Session 6: Maintenance of Systems

FAST Act Guardrail Training
Highway Barrier Installer, Inspector and Maintenance Training

Session 6: Maintenance of Systems

Session 6 6-1

Session 6 Learning Outcomes

At the end of this session, you will be able to:

- Know how damaged barrier MAY BE assessed for maintenance response.
- Understand when a damaged barrier terminal MAY no longer function.
- Effectively delineate damaged hardware prior to repair.

Session 6 6-2

Introduction

- Barriers need routine inspection and maintenance.
- Barrier may need to be repaired after crashes or long term exposure.

Session 6 6-3

Need To Repair

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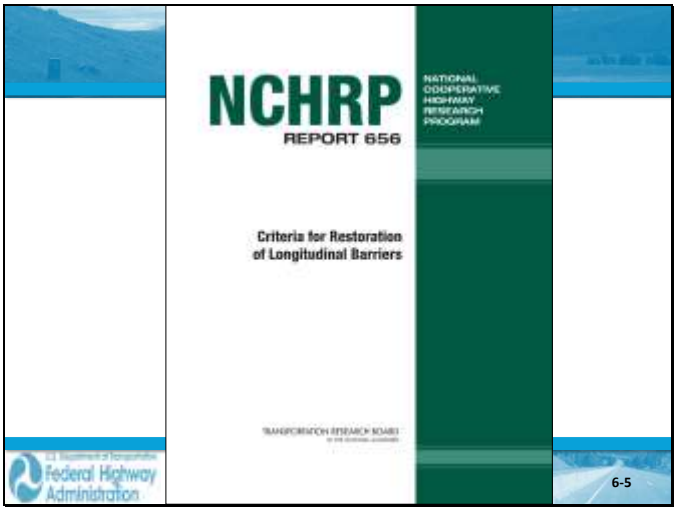

Federal Highway Administration | 6-5

Determine Extent of Damage

NCHRP Report 656 is intended to identify methods to better determine whether minor damage to W-Beam barriers poses a crash safety risk. It is intended to enable maintenance crews to prioritize repairs.

REF: NCHRP 656 – Criteria for Restoration of Longitudinal Barriers

Federal Highway Administration | Session 6 | 6-6

Modes of Barrier Damage

BARRIERS
(Based on experimental testing)

- Post and rail deflection
- Rail deflection only
- Rail flattening
- Posts separated from rail
- Missing/broken posts
- Missing blockouts
- Twisted blockouts
- Non-manufactured holes
- Damage at a rail splice
- Vertical tear
- Horizontal tear

End Treatments
(Based on Engineering Judgment)

- Damaged end post
- Anchor cable missing
- Anchor cable loose
- Anchor cable bracket
- Stub height
- Lag screws
- Bearing plate

Note: These evaluations were based on analysis of the "Old" system under 350 and not on MGS system.

REF: NCHRP 656 – Criteria for Restoration of Longitudinal Barriers

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Low Speed Impact Prior to Damage

REF: NCHRP 656 – Criteria for Restoration of Longitudinal Barriers

Federal Highway Administration | Session 6 | 6-8

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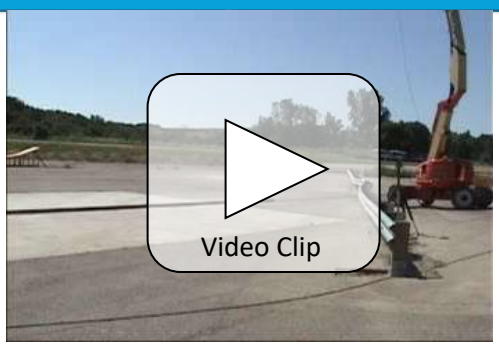
Test Level 3 After Damage

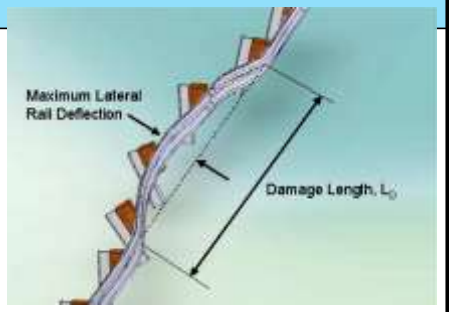
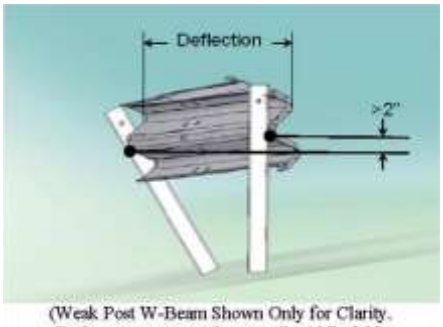


REF: NCHRP 656 – Criteria for Restoration of Longitudinal Barriers

Federal Highway Administration | Session 6 | 6-9

Barriers

NCHRP REPORT 656

Damage Mode	Repair Threshold	Relative Priority	Measurement
Post and Rail Deflection	One or more of the following thresholds: •More than 9 inches of lateral deflection anywhere over a 25 ft length of rail. •Top of rail height 2 or more inches lower than original top of rail height.	High	  (Weak Post W-Beam Shown Only for Clarity. Each measurement taken at rail middle fold)
	6-9 inches lateral deflection anywhere over a 25 ft length of rail.	Medium	
	Less than 6 inches of lateral deflection over 25 ft length of rail.	Low	


Damaged Materials: Barrier
Excessive deflection (>9") – recommended HIGH priority
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Session 6
6-11


Bends within compression-based terminal may cause unwanted buckling– little energy absorption – HIGH priority
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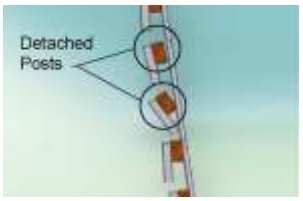
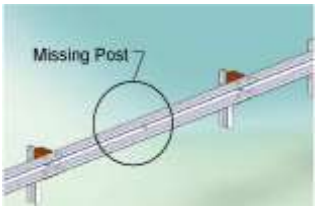
Session 6
6-12

Barriers

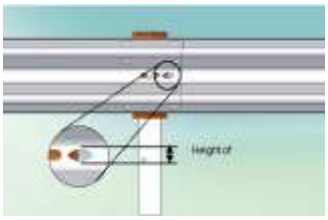
NCHRP REPORT 656

Damage Mode	Repair Threshold	Relative Priority	Measurement
Posts Separated from Rail	• 2 or more posts with blockout attached with post-rail separation less than 3 inches. • 1 or more post with post-rail separation which exceeds 3 inches.	Medium	
	• 1 post with blockout attached with post-rail separation less than 3 inches.	Low	Note: 1.If the blockout is not firmly attached to the post, use the missing blockout guidelines. 2.Damage should also be evaluated against post/rail deflection guidelines.
Missing/Broken Posts	1 or more posts •Missing •Cracked across the grain •Broken •Rotten •With metal tears	High	

Post separation - Recommended HIGH or MEDIUM priority

Barriers

NCHRP REPORT 656

Damage Mode	Repair Threshold	Relative Priority	Measurement
Non-Manufactured holes (such as crash induced holes, lug-nut damage, or holes rusted-through the rail)	• More than 2 holes less than 1" in height in a 12.5' length of rail. • Any holes greater than 1" height. • Any hole which intersects either the top or bottom edge of the rail.	High	
	1-2 holes less than 1" in height in a 12.5' length of rail.	Medium	

Federal Highway Administration

Session 6

6-15

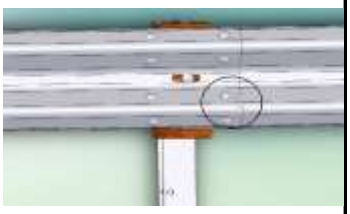
Federal Highway Administration

Session 6

6-16

Barriers

NCHRP REPORT 656

Damage Mode	Repair Threshold	Relative Priority	Measurement
Damage at a rail splice	More than 1 splice bolt: •Missing •Damaged •Visibly missing any underlying rail •Torn through rail	High	
	1 splice bolt: •Missing •Damaged •Visibly missing any underlying rail •Torn through rail	Medium	

U.S. Department of Transportation Federal Highway Administration

Session 6

6-17

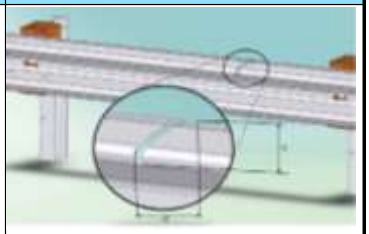
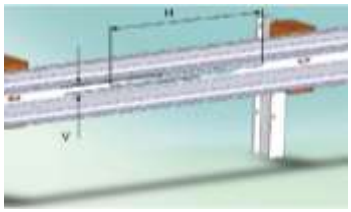
U.S. Department of Transportation Federal Highway Administration

Session 6

6-18

Barriers

NCHRP REPORT 656

Damage Mode	Repair Threshold	Relative Priority	Measurement
Vertical Tear	Any length vertical (transverse) tear	High	
Horizontal Tear	Horizontal (longitudinal) tears greater than 12 inches long or greater than 0.5 inches wide. Note: for horizontal tears less than 12 inches in length or less than 0.5 inches in height, use the non-manufactured holes guidelines.	Medium	


Barriers
Is it OK to use Weathering Steel (sometimes called Cor-Ten, A-588, or Rusting Steel) in longitudinal barriers?


Barriers
U.S. Department of Transportation
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Session 6
6-22

Terminals

NCHRP REPORT 656

Damage Mode	Repair Threshold	Relative Priority	Measurement
Damage End Post	Not functional (sheared, rotted, cracked across the grain)	High	
Anchor Cable	Missing	High	

End Terminals

- Check for nuisance hits on terminals to be sure post #1 is not damaged.
- Even with claims of "reusability" – use best judgment and closely examine all salvageable parts.
- Impact Heads may be re-usable based on state policy and manufacturers recommendations (generally say no).

Just BAD - HIGH


No tension capability – the head **may** work on head-on hit - HIGH
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Session 6
6-25


No tension capability – the head probably will work on head-on hit - HIGH
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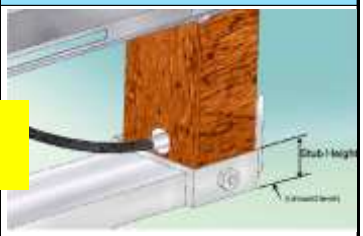
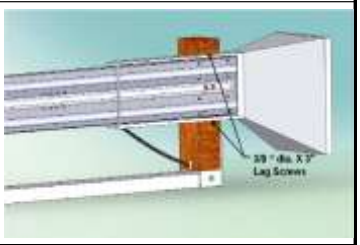
Session 6
6-26

End Terminals

NCHRP REPORT 656

Damage Mode	Repair Threshold	Relative Priority	Measurement
Stub Height	Height which exceeds 4”	Medium	
Lag Screws (Energy Absorbing Terminals Only)	Missing or failed lag Screws	High	

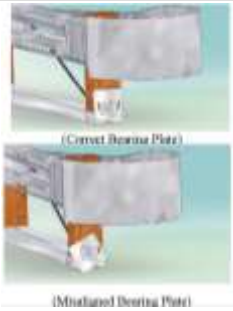
Caution: Excessive height could have severe consequences


FATAL FLAW
Federal Highway Administration
Session 6
6-29


Impact head not parallel to rail – don't know how serious
Just POOR construction
Federal Highway Administration
Session 6
6-30

End Treatments

NCHRP REPORT 656

Damage Mode	Repair Threshold	Relative Priority	Measurement
Bearing Plate	Loose or Misaligned	Medium	
	Missing Bearing Plate	High	 (Missing Bearing Plate)


Damaged Terminals
Can't explain but no tension - HIGH
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Session 6
6-33


Damaged Terminals
No tension, impact head damaged – doubtful work - HIGH
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Session 6
6-34


Other Problems?
Small tear and Incorrect lap – fairly LOW
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Federal Highway Administration
Session 6
6-35


Temporary Barrier Delineation
Delineate damaged areas while evaluating damage. Make repairs as soon as practical.
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Session 6
6-36


Temporary Barrier Delineation
Federal Highway Administration
Session 6
6-37


Temporary Barrier Delineation
Spear –worse than no tension – must be treated (drop beam) immediately- HIGH
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Session 6
6-38

Temporary Cable Repair

Removal of damaged posts will eliminate a spearing hazard for opposing traffic.

Federal Highway Administration

Session 6

6-39

Crash Cushion Repair

This is a blunt end until repaired. Good delineation.
Have manufacturer's Installation Manual available.

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Session 6

6-40


How Serious is this???
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Session 6
6-41


Crash Cushion Repair
Ensure all mounting hardware is correct, in place & properly secured.
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Session 6
6-42

Crash Cushion Repair

Typical QuadGuard Cartridges

Place proper cartridges in the correct system & in the proper order

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Crash Cushion Repair

ADIEM

Coating needs repair to protect from weathering degradation

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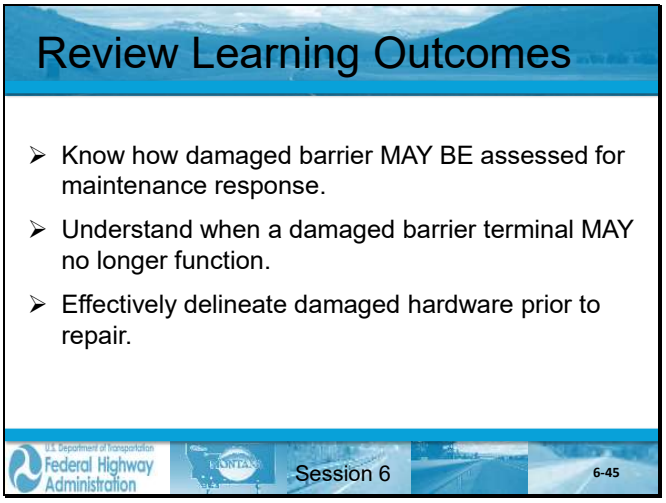
Review Learning Outcomes
Know how damaged barrier MAY BE assessed for maintenance response.
Understand when a damaged barrier terminal MAY no longer function.
Effectively delineate damaged hardware prior to repair.
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Session 6
6-45