AN OVERVIEW OF THE CANADIAN ROUNDABOUT DESIGN GUIDE

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Introduction

In recent years, a proliferation of roundabouts has been observed throughout Canada. To date, there is no single source of guidance about the design, construction, operation, and maintenance of roundabouts that is available for all Canadian practitioners. Each area of the country has chosen to take guidance from a variety of sources including the use of guidelines from other countries, in particular the United Kingdom (UK – TD 16/07) and the United States (US – NCHRP Report 672).

Recognizing the need for consistency and direction, the Transportation Association of Canada (TAC) has initiated development of the *Canadian Roundabout Design Guide (CRDG)*. Publication of the guide is scheduled for the Spring of 2015 and will be developed as a supplement to the *Geometric Design Guide for Canadian Roads*, which is currently being rewritten and is slated for release in 2016. TAC has appointed the team of Hatch Mott MacDonald and Boulevard Transportation to prepare the CRDG.

Developing the Guide

Origins of the Guide date back many years. *"During discussions at the Road Safety Standing Committee meeting in September of 2003 it was recognized that roundabouts require special consideration and that issues regarding their safety, design, and operation should be further explored. Therefore a Joint Roundabout Subcommittee (JRSC) was formed with about 15 representatives from across Canada to address these issues. The Joint Roundabout Subcommittee also includes a liaison from each of the three Standing Committees (Road Safety, Geometric Design, and Traffic Operations and Management)"* [that report to Chief Engineers Council].

In 2008, the JRSC spearheaded development of the *Synthesis of North American Roundabout Practice*. This report "describes current practices and experiences with roundabouts. It forms an expanded counterpart to National Cooperative Highway Research Program (NCHRP) Synthesis 264, *Modern Roundabout Practice in the United States*, published in 1998." The report served as an introductory investigation into roundabouts, their operations and their benefits, providing important context for this evolving form of intersection treatment.

Development of the CRDG formally began in 2010. TAC projects of this nature are often funded through donations from Federal, Provincial and Municipal government agencies and private sector members. In return for their financial contribution, the contributor is

offered a position on the Project Steering Committee (PSC). Funding partners for this project (and members of the PSC) include:

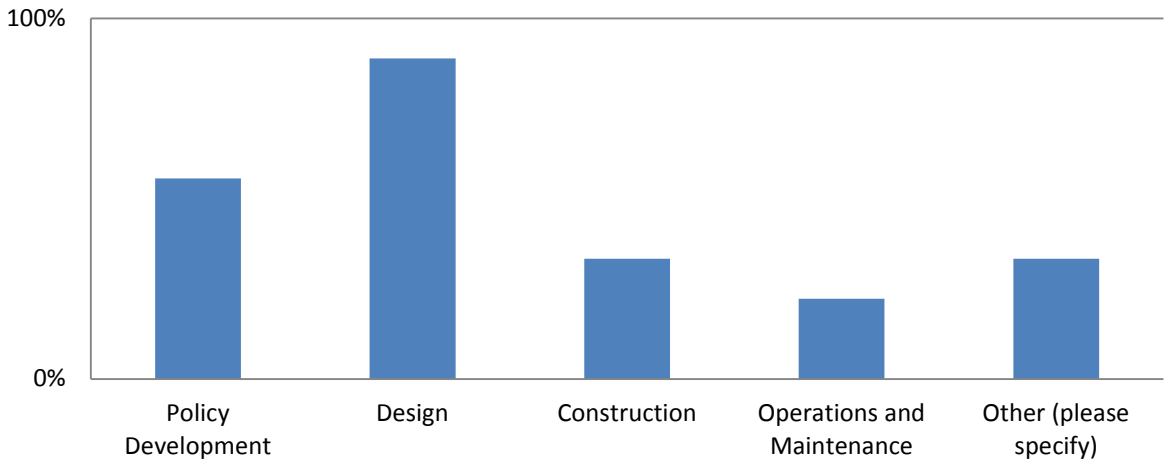
- City of Calgary
- Prince Edward Island Transportation and Infrastructure Renewal
- Region of Waterloo
- Alberta Transportation
- Manitoba Infrastructure and Transportation
- Ontario Ministry of Transportation
- British Columbia Ministry of Transportation and Infrastructure
- City of Mississauga
- Nova Scotia Department of Transportation and Infrastructure Renewal
- City of Ottawa
- Ministère des Transports du Québec
- New Brunswick Department of Transportation
- City of Winnipeg
- Cement Association of Canada

One noteworthy aspect in writing the document is the requirement to produce the Guide in both official languages – English and French. This presents several challenges, including differing terminologies and a variation in the number of words required to state similar concepts. It is an important consideration in undertaking the project that is somewhat unique to Canada.

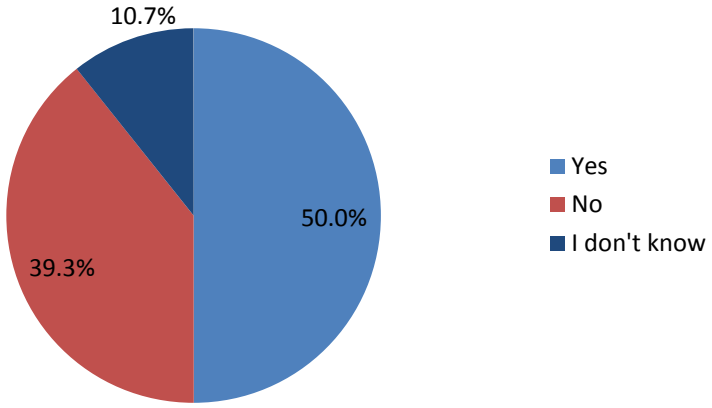
Survey Results

One of the initial tasks was to conduct a survey of professionals, practitioners and policy makers from across Canada and the United States regarding roundabout design practices. There were 28 respondents to the survey. The results are as follows:

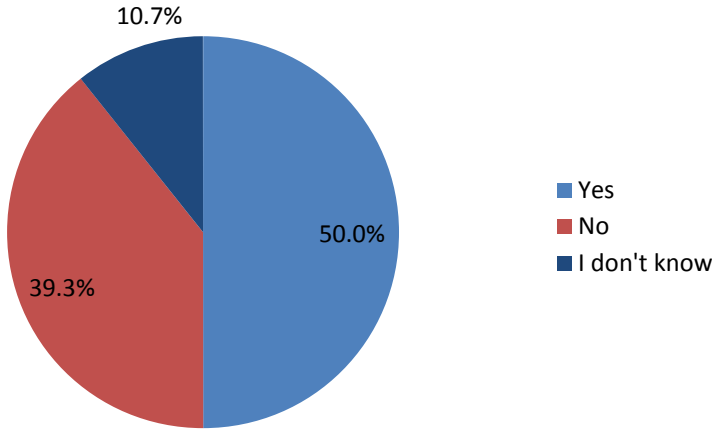
1. *Which of the following best describes your role in roundabout implementation? (Select all that apply)*



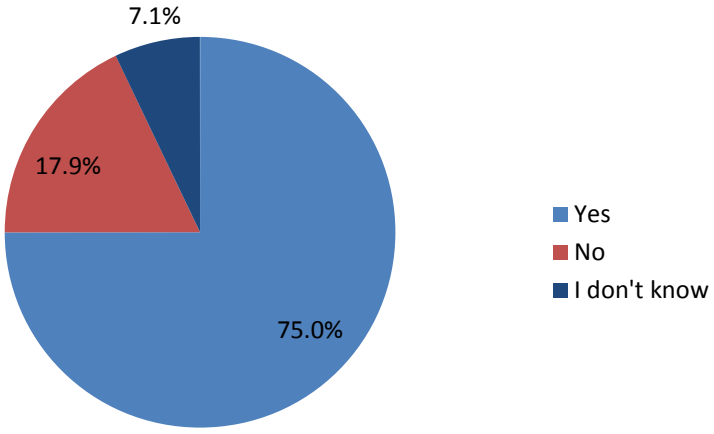
2. *Do you have any roundabouts in your community/jurisdiction?*



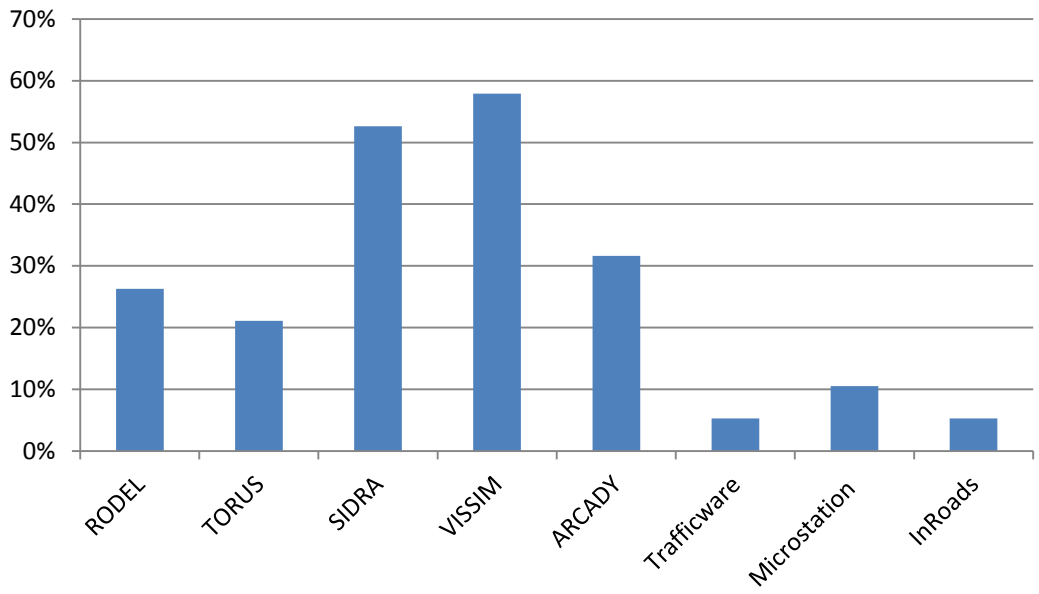
3. *Does your community/agency have a roundabout policy in place?*



4. *Is there a roundabout design guide or design guidelines currently in use in your community/agency?*



5. What software does your agency use in the analysis and/or design of roundabouts?



Guide Structure and Content

The Guide will focus on roundabout design, explaining the process from planning to maintenance. A stand-alone document, the Guide is intended to supplement the *Geometric Design Guide for Canadian Roads* and similarly recognizes the need for flexibility in the design of roundabouts to accommodate specific local conditions. To this end, the CRDG will recommend that the information presented be used as a "guideline" and not a "standard", as the latter term implies a level of exactness that is not possible under typical circumstances. Possible exceptions include pavement markings and signing, which may be statutory requirements in certain jurisdictions.

Where available, Canadian experience will serve as the basis for the design guidelines presented in the document. The PSC strongly believes that the credibility of roundabout design and the Guide itself are enhanced through the use of examples from closer to home. Since traffic laws, design vehicles, weather conditions, size and nature of community, and other factors vary widely between municipalities across Canada, the Guide will provide a variety of options and contexts where roundabouts have been implemented, and the desired results achieved. This enables users to assess the merit of a particular measure based on information derived from similar conditions.

Early in the development process, questions arose regarding the design philosophy to emulate, recognizing that both the UK and US approaches were widely applied by practitioners in Canada. It was agreed that the Guide would be based on a blend of the pros of both the British and American guides, while incorporating "design domain" ranges consistent with the *Geometric Design Guide for Canadian Roads*.

The material in the Guide is organized into fourteen chapters:

CHAPTER 1 Introduction

1.1 Preface

The section will provide a brief introduction to roundabouts and explain the organization of the Guide and how the document is intended to be used in roundabout design.

1.2 What is a Roundabout?

This section will provide a brief description of the evolution of the roundabout from the rotary and traffic circle to the current day roundabout and will include a comparison between the different designs. A roundabout will be defined and a description of its physical features (layout), its operational features (vehicle movements) and its purposes (benefits of a roundabout) will also be provided. An overview of the various types of roundabouts that are being utilized throughout the world will be included.

1.3 Why Use Roundabouts?

This section will detail the rationale and benefits of using roundabouts and contrast the different forms of traffic control for at grade intersections, which include regulatory signs (yield/stop), traffic control signals and roundabouts. It will explain that the selection of traffic control will depend on the configuration of the intersection and a number of other parameters, but note that roundabouts present several advantages, including:

- Safety – Reduce conflicts, less severe collisions
- Traffic capacity and flow – Higher capacity, left turn management
- Pedestrians and cyclists – Dedicated phases and facilities
- Public transportation – Transit priority
- Design and space – Roadway transition, city gateway, landmark
- Environment – Landscaping, reduced emissions and fuel consumption
- Maintenance – No signal maintenance, but winter maintenance can be more demanding
- Cost – Based on size can be more than a traffic signal, but less maintenance costs

A comparison of roundabouts to traffic circles and rotaries will be provided.

1.4 History of Roundabouts in Canada

The section will reflect on the evolution of roundabouts in Canada from the installation of the first roundabout to examples of existing roundabouts throughout the entire country. A tabulation of Canadian documents that have been prepared to guide roundabout design will also be referenced in this section.

CHAPTER 2 Policy Considerations

2.1 Suitability

This section will describe areas suitable for roundabout installation, with specific examples of road categories. The narrative will also describe locations where roundabouts would not typically be suitable, such as non-compatible approach types and locations with high volumes of heavy vehicles, pedestrians or cyclists.

2.2 Environment and Sustainability

This section will outline the environmental benefits of roundabouts, which include decreased:

- Fuel consumption due to reduced delay times;
- Emissions as a result of reduced idle times and acceleration from complete stops;
- Noise pollution;
- Maintenance costs; and
- Collision costs.

2.3 Traffic Calming

This section will explain the traffic calming benefits of roundabouts, which can be used in residential areas to reduce traffic speeds and discourage shortcutting.

2.4 Speed

This section will discuss speed limits and approach speeds, which should be similar to roundabout design speed in order to ensure smooth transition. The use of deflections to reduce entry speed will also be outlined. The discussion will highlight the importance of approach visibility so that drivers can react accordingly. The Speed-Radius Relationship and reference to formula for calculation based on vehicle path will also be provided.

CHAPTER 3 Planning

3.1 Rationale for Using Roundabouts

This section will provide a description of the advantages and disadvantages of implementing roundabouts as a method of intersection control when compared with more traditional forms (i.e., traffic signals, stop-control, etc.). The section will also include advice on how to determine the applicability of a roundabout under specific circumstances. Factors such as traffic volumes, collision history, geometry, siting/location, users, and cost, which are highlighted in the subsections that follow, will be noted. A screening tool to aid in identifying potential locations for roundabout installation may be created.

3.2 Siting Considerations

This section will provide a description of general site features that are suitable or not suitable for roundabout implementation. The section will also provide a high level overview of jurisdictional policies, general guiding principles and a more extensive decision making process to aid in the site selection process.

3.3 Retrofit Considerations

This section will provide a description of the challenges associated with retrofitting an existing intersection with a roundabout and note mitigation measures that will ease the implementation process and facilitate smooth operations after implementation.

3.4 Multi-Modal Considerations

This section describes the importance of considering the impact to all modes of transportation that would be utilizing the roundabout including, but not limited to, pedestrians, pedestrians with visual impairment or mobility challenges, bicyclists, trucks, transit, emergency vehicles, rail crossings, older people, motorcycles, etc.

3.5 School Site Considerations

This section will describe the benefits and impacts of implementing roundabouts in a school zone. It will also provide examples of schools that have a roundabout in close proximity and the observed safety improvements.

3.6 Accessibility Considerations

This section will highlight the accessibility requirements to be considered in assessing the feasibility of implementing a roundabout and design features (i.e. pavement treatments, audio indications, pedestrian signals, etc.) that help to facilitate use of the roundabout by all people regardless of their abilities. The section will also include a description of the potential problems that can be encountered by persons with mobility and sight challenges when traversing a roundabout.

3.7 Access Management Considerations

This section describes access management considerations, noting the benefits to adjacent landowners and potential impact to driveway access in close proximity to the roundabout. The narrative will also describe the factors that influence the provision of access and their implications for roundabout design, which include: capacity of minor movements at the access point, need to provide left-turn storage, available spacing between the access point and the roundabout, sight distance requirements, etc.

3.8 Financial Considerations

This section will describe typical costs for roundabout implementation, operation and maintenance. It will contrast the cost of roundabouts when compared with the

implementation of a stop-controlled or signalized intersection and provide a description of the various factors that can influence construction cost, including approach roadway widths, pavement area at the intersection, realignment, grading or drainage work, landscaping, construction staging and traffic management, etc.

CHAPTER 4 Accommodating All Users

4.1 Trucks and Other Large Vehicles

This section will provide an overview of the various design elements or treatments available to accommodate trucks. Such design elements or treatments include: entry and exit widths, truck aprons, diameter lengths, mountable central islands. It is noted that the designer will need to decide the vehicle path the truck is permitted to take on entering the roundabout, which will then determine the design of the roundabout (e.g., permission to track across lanes, need to maintain their own lanes, etc.). The pros and cons associated with each of the design elements will be included as part of this section.

4.2 Transit

This section will briefly describe the accommodation of transit vehicles at a roundabout. It is noted that if the roundabout has been designed appropriately for large vehicles, the transit vehicle should be easily accommodated without any requirement to utilize the truck apron. The most important requirement to be included as part of the roundabout design for transit vehicles is the strategic placement/location of bus stops to minimize walking distances for the transit user and to minimize impacts on the road user (i.e., queue backs) and the provision of adequate spacing for the bus stop.

4.3 Pedestrians

This section will provide an overview of how pedestrians are accommodated at roundabouts. It will provide a brief description of roundabout design elements (e.g., splitter islands, shorter crossing distances, setback from circulatory roadway, pedestrian refuge areas, slower traffic speeds, optimizing roundabouts, maximizing visibility of pedestrian, etc.) that enhance the pedestrian crossing experience. It will also describe the different pedestrian treatments possible at a roundabout, including the informal crossing, zebra crossing or stand-alone signal controlled crossing (Hawk, Pelican, Puffin or Toucan). The section will also include subsections that explain two key features of pedestrian accommodation – markings and signalization.

4.4 Cyclists

This section will compare the conflict points at a traditional intersection versus a roundabout for the cyclist, identify roundabout design features to enhance the cyclist experience and provide an overview of the various roundabout treatments that can be implemented for cyclists. Specific roundabout design features used to enhance the cyclist roundabout experience include reduced circulatory roadway width, increasing deflection, reducing entry speeds, etc. Treatments to address cyclist concerns can include painted cycle lanes on the circulatory roadway, physically separated bicycle track

running outside of the circulatory roadway, signage for drivers noting present of cyclists, priority regulations. The pros and cons of each of these treatments will also be provided.

4.5 Vulnerable Road Users

This section will provide a brief overview of the various design elements used to enhance the accessibility of the roundabout for vulnerable road users, which includes persons with disabilities, seniors and others with unique needs. Examples include shorter crossing distances, wayfinding applications, alignment refinements, detectable edge treatments, gap and yield detection, landscaping or even pedestrian signals.

CHAPTER 5 Traffic

5.1 Introduction

This section will provide an introduction on how roundabouts handle traffic flow and the methods for evaluating design capacity. Performance can be evaluated based on delay, volume/capacity ratio, queue length, and/or level of service.

5.2 Capacity Analysis

This section will provide an overview of capacity analysis and how it can be assessed through the use of different tools or methods. The section will also provide:

- A description of how to collect turning movement data;
- The process to convert turning movement data to roundabout flow rates; and
- A method to calculate passenger vehicle equivalent for converting data to uniform traffic volumes.

5.3 Simplified Method

This section will provide a description of the simplified method of analysis developed by the Centre for the Study of Urban Planning, Transportation and Public Facilities (Centre d'etudes sur les reseaux, les transports, l'urbanisme et les constructions publiques (CERTU)). The section will describe equations and provide sample calculations for this capacity analysis method that is applicable for rural or suburban single lane roundabout with a central island radius greater or equal to 15 m.

5.4 Detailed Method

This section will provide an introduction to detailed methods of capacity analysis, including the empirical method and the gap acceptance method. Brief descriptions of each method and their differences will be included.

5.5 Tools

This section provides a description of the different software tools available to evaluate roundabout performance. Each tool will be described briefly in terms of how it functions and the type of results provided. The tools include:

- Empirical method software: RODEL, ARCADY, GIRABASE
- Gap acceptance software: aaSIDRA, HCS
- Micro simulation software: CORSIM, VISSIM and PARAMICS

5.6 Delays

This section will provide a description of the different types of delay and how a roundabout can help to reduce delay compared to stop controlled or signalized intersections. Such delays include:

- Control delay or stopped delay based on the time it takes vehicles to stop; and
- Geometric delay based on the reduction in vehicle speeds as a result of the intersection.

CHAPTER 6 Safety

6.1 Safety Improvement

This section will provide an overview of the safety benefits of a roundabout as a method of intersection control. In particular, the differences between roundabouts and more traditional intersections in terms of road design, operational functionality and human behaviour will be compared. The section will also include a summary of crash prediction methodologies that can be considered when designing a roundabout.

6.2 Collision Reduction

This section will provide examples of before and after studies undertaken internationally (e.g., Australia, United Kingdom, United States, etc.) and observations and statistics related to collision reduction. The section will highlight that the main reason for the reduction in collisions is the elimination of potential conflicts.

6.3 Typology of Collisions in Roundabouts

This section will provide an overview of the various types of collisions that can occur on a roundabout. From data collected in other countries, it is observed that the types of collisions that occur on a more frequent basis include: failure to yield at entry, running off of the circulatory roadway, loss of control at entry and rear-end collision at entry. The section will note that the type of collisions occurring in an urban environment differ from the rural, where single vehicle collision are most common.

6.4 Speed Limits on Roundabout Approaches

This section will provide a brief summary of possible approach speed design requirements that can be incorporated to prepare entry into a slower driving speed in the circulatory roadway. Specific elements can include the visibility of the roundabout, the provision of curbing, the use of splitter islands and the approach curves. Alternate measures that can also be considered to reduce the speeds on the approaches include warning beacons, rumble strips, speed reduction markings or vehicle-activated speed warning signs.

CHAPTER 7 Types and Applications

7.1 Roundabout Types and Characteristics

This section will summarize the different types of roundabouts based on size. The section will explain that each type has its own characteristics and is most appropriate for certain applications.

7.2 Mini-roundabouts

This section will provide a description of mini-roundabout characteristics and suitable locations for their implementation. The section will note that the central island of a mini-roundabout should be designed to allow larger vehicles to pass over it as its radius is typically too small for larger vehicle manoeuvres.

7.3 Compact Roundabouts

This section will provide a description of small roundabout characteristics and suitable locations for their implementation. The section will note that a small roundabout is not ideal for heavy vehicles and should not be used on public transit routes, and that the small size and low speeds is more “friendly” for pedestrians and cyclists.

7.4 Medium Roundabouts

This section will provide a description of medium roundabout characteristics and suitable locations for their implementation. The section will note that medium roundabouts are typically single lane operation with larger geometry than the small roundabout, and permit more optimal traffic flow. Design could include larger splitter islands to accommodate pedestrian crossings.

7.5 Large Roundabouts

This section will provide a description of large roundabout characteristics and suitable locations for their implementation. The Guide will note that large roundabouts can include multiple lanes allowing them to accommodate larger traffic volumes, and have more generous geometry, allowing higher traffic speeds and better vehicle flow, but are less ideal for pedestrian crossings.

7.6 Turbo Roundabouts

This section will provide a description of turbo roundabout characteristics and how they function. The section will explain that a turbo roundabout is a unique design developed in the Netherlands that includes perpendicular entries to the central section and distinct lane dividers to guide vehicles within the central section.

CHAPTER 8 Geometric Design

8.1 Introduction

This section will provide an introduction to the geometric design of roundabouts and the different aspects that must be considered. The section will explain that roundabout design is an iterative process that requires a well-balanced concept.

8.2 General Geometric Considerations

This section will provide a description of the design principles used to determine geometric configurations, which include design speed, design vehicle, number of lanes, user types and location characteristics. The section will provide a description of different design elements, such as:

- Approach alignment and approach angles;
- Formula for calculation of vehicle speed based on radius size; and
- How slopes can affect a roundabout and the limitations for implementation in these cases.

8.3 Curbs

This section will briefly describe the curb height requirements on the central island, at the outer edges of the roundabout (shoulders) and also along the splitter islands. The section will denote that the type of curb is influenced by the speeds of the approaches, the circulatory roadway and the governing geometric design guidelines. Situations where curbs can or should be implemented will also be described (e.g., pedestrian refuge provided with a curbed splitter island or to reduce circulatory roadway width with the use of curbs, etc.).

8.4 Central Island

This section will describe the characteristics of the central island to be determined as part of the design process. The section will note that these characteristics include: its position with respect to the main and secondary axes of the intersection, the shape of the island, its influence on path deflection, the need for a mountable apron, its radius, landscaping requirements or opportunities, accommodation of the design vehicle, etc.

8.5 Circulatory Roadway

This section will describe the characteristics of the circulatory roadway to be determined as part of the design process. The section will note that these characteristics include: outside radius, width of the circulatory radius, distance between outside curb and shoulder line, differences with and without a mountable apron, outward slopes, super-elevation requirements, prohibition of parking and stopping zones, etc.

8.6 Entries and Exits

This section will describe the characteristics associated with entry into and exit from the circulatory roadway. The section will explain the entry characteristics to be taken into consideration in the design process, which include: approach half widths, entry widths, entry flaring, entry angles, entry capacity requirements dependent on entering traffic volumes, entry radii, design vehicle requirements, entry lane alignments, snow clearing operational requirements, etc. Characteristics of the exit to be taken into consideration in the design process include: exit radii, exit widths, exit curb radii, exit speeds, curbing, etc. Calculations for determining the entry and exit characteristics will also be included.

8.7 Splitter Islands

This section will describe the characteristics of the splitter island. It will be noted that its design geometry is a main determinant of roundabout functionality and influences capacity and safety. The section will identify characteristics to be taken into consideration in the design process, which include: shape, location with respect to the entry and exit lanes, location with respect to the roundabout radius, clearance requirements, its ability to meet the objectives of entry, exit and junction curves, minimum width requirements, specific dimensions (e.g., functionality as a pedestrian refuge, height, base width, entry and junction radii, etc.)

8.8 Right-turn Bypass Lane

This section will provide a brief explanation about the instances where a right-turn bypass lane can/should be implemented (listing of pros and cons), restrictions to the implementation of right-turn bypass lane, and design options related to traffic operations at the exit, turning radii, speed requirements/restrictions, consideration for alternate users, etc.

8.9 Visibility

This section will describe the visibility criteria and associated calculations for the design of a roundabout, which include: stopping sight distances and intersection sight distances. Stopping sight distances will include a review of the requirements associated with the approach site distance, visibility at the entry to the roundabout, visibility to the right of the driver, the sight distance on the circulatory roadway and the sight distance to the crosswalk on the immediate downstream exit. Intersection sight distances will include a review of the requirements associated with entry to the roundabout through the use of the sight triangle. Minimum height requirements will be included as part of this section.

8.10 Multi-Lane Roundabouts

This section will provide information about multi-lane roundabouts and their characteristics. The section will explain that the design should consider the interaction between vehicles within the roundabout. It will also address the manoeuvrability of trucks within the roundabout and the possibility that larger vehicles could take up more space than a standard vehicle. The need to consider options for construction staging when building a single lane roundabout as an interim design with multi-lane configuration to be added in the future will be addressed. Pavement markings and signage are also important for multi-lane roundabout operations and should be considered in connection with the geometric design.

8.11 Roundabouts on High-Speed Roads

This section will describe the design considerations for roundabouts on high speed roads. The section will explain geometry and approach design measures for managing traffic speed before entering roundabouts to ensure smooth transition. The importance of visibility and appropriate signage in the approach lanes will also be emphasized.

8.12 Access Control

This section will explain that access control in proximity to a roundabout is similar to conventional intersections. The section will emphasize that direct access within a roundabout should be avoided or minimized to prevent additional conflict points. Access points close to the roundabout should be spaced to reduce the impact on operations and safety.

8.13 Design Methodology

This section will provide a description of the different steps involved in the roundabout design process. The design elements will include:

- Design vehicle
- Traffic volumes
- Number of entering/exiting/circular lanes
- Inscribed circle diameter
- Entry deign
- Circular design
- Exit design
- Right turn bypass lanes

CHAPTER 9 Signing

9.1 Introduction to Signing

This section will provide an introduction to the different types of signage to be used in a roundabout and the approach lanes. The section will explain that signage is used to

announce the presence of a roundabout and to orient users to the appropriate directions. While specific signs may vary across the country, the general principles will be consistent.

9.2 Regulatory Signs

This section will provide a description of regulatory signs used with roundabouts, including: Yield, Keep Right, One-Way, Crossing Indication and Lane Designation. Typical purpose, placement and dimensions of each sign or type will be specified.

9.3 Warning Signs

This section will provide a description of warning signs used with roundabouts, including Roundabout Ahead, Yield ahead, warning chevrons, Hazard Markers, Pedestrian crossing and Advisory Speed. Typical purpose, placement and dimensions of each sign or type will be specified.

9.4 Destination Signs

This section will provide a description of destination signs used with roundabouts, including Destination indications at exit lanes and map type schematic before entering the roundabout. Guidance will be provided on placement in relation to roadway type (e.g. design speed, number of lanes, etc.).

9.5 Sign Locations

This section will provide a summary of the different types of signs placed near roundabouts, giving an overall view of the signs and their presentation. Options for specific locations and spacing of approach signs will be specified.

CHAPTER 10 Pavement Markings

10.1 Markings at all Roundabouts

This section will provide a description of pavements markings typically found in roundabouts. This will include yield lines and channelized markings (including lane edge markings and lane arrows). The section will note that lane markings should comply with typical roadway markings along shoulders and splitter islands. Crosswalk, trail crossing markings, and bike lane markings will also be described and/or reference to other sections of the document to specify measures for these users (e.g. crosswalk markings and elephant's feet markings). Suggested dimensions for pavement marking will be provided.

10.2 Circulatory Road Markings at Multi-Lane Roundabouts

This section will provide a description of circulatory road marking options for multi-lane roundabouts, including entry lane markings (including arrow and gore marking options), partial concentric lane markings, and exit lane markings. The section will include a description of how these markings can affect driver perception in multi-lane roundabouts.

When circular road markings are used they must be complemented with adequate lane designations in the roundabout approach to ensure entry lane choices.

CHAPTER 11 Signalization

11.1 Introduction to Signalization

This section will describe the types of signalization for roundabouts, and their applicability. The section will highlight the main signalization types, which are intended to control: the flow and priority of vehicle movements; pedestrian and/or trail crossings, and railway crossings. A description of different signals used to manage pedestrian crossings will be provided. This section will also highlight the signalling measures used to deal with various rail crossing cases.

11.2 Signalization for Circulation and Vehicle Flow

This section will explain the circumstances under which signalization of roundabout approaches may be required to control the flow of vehicles. This technique, known as metering, typically includes a queue detector to determine when the control signal should be activated.

11.3 Signalization for Crosswalks

The section will explain the circumstances under which signalization is needed to process significant volumes of pedestrians and cyclists crossing the approach lanes or when users have trouble crossing as a result of heavy traffic volumes. The section will include a description of different signal or flasher systems used to manage pedestrian crossings.

11.4 Signalization for Railway Crossings

This section will include a description of signalling measures to deal with various rail crossing cases.

CHAPTER 12 Illumination

This section will describe the purpose of illumination, elements of the roundabout that should be illuminated, and the recommended placement and vertical height of illumination units. The section will also include methods and procedures for determining the degree of illuminance, equipment type and location (e.g., as far removed as possible from the critical conflict areas).

CHAPTER 13 Landscaping

13.1 Visual Analysis

This section will highlight the purpose of landscaping and discuss methods of incorporating landscape elements into the roundabout design, while ensuring safety of all users. The section will explain how lanscaping can be used to provide a “proper

perception" of the intersection to those using the roundabout. Landscaping of the central island and the broader intersection area should enhance the overall roundabout experience by safely guiding users through the intersection while defining the structure of the intersection.

13.2 Design Concept in Relation to the Local Context

This section will illustrate how landscaping of the roundabout can be adapted to fit its surroundings. The section will provide examples for: new residential subdivisions, urban centres, suburban municipalities and small towns, rural settings and small communities, schools, interchanges, gateway and traffic calming treatments, commercial developments, and intersections with unusual geometry or closely spaced intersections.

13.3 Perception Sequences

This section will explain how the landscaping of a roundabout should result in a sequential thought process by which the driver of the vehicle perceives the roundabout on the approach. The section will highlight specific elements of the sequence, which include: a discontinuity perspective, a recognition perspective and a geometric understanding perspective.

13.4 Basic Recommendations

This section will provide guidance regarding the proper (and improper) use of landscaping. Specific elements that will be discussed include: maintaining clear sight lines, deterring pedestrians from utilizing the central island, ensuring roundabout manoeuvres are not hindered, and meeting sight distance requirements and roundabout operating requirements. Furthermore, this section will describe in more detail landscaping practices for the central island, the splitter islands and the approaches, explaining the purposes of each and providing examples of implemented landscaping.

13.5 Community Expression

This section will reiterate that a landscaped central island can act as a landmark, defining the character of the community and providing a visual identification of the type of environment that the roundabout user will be entering. The section will note that the roundabout design can also be used by community leaders or politicians as a sign of their commitment to the community at large.

CHAPTER 14 Construction, Operations, Maintenance and Rehabilitation

14.1 Construction

This section will provide an overview of the main elements to be considered when a roundabout is to be constructed. These elements include: construction staging requirements, which are dependent on traffic conditions (e.g., no traffic, some traffic or full traffic), construction plans, utility relocation, and construction coordination. A brief

overview of the types of costs that are typically associated with the construction of a roundabout and a comparison to the traditional intersection will also be included.

14.2 Operation

This section will address operations during construction as well as for maintenance activities post-construction. The section will highlight work zone traffic control for roundabout construction (dependent upon the construction staging approach), traffic management for utilities and maintenance works in and near the roundabout, and traffic management for special conditions and events (e.g. oversize vehicles).

14.3 Maintenance

This section will identify and discuss key maintenance considerations for roundabouts including landscaping maintenance, snow removal, pavement maintenance, and utility maintenance. The section will also provide a summary of winter control experience in Canada and the U.S.

14.4 Rehabilitation

This section will address rehabilitation requirements. The section will note that rehabilitation of the roundabout will likely occur when required or following the overarching guidelines and protocols of the governing jurisdiction. It is important to note that any rehabilitation work will need to ensure that specific design requirements of the roundabout are maintained (e.g., mountable curb height of the central island).

Work to Date and Future Directions

To date, the Project Team has completed the design practices survey, prepared an annotated Table of Contents summarizing the material and references to be included in the document, drafted a design philosophy discussion paper, and commenced writing several sections of the Guide. A data dictionary listing the reference documents cited for the Guide is also being maintained.

The next steps in the process include:

- Drafting and editing the remaining Guide content (April – August 2014)
- Meeting with the PSC to review draft content (September 2014)
- Revising the draft content based on input received from the PSC (September – December 2014)
- Submitting the draft final Guide to the PSC (March 2015)
- Revising the Guide to address comments received and presenting the final Guide to the PSC for approval (April 2015)

Concluding Remarks

By providing a consistent and methodical approach to roundabout design across Canada, the Guide eliminates the need for individual road authorities to develop their own

guidelines. The presence of national guidelines also helps to mitigate liability concerns often expressed by reluctant transportation professionals. In addition, the Guide addresses several key issues, including planning and policy, oversize vehicles, vulnerable road users and public consultation.

The partnership arrangement between TAC and the project funding partners has provided an excellent opportunity to develop this guiding document to the mutual benefit of the organizations and transportation professionals in Canada. The support of the TAC Chief Engineer's Council and the three governing standing committees will also play a critical role in ensuring a quality product and timely completion of the Guide. It is because of these efforts that transportation professionals in Canada will have needed guidance in the design and implementation of roundabout projects across the country.

The views expressed in this paper do not necessarily reflect the opinions of TAC, the JRSC or the PSC.

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