

Roundabouts and Access Management

ABSTRACT

This paper discusses the implementation of a series of four roundabouts on a suburban arterial serving a strip commercial area. The project is located on South Golden Road which is one of Golden, Colorado's primary commercial arterial corridors. With four through lanes and a center turn lane, it handled through traffic, but access from business and side streets was a significant problem. Plans for a new shopping center elevated citizens concerns about traffic in the corridor. In designing improvements for the corridor, the City wished to slow traffic, improve access, safety and aesthetics. The roundabouts were constructed in 1998 - 1999 and were fully operational in late 1999. This paper shows how a series of roundabouts can be implemented in a commercial arterial corridor to provide a more aesthetically pleasing area, while maintaining traffic flow and providing additional pedestrian protection. Before and after data demonstrates the changes in traffic volumes, accidents and economic activity. The series of urban roundabouts in series resulted in a corridor where traffic moves slowly, vehicles experience little delay at major intersections, and pedestrians can readily access the many businesses in the area. The net result is a vibrant commercial corridor.

BACKGROUND

The City of Golden is nestled into the foothills of the Rocky Mountains on the west side of the Denver metro area. The City contains about 17,000 people and has a traditional downtown bordered by the Colorado School of Mines and the Coors Brewery. South Golden Road is located 2 miles southeast of the Old Town and was originally constructed as a suburban highway with four travel lanes, center turn lane (suicide lane), and wide parking/shoulders. At places, it measured 84 feet in width and had bits and pieces of attached and detached walks. Driveways were allowed indiscriminately and many had continuous access along their entire frontage. Traffic signals were installed at the main intersections including Ulysses Street and Johnson Road. The corridor served several residential areas, many businesses including several fast-food restaurants, and a small shopping center.



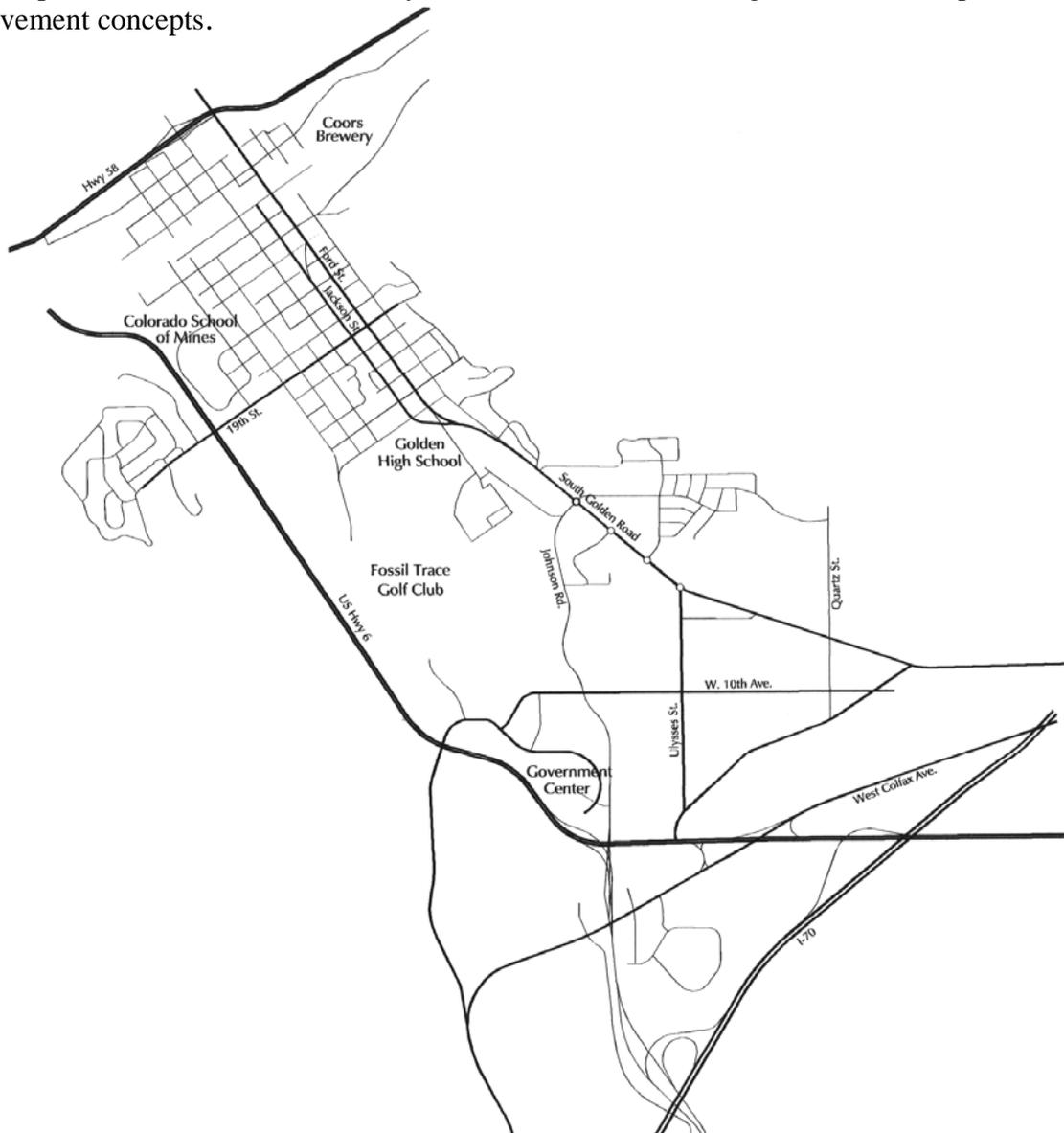
South Golden Road Before Improvements

The unrestricted access created a safety concern with the center turn lane due to numerous conflicting left-turn movements. The width of the roadway encouraged speeding and was difficult to cross, especially for elderly pedestrians. Traffic volumes were in the range of 11,000 to 12,000 vehicles per day.

Due to these concerns, the City began investigating ways of creating a safer, more pedestrian-friendly and aesthetically appealing environment. In 1993, a series of open house meetings with local businesses and area residents was held to develop urban design solutions for the corridor. The intent was to narrow the pavement width by eliminating the parking/shoulder lanes, installing medians and detached walks, and providing other amenities. Consensus was never reached on any plan due to access concerns of businesses and the effort died.

IMPETUS TO PROJECT START

In 1998, the City received a development proposal for a shopping center that included a 70,000 square foot grocery store to be located on South Golden Road. This triggered a reaction from residents of the area about the traffic on South Golden Road, especially the need for a traffic signal at Utah Street. Residents felt that the additional shopping center traffic would make it impossible to get out of Utah Street onto South Golden Road. This reopened the South Golden Road improvement issue and the City staff asked its traffic engineer to develop alternative improvement concepts.



CITY OBJECTIVES

The City articulated several objectives for any improvements to South Golden Road:

- Reduce vehicular conflicts and increase safety;
- Create a more aesthetically pleasing area;
- Create a more pedestrian-friendly environment;
- Reduce delays for entering traffic at Utah Street;
- Reduce queue delays to reduce travel time.

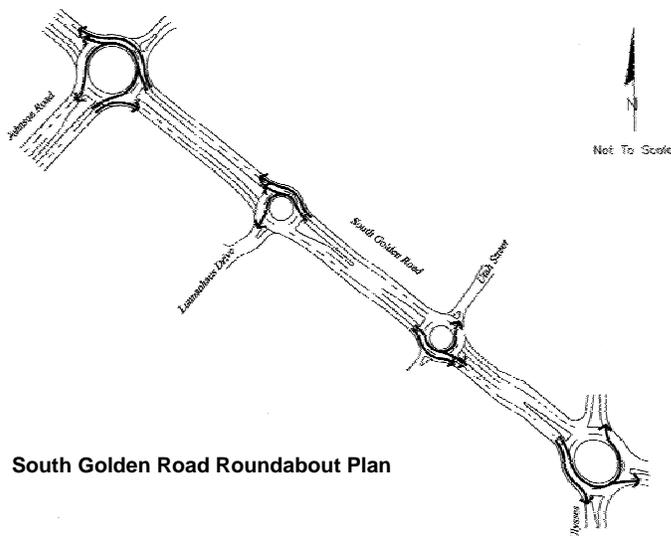
Two alternative concepts for South Golden Road were developed:

1. Narrow the roadway, provide medians and wide detached sidewalks, and install a new traffic signal at Utah Street.
2. Narrow the roadway, provide medians and wide detached sidewalks, and construct two roundabouts at Utah Street and Ulysses Street. This would involve removing the existing traffic signal at Ulysses Street.

City staff and elected officials were immediately receptive to the roundabout concept. The traffic calming aspects combined with the obvious qualities of the roundabout concept met the City objectives for the corridor. Moreover, the ease of U-turns at the roundabouts appeared to actually improve access to businesses in the corridor. The staff was so impressed with the concept that they requested the addition of a third roundabout at Johnson Road.

DEVELOPING THE CONCEPTS

The City staff enthusiastically took on the task of presenting alternatives including the traditional traffic control and the roundabout version to the City Council, residents, and businesses in the area. After learning about the potential benefits of roundabouts, several businesses and city council embraced the concept. The biggest opponent was the developer and major tenant of the new shopping center. King Soopers, one of the major grocery chains in the state, balked at having their major entrance on the proposed Ulysses roundabout. None of their stores was served by a roundabout and they were wary of potential negative public reaction. City officials presented the



roundabout concept to the President of King Soopers. The City offered to tear the roundabout out if it appeared to affect the new store's sales. King Soopers agreed to try the concept and the project quickly moved into design.

The City then began meeting with the local merchants to define their specific design concerns and review the roundabout concept. Most were neutral on the concept and more concerned on changes affecting their properties and disruption during construction. A car-wash owner, however, had worked in Vail and was a big proponent of the roundabout concept. The Pizza Hut manager, who had studied the gridlock that occurred at peak hour in the parking lot of the Wendy's across the street, concluded that the delay that occurred waiting for a gap sufficient to make a left turn was the problem. The result was his insistence that a fourth roundabout be added and that their access be only right in and right out. This fourth roundabout was the hardest to sell as the veterinary clinic across the street strenuously objected because they thought vehicles with horse trailers wouldn't be able to get around the circle and into their driveway. Numerous meetings and AutoTurn sketches never did overcome their skepticism.

IMPLEMENTATION

While the shopping center development schedule dictated construction and opening of the roundabout by late fall 1998, the City intended to phase the rest of the project the following years when funds became available. The Ulysses roundabout was constructed on a fast track schedule and opened in November 1998. The initial public reaction was mixed, but positive response appeared to outweigh negative response. More importantly, King Soopers exceeded its sales projections and has had no further opposition to the project.



South Golden Road/Ulysses Street

After considering the initial public reaction to the roundabout concept, city council decided to accelerate completion of the entire project to 1999 by shifting funding to this project. The other three roundabouts and roadway reconstruction were designed in the spring of 1999, and construction commenced in mid-1999.

The construction reached a stage where the other three roundabouts could be opened to the public in early December, 1999. Despite freezing temperatures, a crowd of several thousand attended the merchant-sponsored grand opening on December 4, 1999.

S. Golden Road Roundabouts	Inside Diameter	Outside Diameter
Ulysses Street	90	145
Utah Street	50	105
Lunnanhaus Drive	50	105
Johnson Road	100	155

PROJECT COSTS

The mile-long project cost \$1.3 million. This includes the four roundabouts, roadway reconstruction, medians, detached sidewalks, utility relocations, design and landscaping. There is no indication that the roundabouts added to the cost of the project and actually saved the cost of traffic signal reconstruction.

ACCIDENT HISTORY

As shown in several other roundabout studies, the South Golden Road roundabouts experienced a significant drop in both the number and severity of accidents. The City has tracked accidents along the corridor since 1996, a period of 3 years prior to installation and now (excluding the construction period) for five years after. Figure 1 displays the number of accidents and the number of injuries for the 3 years prior to installation and the 5 years after. Total annual accidents have been reduced from a pre-installation high of 123 accidents to 17 in 2005, the last full year of reporting, even though traffic volumes have increased from 11,500 vehicles per day in 1996 to 15,500 vehicles per day in 2005. More significantly, there were 31 injuries in the 3-year pre-installation period and only 3 injuries in the 6 years afterward. Note that few of the post installation accidents occurred at the roundabouts. While some of this decline can be attributed to better access control, the more important factors are the safer roundabout concept of traffic control and the decline in vehicle speeds. With 4 roundabouts located within the half-mile corridor, 85% percentile speeds declined from 47 mph to 33 mph (as measured at points midway between the roundabouts).

SLOWER SPEEDS BUT FASTER TRAVEL TIMES

While average speeds have gone down, travel time has also gone down. Prior to the roundabouts, the corridor had 2 traffic signals and average travel time through the corridor was calculated to be 78 seconds. A third traffic signal was being considered which would have increased travel time to 103 seconds. Since the roundabouts service vehicles with less delay per vehicle than traffic signals, the current travel time through the corridor is estimated to be 68 seconds.

More significant for businesses is the delay experienced entering or exiting their sites. Before installation of the roundabouts,



the average delay at business access points was 28 seconds, with maximum delays of 118

seconds. After installation of the roundabouts, average delay was reduced to 13 seconds and maximum delay to 40 seconds.

Some of this reduction in delay is due to improved access control due to the installation of medians. Most driveway access points were converted to right-turn-only accesses and only four full movement access points were constructed. The presence of the roundabouts allows convenient U-Turns near most of the business access drives. The right-turn/U-Turn movement has proven much quicker and safer than the previous left-turns onto the old high-speed South Golden Road.

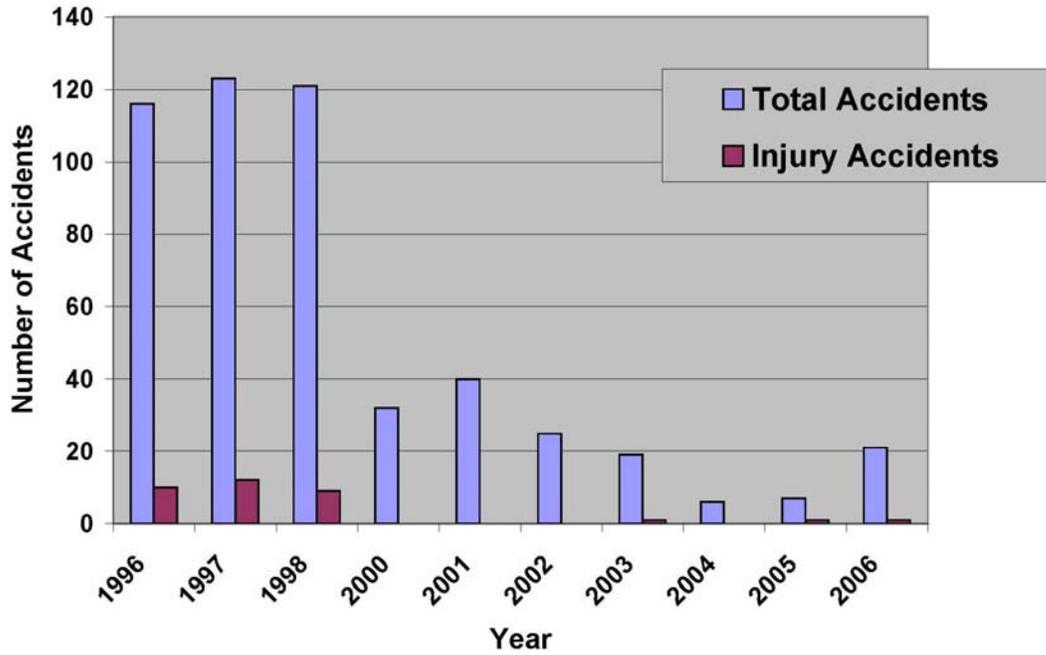
ARE ROUNDABOUTS GOOD FOR BUSINESS?

While the aesthetic improvements, including underground utilities, wider sidewalks and landscaping, certainly have contributed to a vibrant business community along South Golden Road, the traffic and safety improvements are probably more significant in the revitalization of the area. Faster travel times, better access control, fewer accidents, and lower delay at business access points have contributed to an increase in economic activity. Figure 3 shows the growth in sales tax revenues along the corridor, which have increased 60% in six years. This area is the only portion of the City that has seen a year over year increase in sales tax revenues during this period which witnessed an economic slowdown in 2002-03. In addition, over 75,000 square feet of retail/office space has been built in the corridor since the installation of the roundabouts.

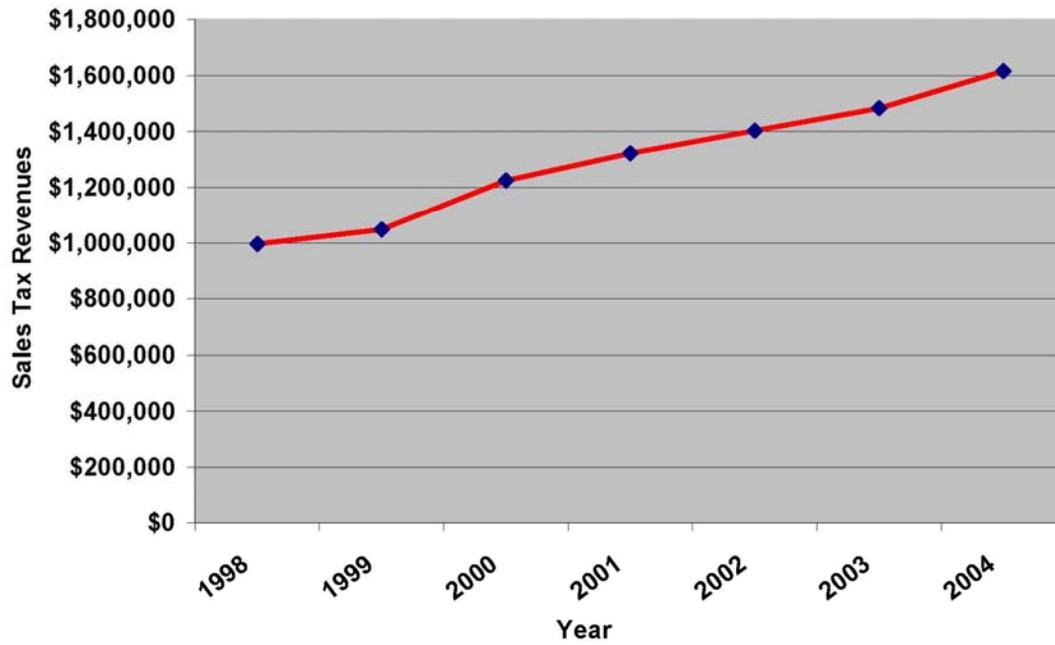
SUMMARY AND CONCLUSIONS

South Golden Road was a typical suburban strip commercial corridor with high numbers of accidents due to a lack of access control. The combination of access control with a center median and the installation of four roundabouts within this half-mile long arterial has resulted in slower speeds, but lower travel times and less delay at business access points. Accident rates have dropped by 85% and injury accidents have declined from 31 in the 3 years prior to installation to only 3 in the 6 years after – a decline in injury accidents rates of 96%. The improvement in traffic flow, vehicular safety and access to businesses combined with amenities such as landscaped medians and pedestrian walkways has stimulated economic activity. Sales tax revenues have increased 60% since installation of the roundabouts and 75,000 square feet of retail/office space has been built.

**Figure 1
Accident History**



**Figure 2
Yearly Sales Tax Revenue**



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