The successful completion of the roundabout design was only possible through the collaborative planning, review, and participation of many dedicated people. On behalf of the study team, we wish to express our sincere appreciation and gratitude to the professors, graduate assistants and the following participants who made the project a success.

David Shipps of TransSystems
Ken Furrier of The Dohn Community School

Introduction

It is only a matter of time before the American approach to driving—accelerate just to wait two minutes at the next red light—is phased out by the British approach to driving—fluid, “always flowing traffic with roundabouts regulated by the yield-at-entry rule…the low-delay intersections keep traffic flowing” (“Roundabout” 1). After all, roundabouts are useful tools to solve numerous traffic problems in contrasting types of intersections. Cincinnati is provided with an opportunity to employ the progressive technique to alleviate traffic: the use of a roundabout interchange connecting McMillan and William Howard Taft.

Roundabouts that occur at freeway ramp junctions and arterial roads are known as roundabout interchanges (“System” 219). Ideal situations for roundabout interchanges are as follows: “Limited queue storage space on bridge crossing, off-ramps, or arterial approaches. In such circumstances, roundabouts operating within their capacity are particularly amenable to solving these problems when compared with other forms of intersection control” (“System” 219). There are two basic types of roundabout interchanges: the one bridge interchange and the two bridge interchange. One type is a large diameter roundabout centered over or under a freeway (see FIGURE IIa). The legs of the crossroad and ramps directly connect to the roundabout (“System” 219). This type of roundabout interchange requires two bridges, and the bridges may =be curvilinear (“System” 220). The freeway may go over the roundabout. Therefore, the freeway may require four bridges, “depend[ing] on the optimum span of the type of structure compared with the inscribed diameter of the roundabout island and on whether the one bridge is used for both freeway directions or whether there is one bridge for each direction. The road cross-section will also influence the design decision” (“System 220). A two-bridge roundabout interchange can include two consecutive interchanges, such as the A50/Heron Cross in the United Kingdom. The interchanges are connected with access roads. This circumstance may be appropriate in instances of connecting parallel one-way streets. The other type of roundabout interchange, the one-bride
roundabout, includes a roundabout at each side of the freeway (see FIGURE IIc). This type of roundabout “defers the need to widen bridges. Unlike signalized ramps that may require exclusive left-turn lanes across the bridge and extra queue storage, this type of roundabout interchange exhibits very little queuing between the intersections since these movements are almost unopposed. Therefore, the approach lanes across the bridge can be minimized” (“System” 220). A two bridge roundabout is proposed to connect McMillan and William Howard Taft, along Interstate 71 in Walnut Hills.

Goals

A goal of the proposed Interstate 71 Roundabout Interchange is to increase accessibility into Walnut Hills and Uptown, improve regional connections and safety on the roadway. The roundabout is intended to alleviate traffic along interstate, off-ramps and the connected arterials. The roundabout will be used to connect parallel one-way streets: McMillan and William Howard Taft. The roundabout is also proposed to spur economic development in Uptown and Walnut Hills through increased access into the neighborhoods. Neighborhood redevelopment will ensue as a result of the economic development created from the roundabout. The roundabout is also proposed to increase social benefits. Little physical impact will result in better social quality. Furthermore, the roundabout is intended to be beneficial to the environment through increased open space and landscaping and reduction of idling, which results in emissions. The below diagram will specifically point out the triple threats, social, economic, and environmental.

Project Description

The roundabout will improve regional connections. The design of the roundabout adds an additional on and off ramps to Interstate 71. Motorists can access northbound Interstate 71 from William Howard Taft and southbound Interstate 71 from McMillan. Motorists heading northbound on Interstate 71 can exit onto McMillan. Therefore, the roundabout will improve regional connections. Increased on and off-ramps also yield increased accessibility into Walnut Hills and Uptown. The roundabout will also connect the parallel arterials of William Howard Taft (westbound) and McMillan (east bound). The roundabout will alleviate traffic, because roundabouts incur 30 to 50 percent increased capacity (Carmel 1). This is beneficial, because more drivers yield more
economic opportunities. For instance, drivers rounding the interchange at 20 miles per hour will be allured by the surrounding stores and features. Therefore, the properties surrounding the roundabout have great potential; neighborhood development will ensue around the roundabout interchange. Furthermore, McMillan (east of Interstate 71) is proposed to be restored to a two-way street. Therefore, the business district has potential to thrive because of the accessibility from both directions.

**Base Year**

The base year of construction will have minimal impact to the surrounding area. During this time all structures encompassing the roundabout will remain in their original locations. A highway roundabout such as this in the state of Ohio will require educational time for drivers. By limiting change in physical structures and landscape drivers will be able to focus on the navigating around.

**Five Year Projection**
The five-year plan of the roundabout has minimal physical impact. The lower impact on the community, the quality of life in the neighborhood typically increases. The only necessary change in the neighborhood with the implementation of the roundabout involves the Dohn School relocation to the rear of the property along Crown Street. Also, by providing the two-way restoration of McMillan, the neighborhood will receive the community feeling back instead of the divided neighborhood effect. Safety is a major concern for the social sustainability of the roundabout. Slow speeds along the roundabout will provide safety to drivers and pedestrians alike. Examples can be found below:

Safety

• All vehicles travel in same direction, never crossing paths which dramatically reduces number of serious crashes
• Slower vehicle speeds give drivers more decision making time
• Roundabouts eliminate head-on and high-speed right-angle collisions
• Accidents with injury decreased by 78% when roundabouts replaced traditional intersections
• There are less conflict points in roundabouts than in traditional intersections
A projection of thirty years out will have dramatic changes to the physical and built environment. Reconstruction of all buildings surrounding the roundabout will take place. Exaggerated building heights on the four corners will anchor the interchanges and draw the east and west sides. The pedestrian bridge will connect Walnut Hills to Clifton, but there will also be an additional draw to condominiums and mixed use on each side.

Alternatives for Pedestrian Crossings
The following are options for crossing the roundabout and the positive and negative aspects for each of the designs. Designs like this will be crucial for year 30 when attractions and housing will be implemented in high density on both sides.

**Environmental**

A goal of the roundabout is to be beneficial to the environment. Research suggests that roundabouts are more beneficial for the environment than typical intersections, because “drivers do not have to wait as long at roundabouts as at signalized intersections, roundabouts are friendlier to both the driver and to the environment” (Jacquemart 12).

Roundabouts allow for a steady stream of traffic which prevents drivers from idling a car and wasting gas. In addition “the reduced amount of paved areas and the reduction in noise and air pollutant emissions are also cited in the European literature as advantages for roundabouts. Field measurements in Sweden showed reductions in pollutant emissions and fuel consumption in the range of 21 to 29 percent” (Jacquemart 12). If designed correctly, roundabout design can benefit the environment. Roundabouts can include pervious
treatments to absorb runoff. Roundabouts are also such an important roadway feature, because they have the potential to serve as gateways, especially if the roundabouts are placed in strategic areas such as main intersections. The center medians can be transformed into gardens, contain statues or public art, and be a symbol for the community. Roundabouts essentially have the potential to redefine an image of a community through the transformation of a roadway intersection.

Another goal of the roundabout is to be beneficial to the economies of the local scale. Roundabouts also cost significantly less than conventional intersections. Conventional traffic light intersections require an average of $125,000 of equipment (“A Guide”). Also, the electricity costs $8,000 to $10,000 per stop light each year (“A Guide”). Findings also show that roundabouts improve the surrounding commercial venues. In 1999 Golden, Colorado changed four intersections into roundabouts. They created a commercial roundabout district. This district had experienced a decrease in injury crashes by 94 percent, and a decrease in overall crashes by 88 percent. Also, the commercial district experienced a sales tax revenue increase of sixty percent which resulted because of the traffic volumes that increased by 35 percent (more customers), speeds that decreased by 30 percent (more time to be allured by signs of stores), and increased traffic volumes of 35 percent (Sides 2). Roundabouts not only cost less to maintain than typical intersections, but also have the capability to improve the appeal of an area. Roundabouts often refresh the image of a community; after all, the new roundabout consists of new pavement and signs. The fresh image allures people to the area. More people yield more customers.

To increase safety, the roundabout will reduce vehicle speeds and increase driver attentiveness (“Traffic” 1). At a typical intersection, drivers often speed up to pass through yellow lights. Yet, because of the curved entrances into the roundabouts, drivers reduce speeds upon entrance (Persaud 2). Also, drivers entering the roundabout must yield to the vehicles already on the roundabout (Persaud 2). Furthermore, severe accidents are reduced; this is because conventional intersections often yield t-bone crashes, whereas roundabouts yield angled crashes have less of an impact (“A Guide”). More crash statistics will be addressed later in this report. Roundabouts also cost significantly less than traditional intersections to maintain.

**Rationale**

The proposed Interstate 71 Roundabout Interchange, adjacent to the neighborhood of Walnut Hills, will connect McMillan and William Howard Taft to Interstate 71. The roundabout is a crucial connector of Walnut Hills to Uptown—the University of Cincinnati, the medical centers, and Cincinnati Zoo and Botanical Gardens—as well as downtown.
The proposed roundabout is currently surrounded by a mix of uses. Residential units, commercial enterprises, and institutions. Commercial and industrial uses line McMillan and residential uses primarily line William Howard Taft.

Based on an existing proposal, the goal of this project was to propose an interchange that would help condense and streamline traffic flowing through the I-71, McMillan and Taft corridor. The Ohio-Kentucky-Indiana (OKI) Regional Council of Governments conducted The Uptown Transportation Study to develop a series of alternates to improve the Uptown area. After evaluating these alternatives, one was selected to be examined and improved by the design team. The proposal is a roundabout interchange that connects Taft and McMillan to each other, as well as to I-71 and an access road to MLK.

The goal of the 2007 Uptown Transportation Study was to: “Develop a comprehensive transportation plan for the Uptown area that serves the needs of the area’s diverse population, responds to existing transportation deficiencies, and supports continuing growth, development, and economic vitality (Governments).” In this study, many alternatives were developed and analyzed. In comparing the alternatives, it was decided that on alternative showed potential for improvement. The S-3 Alternative proposes ramps to/from I-71 connecting to Taft Road in the South and MLK on the North. Between Taft and MLK would be two one-way access roads, one on each side of I-71. The original proposal also has two turn lanes that divert traffic to/from Taft Road to McMillan (Governments). This specific design is where the proposal for the roundabout comes in. In lieu of routing all traffic to Taft and then utilizing two turn lanes to connect to McMillan, the roundabout will connect Taft and McMillan while allowing traffic to flow continuously in all directions.
The roundabout will have significant improvements to various aspects of the surrounding community. The roundabout will disrupt a significant amount less of land than the S-3 proposal. Disrupting less land will maintain the integrity and character of the surrounding community. It is important to the Walnut Hills community that traffic still flow freely along the McMillan corridor. The current S-3 alternative will make traffic flow along McMillan be convoluted. An improvement to traffic flow will bring much attention to the area and benefit both the Uptown area, as well as Walnut Hills.

In 2007 OKI presented their findings in the Uptown Transportation Study. The goal of this study was to: “Develop a comprehensive transportation plan for the Uptown area that serves the needs of the area’s diverse population, responds to existing transportation deficiencies, and supports continuing growth, development, and economic vitality (Governments).” In this study, many alternatives were developed and analyzed. In comparing the alternatives, it was decided that on alternative showed potential for improvement. The S-3 Alternative proposes ramps to/from I-71 connecting to Taft Road in the South and MLK on the North. Between Taft and MLK would be two one-way access roads, one on each side of I-71. The original proposal also has two turn lanes that divert traffic to/from Taft Road to McMillan (Governments). This specific design is where the proposal for the roundabout comes in. In lieu of routing all traffic to Taft and then utilizing two turn lanes to connect to McMillan, the roundabout will connect Taft and McMillan while allowing traffic to flow continuously in all directions.

The current concept for the I-71 roundabout has it being two lanes. Two lane roundabouts can be more confusing for the driver and therefore lead to more accidents. To help mitigate the issues associated with two lane roundabouts, it is important to have excellent signage.
and pavement markings. A precedent for this can be found in New Albany, OH at the intersection of Morse Rd and Johnstown Rd. Examining satellite images and visiting the roundabout helped to develop greater knowledge of how these signs and markings can be applied to the I-71 roundabout.

**Reasoning**

The presence of two one-way streets carrying traffic to and from I-71 creates an opportunity for the effective implementation of a roundabout interchange. The current S-3 Alternative as describes by the Uptown Transportation Study improves the existing I-71 interchange at Taft and McMillan Roads by adding ramps to the southern leg of the interstate and connecting the existing ramps to Martin Luther King Blvd. The alternative does not capitalize on the one-directional flow of the two streets crossing the interstate, which in conjunction with the one-directional interstate ramps, allows a unique opportunity to combine four intersections into one. Existing traffic flows take on a counterclockwise motion through a series of four signalized intersections along Taft Rd. and McMillan Rd. A roundabout will eliminate circulating traffic from these signalized intersections and streamline the counterclockwise movements in more efficient merge/diverge sequences.

Aside from traffic flows, the roundabout alternative to the S-3 design is advantageous in that it requires far less land acquisition. The S-3 design consists of extensive right-of-way takes, but the roundabout will require at most one building to be relocated. The roundabout allows the interstate ramps to intersect the cross streets very close to the interstate rather than at existing signalized intersections that lie farther away. Therefore, small strips of land adjacent to I-71 are needed for the roundabout, whereas a significant area is required to construct ramps according to the S-3 design.

The roundabout alternative designs shown in the following section are based on Federal Highway Administration (FHWA) and Ohio Department of Transportation (ODOT) standards. The inner lane of travel has a minimum radius of 200 feet to accommodate speeds of up to 20 m.p.h. All lanes are 12 feet wide and all vertical clearances are at least 16.5 feet, which allow the interchange to meet all interstate criteria.

Future traffic data was obtained from TranSystems according to traffic demand models for the year 2030. Based on peak hour volumes entering the roundabout, a 2-lane circulating design was selected for each alternative. The traffic models show that a 2-lane roundabout will operate above capacity during peak hours, but the models do not take into consideration a new interchange at Martin Luther King Blvd. The roundabout designs operate on the assumption that a significant proportion of the traffic volume entering I-71 northbound will do so via the proposed interchange at I-71 and MLK.
The S-3 alternative adds two additional ramps on the southern leg of I-71 that intersect MacMillan Rd. These ramps continue northward as one-way access roads that also intersect Taft Rd. and Martin Luther King Blvd, before rejoining the interstate north of MLK. The existing ramps on Taft and McMillan are removed.
Alternative 1 is a basic two-lane roundabout design. Vehicles must yield to circulating traffic when entering the roundabout, and then may proceed to an exit lane without yielding. Pavement marking lines, in addition to arrows and signs, direct vehicles to available exit lanes at each node. There are two entrance and exit lanes at each node. Alternative 1 is a simple design, but it requires all traffic to enter the roundabout without bypassing any nodes.

Alternative 2

In the design for Alternative 2, there are two entrance and exit lanes at each node, except for the southbound lanes west of the interstate, due to lower traffic volumes. The existing ramp from southbound I-71 to Taft Rd. is used to bypass the northwest node. Another bypass lane is used on the northeast node for traffic leaving Taft Rd. and
traveling northbound. This design is more complex but allows some traffic to bypass the roundabout.

**Alternative 3**

Alternative 3 includes a “peanut” shaped layout that is intended to increase the distance between the roundabout and a building located at the southwest node. This design also allows for two-way traffic on McMillan St. east of the roundabout.

**Alternative 4**

Alternative 4 introduces a bypass lane on the interior of the roundabout for traffic leaving McMillan St. and proceeding to I-71 northbound. In conjunction with the bypass lanes for the northern nodes, this alternative significantly reduces the volume of traffic entering the roundabout during both morning and afternoon commutes. However, the interior bypass lane adds to the complexity of the southwest node.
Implementation/Funding Strategies

In many cases, the concept of a roundabout is not well accepted in the community. However, after a roundabout is implemented the public perception increases significantly. If the community is involved more in the project from the beginning, hopefully the public perception will be positive earlier. To attempt to accomplish this, a community action plan should be put into process to keep all parties in the know. A great example of this is in the town of Carmel, In. Numerous roundabouts were implemented and to keep the community involved, a website was created. This website provided useful information on the benefits of a roundabout, tips on how to navigate a roundabout including vehicle and pedestrian videos, construction and detour updates. This website can serve as a model for a potential website for the I-71 roundabout. In addition, a pamphlet can be passed out to local businesses and community members (Mayor).

A typical American response to roundabouts is that the roundabout is a European phenomenon that cannot and should not be implemented in the United States, because the roundabouts are too difficult to navigate. However, the prior data suggests that Congress and the Federal Highway Administration are working to change the negative outlooks of American drivers. These agencies are working to educate the public about the benefits of roundabouts.

These agencies are also working to make roundabouts eligible for special funding to promote the growth. Therefore, an increase of roundabouts in the United States may change American perceptions of roundabouts, especially if safety and efficiency are indeed improved.

Overall funding would most likely come from Ohio Department of Transportation and National Highway Administration.

Landscaping is a significant factor in creating an environment around the roundabout. Implementation and funding could come from grants offered by the state. In recent years landscaping around highways has become a major factor for creating corridors and a visual appeal for communities running along national systems. Ohio Department of Transportation has acknowledged the need for communities to create identity and has created a Gateway Landscaping Program. The program provides funding for the purchase of trees, shrubs, and
other landscaping materials with the hopes of establishing enhancements in the corridors of communities. A community, such as Walnut Hills, wanting to take advantage of the program would need to apply and supply a work crew and the resources to implement.

**Responses to Roundabouts in the US**

According to the National Cooperative Highway Research Program “A survey of residents and workers near the Montpelier, Vermont roundabout indicated that 56 percent of the respondents had a favorable opinion of the roundabout, 29 percent had a neutral opinion, and 15 percent had an unfavorable opinion. Of the 106 respondents, 93 percent had driven through the roundabout, 82 percent had walked through the roundabout, and 18 percent had bicycled through the roundabout. No differences in opinion were discerned among the drivers, pedestrians, and bicyclists” (Jacquemart 20).

After the first American prestigious roundabout in Clearwater, Florida was proposed, many of the residents protested the new road project (Sides 2). However, after the Clearwater Beach Entryway Roundabout opened in 1999, the residents and business owners presented the City of Clearwater funding to encourage the construction of a second roundabout (Sides 2). In the following years, residents of Clearwater rallied the City to convert 14 more intersections into roundabouts (Sides 2).

These examples exemplify the initial, negative reaction to roundabouts in the United States. However, once the roundabouts are installed and properly working, the citizen approval drastically changes. Citizens even demanded more roundabouts. Therefore, those with power to implement roundabouts should not waver the implantation based on citizen’s initial opposition, because it is very likely that the citizens will approve the roundabout once the roundabout is installed and properly operating.

**Precedent Studies**

The National Cooperative Highway Research Program states that a “substantial reduction in injury accidents has been the primary reason for the great success of modern roundabouts in France and in Germany. The significant decline in crashes occurs because of the reduction of
points of conflict. Points of conflict are areas in which accidents with other cars, pedestrians, or bicyclists can occur (see FIGURE 1a). Limiting traffic and separating the movements through the use of splitter islands reduces the number of conflict points to eight in a roundabout in comparison to a common four-way intersection with a total of 32 possible conflict points (Persaud 2).

Many studies have proved this finding. For instance, Schoon and van Minnen investigated 181 Dutch intersections that were transformed from a traffic signal or stop sign intersection to a roundabout (Persaud 2). The study found that crashes and injuries decreased by 47 in the former traffic signal and 71 percent in the former stop sign intersections. Furthermore, the severe injury crashes were reduced by 81 percent (Persaud 2). Similarly, Troutbeck reported an average of 74 percent decrease in the rate of injury crashes at 73 intersections in Australia that were converted from typical signal designs to roundabouts (Persaud 2). Elvik supports this conclusion with the finding that conversion of a yield, two-way stop, or traffic signal control to a roundabout lessens the total of injury crashes by 30-40 percent (Persaud 2). Furthermore, bicycle crashes were lessened by 20 percent (Persaud 2). The number of accidents involving pedestrians was decreased by 30 percent. Pedestrians are also typically safer because of several reasons. Pedestrians do not actually cross the roundabout, they circumnavigate or cross the vehicular entrances (Persaud 2). At the vehicular entrance crossways, the splitter islands allow for safer crossings because pedestrians do not have to jolt continuously cross two lanes of traffic. Instead, the pedestrian cross one lane of traffic, break in the splitter island, then cross the other lane of traffic. Furthermore, pedestrian crossings are placed one car length from the entry point (Persaud 2).

According to the National Cooperative Highway Research Program “All of the survey respondents agreed that U.S. roundabouts performed well in terms of the following criteria: shorter delays, increased capacity, improved safety, and improved aesthetics” (Jacquemart 32). Also, the study showed that “delay measurements at seven roundabout sites showed that the peak-hour delays decreased by about 75 percent, in relation to the previous traffic control. Before-and-after crash statistics at 11 existing roundabouts showed a reduction of 37 percent in total crashes, 51 percent in injury crashes, and 29 percent in property damage-only crashes. For the eight small-to-moderate-size roundabouts, with an outside diameter of up to 37 m (121 ft), the crash reductions were statistically significant for total crashes (a reduction of 51 percent) and for injury crashes (a reduction of 73 percent)” (Jacquemart 32)
When researching the concept of imposing a roundabout, several precedents proved to be beneficial to the development of the roundabout. First, in Vail, Colorado, overcrowding of freeway interchanges became problematic so engineers proposed $15 million worth of interchange ramps. The residents demanded that greener alternatives be considered. The resulting interchange was North America’s first interchange roundabout. This roundabout decreased the cost to $2.8 million and was able to withstand a capacity of 2700 vehicles per hour. Accidents at the interchange decreased by 12% in the first year of service. This roundabout is similar to the proposed roundabout at McMillan and Taft because it is an interchange style roundabout that can carry a high capacity. The diameter of the roundabout is approximately half of the I-71 roundabout. A successful implementation in Vail, Colorado gives hope to a successful implementation along I-71.

**Bibliography**

**IV. Conclusion**
Roundabouts are much more than a street device. Roundabouts have the potential to transform an area. Not only is a roundabout a radical improvement to a roadway, but roundabouts can be used as a visual enhancement to an area as a gateway. Roundabouts are an tool that increases safety along the street, enhances driver attentiveness, reduces automobile idling, and efficiently streams traffic through an area. Roundabouts are cost effective and save thousands of dollars that traditional intersections require for the electricity of signals. Even though many people are skeptical about roundabouts—thinking they are confusing, overwhelming, and hinder traffic flow—studies have proved the opposite. The more roundabouts that are implemented and effective, the more drivers will be accepting. It is only a matter of time that roundabout implementation in the United States will match the Europeans.

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