Minnesota CSAH 42: A Case Study Illustrating Traffic Signal Removal as an Access Management Strategy

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ABSTRACT

County State Aid Highway (CSAH) 42 is a major east-west arterial serving the southern suburbs of the Twin Cities metropolitan area in Minnesota. This corridor represents an excellent case study in both how to and how not to manage access along a major suburban arterial.

The existing highway corridor configuration was developed over a number of decades and illustrates a number of poor access management practices, including lack of coordination among local government jurisdictions in terms of traffic engineering and land use planning, over-reliance on traffic signalization as a solution to traffic operations and safety issues, and lack of planning for alternative access to land development (e.g., backage or frontage roads).

In contrast, an access management project currently underway along the corridor illustrates a number of proactive access management practices being practiced by the local governments involved in the project, including use of microscopic traffic simulation to analyze alternatives and educate stakeholders, careful attention to commercial business concerns along the corridor, and use of innovative and difficult access management treatments.

Key words: access management strategies—signalization—traffic signal removal
PROBLEM STATEMENT

Managing access along existing urban and suburban arterial corridors that are also commercial corridors is an inherently difficult task. Arterial roadways should primarily function in a manner that channels through traffic with a high level of service and at a relatively high mean travel speed; direct access to adjacent land and development should be kept to a minimum. However, commercial businesses along such corridors depend on these roads for customer access; they prefer a high degree of visibility from the road to the business and the most direct access possible for potential customers. The need to serve through traffic while also meeting the desires of commercial businesses creates a difficult balancing act at best and conflicts at worst.

RESEARCH OBJECTIVES

This paper presents a case study that illustrates both how to and how not to manage access along a major suburban arterial. The case study focuses on County State Aid Highway (CSAH) 42, a major east-west arterial serving the southern suburbs of the Minneapolis/St. Paul, Minnesota metropolitan area. The existing highway corridor configuration, developed over a number of decades, illustrates a number of poor access management practices. In contrast, an access management project currently underway along the corridor illustrates a number of proactive access management practices.

CURRENT ACCESS MANAGEMENT PRACTICES ON CSAH 42

Corridor Location and Function

County State Aid Highway (CSAH) 42 is a major suburban arterial located in the southern potion of the Minneapolis/St. Paul, Minnesota metropolitan area (see Figure 1). As its name implies, the arterial is managed by the counties it traverses; however, it is an important enough route for through traffic that it receives state aid. The roadway is functionally classified as a nonfreeway principal arterial and is on the National Highway System (NHS). Figure 2 provides a view to the west down the corridor as it existed in mid-2002. Note that photo was taken during a weekday off-peak time. Four sets of traffic signals within the sub-corridor are visible in the image.
Figure 1. Location of CSAH 42 (from Microsoft Streets and Trips)

Figure 2. Pre-project view of CSAH 42 looking west (taken by the authors)
Overall Corridor Plan and Concept

An overall plan was developed for the entire CSAH 42 corridor in 1999 by BRW, Inc. consultants and other team members. This study noted the importance of the CSAH 42 corridor as the only continuous east-west arterial in the southern portion of the Twin Cities metropolitan area with good connections to the north-south freeway system. It also noted the importance of the roadway in serving major retail areas, including a regional shopping mall and a number of lower level retail facilities. The study noted a number of issues along the corridor, including large and growing traffic volumes, through-oriented travel, existing access management issues, and a high density of traffic signalization in some portions of the corridor.

The study noted that a low level of traffic congestion existed in the late 1990s at peak hours under current traffic conditions, but, given development growth rates along the corridor, that traffic would likely double over the next 25 years. The study also noted a problematic lack of a supporting roadway system along portions of the corridor, so that trips between commercial developments along the corridor had no route options but to return to the CSAH 42 mainline.

The 1999 overall corridor plan identified a range of potential solutions for the corridor, ranging from no-build to a high-cost alternative involving grade separating a number of high-volume intersections. The no-build alternative produced a large number of traffic level service F delays in the western half of the corridor by the year 2020. The recommended alternative involved a number of moderate cost improvements that would largely meet the desired objectives for level of service, travel speed, and safety. The recommended improvements included the following:

- Better access management and better coordinated land use planning throughout the corridor
- Addition of through traffic lanes in selected portions of the corridor
- Traffic signal modifications and signal removal at selected locations
- Development of supporting roadway systems, primarily backage roads at selected locations
- Addition of auxiliary (right and left turn) lanes in selected locations

Sub-Corridor Examined for This Paper

More detailed planning studies and design work has followed for particular segments of the corridor that are most in need of improvement. One of the most challenging sections of the corridor turned out to be the centrally located segment running between the cities of Savage and Burnsville, which also straddles the boundary between Scott and Dakota Counties. This segment (Segment 8 of the 1999 overall corridor plan) runs between Glendale Road in Savage to CSAH 5 in Burnsville, a distance of about 1.6 miles. Segment 8 was selected for a detailed planning study and ultimately for design; the detailed planning study took place in 2001 and 2002, and design work was finished in 2006. Figure 3 shows a map of Segment 8. The county and city boundary are in red.

When detailed planning began, Segment 8 had four through traffic lanes, raised or flush/grass medians throughout, and an extensive system of auxiliary turning lanes. There were very few (six) direct driveway accesses along this segment of CSAH 42; all but one of these had right-in right-out access only. However, there were 14 minor public road accesses, all with full movement access. There were six traffic signals within the 1.6 miles (including one on each end), creating an average spacing between signals of less than the half-mile or more that would be optimal for allowing through traffic to move at the desired mean travel speed at peak times.
The two signals at the western end of the corridor were spaced only about 700 feet apart. Traffic signals, in particular the most closely spaced one at Huntington Avenue, were added along this corridor on an incremental basis to deal with “spot” safety issues; there was never a systematic analysis of traffic signalization until the detailed planning study was conducted after 2000. This, along with the lack of a supporting roadway system, turned out to be the main consideration in improving the future performance of the sub-corridor.

Segment 8 is a mixed land use corridor. The western and eastern portions are characterized by strip commercial development, while the middle portion is more industrial in nature. Figure 4 illustrates the development patterns: commercial areas are in red, industrial areas are in purple, undeveloped areas are in light green, a dashed black line represents the county and city boundary, and CSAH 42 is a solid red line. There are also recreational land use areas immediately adjacent to the corridor segment. One feature of the sub-corridor that became evident during this study was the lack of a supporting road system and, even more importantly, a supporting road system that crossed city and county boundaries. It can be seen in Figure 4 that the supporting roadway system parallel to CSAH 42 is incomplete and fragmented. Of particular interest is that development has been allowed to occur in places where backage roads could have been developed and supporting roads are not connected across city and county boundaries. Instead, a major warehouse and a city park were developed over logical routes for backage roads. Past lack of communication among the local government jurisdictions is quite visible on any map or aerial photograph.
Critical Issues for the Sub-Corridor

This corridor provides an excellent illustration of the proposition that access management is not just about driveways and medians. In fact, there were very few private, direct driveways and very few full median openings, yet access management concerns did exist in the form of many full intersections with minor public roads, the lack of an effective supporting public road system, a high density of traffic signalization, a lack of intergovernmental coordination of both land use planning and transportation system development, and a lack of necessary supporting roadway systems for land development.

PROACTIVE ACCESS MANAGEMENT PRACTICES FOR CSAH 42

Recommended Improvement Types for the Sub-Corridor

The detailed planning study conducted in 2001 and 2002 by a team led by Howard R. Green Company quickly began to focus on alternatives that involved a moderate-cost set of improvements to the Segment 8 sub-corridor. This is because high-cost improvements such as interchanges did not appear to be needed within the planning time horizon to attain most safety and operational objectives, and no-build approaches produced a situation by the year 2020 in which the sub-corridor was dysfunctional in terms of traffic flow, traffic level of service, and mean travel speed. Much of the poor future performance could be attributed to the high density of closely spaced traffic signals. The moderate-cost treatments considered included the following:

- Adding through lane capacity
- Adding auxiliary lanes, mainly at major public road intersections
- Closure of direct, private driveways
• Traffic signal removal and traffic signal system optimization
• Reconfiguration of minor public road intersections to reduce full median openings, precluding of some movements, and reduction of conflict points
• Completion of an alternative access road system to better interconnect commercial areas along the corridor
• Better coordination of land use planning and transportation planning along the sub-corridor

Detailed Sub-Corridor Planning and Stakeholder Involvement and Education Process

As might be expected given the commercial and industrial land uses along the sub-corridor, mentioning the moderate-cost treatments listed above provoked concern and opposition from business owners and developers. Businesses in the vicinity of Huntington Avenue went so far as to organize a small group to gain a greater opportunity to provide input during the detailed planning process. Most business concerns revolved around the prospect of the removal of traffic signals and the reduction of through and left turning movements at selected minor public road intersections. There was much less controversy about other potential treatments, including driveway closures.

At this point, the project planning team decided to embark on a comprehensive program of business stakeholder involvement and education. This program included the following components in addition to a more standard set of public involvement meetings and open houses:

• A business inventory and classification. A complete inventory of commercial and industrial businesses along the sub-corridor was prepared, along with a listing of vacant, lease-able spaces and vacant, developable land. Commercial businesses were classified into three groups: drive-by, destination, and mixed. Drive-by businesses are those that depend primarily on impulse traffic and perhaps on new customers. An example would be a convenience store. Destination businesses largely depend on planned trips and new, unfamiliar customers. An example would be a furniture store. Mixed businesses are in between. As is generally the case along arterial roadways, a large majority of businesses (about 80%) are either mixed or destination businesses. Drive-by businesses tend to be the most concerned about changes in access management because their customers are more impulsive and unfamiliar with the area. The inventory was used in part to identify the businesses that might be expected to be most concerned about changes to the roadway.

• A formal meeting with the Huntington Avenue area business group. This group was already organized, and the meeting was held to better understand their concerns about the sub-corridor, its problems, and their likely position on various potential improvements. If there was a “center” of discontent about the possibility of change along the sub-corridor, this was thought by the planning team to be it. This meeting in effect became a focus group about a small portion of the sub-corridor.

• One-on-one interviews with selected businesspersons along the corridor. Personal interviews (or telephone interviews) were conducted with a selected set of business owners and managers along the corridor. Emphasis was placed on drive-by businesses, businesses in the immediate vicinity of Huntington Avenue, and two major industries in the vicinity of Huntington Avenue who had not joined the Huntington Avenue group mentioned previously.

• Development of a microsimulation traffic model for the sub-corridor. The consulting team developed a microsimulation to illustrate the future performance of the sub-corridor under various improvement scenarios. SimTraffic 5.0 was the software used for this purpose. The microsimulations were used at various times in the planning process as educational and discussion tools. Figure 5 shows a screen shot of a simulation of the “No-Build” scenario during the p.m. peak period. In this example, eastbound traffic backs up all the way between one signal and the
next. This alternative future was one that most business owners along the corridor were very eager to avoid. The visualization helped them understand how detrimental certain features of the existing roadway (especially the close traffic signal spacing) would become for their businesses as traffic doubled along the sub-corridor.

Figure 5. Screenshot of the results of a microsimulation, p.m. peak, no-build alternative (from Howard R. Green Company)

The outcomes of this involvement and education process were interesting. As a first benefit, a very good understanding of the businesses most likely to be impacted by change was developed. For each of these businesses, estimates of additional travel time and circuity of distance for customers were eventually developed, given the recommended improvements and changes in access. Several of these estimates were diagrammed for presentation to city and county officials so that they could understand the tradeoffs involved. Added access travel time could be shown to be relatively minor compared to the offsetting reductions in travel time on the mainline that could be gained through such strategies as adding through travel lanes, removing selected traffic signals, and limiting movements at minor public road intersections. Figure 6 shows an example of a circuity-of-access diagram that was developed.
A second benefit was that the meeting with the Huntington group and the interviews revealed that the business community was already well informed about the potential improvements along the sub-corridor and that many of them understood that something substantial had to be done to handle future traffic volumes. There was a high level of support for adding through lanes along the corridor, but a need for additional education about access management, supporting roadway system development, and particularly the impacts of traffic signals and close signal spacing. This educational need was mainly filled by the micro simulation.

A final benefit of the process was that almost all businesses came to understand that a project involving moderate-cost improvements would be beneficial for most of them. Most businesses became supportive of a concept in which the project was staged with development of a supporting road system first and changes to the mainline following only after full completion of the backage road system. Opposition to the proposed alternative subsided until there was only one business in open opposition out of about 50 included in the business inventory. This business was a drive-by-oriented fast food restaurant located on a corner lot immediately next to the Huntington Avenue traffic signal. The owner and manager indicated that they felt that traffic signal removal would be highly detrimental to their business. Most businesses bought into the proposed alternative and felt that they had contributed the concept of staging the project.

A consensus began to develop among the business community that a reasonable improvement plan would involve a staged project, in which a supporting roadway system was developed first, followed by capacity improvements, intersection modifications, and traffic signal system modifications. This plan was agreed to by the two cities and counties involved. The fast food restaurant at the corner of Huntington Avenue remained concerned and opposed to the consensus alternative.
Final Plan for the Sub-Corridor

Because of the success of the business stakeholder involvement and education process, the final plan for CSAH Segment 8 was able to include what might be termed “difficult-to-accomplish” access management treatments, including the closure of almost every private driveway, the removal of two traffic signals, and the partial closure of several median openings along the route. Figure 7 shows a detail of the recommended design. The mainline is in yellow, the raised medians are red, new supporting roads are in purple, two three-quarters intersections are visible, and only one traffic signal is remaining.

The final plan included the following features:

- Two additional through traffic lanes for the entire 1.6 miles. The resulting cross-section would be a six-lane, median-divided roadway with auxiliary turning lanes.
- Closure of all but one direct driveway access and restricting it to a right-in right-out access. The remaining direct driveway access serves a major industrial facility and is well-spaced from adjacent minor public road accesses.
- Removal of the two traffic signals located at Huntington and Southcross. Four traffic signals would remain in operation, each with a spacing of greater than one-half mile to the next.
- Substitution of partial movement intersections for full intersections at Huntington, Ewing, Southcross, and Newton. The intersection design template chosen for the minor public road intersections was a three-quarters intersection, which allows for inbound right turns and left turns from the mainline, but no outbound left turns and no crossing movements (see Figure 8). This design reduces conflict points from 32 in a typical intersection to 10.
- Development of a more complete supporting (backage) road system along the sub-corridor, to be completed prior to the development of changes to the mainline of CSAH 42.
Project Design and Current Construction Status

The design of the project moved ahead between 2002 and 2006. Several open house-style meetings were held along the way by the design engineering team (led by Bolton and Menk) to do the following:

- Present the recommended roadway design
- Outline activities and the schedule to complete the project, especially project staging
- Discuss potential construction impacts on adjacent properties during construction
- Identify future public involvement opportunities

The supporting roadway system was designed beginning in 2005. It should be completed in 2007. The entire project, including all mainline improvements, is scheduled to be completed in 2008.

CONCLUSIONS

A number of lessons can be learned from this case study project, including the following:

- Access management is not just about driveways. Considerations such as supporting roadways, coordinated land use planning, minor public roadway intersections, and traffic signal density are just as important to keep in mind along commercial arterial corridors.
- Traffic signal removal is difficult, but may be of great value as a strategy for managing access along urban and suburban arterial corridors.
- Close involvement of the business community should occur throughout the planning and design process for corridor access management projects along commercial corridors.
• An inventory of businesses by type is useful for understanding which businesses in a commercial corridor might have the most at stake under various project alternatives.
• Microsimulation is very valuable as an educational tool, suggesting a "seeing is understanding" approach. In the case of this project, businesses came to understand the undesirable outcomes of the "no-build alternative" as well as the implications of keeping the closely spaced traffic signals.
• In the end, not all business owners and developers will be satisfied, but the majority probably can be satisfied even when difficult changes are proposed.
• Project staging can be a valuable tool for gaining support or at least for reducing opposition. In the case of this project, designing and building the supporting road system first and then modifying the mainline became a strategy that both the businesses and the local jurisdictions could support.
• Access management problems are usually generated incrementally, and they can be undone or at least partially improved in the same way. This project will eventually involve the provision of a supporting road system that was neglected, removal of two traffic signals that were unwisely installed, and reductions in private driveways and minor public roadway access.

A modified version of business stakeholder involvement and education process developed for the CSAH 42 project has recently been used in developing a plan for a section of U.S. Highway 10 in the city of Anoka, Minnesota. This highway segment is located in the northwest part of the same metropolitan area as CSAH 42 and is an arterial roadway in a commercial area that will almost certainly need to be converted into a freeway given anticipated future traffic volumes. Again, the process appears to have been successful in creating a near-consensus about the preferred direction for improvements. Components included a group meeting with concerned businesspersons, an inventory of businesses along the route, personal or telephone interviews with selected business owners who were thought to have the most at stake, a planning and design charrette with business owners only, and an open house for the general public, at which general project alternatives were discussed.

REFERENCES