Design Meets Reality

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Agenda

- Design Element Considerations
- Post Construction Issues
- Crash Statistics
- Proposed Concept
- Lessons Learned
13 Controlling Elements of Design

1. Design speed
2. Lane width
3. Shoulder width
4. Bridge width
5. Horizontal alignment
6. Superelevation
7. Vertical alignment
8. Grade
9. Stopping sight distance
10. Cross slope
11. Vertical clearance
12. Lateral offset to obstruction
13. Structural capacity
13 Controlling Elements of Design

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Lane Width and Shoulder Width

RDO1-TS-3A
13 Controlling Elements of Design

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Horizontal Alignment and Superelevation

\[ E_{\text{MAX}} = 0.08 \text{ DESIRABLE} \]

- FULL S.E.
- 0.068 FT./FT. LEFT
13 Controlling Elements of Design

1. Design speed
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### TABLE II. 4 AND 6 LANE ARTERIAL - DESIGN STANDARDS

<table>
<thead>
<tr>
<th>DESIGN STANDARDS (FOR GIVEN DESIGN SPEED)</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIMUM RADIUS (FT.) 0.06 MAX. S.E.</td>
<td>300</td>
<td>420</td>
<td>585</td>
<td>730</td>
<td>930</td>
<td>1130</td>
<td>1330</td>
<td>1530</td>
<td>1730</td>
</tr>
<tr>
<td>MINIMUM RADIUS (FT.) 0.08 MAX. S.E.</td>
<td>275</td>
<td>380</td>
<td>510</td>
<td>660</td>
<td>835</td>
<td>1065</td>
<td>1335</td>
<td>1635</td>
<td>1820</td>
</tr>
<tr>
<td>MINIMUM RADIUS (FT.) 0.08 MAX. S.W.</td>
<td>250</td>
<td>350</td>
<td>465</td>
<td>600</td>
<td>760</td>
<td>965</td>
<td>1185</td>
<td>1390</td>
<td>1620</td>
</tr>
</tbody>
</table>

**MINIMUM STOPPING SIGHT DISTANCE (FT.)**
- LEVEL TERRAIN: 200 ft
- ROLLING TERRAIN: 200 ft
- MOUNTAINOUS TERRAIN: 200 ft

**MINIMUM "K" VALUE**
- CREST VERTICAL CURVE: 19 ft
- SAG VERTICAL CURVE: 37 ft

**MINIMUM PASSING SIGHT DISTANCE (FT.)**
- 105 ft

**MINIMUM "K" VALUE FOR CREST VERTICAL CURVE**
- 42 ft

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**Grade**

- **RDO1-TS-3A**
- **Super Elevation**
  - 4.00%
  - 2.58%
13 Controlling Elements of Design

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Stopping Sight Distance

**RDO1-TS-3A**

**MINIMUM STOPPING SIGHT DISTANCE (FT.)**

- Distance: 2,449' > 570'
- 1,068' > 570'

**Table II. 4 and 6 Lane Arterial - Design Standards**

<table>
<thead>
<tr>
<th>MINIMUM STOPPING SIGHT DISTANCE (FT.)</th>
<th>50</th>
<th>50</th>
<th>50</th>
<th>50</th>
<th>50</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINIMUM RADIUS [FT.], 0.06 MAX. R.E.</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>MINIMUM PASSING DISTANCE (FT.), 0.06 MAX. R.E.</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
<td>275</td>
</tr>
<tr>
<td>MAXIMUM RADIUS [FT.], 0.06 MAX. R.E.</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>MAXIMUM ROLLING TERRAIN</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>MAXIMUM MOUNTAINOUS TERRAIN</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>MINIMUM STOPPING DISTANCE (FT.)</td>
<td>570</td>
<td>570</td>
<td>570</td>
<td>570</td>
<td>570</td>
<td>570</td>
</tr>
</tbody>
</table>

See standard drawings ROD1-SE-2 and ROD1-SE-3.
Other Design Elements

- Intersection sight distance
- Offset turn lane
- Turn lane storage
Other Design Elements

- Intersection sight distance
- Offset turn lane
- Turn lane storage
## Intersection Sight Distance

### RDO1-SD-5

<table>
<thead>
<tr>
<th>Single Unit Truck</th>
<th>Intermediate Semi-Trailers</th>
</tr>
</thead>
<tbody>
<tr>
<td>40’-64’ MEDIAN</td>
<td>35’-50’ MEDIAN</td>
</tr>
</tbody>
</table>

#### Design Speeds
- **Single Unit Truck**
  - 2,451’
  - 2,451’>750’
  - 2,451>1,330’

#### Intermediate Semi-Trailers
- 1,072’
- 1,072’>750’
- 1,072<1,330’
Other Design Elements

- Intersection sight distance
- Offset turn lane
- Turn lane storage
The following guidelines apply to four-lane divided highways with a maximum median...
Other Design Elements

- Intersection sight distance
- Offset turn lane
- Turn lane storage
Turn Lane Storage Design

TDOT Roadway Design Section 2
Preliminary Design

V_L: LEFT TURNING VOLUME (VPH)
So, What’s the Problem
THP: 2 Portland High students killed in crash

Adam Tamburin, The Tennessean and Josh Cross, Gannett Tennessee  12:13 a.m. CST November 4, 2014

2 hurt in wreck Wednesday at site of fatal Nov. crash

Dessislava Yankova, Nashville  7:18 a.m. CST February 5, 2013
Direction of Fatal Crash
Total Crashes

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal Crashes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Incapacitating Injury Crashes</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Other Injury Crashes</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Property Damage Crashes</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>
Injury Severity

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Killed</th>
<th>Total Incapacitating Injuries</th>
<th>Total Other Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>2011</td>
<td>0</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>2014</td>
<td>2</td>
<td>5</td>
<td>12</td>
</tr>
</tbody>
</table>
Clearance Time

\( V_i = 0 \text{ mph} \)
\( V_f = 22 \text{ mph} \)
\( S = 125 \text{ ft} \)
\( a = \text{?} \)
\( a = \frac{V_f^2 - V_i^2}{2S} \)
\( a = 4.12 \text{ ft/s}^2 \)

\( V = 70 \text{ mph} \)
\( t = 7.83 \text{ sec} \)
\( s = \text{?} \)
\( s = V \times t \)
\( s = 804 \text{ ft} \)

\( V_i = 0 \text{ mph} \)
\( V_f = 22 \text{ mph} \)
\( a = 4.12 \text{ ft/s}^2 \)
\( t = \text{?} \)
\( t = \frac{V_f - V_i}{a} \)

\( V = 60 \text{ mph} \)
\( s = \text{?} \)
\( s = V \times t \)
\( s = 689 \text{ ft} \)
Conceptual Design
Conceptual Conflicts

14 Total Conflict Points
Lessons Learned

• Visualize design
• Safety considerations
• Future training
• Check all appropriate design vehicles
THANK YOU

Questions & Comments
Contact Information

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CONCEPTUAL DRAWING
RCUT (I-TURN)
STATE ROUTE 109
AT OLD HIGHWAY 109/SCOTTY PARKER ROAD
SUMNER COUNTY