

# Cable Barriers: Texas Research

Scott Cooner, P.E.  
Program Manager

Texas Transportation Institute – Arlington Office





# Presentation Outline

- ◆ Cross-median crash problem
- ◆ Evolution of cable barrier in Texas
- ◆ Overview current research project
- ◆ Highlight key issues
- ◆ Wrap-up

# Cable Barrier - Advantages

- ◆ Lower initial cost
- ◆ Effective vehicle containment
- ◆ Designed to facilitate quick and easy repairs
- ◆ Used with median cross slopes as steep as 4:1
- ◆ Low deceleration forces upon the vehicle and its occupants
- ◆ No drainage issues

# Cable Barrier - Challenges

- ◆ Accommodate deflection distance
- ◆ Damage even with moderate impacts
- ◆ Require maintenance every impact
- ◆ May require periodic inspections
- ◆ Containment of trucks
- ◆ Barrier penetration



# Cross-Median Crashes: Urban



# Cross-Median Crashes: Rural

- ◆ I-35 Hewitt
  - 7 fatalities
- ◆ US75 Sherman
  - 10 fatalities



## HOW THE ACCIDENT HAPPENED

About 4:29 p.m. on Sept. 20, 2004, Miroslaw Jozwiak was driving his 18-wheeler north on U.S. Highway 75 at 65 mph. What happened next:

**1** The 18-wheeler went from the right lane to the passing lane. Then, without slowing, it began to veer to the left, through the grassy median and into southbound traffic.

**2** The 80,000-pound rig rammed the front-left corner of Lisa Martin's Ford Expedition. In the passing lane, Manuel Esparza's Ford F-150 pickup slammed into the side of the 53-foot trailer.

**3** The pickup was nearly torn apart, but remained in the roadway. Five occupants died, two were injured. The 18-wheeler dragged the SUV into the grass and rolled it over. Both vehicles rolled over. Both vehicles caught fire. All five people in the SUV died. Mr. Jozwiak suffered minor injuries.



SOURCE: National Transportation Safety Board; Sherman Police Department

SERGIO PEÇANHA/Staff Artist

Motorcoach Median  
Crossover and Collision  
With Sport Utility Vehicle  
Hewitt, Texas  
February 14, 2003



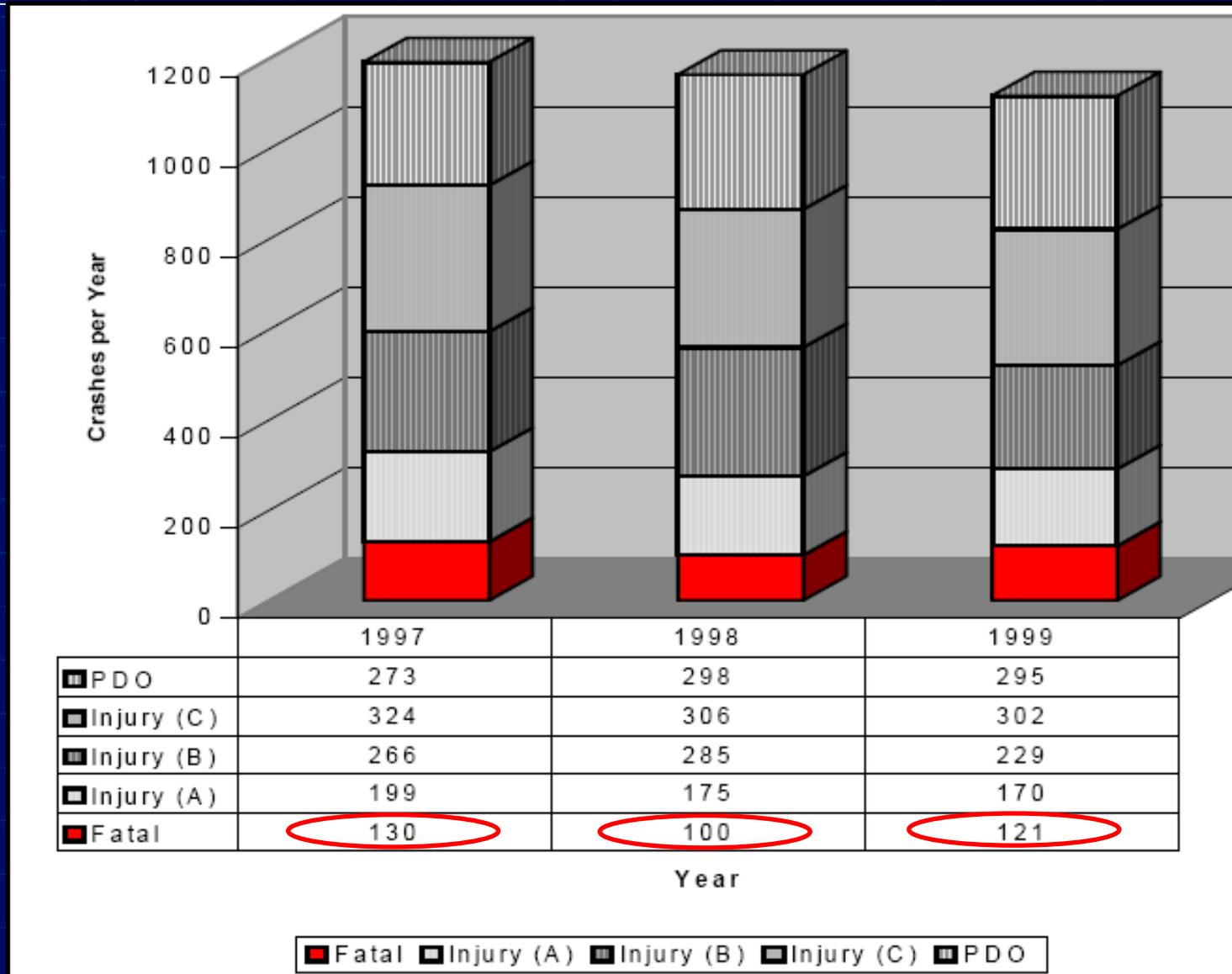
Highway Accident Report  
NTSB/HAR-05/02

PB2005-916202  
Notation 7727A



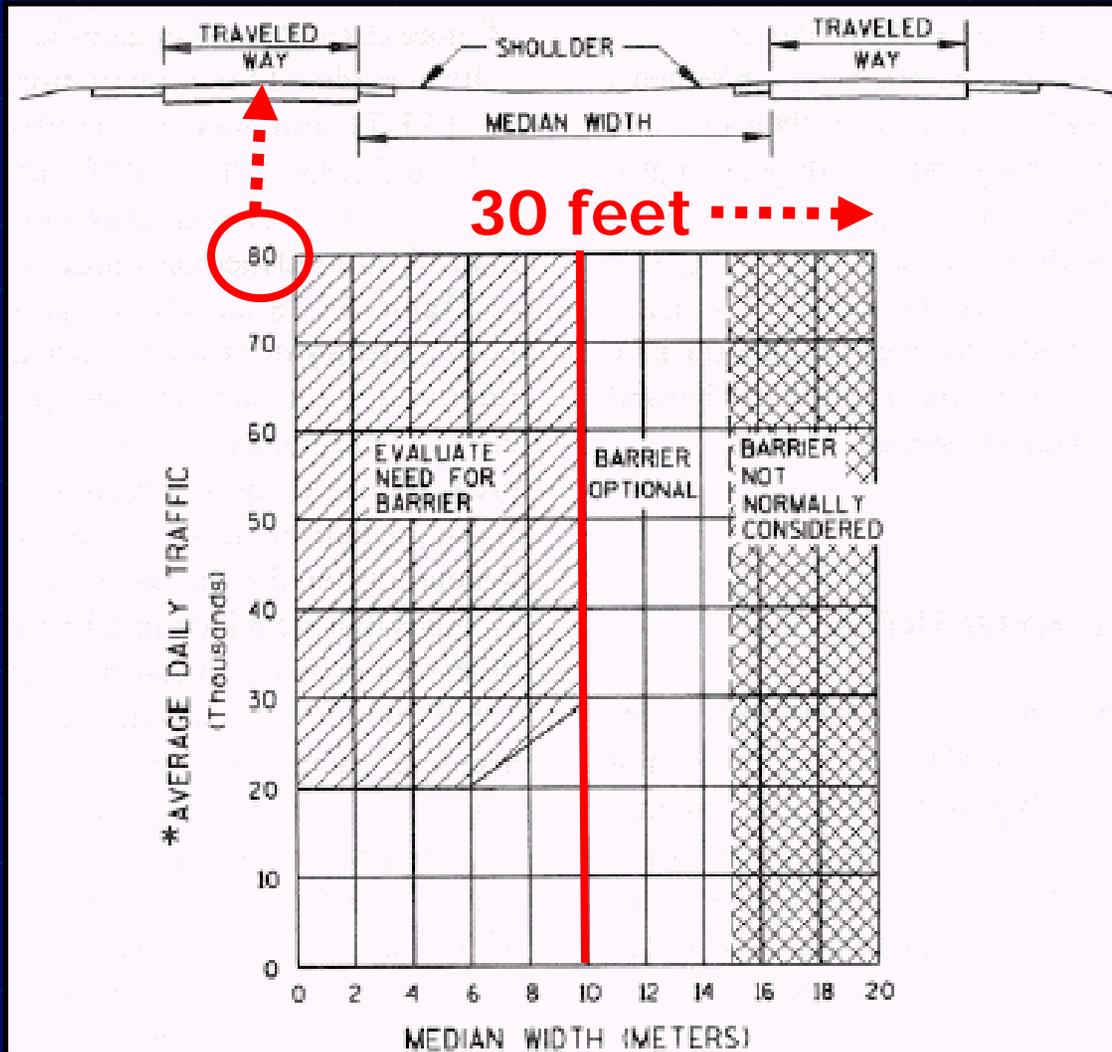
National  
Transportation  
Safety Board  
Washington, D.C.

# Cross-Median Crashes: Stats



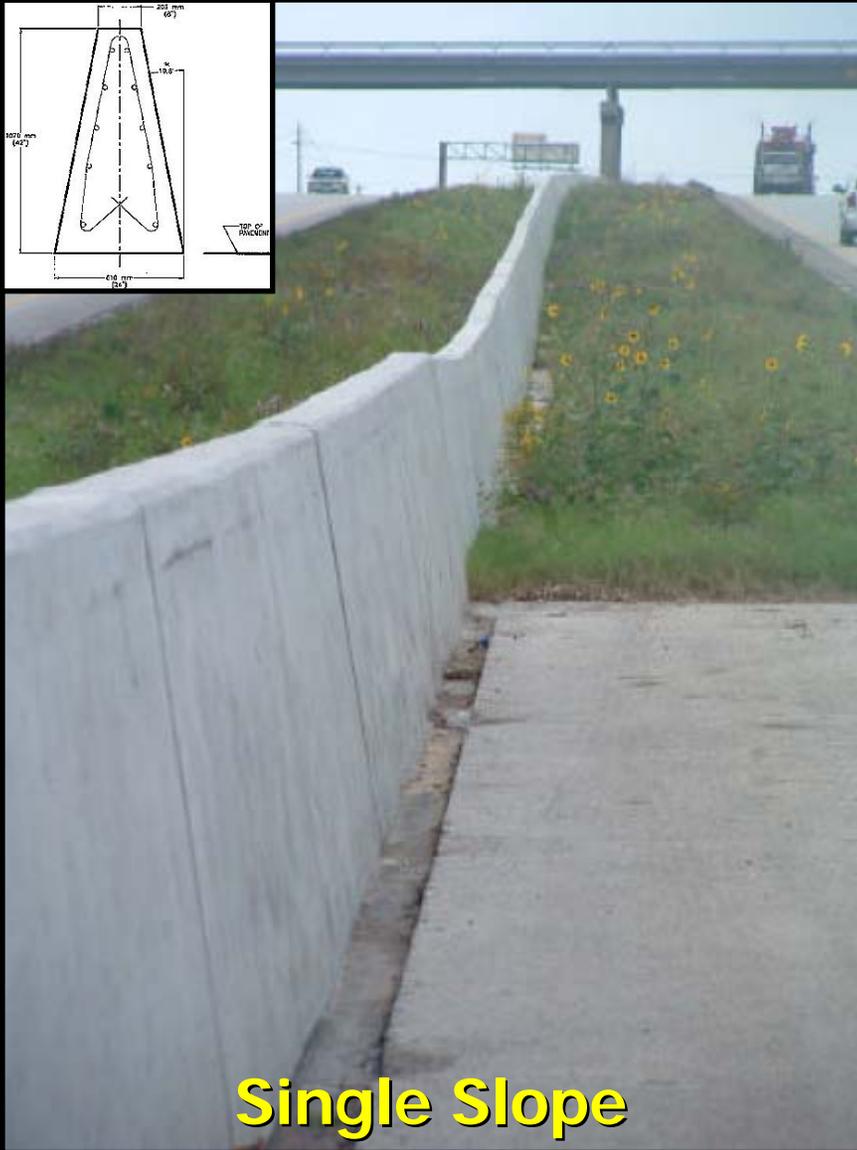
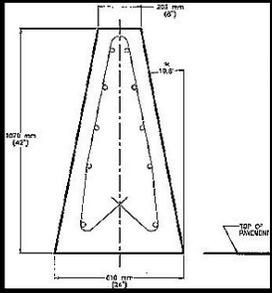


# Median Barrier Warrants

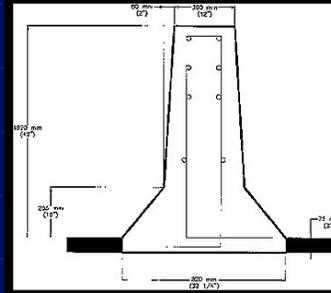




# Traditional Median Barriers



**Single Slope**



**Jersey**

# Cable Evolution in Texas

## Research support – Project 0-4254

Table 6-7. Benefit/Cost Ratios for Installing High-Tension Cable Barriers over Concrete Barriers: Favorability.

Median Width (ft)	AADT (in 1000)																									
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125
0	0	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.7	0.7
5	0	2.0	1.9	1.7	1.6	1.6	1.5	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8
10	0	2.1	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.8	0.8
15	0	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.1	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9
20	0	2.2	2.0	1.9	1.8	1.7	1.7	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.9
25	0	2.1	2.0	1.9	1.8	1.7	1.7	1.6	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0
30	0	2.0	1.9	1.8	1.8	1.7	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0
35	0	2.0	1.9	1.8	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1
40	0	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1
45	0	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.1
50	0	1.8	1.8	1.7	1.7	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2
55	0	1.8	1.8	1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2
60	0	1.8	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2
65	0	1.8	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3
70	0	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3
75	0	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3
80	0	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3
85	0	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3
90	0	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
95	0	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
100	0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
105	0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4
110	0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4
115	0	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4
120	0	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4
125	0	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4

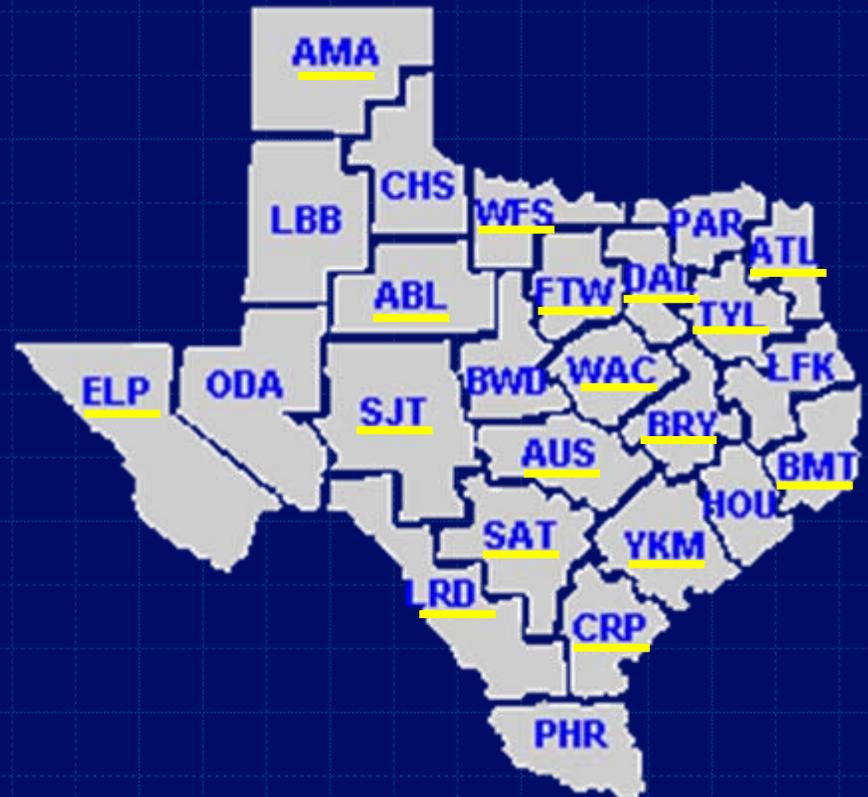
**B/C ≥ 1.5**

\*Based on a 4-lane, 65 mph (88 km/hr) posted speed limit scenario

\*\*Due to the deflection characteristic of cable barriers upon impact, installing on medians with a width less than 20 ft is usually not appropriate

# Cable Evolution in Texas

- ◆ Safety bond \$\$\$ - 600 million
- ◆ \$157 million for cable median barrier
  - 94 projects
  - 738 miles
- ◆ \$30 million
  - Both CTB and cable
  - 85 miles
- ◆ 17 of 25 Districts



# Cable Evolution in Texas

## ◆ Cost, availability and experience

- Gibraltar
- Brifen
- Trinity
- NUCOR/GSI



U.S. Department of Transportation  
Federal Highway Administration

2006

Priority, Market-Ready Technologies and Innovations

### Cable Median Barriers

New

**Problem:** An alternative to traditional concrete and metal-beam barriers is needed because these structures can be expensive and difficult to install.

Median crossover crashes often result in fatalities or severe injuries to occupants of the errant vehicle and the motorists in the opposing traffic lanes. State departments of transportation (DOT) are interested in reducing median crossover crashes through the use of median barriers. The concrete and metal beam barriers traditionally used to prevent these crashes, however, are difficult to install on sloped terrain where their performance is often suboptimal. In addition, concrete and metal beam barriers are expensive, and State and local agencies often lack the resources to rapidly deploy these technologies to areas where vehicles frequently cross over the adjacent medians.

**Putting it in Perspective**

Many States have collected data that demonstrate the significant impacts of cross-median crashes:

- Between 1990 and 1999, only 2.4 percent of all interstate crashes in Iowa were cross-median crashes, yet these crashes resulted in 32.7 percent of all interstate fatalities.
- From 1999 to 2000, more than 70 people in South Carolina lost their lives in 57 separate interstate crossover median crashes.
- North Carolina DOT has found cross-median crashes to be three times more deadly than other freeway crashes. Cross-median barriers are expected to lead to an estimated 90 percent reduction in these types of collisions.

**Solution:** Promote the accelerated deployment of cable median barriers

As an alternative to concrete and metal beam barriers, some States are turning to cable median barriers in areas where there is sufficient median width and a high potential for crashes.

Although cable barriers have been used since the 1960s, it was not until the 1990s that some State DOTs started using a modified cable rail as a median barrier. Today, many States, including Arizona, Colorado, North Carolina, Ohio, Oklahoma, Oregon, South Carolina, Utah, and Washington State, are installing cable barriers in medians originally built without barriers. New data suggest that cable median barriers are an effective

Recent research shows that cable median barriers are more forgiving than traditional concrete and metal beam barriers and can be effective when installed on sloping terrain. Collision forces are deflected laterally thereby reducing the forces transmitted to vehicle occupants.

Left: A standard three-strand cable median barrier is shown.  
Below: A high-tension four-strand cable median barrier is shown.

SAFETY & DESIGN



# Cable Evolution in Texas

## ◆ I-820 – Fort Worth

- Summer 2003
- 1 mile Brifen



# 5609 Research

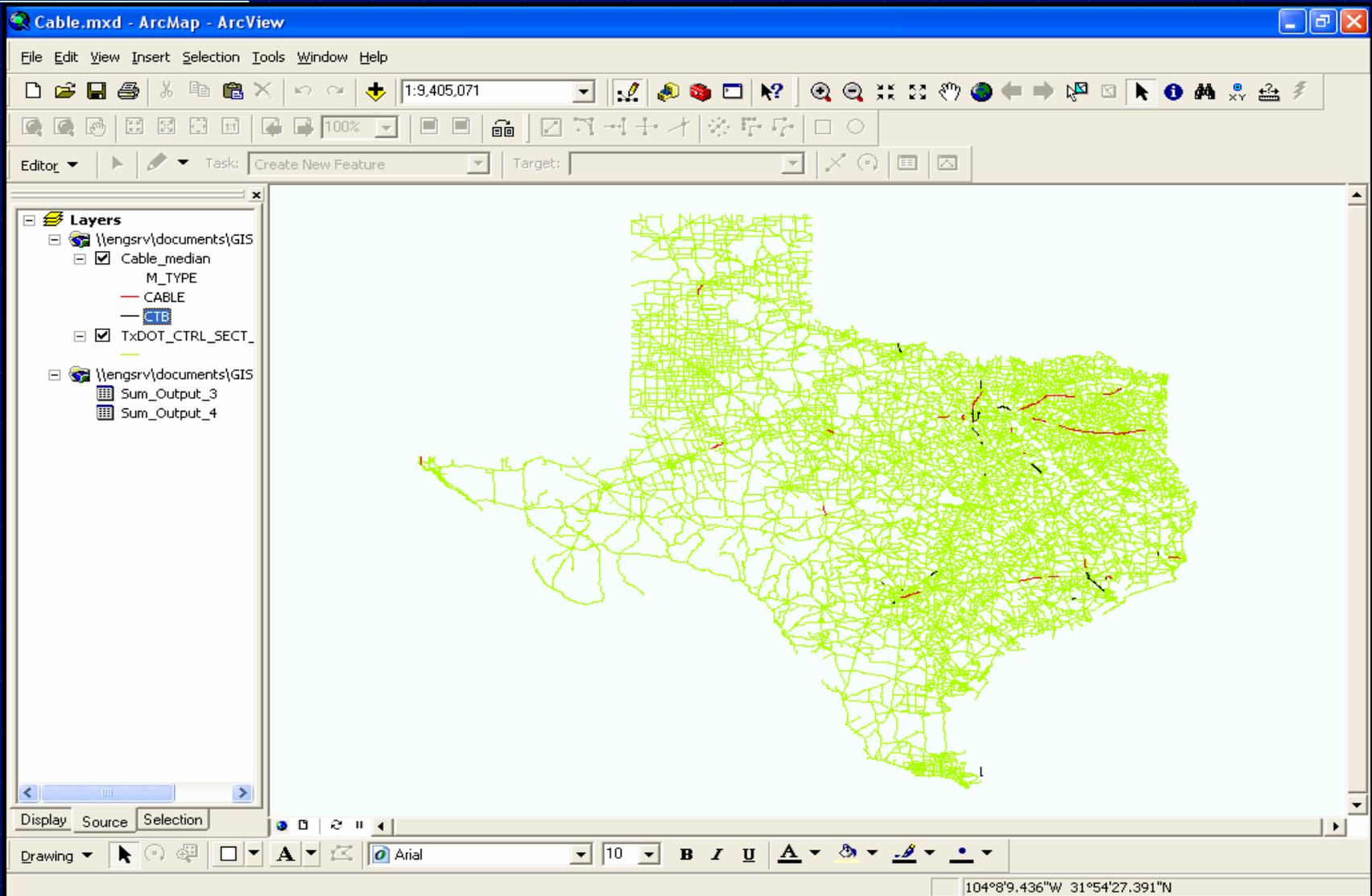
- ◆ Cable in-service performance evaluation
  - Maintenance
  - Safety
- ◆ Comparison of cable vs. concrete
- ◆ 18-month project
  - Completion in February 2008



# 5609 Research

- ◆ In-Service Evaluation of Cable Median Barrier Performance
- ◆ Program Coordinator – **A. Rory Meza (DES)**
- ◆ Project Director – **Roy Parikh (FTW)**
- ◆ Project Advisors
  - **Jimmy Bodiford (FTW)**
  - **Brian Crawford (ABL)**
  - **Bobby Dye (DES)**
  - **Darwin Myers (DAL)**
  - **Grover Schretter (FTW)**
  - **Lance Simmons (ATL)**

# 5609 Research: GIS Analysis



**Note: red line = cable barrier and black line = concrete barrier**

# Key Issues



## ◆ Design

- Placement
- Test level
- Post type
- Anchor

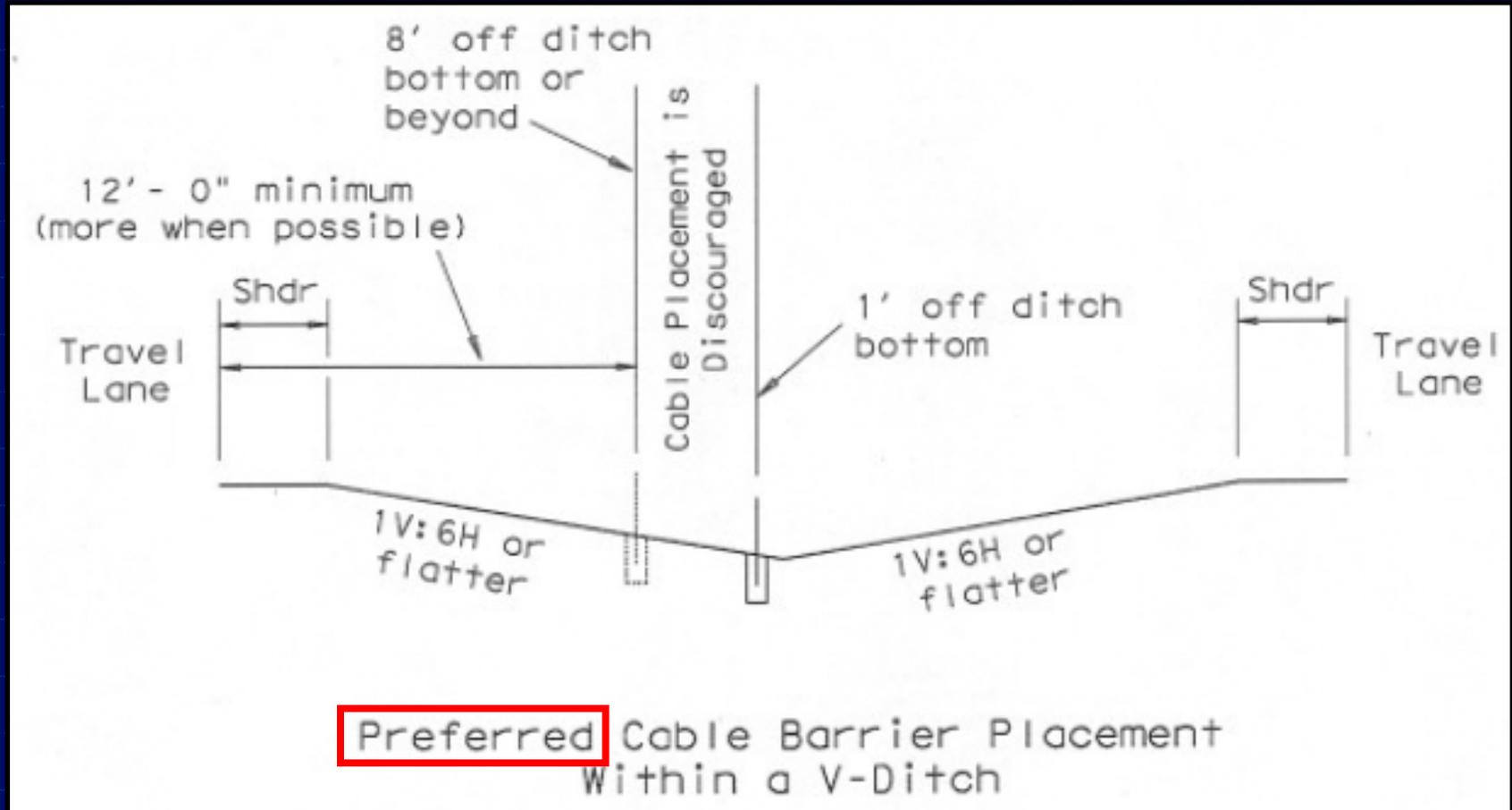
## ◆ Maintenance

- Impacts
- Repair

## ◆ Safety



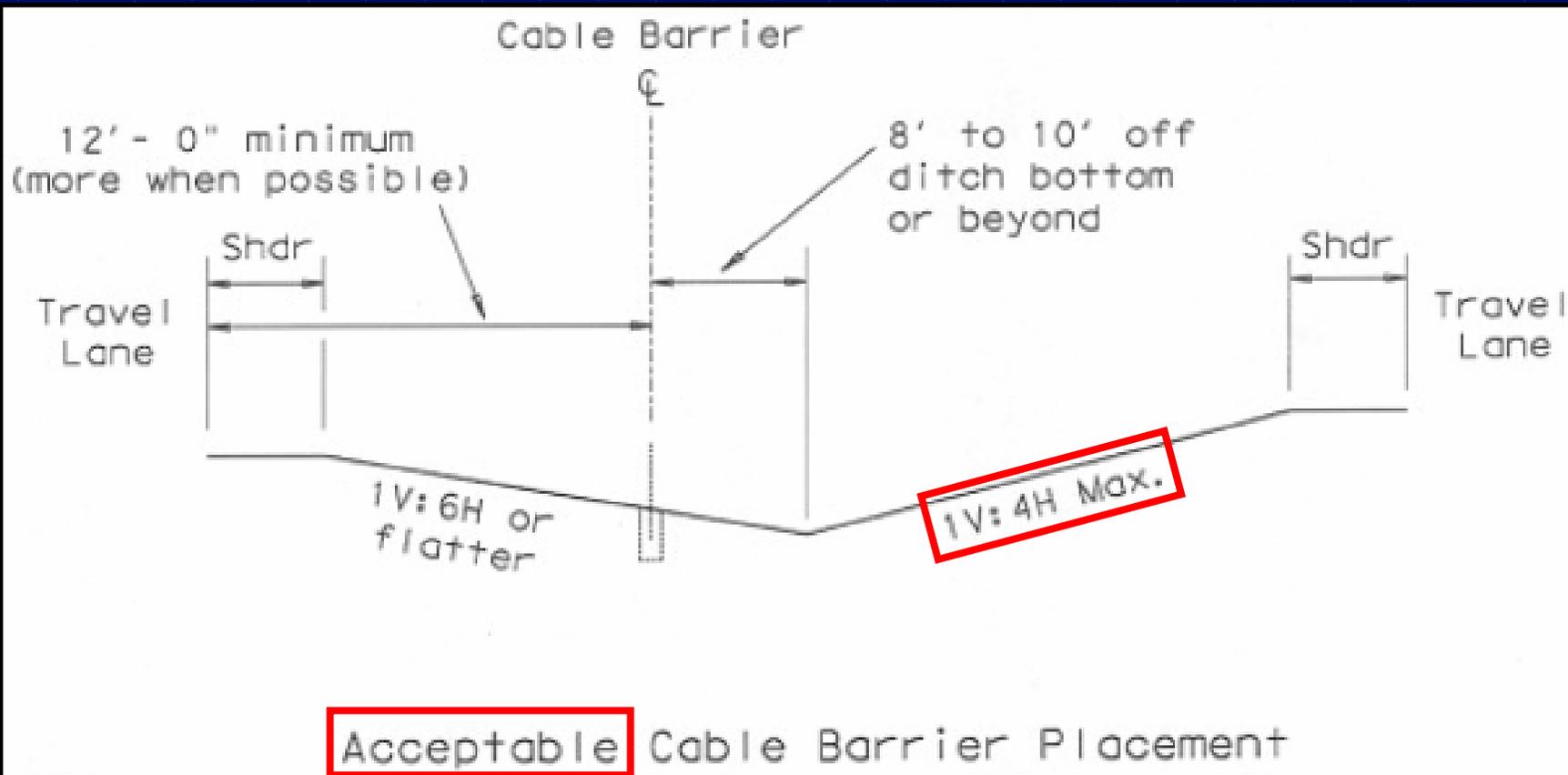
# Design: Placement



TxDOT Design Division memorandum dated June 21, 2006



# Design: Placement



TxDOT Design Division memorandum dated June 21, 2006



# Design: Placement

- ◆ Shoulder
  - Higher frequency of impacts
  - Maintenance concerns
- ◆ Median
- ◆ Both sides





# Design: Placement

- ❖ Provision of emergency crossovers
  - Enforcement
  - Response time
- ❖ Utilize overpass locations





# Design: Test Level

- ◆ NCHRP 350
  - TL-3
  - TL-4
- ◆ Primary consideration is truck percentage



# Design: Post Type



**Socketed**



**Mow Strip**

# Key Issue: Anchor Design

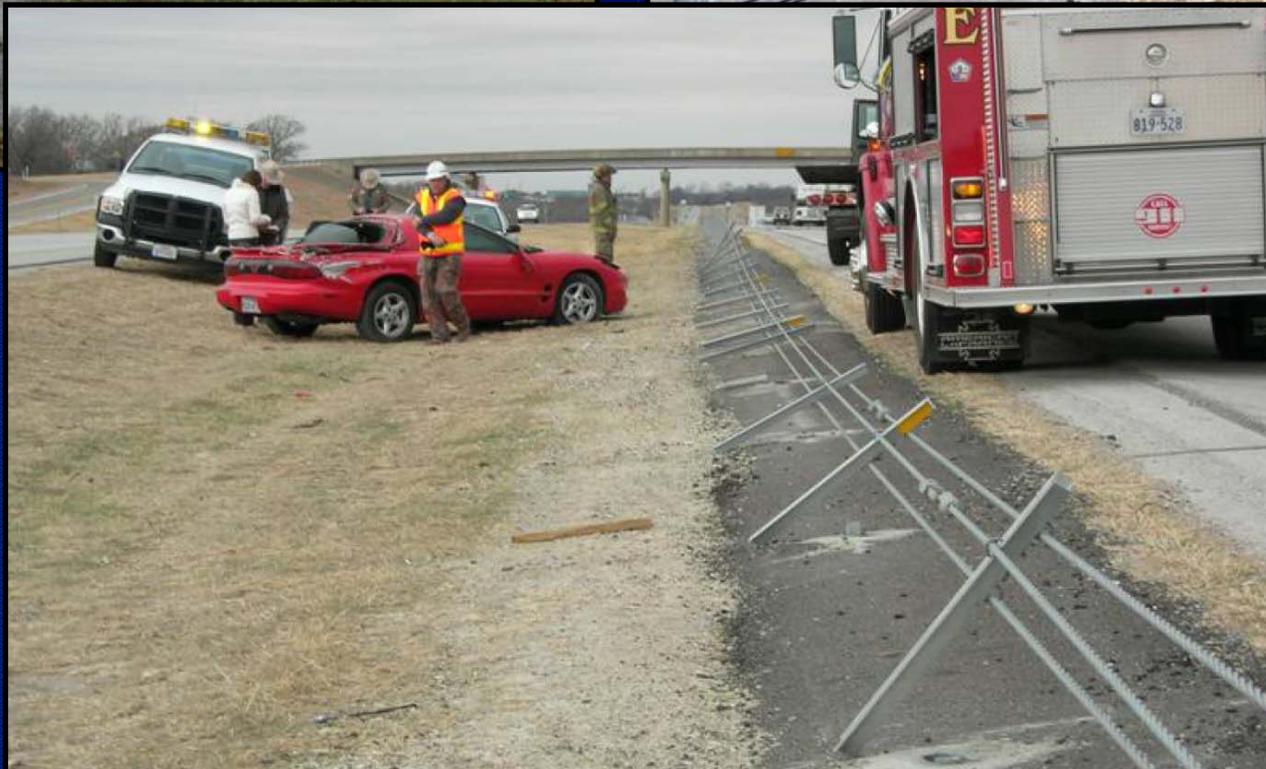


- ❖ Soil conditions
- ❖ Weather concerns



**I-20 Kaufman County**

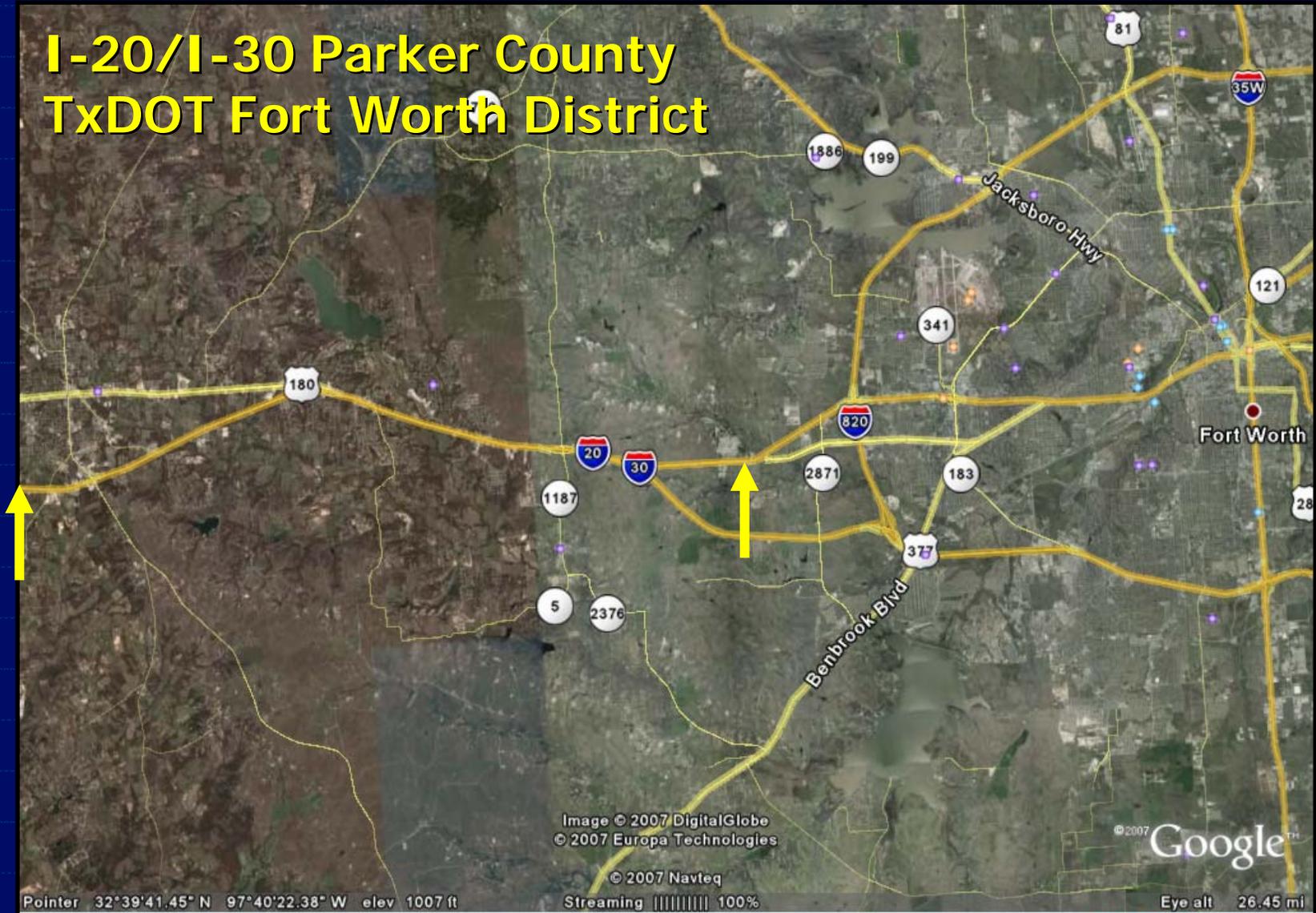
# Maintenance: Impacts



# Maintenance: Impacts



## I-20/I-30 Parker County TxDOT Fort Worth District



# Maintenance: Impacts



Barrier	# of Impacts	Avg. Posts	Avg. Men	Avg. Time (hrs)	Volume Range
<b>Brifen</b> <sup>1</sup>	<b>65</b>	<b>6.6</b>	<b>3.75</b>	<b>1.26</b>	<b>70 – 77K</b>
<b>Trinity</b> <sup>1</sup>	<b>76</b>	<b>8.6</b>	<b>3.67</b>	<b>1.18</b>	<b>30 – 65K</b>
<b>NUCOR</b> <sup>2</sup>	<b>6</b>	<b>9.5</b>	<b>3.17</b>	<b>1.83</b>	<b>24 – 28K</b>
<b>TOTALS</b> <sup>3</sup>	<b>147</b>	<b>7.8</b>	<b>3.53</b>	<b>1.25</b>	<b>24 – 77K</b>

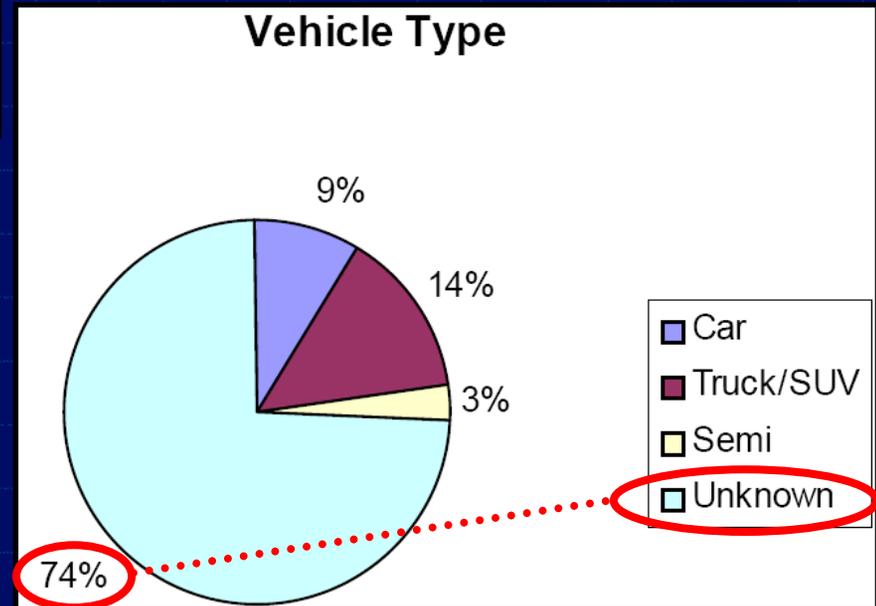
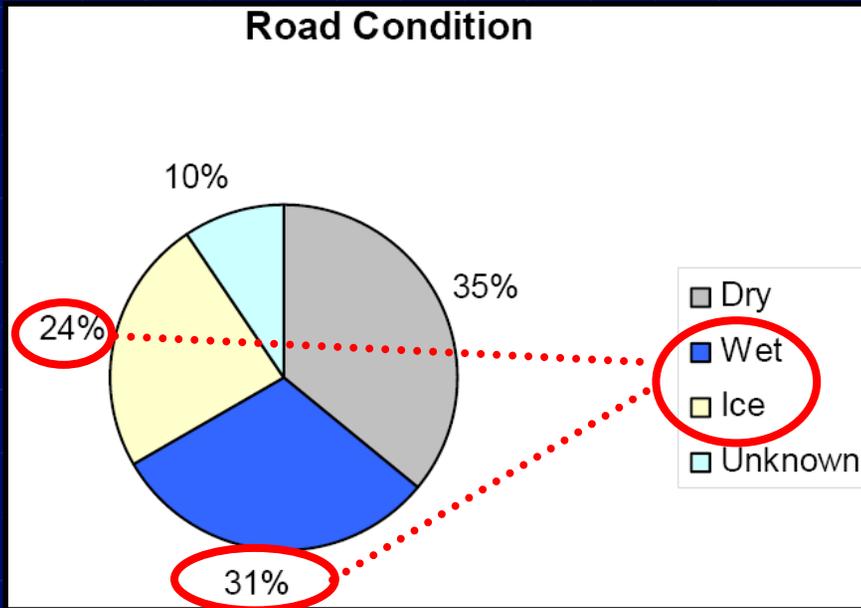
1 Brifen & Trinity data for 57 week time period

2 NUCOR data for 27 week time period

3 25 mile section on I-20/I-30 in Parker County



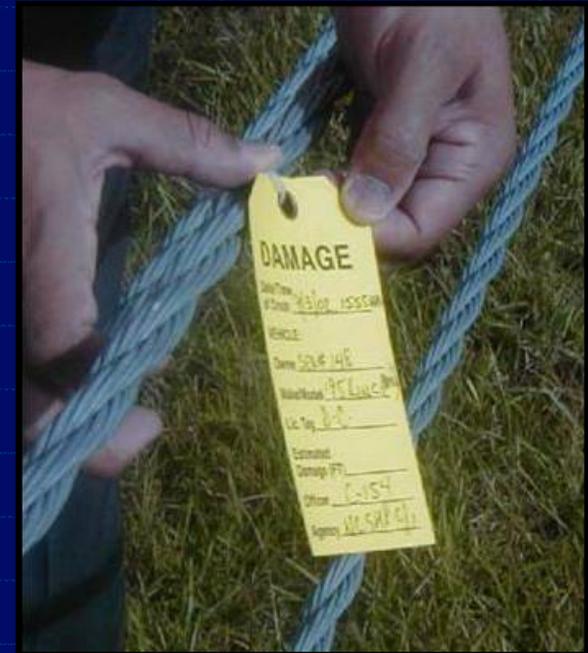
# Maintenance: Impacts



# Maintenance: \$ Recovery



- ◆ High % “unknown” vehicles
- ◆ North Carolina
  - State police damage tags
  - Significant improvement



Barrier Type	Hits	Total Property Damage	State Property Damage
Cable	1,592	\$9,599,568	\$955,763
Weak Post	567	\$3,669,675	\$419,775
W-Beam	1,266	\$8,778,927	\$488,260
Concrete*	67	\$379,900	\$3,250
<b>Total</b>	<b>3,486</b>	<b>\$22,428,070</b>	<b>\$1,867,048</b>

# Maintenance: Impacts



# Maintenance: Impacts

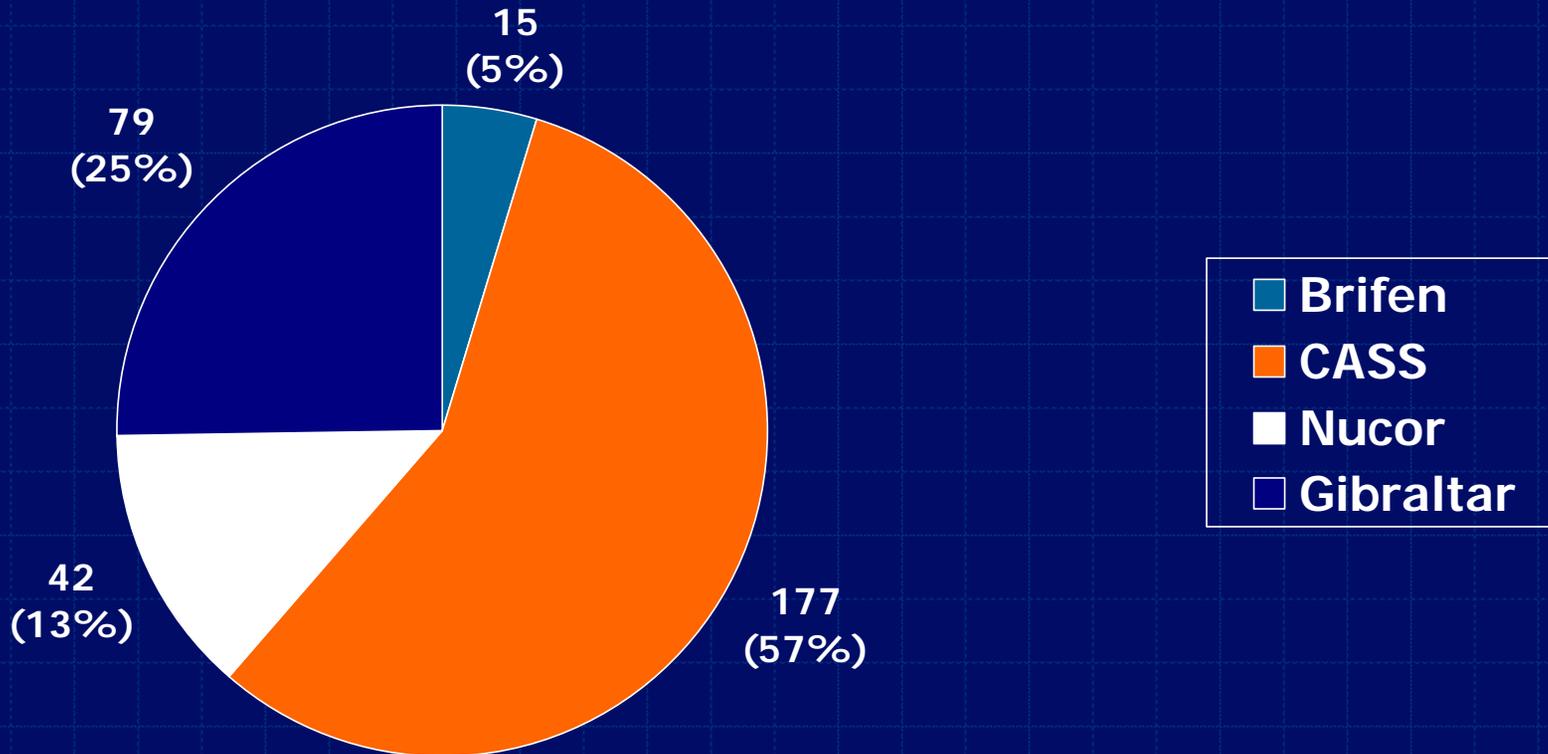


<b>District</b>	<b>San Antonio</b>	
<b>Roadway</b>		
<b># of Miles</b>	<b>19</b>	
<b>Barrier Type</b>	<b>NUCOR/GSI</b>	
<b>Dates</b>	<b>August 2006 – April 2007</b>	
	<b>Total</b>	<b>Average</b>
<b># of Impacts</b>	<b>83</b>	<b>9.7/month</b>
<b>Linear Damage (ft)</b>	<b>11,964</b>	<b>140.8</b>
<b># of Posts</b>	<b>690</b>	<b>8.1</b>

# Maintenance: Mileage



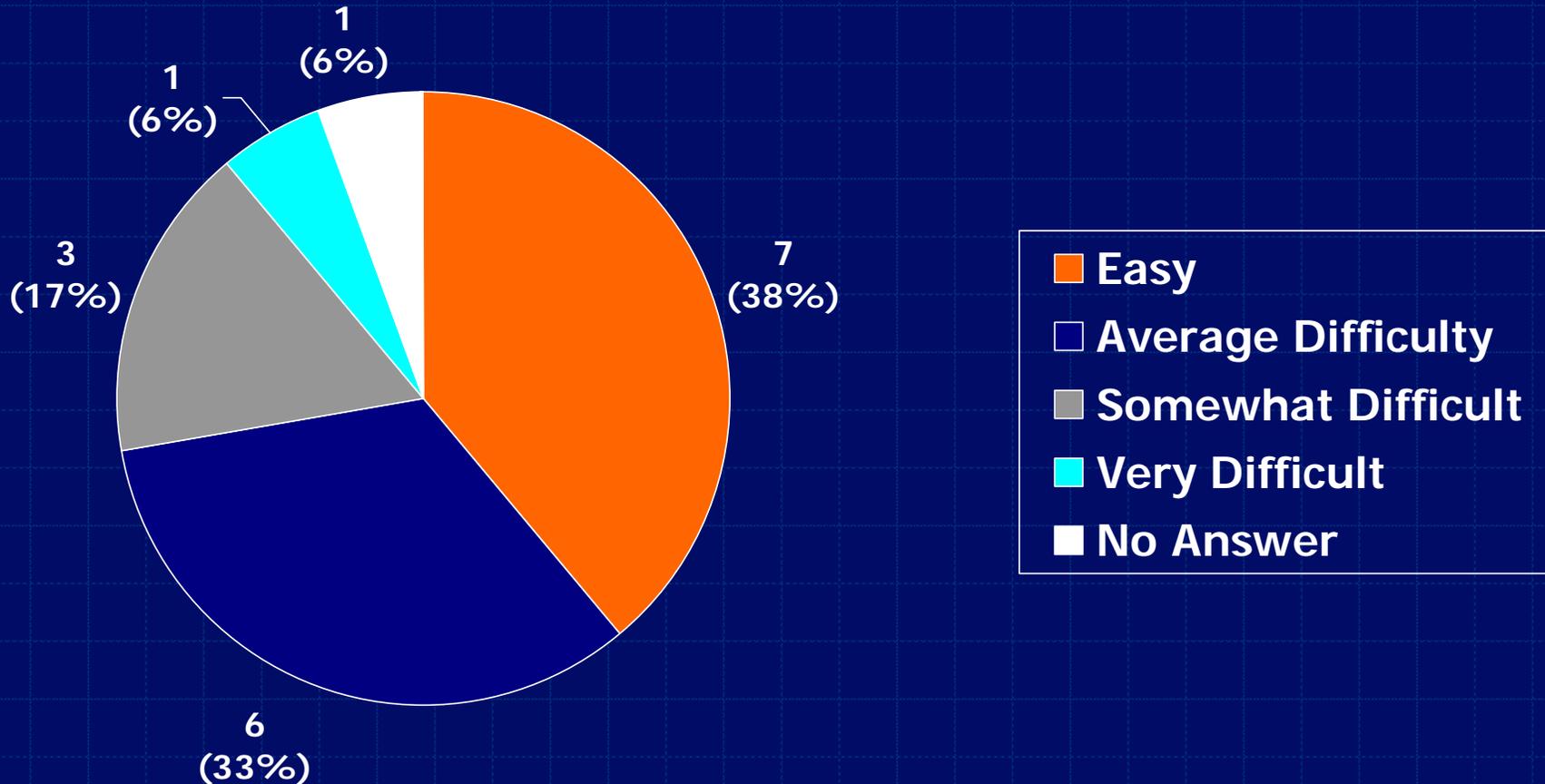
## Total Miles of Different Types of Cable Barrier System Installed in Texas



# Maintenance: Repair



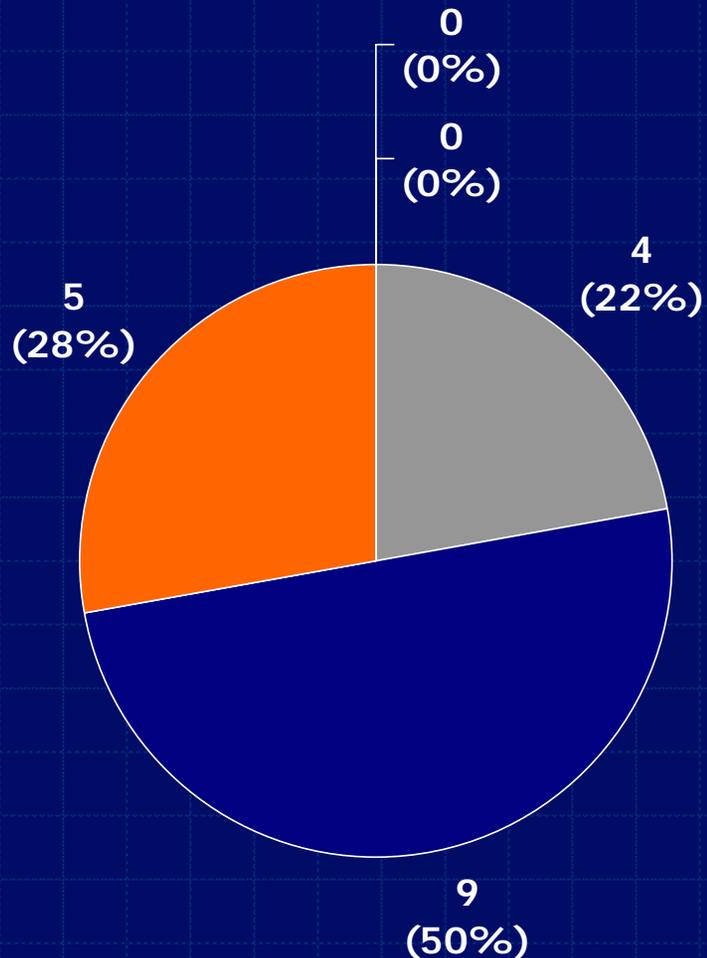
## Level of Difficulty in Repairing the Cable Barrier System



# Maintenance: Repair



## Availability of Repair Parts

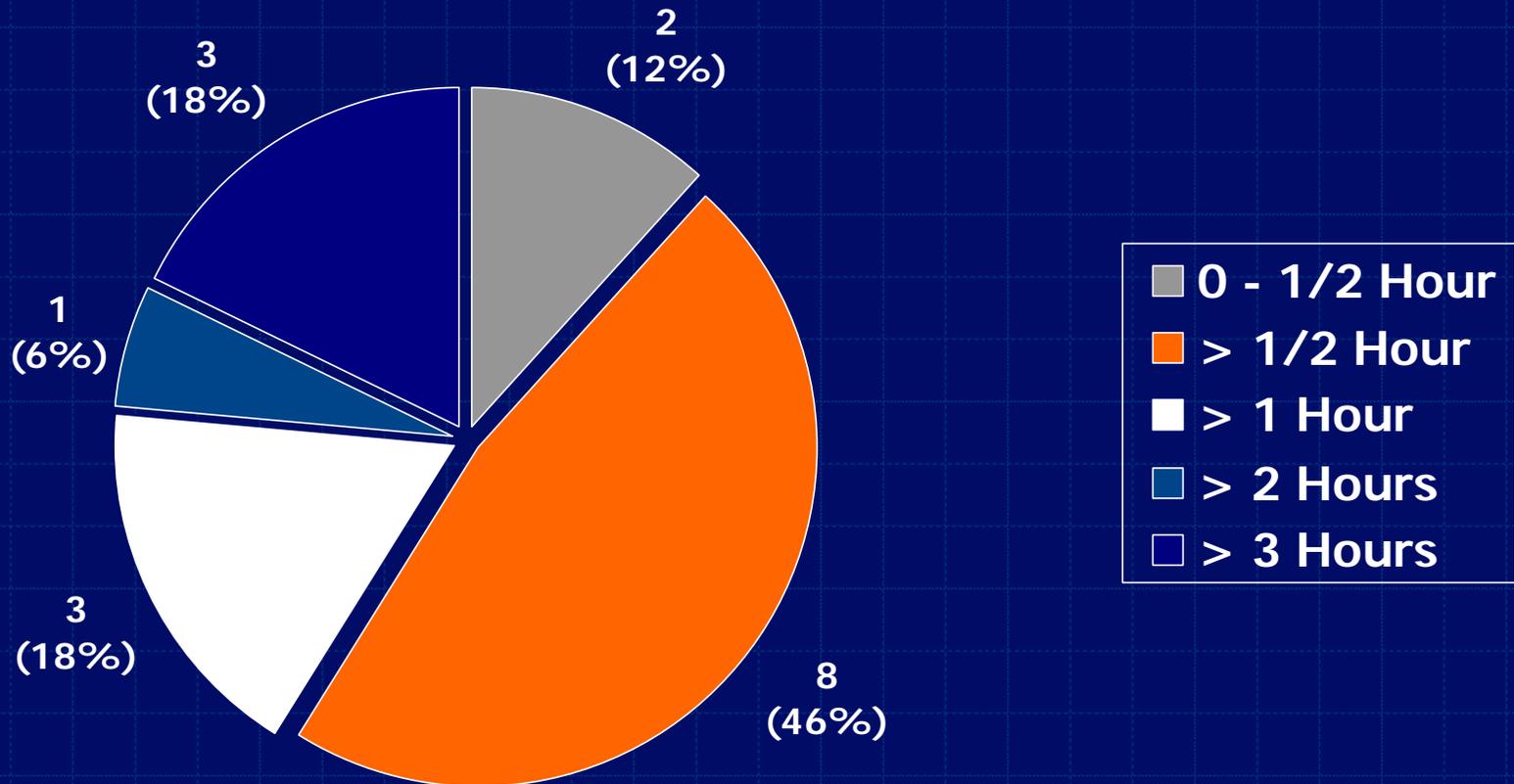


- Always Available
- Average Availability
- Somewhat Difficult
- Very Difficult
- No Answer

# Maintenance: Repair



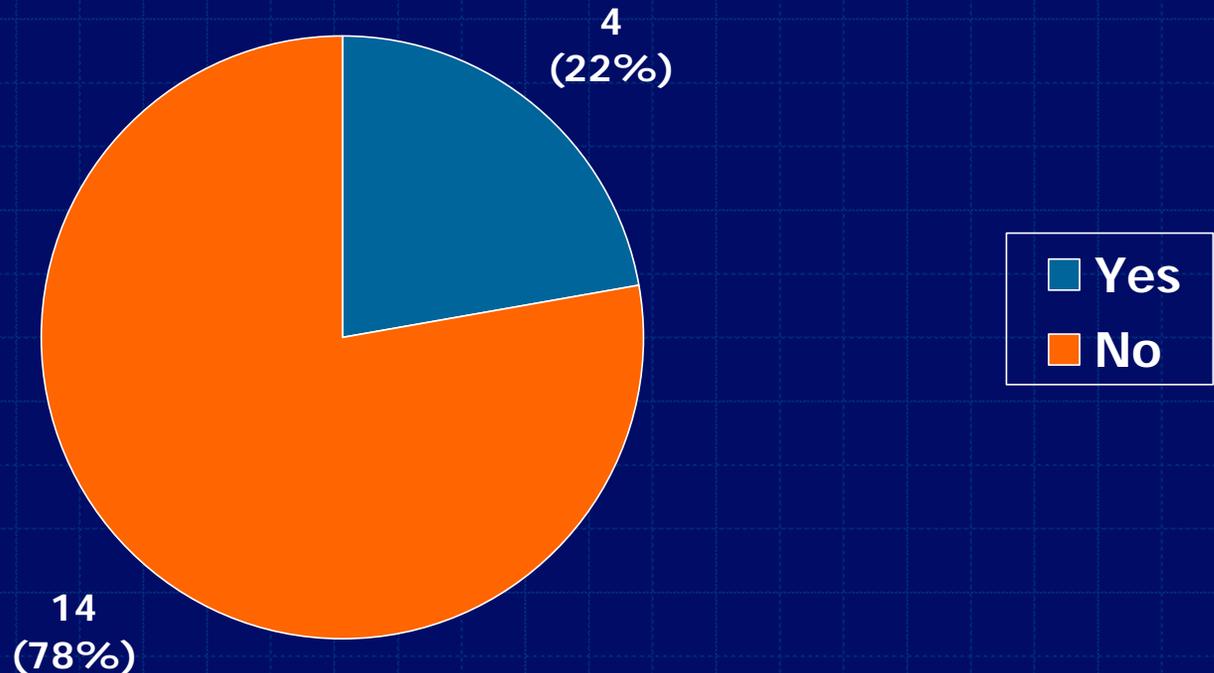
## Average Time Spent on Repairs



# Maintenance: Containment



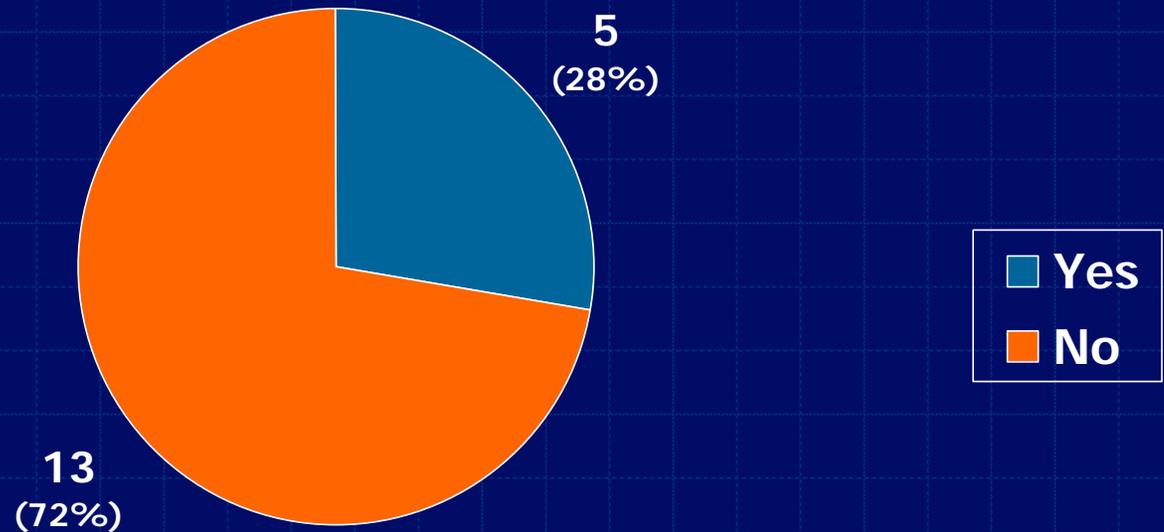
**Number of Maintenance Sections with Penetration of Passenger Vehicles through the Cable Median Barrier System**



# Maintenance: Containment



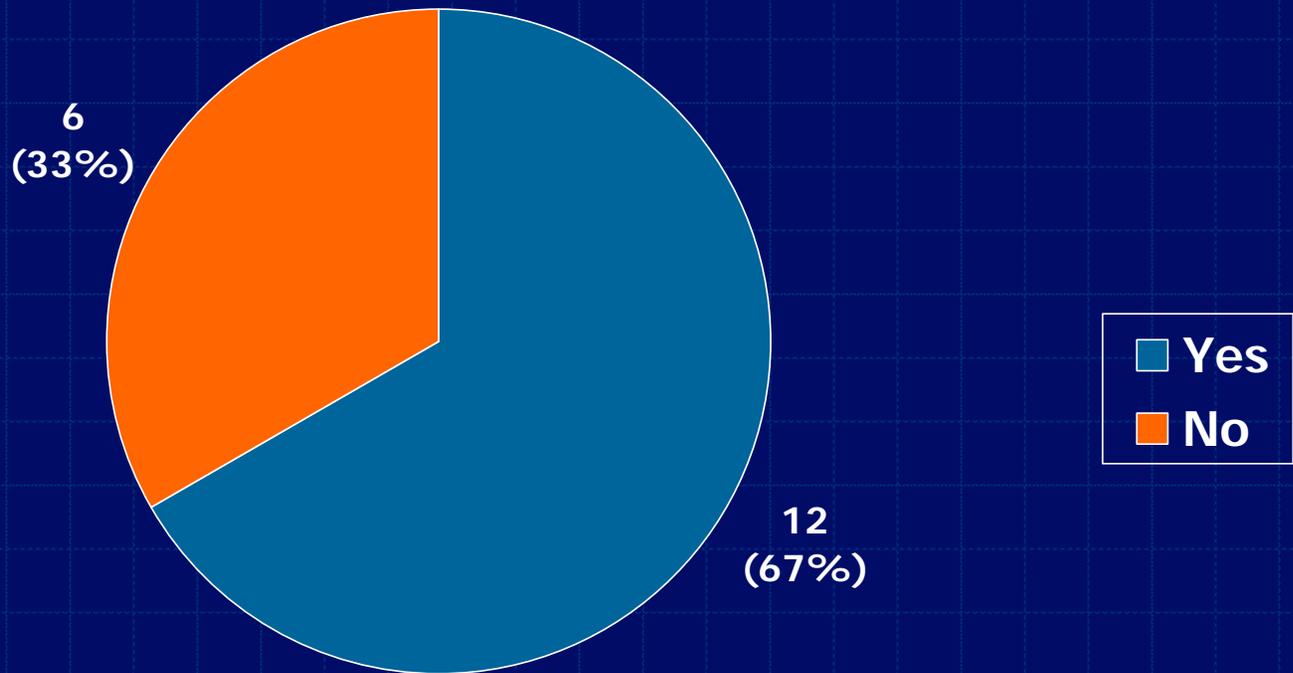
## Number of Maintenance Sections with Penetration of Trucks through the Cable Median Barrier System



# Maintenance: Mow Strips



## Number of Maintenance Sections with Mow Strips along the Cable Barrier System Installation



# Safety: Fatal Crashes



◆ One year before and after - 335 mi. of cable

One-year Pre-Installation		One-year Post-Installation	
Cross-Median Fatal Crashes	Cross-Median Fatalities	Cross-Median Fatal Crashes	Cross-Median Fatalities
<b>47</b>	<b>52</b>	<b>1</b>	<b>1</b>

# Wrap-up: Website

Homepage – [www.medianbarrier.net](http://www.medianbarrier.net)

Median barrier research - Mozilla Firefox

File Edit View History Bookmarks Tools Help del.jcio.us

http://www.medianbarrier.net/

## In-Service Evaluation of Cable Median Barrier Performance



[HOME](#) [LINKS](#) [TEAM MEMBERS](#) [IMAGES](#) [SCHEDULE](#) [CONTACT US](#) [CABLE REPAIR LOG](#)

When they occur, cross-median crashes are typically very violent in nature and have a high probability of multiple serious injuries and deaths. Many of these severe cross-median crashes can be prevented with adequate barrier protection. In order to maximize the amount of barrier put in place, TxDOT has started to install cable median barrier systems (sometimes referred to as wire rope or wire safety fence) in addition to traditional concrete barriers. Cost data has shown that cable barriers are approximately one-third the cost of concrete barriers per mile, making them a cost-effective option. There have generally been four NCHRP Test Level 3 cable barrier products installed in Texas: (1) Brifen wire rope safety fence, (2) Trinity Industries CASS™, (3) Nucor Steel Marion High Tension Cable and (4) Gibraltar. Three NCHRP 350 Level 4 systems are also available for use in Texas.

This project will assess and document the in-service performance of the various cable barrier installations in Texas. The research will evaluate TxDOT's experience with cable median barrier by analyzing its installation cost, maintenance costs, maintenance experiences, and crash history before and after implementation. The project will develop recommendations and guidelines to direct TxDOT staff for future cable median barrier installations.

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W3C XHTML 1.0 | W3C CSS 2.0

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# Wrap-up: In-Service Assistance

## Cable Barrier Maintenance/Repair Log Form Page

A SURVEY: Maintenance/Repair Log - Mozilla Firefox

File Edit View History Bookmarks Tools Help deljicio.us

http://medianbarrier.net/phpsurveyor/index.php?sid=2

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### Maintenance/Repair Log

Wire Cable Median Barrier Systems

There are questions in this survey.

#### ACCIDENT INFORMATION

01: DATE (M/D/YR)

Format: YYYY-MM-DD  
(eg: 2003-12-25 for Christmas day)

02: LIGHT CONDITION

Choose only one of the following

Please choose..

03: TIME

03A: DISTRICT

03B: MAINTENANCE SECTION

04: ROAD CONDITION

Choose only one of the following

Please choose..

05: HIGHWAY

06: APPROX. REFERENCE MARKER

07: DIRECTION OF TRAVEL

Choose only one of the following

Please choose..

08: VEHICLE TYPE

Choose only one of the following

Please choose..

09: PROPERTY DAMAGE ONLY

Choose only one of the following

Please choose..

Done

McAfee SiteAdvisor AdBlock



# Wrap-up: Conclusions

- ◆ Texas is aggressively installing cable median barriers
- ◆ Preliminary results are positive
- ◆ For more information:
  - Project 0-4254 median barrier guidelines report:
    - ◆ <http://tti.tamu.edu/documents/0-4254-1.pdf>
  - Contact me:
    - ◆ (817) 261-1661 or [s-cooner@tamu.edu](mailto:s-cooner@tamu.edu)