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Bike Planning in Oregon Communities

Tara Weidner, P.E.

With support from...Peter Schuytema, P.E.
ODOT Transportation Planning Planning Analysis Unit

PSU Friday Seminar
February 21, 2014
“State departments of transportation aren't known for being the most progressive public agencies. But, in response to economic and demographic changes, Oregon's DOT (ODOT) is breaking the mold by embracing a multimodal transformation.” – Bike Portland 5/24/13

**Context:**
Economic/demographic trends -- changing needs and behaviors
Funding -- constraints/decline

**Change in Thinking:**

- **Modal Silos**
  - Highway-Centric
  - Built on mode-based funding

- **Multi-/Inter-modal** (freight + person)
  - Org structures, processes, policies
  - Built on needs/functions

Coordinated decisions, research, change in thinking/functions across ODOT’s modal divisions and within regional offices
**Bicycling’s Niche..... Short trips**

---

### Bicycling and Walking Levels by Trip Distance

<table>
<thead>
<tr>
<th></th>
<th>3.1&lt;4.7 mi.</th>
<th>1.6&lt;3.1 mi.</th>
<th>0&lt;1.6 mi.</th>
<th>2.8-4.0 mi.</th>
<th>1.6&lt;2.8mi.</th>
<th>0&lt;1.6 mi.</th>
<th>2.8-4.0 mi.</th>
<th>1.6&lt;2.8mi.</th>
<th>0&lt;1.6 mi.</th>
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<td><strong>Netherlands</strong></td>
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<td>13%</td>
<td>18%</td>
<td>39%</td>
<td>9%</td>
<td>14%</td>
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<td>35%</td>
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<td>28%</td>
<td>24%</td>
<td>31%</td>
<td>7%</td>
<td>12%</td>
<td>16%</td>
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<td><strong>Germany</strong></td>
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<tr>
<td><strong>U.S.</strong></td>
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<td></td>
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</tr>
</tbody>
</table>

**Legend:**
- □ = bicycling
- ■ = walking

---

Need for Bike Planning/Analysis

1913 ODOT Slogan: "Get Oregon Out of the Mud"

Goal:
Safe for all users
Connects you to where you want to go
How does ODOT Headquarters help

• Active Transportation Group (2011)

• Transportation Planning Group

• Transportation Planning Analysis Unit
  • Develops urban, regional and statewide
  • Applies models to support:
    – ODOT policy analysis
    – Project development
    – Urban area transportation-land use planning
  • Performs complex planning analysis /projects
  • Review analysis work by consultants
  • A resource for State, Region Staff, and Consultants
ODOT Transportation Planning Analysis Unit (TPAU)

Using data to support decisions
**ODOT’s Analysis Procedure Manual (APM)**

**What**: Methodologies and Best Practices for analysis of Oregon Transportation Projects

**Why**: Improve and standardize analysis

**Who**: Used by consultants on ODOT projects; Used by ODOT in analysis and project review.

- Continually updated to state of the practice
- Unique and praised nationally
Analysis Procedures Manual (APM)

About the APM

The Analysis Procedures Manual (APM) provides the current methodologies, practices and procedures for conducting long term analysis of Oregon Department of Transportation (ODOT) plans and projects.

A major update of the manual is currently in progress. APM version 2 will incorporate methodologies from sources such as the 2010 Highway Capacity Manual (HCM) and the Highway Safety Manual (HSM). As new chapters or sections of APM version 2 are completed, they will be published on this webpage, and APM version 1 will be modified to refer to the version 2 procedures.

The APM does not establish any accepted or preferred software. Any analysis software is acceptable as long as it is consistent with the current APM and HCM.

Announcements

The APM has been updated. Please see the August 2013 Change Sheet and December 2013 Change Sheet for what has changed.

APM User Group

The Analysis Procedures Manual User Group (APMUG) is open to all interested parties either internal or external to ODOT. For information on APMUG, see the Analysis Procedures Manual User Group (APMUG) Guidelines. If you are interested in joining the group, contact Doug Norval.

http://www.oregon.gov/ODOT/TD/TP/Pages/Tools.aspx
APM Version 1

APM Version 1 - All chapters - 6.3MB

Appendices

Appendix A - Resources
Appendix B - Glossary
Appendix C - ODOT Traffic Engineering Authority
Appendix D - Sample Count Request and Sample ODOT Counts
Appendix E - Procedure for Analysis and Design of Weaving Sections, A User's Guide
Appendix F - Example Narratives
  - F.1 US 97 Bend North Corridor Solutions Project (Example of a System Project) (Report) (Report Appendices)
  - F.2 Constitution Area Refinement Study (Example of a Point Project)
  - F.3 US 199 Expressway Upgrade Project (Example of a Linear Project)
Appendix G - Example Tech Memos
  - G.1 Fern Valley Interchange Existing Conditions Tech Memo (Report) (Figures)
  - G.2 Constitution Area Refinement Study Future No-Build Tech Memo (Report) (Figures)
  - G.3 Grandview - Nels Anderson Traffic Analysis Technical Memo (Report) (Figures)
Appendix H - Forms
  - H.1 Field Inventory Worksheet
  - H.2 Saturation Flow Rate Data Collection Form
  - H.3 Preliminary Traffic Signal Warrant Analysis Form
  - H.4 Noise, Air and Energy Traffic Requirements Checklist

APM Version 2 (In Progress)

New chapters of APM V2 are posted here as they are completed.

APM Version 2 - All Chapters - 3.8MB

Individual Chapters

Preface
Chapter 1 - ODOT Information
Chapter 2 - Scoping Projects
Chapter 3 - Transportation System Inventory
Chapter 4 - Safety
Chapter 5 - Developing Existing Year Volumes
Chapter 6 - Future Year Forecasting
Chapter 7 - System Planning Analysis
Chapter 8 - Mesoscopic Analysis
Chapter 9 - Performance Measures
Chapter 10 - Analyzing Alternatives
Chapter 11 - Segment Analysis
Chapter 12 - Unsignalized Intersection Analysis
Chapter 13 - Signalized Intersection Analysis
Chapter 14 - Multimodal Analysis
Chapter 15 - Traffic Simulation Models
Chapter 16 - Environmental Traffic Data
Chapter 17 - Travel Demand Modeling
Chapter 18 - Operational Analysis
Chapter 19 - Traffic Analysis Documentation
APM Multimodal chapter (draft)

Tiered Analysis Methods

- **“Planning”**
  - Qualitative Assessment
  - Level of Traffic Stress
  - Simplified MMLOS
  - Full MMLOS

- **“Operations”**

- **“Design”**

- RTP
  - TSP/Corridor Plan
  - Refinement Plan
  - Project Screening
  - Refinement Plan
  - Project Development
### Full MMLOS: HCM 2010

#### Bike LOS Equations

**Link LOS**

- \( I_{b,\text{link}} = 0.760 + F_v + F_S + F_p + F_w \)
  - \( F_v \): Volume Factor
  - \( F_S \): Speed Factor
  - \( F_p \): Pavement Condition Factor
  - \( F_w \): Cross-Section Factor

- \( F_p = \frac{7.066}{P_c^2} \)
  - Pavement condition rating (1–5)

- \( F_v = 0.507 \ln \left( \frac{v_{ma}}{4 \times N_{th}} \right) \)
  - Number of through lanes in travel direction

- \( F_S = 0.199 \left[ 1.1199 \ln (S_{Ra} - 20) + 0.8103 \right] (1 + 0.1038 P_{HVd})^2 \)
  - Vehicle running speed (≥ 21 mi/h)
  - Adjusted percent heavy vehicles

**Link LOS Equation**

\[
I_{b,\text{seg}} = 0.160 I_{b,\text{link}} + 0.011 F_{bi} e^{k_{\text{int}}} + 0.035 \frac{N_{ap,\text{r}}}{(L/5280)^2} + 2.85
\]

- \( I_{b,\text{seg}} \): Bike Segment LOS Score
- \( I_{b,\text{link}} \): Bike Link LOS Score
- \( F_{bi} \): Indicator Variable
- \( e^{k_{\text{int}}} \): Bike Intersection LOS Score
- \( N_{ap,\text{r}} \): Number of access points on right side
- \( L \): Segment length (mi)
- \( k_{\text{int}} \): Constant

**Intersection LOS**

- \( I_{b,\text{int}} = 4.1324 + F_w + F_v \)
  - \( F_w \): Motorized traffic volume in travel direction
  - \( F_v \): Vehicle Volume Factor

- \( F_w = 0.0153 W_{ct} - 0.2144 W_t \)
  - \( C_l \): Curb-to-curb cross-street width
  - \( W_t \): Total width of outside lane, bike lane, paved shoulder

**Link LOS Results**

- Results in LOS A-F for each element of the road/bike network.
### Full MMLOS : HCM 2010 MMLOS Data

<table>
<thead>
<tr>
<th>Pedestrian</th>
<th>Bike</th>
<th>Transit</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Auto lane width</td>
<td>• Auto volume/speed</td>
<td>• Access (ped LOS)</td>
</tr>
<tr>
<td>• Bike lane/shoulder width</td>
<td>• % Heavy Vehicles</td>
<td>• Frequency/wait</td>
</tr>
<tr>
<td>• Buffers</td>
<td>• Pavement condition</td>
<td>• Perceived travel time</td>
</tr>
<tr>
<td>• Sidewalks</td>
<td>• Bike Lane</td>
<td>• Bus travel speed</td>
</tr>
<tr>
<td>• Auto volume/speed</td>
<td>• Lane/shoulder width</td>
<td>• Stop amenities</td>
</tr>
<tr>
<td>• Street crossing difficulty</td>
<td>• On-street parking</td>
<td>• Late arrivals</td>
</tr>
<tr>
<td></td>
<td>• Driveway density</td>
<td>• Crowding/Id factor</td>
</tr>
</tbody>
</table>

**Links/Segments**

**Intersections**

| Permitted turns on red         | Through lane widths                       | Detailed Data Needed (including intersection distances) |
| Cross-street auto volume & speed | Bike lane width                           |                                                       |
| Crossing length               | Cross-street width                        |                                                       |
| Ave Pedestrian delay          | Auto volume                               |                                                       |
| Channelization                |                                           |                                                       |

- Detailed Data Needed (including intersection distances)
APM Multimodal chapter (draft)

Tiered Analysis Methods

Increasing Detail

“Planning”

“Operations”

“Design”

Level of Traffic Stress

Qualitative Assessment

Simplified MMLOS

Full MMLOS

RTP

TSP/Corridor Plan Refinement Plan Project Screening

Refinement Plan Project Development
**Simplified MMLOS**

- 2010HCM/NCHRP3-70 Principal Investigators
- Most influential factors on Bike (& Ped) LOS
- Limited Data requirements:
  - Number of Traffic Lanes (1 or more)
  - Bike Lane Present
  - Speed Limit (30mph or higher)
  - Unsigned Intersection Conflicts per mile (0 or more)
- Calculates Bike **LOS A-F** score for network link

### ODOT Spreadsheet – Simplified MMLOS

#### Step 1: Model

<table>
<thead>
<tr>
<th></th>
<th>DF</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>Pr &gt; ChiSq</th>
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</thead>
<tbody>
<tr>
<td>Intercept – LOS F</td>
<td>1</td>
<td>1</td>
<td>-1.69</td>
<td>0.41</td>
</tr>
<tr>
<td>Intercept – LOS E</td>
<td>2</td>
<td>1</td>
<td>-3.64</td>
<td>0.4</td>
</tr>
<tr>
<td>Intercept – LOS D</td>
<td>3</td>
<td>1</td>
<td>-2.74</td>
<td>0.4</td>
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<tr>
<td>Intercept – LOS C</td>
<td>4</td>
<td>1</td>
<td>-1.55</td>
<td>0.39</td>
</tr>
<tr>
<td>Intercept – LOS B</td>
<td>5</td>
<td>1</td>
<td>0.141</td>
<td>0.39</td>
</tr>
<tr>
<td>Number of Traffic Lanes</td>
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<td>0.15</td>
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<tr>
<td>Bike Lane Present</td>
<td>1</td>
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<td>1.22</td>
<td>0.13</td>
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<tr>
<td>Speed Limit</td>
<td>1</td>
<td>0</td>
<td>-1.606</td>
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<tr>
<td>Unsign Intersection Conflict/mile</td>
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<td>0</td>
<td>-0.421</td>
<td>0.13</td>
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</table>

#### Step 2: Variable Values

<table>
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<tr>
<th>Variable</th>
<th>Test 1</th>
<th>Test 2</th>
<th>Test 3</th>
<th>Test 4</th>
<th>Test 5</th>
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</thead>
<tbody>
<tr>
<td>Number of Traffic Lanes (= 1 if # lanes is 1; if # of lanes &gt; 1 coded as 2)</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Bike Lane Present (=1 if present; else =0)</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Speed Limit (=1 if limit &lt;= 30mph, otherwise = 2)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Unsign Intersection Conflict/mile (=1 if &gt; 0, else =0)</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Step 3: Model Results (Cumulative probability)

<table>
<thead>
<tr>
<th>U(LOS&lt;=F)</th>
<th>Test 1</th>
<th>Test 2</th>
<th>Test 2</th>
<th>Test 2</th>
<th>Test 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025086836</td>
<td>0.057495</td>
<td>0.16341981</td>
<td>0.19623408</td>
<td>0.2018132</td>
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</tr>
<tr>
<td>U(LOS&lt;=E)</td>
<td>Test 2</td>
<td>Test 2</td>
<td>Test 2</td>
<td>Test 2</td>
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<tr>
<td>0.0669475</td>
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<td>0.19623408</td>
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<td>U(LOS&lt;=D)</td>
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<tr>
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<td>U(LOS&lt;=C)</td>
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<td>Test 2</td>
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<td>0.37285273</td>
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<td>0.61661618</td>
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<td>0.8538348</td>
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<tr>
<td>U(LOS&lt;=B)</td>
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<td>Test 2</td>
<td>Test 2</td>
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#### Step 4: Final Result (LOS Probability)

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<th>Prob(LOS=F)</th>
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<th>Test 2</th>
<th>Test 2</th>
<th>Test 2</th>
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<td>0.2018132</td>
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</tr>
<tr>
<td>Prob(LOS=E)</td>
<td>Test 2</td>
<td>Test 2</td>
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<tr>
<td>0.04341064</td>
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<tr>
<td>Prob(LOS=D)</td>
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<td>Test 2</td>
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<td>Test 2</td>
<td>Test 2</td>
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</tr>
<tr>
<td>Prob(LOS=B)</td>
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<td>Test 2</td>
<td>Test 2</td>
<td>Test 2</td>
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<td>0.1155748</td>
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</tr>
<tr>
<td>Prob(LOS=A)</td>
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<td>Test 2</td>
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</table>
Simplified MMLOS Validation

<table>
<thead>
<tr>
<th>Clip #</th>
<th>Outside Lane width (ft)</th>
<th>Bike Lane/Shoulder width (ft)</th>
<th>Number of Through Lanes</th>
<th>Divided/Undivided roadways (D/U)</th>
<th>Peak Hour Vol (vph)</th>
<th>Heavy Vehicle (%)</th>
<th>Posted Speed Limit (mph)</th>
<th>Pavement Rating (1-5)</th>
<th>% On Street Parking (OSP)</th>
<th>Sig. Int Dist (ft)</th>
<th>Unsignalized Conflict Per Mile</th>
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<tbody>
<tr>
<td>321</td>
<td>12</td>
<td>5</td>
<td>2</td>
<td>D</td>
<td>2146</td>
<td>0</td>
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<td>20</td>
<td>4</td>
<td>0</td>
<td>52</td>
<td>0</td>
</tr>
</tbody>
</table>

**Clip 321**
- Bike lane
- High Vol
- 45mph
- driveways

**Clip 309**
- Low vol
- Undivided
- 20 mph
APM Multimodal chapter (draft)

Tiered Analysis Methods

Increasing Detail

- “Design”
- “Operations”
- “Planning”

Level of Traffic Stress

Qualitative Assessment

Simplified MMLOS

Full MMLOS

RTP
TSP/Corridor Plan
Refinement Plan
Project Screening
Refinement Plan
Project Development
## Planning – Qualitative Assessment

<table>
<thead>
<tr>
<th>Pedestrian</th>
<th>Bike</th>
<th>Transit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Segments</strong></td>
<td><strong>Segments</strong></td>
<td></td>
</tr>
<tr>
<td>- Auto lane width</td>
<td>- Functional Class optimum type</td>
<td>- Frequency, on-time</td>
</tr>
<tr>
<td>- Bike lane/shoulder</td>
<td>- Shoulder/width</td>
<td>- Transit speed/times</td>
</tr>
<tr>
<td>- Buffers</td>
<td>- Auto lane width</td>
<td>- Stop amenities</td>
</tr>
<tr>
<td>- Sidewalk/paths</td>
<td>- Grade</td>
<td>- Ped/Bike Network connections</td>
</tr>
<tr>
<td>- Lighting</td>
<td>- Pavement condition</td>
<td></td>
</tr>
<tr>
<td>- Auto volume/speed</td>
<td>- Obstructions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- On-street parking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Auto volume/speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Data available from aerial photos;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>good-fair-poor ratings</td>
</tr>
<tr>
<td><strong>Intersections</strong></td>
<td><strong>Intersections</strong></td>
<td></td>
</tr>
<tr>
<td>- Traffic control</td>
<td>- Traffic control</td>
<td></td>
</tr>
<tr>
<td>- Crossing width</td>
<td>- Crossing width</td>
<td></td>
</tr>
<tr>
<td>- Median islands</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data available from aerial photos; good-fair-poor ratings.
Qualitative Assessment  Example

**OR99 Corridor Plan (Talent, OR)**

<table>
<thead>
<tr>
<th>Segment/Intersection</th>
<th>Mode</th>
<th>Pedestrian</th>
<th>Bicycle</th>
<th>Transit</th>
<th>Auto</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Existing Conditions – (Four Lanes)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapp Rd to Amos Rd</td>
<td>Poor</td>
<td>Poor</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>OR99 at Armos Rd</td>
<td>Poor</td>
<td>Poor</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Amos Rd to Creel Rd</td>
<td>Poor</td>
<td>Poor</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>OR 99 at Creel Rd</td>
<td>Poor</td>
<td>Poor</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Scenario 1 - Five lanes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapp Rd to Amos Rd</td>
<td>Good</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>OR99 at Armos Rd</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Amos Rd to Creel Rd</td>
<td>Good</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>OR 99 at Creel Rd</td>
<td>Fair</td>
<td>Fair</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Scenario 2 – Three lanes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapp Rd to Amos Rd</td>
<td>Good</td>
<td>Fair</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>OR99 at Armos Rd</td>
<td>Good</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Amos Rd to Creel Rd</td>
<td>Good</td>
<td>Fair</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>OR 99 at Creel Rd</td>
<td>Good</td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td></td>
</tr>
</tbody>
</table>

Source: simplification of DEA OR99 Corridor Plan (date?)
APM Multimodal chapter (draft)

Tiered Analysis Methods

- "Design"
- "Planning"
- "Operations"

Increasing Detail

- Full MMLOS
- Simplified MMLOS
- Level of Traffic Stress
- Qualitative Assessment

RTP
- TSP/Corridor Plan
- Refinement Plan
- Project Screening
- Project Development

Qualitative Assessment
Planning (connectivity) – Bike Level of Traffic Stress (BLTS)

- Classifies road segments based on perceived safety issues with close proximity to traffic.
- Allows for quick assessment of system connectivity without burden of more intensive (MMLOS) methods.
- Ability to prioritize improvements, to maximize connectivity for different user groups.
- Most data should be part of TSP (Transportation System Plan) inventories or easily obtainable.
- Visual-based results for easy communication between staff, stakeholders, and the public.
Base on Bicycle User Groups

Bicyclists see different “networks” based on perceived “level of traffic stress (LTS)”

• Strong And Fearless (<1%)
• Enthused and Confident (7%)
• Interested but Concerned (60%) ← biggest market
• No Way No How (33%)

LTS = combines link & downstream intersection

(Roger Geller, 2006)
BLTS Method – Example LookUp tables

**LTS 1:** Bikeable by anyone, including younger children

**LTS 2:** For your basic adult cyclist (younger children accompanied by adult)

**LTS 3 or 4:** For Advanced Cyclists

---

**Table 4. Criteria for Level of Traffic Stress in Mixed Traffic**

<table>
<thead>
<tr>
<th>Speed Limit</th>
<th>2-3 lanes</th>
<th>4-5 lanes</th>
<th>6+ lanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 25 mph</td>
<td>LTS 1&lt;sup&gt;a&lt;/sup&gt; or 2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>LTS 3</td>
<td>LTS 4</td>
</tr>
<tr>
<td>30 mph</td>
<td>LTS 2&lt;sup&gt;a&lt;/sup&gt; or 3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>LTS 4</td>
<td>LTS 4</td>
</tr>
<tr>
<td>35+ mph</td>
<td>LTS 4</td>
<td>LTS 4</td>
<td>LTS 4</td>
</tr>
</tbody>
</table>

(Mekuria, Furth and Nixon 2012) pp. 21

---

Low-Stress Bicycling & Network Connectivity, MTI Report 11-19, Mineta Transportation Institute. (May 2012)
Other BLTS criteria:

• Segments
  – Separated bike facilities (paths, cycle tracks, and bicycle-permitted walkways) are always LTS 1.
  – Bike lane LTS dependent on adjacent parking

• Intersection Approaches (through cyclists)
  – Based on presence and length of right turn lanes
  – Dependent on if right turn lane is to right of bike lane (Oregon Standard)
  – Right turn lanes without bike lanes always creates a high-stress location (LTS 3 or 4) unless turn lane is short.

• Intersection Crossings
  – Signalized crossings are protected, LTS 1 assumed.
  – Dependent on presence of median (6 ft+) refuges
  – Crossing LTS based on total number of lanes and speed limit.
## Bike Level of Traffic Stress Classifications

<table>
<thead>
<tr>
<th>LTS 1</th>
<th>LST 2</th>
<th>LTS 3</th>
<th>LTS 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Low speeds, volumes</td>
<td>▪ Slightly higher speeds</td>
<td>▪ Moderate speeds</td>
<td>▪ Moderate to high speeds</td>
</tr>
<tr>
<td>▪ 1-2 lanes total</td>
<td>▪ 1-3 lanes total</td>
<td>▪ 1-5 lanes total</td>
<td>▪ 2-5+ lanes total</td>
</tr>
</tbody>
</table>

### Intersection Approaches & Crossings

<table>
<thead>
<tr>
<th>Easy crossing</th>
<th>Not difficult</th>
<th>Perceived safe</th>
<th>Unsafe/difficult</th>
</tr>
</thead>
</table>

### Stress Level

<table>
<thead>
<tr>
<th>Low Stress</th>
<th>Little stress but requires more attention</th>
<th>Moderate stress, tolerable for many cyclists</th>
<th>High stress for experienced or skilled cyclists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitable for all cyclists &amp; kids</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Typical Functional Class

<table>
<thead>
<tr>
<th>Residential local streets and separated paths</th>
<th>Collector-level streets with bike lanes and CBD</th>
<th>Low speed arterials with bike lanes –or- moderate speed 2-3-lane roads</th>
<th>High-speed/multi-lane roads with narrow or no bike lanes</th>
</tr>
</thead>
</table>

**Elem School**

**Target level**
**ODOT BLTS Method Modifications**

- Reformatted tables to remove inconsistencies
- Impact of left turn lanes on bicycle routing
- Added considerations for buffered bike lanes and shared-lane markings
- More flexibility on outside rider factors – hills, pavement condition, driveway density, etc.
- Rural application using volumes and shoulder width
- Considering extension to Ped LTS, and use with travel model
Irrigon Bicycle, Pedestrian and Transit TSP Update

**Opportunity 6 Evaluation**

<table>
<thead>
<tr>
<th>Level of Traffic Stress</th>
<th>Improvement: Continue the multi-use path on the north side of US 730 between 1st Street and 3rd Street to connect existing multi-use path with RRFB.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualitative Multi-Modal Level of Service</td>
<td>Before Improvement: Pedestrian / Bicycles – Poor</td>
</tr>
<tr>
<td>Level of Traffic Stress</td>
<td>LTS 3</td>
</tr>
</tbody>
</table>

*Existing Bicycle Level of Traffic Stress (DRAFT)*

Level of Traffic Stress (LTS) is a qualitative measurement of people’s willingness to bicycle on a given road segment with existing conditions. LTS 1 is excellent and is suitable for even small children. LTS 4 exceeds the tolerance of the vast majority of people on bicycle.
Bicycle Level of Traffic Stress Analysis: Salem, Oregon

Haizhong Wang (Civil Engineering, OSU)
Matthew Palm (Public Policy, OSU)
Jonathon Mueller (Civil Engineering, OSU)
Overall Stress Levels – Salem, OR
Salem Application: LOS 1 & 2 Islands With Downtown Highlighted
Innovative Bike Analysis Projects using ODOT methods

- St. Helens US30/Columbia Blvd Streetscape Plan - LTS
- Scappoose TSP - LTS
- Irrigon Bike-Ped Plan
  LTS, qualitative
- Amity TSP - LTS
- Brookings TSP – MMLOS quant/qualitative, LTS
- Oregon 99/Talent TSP Study – Qualitative MMLOS
- Ashland TSP – HCM MMLOS quantitative
Other ODOT Bike-Related Research

- Bike Count storage/standards (PSU Portal)
- Bike App – PSU research (Miguel Figliozzi, PSU)
- Travel Cost Index (economic multi-modal connectivity tool) (Liming Wang, PSU)
- Future Changes Cognitive Map (Haizhong Wang, PSU)
- Pilot DOT for “Strava” Bike Data
Strava Heat Map

2013 Statewide Coverage

- 10K-30K Trips/Yr
- 5K-10K
- 1K-5K
- 100-1K
- <100

Portland

Ashland

Bend
Other ODOT Bike-Related Efforts

• Bicycle and Pedestrian Travel Assessment Report (June 2011) (Alta Planning & Design)

• 3 upcoming ODOT Statewide Policy Plans:
  – Transportation Options Plan (ongoing, 2015)
  – Bike-Ped Plan (ongoing, 2015)
  – Transit Plan

• Oregon Bike Tourism
  (http://rideoregonride.com/)
Questions?
For more information...
BLTS methodology:
http://transweb.sjsu.edu/project/1005.html

ODOT Analysis Procedures Manual
http://www.oregon.gov/ODOT/TD/TP/Pages/APM.aspx

ODOT Active Transportation

ODOT Transportation Planning Analysis Unit
http://www.oregon.gov/ODOT/TD/TP/Pages/Tools.aspx
Active Transportation: ODOT's Response to Community and User Needs

The phrase “active transportation” refers to sustainable, multimodal transportation solutions that connect people to where they need to go - such as work, school and to access essential services using “active” modes such as walking, bicycling, and taking public transit. At the Oregon Department of Transportation, it means that and more: active transportation includes strategically investing in infrastructure in response to community and user needs.

ODOT created the Active Transportation Section as a part of its continuing transformation to an agency that manages a multimodal, community-focused, statewide transportation system. The Active Transportation Section brings many related programs together in order to deliver more broad-based, solution-oriented projects.

On July 12, 2011, ODOT Director Matt Garrett had this to say:

“Our funding structure is overwhelmingly dedicated to highway programs, so we have to be imaginative in how we use discretionary funds and other funding that is directed to non-highway programs...”

I think by bringing more discipline to the process and developing a new frame of reference through which we see proposals, we can be more strategic and we can leverage the funds to get a bigger system impact...” (See full article below.)

Active Transportation Spotlight

Want to know more about the Active Transportation Section?
- Active Transportation Fact Sheet
- ODOT Director's Message

Popular Topics
- Bicycle and Pedestrian Maps
- Scenic Byways Driving Guide
- Oregon Bicycle Manual
- Bicycle and Pedestrian Design Guide
- Bicycle and Pedestrian Plan
- Local Agency Guidelines (LAG Manual)
- Online Forms
- Project Funding
- Statewide Transportation Improvement Program (STIP)
- Enhance and Fix-It STIP Guide
- ConnectOregon
- Multi-Modal Transportation
- Sustainable Transportation System

Current Topics

2013 Active Transportation Conference
At the January 7, 2013, Active Transportation Section Conference, the role, vision and goals of the section were presented.
- Powerpoint Presentation

Enhance Project Funding
Changes in how the State Transportation Improvement Program (STIP) is funding projects. Read more...
- Project Funding Webpage
- STIP Enhance Webpage

Metro's Active Transportation Program
Find out how Metro and partners across the region are working to complete the regional active transportation network.
- Metro Webpage


http://www.oregon.gov/ODOT/TD/AT/Pages/contact_us.aspx
CLOSER LOOK
Oregon's Rising Levels of Bicycling
by Susan Peithman, Bicycle Transportation Alliance

Oregon is a safe and wonderful place to ride a bicycle. In terms of culture, infrastructure, and politics, Oregon is welcoming and encouraging to bicyclists. It is no wonder that bicycling's popularity has grown faster here than anywhere in the United States. Between 2000 and 2009, the share of commuters who bicycle to work increased from 1.07% to 2.34%, a larger jump than in any other state. Oregon also saw a 193% increase in bicycle commuters between 1990 and 2009—the greatest increase among states.

Of all 50 states, Oregon has the greatest percentage of commuters who bike to work (2.1%). Of these bicycle commuters, 33% are women, significantly higher than the national average of 26% and second only to Montana where 34% of bicycle commuters are women.

The visibility of bicycling encourages even more people to ride and makes roads safer, as drivers and all road users are aware of bicyclists. In Portland, where the amount of cyclists has doubled over the past decade, the number of crashes involving a person on a bike has remained relatively constant. This trend indicates the roads are becoming safer as more people ride bikes (see chart below).

Oregon’s rapidly increasing bicycle use is largely a product of the state’s already prominent bicycle culture, which encompasses everything from casual riders to racing teams and “ZooBombers.” Throughout the state, and especially in the city of Portland, bicycles intermingling with cars and pedestrians are commonplace.

Oregon has been inviting to bicyclists as early as the 1970s. Because of a 1973 law establishing urban growth boundaries, on-street, destinations in Oregon’s urban areas are built close to each other in a well-organized grid layout. This planning encourages the 2- to 3-mile trips convenient for bicycle travel. Additionally, Oregon’s “Bicycle Bill” of 1971 mandates bicycle accommodations in all transportation facilities and ensures that at least 1% of transportation funding is devoted to bicycling infrastructure.

Oregonians find it easier to pick up bicycling than people in most other states because of the relative abundance of bicycle-friendly infrastructure and government policy. Portland alone has over 325 miles of bike paths, and bike racks are available at any major destination. Even Portland’s stoplight timings are set to slow cars making streets safer for bicyclists. This dedication to promoting bicycling was recently further bolstered by the Jobs and Transportation Act of 2009, which supports green and active transportation. Consequently, people considering making the switch from cars to bicycles find it convenient, safe, and enjoyable.

Progressive bicycle legislation is possible in Oregon because bicyclists are represented by well-staffed and well-funded advocacy groups. The statewide advocacy organization, the Bicycle Transportation Alliance (BTA), has the highest number of staff per capita served (4.2 per 1 million people) and has 6,000 members, ranking third among statewide organizations for membership. The BTA is influential in urban politics and responsible for many of Oregon’s bicycling improvements. Its Safe Routes to Schools program, for example, operates at over 70 schools.

Though Oregon is already America’s leader in bicycle culture, the future of the state’s bicycle policy is ever progressive and ambitious. Portland, working closely with the BTA, finalized a 20-year, $613 million plan for improvements to its bicycling infrastructure. The plan, the nation’s most ambitious, calls for 368 miles of on-road bikeways, 78 miles of bike trails, and 256 miles of bicycle boulevards. Oregon is committed to growing its population of bicyclists in the years to come.
**Bike LTS Example – Burns, OR**

- **LTS 1**
- **LTS 2**
- **LTS 3**
- **LTS 4**

- Non-standard right turn lane with no bike lane
- Four-lane roadway crossing controls minor street LTS.
- Segment LTS based on two lanes of mixed traffic at 25 mph.
- Local streets are LTS 1 based on two lanes and 25 mph.
- Local street crossings of US20 are LTS 1.
- Non-standard right turn lane with no bike lane