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Acknowledgements

We would like to acknowledge all those who completed our survey. Your invaluable insight informed our understanding of how roundabouts are maintained. Further, we would like to thank the City of Carmel for taking the time to share their best practices, adjustments made based on experience, and maintenance specifications and schedules. This manual would not have been possible without the knowledge and first-hand experience of all those who participated.

Introduction

In recent years, roundabouts have become more prevalent in the United States. Their growing popularity is a result of their proven advantages over other signalized and non-signalized intersections. Agencies across the country are adding roundabouts to their roadways at a growing rate. Once the roundabouts are placed, it is up to the road owners to maintain them. Roundabouts require a more detailed maintenance plan than a regular intersection, and their unique design and function can present maintenance challenges.

This maintenance manual serves as an additional resource for communities who have implemented roundabouts or are considering them. There are a few other published guides, such as the NCHRP Report 672, Roundabouts: An Informational Guide, and the Wisconsin DOT Facilities Development Manual. However, the information covered in these guides is very broad. This manual will provide specific information regarding roundabout maintenance.

Research for this manual began by determining the most common questions and problems relating to roundabout maintenance, as well as existing materials published on roundabout maintenance. A survey was created for agencies with the most experience in maintenance. Cities in and around Indiana with the highest number of roundabouts were determined and contacted to complete the survey. Agencies returned written responses or were interviewed regarding maintenance. The gathered information was compiled to create this document. A summary of the information in this guide has been published in a small flipbook as well.

The information and statements in this document are suggestions for roundabout maintenance practices, not standards. Best maintenance methods and practices will be determined as more time passes and more roundabouts are installed. This guide is a preliminary look at maintenance procedures based on the knowledge agencies have gained thus far. Owners must realize that every roundabout is different due to size, traffic amounts, individual features, and necessary maintenance tasks. There cannot be one solution applied to all roundabouts. For official maintenance requirements, consult your state’s Department of Transportation or the NCHRP Report 672, Roundabouts: An Informational Guide.
Section I: Winter Maintenance

The circular shape of roundabouts must be considered when clearing snow from these roadway features. Improper plowing and de-icing can result in damage to curbs from the plows and create dangerous driving conditions for motorists.

Snowplowing

Typically, no special equipment is required for plowing roundabouts; however, drivers should be trained in advance on proper roundabout plowing techniques. The best method for snow removal is to start in the center of the roundabout. It is up to each individual community whether they would like to plow the truck apron. Some believe it should be plowed for the trucks and vehicles that utilize it. Others do not plow the apron for preservation purposes. This prevents plows and salt treatments from damaging the aprons.

Note that not all truck aprons are wide enough to fit the plow blade, and therefore cannot be plowed. Regions that receive large amounts of snow should consider this in the design and planning of their roundabouts. One agency surveyed said that they made all of their truck aprons twelve feet wide to accommodate plows. Depending on the amount of snow expected for the region and the size of plow trucks used, aprons should range from 10-12 feet if plowing will be necessary.

If a truck apron will be plowed, direct drivers to mount the apron and clear it first. Then, work in continuous circles in the same direction as traffic and gradually plow to the outer edge of the roundabout. A secondary truck, meanwhile, can remove snow from the roundabout exits and entrances. If a secondary driver is not available, the original driver can clear the approaches once the circulatory roadway has been cleared.

In some areas, storage of the plowed snow can become an issue. Snow should always be plowed to the right and outside of a roundabout. It is not advised to use the central island as a snow storage space. Snow stored on the central island can cause issues with drainage as well as melting and refreezing onto the circular roadway. This not only creates unsafe driving conditions, but increases maintenance costs due to the extra labor and de-icing materials needed to clear the runoff. Snow storage in the central island can also prevent trucks from using the truck apron. If snow buildup on the outside of a roundabout becomes an issue, snow should either be pushed back further from the curb or hauled from the area.

Communities new to roundabouts often run into the problem of plows damaging the corners on roundabout entries and exits, or other curb areas. The repairs for this are an unnecessary expense and are unsightly for drivers passing through the intersection. Thankfully, a number of precautions can be taken to prevent plows from damaging roundabouts. In areas where heavy snowfall is expected, snow poles can be used to mark roundabout boundaries. Some communities also requested plow drivers to reduce their speeds when clearing roundabouts. Another preventative method includes designing or re-designing roundabouts to have mountable curbs. Mountable curbs reduce the damage caused by snow plows because they allow the plows to move up and down on the curb, making it easier for plows to clear truck aprons and maneuver around corners.
One advantage roundabouts offer in regards to snowplowing is a safe place for plows to turn around. Instead of backing up in an intersection, drivers can navigate through a roundabout to change the plow’s direction. This is much safer than backing the truck and should be taken into account when planning plow routes. Agencies should use roundabouts to their full advantage as turnaround points on snow plow routes.

**De-icing**

There is some debate whether the best method for de-icing is with liquid or granular chemicals. Among the agencies interviewed for this guide, it was concluded that the better solution is granular salt. Liquid treatments are utilized by some communities, but this study concluded overall that granular treatments were more effective. Salts work with lower temperatures and larger amounts of snow, so it is recommended to use them when treating roundabouts. Using a liquid treatment in roundabouts can create a slick surface for vehicles. If liquid is used, it is recommended to use it in combination with salt treatment.

Be cautious when selecting what type of salt to use. Some communities have reported damage to landscaping from salt getting onto the vegetation. Excessive use of salt can also cause damage to curbs and other elements of the roundabout; however, this problem is to be expected on any roadway.

**Equipment**

There is no special equipment needed for plowing and de-icing roundabouts. Either single axle or tandem plows can be used. However, there are some specific maintenance tasks that can increase the durability of the plow trucks themselves. Some communities interviewed during the research process noticed more wear on the passenger side springs. This occurs due to the higher amount of weight and pressure put on the passenger side of trucks that frequently travel through roundabouts. They advised purchasing stronger and more durable springs for the trucks. One agency stated that now they are using 9,500# springs on the driver side of the front and 10,500# springs on the passenger side.

Tires are another concern. Maintenance trucks that frequently pass through roundabouts often notice more tire wear on the passenger side of the trucks, due to the increased turning. To mitigate this extra wear, trucks that frequent roundabouts may need to have their tires rotated more often than trucks traveling on straight roads.
Section II: Summer Maintenance

Landscaping is an important aspect of roundabouts because it helps guide motorists’ sight lines and makes roundabouts more visually appealing than other intersections. As a vital element in a roundabout, the landscaping must be maintained. This involves everything from choosing the best vegetation for each roundabout to positioning maintenance crews while performing work. This section will guide communities in landscaping maintenance aspects.

Suggested Landscaping

Some communities with roundabouts have established guidelines restricting what can and cannot be placed in the central island and on the splitter islands. Landscaping in the central islands should be dependent on the speed of approaching cars. In roundabouts with approach speeds over 40 mph, avoid placing large trees (diameter over 4 inches), large rocks, statues, and other large features. This helps to prevent injury in case of errant vehicles. Detailed descriptions of what is advised for sizes and heights of elements in the central island may be included in the layout by the designers.

This research project found it is best to have some landscaping in the central island, provided that it is safe for drivers. Landscaping elements can be tailored to guide motorists’ sightlines to the direction they need to look for correctly navigating the roundabout. Landscaping in the central island can slow speeds and encourage drivers to look left instead of across the roundabout.

Central Island Maintenance

Parking a maintenance vehicle during operations requires some consideration. In some roundabout designs, an inset is incorporated for this purpose. In roundabouts with this feature, simply park the maintenance vehicle in the designated inset. If there is not an inset, the alternative is the truck apron. Make sure to park the truck in an area where it will not block sightlines for drivers still using the roundabout. For example, when working at an intersection where more traffic circulates through the north and south approaches, park the truck on the east or west side of the apron. Be sure to account for the time of day, as these conditions could change. These types of maintenance tasks should not take more than an hour, so follow your agency’s procedures for a short dura-

Figure 3. Example of landscaping in the central island. Small trees, low walls, and low shrubs.

Figure 4. Example of maintenance trucks parking on apron
tion work-zone set-up. If a large vehicle that would normally utilize the truck apron does approach the intersection, it may need to be temporarily redirected or take a detour.

**Splitter Island Maintenance**

Landscaping on splitter islands should be limited to low grass, shrubs, and other perennials. Splitter islands should be maintained on a regular basis to prevent grasses or shrubs from growing too high and obstructing sightlines. The maintenance procedures should be the same as for any other median on a divided roadway. It is important that drivers have an unobstructed view across the splitter island so they can see cars circulating in the roundabout before they enter. It is also helpful to line pedestrian crosswalks with low shrub to highlight the location of the crosswalk.

**Landscaping Contracts**

Many owners contract out some or all of their landscaping to private agencies. In such situations, there are two recommended ways to set up the agreement. The first is to note each roundabout to be maintained, list the vegetation on each roundabout, and specify the maintenance needed. The second option is to create a list of all vegetation located at any or all of the contracted roundabouts and specify maintenance for each plant type. The city can establish maintenance work schedules with the contractor, as well as the standards to be upheld and the contractor’s evaluation criteria.
Section III: Pavement

Pavement maintenance should be completed regularly. This includes sweeping, re-striping, and repairing damaged roadways and curbs. This section will detail maintenance best practices in relation to these pavement issues.

Street Sweeping

Street sweeping is a necessary maintenance task in roundabouts because debris and other materials can build up around the edges over time. Debris is constantly pushed to the outer boundaries of the roundabout by circulating vehicles. Too much debris build-up can create unsafe driving conditions. Our research found that streets should ideally be swept at least once per year. No special equipment is needed for sweeping the roundabout and the work can be contracted out to a private company if necessary.

One problem reported by a community interviewed for this manual was pavement smoothing on a circulatory roadway. The continuous traffic and friction from the tires causes a polishing effect. If this occurs, it is advised to use a sweeper with steel bristles to clear rubber build-up on the pavement. This can be a short term solution and eventually the best solution will be to repave these ‘polished’ areas.

Pavement Markings

Striping in roundabouts can be marked either with paint or thermoplastic. There is some disagreement over which material is better suited to roundabouts. Paint does not last as long as thermoplastic; however, it is less expensive. Some local agencies have found that the thermoplastic markings can be torn up by the plows in the winter, as they are raised slightly above the street grade. One of the agencies interviewed during this project plans to test an in-laid or ground-in thermoplastic to eliminate this problem. Ultimately, it is up to the owners to decide which striping method they would like to use on their roundabouts.

If the pavement markings on a roundabout have worn off completely, it is best to consult the as-built plans to make sure the pavement markings are re-striped correctly. The markings in a roundabout are specifically placed and their position should not be estimated. Position of the markings greatly impacts functionality of the roundabout. If as-built plans are not available, aerial map satellite images may be available for reference.
In the situation where the centerline of a two-lane roundabout needs to be re-striped, only the inside lane must be closed. Park any maintenance vehicles and position workers in the inner lane and complete the work from the inside. Place adequate work zone warning signs to alert drivers of the activity.

**General Pavement Maintenance**

For general maintenance such as filling potholes and repairing curbs, procedures are consistent with those used for a regular roadway. Refer to “Section IV: Access During Maintenance Activities” for detailed directions on how to set up work zones and direct traffic in roundabouts.

Another element of pavement maintenance is cleaning the truck aprons. Over time, truck aprons acquire tread markings from the larger vehicles. Some communities have started power washing the truck aprons as part of their maintenance plan for roundabouts. Workers should use hand-held power washers to thoroughly clean the truck apron. The procedure is recommended twice yearly, or when concrete is being resealed.
Section IV: Access During Maintenance Activities

This section details how to handle traffic control in a roundabout. It includes appropriate conditions to detour traffic and how it is done, as well as discussing best practices in partially closing roundabouts for maintenance work.

Note: This is a summary of guidelines published by the Indiana MUTCD, ATSSA Temporary Traffic Control for Roundabouts, and WisDOT Facilities Development Manual. It is intended to provide a quick and easy reference for roundabout specific work zone set up. Indiana LTAP is not liable for these guidelines as they are all referenced from other sources.

Detouring Traffic

When performing any type of maintenance on roundabouts, it is best to have no traffic circulating. This is done by detouring motorists; however this is not always feasible or justifiable. A detour does not need to be set up for simple landscaping maintenance or patching a pothole.

For long term work that will block the circulatory roadway of a roundabout, the ideal solution is to detour traffic. This is especially desirable for intersections that have high traffic volumes and large trucks that frequently pass through. Detour signs should be placed well in advance of the intersection. A street name may be mounted with the Detour sign. A STREET CLOSED sign may be used instead of a ROAD CLOSED sign, as well as additional DO NOT ENTER signs. Be sure to alert emergency personnel prior to setting up a detour for the intersection. A diagram of correct detour sign placement is located at the end of this section.

Work Zone Setup

There are many instances that require lane closures for a roundabout. This could range from accessing a manhole in the circulatory roadway to roadway repairs. The necessary work zone set-up will vary depending on the specific task and the type of roundabout that needs work. For maintenance procedures that would only take up a portion of a lane, it is still best to close the entire lane to ensure safety for workers. Plan ahead for when a flagger crew will be needed.

When setting up temporary traffic control, take into account a clear line of sight for motorists. Be sure to maximize sightlines for flaggers or any traffic transitions that may occur. There should always be a clear line of sight from the flagger symbol sign to the flagger. Also remember to accommodate for large vehicles with trailers as well as any other large vehicles when installing channelizing devices and other traffic control.

Single Lane Closure in a Multi-Lane

For some maintenance on two-lane roundabouts, it will only be necessary to close one lane. In this situation it is possible to maintain continuous traffic flow through the roundabout. Merge all traffic down to one lane before entering. Direct traffic into either the center lane or the outer lane, depending on the work location. To close the center lane, merge traffic upstream and the roundabout will temporarily function as a single lane. When closing the outer lane, take extra care on entrances and exits and make sure sight lines are not blocked for drivers. Try to work in quarter sections so that only one exit is closed at a time; this keeps as much traffic flowing as possible. Refer to the diagram at the end of this section.
**Full Closure of Circulatory Roadway**

When closing a section that blocks the entire circulatory roadway, some traffic must be directed around in the opposite direction of travel. Flaggers should be positioned at all approaches with adequate signing beforehand. Then, each approach will alternate releasing cars. A diagram with this type of work zone setup is included at the end of this section.

Some roundabouts with high traffic volume may require law enforcement assistance. This ultimately is up to the local government to decide when necessary. For the purposes of this manual, it is recommended to use law enforcement in areas with higher traffic volumes. This could depend on the time of day or the size of the roundabout. It is also recommended for intersections that have a heavy truck volume. Plan ahead for when law enforcement will be needed.

**General Work Zone Setup Information**

The best times for maintenance in a roundabout are typically between 9 am and 3 pm; however, this may vary. Rush hour times should be avoided due to the increased traffic. If maintenance must be done during peak travel times, consider using law enforcement to help with traffic control. An alternative to maintenance during heavy daytime traffic is to perform some tasks at night. There are several roundabout maintenance tasks that can be done at night, including repaving and striping.

Pedestrians and bicyclists must also be considered when setting up work zones. In intersections with high volumes of pedestrians or bicycles, make sure the work zone set up provides a safe walking or riding path.
Tapers

**Merging Taper**
A merging taper requires the longest distance because drivers are required to merge into common road space. A merging taper should be long enough to enable merging drivers to have adequate advance warning and sufficient length to adjust their speeds and merge into an adjacent lane before the downstream end of the transition.

Following is a table of merging taper lengths (L) and the maximum spacing of channelizing devices for various speeds and widths of closing.

<table>
<thead>
<tr>
<th>Taper Length*</th>
<th>Speed Limit (mph)</th>
<th>Max. Spacing of Devices (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>25</td>
<td>105</td>
<td>115</td>
</tr>
<tr>
<td>35</td>
<td>205</td>
<td>225</td>
</tr>
<tr>
<td>45</td>
<td>450</td>
<td>495</td>
</tr>
<tr>
<td>55</td>
<td>550</td>
<td>605</td>
</tr>
<tr>
<td>65</td>
<td>650</td>
<td>715</td>
</tr>
</tbody>
</table>

*Following are the formulas used to calculate taper length:

- **Posted Speed**
  - 40 mph or under: \( L = \frac{WS^2}{60} \)
  - 45 mph or over: \( L = WS \)

where: \( L \) = taper length in feet; \( W \) = width of offset in feet; and \( S \) = posted speed limit, or off-peak 85th percentile speed prior to work starting, or the anticipated speed in mph.

**Shifting Taper**
A shifting taper is used when a lateral shift is needed. A shifting taper should have a length of .5L.

**Shoulder Taper**
A shoulder taper may be beneficial on a high-speed roadway where shoulders are part of the activity area and are closed, or when improved shoulders might be mistaken as a driving lane. Shoulder tapers should have a length of at least 0.33 L.

**Downstream Taper**
A downstream taper should have a minimum length of 50 feet and a maximum length of 100 feet with devices placed at a spacing of approximately 20 feet.

**One-Lane, Two-Way Taper**
A one-lane, two-way taper is used in advance of an activity area that occupies part of a two-way roadway in such a way that a portion of the road is used alternately by traffic in each direction. A one-lane, two-way taper should have a minimum length of 50 feet and a maximum length of 100 feet with channelizing devices at approximately 20-foot spacings.

**Advance Warning Area**
The distance from the first sign to the start of the transition area should be long enough to give motorists adequate time to respond to the conditions. The tables below summarize layout dimensions as referenced in the typical application diagrams.

**Summary of Layout Dimensions**

**Suggested Advance Warning Sign Spacing**

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance Between Signs (in feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Urban (low speed)</td>
<td>100'</td>
</tr>
<tr>
<td>Urban (high speed)</td>
<td>350'</td>
</tr>
<tr>
<td>Rural</td>
<td>500'</td>
</tr>
<tr>
<td>Expressway/Freeway</td>
<td>1,000'</td>
</tr>
</tbody>
</table>
Maximum Spacing of Channelizing Devices (in feet)

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Taper</th>
<th>Buffer/Work Space</th>
<th>Downstream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-lane</td>
<td>20'</td>
<td>2 x Speed Limit</td>
<td>20'</td>
</tr>
<tr>
<td>Multi-lane</td>
<td>Speed Limit</td>
<td>2 x Speed Limit</td>
<td>20'</td>
</tr>
</tbody>
</table>

Tapers and Flagger Station Distances (in feet)

<table>
<thead>
<tr>
<th>Speed Limit (mph)</th>
<th>Two-Lane</th>
<th>Multi-Lane **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Two-Way Taper *</td>
<td>Merging Taper 12' lane</td>
<td>Shifting Taper 12' lane</td>
</tr>
<tr>
<td>20</td>
<td>100'</td>
<td>80'</td>
</tr>
<tr>
<td>25</td>
<td>100'</td>
<td>125'</td>
</tr>
<tr>
<td>30</td>
<td>100'</td>
<td>180'</td>
</tr>
<tr>
<td>35</td>
<td>100'</td>
<td>245'</td>
</tr>
<tr>
<td>40</td>
<td>100'</td>
<td>320'</td>
</tr>
<tr>
<td>45</td>
<td>100'</td>
<td>400'</td>
</tr>
<tr>
<td>50</td>
<td>100'</td>
<td>500'</td>
</tr>
<tr>
<td>55</td>
<td>100'</td>
<td>600'</td>
</tr>
<tr>
<td>60</td>
<td>100'</td>
<td>720'</td>
</tr>
<tr>
<td>65</td>
<td>100'</td>
<td>780'</td>
</tr>
</tbody>
</table>

* Refers to a one-lane, two-way traffic taper (see pages 7 and 26).
** Multi-lane layouts use buffer zones instead of flagger stations

Note: Downstream taper = 100 feet

Typical Application Diagrams

The diagrams on the following pages represent examples of the application of principles and procedures for safe and efficient temporary traffic control in work zones. The layouts represent minimum requirements. It is not possible to include illustrations to cover every situation which will require work area protection. They are not intended as a substitute for engineering judgment and should be altered to fit the conditions of a particular site. All traffic control devices used must be in compliance with the IMUTCD. Guidelines for taper lengths are given. Refer to previous page for more specific information on taper lengths. For further information, refer to Part 6 of the IMUTCD.
Procedure for Detouring a Roundabout (Oregon DOT)
Partial Closure of a Single Lane Roundabout (Indiana MUTCD)
Outer and Inner Closure of a Multi-Lane Roundabout (Virginia DOT)
Closure of the Inner Closure of a Multi-Lane Roundabout (Virginia DOT)
Resources


