Cost Effective Roadside Environment

Indiana Division

Federal Highway Administration
FHWA's Vision

“Create the best transportation system in the world for the American people through proactive leadership, innovation and excellence in service.”
FHWA’s Goals

- Mobility
- Productivity
- Human and Natural Environment
- National Security
- Safety
Highway Safety Elements

Driver  Vehicle  Roadway
National Crash Trends

Fatality Rate (per 100 Million Vehicle Miles)

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940</td>
<td>10.9</td>
</tr>
<tr>
<td>1950</td>
<td>7.2</td>
</tr>
<tr>
<td>1960</td>
<td>5.1</td>
</tr>
<tr>
<td>1970</td>
<td>4.7</td>
</tr>
<tr>
<td>1980</td>
<td>3.3</td>
</tr>
<tr>
<td>1990</td>
<td>2.1</td>
</tr>
<tr>
<td>1995</td>
<td>1.7</td>
</tr>
</tbody>
</table>
Indiana Crash Trends

Fatality Rate (per 100 Million Vehicle Miles)

- 1975: 3
- 1980: 3
- 1985: 2
- 1990: 2.4
- 1995: 1.5

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Safety Opportunities

★ Educate
★ Promote Safety Belt and Air Bag Use
★ Reduce Impaired Driving
★ Manage Speed
★ Develop Safer Vehicles
★ Design Safer Roadway Environments
Roadside Obstacles

Nearly 30% of all traffic fatalities are caused by collisions with fixed objects.

Trees/Shrubs
Guardrail
Embankments
Utility Poles
Why Drivers Leave the Roadway

- Forced Off By Other Drivers
- Inattention
- Excessive Speed
- Fatigue
- To Avoid An Obstacle
- Driving Impaired
- Vehicle Failure
- Weather Conditions
"Forgiving Roadside" Concept

- Recognizes that good drivers can make mistakes and stray from the roadway.
- Provides a recovery opportunity for drivers.
Clear Zone

★ The total roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles.
Design Options

- Remove Obstacles
- Relocate Obstacles
- Redesign Obstacles (Breakaway Devices)
- Shield Obstacles
Cost Effective Analysis
Cost Effective Analysis Uses

★ Evaluate Need For Barriers
★ Evaluate Best Treatment
★ Prioritize
★ Establish Policy
Agency Cost

Installation  Accident Repair  Routine Maintenance  Salvage
User Costs (Annual Accident Cost)

- Collision
- Severity
- Accident Type Costs
Need a Common Comparison for Different Investments over Time
Discounting

- Time Value of Money
- Low - Current Investments
- High - Future Investments
\textbf{Accident Costs}

\begin{itemize}
  \item Property Damage Only Accident Level 1 = $625
  \item Property Damage Only Accident Level 2 = $3,125
  \item Slight Injury Accident = $3,750
  \item Moderate Injury Accident = $12,500
  \item Severe Injury Accident = $200,000
  \item Fatal Accident = $1,000,000
\end{itemize}
Fatal Accidents

* FHWA - $1,500,000
* ROADSIDE - $1,000,000
* Agency Policy - ?
Total Accident Cost = (Cost of Severity Index) \times (Probability of Severity Index)
<table>
<thead>
<tr>
<th></th>
<th>60 Km/h</th>
<th>80 Km/h</th>
<th>100 Km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree (150 mm)</td>
<td>2.6</td>
<td>2.7</td>
<td>3.0</td>
</tr>
<tr>
<td>1:2 Foreslope</td>
<td>3.2</td>
<td>3.8</td>
<td>4.3</td>
</tr>
<tr>
<td>(2 meter height)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal</td>
<td>2.0</td>
<td>2.3</td>
<td>2.7</td>
</tr>
<tr>
<td>Barrier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAT</td>
<td>2.2</td>
<td>2.6</td>
<td>3.2</td>
</tr>
</tbody>
</table>
Collision Frequency

- Encroachments
- Traffic Volume
- Geometrics
- Angle
- Hazard
Cost Effective Analysis System

Results with ROADSIDE

★ Present Worth and Annual Cost for both Total and Agency Costs
Cost Effective Analysis Example

Highway
- Two-way, Two-lane Undivided
- Lane Width = 3.3 meters
- No Shoulder

Traffic
- Design Year (20 years) Traffic = 1,806 VPD
- Traffic Growth = 3.0%
- Design Speed = 100 km/h
Cost Effective Analysis Example
Continued

Feature

- 3.0 meter x 3.0 meter Concrete Box Culvert
- 0.3 meter Protruding Headwall
- 1:2 Taper Wingwalls
Cost Effective Analysis Example
Continued - Design Options

★ Do Nothing

★ Extend Concrete Box Culvert to Clear Zone (9 meters)

★ Extend Concrete Box Culvert; Lane Width and Shoulder (3.6 meter and 1.2 meter respectively)

★ Eliminate Headwall, Rebuild Wingwalls (1:4), and Install Pipe Grates
## Cost Effective Analysis

### Comparisons

<table>
<thead>
<tr>
<th>Option</th>
<th>Annual Accident Cost</th>
<th>Annual Highway Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1 (Do Nothing)</td>
<td>$980</td>
<td>$0</td>
</tr>
<tr>
<td>Option 2 (Extend to Clear Zone)</td>
<td>$184</td>
<td>$736</td>
</tr>
<tr>
<td>Option 3 (3.6 m lane and 1.2 m shoulder)</td>
<td>$765</td>
<td>$589</td>
</tr>
<tr>
<td>Option 4 (1:4 Foreslope)</td>
<td>$89</td>
<td>$441</td>
</tr>
</tbody>
</table>
## Benefit/Cost Analysis Comparisons

<table>
<thead>
<tr>
<th>Option 2 (Extend to Clear Zone)</th>
<th>Option 3 (3.6 meter lane and 1.2 meter shoulder)</th>
<th>Option 4 (1:4 Foreslope)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefit/Cost Ratio 1.1</td>
<td>0.4</td>
<td>2.0</td>
</tr>
</tbody>
</table>
Cost Effective Analysis

★ Tool
★ NOT THE ANSWER
Comparing Alternatives

Establish Policy

Prioritize for "Best Treatment"

AND

Cost Effective Analysis Benefits
IT CAN SAVE YOU MONEY