



## 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

Texas Transportation Institute logo, Texas Department of Transportation logo, and UTA logo are visible at the bottom.

## 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)



Photo Courtesy of TxDOT



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## 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)

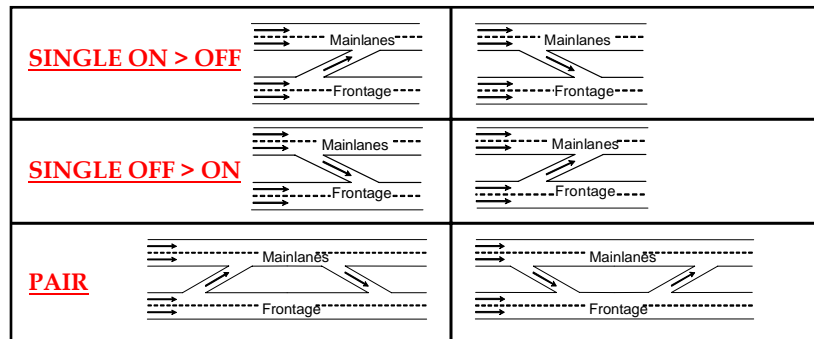


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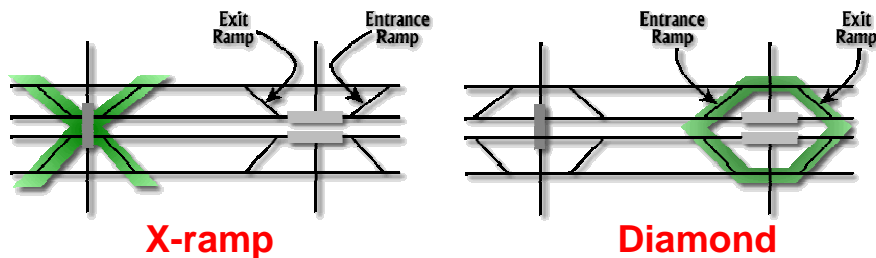
## #1: When to Consider Reversals

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



## #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

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

## Braided Ramp Studies

- Bonilla & Urbanik (376-2F) – 1986
- Grade-separation when:
  - Weaving or access problems not solved by ramp elimination or relocation
- Warrants
- Guidelines



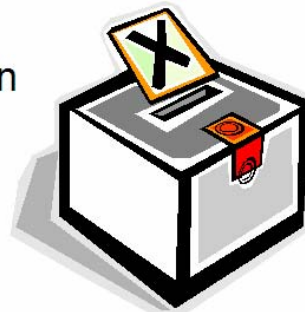


# DISTRICT SURVEYS

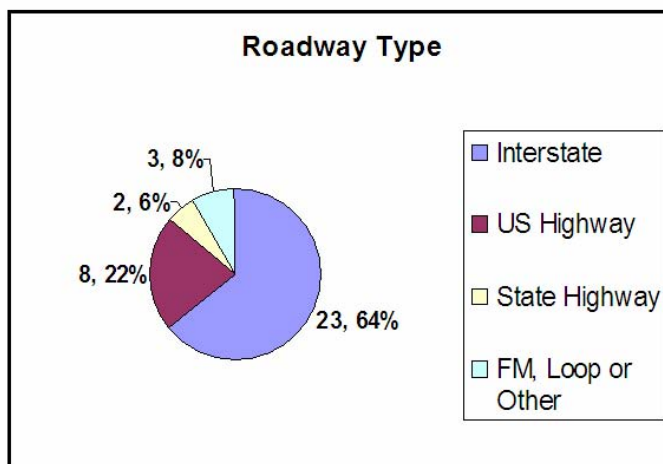


## Survey Questions

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

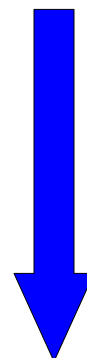


## Roadway Type



## 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

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- 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

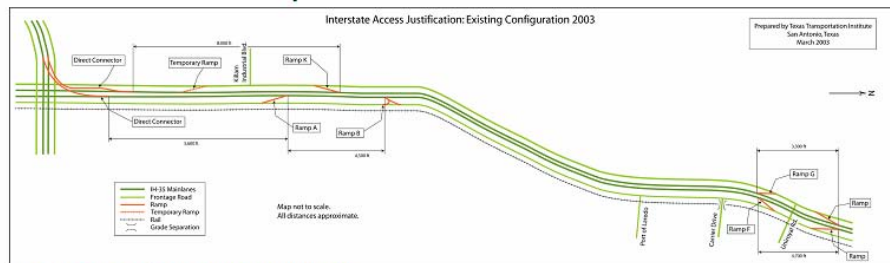


## CASE STUDIES



## Identify and Select Study Sites

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

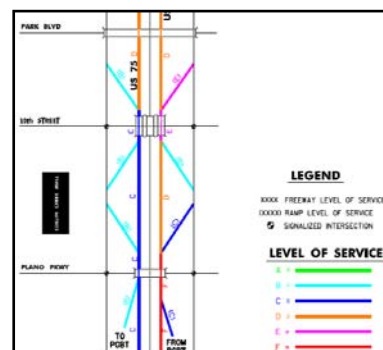


Graphic Courtesy of Texas Transportation Institute



## 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

### Parks Mall of Arlington



## 2

## Roadway Layout






## 2

## Improved Frontage Road



## 2

## Evaluation Results

Evaluation	Outcome
	+
	+
	+



**Lesson learned:** speed enforcement needed on frontage road.

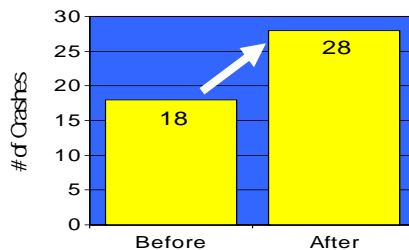


## Following Evaluation

### Fort Worth Star-Telegram

*Accidents up on improved IH 20 frontage road*

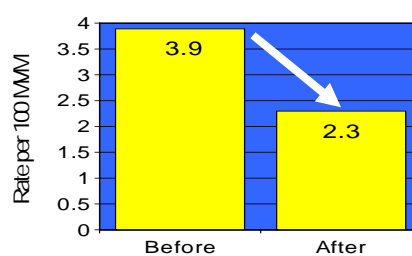
#### Crash Frequency



### TTI Analysis

*Crash rate actually significantly reduced*

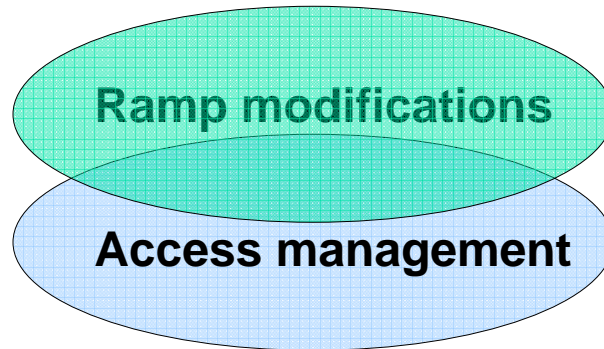
#### Crash Rate



## GUIDELINES FOR SUCCESSFUL IMPLEMENTATION OF RAMP REVERSAL AND X-RAMP PROJECTS



## Guidelines Synergy



## 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**

Tools | Links | What's New | Help

SH 6 (Earl Rudder Freeway) Ramp / Frontage Road Improvements - From Greens Prairie Road to FM 159

**Brazos County**

The Bryan District is currently developing a project to improve traffic flow within the SH-6 corridor. The improvements will include adjustment or addition of access ramps, conversion of the frontage roads to one-way operation and construction of additional turn-around interchanges. Public meetings were held to assist in determining the preferred improvements.

No new right-of-way acquisition is required for this project.

Construction is anticipated to begin in 2006.

Additional information about this project can be obtained by contacting:

Mr. Karl Nelson, P.E.  
Bryan Area Engineer

Phone: 979-779-6233  
Fax: 979-779-1375  
E-mail: [knelson@dot.state.tx.us](mailto:knelson@dot.state.tx.us)

Bryan Area Office  
2102 Tabor Road - In Bryan

[Back to Brazos County project list](#)

[Return to Bryan District county list](#)

Graphic from TxDOT website - [www.dot.state.tx.us](http://www.dot.state.tx.us)



## Guideline 4 - Encouragement

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







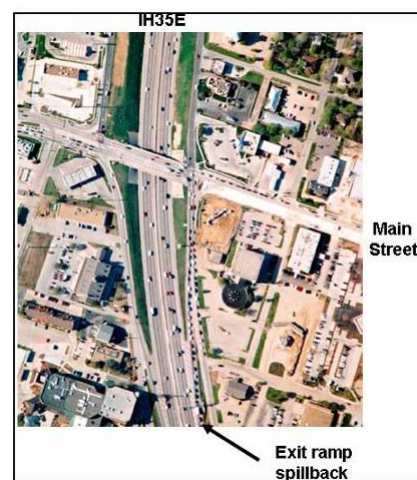
## Guideline 6 - Engineering

- 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.

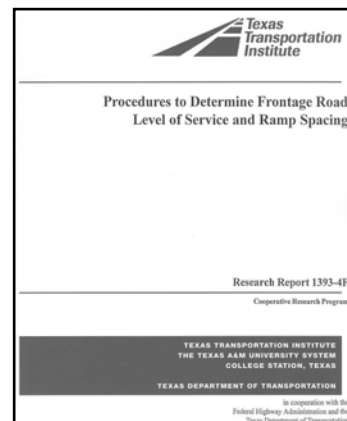


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## Guideline 21 - Evaluation

- 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:

<ftp://ftp.dot.state.tx.us/pub/txdot-info/rti/psr/5105.pdf>

