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BROAD STREET ROUNDABOUT – POSITION PAPER

by

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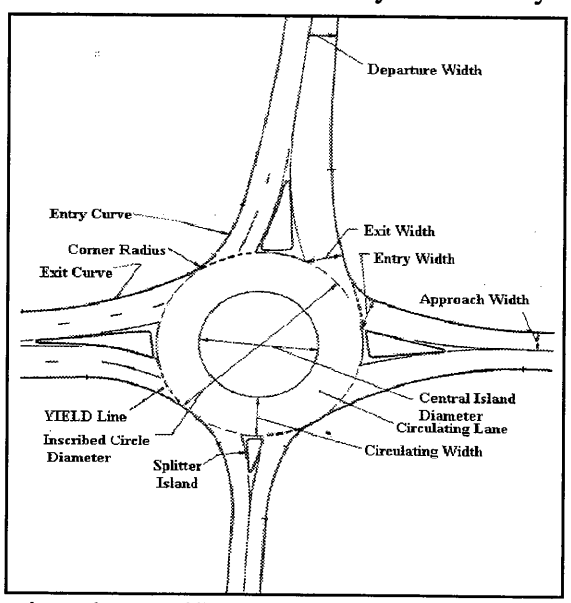
The purpose of this document is to describe circumstances supporting the final decisions for design and construction of a roundabout on Broad Street in Nashua, New Hampshire. It also describes operational conditions that have been recorded since completion of the roundabout.

WHAT IS A MODERN ROUNDABOUT?

The Broad Street intersection is by definition a "Modern Roundabout". The main characteristic of a modern roundabout is the "yield-at-entry" rule,



meaning that traffic entering the roundabout must yield to traffic within. Other characteristics include deflection of the vehicle path by use of a circular center island, and splitter islands on each approach. The splitter islands control entry speed and deter illegal left turns. They also serve as refuge islands for pedestrians. Other elements include yield lines downstream of the pedestrian crossings, no pedestrian access to the center island or through the circular roadway, good sight distance, good lighting and signing, and no parking in the roundabout.

Modern roundabouts are smaller than traditional "Rotaries", generally 100 to 150-feet in outer diameter as opposed to 150 to 300-feet in diameter (otherwise referred to as the "Inscribed Circle Diameter." The Broad Street roundabout has an inscribed circle diameter of 120-feet. There are several rotaries in New Hampshire, including one in Portsmouth off I-95, one in Epson at U.S. Route 4 and N.H. Route 28, and one just outside of Manchester near Lake Massabesic. Also, the Commonwealth of Massachusetts is known for its large rotaries. Because rotaries are larger, they move more vehicles at higher speeds ranging from 30 to 45 mph. Roundabouts are smaller and force vehicles to slow to speeds ranging from 15 to 20 mph. This difference is significant for several reasons: (a) higher speeds make entering the rotary more difficult, (b) higher speeds result in more severe accidents, and (c) higher speeds make crossings for pedestrians potentially more dangerous. *(CONTINUED ON PAGE 4)*

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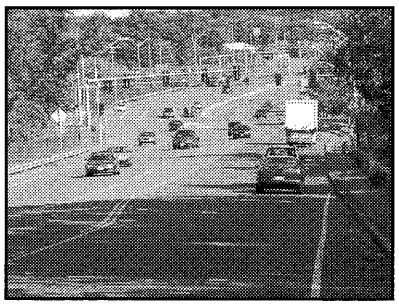
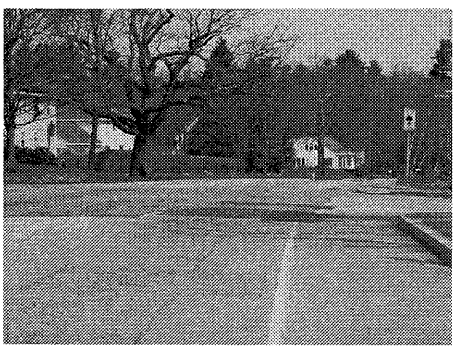
One of the main benefits of a compact modern roundabout is "Traffic Calming." The Institute of Traffic Engineers defines traffic calming as the combination of physical measures that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users. In other words, roundabouts force cars to slow down, thereby making the intersection safer and more desirable for motorists and pedestrians.

BROAD STREET BACKGROUND INFORMATION



Between 1983 and 2000, the traffic on Broad Street (State Route 130) increased from around 12,800 to over 17,000 vehicles per day. As part of the F.E. Everett Turnpike reconstruction, Broad Street was widened from 2 to 7-lanes between the Turnpike and Coliseum Avenue. Between Coliseum Avenue and Dublin Avenue, Broad Street narrows to 3-lanes, and between Dublin Avenue and the Hollis Town Line, Broad Street narrows to 2-lanes.

Broad Street is a regional highway that provides one of the most direct links to the Town of Hollis. The new high school was projected to add over 1,500 vehicle trips per day, most of which would be making left turns into the new high school in the morning, and right turns out of the school in the afternoon. At the easterly terminus with the Turnpike (Nashua Mall), Broad Street is redeveloping into a vibrant commercial zone, with Kohl's Department Store, Home Depot, and the Christmas Tree Shop to name a few. The remainder of Broad Street is residential. There are many homes that front directly onto Broad Street, and it serves two elementary schools (Birch Hill and Broad Street), in addition to the new high school.



FINDINGS – ROUNDABOUT VS. TRAFFIC SIGNAL

The Division of Public Works performed a due diligence analysis of the benefits of a roundabout compared with a conventional traffic signal. The following primary criteria were researched and compared:

Item	Modern Roundabout	Traffic Signal
Low Crash Severity	Excellent	Poor
Low Vehicle Speeds	Excellent	Poor
Pedestrian Safety	Good	Fair
Bicycle Safety	Good	Fair
Aesthetics	Excellent	Poor

Low Crash Severity:

A 1997 study conducted by the U.S. Transportation Research Board revealed that intersections converted to roundabouts reduced overall crashes by 37-percent, and reduced injury accidents by 51-percent. The reasons have to do with the lower number of conflict points resulting in simplified decision making, and the lower vehicle speeds resulting in lower forces of impact.

Low Vehicle Speeds:

Modern roundabouts slow cars. Slowing in residential areas such as Broad Street has many benefits, but the most significant are safety of pedestrians. Roundabouts are designed to slow vehicles to 15-20 mph, while

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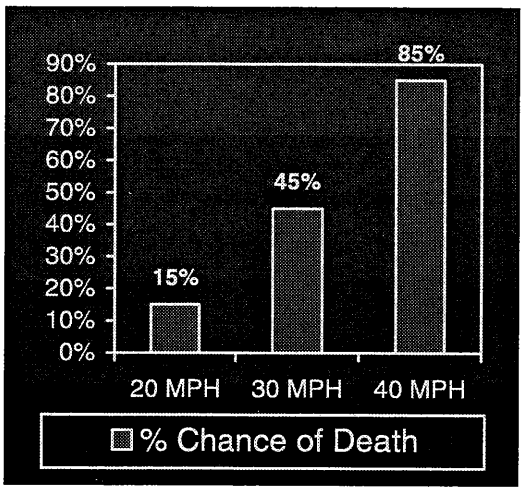
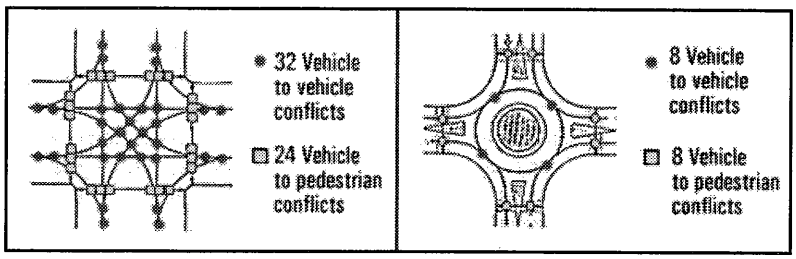
traffic signals encourage many drivers to accelerate their vehicles through intersections in order to "beat the red lights." A study conducted by the UK Department of Transportation revealed that pedestrian fatality rates increased substantially with vehicle speed (see graph on right).



Pedestrian Safety:

Roundabouts are safer for pedestrians than conventional traffic signals. A study of 181 intersections in Norway converted to roundabouts reduced pedestrian casualties by 89-percent. The reasons are due to reduced conflict points and lower vehicle speeds. At a 4-legged conventional signalized intersection, there are 24 vehicle-to-pedestrian conflict points. At a 4-legged roundabout, this number is reduced to 8 (see figure below). As indicated previously, roundabouts also reduce vehicles speeds thereby improving chances for pedestrians to survive a collision.

Bicycle Safety:

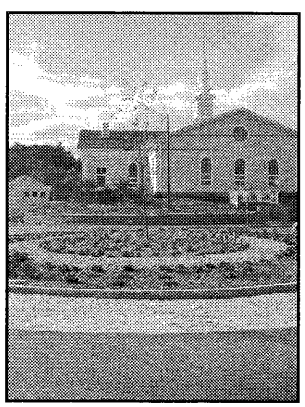


Accident data from Europe regarding bicycle safety shows mixed results. According to one study in the United Kingdom, 15-percent of all intersection accidents in 1984 involved at least one bicyclist, but 22-percent of all roundabout accidents involved at least one bicyclist. Contrary to the British experience, a study in the Netherlands of 181 mini-roundabouts that were converted from three and four-legged intersections found injuries to bicyclists decreased from an average of 1.3 casualties per year to 0.37 casualties per year; a reduction of 72-percent.

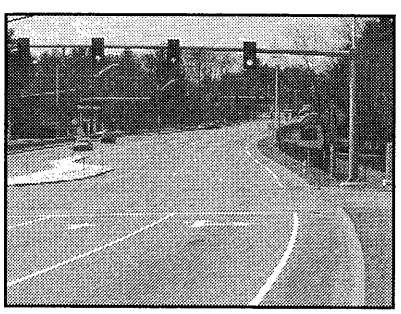
In contrast with the data from the United Kingdom, the U.S. Department of Transportation Roundabout Informational Guide quotes, "Roundabouts slow drivers to speeds more compatible with bicycle speeds, while reducing high-speed conflicts and simplifying turn movements for bicyclists." In summary, it could be said that roundabouts may or may not affect the number of bicycle accidents, but appear to have benefit as far as reducing bicyclist casualty rates.

Aesthetics:

There is not much debate that if properly constructed, roundabout intersections are more attractive than signals. The city incorporated many decorative features, including ornamental street lighting, a cobblestone truck apron, vertical granite curbing, brick accents on the splitter islands, stone walls, and enhanced landscaping that consists of hundreds of flowering perennials and shrubs.



Because there are no large poles and mast arms, the intersection appears less visually cluttered. Also, because there are fewer entrance lanes, the intersection appears more compact. This creates an intersection that is more in scale with the surrounding neighborhoods, and also provides a human scale to the intersection. By contrast, most signalized intersections provide separate left-turn lanes, which create an expansive area of pavement. With the roundabout, these lane areas have been replaced with raised splitter islands that dually provide vehicle delineation and pedestrian refuge.



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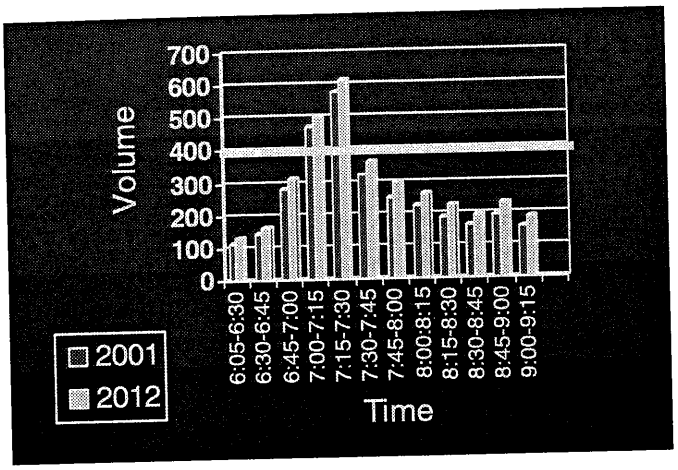
TRAFFIC DATA – ROUNDABOUT VS. TRAFFIC SIGNAL

Before Construction:

While planning for the roundabout, the Division of Public Works performed several capacity studies to determine how a single lane roundabout would function with the new high school. Traffic volumes were projected out 10-years to determine how the roundabout would perform with continued traffic growth on Broad Street. For both the 2002 and 2012 planning years, traffic volumes were below the design capacity for all hours of the day, with the exception of the morning peak hour, which combines commuting traffic with high school traffic.

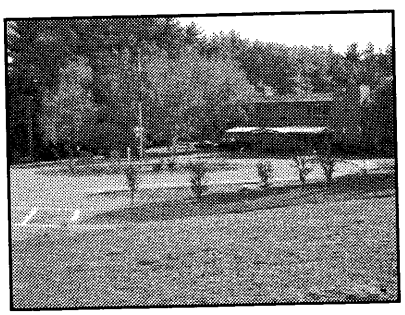


After Construction:

Since the opening of the new high school, the Division of Public Works has conducted travel time studies on Broad Street. The data shows that travel times have improved significantly since the first week of school. This can be attributed to many causes, including completed construction, placement of final pavement markings, driver familiarity, better driver performance, modified travel times, and alternate travel routes. The worst condition existed during the first several days of school. Drivers were not anticipating the enormous volume of high school traffic. To complicate matters, construction of the roundabout had not been finished.

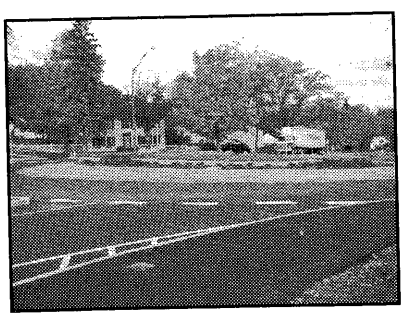
TRAFFIC DATA SUMMARY

Since opening of the high school, there has been tremendous driver adaptability to the fact that over 750 new cars and more than 35 new school buses are traveling along Broad Street each morning and afternoon. This is a significant amount of traffic that arrives within a short timeframe. Given the current 2-lane configuration of Broad Street, the Division of Public Works feels the roundabout is handling the traffic reasonably well.



Regarding the initial concern for pedestrians, the Division has not observed any problems, and has counted upwards of 40 students in a single morning. Discussions with the school crossing guards revealed a high level of satisfaction with the roundabout, especially the pedestrian islands.

WHY IS THE ROUNDABOUT A BETTER SOLUTION?



Despite concerns related traffic capacity, the Division of Public Works, the School Department, and the Police Department feel that construction of the roundabout was the best alternative for Broad Street.

By constructing the roundabout, the City was able avoid an expensive road widening project, and was able to minimize land-taking impacts to adjacent properties. On a larger scale, the City has been able to slow traffic in the vicinity of the high school, create a safe and attractive intersection, and ultimately preserve the residential character of the Broad Street area.

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