1-5-1 Subject Numbering System — June 2005

DEFINITIONS

Chapter: A main divisional unit of this manual, addressing one of the major functions of traffic engineering or supporting functions.

Section: A grouping of related subjects within a chapter.

Subject: A specific guideline, policy or procedure.

SUBJECT NUMBERING

The manual is divided into topical chapters with each chapter having one or more sections that are divided into specific treatments of material, called subjects.

Chapters, sections and subjects are all numbered.

Chapter numbers are numbered consecutively, generally without gaps. Sections and subjects are numbered consecutively or sometimes with gaps--5, 10, 15, 20--to allow for future insertions of material at the most appropriate locations within the chapter or to follow the MUTCD numbering system.

Chapters 2 through 10 are allotted to subjects related to traffic control devices covered in the corresponding Parts 2 through 10 of the MUTCD.

1-5-5 Table of Contents — ~~April~~ January 2018~~2017~~

CHAPTER 1 - GENERAL

2-1-1 Introduction **September 1992**

Beginning with Chapter 2 and extending through Chapter 9, Bicycle Facilities, the TEOpS entry heading and numbering system will follow the corresponding system in the MUTCD. The SECTION designation will be numerical instead of alphabetic as in the MUTCD partly in order to differentiate between the two.

2-1-3 Standardization **December 2005**

Although the Department exercises no control over the usage of non-conforming signs on other systems, except on sections being built under state contracts, the Department can and *should* be looked to for direction in preserving the uniformity of all traffic control devices. Signs are of special concern because they can be designed in almost endless variation.

Part 1 of the MUTCD gives specific positive purposes for the use of standardized traffic control devices. If these were closely followed by all agencies there would be no need for further discussion. Unfortunately, there are some who believe that non-uniform signs are more effective, generally because of their uniqueness. The following discussion is intended to counter this attitude and service as a resource in replying on the subject of uniformity or objecting to the use of non-conforming signs.

While it *should* be quite clear as to the purposes of signing for the benefit of the motoring public, there are other purposes for signing which *may* be installed on streets and highways, some of which have no benefit to motorists at all. These side purposes *may* include efforts to:

- Attract
- Notify, inform
- Advertise
- Educate
- Influence
- Propagandize
- Memorialize
- Placate
- Landmark
- Reinforce

The consequences of displaying non-conforming signs would be expected to mainly affect the motorist, but sometimes *may* affect others, such as pedestrians. These consequences *may* include:

- Misinterpretation
- Incorrect message
- Message contrary to law
- Distracting from driving task
- Distracting from important signs
- Incomprehensive message
- Generation of humor rather than seriousness
- False trust by others (pedestrians)
- Wasted money
- Bad precedent
- Loss of respect
- Poor materials (deterioration)
- Poor aesthetics
- Liability

EXAMPLES

Some specific examples follow which are intended to explain why the usage is undesirable.

Slow Children

The use of this sign is probably the most common non-standard to be found on local streets. It is typically a black on yellow rectangular sign, with a running child figure. A variation *may* add the phrase “at play.” It is often shown in sign catalogs.

The purpose of this sign is largely to placate the residents. While their concern for the safety of their children is understandable, the real issue is not being addressed, which the hazard is caused by children either playing in the street or entering the street without exercising care. Both of these actions are illegal. The sign therefore tends to endorse illegal actions, and that is why it *should* not be used.

Motorist Stop/Yield to Pedestrians

This sign is commonly a red and white rectangle, but could have several variations. It is usually erected at the crosswalk. A variation seen in other states refers to children and is probably used at crossings of neighborhood school routes. The departure from shape, color and message tends to diminish the impact of conforming signing. It *should* be expected that the public is slightly confused as to what is expected at these "special" places. The most serious reason why they *should* not be used would be if the pedestrians themselves observed the signs and reacted differently, thereby not exercising their normal caution. In Wisconsin, pedestrians have the right of way only if they do not cause the motorist to have difficulty in stopping.

Black Spot

This sign is used in foreign countries and perhaps in this country to indicate the scene of one or more fatal accidents. It is intended to warn motorists of a perceived dangerous location as well as to memorialize the location. In Wisconsin crosses have been erected by private persons to do the same thing. The negative aspects of this activity are the possibility that motorists will be distracted, that the location is only randomly the scene of a fatality, that the sign itself *may* be an obstruction to sight or otherwise an obstacle; that the sign is not informative as to what the hazard might be if there was one; and the prospect that the memorial will be unpleasant to local people if the victim was local.

Directional Signs to Generators

In a recent contract funded with federal aid, provisions were made to install directional signs on a downtown street. The design of the signs was non-conforming regarding the MUTCD Sections 1A.02 and 2D.02 through 2D.08. The signs had two-color backgrounds, had arrows set in circles, which were black and white and raised above the sign surface and extended out beyond the edge of the sign, and had letter fonts and sized which would have made the signs illegible to the motoring public. The signs were removed from the project.

This was admittedly an extreme case of non-conformance. However, it is our obligation to advise that there are definite standards on all features of guide signs. To the extent that signs depart from any of these standards, the motoring public is not served, but rather some other interest is being addressed, some of which are listed above, along with the consequences.

2-1-7 Dynamic Speed Display Signs ~~June 2014~~December 2017

PURPOSE

The MUTCD section 2A.07 allows usage of Dynamic Speed Display Signs to measure and display individual speeds at a specific location. These signs are commonly referred to as "speed display signs," "driver feedback signs" or "your speed is" signs. The signs are activated by radar to detect and display individual vehicle speeds to the vehicle driver. The expectation is that the driver will compare his speed with the legal posted speed and adjust accordingly. These sign installations may be portable installations that are installed on a temporary basis or may be permanent installations attached to new or existing signing. Local units of government have requested to install this signing. This policy provides guidance on the usage of these signs on state maintained roadways.

DEFINITIONS

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

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

Conventional Highways are defined as 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.

POLICY

Requests to install and maintain dynamic speed display signs on DOT-maintained roadways **shall** be made in writing by a local unit of government. Each request **shall** include a map showing the proposed location of the dynamic speed display sign(s). Upon Region review, approval or denial **shall** be made by a letter to the local unit of government. If approval is granted, the letter **shall** confirm that all provisions of this policy are met by the request. If approval is given, the Region *should* also provide a copy of the R2-1C standard sign plate with the approval letter so consistency is maintained in the design and manufacture of the signs.

QUALIFYING CRITERIA

The following criteria **shall** be used by the Region to determine whether a roadway would qualify for dynamic speed display signs.

1. Dynamic Speed Display Signs *may* be allowed in the following locations on the state highway system:
    a. School Speed Limit Zones
    b. Reductions in Speed Zones within a community
    c. Work Zone speed limit areas.
2. Portably mounted dynamic speed display signs *may* be permitted at locations where they can safely be deployed for a time period not to exceed eight days.
3. Dynamic speed display signs for work zones *may* be allowed for the duration of the project. The decision to utilize dynamic speed display signs for construction work zones is determined through the work zone transportation management plan process.
4. Except for work zone areas, dynamic speed display signs **shall not** be allowed on freeways and expressways, including ramps.
5. The usage of dynamic speed display signs is limited to one sign per approach of speed transition zones such as at city limits, school zones or speed reduction transition. Transition points from expressways to conventional highways may be permitted.
6. Dynamic Speed Display sign installations **shall** comply with all NCHRP 350 crashworthy requirements.
7. When permanent mounted dynamic speed display signs are used, they **shall** be placed next to or downstream (typically 100'-200') of the regulatory speed limit sign (R2-1) or school speed assembly sign (S4-51) sign. The signs **shall** be at the same mounting height.
8. Dynamic speed display signs that do not conform to this policy **shall** be removed. Notification to communities **shall** be made by written letter. If existing non-permitted signs are not removed, WisDOT will remove the sign(s) at the owner's expense.
9. The local unit of government **shall** be responsible for manufacture, liability, installation and maintenance costs.
10. The local unit of government **shall** affix an identification label to the back of each sign, per Wisconsin State Statute 86.19(5).
11. WisDOT reserves the right to remove or move dynamic speed display signs in the event of a speed zone change, maintenance work or improvement project. WisDOT will notify the local unit of government, in writing, of the work and all costs associated with moving or removing the dynamic message speed signs. All costs for such moves **shall** be paid by the local unit of government.
12. The size lettering used on dynamic speed display signs **shall**, at a minimum, match the adjacent speed limit sign (see R2-1C sign plate).

USAGE CRITERIA

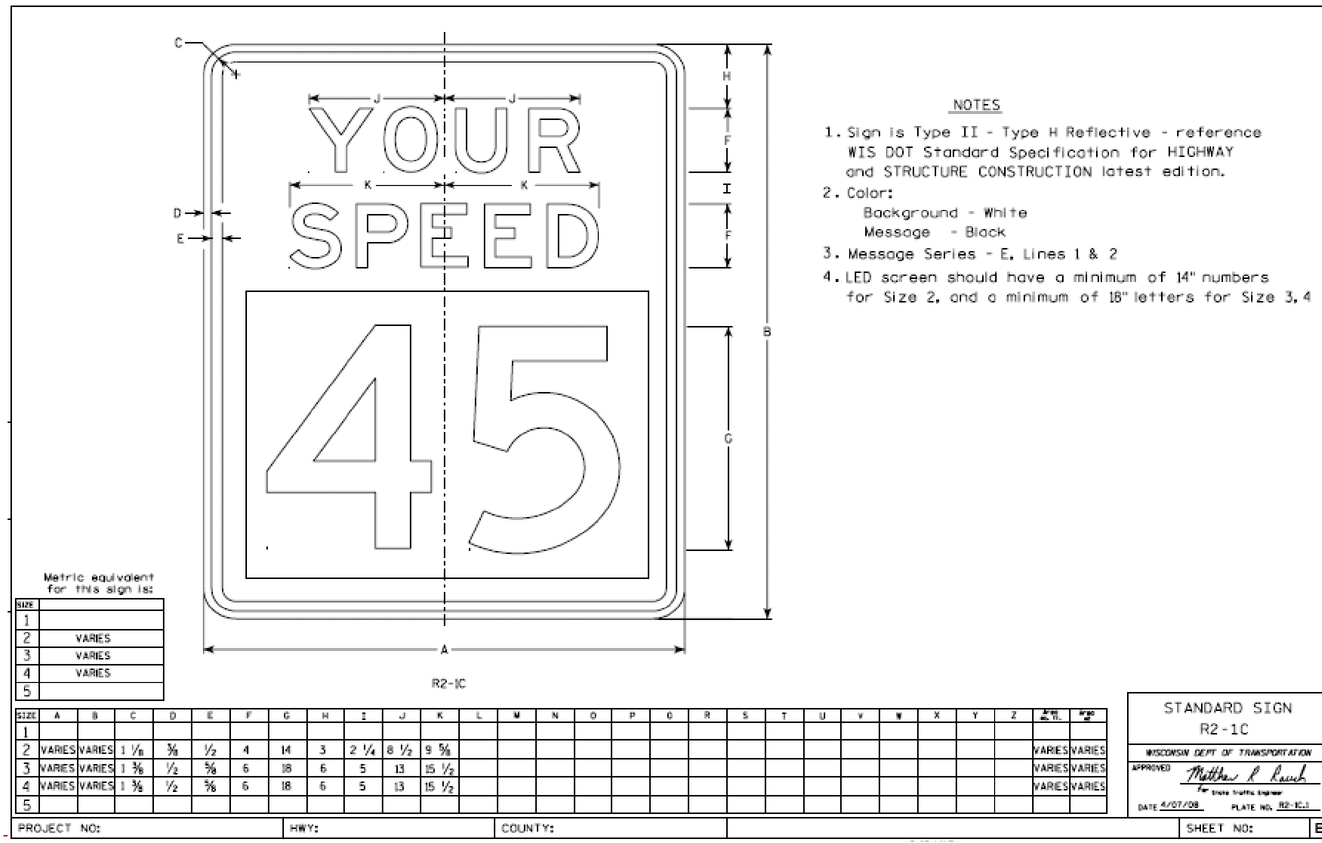
1. Dynamic speed display signs installed in permanent speed zones *should* operate 24 hours a day, 7 days a week.
2. Dynamic speed display signs installed on a temporary speed zone *should* operate for the time period that the speed zone is in effect (e.g. school zones or work zones).
3. For work zones, the dynamic speed display signs *should not* be overused. Only one dynamic speed display sign *should* be used per direction of traffic flow.

SIGN DESIGN CRITERIA

1. The R2-1C sign (See Figure 1) **shall** be used for permanent applications.
2. The changeable portion of the dynamic speed display sign **shall** have a black background with an amber (yellow) legend. On devices equipped with flip discs, the legend color *may* be yellow or green.

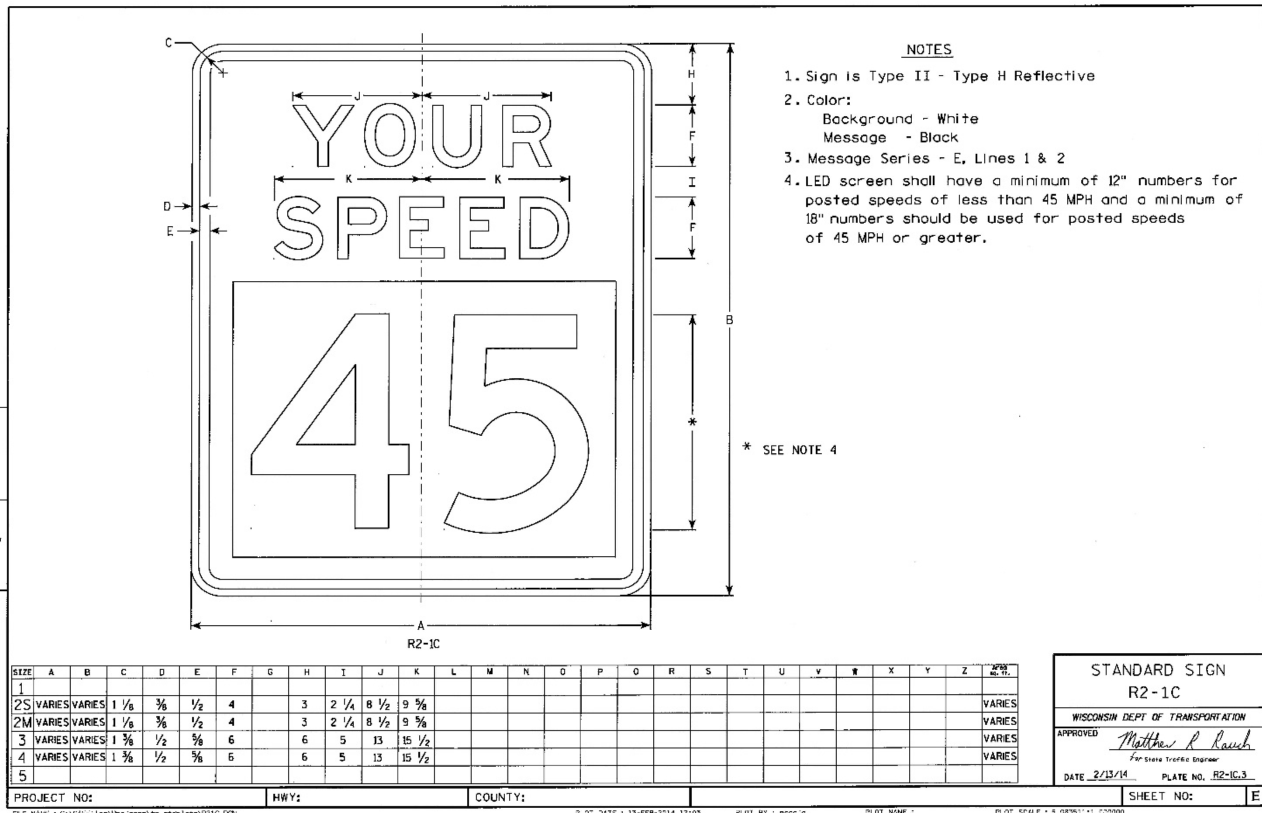
Only one sign, in each direction of a two-way street approach or back-to-back signs, will be allowed for each crosswalk approach.

3. The changeable message portion of the sign **shall** display the speed of the approaching vehicle as “XX” in miles per hour. The following standards apply to the changeable message portion of the sign:
    a. The sign **shall** flash at drivers traveling over the posted speed limit.
    b. The flash rate *should* be between 50 and 60 cycles per minute.
    c. Threshold speed setting *should* be set at 20mp below and above the posted speed.
    d. For speeds measured over the speed threshold setting, the dynamic speed display sign **shall** go blank.
    e. The dynamic speed display sign **shall** be either blank or display zeros when no vehicles are present.



SIZE	
1	
2	VARIES
3	VARIES
4	VARIES
5	

SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[illegible]	[illegible]
1																												
2	VARIES	VARIES	1 1/8	3/8	1/2	4	14	3	2 1/4	8 1/2	9 5/8																VARIES	VARIES
3	VARIES	VARIES	1 3/8	1/2	5/8	6	18	6	5	13	15 1/2																VARIES	VARIES
4	VARIES	VARIES	1 3/8	1/2	5/8	6	18	6	5	13	15 1/2																VARIES	VARIES
5																												



SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Area sq. ft.
1																											
2S	VARIES	VARIES	1 1/8	3/8	1/2	4		3	2 1/4	8 1/2	9 5/8																VARIES
2M	VARIES	VARIES	1 1/8	3/8	1/2	4		3	2 1/4	8 1/2	9 5/8																VARIES
3	VARIES	VARIES	1 3/8	1/2	5/8	6		6	5	13	15 1/2																VARIES
4	VARIES	VARIES	1 3/8	1/2	5/8	6		6	5	13	15 1/2																VARIES
5																											

Figure 1. Dynamic Speed Display Sign R2-1C

2-1-8 LEDs (Blinker Signs) June 2014

PURPOSE

The MUTCD section 2A.07 provides standards and options for the usage of Light Emitting Diode (LED) units within the face of a sign and in the border of a sign to improve conspicuity and increase the legibility of sign legends and borders. This policy provides requirements and guidance on the proper use of the LED (commonly referred to as blinker) signs on state-maintained highways. Per the MUTCD, these blinker signs *may* be used on STOP signs, Warning signs and other regulatory signs such as speed limit sign or school signs. This policy provides guidance and requirements for usage on state-maintained highways.

BACKGROUND

The MUTCD includes language in 2A.07 which provides guidelines for the proper use of these devices. They are considered similar to flashing beacons in section 4L of the MUTCD. The limiting guidelines under which they are considered in the Wisconsin Supplement are:

- Guideline 1: Demonstrated crash problem
- Guideline 2: Visibility restrictions
- Guideline 3: Unusual geometrics
- Guideline 4: Poor conspicuity—sign blending in with the environment

These four guidelines apply to all public highways and streets, including those not under state jurisdiction. The policy statements below pertain specifically to state-maintained highways.

DEFINITIONS AND MUTCD REQUIREMENTS (IF LEDS USED)

1. LEDs **shall** have a maximum diameter of ¼ inch and **shall** be the following colors based on the type of sign:
    a. White or red, if used with STOP or YIELD signs.

   b. White, if used with regulatory signs other than STOP or YIELD signs.
   c. White or yellow, if used with warning signs.
2. If flashed, the LED units **shall** flash simultaneously at a rate of more than 50 and less than 60 times per minute.
3. The uniformity of the sign design **shall** be maintained without any decrease in visibility, legibility, or driver comprehension during either daytime or nighttime conditions.
4. A module of multiple LED units used as a closely-spaced, single light source **shall** only be used within the sign face for legends or symbols.

POLICY

The usage of any illumination methods for traffic signs, including LEDs, is strictly limited to situations with documented safety concerns.

1. Local authorities **shall not** be allowed to installed units on state-maintained highways.
2. Blinker signs **shall** only be considered at existing locations. A conversion from a two to four way stop is also considered an existing location. New locations **shall not** be considered until such time as a minimum of one-year crash data, volume data and other traffic data is available for a traffic evaluation safety **shall** be submitted to the State Safety Engineer for review.
3. For blinker STOP and STOP AHEAD signs, at a minimum, consider at intersections that meet both of the following criteria:
   a. Crashes due to failure to stop (i.e. running the stop sign), not failure to yield the right of way (i.e. stopping and then proceeding)
   b. At least two documented failures (crash reports) to stop in the most recent 12 month period, or three documented failures to stop within the past five years.
4. Other countermeasures *should* be considered first, prior to installation of blinker STOP and STOP AHEAD signs, to address safety concerns such as:
   a. Clearing vegetation
   b. Double-marking STOP or STOP AHEAD signs
   c. Flags on signs
   d. Rumble strips
   e. Increasing sign sizes
   f. Flashing beacons
   g. Others.
5. Side-by-side ramps are common at partial cloverleaf interchanges where entrance and exit ramps operate directly adjacent to one another rat the interchange ramp terminal. Geometric design techniques to discourage wrong way maneuvers *should* be considered at side-by-side ramps. Where design constraints exits, blinker WRONG WAY signs *may* be utilized at side-by-side interchange ramps, provided there are documented wrong way movements noted by law enforcement or the Department. Blinker WRONG WAY signs **shall** not be used at locations other than side-by-side interchange ramps. WRONG WAY blinker signs shall only be used downstream of the ramp termini.
6. To maximize the effectiveness of the blinker WRONG WAY signs, vehicle actuated and time-of-day usage **shall** be considered by the Region. Some examples of time-of day usage would include:
   a. Operation during periods when wrong way drivers are prevalent.
   b. Operation during periods of low visibility or darkness, which may include a photocell operation.
7. In order to avoid a proliferation of blinker signs, at this time they **shall** only be used for STOP, STOP AHEAD, and WRONG WAY signs (at side-by-side ramps). These are considered the more important of the regulatory and warning sign series. There is the longstanding concern that overuse of the blinker signs will diminish their effectiveness.

   *There have been requests to utilize different types of blinker signs. To address these requests, the

Bureau of Traffic Operations is in the process of coordinating the evaluation of different types of blinker signs, and the evaluation results will determine the potential expansion of use per statewide policy. Presently, blinker signs are currently being evaluated on chevron signs in the SE and SW Regions, where there is a dynamic (vehicle actuated) system.

Any requests for additional blinker sign evaluations **shall** be approved by the Bureau of Traffic Operations.

8. Blinker STOP AHEAD signs **shall** be furnished and installed by WisDOT on state highways based on the criteria noted above.
9. Do not install blinker STOP signs and STOP AHEAD signs on the same approach. If used where there is a curve or hill approaching a STOP sign, use blinker on STOP AHEAD sign rather than STOP sign.
10. Do not mix beacons and blinker signs with STOP and STOP AHEAD signs on the same approach.

A cost comparison analysis *should* be done to determine where beacons or blinker sign is more appropriate. Studies have not been performed to determine if one device is more appropriate than the other.

2-1-30 Sign Numbering — January 2007

Section 86.19(5) Wis. Stat. provides that all maintaining agencies in the state must affix a unique code number to each of their signs for the purpose of identifying the owner of the sign if it *should* be found elsewhere. Whereas the vandalism sticker is prescribed by law to be applied to the face of the sign, there is no provision about sign numbers in 86.19 (5) to that effect, and therefor the number *may* be placed on the back of the sign, although it could be incorporated unobtrusively into the stenciling.

The format of the sign number *should* follow the example below for the Town of Big Flats in Adams County:

1-02

The numerals *should* be one inch in height and made of durable materials such as stencil paste on adhesive-backed vinyl film. Felt pen ink will not last. Paint applied directly to aluminum *may* come of if the aluminum is not specifically treated.

The numbers to be used are on the following pages.

2 ASHLAND

Townships		Cities & Villages	
02	Agenda	201	Ashland (C)
04	Ashland	106	Butternut (V)
06	Chippewa	251	Mellen (C)
08	Gingles		
10	Gordon	Unincorporated Villages	
12	Jacobs	09	Cayuga
14	La Pointe	05	Clam Lake
16	Marengo	06	Glidden
18	Morse	02	High Bridge
20	Peeksville	13	Marengo
22	Sanborn	05	Morse
24	Shanagolden	11	Odanah
26	White River	13	Sanborn

1 ADAMS

Townships		Cities & Villages	
02	Adams	201	Adams (C)
04	Big Flats	291	Friendship (V)
06	Colburn		
08	Dell Prairie	Unincorporated Villages	
10	Easton	17	Arkdale
12	Jackson	10	Brooks
14	Leola	17	Dellwood
16	Lincoln	10	Grand Marsh
18	Monroe	15	New Rome
20	New Chester	04	Plainville
22	New Haven	05	White Creek
24	Preston		
26	Quincy		
28	Richfield		
30	Rome		
32	Springville		
34	Strongs Prairie		

3 BARRON

Townships		Cities & Villages	
02	Almena	101	Almena (V)
04	Arland	206	Barron (C)
06	Barron	111	Cameron (V)
08	Bear Lake	211	Chetek (C)
10	Cedar Lake	212	Cumberland (C)
12	Chetek	116	Dallas (V)
14	Clinton	136	Haugen (V)
16	Crystal Lake	171	Prairie Farm (V)
18	Cumberland	276	Rice Lake (C)
20	Dallas	186	Turtle Lake (V)
22	Dovre	151	New Auburn (V)
24	Doyle		Also in Chippewa
26	Lakeland		
28	Maple Grove	Unincorporated Villages	
30	Maple Plain	05	Angus
32	Oak Grove	13	Barronett
34	Prairie Farm	16	Brill
36	Prairie Lake	19	Campia
38	Rice Lake	23	Canton
40	Sioux Creek	08	Comstock
42	Stanfold	14	Hillsdale
44	Stanley	23	Lehigh
46	Sumner	05	Mikana

48	Turtle Lake	07	Poskin
50	Vance Creek		

4 BAYFIELD

Townships		Cities & Villages	
02	Barksdale	206	Bayfield (C)
04	Barnes	201	Ashland (C)
06	Bayfield	151	Mason (V)
08	Bay View	291	Washburn (C)
10	Bell		
12	Cable		
14	Clover		
16	Delta		
18	Drummond		
20	Eileen		
21	Hughes		
22	Iron River		
24	Kelly		
26	Keystone		
28	Lincoln		
30	Mason		
32	Namekegon		
34	Orients		
36	Oulu		
38	Piben		
40	Port Wing		
42	Grandview		
46	Russell		
48	Tripp		
50	Washburn		

Unincorporated Villages	
07	Barkpoint
14	Benoit
02	Bingo
05	Cornucopia
08	Delta
02	Fresh Air
22	Grandview
07	Herbster
20	Moquah

5 BROWN

Townships		Cities & Villages	
10	Eaton	102	Allouez (V)
12	Glenmore	104	Ashwaubenon (V)
14	Green Bay	106	Bellevue (V)
18	Holland	126	Hobart (V)
22	Humboldt	116	Denmark (V)
24	Lawrence	216	De Pere (C)
25	Ledgeview	231	Green Bay (C)
26	Morrison	136	Howard (V)
28	New Denmark	171	Pulaski (V)
30	Pittsfield	178	Suamico (V)
34	Rockland	191	Wrightstown (V)
36	Scott		
40	Wrightstown		

Unincorporated Villages	
15	Anston
19	Big Suamico
20	Greenleaf
12	Little Rapids
11	New Franken
13	Wayside
20	W. Wrightstown

6 BUFFALO WSP-6

Townships		Cities & Villages	
02	Alma	201	Alma (C)
04	Belvidere	206	Buffalo (C)
06	Buffalo	111	Cochrane (V)
08	Canton	226	Fountain City (C)
10	Cross	251	Mondovi (C)
12	Dover	154	Nelson (V)
14	Gilmanton		
16	Glencoe		
18	Lincoln		
20	Maxville		
22	Milton		
24	Modena		
26	Mondovi		
28	Montana		
30	Naples		
32	Nelson		
34	Waumandee		

7 BURNETT

Townships		Cities & Villages	
02	Anderson	131	Grantsburg (V)
04	Blaine	181	Siren (V)
06	Daniels	191	Webster (V)
08	Dewey		
10	Grantsburg		
12	Jackson		
14	La Follette		
16	Lincoln		
18	Meenon		
20	Oakland		
22	Roosevelt		
24	Rusk		
26	Sand Lake		
28	Scott		
30	Siren		
32	Swiss		
34	Trade Lake		
36	Union		
38	Webb Lake		
40	West Marshland		
42	Wood River		

Unincorporated Villages	
16	Danbury
14	Ferron Park
12	Gaslyn
07	Hertel
01	Randall
10	Yellowlake

8 CALUMET

Townships		Cities & Villages	
02	Brillion	206	Brillion (C)
04	Brothertown	211	Chilton (C)
06	Charlestown	136	Hilbert (V)
08	Chilton	261	New Holstein (C)
10	Harrison	179	Sherwood (V)
12	New Holstein	181	Stockbridge (V)
14	Rantoul	201	Appleton (C)
16	Stockbridge	160	Potter
18	Woodville	241	Kiel
		251	Menasha

Unincorporated Villages	
05	Darboy
09	Dundas
01	Forest Junction
03	Hayton
05	Highcliff

9 CHIPPEWA

Townships		Cities & Villages	
02	Anson	206	Bloomer (C)
04	Arthur	106	Boyd (V)
06	Auburn	111	Cadott (V)
08	Birch Creek	211	Chippewa Falls (C)
10	Bloomer	213	Cornell (C)
12	Cleveland	161	New Auburn (V) also in Barron Co.
14	Colburn		
16	Cooks Valley	281	Stanley (C)
18	Delmar	128	Lake Hallie (V)
20	Eagle Point		
22	Edson		
24	Estella		
26	Goetz		
28	Hallie		

Unincorporated Villages	
16	Albertville
18	Arnold
02	Cobban

32	Howard	10	Eagleton
34	Lafayette	01	Jim Falls
35	Lake Holcombe		
36	Ruby		
38	Sampson		
40	Sigel		
42	Tilden		
44	Wheaton		
46	Woodmohr		

10 CLARK

Townships		Cities & Villages	
02	Beaver	201	Abbotsford (C)
04	Butler	211	Colby (C)
06	Colby	111	Curtiss (V)
08	Dewhurst	116	Dorchester (V)
10	Eaton	131	Granton (V)
12	Foster	231	Greenwood (C)
14	Fremont	246	Loyal (C)
16	Grant	261	Neillsville (C)
18	Green Grove	265	Owen (C)
20	Hendren	286	Thorp (C)
22	Hewett	191	Withee (V)
24	Hixon	186	Unity (V)
26	Hoard		
28	Levis		Unincorporated Villages
30	Loyal	07	Chili
32	Longwood	20	Humbird
3	Lynn	27	Riplinger
36	Mayville	23	Tioga
38	Mead	10	Willard
40	Mentor		
42	Pine Valley		
44	Reseberg		
46	Seif		
48	Sherman		
50	Sherwood		
52	Thorp		
54	Unity		
56	Warner		
58	Washburn		
60	Weston		
62	Withee		
64	Worden		
66	York		

11 COLUMBIA

Townships		Cities & Villages	
02	Arlington	101	Arlington (V)
04	Caledonia	111	Cambria (V)
06	Columbus	211	Columbus (C)
08	Courtland	116	Doylestown (V)
10	Dekorra	126	Fall River (V)
12	Ft. Winnebago	127	Friesland (V)
14	Fountain Prairie	246	Lodi (C)
16	Hampden	171	Pardeeville (V)
18	Leeds	271	Portage (C)
20	Lewiston	172	Poynette (V)
22	Lodi	176	Randolph (V)
24	Lowville	177	Rio (V)
26	Marcellon	291	Wisconsin Dells (C)
28	Newport	191	Wyocena (V)
30	Otsego		
32	Pacific		Unincorporated Villages
34	Randolph	119	Okee
36	Scott		
38	Springville		
40	West Point		
42	Wyocena		

12 CRAWFORD

Townships		Cities & Villages	
02	Bridgeport	106	Bell Center
04	Clayton	116	De Soto (V)
06	Eastman	121	Eastman (V)
08	Freeman	126	Ferryville (V)
10	Haney	131	Gays Mills (V)
12	Marietta	146	Lynxville (V)
14	Prairie du Chien	151	Mt. Sterling (V)
16	Scott	271	Prairie du Chien (C)
18	Seneca	181	Soldiers Grove (V)
20	Utica	182	Steuben (V)
22	Wauzeka	191	Wauzeka (V)
			Unincorporated Villages
		05	Barnum
		05	Petersburg

13 DANE

Townships		Cities & Villages	
02	Albion	106	Belleville (V)
04	Berry	107	Black Earth (V)
06	Black Earth	108	Blue Mounds (V)
		109	Brooklyn (V)
08	Blooming Grove	111	Cambridge (V)
10	Blue Mounds	112	Cottage Grove (V)
12	Bristol	113	Cross Plains (V)
14	Burke	116	Dane (V)
16	Christiana	117	Deerfield (V)
18	Cottage Grove	118	De Forest (V)
20	Cross Plains	221	Edgerton (V)
22	Dane	251	Madison (C)
24	Deerfield	151	Maple Bluff (V)
26	Dunkirk	154	McFarland (V)
28	Dunn	152	Marshall (V)
32	Madison	153	Mazomanie (V)
34	Mazomanie	255	Middleton (C)
36	Medina	258	Monona (C)
38	Middleton	157	Mt. Horeb (V)
40	Montrose	165	Oregon (V)
42	Oregon	176	Rockdale (V)
44	Perry	181	Shorewood Hills (V)
46	Pleasant Springs	281	Stoughton (C)
48	Primrose	282	Sun Prairie (C)
50	Roxbury	286	Verona (C)
52	Rutland	191	Waunakee (V)
54	Springdale		
56	Springfield		Unincorporated Villages
58	Sun Prairie	20	Basco
60	Vermont	27	Klevenville
62	Verona	12	London
64	Vienna	34	Morrisonville
66	Westport	27	Mt. Vernon
68	Windsor	20	Paoli
70	York	27	Riley

14 DODGE

Townships		Cities & Villages	
02	Ashippun	206	Beaver Dam (C)
04	Beaver Dam	106	Brownsville (V)
06	Burnett	111	Clyman (V)
08	Calamus	211	Columbus (C)
10	Chester	226	Fox Lake (C)

Townships		Cities & Villages	
12	Clyman	230	Hartford (C)
14	Elba	236	Horicon (C)
16	Emmet	136	Hustisford (V)
18	Fox Lake	141	Iron Ridge (V)
20	Herman	241	Juneau (C)
22	Hubbard	143	Kekoskee (V)
24	Hustisford	146	Lomira (V)
26	Lebanon	147	Lowell (V)
28	Le Roy	251	Mayville (C)
30	Lomira	161	Neosho (V)
32	Lowell	176	Randolph (V)
34	Oak Grove	177	Reeseville (V)
36	Portland	186	Theresa (V)
38	Rubicon	291	Watertown (C)
40	Shields	292	Waupun (C)
42	Theresa		
44	Trenton		
46	Westford		
48	Williamstown		

Unincorporated Villages	
07	Astico
05	Atwater
15	Knowles
21	Marshville
17	Minnesota Jct
20	Richwood
17	Rolling Prairie
10	Woodland

15 DOOR

Townships		Cities & Villages	
02	Baileys Harbor	121	Ephraim (V)
04	Brussels	127	Forestville (V)
06	Clay Banks	181	Sister Bay (V)
08	Egg Harbor	281	Sturgeon Bay (C)
10	Forestville	118	Egg Harbor (V)
12	Gardner		
14	Gibraltar		
16	Jacksonport		
18	Liberty Grove		
20	Nasewaupee		
22	Sevastopol		
24	Sturgeon Bay		
26	Union		
28	Washington		

Unincorporated Villages	
14	Detroit Harbor
09	Ellison Bay
07	Fish Creek
08	Jacksonport-Sturgeon Bay
05	Mapelwood
53	Sawyer-Sturgeon Bay
14	Washington Island
04	Carlsville

16 DOUGLAS

Townships		Cities & Villages	
02	Amnicon	146	Lake Nebagamon (V)
04	Bennett	165	Oliver (V)
06	Brule	171	Poplar (V)
08	Cloverland	181	Solon Springs (V)
10	Dairyland	281	Superior (C)
12	Gordon	182	Superior Village (V)
14	Hawthorne		
16	Highland		
18	Lakeside		
20	Maple		
22	Oakland		
24	Parkland		
26	Solon Springs		
28	Summit		
30	Superior		
32	Wascott		

Unincorporated Villages	
55	Allouez
14	Amnicon Lake
55	Billings Park
10	Blueberry
55	East End
14	Foxboro
07	Hines
55	Itesca
05	Dairyland
14	Patzau
12	South Range
01	Wentworth

17 DUNN

Townships		Cities & Villages	
02	Colfax	106	Boyceville (V)
04	Dunn	111	Colfax (V)
06	Eau Galle	116	Downing (V)
08	Elk Mound	121	Elk Mound (V)
10	Grant	141	Knapp (V)
12	Hay River	251	Menomonie (C)
14	Lucas	176	Ridgeland (V)
16	Menomoniee	191	Wheeler (V)
18	New Haven		
20	Otter Creek		
22	Peru		
24	Red Cedar		
26	Rock Creek		
28	Sand Creek		
30	Sheridan		
32	Sherman		
34	Spring Brook		
36	Stanton		
38	Tainter		
40	Tiffany		
42	Weston		
44	Wilson		

Unincorporated Villages	
13	Caryville
02	Downsville
11	Meridean
12	Rusk
13	Rock Falls

18 EAU CLAIRE

Townships		Cities & Villages	
02	Bridge Creek	201	Altoona (C)
04	Brunswick	202	Augusta (C)
06	Clear Creek	221	Eau Claire (C)
08	Drammen	126	Fairchild (V)
10	Fairchild	127	Fall Creek (V)
12	Lincoln		
14	Ludington		
16	Otter Creek		
18	Pleasant Valley		
20	Seymour		
22	Union		
24	Washington		
26	Wilson		

Unincorporated Villages	
03	Allen
03	Foster

19 FLORENCE

Townships		Unincorporated Villages	
02	Aurora	05	Spread Eagle
04	Commonwealth		
06	Fence		
08	Fern		
10	Florence		
12	Homestead		
14	Long Lake		
16	Tipler		

20 FOND DU LAC

Townships		Cities & Villages	
02	Alto	106	Brandon (V)
04	Ashford	111	Campbellsport (V)
06	Auburn	121	Eden (V)
08	Byron	126	Fair Water (V)
10	Calumet	226	Fond du Lac (C)
12	Eden	151	Mt. Calvary
14	Eldorado	161	N. Fond du Lac (V)
16	Empire	165	Oakfield (V)
18	Fond du Lac	276	Ripon (C)
20	Forest	176	Rosendale (V)
22	Friendship	181	St. Cloud (V)
24	Lamartine	142	Kewauskum (V)

26	Marshfield	292	Waupun (C)
28	Metomen		
30	Oakfield		
32	Osceola		
34	Ripon		
36	Rosendale		
38	Springvale		
40	Taycheedah		
42	Waupun		

Unincorporated Villages	
13	Calvary
04	Hamilton
20	Malone
15	Oak Center
20	Peebles
04	S. Byron
11	Van Dyne

21 FOREST

Townships		Cities & Villages	
02	Alvin	211	Crandon (C)
04	Argonne		
06	Armstrong Creek		
08	Blackwell		
10	Caswell		
12	Crandon		
14	Freedom		
16	Hiles		
18	Laona		
20	Lincoln		
22	Nashville		
24	Popple River		
26	Ross		
28	Wabeno		

Unincorporated Villages	
02	Argonne
14	Carter
05	Cavour
08	Hiles
11	Jones Spur
11	Mole Lake
11	Nashville
01	Nelma
13	Newald
14	Padus
10	Planets
14	Soperton
10	Keith

22 GRANT

Townships		Cities & Villages	
02	Beetown	106	Bagley (V)
04	Bloomington	107	Bloomington (V)
06	Boscobel	108	Blue River (V)
08	Cassville	206	Boscobel (C)
10	Castle Rock	111	Cassville (V)
12	Clifton	211	Cuba City (C)
14	Ellenboro	116	Dickeyville (V)
16	Fennimore	226	Fennimore (C)
18	Glen Haven	136	Hazel Green (V)
20	Harrison	246	Lancaster (C)
22	Hazel Green	147	Livingston (V)
24	Hickory Grove	151	Montfort (V)
26	Jamestown	152	Mt. Hope (V)
28	Liberty	153	Muscoda (V)
30	Lima	171	Patch Grove (V)
32	Little Grant	271	Platteville (C)
34	Marion	172	Potosi (V)
36	Millville	186	Tennyson (V)
38	Mt. Hope	191	Woodman (V)
40	Mt. Ida		
42	Muscoda		
44	North Lancaster		
46	Paris		
48	Patch Grove		
50	Platteville		
52	Potosi		
54	Smelser		
56	South Lancaster		
58	Waterloo		
60	Watterstown		
62	Wingville		
64	Woodman		
66	Wyalusing		

Unincorporated Villages	
27	Georgetown
13	Kieler
13	Louisburg
11	Sinsinawa
14	Stitzer
20	Werley

23 GREEN

Townships		Cities & Villages	
02	Adams	101	Albany (V)
04	Albany	206	Brodhead (C)
06	Brooklyn	106	Brooklyn (V)
08	Cadiz	110	Browntown (V)
10	Clarno	251	Monroe (C)
12	Decatur	151	Monticello (V)
14	Exeter	161	New Glarus (V)
16	Jefferson		
18	Jordan		
20	Monroe		
22	Mt. Pleasant		
24	New Glarus		
26	Spring Grove		
28	Sylvester		
30	Washington		
32	York		

Unincorporated Villages	
05	Clarno
08	Juda
04	Martintown

24 GREEN LAKE

Townships		Cities & Villages	
02	Berlin	206	Berlin (C)
04	Brooklyn	231	Green Lake (C)
06	Green Lake	141	Kingston (V)
08	Kingston	251	Markesan (C)
10	Mackford	154	Marquette (V)
12	Manchester	271	Princeton (C)
14	Marquette		
16	Princeton		
18	St. Marie		
20	Seneca		

Unincorporated Villages	
04	Dalton

25 IOWA

Townships		Cities & Villages	
02	Arena	101	Arena (V)
04	Brigham	102	Avoca (V)
06	Clyde	106	Barnevald (V)
08	Dodgeville	108	Blanchardville (V)
10	Eden	111	Cobb (V)
12	Highland	216	Dodgeville (C)
14	Landen	136	Highland (V)
16	Mifflin	137	Hollandale (V)
18	Mineral Point	146	Linden (V)
20	Moscow	147	Livingston (V) Also in Grant Co.
22	Pulaski		
24	Ridgeway	251	Mineral Point (C)
26	Waldwick	151	Montfort
28	Wyoming	176	Rewey (V)
		177	Ridgeway (V)
		153	Muscoda (V) Also in Grant Co.

Unincorporated Villages	
07	Edmund
13	Jonesdale

26 IRON

Townships		Cities & Villages	
02	Anderson	236	Hurley (C)
04	Carey	251	Montreal (C)
06	Gurney		
08	Kimball		
10	Knight		
12	Mercer		
14	Oma		
16	Pence		
18	Saxon		
20	Sherman		

Unincorporated Villages	
03	Cedar
04	Defer
08	Gile
05	Iron Belt
06	Manitowish
10	Powell

07	Sandrock
10	Springstead
01	Upson
07	Van Buskirk

27 JACKSON

Townships		Cities & Villages	
02	Adams	101	Alma Center (V)
04	Albion	206	Black River Falls (C)
06	Alma	136	Hixton (V)
08	Bear Bluff	151	Melrose (V)
10	Brockway	152	Merrillan (V)
12	City Point	186	Taylor (V)
14	Cleveland		
16	Curran	Unincorporated Villages	
18	Franklin	01	Disco
20	Garden Valley	05	Pray
22	Garfield	11	Sechlerville
24	Garfield		
26	Irving		
28	Knapp		
30	Komensky		
32	Manchester		
34	Melrose		
36	Millston		
38	North Bend		
40	Northfield		
42	Springfield		

28 JEFFERSON

Townships		Cities & Villages	
02	Aztalan	111	Cambridge (V)
04	Cold Spring	226	Ft. Atkinson (C)
06	Concord	241	Jefferson (C)
08	Farmington	141	Johnson Creek (V)
10	Hebron	146	Lac LaBelle (V)
12	Ixonia	246	Lake Mills (C)
14	Jefferson	171	Palmyra (V)
16	Koshkonong	181	Sullivan (V)
18	Lake Mills	290	Waterloo (C)
20	Milford	291	Watertown (C)
22	Oakland	292	Whitewater (C)
24	Palmyra		
26	Sullivan	Unincorporated Villages	
28	Sumner	07	Helenville
30	Waterloo	10	Hubbleton
32	Watertown	01	Jefferson Jct
		13	Oak Hill
		13	Rome

29 JUNEAU

Townships		Cities & Villages	
02	Armenia	111	Camp Douglas (V)
04	Clearfield	221	Elroy (C)
06	Cutler	136	Hustler (V)
08	Finley	146	Lyndon Station (V)
10	Fountain	251	Mauston (C)
12	Germantown	161	Necedah (V)
14	Kildare	261	New Lisbon (C)
16	Kingston	186	Union Center (V)
18	Lemonweir	291	Wisconsin Dells (C)
20	Lindina	191	Wonewoc (V)
22	Lisbon		
24	Lyndon	Unincorporated Villages	
26	Marion	14	Cloverdale
28	Necedah	04	Finley
30	Orange	08	Mather
32	Plymouth	08	Meadow Valley
34	Seven Mile Creek	14	Sprague
36	Summit		
38	Wonewoc		

30 KENOSHA

Townships		Cities & Villages	
02	Brighton	241	Kenosha (C)
04	Bristol	131	Genoa City (V)
06	Paris	171	Paddock Lake (V)
10	Pleasant Prairie	174	Pleasant Prairie (V)
12	Randall	181	Silver Lake (V)
14	Salem	186	Twin Lakes (V)
16	Somers		
		Unincorporated Villages	
		05	Bassett
		06	Benet Lake
		06	Camp Lake
		05	Cross Lake
		05	Crow Lake
		06	Fox River
		08	New Munster
		05	Powers Lake
		05	Richmond, Ill
		08	Slades Corners
		06	Trevor
		04	Truesdell
		06	Wilmot
		02	Woodworth

31 KEWAUNEE

Townships		Cities & Villages	
02	Ahnapee	111	Casco (V)
04	Carlton	146	Luxemburg (V)
06	Casco	201	Algoma (C)
10	Franklin	241	Kewaunee (C)
12	Lincoln		
14	Luxemburg		
16	Montpelier		
18	Pierce		
20	Red River		

32 LA CROSSE

Townships		Cities & Villages	
02	Bangor	106	Bangor (V)
04	Barre	136	Holmen (V)
06	Burns	246	La Crosse (C)
08	Campbell	265	Onalaska (C)
10	Farmington	176	Rockland (V)
12	Greenfield	191	West Salem (V)
14	Hamilton		
16	Holland	Unincorporated Villages	
18	Medary	09	Midway
20	Onalaska	05	Mindoro
22	Shelby		
24	Washington		

33 LAFAYETTE

Townships		Cities & Villages	
02	Argyle	101	Argyle (V)
04	Belmont	106	Belmont (V)
06	Benton	107	Benton (V)
08	Blanchard	108	Blanchardville (V)
10	Darlington	211	Cuba City (C)
12	Elk Grove	216	Darlington (C)
14	Fayette	131	Gratiot (V)

16	Gratiot	281	Shullsburg (C)
18	Kendall	181	South Wayne (V)
20	Lamont	136	Hazel Green (C)
22	Monticello		
24	New Diggings		
26	Seymour		
28	Shullsburg		
30	Wayne		
32	White Oak Springs		
34	Willow Springs		
36	Wiota		

Unincorporated Villages

17	Calamine
14	Dunbarton
12	Leadmine
02	Leslie
18	Woodford

34 LANGLADE

Townships		Cities & Villages	
02	Ackley	201	Antigo (C)
04	Ainsworth	191	White Lake (V)
06	Antigo		
08	Elcho		
10	Evergreen		
12	Langlade		
14	Neva		
16	Norwood		
18	Parrish		
20	Peck		
22	Polar		
24	Price		
26	Rolling		
28	Summit		
30	Upham		
32	Vilas		
34	Wolf River		

Unincorporated Villages

12	Bryant
07	Deerbrook
05	Elton
17	Hollister
07	Kempster
06	Lily
17	Markton
02	Pearson
08	Phlox
06	Pickerel
15	Summit Lake

35 LINCOLN

Townships		Cities & Villages	
02	Birch	251	Merrill (C)
04	Bradley	286	Tomahawk (C)
06	Corning		
08	Harding		
10	Harrison		
12	King		
14	Merrill		
16	Pine River		
18	Rock Falls		
20	Russell		
22	Schley		
24	Scott		
26	Skanawan		
28	Somo		
30	Tomahawk		
32	Wilson		

Unincorporated Villages

10	119 Bloomville
11	Doering
10	Gleason
01	Irma
05	Jeffris
15	Spirit Falls
02	Heafford Jct

36 MANITOWOC

Townships		Cities & Villages	
02	Cato	112	Cleveland (V)
04	Centerville	126	Francis Creek (V)
06	Cooperstown	241	Kiel (C)
08	Eaton	251	Manitowoc (C)
10	Franklin	151	Mishicot (V)
12	Gibson	176	Reedsville (V)
14	Kossuth	181	St. Nazianz (V)
16	Liberty	286	Two Rivers (C)
18	Manitowoc	186	Valders (V)
20	Manitowoc Rapids	191	Whitelaw (V)
22	Maple Grove	147	Maribel (V)
24	Meeme	132	Kellnersville (V)
26	Mishicot		
28	Newton		
30	Rockland		
32	Schleswig		
34	Two Creeks		
36	Two Rivers		

Unincorporated Villages

10	Branch
15	Collins
01	Grimms
02	Hika
15	Quarry
13	Tisch Mills

37 MARATHON

Townships		Cities & Villages	
02	Bergen	201	Abbotsford (C)
04	Berlin	102	Athens (V)
06	Bern	104	Birnamwood (V)
08	Bevent	106	Brokaw (V)
10	Frighton	211	Colby (C)
12	Cassel	116	Dorchester (V)
14	Cleveland	121	Edgar (V)
16	Day	122	Elderon (V)
18	Easton	126	Fenwood (V)
20	Eau Pleine	136	Hatley (V)
22	Elderon	145	Kronewetter (V)
24	Emmett	151	Marathon City (V)
26	Frankfort	250	Marshfield (C)
28	Franzen	251	Mosinee (C)
30	Green Valley	176	Rothschild (V)
32	Guenther	281	Schofield (C)
34	Halsey	181	Spencer (V)
36	Hamburg	182	Stratford (V)
38	Harrison	186	Unity (V)
40	Hewitt	291	Wausau (C)
42	Holton	192	Weston (V)
44	Hull		
46	Johnson		
48	Knowlton		
52	Maine		
54	Marathon		
56	Mc Millan		
58	Mosinee		
60	Norrie		
62	Plover		
64	Reid		
66	Rib Falls		
68	Rib Mountain		
70	Rietbrock		
72	Ringle		
74	Spencer		
76	Stettin		
78	Texas		
80	Wausau		
82	Weston		
84	Wien		

Unincorporated Villages

23	Corinth
24	Dancy
14	Galloway
39	Granite Heights
23	Milan
12	Moon
02	Naugart
08	Rozellville

38 MARINETTE

Townships		Cities & Villages	
02	Amberg	111	Coleman (V)
04	Athelstane	251	Marinette (C)
06	Beaver	261	Niagara (V)
08	Beecher	271	Peshtigo (C)
10	Dunbar	171	Pound (V)
12	Goodman	191	Wausaukee (V)
14	Grover	121	Crivitz (V)
16	Lake		
18	Middle Inlet		
20	Niagara		
22	Pembine		
24	Peshtigo		
26	Porterfield		
28	Pound		

Unincorporated Villages

01	189 Cedarville
02	Intervale
08	Loomis
17	Mc Allister
01	Marek

30	Silver Cliff	13	Walsh
32	Stephenson		
34	Wagner		
36	Wausaukee		

39 MARQUETTE

Townships		Cities & Villages	
02	Buffalo	121	Endeavor (V)
04	Crystal Lake	251	Montello (C)
06	Douglas	161	Neshkoro (V)
08	Harris	165	Oxford (V)
10	Mecan	191	Westfield (V)
12	Montello		
14	Moundville	Unincorporated Villages	
16	Neshkoro	03	Briggsville
18	Newton	06	Glen Oak
20	Oxford		
22	Packwaukee		
24	Shields		
26	Springfield		
28	Westfield		

73 MENOMONEE

01 Indian Reservation
Township of Menomonee
County of Menomonee

Unincorporated Villages w/Post Offices

01 Keshena
01 Neopit

40 MILWAUKEE

Unincorp.Villages		Cities & Villages	
57	Alois	106	Bayside (V)
57	Bay View	107	Brown Deer (V)
67	Carrollville	211	Cudahy (C)
57	Granville	126	Fox Point (V)
57	North Milwaukee	226	Franklin (C)
67	Oakwood	231	Glendale (C)
68	Saint Martins	131	Greendale (V)
56	Silverdale	236	Greenfield (C)
57	Tippecanoe	136	Hales Corners (V)
57	Wood	251	Milwaukee (C)
		265	Oak Creek (C)
		176	River Hills (V)
		281	Saint Francis (C)
		181	Shorewood (V)
		281	South Milwaukee (C)
		291	Wauwatosa (C)
		292	West Allis (C)
		191	West Milwaukee (V)
		192	Whitefish Bay (V)

41 MONROE

Townships		Cities & Villages	
02	Adrian	111	Cashton (V)
04	Angelo	141	Kendall (V)
06	Byron	151	Melvina (V)
08	Clifton	161	Norwalk (V)
10	Glendale	165	Oakdale (V)
12	Grant	281	Sparta (C)
14	Greenfield	286	Tomah (C)
16	Jefferson	191	Wilton (V)
18	La Fayette	192	Wyeville (V)
20	La Grange	185	Warrens (V)
22	Leon		
24	Lincoln	Unincorporated Villages	
26	Little Falls	02	Camp Mc Coy
28	New Lyme	13	Cataract
30	Oakdale	03	Shennington
32	Portland	02	Sparta Military
34	Ridgeville	07	Tunnel City
36	Scott	03	Valley Jct
38	Sheldon		
40	Sparta		
42	Tomah		
44	Wellington		
46	Wells		
48	Wilton		

42 OCONTO

Townships		Cities & Villages	
02	Abrams	231	Gillett (C)
06	Armstruck	146	Lena (V)
08	Bagley	265	Oconto (C)
10	Brazeau	266	Oconto Falls (C)
12	Breed	171	Pulaski (V)
14	Chase	181	Suring (V)
16	Doty		
18	Gillett	Unincorporated Villages	
19	How	23	Lakewood
20	Lakewood	08	229 Mosling
22	Lena	02	Mountain
24	Little River	12	Sobieski
26	Little Suamico		
28	Maple Valley		
29	Morgan		
30	Oconto		
32	Oconto Falls		
34	Pensaukee		
36	Riverview		
38	Spruce		
40	Stiles		
42	Townsend		
44	Underhill		

43 ONEIDA

Townships		Cities & Villages	
02	Cassian	276	Rhinelander (C)
04	Crescent		
06	Enterprise	Unincorporated Villages	
08	Hazelhurst	17	Clearwater Lake
10	Lake Tomahawk	12	Gagen
12	Little Rice	01	Harshaw
14	Lynne	10	McNaughton
16	Minocqua	14	Pelican Lake
18	Monico	16	Robbins
20	Newbold	15	Roosevelt
22	Nokomis	15	Starks
24	Pelican	07	Tripoli
26	Piehl		
28	Pine Lake		
30	Schoepke		
32	Stella		
34	Sugar Camp		
36	Three Lakes		
38	Woodboro		
40	Woodruff		

44 OUTAGAMIE

Townships		Cities & Villages	
02	Black Creek	201	Appleton (C)
04	Bovina	106	Bear Creek (V)
06	Buchanan	107	Black Creek (V)

08	Center	111	Combined Locks (V)
10	Cicero	136	Hortonville (V)
12	Dale	137	Howard (V)
14	Deer Creek	241	Kaukauna (C)
16	Ellington	141	Kimberly (V)
18	Freedom	146	Little Chute (V)
20	Grand Chute	261	New London (C)
22	Grenville	155	Nichols (V)
24	Hortonia	281	Seymour (C)
26	Kaukauna	181	Shiocton (V)
28	Liberty	191	Wrightstown (V)
30	Maine		
32	Maple Creek	Unincorporated Villages	
34	Oneida	06	Medina
36	Osborne	16	Sugar Bush
38	Seymour		
40	Vandenbrock		

45 OZAUKEE

Townships		Cities & Villages	
02	Belgium	105	Bayside (V)
04	Cedarburg	106	Belgium (V)
06	Fredonia	211	Cedarburg (C)
08	Grafton	126	Fredonia (V)
12	Pt. Washington	131	Grafton (V)
14	Saukville	255	Mequon (C)
		271	Pt. Washington (C)
Unincorp. Villages		181	Saukville (V)
03	Waubeka	186	Thiensville (V)
		161	Newburg (V)

46 PEPIN

Townships		Cities & Villages	
02	Albany	216	Durand (C)
04	Durand	171	Pepin (V)
06	Frankfort	181	Stockholm (V)
08	Lima		
10	Pepin	Unincorporated Villages	
12	Stockholm	07	Arkansaw
14	Waterville		
16	Waubeek		

47 PIERCE

Townships		Cities & Villages	
02	Clifton	106	Bay City (V)
04	Diamond Bluff	121	Ellsworth (V)
06	Ellsworth	122	Elmwood (V)
08	El Paso	151	Maiden Rock (V)
10	Gilman	171	Plum City (V)
12	Hartland	271	Prescott (C)
14	Isabelle	276	River Falls (C)
16	Maiden Rock	181	Spring Valley (V)
18	Martell		
20	Oak Grove	Unincorporated Villages	
22	River Falls	16	Beldenville
24	Rock Elm	02	Diamond Bluff
26	Salem	15	Hager City
28	Spring Lake	09	Martell
30	Trenton		
32	Trimbelle		
34	Union		

48 POLK

Townships		Cities & Villages	
02	Alden	201	Amery (C)
04	Apple River	106	Balsam Lake (V)
06	Balsam Lake	111	Centura (C)
08	Beaver	112	Clayton (V)
10	Black Brook	113	Clear Lake (V)
12	Bone Lake	116	Dresser (V)
14	Clam Falls	126	Frederic (V)
16	Clayton	146	Luck (V)
18	Clear Lake	151	Milltown (V)
20	Eureka	165	Osceola (V)
22	Farmington	281	St. Croix Falls (C)
24	Garfield	168	Turtle Lake (V)
26	Georgetown		Also in Barron Co.
28	Johnstown	Unincorporated Villages	
30	Laketown	14	Andrus
32	Lincoln	23	Cushing
34	Lorain	16	Deronda
36	Luck	23	Evergreen
38	Mc Kinley	08	Joel
40	Milltown	07	Lewis
42	Osceola	19	Lorain
44	St. Croix Falls	21	Nye
46	Sterling	12	Wanderoos
48	West Sweden	10	Wolfcreek

49 PORTAGE

Townships		Cities & Villages	
02	Alban	101	Almond (V)
04	Almond	102	Amherst (V)
06	Amherst	103	Amherst Jct (V)
08	Belmont	141	Junction City (V)
10	Buena Vista	151	Milladore (V)
12	Carson	161	Nelsonville (V)
14	Dewey	171	Park Ridge (V)
16	Eau Pleine	176	Rosholt (V)
18	Grant	281	Stevens Point (C)
20	Hull	191	Whiting (V)
22	Lanark	173	Plover (V)
24	Linwood		
26	New Hope	Unincorporated Villages	
28	Pine Grove	17	Arnott
30	Plover	14	Bancroft
32	Sharon	05	Coddington
34	Stockton	17	Custer
		16	Polonia

50 PRICE

Townships		Cities & Villages	
02	Catawba	111	Catawba (V)
04	Eisenstein	141	Kennan (V)
06	Elk	271	Park Falls (C)
08	Emery	272	Phillips (C)
10	Fifield	171	Prentice (V)
12	Flambeau		
14	Georgetown	Unincorporated Villages	
16	Hackett	12	Brantwood
18	Harmony	04	Dover
20	Hill	13	Kaiser
22	Kennan	13	Kennedy
24	Knox	06	Lugerville
26	Lake		
28	Ogema		
30	Prentice		
32	Spirit		

34	Worcester

51 RACINE

Townships		Cities & Villages	
02	Burlington	206	Burlington (C)
04	Caledonia	104	Caledonia (V)
06	Dover	121	Elmwood Park (V)
08	Mt. Pleasant	151	Mt Pleasant (V)
10	Norway	161	North Bay (V)
12	Raymond	276	Racine (C)
14	Rochester	176	Rochester (V)
16	Waterford	181	Sturtevant (V)
18	Yorkville	186	Union Grove (V)
		191	Waterford (V)
		192	Wind Point (V)

Unincorp. Villages	
02	Franksville
03	Kansasville
05	Wind Lake

52 RICHLAND

Townships		Cities & Villages	
02	Akan	106	Boaz (V)
04	Bloom	11	Cazenovia (V)
06	Buena Vista	146	Lone Rock (V)
08	Dayton	276	Richland Center (C)
10	Eagle	186	Viola (V)
12	Forest	196	Yuba (V)
14	Henrietta		
16	Ithaca		
18	Marshall		
20	Orion		
22	Richland		
24	Richwood		
26	Rockbridge		
28	Sylvan		
30	Westford		
32	Willow		

Unincorporated Villages	
02	Bloom City
12	Excelsior
09	Gillingham
03	Gotham
03	Sextonville
12	Tavera
10	Twin Bluffs
02	West Lima

53 ROCK

Townships		Cities & Villages	
02	Avon	206	Beloit (C)
04	Beloit	210	Brodhead (C)
06	Bradford	111	Clinton (V)
08	Center	221	Edgerton (C)
10	Clinton	222	Evansville (C)
12	Fulton	126	Footville (V)
14	Harmony	241	Janesville (C)
16	Janesville	257	Milton (V)
18	Johnstown	165	Orfordville (V)
20	La Prairie		
22	Lima		
24	Magnolia		
26	Milton		
28	Newark		
30	Plymouth		
32	Porter		
34	Rock		
36	Spring Valley		
38	Turtle		
40	Union		

Unincorporated Villages	
17	Afton
03	Avalon
15	Hanover
11	Lima Center
19	Shopiere
19	Tiffany
03	Emerald Grove
12	Cainville

54 RUSK

Townships		Cities & Villages	
02	Atlanta	106	Bruce (V)
04	Big Bend	111	Conrath (V)
06	Big Falls	131	Glen Flora (V)
08	Cedar Rapids	136	Hawkins (V)
10	Dewey	141	Ingram (V)
12	Flambeau	246	Ladysmith (C)
14	Grant	181	Sheldon (V)
16	Grow	186	Tony (V)
18	Hawkins	191	Weyerhaueer (V)
20	Hubbard		
22	Lawrence		
24	Marshall		
26	Murry		
28	Richland		
30	Rusk		
32	South Forks		
34	Strickland		
36	Stubbs		
38	Thornapple		
40	True		
42	Washington		
44	Wilkinson		
46	Willard		
48	Wilson		

Unincorporated Villages	
02	Apollonia
10	Crane
17	Horseman
02	Island Lake
17	Kalish
11	Walrath

55 ST. CROIX

Townships		Cities & Villages	
02	Baldwin	106	Baldwin (V)
04	Cady	116	Deer Park (V)
06	Cylon	231	Glenwood City (C)
08	Eau Galle	136	Hammond (V)
10	Emerald	236	Hudson (C)
12	Erin Prairie	261	New Richmond (C)
14	Forest	161	North Hudson (V)
16	Glenwood	276	River Falls (C)
18	Hammond	176	Roberts (V)
20	Hudson	181	Somerset (V)
22	Kinnickinnic	182	Star Prairie (V)
24	Pleasant Valley	184	Spring Valley (V)
26	Richmond	191	Wilson (V)
28	Rush River	192	Woodville (V)
30	St. Joseph		
32	Somerset		
34	Springfield		
36	Stanton		
38	Star Prairie		
40	Troy		
42	Warren		

Unincorporated Villages	
13	Boardman
15	Burkhardt
17	Hersey
15	Houlton
06	Jewett

56 SAUK

Townships		Cities & Villages	
02	Baraboo	206	Baraboo (C)
04	Bear Creek	111	Cazenovia (V)
06	Dellona	141	Ironton (V)
08	Delton	146	Lake Delton (V)
10	Excelsior	147	La Valle (V)
12	Fairfield	148	Lime Ridge (V)
14	Franklin	149	Loganville (V)
16	Freedom	151	Merrimac (V)
18	Greenfield	161	North Freedom (V)
20	Honey Creek	171	Plain (V)
22	Ironton	172	Prairie du Sac
24	La Valle	276	Reedsburg (C)
26	Merrimac	176	Rock Springs (V)
28	Prairie du Sac	181	Sauk City (V)
30	Reedsburg	182	Spring Green (V)
32	Spring Green	191	West Baraboo (V)
34	Sumpter	291	Wis Dells (C)
36	Troy		
38	Washington		
40	Westfield		

Unincorporated Villages	
17	Badger

42	Winfield	01	Devils Lake
44	Woodland	19	Hillpoint
		04	Mirror Lake

57 SAWYER

Townships		Cities & Villages	
02	Bass Lake	111	Corderay (V)
04	Couderay	121	Exeland (V)
06	Draper	236	Hayward (C)
08	Edgewater	176	Radisson (V)
10	Hayward	190	Winter (V)
12	Hunter		
14	Lenroot	Unincorporated Villages	
16	Meadow Rock	14	Hauer
18	Meteor	02	Lemington
20	Ojibwa	03	Loretta
22	Radisson	03	Oxbow
24	Round Lake	14	Reserve
26	Sand Lake	14	Stone Lake
28	Spider Lake	16	Weirgor
30	Weirgor	04	Wooddale
32	Winter	04	Yarnell

58 SHAWANO

Townships		Cities & Villages	
02	Almon	101	Aniwa (V)
04	Angelica	106	Birnamwood (V)
06	Aniwa	107	Bonduel (V)
08	Bartelme	108	Bowler (V)
10	Belle Plaine	111	Cecil (V)
12	Birnamwood	121	Eland (V)
14	Fairbanks	131	Gresham (V)
16	Germania	282	Marion (C)
18	Grant	151	Mattoon (V)
20	Green Valley	171	Pulaski (V)
22	Hartland	281	Shawano (C)
24	Herman	186	Tigerton (V)
26	Hutchins	191	Wittenberg (V)
28	Lessor		
30	Maple Grove	Unincorporated Villages	
32	Morris	09	Caroline
34	Navarino	09	Hunting
36	Pella	02	Krakow
38	Red Springs	12	Leopolis
40	Richmond	12	Lyndhurst
42	Seneca	10	Pulcifer
44	Washington	20	Red River
46	Waukechon	01	Shepley
48	Wescott	07	Split Rock
50	Wittenberg	20	Thornton
52	Stockbridge	21	Tilleda
		02	Zachow

59 SHEBOYGAN

Townships		Cities & Villages	
02	Greenbush	101	Adell (V)
04	Herman	111	Cascade (V)
06	Holland	112	Cedar Grove (V)
08	Lima	121	Elkhart Lake (V)
10	Lyndon	131	Glenbeulah (V)
12	Mitchell	135	Howards Grove (V)
14	Mosel	141	Kohler (V)
16	Plymouth	165	Oostburg (V)
18	Rhine	271	Plymouth (C)
20	Russell	176	Random Lake (V)
22	Scott	281	Sheboygan (C)
24	Sheboygan	282	Sheboygan Falls (C)
26	Sheboygan Falls	191	Waldo (V)
28	Sherman		
30	Wilson	Unincorporated Villages	
		07	Haven
		04	Hingham

60 TAYLOR

Townships		Cities & Villages	
02	Aurora	131	Gilman (V)
04	Browning	146	Lublin (V)
06	Chelsea	251	Medford (C)
08	Cleveland	176	Rib Lake (V)
10	Deer Creek	181	Stetsonville (V)
12	Ford		
14	Goodrich	Unincorporated Villages	
16	Greenwood	18	Donald
18	Hammel	04	Hannibal
20	Holway	08	Interwald
22	Jump River	09	Perkinstown
24	Little Black	06	Polley
26	Mc Kinley	03	Whittlesey
28	Maplehurst		
30	McKinley		
32	Medford		
34	Molitor		
36	Pershing		
38	Rib Lake		
40	Roosevelt		
42	Taft		
44	Westboro		

61 TREMPEALEAU

Townships		Cities & Villages	
02	Albion	201	Arcadia (C)
04	Arcadia	206	Blair (C)
06	Burnside	121	Eleva (V)
08	Caledonia	122	Ettrick (V)
10	Chimney Rock	231	Galesville (C)
12	Dodge	241	Independence (C)
14	Ettrick	265	Osseo (C)
16	Gale	173	Pigeon Falls (V)
18	Hale	181	Strum (V)
20	Lincoln	186	Trempealeau (V)
22	Pigeon	291	Whitehall (C)
24	Preston		
26	Sumner	Unincorporated Villages	
28	Trempealeau	14	Centerville
30	Unity		

62 VERNON

Townships		Cities & Villages	
02	Bergen	111	Chaseburg (V)
04	Christiana	112	Coon Valley (V)
06	Clinton	116	De Soto (V)
08	Coon	131	Genoa (V)
10	Forest	236	Hillsboro (C)
12	Franklin	146	La Farge (V)
14	Genoa	165	Ontario (V)
16	Greenwood	176	Readstown (V)
18	Hamburg	181	Stoddard (V)
20	Harmony	186	Viola (V)
22	Hillsboro	286	Viroqua (C)
24	Jefferson	291	Westby (C)
26	Kickapoo		

		Unincorporated Villages	
28	Liberty	05	Mt. Tabor
30	Stark	21	Rockton
32	Sterling	05	Valley
34	Union	20	Victory
36	Viroqua	16	West Prairie
38	Webster		
40	Wheatland		
42	Whitestown		

63 VILAS

Townships		Cities & Villages	
02	Arbor Vitae	221	Eagle River (C)
04	Boulder Junction		
06	Cloverland	Unincorporated Villages	
08	Conover	12	Knudson
10	Lac Du Flambeau	05	Lac Du Flambeau
12	Lincoln	12	Land O'Lakes
14	Phelps	14	Mishike
16	Plum Lake	09	Presque Lake
18	Presque Isle	05	Rest lake
20	St. Germain	10	St. Germain
22	Manitowish Waters	08	Sayner
24	Land O'Lakes	08	Starlake
26	Washington	01	Trout Lake
28	Winchester	09	Winegar

64 WALWORTH

Townships		Cities & Villages	
02	Bloomfield	206	Burlington (C)
		116	Darien (V)
04	Darien	216	Delavan (C)
06	Delavan	121	East Troy (V)
08	East Troy	221	Elkhorn (C)
10	Geneva	126	Fontana (V)
12	La Fayette	131	Genoa City (V)
14	La Grange	246	Lake Geneva (C)
16	Linn	153	Mukwonago (V)
18	Lyons	181	Sharon (V)
20	Richmond	191	Walworth (V)
22	Sharon	291	Whitewater (C)
24	Spring Prairie	192	Williams Bay (V)
26	Sugar Creek		
28	Troy	Unincorporated Villages	
30	Walworth	02	119 Allen Grove
32	Whitewater	15	College Camp
		12	Honey Creek
		04	Lake Beulah
		01	Pell Lake
		09	Springfield
		14	Troy Center
		08	Zenda

65 WASHBURN

Townships		Cities & Villages	
02	Barronett	106	Birchwood (V)
04	Bashaw	151	Minong (V)
06	Bass Lake	282	Shell Lake (C)
08	Beaver Brook	281	Spooner (C)
10	Birchwood		
12	Brooklyn	Unincorporated Villages	
14	Casey	18	Earl
16	Chicog	06	Lampson
18	Crystal		
20	Evergreen		
22	Frog Creek		
24	Gull Lake		
26	Long Lake		
28	Madge		
30	Minong		
32	Sarona		
34	Spooner		
36	Spring Brook		
38	Stinnett		
40	Stone Lake		
42	Trego		

66 WASHINGTON

Townships		Cities & Villages	
02	Addison	131	Germantown (V)
04	Barton	236	Hartford (C)
06	Erin	141	Jackson (V)
08	Farmington	142	Kewaskum (V)
10	Germantown	251	Milwaukee (C)
12	Hartford	181	Slinger (V)
14	Jackson	291	West Bend (C)
16	Kewaskum	161	Newburg (V)
18	Polk		
20	Richfield	Unincorporated Villages	
22	Trenton	01	Aurora
24	Wayne	01	Allenton
26	West Bend	10	Colgate
		10	Hubertus
		05	Rockfield

67 WAUKESHA

Townships		Cities & Villages	
02	Brookfield	106	Big Bend (V)
04	Delafield	206	Brookfield (C)
06	Eagle	107	Butler (V)
08	Genesee	111	Chenequa (V)
10	Lisbon	216	Delafield (C)
14	Merton	116	Dousman (V)
16	Mukwonago	121	Eagle (V)
22	Oconomowoc	122	Elm Grove (V)
24	Ottawa	136	Hartland (V)
28	Summit	146	Lac La Belle (V)
30	Vernon	147	Lannon (V)
32	Waukesha	151	Menomonee Falls (V)
		152	Merton (V)
Unincorp. Villages		250	Milwaukee (C)
13	Duplainville	251	Muskego (C)
04	Genesee Depot	153	Mukwonago (V)
07	North Lake	158	Nashotah (V)
11	Okauchee	261	New Berlin (C)
02	Statesan	161	North Prairie (V)
05	Templeton	265	Oconomowoc (C)
		166	Oconomowoc Lake (V)
		171	Pewaukee (V)
		270	Pewaukee (C)
		181	Sussex (V)
		191	Wales (V)
		291	Waukesha (C)

68 WAUPACA

Townships		Cities & Villages	
02	Bear Creek	106	Big Falls (V)
04	Caledonia	211	Clintonville (C)
06	Dayton	121	Embarrass (V)
08	Dupont	126	Fremont (V)
10	Farmington	141	Iola (V)
12	Fremont	251	Manawa (C)
14	Harrison	252	Marion (C)
16	Helvetia	261	New London (C)
18	Iola	165	Ogdensburg (V)

20	Larrabee	181	Scandinavia (V)
22	Lebanon	291	Waupaca (C)
24	Lind	292	Weyauwega (C)
26	Little Wolf		
28	Matteson		**Unincorporated Villages**
30	Mukwa	05	King
32	Royalton	07	Northland
36	Scandinavia	15	Northport
38	Union	02	Readfield
40	Waupaca	05	Sheridan
42	Weyauwega	19	Symco
44	Wyoming		

69 WAUSHARA

Townships		Cities & Villages	
02	Aurora	111	Coloma (V)
04	Bloomfield	136	Hancock (V)
06	Coloma	146	Lohrville (V)
08	Dakota	171	Plainfield (V)
10	Deerfield	191	Redgranite (V)
12	Hancock	291	Wautoma (C)
14	Leon	191	Wild Rose (V)
16	Marion		
18	Mt. Morris		**Unincorporated Villages**
20	Oasis	01	Auroraville
22	Plainfield	07	Pine River
24	Poy Sippi	02	W. Bloomfield
26	Richford		
28	Rose		
30	Saxeville		
32	Springwater		
34	Warren		
36	Wautoma		

70 WINNEBAGO

Townships		Cities & Villages	
02	Algoma	201	Appleton (C)
04	Black Wolf	251	Menasha (C)
06	Clayton	261	Neenah (C)
08	Menasha	265	Omro (C)
10	Neenah	266	Oshkosh (C)
12	Nekimi	191	Winneconne (V)
14	Nepeuskun		
16	Omro		**Unincorporated Villages**
18	Oshkosh	13	Allenville
20	Poygan	15	Butte Des Morts
22	Rushford	11	Eureka
24	Utica	12	Fisk
26	Vinland	03	Larsen
28	Winchester	12	Pickett
30	Winneconne	07	Rush Lake
32	Wolf River	11	Waukau
		09	Winnebago

71 WOOD

Townships		Cities & Villages	
02	Arpin	101	Auburndale (V)
04	Auburndale	106	Biron (V)
06	Cameron	271	Pittsville (C)
08	Cary	171	Port Edwards (V)
10	Cranmoor	251	Marshfield (C)
12	Dexter	151	Milladore (V)
14	Grand Rapids	261	Nekoosa (C)
16	Hansen	178	Rudolph (V)
18	Hiles	186	Vesper (V)
20	Lincoln	291	Wisconsin Rapids (C)
22	Marshfield	122	Hewitt (V)
24	Milladore	100	Arpin (V)
26	Port Edwards		
28	Remington		**Unincorporated Villages**
30	Richfield	14	Babcock
32	Rock	12	Blenker
34	Rudolph	06	Dexterville
36	Saratoga	16	Lindsey
38	Seneca		
40	Sherry		
42	Sigel		
44	Wood		

2-1-35 Size of Signs — September 2010

PURPOSE

This subject provides general guidance on the sizes of signs to be used based on certain highway characteristics. **This guideline does not apply to sizes for STOP signs. There is a separate guideline pertaining to the required sizes for STOP signs for roadways (TEOpS 2-2-5).**

DEFINITIONS

For the purposes of this guideline, highways are grouped by certain characteristics into a defined highway facility:

Freeways are divided arterial highway facilities that have full control of access by means of grade separation at interchanges only.

Expressways are divided arterial highway facilities that have partial control of access, generally with grade separations at major intersections.

Conventional highways are either divided or undivided roadway facilities that have no control of access and no grade separations at intersections.

2S is the sign size designation of conventional highway signs for single-lane conventional highways or multi-lane conventional highways with a posted speed of 35mph or less.

2M is the sign size designation of regulatory and warning signs for multi-lane conventional highways with a posted speed of 40mph.

POLICY

This guideline establishes the standard sign size to be used for each defined highway facility. Signs larger than the standard size *may* be used selectively and with documentation of the specific situational reason for use of a sign larger than the standard. Whenever a sign smaller than the standard is used, the conditions such as space or visibility constraints *should* be documented and approved by the Regional traffic engineer. The designer **shall** work with the Region Traffic Section to determine the proper sign sizes:

1. Freeways and interstate highways, size 5 signs, regardless of the posted speed limit.
2. Expressways with posted speed limits of 65 mph, use size 5 signs. Expressways with posted speed limits of 60, 55, or 50 mph, use size 4 signs. Use size 2S signs for side road approaches or that when approaching a highway facility would require a larger sign size under this guideline, use the larger size.
3. On and off ramps for service interchanges, use size 2S signs. System interchange ramps, use size 5 signs.
4. Conventional highways with single lanes (all speeds) and multi-lane conventional highways with a posted speed of 35 mph or less, use size 2S signs. Size 2M signs *may* also be used, at the discretion of the Region, to upsize sign sizes on single lane conventional highways or multi-lane conventional highways with a posted speed of 35 mph or less.
5. Conventional multilane roadways, with a posted speed of 40 mph, use size 2M regulatory and warning signs.
6. Conventional multi-lane roadways, with a posted speed of 45 mph or greater, us size 3 signs. As an option, size 2M *may* be used for urban conventional multi-lane roadways with posted speeds of 45 mph if there are limiting physical factors that would not make size 3 signs feasible. Some of these limiting physical factors would include: narrow terrace or median widths, close driveway spacing and close intersection spacing.
7. Size 1 signs *may* be used on streets and highways which are neither state trunk highways, nor connecting highways when there is no more than one lane of traffic in each direction, and the posted speed limit is 30 mph or less.
8. Additional sign size criteria for bypasses are contained in TEOpS 2-15-53 (bypass Signing).

2-1-41 Jurisdictional Boundary Signs — January 2015

GENERAL

Communities *may* request informational signing to either identify their municipal boundaries or to promote/advertise their community. These types of signs are considered to be Jurisdictional Boundary signs and *may* take the form of three different types of signs:

- Welcome signs
- Enhanced political boundary signs
- Community population signs.

The community population signs and enhanced political boundary signs are considered a traffic sign and are allowed on the highway right-of-way. Welcome signs are interpreted as an off right-of-way. Some of these signing requests *may* get complicated as there are many different types of designs, messages and installation methods that are often proposed. This policy provides guidance for working with these types of signing requests.

AUTHORITY

Section 86.19 of the Wisconsin statutes prohibits signs within the limits of any highway except as are necessary for the guidance or warning of traffic and certain other exceptions as provided in that section. This statute also requires the Department to prescribe regulations with respect to erection of signs on public highways.

The MUTCD Section 1A.01 states that advertising messages **shall not** appear on traffic control devices and Section 1A.10 states that the design, application and placement of traffic control devices, other than those adopted in the MUTCD are prohibited.

Therefore, the 2009 MUTCD and Wisconsin State Statute 86.19 have specific standards regarding the design and installation of such signing:

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges.

Expressways are defined as divided arterial highway facilities that have partial control access and generally with grade separations at major interchanges.

Conventional highways are defined as either divided or undivided roadway facilities that have no control of access or grade separations at intersections. These highways can be two-lane or multi-lane facilities.

POLICY FOR COMMUNITY WELCOME SIGNS

Welcome signs are defined as any sign or marker that is erected by or for a local government near the municipal boundary with the primary function of welcoming people to the community.

1. Welcome signs along state highways **shall** only be permitted when located off the highway right-of-way with a permit as required for outdoor advertising signs and provided for in Trans 201.05.
2. Existing permitted welcome signs inside the highway right-of-way will be allowed to remain temporarily without modification or replacement until the end of their useful life. Unpermitted welcome signs **shall** be removed as soon as possible.
3. Temporary existing welcome signs must be located outside the minimum clear zone specified in the Facilities Development Manual. No welcome sign *may* be allowed to remain if it is a safety hazard. The permit holder **shall** be responsible for any costs incurred by the Department to correct or eliminate hazards related to the welcome sign.
4. Temporary existing on right-of-way welcome signs **shall** meet the standards for breakaway supports unless the sign is not reachable by an errant vehicle. Landscaping features such as retaining walls, landscape timbers or ground-mounted lighting fixtures **shall not** be allowed to remain if they are reachable by an errant vehicle.
5. Temporary existing welcome signs **shall not** have auxiliary plaques.

POLICY FOR ENHANCED POLITICAL BOUNDARY SIGNS

Enhanced political boundary signs are more of an informational sign as they do not directly provide a guidance function for the motorist. These signs are traffic signs that are installed on conventional highways, in the highway right-of-way, at the municipal limits by permit. The signs serve the functions of conveying the municipal limits of a community and *may* tie into the theme of the community by utilizing different colors and/or a pictograph on the sign.

GENERAL POLICY CRITERIA

1. If off-right-of-way location efforts fail for a welcome sign, then a community could apply for a permit to install and maintain an “enhanced political boundary sign.” Enhanced political boundary signs **shall not** be allowed if there is an off-right-of-way welcome sign in place.
2. If an enhanced political boundary sign is installed, then WisDOT would remove the standard population sign.
3. Enhanced political boundary signs *should* be ground-mounted on the right side of the roadway. Ground-mounted median signs *may* be installed if right-side installation opportunities are not available. No overhead sign installations are allowed.
4. Supplemental signs (tree city USA, 1979 baseball champs, lions clubs, etc.) **shall not** be allowed on the enhanced political boundary signs or supports.
5. Enhanced political boundary signs **shall** only be allowed on conventional highways for incorporated cities and villages, located at the municipality border. Enhanced political boundary signs **shall not** be allowed for townships or unincorporated communities.
6. All enhanced political boundary sign requests, including CSS projects, **shall** be approved by the Region Traffic Engineer. Requestor **shall** furnish proposed locations, sign and pictograph design and type of supports used.
7. The community population number *may* be included on the enhanced political boundary sign.
8. The community **shall** be responsible for all costs associated with the manufacture, installation and maintenance of the permitted enhanced political boundary signs.

SIGN DESIGN STANDARDS

1. Destinations, arrows or specific traffic generators **shall not** be allowed on the signs.
2. The pictograph (logo) height **shall not** exceed two times the height of the upper case letters and **shall** be located at the top or left side of the sign. The pictograph **shall** be the official designation adopted by the jurisdiction. The pictograph *may* contain wording, provided it is not a commercial advertising message. Only one pictograph is allowed per sign.
3. Enhanced political boundary signs **shall not** be lighted or contain any animated or moving parts, flashing lights or disks.
4. Ata minimum, enhanced political boundary signs **shall** utilize Type H—High Intensity sheeting.
5. Minimum letter size **shall** be 4 ½” lowercase, 6: uppercase letters. Maximum sign size **shall** be 72: width by 48: height.
6. Sign base material **shall** be in accordance with Section 637 of the WisDOT Standard Construction Specifications.
7. The sign shape **shall** be rectangular. Aluminum signs **shall** have rounded corners.
8. Border is required on the signs and **shall** be retroreflective, and of the same color as the text.
9. Colors **shall** meet the standards for highway colors specified by the Federal Highway Administration.

Two color combinations *may* be used which are:

- White or yellow on blue, green or brown
- Blue, green, black or brown on white
- Red or orange on white, but not the reverse
- The background colors of orange, red, yellow, purple, or the fluorescent versions thereof, fluorescent yellow green and fluorescent pink **shall not** be allowed. One background color only allowed. Lettering and border (if used) **shall** be of the same color.

SIGN INSTALLATION STANDARDS

1. The standard WisDOT posts (4” x 6” wood or 2” x 2” tube steel) *may* be used. The community also *may* be allowed to utilize other types of sign posts. Non-standard sign posts **shall** conform to TEOpS 2-15-52.
2. Sign installation and placement **shall** be per WisDOT standards.

3. Sign mounting height **shall** be five feet to bottom of sign.
4. Sign locations **shall** be approved by WisDOT. Signs **shall** be located outside of the influence area of an intersection (typically 200' minimum distance from the intersection).
5. WisDOT **shall** approve any proposed landscaping plans. Any landscaping items **shall** meet breakaway standards or be shielded with FHWA approved shielding. For example, there is a 20" high decorative curb that meets FHWA standards.

POLICY FOR COMMUNITY POPULATION SIGNS

1. City or village limit signs *may* be installed on freeways or expressways at or near where the highway enters the municipality, unless the city or village is identified on the primary guide signs or a supplemental guide sign.
2. City or village population signs **shall** be installed on conventional highways at or near where the highway enters the municipal limits. WisDOT will install and maintain the standard signs with the official current decennial census figures. No other signs **shall** share the supports.
3. If the city or village requests a population update, the Regional Traffic Engineer *may* authorize the municipality to modify the numbers with a white on green Type H adhesive overlay, using the same size and font as the original sign.
4. Signing for unincorporated communities is covered in TEOpS 2-4-48.

APPLICATION AND PERMIT

1. Permit **shall** be approved by the WisDOT Regional Traffic Engineer.
2. The application from the requesting community **shall** contain a plan showing the sign location9s) and sign fabrication detail (including colors and heights of letters and pictograph).

2-1-42 State Entrance Signing — February 2017

PURPOSE

In the past, several different signs have been installed along Department-maintained roadways at state entrances. In some cases, several signs have been installed on the same support. At some state entrances, blue signs with the state outline (I2-1-B) are installed. Based on an interpretation received from FHWA in 2013, the shape of these signs is not in conformance with the 2009 MUTCD. This policy will define the appropriate sequence of signs when entering the state along a Department-maintained roadway.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

Conventional Highways are defined as either divided or undivided roadway facilities that have no control of access with grade separations at intersections. These highways can be two lane or multilane facilities.

POLICY

Freeways and Expressways

The standard order of sign installations along a freeway or expressway, beginning at the state line, is shown below. 200' minimum spacing *should* be maintained between each sign installation. Note that this order may need to be adjusted based on field conditions.

1. I2-1 (Wisconsin) with I2-2 (County name) directly below.
2. J4-series (Reassurance Assembly)
3. R2-1 (Speed Limit)
4. R5-53-A (Buckle Up – It's the Law)
5. R5-60 (Move Over or Slow Down)

6. D12-5 (Travel Info Call 511)

Conventional Highways

The standard order of sign installations along a conventional highway, beginning at the state line, is shown below. 200’ minimum spacing *should* be maintained between each sign installation in rural areas. 100’ minimum spacing *should* be maintained between each sign in urban areas. Note that this order may need to be adjusted based on field conditions.

1. I2-1 (Wisconsin) with I2-2 (County name) directly below.
2. I2-3 (Community population sign) – only if entering municipal limits
3. J4-series (Reassurance Assembly)
4. R2-1 (Speed Limit)
5. D2-series – not used if entering municipal limits

IMPLEMENTATION

There is no formal phase-in period for installation of this signing. Existing non-conforming state entrance signs will be allowed to remain in place until the end of their useful life. Useful life ends when the sign message no longer meets legibility or condition standards. Existing non-conforming state entrance signs may be replaced prior to the end of their useful life when opportunities arise such as knockdown or damage, when other work is occurring nearby, or when projects make replacement practical.

2-1-45 Usage of Fluorescent Sheeting on Signs August 2013

PURPOSE

Fluorescent colored sheeting cab be advantageous to use on certain traffic signs. In addition to enhanced nighttime retroreflectivity, the fluorescent color allows for greater daytime conspicuity of signs as well. This is especially important for enhancing traffic safety of the motorist and addressing the fact that a greater percentage of people in our population are becoming older and their eyesight requires a brighter sheeting material.

There are three colors of fluorescent sheetings that are commercially available: orange, yellow and yellow-green. The Federal Highway Administration allows the use of fluorescent yellow-green sheeting on some warning signs for pedestrian, bicycle, playground and school applications. The following guidelines limit the usage of the three fluorescent sheeting colors to certain specific signs in order to retain the unique quality of the sheeting.

POLICY

Fluorescent Yellow Sheeting

Beginning in 2010, WisDOT has been in the process of converting yellow warning signs from ASTM D4956 Type IV (prismatic high intensity yellow) to ASTM D4956 Type XI fluorescent yellow, starting with the most critical of warning signs. Phase 1 (June 2010) included signs such as Stop Ahead, No Passing Zone, Pedestrian Crossing, Chevrons and Large Arrows. Phase 2 (June 2012) included Curve and Turn signs, Intersection Warning signs, advisory speed signs and bridge object markers. The final phase for implementation (Phase 3) will be for the remainder of the warning signs. This change will be complete by December 1, 2013. Beginning with the December 2013 letting, all warning signs on WisDOT projects will be converted to ASTM D4956 Type XI fluorescent yellow. Replace existing conventional yellow signs with fluorescent yellow as they wear out, through improvement projects or sign damage/knockdowns.

All chevrons in a curve or turn **shall** match sheeting color (either fluorescent yellow or conventional yellow). If warning signs are doubled up on an approach, the sheeting **shall** match (either fluorescent yellow or conventional yellow). Supplemental warning plaques **shall** match the main signs that they supplement. No mixing of colors.

Fluorescent Yellow-Green Sheeting

S1-1 School Crossing Signs, S4-51 School Speed Limit Assemblies, S4-52 School In-Street Pedestrian Crossing Signs, S4-5 School Reduced Speed Limit Warning Signs on the WisDOT highway system **shall** use fluorescent yellow-green sheeting. The usage of fluorescent yellow-green sheeting **shall** also be used on the Ahead plaque (WF16-9P) for the School Advance Sign location, and Diagonal Down Arrow Signs (WF16-7L and WF16-7R) for the School Crossing Sign location. No other signs **shall** use the fluorescent yellow=green sheeting.

S3-1 School Bus Stop Ahead and S3-51 School Bus Traffic Signs

Replace existing conventional yellow signs with fluorescent yellow signs as they wear out, through improvement projects or damage claim knockdowns. All School Bus Stop Ahead signs and School Bus Traffic signs **shall** be replaced with the fluorescent yellow-green symbol sign no later than January 1, 2016.

Any signs with fluorescent yellow=green sheeting other than the School Crossing signs that were installed before the date this policy became effective *may* remain in place. Once these signs have reached their useful life, the Region **shall** replace them with regular yellow sheeting signs.

Fluorescent Orange Sheeting

Fluorescent orange sheeting **shall** be used on all work zone warning signs.

Fluorescent orange sheeting **shall** be used for all construction detour route assemblies (M4-5 TO, M5 and M6 series arrows and M4-8 detour plaques) and traffic control fixed message signs.

2-1-50 Snowmobile Trail Signing — August 1995

At some locations on state trunk highway right-of-ways, local agencies *may* erect signing for the purpose of directing and controlling snowmobile operations. This is permissible unless there is some problem generated by the existence of snowmobiles at specific locations. Signing for the snowmobile trails is described in Administrative Code NR 50, and also described with typical applications illustrated in DNR's "Trail Signing Handbook", 1994. A copy of this book *should* be kept in each traffic section.

In interpreting this book the following is offered:

1. Any and all responsibility for signing along the trail is local, including installation and maintenance.
2. The Department's responsibility includes only signs which *may* be requested directing to trail head parking lots, and such warning signs directed to motorists advising of snowmobile crossings where these warnings are warranted.
3. Regarding illustrations in the book (figures on pages 19-22 and page 28):
    a. Warning signs on the trail when visible from the highway *should* be the minimum size specified.
    b. Orange markers on the right-of-way would usually be unnecessary except to mark a turn.
    c. STOP signs are shown too close to the highway. They *should* be back of the snowplowing range, at least 20' from the pavement and desirably more.
    d. STOP signs *should* be parallel to the highway, and the trail approaching the highway *should* be aligned to be as near to a right angle as possible.
    e. Warning signs on the highway are shown routinely in the illustrations. On state trunk highways they are only to be installed where warranted, usually due to sight conditions.
4. On page 12 of the handbook: "If requested, the Department will install and maintain guide signs for trail head parking lots. The signs *should* contain the word 'Parking.'"

    The term "snowmobile route" is defined to mean snowmobile travel on an unplowed roadway. Consequently, "routes" are not to be signed on state trunk highways or connecting highways.
5. Sign posts on the right-of-way installed by local agencies **shall** meet the same small support safety standards as those erected by the Department.
6. Trail signs **shall not** be attached to any of the Department's signposts.

2-1-55 Alternate Roadway Signing — April 2001

PURPOSE

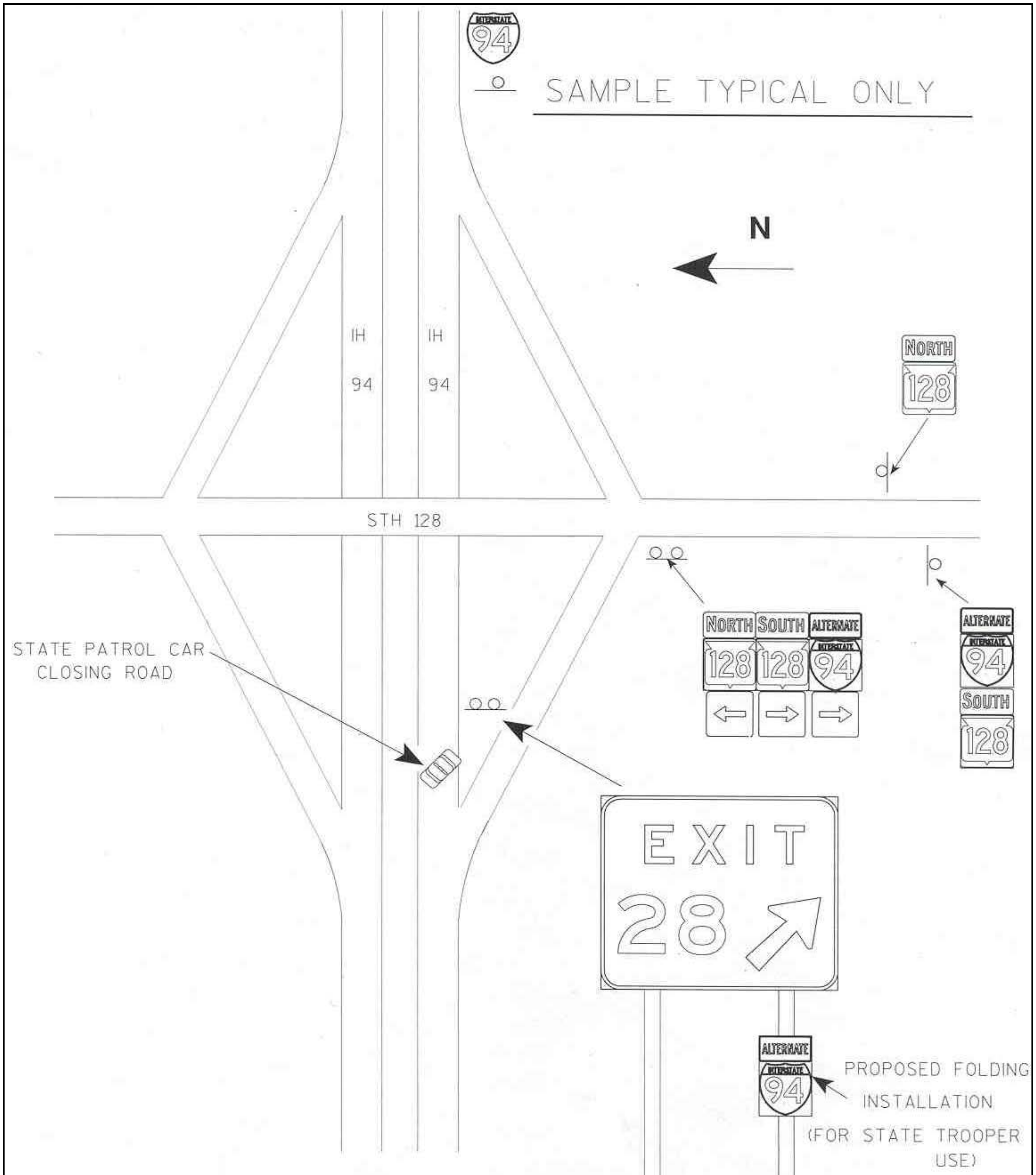
In some areas of the state, there are sections of roadways that are frequently closed to traffic for brief periods of time. As a result, motorists are directed to use an alternate route, usually by law enforcement officials. Many of these alternate route locations are used frequently enough that they could be permanently signed as alternate roadways.

There are several benefits of alternate roadway signing. Alternate signing can direct traffic onto an alternate roadway in case the mainline roadway is closed, due to bad weather, crashes, or other incidents. A permanently signed alternate route can assist State Patrol Troopers and other personnel because less manpower will be required to direct motorists on an alternate route.

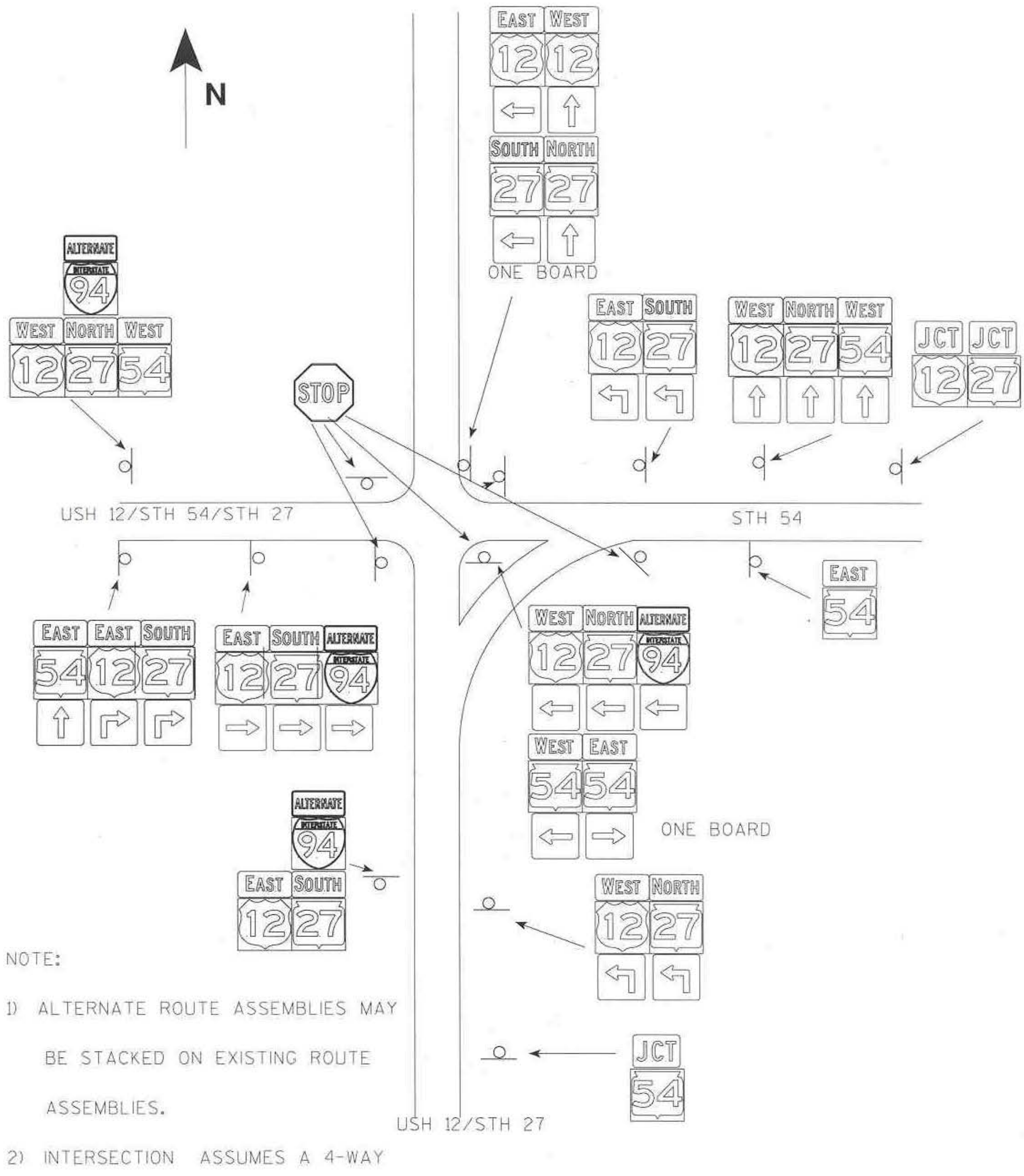
INSTALLATION GUIDELINES

The following criteria *should* be considered by each Regional Traffic Section in the design/implementation of permanent signing for an alternate roadway. It *should* be noted that this type of alternate route signing is optional in each Region and the Region will have the final say on whether to approve or deny this signing. Example details are also provided as part of this policy. This policy applies to the signing of alternate routes for mainline roadways that re on the WisDOT system.

1. During the design of alternate roadway signing, the Regional Traffic Section *should* contact the State Patrol and local highway officials for comment. Some existing county trunk highways and local roads *may* not be suitable as alternate traffic routes. The Region *should* check to see if the alternate route being considered has been previously designated a long truck route. Per Wisconsin Administrative Code 276.08, once a route is permanently signed as an alternate, it will legally be considered a long truck route. The Region *should* be aware that there is a potential problem of truckers legally using the alternate route even if the main route is open.
2. The alternate marker (M4-1 sign) **shall** be used in conjunction with the appropriate route marker shield. For interstate applications, the alternate marker (MB4-1 sign) **shall** be used with the interstate marker shield. The MB4-1 sign has white lettering on a blue background.
3. Figure 1 shows the use of a horizontal-cut aluminum folding alternate roadway sign. The folding alternate roadway sign is mounted below the EXIT gore sign. The State Patrol or other law enforcement officials could flip this sign open in times of roadway closure. Once traffic is directed off the mainline roadway, there would be alternate signing all along the alternate route that would direct motorists. **Usage of this sign has been determined to be optional. It is recommended that the Regional Traffic Section contact their State Patrol Regional office for input on the usage of this sign.**
4. No cardinal direction signs *should* be placed on the alternate route sign assemblies unless a specific direction is required.
5. The use of a vertical route panel is encourage wherever possible (as shown on the examples). The placement of alternate route assemblies in urban areas *may* be difficult due to space restrictions. Alternate route assemblies *may* be stacked on existing route assemblies. Normally, 24” and 36” marker heads are used. For extreme space constraints, 18” marker heads can be specially ordered. For roadways that have multiple route assemblies (i.e. Interstate 39-90-94 in Southwest Region), one of the numbers can be used for the alternate route assembly on the alternate route.
6. The horizontal size of the alternate route marker sign *should* be the same as the horizontal size of the roadway marker signs already on the roadway.
7. The placement of reassurance markers will differ on each route, but in general they *should* be placed every (+/-) 5 miles, or as needed. The alternate reassurance markers *should* be stacked whenever possible and *may* be placed with every reassurance marker on the roadway.
8. Generally, for a stop condition or right turn no stop condition, alternate route assemblies with advanced turn arrows would not be used, as shown on Figure 2. However, conditions such as unusual intersection geometrics and/or multi-lanes *may* require the addition of alternate assemblies with advanced turn arrows.
9. For a no stop condition, as shown on Figure 3, alternate route assemblies with advanced turn arrows *should* be used.
10. It is recommended that the Regions send their completed alternate roadway signing layouts to Central Office Traffic Operations for review prior to installation.



TYPICAL INTERCHANGE
ALTERNATE SIGNING PLAN
FIG. 1



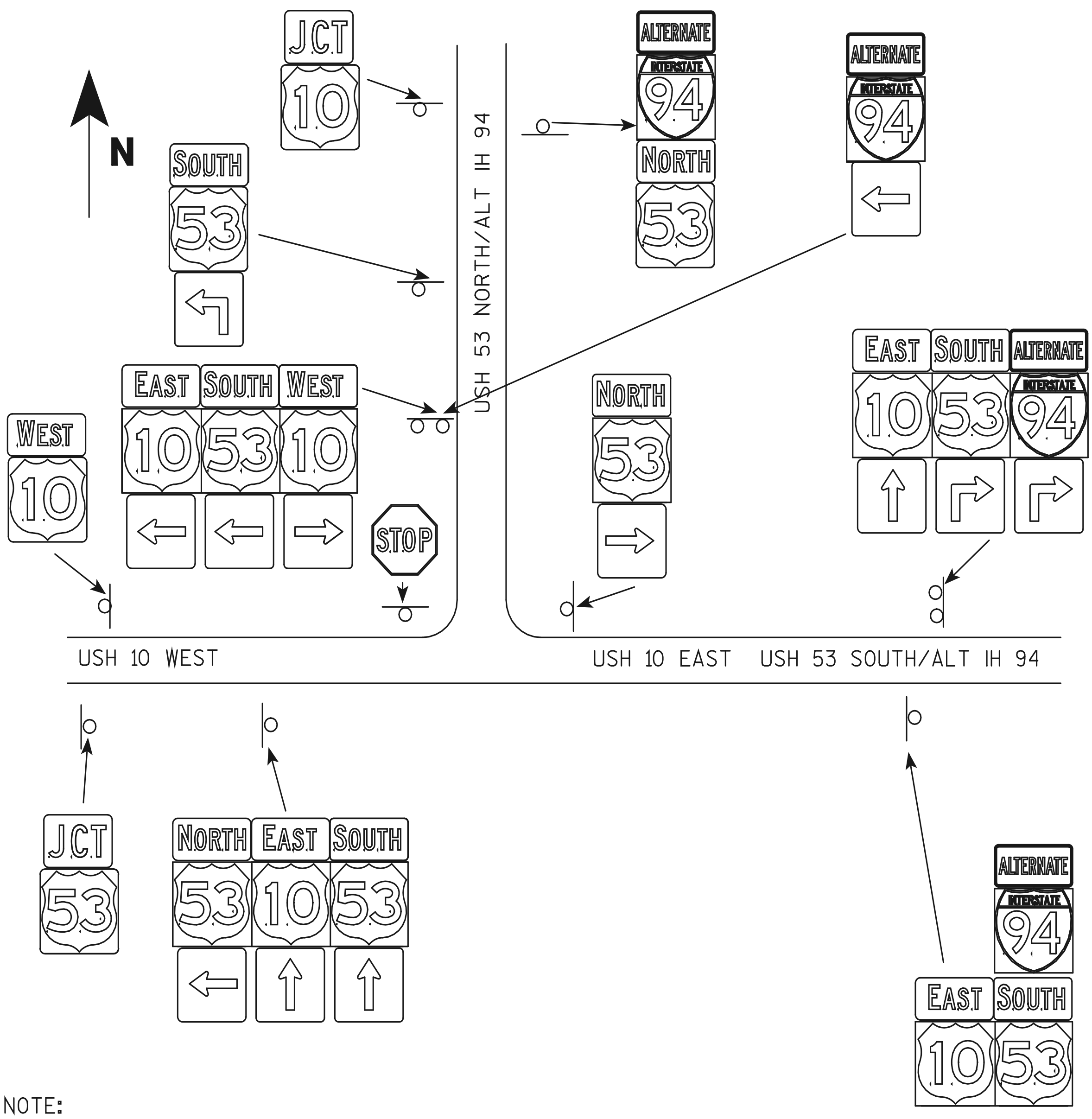
NOTE:

1) ALTERNATE ROUTE ASSEMBLIES MAY BE STACKED ON EXISTING ROUTE ASSEMBLIES.

2) INTERSECTION ASSUMES A 4-WAY STOP CONDITION.

SAMPLE TYPICAL ONLY

- FIG 2 -



NOTE:

1) ALTERNATE ROUTE ASSEMBLIES MAY BE STACKED ON EXISTING ROUTE ASSEMBLIES.

2) INTERSECTION ASSUMES A "NO STOP" CONDITION FOR USH 10 TRAFFIC.

SAMPLE TYPICAL ONLY

- FIG 3 -

PURPOSE

Community Sensitive Design for signing is the incorporation of a sign or logo to blend in architecturally with a structure. There are many requests to utilize community Sensitive Designs (CSD) for signing along state-maintained highways. This type of signing can be very popular because they add an aesthetic community value to the roadway. However, there are several policies and guidelines that have to be followed in this approach. MUTCD section 1A.01 states that Traffic Control Devices or their supports **shall not** bear any advertising message or any other message that is not related to traffic control. Advertising is only allowed on signs off of the highway right-of-way. Wisconsin State Statute 86.19(1) states that no sign **shall** be placed within the limits of any street except such as necessary for the guidance or warning of traffic.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

Conventional highways are defined as divided or undivided roadway facilities that have limited access with no grade separations at intersections. These highways *may* be two lane or multi-lane facilities.

POLICY

Any Community Sensitive Design for signing *should* ensure that the message or logo does not compete with the essential message of any official traffic signs, nor create a distraction from conveying essential traffic information. In addition, any Community Sensitive Design for signing needs to ensure that there is no advertising of any kind. Welcome signs as part of the design aspect of a structure **shall not** be allowed. Stand-alone welcome signs are covered in TEOpS 2-1-41.

GUIDELINES

Community Sensitive Designs for signing will be allowed on state-maintained roadways provided the following criteria are met:

1. Except for street name identifications (covered in items 2, 3 and 4 below), other word messages **shall not** be used, including wording within logos.
2. Street name identifications *may* be formed into the concrete as part of the structure. They **shall** be independent and not included as part of a logo.
3. On freeways and expressways, street name identifications **shall** be a minimum of 6” lowercase or 8” uppercase letters, with a minimum letter stroke width equivalent to FHWA Series E.
4. On conventional highways, street name identifications **shall** be a minimum of 4 ½” lowercase or 6” uppercase letters, with a minimum letter stroke width equivalent to FHWA Series E.
5. Logos or designs **shall not** bear any resemblance to official logos already in place on official guidance or motorist Specific Information Signs (SIS signs).
6. Logos or designs **shall not** bear any resemblance to official advertising, correspondence or municipal logos.
7. Logo and designs, including designs for street name identifications, **shall** be submitted to WisDOT Central Office, Bureau of Highway Operations for review and approval.
8. Any existing non-conforming Community Sensitive Design signing already in place **shall** be allowed to remain until the end of its service life. Once the design has reached the end of its service life, it **shall** be removed and not be replaced.
9. Some architecturally acceptable logos would include logos of:
    a. Wildlife
    b. State Capitol
    c. State outline
    d. Floral patterns
    e. Outlines of city buildings

f. Animals

g. Ships/boats.

10. Internally or externally illuminated logos **shall not** be allowed.
11. Portraits of people **shall not** be allowed.
12. Logos or designs *should* be uniquely related to the community in which the structure is located.
13. Bridge painting is not allowed to resemble a sign or message.

2-1-65 Pedestrian Crossing Flags December 2017

GENERAL

There are currently efforts by communities to enhance the visibility of pedestrians within crosswalks. Typically, these are crosswalks that are not at a stop or signalized location. Communities have adopted a pedestrian flag program where flags are provided at the pedestrian crossing to assist with increasing visibility of pedestrians crossing the street. This flag concept is similar to the concept of placing retroreflective material on clothing. Based on an April 27, 2005 Interpretation Letter from FHWA, it has been determined that these flags are not traffic control devices and therefore, no direct guidance is given in the 2009 MUTCD on the design and application of pedestrian flags. The 2009 MUTCD, Section 6E.03 does provide standards and guidance for hand signalizing devices, including flags, for work zones.

This policy is developed to provide specific guidelines for handling requests for the installation of pedestrian crossing flags for crossings on the state highway system.

POLICY

1. All requests to install pedestrian flag devices **shall** be made by the municipality.
2. Flag holder devices **shall not** be attached to WisDOT maintained sign posts.
3. The municipality **shall** be responsible for all installation and maintenance costs of the flag devices.
4. Pedestrian Crossing flags **shall** only be allowed at WisDOT permitted crosswalks.
5. For maximum visibility, flags **shall** be red or fluorescent orange-red in color. Flags **shall** be made of a retroreflective material or have a retroreflective strip attached to them.
6. Flags **shall** be a minimum of 18” x 18” in size, with a minimum 30” staff.

2-2-4 STOP and YIELD Signs for Separated Turn Lanes — August 2013

PURPOSE

The MUTCD, Section 2B.04 provides general guidance for the determination of STOP or YIELD sign usage to determine the right-of-way at intersections. The MUTCD also states that for signalized intersections, a STOP or YIELD sign **shall** only be used if there is a separated turn lane that is not controlled by the traffic signal.

In addition to separate, unsignalized turn lanes at signalized intersections, WisDOT has also installed roundabouts with separated turn lanes where the approaching, right-turning traffic can utilize a “bypass” lane to avoid going through the roundabout circle altogether.

Questions about whether to use a STOP or YIELD sign or no control for these applications has led to an inconsistent practice throughout the State. The purpose of this policy is to provide guidance on the signing treatments that are available and when they *should* be used, in order to help achieve a better consistency of practice statewide.

POLICY AND GUIDELINES

Signalized Intersections with Separated (Unsignalized) Turn Lane

1. Right turn lane with dedicated, long parallel receptor lane on the receiving roadway; typically a STOP or YIELD sign would not be used. An added lane warning sign (W4-6) *should* be used in these cases. If traffic or crash problems persist, a YIELD sign *may* be used.
2. If there are two or more receptor lanes on the receiving roadway, a YIELD sign *should* be used. If traffic or crash problems persist, a STOP sign *may* be used in lieu of the YIELD sign.
3. If there is only one receptor lane on the receiving roadway, a STOP sign *should* be used. A YEILD sign *may* be used in lieu of a STOP sign where there is wider pavement and an available recovery area.
4. If double separated right turn lanes are used at a signalized intersection, traffic signal control **shall** be utilized.
5. If traffic or crash problems persist with any YIELD sign control, STOP signs or signal control *should* be considered.

Roundabouts with Separated Right Turn Lanes

1. YIELD signs *should* be used for both single and double separated right turn lanes at roundabouts.
2. If traffic or crash problems persist with any YIELD sign control, STOP signs *should* be considered.

SIGNING IMPLEMENTATION

1. The guidelines listed in Part B *should* be followed for newly installed intersections.
2. For existing intersections with signing not meeting these guidelines, there is no compliance date for making these changes. However, opportunities *should* be utilized through improvement projects, knockdowns or routine sign replacements to bring the signing up to the current guidelines.

2-2-4.5 STOP and YIELD Signs on Driveways and Private Roads — April 2008

GENERAL

The Department uses regulatory and warning signs conservatively, as recommended in the Manual on Uniform Traffic Control Devices (Section 2A.04). This conservative use is important to retain the effective impact of signs on driver behaviors; used in excess, regulatory and warning signs tend to lose their effectiveness. There is the concern that a proliferation of unnecessary STOP or YIELD signs at driveways and private roads will lead to their disregard and could cause potential safety issues at locations where STOP or YIELD signs are necessary.

Oftentimes the Department is requested to install and/or maintain STOP or YIELD signs for driveways and private roads. The Department is not obligated to provide STOP or YIELD signs for many of these locations, by basis of Wisconsin Statutes and the 2009 MUTCD.

AUTHORITY

The following Wisconsin State Statutes establish relevant rules of the road that drivers must obey without requiring a sign to be posted and describe the authority to place signs, and the MUTCD Sections provide standards and guidance for installations of these signs.

Chapter 346, Rules of the Road

s. 346.02 (7) Applicability of Provisions Requiring Signposting.

> …Whenever a particular section does not state that signs are required, such section is effective even though no signs are erected or in place.

s. 346.18 (4) Entering Highway from Alley or Non-highway Access.

> The operator of a vehicle entering a highway from an alley or from a point of access other than another highway **shall** yield the right-of-way to all vehicles approaching…

s. 346.18 (7) (b) Entering Alley or Driveway from Highway

> The operator of any vehicle crossing a sidewalk…**shall** yield the right-of-way to any pedestrian…on the sidewalk.

s.346.41 (1) Display of Unauthorized Signs and Signals Prohibited

> No person **shall** place, maintain or display upon or in view of any highway...any unauthorized sign…which: (a) purports to be…an official traffic sign…

MUTCD, 1A.08, Authority for Placement of Traffic Control Devices.

> Traffic control devices… **shall** be placed only as authorized by a public authority or the official having jurisdiction…
>
> Any unauthorized sign placed on the highway right-of-way by a private organization or individual constitutes a public nuisance. All unofficial and nonessential traffic control devices, signs, or messages *should* be removed.
>
> All regulatory traffic control devices **shall** be supported by laws, ordinances, or regulations.

These statutory provisions clarify that signs are not required in order to effect a requirement to comply with rules of the road, and it is apparent that a motorist is not required to comply with rules of the road, and it is apparent that a motorist is not required to stop before entering a street or highway from a driveway. STOP signs are not required in these situations. The following policy is established consistent with the stated objective of conservatively using regulatory signs to retain their effectiveness.

POLICY

1. STOP signs or YIELD signs **shall not** be erected on state highway right-of-way at driveways, except as noted below:
    a. STOP or YIELD signs **shall** be installed and maintained by WisDOT at driveways to state, county or municipal parks, and state forest, driveways on school grounds, and driveways to county institutions. These intersections often appear to be driveways, but are defined as highways under s.340.01(22).
    b. If a private driveway operates and functions like a public street, the Regions *may* provide a temporary exception to allow a STOP or YIELD sign while working to encourage the local government to make the intersecting road a public roadway.
    c. When there are demonstrated operational or safety issues resulting from a lack of a STOP or YIELD sign, and best efforts of the region to locate the STOP or YIELD sign off of the state highway right-of-way do not work, a permit *may* be granted by the Region to allow the STOP sign in the highway right-of-way. The permit *should* be documented using the standard application/permit to work on highway right-of-way (DT 1812 form). The owner of the STOP or YIELD sign **shall** be responsible for the installation and long-term maintenance of the sign.
2. For pre-existing STOP or YIELD signs installed at driveway connections to state highways, not consistent with this policy and located in the right-of-way of the state highway, the Region *should* remove the sign from the right-of-way. Before removal, make every effort to work with the driveway owner, as opportunities permit, to relocate privately owned STOP or YIELD signs off of the state

highway right-of-way. An ideal time for working with property owners for relocation of STOP or YIELD signs would be during an improvement project or if any other work is being performed on the right-of-way.

3. STOP or YIELD signs for private driveways connecting to state highways *should* be located of the state highway right-of-way in a location that is reasonably close to the ideal starting point. The 2009 MUTCD, Section 2A.16 states that a STOP sign *may* be located a maximum of 50 feet from the mainline roadway edgeline.
4. When privately owned STOP or YIELD signs are allowed in the highway right-of-way, the proper size STOP or YIELD sign for that particular state trunk highway **shall** be used, in accordance with TEOpS 2-2-5. In addition, the owner of the private road or driveway **shall** install STOP or YIELD in accordance with the MUTCD, Sections 2B.04, 2B.05, 2B.06, 2A.18, 2A.19 and 6F.05.

2-2-5 Size of STOP Signs on Roadways — September 2010

PURPOSE

The intent of this policy is to establish minimum STOP sign sizes on WisDOT roadway. These guidelines are applicable for intersections with single-lane conventional State Trunk Highways, intersections with multi-lane conventional State Trunk Highways and intersections with Expressways.

DEFINITIONS

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

Expressways are divided arterial highway facilities that have partial control of access, generally with grade separations at major intersections.

Conventional highways are defined as 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.

INSTALLATION GUIDELINES

The following minimum sizes **shall** be used for the installation of STOP signs on WisDOT system roadways.

1. A 36" STOP sign size **shall** be used for all STH/STH intersections, regardless of the number of approach lanes on each STH.
2. A 36" STOP sign size **shall** be used for all roadways intersecting multi-lane conventional state trunk highways and expressways.
3. A 36" STOP sign size **shall** be used for multi-lane conventional roadways intersecting single-lane conventional state trunk highways.
4. A 30" STOP sign size **shall** be used for single-lane conventional roadways intersecting single-lane conventional state trunk highways.
5. Additional STOP sign size criteria for bypasses are contained in TGM 2-15-53 (Bypass Signing).

If there are demonstrated or perceived problems at these intersections, the Regions have the option of increasing the STOP sign size. A traffic engineering study can be used to identify problems at intersections. Justification *may* be based on unusual roadway geometrics, crash problems, or sight restrictions.

2-2-12 In-Street Pedestrian Crossing Signs — June 2005

PURPOSE

The MUTCD section 2B.12 allows usage of in-street pedestrian crossing signs to remind motorists of laws regarding pedestrian right-of-way at an unsignalized location. While these signs *may* be useful to remind motorists of traffic/pedestrian right-of-way laws, it is important to develop and use additional application standards to promote consistency, safety and efficiency of the roadway. Local units of government have requested to install this signing. This policy provides guidance on the usage of these signs on state maintained roadways.

POLICY

Local units of government **shall** request, in writing, permission to install and maintain in-street pedestrian crossing signs on DOT permitted crosswalks. A map **shall** be provided to the District by the local unity of government showing the proposed locations of the in-street pedestrian crossing signs. Upon District review, approval or denial *should* be made by a letter to the local unit of government. If approval is given, the District *should* also provide a copy of the R1-6 standard sign plate with the approval letter so consistency is maintained in the design and manufacture of the signs.

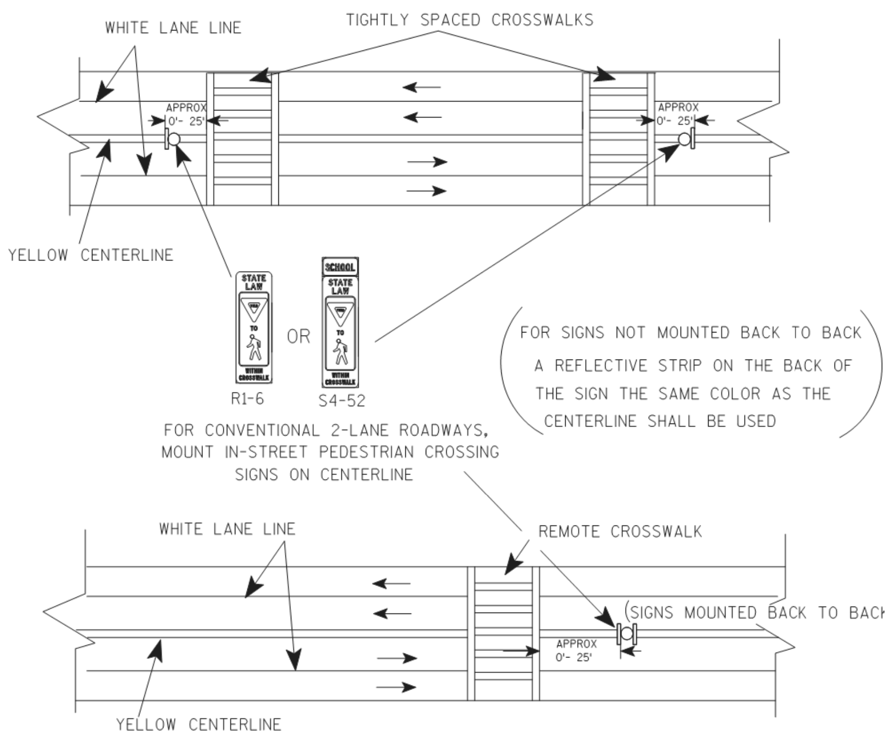
The following guidelines **shall** be used by the District to determine whether a roadway crossing would qualify for in-street pedestrian crossing signs.

GUIDELINES

1. The local unit of government **shall** be responsible for all liability costs.
2. Only the R1-6, in-street YIELD TO PEDESTRIANS WITHIN CROSSWALK sign **shall** be allowed only on roadways with posted speeds of 40 mph or less.
3. The R1-6, in=street YIELD TO PEDESTRIANS WITHIN CROSSWALK sign message shall only be used in Wisconsin since State Statute 346.24 requires drivers must yield to a pedestrian in a crosswalk. The R106a, STOP FOR PEDESTRIANS WITHIN CROSSWALK, sign should not be used.
4. Existing in-street pedestrian crossing signs that do not conform to this policy **shall** be removed. Notification to communities **shall** be made by written letter. *Should* existing non-permitted signing not be removed, WisDOT will remove the sign(s).
5. The in-street YIELD TO PEDESTRIAN sign **shall** only be used as a supplement to the standard pedestrian crossing sign (W11-2) with diagonal down arrow (WF16-7L/R) or standard school warning sign (S1-1) with diagonal down arrow (W16-7L/R). As an exception, the in-street YIELD TO PEDESTRIAN WITHIN CROSSWALK sign *may* be used alone provided there are no sight restrictions.
6. The in-street YIELD TO PEDESTRIAN sign **shall** only be used as an in-street sign, not on the outside shoulder or parking lane.
7. The in-street YIELD TO PEDESTRIAN sign **shall** only be used at marked and maintained crosswalk approaches that are not controlled by a STOP sign or traffic signal. Signs *should* be restricted to key locations, such as high volume pedestrian crosswalks, to avoid overuse. The minimum spacing of signs **shall** be every other block, where there are several consecutive marked and maintained pedestrian crossings.
8. The sign locations **shall not** impede traffic movements (through or turning). Signs *may* have to be temporarily removed due to maintenance operations or oversized loads. WisDOT is not responsible for sign removal or reinstallation costs.
9. Only one sign, in each direction of a two-way street approach or back-to-back signs, will be allowed for each crosswalk approach.
10. For pedestrian crossing applications, the signs **shall** have a black legend on yellow background the design on the R1-6 sign plate **shall** be used.
11. For school crossing applications, the signs **shall** include the SCHOOL plaque and **shall** have black legend on fluorescent yellow-green background. The design on the S4-52 sign plate **shall** be used.
12. The reduced size in-street school warning sign (S1-1) with reduced size AHEAD sign (WF16-9P) or reduced size diagonal down arrow sign (WF16-7L/R) *may* be used in lieu of in-street pedestrian crossing signs for school applications as shown in the MUTCD, sections 7B.08 and 7B.09.
13. Supports **shall** be freestanding (maximum 2” square or 2” round post), meeting National Cooperative Highway Research Program (NCHRP) 350 breakaway standards. The maximum mounting height **shall** be 2 feet to the bottom of the sign. The sign **shall** be securely attached to the pavement if left in place for more than 24 hours. Sign support bases **shall not** be bolted or cored into the pavement.
14. Communities *may* use the following mounting devices. Mounting devices not included in this list **shall** be a proved by the District Traffic section, prior to use:
    a. *Impact Recovery Systems* Mount or Portable models (portable model #103QR or fixed model #101NS).
    b. *Safe-Hit* Surface Mount or Potable models (portable model #ST948PCD44WX or fixed model #ST948SMP44WX).

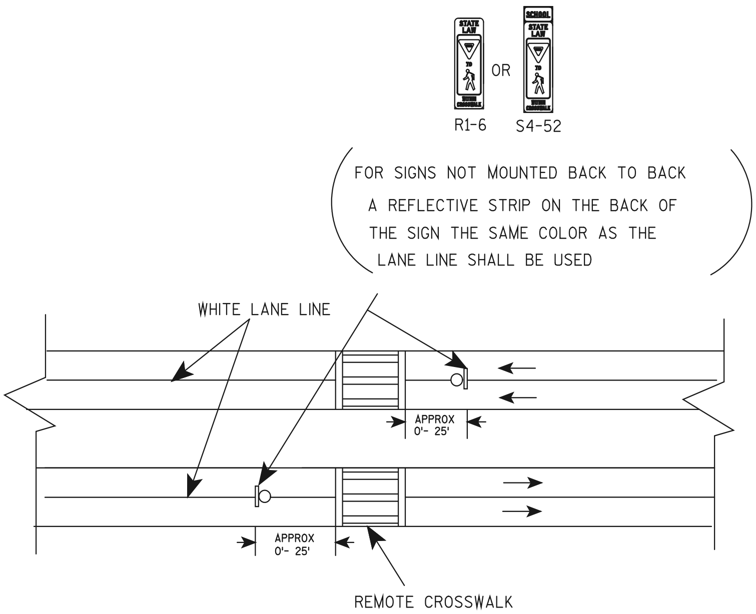
15. For signs not mounted back-to-back, a reflective strip the same color as the centerline or lane line **shall** be used to warn traffic approaching from the opposite direction.
16. The local unit of government **shall** be responsible for manufacture, liability, installation and maintenance costs, which includes removal prior to snowfall and re-installation in the spring. If signs are not removed prior to November 1, WisDOT will remove and charge the local unit of government for all costs associated with removal. The in-street pedestrian crossing signs **shall not** be installed prior to April 1.
17. The local unit of government **shall** affix an identification label to the back of each sign, per Wisconsin State Statute 86.19(5).

TYPICAL PLACEMENT OF IN-STREET PEDESTRIAN CROSSING SIGN



FOUR LANE UNDIVIDED SECTION

TYPICAL PLACEMENT OF IN-STREET PEDESTRIAN CROSSING SIGNS



FOUR LANE DIVIDED SECTION

2-2-13 Location of Speed Limit Signs — June 2015

PURPOSE

The following is to provide policy guidelines for distance between and proper location of speed limit signs. The policy pertains to signing on freeways, expressways, and conventional highways.

BACKGROUND (AUTHORITY)

The Wisconsin Statutes in Section 346.57 discusses Speed Restrictions. The statutes require certain statutory limits to be posted. Refer to this statute for locations that require Speed Limit signs to be posted.

TEOpS 13-5-1 discusses the statutory and approval process and setting limits. Refer to this section for information on these issues.

The MUTCD Section 2B-13 discusses location of Speed Limit signs.

Note: Reduce speed ahead sign requirements and placement is covered under a separate TEOpS 2-3-30, “Reduced Speed Ahead” signing.

POLICY

Based on the requirements in the MUTCD Section 2B-13, the following **shall** be the location where speed limit signs **shall** be placed:

1. Speed limit signs **shall** be placed at points of change from one speed limit to another and when leaving a zoned area such as a town, village, city, or municipality to return to rural speed.
2. After a school zone, where speed limit was reduced.

The following chart or table indicates MINIMUM criteria for each specific speed limit:

70/65/60/55/50 mph (Freeways)

1. After each interchange
2. Beginning and end of freeway segment
3. Changes in speed zone (double mark—outside and inside shoulder for reductions from 70 or 65 to 65/60/55/50 mph)

65/60/55/50 mph (Expressways)

1. After each interchange
2. At state or county highways
3. Changes in speed zone (consider double marking outside and inside shoulder)
4. Beginning and end of expressway section

Note: An expressway is defined as a divided arterial highway facility that has partial control of access and generally with grade separations at major intersections.

55 mph (Conventional Highways)

1. Leaving a zoned area less than 55 mph such as a town, village, city or municipality
2. After every state highway in a rural area
3. Typically after major intersections with higher volumes
4. Reminder signs *should* be spaced approximately every 15 miles, when signs under criteria 1, 2, or 3 do not provide a reminder within 15 miles

50/45 mph (Conventional Highways)

1. At points of change from one speed limit to another
2. After major intersections with higher volumes
3. Every ½ mile (maximum distance between reminder signs)

Note: Engineering judgment *should* be used when placing every ½ mile to coordinate with other criteria above such as after major intersections to avoid unnecessary duplication.

40 mph and BELOW (Conventional Highways)

1. After major intersections with higher volumes
2. **Maximum** distance between reminder signs
    a. 40 mph = 2000 feet
    b. 35 mph = 1500 feet
    c. 30 mph = 1000 feet
    d. 25 mph = 1000 feet

Note: Field conditions *may* require varying from these criteria for these speed and highway categories.

SIZE OF SIGNS

See TEOpS 2-1-35 for optimum size of signs.

DOUBLE MARKING

Double marking (right and left side) for the first set of signs **shall** be employed for any reduction from 70 or 65 mph and *should* be employed for other speed limit reductions on divided highways.

PHASE IN PERIOD

As signs are replaced due to wear or where there are problem areas with spacing, maximum of five years from the effective date of this policy.

WORK ZONE TRAFFIC CONTROL SPEED LIMIT SIGNS

The spacing shown in this policy does not apply to work zone traffic control speed limit changes. See work zone standard detail drawings for applicable requirements.

2-2-15 NO TURNS (R3-3) Signs—Freeways November 1992

In the early 1970s there was some special concern expressed about wrong-way movements on the freeway system. Some of the concern was being generated by the Federal Highway Administration, and some of it was local in nature. As a result, standardized signing practices were developed and implemented throughout the state on the freeway system. Along with some other extensive signing, NO TURNS signs were installed in the areas between the merging roadways at on-ramps on all freeways. These signs were intended to discourage illegal U-turns, whether made purposefully or by accident. There was subsequently some feedback from the State Patrol that the signing improvements were effective in reducing wrong-way movements.

Unfortunately, the NO TURNS signs in the merging area are in a rather vulnerable location and have no doubt suffered more than their share of knockdowns, thus incurring maintenance costs, and costs and damages to the public. Over the years, the public has come to understand and accept the restrictive nature of the freeway roadways, which make U-turns difficult.

Consequently, it has been determined that there is no longer a need for the sign, and it can be eliminated.

There *may* be some specific locations where the geometrics or condition peculiar to the locations, or where an awareness of unusual driving habits, would seem to make the retention of these signs desirable. In these cases, the R3-3 sign *may* still be used. Consultation with the State Patrol or other enforcement agencies *may* be desirable in these instances.

2-2-19 No U-Turn Sign (Freeway/Expressway median Crossover Sign Placement) January 2013

GENERAL

The MUTCD Section 2B.18 gives some guidance and options for the placement of No U Turn Signs (R3-4 sign with R3-4a plaque, or R3-4B sign). However, the 2009 MUTCD is lacking on guidance for the placement of these signs in median crossovers. Guidance as to the proper number and placement of these signs in the median is important. The median width plays a role in the effective placement of the signs.

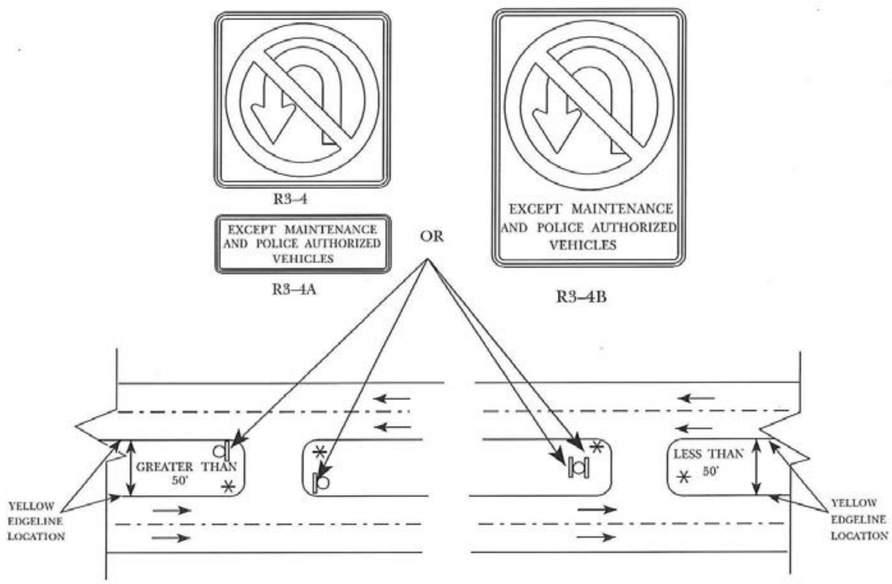
GUIDANCE/POLICY

The following guidelines/policy apply to these signs:

1. The Region has the option of using the R3-4 sign with R3-4A supplemental plaque or the combination R3-4B sign for these applications.
2. If used for freeway and expressway median crossovers with a width of 50 feet or greater (distance from yellow edgeline to yellow edgeline), separate No U-Turn signs **shall** be installed on the far side of the median crossover facing traffic.
3. If used for freeway and expressway median crossovers with a width of less than 50 feet (distance from yellow edgeline to yellow edgeline), the No U-Turn signs *may* be mounted back-to-back in the center of the median. Vegetation or other sight obstructions *should* be considered to ensure visibility of the signs all year.
4. A double yellow delineator *should* be placed on the left side of the through roadway on the near side of the crossover for each roadway (see Figure 1).
5. Any existing median crossover No U-Turn signs not conforming to this policy will be allowed to remain in place until the end of their useful life. Useful life ends when the sign message no longer meets legibility or condition standards. Existing signs *may* be removed prior to the end of their useful life when opportunities arise such as knockdown or damage, when other work is occurring nearby, or when projects make removal practical.

Figure 1

MEDIAN CROSSOVER SIGNING AND DELINEATION



* DOUBLE YELLOW DELINEATOR (ON SEPARATE POST)

2-2-19.1 No U-Turn Signs (Controlled Intersection Placement) April 2010

BACKGROUND

Historically, Wisconsin State Law has not allowed U-turns at intersections controlled by traffic control signals or intersections controlled by an officer. Effective January 1, 2010, the State law was changed to make U-turns legal at intersections that do not have signs prohibiting the maneuver. Traffic engineering experience has shown that the permitting of U-turns at controlled intersections can be a safe and beneficial traffic maneuver. From an economic standpoint, the permitting of U-turns can reduce costs and issues connected with access control where highway projects result in median closings because reasonable access to the businesses can be possible via U-turns. It is noteworthy to point out that all other states allow U-turns at intersections to one degree or another.

For dual left turn applications, Wisconsin State Statute 346 states that U-turns would be made from the innermost left turn lane in the same fashion as a left turn. Vehicles on the intersecting streets turning right on red will need to yield to the U-turning vehicle. Statute 346 also states that backing is not permitted as part of a U-turn maneuver, therefore a motorist will need to have knowledge of the turning radius of their vehicle. A U-turn is also prohibited on undivided highways for crest and vertical curve locations where the sight distance is less than 500 feet.

Usage of turn prohibition signs, specifically No U-turn Signs, is covered in MUTCD Section 2B.19. However, the MUTCD does not get into specific engineering criteria as to when signs *should* be used. Motorists are not necessarily familiar with state statute language and signing *may* be appropriate at certain intersections to prohibit U-turns, due to motorist safety issues or to help enforce the state statute. Wisconsin State Statute 346 gives maintaining governments the authority to prohibit U-turns at specific intersections. Intersections where U-turns are prohibited **shall** be signed.

DEFINITIONS

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

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

Conventional highways are defined as 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.

QUALIFYING CRITERIA FOR SIGNING

1. No U-Turn (R3-4 signs) **shall** be installed at the following signal and stop controlled intersections where U-turns are prohibited:
    a. Intersections where there are existing no left turn signs: The no U-turn (R3-4) sign **shall** be installed at these locations in conjunction with the no left turn (R3-2) sign. The combination no left turn/no U-turn (R3-18) sign *may* be utilized for these locations instead.
    b. Intersections where there are signalized right turns that operate simultaneously with protected left turn movements. The no U-turn (R3-4) sign *may* be utilized for these locations instead.
    c. Signalized intersections that are interconnected to a railroad crossing and operate with advance (not simultaneous) pre-emption. The no U-turn (R304) sign **shall** be installed on any divided highway approach that crosses the railroad tracks.
2. No U-turn (R3-4) signs *may* be installed at other signal and stop controlled intersections that have demonstrated the following operational issues:
    a. Intersections with less than 500 feet of sight distance and demonstrated crashes attributed to U-turns that are above the statewide average for that type of intersection.
    b. Intersections with dual left turn lanes and demonstrated problems with motorists making U-turns from the outside left turn lane. For this issue, the lane control sign (R3-8 UU) *should* be used to emphasize that U-turns *may* only be made from the inside left lane. For overhead signing applications, the R3-5U (with 6” black border) *may* be installed in place of the R3-5L or R3-50L.
    c. Intersections with a deficient truck turning radius that present repeated problems with trucks backing up to complete a U-turn, signs and/or signals being damaged or other safety or operational issues cause by the deficient truck turning radii. Intersections *may* have signing to just restrict trucks in making U-turns. For these applications, the standard no U-turn (R3-4) sign with supplemental truck plaque (M4-4) sign would be used.
    d. Temporary signalized intersections during improvement projects where left turns *may* be restricted or eliminated.
    e. Intersections that have poor geometrics and there are demonstrated crashes attributed to U-turns that are above the statewide average for that type of intersection. Examples would be skewed intersections or nearby railroad crossings.
3. Eliminations of signs. In the past, many signalized intersections were signed mainly from requests by law enforcement due to repeated problems with illegal U-turns at intersections and the signs aided in enforcement of the law. The Region *should* make efforts to review these intersections, based on the criteria outlined in items 1 and 2 above, and adjust or remove signs as necessary.

GUIDANCE FOR FIELD PLACEMENT OF SIGNS

1. Installation of no U-turn signs at controlled intersections can be challenging due to lack of space to install signs and the presence of many other signs. A minimum of on no U-turn sign **shall** be installed at each intersection approach where the U-turn move is prohibited. Below is a hierarchy of where the sign *should* be installed:
    a. Primary choice is mounting of the no U-turn (R3-4) sign on the far side median signal pole if it does not conflict with any other signs (keep right, etc.).
    b. Secondary choice is to install the no U-turn (R3-4) sign side-by-side with the keep right sign on the far side median signal pole. This *may* be accomplished by a separate post or bracket system. If a bracket system is used, the no U-turn sign *should* be mounted to the left of the keep right sign.
    c. Third choice is to install the no U-turn (R3-4) sign on a nearside median signal pole.

   d. Fourth choice is to install the no U-turn (R3-4) sign underneath the keep right on the far side median signal pole. This option is the last desirable because the no U-turn sign will be lower than the minimum 5 foot mounting height as specified by the MUTCD.

2. A second no U-turn (R3-4) sign *may* be installed in advance of the intersection approach for areas where compliance is still a problem that is resulting in safety issues or if visibility of the mandatory no U-turn sign is compromised due to intersection geometrics or the presence of other signs.

3. Placement of the ground mounted R3-8UU sign mentioned in 2B above *should* be in advance of the near median signal head in the median at a minimum distance of 150 feet back from the signal.

2-2-20 Intersection Lane Control Sign — May 2011

PURPOSE

The MUTCD sections 2B.19, 2B.20, 2B.21, and 2B.22 provide standards and guidance for the usage of intersection lane control signs, mandatory movement lane control signs, optional movement lane control signs, and advanced intersection lane control signs. This policy provides requirements and guidance to the proper use of the signs on state maintained highways.

DEFINITIONS

1. Intersection lane control signs (R3-5 through R3-8 and R3-20L or LL and R3-20R or RR) include mandatory movement lane control signs, optional movement lane control signs, and advanced intersections lane control signs.
2. Mandatory movement lane control signs are as follows:
   a. R3-5, R3-5A, R3-5XL and R3-50 series contain an arrow and word ONLY
   b. R3-7 series indicate RIGHT (CENTER or LEFT) LANE MUST TURN RIGHT (CENTER or LEFT).
3. Optional movement lane control signs (R3-6 series) indicate a combination arrow.
4. Advanced intersection lane control signs (R3-8 series) indicates the configuration of all lanes ahead. The R3-20 series signs indicate the start of a turn lane with the text LEFT (RIGHT) TURN LANE (tilting down arrow).

POLICY

1. Mandatory movement lane control signs (Figures 1, 2 and 3)

   R3-5, R3-5A, R3-5XL and R3-50 series are generally used as overhead signs directly over the lane to which they apply. The R3-5, R3-5A, R3-5XL and R3-6 **shall not** be used as a ground mounted sign on a multi lane approach.

   R3-7 series signs **shall** only be used as ground mounted signs. The RIGHT (LEFT) LANE MUST TURN RIGHT (LEFT) **shall** be installed whenever there is a mandatory turn lane and **shall** be accompanied by pavement marking arrows/only per 3B.20 of the MUTCD. A mandatory turn lane is one where a through lane becomes a mandatory turn lane and the driver must change lanes in order to continue straight. An R3-7 series sign *should* be placed in advance of the intersection and repeated at the intersection depending on space availability for signs and the speed limit of the roadway. For higher speed roadways, 45 MPH or higher place the sign a minimum of 400’ prior to the intersection and repeat the sign at the intersection. For lower speed roadways, 40 MPH and below, place the sign a minimum of 300’ prior to the intersection and repeat the sign if necessary. An option to the R3-7 series ground mounted sign is an overhead R3-5 series sign (ONLY, ARROW). NOTE: The R3-8 series sign *may* be used in lieu of the R3-7 series sign when there is only one lane approaching an intersection and the roadway widens into separate turn lane(s).

2. Optional movement lane control signs

   R3-6 series signs indicate a combination arrow and are installed overhead. The word OK **shall not** be used on the sign per 2B.19 of the Wisconsin supplement to the 2009 MUTCD.

3. Advanced intersection lane control signs (Figures 4, 5, 6, 7, 8, 9 and 10)
   R3-8 signs show the configuration of all lanes ahead. This sign *should* be placed in advance of the tapers for the turn lanes to allow for drivers to read the sign and change lanes accordingly. This sign is

required for complex intersections where it *may not* be apparent to the driver what each lane movement is. Examples where it is not apparent include horizontal and vertical curves approaching an intersection or lack of physical barrier channelization. Examples of complex intersections include dual rights and dual lefts. At other locations, it is an optional sign.

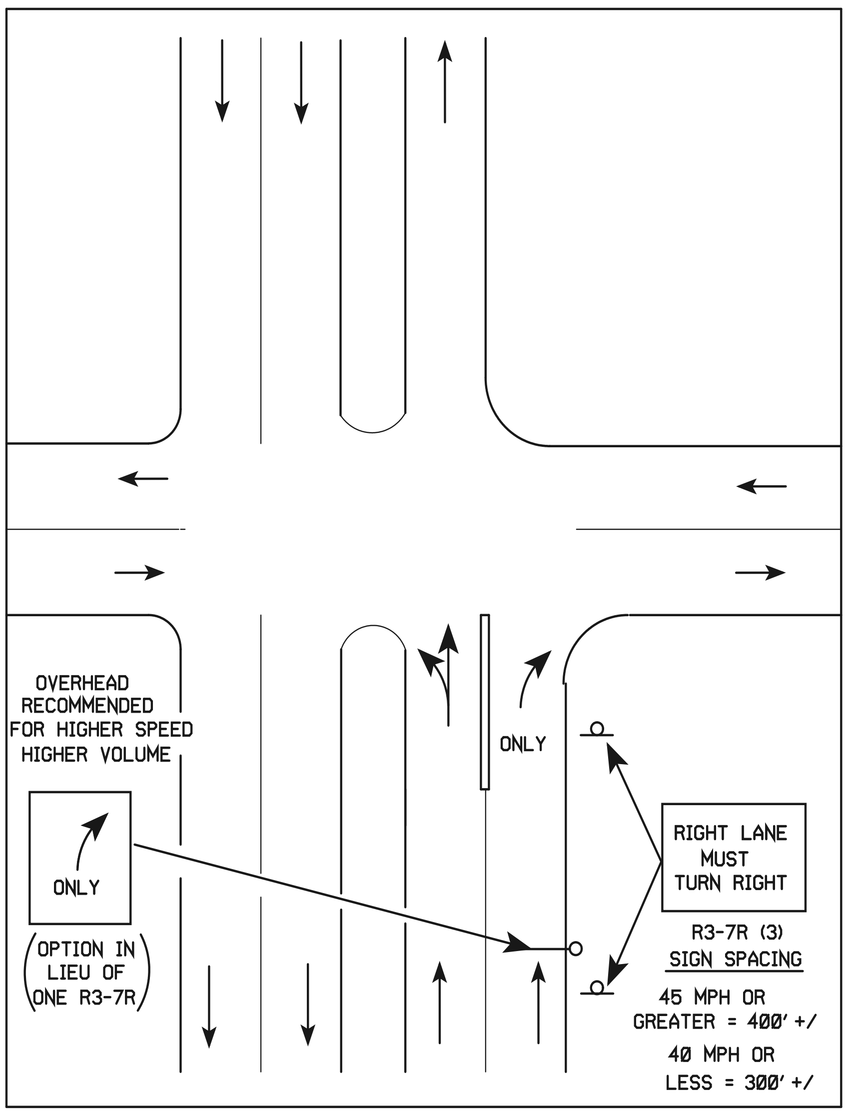
R3-20L or LL and R3-20R or RR signs which indicate LEFT (RIGHT) TURN LANE and tilted down arrow are intended to be placed at the start of the taper for the turn lane. This sign is required:

a. For dual left turns where there is a median physical separation.
b. At single or dual turn lanes where there is a physical separation between the left turn lane and through lane. Note: If the R3-20 sign is used between the through lane and turn lane per Figure 7, the advanced sign is optional.

The R3-20 series sign is not necessary at other locations unless there is a horizontal curve where the driver cannot distinguish the turn lane taper from the through lane.

4. Mandatory turn lane downstream of an intersection (Figure 3)

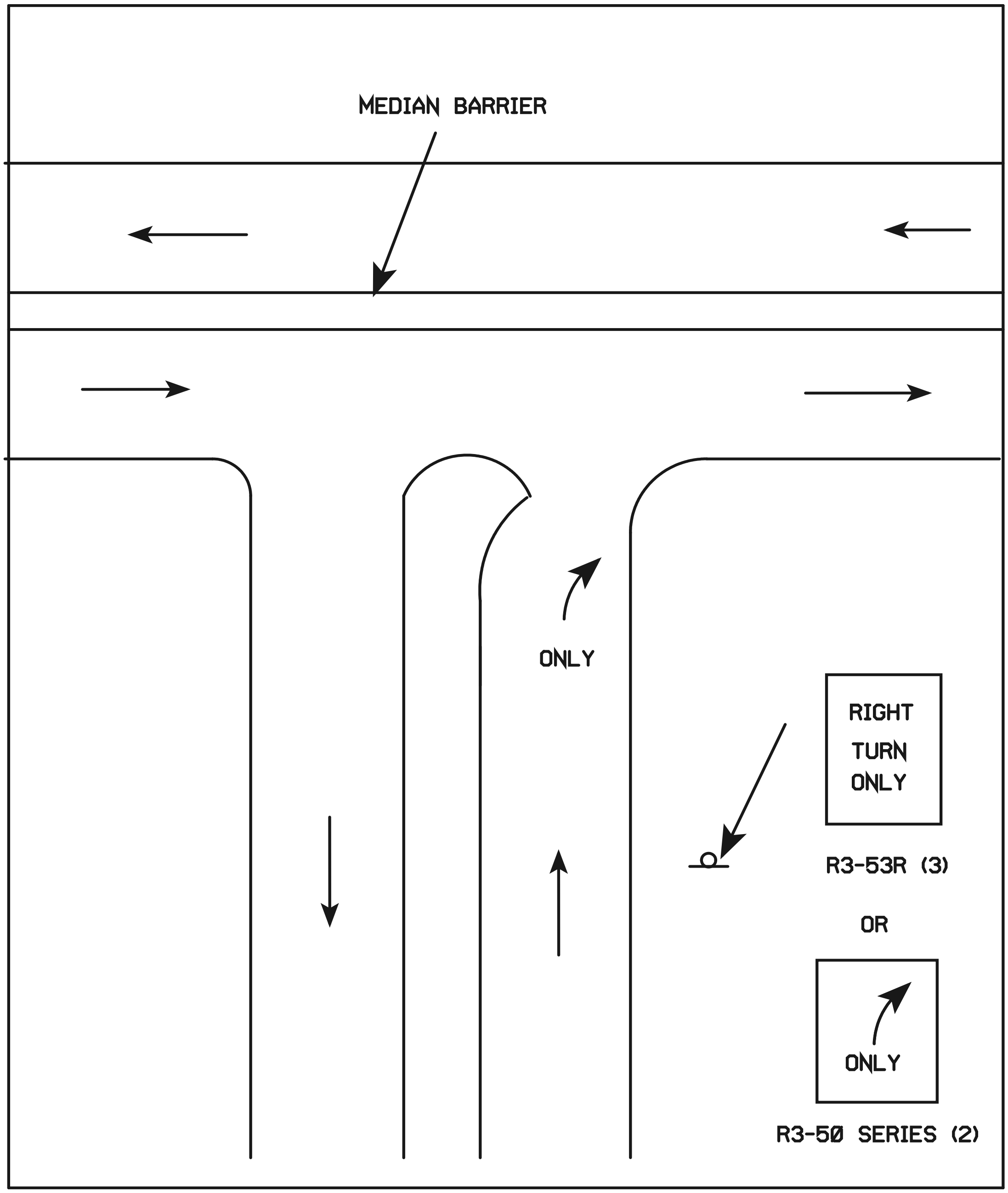
An R3-7 series sign, RIGH (LEFT) LANE MUST TURN RIGHT (LEFT) **shall** be used where a lane becomes a mandatory turn lane after an intersection. Option—overhead sign R3-5 series sign is recommended for higher speed facilities in lieu of the ground mounted R3-7 series sign.



MANDATORY MOVEMENT LANE CONTROL SIGNS

FIGURE 1

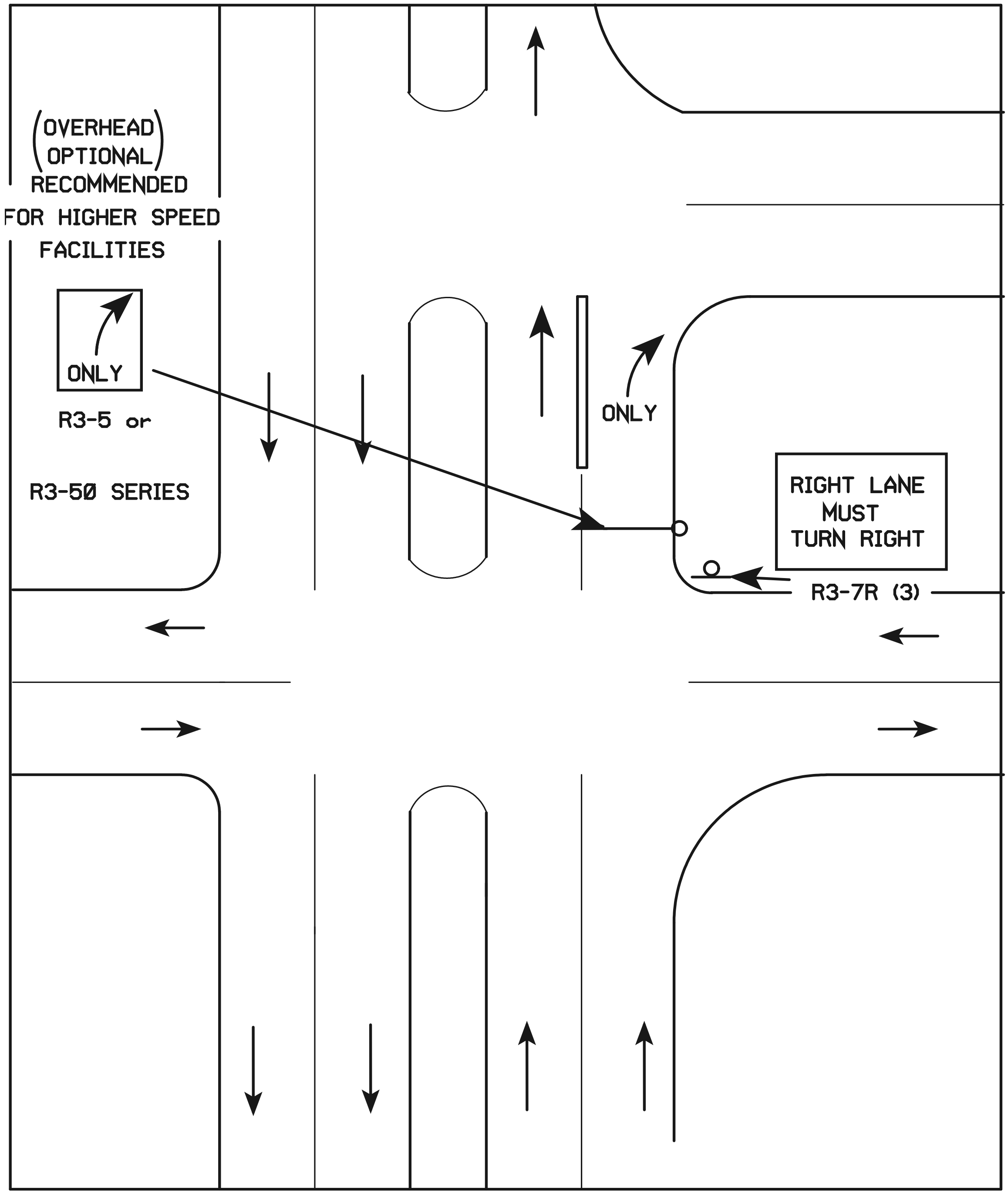
CODE



MANDATORY MOVEMENT LANE CONTROL SIGNS

FIGURE 2

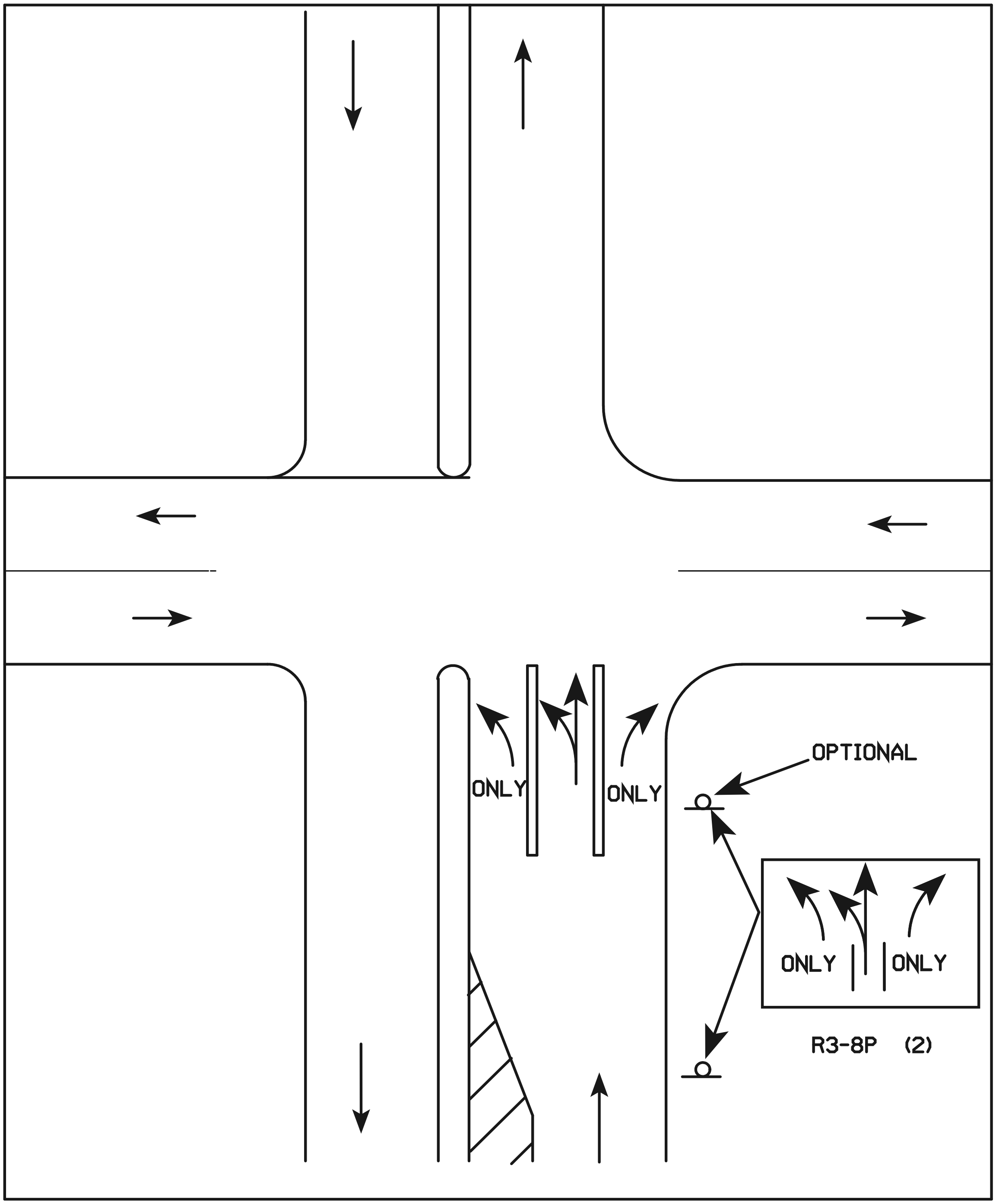
: CODE



MANDATORY TURN LANE AFTER INTERSECTION

FIGURE 3

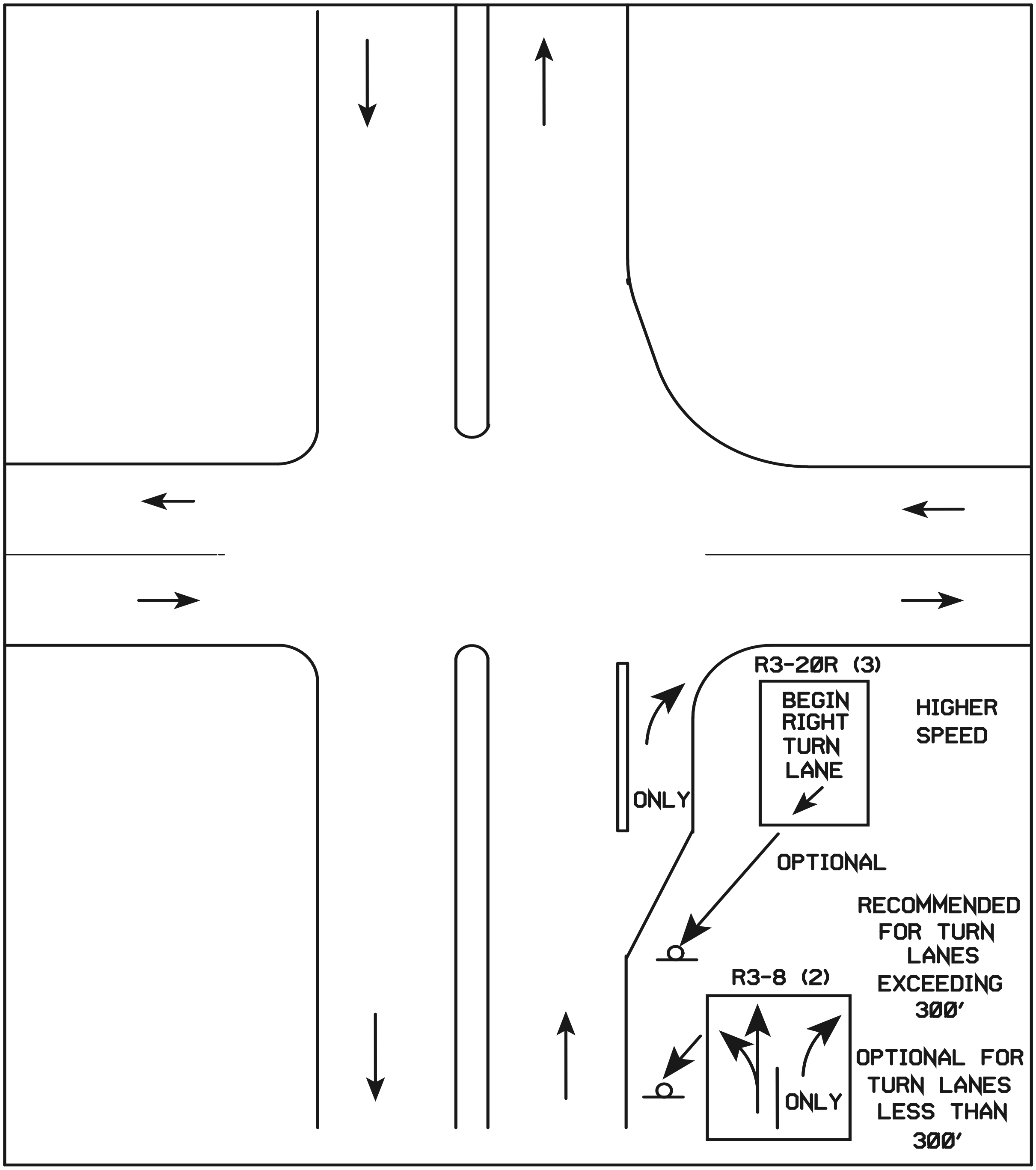
E CODE



ADVANCED INTERSECTION LANE CONTROL SIGNS

FIGURE 4

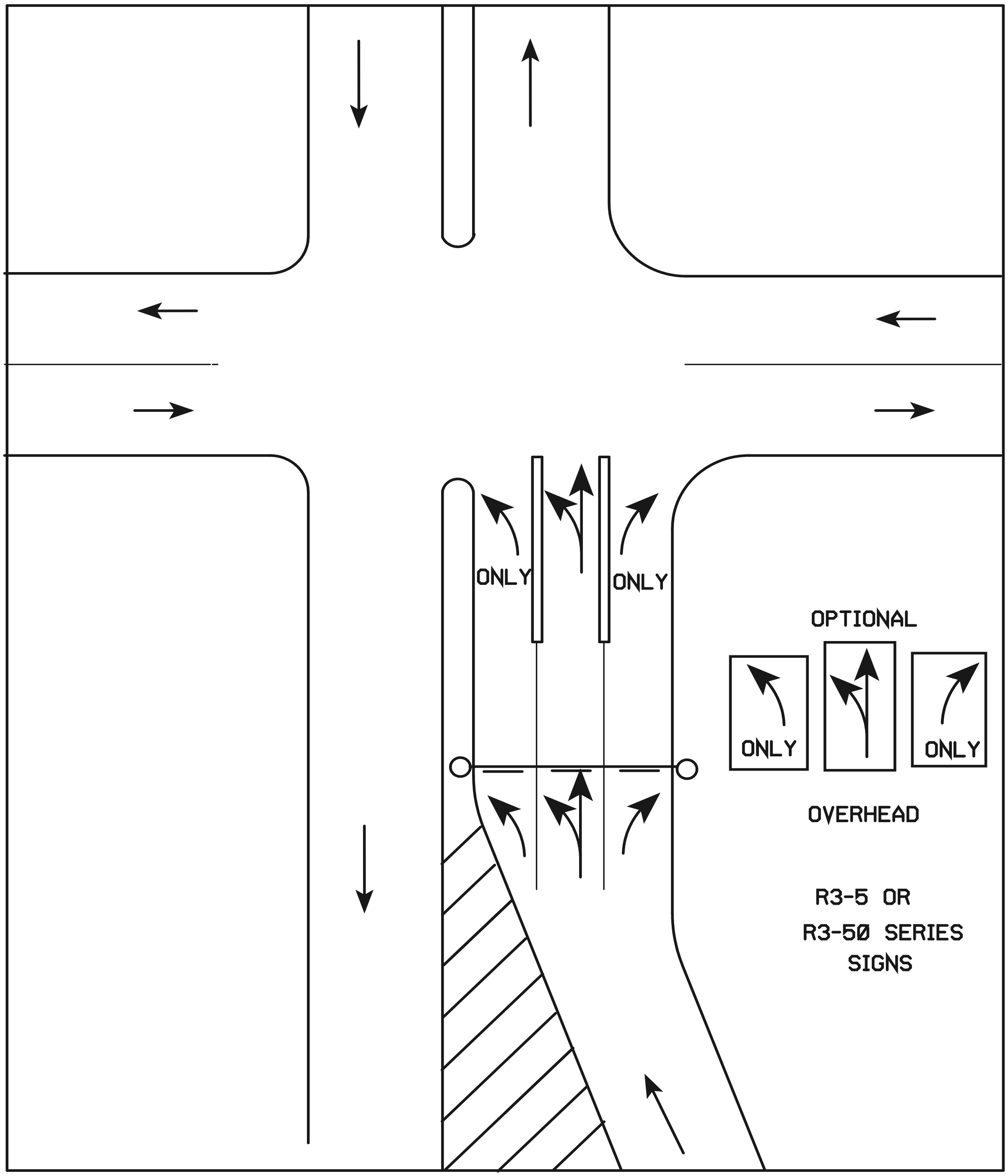
SIZE CODE



ADVANCED INTERSECTION LANE CONTROL SIGNS

FIGURE 5

E CODE

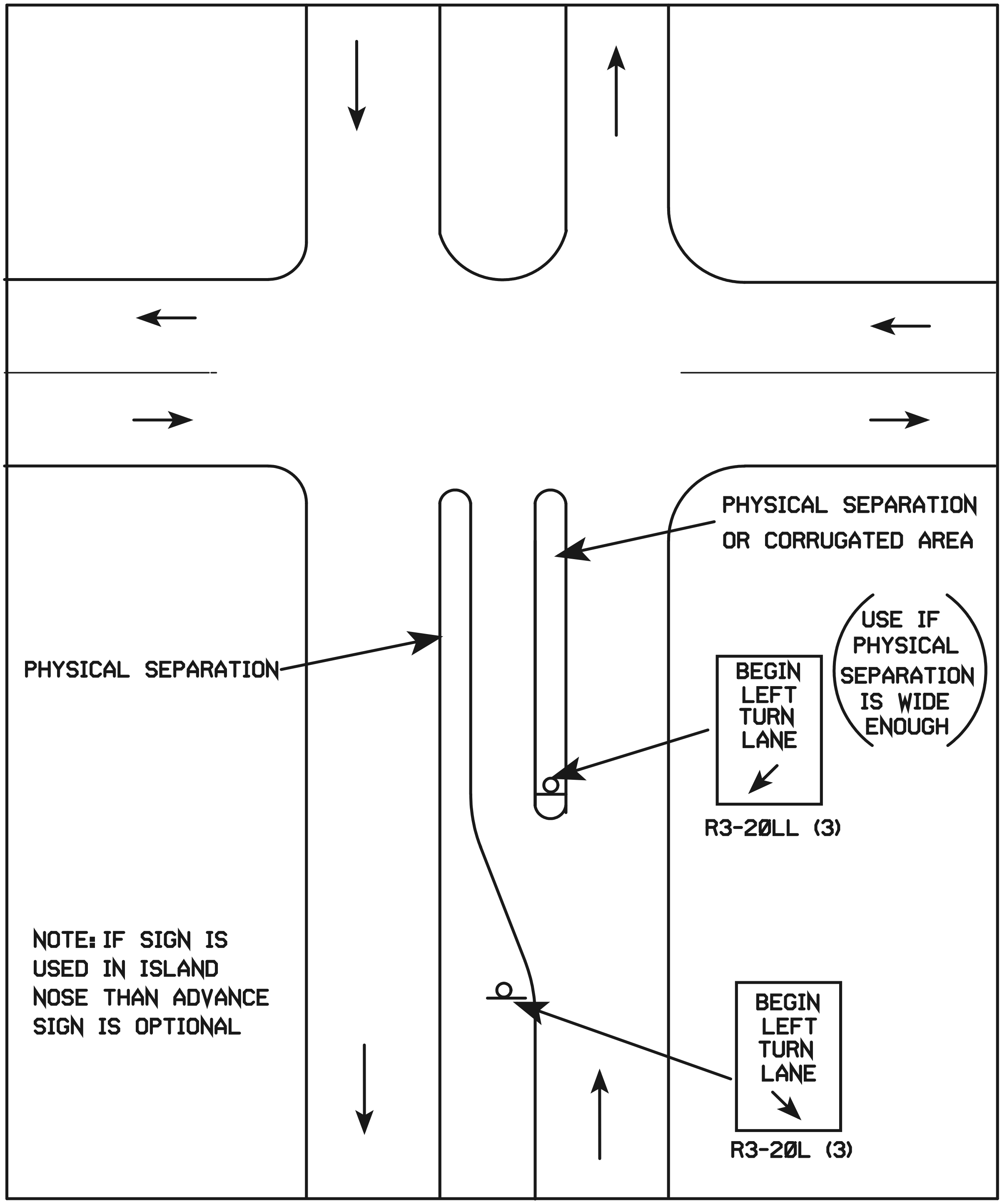


ADVANCED INTERSECTION LANE CONTROL SIGNS

(OVERHEAD LANE CONTROL SIGNS)

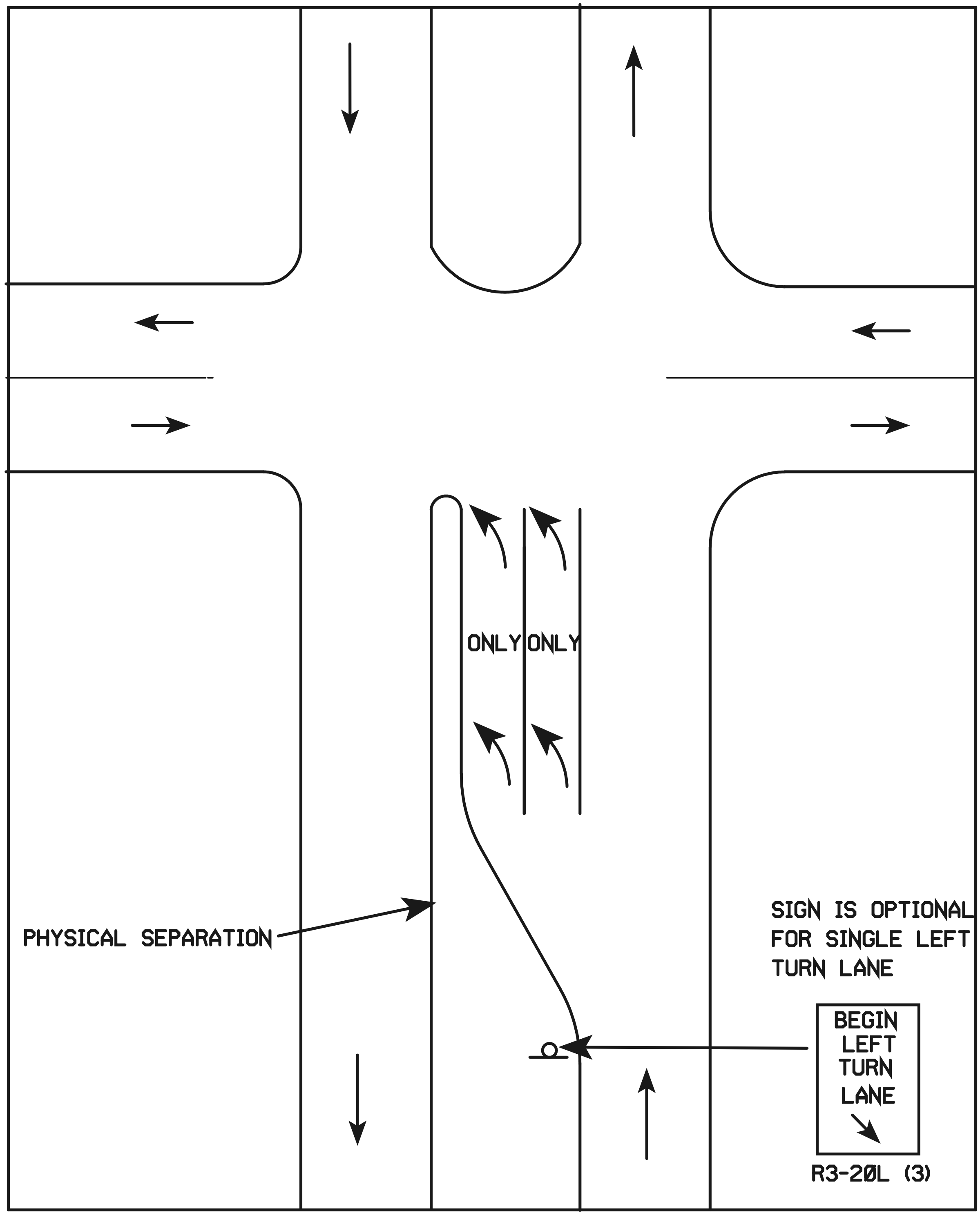
FIGURE 6

CODE



ADVANCED INTERSECTION LANE CONTROL SIGNS

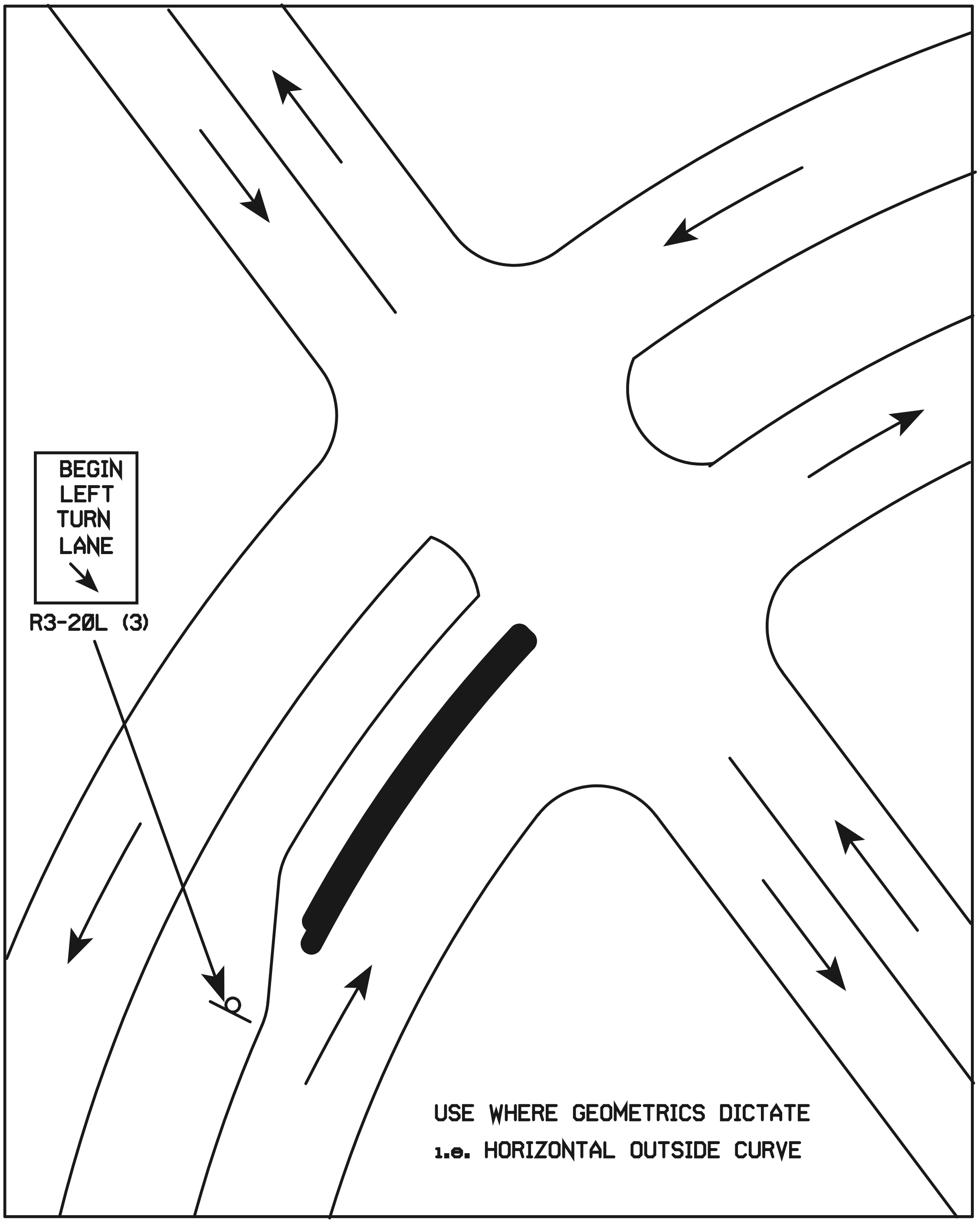
FIGURE 7



ADVANCED INTERSECTION LANE CONTROL SIGNS

FIGURE 8

CODE

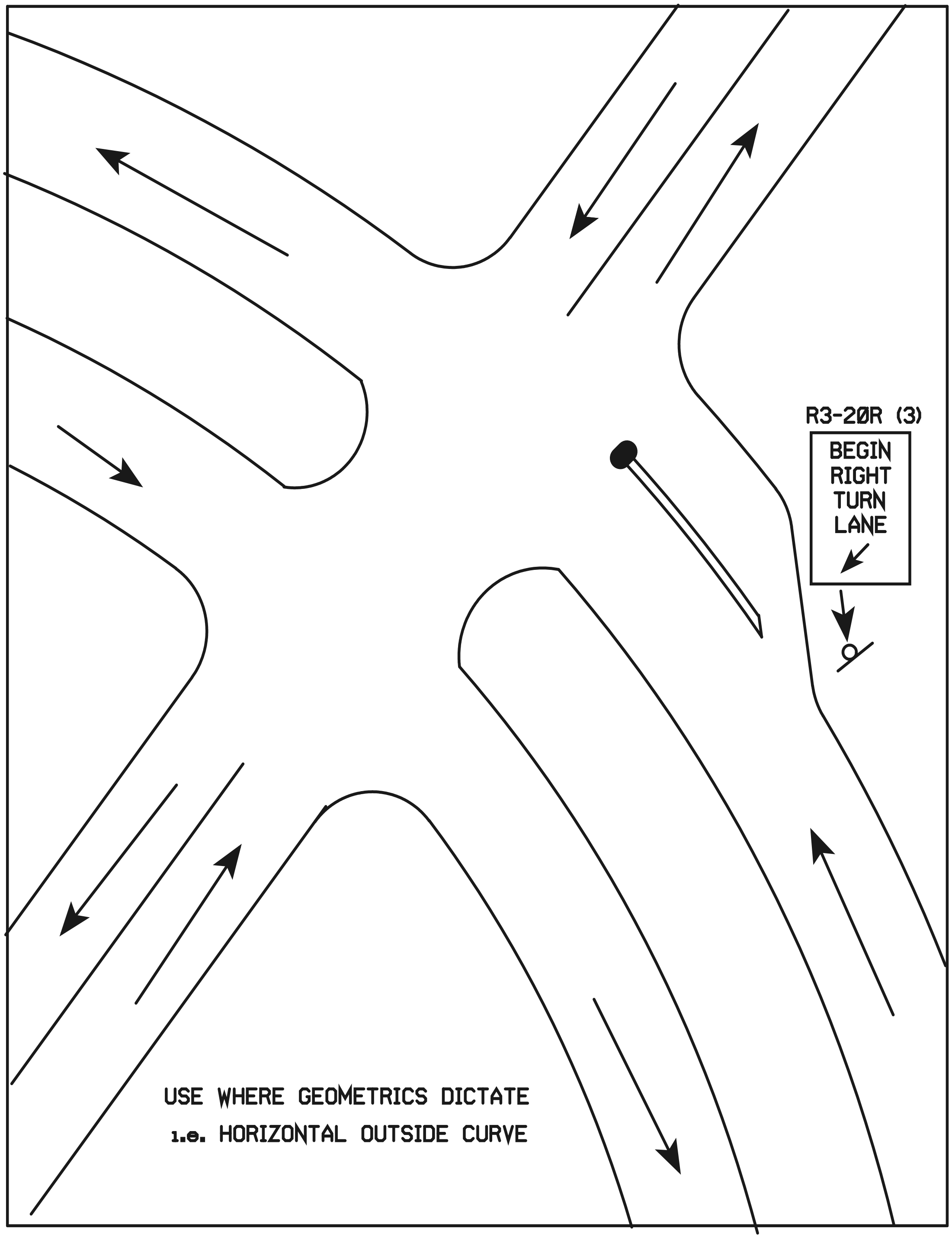


ADVANCED INTERSECTION LANE CONTROL SIGNS

(LEFT TURN LANE ON CURVE)

FIGURE 9

IZE CODE



ADVANCED INTERSECTION LANE CONTROL SIGNS

(RIGHT TURN LANE ON CURVE)

FIGURE 10

ZE CODE

2-2-28 Restricting Pedestrians and Non-motorized Vehicles on Expressways and Freeways August 2013

PURPOSE

The operation of non-motorized vehicles or pedestrians on high-speed multi-lane facilities are incompatible uses that create hazards. The Department *may* prohibit certain traffic on freeways or expressways. To apply these restrictions on traffic, the Department is required to erect and maintain official signs giving notice of the prohibition.

This subject provides guidance on the official signs that *may* be used to give notice of restrictions on the use of controlled access highways, expressways and freeways.

AUTHORITY

State Statute 349.105 provides the authority to prohibit certain traffic on expressways and freeways. The authority in charge of maintenance of an expressway or freeway *may*, by order, ordinance or resolution, prohibit the use of such expressway or freeway by pedestrians, persons riding bicycles or other non-motorized traffic or by persons operating mopeds or motor bicycles. The state or local authority adopting any such prohibitory regulation **shall** erect and maintain official signs giving notice thereof on the expressway or freeway to which such prohibition applies.

DEFINITIONS

State Statute 990.01 (9a) Freeway means a highway with full control of access and with all crossroads separated in grade from the pavements for through traffic.

State Statute 990.01 (7a) Express highway or expressway is a divided arterial highway for through traffic with "full" or "partial" control of access and generally with grade separations at intersections. "Full" control of access means that the authority to control access is exercised to give preference to through traffic by providing access connections with selected public roads only and by prohibiting crossings at grade or direct private driveway connections. "Partial" control of access means that the authority to control access is exercised to give preference to through traffic to a degree that, in addition to access connections with selected public roads, there *may* be some crossings at grade and some private driveway connections.

Listings of declared freeways and expressways are available from the Region Planning Section.

POLICY FOR HIGHWAYS CLOSED TO CERTAIN TRAFFIC

Freeways

Freeways **shall** be closed to use by pedestrians, by persons riding bicycles or other non-motorized traffic and by persons operating mopeds or motor bicycles. Any exceptions to open freeway segments to use by pedestrians, by persons riding bicycles or other non-motorized traffic and by persons operating mopeds or motor bicycles *may* only be approved by the Director of the Bureau of Traffic Operations and listed in this policy.

Freeway exceptions (approved by Director, Bureau of Traffic Operations): none, as of October 1, 2007.

Expressways

Expressways *should* be open to use by pedestrians, by persons riding bicycles or other non-motorized traffic and by persons operating mopeds or motor bicycles. A general exception to open use of expressways is for those expressways with a parallel trail for pedestrians, persons riding bicycles or other non-motorized traffic and by persons operating mopeds or motor bicycles. In those cases the Department **shall** prohibit that traffic from using the expressway and erect and maintain signs giving notice of the prohibition. Any other exceptions to close expressway segments to use by pedestrians, by persons riding bicycles or other non-motorized traffic and by persons operating mopeds or motor bicycles *may* only be approved by the Director of the Bureau of Traffic Operations and listed in this policy.

Expressway exceptions (approved by Director, Bureau of Traffic Operations): USH 10, Wood County, from CTH BB to CTH N

SIGN INSTALLATION POLICY

The R5-57 sign (see Figure 1) **shall** be erected on each ramp leading from a crossroad or frontage road to a restricted freeways or expressway within approximately 100 feet of the point where the ramp leaves the crossroad, and at other locations where pedestrian entrance has occurred or *may* reasonably be anticipated.

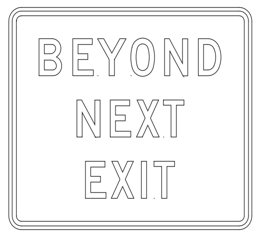
Transition from expressway to freeway

For areas that transition from a non-restricted expressway to a restricted freeway, the R5-57 sign *should* be placed after the last at-grade intersection and the R5057B sign (see Figure 2) BEYOND NEXT EXIT *may* be used to supplement the R5-7 sign. The R5-57 sign *should* be placed on all freeway on-ramps after this point.

Figure 1

R5-57

Figure 2



R5-57B

2-2-30 Engine Brake Signing ~~November 2017~~January 2018

PURPOSE

One method of slowing the motion of a vehicle is to use the compression of the engine as part of vehicle braking. This method is often referred to as compression braking or exhaust braking. Engine braking can produce excessive, undesirable noise when muffler systems are not functioning as designed or are otherwise inadequate.

Noise from engine braking in vehicles with inadequate muffler systems has led some communities to take actions to restrict the noise. Compression braking is typically an unavoidable result of operating a vehicle that the driver cannot prevent or fully disengage. However, for some vehicles there are driver choices as to whether or when engine compression braking is used. Objectionable noise levels *may* be produced by any car or truck when using compression braking and often are related to equipment failure or aftermarket modifications.

There are several advantages to compression braking on vehicles and especially on large trucks. In addition to assisting deceleration, when a truck engine brake system is engaged, it helps prevent the conventional truck air brakes from overheating, thus saving on the normal wearing life of the truck air brakes. This is especially true on roadways with steep downgrades with long distances, where the safety of the truck can be enhanced by the use of engine brakes.

Communities have installed or requested signing on state highways to address noise concerns associated with use of compression braking. The Department controls traffic signs on highways maintained by the state. Local governments do not have the authority to erect signs on those highways except when written permission is provided by the Department.

The Department supports efforts to deal with excessive noise from all vehicles and encourages enforcement of laws requiring effective mufflers (for example, State Statute Section 347.39). The use of signs specific to engine or compression braking has become popular among many communities, although it is unclear whether those signs are effective or necessary. Generally, the Department does not allow installation of traffic signs on state highways that have not been shown to be necessary or effective. In the case of engine braking, the Department has chosen to work with communities and allow limited use of these signs on state highways under certain conditions, despite the lack of evidence that they are effective in reducing noise problems.

POLICY

The Department *may* permit local governments to place signs on highways under WisDOT jurisdiction subject to the requirements included here:

~~1. A permit will be issued only when the local government has in place a noise ordinance that provides a basis for enforcing the sign(s). The noise parameters listed in Wisconsin Administrative Code - Chapter TRANS 405 *may* be used to help set noise level criteria.~~

~~2.~~1. Requests for a permit to allow these signs must be in writing to the WisDOT Regional Office and *should* contain the following information
   a. Locations where signs are to be installed, including state highway route number and distance to the nearest public roadway intersection
   b. Sign offset (distance from edge of travel lane) and type of post to be used
   c. Assurance that sign will be free standing (not attached to other signs)
   ~~d. Copy of local government noise ordinance~~

~~3.~~2. The local government **shall** be responsible for supplying, installing, and maintaining the signs in conformance with the permit. The local government **shall** furnish their identification sticker on the sign.

~~4.~~3. The local government must be committed to actively enforce the requirements of the signs with local law enforcement personnel.

~~5.~~4. Only the standard ENGINE BRAKE MUFFLERS REQUIRED~~NO ENGINE BRAKING EXCEPT IN EMERGENCY~~ sign (R10-64) *may* be used on highways under state maintenance responsibility and those signs *may* be installed only on conventional highways at or near the corporate limits of the community (see Figure 1). This sign **shall not** be used on freeways, expressways, interchange ramps, or site-specific locations on conventional highways.
   ~~a. The optional WITHIN CITY (VILLAGE) LIMITS plaque (R1-64F) *may* be used to supplement the R10-64 sign when there are persistent or perceived problems with enforcement of engine braking on the roadway throughout the community (see Figure 2).~~
   ~~b.~~a. For freeway locations going through communities, engine brake signs *may* be permitted on conventional state highways after the entry point to the conventional highway from the freeway, provided signs are already approved at the city/village limits.
   ~~c.~~b. Engine brake signs *may* be allowed for urbanized townships provided they have ~~an ordinance and~~ the means to enforce it. Documentation **shall** be provided by the local law enforcement indicating that the ordinance will be enforced throughout the township. Urbanized townships are defined by having at least two of the following features:
      i. Urban cross section
      ii. Residential development abutting the highway that meets the definition of "semiurban district" as defined in Wisconsin State Statutes 346.57(1)(b)
      iii. Reduced speed zone
      iv. Qualify for an unincorporated community sign.

      For qualifying urban townships, only 1 sign is allowed in each direction on any given state highway. The signs **shall** be installed at the township limits.
   ~~d. Due to potential concerns for the safety of truckers and other motorists, the signs **shall not** be used for steep downgrades that meet the following conditions:~~
      ~~i. 5% grade and more than 3,000 feet long~~
      ~~ii. 6% grade and more than 2,000 feet long~~
      ~~iii. 7% grade and more than 1,000 feet long~~
      ~~iv. 8% grade and more than 750 feet long~~
      ~~v. 9% grade and more than 500 feet long~~
      ~~vi. Any grade steeper than 9%, regardless of length.~~
   ~~e.~~c. The local government must obtain the approval of the appropriate Regional office for the location(s) of the sign(s). The sign language **shall** meet the requirements of the WisDOT R10-64 and R10-64F sign plates as described in item 4.
   ~~f.~~d. Any other signs related to use of engine braking installed on highways under WisDOT jurisdiction within or for the local government that do not meet the requirements of this policy *should* be replaced~~**shall** be changed~~ by the local government, as opportunities arise (knockdowns, improvement projects or replacement due to age) to comply with this policy~~ or be removed~~.

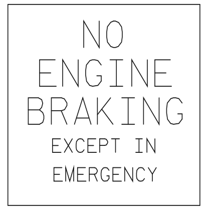


Figure 1

(R10-64 Sign)

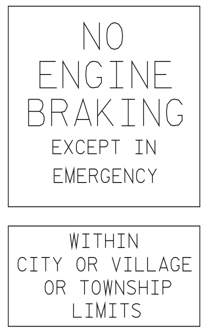
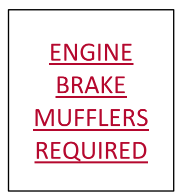


Figure 2

(R10-64 Sign with R10-64F Supplemental Plaque)

Figure 2. R10-64 Sign



2-2-35 Littering Signs — September 2000

PURPOSE

The intent of this guideline is to eliminate signs that inform the public about fines for littering since the signs are not necessary for the guidance or warning of traffic.

Signs with the message $500 FINE FOR THROWING LITTER OR TRASH ON HIGHWAYS KEEP WISCONSIN CLEAN (R5-56) have been installed on state highways in the past. The purpose of these signs was to discourage littering and to reinforce to motorists the maximum statutory fine for littering on highways. While littering has the potential to create safety hazards as well as diminishing the quality of state highways, there is reason to believe that usage of these signs has a minimal effect on curbing littering problems. The State Patrol has mentioned that these signs have little effect on the motoring public, the law is very difficult to enforce, and citations have very rarely been given out. The State Patrol does not object to removing these signs. Due to previous cutbacks in resources and funding, these signs had previously been declared nonessential. Given the limited effectiveness of the signs, it has been determined these signs are not necessary.

POLICY

Littering signs (R5-56) are declared nonessential on state highways. As a result, the following actions are expected:

1. No new littering signs **shall** be erected on state highways.
2. Littering signs that have been installed on state highways will be allowed to remain in place until the end of their useful life, when they are to be removed and not replaced. Useful life ends when the sign message no longer meets legibility or condition standards. Littering signs *may* be removed prior to the end of the signs' useful life when opportunities arise such as knockdown or damage, when other work is occurring nearby, or projects make removal practical.

2-2-40 Seatbelt Signs ~~August 2001~~January 2018

PURPOSE

~~The intent of this guideline is to limit the usage of these signs to specific spot locations, since these signs are not essential to the guidance or warning of traffic. Due to previous cutbacks in resources and funding, these signs had previously been declared non-essential.~~

Over the years seatbelt signs have been installed to reinforce to motorists the importance of fastening safety belts and to remind motorists that there are penalties for people not fastening safety belts. These signs were placed at various locations on state highways and in rest areas, waysides, and weigh stations. It is typically expected that many motorists now know the importance of buckling up by means of media advertisements and safety campaigns. ~~However, it is still beneficial to place these signs in specific spot locations to serve as a gentle reminder to the motoring public.~~ Consequently, it has been determined that these signs are no longer necessary.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

Conventional highways are defined as either divided or undivided roadway facilities that have no control of access with grade separations at intersections. These highways can be two-lane or multilane facilities.

POLICY

1. ~~Seatbelt signs *should* be installed at major entry points into the state. Major entry points are defined as locations on freeways and expressways, but not on conventional highways.~~
2. ~~Seatbelt signs *should* be located on all freeways, expressways, and conventional highways leaving the outskirts of Class I, II, and III Cities as defined by the latest edition of the Wisconsin Blue Book. For contiguous cities in metropolitan areas, the signs *should* be located after the last city that is on the following list. For reference, listed below are the Class I, II, III cities from the 2013-2014 Wisconsin Blue Book:~~

	~~Class I~~	
	~~Milwaukee~~	
	~~Class II~~	
~~Appleton~~	~~Kenosha~~	~~Sheboygan~~
~~Eau Claire~~	~~La Crosse~~	~~Waukesha~~
~~Fond du Lac~~	~~Madison~~	~~Wauwatosa~~
~~Green Bay~~	~~Oshkosh~~	~~West Allis~~
~~Janesville~~	~~Racine~~	
	~~Class III~~	
~~Baraboo~~	~~Hartford~~	~~Oconomowoc~~
~~Beaver Dam~~	~~Kaukauna~~	~~Pewaukee~~
~~Beloit~~	~~Manitowoc~~	~~River Falls~~
~~Brookfield~~	~~Marinette~~	~~Stevens Point~~
~~Chippewa Falls~~	~~Marshfield~~	~~Sun Prairie~~
~~Cudahy~~	~~Menasha~~	~~Superior~~
~~De Pere~~	~~Middleton~~	~~Two Rivers~~
~~Fort Atkinson~~	~~Muskego~~	~~Watertown~~
~~Franklin~~	~~Neenah~~	~~West Bend~~
~~Glendale~~	~~New Berlin~~	~~Wisconsin Rapids~~
~~Greenfield~~	~~Oak Creek~~	

3. ~~Seatbelt signs *may* be placed in rest areas, travel information centers, and weigh stations.~~

1. No new seatbelt signs **shall** be erected.
2. ~~4.~~ Seatbelt signs that have been installed ~~elsewhere on state highways (which includes waysides and locations between cities)~~ will be allowed to remain in place until the end of their useful life, when they *should* be removed and not replaced. Useful life ends when the sign message no longer meets legibility or condition standards. Seatbelt signs *may* be removed prior to the end of the signs' useful life when

opportunities arise such as knockdown or damage, when other work is occurring nearby, or projects make removal practical.

2-2-41 Community Parking Restriction Signs December 2008

PURPOSE

Oftentimes, municipalities will adopt ordinances for the prohibition or restriction of parking on certain roadways during certain periods of time. Wisconsin State Statutes 349.13(1e)(c)(2) gives municipalities the authority to enact ordinances and post signs at or reasonably near the corporate limits of the municipality on all state and county trunk highways and connecting highways.

The intent of posting signs is to inform motorists that 24-hour parking limitations, night parking regulations or snow emergency regulations are in effect in the municipality. It is the responsibility of the motorist to contact the governing body to determine the specifics of the actual ordinance. Posting of signs allows law enforcement to effectively enforce the municipal parking ordinances.

POLICY

The following rules **shall** apply for local governments requesting community parking restriction signs on highways under WisDOT jurisdiction:

1. The local government must pass a parking ordinance prior to requesting the sign(s).
2. The local government **shall** submit a written request to the WisDOT Regional Office for a permit to install and maintain the signs. The permit may be in the form of a letter.
   This request for a permit from the local government *should* contain the following items:
   a. Sign message in accordance with items 4 and 8 of this policy
   b. Sign offset (distance from edge of travel lane)
   c. Where sign is proposed to be located
   d. Type of post used
   e. Assurance that sign will be freestanding (not attached to other signs)
   f. Copy of local government parking ordinance.
   Once the permit is granted, the local government is responsible for supplying, installing and maintaining these signs in conformance with the permit.
3. It **shall** be the responsibility of the local law enforcement personnel to enforce the ordinance or the sign(s).
4. The sign message shall meet the requirements of the WisDOT R7-66 municipal parking sign plate (see Figure 1). See item 8 for approved supplemental messages. The local government must obtain the approval of the appropriate WisDOT Regional Office for the location(s) of the sign(s).
5. The R7-66 sign shall only be used on conventional highways at or near the corporate limits of the community. This sign shall not be used at site-specific locations on conventional roadways, freeways, expressways or interchange ramps.
6. Municipal parking sings not meeting the layouts outlined in this policy will be allowed to remain in their place until the end of their useful life. At that time, they should be removed and replaced with signs conforming to this policy. Useful life ends when the sign message no longer meets legibility or condition standards. Municipal parking signs may be removed prior to the end of the signs' useful life when opportunities arise such as knockdown or damage, when other work is occurring nearby, or projects make removal practical.
7. For townships, the signs should be placed at the boundary of built-up areas where the ordinance applies.
8. A maximum of three supplemental message **shall** be used on a sign. The six approved supplemental messages are:
   a. NIGHT
   b. SNOW EMERGENCY
   c. 24 HR
   d. X:XX AM – X:XX AM (example: 2:00 AM – 7:00 AM)
   e. DATE – DATE (example: NOV 15 – MAR 15)
   f. ODD / EVEN

Figure 1

2-2-45 Move Over or Slow Down Signs ~~November 2016~~January 2018

PURPOSE

The intent of this guideline is to restrict the usage of signs that inform the public about Moving Over or Slowing Down for Stopped Emergency Vehicles to locations that are most helpful to motorists.

Signs with the message “MOVE OVER OR SLOW DOWN FOR STOPPED VEHICLES WITH FLASHING LIGHTS” (R5-60) are installed on state highways as a reminder to motorists to slow down or move over for emergency/law enforcement vehicles that are on the roadway. These signs were installed in a partnership between Bureau of Traffic Operations and Bureau of Transportation Safety to educate motorists of this law. While signs can be a useful tool to help re-enforce a law, education and enforcement are also effective and essential tools that must be used with highway signing. These signs are primarily focused to motorists entering the state and *may* be unfamiliar with the Move Over or Slow Down Law. As for a reminder tool, other, more effective educational efforts have been employed in lieu of signs. These educational efforts often times consist of public service announcements through the media, reminders included in DMV vehicle registration notices and driver education. However, due to budgetary concerns and the concern about over signage, signs *should* only be installed in locations that are the most effective for motorists.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

Conventional Highways are defined as either divided or undivided roadway facilities that have no control of access with grade separations at intersections. These highways can be two lane or multilane facilities.

POLICY

1. Any requests to install ~~–~~“MOVE OVER OR SLOW DOWN FOR STOPPED VEHICLES WITH FLASHING LIGHTS” (R5-60) signs **shall** be reviewed by the statewide Traffic Incident Management Committee and approved by the State Traffic Engineer prior to installation.

2. “MOVE OVER OR SLOW DOWN FOR STOPPED VEHICLES WITH FLASHING LIGHTS” (R5-60) signs **shall** be installed in all rest areas and weigh stations serving freeways and expressways.

~~2.~~3. The following mainline locations have been approved for installation of “MOVE OVER OR SLOW DOWN FOR STOPPED VEHICLES WITH FLASHING LIGHTS” (R5-60). Signs **shall** be installed at these locations:

SW Region:

- IH 39 northbound in Rock County north of the state line
- IH 39 northbound in Dane County north of USH 51 in Madison
- IH 39 northbound in Columbia County north of IH 90-94
- IH 39 southbound in Columbia County south of IH 90-94
- IH 39 southbound in Dane County south of USH 12-18
- IH 90 eastbound in La Crosse County east of the state line
- IH 90 eastbound in Monroe County east of IH 94
- IH 90 westbound in Columbia County west of IH 39

- IH 90 westbound in Monroe County west of IH 94
- IH 94 eastbound in Dane County east of IH 39-90
- IH 94 westbound in Monroe County west of IH 90
- USH 18 westbound in Dane County west of Dairy Ridge Rd
- USH 151 northbound in Grant County north of the state line
- USH 151 northbound in Dane County north of IH 39-90-94

SE Region:

- IH 41 northbound in Washington County north of USH 45
- IH 43 northbound in Milwaukee County at Holt Ave
- IH 43 northbound in Ozaukee County north of STH 60
- IH 94 eastbound in Milwaukee County east of 84th St
- IH 94 westbound in Kenosha County west of the state line
- IH 94 westbound in Waukesha County west of the Milwaukee County line
- USH 12 westbound in Walworth County west of the state line
- STH 119 westbound in Milwaukee County east of IH 94

NE Region

- IH 41 southbound in Outagamie County south of the Brown County line
- IH 43 southbound in Brown County south of STH 172
- USH 10 westbound in Winnebago County west of IH 41
- USH 41 northbound in Brown County north of CTH B
- USH 41 southbound in Marinette County south of Marinette
- USH 41 southbound in Brown County south of CTH B
- STH 29 westbound in Brown County west of IH 41

NC Region

- IH 39 northbound in Portage County at Stevens Point
- IH 39 southbound in Marathon County south of Business 51
- IH 39 southbound in Portage County at Stevens Point
- USH 51 northbound in Marathon County north of STH 29
- USH 45 southbound in Vilas County south of the state line
- STH 29 eastbound in Marathon County east of USH 51
- STH 29 westbound in Marathon County west of USH 51
- STH 153 westbound in Marathon County east of IH 39

NW Region

- IH 94 eastbound in Saint Croix County east of the state line
- IH 94 eastbound in Eau Claire County east of USH 53
- IH 94 westbound in Dunn County west of STH 29
- USH 2 eastbound in Douglas County south of Superior
- USH 53 northbound in Chippewa County north of STH 29
- STH 29 eastbound in Chippewa County east of USH 53

2-2-50 Spacing of Reminder Signs — January 2007

EMERGENCY STOPPING ONLY

The R8-7 EMERGENCY STOPPING ONLY sign **shall** be sued on expressways and freeways only. The R8-7 sign *should* be placed at random intervals of about 15 miles, generally being located just beyond the signing required after an interchange.

SLOWER TRAFFIC KEEP RIGHT

The R4-3 SLOWER TRAFFIC KEEP RIGHT sign *may* be used on multiple-lane roadways to reduce unnecessary waving. On conventional highways, it *should* be erected just beyond the beginning of a multiple-lane pavement and selected locations where there is a tendency on the part of the motorist to drive in the left-hand lane (or lanes) below the normal speed of traffic. On freeways and expressways, the sign **shall** be erected at random intervals of about 7 ½ miles, generally just beyond the signing required after an interchange. It *should* not be used on the approach to an interchange or through an interchange area. Successive signs **shall** be alternated between the median and the right-hand side of the roadway.

2-2-51 Except Right Turn Signals — March 2011

PURPOSE AND BACKGROUND

The RIGHT TURN NO STOP sign is occasionally used below a STOP sign for intersections where an engineering study indicates that right turns do not have to stop. Many of these intersections are in urban areas with high right turning traffic volumes and oftentimes have a lack of space to construct a pork chop island with a separated free flow right turn lane. FHWA has previously discouraged the usage of the RIGHT TURN NO STOP sign, and as a result the Department used it very sparingly after exhausting all other traffic control strategies.

The MUTCD now allows the usage of a supplemental plaque below a STOP sign at intersections that allow a right turn to free flow.

POLICY

The EXCEPT RIGHT TURN (R10-10-P sign) is approved for usage on WisDOT maintained roadways, provided the following policy criteria are met:

1. An engineering study of the intersection is performed and it is determined that the geometrics and traffic volumes make it possible for free-flowing right turns.
2. Existing locations should be reviewed periodically to see if geometric conditions can be changed (upcoming improvement project) or if the traffic volumes are still applicable. Discussion with local officials may result in developing other control strategies. At some locations, it may be possible to install right-turn channelization.
3. RIGHT TURN NO STOP (R1-51) signs should be replaced with the EXCEPT RIGHT TURN (R1-10-P) signs as opportunities permit (improvement projects, knockdown replacement and replacement due to age).

2-2-53 Signing for Flashing Yellow Arrow Traffic Signals — December 2013

PURPOSE AND BACKGROUND

The MUTCD allows the usage of a flashing yellow left turn arrow that is intended to provide a safer, more efficient left turn for motorists. National studies have indicated that drivers have fewer crashes with the flashing yellow left-turn arrow than with the traditional yielding left-turn indication.

FHWA has indicated that flashing yellow arrow educational signing for motorists is normally not needed, since the obvious intent of the flashing yellow arrow is to yield to oncoming motorists. This is the reason why no signing for flashing yellow arrows is included in the MUTCD. However, since the flashing yellow arrow is new to Wisconsin, there has been concern expressed by WisDOT and other municipalities that the motorist will not realize that they need to turn with caution and potentially yield to oncoming motorists. Educational efforts involving the media have been utilized to address this concern. Another motorist education effort is the installation of temporary signing. This policy will address the installation of signing for flashing yellow arrow signals, both for a temporary educational effort and to address any problem areas.

QUALIFYING CRITERIA FOR SIGNING

The LEFT TURN YIELD ON FLAHSING YELLOW ARROW (R10-50) sign has been designed for usage on WisDOT maintained roadways, provided the following policy criteria are met:

1. The LEFT TURN YIELD ON FLASHING YELLOW ARROW (R10-50) sign, at the discretion of the Region Traffic Engineer, may be used for all new flashing yellow arrow installations in problem areas or new areas, for a time period of one year from the date of the signal installation. After the one year time period, the signs should be removed and returned to the appropriate Region Sign Shop.
2. The LEFT TURN YIELD ON FLASHING YELLOW ARROW (R10-50) sign *may* remain in place at intersections with flashing yellow arrow signal indications, for longer time periods or indefinitely. Reasons for allowing the sign(s) to remain in place may be demonstrated problems with motorists failing to yield on the flashing yellow arrow indication or continued unfamiliarity of flashing yellow arrow signal in an area.

GUIDELINES FOR FIELD INSTALLATION OF SIGNS

1. Primary choice for mounting of the LEFT TURN YIELD ON FLAHSING YELLOW ARROW (R10-50) sign is the far side overhead signal that has a flashing left yellow arrow indication.
2. Secondary choice for mounting of the LEFT TURN YIELD ON FLAHSING YELLOW ARROW (R10-50)

sign is the far side ground mounted signal that has a flashing left yellow arrow indication.

3. Third choice for mounting of the LEFT TURN YIELD ON FLASHING YELLOW ARROW (R10-50) sign is the near side ground mounted signal that has a flashing left yellow arrow indication.

2-2-54 Stop for School Bus Flashing Red Lights State Law Sign — September 2009

PURPOSE

Wisconsin State Statute 346.48 mandates that motorists approaching a school bus from the front or rear **shall** stop when the bus is displaying the flashing red lights. The exception to this is oncoming motorists would not have to stop if there is a physical separation in the median, as in the case of divided highways. Oftentimes, requests come to the WisDOT Region offices to install signs for areas where motorist compliance is problematic. Typically these are areas where there are multiple school bus stops and the sight distance does not warrant the placement of the SCHOOL BUS STOP AHEAD (S3-1) warning sign. In the past, the STOP FOR SCHOOL BUS FLASHING RED LIGHTS STATE LAW *R59-51) sign has been installed for these problem areas. However, due to a lack of statewide guidance, these signs have been used inconsistently.

MUTCD Section 2B.54 allows the customization of regulatory signs to aid in the enforcement of other laws or regulations. Therefore, the STOP FOR SCHOOL BUS FLASHING RED LIGHTS STATE LAW (R59-51) sign has been designed to reinforce Wisconsin State Statute 346.48 and aid law enforcement for problem areas. Listed below are criteria that *should* be followed when considering the placement of these signs.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided or undivided roadway facilities that have partial control of access and generally with grade separations at major intersections.

Conventional highways are defined as divided or undivided roadway facilities that have limited access with no grade separations at intersections. These highways *may* be two-lane or multi-lane facilities.

POLICY

Below are policy criteria that *should* be applied when considering installations of the STOP FOR SCHOOL BUS FLAHSING RED LIGHTS STATE LAW (R-59-51) sign.

1. For installation of the STOP FOR SCHOOL BUS FLASHING RED LIGHTS STATE LAW (R59-51) sign on expressways, TEOpS 2-3-55 *should* be followed.
2. If a specific school bus stop has a sight distance less than the minimum visibility distance for warning signs per the MUTCD, the SCHOOL BUS STOP AHEAD (S3-1) warning sign *should* be used.
3. The STOP FOR SCHOOL BUS FLAHSING RED LIGHTS STATE LAW (R59-51) sign *may* be used for segments of conventional highways that have the following criteria:
    a. Multiple stops on a segment of roadway
    b. Documented compliance problems exist,
    c. Sight distance is not a factor that would not allow the use of warning signs for most of the stops in the segment of roadway.
4. If the STOP FOR SCHOOL BUS FLASHING RED LIGHTS STATE LAW (R59-51) sign is warranted, it *should* be installed at the beginning of the segment and *may* be repeated every five miles if the segment is greater than 5 miles or after major intersections (at the discretion of the Region Traffic Engineer).
5. In considering the usage of this sign, the Regions are encouraged to obtain a school bus route map or other information supplied by the school district to identify the locations of the stops. The Region *should* contact the school districts annually to determine where stops are no longer made so that signing can be adjusted accordingly.

2-3-10 Use of Chevrons July 2012

GENERAL

The MUTCD classifies the chevron as an alignment sign, but it is basically a delineator with a directional connotation, which is the aspect of the sign that relegates its use to horizontal curves. It is not to be used at roadway width transitions, lane drops, or approaches to narrow bridges. It is also not to be used singly, because that will not adequately develop the directional message. Another inappropriate use is in a cluster at the end of a T-intersection.

Chevrons (W1-8) signs *may* be used in combination with the large night arrow (W1-6) sign or without the large night arrow sign. Table 2C-5 of the MUTCD provides guidance as to when chevron signs are used.

The MUTCD, Table 2C-6 contains spacing criteria for installations of chevrons, which has been included as part of this policy.

GUIDANCE

The following guidelines apply to these signs:

1. It is desirable to position one chevron directly ahead of an approaching vehicle while the vehicle is on the approach tangent, and begin spacing in both directions from that point.
2. Extend to the point of curvature, and to the point of tangency; do not alter the spacing to meet these points, however.
3. A minimum of three signs **shall** be used, even if they extend beyond the point of curvature. Also, per the MUTCD, the spacing of chevron signs *should* be such that the road user has at least two in view, until the change in alignment eliminates the need for the signs.
4. Chevron signs **shall not** be placed on the far side of a T-intersection to warn drivers that a through movement is not possible.
5. Chevron signs **shall not** be used to mark obstructions within the roadway.
6. Follow the spacing table below, making adjustments for conflicts with driveways, signs, etc. The chevron spacing shown below are maximum distances between chevrons. Chevrons may be spaced closer to address curves with tighter radius measurements.

Chevron signs **shall** be mounted at a 4-foot minimum height (measured from the bottom of sign to the elevation of the near edge of traveled way). They **shall** be aimed toward traffic rather than located perpendicular to the curve.

The chevron sign *may* be used only where an emerging or demonstrated accident problem exists. On highways to be reconstructed it is unlikely that accidents will be expected to occur on the re-alignment. Therefore chevron signs *should not* normally be specified on new construction, unless required by Table 2C-5 of the MUTCD.

CHEVRON ALIGNMENT SIGN SPACING

Posted Advisory Speed (mph)	Curve Radius (feet)	Maximum Spacing (feet)
15 mph or less	less than 200	40
20	200 - 400	80
25	200 – 400	80
30	200-400	80
35	401-700	120
40	401-700	120
45	401-700	120
50	701-1,250	160
55	701-1,250	160
60	greater than 1,250	160
65	greater than 1,250	200

7. Existing signs not installed at this spacing *should* be adjusted when opportunity permits, due to improvement projects, knockdowns or if problems are present.

2-3-14 Hill Blocks View Signs — June 2005

PURPOSE

The MUTCD section 2C.18 says the Hill Blocks View sign (W7-6) *may* be used in advance of a crest vertical curve to advise road users to reduce speed as they approach and traverse the hill as only limited stopping sight distance is available. If used, it *should* be supplemented by an advisory speed (W13-1) plaque indicating the recommended speed for traveling over the hillcrest based on available stopping sight distance. See MUTCD section 2C.36 for visibility chart for various speeds. Advisory speed plaque speed is based on available visibility distance. This policy provides guidance on when these signs *may* be considered for usage of state-maintained highways.

TRUCK ENTRANCE signs have been commonly used for driveways with limited sight distance; however, their usage is exclusive to driveways or side streets with high truck traffic volumes.

POLICY

While guidance on crossroad and side road warning sign usage and criteria are provided in the MUTCD, less guidance is provided on driveways. This policy provides for the use of HILL BLOCKS VIEW sign where driveways are after a crest vertical curve. Signs such as BLIND ENTRANCE and HIDDEN DRIVEWAY are not in the MUTCD. However, the HILL BLOCKS VIEW sign is an approved sign in the MUTCD. It has been general practice not to provide warning signs for driveways. The HILL BLOCKS VIEW sign is intended for use in lieu of the BLIND ENTRANCE or HIDDEN DRIVEWAY signs, both of which are not approved in the MUTCD.

GUIDELINES

The following step-by-step criteria *should* be used to determine if a HILL BLOCKS VIEW sign is warranted for driveways:

1. First, the driveway must have inadequate sight distance per the visibility chart in the MUTCD section 2C.37 when determining the need for the sign due to a crest vertical curve. Vision problems due to horizontal curvature or vegetation **shall not** warrant use of this sign.
2. The volume of the driveway **shall** be a minimum of 40 ADT (25 in, 25 out). A typical one-family residence generates about 10 trips per day and therefore would not qualify for the sign. Note: a side road with 100 ADT or greater requires a type B1/B2 intersection as opposed to a type C/D intersection which would be used for under 100 ADT. 50 ADT provides for a driveway for a small business.
3. Verify that the volumes exceed 50 ADT at least once per week or 50 days per year.

NOTE: Crash history – if the driveway does not meet the volume criteria above, but a crash analysis indicates there is a crash history at the driveway location, a sign *may* be considered.

Location of the sign *should* be per MUTCD Table 2C-4.

2-3-18 Merge Sign Locations — March 2016

PURPOSE

This policy will define merge sign locations on all freeways and expressways.

POLICY

Merge signs should be placed in accordance with Condition A, Table 2C-4 of the MUTCD. This distance shall be measured in an upstream direction, starting at the theoretical gore.

In some cases, particularly existing ramps at tight urban interchanges, this distance may not be achievable, due to substandard geometrics. In these cases, the merge signs will have to be installed where they can be accommodated.

2-3-19 Divided Highway Warning Signing — September 2009

GENERAL

The MUTCD Sections 2C.22 and 2C.23 covers the usage of the divided highway warning signs (W6-1 and W6-2 signs). However, the MUTCD guidance is very general in nature and does not tie into specific factors such as posted speed and length of divided section. Oftentimes for shorter segments with lower speeds, the DIVIDED HIGHWAY AHEAD warning signs *may* be deleted. This policy will provide for a statewide policy for consistent usage.

POLICY

Below is the statewide policy for the usage of divided highway signs.

1. The DIVIDED HIGHWAY AHEAD (W6-1) warning sign *should* be installed in advance of two-lane-to-four-lane transitions that are physically divided by a median. Standard Detail Drawing 15C21-3 shows a typical installation of this sign.
2. The DIVIDED HIGHWAY AHEAD (W6-1) sign *should* only be used in transition to a section of highway that is divided, not a specific intersection.
3. The DIVIDED HIGHWAY AHEAD (W6-1) warning sign *should not* be used for locations where there is two-way traffic to single-lane divided.
4. If posted speeds are 45 mph or above, the DIVIDED HIGHWAY AHEAD sign *may* be used if the divided area is greater than 1,000 feet. The signs would be used at the beginning of the divided section only.
5. A DIVIDED HIGHWAY ENDS (W6-3) sign *should* be used at the end of the divided highway section, in accordance with Standard Detail Drawing 15C21-3, to give warning and notice that traffic is now two lanes.

2-3-27 BUMP and ROUGH ROAD Signs — January 2013

PURPOSE

This policy provides guidance on the use of BUMP (W8-1) signs, BUMPS (W8-1A) signs, DIP (W8-2) signs and ROUGH ROAD (W8-8) signs.

DEFINITIONS

A sharp rise or depression is defined as a roadway deficiency that is sufficiently abrupt to create considerable discomfort to passengers, to cause shifting of the cargo, or to deflect a vehicle from its true course at normal roadway driving speeds.

A minor rise or depression is defined as a roadway deficiency that is noticeable enough to divers to cause a minor discomfort, but not enough of a deficiency to be a safety hazard.

POLICY

1. For sharp rises or depressions in the profile of the roadway, the BUMP or DIP sign *should* be installed both in advance of the condition and at the location of the rise or depression. The BUMP or DIP sign installed at the location of the rise or depression **shall** have the diagonal downward arrow sign (W16-7L or W16-7R) installed below it. The BUMP or DIP sign installed in advance of the condition **shall** have the AHEAD (W16-9P) installed below it.
2. For minor rises or depressions in the profile of the roadway, the BUMP or DIP sign *may* be installed both in advance of the condition and at the location of the rise or depression. The BUMP or DIP sign installed at the location of the rise or depression **shall** have the diagonal downward arrow (W16-7L or W16-7R) sign installed below it. The BUMP or DIP sign installed in advance of the condition **shall** have the AHEAD (W16-9P) sign installed below it. If the condition is the result of pavement buckling, BUMP signs **shall** be installed both in advance of the condition and at the location of the condition on higher-speed roadways (45 mph posted speed and above).
3. For segments of roadways with multiple sharp rises or depressions, the ROUGH ROAD sign or BUMPS sign *should* be installed in advance of the segment. The advanced location of the ROUGH ROAD sign or BUMPS sign **shall** be supplemented with the NEXT XX MILES (W57-51) plaque. The BUMP or DIP sign *should* be installed at locations of rises or depressions. The BUMP or DIP sign installed at the location of the rise or depression **shall** have the diagonal downward arrow (W16-7L or W16-7R) sign installed below it.
4. For segments of roadways with multiple minor rises or depressions, the ROUGH ROAD sign or BUMPS sign *may* be installed in advance of the segment. The advanced location of the ROUGH ROAD sign or BUMPS sign **shall** be supplemented with the NEXT XX MILES (W57-51) plaque. The BUMP or DIP sign *should* be installed at locations of rises or depressions. The BUMP or DIP sign installed at the location of the rise or depression **shall** have the diagonal downward arrow (W16-7L or W16-7R) sign installed below it.
5. Type A flashing lights or orange flags *may* be used on the advanced sign assembly, depending on the severity of the bump or dip.
6. Signs *should* have a yellow background. Orange background signs *should* only be used if the roadway deficiencies are construction related.

2-3-30 Speed Reduction Signs (Reduced Speed Ahead) March 2016

PURPOSE

This guidance is to establish the appropriate use and location of the speed reduction sign in relation to the speed limit sign for the lower speed zone. This policy pertains to signing on freeways, expressways and conventional highways.

BACKGROUND (AUTHORITY)

The MUTCD in Section 2C-38 covers the usage of the Reduced Speed Limit Ahead sign (W3-5 sign). The MUTCD Section 2C, Guidelines for Advanced Placement of Warning Signs, Table 2C-4, Condition B, addresses the placement of advanced warning signs with minimum distances. However, based upon experience and from the establishment of a “comfortable braking distance,” these distance guidelines have been increased per the chart contained herein.

POLICY

General Speed Reductions

A speed reduction (W3-5) sign **shall** be erected in advance of downward changes of the speed limit from 70, 65, 60 or 55 mph regardless of the amount of reduction, and from 50 mph or below for reductions of 15 mph or more. The speed reduction sign **shall not** be used for reductions of 10 mph or less for speeds of 50 mph or below.

School Speed Reductions

In accordance with Section 7B.16 of the MUTCD, a Reduced School Speed Limit Ahead Sign (S4-5) should be installed in advance for reductions of 15 mph or more (from posted speed limit to school speed limit).

1. **Sign Spacing in Advance of Reduced Speed Zone:** Signs **shall** be placed to provide adequate time for the driver to perceive, identify, decide and perform the speed reduction. The following table establishes the minimum distances to be used for the speed reduction signs. The table was developed by modifying the distance chart for Advanced Placement of Warning Signs, Table 2C-4, Condition B of the MUTCD, (deceleration to listed advisory speed). The modifications provide more time for the driver to respond, as opposed to the warning signs when a driver is required to decelerate to a specific speed, based on a road condition. The increased distance between the speed reduction sign and the speed limit sign provides additional time to decelerate. This is consistent with the guidance in the MUTCD, Section 2C-5 which indicates the time necessary for Perception, Identification/understanding, Emotion/decision making, and Volition/execution of decision (PIEV) is higher for signs that involve more driver judgment, as opposed to warning signs. In particular, the comfortable braking distance and therefore the execution distance is being increased to the following:

SPEED REDUCTION SIGN DISTANCE IN ADVANCE OF SPEED LIMIT SIGN
MINIMUM DISTANCES (in feet)

From Speed Limit	To Speed Limit 65	55	50	45	40	35	30	25	20	15
70 --------------	700	700	700							
65 --------------		700	700	700	-	-	-	-	-	
60 --------------		600	600	600	-	-	-	-	-	
55 --------------	-		500	500	500	550	600	600	600	600
50 --------------	-	-	-	-		550	550	600	600	600
45 --------------	-	-	-	-	-		450	475	500	525
40 --------------	-	-	-	-	-	-		425	450	475
35 --------------	-	-	-	-	-	-	-		375	400
30 --------------	-	-	-	-	-	-	-	-		325

2. **Sizes of Signs:** Size of signs **shall** be in accordance with TEOpS 2-1-35.
3. **Double Marking:** Double marking (right and left side) **shall** be employed for any reduction from 70 mph or 65 mph and *may* be employed for other speed limit reductions, especially on divided or multi-lane highways and for added emphasis. If a double-marked REDUCED SPEED AHEAD sign assembly (R2-5A and W13-1W) is replaced on one side of the roadway with a W3-5 SPEED REDUCTION sign, the R2-5A and W13-1W sign on the other side of the roadway **shall** also be replaced with a W3-5 SPEED REDUCTION sign.

4. **Phase in Period:** Signs *should* be adjusted to conform to this guideline when opportunities arise, such as knockdowns or damage, when other work is occurring nearby, or projects make removal practical.
5. **Work Zone Traffic Control Speed Limit and Reduced Speed Ahead Signs:** The spacing shown in this policy does not apply to work zone traffic control speed limit changes. See the Work Zone Standard Detail Drawings for applicable requirements.

2-3-35 Advisory Speed on Curves — July 2012

PURPOSE

To establish uniformity and consistency when determining the proper advisory speed for turns and curves and subsequent installation of advisory speed plaques.

BACKGROUND

The MUTCD provides requirements for the proper use of horizontal alignment signing, Advisory Speed plaques, Truck Rollover Warning signs, Advisory Exit and Ramp Speed signs. They are contained in the following sections:

1. Horizontal Alignment signs – MUTCD Sections 2C.06 and 2C.07
2. Truck Rollover Warning signs –MUTCD Section 2C.13
3. Advisory Speed Plaques –MUTCD Section 2C.08
4. Supplemental warning plaques – MUTCD Section 2C.53 and 2C.54
5. Advisory Exit, Ramp and Curve speed signs – MUTCD Section 2C.14
6. Horizontal Alignment Sign Usage –MUTCD Table 2C-5

On state trunk highways it is required that all curves and turns less than posted or statutory speed be signed in advance, with curve warning signs for curves 35 mph or above, or turn warning signs for turns 30 mph or less. The MUTCD (Sections 2C.06 and 2C.07) has instructions related to signing curves, turns, winding roads, etc. The MUTCD states in Section 2C.06 that if the roadway is less than 1000 ADT, an advisory speed plaque *should* be used to supplement the curve or turn warning sign where the posted speed varies from the curve speed by 10 mph or more.

The MUTCD Table 2C-5 states that advisory speed plaques are:

1. Recommended where the difference between the speed limit and advisory speed is 5 mph.
2. Required where the difference between speed limit and advisory speed is 10 mph or more.

MUTCD Table 2C-5. Horizontal Alignment Sign Selection

Type of Horizontal Alignment Sign	Difference Between Speed Limit and Advisory Speed				
	5 mph	10 mph	15 mph	20 mph	25 mph or more
Turn (W1-1), Curve (W1-2), Reverse Turn (W1-3), Reverse Curve (W1-4), Winding Road (W1-5), and Combination Horizontal Alignment/Intersection (W1-10) (see Section 2C.07 to determine which sign to use)	Recommended	Required	Required	Required	Required
Advisory Speed Plaque (W13-1P)	Recommended	Required	Required	Required	Required
Chevrons (W1-8) and/or One Direction Large Arrow (W1-6)	Optional	Recommended	Required	Required	Required
Exit Speed (W13-2) and Ramp Speed (W13-3) on exit ramp	Optional	Optional	Recommended	Required	Required

INTRODUCTION

The determination and posting of advisory speeds for changes in horizontal alignment is a universal practice throughout the nation. It was initially tried by the State of Missouri in 1937 followed shortly thereafter by a number of other state highway departments. The preeminent research was done by R. A. Moyer and D. S. Berry (1) published by the Highway Research Board in 1940 as a recommendation for signing changes in roadway alignment. Curve advisory speed posting was adopted as a suggested option in the 1948 *Manual on Uniform*

Traffic Control Devices (2).

The initial research by Moyer and Berry established the basic need, procedures and criteria for determining advisory speeds. The use of a ball-bank Indicator was recommended as an acceptable instrument for establishing a “safe speed” on a horizontal curve. Their recommendations were the following ranges of values:

Table 1. Recommended Criteria for Curve Advisory Speed Determination
(Source: Moyer and Berry, 1940, Ref. 1)

Speeds (mph)	Ball Bank Reading	Side Friction Factor
≤ 20	14°	0.21
25 – 30	12°	0.18
≥ 35	10°	0.15

The Moyer/Berry research also indicated that the curve “safe speed” could be computed using the standard curve formula if the curve radii and super elevation were known using the above noted equivalent side friction factors. While they noted the advisory speed as being the “safe speed” for the curve, the advisory speed actually represented the comfortable speed that the curve could be driven without experiencing lateral acceleration discomfort.

This procedure and criteria for advisory speed determination has become nearly universally accepted in the highway engineering profession and typically is used by most transportation agencies. However, there has been concern that the ball-bank method of determining advisory speeds *may* be outdated and not the best procedure. The need to update the procedures and criteria has been noted by the highway community for a number of years. Recognizing the age of the research, minor variations have been made in the criteria and its application in some roadway jurisdictions (3).

Many motorists also have observed that advisory speed signing is overly conservative and many exceed the posted advisory speeds. Another factor is that current vehicles have suspension and steering systems that are significantly improved providing better stability, cornering capabilities and driving comfort compared with typical vehicles at the time of the initial research.

The following guidelines establish new values that satisfy the motorists’ needs. The current research has been reviewed with three methods addressed to determine an acceptable advisory speed. The recommended criteria have been adjusted to represent the current driving practices. While it is recognized that most roadways are posted with advisory speeds based on the older criteria, it appears logical to raise the values to provide realistic postings that are compatible with driving practices.

The provisions of the MUTCD encourage a restudy of the horizontal alignment signing. The MUTCD has a liberal compliance period of at least 10 years to implement the new horizontal alignment signing, so the engineering studies for curve advisory speeds can be done over a period of several years on a systematic basis with appropriate publicity so the public understands the revisions. Drivers will have to modify their driving habits so they do not incorrectly assume that posted advisory speeds can be driven at a higher speed. However, an adequate factor of safety is addressed in the new criteria so drivers even assuming a higher speed is acceptable *should not* be subjected to undue hazards. The older postings, while usually a lower speed, can remain in place until the new engineering study is completed and signs installed. It will be desirable to change all advisory speed plaques along a roadway at the same time to minimize motorist confusion.

DISCUSSION

There are several areas of concern/discussion:

- The ball-bank indicator method *may not* be current nor the best method for determining advisory speeds (5).
- The current practice results in advisory speeds that are too conservative and are far below the 85th percentile speed of drivers traversing the curves (5) (6) (7).
- Current vehicle suspension and cornering capabilities are substantially better than those of vehicles that were used to determine the older criteria (8). As a result, drivers today can comfortably drive curves at speeds higher than those that would have been comfortable with older vehicles.
- The criteria for curve advisory speeds *should* be comparable to the design criteria in the AASHTO *Policy on Geometric Design for Highways and Streets* (9).
- The curve advisory speed practices in some jurisdictions have deviated from an adequate and universally accepted criteria resulting in posted advisory speeds well below prevailing curve speeds

(3)(6). This results in inconsistent curve advisory speed postings from one jurisdiction to another.

- The current criteria do not consider truck advisory speeds and truck roll-over considerations (10) (11).
- Some inconsistencies have been noted in comparing current ball bank criteria with side friction factors used for curve design (8).

The research generally documented that drivers are often exceeding the existing posted advisory speeds by 7 to 10 miles per hour. An increase of 2 degrees for ball-bank indicator readings and comparable side friction factors is equivalent to 8 to 10 miles per hour increase in advisory speeds. The application of an accelerometer that measures lateral acceleration provides a direct determination of side friction factors and accommodates new instrumentation for advisory speed determinations. Minor adjustments in the relationship between ball-bank readings and side friction factors makes the ball-bank procedure and accelerometer determinations comparable. The use of the horizontal curve design speed equation remains an acceptable procedure using the newly recommended side friction factors.

There appears to be no reason to limit the advisory speed determination methods but instead recognize that any of the three methods are acceptable:

- The traditional ball-bank indicator
- Design speed equation or
- Accelerometer.

There is a fourth method called the Compass Method by Texas Transportation Institute (TTI), but requires extensive field work (measuring points throughout the curve), so is not being considered for WisDOT. The expansion of acceptable determination methods and change in criteria *should* offset current procedural deviations with the new MUTCD requirements encouraging wider and universal application of acceptable advisory speeds. The recommended criteria for advisory speed determinations are as follows:

Table 2. Recommended Criteria for Curve Advisory Speed Determination
(Source: Adapted from Carlson and Mason 1999, Ref. 8)
Revised by WISDOT to include Truck Advisory data

Speeds (mph)	Ball Bank Reading	Lateral Acceleration (g)
≤ 20	16°	0.28
25 – 30	14°	0.24
≥ 35	12°	0.21
Truck (All Speeds)	10	0.17

The new criteria are comparable to the current AASHTO design criteria. Some research has proposed higher values, but those values result in advisory speeds that exceed the observed speeds of drivers in curves, are above comfortable lateral acceleration levels, and reduce the margin of safety. Studies show that maximum side friction factors developed between passenger car tires and wet pavement in poor condition can be as low as approximately 0.35 at high speeds (9) (14).

For large trucks, there is a potential danger of overturning if the truck enters a curve at too high of a speed. For sharp curves, such as loop exit ramps, it *may* be necessary to post truck advisory speeds. Current research indicates that truck-overturning situations are limited and inconsistent when side friction factors are less than 0.35 (12). Theoretically, truck advisory speeds could be determined based on a side friction factor of 0.21, or a ball-bank reading of 12 degrees, and still provide a reasonable overturning safety factor below the 0.35 overturning threshold. But this assumes that the truck follows the exact radius of the curve, which is unlikely in actual practice. Most drivers make steering corrections as they traverse a curve, sometimes steering a radius larger than the actual curve radius, sometimes steering a radius sharper that the actual curve radius. It must be recognized that if the truck is steered on a radius of ⅔ to ¾ of the actual curve radius, then the safety factor below the overturning threshold nearly disappears. As a result, it is recommended that the criteria for posting truck advisory speeds be based on a side friction factor of 0.17, or a ball-bank reading of 10 degrees, for all speed ranges to ensure a reasonable overturning safety factor. This would result in truck advisory speeds below the advisory speeds determined for passenger cars.

For New Construction Projects the following option *may* be used in lieu of the ball bank indicator method:

Method 1: Determining Advisory Speeds Using the Design Speed Equation

The design of highway curves is based on the relationship between design speed, radius of curvature, super elevation, and side friction (centripetal acceleration). The mathematical relationship between these variables is given by the equation (9):

$$V = \sqrt{15R(0.01e + f)}$$

Where: V = Design speed (mph)

R = Curve radius (feet)

e = Super elevation (%)

f = Side friction factor

The same equation can be used to calculate the advisory speed for a curve, if the curve radius and super elevation are known. The side friction factor is the same as lateral acceleration (measured in "g's"), and is based on driver comfort. For highway design, side friction factors are set by AASHTO geometric design policies, and are generally in the range of 0.08 to 0.30 depending on design speed. As previously discussed, recent studies have suggested that the values in the current design manual are overly conservative, and when this equation is used to determine the advisory speed for a curve, the lateral acceleration rates contained in Table 2 can be used. This equation *may* have to be solved iteratively because the value for the side friction factor, f, is different for different ranges of advisory speed, V. For example, suppose that a curve has a 200-foot radius and a super elevation of 4%. If it is initially assumed that the value of the lateral acceleration is 0.21 (applicable for passenger car advisory speeds of 35 mph or more), the calculated advisory speed is 27 mph. This means that the lateral acceleration value *should* have been 0.24 (applicable for advisory speeds of 25 to 30 mph), and the advisory speed is recalculated as 29 mph. Calculated advisory speeds *should* be rounded to the nearest 5 mph increment, so a 30 mph advisory speed would be used for this curve. The rounded passenger car advisory speeds calculated for various combinations of super elevation and curve radius are shown in Table 3.

Table 3. Rounded Passenger Car Advisory Speeds (mph) Based on Design Speed Equation

Radius (ft)	Super elevation (%)				
	-2	2	4	6	8
100	20	20	20	20	20
200	25	30	30	30	30
400	35	35	40	40	40
600	40	45	45	50	50
800	50	55	55	55	60
1000	55	60	60	65	65

In some cases, the curve radius and super elevation can be taken from as-built plans for a roadway that has been constructed fairly recently. However, it must be considered that a roadway that has been in service for many years *may* have been resurfaced one or more times since original construction. As a result of resurfacing, the super elevation of the curve *may* have changed, and the original plans *may* no longer be representative of field conditions. In other cases, the original plans *may* no longer be available.

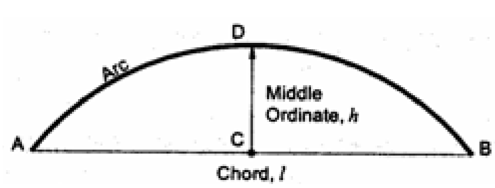
If aerial photography is available, the curve radius can be determined by comparing circular curve templates with the aerial photograph. In the field, the approximate curve radius can be determined by the chord and middle ordinate method of measurement. This is illustrated in Figure 2. To determine the curve radius, measure a chord of any convenient length (usually 100 feet), straight across from one point on the edge of the road to another point on the edge of the road within the curve (line AB in Figure 2) where the curvature is uniform. Also measure the middle ordinate from the center of the chord to the edge of the road (line CD in Figure 2). The radius of the curve can be calculated as:

$$R = \frac{l^2}{8h} + \frac{h}{2}$$

Where: R = Curve radius (feet)
l = Chord length (feet)
h = Middle ordinate (feet)

The precision of this calculation is obviously limited by the ability to accurately measure the middle ordinate which would be as small as 1.25 feet (assuming a chord of 100 feet) for a curve with a radius of 1000 feet.

Figure 2. Measurement of Curve Chord and Middle Ordinate



(Source: Northwestern University Center for Public Safety)

The super elevation can be measured in the field using a 4-foot carpenter's level. As illustrated in Figure 3, position the level across the lane. With one end of the level on the road surface, measure the vertical distance from the road surface to the other end of the level. The cross slope of the roadway can then be calculated as the vertical distance divided by the length of the level. The super elevation *should* be measured in several locations along the curve, since it *may* vary. Also, the super elevation *should* be measured separately for each lane of the roadway.

Figure 3. Measuring Super elevation with a Carpenter's Level
(Source: Northwestern University Center for Public Safety)

Another method for determining the super elevation in the field is to stop a vehicle equipped with a ball-bank indicator (discussed in the next section) on the curve and read the degrees of deflection on the ball-bank. The super elevation is calculated as:

$$e = (\tan D) \times 100\%$$

Where: e = Super elevation (%)

D = Degrees of deflection on ball-bank indicator

Again, this measurement *should* be made at several locations within the curve, and *should* be measured separately for each lane.

Method 2: Ball-Bank Indicator Method

Advisory speeds *may* be determined in the field using a vehicle equipped with a ball-bank indicator and an accurate speedometer. The simplicity of this technique has led to its widespread acceptance as a guide to determining advisory speeds for changes in horizontal alignment. Figure 4 shows a typical ball-bank indicator.

The ball-bank indicator consists of a curved glass tube, which is filled with a liquid. A weighted ball floats in the glass tube. The ball-bank indicator is mounted in a vehicle, and as the vehicle travels around a curve the ball floats outward in the curved glass tube. The movement of the ball is measured in degrees of deflection, and this reading is indicative of the combined effect of super elevation, lateral (centripetal) acceleration, and vehicle body roll. The amount of body roll varies somewhat for different types of vehicles, and *may* affect the ball-bank reading by up to 1°, but generally is insignificant if a standard passenger car is used for the test. Therefore, when using this technique, it is best to use a typical passenger car rather than a pickup truck, van, or sports utility vehicle.

Figure 4. Ball-bank Indicator

To ensure proper results, it is critical that the following steps be taken before starting test runs with the ball-bank indicator:

- Inflate all tires to uniform pressure as recommended by the vehicle manufacturer
- Calibrate the test vehicle's speedometer
- Zero the ball-bank indicator

The vehicle speedometer *should* be calibrated to ensure proper and consistent test results. This can be done by checking the vehicle speed with a radar or laser speed meter, or by timing the vehicle over a measured distance (such as milepost spacing). Alternatively, a moving radar unit can be used to measure speed while conducting the ball-bank test runs rather than relying on the vehicle's speedometer.

The ball-bank indicator must be mounted in the vehicle so that it displays a 0° reading when the vehicle is stopped on a level surface. The positioning of the ball-bank indicator *should* be checked before starting any test. This can be done by stopping the car so that its wheels straddle the centerline of a two-lane highway on a tangent alignment. In this position, the vehicle *should* be essentially level, and the ball-bank indicator *should* give a reading of 0°. It is essential that the driver and recorder be in the same position in the vehicle when the ball-bank indicator is set to a 0° reading as they will be when the test runs are made because a shift in the load in the vehicle can affect the ball-bank indicator reading.

Starting with a relatively low speed, the vehicle is driven through the curve at a constant speed following the curve alignment as closely as possible, and the reading on the ball-bank indicator is noted. On each test run, the driver *should* reach the test speed at a distance of at least ¼ mile in advance of the beginning of the curve, and maintain the same speed throughout the length of the curve. The path of the car *should* be maintained as nearly as possible in the center of the innermost lane (the lane closest to the inside edge of the curve) in the direction of travel. If there is more than one lane in the direction of travel, and these lanes have differing super elevation rates, drive in the lane with the lowest amount of super elevation. Because it is often difficult to drive the exact radius of the curve and keep the vehicle at a constant speed (cruise-control helps to maintain a constant speed), it *may* take several test runs in each direction be made to more accurately determine the ball-bank reading for any given speed. On each test run, the recorder must carefully observe the position of the ball throughout the length of the curve and record the deflection reading that occurs when the vehicle is as nearly as possible driving the exact radius of the curve.

If the reading on the ball-bank indicator for a test run does not exceed an acceptable level (as indicated by the recommended criteria in Table 2), then the speed of the vehicle is increased by 5 mph and the test is repeated. The vehicle speed is repeatedly increased in 5 mph increments until the ball-bank indicator reading exceeds an acceptable level. The curve advisory speed is set at the highest test speed that does not result in a ball-bank indicator reading greater than an acceptable level.

Figure 5 is an example of a data collection form that can be used to record the results of ball-bank indicator test runs. In the example in Figure 5, test runs were started at 25 mph, with ball-bank indicator reading of about 6°. This is well below the suggested criteria of 14° for a speed of 25 mph. The speeds of the test runs were gradually increased until the speed of 35 mph gave readings of 10° to 12°. These are the highest readings attained without exceeding and the suggested criteria of 12° for a speed of 35 mph or more. This study would result in posting an advisory speed of 35 mph for both directions of travel for this curve. Several alternative field data collection and supervisor approval forms are shown in the Appendix.

Figure 5. Sample Ball-Bank Indicator Data Collection Form

BALL-BANK INDICATOR STUDY						
LOCATION: ***STATE ROUTE 43***						
COUNTY: ***DAVIS***			SECTION:			
POSTED SPEED (MPH): ***55***			PAVEMENT CONDITION: ***DRY***			
DATE:			VEHICLE: ***2008 CHEVROLET IMPALA***			
DRIVER: ***SEYFRIED***			RECORDER: ***PLINE***			
REMARKS:						
DIRECTION OF TRAVEL	PHOTO LOG MILE		SPEED (MPH)	BALL-BANK READING (DEGREES)		
	START CURVE	END CURVE		RUN 1	RUN 2 IF NEEDED	RUN 3 IF NEEDED
NORTH	***8.32***	***8.65***	***25***	***6***	***7***	***6***
			30	***9***	***10***	***10***
			35	***12***	***12***	***11***
			40	***15***	***13***	***14***
SOUTH	***8.65***	***8.32***	***25***	***6***	***6***	***5***
			30	***9***	***8***	***9***
			35	***11***	***10***	***11***
			40	***13***	***14***	***14***

Method 3: Accelerometer

An accelerometer is an electronic device which can measure the lateral (centripetal) acceleration experienced by a vehicle as it travels around a curve. Typically, method 1 and 2 are used. However, if the Region has an accelerometer, this method is acceptable to use as an alternative to the ball-bank indicator method.

Establishing Advisory Speeds

Using any of the three methods noted above *should* result in the same advisory speed for a curve. It is important to reiterate that the advisory speed criteria are based on driver comfort, not safety. A sufficiently skillful driver *may* be able to traverse a curve on dry pavement at a speed considerably higher than the advisory speed without exceeding the friction capabilities of the pavement. However, most drivers would choose not to drive at a higher speed because they would experience uncomfortable levels of lateral acceleration.

The MUTCD indicates that the "advisory speed **shall** be determined by an engineering study that follows established engineering practices" (Section 2C.08). The Manual further defines an engineering study as "the comprehensive analysis and evaluation of available pertinent information, and the application of appropriate principles, Standards, Guidance, and practices as contained in this Manual 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 performed by an engineer, or by an individual working under the supervision of an engineer or sign shop supervisor, through the application of procedures and criteria established in this policy. An engineering study **shall** be documented" (MUTCD Section 1A.13).

Therefore, the establishment of advisory speeds must follow standard procedures developed and adopted by the engineering personnel of an agency. All field work used for determining the advisory speeds must be performed under the supervision of an engineer or sign shop supervisor. Finally, the data collected and analysis performed must be preserved in written documentation. The Appendix contains a sample curve advisory speed study supervisor approval form that can be used to document the field data collection.

The maximum comfortable operating speed on a curve can be determined using any of the three methods discussed above (design speed equation, ball-bank indicator, or accelerometer). The advisory speed for the curve *should* be set at the 5-mph increment nearest to this maximum comfortable speed. The advisory speed to be posted *should not* be arbitrarily reduced below the comfortable speed determined using these methods, because an unrealistically low advisory speed will lose credibility among drivers, and create inconsistencies that *may* lead drivers into traveling at too high a speed through other curves.

Advisory speed plaques are only used in conjunction with appropriate warning signs, and never alone. Turn, Curve, Reverse Turn, Reverse Curve, and Winding Road signs are used in locations where it is desirable to warn drivers of changes in the horizontal alignment of the roadway. The MUTCD indicates that the use of Turn or Reverse Turn signs *should* be limited to changes in alignment where the advisory speed is 30 mph or less. The Curve or Reverse Curve signs are intended for use where the advisory speed is greater than 30 mph.

Where a Reverse Curve warning sign or a Winding Road warning sign is used, the advisory speed *should* be based on the curve with the lowest comfortable operating speed. However, if one curve in the series has a dramatically lower comfortable speed, it would be desirable to place a separate warning sign with the appropriate advisory speed for that individual curve.

In some cases, there *may* be other factors that influence the selection of the advisory speed in addition to the comfortable operating speed on the curve. Available sight distance or deceleration distance (on an exit ramp) *may*, in some cases, require an advisory speed lower than the comfortable operating speed for the curve.

Truck Advisory Speeds

The appropriate warning signs for truck rollover concerns require more than just determination of truck advisory speeds. Large trucks, tank trailers and truck freight trailers have a high center of gravity and are susceptible to rollover crashes on a sharp curve. The loop ramps on freeway interchanges and direct freeway-to-freeway connections are sometimes subject to truck rollover problems. The potential for such crashes *may* increase because of radius of horizontal curvature, inadequate deceleration length or deficient specific signing. Truck rollover theoretically can occur when the lateral acceleration exceeds 0.30, but no calculated lateral acceleration less than 0.35 has been determined in any truck rollover collisions. A Ball Bank reading of 10 degrees (side friction = 0.17) be used to provide a reasonable factor of safety. This value is about half the critical side friction factor accommodating those occasions where the truck *may* exceed the posted truck advisory speed or the truck travels a curve radius that is less than the actual roadway curvature. These criteria will generally produce a truck advisory speed that is approximately 5 mph less than the advisory speeds determined for passenger cars, except for the lower speed ranges.

The MUTCD, Section 2C.13, Section 2C.14 and Table 2C-5 (Figure 1 of this policy), covers the use of the Truck Rollover Warning sign (W1-13), Advisory Exit Speed sign (W13-2), and the Advisory Ramp Speed sign (W13-3). The application of these signs **shall** be based on an engineering study that considers the roadway and operational characteristics that *may* contribute to a loss of vehicle control and potential truck rollovers. It is suggested that the engineering study for Truck Rollover Warning signs address the following considerations;

1. Speed data and advisory speed determinations.
2. Traffic characteristics.
3. Roadway geometrics.
4. Recommended traffic control devices.

It *should* be noted that any posted Advisory Speed for the Truck Rollover signing *should* reflect the truck advisory speed determination. The MUTCD provides a number of other devices that can be used in conjunction with the above signs to address truck rollover consideration such as:

- Chevron Alignment signs (W1-8)
- Combination Horizontal Alignment/Advisory Speed sign (W1-1a and W1-2a)
- One Direction Large Arrow sign (W1-6)
- Combination Horizontal Alignment/Advisory Exit and/or Advisory Ramp Speed Signs (W13-6 and W13-7).

See TEOpS 2-3-36 for policies related to exit advisory speed signage.

Additionally, the warning can be enhanced with enlarged signing, a TRUCK header panel, or flashing beacons. The traffic engineering study *should* address the recommended signing for the specific field conditions.

POLICY

FIELD REVIEW OF CURVES AND TURNS

1. The setting of advisory speeds on existing curves and turns *should* be performed by the ball-bank indicator method for existing roadways utilizing Table 2 above.
2. The Accelerometer (Method 3) *may* be used as an alternative to the ball-bank indicator for Regions that have this device.
3. For ramps that have problems with truck rollovers and/or have the tippy truck signs installed, the truck ball bank reading of 10 degrees *should* be used.
4. For new construction, the design speed chart (Table 3) noted above *may* be used where the super elevation and radius are known.

Curve signing determined on the basis of calculated values *should* always be verified in the field by the ball bank method.

SIGNING IMPLEMENTATION

1. For consistency of motorist expectation, signing field changes *should* be organized where entire routes are done at approximately the same time. Breakpoints *should* occur in the route at locations where the highway travels through a community that has a speed zone reduction.
2. Signing field changes *should* be incorporated into improvement projects as much as possible. Roadway segments on each side of the improvement project *should* terminate at a STH/STH or municipal limit breakpoint.
3. Table 2C-5 in the MUTCD (see Figure 1 of this policy) **shall** be utilized in the determining the proper treatment of horizontal alignment sign(s).
4. For advisory speed reductions of 25 mph or greater, chevrons (W1-8 signs) *should* be used. For these advisory speed reductions, a night arrow (W1-6 sign) *may* be used to supplement the chevrons for advisory speed reductions of 25 mph or greater.
5. For advisory speed reductions that are greater than 5 mph and less than 25 mph, the usage of the night arrow (W1-6 sign) is the first choice of sign that *should* be used. For these advisory speed reductions, chevrons (W1-8 signs) are typically used in locations where there are demonstrated problems.
6. For a Winding Road (W1-5 sign)/Advisory speed (W13-1sign) application, where night arrows (W1-6 signs) and/or chevrons (W1-8 signs) are required on specific curves, the first curve in the series **shall** be signed with the night arrow and/or chevrons. Subsequent curves in the winding road series **shall** be signed with night arrows and /or chevrons if recommended/required by Table 2C-5 in the MUTCD (see Figure 1 of this policy).
7. For a Reverse Curve (W1-4 sign)/Advisory speed (W13-1 sign) application, the curves in the series **shall** be signed with night arrows and /or chevrons if recommended/required by Table 2C-5 in the MUTCD (see Figure 1 of this policy).
8. Turn warning signs **shall** be used where advisory speeds have been determined to be 30 mph or less.
9. Regulatory speed limit signs are normally not posted on ramps. For application of warning signs on service interchange ramps (non-freeway to freeway), relative to MUTCD Table 2C-5, a 10-mph reduction from the mainline posted speed should be used.
10. Each direction on the roadway should be evaluated independently of the other direction in the determination of the proper horizontal alignment signing.

PHASE IN COMPLIANCE

- In order to allow for resources to make the changes to the advisory speeds, the following **shall** apply:
- When signing is replaced with an improvement project, the advisory speeds **shall** be established based on the new policy. This can either be accomplished by one of the methods noted in this policy.
- For other sections of roadway, the changes **shall** be made for an entire segment of highway between two cities, towns or villages. Curve and turn advisories *should not* be changed for one isolated location; rather for an entire segment between communities or within a county.
- Phase in period – December 31, 2019 (MUTCD Compliance Date).

ACKNOWLEDGMENTS

NCUTCD – Regulatory and Warning Signs Technical Committee and Task Force and Bob Seyfried,

Northwestern University Center for Public Safety.

REFERENCES

1. Guidelines for the Determination of Advisory Speeds (NCUTCD Task force from the Regulatory and Warning Signs Technical Committee.)
2. *Manual on Uniform Traffic Control Devices for Streets and Highways,* Public Road Administration, Washington, D.C., August 1948, page 39 and 53.
3. Paul J. Carlson and John M. Mason, "Relationship Between Ball Bank Indicator Readings, Lateral Acceleration Rates and Vehicle Body-Roll Rates", *Transportation Research Record 1658*. Washington DC: Transportation Research Board, January 1999.
4. *A Policy on Geometric Design of Highways and Streets,* American Association of State Highway and Transportation Officials, Washington, D. C., 2004.
5. R. Milstead, X. Qin, B. Katz, J. Bonneson, M. Pratt, J. Miles, and P. Carlson, "Procedures for Setting Advisory Speeds on Curves, Federal Highway Administration, Washington D.C., 2011.

APPENDIX

SAMPLE FIELD DATA COLLECTION FORMS

1. Curve Advisory Speed Calculations
2. Ball-Bank Indicator Test Supervisor Approval
3. Ball-Bank Indicator Study Form
4. Ball-Bank Indicator Test Summation
5. Curve Advisory Speed Determination Field Data Sheet

Advisory Speed Approval

Jurisdiction: ____

Location: ____

From: ____________________________ **to:** ______________________________

Project No. /Title: ____

Advisory Speed Study Attached:

Ball Bank Indicatory Study _____ **Date:** _______________

Speed Formula Calculations_____ **Date:** _______________

Accelerometer Readings _____ **Date:** _______________

Completed By: _________________________________ **Date:** _______________

Study Approval:

Name: __________________________________ **Title:** ______________________

Date: _______________

Curve Advisory Speed Calculations
Method # 1

Sheet ___of____

Completed By: ________________________________ **Date:** _______________

Jurisdiction: ____

Location: ____

From: ___________________________ **To:** _____________________________

Project No. /Title: ____

$$V = \sqrt{15R(0.01e + f)}$$

DIRECTION OF TRAVEL	CURVE BEGIN STA.	CURVE END STA.	CURVE RADIUS (ft)	SUPER-ELEVATION (%)	SIDE FRICTION	ADVISORY SPEED (mph)	WARNING SIGN

Remarks: ____

Study Approval:

Name: _________________________________ **Title:** ______________________
Date: _______________

BALL-BANK INDICATOR STUDY						
LOCATION:						
COUNTY:			SECTION:			
POSTED SPEED (MPH):			PAVEMENT CONDITION:			
DATE:			VEHICLE:			
DRIVER:			RECORDER:			
REMARKS:						

DIRECTION OF TRAVEL	PHOTO LOG MILE		SPEED (MPH)	BALL-BANK READING (DEGREES)		
	START CURVE	END CURVE		RUN 1	RUN 2 IF NEEDED	RUN 3 IF NEEDED

BALL BANK INDICATOR TEST SUMMATION (OPTIONAL)

Jurisdiction: ________________________________ **Date:** ________________

Location: ____

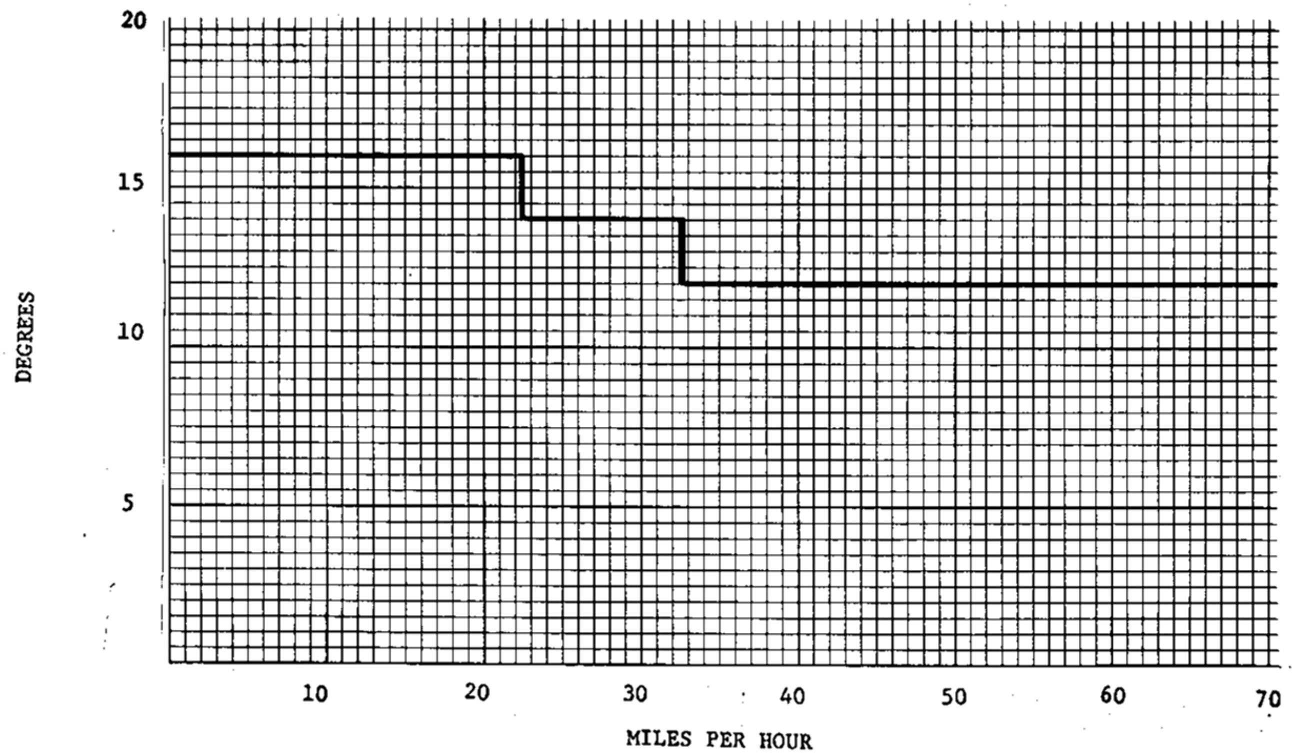
Weather: ________________________ **Road Surface:** ____________________

Driver: __________________________ **Recorder:** ________________________

Vehicle: _________________________ **Posted Speed Limit:** ______________

Direction: ______________ **Begin Curve:** ___________ **End Curve:** _________

Show each vehicle test run as a dot on the graph



SUMMARY FOR A SECTION OF ROADWAY

CURVE ADVISORY SPEED DETERMINATION FIELD DATA SHEET	
Highway:	**County:**
Section:	**Date:**
Posted Speed (mph):	**Pavement Condition:**
Vehicle:	**Driver/Recorder:**
Remarks:	
BALL BANK READINGS: 12 degrees for speeds of 35 mph or more **14 degrees for speeds of 25 to 30 mph** **16 degrees for speeds of 20 mph or less**	

Direction of Travel	Curve Direction		Beg. Curve	End Curve	Tangent Length	Ball Bank Reading	Advisory Speed (mph)		Curve Warning Sign	
	LT	RT	MP	MP	Miles	Degrees	Current	Recom-mended	Sign No.	Size

2-3-36 Ramp Warning Signs — August 2009

PURPOSE

The MUTCD in Section 2C.36 sets forth standards for Exit, Ramp and Curve advisory speed signs, which *may* be used to advise motorists of the maximum recommended speed on a ramp. In usual practice, the speed and condition warned of is just beyond the gore of the ramp. Other guidance in 2C.36 indicates that where additional advisory speed indication is needed on the ramp well beyond the gore area, a standard warning sign with an ADVISORY SPEED plaque (W13-1) is to be used.

To provide for the uniformity of the application of the EXIT, RAMP, and CURVE advisory speed signs, the following use and application guidelines are prescribed where ramp speed control is determined to be necessary.

The MUTCD, Table 2C-4, provides advanced placement distances for EXIT, RAMP, and CURVE advisory speed signs along with other warning signs such as STOP AHEAD, YIELD AHEAD, SIGNAL AHEAD and ROUNDABOUT AHEAD. This is determined by the posted or 85th percentile speed and then suing Table 2C-4 in the MUTCD to determine the appropriate sign placement distance. Oftentimes for ramps there is no posted speed and speed studies are not normally performed. Utilization of the posted speed on the mainline roadway instead can result in an unreasonable placement distance that is too far back and the sign *may* end up on the mainline roadway, especially for shorter exit ramps. Ultimately, this can lead to inconsistencies in sign placement. Guidance is necessary for the placement of these signs.

POLICY

STOP AHEAD (W3-1), YIELD AHEAD (W302), SIGNAL AHEAD (W3-3) AND ROUNDABOUT AHEAD (W2-6 and W2-6P) Signs

The following methods *may* be utilized to determine the appropriate placement of STOP AHEAD, YIELD AHEAD, SIGNAL AHEAD and ROUNDABOUT AHEAD warning signs on ramps. Table 2C-4 *should* be used for placement of the signs.

1. Assumption of a 10 mph reduction from the mainline speed for the placement of the signs.
2. For ramps of a short length (where utilization of Table 2C-4 cannot be met), placement of the signs *should not* exceed a distance of 50 feet upstream of the EXIT gore sign (E5-1 or E5-1A).

EXIT Advisory Speed Sign (W13-2)

The EXIT SPEED sign will normally be used at:

1. Off-ramps on freeways and expressways when the ramp connects to a conventional state trunk highway or local crossroad.
2. Ramp connections between freeways where the guide signing establishes that the ramp is an exit. The EXIT DIRECTION sign will have an exit number panel. Ramps between freeways, which are not identified with an exit number on the EXIT DIRECTION sign *should* be signed with a CURVE or TURN sign with appropriate advisory speed when reduced speed is necessary.

The following methods *may* be utilized to determine the appropriate placement of EXIT ADVISORY SPEED signs. MUTCD Table 2C-4 *should* be used for placement of the signs.

1. Assumption of a 10 mph reduction from the mainline speed for the placement of the signs.
2. Utilization of a ball bank indicator or design speed equation, shown in TEOpS 2-3-35, to determine the start of curvature and the appropriate exit speed.

Modified EXIT ADVISORY SPEED Signs (W13-2A and W13-2B)

The modified exit advisory speed signs (see Figures 1 and 2) *may* be used at the following locations, provided the following criteria are met:

1. For advisory speeds of 30 mph or less for off-ramps on freeways and expressways or ramp connections between freeways where the guide signing establishes that the ramp is an exit.
2. Existing locations where there are run-off-the-road crashes as a result of a sharp horizontal alignment. The signs *may* also be installed in new locations that are perceived to be potential problem areas. The usage of signs in new locations **shall** be approved by the Region Traffic Engineer.

RAMP ADVISORY SPEED Sign (W13-3)

The RAMP ADVISORY SPEED sign will normally be used at:

1. Ramps along freeways or expressways that provide access to safety rest areas, scales, scenic outlooks and tourist information centers where traffic must return directly to the freeway or expressway upon leaving the facility.
2. Ramps from local roads or conventional state trunk highways serving as connections to freeways or expressways, or to other conventional highways.

CURVE ADVISORY SPEED Sign (W13-5)

The CURVE ADVISORY SPEED sign (W13-5) **shall not** be used on WisDOT roadways. For curve delineation on ramps, the standard curve warning sign (W1-2L or W102R) with ADVISORY SPEED plaque (W13-1) *should* be used. The standard curve warning sign with advisory speed plaque gives motorist s more positive guidance as to the direction of the curve versus the W13-5 sign.

General Criteria

In accordance with directions prescribed in Section 2C.36, the EXIT SPEED or RAMP ADVISORY SPEED sign *should* be posted along the deceleration lane. Final locations *should* be carefully established which are devoid of visual conflicts with other signs or physical roadway elements, such as bridge columns. Practically, the sign locations *should* be midway along the deceleration lane, but moved closer to the beginning of the ramp taper for conditions requiring significant reductions in speed. The distance values of Table 2C-4, Condition B, for general warning sign placement suggest desirable minimum values, but will have to be modified in order to keep the sign "along the deceleration lane" and far enough away from the EXIT DIRECTION signs to avoid its being hidden or obscured. Approach speeds *may* be assumed to be the posted speed limit.

Figure 1. W13-2A Sign

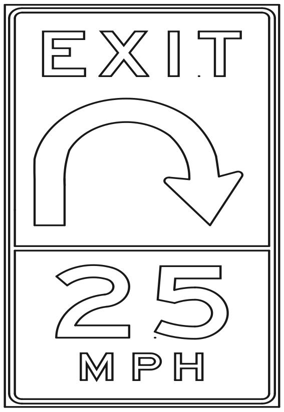
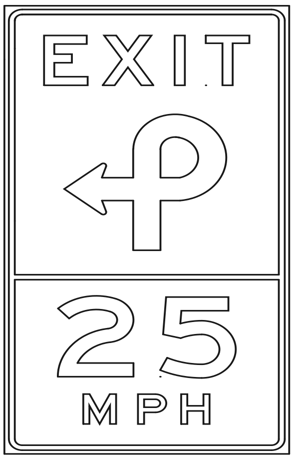


Figure 2. W13-2B Sign



2-3-38 NO PASSING ZONE Signs — April 1996

NO PASSING ZONE (W14-3) signs **shall** be placed at the beginning of all no passing zones whether for sight restrictions, narrow bridges, passing lanes, divided highway and approaches or intersectional except as provided below. In making the pennant mandatory on state trunk highways in the early 1970s, it was the intent of the administration that they *should* be installed at all zones, including barrier lines at intersections. This is implied in a memo to all Regions on April 18, 1973.

Where a no passing zone related to sight conditions occurs at a stop sign-controlled or signal-controlled intersection, the zone will be broken for the intersection and resume on the other side. The continuation of the zone beyond the intersection does not require another W14-3 to be installed.

In communities where the state trunk highway is maintained by the Department, it is not necessary to install W14-3 signs at the beginning of no passing zones or barrier lines that occur within speed zones of 35 mph or less.

2-3-40 Trail Crossing Signs September 2010

PURPOSE

This policy provides guidance on the use of TRAIL CROSSING signs where emphasis is needed to alert motorists of recreational vehicles crossing highways. In order for a trail crossing to be signed under this policy, the trail itself must be federal, state, or locally authorized and open to the public.

TRAIL CROSSING signs covered under this policy include the following signs:

1. SNOWMOBILE CROSSING (W11-6) sign
2. BICYCLE CROSSING (W11-1) sign
3. EQUESTRIAN CROSSING (W11-7) sign
4. BRIDLE PATH sign (W11-56) sign
5. TRAIL CROSSING, symbol message (W11-15) sign*
6. TRAIL CROSSING, word message (W11-15a) sign**

*The TRAIL CROSSING symbol message (W11-15) sign is normally used to sign trails that have predominantly pedestrian and bicycle usage.

**The TRAIL CROSSING word message (W11-15a) sign is normally used to sign trails that have other groups using the trail in addition or besides pedestrian and bicycle usage.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separations at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

POLICY

1. Trail crossing signs are not permitted on freeways.
2. Trail crossing signs **shall** be installed for all 65 mph expressway trail crossings, whether there is a sight restriction or not. This only applies to non-intersection crossings on 65mph expressways (see Item 4 below).
3. Trail crossing signs *may* be placed on all other highways provided there is deficient sight distance per Section 2c.46 of the MUTCD. Sections 2C-49 and 50 of the MUTCD also give additional criteria when trail crossing signs *may* be desirable.
4. Trail crossing signs *may* also be used to alert motorists to unexpected entries of recreational vehicles, pedestrians or bicyclists in the roadway.
5. Trail crossing signs *should* only be used for non-intersection crossings. There *may* be extreme cases where there is a demonstrated crash history or site problems at intersections that would warrant trail crossing signs in addition to the crossroad or side road warning signing.
6. STOP signs (18” x 18”) are required on the recreational trail per the Wisconsin DNR trails handbook and they are required per the MUTCD for any shared-use path where bicyclists are required to stop. The trail owner **shall** install the STOP signs on the recreational trail prior to the installation of the trail crossing warning signs on the roadway.
7. Because the trail STOP signs are in the STH right-of-way, the Region **shall** issue a permit, in form of a letter, to the trail owner for the placement of the STOP signs on the trail. The permit *should* make it clear that the trail owner is responsible for the initial installation and long-term maintenance of the signs.

2-3-41 Deer Crossing Signing August 2009

GENERAL

Deer crashes have been one of the highest crash types on state highways in recent years. There are a number of factors which *may* influence the deer crash rate, including herd population, herd migration, herd location, roadside vegetation management, roadway factors (speed limits, lighting, etc.), driver education, use of deer crossing deterrent devices (reflectors, scent boxes, vehicle whistles, wildlife underpasses, etc.), active warning devices such as motion detectors/warning light or static warning signs. Traditionally, static warning signs have been installed in areas with higher deer-vehicle crashes (DVCs). There has been much debate over the usage of static deer crossing signs and their effectiveness. Many transportation professionals recognize the fact that warning signs are most effective *result in alteration of speed and/or path choice) when there is an obvious danger ahead (example would be curve or turn). The use of warning signs that alert drivers to sporadic or general possibilities *deer crossing and slow children moving signs) have been shown to not have a consistent impact on driver behavior. The widespread use or sign proliferation also reduces the effectiveness of the sign and leads to driver disregard. Several states and agencies have performed studies to assess the effectiveness of static deer crossing warning signs. The studies have concluded that the usage of static deer crossing warning signs do not generally reduce vehicle speeds (one measure of warning sign effectiveness). As a result, the studies have yielded no reduction in DVCs.

SUPPORTING DOCUMENTATION

Static sign studies have been performed by the following states and/or agencies:

1. *Assessing the Effectiveness of Deer Warning Signs*. Published by Kansas Department of Transportation and University of Kansas at Lawrence, April 2006,
2. *Wildlife—Vehicle Collision and Crossing Mitigation Measures: A Toolbox for the Montana Department of Transportation*. Published by Montana Department of Transportation and Montana State University, May 2007.
3. *An Ecological Landscape Study of Deer-Vehicle Collisions in Kent County, Michigan*. Published by Kent County Road Commission and White Water Associates, Inc., January 2004.
4. *Deer Crossing Signs and Technologies*. Published by Deer-Vehicle Crash Information Clearinghouse (DVCIC), Maintained by Texas Transportation Institute, www.deercrash.com
5. *Deer Signs Research Study*. Published by Minnesota Department of Transportation and University of Minnesota, www.lrrb.gen.mn.us/pdf/200413.pdf

Several dynamic types of deer crossing signs are currently being explored as potential countermeasures and are discussed in the studies listed above. These types of signs have been designed to activate when deer are detected near the roadway. Studies are taking place in Indiana, Minnesota, Montana, Pennsylvania, Utah and Washington. The development of methods to control car/deer collisions is continuing to evolve, and over time policies such as this will be subject to change. At present, due to funding limitations, WisDOT is not utilizing dynamic deer crossing warning sign systems. However, WisDOT is periodically reviewing studies from other states and municipalities as they progress. WisDOT will consider issuing a permit to an entity to pursue the usage of dynamic deer crossing signs.

One effective countermeasure pointed out in the Kansas study is the usage of public awareness techniques to educate the motoring public regarding the seasonal and time of day characteristics of deer-vehicle crashes. This could be accomplished effectively through the different types of media outlets.

POLICY

Based upon the findings of various studies mentioned above, WisDOT will implement the following policy for usage of static deer crossing warning signs:

1. No new static deer crossing warning signs will be installed on state highways.
2. Static deer crossing signs that are currently in place will be allowed to remain until the end of their useful life or when opportunities for removal are available. These opportunities would include sign knockdowns and improvement projects.

2-3-43 Parallel On-Ramp Lane Reduction Signing — July 2012

BACKGROUND AND PURPOSE

At some interchange locations, long parallel (acceleration) entrance ramps are constructed to allow vehicles ample distance to get up to the mainline travel speeds, thus helping to eliminate slowing down of the mainline traffic. Questions have arisen as to whether warning signs, such as the LANE ENDS symbol (W4-2 sign). The MUTCD, Section 2C-42 states that LANE ENDS signs *should not* be installed in advance of the downstream end of an acceleration lane. It *should* also be noted that the MUTCD, Section 2C-42 states that a LANE ENDS sign *may* be installed on a freeway entrance ramp. These would be cases where the signs would be beneficial by exercising engineering judgment in certain locations. In absence of specific guidance in the MUTCD, this policy will provide additional guidance as to where the LANE ENDS sign *may* be utilized for long parallel entrance ramps.

GUIDELINES

The following is guidance relating to the usage of the LANE ENDS (W4-2) sign on long parallel (acceleration) ramps:

1. Issues with motorists not realizing that the entrance ramp is not a mainline or auxiliary exit lane. This could be exhibited by last-minute merge movements or braking.
2. Slowing down and last of mainline traffic caused by last-minute lane changes.
3. Crash issues relating to the last-minute, quick lane changes or braking.
4. The LANE ENDS (W4-2) sign *should not* be used on all parallel entrance ramps. Parallel entrance ramps should be evaluated on a case-by-case basis.
5. Parallel entrance ramps that have been previously signed *should* be evaluated as opportunities permit (improvement projects, routine sign replacements, knockdowns, etc.). This *should* be done prior to removing any signs. Any parallel entrance ramps not meeting the above guidance criteria *should* have the LANE ENDS (W4-2) sign removed.

2-3-45 Icy Bridge Deck Signing — April 1989

GENERAL

The Regional Traffic Engineer *may* use the BRIDGE MAY BE ICY (W8-64) sign on bridges which display problems caused by the formation of ice.

The use of the BRIDGE MAY BE ICY sign **shall** be based on Region discretion. The Region can be aided in this decision by checking with local maintenance and law enforcement officials to see if an ice problem exists at a bridge site. The Region can also analyze crash rates at the bridge site that are based on ice.

The WATCH FOR ICE ON BRIDGE sign **shall** no longer be used. The existing WATCH FOR ICE ON BRIDGE signs *should* be replaced as they wear out.

2-3-49 Determination of Sight Distance for Warning Signs — June 2015

PURPOSE

The MUTCD provides guidance for the installation of several types of vehicular and non-vehicular warning signs. Some of these signs include the SCHOOL BUS STOP AHEAD, SNOWMOBILE CROSSING, fire truck, side road and crossroad warning signs. The MUTCD states that many of these types of warning signs *should* be used where the road user's sight distance is restricted, or the condition, activity or entering traffic would be unexpected.

The May 25, 2011, MUTCD Section 2C.46, provides additional guidance regarding proper sight distance in determining the need for a warning sign. This table on minimum visibility distances references Table 9-6, pages 9-38 (intersection sight distance—left turn from stop) of the AASHTO Standard Highway and Street Design Manual. This table provides an added factor of safety beyond the traditional stopping sight distances.

It *should* be noted that the minimum visibility table shown below is just for determination if the warning sign is needed. These are not sign placement criteria. Sign placement criteria is provided in MUTCD Table 2C-4.

Minimum Visibility Distance

Posted or 85th Percentile Speed	Minimum Visibility Distance (ft.)
25 MPH	280
30 MPH	335
35 MPH	390
40 MPH	445
45 MPH	500
50 MPH	555
55 MPH	610
60 MPH	665
65 MPH	720
70 MPH	775

One question that has been commonly asked is "What are the acceptable field methods that can be utilized to determine the actual minimum visibility distance in order to provide accuracy and consistency?" Listed below are several guidelines that *may* be utilized to assist in this effort and to provide for a consistent application statewide.

GUIDELINES

Cone Method (Preferred)

1. A 28” height cone *should* be used as a target at the location of the hazard (i.e. snowmobile crossings, pedestrian crossings and school bus stops). In lieu of a 28” height cone, a mailbox or other alternative methods approved by the Region *may* be used as a target.
2. Set the Distance Measuring Instrument (DMI) when the entire cone is first visible and measure the distance to the cone.

Vehicle Visibility Method (Optional)

1. For the installation of side road and crossroad warning signs, park on the side road and determine where mainline vehicle is first visible. Measure the distance between the mainline vehicle and the side road vehicle to determine minimum visibility distance.
2. An optional method that *may* be used is to park at the intersection or crossing and count the seconds, starting when the mainline vehicle is first visible and equate the time to a distance. For example, at 60 mph, a vehicle travels approximately 88 feet per second. Therefore, at a minimum visibility distance of 665 feet, it would take 8 seconds for the vehicle to reach the intersection or crossing.

2-3-50 Horse Drawn Vehicles — January 2003

GENERAL

The use of highways by horse drawn vehicles is a common activity of some farming religious sects active in several regions of the state. These low-speed vehicles traveling on the roadway proper or on the shoulder introduces some hazards which are magnified because of the frailty of the horse drawn vehicles and the vulnerability of the occupants and the horse. In view of the potential for injury, HORSE DRAWN VEHICLE (W11-12) signs *should* be installed at locations which satisfy the following conditions:

1. The usage of the segment of the state trunk highway by horse drawn vehicles is on a frequent or recurring basis.
2. To the satisfaction of the region, the farmer(s) are using the state trunk highway only where other routes are not available or otherwise not safe or attractive. The Region *should* get input from the local highway and law enforcement officials and *should* make an effort to try and convince the religious sects to drive their horse drawn vehicles on the shoulder and not in the travel lane.
3. The Region *should* consider the shoulder width and configuration (i.e. rumble strips, etc.) and sight distance of the roadway in their decision on whether to sign the roadway.

Each segment being used *should* be identified by the Region and/or County Highway Safety Committee and HORSE DRAWN VEHICLE signs **shall** be posted at the beginning of the segment. The Region has the option of adding the NEXT XX MILES (W57-5 1) sign to the HORSE DRAWN VEHICLE sign. The HORSE DRAWN VEHICLE sign **shall** be placed after every major intersection, such as a STH or CTH intersection.

The Region *should* be alert for discontinuance of usage and remove the signs under that condition.

2-3-51 Pedestrian Crossing Warning Signs — August 2013

PURPOSE

The MUTCD provides general guidance for the installation of pedestrian related warning signs. These signs are considered to be the W11-2 (pedestrian crossing sign), W11-9 (wheelchair crossing sign) and the S1-1 (school crossing sign assembly).

There are some standards and guidance contained in the May 25, 2011 MUTCD. However, there are several undocumented state practices involving the application of these types of signs. There is a need to encompass the guidance and standards from all of these resources into a single document that will be able to assist the practitioner and provide for a consistent statewide application.

POLICY

Pedestrian Crossing Signs

1. Pedestrian crossing signs *should* be used where there are higher volumes of pedestrian activity and at mid-block crossings where crossings are unexpected or the visibility distance, as defined in MUTCD section 2C.46 is deficient. Pedestrian crossings signs *may* be used at unsignalized and non-stop control intersections.

2. The Pedestrian Crossing Sign with AHEAD plaque (W16-9P) *may* be used in sight deficient areas where pedestrians walk along the edge of the roadway.
3. Crosswalk Locations
    a. A Pedestrian Crossing Sign *may* be installed in locations without a crosswalk.
    b. On state highways, crosswalks are maintained by the local unit of government by permit (DT 2136 form).
    c. A crosswalk *may* be installed without a pedestrian crossing sign for roadways with posted speeds of 40 mph or less.
    d. For roadways with posted speeds of 45 mph or higher, new marked crosswalks alone, without other measures to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, *should not* be installed across uncontrolled roadways (see MUTCD, Section 3B.19, paragraph 09).
4. Pedestrian Crossing Signs located on WisDOT maintained roadways, **shall** be installed and maintained by WisDOT.
5. Pedestrian Crossing Signs **shall not** be utilized at a signalized or stop controlled intersection. The Wheelchair Crossing Sign *may* be used at a signalized or stop controlled intersection.
6. Pedestrian Crossing Signs *may* be used at an unsignalized right turn bypass. Another option at an unsignalized right turn bypass is to utilize the Yield Here to Pedestrians (R1-5 sign) at the crosswalk location.
7. The Pedestrian Crossing Sign (W11-2) and arrow plaque (W16-7L/R) **shall** be placed at the point of crossing.
8. For roadways with posted speeds of 45 mph or greater, the Pedestrian Crossing Sign (W11-2) with ahead plaque (W16-9P) **shall** be installed in advance of the crossing.
9. For multiple pedestrian crossings that are close together on roadways with posted speeds that are lower than 45 mph, the Pedestrian Crossing Sign (W11-2) with ahead plaque (W16-9P) *may* be used in lieu of signs at the point of crossing.
10. The W11-15 or W11-15a, Recreational Trail Crossing sign **shall** follow the parameters listed above similar to the W11-2 Pedestrian Crossing Sign.
11. The W11-9 Wheelchair Crossing Sign **shall** follow the parameters listed above similar to the W11-2 Pedestrian Crossing Sign, with the exception that it *may* be used at signalized and stop controlled intersections.

School Crossing Signs

1. School Crossing Signs *may* be used at signalized controlled intersections.
2. Regardless of posted speed, the School Crossing Assembly (S1-1 sign with WF16-7L/R plaque) **shall** be installed at every crossing. If two crossings are at one intersection (far side and near side), both crossings do not need to be signed.
3. For multiple School Crossings, the advance warning sign is not required in advance of every crossing.
4. Engineering Judgment should be utilized to determine if the advance sign is required in advance of each crossing in a series.
5. For placement of School Crossing signs, refer to TEOpS 2-3-54.

2-3-54 School Area Signing — March 2011

PURPOSE

The MUTCD has expanded the usage of signing for school areas. This policy will summarize the standards and guidance contained in Part 7 of the MUTCD and will address three specific applications of School Area signing on the state highway system. This policy pertains to signing on conventional highways and expressways.

BACKGROUND

Part 7 of the MUTCD and Wisconsin State Statute 118.08 provide support for the guidelines listed in this policy.

POLICY FOR SCHOOL AREA SIGNING

The installation of School Area signing on the State Highway System can be addressed with three different types of applications:

1. School Zone Signing. School Zones are school areas that would include buildings and/or grounds that border the roadway, but would have no specific crossing. The grounds may or may not have fencing.

"School grounds" refers to public and private schools and their surrounding grounds where any of grades K through 12 are regularly taught during the normal school year.

a. The S1-1 School Warning sign **shall** be installed in advance of the school grounds at the prescribed warning sign distance outlined in MUTCD Table 2C-4.

b. The supplemental WF16-9P AHEAD plaque **shall** be installed under the S1-1 School Warning sign.

c. The R2-6P FINES HIGHER plaque **shall** be installed under the School Zone assembly (S1-1 Sign with WF16-9P plaque).

d. The END SCHOOL ZONE (S5-2 Sign) **shall** be installed at the end of all school zones and areas. If there is a regulatory speed limit at the end of the school zone or area, the END SCHOOL ZONE (S5-2) sign should be mounted under the R2-1 sign. The mounting height of the END SCHOOL ZONE sign mounted under a speed limit sign should be 4' to the bottom of the secondary sign or 5' to the bottom of the lowest plaque in urban areas where there are pedestrians or parked cars.

2. School Advance Crossing Signing. The School Advance Crossing Signing is used to warn motorists that they are approaching a crossing where school children are present. The crossing may be in the same roadway where the school is located or may be on a neighboring roadway, based on the school's master plan of the school routes.

    a. The S1-1 School Warning sign **shall** be installed in advance of the school grounds at the prescribed warning sign distance outlined in MUTCD Table 2C-4.

    b. The supplemental WF16-9P AHEAD plaque **shall** be installed under the S1-1 School Warning sign.

    c. The R2-6P FINES HIGHER plaque **shall** be installed under the School Zone assembly (S1-1 Sign with WF16-9P plaque). The mounting height should be 4' to the bottom of the lowest plaque or 5' to the bottom of the lowest plaque in urban areas where there are pedestrians or parked cars.

    d. If the school crossing is located on a cross street in close proximity to the turning motorist, the WF16-6P Advance Direction Arrow should be used in lieu of the WF16-9P AHEAD plaque.

3. School Crossing Signing. The School Crossing signing is used at the location where the school children cross the roadway. Crosswalk marking is required whenever school crossing signs are used per the MUTCD. Crossing locations are established based on the school's route master plan as shown in the MUTCD, Section 7A.02.

    a. The S1-1 School Warning sign **shall** be installed at the crossing location.

    b. The WF16-7L/R Diagonal down arrow warning sign **shall** be installed under the S1-1 School Warning sign.

If the school crossing is located on the same roadway as the school property, then the school advance assembly can function in a dual purpose as the advanced sign for the school bordering the roadway and the advance sign for the school crossing. The school advanced sign does not need to be duplicated for this situation (See Figures 2 and 3).

POLICY FOR ADDITIONAL SIGNING FOR SCHOOL AREAS

Listed below are other signs covered in the MUTCD, Part 7, that are installed on the state highway system.

1. School Bus Stop Ahead (S3-1) Sign
    a. The word message SCHOOL BUS STOP AHEAD (S3-1 signs) shall no longer be used. The new sign is a School Bus / Children symbol that is fluorescent yellow green in color and is still the S3-1 sign code. The existing SCHOOL BUS STOP AHEAD word message signs in the field shall be replaced with the new symbol signs by no later than December 31, 2015.
    b. In order to determine if a School Bus Stop *qualifies* for a sign, the Minimum Visibility Distance table in MUTCD Section 2C.36 *should* be used.
    c. If a School Bus Stop qualifies for a sign (based on the Minimum Visibility Distance outlined above), MUTCD Table 2C-4 **shall** be used to determine field placement of the sign(s).
2. Reduced School Speed Limit Ahead (S4-5 Sign).
    a. A Reduced School Speed Limit Ahead Sign (S4-5) **shall** be installed for reductions of 15 mph or more.
    b. The distance table in TEOpS 2-3-30 should be used in determining the placement distance of

the Reduced School Speed Limit Ahead Sign (S4-5) from the School Speed Limit (S4-51 Sign).

3. School Speed Limit (S4-51 Sign).
    a. Wisconsin State Statute 346.57 places a Statutory Fixed Speed Limit of 15 mph on school crossings when children are present and the crossing is properly signed. Wisconsin State Statute 349.11 allows the Department of Local units of government the authority to modify this speed restriction on their respective maintained roadways. WisDOT recommends that the school speed limit be 10 mph less than the speed limit of the roadway. The School Speed Limit (S4-51 Sign) **shall** be installed at all school areas and crossings where the speed restriction is modified.
    b. For school areas and crossings, the School Speed Limit (S4-51 Sign) should be installed in areas that are urban or have school children walking/crossing within the right-of-way.
    c. For school areas and crossings in fringe or rural areas, the School Speed Limit (S4-51 Sign) *may* be installed. However, the signs are generally not installed in these areas, unless school children are walking or crossing within the right-of-way. If the signs are installed in these areas, they should be 10 mph less than the posted speed limit of the roadway.
4. Flashing Beacons.
    a. The local unit of government *may* be allowed by permit to install a flashing beacon on one of the school area signs in each direction of roadway travel. RRFB's (Rectangular rapid flash beacons) may be allowed by permit on the school crossing sign assembly (S1-1 and WF16-7L/R) only, since this would be the location of the physical crossing. Policy criteria for flashing beacon usage is covered in TEOpS 4-5-1 and the application/permit form (DT 1877 form).

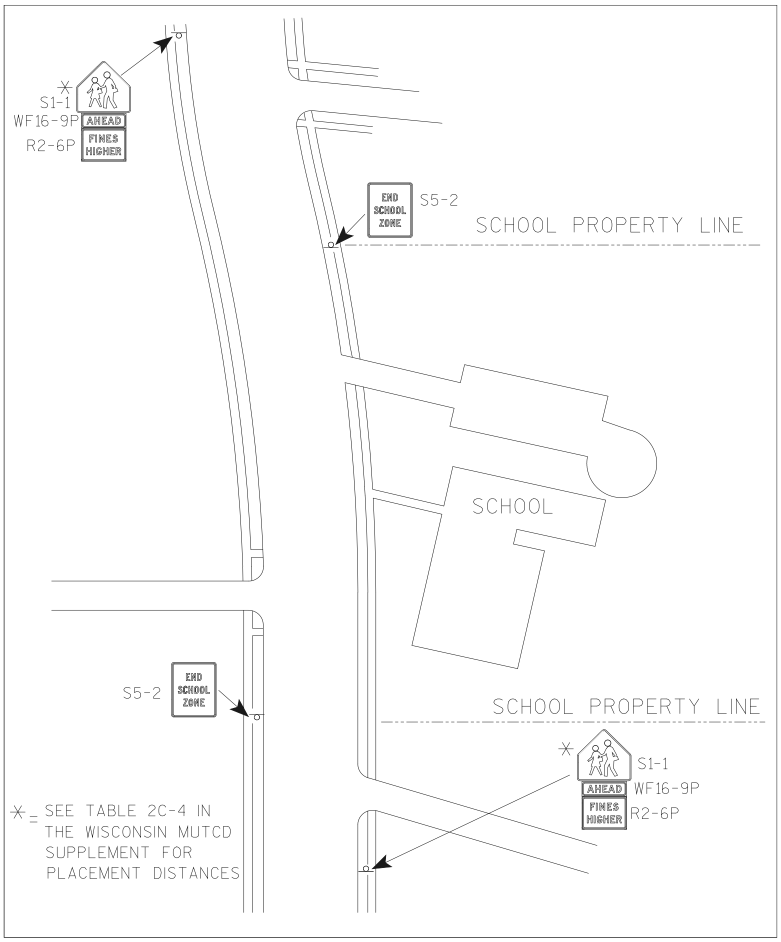


FIG. 1 RURAL SCHOOL WITHOUT CROSSING

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

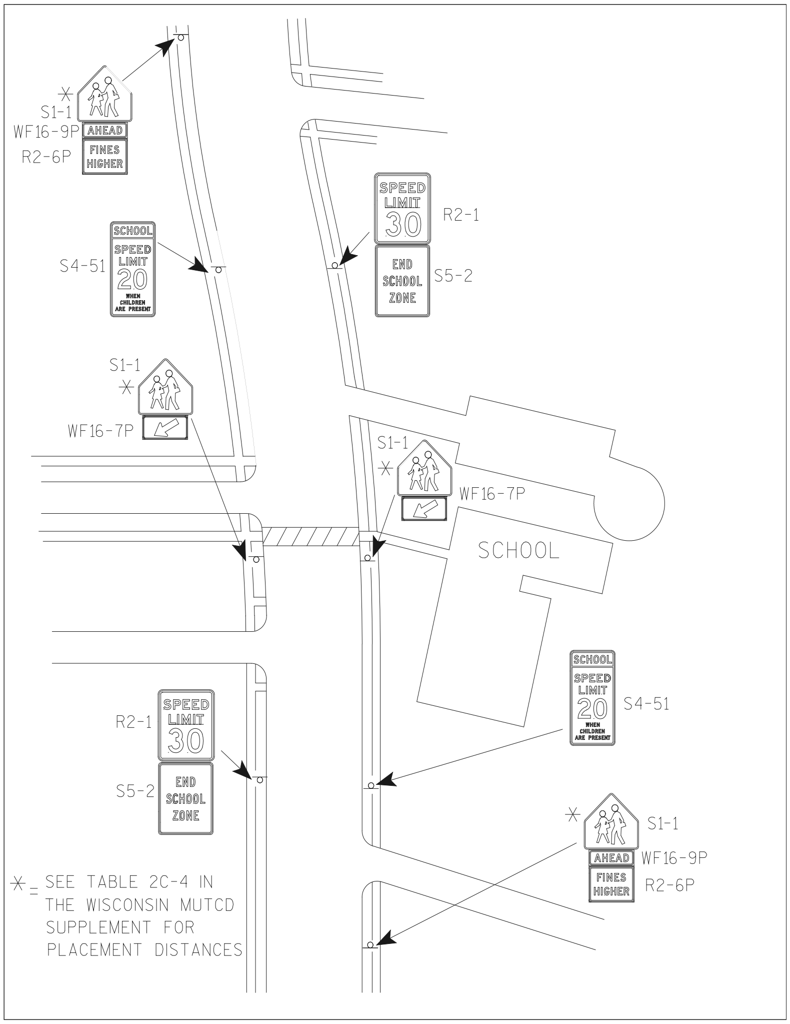


FIG. 2 URBAN SCHOOL CROSSING (WITHOUT REDUCED SCHOOL SPEED ZONE SIGNS)

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

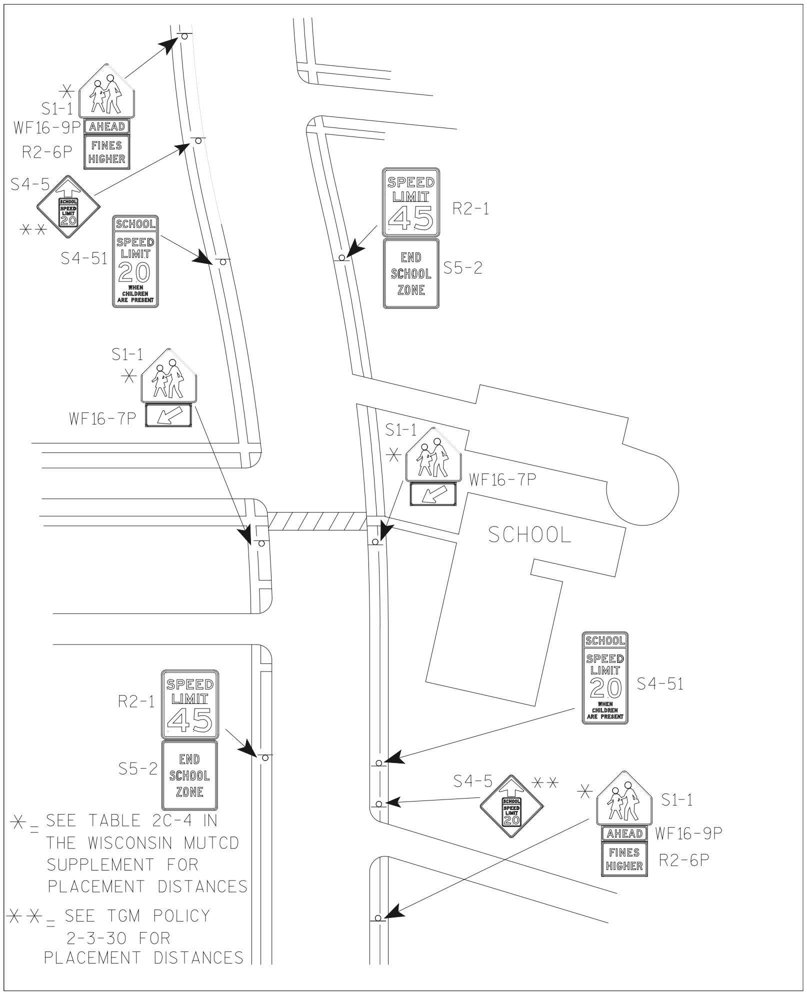


FIG. 3 URBAN SCHOOL CROSSING (WITH REDUCED SCHOOL SPEED ZONE SIGNS)

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

2-3-55 School Bus Stops on 65 mph Expressway — December 2013

PURPOSE

The MUTCD Section 7B-13 states that school bus stop signs are not intended to be used at every school bus stop location. It *should* be used where terrain and roadway features limit the approach sight distance and where there is no opportunity to relocate the stop to another location with adequate visibility. However, with the expanding usage of 65 mph multilane expressways, there is a natural safety concern about school buses stopping on these routes. This concern stems from the fact that motorists typically do not expect to encounter school buses stopping on 65 mph highways and also because of the higher operating speeds of traffic. Therefore, inadequate sight distance is not exclusively a factor. As a result, the accident potential on 65 mph expressways between school buses and other vehicles is increased. The purpose of this policy is to provide a consistent statewide policy on the signing of school bus stops on 65 mph expressways. **This policy only applies to expressways having 65 mile per hour speed limits and having school bus traffic either on or beside the expressway.**

DEFINITIONS

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections. This definition of expressway includes both designated and nondesignated expressways.

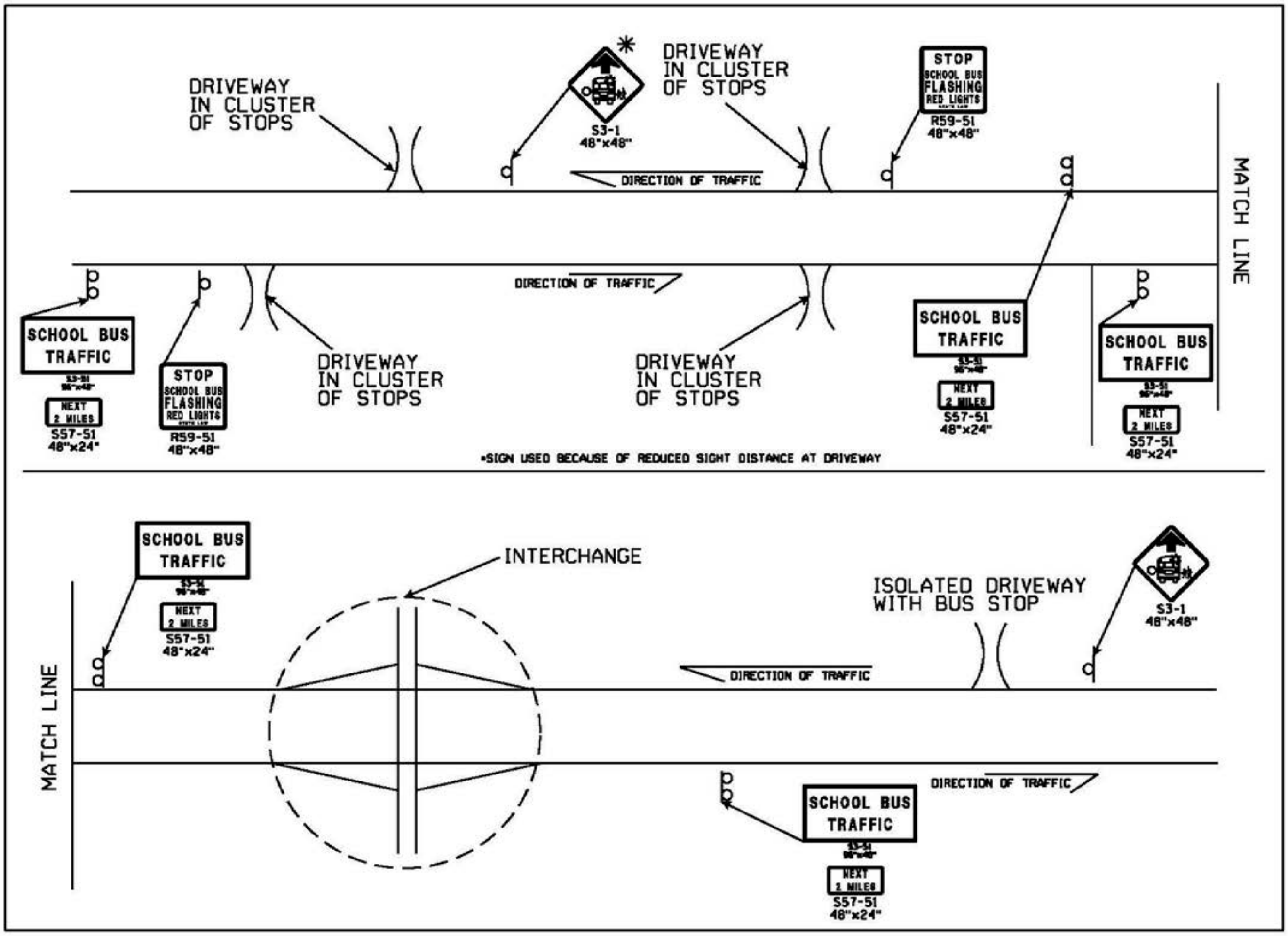
POLICY AND INSTALLATION GUIDELINES

For the application of this policy, the Region is encouraged to obtain a school bus route map or other information supplied by the school district to identify locations of the stops. The Region *should* contact school Districts each year as to where stops are no longer made so the signing can be adjusted accordingly, or where new stops are made. The Region *may* convey to the school officials that signs will be removed unless this information is provided. If the Region is not aware of stops, or the expectation of stops, the school bus stop signs will not be installed.

A map is provided by the Wisconsin Department of Public Instruction that shows all of the school district boundaries in the state. To order a copy of this map, the telephone number is 1-800-243-8782.

1. The "SCHOOL BUS TRAFFIC" (S3-51) sign, when required, *should* be placed on the right side of the roadway at the beginning of the segment of the expressway that includes the stops or driveways with potential stops. This sign is not intended to be used for isolated stops (see item #4 for isolated school bus stop signing). This sign **shall** be supplemented with the "NEXT __ MILES" (S57-51) sign. For this sign, the Region *may* permit the school district the option of supplementing it with one or two flashing yellow beacons mounted directly above the sign. The beacons **shall** be activated by 365 day timers to accurately define the periods of school bus activity. The school district will be solely responsible for the installation, operation and maintenance of the flashing beacons. All existing flashing beacons that have been installed, operated and maintained by the Regions can continue to be operated and maintained by the Regions.
2. The "STOP FOR SCHOOL BUS FLASHING RED LIGHTS STATE LAW" (R59-51) sign *should* be used at the beginning of the segment of the expressway that includes the stops or driveways with potential stops. This sign *should* be erected after the "SCHOOL BUS TRAFFIC" (S3-51) sign outlined in item 1 above.
3. The "SCHOOL BUS TRAFFIC" (S3-51) sign *should* be repeated after every interchange and *may* be repeated after every State Trunk Highway, County Trunk Highway or after higher volume local road intersections. These signs **shall** be placed on the right side of the roadway only. Higher volume local road intersections are those serving retail shopping, commercial activity, recreational activity or other activities with high concentrations of entering/leaving traffic or heavy slow moving vehicle traffic. The S3-51 sign would not be installed after at-grade intersections of lower volume local roads that are dead ends or only serve individual property owners. The "NEXT __ MILES" (S57-51) sign **shall** be used with these signs.
4. For individual school bus stops, within a cluster or isolated stops, the Region has the option of using the "SCHOOL BUS STOP AHEAD" (S3-1) warning sign at those selected stops. Criteria for this usage could be reduced sight distance, heavy volume of trucks, etc. The minimum site distance criteria for this facility is 720 feet, per the minimum visibility distance table for warning signs in the MUTCD 2C-36. If the Region elects to use these signs at selected stops, they *should* be placed a suggested minimum of 1000 feet in advance of the stop per the MUTCD 2C-05. Flags and double marking of these signs are also optional.

Figure 1.



2-3-60 Children at Play Signs — May 2011

GENERAL

Section 2C.03 of the MUTCD allows for the development of customized word messages on warning signs. These customized word messages *may* be developed to fulfill signing needs based on engineering study or engineering judgment. However, Section 2C.02 of the MUTCD states that the usage of warning signs *should* be kept to a minimum, as the unnecessary use of warning signs tends to breed disrespect for all signs. The over usage of signs *may* result in information overload for the motorist, which can impact safety.

BACKGROUND

Periodically, the Department receives requests to install the following types of Child Crossing Signs:

Children at Play

Watch For Children

Slow Children

Usage of these types of signs has been discouraged by the Federal Highway Administration, Institute of Transportation Engineers, and many other States and Local Units of government for the following reasons:

1. Signs lose credibility with motorists when they appear too often.
2. Warning signs are most effective when they warn of consistent, not occasional conditions. Children are not likely to be consistently playing at a particular location in the street at all times (unlike at playgrounds or parks).

   As a result, the signs mentioned above could lose their effectiveness.

3. These signs provide parents and children with a false sense of security that their children are safe when playing in or near the street.
4. Some before and after studies have indicated no reductions in vehicle speeds or crashes with the signs present.
5. Because these signs are typically warning signs, they are not enforceable.
6. In lieu of signing, more effective countermeasures *may* be employed to increase motorist visibility on the roadway. Some of these countermeasures could include:
   a. Restricting parking or trimming vegetation to increase sight distance.
   b. Education and awareness efforts.
   c. Installation of traffic calming devices for urban low-speed areas.

POLICY FOR CHILD CROSSING SIGNS

1. No new Child Crossing Signs **shall** be installed on State Highways.
2. Existing Child Crossing Signs on State Highways *may* be allowed to remain until the end of their useful life. Other opportunities such as knockdown damage, improvement projects or change in conditions *may* make it possible to have the signs removed earlier.

2-3-64 Type I Object Markers under Keep Right Signs — December 2011

GENERAL AND BACKGROUND

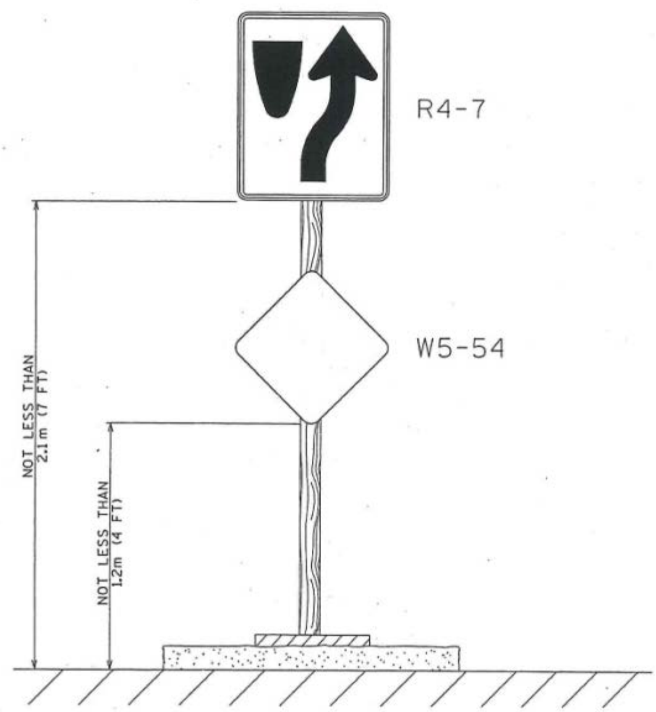
The MUTCD, Section 2C-64 allows the usage of a Type I Object Marker (W5-54 sign) to emphasize the approach end of a median island. This can give the median island additional visibility during nighttime, poor weather conditions or situations where the pavement markings or curb and gutter is covered by snow. The Object Marker can be especially helpful in higher speed areas (45 mph and above) and areas where medians start. Typically, many of these areas *may* have a Keep Right (R4-7) sign installed. An advantage of installing a secondary object marker (W5-54 sign) below the Keep Right will allow for increased visibility of the approach end of the median because the Object Marker (W5-54 sign) is mounted at 4 feet, which is more in the line of sight for a motorist. The Object Marker (W5-54 sign) is manufactured with fluorescent yellow sheeting, so it will reflect well at night and have better daytime conspicuity as well.

POLICY

1. The W5-54 sign **shall** be placed below the Keep Right (R4-7 sign) at all 45 mph or higher posted speed limits where the highway transitions from an undivided to divided roadway (See Standard Detail Drawing 15C21-3).
2. The W5-54 sign *should* be placed below the Keep Right (R4-7 sign) at the first median in a series of medians, where the posted speed in 45 mph or higher.
3. The W5-54 sign *may* be used (with or without the R4-7 sign) to emphasize approach ends of median islands for other areas that have exhibited problems with limited visibility or vehicle impacts.
4. The mounting height of the W5-54 sign **shall not** be less than 4 feet (see Figure 1).
5. The W5-54 sign *may* be placed on the back side of the post for the Keep Right (R4-7 sign), where additional emphasis is needed (typically areas with no curb and gutter). The W5-54 signs *should* be mounted back-to-back at the same mounting height.

IMPLEMENTATION

There is no formal phase-in period for installation of this signing. Signing field revisions *may* be accomplished through improvement projects or through the TMA process as Keep Right signs are routinely replaced. Signs *may* also be installed through the TMA process to address problem areas.



2-3-65 Rumble Strip Signing ~~January 2013~~January 2018

GENERAL

In an effort to reduce run off the road and head-on collisions, the Department has implemented the usage of continuous rumble strips on rural two-lane roadways, in accordance with FDM 11-15-1. The rumble strips wil be installed on the centerline location and the edgeline locations. The centerline and/or edgeline marking can either be applied within the rumble strip or to the side of the rumble strip.

The usage of centerline and shoulder rumble strips has proven to be quite effective since they were installed on STH 142, Kenosha County in 2006 as a test location. A 2005 NCHRP Report (Synthesis 339) has shown several states where crashes were reduced as a result of centerline rumble strips. However, the NCHRP report did indicate some potential concerns with the application of the centerline rumble strips. Motorists are not normally accustomed to continuous rumbles, especially on the centerline. There is the concern that upon running over a centerline rumble, a motorist could “react to the left” and thus move to the left of the centerline. There are also concerns from ambulance drivers that the driving over a centerline rumble would potentially cause monitors to malfunction.

Because the centerline rumbles are more unexpected to the motorist than edgeline rumbles, and in response to the concerns outlined above from the NCHRP report, WisDOT previously installed~~will install~~ the Centerline Rumble Strip (W8-70 sign) on roadway segments having the centerline rumbles as an interim measure to assist in the education of motorists. Since that time,~~Over time as~~ additional rural two-lane roadway segments have received centerline rumble strips, and motorists ~~will~~ have become more accustomed to them. Therefore, these signs are no longer necessary~~and warning signs will no longer be necessary~~.

The policy below will address the installation of centerline rumble strip warning signs on WisDOT maintained roadways.

POLICY

~~For current centerline rumble strip projects (let prior to December 2013)~~

1. ~~The Centerline Rumble Strip (W8-70 sign) shall be placed at the beginning of the centerline rumble strips with a supplemental mileage plaque (W57-51 sign).~~

2. ~~The Centerline Rumble Strip (W8-70 sign) should be placed after major sideroads (STH and CTH intersections) with the mileage plaque (W57-51 sign).~~
3. ~~The distance between the Centerline Rumble Strip (W8-70) warning signs should be no more than 5 miles.~~

~~For centerline rumble strip projects (let date of December 2013 and after)~~

1. The Centerline Rumble Strip (W8-70 sign) with a supplemental mileage plaque (W57-51 sign) shall not be installed.
2. Centerline Rumble Strip (W8-70 sign) with a mileage plaque (W57-51 sign) that have previously been installed on projects will be allowed to remain until the end of their useful life or when opportunities arise such as knockdown or damage or projects make removal practical.

2-3-70 Low Flying Plan Sign — November 2016

GENERAL AND BACKGROUND

Federal Aviation Regulations require aircraft, except when necessary for takeoff and landing, to maintain a minimum altitude of 1000’ in congested areas, and 500’ in other-than congested areas. Exceptions are also granted for certain restricted category aircraft, such as crop-dusting airplanes. These exceptions may cause airplanes to fly at a low altitude over the roadway, causing potential hazard or concern for motorists.

In the past, various signs have been installed to alert motorists to these low-flying aircraft. This policy will clarify when these signs *may* be installed, and establish a statewide standard sign for these locations.

POLICY

Low flying plane warning signs *may* be installed at locations where planes regularly fly at altitudes below 500’ over or in the immediate vicinity of the roadway. Examples of these locations include airports with runways adjacent to the highway and fields with regular crop-dusting activities. FAA and Bureau of Aeronautics comments *may* also be taken into consideration.

Standard sign plate W11-57 has been developed for use at these locations. This sign *should* be installed per Condition B: Deceleration to the listed advisory speed (0 mph) in Table 2C.4 of the MUTCD. No sign is necessary at the crossing itself.

IMPLEMENTATION

There is no formal phase-in period for installation of this signing. Existing signs will be allowed to remain in place until the end of their useful life. Useful life ends when the sign message no longer meets legibility or condition standards. Existing signs *may* be replaced prior to the end of their useful life when opportunities arise such as knockdown or damage, when other work is occurring nearby, or when projects make replacement practical.

2-4-19.1 Business Route Marking — April 1997

The Business Route Marker is an auxiliary marker used to identify Business Routes which have been established pursuant to either Section 84.02(4) or 84.02(6) of the Statutes. The latter section terms them Alternate Routes, but they **shall** be signed as Business Routes.

Business route establishment begins with a locally initiated request to the Regional office. The Region **shall** require that the request come from a municipal official or body of the local community, not an association or chamber of commerce, etc. The Region **shall** request information on the appropriateness of the route, the unity of community regarding the location and service provided, the structural and geometric adequacy of the route, the adequacy of the traffic control, and such other factors as *may* be pertinent.

If the Region office finds the establishment to be in the interests of the motoring public it **shall** make a favorable recommendation to the State Traffic Engineer, who **shall** have the authority for approval.

When the approved route falls completely upon the existing state trunk highway and connecting highway system the Department will initially install and subsequently maintain all route marking.

When all or any portion of the approved route is on local streets or highways, including county trunk highways, the Department will agree to install the initial markers, but subsequent maintenance of the markers will be the responsibility of the community. The Department will however maintain those markers at the beginnings of the route which face traffic on the regular state trunk highway route.

Failure of the city or village to properly maintain the signs or to comply with other conditions of the approval will be cause for the Department to withdraw approval and remove the signs. Regional offices will be responsible for periodically inspecting the condition of all signs to ensure that they are kept in good condition.

If a business route is proposed related to a U.S. Highway designation the route has to have the approval of AASHTO. Please contact the central office Bureau of Traffic Operations for instructions regarding this approval.

2-4-33 Trailblazer Assemblies — April 1997

It *may* be desirable to provide trailblazing at key locations to enable unfamiliar motorists to find their way to certain major state trunk highways, particularly freeways. The Regions *should* analyze these needs and install or authorize the necessary signing. It is recommended that the trailblazing needs be discussed with the local officials and agreement reached as to the need for signing, the amount of signing and the details of locating and installing the signs. The Department *may* erect and maintain necessary signs on the STH system and on connecting highways, and *may* sell the signs to the local authority for installation on local streets. Locations on local streets *should* have Department approval. The Region is expected to inspect the signing periodically, regardless of who maintains it, and work out arrangements for correcting any deficiencies.

2-4-40 Historical Marker Guide Signs — ~~April 1999~~January 2018

GENERAL

All historical markers which have been approved by the State Historical Marker Committee and marked by the State Historical Society **shall** be signed in accordance with these guidelines.

1. Marker Adjacent to Any Highway. HISTORICAL MARKER ½ MILE (D5-63) signs, as appropriate, *should* be erected approximately one-half mile in advance of the marker. Distances other than ½ mile *may* be substituted where site conditions prevent using the distance of ½ mile. HISTORICAL MARKER (LEFT, OR RIGHT ARROW) (D5-64) signs **shall** be erected at the entrance to the marker.

   A wayside with a historical marker *should* have a HISTORICAL MARKER (DB569E) sign installed below the WAYSIDE signs.

2. Marker Remote from the State Trunk Highway System. The historical marker must be located not more than 2 miles from the state trunk highway. The point where traffic must leave the state trunk highway to get to the marker **shall** be a route giving access to the marker by the most direct route. ~~A ROAD TO HISTORICAL MARKER 1/2 MILE (D5-63A) sign would be installed on the state trunk highway.~~

> ~~Distances other than 1/2 mile *may* be substituted where site conditions prevent using the distance of 1/2 mile. At the intersection a~~A HISTORICAL MARKER (LEFT OR RIGHT ARROW) sign would be installed in advance of the appropriate intersecting roadway (See TEOpS 2-4-41). Signing for both directions of traffic *may* be provided at one location or signing *may* be provided for one direction of traffic at one location and for the other direction at another location. In either case, only a maximum of 4 signs per each marker *may* be erected on the state trunk highway. No signing *may* be used to direct traffic from one state trunk highway to a historical marker on another state trunk highway Route. The sign~~s ROAD TO HISTORICAL MARKER 1/2 MILE and~~ HISTORICAL MARKER (LEFT OR RIGHT ARROW), **shall not** be placed until the required signing (Paragraph 1) on the local road has been installed by the maintaining authority.

All signs on the state trunk highway are furnished, erected and maintained by the Wisconsin Department of Transportation and all signs located on connecting streets or local streets are the responsibility of the maintaining authority.

2-4-41 Advance Supplemental Guide Signs — November 2016

PURPOSE

The Department places signs to various traffic generating facilities on the state highway system. In the past, several of these facilities have been signed with advance guide signs (…½ Mile or Road To…½ Mile) located ¼ to 1 mile in advance of the required turn, and directional guide signs (Name of Facility with arrow) located 0-1000' from the turn. This practice has been inconsistent across the state. This policy will clarify when to install advance guide signs, and where both advance and directional guide signs *should* be located. This policy will not define which facilities *may* be signed for. Refer to TEOpS 2-15-3 for further information.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

Conventional Highways are defined as either divided or undivided roadway facilities that have no control of access with grade separations at intersections. These highways can be two lane or multilane facilities.

Traffic Generators are defined as any facility, activity, or special point of interest which attracts large numbers of people, the majority of whom are unfamiliar with the local area and/or access route.

POLICY

Facilities Adjacent to Any Highway

These facilities have a driveway directly off of a State or US Highway. These facilities *may* be located on conventional highways or expressways. Facilities adjacent to a highway that qualify for traffic signage are typically publicly owned and operated locations serving the motoring public. Examples of these facilities include Waysides and Historical Markers.

Advance guide signs for qualifying facilities *should* be installed approximately one-half mile in advance of the driveway. Other distances *may* be substituted where site conditions prevent using the distance of ½ mile.

Directional guide signs **shall** be installed at the entrance to the facility.

Facilities Remote from the State Trunk Highway System

These facilities do not have driveways on a State or US Highway; therefore, the motorist would be required to turn off of the highway onto a county or local road to access the facility. Many types of facilities *may* qualify for this type of signing.

Advance guide signs (Road To…1/2 Mile) *should not* be installed for these facilities.

Directional guide signs for qualifying facilities *should* be installed approximately 500' in advance of the appropriate intersecting roadway. This distance *may* be adjusted based on field conditions, but *should not* be less than 200' in rural areas or 100' in urban areas. A word message (Next Right, Second Left, etc) *may* be used in place of an arrow where necessary.

IMPLEMENTATION

There is no formal phase-in period for installation of this signing. Existing signs will be allowed to remain in place until the end of their useful life. Useful life ends when the sign message no longer meets legibility or condition standards. Existing signs *may* be replaced prior to the end of their useful life when opportunities arise such as knockdown or damage, when other work is occurring nearby, or when projects make replacement practical.

2-4-44 Conventional Roads on Approaches to Interchanges — July 2012

BACKGROUND AND PURPOSE

The MUTCD Section 2D-45 states that guide signing **shall** be utilized for multi-lane conventional roads approaching an interchange. The guide signs **shall** incorporate the destination, route shield and cardinal direction arrow.

“Enhanced” guide signs that incorporate the destination, route shield and cardinal direction arrow are referred to as Entrance Direction signs in the MUTCD. However, it *should* be noted that the MUTCD does not require the usage of Entrance Direction signs at all multi-lane conventional roads approaching an interchange. Entrance Direction signs can get quite large and costly to install and maintain. This *may* be especially true if there are right-of-way restrictions that require the usage of overhead guide signs.

However, there are applications on certain interchange crossroads where the enhanced type of Entrance Direction signs are valuable, specifically for arterial interchange crossroads with higher traffic volumes. Guide signing for collector/distributor types of interchange crossroads can, in most cases, be accomplished by traditional means with independent route assemblies (J-series) and destination/direction (D1-series) signs.

This policy will differentiate between the different types of guide signing for interchange crossroads (both single and multi-lane) and provide guidance as to the types of guide signing that *should* be used.

DEFINITIONS

Arterial interchange crossroads are defined as roadways used primarily by through traffic, usually on a continuous route or a highway designated as part of an arterial system.

Collector/distributor interchange crossroads are defined as roadways that in rural areas connect small towns and local highways to arterials highways and in urban area provides land access and traffic circulation within residential, commercial, and business areas and connects local highways to the arterial highways.

POLICY

Single-lane Crossroad Approaches to Interchange (See Figure 1)

1. Traditional route assemblies (J-series) *should* be used.
2. Destination/Direction signs (D1-series) *should* be used.

Multi-lane **Arterial** Crossroad Approach to Interchange (See Figure 2)

1. The junction assembly (J1-series) *should* be the first sign used in the series.
2. The advanced Entrance Direction (D1-72 sign) *should* follow the junction assembly.
3. The Entrance Direction sign (D1-71) *should* be used to designate the direction of travel (left, right or ahead).
4. An advance left turn assembly (J2-series) *should* be used to provide guidance for the second ramp. The primary location of the advance left turn assembly *should* be in the median. The advance left turn assembly *may* be placed on the right side as an optional location.
5. An Entrance Direction sign (D1-70) *should* be used to provide guidance for the second ramp.

Multi-lane **Collector/Distributor** Crossroad Approach to Interchange (See Figure 3)

1. The junction assembly (J1-series) *should* be the first sign used in the series.
2. Advanced route assemblies (J2-series) *should* follow the junction assembly. The left movement *may* utilize an up arrow or the word USE LEFT LANE. The left lane portion of the advanced route assembly

may be mounted in the median.

3. The traditional destination/direction sign (D1-series) *should* be used to designate the destination and direction of travel.
4. A route turn assembly (J3-series) *should* be installed for the first ramp.
5. An advance left turn assembly (J2-series) *should* be used to provide guidance for the second ramp. The primary location of the advance left turn assembly *should* be in the median. The advance left turn assembly *may* be placed on the right side as an optional location.
6. A route turn assembly (J3-series) *should* be installed for the second ramp.

Overhead Signing Options for Multi-lane Arteria Crossroad Approach to Interchange (See Figures 4-5)

Overhead guide signs *may* be used in lieu of the ground mounted Entrance Direction signs for some multi-lane arterial crossroad approaches to interchanges. Qualifying factors for overhead guide signs would be limited right-of-way that would prohibit the installation of ground mounted guide signs, high traffic volumes, dual/triple left turn lanes and look-ahead mandatory left-turn lanes.

IMPLEMENTATION

FHWA has mandated a compliance date of December 31, 2019 for completion of these signing revisions. Signing field revisions *should* be accomplished through improvement projects as much as possible. The TMA process *may* also be used to revise signing, if the sign revisions are feasible (do not require the installation of Type I or overhead guide signs).

FIG. 1 SINGLE-LANE GUIDE SIGNING AT INTERCHANGE.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

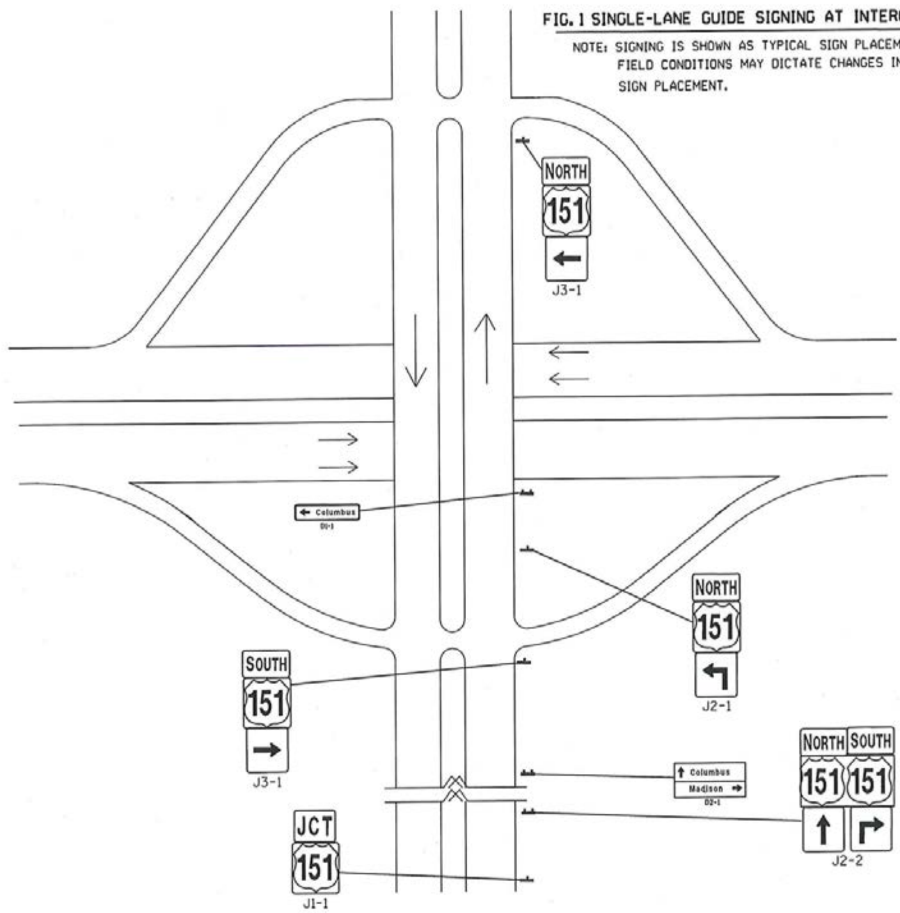


FIG. 2 MULTI-LANE CROSS-ROAD GUIDE SIGNING AT INTERCHANGE.
(ARTERIAL CROSSROAD)

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

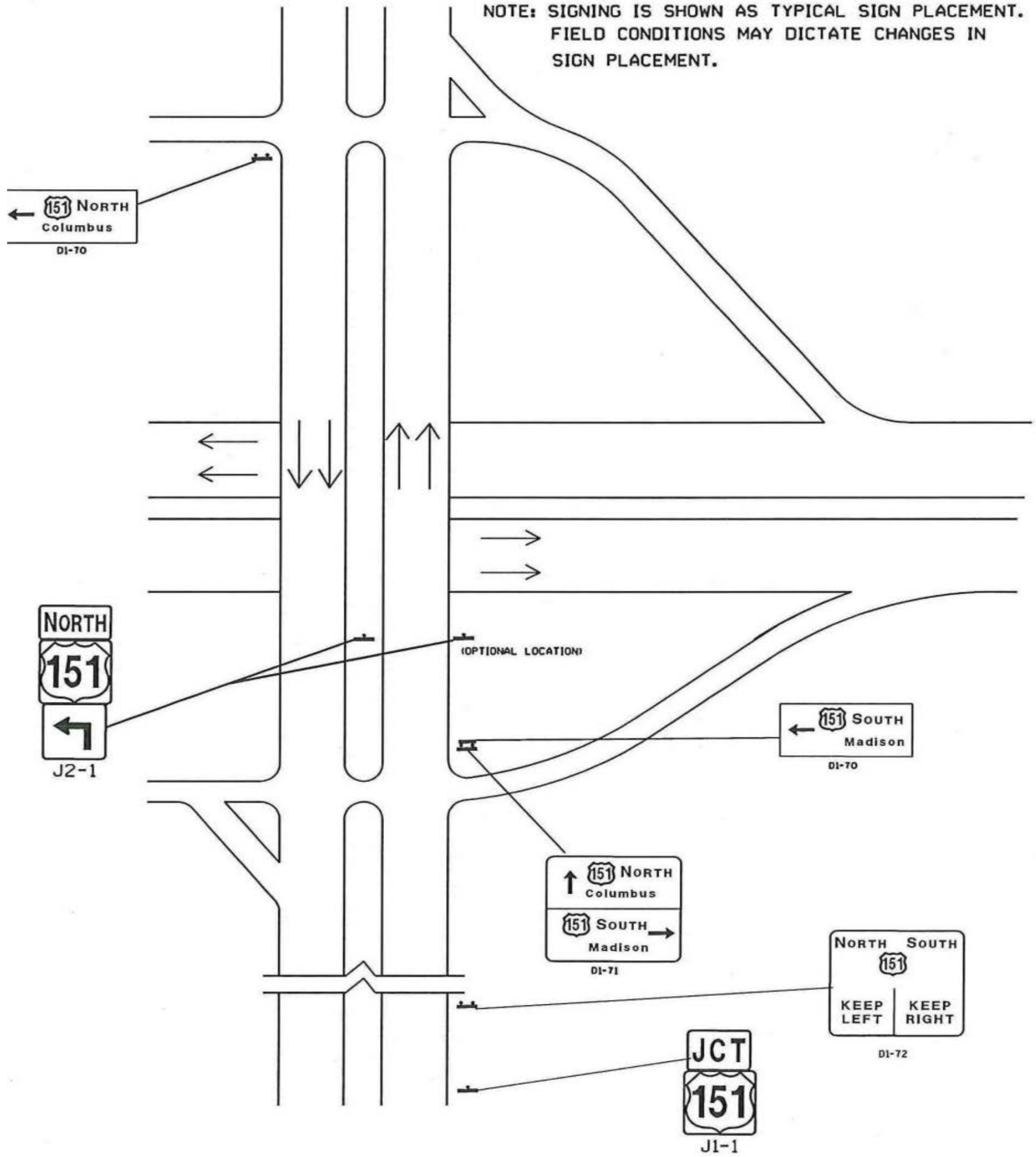


FIG. 3 MULTI-LANE GUIDE SIGNING AT INTERCHANGE.
(COLLECTOR/DISTRIBUTOR CROSSROAD)

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

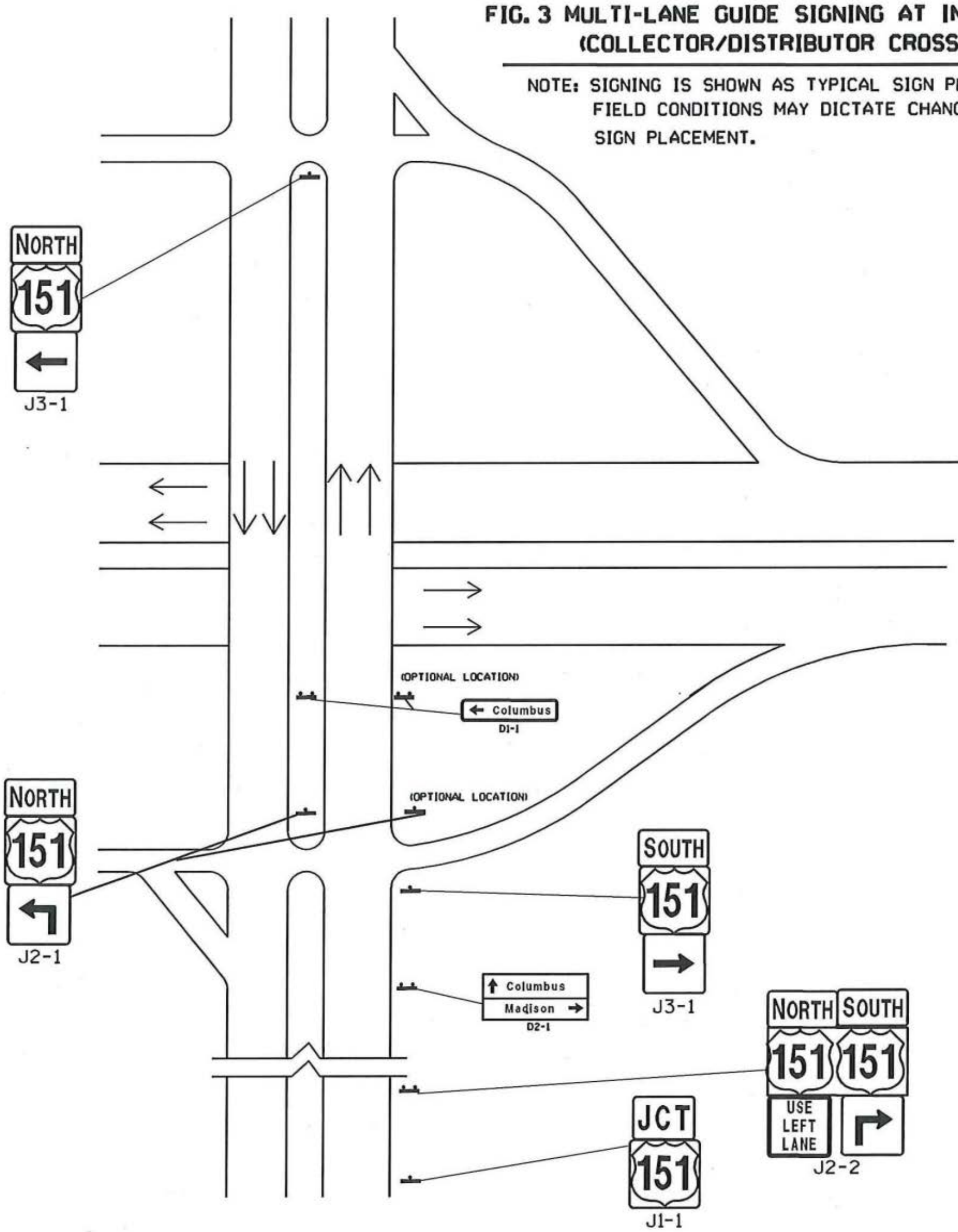


FIG. 4 OVERHEAD GUIDE SIGNING MULTI-LANE CROSSROAD AT INTERCHANGE. (ARTERIAL CROSSROAD)

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

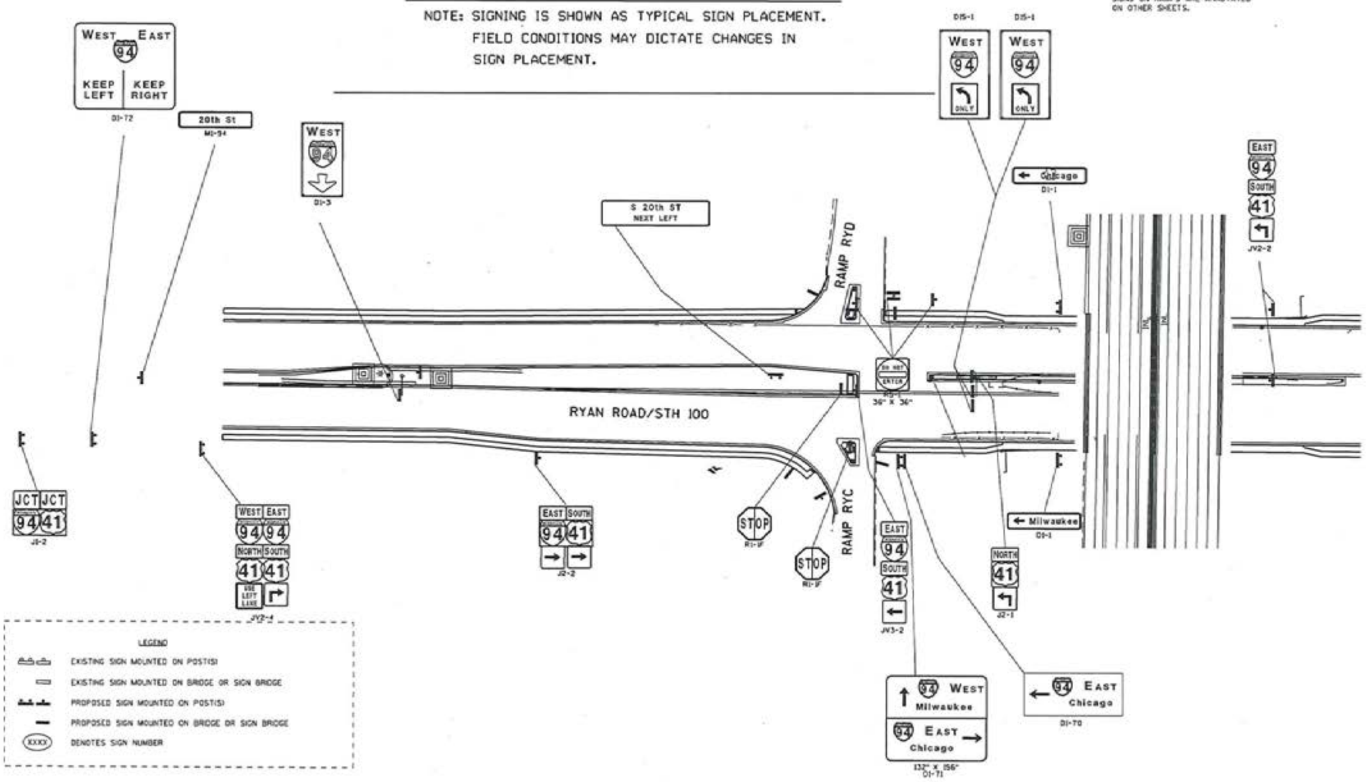
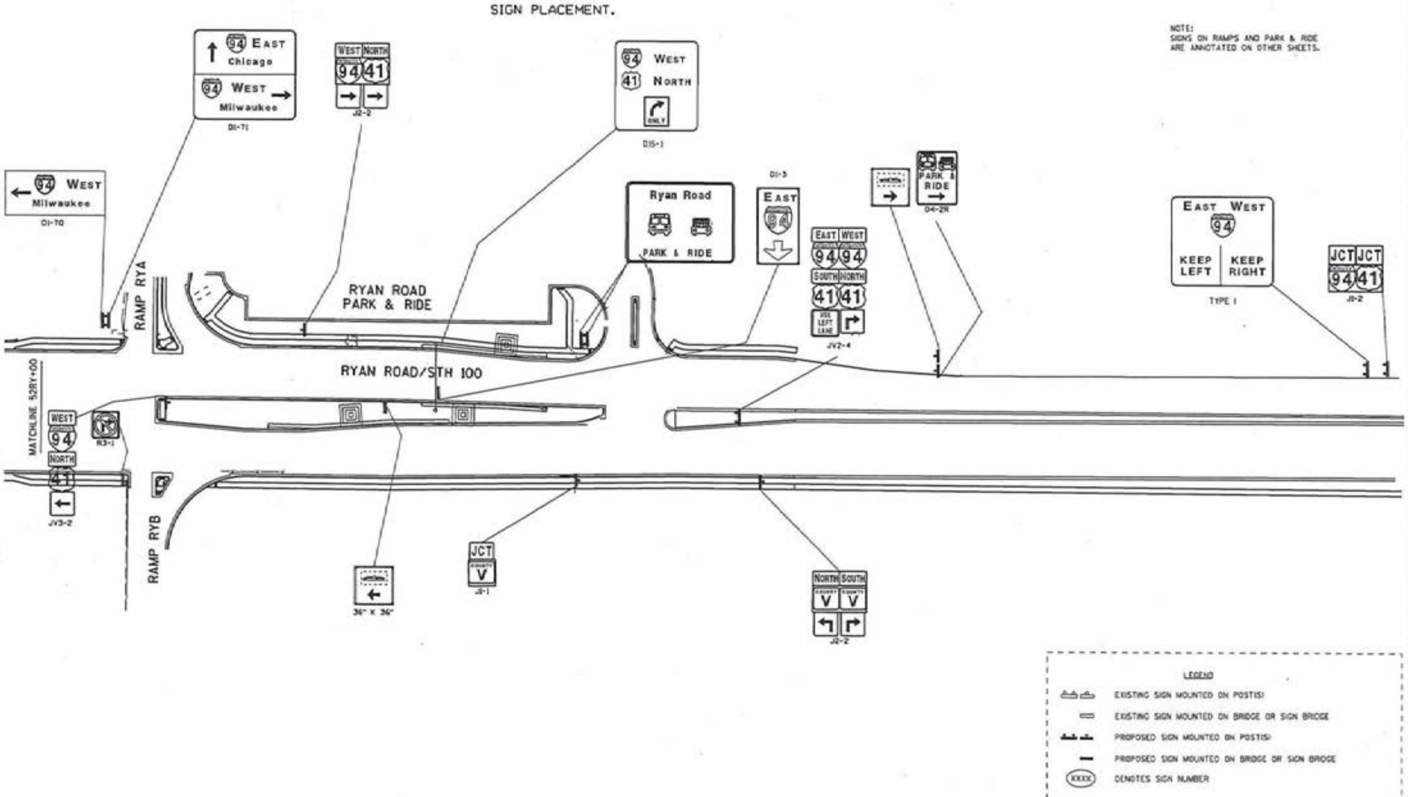


FIG. 5 OVERHEAD GUIDE SIGNING MULTI-LANE CROSSROAD AT INTERCHANGE. (ARTERIAL CROSSROAD)

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.



2-4-45.1 Emergency Hospital Signing ~~August 2016~~January 2018

PURPOSE

The purpose of the official Hospital sign is to designate hospitals with emergency care facilities. It is not intended for designating hospitals that cannot accept emergencies.

Signs (STANDARD SIGN D9-2 "H" symbol with appropriate arrow) will be furnished and maintained by the Department, on the state trunk highway system (if the state trunk highway does not lead directly past the hospital) for public and private hospitals meeting the American Medical Association (AMA) criteria. Thus signs would be warranted on a freeway or a state trunk highway that bypasses a community having a qualifying hospital. When a highway bypasses a municipality having a hospital, the Department will erect signs at appropriate locations on the bypass where motorists can best be directed into the municipality to the hospital.

Hospital signs and trailblazers on connecting streets and on local streets will not be furnished, erected, or maintained by the Department. At that point any further trailblazing is the responsibility of the local unit of government having maintenance jurisdiction over the highway carrying the route to the hospital.

No signing will be done on the state trunk highway system until signs have been erected on the local portion of the route to the hospital.

H signs *may* be erected only after being authorized by the Central Office, when the criteria in the following guidelines are met.

The following are guidelines for hospital signing:

1. A~~n H~~ sign may be warranted for a public or private hospital which has continuous emergency care capability as defined by the American Medical Association and which is in their categorized report. Attached to the policy is a listing of hospitals that have been approved by the American Medical Association for Emergency Care Facilities. Hospitals included on this list may be signed provided they meet the rest of the criteria outlined in this policy.
2. A~~n H~~ sign may be warranted on a freeway when the hospital is within a community contiguous to or near the freeway, or not more than 15 miles from the freeway.
3. A~~n H~~ sign may also be warranted on a major highway which is not a freeway but which bypasses a community having a qualifying hospital.
4. On a freeway or other highway that bypasses a community having a hospital, ~~the H~~ a sign will be erected:
   a. Only at the point or points giving access to the most direct route to the hospital.
   b. Only once for traffic in each direction on a given highway.
5. Hospital signs will not be erected on State Trunk Highways leading directly into communities having hospitals except as those highways are HOSPITAL routes as described in item 6.
6. Hospital signs and trailblazers will be erected and maintained on the State Trunk Highway System by the Department but not until it receives assurance from the hospital administration that any Hospital Route Signs required on local roads and streets have been erected.
7. The name of the hospital will be utilized only in those cases where there is more than one hospital on the route, each of which appears on the list of hospitals, which have approved emergency facilities, and each of which is approximately the same distance from the point at which the routes to the hospitals diverge. The hospital name sign will be utilized only at that divergence point, and not with other trailblazers between the beginning of the signed hospital route and the point of divergence, nor between the point of divergence and the hospital itself.

The Department will remove signs from the state trunk highways when notified that a facility does not meet the criteria for an Emergency Care Facility, and are not included on the attached lists.

City	Region	Hospital
Antigo	NC	Langlade Hospital - An Aspirus Partner
Berlin	NC	Berlin Memorial Hospital
Eagle River	NC	Ministry Eagle River Memorial Hospital
Friendship	NC	Moundview Memorial Hospital & Clinics, Inc.
Marshfield	NC	Ministry Saint Joseph's Hospital
Merrill	NC	Ministry Good Samaritan Health Center
Park Falls	NC	Flambeau Hospital

Rhinelander	NC	Ministry Saint Mary's Hospital
Shawano	NC	Shawano Medical Center
Stevens Point	NC	Ministry Saint Michael's Hospital
Tomahawk	NC	Ministry Sacred Heart Hospital
Waupaca	NC	Riverside Medical Center
Wausau	NC	Aspirus Wausau Hospital
Weston	NC	Ministry Saint Clare's Hospital
Wild Rose	NC	Wild Rose Community Memorial Hospital
Wisconsin Rapids	NC	Riverview Hospital Association
Woodruff	NC	Howard Young Medical Center
Appleton	NE	Appleton Medical Center
Appleton	NE	St. Elizabeth Hospital
Chilton	NE	Calumet Medical Center
Fond du Lac	NE	Agnesian HealthCare / St. Agnes Hospital
Green Bay	NE	Aurora BayCare Medical Center in Green Bay
Green Bay	NE	Bellin Hospital
Green Bay	NE	St. Mary's Hospital Medical Center
Green Bay	NE	Green Bay - St. Vincent Hospital
Manitowoc	NE	Holy Family Memorial Inc.
Marinette	NE	Bay Area Medical Center
Neenah	NE	Children's Hospital of Wisconsin - Fox Valley
Neenah	NE	Theda Clark Medical Center
New London	NE	New London Family Medical Center
Oconto	NE	Bellin Health Oconto Hospital
Oconto Falls	NE	Community Memorial Hospital
Oshkosh	NE	Aurora Medical Center in Oshkosh
Oshkosh	NE	Mercy Medical Center
Ripon	NE	Ripon Medical Center Inc.
Sheboygan	NE	Aurora Sheboygan Memorial Medical Center
Sheboygan	NE	St. Nicholas Hospital
Sturgeon Bay	NE	Ministry Door County Medical Center
Two Rivers	NE	Aurora Medical Center of Manitowoc County
Amery	NW	Amery Regional Medical Center
Ashland	NW	Memorial Medical Center
Baldwin	NW	Western Wisconsin Health
Barron	NW	Mayo Clinic Health System - Northland in Barron
Black River Falls	NW	Black River Memorial Hospital
Bloomer	NW	Mayo Clinic Health System - Chippewa Valley in Bloomer
Chippewa Falls	NW	St. Joseph's Hospital
Cumberland	NW	Cumberland Healthcare
Durand	NW	Chippewa Valley Hospital
Eau Claire	NW	Mayo Clinic Health System in Eau Claire
Eau Claire	NW	Oakleaf Surgical Hospital
Eau Claire	NW	Sacred Heart Hospital
Grantsburg	NW	Burnett Medical Center
Hayward	NW	Hayward Area Memorial Hospital
Hudson	NW	Hudson Hospital & Clinics
Ladysmith	NW	Rusk County Memorial Hospital
Medford	NW	Aspirus Medford Hospital & Clinics, Inc.
Menomonie	NW	Mayo Clinic Health System - Red Cedar, Inc.
Neillsville	NW	Memorial Medical Center
New Richmond	NW	Westfields Hospital
Osceola	NW	Osceola Medical Center
Osseo	NW	Mayo Clinic Health System - Oakridge in Osseo
Rice Lake	NW	Lakeview Medical Center
River Falls	NW	River Falls Area Hospital
Shell Lake	NW	Indianhead Medical Center / Shell Lake
Spooner	NW	Spooner Health System
St. Croix Falls	NW	St. Croix Regional Medical Center
Stanley	NW	Ministry Our Lady of Victory Hospital
Superior	NW	St. Mary's Hospital of Superior
Whitehall	NW	Gundersen Tri-County Hospital & Clinics
Brookfield	SE	Wheaton Franciscan - Elmbrook Memorial Campus

Burlington	SE	Aurora Memorial Hospital of Burlington
Elkhorn	SE	Aurora Lakeland Medical Center in Elkhorn
Franklin	SE	Midwest Orthopedic Specialty Hospital
Franklin	SE	Wheaton Franciscan Healthcare - Franklin
Gl~~re~~endale	SE	Orthopaedic Hospital of Wisconsin
Grafton	SE	Aurora Medical Center in Grafton
Hartford	SE	Aurora Medical Center in Hartford
Kenosha	SE	Aurora Medical Center in Kenosha
Kenosha	SE	Kenosha - UHS, Inc.
Lake Geneva	SE	Mercy Walworth Hospital and Medical Center
Menomonee Falls	SE	Community Memorial Hospital of Menomonee Falls, Inc.
Mequon	SE	Columbia Center
Mequon	SE	Columbia St Mary's Inc. - Ozaukee Campus
Milwaukee	SE	Aurora Sinai Medical Center
Milwaukee	SE	Aurora St. Luke's Medical Center / South Shore
Milwaukee	SE	Children's Hospital of Wisconsin
Milwaukee	SE	Columbia St. Mary's Hospital Milwaukee
Milwaukee	SE	Froedtert Memorial Lutheran Hospital Inc.
Milwaukee	SE	Wheaton Franciscan Healthcare - St. Francis
Milwaukee	SE	Wheaton Franciscan - St. Joseph Campus
Oconomowoc	SE	Oconomowoc Memorial Hospital
Racine	SE	Wheaton Franciscan Healthcare - All Saints, Inc.
Summit	SE	Aurora Medical Center in Summit
Waukesha	SE	Waukesha Memorial Hospital
Wauwatosa	SE	Midwest Spine and Orthopedic Hospital and Wisconsin Heart Hospital
West Allis	SE	Aurora West Allis Medical Center
West Bend	SE	St. Joseph's Community Hospital of West Bend Inc.
Baraboo	SW	St. Clare Hospital & Health Services
Beaver Dam	SW	Beaver Dam Community Hospitals Inc.
Beloit	SW	Beloit Health System
Boscobel	SW	Gundersen Boscobel Area Hospital and Clinics
Columbus	SW	Columbus Community Hospital
Darlington	SW	Memorial Hospital of Lafayette Co.
Dodgeville	SW	Upland Hills Health Inc.
Edgerton	SW	Edgerton Hospital & Health Services
Fort Atkinson	SW	Fort HealthCare
Hillsboro	SW	Gundersen St. Joseph's Hospital & Clinics
Janesville	SW	Mercy Hospital and Trauma Center
Janesville	SW	St. Mary's Janesville Hospital
La Crosse	SW	Gundersen Lutheran Medical Center
La Crosse	SW	Mayo Clinic Health System - Franciscan Healthcare in La Crosse
Lancaster	SW	Grant Regional Health Center
Madison	SW	Meriter-Unity Point Health
Madison	SW	St. Mary's Hospital
Madison	SW	UW Hospital & Clinics
Mauston	SW	Mile Bluff Medical Center
Monroe	SW	Monroe Clinic
Platteville	SW	Southwest Health Center
Portage	SW	Divine Savior Healthcare
Prairie du Chien	SW	Prairie du Chien Memorial Hospital
Prairie du Sac	SW	Sauk Prairie Healthcare
Reedsburg	SW	Reedsburg Area Medical Center
Richland Center	SW	The Richland Hospital Inc.
Sparta	SW	Mayo Clinic Health System - Franciscan Healthcare in Sparta
Stoughton	SW	Stoughton Hospital Association
Tomah	SW	Tomah Memorial Hospital
Viroqua	SW	Vernon Memorial Healthcare
Watertown	SW	UW Health Partners Watertown Regional Medical Center
Waupun	SW	Waupun Memorial Hospital

2-4-45.2 Emergency Medical Care Signing Policy — March 2016

PURPOSE

The purpose of emergency medical services signing is to provide direction for the motorist to the closest emergency medical care facility or hospital. The MUTCD, Section 2I.02 allows the usage of emergency medical care signing to facilities other than hospitals provided they meet certain criteria. The MUTCD also encourages states to develop guidelines for the usage of the Emergency Medical Services Sign. The Emergency Medical Care sign (D9-13C sign or E10-63 or E10-64 sign) provides direction to designated facilities other than hospitals that provide 24-hour emergency care.

Signs (Standard sign D9-13C with appropriate arrow or E10-63 or E10-64 sign) will be furnished and maintained by the Department on the state trunk highway system (if the state trunk highway does not lead directly past the emergency care facility) for emergency medical care facilities that meet the criteria specified in Section B of this policy. When a highway bypasses a municipality that has a qualifying emergency medical care facility, the Department will erect signs at appropriate locations on the bypass where motorists can best be directed into the municipality to the emergency medical care facility.

Signs and trailblazers on connecting streets and on local streets will not be furnished, erected, or maintained by the Department. At that point any further trailblazing is the responsibility of the local unit of government having maintenance jurisdiction over the highway carrying the route to the emergency medical care facility.

Signs *may* be erected only after being authorized by the Bureau of Traffic Operations, when the criteria in the following guidelines are met.

POLICY

The following are guidelines for emergency medical care facility signing:

1. A sign *may* be warranted for a public or private emergency medical care facility which has continuous emergency care capability as defined by the American Medical Association (AMA) and which is AMA Board Certified. Attached to the policy is a listing of emergency medical care facilities that are Board Certified by the AMA. Emergency Medical Care facilities included on this list *may* be signed provided they meet the rest of the criteria outlined in this policy.
2. The following criteria **shall** be used to determine if an Emergency Medical Care facility qualifies for signing:
   a. Continuous 24-hour, 7 days per week emergency care capability.
   b. Emergency department facilities with a physician trained in emergency medical procedures on duty (or emergency care nurse on duty within the emergency department with a physician on call).
   c. Board certified by the American Medical Association and a licensed medical care facility by the State of Wisconsin.
   d. Equipped for radio voice communications with ambulances and other hospitals.
3. A sign *may* be warranted on a freeway when the emergency medical care facility is within a community contiguous to or near the freeway, or not more than 15 miles from the freeway.
4. A sign *may* also be warranted on a major highway which is not a freeway but which bypasses a community having a qualifying emergency medical care facility.
5. On a freeway or other highway that bypasses a community having an emergency medical care facility, a sign will be erected:
   a. Only at the point or points giving access to the most direct route to the facility.
   b. Only once for traffic in each direction on a given highway.
6. Emergency Medical Care signs *should not* be erected on the same State Trunk Highway within the same community having a qualifying hospital that is already signed. An exception can be made if the emergency medical care facility is closer to the state trunk highway as described in Item 8.
7. Signs and trailblazers *may* be erected and maintained on the State Trunk Highway System by the Department but not until after trailblazer signs on local roads and streets have been erected.
8. If a new hospital is signed on the same highway in a community that has emergency medical care

facility signing, the existing emergency medical care facility signs **shall** be removed. An exception can be made if the emergency medical care facility is closer than the hospital at the same intersection or interchange. In this case, both facilities could be signed.

9. The name of the emergency care facility will not be utilized on the signing unless there is more than one facility on the route, each of which appears on the list of approved emergency medical care facilities, and each of which is approximately the same distance from the point at which the routes to the facilities diverge. The emergency medical care facility name sign will be utilized only at that divergence point, and not with other trailblazers between the beginning of the signed route and the point of divergence, nor between the point of divergence and the emergency medical care facility itself.

The Department will remove signs from the state trunk highways when notified that a facility does not meet the criteria for an Emergency Care Facility, and are not included on the attached list.

Summary of AMA Board Certified Emergency Medical Care Facilities

Updated October 2015

Hospital	**Address**	**City**	**Region**	**Remarks**
St. Mary's Care Center	Reiner Rd.	Sun Prairie	SW	
Mercy Hospital and Trauma Center	3400 Deerfield Dr.	Janesville	SW	
Pro Health Care	240 Maple Ave.	Mukwonago	SE	

2-4-48 Signing for Unincorporated Communities — May 2015

PURPOSE

The purpose of this policy is to establish standards for the use of signs identifying or directing to unincorporated communities.

DEFINITIONS

Unincorporated communities are defined as historically named and recognized communities without official boundaries or government, generally located within a township, which often will have a different name.

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

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

Conventional highways are defined as 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.

POLICY

Identifying Unincorporated Communities

Signs *may* be installed on conventional state trunk highways as near as possible to the generally recognized entrance to an unincorporated community, subject to WisDOT general signing criteria and the following guidelines.

1. The unincorporated community must be located and identified by name on the official State Highway Map.
2. If an unincorporated community is not shown on the official State Highway Map, the community *may* contact the WisDOT Surveying and Mapping Section to officially request map placement. Some specific criteria for inclusion on the official State Highway map include:
    a. There must be adequate space on the map to display the community name and symbol.
    b. The community *should* have a reasonable permanent population (a minimum of 50 people) within a reasonable geographic proximity (1/4 miles in each direction of a common intersection or ½ mile in diameter).
    c. The community *should* have either a dependable motorist service (such as a service or repair garage) or a major attraction (such as a consolidated school or major industry) or a recognized point of interest to which tourists might be directed to
3. Signs *may* be installed for an unincorporated community, in advance of a map printing, provided the

community has been approved by the Surveying and Mapping Section to be on the official State Highway Map.

4. The request for signs request must come from residents and/or business owners within the unincorporated community and be approved in writing by the governing body of the township or municipality surrounding the unincorporated community.
5. Signs identifying unincorporated communities **shall not** be permitted on freeways or expressways.
6. These signs **shall** be made according to the unincorporated version of the DOT standard sign code I2-3.

Directing to Unincorporated Communities

Signs *may* be installed on expressways or conventional state trunk highways directing to an unincorporated community, subject to WisDOT general signing criteria and the following guidelines:

1. The unincorporated community must be located and identified on the official State Highway Map.
2. The unincorporated community must be located within five miles of the State Highway intersection.
3. When the unincorporated community is located on a roadway other than a State Trunk Highway, signs identifying the community on that roadway must be in place prior to allowing any sign on a state highway directing to the community.
4. The sign(s) request must come from residents and/or business owners within the unincorporated community and be approved in writing by the governing body of the township or municipality surrounding the unincorporated community.
5. Signs directing to unincorporated communities **shall not** be permitted on freeways. Such signs *may* be permitted on expressway approaches to an at-grade intersection. They **shall not** be permitted on the expressway approaches to an interchange exit.
6. These signs **shall** be made according to the DOT standard sign code D1-1.

Existing unincorporated community signs that do not meet the WisDOT general signing criteria and above guidelines *may* remain until the end of their useful life. Useful life is defined as undamaged and legible to drivers. Once such non-conforming signs have reached the end of their useful life, they **shall** be removed and **shall not** be replaced.

2-4-48.1 Neighborhood Watch Signing — August 2009

PURPOSE

Wisconsin State Statute 66.0429 allows cities or villages to place Neighborhood Watch signs upon the highway right-of-way within its corporate limits. Per Statute, the program is required to be authorized by the law enforcement agency of the city or village and must be approved by the city council or village board. Furthermore, State Statute 66.0429 (2) states that the sign must be of a uniform design approved by the Department of Transportation. Often times the Department is requested to provide a detail of the official sign.

Communities that have adopted such a program often request signing on the state highway system. The Department controls traffic signs on highways maintained by the state. Local governments do not have the authority to erect signs on those highways except when written permission is provided by the Department.

DEFINITIONS

Freeways are defined as arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

Conventional highways are defined as divided undivided roadway facilities that have limited access with no grade separations at intersections. These highways *may* be two lane or multilane facilities.

POLICY

The Department *may* permit local governments to place signs on highways under WisDOT jurisdiction subject to the requirements included here:

1. The city or village must have a neighborhood watch program in place that is authorized by the law enforcement agency of the city or village and approved by the city council or village board.
2. Requests for a permit to allow these signs must be in writing to the WisDOT Regional Office and *should* contain the following information:
    a. Locations where signs are to be installed, including State highway route number and distance to the nearest public roadway intersection
    b. Sign offset (distance from edge of travel lane) and type of post to be used
    c. Assurance that sign will be free standing (not attached to other signs)
    d. Documentation of city or village program.
3. The local government **shall** be responsible for supplying, installing, and maintaining the signs in conformance with the permit. The local government **shall** furnish their identification sticker on the sign.
4. The *recommended* sign for cities and villages is the NEIGHBORHOOD WATCH COMMUNITY sign (D12-50) (See Figure 1). There is a space for a 12” x 12” logo.
5. Acceptable logo designs are (See Figure 2):
    a. “Eye” style logo.
    b. Criminal logo.
6. There is no sunset date for signs already installed that do not conform to this policy. Rather, communities are encouraged to follow this consistent sign design.
7. The city or village must obtain the approval of the appropriate Regional office for location(s) of the signs(s).
8. Signs are only allowed at the corporate limits upon entering a community.
9. Per intent of State Statute 60.23 (17m) neighborhood watch signs **shall not** be allowed for townships on the state highway system. They *may* be placed on township maintained roadways and county roadways, if approved by the County Board.
10. For signs off the State Highway System, per State Statute 66.0429, WisDOT is required to approve the sign design.
11. Neighborhood Watch signs **shall not** be allowed on freeways, including ramps and 65 mph expressways.
12. Signs will be removed if official Neighborhood Watch program for the community no longer exists.

Figure 1

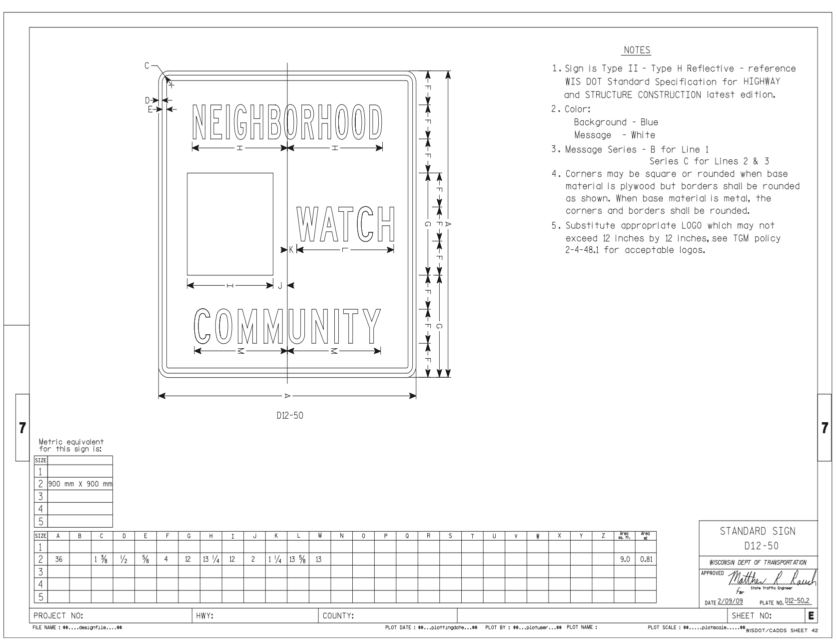


Figure 2 (Acceptable Logo Designs)

2-4-49 Street Name Signs — January 2015

PURPOSE

The MUTCD, Section 2D.43 states that street name signs *should* be installed at intersections. Standards and guidance are contained in Section 2D.43 of the MUTCD regarding letter sizes, colors and retroreflectivity of the street name signs.

Traditionally, local units of government have installed ground mounted street name signs at intersections of WisDOT maintained roadways. These ground mounted street name signs are installed and maintained by the local unit of government, in accordance with the MUTCD.

The MUTCD, Section 2D.43 also provides guidance and standards on the design of overhead street name signs at intersections. These types of overhead street name signs are commonly mounted on overhead traffic signal structures at the intersection. The overhead street name signs provide a lot of value in that they are larger and easier for the motorist to see (especially in urban environments where there are a lot of other competing signs, two or more travel lanes in each direction and closely spaced intersections). Now that the usage of traffic signal monotube arms have replaced the more traditional trombone arm traffic signal structure in Wisconsin, the attachment of overhead street name signs to the traffic signal structure has become much more practical.

The following policy criteria applies to both ground mounted and overhead street name signs that are installed on WisDOT roadways.

POLICY

<u>Ground Mounted Street Name Signs</u>

1. Local units of government are allowed to install ground mounted street name signs on WisDOT roadways. No permit is required for ground mounted street name signs.
2. Ground mounted street name signs **shall not** be installed on WisDOT maintained sign posts. Ground mounted street name signs **shall** be placed on their own supports and *should* be placed in the opposite quadrant as the STOP sign, typically on the left side so they do not obstruct the motorist's view of the STOP sign or any other signs.
3. The local unit of government **shall** pay for all costs associated with the manufacture, installation and maintenance of ground mounted street name signs.

<u>Overhead Street Name Signs</u>

1. WisDOT will install and maintain overhead street name signs on WisDOT maintained traffic signal monotube structures only.
2. In accordance with TEOpS 2-4-50, WisDOT **shall** also install advance crossroad name signs on divided roadways with posted speeds of 45 mph or greater and 2-lane conventional highways with posted speeds of 55 mph that are on the national Highway System. The Region has the option to additionally install advance crossroad name signing on divided roadways with posted speeds of less than 45 mph.
3. For overhead street name signs mounted on traffic signal monotube arms, in addition to the overall sign size restrictions, the sign **shall** not exceed a lateral mounting distance of 15 feet from the upright (distance from upright to center of sign). See SDD 9E-8 (sheets a-d) for the placement of overhead street name signs on traffic signal monotubes.
4. For WisDOT maintained overhead street name signs, only the standard M1-94H or M1-94S sign with white letters on green background will be allowed.
5. For existing overhead street name signs that have already been permitted on WisDOT maintained traffic

signal monotube structures, WisDOT *may* assume the maintenance of the signs (permission needed from local unit of government), provided the signs meet WisDOT design standards. Otherwise, the signs would be grandfathered until they wear out and then replaced by signs that meet WisDOT design standards and maintained by WisDOT at that point.

6. For existing WisDOT maintained urban traffic signal monotube structures that do not currently have street name signs attached to them, the overhead street name signs *may* be installed as part of an improvement project. If the local unit of government wishes to have overhead street name signs installed prior to an improvement projects, they will need to incur the installation costs. Maintenance of the signs will be by WisDOT.

Sign Design and Manufacture

1. Due to wind loading restrictions on overhead traffic signal monotubes, overhead sign sizes *should not* exceed 18” in height or 108” in length. If larger street name signs are needed (i.e. longer street names or different street names in each direction), then the monotube wind loading calculations **shall** be calculated to ensure adequate wind loading (see Traffic Signal Design Manual 6-1-11).
2. For overhead street name signs, 12” initial upper case/9” lower case *should* be used for the street name. If overall sign size is a concern, 8” initial upper case/6” lower case letter heights *may* be used.
3. For all ground mounted street name signs, only blue, brown, white or green backgrounds **shall** be used. The legend for ground mounted street name signs **shall** be white for blue, brown or green background signs. The legend **shall** be black for white background signs. Overhead street name signs on WisDOT maintained traffic signal monotube structures **shall** be white letters on green background.
4. Pictographs in the form of a community symbol or highway route shield *may* be used on either non-WisDOT maintained overhead street name signs or any ground mounted street name signs. The height and width of the pictograph **shall not** exceed the height of the upper case letter of the principle legend on the sign. Pictographs **shall not** contain commercial advertising.
5. For new overhead and ground mounted street name signs, the mixture of initial upper case / lower case lettering **shall** be used. Existing street name signs with all capital letters are allowed to remain until they wear out or are replaced in projects.
6. Ground mounted street name signs *should* have a minimum letter heights of 6” initial upper case / 4 ½” lower case for 2 lane conventional highways (all posted speeds) and multi-lane conventional highways (posted speeds 40 mph or less). Ground mounted street name signs on multi-lane conventional highways with posted speeds greater than 40 mph *should* have minimum letter heights of 8” initial upper case / 6” lower case. 4” initial upper case / 3” lower case letters *may* be used on local two-lane streets with posted speed limits of 25 mph or less.
7. Supplementary lettering to indicate the direction (North, South, East or West) or the type of street (St, Ave, or Rd) *may* be used. For ground mounted street name signs, minimum supplementary letter heights of 3” upper case / 2 ¼” lower case letters *should* be used. For overhead street name signs with 12” initial upper case/9” lower case letter heights for the street name, supplementary letter heights of 6” initial upper case / 4 ½” lower case letters **shall** be used. If using 8” initial upper case/6” lower case letter heights for the street name, 4” initial upper case/3” lower case supplementary letters **shall** be used. If used, route shields on overhead street name signs **shall** be the same height as the upper case letters of the street name.

2-4-50 Advance Crossroad Name Signs — May 2011

PURPOSE

This guideline provides information on the appropriate use of advance crossroad name signs. These signs are used on certain urban and rural roadways to identify and provide advance notice on the approach to intersections to allow safe reaction times and to orient unfamiliar motorists to their destinations.

These signs are provided for as optional street name signs in the MUTCD Section 2D.44. When an intersection warning sign (W2-1 through W2-6) is installed for the intersection, a similar function *may* be achieved with a supplemental advance street name plaque. Use of the advance cross road sign is preferred over the advance street name plaque. WisDOT has authority under ss. 86.19 to place these signs to guide and warn traffic.

POLICY

Advance crossroad name signs *should* be used selectively for at grade intersections. Two primary criteria exist for determining whether crossroad name signs *should* be used: the character of the highway and the character of the intersecting roadway. The use of signs *should* reflect both considerations.

1. Criteria related to the State Highway:
    a. Advance Crossroad Name Signs **shall** be used for at grade intersections of all urban and rural 4 lane divided highways with posted speeds 45 mph and greater.
    b. Use of Advance Crossroad Name Signs is optional on 4 lane urban and rural divided highways with posted speeds less than 45 mph. Problem situations on these types of highways *may* warrant this signing.
    c. Advance Crossroad Name Signs **shall** be used on all 2 lane conventional highways that are on the National Highway System which have a posted speed limit of 55 mph.
    d. The use of Advance Crossroad Name Signs **shall** be optional on all other 2 lane conventional highways that do not meet the criteria listed above in item 1c. Problem situations on this type of highway *may* warrant this signing.
2. Criteria related to the intersecting roadway:
    a. Advance crossroad name signs *should* be used for Intersecting roads that serve retail shopping, commercial activity, or other activities with high concentrations of entering or leaving traffic, or heavy slow moving vehicle traffic.
    b. Advance crossroad name signs are normally not used for intersections with another state highway or a county trunk highway. Those intersections *should* have junction signing in place and are referenced with highway numbers or letters rather than road names.
    c. Advance crossroad name signs *should not* be used for intersections with roads that are dead ends or only serve an individual property owner.
3. Sign placement and details:
    a. Directional arrows **shall** be used on all signs. For intersecting crossroads with different road names to the left and right, a D1-1 or D1-2 sign would be used. A D1-61 sign with two arrows would be used for intersecting roadways having the same name in both directions. In some locations, such as freeway off ramps with intersecting roadways having the same name in both directions, it may be beneficial to list the cardinal directions on the sign (D1-60 sign).
    b. In urban or semi-urban areas, there *may* be cases where there are closely spaced intersections or median cut-outs where the usage of directional arrows could cause potential motorist confusing with turning at the wrong location. For these locations, in lieu of signs with directional arrows, an option would be to utilize sign with the word text of NEXT INTERSECTION (D1-63 sign), SECOND INTERSECTION (D1-64 sign) or NEXT SIGNAL (D1-65 sign).
    c. Advance Crossroad Name Signs *should* be placed on the right side of the roadway. On divided highways, where there is a left turn only situation, the sign *should* be placed in the median. When there are three or more travel lanes in each direction, signs *should* be installed on the right side of the roadway and the median side of the roadway.
    d. Placement of signs *should* follow the MUTCD Table 2C-4, condition B, deceleration to condition of 0 mph). The distance of these signs from the intersection *may* vary due to the presence of other signing in the area; however, it *should not* be less than 500 feet for speeds 45 mph and above.
    e. Additional Advance Crossroad Name Sign size criteria for bypasses are contained in TEOpS 2-15-53 Bypass Signing.
    f. Lettering sizes for Advance Crossroad Name Signs **shall** be as follows:
        i. High Speed Roadways (45 mph or above): 4 ½” lower case/6” upper case for conventional state trunk highways and 6” lower case/8” upper case for expressway crossroads; 4 ½” lower case/6” upper case or 6” lower case/ 8” upper case for 4 lane divided or undivided highways.
        ii. Low Speed Roadways (less than 45 mph): 4 ½” lower case/6” upper case.

2-4-51 Rustic Road Signs — January 2007

GENERAL

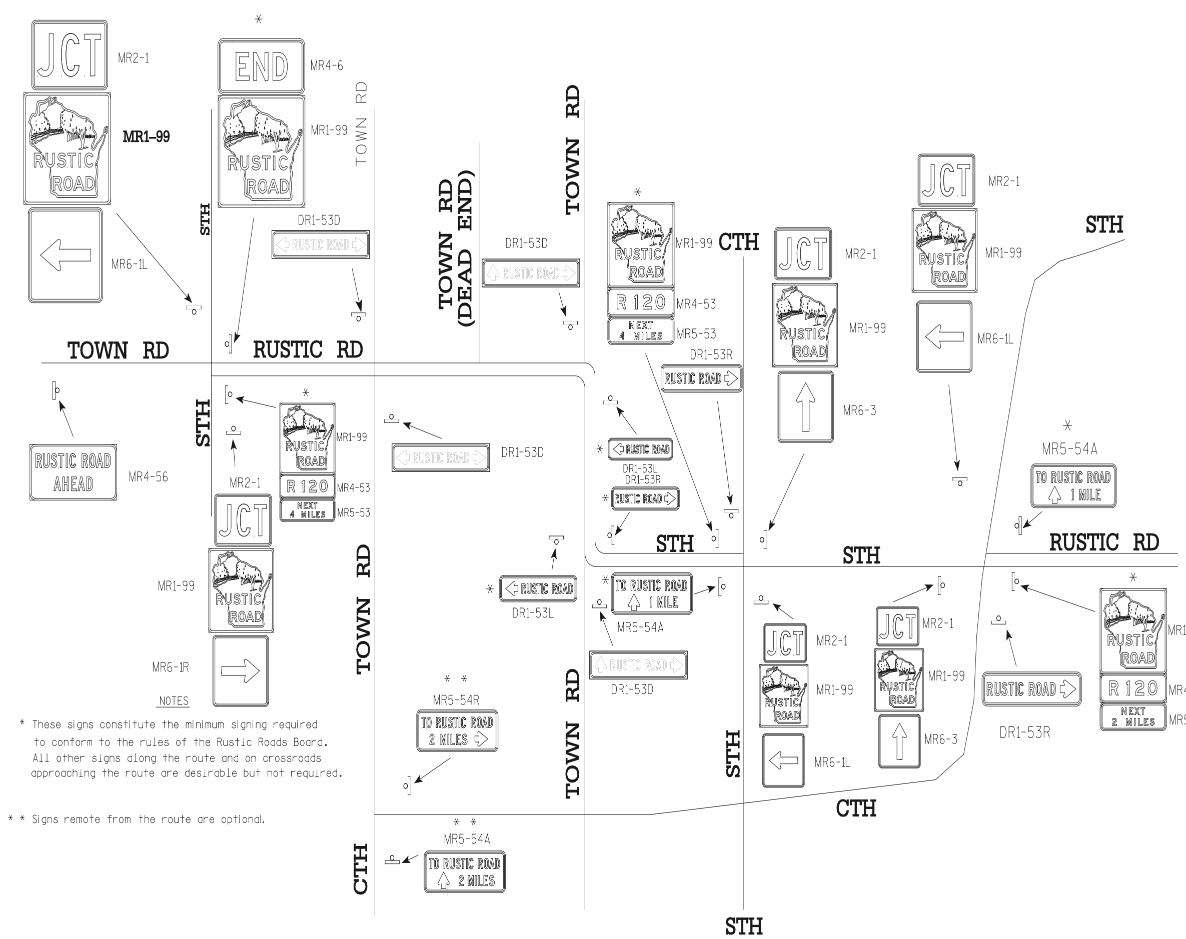
The Wisconsin Administrative Code Trans-RR 1 contains all of the rules for the application procedures and sign installation/maintenance criteria for Rustic Road Signing. The Wisconsin Department of Transportation has organized a Rustic Roads Board that maintains all of the rules in Wisconsin Administrative Code Trans-RR1. In addition to these rules, there is a need to also provide clear guidance on the minimum signing that is required to conform to the rules of the Rustic Roads Board. The goal of this guidance is to provide for a statewide consistent method of signing and clearly define what the signing the Department is responsible for and what signing the Local maintaining authority is responsible for.

POLICY

Below are the guidelines for the installation and maintenance of Rustic Road Signing:

1. A minimum amount of signing *should* be used in order to avoid additional sign clutter at intersections, which can lead to safety issues. Figure 1 shows examples of the minimum amount of signing required to conform to the rules of the Rustic Roads Board.
2. On the state highway system, the Department **shall** pay for the installation and maintenance of all Rustic Road signing.
3. For Rustic Road signing off of the state highway system, the Department will provide all signs to the local unit of government at no charge. The local unit of government **shall** pay for all installation and maintenance costs including posts and mounting hardware.
4. As signs on the local system wear out and need to be replaced, the local unit of government *may* request replacement signs, at no charge, from the Department.

Figure 1



2-4-52 Heritage Directional Signs December 2013

PURPOSE

In 1994, WisDOT and Wisconsin Department of Tourism enacted the Heritage Directional Signing program through a Cooperative Agreement between the two agencies. The Department of Tourism had the responsibility to work with the application process for businesses requesting signs and maintained a brochure of the eligible businesses. Tourism furnished the signs to WisDOT and the Department of Tourism covered installation and long term maintenance of the signs.

In August of 2013, the Department of Tourism indicated that they were no longer maintaining the Heritage Signing program and instead have focused on other means to promote this tourism effort. As a result, no new Heritage Direction signs will be installed on state highways from this time forward. This guideline provides information on the signing phase-out plan that was approved by Dept. of Tourism and WisDOT.

GUIDELINES

Listed below are guidelines for the installation and removal of Heritage Directional signing on WisDOT roadways, M1-85, M1-85C and M1-85d, which were agreed upon by the Department of Tourism and WisDOT:

1. New Heritage Direction signs **shall not** be installed on WisDOT roadways.
2. Existing Heritage Direction signs *may* be allowed to remain in place until the end of their useful life. Other opportunities such as knockdown damage, improvement projects or change in conditions *may* make it possible to have the signs removed earlier.
3. If WisDOT staff receives a call from a business requesting a replacement Heritage Directional sign, refer the name and contact information to the State Signing Engineer, who in turn will work with the requestor and Tourism to find a potential alternative signing program (SIS, TODS, White Arrow boards).
4. If WisDOT removes a Heritage Directional sign, the Region *should* let the State Signing Engineer know, who will subsequently let Tourism know.

2-4-53 Auto Tour Signing Policy December 2013

PURPOSE

Section 2H.07 of the MUTCD provides information on the appropriate use of Auto Tour Signs. These signs are used on certain urban and rural roadways to identify special routes that have certain cultural, historical or educational significance. These types of routes have been approved by the Wisconsin legislature and are included in the Wisconsin State Statutes. Examples of these routes are: The Rock River Trail, the Wild Rivers Trail, Lake Michigan Circle Tour, Lake Superior Circle Tour, Great River Road, and Green Bay Ethnic Trail.

This policy expands upon the language in the MUTCD by providing additional guidelines and standards on the usage of Auto Tour signs on WisDOT maintained roadways.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial controlled access and generally with grade separations at major intersections.

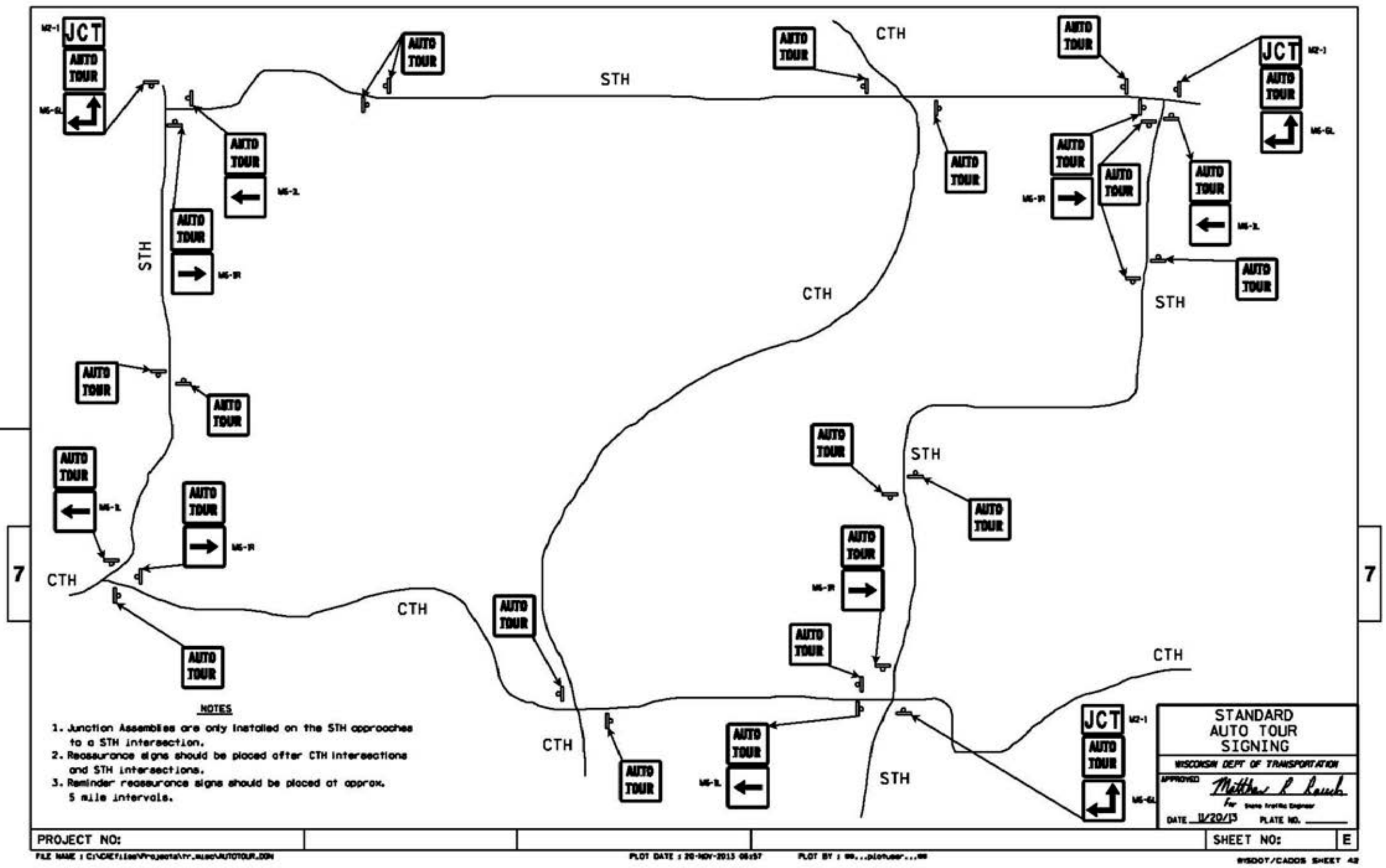
Conventional highways are defined as either divided or undivided roadway facilities that have no control of access with grade separations at intersections. These highways can be two-lane or multi-lane facilities.

POLICY

1. Auto Tour route signing is not intended to sign to a specific destination. Particular destinations tying into an Auto Tour route are typically listed on a website, brochure or other means.
2. Auto Tour route signs **shall not** be installed on freeways or expressways except as to provide continuity between discontinuous segments of conventional roadways that are designated as auto tour routes, for which the freeway or expressway provides the only connection between segments.
3. Auto Tour signing **shall** have the approval of the local unit(s) of government prior to signing on the state

system.

4. A minimum amount of signing *should* be used in order to avoid additional sign clutter at intersections, which can lead to safety issues. Signs *should* also be close enough that the route can be easily followed without additional direction.
5. Design and Layout of Auto Tour Signing **shall** be approved by the Bureau of Traffic Operations.
6. For Auto Tour signs having the M1-92 or M1-98 sign code, the requesting groups **shall** pay all costs associated with installation and maintenance of Auto Tour signs. As signs on the local system wear out and need to be replaced, the local unit of government *may* request replacement signs from the Department at the local unit's expense.
7. For Auto Tour signs having the M1-7, M1-91, M1-93, M1-96, or M1-97 sign code, WisDOT **shall** pay for all cost associated with the installation and maintenance of the signs.



2-4-55 Stream/River/Lake Signs — September 2001

PURPOSE

Guide signs noting stream, river, and lake crossings have traditionally been installed on WisDOT roadways to assist motorists. When used in a controlled manner, these signs have benefits because they can help an unfamiliar motorist find their location when using a map and can also be informative on pointing out the location of important bodies of water for tourists or sporting use. However, in the past, usage of these signs has been uncontrolled, resulting in sign installations for everything from dry ditches to bodies of water not on the state map or recognized by the Wisconsin Department of Natural Resources. The intent of this policy is to establish control and statewide consistency on the usage of these signs.

DEFINITIONS

<u>Freeways</u> are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

<u>Expressways</u> are defined as divided arterial highway facilities that have partial controlled access, and generally by means of grade separation at major intersections.

INSTALLATION GUIDELINES

Stream, river and lake crossing guide signs *may* be used provided the following criteria are met:

1. For freeways and expressways. The body of water to be signed has a name shown on the current official State of Wisconsin Highway Map that is published by the Wisconsin Department of Transportation. Any bodies of water not having a name shown on this map **shall not** be signed for.
2. For conventional highways. The body of water to be signed has a name shown on the current official State of Wisconsin Highway Map or the current official County Highway Maps that are published by the Wisconsin Department of Transportation. Any bodies of water not having a name shown on these maps **shall not** be signed for.
3. Any existing stream, river, or lake crossing signs that are in place and do not meet the criteria listed in items 1 or 2 above, will be allowed to remain in place until the end of their useful life. Once the signs have reached their useful life, they **shall** be removed and not be replaced. Useful life is defined as the sign being legible for its intended usage.

2-4-60 Township Boundary and Land Use Zoning Signs — August 2000

PURPOSE

In the past, there have been requests by both urban and rural townships to have township boundary signs and land use zoning signs erected on WisDOT system roadways in order to identify themselves to motorists. In 1997, Assembly Bill 114 created a procedure that allows certain towns to become “urban towns” in order to specify the towns that are eligible to invoke this procedure and to define the authority granted to towns that become urban towns. As of the date of this policy, Assembly Bill 114 **did not pass.**

The intent of this policy is to establish a statewide policy and to control the clutter of signs on WisDOT system roadways by not allowing the use of these signs.

POLICY

Township Boundary signs and/or Township Land Use Zoning signs *should not* be installed on WisDOT system roadways, or right of ways, either individually or as part of a sign assembly. Zoning requirements are easily obtainable from local governments, thus making this signing unnecessary because these signs do not serve to guide or orient the average motorist. Similarly, township boundary signs do not have sufficient orientation value to warrant installation on the state highway or right-of-way system, since townships are not even shown on the state map.

In some cases, Township Boundary signs *may* be allowed by the Department for urbanized townships only. Requests for signing for urbanized township signs will be reviewed by the Department on a case-by-case basis and a permit *may* be granted.

Any existing Township Boundary signs or Township Land Use Zoning signs located on WisDOT system roadways that have not been permitted **shall** be removed no later than July 1, 2001.

2-4-65 Amenity Signs — April 2001

PURPOSE

The intent of this guideline is to establish standards for the use of signs which provide information about services provided at roadside facilities, including waysides and historical markers. The guideline is intended reduce the number of certain informational signs and messages in order to retain or improve the impact of other guidance and warning signs. The guideline also reflects the need to focus signing efforts and resources on the signs of highest value for safety and mobility.

Amenity signs, often referred to as “fingerboard” signs, have been installed in the past to give information about services available in the site. These signs were typically mounted below the advance signs to the facility.

The amenity signs covered under this policy include the DB5-69, DG5-69, and DN5-69 series:

- Toilet Sign (DB-5-69A, DG5-69A, and DN5-69A)
- Boat Landing Sign (DB5-69B, DG5-69B, and DN5-69B)
- Drinking Water Sign (DB5-69C, DG5-69C, and DN5-69C)
- Picnic Tables Sign (DB5-69D, DG5-69D, and DN5-69D)

- Historical Marker Sign (DB5-69E)
- Memorial Marker Sign (DB5-69F)

Motorists are accustomed to expecting certain amenities at waysides which reduces the value of some amenity signs. Signs are appropriate for other amenities that motorists are not accustomed to, or are not part of the standard expectation for the roadside facility.

POLICY

1. Toilet, Drinking Water, and Picnic Table signs shall not be installed on state highways. Those Toilet, Drinking Water, and Picnic Tables signs previously installed on state highways will be allowed to remain in place until the end of their useful life, when they should be removed and not replaced. Useful life ends when the sign message no longer meets legibility or condition standards. These signs may be removed prior to the end of the signs useful life when opportunities arise such as knockdown or damage, when other work is occurring nearby, or projects that make removal practical.
2. Boat Landing, Historical Marker, and Memorial Marker signs should continue to be installed on state highways. These signs should be mounted below the advance sign to the facility.

2-15-1.1 AASHTO Guide for Supplemental Signs — September 2007

GUIDELINES

Following is a copy of the 2001 AASHTO Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways. These are the AASHTO Guidelines that are incorporated by reference in Section 2E.35 of the MUTCD. This section of the MUTCD also recommends that states *should* adopt an appropriate policy for installing supplemental signs using the AASHTO Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways.

The department has adopted policy pursuant to Section 2E.35 which is found in TEOpS 2-15-3. Both the AASHTO Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways" as incorporated in the MUTCD and the department policy found in TEOpS 2-15-3 apply.

PART I
Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways

PART II
Guidelines for Airport Guide Signing

PART III
List of Control Cities for Use in Guide Signs on Interstate Highways

2001

ISBN 1-56051-154-0

**Published by the
American Association of State
Highway and Transportation Officials
444 North Capitol Street, N.W., Suite 249
Washington, D.C. 20001**

PART I

Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways

The *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD) is the national standard for installing traffic control devices on all roads open to public travel. The MUTCD contains the standards for signing freeways and expressways for motorists who are unfamiliar with an area, but who are traveling between and through the Nation's principal traffic generating centers.

The selection of information to be presented at an interchange is critical to the safe and efficient use of the highway system. The MUTCD provides mandatory requirements for installing many freeway signs, but leaves other signing discretion to the States. One of these discretions is the selection of destinations to be used on major guide signs and supplemental guide signs. Numerous facilities that warrant inclusion on supplemental guide signs, and the addition of new facilities, have posed signing problems in many states.

The guidelines contained herein were developed to assist the States in selecting the most appropriate generators for display on freeway supplemental guide signs. These guidelines provide a basis for development of individual State policies which should consider local needs, customs, and legal requirements.

The MUTCD provides several restrictions on the use of supplemental guide signs on freeways. Those portions of the MUTCD are repeated below.

Sec. 1A-3.1 "Traffic control devices shall be placed only by the authority of a public body or official jurisdiction, for the purpose of regulating, warning, or guiding traffic. No traffic control device or its support shall bear any advertising or commercial message, or any other message that is not essential to traffic control... All unofficial and non-essential signs should be removed."

Sec. 2F-20 "...the major signs at freeway interchanges and on their approaches are advance guide signs and exit direction signs. It is essential that the same destination messages be displayed on these signs. New destination information should not be introduced into the major sign sequence for one interchange, nor should information be dropped... Supplemental guide signing should be used sparingly, as provided in Section 2E-28."

Sec. 2E-28 "Information regarding destinations accessible from an interchange, other than places shown on the standard interchange signing, may be shown on a supplemental guide sign. Such a sign may list one or two destinations followed by the interchange number (and suffix) or if interchanges are not numbered, by the legend 'NEXT RIGHT' or 'SECOND RIGHT' or both, as appropriate. The supplemental guide sign installation should be erected approximately midway between the two major advance guide signs. If only one advance guide sign is used, the supplemental guide sign should follow by at least 800 feet.

Supplemental signing can reduce the effectiveness of the other important guide signing because of the possibility of overloading the vehicle operator's capacity to receive and make decisions on visual messages. The AASHTO *Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways* is incorporated in this section as a guide. States may develop an appropriate policy for such signing. Such items as population, traffic generated, and distance should be taken into account.

Only one supplemental guide sign may be used on each interchange approach. If used, it is normally installed as an independent guide assembly. Guide signs directing motorists to park-and-ride facilities shall be considered as supplemental signs..."

Sec. 2F-34 "Scenic area signing should be consistent with that specified for rest areas. Standard messages should read 'SCENIC AREA' or 'SCENIC VIEW' or the equivalent."

Sec. 2H-16 "Supplemental guide signs with a white legend and border on a brown background may be used on an expressway or freeway when a park or recreational or cultural interest area is signed as a significant destination for users of these roads. The same color combination may be used for the advance guide sign and the exit direction sign for an interchange where the crossroad leads exclusively to a park, or to a recreational or cultural interest area.

Where the crossroads of an expressway or freeway leads to a destination other than a park or a recreational or cultural interest area, the advance guide sign and the exit direction sign shall retain the white on green color combination.

All gore signs shall have a white legend on a green background, regardless of the above conditions. The background color of the interchange exit number panel shall match the background color of the guide sign proper."

Secs. 2F-41, 2E-42, 2D-49 (paraphrased) If they do not interfere with signing for interchanges or, other equally critical points, miscellaneous guide signs, or various types may be used to show state, county, and other significant local jurisdictional boundaries. Signs of this character should not be installed unless there are specific reasons for orienting the users of the freeway or identifying control points for activities that are clearly in the public interest.

Sec. 2F-40 "The commonly used name or trailblazer symbol for a toll facility may be displayed on free sections of the Interstate System at

1. the last exit before entering a toll section of the Interstate System;

2. the interchange or connection with a toll facility, whether or not the toll facility is a part of the Interstate System; and

3. other locations within a reasonable approach distance of toll facilities when the name or trailblazer symbol for the toll facility would provide better guidance to drivers unfamiliar with the area than would place names and route numbers.

The toll facility name or marker may be included as a part of the guide sign installations on intersecting highways and approach roads to indicate the interchange with a toll section of an Interstate highway. Where needed for the proper direction of traffic, a trailblazer for a toll facility that is part of the Interstate System may be displayed with the Interstate trailblazer assembly."

General Criteria and Limitations

General signing criteria and limitations should be established by the States. Generators which have the greatest traffic should be shown on supplemental guide signs. This does not mean that all facilities that meet the criteria should automatically receive informational signing. Signing for traffic generators is considered supplemental to the overall signing system for freeways. Therefore, before a sign for a traffic generator is installed, sufficient space should exist to accommodate the placement of the sign without interfering or conflicting with required signing. Normally, supplemental guide signs for traffic generators should not be installed at freeway-to-freeway interchanges.

Not more than one supplemental guide sign for a traffic generator should be provided in each direction along any freeway. Signs for these facilities shall be located in advance of the interchanging road that provides the most direct route to the facility.

Information relating to a traffic generator should be displayed at the freeway exit nearest to the facility. Consideration may be given to displaying the information at a second freeway when the prime criterion is exceeded by at least 50 percent and the traffic generator is within two-thirds of the specified distance for the nearest freeway and within the specified distance for the farthest freeway. Supplemental guide signs should not be erected for a traffic generator that would require a motorist to travel on the interchanging road beyond a second freeway.

Signing for a seasonal generator may be displayed when warranted. Such signing shall be removed at the end of the season, or a changeable message type installation may be used.

Two traffic generators may be displayed on a single, permanent, or seasonal guide sign. When more than two traffic generators meet the signing criteria, generators having the greatest need for signing should be shown. Permanent supplemental guide sign and seasonal supplemental guide sign information for traffic generators may be installed on the same supports.

Signing for a traffic generator should not be displayed on a supplemental guide sign until signing has been installed at the ramp terminals and along the interchanging road and other roads as necessary to direct the motorist from the freeway to the traffic generator.

Specific Criteria

Certain types of generators appear through attendance or special activities to warrant signing with minimal traffic volume criteria. While it is recommended that criteria be established, signs may, at the option of the States, be erected for the following types of generators, without establishing a traffic volume warrant.

1. Major airports
2. Major military installations
3. Major colleges and universities
4. Federal and State parks
5. Major recreational areas
6. Other incorporated cities

Other generators that may qualify for signing on the conventional highway system are not normally of interest to the freeway user. Except under unusual circumstances, supplemental signing should not be considered for the generators shown in Table I. This table is not all-inclusive, but provides an indication of the type of facilities not normally warranting signs.

Table II provides guidelines to establish criteria for selection of destinations to be shown on supplemental guide signs. In view of the broad range of population densities throughout the Nation, numerical values may be altered as required by local conditions. A typical selection of generators was included in this table and geographical conditions, legal requirements, or administrative policy may require certain deletions or expansion of the table in individual states.

TABLE I
Traffic Generators That Do Not Normally Warrant Signing

Businesses
TV/Radio Stations
Theaters
Motels/Hotels/Inns*
Trailer Parks*
Industrial Parks and Plants
Shopping Centers

Cemeteries
Local or State
Private/Public
Military

Communities
Civil Centers Military
Libraries
Churches
Subdivisions

Governmental
Research/Experimental
County and City Facilities
Courthouses
Driver's License Centers
Highway Buildings
Jails/Prisons
Civil Defense Facilities
Maintenance Facilities
Power Plants

Historical
Homes and Buildings
Privately Owned Facilities

Medical
Mental Facilities
Research Facilities
Sanitariums
Infirmaries or Treatment Centers
Veterans Facilities
County, Fraternal, or Nursing Homes
Retirement Facilities
Humane Facilities
Emergency Medical Services*

Military
Sites or Detachments
Armories
Arsenals

Recreational/Conservational
Country Clubs and Golf Courses
Fish Hatcheries, Game Farms, Preserves, and Refuges
Tree Nurseries/Arboretums
Points of Interest
Camps: Scout, Church, 4 H, Youth, and YMCA/YWCA

Schools
Grade/High
Vocational/Trade
Seminaries
Private

*Items may be included on Motorist Service signs (GAS-FOOD-LODGING-HOSPITAL-CAMPING)

TABLE II

Guideline Criteria for Signing Traffic Generators

These numerical values are provided as guides and may be modified by each state as required by local conditions, laws, and customs.

Type of Generator	Specific Criteria	Major Metro Area[1]	Urban Area[2]	Rural Area
College or University	Total Enrollment Full & Part Time Students or	4,000	2,500	1,500
	No. of Trips[3] Generated Annually	900,000[3a] 1,200,000[3b]	550,000 750,000	300,000 450,000
	Distance from Interchange (mi)[4]	3	4	5
Military Bases	No. of Employees & Permanently Assigned Military Personnel or	5,000	4,000	3,000,000
	No. of Trips[3] Generated Annually	5,000,000[3c]	4,000,000	3,000,000
	Distance from Interchange (mi)[4]	5	7.5	10
Arenas Auditoriums Convention Halls	Annual Attendance	300,000	250,000	200,000
Stadiums	No. of Seats (If Applicable)	6,000	5,000	4,000

TABLE II (continued)

Type of Generator	Specific Criteria	Major Metro Area[1]	Urban Area[2]	Rural Area
State & National Parks Monuments Major Recreational Areas (Fairgrounds, Amusement Parks, Zoos, Etc.)	Distance from Interchange	5	5	5

[1] 50,000 or more population in Urban Area.

[2] 5,000-49,999 population in Urban Area.

[3] Trip: A single or one-direction vehicle movement to the generator. The following trip generation rates are suggested:

- [3a] College or University without dorms, each student=1.5 trips
- [3b] College or University with dorms, each student=2 trips
- [3c] One employee or military personnel=0.9 trips

[4] The distance may be increased 1/2 mile for each 10 percent over the minimum requirement listed to a maximum of two times the minimum distance listed.

Note: When the traffic generator is not located on the crossroad, written confirmation is required from the local government agency that they will install and maintain trailblazing signing for the logical direction of traffic to the facility.

2-15-3 AASHTO Guide for Supplemental Signs — April 2017

DIRECTIONAL AND INFORMATIONAL SIGN REQUESTS

The following is a table intended to provide preliminary information on the eligibility of specific sign requests for installation on the state trunk highway system, including freeways and expressways. It **shall** be used in combination with the rest of this subject, which gives more specific qualifying criteria.

Abbreviations:

Supplemental C: The category for traffic generator supplemental signing on conventional highways

Supplemental F: the category for traffic generator supplemental signing on freeways

SS (numbers): A reference to a numbered subsection of the state statutes

TEOpS (numbers): A reference to another subject in the Traffic Engineering, Operations and Safety Manual

Trans 200.nn: A reference to a subsection in Chapter Trans 200 of the Wisconsin Administrative Code

DESTINATIONS or INFORMATION	CATEGORIES	AUTHORIZATION	REMARKS
Agricultural Experiment	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Agricultural Farms	Not Permitted		
Air Traffic Control	Not Permitted		
Airport – Major	Govt. Transportation		
Airport – Public General Aviation	Govt. Transportation		
Amtrak Station	Govt. Transportation		
Amusement Parks	Supplemental C, SIS,	SS 86.195	Qualifying Criteria

	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Animal Hospitals, Emergency	Not Permitted		
Animal Ranches	Not Permitted		
Animal Shelters	Guidance Signs	Trans 200.03	
Arboretums	Supplemental C		Qualifying Criteria
Arenas, multi-purpose	Supplemental F & C		Qualifying Criteria
Armories, Reserve Ctrs	Supplemental C		Qualifying Criteria
Arrow Boards	Guidance Signs	Trans 200.03	aka Guidance signs
Athletic Fields and/or Facilities	Community wayfinder Guidance Signs	TEOpS 2-15-60Trans 200.03	
Attractions	SIS	SS 86.195	
Auditoriums	Supplemental F & C		Qualifying Criteria
Auto Repair	Not permitted		
Aviation Flight School	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Banners	Information	TEOpS 13-12-1	
Boat Landings	Inter-agency		Conventional Hwy only
Botanical Gardens	Supplemental C		Same as Arboretums
Braking, Engine (Jake)	Special	TEOpS 2-2-30	
Bus Terminals	Not Permitted		
Business District	Special Community wayfinder	TEOpS 2-6-50 TEOpS 2-15-6	Alternative to “Downtown”
Cabins, Cottages, Non-rental	Not Permitted		
Cabins, Cottages, Rental	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Camping, including Logo	SIS, TODS, Guidance Signs		Category depends upon highway type
Campgrounds (public)	Inter-agency		
Camps, Private	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Canoe, Kayak, Tubing Facilities	TODS	SS 86.196	
Casinos	Supplemental F & C		Qualifying Criteria
Cemeteries	Not permitted		See Veterans Cemeteries
Churches	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
City Hall	Community wayfinder	TEOpS 2-15-6	
City Parks	Community wayfinder	TEOpS 2-15-6	
Civic Centers	Community wayfinder	TEOpS 2-15-6	
Clinics	Not Permitted		
Colleges	Supplemental F & C		Qualifying Criteria
Community Destination Signs	Community wayfinder	TEOpS 2-15-6	aka “Wayfinder” signs
Community Welcome Signs	Special/Not Permitted	TEOpS 2-1-41	
Conservation Center	Inter-agency		Conventional Hwy only
Convention Centers	Supplemental F & C Community wayfinder Guidance Signs	 TEOpS 2-15-6 Trans 200.03	Qualifying Criteria Also TEOpS 2-15-60
Correctional Institutions	Inter-agency		Conventional Hwy only
Country Clubs	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
County Fairgrounds	Inter-agency		
County Institutions (Healthcare Facilities)	Inter-agency, Guidance Signs	 Trans 200.03	 also TEOpS 2-15-60
County Parks	Inter-agency		
Courthouses	Community wayfinder	TEOpS 2-15-6	
Crime Stoppers	Special/Not Permitted		
Cruises, Boat	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Dance Halls	Not Permitted		
D.A.R.E.	Special/Not Permitted		
DMV Service Center	State Govt. Service Centers/Intra-agency		Conventional Hwy only
DNR Service Center	State Govt. Service Centers		Conventional Hwy only
Dog Tracks	Supplemental F & C		Qualifying Criteria
Donation Centers	Community wayfinder	TEOpS 2-15-6	
Downtown	Special Community wayfinder	TEOpS 2-6-50TEOpS 2-15-6	

Drive-In Theatres	TODS	SS 86.196	
Emergency Medical Treatment	Special	TEOpS 2-4-45.1 & TEOpS 2-4-45.2	Emergency Room criteria
Emissions Testing Station	State Govt. Service Centers/Intra-agency		Conventional Hwy only
Environmental Center	Inter-agency Guidance Signs	Trans 200.03	Conventional Hwy only, also TEOpS 2-15-60
Events, Special	Special	TEOpS 2-15-25	
Exhibition, Exposition Center	Supplemental F & C Guidance Signs	Trans 200.03	Qualifying Criteria also TEOpS 2-15-60
Fairgrounds	Inter-agency		
Factories	Not permitted		
Ferries	Govt. Transportation		
Fish Hatcheries	Inter-agency		Conventional Hwy only
Food, includes logo	SIS, TODS	SS. 86.195 SS 86.196	
Forest boundaries	Not permitted		
Forest Headquarters	Inter-agency		
Freight Terminals	Not Permitted		
Fuel (with logo)	SIS, TODS	SS. 86.195 SS 86.196	
Game Farms	TODS		
Gas, (with logo)	SIS, TODS	SS. 86.195 SS 86.196	
Golf Courses	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Government Offices	State Govt. Service Centers		Also the State Capitol
Gun Clubs, Ranges	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Half-way Houses	Not Permitted		
Health Clubs	Not Permitted		
Heritage Tourism Sites	Program discontinued as of 12/1/13		Also TEOpS 2-4-52
Highway Departments	Not Permitted		
Highway Maintenance Facilities	Not Permitted		
Historic Buildings	Special or Inter-Agency		Could be Community wayfinder
Historic District / Historic Downtown	Special or Community wayfinder	TEOpS 2-6-55 TEOpS 2-15-6	
Historic Neighborhoods	Not Permitted		
Historic Sites	Special or Inter-Agency		Conventional Hwy only
Historic Society Sites	Special or Inter-Agency		
Historical Markers		TEOpS 2-4-40	
Horseback Riding	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Hospitals	Special	TEOpS 2-4-45.1	Emergency Room criteria
Hotel (See Lodging)	SIS, TODS, Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Humane Society Shelter	Guidance Signs Community wayfinder	Trans 200.03 TEOpS 2-15-6	also TEOpS 2-15-60
Ice Arenas, community	Community wayfinder	TEOpS 2-15-6	
Industrial Parks	Supplemental C		
Jails	Not Permitted		
Jurisdictional Boundary Signs	Information	TEOpS 2-1-41	
Kennels	Not Permitted		
Lake, River, Stream	Information	TEOpS 2-4-55	
Libraries	Community wayfinder Guidance Signs	TEOpS 2-15-6 Trans 200.03	alsoTEOpS 2-15-60
Local Parks	Community wayfinder Inter-agency	TEOpS 2-15-6	
Lodging (with logo) (without logo)	SIS TODS Guidance Signs	SS. 86.195 SS 86.196 Trans 200.03	also TEOpS 2-15-60
Logos on Signs	SIS	SS. 86.195	also TEOpS 2-15-4
Main Street Community	Special/Not permitted		

Malls	Not Permitted		
Marinas (Public)	Inter-agency		Qualifying Criteria
Marinas (Privately owned)	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Memorial Facilities	Information	SS. Chapter 84	Legislated
Mental Facilities (Public)	Not Permitted		
Military Academies	Community wayfinder	TEOpS 2-15-6	
Military Bases, Major	Inter-agency		
Mobile Home Parks	Not Permitted		
Motel (See Lodging)	SIS, TODS, Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Museums	Supplemental F & C TODS, Guidance Signs	SS 86.196 Trans 200.03	Could also be Community Wayfinder
National Forest boundaries	Not Permitted		Off R/W only
National Historic Landmark	Inter-agency		Could also be Historical Marker Guide Signs (TEOpS 2-4-40)
Neighborhood Watch	Special	ss. 66.0429(2) ss. 60.23(17m)	ss. 86.19 & TEOpS 2-4-45.3
NEXT (n) EXITS	Information		Primary signing, freeway only
Nursing Homes – Private	Not Permitted		See County Institutions
Office Buildings	Not Permitted		See Government Offices
Orchards	TODS	SS 86.196	
Park & Ride Lots	Govt. Transportation		
Parks, State/county/local	Inter-agency		Or Community wayfinder
Parking Lots, municipal	Community wayfinder	TEOpS 2-15-6	
Parking Restrictions	Special	ss. 349.13 TEOpS 2-2-41	MUTCD 2B.41
Pharmacy	Not Permitted		
Police Stations	Community wayfinder	TEOpS 2-15-6	
Population Signs	Information	TEOpS 2-1-41	
Ports	Supplemental F & C		Great Lakes Shipping only
Post Offices	Community wayfinder	TEOpS 2-15-6	
Power Plants (utilities)	Not Permitted		
Preserves, Nature/Wildlife	Not Permitted		See Wildlife Refuges & Watchable Wildlife
Prisons	Inter-agency		Conventional Hwy only
Private Camps	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Public Access, lake/river	Inter-agency		
Race Tracks	Supplemental F & C		Qualifying criteria
Rail Passenger Stations	Govt. Transportation		Amtrak only
Recreation Trails	Guidance Signs	TEOpS 2-15-15 Trans 200.03	also TEOpS 2-15-60
Recycling Centers	Community wayfinder	TEOpS 2-15-6	
Rehabilitation Centers	Not Permitted		
Religious Camps	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Religious Worship	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Research Facilities	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Resorts	TODS, Guidance Signs	SS 86.196 Trans 200.03	also TEOpS 2-15-60
Restaurants	SIS, TODS, Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Retirement Facilities	Not Permitted		
River, Lake, Stream	Information	TEOpS 2-4-55	
Sanitariums (Public)	Community wayfinder Supplemental C	TEOpS 2-15-6	
Schools, High, Middle, Elementary	Community wayfinder Guidance Signs	TEOpS 2-15-6 Trans 200.03	also TEOpS 2-15-60
Scientific Experiment (public owned)	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Seminaries	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Service Organization	Not Permitted		
Sheriff Freeway Patrol Substations	Inter-agency		Freeways Only
Shooting Ranges	Guidance Signs	Trans 200.03	also TEOpS 2-15-60

Shopping Centers	Not Permitted		
Ski Areas, Downhill	Inter-agency		
Skiing – Cross Country Trails	Inter-agency		Conventional Hwy only, For trailheads only
Snowmobile Trails (named)		TEOpS 2-1-50 TEOpS 2-15-15	
Stadiums	Supplemental F & C		Qualifying criteria
State Forest / State Parks Boundaries	Not Permitted		
State Forest / Parks HQs	Inter-agency		
State Historical Markers		TEOpS 2-4-40	
State Historic Sites	Supplemental or Inter-agency		Operated by WI Historical Society
State Patrol HQs	Intra-agency		
State Trails	Inter-agency	TEOpS 2-15-15	
Subdivisions	Not Permitted		
Supper Clubs	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Swimming Pools & Natatoriums	Community wayfinder	TEOpS 2-15-6	
Synagogue	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Taverns	Not Permitted		
Technical College	Supplemental F & C		Qualifying criteria
Theaters, Live	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Theatres, Movie	Not Permitted		
Tourist Information Centers		TEOpS 2-6-35	County or Local
Tourist Oriented Directional Signs	TODS category	ss. 86.196, Trans 200.08	
Township Boundary	Not permitted	TEOpS 2-4-60	
Trails, Recreation	 Guidance Signs	TEOpS 2-15-15 Trans 200.03	 also TEOpS 2-15-60
Train rides (Entertainment)	TODS Guidance Signs	SS 86.196 Trans 200.03	 also TEOpS 2-15-60
Train station	Govt. Transportation		See Amtrak & Rail Passenger Stn
Travel Information	Inter-agency		State Tourism
Tree City	Special / Not Permitted		
Tree Nurseries	Not Permitted		
Truck Stops, Truck Parking	SIS, TODS		
Tubing, River	TODS	SS 86.196	
TV/Radio Stations	Not Permitted		
Unincorporated Communities	Information and/or Special	TEOpS 2-4-48	
Universities	Supplemental F & C		Qualifying criteria
UW Extension Offices	Not Permitted		
Vehicle Emissions Testing Stations	State Govt. Service Centers/Intra-agency		Conventional Hwy only
Vehicle Registration	State Govt. Service Centers/Intra-agency		Conventional Hwy only
Veterans Cemeteries		TEOpS 2-15-20	
Veterans Centers	Inter-agency		
Veterans Memorials	Not Permitted		
Vocational Schools	Supplemental F & C		
Watchable Wildlife Area	Inter-agency		DNR designation
Wayfinder Signs	Community wayfinder	TEOpS 2-15-6	
Welcome To	Not Permitted	TEOpS 2-1-41	
Wildlife Refuges	Supplemental C Guidance Signs	 Trans 200.03	Conventional Hwy only, To Instructional Centers only
Wineries	TODS	SS 86.196	
Youth Camps	Guidance Signs	Trans 200.03	also TEOpS 2-15-60
Zoos	Supplemental F & C Community wayfinder Guidance Signs	 TEOpS 2-15-6 Trans 200.03	Qualifying criteria also TEOpS 2-15-60

Any facilities not included in this listing, **shall** be considered non-qualifying and **shall not** be permitted.

DEFINITIONS

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

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

Conventional highways are defined s 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.

Traffic generators are defined as any facility, activity, or special point of interest which attract large numbers of people, the majority of whom are unfamiliar with the local area and/or access routes.

Trailblazing signs, in this context, are community destination signs or other directional guide signs that direct subsequent turns on local streets to reach a destination.

GENERAL PURPOSE AND GUIDELINES

Department Functions and Responsibilities

The Wisconsin Department of Transportation (hereinafter referred to as Department) has the primary responsibility to develop, maintain, and operate a state trunk highway system designed to move traffic from one destination to another in a safe, efficient, and expeditious manner. Erecting and maintaining highway traffic signs on the state highway system is a part of this responsibility.

Standards for the design and application of all highway traffic signs erected on public highways are specified in the MUTCD which, in turn, is required by statute to conform to national standards on highway signing. Refer to SS 84.02(4)(e) and (f), SS 84.60(1)(a) and SS 349.065.

Signing under permit is addressed in Chapter Trans 200.03 Wisconsin Administrative Code. Specific Information Signing (Logo), authorized pursuant to SS. 86.195, is addressed in Chapter Trans 200.06, Wisconsin Administrative Code.

The basic supposition of supplemental signing is that the facility or institution as a class is of interest and concern to a sufficient number of motorists to warrant special directional signing. It is also a basic assumption that the purpose of this signing is guidance and not advertising.

It is the purpose of these guidelines to describe all types of facilities and institutions for which signs *may* be erected on State Highway right-of-way by state forces or under contract to the state. Conversely signs will not be permitted for any type of facility or institution not addressed herein.

Need for Signing Policy

The Highway Beautification Act of 1965, public law 89-285, placed severe restrictions on billboard advertising. Governor Lee S. Dreyfus issued an administrative order in 1981, requiring the Department to permit supplemental guide signs, directing to the University of Wisconsin campuses. Ever since, there has been a substantial demand on the Department to permit additional directional signs on highway rights-of-way. In order to respond to all sign requests in a fair and consistent manner, the Department recognized the need to establish a signing policy that addressed all aspects of highway signing while maintaining a safe and logical sequence of informational displays in the highway environment. This document supersedes all previous policy guidance on supplemental signing for public and private facilities.

Although the WMUTCD contains standards for design and application of traffic control devices, it does not contain specific criteria on the following subjects:

(1) Allowable sign messages,

(2) Qualifications which permit placement of highway signs for various facilities and/or activities, or

(3) Priority (ranking) of the various sign groups on the basis of highway user needs which, in turn, *should* determine the selection process for sign installations.

These guidelines provide criteria by which to evaluate all highway signing requests in an equitable manner without penalizing the greater majority of highway users.

Human Factors

As vehicles move along a highway, each driver is confronted with many elements; the presence of other vehicles and pedestrians, roadway alignment and other design features, roadside signs and other obstacles, commercial development, wildlife, and adverse weather conditions. Any or all of these factors *may* affect highway safety, as well as the driver’s ability to observe, assimilate, and react to pertinent highway sign messages.

Studies of human behavior have shown that a driver can focus attention on only one thing at a time, but he can respond very rapidly to several stimuli. However, receiving too much information in a short time can adversely affect the driver’s ability to process information effectively, causing what is known as information overload. Information overload is a condition in which the driver is unable to perceive and/or use the information displayed. When this condition occurs, the driver will shift attention from one source of information to another and *may* overlook important sign messages.

Considering the large number of highway elements confronting each driver, it is apparent that the amount of information which can be effectively conveyed by traffic signs, is limited. Therefore, a system for avoiding information overload must be established.

MUTCD References

As a general background, several pertinent paragraphs from the MUTCD, as adopted by Wisconsin, are enumerated below.

Section 1A.01 Purpose of Traffic Control Devices

Support:

The purpose of traffic control devices, as well as the principles for their use, is to promote highway safety and efficiency by providing for the orderly movement of all road users on streets and highways throughout the Nation.

Traffic control devices notify road users of regulations and provide warning and guidance needed for the reasonably safe, uniform, and efficient operation of all elements of the traffic stream.

Standard:

Traffic control devices or their supports shall not bear any advertising message or any other message that is not related to traffic control.

Support:

Tourist-oriented directional signs and Specific Service signs are not considered advertising; rather, they are classified as motorist service signs.

Section 1A.02 Principles of Traffic Control Devices

Support:

This Manual contains the basic principles that govern the design and use of traffic control devices for all streets and highways open to public travel regardless of type or class or the public agency having jurisdiction. This Manual's text specifies the restriction on the use of a device if it is intended for limited application or for a specific system. It is important that these principles be given primary consideration in the selection and application of each device.

Guidance:

To be effective, a traffic control device *should* meet five basic requirements:

A. Fulfill a need;

B. Command attention;

C. Convey a clear, simple meaning;

D. Command respect from road users; and

E. Give adequate time for proper response.

Section 2D.02 Application

Support:

Guide signs are essential to direct road users along streets and highways, to inform them of intersecting routes, to direct them to cities, towns, villages, or other important destinations, to identify nearby rivers and streams, parks, forests, and historical sites, and generally to give such information as will help them along their way in the most simple, direct manner possible.

Section 2D.03 Color, Retroreflection and Illumination

Standard

Except where otherwise specified herein for individual groups of signs, guide signs on streets and highways shall have a white message and border on a green background. All messages, borders, and legends shall be retroreflective and all backgrounds shall be retroreflective or illuminated.

Historic downtown, State and National Historic Sites and Historical Marker signs shall have a white retroreflective message and border on a brown retroreflective background.

Section 2D.07 Amount of Legend

Support:

The longer the legend on a guide sign, the longer it will take road users to comprehend it, regardless of letter size.

Guidance:

Guide signs *should* be limited to three lines of principal legend. Where two or more signs are included in the same overhead display, the amount of legend *should* be minimized. The principal legend *should* include only place names, route numbers, and street names.

Option:

Symbols, action information, cardinal directions, and exit numbers *may* be used in addition to the principal legend where sign space is available.

Section 2E.02 Freeway and Expressway Signing Principles

Support:

The development of a signing system for freeways and expressways is approached on the premise that the signing is primarily for the benefit and direction of road users who are not familiar with the route or area. The signing furnishes road users with clear instructions for orderly progress to their destinations.

Section 2E.03 General

Support:

Signs are designed so that they are legible to road users approaching them and readable in time to permit proper responses. Desired design characteristics include: (a) long visibility distances, (b) large lettering and symbols, and (c) short legends for quick comprehension.

Standard:

Standard shapes and colors shall be used so that traffic signs can be promptly recognized by road users.

(End of MUTCD references)

<u>Signing Priorities</u>

Basic concepts of traffic engineering recognize that the primary function of traffic control signs is to warn, regulate, and guide traffic. Sign spacing and the amount of information displayed have an impact on the driver's ability to read and respond to sign messages in an expected, predictable manner.

Accordingly, traffic control signs on the highway are primarily intended to enable drivers to react promptly, naturally, and properly to the traffic and design conditions encountered; to advise of the regulations and use of streets and highways; to warn of potential roadway hazards; and to provide guidance to major destinations.

Secondary functions of traffic control signs are to advise drivers of various services normally required to complete an extended journey (emergency services, motorist services, public transportation), and of supplemental services, such as recreational facilities or points of interest.

Traffic control signs can be classified into eight basic sign groups. Following is the order of priorities for these sign groups, and a brief description of their specific function, as adopted by the national committees of the American Association of State Highway and Transportation Officials and the Institute of Transportation Engineers.

1. Regulatory Signs - Advise the driver of traffic laws or regulations concerning vehicle operation on the highway.
2. Warning Signs - Advise the driver of unexpected highway conditions which require extra care in driving.
3. Navigational Guide Signs - Identify the route, or routes, that the driver *should* follow to complete a trip. Navigational guide signs indicate directions and distances to cities and to other destinations or regions.
4. Emergency Services Signs - Advise of and direct the driver to facilities providing emergency medical service or assistance. Such facilities include state enforcement agencies and hospitals providing outpatient emergency medical treatment.
5. Motorist Services Signs - Advise of and direct the driver to basic services normally needed to complete a long trip (motor fuel, food, lodging, camping, tourist information centers, and rest areas).
6. Public Transportation Signs - Advise of and direct the driver to facilities providing commercial passenger travel service (airports, park and ride lots, rail passenger stations).
7. Traffic Generator Signs - Advise of and direct the driver to activities, facilities, or special points of interest which attract large numbers of people, a majority of whom are unfamiliar with the local area and/or access routes.
8. General Information Signs - Advise the driver of information that *may* be of interest, though not necessary for travel (municipal boundaries, landmarks).

Signing needs to be evaluated and signs installed in descending order of the priorities indicated as long as adequate space between signs is maintained, thus avoiding information overload and confusion to the driver.

It *may* be necessary to prioritize sign requests. An example of this situation would be where there are more qualifying traffic generators than can be accommodated under the established guidelines. In these circumstances, the several qualifying generators will be ranked according to which generator exceeds, by the greater percentage, the minimum criterion for signing. Those exceeding the warrants by the greatest percentage will be given priority. Where specific criteria are not applicable, those traffic generators closest to the intersection where signing is requested **shall** determine the priority for signing.

FREEWAY & EXPRESSWAY GUIDE SIGNING GENERAL POLICY CRITERIA & RESTRICTIONS

Guide signing can be divided into two basic categories: primary and supplemental. Each category is subject to various practical requirements.

Primary signing includes standard interchange and intersection signing, destination signs, distance signs, required motorist services signs, plus regulatory, warning, and route marker signs. This type of signing always takes precedence in the signing scheme of any intersection or interchange because it is directly related to the primary purpose of the intersection or interchange.

Supplemental freeway signing includes signing to places of lesser importance. Signing for traffic generators is considered secondary to primary signing needs. Highway signing is not intended for the purpose of advertising or promoting the facility, but to direct and guide traffic seeking that facility.

As stated in the MUTCD Section 2E-35:

Support:

Supplemental Guide signs can be used to provide information regarding destinations accessible from an interchange, other than places shown on the standard interchange signing. However, such Supplemental Guide signing can reduce the effectiveness of other more important guide signing because of the possibility of overloading the road user's capacity to receive visual messages and make appropriate decisions.

Guidance:

No more than one Supplemental Guide sign *should* be used on each interchange approach.

A Supplemental Guide sign (see Figure 2E-24) *should not* list more than two destinations. Destination names *should* be followed by the interchange number (and suffix), or if interchanges are not numbered, by the legend NEXT RIGHT or SECOND RIGHT or both, as appropriate. The Supplemental Guide sign *should* be installed as an independent guide sign assembly.

Where two or more Advance Guide signs are used, the Supplemental Guide sign *should* be installed approximately midway between two of the Advance Guide signs. If only one Advance Guide sign is used, the Supplemental Guide sign *should* follow it by at least 245 m (800 feet). If the interchanges are numbered, the interchange number *should* be used for the action message.

States and other agencies *should* adopt an appropriate policy for installing supplemental signs using “The AASHTO Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways.” In developing policies for such signing, such items as population, amount of traffic generated, distance from the route, and the significance of the destination *should* be taken into account.

Standard:

Guide signs directing drivers to park and ride facilities shall be considered as Supplemental Guide signs (see Figures 2E-25).

(End of MUTCD reference)

Placement of supplemental guide signs for a traffic generator **shall** be limited to the nearest freeway or expressway. Signing which would require a motorist to travel on the crossroad beyond another state highway and/or through a community **shall not** be permitted.

Supplemental signs **shall not** be permitted in advance of a system interchange connecting two freeways in which all legs or roadways are declared freeways.

The minimum spacing between guide signs *should not* be less than 800 feet on freeways and expressways (see Figure 1 on page 15). Actual sign installation will depend on whether there is sufficient longitudinal space to accommodate the new sign Installation without violating the minimum allowable 800 feet spacing between signs.

Along a freeway, only one supplemental guide sign **shall** be permitted in each direction of travel for a traffic generator. Signs for generators are to be located In advance of the interchanging roadway that provides the most direct and best route to the facility. In determining the most direct and best route, the Department will consider all relevant conditions including directness of route, speed of travel, length of travel, and ease of locating the facility.

Information relating to more than two traffic generators **shall not** be displayed on supplemental guide signs in advance of an interchange. Both traffic generators **shall** be shown on a single supplemental guide sign installation except where a traffic generator message is included as part of a major guide sign destination. The traffic generator message on the major guide sign **shall** count as one of the two acceptable signs, but an additional sign installation *may* be allowed in such cases.

In the event that there are more than two qualifying facilities, the two facilities that generate the greatest need for providing directional information to motorists **shall** have signs displayed. In determining which signs are most necessary, the Department will consider such factors as the amount of traffic generated, distance from the freeway exit, and ease of locating the facility. If a quantitative comparison is needed, the Principal Destination formula in TEOpS 2-15-5 *may* be used, substituting comparable attendance or enrollment figures for the population.

TABLE 1

GENERAL QUALIFYING CRITERIA FOR SIGNING TRAFFIC GENERATORS ON FREEWAYS OR EXPRESSWAYS

TYPE OF GENERATOR	SPECIFIC CRITERIA	POPULATION OF METROPOLITAN AREA		
		Major[1] OVER 500,000	Urban 50,000-500,000	Rural Under 50,000
Colleges, Universities, Vocational, Technical & Adult Education Colleges	Minimum Campus Enrollment[2]	2,500	1,000	1,000
	Maximum Distance From Interchange (mi.)	2	8	12
Multipurpose Arenas, Auditoriums, Fairgrounds, Museums, Race Tracks, Stadiums, & Zoos.	Minimum Annual Attendance	300,000	200,000	100,000
	Minimum No. of Seats (If Applicable)	6,000	5,000	4,000
	Maximum Distance from Interchange (mi)	2	5	7

[1] Major Metropolitan Area is defined as within Milwaukee County.

[2] Campus enrollment is defined as the total number of full and part-time students that physically attend classes on the specific campus site.

Information relating to traffic generators **shall not** be displayed on a supplemental guide sign until signing has been installed along the interchanging and/or intersecting minor roads to adequately direct the motorist from the freeway exit or intersecting road to the facility. (See <u>SUBSEQUENT TRAILBLAZING SIGNING</u> in **PART 5**.)

For additional specific criteria, see **PART 6** and **PART 7**.

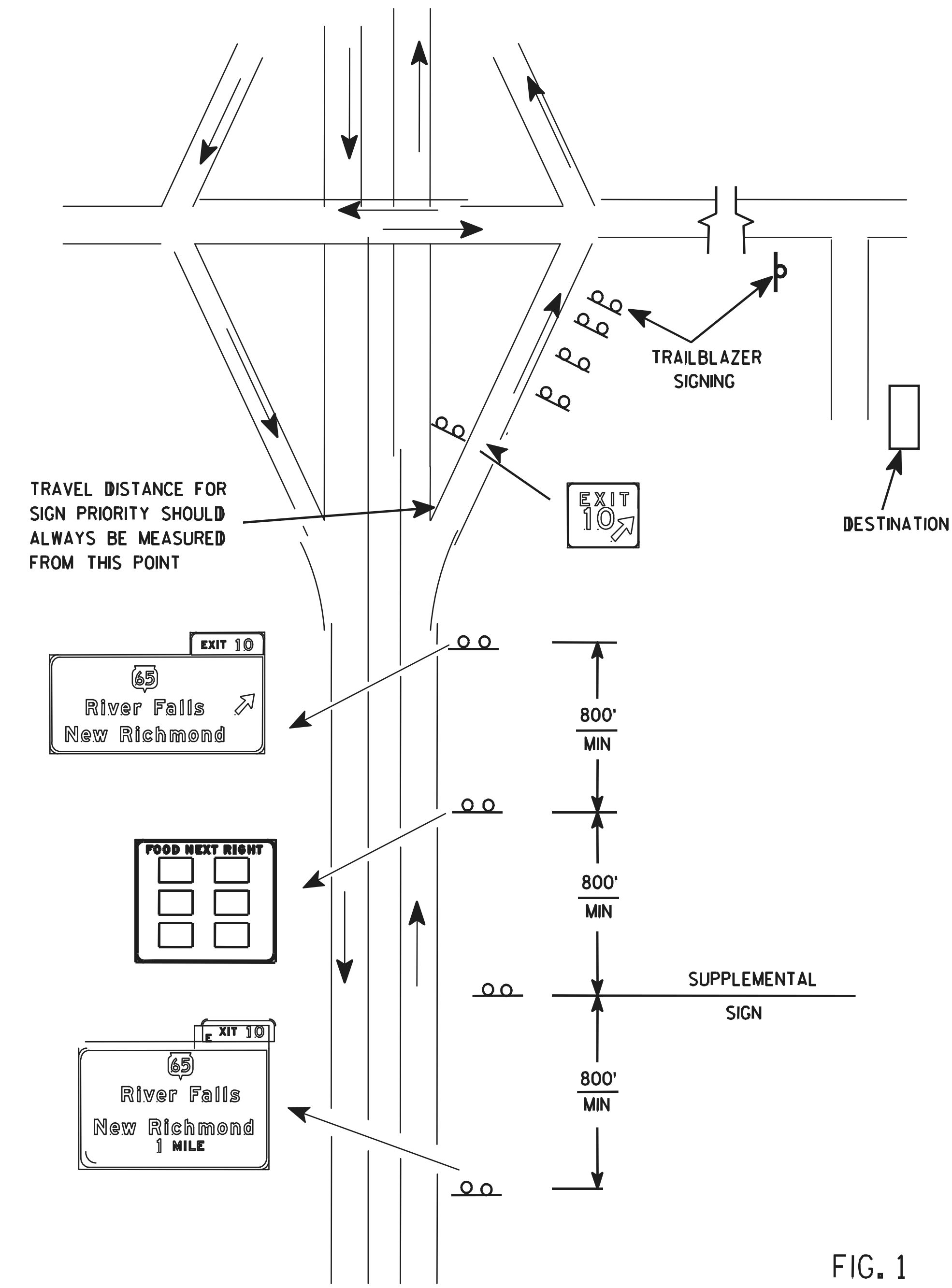


FIG. 1

CONVENTIONAL HIGHWAY GUIDE SIGNING GENERAL POLICY CRITERIA & RESTRICTIONS

1. All specific WisMUTCD requirements must be met in all situations.
2. Location and placement of all signing is dependent upon the availability of longitudinal spacing (200 feet desirable, 100 feet minimum) with respect to existing traffic control devices.
3. A significant portion of the traffic volume generated by the facility must be drivers who are unfamiliar with the local area and/or access routes to the facility. The adverse effects on highway operations created by motorists seeking a facility without guide signing will also be taken into consideration.
4. In designing signs and selecting locations for sign installation on state highways, the department retains the authority to specify message content (including abbreviations), size of sign, sign location, and combination of message, in accordance with standards for acceptable signing practice. The department also retains the authority to deny requests for signing where it deems acceptable standards cannot be

met, including locations where other supplement al signs are already in place.

5. Signing for a specific traffic generator:
    a. **Shall** be limited to a maximum of four signs on state trunk highways
    b. **Shall** be installed only at an intersection that gives the best, most direct access to the traffic generator
    c. **Shall not** be installed at more than one intersection for each direction of traffic on a state trunk highway, but not necessarily at the same intersection for both directions.
6. Signing will normally not be permitted if the establishment is readily visible from the state trunk highway.
7. An on premise sign identifying the facility is required. A sign *may* be installed on the highway fronting a facility if the on premise sign is not feasible due to terrain-related visibility.
8. Supplemental signs and/or trailblazing signs **shall not** be permitted at an intersection from one state highway to another state highway.
9. Placement of supplemental guide signs for a traffic generator **shall** be limited to nearest state highway. Signing which would require a motorist to travel on the crossroad beyond another state highway and/or through a community **shall not** be permitted.
10. Facilities must be open a minimum of five days a week, including normal business hours.
11. The traffic generator must be located within the distance noting in Table 2 from the highway intersection at which signing is requested, unless a different distance is noted in other specific criteria.
12. Signing for a seasonal generator **shall** be covered, removed, or overlaid with a “CLOSED” plaque during the off-season.
13. When two or more qualifying facilities are affiliated with the same agency or institution and share a common access, only one specific name will be permitted on the sign to identify the conglomerate.
14. A facility *may*, at any time, request that a sign erected under these guidelines be removed and the department will arrange for its removal.

TABLE 2. General Qualifying Criteria for Signing Traffic Generators on Conventional Highways

TYPE OF GENERATOR	SPECIFIC CRITERIA	POPULATION OF METROPOLITAN AREA			
		Major[1] Over 500,000	Urban 50,000 – 500,000	Urban 20,000 – 50,000	Rural Under 20,000
Colleges, Universities, Vocational, Technical & Adult Education Colleges	Minimum Campus Enrollment[2]	2,500	750	500	500
	Maximum Distance from Intersection (mi.)	2	8	12	15[3]
All Other Traffic Generators	Minimum Annual Attendance	150,000	100,000	50,000	20,000
	Minimum No. of Seats (if applicable)	3,000	2,500	2,000	2,000
	Maximum Distance from Intersection (mi.)	2	7	10	15[3]

[1]Major Metropolitan Area is defined as within Milwaukee County.
[2] Campus enrollment is defined as the total number of full and part-time students that physically attend classes on the specific campus site.
[3]The distance designated, or half the distance to the next parallel State Trunk Highway, whichever is greater.

Subsequent Trailblazing Signing

Appropriate local road signing to guide motorists to a facility which will be signed from a State Highway or freeway is the responsibility of the facility and the local road authority.

Information relating to traffic generators **shall not** be displayed on a supplemental guide sign until signing has been installed along the interchanging and/or intersecting minor road and other roads to adequately direct the motorist from the freeway exit or intersecting road to the facility. In determining whether there is adequate signing to direct the motorist from the State Highway to the facility, the Department will consider such factors as the directness of the route, the distance involved, and the environment in which the signs are installed.

These signs, used only on non-freeways, are to be placed at sufficiently frequent intervals to adequately guide and reassure motorists. A trailblazing sign with the appropriate arrow **shall** be placed in advance of each intersection where the route changes from one highway to another or where there *may* be confusion as to the direction, which the route takes.

The Department *may* issue a written permit for trailblazing signing on a conventional State Highway to a qualifying traffic generator, which has been signed from a freeway or expressway exit ramp. Subsequent trailblazing signing **shall not** be erected on a State Trunk Highway without such written authority.

Supplemental signs and/or trailblazing signs **shall not** be permitted through a system interchange from one freeway to another or at an intersection from one conventional State Highway to another conventional State Highway.

CATEGORIES & SPECIFIC CRITERIA

The following are categories and relevant information regarding directional and informational signs permitted on the state trunk highway system. References are made to authorization in the statutes, administrative rules, MUTCD, and other subjects in the TEOpS. For each type of sign listed earlier, there is a category below, a TEOpS reference, and/or a notice that the sign is not permitted.

Community Destination (Wayfinder) Signs

These signs are installed, owned and maintained by the community. They direct to area destinations such as Downtown, or Historic District, and individual destinations such as City Hall, Convention Center, museums, and local parks. The individual destinations are generally publicly owned and operated for public use or privately owned non-profit and open to the public. Complete guidance is in TEOpS 2-15-6.

Government Service Centers

State agencies *may* request signs to be installed on state trunk highways to direct traffic to certain service centers. This policy pertains only to state agencies. Local agencies are not included since local agencies generally serve local traffic and the need is not as significant.

Signs *may* be permitted on a state highway only when the service center is not located directly on the state highway system; signs will not be permitted on the state highway system when extensive trail blazing would be required or when guidance *may* be reasonably provided to the service center using street names and addresses.

No signs will be permitted on freeways or expressways.

Signs *may* be allowed at only two intersections of the state trunk highway system with county or local roads for any service center or complex of service centers.

Sign messages must be approved by the department and signs *may* only be installed under the direction of the department.

Service centers are those governmental offices whose primary purpose is to provide direct customer service to the public. Service centers do not include those offices that are predominantly administrative or serving internal agency operations. The extent of external customer traffic will be considered in determining eligibility for service center signs.

The service center requesting the sign is responsible for all costs related to those signs which are incurred by the department.

This guidance is premised on the view that only a select number of locations will qualify for signs. *Should* the number of signs allowed under this guidance adversely affect the safe and efficient operation of the state highway system, signs *may* be further restricted.

Government Transportation Facilities

Guide signs are Department funded and installed on freeways and conventional highways.

Major Airport

> The facility must provide regularly scheduled commercial passenger flights and be located within 15 miles of the freeway or expressway, or within 5 miles of a conventional state trunk highway. Signing to General Mitchell International Airport and Austin Straubel International Airport **shall** be evaluated as a special case.

Public Airport, General Aviation

The facility must be classified as a Large General Aviation Airport or Medium General Aviation Airport, as listed in the Wisconsin State Airport System Plan that is published by the Wisconsin Department of Transportation, Bureau of Aeronautics. The General Aviation airport **shall** be located within 15 miles of the freeway or expressway, or within 5 miles of a conventional state trunk highway.

Park & Ride Lots

The facility must provide free parking, be approved by the Department, and be located within ½ mile of the state trunk highway.

Ports and Harbors

The port or harbor facilities must serve commercial Great Lakes shipping and be located within 10 miles of the freeway or expressway, or within 5 miles of the conventional state trunk highway.

Amtrak Passenger Stations

Facility must provide regularly scheduled intercity passenger service, protection for passenger comfort, public parking, and be within 5 miles of the state trunk highway.

Ferries

Facility must provide regularly scheduled passenger service, protection for passenger comfort, public parking, and be within 5 miles of the state trunk highway.

Guidance Signs

Sometimes called arrow boards, guidance signs are only permitted on conventional state highways or expressway approaches to at-grade intersections. As prescribed in the Wisconsin Administrative Code Chapter Trans 200, these narrow horizontal sign panels *may* bear the names of, and direct to:

- Resorts,
- Hotels,
- Places of public entertainment or instruction,
- Any place of religious worship,
- County institutions,
- Scientific experimental locations for the furtherance of agriculture, science or art.

The term “entertainment” in this case does not include nightclubs, taverns, or similar establishments.

The regions *may* issue a permit; there is no permit fee, and installation **shall** be by the requestor’s choice of a WisDOT approved signing contractor or county signing crew. Detailed department guidelines and the permit application Form DT1903 are contained in TEOpS 2-15-60.

Information Signs

Information signs *may* be permitted or installed by the Department to identify geographic features and/or provide information to the traveling public. Qualifying geographic features are those found on the official state highway map.

The following specific guidelines **shall** be applied to these individual signs.

- City or village population signs limit signs *may* be installed and maintained by the Department in accordance with TEOpS 2-1-41.
- County Line signs **shall** be installed by the Department on all state highways at or near the county line. No other signs **shall** share the supports.
- Lake, River or Stream signs *may* be installed and maintained by the Department in accordance with TEOpS 2-4-55.
- Memorial Facilities signs **shall** be installed and maintained by the Department in accordance with Chapter 84 of the State Statutes.
- NEXT (n) EXITS signs *may* be installed and maintained on freeways by the Department, upon request by an incorporated city or village being appropriately served by two or more consecutive exits.
- Street Name Signs *may* be independently installed and maintained on the STH right-of-way by the municipality with jurisdiction over the side road or crossroad.

- Unincorporated Community signs *may* be installed and maintained by the Department in accordance with TEOpS 2-4-48.
- Advance Crossroad Name signs *may* be installed and maintained by the Department in accordance with TEOpS 2-4-50.

Inter-Agency Facilities

Signs *may* be permitted on the basis of agreements with other state, federal, and county agencies, such as state and county historical societies, the Department of Natural Resources, and Department of Tourism. In most cases, the Department of Transportation will arrange for sign installation and maintenance and request reimbursement. Agreements and permits are subject to the department's evaluation and approval based on the following specific requirements.

- Boat landings; public access to lakes & rivers
    - Conventional highways only.
    - No attendance criteria.
    - A sign **shall not** be permitted unless the access point is located on a road that is sufficiently improved so that a passenger car can use the road without being scratched, dented, or otherwise damaged.
    - Additional criteria:
        - Maximum distance from state trunk highway intersection: 2 miles
        - Parking provided at access site
        - Gravel surface (or better) at access site
        - Improved boat-launching ramp
- Campgrounds, public
    - Conventional highways only
    - No attendance criteria
    - Signing *may* be permitted on conventional highways only, subject to all other general criteria applicable to each facility and location
    - Additional criteria:
        - Public-owned and operated campgrounds *may* be signed if they have a minimum of 50 campsites, adequate toilet facilities, and safe drinking water
        - Only requests from the public agency owning the campground **shall** be considered
        - Campgrounds that are a part of a national, state, county, or local park **shall not** be signed separately, but signing *may* be considered for the park
    - Privately-owned camping facilities *may* qualify for signing under the Specific Information Sign (SIS), Tourist-Oriented Directional Sign (TODS)< or Trans 200 Guidance Sign programs
- Conservation or environmental centers
    - Supplemental signing *may* be permitted on conventional highways, subject to the general criteria applicable to each facility and location and the following additional criteria:
        - Provide on-site, off-street parking for minimum 50 vehicles
        - Provide educational programs and/or audio/visual presentations
    - Centers that are part of a national, state, county, or local park or forest **shall not** be signed separately, but signing *may* be considered for the park or forest headquarters entrance
- Corps of engineering facilities (such as lock and dam sites)
    - Conventional highways only
    - No attendance criteria
    - Signing *may* be permitted on conventional highways only, subject to all other general criteria applicable to each facility and location
    - Additional criteria:
        - Must provide picnic and park facilities
        - Must provide viewing provisions for the public
        - Must provide parking for 25 vehicles or more
- Fairgrounds, state and county
  Supplemental signing *may* be permitted on freeways or conventional highways, subject to all the general criteria applicable to each facility and location
- Fish hatcheries
    - Conventional highways only
    - No attendance criteria
    - Signing *may* be permitted on conventional highways only, subject to all other general criteria applicable to each facility and location

  - Additional criteria:
    - Must be state-owned facilities
    - Must provide visitor accommodations
- Forest headquarters
  - No attendance criteria
  - Supplemental signing *may* be permitted on freeways or conventional highways, subject to all other general criteria applicable to each facility and location
  - Additional criteria:
    - Provide on-site, off-street parking for minimum 50 vehicles
    - Provide educational programs and/or audio/visual presentations
  - Only requests from the public agency managing the forest **shall** be considered
- Historic sites
  - Conventional highways only
  - No attendance criteria
  - Sings on freeways or conventional highways *may* be permitted for state historical sites operated by the Wisconsin Historical Society, subject to all other general criteria applicable to each facility and location
- Institutions, county (publicly-owned nursing homes)
  - Conventional highways only
  - No attendance criteria
  - Signing *may* be permitted on conventional highways only, subject to all other general criteria applicable to each facility and location
- Marinas (publicly-owned)
  - Signs on freeways or conventional highways *may* be permitted for marinas, subject to all other general criteria applicable to each facility and location
  - Additional criteria:
  - To qualify for freeway signs, the marina **shall** have a minimum of 500 boat slips
  - To qualify for conventional highway signs, the marina **shall** have a minimum of 125 boat slips
- Military bases, major

  Signs *may* be permitted to Fort McCoy, Volk Field, and Camp Williams
- National historic landmarks
  - Signs *may* be permitted for freeways, expressways and conventional highways, subject to all other general criteria applicable to each facility and location
  - Additional criteria:
    - The site **shall** be a documented national historic landmark that is officially on the listing for National Historic Landmarks in Wisconsin designated by the secretary of the U.S. Department of the Interior (www.nps.gov/nhl/find/statelists/wi/WI.pdf)
    - Only historical sites are eligible, not individual buildings
    - A historical site is comprised as a complex of buildings or an entire district that is a documented national historic landmark
- Parks, national state, and county freeway
  - Supplemental signing *may* be permitted, subject to the general criteria applicable to each facility and location
  - No annual attendance criteria
  - Signing *may* be erected for state parks with the Department of Transportation and the Department of Natural Resources mutually agreed upon. The following **shall** be provided as a minimum:
    - Off-highway parking
    - Safe drinking water
    - Toilet facilities
    - 50 camping sites
    - Swimming
    - Handicapped-accessible camping and picnic areas
    - State parks **shall** also offer other special attractions, such as skiing, nature trails, improved hiking trails, interpretive centers, vistas and overlooks, or be of statewide historical significance
- Conventional highway
  - Supplemental signing *may* be permitted, subject to the general criteria applicable to each facility and location
  - No annual attendance criteria

    - Signing *may* be erected for state parks with the Department of Transportation and the Department of Natural Resources mutually agreed upon. The following **shall** be provided as a minimum:
        - Off-highway parking
        - Safe drinking water
        - Toilet facilities
        - Handicapped-accessible camping and picnic areas
        - State parks **shall** also offer other special attractions, such as skiing, nature trails, improved hiking trails, interpretive centers, vistas and overlooks, or be of statewide historical significance
- Prisons, federal/state
    - Conventional highways only
    - No attendance criteria
    - Signing *may* be permitted on conventional highways only, subject to all other general criteria applicable to each facility and location
- Sheriff freeway substations
    - Signs on freeways *may* be permitted for county sheriff freeway substations
    - County sheriff's office **shall** have unique statutory authority for patrolling the freeway system to qualify for signage. Presently, only Milwaukee County has this statutory authority.
- Ski areas, downhill
    - No attendance criteria
    - Signs on freeways or conventional highways *may* be permitted for downhill ski areas, subject to all other general criteria applicable to each facility and location
- Travel information, state
    - No attendance or usage criteria
    - Subject to other general criteria, state travel information stations *may* be signed under mutual agreement between the Department of Transportation and the Department of Tourism. As a minimum, the locations **shall** provide parking facilities and public restrooms.
- Veterans centers/facilities
    - No attendance or usage criteria
    - Signs on freeways or conventional highways *may* be permitted for veterans centers with hospitals providing major medical or outpatient services, subject to all other general criteria applicable to each facility and location
- Intra-agency
  Signs are permitted under agreements with other divisions in the Department of Transportation, such as DMV and DSP. No reimbursement is required.
- Special
  This category addresses these specific types of signs which are described in other parts of the TEOpS or in other policies
    - Downtown: the department permits downtown sign(s) at strategic freeway or expressway exit(s) into the city in accordance with TEOpS 2-6-50
    - Historic downtown/district: the department permits historic downtown or historic district sign(s) at strategic freeway or expressway exit(s) into the city in accordance with TEOpS 2-6-55
    - Business district: as an alternative to downtown, the department permits business district signs on conventional highways at main street intersections
    - Emergency medical: standard hospital or emergency medical services signs are installed by the department on state trunk highways to direct to facilities which meet the qualifying criteria in TEOpS 2-4-45.1 and 2-4-48
    - Unincorporated communities: the department *may* install signs directing to unincorporated communities in accordance with TEOpS 2-4-48
    - Engine braking: WisDOT standard signs are permitted on conventional highway entrances to communities in accordance with TEOpS 2-2-30
    - Events, special: the department *may* permit signs directing to special events in accordance with TEOpS 2-15-25
    - Heritage tourism: program has been discontinued as of 12/1/13 in accordance with TEOpS 2-4-52
    - Neighborhood watch: approved signs are permitted within cities and villages under State Statute 66.0429(2). Further guidance is provided in TEOpS 2-4-45.3
    - Parking restrictions: no parking zones and seasonal or overnight parking restrictions *may* be signed by the department or cities and villages in accordance with State Statute 349.14. Sign

messages *should not* attempt to detail complex parking ordinances. Further guidance is provided in MUTCD Section 2B.41 and TEOpS 2-2-41.

- Miscellaneous non-permitted: some municipalities desire various nonstandard promotional signs. Examples include, but are not limited to, CRIME STOPPERS, DARE COMMUNITY, MAIN STREET USA, TREE CITY, COMMUNITY RECYCLING, SERVICE CLUBS, WELCOME TO ____, and HOME OF THE ____. Such signs **shall not** be permitted on the state highway right-of-way under WisDOT jurisdiction. They *may* be displayed at or outside the right-of-way line.

- Special information signs (SIS)
  - References: State Statute 86.195 and Administrative Code Trans 200.06. Specific information signs are only allowed on the highway segments listed in this statute.
  - Business signs are separately attached rectangular plates which show the brand, symbol, trademark, name or combinations of these for motorist services accessible from an approaching interchange or intersection. They are commonly called “logos” and are confined to five categories: fuel, meals, lodging, camping, and attractions.
  - Specific information signs are technically the blue rectangular sign panel on which the business signs are mounted along with directional information.
  - Interstate logos: Wisconsin is under contract to administer this signing program for the department. He contractor verifies the qualifications, and installs and maintains all signs. Application and annual fees are charged.
  - All inquiries, including damage reports, *may* be referred to Jordan VanGeffen at 1(844)496-9163 or visit the website.
- Tourist-oriented directional signs (TODS)
  - References: State Statute 86.196, and Administrative Code Trans 200.08
  - These signs are blue panels in rural areas (outside urban area boundaries) on conventional state highways that are not under the SIS sign program. Businesses which make all or most of their sales to visitors or tourists *may* be eligible. Applications, installation, and maintenance *should* be arranged by the county, subject to the approval of the maintaining authority. Application and renewal fees are charged. These signs are not permitted on the freeway system.

SPECIFIC POLICY FOR SUPPLEMENTAL SIGNS ON FREEWAYS & EXPRESSWAYS

The document, *Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways*, published in 2001 by the American Association of State Highway and Transportation Officials, has been used as the basis for WisDOT policy in order to be in substantial conformance with the national standards, required by Federal and State law. This AASHTO document is reprinted with permission in TEOpS 2-15-1.1.

Supplemental guide signs, directing to municipalities, *may* be permitted, upon request, as provided for in ss. 86.19(6), but subject to the other general policy criteria & restrictions in PART 4. Qualifying municipalities **shall** be incorporated cities or villages shown on the official State Highway map and **shall** be within 5 miles of the freeway exit. The municipality **shall** be billed for all costs of fabrication, installation, maintenance and removal. The Department **shall** specify the sign design and *may* arrange for fabrication, installation, maintenance and/or removal.

Signing for a municipality or traffic generator *should not* be displayed on a supplemental guide sign until signing has been installed at the ramp terminals and along the interchanging road and other roads as necessary to direct the motorist from the freeway exit to the municipality or traffic generator.

Signing for a seasonal generator *may* be displayed when warranted. Such signing **shall** be removed, covered, overlaid with a "CLOSED" plaque, or fitted with a “CLOSED” flip-panel during the off-season.

The cost of signs erected under this section of the guidelines, **shall** be segregated from other signs in order to properly invoice the municipality or facility to cover the cost of installation and maintenance of these signs. The cost of the installation **shall** include the cost of the signs, posts, mounting hardware, labor, vehicles and miscellaneous materials.

Sign installation and cost reimbursement methods are in **PART 9**.

If only one municipality or facility makes a request but others could qualify later, the initial facility will be invoiced for the total initial installation cost. The subsequent facility will be invoiced only for the additions to the existing installation. The facilities *may* agree between themselves to share the costs in a different manner, but no such agreement **shall** involve the Department. (For example: The first facility *may* request the second to reimburse it for a portion of the post cost.)

Maintenance costs associated with these signs **shall** be shared equally by all destinations on the installation. Maintenance includes replacement of the signs when they wear out and the cost of repairing the signs in the case of damage, when that cost is not recovered from the person causing the damage.

A facility or municipality *may*, at any time, request that a sign erected under these guidelines be removed and the Department will arrange for its removal.

If a facility or municipality fails to pay any invoice within six months of billing, the Department will remove the sign.

<u>In-Place Signing</u>

1. Conforming to Policy: Signs which are in place and meet all established provisions of this policy *may* remain in place until they have reached the end of their useful life, or are rendered useless by damage or vandalism. If desired, the sign(s) will be replaced, and the facility served by the sign **shall** pay the full cost of replacement.

   Before replacing a sign when it wears out or is damaged, the Department will evaluate other requests for signing at the same location, selecting the request with the greatest priority among the requests. If there are no other requests, the Department will contact each facility on the sign to determine whether or not they wish their name retained and are willing to bear the replacement cost. The Department is not obligated to leave a sign in place after judging it to be worn out, merely because the facility is unwilling to pay for a replacement.

2. Non-conforming Signs will be allowed to remain until the end of their useful life, or are rendered useless by damage or vandalism, or are removed under a sign replacement or highway reconstruction project. Prior to the removal of any non-conforming signs, the Region **shall** contact the Bureau of Traffic Operations to discuss potential political impacts and acceptable signing alternatives.

3. Sign Replacement Program: Periodically, the Department replaces traffic signs along a complete segment of a highway route, so that all devices are uniformly maintained and proper retroreflectivity is assured on all signs. When this activity occurs, supplemental guide signing to traffic generators will generally be included in the replacement program, and facilities will be billed for their particular sign costs.

<u>Milwaukee Metropolitan Area: Specific Policy</u>

Because of the numerous and often closely-spaced interchanges, the frequency of in-place primary signing, and the adequacy of route and str5eet identification signing already in place, supplemental signing is limited by these additional restrictions:

1. All supplemental signing—downtown loop:

   Other than supplemental guide signing for National Major League Sports teams venues, signing for any other specific facility or generator (including educational institutions) **shall not** be permitted on the entire length of I-794, nor on any downtown freeway comprising a loop bounded by McKinley Avenue on the north, I-43 on the west, I-794 on the south and Lincoln Memorial Drive on the east. The only exceptions to these restrictions *may* be: LAKEFRONT, PORT OF MILWAUKEE, DOWNTOWN, or any large area within the loop boundaries which can be meaningful to the visitor and whose area name has broad community support (subject to Department approval). Signing for such large area(s) will be considered on the basis that it is a substitute for other exceptions named herein and in consideration of the other space restrictions cited in this policy. If a substitute is approved, it *may* be funded with Department funds. National Major League Sports teams venues *may* be permitted if they follow all other criteria as spelled out in this policy.

2. Medical facilities:

   Signing to the Milwaukee Regional Medical Center (but not to individual facilities within the Regional Medical Center) will be permitted.

SPECIFIC POLICY FOR SUPPLEMENTAL SIGNS ON CONVENTIONAL HIGHWAYS

The basic supposition of supplemental signing is that the facility or institution as a class is of interest and concern to a sufficient number of motorists to warrant special directional signing. It is also a basic assumption that the purpose of this signing is guidance and not advertising.

Supplemental guide signs, directing to municipalities, *may* be permitted, upon request, as provided for in ss.

86.19(6), but subject to the other general policy criteria & restrictions listed previously. Qualifying municipalities **shall** be incorporated cities or villages shown on the official State Highway map and **shall** be within 5 miles of the state highway intersection. The municipality **shall** be billed for all costs of fabrication, installation, maintenance and removal. The Department **shall** specify the sign design and *may* arrange for fabrication, installation, maintenance and/or removal.

Signing for a municipality or traffic generator *should not* be displayed on a supplemental guide sign until signing has been installed along the intersecting road and other roads as necessary to direct the motorist from the intersection to the municipality or traffic generator.

Signing for a seasonal generator *may* be displayed when warranted. Such signing **shall** be removed, covered, overlaid with a "CLOSED" plaque, or fitted with a “CLOSED” flip-panel during the off-season.

Only one supplemental sign designating traffic generators *may* be erected under this policy on the approach to an intersection, and the maximum number of facilities listed on the sign **shall** be three.

Actual sign installation will depend upon sufficient longitudinal space to accommodate the new sign without violating the minimum spacing between signs.

Signing on connecting highways **shall** be the responsibility of the respective local unit of government having jurisdiction. The provisions of this policy **shall not** be construed to be the policy for the signing on connecting highways.

The cost of signs erected under this section of the guidelines, **shall** be segregated from other signs in order to properly invoice the municipality or facility to cover the cost of installation and maintenance of these signs. The cost of the installation **shall** include the cost of the signs, posts, mounting hardware, labor, vehicles and miscellaneous materials, and *may* be based on average costs for a typical installation.

Sign installation and cost reimbursement methods are in **PART 9**.

If only one municipality or facility makes a request but others could qualify later, the initial facility will be invoiced for the total initial installation cost. The subsequent facility will be invoiced only for the additions to the existing installation. The facilities *may* agree between themselves to share the costs in a different manner, but no such agreement **shall** involve the Department. (For example: The first facility *may* request the second to reimburse it for a portion of the post cost.)

Maintenance costs associated with those signs **shall** be shared equally by all facilities in the installation. Maintenance includes replacement of the signs when they wear out and the cost of repairing the signs in the case of damage, when that cost is not recovered from the person causing the damage.

In-Place Signing

1. (1) Conforming to Policy: Signs which are in place and meet all established provisions of this policy *may* remain in place until they have reached the end of their useful life, or are rendered useless by damage or vandalism. If desired, the sign(s) will be replaced, and the facility served by the sign **shall** pay the full cost of replacement.

   Before replacing the sign when it wears out, the Department will evaluate other requests for supplemental signing at the same location (if any), selecting the sign with the greatest priority from among the requests prior to contacting a facility with the original sign to determine whether or not they wish the sign replaced and are willing to bear the cost. The Department is not obligated to leave a sign in place after judging it to be worn out merely because the facility is unwilling to pay for a replacement.

2. Non-conforming Signs will be allowed to remain until the end of their useful life, or are rendered useless by damage or vandalism, or are removed under a sign replacement or highway reconstruction project. Prior to the removal of any non-conforming signs, the Region **shall** contact the Bureau of Traffic Operations to discuss potential political impacts and acceptable signing alternatives.

3. Sign Replacement Program: Periodically, the Department replaces traffic signs along a complete segment of a highway route, so that all devices are uniformly maintained and proper retroreflectivity is assured on all signs. When this activity occurs, supplemental guide signing to traffic generators will generally be included in the replacement program, and facilities will be billed for their particular sign costs.

METHODS FOR SIGN INSTALLATION AND COST REIMBURSEMENT

There are several methods that can be utilized by the regions for the installation and maintenance of signs for supplemental traffic generators. County forces *may* be used for the installation and maintenance of Type II signs. The statewide open-end signing contractor *should* be used for all Type I signs and *may* be used for Type

II signs also. Private individuals or facilities themselves **shall not** be allowed to install signs on WisDOT roadways.

The common methods for accomplishing sign installation are detailed below. The regions have the opportunity to work within these guidelines and select a method that best fits the region and/or situation.

Setting up a Professional and Technical Project ID (P & T ID)

When cost reimbursement is part of the permit agreement, the Region **shall** set up an individual P & T project ID to track all costs, which would include sign manufacturing, installation (either County or Contractor), subsequent maintenance and/or replacement, and any Region personnel field layout costs associated with the sign request. Under this method, if county crews install the signs, the signs **shall** be furnished by WisDOT. The Region *should* furnish the P & T project ID to the county to charge their time, fleet and material costs. WisDOT staff *should* stake the sign location(s).

If the statewide open-end contractor is utilized, it is expected that the contractor will furnish the signs. WisDOT will provide the sign fabrication detail to the contractor and field stake the location of the sign(s). Charge the P & T project ID for all sign manufacture, for county installation and/or contractor installation costs once invoices are received.

Permitting the County to Install a Sign Directing to a County Facility

This method would only be utilized if a county were to request a sign for one of their own facilities off the state trunk highway. WisDOT would permit the county to install the sign(s). If this option were utilized, WisDOT would field stake the sign location and *may* either provide a fabrication detail so the county can get the sign made or manufacture and sell the sign to the county. If WisDOT manufactures the sign for the county, the Region *should* utilize the Sales to Others Form (DT1668). The Region *should* fill out the form and send it to the Central Office Sign Mfg. Shop. The requestor will then be invoiced for the sign manufacture costs. This option would only be used for county facilities.

Signing for Government, State University Facilities

For these types of government facilities, the Region *may* elect to have them work directly with the county. If this option were utilized, WisDOT would field stake the sign location and provide a fabrication detail to the requesting agency. The requesting agency would then work directly with the county to get the sign(s) manufactured and installed. The county would direct bill all charges to the requestor.

WisDOT *may* manufacture the sign(s) also. If WisDOT manufactures the sign(s), the Region *should* utilize the Sales to Others Form (DT 1668 form). The Region *should* fill out the form and send it to the Central Office Sign Mfg. Shop. The requestor will then be invoiced for the sign manufacture costs.

Figure 2. REQUEST FOR GUIDE SIGN INSTALLATION ON STATE HIGHWAY

Sign Requested For
- ☐ College/University
- ☐ Institution
- ☐ Municipality
- ☐ Other - ___________________

Name of Requesting Facility or Municipality

Street Address | City | Zip Code

Contact Person ____ Phone ___________________________
Email ___________________________

SIGN MESSAGE or What does the sign direct to?

PROPOSED SIGN LOCATIONS

Hwy. Interchange or Intersection	Town/City/Village	County of	Traffic Direction at Proposed Sign Site ________-bound on Hwy. _________
Hwy. Interchange or Intersection	Town/City/Village	County of	Traffic Direction at Proposed Sign Site ________-bound on Hwy. _________

Additional requests *should* be submitted on a separate form.

The requesting facility agrees to and will abide by the conditions contained within the Supplemental Guide Sign Policies and general signing policy provisions attached to this application, which is made by the undersigned official under proper authority to act on behalf of the facility represented above. The requestor agrees to pay for installation costs and costs to replace the signs when they have reached the end of their useful life or repairs if they become damaged, when the cost is not recovered from the person(s) causing the damage.

Signature of Authorized Official | Title | Date

- ☐ APPROVED
- ☐ DENIED

____
Regional Traffic Engineer | Date

2-15-4 Pictographs on Signs — March 2011

PURPOSE

This guideline provides criteria for determining when pictographs *may* be allowed on supplemental traffic generator signs which qualify for a permit under TEOpS 2-15-3 (Sign Categories and Policy for Directional Signing). The term “pictograph” is defined by the Federal Highway Administration as a pictorial representation used to identify a governmental jurisdiction, a governmental agency, a governmental approved university or college, or a branch of the military service. In general, the use of pictographs is limited to those conditions where an easily recognized, widely understood pictograph *may* add to the effectiveness of a standard text sign by providing a quick visual cue to drivers in need of guidance. This guideline establishes criteria for determining when pictographs *may* be used, and establishes standards for the type and design of pictographs in order to assure their effective use through consistent application. The guideline also is intended to prevent the inappropriate use of pictographs as a means of promoting or advertising destinations, as advertising on the right of way is not legal.

DEFINITIONS

<u>Freeways</u> are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

<u>Expressways</u> are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

<u>Conventional highways</u> are defined as either divided or undivided roadway facilities that have no control of access with grade separations at intersections. These highways can be two lane or multilane facilities.

<u>Pictographs</u> are defined as a pictorial representation used to identify a governmental jurisdiction, a governmental agency, a military base or branch of service, a governmental-approved university or college, or a government-approved institution.

<u>Logos</u> are defined as a distinctive emblem or trademark that identifies a commercial business and/or the product or service offered by the business.

<u>Symbols</u> are defined as the approved design of a pictorial representation of a specific traffic control message for signs, pavement markings, traffic control signals, or other traffic control devices, as shown in the MUTCD.

POLICY

Pictographs *may* be used on supplemental traffic generator signs, provided that the following criteria are met:

- The supplemental traffic generator sign **shall** be approved for installation by meeting the criteria outlined in TEOpS 2-15-3 (Sign Categories and Policy for Directional Signing). Central office approval **shall** be obtained for any pictograph requests.
- Pictographs **shall** only be allowed for guide signs that are listed below:
  - Colleges/universities
  - Auto tour route (Great River Road, Lack Michigan/Superior Circle Tour)
  - Wayfinding signing
  - Airport signing
  - Street name signs, including overhead
  - Military branch
  - Qualifying federal government facilities (US Fish & Wildlife Service, National Park Service, US Forest Service)
- College and university pictographs **shall** be the official seal adopted by the educational institution. Pictorial representatives of college and university programs are not permitted.
- Advanced street name signs **shall not** contain pictographs.
- Auto tour route pictographs **shall not** be displayed on advance guide or exit direction signs. Auto tour route pictographs **shall** only be displayed on supplemental guide signs on freeways and expressways. For conventional highways, auto tour route pictographs **shall** be displayed on conventional route assemblies.
- Military branch pictographs **shall not** be displayed on advance guide or exit direction signs. Military branch pictographs, related to military installations, **shall** only be displayed on supplemental guide signs.
- Commercial graphics for businesses **shall not** be used on community wayfinding signs, including within the pictographs.
- Wayfinding signing **shall** be approved for installation by meeting the criteria outlined in TEOpS 2-15-6.
- The pictograph **shall** fit within the sign face and *should* be placed to the left of the accompanying message. Whenever the addition of a pictograph requires a change in the size or shape of a sign, <u>all costs of the change must be paid by the requestor.</u>
- The maximum dimension (height or width) of a pictograph **shall not** exceed the size of the route shield

on the guide sign. If the guide sign does not include a route shield, the maximum size of the pictograph (height or width) **shall not** exceed two times the height of the destination legend.

Typical Sizes of Pictographs

Lettering Size on Sign	Pictograph Dimensions
6" upper case / 4 ½" lower case	12" x 12"
8" upper case / 6" lower case	16" x 16"
10" upper case / 8" lower case	20" x 20"
13.33" upper case / 10" lower case	26" x 26"
16" upper case / 12" lower case	32" x 32"
20" upper case / 15" lower case	40" x 40"

- Pictographs **shall** be retroreflective. Colors, arrows, and borders of the logos *should* meet the requirements defined in TEOpS 2-15-6.
- Pictographs that resemble an official traffic control device **shall not** be used.
- The sign requestor **shall** pay for the manufacture, installation, and maintenance of all pictographs, including the sign(s) and posts. The actual method of pictograph installation will be left up to the discretion of each regional traffic section.
- Pictographs currently installed that do not meet the criteria in this policy will be allowed to remain in place until the end of their useful life. Useful life ends when the pictograph message no longer meets legibility or condition standards. Existing pictographs **shall** be removed prior to the end of their useful life when opportunities arise such as knockdown or damage, when other work is occurring nearby, or projects make removal practical.

2-15-5 Destinations on Signs ~~June 2005~~December 2017

GENERAL

The display of appropriate destinations on guide signs can be particularly helpful to drivers, regardless of the type of road or highway. It is the purpose of this policy to set specific standards and guidelines for the selection of destination names for various types of guide signs on each classification of highway. General guidance is provide din the following sections of the MUTCD.

Section 2D.37 Destination Signs (D1 Series)
Section 2D.36 Distance Signs (D2 Series)
Section 2E.07 Characteristics of Urban Signing
Section 2E.10 Amount of Legend on Guide Signs
Section 2E.12 Pull-Through Signs
Section 2E.13 Designation of Destinations
Section 2E.30 Interchange Guide Signs
Section 2E.33 Advance Guide Signs
Section 2E.35 Other Supplemental Guide Signs
Section 2E.36 Exit Direction Signs
Section 2E.39 Distance Signs
Section 2E.40 Interchange Sequence Signs
Section 2E.41 Community Interchanges Identification Signs
Section 2E.42 NEXT X EXITS Sign

DEFINITIONS

1. Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.
2. Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.
3. Conventional highways are defined as either divided or undivided roadway facilities that have no control of access or grade separations at intersections. These highways can be two-lane or multi-lane facilities.
4. A major state trunk highway (STH) is defined as
    a. A state highway operated as a freeway
    b. A highway designated as part of the National Highway System, or
    c. A state highway route or segment approved as such by the state traffic engineer, based on its character as a principal route for cross-state traffic, traffic between major cities in Wisconsin and

adjacent states, or traffic from major cities to major northern resort areas.

5. A standard highway is defined as any conventional state or local highway which is not a major STH.

6. Urban areas are defined as

   a. An established urbanized area, based on the US Bureau of the Census and adjusted by metropolitan planning organizations and the DOT

   b. Two or more contiguous cities and/or incorporated villages, or

   c. A single city or incorporated village which is not contiguous with any other.

7. National control cities are Chicago, Milwaukee, Beloit, Rockford, Janesville, Madison, Wisconsin Dells, La Crosse, Albert Lea, Eau Claire, St. Paul, Sheboygan, and Green Bay.

8. Regional Control Cities are defined as

   a. Urban areas in Wisconsin or within 60 miles of the state line with a population in the most recent decennial census of 30,000 or more.

   b. Other communities, such as Sturgeon Bay, Woodruff, Minocqua, and Lake Geneva, which are approved by the State Traffic Engineer based on their character as widely known tourism destinations, and

   ~~7.~~c. Urban areas on or north of Highway 64 with a population exceeding 3,500, and urban areas south of Highway 64 with a population exceeding 10,000.

~~8.~~9. Communities are defined as

   a. Any urban area, or

   b. An unincorporated village which is identified on the official state highway map and is not adjacent to or within an urban area.

PRINCIPAL DESTINATION CALCULATION

A Principal Destination is defined as a community served by a standard highway and located within 25 miles of a major state trunk highway, as measured along the standard highway, and having a location and population such that

$$\frac{Pp}{Pc} \geq \frac{Dp}{Dc} \quad \text{where}$$

Pp = Population of Principal Destination (from official state highway map)

Dp = Distance in whole miles from the major STH to the Principal Destination

Pc = Population of the community closest to the major STH and in the same direction from it (from official state highway map)

Dc = Distance in whole miles to the closest community

If more than one community meets the above criteria, the community for which the term

$$\frac{Pp}{Pc} - \frac{Dp}{Dc}$$ is the greatest **shall** be selected.

Notes: When measuring distances Dp and Dc, it is recommended that consistency be applied in what points are being measured to.

Where the through highway passes adjacent to or within the closest community, Dc will approach zero, and $\frac{Dp}{Dc}$ will approach infinity.

Therefore, in this case, the closest community **shall** be the principal destination.

POLICY

On Hwy / Intersecting		Standard STH	Major STH	Interstate Highway

Standard Highway	**Ahead Destination**	Next Community	Regional Control City (1)	(2)
	Crossroad Destination	Next Community	Principal Destination	Principal Destination
Major STH	**Ahead Destination**	Next Community	Regional Control City (1)	(2)
	Crossroad Destination	Regional Control City	Regional Control City	Regional Control City
Interstate Highway	**Ahead Destination**	Next Community	Regional Control City (1)	National Control City
	Crossroad Destination	National Control City	National Control City	National Control City

1. If the major STH is constructed and signed as an expressway or freeway, an ahead destination is generally not displayed except as a pull-though sign at a system or directional interchange.
2. An ahead destination is generally not displayed except as a pull-through sign at a system or directional interchange.

SPECIFIC SELECTION CRITERIA

1. **On standard state trunk highways:** Destination signs (D1 series) *should* be used on the standard state highway approach to a numbered interstate. If designated, the “ahead” destination **shall** be the closest community on the through route. The first choice of destination names for the interstate **shall** be the closest national control city in each direction. The first choice of destination name for other freeways **shall** be the closest regional control city in each direction.
    a. If the intersecting route does not serve a national control city, then the regional control city, next community, or principal destination *may* be designated.
    b. Unincorporated communities meeting the qualifying criteria in definition 9 *may* be displayed on destination signs (D1 series) on conventional state highways.
    c. Unincorporated communities **shall not** be displayed on distance signs (D2 series) unless the community is designated a regional control city according to the definition 8b. However, they *may* be identified as unincorporated on the I2-3 name sign.
2. **On major state trunk highways:** Use regional control cities according to definition 8 and selected as follows:
    a. Select urban areas meeting the criteria of definition 8a & 8b
    b. If less than two meet the criteria of 8a or 8b, select urban area(s) meeting the criteria of 8c
    c. If the distance between areas selected above exceeds 160 miles, select urban areas between them, which meet the criteria of 8c.

    Unincorporated communities **shall not** be displayed on freeway or expressway exit signs, unless the community has been designated a regional control city according to the definition 8b.
3. **On interstate highways:** Use national control cities, except regional control cities or principal destinations *may* be selected as appropriate for intersecting highway destinations.
4. **Urban areas with more than one city or village:**
    a. On highways which serve the largest city in the urban area, only the largest city **shall** be named and **shall** be considered to represent the entire urban area.
    b. Destination signs **shall not** be erected within an urban area directing to a city or village within the same urban area, except:
        i. On major state trunk highways, signs *may* direct to the central business district of the largest city
        ii. On highways near the edge of urban areas, signs *may* direct to the largest city in the urban area which is served by the crossroad
        iii. In bi-state urban areas, signs *may* direct to the largest out-of-state city.
5. **Control cities beyond the end of a highway:**

A national or regional control city located beyond the end of a highway *may* be considered to be served by that highway if the connecting route:

a. Is of the same or higher classification, and

b. Continues in the same general direction as the ending highway, and

c. Carries considerable through traffic from the ending highway.

6. **Bi-state urban areas:**

In determining the population of an urban area, part of which is in Wisconsin and part of which is in an adjacent state, for the purpose of selecting regional control cities, the population of the in-state and out-of-state cities **shall** be added. Directional signs *may* name the largest Wisconsin city and/or the largest out-of-state city, as provided in criteria 4c(3) above.

7. **Other supplemental guide signs:**

Additional communities are allowed on other supplemental guide signs. Only one supplemental guide sign with cities/communities **shall** be allowed per interchange, maximum of two cities/communities per sign.

8. When opportunity presents itself (improvement project, refurbishment project, etc.), the destinations on primary and supplemental guide signs *should* be reevaluated to ensure conformance to this policy.

2-15-6 Community Wayfinding Signs — January 2015

PURPOSE

This policy sets the uniform, Wisconsin state standards for signs, which communities *may* install by permit on conventional State Trunk Highways under DOT jurisdiction to provide directional guidance to public facilities and traffic generators within the community.

The MUTCD Section 2D.50 provides guidelines and standards for Community Wayfinding signing. Substantial conformance of these signs to the MUTCD and DOT policy is required by state law. Poorly designed and/or cluttered guide signs will not meet these requirements and could adversely impact safety.

On local streets and connecting highways, local agencies have the authority to install destination signs for local attractions and generators. If there is deviation from state and national standards to the extent that highway signing would adversely affect driving behavior, local agencies *may* face liability problems.

Therefore this policy establishes the following to be applied to Community Wayfinding Signing on State Highways under DOT jurisdiction:

1. the qualifying criteria for Community Wayfinding Signing;
2. guidance on qualifying destinations or facilities;
3. clarification of sign design and installation standards, applicable to WisDOT
4. the application and permit process for roadways under WisDOT jurisdiction.

DEFINITIONS

Community Wayfinding Signs

These are the signs, allowed by permit, which are owned and maintained by the community and direct to

1. municipal area destinations such as Downtown, or Historic District,
2. individual destinations that are publicly leased or owned and operated for public use, such as City Hall, Convention Center, and local parks, or
3. Privately owned non-profit facilities open to the public, such as a local museum or ice center.

Trailblazing Signs

In this context, these are community destination signs that direct subsequent turns on local streets to reach the destination.

Trailblazing (directional route signing) to state routes is the responsibility of WisDOT and will not be permitted on Community Wayfinding Signs.

POLICY FOR INSTALLATION ON STATE TRUNK HIGHWAYS

The Department will allow the local agency, by permit, to install and maintain community wayfinding signs on the right-of -way of the conventional state trunk highway system, subject to the destinations, design, location, and maintenance of the signs being reviewed and found satisfactory by the Department. These signs **shall not** be permitted on freeways or expressways.

WisDOT *may* fund the installation of wayfinding signs as part of a Community Sensitive Solutions project. For all Community Sensitive Solutions projects that include wayfinding signs, the sign design and locations **shall** be reviewed for conformity to WisDOT and MUTCD policies by the Region Traffic Operations. Wayfinding signs that are funded and installed as part of a Community Sensitive Solutions project **shall** be maintained by the community.

This policy does not apply to banners or civic displays, which are addressed in TEOpS 13-12-1.

Qualifying Criteria for Community Wayfinding Signing Programs

Community wayfinding signs will not be permitted outside a readily apparent urban developed area, usually characterized by a reduced speed limit, nearby transition to curb and gutter, and dense residential and/or business development adjacent to the highway.

Geographical areas or districts within a community *may* be permitted Community Wayfinding Signing. Two or more adjacent communities in an urbanized area *may* coordinate a common signing program, but the department will issue separate permits to each individual municipality.

No countywide programs will be permitted.

The community must develop a Master Plan for Community Wayfinding Signing, which contains the following information:

1. A map of the community, including the city street/local road system, which clearly identifies:
    a. Exact locations of destinations and attractions to be included in this signing program.
    b. State trunk highway approaches to city street/local road intersections where signing is proposed.
    c. Which destination(s) and attraction(s) are to be signed on each state trunk highway approach at each city street/local road intersection
    d. City street/local road intersections where trailblazing signing is required to direct motorists to each facility.
2. A concept design of a typical community wayfinding sign, which *may* include the city logo, a street name and up to a total of three destinations/attractions. A maximum of three destinations *should* be displayed on a sign.

The Master Plan **shall** be submitted to the WisDOT Regional Traffic Engineer for review. This submittal **shall** be initiated and coordinated by the community and **shall** identify one contact or lead person in the community, through which all Department correspondence and contact will be made.

If a community obtains DOT approval for Community Wayfinding Signing, no new requests for traffic generator signing, which would qualify for Community Destination Signs, will be approved within the community.

Qualifying Destinations or Facilities

Destinations or attractions must be of general interest to the traveling public and **shall not** be a retail, business or manufacturing center. The individual destinations **shall** be publicly leased or owned and operated facilities for public use or privately owned non-profit facilities open to the public.

Destinations which qualify for either Supplemental Traffic Generator signing or Community Wayfinding Signing,

1. *should* be included on the Community Wayfinding Signs,
2. *may* be on permitted supplemental signing,
3. but **shall not** be on both at the same intersection approach.

A specific destination **shall** only be displayed on one sign structure in each direction on a highway unless straight ahead signing is also approved by the Regional Traffic Engineer.

This type of signing **shall not** display advertising for a commercial product or service.

IH, USH or STH directional signage **shall not** be allowed on Community Wayfinding signs.

Sign Design Standards

Shape

The shape of the signs **shall** be rectangular and *may* have rounded corners. A rounded or other regular geometric shape on the top will be allowed to accommodate a logo.

Pictograph

Only one community pictograph *may* be incorporated in the top of the sign subject to WISDOT approval. If used, it **shall** be simple and easily recognizable. The height of the pictograph **shall not** exceed two times the height of the upper-case letters of the principal legend on the sign. For coordinated programs, a unique pictograph for each municipality *may* be used.

If a community name is to be displayed at the top of the sign panel, instead of or in addition to a pictograph, the lettering **shall** be of a size, font style and high color contrast for motorists to read at the posted speed.

All signs in a Community Wayfinding Signing program **shall** have the same format. If a community pictograph, and/or name, and/or street name, is to be used on any sign, it **shall** be used on all signs in the community program.

Pictographs for destinations and attractions **shall not** be permitted, since the traveling public will not recognize pictographs of local destinations.

Facing

Sign panel legends and backgrounds **shall** be reflective to meet the minimum standards of High Intensity sheeting.

Fluorescent reflective sheeting of any color **shall not** be permitted on these signs.

The sign **shall not** contain any animated or moving parts, flashing or moving lights, or flashing disks.

Color

Colors **shall** meet the standards for highway colors specified by the Federal Highway Administration. Color combinations **shall** have high contrast. Two-color combinations which *may* be used are:

1. White or yellow on blue, green or brown.
2. Blue, green, black or brown on white.
3. Red or orange on white, but not the reverse.
4. A third color, if used, must provide suitable contrast (i.e., not red on blue).

The background colors of orange, red, yellow, purple, or the fluorescent versions thereof, fluorescent yellow-green and fluorescent pink **shall not** be permitted on Community Destination Signs. One background color is preferred. A third color for the logo area *may* be used, or that area *may* be reversed in color. Color plaques or accents **shall not** be used under arrows or destination names. Lettering, arrows, and border **shall** be the same color.

Border

Border is optional. If used, it **shall** be plain, retroreflective, not decorative, and the same color as the letters.

Lettering & Sign Size

A minimum Series B font as specified in the Standard Highway Signs manual is preferred. A similar font is allowable, unless the style detracts noticeably from legibility.

The preferred letter size is 6” Upper Case/ 4 ½” Lower Case. In areas, where the posted speed is less than 35 mph, a minimum 5” Upper Case/ 3 ¾” Lower Case or 5” Capital Letters will be allowed.

The resulting sign width **shall not** exceed five feet adjacent to a roadway posted at 35 MPH or above. The sign width **shall not** exceed four feet adjacent to a roadway posted at 30 MPH or below.

Arrows

Arrows **shall** be as big in dimension as the lettering, and the same color as the adjacent lettering. The arrows **shall not** have encircling accents, or contrasting mini-backgrounds.

Arrows **shall** be left of the message for left destinations, and right of the message for right destinations.

Ahead arrows **shall not** be used except in combination with left and/or right arrow(s) and destination(s) to pull through to one major area destination, such as DOWNTOWN, or direct ahead to one or more qualifying destinations where the through route turns. When used, ahead arrows **shall** be on the left side of the top line.

Destinations

Destinations/attractions on a community destination sign **shall** be displayed (from top to bottom of sign) in the following sequence:

1. ahead destination (if used);
2. left-oriented destinations/attractions (closest to furthest);
3. right-oriented destinations/attractions (closest to furthest).

Community Wayfinding Signs *should* be limited to three destinations per sign.

Sign Installation Standards

Signs **shall** be installed by the community on separate supports furnished and typically used by the community. They **shall not** be combined with other signing by the community or the Department.

If signing is approved on the state trunk highway directing to a facility, any necessary trailblazing signing **shall** be installed on the city streets/local roads by the community before signing is installed on the state trunk highway.

The community **shall** affix an identification code number label to the back of each sign in accordance with State Statute Section 86.19(5) and TEOpS 2-1-30.

Sign supports **shall** conform to TEOpS 2-15-52.

Sign installation and placement **shall** be in accordance with WisDOT Standard Sign Details A4-3, A4-4, and A4-8, A4-9, A4-11, or A5-9, as applicable.

Signs **shall** be placed in advance of the intersection where a turn would be required.

Only one sign **shall** be permitted in each direction approaching an intersection and it *should* be located on the right side of the roadway.

The preferred sign spacing is 200 feet from any other highway sign. The minimum spacing **shall** be 100 feet.

Signs erected on the state trunk highway system **shall** have their locations approved by the Regional Traffic Engineer. Signs at all locations *should* be installed with due care to be visible, and to not obscure other traffic control devices. Further guidance on location is contained in Section 2A.16 of the MUTCD.

Application and Permit

Sign destinations, designs, and locations on State highways under DOT jurisdiction **shall** be approved by the WisDOT Regional Traffic Engineer. Installation of these signs **shall** be through this permit process.

Upon receipt of a master plan for Community Wayfinding Signing, including the typical standard sign design and the identification of the community contact person, the Regional Traffic Engineer will review the plan for

1. appropriate qualifying destinations,
2. direct and effective routing to the destinations, including trailblazing on local roadways,
3. appropriate sign locations,
4. individual sign designs, and
5. roadside conditions and constraints.

In order to expedite the process, the community *should* prepare the master plan in compliance with the guidelines in this policy. Any necessary denials or revisions *may* cause a return of the plan to the community contact person, resulting in a delay of the permit.

The permit will consist of an approved master plan attached to a permit letter signed by the Regional Traffic Engineer, and *may* include the necessary standard sign installation details mentioned above.

All sign panel designs *should* be reviewed and approved by the Regional Traffic Engineer before fabrication.

The community **shall** be responsible for the construction, installation and maintenance of the community wayfinding sign structures and sign panels at its own expense.

If community wayfinding signs are not properly maintained, the community **shall**, upon request by WisDOT, replace or remove the signs at its own expense. If not replaced or removed within 30 days of notification, WisDOT will remove the community wayfinding signs at the expense of the community.

Roadway reconstruction and/or installation of new regulatory, warning or guide signs *may* necessitate relocation or removal of community wayfinding signs by the community at its own expense.

GRANDFATHER CLAUSE

Existing permitted Community Wayfinding Signs will be allowed to remain temporarily without modification or replacement until the end of their useful life, or December 31, 2015, whichever comes first. Unpermitted signs **shall** be removed as soon as possible, unless they meet the standards contained in this policy. In that case, the community *may* apply for a retroactive permit by submitting the required master plan.

SAMPLE PERMIT FORM LETTER

Copy and paste to your Region letterhead.
Provide date, contact name, and address
Modify as needed.

RE: **Community Wayfinding Signing Permit**

This letter **shall** serve as the Community Wayfinding Signing Permit for (city, village, town) of (name) to install and maintain guidance signing on STH (number) as contained and approved in the attached master plan.

No additions or changes will be allowed without a revised and approved master plan.

WisDOT Standard Sign Installation Details, A4-3, A4-4, and (others as needed), are attached. Adherence to these standards is required.

Sincerely,

(signature)

(name, P.E.)
(Region) Traffic Engineer

2-15-7 Temporary Traffic Generator Signing on Improvement Projects — January 2013

BACKGROUND AND PURPOSE

Section 2E-35 of the MUTCD allows states and other agencies the option to adopt policies for Supplemental Traffic Generator (Directional Signing). Correspondingly, WisDOT has adopted a Supplemental Traffic Generator policy for permanent signs (TEOpS 2-15-3). However, there are cases (most notably improvement projects) where temporary Supplemental Traffic Generator signs are needed. Temporary Traffic Generator signs *may* be needed to temporarily replace SIS signs or previously approved Supplemental Traffic Generator signs that were previously installed on the roadway, but taken down temporarily for the project. There are other times where a business *may not* have been previously signed, but the improvement project closes off an access to a business and temporary signs *may* be needed to ease the construction impact to the business. In some of these cases, a Temporary Business Guidance Sign *may* be permitted.

The following policy provides guidance on the different types of Temporary Traffic Generator signs that *may* be utilized on improvement projects.

DEFINITIONS

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

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

Conventional Highways are defined as 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.

POLICY

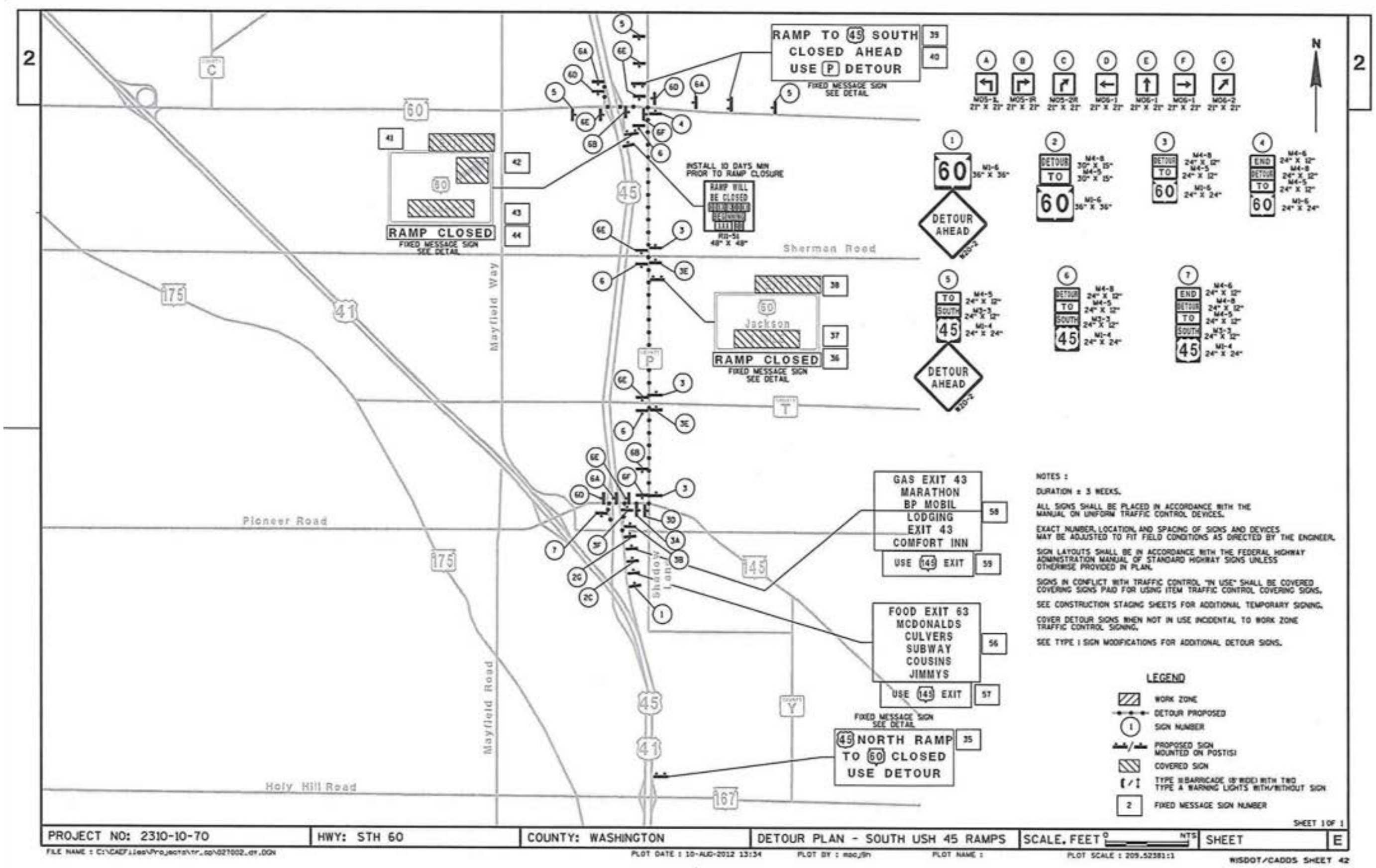
Projects that have previously approved SIS or Supplemental Traffic Generator Signs that have been temporarily removed during construction.

1. Temporary SIS Signs and Supplemental Traffic Generator signs **shall** only be allowed for approved SIS or Supplemental Traffic Generator signs that were removed as part of the improvement project (See Figure 1).
2. Temporary SIS Signs and Supplemental Traffic Generator signs **shall** be black on orange and contain no logos.
3. Temporary SIS Signs and Supplemental Traffic Generator signs **shall** be designed by WisDOT Bureau of Traffic Operations for all Regions, except SE. For SE Region projects, the signs **shall** be designed by the SE Region Traffic Operations. Sign details and installation details *should* be included as part of the improvement project plans.
4. Temporary SIS Signs and Supplemental Traffic Generator signs are typically paid for as part of the improvement project under the bid item, Traffic Control Signs Fixed Message.

Temporary Business Guidance Signs (signs not previously approved as SIS or Supplemental Traffic Generator signs).

1. Temporary directional signing for local businesses *may* be allowed in the highway right-of-way, at locations approved by the Project Manager.
2. Privately erected signs **shall** require an approved permit (see attached Temporary Business Guidance Signs Permit Application). Privately erected signs Temporary directional signing for local businesses **shall not** be allowed on freeways, expressways or at the exit ramp.

Figure 1. Example of Temporary SIS Signs for Improvement Projects



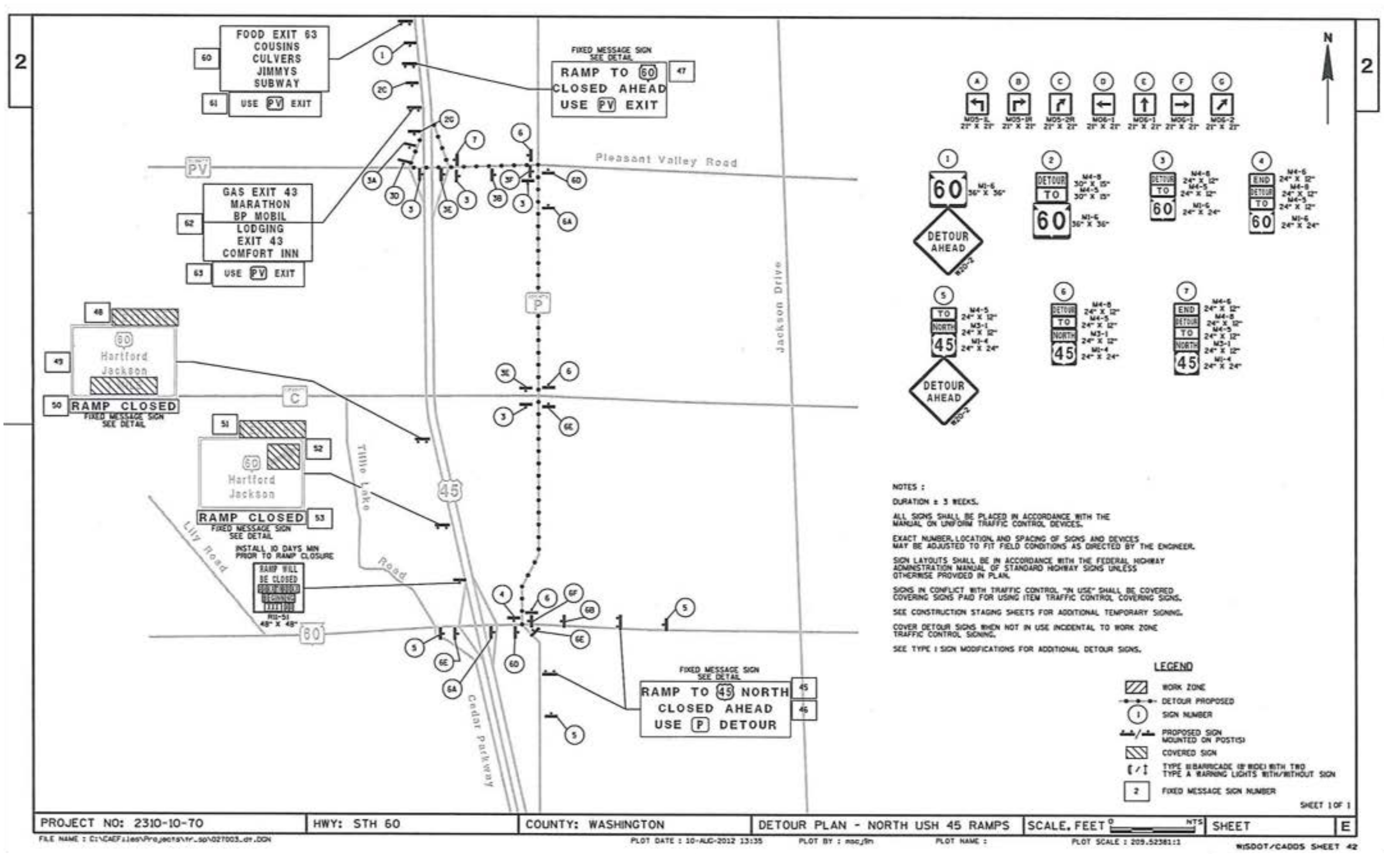


Figure 2. Temporary Business Guidance Signs Permit Application

APPLICATION FOR PERMIT TO INSTALL TEMPORARY BUSINESS SIGN(S) ON HIGHWAY RIGHT-OF-WAY DURING IMPROVEMENT PROJECT

APPLICANT:	
ADDRESS OF BUSINESS / ACTIVITY:	
PHONE:	
TYPE OF BUSINESS / ACTIVITY:	
SIGN LOCATION(S): (number and placement to be coordinated with Project Engineer)	
On what highway?	At or approaching intersection with what highway?
1) On:	At:
2) On:	At:
3) On:	At:
4) On:	At:
5) On:	At:
6) On:	At:
Remarks:	
Two drawings MUST be attached: One drawing must show the proposed sign design(s) and dimensions and the other must show the proposed sign location(s).	

I apply for permission to install and maintain temporary directional signs at the locations listed and in conformance with the guidelines attached to this application. I agree to comply with these guidelines and will remove all signs upon completion of the project, or when directed by the project engineer. I understand that signs may be removed without notice if they do not comply with the attached guidelines, do not match the attached drawings or do not comply with any additional conditions stated on or attached to the permit. I further understand that WISDOT is not responsible for lost or stolen temporary signs.

____
Applicant signature

Reviewed by: ________________
Traffic Operations

Approved by: ____________________
Project Manager

____
Maintaining authority (if sign location is not on STH, a representative's signature is required)

Project I.D.: ______________________

GUIDELINES FOR INSTALLATION OF TEMPORARY BUSINESS GUIDANCE SIGNS ON IMPROVEMENT PROJECTS

Whenever a traffic generator (typically a commercial business) normally obtains its access from within the limits of a construction project or detoured roadway, WisDOT may allow the placement of temporary directional signs in the highway right-of-way at locations approved by the Project Manager. **Privately erected signs require an approved permit (see attached permit form) and will not be allowed on the mainline of freeways or expressways or at the exit ramp. Approval may be granted to place a sign at the intersection where the ramp connects to the crossroad (ramp termini). Signs with generic messages not containing individual business names (e.g., Access to Downtown) should generally be shown on the traffic control plan and erected as part of the improvement contract as a fixed message sign (643.1000 pay item) in orange background and black letters** Typical locations for generic message signs in the improvement contract may include endpoints of the construction project or detour (as shown on Standard Detail Drawing 15C2-(X)a, Detail A), sideroads approaching the project.

The following guidelines apply to privately erected signs along conventional highways (non-freeway/non-expressway) or at the ramp termini where it connects to the crossroad near the project:

1. The signs will not obstruct the view of, interfere with, or be attached to official traffic control devices such as signs and barricades, or obstruct the view of drivers entering or traveling on the highway. Signs shall be placed to allow at least 6 feet of clearance from edge of gravel shoulder to edge of sign, or at least 2 feet from back of curb to edge of sign (per MUTCD 2A.19). Signs shall be placed as near the right-of-way line as possible and shall not be placed in the median of divided highways.

2. Where several neighboring businesses are affected, every effort shall be made to identify these businesses on common signs. In the interest of legibility and not creating undue distraction to drivers, it may be necessary to identify businesses by their general location, e.g., “Main Street Businesses”, “Downtown Businesses”, or “City Business District”, rather than by individual business names. Use the phrase “Access To” instead of “Open To” on signs to clarify that although access is provided to businesses, the roadway is still closed to through traffic. No one sign may be larger than 4’ x 6’. For a sign request for one business the maximum sign size is 2’ x 4’.

3. If access to the business(s) will be through the closed portion of the highway under construction, one directional sign at the beginning of the detour, from each direction, will be allowed. Additional “trailblazers” may be necessary to guide traffic along the closed portion of the road, as approved by the Project Engineer.

4. If access to the business(s) will be via a road connecting the detour route to the closed portion of the highway, one sign will be allowed in each direction on the detour at the point where a motorist must leave the detour. Additional “trailblazers” may be necessary to guide traffic along the local road system after leaving the detour route. These signs must be approved by the Project Engineer and the local road’s maintaining authority.

5. For uniformity and readability, the lettering shall be black block style letters on an orange or white background and shall conform to the following size requirements: 4” high for posted

speeds less than 45 mph; 6" high for posted speeds 45 mph or greater. No other colors will be allowed for lettering. Business logos may be used as an alternative to word messages but maximum allowable logo size is 4 square feet per policy in Traffic Guidelines Manual. Trademark logos may be permitted in alternate colors subject to approval by the Project Engineer. No advertising is allowed on signs such as SALE, or MERCHANDISE REDUCED.

6. Sign supports shall be of FHWA approved breakaway materials, i.e., 4" x 4" wood posts, or smaller, as appropriate to the size and weight of the sign. It is the responsibility of the sign installer to contact Diggers' Hotline at 1-800-242-8511 prior to installation. When it is not possible to mount the signs on post supports, use portable mounts, i.e type II or III barricades, approved by the Project Engineer. Business signs shall not be placed on any devices that are part of the official traffic control for the project. In urban locations, the project manager may have the work zone contractor install a type III barricade for mounting of the sign, and coordinate obtaining the sign from the permit requestor. This avoids the permit requestor being out on our state highways in high traffic volume areas for safety reasons.

The following guidelines apply along freeway/expressway mainline:

1. No privately erected signs will be allowed on mainline freeways/expressways. Temporary Business Signs are **<u>not allowed on freeway.</u>** All signs on mainline freeways/expressways will be erected by contractor, county, or state forces, at the discretion of the Region Traffic Operations Engineer. Where there are existing green traffic generator signs on the freeway that met statewide policy approval (TGM 2-15-3) prior to the project starting, temporary fixed message sign details should already be included in the original contract. Examples: University of Wisconsin, Waukesha or Bristol Renaissance Faire.

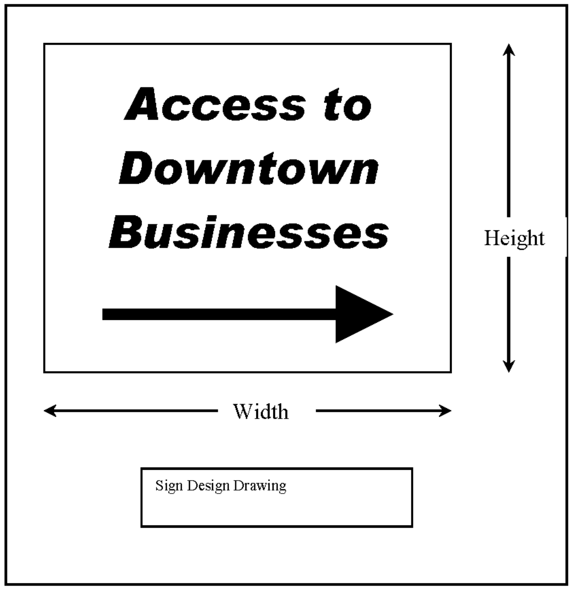
General Coordination & Permit Conditions for Privately Erected Signs

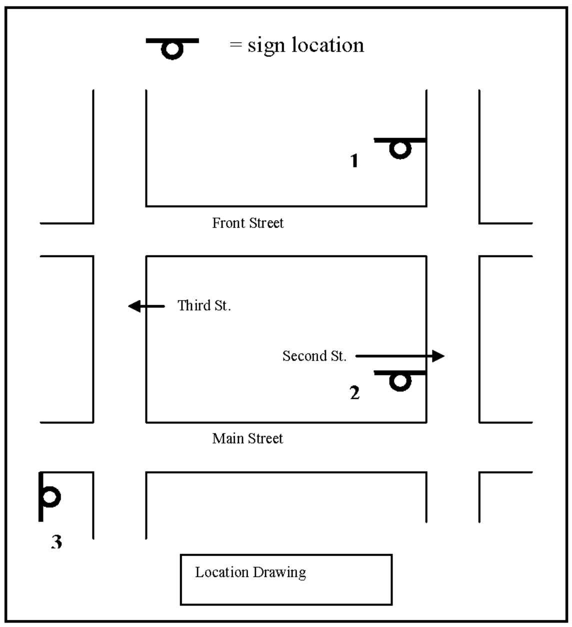
The Project Engineer will coordinate the design and placement of the signs with the owner, and the Project Manager will grant or deny approval. All approved signs, their design and locations, will be documented on the permit form attached to these guidelines. A copy of the permit shall be sent or faxed to the WisDOT Region Traffic Engineer and the maintaining authority in the case of local roads. The approved signs will be erected and removed at the expense of the applicant. If consultation on sign design or installation requirements is needed, contact the Region Traffic Engineer.

If non-complying signs or signs with potential to cause safety problems are located on a project, the Project Engineer will notify the business identified on the sign. Such signs not removed or corrected immediately will be removed by the department or its representatives and the cost billed to the sign owner.

All temporary signs must be removed by the applicant within 48 hours following restoration of normal traffic patterns. Such signs not removed after 48 hours will be removed by the department or its representatives and the cost billed to the sign owner. The Project Engineer is responsible for seeing that all signs are removed at the completion of the project.

Example of required drawings:





2-15-11 Transition, Two to Four Lanes — June 2005

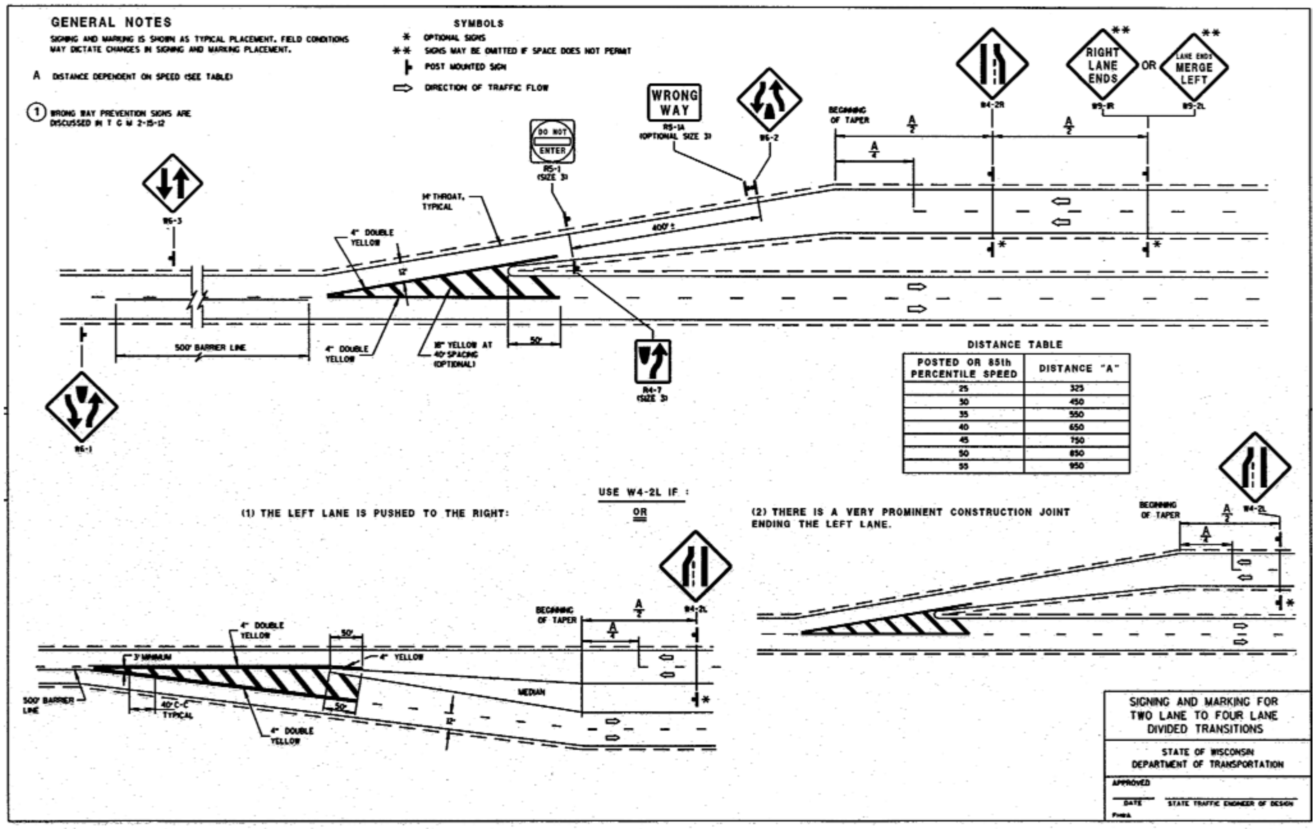
GUIDANCE

Figure 1 portrays recommended pavement markings and signing for typical transitions of two-lane highways to divided highways.

The main feature of the pavement markings is the formation of a large “V,” which will give continuous guidance to the left of the driver leaving the divided section.

The choice between using a W4-2R or L has been debated and has arguments on both sides. The illustration provides an acceptable signing choice in the absence of any other determinant factors.

Figure 1. Marking and Signing for Two-Lane to Four-Lane Divided Transitions



2-15-12 Wrong Way Prevention — November 2015

PURPOSE

Prevention of wrong way movement is a concern wherever an entire roadway is dedicated to one-way traffic. Wrong-way prevention signing consists of the appropriate use and placement of Turn Prohibition signs, Keep Right signs, DO NOT ENTER signs, WRONG WAY signs, ONE WAY signs, and Divided Highway Crossing signs.

The need for wrong way prevention signing in any situation is determined by the complexity of the situation requiring positive guidance and the consequence of error. The following guidance and details are intended to define the typical amount of signing for the various applications.

APPLICATIONS

DIVIDED HIGHWAY WITH WIDE MEDIAN intersection with TWO-WAY CROSS STREET (See Figure 1)

This typical signing plan *should* be sufficient for most intersections of this type.

The MUTCD Section 2B.37 and Figure 2B-12 allows the single installation of DO NOT ENTER and WRONG WAY SIGNS. Where the median width is 30 feet or greater, the signs *should* be installed on the median side.

DIVIDED HIGHWAY WITH NARROW MEDIAN intersection with TWO-WAY CROSS STREET (See Figure 2)

This typical signing plan *should* be sufficient for most intersections of this type. Additional needs *may* be met by installing additional signs as shown in MUTCD Figure 2B-15.

The MUTCD Section 2B.37 and Figure 2B-12 to allow the single installation of DO NOT ENTER and WRONG WAY SIGNS. Where the median width is less than 30', the signs *should* be installed on the outer side.

DIVIDED HIGHWAY WITH WIDE MEDIAN intersection with INTERCHANGE RAMPS (See Figure 3)

This typical signing plan *should* be sufficient for most intersections of this type. It combines the typical signing requirements from **Figure 1** with the Standards, Guidance and Options in the MUTCD Section 2B.41 and Figure 2B.18, except that the Turn Prohibition signs are designated optional. This is consistent with the last Option paragraph in the MUTCD Section 2B.18.

DIVIDED HIGHWAY WITH NARROW MEDIAN intersection with INTERCHANGE RAMPS (See Figure 4)

This typical signing plan *should* be sufficient for most intersections of this type. It combines the typical signing requirements from **Figure 2** with the Standards, Guidance and Options in the MUTCD Section 2B.41 and Figure 2B.18, except that the Turn Prohibition signs are designated optional. This is consistent with the second to last Option paragraph in the MUTCD Section 2B.18.

TWO-WAY UNDIVIDED HIGHWAY intersection with INTERCHANGE RAMPS (See Figure 5)

This typical signing plan *should* be sufficient for most intersections of this type. It reflects the Standards, Guidance and Options in the MUTCD Section 2B.41 and Figure 2B.18, except that the Turn Prohibition signs are designated optional. This is consistent with the second to last Option paragraph in the MUTCD Section 2B.18.

TRANSITION FROM TWO-WAY UNDIVIDED HIGHWAY TO DIVIDED HIGHWAY (See Figure 6)

This typical signing plan *should* be sufficient to prevent wrong-way movements in these transition areas. TEOpS 2-15-11 illustrates the overall signing and pavement marking requirements in greater detail.

DIVIDED HIGHWAY WITH INTERSECTING SIDEROAD (See Figures 7 and 8)

These typical signing plans *should* be sufficient for most side roads of these types. Additional needs *may* be met by installing additional signs as shown in the MUTCD Figure 2B-15.

The MUTCD Section 2B.37 and Figure 2B-12 allows for the single installation of the DO NOT ENTER and WRONG WAY signs. Where the median width is less than 30’, the signs *should* be installed on the outer side.

DIVIDED HIGHWAY WITH NARROW OR WIDE MEDIAN DRIVEWAY (See Figures 9, 10 ,11, 12 and 13)

These typical signing plans *should* be sufficient for most driveways of these types. Additional needs *may* be met by installing additional signs as shown in the MUTCD Figure 2B-15.

The MUTCD Section 2B.37 and Figure 2B-12 allows for the single installation of the DO NOT ENTER and WRONG WAY signs. Where the median width is less than 30’, the signs *should* be installed on the outer side.

ROUNDABOUTS (See Figure 14)

This typical signing plan *should* be sufficient for the prevention of wrong way movements on roundabouts with single and multiple approach lanes and interchange off-ramps.

DIVIDED HIGHWAY WITH SIGNALIZED WIDE MEDIAN INTERSECTION (See Figure 16)

This typical signing plan *should* be sufficient for most intersections of this type.

The MUTCD Section 2B.37 and Figure 2B-12 allows the single installation of DO NOT ENTER and WRONG WAY SIGNS. Where the median width is 30 feet or greater, the signs *should* be installed on the median side.

DIVIDED HIGHWAY WITH SIGNALIZED NARROW MEDAN INTERSECTION (See Figure 17)

This typical signing plan *should* be sufficient for most intersections of this type. Additional needs *may* be met by installing additional signs as shown in MUTCD Figure 2B-16.

The MUTCD Section 2B.37 and Figure 2B-12 to allow the single installation of DO NOT ENTER and WRONG WAY SIGNS. Where the median width is less than 30’, the signs *should* be installed on the outer side.

POLICY

At approaches to multi-lane roadways with median widths less than 30’, the R6-1 ONE WAY sign **shall** be installed at the near right installation above the STOP or YIELD sign. At approaches to multi-lane roadways with median widths 30’ or greater, two R6-1 ONE WAY signs **shall** be installed back to back at the near right installation above the STOP or Yield sign. The R6-1 ONE WAY sign **shall** be used at “T” intersections with divided highways or above the roundabout directional arrow (R6-4b) sign.

At divided highways with wide medians that have a STOP or Yield sign in the median, a R6-1 ONE WAY sign **shall** be installed back to back above the STOP or Yield sign (See Figure 15).

The R6-2 ONE WAY sign **shall** be used for all other locations on the STH system.

The DO NOT ENTER sign **shall** be installed where it does not obscure the outline or shape of STOP or YIELD signs. If space does not permit, it is permissible to trim the DO NOT ENTER sign into an octagon shape, however the preference is to install the DO NOT ENTER sign on a separate post, next to the STOP sign.

GUIDELINES

Short divided sections with low traffic volumes and a posted speed of 40 mph or less *may* not need the DO NOT ENTER and WRONG WAY signs.

An urban boulevard with frequent cross streets and median openings *should* not need repeated DO NOT ENTER and WRONG WAY signs.

A history of wrong way movements and/or related crashes *may* warrant further measures. If visibility of the far roadway from the side street or ramp is obscured by geometrics or cross section, additional ONE WAY signs *may* be necessary and positioned as shown in the MUTCD Figure 2B-15.

Highway lighting *may* be a solution to visibility problems, eliminating the need for extra signing.

Pavement marking arrows *may* be used to supplement signing and reinforce the wrong way prevention message, especially on exit ramps.

Freeway ramps *may* warrant additional signing and marking strategies to help prevent wrong way movements. The following strategies *may* be used at freeway ramp locations that have exhibited problems with wrong way drivers entering the freeway:

1. Upsizing of DO NOT ENTER and WRONG WAY signs
2. Stop bars and type 4 pavement marking arrows
3. Dotted pavement marking line extensions through the intersection

The following strategies *may* be used in addition to the ones above or on their own. All of the following strategies are optional, and **shall** only be used at side by side ramp locations that have exhibited problems with wrong way drivers entering the freeway:

1. Additional WRONG WAY signs mounted below the DO NOT ENTER signs at a 3 foot mounting height as measured vertically from the bottom of the sign to the top of the near edge of pavement.
2. Reflective strips on WRONG WAY and DO NOT ENTER sign posts. These strips **shall** be 2 inches wide, composed of red Type H sheeting on 0.040 inch sheet aluminum, and **shall** run from the bottom of the sign to within 2 feet above the edge of pavement.
3. A FREEWAY ENTRANCE sign placed at the entrance to the on ramp
4. Dynamic (flashing) WRONG WAY signs

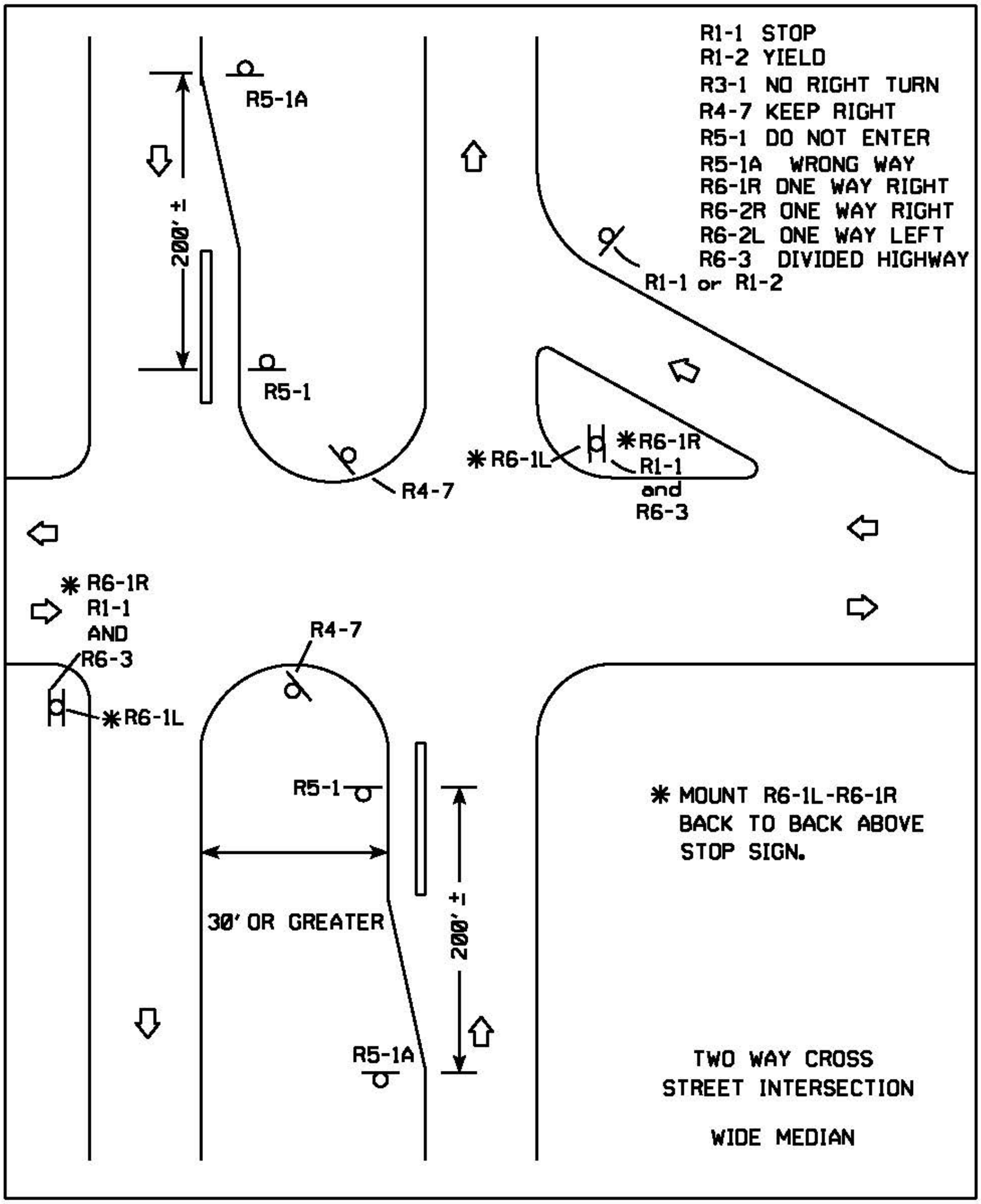


FIG. 1 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

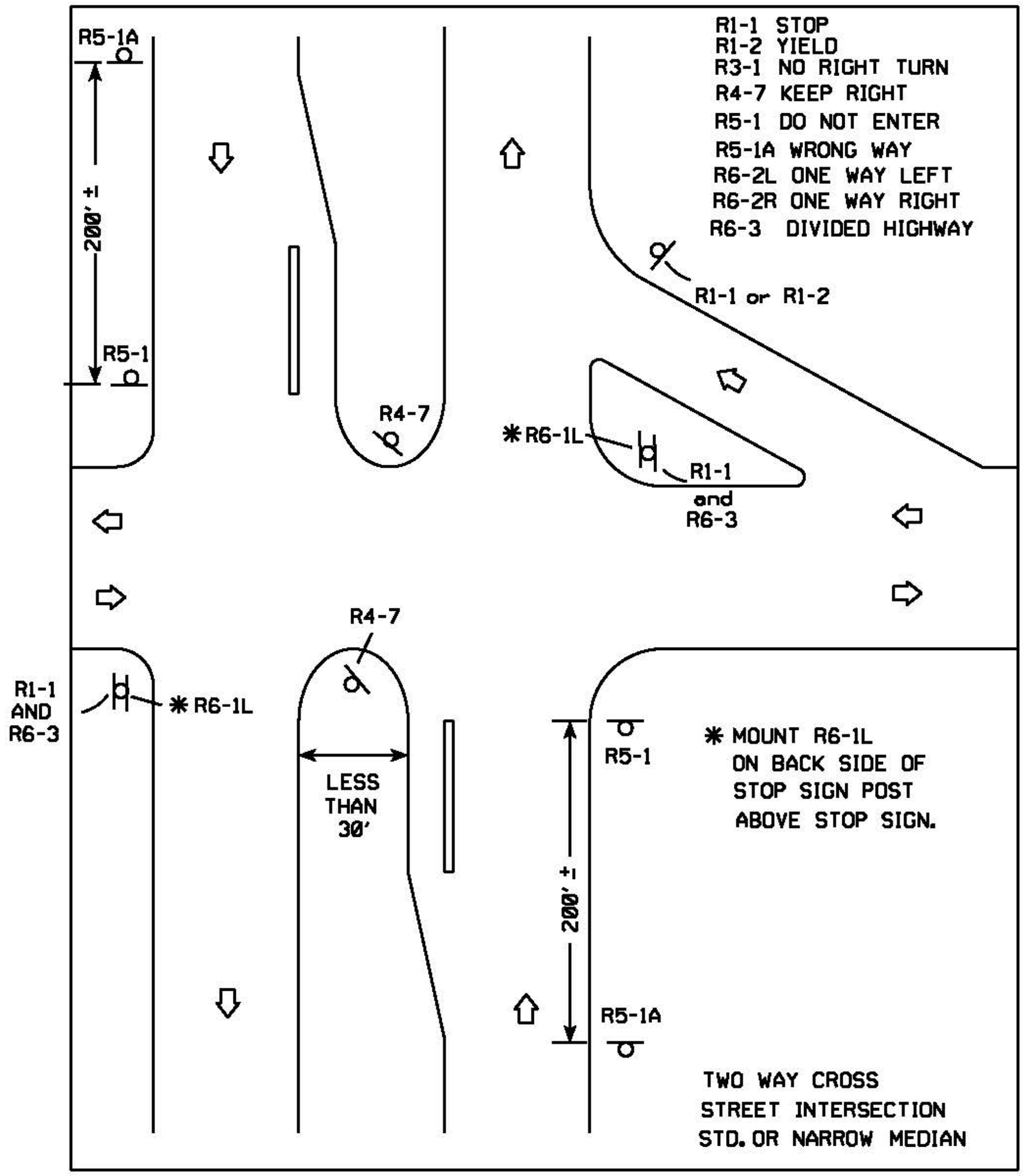


FIG. 2 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

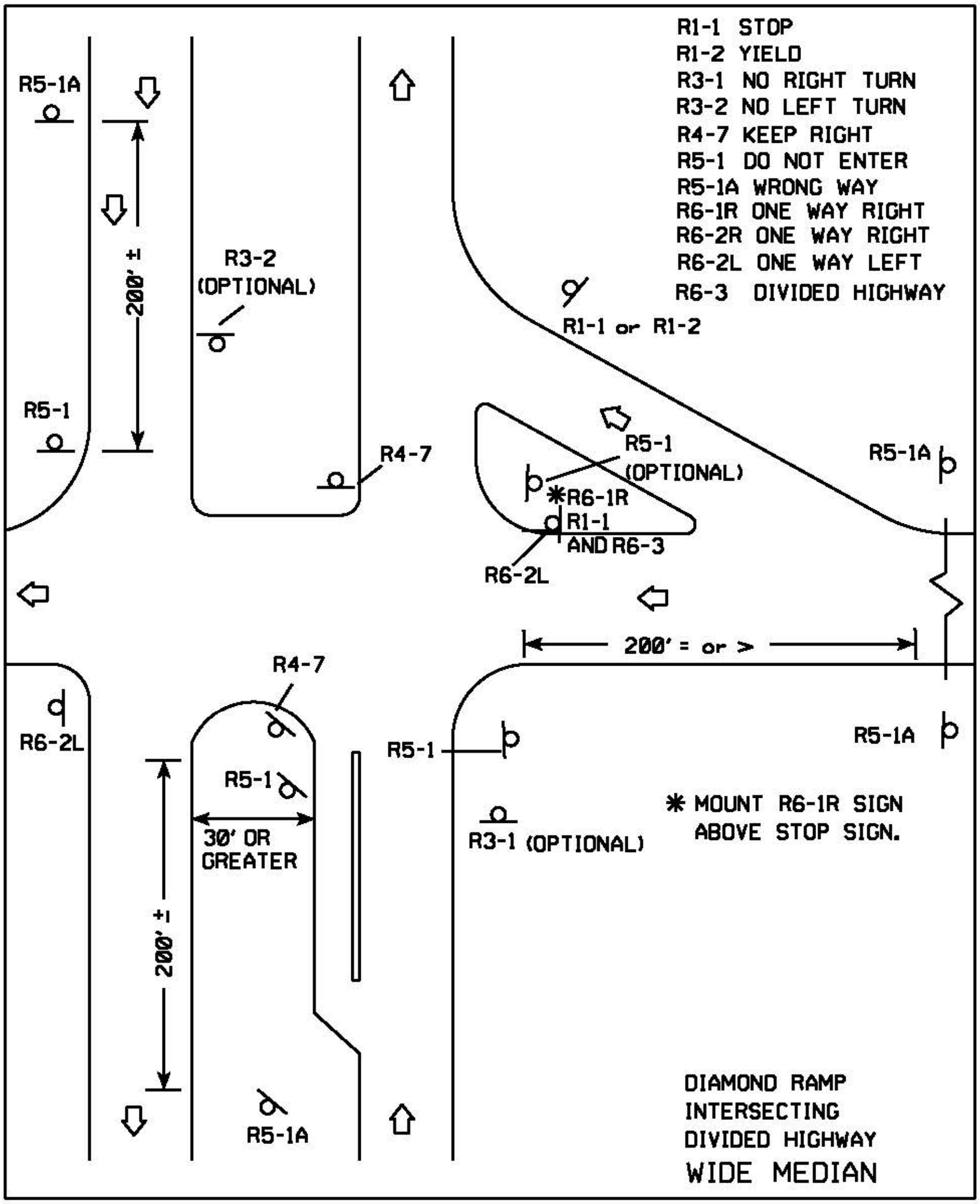


FIG. 3 WRONG WAY SIGNING RELATIVE TO RAMP.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

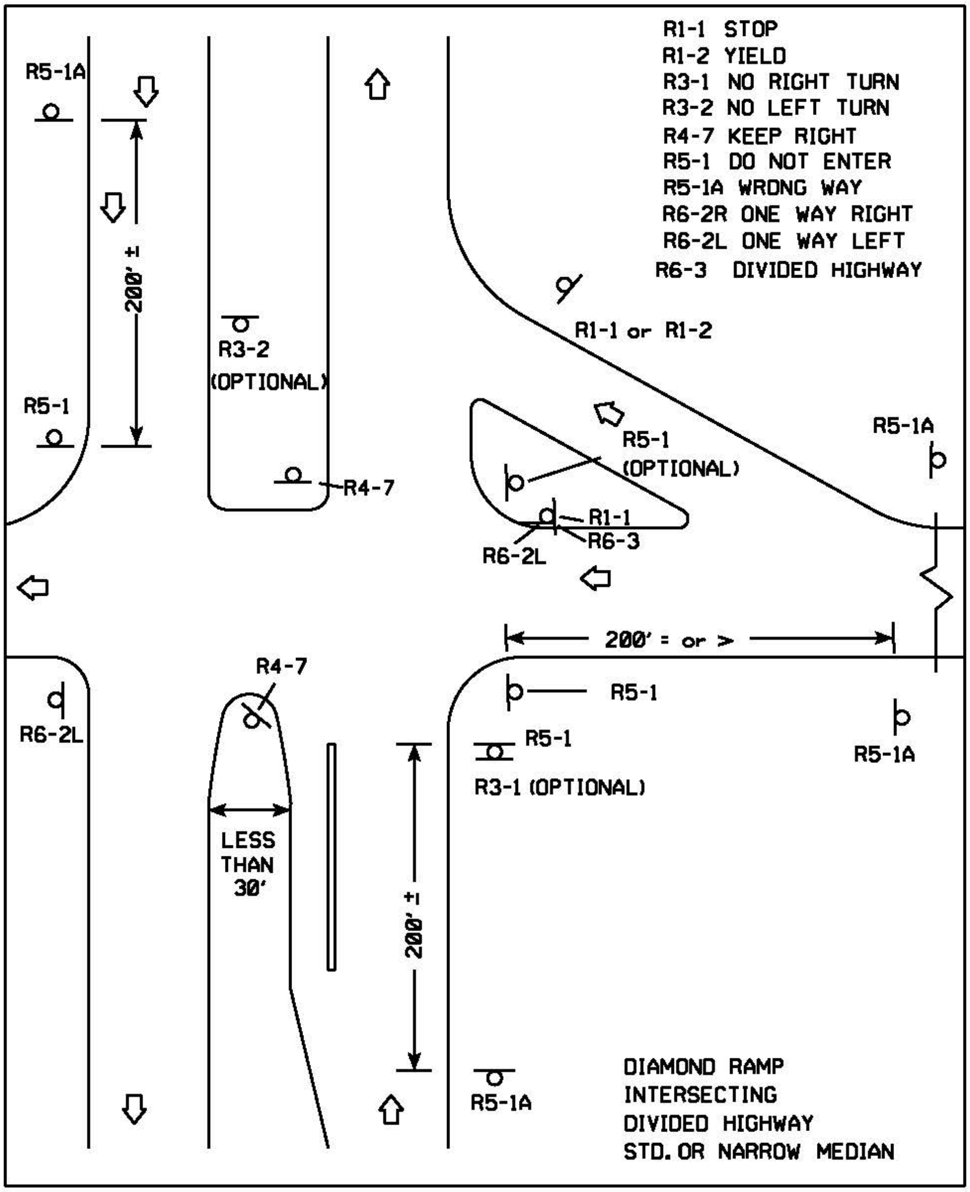


FIG. 4 WRONG WAY SIGNING RELATIVE TO RAMP.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

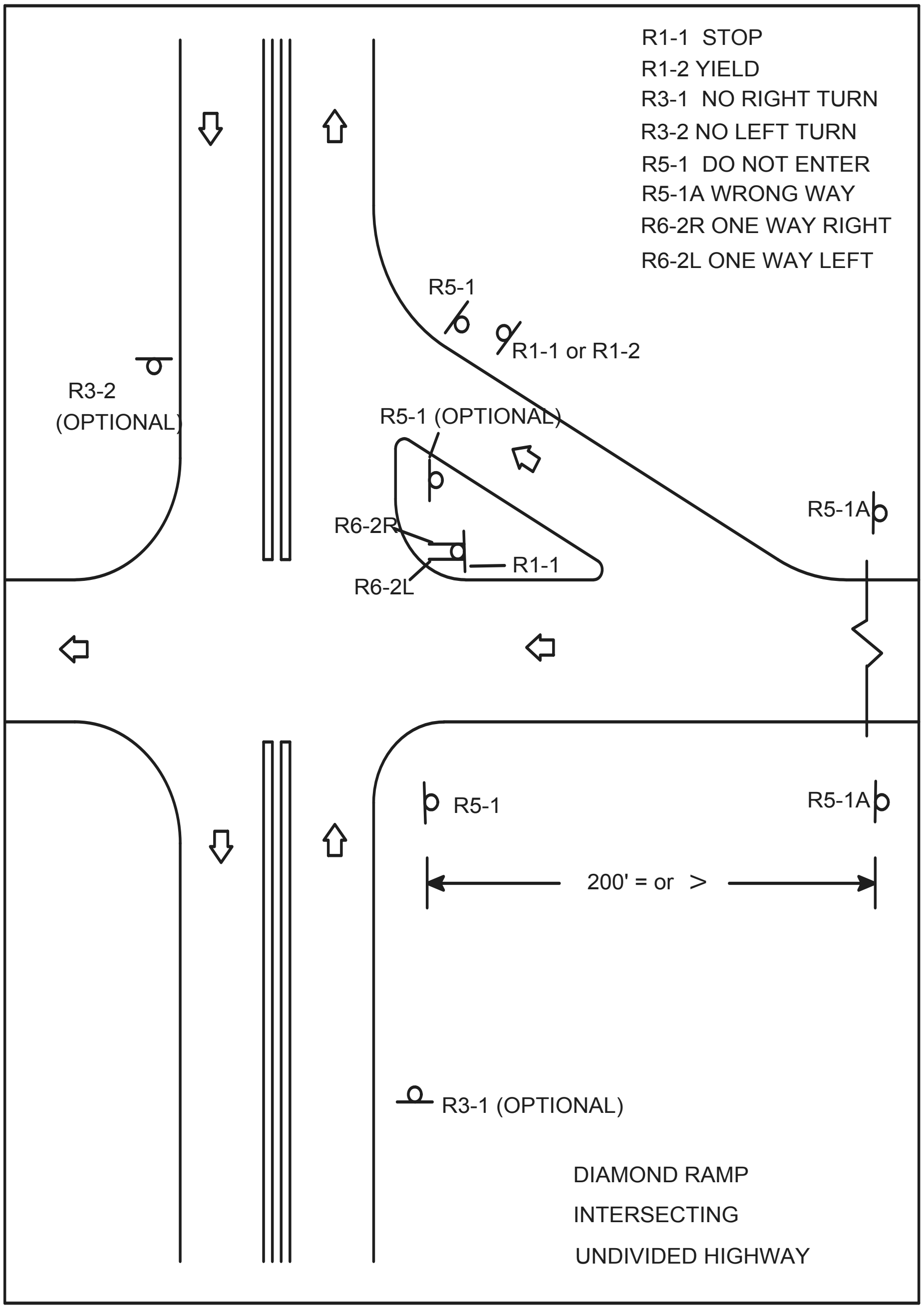


FIG. 5 WRONG WAY SIGNING RELATIVE TO RAMP.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

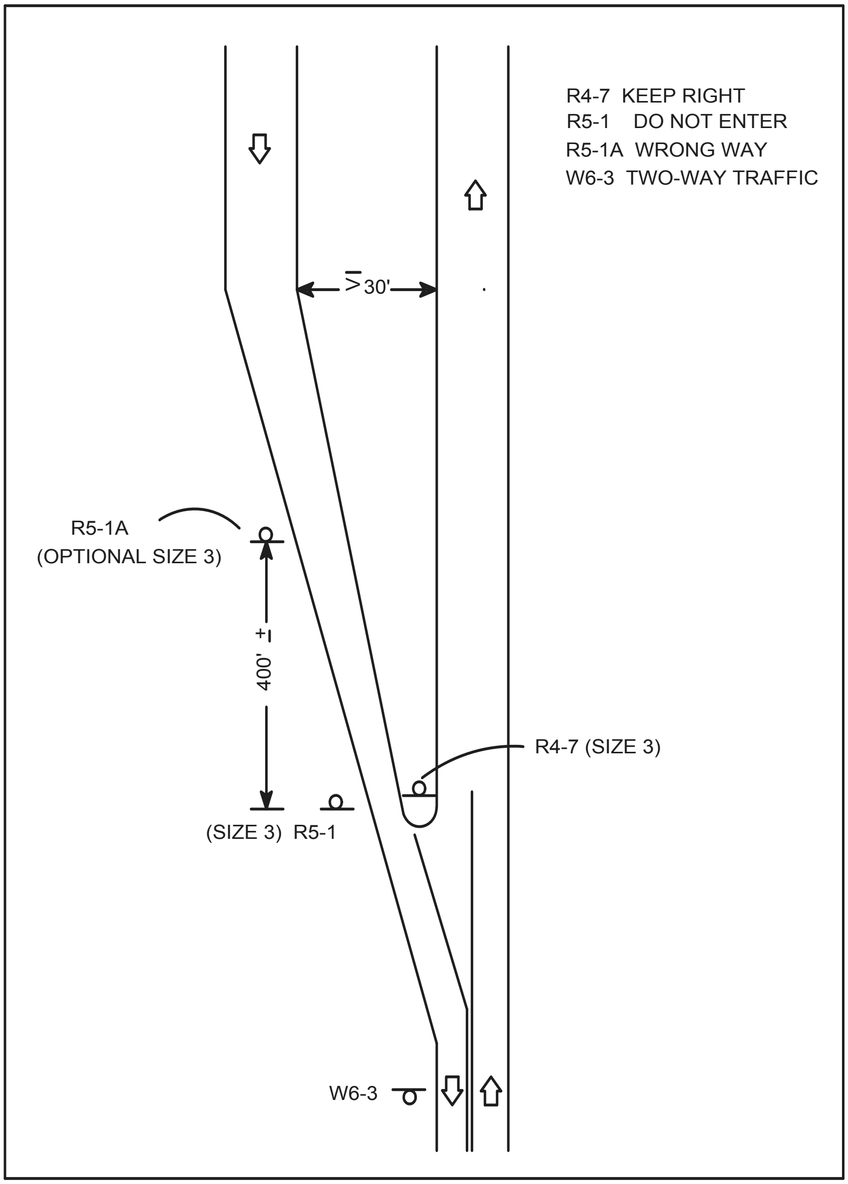


FIG. 6 TRANSITION FROM TWO-WAY UNDIVDED HIGHWAY TO DIVIDED HIGH

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT.
FIELD CONDITIONS MAY DICTATE CHANGES IN
SIGN PLACEMENT.

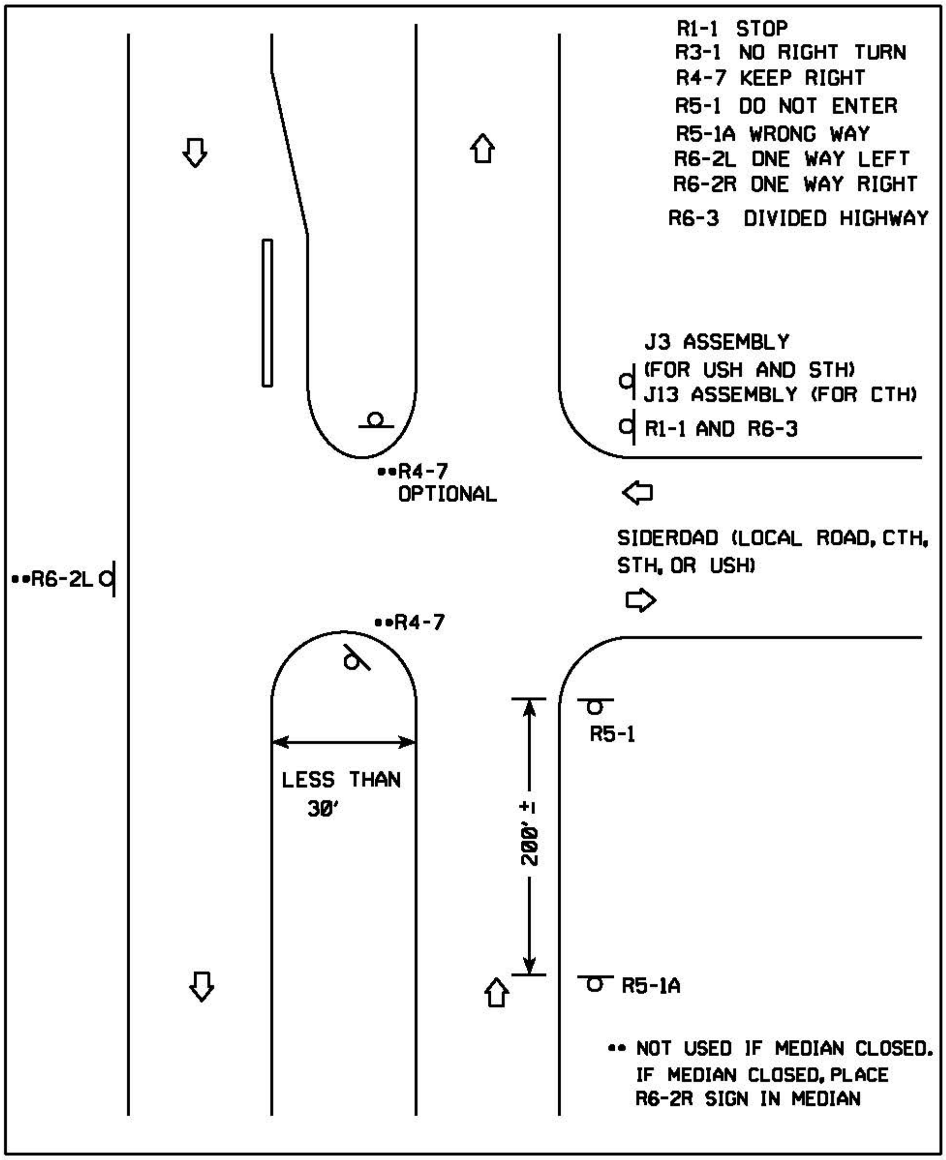


FIG. 7 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT.
FIELD CONDITIONS MAY DICTATE CHANGES IN
SIGN PLACEMENT.

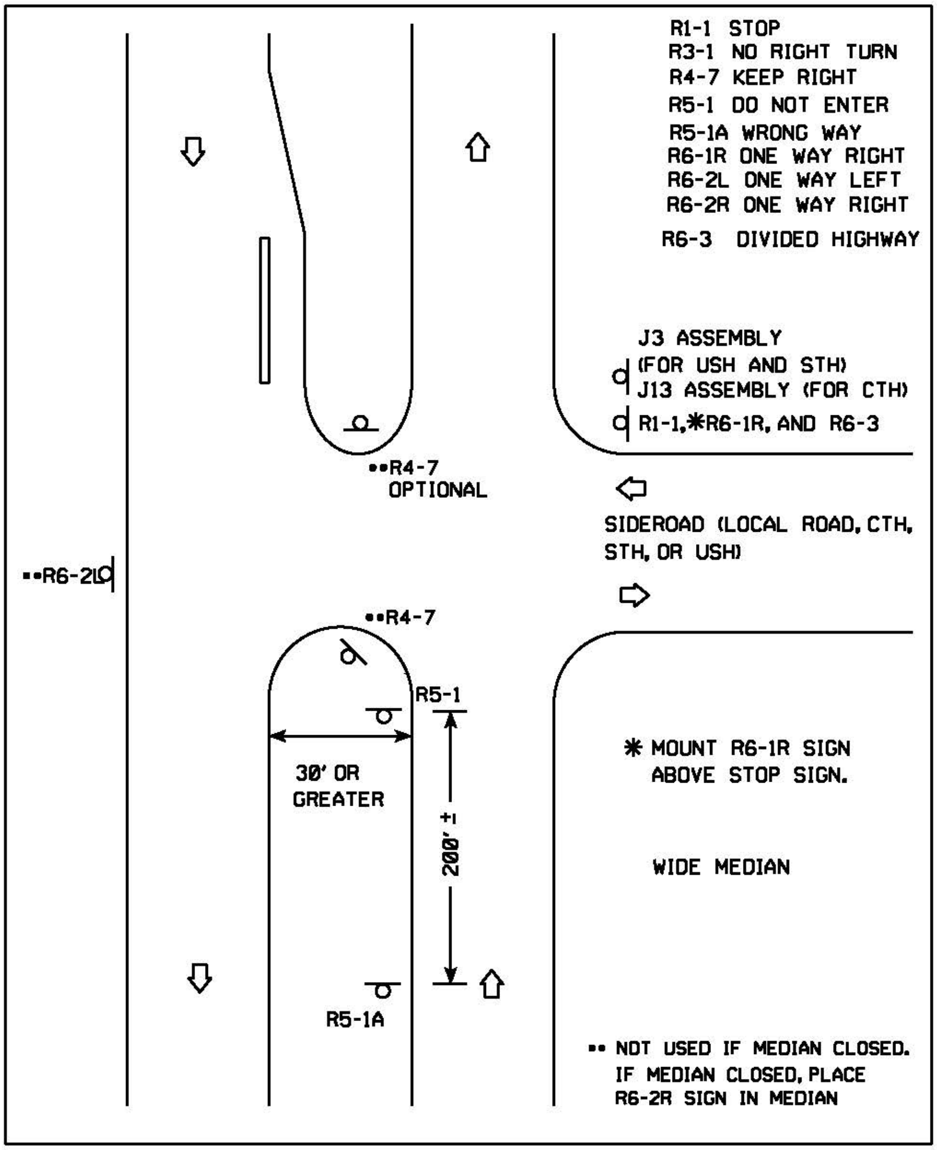


FIG. 8 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

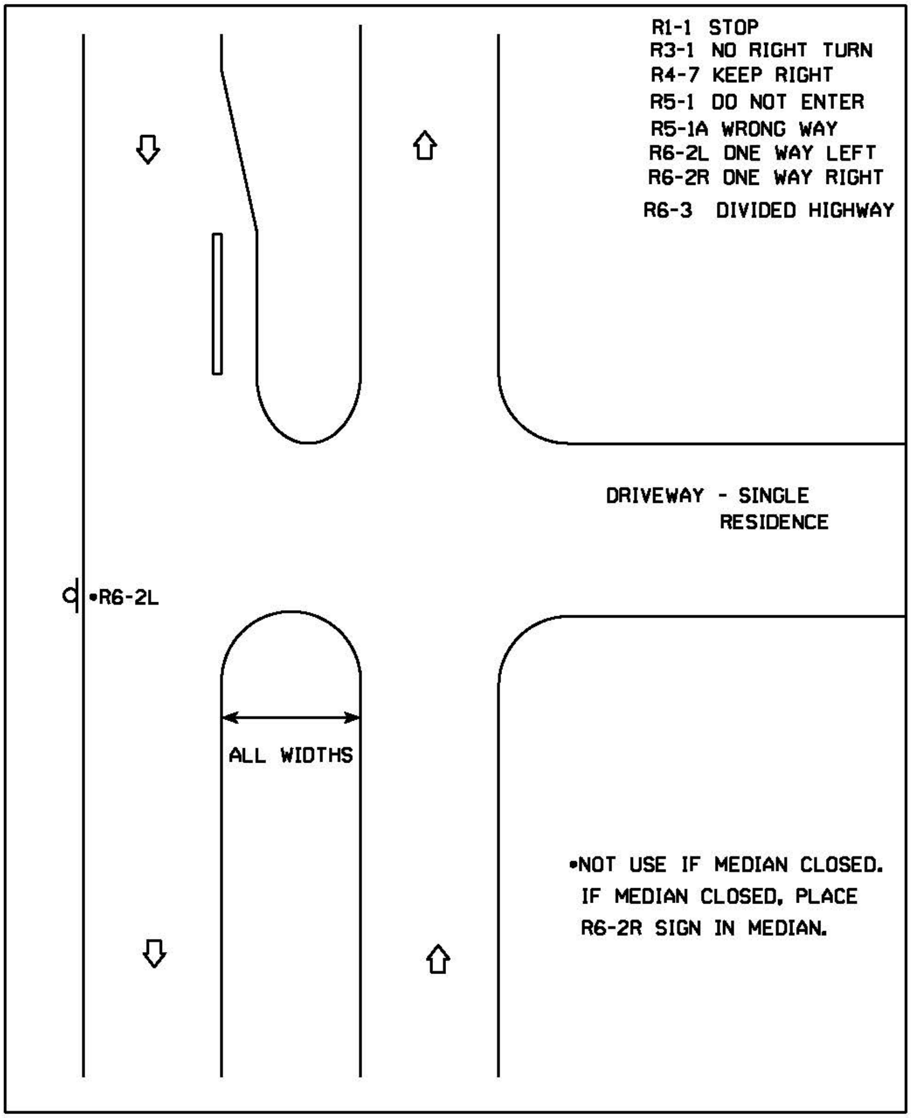


FIG. 9 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

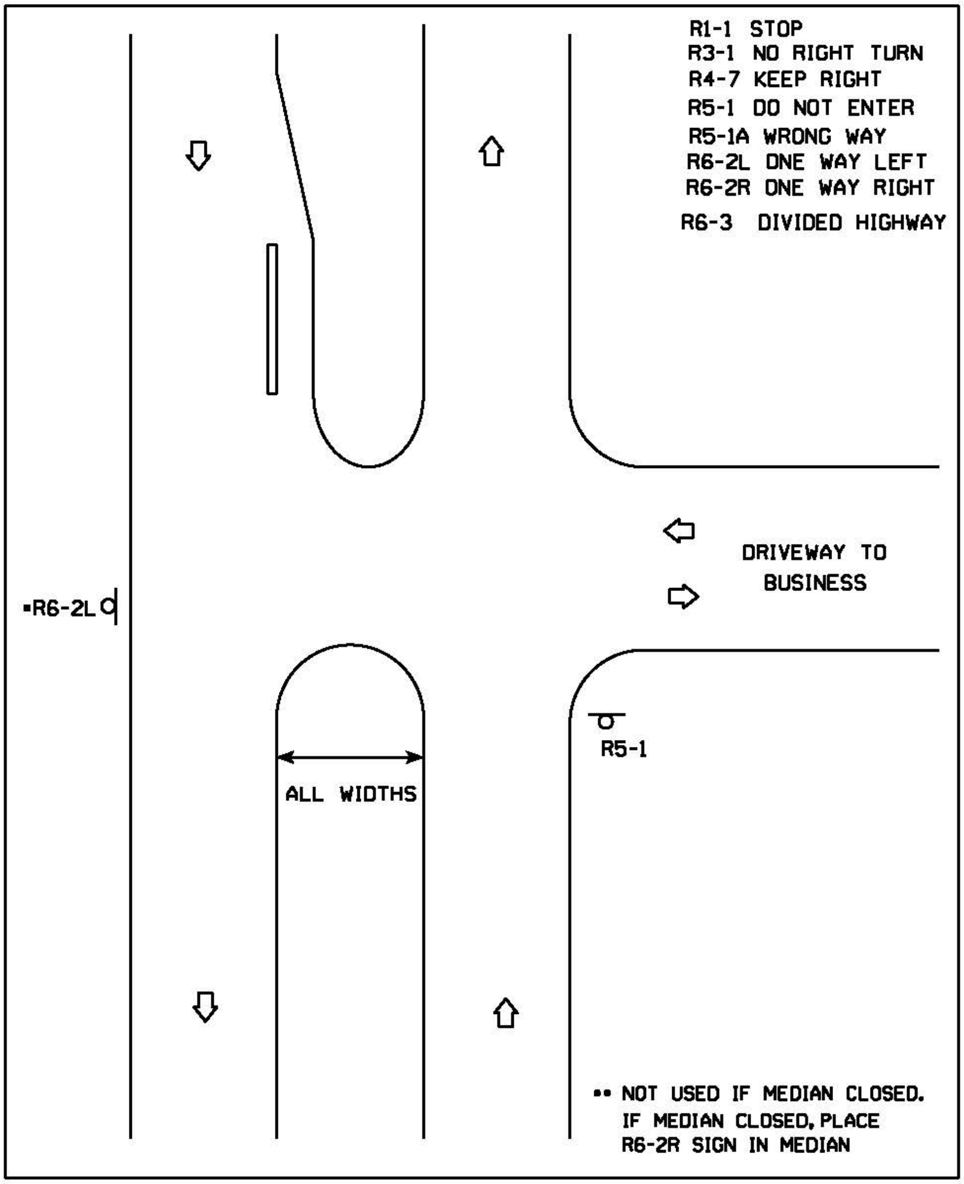


FIG. 10 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

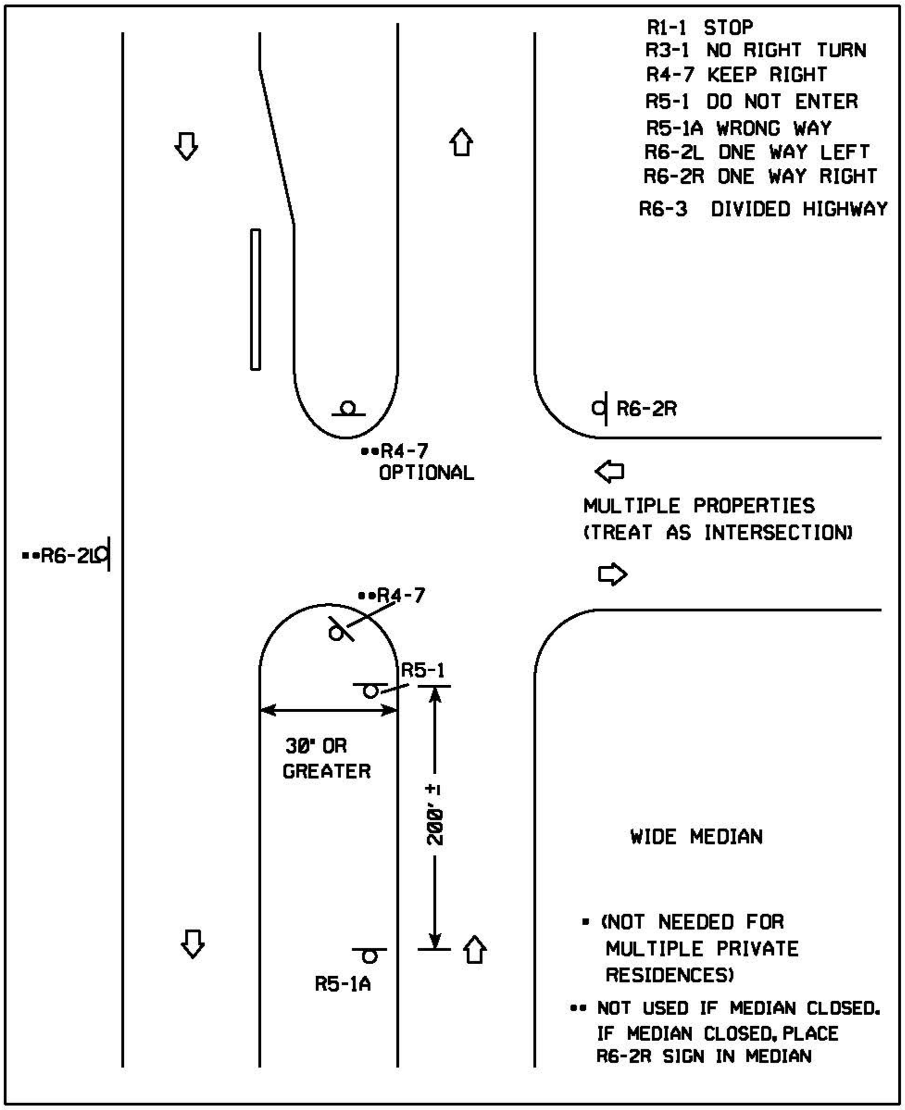


FIG. 11 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT.
FIELD CONDITIONS MAY DICTATE CHANGES IN
SIGN PLACEMENT.

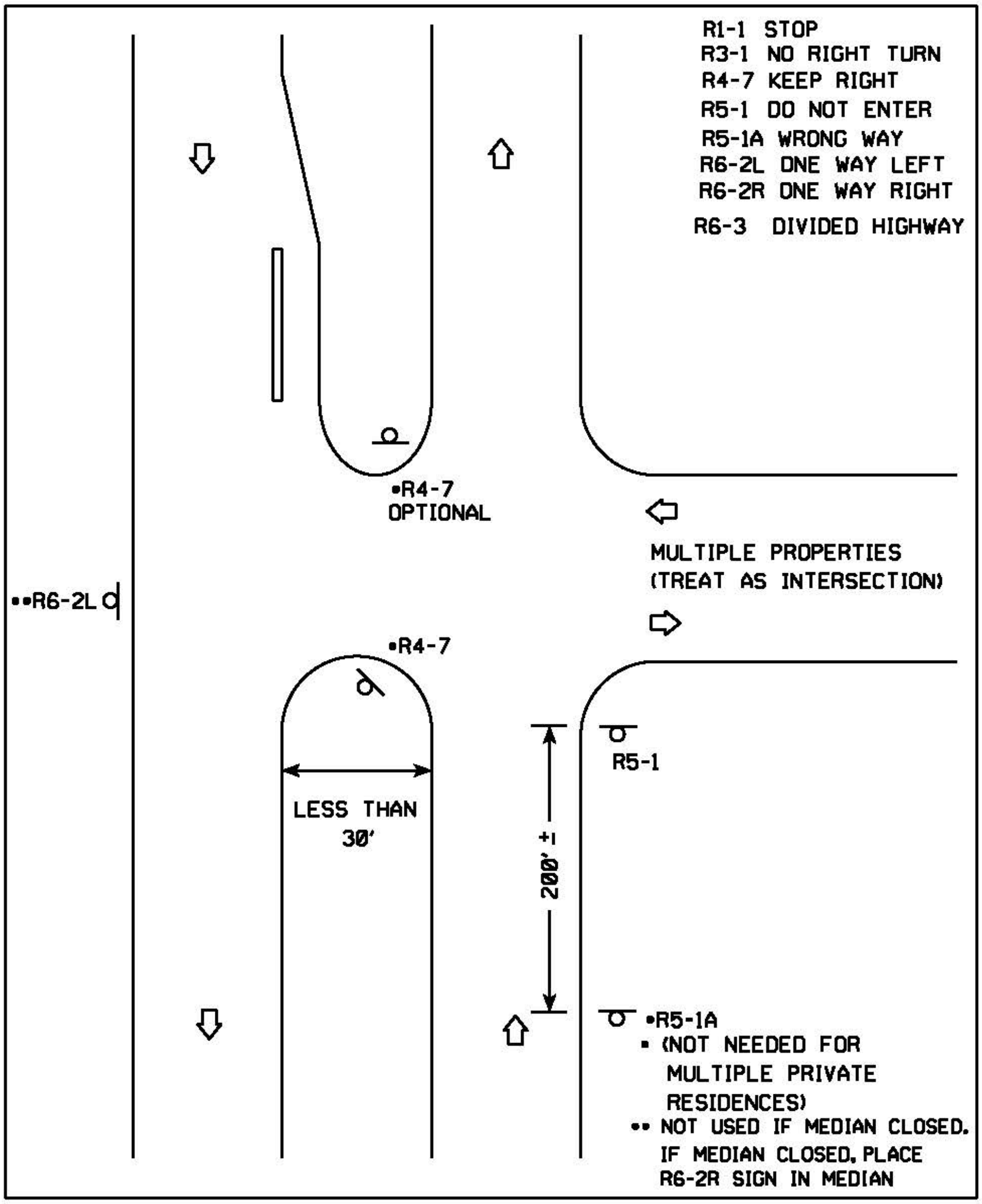


FIG. 12 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

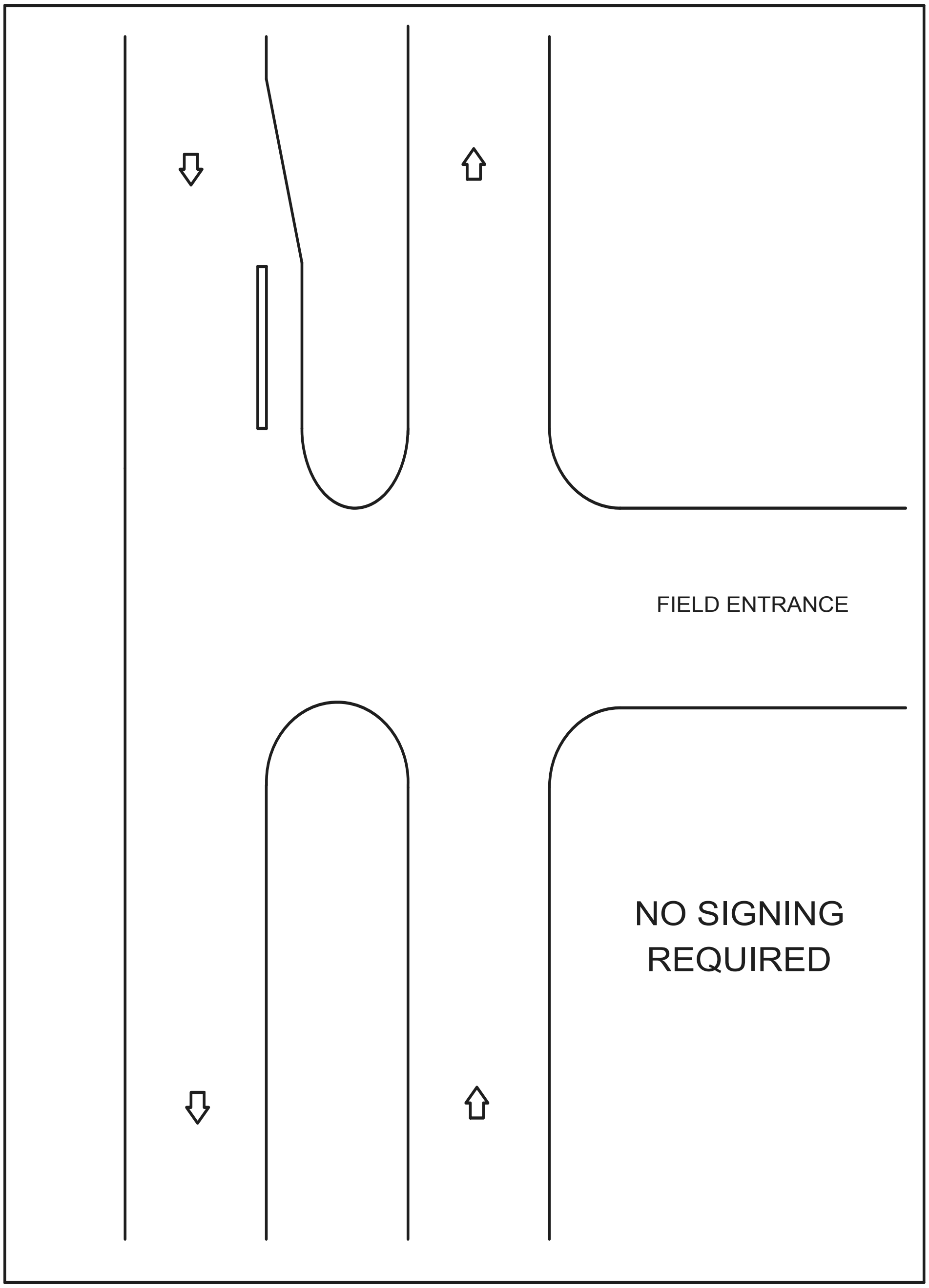


FIG. 13 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT.
FIELD CONDITIONS MAY DICTATE CHANGES IN
SIGN PLACEMENT.

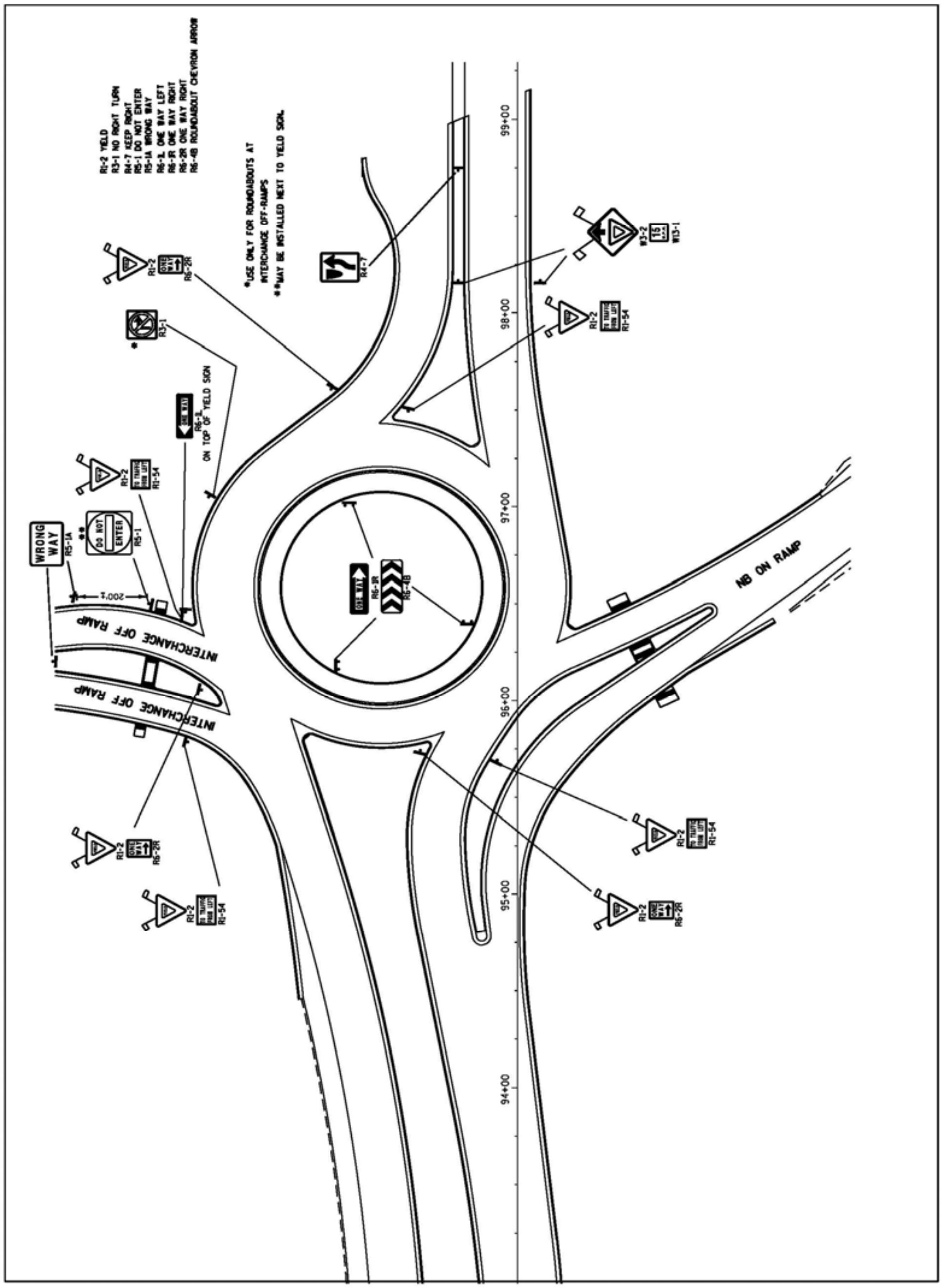


FIG. 14 WRONG WAY SIGNING RELATIVE TO ROUNDABOUT

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT

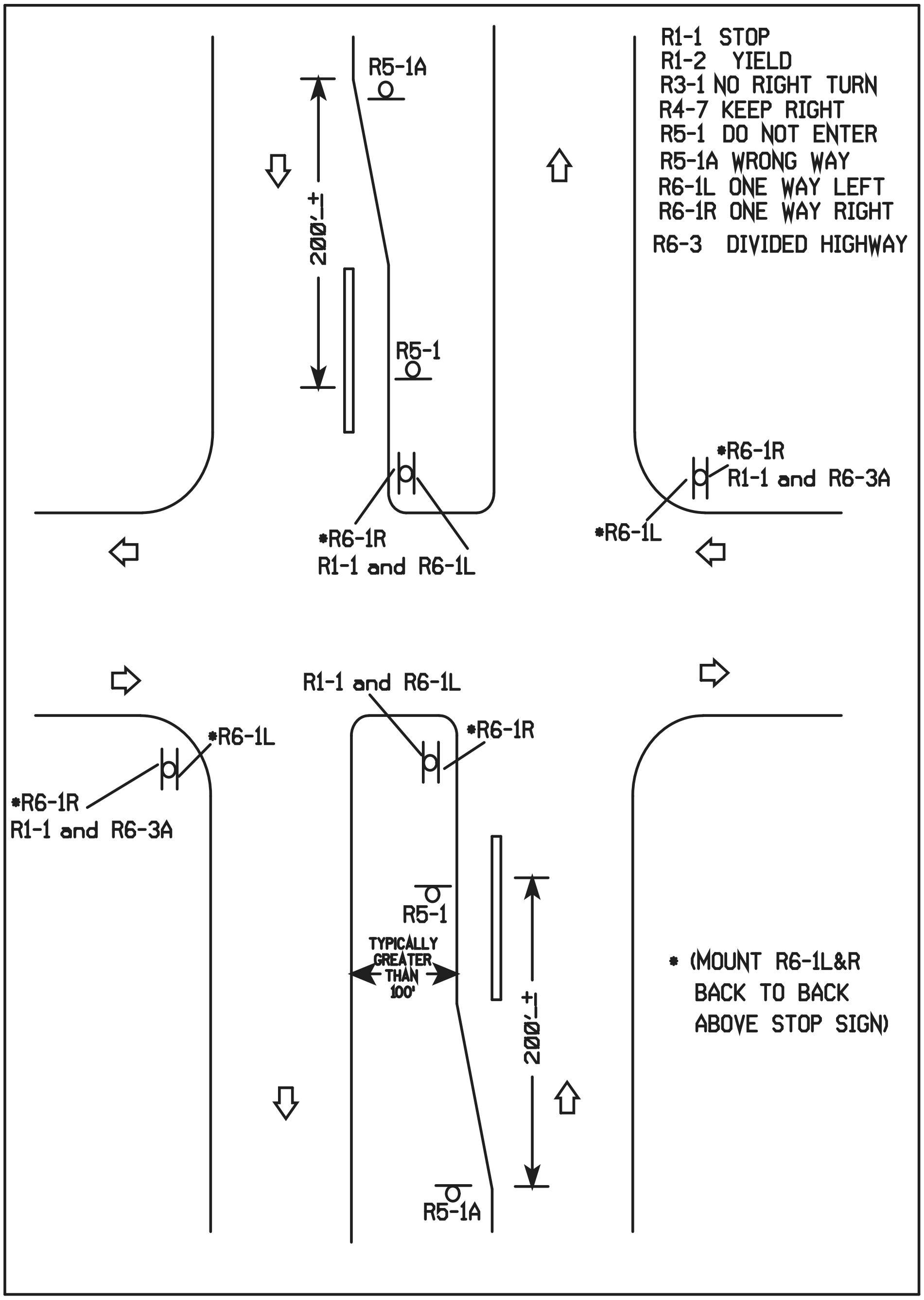


FIG. 15 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

(WIDE MEDIAN WITH STOP OR YIELD SIGN IN MEDIAN)

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT.
FIELD CONDITIONS MAY DICTATE CHANGES IN
SIGN PLACEMENT.

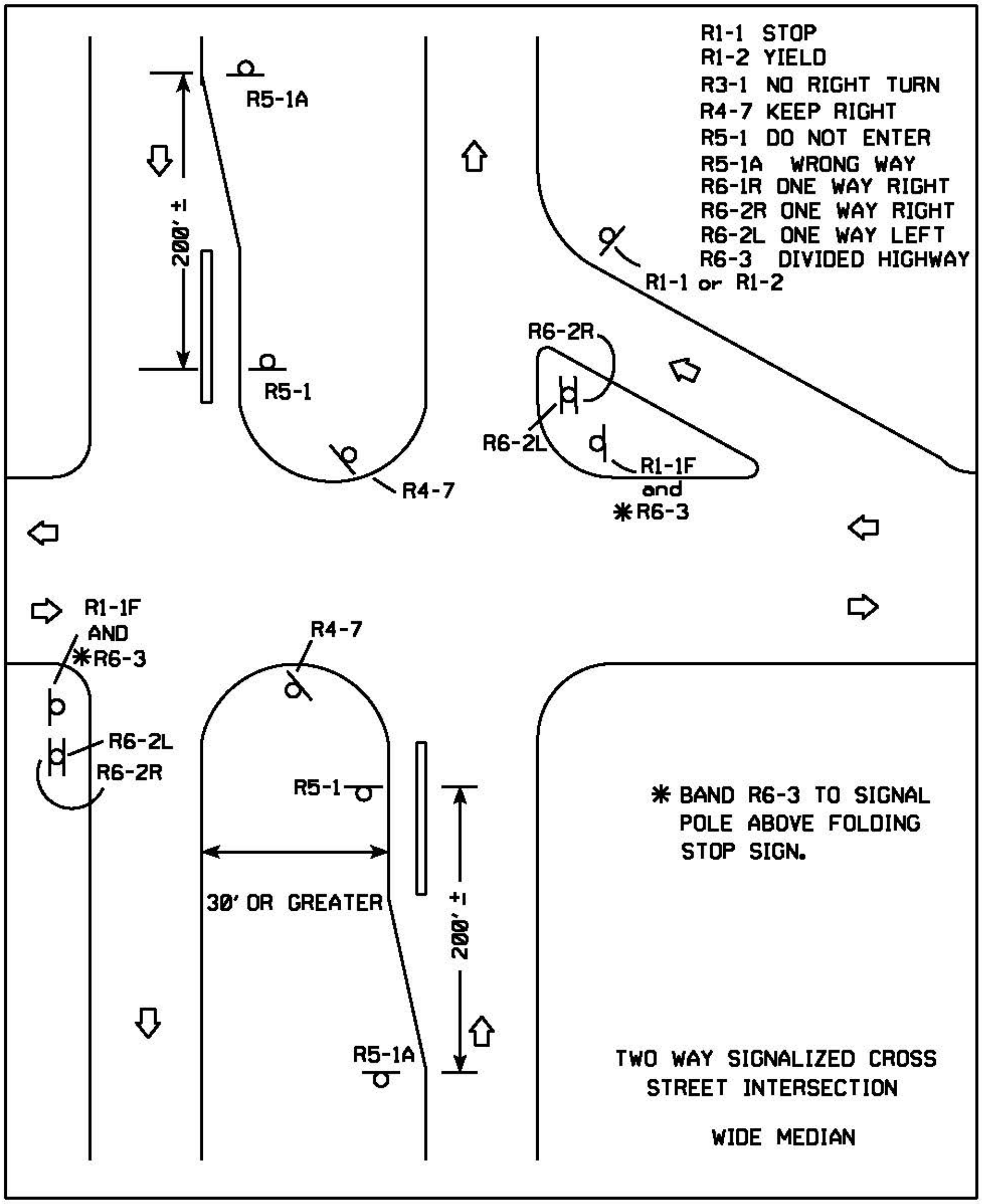


FIG. 16 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT. FIELD CONDITIONS MAY DICTATE CHANGES IN SIGN PLACEMENT.

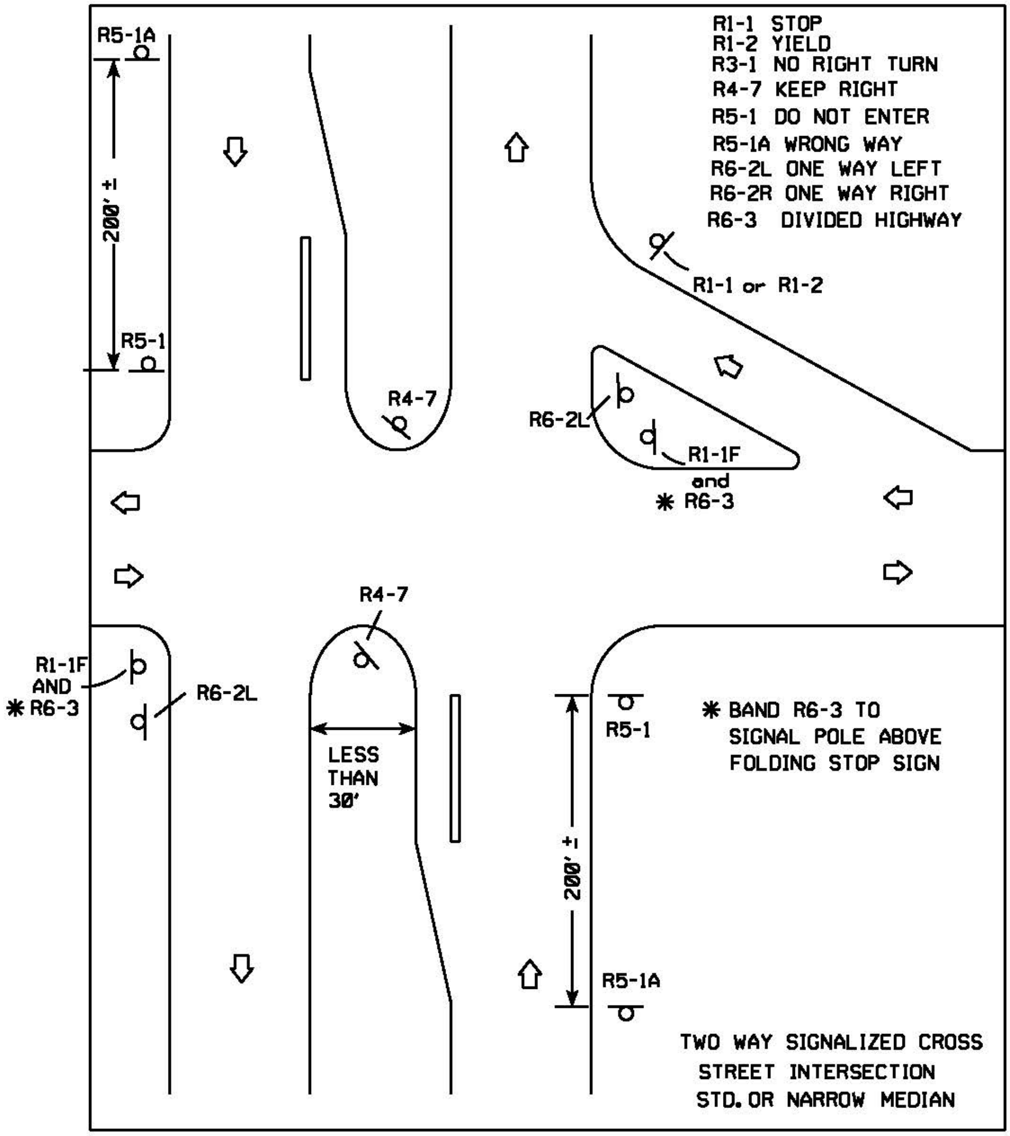


FIG. 17 WRONG WAY SIGNING RELATIVE TO DIVIDED HIGHWAY.

NOTE: SIGNING IS SHOWN AS TYPICAL SIGN PLACEMENT.
FIELD CONDITIONS MAY DICTATE CHANGES IN
SIGN PLACEMENT.

2-15-15 Recreational Trail Signing — January 2015

PURPOSE

This policy provides guidance for the installation of guide signs to direct traffic to major access points for public recreational trails. This policy does not address warning signs that *may* apply to locations where the recreational trail crosses a highway.

DEFINITION

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

Conventional highways are defined as either divided or undivided roadway facilities that have no control of access with grade separations at intersections. These highways can be two-lane or multilane facilities.

POLICY

The following criteria **shall** apply for a trail to be eligible for signing on WisDOT-maintained roadways:

1. Public recreational trails owned and/or managed by the state government **shall** be the only trails that qualify for signing on freeways.
2. Public recreational trails owned and/or managed by the state or county government, or by a multi-state agency or commissions **shall** be the only trails that qualify for signing on expressways.
3. Public recreational trails owned and/or managed by the state or county government, by a multi-state agency or commission, or by a city, village, or township *may* be signed for on conventional highways.
4. All trailblazing signing off the State Trunk Highway system **shall** be in place prior to the installation of any signs on the State Trunk Highway system.
5. The trail **shall** be constructed and maintained to Wisconsin DNR standards, with an improved surface of compacted aggregate or better and be open year round. National Trails, as established by Congress, on the National Trails System with a natural surface *may* qualify for signing, provided the access points to be signed meet all other applicable criteria, including off-street parking facilities.
6. Evidence of poor trail maintenance or inadequate or poor trailblazing signage will be cause to remove any existing signs from the State Trunk Highway system.
7. The message on the signs *should* read “XX State Trail” for state owned trails and “XX Trail” for county, regional, city, village or township trails. The signs **shall** be composed of white lettering on a brown background.
8. For all roadways, only the trail termini will be signed. Intermediate access points *may* qualify for signing. The intermediate access points **shall** be spaced a minimum of 15 miles. A maximum of 2 signs **shall** be installed, one in each direction of travel, for each trail access point to be signed. For freeways and expressways, a directional sign (D1 sign) **shall** be placed on the freeway/expressway ramp to lead to the trail access.
9. Trail termini and intermediate access points *should* have the following amenities:
    a. Public restrooms or toilets on freeways and expressways, but are optional on conventional highways
    b. Public, off-street paved or gravel parking facilities
    c. Trail information
10. Where trail access points from two different trails have the same point of access from the State Trunk Highway, both trail names **shall** be identified on the same sign.
11. These signs **shall** be placed at the closest State Trunk Highway intersections to the trail termini. Trailblazing signing from a conventional State Trunk Highway to another conventional State Trunk Highway will not be allowed.
12. For freeways, expressways, and conventional highways, trail access points **shall** be no more than 5 miles from the nearest exit or State Trunk Highway.
13. The cost for fabrication, installation, and maintenance of any recreational trail signing **shall** be the responsibility of the trail owner or managing organization or agency. WisDOT **shall** coordinate the fabrication, installation, and maintenance of all signs on State Trunk Highways, including ramps, and **shall** be reimbursed for all costs. Installation of signs *may* be performed by WisDOT forces or by permit/letter.

2-15-16 ATV Route Signing — November 2015

PURPOSE

Section 23.33(1)(c) Wisconsin Statute defines an all-terrain vehicle (ATV) route as a highway or sidewalk designated for use by ATV operators by the governmental agency having jurisdiction as authorized under this section. In addition, s. 23.33(11)(am)(3) allows ATV operation on non-interstate highway bridges 1,000 feet in length or less by ordinance of the county and the municipality in which the bridge is located, regardless of jurisdiction.

At some locations on state trunk highway right of way, local agencies *may* erect signing for the purpose of directing and controlling ATV trail operations. This is permissible unless there is some problem generated by the existence of ATVs at specific locations. Signing for ATV trails and routes is described in Administrative Code NR 64.12 and also described with typical applications illustrated in WDNR's "Trail Signing Handbook", 2012. A copy of this book *should* be kept in each traffic section. This policy will clarify that handbook with regards to ATV use on WisDOT maintained highways.

DEFINITIONS

ATV crossing: A location where an ATV route or trail crosses, but does not run along, a highway.

ATV route: Any roadway or sidewalk properly designated for use by ATV operations per s. 23.33.

ATV trail: A marked corridor on public property or on private lands subject to public easement or lease, designated for use by all-terrain vehicle operators by the governmental agency having jurisdiction, but excluding roadways of highways except those roadways that are seasonally not maintained for motor vehicle traffic.

POLICY

ATV crossing warning signs:

1. ATV crossing warning signs (W11-50) are shown routinely in the WDNR Trail Signing Handbook. On state maintained highways, these signs **shall** only be installed by WisDOT, and only where warranted due to sight conditions, per the table in Section 2C.46 of the MUTCD.
2. WisDOT will assume the installation and maintenance costs for any ATV Trail crossing warning signs installed on the state highway system.

ATV Route guide signs and arrows:

The following policy criteria **shall** be used when ATV Route guide signs are requested from municipalities:

1. ATV Route signs (D11-10) **shall** be installed immediately downstream from where an ATV Route turns onto a State or US Highway. From a safety standpoint, it is desirable to keep ATVs on the shoulder; however, this *may* cause shoulder rutting issues, especially in locations where ATVs will tend to straddle the paved shoulder/gravel shoulder transition. For this reason, it *may* be desirable to supplement the initial D11-10 signs with “STAY ON PAVEMENT” (R4-55) or “STAY ON SHOULDER” (R4-55-S) signs, mounted directly below the D11-10 sign. Region maintenance *should* be consulted to determine if these signs are necessary. A second D11-10 sign **shall** be installed where the ATV Route turns off of the State or US Highway. This sign **shall** be supplemented with an appropriate M7 series arrow.
2. It *should* be noted that the WDNR Trail Signing Handbook shows a 6” x 12” “directional arrow” above a 6” x 6” ATV symbol sign at locations where the ATV route ends at an ATV trail. This combination of sign **shall not** be installed along ATV routes on State or US Highways. This “directional arrow” sign mimics the design of standard large one-direction (night) arrows. As ATV users will be using some or all of the traffic lane, these signs will be installed at the same offset and mounting height as other traffic signs. This could lead to motorist confusion. ATV routes on State or US Highways ending at ATV trails **shall** utilize the D11-10/M7 sign combinations.
3. The county or local municipality **shall** be required to obtain a permit (see TEOpS 2-15-3) for these signs from the WisDOT Region Traffic Engineer. The written request *should* contain:

    a. A copy of both the municipal and county ordinances

    b. A map showing the ATV Route

    The Region Traffic Engineer *should* contact Bureau of Highway Maintenance (BHM), State ROW Permits Engineer, to ensure that the county and municipal ordinances have been reviewed by WisDOT and WDNR. Signs **shall not** be erected until the ordinances are legally in effect. The current BHM contact is Bob Fasick, (608) 266-3438.
4. WisDOT will set up a Professional and Technical Project ID to charge costs to and will coordinate manufacture and installation of the signs. All costs for the installation and maintenance of ATV Route signs **shall** be billed to the county or local municipality. For county requested signs, the Sales to Others process *may* be utilized in lieu of the P&T process.
5. All ATV Route signs, auxiliary arrows and plaques, and ATV crossing signs on State or US Highways

shall be installed on WisDOT standard breakaway supports. Mounting height and offset **shall** follow sign plate A4-3.

Other comments on the WDNR Trail Signing Handbook:

1. Any and all responsibility for signing along trail, off of the state highway, is local, including installation and maintenance.
2. Regarding illustrations in the book:
    a. Warning signs on the trail when visible from the highway *should* be the minimum size specified.
    b. Orange markers on the right-of-way would usually be unnecessary except to mark a turn.
    c. STOP signs are shown too close to the highway. They *should* be back of the snowplowing range, at least 20' from the pavement and desirably more.
    d. STOP signs *should* be parallel to the highway, and the trail approaching the highway *should* be aligned to be as near to a right angle as possible.
3. On page 14 of the handbook: If requested WisDOT will install and maintain guide signs for trail head parking lots. The signs *should* contain the word "Parking".
4. Trail sign posts on the right of way installed by local agencies **shall** meet the same small support safety standards as those erected by WisDOT.
5. Trail signs **shall not** be attached to any of WisDOT's signposts.

ADDITIONAL INFORMATION

BHM has developed a comprehensive policy on ATV routes and Trails that is available at HMM 09-10-11.

2-15-20 Cemetery Signing — January 2003

PURPOSE

This policy provides guidance for the permitting of signs on WisDOT-maintained roadways directing road users to certain cemeteries. These guidelines apply to conventional highways, expressways, and freeways.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have full controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have partial control of access and generally with grade separations at major intersections.

Conventional highways are defined as either divided or undivided roadway facilities that have no control of access with grade separations at intersections. These highways can be two-lane or multi-lane.

POLICY

The following criteria **shall** apply for a cemetery to be eligible for signing on WisDOT maintained roadways:

1. Only veterans' cemeteries that are exclusively for veterans and that are owned and/or managed by the state or national Department of Veterans Affairs are eligible to be permitted for signing under this policy. The primary function of the facility **shall** be a cemetery. Presently, the Northern Wisconsin Veterans Memorial Cemetery in Spooner and the Southern Wisconsin Veterans Memorial Cemetery near Union Grove are the only two veterans cemeteries that qualify for signage under this policy.
2. All other cemeteries **shall** not be signed on WisDOT maintained roadways.
3. Signing from one conventional State Trunk Highway to another conventional State Trunk Highway will not be allowed. Any necessary signing off of the State Trunk Highway system **shall** be in place prior to the installation of any signs on the State Trunk Highway system.
4. The signs **shall** be white message on green background.
5. On conventional highways, signs *should* be erected a minimum of 500 feet in advance of the intersection or cemetery entrance.
6. On freeways and expressways, signs *should* be erected within one mile in advance of the exit ramp or

side road. Destination signs (D1-1 signs) **shall** be erected at or near the end of the exit ramp or side road approach.

7. For freeways, expressways, and conventional highways, the cemetery **shall** be no more than 5 miles from the nearest exit or State Trunk Highway.
8. The cost for fabrication, installation, and maintenance of this signing **shall** be the responsibility of the cemetery owner or managing organization or agency. WisDOT **shall** coordinate the fabrication, installation, and maintenance of all signs on State Trunk Highways, including ramps, and **shall** be reimbursed for all costs.

2-15-30 Hydrant Signing — November 2015

PURPOSE

Coordination with fire departments has indicated problems with limited identification of fire hydrant locations from the freeway or expressway. This is especially important in areas where the view of fire hydrants from the highway is obstructed. It has been learned that response to freeway or expressway fires can be a two-squad operation. There is response time to the freeway or expressway fire scene, and there is response time to fire hydrants off of the highway right-of-way. The freeway or expressway response crew must coordinate location and hook-up to the hydrant. When location of the hydrant is uncertain, time is lost. The purpose of this guideline is to establish criteria on the usage of fire hydrant location signs and sign identification blades along noise walls.

DEFINITIONS

Freeways are defined as divided arterial highway facilities that have <u>full</u> controlled access, by means of grade separation at interchanges only.

Expressways are defined as divided arterial highway facilities that have <u>partial</u> control of access and generally with grade separations at major intersections.

POLICY

The placement of hydrant signs is most critical where the vision of the fire hydrant or local street from the highway (freeway or expressway) is restricted. Sounds walls are an excellent example of where vision is completely restricted. Topography of landscape *may* also hinder vision. It is the intent of the Department to install hydrant signs that satisfy the following conditions:

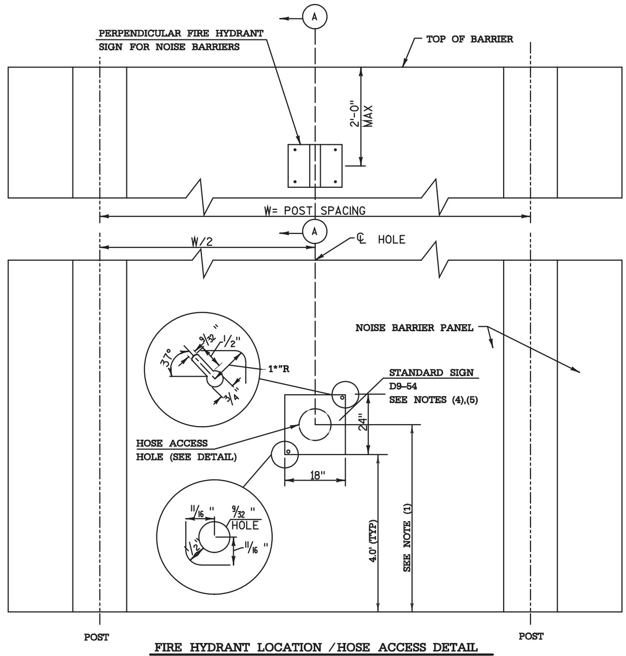
1. At all sound wall installations where the wall creates a visual and physical barrier between the roadway and the hydrant.
2. At locations where topography or landscape create a visual or physical barrier between the highway and the hydrant, the hydrant signs *should* be mounted either on posts or the right-of-way fence on the highway side.
3. At locations where crash experience is above average, and expeditious response is advantageous.
4. At locations where fire hose standpipes have been installed. Signs *should* be mounted on posts near the standpipe access joint.
5. The local fire department or fire district **shall** pay for all costs of the sign, sign blade and all mounting hardware. This includes the costs for initial installation and long-term maintenance. The Department *may* pay for the initial installation provided they are part of a project.

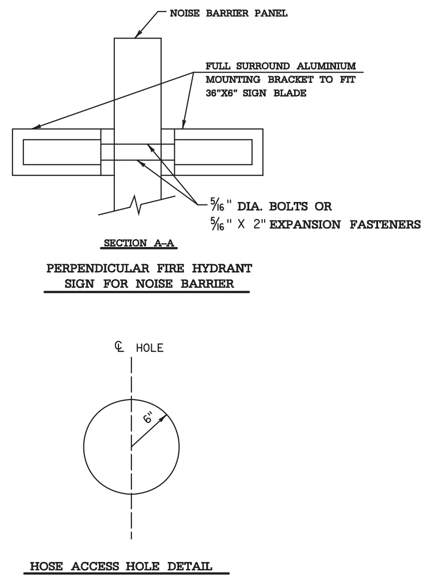
SIGN INSTALLATION

1. The hydrant sign (D9-54 sign) **shall** be placed, with movable capability, over the fire hose access hole (See Figure 1).
2. A two-sided sign blade (D9-54A sign) with blue Type H Reflective sheeting **shall** be placed on all new sound wall installations. Existing sound wall installations without the two-sided blade *should* be retrofitted with the blade as opportunities allow. The sign blade *should* be placed near the top of the sound wall on the highway side, above the fire hose access hole (See Figure 1).

Standard sign plate D9-54 (See Figure 2) has been developed for hydrant signs (See attached sign plate detail). The sign is white on green, containing a fire hydrant symbol and the approximate numerical address of the fire hydrant.

It is strongly encouraged that contact is made with the fire department jurisdictions responding to the freeway or expressway to verify the numerical address of the hydrant.



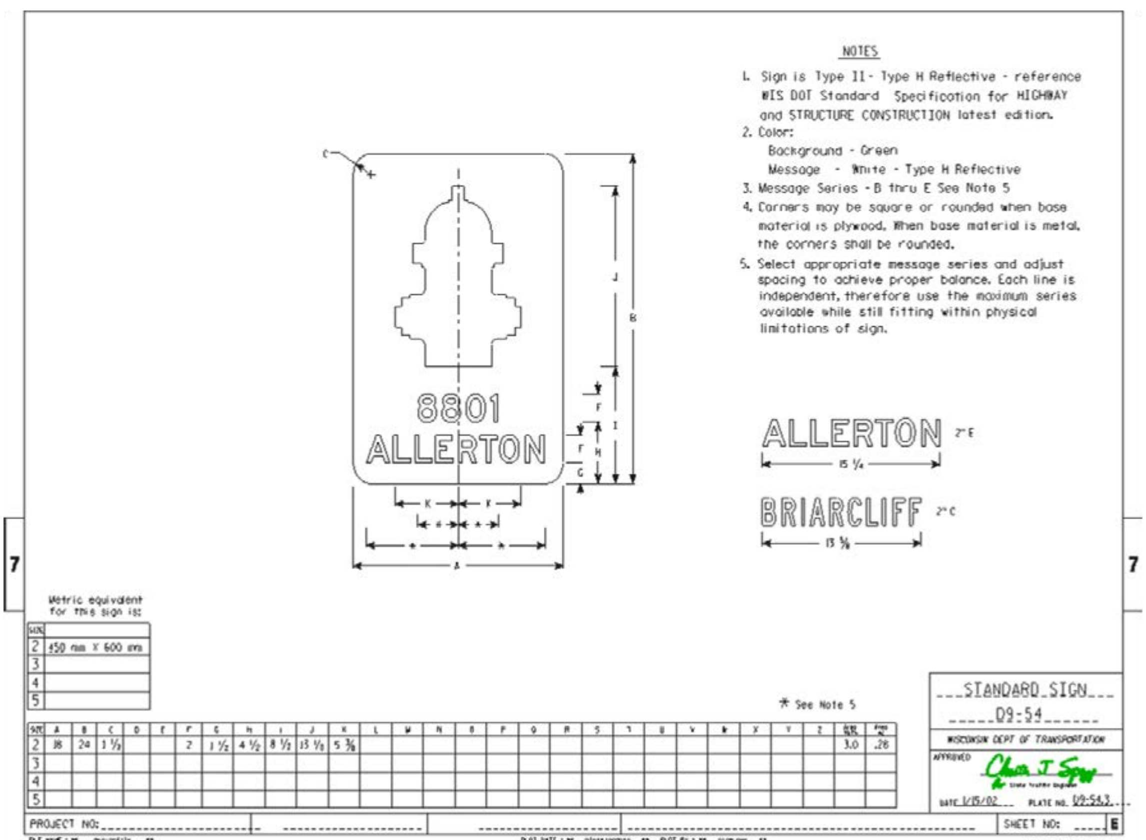


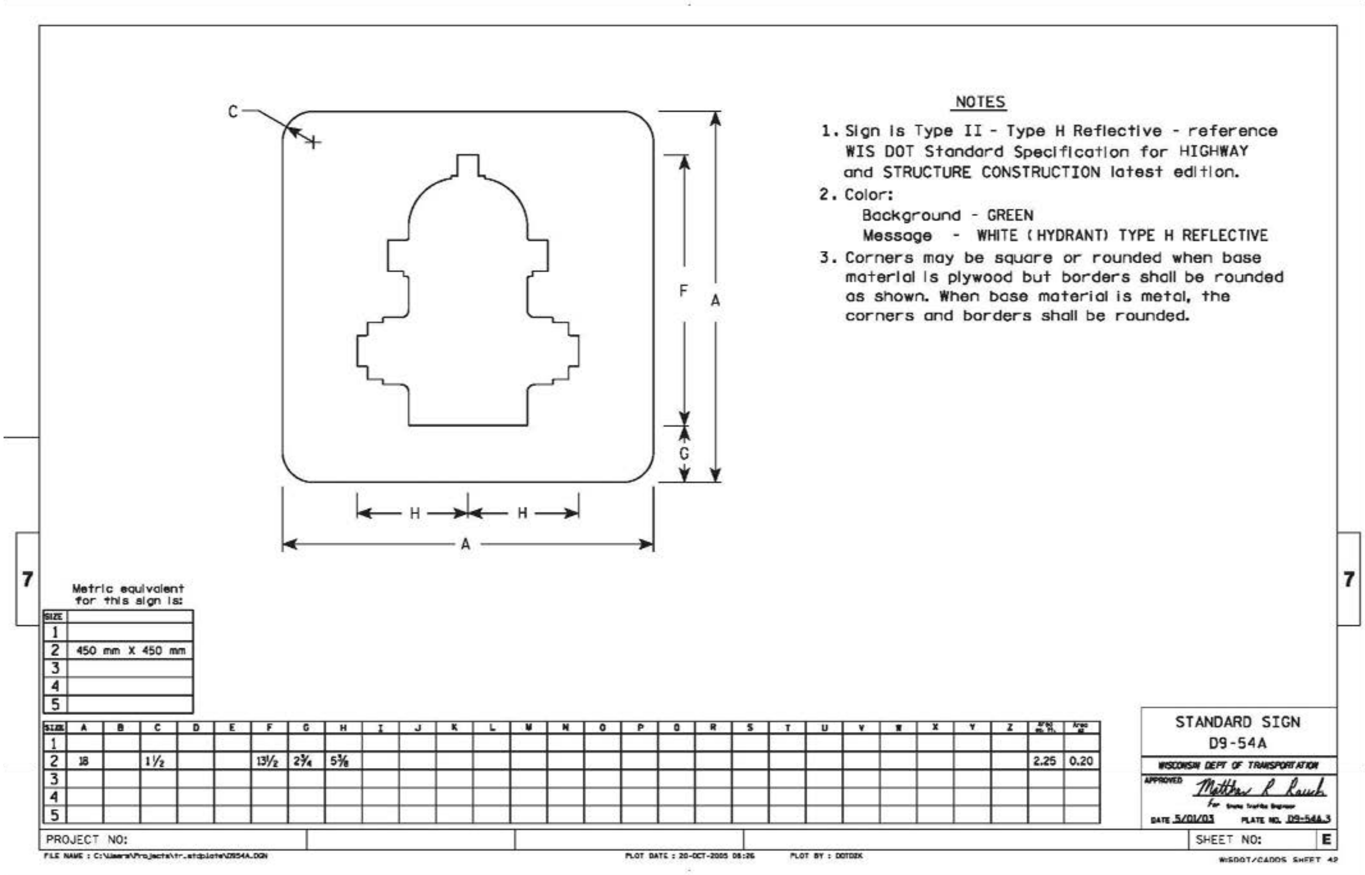
NOTES:

1. STANDARD SIGNS D9-54 WILL BE FURNISHED BY THE CONTRACTOR. SEE PLAN.

2. THREE STANDARD SIGNS D9-54 TO BE FURNISHED PER STATION. ONE SIGN SHALL BE INSTALLED ON EACH SIDE OF THE BARRIER. ONE ADDITIONAL SIGN TO BE INSTALLED ON FENCE AT R/W LINE WITH MESSAGE FACING AWAY FROM FREEWAY.

3. ADDITIONAL FIRE HYDRANT SIGNS SHALL BE ATTACHED TO THE NOISE BARRIER PANEL NEAR THE TOP OF THE BARRIER. SEE DETAIL ABOVE, PAID FOR UNDER "PERPENDICULAR FIRE HYDRANT SIGN FOR NOISE BARRIERS". SEE SPECIAL PROVISIONS.





2-15-31 Signing for Low Inlets Along Barrier Walls March 2011

PURPOSE

County maintenance personnel, first responders, and WisDOT maintenance staff have indicated problems with identification of low inlets along freeway barrier walls. There could be times that the inlets are covered with snow, ice or other debris that makes location difficult. Clogged inlets can present potential traffic safety issues and efficient, rapid location of them is very essential.

FHWA has indicated that a sign used for marking such inlets would not be considered an official traffic sign. Technically, the sign would not be in the line of sight or directed to passing motorists.

This policy governs the design and placement of signing for low inlets along freeway barrier walls.

POLICY

The sign used for the identification of low inlets along barrier walls is the green object marker (W5-53S) sign. This sign *may* be used, provided the following criteria are met:

1. The request to use the signs **shall** be coordinated with both the WisDOT Region Maintenance Engineer and Traffic Engineer.
2. The signs **shall** be installed on the face of the barrier, near the top to prevent covering by snow. See Figure 1 for typical installation detail.
3. Signs are paid for under the bid item: Signs Reflective Type II.
4. The signs **shall** be manufactured on 0.040” thick aluminum and fastened to the concrete wall with an adhesive with 1 ½” concrete anchor screws at each corner.
5. Replacement signs for maintenance **shall** be obtained through WisDOT.

Figure 1. Typical Installation of Storm Drain Inlet Marking

2-15-36 Distance Signs, D2-Series and Post-Interstate E8-Series   February 2008

PURPOSE

The purpose of this policy is to provide guidance for the use of Distance signs on State Highways under Department of Transportation jurisdiction. This policy guidance will address the selection of destinations, consistent determination of appropriate distances, sign design, and typical Distance sign placement.

General guidance on selection of destinations can be found in the MUTCD Sections 2D.37 and 2E.35. Specific guidance on the selection of destination cities can be found in TEOpS 2-15-5.

Guidance on the location of Distance signs is found in MUTCD Sections 2D.38 and 2E.39.

This policy does not apply to Interchange Sequence signs, which are addressed in MUTCD Section 2E.36.

B. Definitions

Distance Signs are defined as guide signs displaying a sequence of one to three destinations ahead with the distance to reach those destinations.

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

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

Conventional Highways are defined as 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.

National Control Cities are Chicago, Milwaukee, Beloit, Rockford, Janesville, Madison, Wisconsin Dells, La Crosse, Albert Lea, Eau Claire, St. Paul, Sheboygan, and Green Bay.

Regional Control Cities are defined as

1. Urban areas in Wisconsin or within 60 miles of the state line with a population in the most recent decennial census of 30,000 or more,
2. Other communities, such as Sturgeon Bay, Woodruff, Minocqua, and Lake Geneva, which are approved by the State Traffic Engineer based on their character as widely known tourism destinations, and
3. Urban areas on or north of Highway 64 with a population exceeding 3500, and urban areas south of Highway 64 with a population exceeding 10,000.

Major Crossroads or Side Roads, in most cases, *should* be state highways, but *may* be a county highway or local arterial serving a nearby community.

POLICY

General Guidance

1. The combination Destination Direction and Distance signs, such as is designated D1-1a. D1-2a, or D1-3a in MUTCD, **shall not** be used on state highways.
2. Unincorporated communities **shall not** be displayed on Distance signs unless the community is

designated a Regional Control City.

3. Traffic generator supplemental sign destinations **shall not** be displayed on Distance signs.
4. The sign design format for distance signs **shall** use upper and lower case letters.
5. The letter sizes **shall** be appropriate for the highway class; minimum 6-inch/4½-inch on conventional highways and minimum 8-inch/6-inch on expressways and freeways.

The selection of destinations **shall** be solely for the purpose of guidance and information for the non-local state highway driver, and **shall not** be used to promote communities, facilities, or preferential routes.

The first line of the sign **shall** designate the next selected "destination" in the direction of travel. If used, a second line of the sign *may* designate the second, or an interim, destination of importance in the direction of travel. The bottom line **shall** designate a National Control City or Regional Control City or the last incorporated city or village of the greatest significance, in that order of priority.

Distances **shall** be rounded up or down, as appropriate, to display the even mile.

Specific Guidance – Conventional Highways

The first destination on a Distance sign on a conventional state highway **shall** display either the next incorporated community (city or village), or the next major crossroad or side road, whichever is deemed the most beneficial information for the driver.

If used, the second line of the Distance sign *may* display the second major crossroad or a subsequent incorporated community served by the state highway. Selection of the community *may* be guided by use of the comparative population and distance formula in TEOpS 2-15-5. Selection *may* also be varied on successive Distance signs to display alternative communities served by the route.

The bottom line of a Distance sign on a state highway **shall** designate a National Control City or Regional Control City or the last incorporated city or village of the greatest significance, in that order of priority. The bottom line control city *should* be the same on all successive Distance signs along the route until that city is reached.

If the conventional state highway does not enter the corporate limits of a community, the community **shall not** be displayed on the Distance sign, but *may* appear on a Direction sign (D1-series) at the appropriate location.

Distances to a crossroad **shall** be rounded to the nearest even mile.

Distances to a community *may* be measured differently depending on the size of the community and how the state highway passes through it.

1. If the community is not very large and the highway serves the central business district, the distance *should* be measured to that "downtown" area and *may* be rounded down.
2. If the highway does not serve the downtown, the distance *may* be measured to the municipal limits or a major crossroad within the municipal limits and *may* be rounded up.
3. If the city is large, the distance *may* be measured to a major crossroad or municipal feature within the city limits.

Specific Guidance – Expressways

The first destination on a Distance sign on an expressway **shall** display either the next incorporated community (city or village), or the next major crossroad or interchange, whichever is deemed the most beneficial information for the driver.

If used, the second line of the Distance sign *may* display the second major crossroad or interchange or a subsequent incorporated community served by the state expressway. Selection of the community *may* be guided by use of the comparative population and distance formula in TEOpS 2-15-5. Selection *may* also be varied on successive Distance signs to display alternative communities served by the route.

The bottom line of a Distance sign on an expressway **shall** designate a National Control City or Regional Control City or the last incorporated city or village of the greatest significance, in that order of priority. The bottom line control city *should* be the same on all successive Distance signs along the route until that city is reached.

If the state expressway does not enter the corporate limits of a community, the community **shall not** be displayed on the Distance sign, but *may* appear on a Direction sign (D1-series) or Exit sign (E1- or E4-series) at the appropriate location.

Distances to a crossroad or interchange **shall** include the exit ramp and **shall** be rounded to the nearest even mile.

Distances to a community *may* be measured differently depending on the size of the community and how the state expressway passes through it.

1. If the community is not very large and the highway serves the central business district, the distance *should* be measured to that “downtown” area and *may* be rounded down.
2. If the highway does not serve the downtown, the distance *may* be measured to the municipal limits or an interchange or major crossroad within the municipal limits and *may* be rounded up.
3. If the city is large, the distance *may* be measured to an interchange or major crossroad or municipal feature within the city limits.

Specific Guidance – Freeways

The first destination on a Distance sign on a freeway **shall** display either the next interchange, or the next incorporated community (city or village), whichever is deemed the most beneficial information for the driver.

If used, the second line of the Distance sign *may* display the second interchange or a subsequent incorporated community served by the freeway. Selection of the community *may* be guided by use of the comparative population and distance formula in TEOpS 2-15-5. Selection *may* also be varied on successive Distance signs to display alternative communities served by the route.

The bottom line of a Distance sign on a freeway **shall** designate a National Control City or Regional Control City or the last incorporated city or village of the greatest significance, in that order of priority. The bottom line control city *should* be the same on all successive Distance signs along the route until that city is reached.

If the freeway does not enter or pass within one mile of the corporate limits of a community, the community **shall not** be displayed on the Distance sign, but *may* appear on an Exit sign (E1- or E4- or E9-series) at the appropriate location.

If the freeway does pass within one mile of the corporate limits of a community, the community *may* be displayed on the Distance sign, and *may* appear on an Exit sign (E1- or E4- or E9-series) at the appropriate location.

Distances to an interchange **shall** include the exit ramp to the crossroad and **shall** be rounded to the nearest even mile.

Distances to a community *may* be measured differently depending on the size of the community and how the freeway serves it.

1. If the community is not very large and the freeway serves the central business district, the distance *should* be measured to a “downtown” interchange and *may* be rounded down.
2. If the freeway does not serve the downtown, the distance *may* be measured to the municipal limits or a major interchange within the municipal limits and *may* be rounded up.
3. If the city is large, the distance *may* be measured to a major interchange or municipal feature within the city limits.

2-15-51 Routine Sign Replacement Criteria — January 2015

PURPOSE

Over time the visual characteristics of signs deteriorate as a result of weather, age and ultraviolet radiation, resulting in reduced legibility performance day and/or night. As a result, signs have to be changed periodically as part of a routine sign replacement. There are a number of mechanisms to accomplish the replacement of signs on the WisDOT system. Often times questions arise as to when signs *should* be changed, who *should* change the signs and what criteria *should* be used in determining replacement. Therefore, it is necessary to have clear, consistent guidelines for the routine replacement of signs on state highways.

FEDERAL HIGHWAYS MINIMUM SIGN RETROREFLECTIVITY VALUES

Section 2A.08 of the MUTCD requires all units of government to use an assessment or management method that is designed to maintain the retroreflectivity of signs at or above the levels prescribed in the MUTCD Table

2A-3. To maintain compliance with the minimum sign retroreflectivity values in the MUTCD, WisDOT utilizes the following approved assessment and management methods:

1. Blanket Replacement. All signs in an area/corridor are replaced at specified intervals. This commonly takes place during improvement projects.
2. Expected Sign Life. Age of the sign is tracked and the sign is replaced when it meets its expected life. Current WisDOT expected sign life period is 12 years.
3. Control Signs. Replacement of signs in the field is based on the performance of a sample of control signs. The data from the control signs can provide engineering support to the Expected Sign Life method. Over time the Expected Sign Life replacement cycle *may* be revised based on data from the Control Signs test deck, which is located at the Madison Sign Shop yard.

DETAILED SIGN REPLACEMENT POLICY

General Sign Replacement due to age/condition of sign

1. The Department's Sign Inventory Management System (SIMS) **shall** be used to track inventory data on signs that include manufacture date of sign, sign sheeting code and condition of sign.
2. Sign date and sheeting code tags **shall** be placed on the upper right corner on the back of Type II signs by the sign manufacturer or contractor. Type I signs **shall** have the sign date and sheeting code tag placed on the lower right corner on the back of the sign. The WisDOT Central Sign Shop provides all date and sheeting code tags to sign manufacturers and contractors.
3. In general, signs *should* be replaced on a twelve year cycle, following the priority established by the Bureau of Traffic Operations on an annual basis.
4. In general, signs needed for let projects will not be supplied through the Region Sign Shops or Central Sign Shops. The exception to this would be if there is an unexpected lack of signs by the contractor that *may* otherwise cause a delay in the completion of the project or needed for safety or operational issues. Detailed guidance is given below on the sign replacement criteria for let projects.
5. County Highway Departments, through Traffic Maintenance Agreements, *should* handle all of the other routine Type II sign replacements where a let project is not anticipated any time soon.
6. WisDOT **shall** provide all signs to the County Highway Departments. There are statewide procurement contracts to handle this. Counties **shall not** furnish signs, other than TODS or TRANS 200 arrow boards that are covered by other policies.
7. Routine Type I sign replacements *should* be performed by Let Contract. The statewide open-end signing contractor *should* only be used for knock-down repairs and replacements of Type I signs, Type I or Type II Supplemental Traffic Generator sign installations or for safety or operational issues where the county cannot get to the site in the timeframe needed.
8. Any signs or posts that are damaged, illegible, leaning, not in proper orientation to the roadway *should* be repaired or replaced as soon as opportunities permit.

Sign Replacement Due to Changes in Sign Standards

1. Signs no longer meeting mounting height, size, message, letter size or sheeting material criteria *may* be replaced through the following methods:
    a. Let Project or refurbishment project in the area.
    b. Knockdown, storm or vandalism damage that would cause the sign and/or posts to be replaced.
2. Examples of signs not meeting standards would include:
    a. Too low of mounting height.
    b. Too close to roadway.
    c. Wrong size sign used for roadway.
    d. Wrong letter size used on sign.
    e. Signs containing Engineer Grade sheeting.
    f. Change of Standard in the MUTCD resulting in a compliance period.

   g. Change of Signing Policy in the Traffic Guidelines Manual.

3. If there is a safety issue/concern due to a sign not conforming to standards, the sign **shall** be replaced or removed as soon as practical. An example would be a restriction of motorist visibility due to an improper mounting height.
4. Analysis of intersection crash data *may* be used to help determine if sign standards attributed to any safety issues.
5. The methods of sign replacement *should* be followed as explained in the General Sign Replacement due to age/condition of sign part of this policy.

Sign Replacement as part of Let Projects

When a Let project will take place in the area in the near future, the Region *should* strive to include all Type I and Type II sign replacements as part of the project. Typical Let projects *may* include roadway reconstruction, pavement overlays, base patching, joint repair and slurry seal projects. Typically the signs on the whole segment of the project would be replaced; however engineering judgment will have to be exercised on the part of the Region to determine the feasibility of this type of replacement.

Below are guidelines that *should* be followed to help determine if replacement of signs on a let project is feasible.

Type I signs

1. Overhead Type I guide signs *should* be replaced in all let projects. The recently published FHWA minimum sign retroreflectivity standards do not permit the usage of Engineer Grade or Encapsulated Lens high intensity sheeting for overhead guide signs. Exceptions to replacement of overhead mounted Type I guide signs can be made if the overhead Type I guide signs are prismatic high intensity sheeting or above and there is another let project programmed or scheduled on the same roadway segment within the next five years. Any signs not conforming to WisDOT and MUTCD policies **shall** be replaced in the let project. **Any exceptions to replacement of Type I signs shall be coordinated with the Region Traffic Engineering Supervisor.**

   All lighted overhead signs **shall** be replaced in the let project unless the signs already contain Type SH reflective sheeting.

2. In general, ground mounted Type I guide signs *should* be replaced in all let projects. Exceptions to replacement of ground mounted Type I guide signs *may* be made if signs that will be replaced in another let project that is programmed or scheduled on the same roadway segment within the next five years. Any signs not conforming to WisDOT and MUTCD policies **shall** be replaced in the let project. **Any exceptions to replacement of Type I signs shall be coordinated with the Region Traffic Engineering Supervisor.**
3. Galvanized steel I-beams *should* only be replaced if Type I sign is not at the proper offset (30 foot desirable / 17.5 foot minimum from edge line to edge of sign) or if the new Type I sign is larger. All corten steel I-beams and bases **shall** be replaced.
4. Steel I-beams and bases that are re-used *should* have the base bolts replaced by utilizing bid item 635.0300 (Sign Supports Replacing Base Connection Bolts).

Type II signs

1. All Type II signs *should* be replaced in all let projects. The recently published FHWA minimum sign retroreflectivity standards do not permit the usage of Engineer Grade on warning and guide signs. It is also WisDOT policy to not use Engineer Grade on any signs, including regulatory signs.
2. **Any exceptions to replacement of Type II signs shall be coordinated with the Region Traffic Engineering Supervisor.** Exceptions for replacement of Type II signs *may* be made if all the following criteria are met:
   a. If signs that will be replaced in another let project that is programmed or scheduled on the same roadway segment in the next five years.
   b. If existing Type II signs are not damaged or do not have any other material defects.
   c. If sign size, mounting height and lateral offset still meet WisDOT standards.
   d. If sign message still conforms to WisDOT and MUTCD policies and minimum FHWA/MUTCD retroreflectivity requirements.

2-15-52 Maintenance of Signs and Sign Post Designs September 2014

PURPOSE

This policy establishes maintenance responsibility for signs and sign post designs on state trunk highways and crossroads intersecting state maintained highways, either by at-grade intersections or service interchanges. In addition, roundabouts often times add complexity for the responsibility of sign maintenance, especially for local and county roadway approaches. DOT improvement projects often include signs that are installed on county highways and local roads. Because the local unit did not install the signs, there are often questions about the responsibility for maintenance, and many of these signs are left to deteriorate. On several occasions the local unit requests a special type of signpost to be used on state maintained highways through their community. As a result, questions arise as to what type of signposts are acceptable, who would maintain the posts and potential liability issues. Therefore, it is necessary to have clear, consistent guidelines for the maintenance of signing, and designs of signposts, on state maintained highways and at locations of local crossroads intersecting state maintained highways.

SIGN MAINTENANCE POLICY

WisDOT is responsible for maintenance of permanent signs on all state trunk highways. As part of its responsibility, WisDOT *may* contract for services to accomplish the maintenance and *may* require that others fund the costs, for example costs of supplemental traffic generator signs, as approved in TEOpS 2-15-3.

Should WisDOT allow a local unit of government to erect or maintain any signing, a permit in the form of a letter **shall** be signed by a representative of the local unit of government and the Region's Traffic Supervisor.

In addition, WisDOT is responsible for maintenance of certain other permanent signs on connecting roadways, local streets and business highways described below. It *should* be noted that this policy is not all-inclusive.

Intersecting and Interchanging Roadways (excluding roundabouts)

1. On local public roadways intersecting state maintained highways, WisDOT will maintain the STOP sign and directional assembly (J3 or J13 assembly), adjacent to the STOP sign.
2. On county roadways intersecting state maintained highways, WisDOT will maintain the STOP sign and directional assembly (J3 or J13 assembly), adjacent to the STOP sign.
3. On local and county roadway interchanges with state maintained highways, between the junction assembly (J1 sign) and the ramp, WisDOT will maintain the route markers and destination signs (D1 signs), including the junction assembly.
4. On local and county roadway interchanges with state maintained highways, between ramp to ramp, WisDOT will maintain all signs. An exception to this would be a special agreement with the local unit of government/county or if WisDOT would not have jurisdiction of the intersecting roadway.
5. On state and U.S. highway interchanges with state maintained highways, WisDOT will maintain all the signs.
6. All advanced signing on local and county roads that intersect state maintained highways **shall** be the responsibility of the county/local unit of government to maintain, regardless of who installed it originally.
7. WisDOT will not maintain street name signs at the intersection.
8. For blinker stop signs and blinker stop ahead signs, refer to the separate policy for criteria and permits.

Roundabouts

1. On all roundabouts with at least one WisDOT maintained approach roadway, WisDOT will maintain, at a minimum, the following signs:
    a. Chevron bank (R6-4b)
    b. One Way signs (R6-1R and R6-2R)
    c. Yield signs (R1-2)
    d. To Traffic From Left Plaque (R1-54)
    e. Splitter island signs (J-3 or D1 series)
2. On state trunk highway approaches, including interchange ramps, WisDOT will maintain all signs,

including overhead sign supports (See Figure 2).

On county and local road approaches, in addition to the Yield sign (R1-2), To Traffic From Left Plaque (R1-54) and One Way sign (R6-2R), WisDOT will also maintain any overhead guide signs that have an Interstate, U.S. or State highway shield on them, including their associated overhead sign support(s) (See Figures 3A and 3B). The county and/or local unit of government would maintain all other signs and associated sign structures on their approaches, including overhead regulatory lane control signs and the ground mounted map sign (D1-62 sign).

3. For roundabouts on Connecting State Highways, WisDOT will maintain any overhead guide signs that have an Interstate, U.S. or State highway shield on them, including their associated overhead sign support(s). For any overhead guide signs that exclusively contain business route signing, the local unit of government would maintain the sign and associated overhead sign support. WisDOT will also maintain any splitter island signs that have a U.S. or State route shield (J-3 or D1 series) and any U.S. or State reassurance marker (J4 series). All other signs in the roundabout on connecting highways **shall** be maintained by the local unit of government.

4. For roundabouts with county highway and/or local road approaches, it is recommended that early in the design process, a Maintenance Agreement be developed. By having the Maintenance Agreement developed early in the design process, the county or local unit of government will clearly have knowledge of what they are to maintain.

   Some particular items that *should* be included in the Maintenance Agreement would include:

   a. Specific signs that WisDOT would maintain and what the locals/county would maintain. This would also include signposts.

   b. Specific overhead sign supports (if any), that WisDOT would maintain and what the locals would maintain.

   c. Recommended inspection frequencies for overhead sign supports that the locals would maintain.

<u>Connecting Highways and Local Streets</u>

1. On connecting highways WisDOT maintains only route markers and trailblazer assemblies, including overhead guide signs that contain interstate, U.S. and State route shields and their associated overhead sign supports or sign bridges. For any overhead guide signs that exclusively contain business route signing, the local unit of government would maintain the sign and associated overhead sign support.

2. On local streets, upon coordination with the local unit of government, WisDOT would maintain only those trailblazer assemblies that are installed and/or approved by WisDOT.

<u>Business Route Signing</u>

1. For business routes located on state maintained highways, WisDOT will install and maintain all route markers.

2. When business routes of state highways are marked over county highways, local streets or highways, WisDOT *may* initially install route markers, but will not be responsible for their maintenance. The installation and maintenance of all other signs **shall** be the responsibility of the local unit of government.

3. Expanded guidance on the usage of business route signing is included in TEOpS 2-4-19.1.

SIGN POST DESIGN POLICY ON STATE MAINTAINED ROADWAYS

1. On state maintained roadways, 4”x6” wood posts and 2”x2” square steel posts are typically used for sign posts. Municipalities *may* be allowed to install signs on customized posts. The municipality **shall** pay for the cost of the customized posts.

2. Any customized posts allowed **shall** be NCHRP 350 or MASH crash compliant. The municipality **shall** provide WisDOT a copy of the certification letter from the Federal Highway Administration.

3. A permit for non-standard sign supports **shall** be filled out by the municipality and signed by the City/Village Engineer or Director of Public Works or Official Governmental Representative and, upon approval, the WisDOT Region Traffic Operations Engineer. A sample Application/Permit form is shown in Figure 4.

4. Municipalities *may* be allowed to paint the posts a neutral color that does not detract from the face of the sign. Acceptable neutral colors are black, brown or dark green.

5. Red, white and orange colors **shall not** be used for signposts. A yellow color *may* only be used if the color is to mark a truck route. The municipality **shall** be required to have a local ordinance in place before painting the posts.
6. For any painted sign posts requiring replacement by WisDOT, the municipality will be responsible for re-painting signposts. Any customized signposts requiring immediate replacement by WisDOT will be replaced with 2”x2” square steel posts or 4”x6” wood posts. The municipality *may* later replace the DOT installed post with a NCHRP 350 or MASH crash compliant customized post at their cost.
7. Municipalities **shall not** paint the backside of the signs.
8. Signs installed on customized sign posts **shall** meet WisDOT/MUTCD design and size standards. WisDOT **shall** provide the municipality with all state-owned signs to be installed on customized sign posts. WisDOT *may* require the municipality to replace signs due to age or damage of signs or changes to sign design standards. WisDOT reserves the right to replace existing signs on customized posts owned by the municipality.
9. Sign installation and placement **shall** be to WisDOT standards. See Standard Sign Plates A4-3 and A4-4 for sign mounting height and lateral offset.
10. Existing customized posts on state maintained highways which are not NCHRP 350 or MASH crash compliant **shall** be replaced immediately with 2”x2” square steel posts, or 4”x6” wood posts. The municipality *may* later replace the DOT installed post with a NCHRP 350 or MASH crash compliant customized post at their cost.
11. Wood 4”x6” posts **shall** have 1 ½” diameter breakaway holes drilled into the 6-inch face of the post, (see figure 1). Breakaway holes are not required in 4”x6” wood posts if the post is mounted behind beam guard or concrete barrier.

Figure 1

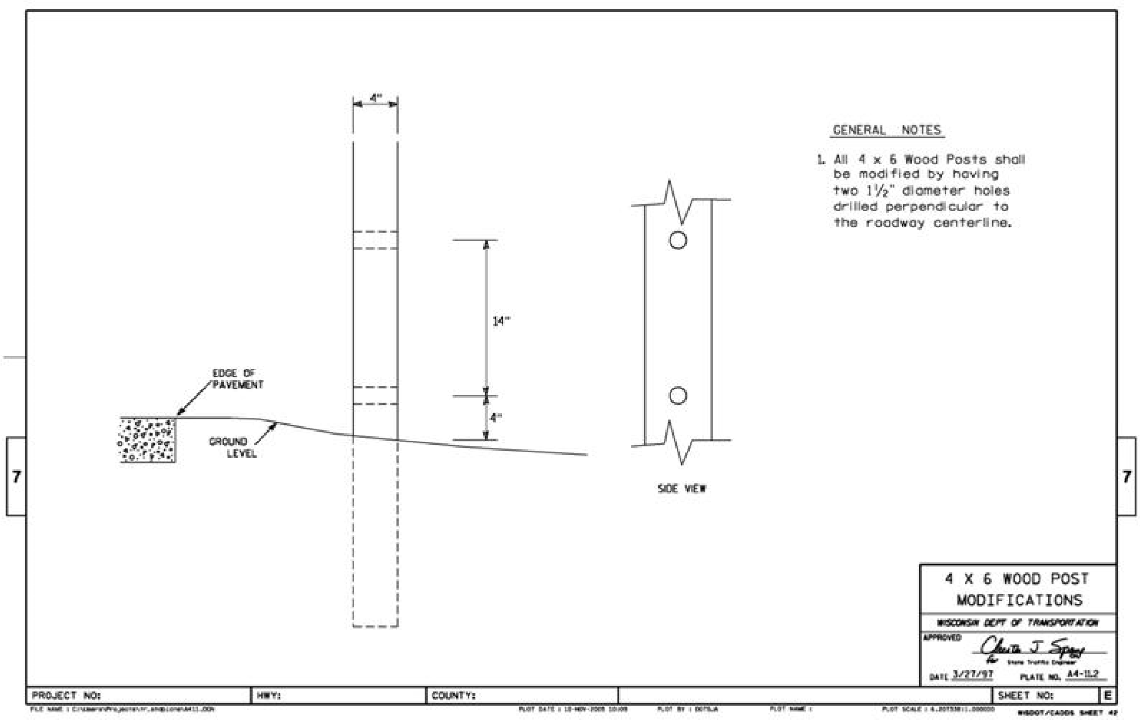


Figure 2. Interchange Roundabout

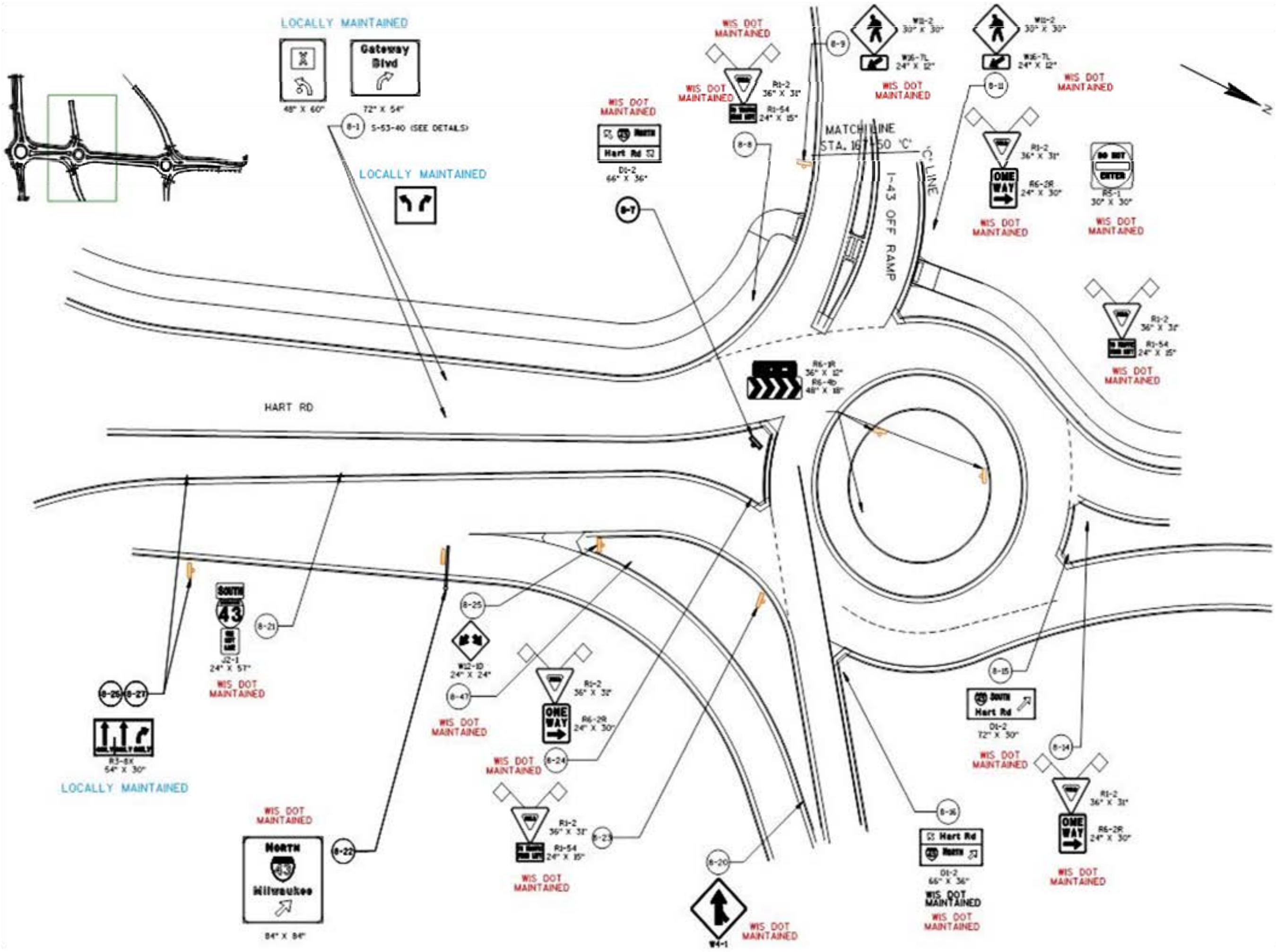


Figure 3A. County Highway / State Highway Roundabout
(Signing for local roads is the same as County Highway signing)

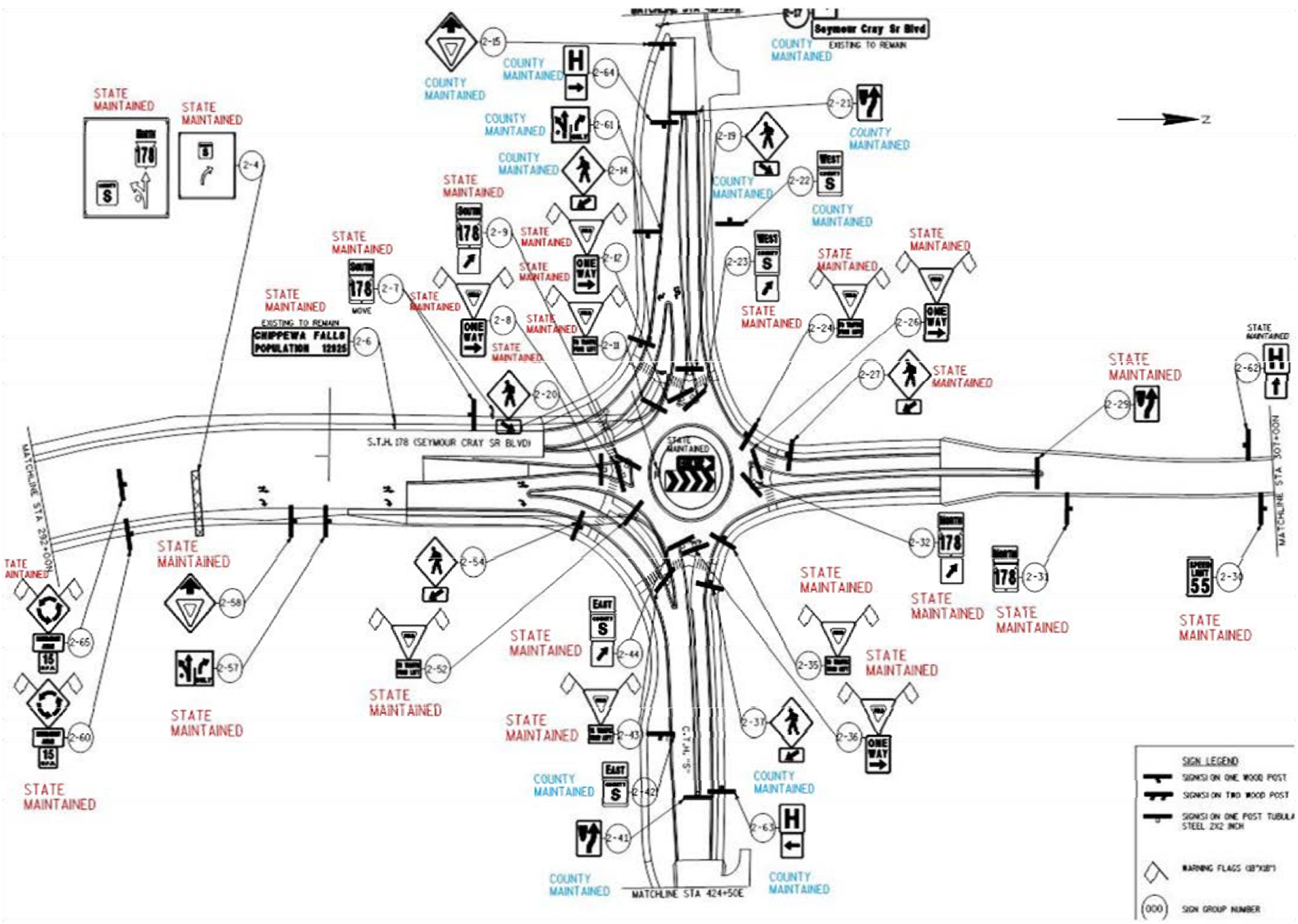


Figure 3B. County Highway / State Highway Roundabout
(Signing for local roads is the same as County Highway signing)

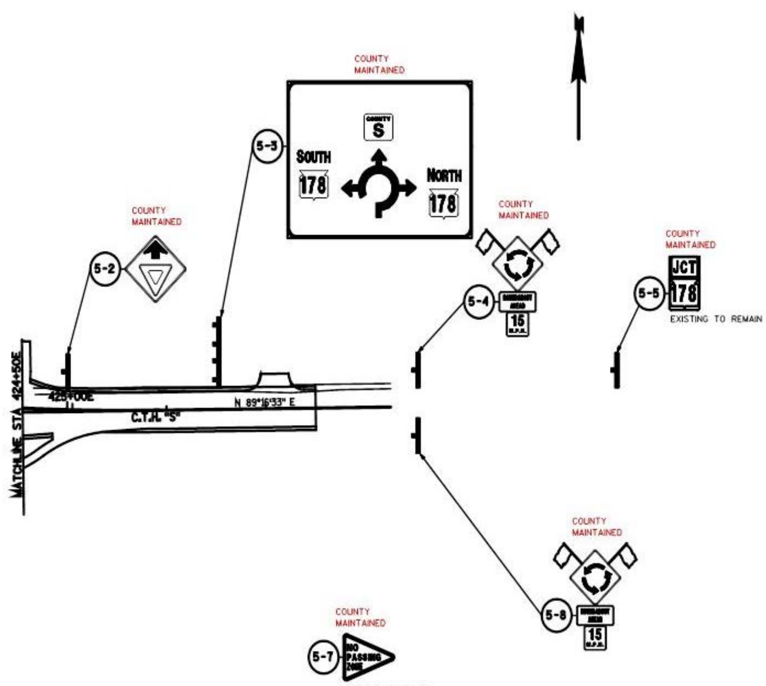


Figure 4. Custom Sign/Post Installation Permit

APPLICATION/PERMIT FOR CUSTOM SIGN POSTS

Wisconsin Department of Transportation
7/2014

When approved, this permit documents the terms and conditions or use by the municipality for installation and/or maintenance of custom sign posts on highways under the jurisdiction of the Wisconsin Department of Transportation. The applicant must obtain this approved permit prior to installation of custom sign posts.

Submit the completed application to the WisDOT Regional Office that has maintenance jurisdiction of the state trunk highway in the county where the posts will be located. A single application may be made for all installations along a continuous segment of highway.

Applicant (City, Village, Town):	County:
Mailing Address:	Area Code-Telephone Number:
	Email Address or FAX Number:
Highway (STH/USH):	Local Street Name of STH/USH:
Installation Limits: From:	To:
Installation Type ☐ Improvement Project Agreement – Project ID: ☐ Installation by Permit – Permit to Work on Highway Right-of-Way (WisDOT form DT1812) required	
Locations:	Items to Install:

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Installation Conditions

1. Terms and conditions of this application/permit shall be in conformance with WisDOT Traffic Guidelines Manual Policy 2-15-52 *Maintenance of Signs and Sign Post Designs*. By entering into this agreement, the Municipality agrees to the terms and cost arrangements in this policy document.
2. For permit requests or sign replacement, WisDOT shall furnish all standard state-owned signs to the municipality for installation on custom posts. For let project installations, the custom posts will be installed as part of construction let plans as non-participating item.
3. All custom sign posts shall be NCHRP 350 or MASH crash compliant. A copy of the certification letter from the Federal Highway Administration shall be attached to this application for each manufacturer's model and style of custom post used.
4. Replacement of custom posts from a different manufacturer or model shall require a new permit/application.
5. The applicant shall retain a copy of this permit and supporting documentation for future reference.
6. Custom post details shall be attached to this application. Region Traffic Operations Engineer shall approve final post design.
7. Region Traffic Operations Engineer shall approve final sign locations. For Improvement Project Agreements, these locations shall be included on the final construction plans.
8. The municipality shall be responsible for costs for removal should future highway projects require the removal of the custom posts.
9. Sign installation and placement shall be to Wisconsin Manual of Uniform Traffic Control Devices and WisDOT standards.
10. This application shall be signed by the City/Village Engineer or the Director of Public Works or Official Governmental Representative.

X

Authorized Representative	Date

Print Name	Title

Approved for the Wisconsin Department of Transportation

Permit Number = Region (NC,NE,NW,SE,SW) – County Number – Permit Number in county

Permit Number

X

Region Traffic Operations Engineer	Date

Print Name	Area Code-Phone Number

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INDEMNIFICATION

The Applicant shall save and hold the State, its officers, employees, agents, and all private and governmental contractors and subcontractors with the State under Chapter 84 Wisconsin Statutes, harmless from actions of any nature whatsoever (including any by Applicant itself) which arise out of, or are connected with, or are claimed to arise out of or be connected with any of the work done by the Applicant, or the construction or maintenance of facilities by the Applicant, pursuant to this permit or any other permit issued by the State for location of property, lines or facilities on highway right-of-way, (1) while the Applicant is performing its work, or (2) while any of the Applicant's property, equipment, or personnel, are in or about such place or the vicinity thereof, or (3) while any property constructed, placed or operated by or on behalf of Applicant remains on the State's property or right-of-way pursuant to this permit or any other permit issued by the State for location of property, lines or facilities on highway right-of-way; including without limiting the generality of the foregoing, all liability, damages, loss, expense, claims, demands and actions on account of personal injury, death or property loss to the State, its officers, employees, agents, contractors, subcontractors or frequenters; to the Applicant, its employees, agents, contractors, subcontractors, or frequenters; or to any other persons, whether based upon, or claimed to be based upon, statutory (including, without limiting the generality of the foregoing, worker's compensation), contractual, tort, or whether or not caused or claimed to have been caused by active or inactive negligence or other breach of duty by the State, its officers, employees, agents, contractors, subcontractors or frequenters; Applicant, its employees, agents, contractors, subcontractors or frequenters; or any other person. Without limiting the generality of the foregoing, the liability, damage, loss, expense, claims, demands and actions indemnified against shall include all liability, damage, loss, expense, claims, demands and actions for damage to any property, lines or facilities placed by or on behalf of the Applicant pursuant to this permit or any other permit issued by the State for location of property, lines or facilities on highway right-of-way in the past or present, or that are located on any highway or State property or right-of-way with or without a permit issued by the State, for any loss of data, information, or material; for trademark, copyright or patent infringement; for unfair competition or infringement of personal or property rights of any kind whatever. The Applicant shall at its own expense investigate all such claims and demands, attend to their settlement or other disposition, defend all actions based thereon and pay all charges of attorneys and all other costs and expenses of any kind arising from any such liability, damage, loss, claims, demands and actions.

Any transfer, whether voluntary or involuntary, of ownership or control of any property constructed, placed or operated by or on behalf of the Applicant that remains on the State's property or right-of-way pursuant to this permit shall not release Applicant from any of the indemnification requirements of this permit, unless the State is notified of such transfer in writing. Any acceptance by any other person or entity, whether voluntary or involuntary, of ownership or control of any property constructed, placed or operated by or on behalf of the Applicant that remains on the State's property or right-of-way pursuant to this permit, shall include acceptance of all of the indemnification requirements of this permit by the other person or entity receiving ownership or control.

Notwithstanding the foregoing, a private contractor or subcontractor with the State under Chapter 84 Wisconsin Statutes, that fails to comply with sections 66.047 and 182.0175 Wisconsin Statutes (1985-1986), remains subject to the payment to the Applicant of the actual cost of repair of intentional or negligent damage by the contractor or subcontractor to any property, lines or facilities placed by or on behalf of the Applicant pursuant to this permit or any other permit issued by the State for location of property, lines or facilities on highway right-of-way, and remains subject to payment to the Applicant for losses due to personal injury or death resulting from negligence by the contractor or subcontractor.

Notwithstanding the foregoing, if the State, or its officers, employees and agents, fail to comply with sections 66.047 and 182.0175 Wisconsin Statutes (1985-1986), the State or its officers, employees and agents, remain subject to the payment to the Applicant of the actual cost of repair of willful and intentional damage by the State, or its officers, employees and agents, to any property, lines or facilities placed by or on behalf of the Applicant pursuant to this permit or any other permit issued by the State for location of property, lines or facilities on highway right-of-way, and remain subject to payment to the Applicant for losses due to personal injury or death resulting from negligence by the State, its officers, employees and agents.

No indemnification of private contractors or subcontractors with the State under Chapter 84 Wisconsin Statutes, shall apply in the event of willful and intentional damage by such private contractors or subcontractors to the property, lines and facilities of the Applicant located on the highway right-of-way pursuant to this permit or any other permit issued by the State for the location of property, lines or facilities on highway right-of-way.

Page 3 of 3

2-15-53 New Bypass Signing — January 2007

PURPOSE

Quite often, a highway bypass is constructed to divert traffic around a community, thus reducing traffic congestion and increasing traffic safety within the community. However, bypasses have the potential to experience more crashes than expected when designed, due primarily to several human factors issues. Even when designed to the proper geometrics, drivers *may not* be mentally prepared for the increased speed of traffic on the bypass and the quick decisions that need to be made, as a result of the increased speed. This has led to several angle type collisions, primarily at intersections.

In February 2006, FHWA prepared a report for WisDOT that outlines several enhancements that *should* be made to increase safety at bypasses. Several of these enhancements include signing improvements. This policy provides requirements and guidance to the proper usage of signs for new bypasses on state maintained highways.

DEFINITIONS

<u>Freeways</u> are defined as divided highways with fully controlled access at interchanges only. Interstate Highways are freeways with the interstate route designation.

<u>Expressways</u> are defined as divided highways with partially controlled access by a combination of interchanges, at-grade intersections, and driveways.

<u>Conventional Highways</u> are defined as 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 <u>Bypass</u> is defined as a new route that diverts traffic around a community and re-connects to the existing routes on the outskirts of the community (See Figure 1).

POLICY

<u>Sign Sizes</u>

1. For all bypasses, regulatory, warning and school signs **shall** be minimum size code 3.
2. Route assemblies *should* be minimum size code 2 for conventional highways and minimum size code 3 for four lane divided and expressway bypasses.
3. Advance crossroad name signs (M1-94 sign) **shall** be size code 3 (8” upper case / 6” lower case) for all conventional highway bypasses 45 mph and higher and all four lane and expressway bypasses. Advance crossroad name signs (M1-94 sign) *may* be size code 2 (6” upper case / 4 ½” lower case) for conventional highway bypasses, less than 45 mph.

<u>Regulatory Sign Installations</u>

1. Double up STOP signs (R1-1 signs) at all side roads (right and left signs). 200’ minimum of centerline on the side road **shall** be used.
2. STOP signs (R1-1 signs) **shall** be installed in the pork chop islands or in the median island.
3. For median widths greater than 40’ (measured from median edge of travel lane to median edge of travel lane), STOP (R1-1 signs) or Yield (R1-2 signs) signs *should* be installed as appropriate at the second crossroad intersection (in the median) of a four-lane bypass. Typically for median widths 30’ or less, the Yield sign is used in the median to discourage any long trucks from hanging over into the adjacent travel lanes.
4. Cross Traffic Does Not Stop signs (R1-52C sign) **shall** be installed below all STOP signs (R1-1 sign) on both two lane and four lane bypasses. For four lane bypasses, the Cross Traffic Does Not Stop sign (R1-52C sign) *should* be placed below the Divided Highway sign (R6-3 or R6-3a sign).
5. The One-Way sign (R6-1 sign) **shall** be used for all divided bypasses. The R6-1 One-Way signs **shall** be placed above the STOP sign (R1-1 sign). Refer to TEOpS 2-15-12 (Wrong-Way Prevention) for additional criteria on Wrong Way signing.
6. Temporary orange warning flags *may* be added to all STOP signs (R1-1 sign). The flags *should* remain in place until the end of their useful life.
7. The Divided Highway Now Open – Use Proper Lane sign (R3-57 sign) *should* be installed 300–500 feet in advance of the intersection on side roads for divided highway bypasses. The sign **shall** remain in place for up to a year and then removed.

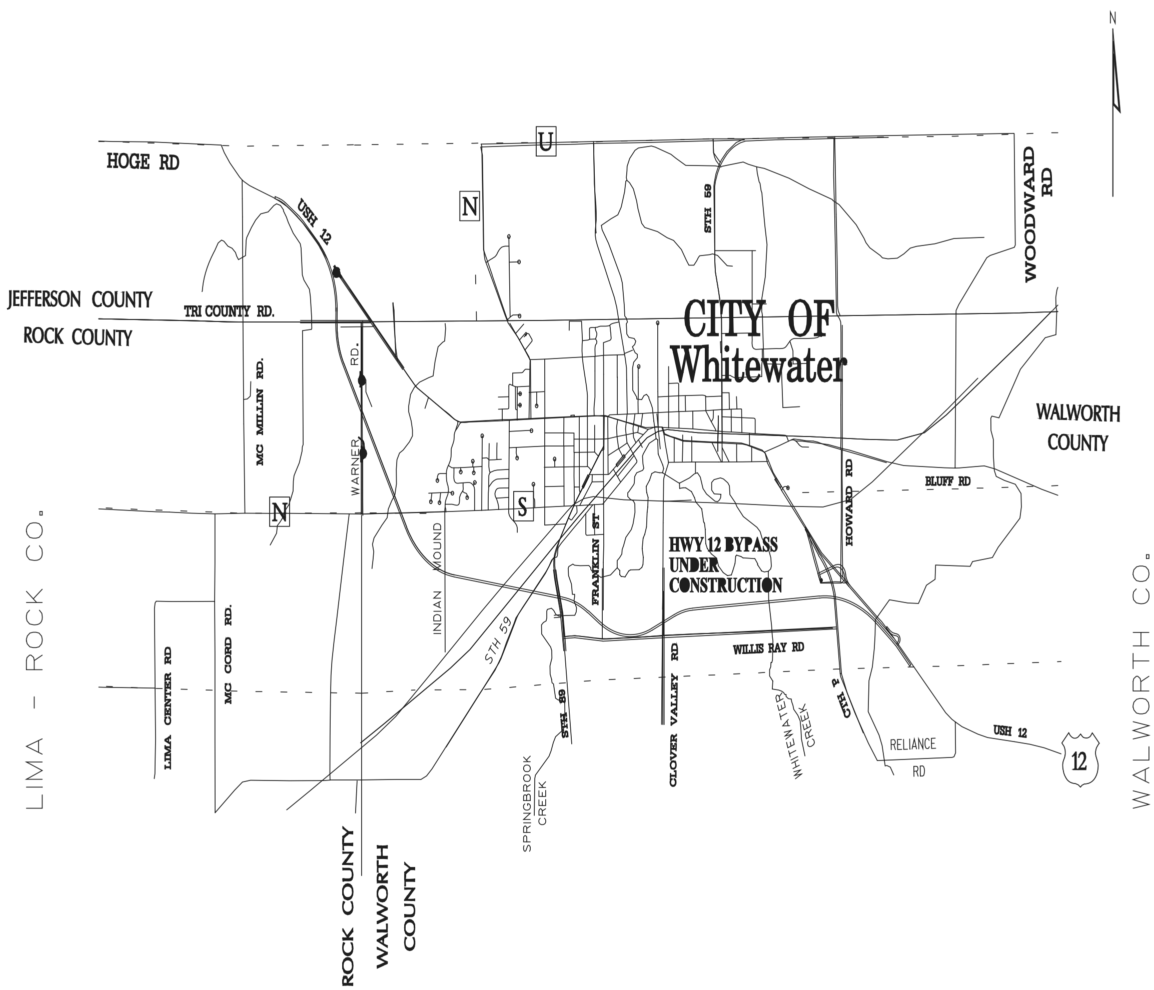
<u>Warning Sign Installations</u>

1. Supplemental roadway name plaques below the crossroad warning signs (W2-1 and W2-2 signs) **shall not** be used. The crossroad warning sign and advanced crossroad name sign **shall** be on separate

installations and spaced properly.

2. Crossroad warning signs *may* be installed at mainline intersections, regardless of sight distance issues.
3. STOP Ahead or Signal Ahead signs **shall** be used on all side roads, regardless of sight distance. STOP Ahead or Signal Ahead signs *may* be doubled up.
4. Temporary orange warning flags *may* be added to all STOP Ahead signs and Signal Ahead signs. The flags *should* remain in place until the end of their useful life.
5. The Two-Way Traffic warning sign (W6-3 sign) **shall** be used if a two-lane bypass is graded or paved for a four-lane capacity that could make it appear like a four lane highway. The Two-Way Traffic warning sign (W6-3 sign) *should* be placed after major intersecting side roads or at least at two mile intervals and *should not* be doubled up.

Figure 1. Sample of New Bypass Highway



2-15-55 Signing for J Turns — December 2011

BACKGROUND

The usage of the Restricted Crossing U-Turn (RCUT), or also referred to as a “J” turn intersection, has been a low cost intersection safety improvement method that was introduced in the early 1980’s. A characterization of a “J” turn intersection is the prohibition of left turn and through movements from side street approaches. Instead, these side street movements are accommodated by requiring drivers to make a right turn onto the main highway, and then make a U-turn at a median opening downstream. Left turns from the main roadway onto the sideroad *may* be allowed to remain at the existing sideroad intersection, or, in the case of a full median closure, *may* be executed by making a U-turn at the downstream median opening and then turning right onto the sideroad.

The Federal Highway Administration has indicated several advantages in the "J-turn" concept over grade-separated interchanges and at-grade intersections. Some of these advantages include increased safety, better operational issues, lower construction costs and less right-of-way impacts. Other states that have implemented the J-turn concept have seen significant safety benefits by eliminating the "far side" right angle crash.

PURPOSE

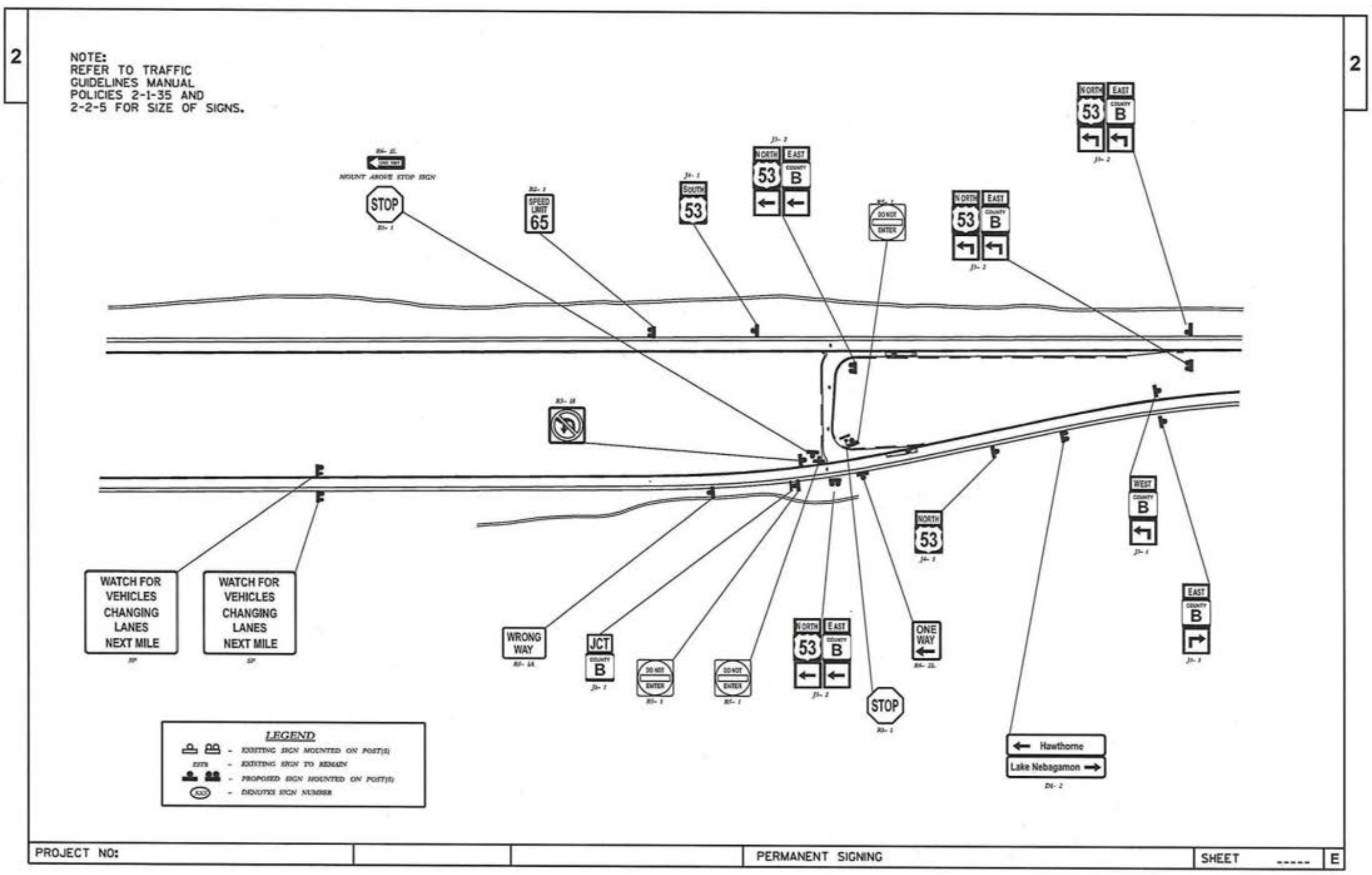
Currently the Federal MUTCD does not contain guidance on the signing of "J" turn intersections. As the construction of "J" turn intersections increases, it is critical to have a consistent signing practice for motorist expectations. The signing can be accomplished utilizing traditional regulatory, warning and guide signs outlines in the MUTCD.

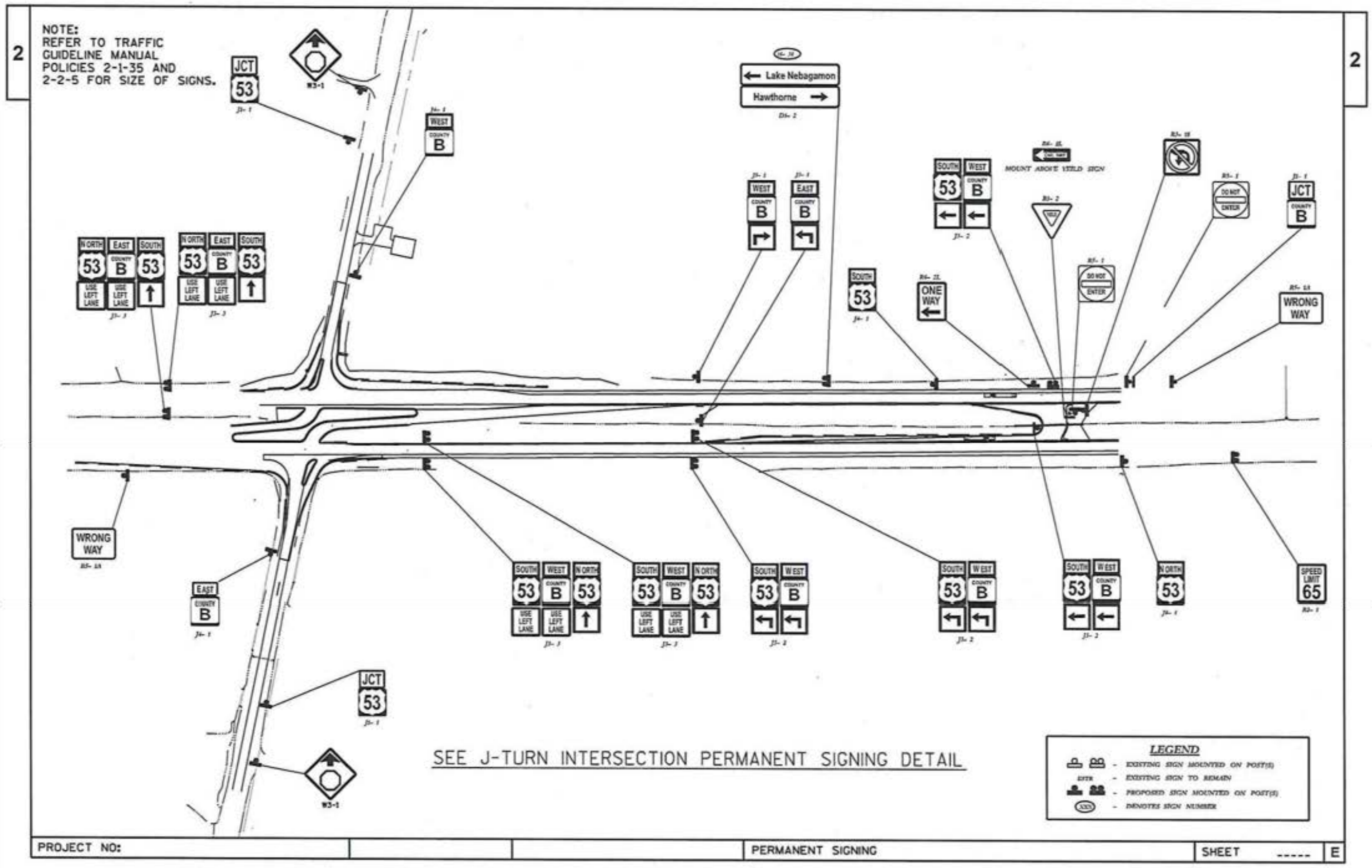
Below are guidelines that *should* be followed for the signing of "J" turn intersections:

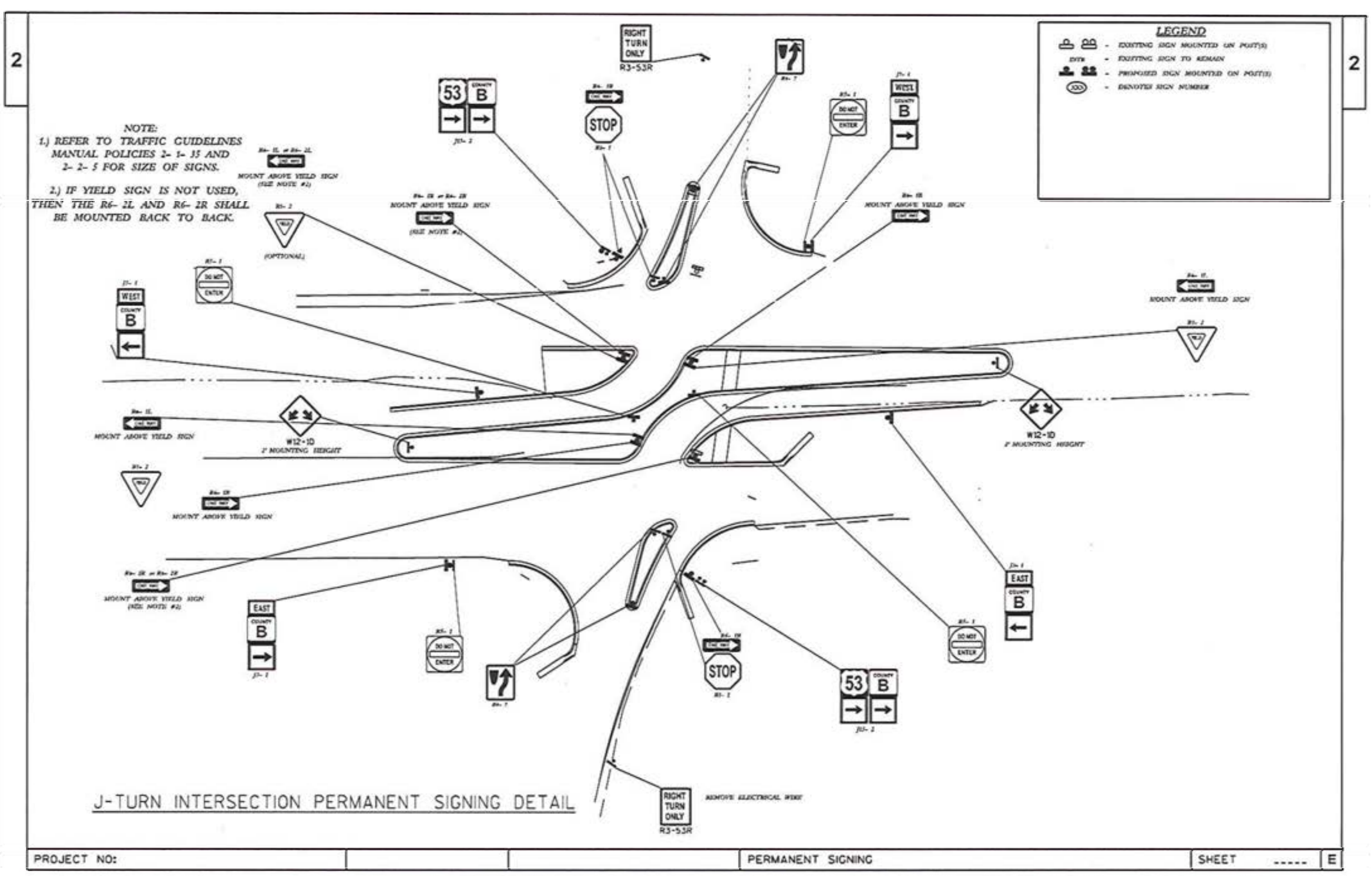
GUIDELINES

The attached typical signing plan *should* be sufficient for most intersections of this type.

1. For numbered or lettered routes, advance directional and directional assemblies *should* be used. For routes that are not numbered or lettered, advanced street name signs *should* be used.
2. On divided roadways with posted speeds of 45 mph or greater or inadequate sight distance, advanced warning signs WATCH FOR VEHICLES CHANGING LANES NEXT MILE *may* be used as a warning to motorists for turning traffic.
3. TEOpS 2-15-12 **shall** be followed for placement of Wrong Way signing.




NOTE:
REFER TO TRAFFIC GUIDELINE MANUAL POLICIES 2-1-35 AND 2-2-5 FOR SIZE OF SIGNS.
JCT 53
Lake Nebagamon
Hawthorne
WEST COUNTY B
WRONG WAY
ONE WAY
SPEED LIMIT 65
SEE J-TURN INTERSECTION PERMANENT SIGNING DETAIL
LEGEND
PROJECT NO:
PERMANENT SIGNING
SHEET ----- E


NOTE:
1.) REFER TO TRAFFIC GUIDELINES MANUAL POLICIES 2- 1- 35 AND 2- 2- 5 FOR SIZE OF SIGNS.
2.) IF YIELD SIGN IS NOT USED, THEN THE R6- 2L AND R6- 2R SHALL BE MOUNTED BACK TO BACK.
RIGHT TURN ONLY
R3-5SR
STOP
MOUNT ABOVE YIELD SIGN
W12-1D
LEGEND
J-TURN INTERSECTION PERMANENT SIGNING DETAIL
PROJECT NO:
PERMANENT SIGNING
SHEET ----- E

2-15-56 Signing for Diverging Diamond Interchanges — January 2015

BACKGROUND

The usage of the Diverging Diamond Interchange (DDI) is a relatively new development in highway design in the United States. DDIs allow free-flow left turns from the crossroad to the freeway on-ramps. This is accomplished by crossing traffic on the crossroad from the right-hand side to the left-hand side through the interchange area.

Several advantages in the DDI concept over traditional diamond interchanges include increased safety, increased capacity of left turn movements, and less right-of-way impacts.

PURPOSE

Currently the Federal MUTCD does not contain guidance on the signing of DDIs.   As the construction of DDIs increases, it is critical to have a consistent signing practice for motorist expectations. The signing can be accomplished utilizing traditional regulatory, warning and guide signs outlined in the MUTCD.

Below are guidelines that *should* be followed for the signing of DDIs:

GUIDELINES

The attached typical signing plans *should* be sufficient for most interchanges of this type. Figure 1 shows a DDI with the crossroad over the freeway, and Figure 2 shows a DDI with the freeway over the crossroad.

Field review of signing is critical before opening the DDI to traffic. Signing *should* be adjusted to ensure that wrong way prevention signs (Do Not Enter, No Left/Right/U-turns) are positioned to minimize the possibility of confusion for drivers.

<u>Single-lane Crossroad Approach to DDI</u>

1. The double reverse curve warning sign (W24-1) *should* be used on all approaches to DDIs. The W24-1 sign **shall** be used on approaches to DDIs with safe operating speed less than posted/statutory speed of the roadway.
2. R3-50A signs *should* be installed above all through lanes on the signal mast arms within the DDI.
3. TEOpS 2-15-12 **shall** be followed for placement of Wrong Way signing. Sign plate R3-4R (reverse no U-turn) has been developed for use at the signals within the DDI.
4. TEOpS 2-4-44 *should* be followed for placement of guide signs.

<u>Mulit-Lane Crossroad Approach to DDI</u>

1. The double reverse curve warning sign (W24-1L) *should* be used on all approaches to DDIs. The W24-1L with an advisory speed sign (W13-1P) **shall** be used on approaches to DDIs with safe operating speed 10 mph or more less than posted/statutory speed of the roadway. When a W24-1 is used, an appropriate supplementary plaque (“All Lanes”, “Left 2 Lanes”, etc.) **shall** be placed below the W24-1L.
2. R3-50A signs **shall** be installed above all through lanes on the signal mast arms within the DDI.
3. TEOpS 2-15-12 **shall** be followed for placement of Wrong Way signing. Sign plate R3-4R (reverse no U-turn) has been developed for use at the signals within the DDI.
4. Approaching the DDI, advance overhead lane selection guide signs (E6 series) **shall** be used.
5. For DDIs with the crossroad over the freeway, J2 and D1-7x series signs *should* be used within the DDI. For DDIs with the freeway over the crossroad, overhead guide signs **shall** be used in place of the J2 series signs.
6. If overhead guide signs are used within the DDI, D1 or J3 series signs *may* be used at the on-ramp terminal within the DDI.

Figure 1.

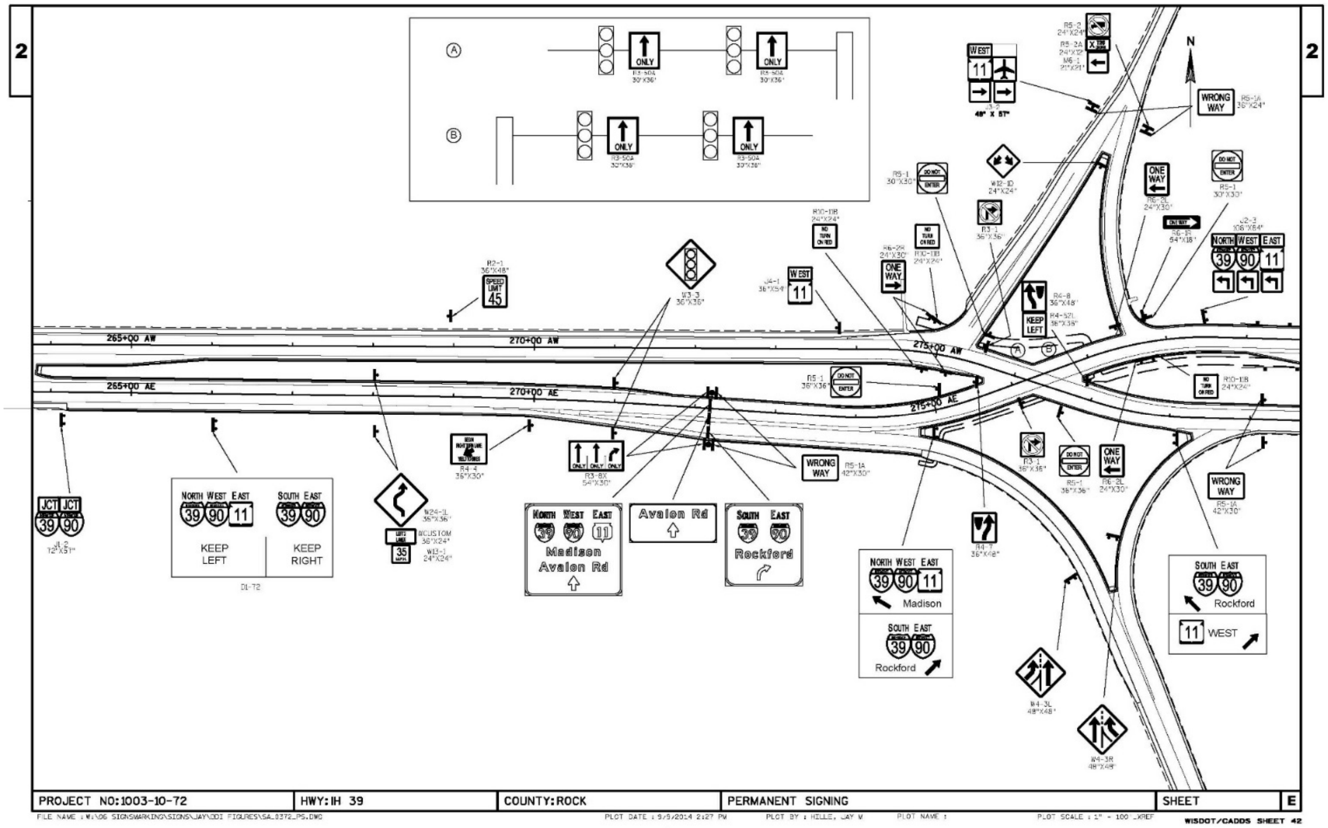


Figure 1. Continued

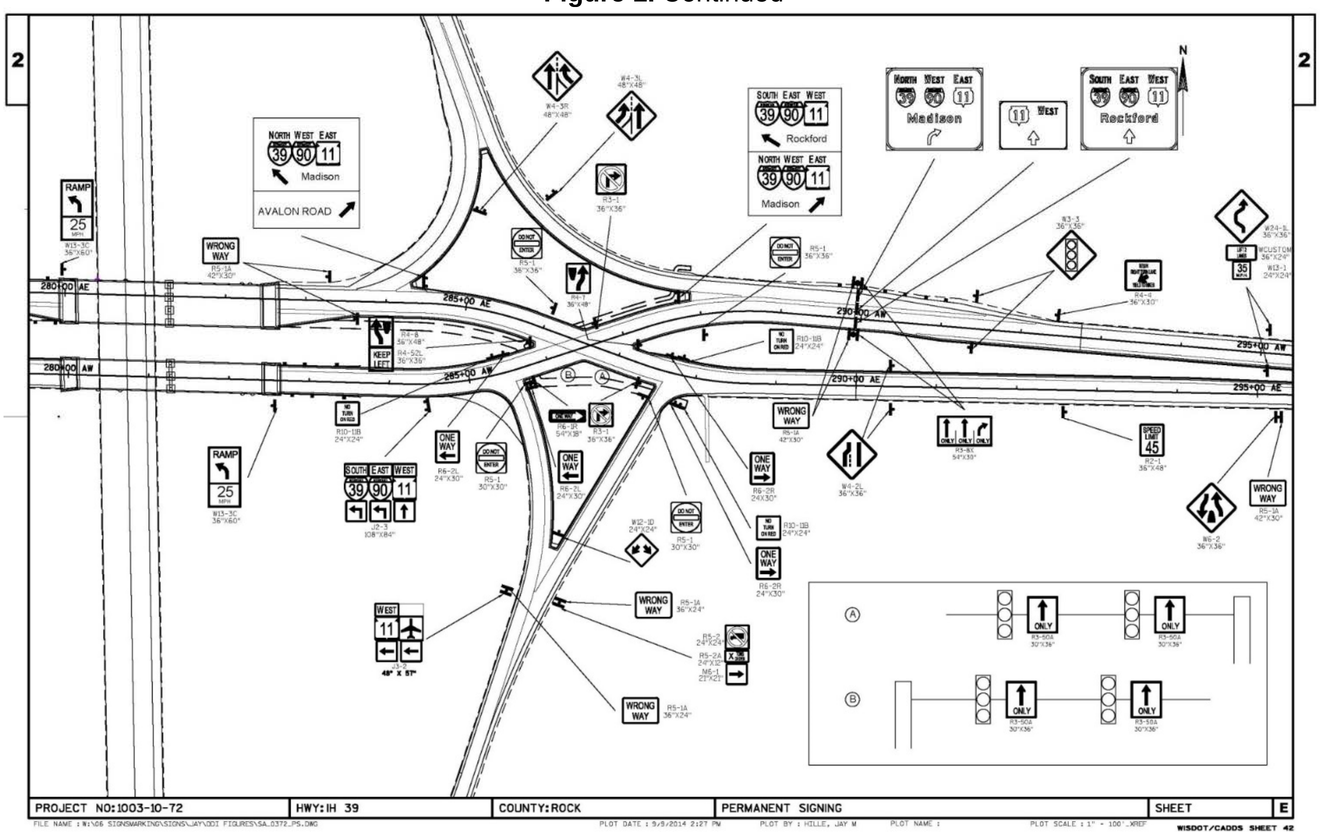


Figure 1. Continued

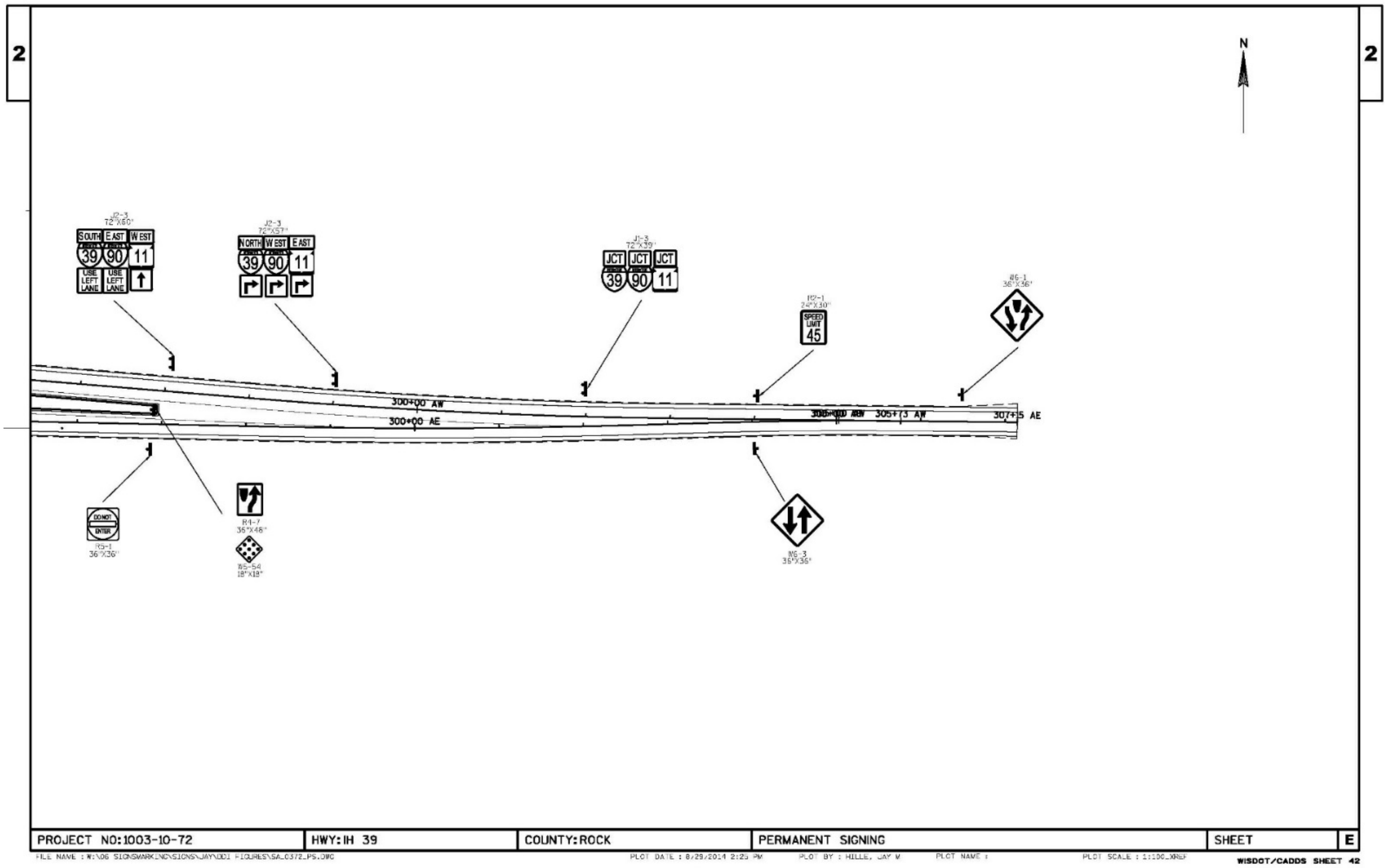


Figure 2.

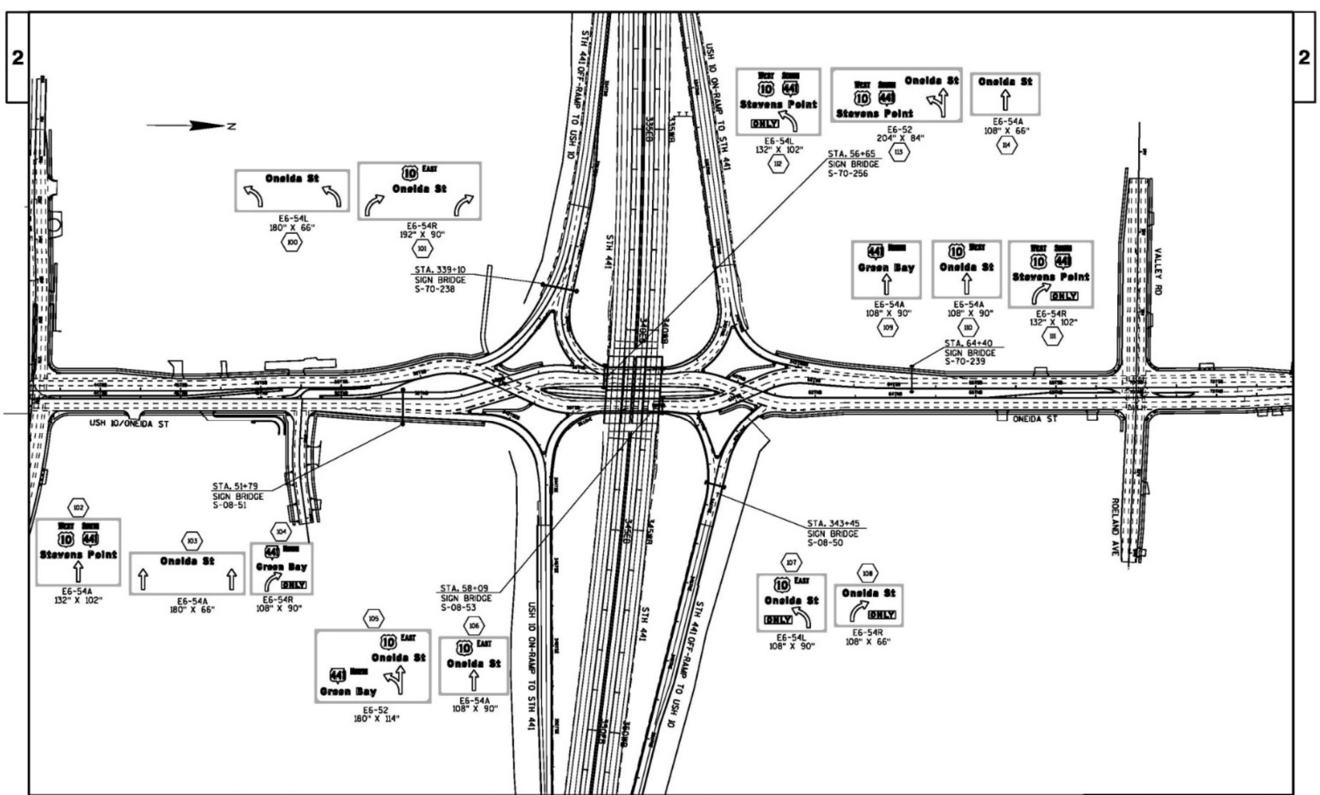


Figure 2. Continued

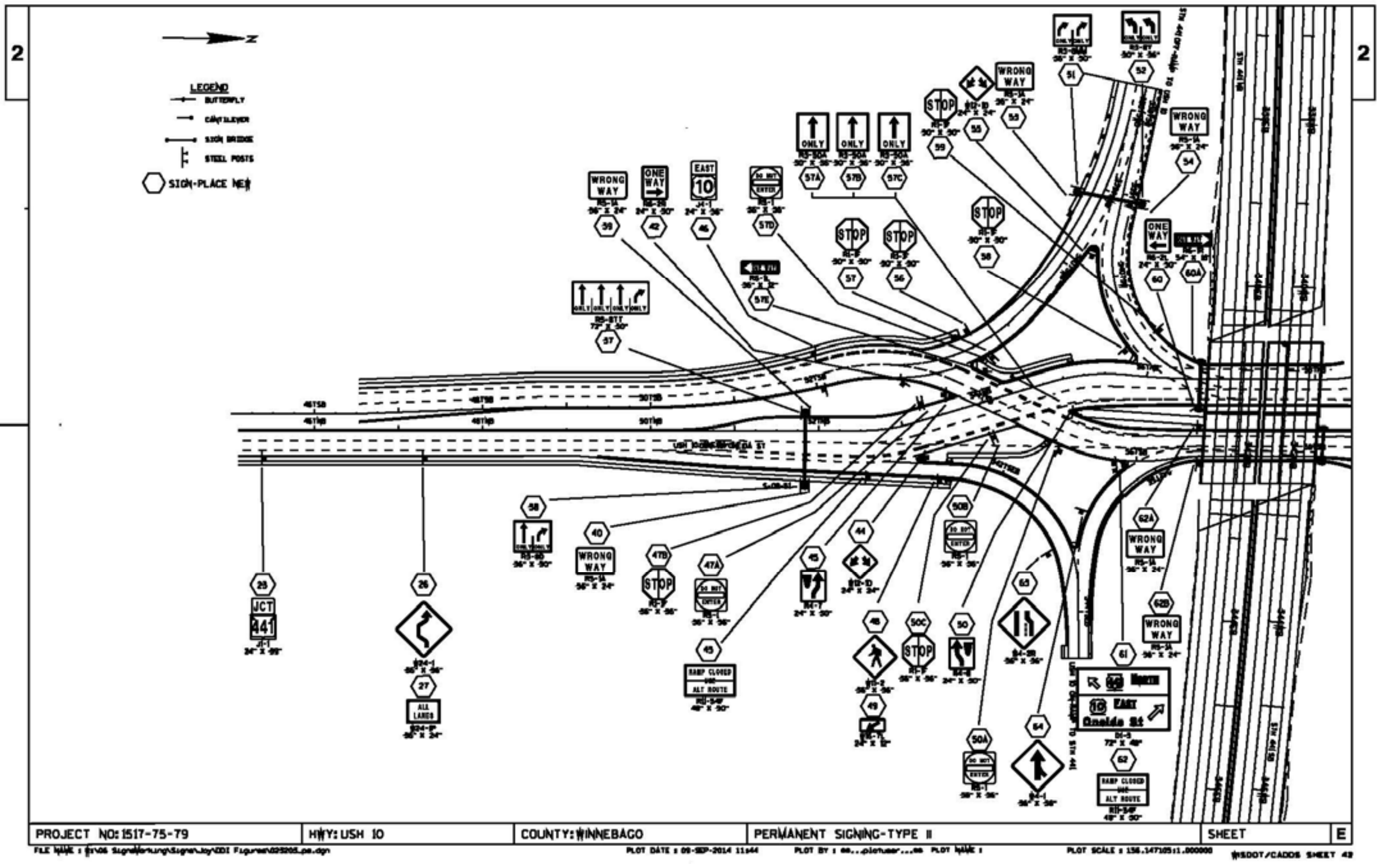
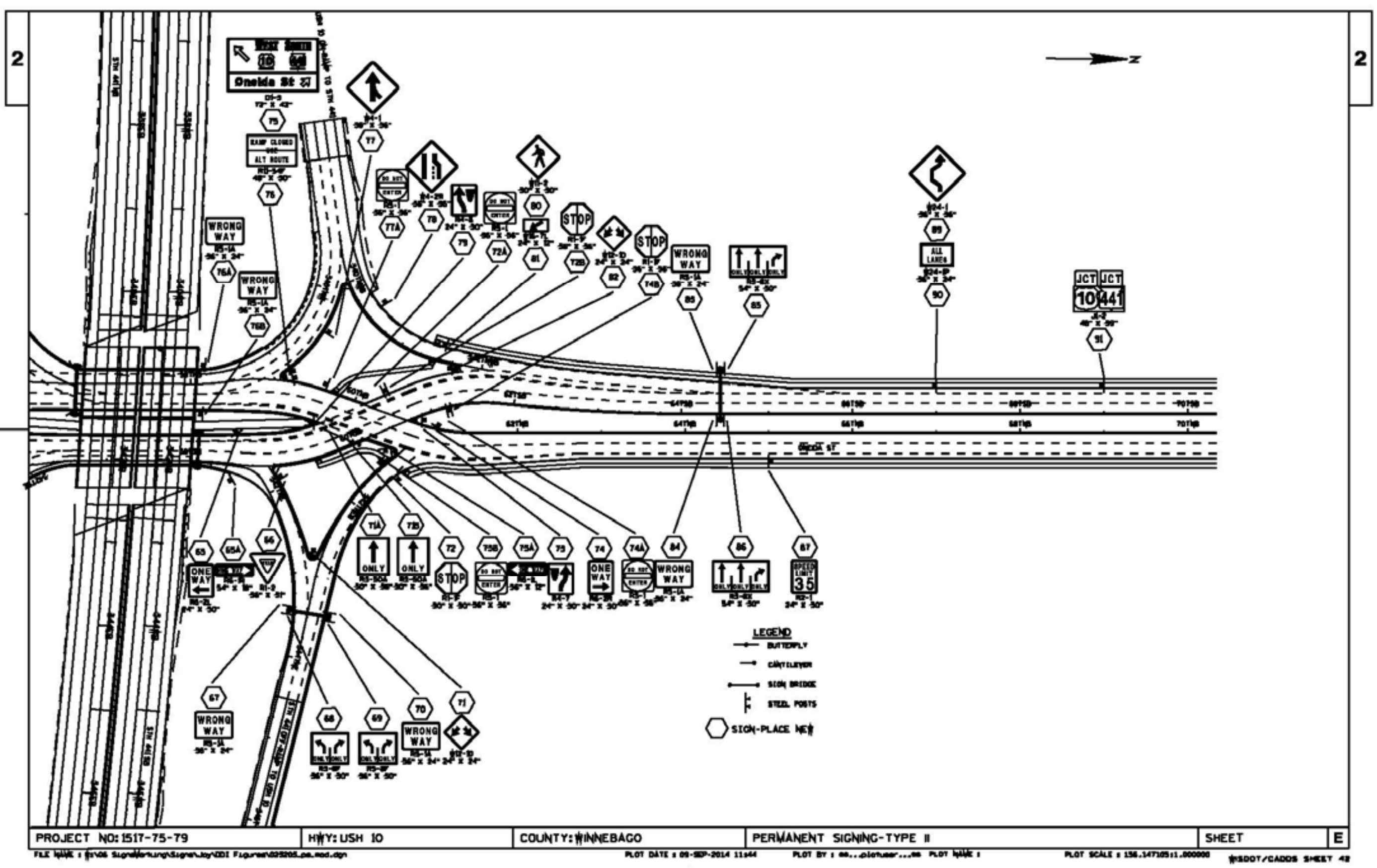


Figure 2. Continued



2-15-58 Specific Information Signs April 2017

PURPOSE

The purpose of this policy is to provide consistent statewide direction for the permitted use of Specific Information Signs under Wisconsin Administrative Code Chapter Trans 200.06 and Wisconsin Statute 86.195.

The Specific Information Signs (SIS) have the business's logos on blue signs. These **shall** only be permitted on SIS highways.

DEFINITIONS

SIS Highway: SIS Highway *may* be a major highway, interstate, freeway, or expressway and are approved by the state legislature. In Trans 200.03, Chapter 86.195 contains all SIS approved highways. (https://docs.legis.wisconsin.gov/statutes/statutes/86/195/6/a)

POLICY

In addition, the following DOT qualifying considerations **shall** be met.

Gasoline

1. Businesses **shall** be open a minimum of 16 hours per day, seven days a week for freeways and expressways.
2. Businesses **shall** be open a minimum of 12 hours per day, seven days a week for other highways.
3. Businesses **shall** provide a restroom, drinking water, and a public telephone.
4. Businesses **shall** provide vehicle services including fuel, oil and water.
5. Businesses **shall** be within three miles of the exit unless no businesses are within the same category the maximum distance *may* be extended to 15 miles.

Food

1. Businesses **shall** be open five days per week and open from at least 10 a.m. to 7 p.m.
2. Businesses **shall** have licensing and approval where required.
3. Businesses **shall** have at least 50 percent of the gross receipts from food and non-alcoholic beverages.
4. Businesses **shall** have a public telephone.
5. Businesses **shall** be within three miles of the exit unless no businesses are within this category the maximum distance *may* be extended to 15 miles.

Lodging

1. Businesses **shall** have licensing and approval where required.
2. Businesses **shall** have adequate sleeping accommodations.
3. Businesses **shall** be within three miles of the exit unless no businesses are within this category the maximum distance *may* be extended to 15 miles.

Camping

1. Businesses **shall** have licensing and approval where required.
2. Businesses **shall** have restrooms, drinking water, and a public telephone.
3. Businesses **shall** have adequate parking accommodations.
4. Businesses **shall** be within three miles of the exit unless no businesses are within this category the maximum distance *may* be extended to 15 miles.

Tourist Attractions

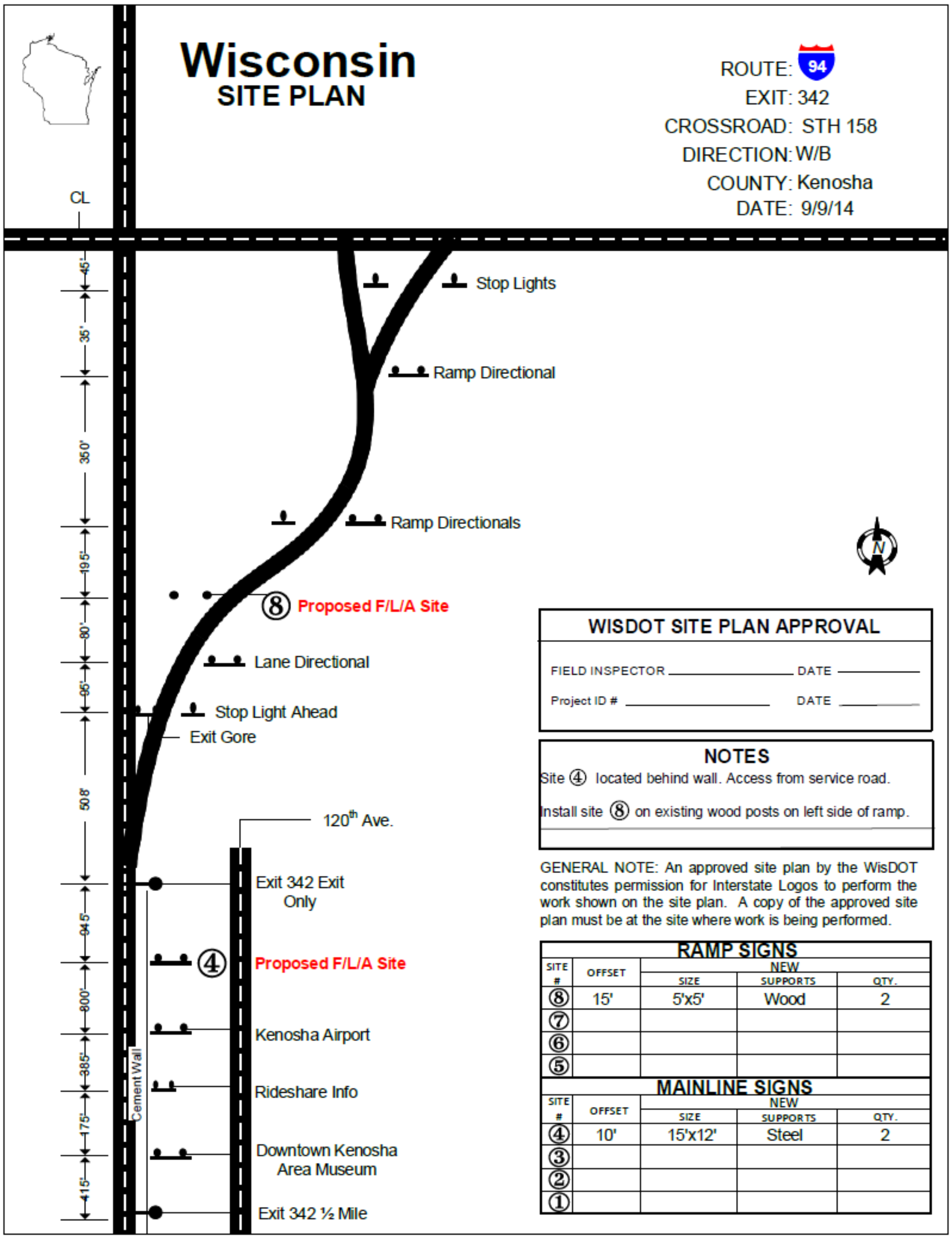
1. The primary purpose **shall** be to provide amusement, historical, cultural, or leisure activities to the public.
2. The business **shall** have regional significance and adequate parking accommodations.
3. Businesses **shall** be within 30 miles of the exit.

4. Applications **shall** be sent to BTO and forwarded onto the Advisory Council for approval.

Installation of Specific Information Signs
Contact Interstate Logos for an application.
4918 Triangle St.
McFarland, WI 53558
(844) 496-9163 or (608) 579-1570
www.wisconsin.interstatelogos.com

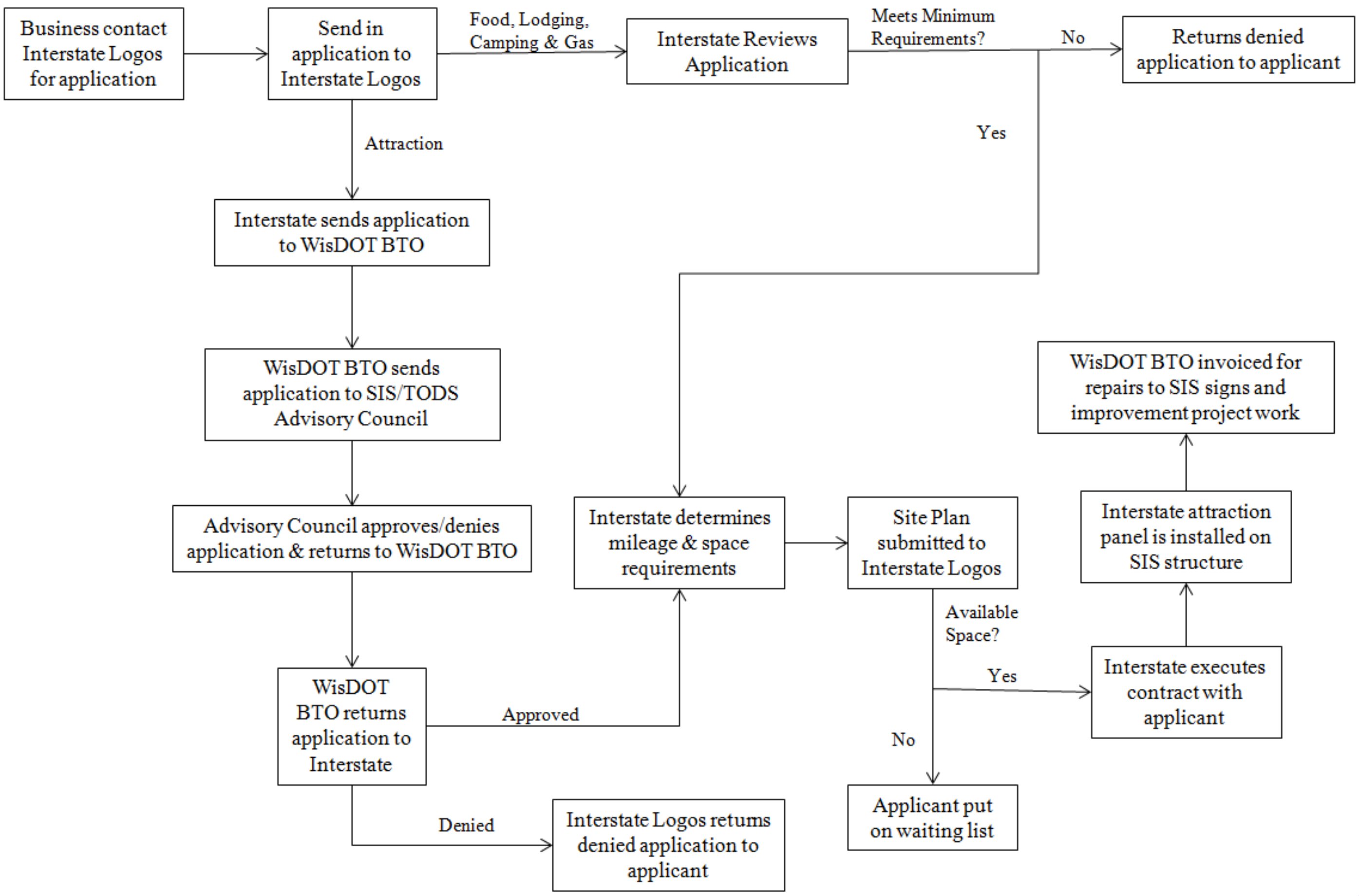
Improvement Projects

- Site Plans **shall** be requested from Wisconsin Logos (see attached example below).
- Project contractors **shall not** perform work on SIS signs.
- STSP 638-010 **shall** be included in projects with SIS signs.



The flow chart below describes the application process to obtain a SIS sign.

SIS Application Process



2-15-59 Tourist Oriented Directional Signs — April 2017

PURPOSE

The purpose of this policy is to provide consistent statewide direction for the permitted use of Tourist Oriented Directional Signs under Wisconsin Administrative Code Chapter Trans 200.08 and the Wisconsin Statute 86.196.

The Tourist Oriented Directional Signs (TODS) are white on blue signs. These are not permitted on SIS highways or in urban areas.

The application/permit form DT1864 incorporates Trans 200.08 and Statute 86.196 and specifies complete guidance on the use of these signs.

DEFINITIONS

SIS Highway: Specific Information Sign highways can be found in TEOpS 2-15-58.

Federal Urban Area: Federal urban areas are defined as "Urban Federal Aid Systems" with populations of 5,000-49,000.

Urban Areas: Urban areas are defined as urban boundaries with populations of 50,000 or greater.

GUIDANCE

The following businesses are qualified for a TODS sign under the gas, food, lodging, or camping categories.

Bed and Breakfast	Campground
Hotel	Motel
RV Park	Resort
Restaurant	Service Station
Coffee Shops	

The following table provides a list of facilities which, if open and available to the public, *may be* eligible for a TODS <u>attraction</u> sign.

American Indian Craft	Amusement Park
Antique Shop	Art Gallery
Bait and Tackle Shop	Beach (privately owned)
Bicycle Rental	Boat Tour
Boat/Canoe Rental	Brewery (with tours)
Candy Store (Primary Business)	Cave (with tours0
Cheese Factory Shop (Primary Business)	Farm Tour
Ferry	Fish Farm
Game Farm (open to Public)	Golf Course
Hot Air Balloon Rides	Museum
Orchard	Park
Petting Zoo	Pick-Your-Own Fruits and Vegetables
Rafting/Tubing Business	Sausage Factory Shop (primary business)
Ski Resort/Hill	Stable
Tree Nursery	Wildlife Refuge
Winery (with tour)	Zoo
Botanical Gardens	Fairgrounds
Water Park	Casino/Bingo

The following table proves a list of facilities which are *not* eligible for TODS <u>attraction</u> signs.

Tennis Court	Fireworks
Book Store	Go-Kart Track
Taxidermy Shop	Grotto
Car Rental	Health Club
Swimming Pool/Natatorium	Hobby Shop
Civic Center	Ice Rink/Arena
Conservation Area	Movie Theater
Outlet Mall	Religious Shrine
Sports Arena/Stadium	

POLICY

TODS signs are intended for use in rural or outlying urban areas. They **shall not** be installed in Federal Urban Areas or Urban Areas due to sidewalks, terraces, and right of way constraints. TODS Signs **shall not** be installed in urban areas.

In addition, the following DOT qualifying considerations **shall** be met.

1. Name changes **shall** require cancellation of the old sign and issuance of a new permit.
2. Only the name of the facility and mileage **shall** be allowed for guidance. Additional sign features, such as vacancy, hours of operation or products offered **shall not** be allowed on the sign or on an attached plaque or board.
3. If a conventional highway facility qualifies for signs in more than one category (TODS, SIS, Trans 200 Guidance or Supplemental Guide sign), only one category will be allowed in each direction.
4. If outdoor advertising signs for the facility are within 1,000 feet of the intersection or entrance, guidance signs **shall not** be permitted.
5. Businesses **shall** be within five miles and have direct access of the State or U.S. Highway.
6. Businesses **shall** have no illegal outdoor advertising signs.

Category specific information:

<u>Gasoline</u>

1. Businesses **shall** have fuel, oil, and water available.
2. Businesses **shall** be open a minimum of twelve hours per day, seven days a week.
3. Businesses **shall** provide a restroom, drinking water, and a public telephone.

<u>Food</u>

1. Businesses **shall** have licensing or approval, where required.

2. Businesses **shall** be open five days per week and open from at least 10 a.m. to 7 p.m.
3. Businesses **shall** have at least 50 percent of the gross receipts from food and non-alcoholic beverages.
4. Businesses **shall** provide a restroom, drinking water, and a public telephone

<u>Lodging</u>

1. Businesses **shall** have licensing or approval, where required.
2. Businesses **shall** have adequate sleeping accommodations.
3. Businesses **shall** have parking accommodations.
4. Businesses **shall** provide restrooms, drinking water, and a public telephone.

<u>Camping</u>

Businesses **shall** have licensing or approval, where required.

Businesses **shall** have parking accommodations.

Businesses **shall** provide restrooms, drinking water, and a public telephone.

<u>Tourist Attractions</u>

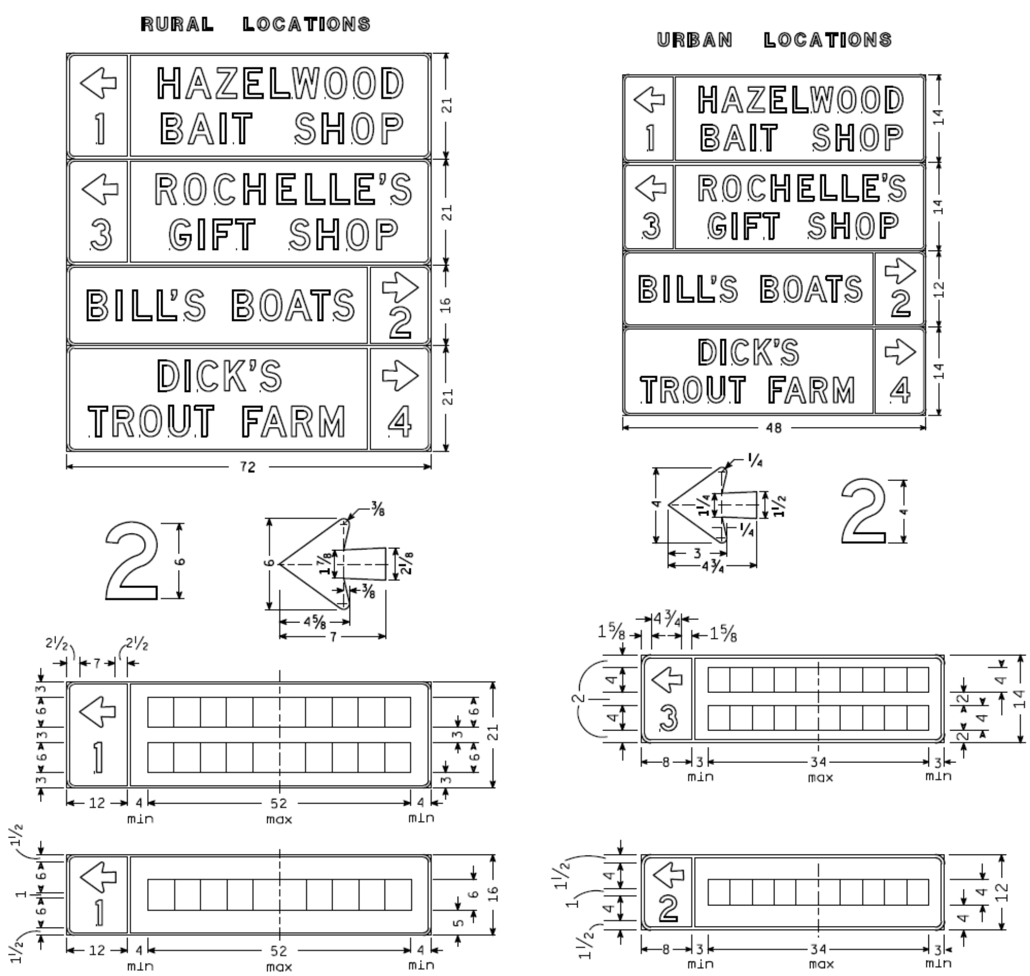
Businesses **shall** have licensing or approval, where required.

Businesses **shall** be open at least eight hours per day, five days a week for three consecutive months.

Businesses **shall** provide restrooms and drinking water

Businesses **shall** have significant interest to the traveling public, as approved by the Advisory Council.

Figure 1. Standard Plate for TODS signs



As shown on Figure 1 of the Standard Sign Plate E10-82, the sign message **shall** consist of 4 or 6 inch white lettering on type H reflective blue background. Letter sizes and spacing **shall** conform to the standards in the FHWA Standard Highway Signs manual. Overall sign sizes used **shall** conform to the dimensions as shown on Figure 1 of the Standard Sign Plate E10-82. A half inch white border with a 1 ½" radius shall be placed around the sign.

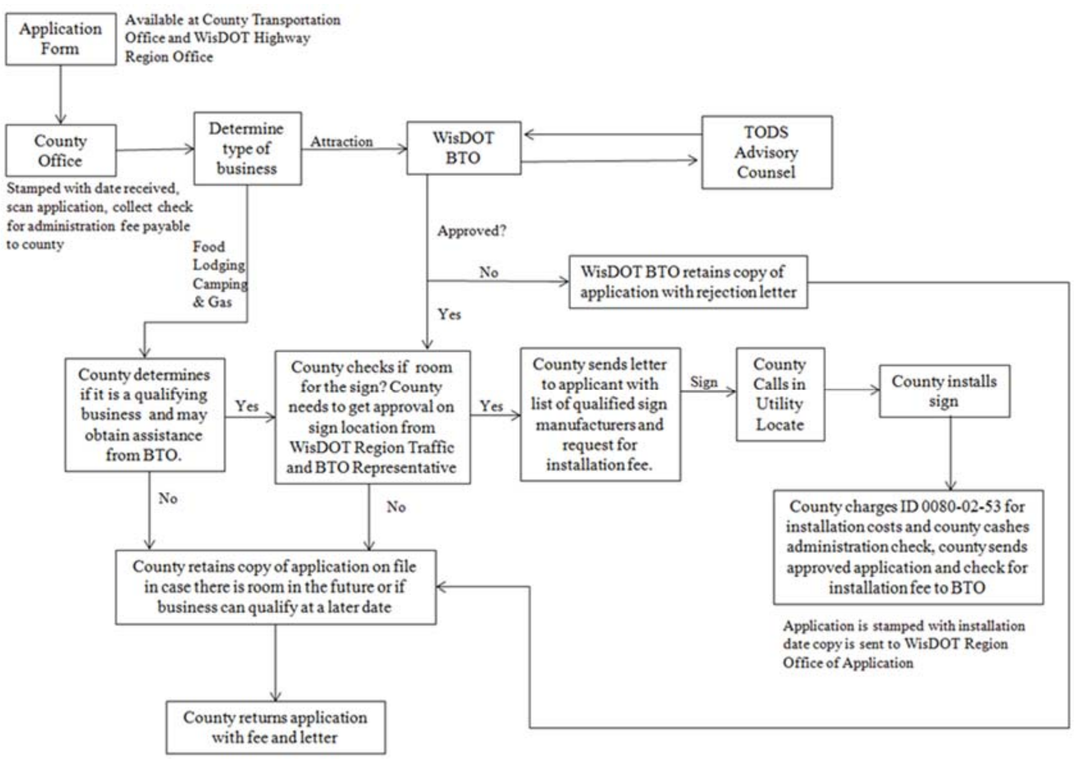
The WisDOT Region office reserves the right to remove non-conforming signs from the highway right-of-way. The owner *may* contact the WisDOT Region office to pick up any signs that have been removed. Upon pickup of the removed signs, the sign owner **shall** be responsible for sign removal costs.

Installation of Tourist Oriented Directional Signs by Counties

1. Businesses **shall** bring in the completed DT1864 form with a check payable to the county for the $100/sign for administration fee. Businesses need to pay fee every 5 years.
2. Once approved, the business *may* have the sign manufactured from one of the businesses on the Qualified Manufacturer list.
3. The business **shall** bring in the sign along with a check for $250 per sign payable to the Wisconsin Department of Transportation. These checks *should* be sent to: Wisconsin Department of Transportation, attn: Jeannie Silver, 3609 Pierstorff St. Madison, WI 53703.
4. Signs **shall** be mounted on 4" x 6" treated posts.
5. For removal and/or installation of 1 sign on existing posts the cost is $100 per sign for the installation fee. Checks *should* be sent to: Wisconsin Department of Transportation, attn: Jeannie Silver, 3609 Pierstorff St. Madison, WI 53703.
6. All applications **shall** be forwarded to Jeannie Silver to verify the location is outside urban area boundaries.
7. All county costs for TODS repairs and installations **shall** be charged to the 0080-02-53 project ID and appropriate invoicing **shall** be submitted to the requestor as outlined in item 3 above.
8. The county *should* only repair damaged TODS when directed to do so by the sign owner.
9. Any existing white arrow boards for the business **shall** be removed before a TODS sign is installed

The application process for a TODS sign is shown below in the Figure 2.

Figure 2. TODS Application Process



TOURIST ORIENTED DIRECTIONAL SIGN APPLICATION/PERMIT

Wisconsin Department of Transportation

DT1864 8/2014
s. 86.196 Wis. Stats., Ch. Trans. 200.08 Wis. Admin. Code

Make Check Payable To

Mail To

INSTRUCTIONS:

1. Complete both sides of the form. PLEASE PRINT CLEARLY.
2. Submit a check for $100 per sign.
   This is an administration fee. Make the check payable to the county in which the proposed sign(s) is (are) located.
3. Staple the check to the upper left corner of this application.
4. This check will be returned if the application is rejected.
5. Send this application and check to your County Highway Commissioner.

Business/Service/Activity NAME for which TODS Sign is Requested

Street Address, City, State, ZIP Code

Business/Service/Activity Category for which TODS Sign is Requested. (Check ONE)
☐ Gas ☐ Food ☐ Lodging ☐ Camping ☐ Tourist Attraction

Services Available at the Facility
☐ Restrooms ☐ Parking ☐ Drinking Water ☐ Public Telephone

Period of Business/Service/Activity Function
☐ Open All Year ☐ Seasonal Operation

Open Each Year
From (month/day): To (month/day):

Hours of Operation	OPEN	CLOSE
Monday	☐ a.m. ☐ p.m.	☐ a.m. ☐ p.m.
Tuesday	☐ a.m. ☐ p.m.	☐ a.m. ☐ p.m.
Wednesday	☐ a.m. ☐ p.m.	☐ a.m. ☐ p.m.
Thursday	☐ a.m. ☐ p.m.	☐ a.m. ☐ p.m.
Friday	☐ a.m. ☐ p.m.	☐ a.m. ☐ p.m.
Saturday	☐ a.m. ☐ p.m.	☐ a.m. ☐ p.m.
Sunday	☐ a.m. ☐ p.m.	☐ a.m. ☐ p.m.

Annual Attendance
(Number is ***Required*** for "TOURIST ATTRACTIONS" only)
Number of Visitors per Year:

Special Rule for FOOD Category
If you are applying for a TODS sign under the FOOD category, please answer the following:

☐ Yes ☐ No 1. Do you serve 3 meals per day?

☐ Yes ☐ No 2. Are at least 50% of your gross annual receipts for food and nonalcoholic beverages?

Sign Conflicts

☐ Yes ☐ No 1. Do you have a "White Arrow Board" sign (Ch. Trans 200.03, Wis. Admin. Code) at the intersection of the proposed TODS signage?

☐ Yes ☐ No 2. Do you have an outdoor advertising sign, which is not in accordance with s.84.30 Wis. Stats. or Ch. Trans. 201 Wis. Admin. Code?

Number of Signs

☐ One TODS sign
(Administration fee is $100 payable to the county)

☐ Two TODS signs
(Administration fee is $200 payable to the county)

Proposed Sign Wording
Fill in the name and the distance from the intersection to the business/service/activity for each TODS Sign requested. Limit the name to one character or space per box.

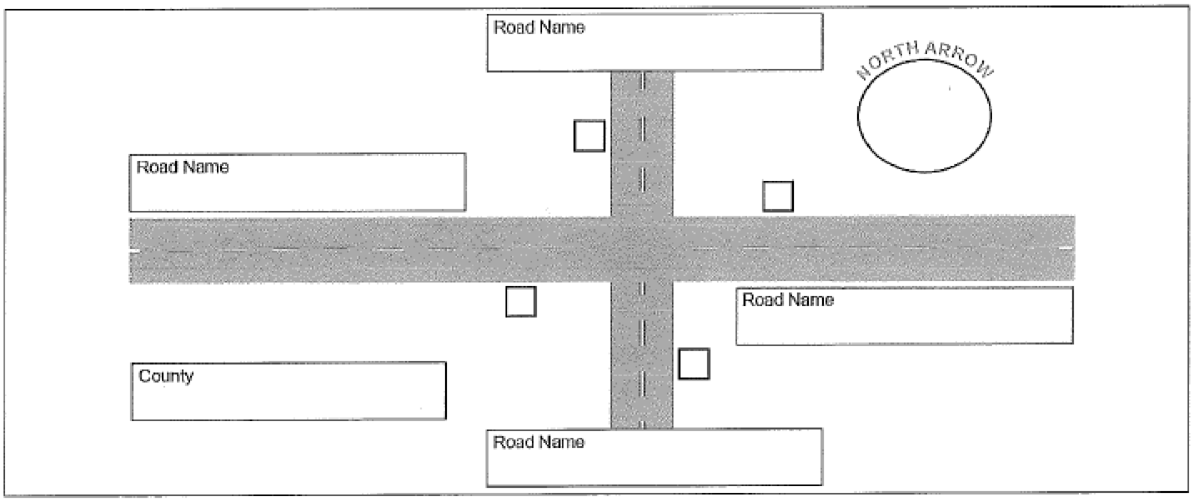
Page **1** of **2**

TOURIST ORIENTED DIRECTIONAL SIGN APPLICATION/PERMIT *(continued)*

Wisconsin Department of Transportation DT1864

PROPOSED SIGN LOCATION INSTRUCTIONS

1. Label the intersecting roads.
2. Place an arrow in the circle pointing to the North.
3. Check (X) one or two of the boxes ☐ corresponding to the proposed sign location(s). (TODS signs are only permitted on State Highways or U.S. Highways. They must direct motorists to businesses, which are located on County Highways or Town Roads.)
4. Place an O (circle) at the approximate location of your business.
5. Write in the name of the county in the lower left corner.
6. Write in any additional details or comments that would be helpful in determining the proposed sign location. (Optional)



CERTIFICATION

I, the applicant, certify that the statements contained on this application/permit are true and correct, and that the business identified is conducted in conformity to all laws applicable to nondiscrimination, and that discrimination is not exercised in regard to race, religion, color, sex, sexual orientation, or national origin. I understand that in addition to the attached administration fee, I am responsible for the manufacturing and installation costs for the proposed sign(s). I understand that this permit is revocable, and that it is subject to renewal every five years. I further understand that if my business is a seasonal business, that a "CLOSED" plaque will be placed on my sign when my business is closed for the season.

Applicant Name (First, MI, Last)	X	
(Area Code) Telephone Number	(Applicant Signature)	(Date – m/d/yyyy)

APPROVAL – APPROVED FOR WISCONSIN DEPARTMENT OF TRANSPORTATION

Subject to present and continuing compliance by the applicant with all requirements of s.86.196 Wis. Stats. and Chapter Trans. 200.08, Wisconsin Administrative Code, a permit is granted for the TODS sign described. This permit expires on the five-year anniversary date of the installation of the TODS sign panel.

X		X	
(WisDOT Region Traffic Engineer)	(Date – m/d/yyyy)	(State Traffic Engineer or Authorized Agent)	(Date – m/d/yyyy)

— For WisDOT Use ONLY —						
SIGN SIZE		PERMIT NUMBER		INSTALLATION DATE		
☐ RURAL (72")	☐ URBAN (48")	County	Number	Month	Day	Year

Page **2** of **2**

2-15-60 Trans 200 Guidance Signing — April 2017

PURPOSE

The purpose of this policy is to provide consistent statewide direction for the permitted use of guidance signs under Wisconsin Administrative Code Chapter Trans 200.

These narrow horizontal signs are only permitted on conventional state highways or expressway approaches to at-grade intersections. As prescribed in subsection Trans 200.03, these signs *may* be permitted to direct to:

- resorts,
- hotels,
- places of public entertainment or instruction,
- any place of religious worship,
- any county institution,
- any scientific experiment location for the furtherance of agriculture or other science or art.

The term “entertainment” in this case does not include nightclubs, taverns, or similar establishments.

Trans 200.03, this policy, and the Application/Permit Form DT1903 specify complete guidance on the use of these signs.

DEFINITIONS

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

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

Conventional Highways are defined as 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.

GUIDANCE

The following table provides a list of facilities which, if open and available to the public, *may* be eligible for a White Arrow Board permit.

MAY BE ELIGIBLE

TYPE OF FACILITY	QUALIFYING CONSIDERATIONS
Agricultural experiment	
Animal shelters	*May* be permitted for County Institutions only.
Athletic fields, facilities	*May* be permitted for facilities that do not qualify for supplemental signing, and community wayfinder signing is not available.
Aviation Flight School	
Cabins, Cottages	For rental periods less than 30 days
Camps, religious or youth	
Campgrounds, RV Parks	Privately owned with rental periods less than 30 days.
Churches	
Condominiums	Only if part of a resort, for rental periods less than 30 days
Convention Center	*May* be permitted for facilities that do not qualify for supplemental signing, and community wayfinder signing is not available.
Country Clubs	Only when open to the public
County Healthcare Facilities	
Cruises, Boat	
Environmental Center	
Exhibition, Exposition Center	*May* be permitted for facilities that do not qualify for supplemental signing, and community wayfinder signing is not available.
Golf Courses	Only when open to the public
Horseback Riding	Only when open to the public
Hotel, Motel, Bed & Breakfast	*May* be permitted as a substitute for “Lodging” category where SIS or TODS is not permitted.
Humane Society Shelter	*May* be permitted for County Institutions only.
Libraries	
Marinas	
Museums and historic sites	*May* be permitted for facilities that do not qualify for supplemental signing, and community wayfinder signing is not available.
Recreational facilities	Facilities open to the public for recreational activities including ATV parks;

	amusement parks; archery ranges; boat, kayak or canoe launches, tours or rental facilities; bowling alleys; casinos; caves; concert venues; curling venues; disc golf courses, fishing piers; go-cart tracks, hanggliding; horseshoe facilities; ice skating rinks; paintball facilities; playgrounds; riding stables; rock climbing; shooting ranges; skate parks; skydiving facilities; sledding hills; splash parks; swimming pools; tour providers (airplane helicopter, tram, boat, walking); volleyball courts; waterski or wake board shows; waterparks.
Religious Worship Facilities	
Research Facilities	
Resorts	For rental periods less than 30 days
Restaurants, Supper Clubs	*May* be permitted as a substitute for "Food" category where SIS or TODS is not permitted.
Schools	
Scientific Experiments	
Seminaries	Only if it contains a public place of worship.
Shooting Ranges, Gun Clubs	Gun clubs **shall** be open to the public as shooting ranges. See types of shooting ranges under Qualifying Considerations for Recreational Facilities.
Theaters	Live entertainment only
Trails - Recreation, Nature, Skiing, Biking, Hiking, Snowshoeing, Snowmobiling, ATV or other vehicle trails	Directing to trailhead access with parking.
Train rides	*May* be permitted as a substitute for "Attractions" category where SIS or TODS is not permitted.
Wildlife Refuges	To instructional centers only
Zoo	*May* be permitted for facilities that do not qualify for supplemental signing, and community wayfinder signing is not available.

The following table provides a list of facilities which are **not eligible** for a White Arrow Board permit. As a general class, all retail or wholesale sales or service establishments **shall not** be approved for White Arrow Board.

NOT ELIGIBLE

Agricultural Farms	Berry Patches	Cranberry Marshes	Tree Farms
	Tree, Plant Nurseries	Produce Stands	Greenhouses
Air Traffic Control			
Animal Hospitals			
Animal Ranches	Game Farms		
Apartments	Buildings	Complexes	
Artists	Art Dealers	Artist Studios	
Auto Repair	Auto Body Repair		
Barber, Beauty Shops			
Builders, Contractors	Carpenters	Electricians	Landscapers
	Painters	Plumbers	Tree Service
Bus Terminals			
Cemeteries		(see TEOpS 2-15-3 & 2-15-20 re: Veterans Cemeteries)	
Clinics			
Crafts supplies, outlets			
Dance Halls			
Factories			
Freight Terminals			
Government Offices			
Halfway Houses			
Health Clubs			
Highway Departments	Maintenance Facilities		
Historic Neighborhoods			
Hospitals			
Jails			
Kennels			
Lakes	Landings		
Malls, Shopping Centers			
Mental Health Facilities (except County)			
Mobile Home Parks			

Movie Theaters			
Nursing Homes, Assisted Living, Private			
Office Buildings			
Pharmacies			
Post Offices			
Power Plants	Utilities		
Private Clubs			
Realtors			
Recycling Station			
Rehabilitation Centers (except County)			
Residences			
Retirement Facilities (except County)			
Sales, Retail or Wholesale		Antique Dealers	Auto Dealerships
	Bait & Tackle Shops	Grocery Stores	Hardware Stores
	Home Furnishings	Home Improvements	Liquor Stores
	Lumber Dealers	Materials Suppliers	Mobile Home Sales
Storage Units			
Subdivisions			
Taverns	Bars	Pubs	Taps
Taxidermists			
TV & Radio Stations			
UW Extension Offices			
Veterans Memorials			

POLICY

White Arrow Boards are intended for use in rural or outlying urban areas. They *should not* be installed in dense urban areas due to sidewalks, terraces, and right of way constraints.

In addition, the following DOT qualifying considerations **shall** be met.

1. The facility **shall** be open to the public.
2. Lodging facilities **shall** have three or more units that **shall** be available for less than 30-day rental periods.
3. Signs *may* only be permitted on the state highway(s) nearest the facility.
    a. Directing to its entrance from the state highway, or
    b. Directing to its entrance on a local road.

Signs directing to facilities beyond other state, US, or Interstate highways **shall not** be permitted.

1. Guidance signing **shall not** be permitted on the right of way at the entrance to a facility if there is sufficient sight distance in which to identify the activity, facility or other type of signing at the entrance. This applies both to businesses that front the roadway and also to those not fronting the roadway, but are visible from the roadway. Minimum visibility distances, based on the posted speed, are found in the following table from MUTCD Section 2C.36.
2. Businesses **shall** have the appropriate operating licenses to receive, maintain, or renew a permit.
3. Name changes **shall** require cancellation of the old and issuance of a new permit.
4. Only the name of the facility **shall** be allowed for guidance. Additional sign features, such as vacancy, hours of operation or products offered **shall not** be allowed on the sign or on an attached plaque or board.

Posted Speed	Minimum Visibility Distance
25 mph	280 ft
30 mph	335 ft
35 mph	390 ft
40 mph	445 ft
45 mph	500 ft
50 mph	555 ft
55 mph	610 ft
60 mph	665 ft
65 mph	720 ft

5. If a conventional highway facility qualifies for signs in more than one category (TODS, SIS, White Arrow

Boards or Supplemental Guide sign), only one category will be allowed. In this case, the White Arrow Boards *should* be discouraged because it is not retroreflective.

6. If outdoor advertising signs for the facility are within 1,000 feet of the intersection or entrance, guidance signs **shall not** be permitted.
7. No more than one arrow board for a facility **shall** be permitted on a state highway in each direction.
8. Guidance sign assemblies **shall** be limited to a maximum of six arrow boards.
9. There *may* be a maximum of two guidance sign assemblies per intersection approach in the same direction.

As shown on Figure 1 of the DT1903 form, the sign message **shall** consist of 4½-inch black block lettering on a non-reflective white background. Letter sizes and spacing **shall** conform to the standards in the FHWA Standard Highway Signs manual. Overall sign sizes used **shall** conform to the dimensions as shown on Figure 1 of the DT1903 form.

The WisDOT Region office reserves the right to remove non-conforming signs from the highway right-of-way. The owner *may* contact the WisDOT Region office to pick up any signs that have been removed. Upon pickup of the removed signs, the sign owner **shall** be responsible for sign removal costs.

Upon approval as a qualifying facility, the region *may* issue the permit Form DT1903, “AUTHORITY TO ERECT DIRECTIONAL SIGNS ON THE STATE HIGHWAY SYSTEM APPLICATION”. There is no permit fee.

Installation **shall** be by the requestor’s choice of a WisDOT approved signing contractor or county signing crew in accordance with Department signing standards as detailed on Figure 2 of the DT1903 form. All costs of sign manufacturing, installation, maintenance, and modification of assemblies **shall** be the responsibility of the requestor(s).

<u>Installation of White Arrow Board Signing by Counties</u>

1. If the sign is fabricated by the County, all charges **shall** be charged to the business. Installation costs **shall** be charged to project ID 0080-02-63.
2. New installation of the sign **shall** be $250 per sign with 4 x 6 treated posts. For removal and/or installation of 1 sign on existing posts the cost will be $100 per sign.
3. Requestor **shall** make checks payable to the Wisconsin Department of Transportation, attn: Jeannie Silver, 3609 Pierstorff St. Madison, WI 53703.
4. The county *should* only repair damaged white arrow boards when directed to do so by the sign owner.
5. All county costs for white arrow board sign repairs **shall** be charged to the 0080-02-63 project ID and appropriate invoicing **shall** be submitted to the requestor as outlined in items 2 and 3 above.

AUTHORITY TO ERECT DIRECTIONAL SIGNS ON THE STATE HIGHWAY SYSTEM APPLICATION

Wisconsin Department of Transportation (WisDOT)
DT1903 9/2015 (Replaces ET602)

Submit completed applications to Wisconsin Department of Transportation Regional Office

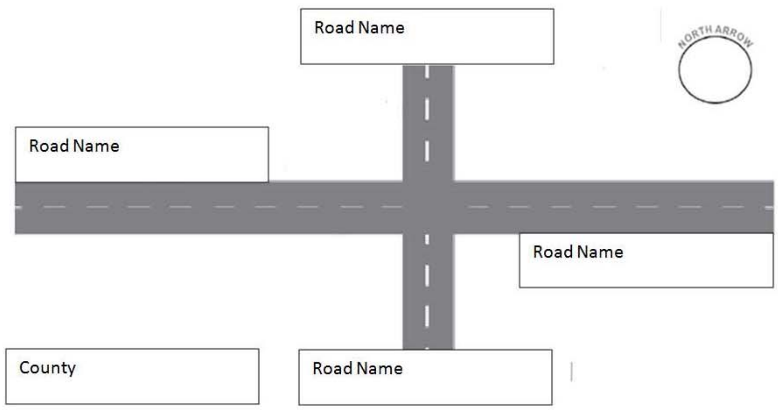
Business/Service/Activity Name for which White Arrow Board sign is Requested

Street	City	State	ZIP Code

Email Address	Phone Number

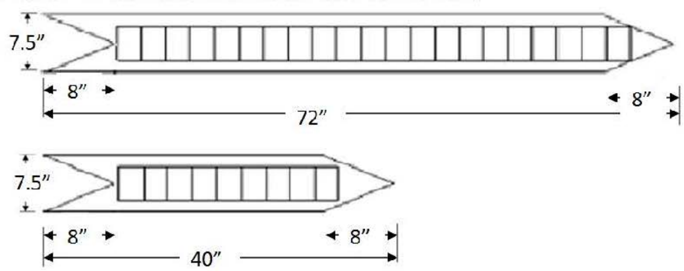
Proposed Sign Location Instructions

1. Label the intersecting roads.
2. Place an arrow in the circle pointing to the North.
3. Check (x) in the boxes corresponding to the proposed sign location.
4. Write the name of the county in the lower left corner.



Proposed Sign Wording

Fill in the name of the business. Limit the name to one character or space per box. Signs shall contain 4.5" black, block lettering on white background.



Number of Signs (select one):

- 1 Sign
- 2 Signs

Sign placed on (select one):

- New Posts
- Existing Posts

I apply for authority to erect and maintain guidance signs at the locations listed on this application. I certify and agree that these signs will conform to the approved design of the Wisconsin Department of Transportation and that I will comply with all the regulations under which authority these signs may be erected. I also certify that I will comply with the attached figures

X

Applicant Signature Date

X

WisDOT Region Signature Date

AUTHORITY TO ERECT DIRECTIONAL SIGNS ON THE STATE HIGHWAY SYSTEM APP *(continued)*

Wisconsin Department of Transportation DT1903

Sign Erection Regulations

Extracted from Chapter Trans 200, Wisconsin Administrative Code

Trans 200.02 Authority for the erection of signs.

1. The Department of Transportation or its authorized representatives in the case of the marked routes of state trunk highways, and local authorities with respect to highways under their exclusive jurisdiction, may place and maintain such traffic signs and signals as they deem necessary to warn, guide, inform, and regulate traffic, and also such signs and signals as are expressly permitted or required by the statutes or by these regulations, subject, however, to such limitations and restrictions as are contained in the statutes and these regulations.

2. The Department of Transportation with respect to the state trunk highway system, and local authorities with respect to highways under their jurisdiction, may erect or permit any department of the federal, state or local government to erect such standard signs as the Department of Transportation or local authorities deem necessary to inform and warn the public of federal or state laws, local ordinances and lawful regulations by any such department.

Trans 200.03 Guidance signs for resorts, hotels, county institutions, etc.

1. Any person or persons conducting a summer or winter resort, hotel, or any place of public entertainment or instruction, or any place of religious worship, or persons having charge of any county institution or of any scientific experiment for the furtherance of agriculture or other science or art may be permitted to erect guidance signs of a type approved by the Department subject to the conditions contained in this section.

2. No guidance sign may be permitted on freeways, including the national system of interstate highways.

3. Only where such institution or business location is removed from the state trunk highway system may such guidance signs be erected.

4. Such guidance signs may be erected at only two intersections of the state trunk highway system with county highways or town roads, and at such intersections of county or town highways as are deemed necessary by the local authorities having jurisdiction over those highways.

5. One sign of an approved size and shape may be erected at the entrance to any of the enumerated institutions or businesses.

6. No person may be permitted to erect or maintain a guidance sign on a highway if that person has any advertising in the vicinity of the intersection where the guidance sign is proposed to be erected or has a business sign under 200.06 on the same highway.

7. All guidance signs erected on any public highway shall be of a type and design approved by the Department. No flashing, illuminated, or reflecting signs or installation shall be permitted.

8. No guidance sign may be erected upon state trunk highway right of way at an intersection with the state trunk highway system until the location and manner of erection of the have the written approval of the Department. No guidance sign may be erected on the right of way of a county and town highway until the location and manner of erection of the sign have the written approval of the local authorities having jurisdiction over the said highway.

9. All guidance signs and their supports shall be maintained in good condition. **Signs or installations not satisfactorily maintained shall be removed by the officers in charge of the maintenance of the highway.**

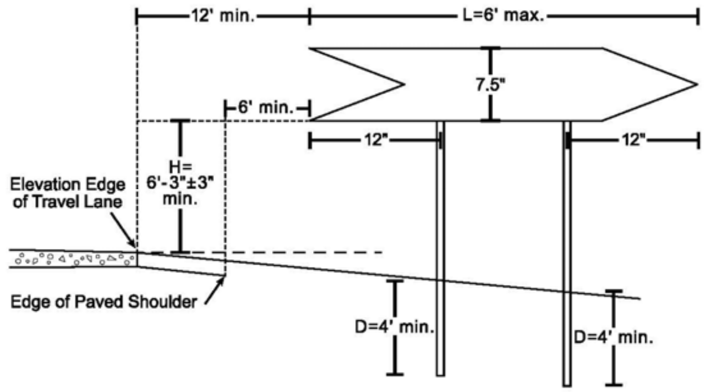
Trans 200.04 Prohibited signs and signals.

1. No person may erect, cause to be erected, permit to be erected or maintain any advertising, warning, route, guide, information, or regulatory sign or signal within the limits of any highway except as authorized in sections 200.02, 200.03, 200.05 or 200.06.

2. No person may place or maintain nor may any public authority permit upon any highway any official traffic control device bearing thereon any commercial advertising except as authorized in 200.06.

AUTHORITY TO ERECT DIRECTIONAL SIGNS ON THE STATE HIGHWAY SYSTEM APP *(continued)*
Wisconsin Department of Transportation DT1903

Figure 2. Typical Installation Detail for Arrow Board Signs
(Supplement to form DT1903)

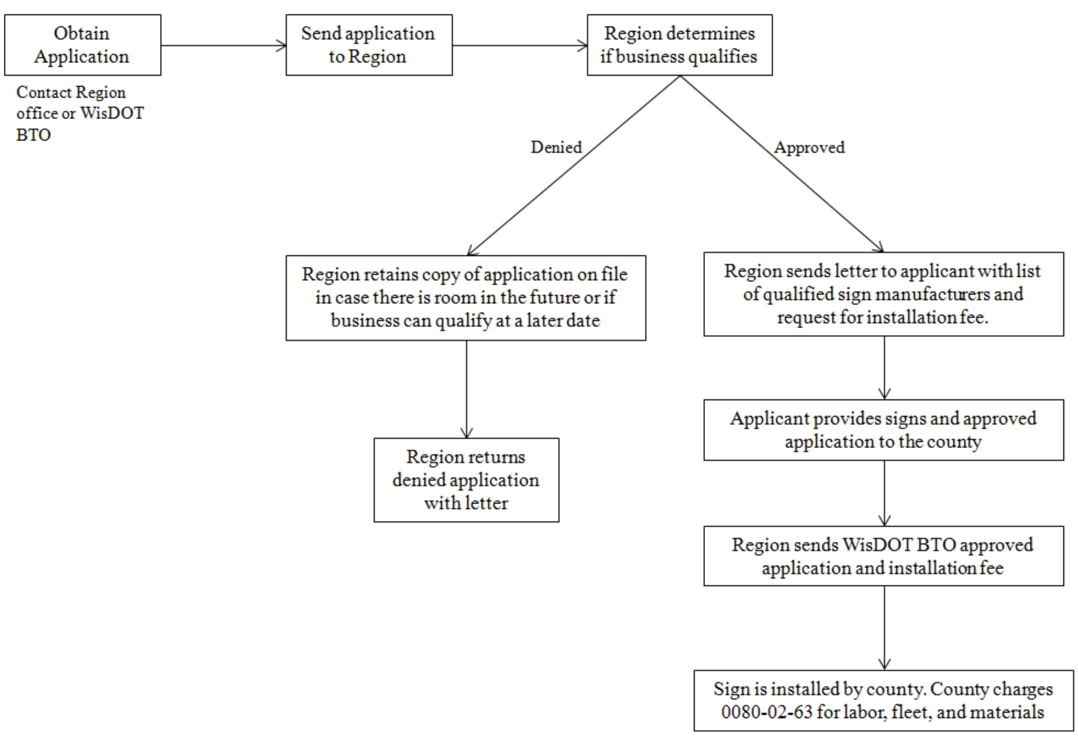


Sign Installation Requirements:

1. The Requestor **shall** contact the county highway department or WisDOT approved Signing Contractor for installation of the signs. Counties should charge all installation and repair costs to ID 0080-02-63. Counties will invoice charges to the requestor. Payment shall be made to: Wisconsin Department of Transportation, Attn: Jeannie Dammen, 3609 Pierstorff Street, Madison, WI 53704.
2. Signs are to be mounted per dimensions shown above.
3. Sign posts are to be treated wood 4 x 4's or 4 x 6's suitable for ground contact.
4. Signs less than 4 feet in length may be mounted on a single post; all other dimensions shown above apply.
5. Signs are to be mounted to project approximately 1 inch above the top of the post.
6. If multiple signs are "stacked" on the same posts, all signs are to be the same length. In this case, the minimum mounting height **shall** be 5' 3" for rural areas.
7. Sign assemblies **shall** be limited to a maximum of six signs per side.
8. There may be a maximum of two guidance sign assemblies per intersection approach in the same direction.
9. Contact Diggers Hotline prior to any excavation (800) 242-3500.
10. 7-Ply Highway Grade High Density Overlay Plywood (5/8") should be used for the sign base material.

The flow chart below describes the application process for a White Arrow Board.

White Arrow Board Process



2-15-61 Signing and Marking Maintenance of Roadside Facilities February 2017

PURPOSE

In addition to the roadways maintained by the Department, there are several types of ancillary facilities that are either constructed or maintained by the Department. This includes rest areas, SWEFs, waysides, park & ride lots, etc. These facilities *may* be maintained either by the Department, or by county or municipal forces via signed agreements. In the past, the maintenance of signs and pavement markings for these facilities has been inconsistent, due to lack of guidance as to how they *should* be maintained. This policy will clarify which signs and pavement markings are to be maintained by the Department, and how this maintenance **shall** be funded.

POLICY

Rest Areas

All rest area signing and pavement marking **shall** be maintained by the Department. All signs along the mainline highway **shall** be paid for either under the standard county RMA Project ID (00XX-01-65) or the appropriate improvement project. In addition, all signing along the exit ramp, up to and including the R8-74 (Cars, Trucks, Trailers, etc.) sign, and all signs along the entrance ramp beginning with the R1-2 (Yield) sign, **shall** also be paid for either under the standard county RMA Project ID or the appropriate improvement project. These signs **shall** be replaced as part of the normal sign replacement cycle.

All sign and pavement marking replacement within the rest area, between the R8-74 sign and the R1-2 sign, **shall** be paid for under the Rest Area maintenance Project ID, which will be provided by the Bureau of Highway Maintenance. These signs and pavement markings **shall** be maintained by the department, and *should* be replaced on the normal replacement cycle. The Region **shall** coordinate with BHM before replacing any signs or pavement markings within rest areas.

Waysides

All wayside signing and pavement marking **shall** be maintained by the Department. All signs along the mainline highway **shall** be paid for either under the standard county RMA Project ID or the appropriate improvement project. This includes any regulatory signs (R1-1, R5-1, R6-2, etc.) located at the wayside driveway. These signs **shall** be replaced as part of the normal sign replacement cycle.

All sign and pavement marking replacement within the wayside **shall** be paid for under the Wayside maintenance Project ID, which will be provided by the Bureau of Highway Maintenance. These signs and pavement markings **shall** be maintained by the department, and *should* be replaced on the normal replacement cycle. The Region **shall** coordinate with BHM before replacing any signs or pavement markings.

SWEFs (Safety and Weight Enforcement Facilities)

All SWEF signing **shall** be maintained by the Department. All signs and pavement markings along the mainline highway **shall** be paid for either under the standard county RMA Project ID or appropriate improvement project. The signs and pavement markings **shall** be replaced as part of the normal replacement cycle.

All sign and pavement marking replacement within the SWEF **shall** be paid for under the appropriate maintenance Project ID for that SWEF, which will be provided by the Bureau of Highway Maintenance. These signs **shall** be maintained by the department, and *should* be replaced on the normal replacement cycle. The Region **shall** coordinate with BHM before replacing any signs or pavement markings.

Park & Rides

The Department has several Park & Ride lots that were constructed under WisDOT LET projects, but that are maintained by either the county or municipality via signed agreement. The Region *should* read these agreements to verify which signs the Department is responsible for. This *may* include off-system directional (D4-series) signs. These signs **shall** be paid for either under the standard county RMA Project ID or the appropriate improvement project, and **shall** be replaced as part of the normal sign replacement cycle.

The Department also has several Park & Ride lots that do not have any such maintenance agreements. For these lots, all signs and pavement markings **shall** be maintained by the Department. These signs and pavement markings **shall** be paid for under the standard county RMA Project ID, and **shall** be replaced as part of the normal replacement cycle.

4-5-1 General Provisions ~~August 2013~~January 2018

GENERAL

Reference is made to the MUTCD Chapter 4L~~ and Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11)~~.

Flashing beacons (a.k.a. flashers, warning flashers, beacons~~, RRFBs hazard identification beacons~~) are a special type of signal indication used to supplement standard regulatory and warning signs. According to the MUTCD, flashing beacons have the following applications:

1. Intersection control beacon
2. Stop beacon
3. Speed limit sign beacon
4. Warning beacon.

Flashing beacons are considered to be part of a sign, as it pertains to the provisions for allowing the installation of the beacons on highway right-of-way. Statutes 84.02 (4)(c) and 86.19 (3) convey exclusive authority for signs and warning devices on the state trunk system to the department.

This policy contains provisions for proper application, design, and permitting of flashing beacons on the STH system.

POLICY

General

The following general criteria apply to all flashing beacon installations on the STH system:

1. There are two types of flashing beacons:
    a. Red—only to be used with STOP signs
    b. Yellow—to be used with any yellow warning (W-series) signs, speed limit, speed limit reduction, and school speed limit signs

    Flashing beacons **shall** only be associated with the sign installations referred to above.
2. Flashing beacons are supplementary to signs. When used, they **shall** be mounted on the same support as the sign which the beacon supplements in accordance with MUTCD 4L.03.
3. Activated flashing beacons **shall not** be approved on the STH system for use in conjunction with train crossings.
4. Emergency vehicle entrances *may* have activated flashing beacons, which will cancel after a pre-timed period of flash.
5. State-owned and permitted installations
    a. The department *may* determine that flashing beacons are needed and *may* install and maintain them at specific sites. In this case, the regional traffic engineer **shall** make a final determination regarding the use of these devices on behalf of the department.
    b. At locations where local authorities determine that the use of flashing beacons is desirable, a permit *may* be issued for the installation and maintenance of flashing beacons. Permitted installations are subject to the approval of the department and the conditions of this policy. Additionally, permits are revocable at the discretion of the department.

Application of Flashing Beacons

The following sections highlight policy items for flashing beacons that *may* be different from those represented in MUTCD Chapter 4L.

Warning beacon: Refer to MUTCD Section 4L.03~~ and to MUTCD – Interim Approval for Optional Use of~~

~~Rectangular Rapid Flashing Beacons (IA-11)~~.

Speed Limit Sign Beacon: Refer to MUTCD Section 4L.04. The department rarely, if ever, would install and maintain flashing beacons with speed limit signs or school speed limit signs. Local authorities **shall** follow the permit requirements stated below.

Stop Beacon: Refer to MUTCD Section 4L.05.

Flashing Beacon Design & Installation

The following provisions pertain to the installation, operation, and maintenance of flashing beacons other than rectangular rapid flashing beacons (RRFBs) on the state trunk highway system.

1. Location
    a. Ground mount: Flashing beacons *may* be ground mounted, where they will be approximately one foot above the sign they supplement. The sign *should* be in the lateral and vertical location as specified in the MUTCD Part 2 (no change). Illustrations of typical ground-mount installations are in Figure 1 below.
    b. Overhead mount: A flashing beacon *may* be mounted on one or both sides of an overhead sign. It *may* be mounted above the sign as long as the entire assembly including the sign has a minimum clearance of 17 feet.
2. For state-maintained installations, the standard size of flashing beacons is 12 inches in diameter. At the discretion of the regional traffic engineer, permitted (not state-maintained) installations that are located in areas with a posted speed less than 30mph *may* use 8-inch diameter beacons.
3. Ground-mounted supports **shall** be the same as are normally used to support the sign, and of the same cross-section as normally used. These **shall** be 4 x 4 or cross-drilled 4 x 6 posts, or in urban areas signal posts on concrete footings, or light poles or wood poles where speeds are low. Usage of any kind of pole **shall** be in conformance with the offsets specified in highway lighting permit policy, FDM 11-15-1.
4. The installation of two posts, one for the sign and the other for the flashing beacon, is not permissible within the clear zone because of the unpredictable behavior of the combination of two posts when struck.
5. Service poles must be offset to the right-of-way line or in conformance with offsets in FDM 11-15-1.
6. Service *may* drop to the top of the support, which would be extended to maintain an 18-foot minimum wire-to-ground clearance as per Wisconsin electrical code. Service *should* preferably be installed underground. In the latter case, the conduit **shall** be run up and attached to the post or pole. The control box *may* be mounted on the post or pole.
7. At the discretion of the regional traffic engineer, solar-powered flashing beacon installations *may* be allowed on the STH system provided the installation meets applicable electrical and crash standards.
8. According to TEOpS 2-1-8, flashing beacons and STOP or STOP AHEAD signs that incorporate flashing displays (e.g. blinker signs) **shall not** be used the same intersection approach.
9. ~~The following provisions pertain the installation, operation, and maintenance of rectangular rapid flashing beacons (RRFBs) on the state trunk highway system:~~
    a. ~~**Shall** be in compliance with the requirements established in Interim Approval IA-11~~
    b. ~~Poles **shall** be in conformance with the offsets specified in FDM 11-15-1.~~
    c. ~~Service *may* drop to the top of the support, which would be extended to maintain an 18-foot drop to the top of the support, which would be extended to maintain an 18-foot minimum wire-to-ground clearance as per Wisconsin electrical code. Service *should* preferably be installed underground. In the latter case, the conduit **shall** be run up and attached to the post or pole. The control box *may* be mounted on the post or pole.~~
    d. ~~At the discretion of the regional traffic engineer, solar-powered flashing beacon installations *may* be allowed on the STH system provided the installation meets applicable electrical and crash standards.~~

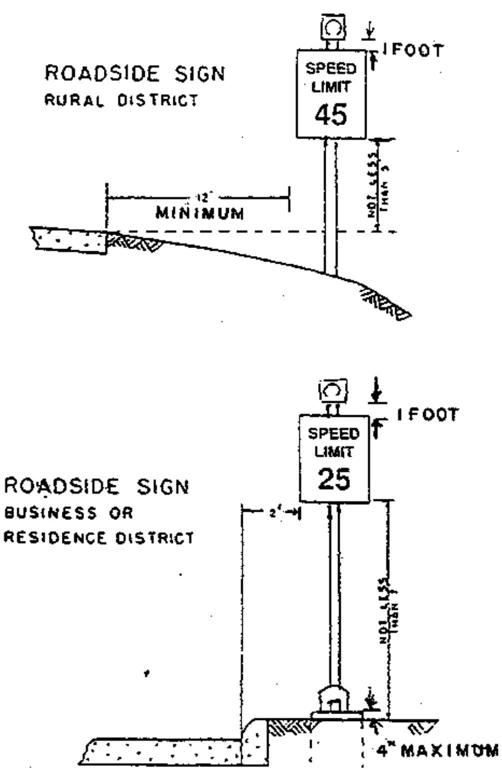
PERMITTING OF FLASHING BEACONS

Any improperly installed electrical equipment *may* pose a hazard to the general public. As such, the department spells out general and specific conditions, which are part of the permit agreement. These conditions are incorporated into the permit form, DT1877, a copy of which is appended to this policy. The MUTCD Chapter 4L and specific conditions stated above **shall** also be followed for flashing beacons installed on all state trunk highways. Flashing beacons installed on connecting highways **shall not** require a WisDOT permit.

The following information provides conditions and processes related to the issuance of permits:

1. Permit applications **shall** be received, and permits issued, by the appropriate regional office.
2. Permits for flashing beacons *may* only be issued to municipalities, not to private individuals at agencies, or to power companies. This *should* result in working with the most responsible and objective agency associated with the safety problem being addressed.
3. The region *may* rightfully deny the issuance of the permit. Reasons for denial *may* include: lack of need, conflict with other traffic control devices, vulnerable location, lack of confidence in the maintaining ability of the subject agency, or knowledge that the request is due to reaction rather than long term need of commitment.
4. The region *may* revoke the permit for any of the reasons above, especially in regard to lack of maintenance, as well as for reasons cited on the permit itself.
5. For permitted flashing beacons installed on signal standards, Standard Detail Drawings 9C2, 9C3, and 9E7 *should* be made part of the permit. SDDs 9C5 and 9D3 for control cabinet installations *may* also apply.
6. In the event of the reconstruction of the highway, reasonable notice *should* be given to the municipality to allow their removal of the equipment and arranging for disconnecting the electrical service.

Figure 1. Standard Flashing Beacon Installations for Rural & Urban Districts



FLASHING BEACON INSTALLATION APPLICATION/PERMIT

Wisconsin Department of Transportation

DT1877 6/2010 s.86.19(3) Wis. Stats.

Submit application in triplicate to Wisconsin Department of Transportation, Regional office.
Make separate application for each flasher or associated pair of flashers desired.
See conditions for installation of flashing beacon on next page(s).

Applicant - Municipality	Unit of Government (County, Town, City, Village)

Mailing Address	Date

Name of 24/7 Emergency Contact	Contact Area Code – Telephone Number	Cell or Pager Number

Description of Beacon				Mounting Height	Lateral Setback
	Incandescent	LED *	☐ Single	Feet	Feet From
Red	☐ 165 w	☐	☐ Pair-as separate installation		☐ Edge of Pavement
Yellow	☐ 116 w	☐	☐ Pair-as same installation for school speed limit signs only		☐ Face or Top of Curb

* If LED indications are used, they shall have an equivalent output to incandescent indications.

Location of Beacon	Facing	Reference to intersection, corporate limit, etc.
	☐ N ☐ E ☐ S ☐ W	

Associated Sign
☐ Stop ☐ Warning ☐ Speed Limit ☐ School ☐ Other

Reason for Erecting Beacon

Application is made for permission to install a flashing beacon as described above. It is understood and agreed that the design, installation and operation of the flashing beacon will comply with the regulations of the Wisconsin Department of Transportation, the State Electrical Code, local ordinances and regulations, as well as specific conditions stated on the next page(s).

The undersigned certifies that he/she is authorized to sign this application on behalf of the named unit of government.

(Authorized Representative) (Date)

(Title)

PERMIT APPROVAL

Permission is granted for the installation described above in compliance with the conditions specified.

Permit Number	Date Issued	Approved for Wisconsin Department of Transportation
FB-		x
		(Traffic Engineer) (Date)

4-5-2 Rectangular Rapid Flashing Beacons ~~August 2016~~January 2018

INTRODUCTION/GENERAL

~~Reference is made to the *FHWA Interim Approval for Optional use of Rectangular Rapid Flashing Beacons (IA-11).*~~

Rectangular Rapid Flashing Beacons (RRFBs) are a special type of beacon used to supplement pedestrian crossing signs at marked crosswalks. FHWA has rescinded FHWA Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11) for all new installations of RRFB devices effective December 21, 2017.

This policy contains provisions for proper application, design, and permitting of RRFBs on the STH system.

POLICY

General

As of December 21, 2017, the installation of any new or replacement RRFBs by any highway agency, including those agencies who received the FHWA's approval to use RRFBs under IA-11, **shall** be prohibited.

~~The following general criteria apply to all RRFB installations on the STH system:~~

1. ~~RRFB installations **shall** be in compliance with the requirements established in the *FHWA Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11).*~~
2. ~~On February 18, 2010, the Department obtained a blanket approval from the Federal Highway Administration (FHWA) for use of the interim approved device (RRFBs) on the state trunk system. This blanket approval does not cover connecting highways or local roads.~~
3. ~~RRFBs installed on connecting highways or local roads **shall** require approval by FHWA since these devices only have interim approval. The local municipality **shall** be responsible for contacting FHWA to receive approval and **shall** notify WisDOT if/when approval is received.~~
4. ~~State-owned and permitted installations:~~
   a. ~~The Department *may* determine that RRFBs are needed and *may* install and maintain them at specific sites. In this case, the Regional Traffic Engineer **shall** make a final determination regarding the use of these devices on behalf of the Department.~~
   b. ~~At locations where local authorities determine that the use of RRFBs is desirable, a permit *may* be issued for the installation and maintenance of RRFBs. Permitted installations are subject to the approval of the Department and the conditions of this policy. Additionally, permits are revocable at the discretion of the Department.~~

~~Location Criteria~~

~~It is recognized that the use of RRFBs *may* affect STH traffic operations by increasing delay and reducing mobility, especially if used near existing signalized or stop controlled intersections. The following location criteria should be met:~~

1. ~~The location is an uncontrolled pedestrian crossing.~~
2. ~~The following minimum volume* thresholds *should* be met:~~
   - ~~20 or more pedestrians during a single hour (any four consecutive 15-minute periods) of an average day, or~~
   - ~~18 or more pedestrians during each of any two hours of an average day, or~~
   - ~~15 or more pedestrians during each of any three hours of an average day.~~

~~* Young (<12), elderly (>85) and disable pedestrians count 2X toward volume thresholds. Additionally, seasonal day volumes can be used in place of average day volumes if the crossing is in a known tourist area.~~

3. ~~A minimum vehicular volume of 1,500 vehicles per day.~~
4. ~~Maximum of four lanes crossed, unless there is a raised median, in which case it can be five lanes.~~
5. ~~There exists a minimum of 300 feet between the subject crossing and the nearest controlled pedestrian crossing or intersection traffic control device on the state trunk highway system. Consideration *should* be~~

given to extending this distance beyond 300 feet if the proposed crosswalk location falls within an auxiliary turn lane for the nearby intersection or if the standing queue from the intersection extends over the proposed crosswalk location.

6. The approach speed is posted at 40 mph or less.

7. Adequate stopping sight distance exists based on FDM 11-10-5 or greater than 8 times the posted speed limit.

The use of RRFBs *may not* be appropriate at locations where this is a combination of both high traffic volumes and high pedestrian volumes. In these situations, there *may* be an increase in crashes and/or delay that make the use of the RRFB inappropriate. Instead a traffic signal or Pedestrian Hybrid Beacon (PHB) *should* be considered, if feasible.

Consideration *should* also be given to spacing between pedestrian crossings – both uncontrolled as well as those supplemented with RRFBs. RRFBs are highly visible and therefore can be confusing or distracting to drivers if there are too many within their field of vision at one time. Historically, 1,200 feet has been a rule of thumb for minimum spacing.

RRFB Design & Installation Requirements

The following provisions pertain to the installation, operation and maintenance of RRFBs on the state trunk highway system.

1. RRFB installations **shall** be in compliance with the requirements established in the *FHWA Interim Approval for Optional Use of Rectangular Rapid Flashing Beacons (IA-11).*

2. RRFBs within 200 feet of a railroad crossing *should* be interconnected to the railroad bungalow and pre-empted upon approach of a train. A sign stating "LIGHTS DON'T FLASH WHEN TRAIN IS APPROACHING" **shall** be installed above each push button and APS push buttons confirming this message *should* also be installed.

3. Poles **shall** be in conformance with horizontal offsets specified in FDM 11-15-1.

4. Service *may* drop to the top of the support, which would be extended to maintain an 18-foot minimum wire-to-ground clearance as per Wisconsin Electrical code. Service *should* preferably be installed underground. In the latter case the conduit **shall** be run up and attached to the post or pole. The control box *may* be mounted on the post or pole.

5. At the discretion of the Regional Traffic Signal Engineer, solar-powered RRFB installations *may* be allowed on the STH system provided the installation meets applicable electrical and crash standards.

6. Pedestrian push buttons **shall** conform to the push button location requirements in MUTCD 4E.08 and 4E.10.

7. The RRFB layout will vary depending on crossing type. Example RRFB layouts are in Figure 1 below.

PERMITTING OF FLASHING BEACONS

Any improperly installed electrical equipment *may* pose a hazard to the general public. As such, the Department spells out general and specific conditions, which are part of the permit agreement. These conditions are incorporated into the permit form, DT1877, a copy of which is appended to this policy. The *FHWA Interim Approval for Optional use of Rectangular Rapid Flashing Beacons (IA-11)* and specific conditions stated above **shall** also be followed for RRFBs installed on all state trunk highways. RRFBs installed on connecting highways **shall not** require a WisDOT permit.

The following information provides conditions and processes related to the issuance of permits.

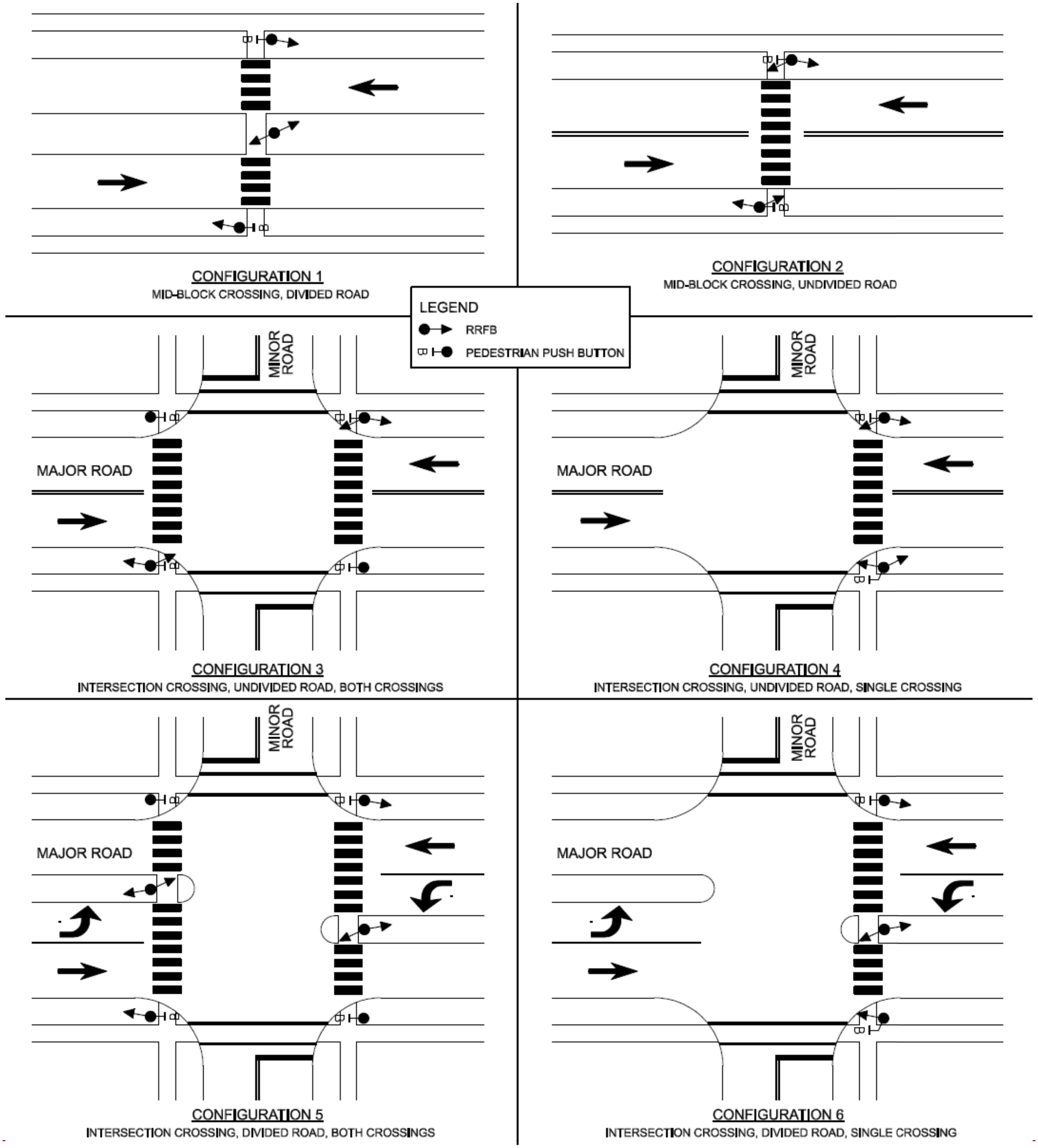
1. Permit applications **shall** be received by and permits issued by the appropriate Regional Office.

2. Permits for RRFBs *may* only be issued to municipalities, not to private individuals at agencies, or to power companies. This *should* result in working with the most responsible and objective agency associated with the safety problem being addressed.

3. The region *may* rightfully deny the issuance of the permit. Reasons for denial *may* include: lack of need; conflict with other traffic control devices; vulnerable location; lack of confidence in the maintaining ability of the subject agency; knowledge that the request is due to reaction rather than long term need of a safety countermeasure.

4. ~~The region *may* revoke the permit for any of the reasons above, especially in regard to lack of maintenance, as well as for reasons cited on the permit itself.~~
5. ~~For permitted RRFBs installed on signal standards, Standard Detail Drawings 9C2 and 9C3 *should* be made part of the permit.~~
6. ~~**In the event of the reconstruction of the highway, reasonable notice *should* be given to the municipality to allow their removal of the equipment and arranging for disconnecting the electrical service.**~~

Figure 1. ~~Typical RRFB Layouts~~



16-1-1 Overview **January 2018**

1.1 Originator

The Traffic Analysis and Safety Unit (TASU) within the Bureau of Traffic Operations (BTO) is the originator of this chapter. Submit all questions and comments concerning this chapter to the DOT Traffic Analysis & Modeling (DOTTrafficAnalysisModeling@dot.wi.gov) mailbox.

1.2 General

This chapter addresses the methodologies and tools for conducting traffic operations analyses for the evaluation and design of WisDOT facilities. Traffic operations analyses provide an assessment of how traffic demands for all modes of travel and the capacity of the facility affect the overall performance of the transportation system. The results of traffic operations analyses assist WisDOT in determining the best way to meet the department's goal of providing a safe, reliable and efficient multimodal transportation system.

There are multiple tools and methodologies for completing traffic operations analysis, each having their own set of capabilities and limitations. Selecting the appropriate analysis procedure and tool is not always intuitive and can prove challenging. The primary goal of this chapter is to address this challenge by providing guidance on the uniform and consistent application of the various traffic operations analysis tools, methodologies and procedures. The policy within this chapter does not cover the travel demand models (TDMs) used to generate traffic forecasts. Refer to the Transportation Planning Manual (TPM), Chapter 9 for additional details regarding traffic forecasting protocols.

1.3 Content

Attachment 1.1 provides an illustration (flow chart) outlining the process for the development and review of traffic models used to conduct traffic operations analyses. For cost-effective traffic analyses, project managers *should* refer to Attachment 1.1 as they develop the project schedules, budgets and management plans.

This chapter defines WisDOT's policy pertaining to traffic analysis tools and methodologies. Use the policy within this chapter in conjunction with WisDOT's Facilities Development Manual (FDM), specifically FDM 11-5-3.7. In the event the two documents provide conflicting information, contact BTO-TASU via the DOT Traffic Analysis & Modeling (DOTTrafficAnalysisModeling@dot.wi.gov) mailbox to confirm the controlling methodology.

1.4 Acronyms/Terminology

The key terms and acronyms used within this chapter include:

AADT – Average Annual Daily Traffic

BPED – Bureau of Planning and Economic Development

BSHP – Bureau of State Highway Programs

BTO – Bureau of Traffic Operations

CDR – Concept Definition Report

Department – Wisconsin Department of Transportation

DOT – Department of Transportation

DHV – Design Hour Volume

DTIM – Division of Transportation Investment Management

DTSD – Division of Transportation System Development

FDM – Facilities Development Manual

FHWA – Federal Highway Administration

GoF – Goodness of Fit

HCM – Highway Capacity Manual

HCM6 – Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis

LOS – Level of Service

Microsimulation – Microscopic traffic simulation. Tools using this methodology analyze the movement of individual vehicles as they travel through a simulated network on a second-by-second or sub-second basis.

MOEs – Measures of Effectiveness

O-D Matrix – Origin-Destination Matrix

PDAS – Program Development and Analysis Section (part of BSHP)

PMP – Project Management Plan

RFP – Request for Proposal

RTOR – Right-Turn on Red

TASU – Traffic Analysis and Safety Unit (part of BTO)

TAT III –Traffic Analysis Tool Box Volume III, published by FHWA

TAT IV - Traffic Analysis Tool Box Volume IV, published by FHWA

TDM – Travel demand models used to generate traffic forecasts

TEOpS – Traffic Engineering, Operations and Safety Manual

TFS – Traffic Forecasting Section (part of BPED)

TOPS Lab – University of Wisconsin, Madison Traffic Operations and Safety Laboratory

Traffic Models – the computer models used to carry out traffic operations analysis. These include both the HCM-based traffic analyses and microsimulation analyses. This does not include TDMs.

TSDM – Traffic Signal Design Manual

V-SPOC – WisTransPortal Volume, Speed and Occupancy Application Suite

WisDOT – Wisconsin Department of Transportation

LIST OF ATTACHMENTS

16-1-2 Basic Principles January 2018

2.1 Establish Project Purpose and Needs and Goals

The traffic analysis requirements for a project are highly dependent on the project goals. If the project goal is to provide a preliminary or planning level assessment of the traffic operations, then a higher-level analysis may suffice. If the goal of the project is to define project-specific design requirements, then a detailed analysis is often necessary.

Every project is unique, with its own set of assumptions and applicable methodologies. A clear understanding of the purpose, needs and goals of the project is critical in determining the necessary level of traffic analysis. When developing the project schedule and budget, consider the traffic analysis and modeling needs, including the associated peer review requirements. Ideally, the traffic analysis and modeling needs *should* dictate the schedule as opposed to having the project schedule dictate the level of traffic analysis conducted for the project. This ensures the appropriate level of traffic analysis is conducted at the most appropriate stage of the project life cycle, reducing the need for any rework. Defining the project schedule without consideration of the traffic analysis needs may compromise the integrity of the traffic models, which in turn may affect the selection of the project alternative.

The process defined within this chapter will be used to clarify the intent and intended outcome of the project and the associated traffic analysis needs while preparing the concept definition report (CDR), project management plan (PMP), request for proposal (RFP) and other project scoping documents. The key internal stakeholders, including the project team, regional traffic engineers and other pertinent staff, *should* hold a project kick-off meeting to reach internal agreement on key project goals and to define the traffic analysis needs early in the process.

2.2 Defining the Traffic Analysis Scope/Level of Effort

To provide clear guidance for the project and to ensure that the project goals and objectives are satisfied, the project team *should* address the following questions during the initial project kick-off meeting:

- What agencies/divisions/bureaus need to be involved in the project as it pertains to the traffic analysis (i.e., who are the intended stakeholders)? What will be their intended level of involvement (project resource, project review, traffic analysis, etc.)?
- In general, what is the purpose of the project, specifically as it pertains to the traffic analysis (i.e., what questions does the traffic analysis need to answer)?
- What type of process will the project address (planning, design, construction, etc.)?
- What type of study area will the project consider (corridor, intersection/interchange, highway segment, etc.)?
- What transportation components will the project address (travel modes, traffic control, facility type, etc.)?
- What types of outputs are important for the decision-making process? What are the intended deliverables? Is the purpose of the evaluation detailed technical assessment, visual animation or both?
- What transportation alternatives does the project need to consider? What evaluation criteria will the project apply?
- Are there any known/key issues about the study area? If so, how will the project address them?
- What are the schedule and budget constraints (including agency review needs) associated with this effort?
- What is the critical path for the project? Does the traffic analysis fall within the critical path? When will changes in the project scope/ purpose significantly affect the project schedule?

The facilitator of the kick-off meeting *should* use DT2290 to guide the discussion of the key aspects of the project, specifically as they pertain to the traffic analysis needs. Circulate the completed DT2290 form to the internal stakeholders immediately after the completion of the kick-off meeting and update the form as necessary as the project progresses. Although the DT2290 form *should* remain a fluid document, be cautious of unnecessary changes to the scope of the project and/or traffic model (i.e., watch out for scope creep).

2.3 Identify Need for Consultant Team

After defining the project goals, objectives and traffic analysis needs, the internal WisDOT project team *should* coordinate closely with the regional traffic operations staff to assess whether the region has the knowledge, time and resources available to conduct the anticipated level of traffic analysis required for the project. Oftentimes, the regional traffic operations staff can perform the simpler traffic analyses (such as the deterministic-HCM analyses) in-house while the more complex and/or demanding traffic analyses (such as the microscopic traffic simulation analyses) typically requires that the work be outsourced to one or more consultant firms.

If in need of consultant services, the internal WisDOT project team *should* follow the process outlined in FDM 8-5 to select and procure the consultant team(s) to perform the necessary traffic analyses for the project. Historically, BTO has maintained master contracts for general traffic engineering services (BTO01) and traffic modeling and analysis services (BTO03). Coordinate with BTO regarding the potential use of either of these master contracts.

After procuring the consultant team(s), the internal WisDOT stakeholders *should* meet with the selected consultant firm(s) to define/clarify their roles, tasks and tentative schedule. WisDOT *should* procure the consultant team(s) and host the traffic analysis kick-off meeting early on during the project process to allow the consultant(s) to provide input on the traffic analysis methodologies, including the identification of the appropriate traffic analysis tool(s). Refer to FDM 11-5-3.7 for details on defining the most appropriate traffic analysis tool(s).

2.4 Initiate Traffic Analyses

Follow the process illustrated in Attachment 1.1 to conduct the necessary traffic analyses. Refer to FDM 11-5-3.7 for details on defining the most appropriate traffic analysis tool(s) and analysis methodologies, TEOpS 16-20 for guidance on conducting microsimulation analyses and TEOpS 16-25 for details pertaining to conducting peer reviews. Details on other aspects of the traffic-model development process shown in Attachment 1.1 are forthcoming.

Coordinate with WisDOT regional traffic staff and/or BTO-TASU as necessary to address any questions/concerns regarding the traffic analyses tool(s), methodologies and/or results.

Attachment 1.1 Traffic Model Development & Review Process

Last Updated: June 29, 2017

List of Abbreviations

FHWA = Federal Highway Administration
BTO = Bureau of Traffic Operations – Traffic Analysis & Safety Unit
BSHP = Bureau of State Highway Programs (Program Development & Analysis
Forecasting = WisDOT Traffic Forecasting Section
DTSD PT = DTSD Project Team
RTO = Region Traffic Operations
RTM = Region Traffic Modeler
PRT = Peer Review Team
CT = Consultant Team
Indep. Consult. = Independent Consultant
CDR = Concept Definition Report
PMP = Project Management Plan
Sim. = Microscopic Simulation

NOTE

The timeline for each task will vary from one project to another depending on the project scope, project limits, & number of alternatives being analyzed. The Project Manager should establish project specific timelines for each task during the project definition/scoping stage.

LEGEND

- DTSD Project Team &/or DTSD Region Leads Task
- Bureau of Traffic Operations (BTO) – Leads Task
- WisDOT Traffic Forecasting Leads Task

1. DEFINE PROJECT

SECTION	ROLE
DTSD PT	Lead Role
DTSD Region	Coordinate with DTSD PT as Needed
FHWA (if applicable)	Review CDR &/or PMP

TASK(S)/GOAL(S)
i. Establish Project Need, Goals & Scope
ii. Identify Project Type & Need for FHWA Involvement
a) Standard/Routine
b) High Profile
c) Mega
iii. Prepare CDR &/or PMP

DELIVERABLE: Project Scope, Project Goals, CDR &/or PMP
TIME LINE: Up to 2 Weeks

Is it a Mega or High Profile Project and/or will it involve FHWA?
Yes → TRACKS A&B: Statewide Level Review (Requires Early Involvement of Statewide Bureaus)
No → TRACK C: Region Level Review (Obtain Input from Statewide Bureaus as Needed)

TRACKS A&B

2A-B. SELECT/PROCURE CONSULTANT TEAM (CT)

SECTION	ROLE
DTSD PT	Lead Role
DTSD Region	Coordinate with DTSD PT as Needed
BTO	Assist DTSD PT as Needed

TASK(S)/GOAL(S)
i. Identify Need for CT to Assist in Analysis of Project
ii. Define Roles/Tasks/Tentative Schedule for CT as applicable
a) Operational Analysis
b) Simulation Model Development &/or Review
c) Other Analysis, Travel Demand Model/Forecast Work, etc.
iii. Select/Procure CT as applicable

DELIVERABLE: Consultant Work Order - Contract
TIME LINE: Up to 6 Weeks

3A-B. DEVELOP DATA COLLECTION PLAN

SECTION	ROLE
DTSD PT	Lead Role
CT From Task 2A (if applicable)	Develop Data Collection Plan/Collect Data
DTSD Region/BTO	Coordinate/Assist DTSD PT as Needed

TASK(S)/GOAL(S)
i. Establish Data Sources & Needs & Define Data Collection Plan
ii. Initiate Data Collection (Data Collection To be Completed By Task 9A/9B)

DELIVERABLE: Data Collection Plan
TIME LINE: Up to 4 Weeks

4A-B. SELECT TRAFFIC ANALYSIS TOOL(S)

SECTION	ROLE
DTSD PT	Lead Role – Coordinate w/RTO & BTO
RTO	Provide Input to DTSD PT
BTO	Provide Input on Analysis Tool(s)
CT From Task 2A (if applicable)	Assist DTSD PT

TASK(S)/GOAL(S)
i. Assess Applicability of Various Analysis Tools
ii. Select Analysis Tool(s) Most Appropriate for Project
iii. DTSD PT/RTO to Prepare Memo on Analysis Tool Selection (To Be Submitted to BTO for Concurrence)

DELIVERABLE: Summary of Analysis Tool Selection Process
TIME LINE: Up to 2 Weeks

Is a Microscopic Simulation Model Proposed for Use?
Yes → TRACK A
No → TRACK B

TRACK A

5A. OUTLINE PROJECT PROCESS

SECTION	ROLE
DTSD PT/Region	Lead Role - w/Input from Statewide Bureaus
CT From Task 2A	Assist DTSD PT with Defining Timeline for Traffic Analysis Tool(s)/Model Development
BTO & RTO	Provide Input on Analysis Methodology
BSHP	Provide Input on Design Values
Forecasting	Provide Input on Forecasting Method
SEWRPC (if applicable)	Provide Input on Forecast Schedule/Method
MPOs (if applicable)	Provide Info on Local Concerns
FHWA (if applicable)	Provide Input on Federal Policy/Issues

TASK(S)/GOAL(S)
i. Discuss Timeline, Goals, Analysis Years, Design Hours, Alternatives
ii. Develop Summary/Outline of Proposed Process, Complete DT2290

DELIVERABLE: Defined Project Process & DT2290
TIME LINE: Up to 2 Weeks

6A. ESTABLISH PEER REVIEW TEAM (PRT)

SECTION	ROLE
DTSD PT/Region	Lead Role – Coordinate w/BTO
BTO	Assist With Indep. Consult. Contract, Member of PRT
RTM or Indep. Consult.	Lead PRT
Region Traffic Ops, BSHP, & Forecasting	Member of PRT
MPOs (if applicable)	Provide Input on Local Concerns

TASK(S)/GOAL(S)
i. Identify PRT Members
ii. Select/Procure Independent Consultant (If Needed)
iii. Define Roles/Schedule for Peer Review

DELIVERABLE: Peer Review Members & Process
TIME LINE: Up to 2 Weeks

7B. INITIATE TRAFFIC FORECAST REQUEST

SECTION	ROLE
DTSD PT/Region	Lead Role
Forecasting & SEWRPC (if applicable)	Provide Input on Data Needs & Schedule for Forecast Development

TASK(S)/GOAL(S)
i. Identify Types of Forecasts, Alternatives, Forecast Years, & Design Hours
ii. Request Forecast Results & Trip Tables (Complete/Submit DT1601)

DELIVERABLE: DT1601
TIME LINE: Up to 2 Weeks

8A. DEVELOP WISDOT TRAFFIC FORECAST

SECTION	ROLE
Forecasting – Central Office	Lead Role
Forecasting – SE Region	Lead Role in SE Region
SEWRPC (if applicable)	Develop Forecast - SE Region

TASK(S)/GOAL(S)
i. Develop Forecast per DT1601 or Review/Approve Forecast per DT1594
ii. Provide Trip Tables as Requested/Needed

DELIVERABLE: Completed/ Approved Forecast
TIME LINE: Varies, See DT1601

9A. RUN OPERATIONAL/ALTERNATIVE ANALYSES

SECTION	ROLE
CT From Task 2A	Lead Role
DTSD PT/Region	Oversee CT's Work
RTO	Review CT's Work
BTO & Statewide Bureaus	Provide Assistance as Needed

TASK(S)/GOAL(S)
i. Run Operational Analysis Utilizing Analysis Tool Selected in Task 4A (Paramics, HCS, Synchro, etc.) for Base & Future/Alternative Scenarios
ii. Prepare Report/Memo Summarizing Analysis Results

DELIVERABLE: Summary of Operational Analyses
TIME LINE: Up to 3 Weeks per Alternative

10A. DEVELOP/CALIBRATE SIMULATION MODEL

SECTION	ROLE
CT Selected in Task 2A	Lead Role
RTM or RTO	Review CT's Work
DTSD PT/Region	Provide Project Oversight

TASK(S)/GOAL(S)
i. Run Base Case Using Sim. Model Selected in Task 4A
ii. Calibrate Base Case to Actual Volumes/Validate
iii. Revise Base Case as Needed per Task 11A
iv. Run Future/Alternative Case(s) & Revise as Needed per Task 10A

DELIVERABLE: Calibrated/ Validated Simulation Model(s)
TIME LINE: Up to 6 Weeks per Alternative

Additional Runs

11A. INDEPENDENT PEER REVIEW (TEOpS 16-25)

SECTION	ROLE
RTM or Indep. Consult. From 6A	Lead Review of Simulation Model, Report to PRT
DTSD PT/Region	Oversee Peer Review Process
WisDOT PRT From 5A	Assist in Peer Review as Needed

TASK(S)/GOAL(S)
i. Conduct Independent Peer Review of Analysis Conducted in Task 9A & Task 10A for Base Scenario
ii. After Approval of Base, Review Future/Alt. Scenario Analysis & Model
iii. Complete DT2291 & DT1887 as applicable

DELIVERABLE: DT2291 & DT1887 as applicable
TIME LINE: Up to 8 Weeks per Alternative

12A. DELIVER FINAL ANALYSIS/REPORT

SECTION	ROLE
CT Selected in Task 2A	Lead Role
DTSD PT	Provide Input as Needed

TASK(S)/GOAL(S)
i. Prepare Summary of Analysis/Calibration Method, Assumptions & Results
ii. Save Final Report & Analysis in WisDOT Project File

DELIVERABLE: Final Calibration/ Analysis Report
TIME LINE: Up to 3 Weeks

TRACK B

5B. OUTLINE PROJECT PROCESS

SECTION	ROLE
DTSD PT/Region	Lead Role
CT From Task 2B (if applicable) &/or RTO	Define Timeline for Traffic Analysis Tool(s)/Model Develop., Provide Input on Analysis Methodology
Statewide Bureaus	Provide Input As Needed
SEWRPC (if applicable)	Provide Input on Forecast Schedule/Method
MPOs (if applicable)	Provide Info on Local Concerns
FHWA (if applicable)	Provide Input on Federal Policy/Issues

TASK(S)/GOAL(S)
i. Discuss Timeline, Goals, Analysis Years, Design Hours, Alternatives
ii. Develop Summary/Outline of Proposed Process, Complete DT2290

DELIVERABLE: Defined Project Process & DT2290
TIME LINE: Up to 2 Weeks

6B. ESTABLISH PEER REVIEW TEAM (PRT)

SECTION	ROLE
DTSD PT/Region	Lead Role
BTO	Assist With Indep. Consult. Contract and PRT As Needed
RTM or Indep. Consult.	Lead PRT
RTO	Member of PRT
BSHP & Forecasting	Assist PRT As Needed
MPOs (if applicable)	Provide Input on Local Concerns

TASK(S)/GOAL(S)
i. Identify PRT Members
ii. Select/Procure Independent Consultant (If Needed)
iii. Define Roles/Schedule for Peer Review

DELIVERABLE: Peer Review Members & Process
TIME LINE: Up to 2 Weeks

7B. INITIATE TRAFFIC FORECAST REQUEST

SECTION	ROLE
DTSD PT/Region	Lead Role
Forecasting & SEWRPC (if applicable)	Provide Input on Data Needs & Schedule for Forecast Development

TASK(S)/GOAL(S)
i. Identify Types of Forecasts, Alternatives, Forecast Years, & Design Hours
ii. Request Forecast Results & Trip Tables (Complete/Submit DT1601)

DELIVERABLE: DT1601
TIME LINE: Up to 2 Weeks

8B. DEVELOP WISDOT TRAFFIC FORECAST

SECTION	ROLE
Forecasting – Central Office	Lead Role
Forecasting – SE Region	Lead Role in SE Region
SEWRPC (if applicable)	Develop Forecast - SE Region

TASK(S)/GOAL(S)
i. Develop Forecast per DT1601 or Review/Approve Forecast per DT1594
ii. Provide Trip Tables as Requested/Needed

DELIVERABLE: Completed/ Approved Forecast
TIME LINE: Varies, See DT1601

9B. RUN OPERATIONAL/ALTERNATIVE ANALYSES

SECTION	ROLE
CT From Task 2B	Lead Role
DTSD PT/Region	Oversee CT's Work
RTO	Provide Input on Analysis Methodology
BTO & Statewide Bureaus	Provide Assistance as Needed

TASK(S)/GOAL(S)
i. Run Operational Analysis Utilizing Analysis Tool Selected in Task 4B (HCS, Synchro, Sidra, etc.) for Base & Future/Alternative Scenarios
ii. Prepare Report/Memo Summarizing Analysis Results

DELIVERABLE: Summary of Operational Analyses
TIME LINE: Up to 3 Weeks per Alternative

11B. DTSD PROJECT TEAM/PEER REVIEW (TEOpS 16-25)

SECTION	ROLE
RTM or Indep. Consult. From 6B	Lead Review of Analysis, Report to PRT
DTSD PT/Region	Oversee Peer Review Process
RTO	Assist in Peer Review as Needed
WisDOT PRT From 5B	Provide Input as Needed

TASK(S)/GOAL(S)
i. Conduct Independent Peer Review of Operational Analysis Conducted in Task 9B for Base Scenario
ii. After Approval of Base, Review Future/Alternative Scenario Analysis
iii. Complete DT1887

DELIVERABLE: DT1887
TIME LINE: Up to 4 Weeks per Alternative

12B. DELIVER FINAL ANALYSIS/REPORT

SECTION	ROLE
DTSD PT &/or CT Selected in Task 2B	Lead Role

TASK(S)/GOAL(S)
i. Prepare Summary of Analysis Method, Assumptions & Results
ii. Save Final Report & Analysis in WisDOT Project File

DELIVERABLE: Final Analysis Report
TIME LINE: Up to 3 Weeks

TRACK C

2C (Optional). SELECT/PROCURE CONSULTANT TEAM (CT) - AS NEEDED

SECTION	ROLE
DTSD PT	Lead Role
DTSD Region	Coordinate with DTSD PT as Needed
RTO	Assist DTSD PT as Needed

TASK(S)/GOAL(S)
i. Identify Need for CT to Assist in Analysis of Project
ii. Define Roles/Tasks/Tentative Schedule for CT as applicable
a) Operational Analysis
b) Simulation Model Development &/or Review
iii. Select/Procure CT as applicable

DELIVERABLE: Consultant Work Order - Contract
TIME LINE: Up to 6 Weeks

3C. DEVELOP DATA COLLECTION PLAN

SECTION	ROLE
DTSD PT	Lead Role
CT From Task 2C (if applicable)	Develop Data Collection Plan/Collect Data
DTSD Region/BTO	Coordinate/Assist DTSD PT as Needed

TASK(S)/GOAL(S)
i. Establish Data Sources & Needs & Define Data Collection Plan
ii. Initiate Data Collection (Data Collection To be Completed By Task 9C)

DELIVERABLE: Data Collection Plan
TIME LINE: Up to 4 Weeks

4C. SELECT TRAFFIC ANALYSIS TOOL(S)

SECTION	ROLE
DTSD PT	Lead Role – Coordinate w/RTO
RTO	Provide Input to DTSD PT
BTO	If Requested, Provide Input on Analysis Tool(s)
CT From 2C (if applicable)	Assist DTSD PT

TASK(S)/GOAL(S)
i. Assess Applicability of Various Analysis Tools
ii. Select Analysis Tool(s) Most Appropriate for Project
iii. DTSD PT/RTO to Prepare Memo on Analysis Tool Selection (To Be Submitted to BTO for Concurrence)

DELIVERABLE: Summary of Analysis Tool Selection Process
TIME LINE: Up to 2 Weeks

5C. OUTLINE PROJECT PROCESS

SECTION	ROLE
DTSD PT/Region	Lead Role
CT From Task 2C (if applicable) &/or RTO	Define Timeline for Traffic Analysis Tool(s)/Model Develop., Provide Input on Analysis Methodology
Statewide Bureaus	Provide Input As Needed
SEWRPC (if applicable)	Provide Input on Forecast Schedule/Method
MPOs (if applicable)	Provide Info on Local Concerns
FHWA (if applicable)	Provide Input on Federal Policy/Issues

TASK(S)/GOAL(S)
i. Discuss Timeline, Goals, Analysis Years, Design Hours, Alternatives
ii. Develop Summary/Outline of Proposed Process, Complete DT2290

DELIVERABLE: Defined Project Process & DT2290
TIME LINE: Up to 2 Weeks

7C. INITIATE TRAFFIC FORECAST REQUEST

SECTION	ROLE
DTSD PT/Region	Lead Role
Forecasting & SEWRPC (if applicable)	Provide Input on Data Needs & Schedule for Forecast Development

TASK(S)/GOAL(S)
i. Identify Types of Forecasts, Alternatives, Forecast Years, & Design Hours
ii. Request Forecast Results & Trip Tables (Complete/Submit DT1601)

DELIVERABLE: DT1601
TIME LINE: Up to 2 Weeks

8C. DEVELOP WISDOT TRAFFIC FORECAST

SECTION	ROLE
Forecasting – Central Office	Lead Role
Forecasting – SE Region	Lead Role in SE Region
SEWRPC (if applicable)	Develop Forecast - SE Region

TASK(S)/GOAL(S)
i. Develop Forecast per DT1601 or Review/Approve Forecast per DT1594
ii. Provide Trip Tables as Requested/Needed

DELIVERABLE: Completed/ Approved Forecast
TIME LINE: Varies, See DT1601

9C. RUN OPERATIONAL/ALTERNATIVE ANALYSES

SECTION	ROLE
RTO &/or CT From Task 2C	Lead Role
DTSD PT/Region	Oversee Analysis
Statewide Bureaus	Provide Assistance as Needed

TASK(S)/GOAL(S)
i. Run Operational Analysis Utilizing Analysis Tool Selected in Task 4C (HCS, Synchro, Sidra, etc.) for Base & Future/Alternative Scenarios
ii. Prepare Report/Memo Summarizing Analysis Results

DELIVERABLE: Summary of Operational Analyses
TIME LINE: Up to 3 Weeks per Alternative

Is a Microscopic Simulation Model Proposed for Use?
Yes → 10C
No → 11C

10C. DEVELOP/CALIBRATE SIMULATION MODEL

SECTION	ROLE
CT Selected in Task 2C	Lead Role
RTM &/or RTO	Oversee CT's Work
DTSD PT/Region	Provide Project Oversight

TASK(S)/GOAL(S)
i. Run Base Case Using Sim. Model Selected in Task 4C
ii. Calibrate Base Case to Actual Volumes/Validate
iii. Revise Base Case as Needed per Task 11C
iv. Run Future/Alternative Case(s) & Revise as Needed per Task 11C

DELIVERABLE: Calibrated/ Validated Simulation Model(s)
TIME LINE: Up to 6 Weeks per Alternative

Additional Runs

11C. DTSD PROJECT TEAM/REGION REVIEW (See TEOpS 16-25)

SECTION	ROLE
RTO	Lead Review of Analysis, Reports to DTSD PT
DTSD PT/Region	Oversees Review
Statewide Bureaus	Assists in Review as Needed

TASK(S)/GOAL(S)
i. Conduct Review of Operational Analysis Developed in Task 9C & if applicable Task 10C for Base Scenario
ii. After Approval of Base, Review Future/Alternative Scenario Analysis & Model (if applicable)
iii. Complete DT2291 & DT1887 as applicable

DELIVERABLE: DT2291 & DT1887 as applicable
TIME LINE: Up to 4 Weeks per Alternative

12C. DELIVER FINAL ANALYSIS/REPORT

SECTION	ROLE
DTSD Project Team &/or CT Selected in Task 2C	Lead Role

TASK(S)/GOAL(S)
i. Prepare Summary of Analysis/Calibration Method, Assumptions & Results
ii. Save Final Report & Analysis in WisDOT Project File

DELIVERABLE: Final Calibration/ Analysis Report
TIME LINE: Up to 3 Weeks

16-15-1 Basic Principles — January 2018

The Highway Capacity Manual (HCM) provides several analytical or deterministic tools that can estimate roadway or intersection capacity, delay, density, and other performance measures for various elements of the street and highway system. The HCM also includes procedures for evaluating bicycle, pedestrian, and transit facilities. In most cases, the HCM is the standard for traffic analysis in the US; its methods are generally reliable and have been well-tested through significant validation efforts. The Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis (HCM6) (1) is the most current version of the HCM.

The HCM6 consists of the following four volumes:

- Volume 1: Concepts
- Volume 2: Uninterrupted Flow
- Volume 3: Interrupted Flow
- Volume 4: Applications Guide (a web-based document, requires a user account)

Each chapter within Volume 2 and Volume 3 of HCM6 has six or more sections covering the following topics: introduction, concepts, methodology, extensions to the methodology, applications and references. The methodology section (typically Section 3) highlights the scope, strengths and limitations of the applicable HCM methodology, and as such, serves as a good reference when determining whether use of the HCM methodology is appropriate. Additional guidance as to when an alternative (non-HCM based) analysis methodology may be appropriate is provided in HCM6, Volume 1, Chapter 7.

The HCM procedures are good for analyzing the performance of isolated and non-congested facilities, but do have limitations. For example, the HCM models cannot account for interactions between network elements (e.g., they cannot reflect the effect of a queue backup at a ramp terminal on the adjacent freeway operations) and they may under-predict the extent of congestion in oversaturated conditions. Consider the strengths and limitations of the HCM methods when selecting the methodology to apply to a particular analysis or study. (See Section 3 of the applicable HCM chapter to identify the strengths and weaknesses of the HCM methodology.) Document the rationale for choosing the selected traffic analysis methodology (HCM-based, microsimulation, etc.) in the Traffic Analysis Tool Selection memoranda and submit to the WisDOT regional traffic staff for approval.

FDM 11-5-3.7 provides a brief description of when and how to apply the HCM methodologies and identifies the WisDOT-supported programs that implement the HCM methodology.

16-15-5 Signalized Intersections — January 2018

5.1 Introduction

Refer to FDM 11-5-3.7 for general guidance on conducting deterministic analysis at signalized intersections. When conducting capacity analysis for signalized intersections, apply the basic signal parameters as outlined in the following section in conjunction with the analysis methodologies outlined in FDM 11-5-3.7.

5.2 Basic Parameters for Capacity Analysis

TSDM 3-2-2 provides recommended parameters to use for the general analysis of state-owned signals; including minimum and maximum green times, pedestrian phase times and cycle lengths. The following provides updated direction for the use of right-turn on red (RTOR) and saturation flow rate. Unless noted otherwise, the policy within this section supersedes the guidance provided in TSDM 3-2-2. If it is unclear which guidance to follow, contact BTO-TASU via the DOT Traffic Analysis & Modeling (DOTTrafficAnalysisModeling@dot.wi.gov) mailbox for clarification.

5.2.1 Right-Turn on Red (RTOR)

5.2.1.1 Background

Right-turns made while facing a red traffic signal indication, permitted under Wisconsin statute 346.37(1)(c)3, can have a beneficial effect on traffic flow and intersection capacity as they reduce the number of vehicles serviced during the green phase. The following section describes how to apply RTOR when conducting capacity analysis for signalized intersections.

5.2.1.2 Dedicated Right-Turn Lanes

Since vehicles making other movements (through or left-turns) *may* block right-turn access at shared left-through-right (LTR) or shared through-right lanes, WisDOT has only investigated RTOR volumes at locations with dedicated right-turn lanes. For the purposes of RTOR inclusion in capacity analyses, a dedicated right-turn lane is any lane that satisfies at least one of the following criteria:

- Pavement markings and/or signage clearly show the lane is dedicated for a right-turn only movement
- Field observations indicate that the lane functions as a de-facto right-turn only lane (requires approval from WisDOT regional traffic staff)
- Subject approach flares out at the intersection such that a right-turning vehicle can safely fit beside a through vehicle within the same lane and field observations show vehicles using the approach flare to make right turns (requires approval from WisDOT regional traffic staff)

Additionally, for RTOR inclusion to be applicable for capacity analysis, the following must exist:

- Right-turns on red are permissible (i.e., field signage does not prohibit this maneuver during the analysis period)
- Vehicle queuing from the adjacent lane does not prevent vehicles wishing to make a right-turn from accessing the dedicated (or de-facto) right-turn lane

For additional clarification, as to what constitutes a right-turn lane for purposes of capacity analysis at signalized intersections, contact the WisDOT regional traffic engineer and or BTO-TASU.

5.2.1.3 RTOR Estimation

An estimate of the proportion of vehicles making RTOR from a dedicated right-turn lane is most accurate when derived from field counts taken at the intersection in question. As it is not always practical to gather this information, WisDOT developed the following recommendations regarding RTOR volumes (V_{RTOR}) in relation to total right-turn demand (V_{RT}):

- <u>Single Right-Turn Lanes at Intersections:</u> $V_{RTOR} = 0.38V_{RT}$ [Equation 5.1]
- <u>Single Right-Turn Lanes at Interchanges:</u> $V_{RTOR} = 0.66V_{RT}$ [Equation 5.2]
- <u>Dual Right-Turn Lanes (Intersections and Interchanges):</u> $V_{RTOR} = 0.30V_{RT}$ [Equation 5.3]

Field studies conducted throughout Wisconsin in 2009 (2) and 2015 (3) guided the development of these recommendations. WisDOT has not studied RTOR at any other intersection configuration, such as shared lanes or triple right-turn lanes, thus unless intersection-specific field data is available to indicate otherwise, the analyst *should* assume that vehicles do not make RTOR movements at these locations. Obtain approval from WisDOT regional traffic staff prior to including RTOR volumes for triple right-turn lanes or shared lanes within the capacity analysis.

The analyst **shall not** use RTOR volumes in the analysis when field signage prohibits this maneuver during the analysis period.

5.2.1.4 RTOR Application

Highway Capacity Software (HCS) and Synchro are the two WisDOT-supported HCM-based software programs for both traffic signal analysis and signal optimization (see FDM 11-5-3.7). HCS uses the same module for both HCM-compliant analysis and for signal optimization. Synchro, however, uses two distinct modules – one which provides HCM-compliant analysis and another which provides signal optimization as well as non-HCM-compliant analysis. The later module uses a proprietary methodology to calculate intersection delay and other values. Changes made in one module do not necessarily transfer to the other module. Therefore, there are nuances in how to conduct HCM-compliant analysis and signal optimization in Synchro which are not present in HCS.

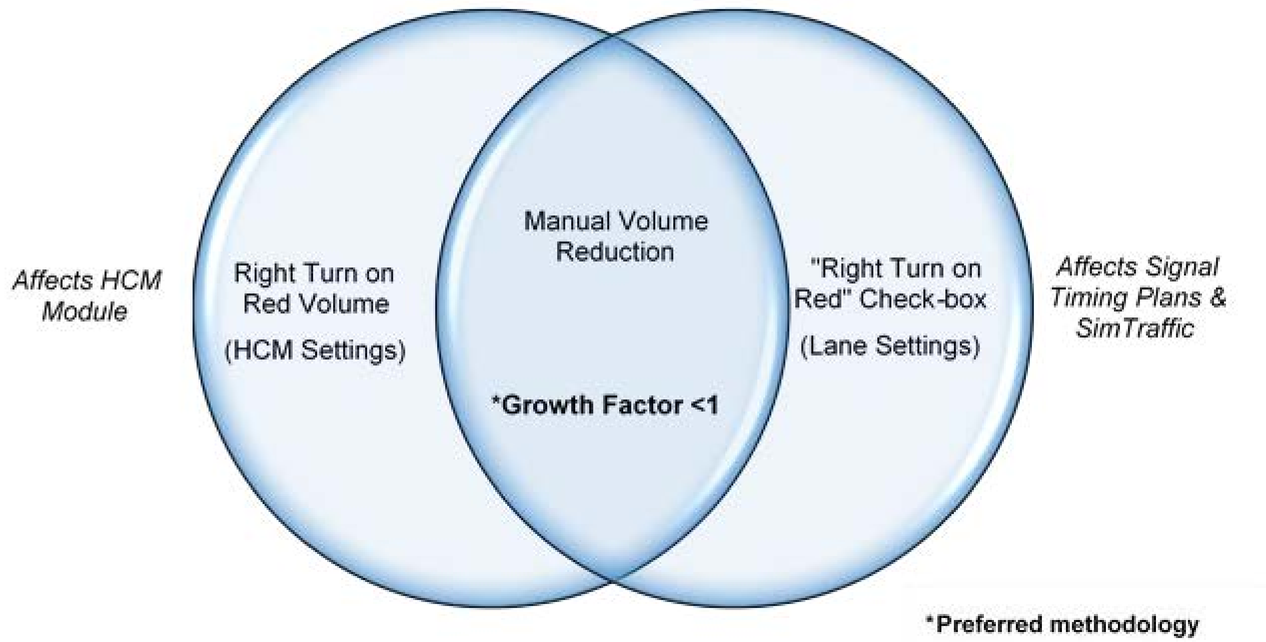
Figure 5.1 provides an overview of the various methodologies available for affecting RTOR in the two modules of Synchro. A subset of the methodologies, those which adjust demand, affect both Synchro modules. As noted in the figure, the “growth factor” method is the preferred methodology when the analyst is using Synchro to conduct HCM-compliant analysis and signal optimization. This methodology involves applying a growth factor of less than one to the right turn movements. Apply the following growth factors, derived from Equations 5.1-5.3, unless field data is available and supports otherwise:

- 0.62 for Single Right-Turn Lanes at Intersections

- 0.34 for Single Right-Turn Lanes at Interchanges
- 0.70 for Dual Right-Turn Lanes (Intersections and Interchanges)

The other methodology to affect both modules in Synchro is to manually reduce the right-turn volumes by the V_{RTOR}. This is less transparent when conducting a peer review and is more prone to typographical error. Therefore, WisDOT prefers the use of the growth factor method in all situations.

Figure 5.1 Synchro RTOR Adjustments Venn Diagram



5.2.1.4.1 HCM-Compliant Analysis

WisDOT provides the following guidance on incorporating RTOR volumes when conducting HCM-compliant analysis. The RTOR volumes used may be based on field-collected values or the equations above (see Equations 5.1 – 5.3).

- HCS: Enter the V_{RTOR}, rounded to the nearest whole vehicle per hour (veh/h), into the “RTOR, veh/h” field for the relevant approaches. This field is at the bottom of the “Primary Input Data” within the HCS “Streets” module, which includes traffic signal analysis.
- Synchro: Use the growth factor method outlined above. Checking the “Right Turn on Red” box in the “Lane Settings” area **does not** affect the HCM-compliant analysis.

Entering the V_{RTOR} value associated with the approach into the “Right Turn on Red Volume” field in the Synchro HCM module is also acceptable, though WisDOT does not prefer this method as it only affects the HCM module. The analyst **shall not** enter a volume other than the default of 0 into the “Right Turn on Red Volume” field in combination with the growth factor method, as it will lead to incorrect results.

5.2.1.4.2 Signal Optimization

In Synchro, changes to the “Right Turn on Red Volume” field in the HCM module do not affect the signal timings or optimization calculations. If the analyst checks a box to allow RTOR within the “Lane Settings” module (automatically checked by default), Synchro uses an algorithm to determine a “Saturated Flow Rate (RTOR)”. Synchro uses the “Saturated Flow Rate (RTOR)” value within the signal optimization function. The RTOR checkbox does not affect the HCM results. Synchro’s proprietary RTOR methodology, enabled via the RTOR checkbox, is not straightforward and is thus not a preferred methodology for developing signal timing plans. When optimizing signals, the analyst *should* uncheck the RTOR box checkbox for all approaches.

WisDOT prefers the use of the growth factor method for conducting signal optimization in Synchro.

5.2.1.4.3 Microsimulation Analysis

WisDOT also currently supports three microsimulation software programs for traffic signal analysis: SimTraffic (associated with Synchro, affected by demand reductions but not by changes within the HCM module), Paramics, and Vissim although, effective January 1, 2018, WisDOT will no longer support for Paramics for new microsimulation analyses (see FDM 11-5-3.7.1.4). The analyst *should not* dictate RTOR volumes within microsimulation programs, as the models *should* determine when these turns happen based on how the right-turning vehicles interact with other vehicles in the system. Where right-turns at signals are critical movements, a good check for reasonableness could be comparing modeled RTOR volumes to field-collected ones. The analyst *should* direct any questions regarding how to model RTOR within a specific microsimulation software program to BTO-TASU via the DOT Traffic Analysis & Modeling (DOTTrafficAnalysisModeling@dot.wi.gov) mailbox.

5.2.2 Saturation Flow Rate

5.2.2.1 Background

One of the many variables that influence the performance of traffic signals is saturation flow (sat. flow) rate. The base saturation flow rate for a lane is the theoretical number of vehicles that could travel through the intersection during one hour of green time under ideal conditions. The saturation headway, or the average time between the front bumper of one vehicle and the front bumper of the vehicle behind it under ideal conditions, determines the saturation flow rate. The HCM6 default values for base saturation flow rate are:

- 1900 passenger cars per hour per lane (pc/h/ln) in metropolitan areas with population >250,000
- 1750 pc/h/ln otherwise

The HCM provides several factors to adjust these base saturation flow rates to account for prevailing conditions at the approach, including heavy vehicle percentages, grade, lane width, etc. More information on flow rate concepts is available in HCM6, Chapters 4 and Chapters 19.

Through movements at signalized intersections typically have high volumes relative to other movements, and therefore have an oversized role in determining the overall timing and phasing, as well as level of service (LOS). Therefore, this policy focuses on the saturation flow rate for through lanes. Additional guidance on the saturation flow rate for left and right turn lanes is forthcoming.

5.2.2.2 Saturation Flow Rate Methodology

A field saturation flow study at an intersection will provide the most accurate measure of experienced flow rates on its approaches. Given the expense, it *may* not be practical to conduct these studies, especially at locations that are operating significantly under capacity.

Since it is impractical to conduct field studies for every intersection and in an effort to gain a better understanding of the range of saturation flow rates, WisDOT funded a study in 2015 to evaluate saturation flow rates at various signalized intersections across the state (3). The study aimed to identify the variables, beyond those already accounted for by the HCM, which influenced the field saturation flow rates. The study followed the methodology laid out in the HCM and only collected data on the saturation flow rate for through lanes.

The 2015 WisDOT sat. flow study (3) found that the following three factors affect the base saturation flow rate of a through lane at a signalized intersection: the urbanized area or cluster population, the total number of approach lanes (left, through and right), and the posted speed limit of the approach. Accordingly, the base saturation flow rate *may* differ from one approach to the next at a given signalized intersection. The field conditions or traffic signal design dictate the total number of approach lanes and the posted speed limit of the approach. The urbanized area or cluster population information is available from either the table or map provided by the 2010 Census Bureau.

WisDOT used the results of this study to develop a methodology to estimate the base saturation flow rate for through lanes at signalized intersections in Wisconsin. Since the methodology accounts for more variables and reflects Wisconsin-specific data, analyst *should* use the WisDOT sat. flow methodology as described below to estimate the base saturation flow rate for through lanes at signalized intersections in Wisconsin. If the WisDOT estimation methodology results in a sat. flow rate less than the relevant HCM default value, specifically if it is less than 1750 pc/h/ln, the analyst *should* consider completing a field study or using the HCM6 default values.

Coordinate with WisDOT regional traffic staff to determine the most appropriate methodology for calculating the base saturation flow rate for through lanes. Unless instructed otherwise, use the HCM default values for the base saturation flow rate for left and right turn lanes.

5.2.2.3 Saturation Flow Rate Estimation

Use the WisDOT sat. flow spreadsheet (a Microsoft Excel based spreadsheet) or the adjustment factors shown in Table 5.1 to implement the WisDOT sat. flow methodology. The WisDOT sat. flow spreadsheet implements equations to apply the various site-specific adjustments in the same general form as HCM6 and calculates the base sat. flow rate by approach.

In lieu of the WisDOT sat. flow spreadsheet, the analyst *may* use the adjustment factors shown in Table 5.1 in conjunction with a starting saturation flow rate value of 1980 pc/h/ln (derived from the 2015 WisDOT sat. flow study (3)) and the following equation:

$$s_0 = 1980 \times f_{Pop} \times f_N \times f_{SL} \qquad \text{[Equation 5.4]}$$

Where:

$s_0 = Base\ saturation\ flow\ rate$

$f_{Pop} = Adjustment\ factor\ for\ population$

$f_N = Adjustment\ factor\ for\ number\ of\ approach\ lanes$

$f_{SL} = Adjustment\ factor\ for\ speed\ limit\ of\ approach$

As with the WisDOT sat. flow spreadsheet, apply the adjustment factors at the approach level.

An example of how to apply the adjustment factors for saturation flow rate follows:

A signalized intersection is in a city with a population of 29,000 (f_{Pop} = 0.95). Looking at an approach with a left-turn lane, two through lanes, and two right-turn lanes (five total approach lanes, so f_N = 0.97) and a posted speed limit of 40 MPH (f_{SL} = 1.00), the resulting base saturation flow rate would be:

$$s_0 = 1980 \times 0.95 \times 0.97 \times 1.00 \qquad s_0 = 1825 \text{ pc/h/ln}$$

Use the resulting S_0, or base saturation flow rate (1825 pc/h/ln), for operational analysis of the two through lanes on this approach. Unless instructed otherwise, use the HCM default values for the left and right turn lanes. Calculate the base saturation flow rate for the other approaches in a similar manner.

Table 5.1 WisDOT Saturation Flow Adjustment Factors

Population Adjustment Factor	
Urbanized Area/ Cluster Population	**Adjustment Factor**
< 2,000	0.91
2,000 - 4,499	0.92
4,500 - 8,999	0.93
9,000 - 18,999	0.94
19,000 - 39,999	0.95
40,000 - 82,999	0.96
83,000 - 170,499	0.97
170,500 - 347,499	0.98
347,500 - 704,499	0.99
≥ 704,500	1.00

Lane Adjustment Factor	
Total # Approach Lanes	**Adjustment Factor**
1	0.88
2	0.94
3	0.96
4	0.97
5	0.97
6	0.98
≥7	0.98

Speed Adjustment Factor	
Posted Speed Limit of Approach (mph)	**Adjustment Factor**
25	0.94
30	0.96
35	0.98
40	1.00
45	1.02
50	1.04
55	1.07

Since the WisDOT sat. flow methodology calculates a Wisconsin, site-specific base saturation flow rate; the analyst *should* apply all other HCM adjustment factors, including the Central Business District (CBD) adjustment factor, as appropriate to calculate the final adjusted sat. flow rate. It is important to note that the WisDOT sat. flow estimation methodology applies only to exclusive through lanes and shared through-right lanes, as these two types of through lanes were the only ones included in the 2015 study.

5.2.2.4 Saturation Flow Rate Application

5.2.2.4.1 HCM-Compliant Analysis and Signal Timing Plan Development

As detailed in FDM 11-5-3.7.3.1, WisDOT currently supports two HCM-based software programs for traffic signal analysis, HCS and Synchro. WisDOT provides the following guidance on entering base saturation flow rates generated from the WisDOT sat. flow methodology.

- HCS: Enter the base saturation flow rate, rounded to the nearest 5 pc/h/ln, into the "Saturation, pc/h/ln" field for the relevant approaches. This field is in the "Traffic" section within the HCS "Streets" module, which includes traffic signal analysis.
- Synchro: In the HCM module, used to generate fully HCM-compliant results, enter the base saturation flow rate, rounded to the nearest 5 vehicles per hour per lane (vphpl), into the "Ideal Satd. Flow (vphpl)" field for the relevant approaches. Alternately, edit this field through the "Lane Settings" module – changes made there carry through to the HCM module.

5.2.2.4.2 Microsimulation Analysis

Capacity is not typically an explicit input within microsimulation programs, as it will vary based on vehicle interactions and various parameters. Since headway dictates saturation flow rate and because each microsimulation program has one or more adjustable parameters characterizing the concept of headway, adjustments to these settings will increase or decrease potential and realized capacities. The analyst *should* calibrate each signalized intersection, ensuring that applicable validation thresholds are met and that field behavior is replicated adequately. Direct any questions regarding how to apply saturation flow rate within a specific microsimulation software program to BTO-TASU via the DOT Traffic Analysis & Modeling (DOTTrafficAnalysisModeling@dot.wi.gov) mailbox.

16-15-70 References — January 2018

1. **Transportation Research Board.** *Highway Capacity Manual, 6th Edition: A Guide For Multimodal Mobility Analysis.* Washington, D.C. : National Academy of Sciences, 2016. ISBN 978-0-309-36997-8.

2. **R.A. Smith National.** *Right Turn on Red Methodology Evaluation.* 2009.

3. **TranSmart Technologies, Inc.** *Signalized Intersection Capacity Data Collection: A Statewide Evaluation of Saturation Flow Rate and Right Turn on Red.* 2015.

16-20-1 Basic Principles — January 2018

1.1 Introduction

Microscopic traffic simulation, or microsimulation, refers to traffic analysis tools that analyze the movement of individual vehicles as they travel through a network. As the simulation progresses, it updates factors such as the vehicle's position and its need to increase/decrease speed or change lanes several times a second. Accordingly, these tools are suitable for evaluating the interaction of different components of the transportation network, such as queues from an intersection that cause lane blockages upstream or complex weaving and merging behaviors. Additionally, the visual animation of traffic flows can make microsimulation traffic models useful for public outreach and stakeholder presentations. Typical situations where microsimulation traffic analysis *may* be appropriate include scenarios that macroscopic tools cannot or do not address well, such as:

- Complex weaving along freeways and/or arterials
- Arterial and freeway interaction (e.g., spill-back from an arterial onto the freeway at an exit ramp)
- Non-traditional or alternative interchange/intersection analysis (e.g., diverging diamond interchanges and continuous flow intersections)
- Turn-lane spillover
- Oversaturated conditions
- Signal and roundabout interaction
- Vehicle/transit/pedestrian interaction

The primary purpose of traffic modeling is to simulate the transportation system under various volume and geometric conditions to assess what (if any) improvements are necessary. Most often, the models represent projected (or future) traffic conditions. Although analysts typically use traffic models to assess the impact of potential capacity/expansion improvements, they can also use microsimulation models to assess non-expansion improvements such as managed lanes, channelization optimizations (e.g., removing shared lane movements), and additional transit service.

WisDOT supports the use of microsimulation traffic models; however, it is important to match the analysis methods with the scale, complexity and technical requirements of the project. Microsimulation modeling work typically requires significantly more time, data and effort than other traffic analysis tools. Thus, prior to selecting microsimulation as the analysis tool, the project team *should* assess whether less resource-intensive traffic analysis tools can sufficiently meet the needs of the project. The project team *should* also consider the project schedule and budget to ensure that they can adequately accommodate the development and review of the microsimulation traffic models. FDM 11-5-3.7 provides additional information and guidance on selecting the most appropriate traffic analysis tool(s).

1.2 Calibration vs. Validation

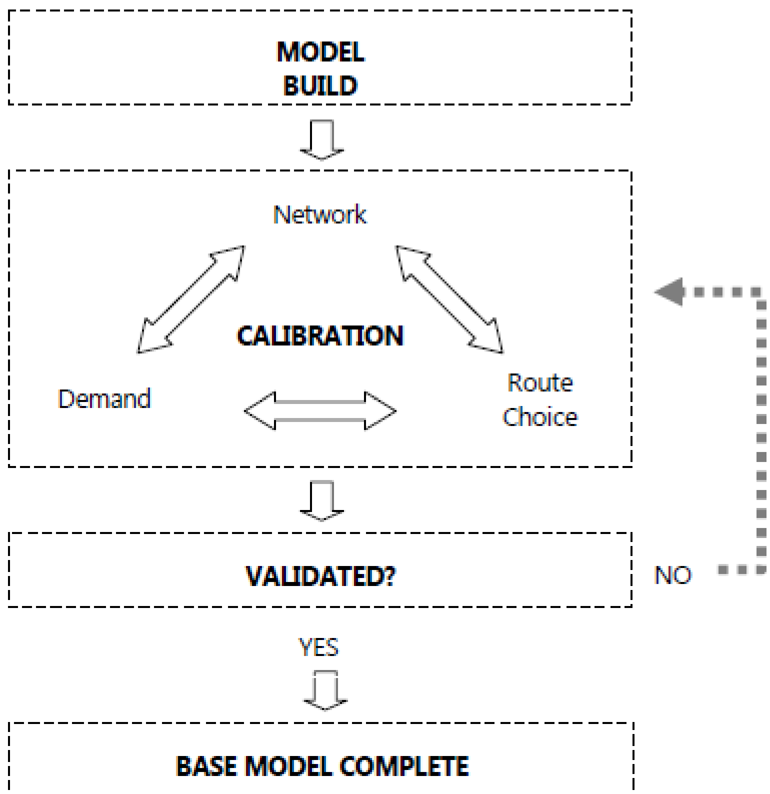
Microsimulation models contain multiple parameters that the analyst can modify to reflect varying degrees of driver behavior, vehicle characteristics and roadway conditions. Developing a traffic model with a reasonably accurate representation of real-world local traffic conditions requires calibration and validation of the model where, for purposes of WisDOT policy, calibration and validation have the following definitions.

Calibration: The process where the analyst adjusts selected input parameters within the traffic model (typically driver behavior elements such as headway and reaction times, driver aggressiveness, etc. and roadway elements such as sign posting) such that the traffic model represents field conditions. See TEOpS 16-20-5 for additional details on the calibration process.

Validation: The independent process where the analyst checks the traffic model outputs against field measured data including, but not limited to, traffic volumes, travel speeds, travel times, intersection queuing and trip-making patterns (e.g., weaving volumes). See TEOpS 16-20-8 for additional details on the validation process.

Calibration and validation are part of an iterative cycle. If, after the initial round of calibration, the model results do not satisfy the validation thresholds, the analyst must conduct additional model calibration and recheck the updated model results against the validation targets. This process continues until the model results meet the validation targets and the traffic model has reached a level of fidelity that is acceptable. Figure 1.1, taken from the New South Wales (NSW) Government Transport Roads & Maritime Services (RMS) 2013 *Traffic Modelling Guidelines* (1), illustrates the iterative relationship between model calibration and validation.

Figure 1.1 Traffic Model Calibration and Validation Process



Source: NSW Transport Roads & Maritime Services 2013 *Traffic Modelling Guidelines*, Figure 11.3 (1)

1.3 Purpose of Calibration & Validation

The process of developing a microsimulation model starts with an existing conditions model and then transitions into the development of various scenarios representing future-year alternatives. The only way to determine that a traffic model reasonably represents real-world traffic conditions is to compare the existing conditions traffic model to traffic conditions observed in the field. If the existing conditions traffic model cannot reproduce the existing traffic conditions with a reasonable degree of accuracy, then analyses of other scenarios will be highly suspect. Therefore, prior to using the model outputs for project or study decisions, especially any related to critical aspects of the design, the analyst **shall** calibrate and validate the microsimulation traffic model in accordance with TEOpS 16-20-5 and TEOpS 16-20-8, respectively. Additionally, the traffic model *should* undergo the peer review process in accordance with TEOpS 16-25, prior to the commencement of work on any other traffic model scenarios or alternatives (e.g., design year no-build traffic model). Conducting the peer review process at the proper time will limit the potential of needing to modify multiple models to address reviewer comments.

After completion of the calibration, validation and peer review processes, the analyst can use the existing conditions model as the starting point for future-year alternative models. Most of the parameters calibrated in the existing conditions model *should* be transferable to the future-year models; however, the analyst *may* need to modify some parameters to account for changes in roadway geometry and/or associated driver behavior. The calibration, validation and peer review processes (TEOpS 16-20-5, TEOpS 16-20-8 and TEOpS 16-25, respectively) are applicable for all future-year model alternatives and the analyst *should* apply them as appropriate.

16-20-2 Traffic Model Development January 2018

2.1 Traffic Model Boundaries

Confusion about the purpose, objectives or physical boundaries of the traffic model can cause delays and other potential problems such as:

- Misunderstandings or ambiguities regarding the purpose/objectives of the traffic modeling effort
- Mission creep or unplanned expansion of the traffic model that could delay the delivery of results, such as unexpected enlargement of the geographical boundaries
- Misapplication of the traffic model (e.g., attempting to use the traffic model at a level of detail for which it was never intended)
- Inappropriate sequencing of activities (e.g., starting to develop the build scenarios before the existing conditions traffic model has been properly calibrated and validated)

Although the above problems can apply to all types of traffic analyses, the complexities associated with microsimulation traffic models only exacerbate the issues. To ensure that there is a clear understanding of the traffic analysis requirements, the project team **shall** work with WisDOT regional traffic staff to define the preliminary traffic model boundaries. After coordinating with WisDOT regional traffic staff, the project team *should* organize a meeting with other key stakeholders to finalize the traffic model boundaries and review/update the DT2290 Traffic Model Scope form as appropriate. In addition to the meeting, it *may* be beneficial to conduct an organized visit to the site to familiarize the team with the current traffic conditions/issues.

Typically, the traffic analysis kick-off meeting will include only those internal stakeholders, and applicable consultant team representatives, who will be involved in the development and/or review of the traffic model. It *may* be beneficial to promote early involvement with the Bureau of Traffic Operations – Traffic Analysis and Safety Unit (BTO-TASU) and the Federal Highway Administration (FHWA), as appropriate, by inviting them to this initial meeting. This is especially true for mega projects, high profile projects and FHWA Projects of Division Interest (PoDI). At a minimum, the project team **shall** invite the FHWA Wisconsin Division Operations Program Manager to the initial kick-off meeting for any interstate project that has a scope of work greater than pavement replacement. Refer to the FHWA/WisDOT "Risk-Based Project Stewardship and Oversight Agreement", provided in FDM 11-5-2-1, for details on FHWA and WisDOT stewardship and oversight of federal-aid projects.

Refer to TEOpS 16-25-2 for additional guidance on determining who *should* participate in the review of the traffic model. In general, BTO-TASU **shall** be involved with the review of all models where FHWA participation is desired or required. It is also advisable to include BTO-TASU when dealing with new, unique or complex modeling concepts or analysis tools, especially if the region does not have the necessary knowledge and/or resources. Direct any questions regarding the need to involve BTO-TASU to the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

After the traffic-analysis kick-off meeting and any site visits, key stakeholders, including the consultant team as applicable, *should* have a good grasp on the following:

- Purpose and objective of the traffic model(s)
- Traffic issues/concerns for the study area
- Applicable traffic analysis method(s) and tool(s)
- Temporal and spatial boundaries of the traffic model(s)
- Analysis scenarios (e.g., existing, no-build, build, etc.)
- Potential data needs and sources

If, after the meeting, there are still components of the DT2290 form that are unknown, the project team *should* coordinate further discussions between WisDOT regional traffic staff, the traffic analyst (i.e., consultant team) and BTO-TASU as appropriate. The following provides additional details on how to define the model limits (spatial and temporal) and analysis scenarios.

2.1.1 Traffic Model Spatial Limits

The limits of the microsimulation traffic model *should* encompass not only the limits of the specific transportation project under study, but it *should* also include all parts of the surrounding transportation network (or zone of influence) that may significantly influence the operations of the study area. When setting the limits of the traffic model, the analyst *should* consider the potential impact of planned/proposed roadway improvement projects and/or strategies, especially if the future improvement may result in a shift in travel patterns. Other adjacent and/or nearby improvement projects may have a significant impact on the spatial limits of the traffic model, especially if the projects are proceeding concurrently (e.g., the traffic model *may* need to be extended to incorporate the adjacent projects or portions of the traffic model may overlap with the model of an adjacent project, etc.). Thus, it is critical to have early coordination with any adjacent and/or nearby projects.

Where practically feasible, the spatial boundaries of the traffic model *should* capture all congestion, existing and future, in the area. Where it is not possible to capture the congestion spatially, evaluate whether extending the temporal limits of the model will allow the traffic model to reflect the traffic congestion (see TEOpS 16-25-2.1.2). In situations where resource or other constraints prevent the traffic model from being extended (spatially or temporally) to allow for the capture of all congestion, coordinate with WisDOT regional traffic staff and other key stakeholders (BTO-TASU, FHWA, etc.) as appropriate to set the traffic model limits. Include discussion on the potential risk of not being able to identify the full extent of congestion for future/alternative scenarios until after completion of the existing conditions model. All key stakeholders *should* agree on the approach to use to compensate for any congestion that occurs outside the established model limits. Initial discussions on the spatial limits of the traffic model *should* occur during project scoping.

The analyst *should* take care not to extend the model limits out further than necessary, as the larger the model, the more complex and time-consuming it will be to calibrate and validate. One-way to measure the complexity of the traffic model is to consider the size of its origin-destination (O-D) matrix, which represents each location (or zone) where vehicles can enter or exit the model. The O-D matrix increases with the square of the number of traffic zones included in a model: a 25-zone model has 625 O-D pairs (25X25 = 625) while a 50-zone model has 2,500 O-D pairs (50X50 = 2,500). Every O-D pair added to the traffic model adds additional time to the network coding, calibration and validation process. Therefore, depending on the size of the study area, it *may* make more sense to break the traffic model into two or more smaller models rather than to develop one large model. (Coordinate with WisDOT regional traffic staff and/or BTO-TASU to assess whether to break one large model into smaller models.) All boundaries of the traffic model *should* occur at logical break points in the roadway network (e.g., locations where the traffic volumes naturally drop-off or locations where traffic attributes such as travel speeds normalize or return to free-flow speeds). Avoid breaking the model at critical study area locations (e.g., avoid breaking the model in the middle of a complex weaving segment between two large interchanges).

Depending on the operational characteristics, it is possible for the limits of the traffic model to extend beyond the end of the project termini. Additionally, microsimulation analysis *may* only be necessary for a portion of the project study area such that the limits of the microsimulation model are smaller than the project limits. For example, if a project study area encompasses three interchanges (interchange A, B and C), of which only one (interchange A) involves complex weaving maneuvers and requires microsimulation analyses, the limits of the microsimulation model would only need to extend far enough to capture the weaving traffic behavior at interchange A. The analyst could then use an HCM-based analysis tool to evaluate the traffic conditions at interchanges B and C. Due to this variability, there is no standard set of guidance for determining the spatial limits of a traffic model. Rather, the geographical boundaries for a microsimulation traffic model needs to be determined on a project-by-project basis. FHWA's *Traffic Analysis Toolbox Volume III (TAT III)*(2) provides some general guidance on determining the spatial limits for a microsimulation model.

The analyst *should not* finalize the spatial limits of the traffic model until field observations document the extent of congestion and length of vehicle queues within the study area. Provide a brief discussion of the geographical traffic model boundaries within DT2290. Document all assumptions and methods regarding the geographical limits for the traffic model within the modeling methodology report and/or other project memoranda as appropriate.

2.1.2 Temporal Model Limits

The temporal limits of the traffic model are dependent on the location of the project and the experienced levels of congestion, and therefore, must be determined on a project-by-project basis. Some general guidance on defining the temporal model limits follows.

2.1.2.1 Temporal Analysis Periods

Depending on the purpose and objectives of the project, the microsimulation traffic model *may* need to address two or more temporal analysis periods (TAPs) where each TAP could encompass anywhere from one to six or more consecutive hours. Typical TAPs addressed with microsimulation models include, but are not limited to the following:

AM Peak Period (AM):	This typically comprises of one or two hours of each weekday between 6 a.m. and 9 a.m., although in severely congested areas it could comprise of four or more hours.
Midday Peak Period (MD):	This period is relevant in areas where traffic patterns peak in the non-traditional commuting hours such as a school or restaurant district. If applicable, it typically is one hour between 11 a.m. and 3 p.m.
PM Peak Period (PM):	This typically comprises of two or three hours of each weekday between 4 p.m. and 7 p.m., although in severely congested areas it could comprise of six or more hours.
Friday Peak Period (Fri):	This period is relevant in areas that experience higher traffic patterns during the Friday peak period versus the typical weekday commute, typically due to the combination of both commuter and recreational traffic.
Sunday Peak Period (Sun):	This period is relevant in areas where there is higher traffic than the typical weekday commute on a Sunday afternoon/early evening as travelers return home from a recreational weekend trip.
Seasonal/Special Event (SP):	This period is relevant in areas that experience unusual traffic patterns due to holidays, tourism and/or special events. This *may* coincide with the Friday and/or Sunday peak period.

The length of the TAP is dependent on extent of congestion in the study area. Although the TAP will vary depending on local field conditions, FHWA's TAT III (2) and TAT IV (3) provide general guidance for determining the appropriate TAPs for a traffic model.

When selecting the TAPs, consider existing field data for traffic volumes, speeds and queues, along with anticipated future traffic volumes and levels of congestion. Where practically feasible, the TAP *should* encompass the entire extent of the congestion (existing and future). If it is not feasible to extend the TAP to capture all congestion, coordinate with WisDOT regional traffic staff and other key stakeholders (BTO-TASU, FHWA, etc.) as appropriate to set the TAPs. Include discussion on the potential risk of not being able to identify the full extent of congestion for future/alternative scenarios until after completion of the existing conditions model. All key stakeholders *should* agree on the approach to use to compensate for any congestion that occurs outside the established TAPs.

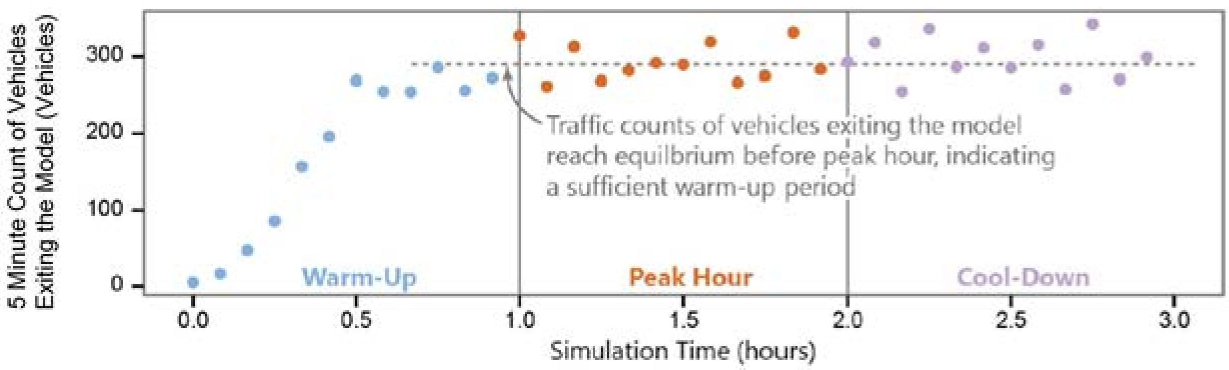
Provide a brief discussion of the TAPs within DT2290. Document all assumptions and methods regarding the TAPs for the traffic model within the modeling methodology report and/or other project memoranda as appropriate.

2.1.2.2 Warm-Up/Cool-Down Periods

In addition to the analysis period, the microsimulation models **shall** also include a warm-up period and *should* include a cool-down period to allow for the build-up and dissipation of congestion. The warm-up period is essential because the roadway network within the traffic model is initially empty and requires some time for the network to reach conditions that reflect the start of the analysis period. Essentially, the first vehicles to enter the study area are driving under free flow conditions. Without a warm-up period, data from the beginning of the analysis period would have a strong bias toward smaller delays (lower congestion) and *may not* reflect real-world conditions. The exact length of the warm-up period will vary from project-to-project; however, as referenced in FHWA's TAT III (2), a good way to approximate the minimum warm-up period, for at least the initial model runs, is to double the free-flow travel time from one end of the network to the other. After completing one or more model runs, verify the adequacy of the warm-up period and extend as appropriate.

The warm-up period is adequate when conditions at the end of the warm-up period reflect the field conditions at the start of the analysis period. One way to assess adequacy of the warm-up period is to review the number of vehicles present at any one time on the network to determine whether the model has reached equilibrium. Once the number of vehicles present on the network stays constant or increases by an amount consistent with the applicable profile, the model has reached equilibrium and signifies the conclusion of the warm-up period. Figure 2.1 provides an illustration of how to verify that the warm-up period is adequate by reviewing the number of vehicles exiting the model.

Figure 2. 1 Warm-Up Duration Verification Example



The cool-down period allows time for the dissipation of queues created during the analysis period which is typically necessary for the traffic model to replicate real-world conditions. Like the warm-up period, the cool-down period will vary depending on local field conditions, but is typically in the range of 15 to 60 minutes. After completing one or more model runs, verify the adequacy of the cool-down period and extend as appropriate.

FHWA's TAT IV (3) provides additional guidance for determining the appropriate warm-up and cool-down periods for a traffic model. Coordinate with WisDOT regional traffic staff and other key stakeholders (BTO-TASU, FHWA, etc.) as appropriate to confirm the warm-up and cool-down periods. Provide a brief discussion of the warm-up and cool-down periods within DT2290. Document all assumptions, methods and exemptions regarding the warm-up and cool-down periods for the traffic model within the modeling methodology report and/or other project memoranda as appropriate.

2.2 Analysis Scenarios

It is generally advantageous to identify the anticipated analysis scenarios/alternatives prior to beginning development of the traffic models. Early identification of the analysis scenarios/alternatives aids in determining the level of effort requirements, resource needs and budget implications. Additionally, by knowing the potential analysis scenarios in advance, the analyst can assess whether the spatial and temporal model limits adequately address all analysis scenarios up front, minimizing the chances of rework and model inconsistencies. When assessing the scenarios/alternatives to model, consider the potential impacts of any adjacent planned or pending projects, especially if the adjacent projects will influence the traffic demand in the study area. The analyst *should* coordinate with WisDOT regional traffic staff and other key stakeholders (BTO-TASU, FHWA, etc.) as appropriate to identify the analysis scenarios/alternatives.

Although the specific details of the analysis scenarios are project dependent, there are four basic analysis categories: 1) Existing (EX) Model, 2) Design Year, No-Build (FEC) Model, 3) Design Year with Minor Improvements (FEC+) Model and 4) Design Year, Build Model. A brief description of each of these analysis scenario categories follows.

Existing (EX): The existing (or base) year traffic model replicates existing field conditions. Existing year traffic conditions *should* reflect the year that is as close to the original start of the traffic analysis as possible. Whenever possible, traffic data *should* be no more than three years old and ideally, all traffic data *should* be from the same year. Ongoing construction or other special circumstances may dictate the need to use older data or data from multiple years.

Coordinate with WisDOT regional traffic staff and other key stakeholders (BTO-TASU, FHWA, etc.) as appropriate to select the existing year. Identify the existing year on the DT2290 form and document the rationale for selecting the existing conditions within the modeling methodology report and/or other project memoranda as appropriate. The analyst **shall** obtain approval of the existing year from the WisDOT regional traffic engineer prior to initiating development of the traffic model.

Design Year, No-Build (FEC): The design year, no-build traffic model reflects design year conditions absent of the proposed project. It will reflect design year traffic volumes and existing geometry or existing geometry with other planned and enumerated (or committed) improvement projects and may include signal timing modifications. As such, another name for this scenario is the future with existing plus committed (FEC) scenario. The planned improvement projects need to occur after the existing year but prior to the proposed project's design year in order to be included in the FEC model. Note that the FEC conditions for a specific project may not match the no-build conditions reflected in a travel demand model (TDM) used in forecasting traffic. Therefore, coordination with the WisDOT traffic forecasting section (TFS) is essential to verify that the traffic forecasts reflect the FEC scenario assumed in the microsimulation model.

The roadway geometry of the FEC model often limits (or constrains) the volume of traffic entering, traveling through or exiting the model. The FEC model, is thus a "constrained" model, and may not reflect the true demand on all segments within the model. Depending on the purpose and objectives of the project, full analysis of a true no-build or "constrained" traffic model *may not* be necessary.

Coordinate with WisDOT regional traffic staff and other key stakeholders (BTO-TASU, FHWA, etc.) as appropriate to identify the need for developing a design year, no-build model and to clarify the need to assess "constrained" conditions. Document the rationale for including or not including the design year, no-build (FEC) model and/or "constrained" conditions within the modeling methodology report and/or other project memoranda as appropriate. The analyst **shall** obtain approval from the WisDOT regional traffic engineer on how to address the design year, no-build (FEC) conditions prior to initiating development of the traffic model.

<u>Design Year, FEC+:</u>

For the traffic model to function with the design year traffic volumes, it *may* be necessary to include minor geometric improvements (e.g., the extension of an existing right or left turn lane or channelization optimizations such as the removal of shared lane movements within the FEC right-of-way, etc.) beyond the committed projects. In these cases, the traffic model actually represents future with existing plus committed plus minor improvements (FEC+) conditions. The project team *should* clearly document these minor improvements within the modeling methodology report and/or other project memoranda as appropriate.

The inclusion of a design year with minor improvements (or FEC+) model is often driven by the need to eliminate the geometric constraints within or adjacent to the traffic model in order to reflect the true demand on all segments within the model. Thus, the FEC+ model is generally (but not always) representative of an "unconstrained" model. The analyst *may* elect to apply other methodologies (such as removing traffic volumes that exit the roadway network prior to the study area) in addition to or instead of including minimum geometric improvements, to develop a design year "unconstrained" traffic model.

Coordinate with WisDOT regional traffic staff and other key stakeholders (BTO-TASU, FHWA, etc.) as appropriate to identify the need for developing a FEC+ model and to clarify the need to assess "unconstrained" conditions. Document the rationale for including or not including the FEC+ model and/or "unconstrained" conditions within the modeling methodology report and/or other project memoranda as appropriate. The analyst **shall** obtain approval from the WisDOT regional traffic engineer on how to address the FEC+ conditions prior to initiating development of the traffic model.

<u>Design Year, Build (ALT):</u>

The design year, build traffic models capture design year conditions with the proposed project improvements. The build traffic models may reflect "constrained" or "unconstrained" conditions. Typically, the analyst will need to develop a traffic model for more than one project alternative.

Due to the complexity and level of effort and resources required to develop microsimulation models, conduct a high-level review of potential alternatives using an HCM-based deterministic analysis tools to narrow down the number alternatives prior to developing the design year, build traffic model alternative using microsimulation.

Coordinate with WisDOT regional traffic staff and other key stakeholders (BTO-TASU, FHWA, etc.) as appropriate to identify the design year, build model alternatives and to clarify the need to assess "constrained" conditions, "unconstrained" conditions or both. Document the rationale for including or not including the "constrained" and/or "unconstrained" conditions within the modeling methodology report and/or other project memoranda as appropriate. The analyst **shall** obtain approval from the WisDOT regional traffic engineer on the design year build alternatives prior to initiating development of the traffic model.

Depending on the specifics of the project, it *may* be beneficial and/or necessary to develop a model that represents the conditions that will exist in the year the proposed project improvements are first opened to traffic (i.e., opening year conditions model). This scenario reflects the opening year traffic volumes and opening year geometry, which includes the existing geometry with the proposed project improvements and any other completed improvement projects. Discuss the need to develop and opening year model with WisDOT regional traffic staff and other key stakeholders (BTO-TASU, FHWA, etc.) as appropriate.

To ensure consistency, avoid confusion and aid in the model reviews, use the file naming convention spreadsheet. For example, a PM peak model of existing conditions for a project referred to as "WIS 1194" submitted on June 15, 2018 would be "WIS 1194_EX_2017_PM_061518". A future, unconstrained model for Alternative 3 looking at the PM peak in year 2045 and submitted on September 29, 2018 would be "WIS 1194_ALT-3_UCD_2045_PM_092918".

2.3 Traffic Model Tree

Prior to development of the microsimulation traffic model, the analyst *should* coordinate with the project team, WisDOT regional traffic staff and BTO-TASU as appropriate to develop the traffic model tree. The purpose of the model development tree is to show all the scenarios to include in the analysis, along with their relationships to one another and the existing conditions model. It formally illustrates the way the model will evolve as the work progresses, and establishes the sequence of work activities. Developing the traffic model tree prior to development of the existing conditions model helps avoid unnecessary work. Whenever possible, the analyst *should* use the same transportation network structure for all temporal analysis periods (AM peak, PM peak, Friday peak, Sunday peak, etc.) within the same year. The fewer the number of model variations, the easier it is to maintain consistency between the different analysis scenarios. Figure 2.2 provides an illustration of a basic traffic model tree.

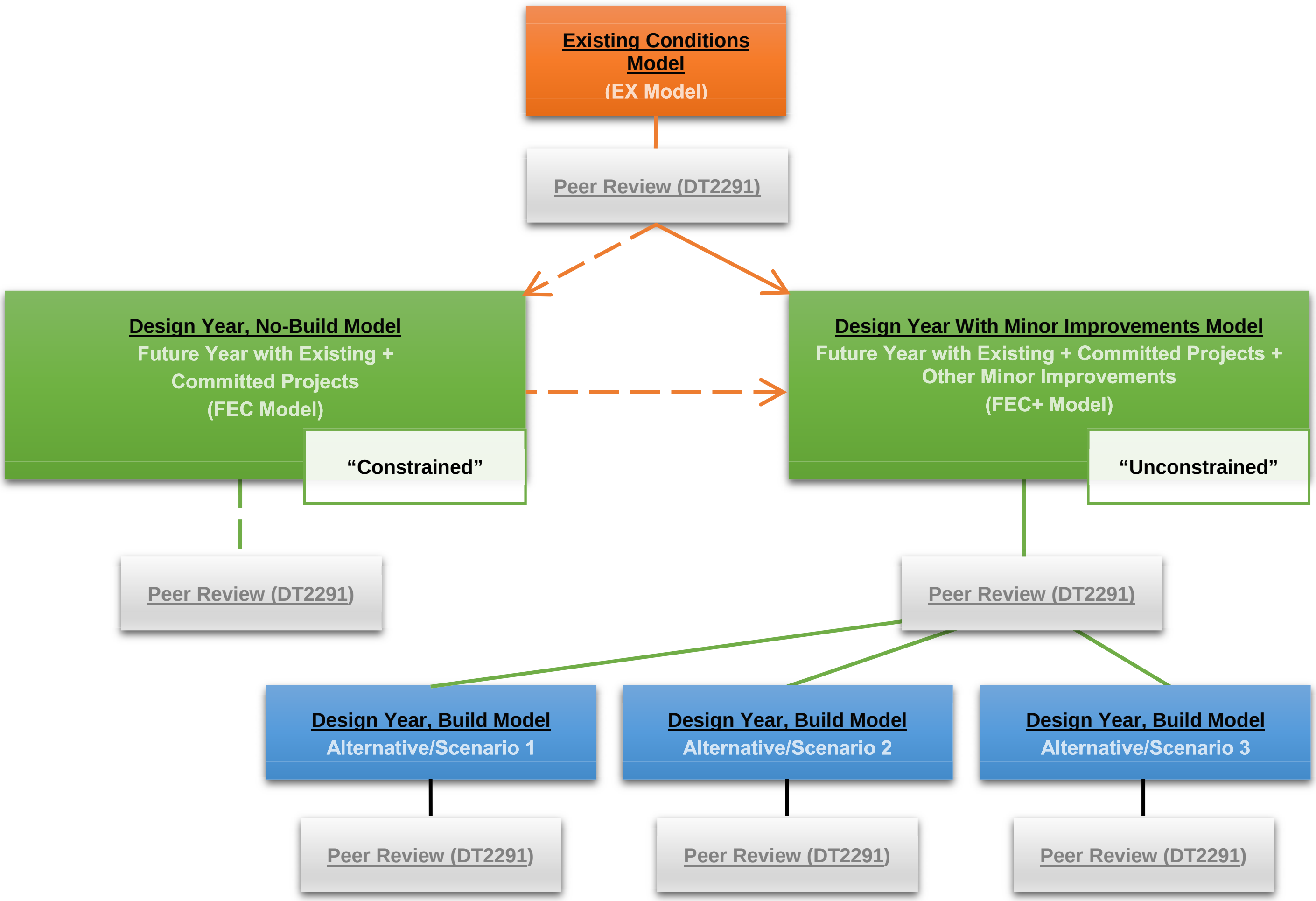
As illustrated in Figure 2.2, each version of the traffic model *should* undergo the peer review process prior to the development of the model for a new scenario. Refer to TEOpS 16-25 for additional details on the peer review process. When the project has a compressed schedule, there may be a temptation to begin development of the design year models prior to completion of the peer review process of the existing conditions model. This is often counterproductive, as the analyst needs to address any comments from the peer review of the existing conditions model in not only the existing (parent) model but also in any of the design year (child) models under development.

2.4 Constructing the Traffic Model

Construct and code the traffic model in accordance with the recommendations of the user guides/manuals for the applicable microsimulation software platform. When developing the model, the analyst *should* consider the following best practices:

- Use aerials and/or design plans as background images to aid in the review
- Minimize the amount of non-link space (dead space in Paramics, connectors in Vissim) where practical
- Label major roadway segments
- Avoid the use of link-specific adjustment factors as much as possible. When their use is necessary, associate link-specific adjustment factors with roadway geometry and/or software limitations. This will make it easier to assess whether the adjustment factor is applicable for other modeling scenarios.

Figure 2.1 Example of a Typical Traffic Model Tree



2.5 Deliverables

It is generally advantageous to establish a list of deliverables prior to beginning development of the traffic models. This list will identify all the documents, videos, computer files and other items that the project team will need to produce. Early identification of the list of deliverables can clarify project expectations and assist with defining resource needs. Typical deliverables include, but are not limited to, the following:

- Traffic Forecasting Methodology Report, typically will include the following attachments
  - Forecasting and O-D Development Methodology
  - Traffic Forecasts
  - Traffic Volume Balancing Methodology
- Traffic Analysis Tool Selection Memoranda
- Modeling Methodology Reports for each model, typically will include the following attachments
  - Existing Traffic Data (e.g., traffic volumes, speeds, queuing, etc.)
  - Exhibit Illustrating the Project Design Plans/Improvements
  - Tables Showing Validation Checks
- Microsimulation Software Files (provide for all temporal analysis periods and analysis scenarios/alternatives)
- DT2290

- DT2291 for each model

For sample formats or questions on any of the above deliverables, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

16-20-3 Measures of Effectiveness (MOEs) January 2018

3.1 Types of MOEs for Validation

The project's purpose, need and objectives typically dictate which MOEs the analyst *should* use for reporting the performance measures of the traffic model. The MOEs chosen for validation of the traffic model; however, are dependent on several factors including, but not limited to, the availability and quality of data, the size of a model, the capability of the microsimulation software, the purpose of the model, and the project scope. The following focuses on the MOEs chosen for validation of the traffic model.

3.1.1 Traffic Volumes

It is critical to validate traffic volumes on the roadway link level and/or the turning-movement level for every microsimulation model, regardless of size or complexity. There are several data sources for traffic volumes with varying levels of availability and/or data quality. Some of these resources include manual counts and various detection methods (e.g., loop, microwave, radar, video, etc.). Sources available in Wisconsin include, but are not limited to, the following:

- WisDOT interactive count map: WisDOT Roadrunner link
- Wisconsin Hourly Traffic Data: WisTransPortal, Wisconsin Hourly Traffic Data Web Access Portal
- V-SPOC detector database: WisTransPortal, V-SPOC: Volume, Speed and Occupancy Application Suite

The BTO-TASU Data Hub provides a list of additional data sources with a brief description of types of data available through each source, a hyperlink to the primary data source, and notes to consider when choosing to use or not use a particular data source. Prior to conducting specialized counts, contact WisDOT regional traffic staff to determine whether there are other data sources available for the project study area. Review, verify and document the validity of the volume data prior to developing the traffic model. Coordinate with WisDOT regional traffic staff as appropriate.

3.1.2 Traffic Speeds

Validation tests for traffic speeds *may* be representative of spot speeds and/or segment speeds. Common sources for spot speed data include, but are not limited to, loop detectors, radar detection or other resources. Common sources for segment speed data include, but are not limited to, Bluetooth detectors, probe data or floating car studies. Document the methodology used to collect and calculate the spot and/or segment speeds. Review, verify and document the validity of the traffic speed data prior to developing the traffic model. Coordinate with WisDOT regional traffic staff as appropriate.

Larger-scale traffic models *may* rely on a combination of spot speed and segment speed validation, while models that are smaller in length *may* rely more on spot speed validation. Where possible, collect and report out spot or segment speed in 15-minute intervals.

Discuss the type of speed data required for model validation with WisDOT regional traffic staff and/or BTO-TASU during the scoping stage of a project.

3.1.3 Travel Times

Travel time validation is a common MOE used for freeway models and arterial corridors. The availability and quality of travel time data has become better in recent years due to advancement in probe data and Bluetooth technologies. Common sources for travel time data include Bluetooth detectors, probe data or floating car studies. Where possible, collect and report out travel times in 15-minute intervals. Review, verify and document the validity of the travel time data prior to developing the traffic model. Coordinate with WisDOT regional traffic staff as appropriate.

If using both segment speeds and travel times for model validation, the roadway limits used for these comparisons *should* be of different lengths. It is desirable to have the travel time comparisons use longer lengths than the segment speed comparisons. The intent of the travel time validation test is to capture vehicle behavior at a larger scale while the intent of the speed validation test, whether spot or segment, is to capture the behavior at a more local level.

Discuss the limits, segmentation and type of travel time data required for model validation with the regional traffic engineer and/or BTO-TASU during the scoping stage of a project.

3.1.4 Intersection Queue Lengths

Intersection queue length is a common MOE used for arterial corridors or smaller freeway/interchange models where collection of other MOEs may not be possible or fiscally feasible. If there is significant congestion at an intersection in the existing conditions, the queue lengths may vary significantly day-to-day or even 15-minute period to 15-minute period. Video detection, loop detection, and field observations are common ways to collect intersection queue data. The methodology for the collection of intersection queues involves some subjectivity and requires sound judgment of vehicle speeds and the number of vehicles to include in the queue (e.g., *should* the vehicle queue include slow moving vehicles or just stopped vehicles?). Review, verify and document the validity of the queue data prior to developing the traffic model. Coordinate with WisDOT regional traffic staff as appropriate.

If queues are used for validation, the project team *should* consider the following questions prior to data collection and when performing comparisons to modeled data.

- If analyzing an interchange, do the exit ramp queues extend back to or close to the mainline?
- Do intersection queues spill back into the adjacent intersection(s)?
- Does data collection capture the average, 95th percentile, and/or maximum queue lengths? Is the desired type of queue length for model validation easily extractable from the selected microsimulation software?
- For multiple lanes, such as a triple left-turn lane, do the queue measurements and comparisons reflect the lane-by-lane queues or the worst-case lane queue?
- How, and at what frequency (every cycle, every 15 minutes, etc.), *should* queues be measured in the field?

Discuss the locations of intersection queues required for model validation with WisDOT regional traffic staff and/or BTO-TASU during the scoping stage of a project.

3.1.5 Lane Utilization

Lane utilization, or the volume/percentage of vehicles using a given lane relative to the other lanes in the same direction, is a common MOE used for freeway corridors or arterial corridors with complex intersection interaction. In Wisconsin, it may be possible to approximate lane utilization from lane-by-lane volume data available through the WisTransPortal, V-SPOC detector database ran by the Wisconsin Traffic Operations and Safety (TOPS) Lab (WisTransPortal, V-SPOC). The V-SPOC database has the most robust coverage in the Madison and Milwaukee metropolitan areas, with more sporadic coverage for other parts of the state. Other methods to collect lane utilization data include manual counts, time-lapse aerial photography or video detection. Review, verify and document the validity of the lane utilization data prior to developing the traffic model. Coordinate with WisDOT regional traffic staff as appropriate.

The analyst *may* use lane utilization as a validation metric for the traffic model; however, they *should* first carefully evaluate and document the quality and availability of the existing data. If used as a validation metric, perform lane utilization comparisons at critical locations within the corridor. Discuss the need for and locations of lane utilization comparisons with WisDOT regional traffic staff and/or BTO-TASU during the scoping stage of a project.

3.1.6 Lane Density

Observed density is a less common metric used for model validation. Video detection or time-lapse aerial photography may allow for the collection of lane density information. Coordinate with WisDOT regional traffic staff and/or BTO-TASU prior to using lane density as a validation metric.

3.1.7 Bottleneck Locations

Bottlenecks signify where recurring congestion occurs within a network. They have a direct relationship to travel times, traffic speeds, and/or intersection queue lengths. Validation of bottlenecks in a traffic model typically occurs through conducting visual observations and/or by creating spatiotemporal graphics displaying observed versus modeled MOEs. If observations indicate the presence of recurring congestion, or a bottleneck, in the existing conditions, the analyst *should* use this MOE as a validation metric.

3.1.8 Throughput

Throughput is a less common metric related to flow rates through an intersection or freeway segment. Possible ways to observe throughput include manual counts, video detection or other methods. WisDOT *should* approve throughput as an acceptable MOE for model validation prior to its use.

3.1.9 Visual Observation

Visual observation is a good preliminary or secondary check for validating the model results to field data, specifically for bottlenecks or queues, however, visual observations **shall not** be the sole MOE used for model validation. Instead, see the MOE descriptions for bottleneck or intersection queue validation.

3.1.10 Weaving Volumes

If existing O-D data is available, the analyst *should* evaluate weaving volumes. Common sources of O-D data included Bluetooth detection, video detection, time-lapse aerial photography and field observations. In absence of field data, it may be possible to conduct a high-level evaluation of weaving percentages using data from travel demand models. Comparisons of weaving volumes are typically applicable to freeway weaving; however, it could also apply to arterials with complex intersection interactions.

If field data is the basis of the weaving volumes/patterns used for validation, the project team *should* document the conditions during field data collection. This may include construction activities, atypical congestion, weather, if school is in session, or other pertinent information.

If a travel demand model is the source of the weaving volumes/patterns used for validation, the project team *should* document general inputs and calibration notes about the travel demand model. These may include the version, socioeconomic data, base year, horizon year, anticipated developments in the project area, or other pertinent information.

If used as a validation metric, perform weaving volume comparisons at critical locations within the corridor. Discuss the need for and locations of weaving volume comparisons with WisDOT regional traffic staff and/or BTO-TASU during the scoping stage of a project. Review, verify and document the validity of the weaving volume data prior to developing the traffic model. Coordinate with WisDOT regional traffic staff as appropriate.

3.1.11 Intersection Delay

Intersection delay dictates the intersection level of service (LOS), noting that if the volume-to-capacity ratio (v/c) exceeds 1.0 the LOS is F regardless of the delay value. Due to the difficulty of the data collection and the variance in day-to-day and minute-to-minute delays at congested intersections, it is not very common to obtain field data on intersection delay. Delay is typically more challenging to quantify than queue lengths, which also provide insight as to how the intersection operates at the approach level. WisDOT *should* approve intersection delay as an acceptable MOE for model validation prior to its use.

3.1.12 Capacity

Similar to throughput, capacity is a less common metric related to how much traffic an intersection, arterial segment or freeway segment can handle. It may be possible to gather field capacity data during oversaturated conditions using manual counts, video detection or other methods. Oftentimes, the analyst will indirectly adjust the capacity as part of the calibration process, therefore capacity may not be a suitable validation MOE. WisDOT *should* approve capacity as an acceptable MOE for model validation prior to its use.

3.1.13 Routing

Vehicle routing checks may be a qualitative exercise based on a project team's familiarity with a corridor, more of a quantitative exercise supported by O-D or demand modeling data, or a combination of both. Although a critical component of model calibration, vehicle routing checks *should not* be the primary model validation MOE.

3.2 Number of MOEs for Validation

3.2.1 Primary vs. Secondary MOEs

The project team *should* discuss, in detail, the type and number of MOEs to use for model validation with WisDOT regional traffic staff during the scoping of a project as they may have a significant effect on the project budget, schedule and resource needs. Involve BTO-TASU, and other key stakeholders, in these discussions as appropriate.

The factors that influence the number of MOEs required for microsimulation model validation may include data availability and quality as well as project type, geometric conditions, traffic patterns, and levels of existing and anticipated congestion. The capabilities of the applicable microsimulation software may have implications on the MOEs. For example, SimTraffic has fewer capabilities when it comes to reporting weaving volumes and routing metrics than Vissim, thus these MOEs may not be appropriate for a SimTraffic model.

To assist in formulating recommendations on the type and number of MOEs to use for model validation from the least to most complex models, each MOE (see TEOpS 16-20-3.1) has either a "primary" or "secondary" designation. The validation checks for all models, regardless of the model complexity, **shall** always include a comparison of traffic volumes. Thus, traffic volumes do not have an associated primary or secondary designation.

The primary MOEs include spot speeds, segment speeds, travel times and intersection queue lengths. The secondary MOEs include intersection queue lengths, lane utilization, weaving, and any other MOE that a project team *may* request for approval (such as intersection delay, throughput, etc.) based on available data. Depending on the purpose and objectives of a project, intersection queue lengths may be either a primary or a secondary MOE. Table 3.1 shows the primary and secondary MOE designations.

Table 3.1 Summary of MOEs for Model Validation

<table>
<tr><th>Metric (MOE)</th><th>MOE Designation</th><td rowspan="15"><u>Summary of MOEs for Model Validation</u>
• 3 to 4 Primary
• 2 to 3 Secondary
• 6+ Upon WisDOT Approval</td></tr>
<tr><td>Link and/or Turning Movement Volumes</td><td>Required for all projects</td></tr>
<tr><td>Segment Speeds</td><td>Primary</td></tr>
<tr><td>Spot Speeds</td><td>Primary</td></tr>
<tr><td>Travel Times</td><td>Primary</td></tr>
<tr><td>Intersection Queues</td><td>Primary or Secondary</td></tr>
<tr><td>Lane Utilization</td><td>Secondary</td></tr>
<tr><td>Weaving Volumes</td><td>Secondary</td></tr>
<tr><td>Density</td><td>Secondary Upon Approval</td></tr>
<tr><td>Intersection Delay</td><td>Secondary Upon Approval</td></tr>
<tr><td>Bottleneck Locations</td><td>Secondary Upon Approval</td></tr>
<tr><td>Throughput</td><td>Secondary Upon Approval</td></tr>
<tr><td>Capacity</td><td>Secondary Upon Approval</td></tr>
<tr><td>Routing</td><td>Secondary Upon Approval</td></tr>
<tr><td>Others?</td><td>Secondary Upon Approval</td></tr>
</table>

3.2.2 Scoring System

The number of MOEs required for validation will vary depending on the complexity of the traffic model, which is dependent on the project type, project scope, corridor type, traffic control, roadway congestion level and type of microsimulation tool used for analysis. To quantify the complexity of the traffic model (specifically a microsimulation traffic model), the department worked with a consultant to establish a scoring system. The same scoring system is applicable for determining the number of MOEs required for validation and defining the level of peer review required. Refer to TEOpS 16-25-2 for details on the model complexity scoring system.

Figure 3.1 provides an illustration of the traffic model level of complexity scoring system. Use Figure 3.1 in conjunction with the Traffic-Model Complexity Scoring Template (a Microsoft Office Excel based worksheet) provided in Attachment 3.1 to develop the overall complexity score for the traffic model. The project team's traffic lead or project manager, in coordination with WisDOT regional traffic staff, *should* complete the scoring template.

The overall traffic model complexity score defines the minimum number of MOEs required for model validation for the project. Depending on data availability, and the project objectives, it might be appropriate to use more than the minimum required MOEs for model validation. Ultimately, it is up to WisDOT regional traffic staff to define the type and number of MOEs to use for model validation. Refer to Table 3.2 for the complexity score associated with each MOE requirement level.

When assessing the complexity of the traffic model and number of MOEs needed for model validation, keep in mind that, due to modified roadway geometry, increased traffic volumes, reduced levels of congestion, etc., it is possible for the model complexity score to be different under future alternative scenarios than it is under existing conditions. Therefore, it is critical to consider both existing conditions and potential future alternatives (including levels of service) when defining the traffic model complexity score and the associated number of MOEs. The highest traffic model-complexity-score across all of the scenarios (existing and future alternatives) dictates the number of primary and/or secondary MOEs required for base model validation.

Figure 3.1 Traffic Model Complexity Scoring Diagram

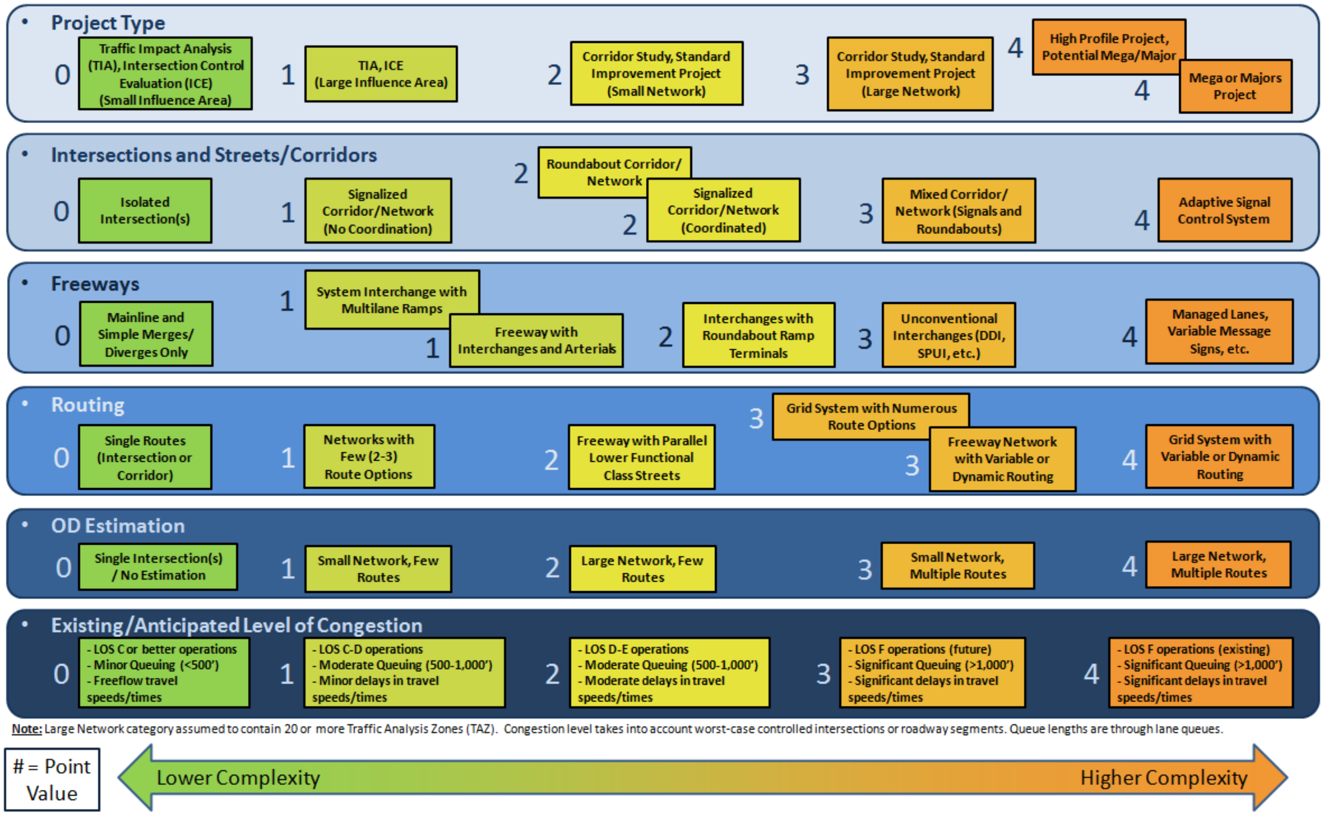


Table 3.2 Number of MOEs Required for Model Validation

Model Complexity Score (a)	Minimum # of MOEs Required for Model Validation (b)
0 – 3	1 to 2 Primary MOEs
4 – 7	1 to 2 Primary MOEs 1 Secondary MOE
8 – 10	2 to 3 Primary MOEs 1 Secondary MOE
11+	2 to 3 Primary MOEs 1 to 2 Secondary MOEs

(a) Model complexity score from the Traffic Model Complexity Scoring Template, Attachment 3.1

(b) Minimum MOEs are those in addition to link and/or turning movement traffic volumes

Use the scores and recommendations shown in Table 3.2 as a guide only. Professional judgment and coordination with WisDOT staff needs to factor into the decisions on the number and type of MOEs to use for validation of the traffic microsimulation model. Document all assumptions and decisions regarding the number and type of MOEs to use for model validation within the modeling methodology report and/or other project memoranda as appropriate.

LIST OF ATTACHMENTS

Attachment 3.1 Traffic Model Complexity Scoring Template

16-20-4 Microsimulation Analysis Software — January 2018

4.1 WisDOT Supported Software

WisDOT currently supports the use of the following programs for microsimulation traffic analysis:

- SimTraffic Version 10, Trafficware
- Quadstone Paramics Version 6, Pitney Bowes (effective January 1, 2018, WisDOT will no longer support)
- Vissim Version 10, PTV Group

Use the most current build number for the software listed above (e.g., SimTraffic 10.1.2.20, Paramics 6.9.3, Vissim 10.03). However, please contact BTO-TASU for consideration of the use of different versions of the software (e.g., SimTraffic 9 vs. SimTraffic 10, Vissim 9 vs. Vissim 10). Do not switch from one software platform to another without first consulting with BTO-TASU. TEOpS 16-20-11 provides additional information on when to consider upgrading the software for a microsimulation model that has either already been completed or is in the process of being developed.

4.2 SimTraffic Overview

Trafficware, a company based out of Sugar Land, Texas, is the developer for both SimTraffic and its companion software Synchro. SimTraffic is the microsimulation platform and Synchro is the macroscopic (or deterministic) platform. Trafficware typically releases major updates to the Synchro/SimTraffic Studio every two to three years.

The Synchro platform is the primary mechanism for drawing the roadway network and coding in several of the parameters for roadway geometry and traffic control. The SimTraffic platform is where the analyst can code in various driver behavior and vehicle characteristics. Both SimTraffic and Synchro use a link-node structure. SimTraffic, tracks every vehicle in the traffic system on a 0.1-second interval. Typical MOEs available through SimTraffic include travel time, vehicle queues and intersection delay.

WisDOT only accepts SimTraffic for arterial analysis and this software is best suited for signalized corridors. Often times, the analyst will use SimTraffic to observe driver behavior and conduct a “reality check” on the Synchro outputs. SimTraffic may also be beneficial for reporting the vehicle queues, especially when vehicles spill-out of the turn lane and block through traffic. If the primary purpose of the SimTraffic model is to conduct “reality checks”, calibration and validation of the traffic model may not be necessary. However, prior to using the model outputs from SimTraffic (or any other microsimulation analysis tool) for project or study decisions, especially any related to critical aspects of the design, the analyst **shall** calibrate and validate the model in accordance with TEOpS 16-20-5 and TEOpS 16-20-8, respectively.

4.3 Quadstone Paramics Overview

Pitney Bowes Software provides support for the microsimulation software Quadstone Paramics from their international office out of Oxfordshire, England. The last update for Paramics occurred in 2012, and it is unclear whether Pitney Bowes Software has plans to release any future updates.

Paramics uses a link-node structure. It is best suited to freeway modeling, and is distinguished by its relatively quick and easy model coding, though this is counterbalanced (and ultimately outweighed) by its lack of detail for simulating complex arterials and its aging usability. Typical MOEs available through Paramics include travel time, speed, vehicle queues, intersection delay, and density. MOE extraction typically happens through the Analyser module.

Effective January 1, 2018, WisDOT will no longer support the use of Paramics on any new projects. Projects that initiated the microsimulation traffic analysis using Paramics prior to January 1, 2018 *may* continue to use Paramics for the duration of the project. However, if the traffic mode requires major revisions (e.g., the analyst has to update the traffic model to reflect different existing conditions), or if the traffic model is more than three years old, the analyst *should* consider switching the traffic models over to Vissim. Consult with the WisDOT regional traffic contact and/or BTO-TASU to determine whether it is appropriate to switch software platforms.

4.4 Vissim Overview

The PTV Group, a company based out of Karlsruhe, Germany (with U.S. offices in Oregon and Virginia), is the developer for the microsimulation software Vissim. The PTV Group typically releases major updates to the Vissim software once a year.

Vissim uses a link-connector structure. Vissim can model any facility, though it is especially known for being able to accurately represent complex arterial corridors. It provides great flexibility, but can be time-consuming to use for modeling due to the many aspects of the software that enable that flexibility. Vissim has many parameters to adjust and ways to replicate real-world driver behaviors, leading to its applicability in almost any situation where deterministic tools and SimTraffic are not sufficient. Typical MOEs available through Vissim include travel time, speed, vehicle queues, intersection delay, and density, though Vissim provides ways to get data from the simulated vehicles at any granularity.

4.4 Other Microsimulation Software

Microsimulation analysis requiring the support, review and/or input from BTO **shall** use one of the WisDOT supported microsimulation software packages. BTO-TASU conducts periodic reviews/evaluations of the microsimulation tools to assess the need to add and/or remove microsimulation tools to/from WisDOT's traffic analysis toolbox. Please contact BTO-TASU, via the DOT Traffic Analysis & Modeling (DOTTrafficAnalysisModeling@dot.wi.gov) mailbox to request consideration of additional microsimulation software tools.

4.5 Selecting a Microsimulation Software

Consider the needs of the project along with the strengths and limitations of the software when selecting the most appropriate tool to use for developing the microsimulation model. In general, if you already have a Synchro model and/or you are looking at a relatively small scale/simple arterial network, consider the use of SimTraffic. All other scenarios, specifically freeway models, will generally require the use of Vissim for microsimulation analyses. Effective January 1, 2018, do not initiate any new microsimulation analyses using Paramics.

Document the rationale for choosing the selected microsimulation software tool in the Traffic Analysis Tool Selection memoranda and submit to the WisDOT regional traffic staff for approval.

16-20-5 Microsimulation Model Calibration — January 2018

5.1 Introduction

Calibrating a traffic model requires the analyst to review and possibly adjust various model parameters (e.g., global and local headway and reaction times, driver aggressiveness, etc.) to get the traffic model to reproduce conditions observed in the field. Failure to calibrate a microsimulation model properly can produce unrealistic or misleading results. Therefore, prior to using the microsimulation model outputs for critical design decisions, the analyst **shall** calibrate the traffic model.

5.2 Calibration Process

The model calibration process is often very complex, labor intensive and resource intensive and may take more time to complete than the initial development of the traffic model. Modifications to the input parameters in one component of the traffic model may have unexpected impacts in other areas of the traffic model. Skipping the model calibration process is not permissible and there is no shortcut to completing model calibration. However, applying the following principles will provide structure and efficiency to the calibration process.

By definition, a model is a simplified representation of reality and no model can reproduce reality perfectly. When developing the model, the analyst *should* strive to balance model perfection with practicality. To help achieve this balance, BTO-TASU developed both quantitative and qualitative validation thresholds for microsimulation models that are dependent on the purpose and need of the traffic model. See TEOpS 16-20-8 for additional details on the WisDOT microsimulation validation thresholds.

5.2.1 Global, Categorical and Local Calibration Factors

The analyst can apply and modify the input parameters within a microsimulation model on a global, categorical or localized level. For the purposes of WisDOT policy, global, categorical and localized calibration factors have the following definitions:

Global Factors: Global factors are those factors/parameters that affect the entire model.

Categorical Factors: Categorical factors are those factors/parameters that affect a category of the links within the model (e.g., every off-ramp, all weaving segments, major street signalized intersection approaches, etc.).

Localized Factors: Localized (or link-specific) factors are those factors/parameters that only influence vehicles while they are driving on a link, a short series of connected links, or through a specific intersection within the model.

When calibrating a traffic model, the analyst *should* adjust the global and categorical, parameters first, and *should* use localized/link-specific factors sparingly and only for the final fine-tuning of the model. Document and justify the use of any localized/link-specific factors by associating them to limitations of the microsimulation software or specific geometric conditions that may influence driving behavior (e.g., a short weaving segment). Relating the localized adjustment factors to geometric conditions or software limitations makes it easier to assess whether to carry the adjustments forward from existing year to alternative scenarios.

5.2.2 Unreleased, Blocked, Stuck/Stalled Vehicles

For purposes of WisDOT policy, unreleased, blocked and/or stuck/stalled vehicles have the following definitions:

Unreleased Vehicles: Unreleased vehicles represent those vehicles that were able to enter the network but were unsuccessful in traveling through the model and were thus not able to exit the network. Typically, the presence of unreleased vehicles results in a downstream traffic volume undercount and gives the false impression that downstream operations are better than they actually are.

Blocked Vehicles: Blocked vehicles are those vehicles that are unable to enter the network at their desired time due to downstream vehicle queues. When vehicle blockage occurs, the traffic model will not be able to capture the true demand on the system and will thus not be able to accurately report out MOEs such as delay and vehicle queues. If the vehicle blockage in the model matches field conditions, it may be necessary to extend the link and/or temporal limits of the model in order to accommodate the entire queue (i.e., congestion). See TEOpS 16-20-2 for additional details on the spatial and temporal model limits.

Stuck/Stalled Vehicles: Stuck or stalled vehicles are vehicles that unexpectedly slow or stop partway through their route. They can cause backups that do not exist in the field.

The presence of unreleased, blocked and/or stuck/stalled vehicles within the traffic model is an indicator of congestion within the model, but may also be a sign of a serious model calibration problem. When calibrating the traffic model, the analyst *should* consider the magnitude and location of the blocking that occurs. If the blocking occurring in the traffic model does not reflect field conditions, or does not meet expectations, reevaluate the spatial and temporal model boundaries, warm-up/cool-down factors and demand profiles (see TEOpS 16-20-2.1) as they may have a direct effect on issues related to blocked vehicles. It may not be necessary, or realistic, to prevent blocking of all vehicles, specifically for the design year, no-build or FEC constrained scenario.

Paramics and Vissim both contain features that allow the analyst to specify a maximum allowable time a vehicle can remain in the same position before removing the stuck/stalled vehicle from the model as if it never existed. The terminology is “blockage removal” for Paramics and “diffusion” for Vissim. Using these features leads to undercounting vehicles and is not realistic. The use of these features in the pre-calibration model building can be helpful, but it is not acceptable for a final calibrated model.

5.2.3 O-D Matrix Estimation

Oftentimes the analyst *may* use a separate O-D matrix estimating software (e.g., Cube by CITILABS, TransCAD by Caliper, Visum by PTV Group, etc.) to develop the O-D matrices for the microsimulation models. Use of a O-D matrix estimating software that is separate from the microsimulation model may be useful, as it will allow the O-D matrix to reflect true demand without influence from network coding problems. However, intersection or other network coding errors within the microsimulation model may affect throughput such that the microsimulation model outputs may not reflect the same volumes as those developed by the O-D matrix estimation tool. Therefore, for preparing the model validation checks, the analyst **shall** run the volumes through the network using the primary modeling software. It is not acceptable to prepare the model validation checks using statistics from the O-D matrix estimation software.

5.3 Traffic Volume Balancing

Usually the available traffic data for a microsimulation study area is unbalanced. For example, starting at an Automatic Traffic Recorder (ATR) station on a freeway mainline and proceeding in the direction of travel, adding the raw on-ramp volumes and subtracting the raw off-ramp volumes, the result will almost never match the volume measured at the next downstream ATR. This happens for three main reasons:

- Often, due to limited resources, it may be necessary to collect intersection and/or ramp traffic counts for multiple locations along the corridor at different times and/or on different days.
- There are inherent imperfections in the data collection process. For example, if a vehicle is changing lanes as it drives over a detection loop, the detector loop could count the vehicle twice (or not count it at all) or, with respect to microwave detectors, a larger vehicle could occlude a smaller vehicle making the smaller vehicle undetectable.
- Data collected manually (such as intersection turning counts) is subject to human error.

Microsimulation models cannot account for these imperfections, so the analyst *should* balance the data to create a mathematically consistent volume set. In general, the analyst *should* use balanced volumes as the traffic volume targets for the existing conditions model. The use of balanced volumes usually removes statistical outliers from the target volume set, making it easier to achieve validation targets.

On arterials and other corridors that are not access controlled, to account for traffic generated by developments located between intersections, it may be necessary to include side or “dummy” zones in the model.

The analyst *should* use a "soft" balancing process to make sure that the development along the corridor can account for any variation in traffic volumes between intersections. Soft balancing means that the volume entering each intersection is comparable to the sum of the volumes leaving the intersections that feed it. Hard balancing, on the other hand, requires the entering volume to equal (exactly) the sum of the relevant upstream volumes (as is the case for an access-controlled facility). Soft balancing is generally acceptable for SimTraffic; however, Vissim and Paramics require the use of hard balancing.

5.4 Vehicle Characteristics and Classification

When coding and calibrating the traffic model, it is important to verify that the vehicle composition (vehicle type, classification, operating characteristics, etc.) included in the model accurately represents that which is present in the project study area.

When available, the analyst *should* use field data to determine the appropriate vehicle mix or classifications, specifically as it pertains to the volume or percentage of heavy vehicles, buses, high-occupancy vehicles (HOVs), pedestrians/bicycles and other vehicle types included in the analysis. Oftentimes the microsimulation model will use separate demand profiles and/or O-D matrices for heavy trucks and passenger vehicles. However, depending on the project purpose, it may be necessary to have additional demand profiles and/or O-D matrices for other travel modes as well.

The format for entering in the specifics on vehicle characteristics and classifications varies depending on the microsimulation software package. However, most software packages have predefined default values that specify various vehicle characteristics including, but not limited to, vehicle length, vehicle acceleration/deceleration rates and vehicle occupancy. The default values are a good starting point; however, the analyst *should* adjust the default values as appropriate to reflect local conditions.

For SimTraffic, the default values are automatically included as part of the initial model set-up. Paramics and Vissim, however, require the analyst to load in the vehicle characteristics files. For Vissim, the analyst *should* use the North American Fleet default values for the initial input values and adjust them as appropriate. For Paramics, use the Wisconsin-specific vehicle fleet file housed by BTO-TASU as the initial starting point. Please contact BTO-TASU via the DOT Traffic Analysis & Modeling(DOTTrafficAnalysisModeling@dot.wi.gov) mailbox to request a copy of the Wisconsin-specific vehicle fleet file for Paramics.

5.5 Route Assignment

The analyst *should* develop the route assignment in coordination with WisDOT regional traffic staff, BTO-TASU and other key stakeholders as appropriate.

16-20-6 Calibration Parameters and Simulation Settings — January 2018

6.1 Overview

Microsimulation models contain many adjustable parameters, and the relevant adjustments vary for each software package. If a model fails to satisfy the validation thresholds, it is essential for the analyst to adjust the appropriate parameters to correct the situation. For example, adjusting driver aggressiveness or link cost factors will not successfully compensate for a flawed O-D matrix. The user manuals and technical support service for each software product provide some guidance on calibration parameters, but these sources may not be privy to the local or specific characteristics for the project study area. Local peer/user groups such as the ITE Simulation and Capacity (SimCap) user group or other independent experts with experience in the relevant software may also provide valuable insight with respect to which model calibration parameters to adjust during the calibration process.

The following text provides details on the key parameters of the traffic model that the analyst *should* consider during the model calibration process. The guidance below is specific for SimTraffic, Paramics and Vissim; however, the general principles are applicable for all microsimulation software packages. This list is not all-inclusive and *should* only serve as a guide to the project team.

6.1.1 Network Coding

Network coding establishes the horizontal and vertical geometry of the roadway network, including intersection spacing and roadway curvature. Network coding also includes appropriate use of settings such as link free-flow speed and turning speeds.

6.1.2 Intersection Traffic Control and Ramp Metering

Intersection controls are devices that regulate traffic flow at intersections (e.g., signals, roundabouts, stop control and ramp meters). Elements of the signals/ramp meters may include the controller type, detector placement, signal heads, signal groups, coordination between signals, signal phasing and/or signal/ramp meter-timing plans.

6.1.3 Closures, Restrictions and Incidents

Closures represent temporary or permanent roadway segment, link, or lane closures (i.e., traffic is restricted from using that particular roadway segment, link, or lane). Restrictions represent links or lanes where travel is restricted, either temporarily or permanently, to specific vehicle types (e.g., lanes designated for HOV or lanes restricting truck use). Incidents include simulated vehicle breakdowns, crashes, etc.

6.1.4 Entrance Ramps

Entrance ramps or freeway merge areas typically require careful coding in microsimulation. This section generally refers to parallel freeway entrance ramps, although there are instances where this feature is appropriate for arterials as well. The reviewer *should* review the lane utilization upstream of the entrance ramp, the aggressiveness of the merging vehicles (e.g., minimum time on entrance ramp, driver headway factors), and the length of the acceleration lane and/or taper parallel to the entrance ramp.

6.1.5 Lane Use Parameters

Lane use parameters control the amount and/or destination of the traffic using each lane. A typical application of these parameters is to pre-position vehicles in advance of a fork in the road.

6.1.6 Zone Structure/Vehicle Inputs

Zone structure and vehicle inputs define where and how traffic is loaded into the network.

6.1.7 O-D Matrices, Demand Profiles & Time Periods

O-D matrices contain the network demand patterns (number of trips traveling between each pair of zones). Time periods and demand profiles control the timing for the release of vehicles into the network (e.g., are the vehicles released at a steady rate or at a gradually increasing/decreasing rate). In some cases, it is necessary to use multiple O-D matrices and/or demand profiles (e.g., there may be one matrix for cars and a second matrix for trucks).

6.1.8 Core Simulation Parameters

Core simulation parameters affect fundamental aspects of vehicle behavior in the network, such as driver aggressiveness and the willingness to merge into small gaps. Default values are acceptable for some parameters, but other parameters require project- or area-specific values.

6.1.9 Routing Parameters/Vehicle Routes

Routing parameters influence the way vehicles travel through the network. If coded improperly, these controls can cause unrealistic or erratic routing.

6.1.10 Vehicle Types and Proportions

The proportion and types of vehicles (such as trucks, buses and HOVs) influences the overall performance of each part of the network.

6.1.11 Stuck/Stalled Vehicles

Stuck or stalled vehicles are vehicles that unexpectedly slow or stop partway through their route. They can cause backups that do not exist in the field.

6.1.12 Special Features

Special features include site or study-specific items such as the use of detectors, car parks, variable message signs, special purpose lanes, speed harmonization, public transit routes, toll lanes, toll plazas, pedestrian modeling, special graphics, plugins or scripts, among others.

6.2 SimTraffic Calibration Parameters

6.2.1 Interval Settings

A critical component of performing a SimTraffic simulation is to set up appropriate simulation intervals. The default settings for the simulation interval include a 3-minute seeding period and a 10-minute analysis period. To be more compliant with HCM analysis methodologies and common microsimulation practices, the modeler *should* extend the seeding period and analysis period beyond these default values. WisDOT recommends using the interval settings setup shown in Table 6.1 for SimTraffic simulation models if SimTraffic is one of the project's official traffic analysis tools (i.e., the project will rely on SimTraffic volume and operation reports to make critical decisions).

The interval setting shown in Table 6.1 are not necessary for applications such as conducting reality checks on Synchro outputs, creating videos for public involvement or performing a high-level screening of an alternative. For high-level applications, a seeding period and one 15-minute analysis interval may be appropriate.

Table 6.1 Recommended Interval Settings for SimTraffic

Interval	Seeding	Recording	Recording	Recording (Peak)*	Recording
Duration	7 mins**	15 mins	15 mins	15 mins	15 mins
PHF Adjust	No	No	No	Yes	No
Anti-PHF Adjust	No	Yes	Yes	No	Yes
Random Seed	Non-zero for repeatable results; Zero for random seeding				

*Peak 15-minute interval is recommended to be the 2nd or 3rd interval in the simulation.

**Seeding interval *should* be long enough for one vehicle to travel through the network or longer than the maximum cycle length in the network, whichever is greater

6.2.2 Parameter Discussion

Attachment 6.1 provides a list of the parameters, along with recommended ranges, that the modeler will typically adjust while calibrating a SimTraffic model. This list provides a good starting point for the parameter value adjustment. A complete list of the adjustable parameters for SimTraffic is available on the BTO, Traffic Analysis, Modeling and Data Management webpage Unless field data supports doing otherwise, modify only those parameters recommended as settings to adjust. Obtain WisDOT staff approval prior to modifying non-recommended adjustment parameters.

Refer to the *Synchro Studio 10 User Guide* (4), for some l tips on calibrating a SimTraffic model. Departing from the Synchro/SimTraffic defaults may not be necessary to validate modeled traffic volumes at moderately congested locations. However, at highly congested locations, it may be necessary to modify the Synchro/SimTraffic defaults to calibrate and validate the traffic model. If validating to intersection queue data, the analyst may need to make minor adjustments to settings such as turning speeds (based on geometry of the intersection) or local headway factors (change in small increments only to improve the locations with long queues.

6.2.3 Common Errors and Warnings

Chapter 23 of the *Synchro Studio 10 User Guide* (4) provides a list of common errors and warning messages along with potential causes and tips for resolving the issues. This list of common errors and warnings may serve as a beneficial resource during the calibration process.

6.3 Paramics Calibration Parameters

WisDOT is currently phasing out the use of Paramics. As noted in TEOpS 16-20-4.3, effective January 1, 2018, WisDOT will no longer support the use of Paramics on any new projects. However, projects that initiated the microsimulation traffic analysis using Paramics prior to January 1, 2018 *may* continue to use Paramics for the duration of the project (although the analyst should consider switching the traffic models over to Vissim if major revisions to the traffic model is necessary or if the model is more than three years old). As such, it is possible that Paramics will still be in use in Wisconsin for several more years necessitating the need to provide some guidance on calibrating Paramics models, specifically for the alternative model development.

Attachment 6.2 provides a list of the parameters, along with recommended ranges, that the modeler will typically adjust while calibrating a Paramics model. This list provides a good starting point for the parameter value adjustment. A complete list of the adjustable parameters for Paramics is available on the BTO, Traffic Analysis, Modeling and Data Management webpage. Unless field data supports doing otherwise, modify only those parameters recommended as settings to adjust. Obtain WisDOT staff approval prior to modifying non-recommended adjustment parameters.

The following typically-used parameters all have direct impacts on model performance. Since different methods with multiple parameter combinations may exist to calibrate a specific modeling condition in Paramics, the analyst *should* first adjust the global parameters and then, only if necessary, adjust the local parameters. As noted in Attachment 6.2, the analyst *should* adjust several of the global and local parameters, such as the dynamic feedback routing factors, in small increments. Apply local adjustment factors (e.g., link-specific headway and reaction time factors) sparingly.

6.3.1 Introduction

This section contains suggested calibration parameter settings based on Wisconsin experience with Paramics. The use of these suggestions may help achieve a well-functioning model more quickly, but do not guarantee success.

6.3.2 Mean Target Headway

Headway is the time between two successive vehicles as they pass a point on the roadway, measured from the same common feature of both vehicles (for example, the front axle or the front bumper). As vehicles drive closer together, the headway decreases and the throughput of the roadway increases. A related concept is the gap, which is the time or distance from the back bumper of the first vehicle to the front bumper of the second vehicle.

Several vehicle behaviors depend on the minimum headway vehicles are willing to accept. An example is the smallest gap that a vehicle will accept when it merges or changes lanes. In Paramics, the MEAN TARGET HEADWAY coefficient strongly influences this behavior.

In effect, reducing the MEAN TARGET HEADWAY coefficient makes vehicles drive more aggressively and increases capacity. Therefore, base any adjustments to this coefficient on the prevalent driving style in the study area. People tend to drive more aggressively in big, congested cities than they do in uncongested rural areas or small towns. As such, use the following as the initial starting point for the MEAN TARGET HEADWAY

- Urban areas: 0.85 to 0.90
- Small Cities: 0.90 to 0.95
- Rural areas: 0.95 to 1.00

Provide documentation and justification for any deviations in these settings in the modeling methodology report.

6.3.3 Generalized Cost Coefficients

Many Paramics networks have situations where vehicles can use more than one route between a given origin and destination. The generalized cost coefficients have a strong influence on the route choice algorithm in the model. These coefficients determine how much weight to assign to time, distance and toll price.

By default, Paramics assumes that such decisions are made 100% based on time, but the coefficients can (and *should*) be adjusted to take distance and tolls into consideration.

For routes without tolls, use the following coefficients:

- 0.667 Time
- 0.333 Distance

Wisconsin does not currently have any toll roads; as such, the toll price cost coefficient is generally not applicable.

6.3.4 Ramp Calibration

Several global and localized parameters affect ramp performance. The following offers some general principles to consider when calibrating the Paramics model to ensure realistic ramp operations.

- Driver gap acceptance is a controlling parameter concerning the operation of ramps. As such, the model timestep settings may affect the ramp performance.
- Increasing ramp length and decreasing minimum ramp time have about the same effect.
- When calibrating the ramps, first adjust ramp aware distance and minimum ramp time leaving any adjustments to local ramp headway factors to the end of the process.
- Generally, leave the local ramp headway factor set to 1.00.
- Unless field conditions indicate otherwise, implement the same settings for all other ramps in the network.

6.3.5 Truck-Related Coefficients

WisDOT recommends using “HEAVIES USE ALL LANES” for Wisconsin Paramics models to spread trucks out into all mainline lanes. Wisconsin does not require trucks to stay in the right lane.

6.3.6 Vehicle Fleet

Use the Wisconsin-specific vehicle fleet file housed by BTO-TASU as the initial starting point for the vehicle fleet and adjust as appropriate to reflect the project-specific conditions. Please contact BTO-TASU via the DOT Traffic Analysis & Modeling(DOTTrafficAnalysisModeling@dot.wi.gov) mailbox to request a copy of the Wisconsin-specific vehicle fleet file for Paramics.

6.4 Vissim Calibration Parameters

Given the complex and iterative nature of model calibration and the large number of calibration parameters provided in Vissim, it is a good practice to start calibration using parameters that a modeler is certain about based on field data or experience. If additional calibration is still necessary, the analyst *may* move to parameters that they are less certain about but willing to experiment with different values. Attachment 6.3 provides a list of the parameters, along with recommended ranges, that the modeler will typically adjust while calibrating the Vissim model. This list provides a good starting point for the parameter value adjustment.

The following typically-used parameters all have direct impacts on model performances. Since different methods with multiple parameter combinations may exist to calibrate a specific modeling condition in Vissim, the analyst *should* first adjust the global parameters and then, only if necessary, adjust the local parameters.

6.4.1 Vehicle Fleet

Use the “North American” vehicle compositions from PTV Group for the initial input values. Based on local project conditions and road types included in the model, it may be necessary to refine or adjust the vehicle classifications (e.g., it may be best to remove the AASHTO WB67D/WB65 tractor and trailer from the fleet when simulating downtown or small neighborhood streets). Direct any specific questions on adjusting the vehicle fleet in Vissim to BTO-TASU via the DOT Traffic Analysis & Modeling(DOTTrafficAnalysisModeling@dot.wi.gov) mailbox.

6.4.2 Simulation Step

In most cases, use 10 seconds per simulation second.

6.4.3 Car Following Model for Freeways

For freeway segments, apply the Wiedmann 99 car following model. Standstill distances (CC0), headway time (CC1) and following variation (CC2) have significant impacts on the car following behaviors. Higher values represent more cautious driving behaviors and lower roadway capacity.

6.4.4 Car Following Model for Urban Arterials

For urban arterials, apply the Wiedmann 74 car following model. Higher values of average standstill distance, additive part of safety distance and multiplicative part of safety distance means more distance between vehicles and therefore lower roadway capacity.

6.4.5 Lane Change Parameters

Lane change parameters are the same for both freeway and arterial segments and the analyst *should* adjust them to match field conditions, especially at merging, diverging and weaving areas.

6.4.6 Local Car Following and Lane Change Parameters

Additional car following and lane change parameter sets can be defined separately as global settings and then only applied for local links and connectors where driving behaviors are different from global definitions.

6.4.7 Connector Lane Change Distance

The default lane change distance for all connectors is 656 feet and is typically representative of arterials. The analyst can, and *should* adjust the default lane change distance higher or lower as needed, especially for freeways and closely-spaced intersections. Additionally, there is an option to have this lane change distance increase for each lane that a vehicle must cross to travel via the connector. The analyst *should* adjust the lane change distance parameters to avoid unrealistic prepositioning and last-minute lane-changing behavior that may arise.

6.4.8 Other Adjustable Parameters

A complete list of the adjustable parameters for Vissim is available on the BTO, Traffic Analysis, Modeling and Data Management webpage. Unless field data supports doing otherwise, modify only those parameters recommended as settings to adjust. Obtain WisDOT staff approval, prior to modifying non-recommended adjustment parameters.

LIST OF ATTACHMENTS

Attachment 6.1	SimTraffic Calibration Parameters
Attachment 6.2	Paramics Calibration Parameters
Attachment 6.3	Vissim Calibration Parameters

16-20-7 Simulation Runs January 2018

7.1 Need for Multiple Simulation Runs

Real-world traffic varies considerably from day to day, and even from minute to minute. Microsimulation models attempt to mimic this effect by using stochastic (randomized) variables to account for variations in driver behavior and departure time. The source of this stochasticity is an algorithm within the microsimulation software package known as a pseudo-random number generator. Since purely random generation of numbers is mathematically problematic, pseudo-random number generators require a seed that initiates the underlying algorithm. This algorithm then generates a stream of millions or more apparently random numbers, which determine the release pattern of vehicles (i.e., how many and when) and the distribution of driver characteristics such as speed, among others, for each microsimulation model run. If the microsimulation software is functioning correctly, two model runs with the same seed will produce identical results.

If the analyst were to conduct only one run of the simulation model, there would be no way to assess whether the model was a good representation of reality as, depending on the seed value and the validity of the model, the results could represent a typical day, an abnormal day or they could mispresent reality altogether. Running multiple runs of the model with different seed values allows the analyst to get a better sense as to whether the model results accurately reflects the range of traffic conditions encountered in the real world. Thus, during the calibration and validation process, the analyst **shall** complete multiple simulation runs.

7.2 Simulation Seeds

Microsimulation software packages use many different types of pseudo-random number generating algorithms, potentially including multiple options within each package, but due to their pseudo-random nature, every type of algorithm will eventually begin to repeat if left running continuously. At the point of repetition, the algorithm will start generating the same stream of numbers in the same order. With certain types of pseudo-random number generators, the seed type can dictate the length of the resulting stream of numbers; zero and even numbers can cause some algorithms to repeat quickly or have other undesirable effects. Out of an abundance of caution, WisDOT has historically and will continue to require the use of prime numbers as seeds.

The purpose of this policy is to assure the uniform use of prime numbers as seeds, provide transparency and allow for the reproducibility of results. It has long been good modeling practice to record the seed number associated with each model run, but this has never been a formal requirement. With adoption of the formal peer review policy (see TEOpS 16-25), it has become necessary to document how the results recorded can be replicated. To ease this process and ensure consistency statewide, WisDOT is specifying the use of the seed values listed in Table 7.1 for all traffic model scenarios. Typically, a calibrated model will not require more than 30 simulation runs. If there is a desire to conduct additional runs, the analyst *should* carefully weigh the potential benefits of conducting additional runs against the additional resource requirements. If, warranted, contact BTO-TASU via the DOT Traffic Analysis & Modeling(DOTTrafficAnalysisModeling@dot.wi.gov) mailbox to receive seed values for additional runs.

Table 7.1 Seed Values

Run Number	Seed Value	Run Number	Seed Value	Run Number	Seed Value
1	**199**	11	**7**	21	**23**
2	**409**	12	**157**	22	**29**
3	**619**	13	**307**	23	**13**
4	**829**	14	**457**	24	**103**
5	**1039**	15	**607**	25	**193**
6	**1249**	16	**757**	26	**283**
7	**1459**	17	**907**	27	**373**
8	**1669**	18	**5**	28	**463**
9	**1879**	19	**11**	29	**28657**
10	**2089**	20	**17**	30	**514229**

Notes:

1. To simplify the process of running the models using the specified seed numbers (especially for Vissim), the seed numbers above represent prime numbers. The first ten runs are prime numbers that have an increment of 210 between each seed value. (To run the first ten runs in Vissim, enter the first seed (199) in the "Random Seed" box under Simulation>Parameters. Set the "Number of runs" to the desired number (up to 10), and then enter 210 as the "Random seed increment". This allows Vissim to complete runs 1-10 with the seed values shown above.
2. The SimTraffic simulation engine generates sequential seeds for multiple runs, the seed values shown above are **not** applicable

7.3 Number of Simulation Runs - Background

The purpose of this policy is to provide transparency and consistency with the determination of the number of simulation runs. Multiple forms of federal guidance exist on the number of simulation runs. FHWA's TAT III (2), Appendix B, outlines a method for determining the number of model runs using the standard deviation of the model results, confidence level (typically 95 percent), confidence interval (suggested to be a multiple or fraction of the model standard deviation) and corresponding t-statistic (see Equation 13 in TAT III (2), Appendix B). The use of the t-statistic reflects the deviation from the normal distribution when there are a limited number of trial runs, typically less than 30. If the initial estimate of the minimum number of runs exceeds the number of runs completed, the analyst must conduct additional model runs and then update the number of runs equation in an iterative fashion until the number of runs completed is equal to or greater than the number of runs required.

The *Highway Capacity Manual 2010* (HCM2010) (5) provides a slightly different method for determining the number of required repetitions for stochastic simulation analyses. The HCM2010 (5) methodology identifies three factors that have an influence on the number of required repetitions: the amount of error allowed in the model results, the confidence level for the model results, and the model variability. This is a more explicit restatement of the methodology outlined in TAT III (2), and the final equation (see HCM2010 (5) Page 7-27, Equation 7-2) to determine the required number of runs is the same with the exception that the HCM2010 (5) methodology uses the z-score instead of the t-statistic. The *Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis* (HCM6) (6) maintains this methodology (see HCM6 (6), Page 7-29, Equation 7-2).

The most recent national guidance on the minimum required number of runs is included as part of the *Guidance on the Level of Effort Required to Conduct Traffic Analysis Using Microsimulation* (7), published by FHWA in March 2014. The methodology outlined in this document uses field data to calculate the error tolerance. After completing several (5-10) initial model runs, the analyst can evaluate the number of required runs, and then, if necessary continue conducting additional model runs until the required number of runs is satisfied.

After reviewing the national guidance describe above, BTO-TASU chose to use the methodology outlined in the FHWA 2014 Guidance (7) as the basis for WisDOT's policy on determining the number of simulation runs. The following details WisDOT's policy regarding the number of simulation runs.

7.4 Number of Simulation Runs - Process

7.4.1 Selecting Test Location Sites

In order to complete the required number of runs calculations, the analyst **shall** select at least one representative location within the model study area for each peak period of analysis. A location is representative if it meets all of the following criteria:

- Lies within the area of interest associated with the purpose of the model
- Is on a facility of the highest or second-highest functional class being modeled
- Experiences higher-than-average traffic demand during the peak period being modeled

Given the data requirements spelled out below, the location(s) selected *should* have enough field data available to complete the required number of runs calculations.

The analyst *may* use the same location for more than one peak period provided it is representative of the peak period conditions. A location may be directional – that is, the location may reflect only the eastbound direction of a two-way facility. In fact, directional locations that match up with the peak traffic flows may be more representative than a location that reflects both directions of travel.

Although the minimum number of locations is one per peak period, for larger models, the analyst *should* include more than one location. A general rule would be to have one location per five miles of freeway or other principal arterial included in the model, with a practical upper limit of four locations per peak period.

7.4.2 Selecting the MOEs to Test

Volume, has historically been, the MOE used for calculating the required number of simulation runs. The national publications providing guidance on determining the number of runs cited in the simulation background (TEOpS 16-20-7-3) use volume in their examples. This may be because volume, in the past, has been the most data-rich MOE. Given advances in technology and data collection methodologies, WisDOT has other MOEs (such as travel time and speed) with sufficient field data that may be available for calculating the number of runs. Refer to TEOpS 16-20-3 for details on other potential MOEs.

In general, the analyst has latitude in selecting the MOE to use for determining the number of runs. The analyst *should* use the same MOE for every location and peak period included in the number of runs evaluation. Volume remains a good starting point, though data availability, the nature of the facility, and the model purpose *should* play a role in the MOE selection.

7.4.3 Use of Field Data

Rather than determining *a priori* what level of error is acceptable when calculating the required number of runs, the analyst *should* compute the error tolerance based on the variability observed in field data. To assist with determining the error tolerance using field data and calculating the number of required runs, BTO-TASU developed a Microsoft Excel based workbook.

The number of runs workbook requires the use of between 3 and 365 field data points, which the analyst would enter into the “Variability Analysis of Field Data” area of the workbook. To preserve the integrity of the test, the data entered **shall** be representative of the operating conditions that align with the purpose of the modeling effort. This permits filtering out data points with atypical conditions such as incidents or inclement weather when normal operating conditions are being modeled, while also requiring that only comparable situations be used where a special condition, such as an event at a stadium, is being analyzed. Selecting field data for entry in such a way as to unduly influence the resulting calculations, is not permissible.

The field data generates a margin of error, from which the spreadsheet then computes an error tolerance percentage. The workbook then uses this tolerance in combination with the initial model run results to calculate a required number of runs. Through thorough testing of the workbook, to account for the stochasticity inherent in the modeling processing, BTO-TASU set a minimum tolerance of one percent, even if the calculated tolerance from field data is lower. There is no upper limit to the tolerance.

7.4.4 Initial Simulation Runs

After entering the field data into the number of runs worksheet, the analyst must perform a series of initial model runs to allow for comparisons between the field data and model result variability. Historically, seven runs have proven to be a sufficient number of runs to capture the variation observed in the field. It provides enough samples to run summary statistics on, and falls within the 5 to 10 initial runs recommended in the most recent national guidance. Accordingly, the analyst **shall** complete seven initial model runs.

To facilitate the consistent use of prime seeds, discussed above in TEOpS 16-20-7.2, the “Initial Runs” portion of the number of runs workbook contains the seeds to use for each simulation run. Using prime number seeds in arithmetic sequence, or primes that are evenly spaced, substantially simplifies the process of running the models using the specified seed numbers, at least in Vissim. To run the initial seven runs in Vissim, enter the first seed, 199, in the "Random Seed" box under Simulation>Parameters. Set the "Number of runs" to 7, and then enter 210 as the "Random seed increment." This allows Vissim to complete seven successive runs with the appropriate seed values.

After the model runs are complete, enter the results from the first location for the selected MOE for the peak hour of the first peak period into the number of runs workbook. The workbook will automatically eliminate any statistical outliers (at the 95% confidence level), and will update the number of valid (non-outlier) runs accordingly. For additional information on how to address outliers, see TEOpS 16-20-7.4.7.

Using the tolerance from the field data, the workbook will compute an estimated number of runs. If the number of valid runs is less than or equal to the estimated number of runs, the test is completed for that location. Continue for other locations and/or other peak periods. If the number of valid runs is less than the estimated number of runs, more runs will be necessary (see the following section).

7.4.5 Additional Simulation Runs

If additional runs are required, enter the additional results data in the "Additional Runs" part of the number of runs workbook. The results from the first seven runs will automatically transfer over. The workbook will update the required number of runs calculations as appropriate to reflect the additional run data. The analyst *should* continue with additional runs, adding one at a time, until either the number of runs completed exceeds the number of runs required, or they have completed 30 runs. If the analysis indicates a need for more than 30 runs, contact BTO-TASU via the DOT Traffic Analysis & Modeling(DOTTrafficAnalysisModeling@dot.wi.gov) mailbox.

7.4.6 Number of Runs to Use for Reporting Results

It is likely that the number of runs will vary for each location and/or peak period of analysis; it may be higher than the seven initial runs for one or more locations and lower for others. The analyst *should* use the highest required number of runs value from any location for reporting model results. This will ensure that the required number of runs is met (and often exceeded) everywhere. If the highest required number of runs is less than seven, use the seeds for the initial seven runs to report results.

Typically, a calibrated model will not require more than 30 simulation runs. However, if the number of runs calculations find that more than 30 runs are necessary, coordinate with WisDOT regional traffic staff and/or BTO-TASU as appropriate to assess whether or not to conduct additional model runs, as it may be necessary to perform additional model calibration. If additional model runs are warranted, contact BTO-TASU via the DOT Traffic Analysis & Modeling(DOTTrafficAnalysisModeling@dot.wi.gov) mailbox to receive the seed values to use.

Unless the results of the model run are determined to be a statistical outlier (see TEOpS 16-20-7.4.5), the analyst **shall** use the results for the appropriate number of runs for the corresponding seed number shown in Table 7.1. See the following section (TEOpS 16-20-7.4.7) for additional information on how to address outliers, in both the number of runs calculations and runs used to report model results.

7.4.7 Model Run Outliers

In a non-technical sense, a model run is a statistical outlier if its value is significantly higher or lower than expected given the other model runs. For the purposes of WisDOT microsimulation analyses, WisDOT defines an outlier as anything outside of the 95% confidence interval, or more than 1.96 standard deviations away from the average value assuming a two-tailed normal distribution. Normally, a t-statistic-based test would be most appropriate data sets with less than 30 samples; however, this would add complexity to the process. More importantly, assuming a normal distribution is consistent with the FHWA 2014 Guidance (7) which serves as the basis for the number of run calculations (TEOpS 16-20-7.3).

Model run outliers are identified in both the initial seven runs and in any additional runs that are required. It is possible for there to be more than one outlier, though this is highly unlikely in the initial seven runs given the significant effect of the outliers themselves on the standard deviation of the sample.

The analyst **shall** remove the statistical outliers from calculations related to the number of runs required, as they overstate the dispersion of results observed in the model and would unnecessarily require a higher number of runs. Identifying outliers in an objective manner eliminates questions surrounding the analyst manually selecting runs to eliminate and will introduce greater consistency across projects.

7.4.8 Model Runs for Future Year Scenarios

The above policy applies to the existing conditions models, as they are the only scenarios with field data. For future scenarios, or for those without any applicable field data, use the same seed numbers associated with the required number of runs from the existing conditions (see Table 7.1 for the seed numbers to use). This includes using the highest required number of runs when reporting results for all other scenarios.

7.4.9 Recommended Process with Limited Field Data

When insufficient field data is available for representative locations, the analyst **shall** use the methodology laid out in Chapter 7 of HCM6 (6). Use volume as the MOE and seven initial runs. For the E_T, the maximum tolerable error, BTO-TASU recommends the use of 2 percent of the average volume at the representative location. If using an alternate maximum tolerable error, document the rationale for using the selected percent tolerable error within the modeling methodology report. Complete this calculation at each location for each peak period. Comply with the "Number of Runs to Use for Reporting Results" section above (TEOpS 16-20-7.4.6).

7.5 Software Considerations

The above policy is applicable for all Vissim and Paramics models, noting that WisDOT will cease support for the use of Paramics on new projects effective January 1, 2018 (see TEOpS 16-20-4). For SimTraffic models, conduct a minimum of seven runs. The SimTraffic simulation engine generates sequential seeds for multiple runs, the seed values shown in Table 7.1 is not applicable. To ensure the use of the same seed values for all model scenarios, make sure to start the multiple run recording with the same value.

16-20-8 Model Validation — January 2018

8.1 Introduction

This section describes the validation metrics and acceptance thresholds required for the MOEs discussed in TEOpS 16-20-3. This policy addresses the validation process for microsimulation traffic models and replaces the 2014 WisDOT Draft Microsimulation Guidelines housed on the www.wisdot.info website. **The policy provided within this document will become final and take effect on January 1, 2018.**

After January 1, 2018, use of the 2014 WisDOT Draft Microsimulation Guidelines will continue to be acceptable only for those projects that satisfy all the following conditions:

- The existing conditions traffic model is complete
- The existing conditions traffic model has undergone the peer review process
- The WisDOT regional traffic engineer and/or BTO-TASU determined that the model was adequately calibrated and validated
- No major revisions to the existing conditions model are necessary

If the project satisfies all the above conditions, the 2014 WisDOT Draft Microsimulation Guidelines may be applicable for all traffic modeling scenarios. However, WisDOT strongly encourages the analyst to assess whether the traffic model would satisfy the new validation thresholds as outlined below.

8.2 Validation Process

To validate that the traffic model reflects real world conditions, the analyst **shall** conduct both quantitative and qualitative checks on the model outputs for the analysis period. The analyst **shall** conduct validation checks of the existing conditions model using field-measured data, including but not limited to, traffic volumes, travel speeds, travel times, intersection queuing and trip-making patterns (e.g., weaving volumes). The analyst shall conduct the validation checks of the alternative models using traffic forecast and other data that is available for the alternative scenario. See TEOpS 16-20-8.3, 16-20-8.4 and 16-20-8.5 for details on the quantitative and qualitative validation thresholds.

During validation, it is also important to confirm that the model meets the purpose and need of the project (e.g., if the purpose of the project is to assess the feasibility of managed lanes, during validation it is important to confirm that the model can capture managed lane alternatives, etc.).

If the model outputs satisfy the validation thresholds (see TEOpS 16-20-8.3, 16-20-8.4 and 16-20-8.5), and the model meets the purpose and need of the project the analyst can consider the model to be valid and can use the model to assess various performance measures and/or MOEs. If the model outputs fail to satisfy the validation thresholds and/or the model does not meet the purpose and need of the project, additional calibration of the model will be necessary.

8.2.1 Historical Validation Process (pre January 1, 2018)

The 2014 WisDOT Draft Microsimulation Guidelines validation process consisted of three realism tests, where realism test 1 looked at traffic volumes, realism test 2 assessed travel times and speeds and realism test 3 considered travel patterns. Realism tests 1 and 2 were quantitative/mathematical tests that used GEH (Geoffrey E. Haver's volume tolerance formula) and absolute and/or percent differences to assess the differences between observed (field) and modeled data. Realism test 3 was a qualitative test that relied on professional judgement to determine if the modeled travel patterns were a good representation of field conditions. The 2014 WisDOT Draft Microsimulation Guidelines required the traffic model to satisfy all criteria in all three realism tests.

Although the realism tests generally provided a good assessment as to whether a traffic model accurately represented real world conditions, there were some concerns with the methodology. Specifically, WisDOT had the following concerns with the 2014 realism tests:

- The acceptance targets for GEH were initially developed for travel demand models, and thus may not be appropriate for microsimulation models.
- Since the original intent of the GEH formula was to evaluate daily or hourly volumes, was it appropriate to apply the GEH formula to 15-minute volumes?
- Depending on whether the modeled value was higher or lower than the target value, the same incremental difference could result in different GEH values. For example, if the target value was 250, a modeled volume of 325 (75 higher than the target) would yield a GEH of 4 while a modeled volume of 175 (75 lower than the target) would yield a GEH of 5. In this example, it appears that a modeled volume that is 75 vehicles higher than the target volume is a closer match to reality than a modeled volume that is 75 vehicles lower than the target volume. Does this make sense?
- Did it make sense to apply travel time realism tests to short routes, especially if performing travel speed realism tests on the same segment?
- How could BTO-TASU ensure that travel times are not blended in with travel speeds (i.e., travel speeds were calculated as the inverse of travel time)?
- How *should* project teams handle situations where there is no data available for a MOE included in one of the realism tests? Data is not always available for both travel time and travel speeds, making it impossible to conduct all three realism tests.
- Was it appropriate to apply the same validation tests for all types of microsimulation models?

In light of the concerns WisDOT had with the 2014 realism tests, BTO-TASU worked with a consultant team to assess whether there were other Goodness of Fit (GoF) metrics and/or validation thresholds that would be better suited for assessing whether a traffic model provided a good representation of reality. As part of the assessment, BTO-TASU and the consultant team conducted literature reviews, surveys of other state DOT practices and evaluation testing. To evaluate the GoF metrics, the consultant team used output from previously developed models, most of which had previously been calibrated and validated in accordance with the 2014 realism tests. The evaluation included models from the three WisDOT supported software tools (SimTraffic, Paramics and Vissim). The SimTraffic models were the only models that did not previously go through the calibration and validation process.

Since most of the models used in the evaluation testing had already undergone the calibration and validation process, the consultant team performed sensitivity testing by modifying model output to broaden the sample size of the data sets. After completing the sensitivity testing, the consultant team assigned a ranking system (with 1 being the best and 7 being the worst) for each MOE to determine the quality of validation for each model. This ranking system helped evaluate both the feasibility and acceptance levels for each of the GoF validation tests.

Through the literature reviews, surveys and evaluation testing; WisDOT determined that an overhaul of the 2014 realism tests were necessary. Although the new validation tests use different GoF metrics, models previously calibrated and validated using the 2014 realism tests *should* still be able to pass the new validation process. The following sections describe the new validation thresholds.

8.2.2 Tiered Validation Process (post January 1, 2018)

Effective January 1, 2018, WisDOT will require the use of a tiered validation approach. In this tiered approach, the Tier 1 test would be a global validation test for a metric and the Tier 2 test would be a local test for that same metric. If a model passes the Tier 1 (global) test, the modeling team would not need to perform the Tier 2 (local) test and a detailed summary of the Tier 2 test would not be necessary. BTO-TASU established the validation acceptance criteria to allow only well calibrated and validated models to pass the Tier 1 (global) test.

Table 8.1 summarizes the tiered validation tests. Refer to TEOpS 16-20-3 to identify the number and type of MOEs on which to perform validation tests, noting that the volume validation tests are required for all traffic models. The analyst *should* satisfy the validation thresholds shown in Table 8.1 for the selected MOEs to the best extent that is practically feasible. If the model is unable to satisfy the validation thresholds outlined in Table 8.1, the analyst **shall** consult with WisDOT regional traffic staff and BTO-TASU prior to finalizing the modeling methodology report and/or proceeding with the development of additional modeling scenarios.

8.3 Tier 1 (Global) Validation Tests

The Root Mean Squared Percent Error (RMSPE) is the primary validation metric for the global tests. This metric was based on the results of literature reviews, surveys of other state DOT practices with respect to GoF metrics to apply to microsimulation models and evaluation testing. The equation for RMSPE is as follows:

$$\textbf{RMSPE} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(\frac{M_i - O_i}{O_i}\right)^2}$$

Where:

M = Modeled Data

O = Observed Data

N = Number of Data Points

i = Observation Point

The Tier 1 (global) validation tests are applicable for link/segment volumes, travel times and travel speeds. Table 8.2 summarizes the Tier 1 (global) validation tests. Refer to TEOpS 16-20-3 to identify the number and type of MOEs on which to perform the Tier 1 (global) validation tests, noting that the Tier 1 volume validation tests are required for all microsimulation traffic models.

Table 8. 1 Validation Tests

MOE	Criteria	Validation Acceptance Threshold	
Volume[a]	All Links > 100 vph (Mainline and Critical[b] Arterials)	Tier 1:	RMSPE <5.0%
		Tier 2:	RNSE <3.0% for >85% of links
	All Turns	Tier 1:	Not Applicable
		Tier 2:	RNSE <3.0% for >75% of turns
Speeds	All Segments or Spot-Speed Locations	Tier 1:	RMSPE <10.0%
		Tier 2:	Within ± (Mainline Posted Speed X 20%) for >85% of locations
Travel Times	All Routes > 1.5 Miles	Tier 1:	RMSPE <10.0%
		Tier 2:	Within ± 15% for >85% of routes
Queues	All Critical[b] Queue Locations	Tier 1:	Not Applicable
		Tier 2:	± 150 feet for queues 300 to 750 long, Within ±20% for queues >750 feet long
Lane Use	All Critical[b] Lane Utilization Locations	Tier 1:	Not Applicable
		Tier 2:	RNSE <3.0% for >85% of locations Consistent with field conditions

[a] Volume validation (Tier 1) tests are required for all traffic models

[b] Critical locations are those locations likely to have an impact on operations to the project study area (e.g., locations with higher traffic volumes, existing or projected level of service is at or approaching unstable flow, queues block or impede travel, weaving areas, merge/diverge locations, etc.)

vph = vehicles per hour

RMSPE = Root Mean Squared Percent Error, See TEOpS 16-20-8.4 for equation

RNSE = Root Normalized Squared Error, See TEOpS 16-20-8-5.1 for equation

Table 8.2 Tier 1 (Global) Validation Tests

MOE	Criteria	Validation Acceptance Threshold	
Volume[a]	All Links > 100 vph (Mainline and Critical[b] Arterials)	Tier 1:	RMSPE <5.0%
Speeds	All Segments or Spot-Speed Locations	Tier 1:	RMSPE <10.0%
Travel Times	All Routes > 1.5 Miles	Tier 1:	RMSPE <10.0%

[a] Volume validation (Tier 1) tests are required for all traffic models

[b] Critical locations are those locations likely to have an impact on operations to the project study area (e.g., locations with higher traffic volumes, existing or projected level of service is at or approaching unstable flow, queues block or impede travel, weaving areas, merge/diverge locations, etc.)

vph = vehicles per hour

RMSPE = Root Mean Squared Percent Error, See TEOpS 16-20-8.4 for equation

8.3.1 Traffic Volumes

The Tier 1 volume validation test is required for all microsimulation traffic models, see Table 8.2. This test requires a global evaluation of the modeled versus observed (field) traffic volumes for all roadway links/segments for which traffic volume data is available. The volume validation tests evaluate the volumes during the peak period analysis times (does not include the warm-up or cool-down periods) included in the model (see TEOpS 16-20-2.1.2 for additional direction on determining the temporal analysis periods).

The traffic model will often be broken into smaller links than what exists in the field, so use the roadway segmentation that exists or is planned to exist in the field to identify locations where volume data comparisons are justified. Focus on the mainline segment and other critical arterials and ramps included in the study area, where critical locations are those locations likely to have an impact on traffic operations.

A benefit of the RMSPE is that it considers relative error, so the results will be the same whether the modeled volume is higher or lower than the observed volume. Sensitivity testing, however, found that the RMSPE was somewhat unstable when volumes were less than 100 vehicles per hour (vph). Thus, the Tier 1 volume validation threshold is only applicable for those roadway links with a minimum volume of 100 vph during the analysis period. Values that may be under 100 vph likely include ramps or arterial roadways that have minimal to no effect on the operations of the facility under study.

The acceptance criteria for the global link volume test is a RMSPE of 5 percent (i.e., to pass the Tier 1 volume validation test, the RMSPE for all links must be less than 5 percent). This acceptance criterion was based on the results of the evaluation testing on previously developed, calibrated and validated models. Only well validated models will pass the 5 percent acceptance criteria. If the model does not pass the 5 percent acceptance criteria, the analyst **shall** proceed onto the Tier 2 volume validation to pinpoint where any issues in the model may exist.

Conduct the Tier 1 volume validation tests by direction for every model run. The analyst should conduct the volume validation for the finest resolution that is feasible, with practical bounds from 15 minutes up to one hour. BTO-TASU realizes that using sub-hourly time periods for validation may not be practical (e.g., data is unavailable at the sub-hourly level, the additional value does not justify the added level of effort required, etc.). Consider the volume validation test satisfied if the model passes the tests at the hourly level. Ideally, however, if using sub-hourly data, strive to satisfy the volume validation test at the sub-hourly level.

Summarize and document the results of the volume validation tests. Include a copy of the volume validation tests as an attachment to the modeling methodology report and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate. For sample formats or questions on the volume validation test, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

8.3.2 Travel Speeds

See TEOpS 16-20-3 to identify whether to apply the Tier 1 travel speed validation test. As shown in Table 8.2, the Tier 1 travel speed validation test requires a global evaluation of the modeled versus observed (field) travel speeds during the analysis period (does not include the warm-up or cool-down period) for all segments where travel speeds are available (either average segment travel speeds or spot speeds). To ensure that the travel speed validation test is independent from the travel time validation test, take care not to use the inverse of travel times to derive the segment travel speeds for the travel speed validation.

The acceptance criteria for the global travel speed test is a RMSPE of 10 percent (i.e., to pass the Tier 1 travel speed test, the RMSPE for all segment/spot speed locations must be less than 10 percent). This acceptance criterion was based on the results of the evaluation testing on previously developed, calibrated and validated models. Only well validated models will pass the 10 percent acceptance criteria. If the model does not pass the 10 percent acceptance criteria, the analyst **shall** proceed onto the Tier 2 travel speed validation to pinpoint where any issues in the model may exist.

Conduct the Tier 1 travel speed validation tests by direction for every model run. The analyst should conduct the speed validation for the finest resolution that is feasible, with practical bounds from 15 minutes up to one hour. BTO-TASU realizes that using sub-hourly time periods for validation may not be practical (e.g., data is unavailable at the sub-hourly level, the additional value does not justify the added level of effort required, etc.). Consider the speed validation test satisfied if the model passes the tests at the hourly level. Ideally, however, if using sub-hourly data, strive to satisfy the speed validation test at the sub-hourly level.

Summarize and document the results of the travel speed validation tests. Include a copy of the travel speed validation tests as an attachment to the modeling methodology report and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate. For sample formats or questions on the travel speed validation test, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

8.3.3 Travel Times

See TEOpS 16-20-3 to identify whether to apply the Tier 1 travel time validation test. As shown in Table 8.2, the Tier 1 travel time validation test requires a global evaluation of the modeled versus observed (field) travel times during the analysis period (does not include the warm-up or cool-down period) for all study routes greater than 1.5 miles in length. To ensure that the travel time validation test is independent from the travel speed validation test, take care not to use the inverse of the segment travel speeds to derive the travel times for the travel time validation.

It is easier for drivers to relate travel time to longer routes versus shorter routes (i.e., a driver may say they drove ½ mile at an average of 60 miles per hour but typically will not say they took 30 seconds to drive the ½ mile). Further, on shorter segments, travel times and travel speeds tend to blend together (i.e., the travel time is often taken as the inverse of travel speed). WisDOT experience with previous projects has shown that it is easiest to make a distinction between travel time and travel speeds when the travel route is at least 1.5 miles long. For these reasons, the Tier 1 validation test for travel times is only applicable to travel routes greater than 1.5 miles long. Unless the use of shorter segments is logical, the analyst *should* combine short travel time segments (those less than 1.5 miles) together to make one longer travel time segment to use for the Tier 1 travel time validation test. If unsure whether to combine segments for the travel time validation test, please contact WisDOT regional traffic staff and/or BTO-TASU. Document the rationale for using the shorter travel time routes or combining routes into one longer segment in the modeling methodology report.

The acceptance criteria for the global travel time test is a RMSPE of 10 percent (i.e., to pass the Tier 1 travel time test, the RMSPE for all routes greater than 1.5 miles must be less than 10 percent). This acceptance criterion was based on the results of the evaluation testing on previously developed, calibrated and validated models. Only well validated models will pass the 10 percent acceptance criteria. If the model does not pass the 10 percent acceptance criteria, the analyst **shall** proceed onto the Tier 2 travel time validation to pinpoint where any issues in the model may exist.

Conduct the Tier 1 travel time validation tests by direction for every model run. The analyst should conduct the travel time validation for the finest resolution that is feasible, with practical bounds from 15 minutes up to one hour. BTO-TASU realizes that using sub-hourly time periods for validation may not be practical (e.g., data is unavailable at the sub-hourly level, the additional value does not justify the added level of effort required, etc.). Consider the travel time validation test satisfied if the model passes the tests at the hourly level. Ideally, however, if using sub-hourly data, strive to satisfy the travel time validation test at the sub-hourly level.

Summarize and document the results of the travel time validation tests Include a copy of the travel time validation tests as an attachment to the modeling methodology report and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate. For sample formats or questions on the travel time validation test, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

8.4 Tier 2 (Local) Validation Tests

If the model fails to pass the Tier 1 (global) validation tests, the analyst **shall** perform the Tier 2 (local) test for the applicable MOEs. The purpose of the Tier 2 validation test is to pinpoint where potential problems in the model may exist. Since the Tier 2 validation test is a localized test, the GoF metric varies depending on the MOE. The Tier 2 (local) validation tests are applicable for link/segment volumes, turning movement volumes, travel speeds, travel times, queues and lane use. Table 8.3 summarizes the Tier 2 (local) validation tests. Refer to TEOpS 16-20-3 to identify the number and type of MOEs on which to perform validation tests, noting that if a model passes the Tier 1 (global) tests for a specific MOE, it is not necessary to perform the Tier 2 (local) tests for that same MOE. Document the rationale for excluding the Tier 2 validation tests (e.g., the MOE in question successfully passed the Tier 1 validation test) in the modeling methodology report. The analyst, however, *should* always perform the Tier 2 turning movement volume test for projects that include intersections.

Table 8.3 Tier 2 (Local) Validation Tests

MOE	Criteria	Validation Acceptance Threshold	
Volume[a]	All Links > 100 vph (Mainline and Critical[b] Arterials)	Tier 2:	RNSE <3.0% for >85% of links
	All Turns	Tier 2:	RNSE <3.0% for >75% of turns

Speeds	All Segments or Spot-Speed Locations	Tier 2:	Within ± (Mainline Posted Speed X 20%) for >85% of locations
Travel Times	All Routes > 1.5 Miles	Tier 2:	Within ± 15% for >85% of routes
Queues	All Critical[b] Queue Locations	Tier 2:	± 150 feet for queues 300 to 750 long, Within ±20% for queues >750 feet long
Lane Use	All Critical[b] Lane Utilization Locations	Tier 2:	RNSE <3.0% for >85% of locations Consistent with field conditions

[a] Link/Segment Volume Tier 2 validation tests are required for all traffic models that do not pass the Tier (1) validation test and Turning Volume Tier 2 validation tests are required for all traffic models that include intersections

[b] Critical locations are those locations likely to have an impact on operations to the project study area (e.g., locations with higher traffic volumes, existing or projected level of service is at or approaching unstable flow, queues block or impede travel, weaving areas, merge/diverge locations, etc.)

vph = vehicles per hour

RNSE = Root Normalized Squared Error, See TEOpS 16-20-8-5.1 for equation

8.4.1 Traffic Volumes

The volume validation test is required for all microsimulation traffic models, however, the Tier 2 volume validation test for links/segments is only required if the model fails to pass the Tier 1 volume validation test. The analyst, however, *should* always perform the Tier 2 turning movement volume test for projects that include intersections. A metric named root normalized squared error (RNSE), which is a variation of the GEH (Geoffrey E. Havers) tolerance formula is the validation metric for local volume tests. The RNSE removes the modeled volume from the basis of normalizing error. The RNSE metric was developed based on literature reviews and evaluation testing. . The equations for GEH and RNSE are shown below.

$$GEH = \sqrt{2\frac{(M-O)^2}{(M+O)}} \qquad RNSE = \sqrt{\frac{(M-O)^2}{O}}$$

Where:

M = Modeled Data

O = Observed Data

The RNSE shares the same general form as the global RMSPE test that is the basis for the global volume test. Additionally, RNSE provides a consistent value above and below a target volume, whereas GEH does not, eliminating some of the concerns BTO-TASU has with the GEH.

Sensitivity testing found that volumes less than 100 vph may erroneously influence the statistics by potentially reducing the impact of critical links with higher volumes not meeting the threshold. Thus, the Tier 2 (local) volume validation threshold is only applicable for those roadway links with a minimum volume of 100 vph during the analysis period. Values that may be under 100 vph likely include ramps or arterial roadways that have minimal to no effect on the operations of the facility under study. The RNSE, however, is applicable to all turning movements (i.e., there is no minimum volume threshold for turning movements).

For the local link volume test, a RNSE of less than 3.0 is required for greater than 85 percent of links over 100 vehicles per hour. For the local turning movement volume test a RNSE of less than 3.0 is required for greater than 75 percent of turns. These acceptance criteria are based on the results of the evaluation testing on previously developed, calibrated and validated models. Though the RNSE test value is more robust than the WisDOT 2014 local volume criteria (realism test 1.1, 1.2 and 1.3), its use did not result in well-validated models becoming invalid. Other agencies including the Washington Department of Transportation and London Department for Transport use a similarly strict criterion (GEH criteria of 3.0).

Conduct the Tier 2 volume validation tests by direction for every model run. The analyst should conduct the volume validation for the finest resolution that is feasible, with practical bounds from 15 minutes up to one hour. BTO-TASU realizes that using sub-hourly time periods for validation may not be practical (e.g., data is unavailable at the sub-hourly level, the additional value does not justify the added level of effort required, etc.). Consider the volume validation test satisfied if the model passes the tests at the hourly level. Ideally, however, if using sub-hourly data, strive to satisfy the volume validation test at the sub-hourly level.

Summarize and document the results of the volume validation tests. Include a copy of the volume validation tests as an attachment to the modeling methodology report and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate. For sample formats or questions on the volume validation test, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

8.4.2 Travel Speeds

See TEOpS 16-20-3 to identify whether to apply the Tier 2 travel speed validation test (note Tier 2 is only required if the model fails to pass the Tier 1 validation test). A combination of absolute error and percent error related to the posted speed limit of a roadway segment is the validation metric for local travel speeds (see Table 8.3). These validation metrics are based on the results of literature reviews, surveys of other state DOT practices and evaluation testing. The range of acceptance for this test is determined by using a threshold of plus or minus 20 percent of the posted speed limit (i.e., a posted speed of 40 mph would have a range of acceptance of plus or minus 8 mph). For the validation testing, the analyst would apply this range of acceptance (plus or minus 20 percent of the posted speed limit) to the observed speed. For example, an observed speed of 31 mph would have a range of acceptance between 23 and 39 mph (31 +/- 8 MPH) if the posted speed were 40 mph.

Since the 2014 realism tests had an acceptance criterion of plus or minus 10 mph regardless of the speed, it was possible for models to pass the realism test even if portions of the study corridor had modeled speeds that were 50% or more higher or lower than the observed speeds. This was most noticeable on arterials. The new local speed test tightens up the travel speed criteria for arterials and provides more flexibility for freeways experiencing congestion as compared to the 2014 realism tests.

Conduct the Tier 2 travel speed validation tests by direction for every model run. The analyst should conduct the travel speed validation for the finest resolution that is feasible, with practical bounds from 15 minutes up to one hour. BTO-TASU realizes that using sub-hourly time periods for validation may not be practical (e.g., data is unavailable at the sub-hourly level, the additional value does not justify the added level of effort required, etc.). Consider the travel speed validation test satisfied if the model passes the tests at the hourly level. Ideally, however, if using sub-hourly data, strive to satisfy the travel speed validation test at the sub-hourly level.

Summarize and document the results of the travel speed validation tests. Include a copy of the travel speed validation tests as an attachment to the modeling methodology report and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate. For sample formats or questions on the travel speed validation test, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

8.4.3 Travel Times

See TEOpS 16-20-3 to identify whether to apply the Tier 2 travel time validation test (note Tier 2 is only required if the model fails to pass the Tier 1 validation test). The 2014 realism test for travel times had separate acceptance thresholds for routes less than seven minutes and routes equal to or greater than seven minutes, where routes less than seven minutes had an acceptance criterion of plus or minus one minute. The one-minute acceptance criterion for short routes was very easy to meet, especially if considering routes with observed travel times of less than one minute. For this reason, BTO-TASU and the consultant team considered several local testing options for travel times to develop a validation threshold that would address the issues the 2014 realism test had concerning short segments.

Percent error is the metric the local travel time validation test. This metric was developed based on the results of literature reviews, surveys of other state DOT practices and evaluation testing. The selected travel time criterion requires modeled travel times to be within plus or minus 15 percent of observed travel times (see Table 8.3). WisDOT experience with previous projects has shown that it is easiest to make a distinction between travel time and travel speeds when the travel route is at least 1.5 miles long. Further, a driver is more likely to start noticing slight changes in travel times on routes 1.5 miles long or longer (e.g., at 45 mph, the driver would take 2 minutes to travel 1.5 miles, any changes in travel time less than 2 minutes will likely be unnoticeable), For these reasons, the local travel time test is only applicable for routes over 1.5 miles in length. Unless the use of shorter segments is logical, the analyst *should* combine short travel time segments (those less than 1.5 miles) together to make one longer travel time segment to use for the Tier 2 travel time validation test. If unsure whether to combine segments for the travel time validation test, please contact WisDOT regional traffic staff and/or BTO-TASU. Document the rationale for using the shorter travel time routes or combining routes into one longer segment in the modeling methodology report.

Conduct the Tier 2 travel time validation tests by direction for every model run. The analyst should conduct the travel time validation for the finest resolution that is feasible, with practical bounds from 15 minutes up to one hour. BTO-TASU realizes that using sub-hourly time periods for validation may not be practical (e.g., data is unavailable at the sub-hourly level, the additional value does not justify the added level of effort required, etc.). Consider the travel time validation test satisfied if the model passes the tests at the hourly level. Ideally, however, if using sub-hourly data, strive to satisfy the travel time validation test at the sub-hourly level.

Summarize and document the results of the travel time validation tests. Include a copy of the travel time validation tests as an attachment to the modeling methodology report and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate. For sample formats or questions on the travel time validation test, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

8.4.4 Queue Lengths

Refer to TEOpS 16-20-3 to identify whether or not to apply the Tier 2 (local) queue validation test, noting that queues can be either a primary or a secondary validation MOE. Typically, if intersection queuing is critical to the design decisions (e.g., the project is assessing the storage length requirements for a left turn lane), queue lengths will be one of the primary validation MOEs for the arterials. Intersection queue lengths are often the primary MOE for validation of a SimTraffic model. The quantitative metrics for queues shown in Table 8.3 are applicable for all models where queue lengths are a primary validation MOE (typically applicable for arterial segments). The qualitative measures discussed in TEOpS 16-20-8.5 are applicable for models that use queue length as a secondary validation MOE (typically applicable for freeway segments).

Upon conducting, BTO-TASU decided to use The validation metric for intersection queue length is a combination of absolute error and percent error. This validation metric was developed based on the results literature reviews, surveys of other state DOT practices and evaluation testing. The acceptance criterion for the intersection queue validation test is an absolute error of plus or minus 150 feet for all observed queues between 300 and 750 feet and a percent error of plus or minus 20 percent for all observed queues greater than or equal to 750 feet. Similar to other tests, 85 percent of locations compared are required to pass the intersection queue validation criteria.

Although the analyst *should* perform the queue length validation test for all models where queue lengths are a primary validation MOE, BTO-TASU realizes there are potential issues with using queue length as a validation metric including, but not limited to:

- Queue lengths are generally unstable and can fluctuate significantly from one moment to the next, thus the queues observed in the field may not reflect the queues that were present during the time of the turning movement count.
- There is no standard procedure for measuring the length of queue. Queues could include only stopped vehicles or they could include stopped and slow moving (less than 5 mph) vehicles.
- Each microsimulation analysis tool has its own proprietary methodology for reporting on queue lengths, so there is a lack of consistency.

As such, the Tier 2 (local) queue validation test is non-binding, in that failure to meet the queue validation thresholds alone will not necessarily require further calibration and validation of the model. If the model is unable to satisfy the queue validation thresholds outlined in Table 8.3, the analyst **shall** consult with WisDOT regional traffic staff and BTO-TASU to assess the need for further model calibration. This coordination **shall** occur prior to finalizing the modeling methodology report and/or proceeding with the development of additional modeling scenarios

Conduct the Tier 2 queue validation tests by direction for every model run. The analyst should conduct the queue validation for the finest resolution that is feasible, with practical bounds from 15 minutes up to one hour. BTO-TASU realizes that using sub-hourly time periods for validation may not be practical (e.g., data is unavailable at the sub-hourly level, the additional value does not justify the added level of effort required, etc.). Consider the queue validation test satisfied if the model passes the tests at the hourly level. Ideally, however, if using sub-hourly data, strive to satisfy the queue validation test at the sub-hourly level.

Summarize and document the results of the queue validation tests. Include a copy of the queue validation tests as an attachment to the modeling methodology report and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate. For sample formats or questions on the queue validation test, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

8.4.5 Lane Utilization

Refer to TEOpS 16-20-3 to identify whether to apply the Tier 2 (local) lane utilization validation test. Other agencies (such as Oregon DOT, Minnesota DOT and Washington DOT) use their traffic volume validation criteria and a comparison of modeled and observed lane utilization percentages. Comparable to the criteria used by Oregon DOT, Minnesota DOT and Washington DOT, the acceptance criterion for lane utilization is a RNSE of less than 3.0 for greater than 85 percent of data points (see Table 8.3). The data points chosen for the lane utilization validation *should* represent those locations where lane usage is critical for the operations of the facility (e.g., weaving areas, upstream of lane drops, etc.).

Although the analyst is encouraged to perform the quantitative lane utilization validation test for areas where lane usage has a significant influence on operations, BTO-TASU acknowledges that data may not always be available to conduct mathematical checks on lane utilization. As such, it may be acceptable to do more of a qualitative assessment to assess that the model reasonably reflects the lane utilization observed in the field. Justify and document the use of any qualitative assessments in the modeling methodology report.

Conduct the lane utilization validation tests by direction for every model run. The analyst should conduct the lane utilization validation for the finest resolution that is feasible, with practical bounds from 15 minutes up to one hour. BTO-TASU realizes that using sub-hourly time periods for validation may not be practical (e.g., data is unavailable at the sub-hourly level, the additional value does not justify the added level of effort required, etc.). Consider the lane utilization validation test satisfied if the model passes the tests at the hourly level. Ideally, however, if using sub-hourly data, strive to satisfy the lane utilization validation test at the sub-hourly level.

Summarize and document the results of the lane utilization validation tests. Include a copy of the lane utilization validation tests as an attachment to the modeling methodology report and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate. For sample formats or questions on the lane utilization validation test, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

8.4.6 Density

Acceptance of quantitative validation testing for density may be acceptable. To use density as a validation check for microsimulation models; the analyst **shall** obtain approval from WisDOT regional traffic staff and/or BTO-TASU.

8.5 Qualitative Validation Tests

The goal of the model validation process is to assure that the model is a good representation of the actual traffic conditions. This means that the model must not only meet the mathematical targets related to traffic volumes, speeds and travel times, but must also be reasonable in terms of overall traffic patterns such as lane choice and routing. Table 8.4 provides a summary of the qualitative validation checks. The analyst **shall** perform the qualitative validation tests for all models, even those that pass the Tier 1 (global) mathematical validation thresholds. Document and justify the decisions made as they pertain to the qualitative validation tests and summarize the findings of the tests in the modeling methodology report.

Table 8.4 Qualitative Validation Tests

MOE	Criteria	Validation Acceptance Threshold
Queues	All Critical Queue Locations	Visually realistic for intersection queues. Quantitative checks required if queues are a primary validation MOE.
Bottlenecks	Replication of Real-World Bottlenecks	Visually realistic for intersection queues and freeway bottlenecks
Routing	All Routes	Represents field conditions and driver behavior. Acceptance of quantitative results require WisDOT approval.
Lane Use	All Critical Lane Utilization Locations	Visually realistic. Quantitative checks encouraged for areas where lane usage has a significant influence on operations.
Freeway Merging	All Merge Locations	Visually realistic
Vehicle Types and Truck Percentages	All Locations	Represents field conditions.

9.1 Recommended Process

Only after calibrating and validating the existing conditions and only after completing the peer review process of the existing conditions model, *should* the analyst proceed with the development of other modeling scenarios. If the analyst chooses to develop the alternatives model prior to calibrating and validating the existing conditions model and/or prior to having the model go through the peer review process, they take the risk that they must go back and revise not only the alternatives model but the existing conditions model as well. This can lead to potential inconsistencies in the modeling scenarios and could result in the need for additional time to calibrate and perform the peer review(s) of the alternatives model. Although it may be tempting, especially when the project has a compressed schedule, to skip or delay the calibration, validation and/or peer review process of the existing conditions model, it may end up being counterproductive and is strongly discouraged.

Refer to TEOpS 16-20-2 for additional details on the model development process, analysis scenarios and traffic model tree.

9.1.1 Carrying Parameters Forward into Model Scenarios

Unless changes to roadway geometry or traffic conditions are expected to alter the driving behavior, the analyst *should* carry the parameters from the calibrated existing conditions model forward, without any changes, to each subsequent scenario. For example, if it is necessary to use a headway of 0.85 to reproduce the level of congestion in the existing real-world network during the AM peak hour, then the analyst *should* use the same 0.85 headway value for the AM peak hour model in the design year.

Document and justify the rationale for modifying any of the existing conditions parameters. Where possible, associate any modification to the existing conditions parameters to changes in geometric conditions that may influence driving behavior (e.g., the design year build alternative lengthens the weaving area resulting in the need for drivers to be less aggressive thus increasing the headway).

9.1.2 Validation of Design Year Models

The only mathematical validation test that is applicable for design year models is the volume validation (both Tier 1 and Tier 2) tests. When conducting the volume validation tests (see Table 8.1) for the design year models, the analyst *should* compare the modeled volumes (i.e., output from the microsimulation model) to the appropriate design year traffic forecasts. Due to future congestion, the microsimulation model may not be able to sufficiently capture the true design year traffic demand within the analysis period, specifically for the no-build or FEC conditions. Under this scenario, the analyst *should* run the model with only the traffic demand for the analysis period (e.g., do not include the demand from the warm-up or cool-down periods) until all vehicles have exited the network, thereby capturing the full demand reflected in the design year traffic forecasts. Apply the volume validation tests (typically for each one-hour period) to both the seed matrix (full demand, no warm-up or cool-down) and analysis period matrix (includes warm-up, analysis period, and cool-down periods) runs. Running the model with the seed matrix allows the analyst to validate that the peak period demand matrix, when isolated, is sound.

Given the context within which quantitative checks on MOEs (specifically travel speeds, travel times, queue lengths and lane utilization) are conducted for the design year models, the validation tests for the MOEs for design year models consist of a visual check of the traffic model for reasonableness. Additionally, the analyst *should* perform the qualitative validation tests as summarized in Table 8.4 as appropriate.

In addition to the visual and qualitative tests, the analyst *should* compare the travel times, travel speeds and queue results from the design year model to existing conditions data to assess whether the relative increase/decrease in each MOE between the scenarios is reasonable.

Conduct the quantitative volume validation tests and qualitative/visual checks by direction for each 15-minute analysis period for every model run. Summarize and document the results of the quantitative volume validation tests and qualitative/visual checks for the average of all (valid) runs. Include a copy the volume validations tests as an attachment to the modeling methodology report and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate. For sample formats or questions on the design year volume validation test, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

9.2 Traffic Volume Development

Work with the WisDOT regional traffic staff and WisDOT-TFS to develop the forecasts for the design year. Chapter 9 of the WisDOT *Transportation Planning Manual* provides details on the process for obtaining and developing traffic forecasts.

The forecasts developed by the WisDOT-TFS typically provide forecasts for the average annual daily traffic

(AADT) and peak-hour intersection turning movement volumes (if requested). The microsimulation models, however, often require the use O-D matrix tables in addition to or instead of turning movement volumes and generally need to capture 15-minute profiles for the warm-up, analysis and cool-down periods. Further, microsimulation models require the use of a balanced volume data set, and oftentimes the traffic forecasts will reflect unbalanced volumes. Thus, in most cases, it will not be possible to enter the forecasts into the microsimulation model directly as provided by the WisDOT-TFS.

Document the methodology used to develop and modify the forecasts for use in the microsimulation models in the Traffic Forecasting Methodology Report and submit to the regional office and WisDOT-TFS for approval. The WisDOT-TFS will typically provide any comments on their review of the forecasting methodology report in DT2340. The regional office will involve BTO-TASU in the review as appropriate.

9.2.1 Design Hour Volumes for Microsimulation Models

The analyst shall coordinate with WisDOT regional traffic staff, WisDOT-TFS and BTO-TASU as appropriate to develop design-hour volumes (DHV) for microsimulation models.

9.2.2 Origin-Destination Matrix Development for Microsimulation Models

The analyst shall coordinate with WisDOT regional traffic staff, WisDOT-TFS and BTO-TASU as appropriate to develop the O-D matrices for microsimulation models.

16-20-10 Documentation/Reporting/Presentation of Results — January 2018

10.1 Modeling Methodology Report

Prior to submitting the traffic model to the WisDOT regional office and other members of the peer review team (see TEOpS 16-25), document the methodology and assumptions used to develop, calibrate and validate the traffic model. Prepare a separate modeling methodology report for each model scenario. The exact format of the modeling methodology report will vary depending on the specifics of the project; however, the content of the report *should* always include the following:

- Project background – What is the goal/purpose of the project and why is microsimulation being used?
- Methodology/assumptions – Identify the methodology used to develop the model, being sure to note any assumptions.
- Calibration parameters – Identify and describe any user-defined parameters (i.e., note where changes to default parameters were made). Provide justification for the use of any localized (link-specific) calibration parameters.
- Validation summary – Summarize the findings of the validation tests. Provide the detailed validation testing results as an attachment to the report. Additionally, submit an electronic copy (preferably in Excel format) of the validation tests to the peer review team members.

Reference other reports such as the Traffic Analysis Tool Selection memo or Traffic Forecasting Methodology Report as appropriate, being sure to provide copies of any referenced documents as an attachment to the modeling methodology report.

For sample formats or questions on what to include in the modeling methodology report, please contact BTO-TASU via the DOT Traffic Analysis & Modeling mailbox (DOTTrafficAnalysisModeling@dot.wi.gov).

10.2 Presentation or Results

It is critical to format the presentation of microsimulation results to the audience because the expectation is that managers, technical staff, public officials and the traveling public will each have different levels of comprehension. For example, the average transportation user may understand the impacts on roadway performance through travel times, delay or congestion levels. If the average commute on a particular corridor increases from 20 minutes in a current year to 40 minutes in the future, the average user may understand how this is going to affect them. Whereas this same audience may have a much more difficult time understanding how future traffic conditions are going to affect them if density increases by 100%.

Generally, most audiences can understand pictures, graphical presentations, simulation videos or screen shots that describe the results. Presentations at public meetings *should* begin by orienting the audience around the modeled scenario. Point out the basic elements of the simulation display and identify traffic conditions that will help to gain the audience's confidence in the model. Animation videos or screen shots are very powerful to display a traffic flow concept that is difficult to grasp using numerical output. For example, depending on the type of data, it may be difficult to identify the start of a freeway bottleneck using numerical output alone. It may be obvious to the analyst where the bottleneck begins but a 30-second video or series of screen shots can convey this message clearly to an audience that is unfamiliar with the model.

10.2.1 Animation Output

Use animation videos or static screen shots exclusively for qualitative assessment. The analyst *should* review the simulation model and focus on the key points of a particular scenario. Before showing the animation videos to an audience outside of the modeling development and/or review team, verify that the driver behavior is realistic. Most microsimulation tools now provide the option to show a 3D visualization of the model, complete with roadway infrastructure and other architectural features. While these features may help to orient the audience to the project study area, take care not to let the presentation graphics overshadow the fundamental engineering objectives of the model. Discuss the requirements for the needs and emphasis of animation output of the traffic model with the WisDOT project team during the project scoping process.

Choosing an appropriate segment of the model to display during presentations requires professional judgment and an understanding of the project's objectives. Typically, the analyst *should* consider the average condition unless the worst case is realistic and the result causes system failure.

Recording animation output minimizes the chance for software and technology issues during presentations. It is generally best to keep the recorded animation videos relatively short (a run time of 2 to 3 minutes). Overlay text on the simulation videos as appropriate to orient the audience and provide information on the model outputs.

10.2.2 Graphical and Numerical Output

A seemingly endless amount of data can be output from most microsimulation models. The importance of such outputs is dependent upon the purpose of the project, operational analysis and microsimulation model. The objective of the analyst is to focus on a few key performance measures that tell the story of how the transportation facility is operating. The analyst *should* carefully choose numerical output that best addresses the objectives of the simulation model and ultimately the overall project.

Understanding the strengths of microsimulation software and knowing how different performance measures are calculated are important aspects of the analysis process. The methods and effectiveness of each software to measure performance may require analysts to use multiple tools to provide a comprehensive analysis of the traffic operations.

Display graphical or tabular data in a clear and concise format so the intended audience can draw conclusions without becoming overwhelmed with the amount of data. Analysts *should* consider supplementary visual cues to draw the audience's attention to the most important pieces of data. Bolding, indenting or highlighting text with different colors can help to increase discrimination between the different levels of data. Colored shading typically represents the following conditions.

Color	Performance Level
Green / Blue	Good
Yellow	Acceptable
Orange	Poor
Red	Failing or Severe

Analysts *should* be cognizant of common vision deficiencies when presenting results with different colors. Consider using redundant visual cures instead of relying on color alone (e.g., use colors along with letters or shapes).

16-20-11 Upgrading Simulation Models — January 2018

Keeping a model relevant and useful often requires upgrading it to the latest release of the simulation software. As noted in TEOpS 16-20-4, the PTV Group typically releases major updates to the Vissim software once a year and Trafficware typically releases major updates to the Synchro/SimTraffic Studio software every two to three years. The software vendor may release minor updates, to address software bugs/errors, as often as once a month. As a note, there have not been any updates to Paramics since 2012.

These releases may or may not affect a specific simulation model but it is important to understand that no matter how small a change, any change could influence the results and validity of a model. This section will go over the questions to ask and the steps to follow when upgrading a model. The purpose of these steps is to give the modeler the information they need to assess the potential impact of upgrading the traffic model and to identify the additional work that may be necessary to re-calibrate and re-validate the traffic model. Before upgrading to a new model version, the analyst **shall** consult with the WisDOT project team, WisDOT regional traffic engineering staff and/or BTO-TASU as appropriate. When determining whether to upgrade, be cognizant of the version of the software that the peer review team has available to them to review the models (it may not be possible to open/use one version of the software in another version).

11.1 Software Upgrades

The general goals of large-scale projects involving microsimulation models usually involve multiple project stages/phases and may take 12 months or longer to complete. During this extended timeline, a software package may go through one or more updates. These updates usually occur for one or more of the following reasons:

- Software bug or error fix
- Feature addition
- Major version release

These updates can play an important role in the application of the software to a project and may require the need to update the model. For example, if the software vendor discovers a bug within the latest version of the software, they may release an update to address/fix the bug. Generally, the analyst *should* update the model to apply the bug fix as soon as possible. If the software update includes new or enhanced features, the modeling team may decide that the new features would benefit the project. If the benefit of adding the additional feature outweighs any potential implications (e.g., additional time/resources needed to revise the model), updating the model to apply the new features may be justified. Since major version releases of the software typically involve larger changes to the analysis methodologies, upgrading the traffic model to a new version may introduce new problems and the analyst is encouraged to hold off on upgrading the model to a later date.

11.2 When to Upgrade

In most cases, when establishing the project scope and budget, the project team assumes/expects that the traffic modeling will be done using a specific version of the software. Thus, the project scope and budget may not be able to absorb the additional time/costs needed to upgrade the traffic model to a new release of the software.

The stage/phase of the model is the most important thing to consider when evaluating whether it is the correct time to upgrade the model. The best time to upgrade a model is usually between major stages of a project. The following list highlights scenarios when the analyst and project team *may* want to consider upgrading a model:

- A new project is using an older model
- There is a major break in a project schedule
- The latest update feature(s) to the software addresses a geometric element or other concern of the project that the older version of the model could not accurately capture
- The latest version update to the software addresses/fixes major bugs/errors

The following list highlights scenarios when upgrading a model might introduce new problems and the analyst and project team *may* decide to upgrade the model later or not at all:

- Current project is almost finished
- Current model is still currently being used to test scenarios
- Model is very large and complex
- Newer version if not available to the peer review team

Ultimately, before upgrading to a new model version, the analyst **shall** consult with the WisDOT project team, WisDOT regional traffic engineering staff and/or BTO-TASU as appropriate.

11.3 Verify Model Calibration and Validation

If the WisDOT project team, WisDOT regional traffic engineering staff and BTO-TASU all agree that there is enough reason to convert the model to a new release/version of the software, it is often advisable for the analyst to compare the outputs/results of the key MOEs from the upgraded model to those of the original calibrated/validated model. This check *should* give the modeler an idea of how much work will be required to get the model to the same level of validity as the previous model. A model that does not require an extensive amount of modifications following an upgrade *should* be able to provide results that are similar and close to the original model.

Depending on the software package and the extent of the software modifications, upgrading the traffic model to the newest software version/release may cause a previously calibrated/validated model to fall out of validation. Therefore, the analyst *should* verify that the model still meets the validation thresholds. The modeler *should* first conduct a high-level, qualitative, assessment of the model, focusing on the components most significantly impacted by the software upgrade, to identify where revisions to the model may be necessary. Upon completing any necessary revisions to the model, the analyst *should* verify the validity of the model by performing the quantitative and qualitative validation tests summarized in TEOpS 16-20-8.

Document the results of the validation tests, either as part of the modeling methodology report or as a separate addendum, and submit to the regional office for review and comment. The regional office will involve BTO-TASU in the review as appropriate.

16-20-12 References January 2018

1. **NSW Transport Roads & Maritime Services.** *Traffic Modelling Guidelines.* New South Wales (NSW), Australia : s.n., 2013. ISBN 978-1-922194-21-3.

2. **Federal Highway Administration.** *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software.* 2004. FHWA-HRT-04-040.

3. **Federal HIghway Administration.** *Traffic Analysis Toolbox Volume IV: Guidelines for Applying CORSIM Microsimulation Modeling Software.* 2007. FHWA-HOP-07-079.

4. **Trafficware, LLC.** *Synchro Studio 10 User Guide.* 2017. Published July 13, 2017.

5. **Transportation Research Board.** *Highway Capacity Manual 2010.* Washington DC : National Academy of Sciences, 2010. ISBN 978-0-309-16077-3.

6. **Transportation Research Board**. *Highway Capacity Manual, 6th Edition: A Guide For Multimodal Mobility Analysis.* Washington, D.C. : National Academy of Sciences, 2016. ISBN 978-0-309-36997-8.

7. **Federal Highway Administration.** *Guidance on the Level of Effort Required to Conduct Traffic Analysis Using Microsimulation.* McLean, VA : Research, Development, and Technology Turner-Fairbank Highway Research Center, 2014. FHWA-HRT-13-026.

SimTraffic Calibration Settings

Last Updated: 11-27-2017

Type of Setting	Parameter Grouping	Parameter Name	Default Settings (per SimTraffic v. 10.1.1.1)	Recommended Parameter Value	Typical Parameters Adjusted During Calibration	Parameter Description
GLOBAL SETTINGS (Adjusted within SimTraffic)	***Driver Parameters***	Yellow Deceleration (ft/s^2)	7.0 - 12.0	8 to 10	Yes	Increase to make drivers less prone to running red lights.
		Speed Factor (%)	0.85 - 1.15	No range specified	Yes	Can be changed to increase or decrease the range of driver speeds (e.g. for a link speed of 50 mph and a speed factor of 1.1, the driver will attempt to maintain a speed of 55 mph).
		Courtesy Deceleration (ft/s^2)	3.0 - 10.0	7 to 9	Yes	Amount of deceleration a vehicle will accept in order to allow a vehicle ahead to make a mandatory lane change. Higher value = more courteous driver.
		Yellow Reaction Time (s)	0.7 - 1.7	No range specified	No	Amount of time it takes a driver to respond to a signal changing to yellow. More aggressive drivers will have a longer reaction time to yellow lights. Longer reaction times tends to reduce red light running for higher speed approaches and vehicles slowing to make a turn, however, may increase red light running for low speed approaches.
		Green Reaction Time (s)	0.2 - 0.8	0.5 to 2.0	Yes	Amount of time it takes the driver to respond to a signal changing green. More aggressive drivers will have a shorter reaction time to green lights.
		Headway at 0 mph (s)	0.35 - 0.65	No range specified	Yes, typically modify last	Interpolation used between these factors. May be necessary to change to match local driver parameters. The default headways provide an Saturation Flow Rate similar to the HCM (1900 vphpl) from 25 to 50 mph.
		Headway at 20 mph (s)	0.80 - 1.80	2 to 2.5		
		Headway at 50 mph (s)	1.00 - 2.20	1.7 to 2.0		
		Headway at 80 mph (s)	1.00 - 2.20	2.0 to 2.5		
		Gap Acceptance Factor	0.85 - 1.15	No range specified	Yes	Gap vehicles will accept at unsignalized intersections, for permitted left-turns, and for right turns on red. Higher values represent more conservative drivers.
		Positioning Advantage (veh)	1.2 - 15.0	Use defaults	No	Drivers will make a positioning lane change when there is ≥x vehicles ahead in the target lane than in the current lane. Higher values are associated with more conservative drivers and cause drivers to line up in correct lane. Lowe values are associated with aggressive drivers and cause drivers to avoid lining up in the correct lane until reaching the mandatory lane change point.
		Optional Advantage (veh)	0.5 - 2.3	Use defaults	No	Drivers will make a desired lane change when ≤x vehicles are ahead in the target lane than in the current lane. Higher values are associated with more conservative drivers and cause drivers to have unbalanced lane use. Lower values are associated with aggressive drivers and cause drivers to use lanes evenly.
		Mandatory Distance Adjustment (%)	50 - 200	No range specified	Yes	Global multiplier for local lane change settings.
		Positioning Distance Adjustment (%)	60 - 150	No range specified	Yes	Global multiplier for local lane change settings.
		Average Lane Change Time (s)	10 - 55	No range specified	No	Average time between lane change maneuvers. Applies only to optional lane changes, which are made to choose a lane with less congestion. Less time applies to more aggressive drivers.
		Lane Change Variance +/- (%)	10 - 30	No range specified	No	Adjustment similar to Average Lane Change Time, but base on driver type. Applies only to optional lane changes, which are made to choose a lane with less congestion. Higher percentage leads to increased awareness of lane change.
	Vehicle Parameters	Vehicle parameters (Occurrence, acceleration, dimensions, etc.)	See Synchro Studio 10 User Guide, Chapter 26 (page 26-7)	Defaults typically acceptable Modify vehicle fleet based on field classification counts if needed	Yes	Modify vehicle percentages based on nearest classification count. Fleet mix should add up to 100% for all truck types and 100% for all car types.

SimTraffic Calibration Settings

Last Updated: 11-27-2017

Type of Setting	Parameter Grouping	Parameter Name	Default Settings (per SimTraffic v. 10.1.1.1)	Recommended Parameter Value	Typical Parameters Adjusted During Calibration	Parameter Description
LOCAL SETTINGS (Adjusted within Synchro)	***Synchro Settings***	Link Speed (Lane Settings)	30	Start with posted. Adjust to reflect free flow speed (typically posted + 5 mph), if needed.	Yes	May be adjusted to match field speeds if data is available and speeds are not being used for validation
		Ideal Saturation Flow Rate (Lane Settings)	1,900	Adjust to match field if field data is available	Yes	Refer to TEOpS 16-15-5 for additional guidance on saturation flow rates for through lanes
		Growth Factor (Volume Settings)	1.0	Use for sensitivity testing or future year scenarios. Do not use for RTOR	No	
		Headway Factor (Simulation Settings)	1.0	0.8 to 1.2	Yes	Can be set on a per-movement basis. Can be used to calibrate the Saturated Flow Rates.
		Turning Speed (Simulation Settings)	9 mph (right-turns) 15 mph (left-turns)	Right turns = 12 to 15 mph	Yes	Default speeds are set for small radius urban intersections. With large suburban intersections, turning speeds may be significantly higher. Right-turns speeds need to be adjusted to or near the freeway speeds when simulating entrance ramps. At low speeds, the Saturated Flow Rate is highly sensitive to small changes in speed. Right-turns: SimTraffic = 9 mph (1545 vph). HCM for protected rights = 1615 vphpl Left-turns: SimTraffic = 15 mph (1883 vph). HCM for protected left-turns = 1805 vph.
		Mandatory Distance (Simulation Settings)	333	Base on field conditions	Yes	Distance ahead vehicle is forced to make lane change. Measured from Stop bar. Increase to allow vehicles to shift into correct lane earlier. Decrease to allow vehicles to shift into lane at the last possible moment. Large cities: Shorter mandatory distances Small towns: Longer mandatory distances. Useful to adjust with congested signals or lane drops after signals. With long turn bays consider setting this to less than the storage distance to allow for some late lane changes.
		Positioning Distance (Simulation Settings)	1320	Base on field conditions	Yes	Distance ahead vehicle starts to attempt lane change. Measured from Stop bar.
		Mandatory Distance2 (Simulation Settings)	880	Base on field conditions	Yes	Additional mandatory distance to make 2 lane changes. Measured from Stop bar. Typically used more for high-speed facilities. See Synchro Studio 10 User Guide, Chapter 28 (pages 28-5 to 28-18)
		Positioning Distance2 (Simulation Settings)	1760	Base on field conditions	Yes	Additional positioning distance to make 2 lane changes. Measured from Stop bar. Typically used more for high-speed facilities. See Synchro Studio 10 User Guide, Chapter 28 (pages 28-5 to 28-18)
		Lane Alignment (Simulation Settings)	Right for right-turns Left for left-turns and thru movements Right-NA for U-turns	Base on field conditions	Yes	
		Enter Blocked Intersection (Simulation Settings)	"No" for intersections	Code 1 vehicle if used Yes for driveways No for high speed movements	Yes	Enter "No" for high speed approaches and movements. "Yes" can help capacity of driveways. In general, controls gridlock avoidance.
		Taper Length (Simulation Settings)	25	Code as part of storage based on field conditions	Yes	Impacts when vehicles can start entering the storage.

Paramics Calibration Settings

Last Updated: 08-31-2017

Type of Setting	Parameter Grouping	Parameter Name	Default Settings (per Paramics v. 6.9.3)	Recommended Parameter Value	Typical Parameters Adjusted During Calibration	Parameter Description
GLOBAL SETTINGS	*Core Settings*	Time steps	2	2 to 4, Typically 4 for models with freeway merging	Yes	Higher Time Step allows vehicles to make decisions based on the car following and lane change logic at a higher frequency.
		Queue gap distance (ft)	32.81	Typically not modified	No	Maximum distance between queuing vehicles.
		Queuing speed (mph)	4.47	Typically not modified	No	Maximum speed of queuing vehicles.
		Heavy vehicles weight (ton)	2.95	Typically not modified	No	Minimum weight of a heavy vehicle.
		Mean target headway (s)	1.00	Urban areas: 0.85 to 0.90 Small Cities: 0.90 to 0.95 Rural areas: 0.95 to 1.00	Yes	Raise to increase distance between vehicles and represent more passive drivers. Lower to decrease distance between vehicles and represent more aggressive drivers.
		Mean driver reaction time (s)	1.00	Urban areas: 0.85 to 0.90 Small Cities: 0.90 to 0.95 Rural areas: 0.95 to 1.00	Yes	Value is associated with the lag in time between a change in speed of the preceding vehicle and the following vehicle's reaction to this change. Raise for more passive drivers. Lower for more aggressive drivers.
		Speed memory	3	1.5x the Time steps value	Yes, if time step value is changed.	Speed Memory is used to store previous vehicle speeds at each Time Step. Speed Memory x time step should be > than the global Driver Reaction Time.
		Minimum gap (ft)	6.56	Typically not modified	No	Minimum gap between stationary vehicles in a queue.
		Loop length (ft)	6.56	Typically not modified on global level	No	Default distance between upstream and downstream edges of a loop detector (2 meters). Detector lengths may be modified locally as well.
		Amber time (s)	3	Typically not modified on global level	No	Default yellow time included in traffic signal phases. This setting should be modified locally based on field signal timing and phasing settings.
		Red time (s)	5	Typically not modified on global level	No	Default red time included in traffic signal phases. This setting should be modified locally based on field signal timing and phasing settings.
		Default curve speed factor	1	Typically not modified	No	Allows vehicles to make turns at a safe speed. Typically not modified.
		Speed drift unit	5	Typically not modified	No	Specifies minimum number of units that the link speed can be altered by in the Link Editor. Typically not modified.
		Wrong lane diversion time (s)	300	Typically not modified	No	Additional cost a vehicle would tolerate in order to reach its destination by choosing an alternative route. Only applies to links that have the "re-route stuck vehicles" flag enabled.
	Assignment Settings	Assignment settings-Time Cost Coefficient	1.000	0.667	Yes, change from default in initial network setup.	Coefficient that defines how travel time affects routing for all vehicles in the network.
		Assignment settings-Distance Cost Coefficient	0.000	0.333	Yes, change from default in initial network setup.	Coefficient that defines how distance affects routing for all vehicles in the network.
		Assignment settings-Toll Price Cost Coefficient	0.000	0	Only if tolling applies. Should be based on prevailing wage rate in the study area.	Coefficient that defines how toll pricing affects routing for all vehicles in the network.
		Assignment settings-Dynamic Assignment: Feedback Period	0	Start with 5 minute feedback period	Yes, change in small increments	Sets period at which link times are fed back into the routing calculations. At the beginning of each feedback period route cost tables are calculated for each viable network node to each destination zone.
		Assignment settings-Dynamic Assignment: Feedback Smoothing	0.500	Adjust to reflect field conditions	Yes, change in small increments	Determines the percentage of historical data to be included in the routing table calculations. The lower the value the more emphasis is placed on historic data.
		Assignment settings-Dynamic Assignment: Feedback Decay	0.995	0.3 to 0.5	Yes, change in small increments	Reduces dynamic feedback costs over time if there is no new data to make new calculations with. This avoids having a rapid oscillation in costs.
		Assignment settings-Dynamic Assignment: Feedback Envelope	0	Adjust to reflect field conditions	Yes, change in small increments	Defines how delay at a distance from a vehicle affects routing decisions. The further away a delay value is from the driver's position, the less weight the driver applies to their route choice decision.
		Assignment settings-Matrix Tuning Level	None	Typically not modified	No	Modifies the demand distribution during simulation. For large networks there is a performance penalty with selection this option.
	Other Parameters	Other parameters-Vehicle types (proportion, familiarity, kinematics, dimensions, etc.)	-	Use Wisconsin-tailored vehicles file. Adjust vehicle type proportions to represent field conditions if possible.	Yes	Adjust to reflect vehicle proportions observed in the field.
		Other parameters-Other global parameters (options menu, etc.)	-	1) Check "Heavies Use All Lanes" 2) TWOPAS HGV climbing model 3) Gap reduction for stopped buses	1) Always check "Heavies Use All Lanes" 2) TWOPAS HGV climbing model use is project specific. 3) Gap reduction for stopped buses use is project specific	1) Allows heavy vehicles (i.e. trucks) to drive in all lanes. WI does not require trucks to stay in right lane. 2) TWOPAS HGV climbing model allows for grades coded in model to affect truck kinematics. Additional effort in coding grades accurately and correctly is needed. 3) Gap reduction for stopped buses should only be used in special-case scenarios where pick ups and drop offs are being modeled.

Paramics Calibration Settings

Last Updated: 08-31-2017

Type of Setting	Parameter Grouping	Parameter Name	Default Settings (per Paramics v. 6.9.3)	Recommended Parameter Value	Typical Parameters Adjusted During Calibration	Parameter Description
LOCAL SETTINGS	Link Parameters	Link Speed	Varies, set by link category	Use field data to code links speeds. If field data is not available, code link speed as posted speed	Yes, changes that stray from posted speed limit should be based on field data.	Drivers typically drive 10% over the posted speed limit in uncongested conditions. Link speed may need to be adjusted to reflect observed travel speeds.
		Link Signpost and Signrange	Varies, set by link category	Base on field conditions. Allow signpost to enter zone on freeways.	Yes	Controls how and when vehicles move to the correct lane upstream of a hazard. Propagation of signposting can be used for widening hazards.
		Link Force Merge	unchecked	Lower priority use	Yes, use sparingly	For links with priority other than major, drivers that have exceeded their patience threshold will force their way into the flow of traffic as long as a conflicting vehicle is not in the driver's path.
		Link Force Across	unchecked	Lower priority use	Yes, use sparingly	For links with priority other than major, drivers that have exceeded their patience threshold will force their way across traffic to join any desired traffic stream as long as a conflicting vehicle is not in the driver's path.
		Link Force Vehicle Aware	unchecked	Could be adjusted if applicable	Yes, if applicable	Used in shared-space pedestrian applications. Can be used to improve the quality of vehicle/pedestrian interaction logic by forcing all vehicles to be aware of pedestrians.
		Link Reaction factor	1.00	Lower priority use, small adjustments only	Yes, use sparingly	Value is associated with the lag in time between a change in speed of the preceding vehicle and the following vehicle's reaction to this change. Raise for more passive drivers. Lower for more aggressive drivers.
		Link Headway factor	1.00	Lower priority use, small adjustments only	Yes, use sparingly	Raise to increase distance between vehicles and represent more passive drivers. Lower to decrease distance between vehicles and represent more aggressive drivers.
		Link Approach Visibility	Normal Link = 0 Roundabout approach = 32.8	Important for roundabouts. Can be used with other unsignalized control.	Yes, typically adjusted with roundabouts.	Aids in vehicles identifying gaps at an unsignalized intersection approach. Important for roundabout calibration.
		Link Stimulus Time	5	Typically not modified based on survey results	No	Lower value results in faster decision time for lane change
		Link Transition Time	5	Typically not modified based on survey results	No	Lower value results in faster lane changing maneuver
		Category Cost Factors	0.8 to 1.0	Typically not modified from defaults	No	Aids in routing control for unfamiliar drivers
		Link Cost Factor	1.00	Adjust as needed to correct local routing issues.	Yes	Aids in routing control for all drivers
	Node Parameters	Node parameters-Allow sneaking	Unchecked	Could be used at congested intersections	Yes	Applies only when multiple vehicles are waiting to transfer to the same outbound link. Allows blocked vehicles to perform their movement before other vehicles of a higher priority. Could be used to reduce queue lengths and simulate more aggressive driving behavior.
		Node parameters-Anticipate gaps	Unchecked	Could be used at congested intersections	Yes	By default vehicles wait for crossing vehicles to complete clear a node before completing their turning movement. This option allows vehicles to complete turning movement once the driver's path across the node is cleared. Could be used to reduce queue lengths and simulate more aggressive driving behavior.
		Turning Penalties	1.00	No range specified	No	Aids in routing control for all drivers
	Entrance Ramp Parameters	Entrance ramp settings-Minimum Ramp Time (s)	2	0 to 2 Typically 1	Yes	Specifies amount of time vehicles must spend on the ramp prior to considering merging maneuver. Use 0 seconds as last resort after modifying headway, ramp aware, or other parameters to calibrate entrance ramp. Use of 0 seconds may be necessary with high volume merges and/or freeway segments.
		Entrance ramp settings-Headway Factor	1.00	0.80 to 1.00	Yes	Target headway for all vehicles on the entrance ramp. Raise to increase distance between vehicles and represent more passive drivers. Lower to decrease distance between vehicles and represent more aggressive drivers.
		Entrance ramp settings-Ramp Aware Distance (ft)	656.2	Modify on case-by-case basis depending on field conditions (topography, visibility of onramp, signing, etc.) and driver behavior or courtesy in study area	Yes	Defines point at which vehicles on the mainline become aware of the entrance ramp. Mainline drivers will only change lanes to allow for merging gaps and will not decelerate or accelerate to create gaps.
	Other Parameters	Other parameters-Gap Acceptance Rules	-	Lower priority use	Yes	Estimation of the minimum time required to clear the theoretical collision point with oncoming vehicles. If time is less than estimation, the driver will complete their movement. Typically used to calibrate queues at unsignalized intersections.
		Other parameters-Variable Speed Limit Rules	-	Typically not modified	No	Controls the speed limit on a route over a set timeframe. Transition times can be specified to avoid abrupt changes.
		Other parameters-Dynamic Tolling Rules	-	Typically not modified	No	May be used in HOT analysis.
		Other parameters-Spatial Test Transfer Rules (Merge or Crossing)	-	Could be used	Yes, typically with roundabouts or short links	Aids in gap acceptance. Generally used with roundabouts or areas with short links.
		Other parameters-Spatial Test Movement Rules	-	Could be used	Yes, typically with roundabouts or short links	Aids in gap acceptance. Generally used with roundabouts or areas with short links.

VISSIM Calibration Settings

Last Updated: 11-27-2017
Source: PTV Vissim 9 User Manual

Type of Setting	Parameter Grouping	Parameter Name	Default Settings (per Vissim v. 9.00-04)	Recommended Parameter Range	Typical Parameters Adjusted during Calibration	Parameter Description
GLOBAL	*Simulation Settings*	Simulation resolution; Time steps (seconds)/Simulation second	10.00	5 to 10	Yes	The simulation resolution has an impact on the behavior of vehicles, pedestrians, and the way they interact. A higher simulation resolution allows vehicles to make decisions based on the car following and lane change logic at a higher frequency.
		Simulation Speed, Simulation second/second	10	Value 1.0: the simulation is run in real-time Value 2.0: The simulation is run at double real-time speed, etc. Maximum option: Runs the simulation at the maximum speed	No	Corresponds to a time lapse factor. It indicates simulation seconds per real-time second. The simulation speed does not affect the simulation results. The simulation speed can be changed during the simulation run.
	Traffic Settings	Vehicle Composition (Veh Type; DesSpeedDistr; RelFlow)		Adjust to represent field conditions	Yes	Adjust relative flows to represent field conditions
		Pedestrian Composition (Ped Type; DesSpeedDistr; RelFlow)		Adjust to represent field conditions	Yes	Adjust relative flows to represent field conditions
	Base Settings	Vehicle Fleet		Use "North American" as default	Yes	Adjust to represent field conditions
		Vehicle/Pedestrian Types	Car, HGV, Bus, Tram, Man, Woman	Adjust to represent field conditions	Yes	Vehicle/pedestrian type allows you to form a group of vehicles/pedestrians with the same technical driving/walking characteristics (e.g., SUV, Crossover, Sedan, Pickup Truck, Sedan, etc.)
		Vehicle/Pedestrian Classes		Typically separate into passenger cars and heavy trucks, but may use any of the FHWA 13 vehicle classes	Yes	By default, the data for all vehicle and pedestrian classes is entered together, but you can show the data for certain vehicle classes and/or pedestrian classes separately in the evaluation.
		Functions (Maximum and Desired Acceleration/Deceleration)	-	Typically use defaults per vehicle type/class	No	Impacts how fast or slow a vehicle will accelerate/decelerate. Generally more critical on steeper grades.
		Distributions (vehicle characteristics, function and distribution)		2D/3D Model - Use "North American" as default, adjust to match field conditions as appropriate	Yes	Allows you to define the specific vehicles (Volkswagen Golf, Audi A4, etc.) that are included in the vehicle fleet.
		Vehicle Characteristics function and distribution		Speed Distribution: left turn 12.4 to 18.6 mph; right-turn 7.5 to 15.5 mph		Adjust to represent field conditions
LOCAL	*Car Following*	Look ahead distance min. (feet)	0.00	Typically not modified	No	Minimum distance that a vehicle can see forward in order to react to other vehicles either in front or to the side of it (within the same link). The minimum look-ahead distance is important when modeling lateral vehicle behavior. If several vehicle can overtake within a lane, this value needs to be greater than 0.00. If several vehicles can overtake within a lane, you can enter a greater look ahead distance to prevent any vehicle from running a red light (when doing so, do not change the number or **Observed vehicles** as this can lead to unrealistic simulation).
		Look ahead distance max. (feet)	820.21	Typically not modified	No	Maximum distance that a vehicle can see forward in order to react to other vehicles either in front or to the side of it (within the same link). May want to extend if modeling rail traffic with block signals.
		Look ahead distance. Observed vehicles	Arterial: 4 Freeway: 2	4	Yes	The number of observed vehicles or number of certain network objects affects how well vehicles in the link can predict other vehicles' movements and react accordingly. Higher value means vehicles can better react to multiple network objects in the network
		Look back distance min. (feet)	0.00	Typically not modified	No	Defines the minimum distance that a vehicle can see backwards in order to react to other vehicles behind (within the same link). The minimum look-back distance is important when modeling lateral vehicle behavior. If several vehicles can overtake with a lane, this value needs to be greater than 0.00. This way you make sure the cars drive in an orderly fashion when two or more vehicles, than specified in the **Observed vehicles** attribute, on the same route want to position themselves at a stop line. This applies in particular to bicycles.
		Look back distance max. (feet)	492.13	Typically not modified	No	Defines the maximum distance that a vehicle can see backwards in order to react to other vehicles behind (within the same link). You can reduce the maximum look-back distance in close-meshed networks (e.g., many connectors over a short distance). This may positively affect the simulation speed.
		Temporary lack of attention duration (s)	0.00	0.00 to 1.00	No	The period of time when vehicles may not react to a preceding vehicle (they do react, however, to emergency braking). With increasing values, the capacity of the affected links decreases.
		Temporary lack of attention probability	0%	0 to 5%	No	Frequency of the lack of attention. With increasing values, the capacity of the affected links decreases.
		Smooth closeup behavior	Selected	Typically not modified	No	If this option **is** checked, vehicles slow down more evenly when approaching a stationary obstacle. If this option **<u>is not</u>** selected, the following vehicle uses the normal following behavior until the speed of the preceding vehicle drops to less than 3.28 feet/second and it comes almost to a halt. The later approach behavior can include a temporary acceleration.
		Standstill distance for static obstacles	Not Selected, 1.64 ft if selected	Typically not modified	No	Standstill distance upstream of static obstacles such as signal heads, stop signs PT stops, priority rules, conflict areas. Not valid for stop signs in parking lots. The attribute **Smooth closeup behavior** must be selected. If this option is not selected, the vehicles us a normally distributed random value [0.5;0.15]. If this option is selected, the vehicles will use the given value.
		Wiedemann 74 Car following model (applicable for arterials) Wiedemann 74-Average standstill distance (feet)	6.56 ft	3.28 to 9.84 ft.	Yes	Defines the average desired distance between two cars. Higher value means larger standstill distance and lower capacity
		Wiedemann 74-Additive part of safety distance	2.00	1 to 3.75 ft	Yes	Value used for the computation of the desired safety distance. Higher value means larger standstill distance and lower capacity
		Wiedemann 74-Multiplic. Part of safety distance	3.00	2 to 4.75 ft	Yes	Value used for the computation of the desired safety distance. Greater value equals greater distribution (standard deviation) of safety distance. Higher value means larger standstill distance and lower capacity

VISSIM Calibration Settings

Last Updated: 11-27-2017
Source: PTV Vissim 9 User Manual

Type of Setting	Parameter Grouping	Parameter Name		Default Settings (per Vissim v. 9.00-04)	Recommended Parameter Range	Typical Parameters Adjusted during Calibration	Parameter Description
LOCAL (CONT)	*Car Following (Cont)*	*Wiedemann 99 Car following model (applicable for freeway/highway)*	Wiedemann 99-CC0 (Standstill Distance) (feet)	4.92 ft	Basic segment: 4.0 to 5.5 Weaving/Merge/Diverge: >4.92	Yes	The average desired standstill distance between two vehicles, it has no variation. Higher value means larger standstill distance and lower capacity
			Wiedemann 99-CC1 (Headway Time) (s)	0.90	Basic segment: 0.7 to 3.0 Weaving/Merge/Diverge: 0.9 to 3.0	Yes	Time distribution of speed-dependent part of desired safety distance. Higher value means more cautious driver and lower capacity
			Wiedemann 99-CC2 ('Following' Variation) (feet)	13.12 ft	Basic segment: 6.56 to 22.97 Weaving/Merge/Diverge: 13.12 to 39.37	Yes	Restricts the distance difference (longitudinal oscillation) or how much more distance than the desired safety distance a driver allows before he intentionally moves closer to the car in front. Higher value means more cautious driver and lower capacity
			Wiedemann 99-CC3 (Threshold for Entering 'Following')	-8.00	Typically not modified	No	It controls the start of the deceleration process (i.e., the number of seconds before reaching the safety distance.) At this stage the driver recognizes a preceding slower vehicle.
			Wiedemann 99-CC4 (Negative 'Following' Threshold)	-0.35	Typically not modified	No	Defines negative speed difference during the following process. Low values result in a more sensitive driver reaction to the acceleration or deceleration of the preceding vehicle.
			Wiedemann 99-CC5 (Positive 'Following' Threshold)	0.35	Typically not modified	No	Defines positive speed difference during the following process. Low values result in a more sensitive driver reaction to the acceleration or deceleration of the preceding vehicle.
			Wiedemann 99-CC6 (Speed dependency of Oscillation)	11.44	Typically not modified	No	Influence of distance on speed oscillation while in the following process. If the value is 0, the speed oscillation is independent of the distance. Larger values lead to a greater speed oscillation with increasing distance.
			Wiedemann 99-CC7 (Oscillation Acceleration) (ft/s^2)	0.82 ft/s^2	Typically not modified	No	Oscillation during acceleration
			Wiedemann 99-CC8 (Standstill Acceleration) (ft/s^2)	11.48 ft/s2	Typically not modified	No	Desired acceleration when starting from standstill (limited by maximum acceleration defined within the acceleration curves).
			Wiedemann 99-CC9 (Acceleration with 50 mph) (ft/s^2)	4.92 ft/s2	Typically not modified	No	Desired acceleration when starting at 80 km/h, approximately 50 mph, (limited by maximum acceleration defined within the acceleration curves).
	Lane Change	General behavior		Free lane selection	Free lane selection or Slow lane rule	No	Free lane selection: vehicles may overtake on each lane Slow lane rule: allows overtaking on freeways or similar links according to the rules in road traffic Regardless of option selected, you can model the general behavior more realistically using the settings under Cooperative lane change
		Maximum deceleration - Own (ft/s^2)		-13.12 ft/s2	-15 to -12	Yes	Upper bound of deceleration for own vehicle. Higher absolute value means more aggressive lane changing behaviors
		-1 ft/s2 per distance - Own (feet)		Arterial: 100 Freeway: 200	100 to 250	No	This reduces the **Maximum deceleration** with increasing distance from the emergency stop distance linearly by this value down to the **Accepted deceleration**.
		Accepted deceleration - Own (ft/s^2)		Arterial: -3.28 Freeway: -1.64	-2.5 to -4	No	Lower bound of deceleration for own vehicle for a lane change
		Maximum deceleration - Trailing (ft/s^2)		-9.84 ft/s2	-12 to -8	No	Upper bound of deceleration for trailing vehicle. Higher absolute value means more aggressive lane changing behaviors
		-1 ft/s2 per distance - Trailing (feet)		Arterial: 100 Freeway: 200	50 to 250	No	This reduces the **Maximum deceleration** with increasing distance from the emergency stop distance linearly by this value down to the **Accepted deceleration**.
		Accepted deceleration -Trailing (ft/s^2)		Arterial: -3.28 Freeway: -1.64	-1.5 to -2.5	No	Lower bound of deceleration for trailing vehicle for a lane change
		Waiting time before diffusion (s)		60.00	60.00 to 200.00	Yes	The maximum amount of time a vehicle can wait at the emergency stop distance for a necessary change of lanes. When this time is reached, the vehicle is removed from the network. Higher value means more tolerance on vehicles waiting at the emergency stop distance for necessary lane changes.
		Min. headway (front/rear), (ft)		1.64	1.5 to 6	No	The minimum distance between two vehicles that must be available after a lane change, so that the change can take place. A lane change during normal traffic flow might require a greater minimum distance between vehicles in order to maintain the speed-dependent safety distance.
		To slower lane if collision time is above (s)		10.00	0 to 0.5	No	Defines the minimum distance to a vehicle in front, in seconds, which must be present on the slower lane, so that an overtaking vehicle switches to the slower lane. Only applicable for **Slow lane rule** or **Fast lane rule**.
		Safety distance reduction factor		0.60	0.1 to 1.0	No	This factor is taken into account for each lane change. During the lane change, Vissim reduces the safety distance to the value that results from the following multiplication: **Original safety distance * safety distance reduction factor.** The default value of 0.6 reduces the safety distance by 40%. Once a lane change is completed, the original safety distance is taken into account again.
		Maximum deceleration for cooperative braking (ft/s^2)		-9.84	-32.3 to -3	No	Specifies to what extent the trailing vehicle is braking cooperatively, so as to allow a preceding vehicle to change lanes into the same lane they are traveling in. The higher the value, the stronger the braking and the greater the probability of changing lanes.
		Overtake reduced speed areas		Not Selected	Typically not modified	No	If this option is selected, vehicles immediately upstream of a reduced speed area may perform a free lane change. The vehicle will acknowledge any reduced speed area of the lane they changed into and adjust their speed accordingly. If the option is not selected (default), vehicles never start a free lane change directly upstream of a reduced speed area and they completely ignore the reduced speed areas on the new lane.
		Advanced merging		Selected	Adjust to match field conditions	Yes	If this option is selected, more vehicles can change lanes earlier, therefore capacity increases
		Consider subsequent static routing decisions		Selected	Typically not modified	No	If this option is selected, vehicles leaving the route identify new routing decisions on the same link in advance and take them into account when choosing the lane. This option must be checked to allow vehicles to identify, in advance, routing decision further downstream.

VISSIM Calibration Settings

Last Updated: 11-27-2017
Source: PTV Vissim 9 User Manual

Type of Setting	Parameter Grouping	Parameter Name		Default Settings (per Vissim v. 9.00-04)	Recommended Parameter Range	Typical Parameters Adjusted during Calibration	Parameter Description
LOCAL (CONT)	*Lane Change (Cont)*	Cooperative lane change		Not Selected	Adjust to match field conditions	Yes	If this option is selected, trailing vehicles will make necessary lane change to facilitate the lane change of a leading vehicle
		> Maximum speed difference (mph)		6.71	Typically not modified	No	Applicable only if **Cooperative lane change** has been selected. Identifies the maximum possible speed difference.
		> Maximum collision time (s)		10.00	Typically not modified	No	Applicable only if **Cooperative lane change** has been selected. Identifies the maximum collision time (time a vehicle can travel before reaching a preceding vehicle or network object that has an impact on its desired speed)
		Lateral correction of rear end position		Not Selected	Typically not modified	No	This causes the vehicle to be aligned to the middle of the lane at the end of the lane change, instead of at an angle in the original lane. This can affect the capacity. Only performed if the **Keep lateral distance to vehicles on next lane(s)** option is selected under "Lateral" behavior.
		> Maximum speed (mph)		1.86	Typically not modified	No	Speed up to which the correction of the rear end position should take place. Lateral correction of the rear end position is not performed for faster vehicles.
		> Active during time period from "x sec" until "x sec" after lane change start		1.00 until 10.00	Typically not modified	No	Time after the start of the lane change at which the lateral movement of the rear end position should start **until** time after the start of the lane change at which the lateral movement of the rear end position should end.
	Lateral	Desired position at free flow		Middle of lane	Typically not modified	No	Lateral orientation of a vehicle within its lane while it is in free traffic flow
		Keep lateral distance to vehicles on next lane(s)		Not Selected	Typically not modified	No	If this option is selected, the vehicles consider the position and therefore the lateral orientation of vehicles on adjacent lanes and keep the **Lateral min. distance**. For this purpose, vehicles even adjust their lateral orientation on their own lane and swerve out of the way. If this option is not selected, vehicles on adjacent lanes are ignored even if they are wider than their lanes, except when they perform a lane change. **Note: using this option can reduce the simulation speed significantly**.
		Diamond shaped queuing		Not Selected	Typically not modified	No	If this option is selected, queues take into account a realistic shape of vehicles with vehicles positioned offset, such as bikes. Vehicles are internally represented not as a rectangle, but as a rhombus.
		Consider next turning direction		Not Selected	Typically not modified	No	Enables more intelligent lateral behavior in case of non-lane-bound traffic. If the option has been selected, a vehicle with this driving behavior does not pass another vehicle on the same lane if this might cause a collision at the next turning connector. To achieve this, attributes that enable passing on the same lane **must** be selected. Note the option **Consider next turning direction** has precedence over option **Desired position at free flow**.
		Collision time gain (s);		2.00	Typically not modified	No	Minimum value of the collision time gain for the next vehicle or signal head, which must be reached so that a change of the lateral position on the lane is worthwhile and will be performed. Calculated based on the desired speed of the vehicle. Smaller values lead to a livelier lateral behavior, since vehicles also have to dodge sideways for minor improvements.
		Minimum longitudinal speed (mph):		2.24	Typically not modified	No	Minimum longitudinal speed which still allows for lateral movements. The default value (2.24 mph) ensures that vehicles can also move laterally if they have almost come to a halt already.
		Time between direction changes (s):		0.00	Typically not modified	No	Defines the minimum simulation time which must pass between the start of a lateral movement in one direction and the start of a lateral movement in the reverse direction. The higher this value, the smaller the lateral movements of vehicles. These lateral movements only take place if overtaking on the same lane is permitted. (Does not affect the lateral movement for a lane change.)
		Default behavior when overtaking vehicles on the same lane	Overtake on same lane	On left - Not Selected On right - Not Selected	Typically not modified	No	When modeling traffic that is not lane-bound, you can allow vehicles to overtake within a lane. **Left:** vehicles are allowed to overtake on a lane to the left; **Right**: vehicles are allowed to overtake on a lane to the right.
			Minimum lateral distance (ft) at 0 mph and 30 mph	Distance standing at 0 mph: 0.66 ft Distance driving at 30 mph: 3.28 ft	Typically not modified	No	Minimum distance between vehicles when overtaking within the lane and keeping the distance to vehicles in the adjacent lanes. **Distance Standing at 0 mph** is the lateral distance of the passing vehicle; **Distance driving at 30 mph** is the lateral distance of the passing vehicles.
		Exceptions for overtaking vehicles of the following vehicle classes		No exceptions listed	Typically not modified	No	Behavior for specific vehicle classes that deviates from the default behavior when overtaking vehicles on the same lane. When modeling traffic that is not lane-bound, you can select vehicle classes which may be overtaken within a lane by vehicles of the defined driving behavior set.
	Signal Control	Reaction to amber signal	Decision model	Continuous Check	Not typically modified	No	Defines the behavior of vehicles when they approach an amber light. **Continuous check:** driver of vehicle continuously decides whether to continue driving or whether to stop. Vehicles assume that the amber light will only be visible for another two seconds. A vehicle will not brake, if its maximum deceleration does not allow it to stop at the stop line, or if it would have to brake for more than 15 ft/s^2. The vehicle will brake, if at its current speed, it cannot drive past the signal head with two seconds. **One decision:** The decision made is maintained until the vehicle crosses the stop line. Calculated using the probability factors.
			Probability Factors	Alpha: 1.59 Beta 1: -0.26 Beta 2: 0.27	Only applicable is **One decision model** is selected, Not typically modified	No	Used to calculate the probability (i.e., whether a driver stops at an amber light or not). $p = \frac{1}{1+e^{-\alpha-\beta_1 v-\beta_2 dx}}$ The following settings make a vehicle continue driving for longer when there is an amber light and occasionally even make it run a red light: The **One decision** option is selected, **Alpha** is greater than the default value 1.59; **Beta1** is greater than the default value 0.27; and **Beta2** is greater than the default -0.26 but less than 0.00.
		Behavior at red/amber signal		Go (same as green)	Not typically modified	No	Used to define country-specific or regional behavior at red/amber signal. Options are **Stop (same as red)** or **Go (same as green); where Stop (same as red) means the** Go **signal is green and the Go (same as green)** means the **Go** signal is red-amber.
		Reduced safety distance close to a stop line	Factor	0.60	0.60	Yes	Higher value reduces the safety distance between vehicles close to the signal stop bar
			Start upstream of stop line (ft)	328.08	Not typically modified	No	Distance upstream of the signal head
			End downstream of stop line (ft)	328.08	Not typically modified	No	Distance downstream of the signal head
		Reaction time distribution		Blank	Typically not modified	No	Reaction time of a vehicle to the **Go** signal. It causes a time delay between the time step when the signal switches to **Go** and the time step when the first vehicle upstream of the corresponding stop line starts to move. If no time distribution is selected, the default time is 0 seconds.

VISSIM Calibration Settings

Last Updated: 11-27-2017
Source: PTV Vissim 9 User Manual

Type of Setting	Parameter Grouping	Parameter Name	Default Settings (per Vissim v. 9.00-04)	Recommended Parameter Range	Typical Parameters Adjusted during Calibration	Parameter Description
LOCAL (CONT)	*Connector-level*	Emergency Stop (feet)	16.40	Adjust to match field conditions	Yes	Distance before the downstream connector where vehicles can make last chance lane changes
		Lane change (feet)	656.20	>656.20	Yes	Distance before the downstream connector where vehicles begin to make lane changes
		Lane change per lane	Not Selected	Adjust to match field conditions	Yes	If this option is selected, the entered lane change attribute value is multiplied by the number of lane changes which a vehicle requires to reach the connector
	Point-level	Speed distributions (mph)	Linear distributions	Adjust to represent the field conditions	Yes	The distribution function of desired speeds is a particularly important parameter, as it has an impact on link capacity and achievable travel times. If not hindered by other vehicles or network objects (e.g., signal controls), a driver will travel at his desired speed. Desired speed distributions are defined independently of vehicle or pedestrian type.
		Time distributions (mph)	Linear distributions	Not typically modified	No	You can use dwell time distributions for: 1) standstill time on parking lots 2) waiting times at toll counters through stop signs or 3) for PT stops to allow adequate time for passengers to board and alight the bus/transit vehicle.

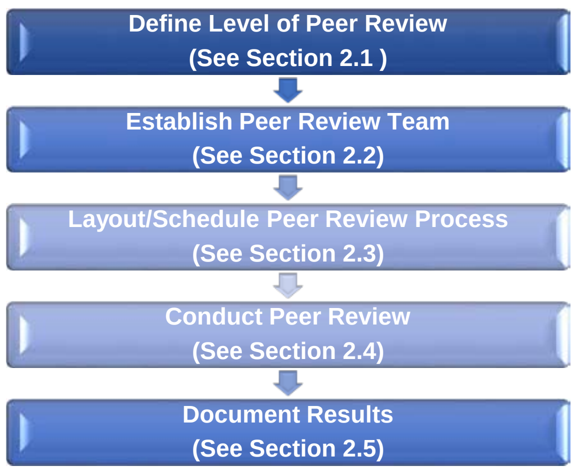
16-25-1 Introduction — January 2018

This policy addresses the peer review process for traffic models utilized to conduct traffic operations analysis for the evaluation and design of all transportation improvement projects. For this policy, traffic models refer to both the Highway Capacity Manual (HCM)-based traffic analyses and microscopic simulation (microsimulation) analyses. This policy does not cover the travel demand models (TDMs) utilized to generate traffic forecasts. Refer to the Transportation Planning Manual (TPM), Chapter 9 for additional details regarding traffic forecasting protocols. The Traffic Model Peer Review Policy provided within this document is required for all projects that initiated traffic modeling on or after January 1, 2016. For projects initiated prior to January 1, 2016, the project team should coordinate with region traffic operations and (as needed) with the Bureau of Traffic Operations (BTO) to determine how this policy should be implemented.

1.1 Overview

A peer review is a structured process for reviewing a traffic model to ensure the use of sound engineering judgment. The primary goal of the peer review process is to protect the department's and public's interests by verifying the integrity of the traffic model by assuring that it provides a reasonably accurate representation of traffic conditions that exist in the field. There are four levels of peer review, which are dependent on the complexity of the traffic model. It can take anywhere from six weeks to over four months to conduct a peer review of the traffic model for one analysis scenario. This may significantly affect the overall schedule and budget for a project and, should thus, be considered early on during project scoping. Figure 1.1 highlights the key steps of the peer review process for HCM and microsimulation traffic models.

Figure 1.1. Traffic Model Peer Review Process Overview



1.2 Background

The Wisconsin Department of Transportation's (WisDOT or the department) Traffic Simulation Modeling Process Lean Initiative led by the Bureau of Planning and Economic Development (BPED) - Traffic Forecasting Section (TFS) with input from BTO – Traffic Analysis and Safety Unit (TASU) and the Bureau of State Highway Programs (BSHP) – Program Development and Analysis Section (PDAS) outlined a process for the development and review of HCM and microsimulation traffic models (does not include TDMs). TEOpS 16-1-1, Attachment 1.1 provides an illustration (flow chart) of the process defined through the lean initiative.

The lean initiative identified that historically there was a lack of consistency in when and how the department reviews the HCM and microsimulation traffic models. To improve consistency across the state concerning the review of these traffic models, BTO-TASU developed the Traffic Model Peer Review policy, focusing on steps 6 and 11 of the overall traffic model development and review process (see TEOpS 16-1-1, Attachment 1.1). ~~This memorandum will serve as the Traffic Model Peer Review Interim Policy until the final policy is developed. Guidance on the remaining tasks outlined in Attachment 1.1 is forthcoming.~~

16-25-2 Process — January 2018

2.1 Define Level of Peer Review

It is the responsibility of the project manager to ensure that the traffic model is peer reviewed, while it is up to region traffic operations to define the peer review requirements. To assist with defining the peer review requirements, this policy defines four levels of peer review for traffic models:

1. Project team level review – The WisDOT project team leads the peer review process, providing a high-level ~~review~~ (e.g., spot-check) and independent (i.e., the reviewer cannot be part of the team developing the traffic model) review of the traffic model. The region traffic modeler (if available) and/or region traffic operations will provide an in-depth review of the traffic model as needed. If the region does not have the available knowledge and/or resources, they *may* contact BTO-TASU for assistance with the in-depth review.

2. Region level review – The region traffic modeler and/or region traffic operations lead the peer review process. The WisDOT project team will provide oversight of the peer review process and BTO-TASU, BSHP –PDAS, BPED –TFS, the Southeast (SE) region – TFS, and other statewide bureaus (SWBs) will assist in the peer review as needed. The region will provide an in-depth review of the traffic model. If the region does not have the available knowledge and/or resources, they *may* contract with an independent consultant (one that is not a member of the consultant team developing the traffic model) to assist as necessary.

3. Independent consultant level review – An independent consultant typically leads the peer review process, but works closely with the region traffic modeler and/or region traffic operations on all aspects of the review. The WisDOT project team will provide oversight of the consultant's peer review and BTO-TASU, BSHP-PDAS, BPED-TFS, SE-TFS and other SWBs will assist in the peer review as needed. The independent consultant will provide an in-depth review of the traffic model while the region traffic modeler and/or region traffic operations will typically provide a high-level review. In cases where the region has the knowledge and resources available, they *may* choose to forego the use of an independent consultant.

4. SWB level review with Federal Highway Administration (FHWA) oversight - An independent consultant typically leads the peer review process, but works closely with the region traffic modeler, region traffic operations, BTO-TASU, BSHP-PDAS, BPED-TFS, SE-TFS, and other SWBs on all aspects of the review. The independent consultant will provide an in-depth review of the traffic model while the region traffic modeler and/or region traffic operations and SWBs will typically provide a high-level review. In cases where the region has the knowledge and resources available, they may choose to forego the use of an independent consultant.

   For projects constructed with federal funds, FHWA oversight of the peer review process will be required to ensure that the traffic model adheres to federal guidelines. The extent of FHWA involvement will vary depending on the specifics of the proposed project.

   Note: ~~BPED-TFS and/or SE-TFS should be involved in all levels of peer review, especially if the traffic model does not utilize the traffic volume and/or demand data directly from an official/approved traffic forecast provided by the department.~~See TPM, Chapter 9 for details on the traffic forecasting section's involvement with traffic model peer reviews.

The level of peer review will vary depending on the complexity of the traffic model, which is dependent on the project type (mega/major project, high profile project, routine improvement project, etc.), project scope, corridor type, traffic control, roadway congestion level, and traffic analysis tool(s) utilized. However, a project team or region level review is typically sufficient for most HCM-based traffic models. The SWBs, specifically BTO-TASU and BPED-TFS, will be involved on high-profile projects, mega/major projects, and those projects that have potential for ~~becoming a mega/major project~~FHWA involvement.

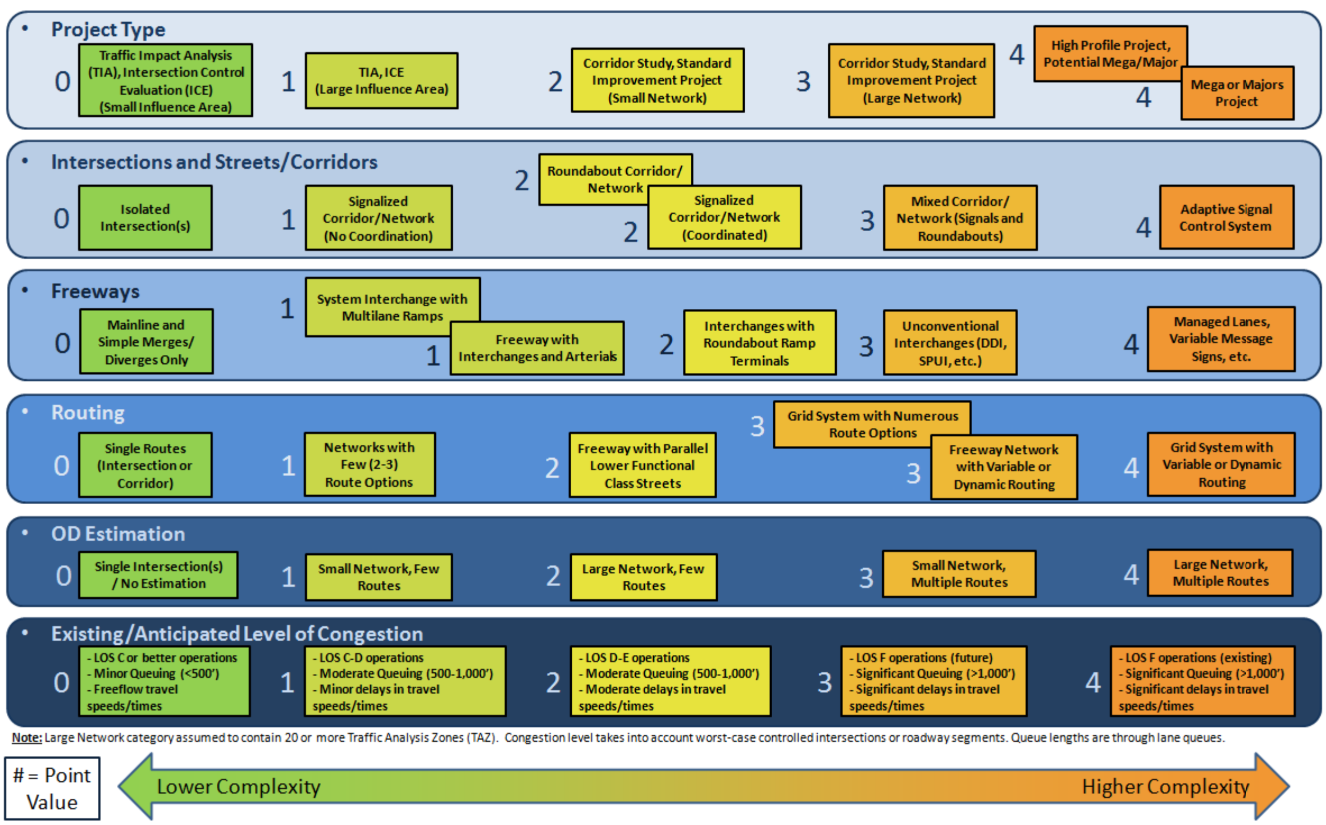
The level of peer review *may* significantly impact the overall schedule and budget for a project, and *should* be determined early on during project scoping. However, the project team often has to wait for the initiation of the traffic analysis in order to define the level of peer review required. Therefore, the project team *should* assume the highest potential peer review level will be required when defining the schedule and budget for a project.

To quantify the level of complexity associated with building and reviewing a traffic model (specifically a microsimulation traffic model), the department worked with a consultant to establish a scoring system. The scoring system defines the level of complexity and the level of peer review required by assigning points within the following categories:

1. Project type
2. Geometric conditions
    a. Arterial corridor
    b. Freeway corridor
3. Traffic pattern/conditions
    a. Routing options
    b. Origin-destination (O-D) matrix development
    c. Level of congestion (existing and future)

Within the geometric conditions category there are two subcategories to define the type of corridor included in the analysis: arterial corridor (includes individual intersections, streets or corridor segments) and freeway corridor. The traffic pattern/conditions category contains three subcategories: routing options, O-D matrix development and existing/anticipated level of congestion. Figure 2.1 provides an illustration of the traffic model level of complexity scoring system.

Figure 2.1. Traffic Model Complexity Scoring Diagram



As illustrated in Figure 2.1, there are several factors within each category and subcategory that define the complexity of a traffic model. For example, the complexity of a traffic model for an arterial corridor is dependent on whether the traffic model is an isolated intersection, an uncoordinated signalized corridor, a coordinated signalized corridor, a roundabout corridor, a mixed traffic control corridor (e.g., a corridor with signals and roundabouts), or an adaptive signal control system. Every factor has an associated level of complexity based on a scale of 0 to 4 (an isolated intersection has a complexity score of 0 while an adaptive signal control system has a complexity score of 4). If multiple factors are applicable, the score associated with the highest level of complexity dictates the overall score for that category or subcategory. For example, a Traffic Impact Analysis (TIA) project with a small influence area by itself has a complexity score of 0; however, if the TIA is a high profile project the score used in the "project type" category would be 4. The highest score within each category/subcategory is then summed to determine an overall complexity score for the traffic model (maximum score of 24). The higher the overall complexity score, the more likely it is that microsimulation traffic models will be necessary. Please refer to Attachment 2.1, a Microsoft® Excel® based template, for assistance with developing the overall complexity score for the traffic model. In coordination with region traffic operations, the project team's traffic lead or project manager *should* complete the traffic model complexity-scoring template.

The overall traffic model-complexity-score defines the minimum peer review requirements for the project. It is possible for a higher (more intense) level of peer review to be completed. Ultimately, it is up to region traffic operations to define the final peer review requirements. Refer to Table 2.1 for the complexity score associated with each peer review level.

Due to modified roadway geometry, increased traffic volumes, reduced levels of congestion, etc., it is possible for the traffic model-complexity-score to be different under future alternative scenarios than it is under existing conditions. Therefore, it is critical to consider both existing conditions and potential future alternatives (including levels of service) when defining the traffic model complexity score and the associated level of peer review required. The highest traffic model-complexity-score across all of the scenarios (existing and future alternatives) dictates the minimum peer review requirements.

Table 2.1. Peer Review Level Requirements

Total Complexity Score [a]	Minimum Required Peer Review	Notes
0-3	Project Team Level Review [b]	• Project team leads peer review • Region provides in-depth review as needed
4-7	Region Level Review [b]	• Region provides in-depth review, • SWBs provide assistance as needed • Independent consultant review as needed
8-10	Independent Consultant Level Review	• Independent consultant leads review [c] • Region provides high-level review • SWBs provide assistance as needed
11+	SWB Level Review With FHWA Oversight [d]	• Independent consultant leads review [c] • Region and SWBs provide high-level review • FHWA oversight *may* be needed

(a) The scoring system identified within this table **shall** act as a guide and not as a rigid requirement. Ultimately, professional judgment will be required to determine the level of peer review needed.

(b) A project team or region level review is sufficient for most HCM-based traffic models.

(c) If the region has the required knowledge and resources, they *may* choose to forego the use of an independent consultant.

(d) This indicates when there is a high probability that FHWA oversight will be required. Prior to developing the traffic models, the project team *should* coordinate with FHWA to determine their level of involvement (if any).

2.2 Establish Peer Review Team

Upon defining the peer review requirements, the project team *should* meet with region traffic operations to identify the peer review participants and establish all internal and external stakeholders. This meeting *should* occur as early as possible, but **shall** occur prior to the initiation of the traffic analysis.

Table 2.2 provides a summary of the stakeholders to consider for inclusion on the peer review team. The peer review process will vary slightly from one project to another, thus Table 2.2 *should* serve as a guide (not a rigid requirement) when establishing the peer review team.

Although Table 2.2 provides insight into when the SWBs and/or FHWA *should* be involved with the peer review, unique situations not covered in the table *may* also trigger the need to involve a SWB or FHWA. Thus, the project team *should* coordinate with the SWBs and FHWA during project scoping to verify their level of involvement (if any) in the peer review process. In general, the SWBs (specifically BTO-TASU) will be involved on all mega/major projects and projects where FHWA participation in the peer review process is desired or required.

If the region does not have the knowledge and/or resources available to conduct the peer review of the traffic model, the project manager will most likely need to select and procure an independent consultant to complete the peer review, regardless of the traffic model complexity. If desired, the region *may* contact BTO-TASU for support, or possibly, to conduct the peer review of the simpler traffic models (traffic model-complexity-score of 0-7).

Table 2.2. Potential Peer Review Participants

Stakeholder [a]	Level of Involvement	Notes
Region		
• Region Traffic Operations • Region Traffic Modeler (if available)	• All levels of peer review	Roles/responsibilities will vary based on level of review required
Statewide Bureaus		
• BTO-TASU and BSHP – PDAS	• SWB with FHWA oversight level review	Provides assistance as needed on all levels of peer review Provides high-level review of all ~~mega/major project traffic models~~projects with potential for FHWA involvement
• BPED-TFS and/or SE-TFS	• All levels of peer review	~~Provides high-level review of traffic volume/demand data (including O-D matrices) included in microsimulation traffic models~~See TPM, Chapter 9 for details on TFS involvement with traffic model reviews
External Stakeholders		
• Independent Consultant	• Independent consultant level review • SWB with FHWA oversight level review	*May* get involved on lower level reviews if region staff do not have the necessary resources [b]
• FHWA	• FHWA oversight review	Typically involved on mega/major projects and Interstate Access Justification Reports (IAJRs) being federally funded
• Local Municipalities, Regional Planning Commissions (RPCs), Metropolitan Planning Organizations (MPOs)	Typically, will not review the traffic model, but *may* participate in peer review discussions to ensure that local concerns are addressed [c]	

(a) The peer review team established for a specific project *may* include more or fewer members than those listed above.

(b) Region traffic operations *should* assess whether they have the knowledge and resources to complete the peer review; if not BTO-TASU may be able to help with the peer review for models with a complexity score of 7 or less. If neither region staff nor BTO-TASU has the capability to conduct the peer review, an independent consultant **shall** be selected/procured to complete the peer review regardless of the traffic model complexity.

(c) Early coordination with the Southeastern Wisconsin Regional Planning Commission (SEWRPC) for mega/major projects located in the SE region is highly recommended.

~~Although Table 2.2 provides insight into when the SWBs and/or FHWA *should* be involved with the peer review, unique situations not covered in the table *may* also trigger the need to involve a SWB or FHWA. Thus, the project team *should* coordinate with the SWBs and FHWA during project scoping to verify their level of involvement (if any) in the peer review process. In general, the SWBs (specifically BTO-TESS) will be involved on all mega/major projects and projects where FHWA participation in the peer review process is desired or required.~~

~~If the region does not have the knowledge and/or resources available to conduct the peer review of the traffic model, the project manager will most likely need to select and procure an independent consultant to complete the peer review, regardless of the traffic model complexity. If desired, the region *may* contact BTO-TESS for support or possibly, to conduct the peer review of the simpler traffic models (traffic model-complexity-score of 0-7).~~

If there is a need for an independent consultant, the project team *should* follow the process outlined in the department's Facilities Development Manual Chapter 8, Section 5 (FDM 8-5) to select and procure a consultant team to perform the necessary peer review. The Statewide Master Contract for Traffic Analysis and Modeling (BTO 03) and the Statewide Master Contract for Traffic Engineering Services (BTO 01) identifies the consultants that have been previously selected and authorized to conduct traffic engineering services (including traffic model peer reviews). The list of consultants on the master contracts are updated every two-years and are available through the Contract Administration Reporting System (CARS) application or through BTO-TASU. If desired, BTO-TASU can provide assistance with the selection of the independent peer review consultant.

In order to ensure a truly independent peer review, it is critical that the consultant chosen to conduct the peer review does not have any affiliation or conflict of interest with the consultant team selected to perform the traffic analysis.

2.3 Layout/Schedule Peer Review Process

Once the peer review team has been established, the project manager **shall** coordinate with the peer review team (typically via a coordination meeting) to identify the following components of the peer review process:

1. Project milestones which will trigger the need for a peer review
2. Roles of the individual peer review members
3. Data requirements
4. Schedule for conducting the peer review(s)
5. Transfer process for traffic model(s) and peer review comments

The following provides additional discussion on each of these components.

2.3.1 Identify Project Milestones

There are typically three major project milestones for a peer review: (1) completion of the existing year traffic model, (2) completion of the design year no-build traffic model and (3) completion of each design year build/project alternative traffic model. Complex traffic models *may* warrant the need for peer reviews at additional project milestones, such as after the initial coding of the traffic model but prior to the full calibration of the traffic model. At the completion of the coordination meeting, both the project team and peer review team *should* have a clear understanding of where the peer review(s) *should* fall within the overall project timeline.

With HCM-based traffic models, the review of the existing year, design year no-build, and design year build/project alternative traffic models can occur simultaneously. However, due to the complexity of microsimulation traffic models, a peer review will typically be required at each of the three milestones described above. Consecutive review of the existing year, the design year no-build and the design year build/project alternative traffic models is ~~required~~strongly encouraged.

In other words, only after calibrating and validating the existing conditions and only after completing the peer review process of the existing conditions model, *should* the analyst proceed with the development of other modeling scenarios (e.g., design year no build, design year build, etc.). If the analyst chooses to develop the model alternatives prior to calibrating and validating the existing conditions model and/or prior to having the model go through the peer review process, they take the risk that they must go back and revise not only the alternatives model but the existing conditions model as well. This can lead to potential inconsistencies in the modeling scenarios and could result in the need for additional time to calibrate and perform the peer review(s) of the alternatives model. Although it may be tempting, especially when the project has a compressed schedule, to skip or delay the calibration, validation and/or peer review process of the existing conditions model, it may end up being counterproductive and is strongly discouraged.

~~In other words, the existing year traffic model **shall** be peer reviewed before the analyst can develop the design year no-build traffic model; and the design year no-build traffic model **shall** be peer reviewed before the analyst can develop the design year build traffic model.~~

The subsequent text provides a description of the three major milestones.

Milestone 1: Completion of Existing Year Traffic Model

The existing year traffic model replicates existing field conditions. Existing year traffic conditions *should* reflect the year that is as close to the original start of the traffic analysis as possible. Whenever possible, traffic data *should* be no more than three years old and ideally, all traffic data *should* be from the same year. Ongoing construction or other special circumstances may dictate the need to use older data or data from multiple years.

A peer review is required at this project milestone to ensure that the traffic model provides an accurate representation of field conditions based on data collected by the project team and/or peer review team. At this milestone, BPED-TFS or SE-TFS *should* verify that the traffic model and traffic forecasts utilize a consistent existing volume data set.

Milestone 2: Completion of Design Year No-Build (FEC) Traffic Model

The design year no-build traffic model reflects design year conditions absent of the proposed project. It will reflect design year traffic volumes and existing geometry or existing geometry with other planned and enumerated (or committed) improvement projects and may include signal timing modification. As such, another name for this scenario is the future with existing plus committed (FEC) scenario. ~~To be included in the design year no-build traffic model, the~~ The planned improvement projects need to occur after the existing year but prior to the proposed project's design year to be included in the FEC model. ~~The design year no-build~~Note that the FEC conditions for a specific project may not match the no-build conditions reflected in ~~the~~ a travel demand model (TDM) used in forecasting traffic. Thus BPED-TFS or SE-TFS *should* verify that the same assumptions (e.g., number of travel lanes) is reflected in both the traffic model and traffic forecasts.

For the traffic model to function with the design year traffic volumes, it *may* be necessary to include minor geometric improvements (e.g., the extension of an existing right or left turn lane or channelization optimizations such as the removal of shared lane movements within the FEC right-of-way, etc.) beyond the committed projects. ~~Minor improvements (such as signal timing improvements) *may* need to be included in the design year no-build scenario in order for the traffic model to function with the design year traffic volumes.~~ In these cases, the traffic model represents future with existing plus committed plus minor improvements (FEC+) conditions. ~~a design year do-minimum condition (e.g., minor improvements to the existing condition).~~ The project team *should* clearly document these ~~do-minimum~~ minor improvements ~~prior to the no-build traffic model peer review.~~within the modeling methodology report and/or other project memoranda as appropriate.

A peer review is required at this project milestone to confirm that the traffic model accurately depicts design year traffic volumes and to verify that the basic structure of the model is consistent with the existing year traffic model. If the analyst properly addresses and carries forward comments from the existing year model, the peer review process at the ~~design year no-build~~FEC project milestone *should* be less intensive than the initial peer review.

Milestone 3: Completion of Each Design Year Build/Project Alternative Traffic Model

The design year build traffic models capture design year conditions with the proposed project improvements. The build traffic models may reflect "constrained" or "unconstrained" conditions. Typically, the analyst will need to develop a traffic model for more than one project alternative.

A peer review is required for each project alternative. Peer reviews are necessary at this project milestone to ensure that the traffic model is consistent with the previous traffic models and to verify that it accurately captures the proposed improvements. Checking for geometric improvements, changes in travel demand/traffic patterns, and consistency against the existing and no-build traffic models *should* be the focus of the design year alternative model reviews. BPED-TFS or SE-TFS *should* verify that the same assumptions (e.g., number of travel lanes) is reflected in the design year build traffic models and traffic forecasts.

2.3.2 Outline Roles/Responsibilities

Table 2.1 and Table 2.2 (shown previously) *may* be able to assist in the assessment of the general roles (e.g., high-level review, assistance as needed, etc.) for each peer review team member. The specific team member responsibilities (e.g., responsible for reviewing model network, responsible for reviewing traffic volume data, etc.), however, *should* be clarified during the coordination meeting.

2.3.3 Define Data Requirements

In an ideal world, all of the traffic data needed to validate that the traffic model is properly calibrated (i.e., provides an accurate representation of real-world conditions) will be collected during the development of the traffic model. In some instances, however, it *may* be necessary for the peer review team to gather additional data as part of the peer review process. If additional data is required, during the initial coordination meeting, the project team *should* define the data collection plan (e.g., how to obtain the data, when to collect the data, and who will collect the data).

Additionally, the peer review team *should* discuss whether there are any previously developed traffic models (specifically microsimulation traffic models) that could serve as a resource for the development, calibration, validation and peer review of the proposed traffic model.

2.3.4 Define Preliminary Schedule

The schedule for the peer review is highly dependent on the complexity of the traffic model and level of peer review required. The peer review of a highly complex traffic model that requires FHWA oversight will take longer to complete than the peer review of a relatively simple traffic model that only requires a project team level review. Since the peer review schedule impacts the overall schedule of the project, it is critical for the project team to define the peer review timeline as early in the project as possible, preferably during project scoping. The project team can utilize Table 2.3 to approximate the amount of time within the overall project schedule to allow for the peer review process. The timelines provided in Table 2.3 assume that BPED-TFS or SE-TFS have already generated and/or reviewed and approved the traffic forecasts utilized within the traffic model.

With the exception of FHWA, all members of the peer review team *may* conduct their review of the traffic model(s) simultaneously. With concurrent reviews, the peer review member should coordinate often during the review process to avoid unnecessary duplication of review efforts. WisDOT~~,~~ *should* complete all internal department peer reviews (project team, region, independent consultant, statewide bureau reviews) prior to FHWA reviewing the traffic model(s). FHWA, however, *may* be available to answer questions and to provide suggestions for items to consider during internal department reviews.

Table 2.3. Peer Review Time Requirements

Level of Peer Review	**Approximate Time Required to Complete Initial Peer Review (Including data collection, coordination, etc.)**
Project Team Level Review	• 1-2 weeks for existing conditions • ~~6 weeks for existing/future volumes review by BPED-TFS or SE-TFS~~ • 1-2 weeks for each additional project milestone/alternative
Region Level Review	• 3-4 weeks for existing conditions • ~~6 weeks for existing/future volumes review by BPED-TFS or SE-TFS~~ • 3-4 weeks for each additional project milestone/alternative
Independent Consultant Level Review	• 4-8 weeks for existing conditions • ~~6 weeks for existing/future volumes review by BPED-TFS or SE-TFS~~ • 4-8 weeks for each additional project milestone/alternative
SWB Level Review *Without FHWA Oversight*	• 4-8 weeks for existing conditions • ~~6 weeks for existing/future volumes review by BPED-TFS or SE-TFS~~ • 4-8 weeks for each additional project milestone/alternative
With FHWA Oversight	• 12-16 weeks for existing conditions • ~~6 weeks for existing/future volumes review by BPED-TFS or SE-TFS~~ • 12-16 weeks for each additional project milestone/alternative

Notes:

- The time ranges shown here are approximate, thus the project team *should* only utilize these timelines to approximate the amount of time within the overall project schedule to allow for the peer review process. Actual timelines are dependent on individual project details such as the amount of data collection and the complexity of the future models.
- All timelines shown here are associated with the review of a microsimulation traffic model. The review time required for HCM-based traffic models is dependent on the region resources.
- The peer review schedule *may* assume concurrent review by all internal WisDOT peer review team members (project team, region, independent consultant, SWB). However, the schedule *should* assume that FHWA peer reviews will only occur after the completion of WisDOT's review.
- If an independent consultant is required, add extra time to the schedule to account for scoping/contracting the independent consultant's work.
- Add additional time (a minimum of 6 weeks per milestone/alternative) to account for BPED-TFS and/or SE-TFS review of the traffic volume demand utilized in the traffic models. See TPM, Chapter 9 and DT2340 for additional details on TFS role in the review of microsimulation traffic models.

~~With the exception of FHWA, all members of the peer review team can conduct their review of the traffic model(s) simultaneously. WisDOT, however, *should* complete all internal department peer reviews~~

~~(project team, region, independent consultant, statewide bureau reviews) prior to FHWA reviewing the traffic model(s). FHWA, however, *may* be available to answer questions and to provide suggestions for items to consider during internal department reviews.~~

2.3.5 Detail Traffic Model/Peer Review Comment Transfer Process

During the initial coordination meeting, the peer review team *should* layout the process for handing off the data (traffic model, peer review comments, etc.) between the analyst and the peer review team. It *may* be helpful for the project manager to set up a schedule for check-in-meetings or conference calls over the course of the peer review to help facilitate the exchange of data. The number and timing of these meetings will vary depending on the complexity of the traffic model, but could include the following:

- A hand-off meeting when the traffic model is ready to go to the reviewer(s),
- A preliminary findings meeting when the reviewer(s) has completed the initial review and developed their first thoughts and questions on the model,
- An ultimate findings meeting when the reviewer(s) has completed the peer review and
- A response meeting when the analyst has addressed the comments raised by the review team.

2.4 Conduct Peer Review

A key concept of the peer review process is to assess whether the traffic model has been implemented in a way that is suitable for meeting the goals and objectives of the study for which it is being built without violating current WisDOT policies (i.e., is the traffic model fit-for-purpose?). To assist the reviewer with making this decision, the project manager *should* provide the peer review team with a summary of the project scope, project goals, and intended purpose of the traffic model prior to initiating the peer review. It is important to affirm that the project scope is stable and unambiguous, as it will be difficult for the reviewer to assess the traffic model's fitness-for-purpose if the purpose itself is subject to change over the duration of the project. The project manager *should* also emphasize that the role of the reviewer is to identify problems and/or make suggestions to improve the quality of the traffic model, but not fix problems associated with the traffic model.

The following provides specific details on how to conduct a peer review for both HCM-based and microsimulation traffic models.

2.4.1 HCM Traffic Model Peer Review

A project team or region-level review will be sufficient for most HCM traffic models, although SWB involvement will be required for mega/major projects. The region traffic modeler and/or region traffic operations **shall** conduct, at a minimum, a high-level review of the HCM traffic model(s) to verify that the analyst has followed standard protocols. To ensure consistency with the review of the traffic models, the reviewer (typically region traffic operations) *should* complete DT1887 – HCM Analysis Review Checklist while conducting their review. The reviewer, as appropriate, *should* insert "not reviewed" on DT1887 to denote which components of the traffic model were not addressed during their review. Attachment 2.2 provides a copy of DT1887.

The primary purpose of DT1887 is to provide a coversheet that summarizes the major concerns/issues the reviewer has on the traffic model. The reviewer *should* document the specific/detailed comments on the traffic model in a separate memorandum and attach it to DT1887.

DT1887 provides a mechanism for the reviewer to easily identify whether the specific parameters within the traffic model (e.g., lane geometry, signal timings, etc.) and overall traffic model is acceptable, conditionally acceptable or unacceptable. These terms are defined as follows:

- Acceptable - The traffic model is acceptable as is without any revisions,
- Conditionally acceptable - The traffic model is acceptable based on the condition that the traffic analyst addresses a few (no more than 5) specific issues or concerns either by revising the traffic model or providing additional justification as to why no additional revisions are necessary,
- Unacceptable – The traffic model needs major revisions.

As illustrated in DT1887, the typical components of the HCM traffic model that *should* be reviewed include:

Traffic Analysis Tool/Version

~~—~~Prior to developing the traffic model, region traffic operations and the analyst *should* have agreed upon the appropriate analysis tool to utilize. The reviewer *should* confirm that the traffic model was developed using the agreed upon analysis tool, specifically that the correct software, software version and software build (e.g., Synchro ~~8 Build 806~~10.1.2.20, Sidra ~~6.1~~7.0.8.6853, etc.) have been utilized. The traffic models *should* only utilize the department-supported software packages. FDM 11-5-3.7 identifies the explicit software packages that the department supports.

The reviewer *should* note any differences in the version and/or build of the software package utilized during the development and review of the traffic model.

Lane Geometry~~ –~~

The reviewer *should* confirm that the traffic model depicts the proper lane geometry, including lane configurations, turn bay lengths, lane widths, right-turn channelization, and distance between intersections. In some situations, the HCM methodology *may not* allow the coding of the actual lane geometrics (e.g., the HCM methodology limits the number of approaches/lanes). In these cases, it *may* be necessary to utilize an alternative tool for the analysis. The analyst **shall** obtain prior approval from region traffic operations prior to utilizing modified lane geometry within the HCM traffic model. The agreed upon modifications to actual lane geometries should be noted on DT1887 or in the accompanying comment memorandum.

Traffic Volumes/Percent Trucks/Peak Hour Factor (PHF)~~ –~~

The reviewer should verify that the appropriate traffic volumes for the defined analysis year and time period have been accurately coded into the traffic model. Design year traffic volumes should reflect official WisDOT traffic forecasts (i.e., forecasts prepared or reviewed and approved by BPED-TFS or SE-TFS).

If applicable, the analyst should provide documentation on the process completed to develop design hour volumes (K30, K100, K250, weekday AM/PM peak, etc.), to produce O-D matrices, and/or balance the traffic volumes along the corridor. The reviewer should look at the documentation and check the volume adjustments for reasonableness.

The reviewer should verify that the appropriate percentage of trucks or heavy vehicles have been included in the analysis. Unless there is one movement that is predominately trucks (e.g., the movement goes into a truck parking facility), as prescribed in the HCM, the traffic model should include the percent of trucks/heavy vehicles based on intersection approach and not by the individual turning movement.

Per FDM 11-5-3, in most cases, the analysis ~~of existing conditions~~ should utilize a PHF based on data collected in the field, and is typically calculated for the intersection as a whole rather than approach or turning movement. ~~FDM 11-5-3 also indicates that design year traffic analysis for the mainline roadway segment *may* utilize a PHF of 1.0.~~ If the existing field-derived PHF is less than 0.92 (the recommended HCM default), however, it may be appropriate to utilize a higher PHF for the analyses of design year conditions. Use of any value other than the field-derived PHF requires approval from the WisDOT regional traffic engineer.

Signal Timing Parameters

~~–~~At a minimum, the reviewer should verify that all traffic models that involve traffic signals utilize appropriate signal timing and phasing plans, saturation flow rates and right-turn-on red (RTOR) volumes. The reviewer should refer to the Traffic Signal Design Manual (TSDM 3-2-2) and TEOpS 16-15-5 for guidance on the recommended traffic signal timing parameters, where TEOpS 16-15-5 is the controlling policy for ~~including~~ saturation flow rates and right-turn-on-red (RTOR) usage. Region traffic operations *may* have additional guidance on the signal timing parameters.

~~As noted in TSDM 3-2-2, RTOR usage is only applicable for signalized intersections with an exclusive right-turn lane. TSDM 3-2-2 indicates that the RTOR volume **shall** be the lesser of the following:~~

~~o (3600/cycle length) * 2 or~~

~~o 50% of the hourly right-turn volume.~~

~~For the SE region the RTOR guidance summarized below should be utilized:~~

~~o For single right-turn lanes – RTOR Volume = 50% of the hourly right-turn volume~~

~~o For dual right-turn lanes – RTOR Volume = 30% of the hourly right-turn volume~~

~~o For triple right-turn lanes – RTOR Volume = 20% of the hourly right-turn volume.~~

~~Regardless of the methodology utilized to calculate it, the RTOR volume should still be included as part of the total intersection volume.~~

Stop-Control/Roundabout Parameters

~~—~~The reviewer should verify that all traffic models that involve stop-controlled intersections utilize appropriate and reasonable critical gap, follow-up times, saturation flow rates, vehicle storage in the median and the presence of an upstream traffic signal. Unless justified otherwise by a field study, default values should be utilized for most parameters.

WisDOT has established Wisconsin specific critical and follow-up headway values for the analysis of roundabouts (see FDM 11-26-20.4, Table 20.3). The reviewer should check for proper usage of these headway values for traffic models that include roundabouts.

Freeway/Highway Parameters

~~—~~For freeway weaving analysis, the reviewer should look at the source of the weaving volumes and verify that the assumptions made to determine the volumes are in accordance with the previously agreed upon methodology. Additionally, the reviewer should check the weaving segment length, number of maneuver lanes and the minimum number of lane changes utilized in the analysis.

For freeway merge or diverge analysis, the reviewer should inspect the basic number of lanes, acceleration or deceleration lengths and volume inputs for accuracy.

For basic highway segments, the reviewer should examine the road classification, access density, no-passing zone inputs and free-flow speed for accuracy.

Measures of Effectiveness (MOEs)

~~—~~The reviewer should look at the key MOEs that are applicable to the proposed project to verify their acceptability in terms of operation. Some of the key MOEs include level of service (LOS), 95th percentile back-of-queue length, delay and density. Additional MOEs *may* include volume-to-capacity ratio (v/c), travel time, and travel time reliability.

Other

~~—~~The reviewer should note any other aspects of the traffic model (e.g., growth rates, gap acceptance, lane utilization, link speeds, etc.) that they checked during their evaluation. Additionally, the reviewer should provide any general comments they have regarding the overall performance of the traffic model.

Upon completion of their evaluation, the reviewer should provide a copy of the completed DT1887 to the project team and/or analyst for their response. The reviewer only needs to complete one DT1887 for an entire corridor; there is no need to complete DT1887 for every intersection along the corridor.

The analyst should note on the DT1887 form how they propose to respond to any comments on the traffic model (e.g., revise the traffic model or provide justification for their original assumptions). ~~The Document Results Section~~Section 2.5 provides additional detail on how to document this correspondence.

2.4.2 Microsimulation Traffic Model Peer Review Overview

Due to their complexity, microsimulation traffic models typically require an independent consultant and/or SWB level of review. Each member of the peer review team should complete DT2291 – Microsimulation Peer Review Report to document their findings, comments, and concerns related to the traffic model. The TFS will document their review in DT2340 – Traffic Forecasting Section Microsimulation Checklist (see TPM, Chapter 9 for additional details). The reviewer, as appropriate, should insert “not reviewed” on DT2291 to denote which components of the traffic model were not addressed during their review. The reviewer shall complete a peer review after each project milestone; however, they *may* combine their comments from each milestone onto one form. Attachment 2.3 provides a copy of DT2291.

The first page of DT2291 is where information regarding the peer review and traffic model is denoted (e.g., review date, reviewer and analyst contact information, model completion/revision date, etc.).

The heart of the DT2291 form (pages 2 through 8) is where the reviewer documents their observations regarding the traffic model features and characteristics. This section of the form uses a three-column format. The left side of the form is where the reviewer identifies the overall acceptably of the traffic model component (acceptable, conditionally acceptable or unacceptable) and notes the extent of the revisions required (no revisions, minor revisions, moderate revisions, or major revisions).

The center of the form provides space for detailed technical comments including reviewer-to-analyst communications. The reviewer should attach or insert additional sketches, screen shots, calculations, or other information that will assist the analyst in understanding the problems identified in the traffic model. Where relevant, DT2291 *may* include suggested techniques for improving the traffic model.

The right side of the form provides an area for the analyst to address the reviewer's comments. This is where the analyst should identify if and how they will revise the traffic model. If the analyst feels that no revisions to the traffic model are necessary, they should provide justification for their original assumptions.

The final section of DT2291 is the reviewer's sign-off. In this section the reviewer should unequivocally inform the analyst and project team whether the model is (or is not) suitable for the intended purpose. If the traffic model is deemed unacceptable, the reviewer summarizes the number and severity of the revisions required (e.g., 2 minor and 1 major revision to the traffic model are required).

While DT2291 provides documentation of the overall peer review process, it should not serve as the sole means of communication between the reviewer and the analyst. The reviewer should document all communications with the analyst and attach them to DT2291 for future reference. Ultimately, it is the responsibility of the project manager to monitor the peer review process to ensure efficient communication between the peer review team and the analyst.

2.4.3 Conducting the Peer Review

Regardless of the software program utilized to develop the traffic model, a good first step is to open up the traffic model and observe the simulation. This allows for a visual inspection of the traffic model to identify if there is anything that just does not look right (e.g., vehicles make dramatic movements, vehicles suddenly drop off the network, vehicles are turning left from an exclusive right-turn lane, etc.). The visual inspection can help the reviewer identify which portions of the traffic model they should concentrate their review efforts.

As illustrated in DT2291, the typical features and characteristics of a microsimulation traffic model that should be reviewed include:

- Network Coding
- Intersection Traffic Control and Ramp Metering
- Closures, Restrictions, and Incidents
- Entrance Ramps
- Lane Use Parameters
- Zone Structure/Vehicle Inputs
- O-D Matrices, Demand Profiles, and Time Periods
- Core Simulation Parameters
- Routing Parameters/Vehicle Routes
- Vehicle Types and Proportions
- Stuck/Stalled Vehicles
- Special Features
- Consistency with Related Traffic Models
- Calibration/Validation
- Documentation

This list is not all-inclusive and should only serve as a starting point for the peer review. It is possible for a traffic model to be deemed acceptable based on all features listed above and yet still not be fit-for-purpose. The reviewer should keep a clear understanding of the project scope, goals, and intended purpose of the traffic model in mind while conducting the peer review. Additionally, the peer review process should always take into consideration the current capabilities and limitations of the software package and version utilized in development of the traffic model as new software features are seldom foolproof. The following text provides details on the key parameters of the traffic model that the reviewer should assess during their evaluation. Currently the department supports the use of SimTraffic, ~~and~~ Paramics and Vissim for microsimulation ~~but realizes that limitations of these software packages *may* justify the utilization of Vissim~~although WisDOT will stop supporting Paramics effective January 1, 2018~~.~~. ~~BTO-TESS must pre-approve the utilization of Vissim.~~ Projects that initiated the microsimulation traffic analysis using Paramics prior to January 1, 2018 may continue to use Paramics for the duration of the project. However, if the traffic mode requires major revisions (e.g., the analyst has to update the traffic model to reflect different existing conditions), or if the traffic model is more than three years old, the analyst *should* consider switching the traffic models over to Vissim. The guidance below is specific for SimTraffic, Paramics and Vissim; however, the general principles are applicable for all microsimulation software packages.

Refer to Exhibit 2.1 for additional information about how to evaluate each key feature of the traffic model.

Network Coding

Network coding establishes the horizontal and vertical geometry of the roadway network, including intersection spacing and roadway curvature. Network coding also includes appropriate use of settings such as link free-flow speed and turning speeds.

Intersection Traffic Control and Ramp Metering

Intersection controls are devices that regulate traffic flow at intersections (e.g., signals, roundabouts, stop control and ramp meters). Elements of the signals/ramp meters *may* include the controller type, detector placement, signal heads, signal groups, coordination between signals, signal phasing and/or signal/ramp meter-timing plans.

Closures, Restrictions and Incidents

Closures represent temporary or permanent roadway segment, link, or lane closures (i.e., traffic is restricted from using that roadway segment, link, or lane). Restrictions represent links or lanes where travel is restricted, either temporarily or permanently, to specific vehicle types (e.g., lanes designated for high-occupancy-vehicles (HOV) or lanes restricting truck use). Incidents include simulated vehicle breakdowns, crashes, etc.

Entrance Ramps

Entrance ramps or freeway merge areas typically require careful coding in microsimulation. This section generally refers to parallel freeway entrance ramps, although there are instances where this feature is appropriate for arterials as well. The reviewer should review the lane utilization upstream of the entrance ramp, the aggressiveness of the merging vehicles (e.g., minimum time on entrance ramp, driver headway factors), and the length of the acceleration lane and/or taper parallel to the entrance ramp.

Lane Use Parameters

Lane use parameters control the amount and/or destination of the traffic using each lane. A typical application of these parameters is to pre-position vehicles in advance of a fork in the road.

Zone Structure/Vehicle Inputs

Zone structure and vehicle inputs define where and how traffic is loaded into the network.

O-D Matrices, Demand Profiles & Time Periods

O-D matrices contain the network demand patterns (number of trips traveling between each pair of zones). Time periods and demand profiles control the timing for the release of vehicles into the network (e.g., are the vehicles released at a steady rate or at a gradually increasing/decreasing rate). In some cases, it is necessary to use multiple O-D matrices and/or demand profiles (e.g., there *may* be one matrix for cars and a second matrix for trucks). The reviewer should evaluate the source of the demand profile and time selection. BSHP-PDAS, BPED-TFS and/or SE-TFS should weigh in on the appropriate use of these features within the traffic model and *may* provide suggestions for source data (e.g., annual traffic recorders [ATR] data).

Core Simulation Parameters

Core simulation parameters affect fundamental aspects of vehicle behavior in the network, such as driver aggressiveness and the willingness to merge into small gaps. Default values are acceptable for some parameters, but other parameters require project-or-area-specific values. Thus, the reviewer should check all core simulation values for reasonableness.

Routing Parameters/Vehicle Routes

Routing parameters influence the way vehicles travel through the network. If coded improperly, these controls can cause unrealistic or erratic routing.

Vehicle Types and Proportions

The proportion and types of vehicles (such as trucks, buses and high-occupancy-vehicles) influences the overall performance of each part of the network. The reviewer should verify that the traffic model utilizes actual field data to the best extent possible.

Stuck/Stalled Vehicles

Stuck or stalled vehicles are vehicles that unexpectedly slow or stop partway through their route. They can cause backups that do not exist in the field. The reviewer should note any problems with stuck or stalled vehicles, including intermittent problems.

Special Features

Special features include site or study-specific items such as the use of detectors, car parks, variable message signs, special purpose lanes, speed harmonization, public transit routes, toll lanes, toll plazas, pedestrian modeling, special graphics, Application Programming Interfaces (APIs), among others.

Consistency with Related Traffic Models

Complex projects often involve a series of related traffic models (existing, future no-build, future build alternatives, different times of day, etc.). To assure the integrity of the study, these traffic models must be consistent. Additionally, adjacent and overlapping model areas should utilize consistent analysis methodologies. The results of the traffic model should not contradict the results of the TDM.

Calibration/Validation

Calibration refers to the process where the analyst adjusts selected input parameters within the traffic model (~~e.g.,~~typically driver behavior elements such as ~~global and local~~ headway and reaction times, driver aggressiveness, etc. and roadway elements such as sign posting) ~~in order to get~~such that the traffic model ~~to reproduce conditions observed in the field.~~represents field conditions. See TEOpS 16-20-5 for additional details on the calibration process.

Validation ~~refers to~~is the independent process where the analyst checks the traffic model outputs against field measured data including traffic volumes, travel speeds, travel times, intersection queuing and trip-making patterns (e.g., weaving volumes). ~~Validation is performed utilizing field data that is different from the data utilized during calibration of the traffic model.~~See TEOpS 16-20-8 for additional details on the validation process.

A properly calibrated and validated traffic model should accurately reflect real-world traffic conditions and should meet the purpose and need of the project. The analyst should document the methodology and assumptions utilized to calibrate and validate the traffic model and submit the ~~calibration/validation~~modeling methodology report along with the traffic model for review by the peer review team.

The reviewer should spot-check the traffic model outputs and compare them to the results documented in ~~the calibration/validation~~the modeling methodology report. If the reviewer cannot produce similar outputs, it *may* indicate an issue with the traffic model's calibration. See TEOpS 16-20 for additional details on model calibration and validation.

Documentation

Proper documentation of modeling methods and assumptions establishes accountability and facilitates efficient revision, updating, and follow-up. The review team should verify proper documentation of the modeling methods.

2.5 Document Results

It is critical to document any correspondence between the peer review team and traffic analyst regarding the peer review process. The correspondence should be documented within or attached to the appropriate review form (DT1887 and/or DT2291), and **shall** include how the traffic analyst revised the traffic model to address the peer review comments or provide justification as to why no revisions to the traffic model were made. On projects where the peer review team and traffic analyst interact frequently, it *may* be necessary to provide a separate document to detail all the correspondences. Attachment 2.4 provides examples of ways to document the communication between the project team and traffic analyst. The project manager **shall** include the additional documentation along with all completed DT1887 and/or DT2291 forms within the project's records file.

The region **shall** provide a summary of the peer review process for all microsimulation traffic models (including all SimTraffic models used for ~~design related~~project or study decisions, especially any related to critical aspects of the design) to BTO-TASU for information and tracking purposes. The summary **shall** identify the following aspects associated with the peer review process:

1. Project information (project identification number, project name, study area, study limits)
2. Name of analyst who constructed the traffic model
3. Name of lead peer reviewer
4. Summary of peer review results (DT1887, DT2291, correspondence documentation)
5. Copy of all FHWA comments on the traffic model

Even if BTO-TASU is not involved with the peer review process, it is generally advantageous for the project team to inform BTO-TASU of any pending peer reviews, specifically those for a microsimulation traffic model. This allows BTO-TASU to assess whether there are any potential overlapping peer reviews that *may* impact the project's schedule.

The project manager or region traffic operations **shall** email a copy of all interim and final DT2291 forms, including FHWA comments, to BTO-TASU vis the DOT Traffic Analysis & Modeling (DOTTrafficAnalysisModeling@dot.wi.gov) mailbox. Region traffic operations **shall** also include a copy of the relevant DT1887 and/or DT2291 forms with the submittal of all Phase II – Alternative Selection Intersection Capacity Evaluation (ICE) reports.

Traffic Model Complexity - Peer Review Scoring Template

FINAL 2015-07-31

WisDOT CO Microsimulation Peer Review Pilot Project

__Instructions:__ Fill in gray boxes to determine level of traffic model peer review effort required. Choose appropriate project category in **Table 1: Project type**. Choose primary network type in **Table 2: Geometrics Scoring** and mark applicable categories. Mark all applicable categories in **Table 3: Traffic Pattern and Congestion Scoring**. Final scoring reflects the highest point value in each table (maximum of 24 points). **Table 4** shows the recommended procedure for selecting and scoping the traffic model peer review. Consider existing conditions and potential future alternatives that the project/study is anticipated to cover.

WisDOT Region:		Ex: SE, SW, NE
Project:		Ex: STH __ Corridor Study
Project ID:		Ex: 1234-56-7890
Project Description:		Ex: City - City
Highway:		Ex: STH __
County:		Ex: Dane County
Traffic Conditions:		Ex: Base (Existing), Base and Future
Modeling Software:		Ex: Paramics, Vissim, SimTraffic

General Project Description:
Ex: Limits of project (Size of Network, # of TAZs), other software used for analysis, anticipated O-D data source, assumptions on Future scenarios, etc.

Table 1: Project Type

Complete (1):		Check all that apply:					
(1) Project Type	Category	Traffic Impact Analysis (TIA), Intersection Control Evaluation (ICE), or similar (Small Influence Area)	Traffic Impact Analysis (TIA), Intersection Control Evaluation (ICE), or similar (Large Influence Area)	Corridor Study/Operational Needs Study or Standard Improvement Project (Small Network)	Corridor Study/Operational Needs Study or Standard Improvement Project (Large Network)	High Profile Project, Potential Mega/Major Project (EA, PEL, EIS)	Mega or Majors Project
	Point Total	0	1	2	3	4	4
	Applicable?	0	0	0	0	0	0

__Note:__ Large Network category assumed to contain 20 or more Traffic Analysis Zones (TAZs).

Table 2: Geometrics Scoring

Choose (1) or (2):		Check all that apply:					
(1) Intersections and Streets/Corridors	Category	Isolated Intersection(s)	Signalized Corridor / Network (No Coordination)	Roundabout Corridor / Network	Signalized Corridor / Network (Coordinated)	Mixed Corridor / Network (Signals and Roundabouts)	Adaptive Signal Control System
	Point Total	0	1	2	2	3	4
	Applicable?	0	0	0	0	0	0
Or							
(2) Freeways	Category	Mainline and Simple Merges/Diverges Only	System Interchange with Multilane Ramps	Freeway with Interchanges and Arterials	Interchanges with Roundabout Ramp Terminals	Unconventional Interchanges (DDI, Echelon, SPUI, etc.)	Managed Lanes, Variable Message Signs, etc.
	Point Total	0	1	1	2	3	4
	Applicable?	0	0	0	0	0	0

Table 3: Traffic Pattern and Congestion Scoring

Complete (1), (2), and (3):		Check all that apply:					
(1) Routing		All-or-Nothing Routing Assignment				Dynamic/Variable Routing	
	Category	Single Routes (Intersection or Corridor)	Networks with Few (2-3) Route Options	Freeway with Parallel Lower Functional Class Streets	Grid System with Numerous Route Options	Freeway Network with Parallel Route Options	Grid System with Numerous Route Options
	Point Total	0	1	2	3	3	4
	Applicable?	0	0	0	0	0	0
(2) OD Estimation	Category	Single Intersection(s) / No Estimation	Small Network, Few Routes	Large Network, Few Routes	Small Network, Multiple Routes	Large Network, Multiple Routes	
	Point Total	0	1	2	3	4	
	Applicable?	0	0	0	0	0	
(3) Existing/Anticipated Level of Congestion	Category	- LOS C or better operations - Minor queuing (<500') - Freeflow travel speeds/times	- LOS C-D operations - Moderate queuing (500-1,000') - Minor delays in travel speeds/times	- LOS D-E operations - Moderate queuing (500-1,000') - Moderate delays in travel speeds/times	- LOS F operations (future) - Significant queuing (>1,000') - Significant delays in travel speeds/times	- LOS F operations (existing) - Significant queuing (>1,000') - Significant delays in travel speeds/times	
	Point Total	0	1	2	3	4	
	Applicable?	0	0	0	0	0	

__Note:__ Large Network category assumed to contain 20 or more TAZs. Congestion level takes into account worst-case controlled intersections or roadway segments. Queue lengths are through lane queues.

Table 4: Scoring Results and Recommendations

Project Type	Total	0
Geometrics Subtotal	Intersections and Corridors	0
	Freeways	0
	Total	**0**
Traffic Pattern and Congestion Subtotal	Routing	0
	OD Estimation	0
	Level of Congestion	0
	Total	**0**
Total Points		**0**

Point Scale	Review Recommendation Type	Estimated Schedule for Initial Review (including data collection, coordination, etc.)
0 - 3	High-level WisDOT Region review.	1-2 weeks existing conditions 1-2 weeks per alternative
4 - 7	WisDOT Region conducts peer review with assistance from independent consultant or BTO as necessary.	3-4 weeks existing conditions 2-3 weeks per alternative
8 - 10	Independent consultant conducts peer review with WisDOT Region input and BTO assistance as necessary.	4-8 weeks existing conditions 2-3 weeks per alternative
11+	Independent consultant conducts peer review with WisDOT Region, BTO, other WisDOT Bureau involvement and FHWA oversight.	2-4 months existing conditions (no FHWA) 1 month per alternative (no FHWA) 3-4 months existing conditions (with FHWA) 1-2 months per alternative (with FHWA)

Access the Excel File via the following link: \\MADFDCVFILPI13\n4public\BHO\Traffic Analysis and Modeling\Peer Review\Scoring Template\07-31-15\2015-07-31 Traffic Model Peer Review Scoring Template - Final.xlsx

HCM ANALYSIS REVIEW CHECKLIST

Wisconsin Department of Transportation (WisDOT)
DT1887 8/2015

		Date Reviewed (m/d/yyyy)		
Project ID(s)	Region:	1st Review	2nd Review	3rd Review
Project Name/Description	Highway(s)	Reviewed By:		

Lead Reviewer	Lead Analyst	Region Contact
Name (First, MI, Last)	Name (First, MI, Last)	Name (First, MI, Last)
Organization/Firm	Organization/Firm	Region/Bureau
(Area Code) Telephone Number	(Area Code) Telephone Number	(Area Code) Telephone Number
Email Address	Email Address	Email Address

TRAFFIC MODEL DESCRIPTION

Model Completion/Revision Date (m/d/yyyy)	Analysis Year(s)	Analysis Scenario/Alternative

Scope of Model (intersections, ramps, corridors, etc. being reviewed)

Analysis Time Period (s)

☐ Weekday AM Peak Hours: ______
☐ Weekday Midday Peak Hours: ______
☐ Weekday PM Peak Hours: ______
☐ Fri Peak Hours: ______
☐ Sat Peak Hours: ______
☐ Sun Peak Hours: ______
☐ Other: ______ Hours: ______

Analysis Tool(s) Utilized

☐ HCS - Version: ______ ☐ Synchro – Version/Build: ______ ☐ Sidra - Version: ______ ☐ Other: ______ - Version: ______

SUMMARY OF REVIEW

Item Reviewed	Overall Model Acceptability	Revision Required	Reviewer Comment(s)	Analyst Response(s)
Traffic Analysis Tool/Version	☐☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable	☐☐☐ No ☐☐☐ Yes		
Lane Geometry	☐☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable	☐☐☐ No ☐☐☐ Yes		
Traffic Volumes, % Trucks, Peak Hour Factor (PHF)	☐☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable	☐☐☐ No ☐☐☐ Yes		

(continued on reverse side)

SUMMARY OF REVIEW *(continued)*

Item Reviewed	Overall Model Acceptability	Revision Required	Reviewer Comment(s)	Analyst Response(s)
Signal Parameters (including RTOR)	☐☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable ☐☐☐ N/A	☐☐☐ No ☐☐☐ Yes		
Stop-Control/Roundabout Parameters	☐☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable ☐☐☐ N/A	☐☐☐ No ☐☐☐ Yes		
Freeway/Highway Parameters	☐☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable ☐☐☐ N/A	☐☐☐ No ☐☐☐ Yes		
Measures of Effectiveness (MOEs)	☐☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable ☐☐☐ N/A	☐☐☐ No ☐☐☐ Yes		
Other:	☐☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable	☐☐☐ No ☐☐☐ Yes		
Overall Model	☐☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable	☐☐☐ No ☐☐☐ Yes		

MICROSIMULATION PEER REVIEW REPORT

Wisconsin Department of Transportation (WisDOT)
DT2291 9/2015

Reviewer, please email completed form to:

To: Project Manager & Region Contact
CC: DOT Traffic Model Peer Review
Subject: DT2291 for Project ID; Traffic Model Name

	1st Review	2nd Review	3rd Review
Date Reviewed (m/d/yyyy):			
Reviewed By:			
Model Completion/Revision Date(m/d/yyyy):			

CONTACT INFORMATION

Lead Reviewer	Lead Analyst	Region Contact
Name (First, MI, Last)	Name (First, MI, Last)	Name (First, MI, Last)
Organization/Firm	Organization/Firm	Region/Bureau
(Area Code) Telephone Number	(Area Code) Telephone Number	(Area Code) Telephone Number
Email Address	Email Address	Email Address

TRAFFIC MODEL DESCRIPTION

Project ID(s)	Project Name/Description	Region:	Highway(s)
Traffic Model Name/Description	Analysis Scenario/Alternative	Analysis Year(s)	

Analysis Time Period (s)

☐ Weekday AM Peak Hours: ☐ Weekday Midday Peak Hours: ☐ Weekday PM Peak Hours: ☐ Fri Peak Hours: ☐ Sat Peak Hours: ☐ Sun Peak Hours: ☐ Other: Hours:

Analysis Tool(s) Utilized

☐ SimTraffic- Version: ☐ Paramics - Version: ☐ Vissim - Version: ☐ Other: - Version:

SCOPE AND EXTENT OF PEER REVIEW

Purpose & Scope of Review

Description/Limit of Model

Configuration Settings

Number of Zones:	Number of Time Steps:	Speed Memory:	Assignment Type:
Mean Target Headway:	Mean Reaction Time	Matrix Structure	Vehicle Classifications/Splits
Seed Values Used for Calibration:			
Seed Values Used for Review:			
Other:			

Were any changes to the model made by the review team? If yes, please describe.

DIRECTIONS

This form is applicable for the review of all microsimulation traffic models, regardless of the traffic software program utilized to develop the traffic model. However, this form focuses on the SimTraffic, Paramics and Vissim microsimulation software packages.

When noting problems or concerns, identify the severity of the issue and the revisions recommended using the following scale: Minor, Moderate, or Major. Check the appropriate box associated with each review (the blue box for the 1st review, the green box for the 2nd review and the purple box for the 3rd review).

If more than one review of the traffic model is required, use different color text to distinguish the comments associated with each review (e.g., comments from the 1st review should be in blue text, comments from the 2nd review should be in green text, and comments from the 3rd review should be in purple text). Provide any supporting tables, screenshots, or additional images in a separate attachment to this form.

OBSERVATIONS, MODEL FEATURES AND CHARACTERISTICS

Geometrics /Traffic Control

Network Coding	*Network Coding establishes the horizontal and vertical geometry of the network. It also includes the appropriate use of settings such as link free-flow speed.* • *For SimTraffic, this is coded within the Synchro module and includes placement and interconnection of nodes and links, number of lanes, lane widths, lane configurations, roadway curvature, storage lengths, and other intersection and network geometry.* • *For Paramics this includes placement and interconnection of nodes, links and link categories, curb points, curves, turn lanes, merge points, stop bars, signposts, and other network infrastructure.* • *For VISSIM this includes the placement and interconnection of links, connectors, desired speed decisions, reduced speed areas, conflict areas, and priority rules.*	
As a whole, network coding is:	**Observations/Comments:**	**Analyst Response**
☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review
Intersection Traffic Control & Ramp Metering	*Intersection Controls are devices that regulate traffic flow at intersections, such as signals, roundabouts, and stop-controlled intersections. Elements of the signals may include the controller type, detector placement, signal heads, signal groups, and/or coordination between signals. Ramp meters control the rate of entry to a freeway. Comments on signal and ramp meter timing plans may be included in this section.*	
As a whole, intersection controls are:	**Observations/Comments:**	**Analyst Response**
☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review

Geometrics /Traffic Control

Closures, Restrictions, & Incidents	*Closures represent links or lanes that are temporarily or permanently closed to traffic. Restrictions represent links or lanes that are temporarily or permanently closed to specific types of vehicles (such as lanes designated for High Occupancy Vehicles or lanes restricting truck use). Incidents include simulated vehicle break-downs, etc.* • *This feature is **not** applicable for SimTraffic*

As a whole closures, restrictions & incidents are:	**Observations/Comments:**	**Analyst Response**
☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review

Entrance Ramps	*Driver behavior and lane utilization approaching entrance ramps should be reviewed in this section.* • *For SimTraffic, modifications to the default mandatory distance and positioning distance settings should be reviewed.* • *For Paramics, modifications to default ramp headway, minimum ramp time, and ramp aware distance should be reviewed. The minimum ramp time setting specifies how long a driver will stay on the parallel entrance ramp before beginning to look for a gap to merge onto the freeway.* • *For VISSIM, the effective merging area defined by the positions of the links and connectors should be reviewed.*

As a whole, the vehicle behavior approaching entrance ramps is:	**Observations/Comments:**	**Analyst Response**
☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review

Lane Use Parameters	*Lane use parameters control the amount and/or destination of the traffic using each lane. A typical application of these parameters is to pre-position vehicles in advance of a fork in the road*

As a whole, lane use parameters are:	**Observations/Comments:**	**Analyst Response**
☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review

<table>
<tr><td rowspan="8">Traffic/Global</td><td>Zone Structure/Vehicle Inputs</td><td colspan="2">Zone structure and vehicle inputs define where and how traffic is loaded into the network.
• For SimTraffic, the intersection turning movement volumes from the Synchro module determine how the traffic is loaded into the network. If volumes are imbalanced in the Synchro network, SimTraffic will assume a traffic source or sink between nodes (such as driveways). Reviewer should note imbalances that may not be realistic or representative of the network.
• For Paramics, zone structure relates to the placement of the zones representing the locations where traffic enters or leaves the network. Observations related to sectors and zone connectors should be included in this section. If the microsimulation model zones are derived from a travel demand model, reviewers should use this section to note any issues related to the consistency of the Paramics input data with respect to the travel demand model data.
• For VISSIM, vehicle inputs control where traffic is loaded into the network and how much is loaded. Reviewer should use this section to note any issues related to the consistency of input data related to the sources.</td></tr>
<tr><td>As a whole, zone structure and vehicle inputs are:</td><td>Observations/Comments:</td><td>Analyst Response</td></tr>
<tr><td>☐ ☐ ☐ Acceptable
☐ ☐ ☐ Conditionally Acceptable
☐ ☐ ☐ Unacceptable
Extent of Revisions Required:
☐ ☐ ☐ No Revisions Required
☐ ☐ ☐ Minor Revisions Required
☐ ☐ ☐ Moderate Revisions Required
☐ ☐ ☐ Major Revisions Required</td><td>1st Review

2nd Review

3rd Review</td><td>1st Review

2nd Review

3rd Review</td></tr>
<tr><td>O-D Matrices, Demand Profiles, & Time Periods</td><td colspan="2">Origin-Destination (O-D) matrices contain the network demand patterns (number of trips between each pair of zones). Time Periods and Demand Profiles control the timing of the release of the trips into the network. In some cases multiple matrices are used (for example separate matrices for cars and heavy trucks). The reviewer should evaluate the source of the demand profile and time period selection.
• For SimTraffic, network-wide O-D Matrices and demand profiles are not applicable. The intersection turning movement volumes, rather than network-wide O-D matrices, determines the origin and destination of the traffic. The Link O-D volumes setting can be modified within Synchro to model the weaving interaction between 2 adjacent intersections (such as zeroing out an off-ramp left-turn to on-ramp left-turn movement at a diamond interchange). Volume adjustment factors, rather than demand profiles, dictate the percentage of peak hour traffic to load into the network for each analysis period. Thus the intersection turning movement volumes, Link O-D volumes, volume adjustment factors (such as growth factor and PHF adjust settings), and the time and duration of the seeding (i.e., warm-up period) and recording (i.e., analysis period) periods should be reviewed.</td></tr>
<tr><td>As a whole, O-D matrices, demand profiles, & time periods are:</td><td>Observations/Comments:</td><td>Analyst Response</td></tr>
<tr><td>☐ ☐ ☐ Acceptable
☐ ☐ ☐ Conditionally Acceptable
☐ ☐ ☐ Unacceptable
Extent of Revisions Required:
☐ ☐ ☐ No Revisions Required
☐ ☐ ☐ Minor Revisions Required
☐ ☐ ☐ Moderate Revisions Required
☐ ☐ ☐ Major Revisions Required</td><td>1st Review

2nd Review

3rd Review</td><td>1st Review

2nd Review

3rd Review</td></tr>
</table>

Traffic/Global

Core Simulation Parameters	*Core simulation parameters affect fundamental aspects of vehicle behavior in the network, such as driver aggressiveness and the willingness to merge into small gaps. Modifications to default software values should be reviewed.* • *For SimTraffic, examples of core simulation parameters to review include driver and vehicle characteristics and behaviors.* • *For Paramics, examples of core simulation parameters to review include mean target headway, mean target reaction time, perturbation, global routing cost coefficients, driver familiarity, time steps, speed memory, allowing heavy vehicles to use all lanes, and matrix tuning.* • *For VISSIM, examples of core simulation parameters to review include Driving Behaviors, Simulation Resolution, and Speed Distributions.*	
As a whole, core simulation parameters are:	**Observations/Comments:**	**Analyst Response**
☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review
Routing Parameters/ Vehicle Routes	*Routing parameters or vehicle routes influence the way vehicles travel through the network. If coded improperly, these controls can cause unrealistic or erratic routing.* • *This feature is **not** applicable for SimTraffic. However, interaction between intersections can be checked as noted with the Link O-D feature in the O-D Matrices, Demand Profiles, & Time Periods section.* • *For Paramics, routing parameters (such as cost factors, turn penalties, modification of the link type hierarchy, and waypoints) override the default routing behavior and profoundly influence the route choice in the network. They are occasionally used to increase or decrease the traffic volume on specific links.* • *For VISSIM, vehicle routes and vehicle routing decisions control the flow of traffic from the entrance points through the network. They can be coded using either actual vehicle flows or percentages.*	
As a whole, traffic routing parameters are:	**Observations/Comments:**	**Analyst Response**
☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review

Traffic/Global			
	Vehicle Types & Proportions	*The proportion of vehicles (such as trucks, buses, and High Occupancy Vehicles) influences the overall performance of each part of the network. Vehicle lengths (such as heavy truck lengths) should be reviewed.*	
	As a whole, vehicle types & proportions are:	**Observations/Comments:**	**Analyst Response**
	☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review
	Stuck/Stalled Vehicles	*This section should be used to note any problems with stuck or stalled vehicles (including intermittent problems). These are vehicles that unexpectedly slow or stop partway through their route (which can cause backups that do not exist in the field).* • *For Paramics, this section should also be used for comments on the use of blockage removal tools, if used.* • *For SimTraffic, this section should be used to comment on if short links may be resulting in stuck or stalled vehicles within the network.*	
	As a whole, stuck/stalled vehicle occurrence is :	**Observations/Comments:**	**Analyst Response**
	☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review
	Special Features	*Special features include site- or study-specific items such as the use of detectors, car parks, variable message signs, special purpose lanes, speed harmonization, public transit routes, toll lanes, toll plazas, pedestrian modeling, special graphics, Application Programming Interfaces (APIs), etc* • *At present, SimTraffic will not model bus stops, bus routes, bus and carpool lanes, light rail, on-street parking, or short term event; thus, the use of special features is typically not applicable in SimTraffic.*	
	As a whole, use of special features is :	**Observations/Comments:**	**Analyst Response**
	☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review

Traffic/Global	***Consistency with Related Traffic Models***	*Modeling studies often involve a series of related models (base model, future no-build, and build alternatives, different times of day, etc.). To assure the integrity of the study as a whole, these models must be consistent.*	
	As a whole, model consistency is :	**Observations/Comments:**	**Analyst Response**
	☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review
Calibration/Validation/Documentation	***Calibration/Validation***	*Calibration refers to the process where the analyst adjusts selected parameters within the traffic model (e.g., global and local headway and reaction times, driver aggressiveness, etc.) in order to get the traffic model to reproduce conditions observed in the field. Validation refers to the process where the analyst checks the traffic model outputs against field measured data including traffic volumes, travel speeds, travel times, intersection queuing and trip-making patterns (e.g., weaving volumes). The reviewer should spot-check the traffic model outputs and compare them to the results documented in the calibration/validation report. If the reviewer cannot produce similar outputs, it may indicate an issue with the traffic model's calibration.*	
	As a whole, model calibration is :	**Observations/Comments:**	**Analyst Response**
	☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review
	Documentation	*Proper documentation of modeling methods and assumptions establishes accountability and facilitates efficient revision, updating, and follow-up. Review team should verify that proper documentation has been provided.*	
	As a whole, model documentation is :	**Observations/Comments:**	**Analyst Response**
	☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review	1st Review 2nd Review 3rd Review

SUMMARY OF REVIEW

Overall Traffic Model	As a whole, the traffic model is :	Summary of the review team's findings and recommendations
	☐ ☐ ☐ Acceptable ☐ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable Extent of Revisions Required: ☐ ☐ ☐ No Revisions Required ☐ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	1st Review 2nd Review 3rd Review

REVIEWER'S CONCULSION (Check One)

☐ ☐ ☐ *It is the opinion of the review team that the model as reviewed and tested is an accurate and reasonable representation of the traffic conditions in the study area for the analysis year, time period, and scenario/alternative indicated in the title block of this document.*

☐ ☐ ☐ *It is the opinion of the review team that the model as reviewed and tested requires correction of ______ errors before it can be regarded as a reasonable representation of the traffic conditions in the study area for the analysis year, time period, and scenario/alternative indicated in the title block of this document. (Indicate number and severity of errors: Minor, Moderate, or Major).*

Prepared By (Signature)	Date	Contact Information
	Click here to enter a date.	Phone: Email:
Prepared By (Signature)	**Date**	**Contact Information (Phone, Email)**
	Click here to enter a date.	Phone: Email:
Prepared By (Signature)	**Date**	**Contact Information (Phone, Email)**
	Click here to enter a date.	Phone: Email:

Attachment 2.4 Sample Correspondence

HCM ANALYSIS REVIEW CHECKLIST
Wisconsin Department of Transportation (WisDOT)
DT1887 8/2015

Project ID(s)	Region:	Date Reviewed (m/d/yyyy) 1st Review	2nd Review	3rd Review
86-75-309	NE	2/29/2016	3/17/2016	

TRAFFIC MODEL DESCRIPTION

Model Completion/Revision Date (m/d/yyyy)	Analysis Year(s)	Analysis Scenario/Alternative
9/12/2015	2040	Future AM and PM peaks, Enhanced Signal (Alternative #2)

Scope of Model (intersections, ramps, corridors, etc. being reviewed)
Intersection of USH 888 (N/S) and STH 747 (E/W), Blue Moose, WI

Analysis Time Period (s)

☒ Weekday AM Peak Hours: 7:00-9:00 | ☐ Weekday Midday Peak Hours: ______ | ☒ Weekday PM Peak Hours: 3:30-5:30 | ☐ Fri Peak Hours: ______ | ☐ Sat Peak Hours: ______ | ☐ Sun Peak Hours: ______ | ☐ Other: ______ Hours: ______

Analysis Tool(s) Utilized

☐ HCS - Version: ______ ☒ Synchro – Version/Build: 8.0.806.61 ☐ Sidra - Version: ______ ☐ Other: ______ - Version: ______

SUMMARY OF REVIEW

Item Reviewed	Overall Model Acceptability	Revision Required	Reviewer Comment(s)	Analyst Response(s)
Traffic Analysis Tool/Version	☒☐☐ Acceptable ☐☐☐ Unacceptable ☐☐☐ Conditionally Acceptable	☒☐☐ No ☐☐☐ Yes	The most recent build of Synchro is used. This is acceptable.	
Lane Geometry	☐☒☐ Acceptable ☐☐☐ Unacceptable ☒☐☐ Conditionally Acceptable	☐☒☐ No ☒☐☐ Yes	WB right turn lane is channelized in the plans but not the model. Please correct. WBR is now shown as channelized in the model	WBR should be channelized. This has been corrected.
Traffic Volumes, % Trucks, Peak Hour Factor (PHF)	☐☒☐ Acceptable ☐☐☐ Unacceptable ☒☐☐ Conditionally Acceptable	☐☒☐ No ☒☐☐ Yes	Heavy vehicle (HV) percentage set to 2% for all approaches. From the 2012 turning movement count, the NB AM has 8% HV and NB PM has 13% HV. Other approaches should also be examined in both peak periods Truck percentages are now acceptable	Saturated Flow Rate (RTOR) has been set to 60 vph. All other RTOR volumes were checked and are in compliance with TSDM 3-2-2-2.

(continued on reverse side)

SUMMARY OF REVIEW *(continued)*

Item Reviewed	Overall Model Acceptability	Revision Required	Reviewer Comment(s)	Analyst Response(s)
Signal Parameters (including RTOR)	☐☒☐ Acceptable ☐☐☐ Unacceptable ☒☐☐ Conditionally Acceptable ☐☐☐ N/A	☐☒☐ No ☒☐☐ Yes	While the EBR Saturated Flow Rate (RTOR) is set to 90 vph, or half of the 180 vph AM demand, it should be set to 60 vph per TSDM 3-2-2-2 since the cycle length is 120 seconds. EBR Saturated Flow Rate (RTOR) was corrected to 60 vph	Saturated Flow Rate (RTOR) has been set to 60 vph. All other RTOR volumes were checked and are in compliance with TSDM 3-2-2-2.
Measures of Effectiveness (MOEs)	☐☒☐ Acceptable ☐☐☐ Unacceptable ☒☐☐ Conditionally Acceptable ☐☐☐ N/A	☐☒☐ No ☒☐☐ Yes	EBL movement has LOS E in the PM while the NBT/SBT have LOS B. Can signal timing be adjusted to make green time more equitable? The adjusted signal timing results in acceptable LOS for all approaches.	Signal timing has been adjusted to allocate more green time to the EBL movement. Now EBL is LOS C, NBT is LOS B, and SBT is LOS C, all of which are acceptable.
Other: Pedestrian movements	☐☒☐ Acceptable ☐☐☐ Unacceptable ☒☐☐ Conditionally Acceptable	☐☒☐ No ☒☐☐ Yes	NB pedestrian traffic was included in the base year analysis – why is this not included here? Given the construction of the path, it is acceptable to not consider pedestrian impacts here.	Though not documented here, an off-road paved path will be constructed to the west as part of this alternative. This will serve NB pedestrian traffic destinations and remove almost all NB pedestrian traffic. Please confirm that it is acceptable to not include any NB pedestrian traffic in analysis.
Overall Model	☐☒☐ Acceptable ☐☐☐ Unacceptable ☒☐☐ Conditionally Acceptable	☐☒☐ No ☒☐☐ Yes	See comments from above Overall model is now acceptable	

			1st Review	2nd Review	3rd Review
Reviewer, please email completed form to:					
To:	Project Manager & Region Contact	Date Reviewed (m/d/yyyy):	2/29/2016	3/17/2016	4/20/2016
CC:	DOT Traffic Model Peer Review	Reviewed By:	RIAWD	RIAWD	RIAWD
Subject:	DT2291 for Project ID; Traffic Model Name	Model Completion/Revision Date (m/d/yyyy):	2/15/2016	3/14/2016	4/18/2016

TRAFFIC MODEL DESCRIPTION

Project ID(s)	Project Name/Description	Region:	Highway(s)
0-11-23-68	Cold Corridor - STH 999 & IH-O, Red Bayou, WI	NW	STH 999 & IH-O

Traffic Model Name/Description	Analysis Scenario/Alternative	Analysis Year(s)
Paramics Base Condition Model	AM, PM, FRI, SUN	2013

Analysis Time Period (s)

☒ Weekday AM Peak	☐ Weekday Midday Peak	☒ Weekday PM Peak	☒ Fri Peak	☐ Sat Peak	☒ Sun Peak	☐ Other: ░░░░░
Hours: 6:30-8:30	Hours: ░░░░░	Hours: 3:15-5:15	Hours: 4:30-6:30	Hours: ░░░░░	Hours: 3:00-5:00	Hours: ░░░░░

Analysis Tool(s) Utilized

☐ SimTraffic - Version: ░░░░░ ☒ Paramics - Version: 7.01 ☐ Vissim - Version: ░░░░░ ☐ Other: ░░░░░ - Version: ░░░░░

SCOPE AND EXTENT OF PEER REVIEW

Purpose & Scope of Review

Provide a detailed review of the base condition model coding and calibration

Description/Limit of Model

STH 999 & IH-O, 0.5 miles south of Random Road north to the West River Bridge

Configuration Settings

# Zones:	# Time Steps:	Speed Memory:	Assignment Type:
25	5	8	All-or-nothing
Mean Target Headway:	**Mean Reaction Time**	**Matrix Structure**	**Vehicle Classifications/Splits**
0.87	0.93	2 O-D matrices, 1 for passenger vehicles & 1 for heavy vehicles	Separate matrices

Seed Values Used for Calibration:	113, 683, 23, 149, 593, 1039, 28567
Seed Values Used for Review:	23, 28567
Other: Variable Speed Limit	Variable speed limit (VSL) applied on IH-O

Were any changes to the model made by the review team? If yes, please describe.

No

OBSERVATIONS, MODEL FEATURES AND CHARACTERISTICS

metrics / Traffic Control

Network Coding

Network Coding establishes the horizontal and vertical geometry of the network. It also includes the appropriate use of settings such as link free-flow speed.

- *For SimTraffic, this is coded within the Synchro module and includes placement and interconnection of nodes and links, number of lanes, lane widths, lane configurations, roadway curvature, storage lengths, and other intersection and network geometry.*
- *For Paramics this includes placement and interconnection of nodes, links and link categories, curb points, curves, turn lanes, merge points, stop bars, signposts, and other network infrastructure.*
- *For VISSIM this includes the placement and interconnection of links, connectors, desired speed decisions, reduced speed areas, conflict areas, and priority rules.*

As a whole, network coding is:	Observations/Comments:	Analyst Response
☐ ☒ ☐ Acceptable ☒ ☐ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable	1st Review Intersection of This Rd and That Dr - the EB approach currently has an exclusive right turn lane, which is not coded in the model (Link 523:524). It is possible that this exclusive right turn lane was added after the model base year	1st Review Lane appears to have been in place prior to 2012 and is marked for buses, bicycles, and right turns only. An exclusive EB right turn lane has been added that extends back to the WB ramp terminal intersection. This change is not expected to affect the results
Extent of Revisions Required: ☐ ☒ ☐ No Revisions Required ☒ ☐ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	2nd Review ***An EB exclusive right turn lane was added on link 523:524. This is used only by buses and right turns, since bicycles are not included in this model.*** 3rd Review ░░░░░	2nd Review ░░░░░ 3rd Review ░░░░░

Routing Parameters/Vehicle Routes

Routing parameters or vehicle routes influence the way vehicles travel through the network. If coded improperly, these controls can cause unrealistic or erratic routing.

- *This feature is __not__ applicable for SimTraffic. However, interaction between intersections can be checked as noted with the Link O-D feature in the O-D Matrices, Demand Profiles, & Time Periods section.*
- *For Paramics, routing parameters (such as cost factors, turn penalties, modification of the link type hierarchy, and waypoints) override the default routing behavior and profoundly influence the route choice in the network. They are occasionally used to increase or decrease the traffic volume on specific links.*
- *For VISSIM, vehicle routes and vehicle routing decisions control the flow of traffic from the entrance points through the network. They can be coded using either actual vehicle flows or percentages.*

As a whole, traffic routing parameters are:	Observations/Comments:	Analyst Response
☐ ☐ ☒ Acceptable ☒ ☒ ☐ Conditionally Acceptable ☐ ☐ ☐ Unacceptable	1st Review Link cost factors are applied in 13 locations. It was noted that link 709:708 has an exceptionally high cost factor of 1000. Why is this so high? This link is located on STH 999 between the Random Rd ramp terminal intersections.	1st Review Link 709:708 cost factor will be adjusted. Other cost factors were generally used for routing purposes at interchanges to prevent vehicles from exiting then re-entering the freeway. No additional changes are proposed - please confirm.
Extent of Revisions Required: ☐ ☐ ☒ No Revisions Required ☒ ☒ ☐ Minor Revisions Required ☐ ☐ ☐ Moderate Revisions Required ☐ ☐ ☐ Major Revisions Required	2nd Review ***This is an acceptable approach.*** 3rd Review The cost factor for link 709:708 was changed to 1 which is acceptable.	2nd Review ***Update completed.*** 3rd Review ░░░░░

Microsimulation Peer Review Form Responses

Date of Last Response: February 29, 2016

Project: 0-11-23-58
Cold Corridor – STH 999 & IH-O
Up North

Analyst: Traffic Models 'R Us (TMRU)

Traffic Model Name/Description: Future Year (2040) AM Model

Analyst's Response Code

A = Agree completely; will revise (no written response required)

RFS = Requires further study in next phase (no written response required)

P = Agree partially; will revise to some degree (see written response)

D = Disagree; will not revise (see written response)

	1st Review:	2nd Review:	3rd Review:
Model Completion/Revision Date(m/d/yyyy):	01/07/16		
Reviewer 1: **An Employee of the State (EOS)**	02/04/16		
Reviewer 2: **Review is All We Do (RIAWD)**	02/11/16		
Reviewer 3: **FHWA**	02/14/16		

Category	Reviewer		Analyst		
	Initials	**Review Comments**	**Response Code**	**Response**	**Markup Complete**
Network Coding	EOS	#1(Link 422:413) # 2 (Link 1109:209 kerb points) #3 (Link 344:229 stopline rotation)	A A A	#1 Link adjusted to provide two lanes	TMRU – 3/02/15
	RIAWD	#1 (Model weave lengths) #2 (Ramp at node 447)	P A	#1 The study team has modified the upstream lane choice rules associated with the mainline weaves between Fake Rd. and False Dr. While there is always a degree of early or late lane changing within the model due to randomly assigned degrees of aggressiveness, awareness, etc., this issue has been mitigated to the greatest extent possible. #2 Ramp parameters modified to mitigate this issue as much as possible. The future AM model should now match the draft PM model, as this issue was more prominent during the future PM peak period.	TMRU – 03/02/15
	FHWA	#1 (Link 29:30 and 29:31) #2 (81st St./St. Peter Ave geometry)	D RFS	#1 The left turn lane here (Link 29:31) has been modeled as separate to prevent vehicles from attempting to move over, therefore blocking the lane and causing a queue. No change is proposed. #2 The design team has indicated that while the DXF does not indicate an allowable movement from SB 81st St to the IH-0 EB entrance ramp, this access could be provided as the team continues to work on design refinements. Movement from SB 81st to IH-0 EB will be modeled, and results of this will help inform the final design decision.	TMRU – 03/02/15