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Background

In February of 2010, The U.S. Environmental Protection Agency (EPA) finalized new minimum monitoring requirements for the nitrogen dioxide (NO₂) monitoring network in support of a 1-hour NO₂ National Ambient Air Quality Standard (NAAQS). In the new monitoring requirements, state and local air monitoring agencies are required to install near-road NO₂ monitoring stations at locations where peak hourly NO₂ concentrations are expected to occur within the near-road environment in large urban areas. In August of 2011, the EPA extended the near-road monitoring requirements to the national carbon monoxide (CO) monitoring network. Per the regulation, at a minimum state and local air agencies must begin operating their required near-road NO₂ monitors by January 1, 2013, and must collocate the near-road CO monitors by January 1, 2015¹.

To assist state and local air agencies in identifying candidate near-road monitoring sites, the EPA has developed a near-road TAD. This analysis utilizes the December 21, 2011 draft version of the near-road TAD to identify candidate near-road monitoring sites in Minnesota. A copy of the near-road TAD and additional information is available at the EPA Monitoring Technology Information Center, <http://www.epa.gov/ttn/amtic/nearroad.html>. As necessary, this document will be updated to reflect changes included in future iterations of the near-road TAD.

Identifying Core Based Statistical Areas Subject to the Near-Road Monitoring Requirements

According to 40 CFR Part 58 Appendix D, state and local air agencies are required to operate one near-road monitoring site in each Core Based Statistical Area (CBSA) with a population of 500,000 or more persons. In addition, CBSAs with 2,500,000 or more persons, or those CBSAs with one or more roadway segments carrying traffic volumes of 250,000 or more vehicles per day are required to operate two near-road monitoring sites.

Table 3 shows the population estimates for large CBSAs in Minnesota. The Minneapolis-St. Paul-Bloomington CBSA is the only CBSA in Minnesota that requires near-road monitoring. The 2009 population estimate for the Minneapolis-St. Paul-Bloomington CBSA is 3,269,814 persons, triggering the requirement for a second near-road monitoring site within the CBSA².

Table 1: U.S. Census Bureau CBSA Population Estimates for Minnesota, 2009 vintage

CBSA	NAME	POPESTIMATE2009	Sites
33460	Minneapolis-St. Paul-Bloomington MN-WI	3,269,814	2
20260	Duluth, MNWI	276,368	--
22020	Fargo, ND MN	200,102	--
41060	St. Cloud, MN	189,148	--
40340	Rochester, MN	185,618	--

[U.S. Census Bureau Population Estimates \(2009 vintage\)](#)

¹ Deployment of near-road CO monitors will be tiered. Monitors in smaller CBSAs are due by January 1, 2017.

² The Minneapolis-St. Paul-Bloomington CBSA is the only CBSA in Minnesota that requires near-road monitoring. As a result the MPCA will be required to site one near-road monitoring site by January 1, 2013, and will evaluate the need for a second monitoring site based on monitoring results.

The CFR also asks states to consider the Annual Average Daily Traffic (AADT) counts of road segments within eligible CBSAs to determine monitoring requirements. Based on the 2010 AADT count data provided by the Minnesota Department of Transportation (MnDOT), the highest AADT count within the Minneapolis-St. Paul-Bloomington CBSA is located along I-94 and I-35W in downtown Minneapolis. The 2010 AADT count for this segment is 267,000 vehicles per day. Table 2 describes the 20 highest traffic segments, based on AADT count, in the Twin Cities metropolitan area in 2010.

Table 2: Top 20 AADT Counts for Road Segments in the Twin Cities Metropolitan Area, 2010

SEQ NUM	ROUTE NAME	LOCATION	YEAR	AADT	RANK
11256 & 11720	I-94 & I-35W	W OF HIAWATHA & E OF PORTLAND AV IN MPLS	2010	267,000	1
10800	I-94	E OF HENNEPIN & LYNDALE AV IN MPLS	2010	191,000	2
11508	I-35E	BETWEEN E&W JCT OF I-94 ST PAUL	2010	185,000	3
11267	I-35W	S OF 31st ST E IN MPLS	2010	175,000	4
11179	I-494	W OF CSAH3 (PENN AV) IN BLOOMINGTON	2010	165,000	5
11256	I-94	OVER THE TH55 BRIDGE IN MPLS	2010	165,000	5
11338	I-94	E OF CSAH53 (DALE ST) IN ST PAUL	2010	165,000	5
11207	I-494	E OF TH100 IN BLOOMINGTON	2010	164,000	8
9846	I-494	321 ATR W OF I-35W	2010	163,000	9
9851 & 9838	I-35W	NB AND SB LANES OF I-35W S OF I-94	2010	160,000	10
11730	I-35W	N OF CSAH3 IN MPLS	2010	158,000	11
11257	I-94	W OF CSAH48 (25th AV / RIVERSIDE AV)	2010	157,000	12
10809	I-35W	N OF CSAH46 (4th ST E) IN MPLS	2010	156,000	13
11347	I-94	&12 E OF TH280 IN ST PAUL	2010	153,000	14
9837	I-94	LOWRY HILL TUNNEL	2010	153,000	14
11348	I-94	&12 W OF TH51 (SNELLING AV) IN ST PAUL	2010	153,000	14
9834	I-94	301 ATR W OF VICTORIA ST IN ST PAUL	2010	153,000	14
68277	I-394	E OF CSAH2 (PENN AV S)	2010	153,000	14
11336	I-94	E OF N JCT I-35E IN ST PAUL	2010	152,000	19
11350	I-94	&12 W OF LEXINGTON PKWY IN ST PAUL	2010	152,000	19

[MnDOT Traffic Volume Data, 2010](#)

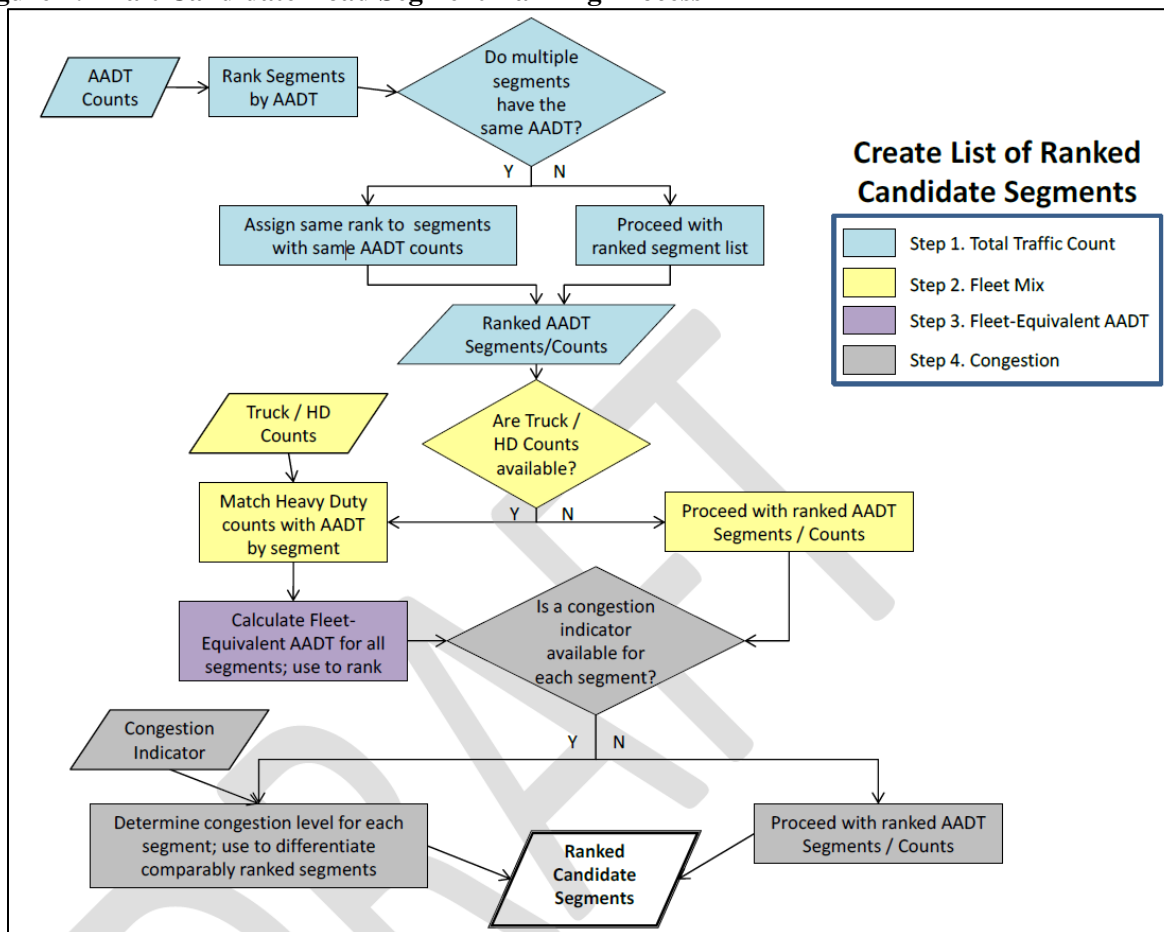
³ This segment was manually calculated based on two overlapping traffic segments.

⁴ This segment is included in the merged I-94 and I-35W segment described in the top ranked traffic segment above.

Identifying Target Road Segments for Near-Road Monitoring

The EPA requires state and local air agencies to site near-road monitoring stations in locations where peak 1-hour NO₂ and CO concentrations are expected to be the highest in the near-road environment. To identify these locations, the EPA recommends that state and local air agencies utilize the most recent AADT counts to identify the most trafficked road segments. Factors such as fleet mix, roadway design, traffic congestion patterns, terrain or topography, and meteorology of candidate road segments can also be considered in identifying road segments for monitoring.

Figure 1: Draft Candidate Road Segment Ranking Process



[Near-road NO₂ Monitoring Technical Assistance Document- Draft, December 21, 2011](#)

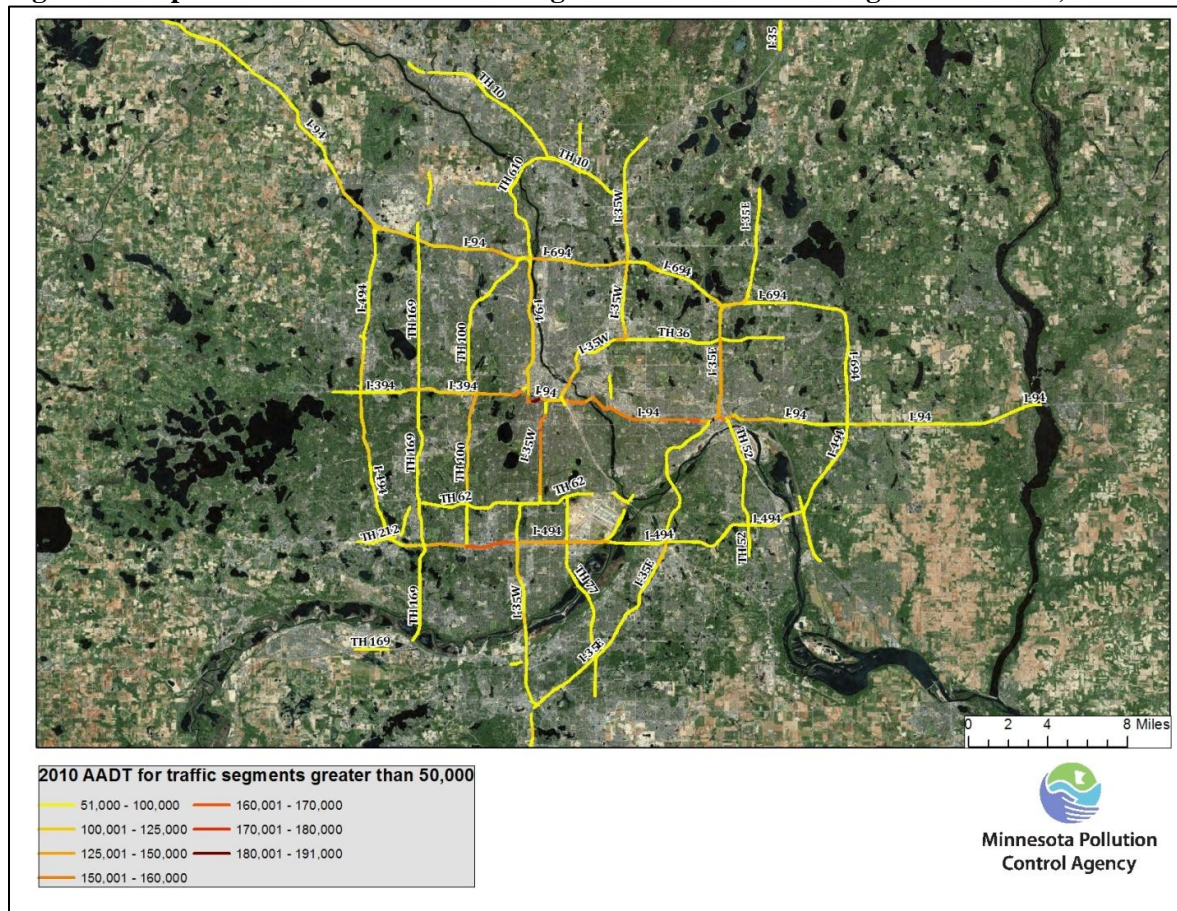
To complete the road segment ranking process, the Minnesota Pollution Control Agency (MPCA) has received 2010 traffic data for the Twin Cities metropolitan area from MnDOT. While two Wisconsin counties (St. Croix and Pierce) are included in the Minneapolis-St. Paul-Bloomington CBSA, traffic data from these counties are not included in this analysis. Based on population density and traffic data for the Minnesota road segments adjacent to the Wisconsin segments, the MPCA does not anticipate that road segments in the Wisconsin counties will have the highest peak 1-hour NO₂ and CO concentrations in the CBSA. Therefore, the exclusion of Wisconsin traffic data should not impact the results of the segment analysis.

Step 1: Total Traffic Count

As described in Figure 1 above, the first step in the traffic data evaluation process is to satisfy the requirement in 40 CFR Part 58, Appendix D, section 4.3, to rank road segments in a CBSA based on the total traffic volume, represented by AADT. The near-road TAD instructs states and local air agencies to generate a list of road segments in the CBSA in descending order, where the segment with the highest AADT is ranked first. Table 2 above includes a ranked list of the top twenty traffic segments in the Minneapolis-St. Paul-Bloomington CBSA in 2010.

Figure 2 below provides a map of traffic segments in the Minneapolis-St. Paul-Bloomington CBSA with 2010 AADT counts greater than 50,000. In general, the most heavily trafficked segments are located within the urban core along I-94 between downtown Minneapolis and St. Paul. Traffic segments along I-35W in the area directly south of downtown Minneapolis and several segments along the I-94 bypass routes also experience heavy daily traffic volumes.

Figure 2: Map of Twin Cities Area Road Segments with 2010 AADT greater than 50,000



Step 2: Fleet Mix

While AADT describes the total volume of traffic on a road, fleet mix data provides specific counts of different types of vehicles that comprise the total traffic volume. Most commonly, fleet mix data differentiates between light-duty passenger vehicles and heavy-duty trucks. Understanding the number of

heavy-duty vehicles within a traffic segment is important because the amount of air pollution emitted on a per vehicle basis between light-duty and heavy-duty vehicles vary greatly.

To assess the fleet mix of road segments within the Minneapolis-St. Paul-Bloomington CBSA, the MPCA utilized the 2010 Heavy Commercial Annual Average Daily Traffic (HCAADT) count data provided by MnDOT. Table 3 includes a ranked list of the top 20 road segments based on HCAADT counts. The table also includes the percentage of heavy-duty (HD) vehicles and the percentage of heavy-duty vehicles within the segment.

Table 3: Top 20 HCAADT Counts for Road Segments in the Twin Cities Metropolitan Area, 2010

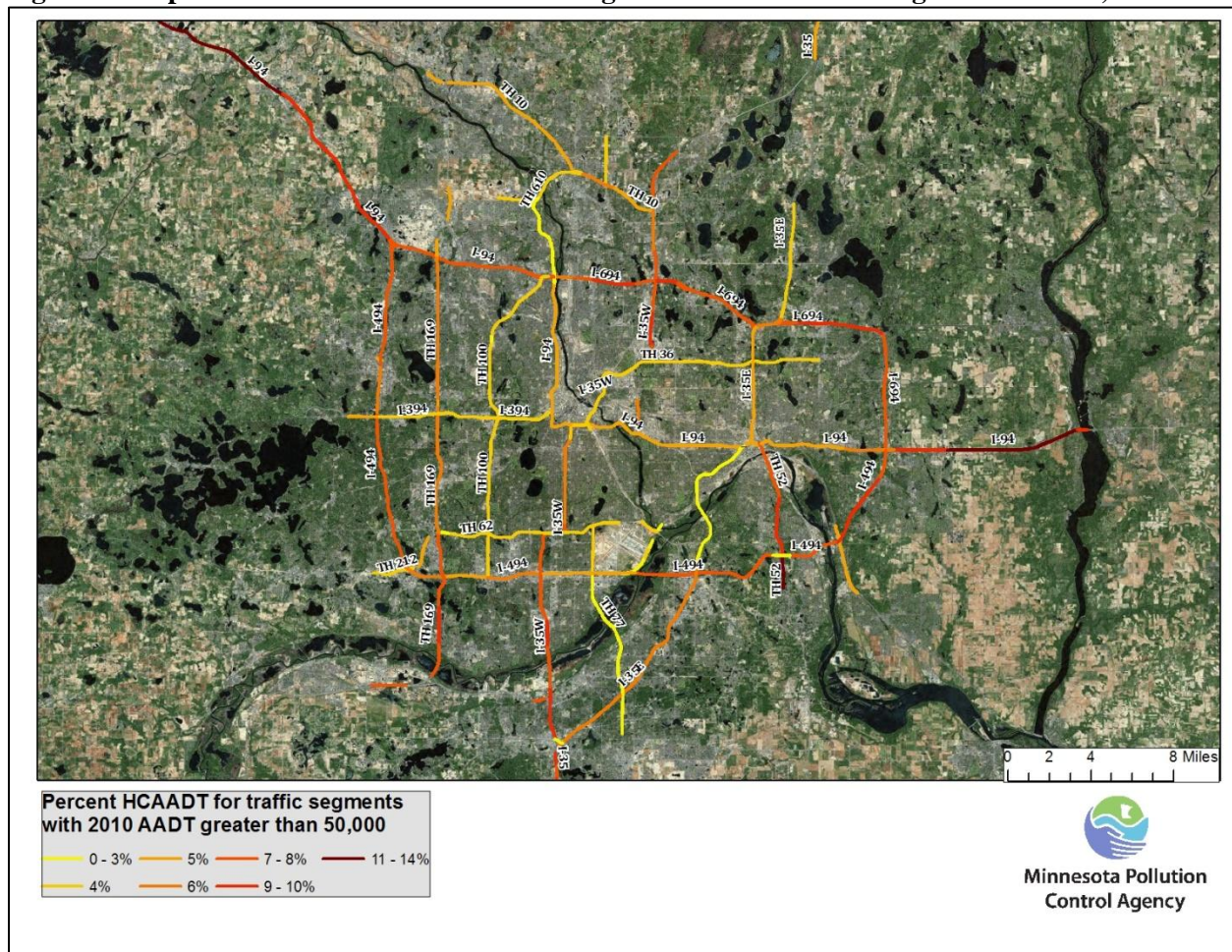
SEQ NUM	ROUTE NAME	LOCATION	HCAADT	HCAADT RANK	PCTHD	AADT RANK
11256+ 11720	I-94 & I-35W	W OF HIAWATHA & E ØRTLAND AV IN MPLS	10,850	1	4%	1
10790	I-94	NW OF 494 IN MAPLE GROVE	10,200	2	9%	63
9859	I-94	342 ATR SE OF CSAH30 (95th AV	10,100	3	9%	69
10231	I-94	E OF 694 & 494	9,400	4	9%	89
10393	I-94	&TH52 NW ØSAH30 (95th AV N) IN MAPE GROVE	9,300	5	10%	136
11179	I-494	W OF CSAH32 (PENN AV) IN BLOOMINGTON	9,200	6	6%	5
9935	I-694	W OF SILVER LAKE ROAD	9,200	6	8%	63
11207	I-494	E OF TH100 IN BLOOMINGTON	9,100	8	6%	8
9846	I-494	321 ATR W Ø 35W	9,100	8	6%	9
11006	I-694	E OF CSAH44 (SILVER LAKE RD)	9,100	8	8%	72
11267	I-35W	S OF 31st ST E IN MPLS	9,000	11	5%	4
11692	I-694	W OF CSAH1 (EAST RIVER RD)	9,000	11	6%	26
10788	I-94	&TH52 W OF TH169 IN MAPLE GROVE	8,900	13	7%	59
11687	I-35W	N OF CO RD C	8,900	13	9%	107
10223	I-94	&12 AT ST CROIX RIVER BR	8,900	13	10%	136
10519	I-694	W OF TH47 IN FRIDLEY	8,800	16	6%	34
11760	I-94	&12 W OF CSAH19	8,800	16	10%	141
10917	I-35W	S OF CSAH88	8,600	18	9%	136
9861	I-94	354 ATR W OF CR 178 (LAKE ELN AV)	8,500	19	10%	182
11730	I-35W	N OF CSAH3 IN MPLS	8,400	20	5%	10
11251	I-694	W OF CSAH77 (5th AVE NW)	8,400	20	8%	77
10791	I-94	&TH52 E ØF 494 IN MAPLE GROVE	8,400	20	8%	79
10225	I-94	&12 W OF TH95	8,400	20	11%	202
11700	I-35	S OF CSAH50	8,400	20	11%	223

[MnDOT Traffic Volume Data, 2010](#)

The traffic segment with the highest ranked HCAADT count in 2010 is located along I-94 and I-35W in downtown Minneapolis, and is also the highest ranked AADT segment. Approximately 10,850 heavy-

duty vehicles travel this segment per day, comprising 4% of the total traffic volume along the segment. Across the Twin Cities metropolitan area, the percent of heavy-duty vehicles contributing to a road u g i o g p v ø u " v q v c n " v t c h h k e " x q Where HCAADT data is available, the " 5 2 ' " v q average percentage of heavy-duty vehicles contributing to total traffic counts is 5%. Figure 3 provides a map of the percentage of heavy-duty vehicles on traffic segments with 2010 AADT counts greater than 50,000. As is expected, road segments along the outer ring of the Twin Cities metropolitan area have the highest proportion of heavy-duty vehicles to light-duty passenger vehicles.

Figure 3: Map of Percent HCAADT for Road Segments with 2010 AADT greater than 50,000



Step 3: Fleet Equivalent AADT

Because it is difficult to directly compare the relative air quality impacts of traffic segments with high AADT counts versus those with a high percentage of HCAADT, the near-road TAD recommends the use of a unique metric that accounts for both total traffic volume and fleet mix. The Fleet Equivalent (FE) C C F V " k p v g i t c v g u " c " t q AADT uognti into a single value. This is accomplished J E by applying a multiplier to the HCAADT count to reflect higher per vehicle air pollution emission rates. The near-road TAD ø u " t g e q o o g p f g f " v h k p t i o " w c n " c t " q h c q f t " " u e g c i n o e g w p n v c ø u " H G " C C

$$FE\ AADT = (AADT - HD_c) + (HD_m * HD_c) \quad \text{Equation 1}$$

Where AADT is the total traffic volume count for a particular road segment, the HD_c variable is the total number of heavy-duty vehicles for a particular road segment (HCAADT), and the HD_m variable is a multiplier that represents the heavy-duty to light duty NO_x emission ratio for a particular road segment.

In assigning the appropriate heavy-duty vehicle emissions multiplier, state and local air quality agencies may develop site specific emissions factors or may utilize the national default heavy-duty to light duty vehicle emission ratio of 10. For the purpose of this analysis, the MPCA has chosen to utilize the national default ratio to calculate the FE AADT of road segments in the Minneapolis-St. Paul-Bloomington CBSA. Table 4 includes a ranked list of the top 20 road segments based on FE AADT counts.

Table 4: Top 20 FE AADT Counts for Road Segments in the Twin Cities Metropolitan Area, 2010

SEQ NUM	ROUTE NAME	LOCATION	FE AADT	FE AADT Rank	AADT Rank	HCAADT RANK	PCT HD
11256 11720	I-94 & I-35W	W OF HIAWATHA & E OF PORTLAND AV IN MPLS	364,650	1	1	1	4%
10800	I-94	E OF HENNEPIN & LYNDAL A IN MPLS	264,800	2	2	26	4%
11508	I-35E	BETWEEN E&W JCT OF I ST PAUL	257,000	3	3	30	4%
11267	I-35W	S OF 31st ST E IN MPLS	256,000	4	4	11	5%
11179	I-494	W OF CSAH32 (PENN AV) IN BLOOMINGTON	247,800	5	5	6	6%
11207	I-494	E OF TH100 IN BLOOMINGTON	245,900	6	8	8	6%
9846	I-494	321 ATR W OF I-35W	244,900	7	9	8	6%
11730	I-35W	N OF CSAH3 IN MPLS	233,600	8	11	20	5%
9851 9838	I-35W	NB AND SB LANES OF I-35W S OF I-94	233,350	9	10	29	5%
10809	I-35W	N OF CSAH46 (46th ST E) IN MPLS	230,700	10	13	25	5%
11256	I-94	OVER TH55 BRIDGE IN MPLS	229,800	11	5	55	4%
11338	I-94	E OF CSAH53 (DALE ST) IN S PAUL	229,800	11	5	55	4%
11692	I-694	W OF CSAH1 (EAST RIVER RD)	226,000	13	27	11	6%
10519	I-694	W OF TH47 IN FRIDLEY	220,200	14	35	16	6%
11257	I-94	W OF CSAH48 (25th AV/ RIVERSIDE AV)	219,100	15	11	68	4%
11336	I-94	E OF N JCT I-35E IN ST PAUL	215,000	16	19	65	5%
11347	I-94	&12 E OF TH280 IN ST PAUL	213,300	17	14	77	4%
9837	I-94	LOWRY HILL TUNNEL	213,300	17	14	77	4%
11348	I-94	&12 W OF TH51 (SNELLING AV) IN ST PAUL	213,300	17	14	77	4%
9834	I-94	301 ATR W OF VICTORIA ST ST PAUL	213,300	17	14	77	4%

[MnDOT Traffic Volume Data, 2010](#)

The traffic segment with the highest ranked FE AADT count in 2010 is located along I-94 and I-35W in downtown Minneapolis, and is also the highest ranked AADT and HCAADT segment. When adjusting for the increased emissions associated with heavy duty vehicle traffic, this segment has a fleet equivalent AADT of approximately 364,650 vehicles per day. Figure 4 provides a map of the 2010 FE AADT counts for traffic segment with a 2010 AADT greater than 50,000. Unlike the maps for the AADT and HCAADT counts, which respectively indicated a concentration of heavy traffic in the urban core or outer ring, the FE AADT data suggests that traffic related air quality impacts are fairly well distributed across the Twin Cities metropolitan area.

Figure 4: Map of FE AADT for Road Segments with 2010 AADT greater than 50,000



Step 4: Congestion

In addition to assessing the total traffic volume on road segments, the near-road TAD asks state and local air quality agencies to consider congestion patterns of candidate road segments. The frequent stopping and starting associated with highly congested roadways generally results in increased vehicle emissions. Figure 5 describes the morning and evening rush hour congestion patterns for traffic segments in the Twin Cities metropolitan area. A road segment is considered congested if estimated travel speeds fall below 45 miles per hour (MPH). The degree of congestion is identified by the number of hours during the rush hour period where travel speeds remain under 45 MPH

