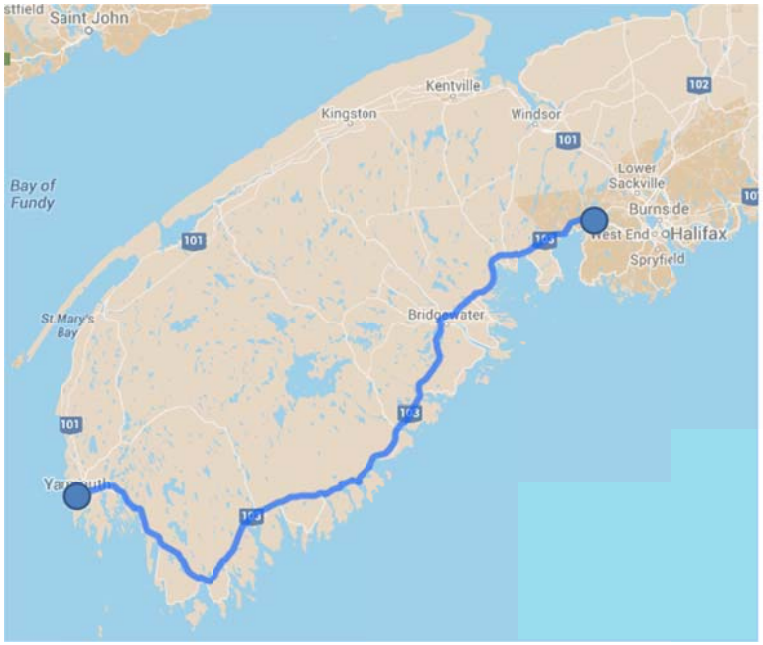

NOVA SCOTIA
Transportation and Infrastructure Renewal

Final Report

WSP

Operational and Safety Review:

Highway 103, Upper Tantallon to Yarmouth

Nova Scotia Transportation and Infrastructure Renewal

March 2015

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Executive Summary

Background

The Highway 103 Operational and Safety Review has been commissioned by the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) to identify current and projected operational and safety deficiencies on the approximately 274 kilometers from Yarmouth to the end of four lane highway west of Tantallon. Highway 103 is considered a feeder route of the National Highway System which makes it eligible for federal cost sharing.

While over 80% of the 274 kilometer Study Area is now two-lane controlled access highway, and the overall average collision rate is comparable to the collision rate for other 100 Series Highways in the Province, peak hour volumes and collision experience between Bridgewater and Tantallon have prompted public concern for safety and requests for twinning. Plans are progressing for twinning the section from Tantallon to Hubbards, however, increasing traffic demands and a number of fatal collisions in recent years have indicated the need for an operational and safety review of the entire highway.

Study Objectives

The primary objectives of the study include:

- Complete a review of Highway 103 from Yarmouth to Tantallon to identify current and projected operational and safety deficiencies.
- Recommend a combination of short term and medium term engineering, education, and enforcement strategies to achieve the safety and operational standards expected of the National Highway System.
- Prepare a Final Report that includes an Action Plan for highway improvements to provide a fully controlled access Highway 103 during a 20 year horizon.

Stakeholder Responses

The following stakeholders were contacted by telephone or Email to obtain comments, suggestions, and recommendations concerning the Highway 103 Study Area:

- NSTIR District Director and Area Managers;
- Highway 103 Committee
- RCMP Highway Patrol
- EHS
- School Transportation Coordinators
- Federal Member of Parliament
- Provincial MLAs
- Mayors / Wardens of Towns, Counties and Municipalities.

Responses from the various Stakeholders have been summarized under the following 3 Es of Highway Safety in Table E-1:

Table E-1: Summary of Stakeholder Responses

Engineering	• More four-lane highway is needed to reduce the potential for head-on collisions, even if toll roads are required. • At-grade intersections on controlled access sections need to be replaced by overpasses. • Sections with poor alignment need to be upgraded or by-passed. • Shoulders need to be widened and maintained. • Roadside bushes have to be cut back to provide improved visibility. • Increase in lane passing opportunities
Education	• Drivers need to travel within the posted speed limits and to adjust speed in accordance to road and traffic conditions. • Drivers should be reminded that a few seconds of distraction from the driving task could lead to disastrous consequences. • Install changeable message signs to provide safety messages • Head lights should be turned-on during poor driving conditions so that tail lights will also be lighted.
Enforcement	• A greater visibility of police is required along the highway to promote better driving habits from motorists. • More enforcement of speed and driver distraction laws is required. • Install radar controlled speed feedback signs to alert motorists to reduced speed zones.

Review of Traffic Volumes

Projected Study Area 2014 Annual Average Daily Traffic (AADT) volumes vary from 11,300 vehicles per day (vpd) at the east end (Tantallon), to a low of 1,550 vpd at Barrington, and then increase to 6,000 vpd at the west end (Yarmouth). Highway sections at the east end between Tantallon and Bridgewater, where 2014 volumes vary from 11,300 vpd to 8,900 vpd, include significant commuter traffic travelling to and from Halifax which result in high AM and PM peak directional traffic volumes. The annual volume growth rates average approximately 1.7% for sections at the eastern end of the Study Area and 1.2% at the western end.

Following completion of the Ingramport Interchange and connector to Trunk 3 in 2017, it is estimated that the 2017 AADT for Section 040 between Tantallon and the new interchange will increase to approximately 14,500 vpd with volumes increasing to 16,100 vpd in 2024 and 18,400 vpd in 2034. Projected 2024 and 2034 volumes in Section 045 between the Ingramport Interchange and Hubbards are expected to be 13,200 vpd and 15,100 vpd, respectively.

Review of Collision Data

Collision data files for the most recent available period (2007 to 2012) provided by NSTIR included a total of 890 collisions for the 274 kilometers of highway in the Study Area. During the six year period there were 586 property damage only (PDO), 282 injury, and 22 fatal collisions reported.

The following observations emanate from review of the average collision rates for 2007 to 2012:

- There is no significant variation between the overall collision average rates for the Highway 103 Study Area, Highway 103 controlled access sections, and the Nova Scotia average collision rates for controlled access highways.
- While the 38 kilometers included in Sections 040 to 060 between Tantallon and Chester account for only 14% of the Study Area of Highway 103, the segment accounts for 28% of the vehicle kilometers of travel and 50% of the fatal crashes.
- The 50 kilometers included in Sections 245 to 270 in Yarmouth County account for 18% of the Study Area of Highway 103 and 14% of the vehicle kilometers of travel, however, that segment includes 27% of the fatal crashes.
- The fatal collision rate of 1.5 per Hundred Million Vehicle Kilometers (HMVK) for the sections between Tantallon and Chester, and in Yarmouth County, is significantly higher than the 0.9 per HMVK for controlled access two lane sections and five times the 0.3 per HMVK Provincial average for four-lane divided highway sections.

Examination of the locations, dates, light, weather, road surface conditions, and contributing factors to the 22 fatal crashes during 2007 to 2012 indicate the following:

- There were five single vehicle collisions; 15 two vehicle collisions; one collision with three vehicles; and one between a bus and a bicycle;
- 16 collisions occurred during **day light**; one at dawn; and five in the dark;
- 14 collisions occurred during **clear weather**; one cloudy; two rain; one snow; one freezing rain; and three not indicated;
- 13 collisions occurred on **dry pavement**; two wet; three ice; two slush; and two not indicated;
- 16 collisions involved vehicles **crossing the center line** and striking an opposing vehicle.

In summary, the majority (67%) of the fatal collisions involved two vehicles travelling in opposite directions hitting one another head-on during ideal light, weather and road surface conditions. While one collision was noted to have involved hydroplaning, and another collision involved a vehicle travelling at high speed in the rain skidding on a curve, there is no indication that highway geometry contributed to collisions. While not stated in the collision files that were provided by NSTIR, it is concluded that lack of driver attention and speed too fast for road conditions were the primary contributing factors to most of the 22 fatal collisions.

Access Control

At the end of 2014 there were 210.0 kilometers of controlled access highway in the Study Area and 63.5 km of highway without access control. With the completion of the Port Joli and Port Mouton By-Passes in 2016, and the future completion of the section between the two bypass sections, the existing 13.8 km of roadway without access control will be replaced with approximately 12 km of controlled access highway. While controlled access sections of Highway 103 are usually free of private entrances and many sections have interchanges and overpasses to eliminate vehicle conflicts, some sections with generally lower volumes have been constructed with intersections to provide access or crossing of the highway.

Posted Speed Limits

While the majority of the Study Area has a posted speed limit of 100 km/h, 44.5 km (16%) of the section has posted speeds of 90 km/h or less. However, with the future completion of the Port Joli to Broad River project, the existing 13.8 km of roadway which is now posted at 90 km/h, 80 km/h and 60 km/h, will be replaced with approximately 12 km of highway which is likely to be posted at 90 to 100 km/h.

Climbing Lanes and Passing Areas

While there are numerous climbing lanes, and a short section of four lane road, in the eastern part of the Study Section between Tantallon and Bridgewater, as well as between EXITS 17 and 19 (Liverpool) and in the section between EXITS 24 and 27 (Shelburne), there are few climbing lanes in Yarmouth County.

Review of Highway Maintenance Guidelines

Review of NSTIR Maintenance Standards, site visits, and Stakeholder feedback; have indicated the following areas where better adherence to maintenance standards is required:

- Many areas were noted with excessive shoulder drop-off from the edge of pavement.
- Ditches and back slopes have trees and tall brush that block sight distance and hide animals, such as deer, near the roadway.
- Areas have been noted where pavement rutting could cause hydroplaning.
- Guide posts are still being used, rather than guardrail.
- Guardrail installations need maintenance to adjust height and straighten posts.
- Many regulatory and warning signs are worn and faded.
- While pavement markings were good when reviewed in October, lines and arrows could be in poor condition by the next spring.
- There have been reported variations in snow and ice control between patrol areas. Also, black ice problems have been noted at Gold River Bridge and other areas.

Review of Highway Design Guidelines

Site visits and review of collision data indicate the following areas where changes to design standards or better adherence to existing design standards are required:

- There are many fixed objects, such as, rocks, poles, signs, roadside culverts, and other existing or abandoned highway infrastructure within the roadside clear zone.
- Side slopes and back slopes appear to be steeper than acceptable in some jurisdictions.
- Many paved shoulders are much narrower than the standards for 2.0 meters outside and 1.5 meters inside.
- There is not a consistent use of deceleration and acceleration lanes on approaches to interchanges and intersections.
- Review of collision data indicates high incidence of deer collisions in some areas.
- Most guardrail installations use long 3.81m (12'6") post spacing without blocks.
- The short four-lane section at EXIT 9 has a relatively narrow and flat median that should have a barrier, possibly cable guardrail, to prevent cross median collisions.
- Many locations, such as at the ends of large culverts, do not have roadside barriers.
- Most guardrail end treatments are the buried type.
- While most bridges are equipped with the Nova Scotia standard post and anchorage system, some installations require maintenance or upgrading.
- There are many private driveways and intersections on controlled access highway sections.

Review of Twinning Criteria

While NSTIR guidelines include twinning of highway sections when AADT volumes are projected to exceed 10,000 vpd, many sections of highway now have AADT volumes exceeding 12,000 vpd before twinning is completed. Since review of fatal collisions in the Highway 103 Study Area indicated a strong correlation between high AADT volumes and areas with higher numbers of fatal collisions, the 10,000 vpd twinning guideline and 20 year volume projections throughout the Study Area should be reviewed when establishing twinning priorities.

While the 38 kilometers included in Sections 040 to 060 between Tantallon and Chester accounts for only 14% of the Study Area of Highway 103, it accounts for 28% of the vehicle kilometers of travel and 11 of the 22 (50%) of the fatal crashes between 2007 and 2012. Review of collision types for the 22 fatal collisions between 2007 and 2012 indicate that ten of the eleven collisions in the 38 kilometer segment between Tantallon and Chester involved vehicles crossing the centerline and striking vehicles travelling in the opposite direction, while only six of the eleven collisions on the other 236 kilometers of the Study Area involved that collision type.

Projected 2014 AADT volumes in Sections 040 to 060 range from 11,300 vpd between Tantallon and Hubbards (Sections 040 and 045) to 8,700 vpd between East River and Chester (Section 060). These sections, as well as other road sections between Chester and Bridgewater, include significant commuter trips, so that they may have higher peak hourly volumes than would

normally be expected from review of AADT volumes. Since twinning of roadways has proven effective in preventing most head-on collisions, plans should be prepared when AADT volumes approach 8,000 vpd so that construction can be completed before volumes approach 10,000 vpd. Twinning could also be considered for sections where additional passing opportunities are required, even though the volume may be less than 8,000 vpd.

Review of Human Factors (Education and Enforcement) Techniques

Human factors review of the details and contributing factors for the 22 fatal collisions indicated the following:

- High volumes and speed contribute to both the probability and severity of collisions on two lane highways.
- Speed too fast for road conditions, such as wet or snow covered surfaces, also contributes to collisions.
- Inattention and distraction to the driving task is a primary contributing factor to collisions.
- Highly visible enforcement could promote reduced driving speeds and good driving habits.
- Speed recording cameras and feedback signs may also be useful in reducing higher end speeds.
- Changeable message signs can be used to inform motorists of road and traffic conditions and to promote safe driving habits.

Maintenance Recommendations

The following maintenance activities should be performed as soon as possible and should be reviewed and acted on as often as required in future years:

1. Consider changes to maintenance standards to maintain gravel shoulders with excessive drop-off from the edge of pavement and continue maintenance activities to ensure that drop-offs do not exceed 50 mm.
2. Remove trees and brush from ditches and back slopes and continue to control roadside vegetation to maintain passing sight distance and provide better visibility of roadside areas where animals, such as deer, may be near the roadway.
3. Post appropriate warning signs at areas where pavement rutting has become a problem and implement corrective measures.
4. Remove guide posts and replace with guardrail or flexible delineators as appropriate.
5. Review existing guardrail installations; adjust height and straighten posts as needed.
6. Replace worn and faded regulatory and warning signs. Examine the retroreflective qualities of large green destination signs and replace those that are no longer visible at night.

7. Review regulatory and maintenance signing at intersections or approaches to intersections where turns are prohibited and ensure that appropriate and consistent signing is provided to advise motorists of these intersections.
8. Ensure that pavement marking lines and arrows are maintained so that they provide guidance during all seasons of the year. Consider use of 150 mm wide lines, rather than 100 mm wide lines, to increase conspicuity.
9. Review winter maintenance standards to ensure that snow and ice control activities are uniform throughout the Study Area of Highway 103.
10. Become aware of, and react to, localized winter conditions, such as black ice at Gold River Bridge, or other winter road problems, such as open areas subject to blowing or drifting snow.

Design Recommendations

While the Design Standards used by NSTIR for roads such as Highway 103 are generally comparable to those used across Canada, three areas have been noted where review is required:

1. Maintain gravel shoulders with excessive drop-off from the edge of pavement and continue maintenance activities to ensure that drop-offs do not exceed 50 mm.
2. Consider changing the Nova Scotia Guideline of 2.5 m for outside useable shoulder width to 3.0 m included in the Transportation of Canada (TAC) guideline; and
3. The use of 6:1 side slopes as indicated in the standard cross section, rather than 4:1, for freeway and major arterial roads as indicated in the design classification tables. Nova Scotia Highway Design Guidelines should be reviewed for consistency.

Site reviews by Consultant team members, as well as stakeholder feedback, have indicated the following areas that require changes in the standard designs used by NSTIR:

4. Install centerline and shoulder rumble strips during construction or repaving projects; ensure that rumble strips are replaced after micro-sealing or repaving.
5. Roadside design should include establishment of an adequate clear zone with removal of fixed objects such as rocks, poles, signs, roadside culverts, and other existing or abandoned highway infrastructure within this area.
6. Designs for new construction and paving projects for Freeway and Major Arterial roadways should include 2.0 meter paved shoulders on all two-lane sections, or 2.0 meters outside and 1.5 meters on the inside for divided roadways.
7. Intersection and interchange designs should include provision for appropriate and consistent acceleration and deceleration lanes.
8. Consider design of two trial sections of animal fencing at the following locations:
    - Section 110 – EXIT 12 to EXIT 13 Bridgewater; and
    - Section 240 – EXIT 30 at Barrington to the Shelburne / Yarmouth County Line.
9. The standard for roadside barrier system (guardrail) installations should be changed to short 1.905 m (6’3”) post spacing with blocks between the rail and the post on all new

and replacement locations on Freeway and Major Arterial roadways. Design standards for guardrail placement should be reviewed to ensure that all potentially hazardous areas are protected and that adequate length of guardrail is provided to protect the approach to a roadside hazard.

10. Energy attenuating type guardrail end treatment should be designed and required for all Freeway and Major Arterial roadways rather than the buried end type.
11. Review the current standard design for bridge end treatment and consider the use of a transition section from the standard W section to a tri-beam section, steel posts, and multiple bolts for bridge end treatment, similar to that used on the US Interstate system.
12. Bridge ends and columns in the median areas of divided highway sections should be protected by guardrail installations should be of sufficient length using 1.905 m (6'3") post spacing, and energy attenuating end treatments.
13. Designs for new and upgraded controlled access sections of Freeway and Major Arterial roadways should include removal of all private driveway accesses, as well as provision of grade separations or interchanges at all intersecting roadways.

Education and Enforcement Recommendations

The following education and enforcement recommendations have emanated from the Human Factors review of the Study Section:

1. Work with the RCMP Highway Patrol detachments to develop a High Visibility Enforcement (HVE) program for the Study Section.
2. Use photo radar to provide warning letters for drivers exceeding the speed limit by more than 10 km/h.
3. Install radar controlled speed feedback signs on the approaches to the 80 km/h speed zone in Clyde River, as well as other areas where drivers may need reminded of speed limit changes.
4. Install changeable message signs to show messages aimed at reducing driver distraction, the need to adjust speed to road conditions, or other safety related messages to promote safer driving habits.

Planning and Construction Recommendations

Planning and construction recommendations have been proposed to provide a 20 year Action Plan to complete a fully controlled access Highway 103 by 2034. The following factors have been considered when preparing the action plan:

1. At-grade intersections on fully controlled access roadway sections should be replaced with interchanges or grade separations based on intersecting volumes, as well as to provide continuity of access control throughout a road section. An at-grade intersection on a long section of otherwise fully controlled access roadway may be unexpected by many drivers.

2. While construction of new sections of controlled access highway may not occur for several years, route location and land use plans should be prepared soon to ensure development does not block possible alignments.
3. New sections of controlled access highway should be constructed based on projected traffic volumes and to eliminate 'missing links' in otherwise long sections of fully controlled access highway.
4. Planning for twinning should begin when AADT volumes approach 8,000 vpd so that construction could be completed before volumes approach 10,000 vpd.
5. Short sections of twinned highway or 2 +1 passing lane sections should be considered to provide additional passing opportunities in areas with higher traffic volumes and where passing opportunities are not satisfied by climbing lanes.

Planning and construction recommendations have been arranged in three groups identified as Priority A, B, and C in Table E-2 and illustrated in Figure E-1. While this is not intended to indicate specific priorities for project implementation, items in Priority A should be considered during the earlier years of the Action Plan, with those in Priority C considered in the later years, of the 20 year Action Plan.

Order of magnitude cost estimates have been included for each recommendation using $ symbols. While actual cost estimates have not been determined, the following 'scale' has been used: $ - less than 500,000; $$ - 500,000 to 10M; $$$ - 10M to 20M; $$$$ - 20M to 50M; and $$$$$ - more than 50M.

Table E-2: Recommendations for Highway 103 Construction Projects

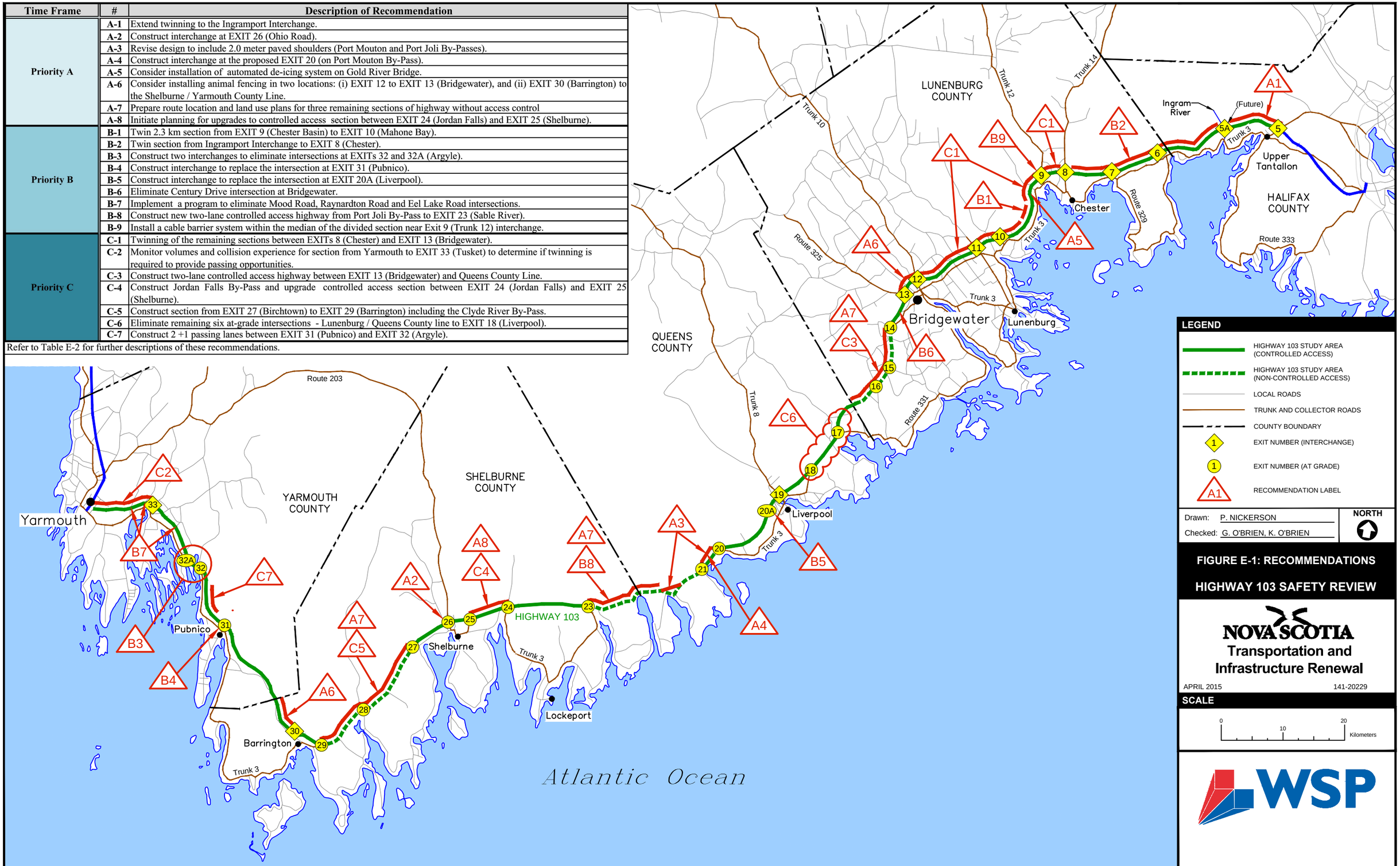
	#	Description	Estimated Cost
Priority A	A-1	Twin Highway 103 Section 040 between the end of the existing four-lane section and the Ingramport Interchange	$$$$
	A-2	Construct an interchange to replace the Ohio Road intersection (EXIT 26)	$$
	A-3	Review and revise the design for the Port Mouton and Port Joli By-Passes to include 2.0 meter paved shoulders.	$
	A-4	Construct an interchange rather than an intersection at the proposed new EXIT 20 on the Port Mouton By-Pass.	$$
	A-5	Consider installation of an automated de-icing system on the Gold River Bridge, potentially as a pilot project in NS.	$
	A-6	Consider installation of sections of animal fencing between EXITS 12 and 13 (Bridgewater) and EXIT 30 (Barrington) and the Shelburne / Yarmouth County Line, potentially as a pilot project to review performance in NS.	$
	A-7	Prepare route location and land use plans for three remaining sections highway without access control involving approximately 50 kilometers of new construction.	$$
	A-8	Prepare route location and land use plans for upgrading the controlled access highway section from EXIT 24 (Jordan Falls) to EXIT 25 (Shelburne), including the Jordan Falls By-Pass.	$
Priority B	B-1	Construct a 2 to 3 kilometer section of twinned highway to provide passing opportunities between EXIT 9 (Chester Basin) and EXIT 10 (Mahone Bay).	$$
	B-2	Twin sections from Ingramport Interchange to EXIT 8 (Chester).	$$$$$
	B-3	Construct two interchanges to eliminate intersections at EXITs 32 and 32A (Argyle) as shown on Figure 6-1.	$$$
	B-4	Construct an interchange to replace the intersection at EXIT 31 (Pubnico).	$$
	B-5	Construct an interchange to replace the EXIT 20A intersection (Liverpool).	$$
	B-6	Eliminate the Century Drive intersection at Bridgewater.	$$
	B-7	Develop and implement a program to eliminate the Mood Road, Raynardton Road and Eel Lake Road intersections in Yarmouth County.	$$$
	B-8	Construct a new two-lane controlled access highway from the Port Joli By-Pass to EXIT 23 (Sable River), including a Sable River By-Pass.	$$$$
	B-9	Install a cable barrier system within the median of the existing divided section in the vicinity of the Exit 9 (Trunk 12) interchange.	$
Priority C	C-1	Complete twinning of the remaining sections between EXITs 8 (Chester) and EXIT 13 (Bridgewater).	$$$$$
	C-2	Monitor volumes and collision experience for the section from Yarmouth to EXIT 33 (Tusket) to determine if some twinning is required to provide passing opportunities.	$$
	C-3	Construct a new two-lane controlled access highway in Lunenburg County between EXIT 13 (Bridgewater) and the Queens County Line.	$$$$$
	C-4	Construct the Jordan Falls By-Pass and upgrade the controlled access section between EXIT 24 (Jordan Falls) and EXIT 25 (Shelburne).	$$$$
	C-5	Construct the section from EXIT 27 (Birchtown) to EXIT 29 (Barrington) including the Clyde River By-Pass.	$$$$$
	C-6	Eliminate the remaining six at-grade intersections between the Lunenburg / Queens County line including EXIT 18 (Liverpool).	$$$$
	C-7	Construct 2 +1 passing lanes between EXIT 31 (Pubnico) and EXIT 32 (Argyle).	$$

NOTES:

1. While the indicated Priorities do not intend to indicate specific timing for project implementation, items in Priority A should be generally be considered during the earlier years of the Action Plan, with those in Priority C considered in the later years, of the 20 year Action Plan.
2. Order of magnitude cost estimates have been included for each recommendation using $ symbols. While actual cost estimates have not been determined, the following 'scale' has been used: $ - less than 500,000; $$ - 500,000 to 10M; $$$ - 10M to 20M; $$$$ - 20M to 50M; and $$$$$ - greater than 50M.

Time Frame	#	Description of Recommendation
Priority A	A-1	Extend twinning to the Ingramport Interchange.
	A-2	Construct interchange at EXIT 26 (Ohio Road).
	A-3	Revise design to include 2.0 meter paved shoulders (Port Mouton and Port Joli By-Passes).
	A-4	Construct interchange at the proposed EXIT 20 (on Port Mouton By-Pass).
	A-5	Consider installation of automated de-icing system on Gold River Bridge.
	A-6	Consider installing animal fencing in two locations: (i) EXIT 12 to EXIT 13 (Bridgewater), and (ii) EXIT 30 (Barrington) to the Shelburne / Yarmouth County Line.
	A-7	Prepare route location and land use plans for three remaining sections of highway without access control
	A-8	Initiate planning for upgrades to controlled access section between EXIT 24 (Jordan Falls) and EXIT 25 (Shelburne).
Priority B	B-1	Twin 2.3 km section from EXIT 9 (Chester Basin) to EXIT 10 (Mahone Bay).
	B-2	Twin section from Ingramport Interchange to EXIT 8 (Chester).
	B-3	Construct two interchanges to eliminate intersections at EXITs 32 and 32A (Argyle).
	B-4	Construct interchange to replace the intersection at EXIT 31 (Pubnico).
	B-5	Construct interchange to replace the intersection at EXIT 20A (Liverpool).
	B-6	Eliminate Century Drive intersection at Bridgewater.
	B-7	Implement a program to eliminate Mood Road, Raynardton Road and Eel Lake Road intersections.
	B-8	Construct new two-lane controlled access highway from Port Joli By-Pass to EXIT 23 (Sable River).
	B-9	Install a cable barrier system within the median of the divided section near Exit 9 (Trunk 12) interchange.
Priority C	C-1	Twinning of the remaining sections between EXITs 8 (Chester) and EXIT 13 (Bridgewater).
	C-2	Monitor volumes and collision experience for section from Yarmouth to EXIT 33 (Tusket) to determine if twinning is required to provide passing opportunities.
	C-3	Construct two-lane controlled access highway between EXIT 13 (Bridgewater) and Queens County Line.
	C-4	Construct Jordan Falls By-Pass and upgrade controlled access section between EXIT 24 (Jordan Falls) and EXIT 25 (Shelburne).
	C-5	Construct section from EXIT 27 (Birchtown) to EXIT 29 (Barrington) including the Clyde River By-Pass.
	C-6	Eliminate remaining six at-grade intersections - Lunenburg / Queens County line to EXIT 18 (Liverpool).
	C-7	Construct 2 +1 passing lanes between EXIT 31 (Pubnico) and EXIT 32 (Argyle).

Refer to Table E-2 for further descriptions of these recommendations.



LEGEND

- HIGHWAY 103 STUDY AREA (CONTROLLED ACCESS)
- HIGHWAY 103 STUDY AREA (NON-CONTROLLED ACCESS)
- LOCAL ROADS
- TRUNK AND COLLECTOR ROADS
- COUNTY BOUNDARY
- EXIT NUMBER (INTERCHANGE)
- EXIT NUMBER (AT GRADE)
- RECOMMENDATION LABEL

Drawn: P. NICKERSON
Checked: G. O'BRIEN, K. O'BRIEN

NORTH

FIGURE E-1: RECOMMENDATIONS

HIGHWAY 103 SAFETY REVIEW

NOVA SCOTIA
Transportation and Infrastructure Renewal

APRIL 2015 141-20229

SCALE

0 10 20 Kilometers

WSP

Sheet: Figure E-1

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1.0 Introduction

1.1 Background

The Highway 103 Operational and Safety Review has been commissioned by the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) to identify current and projected operational and safety deficiencies on the approximately 274 kilometers from Yarmouth to the end of four lane highway west of Tantallon (Figure 1-1). Highway 103 is considered a feeder route of the National Highway System which makes it eligible for federal cost sharing.

While over 80% of the 274 kilometer Study Area is now two-lane controlled access highway, and the overall average collision rate is comparable to the collision rate for other 100 Series Highways in the Province, peak hour volumes and collision experience between Bridgewater and Tantallon have prompted public concern for safety and requests for twinning. Plans are progressing for twinning the section from Tantallon to Hubbards, however, increasing traffic demands and a number of fatal collisions in recent years have indicated the need for an operational and safety review of the entire highway.

1.2 Study Objectives

The primary objectives of the study include:

- Complete a review of Highway 103 from Yarmouth to Tantallon to identify current and projected operational and safety deficiencies.
- Recommend a combination of short term and medium term engineering, education, and enforcement strategies to achieve the safety and operational standards expected of the National Highway System.
- Prepare a Final Report that includes an Action Plan for highway improvements to provide a fully controlled access Highway 103 during a 20 year horizon.

1.3 Review of Traffic Volumes

Traffic Volumes - Primary Highway System 2004 - 2013 (NSTIR March 2014) indicates that annual average daily traffic (AADT) volumes vary from 10,500 vehicles per day (vpd) at the east end (Tantallon), to a low of 1,500 vpd at Barrington, and then increase to 5,200 vpd at the west end (Yarmouth). Highway sections at the east end, where AADT volumes varied from 8,000 vpd to 10,500 vpd, include significant commuter traffic travelling to and from Halifax which result in high AM and PM peak directional traffic volumes. Current 2014 volumes and projected 2024 and 2034 volumes for each road section are discussed in detail in Section 3.1.

1.4 Review of Collision Data

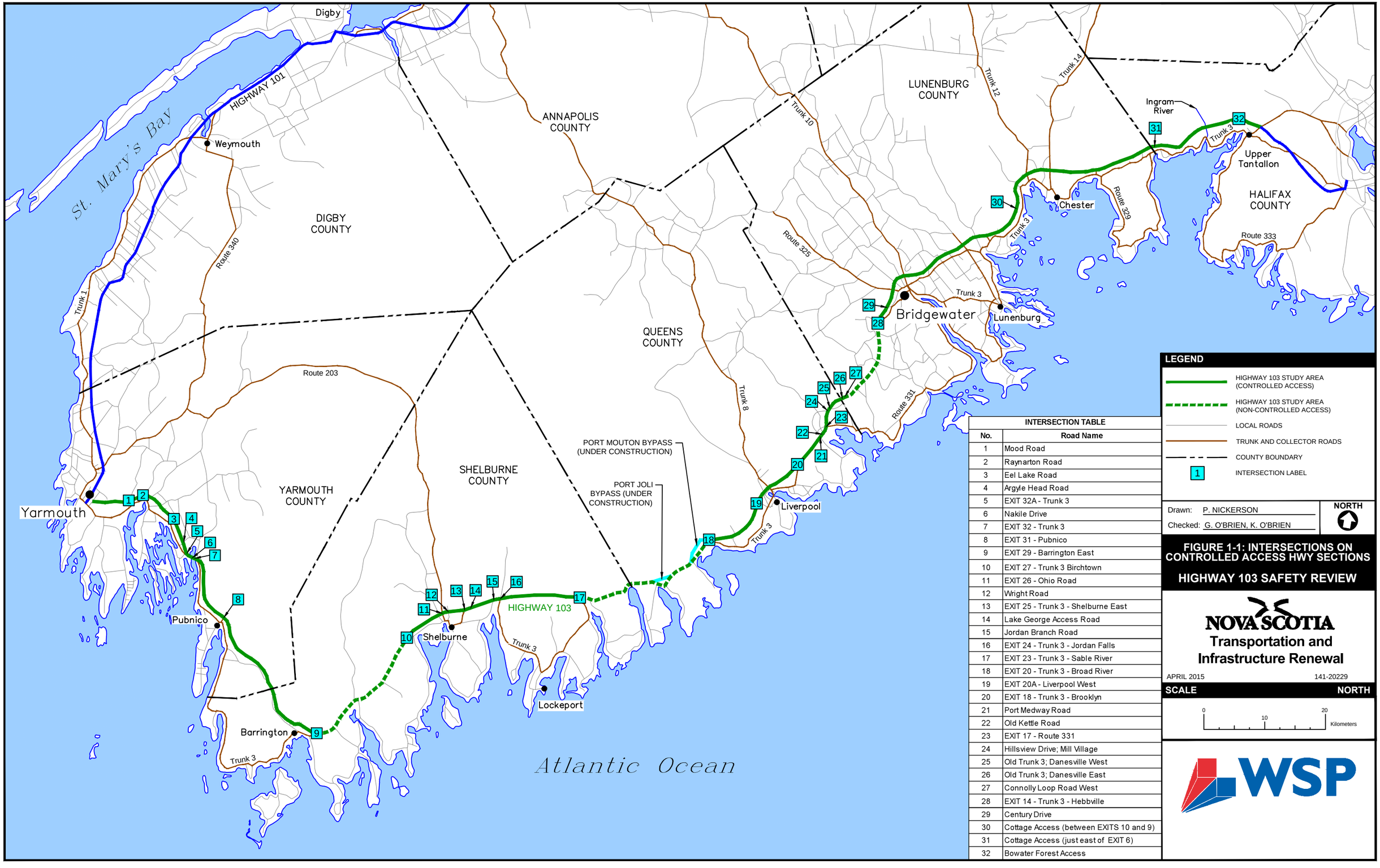
Collision data files for the most recent available period (2007 to 2012) provided by NSTIR included a total of 890 collisions for the 274 kilometers of highway in the Study Area. During the six year period there were 586 property damage only (PDO), 282 injury collisions, and 22 fatal reported collisions. Collision rates and contributing factors are discussed in Section 3.2.

1.5 Review of Access Control

A controlled access highway is typically a freeway where all access is at interchanges and all crossing roads are grade separated or an expressway where access is at interchanges or intersections. However, 'access control' in Nova Scotia refers to road sections that have been designated as a controlled access highway by Governor in Council as authorized in the Public Highways Act. Where a road has been designated as a controlled access highway, permission is required from the Minister for construction of any driveway to connect to the road, or erection of signs and buildings, within designated distances from the edge of the right of way.

While controlled access sections of Highway 103 are generally free of private entrances and many sections have interchanges and overpasses to reduce vehicle conflicts, some sections where volumes are generally lower have been constructed with at-grade intersections to provide access to or crossing of the highway. Intersections on controlled access highway sections are illustrated on Figure 1-1.

At the end of 2014 there were 210.0 kilometers of controlled access highway in the Study Area (Table 1-1) and 63.5 km of highway without access control (Table 1-2). With the completion of the Port Joli and Port Mouton By-Passes expected in 2016, and the future completion of the section between the two bypass sections, the existing 13.8 km of roadway without access control will be replaced with approximately 12 km of controlled access highway.



INTERSECTION TABLE	
No.	**Road Name**
1	Mood Road
2	Raynarton Road
3	Eel Lake Road
4	Argyle Head Road
5	EXIT 32A - Trunk 3
6	Nakile Drive
7	EXIT 32 - Trunk 3
8	EXIT 31 - Pubnico
9	EXIT 29 - Barrington East
10	EXIT 27 - Trunk 3 Birchtown
11	EXIT 26 - Ohio Road
12	Wright Road
13	EXIT 25 - Trunk 3 - Shelburne East
14	Lake George Access Road
15	Jordan Branch Road
16	EXIT 24 - Trunk 3 - Jordan Falls
17	EXIT 23 - Trunk 3 - Sable River
18	EXIT 20 - Trunk 3 - Broad River
19	EXIT 20A - Liverpool West
20	EXIT 18 - Trunk 3 - Brooklyn
21	Port Medway Road
22	Old Kettle Road
23	EXIT 17 - Route 331
24	Hillsview Drive; Mill Village
25	Old Trunk 3; Danesville West
26	Old Trunk 3; Danesville East
27	Connolly Loop Road West
28	EXIT 14 - Trunk 3 - Hebbville
29	Century Drive
30	Cottage Access (between EXITS 10 and 9)
31	Cottage Access (just east of EXIT 6)
32	Bowater Forest Access

LEGEND

- HIGHWAY 103 STUDY AREA (CONTROLLED ACCESS)
- HIGHWAY 103 STUDY AREA (NON-CONTROLLED ACCESS)
- LOCAL ROADS
- TRUNK AND COLLECTOR ROADS
- COUNTY BOUNDARY
- 1 INTERSECTION LABEL

Drawn: P. NICKERSON

Checked: G. O'BRIEN, K. O'BRIEN

NORTH

FIGURE 1-1: INTERSECTIONS ON CONTROLLED ACCESS HWY SECTIONS

HIGHWAY 103 SAFETY REVIEW

NOVA SCOTIA
Transportation and Infrastructure Renewal

APRIL 2015 141-20229

SCALE NORTH

0 10 20 Kilometers

WSP

Sheet:Figure 1-1

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Table 1-1: Controlled Access Highway Sections

Section Decription	Km [1]	Length (Km)	Intersections (Km, Road Name, Details)			
			No. [2]	Km [1]	Road Name	Details [3]
Hardscratch Road Yarmouth to EXIT 29 Barrington East	0.0 - 61.8	61.8	1	6.4	Mood Road	No Left Turns; Overhead Flashing Light
			2	9.0	Raynardton Road	No Left Turns; Overhead Flashing Light
			3	15.4	Eel Lake Road	No Left Turns; Overhead Flashing Light
			4	19.9	Argyle Head Road	No Turns
			5	21.9	EXIT 32A - Trunk 3	WB LT; EB RT; Overhead Flashing Light
			6	22.8	Nakile Drive	WB LT; Overhead Flashing Light
			7	22.9	EXIT 32 - Trunk 3	EB LT; WB RT with Island; Overhead Flashing Light
			8	36.0	EXIT 31 - Pubnico	WB LT; EB LT; EB RT; EB ACCEL; Flashing Light
			Shelburne County Line (Km 50.3)			
			9	61.8	EXIT 29 - Barrington East	WB LT; EB RT and EB ACCEL with Islands
EXIT 27 Birchtown to EXIT 23 Sable River	84.9 - 115.4	30.5	10	84.9	EXIT 27 - Trunk 3 Birchtown	EB RT; EB-Accel; WB LT (no bulb)
			11	91.9	EXIT 26 - Ohio Road	EB LT; EB RT; WB LT; Flashing Light
			12	92.6	Wright Road	No Turns to Hwy 103
			13	95.9	EXIT 25 - Trunk 3 - Shelburne East	EB RT; WB LT (no bulb)
			14 [4]	96.7	Lake George Access Road	
			15 [4]	101.1	Jordan Branch Road	
			16 [4]	101.6	EXIT 24 - Trunk 3 - Jordan Falls	
			17 [4]	115.4	EXIT 23 - Trunk 3 - Sable River	WB LT (no bulb)
EXIT 20 Broad River to East of Danesville	142.7 - 179.5	36.8	**Queens County Line (Km 124.9)**			
			18	142.7	EXIT 20 - Trunk 3 - Broad River	WB LT
			19	153.6	EXIT 20A - Liverpool West	EB LT; EB RT Island; WB LT; Flashing Light
			20	165.4	EXIT 18 - Trunk 3 - Brooklyn	EB RT Island; EB ACCEL Island; WB LT; Flashing Light
			21	169.6	Port Medway Road	EB LT, WB LT; Flashing Light
			22	170.0	Old Kettle Road	No Turns
			23	171.5	EXIT 17 - Route 331	EB LT, WB LT; Flashing Light
			24	174.3	Hillsview Drive; Mill Village	
			25	174.8	Old Trunk 3; Danesville West	
			Lunenburg County Line (Km 177.2)			
			26	177.3	Old Trunk 3; Danesville East	
			27	178.2	Connolly Loop Road West	
EXIT 14 Hebbville to Beginning 4-lane Tantallon	192.6 - 273.5	80.9	28	192.8	EXIT 14 - Trunk 3 - Hebbville	EB RT; WB LT
			29	197.7	Century Drive	No Turns; Flashing Light
			30	226.8	Cottage Access (between EXITS 10 and 9)	No Turns
			Halifax County Line (Km 254.5)			
			31	255.0	Cottage Access (just east of EXIT 6)	
			32	271.1	Bowater Forest Access	EB LT; WB LT
TOTAL		210.0				

NOTES:
1. Kilometer posts on Highway 103 start a 0 km at Hardscratch Road, Yarmouth, and approximately 274 km at the beginning of four lane road near Tantallon.
2. These intersection numbers are shown on Figure 1-1.
3. LT - Left Turn lane; RT - Right Turn Lane; ACCEL - Acceleration Lane; 'no bulb' indicates left turn lane without a painted deflecting bulb
4. There are also several private driveways near these locations.

Table 1-2: Uncontrolled Access Highway Sections

Section Decription	Km [1]	Length (Km)
EXIT 29 Barrington East to EXIT 27 Birchtown	61.8 - 84.9	23.1
EXIT 23 Sable River to EXIT 20 Broad River [2]	115.4 - 142.7 [2]	27.3
East of Danesville to EXIT 14 Hebbville	179.5 - 192.6	13.1
	TOTAL	63.5

NOTES:
1. Kilometer posts on Highway 103 start at 0 km at Hardscratch Road, Yarmouth, and approximately 274 km at the beginning of the four lane section near Tantallon.
2. With the completion of the Port Joli By-Pass in 2015, the Port Mouton By-Pass in 2016, and the future completion of the intervening section, the 13.8 km existing section of road from west of Port Joli to the existing Broad River intersection (128.9 to 142.7) will be replaced by approximately 12.0 km of controlled access highway.

1.6 Review of Posted Speed Limits

While the majority of the Study Area has a posted speed limit of 100 km/h, 44.5 km (16%) of the section has posted speeds of 90 km/h or less (Table 1-3). However, with future completion of the Port Joli to Broad River project, the existing 13.8 km of roadway which is now posted at 90 km/h, 80 km/h and 60 km/h, will be replaced with approximately 12 km of highway which will is likely to be posted at 90 to 100 km/h. Speed zones throughout the Study Area are illustrated on Figure 1-2.

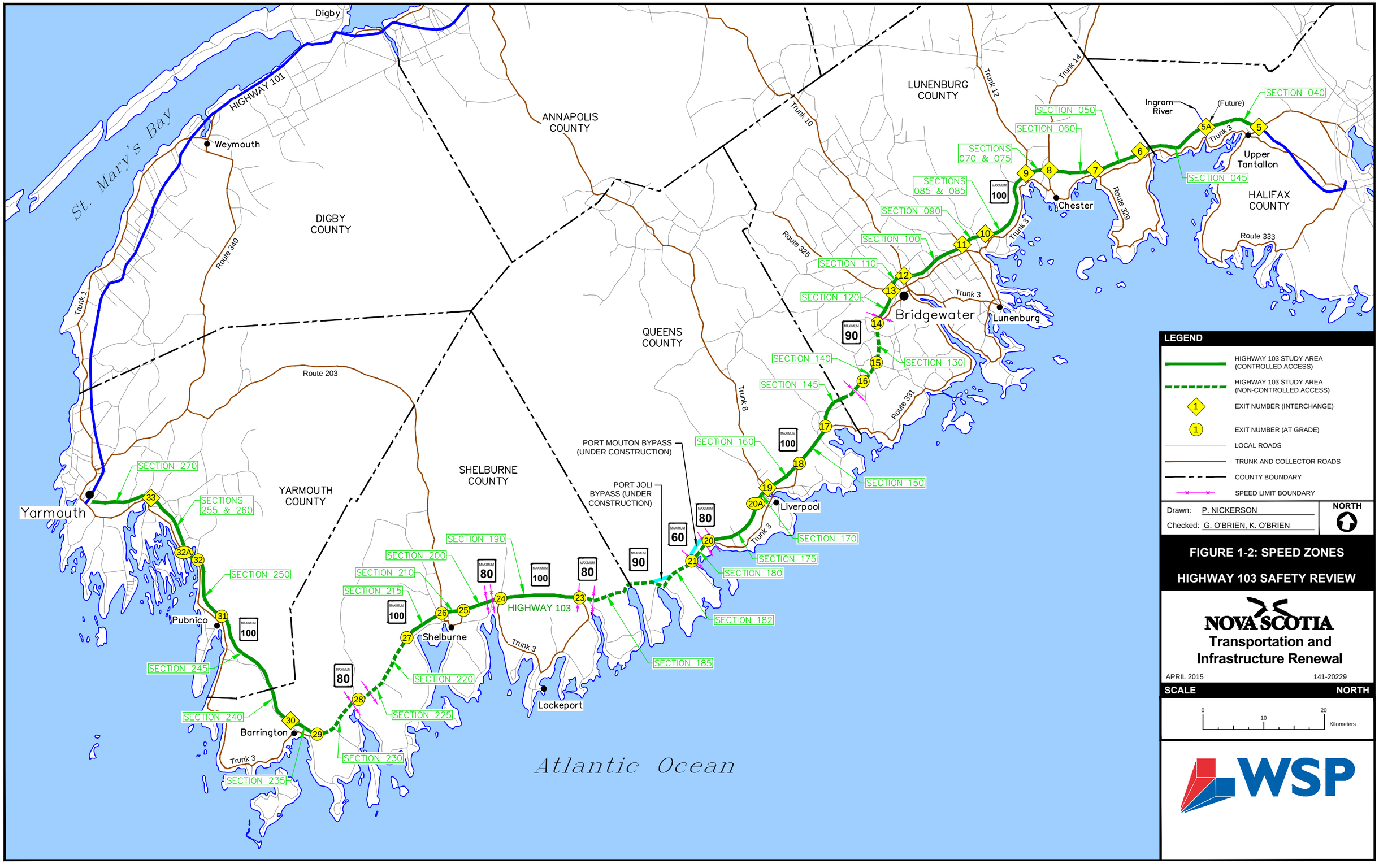
Table 1-3: Posted Speed Limits

Section Decription	Km [1]	Posted Speed	Section Length
Hardscratch Road to West of Clyde River	0.0 - 69.9	100	69.9
West of Clyde River to East of Clyde River	69.9 - 72.4	80	2.5
East of Clyde River to Jordan Falls	72.4 - 100.6	100	28.2
Jordan Falls	100.6 - 101.6	80	1.0
Jordan Falls to Sable River	101.6 - 114.7	100	13.1
Sable River	114.7 - 116.5	80	1.8
Sable River to Port Mouton	116.5 -138.2	90	21.7
Port Mouton to West of Broad River	138.2 - 141.4	60	3.2
West of Brorad River to Broad River	141.4 - 142.8	80	1.4
Broad River to East of Danesville	142.8 -179.9	100	37.1
East of Danesville to Hebbville	179.9 - 192.8	90	12.9
Hebbville to Begin Four-Lane West of Tantallon	192.8 - 273.5	100	80.7
		TOTAL 100 km/h	**229.0**
		TOTAL 90 km/h	**34.6**
		TOTAL 80 km/h	**6.7**
		TOTAL 60 km/h	**3.2**
		TOTAL ALL	**273.5**

NOTES:
1. Kilometer posts on Highway 103 start at 0 km at Hardscratch Road, Yarmouth, to approximately 274 km at the beginning of the four lane section near Tantallon.
2. With the completion of the Port Joli By-Pass in 2015, the Port Mouton By-Pass in 2016, and the future completion of the intervening section, the 13.8 km existing section of road from west of Port Joli to the existing Broad River intersection (128.9 to 142.7) will replaced by approximately 12.0 km of 100 km/h speed zone, which will increase the 100 km/h posted sections to approximately 241 km.
3. Yarmouth - Shelburne County Line (km 50.3), Shelburne - Queens County Line (km 124.9), Queens - Lunenburg County Line (km 177.2), Lunenburg - Halifax County Line (km 254.5).

1.7 Review of Climbing Lanes

While there are numerous climbing lanes (and a short section of four lane road) in the eastern part of the Study Area (Figure 1-3) – as well as between EXITS 17 and 19 (Liverpool) and in the section between EXITS 24 and 27 (Shelburne) – there are few climbing lanes in Yarmouth County. The need for additional passing lanes, especially in areas with volumes in excess of 5000 vpd, is discussed in Section 7.



LEGEND

- HIGHWAY 103 STUDY AREA (CONTROLLED ACCESS)
- HIGHWAY 103 STUDY AREA (NON-CONTROLLED ACCESS)
- EXIT NUMBER (INTERCHANGE)
- EXIT NUMBER (AT GRADE)
- LOCAL ROADS
- TRUNK AND COLLECTOR ROADS
- COUNTY BOUNDARY
- SPEED LIMIT BOUNDARY

Drawn: P. NICKERSON

Checked: G. O'BRIEN, K. O'BRIEN

NORTH

FIGURE 1-2: SPEED ZONES

HIGHWAY 103 SAFETY REVIEW

NOVA SCOTIA
Transportation and Infrastructure Renewal

APRIL 2015 141-20229

SCALE NORTH

0 10 20 Kilometers

WSP

SheetFigure 1-2

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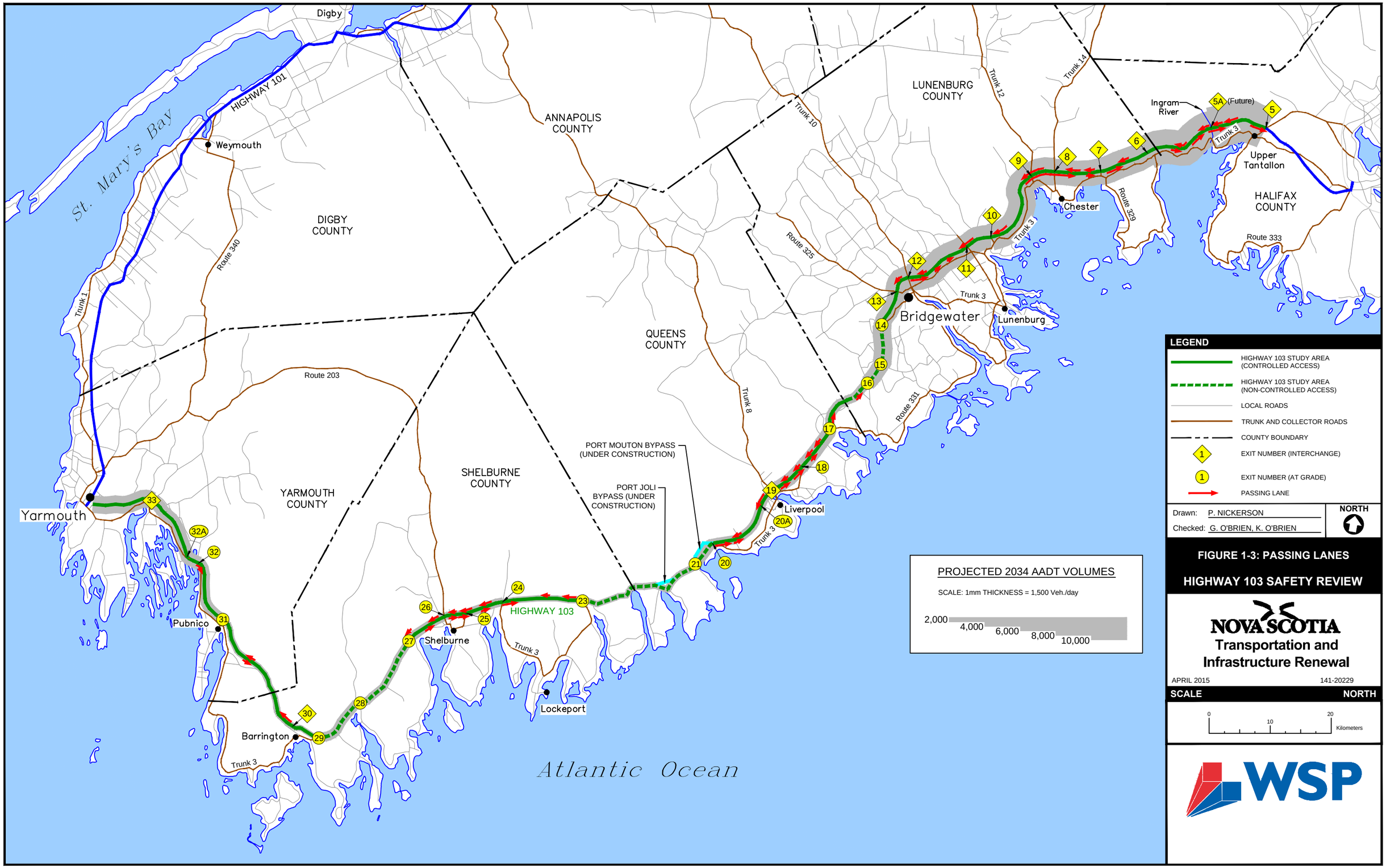

Digby
HIGHWAY 101
St. Mary's Bay
Weymouth
DIGBY COUNTY
ANNAPOLIS COUNTY
LUNENBURG COUNTY
Trunk 10
Trunk 12
Trunk 14
Ingram River
5A (Future)
5
Trunk 3
Upper Tantallon
HALIFAX COUNTY
Route 333
9
8
7
6
Chester
Route 329
Route 325
10
Trunk 3
12
11
13
Bridgewater
Trunk 3
Lunenburg
14
15
16
Route 331
17
Trunk 1
Route 340
Route 203
Trunk 8
QUEENS COUNTY
PORT MOUTON BYPASS (UNDER CONSTRUCTION)
PORT JOLI BYPASS (UNDER CONSTRUCTION)
SHELBURNE COUNTY
YARMOUTH COUNTY
18
19
Liverpool
20A
Trunk 3
21
20
Yarmouth
33
32A
32
Pubnico
31
HIGHWAY 103
24
26
25
23
27
Shelburne
Trunk 3
28
30
29
Barrington
Lockeport
Trunk 3
Atlantic Ocean
PROJECTED 2034 AADT VOLUMES
SCALE: 1mm THICKNESS = 1,500 Veh./day
2,000
4,000
6,000
8,000
10,000
LEGEND
HIGHWAY 103 STUDY AREA (CONTROLLED ACCESS)
HIGHWAY 103 STUDY AREA (NON-CONTROLLED ACCESS)
LOCAL ROADS
TRUNK AND COLLECTOR ROADS
COUNTY BOUNDARY
1 EXIT NUMBER (INTERCHANGE)
1 EXIT NUMBER (AT GRADE)
PASSING LANE
Drawn: P. NICKERSON
Checked: G. O'BRIEN, K. O'BRIEN
NORTH
FIGURE 1-3: PASSING LANES
HIGHWAY 103 SAFETY REVIEW
NOVA SCOTIA
Transportation and Infrastructure Renewal
APRIL 2015
141-20229
SCALE
NORTH
0
10
20
Kilometers
WSP
Sheet:Figure 1-3
FILE: K:\DARTMOUTH\20\14\141-20229 NSTIR_HWY 103 SAFETY REVIEW\11_DWG\11.7_TRAFFIC\141-20229 - FIGURES.DWG

2.0 Stakeholder Contacts and Feedback

2.1 Contacts

The following stakeholders were contacted by telephone or Email to obtain comments, suggestions, and recommendations concerning the Highway 103 Study Area:

- NSTIR District Director and Area Managers;
- Highway 103 Committee
- RCMP Highway Patrol
- EHS
- School Transportation Coordinators
- Federal Member of Parliament
- Provincial MLAs
- Mayors / Wardens of Towns, Counties and Municipalities.

While the original intent was to speak with each of approximately 30 contacts by telephone, due to problems making personal contacts and getting calls back, it was determined to complete the process by Email. The following Email was sent requesting stakeholder input:

> *WSP Canada Inc. has been retained by the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) to complete an operational and safety review of approximately 274 kilometers of Highway 103 from Tantallon to Yarmouth.*
>
> *The objectives of the review are to identify current and projected operational and safety deficiencies, and to recommend practical short term and medium term engineering, education, and enforcement strategies to ensure preservation of acceptable levels of service and safety.*
>
> *While we are reviewing projected traffic volumes, collision data, and roadway characteristics for the various highway sections, we are also interested in receiving your input with regards to the safety and performance of specific highway sections in your area, or at other locations along the study section of Highway 103.*

2.2 Summary of Stakeholder Responses

The responses from the various Stakeholders which are included in Appendix B, Pages B-1 and B-2, are summarized under the 3 E's of Highway Safety in Table 2-1 :

Table 2-1: Summary of Stakeholder Responses

Engineering	• More four-lane highway is needed to reduce the potential for head-on collisions, even if toll roads are required. • At-grade intersections on controlled access sections need to be replaced by overpasses. • Sections with poor alignment need to be upgraded or by-passed. • Shoulders need to be widened and maintained. • Roadside bushes have to be cut back to provide improved visibility. • Increase in lane passing opportunities
Education	• Drivers need to travel within the posted speed limits and to adjust speed in accordance to road and traffic conditions. • Drivers should be reminded that a few seconds of distraction from the driving task could lead to disastrous consequences. • Install changeable message signs to provide safety messages • Head lights should be turned-on during poor driving conditions so that tail lights will also be lighted.
Enforcement	• A greater visibility of police is required along the highway to promote better driving habits from motorists. • More enforcement of speed and driver distraction laws is required. • Install radar controlled speed feedback signs to alert motorists to reduced speed zones.

3.0 Traffic Volume Projections and Collision Rate Analysis

3.1 Traffic Volume Projections

NSTIR generally obtains machine traffic counts on sections of Highway 103 every three years and publishes Annual Average Daily Traffic (AADT) volumes in an annual publication of *Traffic Volumes Primary Highway System 2004 - 2013*. Historical AADT section volumes from 1980 to 2013 have been used to complete regression analyses, provide volume projection equations, and projected 2014, 2024, and 2034 AADT volumes for each road section from Tantallon to Yarmouth. Regression analyses are included in Figures B-1 to B-31 (Appendix B, Pages B-3 to B-10) and annual percentage growth rates and volume projections are summarized in Table 3-1.

Projected 2014 AADT volumes (Table 3-1) vary from 11,300 vehicles per day (vpd) at the east end (Tantallon), to a low of 1,550 vpd at Barrington, and then increase to 6,000 vpd at the west end (Yarmouth). Variations in projected 2014, 2024 and 2034 AADT section volumes throughout the 274 kilometer Study Area are shown diagrammatically in Figure 3-1: AADT Projections by Control Sections (2014, 2024, and 2034). Highway sections at the east end between Tantallon and Bridgewater where 2014 volumes vary from 11,300 vpd to 8,900 vpd include significant commuter traffic travelling to and from Halifax which result in high AM and PM peak directional traffic volumes. Annual volume growth rates average approximately 1.7% at the eastern end of the Study Area and 1.2% at the western end.

Active or planned construction projects will result in some highway section boundary and volume changes by 2017. The following changes are expected:

- With the completion of the Ingramport Interchange and connector to Trunk 3 in 2017, the section boundary between Sections 040 and 045 (Table 3-1) will be relocated from Ingram River Bridge to the Connector Overpass. Traffic diverted to the Connector will result in increased volumes on Section 040 east of the interchange; however, there will not be any significant change in Section 045 volumes west of the interchange. Using data extracted from *Highway 103 Proposed Boutilier's Point Interchange Traffic Study* (WSP Canada Inc., September 2010), it is estimated that diverted traffic will increase the 2017 AADT for Section 040 by 2,600 vehicles per day (vpd) to approximately 14,500 vpd. The projected 2024 and 2034 Section 040 volumes are expected to increase to 16,100 vpd and 18,400 vpd, respectively, and projected 2024 and 2034 Section 045 volumes are expected to increase to 13,200 vpd and 15,100 vpd, respectively.

- The completion of the Port Joli and Port Mouton By-Pass projects will change the section boundaries for Sections 175, 180, and 182 (Table 3-1) as intersections that now are used as section boundaries are either relocated or completely by-passed. While the change is

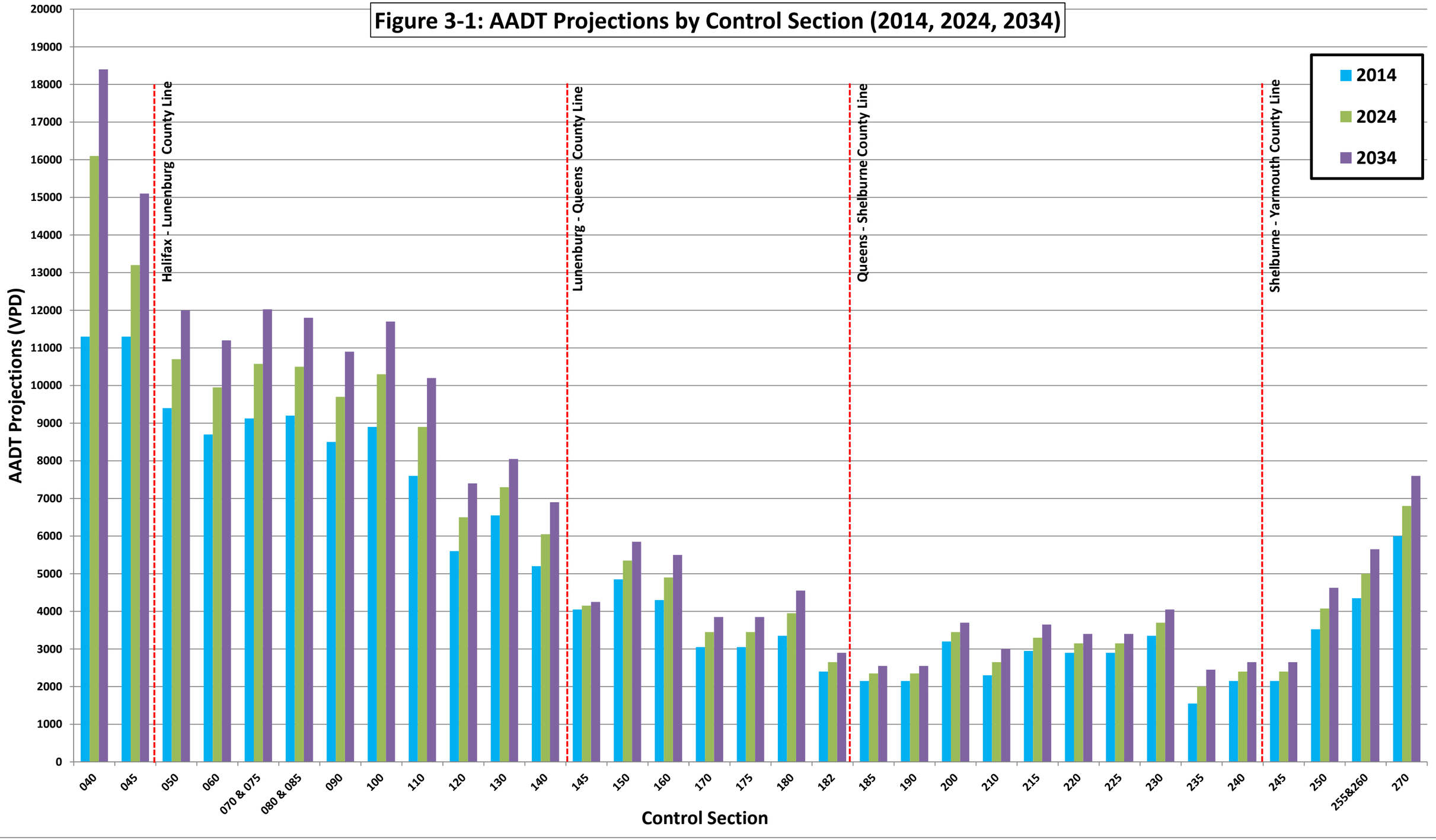
not expected to affect projected volumes on Section 175, projected volumes on Sections 180 and 182 will probably be reduced as local traffic is removed from Highway 103. Projected 2024 and 2034 volumes for Sections 180 and 182 included in Table 3-1, which have not been adjusted, must await future traffic count programs to see how the highway realignment will affect traffic volumes.

Table 3-1: Summary of Volume Projections for 2014, 2024, and 2034

Section [1] Number	Description [1]	Length kms.	Regression Figure [2]	Annual % Growth	AADT Projections [4]		
					2014	2024	2034
040	Route 213 Tantallon to Ingram River Bridge	9.17	B-1	1.7	11300	16100	18400
045	Ingram River Bridge to EXIT 6 Hubbards	11.99	B-1	1.7	11300	13200	15100
050	EXIT 6 Hubbards to EXIT 7 East River	9.28	B-2	1.4	9400	10700	12000
060	EXIT 7 East River to EXIT 8 Trunk 14 Chester	7.14	B-3	1.4	8700	9950	11200
070 & 075	Exit 8 Trunk 14 Chester to EXIT 9 Trunk 12 Chester Basin	4.12	B-4	1.6	9125	10575	12025
080 & 085	EXIT 9 Trunk 12 Chester Basin to EXIT 10 Oakland Lake	13.75	B-5	1.4	9200	10500	11800
090	EXIT 10 Oakland Lake to EXIT 11 Route 324 Blockhouse	4.80	B-6	1.4	8500	9700	10900
100	Exit 11 Route 324 Blockhouse to EXIT 12 Trunk 10 Bridgewater	11.66	B-7	1.6	8900	10300	11700
110	EXIT 12 Trunk 10 Bridgewater to EXIT 13 Route 325 Bridgewater	3.23	B-8	1.7	7600	8900	10200
120	EXIT 13 Route 325 Bridgewater to EXIT 14 Trunk 3 Hebbville	6.64	B-9	1.6	5600	6500	7400
130	EXIT 14 Trunk 3 Hebbville to EXIT 15 Italy Cross	6.42	B-10	1.5	6550	7300	8050
140	EXIT 15 Italy Cross to EXIT 16 Camperdown School Road	3.86	B-11	1.6	5200	6050	6900
145	EXIT 16 Camperdown School Road to EXIT 17 Route 331 Mill Village	10.65	B-12	0.0	4050	4150	4250
150	EXIT 17 Route 331 Mill Village to EXIT 18 Trunk 3 Brooklyn	8.09	B-13	1.0	4850	5350	5850
160	EXIT 18 Trunk 3 Brooklyn to EXIT 19 Trunk 8 Liverpool	6.40	B-14	1.4	4300	4900	5500
170	EXIT 19 Trunk 8 Liverpool to EXIT 20A Liverpool	3.48	B-15	1.3	3050	3450	3850
175	EXIT 20A Liverpool to EXIT 20 Summerville Centre	10.79	B-16	1.3	3050	3450	3850
180	EXIT 20 Summerville Centre to EXIT 21 Port Mouton	3.80	B-17	1.8	3350	3950	4550
182	EXIT 21 Port Mouton to Queens / Shelburne County Line	14.21	B-18	1.0	2400	2650	2900
185	Queens / Shelburne County Line to EXIT 23 Sable River	9.53	B-19	1.0	2150	2350	2550
190	EXIT 23 Sable River to EXIT 24 Jordan Falls	13.71	B-20	1.0	2150	2350	2550
200	EXIT 24 Jordan Falls to EXIT 25 East End Shelburne By-Pass	5.72	B-21	0.8	3200	3450	3700
210	EXIT 25 East End Shelburne By-Pass to EXIT 26 Route 203 Ohio Road	4.03	B-22	1.5	2300	2650	3000
215	EXIT 26 Route 203 Ohio Road to EXIT 27 Trunk 3 Birchtown	6.94	B-23	1.2	2950	3300	3650
220	EXIT 27 Trunk 3 Birchtown to Clinton Road	7.96	B-24	0.9	2900	3150	3400
225	Clinton Road to EXIT 28 Clyde River	5.39	B-25	0.9	2900	3150	3400
230	EXIT 28 Clyde River to EXIT 29 East of Barrington	9.80	B-26	1.0	3350	3700	4050
235	EXIT 29 East of Barrington to EXIT 30 Barrington	4.30	B-27	n/a	1550	1950	2350
240	EXIT 30 Barrington to Shelburne / Yarmouth County Line	7.20	B-28	1.2	2150	2400	2650
245	Shelburne / Yarmouth County Line to EXIT 31 Pubnico	14.30	B-28	1.2	2150	2400	2650
250	EXIT 31 Pubnico to EXIT 32 East of Argyle Causeway	12.60	B-29	1.6	3525	4075	4625
255&260	EXIT 32 East of Argyle Causeway to EXIT 33 Tusket	13.20	B-30	1.0	4350	5000	5650
270	EXIT 33 Tusket to Hardscratch Road Yarmouth	10.15	B-32	1.3	6000	6800	7600
	Total Study Section Length	**274.31**					

NOTES:
1. Section numbers and descriptions are from *Traffic Volumes Primary Highway System: 2004 to 2013* ; NSTIR March 2014.
2. Regression analysis figures are included in Appendix B.
3. AADT is Annual Average Daily Traffic volume
4. Volume projections have been obtained from regression analysis of historical AADT data from 1980 to 2013

Figure 3-1: AADT Projections by Control Section (2014, 2024, 2034)



3.2 Collision Rate Analysis

3.2.1 Calculation of Collision Rates

Collision data files for 2007 to 2012 provided by NSTIR included a total of 890 collisions for the 274 kilometers of highway in the Study Section. During the six year period there were 586 property damage only (PDO), 282 injury, and 22 fatal collisions reported.

NSTIR qualifies the significance of collision experience on a section of highway by comparing the collision rate on the section being studied to the average collision rate for many other sections of road with similar design and roadside development features. The standard of comparison is the number of collisions per 100 million vehicle kilometers (HMVK), obtained by multiplying the section length in kilometers by the annual average daily traffic (AADT) volume by 365 days in a year and dividing by 100 million. Annual numbers of collisions by severity, annual collision rates, and the overall average rate for 2007 to 2012, for each highway section, are included in Table B-1, Appendix B (Pages B-11 to B-16). Total collision data and rates for the six year period from 2007 to 2012 are included in Table 3-2.

Additional collision data are also summarized in the following:

- Figure 3-2: Total Collision Rate per HMVK by Control Section (2007 to 2012)
- Table 3-3: Summary of Average Collision Rates*;*
- Figure 3-3: Total Fatal Collisions by Control Section (2007 to 2012)*;* and
- Table 3-4: Contributing Factors - Fatal Collisions (2007 to 2012).

3.2.2 Evaluation of Collision Rates

Historically NSTIR published collision rates for each road section, as well as average collision rates for various road classes from four-lane divided highways (Class 1) to two-lane collector roads (Class 11). The Study Area of Highway 103 includes two-lane controlled access highways (Class 5), partially controlled access highways (Class 6), and those without access control (Class 7), which are identified in Table 3-2. Average highway section collision rates for 2007 to 2012 are illustrated in Figure 3-2. Collision rates for each highway section for the six year period 2007 to 2013, as well as average collision rates for 2007 to 2012 for the following groups of sections, are also included in Table 3-2:

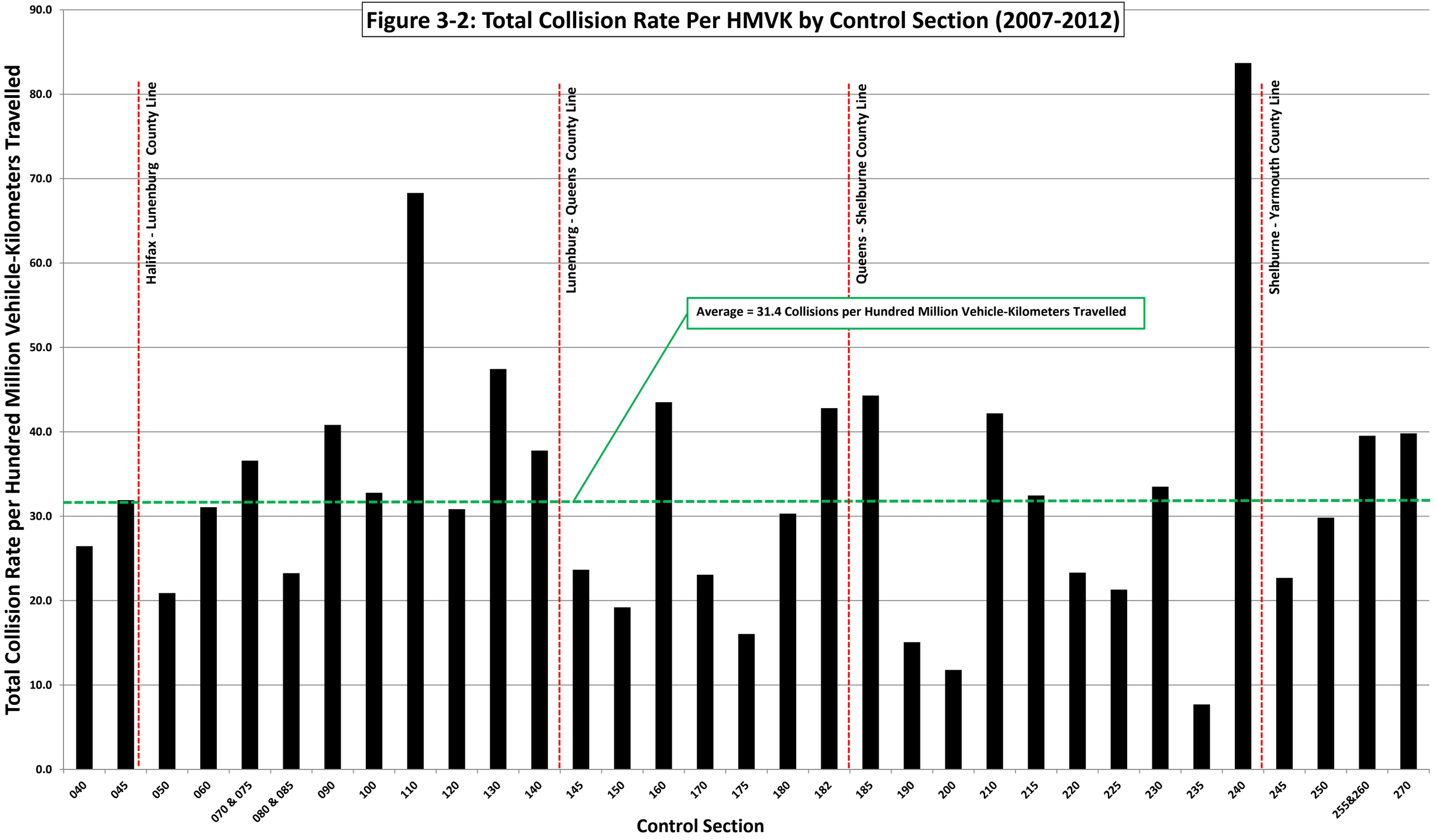
- All Study Area highway sections 040 to 270;
- All Study Area controlled access highway sections;
- Highway sections 040 to 060 (Tantallon to Chester); and.
- Highway sections 245 to 270 (Yarmouth County)

Table 3-2: Summary of Average Collision Rates by Highway Section

Section [1]	Description [1]	Road [2]	Length	AADT Projections [4]			HMVK [5]	Number of Collisions 2007 - 2012 [6]				Collision Rate per HMVK [8]			
Number		Type	kms.	2014	2024	2034	2007-12	PDO [7]	Injury	Fatal	Total	PDO	Injury	Fatal	Total
040	Route 213 Tantallon to Ingram River Bridge	5	9.17	11300	16100	18400	1.9652	34	16	2	52	17.3	8.1	1.0	26.5
045	Ingram River Bridge to EXIT 6 Hubbards	5	11.99	11300	13200	15100	2.5695	49	29	4	82	19.1	11.3	1.6	31.9
050	EXIT 6 Hubbards to EXIT 7 East River	5	9.28	9400	10700	12000	1.7704	27	7	3	37	15.3	4.0	1.7	20.9
060	EXIT 7 East River to EXIT 8 Trunk 14 Chester	5	7.14	8700	9950	11200	1.2553	31	6	2	39	24.7	4.8	1.6	31.1
070 & 075	Exit 8 Trunk 14 Chester to EXIT 9 Trunk 12 Chester Basin	5	4.12	9125	10575	12025	0.7654	22	6	0	28	28.7	7.8	0	36.6
080 & 085	EXIT 9 Trunk 12 Chester Basin to EXIT 10 Oakland Lake	5	13.75	9200	10500	11800	2.5800	38	21	1	60	14.7	8.1	0.4	23.3
090	EXIT 10 Oakland Lake to EXIT 11 Route 324 Blockhouse	5	4.80	8500	9700	10900	0.8573	24	10	1	35	28.0	11.7	1.2	40.8
100	Exit 11 Route 324 Blockhouse to EXIT 12 Trunk 10 Bridgewater	5	11.66	8900	10300	11700	2.1052	49	20	0	69	23.3	9.5	0	32.8
110	EXIT 12 Trunk 10 Bridgewater to EXIT 13 Route 325 Bridgewater	5	3.23	7600	8900	10200	0.4975	30	4	0	34	60.3	8.0	0.0	68.3
120	EXIT 13 Rouite 325 Bridgewater to EXIT 14 Trunk 3 Hebbville	5	6.64	5600	6500	7400	0.7782	20	4	0	24	25.7	5.1	0.0	30.8
130	EXIT 14 Trunk 3 Hebbville to EXIT 15 Italy Cross	7	6.42	6550	7300	8050	0.9063	26	17	0	43	28.7	18.8	0.0	47.4
140	EXIT 15 Italy Cross to EXIT 16 Camperdown School Road	7	3.86	5200	6050	6900	0.4235	8	8	0	16	18.9	18.9	0.0	37.8
145	EXIT 16 Camperdown School Road to EXIT 17 Route 331 Mill Village	6	10.65	4050	4150	4250	0.9299	12	10	0	22	12.9	10.8	0.0	23.7
150	EXIT 17 Route 331 Mill Village to EXIT 18 Trunk 3 Brooklyn	5	8.09	4850	5350	5850	0.7808	8	7	0	15	10.2	9.0	0.0	19.2
160	EXIT 18 Trunk 3 Brooklyn to EXIT 19 Trunk 8 Liverpool	5	6.40	4300	4900	5500	0.5516	17	7	0	24	30.8	12.7	0	43.5
170	EXIT 19 Trunk 8 Liverpool to EXIT 20A Liverpool	5	3.48	3050	3450	3850	0.2168	3	1	1	5	13.8	4.6	4.6	23.1
175	EXIT 20A Liverpool to EXIT 20 Summerville Centre	5	10.79	3050	3450	3850	0.6855	5	6	0	11	7.3	8.8	0.0	16.0
180	EXIT 20 Summerville Centre to EXIT 21 Port Mouton	7	3.80	3350	3950	4550	0.2639	6	2	0	8	22.7	7.6	0	30.3
182	EXIT 21 Port Mouton to Queens / Shelburne County Line	7	14.21	2400	2650	2900	0.7242	14	17	0	31	19.3	23.5	0.0	42.8
185	Queens / Shelburne County Line to EXIT 23 Sable River	7	9.53	2150	2350	1550	0.4289	11	8	0	19	25.6	18.7	0.0	44.3
190	EXIT 23 Sable River to EXIT 24 Jordan Falls	6	13.71	2150	2350	2550	0.5970	5	4	0	9	8.4	6.7	0.0	15.1
200	EXIT 24 Jordan Falls to EXIT 25 East End Shelburne By-Pass	6	5.72	3200	3450	3700	0.3394	2	2	0	4	5.9	5.9	0.0	11.8
210	EXIT 25 East End Shelburne By-Pass to EXIT 26 Route 203 Ohio Road	5	4.03	2300	2650	3000	0.1896	6	2	0	8	31.6	10.5	0.0	42.2
215	EXIT 26 Route 203 Ohio Road to EXIT 27 Trunk 3 Birchtown	5	6.94	2950	3300	3650	0.4006	8	5	0	13	20.0	12.5	0.0	32.5
220	EXIT 27 Trunk 3 Birchtown to Clinton Road	7	7.96	2900	3150	3400	0.4717	5	6	0	11	10.6	12.7	0.0	23.3
225	Clinton Road to EXIT 28 Clyde River	7	5.39	2900	3150	3400	0.3285	2	4	1	7	6.1	12.2	3.0	21.3
230	EXIT 28 Clyde River to EXIT 29 East of Barrington	7	9.80	3350	3700	4050	0.6255	13	7	1	21	20.8	11.2	1.6	33.6
235	EXIT 29 East of Barrington to EXIT 30 Barrington	5	4.30	1550	1950	2350	0.1294	1	0	0	1	7.7	0.0	0.0	7.7
240	EXIT 30 Barrington to Shelburne / Yarmouth County Line	5	7.20	2150	2400	2650	0.3106	18	8	0	26	57.9	23.8	0.0	83.7
245	Shelburne / Yarmouth County Line to EXIT 31 Pubnico	5	14.30	2150	2400	2650	0.6170	6	6	2	14	9.7	9.7	3.2	22.7
250	EXIT 31 Pubnico to EXIT 32 East of Argyle Causeway	5	12.60	3525	4075	4625	0.9386	17	10	1	28	18.1	10.7	1.1	29.8
255&260	EXIT 32 East of Argyle Causeway to EXIT 33 Tusket	5	13.20	4350	5000	5650	1.1887	36	9	2	47	30.3	7.6	1.7	39.5
270	EXIT 33 Tusket to Hardscratch Road Yarmouth	5	10.15	6000	6800	7600	1.1803	33	13	1	47	28.0	11.0	0.8	39.8
Totals for 2007 to 2012 for All Highway Sections			**274.31**				**28.3723**	**586**	**282**	**22**	**890**	**20.7**	**9.9**	**0.8**	**31.4**
Totals 2007 to 2012 for All Controlled Access Highway Sections			**183.26**				**22.3335**	**482**	**197**	**20**	**699**	**21.6**	**8.8**	**0.9**	**31.3**
Totals for 2007 to 2012 for Sections 040 to 060 - Route 213 Tantallon to Trunk 14 Chester			**37.58**				**7.5604**	**141**	**58**	**11**	**210**	**18.6**	**7.7**	**1.5**	**27.8**
Totals for 2007 to 2012 for Sections 245 to 270 - Yarmouth County			**50.25**				**3.9246**	**92**	**38**	**6**	**136**	**23.4**	**9.7**	**1.5**	**34.7**

NOTES:
1. Section numbers and descriptions are from *Traffic Volumes Primary Highway System: 2004 to 2013* ; NSTIR March 2014.
2. Road type refers to level of access control; Type 5 is a two-lane fully controlled access road with interchages and some intersections; Type 6 is partially controlled; Type 7 has frequent residential and commercial driveways
3. AADT is Annual Average Daily Traffic volume
4. Volume projections have been obtained from regression analysis of historical AADT data from 1980 to 2013
5. HMVK is Hundred Million Vehicle Kilometers travelled on each section from 2007 to 2012; See Table B-1, Appendix B, for details.
6. Number of Collisions is the total number of collisions for the 6 year period 2007 to 2012; See Table B-1, Appendix B, for details.
7. PDO is Property Damage Only.
8. Overall collision rates for 2007 to 2012; Collision rates are 'Number of Collision per HMVK'

Figure 3-2: Total Collision Rate Per HMVK by Control Section (2007-2012)



Average collision rates for all of the Highway 103 study area are compared to overall Nova Scotia average collision rates for two-lane controlled access and four-lane divided highways in Table 3-3. The following observations emanate from review of the average collision rates:

- There are no significant variations between the average collision rates for the Highway 103 Study Area, Highway 103 controlled access sections, and the overall Nova Scotia average collision rates.
- While the 38 kilometers included in Sections 040 to 060 between Tantallon and Chester account for only 14% of the Study Area of Highway 103, the segment accounts for 28% of the vehicle kilometers of travel and 50% of the fatal crashes.
- The 50 kilometers included in Sections 245 to 270 in Yarmouth County account for 18% of the Study Area of Highway 103 and 14% of the vehicle kilometers of travel, however, that segment includes 27% of the fatal crashes.
- The fatal collision rate of 1.5 per HMVK for the sections between Tantallon and Chester, and in Yarmouth County, is significantly higher than the 0.9 per HMVK for controlled access two lane sections and five times the 0.3 per HMVK Provincial average for four-lane divided highway sections.

Table 3-3: Summary of Average Collision Rates

Highway Type	Length kms	HMVK [1]	Collision Numbers		Average Collision Rate per HMVK [2]			
			Total	Fatal	PDO	Injury	Fatal	Total
Highway 103 Study Area 2007 to 2012 [3]								
Total Study Area	274	28	890	22	20.7	9.9	0.8	31.4
Study Area Controlled Access Sections	183	22	699	20	21.6	8.8	0.9	31.3
Sections 040 to 060 (Route 213 Tantallon to Trunk 14 Chester)	38	8	210	11	18.6	7.7	1.5	27.8
Sections 245 to 270 (Yarmouth County)	50	4	136	6	23.4	9.7	1.5	34.7
NSTIR Published Average Collision Rates [4]								
Average Rates for Four-Lane Divided Highways with Wide Median					18.1	9.3	0.3	27.7
Average Rates for Two-Lane Controlled Access Highways					21.5	11.2	0.9	33.6

NOTES:
1. HMVK is Hundred Million Vehicle Kilometers of Travel
2. Collision rate is number of reported collison per HMVK.
3. Data for Highway 103 have been extracted from Table 3-2.
4. NSTIR average rates are from the most recent publication of Motor Vehicle Collision Rates for Numbered Highways and Sections (2001 to 2005)

The graphical display of collision rates by highway section in Figure 3-2 illustrates the variation in the relationship between the number of collisions and exposure measured by vehicle kilometers of travel over the six year period 2007 to 2012. While the average rate is 31.4 collisions per HMVK, it is noted that Section 110 (Trunk 10 to Route 325, Bridgewater) and

Section 240 (Barrington Interchange to Shelburne / Yarmouth County Line) have rates two to three time the average. Review of volume and collision data for the two sections indicate the following:

- Section 110 (Trunk 10 to Route 325, Bridgewater) – This is a relatively short 3.23 kilometer long section of highway with 2007 to 2012 volumes that have varied from 6,800 to 7,400 vehicles per day. There were 34 reported collisions (30 PDO and 4 injury collisions) with 5 to 7 collisions per year (Table B-1, Appendix B). Review of collision details indicated that 50% of the collisions involved animals (16 deer and one raccoon). Four collision reports did not include any details; six were weather related; and the remaining seven can best be attributed to driver inattention. The very high number of reported deer collisions may indicate that installation of animal fencing could be appropriate along this highway section, and at other sections of highway where high numbers of animal collisions have occurred.
- Section 240 (Barrington Interchange to Shelburne / Yarmouth County Line) – While this section has a moderate length of 7.2 kilometers, the 2007 to 2012 volumes were very low, varying from 1800 to 2000 vehicles per day. There were 26 reported collisions (18 PDO and 8 injury collisions). Review of collision details indicated that 10 collision reports (38%) did not include any details; five involved deer; four were winter weather related; one was an opposing direction sideswipe involving three vehicles; and six were single vehicle collisions. The higher than average collision rate for this section can be attributed to the very low traffic volumes.

3.2.3 Review of Fatal Collision Contributing Factors

The total numbers of fatal collisions by highway section are shown graphically in Figure 3-3 and contributing factors are summarized in Table 3-4.

The majority of the 22 fatal collisions are clustered at the east end and west end of the Study Area with 11 fatal collisions (50%) in the 38 kilometers long section between Tantallon and Chester and six fatal collisions (27%) in the 50 kilometer section in Yarmouth County. Both sections are designated as controlled access with 100 km/h posted speed limits. The section in Yarmouth County has seven at-grade intersections with paved roads; however, there was no indication that intersection collisions were involved between 2007 and 2012. The fatal collision rate of 1.5 per HMVK for these sections is significantly higher than the 0.9 per HMVK for controlled access two lane sections and five times the 0.3 per HMVK Provincial average for four-lane divided highway sections.

The locations, dates, light, weather, road surface conditions, and contributing factors to the 22 fatal crashes during 2007 to 2012 are included in Table 3-4, sorted by highway section number. The information in the table is summarized in the following statements:

- There were five single vehicle collisions; 15 two vehicle collisions; one collision with three vehicles; and one between a bus and a bicycle;

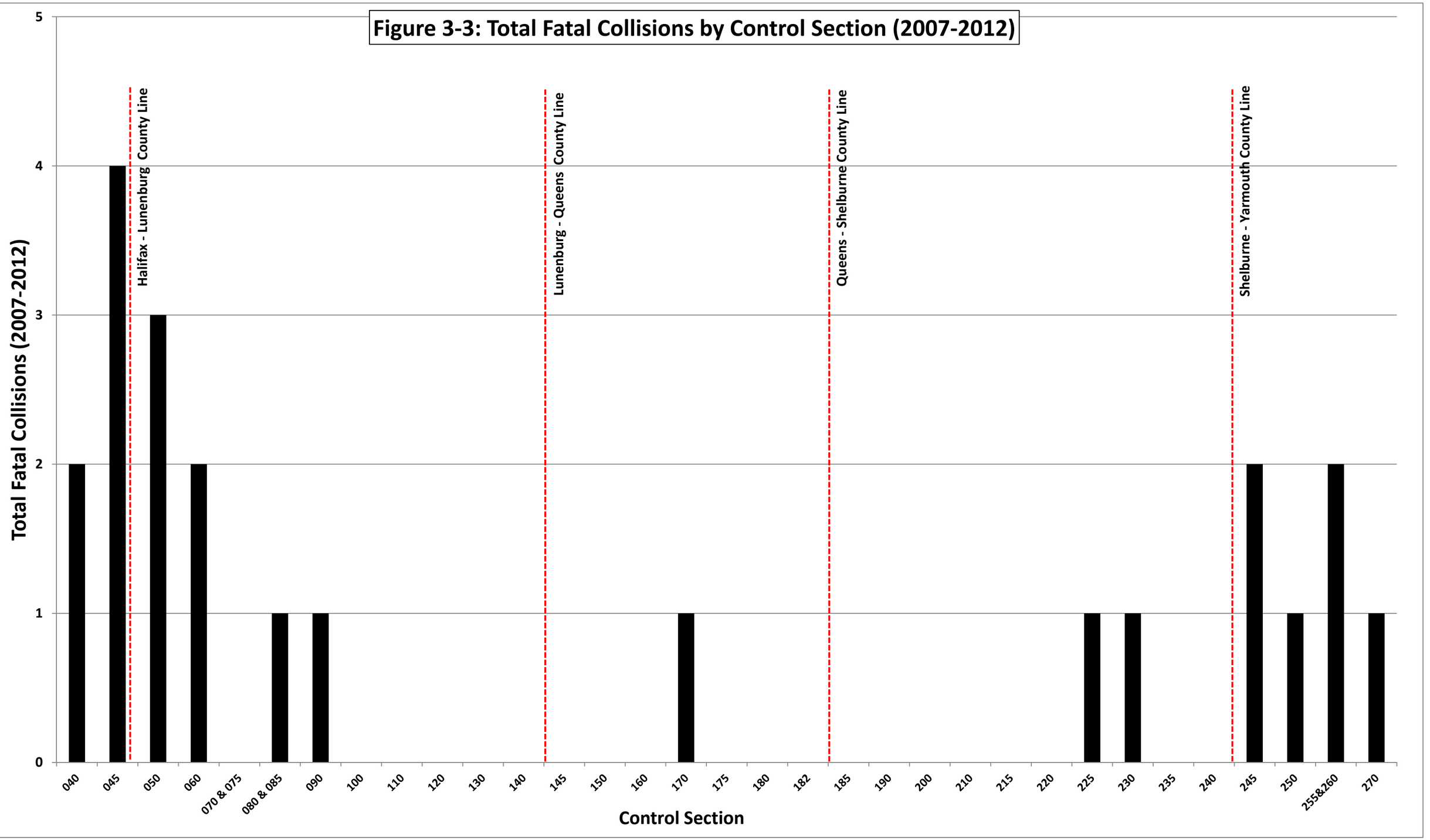
- 16 collisions occurred during **day light**; one at dawn; and five in the dark;
- 14 collisions occurred during **clear weather**; one cloudy; two rain; one snow; one freezing rain; and three unavailable;
- 13 collisions occurred on **dry pavement**; two wet; three ice; two slush; and two unavailable;
- 16 collisions involved vehicles **crossing the center line** and striking an opposing vehicle.

In summary, the majority (67%) of the fatal collisions involved two vehicles travelling in opposite directions hitting one another head-on during ideal light, weather and road surface conditions. While one collision was noted to have involved hydroplaning, and another collision involved a vehicle travelling at high speed in the rain skidding on a curve, there is no indication that highway geometry contributed to collisions. While not stated in the collision files that were provided by NSTIR, it is concluded that lack of driver attention and speed too fast for road conditions were the primary contributing factors to most of the 22 fatal collisions.

Table 3-4: Contributing Factors - Fatal Collisions (2007 to 2012)

County Name	Community Name	Section	Collision Date	Time	Light	Weather	Surface	Contributing Factors
HALIFAX	Upper Tantallon	40	2008 Jun 08	17:51	Day	U/A	U/A	WB VEHICLE COLLIDED WITH EB VEHICLE IN EB PASSING LANE
HALIFAX	Head of St. Margarets Bay	40	2012 Jul 21	10:47	Day	Clear	Dry	WB V1 HIT WB V2 IN PASSING LANE;V1 CROSSED CENTERLINE AND HIT EB VEHICLE
LUNENBURG	Hubbards	45	2007 Jul 30	15:10	Day	Raining	Wet	VEHICLE HYDROPLANED AND WENT INTO PATH OF OPPOSING VEHICLE
HALIFAX	Hubbards	45	2008 Dec14	17:39	Dark	Clear	Dry	VEHICLE CROSSED THE CENTER LINE AND HIT OPPOSING VEHICLE
HALIFAX	Halifax	45	2008 Mar23	15:16	Day	Clear	Dry	VEHICLE CROSSED THE CENTER LINE AND HIT OPPOSING VEHICLE
LUNENBURG	Simms Settlement	45	2009 Feb 17	6:05	Dark	Clear	Dry	WB VEHICLE DRIVING IN EB LANE STRUCK EB VEHICLE HEAD-ON
LUNENBURG	East River	50	2007 Nov 24	0:50	Dark	Clear	Dry	WB VEHICLE STUCK BY EB VEHICLE THAT CROSSED THE CENTER LINE
LUNENBURG	Simms Settlement	50	2008 Sep17	10:40	Day	U/A	U/A	AN AMBULANCE CROSSED THE CENTERLINE AND LEFT ROAD ON LEFT SIDE. PATIENT DIED.
LUNENBURG	East River	50	2010 Mar 27	17:23	Day	Clear	Dry	EB VEHICLE OVERTOOK VEHICLE IN PASSING LANE; DRIFTED LEFT OF CENTER AND HIT WB VEHICLE
LUNENBURG	East Chester	60	2008 Mar 28	14:44	Day	Snowing	Slush	EB VEHICLE SLID SIDEWAYS AND WAS T-BONED BY ANOTHER VEHICLE
LUNENBURG	East Chester	60	2011 Oct 01	14:40	Day	Raining	Wet	HIGH SPEED WB VEHICLE SKIDDED ON CURVE; CROSSED CENTERLINE; HIT EB VEHICLE HEAD-ON
LUNENBURG	Martins River	85	2007 Jan 14	15:25	Day	U/A	Ice	VEHICLE LOST CONTROL ON ICY ROAD; CROSSED CENTER LINE AND HIT OPPOSING VEHICLE
LUNENBURG	Blockhouse	90	2007 May 27	15:20	Day	Clear	Dry	TWO WB VEHICLES WERE STRUCK BY AN EB VEHICLE THAT CROSSED CENTER LINE
QUEENS	Milton	170	2012 Nov 12	15:47	Day	Clear	Dry	DRIVER EB VEHICLE POSSIBLY FELL ASLEEP AND CROSSED CENTERLINE INTO SIDE OF A WB TRACTOR TRAILER
SHELBURNE	Clyde River	225	2012 Dec 09	18:45	Dark	Clear	Dry	EB VEHICLE; PASSENGER GRABBED WHEEL; VEHICLE WENT ON SHOULDER THEN ROLLED SEVERAL TIMES
SHELBURNE	Barrington	230	2011 Mar 23	12:20	Day	Cloudy	Dry	EASTBOUND VEHICLE FAILED TO NEGOTIATE LEFT HAND TURN; LEFT ROAD AND HIT UTILITY POLE
YARMOUTH	East Pubnico	245	2008 Mar 06	7:10	Day	Clear	Icy	WB VEHICLE LOST CONTROL ON BLACK ICE; ENTERED SOUTH DITCH AND FLIPPED SEVERAL TIMES
YARMOUTH	East Pubnico	245	2009 Jul 12	22:00	Dark	Clear	Dry	WB BUS SRUCK WB CYCLIST; CYCLIST SUSPECTED OF ALCHOL IMPAIRMENT
YARMOUTH	Lower Argyle	250	2011 May 30	19:00	Day	Clear	Dry	WB VEHICLE WENT ON SHOULDER THEN CROSSED BOTH LANES; LANDED ON ROOF IN DITCH
YARMOUTH	Belleville	260	2007 Dec 21	9:32	Day	Clear	Ice	WB VEHICLE LOST CONTROL ON ICY ROAD; CROSSED CENTER LINE AND HIT EB VEHICLE
YARMOUTH	Belleville South	260	2008 Aug 23	10:10	Day	Clear	Dry	EB VEHICLE CROSSED CENTER LINE AN HIT WB TRUCK
YARMOUTH	Arcadia	270	2010 Mar 05	7:34	Dawn	Freezing Rain	Slush	WB VEHICLE; SNOW TIRES ON FRONT; ALL SEASON ON REAR; CROSSED CENTERLINE STRUCK EB VEHICLE

Figure 3-3: Total Fatal Collisions by Control Section (2007-2012)



4.0 Maintenance Standards and Road Condition

This Chapter summarizes review of NSTIR's *Highway Maintenance Standards*[1] manual and provides a commentary of roadway and roadside maintenance throughout the Study Area of Highway 103. The Chapter has been sub-divided by maintenance category, including the following:

- General Maintenance Standards
- Surface Maintenance
- Roadside Maintenance
- Drainage Maintenance
- Traffic Control
- Snow and Ice Control

The highway was reviewed from the intersection of Hardscratch Road in Yarmouth to the overpass at Exit 5 in Tantallon during site visits completed during October 2014. The review focused on the above noted maintenance categories (with the exception of snow and ice control), in particular with regard to the observed level of conformity to current standards.

The following sections provide an overview of each maintenance category and discussion of Highway 103 based on field observations. Selected pages of the Manual are included on Pages C-1 to C-30 (Appendix C) of this Report as a convenience to readers. Documentation of the maintenance survey is included on Pages C-31 to C-45.

4.1 General Maintenance Standards

Although the current *Highway Maintenance Standards* deal with maintenance on all highways within the Province, there are particular sections that deal specifically with 100 Series highways. A discussion of General Maintenance Standards serves as the introduction to the Manual and defines the basic responsibilities of Supervisors and Area Managers to perform work required to meet the standards described in the Manual. While the two pages of the introduction section are included as Pages C-3 and C-4, the following items warrant emphasis:

- Item 3 - The Area Manager is responsible to obtain the "Annual Condition Defects Report" from each Supervisor yearly on or before the last day of November. These reports are used to set priorities for major maintenance projects and plan work for the next maintenance season within the Areas and thus the Districts of the Province to address the various deficiencies on the road system.
- Item 7 - The Supervisor is responsible to ensure that the highway right-of-way is maintained in a condition that ensures safe passage of vehicular traffic.

[1] *Highway Maintenance Standards*, Nova Scotia Transportation and Infrastructure Renewal (Effective July 2009; Latest Revision November 2013). Available: http://novascotia.ca/tran/highways.

- Item 9 - The Routine Road Patrol Frequency Table indicates that the Supervisor is to patrol each section of Level 1A highway, such as Highway 103, two times each week. Deficiencies are to be recorded and plans prepared to correct the various items as they become apparent.

The Manual includes chapters for various maintenance activities such as Surface Maintenance, Roadside Maintenance, Drainage Maintenance, Traffic Control, and Snow and Ice Control. Each chapter is then subdivided into particular maintenance activities.

4.2 Surface Maintenance

Chapter 1 deals with "Surface Maintenance", covering such topics as Grading, Shoulder Maintenance, Shoulder Grading, Dust Control, Street Sweeping, Gravel Patching, Hand Patching, Spreader Patching, Storm Damage, and Unclassified Maintenance. Clearly the 100 Series maintenance does not deal with the topics of Grading, Dust Control, Street Sweeping, and Gravel Patching.

4.2.1 Shoulder Maintenance

Shoulder Maintenance (Page C-5, Appendix C) deals with erosion and washout of the shoulders (for areas less than 100 meters and greater than 100 meters). All washouts adjacent to the traveled lane are to be signed within 24 hours of detection no matter the length. For sections less than 100 meters in length, the Operation Supervisor is given the following time periods to address the deficiency based on the depth of the deficiency:

- 100 mm to 150 mm - 30 Days
- 151 mm to 300 mm - 7 days
- Greater than 300 mm - immediately

For sections greater than 100 meters in length and depth deficiencies greater than 100 mm, repair work shall be based on the "Annual Condition Defects Report".

Site Visit Observations

Useable gravel shoulders varied in widths from a low of 1.9m on the south side of section 120 to a high of 3.3m on the south side of section 270. Low shoulders (material not flush with the edge of the pavement) as per Chapter 1, Section 2 (See Page C-5, Appendix C) exist at a few locations along the surveyed section. While shoulders were generally well maintained, there were many locations at which field observations indicated the need for shoulder maintenance. The following provides a few examples from Lunenburg County:

- Section 140 from Exit 16 Camperdown School Road to Exit 15 at Italy Cross Road on both the north and south side of the road the shoulder is low near kilometer 184.3;

- Section 130 from Exit 15 at Italy Cross to Exit 14 at Trunk 3 in Hebbville on both the north and south side of the road the shoulder is low near kilometer 187.7;
- Section 060 from Trunk 14 at Chester Exit 8 to East River Exit 7 on both the north and south side of the road the shoulder is low near kilometer 241.5.

It was also noted that recycled asphalt used to shoulder the hill on the eastbound lane on section 040 near kilometer marker 267 is starting to wash away and should be addressed by Maintenance. Useable gravel shoulders are supposed to be sloped from the edge of the paved shoulder at a slope of approximately 5% from the edge of pavement to the rounding. Those locations where low shoulders were found in the field also had various slopes ranging from a low of approximately 3% to a maximum of up to 10% whereas the standard is 5%. Locations with the higher shoulder drops and greater side slope require remedial action immediately.

4.2.2 Hand Patching and Spreader Patching

Hand Patching and Spreader Patching (Pages C-6 to C-8, Appendix C) are used to repair surface defects with hot or cold mix asphalt material placed by hand or by means of an automatic patching machine.

Site Visit Observations

Field inspections did not find any pot holes, depressions, or pavement edge defects that required attention. There were two minor locations, however – Section 245 near kilometer 38 and Section 160 near kilometer 160 – where the east bound lane had some distortion. These sections should be reviewed in the spring to see if spreader patching is required. Generally the asphalt surface in the traveled lanes was in good condition.

There was a large variance of paved shoulder widths measured from the center of the white line to the edge of the pavement throughout the Study Area ranging from a low of 0.55m within section 215 to a high of 2.2m within section 120.

Not all sections had rumble strips along the center line of the road or along the outside of the white lines marking the shoulders. Section 200 had recently been micro-sealed, which filled the rumble strip along the roadway. Some sections of the surveyed highway had a rumble strip along the center line only. Future paving or resurfacing contracts should specify the replacement of rumble strips for the center line and white shoulder lines of the road. Also, the Department should upgrade paved shoulders to the standard width during all future repaving projects.

Photo 4-1: The approximately one meter wide paved shoulder does not have a rumble strip.

Photo 4-2: The shoulder drop-off appears to be excessive.

4.3 Roadside Maintenance

Chapter 2 of the Manual deals with such roadside maintenance activities as brush-cutting (by machine and manually), mowing, debris / litter clean up, seeding, and weed control.

4.3.1 Brush Cutting

Brush cutting by machine (Pages C-9 to C-11, Appendix C) is to be performed on areas that affect minimum stopping and passing sight distances (See tables on Page C-10). In addition, machine brush cutting is to be performed on brush that obstructs traffic signage. Manual brush cutting (Pages C-11 to C-13) has similar standards as brush cutting by machine other than it is in areas where it is not practical to use machines. Brush cutting for these types of obstructions is to be completed within 21 days or immediately if they pose a serious hazard (Page C-10).

Site Visit Observations

Brush cutting within the ROW varied significantly throughout the surveyed area. For example, in some sections in Yarmouth and Shelburne Counties, the entire Right of Way (ROW) has been cut by machine. In other sections, although it is evident that attempts were made to address clearing, there were still sections that additional cutting should be done (i.e. section 220, and

especially section 190 near marker 105). In the latter location, trees on the inside of the curve appear to be reducing the safe stopping sight distance for eastbound traffic.

In many locations within Lunenburg and Halifax Counties, trees (not bushes) are very close to overhanging the guardrail systems on the roadway shoulders. Due to the terrain (i.e. in the case of rock outcrops) it may not be possible to cut the trees by machine. The trees and bushes located close to the shoulders of the road allow wild animals to remain out of sight to motorists, which can limit their ability to take evasive action in the event that the animal enters the roadway. In addition, various traffic signs along the surveyed highway were partially obscured by trees / brush as noted in the survey documentation (Pages C-31 to C-45).

Based on Study Area observations, it appears that brush cutting was the maintenance activity most deferred by NSTIR Maintenance Staff, despite the fact that it is arguably the most obvious to the traveling public. Those areas where trees and bushes have not been cut will make it difficult to detect wild animals at the roadside. Also, the lack of proper brush control may give motorists a feeling that the road itself is narrowing and may cause some drivers to 'crowd' the centerline.

Photo 4-3: Lack of brush control has allowed trees to grow in the ditch area.

Photo 4-4: When vegetation has been allowed to grow to the point it overhangs the shoulder, motorists will have minimal opportunity to observe animals that may enter the road.

Photo 4-5: While vegetation control appears acceptable, additional cutting will be required soon to keep it from becoming high enough to hide animals.

Photo 4-6: Vegetation in this area has been cleared to the limit of the right-of-way, providing clear sight lines.

The brush cutting policy leaves the Operations Supervisor with considerable flexibility in its interpretation. In some locations the entire right of way is being cut, while in other locations minimal cutting is taking place allowing the trees to again take over the right of way to the back of the guardrail. A more defined distance from the edge of the paved surface or ditch line would help ensure that all highway sections are treated in a similar manner throughout the Province.

4.3.2 Machine mowing

Machine mowing is to be performed on all Level 1A and selected Level 1B roads as per the Department's policy *Maintenance Mowing Plan for 100 Series Divided Highways*[2] as listed in Manual 23, PR5023. Vegetation exceeding 300mm in height shall be mowed for all Level 1B highways. The width of the area to be mowed shall be from the edge of the pavement to the back or the end of the shoulder rounding on a yearly basis.

Site Visit Observations

Shoulders in the surveyed area appear to meet the mowing requirement.

[2] *Maintenance Mowing Plan for 100 Series Divided Highways,* Manual 23, PR5023. Nova Scotia Transportation and Infrastructure Renewal.

4.3.3 Debris and Litter Clean-up

Debris and Litter Clean-up (Pages C-14 and C-15) is the physical removal and proper disposal from the ROW of objectionable material such as roadside rubbish, dead animals, unlawful signs, and fallen trees that may affect the traveling public. Page C-15, Appendix C, lists the criteria based on size that Debris and Litter are to be removed for all road classifications within the Province.

Site Visit Observations

Based on visual review on the field inspection dates (October 2014), debris and litter clean-up appears to be consistent with policy requirements. Only a very few dead animals were seen near the paved shoulders of the road. These dead small animals were recently killed and may not have been recorded yet by the Operations Supervisor on his weekly inspections. Rubbish was noted along the edge of the ROW where measurements were taken to the brush line; however, this would not be expected to affect the safe travel of the public on the Highway.

4.4 Drainage Maintenance

Chapter 3 of the Manual deals with drainage management activities such activities as grader ditching, ditching, culvert installation, catch basin installation/maintenance, storm sewer installation/maintenance, and culvert maintenance.

Site Visit Observations

Many of the drainage structures along the various sections of Highway 103 have not changed since their original installation / construction. Some of the older sections of the Highway now have trees overgrowth in ditches, thus partially blocking the drainage of the Highway (see field notes for Highway 103 Sections 100, 090, 050, 045, and 040 on Pages C-43 to C-45).

4.5 Traffic Control

Chapter 5[3] of the Manual (Pages C-17 to C-22) deals with Traffic Control and the various devices to inform road users of regulations, warn of roadway characteristics and hazards, and provide information necessary for route selection. These devices consist of signs, pavement markings, guardrail, and jersey barriers.

4.5.1 Signage

Regulatory signs (i.e. Speed Zone, Stop, Yield, One Way, Do Not Enter) are considered critical signs and must be replaced immediately by the Operations Supervisor when damaged or missing. Permanent signs may not be relocated without the approval of the Area Manager and the Traffic Authority.

[3] The most recent version of *Highway Maintenance Standards does not include* Chapter 4.

Warning signs (i.e. chevrons, road narrows, hidden driveway, reduced curve speed, bridge freezing, etc.) are erected as directed by the District Traffic Authority and are to be replaced as they become broken or missing by the Operation Supervisor during regular road patrols. Page C-18 of the extracted Highway Maintenance Standards pages lists various response times for various types of signs (from critical signs to large informational signs) by road classification.

Site Visit Observations

While regulatory and warning signs appeared to be installed where appropriate, many instances were noted where signs were in poor condition. In some instances, signs were obscured by trees and brush located within the ROW. A retroreflectivity survey should be performed or signs scheduled for replacement for regulatory, warning, and destination signs to ensure they comply with standards. Many signs appear to be older and thus may have lost some of their retroreflectivity properties.

Photo 4-7: This sign, which is worn and faded, should be replaced by signage with adequate display and retroreflectivity.

Photo 4-8: This warning zone sign which is worn and faded should be replaced by signage with adequate display and retroreflectivity.

4.5.2 Pavement Markings

Pavement Markings (i.e. directional arrows, stop bars, cross hatching, school crossings, gore area markings etc.) are established in accordance with the *Manual of Uniform Traffic Control Devices*

for Canada (MUTCDC). All required markings are to be re-applied on an annual basis. Additional pavement markings will be applied as directed by the District Traffic Authority.

4.5.3 Traffic Line Painting

All Level 1A highways shall have traffic lines painted on an annual basis Prior to July 31st.

Site Visit Observations

At the time of the survey of Highway 103 (October 2014) the centerline, lane dividers and edge lines appear to have been painted as per the requirements.

4.5.4 Guide Post Installation and Maintenance

Guide posts are generally used for shoulder delineation but are no longer installed along Level 1A highways.

Site Visit Observations

Those guide posts that are still located along the road (Photo 4-9) have been there for years and are being replaced as sections of the road are upgraded by the Capital Paving Program.

Photo 4-9: The guideposts illustrated should not be used on this road class. The steep embankment appears to warrant a guardrail installation.

Guardrail Installation / Maintenance

There are different types of guardrail installed along the various sections of Highway 103 from the newest installation on the Barrington By-Pass to the older 'standard' installations.

Site Visit Observations

While section 235 of the survey (Barrington Bypass) had the new collapsible end treatment for the guardrail, most sections of guardrail on Highway 103 had the ends flared and buried. Most guardrails were the older type with long 3.81 meter (12'6") post spacing; however, newer installations have been changed to short 1.905 meter (6'3") post spacing with blocking system. While most guardrails were attached to the crash blocks of the bridges and had an additional protective channel attached to the posts adjacent to the structure, some structures do not have

appropriate guardrail connections. Some sections of railing (e.g. Section 180, kilometer 142.4 and Section 100, kilometer 204.9, 208, and 209) should be marked as they are in need of replacement.

4.5.5 Jersey Barriers

The only jersey barriers installed along the surveyed section of Highway 103 were at the bridge repair site located within section 050, which appears to be set up as required with the proper advance signage, tapers, etc. to protect the workers within the construction zone.

4.5.6 Lighting

Luminaires at all interchanges have been changed to the LED versions in recent years.

4.6 Snow and Ice Control

Chapter 6 of the Manual (Pages C-23 to C-30) deals with Snow and Ice Control which includes plowing, anti-icing (direct liquid application) pre-wet salting, salting, sanding, and ice blading of roads before, during and after winter weather events.

Level 1A roads are required to be essentially bare within eight (8) hours as per winter maintenance levels of service (See table at bottom of Page C-25). De-icers may be in the form of a direct liquid application applied prior to a storm provided the temperature is between 0^{o}C and -7^{o}C. Pre-Wet Salt may be used on road temperatures between 0^{o}C and -10^{o}C. De-icers should not be used if the temperature of the road surface is below -10^{o}C and falling. Sand is not normally used on Level 1A Highways but may be used during extreme cold weather and slippery conditions.

Turn around locations for plows assigned to 100 series work have been a concern at County lines and individual Department Bases throughout the Province for many years. Plows generally turn at interchanges using the ramps and overpass but by doing so they can leave either the main roadway or the ramps unplowed.

Site Visit Observations

NSTIR Maintenance Staff have installed offset turning areas at the Yarmouth / Shelburne County line so that plows from each County can turn safely as the unit is entirely off the highway traveled way. Perhaps other Bases or Areas may want to investigate this type of plow turning area rather than attempting to perform three point turns with the equipment during Snow and Ice Control activities on the busy highways.

Other examples of dedicated turn around areas for plows were located west of Exit 12 near kilometer 202.0 and at the Chester /Lunenburg Centre boundary east of Exit 10 near kilometer 221.8.

5.0 Road Design Standards

5.1 Review of Nova Scotia Design Guidelines

As part of the analysis, the *Highway Design Guidelines* (See Figure 5-1) of the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR) were reviewed relative to other jurisdictions and against the Transportation Association of Canada (TAC)'s "*Geometric Design Guide for Canadian Roads*".

DESIGN GUIDE

PARAMETER / FUNCTIONAL CLASSIFICATION	FREEWAY & MAJOR ARTERIAL A,B	MINOR ARTERIAL C	MINOR ARTERIAL D	COLLECTOR MAJOR E	COLLECTOR MINOR F	LOCAL G	LOCAL H	LOCAL I	LOCAL J	TRUCK ROUTE M	TRUCK ROUTE N
DESIGN YEAR TRAFFIC, AADT	>10000	>5000	<5000	>3000	<3000	>300	<300	<50			
DESIGN HOURLY VOLUME	>450	>450	<450	>250	<250						
DESIGN SPEED RANGE, km/h	120–90	100–80	90–80	90–80	80–70	80–60	70–50		50	90–80	80–50
GRADIENT – MAXIMUM, %	6	7	7	8	9	10	12		8	7	9
SURFACE TYPE	PAVED	PAVED	PAVED	PAVED	PAVED	OPTIONAL	UNPAVED	UNPAVED	OPTIONAL	PAVED	OPTIONAL
LANE WIDTH, m	3.7	3.7	3.5	3.5	3.3	3.0	4.0	3.3	3.0	3.5	3.3
SHOULDER TYPE	PAVED OUT–2.0 IN–1.5	PAVED 0.5	PAVED 0.3	PAVED 0.0–0.2[1]	UNPAVED	UNPAVED			OPTIONAL	UNPAVED	UNPAVED
SHOULDER WIDTH (USEABLE),m	OUT–2.5 IN–2.0	2.2	2.0	2.0	1.5	1.2			1.6	2.0	1.2
SHOULDER ROUNDING, m	0.8	0.6	0.6	0.4	0.4	0.4			0.4	0.6	0.4
FINISHED TOP WIDTH, m	13.5–14.0	13.(	12.2	11.8	10.4	9.2	8.0	6.6	10.0	12.2	9.8
SIDE SLOPES[2]	4:1	3:1	3:1	2:1	2:1	2:1	1.5:1	1.5:1	2:1	2:1	2:1
BACK SLOPES[3]	3:1	2:1	2:1	2:1	2:1	2:1	1.5:1	1.5:1	2:1	2:1	2:1
MINIMUM ROW WIDTH[4]	150 & 60	60	60	56	50	40	30	30	40	50	50

DESIGN SPEED PARAMETERS[5]

DESIGN SPEED, km/h	120	110	100	90	80	70	60	50
POSTED SPEED – MAXIMUM, km/h	120	110	100	90	80	70	60	50
HORIZONTAL CURVE – MINIMUM RADIUS, m[6]	750	600	440[7]	340	250	190	130	90
STOPPING SIGHT DISTANCE – MINIMUM, m[8]	290	250	210	170	140	110	85	65
VERTICAL SAG CURVE – MINIMUM, k[9]	60	55	50	40	30	25	20	11
VERTICAL CREST CURVE – MINIMUM, k	105	85	70	55	35	22	15	7
PASSING SIGHT DISTANCE – MINIMUM, m	800	730	680	610	550	490	410	350

NOTES:
1. 0.0 FOR AADT <5000; 0.2 FOR AADT >5000.
2. ON EMBANKMENTS OVER 3m, MAY BE REDUCED TO 2:1 WITH THE INSTALLATION OF GUARDRAIL IF ECONOMICALLY FEASIBLE.
3. MAXIMUM SLOPES; STEEPER SLOPES MAY BE PERMITTED AS DETERMINED BY LABORATORY TESTS; IN CUTS OVER 3m MUST BE DETERMINED BY LABORATORY TESTS PRIOR TO CONSTRUCTION.
4. ROW LIMIT TO BE ADJUSTED TO ALLOW FOR MINIMUM OF 5.0m BEYOND DAYLIGHT LOCATION OR EXCEPTIONALLY 3.0m MAY BE ACCEPTABLE.
5. RURAL; FOR URBAN SEE TAC GEOMETRIC DESIGN GUIDE FOR CANADIAN ROADS
6. BASED ON MAXIMUM SUPER ELEVATION OF 0.06 m/m.
7. MINIMUM RADIUS OF 1270m REQUIRED TO ACHIEVE HORIZONTAL SIGHT DISTANCE WHEN JERSEY BARRIER USED.
8. BASED ON EYE HEIGHT OF 1.05m AND OBJECT HEIGHT OF 380mm.
9. K–VALUES ARE BASED ON HEADLIGHT CONTROL.
10. THE TAC GEOMETRIC DESIGN GUIDE FOR CANADIAN ROADS SHOULD BE CONSULTED WHEN COMBINING MINIMUM VALUES.

Manager Highway Planning and Design
Director Highway Engineering Services
Executive Director Highway Engineering and Construction

NOVA SCOTIA
Transportation and Infrastructure Renewal

No.	REVISION
2	CORRECTION TO CLASS – MAY 2013
1	CHANGE TO NOTES – OCT 2010

Scale : N.T.S.
Drawn by : M.LABRECHE
Checked by : K.BOODY
Date of Plan : AUG2009
File No. : S–2009–001

HIGHWAY DESIGN GUIDELINES

Figure 5-1: Nova Scotia Highway Design Guidelines [File No. S-2009-001]

Relative to this particular project, the design guidelines for Freeway & Major Arterial roadways and Minor Arterial A roadways were considered. In general, the design year traffic (AADT), the design hourly volume, and design speed range parameters were consistent with expectations for these particular classifications of roadways. The parameters were reviewed as generally consistent with Table 1.3.4.1 of the "*Geometric Design Guide for Canadian Roads*".

The roadway cross-sectional elements for Nova Scotia's Highway Design Guidelines were reviewed against similar design criteria utilized in the Province of New Brunswick and as

recommended in the "*Geometric Design Guide for Canadian Roads*", Chapter 2.2. The following is a summary of comparable design elements:

- Gradient, Maximum (%): TAC generally acknowledges that maximum gradients by classification and land use are often a matter of policy, and thus vary from jurisdiction to jurisdiction. The maximum gradients noted in the Nova Scotia design guidelines are generally consistent with provinces that share similar topography;
- Lane Width: A 3.7m lane width is generally consistent with most Canadian jurisdictions and TAC guidelines for these roadway classifications.
- Shoulder Type and Shoulder Width (Useable): In Nova Scotia, for a Freeway & Major Arterial roadway, the shoulder type is paved with dimensions of 2.0 metres out and 1.5 metres in. The useable shoulder width for this classification of roadway is 2.5 metres out and 2.0 metres in. For a Minor Arterial A roadway, it is also paved on both sides of the road with a 0.5 metre dimension. The useable shoulder width for this classification of highway is 2.2 metres for both sides of the roadway.
    - Under TAC clause 2.2.4.2, it is recommended that for divided rural roadways, the right shoulder width (useable) for all roadway designations and design speeds should be 3.0 metres and the left shoulder width (useable) should be 1.5 metres. Further, under this Clause, for roadways with an equivalent classification to a Nova Scotia Minor Arterial A, the shoulder widths should be 3.0 metres (based on the design hourly traffic volume).
    - In reviewing a neighbouring jurisdiction (New Brunswick), for a Freeway & Major Arterial roadway (4-lane), the shoulder type is paved with dimensions of 3.0 metres on the right and 0.8 metres on the left. The right dimension represents the useable shoulder width for this classification of roadway but it is noted that only 0.8 metres is full-depth pavement and the remaining dimension is typically only asphalt seal. The total useable width on the left is 1.5 metres. For a Minor Arterial A roadway in New Brunswick (RAU110 and RAU100), it is paved on both sides of the road with a 3.0 metre dimension and a useable shoulder width of 3.0 metres. Similar to above, it is noted that only 0.8 metres on each side are full-depth pavement and the remaining dimension is typically only asphalt seal. For a Minor Arterial A roadway in New Brunswick (RAU90), it is paved on both sides of the road with a 0.8 metre dimension (full depth asphalt) and a useable shoulder width of 2.5 metres.
- Shoulder Rounding: In Nova Scotia, for a Freeway & Major Arterial roadway, the shoulder rounding is 0.8 metres and for a Minor Arterial A roadway, it is 0.6 metres.
    - Under TAC clause 2.2.4.5, shoulder rounding of 1.0 metres is typically used for design speeds greater than 100 km/hr and 0.5 metres for design speeds less than 100 km/hr.
    - A review of several Canadian jurisdictions indicated that there seems to be variability in the shoulder rounding dimensions across the country and no consistent standard.

- Side Slopes: In Nova Scotia, for a Freeway & Major Arterial roadway, the side slopes are noted as 4:1 and for a Minor Arterial A roadway as 3:1. However, it is noted that on embankments over 3 metres the side slope may be reduced to 2:1 with the installation of guardrail, if economically feasible.
    - A review of several Canadian jurisdictions indicated that the Nova Scotia Highway Design Guidelines are generally consistent to the guidelines being utilized across the Canada.
    - TCH Route 2 in New Brunswick generally has been constructed with 6:1 slopes for embankments less than two meters; 4:1 for two to five meters; and 2:1 for greater than five meters.
- Back Slopes: In Nova Scotia, for a Freeway & Major Arterial roadway, the back slopes are noted as 3:1 and for a Minor Arterial A roadway as 2:1. However, it is noted that steeper slopes may be permitted as determined by laboratory tests for varying soils conditions.
    - A review of several Canadian jurisdictions indicated that the Nova Scotia Highway Design Guidelines are generally consistent to the guidelines being utilized across the Canada.
- Minimum ROW Width: A review of several Canadian jurisdictions indicated that the Nova Scotia Highway Design Guidelines are generally consistent to the guidelines being utilized across the Canada.

In summary, Nova Scotia Highway Design Guidelines are generally consistent with the Transportation Association of Canada (TAC)'s "*Geometric Design Guide for Canadian Roads*" and practices in other Canadian jurisdictions. However, it is recommended that NSTIR review the following areas of the Design Guidelines:

- The difference between the NS guideline of 2.5 m for outside useable shoulder width compared to the TAC guideline of 3.0 m.; and
- The use of 6:1 side slopes as indicated in the standard cross section, rather than 4:1, for freeway and major arterial roads as indicated in the design classification tables. Nova Scotia Highway Design Guidelines should be reviewed for consistency.

5.2 Observations and Recommendations Arising from Site Visit

Observations and recommendations related to various design and maintenance features along Highway 103 that arose from site visits by consultant team members are discussed and illustrated in the following sections.

5.2.1 Clear Zones

It is important to establish and maintain an adequate clear zone of 10m to 15m adjacent to the travelled lanes of major highways to protect occupants of errant vehicles from collisions with fixed objects. Fixed objects may include rocks, poles, signs, roadside culverts, and other existing or abandoned highway infrastructure, as illustrated by the following photos.

Photo 5-1: Land access and cross median culverts with vertical head walls often have fatal consequences for striking vehicles. Approach slopes should be approximately 10:1 with grates to prevent wheel entrapment.

Photo 5-2: Light standards with non-frangible bases become roadside hazards when located in the clear zone. Installations at intersections and exit ramps should use frangible bases.

Photo 5-3: This utility pole with multiple services is located at EXIT 26, Ohio Road, Shelburne. While poles are required to support overhead flashing warning lights, they should either be located outside the clear zone, or protected by an appropriate roadside barrier system.

Photo 5-4: The large sign and protruding rock are located approximately seven meters from the edge of pavement. Rock outcrops should be removed during construction; signs should either be located further from the road or protected by an appropriate roadside barrier system.

Photo 5-5: This appears to be an abandoned bridge abutment within the roadway recovery area which presents itself as a vertical wall to traffic leaving the roadway. This installation and similar roadside obstacles should either be removed during construction or protected by an appropriate roadside barrier system.

Photo 5-6: This is a utility cabinet that contains an NSTIR permanent traffic counter with guard rail perpendicular to the roadway. If protection is considered to be needed, an appropriate roadside barrier system should be installed parallel to the roadway

5.2.2 Shoulders

Shoulders along highways provide a safe separation between the travelled portion of the roadway and ditches, embankments, overpass columns, bridge rails, and other roadside obstacles, as well as providing an area for emergency stops. The *Nova Scotia Highway Design Guidelines* require a paved shoulder with dimensions of 2.0 metres out and 1.5 metres in for Freeway and Major Arterial roadways. The *Geometric Design Guide for Canadian Roads* recommends shoulder widths of 3.0 metres (out) and 1.5 metres (in), however, the Nova Scotia guide indicates useable shoulder widths of 2.5 metres (out) and 2.0 metres (in). The Study Area of Highway 103 has a variety of shoulder widths which are illustrated in the following photos.

Photo 5-7: Between Sable River and Broad River the paved and usable shoulder widths are significantly less than required by design guidelines. While the completion of the Port Joli and Port Mouton By-Passes will replace a portion of this section with current standard roadways, the remaining parts will still have narrow shoulders.

Photo 5-8: This section of highway has a reasonable usable shoulder width; however, the narrow paved shoulder presents a potential hazard for vehicles that may 'hit' the shoulder pavement drop-off. Current guideline width paved shoulders should be provided.

Photo 5-9: While the paved portion is wider than that shown in Photo 5-8, both the paved and usable shoulder widths are less than required by the design guidelines.

Photo 5-10: Paved and usable shoulder widths at this location appear to meet the Nova Scotia guideline requirements.

5.2.3 Guard Rail

Roadside barrier systems, commonly referred to as guardrails, are provided to protect vehicles from roadside obstacles and water hazards. Guardrail used in Nova Scotia has typically involved long 3.81 m (12‘6”) post spacing with buried ends. However, newer installations use short 1.905 m (6’3”) post spacing with blocks between the rail and the post to prevent an impacting vehicle from snagging a post, as well as energy attenuating end treatments. Several guardrail installations and roadside areas where a barrier system should be installed are illustrated in the following photos.

Photo 5-11: This installation includes 3.81 m (12'6") post spacing without blocks. It is also noted that there is only minimal embankment material behind the guardrail to provide lateral earth resistance to the posts.

Photo 5-12: While this location has a buried end treatment that may cause a striking vehicle to become airborne, the section beyond the end treatment includes 1.905 m (6'3") post spacing with blocks. This type of end treatment should not be used on freeway or major arterial roadways.

Photo 5-13: This impact attenuating end treatment is similar to the type that should be used on all guardrail end sections on Highway 103.

Photo 5-14: While the guardrail end treatment is appropriate, it appears that there is insufficient barrier approach length to adequately protect drivers from the roadside obstacle. It is recommended that barrier approach lengths be review on Highway 103 installations to confirm that there is sufficient length to adequately protect motorists from a hazard.

Photo 5-15: This recently repaved or upgraded area with a steep embankment slope near km 206.8 adjacent to a watercourse should be evaluated to determine if guardrail is required.

Photo 5-16: Concrete box culverts such as this one at km 105.1, and another one at km 104.5, protrude from the embankment within the clear zone. It is recommended that these installations be adequately protected by appropriate roadside barrier systems, or modified to provide adequate protection for motorists.

Photo 5-17: This photo illustrates a dangerous and somewhat hidden vertical drop-off at a twin culvert installation at km 123.9. It is recommended that this, and similar locations, installations be adequately protected by appropriate roadside barrier systems, or modified to provide adequate protection for motorists.

5.2.4 Bridge End Treatments

Special guardrail sections are required at bridge ends to provide a transition from the relatively flexible roadside guardrail sections to the rigid concrete bridge. While older road sections have often used a simple lap joint with a single bolt attachment, current installations use short post spacing, blocks, a steel rub rail, and five bolts. Typical installations on Interstate highways in the United States use a special transition from the standard W section to a tri-beam section, steel posts, and multiple bolts for bridge end treatments (Photo 5-21).

Bridge ends and columns in the median areas of divided highway sections should be protected by guardrail using 1.905 m (6’3”) post spacing with blocks between the rail and the post, and energy attenuating end treatments. Guardrail installations should be of sufficient length to minimize the possibility of a vehicle entering the median and falling into the space between the twinned bridges, or striking a bridge column.

Photo 5-18: The rails on the Jordan River Bridge do not meet the current requirements of the Canadian Highway Bridge Design Code. It is also noted that the approach guardrail does not appear to be fastened to the bridge end.

Photo 5-19: This is an example of the older style bridge end treatment where the single bolt is missing. Note that even if a vehicle striking this bridge end did not displace the guardrail and hit the crash block, it would hit the high curbed end section of the bridge rail system.

Photo 5-20: This is an example of a typical bridge end treatment. Note that the approach rail has closely spaced and blocked posts with an added steel wheel rub rail, and that the high curb section of the concrete bridge rail is no longer used.

Photo 5-21: This is an example of a typical bridge end treatment used on Interstate 95 in Maine.

5.2.5 Intersections

There are 32 identified at-grade intersections (Table 1-1) on the 210 kilometers of controlled access highway sections, including eight intersections where some, or all, turns are prohibited (Photo 5-22). While not individually identified, there are also several additional private residential driveway and cottage access road intersections (Photo 5-23) where vehicles have unrestricted movements in 100 km/h speed zones.

Photo 5-22: While this type of warning sign has been used at some intersections where turns are prohibited, the use of advance warning signs is inconsistent.

Photo 5-23: This photo is typical of a driveway access directly onto a 100 km/h controlled access section of Highway 103. Since motorists travelling on the highway of this classification do not expect driveway accesses, these locations are potentially hazardous for both highway and driveway users.

The following additional observations and recommendations apply to intersections on controlled access highway sections:

1. Since there are many intersections where turns are prohibited, it is recommended that a standard approach for intersection advance warning signage be developed and implemented so motorists will have appropriate and consistent notice of these intersections in 100 km/h zones on controlled access highway sections.
2. Since drivers who have travelled considerable distance on sections with full access control where all intersecting roads are grade separated, or have interchanges, do not expect to encounter an at-grade intersection, a program should be developed to construct overpasses and / or interchanges to eliminate these intersections. Century Drive near

Bridgewater, Ohio Road at Shelburne, the planned intersection at Port Mouton, Pubnico, and at-grade intersections in Yarmouth County, should all be included in this program.

3. A program should be developed to remove private driveway accesses from controlled access sections.
4. While most intersections with paved roads have left turn lanes, and many have right turn lanes, volumes at the following intersections should be evaluated to determine if additional turning lanes are required and reviewed considering timing of recommended grade separations:
    - Nakile Drive (Argyle) – eastbound right turn lane;
    - Ohio Road (Shelburne) – eastbound acceleration lane;
    - Planned intersection Port Mouton – turning lanes;
    - Port Medway Road (Mill Village) – right turn lanes; and
    - Route 331 (Mill Village) – right turn lanes.
5. Left turn lanes on high speed rural highways are usually designed with a painted deflecting bulb to separate the through traffic from left turning vehicles as shown in Figure 5-2. However, some intersections (Table 1-1) including EXIT 27 Birchtown, EXIT 25 Shelburne, and EXIT 23 Sable River, were constructed as an urban type of left turn lane that does not have a bulb. These intersections should be upgraded with signage and pavement markings to identify lane usage and to avoid motorist confusion.

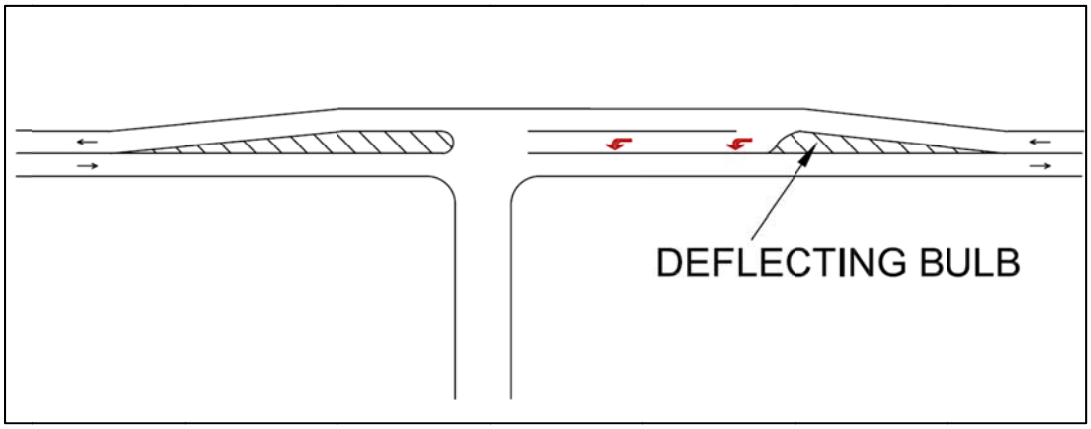


Figure 5-2 - Left Turn Lane Sketch Showing Painted Deflecting Bulb

6.0 Identification of Improvement Projects

The projects discussed in the following sections are intended to improve highway safety and to upgrade the 274 kilometers of Highway 103 from the end of existing four-lane highway to Yarmouth to a fully control access highway over the next 20 years.

6.1 Potential Interventions to Improve Highway Safety

6.1.1 Speed Control

The following human factors techniques have been considered as interventions to reduce speed to reduce crash occurrence and severity.

- **High visibility enforcement (HVE).** NSTIR should enlist the cooperation of the RCMP Highway Patrol to provide enforcement in a sustained and very visible manner particularly in the eastern sections from Halifax to Chester. Police presence would deter drivers from violating traffic regulations. There are several proven methods for producing sustained reductions in speeding behavior. One method is to issue warnings to drivers travelling five more km/h over the speed limit. Stops should be accompanied by a flyer describing fatalities and serious injuries related to speeding over the past 5 years. These flyers help to produce buy in for the program, and stops to warn drivers traveling five km/h or more over the speed limit increases the frequency of stops and will convey the message that the speed limit does not have as much 'cushion' as driver experience may have suggested.

  Speed enforcement should be carried out at locations where vehicles violating the speed limit can be flagged by police vehicles with flashing lights and a portable sign reading speed enforcement. This approach contributes to educate drivers passing the flagging site who were not speeding at that point in time. Because most crashes occurred during daylight hours, enforcement should focus on these times, particularly during the afternoon hours.

- **Photo radar to deliver warnings**. An innovative way of enhancing police stops is to install radar speed controlled cameras to provide warnings, along with educational flyers documenting crashes where speeding was a factor, to all drivers caught exceeding the speed limit by five km/h or more. These flyers should also mention the most recent crash statistics for Highway 103. Camera locations should be moved periodically and should be located at areas with a higher proportion of crashes.

- **Radar controlled speed feedback signs.** The use of radar controlled signs that display the posted speed limit, as well as actual vehicle speed, provide an effective method to

remind speeding drivers of the need to slow down and reinforce speed zone changes. These signs are particularly effective at locations where there are significant reductions in the posted speed limit at the entrance to communities, or near curves and interchanges with a crash history. These signs have been used effectively on the approaches to toll booths on the Cobequid Pass (Highway 104) and the MacKay Bridge in Dartmouth. To enhance their continued effectivity, the signs should remain blank and not display speeds in the lower or higher speed thresholds.

6.1.2 General Highway Safety

The following human factors techniques have been considered to provide general highway safety education to motorists:

- **Speeding feedback signs**. These signs should be placed at the entrance and exit of communities along the route to target regular road users who live along the route. The signs would post the percentage of drives not speeding during the previous week along with the record. In order to install these signs it would be necessary to obtain data on speeding which could be obtained by solar powered speed signs or speed cameras.

- **Changeable safety message signs.** These signs could display messages concerning the dangers of cell phone use and texting while driving, the need to adjust speed to weather and road conditions, and other safety considerations that are deemed important from time to time. The installation of changeable message advisory signs at strategic locations can help increase the efficacy of the speed cameras. These signs should provide a variety of safety messages, some examples of which may include the following:
    - DRIVE ATTENTIVELY
    - DON'T TEXT AND DRIVE – ARRIVE ALIVE!
    - WATCH FOR MOTORCYCLES
    - REDUCE SPEED ON WET PAVEMENT
    - REDUCE SPEED ON SNOW AND ICE
    - BUCKLE UP! IT'S THE LAW!
    - IS YOUR SEAT BELT FASTENED?

- **Outreach to commercial transport vehicle operators**. Since commercial trucks and buses travel the Study Area of Highway 103 frequently, often on a daily basis, it could be advantageous to obtain feedback from drivers with regards to road conditions and driving habits. A quarterly outreach to commercial transport operators concerning their observations of traffic and road conditions will not only provide added information with regards to potential safety concerns in the study area, but will also provide an opportunity for commercial operators to monitor transportation safety within their respective fleets.

6.2 Highway Twinning Projects

While NSTIR guidelines include twinning of highway sections when AADT volumes are projected to exceed 10,000 vpd, many sections of highway now have AADT volumes exceeding 12,000 vpd before twinning is completed. Since review of fatal collisions in the Highway 103 Study Area indicated a strong correlation between high AADT volumes (Figure 3-1) and the areas with higher numbers of fatal collisions (Figure 3-3), it seems wise to review the 10,000 vpd twinning guideline and 20 year volume projections throughout the Study Area.

While the 38 kilometers included in Sections 040 to 060 between Tantallon and Chester accounts for only 14% of the Study Area of Highway 103, it accounts for 28% of the vehicle kilometers of travel and 11 of the 22 (50%) of the fatal crashes between 2007 and 2012. Review of collision types (Table 3-4) indicates that ten of these collisions involved vehicles crossing the centerline and striking vehicles travelling in the opposite direction, while only six of the eleven collisions on the other 236 kilometers of the Study Area involved that collision type.

Projected 2014 AADT volumes in Sections 040 to 060 range from 11,300 vpd between Tantallon and Hubbards (Sections 040 and 045) to 8,700 vpd between East River and Chester (Section 060). These sections, as well as other road sections between Chester and Bridgewater, include significant commuter trips, so that they may have higher peak hourly volumes than would normally be expected from review of AADT volumes. Since twinning of roadways has proven effective in preventing most head-on collisions, plans should be prepared when AADT volumes approach 8,000 vpd so that construction can be completed before volumes approach 10,000 vpd. Twinning could also be considered for sections where additional passing opportunities are required, even though the volume may be less than 8,000 vpd.

It is recommended that the following sections be considered for twinning by 2034:

- 80 kilometers from west of Tantallon to Hebbville to address projected volumes; and
- Monitor volumes and collision experience for the section from Yarmouth to EXIT 33 (Tusket) to determine if some twinning is required to provide passing opportunities.

6.3 Climbing Lanes and Passing Areas

While there are numerous climbing lanes, and a short section of four lane road, in the eastern part of the Study Area between Tantallon and Bridgewater, as well as between EXITS 17 and 19 (Liverpool) and in the section between EXITS 24 and 27 (Shelburne), there are few climbing lanes in Yarmouth County. The 13.75 kilometer section between EXIT 9 at Chester Basin and EXIT 10 near Mahone Bay also has an approximately 10 kilometers long section without climbing lanes.

NSTIR has prepared preliminary plans to construct two sections of 2 +1 lanes to provide passing opportunities between EXITS 9 and 10; however, since this section should be considered for future twinning, it would be unwise to spend several million dollars on a temporary widening

project. Since the section of highway is relatively flat such that there will not be significant cuts and fills, twinning should not be as complicated as in other areas. It is recommended that an approximately 2 km to 3 km section be considered for twinning to provide passing opportunities in this area while also achieving part of the longer term need to complete twinning through the section.

Twinning parts of the ten kilometer section between Yarmouth and EXIT 33 at Tusket, as well as consideration of a 2+1 passing lane section east of EXIT 32 (Pubnico), should be considered to provide passing opportunities.

6.4 New and Upgraded Controlled Access Projects

There are four sections that need to be upgraded with some requiring new construction for three existing uncontrolled access sections (Table 1-2); as well as for a section of road between Shelburne and Jordan Falls now designated as controlled access that requires significant upgrading. All sections of Highway 103 should be upgraded to provide full control of access and planning should begin for new controlled access highway sections to replace the following:

- Approximately 23 kilometers from EXIT 29 at Barrington to EXIT 27 at Birchtown, including the Clyde River By-Pass;
- Approximately 6 kilometers of highway between EXIT 25 east of Shelburne to EXIT 24 at Jordan Falls which is designated as a controlled access highway section but has several intersections and requires construction of the Jordan Fall By-Pass;
- Approximately 14 kilometers from EXIT 23 Sable River to the west end of the Port Joli By-Pass, including the Sable River By-Pass; and
- Approximately 15 kilometers from the Queens / Lunenburg County Line at Danesville to EXIT 14 Hebbville.

6.5 Intersections on Controlled Access Highway Sections

While many of the existing intersections on controlled access sections (Table 1-1) will be eliminated by construction of the four highway sections discussed in Section 6.4, and others will eventually be eliminated by twinning projects over the next 20 years, others will require site specific spot improvements. A proposed program for elimination of all intersections is included in Table 6-1.

While many of the intersections are on lower volume sections of highway and possibly with low intersecting volumes, several intersections – including those in Yarmouth County, the Ohio Road (EXIT 26) intersection, the proposed new EXIT 20 intersection at Port Mouton, and Century Drive near Bridgewater – are in long sections of fully controlled access highway and as such will be unexpected by many road users. These at-grade intersections should be eliminated by construction of overpasses or interchanges on a schedule suggested in Table 6-1.

Table 6-1: Intersections Recommended for Elimination on Controlled Access Sections

Section Decription	Km [1]	Length (Km)	Intersections (Km, Road Name, Details)			
			No. [2]	Km [1]	Road Name	Elimiation Details[3]
Hardscratch Road Yarmouth to EXIT 29 Barrington East	0.0 - 61.8	61.8	1	6.4	Mood Road	Priority B (Overpass)
			2	9.0	Raynardton Road	Priority B (Overpass)
			3	15.4	Eel Lake Road	Priority B (Overpass)
			4	19.9	Argyle Head Road	Priority B (Service Road)
			5	21.9	EXIT 32A - Trunk 3	Priority A (Include Intersections 13 to 16 in two Interchanges - Figure 6-1)
			6	22.8	Nakile Drive	
			7	22.9	EXIT 32 - Trunk 3	
			8	36.0	EXIT 31 - Pubnico	Priority A (Interchange)
			Shelburne County Line (Km 50.3)			
			9	61.8	EXIT 29 - Barrington East	Priority C (Part of New Alignment)
EXIT 27 Birchtown to EXIT 23 Sable River	84.9 - 115.4	30.5	10	84.9	EXIT 27 - Trunk 3 Birchtown	Priority C (Part of New Alignment)
			11	91.9	EXIT 26 - Ohio Road	Priority A (Interchange)
			12	92.6	Wright Road	Priority B (Service Road)
			13	95.9	EXIT 25 - Trunk 3 - Shelburne East	Priority C (Intersections 13 to 16 are Included in New Alignment)
			14	96.7	Lake George Access Road	
			15	101.1	Jordan Branch Road	
			16	101.6	EXIT 24 - Trunk 3 - Jordan Falls	
			17	115.4	EXIT 23 - Trunk 3 - Sable River	Priority C (Part of New Alignment)
EXIT 20 Broad River to East of Danesville	142.7 - 179.5	36.8	**Queens County Line (Km 124.9)**			
			18	142.7	EXIT 20 - Trunk 3 - Broad River	Priority A (Interchange)
			19	153.6	EXIT 20A - Liverpool West	Priority A (Interchange)
			20	165.4	EXIT 18 - Trunk 3 - Brooklyn	Priority C (Interchange)
			21	169.6	Port Medway Road	Priority C (Interchange)
			22	170.0	Old Kettle Road	Priority C (Service Road)
			23	171.5	EXIT 17 - Route 331	Priority C (Interchange)
			24	174.3	Hillsview Drive; Mill Village	Priority C (Overpass and Service Road)
			25	174.8	Old Trunk 3; Danesville West	Priority C (Service Road)
			Lunenburg County Line (177.2)			
			26	177.3	Old Trunk 3; Danesville East	Priority C (Part of New Alignment)
			27	178.2	Connolly Loop Road West	Priority C (Part of New Alignment)
EXIT 14 Hebbville to Beginning 4-lane Tantallon	192.6 - 273.5	80.9	28	192.8	EXIT 14 - Trunk 3 - Hebbville	Priority C (Part of New Alignment)
			29	197.7	Century Drive	Priority B (Overpass)
			30	226.8	Cottage Access (between EXITS 10 and 9)	Priority B (Part of Twinning Project)
			Halifax County Line (254.5)			
			31	255.0	Cottage Access (just east of EXIT 6)	Priority A (Part of Twinning Project)
			32	271.1	Bowater Forest Access	Priority A (Part of Twinning Project)
TOTAL		210.0				

NOTES:

1. Kilometer posts on Highway 103 start a 0 km at Hardscratch Road, Yarmouth, and approximately 274 km at the beginning of four lane road near Tantallon.
2. These intersection numbers are shown on Figure 1.2.
3. Recommendations have been arranged as Priority A, B, and C. While not intend to indicate specific priorities for project implementation, items in Priority A should be considered during the earlier years of the Action Plan, with those in Priority C considered in the later years, of the 20 year Action Plan.

The EXIT 26 (Ohio Road) intersection at Shelburne should be considered for replacement by an interchange during the early years of the proposed 20 year Action Plan (Table 7-1, Priority A). The following intersections should be considered for replacement with interchanges in later years (Priority B) to remove the 'surprise' element of intersections in long sections of controlled access highway as discussed in Section 6.5:

- Three intersections at EXITS 32 and 32A at Argyle; see Proposed Concept on Figure 6-1;
- EXIT 31 Pubnico; and
- EXIT 20A west of Liverpool.

NOTES:

1. ALL PROPOSED CHANGES SHOWN ARE CONCEPTUAL ONLY. LAYOUT SUBJECT TO CHANGE BASED ON PROPERTY BOUNDARY AND ENVIRONMENTAL RESTRICTIONS.
2. ALL PROPERTY BOUNDARIES SHOWN ARE APPROXIMATE ONLY AND MAY NOT REFLECT AMENDMENTS SINCE 2007.
3. AERIAL IMAGERY TAKEN FROM 2015 GOOGLE EARTH.

SCALE

0 100 200 Meters

Drawn: P. NICKERSON

Checked: G. O'BRIEN, K. O'BRIEN

FIGURE 6-1: ARGYLE INTERCHANGE CONCEPT

HIGHWAY 103 SAFETY REVIEW

NOVA SCOTIA
Transportation and Infrastructure Renewal

APRIL 2015 141-20229

WSP

FILE: K:\DARTMOUTH\201.41\141-20229 NSTIR_HWY 103 SAFETY REVIEW\11_DWG\11.7_TRAFFIC\141-20229 - FIGURES.DWG Sheet Figure 6-1

7.0 Summary and Recommendations

7.1 Summary

Details of the review and analysis of the Study Area of Highway 103 are included in the following sections.

7.1.1 Traffic Volumes

Study Area 2014 AADT volumes vary from 11,300 vehicles per day (vpd) at the east end (Tantallon), to a low of 1,550 vpd at Barrington, and then increase to 6,000 vpd at the west end (Yarmouth). Highway sections at the east end between Tantallon and Bridgewater, where 2014 volumes vary from 11,300 vpd to 8,900 vpd, include significant commuter traffic travelling to and from Halifax which result in high AM and PM peak directional traffic volumes. Also, following completion of the Ingramport Interchange and connector to Trunk 3 in 2017, it is estimated that the 2017 AADT for Section 040 between Tantallon and the new interchange will increase to approximately 14,500 vpd, with volumes increasing to 16,100 vpd in 2024 and 18,400 vpd in 2034. Projected 2024 and 2034 volumes in Section 045 between the Ingramport Interchange and Hubbards are expected to be 13,200 vpd and 15,100 vpd, respectively. The annual volume growth rates for other sections average approximately 1.7% at the eastern end of the Study Area and 1.2% at the western end.

7.1.2 Collision Data

The following observations emanate from review of the average collision rates for 2007 to 2012:

- There is no significant variation between the overall collision rates for the Highway 103 Study Area, Highway 103 controlled access sections, and the Nova Scotia average collision rates for controlled access highways.
- While the 38 kilometer section included in Sections 040 to 060 between Tantallon and Chester accounts for only 14% of the Study Area of Highway 103, it accounts for 28% of the vehicle kilometers of travel and 50% of the fatal crashes.
- The 50 kilometer section included in Sections 245 to 270 in Yarmouth County accounts for 18% of the Study Area of Highway 103 and 14% of the vehicle kilometers of travel, however, it accounts for 27% of the fatal crashes.
- The fatal collision rate of 1.5 per Hundred Million Vehicle Kilometers (HMVK) for the sections between Tantallon and Chester, and in Yarmouth County, is significantly higher than the 0.9 per HMVK for controlled access two lane sections and five times the 0.3 per HMVK Provincial average for four-lane divided highway sections.

Examination of the locations, dates, light, weather, and road surface conditions, and contributing factors to the 22 fatal crashes during 2007 to 2012 indicated that the majority (67%) involved two vehicles travelling in opposite directions hitting one another head-on during ideal light, weather and road surface conditions. While not stated in the collision files that were provided by

NSTIR, it is concluded that lack of driver attention and speed to fast for road conditions were the primary contributing factors to most of the 22 fatal collisions.

7.1.3 Access Control

At the end of 2014 there were 210.0 kilometers of controlled access highway in the Study Area and 63.5 km of highway without access control. With the completion of the Port Joli and Port Mouton By-Passes in 2016, and the future completion of the section between the two bypass sections, the existing 13.8 km of roadway without access control will be replaced with approximately 12 km of controlled access highway. While controlled access sections of Highway 103 are usually free of private entrances and many sections have interchanges and overpasses to eliminate vehicle conflicts, some sections with generally lower volumes have been constructed with intersections to provide access or crossing of the highway. A program to remove private driveways, and replace existing and planned at-grade intersections on controlled access highway sections with overpasses or interchanges, should be developed to ensure public safety on those highway sections.

7.1.4 Posted Speed Limits

While the majority of the Study Area has a posted speed limit of 100 km/h, 44.5 km (16%) of the section has posted speeds of 90 km/h or less (Table 1-3). However, with the future completion of the Port Joli to Broad River project, the existing 13.8 km of roadway which is now posted at 90 km/h, 80 km/h and 60 km/h, will be replaced with approximately 12 km of highway which is likely to be posted at 90 to 100 km/h.

7.1.5 Climbing Lanes and Passing Areas

While there are numerous climbing lanes, and a short section of four lane road, in the eastern part of the Study Section between Tantallon and Bridgewater, as well as between EXITS 17 and 19 (Liverpool) and in the section between EXITS 24 and 27 (Shelburne), there are few climbing lanes in Yarmouth County.

7.1.6 Stakeholder Responses

The responses from the various Stakeholders have been summarized under the following 3 Es of Highway Safety in Table 7-1:

Table 7-1: Summary of Stakeholder Responses

Engineering	• More four-lane highway is needed to reduce the potential for head-on collisions, even if toll roads are required. • At-grade intersections on controlled access sections need to be replaced by overpasses. • Sections with poor alignment need to be upgraded or by-passed. • Shoulders need to be widened and maintained. • Roadside bushes have to be cut back to provide improved visibility. • Increase in lane passing opportunities
Education	• Drivers need to travel within the posted speed limits and to adjust speed in accordance to road and traffic conditions. • Drivers should be reminded that a few seconds of distraction from the driving task could lead to disastrous consequences. • Install changeable message signs to provide safety messages • Head lights should be turned-on during poor driving conditions so that tail lights will also be lighted.
Enforcement	• A greater visibility of police is required along the highway to promote better driving habits from motorists. • More enforcement of speed and driver distraction laws is required. • Install radar controlled speed feedback signs to alert motorists to reduced speed zones.

7.1.7 Highway Maintenance

Review of NSTIR Maintenance Standards, site visits, and Stakeholder feedback; have indicated the following areas where better adherence to maintenance standards is required:

- Many areas were noted with excessive shoulder drop-off from the edge of pavement.
- Ditches and back slopes have trees and tall brush that block sight distance and hide animals, such as deer, near the roadway.
- Areas have been noted where pavement rutting could cause hydroplaning.
- Guide posts are still being used, rather than guardrail.
- Guardrail installations need maintenance to adjust height and straighten posts.
- Many regulatory and warning signs are worn and faded.
- While pavement markings were good when reviewed in October, lines and arrows could be in poor condition by the next spring.
- There have been reported variations in snow and ice control between patrol areas. Also, black ice problems have been noted at Gold River Bridge and other areas.

7.1.8 Highway Design

Site visits and review of collision data indicate the following areas where changes to design standards or better adherence to existing design standards are required:

- There are many fixed objects, such as, rocks, poles, signs, roadside culverts, and other existing or abandoned highway infrastructure within the roadside clear zone.
- Side slopes and back slopes appear to be steeper than acceptable in some jurisdictions.
- Many paved shoulders are much narrower than the standards for 2.0 meters outside and 1.5 meters inside.
- There is not a consistent use of deceleration and acceleration lanes on approaches to interchanges and intersections.
- Review of collision data indicates high incidence of deer collisions in some areas.
- Most guardrail installations use long 3.81m (12’6”) post spacing without blocks.
- The short four-lane section at EXIT 9 has a relatively narrow and flat median that should have a barrier, possibly cable guardrail, to prevent cross median collisions.
- Many locations, such as at the ends of large culverts, do not have roadside barriers.
- Most guardrail end treatments are the buried type.
- While most bridges are equipped with the Nova Scotia standard post and anchorage system, some installations require maintenance or upgrading.
- There are many private driveways and intersections on controlled access highway sections.

7.1.9 Human Factors (Education and Enforcement)

Human factors review of the details and contributing factors for the 22 fatal collisions indicated the following:

- High volumes and speed contribute to both the probability and severity of collisions on two lane highways.
- Speed too fast for road conditions, such as wet or snow covered surfaces, also contributes to collisions.
- Inattention and distraction to the driving task is a primary contributing factor to collisions.
- Highly visible enforcement could promote reduced driving speeds and good driving habits.
- Speed recording cameras and feedback signs may also be useful in reducing higher end speeds.
- Changeable message signs can be used to inform motorists of road and traffic conditions and to promote safe driving habits.

7.2 Recommendations

The following recommendations emanate from the review and analysis of volume projections, collision data, maintenance and design standards, site visit observations, and human factors evaluation of the Highway 103 Study Area.

7.2.1 Maintenance

The following maintenance activities should be performed as soon as possible and should be reviewed and acted on as often as required in future years:

1. Consider changes to maintenance standards to maintain gravel shoulders with excessive drop-off from the edge of pavement and continue maintenance activities to ensure that drop-offs do not exceed 50 mm.
2. Remove trees and brush from ditches and back slopes and continue to control roadside vegetation to maintain passing sight distance and provide better visibility of roadside areas where animals, such as deer, may be near the roadway.
3. Post appropriate warning signs at areas where pavement rutting has become a problem and implement corrective measures.
4. Remove guide posts and replace with guardrail or flexible delineators as appropriate.
5. Review existing guardrail installations; adjust height and straighten posts as needed.
6. Replace worn and faded regulatory and warning signs. Examine the retroreflective qualities of large green destination signs and replace those that are no longer visible at night.
7. Review regulatory and maintenance signing at intersections or approaches to intersections where turns are prohibited and ensure that appropriate and consistent signing is provided to advise motorists of these intersections.
8. Ensure that pavement marking lines and arrows are maintained so that they provide guidance during all seasons of the year. Consider use of 150 mm wide lines, rather than 100 mm wide lines, to increase conspicuity.
9. Review winter maintenance standards to ensure that snow and ice control activities are uniform throughout the Study Area of Highway 103.
10. Become aware of, and react to, localized winter conditions, such as black ice at Gold River Bridge, or other winter road problems, such as open areas subject to blowing or drifting snow.

7.2.2 Design

While the Design Standards used by NSTIR for roads such as Highway 103 are generally comparable to those used across Canada, three areas have been noted where review is required:

1. Maintain gravel shoulders with excessive drop-off from the edge of pavement and continue maintenance activities to ensure that drop-offs do not exceed 50 mm.
2. Consider changing the Nova Scotia Guideline of 2.5 m for outside useable shoulder width to 3.0 m included in the Transportation of Canada (TAC) guideline; and

3. The use of 6:1 side slopes as indicated in the standard cross section, rather than 4:1, for freeway and major arterial roads as indicated in the design classification tables. Nova Scotia Highway Design Guidelines should be reviewed for consistency.

Site reviews by Consultant team members, as well as stakeholder feedback, have indicated the following areas that require changes in the standard designs used by NSTIR:

4. Install centerline and shoulder rumble strips during construction or repaving projects; ensure that rumble strips are replaced after micro-sealing or repaving.
5. Roadside design should include establishment of an adequate clear zone with removal of fixed objects such as rocks, poles, signs, roadside culverts, and other existing or abandoned highway infrastructure within this area.
6. Designs for new construction and paving projects for Freeway and Major Arterial roadways should include 2.0 meter paved shoulders on all two-lane sections, or 2.0 meters outside and 1.5 meters on the inside for divided roadways.
7. Intersection and interchange designs should include provision for appropriate and consistent acceleration and deceleration lanes.
8. Consider design of two trial sections of animal fencing at the following locations:
    - Section 110 – EXIT 12 to EXIT 13 Bridgewater; and
    - Section 240 – EXIT 30 at Barrington to the Shelburne / Yarmouth County Line.
9. The standard for roadside barrier system (guardrail) installations should be changed to short 1.905 m (6’3”) post spacing with blocks between the rail and the post on all new and replacement locations on Freeway and Major Arterial roadways. Design standards for guardrail placement should be reviewed to ensure that all potentially hazardous areas are protected and that adequate length of guardrail is provided to protect the approach to a roadside hazard.
10. Energy attenuating type guardrail end treatment should be designed and required for all Freeway and Major Arterial roadways rather than the buried end type.
11. Review the current standard design for bridge end treatment and consider the use of a transition section from the standard W section to a tri-beam section, steel posts, and multiple bolts for bridge end treatment, similar to that used on the US Interstate system.
12. Bridge ends and columns in the median areas of divided highway sections should be protected by guardrail installations should be of sufficient length using 1.905 m (6’3”) post spacing, and energy attenuating end treatments.
13. Designs for new and upgraded controlled access sections of Freeway and Major Arterial roadways should include removal of all private driveway accesses, as well as provision of grade separations or interchanges at all intersecting roadways.

7.2.3 Education and Enforcement

The following education and enforcement recommendations have emanated from the Human Factors review of the Study Section:

1. Work with the RCMP Highway Patrol detachments to develop a High Visibility Enforcement (HVE) program for the Study Section.
2. Use photo radar to provide warning letters for drivers exceeding the speed limit by more than 10 km/h.
3. Install radar controlled speed feedback signs on the approaches to the 80 km/h speed zone in Clyde River, as well as other areas where drivers may need reminded of speed limit changes.
4. Install changeable message signs to show messages aimed at reducing driver distraction, the need to adjust speed to road conditions, or other safety related messages to promote safer driving habits.

7.2.4 Planning and Construction

Planning and construction recommendations have been proposed to provide a 20 year Action Plan to complete a fully controlled access Highway 103 by 2034. The following factors have been considered when preparing the action plan:

1. At-grade intersections on fully controlled access roadway sections should be replaced with interchanges or grade separations based on intersecting volumes, as well as to provide continuity of access control throughout a road section. An at-grade intersection on a long section of otherwise fully controlled access roadway may be unexpected by many drivers.
2. While construction of new sections of controlled access highway may not occur for several years, route location and land use plans should be prepared soon to ensure development does not block possible alignments.
3. New sections of controlled access highway should be constructed based on projected traffic volumes and to eliminate 'missing links' in otherwise long sections of fully controlled access highway.
4. Planning for twinning should begin when AADT volumes approach 8,000 vpd so that construction could be completed before volumes approach 10,000 vpd.
5. Short sections of twinned highway or 2 +1 passing lane sections should be considered to provide additional passing opportunities in areas with higher traffic volumes and where passing opportunities are not satisfied by climbing lanes.

Planning and construction recommendations have been arranged in three groups identified as Priority A, B, and C in Table 7-1 and illustrated in Figure 7-1. While this is not intended to indicate specific priorities for project implementation, items in Priority A should be considered during the earlier years of the Action Plan, with those in Priority C considered in the later years, of the 20 year Action Plan.

Order of magnitude cost estimates have been included for each recommendation using $ symbols. While actual cost estimates have not been determined, the following 'scale' has been used: $ - less than 500,000; $$ - 500,000 to 10M; $$$ - 10M to 20M; $$$$ - 20M to 50M; and $$$$$ - more than 50M.

Table 7-2: Recommendations for Highway 103 Construction Projects

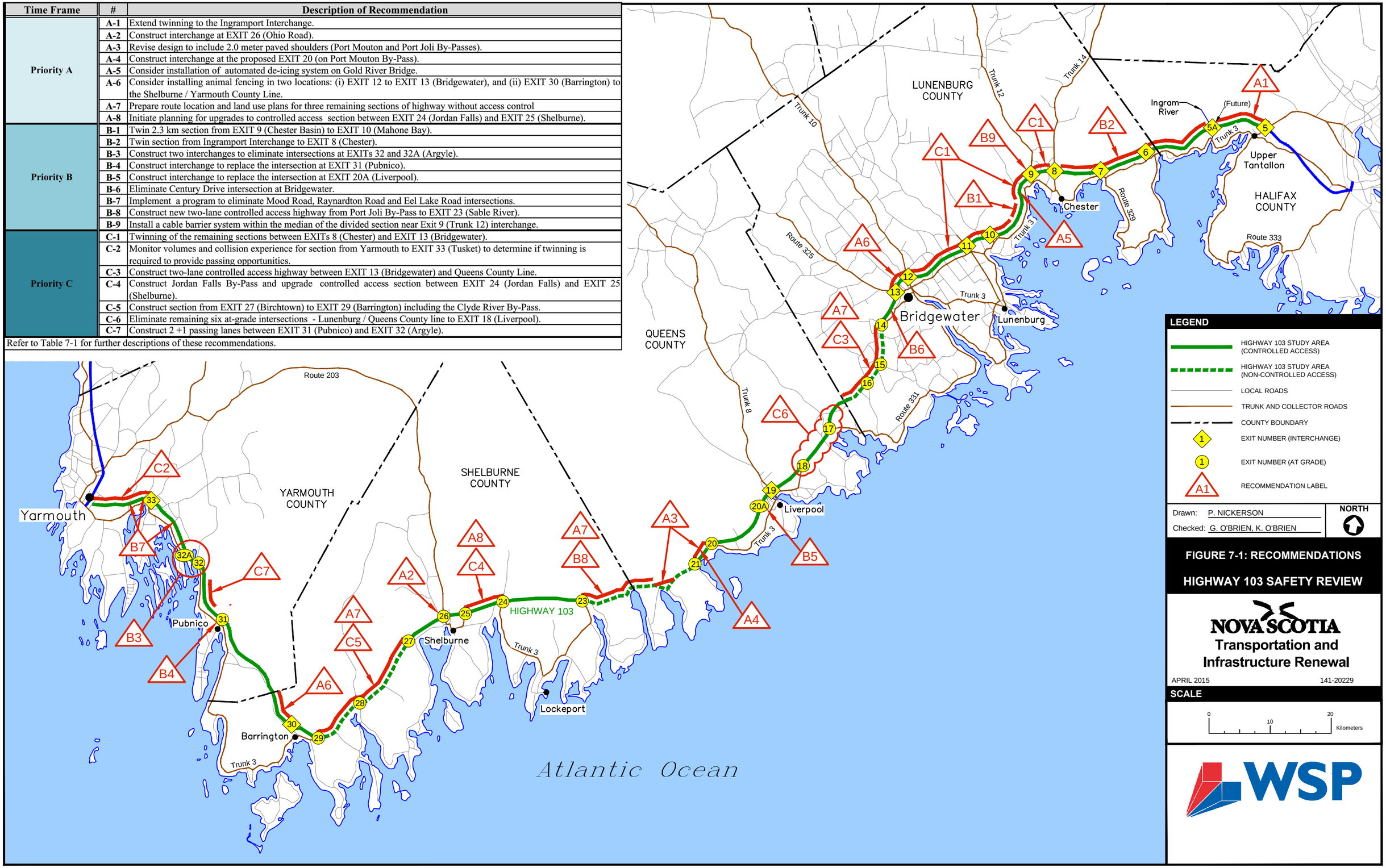
	#	Description	Estimated Cost
Priority A	**A-1**	Twin Highway 103 Section 040 between the end of the existing four-lane section and the Ingramport Interchange	$$$$
	A-2	Construct an interchange to replace the Ohio Road intersection (EXIT 26)	$$
	A-3	Review and revise the design for the Port Mouton and Port Joli By-Passes to include 2.0 meter paved shoulders.	$
	A-4	Construct an interchange rather than an intersection at the proposed new EXIT 20 on the Port Mouton By-Pass.	$$
	A-5	Consider installation of an automated de-icing system on the Gold River Bridge, potentially as a pilot project in NS.	$
	A-6	Consider installation of sections of animal fencing between EXITS 12 and 13 (Bridgewater) and EXIT 30 (Barrington) and the Shelburne / Yarmouth County Line, potentially as a pilot project to review performance in NS.	$
	A-7	Prepare route location and land use plans for three remaining sections highway without access control involving approximately 50 kilometers of new construction.	$$
	A-8	Prepare route location and land use plans for upgrading the controlled access highway section from EXIT 24 (Jordan Falls) to EXIT 25 (Shelburne), including the Jordan Falls By-Pass.	$
Priority B	**B-1**	Construct a 2 to 3 kilometer section of twinned highway to provide passing opportunities between EXIT 9 (Chester Basin) and EXIT 10 (Mahone Bay).	$$
	B-2	Twin sections from Ingramport Interchange to EXIT 8 (Chester).	$$$$$
	B-3	Construct two interchanges to eliminate intersections at EXITs 32 and 32A (Argyle) as shown on Figure 6-1.	$$$
	B-4	Construct an interchange to replace the intersection at EXIT 31 (Pubnico).	$$
	B-5	Construct an interchange to replace the EXIT 20A intersection (Liverpool).	$$
	B-6	Eliminate the Century Drive intersection at Bridgewater.	$$
	B-7	Develop and implement a program to eliminate the Mood Road, Raynardton Road and Eel Lake Road intersections in Yarmouth County.	$$$
	B-8	Construct a new two-lane controlled access highway from the Port Joli By-Pass to EXIT 23 (Sable River), including a Sable River By-Pass.	$$$$
	B-9	Install a cable barrier system within the median of the existing divided section in the vicinity of the Exit 9 (Trunk 12) interchange.	$
Priority C	**C-1**	Complete twinning of the remaining sections between EXITs 8 (Chester) and EXIT 13 (Bridgewater).	$$$$$
	C-2	Monitor volumes and collision experience for the section from Yarmouth to EXIT 33 (Tusket) to determine if some twinning is required to provide passing opportunities.	$$
	C-3	Construct a new two-lane controlled access highway in Lunenburg County between EXIT 13 (Bridgewater) and the Queens County Line.	$$$$$
	C-4	Construct the Jordan Falls By-Pass and upgrade the controlled access section between EXIT 24 (Jordan Falls) and EXIT 25 (Shelburne).	$$$$
	C-5	Construct the section from EXIT 27 (Birchtown) to EXIT 29 (Barrington) including the Clyde River By-Pass.	$$$$$
	C-6	Eliminate the remaining six at-grade intersections between the Lunenburg / Queens County line including EXIT 18 (Liverpool).	$$$$
	C-7	Construct 2 +1 passing lanes between EXIT 31 (Pubnico) and EXIT 32 (Argyle).	$$

NOTES:

1. While the indicated Priorities do not intend to indicate specific timing for project implementation, items in Priority A should be generally be considered during the earlier years of the Action Plan, with those in Priority C considered in the later years, of the 20 year Action Plan.
2. Order of magnitude cost estimates have been included for each recommendation using $ symbols. While actual cost estimates have not been determined, the following 'scale' has been used: $ - less than 500,000; $$ - 500,000 to 10M; $$$ - 10M to 20M; $$$$ - 20M to 50M; and $$$$$ - greater than 50M.

Time Frame	#	Description of Recommendation
Priority A	A-1	Extend twinning to the Ingramport Interchange.
	A-2	Construct interchange at EXIT 26 (Ohio Road).
	A-3	Revise design to include 2.0 meter paved shoulders (Port Mouton and Port Joli By-Passes).
	A-4	Construct interchange at the proposed EXIT 20 (on Port Mouton By-Pass).
	A-5	Consider installation of automated de-icing system on Gold River Bridge.
	A-6	Consider installing animal fencing in two locations: (i) EXIT 12 to EXIT 13 (Bridgewater), and (ii) EXIT 30 (Barrington) to the Shelburne / Yarmouth County Line.
	A-7	Prepare route location and land use plans for three remaining sections of highway without access control
	A-8	Initiate planning for upgrades to controlled access section between EXIT 24 (Jordan Falls) and EXIT 25 (Shelburne).
Priority B	B-1	Twin 2.3 km section from EXIT 9 (Chester Basin) to EXIT 10 (Mahone Bay).
	B-2	Twin section from Ingramport Interchange to EXIT 8 (Chester).
	B-3	Construct two interchanges to eliminate intersections at EXITs 32 and 32A (Argyle).
	B-4	Construct interchange to replace the intersection at EXIT 31 (Pubnico).
	B-5	Construct interchange to replace the intersection at EXIT 20A (Liverpool).
	B-6	Eliminate Century Drive intersection at Bridgewater.
	B-7	Implement a program to eliminate Mood Road, Raynardton Road and Eel Lake Road intersections.
	B-8	Construct new two-lane controlled access highway from Port Joli By-Pass to EXIT 23 (Sable River).
	B-9	Install a cable barrier system within the median of the divided section near Exit 9 (Trunk 12) interchange.
Priority C	C-1	Twinning of the remaining sections between EXITs 8 (Chester) and EXIT 13 (Bridgewater).
	C-2	Monitor volumes and collision experience for section from Yarmouth to EXIT 33 (Tusket) to determine if twinning is required to provide passing opportunities.
	C-3	Construct two-lane controlled access highway between EXIT 13 (Bridgewater) and Queens County Line.
	C-4	Construct Jordan Falls By-Pass and upgrade controlled access section between EXIT 24 (Jordan Falls) and EXIT 25 (Shelburne).
	C-5	Construct section from EXIT 27 (Birchtown) to EXIT 29 (Barrington) including the Clyde River By-Pass.
	C-6	Eliminate remaining six at-grade intersections - Lunenburg / Queens County line to EXIT 18 (Liverpool).
	C-7	Construct 2 +1 passing lanes between EXIT 31 (Pubnico) and EXIT 32 (Argyle).

Refer to Table 7-1 for further descriptions of these recommendations.



LEGEND

- HIGHWAY 103 STUDY AREA (CONTROLLED ACCESS)
- HIGHWAY 103 STUDY AREA (NON-CONTROLLED ACCESS)
- LOCAL ROADS
- TRUNK AND COLLECTOR ROADS
- COUNTY BOUNDARY
- EXIT NUMBER (INTERCHANGE)
- EXIT NUMBER (AT GRADE)
- RECOMMENDATION LABEL

Drawn: P. NICKERSON
Checked: G. O'BRIEN, K. O'BRIEN

NORTH

FIGURE 7-1: RECOMMENDATIONS

HIGHWAY 103 SAFETY REVIEW

NOVA SCOTIA
Transportation and Infrastructure Renewal

APRIL 2015 141-20229

SCALE

0 10 20 Kilometers

WSP

Sheet Figure 7-1

FILE: K:\DARTMOUTH\201401\141-20229 NSTIR_HWY 103 SAFETY REVIEW\11_DWG\11.7_TRAFFIC\141-20229 - FIGURES.DWG

Appendix A

Terms of Reference

NOVA SCOTIA
Transportation and Public Works

PO Box 186
Halifax, NS
B3J 2N2

REQUEST FOR PROPOSALS
For
Operational and Safety Review
Highway 103, Upper Tantallon to Yarmouth
Department of Transportation and Infrastructure Renewal

Highway Engineering Services Standing Offer Tender #60145459

Responses to this Request for Proposal Must be Received in the:
Nova Scotia Department of Transportation and Infrastructure Renewal
1672 Granville Street, Halifax, NS, B3K 2N2

No later than the Closing Date and Time:
April 25, 2014
10:00 am

Department Contacts:
Paul J Smith
Tel. (902)424-3134
Michael C Croft
Tel. (902)424-3548

Facsimile bids **will not** be accepted.

If conflicting information occurs between this page and the remainder of the document, this page is considered correct.

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1.0 Background

Highway 103 from Upper Tantallon to Yarmouth is a mixture of four lane controlled access, two lane controlled access and two lane non controlled access sections. The total length of the study area is approximately 274 km. Average annual daily traffic volumes range between 1,500 to 9,800 with high peak hour directional traffic demands on the west end due to commuter travel to and from Halifax Regional Municipality, the prime employment center and also to a lesser degree near other smaller communities such as Bridgewater, Liverpool, Yarmouth, etc. Highway 103 is considered part of the "feeder system" of the designated National Highway System.

The increasing traffic demand has been recognized by the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR). Expansion of the existing highway to a four lane divided facility from Upper Tantallon to Hubbards is being planned although it is not yet part of the five year plan. Construction of an interchange and connector road at Ingramport has recently commenced. Also a by-pass in the Port Mouton / Port Joli area has commenced.

The programming for any future upgrading will be phased and dependent upon priorities and the allocation of available funding from the Federal and Provincial governments, as well as satisfaction of governing environmental regulations.

2.0 Objective

The primary objective of this study is to complete a safety review of Highway 103, from Upper Tantallon to Yarmouth, including identification of the current and projected operational and safety deficiencies and recommendations for practical short and medium term engineering, education, management and law enforcement strategies to ensure preservation of an acceptable level of service and safety performance.

This project involves the development of a safety improvement plan that will ensure satisfactory safety performance levels will be maintained on the two lane sections until roadway upgrading to a 4 lane divided facility becomes a reality.

The study should consider, but not be limited to, strategies in the following areas:

1. Design & design standards changes
2. Safety counter measures
3. Geometric improvements
4. Traffic control
5. Enforcement
6. Education
7. Access management

8. Intersection replacement
9. Twinning
10. Passing lanes / 2+1 roads

3.0 Duties of the Consultant

- Meet with the project management team as per the schedule specified in Section 6.0 (Meetings and Reports).

- Become familiar with the study area, including: existing highway infrastructure; horizontal and vertical alignment; and traffic composition.

- Review safety concerns received by the Department from the public and recorded in the media. Consultant should meet with the "Hwy 103 Committee" advocacy group.
  Consult local NSTIR Area Managers, Construction Manager, Operation Supervisors, District Traffic Supervisor(s), local fire departments, and RCMP.

- Establish and project (20 year horizon) the traffic volumes and composition characteristics.

- In this type of study normal practice would be to document and analyze the recent 10 year collision history (for trends, patterns and primary contributory factors) and perform comparative analyses with highways of similar classification, however, the consultant is advised that the availability of provincial collision data from 2007 to present is limited (although we are currently adding location information to the 100 Series Highway collisions). Therefore the consultant must provide an acceptable means to deal with this limitation (eg. Accessing collision data from other means such a RCMP and EHS files). Pre 2007 provincial collision data is available.

- Document the general description of the road geometry including the extent and location of passing opportunities and climbing lanes; access locations contributing to road safety deficiencies; general condition of roadside hardware (signs, guardrail and overhead lighting); the road surface condition with respect to surface distress, rutting and drainage. Document and evaluate current geometric design, traffic control and maintenance standards, practices and procedures. This may be supplemented by the use of NSTIR's ARAN data.

- Document current law enforcement programs, levels and regulatory framework.

- Identify current and projected safety deficiencies and practical short term (1 to 5 years) and medium term (5 to 10 years) engineering, education, management and enforcement countermeasure recommendations.

- The recommendation summary should include an implementation schedule, expected benefits and cost estimate.

- Prepare a final report that documents study purpose, procedures, assumptions, findings, conclusions, recommendations and action plan for a 20 year horizon period pertinent to understanding the methods and results. The final report should include a graphical representation of findings.

- Present the study findings to project management team and Department executive.

4.0 Duties of the Department

- Meet with the consultant on an arranged schedule.

- Provide the consultant with copies of available plans of the existing Highway 103; design plans for upgrading or twinning where available; time frame and nature of other future changes; traffic collision records where available; maintenance standards, practices and procedures; historical traffic volumes; data from the Automated Road Analayzer (ARAN) program; and recent public correspondence concerning the safety of the proposed highway.

5.0 Guidance

A project management team will administer the technical and analytical work of the consultant. The team will consist of representatives from NSTIR. The consultant will report to the project management team chair, responsible for overall administration of the study.

Acceptance and approval of the work will take place after the project management team has been satisfied that the requirements, as specified in the contract, have been met.

6.0 Meetings and Reports

The Consultant shall meet with the project management team for the project initiation, an interim meeting and other meetings as required during the duration of the project. All meetings will be held at NSTIR’s offices, Johnston Building, Granville St., in Halifax,

Nova Scotia. The Consultant shall also make an oral presentation to the project management team and TIR executive within **14** days of submission and acceptance of the final report. The initial meeting with the consultant will be to finalize the study requirements, data requirements, methodologies to be used and time frame for completion.

The consultant shall provide **10** bound copies and one unbound copy of the final report. All copies of final report shall be on letter size paper and appropriately titled. The font used shall be Times New Roman 12 and the text shall have full justification. . The final report shall include an executive summary and a list of references. The final report shall contain the Terms of Reference attached as an appendix.
An electronic draft final report in PDF for the study must be submitted along with an oral presentation for comment and possible amendments before the final version is submitted. Required copies of the draft final report shall be submitted **5 working days** prior to the final meeting.

7.0 Study Schedule

The study shall be completed and the required copies of the final report presented within **four** months of award of contract. The ability of the consultant to commit the necessary resources to complete the required work in a short time frame will be an important consideration in the evaluation of proposals. The consultant shall schedule the initial meeting with the project management team within **two** weeks of notification of award of contract.

8.0 Ownership of Information

The consultant agrees that all information collected, materials gathered and reports produced shall be the property of the Province of Nova Scotia. The consultant shall not be permitted to publish or in any way use said information without the expression or prior approval of NSTIR.

All documents, including proposals, submitted to the Province are subject to disclosure under the Nova Scotia Freedom of Information and Protection of Privacy Act. By submitting a proposal the proponent thereby agrees to public disclosure of its contents. Any information the proponent considers 'personal information' because of its proprietary nature should be marked as "confidential", and will be subject to appropriate consideration as defined within the Nova Scotia Freedom of Information and Protection of Privacy Act.
Information pertaining to this competition or any Department obtained by the proponent as a result of participation in this project is confidential and must not be disclosed without written authorization from the Province.

9.0 Consultant Expertise/Eligibility

The consultant's project team shall be multi-disciplinary. Members shall have experience and knowledge in the areas of driver behaviour, public education, road safety reviews/audits, highway design and operation, traffic management, and road construction/maintenance. The engineering principal shall be a registered member of the Association of Professional Engineers of Nova Scotia (APENS).

Prospective proponents are not eligible to submit a proposal if current or past corporate or other interests may, in the Province's opinion, give rise to a conflict of interest in connection with this project.
The successful proponent may be required to demonstrate financial stability and may be required to register to conduct business in Nova Scotia.

10.0 Proposal Requirements

Six copies of your proposal (fax copies are not acceptable) are to be delivered by 10:00 am local time, April 25, 2014 to:

NS Transportation & Infrastructure Renewal
Johnston Building Reception Desk
1672 Granville Street
Halifax, NS
B3J 3Z8

Proposals and their envelopes should be clearly marked with the name and address of the proponent, the Request for Proposal number, and the project or program title. Late proposals will not be accepted and will be returned to the proponent.

Proponents are solely responsible for their own expenses in preparing, delivering or presenting a proposal and for subsequent negotiations with the Province, if any. Proposals must be open for acceptance for at least **90** days after the closing date. Upon acceptance, prices will be firm for the entire contract period unless otherwise specified.

Project proposals shall contain the following information.

- A detailed work plan, including intended approach and methodology for the study, with respective time frames to permit progress monitoring.

- A list of all information and data sources available to the consultant and expected to be used in the study.

- A summary of company and project member experience in areas related to these terms of reference.

- The proposed consultant team, including a curriculum vitae for all team members. Professional engineering staff must be licensed to practice in the Province of Nova Scotia.

- Number of person-days for each team member by task assigned to the project. For consistency, the basis of remuneration will be per **8 hour day** for all team members.

- A breakdown of the total costs to undertake the project (to be separately sealed in an envelope and attached to the proposal) including labour costs, related expenses, printing costs and professional services obtained outside of the firm. In order to assess level of effort, time commitments for all team members (**excluding labour costs**) shall be included in the main body of the proposal. Prices quoted are to be in Canadian dollars and exclusive of federal and provincial taxes.

- A list of client references.

- All Metric units where possible.

By submitting a proposal, the proponent warrants that all components required to deliver the services requested have been identified in the proposal or will be provided by the Consultant at no additional charge. The proposal must be signed by the person(s) authorized to sign on behalf of the proponent and to bind the proponent to statements made in response to this Request for Proposal.

11.0 Extra Work

The consultant may be required to undertake additional work not specified in the contract. Prior to starting this additional work the consultant shall submit a detailed breakdown of the costs, including all expenses, to complete the extra work and obtain written approval from the project management team.

12.0 Request for Proposal Amendments

All proponents will be notified in writing by the Procurement Branch regarding any changes made to the Request for Proposal or any appendices or any change in the closing date or time. When these changes occur within **five** government business days of the close of the proposal, the proposal closing date may be extended to allow for a suitable number of bid preparation days between the issuance of the change and the closing date.

13.0 Payment Schedule

The payment for this study will be a lump sum payment upon acceptance of the Final Report by NSTIR.

The consultant is expected to provide a level of service consistent with a budget of **$90,000**.

14.0 Evaluation of Proposals

Proposals shall be evaluated based on the "Government Procurement Process: Architects and Professional Services".

The criteria for evaluating proposals, based on technical and managerial merit, will be made based on the following categories and weights.

Understanding of Project and Objectives	15 points
Experience and Expertise of the Proponent on Similar Projects	10 points
Qualification and Experience of Team Members on Similar Projects	20 points
Proposed Methodology and Approach	25 points
Project Management	10 points
Proposal Quality	5 points

Accepted proposals will first be evaluated on the basis of their technical and managerial merit and then on the basis of price. The technical submission shall be rated as shown above, out of 85 points, and the remaining 15 points shall be allotted based on price. Only those proposals achieving an aggregate score of 68/85 (80%) or greater will have their sealed cost envelopes opened. The lowest price shall be awarded 15 points (all prices within 5% will receive the same price points). The next lowest price (beyond 5%) will receive 12 points. Points for other submissions will be assigned with 3 fewer points for each successively higher priced price proposal. But again, each time the same score will be awarded if successive prices are within 5% of the last highest price. The proposal with the highest total points will be awarded the contract. Proposals not meeting the required 68/85 will have their unopened cost envelopes returned.

Notwithstanding the technical/managerial and price scores, the NSTIR reserves the right to reject any proposal where prices are deemed unreasonable relative to other prices bid, typically a 25% variance from the average qualified bid (excluding the bid in question).

The Department reserves the right to negotiate any or all conditions of the Consultant's proposed work plan and reject all submitted proposals. Unsuccessful proponents may request a debriefing meeting following execution of a contract with the successful proponent.

15.0 Contract Procedures

Notice in writing to a proponent of the acceptance of its proposal by the Province and the subsequent full execution of a written contract will constitute a contract for the goods or services, and no proponent will acquire any legal or equitable rights or privileges relative to the goods or services until the occurrence of **both** such events.

16.0 Performance Evaluation

After the project has been completed the project management team chair will evaluate the performance of the successful firm. A copy of the performance evaluation will be provided to the consultant and a debriefing meeting held if requested. The evaluation report will be kept on record by TIR and used in the assessment of future proposals submitted.

17.0 Inquiries

All enquiries related to this Request for Proposal are to be directed to the following person(s). Information obtained from any other source is not official and may be inaccurate. Enquiries and responses may be recorded and may be distributed to all proponents at the Province's option.

Department Contacts: Paul J Smith
Tel: 902-424-3134
E-mail: smithpj@gov.ns.ca

Michael C Croft
Tel: 902-424-3548
E-mail: croftmi@gov.ns.ca

Appendix B

Stakeholder Feedback

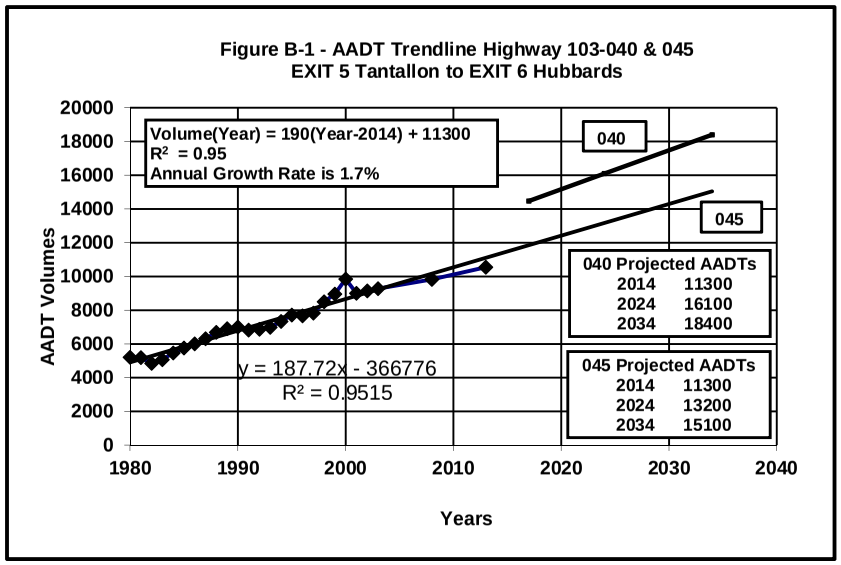
Volume and Collision Data

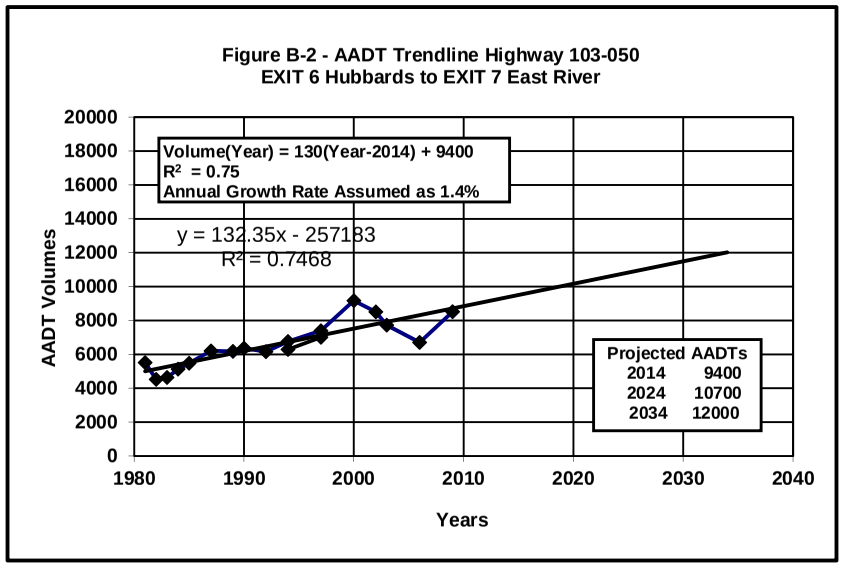
Summary of Stakeholder Feedback

The following comments and suggestions were received from November 2014 to January 2015.

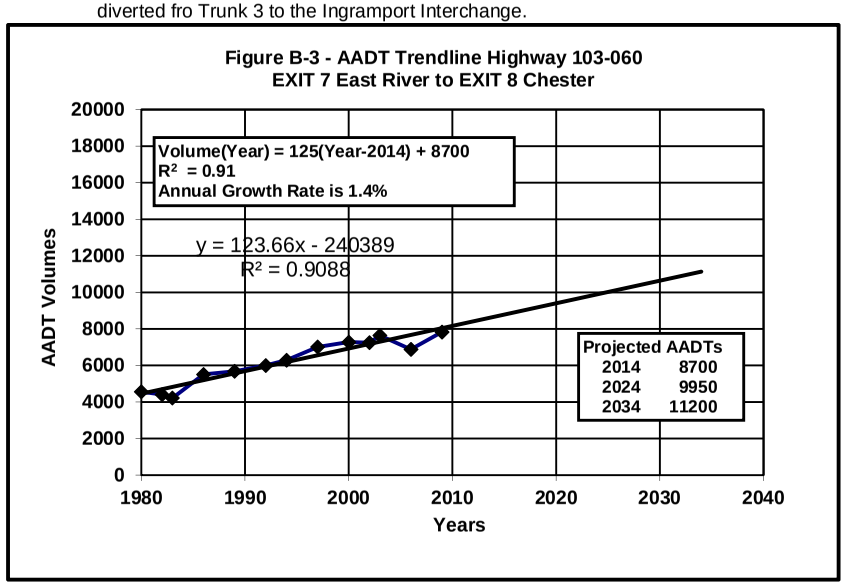
- Argyle Causeway intersections; need eastbound right turn lane at Nakile Drive;
- At-grade intersections in Yarmouth County at Mood Road, Eel Lake Road and Raynardton Road
- Lack of passing lanes between EXIT 9 and EXIT 10
- Passing lanes (2 +1) between Gold River and Mahone Bay
- While there are cameras at Granite Village, EXIT 12 and Hubbards, there are no pavement temperature sensors in Lunenburg or Queens Counties
- Need for acceleration and deceleration lanes at intersections
- Some wheel track rutting east of Pubnico
- Curve at Granite Village
- Curve at Villagedale
- Icing problem on the Gold River Bridge
- Drivers do not slow down for the 80 km/h zone at Clyde River and do not stop for school buses.
- Residents have requested extending Clyde River 80 km/h zone further to the west
- Need rumble strips on all road sections
- Exit at EXIT 29 [Barrington east intersection] is sloped away from the road making distance difficult to judge; particularly difficult with winter road conditions
- Extend guardrail along the south side of Highway 103 to protect the Mahone Bay water supply
- The challenge of an undivided highway is the possibility of a high speed head-on collision
- Variable snow removal at the Halifax – Lunenburg County Line, Hubbards
- Post 90 km/h minimum speed on the 100 km/h sections
- Bush cutting
- Inconsistent presence of RCMP enforcement
- Drivers failing to turn on head lights during poor driving conditions
- Twinning is always a hot topic at social gatherings
- Construct more passing areas; perhaps 1+2
- Speed in reduced speed areas at Sable River and Clyde River
- Ohio Road (EXIT 26) needs an interchange
- Some local people want more advertising signs for Shelburne at Ohio Road
- Intersections in the Pubnico and Argyle areas experience poor visibility due to fog
- High volumes increasing each year; twinning is the only solution

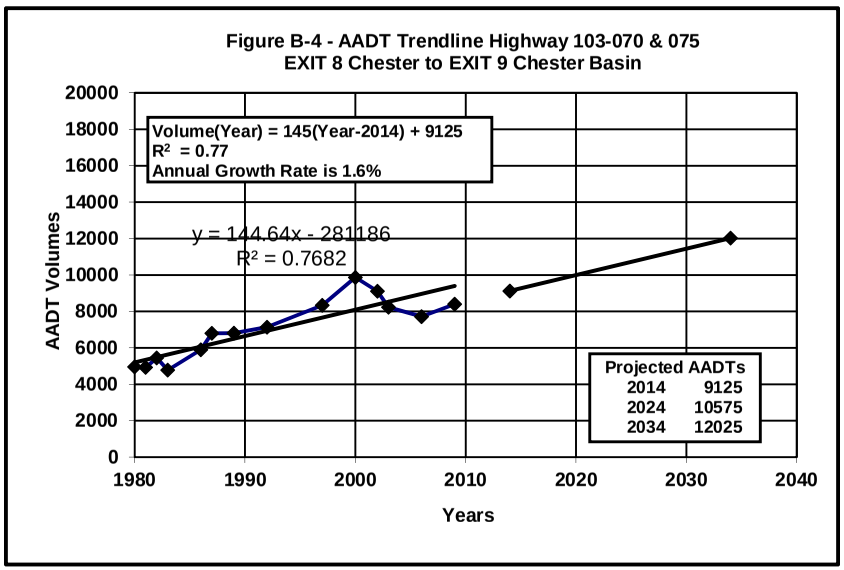
- Driver inattention is a problem
- Twinning should be the end goal even if it requires tolls
- Maintenance – vegetation control; filling pot holes; plowing; and salting
- Better control of center line painting
- RCMP enforcement – speeding; texting; drinking; etc.
- Changeable message signs to post notices concerning road conditions, safety reminders concerning cell phone use and texting, etc.
- Check areas on hills where water running down the hill promotes hydroplaning
- Many advertising signs on lands beside controlled access highways
- Driver inattention; lack of patience with regard to passing; not adjusting speed to reflect road conditions
- Road markings are not clear; need better marking
- Lack of a strong visibility of RCMP on Highway 103
- Enforce the speed limit; also pay attention to slow drivers under 90 km/h in the 100 zone
- Install more passing lanes between Mahone Bay and Chester and between Bridgewater and Liverpool
- The Route 331 (EXIT 17) intersection has been the site of fatal collisions
- It will be good to see the Port Joli and Port Mouton By-Passes finished; will 103 be upgraded between those two sections
- The Granite Village curve just west of the Queens / Shelburne County line is a major safety issue
- LED lighting does not provide the same amount of light at intersections as the previous lighting type
- There appears to be a problem at Oakhill (km 205 – 206) where water flows on the road causing a hydroplaning situation
- Between EXIT 11 and 12 near the Christmas tree lot there appears a problem with water on the road that causes abnormal black ice and hydroplaning
- Since there is no roadway lighting except at intersections, more reflective marker would be helpful
- Bushes need to be cut back since Lunenburg County has a large deer population
- The Gold River Bridge has a black ice problem
- Slow drivers cause problems during busy travel time; there are insufficient passing lanes
- There appears to be a rutting problem between EXIT 17 at Mill Village to EXIT 19 at Trunk 8 Liverpool
- Clyde River residents want the 80 km/ zone reduced to 60 km/h
- The road is very twisty near the Queens / Shelburne county line
- Intersections in Yarmouth County are a safety concern





NOTE: Projected 2016 to 2034 volumes in Section 040 have been adjusted to account for trips diverted fro Trunk 3 to the Ingramport Interchange.





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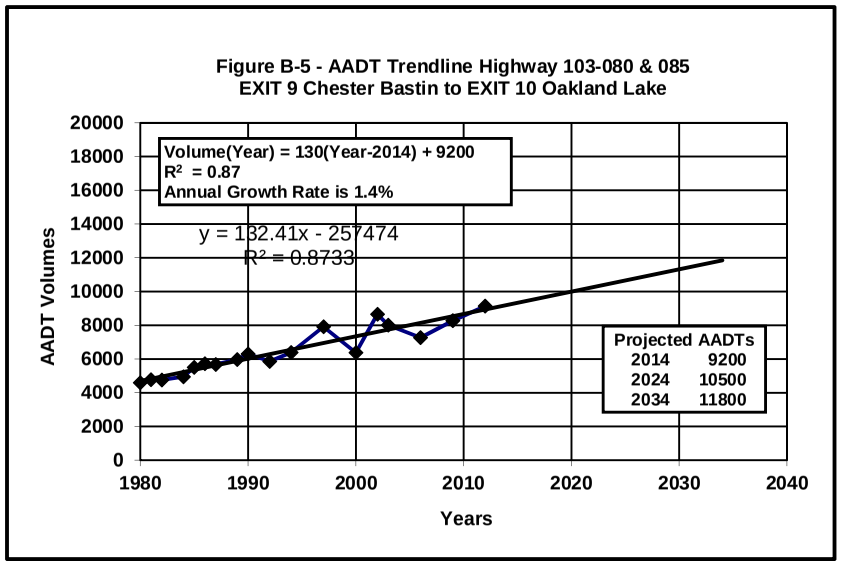

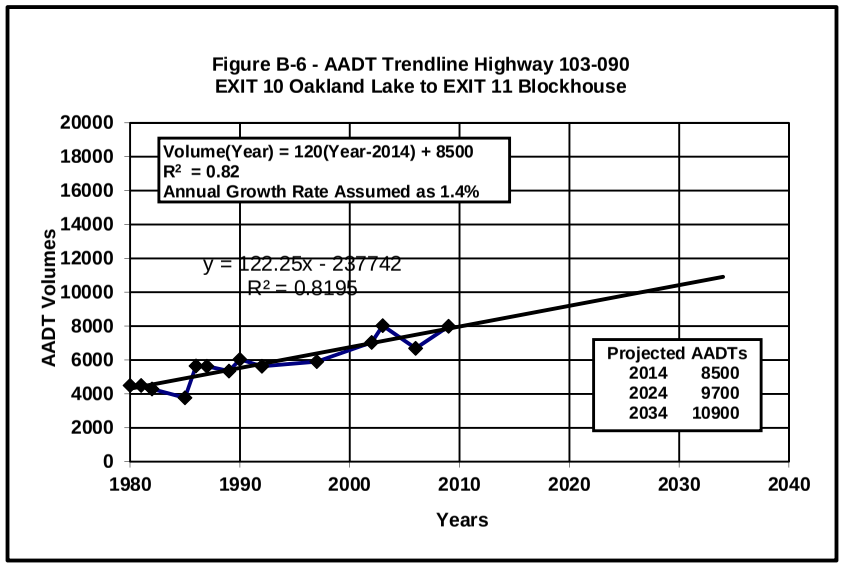

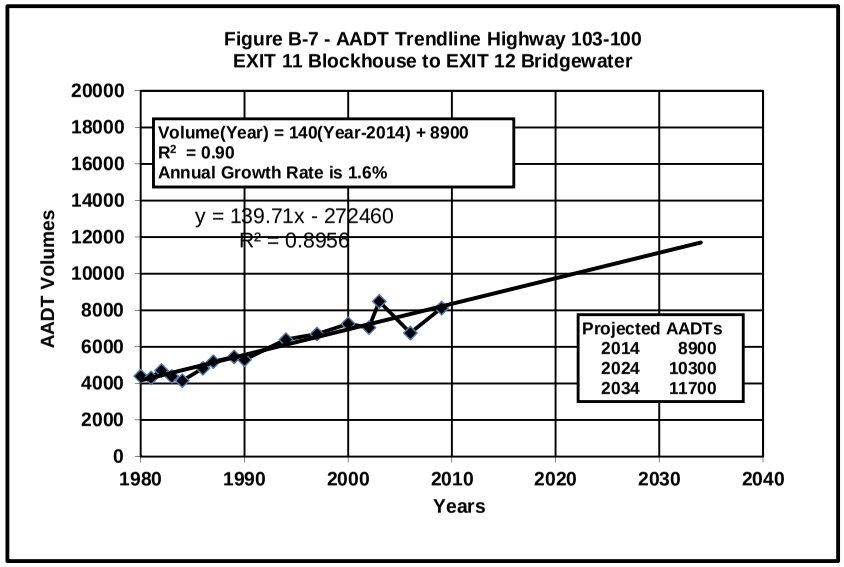

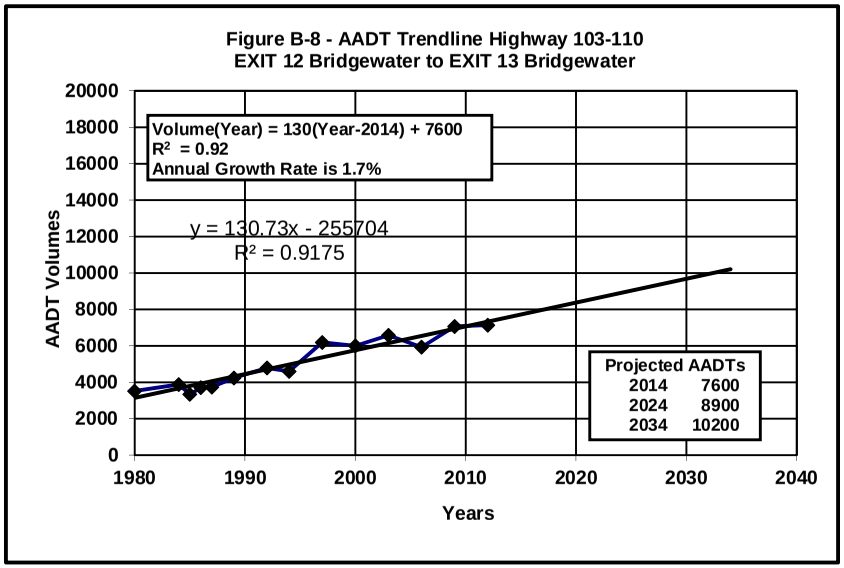

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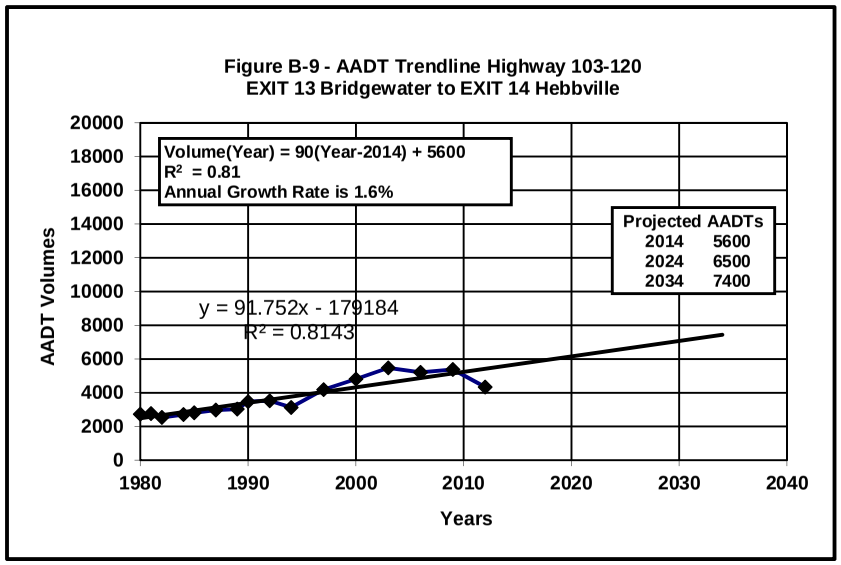
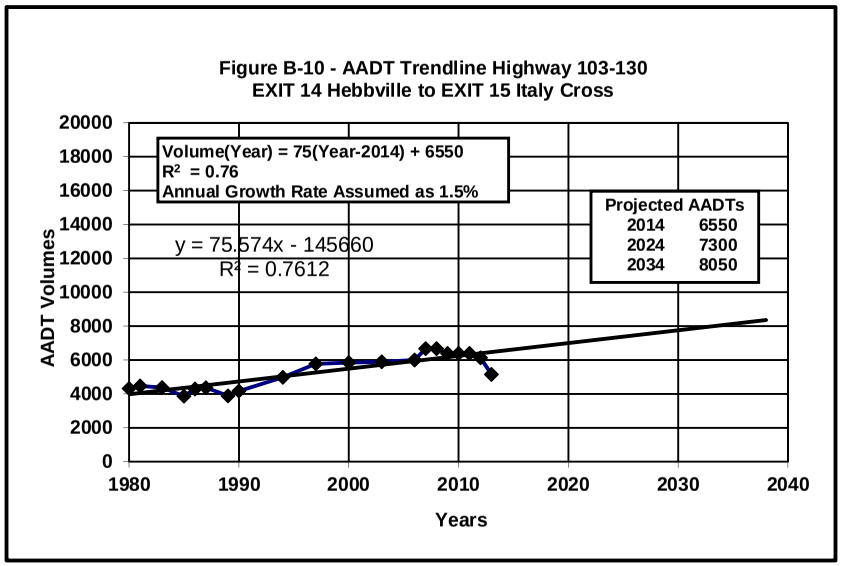
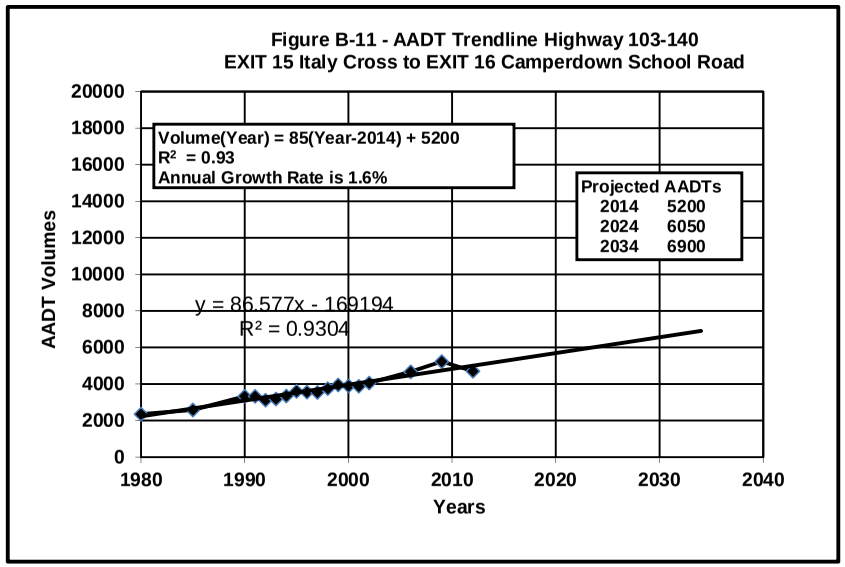
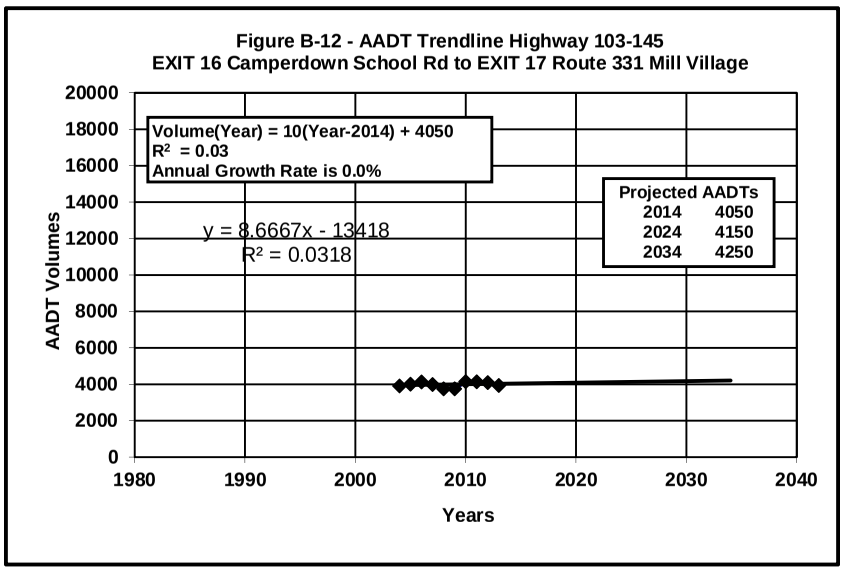








Source: NSTIR Historical machine count program data.

Figure B-13 - AADT Trendline Highway 103-150
EXIT 17 Route 331 Mill Village to EXIT 18 Brooklyn

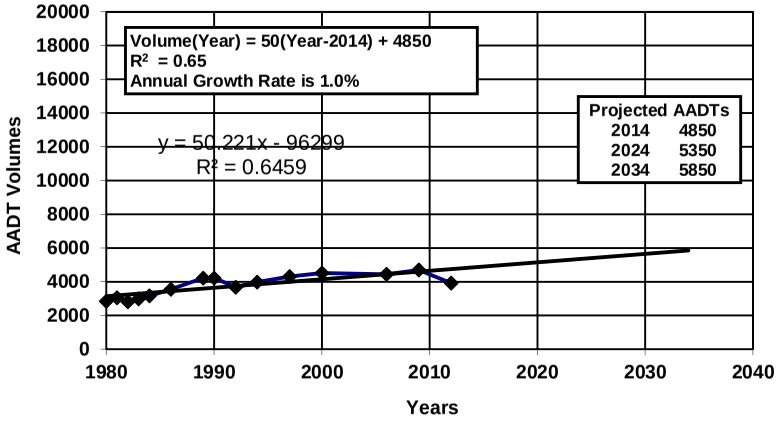


Figure B-14 - AADT Trendline Highway 103-160
EXIT 18 Brooklyn to EXIT 19 Trunk 8 Liverpool

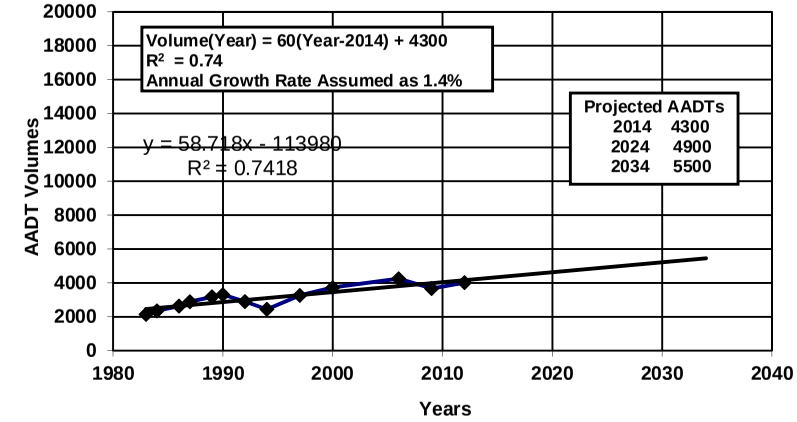


Figure B-15 - AADT Trendline Highway 103-170
EXIT 19 Trunk 8 Liverpool to EXIT 20A Liverpool

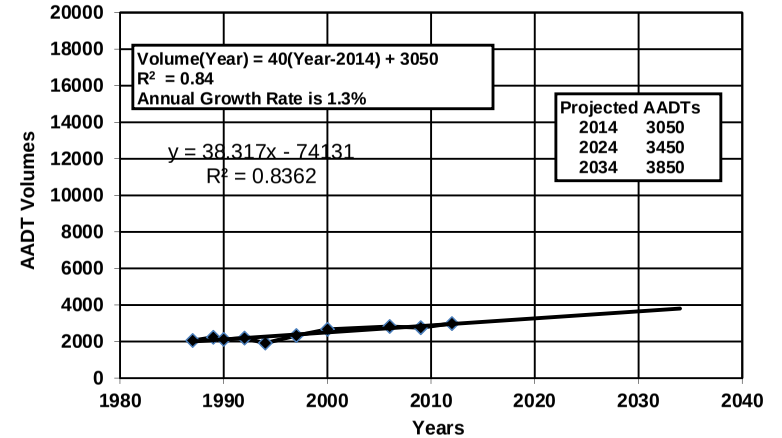
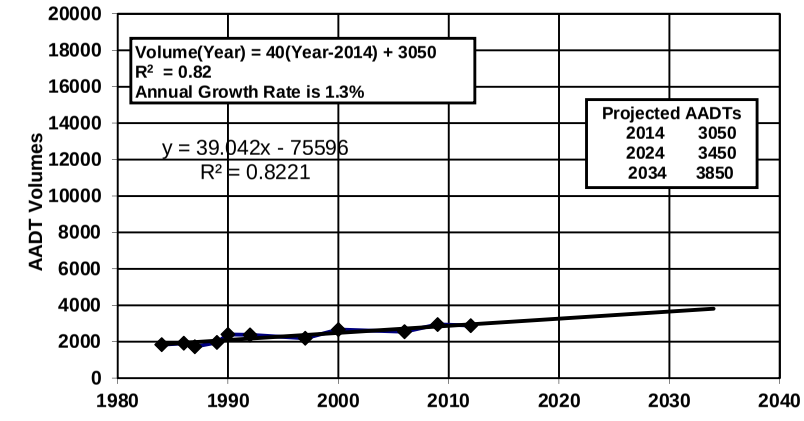
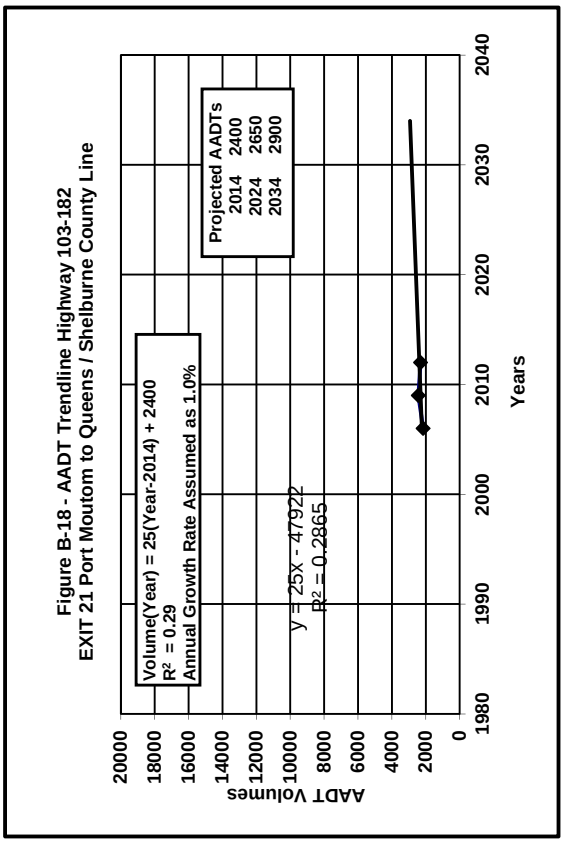
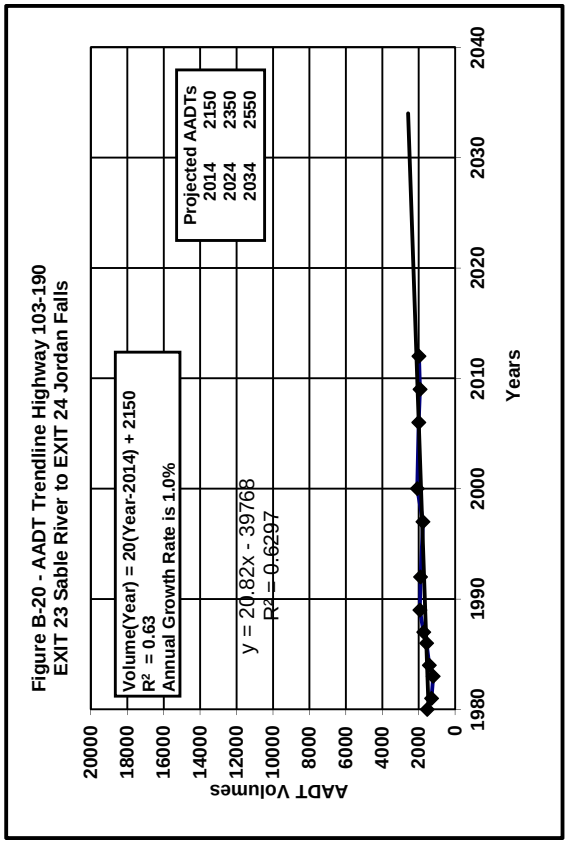


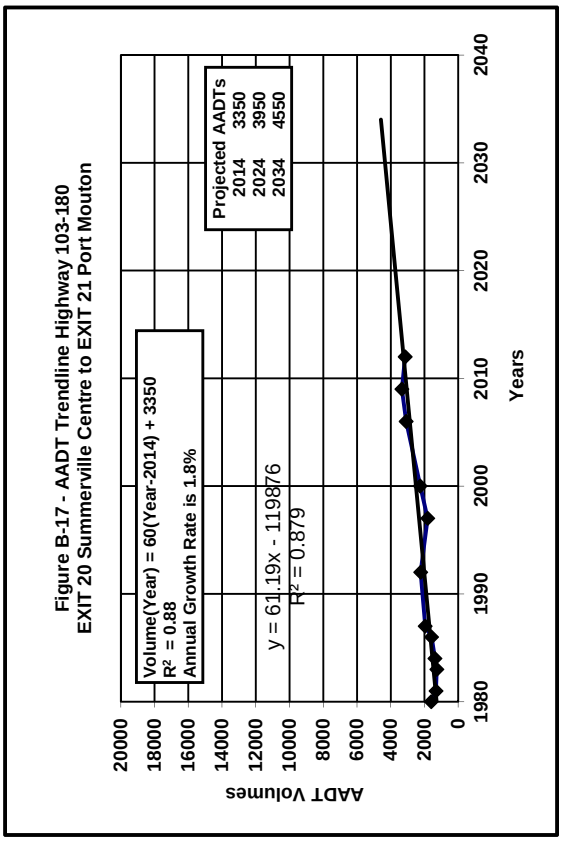
Figure B-16 - AADT Trendline Highway 103-175
EXIT 20A Liverpool to EXIT 20 Summerville Centre

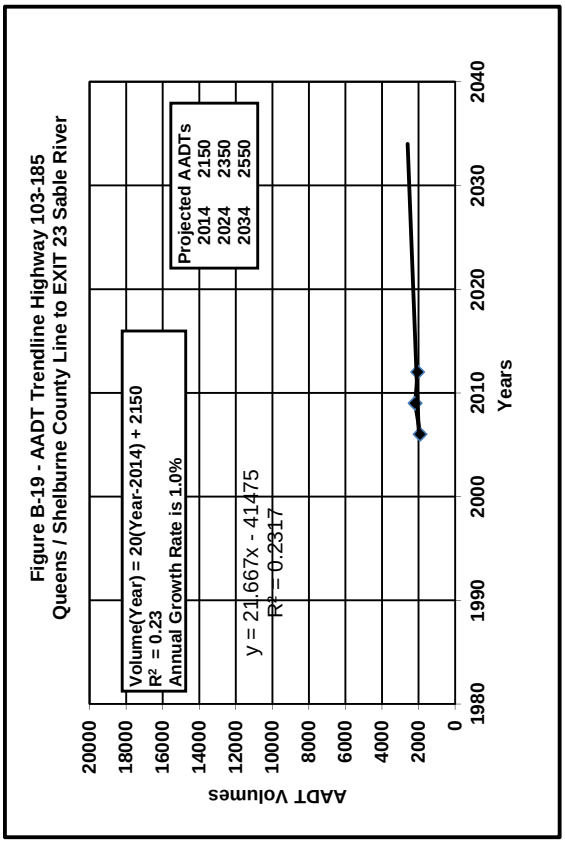


Source: NSTIR Historical machine count program data.

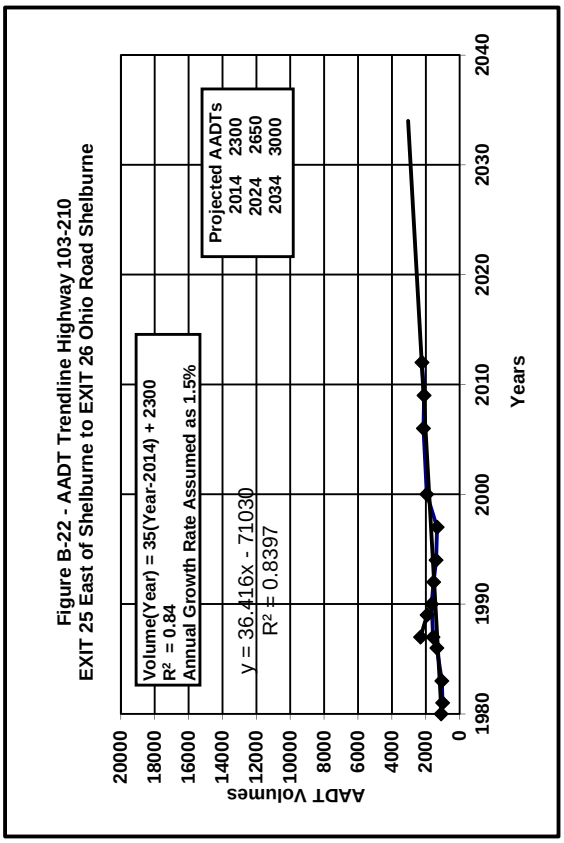


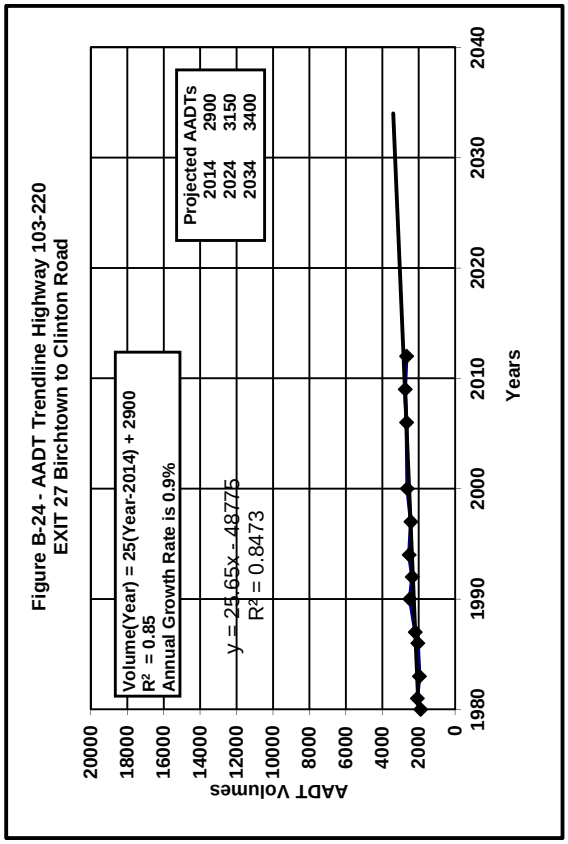


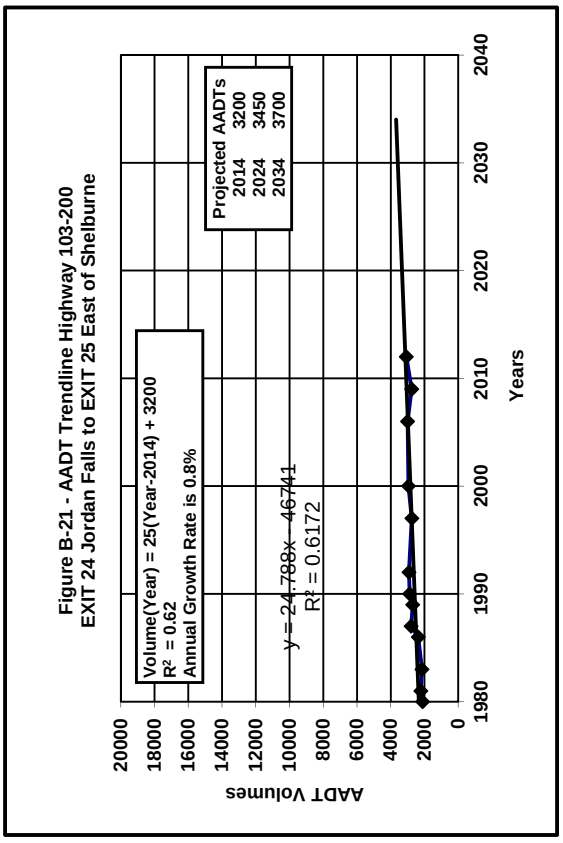


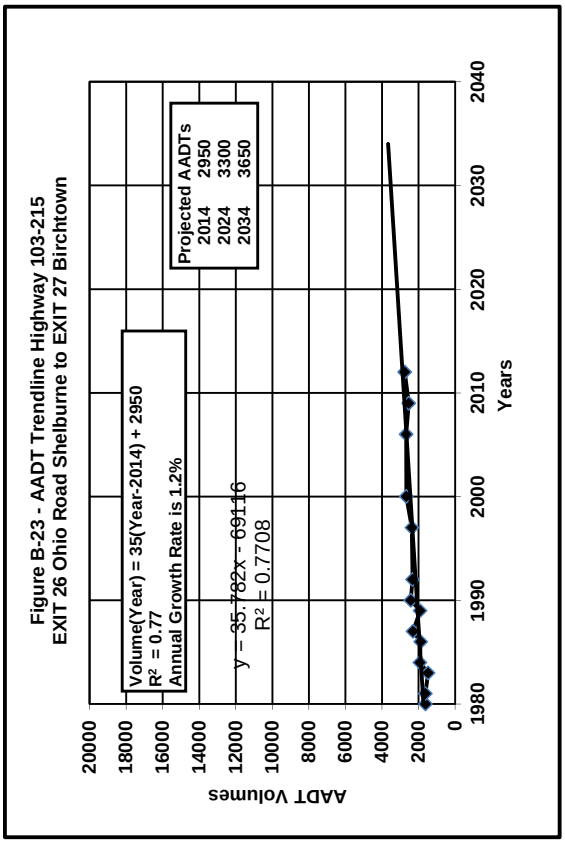


Source: NSTIR Historical machine count program data.

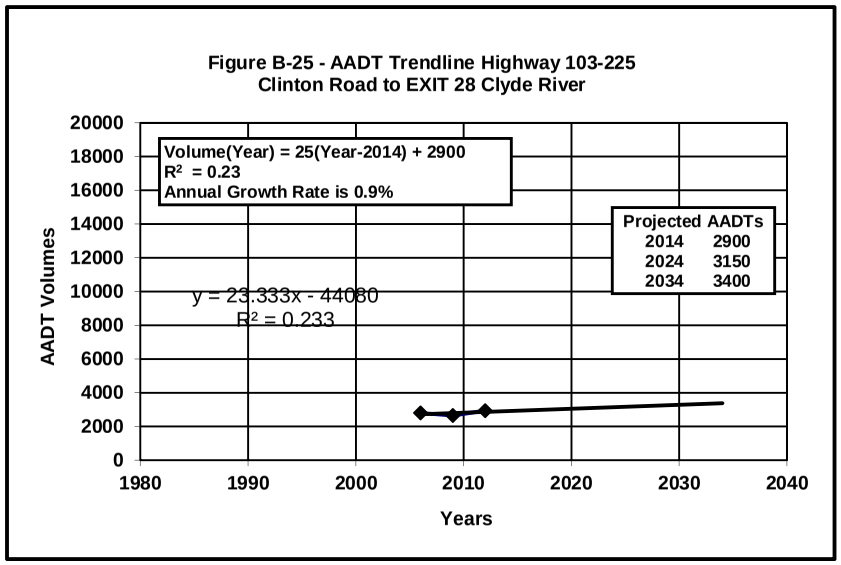


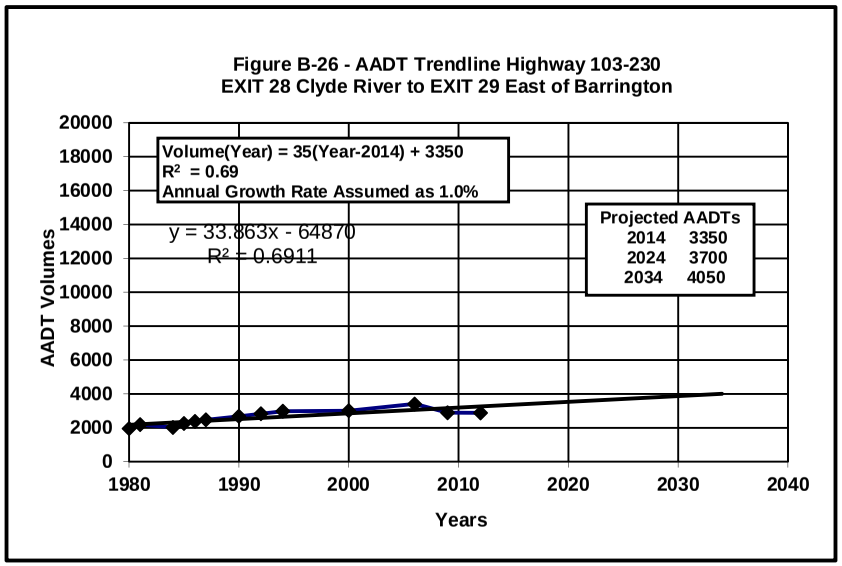


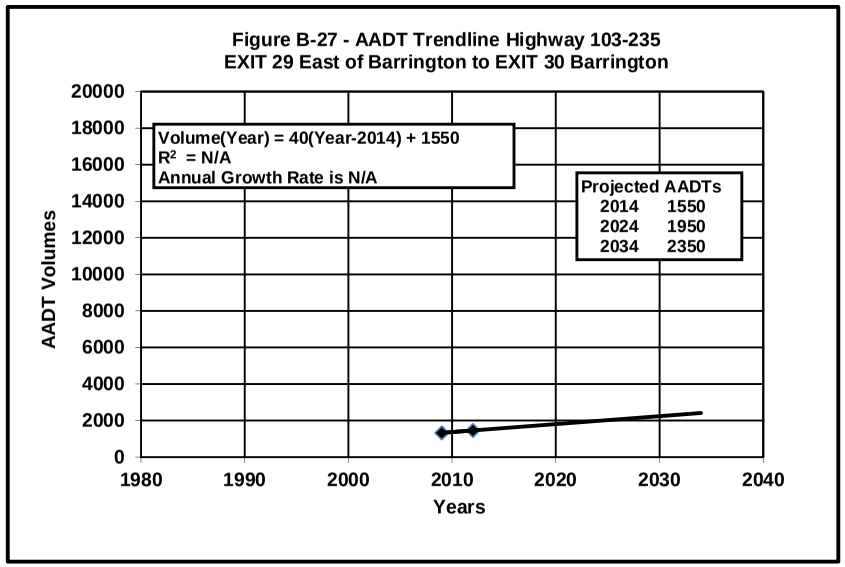


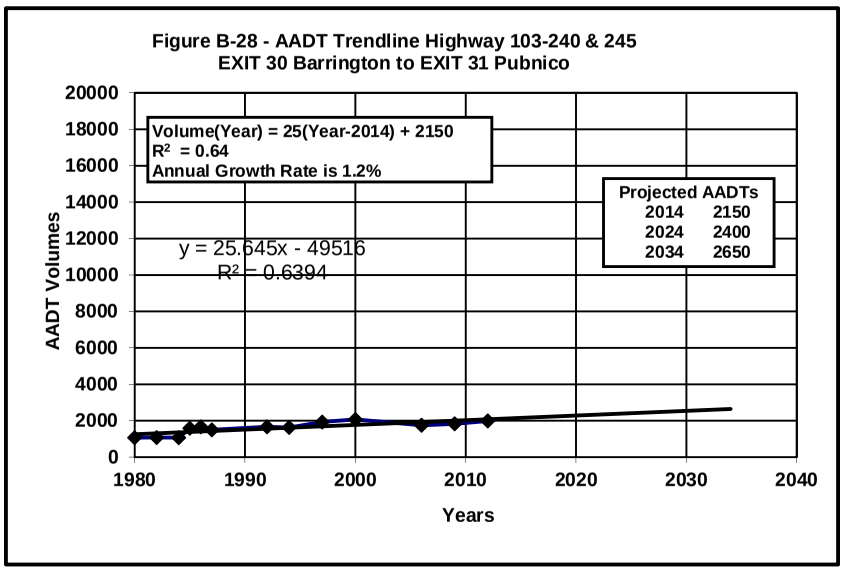


Source: NSTIR Historical machine count program data.

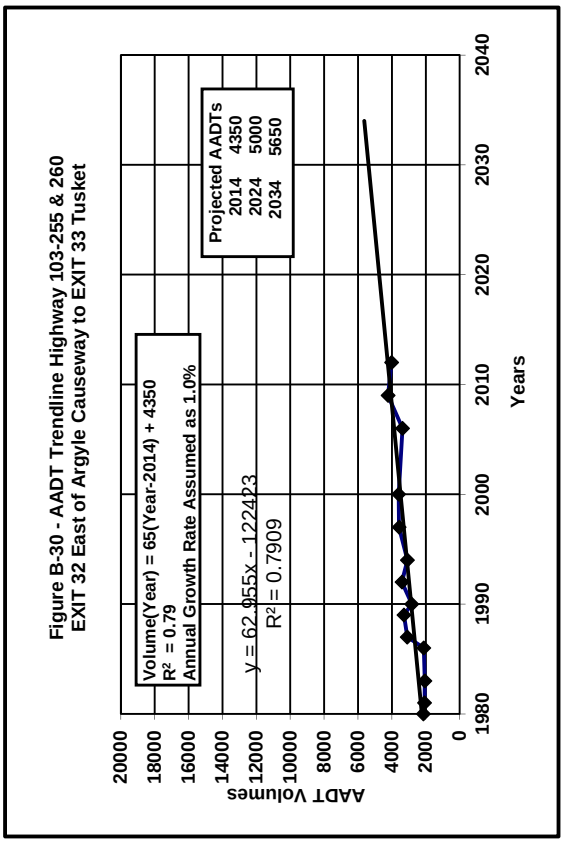


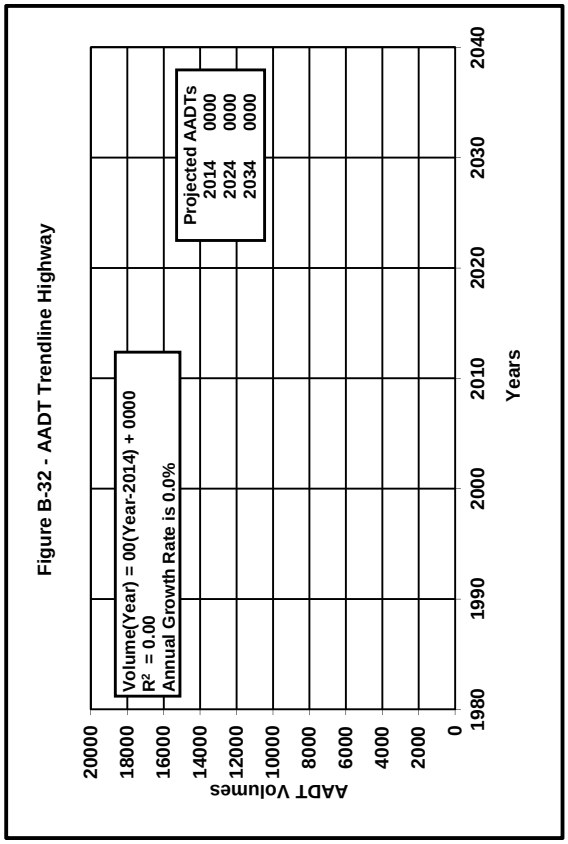


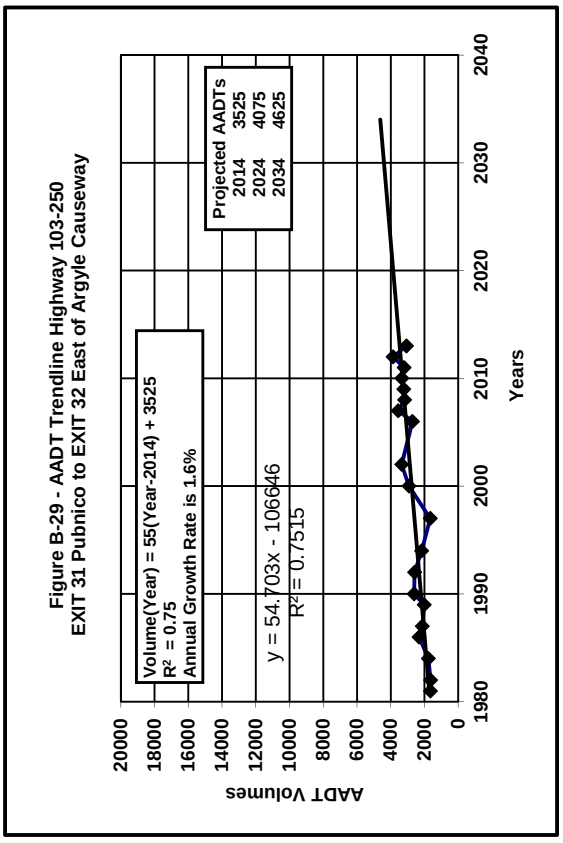


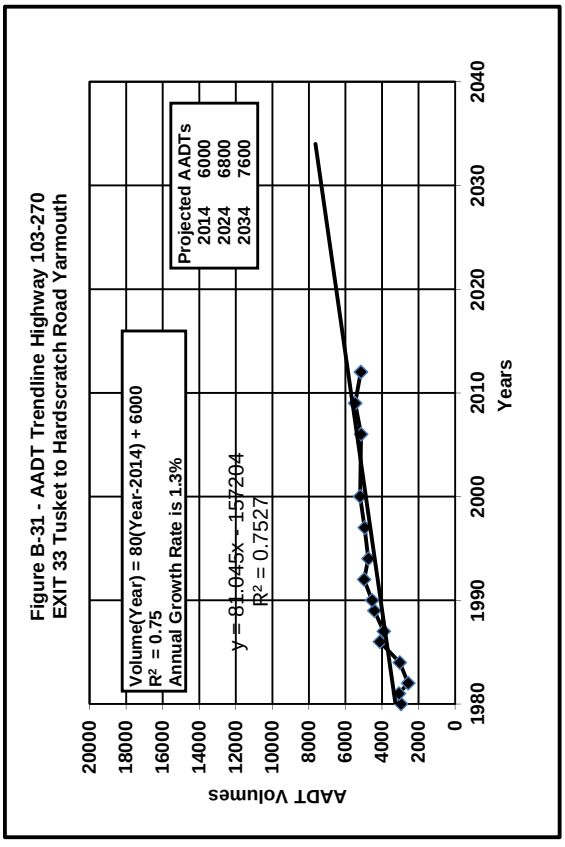


Source: NSTIR Historical machine count program data.









Source: NSTIR Historical machine count program data.

Table B-1- Highway 103 - Sections 040 to 270 - Collision Rates 2007 to 2012											
Year	Length	AADT[1]	HMVK[2]	Number of Collisions				Collision Rate per HMVK			
				PDO	Injury	Fatal	Total	PDO	Injury	Fatal	Total
Highway 103 - Section 040 (Route 213 Tanatallon to Ingram River Bridge)											
2007	9.17	9,830	0.3290	5	3	0	8	15.2	9.1	0.0	24.3
2008	9.17	9,830	0.3299	12	2	1	15	36.4	6.1	3.0	45.5
2009	9.17	9,540	0.3193	6	3	0	9	18.8	9.4	0.0	28.2
2010	9.17	9,820	0.3287	1	5	0	6	3.0	15.2	0.0	18.3
2011	9.17	9,820	0.3287	4	1	0	5	12.2	3.0	0.0	15.2
2012	9.17	9,820	0.3296	6	2	1	9	18.2	6.1	3.0	27.3
Totals and Average Rate			1.9652	34	16	2	52	17.3	8.1	1.0	26.5
Highway 103 - Section 045 (Ingram River Bridge to EXIT 6 Hubbards)											
2007	11.99	9,830	0.4302	10	3	1	14	23.2	7.0	2.3	32.5
2008	11.99	9,830	0.4314	9	9	2	20	20.9	20.9	4.6	46.4
2009	11.99	9,540	0.4175	6	5	1	12	14.4	12.0	2.4	28.7
2010	11.99	9,820	0.4298	11	5	0	16	25.6	11.6	0.0	37.2
2011	11.99	9,820	0.4298	7	5	0	12	16.3	11.6	0.0	27.9
2012	11.99	9,820	0.4309	6	2	0	8	13.9	4.6	0.0	18.6
Totals and Average Rate			2.5695	49	29	4	82	19.1	11.3	1.6	31.9
Highway 103 - Section 050 (EXIT 6 Hubbards to EXIT 7 East River)											
2007	9.28	8,250	0.2794	5	3	1	9	17.9	10.7	3.6	32.2
2008	9.28	8,400	0.2853	9	2	1	12	31.5	7.0	3.5	42.1
2009	9.28	8,520	0.2886	3	1	0	4	10.4	3.5	0.0	13.9
2010	9.28	8,900	0.3015	4	1	1	6	13.3	3.3	3.3	19.9
2011	9.28	9,000	0.3048	5	0	0	5	16.4	0.0	0.0	16.4
2012	9.28	9,150	0.3108	1	0	0	1	3.2	0.0	0.0	3.2
Totals and Average Rate			1.7704	27	7	3	37	15.3	4.0	1.7	20.9
Highway 103 - Section 060 (EXIT 7 East River to EXIT 8 Trunk 14 Chester)											
2007	7.14	7,600	0.1981	9	0	0	9	45.4	0.0	0.0	45.4
2008	7.14	7,700	0.2012	8	0	1	9	39.8	0.0	5.0	44.7
2009	7.14	7,850	0.2046	3	2	0	5	14.7	9.8	0.0	24.4
2010	7.14	8,200	0.2137	6	1	0	7	28.1	4.7	0.0	32.8
2011	7.14	8,325	0.2170	3	2	1	6	13.8	9.2	4.6	27.7
2012	7.14	8,450	0.2208	2	1	0	3	9.1	4.5	0.0	13.6
Totals and Average Rate			1.2553	31	6	2	39	24.7	4.8	1.6	31.1
Highway 103 - Sections 070 & 075 (Exit 8 Trunk 14 Chester to EXIT 9 Trunk 12 Chester Basin)											
2007	4.12	8,100	0.1218	1	2	0	3	8.2	16.4	0	24.6
2008	4.12	8,250	0.1244	5	0	0	5	40.2	0.0	0	40.2
2009	4.12	8,400	0.1263	6	0	0	6	47.5	0.0	0	47.5
2010	4.12	8,550	0.1286	4	0	0	4	31.1	0.0	0	31.1
2011	4.12	8,700	0.1308	2	2	0	4	15.3	15.3	0	30.6
2012	4.12	8,850	0.1335	4	2	0	6	30.0	15.0	0	45.0
Totals and Average Rate			0.7654	22	6	0	28	28.7	7.8	0	36.6
Highway 103 - Sections 080 & 085 (EXIT 9 Trunk 12 Chester Basin to EXIT 10 Oakland Lake)											
2007	13.75	8,000	0.4015	4	9	1	14	10.0	22.4	2.5	34.9
2008	13.75	8,150	0.4101	7	3	0	10	17.1	7.3	0.0	24.4
2009	13.75	8,270	0.4151	6	3	0	9	14.5	7.2	0.0	21.7
2010	13.75	8,800	0.4417	5	1	0	6	11.3	2.3	0.0	13.6
2011	13.75	9,000	0.4517	9	1	0	10	19.9	2.2	0.0	22.1
2012	13.75	9,140	0.4600	7	4	0	11	15.2	8.7	0.0	23.9
Totals and Average Rate			2.5800	38	21	1	60	14.7	8.1	0.4	23.3

Table B-1- Highway 103 - Sections 040 to 270 - Collision Rates 2007 to 2012											
Year	Length	AADT[1]	HMVK[2]	Number of Collisions				Collision Rate per HMVK			
				PDO	Injury	Fatal	Total	PDO	Injury	Fatal	Total
Highway 103 - Section 090 (EXIT 10 Oakland Lake to EXIT 11 Route 324 Blockhouse)											
2007	4.89	7,750	0.1383	6	1	1	8	43.4	7.2	7.2	57.8
2008	4.89	7,850	0.1405	2	1	0	3	14.2	7.1	0.0	21.4
2009	4.89	7,990	0.1426	3	3	0	6	21.0	21.0	0.0	42.1
2010	4.89	8,000	0.1428	6	0	0	6	42.0	0.0	0.0	42.0
2011	4.89	8,150	0.1455	3	3	0	6	20.6	20.6	0.0	41.2
2012	4.89	8,250	0.1477	4	2	0	6	27.1	13.5	0.0	40.6
Totals and Average Rate			0.8573	24	10	1	35	28.0	11.7	1.2	40.8
Highway 103 - Section 100 (Exit 11 Route 324 Blockhouse to EXIT 12 Trunk 10 Bridgewater)											
2007	11.66	7,850	0.3341	11	3	0	14	32.9	9.0	0	41.9
2008	11.66	8,000	0.3414	5	3	0	8	14.6	8.8	0	23.4
2009	11.66	8,120	0.3456	9	3	0	12	26.0	8.7	0	34.7
2010	11.66	8,350	0.3554	9	2	0	11	25.3	5.6	0	31.0
2011	11.66	8,480	0.3609	6	5	0	11	16.6	13.9	0	30.5
2012	11.66	8,620	0.3679	9	4	0	13	24.5	10.9	0	35.3
Totals and Average Rate			2.1052	49	20	0	69	23.3	9.5	0	32.8
Highway 103 - Section 110 (EXIT 12 Trunk 10 Bridgewater to EXIT 13 Route 325 Bridgewater)											
2007	3.23	6,800	0.0802	4	1	0	5	49.9	12.5	0.0	62.4
2008	3.23	6,950	0.0822	5	0	0	5	60.9	0.0	0.0	60.9
2009	3.23	7,070	0.0834	6	1	0	7	72.0	12.0	0.0	84.0
2010	3.23	7,100	0.0837	6	0	0	6	71.7	0.0	0.0	71.7
2011	3.23	7,100	0.0837	3	2	0	5	35.8	23.9	0.0	59.7
2012	3.23	7,140	0.0844	6	0	0	6	71.1	0.0	0.0	71.1
Totals and Average Rate			0.4975	30	4	0	34	60.3	8.0	0.0	68.3
Highway 103 - Section 120 (EXIT 13 Rouite 325 Bridgewater to EXIT 14 Trunk 3 Hebbville)											
2007	6.64	5,200	0.1260	2	0	0	2	15.9	0.0	0.0	15.9
2008	6.64	5,300	0.1288	5	1	0	6	38.8	7.8	0.0	46.6
2009	6.64	5,380	0.1304	3	0	0	3	23.0	0.0	0.0	23.0
2010	6.64	5,400	0.1309	3	2	0	5	22.9	15.3	0.0	38.2
2011	6.64	5,400	0.1309	3	1	0	4	22.9	7.6	0.0	30.6
2012	6.64	5,400	0.1312	4	0	0	4	30.5	0.0	0.0	30.5
Totals and Average Rate			0.7782	20	4	0	24	25.7	5.1	0.0	30.8
Highway 103 - Section 130 (EXIT 14 Trunk 3 Hebbville to EXIT 15 Italy Cross)											
2007	6.42	6,670	0.1563	4	0	0	4	25.6	0.0	0.0	25.6
2008	6.42	6,670	0.1567	6	4	0	10	38.3	25.5	0.0	63.8
2009	6.42	6,390	0.1497	4	4	0	8	26.7	26.7	0.0	53.4
2010	6.42	6,390	0.1497	9	4	0	13	60.1	26.7	0.0	86.8
2011	6.42	6,390	0.1497	2	3	0	5	13.4	20.0	0.0	33.4
2012	6.42	6,130	0.1440	1	2	0	3	6.9	13.9	0.0	20.8
Totals and Average Rate			0.9063	26	17	0	43	28.7	18.8	0.0	47.4

Table B-1- Highway 103 - Sections 040 to 270 - Collision Rates 2007 to 2012											
Year	Length	AADT[1]	HMVK[2]	Number of Collisions				Collision Rate per HMVK			
				PDO	Injury	Fatal	Total	PDO	Injury	Fatal	Total
Highway 103 - Section 140 (EXIT 15 Italy Cross to EXIT 16 Camperdown School Road)											
2007	3.86	4,800	0.0676	2	2	0	4	29.6	29.6	0.0	59.1
2008	3.86	5,000	0.0706	2	1	0	3	28.3	14.2	0.0	42.5
2009	3.86	5,230	0.0737	1	1	0	2	13.6	13.6	0.0	27.1
2010	3.86	5,000	0.0704	1	0	0	1	14.2	0.0	0.0	14.2
2011	3.86	5,000	0.0704	1	4	0	5	14.2	56.8	0.0	71.0
2012	3.86	5,000	0.0706	1	0	0	1	14.2	0.0	0.0	14.2
Totals and Average Rate			0.4235	8	8	0	16	18.9	18.9	0.0	37.8
Highway 103 - Section 145 (EXIT 16 Camperdown School Road to EXIT 17 Route 331 Mill Village)											
2007	10.65	3,990	0.1551	2	2	0	4	12.9	12.9	0.0	25.8
2008	10.65	3,760	0.1466	3	0	0	3	20.5	0.0	0.0	20.5
2009	10.65	3,760	0.1462	1	3	0	4	6.8	20.5	0.0	27.4
2010	10.65	4,150	0.1613	3	2	0	5	18.6	12.4	0.0	31.0
2011	10.65	4,140	0.1609	2	1	0	3	12.4	6.2	0.0	18.6
2012	10.65	4,100	0.1598	1	2	0	3	6.3	12.5	0.0	18.8
Totals and Average Rate			0.9299	12	10	0	22	12.9	10.8	0.0	23.7
Highway 103 - Section 150 (EXIT 17 Route 331 Mill Village to EXIT 18 Trunk 3 Brooklyn)											
2007	8.09	4,500	0.1329	0	2	0	2	0.0	15.1	0.0	15.1
2008	8.09	4,600	0.1362	1	0	0	1	7.3	0.0	0.0	7.3
2009	8.09	4,700	0.1388	2	2	0	4	14.4	14.4	0.0	28.8
2010	8.09	4,500	0.1329	0	0	0	0	0.0	0.0	0.0	0.0
2011	8.09	4,200	0.1240	4	1	0	5	32.3	8.1	0.0	40.3
2012	8.09	3,920	0.1161	1	2	0	3	8.6	17.2	0.0	25.8
Totals and Average Rate			0.7808	8	7	0	15	10.2	9.0	0.0	19.2
Highway 103 - Section 160 (EXIT 18 Trunk 3 Brooklyn to EXIT 19 Trunk 8 Liverpool)											
2007	6.40	4,200	0.0981	4	1	0	5	40.8	10.2	0	51.0
2008	6.40	4,000	0.0937	3	1	0	4	32.0	10.7	0	42.7
2009	6.40	3,670	0.0857	0	2	0	2	0.0	23.3	0	23.3
2010	6.40	3,800	0.0888	1	1	0	2	11.3	11.3	0	22.5
2011	6.40	3,900	0.0911	4	1	0	5	43.9	11.0	0	54.9
2012	6.40	4,020	0.0942	5	1	0	6	53.1	10.6	0	63.7
Totals and Average Rate			0.5516	17	7	0	24	30.8	12.7	0	43.5
Highway 103 - Section 170 (EXIT 19 Trunk 8 Liverpool to EXIT 20A Liverpool)											
2007	3.48	2,800	0.0356	0	0	0	0	0.0	0.0	0.0	0.0
2008	3.48	2,800	0.0357	0	0	0	0	0.0	0.0	0.0	0.0
2009	3.48	2,760	0.0351	1	0	0	1	28.5	0.0	0.0	28.5
2010	3.48	2,800	0.0356	1	1	0	2	28.1	28.1	0.0	56.2
2011	3.48	2,900	0.0368	0	0	0	0	0.0	0.0	0.0	0.0
2012	3.48	2,990	0.0381	1	0	1	2	26.3	0.0	26.3	52.5
Totals and Average Rate			0.2168	3	1	1	5	13.8	4.6	4.6	23.1

Table B-1- Highway 103 - Sections 040 to 270 - Collision Rates 2007 to 2012

Year	Length	AADT[1]	HMVK[2]	Number of Collisions				Collision Rate per HMVK			
				PDO	Injury	Fatal	Total	PDO	Injury	Fatal	Total
Highway 103 - Section 175 (EXIT 20A Liverpool to EXIT 20 Summerville Centre)											
2007	10.79	2,850	0.1122	2	1	0	3	17.8	8.9	0.0	26.7
2008	10.79	2,900	0.1145	1	3	0	4	8.7	26.2	0.0	34.9
2009	10.79	2,950	0.1162	0	0	0	0	0.0	0.0	0.0	0.0
2010	10.79	2,900	0.1142	0	0	0	0	0.0	0.0	0.0	0.0
2011	10.79	2,900	0.1142	0	1	0	1	0.0	8.8	0.0	8.8
2012	10.79	2,890	0.1141	2	1	0	3	17.5	8.8	0.0	26.3
Totals and Average Rate			0.6855	5	6	0	11	7.3	8.8	0.0	16.0
Highway 103 - Section 180 (EXIT 20 Summerville Centre to EXIT 21 Port Mouton)											
2007	3.80	3,000	0.0416	1	0	0	1	24.0	0.0	0.0	24.0
2008	3.80	3,020	0.0420	0	0	0	0	0.0	0.0	0.0	0.0
2009	3.80	3,340	0.0463	0	0	0	0	0.0	0.0	0.0	0.0
2010	3.80	3,300	0.0458	2	1	0	3	43.7	21.8	0.0	65.5
2011	3.80	3,200	0.0444	3	1	0	4	67.6	22.5	0.0	90.1
2012	3.80	3,150	0.0438	0	0	0	0	0.0	0.0	0.0	0.0
Totals and Average Rate			0.2639	6	2	0	8	22.7	7.6	0	30.3
Highway 103 - Section 182 (EXIT 21 Port Mouton to Queens / Shelburne County Line)											
2007	14.21	2,200	0.1141	3	4	0	7	26.3	35.1	0.0	61.3
2008	14.21	2,300	0.1196	2	2	0	4	16.7	16.7	0.0	33.4
2009	14.21	2,440	0.1266	1	5	0	6	7.9	39.5	0.0	47.4
2010	14.21	2,400	0.1245	4	1	0	5	32.1	8.0	0.0	40.2
2011	14.21	2,300	0.1193	1	2	0	3	8.4	16.8	0.0	25.1
2012	14.21	2,310	0.1201	3	3	0	6	25.0	25.0	0.0	49.9
Totals and Average Rate			0.7242	14	17	0	31	19.3	23.5	0.0	42.8
Highway 103 - Section 185 (Queens / Shelburne County Line to EXIT 23 Sable River)											
2007	9.53	2,000	0.0696	2	2	0	4	28.7	28.7	0.0	57.5
2008	8.53	2,100	0.0656	2	1	0	3	30.5	15.3	0.0	45.8
2009	9.53	2,190	0.0762	1	2	0	3	13.1	26.3	0.0	39.4
2010	9.53	2,100	0.0730	0	0	0	0	0.0	0.0	0.0	0.0
2011	9.53	2,100	0.0730	4	2	0	6	54.8	27.4	0.0	82.1
2012	9.53	2,050	0.0715	2	1	0	3	28.0	14.0	0.0	42.0
Totals and Average Rate			0.4289	11	8	0	19	25.6	18.7	0.0	44.3
Highway 103 - Section 190 (EXIT 23 Sable River to EXIT 24 Jordan Falls)											
2007	13.71	2,000	0.1001	2	0	0	2	20.0	0.0	0.0	20.0
2008	13.71	2,000	0.1004	0	1	0	1	0.0	10.0	0.0	10.0
2009	13.71	1,930	0.0966	2	1	0	3	20.7	10.4	0.0	31.1
2010	13.71	2,000	0.1001	0	1	0	1	0.0	10.0	0.0	10.0
2011	13.71	2,000	0.1001	1	1	0	2	10.0	10.0	0.0	20.0
2012	13.71	1,990	0.0999	0	0	0	0	0.0	0.0	0.0	0.0
Totals and Average Rate			0.5970	5	4	0	9	8.4	6.7	0.0	15.1
Highway 103 - Section 200 (EXIT 24 Jordan Falls to EXIT 25 East End Shelburne By-Pass)											
2007	5.72	2,900	0.0605	0	0	0	0	0.0	0.0	0.0	0.0
2008	5.72	2,800	0.0586	0	0	0	0	0.0	0.0	0.0	0.0
2009	5.72	2,760	0.0576	1	1	0	2	17.4	17.4	0.0	34.7
2010	5.72	2,800	0.0585	1	0	0	1	17.1	0.0	0.0	17.1
2011	5.72	1,900	0.0397	0	1	0	1	0.0	25.2	0.0	25.2
2012	5.72	3,080	0.0645	0	0	0	0	0.0	0.0	0.0	0.0
Totals and Average Rate			0.3394	2	2	0	4	5.9	5.9	0.0	11.8

Table B-1- Highway 103 - Sections 040 to 270 - Collision Rates 2007 to 2012

Year	Length	AADT[1]	HMVK[2]	Number of Collisions				Collision Rate per HMVK			
				PDO	Injury	Fatal	Total	PDO	Injury	Fatal	Total
Highway 103 - Section 210 (EXIT 25 East End Shelburne By-Pass to EXIT 26 Route 203 Ohio Road)											
2007	4.03	2,100	0.0309	1	0	0	1	32.4	0.0	0.0	32.4
2008	4.03	2,100	0.0310	1	1	0	2	32.3	32.3	0.0	64.6
2009	4.03	2,100	0.0309	1	0	0	1	32.4	0.0	0.0	32.4
2010	4.03	2,150	0.0316	1	0	0	1	31.6	0.0	0.0	31.6
2011	4.03	2,200	0.0324	2	0	0	2	61.8	0.0	0.0	61.8
2012	4.03	2,230	0.0329	0	1	0	1	0.0	30.4	0.0	30.4
Totals and Average Rate			0.1896	6	2	0	8	31.6	10.5	0.0	42.2
Highway 103 - Section 215 (EXIT 26 Route 203 Ohio Road to EXIT 27 Trunk 3 Birchtown)											
2007	6.94	2,600	0.0659	0	1	0	1	0.0	15.2	0.0	15.2
2008	6.94	2,600	0.0660	3	1	0	4	45.4	15.1	0.0	60.6
2009	6.94	2,540	0.0643	2	1	0	3	31.1	15.5	0.0	46.6
2010	6.94	2,600	0.0659	0	2	0	2	0.0	30.4	0.0	30.4
2011	6.94	2,700	0.0684	2	0	0	2	29.2	0.0	0.0	29.2
2012	6.94	2,760	0.0701	1	0	0	1	14.3	0.0	0.0	14.3
Totals and Average Rate			0.4006	8	5	0	13	20.0	12.5	0.0	32.5
Highway 103 - Section 220 (EXIT 27 Trunk 3 Birchtown to Clinton Road)											
2007	7.96	2,700	0.0784	1	0	0	1	12.7	0.0	0.0	12.7
2008	7.96	2,700	0.0787	1	0	0	1	12.7	0.0	0.0	12.7
2009	7.96	2,750	0.0799	2	3	0	5	25.0	37.5	0.0	62.6
2010	7.96	2,700	0.0784	0	2	0	2	0.0	25.5	0.0	25.5
2011	7.96	2,700	0.0784	0	1	0	1	0.0	12.7	0.0	12.7
2012	7.96	2,670	0.0778	1	0	0	1	12.9	0.0	0.0	12.9
Totals and Average Rate			0.4717	5	6	0	11	10.6	12.7	0.0	23.3
Highway 103 - Section 225 (Clinton Road to EXIT 28 Clyde River)											
2007	5.39	2,700	0.0531	0	1	0	1	0.0	18.8	0.0	18.8
2008	5.39	2,700	0.0533	0	0	0	0	0.0	0.0	0.0	0.0
2009	5.39	2,640	0.0519	2	1	0	3	38.5	19.3	0.0	57.8
2010	5.39	2,800	0.0551	0	1	0	1	0.0	18.2	0.0	18.2
2011	5.39	2,900	0.0571	0	1	0	1	0.0	17.5	0.0	17.5
2012	5.39	2,940	0.0580	0	0	1	1	0.0	0.0	17.2	17.2
Totals and Average Rate			0.3285	2	4	1	7	6.1	12.2	3.0	21.3
Highway 103 - Section 230 (EXIT 28 Clyde River to EXIT 29 East of Barrington)											
2007	9.80	3,000	0.1073	5	2	0	7	46.6	18.6	0.0	65.2
2008	9.80	2,900	0.1040	1	2	0	3	9.6	19.2	0.0	28.8
2009	9.80	2,890	0.1034	3	0	0	3	29.0	0.0	0.0	29.0
2010	9.80	2,900	0.1037	3	2	0	5	28.9	19.3	0.0	48.2
2011	9.80	2,900	0.1037	1	1	1	3	9.6	9.6	9.6	28.9
2012	9.80	2,880	0.1033	0	0	0	0	0.0	0.0	0.0	0.0
Totals and Average Rate			0.6255	13	7	1	21	20.8	11.2	1.6	33.6

Table B-1- Highway 103 - Sections 040 to 270 - Collision Rates 2007 to 2012

Year	Length	AADT[1]	HMVK[2]	Number of Collisions				Collision Rate per HMVK			
				PDO	Injury	Fatal	Total	PDO	Injury	Fatal	Total
Highway 103 - Section 235 (EXIT 29 East of Barrington to EXIT 30 Barrington)											
2007	4.30	1,300	0.0204	0	0	0	0	0.0	0.0	0.0	0.0
2008	4.30	1,300	0.0205	0	0	0	0	0.0	0.0	0.0	0.0
2009	4.30	1,330	0.0209	1	0	0	1	47.9	0.0	0.0	47.9
2010	4.30	1,400	0.0220	0	0	0	0	0.0	0.0	0.0	0.0
2011	4.30	1,450	0.0228	0	0	0	0	0.0	0.0	0.0	0.0
2012	4.30	1,460	0.0230	0	0	0	0	0.0	0.0	0.0	0.0
Totals and Average Rate			0.1294	1	0	0	1	7.7	0.0	0.0	7.7
Highway 103 - Section 240 (EXIT 30 Barrington to Shelburne / Yarmouth County Line)											
2007	7.20	1,800	0.0473	0	3	0	3	0.0	63.4	0.0	63.4
2008	7.20	1,900	0.0501	3	1	0	4	59.9	20.0	0.0	79.9
2009	7.20	2,070	0.0544	1	3	0	4	18.4	55.1	0.0	73.5
2010	7.20	2,050	0.0539	4	0	0	4	74.2	0.0	0.0	74.2
2011	7.20	2,000	0.0526	3	0	0	3	57.1	0.0	0.0	57.1
2012	7.20	1,990	0.0524	7	1	0	8	133.5	19.1	0.0	152.6
Totals and Average Rate			0.3106	18	8	0	26	57.9	25.8	0.0	83.7
Highway 103 - Section 245 (Shelburne / Yarmouth County Line to EXIT 31 Pubnico)											
2007	14.30	1,800	0.0940	1	1	0	2	10.6	10.6	0.0	21.3
2008	14.30	1,900	0.0994	1	0	1	2	10.1	0.0	10.1	20.1
2009	14.30	2,070	0.1080	0	0	1	1	0.0	0.0	9.3	9.3
2010	14.30	2,050	0.1070	2	1	0	3	18.7	9.3	0.0	28.0
2011	14.30	2,000	0.1044	0	3	0	3	0.0	28.7	0.0	28.7
2012	14.30	1,990	0.1042	2	1	0	3	19.2	9.6	0.0	28.8
Totals and Average Rate			0.6170	6	6	2	14	9.7	9.7	3.2	22.7
Highway 103 - Section 250 (EXIT 31 Pubnico to EXIT 32 East of Argyle Causeway)											
2007	12.60	3,560	0.1637	2	2	0	4	12.2	12.2	0.0	24.4
2008	12.60	3,180	0.1466	2	2	0	4	13.6	13.6	0.0	27.3
2009	12.60	3,230	0.1485	4	2	0	6	26.9	13.5	0.0	40.4
2010	12.60	3,340	0.1536	2	1	0	3	13.0	6.5	0.0	19.5
2011	12.60	3,210	0.1476	2	0	1	3	13.5	0.0	6.8	20.3
2012	12.60	3,870	0.1785	5	3	0	8	28.0	16.8	0.0	44.8
Totals and Average Rate			0.9386	17	10	1	28	18.1	10.7	1.1	29.8
Highway 103 - Sections 255 and 260 (EXIT 32 East of Argyle Causeway to EXIT 33 Tusket)											
2007	13.20	4,000	0.1927	5	1	1	7	25.9	5.2	5.2	36.3
2008	13.20	4,100	0.1981	5	1	1	7	25.2	5.0	5.0	35.3
2009	13.20	4,230	0.2038	7	0	0	7	34.3	0.0	0.0	34.3
2010	13.20	4,200	0.2024	7	4	0	11	34.6	19.8	0.0	54.4
2011	13.20	4,100	0.1975	6	2	0	8	30.4	10.1	0.0	40.5
2012	13.20	4,020	0.1942	6	1	0	7	30.9	5.1	0.0	36.0
Totals and Average Rate			1.1887	36	9	2	47	30.3	7.6	1.7	39.5
Highway 103 - Section 270 (EXIT 33 Tusket to Hardscratch Road Yarmouth)											
2007	10.15	5,250	0.1945	9	1	0	10	46.3	5.1	0.0	51.4
2008	10.15	5,350	0.1987	5	2	0	7	25.2	10.1	0.0	35.2
2009	10.15	5,470	0.2026	5	2	0	7	24.7	9.9	0.0	34.5
2010	10.15	5,350	0.1982	5	1	1	7	25.2	5.0	5.0	35.3
2011	10.15	5,250	0.1945	6	5	0	11	30.8	25.7	0.0	56.6
2012	10.15	5,160	0.1917	3	2	0	5	15.7	10.4	0.0	26.1
Totals and Average Rate			1.1803	33	13	1	47	28.0	11.0	0.8	39.8

Appendix C

Maintenance Standards and Review

Department of Transportation and Infrastructure Renewal

Highway Programs

HIGHWAY MAINTENANCE STANDARDS

Effective 1 July 2009

Updated July 2011
Updated Chapter 6: Sept. 2013
Updated with Appendix A: Nov. 2013

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GENERAL MAINTENANCE STANDARDS (Revised July 1, 2009)

1. All maintenance work and materials shall conform to the Department's "Highway Construction and Maintenance Standard Specifications" and "Manual 23", except as modified in these Maintenance Standards.

2. The Supervisor shall be defined as any person designated by the Area Manager to supervise maintenance activities as described in these "Maintenance Standards". The Supervisor or other designated person may also direct others (CUPE staff) to perform work as required to meet these "Maintenance Standards".

3. On or before 30th Nov of each year, the Area Manager shall be responsible to obtain the "Annual Condition Defects Report" from each Supervisor. This Report shall be used to prioritize and plan work for the upcoming maintenance season.

   This report shall be considered a priority list of major maintenance projects only. Typical projects usually greater than $5,000 in value shall include spreader patching, graveling roads, cross culvert replacement and bridge check replacement. Routine maintenance work such as repairing washouts or replacing driveway culverts and capital reconstruction work shall not be included in this report.

   If required, each deficiency shall be accompanied with a brief proposal on how to rectify the deficiency and an estimate of the cost for the proposed work.

4. The supervisor shall maintain complete and accurate records of work completed during the year.

5. The timelines of these "Maintenance Standards" do not apply during the following periods with the exception of pothole patching and immediate hazards:

   - Winter operations (December to March)
   - Spring shoulder season (4 weeks past official end of winter operations)
   - Spring weight restrictions

   When performing summer maintenance activities (other than pothole patching) during these periods, the Supervisor shall make every reasonable attempt to follow the timelines of these "Maintenance Standards" when practically possible.

6. During summer, winter and spring shoulder season operations, when the Supervisor encounters or is made aware of hazardous conditions (any condition which poses significant and immediate danger to the motoring public), he shall immediately take whatever safety precautions are necessary to safeguard the

GENERAL MAINTENANCE STANDARDS (Revised July 1, 2009)

traveling public. If required, repairs shall be scheduled as soon as practically possible.

7. It is the responsibility of the Supervisor to ensure that the highway right-of-way is maintained in a condition that ensures safe passage of vehicular traffic.

8. This "Maintenance Standard" establishes levels of service for maintenance activities on Provincial Highways. The following table defines highway maintenance levels of service based on road classification and traffic volumes.

Pothole Criteria and Response Time Table

LEVEL OF SERVICE	Level 1A	Level 1B	Level 2	Level 3	Level 4
Type of Roads	All 100 Series and selected high volume highways	All Trunks and selected highways as per AADT limits	All Routes and selected highways as per AADT Limits	All local roads	All gravel roads
AADT Limits	Greater than 7,500	Between 7,500 – 4,000	Between 4,000 – 1,500	Less than 1,500	N/A

9. Where possible, the Supervisor may combine road patrols with other work being carried out during the day (or shift). The "Routine Road Patrol Frequency Table" below sets out the minimum frequency of inspections necessary to ensure reasonable levels of service on sections of highway, which have not been inspected during the normal course of other duties.

Routine Road Patrol Frequency Table

LEVEL OF SERVICE	FREQUENCY
Level 1A	2 times/week
Level 1B	1 time/week
Level 2	1 time/2 weeks
Level 3	1 time/month
Level 4	1 time/month*

** Level 4 with AADT less than 50 vehicles may be inspected 1 time/2 months*

CHAPTER 1 SURFACE MAINTENANCE Plant Maintenance Order Type: RO01
Section 2 Shoulder Maintenance Activity Type: 111

STANDARD

1. Erosion/Washouts/Low Shoulders less than 100 metres in length

Erosion and washouts are the loss of shoulder material. This condition usually occurs during rain storms, sea surges or when snow melts. The most common problem areas are where guardrail has been installed, along and/or at the bottom of steep grades, and inside of turns.

All washouts and low shoulders shall be repaired as outlined in the "Erosion, Washout and Low Shoulders Response Time Table" below.

Low shoulders exist when the shoulder material is not flush with the edge of the pavement. This condition usually occurs due to insufficient granular material.

All washouts adjacent to the edge of travelled lane and any low shoulders that pose a potential hazard to the traveling public shall be signed within 24 hours of detection.

Erosion, Washout and Low Shoulder Response Time Table

Erosion, Washout and Low Shoulder Response Times	**Depth of Deficiency** (For all Levels of Service)		
	100 mm to 150 mm	151 mm to 300 mm	Greater than 300 mm
Less than 100 m in length	30 days	7 days	Immediately

2. Washouts / Low Shoulders greater than 100 metres in length

For continuous lengths greater than 100 metres and greater than 100 milimetres in depth, repair work shall be based on the "Annual Condition Defects Report", at the discretion of the Supervisor. All washouts adjacent to the edge of travelled lane and any low shoulders that pose a potential hazard to the traveling public shall be signed within 24 hours of detection.

CHAPTER 1 SURFACE MAINTENANCE
Section 7 Hand Patching

Plant Maintenance Order Type: RO01
Activity Type: 132

DEFINITION

Hand patching is the process of repairing paved surface defects with hot or cold mix asphalt material placed by hand or automatic patching machine. This includes patching potholes, depressions, pavement edge defects or distressed areas and asphalt gutters.

PURPOSE

To eliminate traffic hazards by filling holes and leveling depressions in the surface and to restore riding quality.

GENERAL

For pothole, miscellaneous patching, and asphalt gutter installation, any preparation work involved such as removal of asphalt and/or gravel and installation of granular material up to a depth of 300 mm shall be included in this activity.

Cold mix asphalt is normally used when hot mix asphalt is not available.

INSPECTION – Road Patrols

1. During routine inspections or as situations arise, the Supervisor shall record deficiencies, post warning signs, schedule repairs and report as specified in the following “Standard” section.

2. The Supervisor shall provide the Area Manager with a prioritized list of road sections that frequently exhibit the conditions as specified in the following “Standard” section. This list shall be included in the “Annual Condition Defects Report”.

STANDARD

1. <u>Potholes</u>

   When weather conditions permit, asphalt concrete hand patching will be undertaken to repair potholes in accordance with these “Maintenance Standards”.

CHAPTER 1 SURFACE MAINTENANCE Plant Maintenance Order Type: RO01
Section 7 Hand Patching Activity Type: 132

Potholes that are causing a hazard shall be repaired immediately. A hazard is defined as a condition which poses a significant and immediate danger to the motoring public.

Pothole conditions not meeting the minimum criteria listed in the "Pothole Criteria and Response Time Table" shall be repaired within the construction season. Work shall be performed in conjunction with other maintenance activities in the vicinity of the pothole.

Pothole Criteria and Response Time Table

Pothole Criteria	Level 1A	Level 1B	Level 2	Level 3
Description	Potholes which are greater than 0.10 m^2 in area (i.e. 0.3 m x 0.3 m) and greater than 100 mm deep.			
Action	Sign immediately and repair within 7 days	Sign immediately and repair within 7 days	Sign within 24 hours and repair within 21 days	Sign within 24 hours and repair within 60 days
Description	Potholes which are greater than 0.10 m^2 in area (i.e. 0.3 m x 0.3 m) and between 50 mm and 100 mm deep.			
Action	Sign immediately and repair within 14 days	Sign immediately and repair within 14 days	Sign within 24 hours and repair within 60 days	Sign within 24 hours and repair within 120 days

2. Hand Patching

When planning work or establishing priority lists for asphalt patching the following types of defects shall be considered:

- Large concentration of small potholes.
- Segregation/Raveling: Pavement material loss leaving voids in the surface.

- Wheel rutting: A longitudinal surface depression developed in the wheel tracks exceeding 20 mm.
- Rippling: Wavy or washboard effect running across the pavement.
- Cracking: Includes longitudinal, transverse, alligator and edge cracks.
- Edge loss: Loss of pavement surface adjacent to the shoulder.
- Distortions: Any deviation of the pavement surface from its original shape.
- Flushing: Pavement surface appears polished or asphalt cement appears on the pavement surface.
- Water ponding: Collection of water on the traveled portion of the highway.
- Repairs around various structures including catch basins, manholes, bridge approaches and bridge drains.

3. Asphalt Gutter Installation

The Supervisor shall note gutter defects that prevent the movement of water including deteriorated asphalt, loss of shape, cracking, worn edges, and excessive gaps between the gutter and the edge of pavement.

Replacement or additional installations of asphalt gutter shall be determined by the Supervisor.

RESOURCES

Equipment: 1 – 2 dump trucks
Compactor (tamper, small roller)
Hand tools (rakes, shovels, wheel barrow)
Tack applicator

Labour: 2 – 3 operators
1 - 2 rakers
1 – 2 crew person(s)
Traffic Control persons (as required)

CHAPTER 2 ROADSIDE MAINTENANCE Plant Maintenance Order Type: RO02
Section 1 Brush Cutting – Machine Activity Type: 114

DEFINITION

The removal of large quantities of brush, shrubs and small trees using mechanically self-propelled equipment.

PURPOSE

To remove undesirable roadside vegetation in order to maintain required sight distances, control roadside growth, ensure proper drainage, and to provide a reasonably neat appearance to the highway right-of-way.

GENERAL

All brush shall be disposed of properly. This shall include the removal, mulching or chipping to achieve a reasonable neat appearance to the highway right-of-way.

Where traffic, pedestrians, housing or other obstructions prohibit the use of certain mechanical equipment, vegetation control shall be achieved with the use of manual hand cutting tools.

INSPECTION

During routine inspections or as situations arise, the Supervisor shall record deficiencies, schedule repairs and report as specified in the following “Standard” section. The Supervisor shall provide the Area Manager with a prioritized list of road sections which exhibit the conditions as specified in the “Standard” section, subsection 1.3 only. This list shall be included in the “Annual Condition Defects Report”.

STANDARD

1.0 Brush Cutting

1.1 When detected, brush (including tree branches) that reduce sight visibility as indicated in the “Minimum Sight Distance Table” below shall be cut within 21 days to a height of not greater than 150 mm from the ground. This shall include such areas as intersections, entrances, interchanges, and shoulders where the vegetation is infringing on guard rails and inside

of curves. If the actual sight distance (as measured in the field) indicates a corresponding speed that is 20 km/h or greater below the posted speed limit, the Supervisor shall correct the condition immediately.

Minimum Site Distance Table

Posted Speed (km/h)	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
Minimum Stopping Sight Distance (m)	45	65	85	110	140	170	200	230
Minimum Passing Sight Distance (m)	-	160	200	240	275	330	400	475

(Sight distance measurements based on eye height of 1.05 m)

1.2 When detected, brush (including trees) on the right-of-way that create one or all of the following conditions, shall either be cut within 21 days, or if the condition poses a serious hazard shall be cut immediately.

1.2.1 Brush that obstructs traffic signs, destination signs, or traffic signs.

1.2.2 Brush (including tree branches) that restricts vertical clearances.

1.2.3 Brush within the shoulder area which restricts passing site distance.

1.3 Locations to be cut by Machine Brush Cutting shall be determined by the Supervisor based on the Department's "Brush Cutting Policy", "Manual 23, PR5039" and/or as indicated in the "Minimum Sight Distance Table" above. This work shall consist of cutting brush within the highway right-of-way, which shall include but is not limited to selected areas such as embankment slopes, ditches and back slopes. Only large sections of

CHAPTER 2 ROADSIDE MAINTENANCE Plant Maintenance Order Type: RO02
Section 1 Brush Cutting – Machine Activity Type: 114

planned machine brush cutting (estimated cost greater than $5,000) shall be included in the “Annual Conditions Defect Report”.

RESOURCES

Equipment: Tractor with a mower attachment or
Grader with a brush cutter or
Excavator with a brush cutter
Attenuator (if required)

Labour: 1-2 operators
Traffic control person (as required)

NORMAL PRACTICE

- Complete hazard assessment.
- Set up temporary signing and traffic control devices.
- Cut brush as required.

METHOD OF MEASUREMENT

Hectares (1 Ha = 10,000 metres squared)

NORMAL OUTPUT

0.8 - 2.0 hectares per day

CHAPTER 2 ROADSIDE MAINTENANCE Plant Maintenance Order Type: RO02
Section 2 Brush Cutting – Manual Activity Type: 155

DEFINITION

The removal of brush, shrubs and other vegetation from localized areas using hand tools where mechanically self propelled equipment is not practical.

PURPOSE

To remove undesirable roadside vegetation in order to maintain required sight distances, control roadside growth, ensure proper drainage and to provide a reasonably neat appearance to the highway right-of-way.

GENERAL

All brush cut by hand shall be disposed of properly. This shall include the removal, mulching or chipping to achieve a reasonably neat appearance to the highway right-of-way.

INSPECTION

During routine inspections or as situations arise, the Supervisor shall record deficiencies, schedule repairs and report as specified in the “Standard” section.

The Supervisor shall provide the Area Manager with a prioritized list of road sections that exhibit the conditions as specified in the “Standard” section, subsections 1.3 and 2.0 only. This list shall be included in the “Annual Condition Defects Report”.

STANDARD

1. Brush Cutting

    1.1 When detected, brush (including tree branches) that reduce sight visibility as indicated in the “Minimum Sight Distance Table” below shall be cut within 21 days to a height of not greater than 150 mm from the ground. This shall include intersections, entrances, interchanges, shoulders, guard rails and inside of curves where the vegetation is infringing on minimum site distance. If the actual sight distance (as measured in the field) indicates a speed restriction that is ≥ 20 km/h below the posted speed

limit, the Supervisor shall correct the condition immediately.

Minimum Site Distance Table

Posted Speed (km/h)	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**
Minimum Stopping Sight Distance (m)	45	65	85	110	140	170	200	230
Minimum Passing Sight Distance (m)	-	160	200	240	275	330	400	475

(Sight distance measurements based on eye height of 1.05 m)

1.2 When detected, brush (including trees) on the right-of-way that creates one or all of the following conditions shall be cut within 21 days, or if the condition poses a serious hazard, immediately:

1.2.1 Brush which obstructs traffic signs, destination signs, or traffic signals.

1.2.2 Brush (including tree branches) which restricts vertical clearances.

1.2.3 Brush within the shoulder area which restricts passing site distance.

1.3 Locations to be cut by Machine Brush Cutting shall be determined by the Supervisor based on the Department's "Brush Cutting Policy", Manual 23, Policy PR5039 and as indicated in the "Minimum Sight Distance Table" above. This work shall consist of cutting brush within the highway right-of-way, which shall include but is not limited to selected areas such as embankment slopes, ditches and back slopes. Only large sections of planned manual brush cutting (estimated cost greater than $5,000) shall

CHAPTER 2 ROADSIDE MAINTENANCE Plant Maintenance Order Type: RO02
Section 4 Debris and Litter Clean-up Activity Type: 116

DEFINITION

The physical removal from the right-of-way and the subsequent disposal of objectionable items such as, but not limited to roadside rubbish, dead animals, unlawful signs, fallen trees, and loose brush. Includes fallen rocks on the driving surface and shoulders.

PURPOSE

Debris and Litter Clean-up acts as a precaution against damage or injury to the travelling public and personnel or equipment engaged in maintenance operations.

GENERAL

All debris shall be removed from the right-of-way and disposed of according to department policy and current governmental and municipal regulations.

All dead animals on the travelled portion and shoulder area of the right-of-way shall be removed and disposed of properly. In areas where a dead animal could create a health hazard, it shall be removed and disposed of immediately.

The Supervisor shall notify the Department of Natural Resources (DNR) of all dead large game animals (i.e. deer) cleared from the roadway surface or those detected beyond the shoulder. As the DNR may wish to retrieve the animal, the Supervisor shall cooperate fully to arrange a mutually agreed upon pick-up location.

INSPECTION

During routine inspections or as situations arise, the Supervisor shall record deficiencies, post warning signs, schedule work and report as specified in the following “Conditions” section.

The Supervisor shall provide the Area Manager with a prioritized list of road sections that frequently exhibit the conditions as specified in the “Conditions” section, subsection (B) only. This list shall be included in the “Annual Condition Defects Report” submitted.

CHAPTER 2 ROADSIDE MAINTENANCE Plant Maintenance Order Type: RO02
Section 4 Debris and Litter Clean-up Activity Type: 116

After winter operations are completed, early spring inspections are to be carried out to check for additional Condition Defects. The Area Manager is to be advised if changes are required to the annual report.

STANDARD

1. Debris Control

1.1 The Supervisor shall be responsible for removing and disposing of all debris and litter on the highway right-of-way as outlined below in the "Debris and Litter Clean-up Criteria Table". For object volumes specified, the Supervisor shall remove debris within the specified time limit.

Debris and Litter Clean-up Criteria Table

Debris Control	Level 1A	Level 1B	Level 2	Level 3 Local Roads	Level 4 Gravel Roads
Paved Surface	Immediately	Immediately	Immediately	Immediately	Full width gravel surface: Greater than 0.01m^3 Immediately
Non-Paved Shoulder	Greater than 0.03 m^3 Within 12 hrs	Greater than 0.03 m^3 Within 24 hrs	Greater than 0.03 m^3 Within 36 hrs	Greater than 0.03 m^3 Within 72 hrs	
Beyond Shoulder	Greater than 0.4 m^3 yearly before Nov. 30	Greater than 0.4 m^3 yearly before Nov. 30	Greater than 0.4 m^3 yearly before Nov. 30	Greater than 0.4 m^3 yearly before Nov. 30	Between 0.4 m^3 and 3.0 m^3 yearly before Nov. 30

The following examples clarify object sizes listed in the above table:

0.01 m^3 = 0.3 m x 0.3 m x 0.1 m (or 12" x 12" x 4")
0.03 m^3 = 0.3 m x 0.3 m x 0.3 m (or 12" x 12" x 12")
0.4 m^3 = 0.75 m x 0.75 m x 0.70 m (or 30" x 30" x 28")
0.4 m^3 = 1.0 m x 1.0 m x 0.4 m (or 39: x 39" x 16")

CHAPTER 5 TRAFFIC CONTROL Plant Maintenance Order Type: RO05
Section 2 Sign Maintenance and Repair Activity Type: 133
Sign Installation Activity Type: 134

DEFINITION

Sign Maintenance and Repair is maintaining signs and posts, including repairing, repainting and washing of existing signs and posts. Includes replacing signs and/or posts missing or beyond repair.

Sign Installation is installing new signs and posts at a new location where no sign was previously in place.

PURPOSE

To ensure the integrity of the signs, to inform the highway users of traffic regulations, to warn of roadway characteristics, and to provide information necessary for route selection.

GENERAL

Signs are devices which may be regulatory, warning or informational and are installed or maintained to provide information and to ensure the safety of the traveling public along public highways. Signs are erected by the Supervisor where directed by the District Traffic Supervisor or Provincial Signing Officer on public highways. No permanent sign shall be installed at a new location or removed from its existing location without the approval from the Area Manager and District Traffic Authority.

The following signs shall be considered as **critical signs**:

- Stop
- Yield
- One Way
- Do Not Enter

Each Supervisor must have access to a current copy of the “Manual of Uniform Traffic Control Devices” for easy reference which they can refer to for sign classification, etc. “Manual 23, PR 5052, Guide Sign Installation at Intersections” provides guidelines for sign installations.

The Supervisor is responsible to have an adequate supply of regulatory and warning signs in stock at all times.

CHAPTER 5 TRAFFIC CONTROL Plant Maintenance Order Type: RO05
Section 2 Sign Maintenance and Repair Activity Type: 133
Sign Installation Activity Type: 134

Signs are classified as follows:

1. Permanent Signs:

   Regulatory Signs: Advise the highway user of traffic regulations which apply at any time or place upon a highway as per the Public Highway Act.

   Warning Signs: Give advance notice of conditions upon or adjacent to a street or highway that are potentially hazardous to drivers.

   Information Signs: Provide information for destinations, selection of route, location of off-highway facilities, and for identification of geographical features or points of interest.

2. Temporary Conditions Signs

   Signs erected to warn highway users of conditions that last a short period of time (ie. Low Shoulder, Bump, Hazard Markers, etc.). The requirement for these signs is outlined in the "Manual of Uniform Traffic Control Devices". The signs are erected by the Supervisors.

INSPECTION – Road Patrols

During routine inspections or as situations arise, the Supervisor shall identify all illegible, poor reflectivity, improperly oriented, or missing signs and schedule work as specified in the "Standard" section.

Any signs greater than 3 square metres which require replacing shall be approved by the Area Manager prior to replacement.

STANDARD

1. Sign Maintenance and Repairs

   The Supervisor shall maintain and repair all signs, in accordance with the "Sign Work Response Time" table on next page.

CHAPTER 5 TRAFFIC CONTROL Plant Maintenance Order Type: RO05
Section 2 Sign Maintenance and Repair Activity Type: 133
Sign Installation Activity Type: 134

Sign Maintenance and Repairs shall include, but is not limited to the following:

1.1 Repair or clean all signs that are illegible (i.e. mud covered, faded, poor reflectivity, bent, improperly oriented, twisted, vandalized, broken or cracked).

1.2 Replace all signs or posts that are missing or replace signs or posts that are beyond repair, bent, improperly oriented, twisted, broken or cracked.

1.3 Report all vandalized or stolen signs to the proper authority along with an estimate of cost to replace.

2. Sign Installation

Any new sign (including posts) that is installed at new locations as directed by the Area Manager and in consultation with the District Traffic Authority.

Sign Work Response Time

Response Times	Level 1A	Level 1B	Level 2	Level 3 & 4
Stop Signs (+ All Critical Signs)	Immediately	Immediately	Immediately	Immediately
Regulatory and Warning Signs	7 Days	14 Days	14 Days	21 Days
Information Signs less than 1 m^2	30 Days	60 Days	90 Days	90 Days
Information Signs greater than 1 m^2	60 Days	90 Days	90 Days	120 Days

CHAPTER 5	**TRAFFIC CONTROL**	Plant Maintenance Order Type: RO05
Section 6	**Guard Rail Maintenance**	Activity Type: 166
	Guard Rail Installation	Activity Type: 167

DEFINITION

Work under “Activity Type 166, Guard Rail Maintenance”, shall include horizontal and vertical realignment of guard rail sections, including replacing reflective delineator.

Work under “Activity Type 167, Guard Rail Installation”, shall include new installations or replacing existing posts or blocks that are missing, broken, excessively split or cracked. Also includes replacing rails and channels that are severely dented, bent, flattened or twisted and repairing cables.

PURPOSE

A guard rail system is used to protect the motorist from a roadside hazard. Hazards can include bridge abutments or piers, light standards, embankments, etc.

GENERAL

To ensure the structural integrity of a guardrail system and safety to the travelling public: rails and channels that are severely damaged are to be replaced, cable guardrail shall be tensioned to specified range and guard rail posts that have excessively damaged or misaligned will be reset to the proper horizontal and vertical alignment.

The guard rail system is to be installed as per the “Nova Scotia Standard Specifications”, “Steel Guardrail Systems and Wooden Guide Posts” (Division 5, Section 6).

New installations will be made at the discretion of the Supervisor, in consultation with the Area Manager.

A guardrail system includes all rail elements, related hardware, reflectors, posts and blocks.

When a section of steel beam guard rail has been damaged by a motor vehicle accident, the Supervisor shall take immediate measures to prevent additional hazards to traffic until such time as permanent repairs can be made, cost may be recoverable.

CHAPTER 5	**TRAFFIC CONTROL**	Plant Maintenance Order Type: RO05
Section 6	**Guard Rail Maintenance**	Activity Type: 166
	Guard Rail Installation	Activity Type: 167

INSPECTION – Road Patrols

During routine inspections or as situations arise, the Supervisor shall record deficiencies, post warning signs and schedule repairs as specified in the following "Standard" section.

The Supervisor shall provide the Area Manager with a prioritized list of road sections that exhibit the conditions as specified in the "Standard" section, subsection 2. This list shall be included in the "Annual Condition Defects Report".

STANDARD

1. Guard Rail Maintenance

   Guard rail posts that have excessively heaved, settled or are excessively inclined shall be reset to the proper horizontal and vertical alignment.

   Guard rail maintenance shall also include the replacement of reflective delineators on posts.

   All guard rail maintenance defects shall be repaired yearly before November 30th.

2. Guard Rail Installation

   Rails and channels that are severely damaged are to be replaced in accordance with the "Guard Rail Installation Response Time Table" below.

   Posts and blocks that severely damaged are to be replaced in accordance with the "Guard Rail Installation Response Time Table" below.

Guard Rail Installation Response Time Table

Guard Rail Maintenance and Installation	Level 1A	Level 1B & 2	Level 3 & 4
Repair or Replacement	21 Days	60 Days	120 Days

CHAPTER 5 TRAFFIC CONTROL Plant Maintenance Order Type: RO05
Section 6 Guard Rail Maintenance Activity Type: 166
Guard Rail Installation Activity Type: 167

Areas where additional hazards have been identified, removal and replacement of guard rail sections over 50 m in length will be undertaken in consultation with the Area Manager.

If a hazard exists with the guard rail system, emergency safety precautions (barricades, signs, jersey barriers, drums, etc.) are to be taken immediately to safeguard the traveling public.

RESOURCES

Equipment: Post hole digger or backhoe
Drill (40 cm minimum length)
Shovels
Wrenches
Crow Bar

Labour: 1 operator if using backhoe
2-3 crew persons
Traffic control persons (as required)

Materials: Posts
Nuts and bolts
W beams and box beams
Cable
Zinc rich paint
Collapsible ends
Box beam posts
Cable barrier posts
Wire rope

NORMAL PRACTICE

- Complete hazard assessment.
- Set up temporary signing and traffic control devices (as required).

CHAPTER 5 TRAFFIC CONTROL Plant Maintenance Order Type: RO05
Section 6 Guard Rail Maintenance Activity Type: 166
Guard Rail Installation Activity Type: 167

- Ensure the elevation and alignment of all guard rail is erected according to the Nova Scotia Standard Specifications, “Steel Guardrail Systems and Wooden Guide Posts” (Division 5, Section 6).

- Guardrail should be raised, when construction or maintenance activities alter the elevation of the roadway, to maintain the effective height above the road surface.

METHOD OF MEASUREMENT

Guard rail maintenance: Work shall be recorded under “Activity Type 166, Guard Rail Maintenance” as metres measured from centre bolt hole to centre bolt hole (3.81 metres).

Guard rail installation: Work shall be recorded under “Activity Type 167, Guard Rail Maintenance” as metres measured from centre bolt hole to centre bolt hole (3.81 metres).

Any work involving only posts shall be recorded as metres of the length of rail affected by the associated posts (i.e. Straightening or replacing one guard rail post may involve removing two lengths of guard rail and would be recorded as 2 x 3.81 m = 7.62 m).

NORMAL OUTPUT

Guardrail installation: 100-300 metres

Guardrail maintenance: 300-500 metres

CHAPTER 6 SNOW AND ICE CONTROL

Plant Maintenance Order Type: RO90
Activity Type: 104
Activity Type: 105
Activity Type: 106
Activity Type: 109

DEFINITION

Snow and ice control includes plowing, anti-icing (direct liquid application (DLA)), salting, pre-wet salting, sanding, and ice blading of roads before, during and after winter weather events.

PURPOSE

The winter maintenance standards establish levels of service on provincial highways. The winter maintenance levels of service for snow and ice control are based on road classification and traffic volumes.

GENERAL

The Supervisor is responsible for ensuring that highways are maintained in accordance with these Winter Maintenance Standards.

The use of salt in environmentally sensitive areas will be monitored and alternatives to salt will be used where practical.

The use of brine as a DLA and/or to pre-wet salt reduces the amount of salt applied to the roads (thereby reducing the impact to the environment), shortens the amount of time required to clear the roads and improves public safety.

The Supervisor shall ensure an accurate inventory of salt is maintained. For stockpiles that have been cross sectioned, the conversion factor of 1405 kg/m^3 shall be used. The conversion factor shall be updated annually.

The Supervisor (or other authorized personnel) shall keep accurate and legible daily logs. The log shall consist of the following information:

- Temperature every hour
- Type and amount of precipitation every hour
- Dispatch, loading and end times for all vehicles
- Operators on duty
- Start and stop of storm event
- Type of activity being performed (plowing, salting, DLA, pre-wetting, sanding)
- Vehicle breakdowns or accidents
- Emergency calls to the dispatch

CHAPTER 6 SNOW AND ICE CONTROL

Plant Maintenance Order Type: RO90
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- Amount of material loaded (salt, brine and sand)
- Supervisor in charge

INSPECTIONS

1. Winter road patrols shall be carried out by designated personnel to monitor road and weather conditions as required. Inspection by road patrols shall cover all routinely observed road conditions, in addition to ensuring that winter levels of service are maintained.

2. The Supervisor is to follow the Department road reporting protocol regarding normal winter road condition reporting. The Supervisor (or other authorized personnel) shall update the Road Condition Reporting System (RCRS)/511 three times per day (6:00 am, 1:00 pm, 4:00 pm) during the winter season, and three times per day (8:00 am, 1:00 pm, 4:00 pm) during the shoulder seasons when weather requires. Any changes in severe weather or road conditions, which occur between specified reporting periods, should be updated immediately on the RCRS/511.

STANDARD

1. The following winter maintenance levels of service for snow and ice control are based on road classification and traffic volumes:

Levels of Service Table

LEVEL OF SERVICE	Level 1A	Level 1B	Level 2	Level 3	Level 4
Type of Roads	All 100 Series and selected high volume highways	Trunks and selected highways as per AADT limits	Routes and selected highways as per AADT Limits	All local roads	All gravel, double chip seal and sand seal roads
AADT Limits	Greater than 7,500	Between 7,500 – 4,000	Between 4,000 – 1,500	Less than 1,500	N/A

2. While this Maintenance Standard establishes levels of service, it is acknowledged that conditions may occur, which temporarily prevent achieving levels assigned. In

CHAPTER 6 SNOW AND ICE CONTROL

Plant Maintenance Order Type: RO90
Activity Type: 104
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such cases, attempts shall be made to keep highways open by utilizing all available equipment.

3. During severe weather conditions, when it becomes evident to the Supervisor that available resources are not sufficient to maintain highways open and passable, the Supervisor shall immediately notify the Area Manager and the RCMP (or local Police force). The Area Manager will determine if the road shall be closed. The Supervisor is required to erect and maintain all road closures following the process outlined in Manual 23 PR5094 Emergency Highway Closing Mobilization.

4. Pre-treating with DLA may be carried out on various sections of paved roads as conditions warrant. Equipment can be deployed up to 16 hours prior to the start of the weather event (snowfall, frost/black ice). If the weather event is expected to start out with above freezing temperatures and rain, do not pre-treat as the chemical will be washed away. If the DLA pre-treatment is applied, an application of salt and/or pre-wet salt is not required at the beginning of the storm.

5. Pre-treating with pre-wet salt may be carried out on paved roads as conditions warrant. Equipment can be deployed up to 2 hours prior to the start of the weather event (snowfall, freezing rain, sleet). If the weather event is expected to start out with above freezing temperatures and rain, do not pre-treat as the salt will be washed away. If the pre-wet salt is applied, an application of salt is not required at the beginning of the storm.

6. From the time unfavourable road conditions occur and winter equipment is required for the safety of the public, it is essential that the response time is kept to a minimum.

7. The Supervisor shall deploy winter maintenance operations prior to the accumulations of the specified snow depth if the roads are hazardous, slippery, or ice or slush is developing.

Winter Levels of Service Description Table

CLASSIFICATION	DESCRIPTION	TIME LIMIT
Level 1A	Essentially bare pavement	Within 8 hours
Level 1B	Essentially bare pavement	Within 12 hours
Level 2	Centre line bare	Within 12 hours
Level 3	Centre line bare	Within 24 hours
Level 4	Snow packed	Within 24 hours

CHAPTER 6 SNOW AND ICE CONTROL

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8. Levels of Service

8.1 Level 1A – Essentially Bare Pavement

The defined level of service for Level 1A is essentially bare pavement, and is the objective to be reached as soon as possible after the storm has ended or abated, normally within eight (8) hours. This level of service applies to 100 Series highways and other selected high volume highways with an average daily traffic volume greater than 7,500 vehicles per day. To achieve this level of service, the Supervisor shall remove snow and apply de-icer as described in these Maintenance Standards.

The use of de-icer is to be controlled, in terms of both quantity and frequency, to meet the specified level of service.

De-icers may be in the form of: 1) brine, or alternative, applied as a DLA; 2) as pre-wet salt, or 3) dry salt. DLA may be completed prior to the start of the storm. DLA may be used on road temperatures between 0°C and -7°C. Pre-wet salt may be used on road temperatures between 0°C and -10°C. Do not pre-wet if road temperature is below -10°C and falling. It is important to evaluate and monitor pavement temperatures, road and weather conditions and trends to ensure proper de-icing treatment and timing of treatment is made.

Sand shall not normally be applied on Level 1A highways. Sand shall only be applied to Level 1A highways during severe cold weather when extremely slippery conditions exist.

A summary of Level 1A service is shown in the “Levels of Service Table” above.

8.2 Level 1B – Essentially Bare Pavement

The defined level of service for Level 1B is essentially bare pavement, and is the objective to be reached, as soon as possible after the storm has ended or abated, normally within twelve (12) hours. This level of service applies to Trunk highways and other selected highways with an average daily traffic volume between 7,500 and 4,000 vehicles per day. To achieve this level of service, the Supervisor shall remove snow and apply de-icer as described in these Maintenance Standards.

The use of de-icer is to be controlled, in terms of both quantity and frequency, to meet the specified level of service.

De-icers may be in the form of: 1) brine, or alternative, applied as a DLA; 2) as pre-wet salt, or 3) dry salt. DLA may be completed prior to the start of the storm. DLA may be used on road temperatures between 0°C and -7°C. Pre-wet salt may be used on road temperatures between 0°C and -10°C. Do not pre-wet if road temperature is below -10°C and falling. It is important to evaluate and monitor pavement temperatures, road and weather conditions and trends to ensure proper de-icing treatment and timing of treatment is made.

Sand is to be applied to all roads or sections of a road designated as being in environmentally sensitive areas. The use of salt in environmentally sensitive areas will be monitored and alternatives to salt will be used where practical.

A summary of Level 1B service is shown in the “Levels of Service Summary Table” above.

8.3 Level 2 – Centre Line Bare

The defined level of service for Level 2 is a minimum centre line bare conditions, and is the objective to be reached as soon as possible after the storm has ended or abated, normally within twelve (12) hours and be maintained until conditions permit baring the pavement full width. This level of service applies to 200 and 300 series Routes and other selected highways with an average daily traffic volume between 4,000 and 1,500 vehicles per day. To achieve this level of service, the Supervisor shall remove snow and apply de-icer as described in these Maintenance Standards.

The use of de-icer is to be controlled, in terms of both quantity and frequency, to meet the specified level of service.

De-icers may be in the form of: 1) brine, or alternative, applied as a DLA; 2) as pre-wet salt, or 3) dry salt. DLA may be completed prior to the start of the storm. DLA may be used on road temperatures between 0°C and -7°C. Pre-wet salt may be used on road temperatures between 0°C and -10°C. Do not pre-wet if road temperature is below -10°C and falling. It is important to evaluate and monitor pavement temperatures, road and

weather conditions and trends to ensure proper de-icing treatment and timing of treatment is made.

Sand is to be applied to all roads or sections of a road designated as being in environmentally sensitive areas. The use of salt in environmentally sensitive areas will be monitored and alternatives to salt will be used where practical.

A summary of Level 2 service is shown in the "Levels of Service Summary Table".

8.4 Level 3 – Centre Line Bare

The defined level of service for Level 3 is a minimum centre line bare condition and is the objective to be reached as soon as possible after the storm has ended or abated, normally within twenty-four (24) hours, and be maintained until conditions permit baring the pavement full width. This level of service applies to all local paved roads with an average daily traffic volume of less than 1,500 vehicles per day. To achieve this level of service, the Supervisor shall remove snow and apply de-icer or sand as described in these Maintenance Standards.

The use of de-icer or sand is to be controlled, in terms of both quantity and frequency, to meet the specified level of service.

De-icers may be in the form of: 1) brine, or alternative, applied as a DLA; 2) as pre-wet salt, or 3) dry salt. DLA may be completed prior to the start of the storm. DLA may be used on road temperatures between 0°C and -7°C. Pre-wet salt may be used on road temperatures between 0°C and -10°C. Do not pre-wet if road temperature is below -10°C and falling. It is important to evaluate and monitor pavement temperatures, road and weather conditions and trends to ensure proper de-icing treatment and timing of treatment is made.

Sand is to be applied to all roads or sections of a road designated as being in environmentally sensitive areas. The use of salt in environmentally sensitive areas will be monitored and alternatives to salt will be used where practical.

The application of de-icer or sand will normally take place after a snowfall. The application of de-icer or sand may be applied at the beginning of a

storm to hills, turns, intersections or railway crossings or where geographical conditions require.

A summary of Level 3 service is shown in the "Levels of Service Summary Table".

Note: For purposes of pilot projects alternatives to above can be considered with prior approval of the Executive Director of Maintenance and Operations.

8.5 Level 4 – Snow Packed

This level of service requires that the road surface be maintained in a snow packed condition as soon as possible after the storm has ended or abated normally within twenty-four (24) hours. This level of service applies only to gravel roads, double chip seal roads and sand seal roads. To achieve this level of service the Supervisor shall remove snow and apply sand as described in these Maintenance Standards.

Gravel, double chip seal and sand seal roads shall only have sand or other approved abrasives applied. The use of salt or other de-icers is strictly prohibited.

The use of sand or other approved abrasives is to be limited, in terms of both quantity and frequency, and normally applied only to hills, turns, intersections, and railway crossings after a storm has ended. Level areas will not normally be sanded unless severe slippery conditions exist. Urban areas may require the full length of the road be sanded.

A snow packed surface is described as a smooth, hard, good driving surface with satisfactory friction with shoulders that are free of loose snow.

During warming trends, it may be more efficient and economical to bare the surface than to try to maintain a snow packed condition.

With the exception of double chip seal and/or sand seal roads, the Supervisor shall ice blade all snow packed surfaces that have washboarded, rutted, potholed, or which exhibit signs of developing slipperiness or where slipperiness has developed, especially due to rain or in rain conditions.

A summary of Level 4 service is shown in the "Levels of Service Summary Table".

CHAPTER 6 SNOW AND ICE CONTROL

Plant Maintenance Order Type: RO90
Activity Type: 104
Activity Type: 105
Activity Type: 106
Activity Type: 109

Levels of Service Summary Table

LEVEL OF SERVICE	Level 1A	Level 1B	Level 2	Level 3	Level 4
Type of Road	All 100 Series and selected high volume highways	Trunks and selected highways as per AADT limits	Routes and selected highways as per AADT Limits	All local paved roads	All gravel, double chip seal and sand seal roads
AADT Limits	> 7,500	7,500 – 4,000	4,000 – 1,500	< 1,500	n/a
Primary Objective	Essentially bare pavement *	Essentially bare pavement *	Centre line bare	Centre line bare	Snow packed
Time to meet primary objective after the end of storm, not exceeding	8 hours	12 hours	12 hours	24 hours	24 hours
Direct Liquid Application (DLA) Application of DLA	up to 16 hours prior to start of storm	up to 16 hours prior to start of storm	up to 16 hours prior to start of storm	up to 16 hours prior to start of storm	n/a
Max. Application Rate	up to 120 l/lane km.	up to 120 l/lane km.	up to 120 l/lane km.	up to 120 l/lane km.	n/a
Pre-Wet Application of Pre-wet Salt	up to 2 hours prior to start of storm	up to 2 hours prior to start of storm	up to 2 hours prior to start of storm	up to 2 hours prior to start of storm	n/a
Max. Application Rate	up to 30%	up to 30%	up to 30%	up to 30%	n/a
Salting Application of salt	Beginning of storm (if no pre-treatment) and during, as required	Beginning of storm (if no pre-treatment) and during, as required	Beginning of storm (if no pre-treatment) and during, as required	Beginning of storm where required (if no pre-treatment), and after	n/a
Max. ** Application Rate (rate based on 2-lane road)	125 kg/CL km	125 kg/CL km	110 kg/CL km	85 kg/CL km	n/a
Plowing Begin plowing when snow accumulation	≤ 25 mm	≤ 25 mm	≤ 50 mm	During storm, as required	During storm, as required
Max allowable accumulation	≤ 75 mm	≤ 100 mm	≤ 150 mm	≤ 200 mm	≤ 200 mm
Sanding Application of sand	- Not normally sanded - Sand only during severe cold with slippery conditions	Beginning of storm for environmentally sensitive areas or during severe cold with slippery conditions	Beginning of storm for environmentally sensitive areas or during severe cold with slippery conditions	- Beginning of storm where required and after storm - for environmentally sensitive areas - slippery conditions when required	- After storm - For environmentally sensitive areas - Slippery conditions when required
suggested Application Rate (rate based on 2-lane road)	n/a	800 kg/CL km	800 kg/CL km	500 kg/CL km	500 kg/CL km

***** *When pavement temperature drops below -10ºC the effectiveness of salt is decreased significantly. Time of day and temperature trends must be considered in salting decisions. With prior approval from the Area Manager, the Supervisor shall use sand or other approved abrasive materials to maintain an even surface free of loose snow with satisfactory friction. A roadway free of snow and ice is considered always to have satisfactory friction. A snow covered roadway has satisfactory friction if permitted vehicles can be driven on it with safety.*

*** Reduced application rates may be used. Reduced rates may be considered based on road temperature, trends, type of weather event, and time of year.*

Highway 103 Maintenance Survey

Yarmouth to Tantallon

October 2014

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HWY 103 Maintenance Survey October 2014

Section 103-270 From Hardscratch Road (0.0 Km) to Exit 33 (10.2 Km) in Tusket in Yarmouth County

CONTROLLED

North side of Road Pavement width 3.80 meters
Paved Shoulder 0.87 meters
Gravel Shoulder 3.20 meters depth <0.050 m Slope 3%
Bush line 2.70 meters (low)

South side of Road Pavement width 3.8 meters
Paved Shoulder 0.87 meters
Gravel Shoulder 3.30 meters depth < 0.050 m Slope 3%
Bush line 2.40 meters (low)

Rumble strip centre line only

6.4 Km - Mood Road crossroad - Traffic permitted to make Right turns at the intersection
pictures of how car makes a Left turn onto Mood Road from HWY 103 coming from Yarmouth

Mood Road Right turns permitted viewed easterly

Mood Road viewed northerly

How traffic makes LEFT turns off HWY 103

9.0 Km - Raynardton Road cross road - Traffic permitted to make right turns at the intersection

.Raynardton Road intersecting HWY 103 viewed easterly

Section 103-260 From Exit 33 (10.2 Km) in Tusket to Exit 32A West Argyle Causeway (21.9 Km)

CONTROLLED

North Side of Road	Pavement Width	3.7 meters
	Paved Shoulder	0.9 meters
	Gravel Shoulder	3.0 meters depth < 0.050 m Slope 3%
	Bush line	3.0 meters (low)
2 South Side of Road	Pavement width	3.75 meters
	Paved Shoulder	0.9 meters
	Gravel Shoulder	2.9 meters depth < 0.050 m Slope 3%
	Bush line	3.0 meters (low)

15.4 Km Eel Lake cross road

Eel Lake Road intersecting HWY 103 viewed easterly

21.6 Km widening for intersection

Section 103-255 From Exit 32 A West Argyle Causeway (21.9Km) to East Argyle Causeway Exit 32 (23.4 Km)

Note curbed island at East Argyle Causeway exit (North side of HWY 103) to ensure traffic on Trunk 3 comes out at a 90 degree angle to HWY 103. Hazzard marker on Island facing west bound traffic.

Curbed island viewed in northerly direction

Section 103-250 From East Argyle Causeway Exit 32 (23.4Km) to Exit 31 at Pubnico (36.0 Km)

23.6 Km widening for climbing lane
25.8 Km Bush cleared to ROW

North Side of Road	Pavement Width 3.7 meters	
	Paved Shoulder 0.85 meters	
	Gravel Shoulder 3.2 meters	depth < 0.050 m Slope 3%
	Bush line 22.2 meters (low)	
2 South Side of Road	Pavement width 3.55 meters	
	Paved Shoulder 1.38 meters	
	Gravel Shoulder 3.0 meters	depth < 0.050 m Slope 3%
	Bush line 21.5 meters (low)	

28.4 Km Bush cutting ends bushes back to 3.0 meters past gravel shoulder

Section 103-245 From Exit 31 at Pubnico (36.0KM0 to Shelburne / Yarmouth County line (50.3 KM)

CONTROLLED
36.5 Km Bushes cut on inside of curve to 37.2 Km
38.0 Pavement distortion for approx 100 meters

North Side of Road	Pavement Width 3.6 meters	
	Paved Shoulder 1.05 meters	
	Gravel Shoulder 3.0 meters	depth < 0.050 m Slope 3%
	Bush line 2.5 meters (low)	
2 South Side of Road	Pavement width 3.6 meters	
	Paved Shoulder 0.9 meters	
	Gravel Shoulder 3.0 meters	depth < 0.050 m Slope 3%
	Bush line 2.8 meters (low)	

43.3 Km Widening East Bound (EB)
44.5 Km Widening ends EB
44.5 Km Widening West Bound (WB)
45.3 Km Widening WB

Note: Very good turning locations for Snow Plows both east and west bound near the County Line

Section 103-240 From Shelburne / Yarmouth County Line (50.3 Km) to Exit 30 (57.5 Km)

54.0 Km widening WB
56.2 Km widening EB
NOTE DISTANCE ERROR FROM EXCEL SHEETS due to new Barrington Bypass

Section 103-235 From Exit 30 (57.5Km) to Exit 29 (61.8 Km) East of Barrington

CONTROLLED
New collapsible end treatment on Guardrail systems for this section
Bushes within the ramps at Exit 30 have recently been cut.
61.6 Km widening EB
NOTE END OF CONTROLLED HIGWAY

Section 103-230 From Exit 29 (61.8 Km) East of Barrington to Exit 28 (71.6 Km) at Clyde River

UNCONTROLLED Section
62.0 Km widening end WB

North Side of Road	Pavement Width	3.8 meters
	Paved Shoulder	0.8 meters
	Gravel Shoulder	2.5 meters depth < 0.050 m Slope 3%
	Bush line	2.7 meters (low)
2 South Side of Road	Pavement width	3.7 meters
	Paved Shoulder	0.8 meters
	Gravel Shoulder	2.3 meters depth < 0.050 m Slope 3%
	Bush line	3.0 meters (low)

62.6 Km Civic # 1712 (north side**) Safe Stopping Sight Distance should be verified**

Civic #1712 viewed northerly

62.6 Km Mail Box for Civic # 1712 south side of HWY 103

Viewed easterly

62.7 Km Civic #1696 (north side) **Safe Stopping Sight Distance should be verified**

Viewed westerly

Viewed easterly

No rumble strips
NOTE narrow gravel shoulders
70.0 Km Speed Zone 80 KM

Section 103-225 From Exit 28 (71.6 Km) at Clyde River to Clinton Road (76.8 Km)

NON CONTROLLED
73.9 Km Rumble strip centre line only

Section 103-220 From Clinton Road (76.8 Km) to Exit 27 at Birchtown (84.9 Km)

NON CONTROLLED

North Side of Road	Pavement Width 3.65 meters Chipseal	
	Paved Shoulder 0.68 meters	
	Gravel Shoulder 2.3 meters depth < 0.050 m Slope 3%	
	Bush line 15.0 meters (low)	
2 South Side of Road	Pavement width 3.9 meters Chipseal	
	Paved Shoulder 1.0 meters	
	Gravel Shoulder 2.8 meters depth < 0.050 m Slope 3%	
	Bush line 17.0 meters (low)	

81.0 Km Advertising sign obscured by bushes
81.9 Km Advertising sign obscured by bushes
82.6 Km Advertising sign obscured by bushes
83.0 Km Advertising sign obscured by bushes
83.2 to 83.4 Km advertising signs obscured by bushes
83.7 Km Business located south side of Hwy 103
84.7 Km widening EB

Section 103-215 From Exit 27 at Birch town (84.9Km) to Exit 26 Route 203 at Ohio Road (91.9 Km)

CONTROLLED
84.9 Km widening WB
85.1 Km widening WB

North Side of Road	Pavement Width 3.9 meters	
	Paved Shoulder 0.55 meters	
	Gravel Shoulder 2.4 meters depth < 0.050 m Slope 3%	
	Bush line 24 meters (low)	
2 South Side of Road	Pavement width 4.45 meters	
	Paved Shoulder 0.55 meters	
	Gravel Shoulder 3.0 meters depth < 0.050 m Slope 3%	
	Bush line 22.0 meters (low)	

87.7 Km widening EB
89.0 widening EB
90.2 widening WB
91.3 widening WB
91.7 widening EB

Section 103-210 From Exit 26 Route 203 at Ohio Road (91.9 Km) to Exit 25 East of Shelburne (95.9 Km)

CONTROLLED
92.2 Km widening WB and EB
93.3 Km widening EB climbing lane
93.8 Km widening EB
95.2 Km widening EB

Section 103-200 From Exit 25 East of Shelburne (95.9 Km) to Exit 24 at Jorden Falls (101.6 Km)

CONTROLLED
96.3 Km widening WB
No rumble strip **NEW Chipseal**
98.5 Km widening EB
99.1 Km widening WB
99.5 Km widening EB
100.9 Km widening WB
100.9 Km **- 80 Km speed zone sign**

Section 103-190 From Exit 24 at Jorden Falls (101.6 Km) to Exit 23 at Sable River (115.4 Km)

UNCONTROLLED
101.6 Km widening EB
102.6 widening EB
102.6 rumble strip centre line only

North Side of Road	Pavement Width 3.75 meters	
	Paved Shoulder 0.9 meters	
	Gravel Shoulder 2.3 meters	depth < 0.050 m Slope 3%
	Bush line 3.0 meters	(low)
2 South Side of Road	Pavement width 3.5 meters	
	Paved Shoulder 0.75 meters	
	Gravel Shoulder 2.7 meters	depth < 0.050 m Slope 3%
	Bush line 3.0 meters	(low)

105 Km Centre line marked to pass but SSD inadequate due to inside of curve trees /bushes
113.4 Km widening WB
114.7 Km widening WB
114.7 Km Speed zone sign 80 K/h and End of Controlled Access HWY

Section 103-185 From Exit 23 at Sable River (115.4 Km) to Shelburne / Queens County line (124.9 Km)

UNCONTROLLED
115.4 Km widening WB
115.6 Km widening WB
Trees to ditch line
119.2 Km Clear cutting of ROW
119.9 Km end of Clear cutting of ROW
122.0 Km Clear Cutting of ROW
122.8 Km end of Clear cutting south side
123.4 Km end of Clear cutting north side

Section 103-182 From Shelburne /Queens County line (124.9 Km) to Exit 21 at port Mouton (138.9 Km)

UNCONTROLLED
125.8 Km Port L'Hebert
126 Km trees overhanging ditch
128.9 Km New Construction north side (western end)
134.6 Km New Construction north side (eastern end)
138.2 Km Speed Zone sign 60 K/h
Exit 21 sign obscured by bushes

Section 103-180 From Exit 21 at Port Mouton (138.9 Km) to Exit 20 at Sumerville Centre (142.7 Km)

UNCONTROLLED
60 K/h Speed Zone
141.4 Km Speed Zone increased to 80 K/h
142.4 Km guardrail
142.4 Km widening WB and EB

Section 103-175 From Exit 20 at Summerville Centre (142.7 Km) to Exit 20 A at Liverpool West (153.6 Km)

CONTROLLED
144.9 Km widening EB

North Side of Road	Pavement Width 3.75 meters	
	Paved Shoulder 0.9 meters	
	Gravel Shoulder 2.4 meters	depth < 0.050 m Slope 3%
	Bush line 2.1 meters (low)	
2 South Side of Road	Pavement width 3.85 meters	
	Paved Shoulder 1.00 meters	
	Gravel Shoulder 2.7 meters	depth < 0.050 m Slope 3%
	Bush line 2.6 meters (low)	

146.2 Km widening EB
146.9 Km widening WB
147.2 Km widening EB
148.0 Km widening WB
149.3 Km destination sign obstructed by bushes
153.2 Km widening WB
153.3 Km widening EB

Section 103-170 From Exit 20 A at Liverpool West (153.6 Km) to Exit 19 at Trunk 8 Liverpool (157.1 Km)

CONTROLLED
154.0 Km widening EB
155.8 Km widening WB
156.5 Km widening WB
156.7 Km widening WB

Section 103-160 From Exit 19 at Trunk 8 Liverpool (157.1Km) to Exit 18 at Trunk 3 in Brooklyn (163.4 Km)

CONTROLLED
157.7 Km Low shoulder for approximately 100 meters south side
158.3 Km widening EB
159.5 Km widening WB
159.7 Km widening EB
160.5 Km widening WB
160.8 Km pavement distortion
161.2 Km widening EB
162.8 Km widening WB
163.3 Km widening EB
163.5 Km widening WB

Section 103-150 From Exit 18 at Trunk 3 in Brooklyn (163.4 Km) to Exit 17 Route 331 Mill Village (171.5Km)

CONTROLLED
165.1 Km widening EB
165.7 Km widening WB
166.1 Km widening EB
166.6 Km widening WB
168.4 Km widening WB
169.5 Km widening WB
169.6 Km widening EB
169.9 Km widening WB
170.0 Km widening WB
171.3 Km widening WB

Section 103-145 From Exit 17 Route 331 Mill Village (171.5 Km) to Exit 16 Camperdown School Road (182.3 Km)

CONTROLLED
172.0 Km widening EB
173.5 Km widening EB
174.3 Km intersection Mill Village Road north side
174.8 Km intersection Danesville Road south side
177.2 Km Lunenburg / Queens County line
178.8 Km widening EB
179.7 Km widening EB
179.5 Km End of Control Access Sign
179.9 Km Speed Zone sign 90 K/h

Section 103-140 From Exit 16 Camperdown School Road (182.3 Km) to Exit 15 at Italy Cross (186.3 Km)

UNCONTROLLED

182.7 Km measurements taken on road surface and shoulder depth

North Side of Road
Pavement Width 3.8 meters
Paved Shoulder 0.7 meters
Gravel Shoulder 2.4 meters **depth > 0.080 meters**
Slope 6% from edge of pavement
Bush line 9.0 meters (low)

LOW SHOULDERS

Note depth of shoulders

South Side of Road Pavement width 4.0 meters
Paved Shoulder 0.85 meters
Gravel Shoulder 2.7 meters **depth > 0.090 meters**
Slope 10% from edge of pavement
Bush line 8.5 meters (low)

LOW SHOULDERS

Note depth of shoulders

184.3 Km Low Shoulders
North side depth > **0.110 meters**
Slope 10% from edge of pavement
South side **depth > 0.135 meters Dangerous**
Slope 10% from edge of pavement

Section 103-130 From Exit 15 at Italy Cross (186.3 Km) to Exit 14 at Hebbville Trunk 3 (192.8 Km)

UNCONTROLLED
187.7 Road measurements taken due to low shoulders (**see pictures of Civic # 17431**)

North Side of Road Pavement Width 3.80 meters
Paved Shoulder 0.85 meters
Gravel Shoulder 2.9 meters **depth > 0.100 m**
Slope 10% from edge of pavement
Bush line 3.0 meters (low)

LOW SHOULDERS

Note low shoulder

South Side of Road Pavement width 3.9 meters
Paved Shoulder 0.80 meters
Gravel Shoulder 2.1 meters **depth > 0.135 m**
Slope 10 % from edge of pavement
Bush line 9.0 meters (low)

LOW SHOULDERS

Note very low shoulder

191.2 Km Shoulders wider and paved
192.6 Km widening EB
192.8 Km intersection

Destination signs and advertising signs blocked by bushes.
Reflectivity of all HWY signs (regulatory, warning and destination) should have the reflectivity checked.

Section 103-120 From Exit 14 at Hebbville (192.8 Km) to Exit 13 Route 325 (199.5 Km)

CONTROLLED
192.8 Km widening WB
193.0 Km widening WB
194.0 Km the following road measurements were taken

North Side of Road Pavement Width 3.60 meters
Paved Shoulder 2.2 meters
Gravel Shoulder 2.2 meters depth < 0.075 m Slope 5%
Bush line 3.0 meters (low)
South Side of Road Pavement width 3.9 meters
Paved Shoulder 1.95 meters
Gravel Shoulder 1.9 meters depth < 0.075 m Slope 5%
Bush line 3.0 meters (low)

Rumble strips centre line and white lines
197.5 Km cross road
198.4 Km widening WB
198.9 Km widening EB
199.0 Km widening WB
199.3 Km widening EB

Section 103-110 From Exit 13 Route 325 (199.5 Km) to Exit 12 at Trunk 10 Bridgewater (202.8 Km)

CONTROLLED
201.3 Km widening WB
202.2 Km widening WB
Plow turning west bound
Narrow shoulders
Rumble strip centre line only

Section 103-100 From Exit 12 Trunk 10 Bridgewater (202.8 Km) to Exit 11 Route 324 in Blockhouse (214.3 Km)

CONTROLLED
Rumble strip centre line only
203.0 Km widening EB
203.2 Km widening WB
203.4 Km widening WB
204.9 Km poor guardrail north side of road
205.5 Km widening EB
205.7 potholes near white line EB
206.0 Km widening WB
207.5 Km widening EB
208 Km poor guardrail section north side of road. Trees near edge of guardrail
208.4 Km widening EB
209 Km poor guardrail section north side of road. Trees near edge of guardrail
209.6 Km Trees near edge of guardrail north side
210.1 Km widening EB
211.0 Km widening EB
212.5 Km Trees near edge of guardrail south side
213.4 Km widening WB

Section 103-090 From Exit 11 Route 324 in Blockhouse (214.3 Km) to Exit 10 at Oakland Lake (219.2 Km)

CONTROLLED
215.8 Km widening WB
216.8 Km Trees near edge of guardrail north side of HWY

Section 103-085 From Exit 10 at Oakland Lake (219.2 Km) to End of Divided Highway (232.0 Km)

CONTROLLED
Rumble strips centre line and white lines
219.2 Km widening WB
221.6 Km widening WB
221.8 Plow turn around for Chester Base - north side of Highway
226.8 Km crossroad to summer cottages No turns permitted
231.4 Km widening EB
231.6 Km widening WB
232.0 Start of FOUR Lanes

Section 103-080 From End of Divided Highway (232.0 Km) to Trunk 12 Exit 9 (232.9 Km)

CONTROLLED
Four Lanes
Rumble strips white lines only
Wide paved shoulders

Section 103-075 From Trunk 12 Exit 9 (232.9 Km) to Start of Divided Highway (234.9 Km)

CONTROLLED
Four Lanes
Rumble strips white line only
Wide paved shoulders

Section 103-070 From the Start of the Divided Highway (234.9 Km) to Trunk 14 at Chester Exit 8 (237.0 Km)

CONTROLLED
234.9 Km widening EB
235.3 Km widening WB
Rumble strips centre line and white lines
Narrow paved shoulders

Section 103-060 From Trunk 14 at Chester Exit 8 (237.0 Km) to East River Exit 7 (244.2 Km)

CONTROLLED
239.4 Km widening WB
239.9 Km widening EB
241.5 Km widening WB

North Side of Road
Pavement Width 4.50 meters
Paved Shoulder 0.6 meters
Gravel Shoulder 2.6 meters **depth > 0.100 m**
LOW SHOULDER
Slope 10 % from edge of pavement
Bush line 2.4 meters (low)

South Side of Road
Pavement width 4.0 meters
Paved Shoulder 0.55 meters
Gravel Shoulder 2.9 meters **depth > 0.100 m**
LOW SHOULDER
Slope 10 % from edge of pavement
Bush line 2.6 meters (low)

242.2 Km widening EB
242.5 Km widening WB
243.1 Km widening EB
243.7 Km widening WB

Section 103-050 From East River Exit 7 (244.2 Km) to Hubbards Exit 6 (253.4 Km)

CONTROLLED
Bridge under construction
244.6 Km Plow turn around south side of Highway
245.2 Km widening EB
247.6 Km widening EB
248.3 Km widening WB
249.3 Km widening WB
249.8 Km the following measurements were taken

North Side of Road
Pavement Width 3.90 meters
Paved Shoulder 1.45 meters
Gravel Shoulder 2.4 meters depth < 0.075 m Slope 5%
Bush line 1.1 meters (low)

South Side of Road	Pavement width	3.9 meters
	Paved Shoulder	2.0 meters
	Gravel Shoulder	2.4 meters depth < 0.075 m Slope 5%
	Bush line	2.6 meters (low)

Rumble strips centre line and white lines

251 Km trees very close to shoulder - north side of HWY
252 Km trees very close to shoulder - south side of HWY
252.7 Km destination sign partially blocked by vegetation

Section 103-045 From Hubbards Exit 6 (253.4 Km) to Ingram River Bridge (265.3 Km)

CONTROLLED
255 Km entrance to summer lake cottages north side
255.6 Km trees near shoulder north side of HWY
256.7 Km widening EB
258.0 Km widening EB
259.2 Km widening WB
259.7 Km trees near shoulder north side of HWY
260.5 Km widening WB
260.6 Km trees near shoulder north side of HWY
261.1 Km widening EB
261.6 Km trees near shoulder north and south side of HWY
263.2 Km widening EB
264.4 Km widening WB
265.1 Km widening WB

Section 103-040 From Ingram River Bridge (265.3 Km) to Route 213 at Exit 5 (274.7 Km)

CONTROLLED
265.5 Km trees near the shoulder south side of the HWY
265.5 Km widening EB
267.0 Km trees near the shoulder south side of HWY . Shoulder (recycled asphalt)starting to wash away
267.5 Km widening WB
268.0 Km widening EB
268.1 Km widening WB
268.8 Km destination sign partially obscured by trees
269.1 Km widening WB
270.4 Km widening WB
271.1 Km Intersection right turns permitted
271.3 Km widening WB
271.5 Km Bridge
272.0 Km widening EB
273.5 start of four lane HWY