Oregon Least Cost Planning - Stage 1 Outcomes: Objectives and General Indicators

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DATE: August 5, 2011

Introduction

This paper documents the objectives, categories, and general indicators decided on during Stage 1 of the OLCP tool development process. It aims to provide project stakeholders and potential users of the OLCP tool with an overview of the decisions that were made during Stage 1, an understanding of how those decisions were made, and an appreciation of how the Stage 1 outcomes will influence Stage 2 of the project.

Legislative Background

In 2009, the Oregon State Legislature adopted the Jobs and Transportation Act, which directed the Oregon Department of Transportation (ODOT) to develop a least cost planning model for use as a decision making tool in the development of plans and projects at the state and regional level. According to the Act (Oregon Revised Statutes 184.653), least cost planning means:

> "A process of comparing direct and indirect costs of demand and supply options to meet transportation goals, policies or both, where the intent of the process is to identify the most cost-effective mix of options."

In response, ODOT is currently developing a methodology for least cost planning in Oregon which could ultimately be used as a decision making tool for the development of transportation plans and projects throughout the state. Key objectives of the Oregon Least Cost Planning (OLCP) effort include helping to ensure transportation decisions are made in a way that is transparent and accountable to the public and makes the best use of public funds to achieve long-term goals.

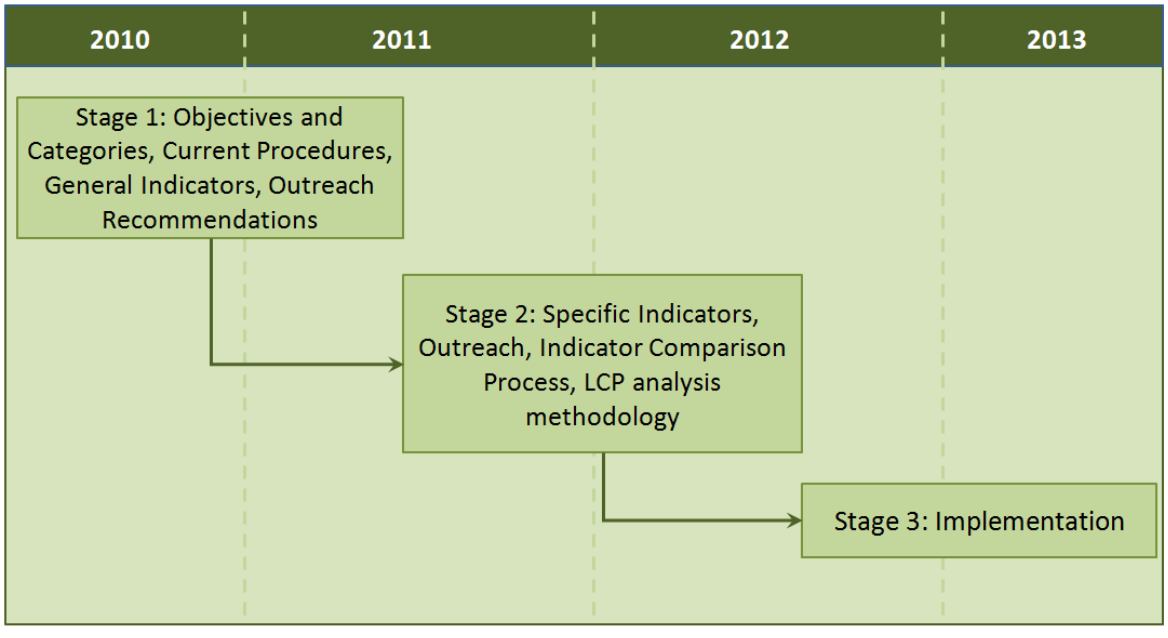
While the legislation instructed ODOT to develop the OLCP methodology for state and regional use, it does not mandate that any specific state, regional, or local agencies use it. Rather, ODOT is developing the methodology with the assistance of other agencies and stakeholders to enable transportation agencies to more fully and consistently evaluate investment impacts on a range of today's concerns, including livability, environment, and economy, as well as traditional capital, maintenance, and operations costs and benefits.

Project Background and Timeline

To develop the tool, ODOT has taken a multi-phased approach including the development of a discussion paper on the history and application of least cost planning to transportation decision making (published in June 2010), as well as a staged process to develop the actual OLCP methodology described below:

- **Preamble:** Explored the beginnings of least cost planning in the electric utility industry and identified opportunities for and barriers to its use in transportation. Presented the key attributes and principles of least cost planning, and researched best practices from around the United States and other countries that are using these principles and attributes to improve their transportation decisions.
- **Stage 1**: Defined the framework for OLCP including transportation system performance categories that describe the kinds of impacts OLCP will evaluate, identified general indicators for each impact category, researched current agency procedures, and developed a recommended OLCP outreach plan.
- **Stage 2:** Identify specific indicators for OLCP, reach out to key stakeholders and potential users, and develop an indicator comparison process and LCP analysis methodology. Develop a guidebook to thoroughly explain the methodology developed and different ways OLCP could be used at a state, metropolitan, and corridor scale, and develop a beta version of the OLCP tool.
- **Stage 3:** Implement OLCP on one or more demonstration projects, as resources permit.

Figure 1: Oregon Least Cost Planning Overall Timeline



Origins of Least Cost Planning

As described in the least cost planning discussion paper, "The History and Application of Least Cost Planning to Transportation," least cost planning is a term originally developed in the

electric utility industry that refers to the consideration of both supply and demand side strategies to meet electricity service requirements. In other words, a basic least cost planning analysis identifies capacity expansion options to meet demand (supply-side), identifies demand minimization options to reduce demand (demand-side), and selects the cost-minimizing combination of the two sets of options. In general, key characteristics of least cost planning include the evaluation of a wide variety of options (including demand management) and the consideration of both environmental and social costs of service.

Key Principles and Technical Attributes of Least Cost Planning

The literature review for the least cost planning discussion paper resulted in a set of Key Principles and Technical Attributes for applying the concept of least cost planning to transportation planning in Oregon. Specifically, the results of that research found that the OLCP tool should include the following Key Principles:

- Address Oregon-specific transportation policy goals and objectives.
- Examine a broad range of multi-modal capacity, demand-management, land-use, maintenance, and other planning options.
- Engage stakeholders in the planning and decision making process.
- Offer a sound and useful basis for making choices among alternative sets of investments and actions.

Additionally, it is recommended that the OLCP tool include the following Technical Attributes:

- Measure the costs and benefits of investments and actions whenever possible.
- Use both quantitative and qualitative evidence.
- Estimate impacts on both travelers and on society at large.
- Account for environmental, social and economic effects.
- Consider interactions among planning options and measure value.
- Account for risk and uncertainty.

Guiding Principles for OLCP Methodology Development

In addition to the Key Principles and Technical Attributes described above, ten Guiding Principles were established for the development of the OLCP methodology. These ten Guiding Principles are listed below:

1. OLCP will seek the most cost-effective solutions considering the goals to be achieved over the long-term, not necessarily the least expensive solution in terms of up-front costs.
2. Existing policy written in the Oregon Transportation Plan (OTP) and Oregon Highway Plan (OHP) lay the foundation for OLCP; these will be used as a starting point and an overall guide, however, the OLCP project may identify how the existing policy can be improved or clarified.

3. The OLCP methodology will complement and supplement existing planning and project development processes, and will utilize and build on existing analysis procedures and tools.
4. The methods developed will enable the OLCP methodology to be useful for every region of the state. For example, recommended methods may allow for flexibility in application or they may differ for urban and rural areas.
5. Use of the OLCP methods will result in information that can be considered and compared in a decision process, not result in one specific solution.
6. There will be multiple tools or techniques that will contribute to the OLCP methodology. For example, OLCP is not expected to be only benefit-cost analysis, only economic impact analysis, or only travel model tools.
7. The recommended methods will allow for an overall understanding of the processes used; they will not result in a "black box."
8. Both qualitative and quantitative information can contribute to evaluation and comparison of possible decisions and both will be utilized in the OLCP methodology where appropriate.
9. The OLCP methodology developed will be consistent with related ODOT efforts, such as those to address greenhouse gas reduction goals, link planning and environmental compliance procedures, and implement practical design.
10. The OLCP methodology developed will not be a static product. ODOT will continue to update and amend the methodology as more is learned and tools and techniques are improved over time.

Stage 1: Goals, Process and Success Factors

This section describes the goals, process, and outcomes achieved in Stage 1 of the OLCP project.

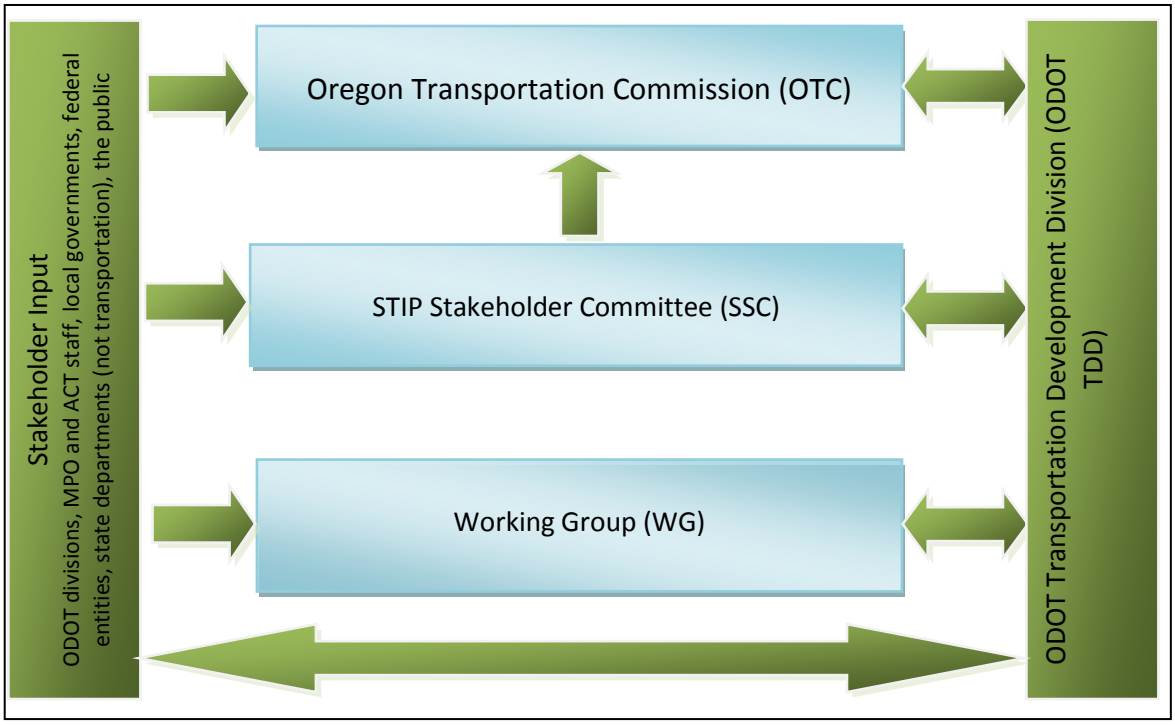
What We Set Out to Accomplish

In Stage 1, the project team worked with project stakeholders to begin developing a framework for the tool that would identify the goals, objectives, and the transportation system performance categories and general indicators that would be included in the OLCP tool. Additionally, a series of framing questions, including the scale of use for the first OLCP tool, as well as the scope of what would (and would not) be addressed in the first iteration of the OLCP tool were established. Additional goals of Stage 1 included better understanding of current ODOT procedures, barriers, and opportunities related to the implementation of OLCP, as well as developing a targeted outreach plan for Stage 2 to reach out to potential tool users and other project stakeholders.

Who Was Involved and How Were Decisions Made?

The decision making structure for the development of OLCP throughout Stage 1 is shown in Figure 2. The composition, roles and responsibilities of each group involved are described below.

Figure 2: Decision Making Structure



Statewide Transportation Improvement Plan (STIP) Stakeholder Committee (SSC): The SSC includes approximately 20 members and provides a balanced representation of stakeholder interests, affected local governments, and geographic areas, as well as a communication link with those interests and groups. Members included leaders from the Federal Highway Administration (FHWA), the Department of Land Conservation and Development (DLCD), the state's economic development department, the business, freight, and environmental communities, Metropolitan Planning Organizations (MPOs), and transit agencies. The group traditionally provides input to ODOT and the OTC on how best to make investment decisions for the STIP and is serving as a project steering committee for OLCP development. Key responsibilities of the SSC during Stage 1 included reviewing and discussing a series of key framing questions (described later in this memo), representing their groups' perspectives during OLCP meetings, and communicating the OLCP project progress with their respective groups.

Working Group (WG): The WG includes technical experts from ODOT and MPO staff and are considered to be potential end-users of the OLCP tool. Divisions within ODOT that are represented on the WG include the Transportation Planning and Analysis Unit (TPAU), public transit, sustainability, freight, operations, and regional staff. During Stage 1, the WG provided technical expertise and feedback to the project team on the development of the OLCP general indicators.

Oregon Transportation Commission (OTC): The OTC is a governor-appointed body that establishes state transportation policy and guides the planning, development, and management of a statewide integrated transportation network. The OTC provides guidance regarding the direction and timing of OLCP development. Briefings with the OTC were held twice during

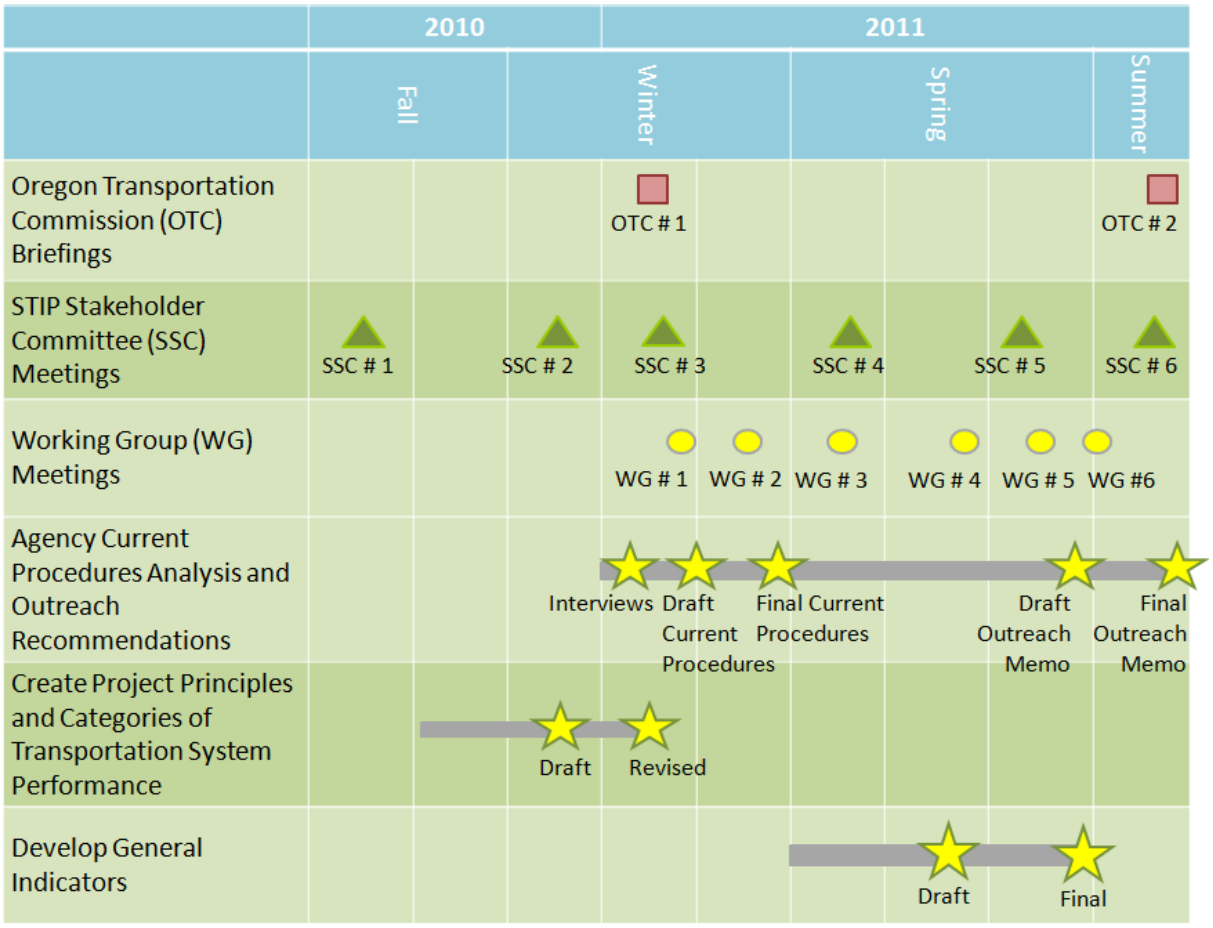
Stage 1 at key milestones to ensure overall concurrence with the progress and direction of the project.

ODOT Transportation Development Division (ODOT TDD): The mission of ODOT TDD is to focus efforts to develop an efficient, safe transportation system that enhances Oregon's economic competitiveness and livability. ODOT TDD staff are responsible for the day-to-day project management of the OLCP project and will ultimately make final recommendations to the OTC.

Stage 1 Timeline

Stage 1 was organized so that several high level project framing questions could be addressed with input from the SSC early in the project. The project team met with the SSC several times in Stage 1 to lay the groundwork for the more technical discussion regarding the general indicators. Once the general indicators were developed the SSC had the opportunity to review them. The research on ODOT current procedures, barriers, and opportunities to OLCP tool implementation was conducted concurrently with the general indicator development. The Stage 1 Timeline is shown below.

Figure 3: Oregon Least Cost Planning Stage 1 Timeline



OLCP "Success Factors"

The project team asked the SSC the following set of questions at its October 2010 meeting to help identify a set of "Success Factors" for the OLCP development project:

- What does a successful outcome for OLCP look like to you?
- What do you think LCP should *not* be?
- How would you describe a successful process?
- What are the key questions that will need to be resolved in Stage 1?

Based on the SSC's discussion, the following Success Factors were developed for the OLCP project. Specifically, SSC members said that OLCP will be a success if:

1. The tool establishes a framework to make decisions that will best meet established goals.
2. The tool helps to construct scenarios that emphasize the risks, choices, and tradeoffs among different alternatives and facilitates thinking more systematically.
3. The tool facilitates the integration of land use and transportation planning.
4. Application of the tool is flexible (i.e. it can be used at various stages in the planning process and in both urban and rural contexts).
5. The tool produces results that are reproducible and transparent and brings more credibility to the transportation decision making process.
6. The tool is considered useful and is utilized frequently by implementing agencies.
7. The tool can be described in simple, easy to understand terms.
8. The benefits of the tool can be clearly demonstrated.
9. The tool is implementable in the near-term.
10. Use of the tool is quick and efficient and does not extend the length of the planning process.

Stage 1 Framing Questions

Over several SSC meetings, a series of high level "framing questions" were addressed to help define the parameters of the OLCP tool and how it should be used. These framing questions were developed based on the OLCP Key Principles and Attributes (listed on page 3) and were designed to serve as the centerpiece of the SSC workplan. The framing questions covered topics designed to help inform the development of the OLCP tool and methodology, such as the level and scale of tool application, the desired categories of transportation system performance, and the desired approach to monetization, among others. The framing questions were ordered and discussed in succession, so that the answer to each question helped to inform all of the questions that followed. The following is a brief summary of the framing questions that were asked and the SSC agreements on each topic:

1. **Portfolios of Actions:** Should OLCP initially be "project based" or "plan based" (portfolios of actions)?

Answer: OLCP should focus first on portfolios of actions.

2. **Scale of Application:** Should Oregon's LCP be designed for application at the state, regional, or local level?

   Answer: OLCP should be designed for use at a state or regional scale first.

3. **OLCP Categories:** What specific environmental, economic, and social transportation system performance categories should be included?

   Answer: The following nine categories should be included: Mobility, Accessibility, Economic Vitality, Environmental Stewardship, Safety and Security, Funding the Transportation System/Finance, Land Use and Growth Management, Quality of Life and Livability, Equity. (These categories are described in more detail in the next section.)

4. **Level of Monetization:** Should OLCP evaluations be expressed only in monetary terms?

   Answer: OLCP should consider monetized, quantitative and qualitative indicators.

5. **Demand Management:** Should OLCP explicitly consider pricing in its suite of demand management options?

   Answer: Yes, OLCP should include pricing in its suite of demand management options.

6. **Risk and Uncertainty:** How can OLCP acknowledge the uncertainties inherent in forecasting and measuring costs and benefits?

   Answer: OLCP will employ a variety of risk analysis tools in implementation to adequately acknowledge uncertainty.

7. **Discount Rate:** What type of discount rate should be used in least cost planning?

   Answer: In general, OLCP will consider different discount rates for different kinds and scales and durations of investments, and will apply a sensitivity testing using a range of discount rates through specific applications of the tool.

   It is of note that the SSC discussed the discount rate topic at several meetings before they arrived on the response above. Continued refinements to the discount rate are expected during Stage 2. In general, it is assumed that OLCP will use discounting in a way that does not overly penalize plans, projects or actions with large upfront costs but benefits occurring in the long or very long term.

8. **Involvement of Stakeholders:** How should OLCP involve stakeholders in the development of specific indicators in Stage 2?

   Answer: OLCP should work mainly with the Working Group, augmenting its participant list as appropriate. Regular briefings to the SSC and to the SSC members' agencies and groups are appropriate for big picture guidance.

Categories of Transportation System Performance

This section describes the OLCP categories of transportation system performance agreed upon by the SSC for inclusion in the OLCP tool. The categories of transportation system performance are the general topics under which the general indicators, specific indicators, and methods for

evaluation were/will be developed. The objectives describe the purpose and intent for each category.

Table 1: OLCP Categories of Transportation System Performance

Category of Transportation System Performance	Description
Mobility	Does the plan or action help reduce travel costs and improve travel time reliability for all modes? Travel cost includes both out-of-pocket expenses and time spent in travel. Reliability includes the extent to which travelers can count on the time their trip will take being consistent from day to day.
Accessibility	Does the plan or action facilitate the ease with which travelers can reach or use modes of transportation? Does the plan or action ease access to opportunities and destinations that give rise to the need for travel?
Economic Vitality	Does the plan or action contribute to the economic prosperity of Oregon (i.e., growth in employment, production or other high value economic activity)?
Environmental Stewardship	Does the plan or action help provide a transportation system that meets present needs without compromising the ability of future generations to meet their needs from the perspective of ecological and social objectives?
Safety and Security	Does the plan or action improve the safety of transportation facilities and systems? Does it help improve security at existing or planned transportation facilities?
Funding the Transportation System / Finance	How does the plan or action impact public accounts? Impacts include effects on fiscal balances and indebtedness
Land Use and Growth Management	Does the plan or action help foster efficient development patterns that optimize travel, housing, employment, and infrastructure spending decisions?
Quality of Life and Livability	Does the plan or action improve the quality of living and working environments, and the experience for people in communities across Oregon?
Equity	Does the plan or action improve the availability of transportation choices among different geographies and population groups? How are the effects of the plan or action distributed across different geographies and population groups?

General Indicators

The categories of transportation system performance described in the previous section were used by the WG to develop a set of general indicators for the OLCP tool. The general indicators were selected to measure performance and evaluate progress toward meeting the objectives of each category. The general indicators listed in Table 2 were identified by the WG and reviewed by the SSC. These indicators will be reviewed for redundancies and used to develop the specific indicators in Stage 2 of the OLCP project. Detailed descriptions of each general indicator are provided in the appendix.

Table 2: OLCP Tool – Categories of Transportation System Performance and General Indicators

Category	General Indicators	
Mobility	• Travel time • Delay • Reliability	• Out of pocket costs • Trip length • Volumes
Accessibility	• Land use • Connectivity/Ease of connections • Modal availability	• Option value • Changes in access • Parking supply and regulations[1]
Economic Vitality	• Economic Impacts of more Efficient Transportation Services • Economic Impacts of Spending for Construction, Operations and Maintenance	• Economic Effects in "Imperfect" Transportation-Using Markets • Local Economic Development and Revitalization Effects
Environmental Stewardship	• Air • Energy and greenhouse gases • Biodiversity	• Land • Water • Community resources
Safety and Security	• Safety - property damage only incidents • Safety - injury incidents • Safety - fatality incidents	• Security – crime • Security - perception of security • Security - resiliency of the transportation network
Funding the Transportation System / Finance	• Capital Costs • Leveraging Funds from Private Sector and Other Public Agencies	• Lifecycle Costs • Operating Revenues • Net Impact on State Fiscal Balance and Debt
Land Use and Growth Management	• Amount and nature of land developed	• Population and employment density
Quality of Life and Livability	• Physical activity • Exposure to pollutants • Community cohesion/severance	• Streetscape/journey ambiance • Access to recreational resources and open space
Equity	• Distribution of benefits/cost by population group • Distribution of benefits/costs by geography.	• Distribution of benefits/costs by user vs. non-user

[1] This general indicator will be re-evaluated in Stage 2 to determine whether it best serves as an input or output to the OLCP tool.

Findings and Next Steps

Stage 1 Outcomes and "Success Factors"

As Stage 1 of the OLCP project reaches completion, it is important to reflect on the status of the project in relation to the ten original "Success Factors" established by the SSC. This ensures that OLCP develops in a way that is useful to key project stakeholders and potential users of the tool. The following table describes each Success Factor and provides an assessment of where the project is currently at in relation to meeting each one.

Table 3: "Success Factors" in Relation to Stage 1 OLCP Outcomes

Success Factors	Current Status	Discussion
The tool establishes a framework to make decisions that will best meet established goals.	On track to meet	The identified categories of transportation system performance, objectives, and general indicators are consistent with established goals and policies in the OTP, and with several other statewide goals and policies as well.
The tool helps to construct scenarios that emphasize the risks, choices, and tradeoffs among different alternatives and facilitates thinking more systematically.	On track to meet	The identified categories of transportation system performance and general indictors will encourage the analysis of trade-offs across goals and the tool will help to construct scenarios that facilitate systematic thinking.
The tool facilitates the integration of land use and transportation planning.	On track to meet	The integration of land use and transportation is explicitly considered in three of the categories of transportation system performance and the interactions between them are generally considered throughout the current framework.
Application of the tool is flexible (i.e. it can be used at various stages in the planning process and in both urban and rural contexts).	On track to meet	Currently the tool is being designed for application at both the state and regional level, and to use existing data flows (which will ensure the tool can be used in both urban and rural contexts).
The tool produces results that are reproducible and transparent and brings more credibility to the transportation decision making process.	Too soon to tell	This success factor will best be tested once a beta version of the tool is developed and applied to a case study. This will happen in Stage 2 and Stage 3 of the project.
The tool is considered useful and is utilized frequently by implementing agencies.	Too soon to tell	This success factor will best be tested after the OLCP tool is launched and made available to potential user agencies and jurisdictions.
The tool can be described in simple, easy to understand terms.	Needs Improve ment	This success factor needs improvement. The term "least cost planning" is confusing to project stakeholders and it is recommended that the project be re-named to enhance overall understanding.
The benefits of the tool can be clearly demonstrated.	Too soon to tell	This success factor will best be tested once a beta version of the tool is developed and applied to a case study. This will happen in Stage 2 and Stage 3 of the project.

Success Factors	Current Status	Discussion
The tool is implementable in the near-term.	On track to meet	Currently, the development of the OLCP tool is on schedule. If resources permit, the tool could be launched in mid-2013.
Use of the tool is quick and efficient and does not extend the length of the planning process.	Too soon to tell	This success factor will best be tested after the OLCP tool is launched and made available to potential user agencies and jurisdictions.

Overall, the OLCP project is on track to meet five of the original ten success factors. Of the remaining five, four are too soon to tell and will best be tested once the tool is more fully developed in Stages 2 and 3 of the project. Of the ten original success factors, only one has been identified as "needing improvement." That success factor states "the tool can be described in simple, easy to understand terms." The problem of being able to quickly and easily explain least cost planning to stakeholders is one that the project management team has been grappling with throughout Stage 1 of the project. To address this issue, the project management team is proposing to re-name the project to help facilitate understanding. This recommendation is described in more detail in the following section.

A New Name for OLCP?

One of the overall findings from Stage 1 is that the term "least cost planning" is confusing to the majority of stakeholders. Frequently, project stakeholders report that they already do "least cost planning," thinking that the term simply refers to cost/benefit analysis or that the tool will simply help transportation decision-makers select alternatives that cost the least amount of money. This confusion was also found in the utility industry, which opted to change the name of "least cost planning" to "Integrated Resource Planning." Similarly, the Puget Sound Regional Council chose to change the name of their least cost planning process to "Benefit-Cost Analysis."

For the OLCP tool to be effective and embraced by potential users, it is important that the purpose and function of the tool be clear and well-communicated. This is why the project management team recommends that Stage 2 of the OLCP project include a process to select a name for the tool that will more accurately reflect the intent and purpose of the tool to potential users and the general public. Names that have been identified at this time for potential consideration include "Value Planning," "True Cost Planning," and "Sustainable Return on Investment." These and other names will be considered in Stage 2, before a final selection is made.

Stage 2 and Next Steps

The work conducted in Stage 1 and described in this memorandum provides a practical foundation for developing the OLCP tool and its user's guide in Stage 2. The decisions made in Stage 1 established parameters for what OLCP will be upon its initial use. For example, OLCP will initially be used for efforts featuring portfolios of actions, at a statewide and/or regional scale, and will include pricing in its suite of demand management options. [Note: this initial guidance does not limit or preclude future expanded uses of OLCP. Rather, initial applications of OLCP will focus on the items described above and earlier in this memo.] The set of 43

general indicators nested within ten categories of transportation system performance provide an organizational starting point for developing specific indicators in Stage 2.

At the beginning of Stage 2, the project team will review the general indicators with the intent of reducing overlap and redundancies before using them to develop and prioritize the specific indicators. The specific indicators will serve as actual metrics for each general indicator. For example, the general indicator of "delay" under the Mobility category could have the specific indicators of "level of service" or "vehicle hours of delay," as shown in Table 4, below. Depending upon data availability and the geographic level of the tool application (state, regional, or corridor), one or more specific indicators may be developed for each general indicator.

Table 4: Example General Indicator and Potential Specific Indicators

Category	General Indicator	Examples of Potential Specific Indicators
Mobility	Delay	Level of Service (LOS)
		Vehicle Hours of Delay (VHD)

Once the specific indicators are identified, estimation methods for each specific indicator will be documented and a beta tool for a specific geography (still to be determined) will be prepared.

The centerpiece of Stage 2 will be a guidebook that thoroughly describes the processes, estimation methods, and expected outcomes of OLCP, how it may be used and best practices for implementation. The guidebook will include information on appropriate applications of the tool, types of data required and data sources, and recommendations on staff trainings and approaches to OLCP tool roll-out. The guidebook will also identify the different ways OLCP can be used at various geographical scales (state, regional, and corridor), and include information on what is in common and what differs in the tool based on geography.

Appendix: General Indicator Descriptions

General Indicators Descriptions

The following pages describe the 43 general indicators developed in Stage 1 of OLCP. The indicators are organized by category of transportation system performance and were identified by the WG and reviewed by the SSC and the OTC. These indicators will be used to develop the specific indicators in Stage 2. Descriptions of the general indicators are provided below:

Mobility:

- **Travel time:** Travel time refers to the amount of time it takes to travel between an origin and destination. It is often considered to be a user cost and/or impediment to travel (though not always). Transportation decision making can affect travel times by either increasing or decreasing the capacity and connectivity of transportation networks (for all modes).

- **Delay:** Delay refers to the increase in travel time experienced due to congested conditions or a breakdown in the transportation network compared to free-flow conditions. Transportation decision making can affect delay by increasing or decreasing the capacity and connectivity of transportation networks, and through other methods such as by providing incident response programs or improving traffic signal timing coordination.

- **Reliability:** Reliability refers to how predictable the travel time is between an origin and destination from one day to the next. For example, a door to door commute of exactly 30 minutes a day would be considered highly reliable. However, a commute time that can range between 15 minutes to an hour, depending on traffic is considered to be highly unreliable. Transportation decision making can impact travel time reliability in a variety of ways, including improving network redundancy, addressing delays at bridge lifts or railroad crossings, addressing high crash locations, and providing real-time travel information to travelers (such as variable message signs or a transit tracker service) to help them make the most efficient route and mode choice.

- **Out of pocket costs:** Out of pocket costs refer to fees paid by travelers, such as tolls, gasoline purchases, transit fares, parking, etc. Transportation decision making can affect out-of pocket travel costs through the implementation of road pricing programs, the establishment of free transit zones, parking fee structures, and other types of programs.

- **Trip length:** Trip length refers to the distance traveled between an origin and destination. Transportation decision making can impact average trip distances by coordinating land use and transportation, implementing a vehicle-miles traveled fee, and increasing the number of transit routes or bikeways to avoid causing out-of-direction travel, among others.

- **Volumes:** Volumes refers to the number of autos, trucks, bicyclists, or pedestrians that travel via a specific transportation facility. It is typically measured in terms of average daily traffic (ADT) for autos, or it can be measured in terms of raw counts (frequently done for bicyclists and pedestrians). Transportation decision making can impact traffic volumes in several ways, including making changes to network redundancy, influencing mode selection, or encouraging peak-spreading, among others.

Note that "consistency with intended function" was discussed as a key mobility component by the SSC. The addition of this general indicator will be considered for inclusion in this category during Stage 2.

Accessibility:

- **Land use:** This general indicator refers to aspects of land use that increase access to and between common destinations, including mixed land uses and measures of density (such as intersection density and activity center density, etc). Transportation decision making can influence land use by shaping and guiding development decisions.

- **Connectivity/Ease of connections:** This general indicator refers to the completeness of a transportation network (for example, whether bicycle facilities connect with each other to create a complete vs. fragmented network), the ease of making connections between transportation networks (for example bicycle and pedestrian connections to transit), and network redundancy (for example, whether alternate routes are present in the case of a traffic incident).

- **Modal availability:** This general indicator refers to the availability of different transportation modes, including bicycle, pedestrian, transit, and auto, as well as to the availability of non-traditional transportation modes, such as the internet for teleworking or online-shopping. Transportation decision making can influence modal availability by prioritizing and identifying the types of capital projects that will be developed.

- **Option value:** This general indicator refers to the value people place on having a travel option available, which they might use under unusual circumstances. For example, the ability to take transit or car-share in the case of a car breakdown helps build redundancy into the transportation network and provides additional value to travelers in the form of improved access. Option value is typically measured with "willingness to pay" surveys, developed in the economics field.

- **Changes in access:** This general indicator refers to changes in access to jobs, housing, and shopping as a result of transportation plans, projects, or actions. Investments in transportation networks, modes, and connectivity can all impact the levels of access to common destinations.

- **Parking supply and regulations**[2]**:** This general indicator refers to the availability, costs, and restrictions placed on parking that may increase or decrease access to destinations by auto travel. Typically, parking supply limitations, fees, and regulations are designed to discourage single occupancy vehicle usage while incentivizing travel by alternate modes.

Economic Vitality:

- **Economic Impacts of more Efficient Transportation Services** (previously *Economic Impacts of Improved Travel Conditions*): This general indicator refers to changes to the state, regional or local economy resulting from improvements in the performance of the transportation system (e.g., travel time saving, improved access, and reduced shipping costs).

[2] This general indicator will be re-evaluated in Stage 2 to determine whether it best serves as an input or output to the OLCP tool.

Examples include: economic development at either end of an expanded freight corridor, and improved labor productivity resulting from reduced commuting times.

- **Economic Impacts of Spending for Construction, Operations and Maintenance** (previously *Economic Impacts of Transportation Spending):* This general indicator refers to changes to the state, regional or local economy resulting from transportation expenditures. These include the short-term impacts of capital spending (e.g., design and construction of a new commuter rail line) and the longer term effects of annually recurring expenditures (e.g., labor costs associated with the operation of commuter trains, track maintenance). Direct, indirect and induced impacts are typically estimated. They may be expressed in terms of jobs, output, income, and/or tax revenue. These in turn may be expressed in gross or net terms (gross includes transfer from other sectors, whereas net includes only net new value to the state economy).

- **Structural Economic Effects of more Efficient Transportation Services** (previously *Wider Economic Impacts*): This general indicator refers to changes to the state, regional or local economy resulting from a transportation plan/project/action, and arising specifically but indirectly from improvements in transportation efficiency over a given geographic area. Examples include: agglomeration economies (changes in productivity resulting from the spatial concentration of firms and workers), or increased output in locations where excessive transportation costs had previously prevented market entry and competition.

- **Local Economic Development and Revitalization Effects** (previously *Community Revitalization/Relocation Effects*): This general indicator refers to a subset of the above three general indicators, and focuses on economic impacts in selected communities (e.g., Economically Distressed Areas). It can be expressed in a variety of economic and real estate metrics, including changes in employment, property value, or in the number of construction permits. Both positive and negative effects will be considered in OLCP (e.g., creation or destruction of jobs associated with business relocation decisions).

Environmental Stewardship:

- **Air:** This general indicator refers to air quality, as regulated under the Clean Air Act. Transportation decision making can impact air quality in a variety of ways, including the emission of Criteria Air Pollutants (e.g. carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, lead, and particulate matter) and Mobile Source Air Toxics (MSATs) during the construction and operation of transportation projects.

- **Energy and greenhouse gases:** This general indicator refers to the energy consumed and green house gases emitted during the design and construction of transportation projects, as well as during transportation maintenance and operations. Transportation decision making can impact energy consumption and greenhouse gas emissions in a variety of ways, including the decision of the types of capital projects to invest in (highway, transit, bike, or pedestrian, etc), the types of programs to invest in (e.g. transportation demand management programs), and/or policies to implement (e.g. road pricing or parking fees that can discourage single occupancy vehicle travel), among others.

- **Biodiversity:** This general indicator refers to refers to the presence and diversity of species (both plant and animal) as well as the conservation of critical habitat. Transportation decision making can influence biodiversity in several ways, including decisions regarding where and how to develop (impacts to habitat), creating impacts to the environment that are harmful to threatened and endangered species (air, water, and noise pollution, etc), and construction and design techniques (split profile roadways[3], wildlife crossings, etc), among others.

- **Land:** This general indicator refers to the conservation of sensitive farm and forest lands, other resource lands, and the preservation of open space. Transportation decision making can impact land in a variety of ways, including compacting soils, fragmenting resource lands, and causing changes to access, among others.

- **Water:** This general indicator refers to stormwater quality, runoff volumes, and groundwater infiltration. Transportation decision making can influence these factors in a variety of ways, including the area of impervious surface coverage, the presence of funds for innovative stormwater treatments, and design and construction techniques that minimize sedimentation and impacts to stream zones and riparian areas, among others.

- **Community resources:** This general indicator refers to historic, cultural, and visual resources, such as historic buildings, community centers, and scenic areas. Transportation decision making can impact these resources in a variety of ways, including displacement, changes in access, or causing changes to the surrounding environment (visual or noise impacts, etc).

Note that a general indicator on impacts to historic transportation resources was discussed by the SSC at their June 2011 meeting. The addition of this general indicator will be considered for inclusion in this category during Stage 2.

Safety and Security:

- **Safety - property damage only incidents:** This general indicator refers to property damage costs that result from transportation incidents. Transportation decision making can influence property damage costs by designing transportation plans, projects, and actions that result in increased safety for all modes and users.

- **Safety - injury incidents:** This general indicator refers to injury costs that result from transportation incidents. Transportation decision making can influence injury costs by designing transportation plans, projects, and actions that result in increased safety for all modes and users.

- **Safety - fatality incidents:** This general indicator refers to costs related to the loss of life that result from transportation incidents. Transportation decision making can influence costs related to the loss of life by designing transportation plans, projects, and actions that result in increased safety for all modes and users.

[3] Split profile roadway construction narrows the right-of-way in a constrained environment through creating a terrace on a slope, thereby reducing site disturbance, materials usage, and habitat impacts.

- **Security – crime:** This general indicator refers to crime rates in and around the vicinity of transportation facilities. Examples include occurrences of crime in parking lots, near transit stations, or at port facilities. Both the type of crime and crime severity are included in this indicator.

- **Security - perception of security:** This general indicator refers to the sense of security that users of a transportation facility experience. Transportation plans, projects, and actions can influence the perception of security by designing for increased visibility (e.g. security cameras), emergency phones, and improved lighting, among other features.

- **Security - resiliency of the transportation network:** This general indicator refers to the resiliency of the transportation network to unexpected events, such as terrorism and natural disasters. Transportation decision making can influence resiliency by designing transportation plans, projects, and actions that consider evacuation routes and issues related to climate change adaptation, among others.

Note that emergency vehicle response time was discussed by the WG and is considered to relate to both safety and security issues. This indicator will be woven into this category during Stage 2 of OLCP.

Funding the Transportation System:

- **Capital Costs**: This general indicator refers to all one-time, non-recurring expenditures associated with the implementation of a plan, project or action. Typical capital costs for a transportation project include right-of-way acquisition costs, permitting costs, design and engineering costs, and construction costs.

- **Lifecycle Costs**: This general indicator refers to all recurring and non-recurring costs incurred over the full life span (or period of analysis) of a plan, project or action; including operations, maintenance, renewal, upgrading and disposal. The residual or salvage value of transportation assets is typically netted out of the lifecycle cost estimates in Least Cost Planning applications.

- **Operating Revenues**: This general indicator refers to changes in revenues generated through the provision of transportation services or access to transportation facilities, resulting from a plan, project or action. Examples of operating revenues include passenger fares, tolls, concessions, parking, and advertising revenues.

- **Leveraging Funds from Private Sector and Other Public Agencies**: This general indicator refers to the extent to which a plan, project or action may be paid for with contributions from the private sector (through various forms of Public Private Partnerships) and from other public agencies (through transportation grants and loan programs, or multi-agency funding initiatives).

- **Net Impact on State Fiscal Balance and Debt**: This general indicator refers to the net change (positive or negative) in the state's budget and borrowing needs, resulting from a plan, project or action; accounting for all short-, medium-, and long-term impacts on outlays and revenues (including, for example, reductions in fuel tax revenue resulting from a Travel Demand Management initiative).

Land Use and Growth Management:

- **Amount and nature of land developed:** This general indicator refers to the amount, type and nature of land development (e.g., residential, commercial, mixed use) in a community. Transportation decision making can influence the amount and nature of land development by making changes to access and modal availability in a certain area. OLCP will consider both the direct and indirect (or secondary) land use impacts of transportation plans/projects/actions.

- **Population and employment density:** This general indicator refers to the number of people or jobs within a certain area. Population and employment density can affect the viability of retail business and transit service within a community. Transportation decision making can influence population and employment densities by changing access to key activity, employment, and residential areas.

- Note that a general indicator to consider the economic "productivity of land" (i.e. economic output per acre) was discussed by the SSC in their June 2011 meeting. The addition of this general indicator will be considered for inclusion in this category during Stage 2.

Quality of Life and Livability:

- **Physical activity:** Transportation systems can influence the amount of physical activity residents of a community get by the presence or absence of active mode infrastructure. Active modes are generally considered to include non-motorized modes, such as biking and walking, and transit (which must often be accessed by foot or bike). Increased levels of physical activity have been show to increase both physical and mental health, which enhances overall quality of life.

- **Exposure to pollutants:** Transportation decision making can increase or decrease the percent of the population that is exposed to pollutants. For example, high traffic volume major arterials that are constructed near residential areas or schools can increase asthma rates among adjacent residents.

- **Community cohesion/severance:** This general indicator refers to the impacts to communities when transportation infrastructure either creates or removes major pedestrian barriers. For example, a negative impact to community cohesion might occur when a new highway bisects an existing neighborhood. On the other hand, a positive impact to community cohesion might occur when a new bridge project provides improved access across a river.

- **Streetscape/journey ambiance:** Transportation decision making can influence the quality of the street environment through the presence of funds for streetscape enhancements for improvements such as street trees, public art, and street furniture. Streetscape environments have been linked to improvements in walkability and to the creation of a "sense of place".

- **Access to recreational resources and open space:** Transportation decision making can impact access to recreational resources, such as shared-use paths and trails, and to open space, such as parks and natural areas. Natural environments and green space have been linked to psychological health and well-being in numerous academic studies.

Note that a general indicator on the "extent of isolation" for specific population groups was discussed by the SSC in their June 2011 meeting. The addition of this general indicator will be considered for inclusion in this category during Stage 2.

Equity:

Distribution of benefits/cost by population group: This general indicator will help identify disparate impacts of transportation decision making among different population groups, such as low-income and minority populations, and potentially among groups based on age, gender, and/or household structure, among others. This can be important to decision-makers to help ensure that the costs and benefits of transportation plans, projects, or actions are distributed equitably among different population groups.

Distribution of benefits/costs by geography: This general indicator will help identify disparate impacts of transportation decision making among different geographies, including regions, urban and rural locations, counties, census tracts, zip codes, and/or transportation analysis zones, among others. This can be important to decision-makers to help ensure that the costs and benefits of transportation plans, projects, or actions are distributed equitably by geography.

Distribution of benefits/costs by user vs. non-user: This general indicator will help identify disparate impacts of transportation decision making among users vs. non-users of the transportation system. This can be important to decision-makers to help ensure that the costs of transportation plans, projects, or actions are distributed equitably between those who will use the transportation system (and directly benefit from it), and those who will not.