2007 WINTER TEXITE MEETING
FEBRUARY 3, 2007

Ramp Reversal Research
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TxDOT Fort Worth District

Research Project 0-5105

- RMC 4 – Traffic Operations
- Project title
  - Development of Guidelines for Ramp Reversal Projects
- Funding
  - $135,262
- Joint Texas Transportation Institute (TTI) and University of Texas at Arlington (UTA) project
TxDOT Project Team

- Lauren Garduno (ODA) – Program Coordinator
- Roy Parikh (FTW) – Project Director
- Project Advisors
  - Brian Barth (DAL)
  - Albert Durant (FTW)
  - Doug Eichorst (ODA)
  - Cynthia Landez (DES)
  - Wade Odell (RTI)

The Research Team

- Scott Cooner (TTI) – Research Supervisor
- Steve Venglar (TTI) – Co- Research Supervisor
- Dr. Jim Williams (UTA)
- Other members:
  - Ed Pultorak (TTI)
  - Yatin Rathod (TTI)
  - Stephen Mattingly (UTA)
  - Phong Vo (UTA)
#1: When to Consider Reversals

- When & where should the use of ramp reversals be considered?

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<th>SINGLE ON &gt; OFF</th>
<th>SINGLE OFF &gt; ON</th>
<th>PAIR</th>
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#2: Diamond vs. X-ramp Pattern

- When & where should an X-ramp pattern be used as opposed to diamond ramp design?
## Pros and Cons: X vs. Diamond

<table>
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<tr>
<th>PROS</th>
<th>CONS</th>
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<tr>
<td>+ Increased development along frontage road</td>
<td>– <em>Costly</em> means of improving signal operation</td>
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<td>+ <em>Reduced through demand</em> on frontage road approach to intersection</td>
<td>– Construction activities will <em>disrupt business</em> along frontage road</td>
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<td>+ <em>Move the weaving area</em> between an entrance ramp and exit ramp from the main lanes to the frontage road, where speeds and volumes are lower</td>
<td>– Invites <em>slingshot maneuvers</em> allowing motorists to bypass cross-street signals; this poses safety and capacity problems on frontage road</td>
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<td>+ <em>Increased storage area</em> for cross-street intersection queuing</td>
<td>– Addresses the queue storage problem but <em>queuing delay will not be remedied</em></td>
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<td>+ Better opportunity to use frontage road as alternate route as part of <em>incident management</em> if auxiliary lanes are provided</td>
<td>– Likely increase in <em>short trips</em> on the freeway</td>
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<td>– Construction of auxiliary lanes may require <em>major reconstruction</em> at cross-streets</td>
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## Braided Ramp Studies

*Bonilla & Urbanik (376-2F) – 1986*

- **Grade-separation when:**
  - Weaving or access problems not solved by ramp elimination or relocation
  - **Warrants**
  - **Guidelines**
DISTRICT SURVEYS

Survey Questions

- Project type
- Date of implementation
- Roadway type
- Project cost
- Project rationale
- Evaluation studies
Roadway Type

- Interstate: 23, 64%
- US Highway: 8, 22%
- State Highway: 3, 8%
- FM, Loop or Other: 2, 6%

Project Rationale

- Safety issues: 68%
- High traffic volumes: 60%
- Inadequate ramp spacing: 43%
- Main lane weaving: 43%
- Political/developer request: 41%
- Land access: 30%
- Frontage road weaving: 11%
Project Rationale - Others

- Two-way to one-way frontage road conversion (6)
- Exit ramp queue spillback (5)
- Better utilize frontage road capacity (2)
- Eliminate two consecutive entrance ramps
- Construction of an additional overpass
- Alleviate frontage road congestion at the arterial street

CASE STUDIES
Identify and Select Study Sites

- Candidate sites
  - Survey, internet searches & previous evaluations
  - 12 ramp reversal case studies
  - 3 X-ramp corridor case studies

Operational Evaluation

- Impacts
  - System delay
- Volume fluctuations
  - Freeway main lanes
  - Frontage road
  - Downstream intersection
- Queuing
- Ramp spacing
Safety Evaluation

- Crash rate before vs. after
  - Main lane
  - Frontage road
  - Total
  - Anecdotal

Basic Economic Evaluation

- Sales tax receipts
  - Corridor vs. citywide

- Property values
  - Corridor

- Business development
2. WB IH 20 in Arlington

- Reversed the Matlock entrance with the FM 157 (Cooper St.) exit
- Construction cost = $7,049,023
- Driving force = improved access to Parks Mall
- Joint funding

Roadway Layout

- Parks Mall
- IH 20
- Cooper St.
- FM 157
- Matlock Road
2 Improved Frontage Road

2-lane Cooper exit

Overhead sign bridge

2 Evaluation Results

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<tr>
<th>Evaluation</th>
<th>Outcome</th>
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<tr>
<td>![Image]</td>
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Lesson learned: speed enforcement needed on frontage road.
GUIDELINES FOR SUCCESSFUL IMPLEMENTATION OF RAMP REVERSAL AND X-RAMP PROJECTS
Guidelines Synergy

Ramp modifications

Access management

Access Management Themes

Texas Access Management Themes . . .

- Improve Safety and Mobility
- Provide Reasonable Access to Developments
- Promote Local Government Partnerships
Guidelines Framework

- 5 categories (based on 5Es of SR2S)
  - Educational
  - Encouragement
  - Engineering
  - Enforcement
  - Evaluation

Guideline 1: Educational

- Use the local media, department resources and other innovative techniques to promote projects:
  - prior to construction
  - during construction
  - after completion
  - following evaluation
Online Fact Sheet

Expressway

SH 5 (Earl Rudder Freeway) Ramp / Frontage Road Improvements - From Green Prairie Road to FM 100

Regional Summary

The SH 5 (Earl Rudder Freeway) project is an overall package of improvements to the SH 5 corridor, including:

- Existing SH 5 corridor alignment
- New SH 5 (Earl Rudder Freeway) alignment
- SH 5 frontage roads
- SH 5 access ramps
- SH 5 interchange

Construction is anticipated to begin in 2008.

Additional information about the project can be obtained by contacting:

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1900 South bounds Street
College Station, TX 77845
Phone: 979-767-3130
Fax: 979-767-3180
Email: earl.jackson@dot.state.tx.us

Guideline 4 - Encouragement

- Encourage funding contributions from local government entities and private developers to offset project implementation costs.
Guideline 6 - Engineering

- Provide adequate storage to prevent vehicles from stacking onto the main lanes.

Exit Ramp Spillback

- Queue spillback from exit ramps is a common occurrence in urban areas, particularly at locations where inadequate storage is available.
Guideline 17 - Enforcement

- Coordinate with law enforcement officials for speed enforcement on frontage roads following ramp modifications.

Guideline 21 - Evaluation

- If evaluation studies are performed prior to project implementation, consider the operational impacts (capacity and level-of-service) on both the freeway main lanes and frontage road facilities.
Parting Message

- Overall, case studies show that the operational, safety and basic economic impacts of ramp modification projects are primarily positive in nature. Further implementation of this type of project is strongly recommended using the guidance developed in the 5105 research.

Questions?

0-5105 Project Summary Report is Online at: