

Methods to Reduce Traffic Speed in High Pedestrian Areas
Revised Work Plan

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Submitted to
Minnesota Local Road Research Board (LRRB)
Minnesota Department of Transportation (DOT)

March 15, 2000

Note: This work plan revises the CTRE proposal accepted by the LRRB in December 1999 in accordance with a letter from the LRRB dated January 4, 2000.

Background

In December 1999, the Minnesota Local Road Research Board (LRRB) awarded the Center for Transportation Research and Education (CTRE) a research project to evaluate the impact of speed reduction strategies in high pedestrian areas in rural counties of Minnesota. In January 2000, we received a letter from the LRRB requesting:

1. Additional study sites of high pedestrian areas
2. Extension of the study period. CTRE originally proposed to complete the work in one summer season. This proposal covers two summer seasons. (We are willing to extend the time farther if required to accommodate construction schedules.)
3. Collaboration with the University of Minnesota Human Factors Research Laboratory (HFRL) to validate their simulator work on techniques to reduce motorist speed. The simulation of the Tofte, Minnesota, road design is of special interest.

The objectives of the research project are to:

1. Examine effectiveness of speed reduction techniques at high pedestrian areas, and
2. Validate the results of traffic calming studies conducted at the University of Minnesota Human Factors Research Lab (HFRL) simulator for the City of Tofte, MN.

The purpose of this revised work plan is to address the board's concerns regarding the number of study sites, the proposed research period, and our collaborative involvement with the University of Minnesota HFRL. The HFRL will submit an independent proposal to the LRRB describing how they will modify their simulations as requested by the LRRB.

In responding to the LRRB's requests, we contacted numerous individuals in Minnesota regarding potential study sites with high pedestrian volumes and for validation of the Tofte simulator work:

- Dave Johnson, Minnesota DOT, Office of Research and Strategic Services (ORSS)
- Manjula Louis, Minnesota DOT, ORSS
- Dave Heyer, Mahnomon County Engineer, project Technical Advisory Panel (TAP) member
- Dave Robley; Douglas County Engineer, project TAP member
- Bob Johns; Director of the University of Minnesota Center for Transportation Studies (CTS)
- Kathleen Harder; Research Associate at the University of Minnesota HFRL
- Rob Garver, Minnesota DOT, Duluth district, Tofte Corridor Manager

- Jim Reieson, MnDOT, Tofte Site Development Unit Manager
- Jim Aemot, Minnesota DOT, Traffic Calming Studies
- Tom Kozojad, Beltrami County Engineer
- Brian Shepherd, Becker Assistant County Engineer
- Cliff Tweedale, Headwaters Regional Planning Commission

The locations that were suggested for pedestrian studies included:

- Twin Lakes in Mahnommen county
- The North shore of Lake Bemidji in Beltrami County
- Three cities on north shore Route 61
 - Grand Marais
 - Lutsen
 - Two Harbors

For simulation validation, collecting pre-construction data in Tofte was suggested. The design developed with the assistance of the HFRL will be constructed in Tofte during the summer of 2001. It makes sense to collect before-condition data in the summer of 2000. A colored pavement treatment is being installed in Schroeder in the summer of 2000. It is too late to collect before-condition data in Schroeder, but speed-adherence data for the built condition will shed light on the effectiveness of this treatment and may provide insight for improving the HFRL simulations.

Following our consultations, CTRE selected four sites to conduct speed control studies. Pedestrian-related study sites are proposed in each of the resort counties of Mahnommen and Beltrami where a high number of pedestrians are observed during the summer. Two other sites, located on the north shore of US 61, will be used for the simulator validation purposes. When the technical advisory panel meets, these sites can be reviewed. This is our best estimate of the most productive locations to develop valuable research insights on speed management techniques.

High Pedestrian Areas

1. The Mahnommen site is on the Minnesota County State Aid Highway (CSAH) 4 in the southeast lakes area of the County. It is located south of Nay-tah-waush between the densely populated areas of North and South Twin lakes. The posted speed limit before entering the area between the lakes is 45 mph, which reduces to 35 mph throughout the study site. This two-lane highway has a 24-foot surface width with an 8-foot paved shoulder on its each side. It has the Average daily traffic (ADT) of 900 vehicles per hour. During summer time, a high number of pedestrians are observed walking on the shoulders.

2. The Beltrami site is located near Lake Bemidji. Due to high volumes of vehicular traffic (1,500 ADT) and pedestrian traffic mixing in the area, the County Board has recently approved upgrading the facility. This three-year project will include adding multi-use trails and widening the shoulders. This site will be an excellent candidate in which we will be able to assist the local agency in evaluating the impact of the roadway physical improvements as well as managing the speed control at the new facility.

HFRL Simulator Results Validation

1. The City of Tofte is located on the north shore of US 61. The University of Minnesota HFRL has recently completed a traffic calming study in that city in which a driving simulator was used to study the impact of light poles, pavement coloring, and planting on drivers behavior. Traffic calming strategies will be built in the summer of 2001. Therefore, it will be not possible to validate the simulator results until the late summer of 2001 or 2002.

It was, however, recommended that CTRE conduct a speed study under the current conditions in Tofte in the summer of 2000. This speed study will assist the HFRL researchers to better assess the impact of the strategies they have studied in the driving simulator. After the deployment of the proposed designs, CTRE will conduct another speed study in Tofte during the summer late of 2001 to validate the simulator results. (This can be postponed to 2002 if the construction runs late in the year.)

2. The City of Schroeder is about four miles south of Tofte on US 61. The two cities have similar traffic characteristics (i.e., traffic volume, speed limit, number of lanes, etc.), and a colored-pavement treatment is being installed at Schroeder in the summer of 2000. Due to the fact that colored pavement was simulated by HFRL research on Tofte, it was suggested that this city could be used to partially validate the simulator results. An added benefit is that data on speed adherence resulting from colored pavement treatment would be immediately available.

Methodology for Traffic Data Collection

Experimental designs to test speed reduction strategies will be developed in conjunction with the Technical Advisory Panel and the communities involved. Traffic data will be collected at the proposed study sites before and after the deployment of the agreed strategies.

Traffic data will be collected using the traffic data collection trailer, shown in Figure 1. The data collection trailer will be positioned at about 500 feet downstream from where the potential speed reduction technique will be situated. The trailer, shown in Figure 1, includes a pneumatic mast to hoist video cameras 30 feet above the pavement's surface in order to videotape traffic operations. Videos are later reduced into traffic flow performance data through the use of image processing technology.



Figure 1. Traffic Data Collection Trailer

Traffic flow performance data (vehicle speed, headways, volume, etc.) will be recorded for five hours each day for two days prior to and two days after a speed reduction technique is in place. Using the Autoscope image processing technology, the recorded videotapes will be analyzed to determine the vehicle types (i.e., passenger cars and non-passenger cars), arrival times, and speeds of approaching vehicles.

A number of traffic behavior significant parameters will be obtained through analysis of the speed data. Some of these parameters were computed directly from the data while others were determined from a graphical representation. The analysis of the speed data will include the following evaluation parameters:

- The time mean speed.
- The speed that 85 percent of the vehicles travel (the 85th percentile speed).

- The ten mph speed interval containing the most observations (the 10-mph pace).
- The percentage of observations in the 10-mph pace.
- The standard deviation of the time speed.
- The percentage of observations complying with posted regulatory and advisory speed limits.
- The time mean speed of the highest 15 percent of speeds.

Except for the mean speed and standard deviation, the balance of these parameters is determined from graphical analysis.

Revised Budget and Schedule

The new proposed budget is estimated on a per site basis to facilitate the addition or elimination of a site as the board members desire (see Table 1). Furthermore, the project duration is extended until December 2001, which allows us to collect traffic data before and after implementing a speed reduction strategy in two subsequent summers. Following the first summer when the "before" data collection is completed, the research team will visit with the local officials to coordinate their efforts in deployment and selection of appropriate speed reduction techniques. Table 2 shows the original-proposed tasks and a revised time plan.

Table 1. Estimated Budget[†]

Personel	
Ali Kamyab, Principal Investigator	
20% for 20 Months	\$19,089
Fringe Benefits, 29.18%	\$5,570
Gary Thomas, Co-Principal Investigator	
33.33% for 3 months	\$6,702
Fringe Benefits, 23.17%	\$1,553
Dennis Kroeger, Technical support	
20% for Six Months	\$4,599
Fringe Benefits, 29.18%	\$1,342
Marcia Brink, Publications Editor	
Two Weeks	\$1,667
Fringe Benefits, 29.18%	\$486
Secretary/Account Clerk	
Three Weeks	\$1,844
Fringe Benefits, 35.47%	\$654
Graduate Assistant	
Quarter time for 20 months	\$12,567
Fringe Benefits, \$800/academic year	\$1,600
Personnel subtotal	\$57,672
Other Direct Costs	
Supplies and Materials	\$1,000
Telephone charges	\$500
Travel	
Mileage - 9000 miles to transport equipment	\$2,700
Lodging - 20 nights for 3 individuals	\$4,200
Per Diem - 30 days for 3 individuals	\$3,600
Other direct costs subtotal	\$12,000
Total Direct Costs	\$69,672
ISU Indirect Costs, 44.5%	\$31,004
TOTAL	\$100,676

Salaries are an estimate based on FY2001 projections

[†] Note: The cost per site is approximately \$20,000. This includes direct expenses for two data collection visits, on-site labor, analysis of data, and writing up the results.

Table 2. Proposed Project Time Plan

Proposed Tasks	April 2000 through Decemeber 2001																
	4	5	6	7	8	9	10	...	4	5	6	7	8	9	10	11	12
I. Form an Advisory Committee	■																
II. Expand literature review		■	■	■	■	■	■	■									
III. Select case studies	Completed																
IV. Develop experimental designs		■	■	■					■	■	■						
V. Schedule data collection		■	■						■	■	■						
VI. Collect traffic data																	
• Mahnomen county			■								■						
• Beltrami county			■								■						
• Tofte				■								■					
• Schroeder				■								■					
VII. Data Analysis					■	■	■						■	■	■		
VIII. Document report								■								■	■