Benefits/ Costs of Access Control Near Interchanges

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Problem Statement

• Access connections near an interchange off-ramp can cause safety and operational problems
• Is it cost-effective to control access by acquiring more LA ROW?
Background

- Interchanges attract development
  - Seldom any coordinated plan
- FDOT has no control over land-use
- Current practice is to acquire 100 ft of LA ROW in urban areas, 300 ft in rural areas
- ROW costs are prohibitive in developed interchange areas

Methodology

- Operational Analysis
  - Extend the operational life of interchange
  - Delay savings by increasing the length of access controlled frontage
- Safety Analysis
  - Effects of access spacing on crash frequency
- B/C Analysis
  - Computing B/C ratio for three scenarios
Original Interchange Model

Operational Analysis (Corsim)

- Modify the existing interchange configuration to an average urban diamond design
- Simulate the operational impacts of 200 feet access spacing
- Continue to simulate the impacts of access spacing at 200-foot increments
New Simulation Model

Assumptions

• Traffic volume proportion on freeway ramp
• Traffic volume proportion on arterial
• Intersection turning movement counts
• Proportion of weaving vehicles
• Heavy vehicle percentage
• Signal progression effects
Operational Effects

![Graph showing the effect of access controlled frontage on volume.]

Reduced Delay (per hour)

- 20 years
- Total reduced delay for 600’ vs. 200’ is about 6950 veh-hrs
- Total reduced delay for 1320’ vs. 200’ is about 7730 veh-hrs
Safety Analysis

• Objective
  – to relate crash frequency to the length of access controlled frontage

• Data Collection
  – 8 Study Sites
  – Crash Data from Year 1999 to 2003

Safety Analysis

Effects of Access Spacing on Number of Crashes

\[ y = -0.0567x + 187.08 \]

\[ R^2 = 0.3854 \]
Safety Analysis (Cont’d)

Effects of Access Spacing on Number of Fatalities

\[ y = -0.0007x + 1.8136 \]
\[ R^2 = 0.235 \]

# of Fatalities

0 500 1000 1500 2000 2500

Access Spacing (ft)

Safety Analysis (Cont’d)

Effects of Access Spacing on Number of Injuries

\[ y = -0.0239x + 94.009 \]
\[ R^2 = 0.2729 \]

# of Injuries

0 500 1000 1500 2000 2500

Access Spacing (ft)
Safety Analysis (Cont’d)

Effects of Access Spacing on # of PDO

\[ y = -0.0321x + 91.261 \]
\[ R^2 = 0.3845 \]

Benefit/ Cost Analysis

\[ B/C = \Delta \text{ user benefits}/\Delta \text{ investment cost} \]

- Alternative A: Purchasing 200 ft of LA Right of Way (Current Practice)
- Alternative B: Purchasing 600 ft of LA Right of Way
- Alternative C: Purchasing 1320 ft of LA Right of Way
Constants for Operational Benefits

- Vehicle Occupancy: 1.25 persons per vehicle
- Working Days: 250 days per year
- Average Cost of Time ($2002): $13.25 per person hour

Source: TTI Urban Mobility Study 2002

Average ROW Costs (per front foot)

- Rural Unimproved: $500
- Rural improved: $1,000
- Urban unimproved: $1,625
- Urban improved: $15,000

Source: FDOT D7
Average Cost of Crashes

- Death: $1,120,000
- Nonfatal Disability Injury: $45,500
- PDO: $8,200

Source: National Safety Council 2003

Benefits and Costs

- Benefits
  - $ Savings of Not Purchasing LA ROW on Developed Land (B1)
  - Decreased Delay (B2)
  - Fewer Crashes (B3)
- Costs
  - Initial Cost of Purchasing Additional LA Right of Way on Undeveloped Land (C1)
**B/ C Ratio**

- Alternative A (200 ft) vs. Alternative B (600 ft)
- Alternative A (200 ft) vs. Alternative C (1320 ft)

<table>
<thead>
<tr>
<th>Total Crashes</th>
<th>Benefit</th>
<th>Cost</th>
<th>Benefit</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Rural</td>
<td>$49</td>
<td>$151</td>
<td>$151</td>
<td>$49</td>
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</tbody>
</table>

**Benefit/ Cost Ratio - 200’ vs. 600’**

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<thead>
<tr>
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<th>Urban</th>
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<td>Benefit</td>
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<td>Total</td>
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<td>B/C Ratio</td>
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<td>151</td>
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Benefit/Cost Ratio - 200’ vs. 1320’

<table>
<thead>
<tr>
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<th>Urban</th>
<th>Rural</th>
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<tbody>
<tr>
<td></td>
<td>Benefit</td>
<td>Cost</td>
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<td>ROW</td>
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<tr>
<td>Total</td>
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<td>B/C Ratio</td>
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<td>65</td>
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</tbody>
</table>

Conclusions

- The benefits of acquiring additional LA ROW near an interchange in advance of development far exceed the cost.
- Minimum Length of LA ROW: 600 feet
- Desirable Length of LA ROW: 1320 feet