



Metropolitan Freeway System 2004 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 MPH 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 upstream 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 three processes:

- Surveillance detectors in roadways
- Historical data
- Airborne traffic control

Electronic surveillance systems exist on about 80% of the metro area freeway system. For this report, the Regional Transportation Management Center collected October, 2004 data from the 4,000 surveillance detectors that are embedded in the road. Data for the non-instrumented segments was collected in June 2004.

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). The projection is based on anticipated growth in traffic volumes (Vehicles Miles Traveled). 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

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freeway constitute a station. 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.

Historical Data

Congestion data for areas of freeway under construction had to be collected from historical data prior to the beginning of construction project. Since congestion data for most of the freeway system comes from surveillance detectors embedded in the roadway, road construction impacts those segments since detectors are disabled. The construction-impacted segments in this report include:

- I-94 between I-494 and Brooklyn Boulevard
- I-494 between I-394 and TH 100

Airborne Traffic Patrol

In August 2003, Mn/DOT teamed with the Minnesota State Patrol Airwing Unit to provide real-time traffic information in the areas not covered by the automated network. The State Patrol aircraft along with a Mn/DOT traffic reporter provided daily traffic reports Monday through Friday from 6:30 am to 8:30 am and from 4:00 PM to 6:00 PM (when the weather was acceptable to fly). This arrangement ended on June 30, 2004.

The Airborne Traffic Patrol gathered the information in June 2004 on these freeway segments for this report:

- I-35E between I-694 and the 35 split;
- I-35W between Lexington Avenue and the 35 split;
- I-494 between I-35E and I-94;
- I-94 between County Road 81 and TH 101;
- TH 52 from I-94 to I-494;
- TH 100 north of I-394; and
- TH 610 between US 10 and TH 252
- I-694 between I-94 and I-35E

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2004 Results

This year we added the new stretch of Hwy 100 to the number of freeway miles. This increased the total centerline miles from 320 to 324. Taking 324 miles X 2 (directional miles) X 2 (AM and PM peak) = 1296 miles, this is an increase from the 1280 miles in years past.

The total number of congested miles went down from 293 miles in 2003 to 280 miles in 2004. Congestion was significantly higher in 2003 due to the number of large-scale construction projects that took place (I-494, I-94, I-35E). In other areas where there was no construction, there was little change in congestion in 2004. Congestion decreased in 2004, especially on I-35E, where construction was completed on the Mississippi River Bridge.

The percentage of miles congested for 2004 was 21.6%, down from 22.9% in 2003. The 2004 congestion measure of 21.6% registered in the amber area, compared with the 2003 congestion rate of 22.9% in the red zone (Page 6).

Congestion was unusually high in 2003 due to the number of construction projects that impacted traffic on Twin Cities' freeways. Specifically, comparing congestion levels for northbound I-35E over the Minnesota River during the afternoon peak period, there was little or no congestion in both 2002 and 2004. However, congestion was significant in 2003 during the construction period with backups up to two miles, especially between West 7th Street and St. Clair Avenue north of the river. South of the river, traffic backed up to TH 110 (also, two miles). Similarly, southbound traffic along this same stretch of interstate accounted for an additional mile of backups.

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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 four scenarios. Given current construction projects planned through the year 2010, the red line, “no build after 2010,” indicates that congestion could grow to 48% on the Twin Cities Urban Freeway System by 2030, given these conditions:

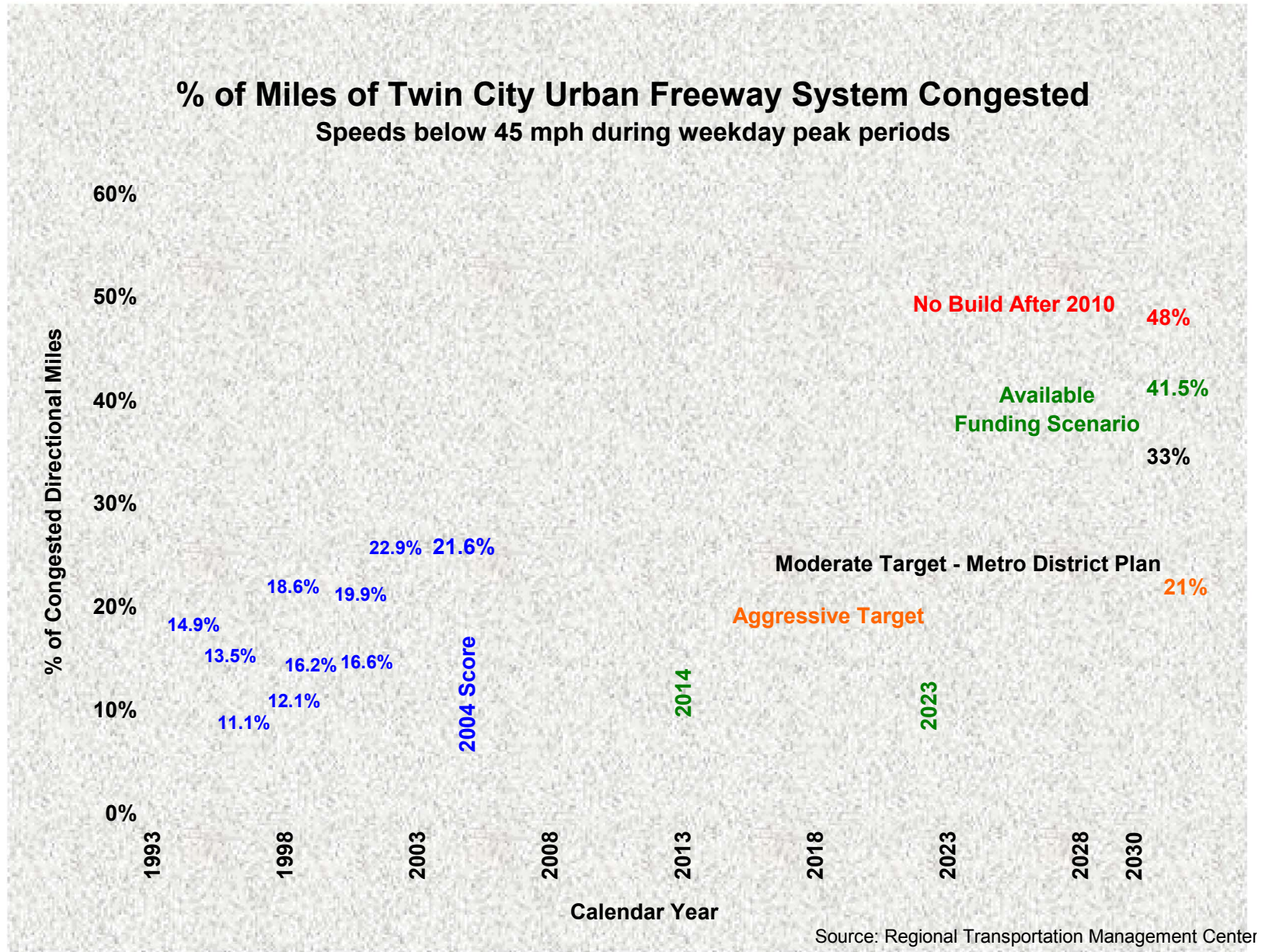
- No new construction after 2010
- No new funding sources became available and no new funding increases.

The green line shows the “available 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 grow to the level of 33% by 2030. The black line demonstrates this scenario. The long-term “moderate” target reduces the rate of growth in congestion.

Finally, maintaining congestion at the “aggressive” target of 21% (orange line) through the year 2030 would require a significant, yet undetermined, commitment. The cost to meet the long-term moderate target exceeds \$100 million per year (in 1999 dollars) in new dollars originally estimated for Moving Minnesota.

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AM Plus PM Miles of Directional Congestion

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

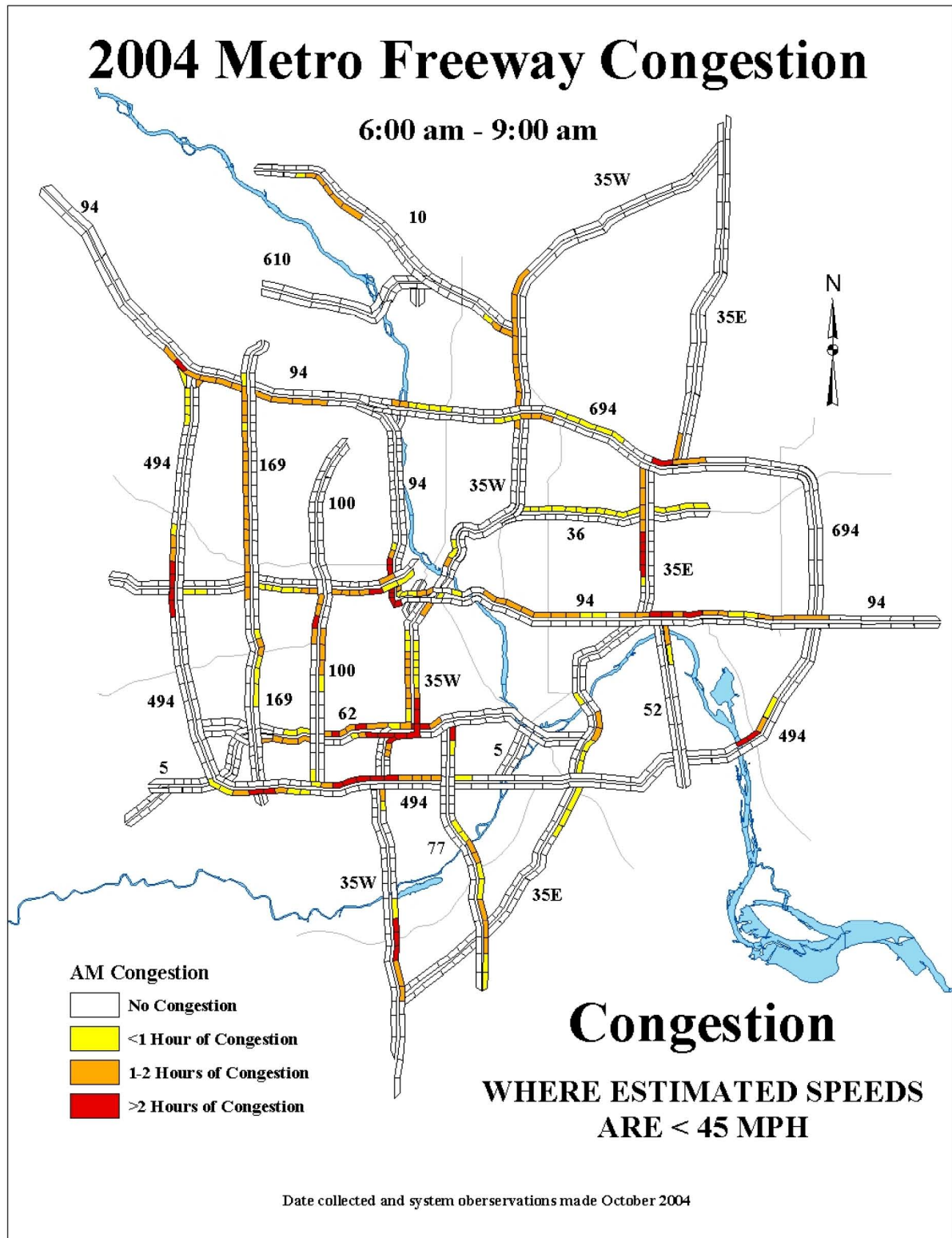
AM Plus PM Percent of Miles of Directional

	1995	1996	1997	1998	1999	Early 2000	Late 2000	2002	2003	2004*
Severe	0.5%	1.1%	1.3%	3.7%	2.7%	3.2%	9.8%	5.5%	6.4%	5.5%
Moderate	4.1%	3.7%	4.2%	5.0%	6.0%	5.3%	7.3%	6.6%	8.2%	8.1%
Low	8.9%	6.3%	6.6%	9.9%	7.6%	8.2%	6.4%	7.9%	8.2%	8.0%
Total	13.5%	11.1%	12.1%	18.6%	16.2%	16.6%	23.4%	19.9%	22.9%	21.5%

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, Percent of miles of directional congestion = am + pm miles (table above) / 1296 miles. 1296 miles = 324 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											
Highway	1994	1995	1996	1997	1998	1999	Early 2000	Late 2000	2002	2003	2004
I-35	-	-	-	-	-	-	-	-	-	0	0
I-35E	6.5	6	5.5	5	7	6.5	7.5	10	10	9	9.5
I-35W	20.5	10	9	11	24.5	24	27	33.5	25.5	25	23
I-94	12	11.5	13	10.5	17	17.5	16	26	23.5	23	23.5
I-394/TH 12	9	6.5	6	5	8.5	8.5	6.5	6	7	8.5	8.5
I-494	14.5	15.5	10	12.5	23	15.5	20	23	15.5	19	18.5
I-694	7.5	6.5	4	4	6	8.5	8	9	9	9.5	9.5
Subtotal	70	58	47.5	48	86	80.5	85	107.5	90.5	94	92.5

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

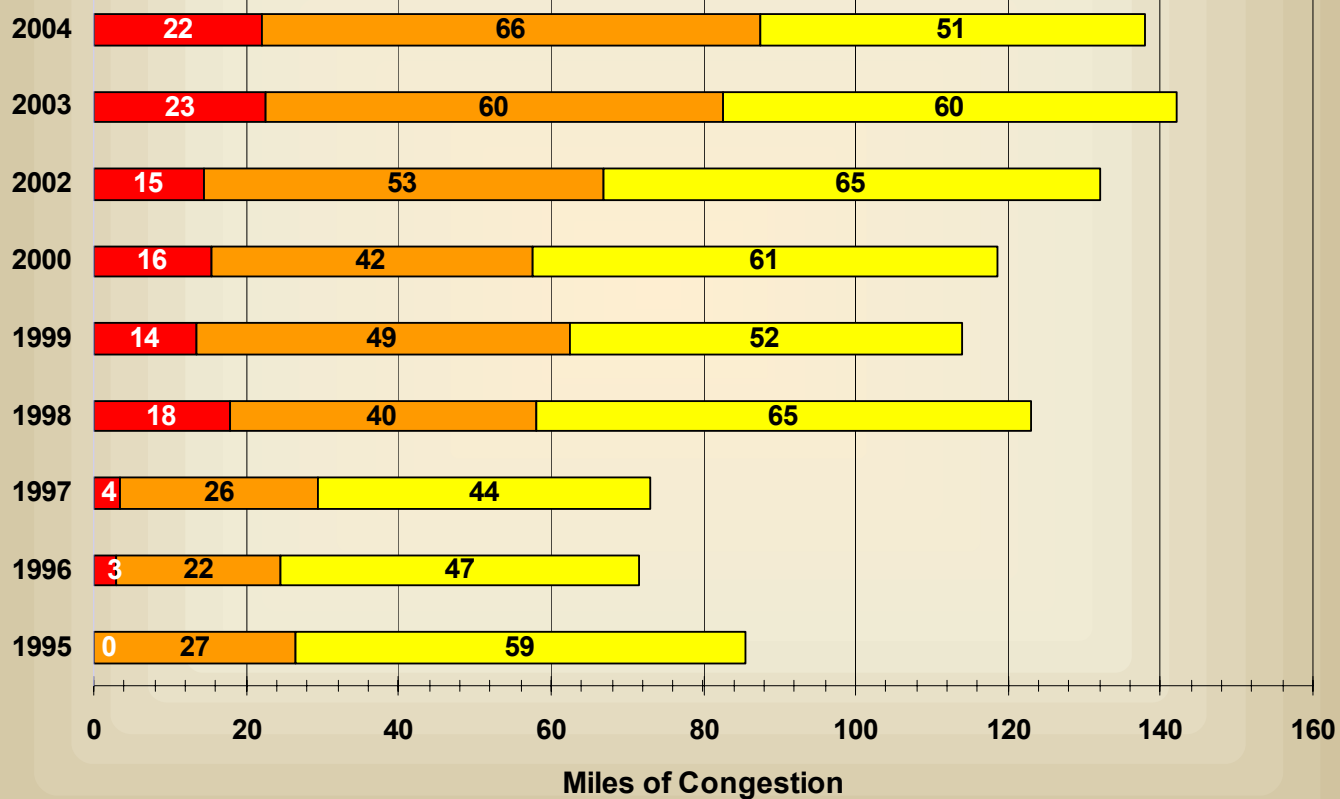
Total Congested Metro Freeway Miles (AM)											
Grand Total	100	85.5	71.5	73	123	114	118.5	149.5	132	142	138

- 1 Before 2004: Interstate Miles = 450 TH Miles = 190 Total Miles = 640
 2004: Interstate Miles = 450 TH Miles = 198 Total Miles = 648
 -added new segment of TH 100

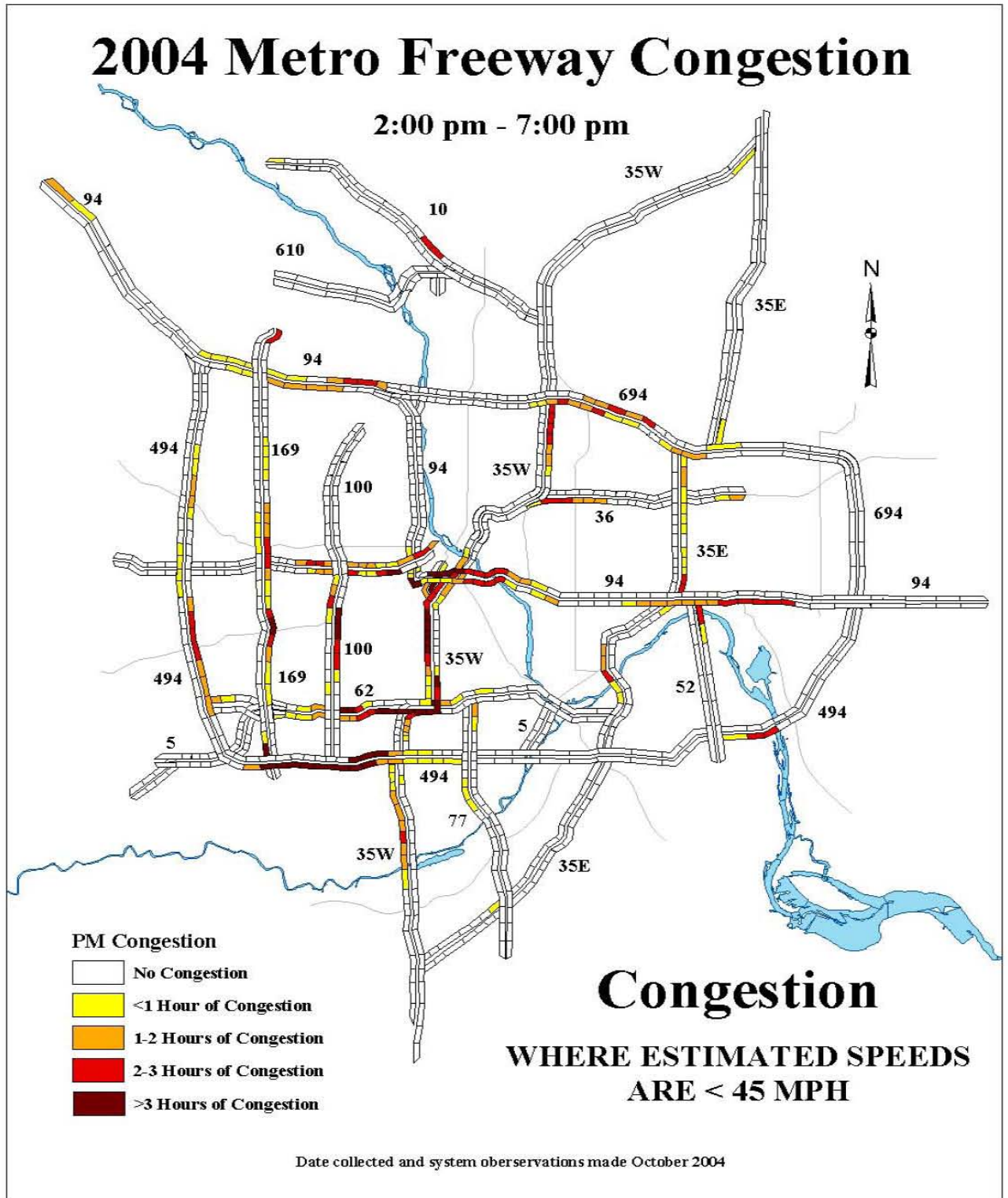
- 2 Congestion was measured for the *freeway* segments of trunk highways

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



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

Congested Interstate Miles (PM) ¹											
Highway	1994	1995	1996	1997	1998	1999	Early 2000	Late 2000	2002	2003	2004
I-35E	-	-	-	-	-	-	-	-	-	0	0
I-35E	4	5.5	4	3.5	8	4.5	3.5	8.5	6.5	15	9.5
I-35W	18	7	5.5	13.5	18.5	16	19	27.5	23	26	24.5
I-94	12	16	10.5	15	23.5	21	17.5	33	25.5	31	29
I-394/TH 12	7	7	4	6.5	7.5	7.5	8	10.5	10.5	11	10
I-494	14	15.5	16	14	20	14.5	15.5	26.5	16	20	20.5
I-694	6	3	4	4.5	6.5	5	5	5	6.5	9	9
Subtotal	59	54	44	57	82	68.5	68.5	111	88	112	102.5

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

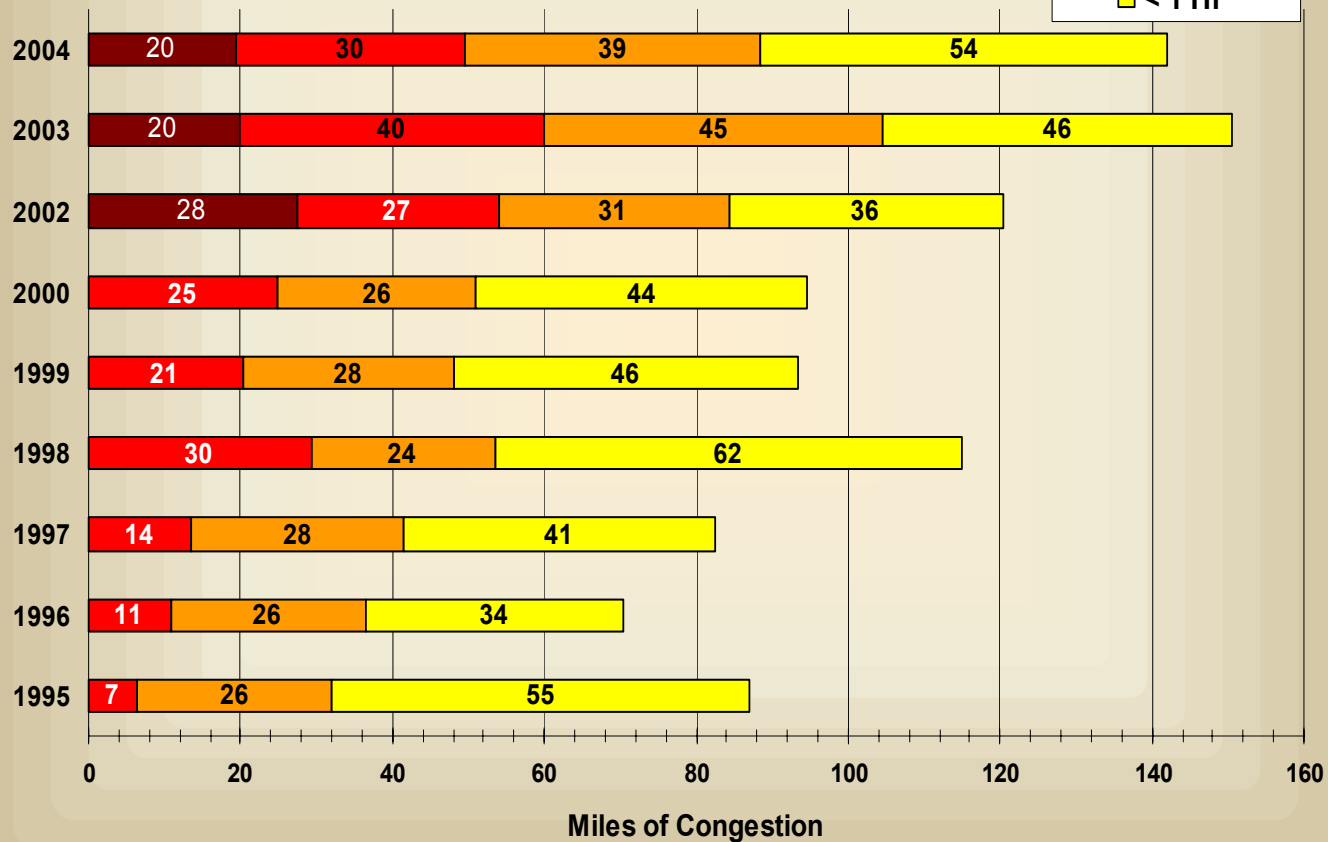
Total Congested Metro Freeway Miles (PM)											
Grand Total	90.5	87	70.5	82.5	115	93.5	94.5	149.5	121	151	142

- 1 1993 - 2000: Interstate Miles = 354 TH Miles = 146 Total Miles = 500
 2002: Interstate Miles = 395 TH Miles = 177 Total Miles = 571
 2003: Interstate Miles = 430 TH Miles = 196 Total Miles = 626
 2004: Interstate Miles = 430 TH Miles = 220 Total Miles = 650

- 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 3:00 - 7:00 PM



Appendix

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Centerline Miles Measured for Congestion

<i>Highway</i>	Centerline Miles of Highway	Limits	Additions for 2004
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	Duluth St to I-94
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		