

Title: Roundabouts - The Nova Scotia Experience

Revision Date: April 23, 2008

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Length: 2705 Words
Photos: 9

ABSTRACT:

From inception to implementation, the paper will outline the process used to introduce the concept of Roundabouts, and the construction of the first Modern Roundabout in Nova Scotia. Other items to be included are: Public awareness, education, ongoing support for this alternative to traditional thinking, future plans and strategies for ongoing implementation.

The first modern roundabout was proposed and constructed at Highway 101 Exit 9 – Avonport. The project included the education of school children on how to walk across the roundabout. The education took the form of an information session with the children at the local school and take home information distributed through the school office.

The future of roundabouts in Nova Scotia will address further Province-wide implementation with examples of roundabouts planned and proposed for future construction. A policy is being drafted to provide direction from a Provincial standpoint on roundabouts, based on British design guidance.

INTRODUCTION

From basic beginnings to full realization and construction, the implementation of roundabouts in Nova Scotia has been, and continues to be, an interesting case study in education, understanding and the struggle of science versus perception.

HISTORY

The concept of circular intersections is not new for Nova Scotia, that of roundabouts with yield on entry, smaller size and deflected through paths is. Rotaries date back in Nova Scotia to the 1950's, the Micmac rotary in Dartmouth and the Armdale rotary in the Halifax Regional Municipality (HRM) are the two most often cited examples of traditional circular intersections in the Province.

The Micmac Rotary was replaced with a Parclo interchange in the late 1980's. The Armdale Rotary has been renovated to more closely conform to modern roundabout geometry in 2007. Public perception and driving behavior has evolved and continues to evolve to interpret the new configuration.



Micmac rotary circa 1961

Two additional rotaries exist on the Provincial system, one in Pictou on Highway 106, the other in Port Hastings on Highway 105, both of which have been redesigned by the Department of Transportation and Infrastructure Renewal (the Department) as roundabouts and await construction when budgets and priorities allow.

INCEPTION

The origins of the implementation of roundabouts in Nova Scotia began with an idea being raised at a meeting between management and staff in 2002. The concept of introducing the modern roundabout to Nova Scotia as an intersection treatment was thought to have merit. A comprehensive research program was pursued including literature searches and consultation with regional design professionals with experience in the field.

FORMALIZATION

When the body of research on roundabout technology became substantial, a Provincial committee was struck in 2003. The Modern Roundabout Committee (MRC) was mandated to "Identify and capitalize on the advantages of the modern roundabout and identify the concerns regarding their usage in Nova Scotia." Membership on the committee was primarily Department employees, with representation from HRM.

DELIVERABLES

Several key outcomes from the MRC work were delivered over the course of the next 18 months. The work of the committee resulted in a list of positive attributes associated with roundabouts being formalized into Nova Scotia's roundabout brochure. This brochure (1) remains the focus of public education surrounding the implementation of roundabouts, and serves as an excellent foundation for discussions on the basics of roundabout safety and operation.

Through substantial research and exposure to other design professionals, it was decided by the MRC to endorse the Geometric Design of Roundabouts (2) from the UK as the design guideline of choice for the Province of Nova Scotia. This document has since been revised and the latest version, TD 16/07 (2) continues to be the design guideline.

In conjunction with the selection of the design guideline, design training was undertaken to ensure that designers, planners and traffic engineers had similar basic understanding of roundabouts. To that end, TMS Consultancy from Coventry in the UK was contracted to present roundabout training in Nova Scotia. Attended by local consulting firms and government engineers, the training prepared the groundwork for the following years of further training and design of roundabouts in the Province.

A critical element of the MRC outcomes was the rewriting (2004) and subsequent proclamation (2005) of the laws pertaining to roundabout operations. The law (3) now clearly indicates that priority is assigned to the vehicles travelling in the circulatory roadway. This adjustment of the Motor Vehicle Act (3) removed the previous misunderstanding of which vehicle had the right-of-way and eliminated the one-on-one operation of the existing rotaries.



School bus travelling on the simulation at CFB Greenwood

Following the completion of the first modern roundabout design in Nova Scotia, at Avonport, by the author, it was decided at the committee level to prepare a life sized simulation of the roundabout prior to construction. This simulation consisted of cones, barrels, temporary paint strips and yield signs placed on the airfield at Canadian Forces Base (CFB) Greenwood. Through cooperation of the military and Department personnel this simulation successfully demonstrated that the roundabout as designed could handle all manner of vehicles from school buses to tractor trailer units.

AVONPORT

The first modern roundabout designed and constructed in the Province of Nova Scotia was constructed on Highway 101, at Exit 9, Avonport (west of Windsor, see map page 6). Following the recommendation of a comprehensive Highway 101 safety study, based on driver expectancy, the interchange was reconfigured into a diamond style interchange to more closely match the other interchanges along the system. The new configuration replaced a less typical 'slip-on/slip-off' arrangement which had highway traffic exiting onto a trunk highway system which served the local community. This resulted in all heavy truck traffic having to proceed through local streets to travel to their destinations.

Staff introduced the concept of the roundabout in 2004 as an option to the senior management and the Ministerial level as a more cost effective solution than the alternatives. Public input was sought through a public open house and approximately 80% of the local residents were in support of the roundabout solution. The primary focus of installing the roundabout was limiting the land take from the adjacent homeowners.

The roundabout consists of a 60m inscribed circle diameter (ICD), with three, two-way roadway legs and two, one-way ramps. The circulatory width is 7.0m with variable width approaches consisting of 3.5m approaching road half-widths flaring as necessary to accommodate the WB-21 design vehicle. Entry angle deflection and entry path curvature were established within the boundaries identified in TD 16/07(2). No truck aprons were designed or installed for this roundabout.



Aerial photo of the
Avonport roundabout

Post construction discussions with local citizens and the school principal in 2006 have highlighted that the roundabout has been well received. Further discussion with the local trucking company has resulted in important design feedback concerning driver behavior at the roundabout and subsequent revisions to the design model for future installations. Comment was returned that the circulatory may be slightly narrow for the trucks, as a result subsequent installations are being designed with 8.0m circulatory widths.



Avonport roundabout, with school in the background

As the construction of the roundabout was drawing to a close in 2006, the Department went to the local school and made a presentation to the student body and staff concerning the roundabout. The provincial brochure (*I*) was distributed with an informational page which described how to drive the newly installed roundabout and more importantly, in this case, how to walk the roundabout for the school children. The presentation to the school children was appreciated by the students and staff with no negative feedback to date.

Driving the Avonport roundabout

Nova Scotia's first modern roundabout will open this summer near your elementary school. It is designed to be safe for both adults and children. But it will take time for everyone to learn the new rules. Please help your child learn to cross the street safely over the roundabout.

For those who use the bridge to get back and forth to school, we repositioned the water tower on the bridge on the east side of the street.

Each year child to cross at the crosswalk ONLY. Kids will be taught to use the "stop, look, listen" rule over the central island. This is dangerous. Design of the roundabout will encourage this, but your help is needed to teach safe choices.

How to drive through a roundabout:

- Slow down:** as you approach the roundabout, follow the arrows on the signs and pavement markings. Be prepared to stop for pedestrians crossing the crosswalk.
- Yield:** vehicles already in the roundabout. They have the right of way. Use the roundabout when there is a gap in traffic.
- Turn:** to the right around the central island in a counter-clockwise direction. As you approach the road where you want to exit, activate your turn signal.
- Exit:** the roundabout to your right. Be prepared to stop for pedestrians crossing the road once you enter.
- Provoke:** must always yield to pedestrians who are legally crossing the road and be courteous toward and to who are sharing the road.

ROUNDABOUTS IN NOVA SCOTIA

Welcome to the Avonport roundabout

- 1 Which way do I go? Here is the crosswalk. I stop, look, and listen. If I see or hear a car, I wait for it to stop. I look at the driver. When I know that the driver can see me, then I go.
- 2 I have crossed to a little island. I stop, look, and listen again. Now it is safe. I use my feet. I am safely across the street.
- 3 I need to cross again here. I stop, look, and listen for cars coming from the roundabout. When it is safe, I use my feet.
- 4 When I cross the bridge, I use the sidewalk.

😊 Crosswalks help me be safe. Remember to stop, look, and listen at the crosswalks and the little island on your way to and from school.

Information page for the Avonport School presentation

DESIGN PHILOSOPHY

With the single new installation at Avonport and one renovated roundabout in HRM at the Armdale rotary, it may be premature to begin discussions of design philosophy. However, a new Provincial committee is being considered to advance the work of the MRC. The Nova Scotia Roundabout Design Committee (NSRDC), will be mandated with preparing regional and local guidance for the aspects and elements of roundabout design particular to the Nova Scotia context.

The particular elements of roundabout design identified to date include but will not be limited to: line painting, signage (regulatory, warning and guidance), overhead lighting, truck aprons, entry angle deflection, entry path curvature, traffic modeling, centre island treatment, circulatory cross-section and design manual. These elements will have guidelines drafted to ensure consistency of approach for drivers and designers. Driver consistency is considered crucial as the new concept of roundabouts spreads across the Province.

Representation on the NSRDC will consist primarily of Department employees, with additional involvement from local municipalities, specifically HRM. When guidelines are prepared and prior to publication, input will be sought from the rest of the Provincial municipal units as appropriate.

CURRENT SITUATION

Province wide, approximately 30 roundabouts are being considered as potential intersection treatments. The majority of the locations being considered are interchange ramp terminal applications. In this construction season, 2008/2009, three roundabouts are scheduled to be constructed. A further six are potential construction for the 2009/2010 construction season.

The three projects which have been designed for 2008/2009 include Highway 101, Exit 5A – Windsor on Wentworth Road, Highway 104, Exit 24 - Stellarton on Foord Street (near New Glasgow) and Highway 125, Exit 7 – Prime Brook on Alexandra Street (near Sydney).

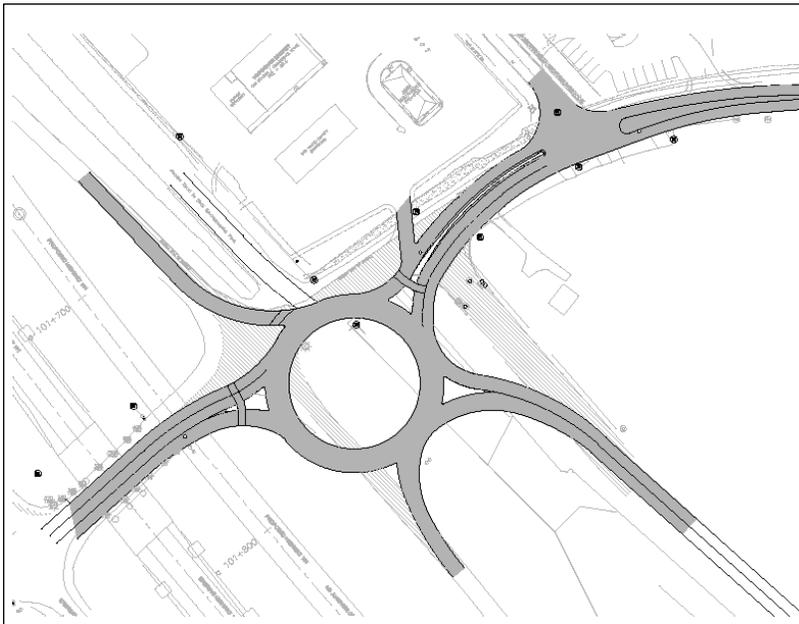


Map identifying existing and proposed roundabout locations

WENTWORTH ROAD

This project, designed by the author, consists of the introduction of a roundabout at an interchange ramp terminal with an additional parallel roadway running adjacent to the highway exit ramp. The roundabout is located on Highway 101, Exit 5A – Windsor on Wentworth Road (see map, page 6). With an ICD of 60m, no truck aprons, circulatory width of 8.0m and approaches flared for WB-21 entry and exit, this roundabout design is typical of the current Provincial design philosophy.

The main focus of the installation is access management and the proximity of adjacent intersections. If a traditional intersection remained as the ramp terminal, four intersections would have existed within a 150m length of Wentworth road. Through the introduction of the roundabout, three of the access points are combined into the one intersection with an additional T-intersection remaining with approximately 150m separation.



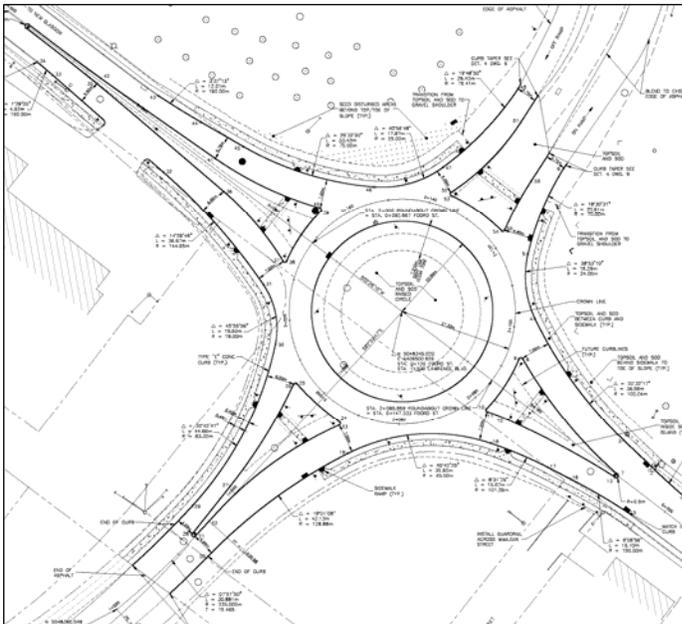
Sketch of Wentworth road roundabout for illustrative purposes

Public consultation on this project consisted of a presentation to Windsor town council in 2007 concerning the overall concept of roundabouts and this particular context. Reactions were mixed with support given for the design to proceed. The tender is scheduled for summer of 2008.

FOORD STREET

This project consists of the introduction of a roundabout at an interchange ramp terminal with an ICD of 60m, no truck aprons, circulatory width of 8.0m and approaches flared for WB-21 entry and exit. The roundabout is located at Highway 104, Exit 24 - Stellarton on Foord Street near New Glasgow (see map, page 6). The design is similar to Wentworth Road; however, the geometry of this roundabout was created with a future view to expansion to a 2 lane circulatory. The Foord Street roundabout is the first new installation of a roundabout designed by a consultant in the Province. The design was completed by CBCL Limited for the Town of Stellarton. On completion, the roundabout will be owned and operated by the Provincial government.

The primary rationale for this installation is to serve the need for an upgraded intersection into a new commercial development. The development is considered a light industrial estate and consists of a large number of lots. The resulting traffic impact study required a controlled intersection at Foord Street.



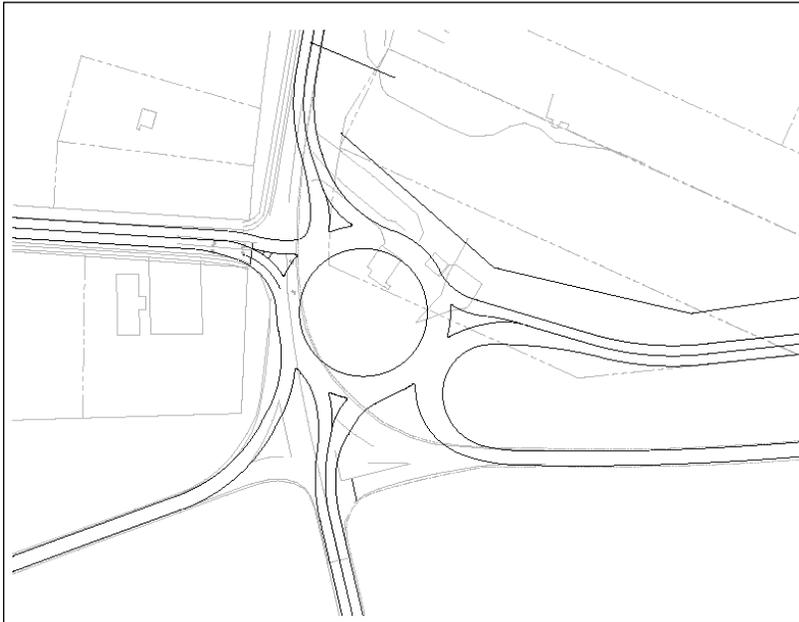
Sketch of Foord Street roundabout for illustrative purposes

As a signalized intersection, the delays and opposing left turn movements would have resulted in less than desirable operating and safety conditions. The roundabout solution was offered and the Town of Stellarton proceeded with the design and tendering of the work. Construction is scheduled for summer 2008.

ALEXANDRA STREET

This project, also designed by the author, consists of the introduction of a roundabout at an interchange ramp terminal with an ICD of 60m, no truck aprons, circulatory width of 8.0m and approaches flared for WB-21 entry and exit. The roundabout is located at Highway 125, Exit 7 – Prime Brook on Alexandra Street near Sydney (see map, page 6). The design is similar to Wentworth Road and Foorde Street with an additional parallel roadway running adjacent to the highway exit ramp.

The Alexandra Street roundabout was proposed for similar reasons to the Wentworth Road intersection. Two intersections were in close proximity to one another. In fact the curve returns of one intersection tied into the beginnings of the curvature of the other intersection. The roundabout also offers the opportunity to adjacent land owners for development of a parallel access road. This road could be constructed by local interests to allow more direct access from the land to the Provincial highway system.



Sketch of Alexandra Street roundabout for illustrative purposes

Public consultation was undertaken on this project through stakeholder meetings in 2007 with citizens in the immediate vicinity of the intersection, the local area Chamber of Commerce, municipal officials and representatives of the adjacent Membertou First Nation. Further, a public open house in 2008 was held with feedback gathered on the roundabout. To date, no negative feedback has been received on the roundabout. Construction is scheduled for summer 2008.

FUTURE SITUATION

Roundabouts are gradually gaining acceptance amongst design practitioners and policy makers. The travelling public of Nova Scotia is being exposed to roundabouts in a controlled, deliberate manner. While many installations of roundabouts are proposed across the Province, final decisions on implementation await further study and feedback from the three projects being constructed in 2008/2009.

Primarily consisting of interchange ramp terminal applications, roundabouts are being proposed to reduce construction costs, improve possibilities for design and reduce land requirements through better management of delay and queuing at proposed locations. It has been found through the introduction of roundabouts at interchange ramp terminals; bridge widths can be reduced by one lane at a minimum, as left turning lanes for the intersections are generally not required.

Introducing roundabouts also alters the manner in which sight lines are evaluated. This has been demonstrated to allow for smaller footprints of diamond interchanges as the sight line constraints associated with bridge abutments are reduced. These are but a few of the anticipated advantages that are being realized through the evaluation of many proposed locations Province wide.

The additional 24 roundabouts in the planning phases may be introduced for operation over the next few years. If these tentative steps are successful and roundabout technology proven acceptable in the Nova Scotia context, the engineering profession will have the potential for solving the various operational and safety concerns imposed by the current infrastructure with the versatile tool of the roundabout.

ACKNOWLEDGMENT

The author would like to acknowledge the guidance and support of the Manager of Highway Planning and Design at NSTIR, Phil Corkum, P.Eng, and that of Retired Director of Highway Engineering Services, Ralph Hessian, P.Eng. It is through mentorship and support that innovation and challenging the status quo can occur for the benefit of the most important client, the travelling public.

Further, the author would like to commend his wife, Tara Boddy, for the enduring patience to tolerate roundabout discussions on each and every drive on the Province's highways and by-ways.

REFERENCES

1. *Roundabouts in Nova Scotia*, Nova Scotia transportation and Public Works,
<http://www.gov.ns.ca/tran/TPWRoundabout.pdf>
Accessed March 15, 2008
2. *Geometric Design of Roundabouts*, Highways Agency, Design Manual for Roads and Bridges,
Volume 6 Road Geometry, Section 2 Junctions, Part 3, TD 16/07
<http://www.standardsforhighways.co.uk/dmrb/vol6/section2/td1607.pdf>
Accessed March 15, 2008
3. *BILL NO. 92* (as introduced), 1st Session, 59th General Assembly, Nova Scotia
Motor Vehicle Act, (amended), An Act to Amend Chapter 293 of the Revised Statutes, 1989, the Motor
Vehicle Act, Clause 10, First Reading: September 23, 2004, Second Reading: September 24, 2004, Third
Reading: October 7, 2004
http://www.gov.ns.ca/legislature/legc/bills/59th_1st/1st_read/b092.htm
Accessed March 15, 2008