

Recommendations Memo #2 Livability and Quality of Life Indicators

TO: Least Cost Planning Project Management Team
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Introduction

The purpose of this memo is to discuss the current application of quality of life and livability indicators to transportation systems in order to help facilitate a decision by ODOT and the Oregon Least Cost Planning (OLCP) Working Group (WG) regarding the inclusion of these indicators in the Least Cost Planning tool. The paper begins with a discussion of how the concepts of livability and quality of life have been defined in the literature and then discusses what is known about how livability and quality of life are influenced by transportation actions. The paper continues with examples of the application of quality of life and livability indicators throughout the transportation planning process, focusing specifically on examples of how these indicators have been used by jurisdictions to evaluate portfolios of actions during transportation system planning. A summary of the issues related to the quantification and monetization of quality of life and livability indicators is provided, and a final set of recommendations regarding the inclusion of these indicators in the OLCP tool is included at the end of this report.

How are “Livability” and “Quality of Life” defined?

“Livability” and “quality of life” are terms which, though in widespread use, do not have single agreed upon definitions. The following section briefly describes the common usage of each term and finishes with a proposed working definition for the Oregon Least Cost Planning tool.

Livability: Derived from the word “livable,” “livability” is defined broadly as “suitability for human living” (Merriam-Webster, 2011). Livability became a popular topic in the 1980s as planners began studying shifts in development patterns from the decline of urban centers to rapidly growing suburban areas (Federal Highway Administration, 2010). A series of reports began to emerge that challenged traditional growth assumptions and highlighted regions that were “pioneering a wide range of innovative efforts to make communities more livable” (Clinton-Gore Administration, 2000). The term also gained popularity through the increase in prevalence of annual surveys that rank the world’s most livable cities, such as the Mercer Worldwide Quality of Living Survey¹, and “The World's Most Livable Cities”

¹ <http://www.mercer.com/press-releases/quality-of-living-report-2010>

report². These surveys use different criteria, but typically assess cities on factors such as political stability, safety, healthcare, education, public services, transportation, recreation, housing, and environmental quality. These surveys began, in part, to help governments and multi-national companies compensate employees fairly when placing them internationally, but have developed into coveted symbols of urban planning success among cities around the world.

The theme of the 90th Annual Meeting of the Transportation Research Board (TRB) held in early 2011 was “Transportation, Livability, and Economic Development in a Changing World. A session entitled “How Do We Measure Livability and Sustainability “grappled with the issue of defining livability and noted that “despite the existence of many programs that focus on livability and sustainability, there is a lack of clear consensus on these topics and how they should be measured and applied” (TRB 90th Annual Meeting Session #284, 2011). Presenters at the session acknowledged the definition issue and asked audience members to share their own definitions of livability. One person said they think livability means “improving the quality of the human experience.” Another offered that livability means “having a high quality of life at an affordable price.”

A survey of the literature and current livability programs shows that livability is generally thought of as having multiple dimensions. For example, a definition provided by the Victoria Transport Policy Institute (VTPI) claims that livability is “affected by a community’s public safety, environmental quality, community cohesion, friendliness, aesthetics, accessibility, pride, and opportunity” (VTPI, 2010). Additionally, recent research conducted on five mature metropolitan livability programs³ throughout the United States resulted in a diverse array of livability objectives (Fabish & Haas, 2010). The types of livability objectives included in these programs include:

- environmental goals (such as air quality, open space, and greenhouse gas emissions);
- economic goals (such as economic revitalization and development);
- land use goals (such as compact, mixed use development);
- transportation goals (such as walkability, accessibility, and transportation choices);
- equity goals (such as affordable housing and mixed-income communities); and
- community development goals (such as sense of place, safety, and public health).

Livability has also emerged at the forefront of the recent Partnership for Sustainable Communities formed by the U.S. Department of Housing and Urban Development (HUD), the U. S. Department of Transportation (DOT), and the Environmental Protection Agency (EPA) in June of 2009. The partnership identifies six livability principles to help the three agencies collaborate to improve access to affordable housing, increase transportation options, lower transportation costs, protect the environment, promote equitable development, and address the challenges of climate change in communities nationwide (US

² http://www.eiu.com/public/topical_report.aspx?campaignid=Liveability2011

³ The five metropolitan livability programs surveyed included the Atlanta Regional Council’s Livable Communities Initiative, the Metropolitan Transportation Commission’s Transportation for Livable Communities Program (San Francisco, CA), Metro’s Transit Oriented Development and Centers Program (Portland, OR), North Central Texas Council of Governments’ Sustainable Development Initiative, and the Metropolitan Council’s Livable Communities Act Grant Program (Minneapolis-St. Paul).

Environmental Protection Agency, 2011). The following six livability principles serve as the foundation of the Partnership:

1. **Provide more transportation choices** to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health.
2. **Promote equitable, affordable housing.** Expand location- and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to lower the combined cost of housing and transportation.
3. **Enhance economic competitiveness.** Improve economic competitiveness through reliable and timely access to jobs, education, and services, as well as expanded business access to markets.
4. **Support existing communities.** Increase community revitalization through transit oriented development, mixed-use development, and land recycling.
5. **Coordinate and leverage federal policies and investment.** Align federal policies and funding to remove barriers to collaboration, leverage funding, plan for future growth, and make smart energy choices such as locally generated renewable energy.
6. **Value communities and neighborhoods.** Invest in healthy, safe, and walkable neighborhoods.

While the scope of the elements considered to contribute to livability are very broad and include aspects of the natural, economic, and social environments, the one thing they all share in common is that they refer to aspects of the built and natural environments. The closely related, but subtly distinct concept of "quality of life" focuses more on the user experience of these environments and is described briefly in the next section.

Quality of Life: Similar to "livability," the term "quality of life" is a very general term that can mean different things to different people (Forkenbrock & Weisbrod, 2001) and covers a variety of domains (Hagerty, et al., 2001). Broadly, quality of life refers to the general well-being of individuals and societies. The term is used in a wide range of professions, including the fields of international development, healthcare, urban planning, and others. According to the Applied Research in Quality of Life Journal⁴, examples of concepts directly related to quality of life and social indicators include "happiness, subjective well-being, life satisfaction, the good life, the good society, economic well-being, family well-being, quality of work life, community quality of life, spiritual well-being, leisure well-being, social well-being, emotional well-being, psychological well-being, and quality of home life, among others" (Michalos, Sirgy, & Estes, 2006). This definition speaks to the broader, subjective aspect of quality of life that serves as the foundation of the concept's meaning.

In the field of urban and regional planning, "quality of life" generally focuses more on community quality of life and social well-being indicators, rather than the more emotional and psychological indicators commonly used in the healthcare and other professions. When urban planners talk about enhancing quality of life, they are generally talking about the external conditions that contribute to quality of life (such as level of income or access to

⁴ The field of quality-of-life studies and social indicators has grown over the past 30 years. Quality-of-life studies are regularly published in many disciplines of basic and applied social sciences. Two professional societies—the International Society for Quality of-Life Studies (ISQOLS) and the International Society for Quality-of-Life Research (ISOQOL) were established in 1995 and their membership has been growing (Michalos, Sirgy, & Estes, 2006).

services and resources); rather than the internal experience of quality of life that is based more on subjective judgment and life satisfaction as a whole (Pichardo-Muñiz, 2010). For example community quality of life indicators refer to the benefits derived from increased physical activity; breathing clean air; having access to transportation choices, jobs, housing, education, open space, and healthy food; having adequate opportunities for recreation and leisure time; living in a pleasant, safe, and cohesive community; and having a sense of social belonging, among others (Forkenbrock & Weisbrod, 2001).

While these are all very similar to the aspects of livability described above, (and indeed the two terms are often used interchangeably in the urban planning field), the distinction lies in the difference between the presence and quality of the amenities of the built and natural environments (livability) and the user experience of those amenities and any associated health benefits (quality of life). For example, where livability might be concerned with the transportation choices a community offers its residents, quality of life refers to the associated health benefits received by residents who have the choice to select more active travel modes. In other words, livability refers to a community's services and amenities, whereas quality of life refers to how those amenities shape and benefit the human experience.

Proposed Working Definition: For the purposes of this memo, the team proposes defining livability as “the attributes of a community that affect its suitability for human living.”⁵ The team proposes defining quality of life as “the effects of a community's livability on its residents.” The following table provides an example of the types of factors that affect community livability under the above definition, and the associated quality of life benefits that could be expected to accrue.

Table 1. Examples of Community Livability Factors and their Associated Quality of Life Benefits

	Livability Factors	Quality of Life Benefits
Economic Development	availability of jobs, services, and retail	disposable income, recreation and leisure time
Housing	affordability, location, diversity of housing types	shelter, safety, and security
Environmental Quality	air quality, aesthetics, noise, water quality, greenhouse gases, parks and open space	physical and mental health, protection from some natural hazards
Community Development	community cohesion, historic and cultural resources, educational opportunities	sense of belonging, sense of place, community resiliency, social capital, upward mobility
Transportation	availability of multi-modal connected networks; mobility; safety; accessibility of jobs, housing, and services; streetscape attractiveness	independence of movement, reasonable and reliable travel times, physical and mental health
Equity	equitable distribution of amenities	sense of social justice, exposure to diverse ideas

⁵ It should be noted that what constitutes “suitability for human living” may vary based on community-specific values and context.

While many of these community livability factors and quality of life benefits will be addressed in other categories of transportation system performance within OLCP, it is important to understand the full breadth and scope of each category before the appropriate general indicators are selected. The issue of double counting and indicator overlap across categories will be addressed in the final recommendations section of this memo.

How Transportation Actions Influence Livability and Quality of Life

The exercise of reviewing the literature and defining livability and quality of life has shown that, at their core, the concepts relate to an incredibly broad set of factors and criteria; essentially everything that affects the human experience. Not surprisingly, we find that transportation can affect a community's overall livability and quality of life in a variety of ways. In fact, some even define livability in transportation terms alone. According to U.S. Secretary of Transportation, Ray LaHood:

“Livability means being able to take your kids to school, go to work, see a doctor, drop by the grocery or post office, go out to dinner and a movie, and play with your kids at the park – all without having to get in your car” (Federal Highway Administration, 2010).

This definition highlights the critical role of transportation choice in creating more livable communities. Additionally, the recently released *Livability in Transportation Guidebook* from FHWA further explores the role of transportation in improving community livability and quality of life. Specifically, the guidebook says:

“Livability in transportation is about using the quality, location, and type of transportation facilities and services available to help achieve broader community goals such as access to good jobs, affordable housing, quality schools, and safe streets. This includes addressing road safety and capacity issues through better planning and design, maximizing and expanding new technologies such as intelligent transportation systems (ITS) and quiet pavements, and using travel demand management (TDM) approaches in system planning and operations. It also includes developing high quality public transportation to foster economic development, and community design that offers residents and workers the full range of transportation choices. And, it involves strategically connecting the modal pieces – bikeways, pedestrian facilities, transit services, and roadways – into a truly intermodal, interconnected system.” (Federal Highway Administration, 2010).

This quote highlights the role transportation investments can play in affecting accessibility, economic development, and transportation choice, all of which contribute to meeting broader community livability and quality of life goals.

A review of the literature shows that transportation can affect the above factors, as well as many others aspects of community livability and quality of life (Forkenbrock & Weisbrod, 2001). According to the National Cooperative Highway Research Program (NCHRP) Report #456, transportation projects can affect an area's visual quality, level of traffic noise, social interactions, and community cohesion, all of which can affect an area's ability to attract new businesses and residents (Forkenbrock & Weisbrod, 2001). We also know that transportation policies and practices can affect traffic safety, delay, local air quality, greenspace, streetscape attractiveness, transportation affordability, the preservation of historic and cultural

resources, and the availability of recreational opportunities (VTPI, 2010; Pichardo-Muñiz, 2010).

Additionally, recent studies have found that transportation can affect social capital, which is defined as “a measure of an individual’s or group’s networks, personal connections, and involvement” (Rogers, Halstead, Gardner, & Carlson, 2010). A study conducted in New Hampshire has found that levels of social capital (as measured by a survey of residents) were higher in neighborhoods with greater walkability (Rogers, Halstead, Gardner, & Carlson, 2010). Additionally, studies by Appleyard (1981) and Hart (2008) have found that residents of lower traffic volume streets are more likely to know their neighbors and show more concern over their local environment than residents of streets with higher traffic volumes and speeds (VTPI, 2010).

Transportation has also been found to influence public health. Adopting more active modes, such as walking, bicycling, or even taking transit can increase daily levels of physical activity when compared to driving. Regular physical activity performed several days a week has been shown to reduce the risk of disease and promote psychological well-being (Center for Disease Control and Prevention, 2011; Gill, et al., 2010).

Overall, transportation has been shown to affect the majority of the livability factors and quality of life benefits identified in Table 1. Table 2, below, provides examples of how transportation can influence each of the identified categories.

Table 2. The Influence of Transportation on Livability Factors and Quality of Life Benefits

	Livability Factors	Quality of Life Benefits	Transportation’s Influence (Examples)
Economic Development	availability of jobs, services, and retail	disposable income, recreation and leisure time	congestion’s affects on business location and business costs
Housing	affordability, location, diversity of housing types	shelter, safety, and security	transportation amenities influence housing price and the location developers choose to build
Environmental Quality	air quality, aesthetics, noise, water quality, greenhouse gases (ghgs), parks and open space	physical and mental health, protection from some natural hazards	several modes emit criteria air pollutants, greenhouse gases, and create noise; streetscape design can influence the amount of greenspace and stormwater runoff; mode use can impact health and safety
Community Development	community cohesion, historic and cultural resources, educational opportunities	sense of belonging, sense of place, community resiliency, social capital, upward mobility	highway/rail projects can divide communities; transportation projects can preserve or destroy historic buildings, bridges, etc; some modes have been shown to increase social capital
Transportation	availability of multi-modal connected networks; mobility;	independence of movement, reasonable and	transportation investments affect modal availability and congestion levels; coordinated transportation

	Livability Factors	Quality of Life Benefits	Transportation's Influence (Examples)
	safety; accessibility of jobs, housing, and services; streetscape attractiveness	reliable travel times, physical and mental health	and land use planning influence accessibility; project design influences streetscape amenities
Equity	equitable distribution of amenities	sense of social justice, exposure to diverse ideas	the distribution of transportation networks can serve some populations more than others; the extent and quality of the network affects mobility-impaired users

Livability and Quality of Life Indicators

What are common quality of life and livability indicators for transportation systems?

Next we turn to examining how transportation plans and projects are being measured in terms of their impacts to community livability and quality of life. To get a better understanding of current research and trends related to the measurement of livability and quality of life, several regional transportation plans, transportation project evaluation criteria, and transportation-related health impact assessments were reviewed, including those listed below⁶. These documents were selected for review because they include indicators that forecast the impacts of transportation plan or project alternatives *prior* to implementation⁷. This is different than performance measures, which are typically designed to monitor changes after implementation (Caltrans, 2009). Findings from the review are listed in Table 3 at the end of this section.

- Puget Sound Regional Council (PSRC) Transportation 2040
- Central Indiana Transit Task Force: Central Indiana Transportation Plan (CITP)
- Portland Metro 2035 Regional Transportation Plan (Metro RTP)
- Change in Motion: Transportation 2035 Plan for the San Francisco Bay Area (MTC RTP)
- United Kingdom Department of Transport NATA *Refresh* – Project Evaluation Framework (NATA)
- Lake Oswego to Portland Transit Project Health Impact Assessment (LOPT HIA)
- Health Impact Assessment on Policies Reducing Vehicle Miles Traveled in Oregon Metropolitan Areas (VMT HIA)

⁶ Note that not all of the document types reviewed reflect analyses regularly performed by DOTs. For example, health impact assessments are currently voluntary, and may not be appropriate, feasible, or eligible for funding under certain circumstances. Recent health impact assessments were reviewed in order to better understand current trends and find possible indicators that would be useful for OLCP. The recommended livability and quality of life indicators included in this memo are intended to be useable by OLCP without a full health impact assessment or other new type of analysis.

⁷ This is true with the exception of the Metro RTP, which includes performance measures to monitor impacts after transportation investments have been made. As such, not all of the measures from Metro's RTP can be used to forecast the impacts of transportation plan alternatives prior to plan implementation.

- Health Impact Assessment on Transportation Policies in the Eugene Climate and Energy Action Plan (ECEAP HIA)

Consistent with the breadth of the definition of livability and quality of life, the regional transportation plans and evaluation frameworks reviewed presented a wide variety of indicators under the umbrella “quality of life” and/or “livability.” For example, the PSRC Transportation 2040 plan included “health,” “safety,” and “security” indicators under the heading “quality of life;” while the MTC RTP included just one “affordability” indicator designed to measure both equity and “livable community” goals. On the other end of the spectrum, the Central Indiana Task Force identified a single “property value premium” indicator to measure community livability benefits in the CIPP, arguing that benefits arising from improvements in transportation choice, etc would be reflected in investors’ and buyers’ increased willingness to pay for a home. Additionally, some of the plans, such as the Metro RTP, did not specifically include measures for livability and/or quality of life. However, elements commonly considered to be included under these terms, such as “human health,” “improvements in transportation choice,” and “fostering vibrant communities” were listed as goals. As such, the Metro RTP performance measures identified as helping to meet these goals were included in this review.

Several other indicators were included in the review that were not necessarily identified as “livability” or “quality of life” indicators in their source document. These were indicators for livability and quality of life that are known to be affected by transportation, such as air quality, noise, community cohesion, landscape, and cultural and historic resources. Many of these indicators are examples from the NATA refresh transportation project evaluation framework, which was used as a case study in the Least Cost Planning Discussion Paper (Oregon Department of Transportation, 2010). While these types of indicators may often be thought of as belonging to other categories (such as environmental quality or community development), it is important to remember that transportation can impact livability and quality of life in these areas too. The issue of double counting and what to do when indicators meet multiple goals will be addressed in the final recommendations section of this memo.

Finally, the review examined indicators used in recent health impact assessments conducted for transportation-related projects. The health impacts assessments were included in this review because of their increasing role in the evaluation of transportation plans and projects and their prominent connection to quality of life. In contrast to the regional transportation plans reviewed, the health impacts assessments all used very similar indicators, including impacts to air quality, traffic collisions, and physical activity. Less prevalent was the use of accessibility indicators (used in the LOPT HIA & VMT HIA) to measure access to healthy food and healthcare, and equity indicators (used in the ECEAP HIA & VMT HIA) to measure impacts on vulnerable populations (such as children and the elderly).

Interestingly, none of the reviewed documents included social capital as an indicator of livability or quality of life. This is likely due to the difficulty in measuring social capital and limited data availability (Rogers, Halstead, Gardner, & Carlson, 2010). The relevant livability and quality of life indicators found in each reviewed document are listed in Table 3. The livability and quality of life category for each indicator, the indicator source

document, and whether the indicator was quantified or monetized is also described in Table 3.

Table 3. Common Indicators for Transportation Impacts on Community Livability and Quality of Life

	General Indicator	Examples of Specific Indicators	Source	Quantitative or Qualitative	Monetized?
Economic Development	Affordability/ Disposable Income	Percent of household income spent on combined housing and transportation costs (can disaggregate by income groups)	CITP MTC RTP	Quantitative (CITP) Unknown (MTC RTP)	Yes (CITP) Unknown (MTC RTP)
Housing	Property Values	“Premium” rate of residential and commercial property appreciation	CITP	Quantitative	Yes
Environmental Quality	Noise Impacts	Properties experiencing noise levels in excess of a specific threshold	NATA	Both	Yes
	Air Quality	Tons of transportation-related air pollutants	NATA CITP LOPT HIA ECEAP HIA Metro RTP VMT HIA	Both (NATA & LOPT HIA) Quantitative (CITP & Metro RTP) Qualitative (ECEAP HIA & VMT HIA)	Yes (CITP) No (NATA, LOPT HIA, ECEAP HIA & Metro RTP)
Community Development	Community Cohesion/ Severance	Addition or removal of major pedestrian barriers (arterials with 4 or more lanes, railroads, river crossings, etc)	NATA	Qualitative	No
	Landscape	- Impacts to unique landscapes - Percent of projects that intersect high value habitat areas	NATA Metro RTP	Qualitative (NATA) Quantitative (Metro RTP)	No
	Heritage / Historic Resources	Historic resources adversely impacted	NATA	Qualitative	No

Transportation	Physical Activity	- Percent mode share of active modes (transit, biking, walking) - Vehicle Miles Traveled (total and per capita)	NATA PSRC LOPT HIA ECEAP HIA Metro RTP VMT HIA	Both (NATA & LOPT HIA) Quantitative (Metro RTP) Qualitative (PSRC, ECEAP HIA & VMT HIA)	No
	Safety	Accident cost savings	PSRC	Quantitative	Yes
		Crash rates, injuries, and fatalities (can disaggregate by mode)	NATA LOPT HIA ECEAP HIA VMT HIA	Both (NATA) Qualitative (LOPT HIA, ECEAP HIA, & VMT HIA)	Yes (NATA) No (LOPT HIA, ECEAP HIA, & VMT HIA)
	Transportation Choice/Option Value	- Percent of households within ¼ mile of transit, in “walkable neighborhoods,” or within ¼ mile of a bicycle route - Number of transportation options available vs. auto accessibility	NATA CITP Metro RTP	Qualitative (NATA) Quantitative (CITP & Metro RTP)	No (NATA & Metro RTP) Yes (CITP)
	Security	Network redundancy (roads and transit)	PSRC	Qualitative	No
	Accessibility	- Access to healthy food retail ¹ , healthcare, recreation facilities, open space, public spaces, and social services - Number and percent of homes within a ½ mile of the regional trail system	LOPT HIA Metro RTP	Qualitative (LOPT HIA) Quantitative (Metro RTP)	No
	Travel Time	Motor vehicle and transit travel time between key origins and destinations	Metro RTP	Quantitative	No
	Streetscape/ Journey Ambiance	Travel corridor aesthetics and anticipated user stress levels	NATA	Qualitative	No
Equity	Distribution of Impacts/ Amenities among Vulnerable Populations	- Health impacts to children, older adults, low-income residents, and people with disabilities - Affordability impacts to low-income and lower-middle income households - Number and percent of homes and environmental justice communities within walking distance to transit	ECEAP HIA MTC RTP Metro RTP	Both (ECEAP HIA) Unknown (MTC RTP) Quantitative (Metro RTP)	No (ECEAP HIA & Metro RTP) Unknown (MTC RTP)

1. Health food retail is defined in the ECEAP HIA as grocery stores with more than four employees, produce stands, and farmers markets

In addition to the commonly used indicators described in Table 3, several potentially relevant transportation-related livability and quality of life performance measures were found in the following reports:

- NCHRP 08-74 Interim Report on Sustainability Performance Measures for State DOTs and Other Transportation Agencies
- TRB Sustainable Transportation Indicators Subcommittee Report
- Greater Portland-Vancouver Indicators (GPVI) Project
- Smart Mobility: A Caltrans Handbook

The draft NCHRP 08-74 report provides numerous performance measures related to elements of quality of life and livability (such as safety, accessibility, equity, mobility, resiliency, economic development, and environmental quality). The measures are broken down by phase of the transportation life-cycle and are too numerous to list here. It is recommended that this document be referenced by the OLCF tool development team upon its anticipated publication later this year.

Additionally the draft regional indicators being developed as part of the GPVI project and the Caltrans Smart Mobility Handbook were reviewed. While several excellent performance measures related to livability and quality of life are proposed for inclusion in these reports, the measures are generally designed to monitor performance after investments are made (as opposed to forecasting impacts) and are therefore unlikely to provide meaningful distinctions between portfolios of projects in a way that would be useful for the Oregon Least Cost Planning tool.

Quantitative and Qualitative Approaches

What do we know about the quantification and monetization of quality of life and livability indicators?

Many of the quality of life and livability indicators commonly used can be assessed quantitatively. Examples include indicators that measure transportation impacts on affordability, property values, noise levels, air quality, safety, physical activity/non-motorized travel, transportation choices, accessibility, mobility, and vulnerable populations. However, very few of these indicators can be monetized. Exceptions include indicators that are either already measured in dollar terms (such as affordability and property values) or indicators that have been the subject of some research (such as the costs of noise impacts on property values or the health care costs associated with poor air quality or traffic collisions).

Other indicators are better measured qualitatively, such as impacts to community cohesion or journey ambiance. While recent research has come a long way in monetizing the value of traditionally non-monetized indicators (such as eco-system services) the time and resources involved is generally not recommended for Least Cost Planning. This is because the value of these indicators is often subjective, and economic tools do not provide easy ways to estimate subjective value, beyond things like “willingness to pay” surveys, which are often costly to implement.

How have qualitative indicators been integrated in the evaluation and comparison of transportation alternatives?

Despite the difficulty of quantifying and monetizing some of the commonly used quality of life and livability indicators, qualitative indicators play a valuable role in assessing transportation impacts on livability and quality of life⁸. For example, the PSRC Transportation 2040 Plan, Central Indiana Transportation Plan, and NATA *Refresh* all incorporate qualitative indicators in their evaluation of plan and project alternatives (ODOT, 2010). Specifically, each one uses a form of extended Benefit-Cost Analysis that includes qualitative indicators in their evaluation processes. This involves finding the net dollar benefit of each alternative and then presenting qualitative measures in conjunction with the monetized results to decision makers so that they can make an informed choice (ODOT, 2010).

Another option for incorporating qualitative indicators is to use Multi-Criteria Analysis to evaluate transportation plans and projects (ODOT, 2010). Multi-Criteria Analysis assigns weights to each indicator and also allows users to evaluate criteria against a set of multiple objectives. This is different from Benefit-Cost Analysis which aggregates monetary valuations to maximize a single objective: society's welfare, expressed in monetary terms.

Conclusions and Recommendations

Which criteria should be used to select livability and quality of life indicators for the Oregon Least Cost Planning tool?

Several criteria were used to arrive at a set of recommended quality of life and livability indicators for inclusion in the Oregon Least Cost Planning tool.

- First, because the tool is being designed to assess portfolios of actions, it is important to focus primarily on indicators that will be able to distinguish one set of plan alternatives from another. This means that indicators that focus more specifically on transportation project design are not recommended, as this level of project detail is not typically available at the system planning stage.
- Second, it is important to consider that the Least Cost Planning tool will be used to select a preferred plan alternative *prior* to implementation. This means that it is important to select indicators that can be used to forecast the impacts of various alternatives, rather than simply monitor their effects after implementation.
- Third, data for the indicator should be readily available and easy to access. While some indicators might otherwise be recommended (such as social capital), limited data availability make these indicators impractical for current consideration in the OLCP tool. However, these indicators may be considered for future inclusion in the OLCP tool if and when the data become more readily available.

⁸ Several studies were reviewed while conducting the literature review that recommended particular survey instruments for measuring subjective quality of life – that is residents' internal perceptions of quality of life and their own well-being (Sirgy & Rahtz, 2006; Gill, et. al., 2010; DeLugan, Hernandez, & Sylvester, 2010). For a variety of reasons it is recommended that the Least Cost Planning tool not use subjective measures of quality of life, but rather focus on external/objective quality of life indicators. This is due to both a lack of readily available data on subjective quality of life, the expense involved in conducting surveys to collect these data, and also to inconclusive research on the link between objective and subjective quality of life measures (McCrea, Shyy, & Stimson, 2006; Lotfi & Koohsari, 2009).

- Finally, it is important to consider the other categories of indicators already identified for inclusion in the Least Cost Planning tool, and identify ways to address issues of overlap and double counting. While it is recognized that each indicator selected will likely relate to several of the OLCP objectives, some indicators may relate more directly to one category than another. Once the final set of indicators is identified, it is recommended that a matrix of indicators be created (as shown in Table 5) that shows how each indicator relates to the various categories of transportation system performance. Indicators that help achieve multiple objectives may be considered for higher weighting in the case that a Multi-Criteria Analysis evaluation method is selected.

What quality of life and livability indicators are recommended for inclusion in OLCP?

Based on the criteria above, the following livability and quality of life general indicators are recommended for inclusion in the Least Cost Planning tool. Recommended general indicators are drawn from those identified in Table 3 and through the literature review. Note that not all of the indicators may be appropriate for all possible applications of the OLCP tool. Some indicators may be more appropriate for an urban context, and the indicators may need to be adjusted based on their application to a statewide or regional geography. Also note that the specific indicators included in Table 4 are only illustrative examples; specific indicators will be selected and finalized during the second phase of the OLCP project.

Table 4. Recommended Livability and Quality of Life General Indicators for inclusion in OLCP

Recommended General Indicator	Examples of Potential Specific Indicators for Consideration	Recommend to Quantify?	Recommend to Monetize?	Notes
Physical Activity	Percent mode share of active modes (transit, biking, walking)	Yes	Potentially	Monetization would require estimating the health care costs of inactivity-related disease and mortality.
Exposure to Pollutants	Percent of homes within close proximity to a major arterial with high traffic and truck volumes	Yes	Potentially	Monetization would require estimating the health care costs of exposure-related disease and mortality.
Community Cohesion/ Severance	Addition or removal of major pedestrian barriers (arterials with 4 or more lanes, railroads, river crossings, etc)	No	No	N/A
Streetscape/ Journey Ambiance	Route miles of corridors enhanced by trees, street furniture, public art, scenic views, etc	No	No	System plan alternatives would be distinguished based on the presence of funds

Recommended General Indicator	Examples of Potential Specific Indicators for Consideration	Recommend to Quantify?	Recommend to Monetize?	Notes
				for streetscape enhancements, not project level designs.
Access to Recreational Resources and Open Space ⁹	Number and percent of homes within a ½ mile of the regional trail system, recreation facilities, open space, and public space	Yes	Potentially	Though closely related to the Accessibility Category, this indicator aims to specifically target access to key amenities known to enhance quality of life.
General Indicators Recommended if/when Data are More Readily Available				
Social Capital	To be determined (TBD)	TBD	TBD	Further research is needed to predict transportation investment impacts on levels of social capital; though the link has been made in numerous studies (Rogers, et. al., 2010).

Note that property value premiums are not recommended for inclusion. This is because property values measure the same thing as other livability and quality of life indicators (such as transportation choice) and it is preferred to measure these benefits directly to avoid issues of double counting. However, it should be noted that hedonic pricing¹⁰ studies have been used to estimate the dollar value of some of the housing-related livability and quality of life indicators in Table 4 (e.g. the price premium for a home close to parks/open space, etc). Such studies may be useful when attempting to monetize the specific livability and quality of life indicators included in OLCP.

The following general indicators from Table 3, and their associated specific indicators, are recommended for consideration in the Least Cost Planning tool under different OLCP categories of transportation system performance, as noted below:

- Affordability (Equity)
- Air quality (Environmental Sustainability)
- Noise impacts (Environmental Sustainability)

⁹ Note that access to healthy food retail, healthcare, and social services was removed from this indicator due to the difficulty in forecasting the location of these specific land uses 20 years into the future.

¹⁰ The hedonic price method (HPM) uses the theory that a good is valued for the attributes it possesses to estimate the implicit or hedonic price of an environmental attribute. It is most commonly used to explain housing price variations that reflect the value of local environmental attributes, such as air pollution, noise, and proximity to parks and/or other amenities.

- Landscape (Environmental Sustainability)
- Heritage/historic resources (Environmental Sustainability)
- Safety (Safety and Security)
- Security (Safety and Security)
- Transportation choice/ option value (Accessibility)
- Travel time (Mobility)
- Distribution of impacts/amenities among vulnerable populations (Equity)

While these indicators are known to influence livability and quality of life, they are more directly related to other categories of transportation system performance in the Least Cost Planning tool. If these indicators are selected, they could be considered for higher weighting in a Multi-Criteria Analysis due to their contributions to multiple OLCP objectives, as demonstrated in Table 5 below. Note that the bold and capital letters reflect the primary category of an indicator, while the lower case letters reflect other related categories.

Table 5. Relation of Potential Indicators to OLCP Categories of Transportation System Performance

Recommended Quality of Life and Livability Indicators	Mobility	Accessibility	Economic Sustainability	Environmental Sustainability	Safety and Security	Funding the Transportation System	Land Use and Growth Management	Quality of Life and Livability	Equity
Physical Activity			x	x				X	
Exposure to Pollutants				x				X	x
Community Cohesion/Severance		x		x				X	
Streetscape/Journey Ambiance		x		x				X	
Access to Recreational Resources and Open Space		x					x	X	
Recommended Indicators for Other Categories that also Contribute to Quality of Life									
Affordability			x					x	X
Air quality				X				x	x
Noise Impacts			x	X				x	x
Landscape				X				x	
Heritage/Historic Resources				X			x	x	
Safety	x				X			x	
Security		x			X			x	
Transportation Choice/Option Value		X						x	x
Travel time	X		x	x				x	
Distribution of Impacts/Amenities Among Vulnerable Populations		x	x					x	X

Annotated Bibliography

Appleyard, D. (1981). *Livable Streets*. Berkeley: University of California Press.

This study was cited by the Victoria Transport Policy Institute (VTPI) as finding that residents of lower traffic volume streets are more likely to know their neighbors and show more concern over their local environment than residents of streets with higher traffic volumes and speeds. This is relevant to this memo in terms of understanding how transportation can impact levels of social capital.

Caltrans. (2009). *Draft Smart Mobility: A Caltrans Handbook*.

This report was reviewed for potential livability and quality of life indicators to include in the OLCP tool. While several excellent performance measures related to livability and quality of life are included in this report, the measures are generally designed to monitor performance after investments are made (as opposed to forecasting impacts) and are therefore unlikely to provide meaningful distinctions between portfolios of projects in a way that would be useful for the Oregon Least Cost Planning tool.

Center for Disease Control and Prevention. (2011, March 22). *Physical Activity*. Retrieved March 23, 2011, from Healthy Places:

<http://www.cdc.gov/healthyplaces/healthtopics/physactivity.htm>

This source was reviewed to better understand the connection between physical activity and quality of life. According to the CDC, regular physical activity performed several days a week has been shown to reduce the risk of disease and promote psychological well-being.

DeLugan, R. M., Hernandez, M. D., & Sylvester, D. E. (2010). *The Dynamics of Social Indicator Research for California's Central Valley in Transition*. *Social Indicators Research Journal*.

This article describes the development and evolution of the Partnership for Assessment of Communities (PAC) in the Central San Joaquin Valley in California and its best practices for social indicator research. PAC is an integrated model of quantitative and qualitative methodology to define and measure community health as compared to traditional quality-of-life indicators. This research is another example of the use of survey instruments to measure community quality of life.

Fabish, L., & Haas, P. (2010). *Measuring the Performance of Livability Programs*. *TRB 90th Annual Meeting (January 23-27, 2011)*, (pp. 8-9). Washington DC.

This article includes a review of five mature metropolitan livability programs throughout the United States, including the Atlanta Regional Council's Livable Communities Initiative, the Metropolitan Transportation Commission's Transportation for Livable Communities Program (San Francisco, CA), Metro's Transit Oriented Development and Centers Program (Portland, OR), the North Central Texas Council of Governments' Sustainable Development Initiative, and the Metropolitan Council's Livable Communities Act Grant Program in Minneapolis-St. Paul. Research findings conclude that the programs included a diverse array of livability objectives, including environmental, economic, land use, transportation, equity, and community development goals.

Federal Highway Administration. (2010). *Livability in Transportation Guidebook: Planning Approaches that Promote Livability*. US Department of Transportation.

This guidebook explores the role of transportation in improving community livability and quality of life. According to the guidebook, transportation investments “can be used to help achieve broader community goals such as access to good jobs, affordable housing, quality schools, and safe streets.”

Forkenbrock, D. J., & Weisbrod, G. E. (2001). *NCHRP REPORT 456: Guidebook for Assessing the Social and Economic Effects of Transportation Projects*. Washington DC: National Academy Press.

This report was reviewed to better understand how transportation can impact community livability and quality of life. The report notes that transportation projects can affect an area’s visual quality, level of traffic noise, social interactions, and community cohesion, all of which can affect an area’s ability to attract new businesses and residents.

Gill, D. L., Chang, Y.-K., Murphy, K. M., Speed, K. M., Hammond, C. C., Rodriguez, E. A., et al. (2010). Quality of Life Assessment for Physical Activity and Health Promotion. *Applied Research Quality Life Journal*, 15-19.

This article notes that despite the clear relationship between physical activity and quality of life, quality of life measures are seldom targeted for physical activity and health promotion programs. The authors attempt to address this gap by developing a 32-item quality of life survey that demonstrates logical relationships between physical activity and psychometric attributes.

GPVI Advisory Team. (2011). *GPVI Emerging Indicators*.

This report was reviewed for potential livability and quality of life indicators to include in the OLCP tool. While several excellent performance measures related to livability and quality of life are included in this report, the measures are generally designed to monitor performance after investments are made (as opposed to forecasting impacts) and are therefore unlikely to provide meaningful distinctions between portfolios of projects in a way that would be useful for the Oregon Least Cost Planning tool.

Hagerty, M. R., Cummins, R. A., Ferriss, A. L., Land, K., Michalos, A. C., Peterson, M., et al. (2001). Quality of Life Indexes for National Policy: Review and Agenda for Research. *Social Indicators Research Journal*.

This article assesses the validity and usefulness of urban quality of life indexes to public policy using 14 criteria applied to the 22 most-used quality of life indexes around the world. The article concludes that quality of life indexes vary greatly in their coverage, definitions, and domains of quality of life and that the indexes generally fail to show how quality of life outputs are sensitive to public policy inputs.

Hart, J. (2008). *Driven To Excess: Impacts of Motor Vehicle Traffic On Residential Quality Of Life in Bristol*. Bristol: Univeristy of the West of England.

This study was cited by the Victoria Transport Policy Institute (VTPI) as finding that residents of lower traffic volume streets are more likely to know their neighbors and show more concern over their local environment than residents of streets with higher traffic volumes and speeds. This is relevant to this memo in terms of understanding how transportation can impact levels of social capital.

Lotfi, S., & Koohsari, M. J. (2009). Analyzing Accessibility Dimension of Urban Quality of Life: Where Urban Designers Face Duality Between Subjective and Objective Reading of Place. *Social Indicators Research Journal*.

This article finds that there are differences between objective and subjective measures of urban quality of life and cautions urban designers not to rely solely on objective measures to understand the planning of urban spaces. While this finding is relevant to the measurement of quality of life for the OLCP tool, it should be kept in mind for the future if/when data on subjective quality of life measures are more readily available.

McCrea, R., Shyy, T.-K., & Stimson, R. (2006). What is the Strength of the Link Between Objective and Subjective Indicators of Urban Quality of Life? *Applied Research in Quality of Life Journal*, 1-18.

This article notes that urban quality of life is usually measured by either subjective indicators using surveys of residents' perceptions and satisfaction with urban living or by objective indicators using secondary data to measure the urban environment. The results of this study show that the relationship between objective and subjective indicators of urban quality of life can be weak, and suggests care should be taken when making inferences about improvements in subjective urban quality of life based on improvements in objective urban quality of life. While this finding is relevant to the measurement of quality of life for the OLCP tool, it should be kept in mind for the future if/when data on subjective quality of life measures are more readily available.

Merriam-Webster . (2011). Retrieved March 17, 2011, from Dictionary: <http://www.merriam-webster.com/dictionary/livability>

This source was reviewed to help better understand and define the term “livability” for the purposes of this memo. Merriam-Webster’s online dictionary defines livability as “suitability for human living.”

Metro. (2010). 2035 Regional Transportation Plan. Portland, OR.

This document was reviewed to get a better understanding of current research and trends related to the measurement of livability and quality of life. The Metro RTP includes performance measures designed to meet goals related to “human health,” “improvements in transportation choice,” and “fostering vibrant communities.” Sample measures from the Metro RTP are included in Table 3 of this memo.

Metropolitan Transportation Commission (MTC). (2009). Change in Motion: Transportation 2035 Plan for the San Francisco Bay Area. Oakland, CA.

This document was reviewed to get a better understanding of current research and trends related to the measurement of livability and quality of life. The MTC RTP includes a single “affordability” indicator designed to forecast impacts to both “equity” and “livable community” goals. Sample measures from the MTC RTP are included in Table 3 of this memo.

Michalos, A. C., Sirgy, J. M., & Estes, R. J. (2006). Introducing the Official Journal of the International Society for Quality-of-Life Studies: Applied Research in Quality of Life (ARQOL). *Applied Research in Quality of Life Journal*.

This article introduces the Applied Research in Quality of Life Journal and was used to help define the term “Quality of Life” for the purposes of this memo. Specifically, this article states that concepts directly related to quality of life and social indicators include happiness,

subjective wellbeing, life satisfaction, economic wellbeing, family wellbeing, community quality of life, spiritual wellbeing, social wellbeing, and psychological wellbeing, among others.

Oregon Department of Transportation (ODOT). (2010). History and Application of Least Cost Planning for Transportation from the Mid-1990s.

This paper was prepared for ODOT as part of the first phase of the Least Cost Planning project. The case studies in this paper (PSRC, NATA Refresh, and CITP) were reviewed to better understand how qualitative indicators have been incorporated into extended benefit-cost analyses.

Oregon Public Health Institute. (2010). Lake Oswego to Portland Transit Project Health Impact Assessment.

This document was reviewed to get a better understanding of current research and trends related to the measurement of livability and quality of life. This HIA includes indicators for air quality, traffic collisions, physical activity, and accessibility to healthy food and healthcare. Sample measures from this HIA are included in Table 3 of this memo.

Pichardo-Muñiz, A. (2010). The Role of Diseconomies of Transportation and Public Safety Problems in the Measurement of Urban Quality of Life. *Applied Research in Quality of Life Journal*.

This article distinguishes between external quality of life (i.e. level of income, access to resources, etc) and subjective quality of life (i.e. stress, leisure time) and was also used to help identify what we know about how transportation policies and practices can impact quality of life (public safety, economic impacts, capacity building, etc).

Puget Sound Regional Council (PSRC). (2010). Transportation 2040. Seattle, WA.

This document was reviewed to get a better understanding of current research and trends related to the measurement of livability and quality of life. The PSRC RTP includes “health,” “safety,” and “security” indicators under the heading “quality of life.” Sample measures from the PSRC RTP are included in Table 3 of this memo.

Rogers, S. H., Halstead, J. M., Gardner, K. H., & Carlson, C. H. (2010). Examining Walkability and Social Capital as Indicators of Quality of Life at the Municipal and Neighborhood Scales. *Applied Research in Quality of Life Journal*.

Through a case study approach this article argues that the generation and maintenance of social capital is an important component of quality of life that may be facilitated by living in walkable neighborhoods.

Sirgy, M. J., & Rahtz, D. (2006). A Measure and Method to Assess Subjective Community Quality of Life. *Applied Research in Quality of Life Journal*.

This article explores the development of a survey instrument designed to measure subjective quality of life. Authors propose that the an annual (or biennial) survey based on their system of measures could provide community leaders with measurement of the level of resident satisfaction/dissatisfaction with community-based services (government, nonprofit, and business services).

Sustainable Transportation Indicators Subcommittee of the Transportation Research Board (ADD40). (2008). Sustainable Transportation Indicators: A Recommended Research Program For Developing Sustainable Transportation Indicators and Data.

This report was reviewed for potential livability and quality of life indicators to include in the OLCP tool. The indicators included in this report generally overlap with the indicators identified through the review of regional transportation plans, transportation project evaluation criteria, and transportation-related health impact assessments.

Texas Transportation Institute. (2010). Project NCHRP 08-74 Sustainability Performance Measures for State DOTs and Other Transportation Agencies Interim Report. National Cooperative Highway Research Program.

The report provides numerous performance measures related to elements of quality of life and livability. The measures are broken down by phase of the transportation life-cycle and are too numerous to list in this memo. It is recommended that this report be referenced by the OLCP tool development team upon its anticipated publication later this year.

TRB 90th Annual Meeting Session #284. (2011, January 24). Conference Interactive Program. Retrieved March 17, 2011, from TRB 90th Annual Meeting (January 23-27, 2011): <http://pressamp.trb.org/conferenceinteractiveprogram/EventDetails.aspx?ID=20813&Email=>

Notes from the author's attendance at this session were used to help inform the discussion of "livability" in this memo and better understand current thinking around the definition of this term. Presenters at this session asked audience members to share their own definitions of livability. One person said they think livability means "improving the quality of the human experience." Another offered that livability means "having a high quality of life at an affordable price."

Upstream Public Health. (2009). Health Impact Assessment on Policies Reducing Vehicle Miles Traveled in Oregon Metropolitan Areas.

This document was reviewed to get a better understanding of current research and trends related to the measurement of livability and quality of life. This HIA includes indicators for air quality, traffic collisions, physical activity, accessibility to healthy food and healthcare, and equity. Sample measures from this HIA are included in Table 3 of this memo.

Upstream Public Health. (2010). Health Impact Assessment on Transportation Policies in the Eugene Climate and Energy Action Plan.

This document was reviewed to get a better understanding of current research and trends related to the measurement of livability and quality of life. This HIA includes indicators for air quality, traffic collisions, physical activity, and equity. Sample measures from this HIA are included in Table 3 of this memo.

Urban Design 4 Health. Inc. (2010). The Hidden Health Costs of Transportation. American Public Health Association.

This report provides a summary of what is known about the health impacts and associated costs of transportation-related decision making. The report notes that while there are few standards or models for estimating the health costs of transportation decision-making, existing research can be used to estimate the population at risk, the magnitude of the health impact, and the health costs associated with any health-related impacts.

US Environmental Protection Agency. (2011, February 3). HUD-DOT-EPA Partnership for Sustainable Communities. Retrieved March 20, 2011, from Smart Growth: <http://www.epa.gov/smartgrowth/partnership/#background>

This recent partnership includes six livability principles to help HUD, DOT, and EPA collaborate to improve access to affordable housing, increase transportation options, lower

transportation costs, protect the environment, promote equitable development, and address the challenges of climate change in communities nationwide. The six livability principles are listed on page 6 of this memo.

Victoria Transport Policy Institute. (2010, November 28). *Community Livability: Helping to Create Attractive, Safe, Cohesive Communities*. Retrieved March 21, 2011, from TDM Encyclopedia: <http://www.vtpi.org/tdm/tdm97.htm>

This website was reviewed for information on defining livability and understanding how transportation actions can impact livability and quality of life. According to this site, transportation policies and practices can affect traffic safety, delay, local air quality, greenspace, streetscape attractiveness, transportation affordability, the preservation of historic and cultural resources, the availability of recreational opportunities, and social capital, among others.

PDF | Quality of life is an increasingly common theme in the health status and health promotion literatures. Six approaches that consider quality of life | Find, read and cite all the research you need on ResearchGate.Â DENNIS RAPHAEL, REBECCA RENWICK, IVAN BROWN and. Irving rootman. Quality of life indicators and health: current. Status and emerging conceptions. (Received 6 July, 1994). Integrated development planning using socio-economic and quality of life indicators. In Innovative approaches to development planning (pp. 113â€216). Paris: UNESCO.Google Scholar.Â Livability of the welfare-state, appreciation-of-life and length-of-life in nations varying in state-welfare-effort. Social Indicators Research, 36, 1â€49.Google Scholar. Verbrugge, L. M., Merrill, S. S., & Liu, X. (1999).Â Michalos A.C. (2017) Social Indicators Research and Health-Related Quality of Life Research. In: Connecting the Quality of Life Theory to Health, Well-being and Education. Springer, Cham. https://doi.org/10.1007/978-3-319-51161-0_2. Quality of life (QOL), according to Britannica, is the degree to which an individual is healthy, comfortable, and able to participate in or enjoy life events. The World Health Organization (WHO) defines QOL as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns". Standard indicators of the quality of life include wealth, employment, the environment, physical and...