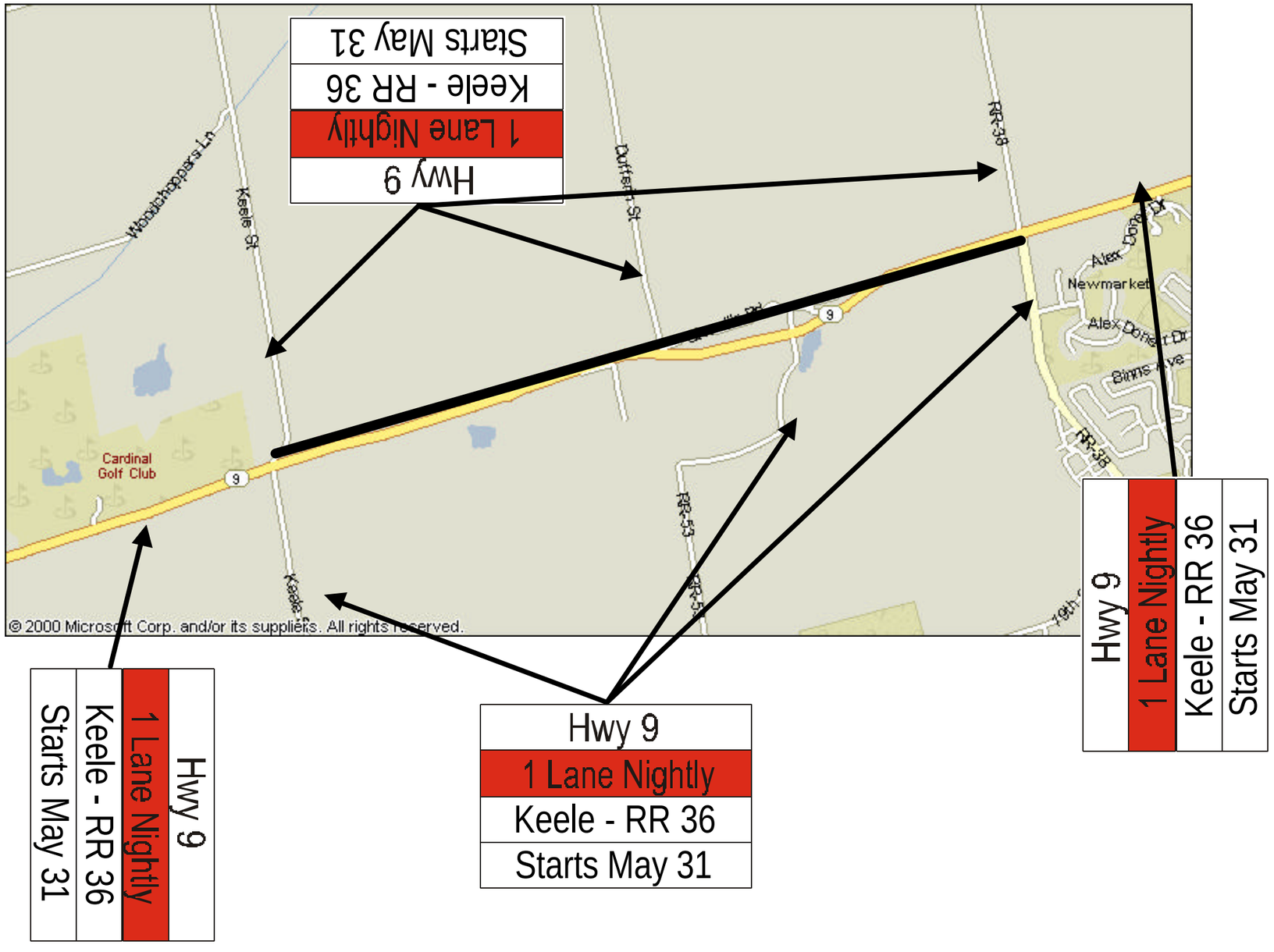


Figure 5.2 – Highway 9 Reconstruction – Advance Notification Signing (ANS)

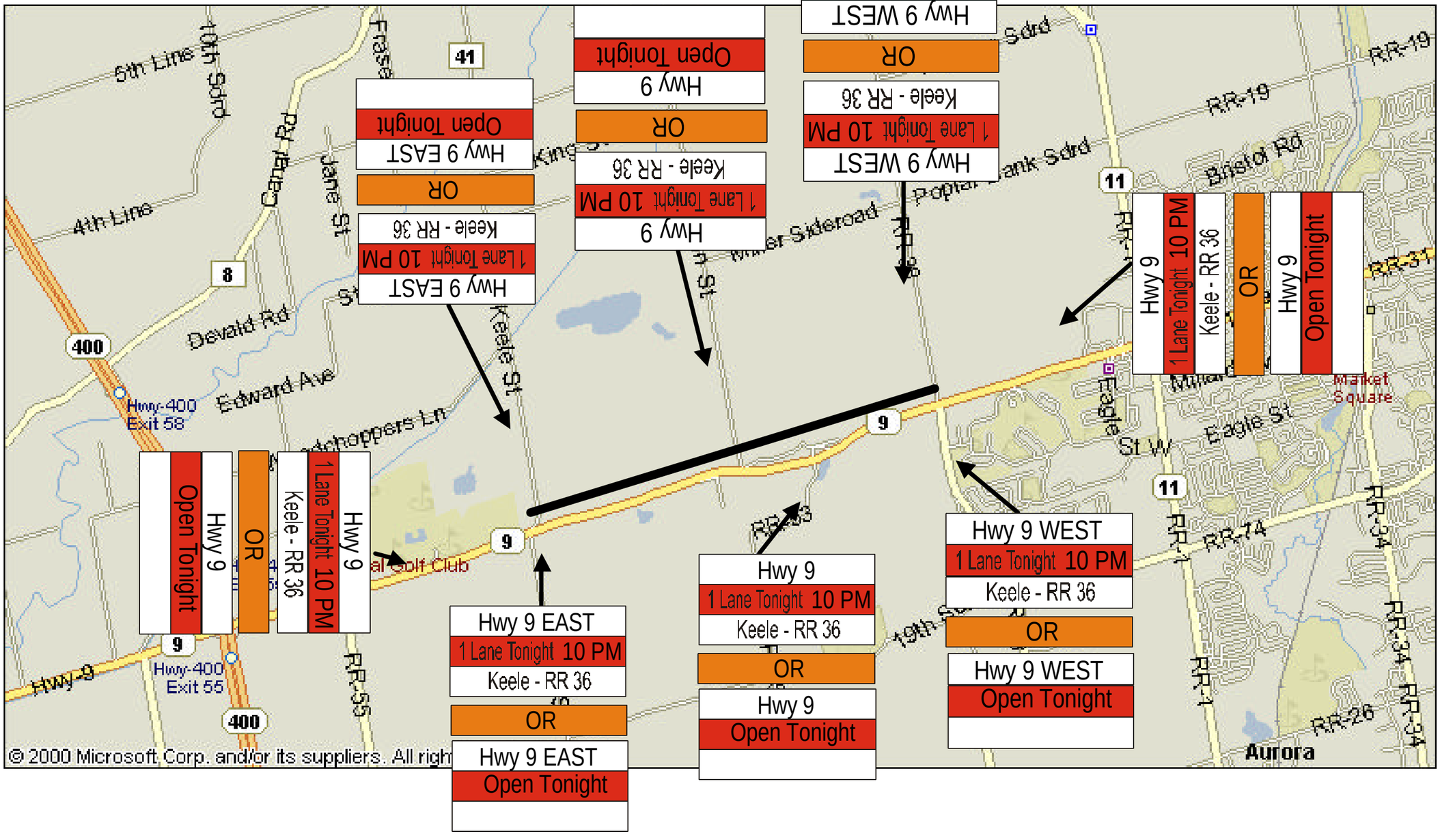


Figure 5.3 – Highway 9 Reconstruction – Advance Warning Signing (AWS)

5.3 Simple Freeway Nighttime Lane Closure – Alternative Route Provided

Outline of the Scenario

Recurring nighttime closures of the two right lanes of westbound Highway 403 from west of Mavis Road to west of the Erin Mills Parkway are necessary to permit the construction of a dedicated HOV lane. This work will require approximately two months to complete.

The closure does not create a critical capacity reduction necessitating a bypass route be provided, however the work will preclude access to the Erin Mills Parkway off-ramp from westbound Highway 403. This navigational restriction will be overcome by providing an alternative route to traffic destined for Erin Mills Parkway via Mavis Road and Eglinton Avenue West. Two options for indicating this route – Alternative Route Signing (ARS) and Detour Route Signing (DRS) will be proposed.

The on-ramps to westbound Highway 403 from Erin Mills Parkway will not be affected.

Figure 5.4 provides an overview of the site. Note that Erin Mills Parkway is shown as Regional Road 1 (RR 1) on the maps.

Advance Notification Phase

Figure 5.5 shows two Advance Notification Signs (ANS) – one for westbound Highway 403 traffic, identifying the planned lane closures, the other for traffic exiting westbound Highway 403 at Erin Mills Parkway, identify the planned ramp closure. These signs would be installed seven (7) to ten (10) days before the commencement of work.

Advance Warning Phase

Figure 5.6 shows the Advance Warning Signing (AWS) for the recurring nightly lane closures and for the recurring nightly off-ramp closure. Signing would be updated daily (05:30 AM) to reflect the planned activities for that night, and blanked when not applicable.

Alternative Route Signing (ARS) is provided downstream of off-ramp closure AWS, indicating an unsigned alternative route via Mavis Drive and Eglinton Avenue West. Drivers with local knowledge will likely be able to follow these alternative route instructions easily. Drivers without local knowledge may not know whether to turn north or south on Mavis Road, but given the grid network of local streets, would likely encounter Burnhamthorpe Road West, and turn west reaching their destination regardless.

If non-local drivers are to be provided more explicit information, Detour Route Signing (DTS) and Detour TrailBlazer Signing (DTS) is needed. This is illustrated in **Figure 5.7**.

Mainline signing remains essentially the same whether ARS or DRS are used, with AWS for the lane closures and off-ramp closure provided. The ARS information directs drivers destined for Erin Mills Parkway to exit at Mavis Road. There, DRS signing provides instructions them to follow D-1. DTS information directs the driver north on Mavis Road, west on Eglinton Avenue, with a pull-through/assurance sign at Mississauga Road, and a termination at Erin Mills Parkway.

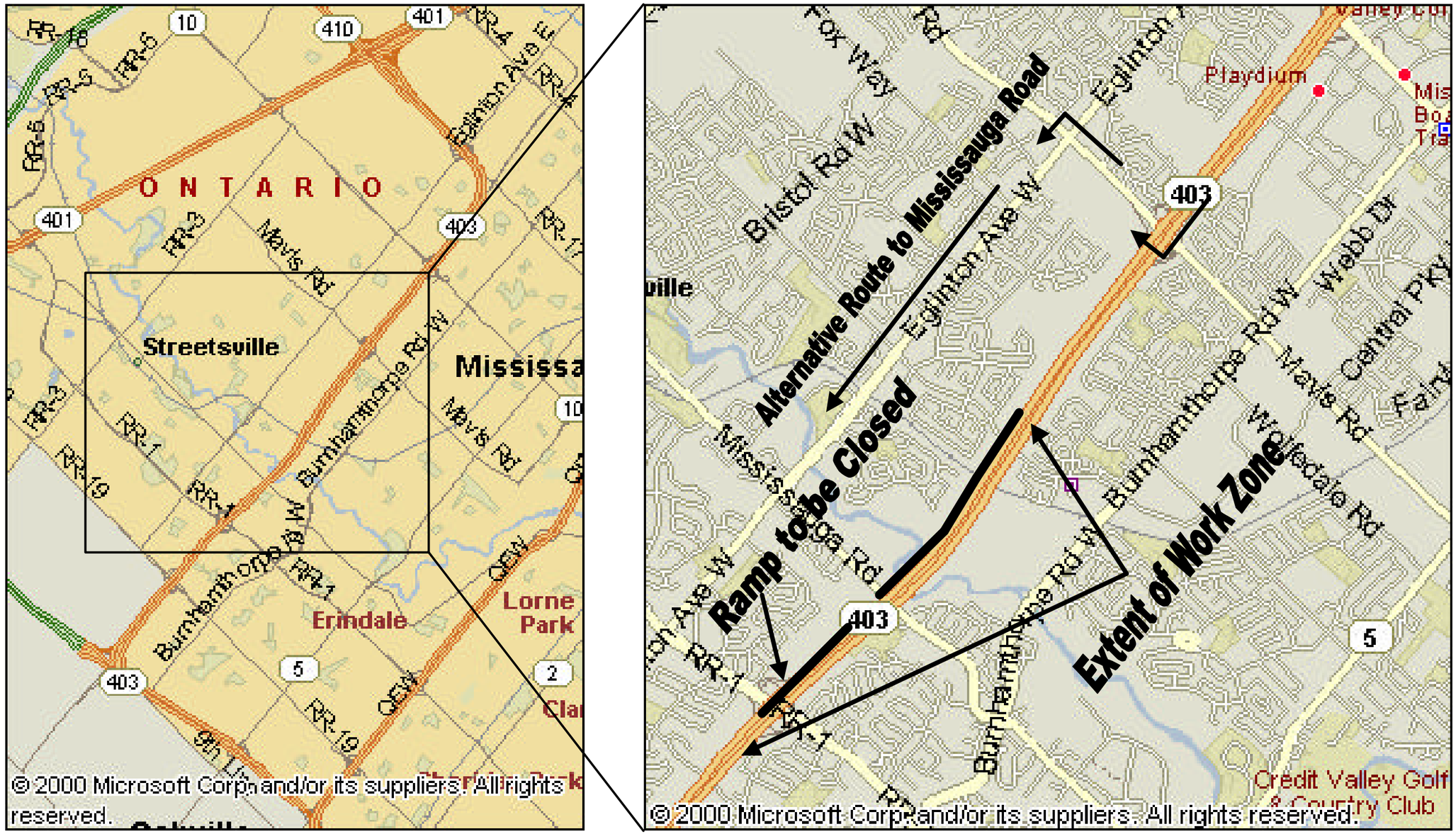


Figure 5.4 – Highway 403 Nighttime Lane Closures with Alternative Route – Overview

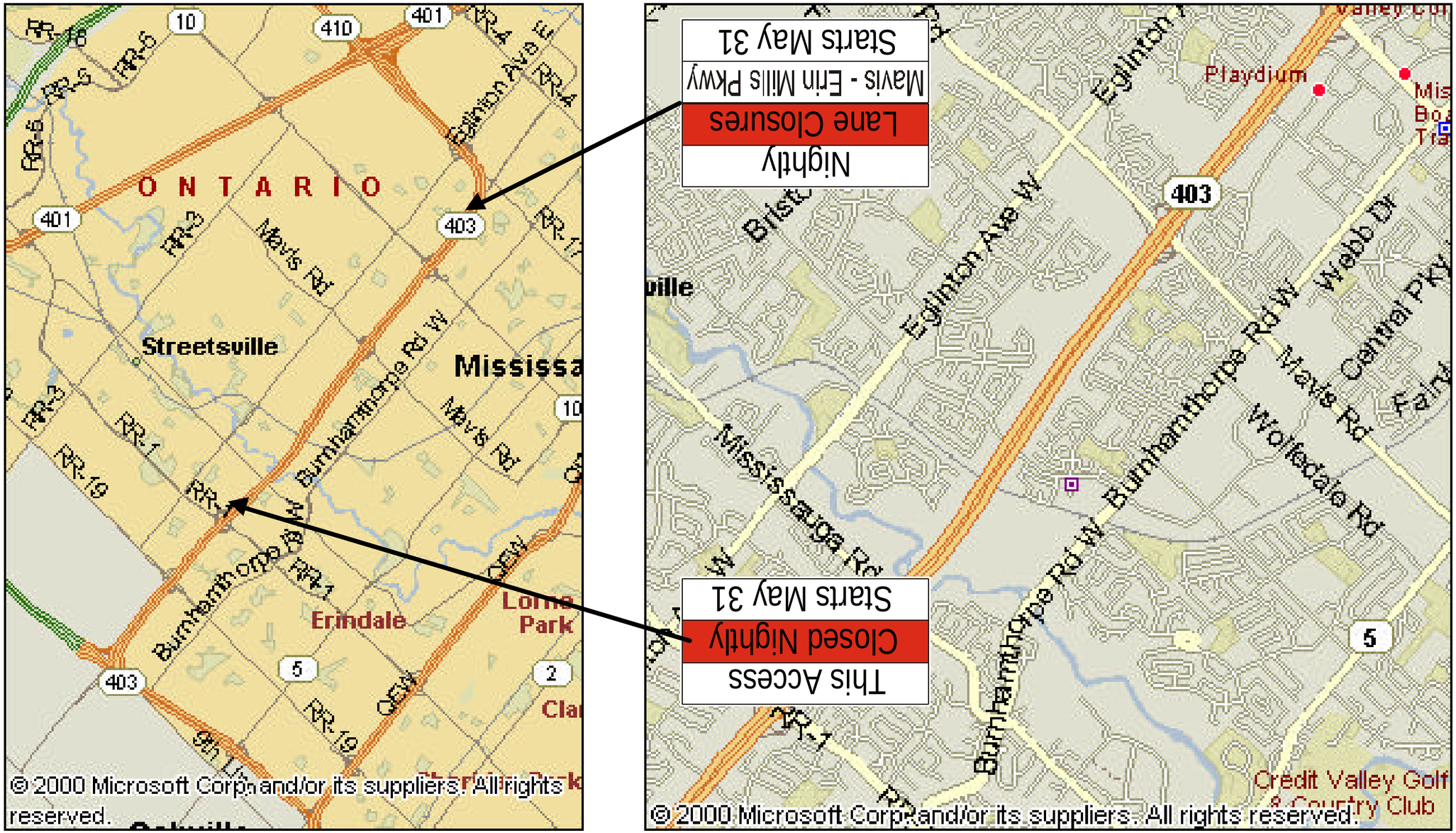


Figure 5.5 - Highway 403 Nighttime Lane Closures with Alternative Route – Advance Notification Phase (ANS)

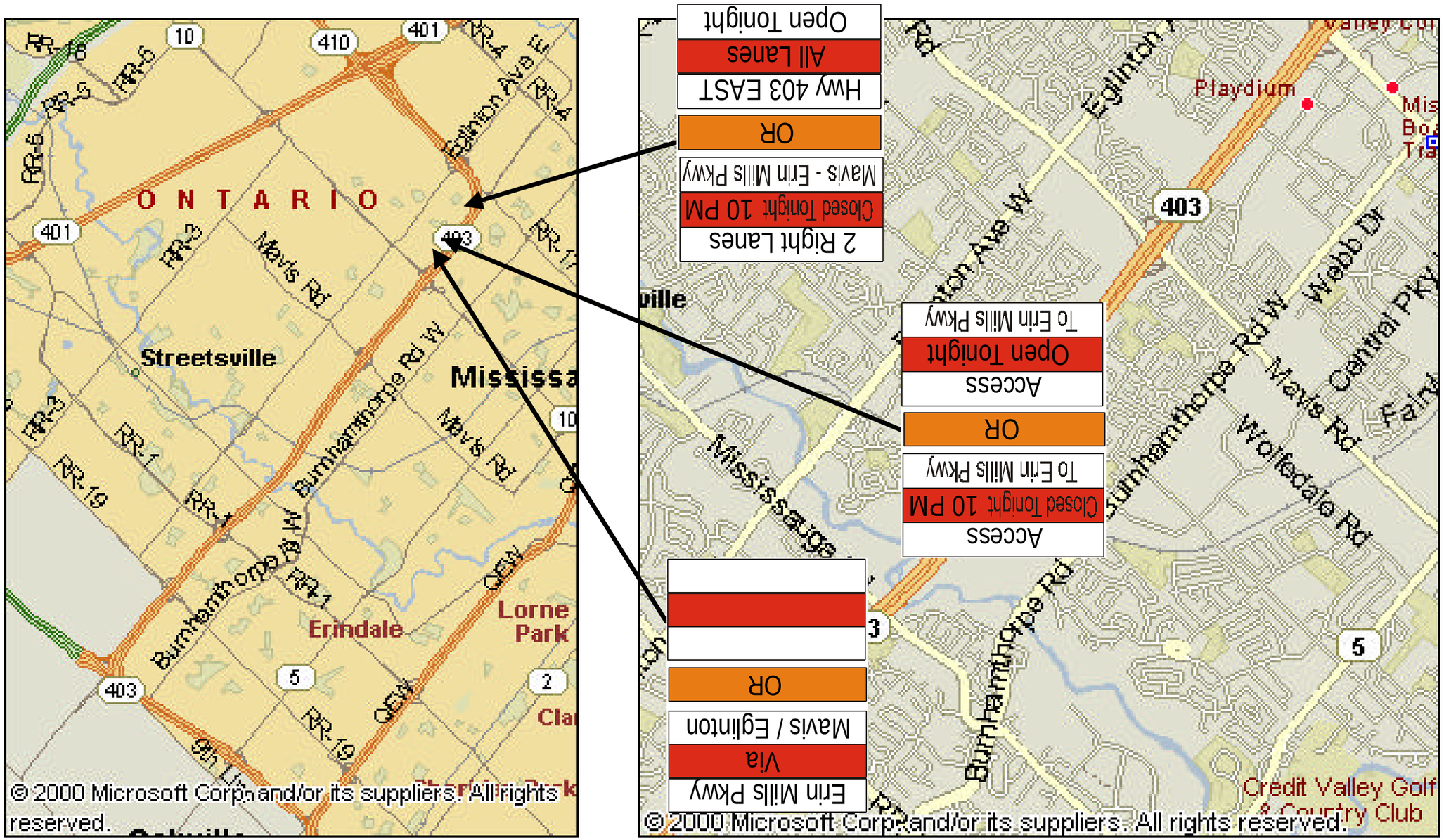
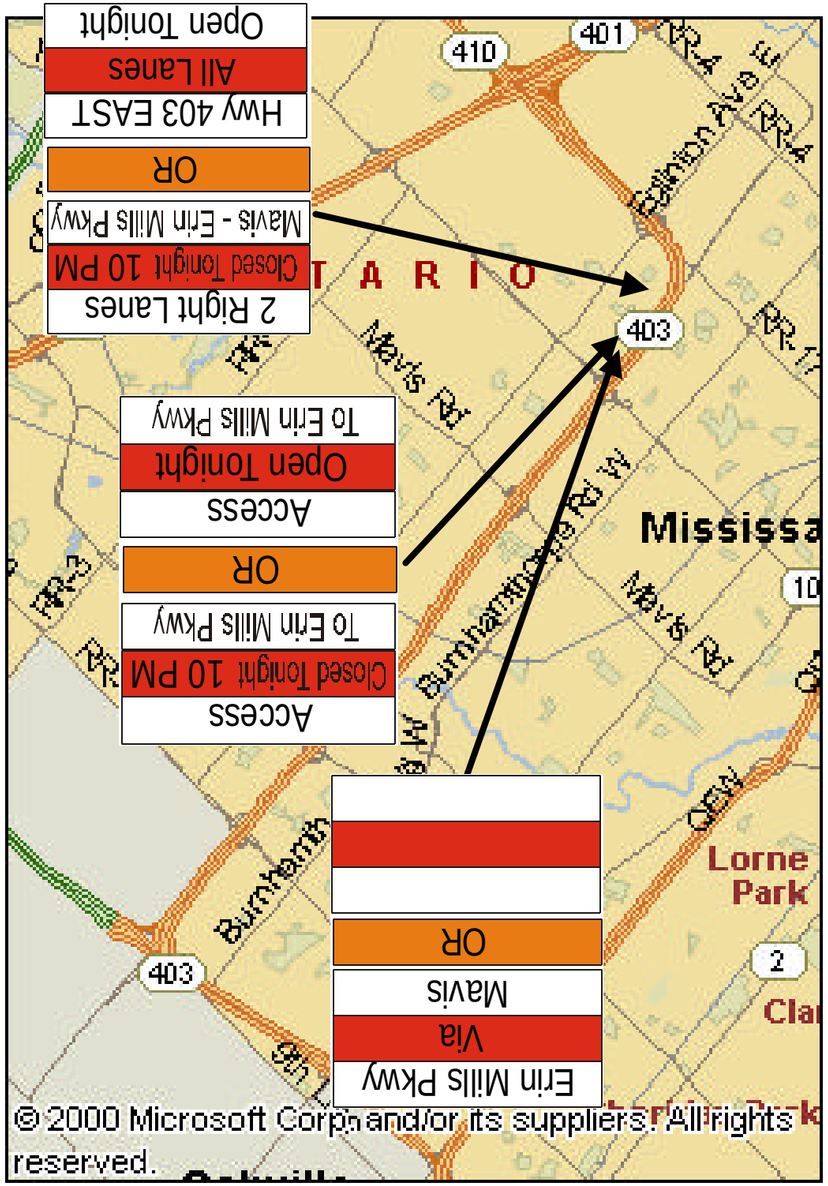


Figure 5.6 - Highway 403 Nighttime Lane Closures with Alternative Route – Advance Warning Phase (AWS) – Main Line Signing



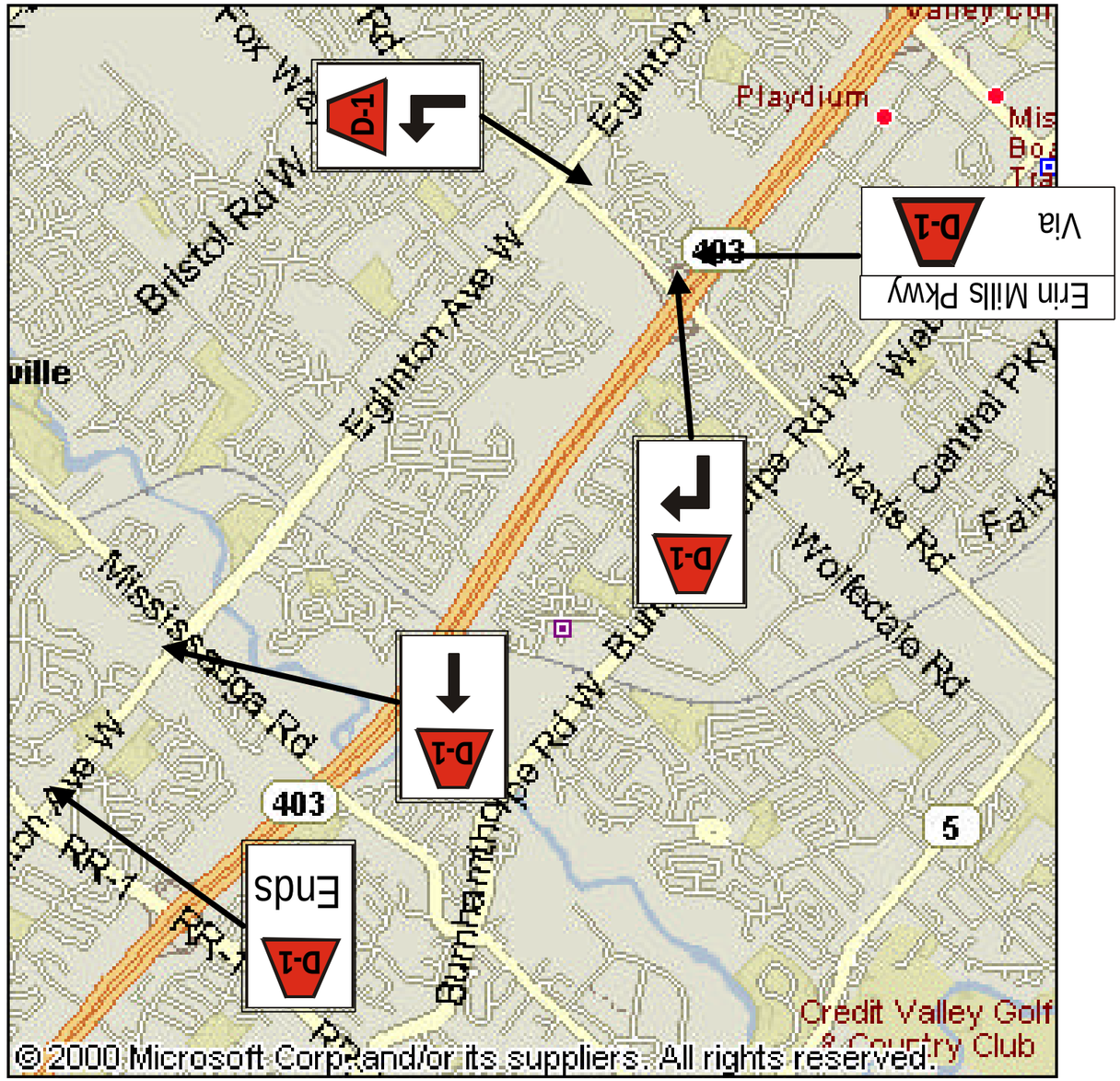


Figure 5.7- Highway 403 Nighttime Lane Closures with Alternative Route – Advance Warning Phase – Detour Route Signing (DRS)

5.4 Complex Freeway Continuous Lane Closures in Collectors

Outline of the Scenario

Bridge deck replacement in the eastbound Collector Lanes of Highway 401 between Yonge Street and Avenue Road (Hogg's Hollow) is scheduled to begin on May 31, 2001, and will require four months to complete. The work will not impact access at the adjacent interchanges, but will create a critical capacity reduction for westbound traffic.

Two through lanes in the Collectors will be maintained throughout the project. This will be achieved by utilizing the left or right paved shoulders as temporary lanes during each detour stage. These lanes, however will be only 3.2 metres wide, and therefore unsuitable for heavy truck traffic.

The westbound on-ramp from Yonge Street southbound is to be foreshortened and will operate under a yield condition during both construction stages. This is expected to create congestion at the merge.

The overall TCTM strategy is to forewarn road users of the critical capacity reductions well in advance, in order to encourage diversion into the Express Lanes, and onto the Highway 407 ETR westbound via Highway 404. This alternative route however, will not be explicitly signed.

Traffic on Yonge Street northbound and southbound, destined for Highway 401 west, will be "intercepted", and directed onto parallel routes, to join Highway 401 west of the work zone. This is expected to reduce demand on the critical westbound on-ramps at this interchange.

Advance Notification Phase

Advance Notification Signing (ANS) is installed between seven (7) and ten (ten) days prior to the commencement of work. **Figure 5.9** shows the different message presentations used in the Express and Collector Lanes

Advance Warning Phase

Advance Notification Signing would be replaced by Advance Warning Signing early (05:30) on the morning of the day on which work is set to begin, and would be maintained in place for the duration of the activity.

Advance Warning Signing (AWS) is provided on westbound Highway 401 in the Express and Collectors, as well as on Highway 404 northbound and southbound. This is illustrated in **Figure 5.10**. Signing on Highway 401 allows drivers to choose to bypass the work zone, either by using Highway 407, or municipal roadways. Neither alternative however, is explicitly signed.

Signing on Highway 404 northbound approaching the Highway 401 interchange and on Highway 404 southbound, upstream of the Highway 407 interchange, allows drivers destined for Highway 401 to alter their route so as to bypass the work zone.

Figure 5.11 illustrates TCTM signs used to advise road users of the preferred lanes for commercial vehicles. These signs are advisory in nature, and messages such as lane restrictions for heavy vehicles require regulatory signing to be enforceable.

Figure 5.12 illustrates the concept of Intercept Alternative Route Signing (IARS). Traffic destined for the affected route is intercepted before reaching it, and is directed along parallel routes to a location on the affected route downstream of the work zone. This may be used as a demand management strategy, or to overcome navigational restrictions. Note that no detour signing is provided, and road users must rely on permanent wayfinding information and local knowledge to navigate the alternative route.

Figure 5.13 illustrates Intercept Detour Route Signing (IDRS). Similar in intent to IARS, IDRS provides explicit signing for the benefit of road users without local knowledge.

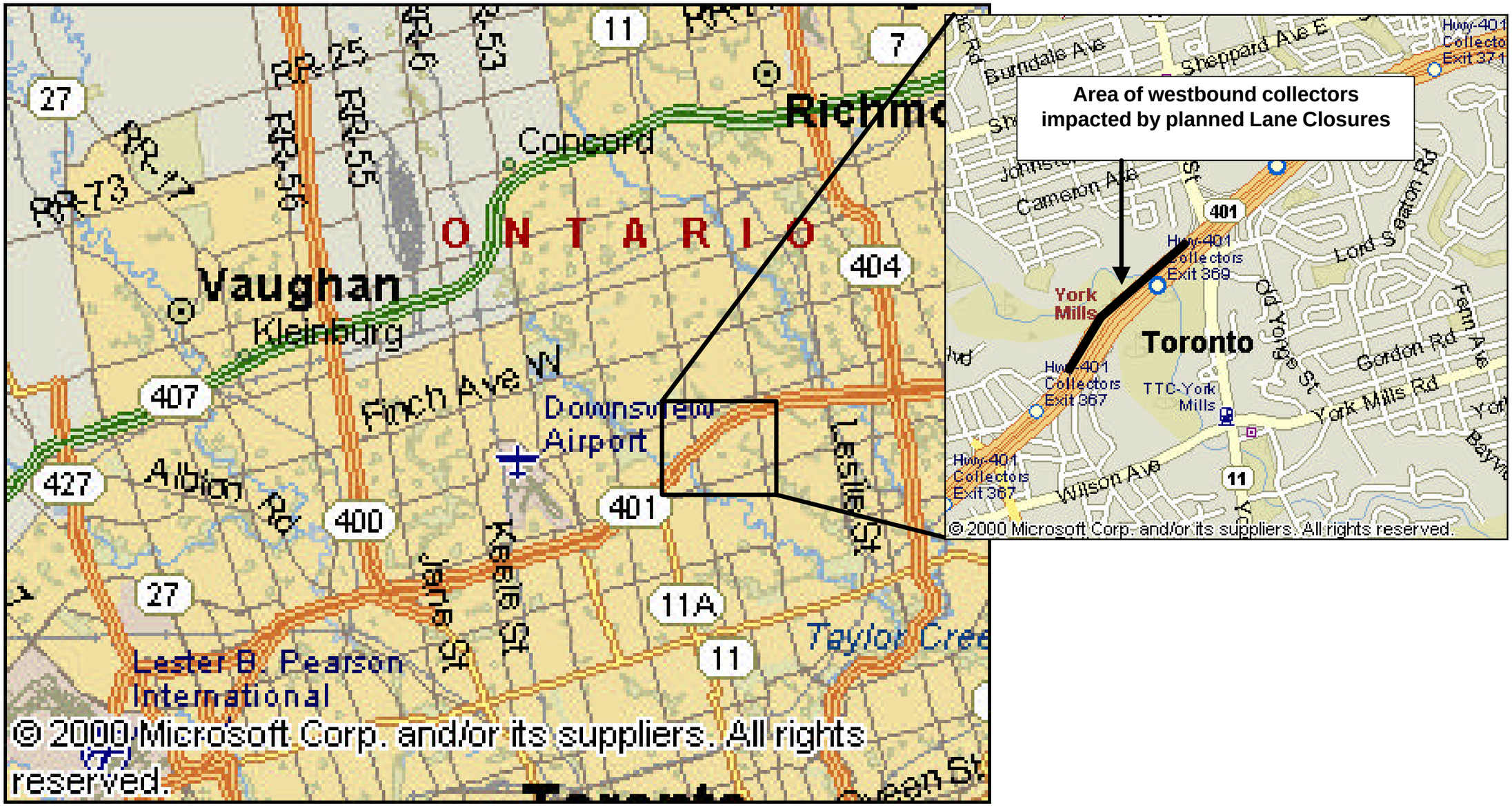


Figure 5.8 - Highway 401 Continuous Lane Closures in Westbound Collectors – Overview

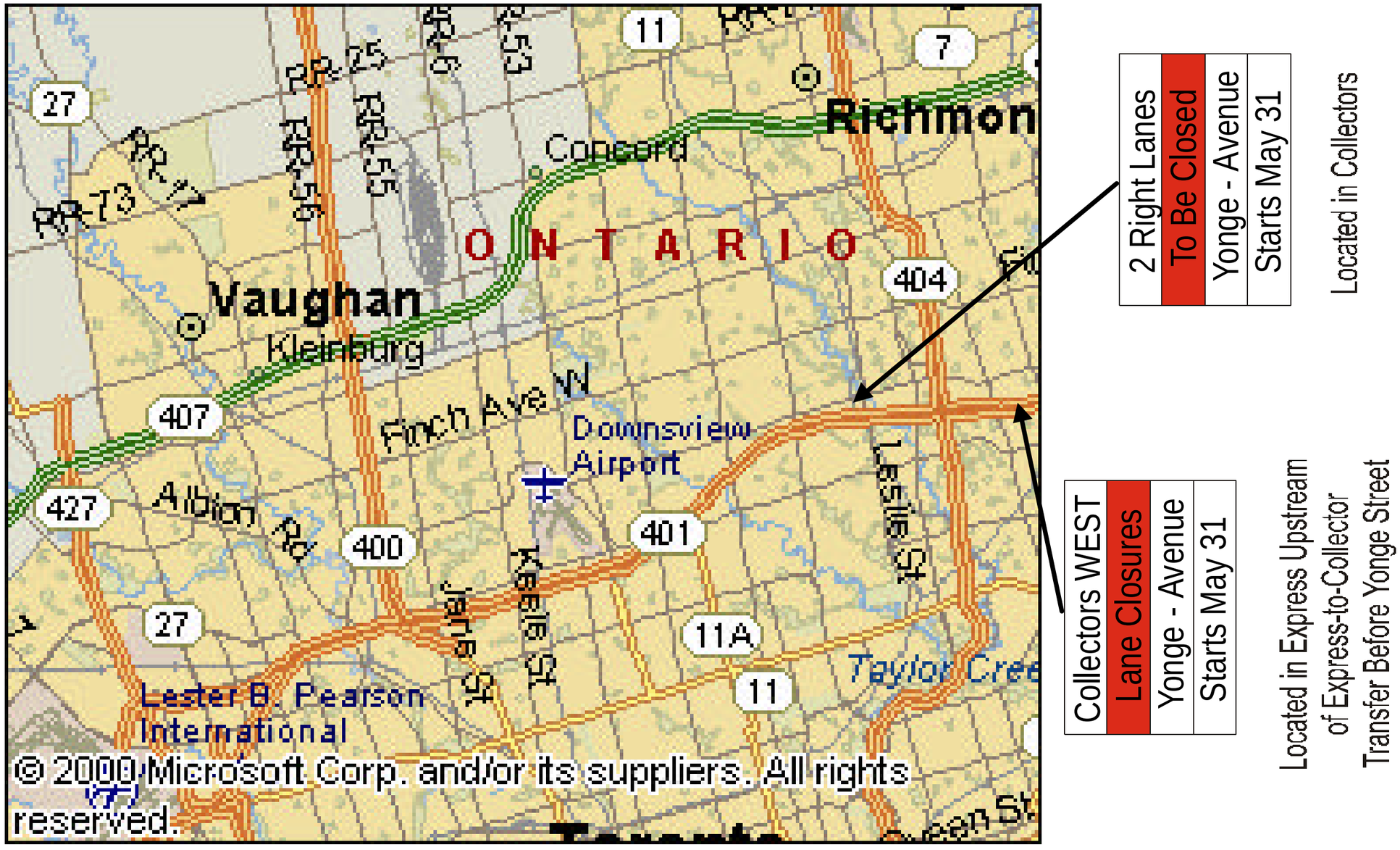
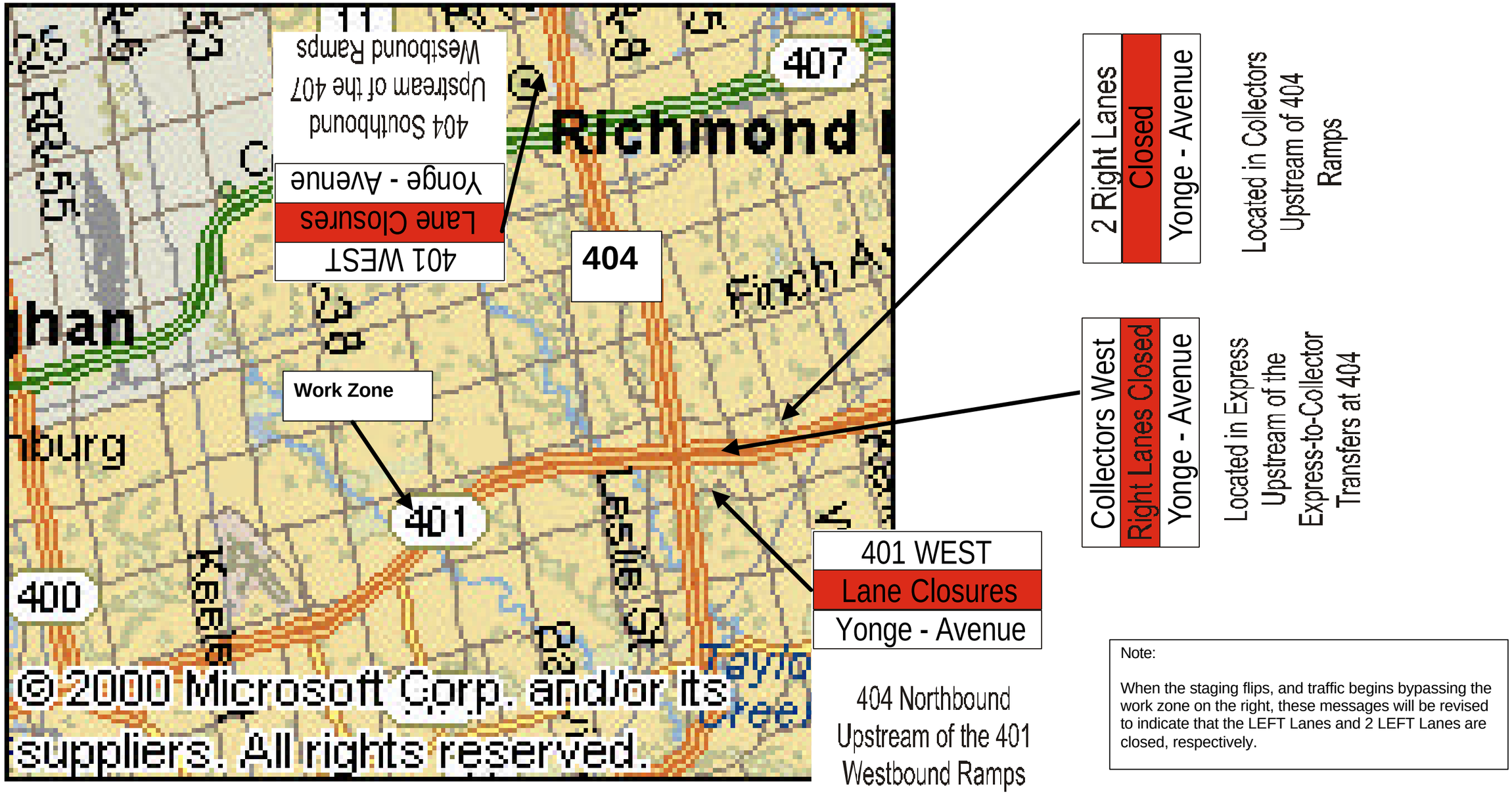


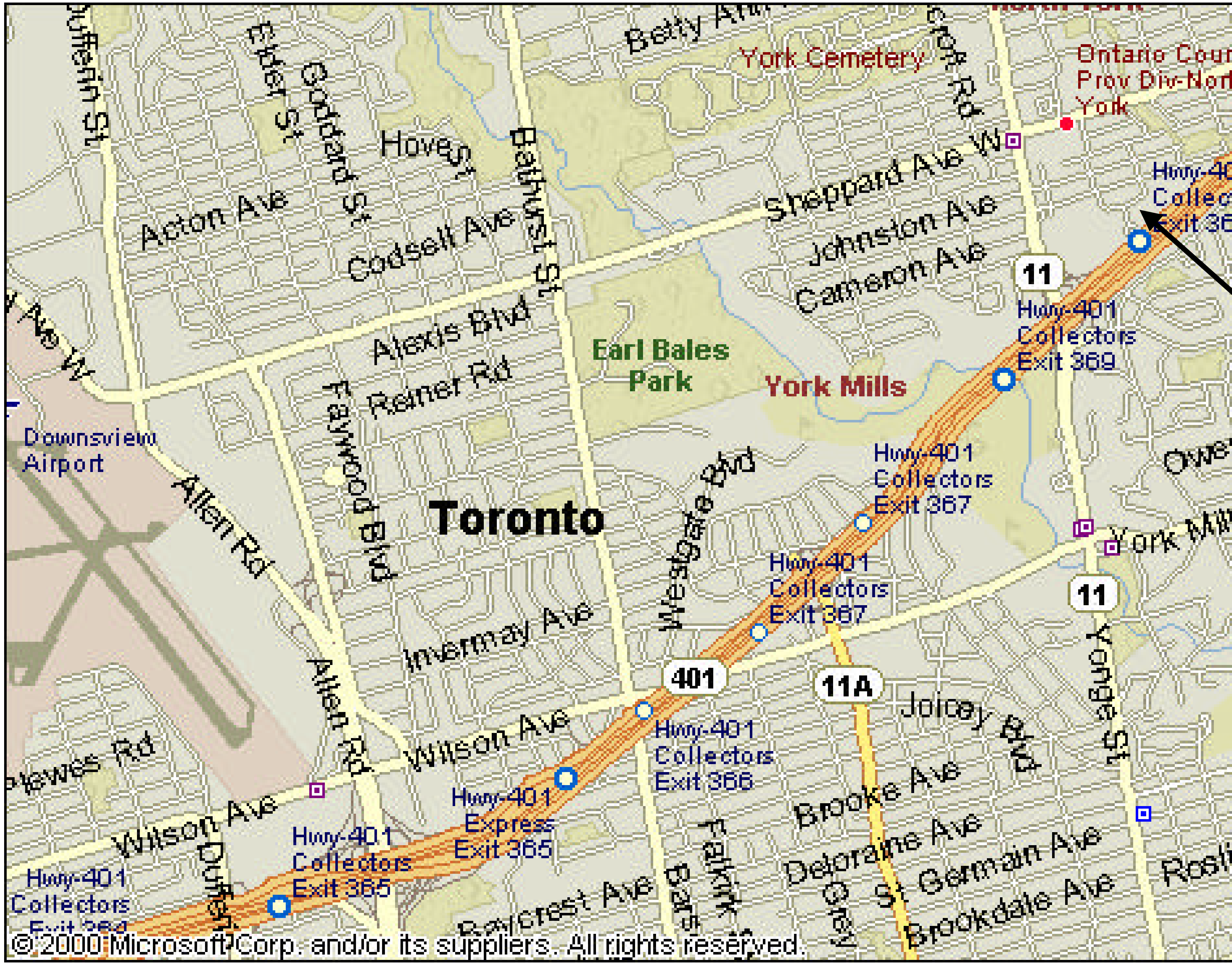
Figure 5.9 - Highway 401 Continuous Lane Closures in Westbound Collectors – Advance Notification Signing (ANS)

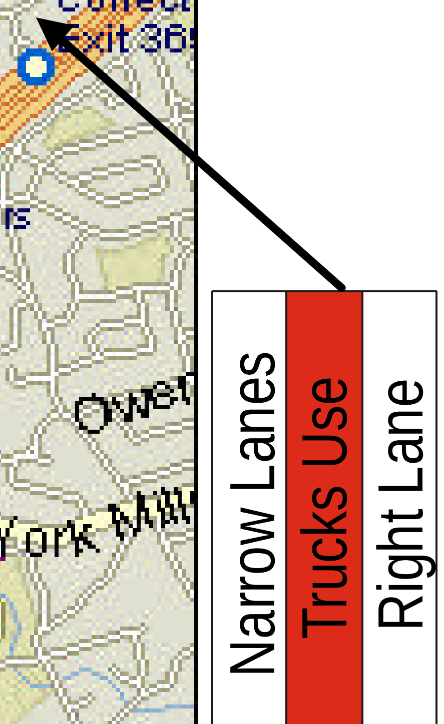


Note:

When the staging flips, and traffic begins bypassing the work zone on the right, these messages will be revised to indicate that the LEFT Lanes and 2 LEFT Lanes are closed, respectively.

Figure 5.10 - Highway 401 Continuous Lane Closures in Westbound Collectors – Advance Warning Signing (AWS) – MainLine





Note:

When the staging flips, and traffic begins bypassing the work zone on the right, this message will be revised to indicate that trucks are to use the LEFT lane.

Figure 5.11 - Highway 401 Continuous Lane Closures in Westbound Collectors – MainLine Signing at Work Zone

Figure 5.12 - Highway 401 Continuous Lane Closures in Westbound Collectors – Intercept Alternative Route Signing (IARS)

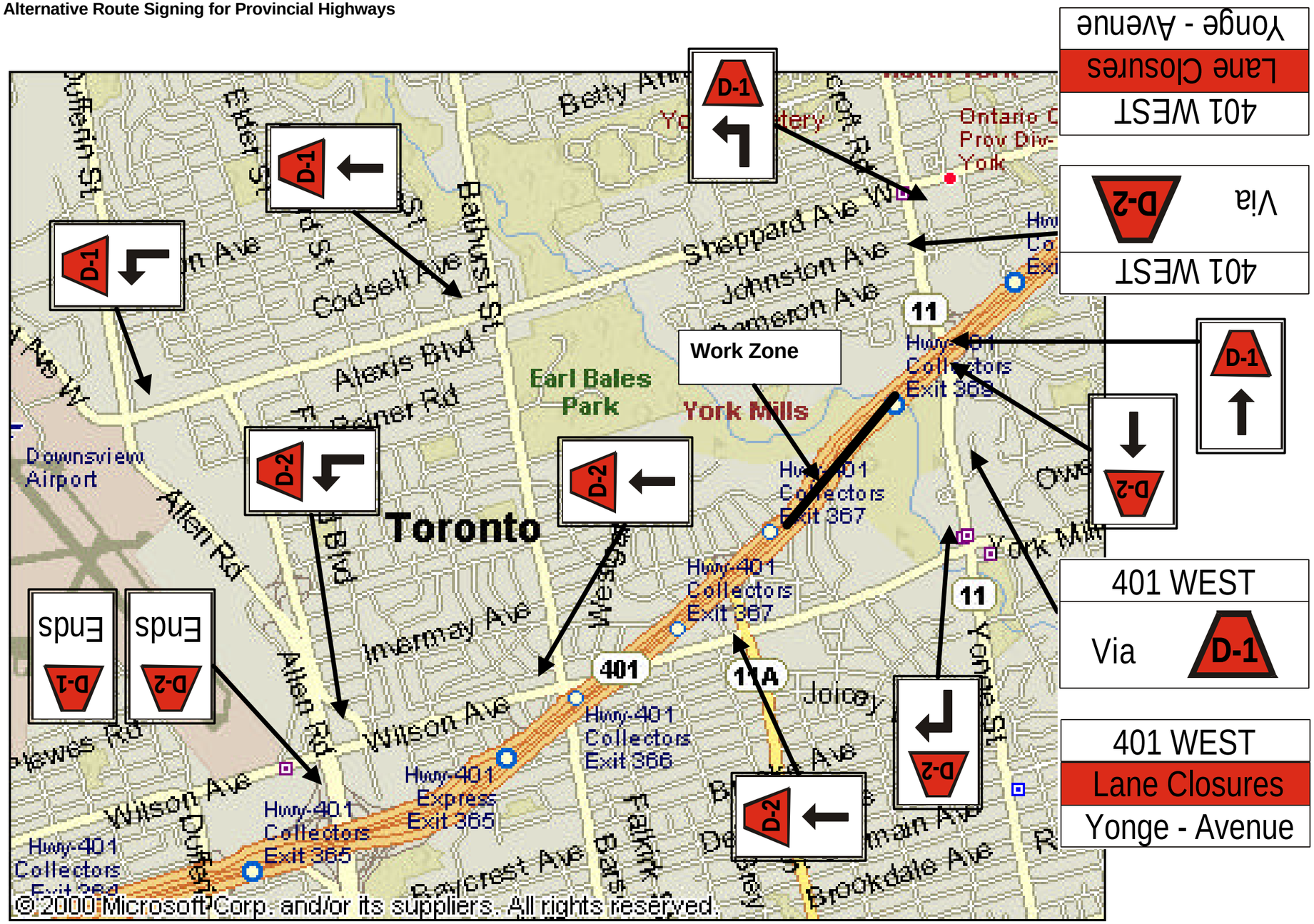


Figure 5.13 - Highway 401 Continuous Lane Closures in Westbound Collectors – Intercept Detour Route Signing (IDRS)

5.5 Complex Freeway Nighttime Lane Closures in Express

Outline of the Scenario

Milling, resurfacing and remarking with durable materials of the westbound express lanes of Highway 401 between the express-to-collector transfer at Brimley Road and the collector-to-express transfer west of Birchmount Road will require recurring nighttime lane closures. Two lanes will be closed at any given time. The precise details of the staging – e.g. what lanes will be closed when – are not yet known.

Work will commence on May 31, 2001 and will require five weeks to complete.

To ease congestion through the work zone, the collector-to-express transfer west of Markham Road will be closed, encouraging traffic to remain in the collectors. No alternative routes will be provided and no advance notification or advance warning will be provided on crossing roadways within the affected area or immediately upstream.

Figure 5.14 provides an overview of the site. **Figure 5.15** indicates the Advance Notification Signing (ANS) requirements. **Figure 5.16** indicates the Advance Warning Signing (AWS) requirements.

Advance Notification Phase

During the Advance Notification Phase, road users require information regarding two planned activities – the planned, recurring closure of lanes in the westbound express, and the planned, recurring closure of the collector-to-express transfer west of Markham Road.

Since the precise details of the lane closures are not known – beyond the facts that they will be recurring, occur in the westbound express lanes between Markham Road and Warden Avenue, and will involve two lanes at any given time – it will be necessary to select appropriate ANS and messages. These messages will then carry over into the Advance Warning Phase.

Closure of the collector-to-express transfer will impact the demand balance between the express and collector lanes, but will not result in any navigational restrictions. Accordingly, it will be signed, but only for information purposes.

Signs should be installed a minimum of seven (7) to ten (10) days prior to the start of work.

Advance Warning Phase

Signing during the Advance Warning Phase will inform drivers of the status of the express lane closures and the transfer lane closures on a daily basis. Accordingly, one of two messages will be displayed each day, indicating that the transfer and all express lanes will be open that night, on that the closures will be in effect as of 10 PM. This information should be updated each day, prior to the morning rush hour (05:30 AM), so drivers have access to this information when making evening plans.

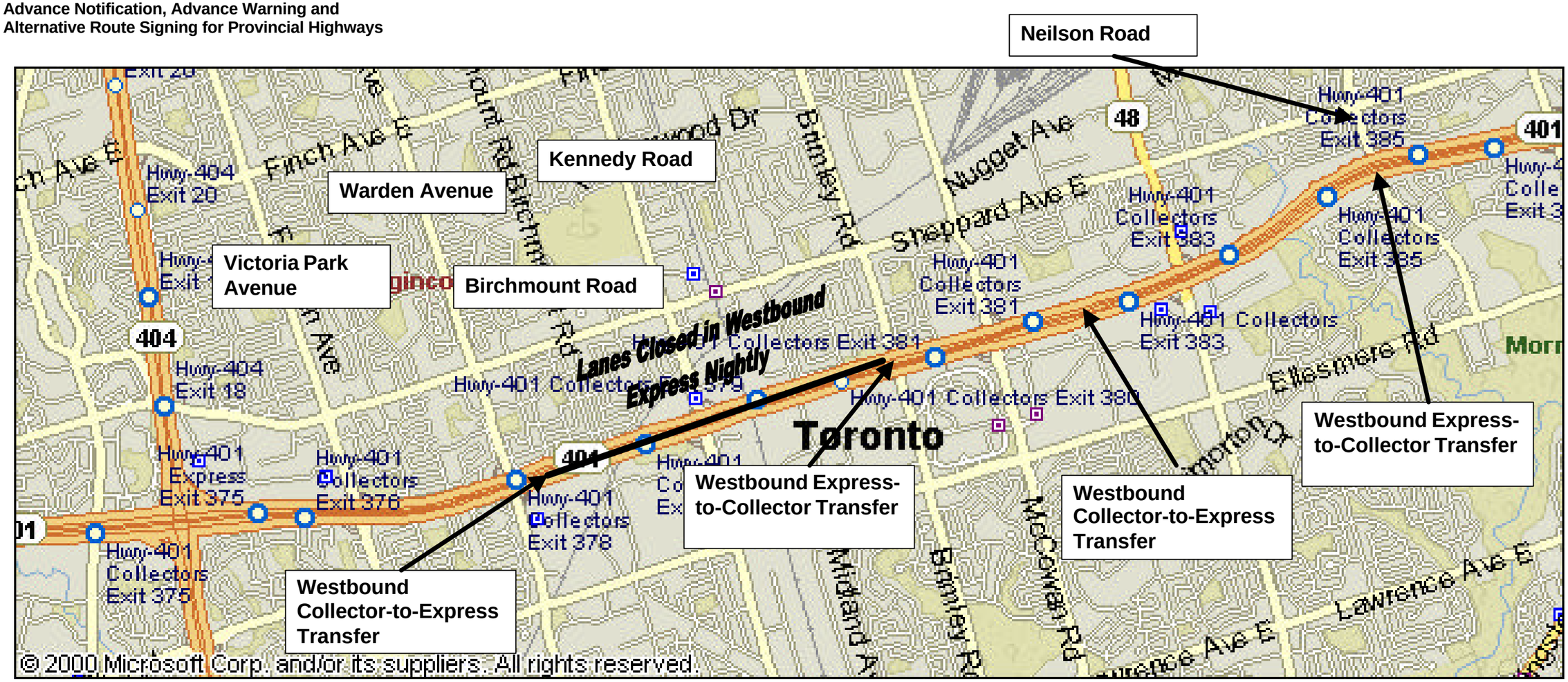


Figure 5.14 – Nighttime Recurring Closure of Lanes in Express - Overview

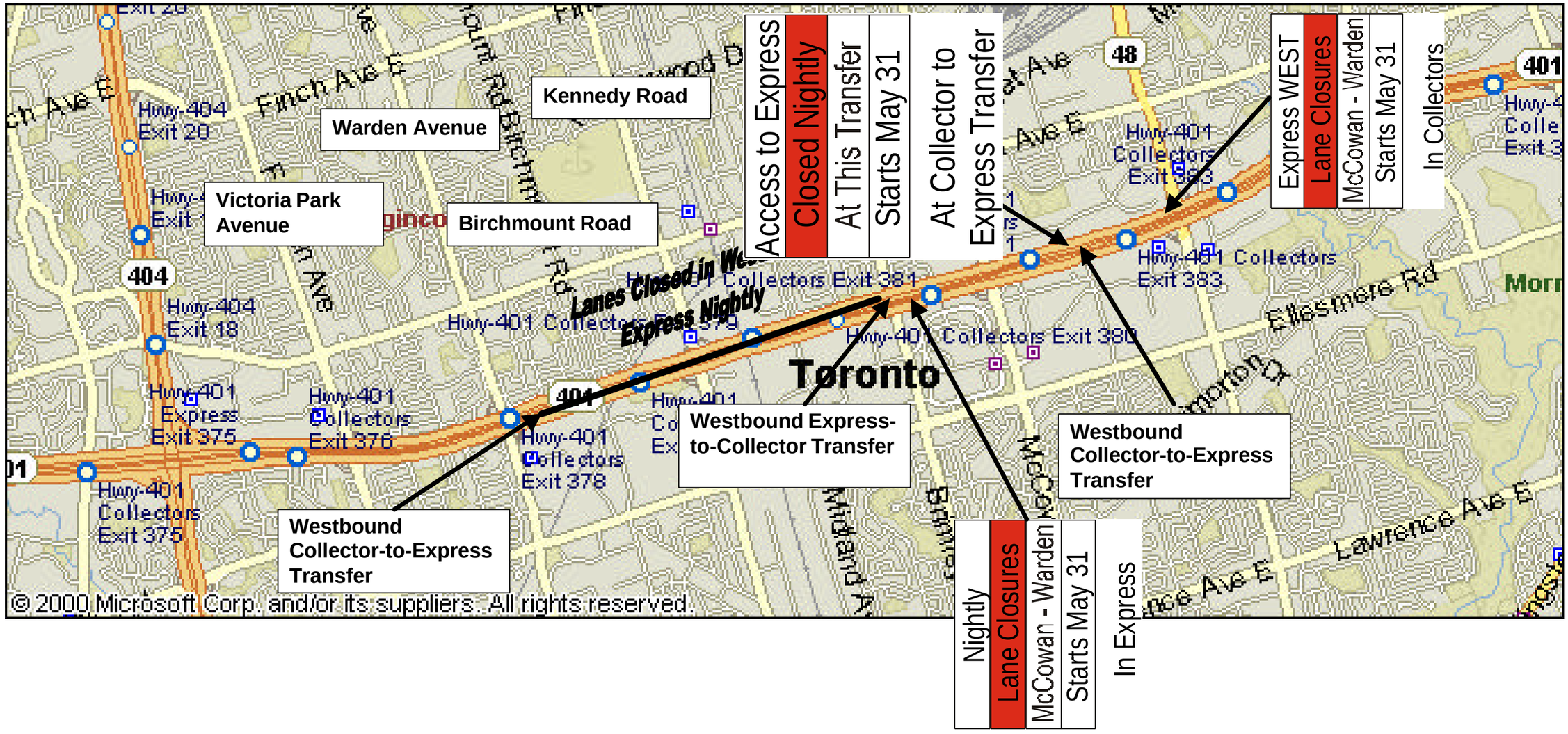


Figure 5.15 – Nighttime Recurring Closure of Lanes in Express – Advance Notification Phase (ANS)

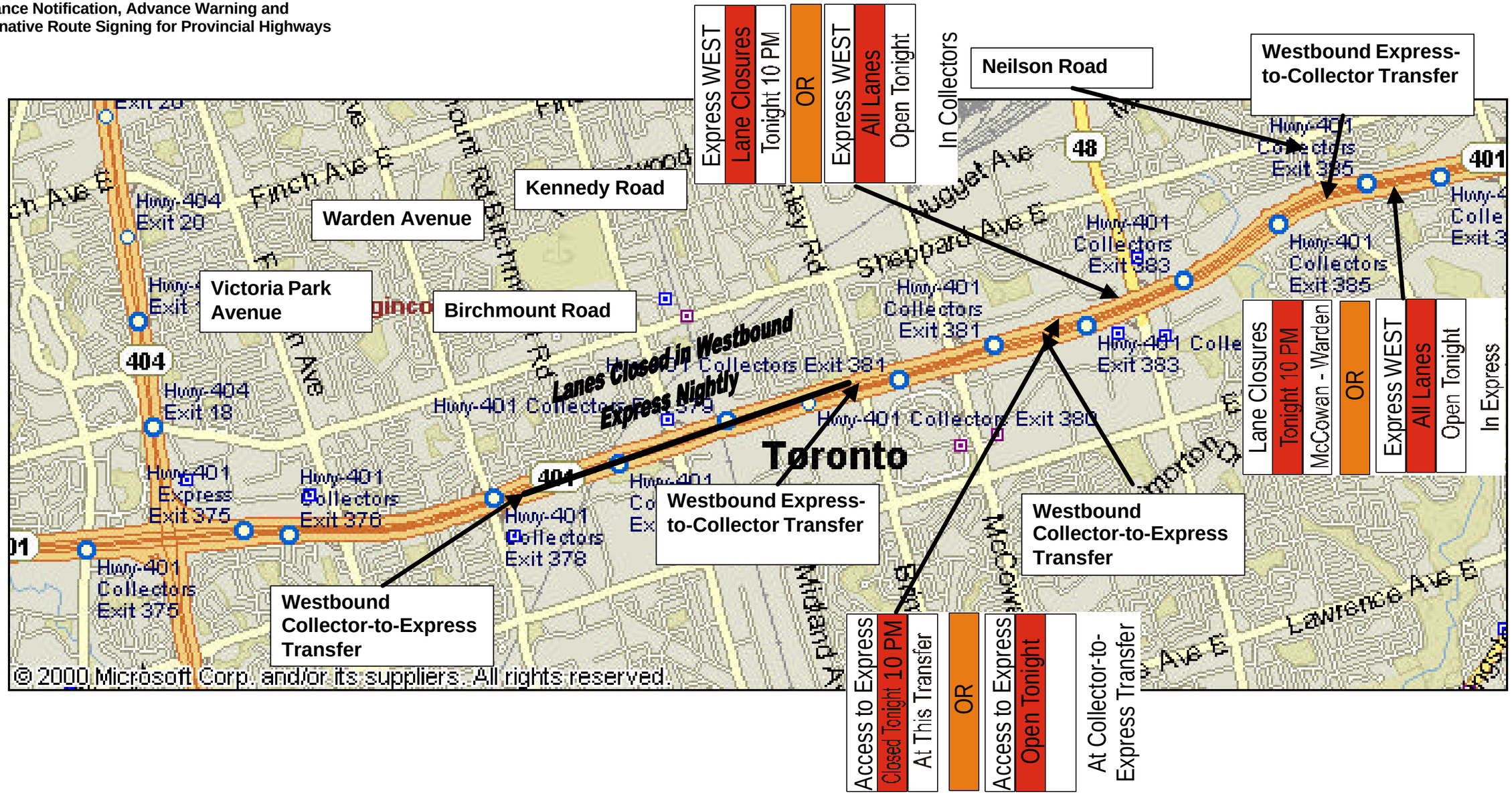


Figure 5.16 – Nighttime Recurring Closure of Lanes in Express – Advance Warning Phase (AWS)

5.6 Complex Freeway Recurring Nighttime Full Closure of Express

Outline of the Scenario

Rehabilitation of bridge structures and culverts in the westbound express lanes of Highway 401 between Brimley Road and Kennedy Road will require recurring, nighttime closures of the entire westbound express lanes. The closure will extend from the express-to-collector transfer at Brimley Road to the collector-to-express transfer west of Birchmount Road.

Work will commence on May 31, 2001 and will require seventeen weeks to complete.

To ease congestion through the work zone, the collector-to-express transfer west of Markham Road will be closed, encouraging traffic to remain in the collectors.

To reduce demand in the collector lanes though the affected area, traffic on Kennedy Road, Brimley Road, McCowan Road and Markham Road destined for westbound Highway 401 will be intercepted and directed along parallel routes (either Ellesmere Road or Sheppard Avenue) to Victoria Park Drive, where it can rejoin the 401 downstream of the affected area. Two alternatives will be modelled, one using IARS the other IDRS.

Traffic on Highway 401 westbound will not be provided an alternative route, but will be directed into the collector lanes, and will be informed of the closure sufficiently in advance to allow road users to exit the facility before reaching the affected area.

Figure 5.17 provides an overview of the site. **Figure 5.18** indicates the Advance Notification Signing (ANS) requirements for mainline traffic. **Figure 5.19** indicates the ANS requirements for crossing roadway traffic. **Figure 5.21** indicates the Advance Warning Signing (AWS) requirements for mainline traffic. **Figure 5.21** also illustrates the IARS on the crossing roadway, while **Figure 5.22 and 5.23** illustrates the IDRS alternative.

Advance Notification Phase

During the Advance Notification Phase, road users on Highway 401 westbound require information regarding two planned activities – the planned, recurring closure of the westbound express lanes, and the planned, recurring closure of the collector-to-express transfer west of Markham Road.

Closure of the collector-to-express transfer will impact the demand balance between the express and collector lanes, but will not result in any navigational restrictions. Accordingly, it will be signed for, but only for information purposes.

Signing on crossing roadways is intended to brief recurring users on the planned intercept alternative routes to be implemented for northbound and southbound traffic on Kennedy Road, Brimley Road, McCowan Road and Markham Road that is destined for westbound Highway 401.

Signs should be installed a minimum of seven (7) to ten (10) days prior to the start of work.

Advance Warning Phase

Signing during the Advance Warning Phase will inform drivers of the status of the express lane closures and the transfer lane closures on a daily basis. Accordingly, one of two messages will be displayed each day, indicating that the transfer and all express lanes will be open that night, on that the closures will be in effect as of 10 PM. This information should be updated each day, prior to the morning rush hour (05:30 AM), so drivers have access to this information when making evening plans.

Intercept Alternative Route Signing

Two types of intercept signing are modelled on the crossing roadways – IARS and IDRS. IARS prescribes an alternative route to reach Highway 401 west (either Sheppard Avenue to Victoria Park Drive for northbound traffic or Ellesmere Avenue to Victoria Park Drive for southbound traffic). This route however receives no temporary signing (e.g. detour trailblazer signing). Drivers must rely on local knowledge and whatever permanent directional signing is available.

IDRS aides the unfamiliar driver by providing a signed detour route throughout. Road users are instructed to follow D-1 or D-2 as appropriate and are guided to the Victoria Park Drive onramp to westbound Highway 401.

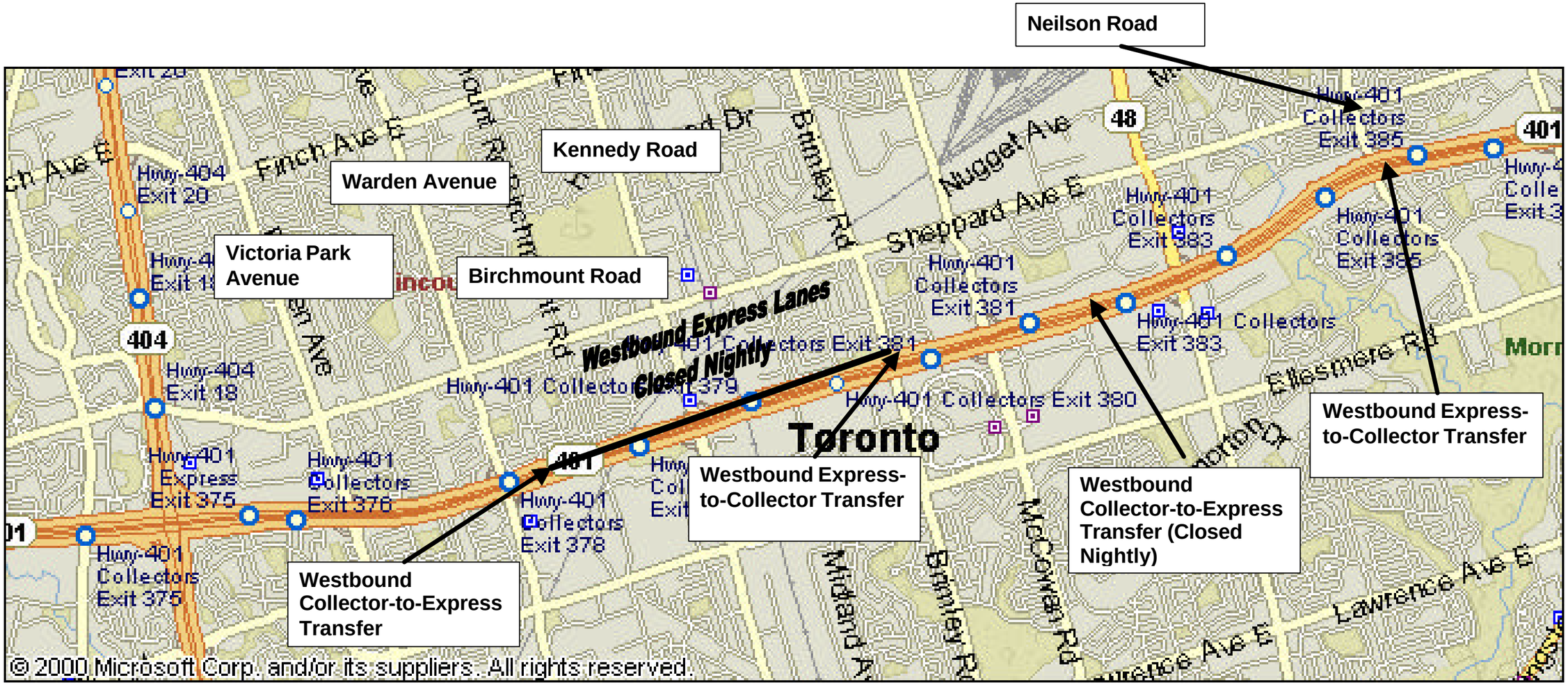


Figure 5.17 – Nighttime Recurring Full Closure of Express Lanes – Overview

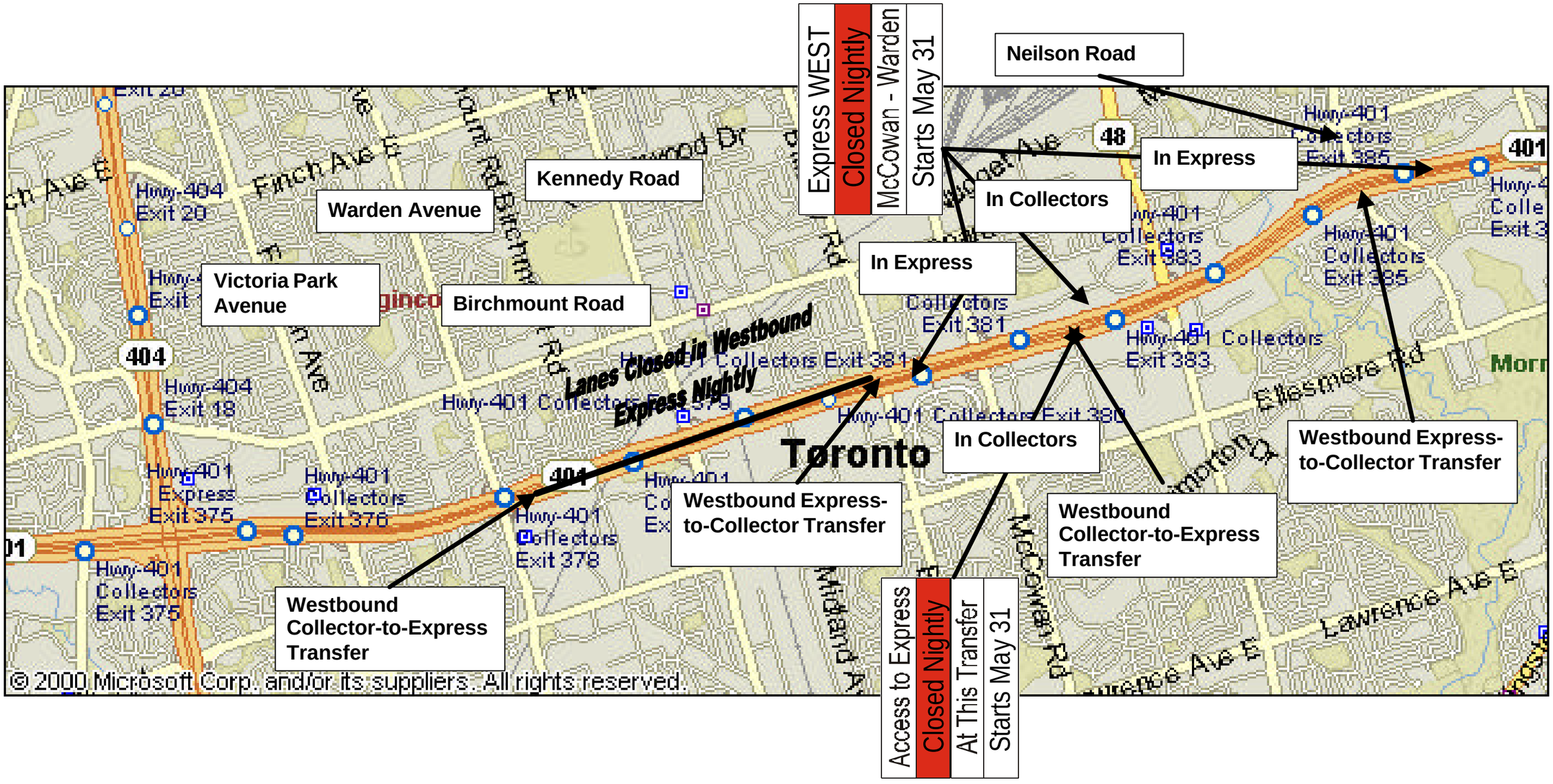


Figure 5.18 – Nighttime Recurring Full Closure of Express Lanes – Advance Notification Signing ANS (Mainline)

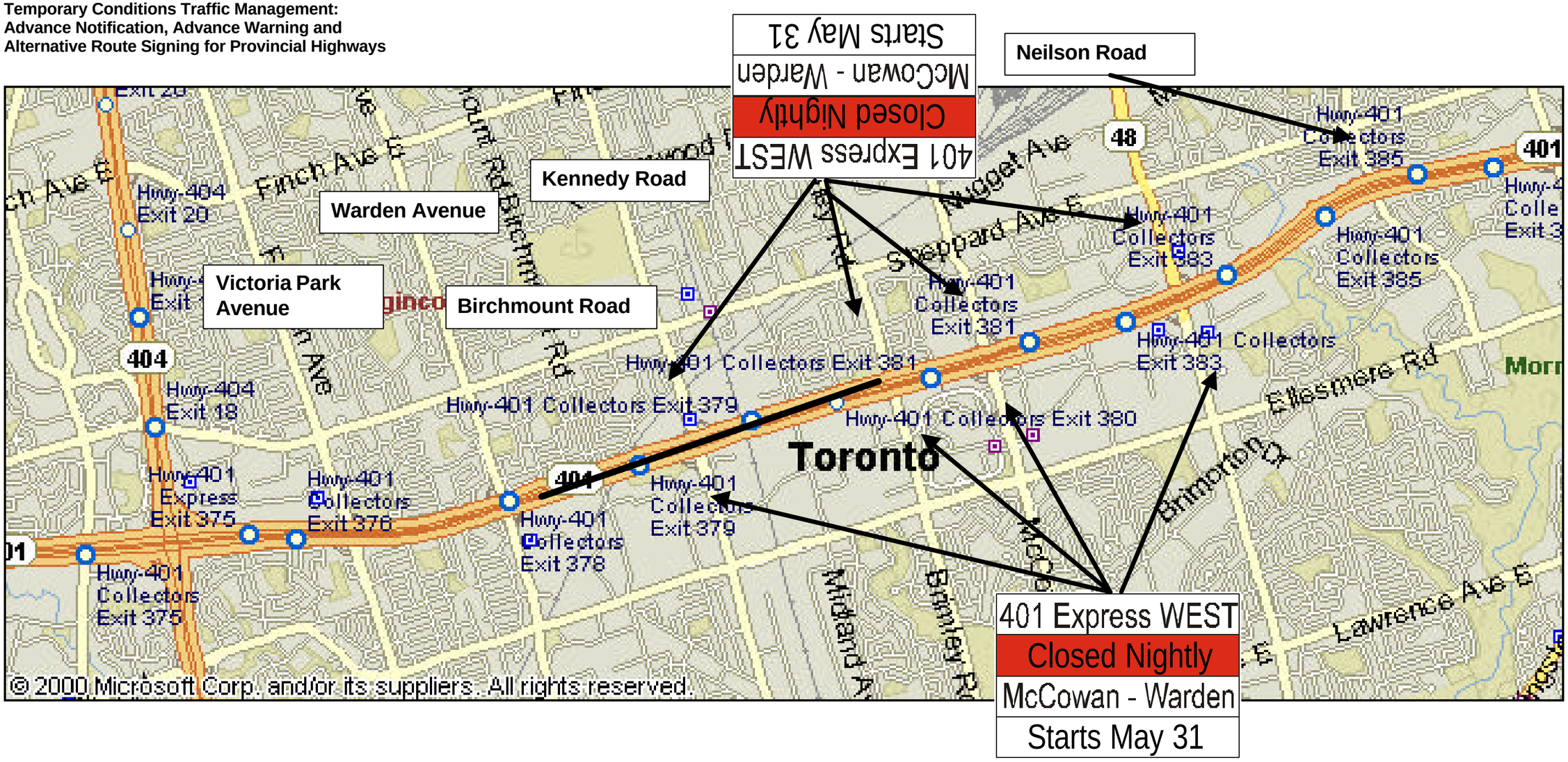


Figure 5.19 – Nighttime Recurring Full Closure of Express Lanes – Advance Notification on Crossing Roadways

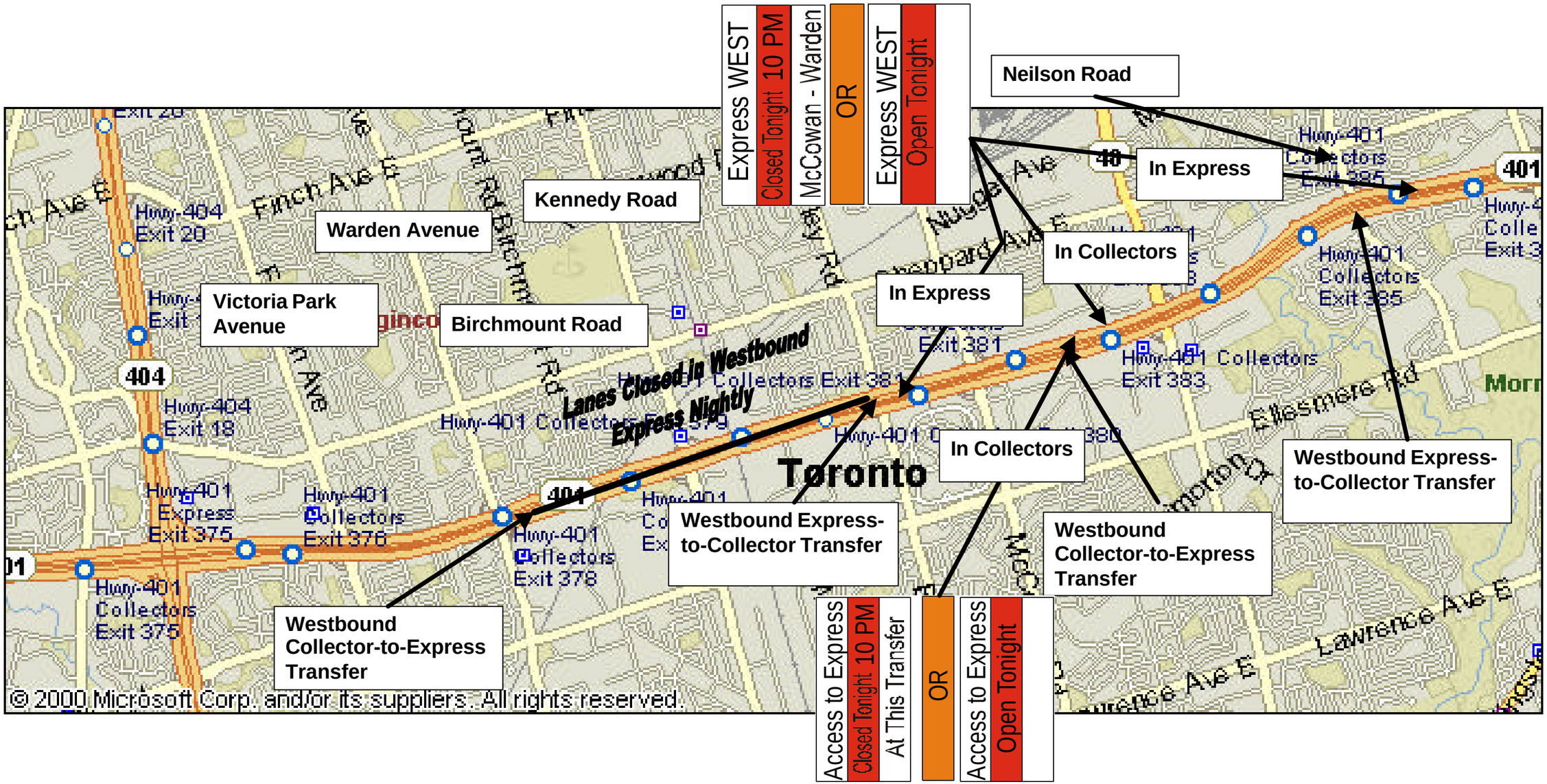


Figure 5.20 – Nighttime Recurring Full Closure of Express Lanes – Advance Warning Signing AWS (Mainline)

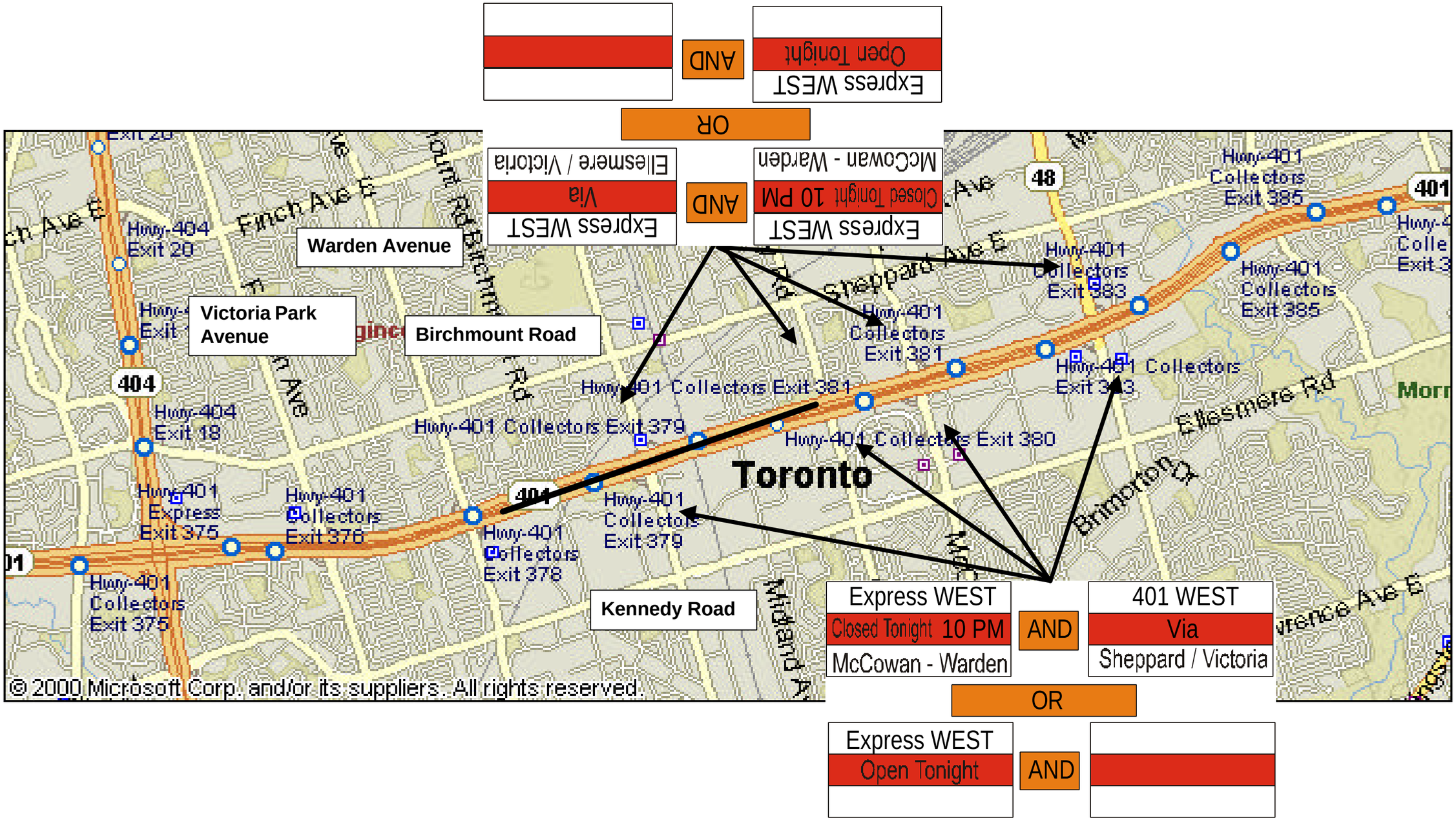
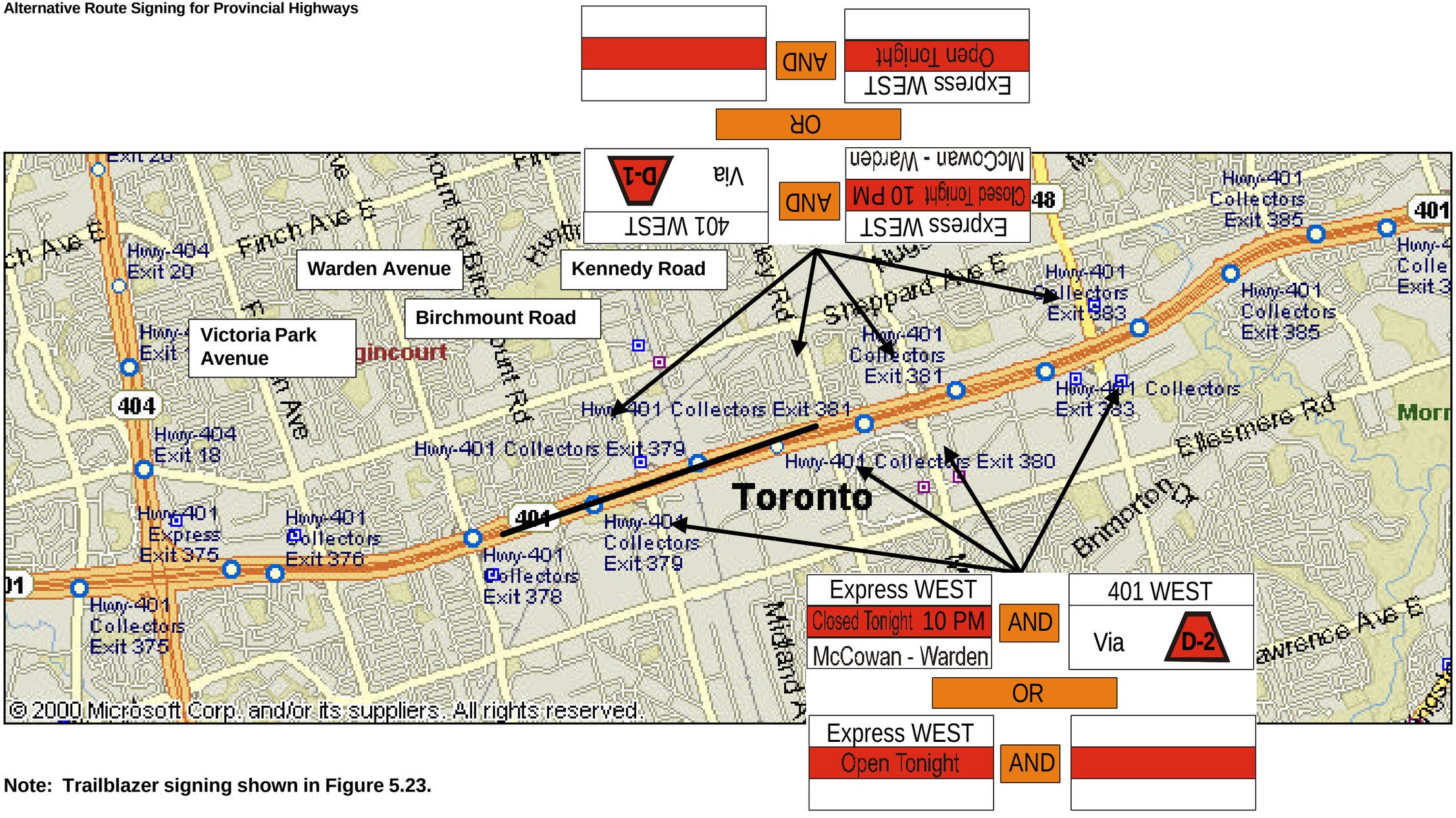


Figure 5.21 – Nighttime Recurring Full Closure of Express Lanes – Intercept Alternative Route Signing IARS (Crossing Roadways)



Note: Trailblazer signing shown in Figure 5.23.

Figure 5.22 – Nighttime Recurring Full Closure of Express Lanes – Intercept Detour Route Signing IDRS (Crossing Roadways)

Note: Trailblazer Signing for D-2 Only.

Figure 5.23 – Nighttime Recurring Full Closure of Express Lanes – Intercept Detour Trailblazer Signing IDTS (Crossing Roadways)

5.7 Complex Freeway Recurring Nighttime Full Closure of Collectors

Outline of the Scenario:

Milling and resurfacing of the eastbound Collector Lanes of Highway 401 between the Collector-to-Express Transfer east of Avenue Road, and the Express-to-Collector Transfer east of Bayview Avenue, is programmed for the Summer of 2001. Work is set to begin on the evening of May 31, 2001. Accomplishing this work with the minimum disruption to traffic requires that it be performed exclusively at night. Recurring, full closures of the collector lanes will be necessary to expedite the safe completion of the work.

Time-of-day restrictions on the work dictate that closures can begin no earlier than 10 PM. The roadway must be fully opened to traffic at the end of each night's work. The closure must be fully removed, with all lanes reopened and all workers and vehicles off the roadway, by 05:30 AM. Updating of any on-roadway signing must also be confined to those hours-of-work.

Drivers on eastbound Highway 401 and on the affected crossing roadway routes are to receive advance notification of the planned closure.

During the closures, it is known that there will be both capacity and navigational restrictions. Working in cooperation with City of Toronto officials, MTO Central Region has decided to showcase its TCTM capabilities by introducing mitigating measures in response to these restrictions, as follows:

1. Highway 401 eastbound traffic will be unable to exit at either Yonge Street or Bayview Avenue.

   Provisions are to be made to re-route traffic wishing to access these crossing roadways via Wilson Avenue and York Mills Road. Traffic will be directed to exit at Avenue Road, where alternative route provisions will to guide them to Yonge Street and Bayview Avenue. Two options for providing alternative route information will be generated; one relying on the local knowledge of drivers, and the other involving the provision of a signed detour route.

2. All Highway 401 eastbound traffic will be directed into the Express Lanes. This is expected to lead to demand in excess of capacity and queuing back along the eastbound collectors.

   Provisions are to be made to manage some of the excess demand via Wilson Avenue, York Mills Road and Leslie Street as an alternative route. Signal timing adjustments, and paid-duty police will ensure orderly movement despite the added demand. Two options for providing alternative route information will be generated; one relying on the local knowledge of drivers, and the other involving the provision of a signed detour route.

3. There will be no access to the Highway 401 eastbound collector lanes from Avenue Road, Yonge Street or Bayview Avenue.

   Provisions are to be made to intercept the traffic on these routes, destined for Highway 401 EAST, and direct it along

Wilson Avenue/York Mills Road and Leslie Street to the Highway 401/Leslie Street interchange. Two options for providing alternative route information will be generated; one relying on the local knowledge of drivers, and the other involving the provision of a signed detour route.

4. Portions of the traffic on the following routes:

   - Bathurst Street northbound;
   - Allen Road northbound and southbound;
   - Dufferin Street northbound; and
   - Wilson Avenue eastbound

   are likely to be destined for Highway 401 EAST, and will join the eastbound Collector Lanes upstream of the closure, adding to the demand congesting the eastbound Express Lanes. These drivers may also be intending to exit at the closed interchanges.

   Provisions are to be made to intercept the traffic on these routes, destined for Highway 401 EAST, and direct it along a parallel route. Traffic on Bathurst Street, Dufferin Street and Wilson Avenue will be directed along Wilson Avenue/York Mills Road and Leslie Street to the Highway 401/Leslie Street interchange. Traffic on Allen Road will be directed along Sheppard Avenue to Leslie Street and the Highway 401/Leslie Street interchange.

   Two options for providing alternative route information will be generated; one relying on the local knowledge of drivers, and the other involving the provision of a signed detour route.

An overview of the project area, identifying the key features of Highway 401 EAST and the adjacent roadway network, is provided in **Figures 5.24 and 5.25**.

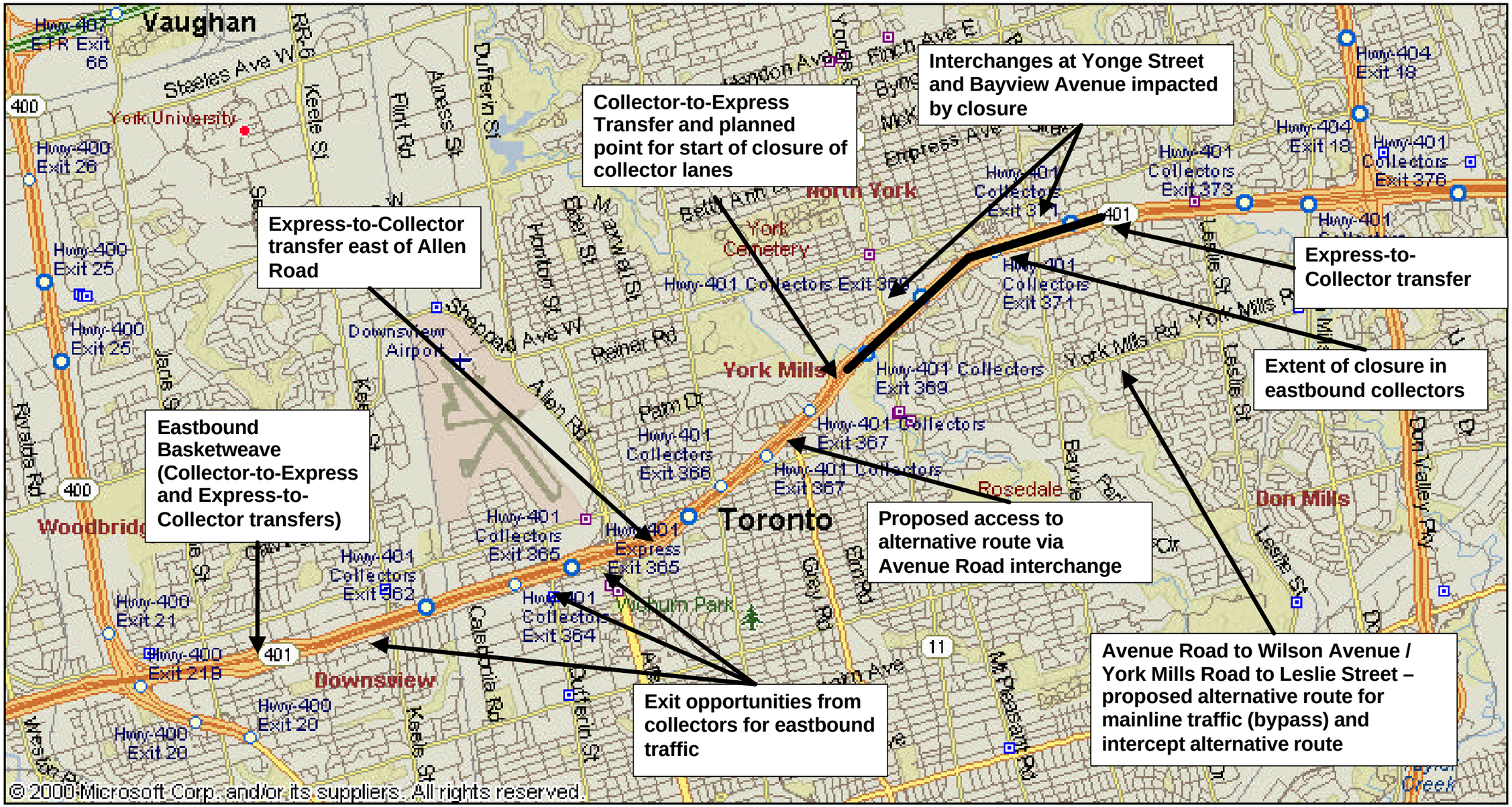


Figure 5.24 – Nighttime Recurring Full Closure of Collector Lanes –- Overview I

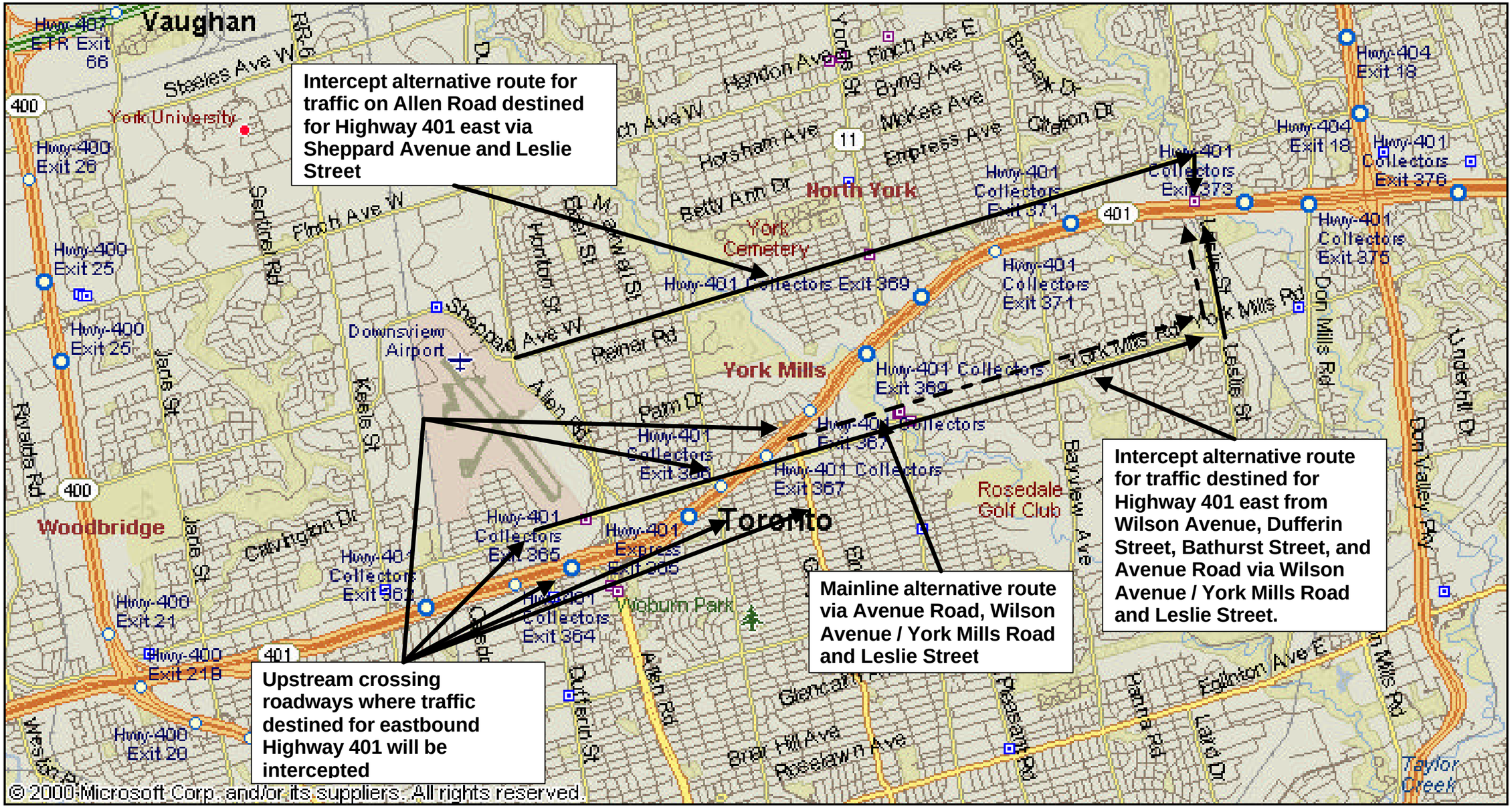


Figure 5.25 – Nighttime Recurring Full Closure of Collector Lanes –- Overview II

Advance Notification Phase:

Main Line Signing

Seven (7) to ten (10) days before work is scheduled to begin, Advance Notification Signs must be installed on Highway 401 EAST, to inform drivers of the pending closure. These signs should be located in both the Express and the Collector Lanes. Refer to **Figure 5.26**.

In the Collector Lanes, advance notification information should be located a minimum of two interchanges upstream of the interchange planned as access to the alternative route. In our scenario Avenue Road is the point of access to the alternative route. Bathurst Street does not provide an exit opportunity for the eastbound Collector Lanes. Therefore Allen Road and Dufferin Street are the two upstream interchanges where drivers may exit the facility in advance of the closure.

The Basketweave west of Keele Street (Express-to-Collector and Collector-to-Express Transfers) are where a great many route selection and navigational decisions are being made and implemented. Upstream of this location represents an ideal point at which to convey the planned closure information, providing there is sufficient space on the roadside and there is an opportunity to present the information without overloading or distracting drivers.

In the Express Lanes, advance notification information should be located at least one Express-to-Collector Transfer upstream of the interchange planned as access to the alternative route. While there is an Express-to-Collector Transfer just east of Allen Road, locating the information upstream of the Basketweave provides drivers with more time to comprehend and react to the information, and two opportunities to exit.

An additional sign is located in the Collector Lanes upstream of the Express-to-Collector Transfer Lanes east of Avenue Road. This serves to notify eastbound traffic that entered the collectors downstream of the signing west of the Basketweave (i.e. from Keele Street, Dufferin Street, Allen Road and Bathurst Street), and provides a second opportunity to read the notification information at a location close to where the closure will occur.

Crossing Roadway Signing

When the closure is implemented, there will be no access to Highway 401 EAST from either the north or south on Avenue Road, Yonge Street or Bayview Avenue.

Although Avenue Road is not within the limits of the closure, it is immediately upstream, and it was decided that re-routing Avenue Road traffic along a parallel route would be safer and more efficient than allowing the on-ramps to remain open.

To forewarn drivers of this planned occurrence, signing is placed on these crossing roadways, in the vicinity of the interchange, for both northbound and southbound traffic. Refer to **Figure 5.27**.

Upstream Crossing Roadway Signing

Traffic on crossing roadways immediately upstream of the planned closure, and destined for Highway 401 EAST, will be impacted by the closure when it is implemented. This includes Wilson Avenue, Bathurst Street, Allen Road and Dufferin Street.

Advance Notification Signing could be deployed on these roadways to advise motorists of the impending closure. In this case however, it was decided that advance notification for these drivers was not practical, thus no signing is proposed.

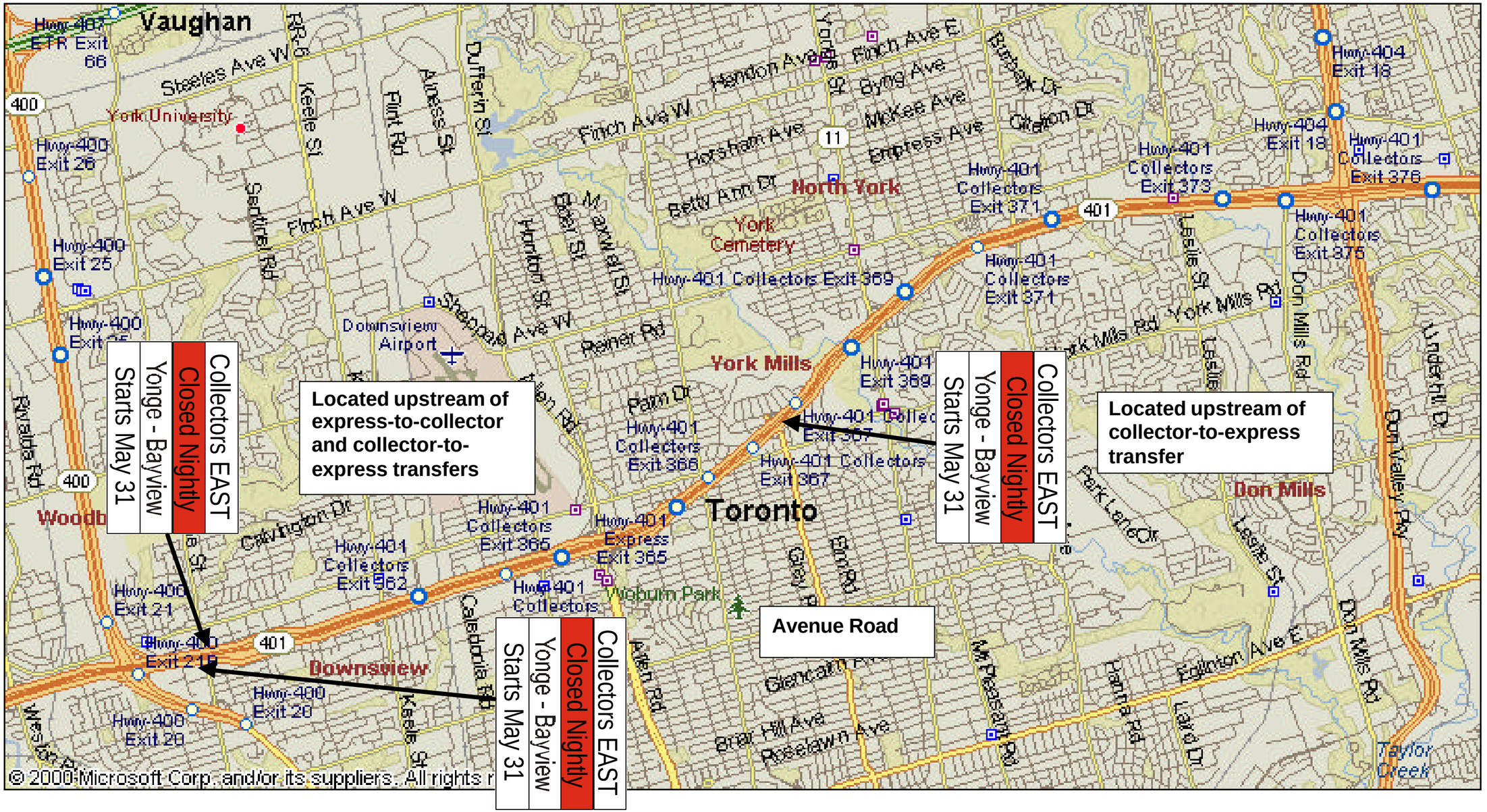


Figure 5.26 – Nighttime Recurring Full Closure of Collector Lanes - Advance Notification Phase ANS (Mainline)

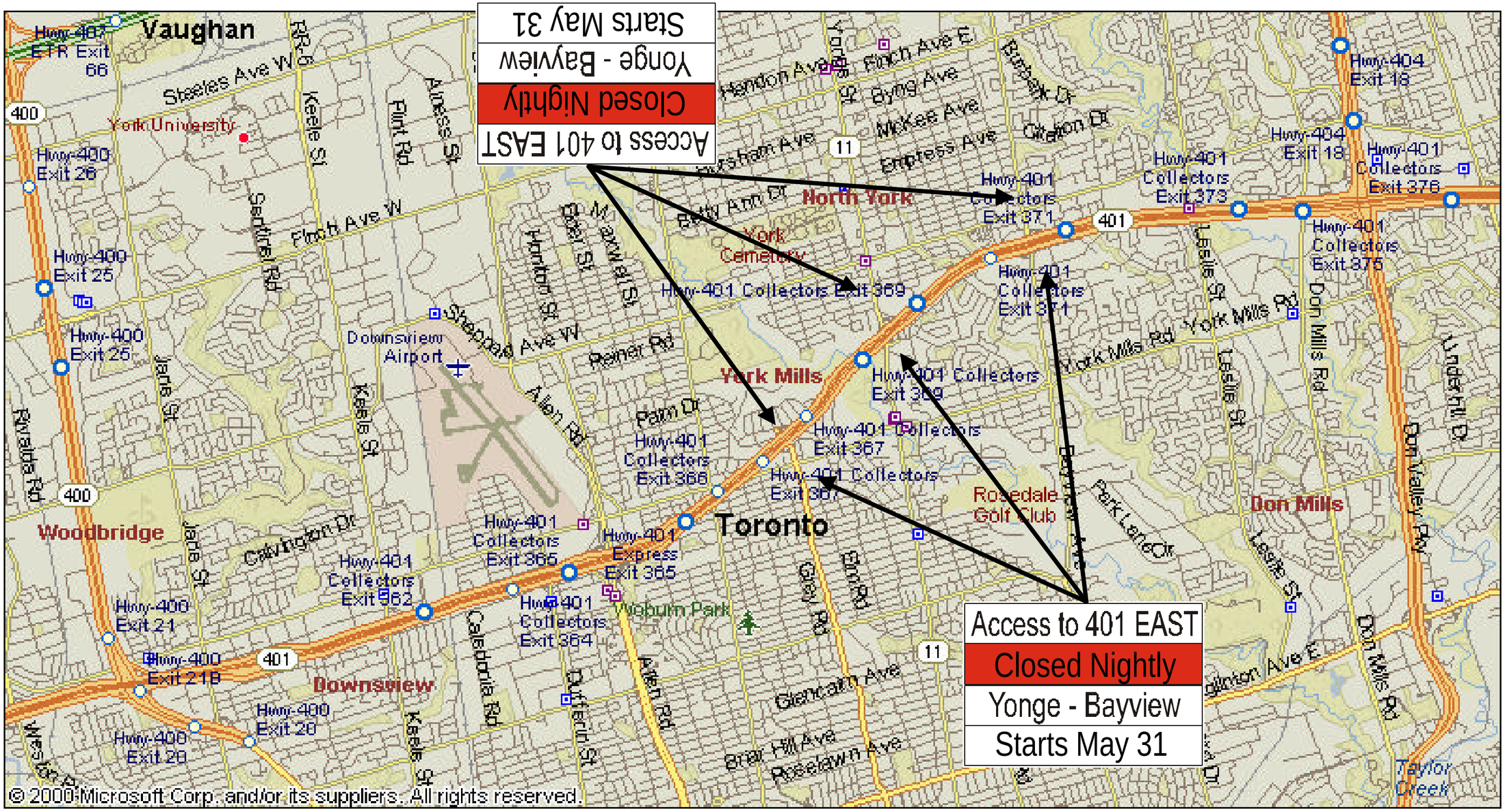


Figure 5.27 – Nighttime Recurring Full Closure of Collector Lanes - Advance Notification Phase (Crossing Roadways)

Advance Warning Phase

Main Line Signing

During the early morning hours (prior to 05:30 AM) of May 31, 2001, work crews visit the signs on Highway 401 east, west of the Basketweave, and update them. The "Starts" tab is removed and the remaining information is changed to indicate that the Collectors EAST will be closed tonight at 10 PM (10 PM May 31, 2001) from Yonge Street to Bayview Avenue.

A second sign, providing alternative route information for those drivers destined for either Yonge Street or Bayview Avenue, is also installed. This information is in place in time for morning commuters and others using the facility during the day to read it. Refer to **Figure 5.28**. A second alternative route sign, is placed in the collectors only, indicating an alternative route to continue on 401 EAST via Avenue Road.

Alternative route signing for the navigational restriction – leading drivers to Yonge Street and Bayview Avenue – as well that for the bypass route - is located on the eastbound off-ramp at Avenue Road. Refer to **Figure 5.28**. As this is an alternative route, and not a detour route, no Detour Trailblazer Signing is provided along the route. Refer to **Figure 5.29** for the DRS option. Drivers must rely on existing, permanent signing and local knowledge to navigate the routes. These signs are blanked when not in use.

If, for whatever reasons, the closure is not going to take place as planned, the information is updated to show the Collector Lanes as "Open Tonight" and the alternative route information is blanked. As the project progresses, these signs will be adjusted each morning to reflect the planned events for that evening.

Traffic in the Express Lanes, destined for Yonge Street and Bayview Avenue, is directed by the second sign to exit at Avenue Road. This is as it would be under normal conditions. Avenue Road, Yonge Street and Bayview Avenue are all accessed via the Express-to-Collector Transfer immediately east of Allen Road.

The specific circumstances of this closure do not require motorists to exit the Express Lanes at an earlier Transfer to access an alternative route to the closed interchanges. If that were the case, the alternative route information would tell drivers to exit the Express Lanes via an earlier Express-to-Collector Transfer by naming an upstream interchange.

For example, the message might read "Yonge – Bayview Via Keele Street", meaning that drivers would be required to exit the Express Lanes at the Basketweave, rather than at the Express-to-Collector Transfer east of Allen Road. The need to exit early would be reinforced as follows:

- by amendments to the overhead guide signing at the Basketweave, by adding "Yonge Street" and "Bayview Avenue" to the list of interchanges served by the Transfer, in black, on a construction orange background; and
- by amendments to the overhead guide signing at the Express-to-Collector Transfer east of Allen Road by adding "Closed Nightly" opposite "Yonge Street" and "Bayview Avenue" in black, on a construction orange background.

Alternative Route for Main Line Traffic Destined for Yonge Street or Bayview Avenue

The navigational impacts of the closure on drivers on Highway 401 EAST, destined for Yonge Street or Bayview Avenue, have to be addressed.

Back at the Basketweave, drivers in both the Express Lanes and the Collectors Lanes were directed to exit at Avenue Road in order to reach Yonge Street and Bayview Avenue. On the Avenue Road eastbound exit ramp, it is necessary to give those drivers the next piece of information required to navigate their alternative route successfully.

This may be done in one of two ways:

- A sign installed on the ramp informs drivers that Yonge Street and Bayview Avenue are accessible via Wilson Avenue, which becomes York Mills Road east of Yonge Street.

  In this case, no detour route signing or trailblazing is provided. It is assumed that drivers know that Wilson Avenue is south of Highway 401, and that Yonge Street and Bayview Avenue are east of Avenue Road. This approach is effective where a tight grid network of parallel routes is available, the routes are straightforward, and the proportion of drivers with local knowledge is high. Refer to **Figure 5.28**.

- The other option is to provide a signed detour route. Drivers are told by a Detour Route Sign (DRS) to follow Detour Trailblazer Signs (DTS) along the route. The detour ends at the last affected roadway – in this case Bayview Avenue. Refer to **Figure 5.29**.

Alternative Route for Main Line Traffic Back to 401 EAST (Bypass)

Where severe congestion is anticipated, and an alternative route is available, it may be desirable to sign this route and encourage some proportion of the through traffic to divert. The decision to provide a bypass route must be taken with care. The cooperation and approval of the road authority having jurisdiction over the alternative route is required. The route must be able to accommodate the full range of traffic anticipated (volume, dimensions, gross weight, turning radii, etc.) while the safety security and convenience of existing road users must also be taken into account.

In our scenario, the route is already handling intercepted traffic from affected and upstream crossing roadways. Encouraging mainline traffic to divert may result in unacceptable levels of congestion. Careful analysis is necessary, and the introduction of mitigating measures to augment capacity and ensure relative safety may be required. For the purposes of illustration, it is assumed that the necessary measures (e.g. timing/phasing changes, paid-duty police, etc.) have been implemented on the alternative routes.

Ideally, the alternative route should overlap the route serving the affected crossing roadways, if it is sufficiently capable of accommodating the additional traffic. In this manner, routing is more straightforward and the signing performs double duty.

In advance of the Avenue Road exit, drivers in the Collectors Lanes were advised of the

option to exit at Avenue Road in order to reach an alternative route leading back to 401 EAST. On the Avenue Road eastbound exit ramp, it is necessary to give those drivers the next piece of information.

This may be done in one of two ways:

- A sign installed on the ramp informs drivers that the alternate route is "Via York Mills/Leslie". In this case, no detour route signing or trailblazing is provided. It is assumed that drivers know that Wilson Avenue is south of Highway 401; that Wilson Avenue becomes York Mills Road; and that Leslie Street is east of Avenue Road. This approach is effective where a tight grid network of parallel routes is available, the routes are straightforward, and the proportion of drivers with local knowledge is high. Refer to **Figure 5.28**.

The other option is to provide a signed detour route. Drivers are told by a Detour Route Sign to follow Detour Trailblazer Signs along the route. The detour ends at the Highway 401/Leslie Street interchange. Refer to **Figure 5.29**. **Figure 5.30** illustrates the Detour Trailblazer Signing (DTS) employed.

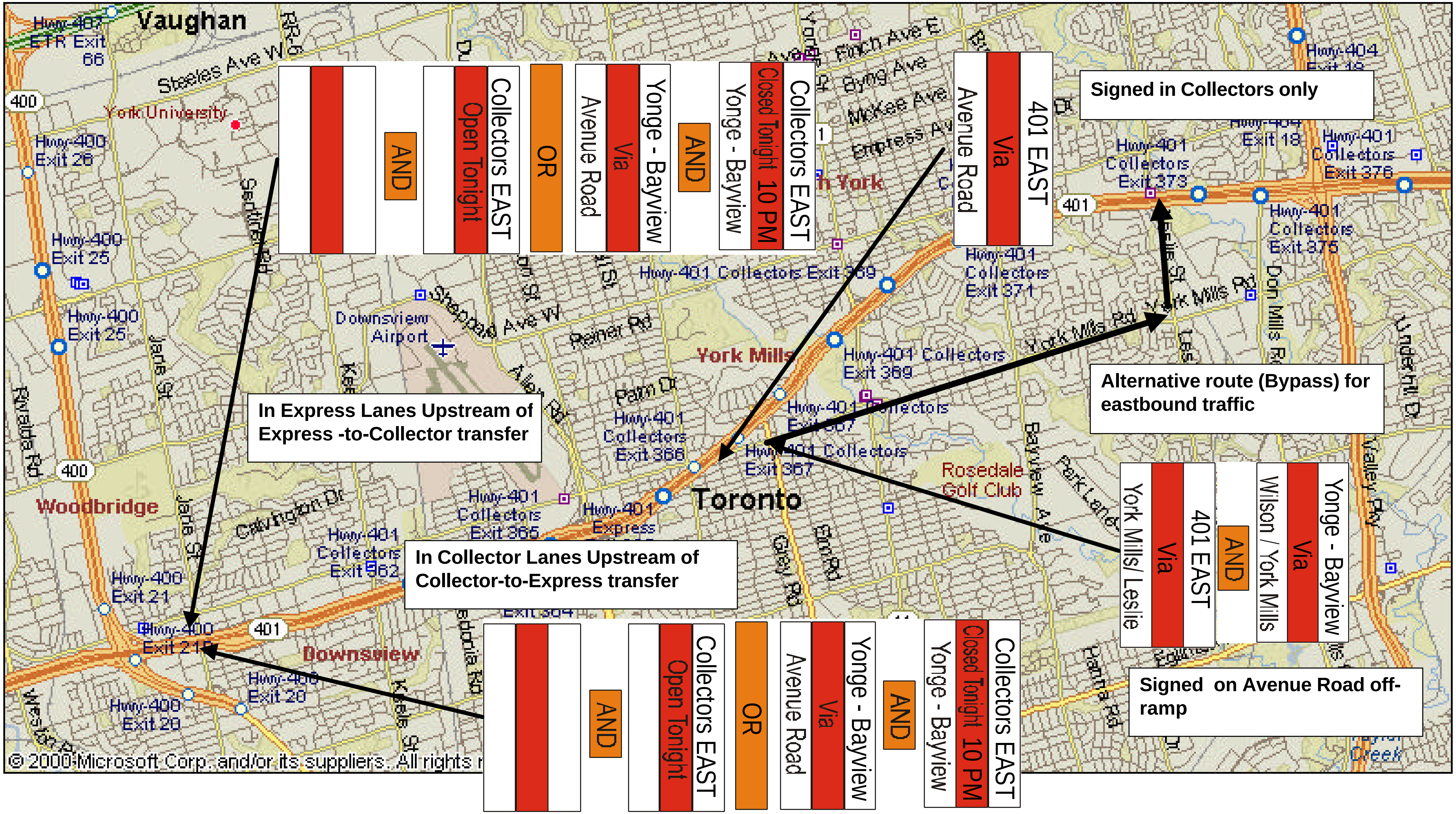
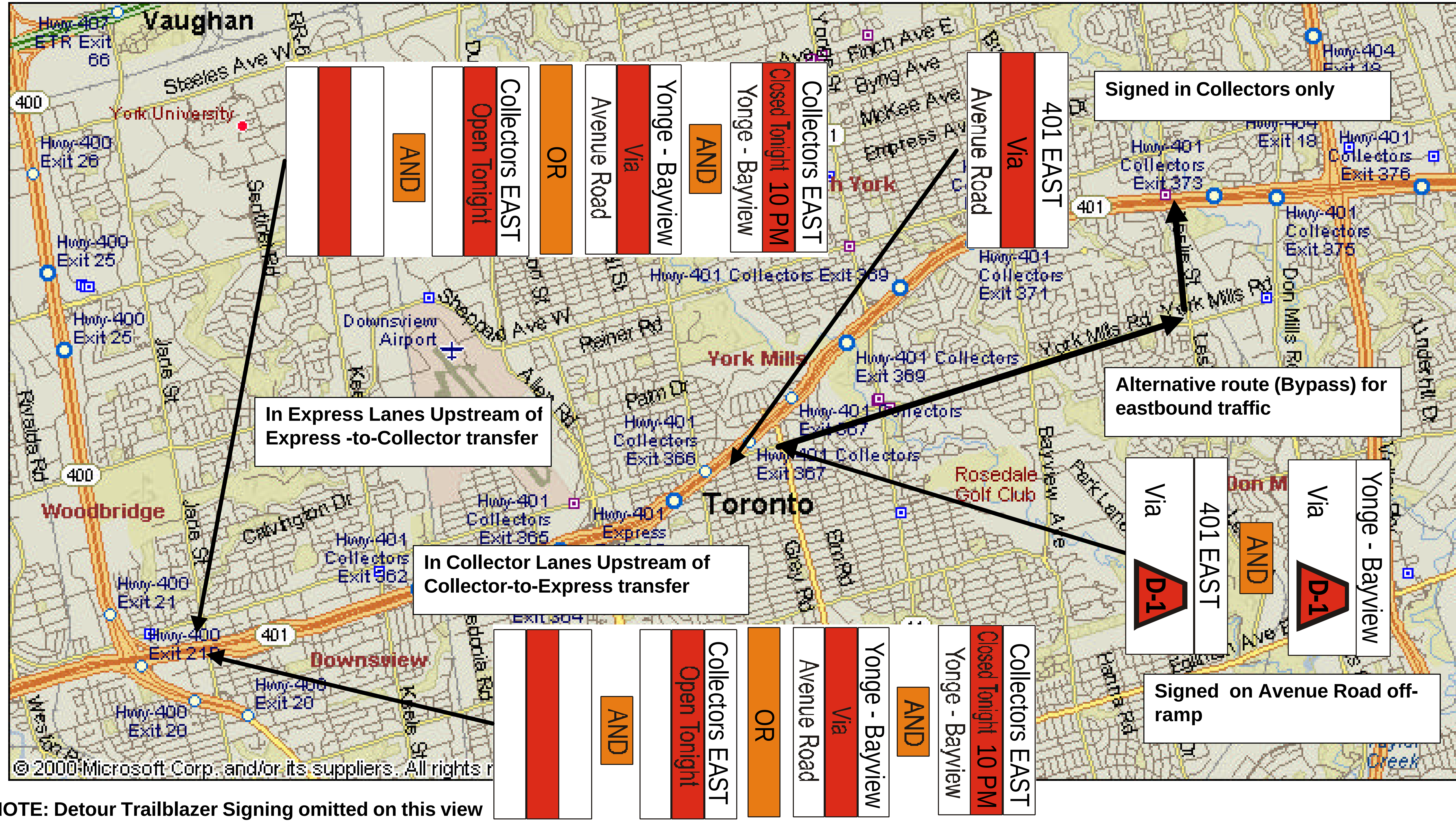


Figure 5.28 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS (Mainline and Alternative Route)



NOTE: Detour Trailblazer Signing omitted on this view

Figure 5.29 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS (Mainline and Detour Route)

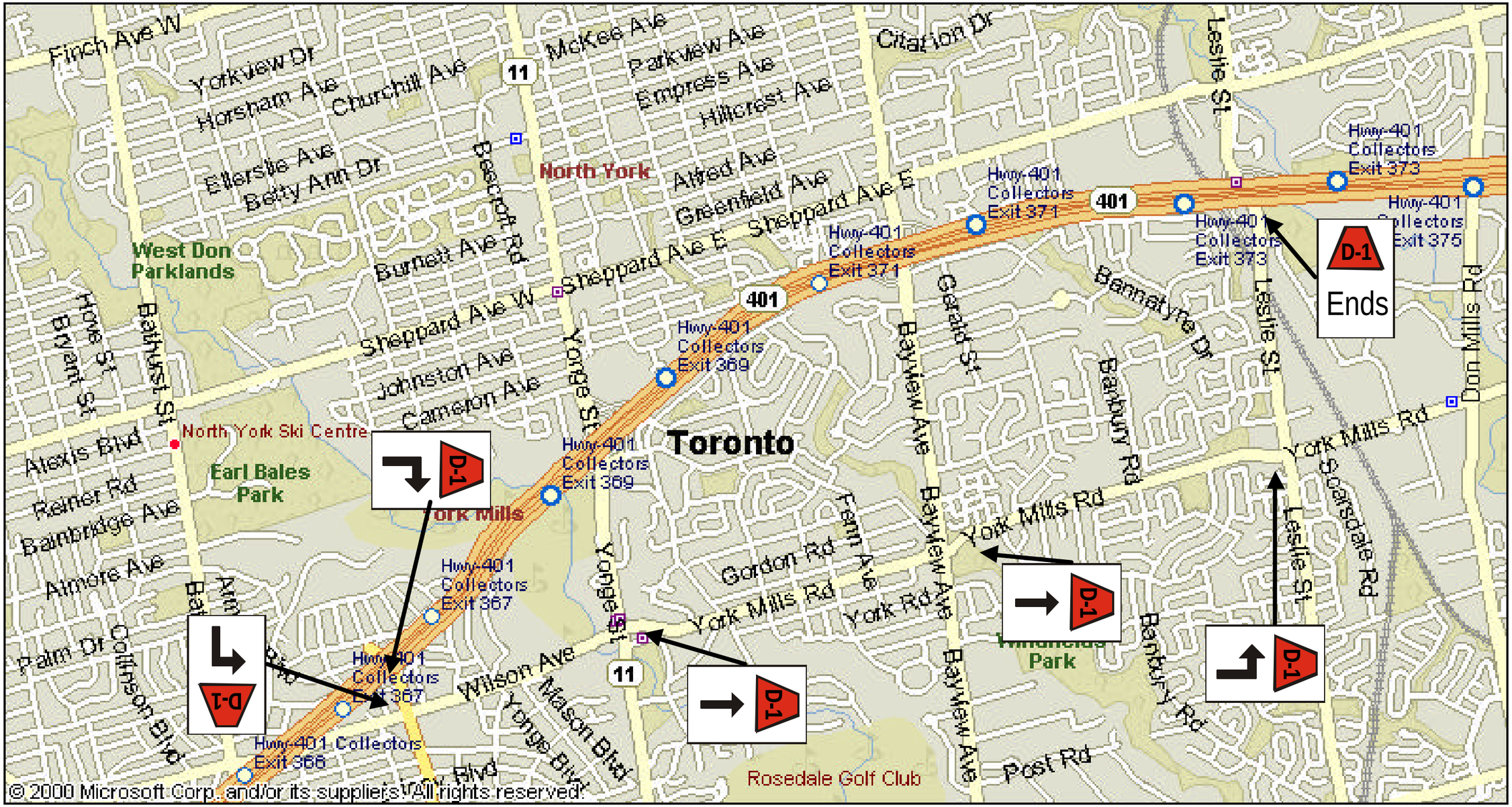


Figure 5.30 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase (Detour Trailblazer Signing DTS)

Crossing Roadway Signing

Information provided to drivers on the crossing roadways must also be updated in the early morning of May 31, 2001. Drivers travelling north and south on Avenue Road, Yonge Street and Bayview Avenue need to know that there will be no access to Highway 401 EAST once the closure is implemented.

At Avenue Road, Yonge Street and Bayview Avenue, the "Starts" tab is removed for the Advance Notification Sign and the remaining information is changed to indicate that "Access to 401 EAST" will be closed tonight at 10 PM (10 PM May 31, 2001) from Yonge Street to Bayview Avenue. Signs on Yonge Street northbound and Bayview Northbound are relocated to a point south of Wilson Avenue/York Mills Road, to allow drivers to divert onto this alternative route during the closure. Refer to **Figure 5.31**.

If a signed detour route is to be used to guide drivers on the affected crossing roadways to Highway 401 EAST, then Intercept Detour Route Signing (IDRS) and Detour Trailblazer Signing (DTS) is required. Refer to **Figures 5.32, 5.37, 5.39 and 5.39.** Traffic routing is the same as with Intercept Alternative Route Signing (IARS), with traffic

If, for whatever reasons, the closure is not going to take place as planned, the information is updated to show the Collector Lanes as "Open Tonight". As the project progresses, these signs will be adjusted each morning to reflect the planned events for that evening.

Crossing Roadway Alternative Route Signing

A second sign, providing alternative route information for those drivers trying to access Highway 401 EAST, may be provided. This sign may simply advocate an alternative route (i.e. Access to 401 EAST Via York Mills/Leslie) or it may lead in to a fully-signed detour route.

Guidance to an alternative route may be sufficient where the route is straightforward and is adequately signed, and where a high proportion of drivers have good knowledge of the local street system. Where this is not the case, a detour route may be more effective.

For an example of Alternative Route Signing for Crossing Roadways, refer to **Figure 5.31**. For an example of a Detour Route for Crossing Roadways, refer to **Figures 5.32**.

If, for whatever reasons, the closure is not going to take place as planned, the alternative route information covered at the same time as the advance warning information is updated to "Open Tonight". As the project progresses, these signs will be adjusted each morning to reflect the planned events for that evening.

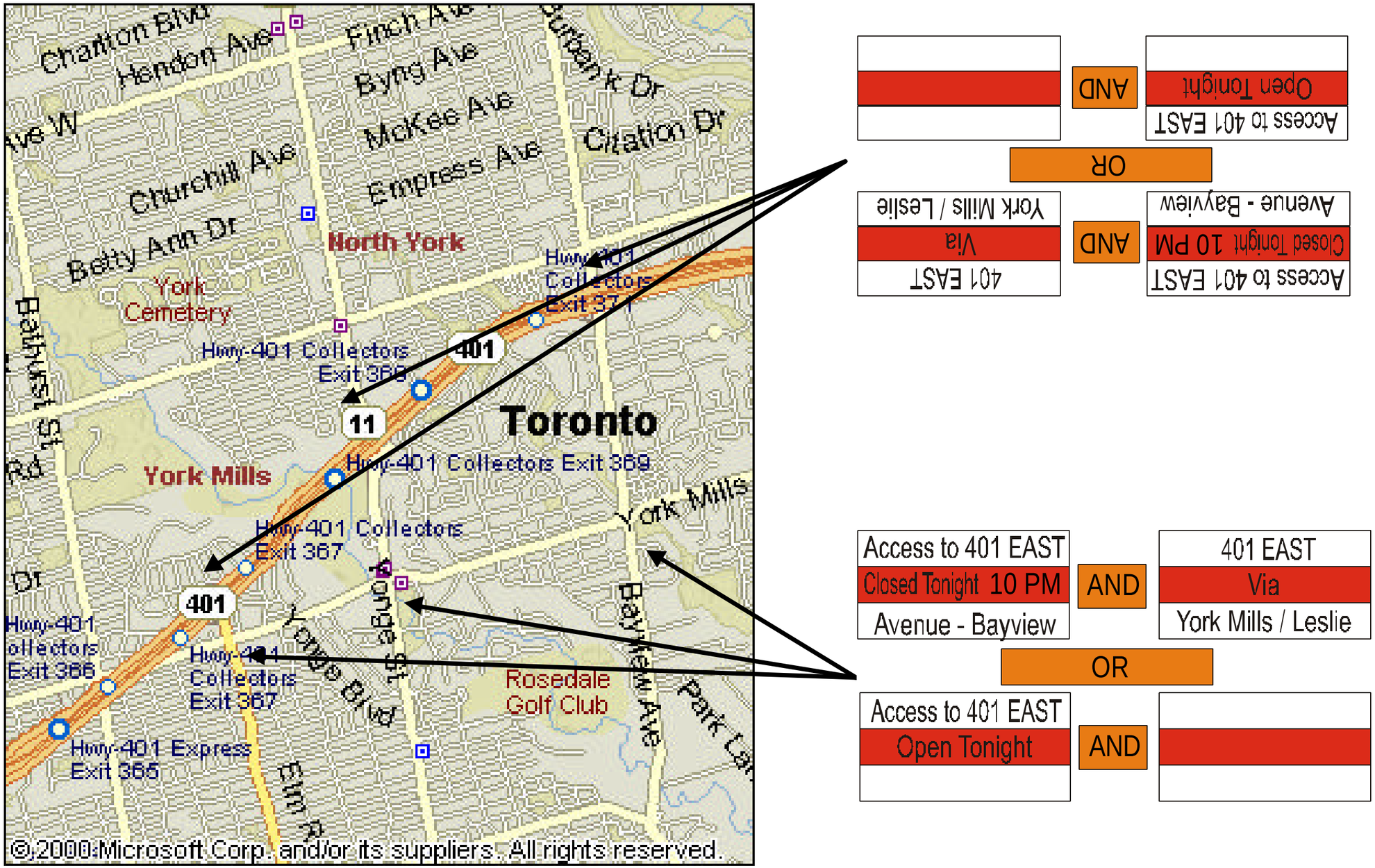
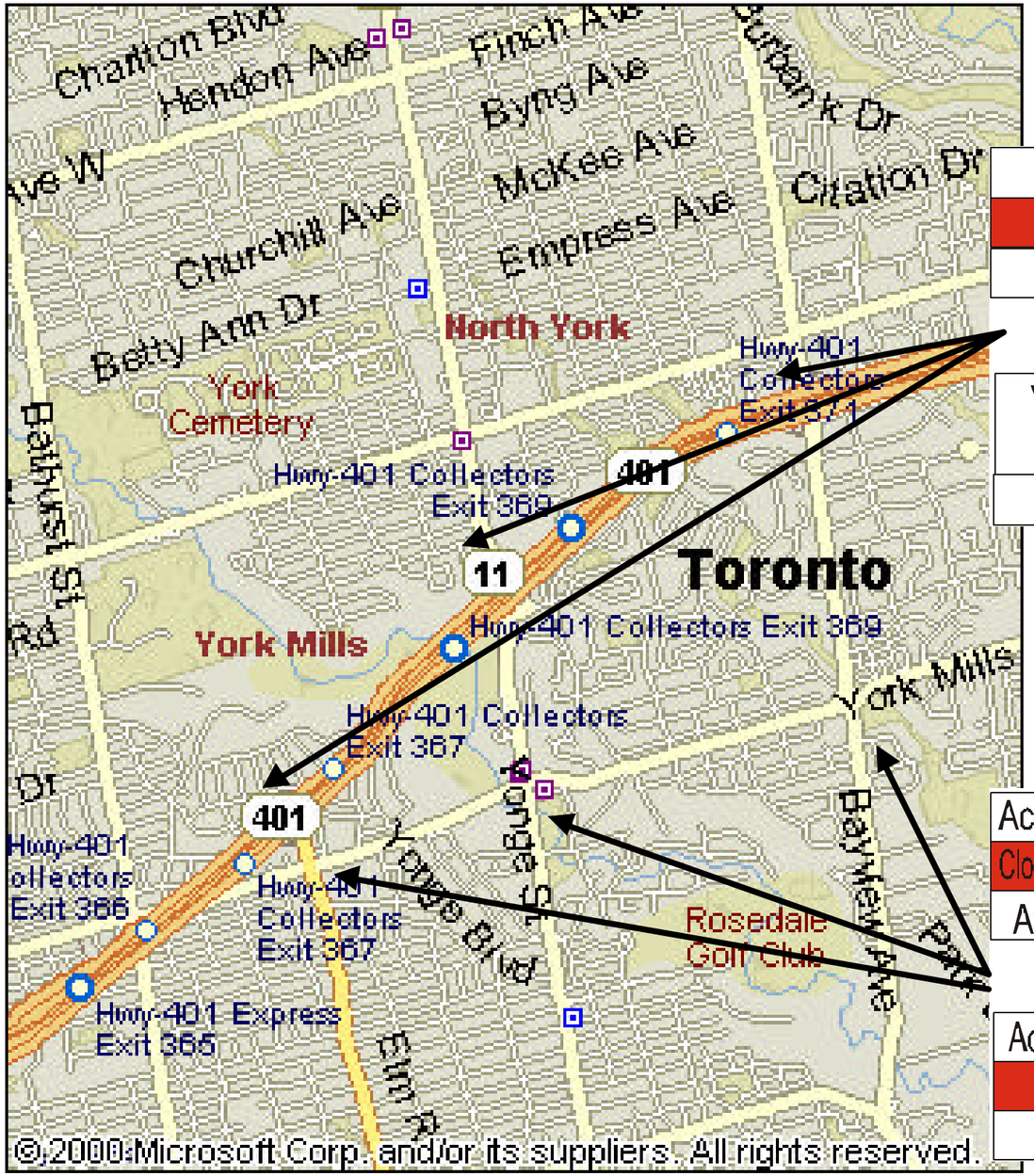
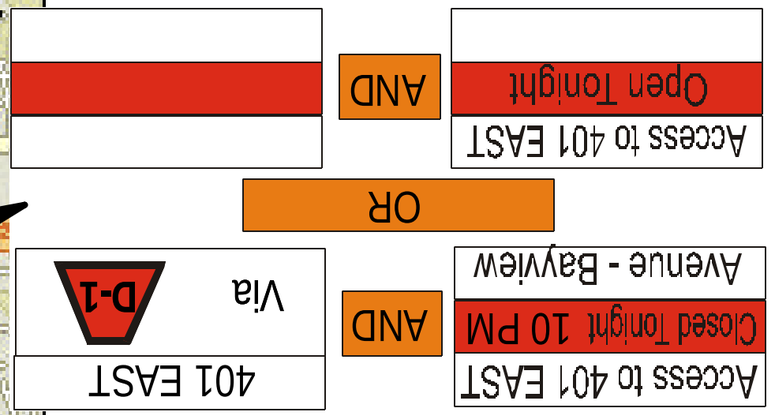


Figure 5.31 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS – (Crossing Roadway)





NOTE: Detour Trailblazer Signing not shown for purposes of clarity. Refer to Figure 5..36, 5.37 and 5.38.

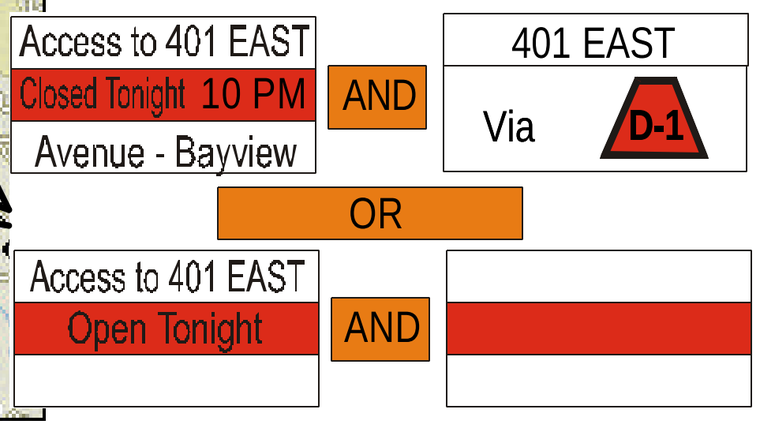


Figure 5.32 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS – (Crossing Roadway Detour Option)

Upstream Crossing Roadway Signing

Drivers on travelling north on Bathurst Street and Dufferin Street, east on Wilson Avenue, and north and south on Allen Road need to be informed of the closure so that they can avoid entering Highway 401 EAST and becoming involved in the eastbound queue. No Advance Notification Signing was installed on these routes.

Early on the morning of May 31, 2001, signs are installed at these locations to inform drivers of the pending closure that evening. They indicate that "401 Collectors EAST" will be closed tonight at 10 PM (10 PM May 31, 2001) from Yonge Street to Bayview Avenue. These signs are positioned so as to provide sufficient advance warning, allowing drivers to choose an alternative routes. Refer to **Figures 5.33 through 5.36**.

If, for whatever reasons, the closure is not going to take place as planned, the information is updated to show the Collector Lanes as "Open Tonight". As the project progresses, these signs will be adjusted each morning to reflect the planned events for that evening.

Upstream Crossing Roadway Alternative Route Signing

Where capacity on the affected link is critical, it may be desirable to "intercept" some of the demand originating upstream of the closure, and re-route it along parallel roadways. In this case, Wilson Avenue/York Mills/Leslie Street has been designated as the alternative route for traffic on Wilson Avenue, Dufferin Street, and Bathurst Street. Traffic on Allen Road, wishing to reach Highway 401 EAST, will be directed along Sheppard Avenue to Leslie Street.

The intercept alternative route information may be provided in one of two ways, both requiring the provision of a second sign following the advance warning information. The information can be provided as alternative route information only, or it can be provided as the lead-in to a signed detour route.

Guidance to an alternative route may be sufficient where the route is straightforward, has adequate permanent signing, and where a high proportion of drivers have good knowledge of the local street system. Where this is not the case, a detour route may be more effective.

For an example of an Intercept Alternative Route Signing for Upstream Crossing Roadways, refer to **Figures 5.33 and 5.34**. For an example of an Intercept Detour Route for Upstream Crossing Roadways, refer to **Figures 5.34 and 5.35**. Detour Trailblazer Signing is shown in **Figures 5.37, 5.38 and 5.39**.

If, for whatever reasons, the closure is not going to take place as planned, the advance warning information is updated to show the Collector Lanes as "Open Tonight" and the alternative route information is blanked. As the project progresses, these signs will be adjusted each morning to reflect the planned events for that evening.

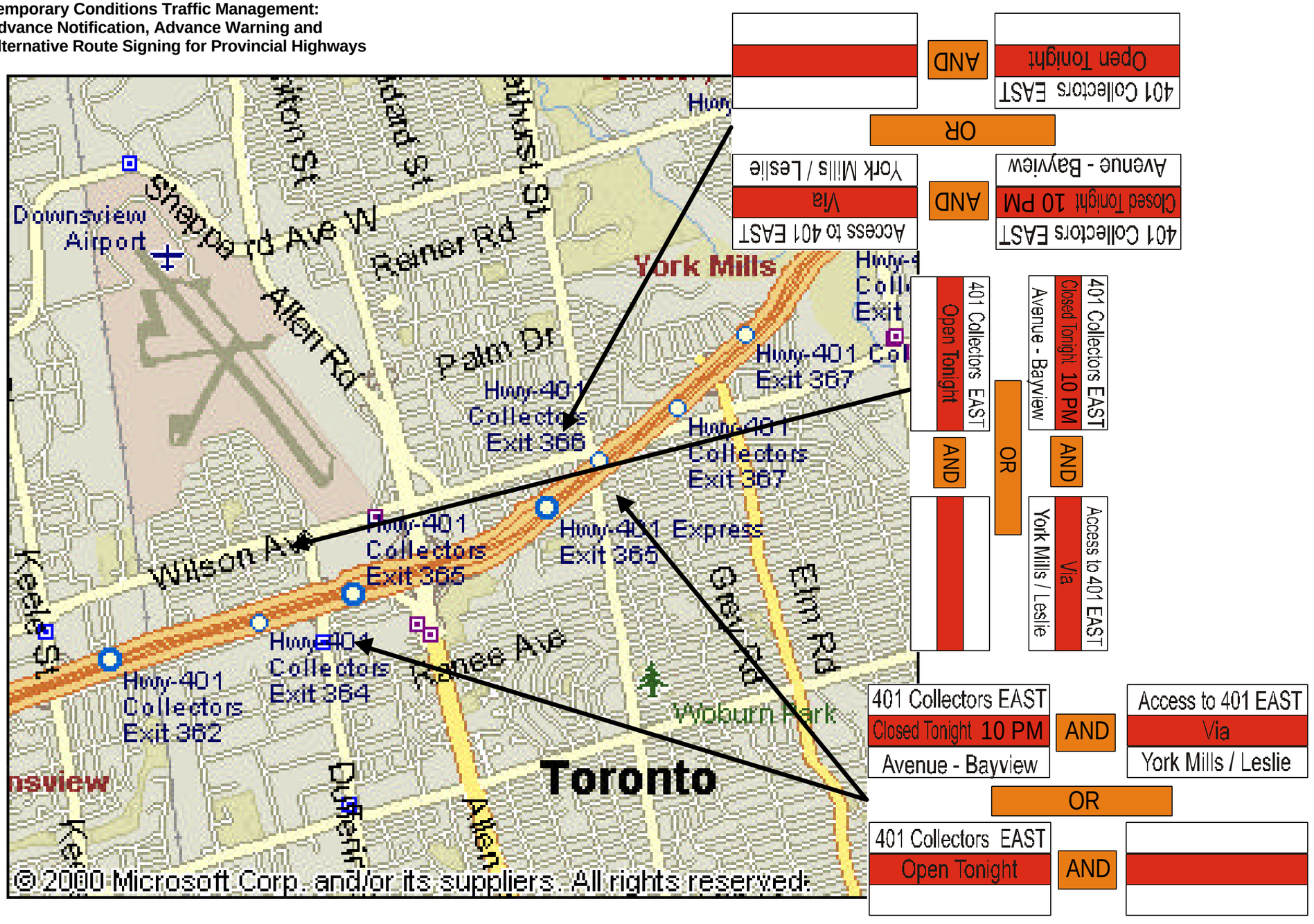


Figure 5.33 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS – (Upstream Crossing Roadways)

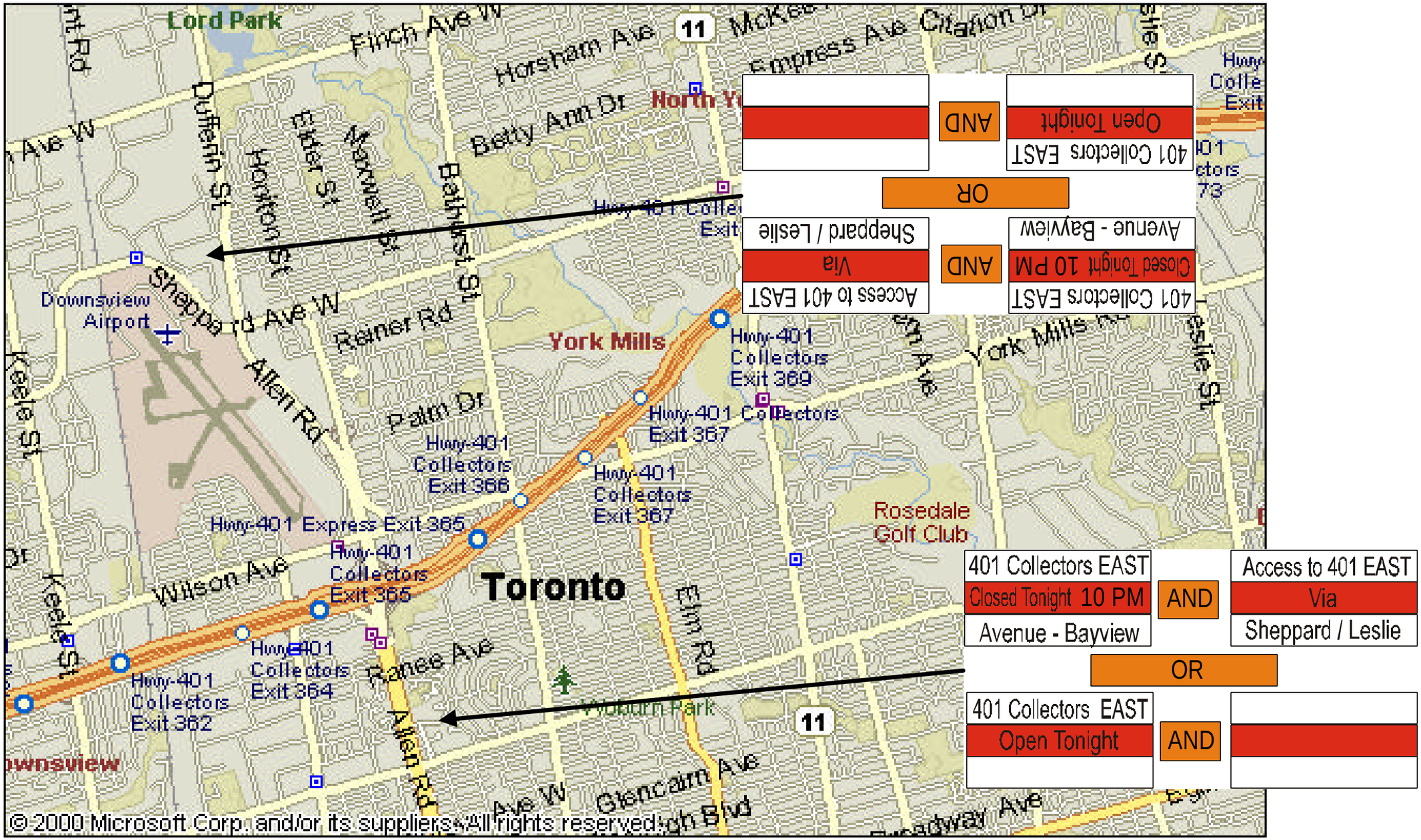


Figure 5.34 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS – (Upstream Crossing Roadways – Allen Road)

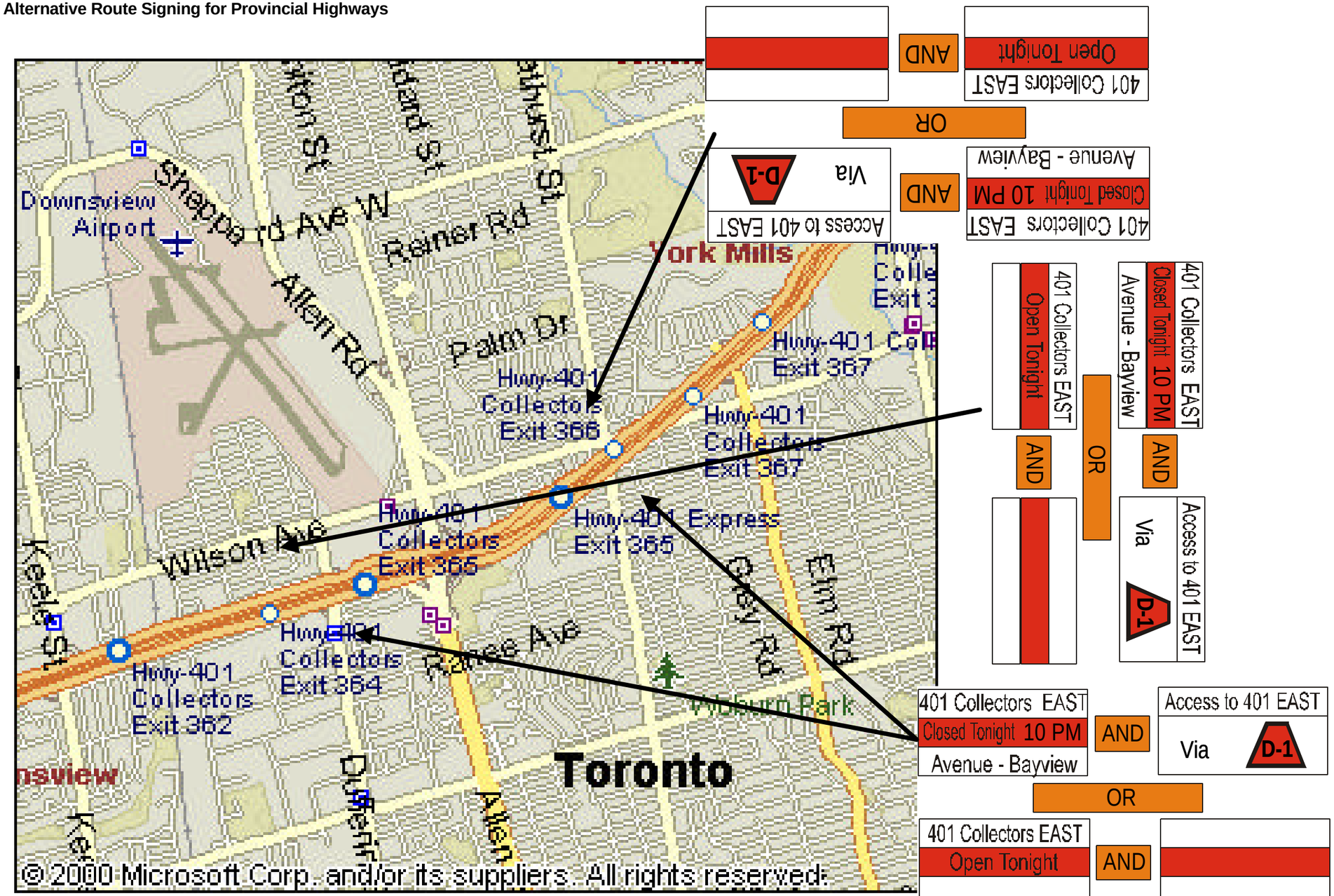


Figure 5.35 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS – (Upstream Crossing Roadways – Detour Option)

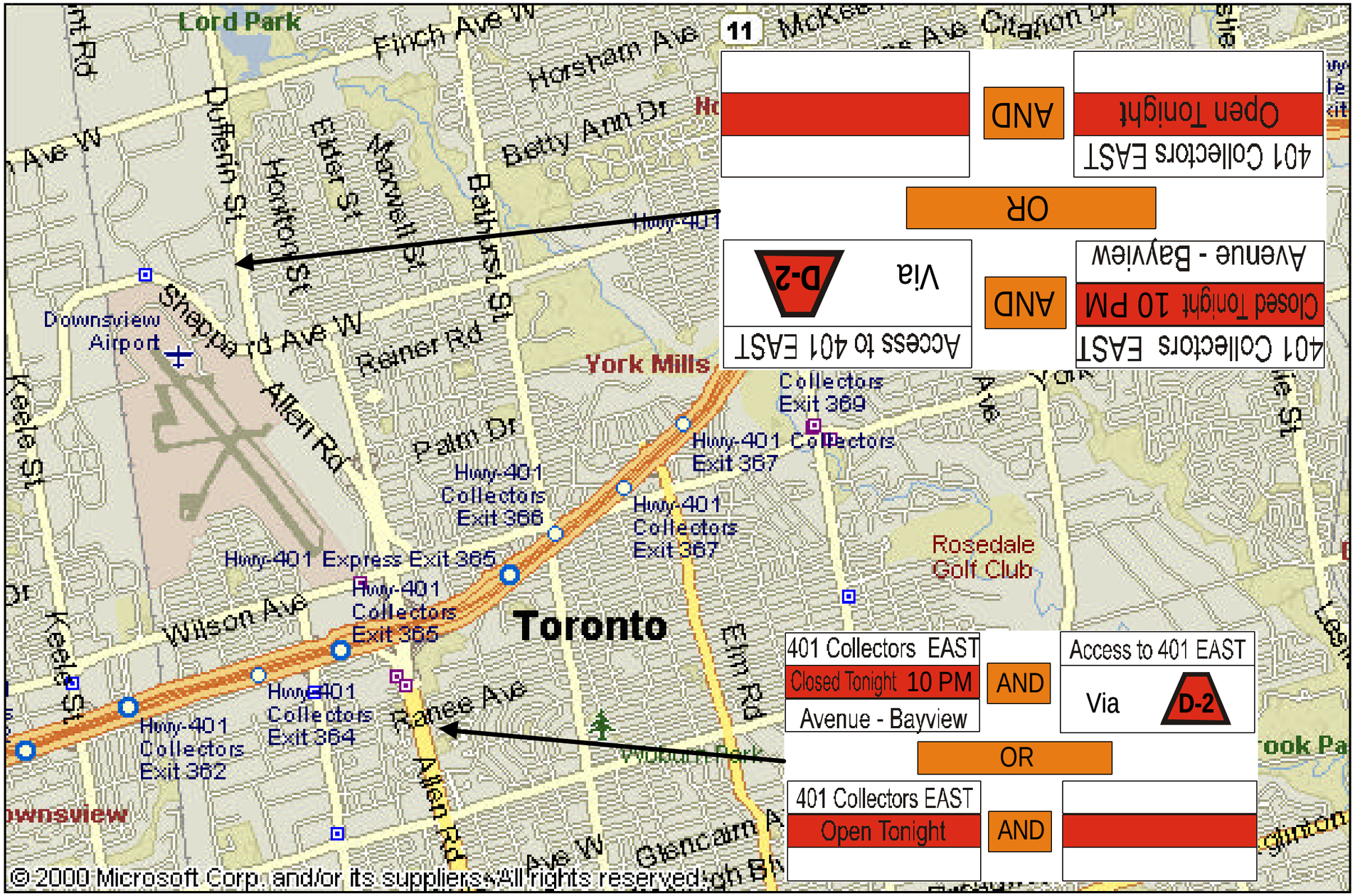


Figure 5.36 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS – (Upstream Crossing Roadways – Allen Road Detour Option)

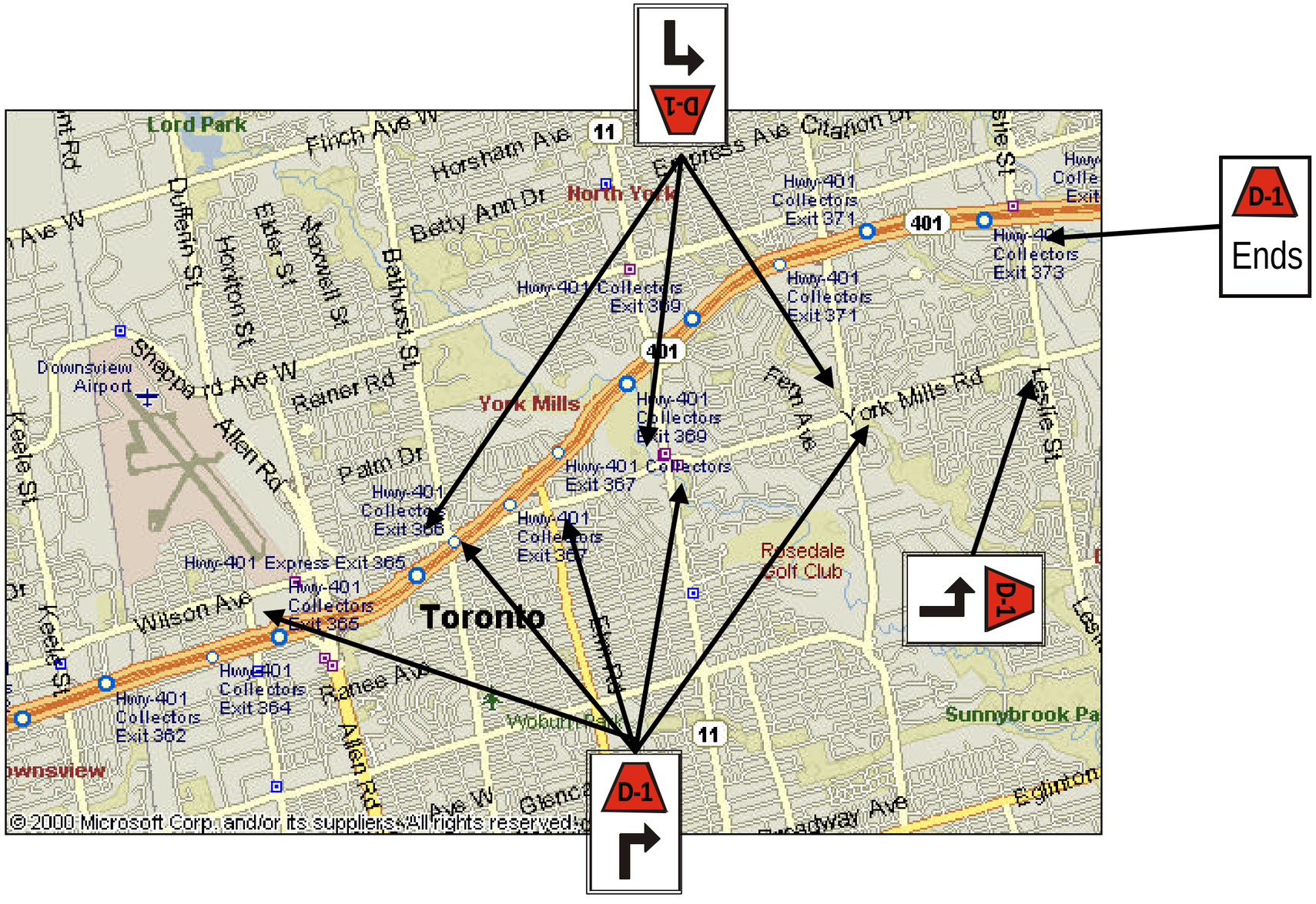


Figure 5.37 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS – (Detour Trailblazer Signing DTS on D-1)

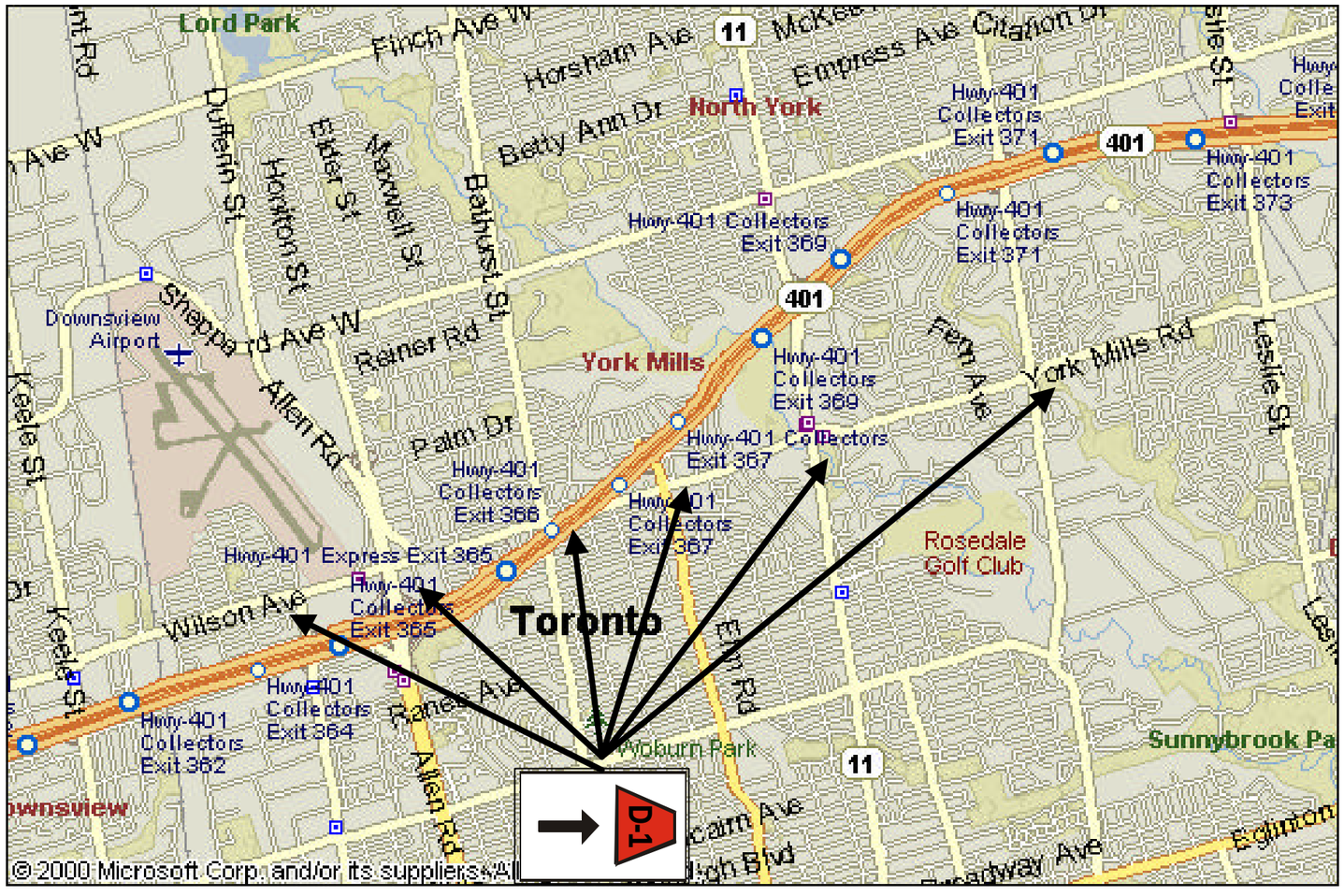


Figure 5.38 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase AWS – (Detour Trailblazer Signing DTS on D-1 – Pullthrough)

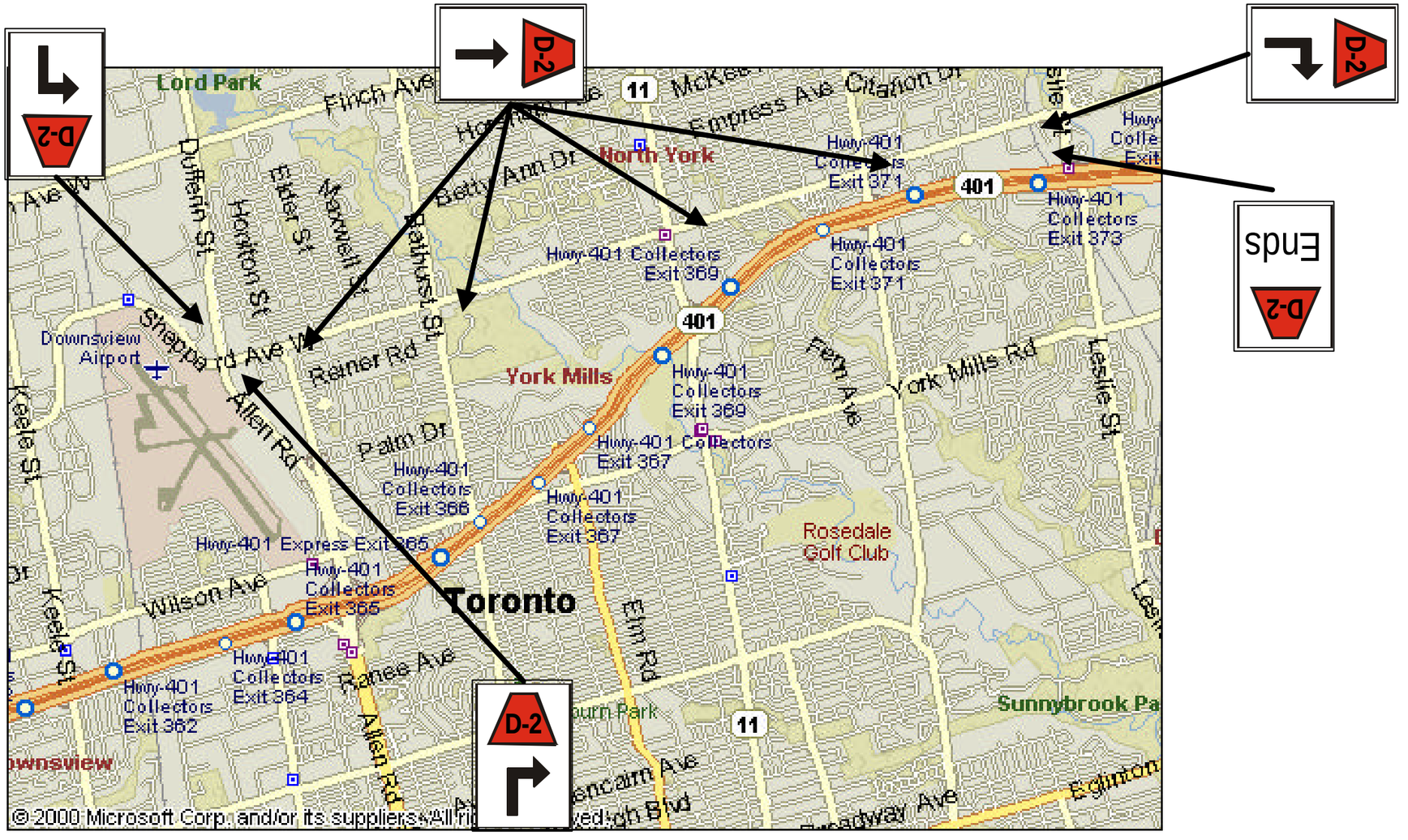


Figure 5.39 – Nighttime Recurring Full Closure of Collector Lanes - Advance Warning Phase – (Detour Trailblazer Signing DTS on D-2)

Temporary Conditions Traffic Management:
Advance Notification, Advance Warning and
Alternative Route Signing for Provincial Highways

Summary

In the preceding scenario, we have applied the following:

- Advance Notification Signing (ANS) on the Main Line Roadway (in this case Highway 401 EAST);
- Advance Notification Signing (ANS) on the Affected Crossing Roadways (i.e. Avenue Road, Yonge Street and Bayview Avenue);
- Advance Warning Signing (AWS) on the Main Line Roadway;
- Advance Warning Signing (AWS) on the Crossing Roadways;
- Advance Warning Signing (AWS) on the Upstream Crossing Roadways (i.e. Bathurst Street, Allen Road, Dufferin Street and Wilson Avenue);
- Alternative Route Signing (ARS), Detour Route Signing (DRS) and Detour Trailblazer Signing (DTS) to mitigate the navigational restrictions imposed by the closure at the Yonge Street and Bayview Avenue interchanges using local roads (by creating an alternative route from Avenue Road across Wilson Avenue and York Mills Road);
- Alternative Route Signing (ARS), Detour Route Signing (DRS) Detour Trailblazer Signing (DTS) to create a bypass route on local roads, intended to reduce mainline congestion (by creating an alternative route from Avenue Road across Wilson Avenue/York Mills Road to Leslie Street); and
- Intercept Alternative Route Signing (IARS), Intercept Detour Route Signing (IDRS) and Intercept Detour Trailblazer Signing (IDTS) to re-route demand upstream of and within the closure, along local roads, to a point downstream of the closure (via Wilson Avenue/York Mills Road to Leslie Street, and Sheppard Avenue to Leslie Street).

It is highly unlikely that any one project would involve the implementation of all of these traffic management strategies simultaneously. The logistical requirements would be significant, and the associated costs may be difficult to justify.

This scenario shows however that several strategies from the TCTM "toolbox" can be overlaid and integrated to mitigate the navigational and capacity impacts of even the most demanding project.

CHAPTER 6

STANDARD DOCUMENTS AND SPECIAL PROVISIONS

TABLE OF CONTENTS

6.1 Introduction

Central Region staff determine which standard documents and special provisions apply on a project-by-project basis. Many of these documents are currently undergoing revision.

For the latest, official versions of standard documents and special provisions, contact the Central Region Traffic Office.

Appendix A – References

Referenced Documents

Ontario Manual of Uniform Traffic Control Devices, Ontario Ministry of Transportation, 1995

Traffic Control Manual for Roadway Work Operations, Field Edition, Ontario Ministry of Transportation, 1989

King's Highway Guide Signing Policy Manual, Ontario Ministry of Transportation, 1990

The Ontario Traffic Manual, Book 7 - Temporary Conditions (when available), Ontario Ministry of Transportation, 2000

Sign Support Manual, Ontario Ministry of Transportation,

The Roadside Safety Manual, Ontario Ministry of Transportation, 1994

Other References

Central Region Traffic Freeway Detour Signing, Ontario Ministry of Transportation, 1994

Human Factors in Highway Work Zones, Human Factors North Inc., for Ontario Ministry of Transportation, 1999

Sign Standards Review, IBI Group and Human Factors North Inc., for Ontario Ministry of Transportation, 1998

Freeway Detour Guide Signing Literature Review, Synectics Transportation Consultants Inc. for Ontario Ministry of Transportation, 2000

Appendix B – Acronyms

Acronym	Phrase	Definition
ANS	Advance Notification Sign(ing)	Signing installed on an affected route prior to the establishment of a work zone. Used to forewarn regular users of a route that work is planned in the near future.
ARS	Alternative Route Sign(ing)	Signing installed on an affected route describing an alternative route to either reach a destination or to bypass congestion. The alternative route itself receives no temporary signing.
AWS	Advance Warning Sign(ing)	Signing installed on an affected route to inform road users of the scope, extent and duration of a planned work activity. Work may be continuous or reoccurring.
DRS	Detour Route Sign(ing)	Signing placed at the beginning of a signed alternative route (D-1), indicating that road users should follow a discrete series of temporary signs (Detour Trailblazer Signs – DTS) to either reach a destination or to bypass congestion.
DTS	Detour Trailblazer Sign(ing)	Signing placed along a signed alternative route to guide road users to either reach a destination or to bypass congestion.
IARS	Intercept Alternative Route Sign(ing)	Signing placed on crossing roadways within or immediately upstream of the work zone, intended to intercept road users destined for the affected route by describing an alternative, parallel route, that bypasses the work zone. Used to reduce demand on the affected route.
IDRS	Intercept Detour Route Sign(ing)	Signing placed on crossing roadways within or immediately upstream of the work zone, intended to intercept road

		users destined for the affected route by indicating a signed, alternative, parallel route, that bypasses the work zone. Used to reduce demand on the affected route.
IDTS	Intercept Detour Trailblazer Sign(ing)	Signing placed along a signed intercept alternative route to guide road users to bypass congestion.
MTO	Ministry of Transportation Ontario	The provincial road authority in the Province of Ontario
MUTCD	Manual of Uniform Traffic Control Devices (Ontario)	The uniform reference in the Province of Ontario on the design and application of traffic control devices. Soon to be superceded by the Ontario Traffic Manual (OTM).
OTM	Ontario Traffic Manual	The Ontario Traffic Manual is a series of uniform references on the design and application of traffic control devices intended to replace the current Manual of Uniform Traffic Control Devices for Ontario (MUTCD).
PVMS	Portable Variable Message Sign	Trailer-mounted or temporarily-installed message boards capable of presenting more than one message (may be text, graphics, or both).
TCMRWO	Traffic Control Manual for Roadway Work Operations	A field reference drawn from the Ontario Manual of Uniform Traffic Control Devices (MUTCD).
TCTM	Temporary Conditions Traffic Management	The strategic use of traffic control devices to present information to road users regarding planned activities impacting navigational freedom and roadway capacity, with the goal of reducing uncertainty, managing demand, and providing alternative routes, as necessary.

VMS	Variable Message Sign	A permanently-installed message boards capable of presenting more than one message (may be text, graphics, or both). Example: COMPASS.