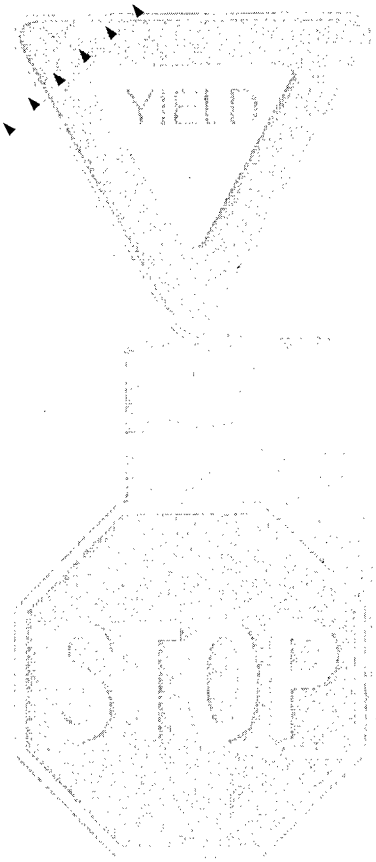
Final Report 1998-23

PB99-119216



The Use of Traffic Control at Low Volume Intersections in Minnesota

Technical Report Documentation Page

1. Report No.	2.	3. Recipier
MN/RC - 1998-23		PB99-119216

4. Title and Subtitle	5. Report Date
THE USE OF TRAFFIC CONTROL AT LOW VOLUME INTERSECTIONS IN MINNESOTA	August 1998
	6.

7. Author(s)	8. Performing Organization Report No.
Timothy A. Chalupnik, P.E.	

9. Performing Organization Name and Address	10. Project/Task/Work Unit No.
Toltz, King, Duvall, Anderson and Associates, Inc. 444 Cedar Street, Suite 1500 St. Paul, MN 55101	11. Contract (C) or Grant (G) No. (C) 73690

12. Sponsoring Organization Name and Address	13. Type of Report and Period Covered
Minnesota Department of Transportation 395 John Ireland Boulevard Mail Stop 330 St. Paul, Minnesota 55155	Final Report - 1998
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Minnesota Department of Transportation (Mn/DOT) studied the use of traffic control at low volume intersections to determine the crash experience at intersections with stop, yield, and no control for low and high speed conditions, as well as analyzing crash data to develop conclusions and recommendations.

Researchers sent survey forms to seven Mn/DOT districts, 87 counties, and 119 cities to collect intersection data and analyzed crash reports at selected intersections.

At low speed intersections, those with stop control experienced the fewest number of accidents. However, yield control and no control can be effective methods of traffic control. At high speed intersections, the type of control had no appreciable effect on crash experience. The report suggested that uncontrolled and yield controlled intersections with three or more crashes associated with the right-of-way control in the last three years be studied to determine the need for more control.

17. Document Analysis/Descriptors		18. Availability Statement
traffic control devices traffic signs stop signs	yield signs no control at intersections low volume intersections	No restrictions. Document available from: National Technical Information Services, Springfield, Virginia 22161

19. Security Class (this report)	20. Security Class (this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	44	

THE USE OF TRAFFIC CONTROL AT LOW VOLUME INTERSECTIONS IN MINNESOTA

Final Report

Prepared by

Timothy A. Chalupnik, P.E.

Toltz, King, Duvall, Anderson and Associates, Inc.
444 Cedar Street, Suite 1500
St. Paul, MN 55101

August 1998

Prepared for the

Minnesota Department of Transportation
Office of Research Services
First Floor
395 John Ireland Boulevard, MS 330
St. Paul, Minnesota 55155

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EXECUTIVE SUMMARY

The Minnesota Department of Transportation (Mn/DOT) sponsored this study to determine the crash experience at low volume intersections and to analyze the crash data to determine conclusions for the use of STOP, YIELD, and NO control. Survey forms were sent to seven Mn/DOT Districts, 87 Counties, and 119 Cities to collect intersection data. Mn/DOT obtained crash reports at selected intersections for a 5-year period. The following is a summary of the report conclusions and recommendations:

Low Speed (30 mph) Intersections

- Of the intersections sampled, the intersections with STOP control experienced the fewest number of crashes.
- In some cases, YIELD control and NO control can be effective methods of traffic control.
- It is suggested that UNCONTROLLED intersections with three or more crashes associated with right-of-way control in the past three years be studied to determine whether more control is needed.
- It is suggested that YIELD controlled intersections with three or more crashes associated with right-of-way control in the past three years be studied to determine whether STOP control is needed.

High Speed (55 mph) Intersections

- Control type had no appreciable effect on crash experience at the intersections sampled.
- It is suggested that UNCONTROLLED intersections with three or more crashes associated with right-of-way control in the past three years be studied to determine whether more control is needed.
- It is suggested that YIELD controlled intersections with three or more crashes associated with right-of-way control in the last three years be studied to determine whether STOP control is needed.

CHAPTER 1
INTRODUCTION

BACKGROUND

An engineer or an official for a road authority does not have defined guidelines to follow to determine whether a STOP or YIELD sign should be used instead of no sign control. Specific warrants for two-way STOP or YIELD control, indicating volume thresholds or number of crashes, do not exist.

General warrants for the use of STOP signs are found in the Minnesota Manual on Uniform Traffic Control Devices (MMUTCD) (1):

> *Because the STOP sign causes a substantial inconvenience to motorists, it should be used only where warranted. A STOP sign may be warranted at an intersection where one or more of the following conditions exist:*
>
> *1. Intersection of a less important road with a main road where application of the normal right-of-way rule is unduly hazardous.*
>
> *2. Street entering a through highway or street.*
>
> *3. Unsignalized intersection in a signalized area.*
>
> *4. Other intersections where a combination of high speed, restricted view, and serious* [crash] *record indicates a need for control by the STOP sign.*

The MMUTCD (1) also states that:

> *Prior to the application of these warrants, consideration should be given to less restrictive measures, such as the YIELD sign...where a full stop is not necessary at all times. Periodic reviews of existing installations may be desirable to determine whether, because of changed conditions, the use of less restrictive control or no control could accommodate traffic demands safely and more effectively.*

General warrants for the use of YIELD signs are also found in the MMUTCD (1):

> *The YIELD sign may be warranted:*
>
> *1. At the entrance to an intersection where it is necessary to assign right-of-way and where the safe approach speed on the entrance exceeds 10 miles per hour.*
>
> *2. On the entrance ramp to an expressway where an acceleration lane is not provided.*
>
> *3. At intersections on a divided highway where the median between the roadways is more than 30 feet wide. At such intersections, a STOP sign may be used at the entrance to the first roadway of the divided highway and a YIELD sign may be placed at the entrance to the second roadway.*
>
> *4. Where there is a separate or channelized right-turn lane, without an adequate acceleration lane.*

5. At any intersection where a special problem exists and where an engineering study indicates the problem to be susceptible to correction by use of the YIELD sign.

LITERATURE SEARCH

Many studies have been performed regarding the use of traffic control signing at intersections. A few studies have focused on "low volume" intersections.

One of the major reports reviewed was the 1981 report "Stop, Yield, and No Control at Intersections" (2), prepared by the FHWA. Observations and measurements were made at 140 low volume intersections in Texas, Florida, and New York.

Another report reviewed was NCHRP Report 320 titled "Guidelines for Converting Stop to Yield Control at Intersections" (3). This report provides a thorough summary of previous studies on intersection traffic control.

OBJECTIVES

Mn/DOT sponsored this study with the following objectives: 1) to determine the crash experience at low volume intersections with STOP, YIELD, and NO control for low and high speed conditions, and 2) to analyze the crash data and develop conclusions and recommendations on the use of traffic control at low volume intersections.

This study focused on traffic control for four-legged intersections; T-intersections were not analyzed. Also, intersections with four-way STOP control were not analyzed.

REPORT OVERVIEW

The research methods and approach used in this study are discussed in Chapter 2. The discussion in Chapter 3 focuses on previous research and the analysis of the survey and crash data. The conclusions and recommendations of the study are summarized in Chapter 4.

CHAPTER 2

RESEARCH METHODS AND APPROACH

RESEARCH METHODS

To meet the objectives of the study, the following work tasks were defined:

1. Prepare survey forms regarding use of traffic control (YIELD control and NO control) at low volume rural and urban intersections.

2. Mail forms (first mailing) to the seven Mn/DOT District Offices, Minnesota Cities over 5,000 population, and the 87 Minnesota Counties. Conduct follow-up telephone calls.

3. Review returned survey forms. Select volume ranges and intersection characteristics representative of intersections with YIELD control and NO control.

4. Prepare survey forms regarding use of STOP control at intersections with volume ranges and characteristics selected.

5. Mail forms (second mailing) to the agencies listed in Task 2.

6. Review returned survey forms.

7. Select 25 low volume intersections for each of the following parameters:

   STOP Control - Low Speed
   STOP Control - High Speed
   YIELD Control - Low Speed
   YIELD Control - High Speed
   NO Control - Low Speed
   NO Control - High Speed

8. Obtain crash records from Mn/DOT for the most recent 5-year period.

9. Analyze crash data and prepare a report stating findings and conclusions.

RESEARCH APPROACH

Survey forms were prepared and mailed to the agencies noted under RESEARCH METHODS, to obtain information on their use of YIELD control and NO control at four-legged low volume intersections. Copies of the forms are included in Appendix A.

The agencies were asked whether they had any YIELD controlled or UNCONTROLLED intersections. They were also asked to identify the documented criteria (traffic volumes, surface type, speeds, sight distance, etc.) used to establish the type of intersection control used in their jurisdiction.

The forms had tables for the agency to provide data on up to five intersections with YIELD control or NO control. Data included main road and cross road speed limits, traffic volume ranges, surface type (paved/unpaved), and sight distance.

Agencies were not expected to perform traffic counts or to measure sight distances in the field. Traffic volumes were provided by checking a box for a range of values, e.g., <100 vehicles per day (vpd), 100-500 vpd, etc. Sight distance was either "Unobstructed", "Obstructed (Bldg., Terrain, etc.)" or "Obstructed (Crops)".

It was determined, from a review of the survey forms returned, that a sufficient number of intersections (25 in each category - low speed and high speed with YIELD control or NO control) with volumes below 500 vpd on each roadway and unobstructed sight distance, would be available for analysis. "General practice has been to classify all intersections of minor roadways with less than 500 vpd with any other roadway as low volume intersections" (2).

A second survey form was sent to the same agencies that were sent the previous survey. The agencies were asked to provide data on up to five intersections with STOP control of the cross road, less than 500 vpd on each roadway, and unobstructed sight distance. Copies of the forms are included in Appendix B.

CHAPTER 3
ANALYSIS

LITERATURE REVIEW

The report "Guidelines for Converting Stop to Yield Control at Intersections" (3) provided an excellent review of previous studies. A summary of those reviews includes the following:

> 1. *Control type has no discernible effect on* [crash] *experience for "low volume" intersections.*
>
> 2. *Conversions of STOP to YIELD control at "low volume" intersections have been met with mixed results of* [crash] *change with evidence of increases, no change and decreases.*
>
> 3. *Many of the warrants reviewed required a minimum number of* [crashes] *before changing from NO control to YIELD control. These ranged from less than one* [crash] *per year to as high as five per year.*

The key findings of the report relevant to this study included:

> 1. *Intersections converted from STOP to YIELD control are likely to experience an increase in* [crashes], *especially at higher traffic volumes. The expected* [crash] *increase is about one* [crash] *every 2 years.*
>
> 2. [Crash] *severity and distribution did not significantly change after conversion from STOP to YIELD.*

3. *Converted YIELD control intersections have a higher* [crash] *rate than established YIELD control intersections.*

4. *Because of reduced motorist delay, fuel cost and other vehicle operating costs, YIELD control is more cost effective than STOP control at all volume levels studied.*

The guidelines for conversion of STOP to YIELD control were identified as follows:

1. *Have adequate sight distance.*

2. *Intersection volume less than 1,800 ADT, major street volume less than 1,500 ADT, and minor street volume less than 600 ADT are potential conversion candidates.*

3. *Intersections experiencing less than three* [crashes] *in 2 years are candidates for conversion.*

The FHWA study "Stop, Yield, and No Control at Intersections" (2) was an in-depth study that included determination of travel times, observation of driver behavior, and benefit-cost analyses. Conclusions of the study included:

1. *The effect of control type on* [crash] *potential at low volume intersections is not appreciable.*

2. *Control type does result in significantly different travel times, with STOP control requiring the longest travel time and YIELD control the shortest.*

The following Table 3.1 summarizes the control criteria suggested by the report:

TABLE 3.1

Control Criteria Summary

Sight Distance	Number of Crashes (Last 3 Years)	Major Roadway Volume	
		≤ 2000 vpd	> 2000 vpd
Adequate	0	NO Control	
	≤ 2	YIELD	
	3	STOP*	
	4+	STOP	
Not Adequate			

* If minor roadway is greater than 300 vpd, YIELD control is appropriate for intersections with less than 4 crashes in 3 years.

SURVEY DATA

The following Table 3.2 summarizes the responses to the two surveys:

TABLE 3.2

Survey Response Summary

Agency Type	Number Of Surveys Mailed	Number (%) Of Surveys Returned	Agency Responses			
			Number (% of Respondents) That Have UNCONTROLLED Intersections	Number That Have Documented Standards For Use	Number (% of Respondents) That Have YIELD Controlled Intersections	Number That Have Documented Standards For Use
Cities	119	47 (39%)	33 (70%)	15	27 (57%)	11
Counties	87	67 (77%)	18 (27%)	5	51 (76%)	17
Mn/DOT Districts	7	5 (71%)	---	---	1 (20%)	---
TOTALS	213	119 (56%)	51	20	79	28

A summary of survey responses is included Appendix C.

INTERSECTION SELECTION

Twenty-five intersections for each of the following parameters were selected for analysis:

Low Speed	High Speed
NO Control	NO Control
YIELD Control	YIELD Control
STOP Control	STOP Control

All of the intersections had the following characteristics:

1. Traffic volumes <500 per day on each roadway

2. Unobstructed sight distance

The "low speed" intersections were taken from the City responses. Speed limits are 30 mph and the roadways are paved. The "high speed" intersections were taken from the County responses. Speed limits are 55 mph and the roadways are both paved and unpaved. The selected intersections are shown in Appendix D.

Intersections provided by Mn/DOT District offices were not selected since intersections with a State Trunk Highway may not be representative of intersections generally located in Minnesota. Only one of the five Districts that returned Survey Form No. 1 utilizes YIELD control, and none have UNCONTROLLED intersections. Also, trunk highways are generally a higher type roadway with a higher grade sheeting on the signs controlling the cross road.

CRASH HISTORY

Mn/DOT searched for and obtained crash reports for the selected intersections for the 1991-1995 period. The number of crashes at each intersection is shown in Appendix D. A summary of the crash data is shown in the following Table 3.3:

TABLE 3.3

Crash Data Summary

Speed/Type of Control	Number of Intersections	Number of Crashes (1991-1995)	95% Confidence Interval (# of Crashes)
Low Speed (30 mph)			
NO Control	25	23*	19-27
YIELD Control	25	16**	13-19
STOP Control	25	1	0-2
High Speed (55 mph)			
NO Control	25	2	1-3
YIELD Control	25	0	---
STOP Control	25	7	6-8

* 14 of the 23 crashes occurred at two intersections.

** 6 of the 16 crashes occurred at one intersection.

Notes:

1. Crashes include only two-vehicle crashes associated with right-of-way control.

2. Contributing factors were usually noted as "failure to yield right-of-way" or "disregarded traffic control device" and sometimes "driver inattention/distraction" or "illegal/unsafe speed".

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Past studies have concluded that:

1. Control type has no appreciable effect on crash experience at low volume intersections.

2. Travel time is significantly affected by signing, with STOP control producing the longest travel time and YIELD control the shortest (2).

3. Even with the anticipated increase in crashes, YIELD control is more cost effective than STOP control.

LOW SPEED INTERSECTIONS

1. Of the low speed intersections sampled, the 25 intersections with STOP control experienced the fewest number of crashes (one crash) during the 1991-1995 period.

2. Of the low speed intersections sampled, the 25 intersections with YIELD control and the 25 UNCONTROLLED intersections experienced a total of 16 and 25 crashes, respectively, during the 1991-1995 period.

3. In some cases, YIELD control and NO control can be effective methods of traffic control at low volume, low speed intersections. There were no crashes at 17 of the 25 YIELD controlled intersections and at 17 of the 25 UNCONTROLLED intersections during the 1991-1995 period.

4. It is suggested that UNCONTROLLED intersections with three or more crashes associated with right-of-way control in the past three years be studied to determine whether more control is needed.

5. It is suggested that YIELD controlled intersections with three or more crashes associated with right-of-way control in the past three years be studied to determine whether the intersections should be converted to STOP control.

   Note: There is no specific criteria to substantiate the number of crashes used as the threshold in items 4 and 5 above. However, three crashes in three years is within the range cited in Ref. (3) for converting from an UNCONTROLLED to a YIELD controlled intersection (see page 7 of this report).

HIGH SPEED INTERSECTIONS

1. Control type had no appreciable effect on crash experience at the high speed intersections sampled. The 25 UNCONTROLLED intersections, the 25 YIELD controlled intersections, and the 25 STOP controlled intersections experienced two, zero, and seven crashes, respectively, during the 1991-1995 period.

2. It is suggested that UNCONTROLLED intersections with three or more crashes associated with right-of-way control in the past three years be studied to determine whether more control is needed.

3. It is suggested that YIELD controlled intersections with three or more crashes associated with right-of-way control in the last three years be studied to determine whether the intersections should be converted to STOP control.

   Note: There is no specific criteria to substantiate the number of crashes used as the threshold in items 2 and 3 above. However, three crashes in three years is within the range cited in Ref. (3) for converting from an UNCONTROLLED to a YIELD controlled intersection (see page 7 of this report).

REFERENCES

(1) Minnesota Department of Transportation, Minnesota Manual on Uniform Traffic Control Devices, Saint Paul, Minnesota, 1991.

(2) Stockton, W.R., Brackett, R.Q., and Mounce, J.M., "Stop, Yield, and No Control at Intersections," Report No. FHWA-RD-81-084, Washington, D.C., Federal Highway Administration, June 1981.

(3) McGee, H.W., and Blankenship, M.R., "Guidelines for Converting Stop to Yield Control at Intersections," NCHRP Report 320, Washington, D.C., Transportation Research Board, 1989.

Appendix A

Survey Form No. 1

Minnesota Department of Transportation
Survey Form
Traffic Control at Low Volume Intersections

City _____

Survey completed by _____
(please print) *Name* *Title*

Phone No. (____) _____

In your City at 4-legged, unsignalized intersections when the main road is under your jurisdiction, please answer the following:

1. Do any intersections have no signs (stop or yield) controlling the intersection?

   Yes _____ No _____

   (If yes, go to number 2)
   (If no, go to number 4)

2. Do you have documented standards which state the criteria under which an intersection would not be controlled by a stop or yield sign?

   Yes _____ No _____

   If yes, which of the following criteria are considered?

   _____ Traffic volumes
   _____ Surface Type
   _____ Speeds
   _____ Sight distance
   _____ Other *(list criteria)*
   _____

3. Select up to five intersections that have no signs (stop or yield) controlling the intersection. Please provide as much of the following information as possible:

ROADWAY INFORMATION	Intersection 1		2		3		4		5	
	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road
Street Name										
Speed Limit										
Traffic Volume (ADT) (mark with X): <100 vehicles/day										
100-500 vehicles per day										
500-1000 vehicles per day										
1000-1500 vehicles per day										
>1500 vehicles per day										
Surface (P=Paved, U=Unpaved)										
Sight Distance (mark with X): Unobstructed										
Obstructed (Bldg., Terrain, etc.)										
Obstructed (Crops)										

4. Are any intersections controlled by yield signs?

Yes _____ No _____

(If yes, go to number 5)
(If no, go to number 7)

5. Do you have documented standards which state the criteria under which an intersection would be controlled by a yield sign?

Yes _____ No _____

If yes, which of the following criteria are considered?

_____ Traffic volumes

_____ Surface Type

_____ Speeds

_____ Sight distance

_____ Other *(list criteria)*

_____

6. Select up to five intersections that are controlled by yield signs. Please provide as much of the following information as possible:

ROADWAY INFORMATION	Intersection 1		2		3		4		5	
	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road
Street Name										
Speed Limit										
Traffic Volume (ADT) (mark with X): <100 vehicles/day										
100-500 vehicles per day										
500-1000 vehicles per day										
1000-1500 vehicles per day										
>1500 vehicles per day										
Surface (P=Paved, U=Unpaved)										
Sight Distance (mark with X): Unobstructed	X		X		X		X		X	
Obstructed (Bldg., Terrain, etc.)										
Obstructed (Crops)										

7. Thank you for taking the time to complete this survey. If you have any questions, please call Tim Chalupnik at (612) 292-4430. Mail the completed survey to:

Tim Chalupnik
TKDA
444 Cedar Street, Suite 1500
St. Paul, MN 55101-2140

Minnesota Department of Transportation
Survey Form
Traffic Control at Low Volume Intersections

County _____

Survey completed by _____
(please print) *Name* *Title*

Phone No. (____) _____

In your County at 4-legged, unsignalized intersections when the main road is either a County Road or a township road, please answer the following:

1. Do any intersections have no signs (stop or yield) controlling the intersection?

   Yes _____ No _____

   (If yes, go to number 2)
   (If no, go to number 4)

2. Do you have documented standards which state the criteria under which an intersection would not be controlled by a stop or yield sign?

   Yes _____ No _____

   If yes, which of the following criteria are considered?

   _____ Traffic volumes
   _____ Surface Type
   _____ Speeds
   _____ Sight distance
   _____ Other *(list criteria)*
   _____

3. Select up to five intersections that have no signs (stop or yield) controlling the intersection. Please provide as much of the following information as possible:

ROADWAY INFORMATION	Intersection 1		2		3		4		5	
	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road
Roadway Name										
Speed Limit										
Traffic Volume (ADT) (mark with X):										
<100 vehicles/day										
100-500 vehicles per day										
500-1000 vehicles per day										
1000-1500 vehicles per day										
>1500 vehicles per day										
Surface (P=Paved, U=Unpaved)										
Sight Distance (mark with X):										
Unobstructed										
Obstructed (Bldg., Terrain, etc.)										
Obstructed (Crops)										

4. Are any intersections controlled by yield signs?

Yes _____ No _____

(If yes, go to number 5)
(If no, go to number 7)

5. Do you have documented standards which state the criteria under which an intersection would be controlled by a yield sign?

Yes _____ No _____

If yes, which of the following criteria are considered?

_____ Traffic volumes

_____ Surface Type

_____ Speeds

_____ Sight distance

_____ Other *(list criteria)*

_____

6. Select up to five intersections that are controlled by yield signs. Please provide as much of the following information as possible:

ROADWAY INFORMATION	Intersection 1		2		3		4		5	
	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road
Roadway Name										
Speed Limit										
Traffic Volume (ADT) (mark with X):										
<100 vehicles/day										
100-500 vehicles per day										
500-1000 vehicles per day										
1000-1500 vehicles per day										
>1500 vehicles per day										
Surface (P=Paved, U=Unpaved)										
Sight Distance (mark with X):	X		X		X		X		X	
Unobstructed										
Obstructed (Bldg., Terrain, etc.)										
Obstructed (Crops)										

7. Thank you for taking the time to complete this survey. If you have any questions, please call Tim Chalupnik at (612) 292-4430. Mail the completed survey to:

Tim Chalupnik
TKDA
444 Cedar Street, Suite 1500
St. Paul, MN 55101-2140

Minnesota Department of Transportation
Survey Form
Traffic Control at Low Volume Intersections

Mn/DOT District _____

Survey completed by _____
(please print) *Name* *Title*

Phone No. (____) _____

In your District at 4-legged, unsignalized intersections when the main road is a trunk highway, please answer the following:

1. Do any intersections have no signs (stop or yield) controlling the intersection?

   Yes _____ No _____

   (If yes, go to number 2)
   (If no, go to number 4)

2. Do you have documented standards which state the criteria under which an intersection would not be controlled by a stop or yield sign?

   Yes _____ No _____

   If yes, which of the following criteria are considered?

   _____ Traffic volumes
   _____ Surface Type
   _____ Speeds
   _____ Sight distance
   _____ Other *(list criteria)*
   _____

3. Select up to five intersections that have no signs (stop or yield) controlling the intersection. Please provide as much of the following information as possible:

ROADWAY INFORMATION	Intersection 1		2		3		4		5	
	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road
Roadway Name										
Speed Limit										
Traffic Volume (ADT) (mark with X): <100 vehicles/day										
100-500 vehicles per day										
500-1000 vehicles per day										
1000-1500 vehicles per day										
>1500 vehicles per day										
Surface (P=Paved, U=Unpaved)										
Sight Distance (mark with X): Unobstructed										
Obstructed (Bldg., Terrain, etc.)										
Obstructed (Crops)										

4. Are any intersections controlled by yield signs?

Yes _____ No _____

(If yes, go to number 5)
(If no, go to number 7)

5. Do you have documented standards which state the criteria under which an intersection would be controlled by a yield sign?

Yes _____ No _____

If yes, which of the following criteria are considered?

_____ Traffic volumes

_____ Surface Type

_____ Speeds

_____ Sight distance

_____ Other *(list criteria)*

_____

6. Select up to five intersections that are controlled by yield signs. Please provide as much of the following information as possible:

ROADWAY INFORMATION	Intersection 1		2		3		4		5	
	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road
Roadway Name										
Speed Limit										
Traffic Volume (ADT) (mark with X):										
<100 vehicles/day										
100-500 vehicles per day										
500-1000 vehicles per day										
1000-1500 vehicles per day										
>1500 vehicles per day										
Surface (P=Paved, U=Unpaved)										
Sight Distance (mark with X):	X		X		X		X		X	
Unobstructed										
Obstructed (Bldg., Terrain, etc.)										
Obstructed (Crops)										

7. Thank you for taking the time to complete this survey. If you have any questions, please call Tim Chalupnik at (612) 292-4430. Mail the completed survey to:

Tim Chalupnik
TKDA
444 Cedar Street, Suite 1500
St. Paul, MN 55101-2140

Appendix B

Survey Form No. 2

Minnesota Department of Transportation
Survey Form
Traffic Control at Low Volume Intersections

City _____

Survey completed by _____
(please print) *Name* *Title*

Phone No. (____) _____

Please provide information on up to five intersections when the main road is under your jurisdiction, and the intersections have the following characteristics:

* Four-legged intersection controlled by stop signs on cross road
* Speed limit of the main road is 30 mph
* Traffic volume of the main road is less than 500 vehicles per day
* Roadway surfaces are all paved
* Sight distance is unobstructed

ROADWAY INFORMATION	Intersection 1		2		3		4		5	
	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road
Street Name										
Speed Limit	30		30		30		30		30	
Cross Road Traffic Volume (ADT) (mark with X):										
<100 vehicles/day	X		X		X		X		X	
100-500 vehicles per day	X		X		X		X		X	

Thank you for taking the time to complete this survey. If you have any questions, please call Tim Chalupnik at (612) 292-4430. Mail the completed survey to:

Tim Chalupnik
TKDA
444 Cedar Street, Suite 1500
St. Paul, MN 55101-2140

Minnesota Department of Transportation
Survey Form
Traffic Control at Low Volume Intersections

County _____

Survey completed by _____
(please print) *Name* *Title*

Phone No. (____) _____

Please provide information on up to five intersections when the main road is either a county road or a township road, and the intersections have the following characteristics:

* Four-legged intersection controlled by stop signs on cross road
* Speed limit of the main road is 55 mph
* Traffic volume of the main road is less than 500 vehicles per day
* Sight distance is unobstructed

ROADWAY INFORMATION	Intersection 1		2		3		4		5	
	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road
Roadway Name										
Speed Limit	55		55		55		55		55	
Cross Road Traffic Volume (ADT) (mark with X):										
<100 vehicles/day	X		X		X		X		X	
100-500 vehicles per day	X		X		X		X		X	
Surface (P = Paved, U = Unpaved)										

___ (x) if you have no intersection with the stated characteristics.

Thank you for taking the time to complete this survey. If you have any questions, please call Tim Chalupnik at (612) 292-4430. Mail the completed survey to:

Tim Chalupnik
TKDA
444 Cedar Street, Suite 1500
St. Paul, MN 55101-2140

Minnesota Department of Transportation
Survey Form
Traffic Control at Low Volume Intersections

Mn/DOT District # _____

Survey completed by _____
(please print) *Name* *Title*

Phone No. (____) _____

Please provide information on up to five intersections when the main road is a trunk highway, and the intersections have the following characteristics:

* Four-legged intersection controlled by stop signs on cross road
* Speed limit of the main road is 55 mph
* Traffic volume of the main road is less than 500 vehicles per day
* Sight distance is unobstructed

ROADWAY INFORMATION	Intersection 1		2		3		4		5	
	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road	Main Road	Cross Road
Roadway Name										
Speed Limit	55		55		55		55		55	
Cross Road Traffic Volume (ADT) (mark with X):										
<100 vehicles/day	X		X		X		X		X	
100-500 vehicles per day	X		X		X		X		X	
Surface (P = Paved, U = Unpaved)										

___ (x) if you have no intersection with the stated characteristics.

Thank you for taking the time to complete this survey. If you have any questions, please call Tim Chalupnik at (612) 292-4430. Mail the completed survey to:

Tim Chalupnik
TKDA
444 Cedar Street, Suite 1500
St. Paul, MN 55101-2140

Appendix C

Survey Summaries

CITY SURVEY SUMMARY

NO.	CITY	SURVEY NO. 1 RETURNED	Questions Answered "Yes" or "No"								Intersection Information Provided		SURVEY NO. 2 RETURNED	SURVEY NO. 2 Intersection Information Provided
			No. 1		No. 2		No. 4		No. 5		No Control (Table 3)	Yield Control (Table 6)		
			Yes	No	Yes	No	Yes	No	Yes	No				
1	Albert Lea	✓	✓			✓	✓			✓	✓	✓	✓	✓
2	Alexandria													
3	Andover													
4	Anoka													
5	Apple Valley	✓	✓		✓			✓			✓			
6	Arden Hills													
7	Austin													
8	Bemidji	✓	✓			✓		✓		✓	✓		✓	
9	Blaine													
10	Bloomington													
11	Brainerd													
12	Brooklyn Center	✓	✓		✓		✓			✓				
13	Brooklyn Park	✓	✓			✓	✓		✓		✓	✓		
14	Buffalo	✓	✓		✓	✓	✓		✓	✓	✓	✓		
15	Burnsville	✓	✓		✓		✓		✓		✓	✓	✓	✓
16	Cambridge													
17	Champlin													
18	Chanhassen													
19	Chaska	✓	✓			✓	✓			✓			✓	
20	Chisholm												✓	✓
21	Cloquet	✓		✓		✓		✓		✓				
22	Columbia Heights													
23	Coon Rapids	✓	✓			✓		✓			✓			
24	Corcoran													
25	Cottage Grove													
26	Crookston												✓	✓
27	Crystal													
28	Detroit Lakes													
29	Duluth	✓		✓			✓		✓			✓	✓	✓
30	Eagan													
31	East Bethel	✓		✓				✓					✓	
32	East Grand Forks													
33	Eden Prairie	✓											✓	✓
34	Edina	✓	✓		✓		✓		✓		✓			
35	Elk River	✓	✓			✓		✓			✓			
36	Fairmont													
37	Falcon Heights	✓		✓				✓						
38	Faribault	✓	✓			✓	✓			✓	✓	✓		
39	Farmington													
40	Fergus Falls													
41	Forest Lake													
42	Fridley	✓	✓		✓		✓			✓	✓	✓	✓	✓
43	Golden Valley													
44	Grand Rapids	✓	✓		✓			✓			✓			

CITY SURVEY SUMMARY

NO.	CITY	SURVEY NO. 1 RETURNED	Questions Answered "Yes" or "No"								Intersection Information Provided		SURVEY NO. 2 RETURNED	SURVEY NO. 2 Intersection Information Provided
			No. 1		No. 2		No. 4		No. 5		No Control (Table 3)	Yield Control (Table 6)		
			Yes	No	Yes	No	Yes	No	Yes	No				
45	Ham Lake													
46	Hastings	✓	✓			✓	✓		✓		✓	✓		
47	Hermantown	✓		✓				✓					✓	✓
48	Hibbing													
49	Hopkins	✓	✓		✓		✓		✓		✓		✓	✓
50	Hugo													
51	Hutchinson	✓		✓			✓			✓			✓	✓
52	International Falls													
53	Inver Grove Heights													
54	Lake Elmo												✓	✓
55	Lakeville	✓		✓				✓						
56	Lino Lakes													
57	Litchfield													
58	Little Canada													
59	Little Falls													
60	Mahtomedi													
61	Mankato													
62	Maple Grove	✓	✓		✓		✓			✓	✓	✓	✓	
63	Maplewood	✓	✓			✓	✓			✓				
64	Marshall	✓	✓			✓		✓		✓	✓	✓	✓	✓
65	Mendota Heights	✓	✓			✓	✓			✓	✓	✓		
66	Minneapolis	✓	✓			✓		✓						
67	Minnetonka													
68	Montevideo													
69	Monticello													
70	Moorhead													
71	Morris													
72	Mound													
73	Mounds View													
74	New Brighton	✓	✓		✓		✓		✓		✓	✓	✓	✓
75	New Hope	✓	✓			✓	✓			✓	✓		✓	✓
76	New Ulm													
77	North Branch													
78	North Mankato													
79	North St. Paul	✓		✓				✓						
80	Northfield													
81	Oak Grove													
82	Oakdale	✓		✓				✓					✓	✓
83	Orono													
84	Otsego													
85	Owatonna													
86	Plymouth													
87	Prior Lake													
88	Ramsey													

CITY SURVEY SUMMARY

NO.	CITY	SURVEY NO. 1 RETURNED	Questions Answered "Yes" or "No"								Intersection Information Provided		SURVEY NO. 2 RETURNED	Intersection Information Provided
			No. 1		No. 2		No. 4		No. 5		No Control (Table 3)	Yield Control (Table 6)		
			Yes	No	Yes	No	Yes	No	Yes	No				
89	Red Wing													
90	Richfield	✓	✓		✓			✓			✓			
91	Robbinsdale	✓	✓			✓	✓			✓	✓	✓	✓	✓
92	Rochester	✓	✓		✓		✓		✓		✓	✓	✓	
93	Rosemount	✓		✓			✓		✓			✓		
94	Roseville													
95	Sartell													
96	Sauk Rapids	✓	✓			✓	✓			✓	✓	✓	✓	✓
97	Savage												✓	✓
98	Shakopee	✓		✓			✓			✓		✓	✓	✓
99	Shoreview													
100	Shorewood													
101	South St. Paul													
102	Spring Lake Park													
103	St. Anthony													
104	St. Cloud	✓	✓			✓		✓			✓			
105	St. Louis Park	✓	✓			✓		✓					✓	
106	St. Paul	✓		✓		✓	✓			✓		✓		
107	St. Peter	✓	✓		✓		✓		✓		✓	✓		
108	Stillwater													
109	Thief River Falls													
110	Vadnais Heights													
111	Virginia City													
112	Waite Park													
113	Waseca													
114	West St. Paul	✓		✓				✓						
115	White Bear Lake	✓	✓			✓	✓			✓	✓	✓		
116	Willmar												✓	
117	Winona	✓	✓		✓		✓			✓	✓	✓		
118	Woodbury	✓	✓		✓			✓			✓		✓	
119	Worthington													
	TOTALS	47	33	13	15	21	27	19	11	20	28	21	27	19

COUNTY SURVEY SUMMARY

NO.	COUNTY	SURVEY NO. 1											SURVEY NO. 2	
			Questions Answered "Yes" or "No"								Intersection Information Provided			
			No. 1		No. 2		No. 4		No. 5		No Control (Table 3)	Yield Control (Table 6)		
		RETURNED	Yes	No	Yes	No	Yes	No	Yes	No			RETURNED	Intersection Information Provided
1	Aitkin County	✓		✓			✓			✓		✓	✓	✓
2	Anoka County													
3	Becker County	✓		✓			✓			✓		✓	✓	✓
4	Beltrami County													
5	Benton County	✓		✓			✓			✓		✓		
6	Big Stone County	✓	✓			✓	✓		✓		✓	✓	✓	✓
7	Blue Earth County	✓		✓			✓			✓		✓	✓	✓
8	Brown County													
9	Carlton County	✓		✓				✓					✓	✓
10	Carver County	✓		✓				✓					✓	✓
11	Cass County	✓		✓				✓						
12	Chippewa County												✓	✓
13	Chisago County													
14	Clay County	✓		✓			✓		✓			✓	✓	✓
15	Clearwater County	✓		✓			✓		✓			✓	✓	✓
16	Cook County	✓		✓				✓					✓	✓
17	Cottonwood County													
18	Crow Wing County	✓		✓				✓					✓	✓
19	Dakota County	✓	✓			✓	✓			✓	✓	✓	✓	✓
20	Dodge County	✓		✓			✓			✓		✓	✓	✓
21	Douglas County	✓		✓			✓			✓		✓	✓	✓
22	Faribault County	✓	✓		✓		✓							
23	Fillmore County	✓		✓			✓		✓			✓		
24	Freeborn County												✓	✓
25	Goodhue County	✓		✓		✓	✓			✓		✓		
26	Grant County													
27	Hennepin County	✓		✓				✓						
28	Houston County													
29	Hubbard County	✓		✓				✓	✓					
30	Isanti County												✓	✓
31	Itasca County	✓		✓				✓					✓	✓
32	Jackson County	✓		✓		✓	✓			✓		✓	✓	
33	Kanabec County	✓		✓			✓			✓		✓	✓	✓
34	Kandiyohi County	✓		✓			✓			✓		✓		
35	Kittson County													
36	Koochiching County	✓	✓			✓	✓			✓	✓	✓		
37	Lac Qui Parle County													
38	Lake County	✓		✓				✓						
39	Lake of the Woods County	✓		✓			✓			✓			✓	✓
40	LeSueur County												✓	✓
41	Lincoln County	✓		✓			✓			✓				
42	Lyon County	✓	✓		✓		✓							
43	Mahnomen County	✓		✓			✓		✓			✓	✓	
44	Marshall County	✓		✓			✓		✓			✓		

COUNTY SURVEY SUMMARY

NO.	COUNTY	SURVEY NO. 1 RETURNED	Questions Answered "Yes" or "No" No. 1 Yes	No. 1 No	No. 2 Yes	No. 2 No	No. 4 Yes	No. 4 No	No. 5 Yes	No. 5 No	Intersection Information Provided No Control (Table 3)	Intersection Information Provided Yield Control (Table 6)	SURVEY NO. 2 RETURNED	SURVEY NO. 2 Intersection Information Provided
45	Martin County	✓	✓			✓	✓		✓		✓	✓	✓	✓
46	McLeod County	✓	✓			✓	✓			✓	✓	✓	✓	✓
47	Meeker County	✓	✓			✓	✓			✓	✓	✓		
48	Mille Lacs County	✓		✓			✓			✓		✓	✓	✓
49	Morrison County	✓		✓			✓			✓		✓	✓	✓
50	Mower County	✓	✓		✓		✓		✓		✓	✓	✓	✓
51	Murray County	✓	✓			✓	✓			✓	✓	✓	✓	✓
52	Nicollet County	✓		✓			✓			✓			✓	✓
53	Nobles County	✓	✓	✓		✓	✓		✓		✓	✓	✓	✓
54	Norman County	✓	✓		✓		✓		✓		✓	✓		
55	Olmsted County	✓		✓			✓			✓		✓	✓	✓
56	Otter Tail County	✓		✓		✓		✓		✓				
57	Pennington County	✓		✓		✓	✓			✓		✓	✓	✓
58	Pine County	✓		✓			✓			✓		✓		
59	Pipestone County	✓	✓			✓	✓			✓	✓	✓		
60	Polk County	✓		✓			✓		✓			✓	✓	✓
61	Pope County	✓		✓		✓	✓			✓		✓	✓	✓
62	Ramsey County	✓		✓				✓					✓	
63	Red Lake County	✓		✓			✓			✓		✓	✓	✓
64	Redwood County	✓		✓		✓	✓			✓		✓	✓	✓
65	Renville County	✓	✓		✓		✓		✓		✓	✓	✓	
66	Rice County													
67	Rock County	✓		✓			✓			✓		✓	✓	✓
68	Roseau County													
69	Scott County	✓		✓				✓					✓	✓
70	Sherburne County	✓		✓				✓					✓	✓
71	Sibley County	✓		✓				✓					✓	✓
72	St. Louis County												✓	✓
73	Steams County													
74	Steele County	✓	✓			✓		✓		✓	✓	✓	✓	✓
75	Stevens County	✓		✓			✓			✓		✓		
76	Swift County	✓		✓			✓		✓			✓	✓	✓
77	Todd County	✓		✓			✓		✓			✓	✓	✓
78	Traverse County	✓	✓			✓	✓			✓	✓	✓	✓	
79	Wabasha County	✓	✓			✓	✓			✓			✓	✓
80	Wadena County	✓		✓			✓		✓			✓	✓	✓
81	Waseca County												✓	✓
82	Washington County	✓		✓			✓					✓		
83	Watonwan County	✓		✓			✓		✓			✓		
84	Wilkin County													
85	Winona County													
86	Wright County	✓		✓				✓						
87	Yellow Medicine County	✓	✓			✓	✓			✓	✓	✓	✓	✓
	TOTALS	67	18	50	5	19	51	16	17	34	15	46	51	46

Mn/DOT DISTRICT SURVEY SUMMARY

		SURVEY NO. 1											SURVEY NO. 2	
			Questions Answered "Yes" or "No"								Intersection Information Provided			
			No. 1		No. 2		No. 4		No. 5		No Control	Yield Control		Intersection Information
NO.	DISTRICT	RETURNED	Yes	No	Yes	No	Yes	No	Yes	No	(Table 3)	(Table 6)	RETURNED	Provided
1	1	✓		✓				✓					✓	✓
2	2	✓		✓				✓						
3	3	✓		✓			✓					✓	✓	✓
4	4												✓	✓
5	6													
6	7	✓		✓				✓					✓	✓
7	8	✓		✓				✓					✓	✓
	TOTALS	5		5			1	4				1	5	5

Appendix D

Intersections Analyzed

INTERSECTIONS ANALYZED UNCONTROLLED 30 M.P.H.			
CITY	MAIN ROAD	CROSS ROAD	NUMBER OF CRASHES (1991-1995)
ALBERT LEA	CAMARY DR.	SPARTAN AVE.	0
ALBERT LEA	LEE PLACE	GORDON LN.	0
APPLE VALLEY	EASTER AVE.	ECHO	0
COON RAPIDS	MISS. BLVD.	LINNET ST.	0
COON RAPIDS	COTTONWOOD ST.	119TH AVE.	0
EDINA	ST. JOHNS	WOODLAND	1
FARIBAULT	1st AVE. NW	9th ST. NW	1
GRAND RAPIDS	1st AVE. SW	3rd ST. SW	0
GRAND RAPIDS	8th AVE. SW	5th ST. SW	0
MARSHALL	HILL ST.	CENTRAL AVE.	0
NEW BRIGHTON	SUNNYSIDE TRL.	17th AVE.	2
NEW BRIGHTON	20th AVE. NW	18th ST. NW	0
RICHFIELD	64th ST.	15th AVE.	2
ROBBINSDALE	ZENITH	41st AVE.	2
ROBBINSDALE	EWING	43rd AVE.	0
ROCHESTER	9th AVE. NE	16th ST. NE	0
ROCHESTER	46th AVE. NW	8th ST.	0
SAUK RAPIDS	10th AVE. N.	4th ST. N.	0
SAUK RAPIDS	8th AVE. N.	1st ST. N.	0
ST. CLOUD	17th ST. SE	10th AVE. SE	1
ST. CLOUD	2nd ST. S.	DANORA PL.	0
ST. PETER	S. 5th ST.	NASSAU	8
ST. PETER	S. 4th ST.	W. ELM	6
WINONA	VALLEY TRL. DR.	OAK PARK CT.	0
WINONA	EDGEWOOD	SUNSET	0
TOTAL			23

INTERSECTIONS ANALYZED YIELD CONTROL 30 M.P.H.			
CITY	MAIN ROAD	CROSS ROAD	NUMBER OF CRASHES (1991-1995)
ALBERT LEA	JOHNSON ST.	MINNESOTA AVE.	2
BROOKLYN CENTER	JUNE AVE. N.	65th AVE. N.	1
BROOKLYN CENTER	KYLE AVE. N.	65th AVE. N.	0
BROOKLYN CENTER	TOLEDO AVE. N.	65TH AVE. N.	0
BURNSVILLE	131st ST.	14th AVE.	0
BURNSVILLE	131st ST.	OAKLAND DR.	0
BURNSVILLE	125th ST.	SKYLINE DR.	0
BURNSVILLE	KEATING AVE.	KEATING CT.	0
CHASKA	W. 4th	CEDAR	0
CHASKA	E. 3rd	ASH	1
CHASKA	E. 3rd	OAK	0
EDINA	LANHAM LANE	FLEETWOOD DR.	0
EDINA	KEMRICH	FLEETWOOD DR.	0
HASTINGS	12th ST.	SPRING ST.	3
HASTINGS	4th ST.	FOREST ST.	0
MARSHALL	2nd ST.	DONITA AVE.	0
MARSHALL	HACKBERRY	DOGWOOD	0
MARSHALL	ROBERT	DESCHEPPER	1
MARSHALL	S. 2nd	JAMES	0
MARSHALL	CHERYL	DONITA	0
NEW BRIGHTON	FOREST LK. RD.	REDWOOD LN.	1
ROBBINSDALE	GRIMES	HALGLO	0
ROBBINSDALE	38th AVE.	ABBOTT	6
ST. PETER	S. 4th ST.	W. NASSAU	0
ST. PETER	S. 4th ST.	W. PARK ROW	1
TOTAL			16

INTERSECTIONS ANALYZED STOP CONTROL 30 M.P.H.			
CITY	MAIN ROAD	CROSS ROAD	NUMBER OF CRASHES (1991-1995)
ALBERT LEA	CLAUSEN AVE.	HIGH ST.	0
ALBERT LEA	GARDEN RD.	RIDGE RD.	0
BURNSVILLE	OAKLAND DR.	132nd ST.	0
BURNSVILLE	WASHBURN AVE.	VINCENT CIRCLE	0
CHISHOLM	9 1/2 ST. NW	2nd AVE. NW	0
CROOKSTON	CENTRAL AVE.	ALEXANDER	0
CROOKSTON	MAIN	5th ST.	0
CROOKSTON	WALSH ST.	4th AVE. NE	1
EDEN PRAIRIE	JACKSON DR.	MEADE LN.	0
HERMANTOWN	HERMANTOWN RD.	OLD MIDWAY RD.	0
HOPKINS	GOODRICH ST.	HAWTHORNE RD.	0
HUTCHINSON	GOEBEL ST.	GRAHAM ST.	0
HUTCHINSON	SUNSET ST.	CHICAGO AV. SW	0
LAKE ELMO	LAVERNE	36th ST. N.	0
MARSHALL	JAMES AVE.	VIKING DR.	0
MARSHALL	DOGWOOD AVE.	SILVERVINE DR.	0
MARSHALL	LAWRENCE ST.	DESCHEPPER ST.	0
ROBBINSDALE	ZENITH	38th AVE. N.	0
ROBBINSDALE	GRIMES	35th AVE. N.	0
ROBBINSDALE	ZANE	40th AVE. N.	0
SAUK RAPIDS	8th AVE.	3rd ST. S.	0
SAUK RAPIDS	3rd AVE. S.	11th ST. S.	0
SAUK RAPIDS	5th AVE. N.	6th ST. N.	0
SHAKOPEE	SHAKOPEE	DAKOTA	0
SHAKOPEE	FULLER	5th	0
TOTAL			1

INTERSECTIONS ANALYZED UNCONTROLLED 55 M.P.H.			
COUNTY	MAIN ROAD	CROSS ROAD	NUMBER OF CRASHES (1991-1995)
BIG STONE	C.S.A.H. 2	C.R. 71	0
BIG STONE	C.R. 52	C.R. 65	0
BIG STONE	C.S.A.H. 4	C.R. 59	0
BIG STONE	C.R. 60	C.R. 63	0
BIG STONE	C.R. 64	C.R. 67	0
BIG STONE	C.R. 71	C.R. 77	0
DAKOTA	180th ST. E.	EMERY AVE.	0
DAKOTA	220th ST. E.	MICHAEL AVE.	0
DAKOTA	205th ST. E.	INGA AVE.	0
NOBLES	TWP. 13	TWP. 120	0
NOBLES	TWP. 7	TWP. 120	0
NORMAN	C.R. 122	C.R. 185A	0
NORMAN	C.S.A.H. 24	C.S.A.H. 33	0
NORMAN	C.S.A.H. 5	C.R. 148	0
PIPESTONE	C.R. 67	C.R. 68	0
RENVILLE	C.R. 69	TWP. 98	0
RENVILLE	C.R. 61	TWP. 38	0
RENVILLE	C.R. 67	TWP. 93	1
RENVILLE	C.R. 54	TWP. 29	0
RENVILLE	C.R. 74	TWP. 122	0
RENVILLE	C.R. 58	TWP. 40	0
RENVILLE	C.R. 55	TWP. 15	0
RENVILLE	C.R. 60	TWP. 317	0
RENVILLE	C.R. 57	TWP. 25	0
RENVILLE	C.R. 59	TWP. 32	1
TOTAL			2

INTERSECTIONS ANALYZED YIELD CONTROL 55 M.P.H.			
COUNTY	MAIN ROAD	CROSS ROAD	NUMBER OF CRASHES (1991-1995)
BECKER	C.R. 126	TWP. 50	0
BIG STONE	C.R. 6	C.R. 71	0
CLEARWATER	C.R. 13	C.R. 30	0
DOUGLAS	C.S.A.H. 15	C.R. 56	0
KANABEC	C.R. 55	C.R. 53	0
KANDIYOHI	C.R. 80	TWP. 9	0
MARSHALL	C.S.A.H. 20	C.S.A.H. 33	0
MCLEOD	C.R. 57	C.R. 51	0
MILLE LACS	C.R. 105	C.R. 119	0
MURRAY	C.R. 30	C.R. 77	0
MURRAY	C.R. 28	C.R. 86	0
PENNINGTON	C.R. 58	C.R. 67	0
PIPESTONE	C.S.A.H. 6	TWP. 88	0
PIPESTONE	C.S.A.H. 16	C.R. 82	0
POLK	C.R. 45	C.R. 16	0
POPE	C.R. 20	C.R. 33	0
RED LAKE	C.S.A.H. 1	TWP. 33	0
REDWOOD	C.R. 12	C.R. 65	0
REDWOOD	C.R. 19	C.R. 54	0
RENVILLE	C.S.A.H. 16	TWP. 108	0
RENVILLE	C.S.A.H. 11	C.R. 61	0
ROCK	C.R. 59	TWP. 70	0
ROCK	C.R. 55	TWP. 51	0
STEVENS	C.S.A.H. 13	TWP. 58	0
STEVENS	C.S.A.H. 75	TWP. 8	0
TOTAL			0

INTERSECTIONS ANALYZED STOP CONTROL 55 M.P.H.			
COUNTY	MAIN ROAD	CROSS ROAD	NUMBER OF CRASHES (1991-1995)
BECKER	C.S.A.H. 13	C.S.A.H. 12	0
BIG STONE	C.S.A.H. 6	C.S.A.H. 21	0
BLUE EARTH	C.R. 39	C.R. 163	0
DAKOTA	C.R. 51	270th ST. E.	0
DOUGLAS	C.S.A.H. 4	C.S.A.H. 21	0
KANABEC	C.R. 18	C.R. 64	0
LE SUEUR	C.S.A.H. 29	C.R. 164	0
MARTIN	C.S.A.H. 44	C.S.A.H. 53	0
MORRISON	C.S.A.H. 2	C.R. 203	1
MURRAY	C.S.A.H. 38	C.S.A.H. 8	1
NICOLLET	C.S.A.H. 15	TWP. 76	0
NOBLES	C.S.A.H. 13	C.S.A.H. 18	0
OLMSTED	C.S.A.H. 3	C.R. 108	1
POLK	C.R. 2	C.R. 5	0
POPE	C.S.A.H. 18	C.S.A.H. 1	1
RED LAKE	C.R. 18	C.R. 3	0
REDWOOD	C.R. 10	C.R. 4	2
ROCK	C.R. 6	TWP. 76	0
SHERBURNE	C.S.A.H. 19	C.R. 38	0
SIBLEY	C.S.A.H. 22	C.S.A.H. 25	0
ST. LOUIS	C.S.A.H. 7	C.S.A.H. 52	0
STEELE	C.R. 32	C.R. 7	1
TODD	C.S.A.H. 24	C.R. 75	0
WADENA	C.S.A.H. 26	C.S.A.H. 7	0
YELLOW MED.	C.S.A.H. 43	C.S.A.H. 3	0
TOTAL			7