APPENDIX 8

DEVELOPMENT OF REASONABLE FURTHER PROGRESS ON-ROAD MOBILE SOURCE EMISSIONS INVENTORIES BASED ON THE MOBILE6.2 MODEL FOR THE DALLAS-FORT WORTH NONATTAINMENT AREA

SUMMARY OF ON-ROAD MOBILE INVENTORY DEVELOPMENT USING THE MOBILE MODEL

This appendix documents the development of the on-road mobile emissions inventory (EI) for the updates to the Dallas-Fort Worth Ozone Nonattainment Area (DFW) Reasonable Further Progress (RFP) State Implementation Plan.

The development of the RFP EIs was done by the North Central Texas Council of Governments (NCTCOG) at the request and under the direction of the Texas Commission on Environmental Quality (TCEQ). The on-road mobile source EIs and control strategy reduction estimates reflect the most recent planning assumptions for the DFW transportation network. Complete documentation of the development and resulting EI is provided in Attachments A and B of this appendix. Because Attachment B documents updated adjusted base year inventories using a 2008 base year, the adjusted base year inventories from the main report should not be used. The final controlled and uncontrolled emissions estimates are summarized in Chapter V: *Summary of Vehicle Miles Travel, Speed, and Emissions* on Pages V.2 through V.8 of Attachment A, in Exhibits V-1 through V-7. The final 2008 adjusted base year emissions estimates are summarized in *Attachment B of this appendix*.

This appendix also documents the development of control strategy reduction estimates for each of the RFP milestone years between 2008 and 2012, and the contingency analysis year 2013. Control strategy emission reduction estimates include the effects of the federal Tier 1 exhaust emissions standards, the DFW vehicle inspection and maintenance program, federal reformulated gasoline Phase 1 and Phase 2, federal Tier 2 exhaust emissions standards and the heavy duty diesel emission certification standards for 2004 and 2007. The emissions summaries include estimates for all control scenarios. The control scenarios are the basis for quantifying the reductions for each control strategy.

APPENDIX 8

ATTACHMENT A

REASONABLE FURTHER PROGRESS

SUPPLEMENT

In July of 2010, the North Central Texas Council of Governments (NCTCOG), in conjunction with Texas Commission on Environmental Quality (TCEQ), had developed the Dallas-Fort Worth (DFW) Reasonable Further Progress (RFP) Emission Inventory (EI) using 2002 as the base year. In December of 2010, TCEQ staff requested to update the adjusted base year (ABY) on-road mobile EI to support an RFP state implementation plan with a 2008 base year. This supplemental report to the RFP EI documents the methodology and results of the ABY EI using 2008 as the base year.

The requested update required ABY EIs only for 2011, 2012, and 2013. The controlled and uncontrolled EIs for all the analysis years remained the same. The new base year is now 2008 pre-1990 control EI because the 2008 vehicle miles of travel (VMT) is now the base year VMT. To develop 2011, 2012, and 2013 ABY EIs, 2008 travel network, VMT distribution, age distribution, and diesel fractions were employed. The input files and the emission factor files are available in Appendix D and E.

The emission estimates of the RFP EI, for each analysis year and control scenarios are summarized in Exhibit V-1 through Exhibit V-7 of the original document. Supplemental tables below replace Exhibits V-4 through V-7 with the new ABY results using 2008 as the base year. Appendix H contains detailed emissions by pollutant and by time of day for all counties and for analysis years. Appendix G contains the detailed tab summary of VMT, speeds, and emissions for all counties and for analysis years.

EXHIBIT V-4

2008 RFP EMISSION INVENTORY DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN SUMMER SEASON, MIDWEEK ON ROAD EMISSIONS (TONS/DAY)										
VOC	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
PRE90/BY	23.20	102.70	21.03	7.42	6.56	6.17	5.09	2.54	62.14	236.86
A	23.20	92.80	21.03	7.42	6.56	6.17	5.09	2.54	56.26	221.08
B	16.75	68.09	15.32	5.67	5.04	4.74	3.89	1.89	41.09	162.49
C	12.67	51.56	11.61	5.62	4.99	4.70	3.85	1.87	30.90	127.77
D	11.92	49.00	10.93	5.32	4.73	4.44	3.63	1.76	29.28	121.02
E	10.33	49.00	9.50	4.77	4.22	3.98	3.26	1.57	29.28	115.91
F	9.08	44.56	8.35	3.53	3.25	2.97	2.43	1.15	26.26	101.57
G	9.08	44.56	8.35	3.53	3.25	2.97	2.43	1.15	26.26	101.57
CS	9.06	44.51	8.33	3.53	3.24	2.97	2.42	1.15	26.22	101.44
CO	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
PRE90/BY	311.30	1,297.25	288.30	111.36	89.40	92.88	75.64	36.65	816.36	3,119.14
A	311.30	1,142.95	288.30	111.36	89.40	92.88	75.64	36.65	722.56	2,871.05
B	239.85	895.26	222.10	85.07	70.03	71.39	58.01	27.85	557.73	2,227.28
C	167.05	600.94	154.66	85.04	70.01	71.37	57.99	27.84	371.85	1,606.76
D	156.08	557.78	144.50	85.26	70.16	71.56	58.12	27.90	344.13	1,515.48
E	128.28	557.78	118.91	75.55	61.66	63.31	51.42	24.64	344.13	1,425.67
F	113.74	506.55	105.47	43.67	36.74	36.85	29.86	14.07	309.53	1,196.47
G	113.74	506.55	105.47	43.67	36.74	36.85	29.86	14.07	309.53	1,196.47
CS	113.35	504.74	105.07	43.32	36.53	36.58	29.64	13.94	308.37	1,191.55
NOx	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
PRE90/BY	36.43	162.41	35.82	22.23	14.06	17.39	14.41	7.23	103.89	413.86
A	36.43	151.61	35.82	22.23	14.06	17.39	14.41	7.23	97.35	396.53
B	29.40	120.58	28.60	16.23	10.67	12.79	10.56	5.31	77.20	311.32
C	23.70	99.43	23.35	16.21	10.65	12.78	10.55	5.30	63.36	265.34
D	22.35	94.49	22.12	16.34	10.76	12.89	10.65	5.35	60.21	255.15
E	20.36	94.49	20.30	15.54	10.05	12.21	10.09	5.07	60.21	248.31
F	17.15	82.27	17.32	12.26	7.57	9.56	7.90	3.95	51.97	209.94
G	16.72	80.11	16.84	11.75	7.31	9.18	7.58	3.79	50.53	203.81
CS	16.08	77.05	16.13	11.00	6.91	8.60	7.10	3.55	48.48	194.92
CO2	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
PRE90/BY	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
A	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
B	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
C	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
D	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
E	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
F	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
G	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
CS	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175

EXHIBIT V-5

2011 RFP EMISSION INVENTORY DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN SUMMER SEASON, MIDWEEK ON ROAD EMISSIONS (TONS/DAY)										
VOC	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	23.11	102.14	20.93	7.39	6.53	6.14	5.06	2.53	61.80	235.63
PRE90	27.11	116.54	25.02	8.96	7.59	7.26	5.94	2.98	71.83	273.23
A	27.11	105.34	25.02	8.96	7.59	7.26	5.94	2.98	65.03	255.23
B	17.66	67.34	16.39	6.22	5.25	5.08	4.14	2.01	41.81	165.90
C	13.10	49.58	12.17	6.17	5.21	5.04	4.10	1.99	30.63	127.98
D	12.37	46.95	11.51	5.88	4.95	4.80	3.91	1.89	29.06	121.31
E	10.49	46.95	9.78	5.21	4.36	4.25	3.46	1.66	29.06	115.22
F	7.99	38.17	7.46	3.33	2.93	2.74	2.22	1.04	23.13	89.01
G	7.99	38.17	7.46	3.33	2.93	2.74	2.22	1.04	23.13	89.01
CS	7.95	38.00	7.42	3.30	2.91	2.72	2.20	1.03	23.03	88.56
CO	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	309.30	1,285.11	286.43	110.34	88.47	92.07	74.91	36.37	808.54	3,091.55
PRE90	357.66	1,434.48	330.68	129.33	100.45	105.89	86.03	41.39	912.61	3,498.53
A	357.66	1,260.78	330.68	129.33	100.45	105.89	86.03	41.39	805.36	3,217.58
B	266.93	936.58	247.06	95.31	75.67	78.64	63.55	30.47	591.22	2,385.42
C	176.69	592.62	163.43	95.30	75.66	78.63	63.54	30.47	370.65	1,646.99
D	166.67	549.39	154.33	95.46	75.76	78.78	63.62	30.50	344.57	1,559.08
E	132.14	549.39	122.48	83.26	65.53	68.53	55.40	26.49	344.57	1,447.79
F	104.11	450.46	96.37	41.04	33.20	34.03	27.30	12.80	278.25	1,077.55
G	104.11	450.46	96.37	41.04	33.20	34.03	27.30	12.80	278.25	1,077.55
CS	103.25	446.69	95.46	40.04	32.65	33.28	26.68	12.47	275.80	1,066.31
NOx	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	35.63	157.72	34.81	21.14	13.56	16.58	13.79	6.85	100.78	400.87
PRE90	39.71	165.52	38.92	26.22	16.05	20.19	17.01	8.22	106.76	438.60
A	39.71	153.21	38.92	26.22	16.05	20.19	17.01	8.22	99.18	418.71
B	34.18	125.25	32.87	18.43	12.06	14.41	12.06	5.85	80.97	336.09
C	24.47	92.13	23.83	18.41	12.04	14.39	12.05	5.84	59.15	262.32
D	23.18	86.93	22.66	18.59	12.19	14.55	12.16	5.90	56.03	252.19
E	20.40	86.93	20.10	17.31	11.12	13.48	11.30	5.46	56.03	242.15
F	14.23	64.13	14.32	11.89	7.04	9.14	7.70	3.65	40.72	172.83
G	13.89	62.62	13.95	11.42	6.80	8.79	7.40	3.51	39.70	168.10
CS	12.07	54.66	11.93	8.77	5.45	6.81	5.70	2.71	34.33	142.41
CO2	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	8,757	36,279	8,174	3,584	2,657	2,895	2,334	1,251	23,250	89,181
PRE90	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
A	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
B	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
C	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
D	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
E	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
F	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
G	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
CS	9,696	38,419	9,151	4,278	2,625	3,360	2,728	1,438	25,003	96,698

EXHIBIT V-6

2012 RFP EMISSION INVENTORY DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN SUMMER SEASON, MIDWEEK ON ROAD EMISSIONS (TONS/DAY)										
VOC	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	23.05	101.83	20.88	7.36	6.50	6.12	5.04	2.52	61.59	234.89
PRE90	28.10	117.22	25.69	9.49	7.83	7.54	6.21	3.01	71.80	276.91
A	28.10	106.08	25.69	9.49	7.83	7.54	6.21	3.01	65.09	259.05
B	17.77	64.89	16.31	6.38	5.23	5.11	4.20	1.97	40.22	162.08
C	13.07	47.29	12.01	6.33	5.19	5.07	4.17	1.95	29.18	124.27
D	12.42	44.93	11.43	6.07	4.96	4.85	4.00	1.86	27.81	118.32
E	10.47	44.93	9.66	5.37	4.35	4.28	3.53	1.64	27.81	112.04
F	7.49	34.64	6.93	3.22	2.75	2.59	2.12	0.96	20.97	81.67
G	7.49	34.64	6.93	3.22	2.75	2.59	2.12	0.96	20.97	81.67
CS	7.45	34.46	6.89	3.18	2.73	2.56	2.10	0.95	20.85	81.17
CO	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	308.41	1,280.48	285.57	109.91	88.06	91.71	74.57	36.25	805.47	3,080.43
PRE90	370.76	1,441.71	337.63	136.09	103.25	109.43	89.61	41.76	912.25	3,542.49
A	370.76	1,268.31	337.63	136.09	103.25	109.43	89.61	41.76	805.84	3,262.68
B	274.71	928.70	250.67	99.48	77.08	80.52	65.63	30.48	583.84	2,391.11
C	178.20	573.79	162.53	99.47	77.07	80.51	65.63	30.47	357.24	1,624.91
D	169.47	535.77	154.75	99.62	77.16	80.65	65.70	30.50	334.94	1,548.56
E	133.42	535.77	121.93	86.57	66.49	69.89	57.01	26.40	334.94	1,432.41
F	100.32	420.71	91.61	40.26	31.71	32.69	26.46	12.01	258.93	1,014.69
G	100.32	420.71	91.61	40.26	31.71	32.69	26.46	12.01	258.93	1,014.69
CS	99.36	416.63	90.60	39.12	31.10	31.86	25.77	11.66	256.28	1,002.38
NOx	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	35.69	157.93	34.86	21.19	13.62	16.63	13.83	6.87	100.91	401.52
PRE90	41.25	166.58	39.86	27.59	16.53	20.83	17.70	8.21	106.94	445.47
A	41.25	154.34	39.86	27.59	16.53	20.83	17.70	8.21	99.45	425.74
B	36.13	126.66	34.18	19.22	12.43	14.76	12.45	5.81	81.46	343.11
C	24.91	89.94	23.88	19.19	12.41	14.75	12.44	5.80	57.50	260.82
D	23.78	85.29	22.86	19.37	12.55	14.90	12.55	5.85	54.78	251.94
E	20.72	85.29	20.08	17.90	11.35	13.69	11.57	5.37	54.78	240.74
F	13.46	59.01	13.39	11.66	6.73	8.77	7.47	3.38	37.35	161.22
G	13.13	57.58	13.03	11.20	6.50	8.43	7.17	3.25	36.40	156.70
CS	10.68	47.19	10.35	7.59	4.70	5.79	4.89	2.22	29.42	122.82
CO2	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	8,758	36,283	8,175	3,584	2,658	2,896	2,334	1,251	23,253	89,191
PRE90	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
A	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
B	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
C	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
D	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
E	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
F	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816

G	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
CS	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816

EXHIBIT V-7

2013 RFP EMISSION INVENTORY
DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN
SUMMER SEASON, MIDWEEK
ON ROAD EMISSIONS (TONS/DAY)

VOC	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	23.05	101.87	20.89	7.36	6.50	6.12	5.04	2.53	61.62	234.98
PRE90	29.13	119.46	26.76	9.90	8.30	7.89	6.48	3.12	74.05	285.09
A	29.13	108.10	26.76	9.90	8.30	7.89	6.48	3.12	67.13	266.81
B	17.98	63.67	16.59	6.49	5.38	5.21	4.28	1.99	40.11	161.69
C	13.13	45.94	12.13	6.44	5.34	5.17	4.25	1.98	28.82	123.20
D	12.58	43.89	11.64	6.20	5.12	4.98	4.10	1.90	27.63	118.04
E	10.53	43.89	9.77	5.46	4.47	4.37	3.61	1.66	27.63	111.40
F	7.08	32.00	6.60	3.08	2.66	2.48	2.03	0.91	19.71	76.56
G	7.08	32.00	6.60	3.08	2.66	2.48	2.03	0.91	19.71	76.56
CS	7.04	31.80	6.55	3.03	2.63	2.45	2.01	0.90	19.58	75.98
CO	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	308.43	1,280.51	285.60	109.89	88.04	91.70	74.56	36.25	805.46	3,080.44
PRE90	383.72	1,467.00	351.34	141.28	108.81	113.85	92.99	43.03	941.97	3,643.99
A	383.72	1,290.51	351.34	141.28	108.81	113.85	92.99	43.03	832.25	3,357.78
B	283.77	937.33	260.30	102.84	80.85	83.45	67.89	31.32	598.14	2,445.89
C	180.76	565.42	165.77	102.83	80.84	83.44	67.88	31.31	357.41	1,635.65
D	173.52	533.08	159.27	102.95	80.93	83.56	67.94	31.34	338.50	1,571.09
E	135.59	533.08	124.58	89.09	69.44	72.09	58.72	27.01	338.50	1,448.11
F	97.64	401.23	89.74	39.37	31.42	32.02	25.89	11.66	251.23	980.21
G	97.64	401.23	89.74	39.37	31.42	32.02	25.89	11.66	251.23	980.21
CS	96.58	396.79	88.62	38.11	30.72	31.10	25.12	11.28	248.34	966.67
NOx	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	35.72	158.03	34.89	21.23	13.64	16.66	13.85	6.88	100.98	401.88
PRE90	42.83	169.65	41.58	28.86	17.73	21.75	18.42	8.49	110.09	459.40
A	42.83	157.18	41.58	28.86	17.73	21.75	18.42	8.49	102.37	439.21
B	38.16	129.42	36.16	19.87	13.25	15.31	12.85	5.96	84.10	355.07
C	25.40	88.79	24.41	19.85	13.23	15.29	12.84	5.95	57.39	263.15
D	24.45	84.78	23.55	20.01	13.37	15.43	12.94	6.00	55.06	255.59
E	21.07	84.78	20.47	18.33	11.97	14.04	11.81	5.46	55.06	242.98
F	12.78	54.95	12.81	11.41	6.73	8.55	7.25	3.26	35.22	152.96
G	12.45	53.57	12.45	10.95	6.50	8.22	6.97	3.13	34.29	148.53
CS	9.47	41.23	9.18	6.54	4.22	5.00	4.19	1.89	25.94	107.66
CO2	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
08ABY	8,759	36,288	8,176	3,585	2,658	2,896	2,334	1,251	23,256	89,202
PRE90	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
A	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
B	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
C	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
D	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670

E	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
F	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
G	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
CS	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670

APPENDIX 8

ATTACHMENT B

D-FW RFP Inventories, Control Strategy Reductions, and Contingency Estimates for 2002, 2005, 2006, 2008, 2011, 2012, and 2013

On-Road Mobile Source Emissions Inventory

September 2010

Collin
Dallas
Denton
Ellis
Johnson
Kaufman
Parker
Rockwall
Tarrant

North Central Texas Council of Governments
Transportation Department

What is NCTCOG?

The North Central Texas Council of Governments is a voluntary association of cities, counties, school districts, and special districts which was established in January 1966 to assist local governments in **planning** for common needs, **cooperating** for mutual benefit, and **coordinating** for sound regional development.

It serves a 16-county metropolitan region centered around the two urban centers of Dallas and Fort Worth. Currently the Council has **236 members**, including 16 counties, 168 cities, 23 independent school districts, and 29 special districts. The area of the region is approximately **12,800 square miles**, which is larger than nine states, and the population of the region is over **6.5 million**, which is larger than 38 states.

NCTCOG's structure is relatively simple; each member government appoints a voting representative from the governing body. These voting representatives make up the **General Assembly** which annually elects a 15-member Executive Board. The **Executive Board** is supported by policy development, technical advisory, and study committees, as well as a professional staff of 312.

NCTCOG's offices are located in Arlington in the Centerpoint Two Building at 616 Six Flags Drive (approximately one-half mile south of the main entrance to Six Flags Over Texas).

North Central Texas Council of Governments
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NCTCOG's Department of Transportation

Since 1974 NCTCOG has served as the Metropolitan Planning Organization (MPO) for transportation for the Dallas-Fort Worth area. NCTCOG's Department of Transportation is responsible for the regional planning process for all modes of transportation. The department provides technical support and staff assistance to the Regional Transportation Council and its technical committees, which compose the MPO policy-making structure. In addition, the department provides technical assistance to the local governments of North Central Texas in planning, coordinating, and implementing transportation decisions.

Prepared in cooperation with the Texas Department of Transportation and the U. S. Department of Transportation, Federal Highway Administration, and Federal Transit Administration.

"The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the views or policies of the Federal Highway Administration, the Federal Transit Administration, or the Texas Department of Transportation."

D-FW RFP Inventories, Control Strategy Reductions, and Contingency Estimates for 2002, 2005, 2006, 2008, 2011, 2012, and 2013

On-Road Mobile Source Emissions Inventory

September 2010

Collin	Parker
Dallas	Rockwall
Denton	Tarrant
Ellis	
Johnson	
Kaufman	

North Central Texas Council of Governments

Transportation Department

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ABSTRACT

TITLE: Dallas-Fort Worth Reasonable Further Progress Inventories, Control Strategy Reductions, and Contingency Estimates for 2002, 2005, 2006, 2008, 2011, 2012, and 2013

DATE: September 2010

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ABSTRACT: The North Central Texas Council of Governments conducted a Regional Further Progress emission inventory to support Texas Commission on Environmental Quality's effort to develop a State Implementation Plan Attainment Demonstration for the Dallas-Fort Worth nine-county nonattainment area for the pollutant ozone. The nine nonattainment counties are Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant County. This report documents the on-road mobile methodologies applied and estimated emission results for analysis year 2002, 2005, 2006 2008, 2011, 2012, and 2013. The nine-county estimated on-road mobile source emissions are reported for volatile organic compounds, carbon monoxide, and oxides of nitrogen for controlled and uncontrolled scenarios.

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GLOSSARY OF ABBREVIATIONS

AADT	-	Annual Average Daily Traffic
AAWT	-	Average Annual Weekday Traffic
ABY	-	Adjusted Base Year
ANSWT	-	Average Non-Summer Weekday Traffic
ATP	-	Anti-Tampering Program
ATR	-	Automatic Traffic Recorder
CAAA	-	Clean Air Act Amendments
CD	-	Compact Disc
CERR	-	Consolidated Emissions Reporting Rule
CMSA	-	Consolidated Metropolitan Statistical Area
CO	-	Carbon Monoxide
DART	-	Dallas Area Rapid Transit
DFW	-	Dallas-Fort Worth
DFWRTM	-	Dallas-Fort Worth Regional Travel Model
DFX	-	Dallas-Fort Worth Expanded Travel Model
EPA	-	Environmental Protection Agency
GISDK	-	Geographic Information System Developer Kit
HAPs	-	Hazardous Air Pollutants
HBW	-	Home-Based Work
HDDBS	-	Heavy-Duty Diesel Bus – School
HDDBT	-	Heavy-Duty Diesel Bus – Transit
HDDV	-	Heavy-Duty Diesel Vehicle
HDGV	-	Heavy-Duty Gas Vehicle
HDV	-	Heavy-Duty Vehicle
HNW	-	Home-Based Non-Work
HOV	-	High Occupancy Vehicle
HPMS	-	Highway Performance Monitoring System
I/M	-	Inspection & Maintenance Program
ITE	-	Institute of Transportation Engineers
JCF	-	Job Control Files
LDGV	-	Light-Duty Gas Vehicle
LDT	-	Light-Duty Truck
LDV	-	Light-Duty Vehicle
LDDV	-	Light-Duty Diesel Vehicle
LED	-	Low Emission Diesel
MC	-	Motorcycles
MPA	-	Metropolitan Planning Area
MPO	-	Metropolitan Planning Organization
MTBE	-	Methyl Tertiary Butyl Ether
MVEB	-	Motor Vehicle Emissions Budgets
NAAQS	-	National Ambient Air Quality Standards
NCT	-	North Central Texas
NCTCOG	-	North Central Texas Council of Governments
NEI	-	National Emission Inventory
NHB	-	Non-Home Based
NIF	-	NEI Input Format
NH_3	-	Ammonia
NO_X	-	Nitrogen Oxides
NSWD	-	Non-Summer Week Day
NTI	-	National Toxics Inventory
NTTA	-	North Texas Transit Authority
O_3	-	Ozone
QA	-	Quality Assurance
QAPP	-	Quality Assurance Project Plan
QC	-	Quality Check
Pb	-	Lead
PEI	-	Periodic Emission Inventory
PM-2.5	-	Particulate Matter 2.5 microns
PM-10	-	Particulate Matter 10 microns
PV	-	Passenger Vehicle
RFP	-	Reasonable Further Progress
RVP	-	Reid Vapor Pressure

GLOSSARY OF ABBREVIATIONS

Continued

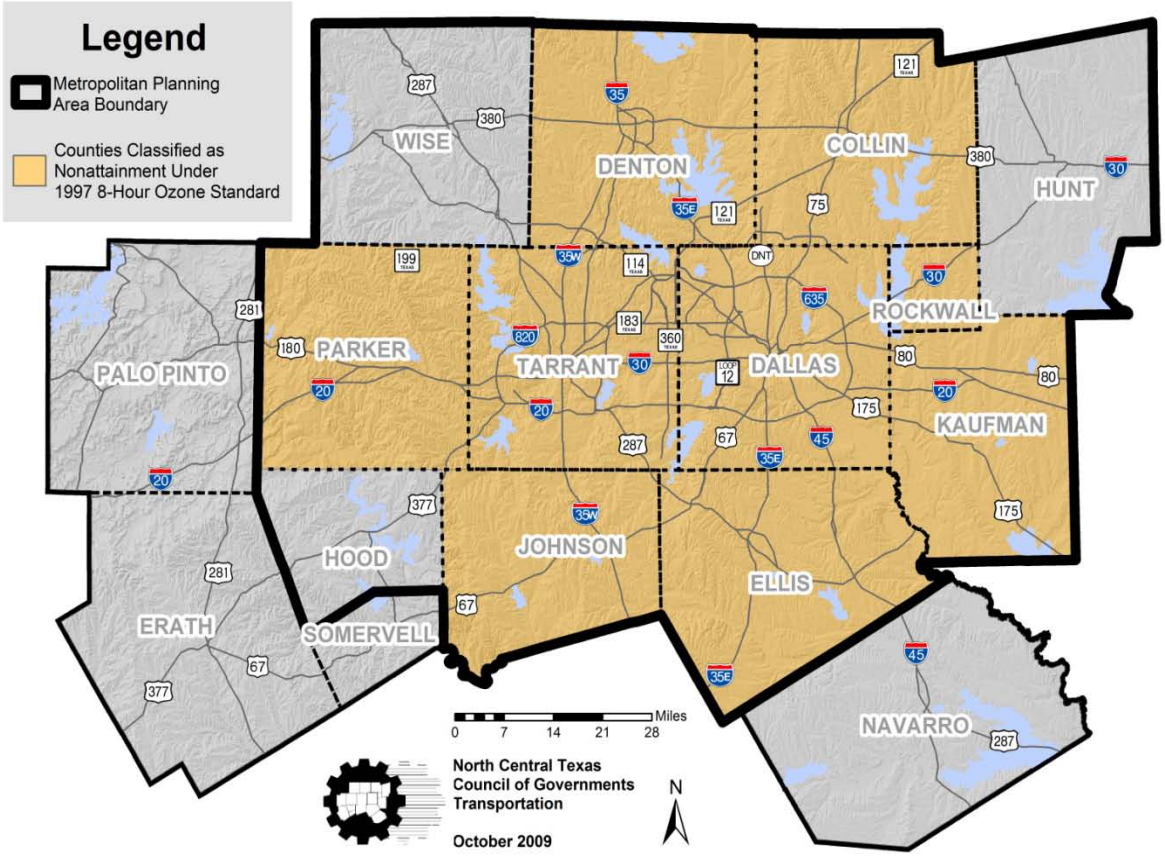
SIP	-	State Implementation Plan
SO_2	-	Sulfur Dioxide
TAP	-	Transportation Analysis Process
TCEQ	-	Texas Commission on Environmental Quality
TOD	-	Time of Day
TSZ	-	Traffic Survey Zone
TTI	-	Texas Transportation Institute
TxDOT	-	Texas Department of Transportation
UI	-	User Interface
V/C (ratio)	-	Volume/Capacity Ratio
VHT	-	Vehicle Hours of Travel
VMT	-	Vehicle Miles of Travel
V/C	-	Volume/Capacity
VDF	-	Volume Delay Function
VHT	-	Vehicle Hours of Travel
VOC	-	Volatile Organic Compounds
VOT	-	Value of Time

I. INTRODUCTION

The North Central Texas Council of Governments (NCTCOG), in conjunction with the Texas Commission on Environmental Quality (TCEQ), has developed the Dallas-Fort Worth (DFW) Reasonable Further Progress (RFP) Emission Inventory. This emission inventory covers the DFW nine-county nonattainment area of Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties as shown in Exhibit I-1.

EXHIBIT I-1

NINE-COUNTY NONATTAINMENT AREA



This report documents the methodology and results of the RFP emission inventory. The RFP emission inventory analysis period includes 2002, 2005, 2006, 2008, 2011, 2012, and 2013. Chapter I outlines the background for the RFP emission inventory, the purpose and scope of the study, the modeling approach, and provides a summary of the nine-county estimated emission totals.

Chapter II documents the procedures used to develop regional vehicle activity estimates in terms of vehicle miles of travel (VMT) and average vehicle speed. These procedures include development of adjustment factors to better reflect regional conditions. Seasonal and hourly adjustment factors were applied to produce 2002, 2005, 2006, 2008, 2011, 2012, and 2013 analysis year vehicle activity, and report vehicle activity in hourly periods. Consistent with previous emission inventory practice, a comparison was made between travel demand model VMT estimates and appropriate Highway Performance Monitoring System (HPMS) VMT, to develop HPMS adjustment factors. Also, a nonrecurring congestion adjustment was applied to account for vehicle emissions due to traffic accidents not captured in the standard four-step travel modeling process.

Chapter III documents the parameters and inputs used to develop on-road mobile source emission factors by utilizing the United States Environmental Protection Agency's (EPA) mobile source model, MOBILE6.2.03. This chapter documents regionally specific calculations, procedures, MOBILE6.2 emission factors, and adjustments to better reflect regional vehicle emissions emitted. The calculations and procedures include vehicle registration, diesel fractions, hourly VMT, and trip length distribution. The adjustments include vehicle inspection maintenance and anti-tampering programs, low emission diesel nitrogen oxide adjustments, Motor Cycle adjustment and VMT-mix.

Chapter IV documents the nine-county nonattainment area vehicle emission calculation procedure. Chapter V summarizes emissions of all pollutants by county and analysis years.

The Appendix contains supplemental information and electronic data that supports the DFW RFP Emissions Inventory.

BACKGROUND

The Clean Air Act Amendments of 1990 (CAAA) requires the EPA to set National Ambient Air Quality Standards (NAAQS) for widespread pollutants considered harmful to public health and the environment. EPA has set NAAQS for six principal pollutants; Ozone (O_3), Particulate Matter (PM), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Oxides (NO_X), and Lead (Pb).

With the signing of the CAAA into law, the four counties of Collin, Dallas, Denton, and Tarrant County in the DFW region were designated as nonattainment under the 1-hour NAAQS for the pollutant ozone. The law also requires the EPA to periodically review the NAAQS to ensure that they provide adequate health and environmental protection and to update these standards as necessary. Upon completion of a scientific review of the 1-hour NAAQS, EPA determined that the 1-hour NAAQS was insufficient to protect human health. As a result, EPA developed the 1997 8-hour NAAQS to place greater emphasis on prolonged exposure to pollutants.

In April 2004, EPA announced that Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties comprise the new DFW nine-county nonattainment area for the pollutant ozone under the new stricter 1997 8-hour NAAQS. With an effective designation date of June 15, 2004, for the 8-hour NAAQS, these nine counties received a “Moderate” ozone classification. That gave the North Central Texas (NCT) region until June 15, 2010, to reach attainment or face a reclassification to “serious”. As a result of not reaching attainment by June

2010, the DFW region will be classified as serious with the new attainment date of June 15, 2013.

TCEQ, the State's environmental agency, is required under the CAAA to submit State Implementation Plan (SIP) revisions documenting that emission of ozone precursors are declining at rates that achieve the NAAQS. The SIP is an air quality plan that contains a collection of regulations and measures to reduce emissions from stationary, area, mobile (on-road and non-road) sources, and demonstrate attainment of the air quality standards. The section of the SIP that demonstrates the plan for the achievement of these emission reductions is subsequently defined as the "Reasonable Further Progress (RFP) plan".

On-road mobile is a key component of the SIP, as a SIP places emission limits on on-road mobile sources. These on-road mobile emission limits are termed motor vehicle emission budgets (MVEBs) and have a direct impact on transportation planning. NCTCOG serves as the Metropolitan Planning Organization (MPO) for transportation in the DFW area and is responsible for developing and maintaining on-road mobile source emission inventories for the region. NCTCOG applies a four-step travel demand model process using TransCAD software to forecast regional vehicle activity and MOBILE6.2.03 (EPA MOBILE Emission Factor Model) with a post-processing application to estimate regional mobile source emissions.

PURPOSE AND SCOPE OF STUDY

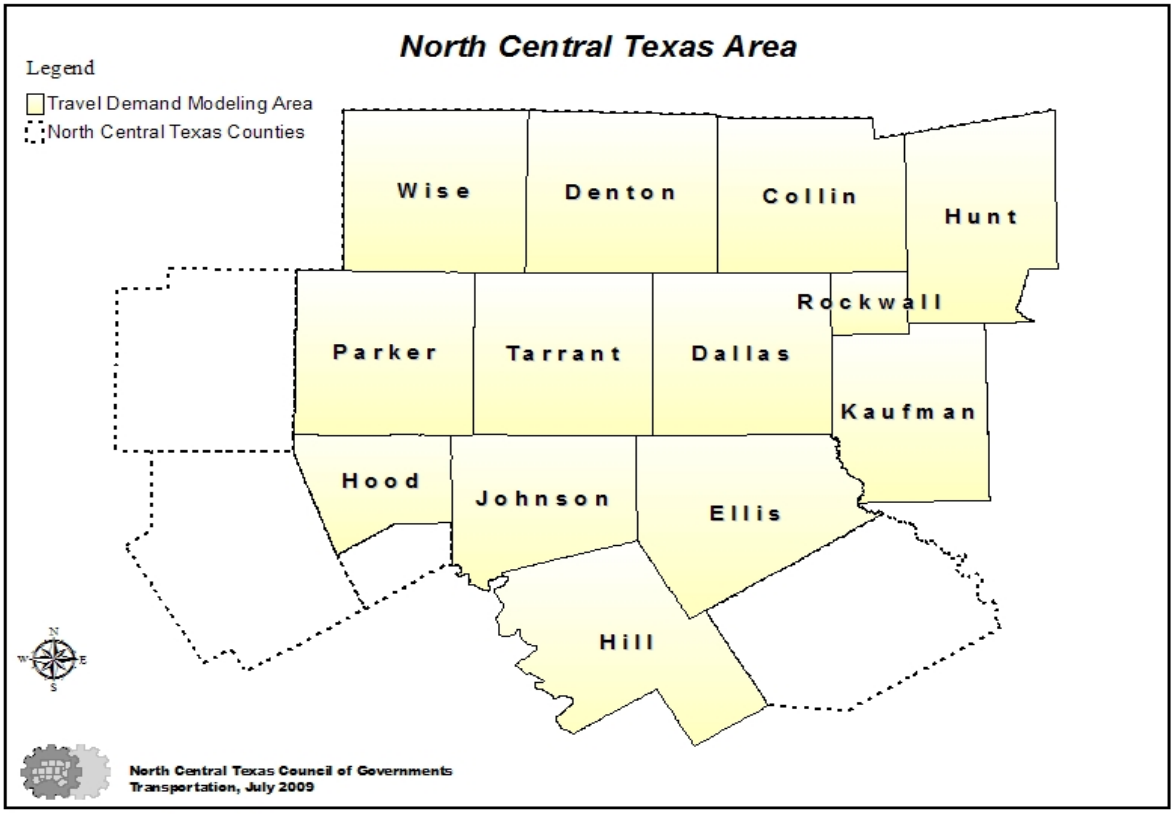
NCTCOG conducted 2002, 2005, 2006, 2008, 2011, 2012, and 2013 analysis year on-road emission inventories to support TCEQ's efforts to develop an attainment demonstration SIP for the DFW nine-county nonattainment area. The on-road mobile pollutants evaluated for these analysis years are volatile organic compounds (VOC), CO, NO_X, and Carbon Dioxide (CO_2).

MODELING APPROACH

The Dallas-Fort Worth Expanded Travel Demand Model (DFX) is employed to estimate VMT and emissions for the 2002, 2005, 2006, 2008, 2011, 2012, and 2013 analysis year. DFX's modeling domain includes Collin, Dallas, Denton, Ellis, Hill, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise Counties. Hill County is not part of the NCT boundary. To capture travel from outside areas, Hill County was included in the modeling domain. The 12-county NCT modeling domain plus Hill County is shown in the Exhibit I-2.

EXHIBIT I-2

NORTH CENTRAL TEXAS MODELING DOMAIN



Several components of the model were updated as part of this model expansion. These

include improvements to the: mode-choice model; vehicle ownership model; external stations; volume-delay-function; transit assignment, and traffic assignment convergence criteria, which are discussed in Chapter II.

Emissions are quantified by treating each control strategy scenario as an individual model run. Exhibit I-3 describes the individual control strategy modeled for all the analysis years. Adjusted Base Year (ABY) is modeled for 2008, 2011, 2012 and 2013 utilizing 2002 base year VMT.

EXHIBIT I-3

EMISSIONS INVENTORY SCENARIOS MODELED

RFP SCENARIOS	Input Files
Pre-1990 FMVCP	PR90
1992 Federal Controls on Gasoline Volatility	
ATP (Dallas and Tarrant only)	A
I/M Program (Dallas and Tarrant Only)	
FMVCP Tier 1	B
Federal Reformulated Gasoline (RFG) Model only Phase 2	C
NLEV	D
Expanded I/M and ATP	E
FMVCP Tier 2	F
Texas Low-Emission Diesel	G
Federal Low-Sulfur Highway Diesel	CS
FMVCP - Heavy-Duty 2007	
Adjusted Base Year	ABY

Final RFP on-road emission estimates by pollutant for summer weekday for each analysis years are shown in Exhibit I-4. Appendix H contains the detailed emissions by county by pollutant and by time-of-day for all NCT counties modeled.

EXHIBIT I-4

REASONABLE FURTHER PROGRESS EMISSION INVENTORY DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN SUMMER SEASON, MIDWEEK ON ROAD EMISSIONS (TONS/DAY)							
VOLATILE ORGANIC COMPOUNDS (VOC)							
	2002	2005	2006	2008	2011	2012	2013
BY/ABY	144.88			180.64	179.45	178.80	178.89
PRE90	206.06	210.68	219.28	236.86	273.23	276.91	285.09
A	187.63	196.01	204.11	221.08	255.23	259.05	266.81
B	167.63	159.42	161.06	162.49	165.90	162.08	161.69
C	149.44	131.10	127.56	127.77	127.98	124.27	123.20
D	146.37	124.97	120.87	121.02	121.31	118.32	118.04
E	145.07	120.46	116.21	115.91	115.22	112.04	111.40
F	-	114.56	108.10	101.57	89.01	81.67	76.56
G	-	-	108.10	101.57	89.01	81.67	76.56
CS		114.56	108.10	101.44	88.56	81.17	75.98

CARBON MONOXIDE (CO)							
	2002	2005	2006	2008	2011	2012	2013
BY/ABY	2,001.68			2,439.29	2,410.82	2,400.67	2,400.73
PRE90	2,770.03	2,822.19	2,912.34	3,119.14	3,498.53	3,542.49	3,643.99
A	2,475.59	2,589.44	2,672.28	2,871.05	3,217.58	3,262.68	3,357.78
B	2,230.55	2,130.59	2,155.86	2,227.28	2,385.42	2,391.11	2,445.89
C	2,006.04	1,712.42	1,594.49	1,606.76	1,646.99	1,624.91	1,635.65
D	2,026.93	1,693.72	1,506.22	1,515.48	1,559.08	1,548.56	1,571.09
E	2,006.20	1,619.40	1,427.15	1,425.67	1,447.79	1,432.41	1,448.11
F		1,508.95	1,276.00	1,196.47	1,077.55	1,014.69	980.21
G		-	1,276.00	1,196.47	1,077.55	1,014.69	980.21
CS		1,508.95	1,276.00	1,191.55	1,066.31	1,002.38	966.67

OXIDES OF NITROGEN (NOx)							
	2002	2005	2006	2008	2011	2012	2013
BY/ABY	306.82			317.59	315.50	315.61	315.37
PRE90	379.40	363.06	379.17	413.86	438.60	445.47	459.40
A	365.86	347.42	362.88	396.53	418.71	425.74	439.21
B	317.07	283.21	291.08	311.32	336.09	343.11	355.07
C	309.19	265.46	260.87	265.34	262.32	260.82	263.15
D	308.27	261.20	250.95	255.15	252.19	251.94	255.59
E	306.99	255.76	245.34	248.31	242.15	240.74	242.98
F	-	242.08	225.10	209.94	172.83	161.22	152.96
G		-	218.50	203.81	168.10	156.70	148.53
CS		242.08	218.50	194.92	142.41	122.82	107.66

CARBON DIOXIDE (CO2)							
	2002	2005	2006	2008	2011	2012	2013
BY/ABY	73,327			72,387	72,366	72,367	72,373
PRE90	73,327	78,741	81,183	89,175	97,104	98,816	101,670
A	73,327	78,741	81,183	89,175	97,104	98,816	101,670
B	73,327	78,741	81,183	89,175	97,104	98,816	101,670
C	73,327	78,741	81,183	89,175	97,104	98,816	101,670
D	73,327	78,741	81,183	89,175	97,104	98,816	101,670
E	73,327	78,741	81,183	89,175	97,104	98,816	101,670
F	-	78,741	81,183	89,175	97,104	98,816	101,670
G	-	-	81,183	89,175	97,104	98,816	101,670
CS	-	78,741	81,183	89,175	97,104	98,816	101,670

II. VEHICLE MILES OF TRAVEL ESTIMATION PROCEDURE

This chapter discusses the methodology used in estimating the vehicle activity measures that influence the air quality in the North Central Texas (NCT) area. These measures include: the vehicle miles of travel (VMT) and the average speed. The current expanded travel model covers the 12-county area of Collin, Dallas, Denton, Ellis, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise Counties. The VMT and speeds were estimated with the Dallas-Fort Worth Expanded Travel Model (DFX) using a link-based methodology for each time period and each day type.

DALLAS-FORT WORTH EXPANDED TRAVEL MODEL COUNTIES

Dallas-Fort Worth Expanded Travel Model

The source of VMT estimates for the reasonable further progress (RFP) emission inventory for the nonattainment counties is the network-based DFX executed by the North Central Texas Council of Governments (NCTCOG) Transportation Department in the TransCAD environment. TransCAD is a Geographic Information System-based commercial travel demand software package for transportation planning. The DFX supports federally required regional transportation planning efforts for the Dallas-Fort Worth (DFW) region. Since 1974, NCTCOG has served as the Metropolitan Planning Organization (MPO) for the DFW area. The Transportation Department provides technical support and staff assistance to the Regional Transportation Council and its technical committees that comprise the MPO policy-making structure.

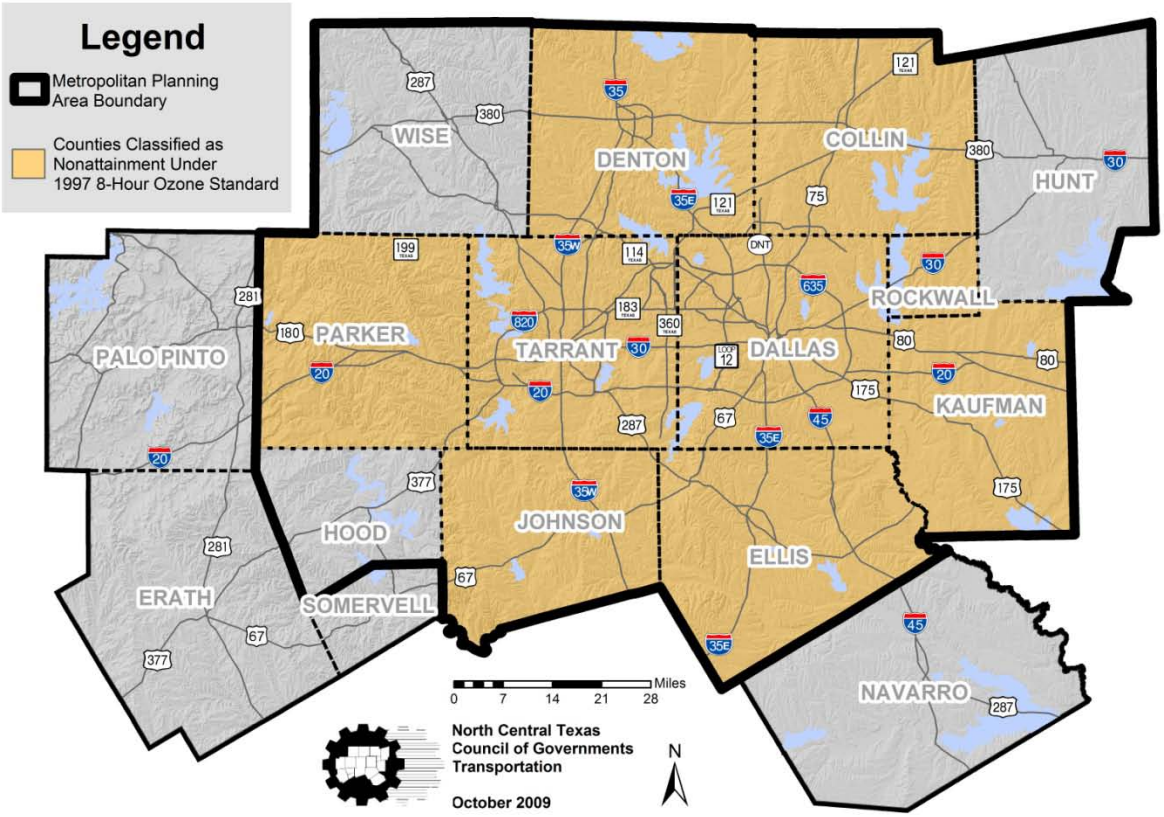
Multimodal Transportation Analysis Process

The forecasting technique of the DFX is based on a four-step sequential process designed to model travel behavior and predict travel demand at regional, sub-area, or corridor levels. These four-steps are: Trip Generation, Trip Distribution, Mode Choice, and Assignment. Exhibit II-1

shows NCTCOG's Metropolitan Planning Area (MPA) in which transportation planning efforts are concentrated and defines the geographical area covered by the DFX.

EXHIBIT II-1

NORTH CENTRAL TEXAS AREA AND METROPOLITAN PLANNING AREA BOUNDARY



The roadway network developed for the RFP emissions inventory contains over 30,000 unique segments constructed to replicate the transportation system of the coverage area. For this RFP inventory, the transportation network was developed for the years 2002, 2005, 2006, 2008, 2011, 2012, and 2013. Each facility link in the network has the following attributes:

- Network Node Numbers (defining the beginning and end of each link)
- Functional Classification
- Type of Traffic Control at Each End of the Link
- Length of Link
- Number of Operational Lanes in the Off-Peak Period
- Traffic Survey Zone
- Area type
- Hourly Capacities
- Number of Operational Lanes in the AM and PM Peak Periods
- Divided/Undivided Roadway Code
- Traffic Direction (one-way or two-way)
- Estimated Loaded Speeds in Each Period
- Speed Limit
- Tolls
- Free-Flow Speeds
- Truck Exclusion Code

Every roadway segment in the network falls in one of the functional classes of centroid connectors, freeways, principal arterials, minor arterials, collectors, ramps, frontage roads, and high occupancy vehicle lanes (HOV).

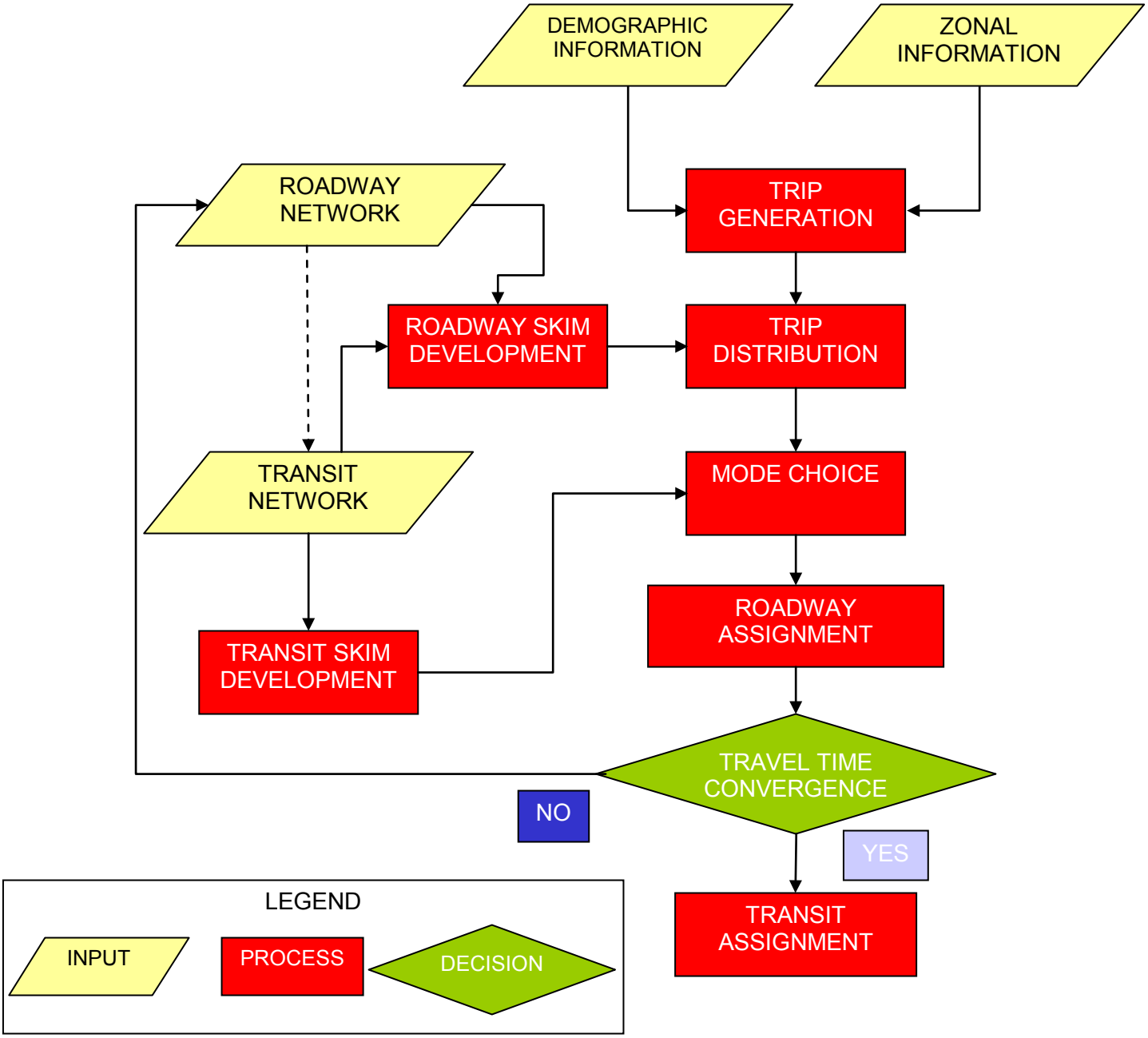
Trip purposes in the DFX are defined in one of four ways: home-based work (HBW), which includes trips from home to work or work to home; home-based non-work (HNW), which includes non-work trips beginning or ending at home; non-home based (NHB), which includes trips where home is neither the origin nor the destination; and Other trips that include all truck trips as well as all external-internal, internal-external, and external-external vehicle trips.

The model process begins with an estimate of the socioeconomic variables for each zone. The data is organized by traffic survey zone (TSZ), the smallest zone size available in DFX. There are 6,672 TSZs in the MPA. The data for each TSZ includes zone centroid; median household income; number of households; population; basic, retail, and service employment; and land area. The information is aggregated to 5,386 Transportation Analysis Process Model Zones (5,303 internal zones plus 83 ESZs), which is the level of detail retained in all four modeling steps. The Trip Generation Model generates the number of weekday person trips sent to and received from

each zone. The Trip Distribution Model determines the trip interaction between each zone and the rest of the zones in the MPA. The Mode Choice Model divides the person trips into two categories of transit and automobile trips. The Assignment Model loads the auto demand onto the roadway network, and the transit passenger trips onto the transit network. Exhibit II-2 depicts the flowchart of the DFW expanded travel model process, commonly referred to as the four-step transportation modeling process. The DFX model application is written by NCTCOG staff in the TransCAD script language known as the Geographic Information System Developer Kit or GISDK, and integrated with a user interface (UI) developed in visual basic programming language.

EXHIBIT II-2

DALLAS-FORT WORTH EXAPANDED TRAVEL MODEL PROCESS
TransCAD TRAVEL FORECAST FLOWCHART



Trip Generation Model

The Trip Generation Model is a computer program written in GISDK script language by NCTCOG staff. The Trip Generation Model converts the population and employment data into person trip ends and outputs the total number of trips produced by and attracted to each zone by trip purpose. The 2002, 2005, 2006, 2008, 2011, 2012, and 2013 population and employment forecasts were generated with the Disaggregate Residential Allocation Model/employment Allocation Model (DRAM/EMPAL) model using travel times from the Roadway and Transit Assignment Steps, consistent with current planning practice. The data can be seen in Exhibit II-3. The cross-classified trip production model is stratified by income quartile and household size. The allocation of TSZ households into the four income quartiles and six household size categories is based on distribution curves developed from the U.S. Census Population data. The cross-classified trip attraction model is stratified by area type, employment type (basic, retail, and service), and, for the case of the HBW trip purpose, income quartile. Area type designations are a function of the population and employment density of a zone.

EXHIBIT II-3

REASONABLE FURTHER PROGRESS EMISSIONS INVENTORY
DALLAS-FORT WORTH MODELING DOMAIN: DFX COUNTIES

Socio-Economic Demographic Summary by County

Analysis Year	2002	2005	2006	2008	2011	2012	2013
Population	5,500,390	5,954,677	6,094,970	6,367,479	6,783,263	6,923,913	7,064,416
Number of Households	2,049,052	2,216,167	2,267,218	2,368,558	2,523,581	2,577,024	2,630,546
Employment Types							
Basic	949,065	931,693	952,993	1,098,855	1,235,763	1,261,310	1,286,992
Retail	645,154	590,541	608,152	770,185	908,503	927,212	946,124
Service	1,650,472	1,788,622	1,837,559	1,881,228	1,978,529	2,014,166	2,049,870
Total Employment	3,244,691	3,310,856	3,398,704	3,750,268	4,122,795	4,202,688	4,282,986

The Trip Generation Model allows the user to input trip rates and trip generation units associated with special generators such as regional shopping malls, hospitals, and colleges/universities. At the end of the generation process, HBW trips are balanced to the estimated trip attractions. All other purposes are balanced to the estimated trip productions in that zone. Because of the uniqueness of the NHB trips, zonal productions for NHB trips are later set equal to the attractions in a given zone.

The Trip Generation Model allows the user to input trip rates and trip generation units associated with special generators such as regional shopping malls, hospitals, and colleges/universities. The regional trip productions and attractions are balanced for each trip purpose. The HBW trip productions are balanced to the estimated trip attractions. The total trip attractions are balanced to the estimated trip productions in that zone for all other trip purposes. Because of the uniqueness of the NHB trips, zonal productions for NHB trips are later set equal to the NHB attractions in a given zone.

Trip Distribution Model

The Trip Distribution Model creates the production-attraction person trip tables for each of the 5,386 Model Zones. The Trip Distribution Model uses the person trips produced by and attracted to each zone, generated in the Trip Generation Model, plus zone-to-zone minimum travel time information from the roadway network to estimate the number of person trips between each pair of zones for each trip purpose. All estimates of roadway travel times include a representation of the time needed for locating a parking space, paying for parking and walking from the car to the final destination. Estimates of these terminal times were derived from NCTCOG's 1994 Workplace Travel Survey and 1996 Household Travel Survey. The model uses a gamma-based gravity formulation technique to estimate the zone-to-zone interchange of trips. Iterations of the gravity

model are required to ensure that the estimated number of zonal trips received equals the projected number of trip attractions generated by the Trip Generation Model.

Mode Choice Model

The Mode Choice Model determines the mode of travel and auto occupancy. Using the information regarding trip maker characteristics (e.g., income and auto ownership), roadway and transit system characteristics (e.g., in-vehicle time and out-of-vehicle time), and travel costs (e.g., auto operating costs, parking costs, and transit fare), the model splits the trips among all applicable modes of travel. The model uses a nested logic formulation for all the trip purposes. The "Other" trips are assumed to be vehicle trips with one occupant and are not processed by the Mode Choice Model. The trip purposes of HBW, HNW, and NHB have nine choice sets: Drive Alone, Two Occupant Shared Ride, Three + Occupancy Shared Ride, walk access to Bus service, auto access to Bus service, walk access to Rail service, auto access to Rail service, walk access to Bus and Rail service with transfer, and auto access to Bus and Rail service with transfer.

Roadway Assignment

The Roadway Assignment Model consists of simultaneous User Equilibrium Origin-Destination assignments of drive alone, shared-ride, and truck vehicle classes for three separate time-of-day periods (6:30 a.m. – 9:00 a.m. Morning Peak, 3:00 p.m. – 6:30 p.m. Evening Peak, and the 18-hour Off-Peak). The drive alone vehicle class is kept separate from the shared-ride vehicle class so that HOV assignments can be performed as an integral part of an equilibrium assignment. Trucks are kept separate from the other vehicle classes so that the modeled truck volumes on all links can be tracked, and a separate value-of-time can be defined for them. A generalized-cost path building technique is embedded within the model, in which the iterative calculation of zone-to-zone impedances are based on weighting factors applied to the capacity-restrained travel time, the distance (representing fuel cost), and tolls. As is standard with all User Equilibrium

procedures, the TransCAD program uses an iterative process to achieve a convergent solution in which no travelers can improve their path by shifting routes. Since the results of the three time-of-day assignments can be combined to obtain total weekday modeled volumes, validation checks can be performed with either time-of-day or weekday observed traffic counts.

Speed Estimation Procedure

The link speed in the DFX is estimated by dividing the length of the link by its loaded travel time. The loaded travel time is the sum of the free-flow travel time, traffic congestion delay, and the delay caused by the traffic control devices (e.g., stop signs, yield signs, and signals). These three elements of the loaded travel time are all functions of the link volume to capacity ratio. These functions are programmed in the volume-delay-function (VDF) that is an essential input to the traffic assignment step. The link capacity is defined as the Level-of-Service "E" capacity for each time period. The result of the traffic assignment step is the final time-period-specific average loaded speeds for each of the 30,000+ links in the roadway network. The VMT and vehicle hours of travel (VHT) for different time periods is included in the output as well to obtain an overall average speed (VMT/VHT) for any desired length of time.

The free-flow (uncongested) speed is defined as the speed limit. Free-flow speeds are an important link attribute since they are the base for calculating the congested (loaded) speeds in the Traffic Assignment step.

The VDF in DFX uses a conical congestion delay form defined for each link functional classification, a non-linear delay curve based on the Webster's uniform delay formulation at signalized intersections, and a linear delay curve for the stop and yield controlled approaches.

The formulation for the conical traffic congestion delay curve is as follows:

$$K_d = \left(1 + \sqrt{A_CONICAL^2 * (1 - \frac{v}{c} + dx)^2 + \left[\frac{(2 * A_CONICAL - 1)}{(2 * A_CONICAL - 2)}\right]^2} - A_CONICAL * (1 - \frac{v}{c} + dx) - \left[\frac{(2 * A_CONICAL - 1)}{(2 * A_CONICAL - 2)}\right]\right)$$

$$C_d = T_0 * (K_d - \{K_d \mid \frac{v}{c} = 0\})$$

where:

C_d	= link congestion delay (minutes);
A_CONICAL	= volume-delay coefficient per functional classification;
T_0	= free-flow travel time (minutes); and
$\frac{V}{C}$	= time-of-day directional $\left(\frac{Volume}{Capacity}\right)$ ratio.

The signal delay portion of the total loaded link travel time is calculated as follows:

$$S_d = \begin{cases} \left[\frac{PARAM_SIG}{MAX\left(1 - \frac{v}{S}, L\right)}\right] & , PARAM_SIG > 0,\ 0 \le v/s \le L_1 \\ CA * \left(\frac{v}{S}\right)^3 + CB * \left(\frac{v}{S}\right)^2 + CC * \left(\frac{v}{S}\right) + CD & , PARAM_SIG > 0,\ L_1 < v/s < L_2 \\ \left[\frac{PARAM_SIG}{MAX\left(1 - \frac{v}{S}, L\right)}\right] & , PARAM_SIG > 0,\ v/s \ge L_2 \\ 0, \text{ otherwise} & \end{cases}$$

where:

S_d = link signal delay (minutes);

PARAM_SIG = link attribute, a function of the approach red time and cycle length; and

$\frac{V}{S}$ = time-of-day directional $\left(\frac{Volume}{SaturationFlowRate}\right)$ ratio.

The L_1 and L_2 are model constants. The CA, CB, CC, and CD variables are constants calculated for every link.

The delay at unsignalized intersections is calculated through a simple linear equation as follows:

$$U_d = \begin{cases} \text{MIN_DELAY} + \text{PARAM_UNSIG}\ (v/c), & \text{PARAM_UNSIG} > 0 \\ 0, \text{ otherwise} & \end{cases}$$

where:

U_d = link stop or yield delay (minutes);

PARAM_UNSIG = link attribute, a function of the link class;

$\frac{V}{C}$ = time-of-day directional $\left(\frac{Volume}{Capacity}\right)$ ratio; and

MIN_DELAY = minimum stop or yield delay (minutes).

The volume-delay curves were calibrated based on the available 2004 daily link traffic counts at more than 10,000 locations (collected by the Texas Department of Transportation(TxDOT)), and the travel time runs along freeway and arterial corridors (performed by several consultants as part of other projects). The time-of-day link counts were not available for the calibration of the model in each time-period.

Finally, all the delay elements are added to the uncongested travel time (based on the free-flow speeds) to produce the total loaded travel time on each roadway segment. Appendix A shows speeds by day by county for each hour of the day. The resulting congested DFX county speeds are listed in Exhibit II-4.

EXHIBIT II-4

REASONABLE FURTHER PROGRESS EMISSIONS INVENTORY
DALLAS-FORT WORTH AREA

AVERAGE MIDWEEK SPEEDS BY FUNCTIONAL CLASSIFICATION

Functional Class	2002	2005	2006	2008	2011	2012	2013
FREEWAYS	61.90	61.89	61.92	61.96	62.02	62.00	61.89
PRINCIPAL ARTERIALS	50.00	50.07	50.12	50.02	49.95	49.95	49.87
MINOR ARTERIALS	45.98	45.96	45.95	46.03	46.00	45.98	45.95
COLLECTORS	35.46	35.44	35.44	36.26	36.22	36.22	36.21
FREEWAY RAMPS	41.90	41.94	42.01	42.52	42.69	42.75	43.05
FRONTAGE ROADS	39.64	39.39	39.38	39.82	40.34	40.40	40.38
HOV LANES	59.73	59.73	59.74	60.05	60.05	60.03	60.31
ROADWAY NETWORK	41.36	41.35	41.36	41.10	41.10	41.11	41.15

Local Street Speeds

The roadway network of the DFX does not contain the details of local (residential) streets. However, a VMT estimate is possible based on data provided by the travel model. Local street VMT is calculated for each county by multiplying the number of intrazonal trips by the intrazonal

trip length and then adding the VMT from the zone centroid connectors. The temporal distribution is assumed to be the same as for non-local streets.

ADJUSTMENTS

Seasonal, Daily, and Hourly Adjustments

The vehicle activity data used for this analysis is representative of August 2008. This section outlines the process used to convert the DFX non-summer weekday (NSWD) activity to summer (June, July, and August) weekday activity.

The Automatic Traffic Recorder (ATR) data for 2008, collected by TxDOT, is used to calculate the necessary conversions. Exhibit II-5 lists the stations used in this analysis.

EXHIBIT II-5

AUTOMATIC TRAFFIC RECORDER STATIONS

Station	Name	Road	County
1	A301 ARLINGTON	US0080	Tarrant
2	S016 JACKSBORO	US0281	Jack
3	S017 DALLAS	US0175	Dallas
4	S026 MCKINNEY	SH0005 S	Collin
5	S027 DENTON	FM0428 S	Denton
6	S040 CORSICANA	IH0045	Navarro
7	S055 DALLAS	SH0183	Dallas
8	S121 MCKINNEY	US0075	Collin
9	S126 DALLAS	IH035E	Dallas
10	S130 FT. WORTH	IH0030	Tarrant
11	S133 TERRELL	US0080	Kaufman
12	S145 TERRELL	IH0020	Kaufman
13	S148 DALLAS	IH035E	Dallas

Station	Name	Road	County
14	S170 DALLAS	IH0635	Dallas
15	S171 DALLAS	IH0635	Dallas
16	S191 DALLAS	IH0020	Dallas
17	S192 ARLINGTON	IH0030	Tarrant
18	S193 FT. WORTH	IH0820	Tarrant
19	S208 WEATHERFORD	IH0020	Parker
20	S220 DALLAS	IH0045	Dallas
21	S221 DALLAS	IH0030	Dallas
22	S237 DALLAS	SS0348	Dallas
23	S122	IH0020	Tarrant
24	S264 WISE	SH0114	Wise

Seasonal and Daily Adjustments

ATR data for August 2008 is organized into five day types: Sunday, Monday, Midweek (Tuesday, Wednesday, and Thursday), Friday, and Saturday. To adjust the representative NSWD weekday data from the DFX to summer weekday, a NSWD to Summer ATR conversion ratio is calculated. The summer portion of the ratio includes traffic volumes recorded between June and August.

Seasonal and daily adjustments for DFX counties are listed in Exhibit II-6.

EXHIBIT II-6

REASONABLE FURTHER PROGRESS EMISSIONS INVENTORY DALLAS-FORT WORTH MODELING DOMAIN 2008 SEASONAL/DAILY ADJUSTMENT FACTORS						
	County Type	**Sunday**	**Monday**	**Midweek**	**Friday**	**Saturday**
DFX Counties (NSWD to Summer)	Core (Dallas/Tarrant)	0.7528	1.0203	1.0203	1.1245	0.9233
	Rural (Collin/Denton)	0.6873	1.0489	1.0489	1.1136	0.8659
	Perimeter (Other Counties)	0.9119	0.9871	0.9871	1.1989	1.0216

Hourly Adjustments

Daily volumes recorded for each of the five day types described above are aggregated by hour to determine the percent of daily traffic occurring during each hour, representing hourly vehicle activity estimates. The DFX county midweek is further detailed by utilizing a time period volume for aggregation, as opposed to the daily volumes provided for the other day types. These time periods correspond to the time periods utilized in the DFX, where, AM Peak is 6:30 a.m. to 8:59 a.m., PM Peak is 3:00 p.m. to 6:29 p.m., and Off-Peak represents all other hours of the day (12:00 a.m. to 6:29 a.m., 9:00 a.m. to 2:59 p.m., and 6:30 p.m. to 11:59 p.m.) Periods split by mid-hour times utilize an equal division of traffic recorded during the hour. Exhibits II-7 shows the hourly adjustments for DFX counties for school and summer season.

EXHIBIT II-7

REASONABLE FURTHER PROGRESS EMISSIONS INVENTORY DALLAS-FORT WORTH MODELING DOMAIN 2008 DFX COUNTY HOURLY ADJUSTMENT FACTORS					
	Sunday	**Monday**	**Midweek**	**Friday**	**Saturday**
12:00 a.m. – 12:59 a.m.	2.49%	1.01%	1.02%	1.08%	2.01%
1:00 a.m. – 1:59 a.m.	1.77%	0.68%	0.68%	0.75%	1.36%
2:00 a.m. – 2:59 a.m.	1.69%	0.65%	0.64%	0.74%	1.28%
3:00 a.m. – 3:59 a.m.	1.09%	0.64%	0.64%	0.68%	0.90%
4:00 a.m. – 4:59 a.m.	0.88%	1.07%	1.03%	0.99%	0.92%
5:00 a.m. – 5:59 a.m.	1.08%	2.79%	2.73%	2.39%	1.48%
6:00 a.m. – 6:29 a.m.	0.82%	2.87%	2.84%	2.47%	1.31%
6:30 a.m. – 6:59 a.m.	0.82%	2.87%	2.84%	2.47%	1.31%
7:00 a.m. – 7:59 a.m.	2.21%	7.02%	6.97%	6.15%	3.46%
8:00 a.m. – 8:59 a.m.	2.91%	6.25%	6.18%	5.59%	4.25%
9:00 a.m. – 9:59 a.m.	4.12%	5.28%	5.20%	4.90%	4.91%
10:00 a.m. – 10:59 a.m.	5.36%	5.04%	4.90%	4.83%	5.52%
11:00 a.m. – 11:59 a.m.	5.81%	5.25%	5.12%	5.20%	6.05%
12:00 p.m. – 12:59 p.m.	6.76%	5.51%	5.36%	5.52%	6.46%
1:00 p.m. – 1:59 p.m.	7.38%	5.58%	5.48%	5.68%	6.54%
2:00 p.m. –2:59 p.m.	7.42%	5.93%	5.82%	6.01%	6.56%
3:00 p.m. – 3:59 p.m.	7.27%	6.59%	6.47%	6.53%	6.60%
4:00 p.m. – 4:59 p.m.	7.11%	7.21%	7.13%	6.87%	6.50%
5:00 p.m. – 5:59 p.m.	6.94%	7.52%	7.40%	6.89%	6.37%
6:00 p.m. – 6:29 p.m.	3.24%	3.03%	3.10%	3.07%	3.02%
6:30 p.m. – 6:59 p.m.	3.24%	3.03%	3.10%	3.07%	3.02%
7:00 p.m. – 7:59 p.m.	5.61%	4.30%	4.55%	5.02%	5.16%
8:00 p.m. – 8:59 p.m.	4.66%	3.33%	3.56%	3.98%	4.35%
9:00 p.m. – 9:59 p.m.	4.00%	2.86%	3.15%	3.58%	4.08%
10:00 p.m. – 10:59 p.m.	3.15%	2.20%	2.45%	3.17%	3.69%
11:00 p.m. – 11:59 p.m.	2.16%	1.51%	1.65%	2.37%	2.90%

Model VMT Adjustments (HPMS Vs DFX)

Consistent with previous emission inventory practices, the DFW MPO used TxDOT's Highway Performance Monitoring System (HPMS) data to adjust modeled VMT to reflect the HPMS data for consistent reporting across the State. This adjustment is based on EPA's guidance for emission inventory development.

To develop the Model VMT adjustment factor, 2004 annual non-summer HPMS VMT was used because 2004 data was used in validation and calibration of the DFX model. Exhibit II-8 shows the comparison of VMT for HPMS and DFX. The adjustment ratio of 0.9695 between the HPMS and DFX data sets is the overall model adjustment factor for vehicle activity applied to model VMT.

EXHIBIT II-8

DALLAS-FORT WORTH AREA 2004 DFX AND HPMS VMT ANALYSIS MODEL VMT ADJUSTMENT FACTOR	
	2004 VMT
HPMS	155,607,158
DFX	160,504,490
HPMS/DFX Ratio	**0.9695**

Non-Recurring Congestion

According to a paper published in the January 1987 ITE Journal by Jeffrey A. Lindley entitled Urban Freeway Congestion: Quantification of the Problem and Effectiveness of Potential Solutions, congestion due to traffic incidents accounts for twice as much as congestion from bottleneck situations. Congestion due to incidents, or nonrecurring congestion, causes emissions not represented in the VMT-based calculations of the base emissions. In order to

include these effects, the delay caused by nonrecurring congestion is added to the freeway travel times and congestion delay due to bottlenecks to obtain an increased freeway travel time, which translates into reduced speed on freeway facilities. Reducing the freeway speeds increases volatile organic compounds (VOC) and nitrogen oxides (NO_X) emissions by 4.9 percent, resulting in a factor of 1.049 for freeway VOC and NO_X emissions in urban and rural counties. This is thought to be a conservative estimate of increased emissions due to nonrecurring congestion. Arterial street emissions are not significantly affected by incidents because alternate routes on the arterial system are generally available. Therefore, this factor is not applied to non-freeway type facilities.

VMT ESTIMATES

The RFP VMT estimates are located in Exhibit II-9 for all counties in the nonattainment area. VMT is summarized by 2002, 2005, 2006, 2008, 2011, 2012, and 2013 model year for each county. Appendix B shows the VMT by county for each hour for all counties.

EXHIBIT II-9

REASONABLE FURTHER PROGRESS EMISSIONS INVENTORY
DALLAS-FORT WORTH NONATTAINMENT AREA

ALL Counties
VEHICLE MILES OF TRAVEL
(Thousands)

	Collin	Dallas	Denton	Ellis	Johnson	Kaufman	Parker	Rockwall	Tarrant	Total
2002	12,911	60,435	11,374	4,369	3,891	3,591	3,155	1,665	37,488	138,880
2005	15,524	63,820	12,827	4,962	4,171	4,446	3,859	1,941	40,104	151,654
2006	16,313	65,301	13,605	5,064	4,153	4,332	3,628	1,951	41,134	155,481
2008	17,368	69,223	15,942	5,816	4,583	4,763	3,882	2,028	44,245	167,851
2011	19,418	74,849	18,048	6,822	5,165	5,414	4,445	2,292	48,622	185,075
2012	20,192	75,495	18,519	7,239	5,344	5,634	4,664	2,322	48,753	188,162
2013	20,897	76,811	19,302	7,538	5,653	5,878	4,851	2,397	50,229	193,556

III. EMISSION FACTOR ESTIMATION PROCEDURE

MOBILE MODEL AND INPUT PARAMETERS

The Environmental Protection Agency's (EPA's) MOBILE6.2 Mobile Source Emission Factor Model is used to develop vehicle emission factors to conduct Reasonable Further Progress (RFP) emission inventory for the Dallas-Fort Worth (DFW) nine-county ozone nonattainment area for analysis years 2002, 2005, ,2006, 2008, 2011, 2012, and 2013. The emission factors are one component in the equation to determine vehicle emissions emitted from the region's on-road vehicles. MOBILE6.2 parameters used to develop emissions inventory are listed in Exhibits III-1 through III-6 with the appropriate data source and/or methodology applied. Exhibit III-7 shows parameters used for eight-hour RFP individual control reduction emission factor ratio development. Information listed applies to all counties unless otherwise specified. Referenced files identifying specific local data are included in Appendix C. MOBILE input files utilizing these parameters and data for each county are included in Appendix D.

EXHIBIT III-1

MOBILE6.2 EXTERNAL CONDITIONS		
Command	**Input Parameter Values**	**Description**
MOBILE Model Version	MOBILE6.2.03	This version was released in November 2003
Calendar Year	2002, 2005, ,2006, 2008, 2011, 2012, and 2013	Analysis Years; Required
Evaluation Month	7	July, representing summer ozone season
Minimum/Maximum Temperature	N/A	See hourly temperatures
Hourly Temperatures	Ozone season temperature	Region specific hourly temperature, provided by TCEQ
Altitude	1	Low altitude; EPA default
Relative Humidity	Ozone season humidity	Region specific hourly humidity, provided by TCEQ
Barometric Pressure	Ozone season pressure	Region specific pressure, provided by TCEQ
ENVIRONMENTAL EFFECTS OF AIR CONDITIONING:	Commands used by MOBILE6.2 to model the extent of vehicle air-conditioning usage.	
CLOUD COVER	0%	EPA default
PEAK SUN	10 a.m. /4 p.m.	EPA default
SUNRISE/SUNSET	7 a.m./8 p.m.	Regionally-specific, provided by TCEQ (http://aa.usno.navy.mil/)

EXHIBIT III-2

MOBILE6.2 VEHICLE FLEET CHARACTERISTICS		
Command	**Input Parameter Values**	**Description**
Registration Distribution	See external files: reg02.*, reg05.*, reg06.*, reg08.* and reg09.*.	County specific July LDV data and area specific July HDV data from TxDOT of corresponding years. LDVs in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties are weighted by County-to-County Worker Flow data from the 2000 census and HDVs from nine counties are summed.
Diesel Fractions	See 02, 05, 06, 08, 11, 12 & 13dieselfractions.txt	1996 EPA defaults applied for light-duty categories and HDBS. Area specific yearly TxDOT registration data used for HDV classes. Rolling window applied to account for analysis year.
Mileage Accumulation Rates	See technical report: M6FLT.007	EPA default; annual mileage accumulation rates by vehicle type and age.
Natural Gas Vehicle (NGV) Fraction	0	EPA defaults.
NGV Emission Factors	None	EPA default; alternate NGV emissions factors for each of the 28 vehicle types, for running and start emissions.

EXHIBIT III-3

MOBILE6.2 ACTIVITY		
Command	**Input Parameter Values**	**Description**
Vehicle Miles of Travel (VMT) Fractions	N/A	POST-PROCESSED. VMT mix fractions are applied to link VMT
VMT By Facility	See technical report: M6.SPD.003	EPA default; VMT fractions by MOBILE6.2 road types are used to combine the four individual road type emissions factors into the “all road types” emissions factors. Data has no impact for this analysis.
VMT By Hour	See external files: hrvmt_*.*	Regionally specific, derived from 2008 ATR data. Specific data sets for midweek (Tues-Thursday).
Speed VMT	N/A	Generated by POLFAC62 utility; No input required.
Average Speed	N/A	Allows a single average speed for combined freeways and arterials for the entire day.
Starts Per Day	See technical report: M6.FLT.003	EPA default; Specifies average number of engine starts per vehicle per day by vehicle types for weekend days and weekdays.
Start Distribution	See technical report: M6.FLT.003	EPA default; allocates engine starts by hour of the day for weekend days and weekdays.
Soak Distribution	See technical reports: M6.FLT.003 and M6.FLT.004	EPA default; alternate vehicle soak duration distributions for weekend days and weekdays.
Hot Soak Activity	See technical reports: M6.FLT.003 and M6.FLT.004	EPA default; specifies a hot soak duration distribution for each of 14 daily time periods for weekend days and weekdays.
Diurnal Soak Activity	See technical report: M6.FLT.006	EPA default; identifies diurnal soak time distributions for each of 18 daily time periods.
Week Day Trip Length Distribution	See external files: 02, 05, 06, 08, 11, 12 & 13wdtrip.*	Regional data derived from the TransCAD Regional Travel Model, distributions applied for a.m. peak (6:00-9:00), p.m. peak (15:00-19:00), and Off-peak.
Weekend Trip Length Distribution	Same values as Week Day Trip Length Distribution; Not Applied	Regional data derived from the TransCAD Regional Travel Model, distributions applied for a.m. peak (6:00-9:00), p.m. peak (15:00-19:00), and Off-peak.
Weekend Vehicle Usage	Flag Activated; No input required	Directs MOBILE6.2 to use weekend activity data for calculating emissions factors.

EXHIBIT III-4

MOBILE6.2 INPUT FILE PARAMETERS
STATE PROGRAMS

Note: Inspection and Maintenance (I/M) Programs and associated Anti-Tampering Programs (ATP) are modeled in a multi-step format to appropriately account for mid-year start dates and varied requirements for particular model year vehicles.

Modeling an ATP for Collin and Denton Counties for analysis year 2002 requires three MOBILE6 input files. This process is utilized in combination with a second multi-step input file equation to account for the mid-year start of the I/M Program. Emission factors from input files a, b, and c, plus a second set, x, y, and z, are calculated as indicated above, then adjusted and combined to account for multiple ATP and mid-year start I/M programs. The basic equations are as follows:

$$\text{Emission Factor } (EF)_{final} = (adj1)(EF_{abc}) + (adj2)(EF_{xyz})$$

where,

$$EF_{abc} = EF_{ATP(a)} + EF_{ATP(b)} - EF_{ATP(c)}$$

$$EF_{xyz} = EF_{ATP(x)} + EF_{ATP(y)} - EF_{ATP(z)}$$

$$adj1 = ((N-1)12 + 8)/12N$$

$$adj2 = 4/12N$$

N = analysis years (Evaluation year - Start year)

For Dallas and Tarrant Counties: one input file (a) models ATP for 1983 model year vehicles. The second file (b) models ATP for post-1983 vehicles. The third file (c) models no ATP. These files are combined as follows:

$$\text{Emission Factor } (EF)_{final} = EF_{ATP(a)} + EF_{ATP(b)} - EF_{ATP(c)}$$

For 2008, 2011, 2012 and 2013 model years Collin, Denton, Ellis, Johnson, Kaufman, Parker, and Rockwall Counties, the above process is utilized with two files. The basic equations are as follows.

$$\text{Emission Factor } (EF)_{final} = (adj1)(EF_{abc}) + (adj2)(EF_{xyz})$$

where,

$$adj1 = ((N-1)12 + 8)/12N$$

$$adj2 = 4/12N$$

N = analysis years (Evaluation year - Start year)

	Input Parameter Values	Description
Stage II Refueling	N/A	Accounted for as an area source category. Allows modeling of at-the-pump refueling emissions.

2002	Anti-Tampering Program (ATP): input files (c) and (z) do not include an ATP program.							
Counties	start year	model years		subject vehicles	test only 1=no 2=yes	frequency 1=annual 2=biennial	compliance rate	checks performed
Dallas/Tarrant (a)	1986	1978	1983	22222 22222222 2	1	1	96%	21112222
Dallas/Tarrant (b)	1986	1984	2000	22222 22222222 2	1	1	96%	22112222
Collin/Denton (a)	2002	1978	1983	22222 22222222 2	1	1	96%	21112222
Collin/Denton (b)	2002	1984	2000	22222 22222222 2	1	1	96%	22112222
Collin/Denton (x)	2003	1978	1983	22222 22222222 2	1	1	96%	21112222
Collin/Denton (y)	2003	1984	2000	22222 22222222 2	1	1	96%	22112222
2005	**Anti-Tampering Program (ATP): input files (c) and (z) do not include an ATP program.**							
Counties	start year	model years		subject vehicles	test only 1=no 2=yes	frequency 1=annual 2=biennial	compliance rate	checks performed
Dallas/Tarrant (a)	1986	1981	1983	22222 22222222 2	1	1	96%	22112222
Dallas/Tarrant (b)	1986	1984	2003	22222 22222222 2	1	1	96%	22112222
Collin/Denton (a)	2002	1981	1983	22222 22222222 2	1	1	96%	22112222
Collin/Denton (b)	2002	1984	2003	22222 22222222 2	1	1	96%	22112222
Collin/Denton (x)	2003	1981	1983	22222 22222222 2	1	1	96%	22112222
Collin/Denton (y)	2003	1984	2003	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (b)	2003	1981	1983	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (y)	2004	1984	2003	22222 22222222 2	1	1	96%	22112222
2006	**Anti-Tampering Program (ATP): input files (c) and (z) do not include an ATP program.**							
Counties	start year	model years		subject vehicles	test only 1=no 2=yes	frequency 1=annual 2=biennial	compliance rate	checks performed
Dallas/Tarrant (a)	1986	1982	1983	22222 22222222 2	1	1	96%	22112222
Dallas/Tarrant (b)	1986	1984	2004	22222 22222222 2	1	1	96%	22112222
Collin/Denton (a)	2002	1982	1983	22222 22222222 2	1	1	96%	22112222
Collin/Denton (b)	2002	1984	2004	22222 22222222 2	1	1	96%	22112222
Collin/Denton (x)	2003	1982	1983	22222 22222222 2	1	1	96%	22112222
Collin/Denton (y)	2003	1984	2004	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (b)	2003	1982	1983	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (y)	2004	1984	2004	22222 22222222 2	1	1	96%	22112222

2008	Anti-Tampering Program (ATP): input files (c) and (z) do not include an ATP program.							
Counties	start year	model years		subject vehicles	test only 1=no 2=yes	frequency 1=annual 2=biennial	compliance rate	checks performed
Dallas/Tarrant (b)	1986	1984	2006	22222 22222222 2	1	1	96%	22112222
Collin/Denton (b)	2002	1984	2006	22222 22222222 2	1	1	96%	22112222
Collin/Denton (y)	2003	1984	2006	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (b)	2003	1984	2006	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (y)	2004	1984	2006	22222 22222222 2	1	1	96%	22112222
2011	Anti-Tampering Program (ATP): input files (c) and (z) do not include an ATP program.							
Counties	start year	model years		subject vehicles	test only 1=no 2=yes	frequency 1=annual 2=biennial	compliance rate	checks performed
Dallas/Tarrant (b)	1986	1987	2009	22222 22222222 2	1	1	96%	22112222
Collin/Denton (b)	2002	1987	2009	22222 22222222 2	1	1	96%	22112222
Collin/Denton (y)	2003	1987	2009	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (b)	2003	1987	2009	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (y)	2004	1987	2009	22222 22222222 2	1	1	96%	22112222
2012	Anti-Tampering Program (ATP): input files (c) and (z) do not include an ATP program.							
Counties	start year	model years		subject vehicles	test only 1=no 2=yes	frequency 1=annual 2=biennial	compliance rate	checks performed
Dallas/Tarrant (b)	1986	1988	2010	22222 22222222 2	1	1	96%	22112222
Collin/Denton (b)	2002	1988	2010	22222 22222222 2	1	1	96%	22112222
Collin/Denton (y)	2003	1988	2010	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (b)	2003	1988	2010	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (y)	2004	1988	2010	22222 22222222 2	1	1	96%	22112222
2013	Anti-Tampering Program (ATP): input files (c) and (z) do not include an ATP program.							
Counties	start year	model years		subject vehicles	test only 1=no 2=yes	frequency 1=annual 2=biennial	compliance rate	checks performed
Dallas/Tarrant (b)	1986	1989	2011	22222 22222222 2	1	1	96%	22112222
Collin/Denton (b)	2002	1989	2011	22222 22222222 2	1	1	96%	22112222
Collin/Denton (y)	2003	1989	2011	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (b)	2003	1989	2011	22222 22222222 2	1	1	96%	22112222
Ellis, Johnson, Kaufman, Parker, and Rockwall (y)	2004	1989	2011	22222 22222222 2	1	1	96%	22112222

EXHIBIT III-4 (continued)

INSPECTION & MAINTENANCE (I/M) COMMANDS: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant I/M data provided by Eastern Research Group.

Note: Multiple I/M external files are required to correctly model the mid-year start date I/M program as discussed above. The values presented below represent the I/M programs with their actual start date. This data is modeled with files designated b and in those without a letter designation. Files designated y include similar data, but with an adjustment made to the start year for Collin, Denton, Ellis, Johnson, Kaufman, Parker, and Rockwall for I/M Programs 1, 2, and 3.

I/M Program	1	2	3	4	5	6	7	Identifies program number when multiple programs are modeled
start year	1990	1990	1990	1996	1996	1996	1996	Dallas and Tarrant Counties
	2002	2002	2002	2000	2000	2000	2000	Collin and Denton Counties (see note above)
	2003	2003	2003	2000	2000	2000	2000	Ellis, Johnson, Kaufman, Parker, and Rockwall Counties (see note above)
end year	2050	2050	2050	2050	2050	2050	2050	Program specifications
frequency	1	1	1	1	1	1	1	Annual testing; program specifications
type	TRC	TRC	TRC	TRC	TRC	TRC	TRC	Computerized test and repair
name	2500/ IDLE	ASM 2525/5015 PHASE-IN	OBD IM	GC	EVAP OBD & GC	GC	EVAP OBD & GC	Exhaust and evaporative; program specifications
I/M Model Years	1950 2050	1950 1995	1996 2050	1950 2006	2007 2050	1950 1995	1996 2050	Program definition; 24 year rolling window, 2-year new car exemption
I/M Vehicles	11111 22222 222 2	22222 11111 111 1	22222 11111 111 1	11111 22222 222 2	11111 22222 222 2	22222 11111 111 1	22222 11111 111 1	All gasoline vehicles tested
I/M Stringency	20.	20.	20.	N/A	N/A	N/A	N/A	Exhaust program only: failure rate for pre 1981 model year vehicles (%)
I/M Compliance	96.							Expected compliance (%)
I/M Waiver Rates	3 3							% waiver rate for pre 1981 vehicles and 1981 and later model year vehicles.
I/M Exemption Age	25							EPA default; age at which a vehicle is no longer subject to mandatory I/M requirements
I/M Grace Period	2							Program definition; age at which a vehicle is first subject to mandatory I/M requirements
I/M Effectiveness	1.0 1.0 1.0							Applies only to exhaust program; optional
I/M Cutpoints	N/A							Optional for exhaust (but required for IM240). Do not use with evaporative.
No I/M Technical Training Course (TTC) Credits	N/A							Optional for exhaust. Do not use with evaporative.
I/M Descriptive File	N/A							Optional for both exhaust and evaporative.

EXHIBIT III-5

MOBILE6.2 FUELS			
Command	**Input Parameter Values**		**Description**
	Core Counties	Perimeter Counties	
Gasoline Sulfur	Not Applied	Not Applied	Allows use of alternate sulfur content for conventional gasoline through calendar year 1999.
Diesel Sulfur	Not Applied	Not Applied	Allows use of avg. diesel fuel sulfur level for all calendar years. Required if PARTICULATES command is used. No affect on HC, CO, NOx or air toxics (except if calculated as ratio to PM).
Fuel Reid Vapor Pressure (RVP)	7.8 (pre-90control) 6.8 psi (control strategy)	7.8 (pre-90control) 7.6 psi(control strategy)	Allows user to specify fuel RVP for area being modeled.
Fuel Program	1 (pre-90control) 4 (control strategy)	1	Core Counties: Reformulated Gasoline (RFG) for southern region; Perimeter Counties: Conventional Gasoline East
Oxygenated Fuels	Not Applied ((pre-90control) Applied (control strategy)	Not Applied	Models effects of oxygenated gasoline on exhaust emissions for all gasoline-fueled vehicle types.
Season	1		EPA default; summer

EXHIBIT III-6

MOBILE6.2 ALTERNATIVE EMISSIONS REGULATIONS AND CONTROL MEASURES		
Command	**Input Parameter Values**	**Description**
No Clean Air Act	APPLIED for Pre-1990 control analyses and individual control ratio development NOT APPLIED for 2002 base year and control strategy analyses.	Models vehicle emissions as if the Federal Clean Air Act Amendments of 1990 had not been implemented.
HDDV NOX OFF-CYCLE EMISSIONS EFFECTS:		
No Defeat Device	N/A	
No NOx Pull Ahead	N/A	
No Rebuild	N/A	
Rebuild Effects	1% for 2002 90% for 2005, 2006, 2008, 2011, 2012 & 2013	Provided by TCEQ
TIER 2 EMISSION STANDARDS AND FUEL REQUIREMENTS: Overrides default Tier 2 emissions standards and fuel requirements settings.		
No Tier2	Applied for individual control ratio development only	Disables Tier 2 requirements.
Tier2 Exhaust Phase-in	N/A	Allows alternate Tier 2 exhaust standard phase-in schedules.
Tier2 Evaporative Phase-in	N/A	Allows alternate Tier 2 evaporative standard phase-in schedules.
Tier2 Certification	N/A	Allows user to specify alternate Tier 2 50,000-mile certification standards.
94+ LDG Implementation	N/A	Applies alternate 1994 and later fleet penetration fractions for LDGVs under the Tier 1, NLEV (or California LEV 1), and Tier 2 emissions standard programs.
No 2007 HDDV Rule	Applied for 2008, 2011, 2012, and 2013 for ratio development only.	Disables 2007 Heavy Duty Diesel Vehicle emissions standards.

EXHIBIT III-7

DFW 8-HOUR RFP CONTROL STRATEGY START YEAR SUMMARY FOR DFW 8-HOUR RFP INDIVIDUAL CONTROL REDUCTION EMISSION FACTOR RATIO DEVELOPMENT				
Rule Description	**Strategy Notes**	**Start Year**	**Individual Control Scenario**	**Input Files**
Pre-1990 FMVCP	Pre-1990 Control	Pre-1990	Pre-1990	PR90
1992 Federal Controls on Gasoline Volatility	Pre-1990 Control Max RVP 7.8 psi	1992	Pre-1990	
ATP (Dallas and Tarrant only)		1986	1	A
I/M Program (Dallas and Tarrant Only)		1990		
FMVCP Tier 1		1994	2	B
Federal Reformulated Gasoline (RFG) Model only Phase 2	Use EPA method to model rather than RFG toggle. Applied for Collin, Dallas, Denton, & Tarrant Counties	1995 (Phase 1) 2000 (Phase 2)	3	C
NLEV		2001	4	D
Expanded I/M and ATP	Collin and Denton	2002	5	E
	Johnson, Kaufman, Parker, Rockwall, Ellis	2003		
FMVCP Tier 2	Phase in 2004 to 2009	2004	6	F
Texas Low-Emission Diesel	15 ppm maximum sulfur Low aromatic HC and high cetane number to control NOx. Post Processing of LED Fractions.	2006	7	G
Federal Low-Sulfur Highway Diesel	15 ppm maximum sulfur content. No benefits for HC, CO & NOx	2006	8	CS
FMVCP - Heavy-Duty 2007	Phase in 2007 to 2010. Add Heavy-Duty 2007 Program to the IM descriptive File.	2007	8	
Adjusted Base Year	Model runs with Pre-90 controls and 2002 VMT	NA	9	ABY

AREA SPECIFIC CALCULATIONS AND PROCEDURES

Vehicle Registration Distribution

Vehicle age distributions are calculated from the Texas Department of Transportation (TxDOT) vehicle registration data. July data sets of corresponding analysis years are utilized for light- and heavy-duty vehicle classes. MOBILE6.2 default values are used for bus categories. Light-duty registration data for Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties are weighted for commute patterns with the County-to-County Worker Flow data from the 2000 Census. Exhibit III-8 identifies the percentages applied for this weighted adjustment. The nine-county summed heavy-duty vehicle data is used for developing the heavy-duty registration portion for EPA vehicle heavy-duty vehicle class 2b through heavy-duty vehicle class 8b. External registration distribution files are named reg and reg_w, followed by a three-letter suffix corresponding to the county name. These files are included in Appendix C.

EXHIBIT III-8

COUNTY-TO-COUNTY WORKER FLOW												
Residence County	County of Employment											
	Collin	Dallas	Denton	Ellis	Johnson	Kaufman	Parker	Rockwall	Tarrant	Wise	Hood	Hunt
Collin	63.80%	12.14%	3.23%	0.09%	0.04%	0.19%	0.13%	0.74%	0.54%	0.00%	0.00%	0.31%
Dallas	6.07%	23.41%	2.09%	0.62%	0.13%	0.57%	0.09%	0.81%	1.84%	0.02%	0.02%	0.17%
Denton	8.28%	10.87%	71.72%	0.17%	0.06%	0.08%	0.15%	0.07%	2.76%	0.29%	0.04%	0.08%
Ellis	1.45%	10.96%	0.44%	91.86%	1.89%	0.42%	0.04%	0.15%	2.17%	0.00%	0.02%	0.05%
Johnson	0.43%	1.97%	0.88%	4.22%	91.16%	0.10%	1.13%	0.07%	17.88%	0.10%	0.73%	0.06%
Kaufman	2.36%	12.70%	0.86%	1.06%	0.06%	89.60%	0.06%	2.67%	0.72%	0.00%	0.00%	0.43%
Parker	0.35%	1.02%	1.30%	0.26%	0.86%	0.00%	87.00%	0.00%	20.05%	1.56%	1.62%	0.02%
Rockwall	8.53%	13.66%	0.95%	0.23%	0.39%	4.07%	0.00%	83.69%	0.54%	0.00%	0.07%	4.23%
Tarrant	0.69%	5.20%	2.18%	0.45%	1.20%	0.06%	0.77%	0.05%	31.27%	0.13%	0.16%	0.05%
Wise	0.56%	1.71%	14.99%	0.26%	0.34%	0.06%	5.61%	0.00%	11.42%	97.90%	0.04%	0.00%
Hood	0.17%	1.17%	0.70%	0.49%	3.81%	0.04%	4.95%	0.00%	10.54%	0.00%	97.26%	0.00%
Hunt	7.30%	5.21%	0.65%	0.27%	0.04%	4.80%	0.07%	11.75%	0.27%	0.00%	0.05%	94.62%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: 2000 Census

Diesel Fractions

Diesel fractions for heavy-duty vehicle categories utilized twelve-county summed yearly July registration data for modeling 2002, 2005, 2006 & 2008 analysis years. July 2009 registration data is used for modeling 2011, 2012, and 2013 analysis years. Light-duty and bus categories utilize MOBILE6.2 default values. The 02, 05, 06, 08, 11, 12 and 13diesel fractions.txt files included in Appendix C, lists specific data used for this analysis.

Hourly Vehicle Miles of Travel

Hourly percentages of Vehicle Miles of Travel (VMT) are calculated from the 2008 TxDOT Automatic Traffic Recorder (ATR) Factors. Approximately twenty-four stations in the Fort Worth and Dallas districts supplied data for this analysis. Daily volumes recorded by the ATR for a set of mid-week days in June, July and August are aggregated by hour to determine the percent of daily traffic occurring during each hour. The external hourly VMT data files are included in Appendix C.

Trip Length Distributions

The Dallas-Fort Worth Expanded Travel Model (DFX) is used to identify the fraction VMT that occurs within time periods (AM Peak, PM Peak, or Off-Peak) that are in 10-minute intervals of 10 minutes or less, 11 to 20 minutes, 21 to 30 minutes, 31 to 40 minutes, 41 to 50 minutes, and 51 minutes or longer. The VMT fractions within these 10-minute intervals are aggregated within the time period to determine the trip length distributions for AM Peak, PM Peak, and Off-Peak. AM Peak distributions are applied from 6 a.m. to 9 a.m., PM Peak distributions are applied from 3 p.m. to 7 p.m., and Off-Peak distributions are applied from 9 a.m. to 3 p.m., and 7 p.m. to 6 a.m. The same trip length distributions are utilized for all 12 counties for weekdays and weekends. Three equivalent trip length files are included in Appendix C.

MOBILE6.2 EMISSION FACTORS

MOBILE6.2 emission factors for all the control scenarios previously are reported in Appendix E.

ADJUSTMENTS

Adjustments are applied to the emission factors in a post-process step. These adjustments are Inspection and Maintenance (I/M) and Anti-Tampering Programs (ATP), Low Emission Diesel (LED) NO_X Adjustment, and Motorcycle Rule benefits. VMT Mix adjustment is applied simultaneously with the emission calculation procedure discussed in Chapter IV.

Inspection/Maintenance and Anti-Tampering Programs

I/M Programs and associated ATPs are modeled in a multi-step format to appropriately account for mid-year start dates. To model 2008, 2011, 2012, and 2013 for Collin, Denton, Ellis, Johnson, Kaufman, Parker, and Rockwall Counties: One input file (b) models I/M and ATP for the actual year the program began. The second file (y) models I/M and ATP for the following year. These files are then adjusted and combined as follows:

$$EmissionFactor(EF)_{Final} = (adj1)(EF_b) + (adj2)(EF_y)$$

Where,

EF_b = Emission factor modeled with actual I/M and ATP start year
EF_y = Emission factor modeled with I/M and ATP start year +1
adj1 = ((N-1)12 + 8)/12N
adj2 = 4/12N
N = analysis years (analysis year –start year)
Analysis year = 2012
Start year
= 2002 (Collin and Denton Counties)
= 2003 (Ellis, Johnson, Kaufman, Parker, and Rockwall Counties)

To model 2002, 2005 & 2006 ATP, three input files are required. One input file (a) models ATP for 1983 model year vehicles. The second file (b) models ATP for post-1983 vehicles. The third

file (c) models no ATP. This process is utilized in combination with a second multi-step input file equation to account for the mid-year start of the I/M Program. Emission factors from input files a, b, and c, plus a second set, x, y, and z, are calculated as indicated above, then adjusted and combined to account for multiple ATP and mid-year start I/M programs. The basic equations are as follows:

$$\text{Emission Factor } (EF)_{final} = (adj1)(EF_{abc}) + (adj2)(EF_{xyz})$$

where,

$$EF_{abc} = EF_{ATP(a)} + EF_{ATP(b)} - EF_{ATP(c)}$$

$$EF_{xyz} = EF_{ATP(x)} + EF_{ATP(y)} - EF_{ATP(z)}$$

$$adj1 = ((N-1)12 + 8)/12N$$

$$adj2 = 4/12N$$

N = analysis years (Evaluation year - Start year)

Exhibit III-9 lists the calculated I/M adjustments applied for this analysis.

EXHIBIT III-9

INSPECTION AND MAINTENANCE PROGRAM ADJUSTMENTS				
	Collin and Denton		Ellis, Johnson, Kaufman, Parker, and Rockwall	
MODEL YEARS	Adj1	Adj2	Adj1	Adj2
2002	0.6667	0.3330	-	-
2005	0.8889	0.1111	0.8333	0.1667
2006	0.9167	0.8333	0.8889	0.1111
2008	0.9444	0.0556	0.9333	0.0667
2011	0.9630	0.0370	0.9583	0.0417
2012	0.9667	0.0333	0.9630	0.0370
2013	0.9697	0.0303	0.9667	0.0333

Low Emission Diesel (LED) NO_X Adjustment

NO_X emission factors for diesel vehicle classes are adjusted to apply the federal low emission diesel program. Exhibit III-10 lists the calculated LED adjustment factors for 2006, 2008, 2011, 2012 and 2013 analysis years.

EXHIBIT III-10

LED NO_X Adjustments							
Vehicle Class	Adjustment Factors						
	2002	2005	2006	2008	2011	2012	2013
LDDV	-	-	0.9386	0.9396	0.9405	0.9419	0.9426
LDDT12	-	-	0.9380	0.9380	0.9380	0.9380	0.9380
HDDV2b	-	-	0.9489	0.9492	0.9507	0.9503	0.9508
HDDV3	-	-	0.9458	0.9477	0.9498	0.9496	0.9497
HDDV4	-	-	0.9434	0.9449	0.9470	0.9470	0.9471
HDDV5	-	-	0.9441	0.9453	0.9470	0.9470	0.9466
HDDV6	-	-	0.9434	0.9454	0.9473	0.9475	0.9478
HDDV7	-	-	0.9427	0.9441	0.9464	0.9465	0.9470
HDDV8a	-	-	0.9408	0.9417	0.9436	0.9441	0.9445
HDDV8b	-	-	0.9416	0.9431	0.9481	0.9489	0.9493
HDDBT	-	-	0.9413	0.9424	0.9440	0.9446	0.9454
HDDBS	-	-	0.9413	0.9420	0.9428	0.9426	0.9427
LDDT34	-	-	0.9444	0.9451	0.9476	0.9480	0.9481

TXLED adjustment factors do not apply to 2002 & 2005 analysis years.

Motor Cycle Emission Adjustment for NO_X and VOC

Motor Cycle emission rate reductions for NO_X and VOC are applied from EPA's default values.

Exhibit III-11 lists the appropriate adjustment for each pollutant type and analysis years.

EXHIBIT III-11

Motor Cycle Adjustment Factors							
Emission Type	Adjustment Factors						
	2002	2005	2006	2008	2011	2012	2013
NOx (Exhaust)	-	-	0.9873	0.9349	0.8321	0.7792	0.7298
VOC (Exhaust)	-	-	0.9920	0.9507	0.8664	0.8199	0.7715
VOC (Evaporative Resting Loss)	-	-	1.0000	0.9266	0.7121	0.6442	0.5764

Vehicle Miles of Travel Mix (or Fractions)

VMT Mix is applied to the emission factors in a post-process methodology. The VMT mix enables assignment of emission factors by vehicle type to a total volume to calculate emissions on a link or functional class. VMT mix is estimated for freeways, arterials, collectors and high occupancy vehicle (HOV) lanes for three time periods and each of the following three areas: DFX Urban Counties (Dallas and Tarrant), DFX Rural Counties (Collin and Denton), and Perimeter Counties (Ellis, Johnson, Kaufman, Parker, and Rockwall). These county groupings were determined by the vehicle activity behavior and demographics of the counties.

Vehicle counts reported in the 2008 TxDOT Vehicle Classification Report provide a base for the distribution of vehicles by type and functional class for the freeway, arterial, and collector VMT Mixes. The number of vehicles in each of the twelve axle-based categories are combined into intermediate groups, and then disaggregated into 28 vehicle types by applying appropriate TxDOT registration data, and/or MOBILE6 defaults. Exhibit III-11 outlines this process. For each functional class, the values are aggregated across the total vehicles to determine the fraction of vehicles from each class. Motorcycles are allocated as 0.1 per cent for each functional class, subtracted from the Light-Duty Gasoline Vehicles category.

EXHIBIT III-12

VEHICLE CLASSIFICATION PROCESS						
Axle-Based Vehicle Classifications		**Intermediate Groups**		**Detailed Groups**		
C	Passenger Vehicles	PV	Passenger Vehicles	Light-Duty Vehicle (LDV)	Light-Duty Gas Vehicle (LDGV)*	
					Light-Duty Diesel Vehicle (LDDV)*	
					Motorcycle (MC)^	
P	2 Axle, 4 Tire Single Unit			Light-Duty Truck (LDT)	LLDT*	LDGT1*
						LDGT2*
					LDDT*	LDDT12*
						LDDT34*
B	Buses	Bus	Buses	Heavy-Duty Diesel Bus – Transit (HDDBT)*		
				Heavy-Duty Diesel Bus – School (HDDBS)*		
				Heavy-Duty Gas Bus (HDGB)*		
SU2	2 Axle, 6 Tire Single Unit	HDV	Heavy-Duty Vehicles	Heavy-Duty Gas Vehicle (HDGV)		HDGV2b
						HDGV3
						HDGV4
						HDGV5
SU3	3 Axle, Single Unit					HDGV6
						HDGV7
						HDGV8a
						HDGV8b
SU4	4+ Axle, Single Unit			Heavy-Duty Diesel Vehicle (HDDV)		HDDV2b
						HDDV3
						HDDV4
SE4	3 or 4 Axle, Single Trailer					HDDV5
						HDDV6
						HDDV7
						HDDV8a
SE5	5 Axle, Single Trailer	HDX	Heavy-Duty Diesel Vehicles – HDDV8b	HDDV8b		
SE6	6+ Axle, Single Trailer					
SD5	5 Axle, Multi Trailer					
SD6	6 Axle, Multi Trailer					
SD7	7+ Axle, Multi Trailer					

Source: Dallas/Fort Worth Ozone Nonattainment Area SIP Support, 2003, TTI

* Categories calculated using MOBILE6 defaults
^ Motorcycles are allocated as 0.1 percent for each functional class, subtracted from the Light-Duty Gasoline Vehicles category.

This “temporary” VMT mix calculation is then redistributed using local truck and non-truck splits identified by the DFX model. This process is performed for each of the three functional classes and three time periods, where AM peak is 6:30 a.m. – 9:00 a.m., PM peak is 3:00 p.m. – 6:30 p.m., and Off-Peak represents all other hours of the day. Motorcycles, light-duty vehicles, and two axle light-duty trucks are classified as non-trucks. Trucks and heavy-duty vehicles with three axles or more, to include buses, are defined as trucks.

A HOV VMT Mix was developed to better represent the restrictions currently applied to the HOV lanes in the DFW area. No heavy-duty trucks are allowed on the HOV lanes during operational hours. The only vehicles allowed are motorcycles, cars, light-duty trucks, and buses. The HOV VMT Mix was calculated from twelve months of observed data between May 2003 and April 2004, the latest detailed data available at the time of this analysis. The data was collected from the Dallas Area Rapid Transit HOV system and provides a breakdown of observed vehicles by carpools, vanpools, and buses. Similarly a tollway mix was developed using toll data from North Texas Toll Authority to better represent vehicle mix on the DFW toll system.

IV. EMISSION CALCULATION PROCEDURE

Emissions estimates are calculated using the EmiLink tool developed by the North Central Texas Council of Governments (NCTCOG). This tool combines vehicle activity and emissions factors to create emissions estimates. Different procedures were applied for the Dallas-Fort Worth Expanded Travel Model (DFX) counties that are outlined in the following sections.

EMILINK

EmiLink provides three main advantages for the creation of the link emissions files. It provides a stream-lined process to go from the MOBILE6.2 Emission Factor files to the emissions output. It provides consistency in results by always incorporating Highway Performance Monitoring System (HPMS) and Automatic Traffic Recorder (ATR) factors into the calculation of volume and vehicle miles of travel (VMT). It also provides a graphical user interface developed in Microsoft Visual Basic for specifying the inputs; this is a more user-friendly interface than the text-based Job Control Format (JCF). Because of these advantages, EmiLink has successfully made the creation of the link-emissions files simpler and consistent.

In order to understand how to use EmiLink, the following sections present the input files, methodology, and output files of EmiLink.

EmiLink Inputs

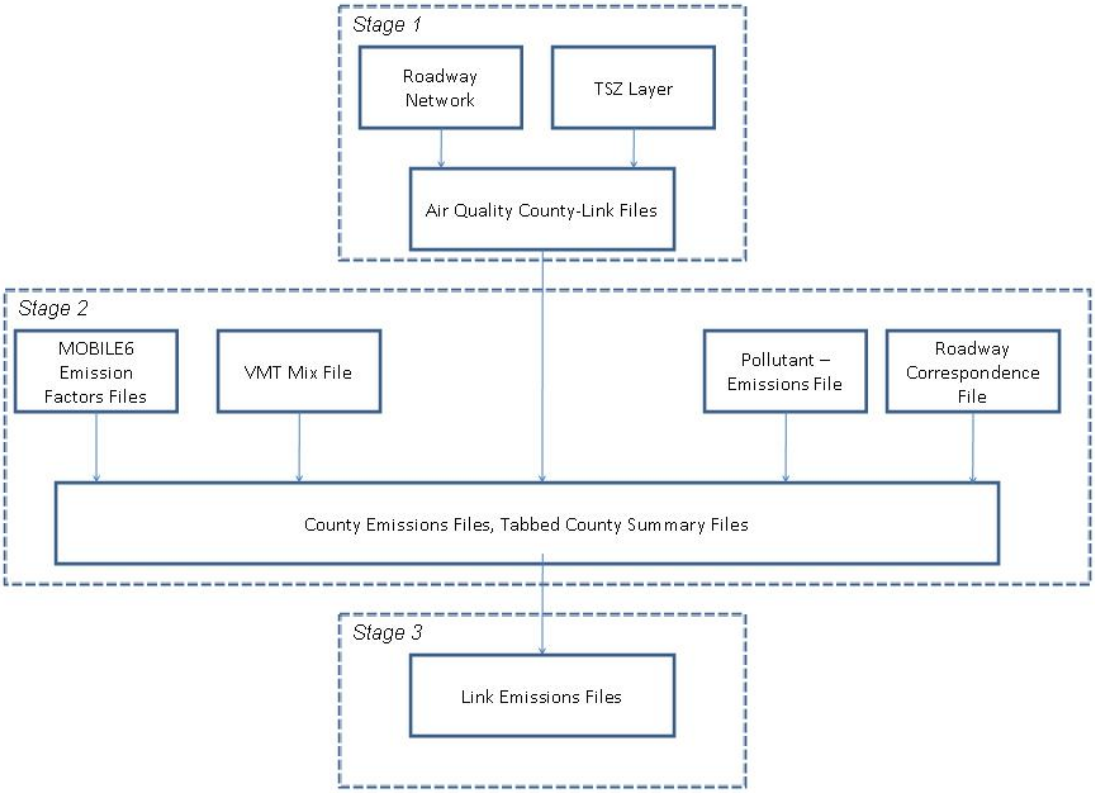
Inputs for EmiLink include emission factors calculated using the United State Environmental Protection Agency (EPA) MOBILE6.2, a roadway correspondence file, a roadway network file, vehicle speed, and VMT calculated by the DFX, and other supplementary files such as VMT mix.

EmiLink Methodology

EmiLink runs in three stages. In the first stage, it processes output of the DFX model run to generate a file that lists each direction of a roadway link, for each of the 26 time-of-day (TOD) periods with the functional class, county, speed, length, VMT, and volume. In the second stage, EmiLink calculates emissions for each pollutant for both directions of each link and generates tabulated files for each county. In the third stage, EmiLink aggregates output from stage two into daily and annual Link Emissions files. The general flow of inputs and outputs is shown in EXHIBIT 1. This section will discuss the calculations performed in each stage.

EXHIBIT IV-1

THREE STAGES IN EMILINK



Stage One

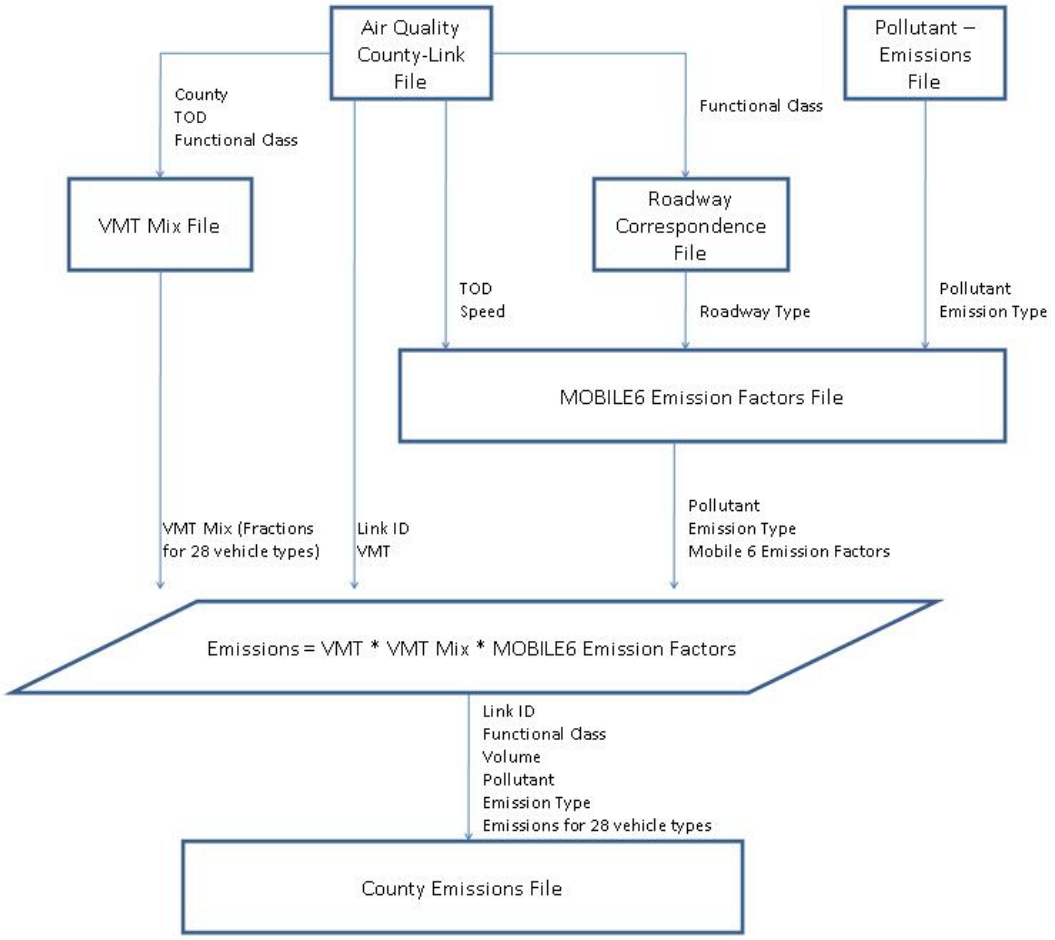
In stage one, the program generates a record of each direction of a link for each time of day in the air quality county-link files; one file is created for each of the nine counties in the modeling area. Each record contains the link ID, endpoints of the link, the time of day, the county where the link is located, the functional class of the link, speed, VMT, and corresponding Traffic Survey Zone (TSZ). There are 26 TOD periods: 22 of the TOD periods are hours, and the remaining four periods are half-hour periods representing parts of the hours that transition between peak and off-peak periods. To accurately represent the VMT and speed during these transitional hours, each of these hours are represented as two half-hour time of day periods.

Stage Two

In stage two, the program calculates emissions for each record of each county-link file produced in stage one for each pollutant-emission type pair. The process uses the air quality county-link files, the VMT mix file, the roadway emission correspondence file, the pollutant-emission type file, and MOBILE6.2 emission factor files. The process of converting these files into county emission files for each county is outlined in EXHIBIT 2**.** The main output files of this stage are nine county files containing pollutant emissions for 28 vehicle types for each direction of a link for each TOD. In addition, an emission summary file is created for each county.

EXHIBIT 2

USING STAGE 2 INPUTES TO CREATE COUNTY EMISSIONS FILES



Stage Three

In stage three, EmiLink calls a Geographic Information System Developer Kit (GISDK) module in TransCAD to concatenate all nine county files created in stage two. Then, the module matches the link IDs within the files with links in the original roadway network file and aggregates the emissions, volume, and VMT for each link. The aggregation of all rows corresponding to a link is simply the sum of the values. For example, the aggregate volume of a link is the sum of the volumes for all rows with the same link ID, and the aggregate pollutant

emissions of a link are the sum of the emissions for that pollutant for all rows with the same link ID. The resulting file contains the link ID, functional class, volume, VMT, and daily emissions for each pollutant. This file is called the daily Link-Emissions file.

The annual Link-Emissions file is also created by multiplying the volume, VMT, and daily emissions for each pollutant in the daily Link-Emissions file by 365. The details of the output files are documented in the next section

Output Files

EmiLink output files include the daily Link-Emissions file, the annual Link Emissions file, the County Totals file, the Air Quality Report Information file, the Error Log file, and the Link Emissions Bin file. The main outputs of EmiLink are the daily and annual Link-Emissions files, which list the daily and annual emissions for each link respectively. In addition, the County Totals files generated after stage two summarize the link emissions by pollutant, TOD, and functional class. EmiLink also creates supplementary output files which include reports and logs that list input settings and intermediate stage output. The main output files are described in the sections below.

Daily Link-Emissions File

The daily Link-Emission File is a Dbase file which lists each link in the roadway network along with corresponding functional class, volume, VMT, and total pounds of emissions for each pollutant occurring each day. The total pounds of emission for each pollutant equals the total pounds of emissions from all vehicle classes for the emission type “Composite.” An example of the daily Link-Emission file is shown in EXHIBIT 3.

EXHIBIT 3

DAILY LINK EMISSION FILE EXAMPLE

Dataview1 - 07LINKPOLLUTANTDAILY

LINK_ID	FUNCL	VOLUME	VMT	SO4	OCARBON	ECARBON	PMTOTAL
4	3	833.7400	2334.4300	0.0016672448	0.0127499286	0.0280800937	0.0424972693
12	3	968.5600	1423.7300	0.0010136589	0.0075660506	0.0166416531	0.0252213639
33	2	11598.1000	23080.2500	0.0164843853	0.1260916629	0.2777043815	0.4202804514
35	3	1142.3800	1724.9900	0.0012257959	0.0090110446	0.0198034393	0.0300402814
63	3	4729.2800	9978.7800	0.0071239661	0.0543115531	0.1195947821	0.1810303107
373	3	2466.7600	6857.4900	0.0048892277	0.0368980459	0.0812060703	0.1229933504
501	2	12336.5400	40463.7900	0.0288846088	0.2200363724	0.4845028297	0.7334238490
1167	2	17613.0600	35930.5600	0.0267512101	0.1971530692	0.4342983749	0.6582026880
2969	4	829.6300	813.0400	0.0008510300	0.0038658155	0.0090316367	0.0137484823
3316	4	6764.6300	5141.1000	0.0053189338	0.0278278245	0.0656997580	0.0988465169
3460	4	2785.8700	1086.4900	0.0013638178	0.0055904145	0.0131468626	0.0201010951
3485	2	25585.8600	57824.0900	0.0510847314	0.5644883142	1.4039490009	2.0195220561
4268	1	29591.0900	29295.1900	0.0288155697	0.5470463805	1.4954162243	2.0712781816
4283	6	1975.8600	414.9200	0.0003532982	0.0041083002	0.0102237017	0.0146853002
4284	7	97.5300	142.4100	0.0001083426	0.0006175135	0.0014305935	0.0021564496
4285	3	22967.5700	14010.2000	0.0139476872	0.1379719515	0.3432747059	0.4951943470
4324	1	32342.9200	9056.0200	0.0089001319	0.1686176763	0.4609073169	0.6384251272
4349	7	6634.6400	2587.5100	0.0020171286	0.0143555563	0.0339549000	0.0503275853
4613	3	5556.2600	3944.9600	0.0033354316	0.0381357745	0.0948099973	0.1362812042
5218	4	5.1400	9.1000	0.0000071390	0.0000393159	0.0000910513	0.0001375062
5867	3	3483.7700	8465.5300	0.0070965875	0.0799040508	0.1984525202	0.2854531599
5923	3	1187.9900	3920.4500	0.0032997547	0.0378703631	0.0941472282	0.1353173467
6365	3	5490.6400	5216.1100	0.0043834921	0.0499428687	0.1241144328	0.1784407944
8136	3	7979.2700	27927.4000	0.0243239841	0.2717150582	0.6726209033	0.9686599481
8730	3	6942.9200	5970.8700	0.0051405061	0.0593459590	0.1470523908	0.2115388564
9138	4	1175.7800	1293.3400	0.0012768382	0.0060291107	0.0139150967	0.0212210456
9261	7	35.8700	23.3200	0.0000182488	0.0001100264	0.0002542453	0.0003825206
9262	6	4553.0800	637.4300	0.0005520669	0.0063027282	0.0156137429	0.0224685380
9285	6	3540.2300	601.8400	0.0005210118	0.0059354801	0.0147022333	0.0211587253
9286	7	0.0000	0.0000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
9371	1	18479.4000	9424.4900	0.0094038721	0.1763838290	0.4811446076	0.6669323102

County Totals Files

The County Totals text files are tab-delimited files that list the daily volume, VMT, and pounds of emissions for each pollutant for each functional class for each TOD period within a 24-hour period.

V. SUMMARY OF VEHICLE MILES OF TRAVEL, SPEED, AND EMISSIONS

Summary emissions results are available in this chapter.

VEHICLE MILES OF TRAVEL (VMT) ESTIMATES

Appendix B shows the summarized VMT estimates by the analysis year and time-of-day (TOD) for the counties.

SPEED ESTIMATES

Appendix A shows the summarized speeds by the analysis year and TOD for the counties.

EMISSION ESTIMATES

The final county emission estimates for each analysis year and control scenarios are summarized in Exhibit V-1 through Exhibit V-7. Appendix H shows the detailed emissions by pollutant, day and TOD for all counties.

Appendix G contains the detailed tab summary of VMT, speeds, and emissions for all counties by analysis year, control scenarios, TOD, functional class, and vehicle type.

EXHIBIT V-1

2002 RFP EMISSION INVENTORY
DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN
SUMMER SEASON, MIDWEEK
ON ROAD EMISSIONS (TONS/DAY)

VOLATILE ORGANIC COMPOUNDS (VOC)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
BY	12.49	61.50	11.34	5.46	5.07	4.68	4.36	1.91	38.07	144.88
PRE90	17.47	91.64	15.68	6.27	5.86	5.33	4.96	2.23	56.61	206.06
A	17.47	80.30	15.68	6.27	5.86	5.33	4.96	2.23	49.52	187.63
B	15.34	71.62	13.85	5.72	5.31	4.90	4.56	2.01	44.33	167.63
C	13.46	62.76	12.19	5.64	5.22	4.82	4.49	1.98	38.88	149.44
D	13.17	61.50	11.95	5.52	5.11	4.72	4.40	1.93	38.07	146.37
E	12.49	61.50	11.34	5.52	5.11	4.72	4.40	1.93	38.07	145.07

CARBON MONOXIDE (CO)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
BY	182.14	815.47	162.65	84.07	73.97	71.32	64.49	29.07	518.51	2,001.68
PRE90	241.62	1,194.35	214.51	93.90	82.57	79.40	71.51	32.80	759.36	2,770.03
A	241.62	1,014.55	214.51	93.90	82.57	79.40	71.51	32.80	644.72	2,475.59
B	214.80	917.24	191.23	84.53	74.36	71.67	64.83	29.20	582.69	2,230.55
C	191.36	806.83	171.02	84.48	74.32	71.63	64.79	29.19	512.43	2,006.04
D	193.09	815.47	172.43	85.27	75.00	72.30	65.35	29.50	518.51	2,026.93
E	182.14	815.47	162.65	85.27	75.00	72.30	65.35	29.50	518.51	2,006.20

OXIDES OF NITROGEN (NOx)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
BY	23.27	123.58	23.29	17.13	10.53	13.34	11.48	6.40	77.79	306.82
PRE90	29.38	156.03	28.90	19.46	12.10	15.16	13.06	7.28	98.03	379.40
A	29.38	147.62	28.90	19.46	12.10	15.16	13.06	7.28	92.89	365.86
B	24.94	127.86	24.75	17.18	10.58	13.38	11.51	6.42	80.44	317.07
C	24.05	124.05	23.98	17.17	10.57	13.37	11.51	6.42	78.07	309.19
D	23.95	123.58	23.89	17.18	10.57	13.38	11.51	6.42	77.79	308.27
E	23.27	123.58	23.29	17.18	10.57	13.38	11.51	6.42	77.79	306.99

CARBON DIOXIDE (CO2)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
BY	6,534	31,516	5,879	2,638	2,186	2,141	1,851	1,015	19,567	73,327
PRE90	6,534	31,516	5,879	2,638	2,186	2,141	1,851	1,015	19,567	73,327
A	6,534	31,516	5,879	2,638	2,186	2,141	1,851	1,015	19,567	73,327
B	6,534	31,516	5,879	2,638	2,186	2,141	1,851	1,015	19,567	73,327
C	6,534	31,516	5,879	2,638	2,186	2,141	1,851	1,015	19,567	73,327
D	6,534	31,516	5,879	2,638	2,186	2,141	1,851	1,015	19,567	73,327
E	6,534	31,516	5,879	2,638	2,186	2,141	1,851	1,015	19,567	73,327

EXHIBIT V-2

2005 RFP EMISSION INVENTORY
DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN
SUMMER SEASON, MIDWEEK
ON ROAD EMISSIONS (TONS/DAY)

VOLATILE ORGANIC COMPOUNDS (VOC)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
CS	10.29	50.05	8.58	3.72	3.71	3.46	3.13	1.37	30.25	114.56
PRE90	20.29	92.18	16.73	6.20	5.96	5.69	5.13	2.36	56.14	210.68
A	20.29	83.00	16.73	6.20	5.96	5.69	5.13	2.36	50.64	196.01
B	16.05	67.63	13.32	5.16	5.02	4.77	4.30	1.93	41.23	159.42
C	12.75	53.97	10.60	5.10	4.97	4.72	4.25	1.90	32.83	131.10
D	12.09	51.68	10.06	4.80	4.72	4.45	4.01	1.78	31.37	124.97
E	10.71	51.68	8.93	4.32	4.23	4.01	3.61	1.60	31.37	120.46
F	10.29	50.05	8.58	3.72	3.71	3.46	3.13	1.37	30.25	114.56

CARBON MONOXIDE (CO)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
CS	142.5	639.4	117.8	51.9	47.0	48.4	42.6	18.9	400.4	1,509.0
PRE90	272.9	1,194.8	225.4	94.5	82.6	87.0	75.9	34.8	754.4	2,822.2
A	272.9	1,050.5	225.4	94.5	82.6	87.0	75.9	34.8	665.9	2,589.4
B	220.9	872.2	182.6	76.3	68.6	71.0	62.2	27.9	548.8	2,130.6
C	172.9	669.8	143.1	76.3	68.6	71.0	62.2	27.9	420.6	1,712.4
D	170.2	660.3	140.8	76.7	68.9	71.4	62.6	28.1	414.7	1,693.7
E	147.9	660.3	122.2	68.6	61.1	63.7	55.8	25.1	414.7	1,619.4
F	142.5	639.4	117.8	51.9	47.0	48.4	42.6	18.9	400.4	1,509.0

OXIDES OF NITROGEN (NOx)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
CS	21.67	93.91	20.14	13.11	8.27	11.09	9.65	4.82	59.42	242.08
PRE90	33.62	142.17	30.53	18.48	11.97	15.69	13.68	6.82	90.10	363.06
A	33.62	132.45	30.53	18.48	11.97	15.69	13.68	6.82	84.19	347.42
B	27.08	108.84	24.59	14.79	9.72	12.60	10.98	5.47	69.15	283.21
C	24.95	100.40	22.85	14.78	9.71	12.59	10.97	5.46	63.75	265.46
D	24.39	98.26	22.39	14.85	9.76	12.65	11.02	5.49	62.39	261.20
E	22.73	98.26	21.02	14.26	9.19	12.11	10.53	5.27	62.39	255.76
F	21.67	93.91	20.14	13.11	8.27	11.09	9.65	4.82	59.42	242.08

CARBON DIOXIDE (CO2)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
CS	7,866	32,487	6,643	2,956	2,324	2,612	2,239	1,159	20,454	78,741
PRE90	7,866	32,487	6,643	2,956	2,324	2,612	2,239	1,159	20,454	78,741
A	7,866	32,487	6,643	2,956	2,324	2,612	2,239	1,159	20,454	78,741
B	7,866	32,487	6,643	2,956	2,324	2,612	2,239	1,159	20,454	78,741
C	7,866	32,487	6,643	2,956	2,324	2,612	2,239	1,159	20,454	78,741
D	7,866	32,487	6,643	2,956	2,324	2,612	2,239	1,159	20,454	78,741
E	7,866	32,487	6,643	2,956	2,324	2,612	2,239	1,159	20,454	78,741
F	7,866	32,487	6,643	2,956	2,324	2,612	2,239	1,159	20,454	78,741

EXHIBIT V-3

2006 RFP EMISSION INVENTORY
DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN
SUMMER SEASON, MIDWEEK
ON ROAD EMISSIONS (TONS/DAY)

VOLATILE ORGANIC COMPOUNDS (VOC)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
PRE90	21.75	96.45	17.99	6.40	5.96	5.57	4.79	2.41	57.96	219.28
A	21.75	86.91	17.99	6.40	5.96	5.57	4.79	2.41	52.33	204.11
B	16.71	68.79	13.92	5.19	4.89	4.55	3.90	1.91	41.19	161.06
C	12.75	52.63	10.64	5.14	4.83	4.51	3.86	1.89	31.31	127.56
D	12.00	50.08	10.02	4.84	4.58	4.25	3.64	1.77	29.69	120.87
E	10.50	50.08	8.79	4.36	4.10	3.83	3.27	1.59	29.69	116.21
F	9.88	47.86	8.28	3.51	3.39	3.10	2.66	1.27	28.16	108.10
G	9.88	47.86	8.28	3.51	3.39	3.10	2.66	1.27	28.16	108.10
CS	9.88	47.86	8.28	3.51	3.39	3.10	2.66	1.27	28.16	108.10

CARBON MONOXIDE (CO)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
PRE90	289.50	1,237.36	242.46	96.36	81.96	84.67	71.23	35.10	773.70	2,912.34
A	289.50	1,087.73	242.46	96.36	81.96	84.67	71.23	35.10	683.28	2,672.28
B	230.35	887.07	193.03	76.25	66.63	67.54	56.95	27.60	550.43	2,155.86
C	165.67	615.18	138.81	76.21	66.59	67.51	56.92	27.58	379.99	1,594.49
D	154.55	573.24	129.52	76.51	66.83	67.79	57.16	27.69	352.92	1,506.22
E	129.36	573.24	108.51	68.21	59.05	60.36	50.84	24.65	352.92	1,427.15
F	121.94	546.46	102.29	43.86	38.99	39.01	33.00	15.69	334.75	1,276.00
G	121.94	546.46	102.29	43.86	38.99	39.01	33.00	15.69	334.75	1,276.00
CS	121.94	546.46	102.29	43.86	38.99	39.01	33.00	15.69	334.75	1,276.00

OXIDES OF NITROGEN (NOx)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
PRE90	34.99	144.72	32.67	21.50	13.53	17.55	14.92	7.78	91.51	379.17
A	34.99	134.54	32.67	21.50	13.53	17.55	14.92	7.78	85.40	362.88
B	27.96	109.58	25.93	16.56	10.63	13.56	11.49	6.00	69.36	291.08
C	24.29	95.35	22.87	16.55	10.62	13.55	11.49	6.00	60.17	260.87
D	22.94	90.60	21.75	16.63	10.69	13.62	11.55	6.03	57.13	250.95
E	21.20	90.60	20.32	16.02	10.11	13.08	11.08	5.80	57.13	245.34
F	19.64	84.52	18.99	14.09	8.60	11.45	9.72	5.07	53.02	225.10
G	19.12	82.46	18.41	13.47	8.28	10.96	9.30	4.85	51.65	218.50
CS	19.12	82.46	18.41	13.47	8.28	10.96	9.30	4.85	51.65	218.50

CARBON DIOXIDE (CO2)

	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
PRE90	8,243	33,200	7,051	3,177	2,421	2,681	2,216	1,226	20,969	81,183
A	8,243	33,200	7,051	3,177	2,421	2,681	2,216	1,226	20,969	81,183
B	8,243	33,200	7,051	3,177	2,421	2,681	2,216	1,226	20,969	81,183
C	8,243	33,200	7,051	3,177	2,421	2,681	2,216	1,226	20,969	81,183
D	8,243	33,200	7,051	3,177	2,421	2,681	2,216	1,226	20,969	81,183
E	8,243	33,200	7,051	3,177	2,421	2,681	2,216	1,226	20,969	81,183
F	8,243	33,200	7,051	3,177	2,421	2,681	2,216	1,226	20,969	81,183
G	8,243	33,200	7,051	3,177	2,421	2,681	2,216	1,226	20,969	81,183
CS	8,243	33,200	7,051	3,177	2,421	2,681	2,216	1,226	20,969	81,183

EXHIBIT V-4

2008 RFP EMISSION INVENTORY
DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN
SUMMER SEASON, MIDWEEK
ON ROAD EMISSIONS (TONS/DAY)

VOC	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	15.63	80.68	13.90	5.38	5.01	4.54	4.18	1.95	49.37	180.64
PRE90	23.20	102.70	21.03	7.42	6.56	6.17	5.09	2.54	62.14	236.86
A	23.20	92.80	21.03	7.42	6.56	6.17	5.09	2.54	56.26	221.08
B	16.75	68.09	15.32	5.67	5.04	4.74	3.89	1.89	41.09	162.49
C	12.67	51.56	11.61	5.62	4.99	4.70	3.85	1.87	30.90	127.77
D	11.92	49.00	10.93	5.32	4.73	4.44	3.63	1.76	29.28	121.02
E	10.33	49.00	9.50	4.77	4.22	3.98	3.26	1.57	29.28	115.91
F	9.08	44.56	8.35	3.53	3.25	2.97	2.43	1.15	26.26	101.57
G	9.08	44.56	8.35	3.53	3.25	2.97	2.43	1.15	26.26	101.57
CS	9.06	44.51	8.33	3.53	3.24	2.97	2.42	1.15	26.22	101.44

CO	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	218.00	1,054.25	191.72	81.38	70.99	68.29	60.61	28.90	665.16	2,439.29
PRE90	311.30	1,297.25	288.30	111.36	89.40	92.88	75.64	36.65	816.36	3,119.14
A	311.30	1,142.95	288.30	111.36	89.40	92.88	75.64	36.65	722.56	2,871.05
B	239.85	895.26	222.10	85.07	70.03	71.39	58.01	27.85	557.73	2,227.28
C	167.05	600.94	154.66	85.04	70.01	71.37	57.99	27.84	371.85	1,606.76
D	156.08	557.78	144.50	85.26	70.16	71.56	58.12	27.90	344.13	1,515.48
E	128.28	557.78	118.91	75.55	61.66	63.31	51.42	24.64	344.13	1,425.67
F	113.74	506.55	105.47	43.67	36.74	36.85	29.86	14.07	309.53	1,196.47
G	113.74	506.55	105.47	43.67	36.74	36.85	29.86	14.07	309.53	1,196.47
CS	113.35	504.74	105.07	43.32	36.53	36.58	29.64	13.94	308.37	1,191.55

NOx	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	25.66	131.47	24.45	15.19	10.25	11.97	10.52	5.54	82.55	317.59
PRE90	36.43	162.41	35.82	22.23	14.06	17.39	14.41	7.23	103.89	413.86
A	36.43	151.61	35.82	22.23	14.06	17.39	14.41	7.23	97.35	396.53
B	29.40	120.58	28.60	16.23	10.67	12.79	10.56	5.31	77.20	311.32
C	23.70	99.43	23.35	16.21	10.65	12.78	10.55	5.30	63.36	265.34
D	22.35	94.49	22.12	16.34	10.76	12.89	10.65	5.35	60.21	255.15
E	20.36	94.49	20.30	15.54	10.05	12.21	10.09	5.07	60.21	248.31
F	17.15	82.27	17.32	12.26	7.57	9.56	7.90	3.95	51.97	209.94
G	16.72	80.11	16.84	11.75	7.31	9.18	7.58	3.79	50.53	203.81
CS	16.08	77.05	16.13	11.00	6.91	8.60	7.10	3.55	48.48	194.92

CO2	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	6,456	31,109	5,806	2,604	2,159	2,113	1,827	1,003	19,311	72,387
PRE90	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
A	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
B	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
C	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
D	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
E	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
F	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
G	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175
CS	8,756	36,277	8,174	3,583	2,657	2,895	2,333	1,251	23,250	89,175

EXHIBIT V-5

2011 RFP EMISSION INVENTORY
DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN
SUMMER SEASON, MIDWEEK
ON ROAD EMISSIONS (TONS/DAY)

VOC	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	15.54	80.15	13.82	5.34	4.97	4.51	4.14	1.93	49.03	179.45
PRE90	27.11	116.54	25.02	8.96	7.59	7.26	5.94	2.98	71.83	273.23
A	27.11	105.34	25.02	8.96	7.59	7.26	5.94	2.98	65.03	255.23
B	17.66	67.34	16.39	6.22	5.25	5.08	4.14	2.01	41.81	165.90
C	13.10	49.58	12.17	6.17	5.21	5.04	4.10	1.99	30.63	127.98
D	12.37	46.95	11.51	5.88	4.95	4.80	3.91	1.89	29.06	121.31
E	10.49	46.95	9.78	5.21	4.36	4.25	3.46	1.66	29.06	115.22
F	7.99	38.17	7.46	3.33	2.93	2.74	2.22	1.04	23.13	89.01
G	7.99	38.17	7.46	3.33	2.93	2.74	2.22	1.04	23.13	89.01
CS	7.95	38.00	7.42	3.30	2.91	2.72	2.20	1.03	23.03	88.56

CO	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	216.10	1,042.06	189.93	80.20	69.87	67.27	59.64	28.53	657.23	2,410.82
PRE90	357.66	1,434.48	330.68	129.33	100.45	105.89	86.03	41.39	912.61	3,498.53
A	357.66	1,260.78	330.68	129.33	100.45	105.89	86.03	41.39	805.36	3,217.58
B	266.93	936.58	247.06	95.31	75.67	78.64	63.55	30.47	591.22	2,385.42
C	176.69	592.62	163.43	95.30	75.66	78.63	63.54	30.47	370.65	1,646.99
D	166.67	549.39	154.33	95.46	75.76	78.78	63.62	30.50	344.57	1,559.08
E	132.14	549.39	122.48	83.26	65.53	68.53	55.40	26.49	344.57	1,447.79
F	104.11	450.46	96.37	41.04	33.20	34.03	27.30	12.80	278.25	1,077.55
G	104.11	450.46	96.37	41.04	33.20	34.03	27.30	12.80	278.25	1,077.55
CS	103.25	446.69	95.46	40.04	32.65	33.28	26.68	12.47	275.80	1,066.31

NOx	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	25.55	130.64	24.29	15.04	10.19	11.86	10.43	5.48	82.03	315.50
PRE90	39.71	165.52	38.92	26.22	16.05	20.19	17.01	8.22	106.76	438.60
A	39.71	153.21	38.92	26.22	16.05	20.19	17.01	8.22	99.18	418.71
B	34.18	125.25	32.87	18.43	12.06	14.41	12.06	5.85	80.97	336.09
C	24.47	92.13	23.83	18.41	12.04	14.39	12.05	5.84	59.15	262.32
D	23.18	86.93	22.66	18.59	12.19	14.55	12.16	5.90	56.03	252.19
E	20.40	86.93	20.10	17.31	11.12	13.48	11.30	5.46	56.03	242.15
F	14.23	64.13	14.32	11.89	7.04	9.14	7.70	3.65	40.72	172.83
G	13.89	62.62	13.95	11.42	6.80	8.79	7.40	3.51	39.70	168.10
CS	12.07	54.66	11.93	8.77	5.45	6.81	5.70	2.71	34.33	142.41

CO2	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	6,454	31,100	5,805	2,604	2,158	2,112	1,826	1,002	19,305	72,366
PRE90	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
A	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
B	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
C	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
D	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
E	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
F	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
G	9,696	38,419	9,151	4,278	3,031	3,360	2,728	1,438	25,003	97,104
CS	9,696	38,419	9,151	4,278	2,625	3,360	2,728	1,438	25,003	96,698

EXHIBIT V-6

2012 RFP EMISSION INVENTORY
DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN
SUMMER SEASON, MIDWEEK
ON ROAD EMISSIONS (TONS/DAY)

VOC	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	15.50	79.88	13.78	5.32	4.95	4.49	4.12	1.93	48.84	178.80
PRE90	28.10	117.22	25.69	9.49	7.83	7.54	6.21	3.01	71.80	276.91
A	28.10	106.08	25.69	9.49	7.83	7.54	6.21	3.01	65.09	259.05
B	17.77	64.89	16.31	6.38	5.23	5.11	4.20	1.97	40.22	162.08
C	13.07	47.29	12.01	6.33	5.19	5.07	4.17	1.95	29.18	124.27
D	12.42	44.93	11.43	6.07	4.96	4.85	4.00	1.86	27.81	118.32
E	10.47	44.93	9.66	5.37	4.35	4.28	3.53	1.64	27.81	112.04
F	7.49	34.64	6.93	3.22	2.75	2.59	2.12	0.96	20.97	81.67
G	7.49	34.64	6.93	3.22	2.75	2.59	2.12	0.96	20.97	81.67
CS	7.45	34.46	6.89	3.18	2.73	2.56	2.10	0.95	20.85	81.17

CO	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	215.37	1,037.86	189.20	79.81	69.51	66.93	59.30	28.41	654.28	2,400.67
PRE90	370.76	1,441.71	337.63	136.09	103.25	109.43	89.61	41.76	912.25	3,542.49
A	370.76	1,268.31	337.63	136.09	103.25	109.43	89.61	41.76	805.84	3,262.68
B	274.71	928.70	250.67	99.48	77.08	80.52	65.63	30.48	583.84	2,391.11
C	178.20	573.79	162.53	99.47	77.07	80.51	65.63	30.47	357.24	1,624.91
D	169.47	535.77	154.75	99.62	77.16	80.65	65.70	30.50	334.94	1,548.56
E	133.42	535.77	121.93	86.57	66.49	69.89	57.01	26.40	334.94	1,432.41
F	100.32	420.71	91.61	40.26	31.71	32.69	26.46	12.01	258.93	1,014.69
G	100.32	420.71	91.61	40.26	31.71	32.69	26.46	12.01	258.93	1,014.69
CS	99.36	416.63	90.60	39.12	31.10	31.86	25.77	11.66	256.28	1,002.38

NOx	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	25.56	130.66	24.30	15.06	10.20	11.87	10.44	5.48	82.04	315.61
PRE90	41.25	166.58	39.86	27.59	16.53	20.83	17.70	8.21	106.94	445.47
A	41.25	154.34	39.86	27.59	16.53	20.83	17.70	8.21	99.45	425.74
B	36.13	126.66	34.18	19.22	12.43	14.76	12.45	5.81	81.46	343.11
C	24.91	89.94	23.88	19.19	12.41	14.75	12.44	5.80	57.50	260.82
D	23.78	85.29	22.86	19.37	12.55	14.90	12.55	5.85	54.78	251.94
E	20.72	85.29	20.08	17.90	11.35	13.69	11.57	5.37	54.78	240.74
F	13.46	59.01	13.39	11.66	6.73	8.77	7.47	3.38	37.35	161.22
G	13.13	57.58	13.03	11.20	6.50	8.43	7.17	3.25	36.40	156.70
CS	10.68	47.19	10.35	7.59	4.70	5.79	4.89	2.22	29.42	122.82

CO2	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	6,454	31,100	5,805	2,604	2,158	2,112	1,826	1,003	19,305	72,367
PRE90	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
A	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
B	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
C	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
D	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
E	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
F	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
G	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816
CS	10,088	38,759	9,395	4,544	3,138	3,497	2,863	1,453	25,080	98,816

EXHIBIT V-7

2013 RFP EMISSION INVENTORY
DALLAS-FORT WORTH NINE COUNTY MODELING DOMAIN
SUMMER SEASON, MIDWEEK
ON ROAD EMISSIONS (TONS/DAY)

VOC	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	15.50	79.92	13.78	5.32	4.95	4.49	4.12	1.93	48.87	178.89
PRE90	29.13	119.46	26.76	9.90	8.30	7.89	6.48	3.12	74.05	285.09
A	29.13	108.10	26.76	9.90	8.30	7.89	6.48	3.12	67.13	266.81
B	17.98	63.67	16.59	6.49	5.38	5.21	4.28	1.99	40.11	161.69
C	13.13	45.94	12.13	6.44	5.34	5.17	4.25	1.98	28.82	123.20
D	12.58	43.89	11.64	6.20	5.12	4.98	4.10	1.90	27.63	118.04
E	10.53	43.89	9.77	5.46	4.47	4.37	3.61	1.66	27.63	111.40
F	7.08	32.00	6.60	3.08	2.66	2.48	2.03	0.91	19.71	76.56
G	7.08	32.00	6.60	3.08	2.66	2.48	2.03	0.91	19.71	76.56
CS	7.04	31.80	6.55	3.03	2.63	2.45	2.01	0.90	19.58	75.98

CO	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	215.38	1,037.90	189.22	79.80	69.50	66.93	59.29	28.40	654.31	2,400.73
PRE90	383.72	1,467.00	351.34	141.28	108.81	113.85	92.99	43.03	941.97	3,643.99
A	383.72	1,290.51	351.34	141.28	108.81	113.85	92.99	43.03	832.25	3,357.78
B	283.77	937.33	260.30	102.84	80.85	83.45	67.89	31.32	598.14	2,445.89
C	180.76	565.42	165.77	102.83	80.84	83.44	67.88	31.31	357.41	1,635.65
D	173.52	533.08	159.27	102.95	80.93	83.56	67.94	31.34	338.50	1,571.09
E	135.59	533.08	124.58	89.09	69.44	72.09	58.72	27.01	338.50	1,448.11
F	97.64	401.23	89.74	39.37	31.42	32.02	25.89	11.66	251.23	980.21
G	97.64	401.23	89.74	39.37	31.42	32.02	25.89	11.66	251.23	980.21
CS	96.58	396.79	88.62	38.11	30.72	31.10	25.12	11.28	248.34	966.67

NOx	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	25.54	130.56	24.28	15.04	10.19	11.86	10.43	5.48	81.98	315.37
PRE90	42.83	169.65	41.58	28.86	17.73	21.75	18.42	8.49	110.09	459.40
A	42.83	157.18	41.58	28.86	17.73	21.75	18.42	8.49	102.37	439.21
B	38.16	129.42	36.16	19.87	13.25	15.31	12.85	5.96	84.10	355.07
C	25.40	88.79	24.41	19.85	13.23	15.29	12.84	5.95	57.39	263.15
D	24.45	84.78	23.55	20.01	13.37	15.43	12.94	6.00	55.06	255.59
E	21.07	84.78	20.47	18.33	11.97	14.04	11.81	5.46	55.06	242.98
F	12.78	54.95	12.81	11.41	6.73	8.55	7.25	3.26	35.22	152.96
G	12.45	53.57	12.45	10.95	6.50	8.22	6.97	3.13	34.29	148.53
CS	9.47	41.23	9.18	6.54	4.22	5.00	4.19	1.89	25.94	107.66

CO2	COLLIN	DALLAS	DENTON	ELLIS	JOHNSON	KAUFMAN	PARKER	ROCKWALL	TARRANT	TOTAL
ABY	6,455	31,103	5,805	2,604	2,158	2,112	1,827	1,003	19,307	72,373
PRE90	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
A	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
B	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
C	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
D	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
E	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
F	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
G	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670
CS	10,440	39,427	9,796	4,737	3,330	3,648	2,977	1,499	25,817	101,670

APPENDIX A. SPEEDS
(ELECTRONIC ONLY)

APPENDIX B. VEHICLE MILES OF TRAVEL
(ELECTRONIC ONLY)

APPENDIX C. MOBILE EXTERNAL FILES
(ELECTRONIC ONLY)

APPENDIX D. MOBILE INPUT FILES
(ELECTRONIC ONLY)

APPENDIX E. MOBILE EMISSION FACTORS
(ELECTRONIC ONLY)

APPENDIX F. EMISSION SOFTWARE TECHNICAL SUPPLEMENTS (ELECTRONIC ONLY)

APPENDIX G. TAB SUMMARY FILES
(ELECTRONIC ONLY)

APPENDIX H. EMISSION ESTIMATES
(ELETRONIC ONLY)

APPENDIX I. QUALITY ASSURANCE PROJECT PLAN