

Overview of Process

In an effort to optimize the value of the Regional Transportation Plan for 2011-2040 (RTP), the WFRC derived its initial Draft Regional Transportation Plan from the best of four multi-modal alternative transportation system models. This process allowed the draft 2011-2040 Regional Transportation Plan to be evaluated not only in terms of individual projects but also in terms of its cumulative anticipated performance.

The four system alternatives were developed by drawing from Wasatch Choice for 2040 recommendations, the transportation needs assessment discussed in Chapter 3, recommendations from individual corridor and area-wide studies, and other public and policy-maker input. The system alternatives evaluation process used both quantitative and qualitative measures to assess the relative ability of each system to meet identified transportation needs of the Region and its primary travel corridors. Ultimately, a core highway and transit system was chosen and individual, well performing projects from the four system alternatives were selected for the initial Draft Regional Transportation Plan. The process used to develop the initial Draft RTP is outlined in the shaded portion of Figure 4-1.



Chapter 4

Photo at Left: UTA TRAX stops at the Fort Douglas Station on the University (Red) Line in this photo captured by James Belmont. Effective systems planning evaluates various alternatives and is critical to selecting a preferred option which leads to successful transportation development throughout the region as exemplified in this image.



Figure 4-1, Initial Draft Regional Transportation Plan Selection Process



DEVELOPMENT OF SYSTEM ALTERNATIVES

Initially four transportation systems development alternatives were drafted for evaluation. A fifth blended alternative was later developed by WFRC Staff from the initial four alternatives. The blended alternative was the basis for the initial draft of the RTP.

The four initial transportation systems were labeled "No-Build", and "Current Plan"; and the "Team A" and "Team B" systems. The "No-Build" system included only those projects which were substantially completed or to which the Region is committed. The "Current Plan" system consisted of the funded and unfunded projects from The Wasatch Front Regional Transportation Plan: 2007-2030.

The "Team A" and "Team B" systems were independently developed by select members of UDOT, UTA, and WFRC staffs. These four system alternatives were then submitted for public and policy-maker input. Modifications in the alternatives were made in an attempt to include all feasible projects recommended by the public, policy-makers, and in the corridor and area-wide studies carried out in the Region. This section briefly describes each of these four alternatives.

No Build

The No Build alternative, as stated above, consists of projects which were substantially completed or to which the Region is committed. It provides a base from which to access the relative ability of each system to meet the stated regional needs and primary travel corridors. All projects in the "No Build" system are included in each of the other

transportation system alternatives. Table 4-1 lists the major highway and transit projects in this alternative. Map 4-1 shows the highway and transit improvements in this alternative.

Current Plan

The Current Plan alternative consists of both the funded and unfunded transit and highway projects from the 2007-2030 Wasatch Front Regional Transportation Plan. Given the level of evaluation and scrutiny previously given this system when it was developed in 2005 and 2006, it was assumed that this system would rate well and should be included as a system alternative. It was determined that unfunded projects from the 2007-2030 Regional Transportation Plan could be included, given that the end of the planning horizon for the new Regional Transportation Plan would be extended from 2030 to 2040 and more revenue would be available. Table 4-2 lists some of the larger projects in this alternative which were not part of the No Build Alternative. Map 4-2 shows all of the proposed projects in this alternative.

Team A and Team B Alternatives

The "Team A" and "Team B" Alternatives were developed independently by select teams consisting of transportation professionals from Utah Department of Transportation, Utah Transit Authority, and Wasatch Front Regional Council. In preparation for alternative development, each team was given needs data, the WFRC system evaluation criteria, and access to UDOT's Planning and Environmental Linkage (PEL) website which provides assembled maps of environmental resources. As stated at the beginning of this Chapter, four multimodal system alternatives were originally developed and evaluated. Based upon that evaluation the Initial Draft Regional Transportation Plan was developed. The description of the initial Draft Regional Transportation Plan can be found at the end of this Chapter.

Improvements to Other Modes

The growth principles adopted by the Wasatch Front Regional Council encourage the promotion of alternative modes to highways and transit modes such as bicycling and walking, help reduce growth in vehicle travel and support healthy living. While many of the alternative modes opportunities are local and should be addressed by city and county officials, the 2011-2040 RTP recommends that bicycle and pedestrian facilities, where appropriate, be included on all highway and transit projects.

In addition, the WFRC has worked with community planners and officials, along with a number of special interest groups throughout the Region, to develop a Regional Bicycle Plan to serve not only a growing number of commuters, but also those individuals traveling by alternative modes to visit major destinations and attractions. The regional bicycle system was assumed to be in place in each of the alternatives. Map 3-1 in Chapter 3, System Needs Assessment, identifies the major destinations and the bicycle corridors that currently serve them.

After the teams had completed their respective system alternatives, their work was reviewed by the WFRC staff, jurisdictional technical staff, stakeholders, and the public at large. Modifications were then made to the alternatives to ensure that projects recommended in previous studies or by stakeholders were represented in at least one of the draft alternatives. Additionally, an effort was made to equalize the system alternative costs. Tables 4-3 and 4-4 lists the major highway and transit projects in each of the two alternatives. Maps 4-3 and 4-4 show all of the proposed projects in the alternatives.



Select No Build System Alternative Projects

Major Highway Projects						
SR-193 Extension – Main Street to 2000 West						
Mountain View Corridor Frontage Roads and Arterial – 5400 South to Redwood Road						
11400 South Interchange						
11400 South – State Street to Bangerter Highway						
Redwood Road – Bangerter Highway to Utah County Line						
5400 South Flex Lanes and Widening – Redwood Road to 4800 West						
Riverdale Road – Washington Boulevard to I-84						
I-15 – 2700 North to I-84						
Major Transit Projects						
Salt Lake City – Provo Commuter Rail						
Airport Light-Rail						
Draper Light-Rail to 12400 South						
Mid-Jordan Light-Rail						
West Valley Light-Rail						



Select Current Plan System Alternative Projects

Major Highway Projects							
West Davis Corridor – I-15 (North) to I-15 / US-89 (Farmington)							
I-15 – Weber, Davis, and Salt Lake Counties							
Mountain View Corridor – I-80 to Utah County Line							
I-215 – I-80 to 4700 South							
Bangerter Freeway – I-15 to 13400 South							
US-89 – Harrison Boulevard to I-15 (Farmington)							
2000 West / 3500 West / Midland Drive – Hinekley Drive	e to West Davis Corridor						
Redwood Road – 9000 South to Bangerter Highway							
I-80 – 1300 East to Parleys Canyon							
State Street – 6000 South to 9000 South							
900 / 700 South - Van Winkle Expressway to 9400 South							
9000 South I-15 to SR-111							
Highland Drive – Fort Union Boulevard to I-15							
Select Major Transit Projects							
Project Name Project Limits							
Draper (South) Light-rail	12400 South to Utah County						
South Davis Bus Rapid Transit (BRT 3)	Centerville to Downtown Salt Lake						
Redwood Road Bus Rapid Transit (BRT 3)	Downtown Salt Lake to Mid-Jordan TRAX						
State Street Bus Rapid Transit (BRT 3)	Downtown Salt Lake to 5300 South TRAX						
1300 East (North) Bus Rapid Transit 3	University of Utah to Fort Union						
South Temple – Foothill—Fort Union BRT3	Downtown Salt Lake to Fort Union						
5600 West Bus Rapid Transit (BRT 3) Downtown Salt Lake to 11800 South							
Sugarhouse Streetcar 2100 South TRAX Station—Highland Drive							
400 South Direct TRAX Link (Light-rail) University of Utah Direct to Salt Lake Central							
1300 East (South) Bus Rapid Transit 3	5300 South TRAX to 12400 South TRAX						
5400 South (West) Bus Rapid Transit 3	5300 South TRAX to 5600 West						
Weber State Bus Rapid Transit (BRT 3)	Ogden Intermodal Center—Weber State University						
3500 South Bus Rapid Transit (BRT 3)	3300 South TRAX to Magna						

Select Team A System Alternative Projects

Major Highway Projects								
West Davis Corridor – 4000 South to I-15 / US-89 (Farmin	West Davis Corridor – 4000 South to I-15 / US-89 (Farmington)							
Mountain View Corridor – I-80 to Utah County Line								
Bangerter Highway Interchanges – I-80 to I-15								
Harrison Boulevard – 2600 North to 3600 South								
I-215 – I-80 (West) to I-80 (East)								
Pioneer Road – 3000 West to Harrison Boulevard								
Legacy Parkway – I-15 / US-89 to I-215								
SR-111 – SR-201 to Herriman Main Street								
Highland Drive – 9400 South to 12400 South								
Various Operational Projects								
Major Transit Projects*								
Project Name Project Limits / Path								
Southwest Bench Bus Rapid Transit 3	Daybreak-Copperton-West Bench-Kearns-International							
	Center-Airport-Salt Lake Central							
Granery Bus Rapid Transit (BRT 3)	900 South TRAX Station-Southwest CBD-200 South-Salt							
7000 South/Fort Union Bus Ranid Transit (BRT 3)	Lake CDD West Bench-Mid Jordan TBAX-Sandy TBAX-							
	Cottonwood Corporate Center-Big Cottonwood							
	Canvon							
9000 South Bus Rapid Transit 3	Daybreak-Little Cottonwood Canyon							
12300 South Bus Rapid Transit 3	Herriman-Draper-12300 South TRAX Station							
North Davis Bus Rapid Transit 3	US 89-Hill Air Force Base-Clearfield FrontRunner							
	Station-West Point							
West Davis Bus Rapid Transit 3	Syracuse-Farmington FrontRunner-Bountiful-Salt Lake							
	City CBD							
*All in-street transit was initially evaluated in equal terms	s as a Bus Rapid Transit							

Select Team B System Alternative Projects

Major Highway Projects							
West Davis Corridor – I-15 (North) to I-15 / US-89 (Farmir	ngton)						
I-15 – Weber, Davis, and Salt Lake Counties							
US-89 – Harrison Boulevard to I-15 (Farmington)							
Harrison Boulevard – 24 th Street to US-89							
SR-193 – West Davis Corridor to US-89							
1800 North – I-15 to 5900 West							
SR-201 – I-15 to SR-111							
6200 South Freeway – I-215 to Mountain View Corridor							
Highland Drive – Fort Union Boulevard to I-15							
9000 South – I-15 to SR-111							
I-215 – Redwood Road to I-15							
Mountain View Corridor – I-80 to Utah County Line							
Bangerter Highway Freeway Upgrade – I-80 to I-15							
I-215 – 2100 North to 4700 South							
I-80 - 1300 East to Summit County Line							
Major Trar	sit Projects						
Project Name	Project Limits / Path						
Bangerter Highway Bus Rapid Transit (BRT 3)	Airport TRAX Line-6200 South-Draper FrontRunner Station						
Interstate 80 Bus Rapid Transit (BRT 3) Salt Lake Central-7200 West							
5400 South Bus Rapid Transit (BRT 3) Murray FrontRunner Station-Mountain							
10400 South Bus Rapid Transit (BRT 3)	10000 South TRAX Station-South Jordan FrontRunner Station-Daybreak						
Denver Rio Grande and Western Light Rail	400 South West Bountiful-3300 South (West Haven						
Washington Boulevard-South Weber Bus Rapid Transit (BRT 3)	North Ogden-Harrisville-Ogden-South Ogden-South Weber						

ALTERNATIVE FOUR STAFF DEVELOPED (TEAM B) TRANSIT PROJECTS

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EVALUATION OF SYSTEM ALTERNATIVES

In an effort to improve the RTP development process, a set of thirteen system evaluation criteria were adopted by the WFRC in the Spring of 2010. The thirteen planning criteria were used to assess each of the system alternatives for its relative

system-wide functionality, responsiveness to corridor needs, fiscal prudence, social and economic value, and environmental costs. As shown in Table 4-5, each of these criteria is linked to the Wasatch Choices for 2040 Growth Principles. The Growth Principles are found in Chapter 2, Regional Visioning, Page 48.

TABLE 4-5RTP Alternative Evaluation Criteria

Measures	Definition**	Supporting Growth Principles
Project Costs	Roadway construction costs and transit construction and operating costs.	Goal 1,6
Travel Time	Estimated 2040 auto and transit travel time through select travel corridors	Goals 1,3,6
Safety	The current average crash rate and severity index on state roads* in which roadway and public transit projects are proposed.	Goal 5
Corridor Specific Goals	How many needs, specific to the corridor or identified by staff and/or the general public, are met by the proposed alternative.	Goals 1,3,7,8,9
Auto Delay	Annual number of hours of vehicle delay caused by traffic congestion during the peak periods.	Goals 1,6
Vehicle Miles Traveled	Total daily vehicle miles traveled	Goals 2,5,6,9
Transit Ridership	Forecasted 2040 linked daily transit trips and passenger miles	Goals 1,2,3,5,6,8,9
Activity Center and Infill Area Access	Sum of all forecasted 2040 peak hour auto and transit commutes of 20 minutes or less to 130 selected activity centers and infill areas.	Goals 1,2,3,4,5,6,9
Economic Access for Disadvantaged Populations	Sum of all forecasted 2040 peak hour vehicle and transit commutes of 20 minutes or less from 37 selected areas with current high concentrations of disadvantaged populations.	Goals 2,4,5,6,8
Freight Access	The cumulative travel times from 17 selected freight centers to the freeway.	Goals 3,6
Environmental Impacts	The total and weighted potential direct impacts of the proposed system upon 49 categories of natural, urban, and demographic resources and constructability issues.	Goals 3,5,6,8,9
Air Pollutant Emissions	Estimated 2040 tons per day of five transportation related emissions	Goals 5,6,9
Non-motorized facilities	Miles of co-incident projects and proposed bike facilities.	Goals 1,2,3,5,8,9
*Crash statistics are only	y available on State facilities	
**All transportation stat	istics are for travel within Weber, Davis, and Salt Lake C	Counties

Both direct measure and relative indicators were used to compare the systems. The process and findings for each of these criteria are discussed in this Chapter section. With a few exceptions, the scores in each of the tables accompanying the discussion of each criterion are based on a one to ten scale with five representing the average score for the four original and the Initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for that measure. Appendix I contains tables with more detailed findings and with the raw values. Table 4-5 briefly describes these criteria.

In addition to the criteria listed in Table 4-5, WFRC staff used system cost as a guiding criterion and, in many cases, considered potential benefit compared with estimated roadway construction costs, and combined transit construction and operating costs.

Transportation System Alternative Cost Scores

that the Bus Rapid Transit (BRT 3) or Enhanced Bus (BRT 1) lines would not replace any of the current transit lines so the operation and maintenance costs were assumed to be additional costs to the system. The transit costs did not include the purchase of rights-of-way whereas roadway costs were increased 20 percent to account for rights-of-way purchases. The relative cost scores found in Table 4-6 are based upon a one to ten scale with five representing the average score for the four original and the initial Draft alternatives. A score greater than 5 for a given alternative indicated that this alternative scored better than average for that measure. Appendix I contains tables with the raw cost estimations.

The transit capital cost estimation for the No Build Alternative was \$3.7 billion dollars and the original four build alternative costs ranged from \$9.3 billion for the Current RTP Alternative to \$12.7 billion for the Team A Alternative.

TABLE 4-6

	No Build	Current Plan	Team A	Team B	Initial Draft RTP				
Transit Construction	8.2	4.8	2.8	4.3	4.9				
Transit Daily Operating	6.1	5.2	4.6	5.0	4.0				
Roadway Construction	9.1	4.3	4.6	3.5	3.5				

*A 1 to 10 scoring method with 5 representing the average value and higher values representing a more favorable outcome

Project Costs

Both the Highway and Transit cost estimates were developed in conjunction with UDOT and UTA respectively. Cost estimations were based upon a per mile cost by project type and were inflated to 2025 dollars to reflect the mid-point of the planning horizon. All cost figures were considered drafts for the purpose of evaluating the various system alternatives and may be different from the values used to financially constrain the completed Plan. In the case of transit, Initially all transit projects operating upon public streets were assumed to be Bus Rapid Transit (BRT 3) until ridership and other factors could be used to justify implementation of an appropriate technology with each of the lines in question. The initial assumption was The operating and maintenance costs of the original four build alternatives ranged from \$2.3 million per day for the Current Plan Alternative to \$2.6 million per day for the Team A Alternative. The initial Draft RTP was, in large part, a blend of the best performing Current RTP Alternative capital projects with many of the Team A operations. Its capital costs were estimated to be about \$9.0 billion and its operating and maintenance costs were estimated to be \$2.9 million dollars a day. It was assumed that further plan refinement would result in lower net operating and maintenance costs as the Bus Rapid Transit (BRT 3) and Enhanced Bus (BRT 1) lines could replace existing services in many cases.

The roadway construction costs for the No Build Alternative was estimated to be \$3.7 billion and the original four build alternative construction cost ranged from \$21.5 billion for the Team A Alternative to \$26.2 billion for the Team B Alternative. The Team B alternative was the primary source of the initial Draft RTP Alternative which was estimated to cost \$26.1 billion to build.

Travel Time

Year 2040 average weekday afternoon peak period auto and transit travel time was forecasted for each of the fourteen travel corridors using the Wasatch Front Travel Demand Model. The afternoon peak period is 3:00 pm through 6:00 pm. The guiding principles in the delineation of the fourteen travel corridors were to cover the entire Wasatch Front Region and to follow projected dominant travel patterns. Because it was important that the modeled trips serve the activity centers in each of the corridors, travel to economic centers in each of the corridors were included as part of the corridor travel path for both vehicles and public transit travel times. These fourteen corridors are illustrated in Maps 4-5.

The cumulative travel time scores for all the fourteen corridors by vehicle and by public transit are found in Table 4-7. The scores found are based upon a one to ten scale with five representing the average score for the four original and the Initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for that measure. The traverse times by mode corridor segment are found in Appendix I. Of important note is that public transit may not have been available to the public in all the alternatives to make the journey across the planning corridor. The public transit travel time for these segments where transit is not available is zero, which would falsely indicate a better score. Where public transit is not available to make the required trip the cell is highlighted and the number of "missing links" are identified along side of the score.

Of the four original alternatives, the cumulative corridor travel times for vehicles ranged from 600 minutes for the Team B Alternative to 687 minutes for the No Build Alternative. The Team B Alternative was the bases for the initial Draft RTP system. This refined system had a cumulative corridor travel time of 566 minutes for auto users.

Safety

The Severe Crash Rate and the Crash Rate Ratio from UDOT's UPLAN data base were used to evaluate the value of each of the system transportation alternatives in terms of their potential safety benefits. The higher the crash rate and the severity of accidents on roads on which highway and transit projects are proposed in a system alternative, the better the safety score that alternative received. The premise behind using the crash rate and the accident severity index is that the projects will resolve many of the safety deficiencies as they reconstruct the roads for additional travel lanes, operational improvements, or for exclusive transit lanes. Enhanced Bus

TABLE 4-7

Planning Corridor	ALT 1 No Bu	ALT 1 – No Build		ALT 2 – Current RTP		ALT 3 – Team A		ALT 4 – Team B		ALT 5 – Initial Draft RTP	
	Auto	Transit	Auto	Transit	Auto	Transit	Auto	Transit	Auto	Transit	
TOTAL	4.4	5.3 score with 13 missing links	5.0	4.7 score with 2 missing links	5.0	5.1 score with 2 missing links	5.1	4.9 score with 0 missing links	5.4	5.0 score with 5 missing links	
*A 1 to 10 scoring method with 5 representing the average value and higher values representing a more favorable outcome											

Relative Corridor Traverse Time Scores

Map 4-5, SYSTEM ALTERNATIVE EVALUATION CORRIDORS

NORTH - SOUTH EVALUATION CORRIDORS

EAST- WEST EVALUATION CORRIDORS

Transportation System Alternative Safety Scores

	No Build	Current RTP	Team A	Team B	Initial Draft RTP			
Crash Rate	1.4	4.6	5.6	6.7	6.8			
Severity	1.1	4.7	6.0	6.4	6.3			
*A 1 to 10 scoring method with 5 representing the average value and higher values representing a more								
favorable out	tcome							

(BRT 1) does not have exclusive transit lanes. Therefore it is not necessary to rebuild the roads and thereby remove road safety issues.

The crash rate (crashes per million vehicle miles traveled) is equal to the number of crashes multiplied by 1 million and divided by the AADT multiplied by 365 and multiplied by the length of the segment (crash rate = (crashes*1,000,000) / (AADT*365*length)). The severity score is based on the number of high severity crashes per segment. A high severity crash is a class 4 or 5, with a class 4 having broken bones and bleeding and a class 5 being a fatal accident. The Wasatch Front Urban Area Safety Index, Map 3-4, currently includes only state roads, due to inconsistency in the reported locations of accidents on either state routes or local roads. For purposes

of relative comparison the safety scores reflect the total, cumulative, rates for all the highway segments and are not provided on a per mile basis. The raw safety scores can be found in Table I-X of Appendix I. The relative crash rate and crash severity rate scores found in Table 4-8 are based upon a one to ten scale with five representing the average score for the four original and the Initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for that measure.

It appears that the initial Draft RTP Alternative would be effective at improving road safety issues given it has a higher Crash Rate score although it spends less on road and transit lane improvements. However, it has somewhat of a lower Severity score. This is more in-line with its somewhat

TABLE 4-9

General Corridor Issues

Category	Category
Avoiding Community Impacts	Incomplete Road Networks
Avoiding Indirect Ecological Impacts	Incomplete High-Occupancy Facilities
Avoiding Direct Ecological Impacts	Incomplete Non-motorized Networks
Non-motorized Safety	Incomplete Traffic System Management
Safety and Security Issues	Incomplete Transit Networks
Service to Economic Centers	Identification of Geographical Chokepoints
Service to Disadvantaged Populations	Highway Efficiency Improvements
Identification of Transit Markets	Transit Efficiency Improvements
Capacity Issues	Inadequate Transportation Design

diminished capital/construction spending. It may also reflect on, urban roads which generally have higher Crash Rates but lower Severity Rates because of lower speed limits.

Corridor Specific Goals

WFRC Staff identified and used both system-wide goals and the corridor specific goals for each of the thirteen corridors illustrated in Map 4-5 for the evaluation of each of the System Alternatives. These goals were derived from many different sources including UDOT, UTA, Wasatch Front Regional Council data sets and multiple stakeholder meetings. In total, 273 goals were identified, with most of these tied to one of the specific corridors. Stakeholders were encouraged to try and express their needs or issues or opportunities rather than as specific projects. It was explained that this would allow the transportation planners to propose different possible solutions to the problem or opportunities identified by the stakeholders. Ultimately, many contributors asked for specific projects. Although their requests for specific projects were noted, the WFRC staff attempted to derive the issues and opportunities generating their specific requests. Generally, the issues fell into the eighteen general categories listed in Table 4-9.

The WFRC Staff assessed whether each of the System Alternatives substantially met each goal in each corridor. Each goal substantially met was given one point and each goal substantially unmet received a zero. The full listing of Issues and Opportunities in found in Appendix I. The number of corridor specific goals met by each of the alternatives for each corridor are found in Appendix I. The corridor specific scores for each of the alternatives found in Table 4-10 are based upon a 1 to 10 scale with five representing the average score for the four original and the Initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for that measure.

TABLE 4-10 Scores for Corridor Specific Goals

	No Build	Current Plan	Team A	Team B	Initial Draft RTP		
Overarching/Region-wide	0	5.6	5.6	5.6	8.3		
West Weber County North/South	0.6	5.8	5.8	5.8	7.0		
East Weber County North/South	0.5	5.9	5.3	5.9	7.4		
North Davis County North/South	0.7	6.3	4.2	6.3	7.6		
South Davis County	0	5.5	7.0	5.9	6.6		
North Weber County East/West	0	5.6	6.9	5.6	6.9		
South Weber County East/West	0	5.9	5.9	6.4	6.9		
North Davis County East/West	0	5.8	5.6	6.7	6.9		
West Salt Lake County North/South	0.8	5.6	6.5	5.6	6.5		
West Central Salt Lake County North/South	0	3.0	7.7	5.4	8.9		
East Salt Lake County North/South	0	5.0	6.3	6.3	7.5		
Salt Lake City Core (N/S and E/W)	0	6.3	6.3	3.1	9.4		
North Salt Lake County East/West	0	6.7	5.8	4.8	7.7		
Mid Salt Lake County East/West	0.5	4.2	5.7	6.1	8.5		
South Salt lake County East/West	0	5.0	6.0	7.0	7.0		
TOTAL	0.2	5.5	5.9	5.9	7.5		
*A 1 to 10 scoring method with 5 representin	g the avera	ge value and hi	gher values	s represent	ing a more		
favorable outcome							

In order to gain some perspective to the auto delay figures, Vehicle Miles Traveled (VMT) and change in auto delay per \$1,000 spent on major roadway construction were paired with simple auto delay values.

Vehicle Miles Traveled is the total motorized vehicle miles (excluding transit) traveled each day. Reductions in the rate of growth in vehicle miles traveled are desirable for many reasons, especially for reducing energy consumption and relieving traffic congestion. In addition, VMT is directly associated with the level of fine particulate matter in the atmosphere.

Due in part to the fact that the lists of system-wide goals and corridor specific goals were given to each of the teams and developers of the initial Draft RTP, these system alternatives received the highest scores. The No-build alternative met only six goals and the Current RTP Alternative met 146 of the 273 goals. The Team A, Team B, and the initial Draft RTP alternatives met 157, 158, and 200 of the goals respectively.

Auto Delay and Vehicle Miles Traveled

"Daily auto delay" is the number of hours of auto delay caused by traffic congestion during the course of an average day. Daily peak period auto delay data was generated for the three WFRC counties and Utah County using the WFRC's Regional Travel Demand Model projections for the year 2040. There are several factors that influence auto vehicle miles traveled. Among these factors are the directness of travel and the ease of driving, compared with using transit. Like transit passenger miles, each of the combined transit and highway system alternatives were analyzed by using the WFRC Regional Travel Demand Model. The model was used to project the number of motorized vehicle miles on major roads in Weber, Davis, Salt Lake, and Utah Counties each day in 2040. The vehicle miles traveled and time delay related scores found in Table 4-11 are based upon a one to ten scale with five representing the average score for the four original and the Initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for that measure. The raw time delay data and

TABLE 4-11

	No Build		Current RTP Team A		Team B			Initial Draft RTP		
	Delay	VMT	Delay	VMT	Delay	VMT	Delay	VMT	Delay	VMT
TOTAL COST	1.3	4.7	6.0	5.1	5.2	5.1	6.4	5.0	6.0	5.1
COST EFFECTIVENESS SCORE	n/a		5.5		4.2		5.3		5.0	
*A 1 to 10 scoring m	athod wit	h 5 ropro	conting t	ha avarac		nd higho	r valuos r	oprocont	ing a mor	0

Auto Delay and Vehicle Miles Traveled*

*A 1 to 10 scoring method with 5 representing the average value and higher values representing a more favorable outcome

vehicle miles traveled forecasts are discussed below and found in Appendix I.

The No Build Alternative had the highest amount of time delay and Vehicle Miles Traveled with 0.7 million hours of delay and 76.2 million vehicle miles traveled in the Weber, Davis, Salt Lake, and Utah Counties each day. The delay is increased because the existing roads are more congested and take longer to traverse. Increased VMT results from drivers traveling longer routes to get to their destinations in an attempt to avoid congestion. The total modeled delay for the build alternatives ranges from 0.3 million daily hours for the Team B Alternative to 0.4 million

daily hours for the Team A Alternative. The total modeled vehicle miles traveled for the build alternatives ranges from 70.0 million miles a day in the Team A Alternative to 72.3 million miles a day in the Team B Alternative.

In terms of cost effectiveness, the build alternatives ranged from a savings of 12,100 hours of delay per day for every million dollars spent for the Current RTP Alternative to a savings of 9,300 hours of delay per day for every million dollars spent for the Team A Alternative, a 26% difference. The initial Draft RTP Alternative saved 11,100 hours of delay per day for every million dollars spent. It is important to note that no transportation improvements were made in Utah County so much of the build alternative delay may be occurring there. Thus, relative values are more important to review than total numbers.

Transit Ridership

Transit ridership can be assessed from many different perspectives. For the purposes of comparing system alternatives, the WFRC staff looked at peak period passenger miles for the entire transit system as well as at daily linked passenger trips. It also gathered this data for the proposed major investment projects, as well as on a cost effectiveness basis. Table 4-12 provides the scores for each of these measures. These are based upon a one to ten scale with five representing the average score for the four original and the initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for that measure. The linked transit passenger

trips and passenger miles for these measures are discussed below and are found in Table I-x of Appendix I.

The passenger miles and linked passenger trips were forecasted for 2040 using the WFRC Regional Travel Demand Model. Passenger miles are the number of miles traveled in the peak period on a transit vehicle by transit users. The morning peak period is 6:00 a.m. though 9:00 a.m. each weekday. The afternoon peak period is 3:00 p.m. through 6:00 p.m. A linked trip is a trip taken by a public transit passenger from their origin to their destination. An un-linked trip or boarding is a trip that starts when the passenger gets on a transit vehicle and ends when they get off a transit vehicle. A linked trip that, for example, starts with a bus and then requires a single transfer to a light-rail vehicle would register as two un-linked trips or two boardings. The values discussed and the scores in Table 4-12 are based upon Weber, Davis, and Salt Lake County ridership. Canyon transportation ridership was not forecasted.

The total modeled peak period passenger miles for the original four alternatives ranges from 2.2 million daily miles for the No Build Alternative to 3.4 million daily miles for the Team A Alternative, an increase of about 55 percent on a system-wide level in Weber, Davis, and Salt Lake Counties. The total modeled linked trips for the original four alternatives ranges from 0.2 million trips a day in the No Build Alternative to 0.4 million trips a day in the Team B Alternative, about a 60 percent increase. However, the change in ridership on the major investment system nearly doubles between the No Build and the Team A Alternatives.

Relative Transit Ridership Scores**

	No Build		Current RTP		Team A		Team B		Initial Draft RTP	
	Miles	Trips	Miles	Trips	Miles	Trips	Miles	Trips	Miles	Trips
All Transit*	3.8	3.6	5.0	5.0	6.0	5.7	5.0	5.1	5.1	5.5
Major Investments Only*	n/a	3.1	n/a	5.1	n/a	6.0	n/a	5.2	n/a	5.6
Major Investment Trips / Cost*	n/a	6.4	n/a	4.7	n/a	5.3	n/a	4.3	n/a	4.3
*Amortized conital and operating costs accuming conital facilities would last 20 years										

*Amortized capital and operating costs assuming capital facilities would last 20 years

**A 1 to 10 scoring method with 5 representing the average value and higher values representing a more favorable outcome

In terms of the relative cost effectiveness of the original four alternatives, they were estimated using daily weekday linked trips, assuming daily operating costs and that capital costs would have a 20 year life-span. The actual life-span for the projects vary greatly by project type. For instance, a vehicle will last from 12 to 30 years, rights-of-way have an infinite life span. The most effective Alternative was the No Build as the No Build transit system that is existing and under construction already serves areas forecasted to be some of the most densely developed portions of the Wasatch Front Region by 2040. The next two most cost effective alternatives are the Team A and the Current RTP Alternatives. These Alternatives were chosen as the basis for the initial Draft RTP. However, the initial Draft RTP was not quite as cost effective as these two Alternatives because it had more daily operating costs. This is because it serves more of the suburban areas than the Team A or the Current RTP Alternatives. It is important to note that both projected ridership numbers and cost estimates were very preliminary at this point in the process and should only be used in comparing alternatives. The capital, operating, and total amortized costs per passenger trips can be found in Table I-x of Appendix I.

Economic Development as Criteria

As noted elsewhere in this document, urban development and transportation can have profoundly positive or negative effects upon each other. Transportation encourages development and development creates demand for transportation. Transportation that supports infill areas, activity centers, helps disadvantaged communities, and supports freight centers has a positive influence upon taxes, personal and business transportation costs, public health, supports a more attractive quality of life for business owners, employees, and their families, and ultimately strengthens the Region's economic future. A transportation system's ability to have a positive impact on these factors is the criteria used to judge the economic development benefits of each of the transportation system alternatives.

Activity Centers and Infill Areas

Activity Centers - In an effort to integrate local plans for activity center development with the regional transportation system, each alternative was evaluated by how well they served activity centers. The level of service was quantified by summing all home-based work trips within 20 minutes transit and auto travel time of each of the identified centers. WFRC staff identified the activity centers through a three step process. First, the activity of each 10 acre square in the region was assigned an activity value using employment and household forecasts. Employment was given a weight of 1.2 and each household was given a weight of 1.0 in this value. Next, clusters or islands of activity were identified in the region using a mapping technique which smoothed the values of these 10 acre blocks and then applied various value ranges to isolate "islands" of activity. Finally, activity centers such as entertainment venues and schools that are not dependent upon households or employment for their activity were identified.

Once each activity center was identified then one or more Traffic Analysis Zones was chosen to represent that activity center in the regional transportation demand model. The number of traffic activity centers chosen to represent each activity center was roughly correlated with the intensity and size of that activity center in order to more highly value large, intense centers over smaller centers of activity. The supportiveness of each of the transportation system alternatives to the region's activity centers lived within a 20 minute commute by auto or public transit to their respective centers.

Infill Areas - When this development is more central to the Region and already has a fully diversified and functioning transportation system, it is called infill development. Infill development makes the region more economically competitive by reducing the public costs of new infrastructure, by decreasing congestion and vehicle miles traveled which in turn limits the impact on other public resources such as good air quality. Each transportation system alternative was evaluated on how well it served infill areas in order to make these areas even more attractive to development and redevelopment.

As was the case with activity centers, the level of service was quantified by summing all home-based work trips within 20 minutes transit and auto travel time of each of the identified locations. The potential infill areas identified in Salt Lake County were those areas of 50 acres or larger which were both identified by the Salt Lake County Cooperative Plan as being vacant or areas of probable or possible change and within the area of the County which is largely built out. The built out area was roughly defined by WFRC Staff as the area east and north of the Bangerter Highway loop near the unincorporated communities of Kearns and Magna. In Davis and Weber Counties WFRC staff used aerial photos and personal knowledge to identify areas of 50 acres or larger which were either vacant or potential areas of change surrounded by development.

Once each infill area was identified, then a traffic analysis zone was chosen to represent that infill area in the regional transportation demand model. Frequently infill areas within a mile of one another were grouped and given one traffic analysis zone designation and large areas with infill potential covering several square miles were given multiple traffic analysis zones to represent them. The supportiveness of each of the transportation system alternatives to the region's activity centers was based upon how many commuters to all the activity centers lived with a 20 minute commute to their respective centers by auto and by public transit.

Maps 4-6 and 4-7 show the identified activity centers and infill areas. Appendix J lists the representative activity centers and infill area traffic analysis zones, and their approximate locations. Appendix I, provides a complete listing of raw scores each category received. Table 4-13 below shows the combined regional activity center and infill location scores for each system alternative. These composite scores are based upon a one to ten scale with five representing the average score for the four original and the Initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for that measure.

TABLE 4-13

Activity Center and Infill Area Access Scores

No Build		Current RTP		Team A		Team B		Initial Draft RTP	
Auto	Transit	Auto	Transit	Auto	Transit	Auto	Transit	Auto	Transit
4.5	3.8	5.2	5.1	4.9	5.4	5.2	5.4	5.2	5.3

*A 1 to 10 scoring method with 5 representing the average value and higher values representing a more favorable outcome

The number of peak period commutes of 20 minutes or less by auto to all the representative activity centers and infill areas for the original four alternatives ranges from 158,000 for the No Build Alternative to 181,000 for the Team B Alternative, a range of about 16 percent. The Team B Alternative was the basis for the initial Draft RTP Alternative for the auto. The initial Draft RTP Alternative further widened the 20 minute auto commute area to include another 2,000 commuters. The number of peak period commutes of 20 minutes or less by transit to all the representative activity centers and infill areas for the original four alternatives ranges from 49,000 for the No Build Alternative to 69,000 for the Team A Alternative, a range of about 41 percent. The initial Draft RTP Alternative for transit decrease the 20 minute transit commute area by about 1,000 commuters.

Economic Access for Disadvantaged Persons

Inadequate access to jobs is one of the most frequently cited obstacles to financial independence for disadvantaged populations. Transportation is the second largest expense for families with limited financial resources. In the year 2000, twenty percent of households with the lowest incomes spent about 39 percent of their income on transportation. For this reason, each transportation system alternative was also evaluated on how well it served concentrations of disadvantaged people.

The level of service to areas with concentrations of disadvantaged people was quantified by summing all employment within 20 minutes transit and auto travel time of each of the identified locations. The areas with concentrations

of disadvantaged people were identified using the latest census information (2000) available for members of minority groups, persons with incomes below the poverty level, the elderly, and households who do not own vehicles. Thirty-seven Census Tracts were identified as having disproportionately high densities of disadvantaged persons.

All of these areas fell into three general locations. These areas are Ogden City, Salt Lake City, and west central Salt Lake County. A single Traffic Analysis Zone was selected to represent each selected Census Tract in the Travel Demand Model. Map 4-8 shows these locations. Appendix J provides a listing of these locations as well as the number of jobs within 20 minutes travel time of each of these areas in each alternative. Table 4-14 below shows the relative access to jobs scores for each of the alternatives. These scores are based upon a one to ten scale with five representing the average score for the four original and the Initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for that measure.

The raw scores found in Appendix I are the sums of all the employment within a 20 minute travel time of each of the areas with high concentrations of disadvantaged persons. For this reason a job that is within 20 minutes travel time of several areas with high concentrations of disadvantaged persons will be counted several times. The cumulative number of jobs within 20 minutes of these locations via auto for the original four alternatives range from 12.0 million for the No Build Alternative to 14.1 million for the Team B Alternative, a range of about 18 percent. The Team B Alternative was the basis

TABLE 4-14

Disadvantaged Population Access to Job Scores

No Build		Current RTP		Team A		Team B		Initial Draft RTP	
Auto	Transit	Auto	Transit	Auto	Transit	Auto	Transit	Auto	Transit
4.5	3.8	5.1	5.2	5.1	5.5	5.3	5.3	5.0	5.3

*A 1 to 10 scoring method with 5 representing the average value and higher values representing a more favorable outcome

for the initial Draft RTP Alternative for the auto. The initial Draft RTP Alternative auto projects decreased this value by 0.5 million to 13.6 million. The cumulative number of jobs within 20 minutes of these locations via public transit for the original four alternatives range from 4.0 million for the No Build Alternative to 5.7 million for the Team A Alternative, a range of about 43 percent. The Current RTP and Team A Alternatives were the basis for the initial Draft RTP Alternative public transit projects decreased this raw value by 0.1 million to 5.6 million.

Freeway Center to Freeway Access

The ability to move freight is an important factor in the Region's ability to maintain and further develop a healthy business climate. Studies by the Federal Highway Administration indicate that about 84 percent of all freight nationwide is delivered via roads and that the demand for freight transportation services will increase 87 percent by 2020. Congestion has more than tripled since 1982 (Texas Transportation Institute) making the cost of doing business more expensive. The per hour cost of delay to a 5-axle combination truck in 2001 was calculated to be \$34.08. Additionally, manufacturing is increasingly dependent upon a "just-in-time" delivery system, which is very susceptible to delay.

"Freight center to freeway access" is defined as the roadway travel time from the closest freeway to major freight terminals. A "Freight Center" is also identified by the density of freight related employment such as trucking, manufacturing, and warehousing and as confirmed for the purposes of the RTP by UDOT's freight planner. Once each freight center was identified, a traffic analysis zone was chosen to represent that freight center in the regional transportation demand model.

The supportiveness of each of the transportation system alternatives to the region's freight centers was based upon the travel time from the representative traffic analysis zone to the nearest freeway. The measured values are the sums, in minutes, of one afternoon peak period travel time from each freight center to the nearest freeway for each transportation system alternative. The major freight centers are identified in Map 4-9. Appendix J provides a listing of these freight centers and the estimated travel times to the nearest freeway. Table 4-15 below shows the relative combined freight access to freeway scores for each of the alternatives. These composite scores are based upon a one to ten scale with five representing the average score for the four original and the Initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for this measure.

The cumulative travel times from the seventeen freight centers to the nearest freeway in the original four alternatives range from 164 minutes for the No Build Alternative to 79 minutes for both the Current Plan and Team B Alternatives. This is a range of about 110 percent. The Team B Alternative was the basis for the Initial Draft RTP Alternative for the auto. Freight center to freeway access was not a factor in the transit system alternative selection. The initial Draft RTP Alternative auto projects slightly increased this cumulative travel time to 82 minutes.

Environmental Impacts

Virtually all transportation projects present tradeoffs between derived benefits and impacts. The 2011-2040 Regional Transportation Plan system alternative development, evaluation and selection process included potential impacts considerations and criteria early in the process in an attempt

TABLE 4-15

Relative Freight Center to Freeway Access Scores

	No Build	Current Plan	Team A	Team B	Initial Draft RTP		
	1.6	5.9	5.8	5.9	5.8		
*A 1 to 10 scoring method with 5 representing the average value and higher values representing a more							
favorable outcome							

to encourage planners to identify and balance both the potential impacts and potential benefits of the proposals. The environmental impact evaluation considered the total and weighted potential direct impacts of the proposed system upon 49 categories of natural, urban, and demographic resources and constructability issues. Air quality impacts were singled out as a separate category and will be discussed later in the document.

The identification of potential impacts was done through Utah Department of Transportation UPEL tool which is one aspect of UDOT's UPLAN process. UPEL stands for Utah Planning and Environmental Linkage. It is a computer based mapping tool and provides a planning level analysis which may be used to compare alternatives but not to certify nor rule out the existence of specific impacts. Impacts are calculated based upon the estimated project footprint. Therefore, only the direct project impacts were assessed. Additionally, because many of the projects are in the concept phase of the planning process, exact locations (and therefore direct impacts) are far from certain. Nonetheless, the WFRC staff attempted to approximate the location and widths of new proposed road and transit projects.

Project widths were estimated by calculating potential width based upon the number of travel lanes and regional averages of non-travel lane width by functional class. If the project was part of the 2007-2030 Regional Transportation Plan, the roadway width was then compared to the future roadway width estimation from the earlier plan and the wider of the two widths was chosen. If a 2011-2040 transit project

was located in the roadway it was assumed that the combine project would require another 30 feet of width along its entire length. The following project types were not assessed for environmental impacts: Corridor Preservation, Operational Improvements, streetcars in mixed-traffic, and Enhanced Bus (BRT 1). The environmental impacts of Corridor Preservation are not typically assessed until a project is programmed for a specific corridor. Operational improvements, streetcar lines in mixed-traffic require little additional rights-of-way and the assessment carried out for the alternative is based primarily upon the impacts of additional rights-of-way.

As indicated above, both total potential impacts and weighted potential impacts were evaluated. Although weighting impacts based upon the value of the resource can be highly subjective, WFRC staff attempted to do so with some assistance from the environmental consultants that created UPEL, recognizing that not weighting impacts by value also comes with limitations. The relative weighted scores are found in Table 4-16 below. The scores in Table 4-16 are based upon a one to ten scale with five representing the average score for the four original and the Initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for this measure. The raw un-weighted and weighted environmental evaluation scores for each of the 49 evaluated categories can be found in Appendix I. Appendix I also provides a discussion of how weighting was applied to each of the evaluated categories and Tables I-X through I-X of Appendix I list the weightings applied to each of the categories.

TABLE 4-16

	No Build	Current Plan	Team A	Team B	Initial Draft RTP	
Natural Environment	NA	4.6	4.6	4.9	5.9	
Construction Environment	NA	5.0	4.1	7.0	3.9	
Urban Environment	NA	4.5	4.6	6.5	4.3	
Demographic Environment	NA	4.5	4.7	6.1	4.7	
*All relative terms of measure						

Weighted Relative Environmental Scores

As illustrated in the Table 4-16 above, the relative weighted scores for the natural environment ranged from 4.6 for the Current Plan and Team A Alternatives to 5.9 for the initial Draft RTP indicating that the initial Draft RTP had the fewest overall relative weighted impacts upon the natural environment. Although the Initial Draft RTP Alternative had the fewest overall potential natural environmental impacts, a review of the differences of 33 percent or more between the alternatives in terms of the ten subcategories of natural impacts is instructive. The most prominent differences are that the initial Draft of the RTP had a 60 to 68 percent lower impact upon ecological hot spot and high diversity locations. This is a highly weighted subcategory of the Natural Environment major category. Most of these

locations are in northwest Weber County and the initial Draft of the RTP recommends fewer projects in that area compared to the other alternatives.

The initial Draft of the RTP has a 35 to 65 percent higher potential impact on waterways than any of the other alternatives. It also has higher potential impacts than Alternative B upon canals (77 percent), streams (65 percent), and water quality (55 percent). Although individual projects were not individually assessed at this stage of the RTP process, some of these differences may be due to several factors. First, they may be due to canyon/mountain located projects. The initial Draft Alternative recommends the widening of I-80 in Parley's Canyon, an exclusive lane transit project in Little Cottonwood Canyon, and the widening of US-89 in Davis County. These are projects that existed individually in the other alternatives but have been combined in the initial Draft RTP Alternative. Second, the difference between initial Draft of the RTP and Alternative B may be due in part to the amount of exclusive lane transit provided. The Team B alternative had significantly fewer transit projects and transit projects were always assumed to require 30 feet of right-of-way beyond the widest road requirement. This would not likely be the case when the transit projects are built as the transit lanes would get a portion of their rights-of-way from the center turn lanes. Lastly, the initial Draft RTP also added the widening of 10200 / 10400 South which may account for impact to streams (Jordan River) and canals. These environmental evaluations were conducted for the final draft RTP and most of its individual projects and can be found in Chapter 8.

Table 4-16 above also illustrates the relative weighted scores for the construction environment. The construction environment major category includes sub-categories such as engineering problems and waste sites. These problems can be overcome by planning and engineering but potentially at a higher cost to the projects. Overall, the initial Draft RTP Alternative scored the worst in this major category on a weighted basis. The most prominent differences between alternatives are that the Initial Draft of the RTP had an 84 to 271 percent higher exposure to steep slopes. Presumably this higher exposure to steep slopes is due in part to the widening of I-80 in Parley's Canyon; an exclusive lane transit project in Little Cottonwood Canyon; the widening of US-89 in Weber and Davis Counties; the new road and widening between SR-193 in Layton and South Ogden, and the extension of Highland Drive. These projects are also likely to increase the exposure of the initial Draft RTP Alternative to other construction environment subcategories such as engineering problems, fault lines, landslides, and Impaired Waters. Other prominent differences are primarily between the initial Draft RTP and the Team B Alternative. These may include additional exposure to hazard and solid waste sites, liquefaction potential, and fault lines. These prominent differences may also be due to the difference in the amount of exclusive lane transit. These environmental evaluations were conducted for the final draft RTP and most of its individual projects and can be found in Chapter 8.

The weighted potential impacts to the Urban Environment are also shown in Table 4-16 above. The Urban Environment Major Category assesses the types of lands taken for project rights-of-ways. These include an assessment of their open space characteristics, land use, development intensity, ownership, and if project sites have historical or archeological significance. Overall, the initial Draft RTP Alternative scored the worst in this major category on a weighted basis. The most prominent differences between the initial Draft of the RTP and all the other alternatives are that it had fewer potential impacts upon agricultural protection areas, open space, and conservation and mitigation areas and more potential impacts upon federal lands, cemeteries, historic sites, and archeological sites. The initial Draft also had more impacts than on Alternative B in terms of parks, commercial/industrial uses, residential uses, medium to high intensity development areas, and private property. Once again, some of the contributing factors to the reduction in impact by the initial Draft RTP Alternative are changes to northwest Weber County projects. Some of the contributing factors to the increase in potential impacts by the Initial Draft RTP Alternative are the mountain/canyon projects, the number of exclusive lane transit projects, and how the transit project impacts were assessed. Care will need to be taken in the project development stage to avoid or mitigate these potential impacts. The environmental evaluations conducted for the final draft RTP and most of its individual projects can be found in Chapter 8.

The weighted potential impacts the Demographic Environment to are also shown in Table 4-16. The demographic environment major category broadly assesses the potential impacts to disadvantaged households and communities. In some ways this is a difficult assessment to make on a system-wide level. Transportation clearly projects provide for disadvantaged populations potential benefits but can change neighborhoods

in negative ways. Other planning criteria were developed to encourage serving disadvantaged communities. None-theless, the analysis carried out for these alternatives indicate that the initial Draft RTP Alternative scores better than the Current RTP, about equal to the Team A Alternative, and somewhat less than the Team B Alternative. Care must be taken in the project development stage to balance serving these communities with better access while minimizing impacts of construction and potential barriers. These environmental evaluations were conducted for the final draft RTP and most of its individual projects and can be found in Chapter 8.

Air Quality

To compare the air quality impacts of the various system alternatives considered in developing the 2040 RTP, WFRC staff estimated the daily on-road mobile source emissions of nitrogen oxides (NOx), direct particulates smaller than 2.5 um (PM2.5), carbon monoxide (CO), volatile organic compounds (VOC), and carbon dioxide (CO2) for each alternative. Many of these tailpipe emissions are included among the criteria pollutants responsible for EPA's non-attainment and maintenance designations, based on the negative health impacts of these pollutants. Carbon dioxide emissions, while non-toxic and not a direct health hazard were included in this analysis for the purpose of documenting some of the major greenhouse gas emissions. The emissions comparison was intended to estimate the relative impact on emissions for each alternative. Winter conditions were used in the model because CO and NOx emissions are more severe in the Winter months. VOC emissions are lower in the winter but the relative VOC emissions for each alternative is still captured in this analysis.

Air Quality Impact Scores

	No Build	Current Plan	Team A	Team B	Initial Draft RTP	
Nitrogen Oxides (NOx)	5.0	5.0	5.0	5.0	5.0	
Direct particulates <2.5um (PM 2.5)	4.9	5.0	5.0	5.0	5.0	
Volatile Organic Compounds (VOC)	4.7	5.1	5.1	5.1	5.1	
Carbon Monoxide (CO)	4.9	5.0	5.1	5.0	5.0	
Carbon Dioxide (CO2)	4.9	5.0	5.0	5.0	5.0	
Tons per day in emitted by mobile sources Weber, Davis and Salt Lake Counties						

By weight, carbon dioxide is by far the single largest tailpipe emission. Of the remaining pollutants, carbon monoxide is the next dominant emission comprising 94 percent of total tailpipe emissions. Emissions of CO have been substantially reduced in the past decades to levels well below the limits defined in the State (air quality) Implementation Plan (SIP). Localized or "hot spot" emissions of CO at sensitive receptor testing sites can be a concern and these impacts are examined in individual project studies. NOx emissions are perhaps the most critical emission to track because NOx contributes both to ozone (O3) pollution in the summer months and particulate matter (PM10 and PM2.5) pollution in the Winter months. VOC emissions also contribute to summer O3 conditions.

Table 4-17 shows the relative air quality emission scores for each of the transportation system alternatives. These composite scores are based upon initial Draft Alternatives. A score greater than five for a given alternative always indicates that this alternative scored better than average for this measure. You will note that the difference between these alternatives in terms of emissions is very small.

Table I-X in Appendix I provides the actual emissions expressed in tons of pollutants per day. In reviewing the results of the emissions analysis, it may be most helpful to look at the relative difference in each emission type for the various alternatives evaluated rather than focusing on the alternative with the lowest total emissions. As mentioned previously, CO and CO2 are the dominant emissions by weight but the greatest air quality challenges for the Wasatch Front Area, in terms of direct toxic impacts to human health, are not with CO2 or even with CO. An examination of the NOx emissions indicates a 0.39 tons/day difference between the three alternatives, a variation of about +/- one percent.

PUBLIC INPUT ON SYSTEM ALTERNATIVES

Pursuant to the requirements of SAFETEA-LU, the Wasatch Front Regional Council developed a set of alternatives for the 2040 RTP based on public involvement scoping and a transportation needs evaluation. These draft alternatives were then displayed at open houses in August 2010, to the respective county councils of governments, the WFRC's technical advisory committees, the Joint Policy Advisory Committee, the Regional Growth Committee, and the WFRC's Transportation Committee. In addition, scoping level and alternatives level comments were accepted from natural resource agencies, chambers of commerce, environmental groups, the local transit workers union, disabled rights groups, Native American groups, low income organizations, senior citizens committees, state, federal and local government agencies, and many other interested citizens and groups. Only a few comments were specifically directed towards the Transportation Systems as a whole; however, many comments were received regarding specific projects. The comments are summarized below.

General Comments

- The draft RTP should emphasize transit over highways
- An air quality analysis needs to be done for each alternative
- "We suggest an all new/expanded rail alternative with criteria pollutant analysis"
- The MOVES model should be used for the above suggested air quality analysis
- Add extensive walk/bike paths and connection nodes to each alternative
- Growth assumptions should be tested using recessionary estimates and optimistic economic forecasts as well
- "I would just recommend that the applicant involve the (Army) Corps (of Engineers) as early in their development plans as they can. This would help to expedite the Section 404 permitting process

Davis County

- 2000 West should be widened to four lanes
- East / West travel is rapidly becoming a problem
- The West Davis Highway should be in the first phase of the 2040 RTP
- Overpasses for I-15 and US-89 should be built to facilitate east / west travel
- Construct West Davis Highway with a Legacy Parkway connection
- The Enhanced Bus (BRT 1) line through Farmington City should be along the I-15 frontage road as agreed to in the Farmington City Master Plan
- A full interchange is needed at Legacy Parkway and Center Street
- Improve the congested I-15 Interchange at Hillfield Road
- Construct a new I-15 Interchange at 1800 North
- Add more bicycle lanes and wider shoulders
- "I feel the best route to move traffic east/west would be SR-193 because its already funded to 2000 West."
- Support a transit loop on SR-193/Hill AFB as noted on Alternative Four

Weber County

- East / West traffic is becoming increasingly congested
- The Weber County portion of the Legacy Highway should be identified and preserved
- Preserve the corridor for the eventual widening of 12th Street west of I-15

- "Monroe Blvd.: From 1300 North to 3100 North—Please Remove"
- Traffic on Harrison Blvd. near Weber State University is at "failure"
- Harrison Boulevard should only have operational improvements, no widening
- The freeway interchange at 24th Street needs improvement
- If the 24th Street Interchange is reconstructed, the 21st Street Interchange will have to be redone as well. "You will lose access to West Haven City"
- The intersection at Harrison Boulevard and U.S. 89 needs to be significantly improved
- There is strong support for a streetcar to Weber State University
- Ogden City should remain the transit hub of Weber County
- The Fairfield Road extension would relieve pressure on Harrison Boulevard
- Any north / south transit line through Ogden City should extend to 2700 North
- Bicycle lanes should be part of any highway or transit project
- A park and ride lot is needed in the Ogden Valley.
- FrontRunner should be shown as extending into Box Elder County
- FrontRunner extensions out to Pleasant View are running mostly empty
- Widen Pioneer Road in Weber County from 1200 West to I-15 as in Alternative 2

Salt Lake County

- Bingham Junction Boulevard south of 7800 South needs to stay in the first phase of the Regional Transportation Plan
- East / west travel, especially across Bangerter Highway, is a problem. The continuous flow intersections do help
- SR-111 needs to remain limited access similar to Bangerter Highway
- Expand 7200 West and 5600 West north of I-80. Connect 5600 West and 7200 West with 700 North in the northwest quadrant of Salt Lake City
- Widen State Street from 6200 South to 8800 South
- Add a major transit investment corridor to the northwest quadrant of Salt Lake City

- The widening of SR-201 west of 5600 West to Magna
- 14600 South west of I-15 needs the railroad bridge removed. However, the road should remain a two lane collector only west of the railroad bridge. BRT service on 5600 West should be provided
- TRAX should extend along 3500 South to 9200 West
- Porter Rockwell Boulevard is now part of Bluffdale City's General Plan.
- An intensive transit service is needed from the 10400 South FrontRunner station up 9400 South to the mouth of Little Cottonwood
- Extension of Highland Drive from 9800 South to Pioneer Road should be shown as new construction
- Add slip ramps to I-15 at 10000 South

SYSTEM EVALUATION SUMMARY

The system evaluation results were reviewed by the WFRC staff and presented to the Regional Growth Committee and the Wasatch Front Regional Council. Each are of the four system alternatives performed better according to some of the evaluation factors than the others. However, the initial *Draft* RTP performed well in some of the more important factors and seemed to emerge as the best overall alternative.

In terms of the highway system the initial *Draft* RTP provided the largest and most costly highway alternative but better addressed corridor travel times, safety, and corridor goals while having the least potential environmental impacts. Also, although not providing the best results, the initial *Draft* RTP Alternative scored well in terms of reducing delay and serving activity centers and infill areas. Care will need to be taken to avoid and mitigate impacts to the disadvantaged communities and to avoid costly alignment decisions. This is especially true for mountain and canyon transportation.

In terms of the transit system, one of the more important factors is ridership gained for the costs incurred. The initial *Draft* was the least expensive to construct but garnered the second highest ridership and second highest anticipated transit passenger miles traveled. This indicates that suggested placement of capital improvements is likely appropriate. However, its operations costs were high. Costs can be adjusted as the projects come to fruition. The initial *Draft* RTP Alternative was best in meeting corridor specific goals,

many of which were transit related. It was also second best in meeting the access needs of the disadvantaged. The initial *Draft* RTP did not perform the best in terms of corridor travel time and it missed some activity centers. These weaknesses were noted and many were resolved in preparing the final *Draft* 2040 RTP. As was the case with the highway system, care should be taken to avoid and mitigate the impacts of transit on the disadvantaged communities and to avoid costly alignment decisions. This is especially true for mountain and canyon transportation.

The initial *Draft* RTP Alternative was gleaned from the first four alternatives. The Regional Growth Committee and the Wasatch Front Regional Council endorsed the initial *Draft* RTP Alternative as the best starting point for the 2040 RTP project selection and refinement process.

The Initial Draft RTP Alternative

The initial *Draft* RTP Alternative was developed after each of the four transportation systems were reviewed and evaluated. Sources were primarily from the 'No-build', "Current Plan", "Team A" and "Team B" Alternatives. Alternative 4 "Team B" was used as a base due to its low system delay and moderate project costs. Every highway project in Alternative 4 was reviewed, followed by every highway project in Alternative 2 and Alternative 3 using (1) the existing volumes for each alternative, (2) the 2040 volumes for each alternative, (3) referencing the Wasatch Choice for 2040, and (4) taking into consideration the comments received regarding the alternatives from the public, planners, engineers, elected officials, and UDOT.

The transit projects were selected and further defined primarily using two methods. First, each project segment was reviewed for average weekday ridership on that segment. Project segments falling under 2,000 riders per day were either eliminated as a 2011-2040 RTP project or redefined as an Enhanced Bus (BRT 1) project. Second, projects from the various alternatives that served the same broad corridor were compared and one of the projects was selected. Generally speaking ridership, environmental impacts, and direction from corridor studies were the primary considerations in this selection method. Table 4-18 lists the initial highway and transit projects for the draft 2040 RTP. Map 4-10 shows the initial highway and transit projects for the draft 2040 RTP.

Select Initial Draft 2011-2040 RTP System Alternative Projects

Major Highway Projects							
West Davis Corridor – 4000 South to I-15 / US-89 (Farmington)							
Mountain View Corridor – I-80 to Utah County Line	Mountain View Corridor – I-80 to Utah County Line						
Bangerter Highway Interchanges – I-80 to I-15							
Harrison Boulevard – 20 th Street to US-89							
I-215 – 2100 North to 4700 South							
I-15 – I-84 to Hillfield Road							
US-89 – Harrison Boulevard to I-15 (Farmington)							
2000 West / 3500 West – West Davis Corridor to Hinkle	ey Drive						
SR-111 – SR-201 to 13400 South							
Highland Drive – Fort Union Boulevard to I-15							
Redwood Road – 9000 South to Porter Rockwell Road							
SR-201 – I-80 (West) to I-15							
Major Transit Projects							
Project Name	Project Path / Limits						
North Ogden – Salt Lake Enhanced Bus (BRT 1) / Bus	North Ogden – Ogden – Riverdale – Falcon Hill–						
Rapid Transit (BRT 3)	Layton–Farmington–Bountiful–Salt Lake						
Salt Lake City – Foothill Drive – Wasatch Drive Bus	 Salt Lake CentraL-University of Utah–Medical 						
Rapid Transit (BRT 3) / Enhanced Bus (BRT 1)	Center-Research Park–East Millcreek-Cottonwood						
	Corporate Center–Cottonwood Canyons						
700 East Bus Rapid Transit (BRT 3)	Salt Lake Central–South Salt Lake-Millcreek-Murray–						
	Holladay–Cottonwood Heights–Fort Union						
State Street Bus Rapid Transit (BRT 3)	State Street - Salt Lake Central–Capitol–South Salt						
	Lake–Millcreek–Murray–Midvale–Sandy/South						
Jordan FrontRunner–Draper FrontRunner							
Draper (South) Light-rail 12400 South to Utah County							
Redwood Road Bus Rapid Transit (BRT 3)	Downtown Salt Lake–Airport East Hub–West Valley–						
	Taylorsville–South Jordan–Draper FrontRunner						
Bangerter Highway Bus Rapid Transit (BRT 3) /	Airport TRAX Line-6200 South-Draper Front Runner						
Enhanced Bus (BRT 1)	Station						
*Projects were designated as Light-rail, Bus Rapid Transit III, or Enhanced Bus (BRT 1) in this alternative							

