



Metropolitan Freeway System 2005 Congestion Report



Minnesota Department of Transportation
Office of Traffic, Security and Operations
Freeway Operations Section
Regional Transportation Management Center

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Purpose and Need

The Metropolitan Freeway System Congestion Report is prepared annually to document those segments of the freeway system that experience recurring congestion. This report is prepared for these purposes:

- Identification of locations that are under capacity
- Project planning
- Resource allocation (e.g., RTMC equipment, incident management planning)
- Construction zone planning
- Department performance measures

Introduction

What is Congestion?

Mn/DOT defines congestion as traffic flowing at speeds less than or equal to 45 miles per hour (M.P.H.). This definition does not include delays that may occur at higher speeds greater than 45 M.P.H. The 45 M.P.H. speed limit was selected since it is the speed where “shock waves” can propagate. Although shock waves can occur above 45 M.P.H. there is a distinct difference in traffic flow above and below the 45 M.P.H. limit.

What is a shock wave?

A shock wave is a phenomenon where the majority of vehicles brake in a traffic stream. Situations that can create shock waves include:

- Changes in the characteristics of the roadway, such as a lane ending, a change in grade or curvature, narrowing of shoulders, or an entrance ramp where large traffic volumes enter the freeway.
- Large volumes of traffic at major intersections with high weaving volumes and entrance ramps causing the capacity of the freeway to reach or exceed design capacity.
- Traffic incidents, such as crashes, stalled vehicles, animals or debris on the roadway, adverse weather conditions and special events.

Shock waves occur at highway locations when drivers' inattentiveness results in sudden braking in dense traffic. Shock waves move upstream toward oncoming traffic at rates varying according to the density and speed of traffic. As the rate of movement of the shock wave increases, the potential for rear end or sideswipe collisions increases. Multiple shock waves can spread from one instance of a slowdown in traffic flow and blend together with other extended periods of “stop-and-go” traffic upstream. This condition is referred to as a “breakdown” in traffic.

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Usually it lasts the remainder of the peak period if traffic volumes are close to or above design capacity. These types of breakdowns are typical in bottleneck locations on the freeway system.

Methodology

Mn/DOT began collecting and processing congestion data in 1993. Since this time, Mn/DOT has improved its data processing and changes in methodology have occurred. These changes as well as variables affecting localized and region-wide traffic volumes, such as ramp metering algorithms, make it difficult to compare congestion from one year to the next. The following are key dates on the progression of developing congestion information in the metro area:

- 1989: Mn/DOT formed a committee to evaluate congestion on Twin Cities metro freeways
- 1993 – 2003: Rapid expansion of the freeway management systems
- Late 1990's: Change in approach from "reducing" congestion to "maintaining" congestion
- 2001 – 2003: Evaluation and adjustments of ramp metering
- 2002: Completion of detection calibration

How is Congestion Measured?

For this report, Mn/DOT derived its congestion data using two processes:

- Surveillance detectors in roadways
- Field observations

Electronic surveillance systems exist on about 85% of the metro area freeway system. For this report, the Regional Transportation Management Center collected October, 2005 data from 2,600 of 4,300 surveillance detectors that are embedded in the Twin Cities freeways.

Generally, the month of October is used for congestion reports since it reflects regular patterns of traffic. With summer vacation season over and school back in session, commuter traffic flows return to normal levels. During the month of October, most summer road construction projects are completed and weather conditions are still generally favorable.

The RTMC evaluates the 648 directional miles of the Twin Cities urban freeway system to develop the AM Plus PM % of Directional Metro Freeway Miles Congested. It tracks the percentage of miles that operate at speeds below 45 MPH for any length of time during the AM and PM peak periods (648 miles AM and 648 miles PM). Mainline detectors are located in each lane of a freeway at about one-half mile intervals. Individual lane detectors located at a given location along the same direction of the freeway constitute a station.

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For the purpose of this report, if any station's detectors experience congestion at any given time, the entire station is identified as congested.

Speed data is based on the median value of data collected at detector locations. Median values are calculated for each five-minute interval for the periods of 6:00 AM to 9:00 AM and 2:00 PM to 7:00 PM for fourteen midweek days. Mn/DOT uses medians, rather than averages, to minimize the effects of extremes in the data. This process mitigates those occasions of roadwork lane closures, significant traffic incidents, and one-time traffic events not related to daily commuting patterns.

The projected congestion levels are based on anticipated growth in traffic volumes (Vehicles Miles Traveled).

Historical Data

Since congestion data for most of the freeway system comes from surveillance detectors embedded in the roadway, road construction impacts those segments because detectors are disabled. In this case historical data from before the start of the construction project is used. Only one construction project impacted the surveillance detectors for the purposes of this report and in this case, I-494 between I-394 and Highway 212, historical data is used. At another construction site where the traffic lanes had been completed but the detectors were not yet available, I-494 between Highway 212 and France Avenue, field observations were used. In addition field observations were used in this report for the 15% of the Twin Cities freeways without surveillance detectors. See Appendix B for a description of the areas without detectors in the roadway.

2005 Results

The total number of congested miles went down slightly from 280 miles in 2004 to 277 miles in 2005. Although the trend of growing congestion can be seen on a number of freeways, and especially I-694, TH 100 and TH 169, there were a number of construction projects that were completed since the last reports data was collected (October 2004) which led to decreased congestion in some areas. These projects include:

- November of 2004: I-94 from Brooklyn Boulevard to I-494 opens as a 6 lane freeway (was 4 lanes before construction)
- December of 2004: TH 100 north of I-394 opens as a 6 lane freeway (was signalized expressway before construction)
- May of 2005: MnPass began operation on I-394¹
- July of 2005: I-494 from 212 to France Avenue opens as a 6 lane freeway (was 4 lanes before construction)

¹ The dramatic drop in congestion on I-394 can be attributed to at least a combination of MnPass and temporary entrance ramp closures from I-494 due to construction. A detailed understanding of how each of these and other factors contributed to lessened congestion on I-394 would require further analysis.

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In addition to differences between roadways, the overall stability of congested miles also masks the differences between the AM and PM peak. In 2005 the miles of congested freeway increased in the AM by 10 miles and decreased in the PM by 13 miles. See pages 9 and 12 for details of individual roadways and individual peaks.

Overall the percentage of miles congested for 2005 was 21.4%, down slightly from 21.6% in 2004. The 2005 congestion measure registered in the green area, meeting MnDOT's performance targets as compared with 2004 when the congestion rate was in the amber zone, a bit worse than the target (see page 5).

Explanation of % Miles of Twin City Urban Freeway System Congested Graph

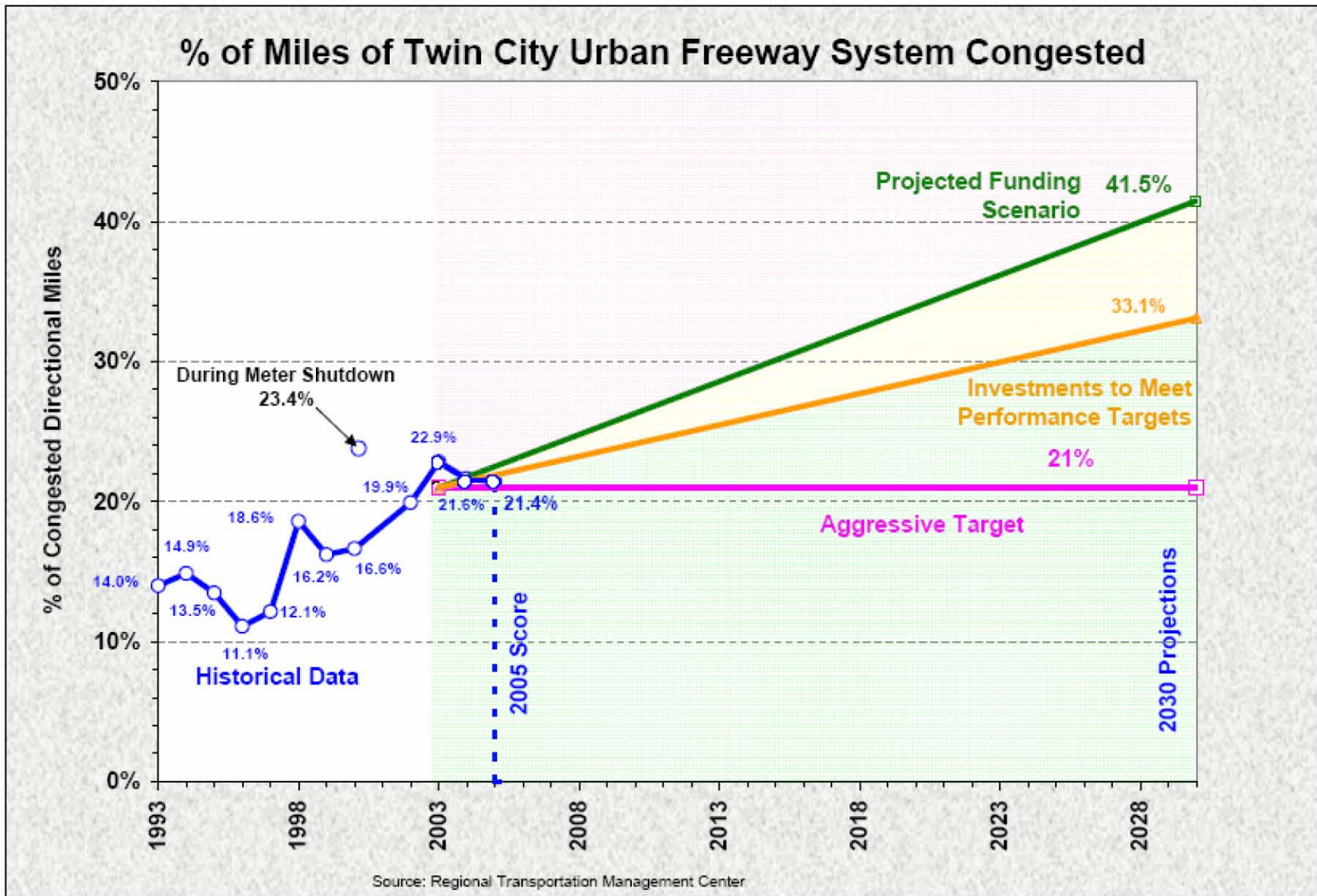
Mitigating congestion is critical to the travelling public. Mn/DOT has limited resources to slow projected increases in congestion. The graph that follows represents levels of congestion based on three scenarios.

The green line shows the "projected funding scenario," where there are no new funding sources or increases in funding. Congestion could increase to the level of 41.5% by the year 2030.

However, if Mn/DOT received the "investment needed to meet its performance targets," as established in the 2003 Statewide Plan, congestion would be expected to grow to the level of 33% by 2030. The gold line demonstrates this scenario. This long-term "moderate" target reduces the rate of growth in congestion.

Finally, maintaining congestion at the "aggressive" target of 21% (pink line) though the year 2030 would require a significant, yet undetermined, commitment.

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AM Plus PM Miles of Directional Congestion

	1995	1996	1997	1998	1999	Early 2000	Late 2000	2002	2003	2004	2005
Severe	7	14	17	48	34	41	125	70	83	72	82
Moderate	52	47	54	64	77	68	93	84	105	105	94
Low	114	81	85	127	97	105	82	101	106	104	101
Total	173	142	156	238	208	213	300	255	293	280	277

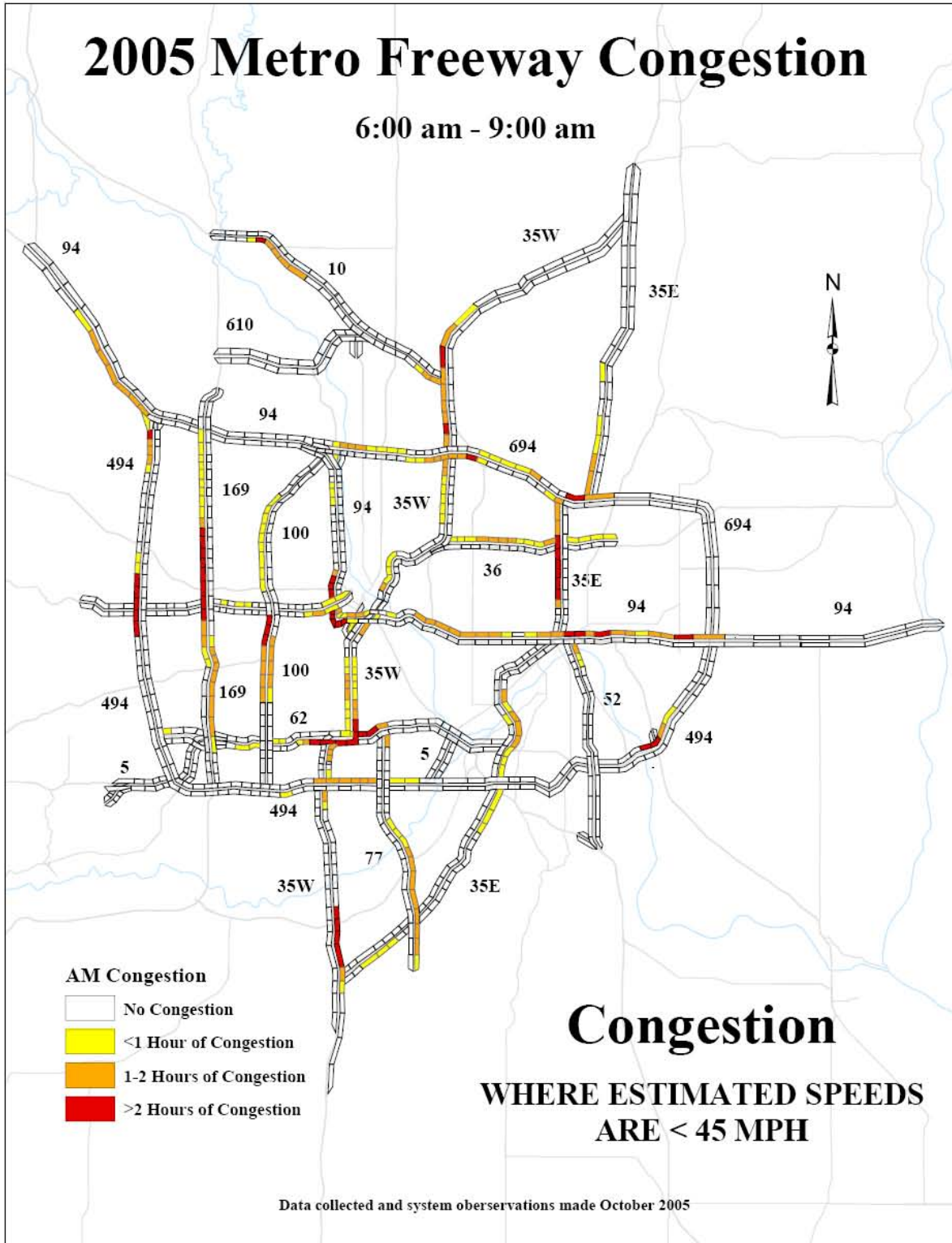
AM Plus PM Percent of Miles of Directional Congestion

	1995	1996	1997	1998	1999	Early 2000	Late 2000	2002	2003	2004 *	2005 *
Severe	0.5%	1.1%	1.3%	3.7%	2.7%	3.2%	9.8%	5.5%	6.4%	5.5%	6.3%
Moderate	4.1%	3.7%	4.2%	5.0%	6.0%	5.3%	7.3%	6.6%	8.2%	8.1%	7.3%
Low	8.9%	6.3%	6.6%	9.9%	7.6%	8.2%	6.4%	7.9%	8.2%	8.0%	7.8%
Total	13.5%	11.1%	12.1%	18.6%	16.2%	16.6%	23.4%	19.9%	22.9%	21.6%	21.4%

For years prior to 2004, Percent of miles of directional congestion = am + pm miles (table above) / 1280 miles. 1280 miles = 320 centerline miles X 2 (directional miles) X 2 (am and pm)

* For 2004 and 2005, Percent of miles of directional congestion = am + pm miles (table above) / 1296 miles. 1296 centerline miles X 2 (directional miles) X 2 (am and pm)

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Directional Metro Freeway Miles Congested 6:00 AM – 9:00 AM

Congested Interstate Miles (AM) ¹												
<i>Highway</i>	1994	1995	1996	1997	1998	1999	Early 2000	Late 2000	2002	2003	2004	2005
I-35	0	0	0	0	0	0	0	0	0	0	0	0
I-35E	6.5	6	5.5	5	7	6.5	7.5	10	10	9	9.5	15
I-35W	20.5	10	9	11	24.5	24	27	33.5	25.5	25	23	26.5
I-94	12	11.5	13	10.5	17	17.5	16	26	23.5	23	23.5	24.5
I-394/TH 12	9	6.5	6	5	8.5	8.5	6.5	6	7	8.5	8.5	4
I-494	14.5	15.5	10	12.5	23	15.5	20	23	15.5	19	18.5	13
I-694	7.5	6.5	4	4	6	8.5	8	9	9	9.5	9.5	12.5
Subtotal	70	56	47.5	48	86	80.5	85	107.5	90.5	94	92.5	95.5

Congested Trunk Highway Miles (AM) ^{1, 2}												
<i>Highway</i>	1994	1995	1996	1997	1998	1999	Early 2000	Late 2000	2002	2003	2004	2005
TH 5	0	0	0	0	0	0	0	0	0	0	0	0
TH 10	-	-	-	-	-	-	-	-	4.5	4.5	4.5	4.5
TH 36	2	2.5	1	1	4	3.5	6	6.5	6	7.5	7.5	7.5
TH 52	1	1	1	1	1	1	1	1	1	1	1	1.5
TH 62	7	7.5	7	8.5	10.5	10	10	8.5	9	10.5	9	6.5
TH 65	0	0	0	0	0	0	0	0	0	0.5	0	0.5
TH 100	4	4	5	4.5	5	5.5	5.5	6	5	4.5	4.5	10.5
TH 169	12	10.5	7	7	13	10	8	16	11.5	13	12.5	15.5
TH 212	0	0	0	0	0	0	0	0	0	0	0	0
TH 610	-	-	-	-	-	-	-	-	0	0	0	0
TH 77	4	4	3	3	3.5	3.5	3	4	4.5	6.5	6.5	6
Subtotal	30	29.5	24	25	37	33.5	33.5	42	41.5	48	45.5	52.5

Total Congested Metro Freeway Miles (AM)												
Grand Total	100	85.5	71.5	73	123	114	118.5	149.5	132	142	138	148

1 Before 2004: Interstate Miles = 450 TH Miles = 190 Total Miles = 640

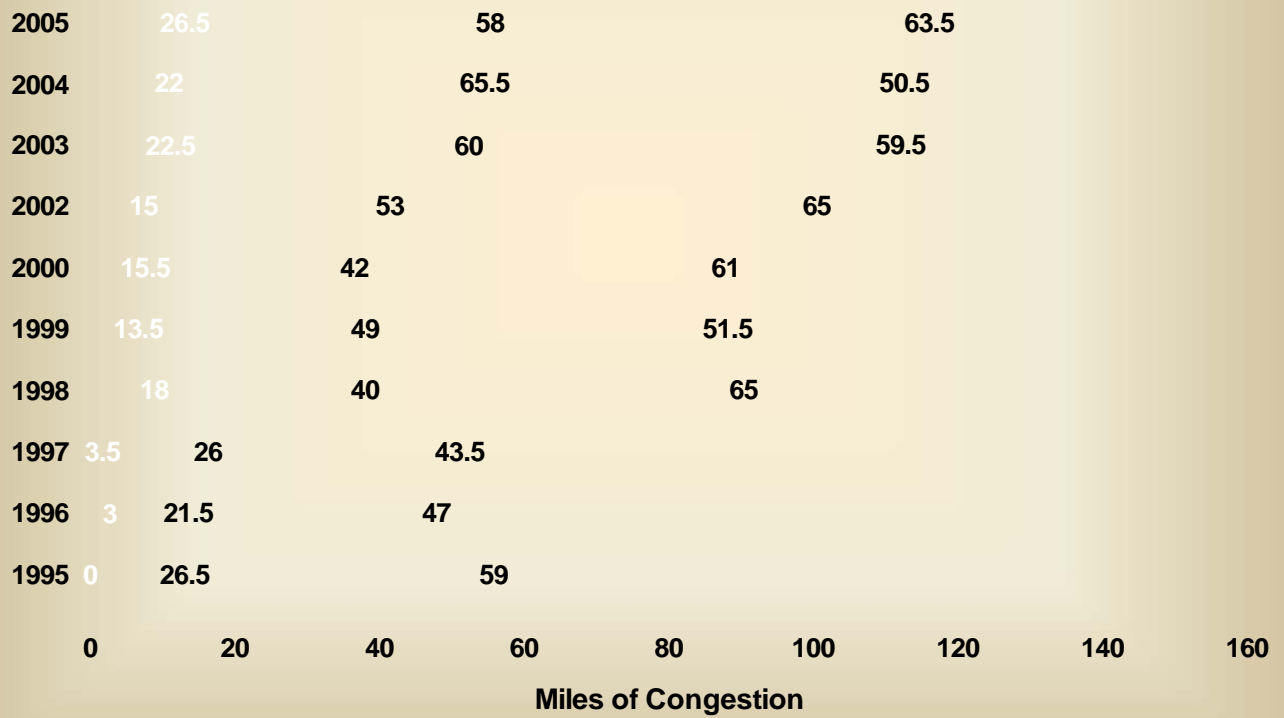
Since 2004: Interstate Miles = 450 TH Miles = 198 Total Miles = 648

2 Congestion was measured for the freeway segments of trunk highways

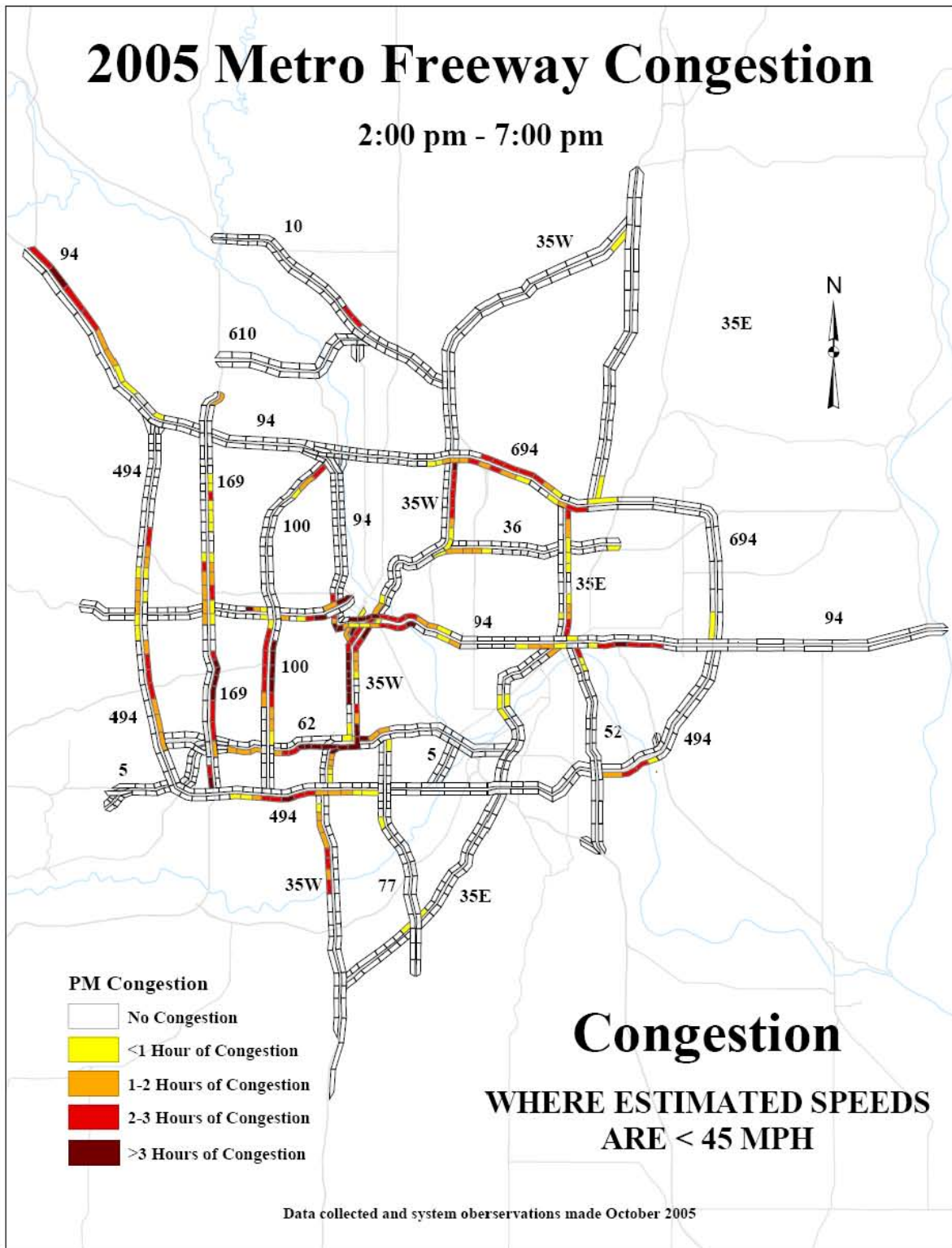
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Miles and Duration of Congestion Metro Interstate and Trunk Highways 6:00 - 9:00 AM

2-3 Hrs
1-2 Hrs
< 1 Hr



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Directional Metro Freeway Miles Congested 2:00 PM – 7:00 PM

Congested Interstate Miles (PM) ¹												
<i>Highway</i>	1994	1995	1996	1997	1998	1999	Early 2000	Late 2000	2002	2003	2004	2005
I-35	-	-	-	-	-	-	-	-	-	0	0	0
I-35E	4	5.5	4	3.5	6	4.5	3.5	8.5	6.5	15	9.5	8.5
I-35W	16	7	5.5	13.5	18.5	16	19	27.5	23	26	24.5	25
I-94	12	16	10.5	15	23.5	21	17.5	33	25.5	31	29	23
I-394/TH 12	7	7	4	6.5	7.5	7.5	8	10.5	10.5	11	10	5
I-494	14	15.5	16	14	20	14.5	15.5	26.5	16	20	20.5	17.5
I-694	6	3	4	4.5	6.5	5	5	5	6.5	9	9	11.5
Subtotal	59	54	44	57	82	68.5	68.5	111	88	112	102.5	90.5

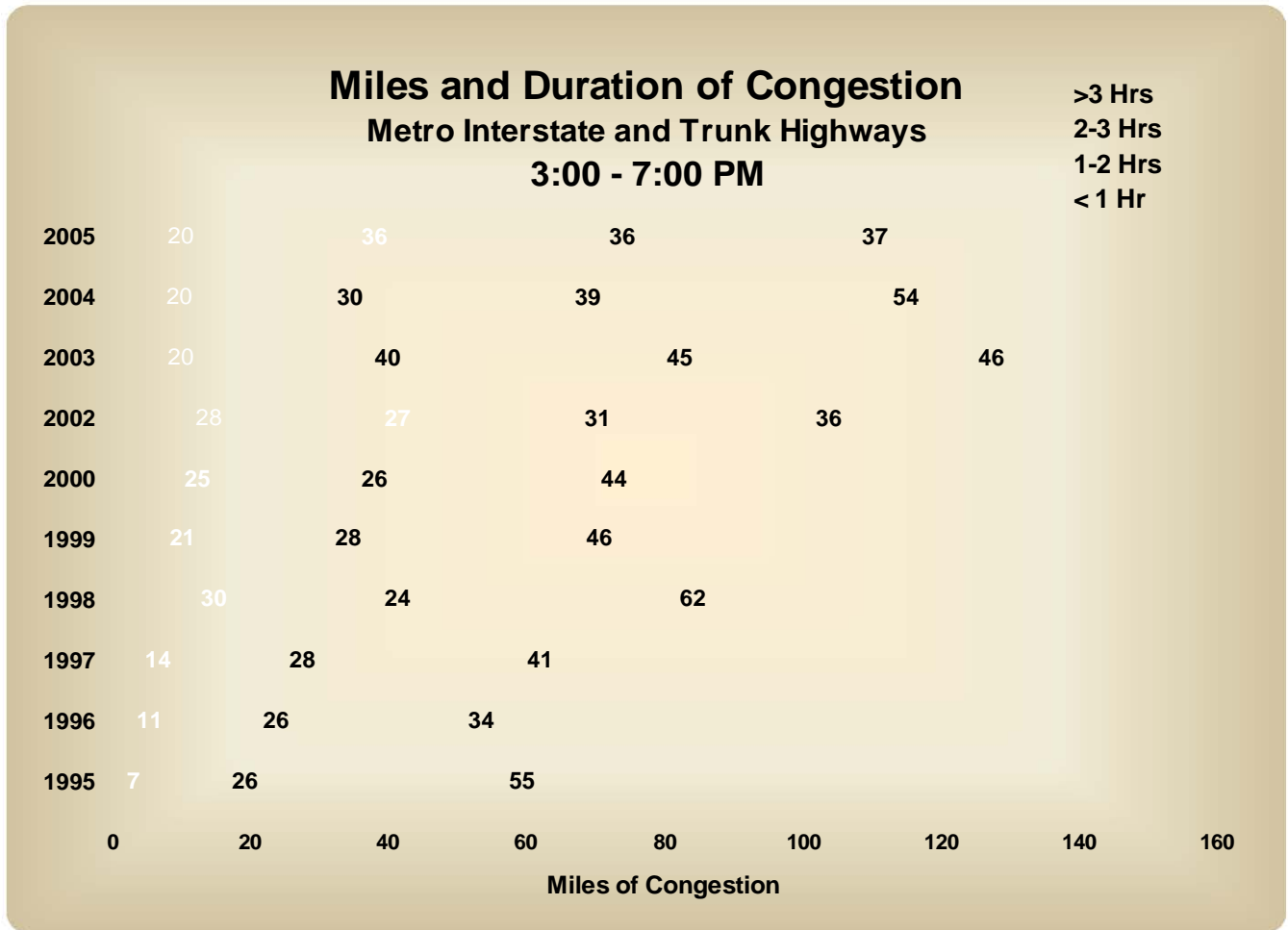
Congested Trunk Highway Miles (PM) ^{1,2}												
<i>Highway</i>	1994	1995	1996	1997	1998	1999	Early 2000	Late 2000	2002	2003	2004	2005
TH 5	0	0	0	0	0	0	0	0	0	0	0	0
TH 10	-	-	-	-	-	-	-	-	1.5	2.5	1.5	1
TH 36	0	1.5	0	0	0.5	2.5	2	4	3	4	4	3
TH 52	0.5	1	1	1	1	0.5	0.5	0.5	0.5	1	1	1.5
TH 62	9.5	7.5	6	10.5	11.5	8.5	7	8.5	7	9.5	11.5	7
TH 65	0	0	0	0	0	0	0	0	1.5	1	1.5	1.5
TH 100	6.5	7	4.5	5.5	6.5	7	8	10.5	6	6	5	9
TH 169	11	12.5	12	5	10.5	6	8	14	12	14	12.5	14.5
TH 212	0	0	0	0	0	0	0	0	1	0	0	0
TH 610	-	-	-	-	-	-	-	-	0	0	0	0
TH 77	4	3.5	3	3.5	3	0.5	0.5	1	0.5	1	2.5	1
Subtotal	31.5	33	26.5	25.5	33	25	26	38.5	33	39	39.5	38.5

Total Congested Metro Freeway Miles (PM)												
Grand Total	90.5	87	70.5	82.5	115	93.5	94.5	149.5	121	151	142	129

1 Before 2004: Interstate Miles = 450 TH Miles = 190 Total Miles = 640
 Since 2004: Interstate Miles = 450 TH Miles = 198 Total Miles = 648

2 Congestion was measured for the *freeway* segments of trunk highways

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Appendix A: Centerline Miles Measured for Congestion

<i>Highway</i>	Centerline Miles of Highway	Limits	Additions for 2005
I-35	10	North split to Hwy 8 & South split to Cty 70	
I-35E	41	Entire Highway	
I-35W	44	Entire Highway	
I-94	51	Rogers to St. Croix River	
I-394/TH 12	13	Central Ave to Downtown Mpls	
I-494	43	Entire Highway	
I-694	23	Entire Highway	
Subtotal	225		

<i>Highway</i>			
TH 5	3	I-494 to Miss Rvr	
TH 10	13	Hwy 169 to I-35W	
TH 36	7	I-35W to English St	
TH 52	6	I-94 to Upper 55th St	
TH 62	12	I-494 to Hwy 55	
TH 65	1	10th St to I-35W	
TH 100	16	I-494 to I-694	
TH 169	17	I-494 to 77th Ave	
TH 212	3	I-494 to Hwy 62	
TH 610	8	Hwy 169 to Hwy 10	
TH 77	10	138th St to Hwy 62	
TH 280	3	I-94 to Broadway	
Subtotal	99		

Grand Total	324		
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Appendix B: 2005 Metro Freeway Data Sources

