



Traffic Guidelines Manual

ORIGINATOR Director, Bureau of Highway Operations		13-5-1
CHAPTER 13	Traffic Regulations	
SECTION 5	Speed Limits	
SUBJECT 1	Statutory Authority and the Approval Process	

A. Background

Why do we have speed limits? Speed limits are an important tool for promoting safety on streets and highways. Limits tell drivers the reasonable speed for a road section under ideal conditions. They also help traffic enforcement by setting standards for what is an unsafe speed.

The concept of establishing speed limits is based upon the nationally accepted principle that the majority of drivers are cautious, prudent and drive at speeds that are reasonable and proper, regardless of the posted speed limit. This “reasonable and proper” theme is part of the Wisconsin Statutes in s.346.57 (4) and s.349.11 (7) and as set forth in the Uniform Vehicle Code (UVC). In part, it reads:

“A person driving a vehicle on a highway shall drive at a careful and prudent speed not greater than nor less than is reasonable and proper, having due regard to the traffic, surface, and width of the highway and of any other condition then existing. A person shall not drive a vehicle upon a highway at a speed greater than that which will permit a stop within the assured, clear distance ahead.”

In other words, motorists are required to drive at a speed that allows them to stop safely. This statute governs the speed of all drivers regardless of any posted speed limits. Differences in speeds at which drivers proceed are a common cause of crashes, often making the roadway less safe. This is an important point because there are several types of speed limits in the State of Wisconsin as indicated below:

Advisory speeds are recommended safe driving speeds to inform drivers of the maximum recommended speed through a curve or for other special roadway conditions. They are posted only in combination with an appropriate warning sign.

Advisory speeds are not enforceable in Wisconsin courts except as driving too fast for conditions.

Regulatory speed limits are enforceable and are categorized as either statutory or modified.

Statutory speed limits are set as maximum/minimum speeds. These limits are established legislatively and apply throughout the State. The Manual on Uniform Traffic Control Devices defines statutory speed as a speed limit established by legislative action that typically is applicable for highways with specified design, functional, jurisdictional and/or location characteristic and is not necessarily shown on speed limit signs. The determining factor for speed limits on freeways and expressways is most often statutory. Engineering speed studies are not required for applying statutory speed limits.

Modified speed limits are utilized in areas requiring speed limits between the statutory maximum speed limits on state, county or local roadways and the 25 MPH *prima facie* speed limits in business and residential areas. These *modified* speed limits are established by administrative action based on a traffic engineering study. They *may* only be set by agencies having legal authority and jurisdiction over the respective roadway in accordance with s. 349.11 Statute. These modified speed limits are often referred to as absolute speed limits and are not to be exceeded regardless of condition. For State Trunk Highways, the authority and jurisdiction to set modified speed limits lies with the Wisconsin Department of Transportation. Connecting highways, although marked as state highway routes, are not State Trunk Highways. The authority and jurisdiction for speed limits on those routes is held by the municipality responsible for maintaining the underlying street or highway, subject to the review and approval of WisDOT. Local agencies are responsible for setting speed limits on all other roads under their jurisdiction in accordance with the provisions of state law. WisDOT approval to change speed limits on local roads and connecting highways is required based on s. 349.11 and s.86.32(1), Statutes. Local units of government have authority to change the speed limit on routes under their jurisdiction (excluding connecting highways) without WisDOT approval for certain circumstances spelled out in s.349.11, Statutes.

B. Terms – Definitions

Speed Zone – A section of street or highway where speed limit different than the statutory speed limit has been established.

Speed Limit – The maximum (or minimum) speed permitted on a section of street or highway. *May* be statutory or it *may* be established within a speed zone on the basis of an engineering study.

Basic Speed Law – No person **shall** operate a motor vehicle at a speed greater than is reasonable and proper for the prevailing conditions.

85th Percentile Speed – The speed at or below which 85 percent of the sample of free flowing vehicles are traveling. This speed *should* be determined by conducting a spot speed study.

Pace – The 10 MPH band of travel speeds containing the largest number of observed vehicles.

Engineering Study/Engineering and Traffic Investigation – The comprehensive analysis and evaluation of available pertinent information, and the application of appropriate principles, standards, guidance and practices as contained in the MUTCD and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. An engineering study **shall** be documented. (Language from MUTCD, 2003 Edition).

C. Highway Definitions

Freeways are divided highways with fully controlled access at interchanges only. Interstate Highways are freeways with the Interstate route designation.

Expressways are divided highways with partially controlled access by a combination of interchanges, at-grade intersections, and driveways.

Conventional Highways are streets or roads other than freeways or expressways. They *may* be divided or undivided, two-lane or multi-lane, and access is available at intersections and driveways.

A Bypass is a route intended to divert traffic around a community and re-connects to routes through a community on the outskirts of the community

D. Philosophy

It has been found that motorists are generally capable of determining the driving speed that is reasonable for prevailing road and traffic conditions unless there are some roadway conditions that they are unaware of or which are not readily apparent and that the majority will subsequently adjust their speed accordingly. The 85th percentile speed, the speed at or below which 85% of the vehicles travel a particular roadway, has been found to best represent this perceived "reasonable" speed. The MUTCD, Section 2B.13 states "when a speed limit is to be posted, it *should* be within ... 5 MPH of the 85th percentile speed of free-flowing traffic." This practice promotes safety as research shows the lowest risk of being involved in a crash occurs at approximately the 85th percentile speed (see "Setting the Speed Limit" in the Wisconsin Statewide Speed Management Guidelines, June 2009¹). The practice also promotes voluntary speed limit compliance as the majority of drivers would be anticipated to observe the limit. A third benefit of posting speed limits close to the 85th percentile speed is the ability to target law enforcement efforts toward the limited number of motorists that speed.

¹ http://dotnet/dtid_bho/extranet/manuals/index.shtm

Unreasonably low speed limits, also called irrational speed limits, are not effective in changing driver behavior and have several negative effects. Research shows that drivers do not reduce their speed to the posted limit on the basis of signage alone (ITE Journal, 2004, "The Effectiveness of Transitional Speed Zones."). While irrational speed limits do not result in desired driver behavior, resulting negative effects include higher financial cost due to need for increased enforcement, higher potential for crashes due to larger variability in vehicle speeds, and encouragement of motorist disregard of other, rational posted speed limits. Irrationally low speed limits also promote a false sense of security among residents and pedestrians who *may* expect that posting lower limits will change drivers' speed behavior.

Driving environment is the main influence on motorists' speeds. A number of factors contribute to the driving environment including design, location within urban or rural areas, and characteristics of traffic, surrounding land use, and access along the roadway. Other factors contribute as well including pavement condition, on-street parking, bicycle and pedestrian activity levels, and level of snow and ice removal. The MUTCD in Section 2B.13 recommends conducting a study every 5 years when there are significant changes in roadway characteristics or surrounding land use. Changes to the regulatory speed limit **shall not** be used as a means to correct spot safety or operational problems when an advisory speed plaque with a warning sign would be more appropriate. Regulatory speed limit changes also *should not* be used to address concerns with noise or specialty vehicles.

E. Purpose of Speed Zones

Speed zones are typically established on roadways where the statutory speed limit or an existing speed zone is no longer appropriate due to changes in land use, access, traffic volumes, levels of congestion, and crashes or crash potential along the highway. Speed zoning is a means of establishing uniform regulatory speed for similar driving conditions throughout the state. It is a means of informing motorists who *may* be unfamiliar with the road of "reasonable" driving speeds under ideal operating conditions. Speed limits within speed zones *should* correlate closely (usually within 5 MPH) with 85th percentile speeds determined by field speed studies to promote safety and voluntary compliance.

F. Authority

Regulatory speed limits in Wisconsin are absolute limits, above which it is unlawful to drive regardless of roadway conditions, traffic volumes, or other factors. The statutory authority for establishment of regulatory speed limits is provided in Sections 346.57 and 349.11, Wis. Stats. These statutes vest the Department with the authority to establish regulatory speed limits on the State Trunk Highway System. Furthermore, they provide the Department with approval authority (refer to Section 349.11(3)(c), Wis. Stats.) over some regulatory speed limits that local units of government would establish on facilities

under their respective maintenance jurisdictions. Figure 1 summarizes the speed limits under s.346.57, Stats. and authority under s.349.11, Stats.

On November 13, 1962, the Highway Commission delegated its statutory authority to the Chief Traffic Engineer, and established the Chief Traffic Engineer as being responsible for maintaining the official records. Later the title of Chief Traffic Engineer was changed to State Traffic Engineer for Highways.

By memorandum of June 5, 1992, from the State Traffic Engineer, the regional offices were authorized to approve speed limit changes on local roads and streets, including county trunk highways, where those changes fall outside the authorized limits that the local authorities *may* exercise as specified in the statutes. In the same memo, the regional offices were authorized to establish reductions in speed limits in construction zones on a temporary basis while the need for the reduction exists. A Traffic Engineer with a PE License is required to sign for any speed study on state maintained highways.

As of October 16, 1995, authority for approval of speed limits which fall within 5 MPH of the measured 85th percentile and no more than 2 MPH below the measured average speed, or which are increased to the statutory speed limit was delegated to a designated approval authority in each region. Speed limits not meeting those criteria **shall** be sent to the State Traffic Safety Engineer in Bureau of Highway Operations.

Figure 1. Speed Zone Summary

Fixed Limits per Statute 346.57(4)*	What Local Governments** Can do Per 349.11(3) and (7)*
(gm) 65 MPH – Freeway/Expressway	WisDOT ONLY
(h) 55 MPH – STH	WisDOT ONLY
(h) 55 MPH – CTH, Town Roads	Lower the speed limit by 10 MPH or less.
(k) 45 MPH – Rustic Roads	Lower the speed limit by 15 MPH or less.
(j) 35 MPH – Town Road (1,000’ min) with 150’ driveway spacing	Lower the speed limit by 10 MPH or less.
(e) 25 MPH – Inside corp. limits of a city or village (other than outlying districts)	Raise the speed limit to 55 mph or less. Lower the speed limit by 10 mph or less.
(f) 35 MPH – Outlying district within city or village limits	Raise the speed limit to 55 mph or less. Lower the speed limit by 10 mph or less.
(g) 35 MPH – Semi urban district outside corp. limits of a city or village	Raise the speed limit to 55 mph or less. Lower the speed limit by 10 mph or less.
(a) 15 MPH – School Zone, when conditions are met.	Raise the speed limit to that of the roadway. Lower the speed limit by 10 MPH or less.
(b) 15 MPH – School Crossing, when conditions are met.	Raise the speed limit to that of the adjacent street. Lower the speed limit by 10 MPH or less.
(c) 15 MPH – Pedestrian Safety Zone, with Public Transit Vehicle Stopped.	No changes permitted.
(d) 15 MPH – Alley	Lower by 10 MPH or less.
(i) 15 MPH – Street or town road adjacent to a Public Park	Lower by 10 MPH or less.
(10) Construction or maintenance zones – as appropriate	State and Local have authority to establish lower limit.
<p>*From Updated 2007-2008 Wis. Stats Database. **All speed limit changes shall be based on a traffic engineering study, including modifications allowed under State Statute. Local governments can implement speed limit changes on the local road system without WisDOT approval when proposals are within the constraints identified above.</p>	

NOTE: s.346.57 (4)(g) is a highway and s.346.57(4)(j) is a town road.

G. Speed Studies

Speed zone reviews are typically initiated as a result of concerns expressed by interested citizens who live nearby or drive along the roads in question, or *may* be triggered by a severe crash that has occurred. These concerns are referred to the traffic section in the region for review. Occasionally citizens or public officials under citizen pressure, request that a particular speed limit be imposed or that some other type of corrective action be taken. Requests for speed zone reviews originating outside the Wisconsin Department of Transportation for STHs *should* come through a mayor or other elected executive, appointed official, government body, or Traffic Safety Commission and be submitted in writing. WisDOT regions contacted directly by state or national legislators *should* notify and coordinate with the Bureau of Highway Operations, Traffic Engineering Section. Any decisions regarding speed limits must be based on facts and an objective analysis of the characteristics of the roadway. Once a study begins, the person requesting the survey *may* be contacted for further input or clarification of the problem.

Engineering studies **shall** include the following:

1. Measure prevailing speed characteristics and determine the 85th percentile speed;
2. Evaluate reported crash experience for the past three to five years;
3. Check the road's geometrics including lane widths, curves, roadside hazards and sight distances;
4. Determination of the 10 mile per hour pace;
5. Determine average speed;
6. Evaluate density and roadside development in terms of the number of driveways and access points where vehicles can enter the traffic flow.

Engineering studies *should* include the following:

7. Consider conflicts with parking practices, and pedestrian and bicycle activity.
8. Evaluate shoulder widths as well as roadway and shoulder conditions.
9. Determine the current level of enforcement.

Additional guidance on assessing need for a speed zone or for modification of a speed zone is available in the Wisconsin Statewide Speed Management Guidelines, June 2009¹.

H. Objectives of a modified speed limit

For a speed limit to be effective, it *should* accomplish the following:

- Reduce the speed differential of vehicles using the highway.
- Be a reasonable speed so the majority of drivers will comply voluntarily.
- Reflect consistent application of traffic engineering principals and guidelines in common circumstances.

Numerous studies have shown that setting a speed limit within 5 MPH of the 85th percentile speed is advisable, to achieve safer operation.

Increments: Speed limit recommendations between adjacent sections of highway outside incorporated cities/villages *should* generally be made in increments of ten MPH, but increments of five MPH are permissible when justified. Inside the incorporated cities/villages these speed limits *should* be in increments of five MPH. The number of such changes *should* be held to a minimum when speed limits are being applied to several adjacent sections of highway.

Length/Transitions: A speed limit *should* generally not be recommended when the length of the total zone would be less than 0.3 miles of a mile in length. A shorter distance *may* be considered or even necessary in urban settings where transitional speed limits are enacted as a buffer between high and low speed limits. The 85th percentile *should* support these transitional zones. Avoid unwarranted step down speed limits; rather base it on the character of the roadway.

In many rural areas where urban sprawl is not present, an abrupt change occurs in the driving environment when entering or leaving an urban area and a transitional speed will not be supported by the 85th percentile speed. Unless the driver perceives a reason to slow down, transitional zones are almost completely ineffective. In these cases, advance signing advising the driver of a drop in the speed limit is the preferred method.

I. Transitional Speed Zones

Generally, it is not recommended to have transitional/step down speed zones. Transitional speed zones are typically less than 0.3 miles in length and provide a means to allow drivers to step down their speed when approaching zones that are reduced due to constraints such as urban areas or construction. Research suggests that drivers *may not* reduce their speed to the posted speed limit on the basis of signage alone. Speed is more dependent on other factors, such as the physical characteristics of a highway. Speed data was analyzed in transitional zones, which resulted in increased dispersion or variance of individual speed. The probability of collisions increased with speed variance. Transitional speed zones had very little effect on the speeds of vehicles downstream as they entered lower speed zones. There needs to be changes in highway characteristics to impact driver behavior. (ITE Journal, 2004, "The effectiveness of Transitional Speed Zones".)

A transitional zone *should* be considered, if the physical characteristics of the roadway change, such as a rural section that transitions to a curb and gutter section with minimal driveways, and then to a curb and gutter section with a significant number of driveways.

Consider no more than 2 step-downs and only if within the 85th percentile speeds. Where there is development in an outlying area, a step down/transitional zone *may* be appropriate. However, where the highway is rural and transitions directly into a community without an outlying business area, the step down/transition zone is probably not appropriate.

J. Speed Study

The Speed Study includes and is conducted as follows: (see Appendix A for example):

- Taken during light to medium traffic conditions on a weekday. Rush hours and adverse weather conditions are typically avoided because they do not represent normal, free-flow traffic.
- Areas such as intersections, railroad tracks, or other factors that will influence speed are avoided. Since modified speed limits are the maximum allowable speeds, the conditions under which speed studies are taken must be close to ideal.
- The speed data are collected by recording the speeds of free flowing motor vehicles using radar, laser or other speed-measuring devices. A representative sample of vehicular speeds is recorded and these speeds would include local residents who drive through the zone. To assist in obtaining representative data, the data collection process *should* be low key so as to limit any affect on driver behavior.
- As a general rule, the minimum sample size *should* never be less than 30 measured spot speeds (for example, 15 vehicles per direction). On higher volume roads the study *should* include about 100 vehicles per lane per direction (e.g., a total of 200 vehicles for a roadway with one lane in each direction, or 400 vehicles total for a roadway with two lanes in each direction). Accurate spot speed measurements are important for setting limits. Spot speed is the instantaneous speed at one location. Data can be collected over multiple weekdays.
- Utilize a minimum 6-second headway, i.e the gap between vehicles *should* be 6 seconds in order to provide for good free flow.
- A one hour time period is the minimum time period used to conduct a study.

Note: Traffic data collection systems using Laser technology are available.

Use of the 85th percentile speed acknowledges that 15% of the drivers are traveling above a speed that is reasonable and proper. This is the 15% of motorists at which enforcement action is directed. Studies have shown that this is the group of motorists that cause many of the crashes and are the most aggressive drivers. There are other

parameters used to evaluate speed data, such as the average, median and pace speeds. However, the 85th percentile speed is the most critical criterion in establishing realistic speed limits.

Figure 2 provides a typical sample 85th percentile study, 10 MPH pace and synopsis of speed distribution.

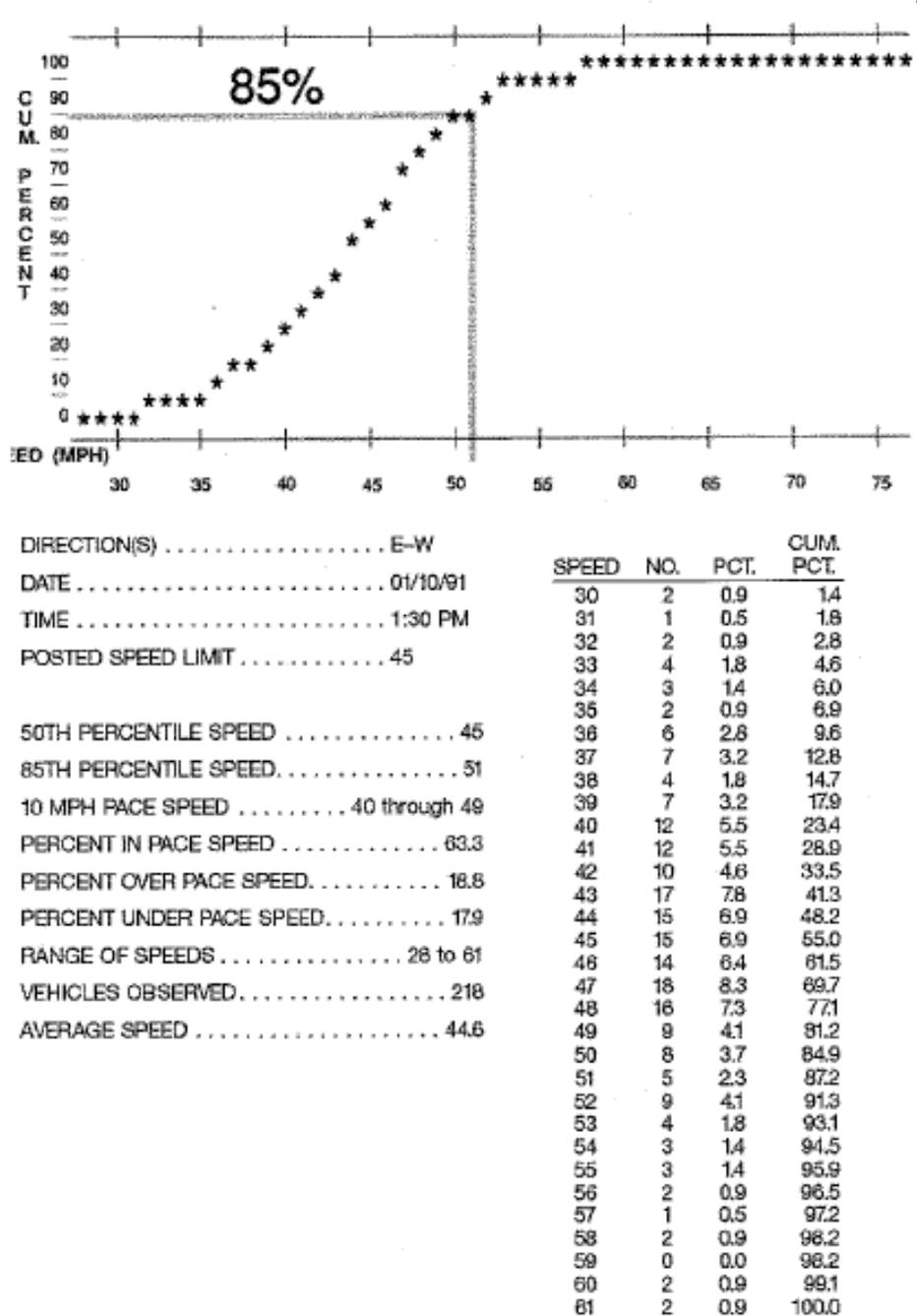


Figure 2a. Speed Distribution Graph

U.S. Highway 18 Speed Study – City & Town of Brookfield - Waukesha County

Direction of Travel	----- Eastbound -----	----- Westbound -----
Location	-0.1 mi w of Brookfield Rd -	-0.25 mi w of Brookfield Rd-
Date	12/14/06	12/14/06
Military Time	12:32-13:24	11:37-12:10
Posted Speed Limit	45 MPH	45 MPH
Lowest Recorded Speed	37 MPH	35 MPH
Highest Recorded Speed	57 MPH	57 MPH
Average Speed	44.2 MPH	45.2 MPH
85 th Percentile Speed	48 MPH	49 MPH
10 MPH Pace	38 - 47 MPH	40 - 49 MPH
% > 35 MPH	100 %	98 %
% > 40 MPH (Req. Lim.)	83 %	87 %
% > 45 MPH (Speed Limit)	32 %	44 %
% > 50 MPH	5 %	11 %
% > 55 MPH	1 %	1 %

Direction of Travel	----- Eastbound -----	----- Westbound -----
Location	- 0.15 mi w of Calhoun Rd -	----- at Woelfel Road -----
Date	12/14/06	12/14/06
Military Time	10:01-10:37	10:54-11:30
Posted Speed Limit	45 MPH	45 MPH
Lowest Recorded Speed	34 MPH	37 MPH
Highest Recorded Speed	55 MPH	51 MPH
Average Speed	43.5 MPH	43.4 MPH
85 th Percentile Speed	47 MPH	47 MPH
10 MPH Pace	38 - 47 MPH	38 - 47 MPH
% > 35 MPH	98 %	100 %
% > 40 MPH (Req. Lim.)	80 %	73 %
% > 45 MPH (Speed limit)	31 %	34 %
% > 50 MPH	5 %	2 %
% > 55 MPH	0 %	0 %

Direction of Travel	----- Eastbound -----	----- Westbound -----
Location	-0.20 mi w of Moorland Rd-	----- at Thomas Lane -----
Date	01/23/07	01/23/07
Military Time	09:11 - 09:55	10:01 - 10:43
Posted Speed Limit	45 MPH	45 MPH
Lowest Recorded Speed	36 MPH	35 MPH
Highest Recorded Speed	52 MPH	51 MPH
Average Speed	44.3 MPH	42.2 MPH
85 th Percentile Speed	48 MPH	46 MPH
10 MPH Pace	39 - 48 MPH	38 - 47 MPH
% > 35 MPH	100 %	98 %
% > 40 MPH (Req. Lim.)	89 %	62 %
% > 45 MPH (Speed Limit)	37 %	16 %
% > 50 MPH	5 %	1 %
% > 55 MPH	0 %	0 %

Red – Greater than posted speed limit Blue – Greater than proposed speed limit

Figure 2b

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Project ID       : EB STH 18
Street          : Blue Mound Rd
Capture Zone    : 0.20 mile west of Moorland Road
Community       : City of Brookfield
County          : Waukesha
Posted Speed Limit: 45
Weather Conditions: Cl damp
*****

Date Range      : 1/23/07
Time Range      : 9:11 AM Through 9:55 AM
Direction(s)   : Approaching
Types of Vehicles : All Vehicles
*****

Lowest Recorded Speed : 36           15th Percentile : 41
Highest Recorded Speed : 52           50th Percentile : 45
Average Speed         : 44.3          85th Percentile : 48
Vehicles Observed    : 100           95th Percentile : 50

10 MPH Pace Speed   : 39 Through 48
Percent In Pace Speed : 85.0
Percent Under Pace Speed : 4.0
Percent Over Pace Speed : 11.0
*****

SPEED  COUNT  PERCENT  CUM.%  SPEED  COUNT  PERCENT  CUM.%
36      2      2.0      2.0    45     15     15.0     63.0
37      0      0.0      2.0    46     12     12.0     75.0
38      2      2.0      4.0    47      6      6.0     81.0
39      5      5.0      9.0    48      8      8.0     89.0
40      2      2.0     11.0   49      5      5.0     94.0
41     10     10.0     21.0   50      1      1.0     95.0
42     13     13.0     34.0   51      4      4.0     99.0
43      6      6.0     40.0   52      1      1.0    100.0
44      8      8.0     48.0

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Figure 2c



WISCONSIN DEPARTMENT OF TRANSPORTATION
SPOT-SPEED FIELD STUDY

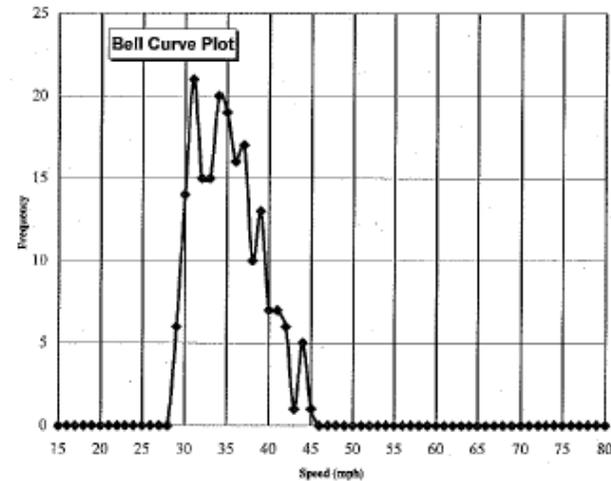
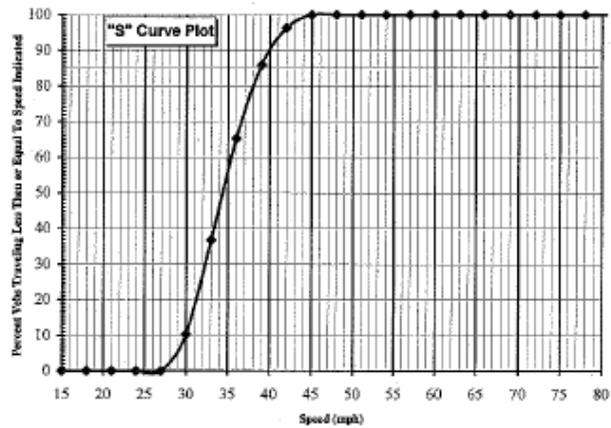
Date: 04/05/07	Hwy: USH 18	Direction: Both	SUMMARY OF VEHICLES BY TYPE: Passenger = 100.0% Trucks = 0.0% Buses = 0.0%
Time: 9:30 AM	Location: Fennimore - East	Posted Speed: 30	
Observer(s): Kory Keppel	Location 2	Weather: Sunny	
	Btw Marsden & Bronson	Pav't Condition:	
	County: Grant		

SPEED RANGE	No. VEHICLES (f)	Speed * #	CUMM No. VEHICLES	CUMM %
15	0	0	0	0.0
16	0	0	0	0.0
17	0	0	0	0.0
18	0	0	0	0.0
19	0	0	0	0.0
20	0	0	0	0.0
21	0	0	0	0.0
22	0	0	0	0.0
23	0	0	0	0.0
24	0	0	0	0.0
25	0	0	0	0.0
26	0	0	0	0.0
27	0	0	0	0.0
28	0	0	0	0.0
29	6	174	6	3.1
30	14	420	20	10.4
31	21	651	41	21.2
32	15	480	56	29.0
33	13	495	71	36.8
34	20	680	91	47.2
35	19	665	110	57.0
36	16	576	126	65.3
37	17	629	143	74.1
38	10	380	153	79.3
39	13	507	166	86.0
40	7	280	173	89.6
41	7	287	180	93.3
42	6	252	186	96.4
43	1	43	187	96.9
44	5	220	192	99.5
45	1	45	193	100.0
46	0	0	193	100.0
47	0	0	193	100.0
48	0	0	193	100.0
49	0	0	193	100.0
50	0	0	193	100.0
51	0	0	193	100.0
52	0	0	193	100.0
53	0	0	193	100.0
54	0	0	193	100.0
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70	0	0	193	100.0
71	0	0	193	100.0
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73	0	0	193	100.0
74	0	0	193	100.0
75	0	0	193	100.0
76	0	0	193	100.0
77	0	0	193	100.0
78	0	0	193	100.0
79	0	0	193	100.0
80	0	0	193	100.0
	193			

STUDY RESULTS

AVERAGE SPEED	50th PERCENTILE	85th PERCENTILE	PACE SPEED RANGE
38.7	34.3	38.9	30.0 to 39.0

% In Pace = 82.9%
% Over Pace = 14.0%
% Under Pace = 3.1%

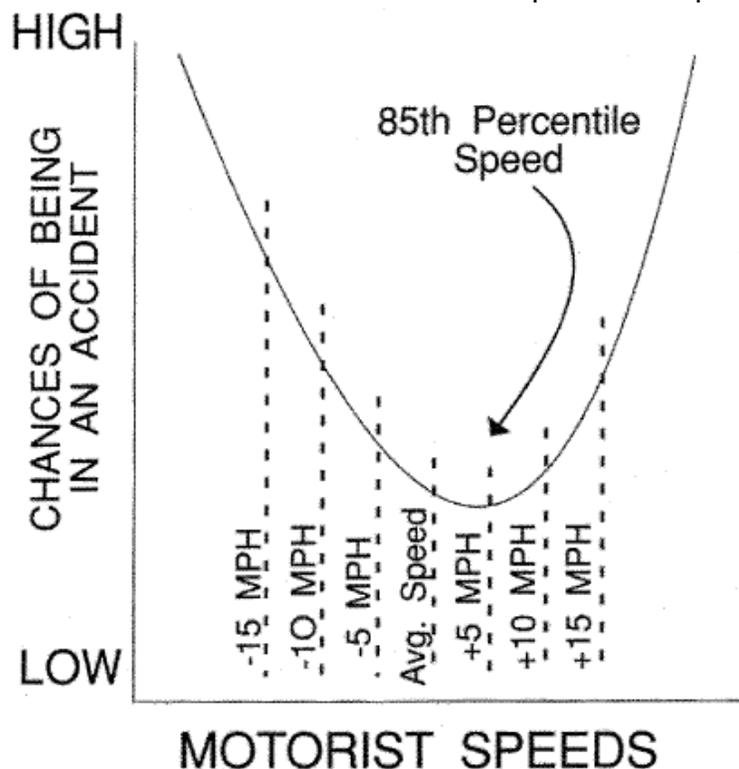


W:\247\Delto\Sprink\Regstar\Speed_Links\Grant\Fennimore USH 18 East\Fennimore 2 - 2001.d\SPD DATA SHEET

Figure 2d

K. Traffic Crash Data

Contrary to popular belief, lower speed limits do not necessarily improve safety. It is inappropriate to compare crashes on a fairly short segment of road to the statewide crash average, because a speed study is taken at the one section of highway you are dealing with. Crashes typically indicate another problem, which is generally not speed. The more uniform the speeds of vehicles in a traffic stream, the less chance there is for conflict and crashes. Posting speed limits lower or higher than what the majority of drivers are traveling produces two distinct groups of drivers: those attempting to observe the speed limit and those driving at a speed they feel is reasonable and prudent. These differences in speeds can result in increased crashes due to tailgating, improper passing, reckless driving, and weaving from lane to lane. However, the number of traffic crashes along any highway is related to numerous factors. Regardless of the roadway involved, there are a statistical number of crashes that can be expected to occur no matter how safe a roadway is made. Investigations of crashes reveal that in the majority of cases there was a clear violation of a traffic law or rule of good driving. Proper analysis and evaluation of these factors require the experience and expertise of a traffic engineer. Based on these studies and as illustrated in the graph, the lowest risk of being involved in a crash occurs at approximately the 85th percentile speed. Figure 3 represents this fact that crashes are lowest at the 85th percentile speed.



Source: "Speed Zoning on Texas Highways" State Department of Highways and Public Transportation, Austin, Texas, October 1990.

Figure 3. Accident Involvement vs. Motorists Speeds

L. Driving Environment

The design, physical condition, and classifications of a roadway have an effect on vehicle speeds because motorists vary their speeds depending on the driving environment. The traffic engineer considers significant items in the driving environment. These items *may* include:

- Traffic volumes
- Roadside development (type, density and lateral offset)
- Roadway and shoulder widths
- Condition of the roadway
- The number of lanes
- Intersections
- Driveways
- Hills, curves
- Urban Roadway cross-section (presence of curb and gutter rather than ditches)
- Parking
- Pedestrians and bicyclists – frequent presence 10% of time.
- Any other factors recorded by the study team.

The number of changes in the speed limit along a given route *should* be minimized. With this in mind, the length of the speed zone *should* be at least 0.3 miles. *Speed limits are not a spot issue*. The traffic engineer bases the recommendation on the conditions that exist at the time of their evaluation and *should not* attempt to consider such things as future growth, anticipated enforcement, or concerns for something that has not happened. Realistic speed limits provide for a uniform and orderly movement of traffic. There is a need for uniformity on all roadways especially where they carry large volumes of traffic through various roadside conditions or numerous adjoining communities.

M. Speed Study Data Evaluation

The 85th percentile speed is the primary indicator of the speed limit that *should* be established. The pace speed is another excellent tool. A normal distribution contains approximately 70 percent of the vehicles within the pace with approximately 15% of the vehicles below and 15% of the vehicles above the limits of the pace speed.

N. The Approval Process - Documentation

In accordance with state statutes, an engineering and traffic investigation must precede the establishment of a modified speed zone on the state trunk highway system. The following elements are expected to be prepared by the region as part of every speed zone engineering and traffic investigation. An engineering and traffic investigation is not required for rural 55 and 65 MPH limits that are established by statute.

1. Speed checks taken at appropriate intervals to determine the 85th percentile and mean of the speed distribution at each of the monitored locations. Exceptions are minor adjustments of existing speed zone termini due to changes in highway features, and development or signage that requires the speed limit sign locations to be adjusted. In addition, for all recommendations sent to the Bureau of Highway Operations:
2. A picture or photo of each location where speed readings were taken. Document the capture zone.
3. Crash history when it bears on the recommendation.
4. A map depicting the limits of both the existing and proposed speed zoning.
5. Documentation of any concurrences or protests by local units of government, particularly where existing speeds are to be altered, and discussion of the reason for a recommended change.

Note: An example of a speed study is shown in Appendix A.

The region *should* prepare the submittal in the prescribed submittal/approval shell. The region will number the declaration in the following manner: SZ-ww-xxx-yyyy-zz, where ww is the county number where the roadway resides (e.g., Dane County would be entered 13, Milwaukee County would be entered 40), xxx is the numeric designation of the highway involved in the declaration, yyyy is the four digit year the request was submitted, (e.g. 2009), and zz is a number in sequence denoting chronological declarations for the roadway throughout the year, beginning with 01. Figure 4 is the submittal/approval document; it is available electronically on the WisDOT Web site at http://dotnet/dtid_bho/extranet/manuals/index.shtm.

When the criteria enumerated in the last paragraph of the Authority Section are met, the region *may* fill out the approval portion of the submittal letter, and fill in the information on speed check verification.

When the criteria for region approval are not met, the region **shall** fill out the recommendation information portion of the letter, indicating the material that is being transmitted with the recommendation. The region **shall** include a memo as a cover page to the recommendation explaining background, summary of the analysis and any additional information that would be helpful for the reviewer.

The region's submittal is reviewed by the State Highway Traffic Safety Engineer at the Bureau of Highway Operations Traffic Engineering Section who identifies, based on region input and other factors, recommendations that *may* be expected to generate special attention or controversy and will review those recommendations with the State Traffic Engineer. The State Highway Traffic Safety Engineer will make routine approvals. Upon approval, the official records are updated and the region is notified. The Bureau of Highway Operations will respond to region recommendations in writing, including an explanation of the reasons for any denials.

O. Local Speed limits

Local governments can implement speed limit changes on the local road system without department approval when proposals are within the constraints shown in Figure 1 contained herein. The traffic study must be per SS 349.11 and MUTCD Section 2B.13. Changes proposed outside the constraints require department approval. Authority is delegated to the region office. It is recommended that the declaration number for this have the format: SZC-ww-xxxxx-yyyy-zz, where ww is the county number where the roadway resides (e.g., Dane County would be entered 13, Milwaukee County would be entered 40), xxxxx is the letter designation or abbreviated name of the highway/street involved in the declaration, yyyy is the four digit year the request was submitted (e.g., 2009), and zz is a number in sequence denoting chronological declarations for the roadway throughout the year, beginning with 01.

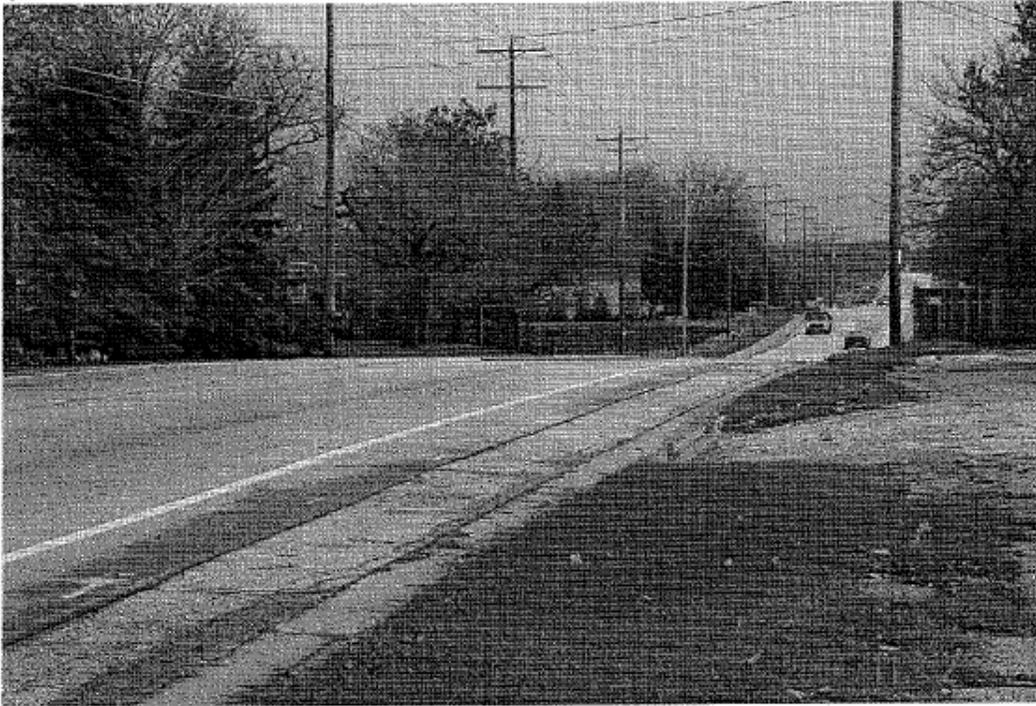
FIGURE 4

Date	<hr/>	PAGE 1 OF 3 SPEED STUDY COVER LETTER
From	<hr/>	
To	<hr/> State Traffic Safety Engineer	
Subject	SPEED ZONE DECLARATION SZ-- <hr/> -- <hr/> -- <hr/> -- <hr/>	
STUDY LOCATION		
Highway/Street Name: <hr/>		
From: <hr/>		To: <hr/>
Municipality: <hr/>		
Segment Length (mi): <hr/>		County: <hr/>
Reason(s) for Speed Limit Change: <hr/>		
REQUEST FOR APPROVAL OF DECLARATION		
For Declaration Requiring Approval by the Bureau of Highway Operations, per TGM 13-5-1		
The Region submits the attached declaration, numbered as above, and recommends approval.		
The following information supporting the recommendation is enclosed with this request (please circle):		
Map showing limits	Speed study data	Crash history data
Aerial / site location photo(s)	Documents of public interest	Highway log files
Other (please specify): <hr/>		
RECOMMENDED BY: <hr/> Region		Date: <hr/>
REVIEWED BY: <hr/> Bureau of Highway Operations		Date: <hr/>
SPEED ZONE REQUEST	APPROVED	NOT APPROVED
Reviewer shall provide comments, in writing, when a request is not approved.		

FIGURE 4, Continued

Date: _____		PAGE 2 OF 3 SPEED STUDY WORKSHEET	
Speed Zone Declaration: _____			
ROADWAY CHARACTERISTICS			
Posted Speed Limit: _____ mph	Is Segment a Transition Zone (circle):	Yes	No
	(If 'Yes', please explain on Page 3)		
Design Speed Limit: _____ mph	Significant On-Street Parking (circle):	Yes	No
	(If 'Yes', please explain on Page 3)		
Number of Lanes: _____	Significant Ped/bike activity (circle):	Yes	No
	(If 'Yes', please explain on Page 3)		
Lane Width (feet): _____	Horizontal curves present (circle):	Yes	No
	(If 'Yes', please explain on Page 3)		
AADT (vehicle / day): _____	Vertical curves present (circle):	Yes	No
	(If 'Yes', please explain on Page 3)		
Year AADT Performed: _____	Number of access points in segment: _____		
Land Use (circle): Urban Suburban Rural		CRASH HISTORY	
Roadway Type (circle): Freeway Non-freeway	Years: _____	to	_____
Functional Class: _____	Number of Years: _____		
Shoulder Type (circle): Paved Gravel C&G	Speed-related crashes: _____		
Shoulder Width (feet): _____	Crash Rate: _____		
Median Type (circle): Divided Undivided TWLTL	Severity Rate: _____		
SPEED STUDY RESULTS			
Posted Speed Limit (mph): _____	Number of observed vehicles: _____		
50th Percentile Speed (mph): _____	10 mph Pace Range: _____		
85th Percentile Speed (mph): _____	Percent vehicles in pace: _____		
Range of Speeds (mph): _____	Percent vehicles over pace: _____		
Percent observed vehicles non-compliant to speed limit: _____	Percent vehicles under pace: _____		

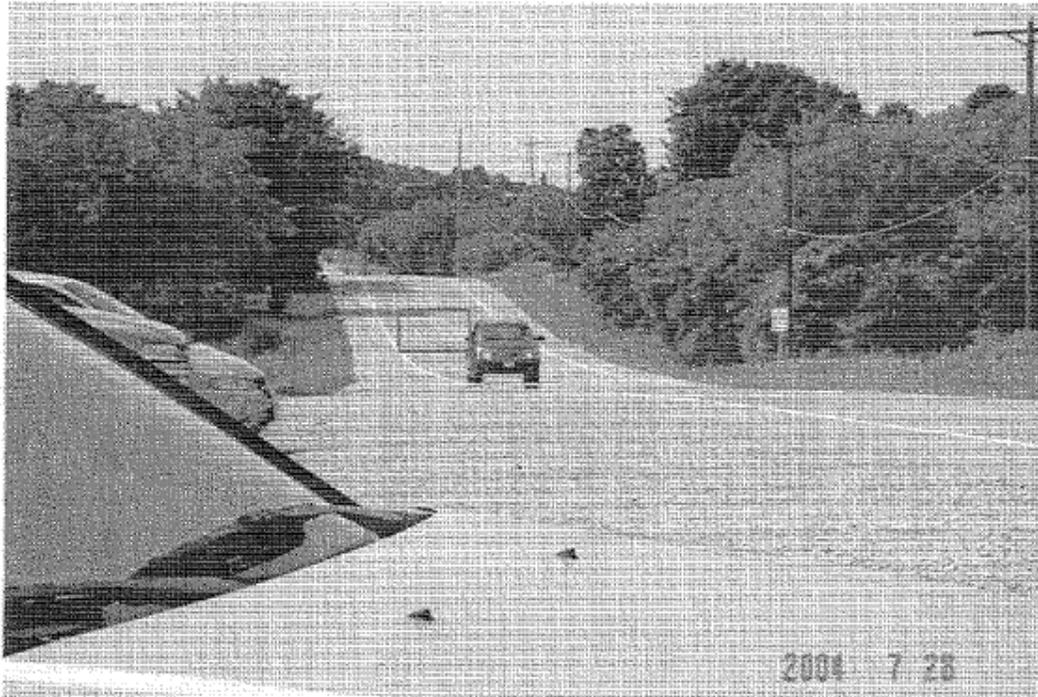
Appendix A – Typical Speed study documentation



Capture Zone - STH 38 @ 0.1 mile east of Nicholson Rd - Husher



Capture Zone - SB 38 @ 0.20 mile north of Brook Rd



Capture Zone - NB 38 @ 0.35 mile south of 4 Mile Rd

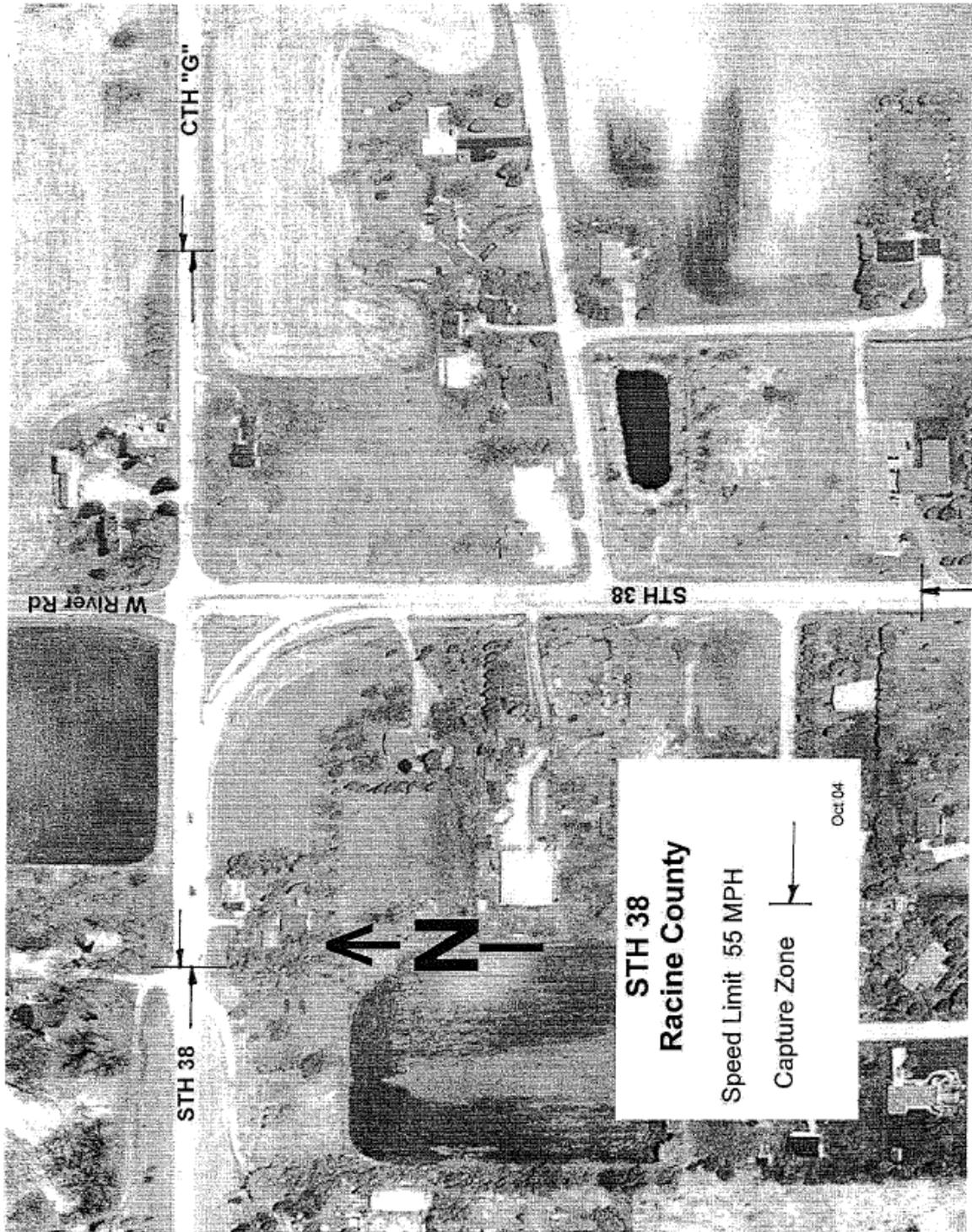
Project ID : NB STH 38
 Street :
 Capture Zone : 0.1 mile east of Nicholson Rd
 Community : Town of Caledonia
 County : Racine
 Posted Speed Limit: 40
 Weather Conditions: dry

Date Range : 11/2/04
 Time Range : 11:10 AM Through 12:11 PM
 Direction(s) : Approaching
 Types of Vehicles : All Vehicles

Lowest Recorded Speed : 34 15th Percentile : 41
 Highest Recorded Speed : 59 50th Percentile : 45
 Average Speed : 46.1 85th Percentile : 51
 Vehicles Observed : 130 95th Percentile : 54

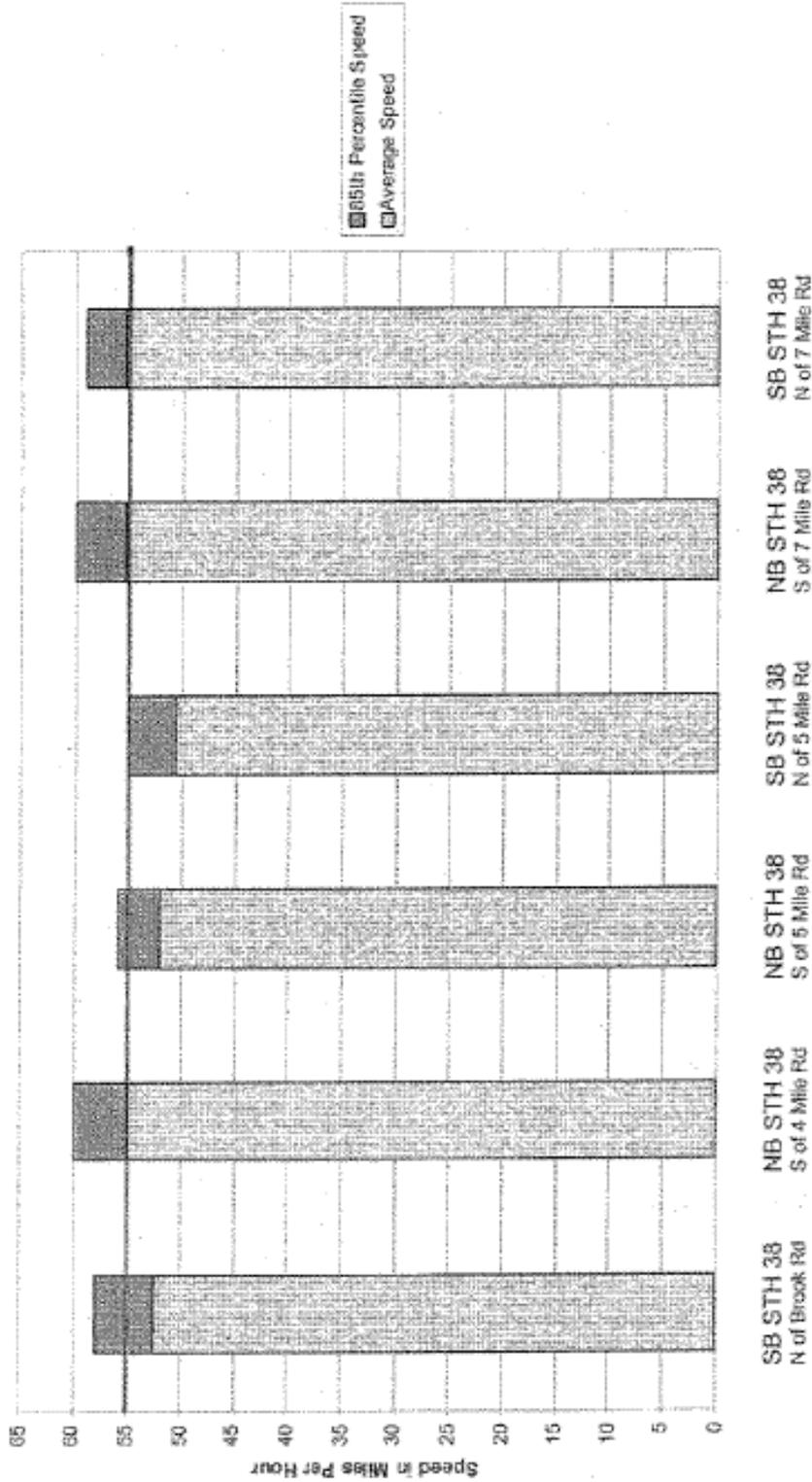
10 MPH Pace Speed : 41 Through 50
 Percent In Pace Speed : 66.9
 Percent Under Pace Speed : 12.3
 Percent Over Pace Speed : 20.8

SPEED	COUNT	PERCENT	CUM. %	SPEED	COUNT	PERCENT	CUM. %
34	1	0.8	0.8	47	8	6.2	59.2
35	0	0.0	0.8	48	4	3.1	62.3
36	3	2.3	3.1	49	10	7.7	70.0
37	1	0.8	3.8	50	12	9.2	79.2
38	3	2.3	6.2	51	9	6.9	86.2
39	4	3.1	9.2	52	7	5.4	91.5
40	4	3.1	12.3	53	4	3.1	94.6
41	11	8.5	20.8	54	1	0.8	95.4
42	7	5.4	26.2	55	2	1.5	96.9
43	12	9.2	35.4	56	2	1.5	98.5
44	7	5.4	40.8	57	0	0.0	98.5
45	12	9.2	50.0	58	0	0.0	98.5
46	4	3.1	53.1	59	2	1.5	100.0



GRAPHICAL SPEED ZONE SUMMARY

STH 38 in Racine - from CTH "K" to Milwaukee County Line



Posted Speed Limit - 55 MPH

July 2004