SRF No. 07450

FINAL MEMORANDUM

TO: Paul Moline, Department of Planning & Water Management
Carver County

FROM: Carla Stueve, PE, PTOE, Associate
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DATE: June 30, 2011

SUBJECT: CARVER COUNTY NON-MOTORIZED FACILITIES INVENTORY

INTRODUCTION

Over the years, the non-motorized modes of transportation of walking and biking have declined. This trend has increased the inactivity of the population, roadway congestion and pollution levels. Often, the lack of non-motorized transportation is due to insufficient infrastructure, including system gaps, barriers and safety hazards.

Carver County has taken the initiative to complete an assessment of their roadway system, to identify the deficiencies for non-motorized modes of transportation. To thoroughly assess safety problems for biking and walking along their roadway facilities, many factors were reviewed, including crash patterns, vehicle speeds, sight distance/visibility, pedestrian exposure to vehicular traffic, and trails, sidewalk and roadway shoulder.

STUDY GOALS

The purpose of the study is to complete an assessment of the non-motorized facilities along Carver County roadways to identify gaps and barriers for pedestrians and bicyclists to access high priority areas, including schools and transit facilities. Based on the assessment results, gaps and barriers were identified that are limiting the ability to walk or bike along these facilities. These gaps and barriers were identified by applying the following safety criteria to these County roadway facilities for pedestrians and bicyclists:

- Traffic volumes >400 average daily traffic (ADT)
- Traffic speed ≥ 40 mph

- Lighting at major intersections
- Three or four-lane undivided roadway
- History of pedestrian/bicycle crashes
- Traffic control at major intersections
- Marked crosswalks
- Non-motorized facilities (trails, sidewalks, six-foot shoulder)

The criteria was reviewed for each County roadway facility, and the roadway segments, near the high pedestrian generators were identified as low, medium or high priority. The results of this study will allow the County to better understand the walkability of their system and identify their needs and priorities to increase safety for non-motorized modes of transportation.

INVENTORY ASSESSMENT

Crash Analysis

A crash analysis was completed for the paved Carver County roadways using the Mn/DOT Minnesota Crash Mapping Analysis Tool (MnCMAT). Five years of crash data were reviewed (2005-2009) to identify locations with pedestrian or bicycle crashes. Based on the information obtained from MnCMAT, there were a total of 16 pedestrian and/or bicycle crashes coded on the County roadway system. It is important to note that none of these crashes resulted in a fatality, however three of the crashes were A-injury (incapacitating) crashes. A map of the County roadway network showing the locations of the 16 crashes as well as a detailed summary of each crash is provided in Appendix C.

Further analysis of these crashes resulted in three County roadway segments with multiple pedestrian and/or bicycle crashes in the five-year study period. These segments include:

- CSAH 10 in Chaska: (half-mile segment) – Three Crashes
- CSAH 17 in Chanhassen: (four-mile segment) – Three Crashes
- CSAH 10 in Watertown (half- mile segment) – Two Crashes

Existing Roadway Characteristics

Data was obtained for the Carver County roadway system to assess the inventory of existing conditions and current gap/barriers for non-motorized modes of transportation and system connectivity. The following information was provided by Carver County as part of their pavement management and current GIS database:

- All County roads, segmented with logical beginning and ending termini
- Existing trails/sidewalks
- Approximate shoulder width and type
- Number of lanes/medians
- Posted speed limits
- Transit data – available from Met Council
- School zones with signing
- ADT – from Mn/DOT flow maps (2009)
- Crosswalks (including signing and markings)
- Traffic control devices (traffic signal/stop control)

Limited information for intersection lighting was available from Carver County's database. The analysis verified locations with lighting using the digital Mn/DOT roadway video log, which was provided by Carver County.

High Priority Pedestrian Generators

With the assistance of Carver County, high priority pedestrian generators, including public and private schools within the County, were identified and highlighted. Carver County includes a total of nine school districts, including Norwood-Young America, Waconia, Watertown-Mayer, Chaska, Minnetonka, Lester Prairie, Belle Plaine, Howard Lake-Waverly-Winsted, and Glencoe. There are a total of 56 public and private school within Carver County. A map was created for each school, listed alphabetically, and included in Appendix A. A one-mile radius was used as an acceptable walking and biking distance for elementary schools and a two-mile radius was used for middle and high schools.

In addition to schools, park-and-ride lots, transit stations and major bus stops were included as pedestrian generators in the analysis. A one-mile radius around these transit facilities was used in the analysis. A map was developed that highlights the walking and biking area for each of the high pedestrian generator transit locations (see Appendix B).

The maps for each of the high pedestrian generator locations highlights the walking and biking area, current non-motorized facilities, and an assessment of the current gaps/barriers along the County roadway system.

IDENTIFICATION OF GAPS/BARRIERS

Based on the information collected from the inventory, gaps and barriers were identified for pedestrians and bicyclists who travel along the County roadway system, such as missing sidewalk and trail segments and physical barriers, with higher priority given to walking and bicycling areas for school and transit facilities. The assessment identified roadways with heavier vehicular volumes, high vehicle speeds, lack of intersection lighting and crossings at major intersections without traffic control devices.

The following criteria were developed to identify potential issues relating to the safety and mobility of pedestrians and bicyclists in Carver County, along County roadways within the walking and biking area for each high pedestrian generator location.

Pedestrian and Bicycle Safety Criteria:

1. **Traffic Volumes > 400 ADT**: Based on the MnMUTCD, which contains traffic control standards along all roadways within the State of Minnesota, roadways with an ADT less than 400 vehicles per day are defined as a low-volume roadway. Low volume roadways can generally accommodate shared modes of transportation. However, as traffic volumes increase, it becomes more important to provide a separate space for bicyclists and pedestrians to travel. Roadways with an ADT > 400 vehicles per day were identified as a safety issue for non-motorized modes of transportation.

2. **Posted Speed Limit ≥ 40 mph:** Speed is a major factor in all types of crashes, and can be particularly fatal in pedestrian and bicycle crashes. As shown in Figure 1, a pedestrian hit at 40 mph has an 85 percent chance of being killed, as opposed to a pedestrian hit at 20 mph, who has a five percent chance of being killed. This is mainly due to motorists having less reaction at higher speeds and the vulnerability of pedestrians and bicyclists traveling along or crossing roadway facilities. A posted speed limit ≥ 40 mph was identified as an issue if more than 50 percent of the segment has a posted speed limit above the threshold.

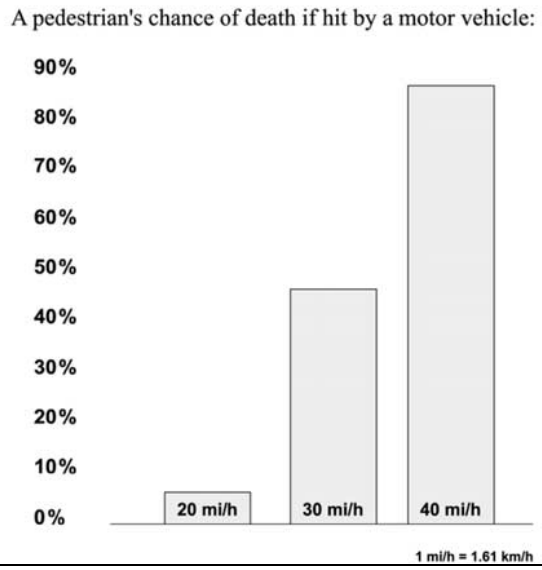

Figure 1
Fatalities Based on Vehicle Speed
Source: NCHRP 500, Volume 10

3. **Lighting at Major Intersections:** The visibility of pedestrians and bicyclists is based on a number of factors, including: screening by physical objects; lack of lighting, and roadway geometry. Providing lighting for pedestrians is a proven safety strategy for vehicles, pedestrians and bicyclists during day and nighttime conditions. Major intersections without current lighting were identified as a potential safety issue.

Figure 2
Crosswalk Lighting
Source FHWA: Publication Number FHWA-HRT-04-100

4. **Three or Four-Lane Undivided Roadway:** The number of lanes that pedestrians and bicyclists need to cross significantly affects their safety. Studies have shown that the number of roadway lanes (three or more lanes vs. two lanes) are directly related to crash rates. In particular, multi-lane roads with raised medians provided significantly lower pedestrian crash rates, compared to similar roads with no raised median. Roadways that have more than two lanes of travel, and do not provide a raised center pedestrian refuge area, were identified as a safety issue.

Figure 3
Multi-Lane Crossing Examples

Source : PedSafe Federal Highway

5. **History of Pedestrian/Bicycle Crashes:** Five years of crash data (2005-2009) in Carver County were reviewed and mapped to identify locations with pedestrian or bicycle crashes. The history of these crashes was identified as one indicator of a potential safety issue for non-motorized modes of transportation. Using the MnCMAT database, locations with pedestrian and/or bicycle crashes coded on the County roadway system were identified as a safety issue.

6. **Traffic Control at Major Intersections:** Traffic control at major intersections can provide many safety benefits for pedestrians and bicyclists crossing roadways with high travel speeds and volumes. Traffic control can provide gaps for pedestrians to cross, by stopping the flow of traffic. However, it is important to note that the improper use of traffic control at unwarranted locations can increase vehicle and pedestrian delay and increase intersections crashes. Major intersections that were lacking traffic control were identified as a potential safety issue.

7. **Marked Crosswalks:** In general, crosswalks at intersections can be marked or unmarked. However, marked crosswalks can be an important tool for increasing visibility of crosswalk locations, identifying preferred pedestrian and bicycle crossings, particularly at mid-block locations. Marked crosswalks have a greater function near high pedestrian generator locations, such as schools zones and near transit facilities. Based on our review of the traffic patterns to/from the major pedestrian generator locations on the

County roadway system, locations where a marked crosswalk may improve safety and has not installed were identified as a potential safety issue.

8. **Non-Motorized Facilities (Trail/Sidewalk or six-ft shoulder):** Pedestrian and bicycle facilities such as trails, sidewalk and usable shoulders provide these modes of transportation with dedicated space within the roadway right-of-way. County roadways lacking facilities for non-motorized modes of transportation were identified as a safety issue.

   - **Sidewalks**— Generally, sidewalks along both sides of the roadway are preferred, providing a physical separation between motorized and non-motorized modes of transportation. In most cases, sidewalks are concrete and provide curb ramps to comply with ADA guidelines.

   - **Trails** — Trails can be paved or unpaved and are sometimes set back or shift direction from the roadway alignment to connect with other trails.

   - **Shoulders (six-foot minimum)** — Wide shoulders on both sides of a road are the minimum requirement for providing a possible place for people to walk. They do not provide a physical separation between motorized and non-motorized traffic, but do provide a space for alternative modes of transportation.

RECOMMENDED PRIORITY IMPROVEMENTS

As shown in the maps provided in the Appendix, the safety criteria described above were applied to the County roadways within the defined radius around each of the high pedestrian generator locations. If the criterion was identified as a safety issue for that roadway, it is identified in bold font. Each County roadway segment was then identified as a low, medium or high priority, based on the number of safety issues identified as follows:

- **0-3 safety issues** highlight as "green"
- **4-6 safety issues** highlight as "yellow"
- **7-8 safety issues** highlight as "red"

CONCLUSIONS

The results of this study will provide Carver County with a comprehensive and detailed assessment of the current non-motorized transportation facilities on their roadway system. In addition, the prioritization of potential safety issues will allow the County to focus on roadway segments with greater safety needs for pedestrian and bicycle traffic. However, the prioritization process is a suggested indicator of safety needs on these facilities. Further analysis is

recommended at these locations to determine the specific safety issues and most effective solutions.

As the County improves the safety of non-motorized transportation facilities along their County roadway system, particularly in high pedestrian generator locations, members of the community will be encouraged to increase the use of non-motorized modes of transportation on County facilities. This will promote a healthier lifestyle and a cleaner environment for residents of Carver County.

Appendix A

School Pedestrian Generator Locations

Appendix B

Transit Pedestrian Generator Locations

Appendix C

Carver County Pedestrian and Bicycle Crash Data