Air Quality Memorandum

REPORT NO. 18

DATE December 24, 2003

SUBJECT CONFORMITY ANALYSIS FOR THE UPDATED 2030 LONG-RANGE PLAN FOR THE WASATCH FRONT REGION

ABSTRACT The Transportation Equity Act (TEA-21) and the Clean Air Act Amendments (CAAA) require that all regionally significant highway and transit projects in air quality non-attainment and maintenance areas be derived from a "conforming" Transportation Plan (Plan) and Transportation Improvement Program (TIP). A conforming Plan or Program is one that has been analyzed for emissions of controlled air pollutants and found to be within emission limits established in the State Implementation Plan (SIP). This conformity analysis is made by the Wasatch Front Regional Council (WFRC), as the Metropolitan Planning Organization for the region, and submitted to the Federal Highway Administration and the Federal Transit Administration for their concurrence. This conformity analysis is being prepared under the final conformity regulations issued jointly by the EPA and USDOT on November 24, 1993 and the July 1997 amendments.

Maps of the transportation projects of the Plan are provided in Appendix 1, and a list of regionally significant transportation projects in the Plan is provided in Appendix 2.

Based on the analysis presented in this document, the WFRC Updated 2030 Plan conforms to the State Implementation Plan for all pollutants in applicable non-attainment or maintenance areas. Therefore, all the transportation projects in Weber, Davis, and Salt Lake Counties included in the Updated 2030 Long Range Plan are found to conform.

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A. Conformity Requirements

Conformity Process

Since the commencement of the planning requirements in the late 1960s, further requirements (most recently the 1998 Transportation Equity Act and the 1990 Clean Air Act Amendments) have added to the responsibilities and the decision making powers of local governments through the Metropolitan Planning Organization. The Wasatch Front Regional Council (WFRC) is the Metropolitan Planning Organization for the Salt Lake and Ogden Urbanized Areas. This report summarizes WFRC's conformity analysis of the Updated Plan with the Division of Air Quality's State Implementation Plan (SIP). This conformity analysis is subject to public and agency review, and requires the concurrence of the Federal Highway Administration and Federal Transit Administration.

In November, 1993, the Environmental Protection Agency and the Department of Transportation issued rules establishing the procedures to be used to show that transportation Plans and Programs conform with the SIP. The conformity rules establish that transportation projects that use federal funds, as well as "regionally significant" transportation projects sponsored by recipients of other federal funds, may not proceed in areas designated as "non-attainment (or maintenance) with respect to the National Ambient Air Quality Standards" until and unless a regional emissions analysis of the Plan and TIP demonstrates that the projects conform with the SIP.

Salt Lake County, Davis County, Salt Lake City, and Ogden City are designated as non-attainment (or maintenance) for one or more air pollutants. Specifically, there are four areas in the Wasatch Front area for which the conformity rules apply. These areas are listed in Table 1 below.

Table 1
Wasatch Front Region Non-attainment Designations

Area	Designation	Pollutant
Salt Lake City	Maintenance Area	Carbon Monoxide (CO)
Ogden City	Maintenance Area	Carbon Monoxide (CO)
	Moderate Non-Attainment Area	Particulate Matter (PM_{10})
Salt Lake & Davis Counties	Maintenance Area	Ozone (O_3)
Salt Lake County	Moderate Non-Attainment	Particulate Matter (PM_{10})

The CAAA established requirements for conformity. These requirements are outlined in 40 CFR 93.109 and include the following:

- Latest planning assumptions
- Latest emissions model
- Consultation
- Transportation Control Measures (TCMs)
- Emissions budget
- Currently conforming plan and TIP
- Project from a conforming plan and TIP
- CO and PM_{10} "hot spots"
- PM_{10} control measures

Each of these requirements will be discussed in the following paragraphs.

Latest Planning Assumptions

Current travel models are based on the latest available (January 2002) socioeconomic data from the Governor's Office of Planning and Budget and the Division of Workforce Services. This socio-economic data was allocated to traffic analysis zone by WFRC for use in the travel demand model during 2002 and 2003.

Latest Emissions Model

The conformity analysis presented in this document is based on the EPA mobile source emissions models: MOBILE5b and PART5. The application of these models will be discussed in greater detail in the Emissions Model section of this document. EPA has recently released a new vehicle emissions model named Mobile6. Application of this new model for conformity purposes is not required until January 29, 2004.

Consultation Process

Air Quality Committee - Section 105 of 40 CFR Part 93 (Conformity Rule) requires, among other things, interagency consultation in the development of conformity determinations. To satisfy this requirement, WFRC, in cooperation with the State Division of Air Quality and several other agencies, drafted a Conformity SIP document to outline the consultation procedures to be used in air quality and transportation planning. While the Conformity SIP has not been officially adopted by the State, WFRC has chosen to follow as much as possible the consultation procedures outlined in the Draft Conformity SIP. As part of the consultation procedures defined in the Draft Conformity SIP, WFRC has formed an Air Quality Committee (AQC) to review the conformity analysis prepared by WFRC staff.

The Air Quality Committee consists of representatives from Wasatch Front Regional Council, Utah Department of Transportation, Utah Transit Authority, Utah Division of Air Quality, County Health Departments, Elected Officials, City and County Planners, Environmental Protection Agency, Federal Highway Administration, and Federal Transit Administration. Local media, public interest groups, and several other interested parties are notified of meetings of the AQC.

AQC members and other interested parties were notified of a meeting of the AQC on October 17, 2003, at which preliminary results of this conformity analysis were presented and reviewed in detail.

Public Comment - The amended Plan for the Wasatch Front Area and this Conformity Analysis were made available for public inspection and comment from October 1 to October 31, 2003. Public hearings were held on October 14 in Weber County, October 21 in Davis County, and October 28 in Salt Lake County.

TCM Implementation

A conformity analysis for the Updated Plan must certify that nothing in the Plan interferes with the implementation of any Transportation Control Measure (TCM) identified in the applicable State Implementation Plan (SIP). There are three TCMs which are part of the non-control strategy SIPs (a non-control strategy SIP does not base attainment or maintenance on quantitative achievement of specific reductions but rather the general implementation of these Transportation Control Measures) applicable to the Wasatch Front region. The three TCMs include rideshare promotion, signal coordination, and a transit service goal (16 million revenue miles in the UTA service area). All of these TCM's have been implemented at the present time and are not adversely affected by any project or commitment in the Updated Plan.

One other TCM identified in the Ozone Maintenance Plan is Employer based Trip Reduction. This program has been in place in Salt Lake and Davis Counties since 1995 for State and local government employers with 100 or more employees. The State Division of Air Quality has the option (under State Rule R307-320) to extend this program to all employers with 100 or more employees. The Utah Transit Authority, through its Rideshare, community outreach, and ECO-Pass programs, assists employers to meet the trip reduction goals. The 2030 Long Range Plan will continue to support Rideshare and other transit efforts.

Emissions Budget

A comparison of mobile source emission estimates to emission budgets defined in the SIP is outlined in this document in Section D - Conformity Determination.

Currently Conforming Plan and TIP

All of the capacity increasing projects in the Updated 2004-2008 TIP for the Wasatch Front Region are identified in the Updated 2030 Long Range Plan. All of the projects identified in the Updated 2030 Long Range Plan are included in the regional emissions analysis. Maps of the transportation networks used for the regional emissions analysis are shown in Appendix 1. The regionally significant Updated Plan projects are given in Appendix 2. The financial plan for the Updated 2030 Plan demonstrates that the Plan is financially constrained.

Projects from a Conforming Plan and TIP

TIP Time-frame - All projects which must be started no later than 2008 in order to achieve the transportation system envisioned by the Updated 2030 Plan are included in the Updated 2004-2008 TIP. The TIP is fiscally constrained, meaning that only those projects with an identified source of funds are included in the TIP. Estimated funding availability is based on current funding levels and reasonable assumptions that these funds will continue to be available.

Regionally Significant - All regionally significant projects, regardless of funding source (federal, state, or local) are included in the Updated Plan. All regionally significant projects are also included in the regional emissions analysis of the Plan. Regionally significant projects are identified as those projects of at least 0.5 miles in length which add through lane capacity to existing principal arterials, or construct a new principal arterial. The 2000 Utah Department of Transportation Functional Classification map was used to identify principal arterials. Interstate highways, freeways, expressways, principal arterials, light rail, and commuter rail are treated as regionally significant projects.

The applied definition of a regionally significant project cited above is consistent with the EPA definition found in 40 CFR 93.101 as follows:

> "*Regionally significant project* means a transportation project (other than an exempt project) that is on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sports complexes, etc., or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area's transportation network, including at a minimum all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel."

The preceding EPA definition of a regionally significant project consists of two main parts: 1) the project serves regional transportation needs, and 2) the project is of a nature that it can be included in the regional travel model.

The definition applied by WFRC meets the EPA definition by identifying principal arterial projects as projects that serve regional transportation needs. All principal arterial projects and passenger rail projects are included in the regional travel model thus satisfying the EPA definition. Other projects on minor arterial and collectors, as well as local transit service, are also included in the regional travel model (and thus the regional emissions analysis) but are not considered regionally significant since they do not serve regional transportation needs as defined by EPA.

Because of their relative impact on air quality, regionally significant projects may not proceed under a conformity lapse even if local funds are used exclusive of federal transportation funds. This conformity analysis finds that the transportation plan conforms. Therefore, the identification of regionally significant projects in this report is for reference only.

CO and PM_{10} "Hot Spot" Analysis

In addition to the regional emissions conformity analysis presented in this document, specific projects within carbon monoxide (CO) and particulate matter (PM_{10}) non-attainment areas are required to prepare a "hot spot" analysis of

emissions. The "hot spot" analysis serves to verify whether or not localized emissions from a specific project will meet air quality standards. This requirement is addressed during the NEPA phase of project approval before FHWA or FTA can issue final project approval.

EPA has not yet identified an approved method for PM_{10} "hot spot" analysis. However, project sponsors are still required to prepare a qualitative analysis of localized PM_{10} impacts for the proposed project as part of their NEPA evaluation. FHWA has issued guidance on qualitative PM_{10} "hot spot" analysis to be used for the NEPA process.

PM_{10} Control Measures

Construction-related Fugitive Dust - Construction related dust is not identified as a contributor to the PM10 non-attainment area, and therefore there is no conformity requirement for construction dust. 40 CFR Section 93.122(d)(1) reads as follows:

> "For areas in which the implementation plan does not identify construction-related fugitive PM10 as a contributor to the non-attainment problem, the fugitive PM10 emissions associated with highway and transit project construction are not required to be considered in the regional emissions analysis."

In the Utah PM_{10} SIP, construction-related PM_{10} is not included in the inventory, nor is it included in the attainment demonstration or control strategies. Construction-related PM_{10} emissions are mentioned in qualitative terms in Section IX.A.7 of the SIP as a maintenance measure to preserve attainment of the PM_{10} standard achieved by application of the control strategies identified in the SIP. Section IX.A.7.d requires UDOT and local planning agencies to cooperate and review all proposed construction projects for impacts on the PM_{10} standard. This SIP requirement is satisfied through the Utah State Air Quality Rules. R307-309-4 requires that sponsors of any construction activity file a dust control plan with the State Division of Air Quality.

Other Conformity Requirements

Transit Fares - Transit fares have and will increase in response to increases in operating costs. The Updated Plan assumes that transit fare box revenues will cover a constant percentage of all transit operating cost, so any fare increases are not inconsistent with the Plan. With any price increase some market reaction is expected. While there have been some short term fluctuations in transit patronage in response to fare increases, the implementation of light rail service and other transit improvements has restored and increased transit patronage within the levels anticipated by the Plan.

Plans for expanding light rail service, increased bus service, and the addition of commuter rail are moving forward. These transit features are envisioned in the Updated Plan and the steps necessary to achieve these transit goals are moving forward including voter approval of a 1/4 cent sales tax increase for transit funding that was passed in November 2000.

B. Transportation Modeling

Since the conformity analysis prepared in 2002, a number of changes have been made to the WFRC travel model practice and procedures in order to improve the model behavior when compared to observed conditions and to keep the model current with or ahead of the state of the practice. A brief discussion of these changes is given in Appendix 3.

Planning Process

Federal funding and approvals for transportation improvement projects in urban areas require that transportation improvements be developed through a comprehensive, coordinated, and continuous planning process involving all affected local governments. The planning process is certified annually by the Regional Council and reported to the Federal Highway Administration and Federal Transit Administration. Every three years FHWA and FTA conduct a more comprehensive certification review. The certification review of 2002 found that the WFRC planning process meets federal requirements. There were some recommendations made to improve WFRC's planning process and these are being addressed.

The documentation of the planning process includes, at minimum, a twenty year Long Range Transportation Plan updated at least every three years; and a three-year to five-year Transportation Improvement Program (capital improvement program) updated and adopted at least every two years. The planning process includes the involvement of local elected officials, state agencies, and the general public.

Travel Characteristics

The WFRC travel model is used to estimate and project highway VMT and vehicle speed. The travel models used for this conformity analysis are available on the compact disc containing the Technical Support Documentation (TSD) for this report.

The model VMT for 2001 is factored to match the 2001 VMT reported by UDOT through the HPMS data reporting system. Due to major construction on I-15 in Salt Lake County, some of the HPMS traffic counts are inconsistent with recent traffic volume trends. Specifically, for Salt Lake County 2001 traffic volumes, freeways are lower and arterials are higher than the trends in the other counties. In addition, trends in other areas of Salt Lake County unaffected by I-15 construction support the notion that overall 2001 HPMS data for Salt Lake County includes some distortions due to I-15 construction. To correct for this construction related traffic count aberration, WFRC adjusted Salt Lake County 2001 HPMS freeway and arterial volumes to better fit trends in the adjacent counties and to better fit data collected from areas of Salt Lake County unaffected by the I-15 construction.

The resulting 2001 HPMS adjustment factor (see Table 2 below) for each area is then applied by functional class to the travel model VMT for future years resulting in the HPMS adjusted future VMT.

Table 2
Summary of 2001 HPMS Factors

	Salt Lake City	Ogden City	Salt Lake County	Davis County
Freeway/Ramp	0.690	1.225	0.989	1.017
Arterial	1.112	0.980	1.086	0.936
Local	2.566	3.321	2.141	3.011

Tables 3a-d summarize for each non-attainment area and analysis year the daily vehicle miles (VMT) and speeds used in the regional emissions analysis. The HPMS adjusted weekday VMT data in Tables 3a-d is also adjusted for seasonal variations (winter or summer) as part of the emission projection calculation. The VMT and speeds shown in Tables 3a-d are for four functional classes of roads (freeway, ramp, arterial, and local), and for four time periods (AM-peak, mid-day, PM-peak, and evening). These four time periods are defined as follows:

AM Peak - 3 hours, 6:00 am to 9:00 am
Midday - 6 hours, 9:00 am to 3:00 pm
PM Peak - 3 hours, 3:00 pm to 6:00 pm
Evening - 12 hours, 6:00 pm to 6:00 am

The speeds are used as input for the Mobile5b emissions model, along with local parameters and factors determined in consultation between WFRC and DAQ, to estimate future emission rates.

The maps provided in Appendix-1 represent the transportation networks modeled for the 2001 base year and four horizon years: 2008, 2012, 2022, and 2030. These horizon years were selected in accordance with 40 CFR Section 93.106(a)(ii).

The regionally significant highway projects included in the Updated 2030 Plan are either new principal arterials or projects that add one or more travel lanes on any principal arterial street and are 0.5 miles or greater in length. Other new capacity projects on collectors and minor arterial streets are also included in the travel model but are not considered regionally significant. The travel characteristics of Tables 3a-d are based on all relevant transportation improvements including the regionally significant projects found in the 2030 Plan for the Wasatch Front Region. For a list of regionally significant projects refer to Appendix 2.

The 1990 travel characteristics for Ogden City are added to Table 3b because 1990 is used as the conformity test for Ogden City PM_{10} emissions in the absence of an approved SIP and budget. Previous modeling efforts for 1990 were based on speed and VMT assumptions that are inconsistent with present modeling methods (congested and free flow conditions versus four time periods). Therefore, the 1996 Ogden model speeds estimated for the October 2000 conformity analysis are used for the 1990 Ogden speeds. Likewise, 1990 VMT is allocated by facility type and time period according to the proportions in the 1996 travel model that was used for the October 2000 conformity analysis.

The reader may also note in Table 3d an unusual drop in arterial VMT in Davis from 2012 to 2022. This drop in arterial VMT is due to the reclassification of Highway-89 in Davis County from an arterial to a freeway. With this drop in arterial VMT there is a corresponding increase in freeway VMT, and total VMT for Davis County follows a consistent growth trend for all the years modeled.

Table 3a

Salt Lake City - Weekday Travel Characteristics

			Base Year				
			2001	**2008**	**2012**	**2022**	**2030**
Freeway VMT (HPMS)	**AM**		380,806	431,342	470,546	583,168	657,347
	Mid		587,064	682,782	757,442	934,158	1,042,552
	PM		507,077	575,723	626,280	766,238	861,920
	Eve		398,969	456,134	500,109	626,620	714,911
Ramp VMT (HPMS)	**AM**		13,404	14,788	15,656	20,367	22,281
	Mid		25,868	28,212	29,852	38,284	41,109
	PM		19,682	21,339	22,856	28,659	30,740
	Eve		17,172	18,496	19,795	24,754	26,971
Arterial & Collector VMT (HPMS)	**AM**		531,632	554,918	572,085	645,720	724,084
	Mid		1,043,895	1,100,164	1,137,199	1,271,570	1,386,904
	PM		828,160	878,103	921,573	1,051,772	1,185,842
	Eve		611,248	636,156	654,586	727,569	789,837
Local VMT (HPMS)	**AM**		152,212	163,425	169,719	202,323	225,860
	Mid		326,850	350,959	364,884	429,107	468,699
	PM		242,938	260,297	270,627	319,506	351,528
	Eve		186,720	199,522	207,016	244,147	267,548
Total			**5,873,697**	**6,372,358**	**6,740,226**	**7,913,964**	**8,798,133**
Freeway Speed (mph)	**AM**		62.3	61.8	60.3	59.4	59.4
	Mid		63.3	63.3	63.3	63.1	62.9
	PM		59.9	58.6	54.7	52.7	52.6
	Eve		63.5	63.6	63.6	63.7	63.8
Ramp Speed (mph)	**AM**		14.5	11.4	12.4	12.0	9.7
	Mid		17.4	15.7	14.1	13.1	12.9
	PM		6.7	8.8	6.4	5.0	4.5
	Eve		29.0	28.9	28.9	29.1	29.1
Arterial & Collector Speed (mph)	**AM**		28.8	28.2	27.8	26.7	26.4
	Mid		29.8	29.3	29.0	28.7	28.7
	PM		26.8	26.0	25.1	24.0	23.6
	Eve		31.3	31.0	30.8	30.8	30.9
Local Speed (mph)	**AM**		17.0	17.0	16.7	17.1	17.2
	Mid		16.4	16.3	16.2	16.6	16.5
	PM		16.6	16.5	16.4	16.8	16.8
	Eve		16.8	16.7	16.6	17.0	17.0

Table 3b							
Ogden City - Weekday Travel Characteristics							
			Base Year				
		1990	**2001**	**2008**	**2012**	**2022**	**2030**
Freeway VMT (HPMS)	**AM**	18,540	33,570	40,272	44,186	50,374	60,199
	Mid	21,050	37,258	46,175	52,040	61,732	71,961
	PM	24,187	45,597	56,266	61,017	69,766	81,915
	Eve	15,947	32,021	37,729	41,176	47,709	55,567
Ramp VMT (HPMS)	**AM**	1,957	3,391	3,564	4,029	4,217	4,931
	Mid	2,407	5,309	6,029	6,748	7,390	8,210
	PM	2,358	4,108	4,640	5,014	5,401	6,291
	Eve	1,348	3,461	4,077	4,459	4,665	5,217
Arterial & Collector VMT (HPMS)	**AM**	128,644	180,790	196,484	214,876	260,509	285,446
	Mid	276,064	333,049	365,980	398,810	470,347	510,972
	PM	205,276	261,365	283,230	310,518	370,252	407,292
	Eve	163,197	225,481	247,477	267,748	312,923	340,112
Local VMT (HPMS)	**AM**	38,640	60,718	67,320	72,580	85,369	93,376
	Mid	91,024	130,641	147,050	157,704	184,760	199,904
	PM	66,757	98,607	110,124	118,513	138,638	150,756
	Eve	49,748	79,368	88,139	94,289	111,057	120,668
Total		**1,107,143**	**1,534,733**	**1,704,556**	**1,853,707**	**2,185,109**	**2,402,817**
Freeway Speed (mph)	**AM**	63.0	60.6	64.3	64.7	64.5	64.5
	Mid	64.9	65.0	65.0	65.0	65.0	65.0
	PM	55.6	57.0	63.0	64.1	62.9	63.2
	Eve	65.0	65.0	65.0	65.0	65.0	65.0
Ramp Speed (mph)	**AM**	35.5	20.8	22.0	16.7	22.0	20.3
	Mid	37.0	25.1	24.4	22.6	23.7	22.1
	PM	34.5	8.9	12.2	18.3	17.2	14.8
	Eve	37.1	29.3	29.3	29.3	29.3	29.3
Arterial & Collector Speed (mph)	**AM**	33.9	33.1	32.4	31.9	31.1	30.0
	Mid	33.4	34.5	33.5	33.3	33.0	32.3
	PM	32.4	30.4	29.5	28.8	27.9	26.5
	Eve	33.9	36.3	35.7	35.6	35.4	35.2
Local Speed (mph)	**AM**	20.0	19.2	18.5	18.4	18.4	18.1
	Mid	20.0	18.8	18.3	18.2	18.2	18.0
	PM	20.0	18.9	18.5	18.4	18.3	18.1
	Eve	20.0	19.0	18.5	18.4	18.4	18.1

Table 3c							
Salt Lake County - Weekday Travel Characteristics							
			Base Year				
			2001	**2008**	**2012**	**2022**	**2030**
Freeway VMT (HPMS)	**AM**		1,740,978	2,065,372	2,255,767	2,868,539	3,267,605
	Mid		2,609,460	3,159,128	3,540,515	4,537,829	5,108,287
	PM		2,188,252	2,641,313	2,875,518	3,657,145	4,178,888
	Eve		1,846,654	2,204,723	2,444,229	3,154,844	3,620,839
Ramp VMT (HPMS)	**AM**		63,527	70,953	82,838	101,727	113,414
	Mid		118,833	136,155	158,263	196,377	216,744
	PM		85,545	96,112	112,181	135,278	149,293
	Eve		78,308	88,799	103,932	129,167	144,876
Arterial & Collector VMT (HPMS)	**AM**		2,041,307	2,406,239	2,667,695	3,065,315	3,475,696
	Mid		3,902,467	4,573,291	5,042,409	5,773,682	6,413,651
	PM		3,218,855	3,760,654	4,216,141	4,894,732	5,463,376
	Eve		2,508,557	2,919,210	3,213,051	3,667,274	4,089,290
Local VMT (HPMS)	**AM**		545,568	637,496	724,022	870,512	966,583
	Mid		1,194,393	1,406,587	1,597,536	1,914,345	2,106,737
	PM		905,497	1,060,104	1,205,068	1,445,257	1,596,635
	Eve		750,304	874,780	992,274	1,186,702	1,309,095
Total			**23,798,504**	**28,100,916**	**31,231,440**	**37,598,724**	**42,221,010**
Freeway Speed (mph)	**AM**		60.6	59.2	58.2	55.9	54.5
	Mid		64.0	64.0	63.9	63.4	63.3
	PM		57.3	56.1	53.7	50.7	47.3
	Eve		64.2	64.3	64.3	64.4	64.4
Ramp Speed (mph)	**AM**		15.8	13.9	12.4	11.8	10.4
	Mid		21.2	18.4	17.9	15.5	15.6
	PM		6.8	7.6	5.1	5.1	5.2
	Eve		29.0	29.0	29.0	29.1	29.1
Arterial & Collector Speed (mph)	**AM**		30.9	30.0	29.4	28.1	27.7
	Mid		31.9	31.3	30.9	30.0	30.0
	PM		27.1	25.5	23.9	22.4	22.1
	Eve		34.0	33.9	33.7	33.4	33.5
Local Speed (mph)	**AM**		18.8	18.7	18.6	18.3	18.2
	Mid		18.5	18.5	18.4	18.1	18.0
	PM		18.6	18.5	18.5	18.2	18.1
	Eve		18.8	18.7	18.6	18.3	18.2

Table 3d							
Davis County - Weekday Travel Characteristics							
			Base Year				
			2001	**2008**	**2012**	**2022**	**2030**
Freeway VMT (HPMS)	**AM**		657,628	751,799	818,170	1,129,412	1,279,624
	Mid		924,973	1,108,176	1,217,452	1,725,178	1,932,127
	PM		828,761	968,656	1,043,677	1,440,006	1,647,719
	Eve		657,520	762,763	837,389	1,204,487	1,354,804
Ramp VMT (HPMS)	**AM**		23,390	25,863	27,641	32,513	35,390
	Mid		39,588	45,395	49,584	59,474	63,692
	PM		30,770	35,154	38,261	45,038	49,170
	Eve		26,648	30,479	33,384	40,087	42,642
Arterial & Collector VMT (HPMS)	**AM**		388,553	448,275	501,003	473,248	517,160
	Mid		698,798	838,619	937,864	905,201	1,006,619
	PM		576,656	684,058	775,010	776,679	835,008
	Eve		484,232	568,368	628,123	587,736	656,882
Local VMT (HPMS)	**AM**		192,808	237,922	260,521	315,399	347,106
	Mid		409,047	506,585	557,437	677,492	743,703
	PM		318,061	389,161	430,737	520,263	570,395
	Eve		268,873	329,613	364,421	440,648	484,735
Total			**6,526,306**	**7,730,885**	**8,520,672**	**10,372,862**	**11,566,776**
Freeway Speed (mph)	**AM**		58.3	61.8	60.2	57.8	61.3
	Mid		64.6	64.6	64.6	64.5	64.7
	PM		57.2	58.3	56.7	50.9	57.7
	Eve		64.7	64.7	64.7	64.8	64.8
Ramp Speed (mph)	**AM**		25.7	23.0	24.1	23.1	25.1
	Mid		27.3	25.9	23.4	25.4	26.5
	PM		19.8	19.2	18.8	18.9	19.3
	Eve		29.0	29.0	29.0	29.0	29.0
Arterial & Collector Speed (mph)	**AM**		36.7	34.9	34.6	33.6	33.9
	Mid		38.2	36.4	36.0	33.8	33.9
	PM		33.6	30.5	30.3	29.7	29.8
	Eve		39.4	38.3	37.9	35.3	35.5
Local Speed (mph)	**AM**		22.0	21.2	20.9	20.9	20.8
	Mid		21.9	21.0	20.8	20.7	20.5
	PM		21.9	21.0	20.8	20.7	20.6
	Eve		22.0	21.1	20.8	20.8	20.7

Ramps

Freeway ramps are now reported as a separate highway facility type for air quality modeling. In previous air quality analysis, freeway ramp traffic was included with total freeway traffic. The HPMS data from UDOT does not distinguish ramp VMT from freeway VMT. WFRC uses the travel model VMT ratio of ramps to freeways to estimate HPMS ramp volumes from total HPMS freeway volumes.

Plan Revisions

The Wasatch Front Regional Council approved a 2030 Long Range Plan and conformity analysis in 2002. In a letter dated August 2, 2002, FHWA and FTA concurred with the conformity analysis for the 2030 Plan. The 2030 Plan and Conformity Analysis prepared in 2002 were amended in August 2003 and are awaiting approval from FHWA and FTA at the time of this writing. This conformity analysis (October 2003) is for an Updated 2030 Long Range Plan.

Lane Miles

Table 4 below gives a summary of the number of freeway, ramp, and arterial lane miles provided in the highway network in each non-attainment area and for each horizon year. The number of lane miles is a useful indication of the growth of the highway infrastructure. Since the August 2003 conformity determination, some changes have been made to the Salt Lake County network coding used in the travel model. In 2001 some sections of SR-201 have been coded as principal arterial rather than freeway, and a number of minor arterials have been added to the network. In 2030 portions of the Mountain View corridor have been coded as principal arterial rather than freeway and still other minor arterials have been added to the network. A comparison of the lane miles below and those reported in the August 2003 conformity determination will bear out these minor network coding changes.

Table 4
Wasatch Front Lane Miles: 2001 - 2030

Lane Miles					
	2001	**2008**	**2012**	**2022**	**2030**
Salt Lake County					
Freeway	679	727	777	847	869
Ramp	72	73	85	94	98
Arterial	2,203	2,288	2,378	2,563	2,735
Grand Totals	2,954	3,089	3,239	3,504	3,703
Davis County					
Freeway	202	249	249	298	351
Ramp	40	42	42	43	53
Arterial	560	570	624	693	711
Grand Totals	802	860	914	1,033	1,115
Salt Lake City					
Freeway	252	256	264	278	286
Ramp	29	29	30	32	32
Arterial	671	671	671	720	732
Grand Totals	952	957	966	1,030	1,050
Ogden					
Freeway	8	11	15	15	15
Ramp	3	3	4	4	4
Arterial	241	243	251	278	281
Grand Totals	252	258	269	296	300

Peak and Off-Peak Speeds

The VMT and speed resulting from each time period depend on the number of vehicle trips assigned by the travel model for that time period. The percentage of trips varies for each time period. The percentages in Table 5 below are based on data from the 1993 Home Interview Survey. Trip purposes "commercial" (COM) and "through" (THRU) are not sampled in the Home Interview Survey. These two trip types are allocated to the four time periods according to the percentages for NHB and IXXI trips respectively.

Table 5
Percent of Trips by Purpose and Time of Day

	AM		Mid-day		PM		Evening	
Purpose	**From Home**	**To Home**	**From Home**	**To Home**	**From Home**	**To Home**	**From Home**	**To Home**
HBW	39%	1%	9%	7%	2%	25%	6%	11%
HBO	15%	2%	13%	13%	10%	16%	12%	20%
NHB	7%	NA	51%	NA	26%	NA	16%	NA
IXXI	20%	NA	29%	NA	26%	NA	25%	NA
COM	6%	NA	53%	NA	26%	NA	15%	NA
THRU	20%	NA	29%	NA	26%	NA	25%	NA

Trip Purpose abbreviations:

HBO - Home Based Other
HBW - Home Based Work
IXXI - Internal/External, External/Internal
NHB - Non-Home Based
COM - Commercial
THRU - Through

Comparison of Modeled Speeds with Observed Data

WFRC continues to adjust modeled speeds to improve consistency with samples of observed speeds. A review of Salt Lake County modeled speeds and observed speeds is summarized in Table 6. Note that modeled off-peak speed is the weighted average of midday and evening speeds as given in Table 3c.

Table 6
Salt Lake County Modeled Speeds Compared to Observed Speeds

	2001 Modeled Speeds (mph)			2000-2002 Observed Speeds (mph)		
Functional Class	**AM Peak**	**PM Peak**	**Off Peak**	**AM Peak**	**PM Peak**	**Off Peak**
Arterial	31	27	32	31	29	31
Freeway	61	58	64	58	54	66

C. Emission Modeling

I/M Programs

Because Davis County adopted an innovative I/M program beginning in 1998, two Mobile5b runs and subsequent data reduction are required in order to simulate the effect of this hybrid I/M program. Briefly, the Davis County program applies the loaded mode IM240 test to vehicles 3, 6, and 9 years old. All other Davis County vehicles receive the basic idle test.

Assumptions for the input files for EPA's MOBILE5b vehicle emissions model include enhanced I/M programs in Salt Lake and Davis Counties by 1998, and basic I/M programs in Weber County. Other PM_{10} on-road mobile source emission rates (road dust and direct tailpipe PM_{10} emissions) are estimated using EPA's PART5 model.

Emission Credits

EPA has issued documentation for modeling the emission credit impacts of three separate mandates for cleaner vehicles. The first credit is for cleaner heavy duty diesel vehicles beginning in 2004 (HD-04). The second credit is for cleaner light duty vehicles beginning in 2001 as part of the National Low Emitting Vehicle (NLEV) agreement between automakers and EPA. The third credit, known as Tier2, requires emission standards for pickup trucks and sport utility vehicles equal to emission standards for passenger cars beginning in 2004. In some limited instances the Tier2 credit results in negative NOx emission rates. This was found to be the case with vehicle emissions on some local class streets beginning in 2017 in the case of "test and repair" I/M program conditions, and beginning in 2014 in the case of "test only" I/M program conditions. To avoid erroneous calculations of negative emission rates, the Tier2 credit for local roads was kept constant at the 2004 value resulting in a conservative (higher) emission rate estimate for future years. Further examination of emission estimates shows that all conformity tests would pass even without the Tier2 credit.

VMT Mix

The VMT mix describes how much a particular vehicle type is used. The national default VMT mix contained in MOBILE5b was used to disaggregate local vehicle type data. The local vehicle type data is collected by UDOT as part of the federal HPMS data collection system and is based on automated counters which classify vehicles based on axle spacing. The UDOT classification is used to group vehicles as light duty (LD) or heavy duty (HD) for each facility type. The EPA default VMT mix is applied to disaggregate the UDOT data into the eight vehicle classes used in MOBILE5b. The significance of the UDOT vehicle type data is that the percentage of trucks found on freeways is much greater than the percentage of trucks on local streets. Using the Mobile5b default VMT mix for all facilities ignores this aspect of actual traffic conditions and results in an overestimation of mobile source emissions.

For a detailed discussion of how these VMT mix calculations were made, please refer to the "VMT Mix Calculation" document available upon request from WFRC.

Vehicle Weights

Facility specific VMT mix data described above was also used to estimate the average vehicle weight on each facility type. Since vehicle weight affects the rate of fugitive dust emissions estimated using the PART5 model, vehicle weight variations on different facilities will affect the amount of fugitive dust created. The VMT mix for each facility type was used to estimate an average vehicle weight for each facility with the following results:

Facility	Average Vehicle Weight (pounds)
Urban - Freeway	6,000
Urban - Arterial	5,200
Urban - Local	3,700

The method for estimating vehicle weights by facility type is described in detail in the "Average Vehicle Weight Calculation" document available upon request from WFRC.

Post Model Adjustments

For conformity analyses prior to 2000 the Wasatch Front Region applied post model adjustments to vehicle emission estimates. Emission credits were modeled for reductions in single occupant vehicle rates for work trips based primarily on increased investments in transit service and rideshare programs, and the projected increase in

telecommuting. Other less significant post model adjustments were also estimated for incident management, pavement re-striping, and signal coordination.

WFRC believes that these programs have a positive effect in reducing vehicle emissions. In practice, however, WFRC has found that documenting the air quality benefits of these programs can be difficult. WFRC will continue to support these emission reduction programs, but credits from these programs have not been included in this conformity analysis.

"Test Only" Credits

Emission estimates in this conformity analysis are based on the "test only" credit for the Salt Lake County I/M program. Salt Lake County's request for "test only" credit for their program was recognized by EPA as recorded in the Federal Register, March 1, 2002. The MOBILE5b model by default reduces I/M program effectiveness by 50% if the program is not operated at a centralized "test only" station. Non-centralized "test and repair" programs can be given a "test only" upgrade from EPA if documentation can be provided demonstrating that the program meets required standards of effectiveness.

I/M Exemptions

As of July 2, 2003 emission tests for vehicles in Utah that are less than six years old are required every other year instead of annually. Older vehicles are still required to pass the annual emissions test. Support for passing this legislation (known as the Harper Bill) was based primarily on the fact that there would be very little impact to regional emissions. Evaluation of the emissions impact of this legislation was performed using the Mobile6 model for two reasons. First, Mobile6 is the most current emissions model available. Second, the flexibility of Mobile6 allows modeling the emissions impact of this legislation quite readily. Attempting to model this measure with Mobile5b would require a separate I/M descriptive file for each scenario year plus multiple model runs to establish baseline and modified emission conditions.

To determine the emissions impact of the Harper Bill in terms of Mobile5b to be used in this conformity analysis, the following procedure was used. The Division of Air Quality made a very detailed evaluation of the emission impact of the Harper Bill using Mobile6 and multiple runs and I/M descriptive files similar to the process described above for Mobile5. The results of this detailed analysis were then compared to a more simplified modeling approach that changed only the GRACE PERIOD command in Mobile6. Grace periods of 1 to 6 years were tested and it was found that a grace period of 3 years best matched the results of the detailed analysis. However, in some cases the 3-year grace period (and even a 4-year grace period) could underestimate emissions when compared with results from the detailed approach. To be conservative, a 5-year grace period was selected as this would always result in higher emissions than the detailed method.

To determine the incremental emissions resulting from the Harper Bill, WFRC used the Mobile6 model to estimate emissions first with no grace period and second with a five-year grace period. The difference between these two emission results is the increment resulting from the Harper Bill. This increment, however, is based on the Mobile6 model. To correct the increment to a Mobile5b value the increment is factored by the ratio of Mobile5b emissions to Mobile6 emissions (each without any I/M exemptions). The resulting Mobile5b increment is then added to the corresponding Mobile5b emission projection. Since this rule took effect midway through 2003, only half of the 2003 increment was applied.

D. Conformity Determination

Based on the transportation systems described in this report, Tables 7-11 support the following conformity findings for the Wasatch Front Area Updated 2030 Long Range Plan:

- The Updated Plan conforms to the applicable controls and goals of the State Implementation Plan (Maintenance Plan) for Carbon Monoxide in Salt Lake City.

- The Updated Plan conforms to the applicable controls and goals of the State Implementation Plan (Maintenance Plan) for Carbon Monoxide in Ogden City.

- The Updated Plan conforms to the applicable controls and goals of the State Implementation Plan (Maintenance Plan) for Ozone in Salt Lake County.

- The Updated Plan conforms to the applicable controls and goals of the State Implementation Plan (Maintenance Plan) for Ozone in Davis County.

- The Updated Plan conforms to the applicable controls and goals of the State Implementation Plan for PM_{10} in Salt Lake County.

- The Updated Plan conforms under the Emission Reductions Criteria for areas without motor vehicle emissions budgets for PM_{10} in Ogden City.

Table 7
Salt Lake City CO
Conformity Determination

Year [a]	2004	2005	2006	2007	2008	2012	2016	2022	2030
Budget (tons/day) [b]	143.79	144.66	145.37	145.37	145.37	145.37	192.06	192.06	192.06
Projection (tons/day) [c]	79.31	75.75	72.32	69.49	67.74	61.83	61.82	66.50	73.67
Conformity (Projection < Budget?)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

[a] Horizon years are 2001, 2008, 2012, 2022, and 2030. Projection of emissions for intervening years is based on interpolation of VMT and speed calculated for the horizon years.

[b] Salt Lake City CO Maintenance Plan.

[c] Emission projections based on Mobile5b.

Table 8
Ogden City CO
Conformity Determination

Year [a]	2004	2005	2006	2007	2008	2012	2016	2022	2030
Budget (tons/day) [b]	36.47	35.92	36.14	36.71	55.00	55.00	55.00	55.00	55.00
Projection (tons/day) [c]	29.59	28.81	27.86	26.92	26.22	22.91	20.27	20.35	22.02
Conformity (Projection < Budget?)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

[a] Horizon years are 2001, 2008, 2012, 2022, and 2030. Projection of emissions for intervening years is based on interpolation of VMT and speed calculated for the horizon years.

[b] Ogden City CO Maintenance Plan.

[c] Emission projections based on Mobile5b.

Ogden PM_{10} Conformity - Ogden City was designated a PM_{10} non-attainment area in August of 1995 based on PM_{10} violations in 1993 or earlier. Since a PM_{10} SIP for Ogden has not yet been submitted, it must be demonstrated that Ogden PM_{10} emissions are either less than 1990 emissions or less than "no-build" emissions. The analysis years 2008, 2012, 2022, and 2030 were selected in accordance with the requirements of 40 CFR Section 93.119(e).

As summarized in Table 9, emission estimates for the Updated 2030 Long Range Plan satisfies the "Build < 1990" test for primary PM_{10} (direct tailpipe particulates and road dust) in Ogden City. It should be noted that the conformity test for Ogden PM_{10} presented below is believed to be conservative for a number of reasons. The 1990 emission estimate could easily have been much higher. Three emission estimate methods were considered to estimate 1990 particulates in Ogden and the most conservative method was selected (see Appendix 4). Also, the additional fugitive dust from the Ogden landfill access road used a lower silt load than suggested by EPA guidance documentation and a conservative assumption was made on the number of wheels input to the PART5 model.

On the projection side the emission estimates reflect the closure of the Ogden landfill in 1998 but no other credit was taken for a number of programs adopted since Ogden City violated the PM_{10} standard. These particulate reducing programs include covered load ordinances, increased frequency of street sweeping, and reduced application of deicing and skid resistant materials (salt and sand). Documentation of these programs has been provided by Ogden City but the actual benefits of these programs are not included in the emission projections below. Other areas that have estimated the benefit of these programs have found a silt load reduction of over 30% for effective street sweeping programs and a 5% silt load reduction when limiting the amount of sand and salt applied to the roads. Ogden City has also implemented a number of specific projects that have a positive effect in reducing particulate emissions including park and ride lots, storm water improvements, shoulder widening and edge striping, and addition of curb and gutter on several projects.

Table 9a
Ogden City PM10 Conformity Determination
Nox Precursor

Year [a]	2008	2012	2022	2030
1990 Emissions (tons/day) [b]	3.49	3.49	3.49	3.49
Projection (tons/day) [c]	2.61	2.06	1.53	1.59
Conformity (Projection < 1990?)	Pass	Pass	Pass	Pass

[a] Analysis years are 2008, 2012, 2022, and 2030 in accordance with 40 CFR 93.119.

[b] 1990 emissions based on Mobile5b.

[c] Emission projections based on Mobile5b.

Table 9b
Ogden City PM10 Conformity Determination
Dust & Tailpipe Particulates

Year [a]	2008	2012	2022	2030
1990 Emissions (tons/day) [b]	2.28	2.28	2.28	2.28
Projection (tons/day) [c]	1.46	1.59	1.86	2.06
Conformity (Projection < 1990?)	Pass	Pass	Pass	Pass

[a] Analysis years are 2008, 2012, 2022, and 2030 in accordance with 40 CFR 93.119.

[b] 1990 Ogden City particulate emissions estimated using particulate emission rates found in WFRC Air Quality Memorandum No. 7, October 1995, p. 16 which are in grams per mile: for fugitive dust on freeways 0.92, on arterials 1.30, and on local streets 1.82; and 0.114 grams/mile for tailpipe particulates. In addition, 0.60 tons of road dust from traffic at the city landfill was added to the 1990 estimate.

[c] Emission projections based on PART5 including road dust and exhaust PM.

Air quality monitoring in Ogden supports the effectiveness of the above-mentioned programs in reducing PM_{10} emissions. A graph of monitored PM_{10} levels in the Ogden area since 1987 showing a steady decline in PM_{10} is included in Appendix 4. The last monitored violation of the PM_{10} standard in Ogden was over 10 years ago in 1993.

Salt Lake and Davis County Ozone Conformity -

Table 10a

Salt Lake & Davis County Ozone - NOx Precursor
Conformity Determination

Year [a]	2004	2005	2006	2007	2008	2012	2015	2020	2021	2022	2030
Budget (tons/day) [b]	65.13	65.95	66.85	67.75	67.75	67.75	77.52	85.63	85.63	85.63	85.63
Projection (tons/day) [c]	59.37	57.29	54.78	52.15	49.92	41.76	37.91	38.43	38.95	39.48	43.89
Conformity (Projection < Budget?)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

[a] Horizon years are 2001, 2008, 2012, 2022, and 2030. Projection of emissions for intervening years is based on interpolation of VMT and speed calculated for the horizon years.

[b] Salt Lake & Davis County Ozone Maintenance Plan.

[c] Emission projections based on Mobile5b.

Table 10b

Salt Lake & Davis County Ozone - VOC Precursor

Conformity Determination

Year [a]	2004	2005	2006	2007	2008	2012	2015	2020	2022	2030
Budget (tons/day) [b]	58.99	58.06	58.43	58.69	58.69	58.69	65.06	71.15	71.15	71.15
Projection (tons/day) [c]	38.59	37.40	36.31	34.91	34.00	31.12	29.54	29.68	30.46	33.60
Conformity (Projection < Budget?)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

[a] Horizon years are 2001, 2008, 2012, 2022, and 2030. Projection of emissions for intervening years is based on interpolation of VMT and speed calculated for the horizon years.

[b] Salt Lake & Davis County Ozone Maintenance Plan.

[c] Emission projections based on Mobile5b.

Salt Lake County PM_{10} - The PM_{10} SIP does not define a budget beyond the year 2003. Therefore, conformity tests are required only for horizon years, and all horizon years after 2003 must conform to the 2003 budget. The proposed State air quality rule R307-310 allows a portion of the surplus primary PM_{10} budget to be traded to the secondary PM_{10} budget (NOx) for conformity purposes provided that the total of primary and secondary PM_{10} projections do not exceed the total of primary and secondary PM_{10} budgets. Table 11a below identifies how this budget trading will be accomplished.

Table 11a
Salt Lake County Primary and Secondary PM_{10} Budgets

Year	2004	2008	2012	2022	2030
Total PM10 Budget*	72.60	72.60	72.60	72.60	72.60
Primary PM10 Budget	40.30	40.30	40.30	40.30	40.30
Secondary PM10 Budget	32.30	32.30	32.30	32.30	32.30
Primary Budget to be Traded	*17.00*	*10.00*	*10.00*	*5.00*	*5.00*
Resulting Secondary PM10 Budget (Nox)	**49.30**	**42.30**	**42.30**	**37.30**	**37.30**
Resulting Primary PM10 Budget (dust)	**23.30**	**30.30**	**30.30**	**35.30**	**35.30**
* Source: Derived from Utah SIP Section 9, Control Strategy and Compliance Schedule for PM10.					

Table 11b
Salt Lake County Secondary PM_{10} Conformity Determination
(NOx Precursor)

Year [a]	2004	2008	2012	2022	2030
Budget (tons/day) [b]	49.30	42.30	42.30	37.30	37.30
Projection (tons/day) [c]	47.51	39.17	32.87	31.32	34.64
Conformity (Projection < Budget?)	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**
[a] 2003 is the last "budget" year included in the PM10 SIP. Horizon years are 2008, 2012, 2022, and 2030.					
[b] Based on the PM10 SIP trading rule as shown above.					
[c] Emission projections based on Mobile5b.					

Table 11c
Salt Lake County Primary PM_{10} Conformity Determination
(road dust and tailpipe particulates)**

Year [a]	2004	2008	2012	2022	2030
Budget (tons/day) [b]	23.30	30.30	30.30	35.30	35.30
Projection (tons/day) [c]	20.86	22.72	25.20	29.93	33.68
Conformity (Projection < Budget?)	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**
[a] 2003 is the last "budget" year included in the PM10 SIP. Horizon years are 2008, 2012, 2022, and 2030.					
[b] Based on the PM10 SIP trading rule as shown above.					
[c] Emission projections based on PART5.					
** *Includes road dust and exhaust PM from PART5.*					

Appendix 1

Transportation Modeling Improvements

The following is a short summary of changes to the WFRC travel model practices and procedures from July 2001 (referred to as Version 2.1) and September 2003 (referred to as Version 3.1). These changes to the model improve the travel model's performance in replicating observed traffic conditions (volume, speed, and distribution) and are consistent with maintaining and improving the state of the practice in travel modeling. For a list of definitions of terms and abbreviations used in this discussion refer to the last section of this appendix.

Documentation & Source Files

Resolution of computer file storage limitation has allowed documentation, relevant GIS layers, and many input source files and creation processes to be packaged with each model run to enhance the modeler's ability to incorporate useful and detailed data in the travel model process.

Socio-Economic Data Input Preparation

Expansion of household categories based on 2000 Census

The 2000 Census provided an opportunity to classify households by size (people in the household), income quartile, and workers per household. An off-model C++ census program was written to apply Census curves to basic zonal information such as the total households, average household size, and average zonal income. The C++ census program determines the total number of households in combinations of the following 6 household size categories (1 person to 6+ person), 4 worker categories (0 to 3+), and 4 income quartile categories. This then becomes basic input to the Auto Ownership, Trip Generation, and Mode Choice steps of the travel model.

Dynamic identification of area type

A key variable in determining average free flow speeds and terminal times is the intensity and type of land use surrounding a highway link. A process was inserted into the model stream that considers the population and employment density of a zone and its four nearest neighbors to estimate the likely area type of that zone. Any links that pass through that zone are then automatically flagged with that type, and a free flow speed is assigned that in part relies on this area type. Thus for any scenarios that test "future CBD level densities" in a Greenfield area, arterial street speeds will respond downward accordingly. Area types are: 1) Rural, 2) Transition, 3) Suburban, 4) Urban, 5) CBD.

Improved free flow speed and capacity methodology

To improve free flow speeds and capacities, methodologies in NCHRP 357 and HCM 2001 were applied. Speeds are now determined by applying an unsignalized speed stratified by functional type and area type, which is then factored by number of stops/mile and the delay/stop for the functional type and area type. Speeds are further adjusted based on whether the link is part of a high priority or low priority corridor. Free flow speeds were compared against locally observed speed data to adjust NCHRP 387 default values. The local speed data was used to validate both free flow speeds and congested speeds.

Capacities are determined by factoring a saturation flow rate by the percentages of heavy vehicles, bus blockages, lane utilization, and green time. Specific links known to have unusually high or low "friction" are flagged and adjusted accordingly.

Unique trip tables for colleges, airport, and Lagoon

Many transit proposals currently under review would serve major trip generators that have a distribution pattern that a gravity model would not adequately determine on its own such as colleges, the airport, and the Lagoon amusement park. Home addresses of college students were obtained from each major college, which allowed creation of a distribution pattern for that college. An airport survey was also available that allowed distribution of airport patrons across the region. In contrast the gravity model had previously allocated trips almost exclusively to neighborhoods nearest the airport. The Lagoon amusement park is another special traffic zone for which total trips were available. The HBO trip purpose to Lagoon had an average trip length of slightly more than 10 minutes. This was thought unreasonable since this is the only major amusement park in Utah. HBO trips were thus extended further to draw from the whole region, but with emphasis on the nearest zones.

Updated highway and transit networks

Numerous automated tools have been developed and applied to help highlight network deficiencies, and facilitate network maintenance. Highway networks are now far more robust than they have ever been. Network coding now involves automated procedures and quality checks to replace error prone and painstaking manual techniques. The networks have further been updated with recently completed projects, the most long range highway plans and programmed transportation improvements, and UTA's current operational plans. Future year transit networks reflect the latest thinking from EIS and New Start submittals.

New Auto Ownership Model

The Version 2.1 auto-ownership model was borrowed from Portland and relied on data that was difficult to project into the future, and much of which could not be validated as having a measurable affect on the number of autos a household might own. The Version 3.1 model was developed entirely on local data, and relies only on 3 significant variables: household size, workers/household, and high or low (bottom quartile) income.

Trip Generation

Production / Attraction rate consolidation

Version 2.1 combined what were three separate travel models for Ogden, Salt Lake, and Provo into a single model. However, the production and attraction equations from those separate models were retained for each area. Further, production equations were based strictly on observed data, and were not smoothed by logical reasoning. For example, the data may have suggested a zero-car household with 3 people would take more shopping trips/day than a zero-car household with 6 people. This cannot logically be explained other than by a small sampling (there may have been 2 zero-car 3-person families that happened to take a lot of trips on the survey date, whereas the 1 zero-car 6-person family happened to take very few). Rates have now been consolidated to regional averages, and smoothed as recommended by an in-house peer review in January 2002.

Regional balancing of HBO trips

HBO trips produced in an urban area and attracted to that same urban area were significantly out of balance. For example, the Utah County area was found to produce about 10% more HBO trips than it attracted. Since HBO trips are heavily weighted toward short, neighborhood trips, it is unreasonable that such a large percentage would be destined north of the county line, and not offset by SL county HBO productions attracted to Utah County. HBO trips were balanced by urban area to help address this.

NHB attractions to SL CBD increased by 10%.

Trips to SL CBD (Large District 9) were compared against the 1993 Home Interview Survey, and it was found that the percentage of SL CBD trips that were non-home based was about 10% lower in the model than it was in the survey. NHB attractions to the CBD were factored up to account for this.

Trip Distribution

Nothing of significance has changed in the structure of distribution. Minor changes have been made to accommodate the off-model trip tables mentioned above, IXXI distribution noted below, and highway assignment improvements (see Highway Assignment).

New IXXI (Internal-External/External-Internal) distribution process.

A significant imbalance in IXXI trips between Utah County and Salt Lake County was discovered in Version 2.1. Before the three models were merged into one, district level factors were used to determine how much of a zone's trips should be IXXI. In Utah County, a much higher percentage of the total trips were IXXI, because Salt Lake was previously modeled as an external station for them. Further, all IXXI trips were distributed an average of 40 minutes within the region. 1993 HIS (Household Interview Survey) data suggests these trips should be closer to 25 minutes within the region (and an unknown time outside the region).

In Version 3.1, IXXI trips are no longer district factors. XI trips are distributed by zonal employment and represent 75% of the total of IXXI. IX trips are distributed by zonal population, and represent 25% of the total. This assumes that on an average weekday there are more people coming from outside the region to attractions within the region

than there are people going from the region to attractions outside the region. IXXI friction factors were also adjusted to better target a 25 minute average.

New friction factors

Friction factors in Version 2.1 were not based directly on local data from the HIS, but were defined more by their ability to replicate average trip lengths from the HIS. Version 3.1 includes a process to estimate and calibrate the correct shape of these curves directly from the 1993 HIS data. Hence, not only are the average trip lengths based on local data, but the distribution profile of trip lengths is more accurate as well.

Mode Choice

New logit models for HBO and NHB purposes

Mode choice was considered one of the "weakest links" in Version 2.1. It has been extensively revised in Version 3.1. Its major deficiencies were lack of independent Logit models for the HBO and NHB purposes. These purposes were essentially factors of the HBW purpose – a practice considered sub-standard by the January 2002 peer review. Independent models for each purpose now exist, estimated from transit on-board survey data collected in the fall of 2002.

Market segmentation for home-based purposes

HBW, HBC, and HBO models have been market segmented by three auto-ownership classes (0,1,and 2+), and two income classes (average/high, and low). Since NHB by definition has no specific household information, it cannot be market segmented using household data.

Walk access to transit methodology revised

Version 2.1 contained an "all or nothing" approach to determining whether a zone had walk access to transit. If the zone centroid was within ½ mile of a bus stop, 100% of the zone had access (3/4 mile for rail). However, centroids often require far more walking than would occur in reality. Further, a wide variance in the size of zones (and hence the number of people who "have access") caused some concern. The all-or-nothing approach is also considered sub-standard.

The new approach attempts to determine the percentage of a zone that truly is within walk distance of transit. GIS data is used to create a 4/10 mile buffer around bus lines, express bus stops, and rail stops. This buffer is then intersected with the TAZs to estimate the number of people and jobs within the buffer. This method is consistent with the state of the practice.

Drive access to transit coding error addressed

A coding flaw was discovered that affected drive access to transit. The previous code ensured drive to transit access in the form of park-n-ride links, but neglected to ensure that there were walk links available to egress the system at the destination. In other words, even though you could easily drive to transit, it may be difficult to find places where you could get off. Modes where drive access can range from 25-85% (express bus, light rail, commuter rail), were seeing only a 10-15% drive share in Version 2.1. This has been corrected.

Summit-formatted output

FTA New Starts funding requests require the analysis of mode choice output using software named "Summit". Summit was developed by FTA for comparing two alternatives to determine "winners and losers". It is a useful tool for all types of alternatives analysis, including highway alternatives. The model can now easily generate the input required for Summit with a simple toggle switch.

Improved transit speeds

Version 2.1 had a carry over from much earlier models which assumed that if a bus traveled on any street outside the CBD or on a freeway, that its average speed (including stops) would be 0.9 multiplied by the average congested speed for vehicles. This may be true under the most extreme congestion, but for most circumstances the relative speeds between buses and private autos is more pronounced. Version 3.1 conducted a substantial review of UTA's scheduled stops (to determine typical average bus speeds), and compared these against average private auto congested speeds obtained using GPS. The resulting factors are noted below.

Bus Speed Factors

Version 2.1 Congested speed factor		Version 3.1 Congested speed factor	
Freeway factor	1.00	Freeway factor	0.90
		Ramp factor	0.50
CBD factor	0.50	Principal/Collector	0.60
All others	0.90	Minor art CBD/urban	0.55
		Minor art Suburban/rural	0.65

Highway Assignment

Highway assignment also occurs as a feedback loop in the distribution phase. The pre mode-choice assignment in distribution and the post mode-choice assignment (final assignment) methods and parameters are consistent, with the exception of trip tables. In distribution, the mode choice split is assumed to be consistent with the 1993 Home Interview Survey, and final assignment accounts for any changes in mode share that are unique to the scenario.

Path impedance function

In Version 2.1, path choice was based on minimizing the following function:

COST= (0.25 * MINUTES + 0.75 * MILES).

When time was the only consideration, freeways were loaded much heavier than they should have been. The heavy weighting on distance was to help bring volumes on both freeways and arterials closer to observed counts. Since the units on time and distance are inconsistent, it is difficult to relate these parameters in this way. In Version 3.1, both time and distance are converted to dollar values. Thus the time savings an alternative route offers is valued at $4.00/hour, and the mileage savings the comparable route offers is valued at $0.10/mile. The result is the following cost function:

COST = [(4 dollars/hour)(1hour/60 minutes)(MINUTES) + (0.10 dollars/mile) * MILES].

This reduces to:

COST = (0.067 * MINUTES + 0.10 MILES).

When factors are scaled up so as to sum to 1 (as in Version 2.1) the function can be written as:

COST = (0.4 * MINUTES + 0.6 * MILES).

Thus Version 3.1 factors can be expressed in dollars, which can facilitate comprehension of the trade-offs between time and distance.

Volume/Delay functions

Version 2.1 volume delay functions were of the standard BPR format:

Congested Time (minutes) = Free flow time * (1 + Coefficient*(V/C)^Exponent)

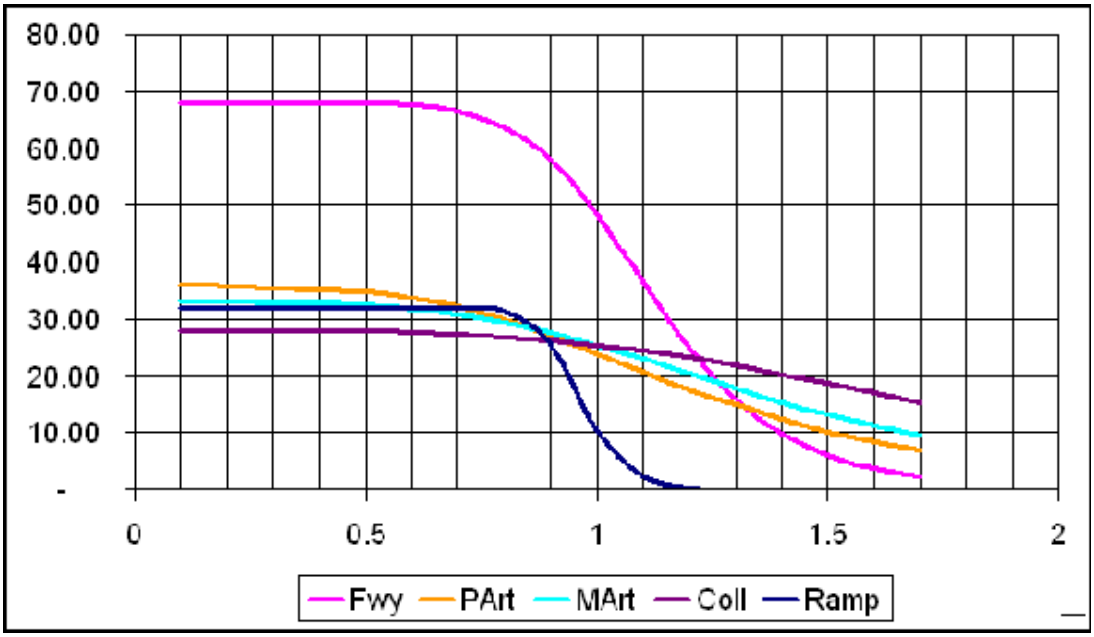
The development of Version 3.1 experimented with Conical and Akcelic functions, but found little significant difference in either curve shapes or assignment results. Thus Version 3.1 continues with BPR format functions. The following compares Version 2.1 to 3.1. The graphic demonstrates the effect of the 3.1 functions. Note that the average speed of ramps drops to 10 mph by V/C = 1. This is to simulate not only the effect of ramp metering, but also the signal delay typically experienced when attempting to enter or leave a freeway ramp.

Volume/Delay Parameters

Version 2.1			Version 3.1		
Facility	**Coefficient**	**Exponent**	**Facility**	**Coefficient**	**Exponent**
Freeways/Ramps	0.88	6.5	Freeways	0.4	8.0
All else (traditional BPR)	0.15	4.0	Ramps	2.0	12.0
			Principals	0.5	4.0
			Minors	0.3	4.0
			Collectors	0.1	4.0

Travel Model Version 3.1 Volume/Delay Functions

Speed (mph)



Volume/Capacity

Reports, Post Processors, Data Management

Model log

Version 3.1 includes a model log that tracks significant values as they are computed in order to facilitate comparison of values.

Demographics

Version 3.1 includes a utility that loads the 2001, 2030, and "Current Scenario" population and employment onto the highway network zones. This is useful for model stream reports and for simple displays and comparisons in Viper or GIS.

Version 3.1 of the travel model also reports demographic statistics by county and large district. It includes script utilities to report the same statistics for any aggregation of TAZs (such as a study area).

Special generators

Version 3.1 of the model reports calculations relevant to special generators to aid in understanding the modeling of these sites.

Network display maps

Numerous predefined Viper maps are included in Version 3.1 of the model.

Highway statistics

The highway statistics report (formerly known as the "Air Quality" report) has been modified to provide statistics on both the intermediate assignment (Distribution), and the final assignment.

Version 2.1 produced the report for just counties and select cities. Version 3.1 has also been modified to easily produce the report for any geographic boundary the user specifies (such as a study area).

New statistics include the percentage of links in each category that have a PM V/C ratio exceeding 1.0, and 1.2.

It also includes a new "Trips Report" that determines the total number of vehicle trips made on non-local streets within a geographic boundary.

Calibration statistics

A job script is available that quickly produces statistics relevant to the calibration and validation of the travel model. Output is only meaningful when produced for the base year (2001). Output includes comparisons and RMSE of modeled volumes with UDOT counts on each facility type and for each county. It also produces similar statistics between modeled speeds and observed GPS speeds.

Mode split shares

The shares report has been updated in accordance with the expanded mode choice model. It has also been modified to make it easier to generate the report for any geographic boundary.

Station activity / track activity

The transit station and track activity template has been improved to make it simpler to understand model output for stations and track segments. An SPSS script must be run in preparation to producing this report.

Managing large run sizes

Model runs will range from 0.5 Gigabyte per run to as much as 15 Gigabytes per run. Most of this data is intermediate files that are stored in the "9Tmp" directory. To facilitate storage of model runs, the 9Tmp directory can be moved or deleted in order to copy travel model files to a compact disc. None of the files necessary to reproduce the model run are included in the 9Tmp directory.

Quality Control

Due to the vast amount of data required as input to the travel modeling process, numerous quality control tools have been developed to help ensure the integrity of that data, which in turn enhances the reliability of the model. These automated features include the following:

- Summaries of key demographic data to compare magnitudes and trends for accuracy.
- Summaries of county to county flow magnitudes and trends for accuracy and reasonableness.
- Cross checks to detect conflicting network data.
- Visual inspection of differences between highway networks.
- Screen line summaries to compare general traffic volumes.
- Checks for correct county and city tag for links.
- Checks that link speeds and volumes are within reasonable ranges.
- Numerous other network detail checks.

Terms and Abbreviations

Trip purposes

HBW:	Home-based work trip
HBC:	Home-based college trip
HBO:	Home-based other trip
NHB:	Non home-based trip
IXXI:	Internal-External/External-Internal (trips with one end outside the network area)
Skims:	Network links comprising a travel path are "skimmed" to determine total travel time.
Logit:	A mathematical approach for expressing the factors involved in an individual's choice between two alternatives. One example is the total number of individuals who choose automobiles vs. the total who choose transit, when considering the travel times and other competitive features of each.
RMSE:	Root Mean Square Error
SPSS:	Statistical Package for the Social Sciences, commercial data analysis software
HIS:	Home Interview Survey, data collection to define personal travel habits
TAZ:	Traffic Analysis Zone, socioeconomic characteristics are defined at this level
CBD:	Central Business District (downtown)
Viper:	The graphical interface tool of the TP+ travel model software used to inspect travel model results.
GPS:	Global Positioning Satellite data is used to measure time and distance in collecting highway speed information.

Appendix - 2
Travel Model Highway Networks

Figure 1a - Salt Lake Area 2001 Highway Network

(see "LN01_SL.pdf" for an electronic copy of this map)

Figure 1b - Ogden/Layton Area 2001 Highway Network

(see "LN01_OG.pdf" for an electronic copy of this map)

Figure 2a - Salt Lake Area 2008 Highway Network

(see "LN08_SL.pdf" for an electronic copy of this map)

Figure 2b - Ogden/Layton Area 2008 Highway Network

(see "LN08_OG.pdf" for an electronic copy of this map)

Figure 3a - Salt Lake Area 2012 Highway Network

(see "LN12_SL.pdf" for an electronic copy of this map)

Figure 3b - Ogden/Layton Area 2012 Highway Network

(see "LN12_OG.pdf" for an electronic copy of this map)

Figure 4a - Salt Lake Area 2022 Highway Network

(see "LN22_SL.pdf" for an electronic copy of this map)

Figure 4b - Ogden/Layton Area 2022 Highway Network

(see "LN22_OG.pdf" for an electronic copy of this map)

Figure 5a - Salt Lake Area 2030 Highway Network

(see "LN30_SL.pdf" for an electronic copy of this map)

Figure 5b - Ogden/Layton Area 2030 Highway Network

(see "LN30_OG.pdf" for an electronic copy of this map)

Appendix-3
Regionally Significant Highway and Transit Projects
Salt Lake and Ogden Areas

2004-2008 TIP
&
Amended 2030 Long Range Plan

2030 Long Range Plan

Regionally Significant Highway Projects

Salt Lake and Ogden Areas

Route	Location	Project Concept, New Lanes	Length (miles)	PHASE 1=2002-2012 2=2013-2022 3=2023-2030
SALT LAKE COUNTY, EAST-WEST FACILITIES				
I-80	State Street to Parleys Canyon	Widening, add 2 lanes	5.6	2
SR-201	Jordan River to 3200 W	Widening, add 2 lanes	2.6	1
SR-201	3200 W to Mountain View Corridor	Widening, add 2 lanes	3.4	2
SR-201 interchanges	7200 W & 8400 W	New	0.0	2
SR-201 interchanges	I-215	New (includes aux. lanes)	0.0	3
3500 S	Redwood to 4000 W	Widening, add 2 lanes	1.6	1
3500 S	4000 W to Mountain View Corridor	Widening, add 2 lanes	2.1	1
4500 S	2300 E to 700 E	Widening, add 2 lanes	2.4	3
4500 S	I-15 to State Street	Widening, add 2 lanes	0.7	1
4700 S	I-15 to Redwood Road	Widening, add 2 lanes	2.0	2
4700 S	4000 W to Mountain View Corridor	Widening, add 2 lanes	2.0	2
9000 So./9400 So.	700 E to 1300 E	Widening, add 2 lanes	1.2	1
9400 S	2100 E to Wasatch Boulevard	Widening, add 2 lanes	2.7	3
9000 S	Bangerter Hwy. to New Bingham Highway	Widening/NC add 2 lanes	1.7	1
11400 S Interchange	@ I-15	New Construction	0.0	1
12300 S/12600 S	900 E to Bangerter Hwy.	Widening, add 2 lanes	6.4	1
13400 S	Mountain View Corridor to Bangerter Hwy.	Upgrade, add 6 lanes	2.0	3
SALT LAKE COUNTY, NORTH-SOUTH FACILITIES				
I-15	Beck Street to 600 N	Widening, add 2 lanes	3.0	3
I-15	I-215 to Beck Street	Widening, add 2 lanes	1.2	3
I-15	10600 S to 14600 S	Widening, add 4 lanes	5.3	1
I-15	14600 S to Utah Co. Line	Widening, add 3 lanes	2.4	1
I-15	10600 S to Utah Co. Line	Widening, add 1 lanes	7.7	2
I-215	I-80 (West Side) to 300 E	Widening, add 2 lanes	12.5	1
700 E	9400 S to 12300 S	Widening, add 2 lanes	3.9	1
900 E	Van Winkle Exp. to 6600 S	Widening, add 2 lanes	2.5	1
2000 E	Fort Union Blvd. to 9400 S	Widening, add 2 lanes	3.6	3
Highland Drive	9400 S to Sego Lily	Widening/NC, add 2 lanes	1.3	1
Highland Drive	Sego Lily to 13800 S	New Construction, add 4 lanes	5.1	2
Highland Drive Conn.	13800 S to Highland Drive	Widening/NC, add 2 lanes	3.5	2
Wasatch Boulevard	7000 S to North Little Cotton. Rd	Widening, add 2 lanes	2.1	2
Redwood Road	9000 S to 10400 S	Widening, add 2 lanes	1.8	1
Redwood Road	10400 S to Bangerter	Widening, add 2 lanes	4.3	1
Redwood Road	Bangerter to Utah County	Widening, add 2 lanes	4.8	1
5600 W	I-80 to 2100 S	Widening, add 4 lanes	3.5	3
Mountain View Corridor	2100 S to 6200 S	New Construction, add 6 lanes	6.3	1
Mountain View Corridor	6200 S to 10500 S	New Construction, add 6 lanes	4.9	2
Mountain View Corridor	10500 S to 13400 S	New Construction, add 2 lanes	3.4	2

Mountain View Corridor	10500 S to 13400 S	New Construction, add 4 lanes	3.4	3
Mountain View Corridor	13400 S to Utah County	New Construction, add 6 lanes	6.9	3
SOUTH DAVIS COUNTY FACILITIES				
I-15	U.S. 89 (Farmington) to 500 S. (Davis Co)	Widening, add 2 lanes	7.0	2
I-15	500 S. (Davis Co) to I-215	Widening, add 2 lanes	3.7	1
I-15	I-215 to Beck Street	Widening, add 2 lanes	1.0	2
Legacy Parkway	U.S. 89 (Farmington) to I-215	New Construction, add 4 lanes	11.0	1
NORTH DAVIS COUNTY, NORTH-SOUTH FACILITIES				
I-15	Weber Co. Line to Hillfield Rd. (SR-232)	Widening, add 2 lanes	6.2	3
I-15	US-89 to 500 S, Bountiful	Widening, add 2 lanes	7.1	3
I-15	500 S, Bountiful to I-215	Widening, add 2 lanes	3.6	2
I-15 Interchange	@ Glovers Lane or Lund Lane	New Construction	0.0	3
Legacy Parkway	Weber Co. Line to Syracuse Rd.	New Construction, add 4 lanes	4.5	2
Legacy Parkway	Syracuse Rd. to Gentile St.	New Construction, add 4 lanes	3.0	3
Legacy Parkway	Gentile St. to I-15/US-89	New Construction, add 2 lanes	9.4	1
Legacy Parkway	Gentile St. to I-15/US-89	Widening, add 2 lanes	9.4	2
US-89	I-15 (Farmington) to Harrison Blvd.	Widening, add 2 lanes	10.5	3
US-89 Interchange	@ Burke Lane	New Construction	0.0	1
US-89 Interchange	@ Shepard Lane	New Construction	0.0	1
US-89 Interchange	@ 400 N (Fruit Heights)	New Construction	0.0	1
US-89 Interchange	@ Oakhills Dr. (SR-109)	New Construction	0.0	2
US-89 Interchange	@ Gordon Ave.	New Construction	0.0	2
US-89 Interchange	@ Antelope Dr.	New Construction	0.0	2
I-15 Interchange	South Layton	New Construction	0.0	1
WEBER COUNTY, EAST-WEST FACILITIES				
12th Street (SR 39)	1200 to W Wall Ave	Widening, add 2 lanes	1.5	2
1200 S	I-15 to Legacy Parkway	Widening, add 2 lanes	4.4	3
Hinckley Drive	I-15 to Wall Ave	Widening, add 2 lanes	0.7	1
30th Street	Washington Blvd. to Harrison Blvd.	Widening, add 2 lanes	1.1	1
5600 S Conn.	I-15 to I-84	New Construction	0.0	2
WEBER COUNTY, NORTH-SOUTH FACILITIES				
Harrison Blvd.	12th St to US-89	Widening, add 2 lanes	6.1	2
Riverdale Rd (SR-26)	SR-126 to Wall Ave	Widening, add 2 lanes	2.8	1
Riverdale Rd (SR-26)	Wall Ave to Washington Blvd	Widening, add 2 lanes	0.7	1
I-15	2700 N to 450 N	Widening, add 2 lanes	2.6	3
I-15	450 N to 12th Street	Widening, add 2 lanes	1.8	2
I-15	12th Street to 31st Street	Widening, add 2 lanes	3.0	1
I-15	31th Street to Davis Co. Line	Widening, add 2 lanes	3.5	3
Legacy Parkway	5500 S (Roy) to Davis Co. Line	New Construction, add 4 lanes	0.8	2
US-89	I-84 to Harrison Blvd.	Widening, add 2 lanes	1.9	1

2030 Long Range Plan
Regionally Significant Transit Projects
Salt Lake and Ogden Areas

Project	Improvement	General Location	Phase
ALL COUNTIES			
Salt Lake - Provo Commuter Rail	New Construction	Current Union Pacific mainline ROW	2
Ogden-Salt Lake Commuter Rail	New Construction	Current Union Pacific mainline ROW	1
Park & Ride lots	New Construction	Various locations (14) region wide	1, 2, & 3
SALT LAKE COUNTY			
Stadium - Medical Center LRT	New Construction	South Campus and Medical Drives	1
SLC--Sandy LRT Line Efficiency Improvements	Upgrade	Main Street SLC to 10000 South	1
West Valley LRT Spur	New Construction	2300 S. to West Valley Intermodal Center	1
Mid Jordan LRT Spur	New Construction	Fashion Place West to Bangerter Hwy.	1
Airport LRT / BRT	New Construction	CBD to Airport	1
Draper LRT Spur	New Construction	10000 South to 12300 S	1
Fort Union BRT	New Construction	Fashion Place West to Fort Union	2
Traverse East (North) LRT / BRT	New Construction	12400 South ot 14600 South	2
Traverse East (South) LRT / BRT	New Construction	14600 South to Utah County	3
Western Transportation Corridor Transitway *	New Construction	Airport LRT to 4700 South	3
Foothill Blvd / I-215 Transitway *	New Construction	University of Utah to Fort Union	3
3500 South LRT	New Construction	West Valley LRT to 8400 W/SR-201	2
Sugarhouse LRT	New Construction	2300 S to 1100 East	1
1300 East (North) BRT	New Construction	U of U to Fort Union	1
1300 East (South) BRT	New Construction	Fort Union to 1300 South	2
Redwood (North) BRT	New Construction	North Temple to 9000 South	1
Redwood (South) BRT	New Construction	90000 South to 14400 South	2
Foothill Blvd. Enhanced Bus	New Construction	U of U to I-80	1
I-215 East Belt Enhanced Bus	New Construction	I-80 to Fort Union	2
Mountain View (North) BRT	New Construction	Airport to 4700 South	2
Mountain View (South) BRT	New Construction	4700 S to 13400 S to Bangerter Hwy. to Traverse East line	2
Gateway Intermodal Center	New Construction	Near 600 West 200 South	1
Mid-Valley Intermodal Ctr.	New Construction	LRT / Commuter Rail Station	1
West Valley Intermodal Center	New Construction	Valley Fair Mall	1
University of Utah Transit Hub	New Construction	LRT Station	1
North Temple Transit Hub	New Construction	LRT Station near Redwood Rd.	2
Union Park Transit Hub	New Construction	Union Park Area	2
West Jordan Transit Hub	New Construction	Near SLCC Jordan Campus	1
Sandy/South Jordan Transit Hub	New Construction	Sandy Civic Center	2
Magna Park & Ride	Upgrade	2100 S / 8400 W	1
Hunter Park & Ride	New Construction	3500 S / Mountain View Corridor	1
East Millcreek Park & Ride	New Construction	3900 S / I-215	1
Kearns Park & Ride	New Construction	4700 S / Bangerter Hwy.	1
Taylorsville Park & Ride	New Construction	4700 S / Redwood Rd.	1
Cottonwood Park & Ride	New Construction	Highland Dr. / 4700 S	2
Knudsen Corner Park & Ride	New Construction	I-215 / Wasatch Blvd.	1

Project	Improvement	General Location	Phase
Other Salt Lake Park & Ride	New Construction	TBA	3
South Valley Bus Maintenance Facility	New Construction	South Salt Lake County	1
Bus Maintenance Facility	New Construction	TBA	3
DAVIS COUNTY			
South Davis (North) BRT	New Construction	Salt Lake City to Farmington	2
South Davis (South) BRT	New Construction	Parrish Lane to SLC	1
North Davis (Ogden-Clearfield) BRT	New Construction	Ogden Intermodal Center to Clearfield Commuter Rail Station	2
North Davis (Layton) BRT	New Construction	Clearfield Commuter Rail Station to Layton Commuter Rail Station	2
North Davis (Kaysville) BRT	New Construction	Farmington Commuter Rail Station to Parrish Lane	2
Layton Transit Hub	New Construction	Layton Commuter Rail Station	1
Woods Cross Transit Hub	New Construction	500 S / I-15	1
Frui9t Heights Park & Ride	New Construction	US-89 / 400 North	1
WEBER COUNTY			
Ogden to WSU BRT	New Construction	24th Street/Harrison to Wasatch Blvd.	1
North Weber Commuter Rail	New Construction	Union Pacific Alignment	1
Washington BRT	New Construction	3100 N to Harrison Blvd.	1
North Davis (Ogden-Clearfield) BRT	New Construction	Ogden Intermodal Center to Clearfield Commuter Rail Station	2

*The Bus Rapid Transit (BRT) corridors have potential for major transit investment including rail.

Appendix – 4
Ogden 1990 Particulate Emissions

Estimation of Ogden City 1990 Particulate Emissions

Method A – DAQ 1990 Utah Air Emission Inventory:

Weber Co. Fugitive Dust from Roads (p 38)	=	7,934.7 tons/year
Weber Co. PM10 from tailpipes (p 29)	=	670.2 tons/year
Weber County 1990 VMT	=	2,970,697
Ogden City 1990 VMT	=	1,107,143
Percent Ogden City VMT	=	37.3%
Prorated Ogden City 1990 Particulates	=	3,209.6 tons/year
Days per year	=	365
Ogden City 1990 Particulates	=	**8.8 tons/day**

Method B – Salt Lake PM10 SIP, Table 9.A.13 (p. 1/3):

Salt Lake County road dust & tailpipe PM10	=	1,100.9 tons/month
Salt Lake Co. 1990 VMT	=	15,767,192
Ogden City 1990 VMT	=	1,107,143
Percent Ogden City VMT	=	7.0%
Prorated Ogden City 1990 Particulates	=	77 tons/month
Days per month	=	31
Ogden City 19990 Particulates	=	**2.49 tons/day**

Method C – WFRC AQ Memorandum No. 7, October 1995, p 16:

Freeway fugitive dust rate	=	0.92 grams/mile
Arterial fugitive dust rate	=	1.30 grams/mile
Local street fugitive dust rate	=	1.82 grams/mile
Tailpipe particulates date	=	0.114 grams/mile
1990 Ogden freeway and ramp VMT	=	87,794
1990 Ogden arterial VMT	=	773,180
1990 Ogden local street VMT	=	246,169
Ogden City 1990 Particulates	=	**1.68 tons/day**

The 1.68 tons/day of particulates from Method-C above is the most conservative of the three emission estimates. Method-C is also recommended by Matt Riffkin in a memo addressed to WFRC. Mr. Riffkin prepared most of the numerical analysis contained in the WFRC Air Quality Memorandum No. 7 including a Build < 1990 conformity test for Weber County PM_{10} before it was determined that the non-attainment area would be limited to Ogden City.

Estimate of 1990 Ogden City Landfill Road Dust Emissions

None of the three methods used above to estimate 1990 particulate emissions in Ogden City accounts for the road dust from the freshly graded access road to the Ogden City landfill. The landfill access road fugitive dust emissions have been estimated using the PART5 model and the assumptions and inputs as described below.

According to George Benford, Ogden City traffic engineer, the landfill access road averaged 3600 feet in length (1.4 miles round trip) and served 300-400 vehicles daily, 80% of which were trucks such as 10-wheeler garbage trucks or dump trucks. The posted speed for the access road is 15 mph. Weather data reports 78 annual precipitation days of 0.01 inches or more in Weber County during 1996. Average vehicle weight was estimated using median vehicle weights for 2BHDDV and LDGT1 vehicle classes according to PART5 user guide, p. 8. The calculation is as follows:

$$0.8(9{,}250) + 0.2(4{,}000) = \mathbf{8{,}200\ lb}$$

A similar calculation is made to estimate the average number of wheels per vehicle:

$$0.8(10) + 0.2(4) = 8.8 \text{ wheels, } \mathbf{use\ 8\ wheels} \text{ (a conservative assumption)}$$

The PART5 user guide (p. 11) suggests varying weight percentages of silt for unpaved roads according to the type of road involved. A more complete table of this same information including mean silt percent values is found in the EPA document "Inspection manual for PM_{10} Emissions from Paved/Unpaved Roads and Storage Piles" October 1989, p. 4-4. Table 4-1 of the EPA report gives a silt percent range of 18-29% and a mean of 24% for a freshly graded haul road for surface coal mining. The landfill road is freshly graded but not in a surface coal mine setting. The silt percent range for dirt rural roads is 5.8-68% with a mean of 28.5%. The freshly graded haul road fits in this range so the 24% silt for a freshly graded haul road was determined to be an appropriate value (even conservative) for the landfill access road. In applying this value in PART5 it was discovered that PART5 will not accept a silt load above 20%, so the 20% value was used in running PART5 (a conservative assumption).

PART5 was run using the inputs described above. The input and output files are found in the TSD as P5_1429B.IN and P5_1429B.OUT. The resulting fugitive dust emission rate from PART5 for a freshly graded haul road is 1,110.78 grams/mile. The total daily emission from vehicles traveling the haul road is estimated as follows:

$$1.4 \text{ miles} * 350 \text{ vehicles} * 1{,}110.78 \text{ g/mile} * 1 \text{ lb} / 453.5 \text{ grams} * 1 \text{ ton} / 2000 \text{ lb} = \mathbf{\underline{0.60}\ tons}$$

Combining the landfill access road value with the conservative estimate of other particulate emissions described in Method-C on the preceding page, the total 1990 Ogden City particulate emissions is estimated as:

$$1.68 \text{ tons/day} + 0.60 \text{ tons/day} = \mathbf{\underline{2.28\ tons/day}}$$

PM10 Monitor Data – Ogden City
1987-2003