

The Evolution of Roundabouts in Newfoundland

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ABSTRACT

Roundabouts have become increasingly common on Canada's roads since the 1990's, however, Newfoundland and Labrador has been slower to adopt roundabouts as a means of intersection control. Today, roundabouts remain fairly new and somewhat controversial to Newfoundlanders. Major news was made in 2014 when a traffic calming circle was removed on Old Topsail Road in St. John's. News headlines were referring to the traffic circle as a roundabout and had a damaging effect on the perception of roundabouts in the region.

The first modern roundabouts in Newfoundland were constructed at the NLL Recycling's Robin Hood Bay Waste Management facility. Two single-roundabouts were built to improve site circulation for residential and commercial vehicles entering the facility. While these modern roundabouts being constructed were a significant milestone, since the roundabouts were not constructed on the public road network, it did not contribute significantly to the profile of roundabouts in Newfoundland.

It was only 2014 that the Town of Paradise built the first roundabout on the public road network at the intersection of Karwood Drive and Kenmount Road, one of the busiest intersections in Paradise. The resulting traffic impact of the construction of this multi-lane roundabout has acted as a catalyst to roundabout development in the Avalon Peninsula. The roundabout served as an example to surrounding municipalities and residents of the benefits of roundabouts by significantly reducing delay at the congested intersection.

As a result, a number single-lane and multi-lane roundabouts have been constructed in the last three years by the City of St. John's and by private developers. As these new roundabouts on the Avalon Peninsula continue to demonstrate the benefits of roundabouts, their popularity continues to increase and is spreading towards more rural parts of Newfoundland. Many municipalities have requested that preliminary designs be completed at some of their busiest intersections. Some of these include the City of Corner Brook, Town of Grand Falls-Windsor, Town of Paradise, Town of Marystown, Town of Torbay and Town of Bay Roberts.

With the current economic condition in many Newfoundland communities, the municipal decision-makers are recognizing the fact that roundabouts can create a multitude of benefits, most noteworthy, long term cost savings over constructing other types of intersections.

This paper strives to outline the past, present and future of roundabouts in the Province of Newfoundland and Labrador. There are unique challenges that exist in the Province with respect to implementation, acceptance, and education which must be explored and discussed in order to understand the optimal way forward to growing a roundabout program in the Province.

HISTORY OF NEWFOUNDLAND

Newfoundland and Labrador has a rich and complex history which was mainly shaped by English, Irish and French influences. Prior to European settlement in Newfoundland and Labrador, the island of Newfoundland was inhabited by Maritime Archaic Indians who settled in the eighth millennium BC. A number of other cultures have also been documented in archeological records over the years, however, most cultures became extinct before or around the time Europeans arrived in Newfoundland [1].

In the early eleventh century, the first European contact was made with Newfoundland when Vikings landed on the Northern Peninsula. While they did not settle permanently and left Newfoundland by the 12th century, they left their mark on the province at L'Anse aux Meadows now a National Historic Site and UNESCO World Heritage Site. It was in 1497 that Giovanni Caboto, known as John Cabot, arrived in Newfoundland waters at Bonavista to discover the New World and claim Newfoundland as a British colony. During the sixteenth and seventeenth century, fishermen from France, Spain, Portugal, Ireland and England arrived in Newfoundland and Labrador to take advantage of the province's abundance in codfish. The majority of early settlers immigrated from southwest England and southeast Ireland before the Great Irish Famine [1].

The French also played a role in shaping Newfoundland's history when Jacques Cartier arrived in 1534. In 1662, a colony was established in Placentia which lead to the development of a number of settlements around Placentia Bay and beyond the Burin Peninsula. During the late seventh century, the French also settled on the islands of Saint-Pierre et Miquelon located to the west of the Burin Peninsula (approximately 30 kilometres). Saint-Pierre et Miquelon is still a colony of France today. While Newfoundland was England's oldest colony, during the seventeenth century, it was mainly inhabited by the French. By the middle of the next century, the majority of the French settlers had left Newfoundland due to growing tension between France and England and military successes elsewhere in North America [1,2].

The British colony of Newfoundland and Labrador was a full Dominion of the British Empire until 1949, which meant it was equal to larger colonies such as Canada, Australia and New Zealand. On March 31st, 1949, Newfoundland and Labrador joined Canada as the country's youngest province. Although Newfoundland and Labrador is the newest province, its capital city, St. John's, is the oldest city in Canada [1,3].

HISTORY OF ROUNDABOUTS

Circular intersections have been part of transportation systems around the world since 1905 when the first documented rotary, the Columbus Circle, was constructed in New York City (Figure 1). A number of rotaries were built in Canada and the United States until they fell out of favour in the 1950's due to safety and operational problems typically caused by these intersections' operational characteristics. These older-style circular intersections operated with the right-of-way given to vehicles entering the roundabout which allowed for high-speed entries, combined with large diameters, allowing for high-speed merging and weaving of traffic. This configuration led to high numbers of collisions and a tendency for the circle to lock up at higher traffic volumes [4,5,6]. A number of rotaries were built in the Atlantic Provinces, some of which have been converted to modern roundabouts today. To the authors knowledge there were no rotaries in Newfoundland.



Figure 1 - Columbus Circle, New York City (1915) [7]

Rotaries were re-engineered into modern roundabouts as an attempt to rectify the operational and safety problems of the older-style circular intersections. The modern roundabout was first introduced in the United Kingdom (UK) in 1963. Modern roundabouts differ from older-style rotaries through three (3) major characteristics including:

- the right-of-way is assigned to vehicles circulating or exiting the roundabout, vehicles entering the roundabout must yield to circulating traffic,
- roundabouts are smaller in size than rotaries, and
- roundabouts have channelized approaches designed with appropriate curvature to reduce entry speeds.

The operational and safety benefit of modern roundabouts have led to modern roundabouts quickly becoming a common method of intersection control throughout Europe, Australia and New Zealand. Canada and the United States were slower in adopting the modern roundabout as a form of intersection control; roundabouts did not emerge until the early 1990's but have become increasingly common over the years [4,5,6].

HISTORICAL INTERSECTIONS

East Coast

Newfoundland's capital city, St. John's, is located on the northeast Avalon peninsula. The City of St. John's has a number of intersections that operate in a similar fashion to roundabouts. A historical intersection was that of Military Road and Kings Road. Local residents recall the intersection operating as a circular intersection with a central island. The intersection was likely more similar to a traffic circle than a roundabout given the size of the intersection. Historical photos of the intersection show a number of buildings located close to the road thus limiting the right-of way available. It is unknown when the installation or removal of the central island occurred, however, record drawings from the City's archives from 1975 depict the intersection without a central island. The intersection now operates as a signalized intersection.

Immediately adjacent to the intersection of Military Road and Kings Road is the intersection of Monkstown Road, Prescott Street and Military Road, known as Rawlins Cross. Rawlins Cross has been a St. John's landmark since the 1840's and was the site of the City's first traffic signals. These two intersections, along with a number of adjacent intersections and one-way streets operate similar to a roundabout. The unique layout combines one-way streets with turning movement restrictions created by traffic islands to create a counter-clockwise flow along segments of Military Road, Prescott Street, Queens Road and Kings Road (Figure 2). It is unclear how long this layout has been in operation, however, record drawings from the City's archives show this layout in 1975.

A similar layout exists in St. John's in the vicinity of Queens Road, Gower Street and Church Hill. The one-way streets and turning movement restrictions created by traffic islands cause traffic to flow counter-clockwise along Queens Road, Gower Street and Church Hill (Figure 3). It is unclear how long this layout has been in operation, however, record drawings from the City's archives show this layout in 1975.

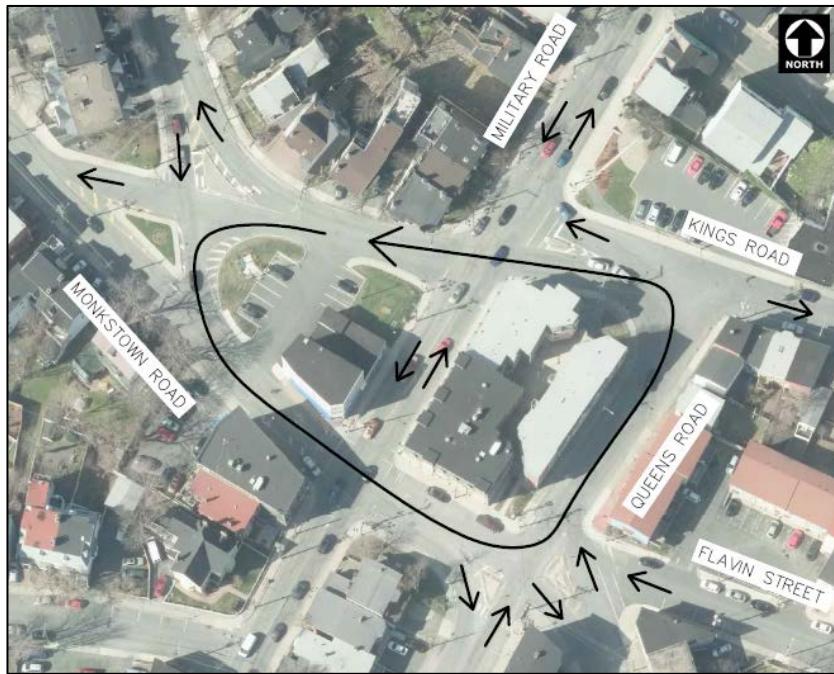


Figure 2 - Rawlins Cross area in St. John's, NL



Figure 3 - Queens Road, Gower Street and Church Hill in St. John's, NL

Central Newfoundland

The Town of Grand Falls-Windsor was founded in 1905 by the Anglo-Newfoundland Development Company. The Company was formed by a British newspaper company who came to Newfoundland in search of a location to build a pulp and paper mill and the Newfoundland Railway. Together they built the town around a pulp and paper mill which opened in 1909. In its early days, the Town was a company town where only employees of the mill and owners of private business could live. The pulp and paper mill officially shut down in February of 2009 and is now in a state of demolition. [8,9].

British influence can be seen in the Grand Falls-Windsor road network in a traffic circle which exists on High Street. The traffic circle is locally known as “the Dummy”, it should be noted that the traffic circle is commonly referred to as a roundabout. According to the Grand Falls-Windsor Heritage Society, the traffic circle was built in the early days of the Town, if not at its conception. The traffic circle is located at the intersection of High Street and Mill Road, which at the time was likely the intersection between the Town’s main street and the road leading up to the mill (Figure 4). “The Dummy” is still in operation today (Figure 5) and was designated as a historical site by the Town in 2006 [10].

West Coast

In 1923, the Prime Minister of Newfoundland and the Reid Newfoundland company engaged the large engineering and manufacturing British firm of Sir. W.G. Armstrong and Company to oversee the construction of a pulp and paper mill and an entire town to house future employees. The government believed a pulp and paper mill on the west coast would boost the poor economy of the area [11].

This development on the west coast of Newfoundland, known as the Townsite Development at the time, was located in Corner Brook (Figure 6). The area had been settled since the mid-19th century and the small village of Corner Brook existed around a saw mill which burned down in the late 1920’s [11]. While no circular intersections were identified, the picture of the Townsite shows what resembles a traffic circle at the end of a driveway or cul-de-sac (in the bottom right corner of Figure 6).



Figure 4 - High Street Traffic Circle in Grand Falls-Windsor (mid 1990s) [10]



Figure 5 - High Street Traffic Circle in Grand Falls-Windsor (2017)



Figure 6 - Townsite Development Corner Brook (late 1920s) [11]

MODERN ROUNDABOUTS IN THE PROVINCE OF NEWFOUNDLAND AND LABRADOR

While roundabouts began appearing in Canada in the 1990's, Newfoundland and Labrador has been slower to adopt roundabouts as a means of intersection control. Today, roundabouts remain fairly new and somewhat controversial to Newfoundlanders. This is can partially attributed to a lack of education with regards to

roundabouts. As an example, in 2012 a traffic circle was built at the intersection of Old Topsail Road and McLoughlan Street in St. John's, NL as part of a traffic calming pilot project (Figure 7)[12].

A well-designed traffic calming circle consists of a raised island which requires drivers to slow down to a speed that allows them to comfortably maneuver around the island. The design of the traffic circle allowed vehicles from the northeast approach to navigate the intersection without being impeded by the traffic circle. The location of the island was not optimal, this combined with an almost fully mountable central island resulted in the traffic circle serving little to no purpose in reducing speeds. As a result, two years later, major news was made when the traffic calming circle was removed on Old Topsail Road in St. John's (Figure 8)[12]. News headlines were referring to the traffic circle as a roundabout, and it was being removed as it was creating safety concerns. This had a damaging effect on the perception of roundabouts in the region.



Figure 7 - Traffic circle on Old Topsail Road

The screenshot shows the CBC News website interface. At the top, there are links for TV, RADIO, NEWS, SPORTS, MUSIC, LIFE, ARTS, LOCAL, MORE, WATCH, LISTEN, LOG IN, and a search bar. Below the header, there is a banner for 'St. John's More Streams' featuring four people. The main navigation menu includes Home, Opinion, World, Canada, Politics, Business, Health, Entertainment, Technology & Science, and Video. A red 'Canada NL' button is visible. The main content area has a large photo of a traffic circle. The headline reads 'Roundabout to be removed from Old Topsail Road'. Below the headline, there is a sub-headline 'Roundabout to wind down Here and Now', a timestamp 'CBC News Posted: Jun 25, 2014 3:24 PM NT | Last Updated: Jun 25, 2014 4:54 PM NT', and a link 'Stay Connected with CBC News'.

Figure 8 - Article about removing the traffic circle on Old Topsail Road

Another example in the central part of the province, was the headline “New ‘roundabout’, rotary proposed for Marystow” (Figure 9). The terms roundabout and rotary were used interchangeably throughout the article. This roundabout was proposed as a result of a petition from residents complaining about the intersection being unsafe and experiencing a high volume of collisions. The article indicated that a design similar to the Mic Mac Rotary (in Dartmouth, NS) would be proposed for the roundabout at the intersection of McGettigan Boulevard

and Harris Drive [13]. The Mic Mac rotary was an older-style circular intersection and was replaced in the 1990's with a partial clover leaf interchange due to its inability to handle large volumes of traffic. Given that the design was compared to a rotary incapable of handling large volumes of traffic and that these older-style intersections typically experienced more collisions than modern roundabouts, this article also had a damaging effect on the perception of roundabouts. To this date, a roundabout has not been constructed at the intersection.

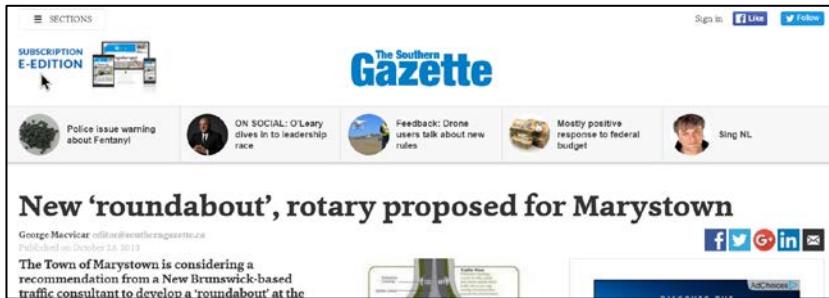


Figure 9 - Article about the proposed roundabout in Marystow

The first two roundabouts constructed in Newfoundland are located at the NLL Recycling's Robin Hood Bay Waste Management facility in St. John's. The two single-lane roundabouts were built in 2008 to improve site circulation for residential and commercial vehicles entering and exiting the facility. The construction of these modern roundabouts was a significant milestone, however, since the roundabouts were not constructed on the public road network, it did not contribute significantly to the profile of roundabouts in Newfoundland.

In 2013, a single-lane roundabout was constructed at the intersection of Hebron Way and Sea Rose Avenue in the East End of St. John's (Figure 10). The roundabout was constructed at a new intersection as part of a retail development. At the time of its construction, there was no significant development around the intersection, which provides access to three cul-de-sacs. While this was the first roundabout constructed on the public road network, there was little reason for the general public to use the roundabout immediately after its construction. Therefore, this roundabout also did not contribute significantly to the profile of roundabouts in Newfoundland.

In 2014, the Town of Paradise built the "first" roundabout on the public road network at the intersection of Karwood Drive and Kenmount Road, one of the busiest intersections in Paradise (Figure 11). While it was actually the fourth roundabout to be constructed in the province, this was the first to be located at a major intersection and receive high media coverage.

The intersection was originally a stop-controlled intersection which was temporarily signalized in the fall of 2010 before being converted to a roundabout. A transportation study completed by the Town in 2011 reported the Karwood Drive and Kenmount Road intersection as the intersection having the highest number of collision in the Town. The four-year collision history (2006-2010) indicated an average of 6 collisions per year and the existing conditions analysis for 2010 reported movements operating at poor levels of service during both the AM and PM peak hours [14].

The resulting traffic and safety impacts of the construction of this multi-lane roundabout has acted as a catalyst to roundabout development in the Avalon Peninsula. The roundabout served as an example to surrounding municipalities and residents of the benefits of roundabouts by improving safety and significantly reducing delay at the congested intersection.



Figure 10 - Hebron Way and Sea Rose Avenue Roundabout



Figure 11 - Karwood Drive and Kenmount Road Roundabout

In 2015, the Waterford Valley High school was built on Topsail Road in the West End of St. John's. An important feature of the new school's site circulation was a single-lane roundabout. The site is accessed from a signalized intersection on Topsail Road, after which traffic immediately enters the roundabout (Figure 12). The roundabout was suggested by the City to accommodate the large volume of left-turning traffic leaving the site.

A number of roundabouts have been designed and approved for the Galway and Clayton developments located in the southwest area of St. John's. Over 10,000 dwelling units, as well as commercial and light industrial uses, have been proposed for the area. The first roundabout in Galway was constructed in 2014 as a ramp terminal on

the Trans-Canada Highway (Route 1) and Danny Drive in the west end of the development. In 2016, the City's first multi-lane roundabout was constructed at the eastbound ramp terminal of the Ruth Avenue interchange on Pitts Memorial Drive (Route 2) (Figure 13). A second multi-lane roundabout will be constructed at the westbound ramp terminal in 2017. The Ruth Avenue interchange provides access to the City of Mount Pearl and the commercial section of the Galway Development. Three internal roundabouts have been planned for the residential portion of the developments and will be constructed in 2017.



Figure 12 - Aerial view of the Waterford Valley High School Roundabout



Figure 13 - Ruth Avenue Interchange Eastbound Ramp Terminal

In 2016, the St. John's International Airport Authority built a multi-lane roundabout at the intersection of World Parkway and Navigator Avenue located at the entrance to the St. John's International Airport (Figure 14). The roundabout was built to improve the intersection at a tight horizontal curve in the new entrance road. The new intersection was built to facilitate new commercial development at the airport. In 2016, the City of St. John's also installed a new single-lane roundabout on Carrick Drive. The roundabout serves as the entrance to the new Paul Reynold's Community Centre.



Figure 14 - World Parkway and Navigator Avenue Roundabout [15]

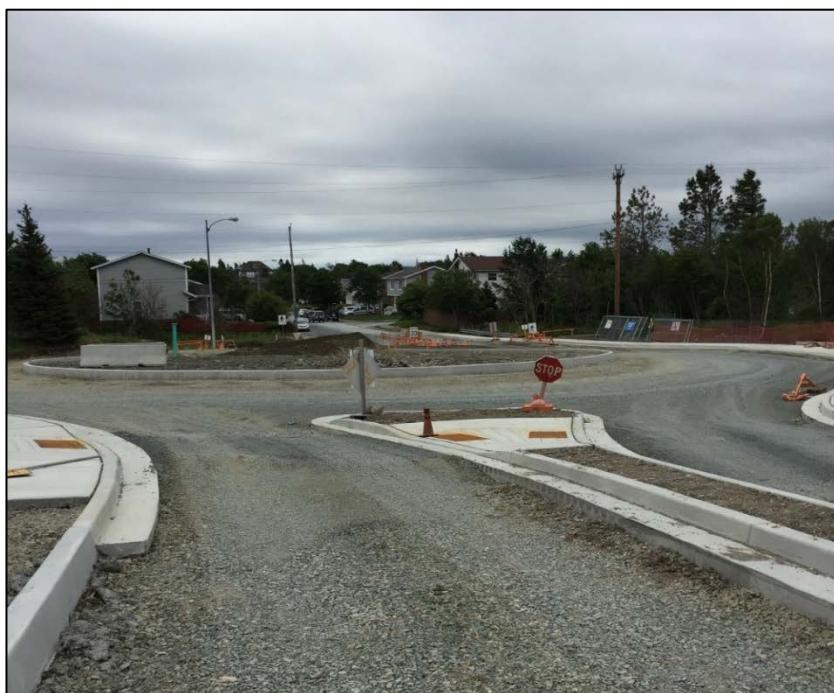


Figure 15 - Carrick Drive Roundabout at the Paul Reynolds Community Centre [16]

The Government of Newfoundland and Labrador began construction of the extension of the Team Gushue Highway (TGH) in 2012. Once completed, the Team Gushue Highway will form a north-south connection from the Trans-Canada Highway (Route 1) to Pitts Memorial Drive (Route 2). Due to the construction of the Team Gushue Highway, the City of St. John's has identified the need for infrastructure improvements at a number of

intersections to provide efficient traffic flow to and from the highway. These “gateway” intersections must work to promote economic development in the area by creating a sense of local identity in order to attract more people to St. John’s.

The existing intersection of Blackmarsh Road, Empire Avenue and Redmond’s Road would connect to the TGH from a new grade-separated interchange. The existing intersection is an operationally complex situation which does not take full advantage of its function as a major gateway into the West End. A single-lane roundabout was identified as the best alternative to provide a “safe”, high-capacity intersection for all road users. Construction of the roundabout is anticipated for 2017, the redevelopment project will introduce an aesthetic that welcomes users of the Team Gushue Highway.

Very few modern roundabouts exist in rural Newfoundland, only one has been identified at this time in central Newfoundland in the Town of Grand Falls-Windsor. Grand Falls-Windsor is the largest Town in the central region of the province. The Town, already known for its historical traffic circle, built a single-lane in 2016 at the intersection of Hardy Avenue, Grenfell Heights and Scott Avenue to improve safety conditions (Figure 16).



Figure 16 - Hardy Avenue, Grenfell Heights and Scott Avenue Roundabout in Grand Falls- Windsor, NL

As these new roundabouts on the Avalon Peninsula continue to demonstrate the benefits of roundabouts, their popularity continues to increase and is spreading towards more rural parts of Newfoundland. With the current economic condition in many Newfoundland communities, the municipal decision-makers are recognizing the fact that roundabouts can create a multitude of benefits, most noteworthy, long term cost savings over constructing other types of intersections.

Many municipalities have requested that preliminary designs be completed at some of their busiest intersections. Some of these include the City of Corner Brook, the Town of Paradise, the Town of Torbay and the Town of Bay Roberts. The roundabout count as of April 2017 for proposed and constructed roundabouts by Newfoundland municipality is shown in Table 1.

Table 1 - Proposed and Constructed Roundabouts by Municipality

| Municipality | Single-lane roundabouts | Multi-lane roundabouts | Approved/Designed | Planned |
|---------------------|-------------------------|------------------------|-------------------|---------|
| St. John's | 6 | 2 | 5 | 14 |
| Paradise | - | 1 | 2 | 13 |
| Grand Falls-Windsor | 1 | - | - | - |
| Holyrood | - | - | 1 | - |
| Torbay | - | - | 1 | - |
| Bay Roberts | - | - | - | 1 |
| Corner Brook | - | - | - | 1 |
| Marysville | | | - | 1 |

ROUNDABOUTS IN SAINT-PIERRE ET MIQUELON, FRANCE

France has the highest number of roundabouts, per capita, than any country in the world. Not surprisingly, the French State of Saint-Pierre et Miquelon, located 30 kilometres to the west of Newfoundland's Burin Peninsula features two (2) modern roundabouts and a mini-roundabout. The two modern roundabouts are located at Rue Abbé Pierre Gervain and Route Nationale 2 (Figure 17) and Boulevard Port-en-Bessin and Route Nationale 2. The mini-roundabout is located at the intersection of Avenue Commandant Roget Birot and Rue Marceau. Google imagery dating back to 2005 shows all three roundabouts in operation. Saint-Pierre et Miquelon appears to have adopted roundabouts as a form of intersection control almost a decade, if not more, earlier than Newfoundland.



Figure 17 - Rue Abbé Pierre Gervain and Route Nationale 2 Roundabout [17]

EDUCATION

One of the most significant issues faced by municipalities or provincial authorities when constructing the first roundabouts in their jurisdiction is providing adequate education to all users of the roundabout, including drivers, pedestrians and cyclists. Studies have shown that the acceptance of roundabouts increases when the public is educated and has a clear understanding on how to properly navigate through roundabouts. Roundabouts, when used properly, are known to reduce collision frequency and severity, as well as optimize intersection efficiency. However, when users are unsure how to navigate through a roundabout, these benefits are not as pronounced. Unfamiliarity with roundabouts can also lead drivers to select alternate routes to avoid the roundabout altogether.

Less than a dozen roundabouts exist in Newfoundland, as a result the majority of the population remains unfamiliar with them, including those in regulatory roles. Very little has been done regarding driver education other than providing information on the municipalities' or provincial websites. The provincial website has an entire page dedicated to inform drivers how to use roundabouts, however the page provides incorrect information (Figure 18). The St. John's International Airport Authority also has a website page that includes roundabout rules and a diagram indicating how to use their roundabout.

Some municipalities host public involvement centres during the design process, however, there are typically no formal education campaigns that ensue. A noteworthy effort was completed for the Karwood Drive and Kenmount Road roundabout located near an Elementary school. During its construction, the Town held a public involvement centre [18] and after its construction the Town of Paradise held an information session on roundabouts for the young children at the Paradise Elementary School.

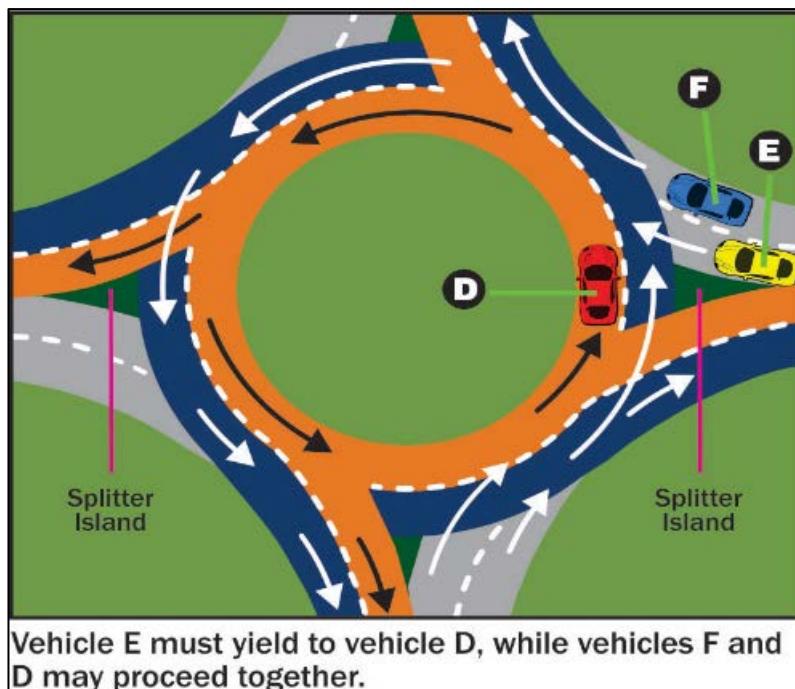


Figure 18 - Incorrect Information from the Government of Newfoundland and Labrador Website [19]



Figure 19 - St. John's International Airport Roundabout Diagram [20]

CONCLUSIONS

Newfoundland and Labrador has a rich and complex history which was mainly shaped by English, Irish and French influences. In 1497 John Cabot, arrived in Newfoundland waters and discovered the New World. After which fishermen from France, Spain, Portugal, Ireland and England began to arrive in Newfoundland and Labrador. The majority of early settlers immigrated from southwest England and southeast Ireland before the Great Irish Famine. The British colony of Newfoundland and Labrador was a full Dominion of the British Empire until 1949, when it joined Canada as the country's youngest province. Although Newfoundland and Labrador is the newest province, its capital city, St. John's, is the oldest city in Canada [1,3].

Circular intersections have been part of transportation systems around the world since 1905. A number of rotaries were built in Canada and the United States until they fell out of favour in the 1950's due to safety and operational problems typically caused by these intersections' operational characteristics. In 1963, rotaries were re-engineered into modern roundabouts as an attempt to rectify the operational and safety problems of the older-style circular intersections. Roundabouts have become increasingly common on Canada's roads since the 1990's, however, Newfoundland and Labrador has been slower to adopt roundabouts as a means of intersection control.

Historically Newfoundland has had very few circular intersections, only one traffic circle was identified in the Town of Grand Falls-Windsor which has been around since the early 1900's. The City of St. John's is believed to have had a circular intersection at the intersection of Military Road and Kings Road, however, no documentation has been found to support this claim. There are two areas in St. John's that combine use a combination of one-way streets and turning movement restrictions and operate similar to a roundabout with traffic flowing counter-clockwise along a number of street segments.

Today, roundabouts remain fairly new and somewhat controversial to Newfoundlanders, and this can be mainly attributed to lack of education and misleading media information. A number of articles have been published in recent years referring to traffic circles and rotaries as roundabouts. These news headlines have had a damaging effect on the perception of roundabouts in the province.

In 2014, the Town of Paradise built the Karwood Drive and Kenmount Road roundabout, and while this was the fourth roundabout in the region, it was the first to be constructed at a major intersection and received high media attention. The intersection located on a major commuting route was known for its operational and safety problems. The resulting traffic impact of the construction of this multi-lane roundabout has acted as a catalyst to roundabout development in the Avalon Peninsula. The roundabout served as an example to surrounding municipalities and residents of the benefits of roundabouts by significantly reducing delay at the congested intersection.

As a result, a number single-lane and multi-lane roundabouts have been constructed in the last three years by the City of St. John's and by private developers. A total of ten (10) roundabouts exist today with nine (9) in the design stages and dozens more in the planning stages. As these new roundabouts continue to demonstrate the benefits of roundabouts, their popularity continues to increase and is spreading towards more rural parts of Newfoundland.

Education efforts have varied between municipalities, but typically include a public involvement centre during the design stages of the roundabout without any formal education campaigns. Information about roundabouts can be found on the websites of municipalities and the province, however, in some instances incorrect information is conveyed. There are unique challenges that exist in the Province with respect to acceptance and education which must be addressed in order to move forward with a successful roundabout program in the Province.

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