TRANSPORTATION MODELING APPROACH

1.0 PURPOSE

The purpose of this paper is to outline the basic transportation modeling procedures for the Columbia River Crossing (CRC) Alternatives Analysis and Environmental Impact Statement (EIS). The paper was developed jointly by the CRC project team (composed of staff from the Washington and Oregon State Departments of Transportation and a consulting team) and four partner agencies: Metro, the Metropolitan Planning Organization (MPO) for Portland, Oregon; the Regional Transportation Council (RTC), the MPO for southwest Washington; TriMet, the tri-county public transportation district in metropolitan Portland, Oregon; and C-TRAN, the transit district serving Clark County and its cities.

Representatives from the CRC project team and the four agencies listed above have formed the CRC Modeling Working Group. The Working Group discusses transportation modeling elements and coordinates modeling work efforts to complete the Alternatives Analysis and EIS. The modeling approach outlined in this paper was developed jointly by the CRC Modeling Working Group.

2.0 PROJECT BACKGROUND

In January 1999, a bi-state leadership committee considered the problem of growing congestion in the Interstate 5 (I-5) corridor within the Portland-Vancouver metropolitan region. In January 2000, the committee recommended that the region initiate a public process to develop a plan for the I-5 corridor. In January 2001, the governors of Oregon and Washington commenced the Portland-Vancouver I-5 Transportation and Trade Partnership (I-5 Partnership). The governors established a 28-member Task Force to guide the development of the strategic plan for the corridor and also invited a community forum of interested stakeholders from both states to provide input and guidance.

Under the I-5 Partnership, the Washington and Oregon State Departments of Transportation, RTC, Metro, TriMet, and C-TRAN jointly produced a series of technical reports addressing conceptual freeway and transit design and operations, environmental impacts, and regional land use impacts. Key findings from this early work were that existing (year 2000) and forecasted (year 2020) problems associated with congestion were substantial and needed to be addressed, and that a range of improvements was feasible to address the I-5 corridor issues.

The regional partners formed a transportation modeling team to address the wide range of issues inherent in developing model networks for a planning effort of this magnitude. The team met regularly to build consensus on issues such as highway and transit assumptions, performance measures, transportation demand management (TDM) assumptions, and others.

Following this initial work, the I-5 Partnership considered public input and by June 2002 published its Final Draft Recommendations. The key next step in addressing potential I-5 corridor solutions is the preparation of an alternatives analysis (Phase 1) and preparation of an EIS (Phase 2). In early October 2005, the Notice of Intent was published in the Federal Register and work on the CRC EIS was initiated.

The purpose of the CRC Alternatives Analysis and EIS is to address present and future travel demand and mobility needs in the Bridge Influence Area, extending from approximately SR 500 in the north to Columbia Boulevard to the south. The action is intended to: a) address travel safety and traffic operations on the I-5 bridges and associated interchanges; b) improve public transportation connectivity, reliability, operations, and modal alternatives between the Vancouver and Portland urban areas; c) address highway freight mobility and interstate travel and commerce needs in the Bridge Influence Area; and d) improve the I-5 river crossing's structural integrity.

2.1 Bridge Influence Area, Corridor Area, and Region

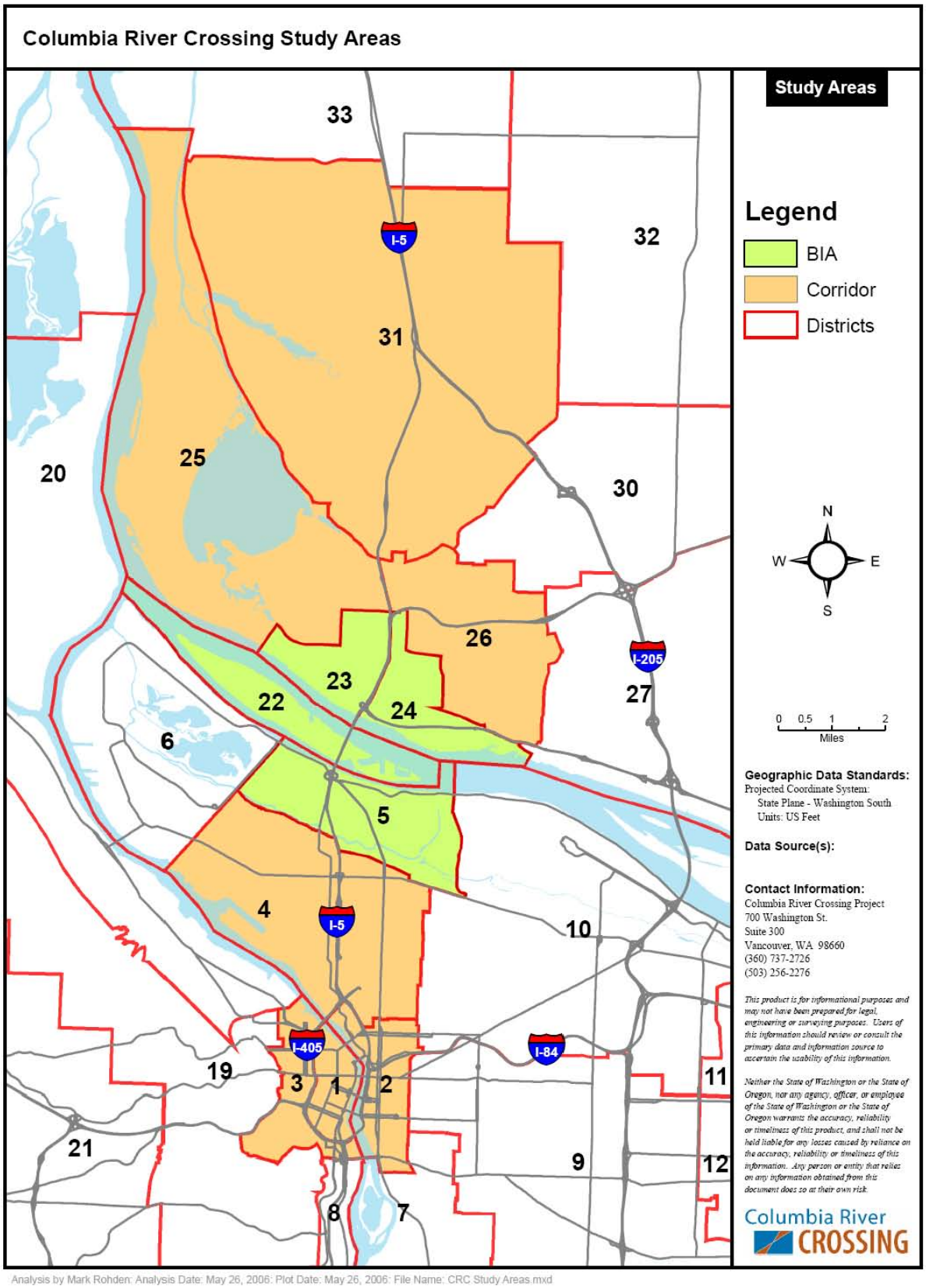
Based on the previous work completed by the I-5 Partnership, the CRC Alternatives Analysis and EIS will focus on Build Alternatives in the Bridge Influence Area as compared to the No Build Alternative. The corridor area, larger than the Bridge Influence Area, will be used to identify potential transportation impacts and mitigation immediately upstream and downstream of the 5-mile Bridge Influence Area. A regional study area encompasses a sub area of the four-county Portland-Vancouver metropolitan area.

The definitions of the three areas are listed below:

- **Bridge Influence Area.** An area approximately 1,000 feet east and west of I-5 and its ramp terminals, from immediately north of the SR 500 interchange to immediately south of the Columbia Boulevard interchange.
- **Corridor Area.** An extension of the Bridge Influence Area north to the future SR 502 interchange in Clark County and south to the Marquam Bridge in downtown Portland.
- **Region.** A sub area of the four-county region that extends east of I-205.

Figure 1 highlights the Bridge Influence Area and the Corridor Area by transportation analysis zone districts, which are a part of the regional travel demand model.

Figure 0. Columbia River Crossing Study Areas



2.2 Coordinated Modeling for the Bi-State Region

There are two MPOs in the bi-state Portland-Vancouver metropolitan area: Metro for Portland, Oregon and the RTC for southwest Washington. Both organizations have travel demand modeling capability and a long history of successfully coordinating their modeling activities. For the purposes of the CRC Alternatives Analysis and EIS, it has been determined that Metro will lead the modeling effort, supported closely by the RTC. The regional travel model at Metro will be expanded and will include population and employment forecasts from southwest Washington that have been approved by Clark County and its cities.

2.3 Analysis Years

Based on the availability of data, regional modeling tools, and guidance from the Federal Transit Administration (FTA) and the Federal Highway Administration (FHWA), the CRC Modeling Working Group has determined that for the Phase 1 Alternatives Analysis (component and alternatives screening prior to the EIS), the year 2005 will serve as the base year for existing conditions and the year 2030 will serve as the future forecast year for the No Build and Build Alternatives. For Phase 2 EIS analysis, the year 2005 will continue to serve as the base year for existing conditions, but the future forecast year may be either the year 2030 or the year 2035, as further discussed in this paper. Below is a summary of rationale for selecting these analysis years:

- **RTC has completed base 2005 highway and transit networks.** Network definition was based on consultation with Vancouver area transportation agencies and C-TRAN to determine projects and service in place in mid-2005.
- **Metro has completed base 2005 highway and transit networks.** Network definition was based on consultation with regional transportation agencies and TriMet to determine projects and service in place in 2005.
- **Extensive traffic and transit data collection was completed in 2005.** Traffic and transit counts and surveys for the I-5 corridor were conducted in 2005 and are being used to validate regional travel demand models.
- **RTC recently completed a fiscally constrained 2030 highway and transit network.** RTC's 2030 Metropolitan Transportation Plan includes a highway network that has been defined and coded. No highway network has been defined for a forecast year beyond 2030. The network is financially constrained and includes I-205 improvements, but not the I-5 CRC project. The transit network, including transit facilities, was recently finalized by C-TRAN.
- **Metro has updated its 2025 highway and transit network to 2030 conditions**. Metro, in consultation with the CRC Modeling Working Group, used its 2025 RTP financially constrained network and developed a 2025-to-2030 project list for inclusion into the 2030 network. The "added" projects consist of roadway improvements that are all outside of the CRC study area and relate to areas added to the region's Urban Growth Boundary since the RTP was adopted in 2000. These projects were approved for modeling purposes by Metro staff.

Detailed descriptions of assumed 2030 highway and transit projects are available in the No Build description technical memorandum previously published.

2.4 Transportation Analysis Zones

Based on the CRC Modeling Working Group's discussions, the CRC project team will use a 2,029 integrated and expanded zone system that includes all transportation analysis zones in Clark, Multnomah, Clackamas, and Washington counties. The integrated zone structure is currently under development. Below are some elements of the 2,029-zone system and improvements that the integrated zone system will contain:

- In Clark County, all 650 zones will be added to the Metro zone system.
- Zone detail has been added in the Rivergate, downtown Portland, and the Portland International Center areas.
- Zone detail has been added in the Damascus and Happy Valley areas.
- The model has been expanded southward to include Newberg, McMinnville, Woodburn, and North Marion County.

2.5 Land Use Allocation

Transportation accessibility is an important determinant of future land use, and the Portland-Vancouver metropolitan area transportation plans developed by Metro and RTC both acknowledge the importance of land use planning when making future transportation investments. Both metropolitan planning organizations are currently in the midst of updating their general land use plans based on their population and employment forecasts.

2.5.1 2005 Base Year

- **RTC worked with Clark County to develop the 2005 Base Year household and employment allocation.** The household data is based on Washington State Office of Financial Management population data for Clark County combined with geographic location data from the Clark County Assessors Office. Employment data was derived from employment information by SIC for December 2004 provided by the Washington State Employment Securities Division. Employment data was aggregated to match the employment types used in the Metro model.
- **The 2005 Base Year data were generated from the MetroScope Integrated Land Use and Transportation Model.** Overall model estimates of households and employment were constrained to control totals estimated by the Regional Econometric Model. Year 2005 household allocation data were adjusted to be consistent with observed building permit trends for the period 2000 to 2004. Detailed transportation analysis zone level allocations for 2005 were reviewed by all jurisdictions having land use authority throughout the Metro region. Household data are available for 64 socio-demographic classes and employment data for 15 Standard Industrial Classes.

2.5.2 2030 Forecast Year

The CRC Modeling Working Group is in agreement that the CRC project needs a single, unified bi-state future land use allocation for all build alternatives considered in the Alternatives Analysis and the EIS. In order to have an agreed upon land use allocation, a series of development steps have been agreed to. In general, the CRC Alternatives Analysis and EIS will use an interim 2030 land use allocation for the Phase 1 Alternatives Analysis (component and alternatives screening prior to the EIS).

- **The RTC and Metro recently developed an interim 2030 land use allocation.** The Bi-State Coordination Committee approved the coordinated 2030 forecast at its March 2006 meeting. This interim 2030 land use allocation will be used for the Phase 1 Alternatives Analysis modeling.
- **The key long-term issue is to update the land use forecast in the fall of 2006 when both Metro's and RTC's interim forecasts will be finalized and also will require a single unified bi-state forecast.** Based on the modeling schedule, this update will be implemented for transportation model runs required for the Alternatives Analysis and EIS.
- **For Phase 2 EIS modeling, an issue to be resolved is the use of 2030 or 2035 forecasts.** Neither MPO expects to have forecasted 2035 land uses by the time Phase 2 is underway, and use

of 2035 forecasts would be inconsistent with Phase 1 work and with FTA requirements. Additional discussion with FHWA and FTA will be required on this topic.

2.6 Modeling Tools and Current Status

The I-5 Partnership Study used Metro's regional travel forecasting model to simulate nine highway and transit option packages to derive transportation performance measures. The highway and transit assignments were done using the EMME/2 software package. Since that time, Metro, RTC, and many agencies in the Portland-Vancouver region have decided to transition from EMME/2 to VISUM assignment software. It is anticipated that this transition will be complete sometime in 2006. As a result of this project starting soon after the initial transition, most of the outputs derived during Phase 1 analysis will be prepared using EMME/2. Limited auto assignment information will be provided to the CRC team using VISUM for flow bundle analyses and traffic operations work. However, during Phase 2, it is expected that both auto and transit assignments will be performed using VISUM. In addition to VISUM, the CRC project team will use the VISSIM, Synchro/SimTraffic, and SUMMIT software packages to further derive transportation performance measures for the CRC build alternatives.

2.6.1 VISUM

VISUM is a comprehensive, flexible software system for transportation planning, travel demand modeling, and network data management. It was developed and is maintained by a firm called PTV. Designed for multi-modal analysis, VISUM integrates all relevant modes of transportation (i.e., car, car passenger, truck, bus, train, pedestrians, and bicyclists) into one consistent network model while providing a variety of assignment procedures. VISUM provides direct network linkage capabilities to VISSIM (see description below). This linkage facilitates network building and permits the use of dynamic path building (i.e., not fixed routes) in VISSIM. Metro and RTC are currently converting data and procedures to work within the VISUM framework.

VISUM coordination, support, and training are critical for the successful transition to VISUM. PTV involvement is also important to ensure that tools are used judiciously. Some experimentation may be required to ensure that the optimum application techniques are used. The VISUM validation will require detailed 2005 calibration assessment.

2.6.2 VISSIM

VISSIM, also developed by PTV, is a microscopic, behavior-based multi-purpose traffic simulation program. For many engineering disciplines, simulation has become an indispensable instrument for the optimization of complex technical systems. This is also true for transportation planning and traffic engineering, where simulation is an invaluable and cost-reducing tool. VISSIM offers a wide variety of urban and highway applications, integrating public and private transportation. Even complex traffic conditions are visualized in a level of detail providing realistic traffic models.

2.6.3 Synchro and SimTraffic

Synchro and SimTraffic are companion traffic operations programs developed by TrafficWare. These programs will be used by the CRC project team to model urban roadways and intersections, including ramp terminals.

Synchro is a software application for optimizing traffic signal timing and performing capacity analysis. The software optimizes traffic signal splits, offsets, and cycle lengths for individual intersections, an arterial, or a complete network. Synchro performs capacity analysis using Highway Capacity methods. Synchro can be used for creating data files for SimTraffic and other third-party traffic software packages. SimTraffic performs micro-simulation and animation of vehicle traffic. With SimTraffic, individual

vehicles are modeled and displayed traversing a street network. SimTraffic models signalized and unsignalized intersections, and roadway segments with cars, trucks, pedestrians, and buses.

2.6.4 SUMMIT

SUMMIT is a model developed by the FTA and is used to calculate transportation system user benefits, which is required by FTA's New Starts process. Transportation system user benefits are those that a traveler perceives from a change in the transportation system. These benefits are calculated using demand model outputs from a baseline and a build alternative. SUMMIT computes the incremental benefit for each origin and destination combination in the transportation system to determine overall system user benefits. User benefits are calculated by purpose and are stratified by the market segmentation that exists within the mode choice model. For example, if the mode choice model stratifies trips by auto ownership, income, and time of day, each of these markets will be evaluated in the user benefit calculation. The SUMMIT software reads one baseline alternative file and one build alternative file for each trip purpose, and compares the data in each file to compute the total difference in the price of travel for auto and transit modes between the baseline and build alternatives, and across market segments and transit accessibility markets, for each trip purpose.

3.0 MODELING SCHEDULE

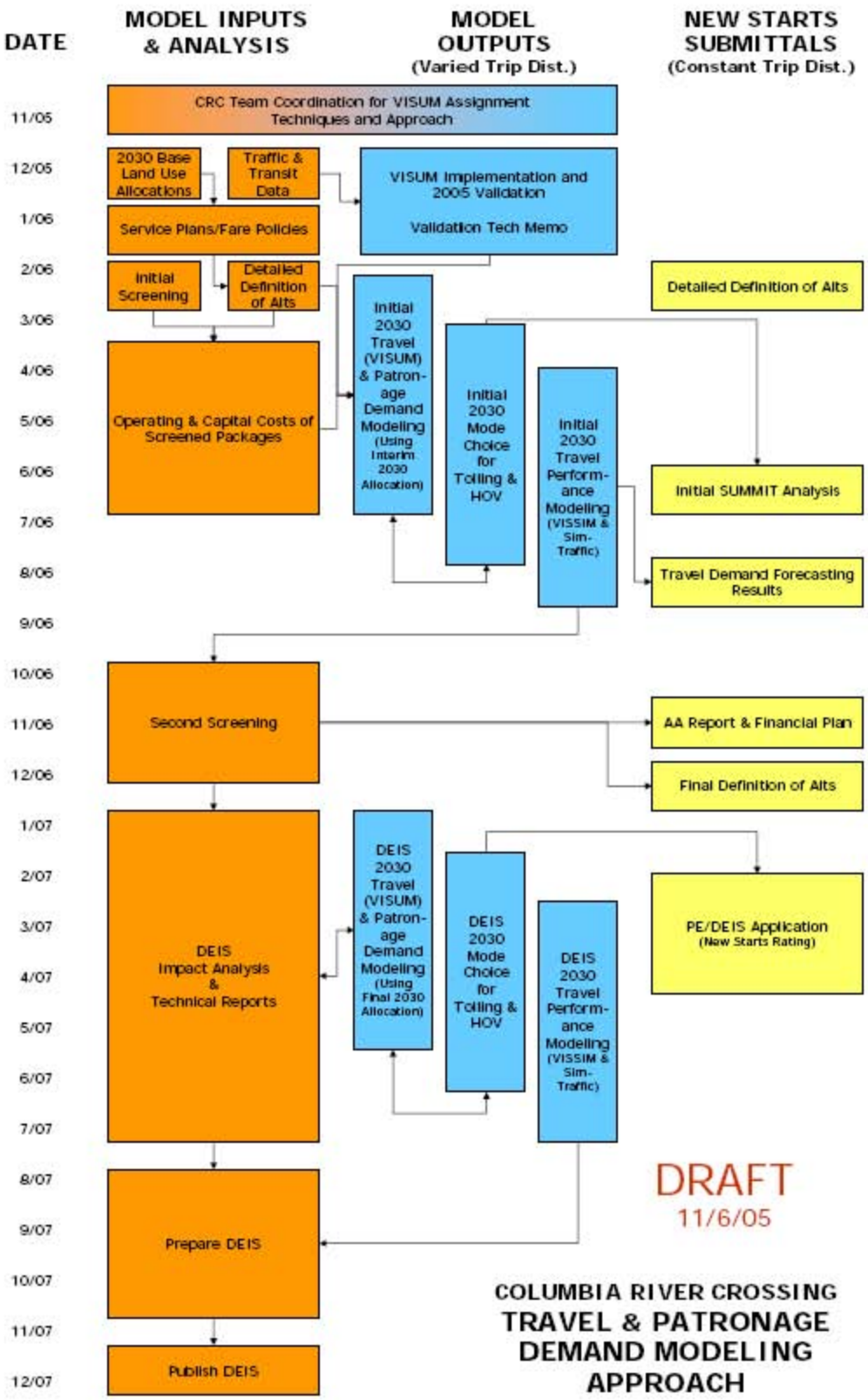
The travel and patronage demand modeling approach consists of: 1) model inputs, which will be developed by the CRC project team; 2) model outputs, which will be completed by Metro and RTC; and 3) New Starts submittals, which will be completed jointly by Metro, RTC, and the CRC project team.

The CRC EIS will be completed in phases. The first phase is an Alternatives Analysis, conducted under NEPA, that will narrow the range of alternatives down to between one to three multi-modal packages to take into the Draft EIS (DEIS). Phase 2 is the preparation of the DEIS, which will catalog the environmental impacts of the remaining multi-modal packages and culminate in the publishing of the Alternatives Analysis/DEIS by December 2007.

Two rounds of modeling will be completed. Phase 1, the first round of modeling, will be completed in the Fall of 2006 to support the second level of screening in the Alternatives Analysis. Phase 2, the second round of modeling, will be completed in the Spring of 2007 to support the EIS impact analysis and technical reports.

Figure 2 depicts the most recent schedule for modeling representative alternatives in Phase 1. Each of the option packages listed in the schedule will be representative of the final packaged alternatives that will be evaluated in Phase 1.

Figure 2. Schedule for Modeling of Phase 1 Alternatives



3.1 Model Inputs

Several of the model inputs to be delivered to Metro and RTC by the CRC project team are described below. CRC project team submittals will be made starting in December 2005 and will continue to August 2008. Model inputs developed by the CRC project team or the four regional partners will include:

1. **Traffic and Transit Data.** The CRC project team has developed a systematic traffic data collection plan. The traffic data will be used to validate the EMME/2 and VISUM assignment results. Transit data will be developed jointly by TriMet and C-TRAN to validate model algorithms, as necessary.
2. **Service Plans and Fare Policies.** TriMet and C-TRAN will assist the CRC project team in developing transit system plans for 2005 Base Year, 2030 No Build, and representative fare policies for all transit build alternatives.
3. **Detailed Definition of Alternatives.** The CRC project team will develop, with the assistance of TriMet and C-TRAN, the Detailed Definition of Alternatives Report as required by FTA. The report will include a description of both the highway and transit networks associated with each alternative.
4. **Capital and Operating Costs.** The CRC project team will develop capital cost estimates for the No Build, Baseline, and Build Alternatives. The CRC project team, with the assistance of TriMet and C-TRAN, will develop the capital and operating cost estimates for the transit system plans. Development of operation cost estimates will require outputs from the modeling effort. The Washington and Oregon State Departments of Transportation will assist with operation and maintenance estimates for the highway elements.
5. **2030 Base Year Land Use Allocation.** Metro and RTC will develop both the interim and final 2030 base year land use allocation for use in the modeling efforts. If necessary, for Phase 2 analysis, Metro and RTC will develop final 2035 land use allocations.
6. **Final Definition of Alternatives.** The CRC project team will develop, with the assistance of TriMet and C-TRAN, the final Definition of Alternatives Report as required by FTA. The report will include a description of the highway and transit networks and the service characteristics associated with each alternative.
7. **Impact Analysis and Technical Reports.** The CRC project team will develop the impact analysis and technical reports that will support the EIS.

3.2 Model Processing and Outputs

This section details the model outputs to be delivered by Metro and RTC to the CRC project team. Model outputs will include:

1. **Existing Year Calibrations.** Metro will validate the travel demand assignment results using CRC project team data in the spring of 2006. Metro will also calibrate the regional demand model as necessary given the modeling assignment outputs. Metro will submit to the CRC project team a validation and calibration technical memorandum for delivery to the FHWA and FTA.
2. **Initial Travel and Patronage Forecasting.** In spring 2006, Metro will code and model multi-modal Build Alternatives for the second level of screening in the Alternatives Analysis. Metro will utilize several of the tools described in the previous section: EMME/2, VISUM, and SUMMIT. Table 1 lists the model runs to be conducted during Phase 1 analysis.
    - VISUM will be used to assign trips for six multi-modal packages, including the 2005 Base Year, the 2030 No Build, the 2030 TSM/TDM Baseline (considered a Build alternative), and three different Build Alternatives.

- SUMMIT will be used to compare the 2030 TSM/TDM Baseline Alternative to the 2030 No Build Alternative and to compare all Build Alternatives to the TSM/TDM Baseline Alternative. For all Build Alternatives, including the TSM/TDM Baseline, a consistent trip assignment will be used and a similar highway alternative will be assumed for comparative purposes.

In addition to the above, the CRC project team will use VISSIM and Synchro/SimTraffic to analyze corridor operations on a microscopic basis.

Table 1. Phase 1 Transportation Modeling Runs for Second Level Screening

Modeling			2005	2030	2030 TSM/TDM-Baseline Build #1	2030	2030	2030
Run	Type	Total	Base Year	No Build		Build #2	Build #3	Build #4
Assignment	VISUM	6	✓	✓	✓	✓	✓	✓
New Starts	SUMMIT	4			✓ Compared to No Build	✓ Compared to TSM/TDM	✓ Compared to TSM/TDM	✓ Compared to TSM/TDM
Tolling	VISUM/ OTHER	4			Runs may consist of 1 2030 & 1 Interim Year Run for One of Above and 1 2030 & 1 Interim Year Run for Another of Above			
Added Runs	As Needed	3		Up to a Total of 3 Additional Runs for Above Alternatives and/or Additional Alternative(s). Land Use Allocation Modeling Equivalent to 3 Runs.				

3.3 New Starts Submittals

The CRC project team intends to make several New Starts submittals throughout the course of the Alternatives Analysis and DEIS. The SUMMIT model will be used a total of four times to refine the alternatives and inform the CRC project team of the expected transportation system user benefits. The New Starts submittals will be developed jointly by the CRC project team, C-TRAN, RTC, Metro and TriMet.

1. **Validation Technical Memorandum.** Produced by Metro, the memorandum will summarize the results of its travel demand model calibration to current conditions, to be certified by C-TRAN and TriMet.
2. **Detailed Definition of the Alternatives.** Previously described above.
3. **Initial SUMMIT Results.** SUMMIT will be run on selected transit alternatives holding the trip distribution and auto skim matrices constant from the TSM/TDM Baseline Alternative to determine transit system user benefits. Each Build Alternative will be evaluated against the baseline alternative.
4. **Travel Demand Forecasting Results.** After the initial SUMMIT results, Metro will compile the travel demand forecasting results and submit to the CRC project team the resulting technical memo. These results will be summarized by the CRC project team in a technical memorandum and submitted to the FTA for their information.
5. **Alternatives Analysis Report and Financial Plan.** The CRC project team will take the results of the modeling and prepare an Alternatives Analysis report for both highway and transit alternatives. The project team will also prepare a Financial Plan.
6. **Final Definition of Alternatives.** Previously described.
7. **PE/DEIS Application and New Starts Reporting.** When a transit locally preferred alternative is arrived at a PE/DEIS Application and the New Starts templates will be prepared for submittal.