

2014 Report on the

Evaluation of Certain Highway Speed Limits

January 2015



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Legislative Request

This report is issued to comply with 2014 Minnesota Law Chapter 312--H.F. 3172, Sec. 36.

EVALUATION OF CERTAIN TRUNK HIGHWAY SPEED LIMITS.

Subdivision 1.

Engineering and traffic investigations.

The commissioner of transportation shall perform engineering and traffic investigations on trunk highway segments that are two-lane, two-way roadways with a posted speed limit of 55 miles per hour. On determining upon the basis of the investigation that the 55 miles per hour speed limit can be reasonably and safely increased under the conditions found to exist on any of the trunk highway segments examined, the commissioner may designate an increased limit applicable to those segments and erect appropriate signs designating the speed limit. The new speed limit shall be effective when the signs are erected. Of all the roadways to be studied under this section, approximately one-fifth must be subject to investigation each year until the statewide study is complete in 2019.

Subd. 2.

Report.

By January 15 annually, the commissioner shall provide to the chairs and ranking minority members of the senate and house of representatives committees with jurisdiction over transportation policy and finance a list of trunk highways or segments of trunk highways that were subject to an engineering and safety investigation in the previous calendar year, specifying in each case the applicable speed limits before and after the investigation.

EFFECTIVE DATE.

This section is effective the day following final enactment and expires on the earlier of January 15, 2019, or the date the final report is submitted to the legislative committees under this section.

The cost of preparing this report for 2014 is \$100,000.

2014 Project Costs				
MnDOT staff time	·			
Project Management, speed	·			
sampling, and data analysis	\$	65,000		
Consultant Costs				
Field Work	\$	20,000		
Project Management, speed				
sampling, and data analysis	\$	15,000		
2014 Estimated Total	\$1	.00,000		

Summary

Minnesota has approximately 7,000 miles of two-lane, two-way roadways that are affected by Minnesota Law Chapter 312--H.F. 3172, Sec. 36. About 5,000 of these miles cross the borders of different Minnesota Department of Transportation districts and require coordination with the districts to conduct a speed study. A schedule of miles to be studied by year and district was developed for these 5,000 or so miles and is shown in Appendix C. The remaining 2,000 miles do not cross MnDOT district boundaries and the timeline for its study is not assigned but is discretionary to the district in which they lie.

All Minnesota two-lane roadways, with a current speed limit of 55 mph were identified and then divided into two categories: coordinated routes and discretionary routes based on whether the roadway crossed a MnDOT district boundary. The coordinated routes were distributed over the five-year study period, taking care to schedule the same highway in the same year across district borders.

Knowing that the 2014 study period would be shortened because of the timing of the law and the need to set expectations and procedures for a five-year study, year one (2014) was assigned fewer miles than the remaining years in the study. Although the initial plan included studying more roadways within 2014, the short timeframe only allowed for the study of approximately 65 percent of the planned coordinated routes, and 30 percent of the discretionary routes.

Additional data from district safety plans will be used to complete the assessment of each roadway involved in this study.

Study Details

Study Overview

This study covers a widespread geographical area over a five-year timeframe. The main tasks for the study include data collection, data analysis, writing recommendations for speed limits, drafting speed authorizations, and signing roadways with the resulting speed limit.

To comply with the legislative language, a study schedule, included in Appendix A, was created for all two-lane, two-way roadways with a 55 mph speed limit in Minnesota. Upcoming roadwork and personnel workload were considered when each roadway was scheduled. Roadways that do not cross MnDOT borders and remain solely in one MnDOT district were not included in the schedule. Instead, the district was allowed to decide when to conduct the study, as long as the roadway or segment was studied within the five year timeframe. Adjustments to this schedule will be made when necessary due to construction activities on state or local roads within the study area, weather, or other unforeseen conditions. There will be fewer miles of roadway studied in 2014 than in subsequent years because of the limited time available since the effective date of the statute. All the required roadways and segments will be analyzed during the five-year timeframe.

Each of the required roadways will have a speed study done. A speed study analyzes the speed at which 85 percent of drivers choose to drive on a road. The study will recommend a speed limit appropriate to how the road is driven. Many other factors also influence the recommendation, such as the number of access points, shoulder width, and crash history. Nine factors are included on the speed study screening considerations worksheet. A sample of this worksheet is included in Appendix B. The nine factors are discussed in greater detail in the next section.

Once the speed study is completed, the District Traffic Engineer reviews all data collected and makes the final recommendations for an appropriate speed limit. When a recommendation to increase a speed limit is made, the MnDOT Office of Traffic, Safety and Technology is then notified to review the new speed authorization. Recommended speed limit increases are reviewed and approved by OTST. Once the speed authorization is signed, each district schedules the appropriate speed limit signs to be installed where necessary. The new speed limits are effective once the new speed limit signs are erected.

It is important to remember that raising a posted speed limit is not inherently making a road "less safe." A properly selected speed limit can increase the safety of the roadway by creating uniform travel speeds for all vehicles, and by setting realistic driver expectations of those trying to cross or enter the roadway.

Study Methodology

In order to complete a speed study on a given corridor, MnDOT must collect several sets of data for each control section. While speed samples (actual speed measurements of vehicles) are a large part of the necessary data, there are many other items that must be considered during a speed study such as roadway geometrics and hazard assessments.

MnDOT District Traffic Engineers and the MnDOT Central Office Traffic Safety Unit met prior to the study kickoff to discuss and agree on the work requirements for the consultant contract for this study. The resulting worksheet is attached in Appendix D.

Items included on that worksheet are: Access points, shoulder width, vertical grades, clear zone assessments, crash history, passing zones, and speed samples. Following is a discussion of items under consideration.

Appendix A: Glossary

Access Points

An access point refers to public roads, a business driveway, a private driveway or a farm field access. During the planning process, it was determined that most rural highways have an average of seven to nine access points per mile. Fewer access points per mile reduce the number and variety of events which drivers must respond.

Shoulder Width

The Highway Safety Manual was used as a basis for the shoulder width consideration. The HSM has a default value of 6-foot wide shoulders. Narrower shoulder widths may result in an increase in the number of crashes. A shoulder, both paved and unpaved, provides a recovery area for errant vehicles and space for disabled vehicles to park.

Vertical Grades

Grade is the rate of change of the vertical alignment. Grade affects vehicle speed and vehicle control, particularly for large trucks.

Clear Zone Assessment

A clear zone is an unobstructed, relatively flat area beyond the edge of the traveled way that allows drivers to stop safely and regain control of their vehicle that leaves the traveled way.

Crash Rate

Several different crash rates will be compared during this analysis, the total crash rate, the fatal and serious injury crash rate, and the critical crash rate. A crash rate can be an effective tool to measure the relative safety at a particular location. The crash rate is combination of crash frequency and vehicle exposure.

Total Crash Rate Equation:

Total Crash Rate = (total crashes)* 1,000,000 / (Length * ADT * Years * 365 Days / Year)

Due to the random nature of crashes, a statistical evaluation is used to determine which locations are below the average crash rate, performing near the average crash rate, those that are above the average crash rate, and those that are statistically significant (i.e. critical) above the crash rate. Using a critical crash rate helps to ensure that locations being selected are actually having something significant happening, and are not just a result of the random nature of crashes. The Critical Crash Rate helps to filter out areas with low Average Daily Traffic, or evaluated over a short time period.

$$R_c = R_a + K * (R_a/m)^{1/2} + .5/m$$

Critical Crash Rate = System wide average crash rate + (Confidence Interval/vehicle miles traveled) 1/2 + (.5/vehicle miles traveled)

K = Confidence Interval; 99.5% K=2.756, 95% K= 1.645, 90% K= 1.282

Passing Zones

A passing zone is an area where drivers are allowed to pass other vehicles traveling in the same direction when opposing traffic is not present.

85th Percentile

The 85th percentile speed is a major parameter used by traffic engineers. It is the speed at or below which 85 percent of all vehicles are observed to travel under free flowing conditions past a nominated point. A vehicle is considered to be in free flow conditions when it is not impacted by the speed of a preceding vehicle.

10 MPH Pace

Ten mile per hour pace is a 10 mile-per-hour increment in speeds that encompasses the highest portion of observed speeds.

A speed study considers all of these elements when conducting the analysis. The DTE considers this analyzed data and their engineering judgment to determine the appropriate speed limit for a roadway

A table listing the road segments studied and the resulting speed limit recommendations are found in Appendix E.

Appendix B: Total Miles for Study by District

55 MPH Trunk Highways – By Lane Mile and District

DISTRICT	ROADWAYS IN A SINGLE DISTRICT	ROADWAYS IN MULTIPLE DISTRICTS	TOTAL LANE MILES
1	402	519	921
2	451	690	1141
3	105	968	1073
4	164	774	938
М	141	347	488
6	469	442	911
7	190	627	817
8	146	614	760
TOTAL	2068	4981	7049

^{*}Trunk highways that do not cross boundaries into another district are scheduled for study at the discretion of the District. The schedule for conducting speed studies on the roadways which cross multiple district boundaries is in Appendix C.

Appendix C: Schedule of Speed Studies – 2014-2018

Speed Study Schedule 2014-2018: Multi-District Roadways*

DISTRICT	YEAR 1: 2014	YEAR 2:2015	YEAR 3: 2016	YEAR 4: 2017	YEAR 4: 2018	TOTAL MILES / MULTI- DISTRICT ROADWAYS
1	85	126	105	176	26	518
2	99	175	120	77	218	689
3	152	207	259	223	127	968
4	104	173	215	133	149	774
M	71	90	72	74	40	347
6	64	92	121	52	113	442
7	60	139	153	128	146	626
8	85	144	105	149	131	614
PER YEAR TOTALS	720	1146	1150	1012	950	4978

^{*}Schedule only reflects roadways that cross one or more MnDOT District borders. Roadways which are contained within one MnDOT District are scheduled at the discretion of the District. Minor discrepancies in the mileage totals are due to rounding.

Speed Study Schedule by Specific Routes, Lengths and Years

YEAR 1-2014	HIGHWAY ROUTES	ROUTE LENGTHS BY MILES	TOTAL MILES
2014	US 71	1.3	
2014	US 212	80.1	
2014	MN 13	83.5	
2014	MN 18	62.1	
2014	MN 23	127.2	
2014	MN 32	130.9	
2014	MN 55	171.3	
2014	MN 60	63.9	720.3

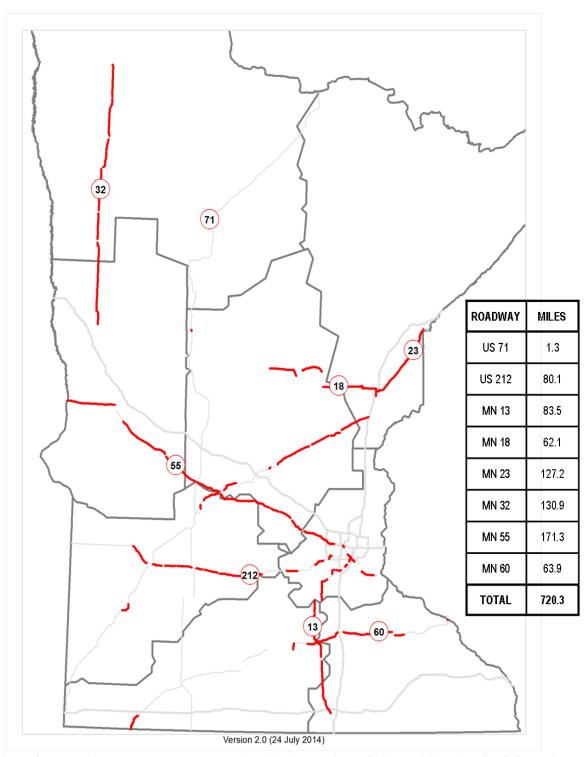
YEAR 2-2015	HIGHWAY ROUTES	ROUTE LENGTHS BY MILES	TOTAL MILES
2015	US 10	12.6	
2015	US 12	124.8	
2015	MN 1	248.1	
2015	MN 3	25.6	
2015	MN 56	46.3	
2015	MN 7	24.4	
2015	MN 22	124	
2015	MN 47	97.9	
2015	MN 56	90.2	
2015	MN 68	100.5	
2015	MN 87	61.1	
2015	MN 210	191.3	1146.8

YEAR 3-2016	HIGHWAY ROUTES	ROUTE LENGTHS BY MILES	TOTAL MILES
2016	I-94	21.7	
2016	US 2	2.8	
2016	US 61	59.9	
2016	US 169	164.3	
2016	MN 68	132.1	
2016	MN 27	179.6	
2016	MN 29	105.2	
2016	MN 30	215.8	
2016	MN 91	58.4	
2016	MN 113	29.6	
2016	MN 119	13.6	
2016	MN 200	168.7	1151.7

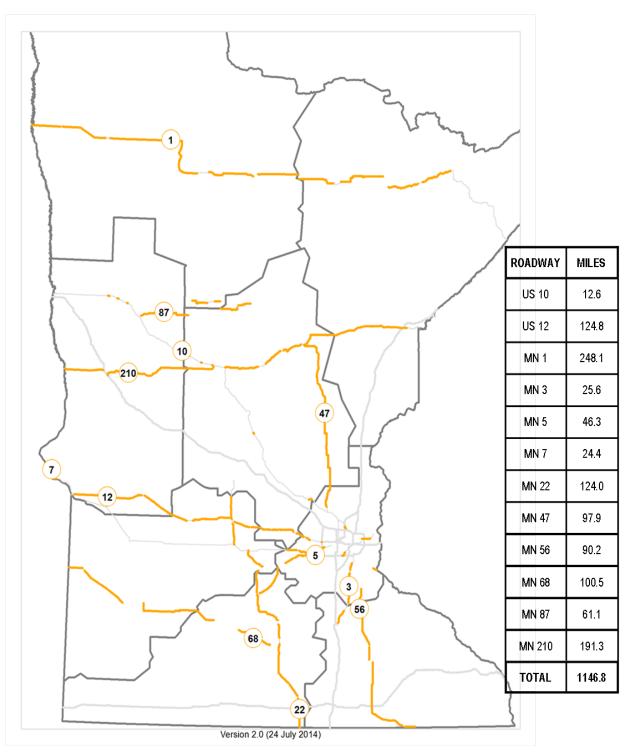
YEAR 4-2017	HIGHWAY ROUTES	ROUTE LENGTHS BY MILES	TOTAL MILES
2017	US 59	26.1	
2017	MN 15	129.6	
2017	MN 19	160.1	
2017	MN 21	24.4	
2017	MN 24	27.4	
2017	MN 28	113.6	
2017	MN 34	80.3	
2017	MN 64	62.4	
2017	MN 65	217.8	
2017	MN 95	104.5	
2017	MN 371	65.4	1011.6

YEAR 5-2018	HIGHWAY ROUTES	ROUTE LENGTHS BY MILES	TOTAL MILES
2018	US 14	182.3	
2018	US 52	51.4	
2018	MN 4	146	
2018	MN 9	204.6	
2018	MN 11	183.2	
2018	MN 25	121.1	
2018	MN 62	35.2	
2018	MN 70	25.8	949.6

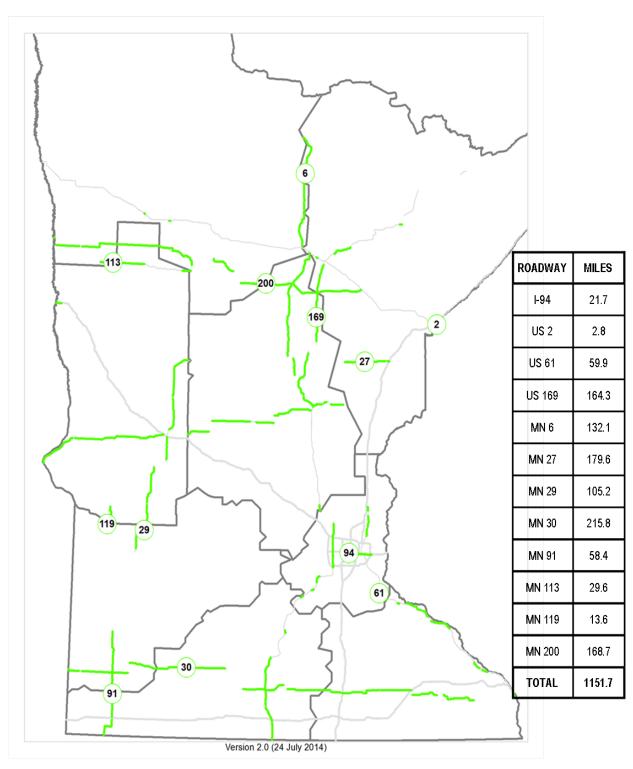
Map of 2014 Speed Studies



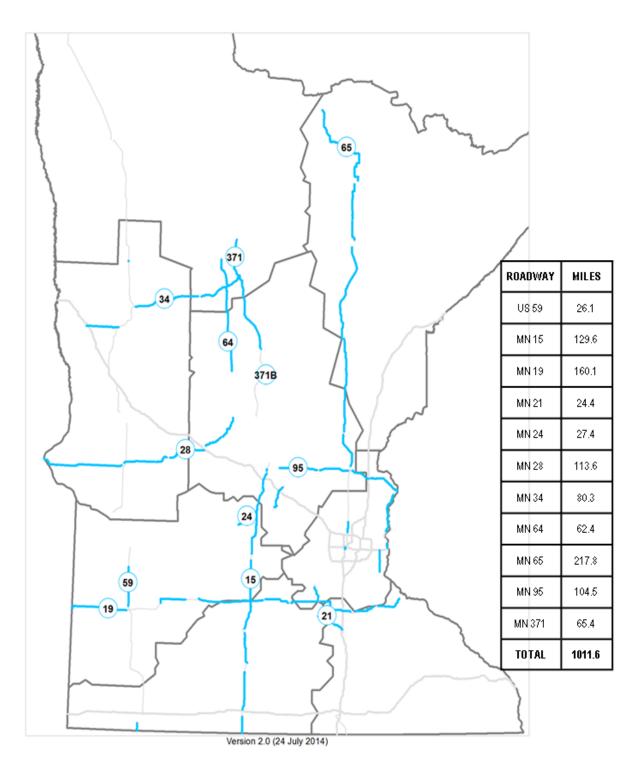
Map of 2015 Speed Studies



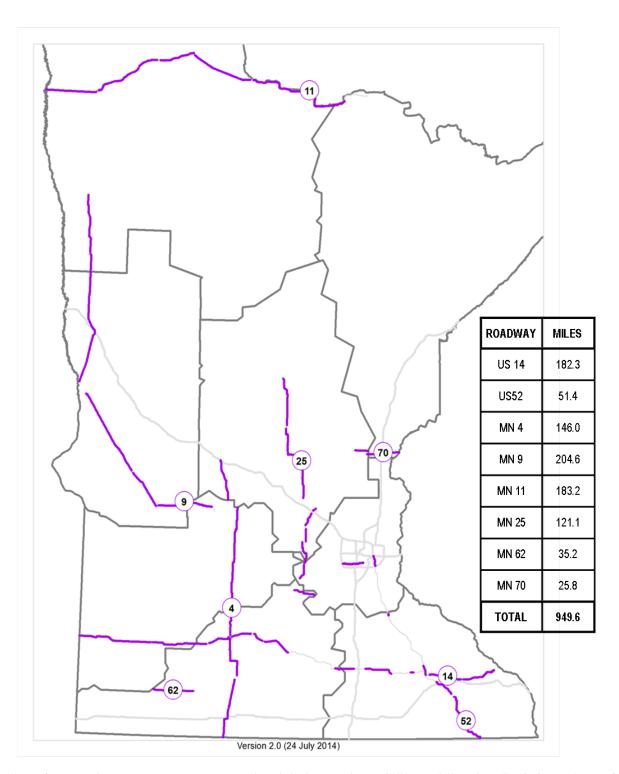
Map of 2016 Speed Studies



Map of 2017 Speed Studies



Map of 2018 Speed Studies



Screening Considerations for Evaluating Rural Two Lane Highways

Highwa	y Number:	Date:

Control Section: Evaluator:

Considerations

- 1. The number of access points (public roads, residential, commercial, industrial, etc.) is below an average of 10 access points per mile
- 2. Shoulder width (regardless of material type) is at 5 feet or greater
- 3. Vertical grades remain at or less than 3% (positive of negative) for the majority of the segment
- 4. A clear zone assessment has been made of the corridor and determined to be satisfactory based on engineering judgment.
- 5. The total five-year crash rate and/or the fatal and serious injury rate (with junction crashes)is below the statewide average for its ADT range
- The total five-year crash rate and/or the fatal and serious injury rate (with junction crashes)is below the critical crash rate based on statewide averages for its ADT range
- 7. Passing zones will meet the posted speed design standard
- 8. The 85th percentile of free flow vehicles is at or above the proposed posted speed limit (per ITE recommendations)
- 9. The 10 mph pace has its upper boundary is at or above the proposed posted speed limit (per ITE recommendations)

Other Comments:

Statewide Crash Rates

Five Years of Crash Data	CR	FAR
Rural 2-lane : ADT ∈[0,1500)	0.64	4.01
Rural 2-lane : ADT ∈[1500,5000)	0.56	2.60
Rural 2-lane : ADT ∈[5000,8000)	0.62	2.32
Rural 2-lane : $ADT \in [8000,\infty)$	0.72	1.87

Symbol Explanation

∈ represents a range or set that your ADT may fall into.

A square bracket [signifies that the number is included in the set and a rounded bracket or parenthesis (indicates that number is not included in that set.

So, for example:

 $ADT \in [0, 1500)$ could be read as "having an ADT from 0 to 1499."

Explanation of the screening considerations for evaluating rural two-lane highways

- 1. Access Points The number of access points per mile comes from the district and county roadway safety plans. During this planning process, it was found that most rural highways had an average of seven to nine access points per mile. The choice of 10 access points was chosen that most average roads would meet this consideration, but roads with significantly higher access densities should be excluded from the considerations.
- 2. <u>Shoulder Width</u> The shoulder width consideration was based on the Highway Safety Manual (HSM). The HSM has a default value of 6' shoulders. A decrease to five-foot shoulders represents only a 4 percent increase in the number of crashes.
- 3. <u>Vertical Grades</u> HSM has an increased crash modification factor for grades in excess of 3 percent during a given segment.
- 4. <u>Clear Zone Assessment</u> Every roadway that is being considered as a candidate to raise the speed should have a clear zone assessment completed. Roadways should have an acceptable amount of hazard free, forgiving roadside for the clear majority of the road. Hazards within the clear zone should be identified, and based on risk should either be removed or documented as being an acceptable risk.
- 5. <u>Crash History</u> Two types of crash rates will be examined: total crash rate and the fatal/serious injury crash rate. Roadways should be evaluated using the five-year statewide crash rates for segments (with intersections included). Evaluations should document: if crash rates are below average for both rates, that there is not a speed related crash problem, and that there are no other traffic safety issues.
- 6. <u>Crash History</u> Two types of crash rates will be examined: total crash rate and the fatal/serious injury crash rate. Roadways should be evaluated using the five-year statewide crash rates for segments (with intersections included). It should be documented if both crash rates are below the computed critical crash rate for both rates.
- 7. <u>Passing Zones</u> Passing zones should be reviewed and understood to ensure that safe passing can still occur where signing is posted.
- 8. <u>85th percentile</u> The Institute of Transportation Engineers uses this recommendation and process for determining how to set speed limits. MnDOT's Traffic Engineering Manual also uses this process.
- 9. <u>10 mph pace</u> The Institute of Transportation Engineers uses this recommendation and process for determining how to set speed limits. MnDOT's Traffic Engineering Manual also uses this process.

Appendix E:

Study Results

					Current	New
	Control	MnDOT	Geographical Description of	Study	Speed	Authorized
Roadway	Section	District	Control Section	Date	Limit	Speed limit
			Jct MN-25 To Benton-Mille Lacs Co			
MN 23	0504	3	Line	2014	55	60
			Mille Lacs-Kanabec Co Line To S Jct			
MN 23	3301	3	MN-65; Dala Ln M-124 Ahd	2014	55	60
			N Jct MN-65; Forest Ave Csah-6 Bhd			
			To Kanabec-Pine Co Line; Cr-68 X-			
MN 23	3302	3	Ing	2014	55	60
			Jct MN-9 To Co Line; Roseville Rd			
MN 23	3408	8	Xing T-2314 Rt T-834 Lt	2014	55	60
			Benton-Mille Lacs Co Line To Central			
MN 23	4801	3	Ave Csah-36 X-Ing	2014	55	60
			Central Ave Csah-36 X-Ing To Mille			
MN 23	4802	3	Lacs-Kanabec Co Line	2014	55	60
MN 23	5801	1	Jct MN-107 To S Jct I-35	2014	55	60
			Kanabec-Pine Co Line; Cr-68 X-Ing			
MN 23	5801	3	To Jct MN-107	2014	55	60
MN 23	7305	3	End Divided Rdwy To Jct I-94	2014	55	60
			MN-55 Junction To End Divided			
MN 23	7305	8	Rdwy	2014	55	60
			Jct Csah-30 To Jct N Ramps I-94 Csah-			
MN 237	7322	3	65 Ahd	2014	55	55
MN 84	1110	3	Jct MN-371;Front St To Jct MN-87	2014	55	55
MN 84	1111	3	Jct MN-87 To Jct MN-200	2014	55	55
TH 106	5622	4	Jct MNTH 29 to Jct USTH 10	2014	55	60
			Crow Wing - Aitkin Co Line to S Jct			
TH 169	0115	3	MNTH 210; 2nd St CSAH 1	2014	55	55
			Mille Lacs - Crow Wing Co Line to			
TH 169	1804	3	Crow Wing - Aitkin Co Line	2014	55	55
			N JCT USTH-169, 12.632 N JCT MNTH-			
TH 18	0102	3	47; MNTH-18 RT; CSAH-2 AHD	2014	55	55
			Mille Lacs - Aitkin Co line to Jct			
TH 18	0103	1	MNTH 65	2014	55	60
TH 18	0114		Jct MNTH 65 to Aitkin-Pine Co line	2014		60
TH 18	1803		Jct MNTH 25 to S Jct USTH 169	2014		55
			S Jct MNTH 47 to Mille Lacs-Aitkin Co		33	
TH 18	4805	1	line	2014	55	60
TH 18	5808		Aitkin - Pine Co line to Jct MNTH 23	2014		60

					Current	New
	Control	MnDOT	Geographical Description of	Study	Speed	Authorized
Roadway	Section	District	Control Section	Date	Limit	Speed limit
TH 32	1402	4	Jct MNTH 34 to Jct USTH 10	2014	55	60
TH 32	1403	4	Jct USTH 10 to Clay-Norman Co Line	2014	55	60
			Mille Lacs- Aitkin Co Line to W Lim			
TH 47	0108	3	Aitkin (outside)	2014	55	55
TH 47	4807	3	N Jct MNTH 27 to Mille Lac Co Line	2014	55	55
TH 54	2607	4	Jct MNTH 47 to Jct MNTH 65	2014	55	60
			Grant-Douglas Co Line to Douglas-			
TH 55	2107	4	Pope Co line	2014	55	60
			Wilkin-Grant Co Line to Jct MNTH 55			
TH 55	2608	4	and MNTH 79	2014	55	60
			Jct MNTH 79 to Grant-Douglas Co			
TH 55	2609	4	Line	2014	55	60
			Stearns-Kandiyohi Co Line to			
TH 55	3410	3	Kandiyohi-Stearns Co line	2014	55	60
TH 55	4712	3	Stearns-Meeker Co Line to Jct TH 22	2014	55	60
			Jct MNTH 22 to Meeker-Stearns Co			
TH 55	4713	3	Line	2014	55	60
			Douglas-Pope Co Line to Jct MNTH			
TH 55	6107	4	29	2014	55	60
TH 55	6108	4	Jct MNTH 29 to Pope-Stearns Co Line	2014	55	60
TH 55	7312	3	Pope-Stearns Co Line to USTH 71	2014	55	60
			Jct USTH 71 to Stearns -Kandiyohi Co			
TH 55	7313	3	Line	2014	55	60
			Kandiyohi-Stearns Co Line to			
TH 55	7314	3	Stearns-Meeker Co Line	2014	55	60
			Meeker-Stearns Co Line to Jct MNTH			
TH 55	7315	3	15	2014	55	60
			JCT MNTH 15 to Stearns- Wright Co			
TH 55	7316	3	line	2014	55	55
			End of bridge 84001, Bois De Sioux			
TH 55	8404	4	River, Jct MNTH 9	2014	55	60
TH 55	8405	4	Jct MNTH 9 to Wilkin-Grant Co Line	2014	55	60
			Stearns-Wright Co Line to Jct MNTH			
TH 55	8606	3	25	2014	55	55
			Jct MNTH 25 to Wright-Hennepin Co			
TH 55	8607	3	Line	2014	55	55
TH 79	2613	4	Jct USTH 59 to Grant-Douglas Co Line	2014	55	60

					Current	New
	Control	MnDOT	Geographical Description of	Study	Speed	Authorized
Roadway	Section	District	Control Section	Date	Limit	Speed limit
			E End Br-87021;Yellow Med-			
			Chippewa Co Ln To S End Br-			
US 212	1212	8	12009;Chippewa-Yellow Med Co Ln	2014	55	55
			Renville-Mcleod Co Line;W Lim			
			Stewart To MN-22 Rt; Leg To US-212			
US 212	4309	8	Wbl Lt	2014	55	60
			3Rd St Nw M-8 Lt; 3Rd St Sw M-29 Rt			
US 212	6510	8	To W Jct US-71 Lt	2014	55	60
			E Jct US-71 Rt; 13Th St N M-44 Lt To			
US 212	6511	8	Jct MN-4 Main St	2014	55	60
			Jct MN-4 Main St To Renville-			
US 212	6512	8	Mcleod Co Line;W Lim Stewart	2014	55	60
US 212	6517	8	Csah-16 Lt To T-225 X-Ing	2014	55	60
			S End Br-12009;Chippewa-Yellow			
			Med Co Ln To W End Br-			
US 212	8712	8	12000;Yellow Med-Chippewa Co Ln	2014	55	55

Note: All speed limits within each control section are not listed in this chart. Other speed limits that may also be present include but are not limited to school speed zones and speed limits through urban areas.