

APPENDIX H
AIR QUALITY ANALYSIS

Air Quality Analysis

The validated YVCOG Urban Area Model was the analytical tool used to assess the impacts of the various transportation packages on the air quality for the Yakima Urban Area. The urban area is no longer in a non-attainment status and as such has no preset budgets for either PM₁₀ or Carbon Monoxide (CO). Despite this, the region still reports and monitors the air quality status of the region.

There are two different maintenance areas for pollutants in the Yakima Urban Area. The PM₁₀ boundary is larger than the CO boundary. Both boundaries are shown in Figure 1.

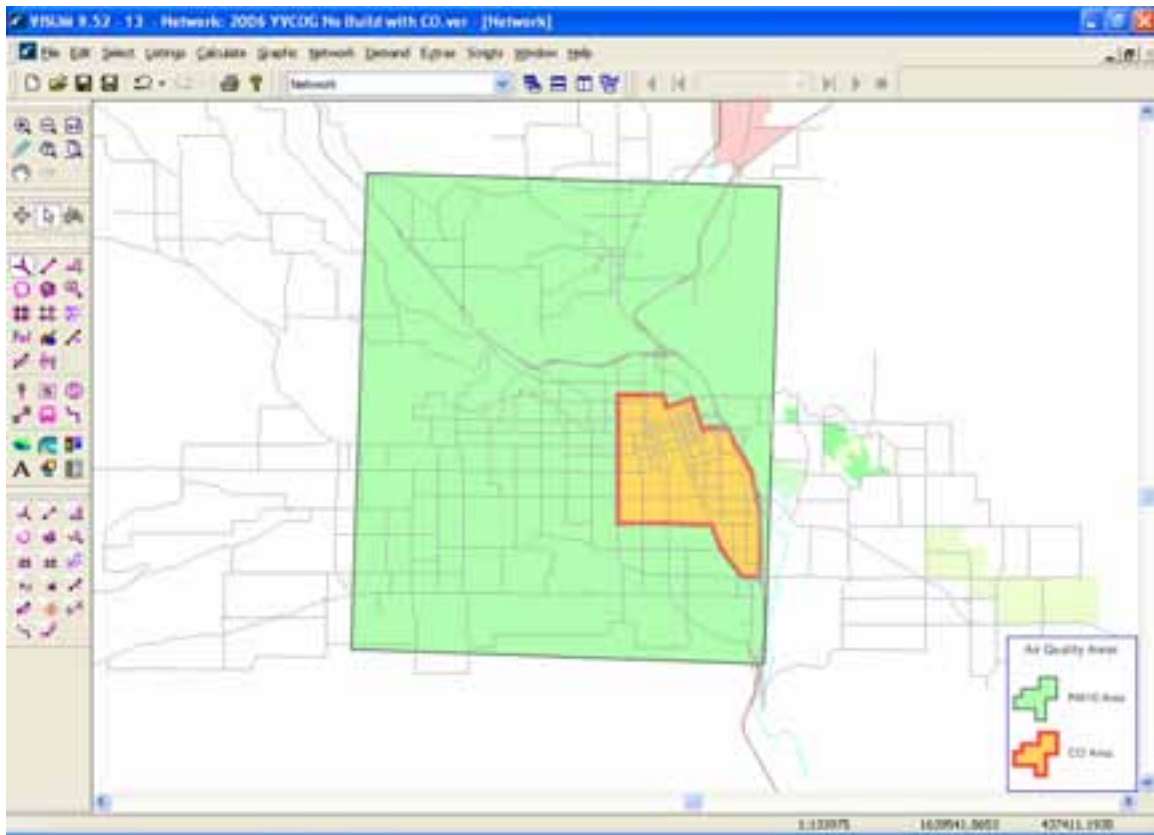


Figure 1. Air Quality Maintenance Areas

The air quality conformity analysis for each forecast year was conducted for the Baseline condition, which assumes no new capacity projects beyond those currently included in WSDOT and local agency Transportation Improvement Programs (TIP). In addition, the analysis was conducted based on the fiscally-constrained M/RTP. Even though it is not included in the financially constrained plan, the conformity analyses were also performed with the inclusion of the widening of I-82 from Selah through Yakima. This widening is the most significant of the “other high-priority” projects in the M/RTP. The long-range widening projects were included to help answer the question of what, if any impact, widening of I-82 will have on the air quality in the Yakima metropolitan area.

PM Peak Vehicle Miles Traveled to Daily Vehicle Miles Traveled

The model, which covers the MPO boundary, is a PM Peak hour model which is currently configured to forecast vehicle demand only. In order to assess PM₁₀ air quality impacts, the PM Peak Hour average vehicle miles traveled need to be converted into both daily and annual values. Traffic counts were used as the source of creating factors to derive daily values from a PM Peak Hour volume.

Peaking factors, all expressed in terms of the relationship of the PM Peak Hour to the Daily Volumes, were generated by link type. These factors were then used to create an average daily condition. The factors used in the VMT conversion for use in the PM₁₀ are shown in Table 1.

Table 1. Conversion Factors for Daily VMT

Link Type	Peaking Factor	Description
10	0.0838	Freeway
20	0.0838	Ramps
30	0.0856	Multi-Lane Highway
40	0.0874	Arterial Class I
50	0.0954	Arterial Class II
60	0.0954	Arterial Class III
70	0.0954	Arterial Class IV
80	0.0954	Collector
90	0.0954	Rural Two-Lane Highway

Once daily Vehicle Miles Traveled were created, the total annual VMT was calculated based on monthly conversion factors supplied from historical traffic counts in the region. These factors are shown in Table 2.

Table 2. Conversion Factors to Monthly Totals

Month	VMT Adjustment Factor	Days per Month
January	0.896	31
February	0.922	28
March	0.982	31
April	1.009	30
May	1.019	31
June	1.061	30
July	1.072	31
August	1.096	31
September	1.029	30
October	1.004	31
November	0.963	30
December	0.951	31

Particulate Matter

PM₁₀ emissions are based solely on the total vehicle miles traveled in the region – regardless of link speed. Once the PM Peak Hour VMT is converted to a monthly total, emission rates from the Department of Ecology and Mobile 6 were used to calculate the total pounds of PM₁₀ emissions for the boundary area. The rates, which include unpaved road dust, paved road dust and tailpipe emissions are shown in Table 3. These rates were supplied to the project team from YVCOG staff.

Table 3. 2006 PM₁₀ Emission Rates

Month	Unpaved Road Dust	Paved Road Dust	Tailpipe
January	0.3490	0.0013	0.0828
February	0.3690	0.0013	0.0828
March	0.3810	0.0039	0.0828
April	0.4100	0.0014	0.0828
May	0.1700	0.0014	0.0828
June	0.2230	0.0014	0.0828
July	0.2790	0.0014	0.0828
August	0.3310	0.0014	0.0828
September	0.3840	0.0014	0.0828
October	0.4130	0.0014	0.0828
November	0.3450	0.0013	0.0828
December	0.3490	0.0013	0.0828

The roadway dust emission rates do not vary into the future, however the tailpipe emission rates do lower slightly into the future. This is a reflection of a cleaner vehicle fleet in the future. With this emission rates and vehicle miles traveled, total annual emissions of PM₁₀ were calculated for each forecast year in the model.

Table 4. PM₁₀ Annual Emissions

Emission	Units	2006 Existing	2012 M/RTP	2017 M/RTP	2027 Baseline	2027 M/RTP without I-82	2027 M/RTP with I-82
Total (tailpipe) VMT ¹	vehicle-miles	2,157,215	2,432,332	2,637,822	3,026,392	3,055,123	3,064,128
VMT on unpaved roads	vehicle-miles	3,823	3,823	3,823	3,823	3,823	3,823
Miles of unpaved roads	miles	50.4	50.4	50.4	50.4	50.4	50.4
VMT on paved roads	vehicle-miles	2,153,392	2,428,509	2,633,999	3,022,569	3,051,300	3,060,305
Tailpipe emission rate	gm/veh-mile ²	0.0498	0.0393	0.0330	0.0272	0.0272	0.0272
Unpaved Road Dust	tons/year	232	232	232	232	232	232
Paved Road Dust	tons/year	576	660	723	837	845	847
Tailpipe	tons/year	43	38	35	33	33	34
Total PM ₁₀	tons/year	851	930	990	1,101	1,110	1,112

As shown in Table 4, over 25% of the total PM₁₀ emissions are due to unpaved roadway dust and another 70% is due to road dust on paved roadways. Less than 3% of the total PM₁₀ emissions are due to tailpipe emissions.

The M/RTP includes several types of improvements that will help reduce future levels of PM₁₀. These include reducing the amount of travel through transportation demand management (TDM) and commute trip reduction (CTR) programs. These programs encourage use of transit, vanpools, carpools, bicycles, and walking. Future increases in alternative modes will help reduce the total VMT for the region. This will reduce both road dust and tailpipe emissions. The Yakima Valley region is also working to reduce the mileage of unpaved roadways. Local agencies in the metropolitan area have annual programs to pave or otherwise overlay existing gravel roadways. The M/RTP also supports acquisition and use of street cleaners to cut down on the PM₁₀ levels from travel on paved roadways. These actions will help the region minimize future PM₁₀ emissions from mobile sources.

It should be noted that the unpaved lane-miles are unchanged in this analysis. This was due to insufficient data to estimate how many miles of gravel roadways would be paved in the future. If more data becomes available, the amount of unpaved road-miles could be reduced in future analysis.

Carbon Monoxide

Similar to PM₁₀ emissions, the CO conformity analysis was performed for 2006, 2012, 2017 and 2027. Unlike PM₁₀, CO rates are based upon both travel speed on roadway links as well as the vehicle miles traveled. These rates, which are calculated using the Mobile 6 model with the vehicle fleet and testing programs for the region, varying by each mile per hour as well as by year. The rates decrease into the future, reflecting the assumption of a newer and cleaner automobile fleet in the future. All rates for vehicle emissions were provided by YVCOG staff.

The travel speed and volume is calculated on each roadway link within the maintenance area using time of day factors to create hour by hour demands on the roadways. With this volume and speed data, the total CO produced is calculated for each link in the maintenance area based upon the rates from Mobile 6 and summed. The time of day factors are shown in Table 5 and the CO emission rates by mile per hour are shown in Table 6.

Table 5. Traffic Variation Time of Day Factors

Hour	Percentage				Hour	Percentage			
	Class 1	Class 2	Class 3	Class 4		Class 1	Class 2	Class 3	Class 4
1	5.1%	4.1%	4.2%	3.0%	13	70.7%	78.9%	73.1%	65.6%
2	4.5%	2.8%	3.3%	1.6%	14	77.5%	84.1%	79.3%	70.6%
3	4.6%	2.5%	3.0%	1.3%	15	89.6%	94.6%	90.7%	86.0%
4	7.6%	4.3%	5.4%	3.2%	16	98.9%	99.1%	98.2%	92.1%
5	23.0%	13.7%	16.8%	11.1%	17	100.0%	100.0%	100.0%	100.0%
6	61.2%	36.3%	41.4%	31.1%	18	70.7%	69.3%	70.1%	71.3%
7	87.5%	73.2%	73.6%	60.2%	19	47.7%	49.3%	53.4%	53.6%
8	70.0%	66.9%	61.7%	55.2%	20	38.6%	38.0%	40.0%	41.8%
9	60.8%	60.2%	55.7%	47.3%	21	31.0%	29.8%	29.6%	29.7%
10	61.5%	65.5%	59.6%	55.6%	22	21.3%	18.8%	19.8%	17.8%
11	66.4%	75.9%	67.8%	62.7%	23	13.3%	11.7%	12.9%	9.7%
12	71.0%	82.8%	78.0%	72.7%	24	7.7%	6.4%	6.3%	4.9%

Table 6. Carbon Monoxide Emission Rates

Speed (mph)	Carbon Monoxide Emission Rates (g/mile)				Speed (mph)	Carbon Monoxide Emission Rates (g/mile)			
	2006	2012	2017	2027		2006	2012	2017	2027
1	176.79	165.26	162.97	158.39	36	20.12	18.82	18.57	18.07
2	176.79	165.26	162.97	158.39	37	19.49	18.18	17.92	17.41
3	151.33	141.76	139.87	136.09	38	18.89	17.57	17.31	16.80
4	119.29	112.20	110.81	108.03	39	18.33	16.99	16.73	16.22
5	99.88	94.30	93.21	91.03	40	17.80	16.44	16.18	15.67
6	86.81	82.27	81.38	79.61	41	17.29	15.93	15.67	15.15
7	77.40	73.59	72.85	71.36	42	16.81	15.43	15.17	14.66
8	70.28	67.03	66.39	65.11	43	16.36	14.96	14.70	14.19
9	64.69	61.90	61.34	60.22	44	15.93	14.52	14.26	13.74
10	60.19	57.76	57.27	56.28	45	15.52	14.10	13.84	13.32
11	56.49	54.35	53.91	53.02	46	15.12	13.69	13.43	12.91
12	53.38	51.50	51.10	50.30	47	14.75	13.31	13.05	12.53
13	50.74	49.07	48.71	47.99	48	14.40	12.94	12.68	12.16
14	48.14	46.98	46.65	45.99	49	14.40	12.94	12.68	12.16
15	46.49	45.16	44.86	44.26	50	14.41	12.95	12.69	12.17
16	44.75	43.57	43.29	42.73	51	14.42	12.96	12.70	12.18
17	43.21	42.16	41.90	41.38	52	14.43	12.97	12.71	12.19
18	41.84	40.89	40.65	40.17	53	14.45	12.98	12.72	12.20
19	40.62	39.77	39.55	39.10	54	14.46	12.99	12.73	12.21
20	39.00	38.15	37.93	37.48	55	14.48	13.01	12.75	12.23
21	36.97	36.07	35.85	35.40	56	15.89	14.11	13.80	13.19
22	35.13	34.19	33.96	33.50	57	17.31	15.21	14.87	14.18
23	33.44	32.47	32.23	31.76	58	18.72	16.32	15.93	15.16
24	31.90	30.89	30.65	30.18	59	20.14	17.43	17.00	16.14
25	30.48	29.43	29.19	28.71	60	21.56	18.54	18.07	17.13
26	29.17	28.09	27.85	27.37	61	22.99	19.65	19.14	18.11
27	27.96	26.85	26.61	26.13	62	24.42	20.78	20.22	19.11
28	26.83	25.70	25.46	24.97	63	25.85	21.90	21.30	20.10
29	25.79	24.63	24.39	23.90	64	27.29	23.02	22.38	21.10
30	24.81	23.63	23.39	22.90	65	28.74	24.16	23.47	22.10
31	23.90	22.70	22.45	21.95	66	28.74	24.16	23.47	22.10
32	23.04	21.82	21.58	21.09	67	28.74	24.16	23.47	22.10
33	22.24	21.00	20.75	20.25	68	28.74	24.16	23.47	22.10
34	21.49	20.23	19.98	19.48	69	28.74	24.16	23.47	22.10
35	20.79	19.51	19.25	18.74	70	28.74	24.16	23.47	22.10

With hour by hour volumes, the speed is calculated for each hour of the day on each and every link in the maintenance area. The hourly volume and speed are then used to calculate the total hourly CO emissions for each link which can then be summed up for the day.

Unlike PM₁₀, Carbon Monoxide is reported on a daily basis.

There is currently no set budget for carbon monoxide in the Yakima metropolitan area. For the conformity analysis, the test is whether or not the plan increases or decreases the emissions for the region. As shown in Table 7, the total CO produced in the region is less than the Baseline condition for each forecast year. Therefore, the M/RTP projects will have a positive affect on reducing CO levels over Baseline conditions.

Table 7. Carbon Monoxide Emissions by Scenario

Analysis Condition	Pounds of CO/Day
2006 Base Year	37,045
2012 No Build	40,502
2012 M/RTP	38,461
2017 No Build	42,510
2017 M/RTP	40,384
2027 Baseline	43,948
2027 M/RTP with I-82	42,316
2027 M/RTP without I-82	42,414

As shown in Table 8, the M/RTP will generally lower both the Vehicle Miles and Vehicle Hours traveled in the Carbon Monoxide maintenance area. This reduction, which reflects the re-distribution of trips in the region based on the model improvements, is the key reason in the reduction of the CO emissions.

Table 8. Vehicle Miles and Hours Traveled in CO Maintenance Area

Scenario	VMT	VHT
2006 Base Year	431,280	13,621
2012 No Build	487,372	15,761
2012 M/RTP	476,016	15,007
2017 No Build	515,396	16,690
2017 M/RTP	505,136	15,970
2027 Baseline	558,365	17,828
2027 M/RTP with I-82	541,765	17,020
2027 M/RTP without I-82	542,626	17,220

The widening of I-82, which will raise the average speed in the urban area on both freeways and arterials, will save less than 100 pounds of CO per day. This is less than 0.25 percent of the daily CO, as compared to not widening I-82. Therefore, widening of I-82 (if funds become available) will not adversely affect CO emissions in the region