Is Wider Safer?
Collision Rates for Three and Five Lane Rural Highways

Dave Stanek, PE
Session 22
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Overview

• Motivation
• Literature Review
• Comparison Site Characteristics
• Collision Rate Comparison
• Summary
Introduction

- State Route 70 north of Marysville
- Rural two-lane highway
Motivation

• Widen highway to improve safety and reduce travel time
• Due to frequent driveways for rural homes and agricultural land, a continuous two-way left turn lane is proposed
• What is the safety effect of three versus five lanes?
Two Lane Undivided Highway to Four Lane Divided Highway
Three Lane Highway to Five Lane Highway
Literature Review: Adding a TWLTL

- 36 percent reduction in all crashes for rural two lane highways (FHWA)
- CMF equation for two lane roads dependent on driveway and left-turn crashes (Highway Safety Manual)
- 13 to 70 percent reduction in all crashes for four lane road (FHWA)
- Iowa and Missouri DOT provide guidance on when to use for rural locations
Literature Review: Widen from 2 to 4 Lanes

• 29 percent reduction in all crashes for two lane to four lane divided highway (TRB Annual Meeting paper)

• Crash frequency equations for two and four lane roads (Highway Safety Manual)
Approach

• Use collision data from comparable sites (cross-sectional study) to predict change in collision rate

• Characteristics used to determine suitability of comparison sites
  • Rural or semi-rural adjacent land uses
  • Daily volume
  • Posted speed
  • Segment length
  • Access points per mile
## 3-Lane Highway Sites

<table>
<thead>
<tr>
<th>Highway</th>
<th>County</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missouri Flat Rd: SR 49 to El Dorado Trail</td>
<td>El Dorado</td>
<td>CA</td>
</tr>
<tr>
<td>SR 12/88: Brandt Rd to Locke Rd</td>
<td>San Joaquin</td>
<td>CA</td>
</tr>
<tr>
<td>SR 99: Palm St to Butler St</td>
<td>Tehama</td>
<td>CA</td>
</tr>
<tr>
<td>SR 104: Fermoy Way to Park Terrace Dr</td>
<td>Sacramento</td>
<td>CA</td>
</tr>
<tr>
<td>SR 138: 77th St to 87th St</td>
<td>Los Angeles</td>
<td>CA</td>
</tr>
<tr>
<td>SR 58: Kensington Dr to East of Flathead Ave</td>
<td>Lane</td>
<td>OR</td>
</tr>
<tr>
<td>SR 99W: NE Granger Ave to NE Elliott Cir</td>
<td>Corvallis</td>
<td>OR</td>
</tr>
<tr>
<td>US 101: Dellmoor Loop to Bailey Ln</td>
<td>Gearhart</td>
<td>OR</td>
</tr>
<tr>
<td>US 40: 2900 South to 2500 South</td>
<td>Uintah</td>
<td>UT</td>
</tr>
<tr>
<td>US 191: KOA Driveway to S Mill Creek Dr</td>
<td>Grand</td>
<td>UT</td>
</tr>
</tbody>
</table>
3-Lane Site Characteristics

10 sites

- **CA**: 50%
- **OR**: 30%
- **UT**: 20%

**Pie Chart**

**Bar Chart**

- **Daily Volume**
  - US 40
  - US 191
  - SR 99
  - SR 104
  - SR 99W
  - SR 12/88
  - US 101
  - SR 58
  - SR 138
  - MF Rd
  - Average
  - SR 70

- **Length (mi)**
  - SR 99W
  - MF Rd
  - SR 12/88
  - SR 58
  - US 40
  - SR 104
  - US 101
  - SR 138
  - SR 99
  - US 191
  - Average
  - SR 70

- **Access Points per Mile**
  - US 40
  - SR 58
  - US 191
  - SR 104
  - SR 12/88
  - US 101
  - SR 99W
  - SR 138
  - MF Rd
  - Average
  - SR 70
## 5-Lane Highway Sites

<table>
<thead>
<tr>
<th>Highway</th>
<th>County</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 70: South of East Gridley Rd to north of Cox Ln</td>
<td>Butte</td>
<td>CA</td>
</tr>
<tr>
<td>SR 99: Feather River Bridge to Garden Hwy</td>
<td>Sutter</td>
<td>CA</td>
</tr>
<tr>
<td>SR 99: SR 113 to Oswald Rd</td>
<td>Sutter</td>
<td>CA</td>
</tr>
<tr>
<td>SR 138: Ave T to 72nd St</td>
<td>Los Angeles</td>
<td>CA</td>
</tr>
<tr>
<td>US 395: Butcher Ln to SR 168</td>
<td>Inyo</td>
<td>CA</td>
</tr>
<tr>
<td>SR 34: Tangent Dr SE to Red Bridge Rd SE</td>
<td>Lebanon</td>
<td>OR</td>
</tr>
<tr>
<td>SR 99: Airport Rd to SR 36</td>
<td>Lane</td>
<td>OR</td>
</tr>
<tr>
<td>US 20: Sodaville Rd to Pleasant Valley Rd</td>
<td>Lebanon</td>
<td>OR</td>
</tr>
<tr>
<td>US 26: SE Vista Loop Dr to SE Veneer Ln</td>
<td>Clackamas</td>
<td>OR</td>
</tr>
<tr>
<td>US 30: Scappoose-Vernonia Rd to Millard Rd</td>
<td>Columbia</td>
<td>OR</td>
</tr>
<tr>
<td>US 40: 1000 South to 2900 South</td>
<td>Uintah</td>
<td>UT</td>
</tr>
<tr>
<td>US 191: Colorado River to Arches Entrance Rd</td>
<td>Grand</td>
<td>UT</td>
</tr>
</tbody>
</table>
5-Lane Site Characteristics

12 sites

- **CA**: 42%
- **OR**: 42%
- **UT**: 17%

### Daily Volume

- **US 395**: 7,600
- **US 191**: 24,700
- **US 20**: 17,470
- **US 40**: 14,800
- **SR 70 (B)**: 7,600
- **SR 99 (L)**: 14,800
- **SR 99 (S1)**: 17,470
- **SR 99 (S2)**: 14,800
- **US 26**: 40
- **US 30**: 40
- **Average**: 17,470

### Access Points per Mile

- **SR 34**: 0.74
- **US 26**: 10.14
- **SR 99 (S1)**: 3.4
- **SR 99 (L)**: 9.6
- **US 20**: 40
- **SR 70**: 40
- **Average**: 21

### Length (mi)

- **SR 34**: 0.74
- **US 26**: 3.4
- **SR 99 (S2)**: 10.14
- **SR 99 (S1)**: 9.6
- **US 20**: 40
- **SR 70**: 40
- **Average**: 21
Collision Data Sources

Missouri Flat Road: 2010-17 (8 years)
- Transportation Injury Mapping System
  https://tims.berkeley.edu/

California State Highways: 2008-17 (10 years)
- Caltrans Traffic Accident Surveillance and Analysis System (TASAS)

Oregon Highways: 2008-17 (10 years)
- Oregon DOT Crash Data System

Utah Highways: 2015-17 (3 years)
- Utah Vehicle Collisions
  https://crashmapping.utah.gov/
3-Lane Collision Data

Average Fatal and Injury Collisions per Million Vehicle Miles

- US 191: 1.27
- US 40: 1.27
- MF Rd: 3.00
- SR 104: 2.24
- US 101: 3.00
- SR 99: 4.06
- SR 12/88: 3.00
- SR 138: 4.06
- SR 58: 7.42
- SR 99W: 4.06
- Average: 4.06
5-Lane Collision Rate

Average Fatal and Injury Collisions per Million Vehicle Miles

- US 40: 0.37
- US 191: 0.37
- SR 99 (S1): 1
- SR 34: 2
- SR 70: 2
- SR 99 (S2): 2
- SR 99 (L): 2
- US 395: 2.68
- US 20: 2.68
- US 26: 2.68
- SR 138: 7.96
- US 30: 7.96

Average: 2.68
Comparison Summary

Average Fatality & Injury Collision Rate
• 3-Lane Highways – 4.06 per MVM
• 5-Lane Highways – 2.68 per MVM
• 34 percent reduction
• Crash Modification Factor - 0.66

Average Fatality Collision Rate
• 3-Lane Highways – 0.159 per MVM
• 5-Lane Highways – 0.108 per MVM
• 32 percent reduction
• Crash Modification Factor - 0.68
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Institute of Transportation Engineers
Joint Western & Mountain Districts Annual Meeting
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Comparison – 3 Lane Sites

Collision Rate vs. Daily Volume

Collision Rate vs. Access Points Per Mile

Collision Rate vs. Length

Collision Rate vs. Highest Posted Speed
Comparison – 5 Lane Sites

- **Collision Rate vs. Daily Volume**
- **Collision Rate vs. Access Points Per Mile**
- **Collision Rate vs. Length**
- **Collision Rate vs. Highest Posted Speed**