



BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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MEMORANDUM

Date January 17, 2013
To Boston Region Metropolitan Planning Organization
From Seth Asante and Efi Pagitsas
MPO Staff
Re Roundabout Installation Screening Tool

Background

The design features of modern roundabouts encourage slower speeds, making them proven strategies for reducing severe-injury crashes. In addition, the yield-on-entry rule and one-way circulating flow of roundabouts reduce the number of conflict points and cut down on angle crashes significantly. As a result of the safety and operational benefits of modern roundabouts, the demand for roundabouts throughout the Commonwealth has risen in the last decade.¹ The Highway Division of the Massachusetts Department of Transportation (MassDOT) and the Boston Region Metropolitan Planning Organization (MPO) often respond to several roundabout requests from municipalities, and are interested in having a consistent tool that would point confidently to a modern roundabout as a viable alternative worthy of further analysis and design. This is especially important for state- and federal-aid-funded roundabout designs.

MPO staff, working in conjunction with an advisory task force, developed a screening tool for staff of these agencies and of MPO communities to use when they review roundabout proposals or consider alternatives for improving intersections (the tool is enclosed, along with accompanying exhibits). Participation from these agencies allowed the screening tool to reflect their experiences and meet their requirements for a comprehensive, effective, and useful tool.

Executive Summary

The installation of a roundabout is beneficial only if the roundabout addresses a unique purpose for the location under study and is located in an environment appropriate for its use. Installing a roundabout for the wrong purpose or in an inappropriate environment may not help address the problems, and may even lead to adverse effects. Twenty-four factors for screening roundabout design were used to develop the tool. The tool addresses problems and project objectives in the following functional areas:

¹ In this document, the word roundabout refers to modern roundabouts, which have a smaller central island and a tighter deflection angle to slow down vehicles entering the roundabout and vehicles in the circulatory lanes to speeds between 20 and 25 mph.

- Safety
- Operations
- Traffic calming
- Community enhancement and aesthetics
- Access management

A brochure accompanying the screening tool includes a brief background of the purpose, needs, uses, and benefits of the tool. The Massachusetts Roundabout Installation Screening form comprises three sections: General Information; Resources: Data and Information Required for Assessment; and the following five steps for applying the screening tool to an intersection:

- Identifying the existing problems
- Identifying the project objectives
- Determining the type of roundabout and the space requirements
- Identifying the factors pertinent to the problem intersection
- Determining if a roundabout is a feasible alternative for the intersection

The outcome of the screening is a decision about whether or not a roundabout alternative is viable and worthy of advancing for additional analysis and design.

Study Objectives

The objective of this study was to develop a roundabout screening tool for MassDOT, the Boston Region MPO, and municipal staff to use when they review proposals for the design and construction of roundabouts or consider alternatives and concepts for improving intersections. By extension, the tool could be used by other interested parties, including consultants. Another objective of the study was to formalize the roundabout screening process to encourage more roundabouts to be built in the commonwealth, while eliminating wasteful design resources spent on roundabout alternatives that are not viable.

Advisory Task Force

MPO staff established an advisory task force to participate in the study. The task force comprised staff from the MassDOT Highway Division and Office of Transportation Planning, the Boston Region MPO, and the Metropolitan Area Planning Council (MAPC). Because these agencies will use the tool, it was important for their staffs to participate in the development of the tool so that it will reflect their experiences and meet their requirements. MPO staff convened two task force meetings to present the evaluation criteria and the screening tool for their review.

Literature Search on Roundabout Screening Tools

As roundabouts become popular in the United States because of their proven safety and operations advantages, many states have developed or are developing policies to guide their implementation. Arizona, California, Florida, Georgia, Kansas, Missouri, Minnesota, Maryland, New York, Oregon, Pennsylvania, Washington, and Wisconsin have guidelines for the installation of roundabouts. Some of those states, including New York, California, and Kansas, have adopted, as their roundabouts development guide, the National Cooperative Highway Research Project (NCHRP) Report 672, with some minor alterations and clarifications.² Although a vast amount of literature exists on roundabout design in the United States, little exists on tools for assessing the feasibility of building a roundabout at a given intersection. Many of the states' roundabout guidelines focus on the identification of appropriate and inappropriate locations for roundabouts, as well as on the design of roundabouts.

The City of Hamilton, in Ontario, developed a screening tool for quick assessment of the feasibility of a roundabout alternative and performance measures for comparing it to other forms of intersection traffic control.³ Iowa State University's Center for Transportation Research has developed planning-level guidelines for screening and assessing the feasibility of roundabouts.⁴ Finally, the National Cooperative Highway Research Program (NCHRP) Report 672 provides planning steps, which include an outline of many of the considerations that project proponents (MassDOT and municipalities) need to investigate before they advance a roundabout proposal to the analysis and design phases. The NCHRP Report 672 is the latest information guide on modern roundabouts.

Selection of Screening Factors

A list of factors for screening roundabouts was developed by MPO staff and sent to task force members for rating. The task force was asked to review each factor and specify whether it should be used for screening roundabout alternatives in Massachusetts by indicating "Yes," or "No," or "Other." In addition, task force members were asked to add their own factors or modify any of the screening factors. Nine of the 11 task force members responded to the survey. The survey yielded 24 screening factors, all of which

² NCHRP Report 672, Roundabouts: Informational Guide, Second Edition, Transportation Research Board, Washington, D.C., 2010.

³ Ron Gallo, Use of Roundabouts in the City of Hamilton, Public Works Department, Region of Waterloo, Canada, June 2008.

⁴ Shauna Hallmark and Hillary Isebrands, Technical Memorandum, Planning-Level Guidelines for Modern Roundabouts, Iowa State University's Center for Transportation Research, Sponsored by Iowa Department of Transportation, November 2008.

were included in the screening tool. Many of the 24 screening factors are documented in Chapter 3 of the NCHRP Report 672, and users are encouraged to reference it for more information on screening roundabout alternatives.

General Information

The first portion of the roundabout screening form contains general information about the study proponent and the intersection and roadway characteristics of the location where a roundabout alternative is being considered.

Resources

The resources required for screening a roundabout, such as data and information, are described after the section on general information. Roundabout screening analysis requires planning-level data to define existing problems, determine the number of lanes, assess space requirements, identify site constraints, and justify a roundabout as a potential alternative. The following are some of the common input data for screening roundabout alternatives.

Traffic Data

Average daily traffic (ADT), truck traffic volumes, and the percentage of left-turning traffic dictate the size of the roundabout. Large trucks often dictate many of a roundabout's dimensions, especially for single-lane roundabouts. It is very important, therefore, to determine estimates of the projected traffic volumes, turning movements, and design vehicle at the start of the screening process. In addition, pedestrian and bicycle volumes, including the number of people with visual impairments who would use the roundabout, are important design input and screening factors.

Safety Data

The crash experience at the intersection where a roundabout is being considered is essential for screening a roundabout alternative because of the proven safety benefits of roundabouts. Of particular importance are crashes involving fatalities or severe injuries and the manner of collision (angle, rear-end, sideswipe, head-on). Collision diagrams should be prepared to provide additional information on crash patterns and locations.

Right-of-Way and Operations Data

The feasibility of a roundabout alternative depends on space requirements and the environment in which it would operate. Therefore, in addition to the traffic and safety data, data on right-of-way and roadway features, such as sidewalks, crosswalks, on-street parking, transit stops, and existing landscaping, are useful. Information on

systems and facilities near the intersection where a roundabout alternative is being considered, such as a coordinated traffic signal system, at-grade railroad crossings, and emergency driveways with preemption, require careful consideration before installing a roundabout.

Roundabout Screening Process

Figure 1 shows a flow chart of a five-step roundabout screening process.⁵

Step 1: Description of Existing Problems

The existing problems at the intersection are identified and described. This is important because a good understanding of the existing problems helps to shape the project objectives and the selection of the appropriate intersection control types.

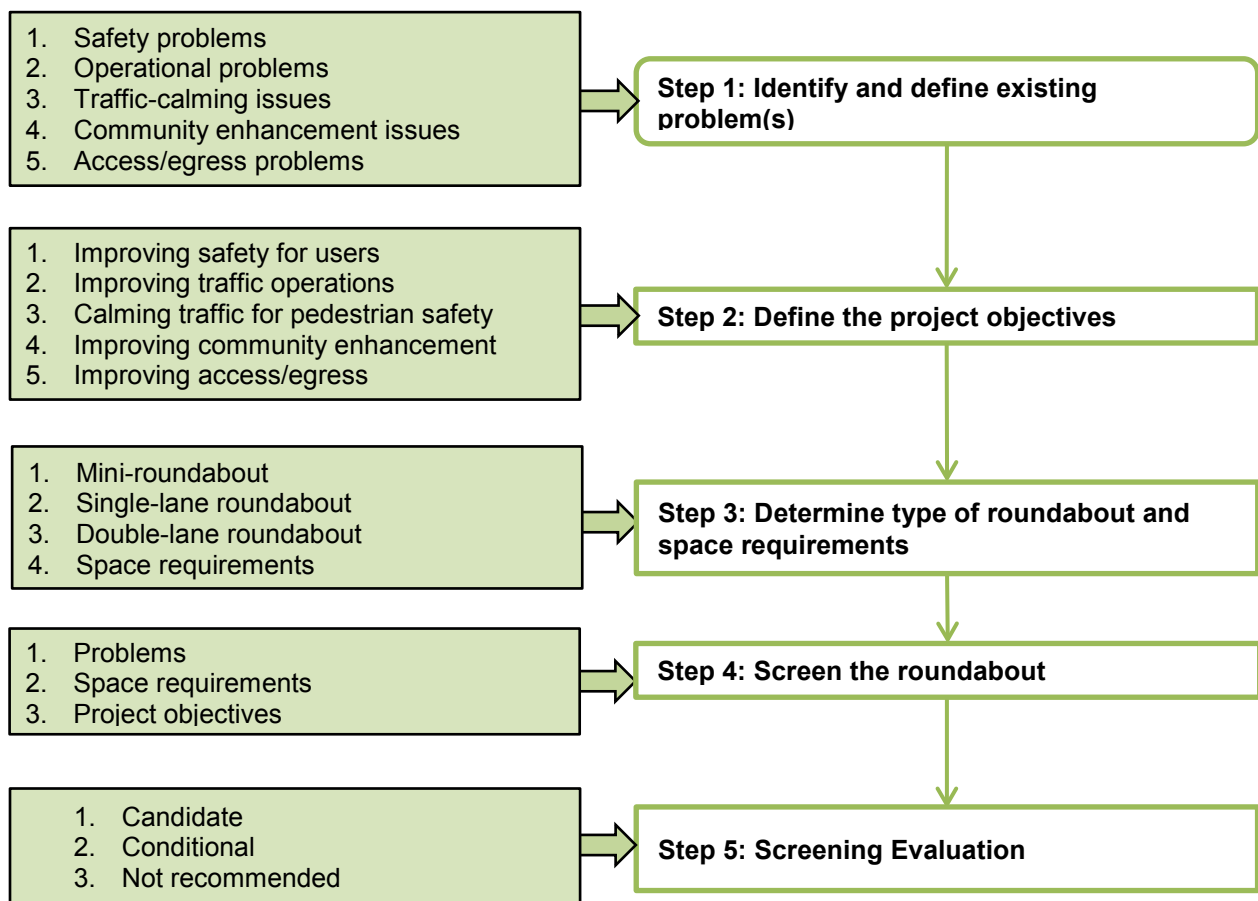


FIGURE 1
A Flow Chart of Roundabout Screening Process

⁵ Chapter 3, section 3.2, of the NCHRP Report 672 discusses some of these processes in detail and readers are encouraged to review them for additional information.

Step 2: Project Objectives

The project objectives are defined and are aligned with the problems identified in Step 1 at the beginning of the process assists decision makers in determining if a roundabout is an appropriate course of action or if additional information is needed. The objectives of the project may include one or more of the following perspectives:

- Roadway user safety
- Operations
- Traffic calming
- Community enhancements and aesthetics
- Access management

Step 3: Type of Roundabout and Space Requirements

The screening process involves evaluating an alternative for an intersection improvement of a properly sized roundabout. Two estimates required at this stage of screening are planning estimates of the following:

- Lane requirements based on capacities of a mini-roundabout, single-lane roundabout, and double-lane roundabout and the projected traffic demand. Exhibits 1, 2, and 3 (included in the tool) are planning-level volumes for estimating preliminary number of lanes through a roundabout to serve traffic demand. These exhibits can be used for planning-level sizing of the type of roundabout that would be needed: mini-roundabout, single-lane roundabout, or double-lane roundabout.

Moving from a single-lane to a double-lane roundabout is a major step, as the number of conflict points is increased for motorists, pedestrians, and bicyclists. Since many road users are not familiar with double-lane (multi-lane) roundabouts, hence, this type of design could present difficulties for pedestrians and bicyclists, and, especially, for people with disabilities. Consequently, double-lane roundabouts could lead to project delays and might be a factor in withdrawing a roundabout alternative from further consideration.

- A space requirement assessment is conducted to determine if there is enough right-of-way to build a properly sized roundabout or if additional right-of-way would be needed. Exhibit 4 of the screen tool contains initial ranges of roundabout parameters that can be used to define the layout of a roundabout for screening purposes.

The cost of land acquisition and the impact on nearby properties could be reasons to dismiss a roundabout alternative. In estimating the space requirements, one needs to account for the number of lanes required, pedestrian and bicycle needs such as sidewalks and crosswalks, and landscaping and utility equipment (such as lighting and signal poles and cables).

Step 4: Roundabout Screening Factors

A roundabout alternative is screened to determine whether the existing problems could be mitigated with a roundabout and whether the environment is appropriate for its use and would not cause adverse impacts. Each of the 24 screening factors was rephrased into a specific question for screening a roundabout alternative. The screening involves answering all of the 24 screening questions that were developed in conjunction with the task force. For each question, a “Yes,” “No,” or “Other” are the available answers. The questions are listed under the following factors:

- Safety factors
- Operational factors
- Traffic-calming factors
- Aesthetics and community enhancement factors
- Access management factors

Opportunities

Roundabout screening involves an assessment of the opportunities that a roundabout alternative may offer, such as:

- **Safety:** The yield-on-entry rule and one-way circulating flow of roundabouts reduce the number of conflict points and cut down on angle crashes significantly. As a result, intersections with a significant number of angle-type crashes or crashes that result in severe injuries are potential candidates for roundabout installations due to the proven safety benefits of roundabouts.
- **Operations:** Roundabouts may provide higher capacities and lower delays operating with the same traffic volumes, than other forms of intersection control. Also, roundabouts can reduce lane requirements between intersections, especially at a bridge or an underpass between interchange ramps.
- **Traffic calming:** The unique features of a roundabout, such as its ability to reduce vehicular speeds and to offer traffic-calming opportunities that create pedestrian-friendly environments for improving safety and mobility for pedestrians, bicyclists, and transit users.
- **Aesthetics and community enhancement:** Roundabouts provide attractive entries or centerpieces to communities. They also provide gateways for developments and other establishments, such colleges and universities.
- **Access management:** Roundabouts used in conjunction with raised medians facilitate the use of U-turns and left-turns at intersections and allow right-in-right-out movements at driveways. Corridors that are hampered with numerous driveways, especially those to businesses, can benefit from this application.

Impacts

Roundabout screening also involves an assessment of the impacts of a roundabout alternative, including the following:

- **Safety:** Multi-lane roundabouts may present difficulties for people with visual impairment, due to their challenges in detecting gaps and determining that vehicles have yielded at crosswalks.
- **Operations:** A roundabout located close to a signalized intersection, where queues may spill back into the roundabout and cause gridlock, may be prevented from operating satisfactorily. Also, roundabouts cannot provide explicit priority or queue preemption for specific users, such as trains and emergency vehicles. In a coordinated arterial signal system, where a roundabout would impede progression through the corridor, it could render the signal systems ineffective.
- **Access management:** Roundabouts may reduce the number of available gaps for midblock crossings due to their continuous processing of traffic.

Step 5: Screening Evaluation

In the roundabout screening process, potential opportunities for advancing a roundabout alternative are identified, and potential red flags for not recommending a roundabout alternative due to adverse impacts. The final outcome of the screening evaluation is a decision about whether or not a roundabout alternative is viable and worthy of advancing for additional analysis and design. Based on the answers to the questions, the analyst selects one of three decisions:

- **Candidate:** Advance a roundabout for further analysis and design if it meets the space requirements and one or more of the project objectives.
- **Conditional:** Advance a roundabout for further analysis and design if it meets the space requirements and one or more of the project objectives under certain conditions, which are determined by the user.
- **Not recommended:** A roundabout is not recommended for further analysis and design if does not meet the space requirements or any of the project objectives.

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Encl.: Roundabout Screening Tool

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