FIELD INSPECTION RATING GUIDE FOR EXISTING GUARDRAIL

2020

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EXISTING GUARDRAIL FIELD INSPECTION GRADING

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GUARDRAIL FIELD INSPECTION RATING GUIDE

(F) PRIORITY
Replace

GRADE F

Unacceptable

Existing guardrail condition is poor, significantly damaged, or deteriorated towards its end of life.

Guardrail considered unable to absorb another vehicular impact and is a safety concern. A second impact results in unacceptable safety performance including barrier penetration and/or vehicle roll over.

Document unacceptable elements as a priority for consideration of replacement by all projects.

(D) DAMAGED
Repair

GRADE D

Damaged but functional

Existing guardrail condition is fair overall. Meets height standards. Isolated locations of damage, but no moderate or severe damage.

Guardrail considered functional - able to absorb additional vehicle impacts with acceptable safety performance.

Document damaged elements for repair, maintenance, or replacement under rehabilitation projects.

(A) ACCEPTABLE
Remain in place

GRADE A-B-C

New or Acceptable

Existing guardrail shows little or no damage.

Condition is excellent to fair with minimal damage. Posts and rail appear to be in good working condition.

Documented inventory or field inspection ratings are not required. No repairs identified.

GRADE F RAIL: Priority conditions- Replace

F-MISS-RAIL

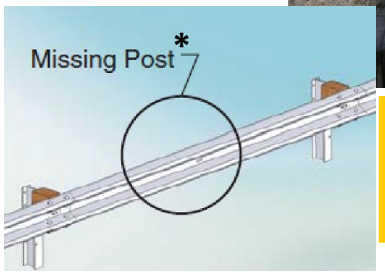
Missing Guardrail

- Replace as soon as crews are available
- Consider temporary barrier, crash cushions for extended periods (> 10 days during Construction)

F- MISS-POST

Missing / Broken Posts

- 1 or more posts missing, cracked across the grain, broken, rotted or with metal tears, disconnected from ground level.
- Includes end posts on guardrail terminals



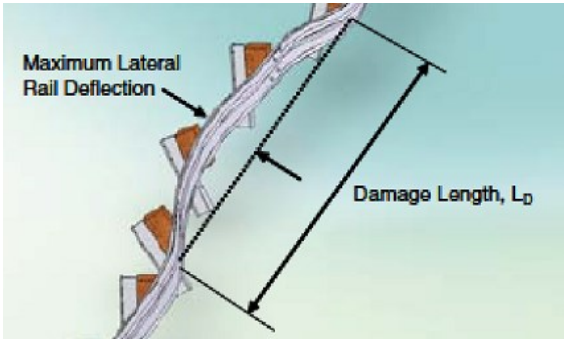
*Exception: Std Plan G-29 with 3 CRT posts each side

F-DEFL

Post & Guardrail deflection > 9''

Over a 25' length of guardrail (between any 4 standard posts):

More than 9'' of lateral deflection



F-HGT Existing Guardrail Height (in-service):

Too low or Too high

Over a 25' length of guardrail (between any 4 standard posts) top pavement to top rail:

Top of W-Beam guardrail less than 26 - 1/2" when spliced at post only (2017 and earlier installations.)

* Top of W-Beam or W31 rail higher than 32 "

* 28" required after raising pavement 29"(+3",-1")

(2011 AASHTO RDG

pg. 5-17, Std Plan G-04)

* Top of W31 guardrail less than 30" when spliced between posts. (2018 and later installations)

(Std Plan G-05)

*Height required when changing pavement elevation

F-IMPR-SPLC

Improper Splice

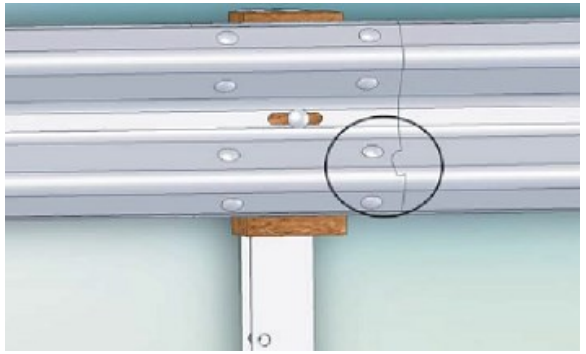
- Splice not consistently located at posts for older 29" guardrail. (≤29'' Height)
- Allowed at 3' midspan only for 31" guardrail per Std Plan G-05 as of 2018 forward, Not < 3' off adjacent post

F-SPLICE-BOLTS

Damage at guardrail splice (2 or more splice bolts damaged)

2 or more splice bolts:

- Missing
- Damaged
- Visibly missing any underlying guardrail
- Torn through guardrail



F-EMBD

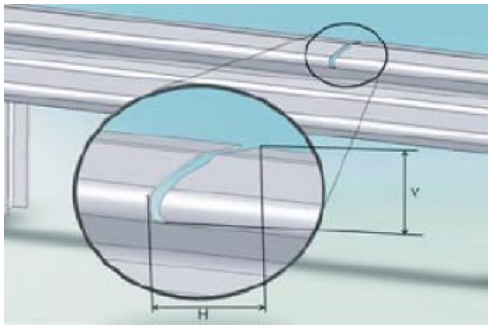
Loss of post embedment

More than one post too exposed due to erosion (6'-7' of post exposed) See Std Plan G-10

F-VERT-TEAR

Vertical Tear

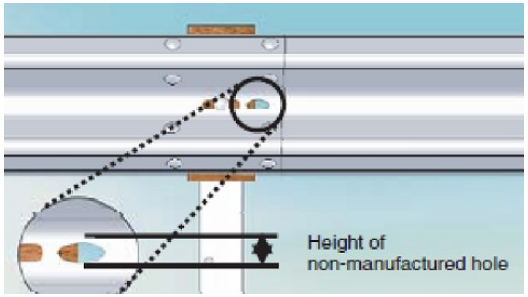
Any length vertical (transverse) tear



F-HOLES

Non-manufactured hole size, spacing

- Crash-induced holes, lug nut damage, or holes rusted through the guardrail, including:
- Any holes with a height greater than 1''
- More than 2 holes with a height less than 1'' over a 12.5' length of rail
- Any hole which intersects the top or bottom edge of guardrail



GRADE F TERMINALS: Priority conditions - Replace

FT-HIT-TERM

"Activated" or Kinked Energy Absorbing Terminal or Crash Cushion

Impacted terminal no longer functional.

Repair or replace during routine maintenance and during work zone activity.

More than one post sheared or cracked.

Damage to foundations that disallows repair.

FT-HGHT

Over length of terminal (37.5' to 50')

Terminal Height too low or too high:

Top of NCHRP 350 or BCT terminal is less than 26 - 1/2'' or > 30''

Top of MASH terminal is < 30'' or higher than 32''

FT-SLPD-END

Sloped concrete ends at 35 MPH+

Do not use for speeds of 35 MPH or higher within the clear zone

Only for temporary or low speed use of 30 MPH or less. (2011 AASHTO RDG 9.2.2)

FT-REFL

No web reflectors within 50' end terminal.
Post top reflectors OK

FT-TX-TWST

"Texas Twist"

"Texas twist" is a turned down guardrail end bolted to ground level

FT-MOD

Modified Terminals

No timber drainage barrier curb or open rock down drains within end terminal area 50'

No web reflectors on 50' terminals.

Use end delineators only.

FT-NO-TRANS

No stiffened transition

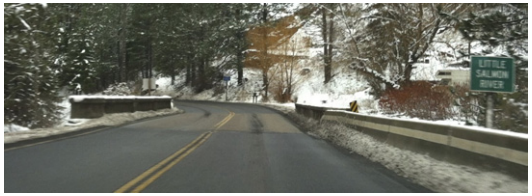
Guardrail transition not stiffened with increasing post density prior to rigid guardrail barrier/wall/ bridge connection

FT-NO-BRIDG

No bridge connection

Guardrail transition not attached to bridge guardrail with a transition piece – there may be a gap between w-beam rail and bridge rail, with no connection.

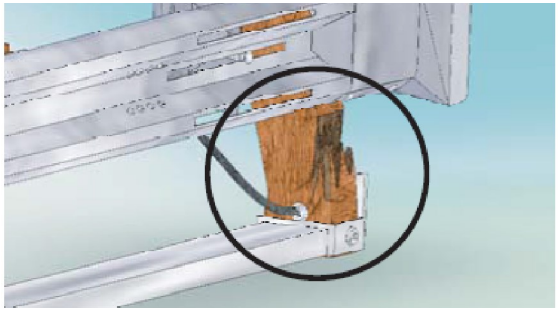
May be older bridges – preexisting designs at the time. New standards may require opposing direction treatment.



FT-DEND-POST

Damaged End Post

Not functional (sheared, rotted, cracked across the grain.)



FT-BCT

BCT Terminals

See Regional End Terminal Replacement Guide for replacement of Breakaway Cable Terminals (BCT's), MASH requirements.

BCT's are not acceptable on 45 MPH or greater roadways or NHS (National Highway System) Routes

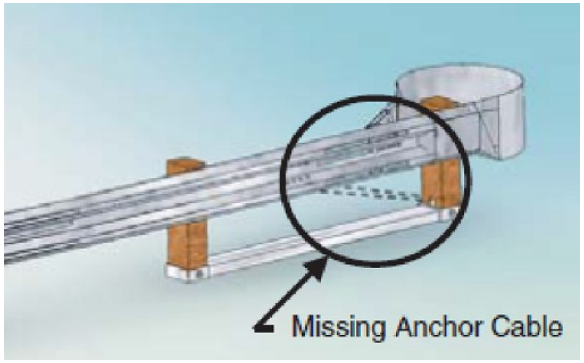
BCT's have no extruding head, no horizontal guardrail and no ground strut slotted

FT-MISS-CBL

Missing Anchor Cable

Missing anchor cable (usually found on a proprietary Slotted Rail Terminal with horizontal slots shown).

Anchor cable also needed on a Breakaway Cable Terminal (BCT).

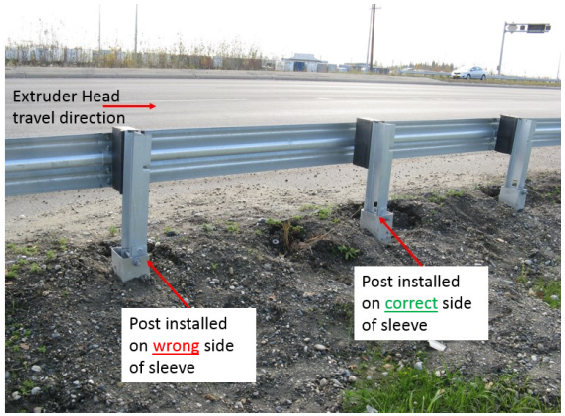


FT-MFR-INSTR

Steel Yielding
Posts on wrong side of sleeve tube

Needs to be on upstream side per manufacturer.

Follow and submit Manufacturer's Checklist for each terminal replacement.



FT-TERM-OFFST

End Terminal offset too far

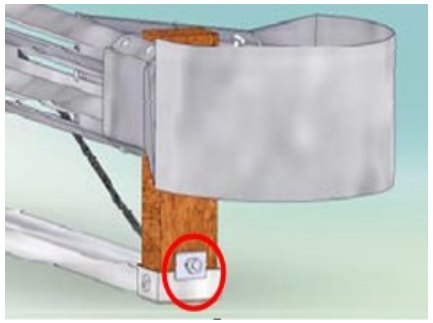
See G-20

2' offset maximum (almost 3' shown) For a 50' terminal.

FT-NO-BRGPL

Missing

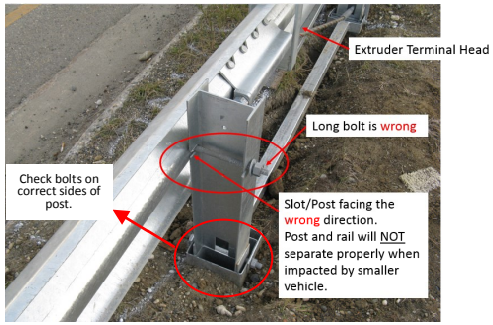
Missing bearing plate behind square washer cable bolt on end post. (See illustration page 26)



FT-MFR-INSTR

Incorrect Terminal Installation

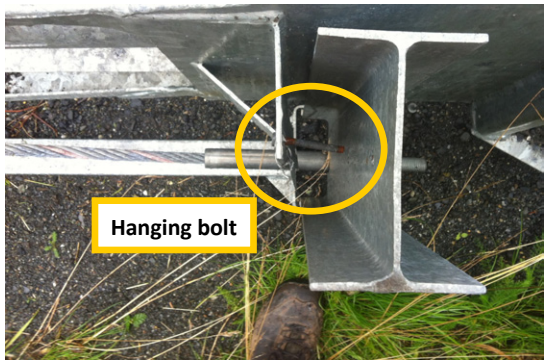
Post or guardrail slots facing wrong way to give way on impact. Long bolts where short bolt required. Review manufacturer's installation instructions for alignment and their checklist.

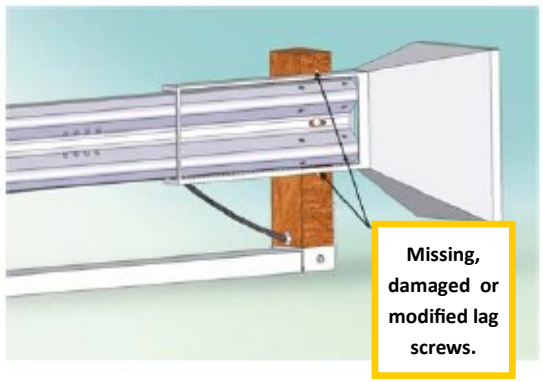


FT-LAG

Lag Screws

Missing or failed lag screws in wood post, extruding terminals Non-galvanized bolting of terminal leads to rusting, poor fit. Improper use of nails. Use manufacturer required connections.

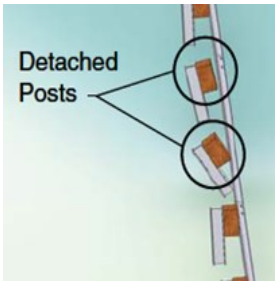




GRADE D RAIL: Damaged - Medium repair schedule

D-POST-SEP

Posts separated from rail



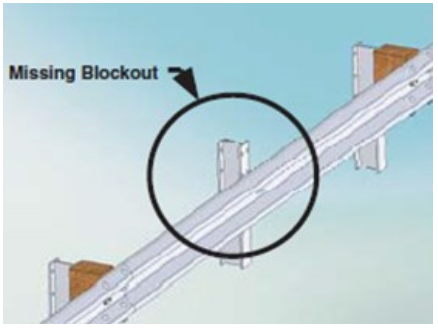
- 2 or more posts with block out attached with a post/rail separation less than 3''.
- 1 or more posts with a post/ rail separation which exceeds 3''.

- If the block out is not firmly attached to the post, use the missing blockout guidelines.
- Damage should also be evaluated against post/rail deflection guidelines.

D-MIS-BLKT

Missing blockouts

- Any blockouts missing. (This leaves a gap to the post)
- Cracked across the grain.
- Cracked from top or bottom of blockout through post bolt hole,rotted.

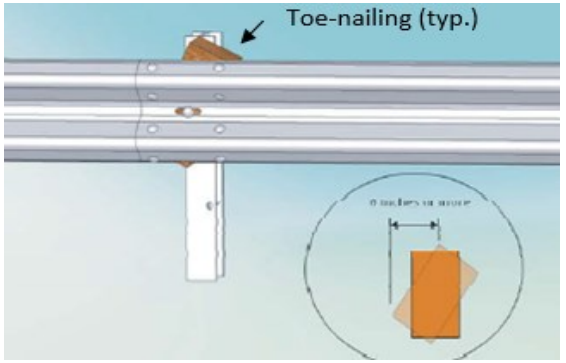


D-TWST-BLKT

Twisted blockouts

Note: Repairs of twisted blockout are relatively quick and inexpensive

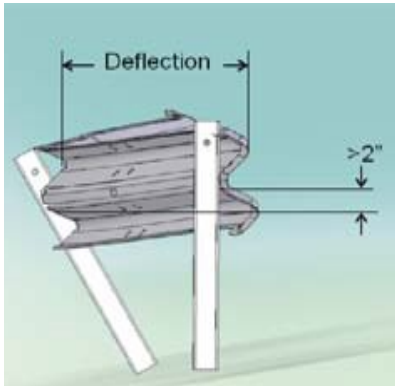
(Missing galvanized 8d toe-nails may be the cause of rotation in the case of wood posts and wood blockouts)



D-DEFL

Post and Rail Deflection ≤ 9”

6-9''. lateral deflection anywhere over a 25’ length of guardrail or between any two adjacent posts

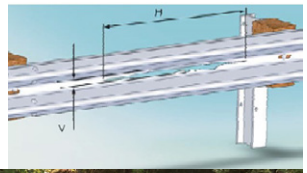


D-HORIZ-TEAR

Horizontal Tear

Horizontal (longitudinal) tears greater than 12'' long or greater than 0.5'' wide

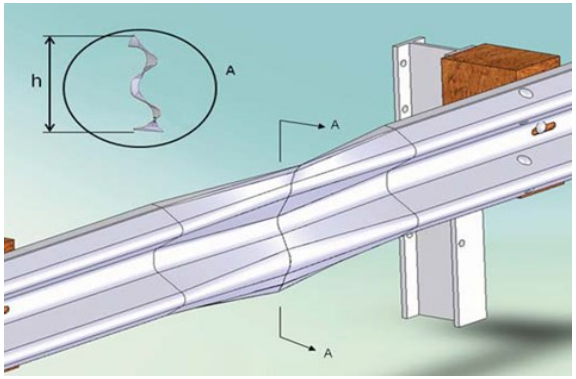
Note: for horizontal tears less than 12'' in length or less than 0.5'' in height, use the non manufactured holes guidelines



D-FLAT-RAIL

Guardrail Flattening

Guardrail cross-section height is more than 17'' (such as may occur if the guardrail is flattened), or guardrail cross -section height is less than 9'' (such as a dent to the top edge)

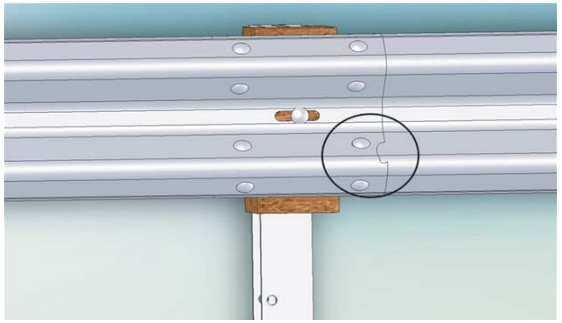


D-SPLIC-BOLT

Damage at guardrail splice (only one bolt damaged)

1 splice bolt

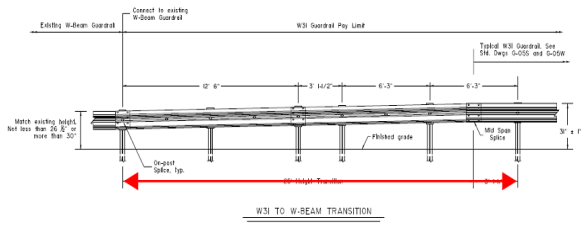
- Missing
- Damaged
- Visibly missing any underlying guardrail
- Torn through guardrail



D-SHORT-TRANS

W-Beam (29") to W31 (31") Transition too Short

≥ 25' transition length required per Std Plan G-11



25' required

D-REFL

Web reflectors location poor

- No longer installed on posts.
- For guardrail repair or replacement, only install between posts,
- Post –top reflectors ok, on top of steel bridge posts as well.

GRADE D TERMINALS: DAMAGED—MEDIUM REPAIR SCHEDULE

DT-STRUT

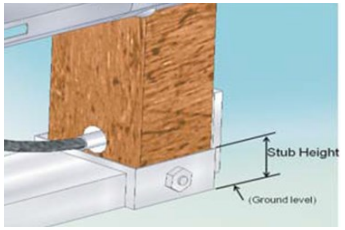
Stub Height or "Floating Strut"

Undercarriage snagging concern

Bottom of strut should be flush with ground or pavement.

Problem when steel soil sleeve tubes, post base stubs have steel height which exceeds 4'' up from ground level.

"Floating Strut" crossbar between 1st and 2nd posts, should be ≤4" from top of strut to adjacent gravel or paved road surface (not used on BCT's.)



DT-FLARE

Parallel Terminal Widening

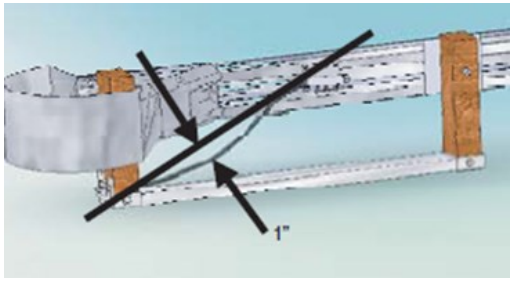
Improper flare pad or approach cross slope (proper flare shown).

See Std Plan G-20

DT-CBL-SLK

Anchor Cable

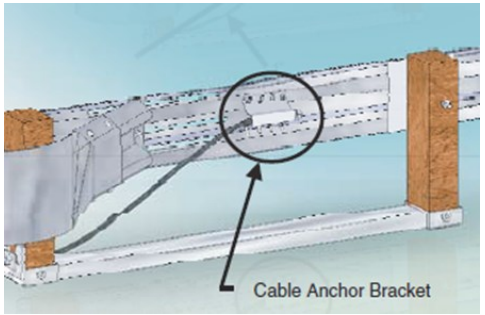
More than 1'' of movement when pushed down by hand



DT-CBL-ANCHR

Cable Anchor Bracket

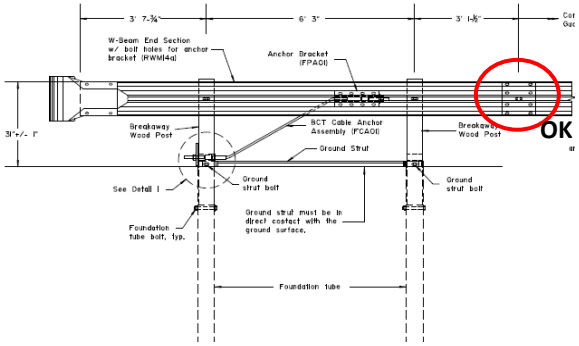
Loose or not firmly seated in guardrail



DT-ANCHR-SPLIC

W31 End Anchor Splice incorrect

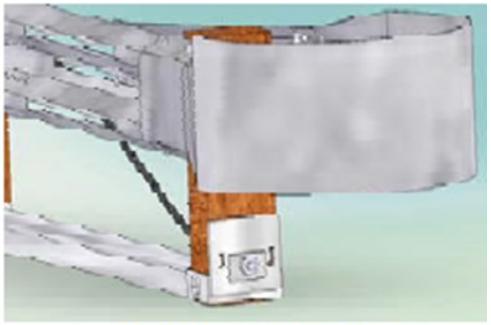
Splice needs to be mid span after second post



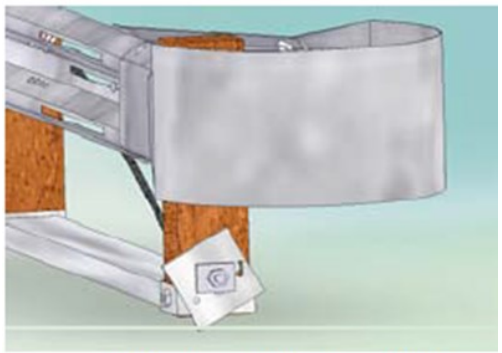
DT-BRG-PLT

Bearing Plate

Loose or misaligned



(Correct Bearing Plate)



(Misaligned Bearing Plate)

DT-BRDGEGAP

Poor bridge connection

3'9" maximum between last bridge guardrail post and thrie beam transition post.

GRADE ABC

ACCEPTABLE

LONG-SPAN GUARDRAIL

(MASH) **(New 2019 +)**

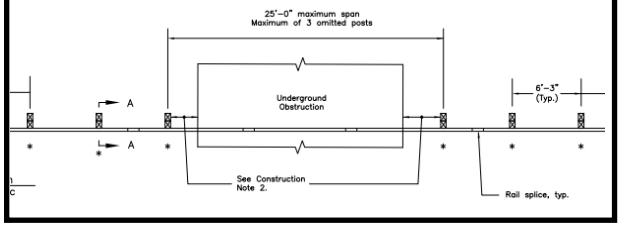
See Std Plan G-29

25' max span skipping ≤ 3 posts, with W31 mid span splices

No nested guardrail

6 Wood CRT posts with holes

1 wood blockout per CRT post



(350) **(2018 and prior)**

Was Std Plan G-28

25’ max span

≤ 3 posts for 27 3/4” w-beam, with splice on posts

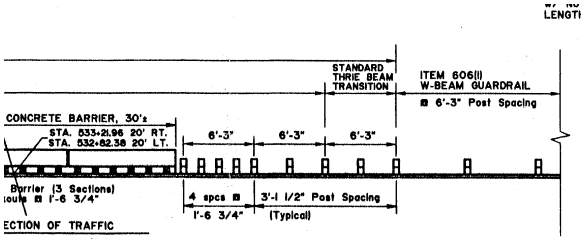
Nested guardrail

2 wood blockouts per CRT Post

Optional

Long-Span Concrete barrier

See design engineer for appropriate use.



BASIC END TERMINAL IDENTIFICATION GUIDE

MASH-16 TERMINALS

MSKT (MASH-16)

SOFT - STOP (MASH-16)

MAX– TENSION

(MASH-16)

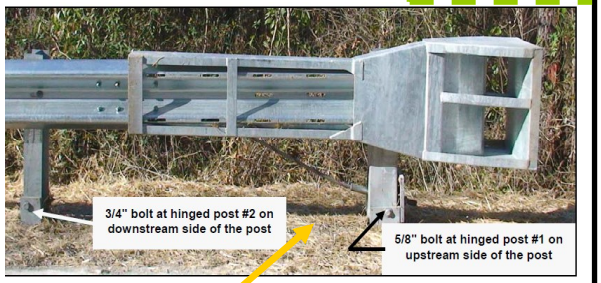
Barrier Systems Inc.

NCHRP-350 Terminals

SKT (350)

Slotted Rail

Extruding head
Cable anchor
Ground strut – BETWEEN posts 1 and 2
Object marker panel flush with extruding head
“2 square” front of head
Square handle backside



Ground Strut

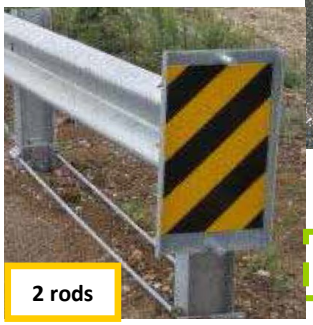
X-TENSION (350)

ET-PLUS (350)

Extruding head
Cable anchor
Ground strut BEHIND posts 1 and 2.
Object marker panel taller than extruding head.
"1 square" front of head
Triangular handle backside

X-LITE (350)

Sliding panels
Slider assembly post 3
Cable anchor posts 2-3
Ground strut rods – 2 sided
Painted shear bolts to blackouts
No steel soil sleeve tubes



Barriers Systems Inc.

SRT-350
(Slotted Guardrail Terminal) (350)

Cable Anchor
Slotted guardrail
Ground Strut
Looks like BCT
But with slots, ground strut

WY-BET (350)

(Box beam)

Older Terminals

(Was Std Plan G-14)

BCT
(Breakaway cable terminal)

Cable anchor
No ground strut
No object marker panel

Not for V > 40 mph or main highways

CRT (existing) Was Std Plan G-25

Features:
Cable anchor
No strut
Round pipe can on end post
Wood breakaway posts in radius.
22" TYP HT

CRASH CUSHIONS

Low Maintenance, "Self restoring"
Complete Manufacturer's installation checklist.
Check with Traffic and Safety before installing.

TAU II - R (350)

Barriers Systems Inc.

REACT (350)

Energy Absorption

TANGENT LENGTH OF NEED

Source: DOT&PF Highway Preconstruction Manual Fig 1130-4

$$LON = \frac{L_H - L_2}{\frac{L_H}{L_R}}$$

FLARE + PARABOLIC LENGTH OF NEED

Source: DOTPF Highway Preconstruction Manual Fig 1130-4

$$LON = \frac{(L_H - L_2) + \frac{b}{a}L_1 - \frac{a(P)}{\sqrt{a^2+b^2}}}{\frac{L_H}{L_R} + \frac{b}{a}}$$

Table 1130-9
Recommended Shy Line Offsets

Design Speed (mph)	Recommended Shy Line Offsets (feet)
80	12.1
75	10.5
70	10.0
60	8.0
55	7.2
50	6.5
45	5.5
40	5.0
30	3.5

Table 1130-10
Flare Rates for Barrier Design (b/a)

Design Speed (mph)	Flare Rate for Barrier Inside the Shy Line (b/a)	Flare Rate for Barrier Beyond the Shy Line (b/a)	
70	1:30	1:20*	1:15**
60	1:26	1:18*	1:14**
55	1:24	1:16*	1:12**
50	1:21	1:14*	1:11**
45	1:18	1:12*	1:10**
40	1:16	1:10*	1:8**
30	1:13	1:8*	1:7**

- * Suggested maximum flare rate for rigid barrier systems.
- ** Suggested Maximum flare rate for semi-rigid systems.

Table 1130-11
Recommended Runout Length for Barrier Advancement Length Determination

	Traffic Volume (ADT)			
	Over 10,000	5,000 to 10,000	1,000 to 4,999	Under 1,000
Design Speed (mph)	Runout Length L_R (ft.)	Runout Length L_R (ft.)	Runout Length L_R (ft.)	Runout Length L_R (ft.)
70	360	330	290	250
65	330	290	250	225
60	300	250	210	200
55	265	220	185	175
50	230	190	160	150
45	195	160	135	125
40	160	130	110	100
35	135	110	95	85
30	110	90	80	70

Tables excerpted from:

(DOT&PF Highway Preconstruction Manual) as of 3-22-19

Manufacturers

Trinity Industries
http://www.trinityhighway.com/
http://www.energyabsorption.com/

BSI
http://www.barriersystemsinc.com/

RSI
http://www.roadsystems.com/

Suppliers

UIS
https://www.uisutah.com/
Phone: 800-424-9825

Coral Sales
http://www.coralsales.com/
Phone: 503-655-6351

Installers

Acme Fence
http://acmefence.net/
Phone: 907-522-1155

McKinley Fence
http://www.mckinleyfence.com/
Phone: 907-563-3731

Northwest Barrier
https://www.nwbarriers.com/
Phone: 907-376-7498

Abbreviations

MASH: Manual for Assessing Safety Hardware

NCHRP: National Cooperative Highway Research Program

HPM: Highway Preconstruction Manual

CRT: Controlled Released Terminal

Notes

This guide is based on NCHRP 656, Std Plans, and DOT&PF experience.

This guide is for use by DOT&PF Design, Construction, and/or Maintenance in planning or prioritizing repair and replacement of existing guardrail through field observation/ inspection.

Observe safe procedures when inspecting near traffic. Wear high visibility garments and use a vehicle with beacons when needed. Avoid blocking of traffic lanes for inspection. Use pullouts, driveways, and shoulders when possible during notetaking. Consider drive through video recording.

For question or comments contact the Regional Traffic & Safety Engineer.