Interregional Corridor Planning

Integration of Performance Measures in Corridor Planning (A Minnesota Perspective)

6th National Access Management Conference
Kansas City, Missouri
August 30, 2004

Howard Preston, PE
CH2M HILL

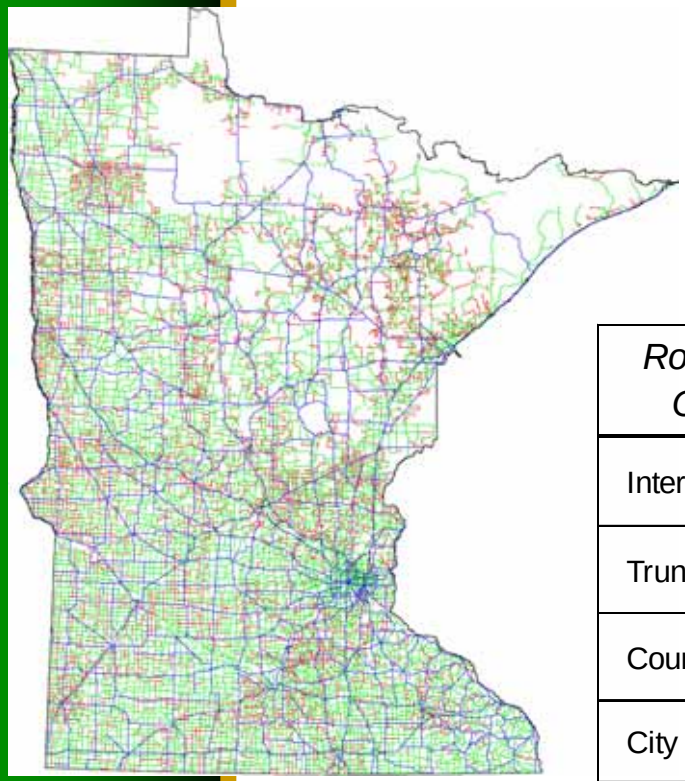
CH2MHILL

Agenda

- Overview of Minnesota's Road System
- Overview of Interregional Corridor System
- Description of the Performance Measures
- The Trunk Highway 10 Corridor
- Wrap Up
- Questions and Answers

CH2MHILL

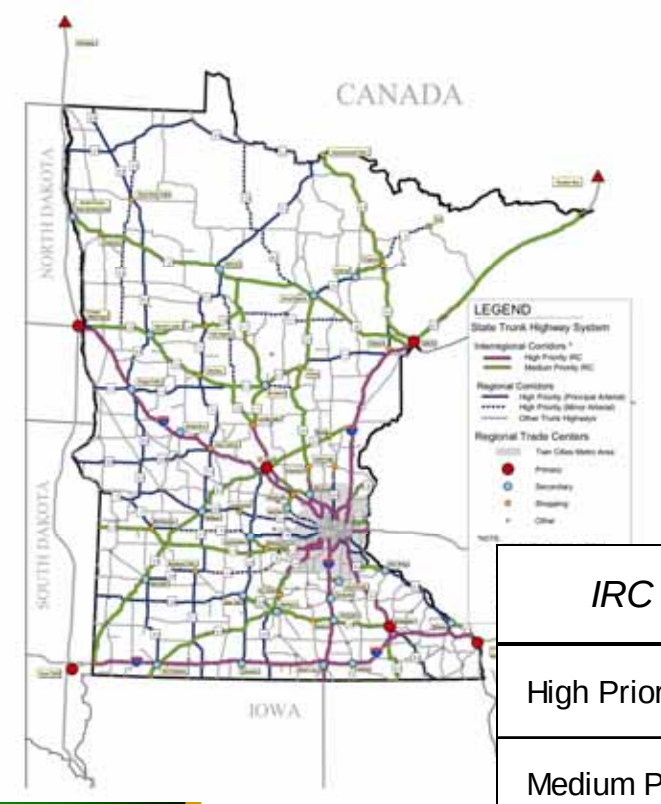
Minnesota's Road System



Roadway Class	*Functional Class*	*Miles*	*MVMT*	*Crashes (Rates)*	*Fatalities (Rates)*
Interstate	Principle Arterial	914 (0.7%)	11,431 (22%)	12,574 (1.1)	50 (0.4)
Trunk Highway	Principal Arterial & Minor Arterial	11,022 (8%)	19,349 (37%)	29,023 (1.5)	269 (1.4)
County	Minor Arterial & Collector	45,430 (33%)	12,748 (25%)	29,320 (2.3)	226 (1.8)
City	Minor Arterial, Collector & Local	18,460 (14%)	7,321 (14%)	29,284 (4.0)	49 (0.7)
Other	Local	59,531 (44%)	1,094 (2%)	3,390 (3.1)	31 (2.9)
State Totals		135,357	51,943	103,591	625

CH2MHILL

Interregional Road System

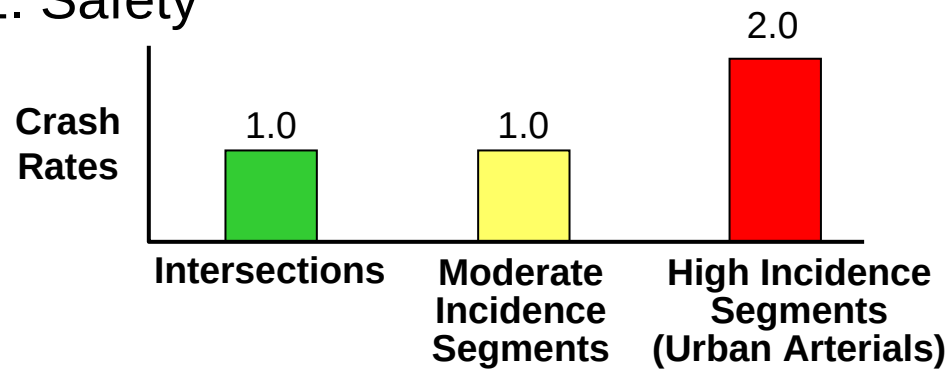


IRC Class	*Functional Class*	*Miles*	*MVMT*	*Crashes (Rates)*
High Priority IRC	Principle Arterial	1007 (0.7%)	5,000 (10%)	5,500 (1.1)
Medium Priority IRC	Principal Arterial	1919 (1.4%)	7,700 (15%)	5,750 (0.75)
High Priority Regional	Principal Arterial & Minor Arterial	2039 (1.5%)	3,600 (6%)	4,700 (1.3)
State Totals		4,965 (3.6%)	16,300 (31%)	15,950 (15%)

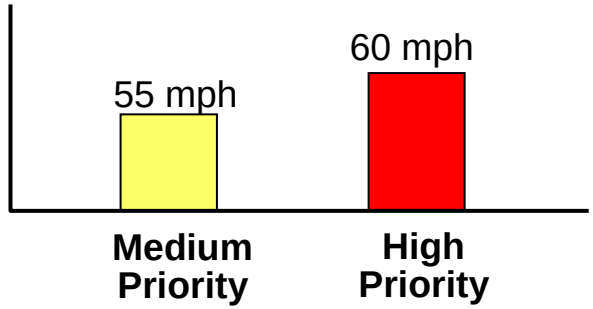
CH2MHILL

Key Corridor Performance Indicators

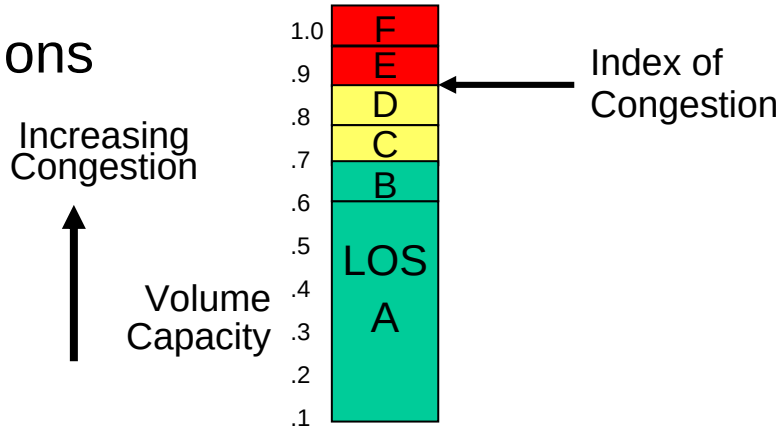
1. Safety



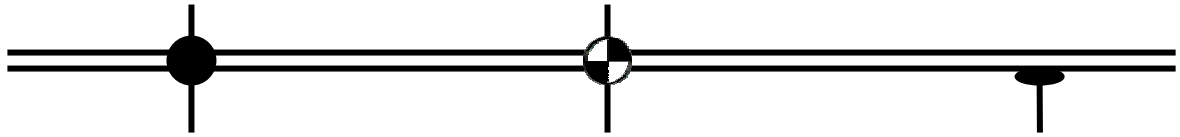
2. Mobility



3. Traffic Operations



4. Access



Intersection Spacing Signal Spacing Driveway Spacing

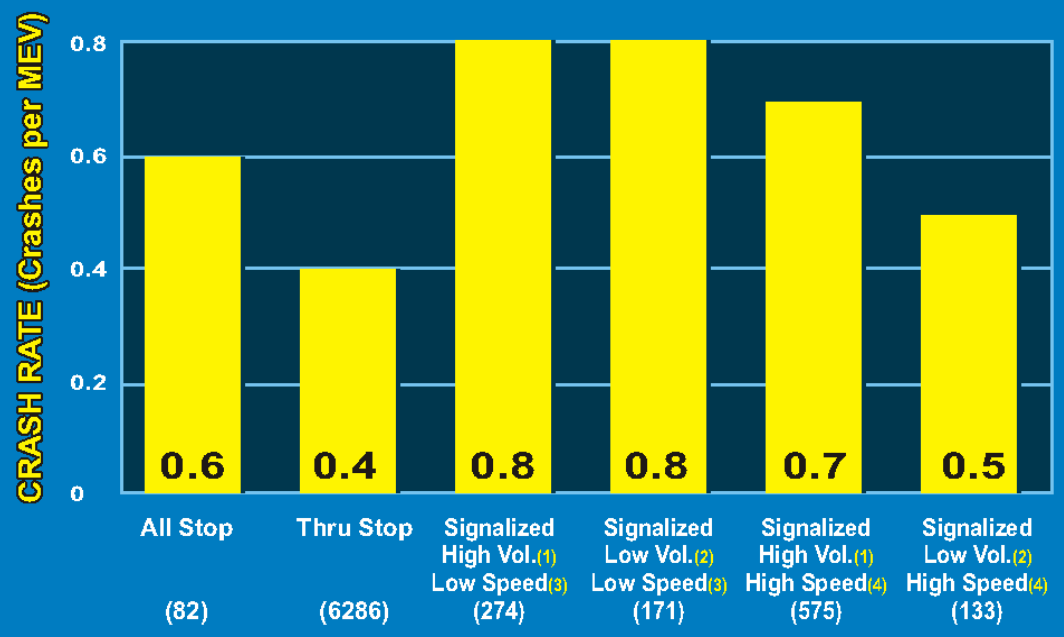
IRC Safety Performance Measures

	Total # Intersections		Median Crash Rate	# ≥ Median		Threshold Crash Rate	# ≥ Target: ELIGIBLE POOL	
				IRC	7 IRCMP		IRC	7 IRCMP
INTERSECTIONS								
Intersections* signalized	229		0.8	115	34	1.0	79	22
unsignalized	444		0.6	224	55	1.0	90	22
Subtotals Intersections	673			339	89		169	44
SECTIONS								
Sections/Facility Type	# Sect.	Length Miles						
Moderate Crash Incidence Type								
Urban 4 Lane Freeway	24	63	0.9	13	5	1.0	11	3
Rural 4 Lane Freeway	61	787	0.7	32	3	1.0	3	0
Rural Expressway	98	669	0.9	50	25	1.0	38	19
Rural 2 Lane	180	1157	0.9	101	15	1.0	89	14
High Crash Incidence Type								
Urban 2 Lane	102	69	2.2	52	6	2.0	59	12
Urban 4 Lane Express	48	101	2.0	25	8	2.0	25	8
Misc.	72	90	2.6	37	8	2.0	44	10
Subtotals Sections	585	2936		310	70		269	66

*Intersections with > 3 crashes/3 years (1997-1999)

CH2MHILL

Intersection Crash Rates (Minnesota) By Control Type and Family



CONTROL TYPE / FAMILY
(no. of intersections)

MEV = million entering veh.
(1) > 15000 MEV (3) < 45 mph
(2) < 15000 MEV (4) > 45 mph

97 - 99 DATA

A-14

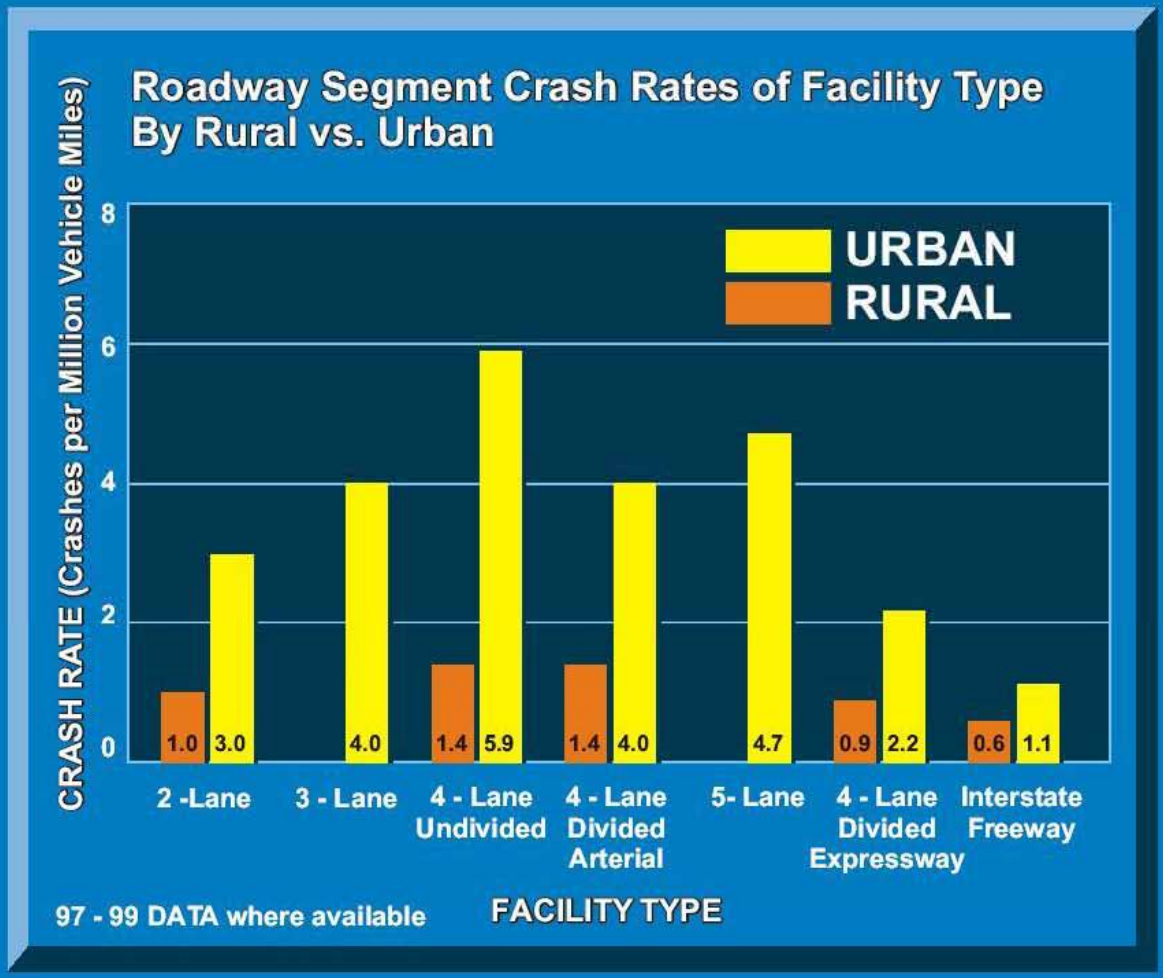
Intersection Crash Rates (Minnesota) By Control Type and Family

Source: Mn/DOT 1997 - 1999 Crash Data (note: Only State Highway Intersections)

Source: Traffic Safety Fundamentals Handbook

HIGHLIGHTS:

- Crash frequency at intersections tends to be a function of exposure - the volume of traffic traveling through the intersection. As a result, the most commonly used intersection crash statistic is the crash rate - the number of crashes per million entering vehicles (MEV).
- Crash frequency also tends to be a function of the type of traffic control at the intersection. Contrary to the popularly held opinion that increasing amounts of intersection control results in increased safety, the average crash rate at signalized intersections (0.7 per MEV) is almost 80% higher than the average crash rate at STOP controlled intersections (0.4 per MEV).
- A wealth of research also supports the conclusion that traffic signals are only rarely safety devices. Most Before vs. After studies of traffic signal installations document increases in the number and rate of crashes, a change in the distribution of the type of crashes and a modest decrease in the severity of the crashes.
- The data at a limited number (82) of All-Way STOP controlled intersections indicates that the average crash rate (0.6) is approximately 25% less than the average at signalized intersections (0.8).
- There is also a limited amount of crash data to support a conclusion that some type of left turn phasing (either exclusive or exclusive/permitted) helps to minimize crashes at signalized intersections.



HIGHLIGHTS:

- Average crash rates vary by location (Rural vs. Urban) and type of facility
- Freeways have the lowest crash rates and are the safest roadway system in the state.
- Rural Roadways have lower crash rates than similar urban roads.
- Urban minor arterials (which serve both a mobility and land access function) have the highest crash rate.
- 4 - Lane Undivided roadways have the highest crash rates. Over the years, this average has been lowered (from a rate of 8.0 in 1990) due to Mn/DOT's efforts to convert the worst segments to either, 3 - Lane, 4 - Lane Divided or 5 - Lane roads.
- Systems of left turn lanes reduce crash frequency on urban arterials 25 to 40%.

Roadway Segment Crash Rates of Facility Types By Rural vs. Urban

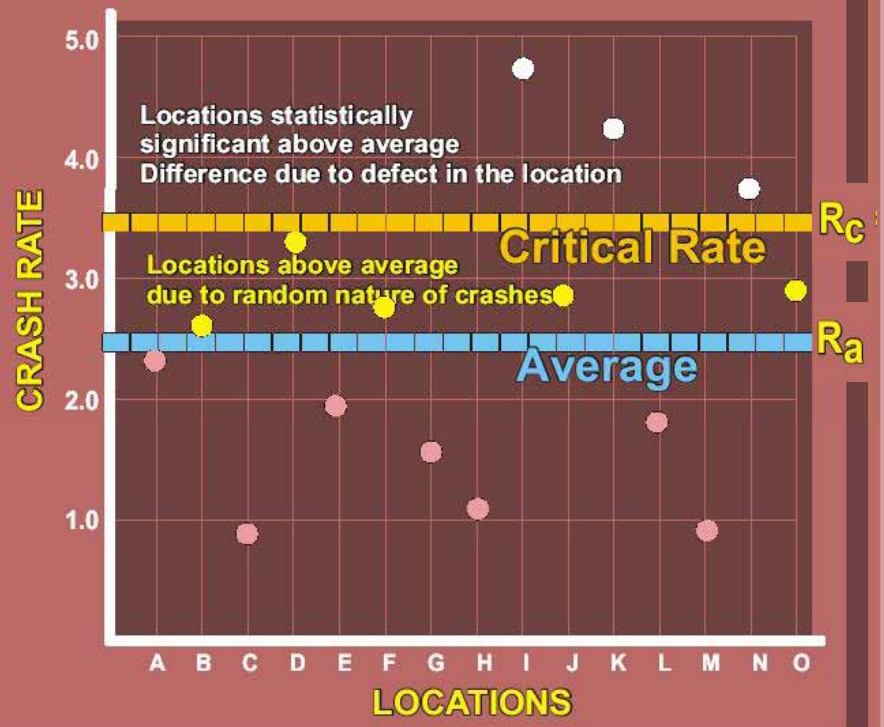
A-18

Source: Mn/DOT Metro Division Office of Traffic Engineering

TRAFFIC SAFETY FUNDAMENTALS HANDBOOK

Source: Traffic Safety Fundamentals Handbook

Effect of Random Distribution of Crashes



B-05

Effect of Random Distribution of Crashes

HIGHLIGHTS:

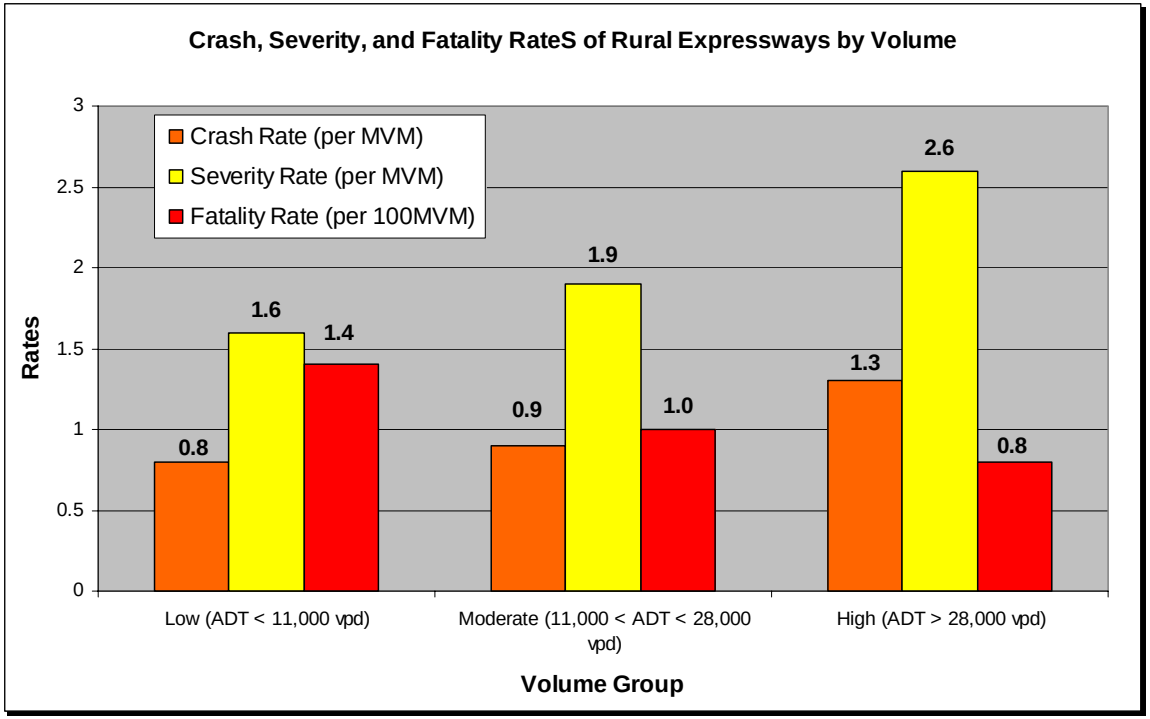
The Concept of "Critical Crash Rate"

- The technique that uses the critical crash rate is considered to be the best for identifying hazardous locations.
- The critical crash rate accounts for the key variables that effect safety, including:
  - The design of the facility
  - The type of intersection control
  - The amount of exposure
  - The random nature of crashes
- The concept suggests that any sample or category of intersections or roadway segments can be divided into three basic parts:
  - Locations with a crash rate below the categorical average: these locations are considered to be SAFE because of the low frequency of crashes and can be eliminated from further review.
  - Locations with a crash rate above the categorical average, but below the critical rate: these locations are considered to be SAFE because there is a very high probability (90-95%) that the higher than average crash rate is due to the random nature of crashes.
  - Locations with a crash rate above the critical rate: these locations are considered to be UNSAFE and in need of further review because there is a high probability (90-95%) that conditions at the site are contributing to the higher crash rate.
- The other primary advantage of using the critical crash rate is that it helps screen out the 90% of the locations that do not have a problem and focuses an agency's attention and resources on the limited number of locations that do have a documented problem (as opposed to a perceived problem).

$$R_c = R_a + K\,(R_a / m)^{1/2} + 0.5/m$$

Source: Traffic Safety Fundamentals Handbook

Effect of Volume on Rural Expressway Crash Rates



Source: Mn/DOT TH 52 Road Safety Audit

Intersection Related Crashes of Rural Expressways by Volume

Volume Group	Major Street Average Daily Traffic (ADT)	Percent Intersection Related Crashes[1]
Low	ADT < 11,000 vpd	27%
Moderate	11,000 vpd < ADT < 28,000 vpd	43%
High	ADT > 28,000 vpd	59%

Source: Mn/DOT TH 52 Road Safety Audit

NOTE:

- Both crash rate and severity rate are seen to increase as the volume increases.
- Unlike the crash and severity rate, the fatality rate decreases as the roadway volume increases.
- Similar to the crash rate and severity rate, the percent of intersection related crashes increases with volumes.

[1]Crashes occurring in interchange areas and also at intersections, alleys and driveways.

CH2MHILL

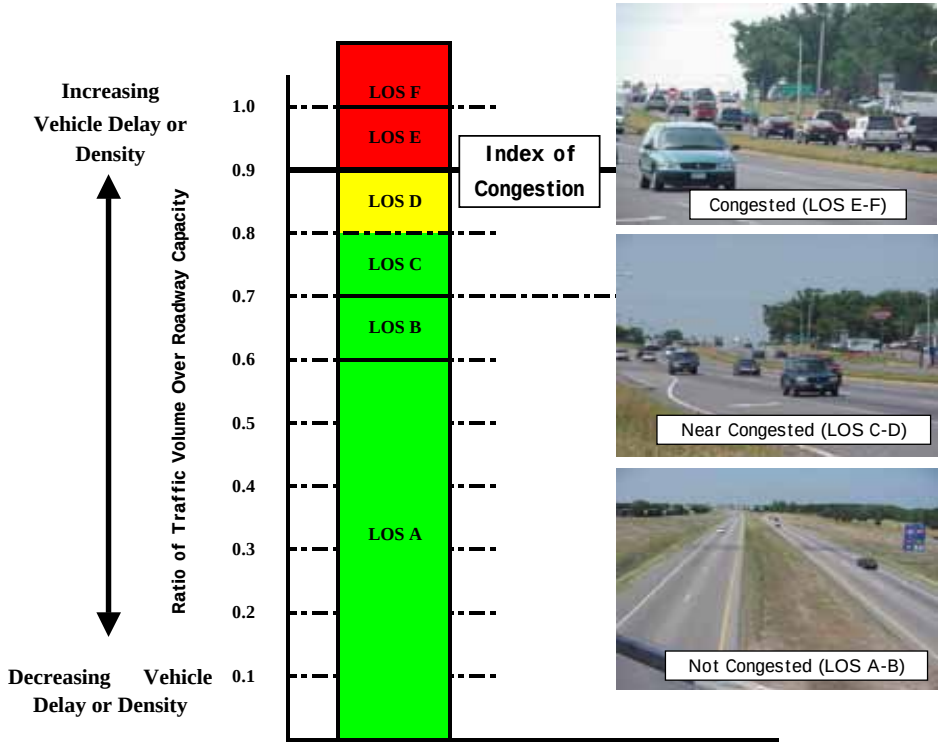
Mobility Performance Measures

- Speed:
  - *High Priority corridors - 60 mph*
  - *Medium Priority Corridors - 55 mph*
- Level of Service
- Actual/Expected Number of Traffic Signals
  - *Safety Issues*
  - *Delay*
  - *Alternatives*
    - Traditional (Interchanges)
    - Emerging (Roundabouts)
    - Experimental (Intersection Decision Support)

http://www.its.umn.edu/research/applications/ids/consortium/index.html

CH2MHILL

Description of Level of Service



Definition: Level-of-Service (LOS) is an Estimate of the Quality of Traffic Flow.

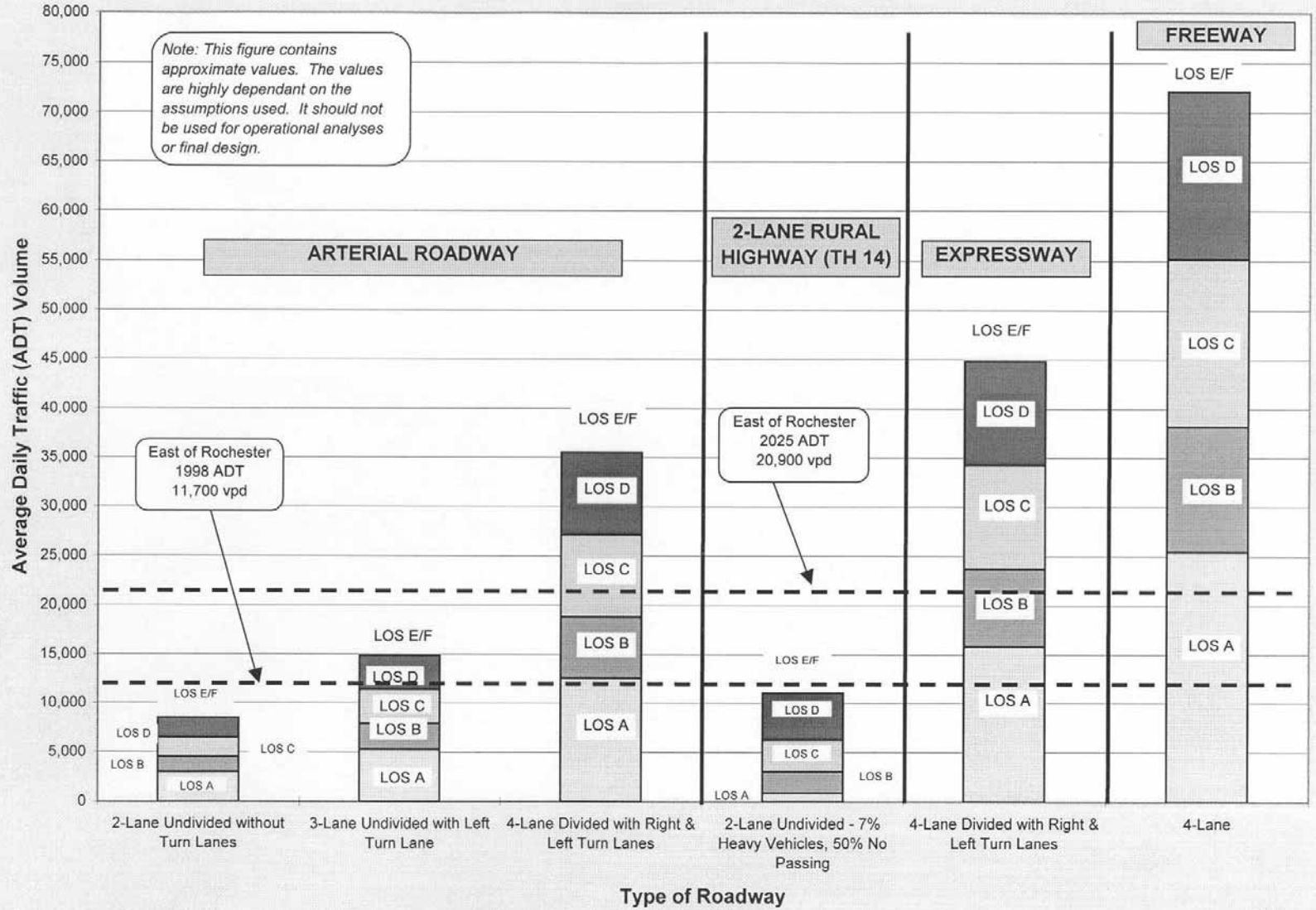
Source: 2000 Highway Capacity Manual (Transportation Research Board)

Key Factors:

1. Roadway Geometry
2. Traffic Volume Characteristics
3. Intersections / Interchanges

Analysis Type:

1. Segments - Freeway vs. Expressway vs. Urban Arterial, etc…
2. Intersections - Signalized vs. Unsignalized

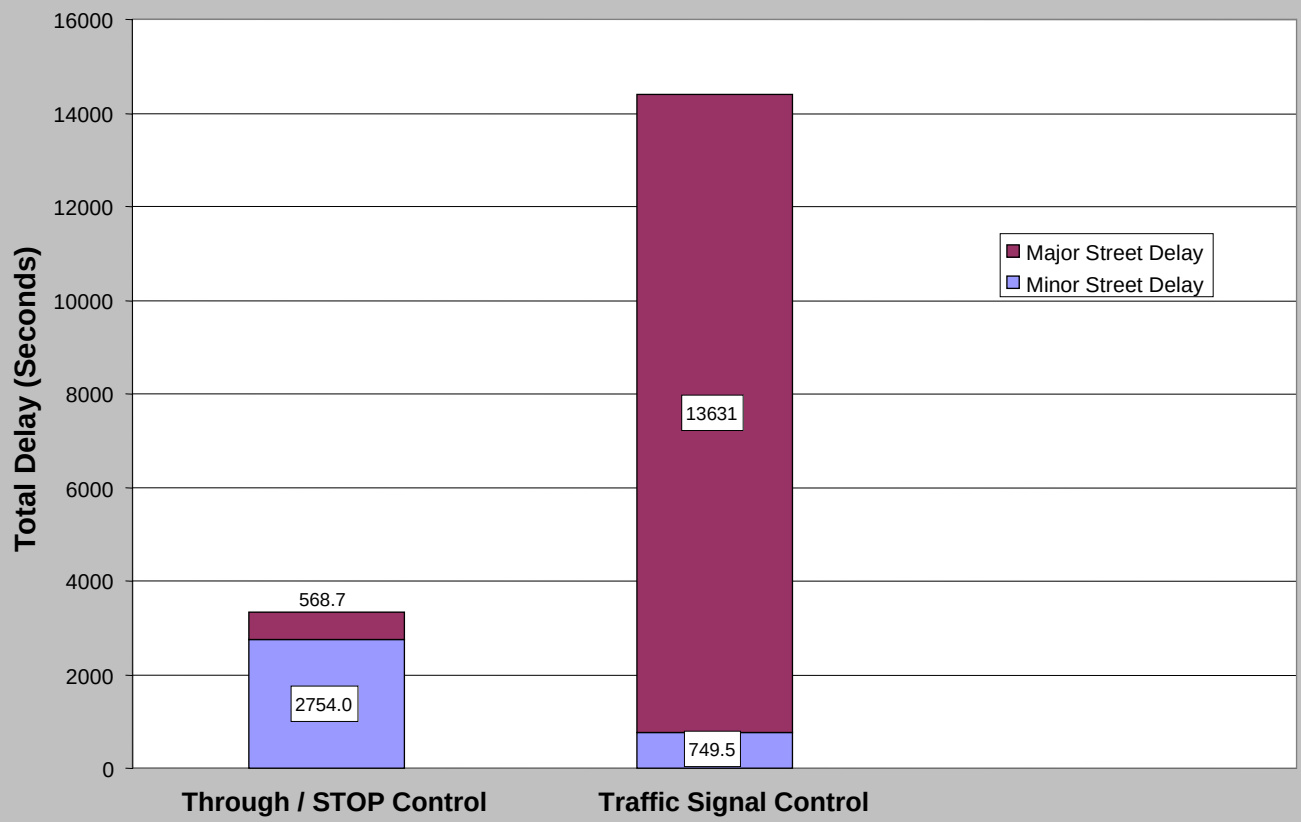


TH 14: Rochester to Eyota
Preliminary Design/EIS

Figure 1
Typical Capacity of Different Types of Roadways

CH2MHILL

Case Study: Change in Intersection Delay

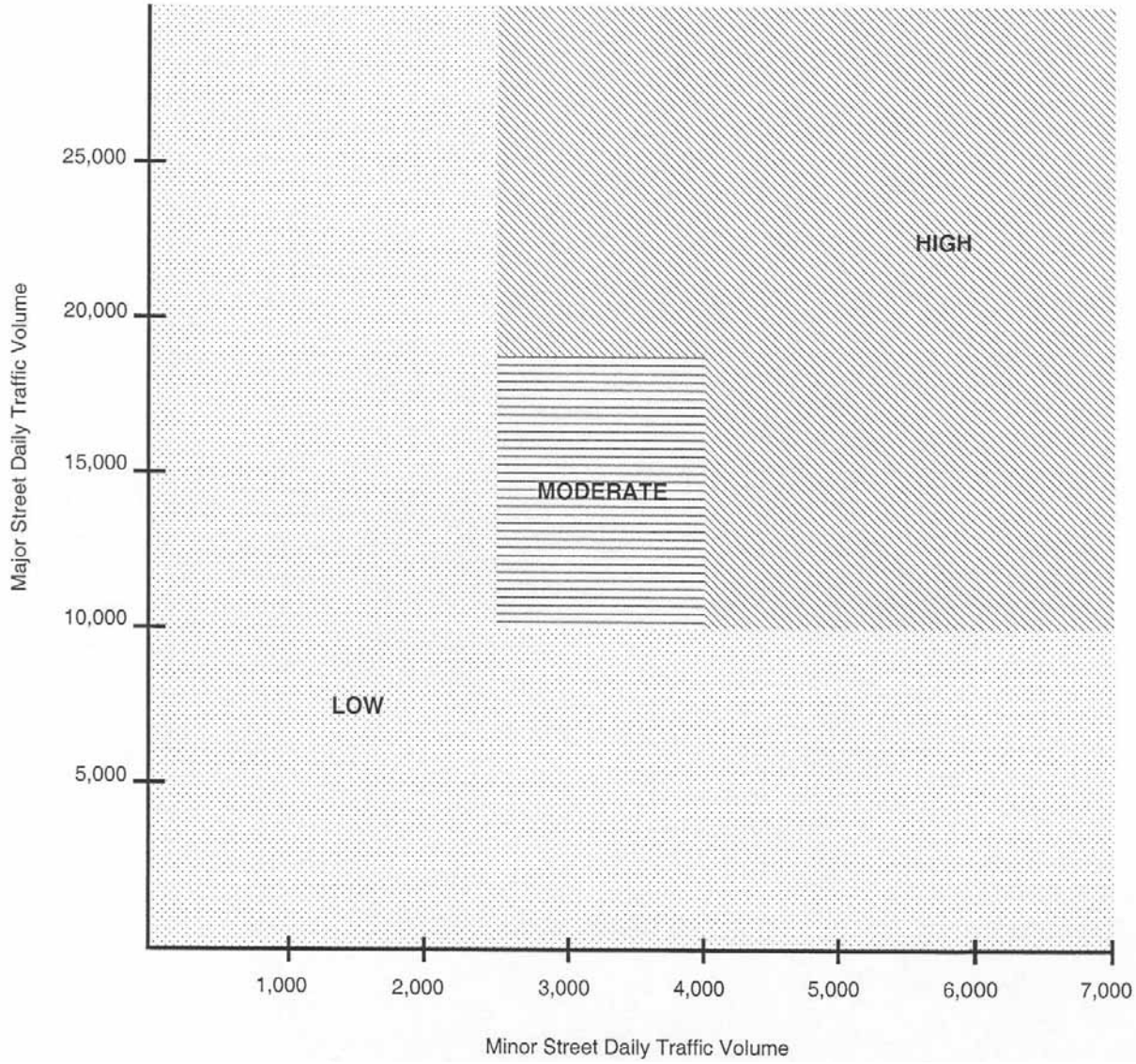


Comparison of TOTAL PM Peak Hour Delay

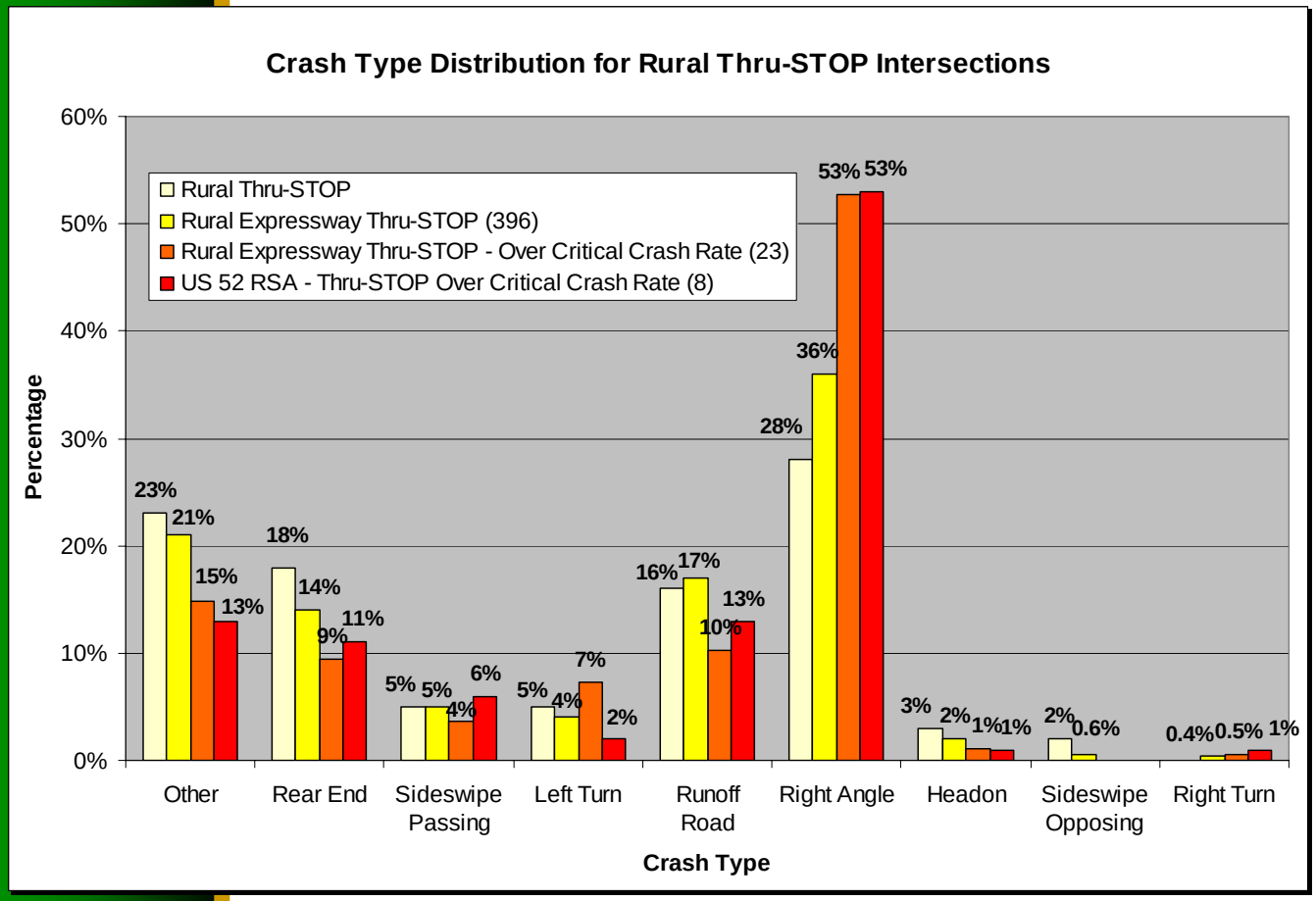
Source: Mn/DOT Peak Hour Turning Movements using Highway Capacity Software

Source: TH 244 / Wedgewood Drive Signal Analysis (Mahtomedi, MN); Howard R. Green Company

Probability of Traffic Signal Installation



Intersection Crash Type Distribution



Source: Mn/DOT 2000 – 2002 Crash Data &
US 52 Road Safety Audit (January 1999 – March 2002 Crash Data)

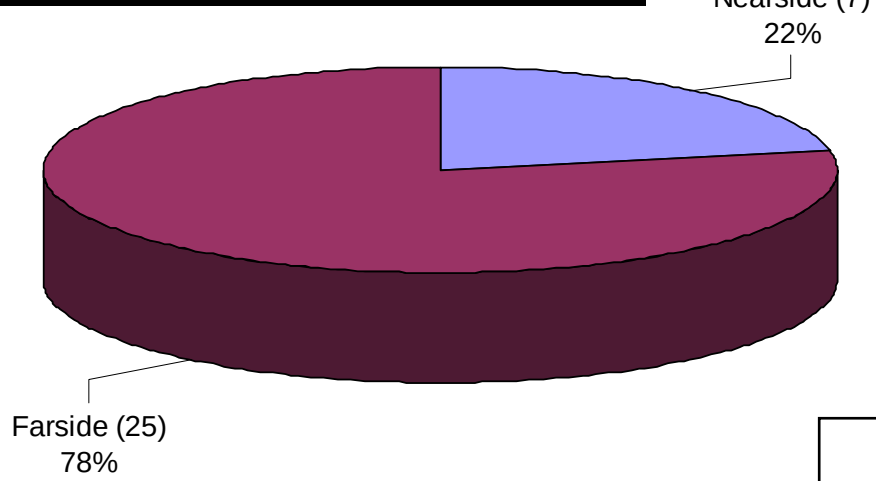
NOTE:

- Thru-STOP intersections for rural expressways have a higher percentage of right angle crashes in comparison to all rural thru-STOP intersections. Most other crash types show a decrease.
- The percentage of right angle crashes significantly increases for rural expressway intersections over the critical crash rates.
- US 52 intersections over the critical crash rate are nearly identical to the crash type distribution of all rural expressway intersections over the critical crash rate.

CH2MHILL

Candidate Intersections - Right Angle Crashes

Right Angle Crash Location

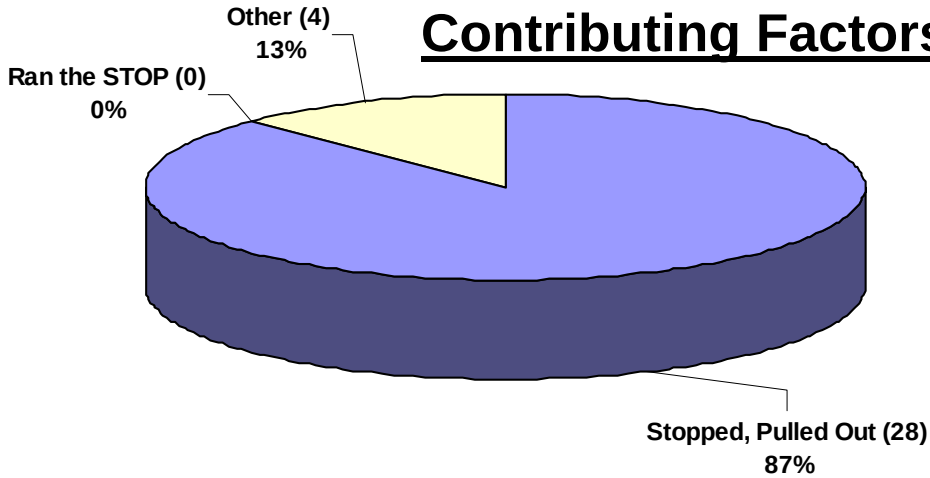


NOTE:

- Nearly 80% of right angle crashes at the candidate intersections occurred on the farside of the intersection (i.e., when vehicle on minor street is pulling out of median cross-over).
- At the candidate intersections, nearly 90% of all right angle crashes were "Stopped, Pulled Out" while no "Ran the STOP" crashes were observed.

Source: Mn/DOT 2000 – 2002 Crash Data

Contributing Factors



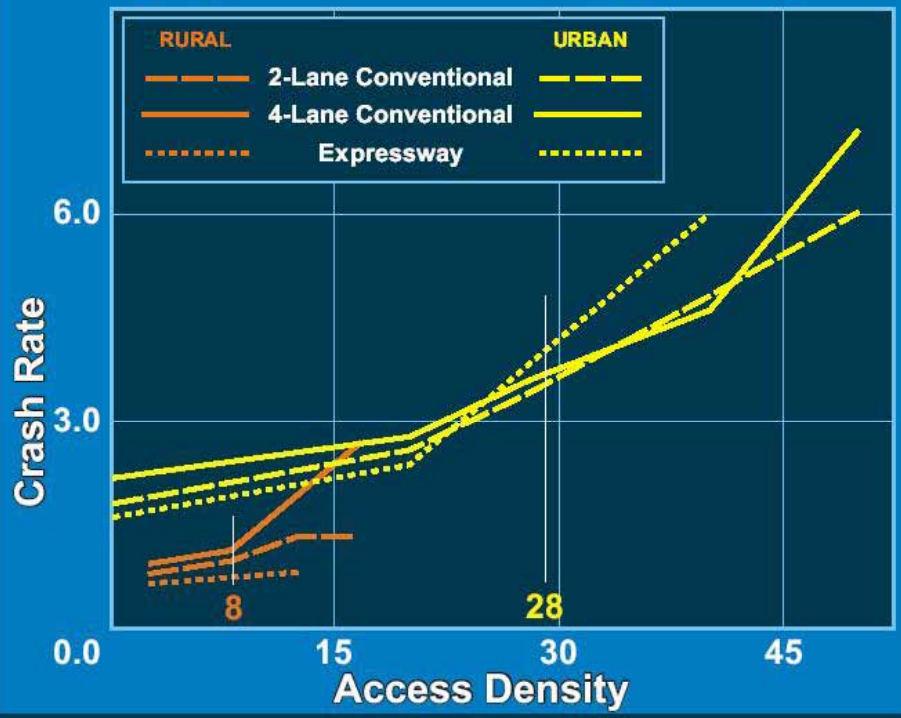
Mn/DOT Access Spacing Guidelines

Category	Area or Facility Type	Typical Functional Class	Intersection Spacing		Signal Spacing	Private Access
			Full Movement I/S	Restricted I/S		
1			**High Priority Interregional Corridors**			
1F	Freeway	Principal Arterials	Interchange Access Only		⊘	⊘
1A-F	Full Grade Separation	Principal Arterials	Interchange Access Only		⊘	⊘
1A	Rural ExUrban By Pass	Principal Arterials	1 mile	⊘	**INTERIM ONLY** By Deviation Only	By Deviation Only
2			**Medium Priority Interregional Corridors**			
2A-F	Full Grade Separation	Principal Arterials	Interchange Access Only		⊘	⊘
2A	Rural ExUrban By Pass	Principal Arterials	1 mile	⊘	**STRONGLY DISCOURAGED** By Deviation Only	By Deviation Only
2B	Urban Urbanizing	Principal Arterials	1 mile	1/2 mile	**STRONGLY DISCOURAGED** By Deviation Only	By Deviation Only
2C	Urban Core	Principal Arterials	300-660 feet dependent upon block length		1/4 mile	Permitted Subject to Conditions
3			**High Priority Regional Corridors**			
3A-F	Full Grade Separation	Principal & Minor Arterials	Interchange Access Only		⊘	⊘
3A	Rural ExUrban By Pass	Principal & Minor Arterials	1 mile	1/2 mile	1 mile	By Exception or Deviation Only
3B	Urban Urbanizing	Principal & Minor Arterials	1/2 mile	1/4 mile	1/2 mile	By Exception or Deviation Only
3C	Urban Core	Principal & Minor Arterials	300-660 feet dependent upon block length		1/4 mile	Permitted Subject to Conditions
4			Principal Arterials in Metro Area and in Primary Trade Centers			
4A-F	Full Grade Separation	Principal Arterials	Interchange Access Only		⊘	⊘
4A	Rural ExUrban By Pass	Principal Arterials	1 mile	1/2 mile	1 mile	By Exception or Deviation Only
4B	Urban Urbanizing	Principal Arterials	1/2 mile	1/4 mile	1/2 mile	By Exception or Deviation Only
4C	Urban Core	Principal Arterials	300-660 feet dependent upon block length		1/4 mile	Permitted Subject to Conditions
5			**Minor Arterials on All Systems**			
5A	Rural ExUrban By Pass	Minor Arterials	1/2 mile	1/4 mile	1/2 mile	By Exception or Deviation Only
5B	Urban Urbanizing	Minor Arterials	1/4 mile	1/8 mile	1/4 mile	By Exception or Deviation Only
5C	Urban Core	Minor Arterials	300-660 feet dependent upon block length		1/4 mile	Permitted Subject to Conditions
6			**Collectors on All Systems**			
6A	Rural ExUrban By Pass	Collectors	1/2 mile	1/4 mile	1/2 mile	Permitted Subject to Conditions
6B	Urban Urbanizing	Collectors	1/8 mile	Not Applicable	1/4 mile	Permitted Subject to Conditions
6C	Urban Core	Collectors	300-660 feet dependent upon block length		1/8 mile	Permitted Subject to Conditions
7			**Specific Access Plan**			
7	All	All.	By Adopted Plan			

Source: Mn/DOT's Access Category System and Spacing Guidelines

CH2MHILL

Roadway Segment Crash Rates as a Function of Facility Type and Access Density (MN Data)



A-21

Roadway Segment Crash Rates as a Function of Facility Type and Access Density (MN)

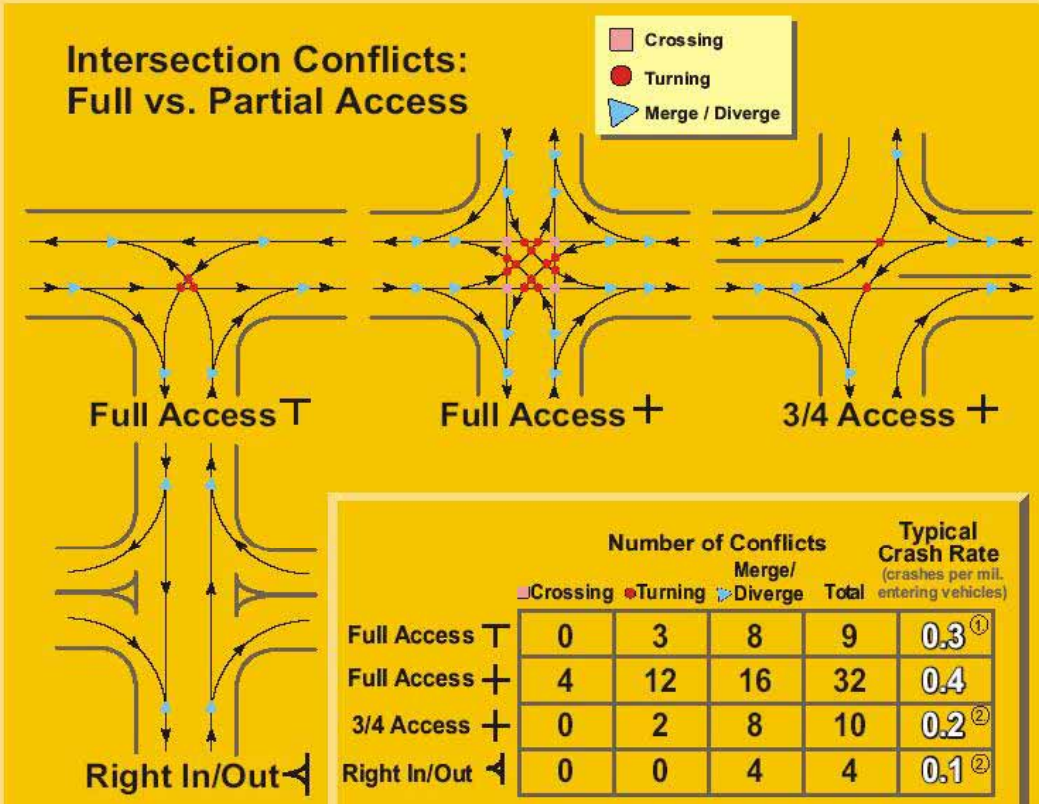
Source: Mn/DOT Research Report 1998-27
"Statistical Relationship between Vehicular Crashes and Highway Access"

HIGHLIGHTS:

- Previous safety research going back 20 years indicated a potential relationship between access density and crash rates. However, this research did not account for other factors that are known to effect crash rates (rural vs. urban, design type of facility, etc.) and none of the data was from Minnesota.
- As a result, in 1998 Mn/DOT undertook a comprehensive review of the relationship between access and safety on Minnesota' s Trunk Highway System. This effort ended with the publication of Research Report No. 1998-27, "Statistical Relationship Between Vehicular Crashes and Highway Access".
- The key components of the research included:
  - Conducting a detailed analysis of a 766 mile sample of the State's 12,000 mile Trunk Highway System.
  - Documenting the density of access and the crash characteristics on over 430 segments of roadway.
  - Conducting rigorous statistical tests in order to achieve a high degree of statistical reliability.
  - Dividing the roadway segments into 11 separate categories in order to account for the primary factors that account for the crash rate variability.
- The significant results include:
  - Documenting for the first time the actual access density (an average of 8 per mile in rural areas and 28 per mile in urban areas).
  - Observing a positive relationship between access density and crash rates in 10 of 11 categories.
  - Identifying a statistically significant tendency (in 5 out of 6 categories with sufficient sample size) for segments with higher access densities to have higher crash rates in both urban and rural areas.

Source: Traffic Safety Fundamentals Handbook

Intersection Conflicts: Full vs. Partial Access



	Number of Conflicts				Typical Crash Rate (crashes per mil. entering vehicles)
	Crossing	Turning	Merge/ Diverge	Total	
Full Access T	0	3	8	9	0.3 ①
Full Access +	4	12	16	32	0.4
3/4 Access +	0	2	8	10	0.2 ②
Right In/Out	0	0	4	4	0.1 ②

C-05

Intersection Conflicts: Full vs. Partial Access

Source: ① Estimated based on Publication FHWA-RD-91-048
② Estimated based on a limited sample of Mn/DOT data

HIGHLIGHTS:

- There is some information that suggests that intersection crash rates are related to the number of conflicts at the intersection.
- Conflict points are locations in or on the approaches to an intersection where vehicle paths merge, diverge, or cross.
- The actual number of conflicts at an intersection is a function of the number of approaching legs ("T" intersection have fewer conflicts than 4-legged intersections) and the allowed vehicle movements (intersections where left turns are prohibited/prevented have fewer conflicts than intersection where all movements are allowed).
- A preliminary review of intersection crash data indicates two key points:
  - Some vehicle movements appear to be more hazardous than others. The data indicates that minor street crossing movements and left turns onto the major street are the most hazardous (possibly because of the need to select a gap from two directions of on-coming traffic). Left turns from the major street are less hazardous than the minor street movements, and right turn movements are the least hazardous.
  - Crash rates at "T" intersection are typically lower than at similar 4-legged intersections and prohibiting/preventing movements at an intersection will likely reduce the crash rate.

Source: Traffic Safety Fundamentals Handbook

TH 10 Corridor Plan

HIGHWAY 10 CORRIDOR PLAN

IRC

HWY 10

Moving Minnesota

Update

November 6, 2002

CH2MHILL

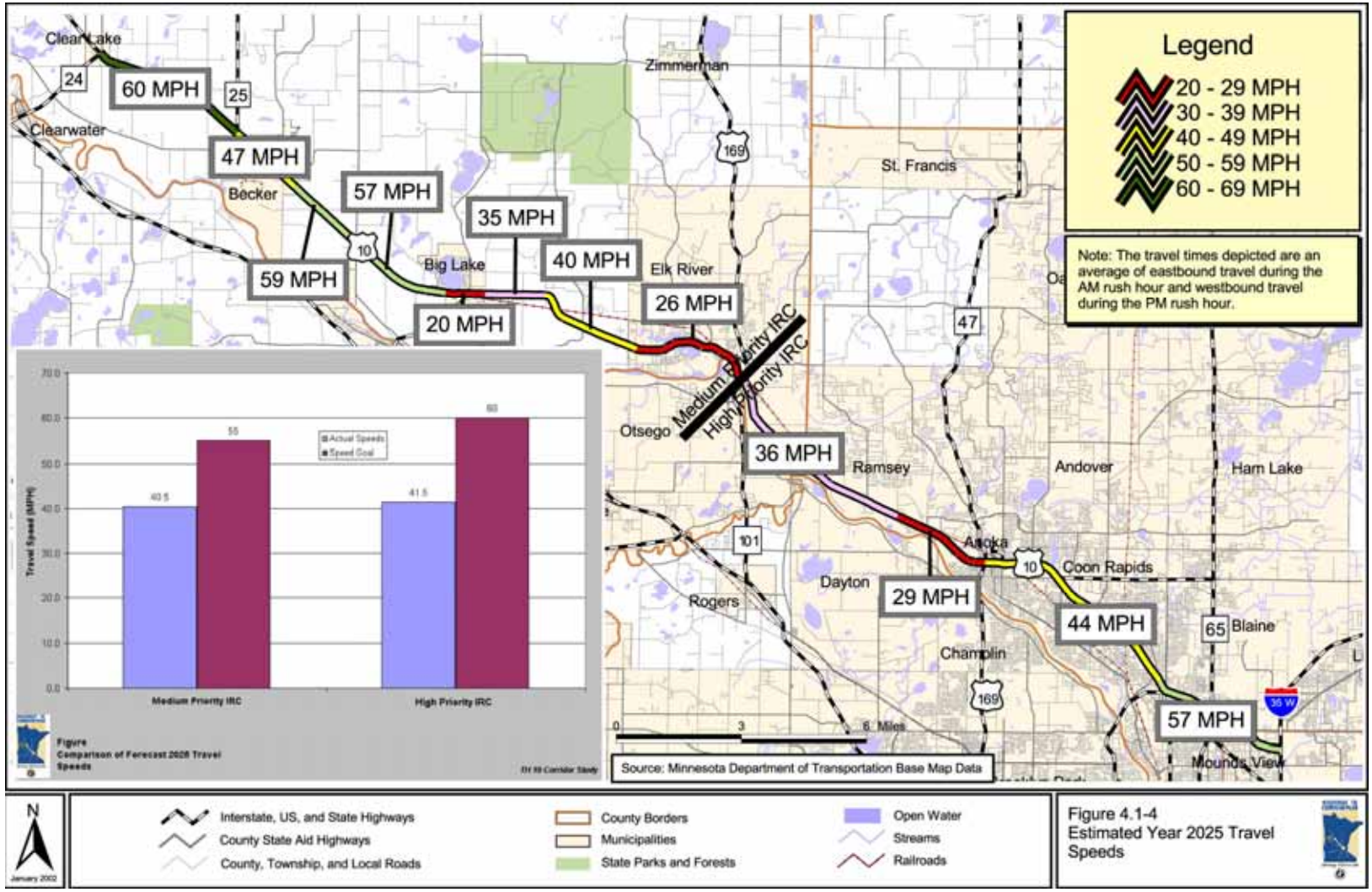
Safety Deficiencies for Intersections and Segments

Intersection / Segment	Crash Rate ≥ Critical Rate	Crash Rate ≥ IRC Target	Comparison to Other Locations
UNSIGNALIZED INTERSCTIONS			
TH 10 / TH 25 / CR 52 (Becker)	**YES**	No	--
TH 10 / CSAH 8 (Becker)	**YES**	No	--
TH 10 / CSAH 23 (Becker) *[Red Yellow Flasher]*	**YES**	No	--
TH 10 / CR 73 (Big Lake)	**YES**	No	--
TH 10 / CSAH 14/15 (Big Lake Township) *[Red/Yellow Flasher]*	**YES**	**YES**	**HIGH CRASH RATE & SEVERITY**
SIGNALIZED INTERSECTIONS			
TH 10 / CSAH 11 (Becker)	**YES**	**YES**	**HIGH CRASH RATE & SEVERITY**
TH 10 / TH 25 (Big Lake)	**YES**	**YES**	--
TH 10 / CSAH 5 (Big Lake)	**YES**	**YES**	**HIGH CRASH RATE & SEVERITY**
TH 10 / Thurston Ave (Anoka)	**YES**	**YES**	--
ROADWAY SEGMENTS			
Through Big Lake (Seg. 5)	No	**YES**	**HIGH SEVERITY**
Big Lake to Elk River (Segs. 6, 7)	**YES**	**YES**	--
TH 169 (Elk River) to Ramsey Boulevard (Seg. 9)	**YES**	**YES**	--

Source: Mn/DOT Crash Data (1998-2000) and Howard R. Green Company

CH2MHILL

Estimated 2025 Travel Speeds



Existing Level-of-Service by Growth Segment

Segment ID	Start Point	End Point	Community	Existing ADT	Classification	Theoretical Peak Hour Density (pcphpl)	Existing Peak Hour Density (pcphpl)	LOS	% Reserve Roadway Capacity
Medium Priority IRC (TH 24 to TH 169)									
1	TH 24	TH 25 (West Jct.)	Clear Lake - Becker	11,000	Rural Expressway	1100	400	A	64%
2	TH 25 (West Jct.)	Liberty Lane	Becker	13,750	Rural Expressway	1100	400	A	64%
3	Liberty Lane	137th Street	Becker (and township)	15,900	Rural Expressway	1100	400	A	64%
4	137th Street	CR 73 (Lakeshore Dr.)	Big Lake	13,850	Rural Expressway	1100	450	A	59%
5	CR 73 (Lakeshore Dr.)	CR 43	Big Lake	15,300	Class III Arterial	800	500	B	38%
6	CR 43	166th Street	Big Lake (and township)	16,900	Rural Expressway	1100	500	A	55%
7	166th Street	Waco Street	Big Lake - Elk River	17,800	Rural Expressway	1100	660	B	40%
8	Waco Street	TH 169 / TH 101	Elk River	22,300	Class I Arterial	800	850	F	(6%)
High Priority IRC (TH 169 to I-35W)									
9	TH 169 / TH 101	Ramsey Blvd.	Ramsey	28,850	Urban Expressway	1100	1020	E	7%
10	Ramsey Blvd.	TH 169 / TH 47	Ramsey - Anoka	50,950	Urban Expressway	1100	1150	F	(5%)
11	TH 169 / TH 47	TH 610	Anoka - Coon Rapids	73,500	Freeway	2300	2360	F	(3%)
12	TH 610	Jct. I-35W	Blaine - Mounds View	61,000	Freeway	2300	1950	D	15%

Source: Howard R. Green Company using Mn/DOT ADT flow data combined with PM peak hour volumes

Forecast 2025 Level-of-Service by Growth Segment (With Northstar Commuter Rail)

Segment ID	Start Point	End Point	Community	Existing ADT	2025 ADT with Northstar	Classification	Theoretical Peak Hour Density (pcphpl)	2025 Forecast Peak Hour Density (pcphpl)	LOS	% Reserve Roadway Capacity
Medium Priority IRC (TH 24 to TH 169)										
1	TH 24	TH 25 (West Jct.)	Clear Lake - Becker	11,000	15,540	Rural Expressway	1,100	550	A	50%
2	TH 25 (West Jct.)	Liberty Lane	Becker	13,750	23,740	Rural Expressway	1,100	700	B	36%
3	Liberty Lane	137th Street	Becker (and township)	15,900	23,650	Rural Expressway	1,100	600	A	45%
4	137th Street	CR 73 (Lakeshore Dr.)	Big Lake	13,850	23,650	Rural Expressway	1,100	750	B	32%
5	CR 73 (Lakeshore Dr.)	CR 43	Big Lake	15,300	29,950	Class III Arterial	800	1,000	F	(25%)
6	CR 43	166th Street	Big Lake (and township)	16,900	35,350	Rural Expressway	1,100	1,050	E	5%
7	166th Street	Waco Street	Big Lake - Elk River	17,800	35,350	Rural Expressway	1,100	1,300	F	(18%)
8	Waco Street	TH 169 / TH 101	Elk River	22,300	42,050	Class I Arterial	800	1,600	F	(100%)
High Priority IRC (TH 169 to I-35W)										
9	TH 169 / TH 101	Ramsey Blvd.	Ramsey	28,850	43,490	Urban Expressway	1,100	1,550	F	(41%)
10	Ramsey Blvd.	TH 169 / TH 47	Ramsey - Anoka	50,950	73,290	Urban Expressway	1,100	1,650	F	(50%)
11	TH 169 / TH 47	TH 610	Anoka - Coon Rapids	73,500	116,660	Freeway	2,300	3,750	F	(63%)
12	TH 610	Jct. I-35W	Blaine - Mounds View	61,000	112,060	Freeway	2,300	3,600	F	(57%)

NOTE: Table 6.2-1 depicts Year 2000, 2005, 2010, 2015, 2020, and 2025 intersection LOS in Anoka and Ramsey under interim improvement scenarios.

Source: Howard R. Green Company using forecast information from Mn/DOT D-3, Sherburne County & Anoka County Transportation Plans, as well as Northstar Commuter Rail EIS.

CH2MHILL

Criteria for Assessment of Signal Risk

Signal Risk	Functional Classification	Cross Street ADT	Signal Warrants Satisfied [1]
Low	Local Street	0-2500	None
Medium	Collector	2501-4000	One Warrant
High	Minor Arterial (+)	> 4001	Two Warrants

Source: Mn/DOT and Howard R. Green Company
Notes: 1. Based on ADT estimate of MMUTCD Signal Warrants

Moderate Risk Intersections

- **TH 10 / CR 55 (Clear Lake Twp.)**
- **TH 10 / CSAH 8 (Becker)**
- **TH 10 / CSAH 4 (Becker)**
- **TH 10 / CR 50 (Becker & Big Lake Twp.)**
- **TH 10 / 172nd Street (Big Lake)**
- **TH 10 / 165th Street (Elk River)**

High Risk Intersections

- **TH 10 / TH 25 (Becker)**
- **TH 10 / CSAH 23 (Becker)**
- **TH 10 / CR 81 (Big Lake Twp.)**
- **TH 10 / Old CR 73 (Big Lake)**
- **TH 10 / CR 43 (Big Lake)**
- **TH 10 / CSAH 14/15 (Big Lake Twp.)**
- **TH 10 / Waco Street (Elk River)**
- **TH 10 / Jarvis Street (Elk River)**

CH2MHILL

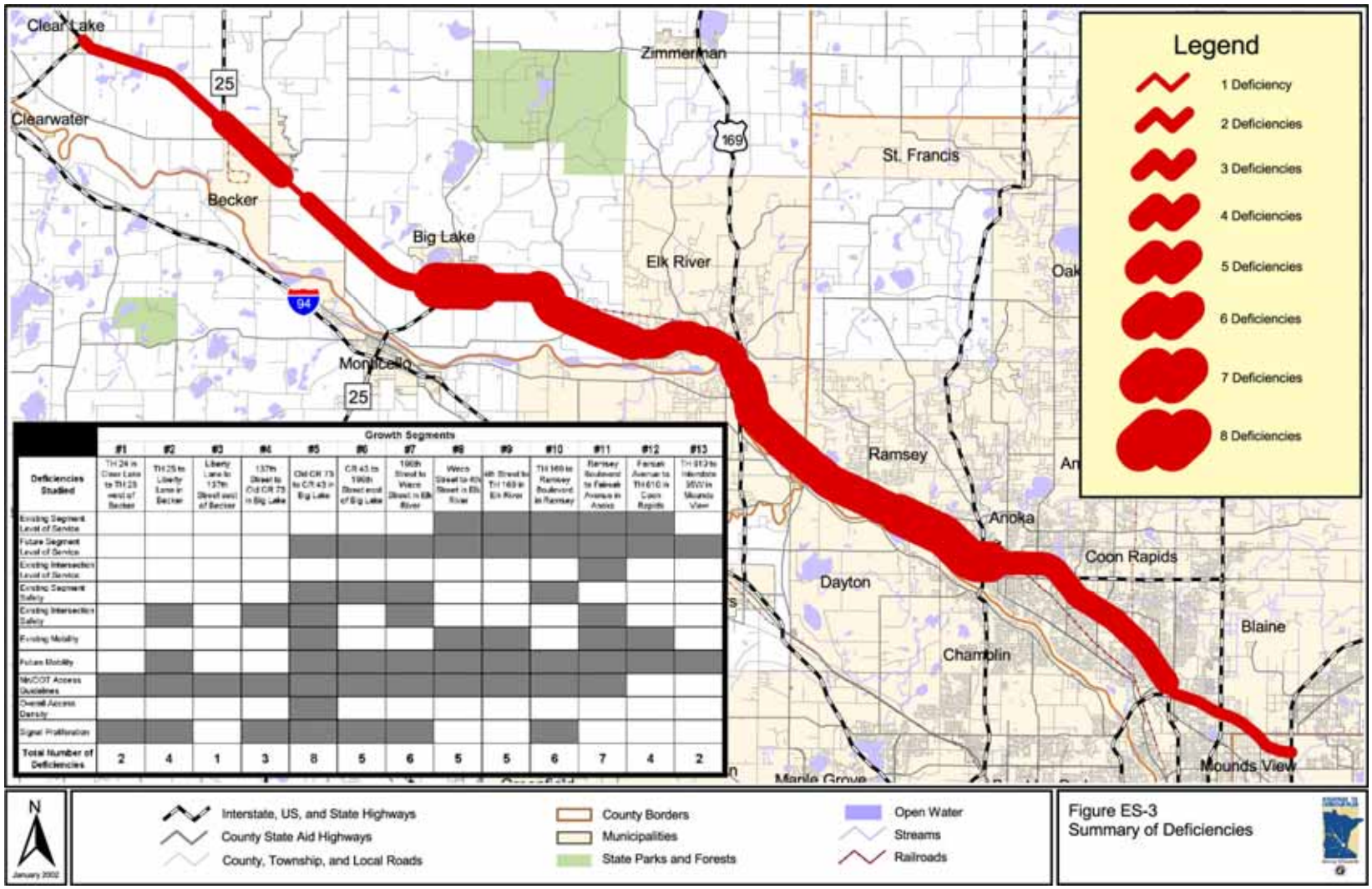
Comparison of Existing Access and Expected Access Based on Mn/DOT Guidelines

Segment of TH 10	IRC Classification (Access Mgmt Category)	Actual # Full Accesses	Actual # Partial Accesses	Actual # Signals	Actual # of Private Accesses	Expected # Full Accesses	Expected # Partial Accesses	Expected # Signals	Expected # of Private Accesses	Accesses Meet Guidelines (Y or N)
TH 24 (Clear Lake) to W TH 25 (Becker)	Medium (2A)	20	1	1	7	10	0	0	0	**No**
W TH 25 (Becker) to 137th St (Becker Township)	Medium (2B)	14	2	1	0	6	8	0	0	**No**
137th St (Becker Township) to West City Limits (Big Lake)	Medium (2A)	16	7	1	15	10	0	0	0	**No**
West City Limits (Big Lake) to Fern St (Big Lake)	Medium (2C)	48	3	2	42	4	5	3	5	**No**
Fern St (Big Lake) to 166th St (Big Lake Township)	Medium (2B)	16	10	0	16	4	6	0	0	**No**
166th St (Big Lake Township) to West City Limits (Elk River)	Medium (2A)	18	3	0	12	6	0	0	0	**No**
West City Limits (Elk River) to 4th St (Elk River)	Medium (2B)	22	5	3	6	6	6	0	0	**No**
4th St (Elk River) to Main St (Elk River)	Medium (2C)	6	10	2	10	1	2	2	2	**No**
Main St (Elk River) to TH 169 (Elk River)	Medium (2B)	4	2	0	2	2	2	0	0	**No**
TH 169 (Elk River) to Fairoak Ave (Anoka)	High (1A)	49	90	6	101	20	0	0	0	**No**
Fairoak Avenue (Anoka) to N Jct I-35W (Mounds View)	High (1A-F)	14	1	0	1	14	0	0	0	**Yes**
TOTAL	**-**	**227**	**134**	**16**	**212**	**83**	**29**	**5**	**7**	**-**

NOTES: For the Urban Core (2C) Category Segments, it was assumed that full accesses would be allowed every 2/10th's of mile with partial accesses occurring every 1/10th of a mile in between. Also, interchanges were assumed to be one access point. Traffic signals listed above may serve one or two access points.

SOURCE: Howard R. Green Company using Mn/DOT Videolog Data and Draft Access Management Guidelines.

Summary of Deficiencies

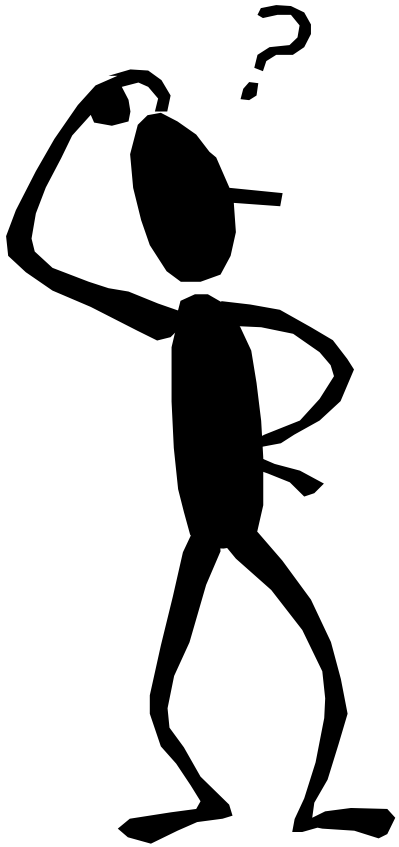


Deficiencies Studied	Growth Segments #1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
Existing Segment Level of Service													
Future Segment Level of Service													
Existing Intersection Level of Service													
Existing Segment Safety													
Existing Intersection Safety													
Existing Mobility													
Future Mobility													
MnDOT Access Guidelines													
Overall Access Density													
Signal Proliferation													
Total Number of Deficiencies	2	4	1	3	8	5	6	5	5	6	7	4	2

Figure ES-3
Summary of Deficiencies

Wrap Up

- Identifying Performance Measures is absolutely critical to the documentation of deficiencies and development of alternative improvement strategies.
  - *If you don't measure it, you can't replicate it if the outcome is good or avoid it if the outcome is bad.*
- The use of consistent performance measures would aid in the development of a prioritized statewide capital improvement program.
- Key Corridor Performance Measures include:
  - *Safety*
  - *Mobility - Speed and Traffic Operations (Level of Service)*
  - *Access*

CH2MHILL

Questions