

Introduction to the Oregon Mosaic Tool



Oregon Mosaic

This handout provides a short overview of the Mosaic tool. It focuses on the tool's features and capabilities and addresses some of the questions the development team has heard from policy makers and other stakeholders.

What is the Mosaic Tool Designed for?

The Mosaic tool is currently designed to assess bundles of projects and actions. Future versions may be designed to accommodate individual projects as well. While some features will need to be revised, basic tool structure and core functionalities will be the same.

INSTRUCTIONS: EIGHT TASKS WITH HYPERLINKS
VERSION 1.0
September 11, 2012

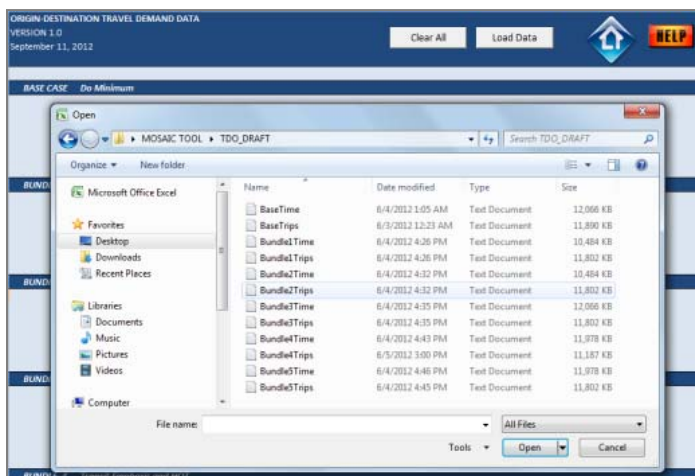
1 SPECIFY OPTIONS FOR ANALYSIS 1.a Specify study area and period of analysis 1.b Name and describe bundles 1.c Select valuation and weighting options	5 CALCULATE SCORES AND DETERMINE WEIGHTS 5.a Enter additional data and calculate scores 5.b Determine weights at the category level first 5.c Determine weights directly at the indicator level
2 ENTER COST AND SCHEDULE DATA 2.a Enter life-cycle investment cost data 2.b Enter revenue estimates & other financial data 2.c Specify roll-out and ramp-up assumptions	6 SPECIFY VALUATION AND OTHER ASSUMPTIONS 6.a Review and edit model parameters 6.b Review time-varying assumptions 6.c Review supporting data and references
3 LOAD TRIP TABLES AND/OR ENTER TRAVEL DATA 3.a Select and load O-D trip tables, or 3.b Enter aggregated travel data 3.c Instruct MOSAIC to read and process data	7 RUN THE ANALYSIS AND PRODUCE RESULTS 7.a Select option for treatment of uncertainty (sensitivity analysis, risk analysis) 7.b Run simulations and produce results
4 LOAD AND/OR ENTER GEOGRAPHIC DATA 4.a Select and load network data files, or 4.b Enter aggregated geographic data 4.c Instruct MOSAIC to read and process data	8 REVIEW AND EXPORT RESULTS 8.a Review charts & tables 8.b Conduct sensitivity testing with control panel

The Mosaic tool is meant to complement—not replace—other models and tools used in the planning process. Its main purpose is to organize and summarize existing data and measurements so that users and decision makers can compare bundles on an equal footing. The tool combines these data with various assumptions and user inputs to produce 41 Specific Indicators of the bundles' impacts, grouped into 9 categories. The Specific Indicators that can be expressed in monetary terms are included as benefits or costs, in the benefit-cost analysis (BCA) portion of Mosaic. The Specific Indicators that

cannot be monetized are expressed as, or converted into, scores and weighted with user-defined weights in the multi-objective decision analysis (MODA) portion of Mosaic.

What Skills Are Needed to Use It?

The Mosaic tool runs in Microsoft Excel 2010 and includes features designed to make it easier to use. These features include: menus,



navigation buttons, hyperlinks, dialog boxes, and a help page. Most calculations are coded directly into cells to enhance transparency and facilitate reviews and future updates.

Technical staff that have some experience manipulating spreadsheets and a basic understanding of transportation appraisal should be able to use the tool and produce results. However, the development of some of the data and measurements used as inputs requires specialized skills (e.g., travel demand modeling, emissions modeling, geographic information systems [GIS]). Also, experience with group facilitation techniques is needed to develop MODA weights with stakeholders.

What Assumptions Need to Be Made?

Embedded in the Mosaic tool are default values for all major assumptions required to conduct an analysis. It also provides a number of “look-up” tables and references to guide users in choosing alternative assumptions. The most critical assumptions to be made before producing results are: the period of analysis (e.g., planning horizon), discount rate, value of time, value of statistical life, and projected growth in real income. These assumptions tend to have a large impact on the outcomes of a BCA. Users will also need to select a scoring scale and develop weights for use in MODA (by default, the tool uses a scoring scale of 0 to 10 (e.g. 0 may signify no impact, 10 may signify major impact) and assigns an equal weight to all MODA indicators).

Most of the assumptions provided in the Mosaic tool are based on official guidance from governmental agencies (e.g., U.S. DOT Office of the Secretary, UK Department for Transport, Interagency Working Group on the Social Cost of Carbon) or derived from well-established data sources and publications (e.g., peer-reviewed journal articles). Selecting values outside the parameters available in the tool may

GENERAL INDICATOR	VARIABLE NAME	UNITS	IN USE	DISTRIBUTION	ORIGINAL VALUES	ORIGINAL UNITS
GENERAL	Real Discount Rate	% per year	4%	Most Likely: 4.0% Low: 3.0% High: 7.0%	4.0% 3.0% 7.0%	% per year
GENERAL	Minimum and Maximum Scores	n/a	0 10	Minimum: 0 Maximum: 10	0 10	n/a
MOBILITY	Travel time	Value of time for PERSONAL trips, LOCAL travel	\$ 12.3	Most Likely: \$12.3 Low: \$8.6 High: \$14.9	\$11.9 \$8.6 \$14.9	\$2012 per hour
MOBILITY	Travel time	Value of time for BUSINESS trips, LOCAL travel	\$ 24.1	Most Likely: \$24.1 Low: \$19.3 High: \$29.0	\$23.4 \$18.7 \$28.1	\$2012 per hour
MOBILITY	Travel time	Value of time for PERSONAL trips, INTERCITY travel, all Surface Modes except High Speed Rail	\$ 17.1	Most Likely: \$17.1 Low: \$14.8 High: \$21.1	\$16.6 \$14.3 \$21.4	\$2012 per hour
MOBILITY	Travel time	Value of time for BUSINESS trips, INTERCITY travel, all Surface Modes except High Speed Rail	\$ 24.1	Most Likely: \$24.1 Low: \$19.3 High: \$29.0	\$23.4 \$18.7 \$28.1	\$2012 per hour
MOBILITY	Travel time	Value of time for PERSONAL trips, INTERCITY travel, High Speed Rail and Air	\$ 32.7	Most Likely: \$32.7 Low: \$28.1 High: \$42.0	\$31.7 \$27.2 \$40.3	\$2012 per hour
MOBILITY	Travel time	Value of time for BUSINESS trips, INTERCITY travel, High Speed Rail and Air	\$ 60.3	Most Likely: \$60.3 Low: \$48.9 High: \$72.3	\$58.5 \$48.8 \$70.3	\$2012 per hour
MOBILITY	Travel time	Value of time for TRUCK drivers	\$ 25.7	Most Likely: \$25.7 Low: \$20.5 High: \$30.9	\$24.9 \$19.9 \$29.9	\$2012 per hour

CATEGORY	GENERAL INDICATORS	INDEX	SPECIFIC INDICATORS	USE IN MOSAIC?
MOBILITY	Travel Time	MO.1	Travel Time	MONETIZED
		MO.2	Hours of Congestion	REPORT ONLY
	Quality of Service	MO.3	Reliability – Recurring congestion	MONETIZED
		MO.4	Reliability – Non-recurring congestion	MONETIZED
	Out of Pocket Costs	MO.5	User Costs	MONETIZED
	Travel Characteristics	MO.6	Mode Split	QUANTITATIVE SCORING
		MO.7	VMT / Capita	REPORT ONLY
ACCESSIBILITY	Proximity	AC.1	Transportation Cost Index	QUANTITATIVE SCORING
		AC.2	Population within X minutes between work and home	QUANTITATIVE SCORING
	Connectivity/Ease of Connections	AC.3	Location of industrial jobs in relation to the regional freight network	QUANTITATIVE SCORING
		AC.4	Population and employment within ¼ mile of a transit stop served by at least 30 vehicles per day	QUANTITATIVE SCORING
	Modal Availability	AC.5	Amount of multi-use paths and bike boulevards	QUANTITATIVE SCORING
		AC.6	Sidewalk coverage	QUANTITATIVE SCORING
ECONOMIC VITALITY	Economic Impacts of Spending for Construction	EV.1	Number of jobs associated with plan or bundle of actions, and associated income metrics	REPORT ONLY
	Economic Impacts of more Efficient Transportation Services	EV.2	Changes in transportation costs by industry (business travel and freight)	MONETIZED
		EV.3	Changes in employment by industry, and associated income metrics	REPORT ONLY
	Structural Economic Effects of Transportation System Improvements	EV.4	Changes in productivity from increased connectivity (agglomeration effects)	MONETIZED

result in inconsistencies or double counting, and may affect the credibility of the results.

What Data Are Required?

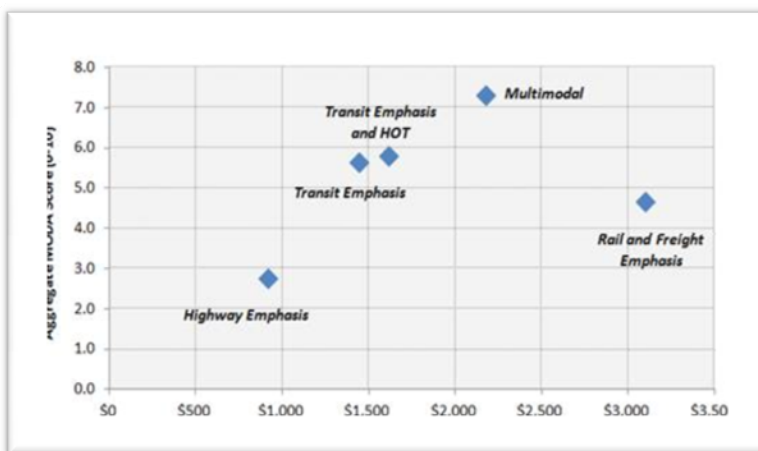
Cost and schedule data for all the bundles selected for analysis are required. Output from a travel demand modeling exercise and projections of travel demand by

mode, under all scenarios, are also strongly recommended. Many other data elements are required to estimate the Specific Indicators identified by the Indicator Development Teams (IDT). These include, for example, changes in emission volumes or in the number of fatal accidents and incapacitating injuries under alternative planning options.

In the absence of data, users may turn to qualitative scoring (a score is assigned directly by users or stakeholders). Use of qualitative scoring for a large number of Specific Indicators, however, would dilute the value of Mosaic. This is particularly true when comparing benefits and costs and assessing whether the proposed bundles generate net public value (total benefits greater than total costs).

What Do the BCA Results Tell Us?

Users of the Mosaic tool can produce a number of summary metrics that indicate whether the total monetized benefits generated by a bundle exceed the costs of implementing it. In BCA, benefits and costs are estimated over multiple years (typically 20 or 30) and expressed in present-day value through discounting. The net present value (NPV) is simply the difference between the present discounted value of future benefits and the present discounted value of future costs. A positive NPV suggests that the bundle is worth investing in (because it generates more monetized benefits than it costs to implement). An internal rate of return helps Mosaic users measure and compare the profitability of investments. It is called internal because it does not incorporate external factors such as interest rate or inflation. It relates to discount rate, in that an internal rate of return greater than the discount rate selected for Mosaic suggests that the bundle is worth implementing. The benefit/cost ratio is the ratio of total benefits to total costs. A benefit/cost ratio greater than 1.0 is equivalent to a positive NPV. A benefit/cost ratio of 2.5, for example, suggests that the bundle will generate \$2.50 in monetized benefits for every dollar invested.



What Do the MODA Results Tell Us?

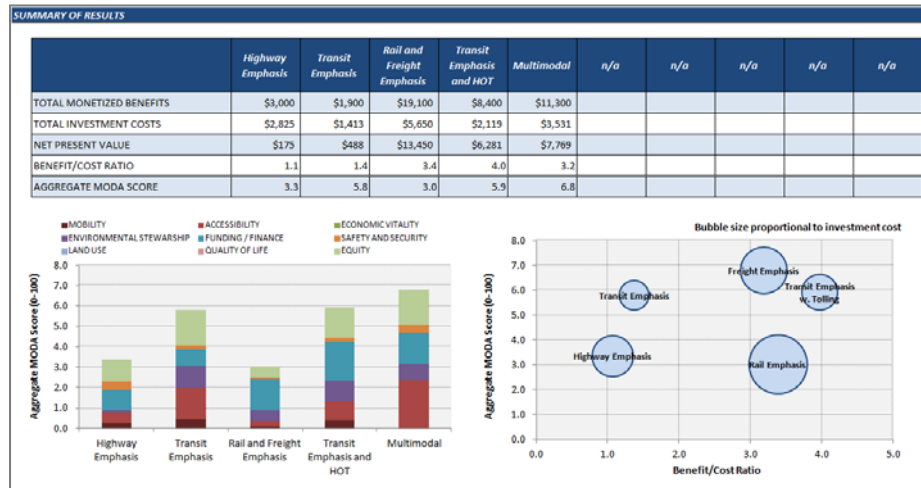
All specific indicators selected for MODA are scored on a scale of 0 to 10. The scores are multiplied by the weights, and the resulting products are summed to provide a total, weighted average score. There is one weighted average score for each bundle. A higher score, closer to 10, suggests that the associated bundle is

preferred overall, when all MODA indicators are considered together and weighted. The scores give an indication of how much “better” one bundle is over another, but are not meant to provide an absolute measure of value. Thus, unlike BCA results, they can only be used to compare and rank bundles within the same MOSAIC application. A chart of aggregate scores versus total investment costs is available

within the tool. It can be used to assess trade-offs between relative performances and costs, and determine the most “cost-effective” bundle(s). The tool also includes tables and charts with average scores by category, helping policy makers assess how the proposed bundles perform against the MODA indicators within each category.

How Does Mosaic Combine BCA and MODA?

In the Mosaic tool, BCA and MODA are performed in parallel. BCA and MODA results are produced and presented separately. Decision makers will need to consider both sets of metrics (BCA results such as NPV or B/C ratio and aggregate MODA score) and weigh them implicitly, using their own judgment.



The tool includes a number of summary tables showing monetized benefits (or costs) and MODA scores, broken down by category. Some summary tables also provide individual MODA scores as well as the measurements used to estimate them.

What Steps Ensure a Fair Evaluation?

These steps will help ensure that results reflect a fair evaluation of bundles in Mosaic:

1. Make sure that a broad variety of projects, programs, and actions are considered when creating the bundles.
2. Define a realistic base case scenario (e.g., do-minimum, as opposed to do-nothing) against which bundles will be assessed.
3. Make sure life-cycle costs of all bundles are estimated fairly and consistently over the full period of analysis.
4. Use the models and best practices identified by the IDT when developing the measurements used as inputs to the tool (e.g., MOVES for all vehicular emissions, PlanSafe for changes in the number and severity of crashes).
5. Use the default assumption values provided in the tool to monetize benefits and costs.
6. Document all steps involved in the development of weights used in MODA.
7. Conduct extensive sensitivity testing and report the results of these tests.
8. Maintain a copy of the Mosaic tool (Excel workbook) used in the evaluation, with its inputs and assumptions saved as well as the documentation of how evaluations were conducted.