HSIP: CR GUARDRAIL INVENTORY AND UPGRADE

Project No.: CFHWY00564/001665

DESIGN STUDY REPORT

ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

PREPARED BY: Lounsbury & Associates, Inc.
3230 C Street, Suite 201
Anchorage, AK 99503

November 2021

ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
DESIGN AND ENGINEERING SERVICES – CENTRAL REGION

DESIGN STUDY REPORT

For

HSIP: CR Guardrail Inventory and Upgrade

Project No.: CFHWY00564/001665

Prepared by:

11/23/2021

Susan A. Acheson, P.E. Date
Project Engineer
Lounsbury & Associates, Inc.
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Cert. of Auth. Number AECC391

Concur by:

_____

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Project Manager

Concur by:

_____

James E. Amundsen, P.E. Date
Highway Design Group Chief

Approved:

_____

Luke S. Bowland, P.E. Date
Preconstruction Engineer

NOTICE TO USERS

The information in this document is compiled for highway safety planning purposes. Federal law prohibits its discovery or admissibility in litigation against state, tribal or local government that involves a location or locations mentioned in the crash data. 23 U.S.C. § 409; 23 U.S.C. § 148(h)(4); Walden v. DOT, 27 P.3d 297, 304-305 (Alaska 2001). This report reflects the thinking and design decisions at the time of publication. Changes frequently occur during the evolution of the design process, so persons who may rely on information contained in this document should check with the Alaska Department of Transportation and Public Facilities for the most current design. Contact the Design Project Manager, Christopher Bentz, at 907-269-0652 for this information.

PLANNING CONSISTENCY

This document has been prepared by the Alaska Department of Transportation and Public Facilities according to currently acceptable design standards and Federal regulations, and with the input offered by the local government and public. The department's Planning Section has reviewed and approved this report as being consistent with present community planning.

CERTIFICATION

The Alaska Department of Transportation and Public Facilities hereby certify that this document was prepared in accordance with Section 520.4.1 of the current edition of the department's Highway Preconstruction Manual and CFR Title 23, Highway Section 771.111(h).

The department has considered the project's social and economic effects upon the community, its impacts on the environment and its consistency with planning goals and objectives as approved by the local community. All records are on file with Central Region - Design and Engineering Services Division, Highway Design Section, 4111 Aviation Avenue, Anchorage, AK 99502.

Luke S. Bowland, P.E. Preconstruction Engineer	Date	Todd Vanhove Chief, Planning	Date

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LIST OF ACRONYMS

1R	Preventative Maintenance
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AHDM	Alaska Highway Drainage Manual
ANSI	American National Standards Institute
APDES	Alaska Pollutant Discharge Elimination System
ARRC	Alaska Railroad Corporation
ATM	Alaska Traffic Manual
ATMS	Alaska Traffic Manual Supplement
BMP	Best Management Practice
BCT	Breakaway Cable Terminal
CR	Central Region
CWA	Clean Water Act
CFR	Code of Federal Regulations
CGP	Alaska Construction General Permit
CDS	Coordinated Data System
DEC	Alaska Department of Environmental Conservation
DOT	U.S. Department of Transportation
DOT&PF	Alaska Department of Transportation and Public Facilities
DOJ	U.S. Department of Justice
DSR	Design Study Report
ESCP	Erosion and Sediment Control Plan
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
GAR	Guardrail Analysis Report
GET	Guardrail End Terminal
HMA	Hot Mix Asphalt
HPCM	Alaska Highway Preconstruction Manual
HMCP	Hazardous Material Control Plan
HSIP	Highway Safety Improvement Program
IES	Illuminating Engineering Society
KPB	Kenai Peninsula Borough
LON	Length of Need
LOS	Level of Service
MADT	Monthly Average Daily Traffic
MASH	Manual for Assessing Safety Hardware
MOA	Municipality of Anchorage
MP	Milepost
MPH	Miles per Hour

MPT	Milepoint
MS4	Municipal Separate Storm Sewer Systems
MSB	Matanuska-Susitna Borough
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NPDES	National Pollutant Discharge Elimination System
PGDHS	A Policy on Geometric Design of Highways and Streets
PIP	Public Information Plan
PROWAG	Proposed Accessibility Standards for Pedestrian Facilities in the Public Right-of-Way
RDG	Roadside Design Guide
RR	Railroad
RSAP	Roadside Safety Analysis Program
ROW	Right-of-Way
SWMM	Storm Water Management Model
SWMP	Storm Water Management Program
SWPPP	Storm Water Pollution Prevention Plan
TCE	Temporary Construction Easement
TCP	Traffic Control Plan
TMP	Traffic Management Plan
TOP	Transportation Operations Plan
TRB	Transportation Research Board
USGS	United States Geological Survey

The Alaska Department of Transportation and Public Facilities (DOT&PF) Highway Preconstruction Manual (HPCM) Section 450 outlines the topics to be discussed in the Design Study Report (DSR). This project has a defined scope approved through the Highway Safety Improvement Program (HSIP) and several DSR sections do not apply. The table below denotes those sections, marked as "YES", that have been included in this document. Items marked as "NO" have been considered and found not to be relevant and/or pertinent to the design of this project and will not be discussed further..

Table 1 Modified DSR Requirements for HSIP Projects

DSR Section	Section Title	Consider/Study	
		YES	NO
1	Project location, existing facilities, and purpose and need for project	✓	
2	Design standards	✓	
3	Alternatives analysis	Not required	
4	Discussion of preferred alternative	Not required	
5	Typical sections	✓	
6	General horizontal and vertical alignment	Not required	
7	Erosion and sediment control	✓	
8	Drainage	✓	
9	Soil conditions	Not required	
10	Access control features	Not required	
11	Traffic analysis	Not required	
12	Safety improvements.	✓	
13	Right-of-Way requirements	✓	
14	Pedestrian and bike accommodations	✓	
15	Utility relocation and coordination	✓	
16	Preliminary work zone traffic control	✓	
17	Pavement design	✓	
18	Cost estimate	✓	
19	Environmental commitments and mitigation	✓	
20	Preliminary bridge layout	Not required	
21	Design exceptions and design waivers	✓	
22	Maintenance considerations	✓	
23	ITS features	Not required	

Table 1 Modified DSR Requirements for 1R Projects (cont'd)

Appdx	Approved design designation and design criteria	Not required	
Appdx	Typical sections	✓	
Appdx	Material recommendations	✓	
Appdx	Approved environmental document	✓	
Appdx	Approved design exceptions and design waivers	✓	
Appdx	Design memos	✓	
Appdx	Traffic analyses (signal warrants, capacity analysis, roundabout analysis, etc.) and speed studies	Not required	
Appdx	3R analysis	Not required	
Appdx	ITS systems engineering analysis	Not required	
Appdx	FHWA concurrence documentation for non-significant ITS project determinations	Not required	
Appdx	VE consideration	Not required	

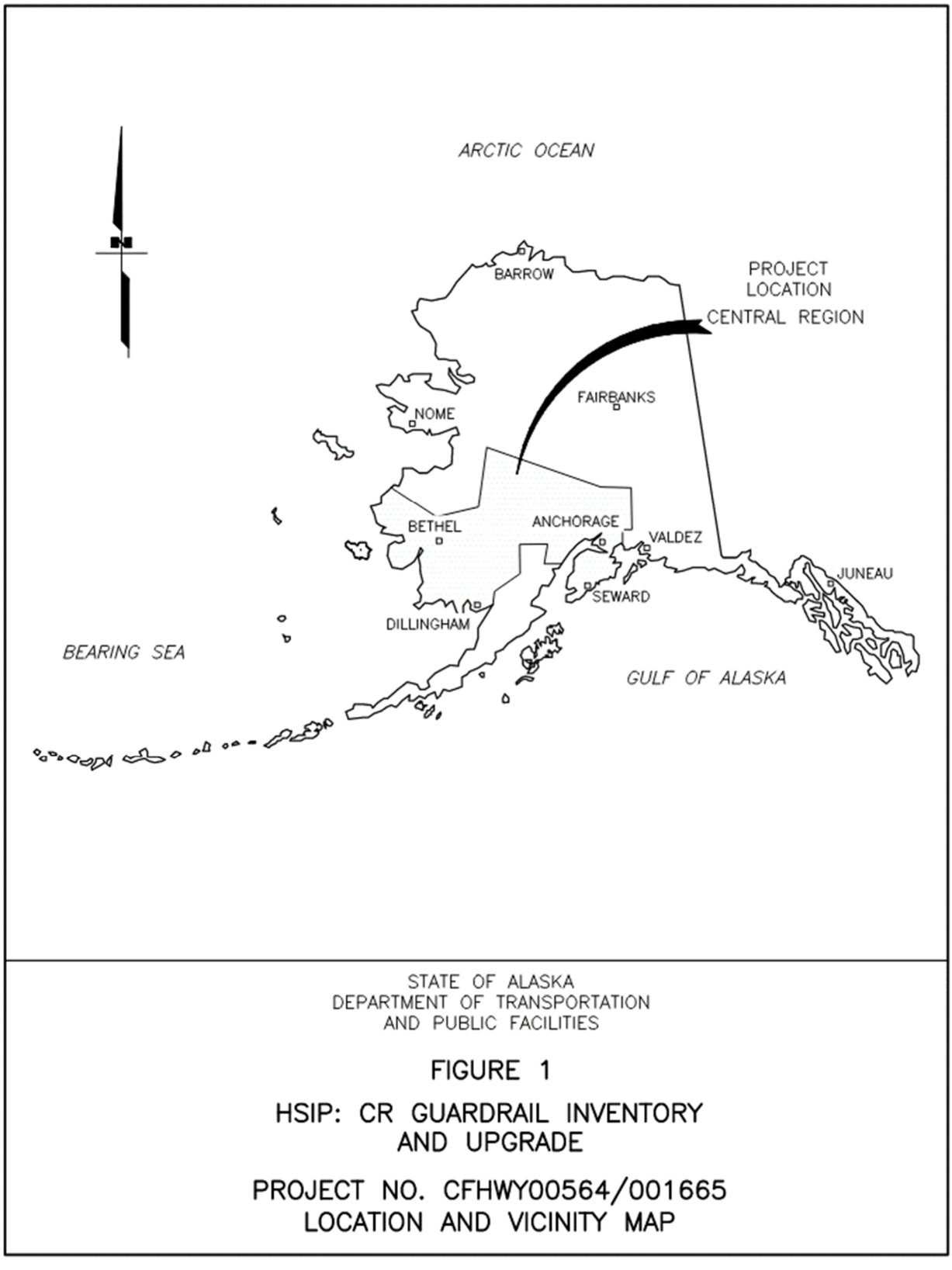


Figure 1 Location and Vicinity Map

1.0 PROJECT DESCRIPTION

The HSIP: CR Guardrail Inventory and Upgrade Project (the Project) includes a field inventory and damage assessment of every run of guardrail on highspeed (50-mph or greater) roadways in the Central Region. This Project will upgrade those that are damaged or do not meet current safety standards. The work is being initiated by the Alaska Department of Transportation and Public Facilities (DOT&PF), Central Region, under the Highway Safety Improvement Program (HSIP). HSIP projects are primarily focused on improving safety on public roadways. The objective of the work is to use public dollars efficiently to maximize lives saved and injuries eliminated per every dollar spent.

This Design Study Report (DSR) will be used to document the results of the field inventory and damage assessment. The DSR will serve as the basis of design recommendations for upgrading certain runs of guardrail, guardrail end terminals (GET's), and associated hardware to meet the standards of the 2016 Manual for Assessing Safety Hardware (MASH).

1.1 Project Location and Description

Proposed improvements would be located on roads throughout the Central Region that are considered high speed roads (roads with posted speed limits of 50 miles per hour or greater). Roads that meet the criteria are listed in Table 3 with the CDS route number and approximate length of road that is highspeed. These roads are typically arterials carrying thousands of vehicles per day with some at higher volumes above ten thousand. *(DOT&PF HSIP Nomination 19CN03,* Appendix D).

A field assessment was completed in 2020 of highspeed guardrail, including their end terminals and associated hardware. The results of that field assessment were documented in a Guardrail Analysis Report (GAR) contained in Appendix F, which organized the data collected to determine where and why guardrail segments are in non-conformance with current standards and require upgrade. Figure 1 shows the project vicinity map.

This project will upgrade guardrail, end terminals and hardware to meet current design standards and will include associated grading, drainage and earthwork to complete the installations.

1.2 Existing Facilities and Land Use

Major highways within the Region include the Glenn Highway, the Parks Highway, the Seward Highway, and the Sterling Highway. The roadway types and characteristics within the Region are diverse. Near the major population centers, the roadways include urban, multilane, and divided freeway segments with high Average Annual Daily Traffic (AADT). The roadways outside of the major population centers are generally more rural in characteristic, consisting of two-lane roadways with shoulders of varying width and lower AADT's.

Table 2 lists the roadway segments by name and milepoint for each route included in this study. The inventory route list was coordinated with DOT&PF to exclude those segments of 50 mph roadways that are being addressed by other planned design or construction projects since the preparation of the HSIP nomination and part 1 of the GAR.

Route Name	Begin MPT	End MPT	Approx. Length (mile)	Notes
Big Lake Road	0.00	3.31	3.31	
Bogard Road	3.88	10.70	6.82	
Bridge Access Road	0.99	3.29	2.30	
C Street	4.35	7.68	3.33	
Fairview Loop Road	0.00	10.94	10.74	Skip MPT 8.2-8.4
Glenn Highway	0.00	118.00	103.78	Skip MPT 33.29-33.53, 41.27-41.35 (left side only), 45.46-46.97, 47.42-47.64 (right side only), 50.98-51.45, 53-56, 66-67, 68.1, 84-92
Holt Lamplight Road	0.00	8.35	8.35	
Hope Road	0.00	15.16	15.16	
International Airport Road	0.18	1.69	1.51	
Kalifornsky Beach Road	0.00	18.42	18.42	
Kenai Spur Highway	See Notes		23.89	MPT 12.78-25.39, 27.20-38.48
Knik Goose Bay Road	8.00	20.00	11.88	Skip MPT 14.88-15.00
Knik River Road	0.00	11.32	11.32	
Miller Loop Road	0.00	5.40	5.40	
Nash Road	0.00	2.40	2.40	
Old Glenn Highway	9.40	17.47	8.07	
O'Malley Road	0.43	3.83	3.40	
Palmer-Fishhook Road	0.00	8.66	8.66	
Parks Highway	See Notes		111.66	MPT 0-4.41, 9.55-11.7, 17-21.53, 22.71-33.24, 34.79-53, 61.4-127.93
Portage Glacier Road	0.00	5.18	5.18	
East Seldon Extension	3.83	6.00	2.17	Wasilla Fishhook Road to Bogard Road
Seward Highway	8.00	114.00	73.55	Skip MPT 0.9-1.7, 17-22.55, 75-90, 98.9-104.5, 106.2-109.6, 111.6-114.5
Sterling Highway	See Notes		90.70	MPT 0-7, 14.15-21.8, 78.9-95.29, 98.35-116.00, 117.18-127.83 Skip MPT 115.00-115.38
Talkeetna Spur Road	0.00	12.32	12.32	
Trunk Road	0.45	6.08	5.63	
Willow Fishhook Road	0.00	31.48	30.55	Skip MPT 21.99-22.92
		Total	**580.50**	

Table 2 Project Route List

1.3 Purpose and Need

The purpose of the Project is to identify guardrail segments on highspeed roads within Central Region that do not meet current safety standards, and to design improvements to bring them up to current standards. The Project defines guardrail segments to include the guardrail, end terminals and associated hardware, and defines highspeed facilities as those that have posted speeds of 50-mph or greater.

The Project is needed to address conditions where existing guardrail segments may fail to perform as intended in roadway departure crashes.

2.0 DESIGN STANDARDS AND GUIDELINES

Design standards and guidelines that apply to the Project are contained in the following publications. This project was developed per Section 1140 of the HPCM for 1R projects. Therefore, project design criteria or design designations have not been developed for this project.

Standard

- Roadside Design Guide (RDG), 4th Edition, AASHTO, 2011.
- Alaska Highway Preconstruction Manual (HPCM), DOT&PF, 2020.

Guidelines:

- Recommended Procedures for the Safety Performance Evaluation of Highway Features, Report 350, NCHRP 350, Transportation Research Board, 1993.
- Synthesis of Highway Practice 202: Severity Indices for Roadside Features, NCHRP, Transportation Research Board, 1994
- Criteria for Restoration of Longitudinal Barriers, Report 656, NCHRP 656, Transportation Research Board, 2010.
- Manual for Assessing Safety Hardware (MASH), 2nd Edition, AASHTO, 2016
- Central Region Memorandum: Set Aside RSAP for Calibration Use ROADSIDE in interim, Amundsen, J. et. al, 4-16-2019.
- Central Region Memorandum: Guardrail Replacement Regional Practice for Projects, 2-27-2020.
- Roadside Design Guide (RDG), AASHTO, 1996, Appendix A.

5.0 TYPICAL SECTION

Work for this project will include reconstructing gravel shoulders for the guardrail installation or constructing new pavement widening for end terminals that have moved due to insufficient length of need. Where required, the guardrail installation will include a two-foot-wide shoulder with a slope of varying grade. Parallel guardrail end terminals will be installed with a two-foot offset in 50 feet of length. Improvements to the roadway typical section are not anticipated. Typical sections showing proposed improvements and approaches to embankment widening will be provided in Appendix A.

7.0 EROSION AND SEDIMENT CONTROL

The project includes temporary and permanent measures to control or prevent erosion and sedimentation during and post project construction. The contractor will prepare a Storm Water Pollution Prevention Plan (SWPPP) prior to construction that conforms to the DOT&PF Best Management Practices (BMPs) for Erosion and Sediment Control. The SWPPP will be prepared in accordance with the DOT&PF contract specifications and follow the guidelines of the Erosion and Sediment Control Plan (ESCP) provided to the contractor. The contractor will submit the SWPPP for approval by the Construction Project Engineer. The contractor will conduct construction activities in accordance with the approved SWPPP. Appropriate erosion and siltation controls will be used and maintained in optimal condition during construction and all other exposed soils/fills will be permanently stabilized. Temporary BMPs will remain in place until permanent erosion and sediment control measures are in place and soil is permanently stabilized.

8.0 DRAINAGE

Work will not change the drainage patterns or discharge quantities of stormwater within the project. Construction will be limited to replacing damaged guardrail and end terminals and may require nominal earthwork and embankment widening. If existing ditches are impacted by grading activities, they will be restored to their current condition and drainage direction once construction is complete.

8.1 Drainage within the Municipality of Anchorage (MOA) and MS4 Permit Compliance

The National Pollutant Discharge Elimination System permit program originated under section 402 of the Clean Water Act (CWA, 33 USC §1251), and requires that storm water discharges to surface water be authorized by permit. In Alaska, the Alaska Department of Environmental Conservation (DEC) has primacy for issuing these permits via the Alaska Pollutant Discharge Elimination System (APDES). DEC has jointly authorized the Municipality of Anchorage (MOA) and the DOT&PF to discharge storm water from municipal separate storm sewer systems (MS4) to surface water and wetlands within the MOA through an individual MS4 permit. This permit, *APDES Permit No. AKS052558*, is effective from August 1, 2020 to July 31, 2025.
To comply with the permit; the project will incorporate, at a minimum, the pollution control measures and Best Management Practices (BMPs) as required by the DEC-approved Storm Water Management Program (SWMP) developed by the MOA. Essential requirements include but are not necessarily limited to:

- The project follows the criteria set forth in the DOT&PF's Alaska Highway Drainage Manual and the MOA's Drainage Design Guidelines as modified by DOT&PF.

- The contractor will develop a SWPPP prior to construction that follows the guidelines of the ESCP provided to the contractor. The SWPPP will comply with the APDES permitting program and the Alaska Construction General Permit (CGP).

- The contractor will describe how to minimize and reduce erosion in the contractor's SWPPP.

- The contractor will comply with all permit conditions with respect to installation and maintenance of control measures, inspections, monitoring (if necessary), corrective actions, reporting and recordkeeping.

- The contractor will address all discharge in the SWPPP. The contractor will prepare a Hazardous Material Control Plan (HMCP).

- The maintenance of the pipes, sewers, and other conveyances will remain the responsibility of the AGENCY.

• State of Alaska will maintain outreach and education through the State of Alaska website. Project specific information will be posted at the project site once construction activity begins.

12.0 SAFETY IMPROVEMENTS

This Project was developed under DOT&PF's HSIP program and all proposed improvements are safety related. The HSIP nomination described safety problems including low guardrail heights, outdated use of Breakaway Cable Terminals (BCT's), steel block-outs used without backup plates, incorrect hardware, apparent inadequacies in length of need, and other safety related damages that degrade the performance of the guardrail systems and could pose a risk to vehicle occupants if struck.

Evaluating all the guardrail and end terminals in Central Region and upgrading those elements that would have an unacceptable safety performance should they sustain more damage improves the safety by reducing the severity of lane departure type of crashes.

13.0 RIGHT-OF-WAY REQUIREMENTS

All work is expected to be contained within the existing ROW and permanent acquisitions are not anticipated. Temporary Construction Easements (TCE) and Permits may be necessary to reconstruct slopes or widen embankments associated with new guardrail and end terminal installation.

14.0 PEDESTRIAN AND BICYCLE FACILITIES

This project does not appear to affect any pedestrian or bicycle facilities.

15.0 UTILITY RELOCATION AND COORDINATION

Work generally is contained within the limits of the existing roadway embankments and utilities are not expected to be impacted. Selected sites where embankments require widening may increase coverage over buried utilities and these could require relocation.

15.1 Utilities

Utilities within Central Region vary by geographic location. The main utilities along the many corridors include overhead electric and street lighting. Along the more rural roadways, utilities include telephone/communication and some signalization. Approximately 85% of the recommended upgrades involve upgrading guardrail and end terminals in existing locations where little to no grading is anticipated. Approximately 15% of the recommendations require relocating end terminals from their existing location. These relocations will be evaluated during detailed design to assess specific utility impacts.

15.2 Railroad Crossings

The project contains railroad crossing on several roadways including C Street, Glenn Highway, International Airport Road, Seward Highway, and Willow Fishhook Road. However, no work will be done in the vicinity of the railroad crossings on C Street or International Airport Road. The crossings on the Glenn Highway are grade separated, therefore a checklist was not required. Two at grade crossings were examined for crossings on the Seward Highway (Moose Pass RR Milepost 0023.780) and Willow Fishhook Road (Willow RR Milepost 0186.890). Both crossings are active crossings and were found to be in compliance with current standards with the exception that vegetation and trees are located within relevant sight distance triangles and clearing of brush and debris should be conducted as routine maintenance or as

part of this construction project. The Railroad Crossing Checklist for these crossings can be found in Appendix E.

16.0 PRELIMINARY WORK ZONE TRAFFIC CONTROL

The HPCM Section 1400.2 sets forth the criteria for determining if a project is to be classified as a "Significant Project" for purposes of determining the level of effort required in developing a TMP. This project meets the definition of "Significant" and therefore requires a TMP. Components of the TMP that are required include a Traffic Control Plan (TCP), Public Information Plan (PIP), and Transportation Operations Plan (TOP).

16.1 Traffic Control Plan (TCP)

During the design phase, specification development will include details in Section 643 to assist the contractor in developing the TCP. This will be coordinated with CR DOT&PF through multiple phases of plan development.

The contractor will develop a TCP during construction, to safely guide and protect the traveling public in work zones, in accordance with the Alaska Traffic Manual (ATM) and the project specifications. The plan will be assessed and approved by the Construction Project Engineer and the Traffic Control Engineer.

The contractor is responsible for providing advance notice to the public, including local businesses, residents, and road travelers, of construction activities that could cause delays, detours, or affect access to adjacent properties.

16.2 Public Information Plan (PIP)

A PIP will be developed prior to beginning construction that will specify the ways and means that the contractor will use to inform the public of upcoming activities that will impact local stakeholders, the roadway users and public entities. The PIP will contain measures to inform stakeholders of project scope, expected work zone impacts, closure details, and recommended action to avoid impacts and changing conditions during construction. Measures to disseminate information include:

- Contractor's Worksite Traffic Supervisor
- Department's Construction section thru the department's 511 system
- Department's Navigator website
- Television, Radio, and/or newspaper
- Other location-specific communication tools

The traveling public should not be caught unaware by any closures, detours, delays, night work, or any potentially disruptive activity.

16.3 Transportation Operations Plan (TOP)

The department will coordinate with relevant public agencies and event organizers and incorporate means and methods for minimizing traffic impacts with the contractor not covered by the TCP or the PIP within the project plans.

17.0 STRUCTURAL SECTION AND PAVEMENT DESIGN

Roadway structural section improvements are not planned for this project. Nominal widening of approach flares or roadway shoulders may be required at select locations. Structural section recommendations, if required, will be provided with the final DSR.

18.0 COST ESTIMATE

The project cost estimate is as follows:

Preliminary Engineering	$	2,654,000
Right-of-Way	$	2,123,000
Utility Relocation	$	531,000
Construction	$	25,232,288
Total	$	30,540,288

19.0 ENVIRONMENTAL COMMITMENTS AND CONSIDERATIONS

The proposed project does not involve any unusual circumstances or significant environmental impacts; it meets the criteria for classification as a Categorical Exclusion per 23 CFR 771.117. A Categorical Exclusion for the project was approved on December 7, 2020. A copy of the document is located in Appendix C.

The contractor will be required to prepare and implement a SWPPP in accordance with Section 7.

The contractor will be required to dispose of solid waste at a DEC approved landfill. The contractor will be responsible for obtaining all necessary permits and clearances for materials sites, disposal sites, and staging areas unless DOT&PF has obtained all necessary permits.

21.0 EXCEPTIONS TO DESIGN STANDARDS

There are no exceptions to design standards anticipated for this project.

22.0 MAINTENANCE CONSIDERATIONS

Maintenance will remain the responsibility of the State of Alaska and the local DOT&PF Maintenance and Operations Station located throughout Central Region.

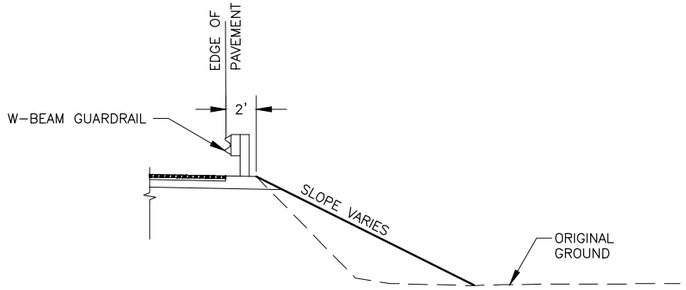
The project will increase the length of guardrail due to the re-calculation of the Length of Need however maintenance efforts will be reduced due to the large scale upgrade of damaged end terminals and guardrail on roadways with speed greater than 50 mph throughout the Central Region.

APPENDIX A

Typical Sections

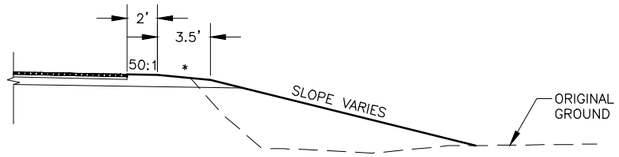
NO.	DATE	REVISION

STATE	PROJECT DESIGNATION	YEAR	SHEET NO.	TOTAL SHEETS
ALASKA	0001665/CFHWY00564	2021	B1	B1



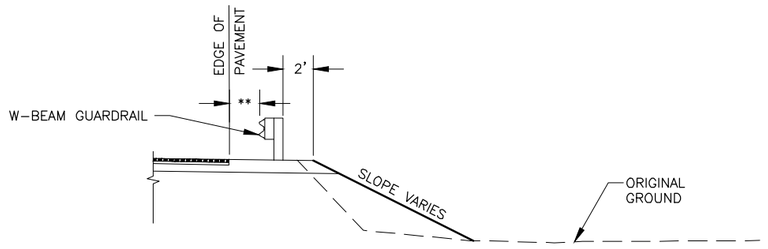
GUARDRAIL

SEE SUMMARY TABLE



WIDENING

STA. XXX+XX TO STA. XXX+XX



END TERMINAL FLARE SECTION

STA. XXX+XX TO STA. XXX+XX

NOTE:

1. WITHIN TWO (2) DAYS AFTER PAVING, PLACE AGGREGATE BASE COURSE, GRADING D-1 AGAINST PAVEMENT EDGE TO ENSURE THERE IS NO VERTICAL DROP AT THE EDGE OF PAVEMENT. USE APPROVED TRAFFIC CONTROL DEVICES IN THE INTERIM.

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION
AND PUBLIC FACILITIES

HSIP: CR GUARDRAIL INVENTORY AND UPGRADE

TYPICAL SECTIONS

STATE OF ALASKA 49TH PROJECT ENGINEER 0000 REGISTERED PROFESSIONAL ENGINEER

PLANS DEVELOPED BY:
LOUNSBURY & ASSOCIATES INC.

PLANS DEVELOPED BY: LOUNSBURY & ASSOCIATES ADDRESS: 3230 C ST, SUITE 201, ANCHORGE AK 99503 PHONE: (907) 272-5451 CERTIFICATE OF AUTHORIZATION NUMBER: AECC391
FILE D:\PWISEFILE\DMS04398\PL_20-001 B SHEETS NORTH.DWG DATE/TIME 11/22/2021 2:49 PM LAYOUT --- DESIGNED SM CHECKED JC DRAFTED DJ

APPENDIX B

Approved Environmental

State of Alaska
Department of Transportation & Public Facilities

EXPEDITED CATEGORICAL EXCLUSION APPROVAL FORM

(NEPA Assignment Program Projects)

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been carried out by DOT&PF pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated November 3, 2017, and executed by FHWA and DOT&PF.

I. Project Information:

A. Project Name: HSIP: Central Region Guardrail Inventory and Upgrade

B. Federal Project Number: 0001665

C. State Project Number: CFHWY00564

D. Primary/Ancillary Project Connections:

N/A

E. CE Designation: 23 CFR 771.117(c)(27)

F. List of Attachments:

A - Figures

B - Tables

C - Typical Site Photos

D - Section 106 PA Streamlined Project Screening Form

E - Optional 23 CFR 71.117(e) Form

G. Project Scope *(Use STIP Project Description)*

Need ID 19217: Evaluation, design, and construction of projects to address safety concerns statewide.

H. Project Description:
The proposed project would evaluate existing guardrails along multiple routes in Central Region (Attachment A, Figures) and update or replace any guardrail segments (Attachment B, Table 1) not meeting the current Alaska Department of Transportation and Public Facilities (DOT&PF) and Federal Highway Administration (FHWA) standards. Project improvements may include the following activities (Attachment B, Table 2):

- Milling and paving
- Digouts
- Embankment reconstruction and stabilization
- Updating guardrail to meet current safety standards
- Utility relocation
- Replacing roadside hardware, end terminals, and signage
- Drainage improvements
- Vegetation clearing and grubbing

I. Provide a brief description of probable impacts (23 CFR 771.117(b)):

1. Work for the proposed project would be within existing DOT&PF right-of-way (ROW). Residential and/or non-residential displacements would not occur.

2. The proposed project is not anticipated to have an adverse effect on a threatened or endangered species or critical habitat area, as no threatened and endangered species or critical habitat occur in the project area.

3. Work is not anticipated to require a U.S. Coast Guard bridge permit. Work would be within the existing DOT&PF ROW and work outside of the existing embankment would be limited to reshaping ditches to their original condition and limited vegetation clearing and grubbing. Therefore, there would be no impacts to wetlands or Waters of the U.S. and a U.S. Army Corps of Engineers permit would not be required.

4. The proposed project is not anticipated to have an adverse effect on any historic properties under the National Historic Preservation Act (Appendix D, Section 106 PA Streamlined Project Screening Form); nor would the project result in the "use" of a Section 4(f) resource.

5. Work is not anticipated to require construction of temporary access, or closure of existing roads, bridges, or ramps, that would cause major traffic disruptions.

6. Work would not involve changes in access control.

7. Work would be within existing DOT&PF ROW and any work outside of the existing embankment would be limited to reshaping ditches to their original condition and limited vegetation and clearing. Therefore, the project would not encroach into a mapped floodplain, or construct across or adjacent to a proposed or designated Wild and Scenic River.

8. Based on review of the U.S Fish and Wildlife Service (USFWS) eagle nest database and a field survey, construction activities would occur within 660 feet of 16 eagle nests (refer to Figure 1 and 2). An eagle nest survey may be conducted prior to construction to determine if a nest is active. If an active nest is discovered, the USFWS would be consulted concerning the need for any mitigation measures. Mitgation measures may include monitoring the birds for disturbance, work timing restrictions during the nesting season (February 1 to August 1), and/or maintaining a work-restricted buffer zone around an eagle activity zone.

II. Expedited Categorical Exclusion:

A. The project meets the criteria of Programmatic Approval 1 or Programmatic Approval 3 authorized in the Nov. 13, 2017 "Chief Engineer Directive – Programmatic Categorical Exclusions", as actions that do not require a CE Documentation Form? *If yes, select the appropriate Programmatic Approval below. If no, a CE Documentation Form is required.* ☒ Yes ☐ No

1. Programmatic Approval 1 ☒

2. Programmatic Approval 3 ☐

B. Does the following statement apply? ☒ Yes ☐ No

"The State has determined that this project has no significant impact(s) on the environment and that there are no unusual circumstances as described in 23 CFR 771.117(b). As such, the project is categorically excluded from the requirements to prepare an environmental assessment or environmental impact statement under the National Environmental Policy Act."

- *If no, the action **cannot** be processed as an Expedited CE.*

C. Additional information:

Project work would entail the removal of existing guardrail posts, which would require excavating between six to ten feet of roadway embankment. The guardrail would be upgraded or replaced with similar materials and embankments would not be extended. Any required reconstruction or stabilization of embankments would occur within the existing footprint. Vegetaton clearing and grubbing would not extend beyond previously disturbed ROW areas and is anticipated to be limited to ditch-to-ditch.

III. Environmental Documentation Approval Signature

Approved by: Brian Elliott [Signature] Regional Environmental Manager

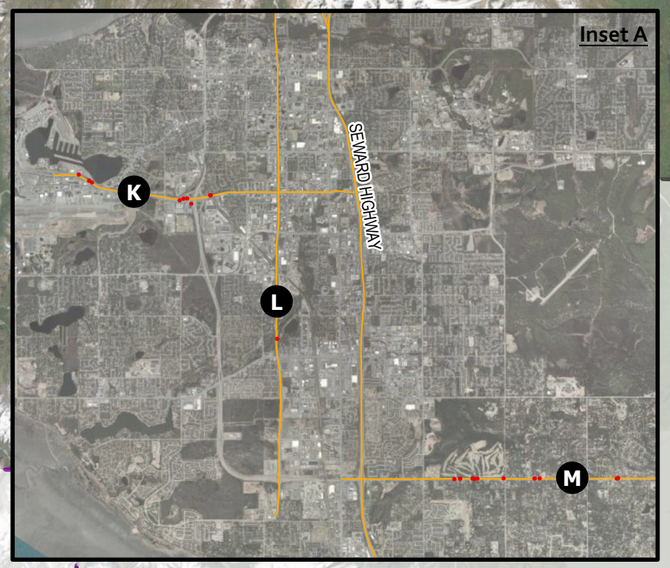
Date: 12/7/2020

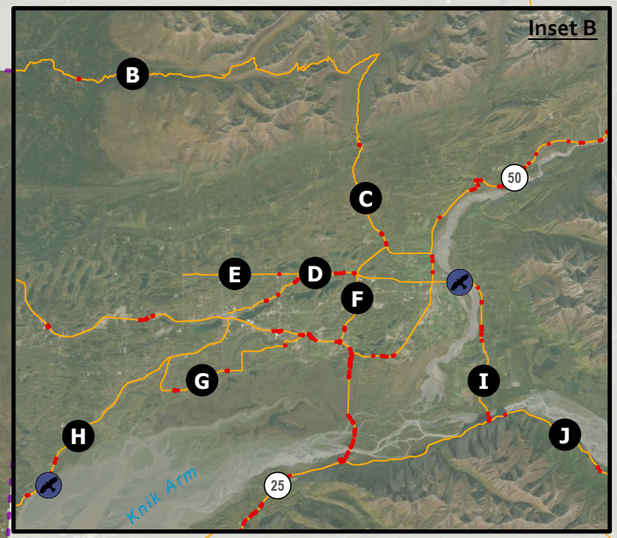
Brian Elliot
[Print Name] Regional Environmental Manager

Attachment A

Figures

Road Identifier	Road Name
A	TALKEETNA SPUR ROAD
B	WILLOW FISHHOOK ROAD
C	PALMER FISHHOOK ROAD
D	BOGARD ROAD
E	EAST SELDON EXTENSION/BOGARD EXTENSION
F	TRUNK ROAD
G	FAIRVIEW LOOP ROAD
H	KNIK-GOOSE BAY ROAD
I	OLD GLENN @ PALMER
J	KNIK RIVER ROAD
K	INTERNATIONAL AIRPORT ROAD
L	C STREET
M	O'MALLEY ROAD
N	PORTAGE GLACIER ROAD





A Road Identifier

(#) Highway Milepoint

Failed Guardrail (point)

Central DOT Boundary

Eagle Nest Location within 760' of Failed Guardrail [1]

New Nest Discovered During Field Survey

USFWS Eagle Nest Location- 330' to 760'

USFWS Eagle Nest Location- Field Verified within 330'

1 *USFWS Eagle Nest Data, DOWL Assumes Accuracy is within 100 feet*

Miles
0 15 30

Expedited Categorical Exclusion Overview

Matanuska Susitna Borough
&
Municipality of Anchorage

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

DOT & PF Project No.CFHWY00564
Federal Project No. 0001665
HSIP: CR Guardrail Inventory

Matanuska Valley to Kenai Peninsula

November 18, 2020 | Figure 1

Q:\50\63129-01\60GIS\Carto\Environmental\Project Overview\Wetland Overview.aprx Nov 18, 2020 11:09 AM User: ssterling
Service Layer Credits: World Imagery: Municipality of Anchorage, Earthstar Geographics
World Imagery: Earthstar Geographics

Road Identifier	Road Name
O	HOPE ROAD
P	KENAI SPUR HIGHWAY
Q	HOLT/LAMPLIGHT ROAD
R	BRIDGE ACCESS ROAD
S	KALIFORNSKY BEACH ROAD
T	NASH ROAD

COOK INLET

Turnagain Arm

Municipality of Anchorage

GIRDWOOD

WHITTIER

SEWARD HIGHWAY

NIKISKI

KENAI

SOLDOTNA

STERLING

STERLING HIGHWAY

See Inset A

COOPER LANDING

MOOSE PASS

SEWARD

NINILCHIK

ANCHOR POINT

HOMER

Inset A

STERLING HIGHWAY

- A Road Identifier
- # Highway Milepoint
- Failed Guardrail (point)

Eagle Nest Location within 760' of Failed Guardrail [1]

- New Nest Discovered During Field Survey
- USFWS Eagle Nest Location- 330' to 760'
- USFWS Eagle Nest Location- Field Verified within 330'

1 USFWS Eagle Nest Data, DOWL Assumes Accuracy is within 100 feet

0 10 20 Miles

Expedited Categorical Exclusion Overview

Kenai Peninsula Borough

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

DOT & PF Project No.CFHWY00564
Federal Project No. 0001665
HSIP: CR Guardrail Inventory

Matanuska Valley to Kenai Peninsula

November 18, 2020 | Figure 2

Q:\50\63129-01\60GIS\Carto\Environmental\Project Overview\Wetland Overview.aprx Nov 18, 2020 11:10 AM User: ssterling

Service Layer Credits: World Imagery: Earthstar Geographics

Attachment B

Tables

Table 1: Project Route List for Field Inventory

Route Name	Begin MPT	End MPT	Approx. Length (mi)	Notes
Big Lake Road	0	3.31	3.31	
Bogard Road	3.88	10.7	6.82	
Bridge Access Road	0.99	3.29	2.3	
C Street	4.35	7.68	3.33	
Fairview Loop Road	0	10.94	10.94	Coordinate with project 56020
Glenn Highway	0	118	109	*Skip MP 66-67, MP 84-92*
Holt Lamplight Road	0	8.35	8.35	
Hope Road	0	15.16	15.16	
International Airport Road	0.18	1.69	1.51	
Kalifornsky Beach Road	0	18.42	18.42	
Kenai Spur Highway	See Notes		29.09	MP 2.47-7.67, 12.78-25.39, 27.20-38.48
Knik Goose Bay Road	8	20	12	
Knik River Road	0	11.32	11.32	
Miller Loop Road	0	5.4	5.4	
Nash Road	0	2.4	2.4	
Old Glenn Highway	9.4	17.47	8.07	
O'Malley Road	0.43	3.83	3.4	
Palmer-Fishhook Road	0	8.66	8.66	
Parks Highway	See Notes		120.06	MP 0-4.41, 9.55-21.53, 22.71-33.24, 34.79-127.93
Portage Glacier Road	0	5.18	5.18	
East Seldon Extension	3.83	6	2.17	Wasilla Fishhook Road to Bogard Road
Seward Highway	8	114	91	*Skip MP 19.95-22.55, 75-90, 98.9-104.5*
Sterling Highway	See Notes		91.1	MP 0-7, 14.15-43.76, 46.45-56.25, 78.9-95.29, 98.35-116.00, 117.18-127.83
Talkeetna Spur Road	0	12.32	12.32	
Trunk Road	0.45	6.08	5.63	
Willow Fishhook Road	0	31.48	31.48	
		Total	618.42	

Table 2: Location of Failed Guardrail and End Terminals Recommended for Repair or Replacement by Route, Milepoint (MPT), and Lounsbury and Associates, Inc. (LAI) Identification number (ID) for Failing Guardrail Segments and End Terminals, and Recommendations

Route Name	MPT	Failing Guardrail Segments LAI IDS	Failing End Terminals LAI IDS	Recommendations
Big Lake Road	0.1	N/A	2407	Replace end terminal
Bogard Road	4.1 to 9.4	5259, 5261, 5264, 5267, 5268, 5269, 5270, 5271, 5272	2436, 2438, 2441, 2442, 2443, 2440, 2429, 2430, 2428, 2427, 2426, 2434, 2424, 2433, 2432,	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair
Bridge Access Road	2.5 to 2.8	5636	3082, 3084, 3078, 3080	Replace bridge connection, maintenance repair, replace entire segments, and replace end terminal
C Street	6.1	5019	N/A	Replace guardrail
East Seldon Extension	4.9 to 5.0	N/A	2681	Replace end terminal
Fairview Loop Road	1.3 to 8.4	5254, 5253, 5252, 5258,	2418, 2416, 2417, 2415, 2413, 2109, 2411, 2412, 2408, 2410	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

Brian Elliott
12/31/2021

Glenn Highway	0 to 36.3, 41.3 to 84.6, 92.7 to 109.9	5001, 5003, 5005, 5006, 5008, 5035, 5036, 5037, 5038, 5039, 5043, 5044, 5045, 5046, 5049, 5050, 5051, 5052, 5055, 5056, 5059, 5064, 5065, 5072, 5074, 5076, 5086, 5087, 5089, 5090, 5095, 5101, 5102, 5103, 5104, 5108, 5124, 5126, 5127, 5128, 5130, 5131, 5132, 5133, 5134, 5135, 5137, 5138, 5139, 5143, 5144, 5145, 5148, 5150, 5151, 5153, 5154, 5155, 5156, 5158, 5163, 5165, 5168, 5173, 5181, 5184, 5188, 5199, 5200, 5208, 5209, 5210, 5212, 5215, 5216, 5220, 5221, 5223, 5225, 5226, 5228, 5237, 5243, 5249, 5250, 5152, 5164, 5504, 5507, 5521, 5537, 5539, 5540, 5541, 5542, 5544, 5545, 5546, 5547, 5549, 5557, 5565, 5567, 5569, 5570, 5572, 5573, 5574, 5575, 5577, 5580, 5582, 5584, 5586, 5593, 5594, 5596, 5611, 5615, 5617, 5618, 5621, 5622, 5623, 5626, 5631, 5632, 5633, 5634, 5509, 5512, 5516	2005, 2008, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2057, 2058, 2059, 2060, 2065, 2066, 2067, 2068, 2070, 2071, 2072, 2074, 2075, 2077, 2079, 2087, 2089, 2092, 2093, 2095, 2096, 2097, 2101, 2103, 2104, 2105, 2108, 2109, 2112, 2113, 2116, 2117, 2118, 2119, 2120, 2126, 2128, 2129, 2130, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2143, 2145, 2147, 2153, 2154, 2157, 2158, 2160, 2161, 2164, 2165, 2166, 2167, 2169, 2174, 2178, 2179, 2180, 2184, 2185, 2187, 2188, 2192, 2194, 2198, 2200, 2202, 2204, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2216, 2218, 2219, 2221, 2222, 2223, 2224, 2225, 2226, 2228, 2229, 2232, 2233, 2234, 2235, 2236, 2238, 2239, 2241, 2243, 2246, 2247, 2248, 2249, 2254, 2255, 2256, 2260, 2262, 2263, 2264, 2268, 2269, 2273, 2274, 2280, 2281, 2283, 2289, 2290, 2291, 2292, 2293, 2294, 2296, 2297, 2298, 2299, 2300, 2159, 2186, 2213, 2258, 2261, 2266, 2270, 2303, 2304, 2305, 2307, 2308, 2312, 2326, 2330, 2331, 2333, 2336, 2337, 2341, 2344, 2345, 2346, 2347, 2350, 2351, 2353, 2354, 2355, 2362, 2363, 2366, 2367, 2369, 2373, 2376, 2379, 2380, 2382, 2383, 2386, 2387, 2388, 2391, 2393, 2395, 2397, 2399, 2403, 2404, 2318, 2846, 2847, 2848, 2849, 2850, 2851, 2852, 2853, 2868, 2869, 2870, 2873, 2875, 2876, 2879, 2881, 2889, 2892, 2893, 2896, 2897, 2898, 2899, 2900, 2901, 2902, 2903, 2904, 2905, 2906, 2908, 2909, 2910, 2911, 2914, 2915, 2922, 2925, 2926, 2927, 2928, 2929, 2930, 2931, 2939, 2941, 2942, 2944, 2945, 2949, 2950, 2951, 2952, 2953, 2954, 2955, 2957, 2958, 2959, 2960, 2961, 2962, 2964, 2965, 2966, 2969, 2970, 2971, 2972, 2974, 2977, 2978, 2979, 2980, 2981, 2982, 2983, 2985, 2986, 2987, 2988, 2989, 2990, 2991, 2992, 2994, 2996, 2997, 3002, 3004, 3007, 3010, 3011, 3012, 3014, 3016, 3017, 3020, 3021, 3023, 3026, 2037, 3030, 3031, 3032, 3040, 3041, 3042, 3043, 3044, 3046, 3048, 3050, 3052, 3053, 3054, 3055, 3056, 3057, 3058, 3060, 3061, 3062, 3063, 3064, 3065, 3068, 3069, 3070, 3071, 3072, 3073, 3074, 3076, 2842, 2855, 2859, 2860, 2861, 2862, 2863, 2864, 2865	Brian Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

Holt/ Lamplight Road	0.9 to 4.0	6060, 6061, 6069, 6079	3804, 3803, 3794, 3795, 3805, 3807, 3809, 3798, 3812, 3813, 3802	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair
Hope Road	0.8 to 14.9	5434, 5435, 5438, 5439, 5444, 5445, 5452, 5453, 5454, 5455, 5460	2700, 2701, 2702, 2703, 2704, 2705, 2706, 2707, 2708, 2709, 2710, 2711, 2713, 2715, 2716, 2717, 2718, 2719, 2720, 2721, 2722, 2723, 2724, 2725, 2726, 2729, 2731, 2732, 2734, 2735, 2736, 2737, 2739, 2740, 2742, 2743, 2744, 2746, 2747, 2748, 2750, 2751, 2752, 2753, 2754, 2755, 2756, 2758, 2759, 2760, 2762, 2763, 2764, 2765, 2766, 2767, 2768, 2769, 2770, 2771, 2772, 2773, 2775, 2776, 2777	Replace entire segments, replace end terminals, and maintenance repair
International Airport Road	0.3 to 1.7	5471, 5473, 5474, 5477	2781, 2791	Replace entire segments, replace end terminal, replace guardrail, and maintenance repair
Kalifornsky Beach Road	2.5 to 2.6, 14.1 to 14.2	6290, 6291	4115	Replace guardrail, replace end terminal, and maintenance repair
Kenai Spur Highway	3.2 to 6.1, 21.8 to 23.2, 28.7 to 38.2	6052, 6058 ,6055, 6293, 6294, 6307, 6295, 6296, 6309, 6297, 6312, 6299, 6313, 6314, 6300, 6303, 6317	3782, 3783, 3790, 3791, 3786, 3787, 3789, 4139, 4140, 4118, 4119, 4142, 4144, 4120, 4121, 4122, 4145, 4123, 4146, 4149, 4150, 4151, 4124, 4125, 4126, 4127, 4152, 4155, 4130, 4156, 4158, 4131, 4133, 4132, 4134, 4135, 4136, 4161, 4163, 4137	Replace entire segment, maintenance repair, and replace end terminal
Knik River Road	0.3 to 11.0	5483, 5488	2803, 2804, 2808, 2807, 2818, 2819	Maintenance repair and replace end terminal

Knik-Goose Bay Road	12.2 to 16.1	5500, 5490, 5491, 5492, 5493, 5495	2820, 2823, 2821, 2822, 2830, 2831, 2832, 2834, 2835, 2838, 2836, 2837, 2824, 2827, 2825, 2841, 2839	Replace entire segments, replace end terminal, and maintenance repair
Nash Road	0.5 to 2.1	5384, 5386	2609, 2610, 2611, 2623, 2624, 2612, 2615, 2616, 2627, 2628, 2617, 2625, 2626, 2629, 2619, 2631, 2620, 2632	Replace end terminal, maintenance repair, and replace entire segment
Old Glenn @ Palmer	13.0 to 17.4	5393, 5394, 5402, 5403, 5404, 5405, 5406, 5407, 5408, 5409, 5410, 5397, 5411, 5412, 5413, 5399, 5416	2651, 2635, 2652, 2637, 2656, 2663, 2666, 2668, 2643, 2648, 2672, 2673, 2671, 2674, 2650	Replace entire segment, replace guardrail, and maintenance repair
O'Malley Road	0.43 to 3.83	521, 5028, 5022, 5022, 5027, 5026, 5025, 5023, 5024	2056, 2041, 2042, 2055, 2043, 2054, 2044, 2053, 2052, 2051, 2050, 2049, 2045, 2048, 2046, 2047	No repair or replacement recommended because the O'Malley Road Reconstruction Project will remove all existing guardrail
Palmer-Fishhook Road	2.6 to 8.4	N/A	2685, 2684, 2694, 2698, 2695, 2697, 2693, 2688, 2690	Replace end terminal and maintenance repair

Parks Highway	0 to 4.5, 10.0 to 39.4, 45.6 to 108.7, 124.6 to 128.1	5883, 5887, 5888, 5884, 5866, 5869, 5873, 5874, 5897, 5899, 5361, 5376, 5375, 5378, 5368, 5369, 5370, 5367, 5365, 5377, 5362, 5363, 5364, 5875, 5878, 5903, 5904, 5905, 5907, 5910, 5913, 5918, 5921, 5924, 5925, 5932, 5933, 5934, 5935, 5937, 5938, 5939, 5942, 5944, 5947, 5948, 5950, 5955, 5958, 5960, 5961, 5962, 5963, 5964, 5965, 5966, 5967, 5968, 5906, 5880, 5882, 5970, 5973, 5975, 5976, 5977, 5978, 5985, 5990, 5994, 5997, 5999, 6000, 6001, 6002, 6005, 6006, 6009, 6012, 6017, 6018, 6021, 6024, 6027, 6028, 6029	2569, 2571, 2583, 2584, 2585, 2586, 2590, 2592, 2592, 2593, 2594, 2597, 2598, 2601, 2602, 2603, 2605, 2606, 2607, 2568, 2578, 2581, 3438, 3439, 3441, 3442, 3444, 3445, 3448, 3454, 3457, 3462, 3463, 3464, 3465, 3466, 3468, 3469, 3471, 3474, 3475, 3479, 3483, 3485, 3486, 3488, 3489, 3491, 3492, 3493, 3498, 3503, 3504, 3505, 3507, 3508, 3509, 3513, 3516, 3517, 3518, 3520, 3521, 3523, 3524, 3525, 3526, 3527, 3528, 3529, 3530, 3532, 3533, 3534, 3536, 3537, 3538, 3539, 3540, 3541, 3542, 3543, 3547, 3548, 3549, 3550, 3551, 3552, 3553, 3554, 3555, 3556, 3557, 3558, 3559, 3560, 3561, 3562, 3564, 3565, 3566, 3567, 3568, 3569, 3570, 3571, 3572, 3573, 3574, 3575, 3576, 3577, 3578, 3579, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3590, 3591, 3592, 3593, 3595, 3596, 3598, 3600, 3602, 3603, 3604, 3605, 3607, 3608, 3609, 3610, 3612, 3613, 3614, 3617, 3618, 3619, 3620, 3621, 3622, 3623, 3624, 3625, 3626, 3627, 3629, 3630, 3631, 3633, 3636, 3642, 3643, 3649, 3650, 3651, 3652, 3653, 3654, 3656, 3657, 3658, 3659, 3660, 3663, 3666, 3667, 3668, 3673, 3674, 3675, 3677, 3678, 3680, 3681, 3682, 3683, 3686, 3690, 3691, 3692, 3693, 3695, 3696, 3697, 3698, 3699, 3700, 3704, 3707, 3708, 3711, 3712, 3715, 3718, 3719, 3721, 3722, 3723, 3724, 3725, 3726, 3727, 3728, 3730, 3731, 3732, 3733, 3734, 3735, 3736, 3737, 3738, 3739, 3740, 3741, 3496	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair
Portage Glacier Road	1.9 to 4.1	5859, 5858, 5857, 5861, 5863	3420, 3436, 3435, 3419, 3416, 3411, 3412, 3422, 2423, 3424, 3433, 3425, 3429, 3431	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

Seward Highway	6.0 to 19.5, 22.4 to 31.2, 35.9 to 74, 89.7 to 98.9, 104.2 to 114.3	5321, 5323, 5290, 5324, 5325, 5312, 5328, 5311, 5319, 5329, 5288, 5287, 5333, 5334, 5286, 5335, 5331, 5330, 5332, 5308, 5285, 5341, 5306, 5343, 5284, 5344, 5350, 5303, 5302, 5301, 5279, 5280, 5278, 5277, 5297, 5294, 5706, 5745, 5746, 5747, 5748, 5749, 5750, 5752, 5755, 5758, 5759, 5760, 6762, 6763, 5766, 5767, 5769, 5740, 5720, 5729, 5716, 5730, 5741, 5731, 5708, 5709, 5735, 5711, 5712, 5736, 5713, 5714, 5738, 5715, 5717, 5773, 5774, 5777, 5779, 5781, 5782, 5784, 5787, 5788, 5791, 5792, 5796, 5797, 5798, 5801, 5803, 5804, 5805, 5806, 5807, 5808, 5809, 5810, 5811, 5814, 5819, 5820, 5821, 5822, 5824, 5825, 5826, 5827, 5828, 5829, 5831, 5832, 5834, 5837, 5838, 5841, 5846, 5847, 5849, 5852, 5854, 5856, 6236, 6237, 6238, 6244, 6245, 6246, 6253, 6254, 6256, 6257, 6259, 6260, 6261, 6263, 6264, 6265, 6268, 6269, 6271, 6272, 6277, 6278, 6279, 6280, 6284, 6285, 6286	2450, 2451, 2452, 2453, 2521, 2522, 2523, 2524, 2468, 2528, 2504, 2505, 2506, 2507, 2508, 2513, 2516, 2518, 2519, 2520, 2529, 2503, 2530, 2465, 2502, 2501, 2531, 2532, 2533, 2534, 2535, 2464, 2500, 2538, 2540, 2541, 2542, 2499, 2498, 2496, 2497, 2495, 2461, 2494, 2493, 2547, 2491, 2492, 2550, 2551, 2460, 2553, 2554, 2457, 2458, 2459, 2463, 2471, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2486, 2487, 2488, 2489, 2490, 2563, 2564, 2566, 2567, 2455, 2454, 3200, 3201, 3202, 3210, 3209, 3208, 3211, 3242, 3212, 3241, 3243, 3215, 3239, 3199, 3237, 3238, 3203, 3218, 3219, 3191, 3220, 3221, 3192, 3193, 3194, 3224, 3195, 3196, 3225, 3226, 3198, 3227, 3228, 3230, 3244, 3245, 3246, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3256, 3260, 3261, 3262, 3263, 3264, 3265, 3266, 3267, 3268, 3269, 3271, 3272, 3273, 3274, 3277, 3278, 3280, 3282, 3283, 3284, 3286, 3287, 3288, 3289, 3290, 3293, 3295, 3297, 3298, 3300, 3301, 3302, 3304, 3305, 3306, 3307, 3308, 3309, 3310, 3311, 3312, 3313, 3314, 3315, 3316, 3318, 3319, 3323, 3324, 3325, 3326, 3327, 3328, 3329, 3330, 3331, 3332, 3333, 3334, 3335, 3336, 3337, 3338, 3339, 3340, 3341, 3342, 3345, 3347, 3348, 3350, 3352, 3355, 3356, 3357, 3358, 3359, 3360, 3361, 3362, 3363, 3364, 3365, 3366, 3369, 3371, 3373, 3374, 3375, 3376, 3377, 3378, 3379, 3380, 3381, 3382, 3383, 3384, 3385, 3386, 3389, 3391, 3392, 3393, 3394, 3395, 3396, 3397, 3398, 3403, 3404, 3405, 3406, 3407, 3408, 4033, 4034, 4035, 4036, 4037, 4038, 4039, 4040, 4041, 4043, 4049, 4052, 4053, 4057, 4058, 4059, 4060, 4062, 4063, 4064, 4065, 4067, 4072, 4073, 4074, 4077, 4079, 4081, 4086, 4088, 4089, 4090, 4091, 4092, 4093, 4094, 4097, 4098, 4100, 4101, 4102, 4104, 4106, 4107, 4108, 4110	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

Sterling Highway	0.5 to 7.2, 14.0 to 38.9, 77.4, 81.1 to 104.3, 107.5 to 115.2, 119.2 to 121.7, 126.6 to 126.9	5639, 5642, 5653, 5659, 5661, 5662, 5663, 5664, 5665, 5669, 5672, 5674, 5677, 5678, 5683, 5684, 5687, 5688, 5690, 5692, 5693, 5694, 5696, 5700, 5701, 5704, 6117, 6123, 6128, 6130, 6133, 6171, 6177, 6179, 6183, 6191, 6192, 6193, 6194, 6195, 6198, 6200, 6203, 6205, 6209, 6210, 6211, 6213, 6215, 6218, 6227, 6223, 6225, 6080, 6132, 6115, 6092, 6094, 6113, 6100, 6102, 6144, 6103, 6155, 6145, 6146, 6112, 6147, 6105, 6154, 6148, 6106, 6150, 6153, 6109, 6107, 6108, 6149	3086, 3087, 3089, 3090, 3091, 3092, 3093, 3095, 3097, 3099, 3100, 3101, 3103, 3104, 3107, 3108, 3110, 3113, 3114, 3116, 3117, 3118, 3120, 3121, 3124, 3125, 3126, 3127, 3128, 3131, 3132, 3136, 3137, 3138, 3139, 3140, 3141, 3145, 3146, 3147, 3149, 3150, 3151, 3153, 3160, 3161, 3163, 3165, 3167, 3168, 3169, 3170, 3171, 3172, 3177, 3179, 3182, 3184, 3186, 3833, 3834, 3835, 3836, 3837, 3838, 3841, 3842, 3843, 3844, 3845, 3846, 3847, 3849, 3850, 3851, 3582, 3856, 3857, 3858, 3859, 3862, 3864, 3865, 3866, 3867, 3868, 3869, 3870, 3871, 3872, 3874, 3875, 3876, 3877, 3879, 3880, 3881, 3887, 3892, 3893, 3894, 3895, 3896, 3897, 3898, 3900, 3901, 3902, 3903, 3904, 3905, 3906, 3907, 3910, 3912, 3913, 3915, 3917, 3920, 3921, 3922, 3923, 3925, 3927, 3928, 3929, 3930, 3931, 3932, 3933, 3934, 3935, 3936, 3946, 3953, 3954, 3955, 3956, 3957, 3959, 3960, 3961, 3964, 3965, 3966, 3956, 3957, 3959, 3960, 3961, 3976, 3986, 3987, 3990, 3993, 4032, 3964, 3965, 3966, 4006, 4031, 3995, 4020, 4021, 4023, 4024, 4026, 4029, 4008, 4009, 4010, 3891, 4011, 4017	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair
Talkeetna Spur Road	5.1 to 5.5	6051	3780, 3781	Replace entire segment
Trunk Road	0.8 to 0.9	6030, 6031, 5418	3743, 3744, 3746, 2676, 2679, 2677	Replace end terminal and replace guardrail
Willow Fishhook Road	16.6 to 31.2	6046, 6050	3757, 3748, 3759, 3760, 3762, 3763, 3765, 3747, 3749, 3750, 3751, 3755, 3766, 3767, 3768, 3769, 3770, 3772, 3773, 3775, 3776, 3778, 3779	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

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Attachment C

Typical Site Photos

Left: Sterling Highway – Missing guardrail post
Right: Sterling Highway – Twisted and missing block

Left: Willow Fishhook Road – Failed end terminal
Right: Hope Road – Twisted block

Left: Sterling Highway – Post separation
Right: Hope Road – Post separation

Left: Glenn Highway – Guardrail deflection and post separation
Right: Glenn Highway – Guardrail failed due to height of rail

Left: Seward Highway – Missing block
Right: Seward Highway – Horizontal tear

Left: Seward Highway – Twisted and missing block
Right: Seward Highway – Missing block

Left: Glenn Highway – Post separation and guardrail deflection
Right: Seward Highway – Missing post

Glenn Highway – Twisted block

Attachment D

Section 106 PA Streamlined Project Screening Form

106 PA Streamlined Project Review Screening Record

Form version 2-23-19

This form is required when Programmatic Allowances are being considered.
It is not needed when circumstances lead directly to Sec 106 consultation under Appendix D.

Project Name: HSIP CR Guardrail Inventory and Upgrade

State Project #: CFHWY00564 **Federal Project #:** 0001665 **Assignable:** ☒ Yes ☐ No

Project Description:

The project would evaluate existing guardrails along multiple routes in Central Region (See attachment) and update or replace guardrail segments that do not meet current DOT&PF and FHWA standards. Improvements may include:
milling and paving; digouts; embankment reconstruction and stabilization; guardrail replacement; utility relocation; replacement of roadside hardware, end terminals, and signage; drainage improvements; vegetation clearing and grubbing.

Project Activities (please list individually; continue on next page if needed)	Indicate which Programmatic Allowance applies (Ex: Tier 1.a or Tier 2.b)	Are all conditions met, including Historic Rds Analysis if applicable?*	
Update, repair or replace guardrail segments not meeting current standards	1.f	☒ Yes	☐ No
Milling and paving	1.a	☒ Yes	☐ No
Digouts	1.a	☒ Yes	☐ No
Embankment reconstruction and stabilization	1.b	☒ Yes	☐ No
Utility relocation	2.l	☒ Yes	☐ No

** If yes, attach documentation of identification efforts that support this decision. This documentation must be sufficient to allow any reviewing party to understand the basis for the decision. The Area of Potential Effect (APE) must be included in this documentation for Tier 2 allowances. If Historic Roads Analysis applies, also document which HRA option was used, and how it was applicable.*

Description of APE (*attach figures): If **all** activities above are Tier 1, an APE is not required*

Guardrail installations at locations in attached table and including embankment areas and drainage facilities including ditches.

Screening Results:

Does the project include any activities which are not covered under the Appendix B Programmatic Allowances and/or which do not meet the conditions? ☐ Yes ☒ No

If yes, conduct standard Section 106 review for the entire project in accordance with PA Appendix D.

I have screened this update and determined that it ☒ Does ☐ Does Not qualify for processing as a Programmatic Allowance.

Erik D Hilsinger
DOT&PF PQI (printed name and signature)

Date: 11/2/2020

Continuation Sheet- 106 PA Screening Review Record

Project Activities-Continuation	Indicate which Programmatic Allowance applies	Are all conditions met, including Historic Rds Analysis if applicable?*	
Replacement of roadside hardware, end terminals, and signage;	1.e	☒ Yes	☐ No
Drainage improvements	1.d	☒ Yes	☐ No
Vegetation clearing and grubbing.	2.c	☒ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No
		☐ Yes	☐ No

Additional comment space: (include Historic Roads Analysis if applicable)

Tier 1 Conditions
1.a. No new ground disturbance would occur as repairs to paving would be made in kind in the vicinity of guardrail repair areas.
1.b. Work will remain within the existing toe of foreslope embankment.
1.d. No new ground disturbance would occur.
1.f. Repairs will be in kind or upgrades with similar materials to existing features. Ground disturbance will be within the road fill prism and no new ground disturbance will result.

Tier 2 General Conditions
1. The project is a transportation project to repair an existing transportation facility.
2. None of the areas of potential effect are located in National Historic Landmarks.
3. The PQI has carefully considered possible effects to historic and archaeological districts.
4. Standing buildings or structures include only roads including some roads previously determined not eligible (a), exempt interstate highways (b), and/or roads (c).
5. Ground disturbance is limited to existing disturbed areas on the prism.
6. The project has no known tribal concerns or public controversy related to historic preservation.

Tier 2 Additional Conditions
2.c Additional consideration was given to the application of vegetation clearing and grubbing in the vicinities listed in the additional conditions. Activities in these areas are limited to guardrail replacement. See attached email string.
2.l Utility relocations will be limited in scope and area and will be undertaken on an as needed basis.

Historic roads analysis was not triggered. The Glenn, Sterling, and Seward Highways are exempt from further consideration.

Table 1: Project Route List for Field Inventory

Route Name	Begin MPT	End MPT	Approx. Length (mi)	Notes
Big Lake Road	0	3.31	3.31	
Bogard Road	3.88	10.7	6.82	
Bridge Access Road	0.99	3.29	2.3	
C Street	4.35	7.68	3.33	
Fairview Loop Road	0	10.94	10.94	Coordinate with project 56020
Glenn Highway	0	118	109	*Skip MP 66-67, MP 84-92*
Holt Lamplight Road	0	8.35	8.35	
Hope Road	0	15.16	15.16	
International Airport Road	0.18	1.69	1.51	
Kalifornsky Beach Road	0	18.42	18.42	
Kenai Spur Highway	See Notes		29.09	MP 2.47-7.67, 12.78-25.39, 27.20-38.48
Knik Goose Bay Road	8	20	12	
Knik River Road	0	11.32	11.32	
Miller Loop Road	0	5.4	5.4	
Nash Road	0	2.4	2.4	
Old Glenn Highway	9.4	17.47	8.07	
O'Malley Road	0.43	3.83	3.4	
Palmer-Fishhook Road	0	8.66	8.66	
Parks Highway	See Notes		120.06	MP 0-4.41, 9.55-21.53, 22.71-33.24, 34.79-127.93
Portage Glacier Road	0	5.18	5.18	
East Seldon Extension	3.83	6	2.17	Wasilla Fishhook Road to Bogard Road
Seward Highway	8	114	91	*Skip MP 19.95-22.55, 75-90, 98.9-104.5*
Sterling Highway	See Notes		91.1	MP 0-7, 14.15-43.76, 46.45-56.25, 78.9-95.29, 98.35-116.00, 117.18-127.83
Talkeetna Spur Road	0	12.32	12.32	
Trunk Road	0.45	6.08	5.63	
Willow Fishhook Road	0	31.48	31.48	
		Total	618.42	

Table 2: Location of Failed Guardrail and End Terminals Recommended for Repair or Replacement by Route, Milepoint (MPT), and Lounsbury and Associates, Inc. (LAI) Identification number (ID) for Failing Guardrail Segments and End Terminals, and Recommendations

Route Name	MPT	Failing Guardrail Segments LAI IDS	Failing End Terminals LAI IDS	Recommendations
Big Lake Road	0.1	N/A	2407	Replace end terminal
Bogard Road	4.1 to 9.4	5259, 5261, 5264, 5267, 5268, 5269, 5270, 5271, 5272	2436, 2438, 2441, 2442, 2443, 2440, 2429, 2430, 2428, 2427, 2426, 2434, 2424, 2433, 2432,	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair
Bridge Access Road	2.5 to 2.8	5636	3082, 3084, 3078, 3080	Replace bridge connection, maintenance repair, replace entire segments, and replace end terminal
C Street	6.1	5019	N/A	Replace guardrail
East Seldon Extension	4.9 to 5.0	N/A	2681	Replace end terminal
Fairview Loop Road	1.3 to 8.4	5254, 5253, 5252, 5258,	2418, 2416, 2417, 2415, 2413, 2109, 2411, 2412, 2408, 2410	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

Glenn Highway	0 to 36.3, 41.3 to 84.6, 92.7 to 109.9	5001, 5003, 5005, 5006, 5008, 5035, 5036, 5037, 5038, 5039, 5043, 5044, 5045, 5046, 5049, 5050, 5051, 5052, 5055, 5056, 5059, 5064, 5065, 5072, 5074, 5076, 5086, 5087, 5089, 5090, 5095, 5101, 5102, 5103, 5104, 5108, 5124, 5126, 5127, 5128, 5130, 5131, 5132, 5133, 5134, 5135, 5137, 5138, 5139, 5143, 5144, 5145, 5148, 5150, 5151, 5153, 5154, 5155, 5156, 5158, 5163, 5165, 5168, 5173, 5181, 5184, 5188, 5199, 5200, 5208, 5209, 5210, 5212, 5215, 5216, 5220, 5221, 5223, 5225, 5226, 5228, 5237, 5243, 5249, 5250, 5152, 5164, 5504, 5507, 5521, 5537, 5539, 5540, 5541, 5542, 5544, 5545, 5546, 5547, 5549, 5557, 5565, 5567, 5569, 5570, 5572, 5573, 5574, 5575, 5577, 5580, 5582, 5584, 5586, 5593, 5594, 5596, 5611, 5615, 5617, 5618, 5621, 5622, 5623, 5626, 5631, 5632, 5633, 5634, 5509, 5512, 5516	2005, 2008, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2057, 2058, 2059, 2060, 2065, 2066, 2067, 2068, 2070, 2071, 2072, 2074, 2075, 2077, 2079, 2087, 2089, 2092, 2093, 2095, 2096, 2097, 2101, 2103, 2104, 2105, 2108, 2109, 2112, 2113, 2116, 2117, 2118, 2119, 2120, 2126, 2128, 2129, 2130, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2143, 2145, 2147, 2153, 2154, 2157, 2158, 2160, 2161, 2164, 2165, 2166, 2167, 2169, 2174, 2178, 2179, 2180, 2184, 2185, 2187, 2188, 2192, 2194, 2198, 2200, 2202, 2204, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2216, 2218, 2219, 2221, 2222, 2223, 2224, 2225, 2226, 2228, 2229, 2232, 2233, 2234, 2235, 2236, 2238, 2239, 2241, 2243, 2246, 2247, 2248, 2249, 2254, 2255, 2256, 2260, 2262, 2263, 2264, 2268, 2269, 2273, 2274, 2280, 2281, 2283, 2289, 2290, 2291, 2292, 2293, 2294, 2296, 2297, 2298, 2299, 2300, 2159, 2186, 2213, 2258, 2261, 2266, 2270, 2303, 2304, 2305, 2307, 2308, 2312, 2326, 2330, 2331, 2333, 2336, 2337, 2341, 2344, 2345, 2346, 2347, 2350, 2351, 2353, 2354, 2355, 2362, 2363, 2366, 2367, 2369, 2373, 2376, 2379, 2380, 2382, 2383, 2386, 2387, 2388, 2391, 2393, 2395, 2397, 2399, 2403, 2404, 2318, 2846, 2847, 2848, 2849, 2850, 2851, 2852, 2853, 2868, 2869, 2870, 2873, 2875, 2876, 2879, 2881, 2889, 2892, 2893, 2896, 2897, 2898, 2899, 2900, 2901, 2902, 2903, 2904, 2905, 2906, 2908, 2909, 2910, 2911, 2914, 2915, 2922, 2925, 2926, 2927, 2928, 2929, 2930, 2931, 2939, 2941, 2942, 2944, 2945, 2949, 2950, 2951, 2952, 2953, 2954, 2955, 2957, 2958, 2959, 2960, 2961, 2962, 2964, 2965, 2966, 2969, 2970, 2971, 2972, 2974, 2977, 2978, 2979, 2980, 2981, 2982, 2983, 2985, 2986, 2987, 2988, 2989, 2990, 2991, 2992, 2994, 2996, 2997, 3002, 3004, 3007, 3010, 3011, 3012, 3014, 3016, 3017, 3020, 3021, 3023, 3026, 2037, 3030, 3031, 3032, 3040, 3041, 3042, 3043, 3044, 3046, 3048, 3050, 3052, 3053, 3054, 3055, 3056, 3057, 3058, 3060, 3061, 3062, 3063, 3064, 3065, 3068, 3069, 3070, 3071, 3072, 3073, 3074, 3076, 2842, 2855, 2859, 2860, 2861, 2862, 2863, 2864, 2865	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

Holt/ Lamplight Road	0.9 to 4.0	6060, 6061, 6069, 6079	3804, 3803, 3794, 3795, 3805, 3807, 3809, 3798, 3812, 3813, 3802	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair
Hope Road	0.8 to 14.9	5434, 5435, 5438, 5439, 5444, 5445, 5452, 5453, 5454, 5455, 5460	2700, 2701, 2702, 2703, 2704, 2705, 2706, 2707, 2708, 2709, 2710, 2711, 2713, 2715, 2716, 2717, 2718, 2719, 2720, 2721, 2722, 2723, 2724, 2725, 2726, 2729, 2731, 2732, 2734, 2735, 2736, 2737, 2739, 2740, 2742, 2743, 2744, 2746, 2747, 2748, 2750, 2751, 2752, 2753, 2754, 2755, 2756, 2758, 2759, 2760, 2762, 2763, 2764, 2765, 2766, 2767, 2768, 2769, 2770, 2771, 2772, 2773, 2775, 2776, 2777	Replace entire segments, replace end terminals, and maintenance repair
International Airport Road	0.3 to 1.7	5471, 5473, 5474, 5477	2781, 2791	Replace entire segments, replace end terminal, replace guardrail, and maintenance repair
Kalifornsky Beach Road	2.5 to 2.6, 14.1 to 14.2	6290, 6291	4115	Replace guardrail, replace end terminal, and maintenance repair
Kenai Spur Highway	3.2 to 6.1, 21.8 to 23.2, 28.7 to 38.2	6052, 6058 ,6055, 6293, 6294, 6307, 6295, 6296, 6309, 6297, 6312, 6299, 6313, 6314, 6300, 6303, 6317	3782, 3783, 3790, 3791, 3786, 3787, 3789, 4139, 4140, 4118, 4119, 4142, 4144, 4120, 4121, 4122, 4145, 4123, 4146, 4149, 4150, 4151, 4124, 4125, 4126, 4127, 4152, 4155, 4130, 4156, 4158, 4131, 4133, 4132, 4134, 4135, 4136, 4161, 4163, 4137	Replace entire segment, maintenance repair, and replace end terminal
Knik River Road	0.3 to 11.0	5483, 5488	2803, 2804, 2808, 2807, 2818, 2819	Maintenance repair and replace end terminal

Knik-Goose Bay Road	12.2 to 16.1	5500, 5490, 5491, 5492, 5493, 5495	2820, 2823, 2821, 2822, 2830, 2831, 2832, 2834, 2835, 2838, 2836, 2837, 2824, 2827, 2825, 2841, 2839	Replace entire segments, replace end terminal, and maintenance repair
Nash Road	0.5 to 2.1	5384, 5386	2609, 2610, 2611, 2623, 2624, 2612, 2615, 2616, 2627, 2628, 2617, 2625, 2626, 2629, 2619, 2631, 2620, 2632	Replace end terminal, maintenance repair, and replace entire segment
Old Glenn @ Palmer	13.0 to 17.4	5393, 5394, 5402, 5403, 5404, 5405, 5406, 5407, 5408, 5409, 5410, 5397, 5411, 5412, 5413, 5399, 5416	2651, 2635, 2652, 2637, 2656, 2663, 2666, 2668, 2643, 2648, 2672, 2673, 2671, 2674, 2650	Replace entire segment, replace guardrail, and maintenance repair
O'Malley Road	0.43 to 3.83	521, 5028, 5022, 5022, 5027, 5026, 5025, 5023, 5024	2056, 2041, 2042, 2055, 2043, 2054, 2044, 2053, 2052, 2051, 2050, 2049, 2045, 2048, 2046, 2047	No repair or replacement recommended because the O'Malley Road Reconstruction Project will remove all existing guardrail
Palmer-Fishhook Road	2.6 to 8.4	N/A	2685, 2684, 2694, 2698, 2695, 2697, 2693, 2688, 2690	Replace end terminal and maintenance repair

1212

Parks Highway	0 to 4.5, 10.0 to 39.4, 45.6 to 108.7, 124.6 to 128.1	5883, 5887, 5888, 5884, 5866, 5869, 5873, 5874, 5897, 5899, 5361, 5376, 5375, 5378, 5368, 5369, 5370, 5367, 5365, 5377, 5362, 5363, 5364, 5875, 5878, 5903, 5904, 5905, 5907, 5910, 5913, 5918, 5921, 5924, 5925, 5932, 5933, 5934, 5935, 5937, 5938, 5939, 5942, 5944, 5947, 5948, 5950, 5955, 5958, 5960, 5961, 5962, 5963, 5964, 5965, 5966, 5967, 5968, 5906, 5880, 5882, 5970, 5973, 5975, 5976, 5977, 5978, 5985, 5990, 5994, 5997, 5999, 6000, 6001, 6002, 6005, 6006, 6009, 6012, 6017, 6018, 6021, 6024, 6027, 6028, 6029	2569, 2571, 2583, 2584, 2585, 2586, 2590, 2592, 2592, 2593, 2594, 2597, 2598, 2601, 2602, 2603, 2605, 2606, 2607, 2568, 2578, 2581, 3438, 3439, 3441, 3442, 3444, 3445, 3448, 3454, 3457, 3462, 3463, 3464, 3465, 3466, 3468, 3469, 3471, 3474, 3475, 3479, 3483, 3485, 3486, 3488, 3489, 3491, 3492, 3493, 3498, 3503, 3504, 3505, 3507, 3508, 3509, 3513, 3516, 3517, 3518, 3520, 3521, 3523, 3524, 3525, 3526, 3527, 3528, 3529, 3530, 3532, 3533, 3534, 3536, 3537, 3538, 3539, 3540, 3541, 3542, 3543, 3547, 3548, 3549, 3550, 3551, 3552, 3553, 3554, 3555, 3556, 3557, 3558, 3559, 3560, 3561, 3562, 3564, 3565, 3566, 3567, 3568, 3569, 3570, 3571, 3572, 3573, 3574, 3575, 3576, 3577, 3578, 3579, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3590, 3591, 3592, 3593, 3595, 3596, 3598, 3600, 3602, 3603, 3604, 3605, 3607, 3608, 3609, 3610, 3612, 3613, 3614, 3617, 3618, 3619, 3620, 3621, 3622, 3623, 3624, 3625, 3626, 3627, 3629, 3630, 3631, 3633, 3636, 3642, 3643, 3649, 3650, 3651, 3652, 3653, 3654, 3656, 3657, 3658, 3659, 3660, 3663, 3666, 3667, 3668, 3673, 3674, 3675, 3677, 3678, 3680, 3681, 3682, 3683, 3686, 3690, 3691, 3692, 3693, 3695, 3696, 3697, 3698, 3699, 3700, 3704, 3707, 3708, 3711, 3712, 3715, 3718, 3719, 3721, 3722, 3723, 3724, 3725, 3726, 3727, 3728, 3730, 3731, 3732, 3733, 3734, 3735, 3736, 3737, 3738, 3739, 3740, 3741, 3496	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair
Portage Glacier Road	1.9 to 4.1	5859, 5858, 5857, 5861, 5863	3420, 3436, 3435, 3419, 3416, 3411, 3412, 3422, 2423, 3424, 3433, 3425, 3429, 3431	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

Seward Highway	6.0 to 19.5, 22.4 to 31.2, 35.9 to 74, 89.7 to 98.9, 104.2 to 114.3	5321, 5323, 5290, 5324, 5325, 5312, 5328, 5311, 5319, 5329, 5288, 5287, 5333, 5334, 5286, 5335, 5331, 5330, 5332, 5308, 5285, 5341, 5306, 5343, 5284, 5344, 5350, 5303, 5302, 5301, 5279, 5280, 5278, 5277, 5297, 5294, 5706, 5745, 5746, 5747, 5748, 5749, 5750, 5752, 5755, 5758, 5759, 5760, 6762, 6763, 5766, 5767, 5769, 5740, 5720, 5729, 5716, 5730, 5741, 5731, 5708, 5709, 5735, 5711, 5712, 5736, 5713, 5714, 5738, 5715, 5717, 5773, 5774, 5777, 5779, 5781, 5782, 5784, 5787, 5788, 5791, 5792, 5796, 5797, 5798, 5801, 5803, 5804, 5805, 5806, 5807, 5808, 5809, 5810, 5811, 5814, 5819, 5820, 5821, 5822, 5824, 5825, 5826, 5827, 5828, 5829, 5831, 5832, 5834, 5837, 5838, 5841, 5846, 5847, 5849, 5852, 5854, 5856, 6236, 6237, 6238, 6244, 6245, 6246, 6253, 6254, 6256, 6257, 6259, 6260, 6261, 6263, 6264, 6265, 6268, 6269, 6271, 6272, 6277, 6278, 6279, 6280, 6284, 6285, 6286	2450, 2451, 2452, 2453, 2521, 2522, 2523, 2524, 2468, 2528, 2504, 2505, 2506, 2507, 2508, 2513, 2516, 2518, 2519, 2520, 2529, 2503, 2530, 2465, 2502, 2501, 2531, 2532, 2533, 2534, 2535, 2464, 2500, 2538, 2540, 2541, 2542, 2499, 2498, 2496, 2497, 2495, 2461, 2494, 2493, 2547, 2491, 2492, 2550, 2551, 2460, 2553, 2554, 2457, 2458, 2459, 2463, 2471, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2486, 2487, 2488, 2489, 2490, 2563, 2564, 2566, 2567, 2455, 2454, 3200, 3201, 3202, 3210, 3209, 3208, 3211, 3242, 3212, 3241, 3243, 3215, 3239, 3199, 3237, 3238, 3203, 3218, 3219, 3191, 3220, 3221, 3192, 3193, 3194, 3224, 3195, 3196, 3225, 3226, 3198, 3227, 3228, 3230, 3244, 3245, 3246, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3256, 3260, 3261, 3262, 3263, 3264, 3265, 3266, 3267, 3268, 3269, 3271, 3272, 3273, 3274, 3277, 3278, 3280, 3282, 3283, 3284, 3286, 3287, 3288, 3289, 3290, 3293, 3295, 3297, 3298, 3300, 3301, 3302, 3304, 3305, 3306, 3307, 3308, 3309, 3310, 3311, 3312, 3313, 3314, 3315, 3316, 3318, 3319, 3323, 3324, 3325, 3326, 3327, 3328, 3329, 3330, 3331, 3332, 3333, 3334, 3335, 3336, 3337, 3338, 3339, 3340, 3341, 3342, 3345, 3347, 3348, 3350, 3352, 3355, 3356, 3357, 3358, 3359, 3360, 3361, 3362, 3363, 3364, 3365, 3366, 3369, 3371, 3373, 3374, 3375, 3376, 3377, 3378, 3379, 3380, 3381, 3382, 3383, 3384, 3385, 3386, 3389, 3391, 3392, 3393, 3394, 3395, 3396, 3397, 3398, 3403, 3404, 3405, 3406, 3407, 3408, 4033, 4034, 4035, 4036, 4037, 4038, 4039, 4040, 4041, 4043, 4049, 4052, 4053, 4057, 4058, 4059, 4060, 4062, 4063, 4064, 4065, 4067, 4072, 4073, 4074, 4077, 4079, 4081, 4086, 4088, 4089, 4090, 4091, 4092, 4093, 4094, 4097, 4098, 4100, 4101, 4102, 4104, 4106, 4107, 4108, 4110	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

Sterling Highway	0.5 to 7.2, 14.0 to 38.9, 77.4, 81.1 to 104.3, 107.5 to 115.2, 119.2 to 121.7, 126.6 to 126.9	5639, 5642, 5653, 5659, 5661, 5662, 5663, 5664, 5665, 5669, 5672, 5674, 5677, 5678, 5683, 5684, 5687, 5688, 5690, 5692, 5693, 5694, 5696, 5700, 5701, 5704, 6117, 6123, 6128, 6130, 6133, 6171, 6177, 6179, 6183, 6191, 6192, 6193, 6194, 6195, 6198, 6200, 6203, 6205, 6209, 6210, 6211, 6213, 6215, 6218, 6227, 6223, 6225, 6080, 6132, 6115, 6092, 6094, 6113, 6100, 6102, 6144, 6103, 6155, 6145, 6146, 6112, 6147, 6105, 6154, 6148, 6106, 6150, 6153, 6109, 6107, 6108, 6149	3086, 3087, 3089, 3090, 3091, 3092, 3093, 3095, 3097, 3099, 3100, 3101, 3103, 3104, 3107, 3108, 3110, 3113, 3114, 3116, 3117, 3118, 3120, 3121, 3124, 3125, 3126, 3127, 3128, 3131, 3132, 3136, 3137, 3138, 3139, 3140, 3141, 3145, 3146, 3147, 3149, 3150, 3151, 3153, 3160, 3161, 3163, 3165, 3167, 3168, 3169, 3170, 3171, 3172, 3177, 3179, 3182, 3184, 3186, 3833, 3834, 3835, 3836, 3837, 3838, 3841, 3842, 3843, 3844, 3845, 3846, 3847, 3849, 3850, 3851, 3582, 3856, 3857, 3858, 3859, 3862, 3864, 3865, 3866, 3867, 3868, 3869, 3870, 3871, 3872, 3874, 3875, 3876, 3877, 3879, 3880, 3881, 3887, 3892, 3893, 3894, 3895, 3896, 3897, 3898, 3900, 3901, 3902, 3903, 3904, 3905, 3906, 3907, 3910, 3912, 3913, 3915, 3917, 3920, 3921, 3922, 3923, 3925, 3927, 3928, 3929, 3930, 3931, 3932, 3933, 3934, 3935, 3936, 3946, 3953, 3954, 3955, 3956, 3957, 3959, 3960, 3961, 3964, 3965, 3966, 3956, 3957, 3959, 3960, 3961, 3976, 3986, 3987, 3990, 3993, 4032, 3964, 3965, 3966, 4006, 4031, 3995, 4020, 4021, 4023, 4024, 4026, 4029, 4008, 4009, 4010, 3891, 4011, 4017	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair
Talkeetna Spur Road	5.1 to 5.5	6051	3780, 3781	Replace entire segment
Trunk Road	0.8 to 0.9	6030, 6031, 5418	3743, 3744, 3746, 2676, 2679, 2677	Replace end terminal and replace guardrail
Willow Fishhook Road	16.6 to 31.2	6046, 6050	3757, 3748, 3759, 3760, 3762, 3763, 3765, 3747, 3749, 3750, 3751, 3755, 3766, 3767, 3768, 3769, 3770, 3772, 3773, 3775, 3776, 3778, 3779	Replace entire segments, replace end terminals, replace guardrail, and maintenance repair

Attachment E

Optional 23 CFR
71.117(e) Form

State of Alaska
Department of Transportation & Public Facilities

23 CFR 771.117(e) FORM
FOR NEPA ASSIGNMENT PROGRAM PROJECTS

Optional for projects classified under
23 CFR 771.117(c)(26), (c)(27) and (c)(28)

I. Project Information:

1. Project Name: HSIP: Central Region Guardrail Inventory and Upgrade
2. Federal-aid Project Number: 0001665
3. State Project Number: CFHWY00564
4. Date prepared: November 20, 2020
5. CE Designation: 23 CFR 771.117(c)(27)

II. Applicability: Does the project involve any of the following? *Use the text boxes to present supporting information.*

If YES is selected for any item, the project cannot be approved under 23 CFR 771.117(c)(26-28)

a. An acquisition of more than a minor amount of right-of-way or that would result in any residential or non-residential displacements. ☐ Yes ☒ No

Work would be within existing DOT&PF right-of-way (ROW). Residential and/or non-residential displacements would not occur.

b. An action that needs a bridge permit from the U.S. Coast Guard, or an action that does not meet the terms and conditions of a U.S. Army Corps of Engineers nationwide or general permit under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899**.** ☐ Yes ☒ No

Work is not anticipated to require a U.S. Coast Guard bridge permit. Work would be within the existing DOT&PF ROW and any work extending outside of the existing embankment would be limited to reshaping ditches to their original condition and limited vegetation clearing and grubbing. Therefore, there would be no impacts to wetlands or Waters of the U.S. and a U.S. Army Corps of Engineers permit would not be required.

c. A finding of "adverse effect" to historic properties under the National Historic Preservation Act. ☐ Yes ☒ No

The proposed project is not to anticipated to have an adverse effect on any historic properties under the National Historic Preservation Act.

d. The use of a resource protected under 23 U.S.C. 138 or 49 U.S.C. 303 [Section 4(f)] except for actions resulting in *de minimis* impacts**.** ☐ Yes ☒ No

Work would be within existing DOT&PF ROW and would not result in "use" of a Section 4(f) resource.

e. A finding of "may affect, likely to adversely affect" threatened or endangered species or critical habitat under the Endangered Species Act. ☐ Yes ☒ No

The proposed project is not anticipated to have an adverse effect on a threatened or endangered species or critical habitat area, as no threatened and endangered species or critical habitat is known to exist in the project area.

f. Construction of temporary access, or the closure of an existing road, bridge, or ramps, that would result in major traffic disruptions. ☐ Yes ☒ No

Work is not anticipated to require construction of temporary access, or closure of existing roads, bridges, or ramps, that would cause major traffic disruptions.

g. Changes in access control**.** ☐ Yes ☒ No

Work would not involve changes in access control.

h. A floodplain encroachment other than functionally dependent uses (e.g. bridges, wetlands) or actions that facilitate open space use (e.g. recreational trails, bicycle and pedestrian paths**.** ☐ Yes ☒ No

Work would be within existing DOT&PF ROW and work outside of the existing embankment would be limited to reshaping ditches to their original condition and limited vegetation grubbing and clearing. Therefore, the Project would not encroach into a mapped floodplain.

i. Construction activities in, across or adjacent to a river component designated or proposed for inclusion in the National System of Wild and Scenic Rivers**.** ☐ Yes ☒ No

The Project would not construct across or adjacent to a proposed or designated Wild and Scenic River.

APPENDIX C

HSIP Nomination

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION & PUBLIC FACILITIES
Central Region Traffic & Safety Section

Federal Fiscal Year (FFY) 2019 Highway Safety Improvement Program (HSIP)
Candidate Description and Cost Estimate

Name:

19CN03: Central Region Guardrail Inventory and Upgrade

Location:

Proposed improvements would be located on roads throughout Central Region that are considered high speed (roads with posted speed limits of 50 miles per hour or greater). Roads that meet the criteria are listed below along with the CDS route number and the length of the road that is high speed. These roads are typically arterials carrying thousands of vehicles per day with some at higher volumes above ten-thousand. Lower volume roads are typically collectors at a few thousand to less than ten-thousand vehicles per day.

If deemed appropriate, additional routes may be added through consultation with Central Region and Statewide Traffic and Safety staff. These routes may be owned by the Alaska Department of Transportation and Public Facilities (DOT&PF), the Municipality of Anchorage, the Matanuska-Susitna Borough, the Kenai Peninsula Borough or another local agency. The posted speeds on the routes of highest concern vary from 50 to 65 miles per hour, the same intent as the Highway Preconstruction Manual (HPCM) Table 1130-12.

	Route Name	CDS Route	Miles
1	Big Lake Road	170073	3.31
2	Bogard Road	170700	10.65
3	Bridge Access Road	117790	3.04
4	C Street	134341	3.29
5	Fairview Loop Road	170028	10.94
6	Glenn Highway	135000	63.55
7	Hope Road	132000	15.16
8	International Airport Road	133800	1.73
9	Kalifornsky Beach Road	115400	18.42
10	Kenai Spur Highway	117600	24.13
11	Knik Goose Bay Road	170044	18.5
12	Miller Loop Road	116100	5.4
13	Nash Road	130500	2.31
14	O'Malley Road	133500	3.4
15	Palmer-Fishhook Road	137000	8.66
16	Palmer-Wasilla Highway	136800	8.23
17	Parks Highway	170000	215.85
18	Portage Glacier Road	132300	5.18
19	East Seldon Extension / Bogard Extension	170088	2.12
20	Seward Highway	130000	109.83
21	Sterling Highway	110000	98.74

22	Talkeetna Spur Road	171000	12.32
23	Trunk Road	170200	5.63
24	Tudor Road	133899	2.19

Safety Problem Description:

A road scan conducted September 7-8, 2017 identified isolated runs of guardrail where:

- Breakaway Cable Terminals (BCT) were still in use
- guardrail height was low (less than 26-1/2")
- steel blockouts were used without backup plates
- Square washers were used on the face of rail
- Length of need appeared to be too short

These conditions may prevent the guardrail from redirecting errant vehicles.

While there have been crashes at guardrail locations on these roads, it is not known if they are at locations with outdated hardware. As such, no crash summary is provided. The risk to vehicle occupants is increased where guardrail and end terminals do not meet National Cooperative Highway Research Program (NCHRP) 350 or Manual for Assessing Safety Hardware (MASH) criteria or may fail to perform as intended in roadway departure crashes.

Proposed Mitigation:

To minimize the potential for the guardrail system to fail to perform as intended, a detailed inventory and rating system will be considered.

- Evaluate appropriateness of installed guardrail and identify potential upgrades to current standards
- Examine guardrail for damage and signs of deterioration to unacceptable levels
- Assess guardrail for compliance with current Federal Highways Administration (FHWA) and DOT&PF standards and specifications. This is expected to include some or all of the following:
    - Checks guardrail system for compliance with crashworthiness standards
    - Determine if Length of Need is in accordance with the HPCM
    - Check hardware for tightness and proper size
    - Check offset blocks for proper position
    - Check for fixed objects within the deflection area
    - Check shoulder width behind the post to ensure proper support of the posts
    - Check guardrail location relative to any curb
    - Where appropriate, check for proper transitioning
    - Check timber posts for damage or rot
    - Check steel posts for rust, being bent or badly deflected
    - Identify other obvious defects of guardrail and end treatments
    - Identify end terminals not meeting manufacturer's installation guidelines

Construction packages will upgrade the following:

- Guardrail with height less than 27"
- Steel blockouts with no backup plates present
- End terminals that do not meet current NCHRP 350 or MASH standards, replacement terminals may include – buried in backslope terminals, parabolic flared terminals or other FHWA compliant terminals based on site conditions
- Blunt ends
- Lack of soil backing behind posts (unless post length is meets Standard Drawing G-10)
- Fixed objects within the deflection area
- Length of Need is not met

All new hardware will be MASH compliant. Existing end terminals that are NCHRP 350 compliant and do not need other modifications will remain.

Areas where existing projects are in design that include guardrail upgrades will be removed from this project. These locations will be documented in the Design Study Report. Other deficiencies not being repaired or replaced will be summarized and addressed as routine maintenance when needed.

A guardrail inventory app was developed by DOT&PF Northern Region for a similar HSIP project and could be used for the proposed work in this nomination.

This project could be bundled or phase constructed as one or more construction projects.

Strategic Highway Safety Plan Conformance:

The proposed improvements are consistent with the Alaska Strategic Highway Safety Plan, Roadway Strategies: Engineering, Strategy 2 - Action 2.3: Implement infrastructure projects to address run off road crashes.

Benefit/Cost Ratio:

This project is presented as a systemic project because it addresses similar characteristics, risk factors, and potential crash types at multiple locations under one project.

A benefit/cost ratio was not prepared because an acceptable Crash Reduction Factor (CRF) has not been identified. The CMF Clearinghouse identified three potential CRFs (Cafiso et al., 2014), however, the CMF Clearinghouse evaluated the quality of the study as low (2 of 5 stars), and the study addressed only multilane divided highways with significantly higher volumes than the roads under consideration.

Cost Estimate:

Based on sampling of principal roads showing 25% areas of concern and multiplied by the length of the project.

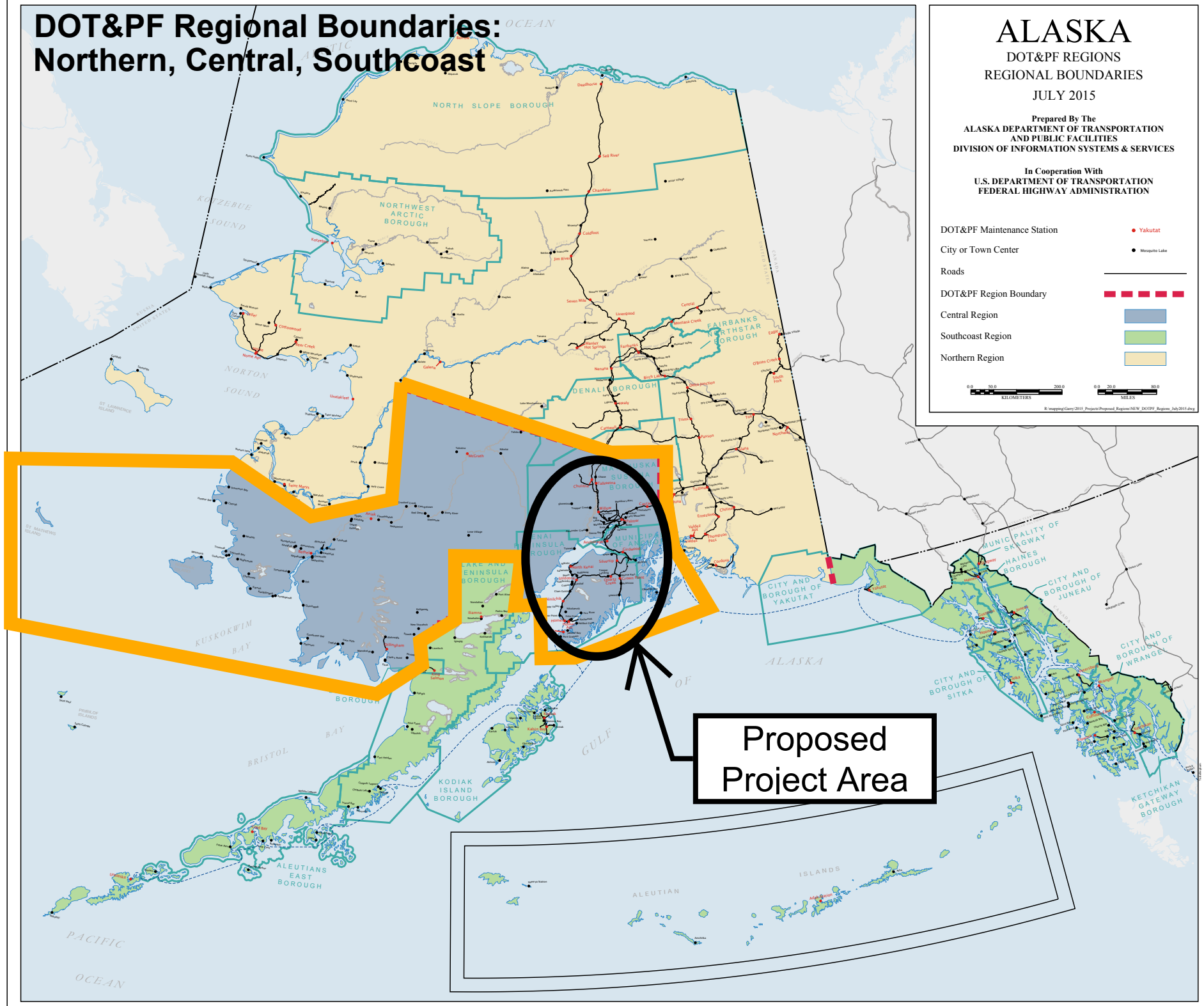
PHASE	AMOUNT	Estimated Start Date
Pre Environmental Engineering (Phase 2):	$1,000,000	FFY 2019
Post Environmental Engineering (Phase 2):	$1,654,000	FFY 2020
Right of Way (Phase 3):	$2,123,000	FFY 2021
Utilities (Phase 7):	$531,000	FFY 2021
Construction (Phase 4):	$19,373,000	FFY 2022

TOTAL: $24,681,000

(Note: All phases include an Indirect Cost Allocation Plan (ICAP) rate of 4.44%. Contract Administration of 25% is included for Construction.)

Attachments:

DOT&PF Regional Boundaries: Northern, Central, Southcoast



Central Region Guardrail Inventory and Upgrades

Cost Estimate

Work		Quantity	Unit	Unit Cost	Total Cost	Remarks
REMOVALS						
606(6)	Removing and Disposing of Guardrail	200000	LF	$3.00	$600,000	
INSTALLATIONS						
606	Guardrail	200000	LF	$25.00	$5,000,000	
606	Parallel Guardrail Terminals	340	EA	$4,900.00	$1,666,000	
606	Guardrail End Terminal with Widening	70	EA	$5,400.00	$378,000	
606	Buried in Backslope Terminal	140	EA	$10,000.00	$1,400,000	
606	Parabolic Flare with widening	140	EA	$8,000.00	$1,120,000	
TRAFFIC CONTROL						
OTHER						
640	Mobilization/Demobilization	1	LS	All Req'd	$1,524,600	15% of pay items
641	Erosion/Pollution Control	1	LS	All Req'd	$609,840	6% of pay items
642	Construction Surveying / Survey Party	1	LS	All Req'd	$508,200	5% of pay items
643	Traffic Maintenance / Flagging / Control	1	LS	All Req'd	$2,032,800	20% of pay items
				Construction Subtotal	$14,839,440	
UTILITIES						
	Electric	0	LS	All Req'd		
	Fiber	0	LS	All Req'd		
	Gas	0	LS	All Req'd		
	Telecom	0	LS	All Req'd		
	Utility Administration		%	25.00%		
				Utilities Subtotal	$508,200	
COST ESTIMATE SUMMARY						WITH 4.44% ICAP
	Preliminary Design (Phase 2)		LS	All Req'd	$2,541,000	$2,654,000
	Right-of-Way Partial Acquisition (Phase 3)		SF		$2,032,800	$2,123,000
	Utilities (Phase 7)		LS	All Req'd	$508,200	$531,000
	Construction (Phase 4)		LS		$14,839,000	$15,498,000
	Construction Administration		%	25.00%	$3,710,000	$3,875,000

Improvements:

Guardrail

Total: $24,681,000

APPENDIX D

Draft Railroad Crossing Checklist

U. S. DOT CROSSING INVENTORY FORM

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

OMB No. 2130-0017

Instructions for the initial reporting of the following types of new or previously unreported crossings: For public highway-rail grade crossings, complete the entire inventory Form. For private highway-rail grade crossings, complete the Header, Parts I and II, and the Submission Information section. For public pathway grade crossings (including pedestrian station grade crossings), complete the Header, Parts I and II, and the Submission Information section. For Private pathway grade crossings, complete the Header, Parts I and II, and the Submission Information section. For grade-separated highway-rail or pathway crossings (including pedestrian station crossings), complete the Header, Part I, and the Submission Information section. For changes to existing data, complete the Header, Part I Items 1-3, and the Submission Information section, in addition to the updated data fields. Note: For private crossings only, Part I Item 20 and Part III Item 2.K. are required unless otherwise noted. An asterisk * denotes an optional field.

A. Revision Date (MM/DD/YYYY)	B. Reporting Agency	C. Reason for Update (Select only one)	D. DOT Crossing Inventory Number
02 / 24 / 2020	☒ Railroad ☐ Transit ☐ State ☐ Other	☒ Change in Data ☐ New Crossing ☐ Closed ☐ No Train Traffic ☐ Quiet Zone Update ☐ Re-Open ☐ Date Change Only ☐ Change in Primary Operating RR ☐ Admin. Correction	868236S

Part I: Location and Classification Information

1. Primary Operating Railroad	2. State	3. County
Alaska Railroad Corporation [ARR]	ALASKA	KENAI PENINSULA

4. City / Municipality	5. Street/Road Name & Block Number	6. Highway Type & No.
☒ In ☐ Near MOOSE PASS	SEWARD HIGHWAY (Street/Road Name) | * (Block Number)	SR 9

7. Do Other Railroads Operate a Separate Track at Crossing? ☐ Yes ☒ No	8. Do Other Railroads Operate Over Your Track at Crossing? ☐ Yes ☒ No
If Yes, Specify RR	If Yes, Specify RR

9. Railroad Division or Region	10. Railroad Subdivision or District	11. Branch or Line Name	12. RR Milepost
☐ None ALASKA	☐ None KENAI	☐ None MAIN LINE	(prefix) | 0023.780 (nnnn.nnn) | (suffix)

13. Line Segment *	14. Nearest RR Timetable Station *	15. Parent RR (if applicable)	16. Crossing Owner (if applicable)
	CROWN POINT	☐ N/A ARR	☒ N/A

17. Crossing Type	18. Crossing Purpose	19. Crossing Position	20. Public Access (if Private Crossing)	21. Type of Train	22. Average Passenger Train Count Per Day
☒ Public ☐ Private	☒ Highway ☐ Pathway, Ped. ☐ Station, Ped.	☒ At Grade ☐ RR Under ☐ RR Over	☐ Yes ☐ No	☒ Freight ☐ Transit ☐ Intercity Passenger ☐ Shared Use Transit ☐ Commuter ☒ Tourist/Other	☐ Less Than One Per Day ☒ Number Per Day 4

23. Type of Land Use
☒ Open Space ☐ Farm ☐ Residential ☐ Commercial ☐ Industrial ☐ Institutional ☐ Recreational ☐ RR Yard

24. Is there an Adjacent Crossing with a Separate Number?	25. Quiet Zone (FRA provided)
☐ Yes ☒ No If Yes, Provide Crossing Number	☒ No ☐ 24 Hr ☐ Partial ☐ Chicago Excused Date Established

26. HSR Corridor ID	27. Latitude in decimal degrees	28. Longitude in decimal degrees	29. Lat/Long Source
☒ N/A	(WGS84 std: nn.nnnnnnn) 60.4080660	(WGS84 std: -nnn.nnnnnnn) -149.3704700	☒ Actual ☐ Estimated

30.A. Railroad Use *	31.A. State Use *
30.B. Railroad Use *	31.B. State Use *
30.C. Railroad Use *	31.C. State Use *
30.D. Railroad Use *	31.D. State Use *
32.A. Narrative (Railroad Use) *	32.B. Narrative (State Use) *

33. Emergency Notification Telephone No. (posted)	34. Railroad Contact (Telephone No.)	35. State Contact (Telephone No.)
800-478-2334	907-265-2462	907-465-8962

Part II: Railroad Information

1. Estimated Number of Daily Train Movements

1.A. Total Day Thru Trains (6 AM to 6 PM)	1.B. Total Night Thru Trains (6 PM to 6 AM)	1.C. Total Switching Trains	1.D. Total Transit Trains	1.E. Check if Less Than One Movement Per Day ☐ How many trains per week?
6	0	0	4	

2. Year of Train Count Data (YYYY)	3. Speed of Train at Crossing
2019	3.A. Maximum Timetable Speed (mph) 35 3.B. Typical Speed Range Over Crossing (mph) From 25 to 35

4. Type and Count of Tracks
Main 1 Siding 0 Yard 0 Transit 0 Industry 0

5. Train Detection (Main Track only)
☒ Constant Warning Time ☐ Motion Detection ☐ AFO ☐ PTC ☐ DC ☐ Other ☐ None

6. Is Track Signaled?	7.A. Event Recorder	7.B. Remote Health Monitoring
☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No

U. S. DOT CROSSING INVENTORY FORM

A. Revision Date *(MM/DD/YYYY)*	PAGE 2	D. Crossing Inventory Number *(7 char.)*
02/24/2020		868236S

Part III: Highway or Pathway Traffic Control Device Information

1. Are there Signs or Signals? ☒ Yes ☐ No

2. Types of Passive Traffic Control Devices associated with the Crossing

2.A. Crossbuck Assemblies *(count)*	2.B. STOP Signs *(R1-1) (count)*	2.C. YIELD Signs *(R1-2) (count)*	2.D. Advance Warning Signs *(Check all that apply; include count)* ☐ None
2	0	0	☒ W10-1 2 ☒ W10-3 0 ☒ W10-11 0 ☒ W10-2 0 ☒ W10-4 0 ☒ W10-12 0

2.E. Low Ground Clearance Sign *(W10-5)*	2.F. Pavement Markings	2.G. Channelization Devices/Medians	2.H. EXEMPT Sign *(R15-3)*	2.I. ENS Sign *(I-13)* Displayed
☐ Yes *(count_____)* ☒ No	☒ Stop Lines ☐ Dynamic Envelope ☐ RR Xing Symbols ☐ None	☐ All Approaches ☐ Median ☐ One Approach ☒ None	☐ Yes ☒ No	☒ Yes ☐ No

2.J. Other MUTCD Signs	2.K. Private Crossing Signs *(if private)*	2.L. LED Enhanced Signs *(List types)*
☐ Yes ☒ No Specify Type _____ Count _____ Specify Type _____ Count _____ Specify Type _____ Count _____	☐ Yes ☐ No	

3. Types of Train Activated Warning Devices at the Grade Crossing *(specify count of each device for all that apply)*

3.A. Gate Arms *(count)*	3.B. Gate Configuration	3.C. Cantilevered *(or Bridged)* Flashing Light Structures *(count)*	3.D. Mast Mounted Flashing Lights *(count of masts)* 4	3.E. Total Count of Flashing Light Pairs
Roadway 2 Pedestrian 0	☒ 2 Quad ☐ Full *(Barrier)* Resistance ☐ 3 Quad ☐ 4 Quad ☐ Median Gates	Over Traffic Lane 2 ☐ Incandescent Not Over Traffic Lane 0 ☒ LED	☐ Incandescent ☒ LED ☒ Back Lights Included ☐ Side Lights Included	8

3.F. Installation Date of Current Active Warning Devices: *(MM/YYYY)*	3.G. Wayside Horn	3.H. Highway Traffic Signals Controlling Crossing	3.I. Bells *(count)*
_____/_____ ☐ Not Required	☐ Yes Installed on *(MM/YYYY)* _____/_____ ☒ No	☐ Yes ☒ No	2

3.J. Non-Train Active Warning	3.K. Other Flashing Lights or Warning Devices
☐ Flagging/Flagman ☐ Manually Operated Signals ☐ Watchman ☐ Floodlighting ☒ None	Count 0 Specify type _____

4.A. Does nearby Hwy Intersection have Traffic Signals?	4.B. Hwy Traffic Signal Interconnection	4.C. Hwy Traffic Signal Preemption	5. Highway Traffic Pre-Signals	6. Highway Monitoring Devices *(Check all that apply)*
☐ Yes ☒ No	☒ Not Interconnected ☐ For Traffic Signals ☐ For Warning Signs	☐ Simultaneous ☐ Advance	☐ Yes ☒ No Storage Distance * _____ Stop Line Distance * _____	☐ Yes - Photo/Video Recording ☐ Yes – Vehicle Presence Detection ☒ None

Part IV: Physical Characteristics

1. Traffic Lanes Crossing Railroad	2. Is Roadway/Pathway Paved?	3. Does Track Run Down a Street?	4. Is Crossing Illuminated? *(Street lights within approx. 50 feet from nearest rail)*
☐ One-way Traffic ☒ Two-way Traffic ☐ Divided Traffic Number of Lanes 2	☒ Yes ☐ No	☐ Yes ☒ No	☐ Yes ☒ No

5. Crossing Surface *(on Main Track, multiple types allowed)* Installation Date * *(MM/YYYY)* _____/_____ Width * 10 Length * 140

☐ 1 Timber ☐ 2 Asphalt ☐ 3 Asphalt and Timber ☒ 4 Concrete ☐ 5 Concrete and Rubber ☐ 6 Rubber ☐ 7 Metal
☐ 8 Unconsolidated ☐ 9 Composite ☐ 10 Other *(specify)* _____

6. Intersecting Roadway within 500 feet?	7. Smallest Crossing Angle	8. Is Commercial Power Available? *
☐ Yes ☒ No If Yes, Approximate Distance *(feet)* _____	☒ 0° – 29° ☐ 30° – 59° ☐ 60° - 90°	☒ Yes ☐ No

Part V: Public Highway Information

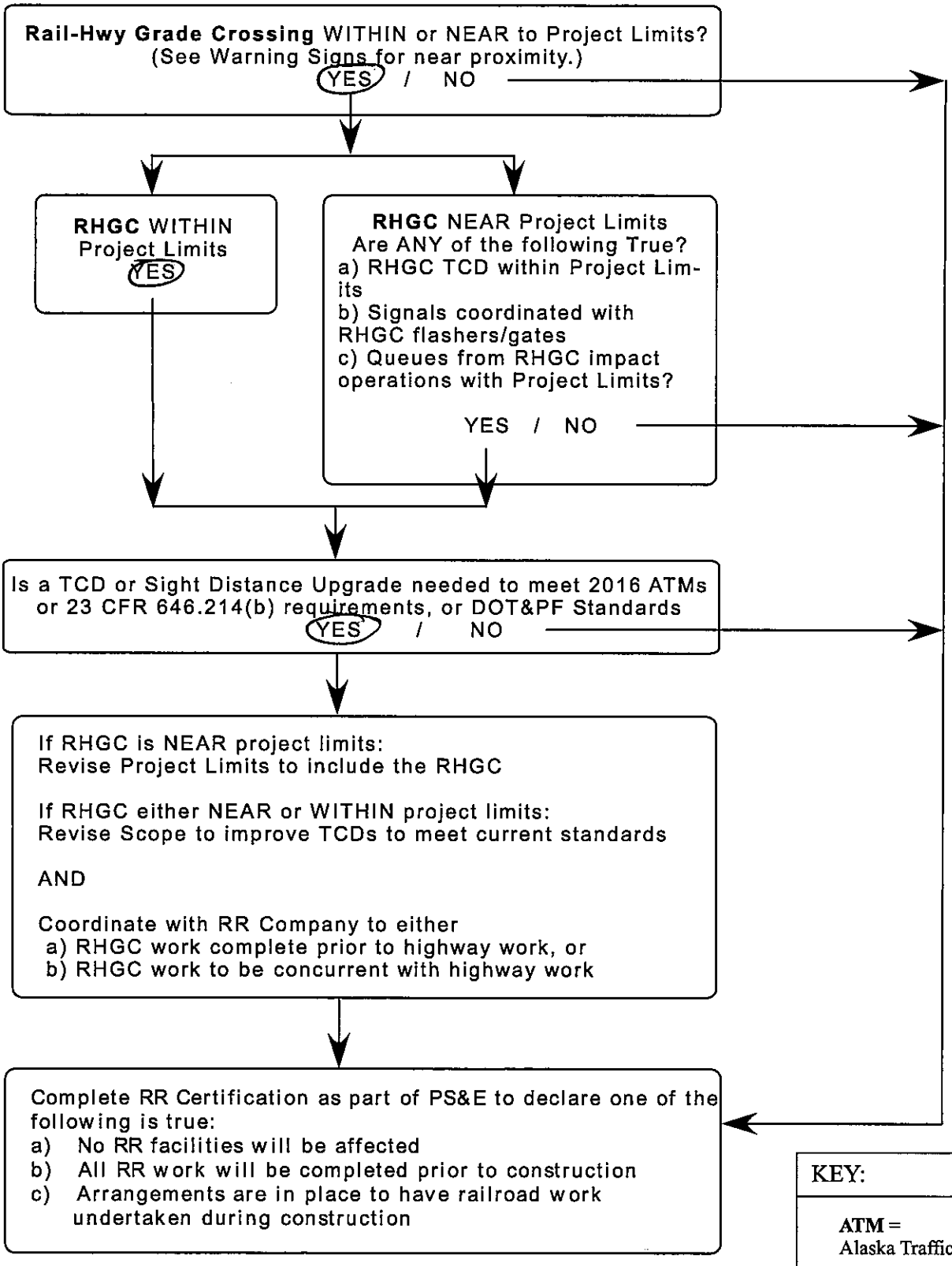
1. Highway System	2. Functional Classification of Road at Crossing	3. Is Crossing on State Highway System?	4. Highway Speed Limit
☐ (01) Interstate Highway System ☒ (02) Other Nat Hwy System (NHS) ☐ (03) Federal AID, Not NHS ☐ (08) Non-Federal Aid	☒ (0) Rural ☐ (1) Urban ☐ (1) Interstate ☐ (5) Major Collector ☐ (2) Other Freeways and Expressways ☒ (3) Other Principal Arterial ☐ (6) Minor Collector ☐ (4) Minor Arterial ☐ (7) Local	☒ Yes ☐ No 5. Linear Referencing System *(LRS Route ID)* * 6. LRS Milepost *	55 MPH ☒ Posted ☐ Statutory

7. Annual Average Daily Traffic *(AADT)*	8. Estimated Percent Trucks	9. Regularly Used by School Buses?	10. Emergency Services Route
Year 2018 AADT 2042	2 %	☒ Yes ☐ No Average Number per Day 2	☒ Yes ☐ No

Submission Information - *This information is used for administrative purposes and is not available on the public website.*

Submitted by _____ Organization _____ Phone _____ Date _____

RAILROAD CROSSING TRAFFIC CONTROL CHECKLIST



The Railroad Crossing Checklist MUST:

1) BE COMPLETED ON SITE AT THE RR CROSSING.
2) Get the responsible Engineer's Review and Concurrence signature.
3) Be completed again, if more than 2 years have passed.

KEY:

ATM =
Alaska Traffic Manual

RHGC =
Railroad Highway Grade Crossing

TCD =
Traffic Control Device

State of Alaska
Department of Transportation and Public Facilities

RAILROAD CROSSING DEVICES CHECKLIST

RR MP	Road name	Road MP	Cross Street/Intersection	Dist From:
23.78	Seward Highway	23.5	Ranger Station Spur	175 ft

Federal Crossing #	Nearest Community	Max Train Speed	Roadway Posted Speed
868236S	Moose Pass	35 mph	55 mph

Road Ownership: State of Alaska

Location notes:

	Name	State#	Federal#
PROJECT	HSIP: Central Region Guardrail Inventory	CFHWY00564	0016665

☐ **NO RAILROAD CROSSINGS ARE AFFECTED BY THIS ROAD PROJECT.**

☐ **ALL CROSSING DEVICES IN PLACE, CORRECT & SIGHT DISTANCE ADEQUATE.**

OR **SELECT THE SCHEDULE OF WORK FOR THE AFFECTED RAILROAD CROSSING:**

☐ **All crossing devices work will be completed before road work begins.**

☐ **Crossing devices work will be concurrent with road work. Railroad notified.**

CHECK FORMS APPLICABLE TO EACH CROSSING AND ATTACH THEM

A,B,C	X	**SIGHT DISTANCE TRIANGLES: All Locations** See SIGHT TRIANGLES pages. ALWAYS ATTACH. Forms A, B, C
2	X	**ADVANCE WARNING SIGNS: All Locations** See ADVANCE WARNING SIGNS page. ALWAYS ATTACH. Form 2.
3	N/A	**PASSIVE DEVICES: Signs & Markings Only** See PASSIVE DEVICES page. Attach if no lights or gates at this crossing. Form 3.
4	X	**ACTIVE DEVICES: Flashing Lights & Gates** See ACTIVE DEVICES page. Attach if there are lights or gates. Form 4.
5	X	**PAVEMENT MARKINGS: 40 MPH or greater** See PAVEMENT MARKINGS page. Attach only where markings used. Form 5.
6	N/A	**PATHWAY SIGNS or MARKINGS** See PATHWAY page. Attach if path signs and/or markings used. Form 6.

Field inspected by: Chris Koenen

On this date: 1 (Month) / 20 (Day) / 2021 (Year)

Registered Engineer's Approval:

X _____ (Printed name)

Date: / /

Notes: Provide a final copy to the Regional Traffic & Safety Engineer and Alaska Railroad Corporation Chief Engineer. This checklist is based upon the 2009 MUTCD and the 2016 Alaska Traffic Manual Supplement (ATMS). This list does not address Temporary Traffic Control.

RR Crossing Devices Checklist

REPAIR or REPLACE ITEMS:

ONLY FOR ITEMS MISSING OR DAMAGED (from page 1)

Form		**WHAT** **Is the issue?**	**WHO** **Will correct it?**	**WHEN** **Will it happen?**
	EXAMPLE	STOP sign missing	The contractor	With this Project, or MP X.x-X.x Project
ABC	**SIGHT DISTANCE TRIANGLES**	Trees within site triangles		
2)	**ADVANCE WARNING SIGNS**	none.		
3)	**PASSIVE DEVICES**	none.		
4)	**ACTIVE DEVICES**	none.		
5)	**PAVEMENT MARKINGS**	none.		
6)	**PATHWAY SIGNS OR MARKINGS**	none.		

STOPPED SIGHT TRIANGLES

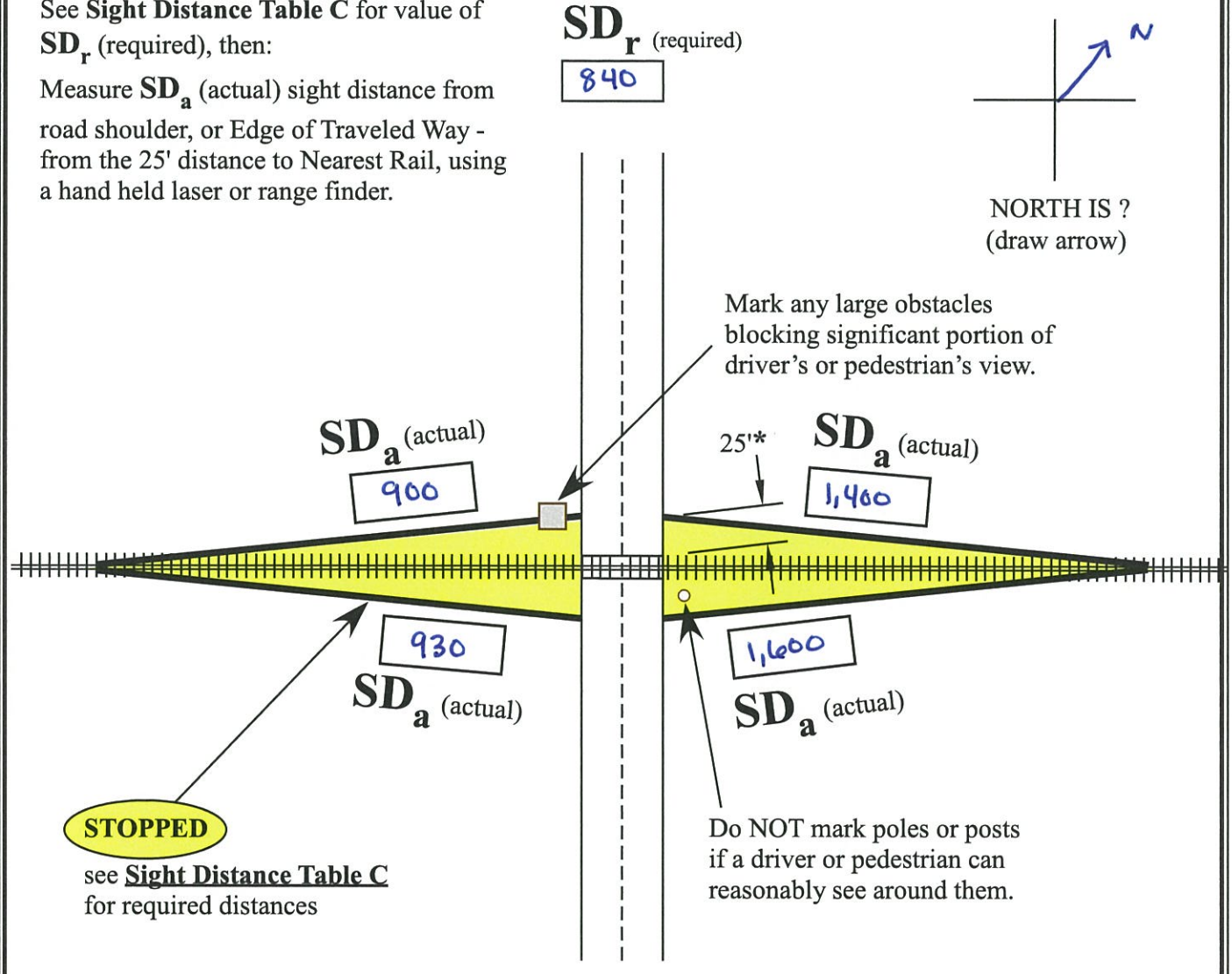
Mandatory Distances - from Table C

Check files for Diagnostic Team (DT) Review, previous Checklist.

Roadway Posted Speed 55 **mph** **Maximum Approved Train Speed** 35 **mph**

See **Sight Distance Table C** for value of SD_r (required), then:

Measure SD_a (actual) sight distance from road shoulder, or Edge of Traveled Way - from the 25' distance to Nearest Rail, using a hand held laser or range finder.



* 25 ft. = Stopped Condition for motorist, measured from the nearest rail. This will normally be 10 ft. back from the STOP bar or the Crossbuck Sign.

This is CASE II, Alaska Policy on RR/Hwy crossings, 1988.

All distances in feet.

DO NOT WALK along tracks or measure along RR Right of Way.
ALL measurements can be taken from road shoulder.

MOVING SIGHT TRIANGLES

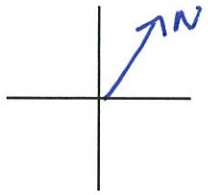
Desired Distances from Table C

Roadway Posted Speed 55 **mph** **Maximum Approved Train Speed** 35 **mph**

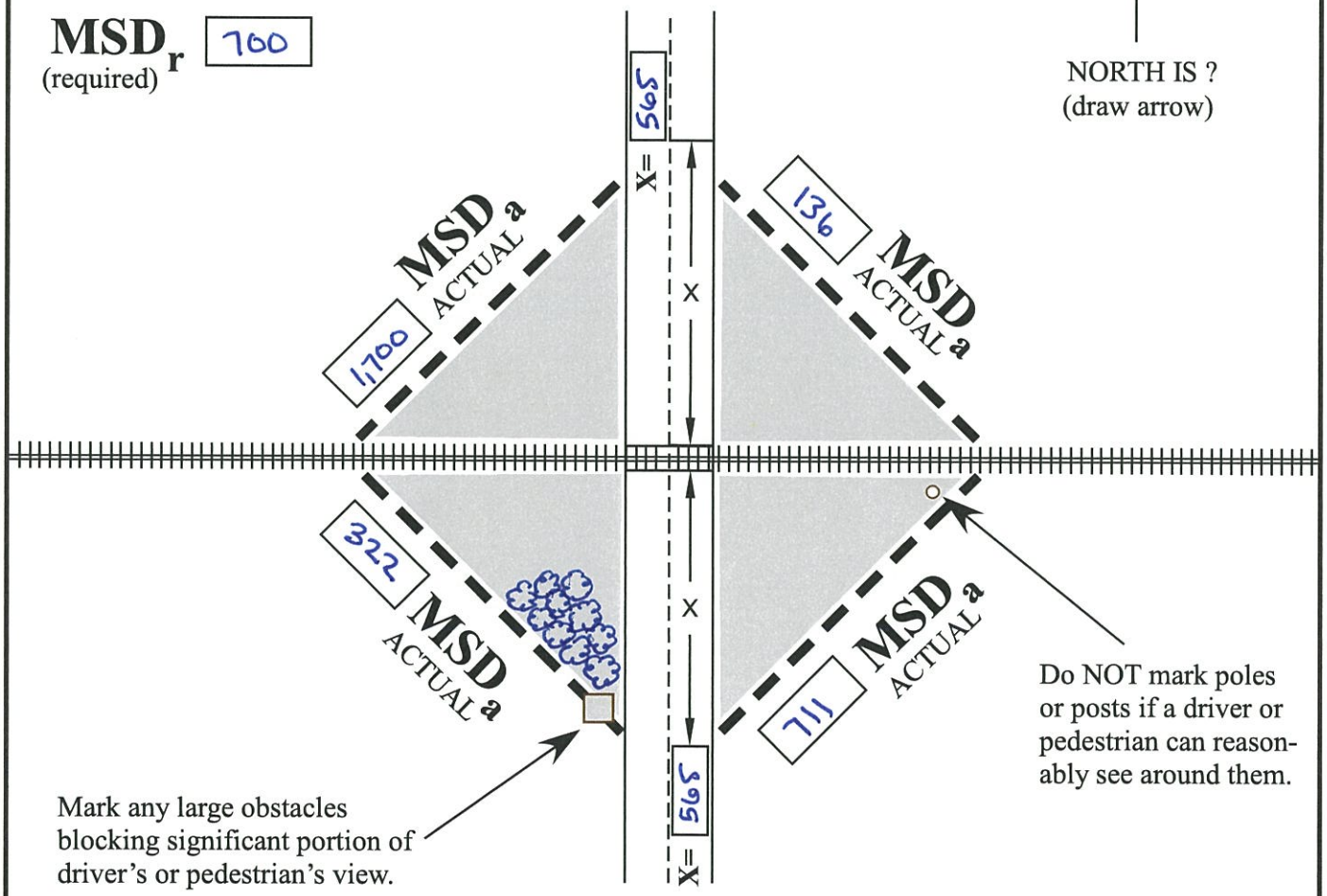
See **Sight Distance Table C** for value of **X** (distance to measure from) and **MSD_r** (required), then: measure **MSD_a** (actual) sight distance from road shoulder or Edge of Traveled Way - using a hand held laser or range finder.

X 565

MSD_r (required) 700



NORTH IS ?
(draw arrow)



Mark any large obstacles blocking significant portion of driver's or pedestrian's view.

Do NOT mark poles or posts if a driver or pedestrian can reasonably see around them.

This is CASE I, Alaska Policy on RR/Hwy crossings, 1988.

All distances in feet.

DO NOT WALK along tracks or measure along RR Right of Way.
ALL measurements can be taken from road shoulder.

State of Alaska DOT/PF Central Region

SIGHT DISTANCE TABLE C

SIGHT DISTANCE TRIANGLE TABLES Distances in FEET Based on the Alaska Policy on Railroad / Highway Crossings 1988

SD_r

STOPPED

SD_r = minimum Sight Distance required

Vehicle Stopped

TRAIN SPEED (mph)	5	10	15	20	25	30	35	40	45	50	55	60
SDr	120	240	360	480	600	720	840	960	1080	1200	1320	1440

OR

MOVING

Vehicle Moving

X

ROAD* SPEED	X Distance along Highway from Track to Measure From (ft)														
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
X	25	45	70	100	135	175	225	275	340	410	490	565	660	750	865

*ROAD SPEED is the Roadway's Posted Speed Limit

MSD_r

MSD_r = Required Sight Distance

TRAIN SPEED (mph)	ROAD POSTED SPEED (mph) 5	10	15	20	25	30	35	40	45	50	55	60	65	70
5	140	110	120	150	190	240	280	350	420	500	570	670	760	870
10	250	170	160	180	210	250	300	360	430	510	580	680	770	880
15	370	240	210	210	240	280	320	380	450	520	600	690	780	890
20	490	300	260	250	270	310	350	400	470	540	620	710	800	910
25	610	380	310	300	310	340	380	430	500	570	640	730	820	930
30	730	450	370	340	350	380	410	470	530	600	670	760	850	960
35	850	520	430	390	390	420	450	500	560	630	700	790	880	990
40	970	590	480	440	440	460	490	540	600	670	740	830	910	1020
45	1090	660	540	490	480	500	530	580	640	710	780	870	950	1060
50	1210	730	590	540	530	550	580	630	680	750	810	910	990	1100
55	1330	810	650	590	580	590	620	670	720	800	860	950	1030	1140
60	1450	880	710	640	630	640	670	710	770	840	900	990	1080	1190

Sight Triangle Definitions

MOVING Case I: Both vehicle and train moving at maximum speed. (Vehicle at Posted Speed Limit, train at Max Approved Speed.)

STOPPED Case II: Vehicle stopped at crossing, and train moving at Max Approved Speed.

Case I is desired for ungated, unsignalized crossings. If Case I cannot be achieved, STOP signs or gates & flashers are required.

Case II is required for ALL crossings, except for industrial tracks and areas. If it can't be met, flagging or other interim mitigation is required.

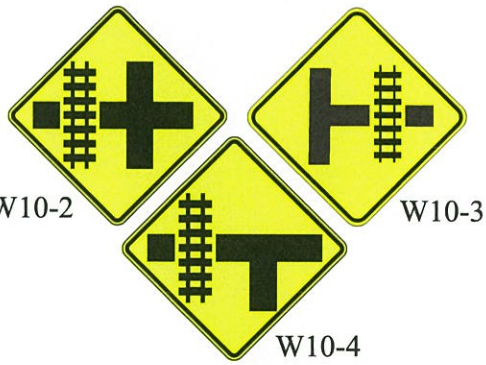
RR 2.0 1/24/20

ADVANCE WARNING SIGNS
TYPICALLY REQUIRED

See the bottom of this page for the few exceptions to using Railroad Advance Warning Signs.

	North bound	South bound	ROAD APPROACH DIRECTION
			Checklist:
8B.06 AK Policy	X	X	**Advance warning sign (W10-1), is almost always used unless adjacent parallel roadway is less than 100 ft away;**
8B.06	N/A	N/A	**THEN use W10-2, 3 or 4 series warning sign, with the correct;**
8B.06	N/A	N/A	**W10-11 series distance sign on the same post. These are always used with the W10-2, 3 or 4 signs**
Std.Plan S-30	N/A	N/A	**Frangible post base, or maximum of 2.5" PST post**
8B.21	N/A	N/A	**No train horn sign if in a Quiet Zone.** (Below W10 signs)
8B.23 AK Policy	N/A	N/A	**Low grade clearance (graphic) sign (and text sign for 3 years), if crossing vertical profile could hang up long vehicles**
8B.06	N/A	N/A	**Advance warning sign(s) placed sufficiently in advance, see Table 2C-4, attached**
8B.10	N/A	N/A	**Tracks out of service sign, for tracks that are not in use, but not removed from roadway**
8C.12	N/A	N/A	**If a circular intersection is within 200 ft, was a design study done, to review queuing to the tracks?**

W10-1


W10-2 W10-3 W10-4

W10-9P

W10-11a


W10-5

W10-5P
(Below W10-5)

R8-9

W10-series, Railroad Advance Warning Signs may ONLY be omitted:
1) On the approaches from a parallel highway edge of less than 100 feet to the tracks.
2) On low-speed low-volume roads where users are advised by personnel on the ground when not to enter the crossing,
3) In business or commercial areas where active devices are in use,
4) Or where physical conditions do not permit an even partially effective display of the signs.

All references are to the 2016 ATMS & 2009 Manual on Uniform Traffic Control Devices.

06 Signs and plaques larger than those shown in Tables 2C-2 and 2C-3 may be used (see Section 2A.11).

Guidance:

07 *The minimum size for all diamond-shaped warning signs facing traffic on exit and entrance ramps should be the size identified in Table 2C-2 for the mainline roadway classification (Expressway or Freeway). If a minimum size is not provided in the Freeway Column, the Expressway size should be used. If a minimum size is not provided in the Freeway or the Expressway Column, the Oversized size should be used.*

Section 2C.05 Placement of Warning Signs

Support:

01 For information on placement of warning signs, see Sections 2A.16 to 2A.21.

02 The time needed for detection, recognition, decision, and reaction is called the Perception-Response Time (PRT). Table 2C-4 is provided as an aid for determining warning sign location. The distances shown in Table 2C-4 can be adjusted for roadway features, other signing, and to improve visibility.

Guidance:

03 *Warning signs should be placed so that they provide an adequate PRT. The distances contained in Table 2C-4 are for guidance purposes and should be applied with engineering judgment. Warning signs should not be placed too far in advance of the condition, such that drivers might tend to forget the warning because of other driving distractions, especially in urban areas.*

Table 2C-4. Guidelines for Advance Placement of Warning Signs

Posted or 85th-Percentile Speed	Advance Placement Distance[1]								
	Condition A: Speed reduction and lane changing in heavy traffic[2]	Condition B: Deceleration to the listed advisory speed (mph) for the condition							
		0[3]	10[4]	20[4]	30[4]	40[4]	50[4]	60[4]	70[4]
20 mph	225 ft	100 ft[6]	N/A[5]	—	—	—	—	—	—
25 mph	325 ft	100 ft[6]	N/A[5]	N/A[5]	—	—	—	—	—
30 mph	460 ft	100 ft[6]	N/A[5]	N/A[5]	—	—	—	—	—
35 mph	565 ft	100 ft[6]	N/A[5]	N/A[5]	N/A[5]	—	—	—	—
40 mph	670 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	—	—	—	—
45 mph	775 ft	175 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	—	—	—
50 mph	885 ft	250 ft	200 ft	175 ft	125 ft	100 ft[6]	—	—	—
55 mph	990 ft	325 ft	275 ft	225 ft	200 ft	125 ft	N/A[5]	—	—
60 mph	1,100 ft	400 ft	350 ft	325 ft	275 ft	200 ft	100 ft[6]	—	—
65 mph	1,200 ft	475 ft	450 ft	400 ft	350 ft	275 ft	200 ft	100 ft[6]	—
70 mph	1,250 ft	550 ft	525 ft	500 ft	450 ft	375 ft	275 ft	150 ft	—
75 mph	1,350 ft	650 ft	625 ft	600 ft	550 ft	475 ft	375 ft	250 ft	100 ft[6]

[1] The distances are adjusted for a sign legibility distance of 180 feet for Condition A. The distances for Condition B have been adjusted for a sign legibility distance of 250 feet, which is appropriate for an alignment warning symbol sign. For Conditions A and B, warning signs with less than 6-inch legend or more than four words, a minimum of 100 feet should be added to the advance placement distance to provide adequate legibility of the warning sign.

[2] Typical conditions are locations where the road user must use extra time to adjust speed and change lanes in heavy traffic because of a complex driving situation. Typical signs are Merge and Right Lane Ends. The distances are determined by providing the driver a PRT of 14.0 to 14.5 seconds for vehicle maneuvers (2005 AASHTO Policy, Exhibit 3-3, Decision Sight Distance, Avoidance Maneuver E) minus the legibility distance of 180 feet for the appropriate sign.

[3] Typical condition is the warning of a potential stop situation. Typical signs are Stop Ahead, Yield Ahead, Signal Ahead, and Intersection Warning signs. The distances are based on the 2005 AASHTO Policy, Exhibit 3-1, Stopping Sight Distance, providing a PRT of 2.5 seconds, a deceleration rate of 11.2 feet/second^2, minus the sign legibility distance of 180 feet.

[4] Typical conditions are locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are Turn, Curve, Reverse Turn, or Reverse Curve. The distance is determined by providing a 2.5 second PRT, a vehicle deceleration rate of 10 feet/second^2, minus the sign legibility distance of 250 feet.

[5] No suggested distances are provided for these speeds, as the placement location is dependent on site conditions and other signing. An alignment warning sign may be placed anywhere from the point of curvature up to 100 feet in advance of the curve. However, the alignment warning sign should be installed in advance of the curve and at least 100 feet from any other signs.

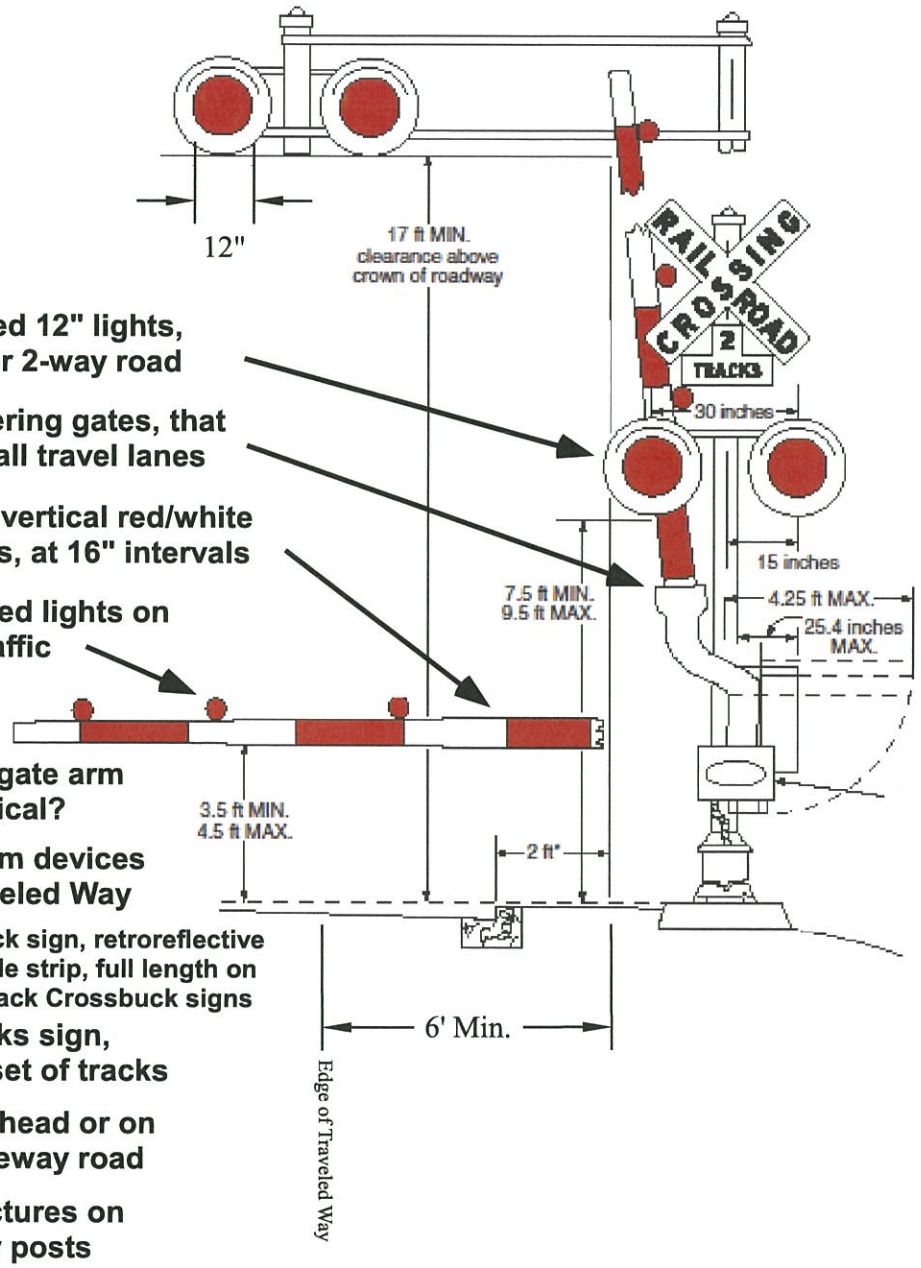
[6] The minimum advance placement distance is listed as 100 feet to provide adequate spacing between signs.

ACTIVE DEVICES
Flashing Lights & Gates

ROAD APPROACH DIRECTION →

Checklist:

	North bound	South bound	
8C.04	X	X	Dual flashing red 12" lights, back to back for 2-way road
8C.04	X	X	Automatic lowering gates, that extend across all travel lanes
8C.04	X	X	Retroreflective vertical red/white stripes on gates, at 16" intervals
8C.04	X	X	Minimum of 3 red lights on gates facing traffic
8C.04	X	X	Does lowering gate arm rest nearly vertical?
	X	X	6' minimum from devices to Edge of Traveled Way
8B.03 8C.02	X	X	Railroad Crossbuck sign, retroreflective front & min. 6" wide strip, full length on back, or back to back Crossbuck signs
8C.01	N/A	N/A	Number of tracks sign, if more than 1 set of tracks
8C.02	N/A	N/A	Red lights overhead or on left side for Oneway road
8C.02	X	X	Overhead structures on non-breakaway posts
8B.18	X	X	Emergency notification sign present
8C.06	N/A	N/A	4 quadrant gate system used where vehicles may try to short-cut through the gates?
8C.06	N/A	N/A	Median barriers used between the lanes for the same reason?



All references are to the 2016 ATMS & 2009 Manual on Uniform Traffic Control Devices.

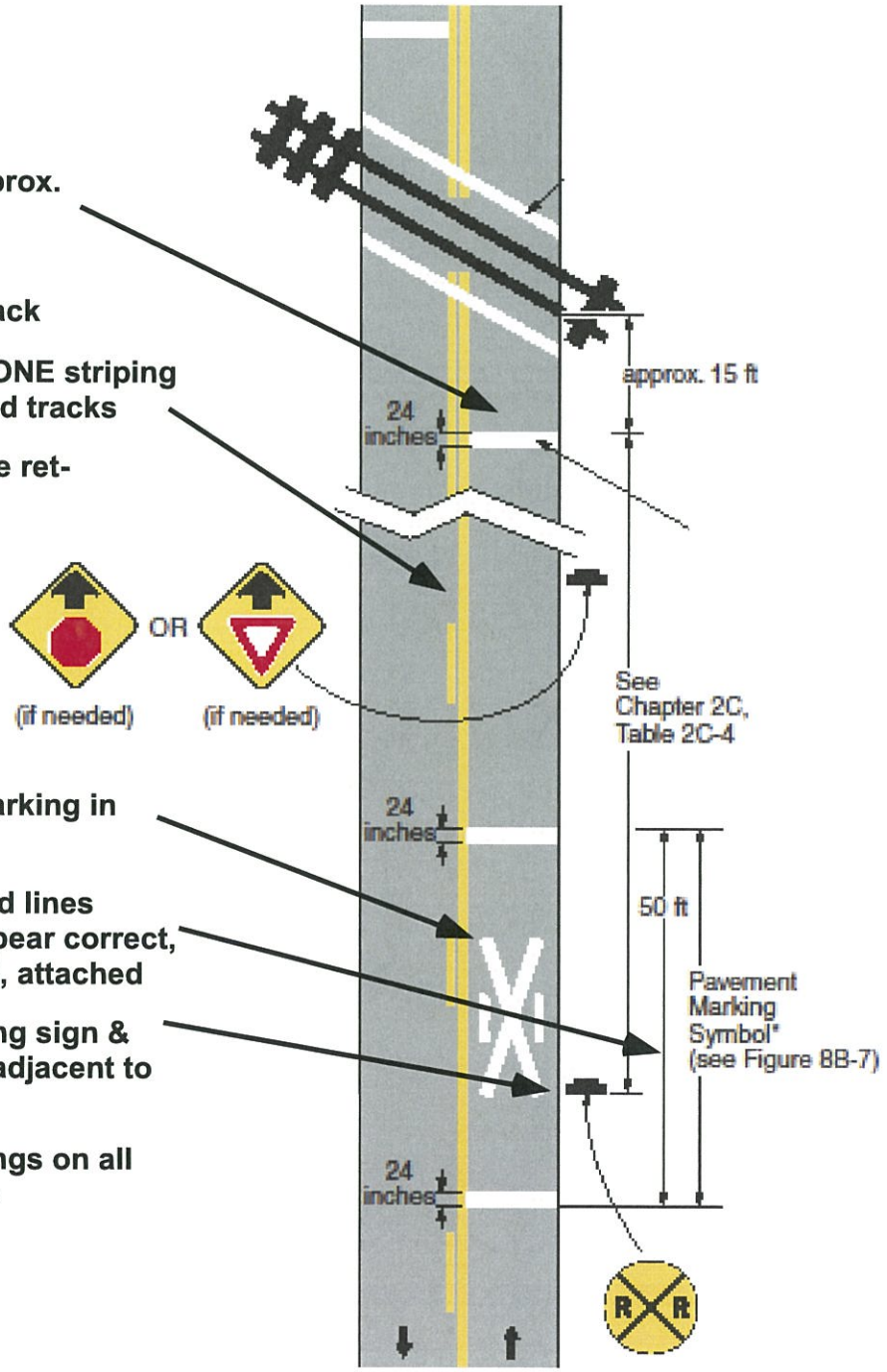
PAVEMENT MARKINGS

ROAD APPROACH DIRECTION

	North bound	South bound	Checklist:
8B.28	X	X	Stop Bar, at approx. 8' from gate
8B.28			OR approx. 15' from edge of track
8B.27	X	X	NO PASSING ZONE striping between "X" and tracks
8B.27	X	X	All markings are ret-roreflective

ROAD APPROACH DIRECTION

	North bound	South bound	
8B.27	X	X	Elongated X marking in roadway
8B.27	X	X	Elongated X and lines dimensions appear correct, per Figure 8B-7, attached
8B.06	X	X	Advance warning sign & Elongated "X" adjacent to each other
8B.27	X	X	Identical markings on all approach lanes

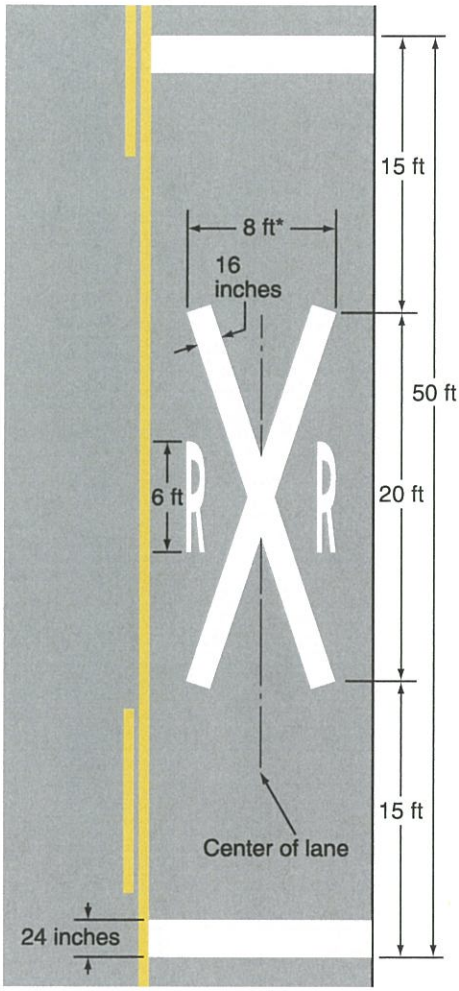


All references are to the 2016 ATMS and 2009 Manual on Uniform Traffic Control Devices.

COPY

Figure 8B-7. Grade Crossing Pavement Markings

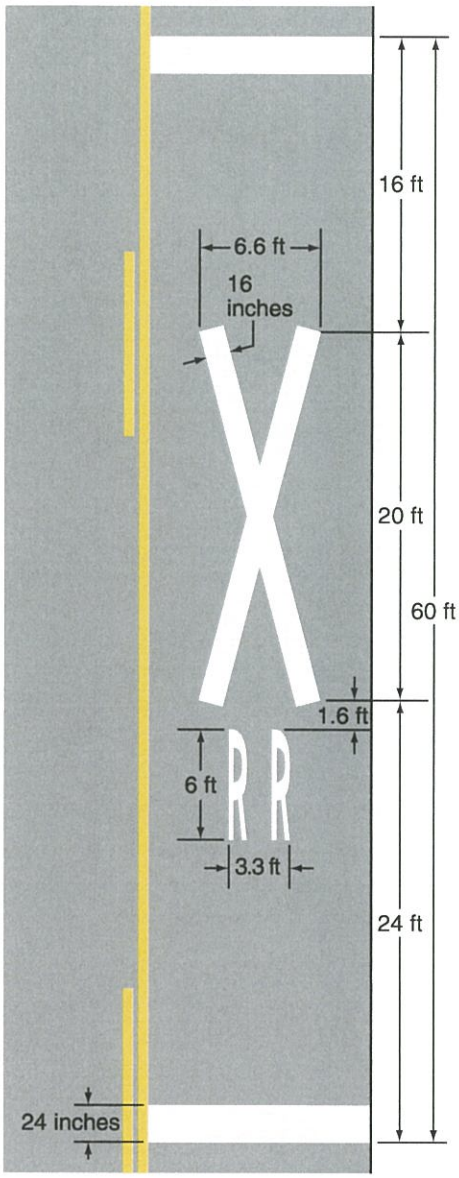
A - Grade crossing pavement marking symbol



*Width may vary according to lane width

Note: Refer to Figure 8B-6 for placement

B - Grade crossing alternative (narrow) pavement marking symbol



Section 8B.28 Stop and Yield Lines

Standard:

01 **On paved roadways at grade crossings that are equipped with active control devices such as flashing-light signals, gates, or traffic control signals, a stop line (see Section 3B.16) shall be installed to indicate the point behind which highway vehicles are or might be required to stop.**

Guidance:

02 *On paved roadway approaches to passive grade crossings where a STOP sign is installed in conjunction with the Crossbuck sign, a stop line should be installed to indicate the point behind which highway vehicles are required to stop or as near to that point as practical.*

03 *If a stop line is used, it should be a transverse line at a right angle to the traveled way and should be placed approximately 8 feet in advance of the gate (if present), but no closer than 15 feet in advance of the nearest rail.*

U. S. DOT CROSSING INVENTORY FORM

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

OMB No. 2130-0017

Instructions for the initial reporting of the following types of new or previously unreported crossings: For public highway-rail grade crossings, complete the entire inventory Form. For private highway-rail grade crossings, complete the Header, Parts I and II, and the Submission Information section. For public pathway grade crossings (including pedestrian station grade crossings), complete the Header, Parts I and II, and the Submission Information section. For Private pathway grade crossings, complete the Header, Parts I and II, and the Submission Information section. For grade-separated highway-rail or pathway crossings (including pedestrian station crossings), complete the Header, Part I, and the Submission Information section. For changes to existing data, complete the Header, Part I Items 1-3, and the Submission Information section, in addition to the updated data fields. Note: For private crossings only, Part I Item 20 and Part III Item 2.K. are required unless otherwise noted. An asterisk * denotes an optional field.

A. Revision Date (MM/DD/YYYY)	B. Reporting Agency	C. Reason for Update (Select only one)	D. DOT Crossing Inventory Number
02 / 26 / 2020	☒ Railroad ☐ Transit ☐ State ☐ Other	☒ Change in Data ☐ New Crossing ☐ Closed ☐ No Train Traffic ☐ Quiet Zone Update ☐ Re-Open ☐ Date Change Only ☐ Change in Primary Operating RR ☐ Admin. Correction	868332U

Part I: Location and Classification Information

1. Primary Operating Railroad	2. State	3. County
Alaska Railroad Corporation [ARR]	ALASKA	MATANUSKA SUSITNA

4. City / Municipality	5. Street/Road Name & Block Number	6. Highway Type & No.
☒ In ☐ Near WILLOW	WILLOW FISHOOK ROAD (Street/Road Name) | * (Block Number)	SR

7. Do Other Railroads Operate a Separate Track at Crossing? ☐ Yes ☒ No	8. Do Other Railroads Operate Over Your Track at Crossing? ☐ Yes ☒ No
If Yes, Specify RR	If Yes, Specify RR

9. Railroad Division or Region	10. Railroad Subdivision or District	11. Branch or Line Name	12. RR Milepost
☐ None ALASKA	☐ None CENTRAL	☐ None MAIN LINE	(prefix) | 0186.890 (nnnn.nnn) | (suffix)

13. Line Segment *	14. Nearest RR Timetable Station *	15. Parent RR (if applicable)	16. Crossing Owner (if applicable)
	WILLOW	☐ N/A ARR	☒ N/A

17. Crossing Type	18. Crossing Purpose	19. Crossing Position	20. Public Access (if Private Crossing)	21. Type of Train	22. Average Passenger Train Count Per Day
☒ Public ☐ Private	☒ Highway ☐ Pathway, Ped. ☐ Station, Ped.	☒ At Grade ☐ RR Under ☐ RR Over	☐ Yes ☐ No	☒ Freight ☐ Intercity Passenger ☐ Commuter ☐ Transit ☐ Shared Use Transit ☒ Tourist/Other	☐ Less Than One Per Day ☒ Number Per Day 4

23. Type of Land Use
☐ Open Space ☐ Farm ☒ Residential ☐ Commercial ☐ Industrial ☐ Institutional ☐ Recreational ☐ RR Yard

24. Is there an Adjacent Crossing with a Separate Number?	25. Quiet Zone (FRA provided)
☐ Yes ☒ No If Yes, Provide Crossing Number	☒ No ☐ 24 Hr ☐ Partial ☐ Chicago Excused Date Established

26. HSR Corridor ID	27. Latitude in decimal degrees	28. Longitude in decimal degrees	29. Lat/Long Source
☒ N/A	(WGS84 std: nn.nnnnnnn) 61.7618190	(WGS84 std: -nnn.nnnnnnn) -150.0494710	☒ Actual ☐ Estimated

30.A. Railroad Use *	31.A. State Use *
30.B. Railroad Use *	31.B. State Use *
30.C. Railroad Use *	31.C. State Use *
30.D. Railroad Use *	31.D. State Use *
32.A. Narrative (Railroad Use) *	32.B. Narrative (State Use) *

33. Emergency Notification Telephone No. (posted)	34. Railroad Contact (Telephone No.)	35. State Contact (Telephone No.)
800-478-2334	907-265-2462	907-465-8962

Part II: Railroad Information

1. Estimated Number of Daily Train Movements

1.A. Total Day Thru Trains (6 AM to 6 PM)	1.B. Total Night Thru Trains (6 PM to 6 AM)	1.C. Total Switching Trains	1.D. Total Transit Trains	1.E. Check if Less Than One Movement Per Day ☐ How many trains per week?
16	4	2	8	

2. Year of Train Count Data (YYYY)	3. Speed of Train at Crossing
2019	3.A. Maximum Timetable Speed (mph) 59 3.B. Typical Speed Range Over Crossing (mph) From 40 to 59

4. Type and Count of Tracks
Main 1 Siding 0 Yard 0 Transit 0 Industry 0

5. Train Detection (Main Track only)
☒ Constant Warning Time ☐ Motion Detection ☐ AFO ☐ PTC ☐ DC ☐ Other ☐ None

6. Is Track Signaled?	7.A. Event Recorder	7.B. Remote Health Monitoring
☒ Yes ☐ No	☒ Yes ☐ No	☐ Yes ☒ No

U. S. DOT CROSSING INVENTORY FORM

A. Revision Date *(MM/DD/YYYY)*	PAGE 2	D. Crossing Inventory Number *(7 char.)*
02/26/2020		868332U

Part III: Highway or Pathway Traffic Control Device Information

1. Are there Signs or Signals? ☒ Yes ☐ No

2. Types of Passive Traffic Control Devices associated with the Crossing

2.A. Crossbuck Assemblies *(count)*	2.B. STOP Signs *(R1-1)* *(count)*	2.C. YIELD Signs *(R1-2)* *(count)*	2.D. Advance Warning Signs *(Check all that apply; include count)* ☐ None
2	0	0	☒ W10-1 1 ☒ W10-3 0 ☒ W10-11 0 ☒ W10-2 0 ☒ W10-4 0 ☒ W10-12 0

2.E. Low Ground Clearance Sign *(W10-5)*	2.F. Pavement Markings	2.G. Channelization Devices/Medians	2.H. EXEMPT Sign *(R15-3)*	2.I. ENS Sign *(I-13)* Displayed
☐ Yes *(count_____)* ☒ No	☒ Stop Lines ☐ Dynamic Envelope ☒ RR Xing Symbols ☐ None	☐ All Approaches ☐ Median ☐ One Approach ☒ None	☐ Yes ☒ No	☒ Yes ☐ No

2.J. Other MUTCD Signs ☐ Yes ☒ No	2.K. Private Crossing Signs *(if private)*	2.L. LED Enhanced Signs *(List types)*
Specify Type _____ Count _____ Specify Type _____ Count _____ Specify Type _____ Count _____	☐ Yes ☐ No	

3. Types of Train Activated Warning Devices at the Grade Crossing *(specify count of each device for all that apply)*

3.A. Gate Arms *(count)*	3.B. Gate Configuration	3.C. Cantilevered *(or Bridged)* Flashing Light Structures *(count)*	3.D. Mast Mounted Flashing Lights *(count of masts)* 3	3.E. Total Count of Flashing Light Pairs
Roadway 2 Pedestrian 0	☒ 2 Quad ☐ Full *(Barrier)* Resistance ☐ 3 Quad ☐ 4 Quad ☐ Median Gates	Over Traffic Lane 2 ☐ Incandescent Not Over Traffic Lane 0 ☒ LED	☐ Incandescent ☒ LED ☒ Back Lights Included ☐ Side Lights Included	9

3.F. Installation Date of Current Active Warning Devices: *(MM/YYYY)*	3.G. Wayside Horn	3.H. Highway Traffic Signals Controlling Crossing	3.I. Bells *(count)*
____/____ ☐ Not Required	☐ Yes Installed on *(MM/YYYY)* ____/____ ☒ No	☐ Yes ☒ No	2

3.J. Non-Train Active Warning	3.K. Other Flashing Lights or Warning Devices
☐ Flagging/Flagman ☐ Manually Operated Signals ☐ Watchman ☐ Floodlighting ☒ None	Count 0 Specify type ADVFLASHR

4.A. Does nearby Hwy Intersection have Traffic Signals?	4.B. Hwy Traffic Signal Interconnection	4.C. Hwy Traffic Signal Preemption	5. Highway Traffic Pre-Signals	6. Highway Monitoring Devices *(Check all that apply)*
☐ Yes ☒ No	☒ Not Interconnected ☐ For Traffic Signals ☒ For Warning Signs	☐ Simultaneous ☐ Advance	☐ Yes ☒ No Storage Distance * ____ Stop Line Distance * ____	☐ Yes - Photo/Video Recording ☐ Yes – Vehicle Presence Detection ☒ None

Part IV: Physical Characteristics

1. Traffic Lanes Crossing Railroad	2. Is Roadway/Pathway Paved?	3. Does Track Run Down a Street?	4. Is Crossing Illuminated? *(Street lights within approx. 50 feet from nearest rail)*
☐ One-way Traffic ☒ Two-way Traffic ☐ Divided Traffic Number of Lanes 2	☒ Yes ☐ No	☐ Yes ☒ No	☐ Yes ☒ No

5. Crossing Surface *(on Main Track, multiple types allowed)* Installation Date * *(MM/YYYY)* ____/____ Width * 10 Length * 35

☐ 1 Timber ☐ 2 Asphalt ☐ 3 Asphalt and Timber ☒ 4 Concrete ☐ 5 Concrete and Rubber ☐ 6 Rubber ☐ 7 Metal
☐ 8 Unconsolidated ☐ 9 Composite ☐ 10 Other *(specify)* ____

6. Intersecting Roadway within 500 feet?	7. Smallest Crossing Angle	8. Is Commercial Power Available? *
☒ Yes ☐ No If Yes, Approximate Distance *(feet)* 240	☐ 0° – 29° ☐ 30° – 59° ☒ 60° - 90°	☒ Yes ☐ No

Part V: Public Highway Information

1. Highway System	2. Functional Classification of Road at Crossing	3. Is Crossing on State Highway System?	4. Highway Speed Limit
☐ (01) Interstate Highway System ☐ (02) Other Nat Hwy System (NHS) ☐ (03) Federal AID, Not NHS ☒ (08) Non-Federal Aid	☒ (0) Rural ☐ (1) Urban ☐ (1) Interstate ☐ (5) Major Collector ☐ (2) Other Freeways and Expressways ☐ (3) Other Principal Arterial ☒ (6) Minor Collector ☐ (4) Minor Arterial ☐ (7) Local	☐ Yes ☒ No	55 MPH ☒ Posted ☐ Statutory

5. Linear Referencing System *(LRS Route ID)* *

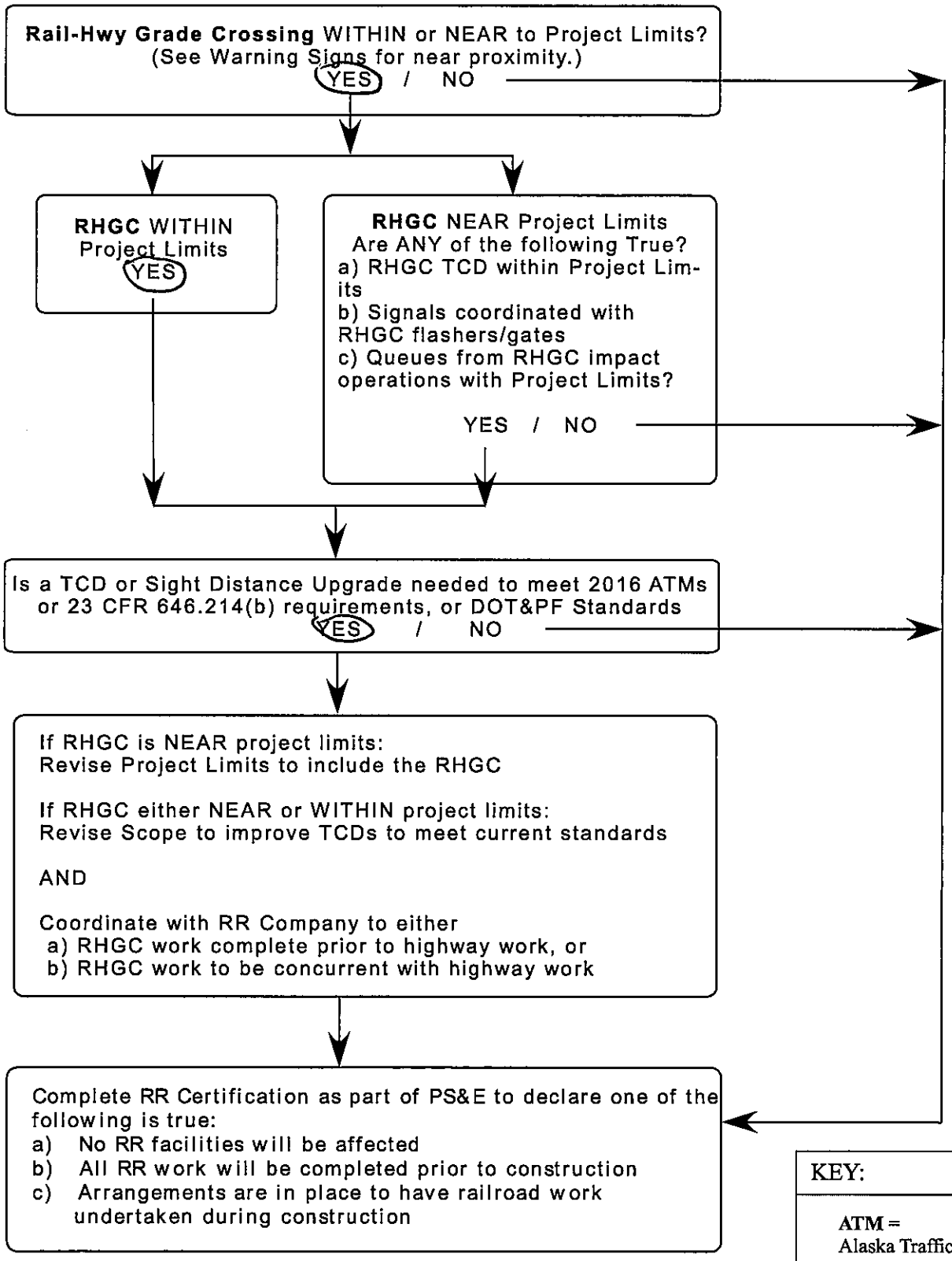
6. LRS Milepost *

7. Annual Average Daily Traffic *(AADT)*	8. Estimated Percent Trucks	9. Regularly Used by School Buses?	10. Emergency Services Route
Year 2018 AADT 583	5 %	☐ Yes ☒ No Average Number per Day 0	☒ Yes ☐ No

Submission Information - *This information is used for administrative purposes and is not available on the public website.*

Submitted by ____ Organization ____ Phone ____ Date ____

RAILROAD CROSSING TRAFFIC CONTROL CHECKLIST



The Railroad Crossing Checklist MUST:

1) BE COMPLETED ON SITE AT THE RR CROSSING.
2) Get the responsible Engineer's Review and Concurrence signature.
3) Be completed again, if more than 2 years have passed.

KEY:

ATM = Alaska Traffic Manual

RHGC = Railroad Highway Grade Crossing

TCD = Traffic Control Device

State of Alaska
Department of Transportation and Public Facilities

RAILROAD CROSSING DEVICES CHECKLIST

RR MP	Road name	Road MP	Cross Street/Intersection	Dist From:
186.89	Willow Fishook Road	30.7	Parks Highway	0.5 mile

Federal Crossing #	Nearest Community	Max Train Speed	Roadway Posted Speed
868332U	Willow	59 mph	55 mph

Road Ownership: State of Alaska

Location notes:

	Name	State#	Federal#
PROJECT	HSIP: Central Region Guardrail Inventory	CFHWY00564	001665

☐	**NO RAILROAD CROSSINGS ARE AFFECTED BY THIS ROAD PROJECT.**
☐	**ALL CROSSING DEVICES IN PLACE, CORRECT & SIGHT DISTANCE ADEQUATE.**

OR **SELECT THE SCHEDULE OF WORK FOR THE AFFECTED RAILROAD CROSSING:**

☐	**All crossing devices work will be completed before road work begins.**
☐	**Crossing devices work will be concurrent with road work. Railroad notified.**

CHECK FORMS APPLICABLE TO EACH CROSSING AND ATTACH THEM

A,B,C	X	**SIGHT DISTANCE TRIANGLES: All Locations** See SIGHT TRIANGLES pages. ALWAYS ATTACH. Forms A, B, C
2	X	**ADVANCE WARNING SIGNS: All Locations** See ADVANCE WARNING SIGNS page. ALWAYS ATTACH. Form 2.
3	N/A	**PASSIVE DEVICES: Signs & Markings Only** See PASSIVE DEVICES page. Attach if no lights or gates at this crossing. Form 3.
4	X	**ACTIVE DEVICES: Flashing Lights & Gates** See ACTIVE DEVICES page. Attach if there are lights or gates. Form 4.
5	X	**PAVEMENT MARKINGS: 40 MPH or greater** See PAVEMENT MARKINGS page. Attach only where markings used. Form 5.
6	N/A	**PATHWAY SIGNS or MARKINGS** See PATHWAY page. Attach if path signs and/or markings used. Form 6.

Field inspected by: Chris Koenen

On this date: 6 / 23 / 2021 (Month / Day / Year)

Registered Engineer's Approval:

X _____ (Printed name)

Date: / /

Notes: Provide a final copy to the Regional Traffic & Safety Engineer and Alaska Railroad Corporation Chief Engineer. This checklist is based upon the 2009 MUTCD and the 2016 Alaska Traffic Manual Supplement (ATMS). This list does not address Temporary Traffic Control.

RR Crossing Devices Checklist

REPAIR or REPLACE ITEMS:

ONLY FOR ITEMS MISSING OR DAMAGED (from page 1)

Form		**WHAT** **Is the issue?**	**WHO** **Will correct it?**	**WHEN** **Will it happen?**
	EXAMPLE	STOP sign missing	The contractor	With this Project, or MP X.x-X.x Project
ABC	**SIGHT DISTANCE TRIANGLES**	Trees within site triangles		
2)	**ADVANCE WARNING SIGNS**	none.		
3)	**PASSIVE DEVICES**	none.		
4)	**ACTIVE DEVICES**	none.		
5)	**PAVEMENT MARKINGS**	none.		
6)	**PATHWAY SIGNS OR MARKINGS**	none.		

STOPPED SIGHT TRIANGLES

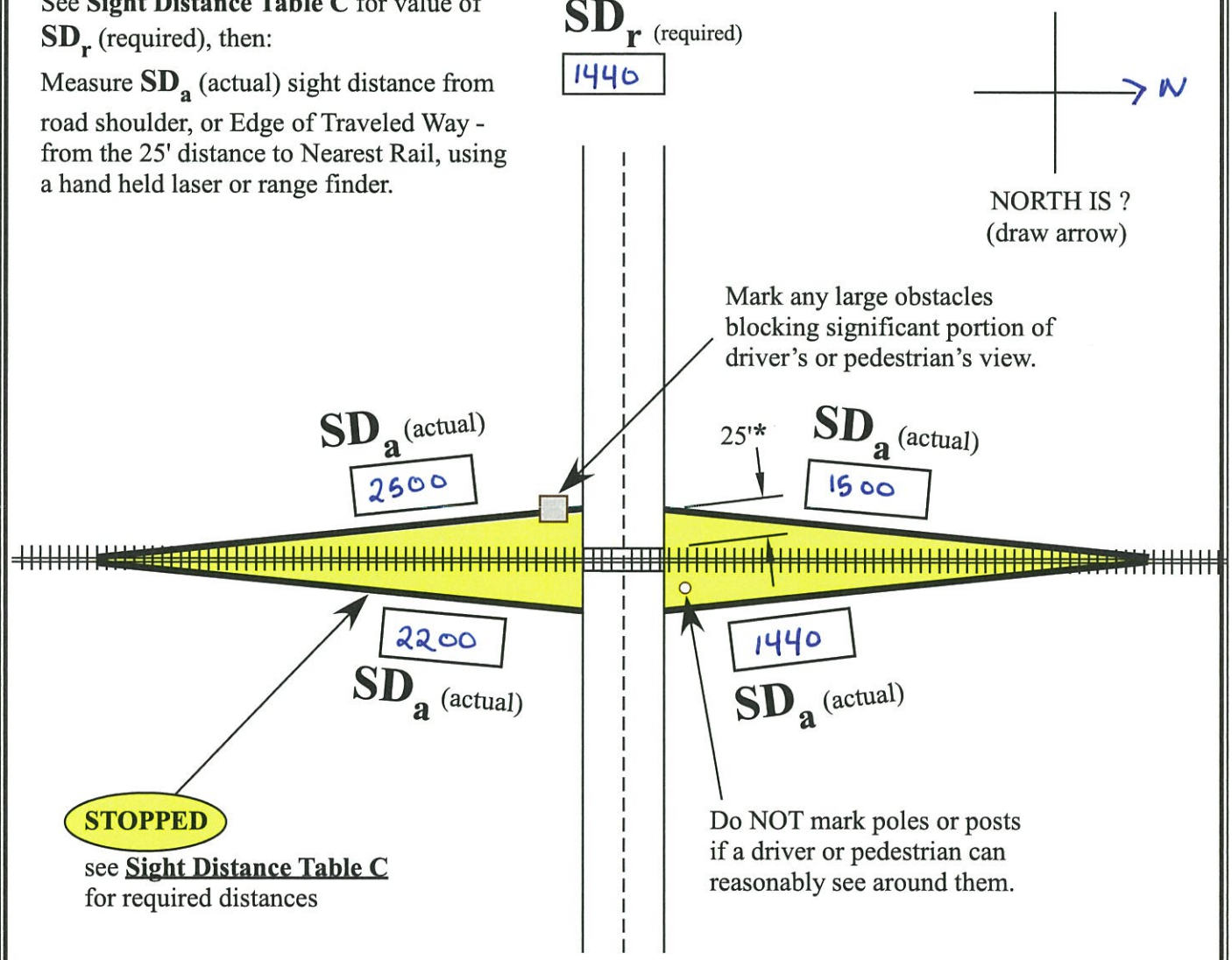
Mandatory Distances - from Table C

Check files for Diagnostic Team (DT) Review, previous Checklist.

Roadway Posted Speed 55 **mph** **Maximum Approved Train Speed** 59 **mph**

See **Sight Distance Table C** for value of SD_r (required), then:

Measure SD_a (actual) sight distance from road shoulder, or Edge of Traveled Way - from the 25' distance to Nearest Rail, using a hand held laser or range finder.



* 25 ft. = Stopped Condition for motorist, measured from the nearest rail. This will normally be 10 ft. back from the STOP bar or the Crossbuck Sign.

This is CASE II, Alaska Policy on RR/Hwy crossings, 1988.

All distances in feet.

DO NOT WALK along tracks or measure along RR Right of Way.
ALL measurements can be taken from road shoulder.

MOVING SIGHT TRIANGLES

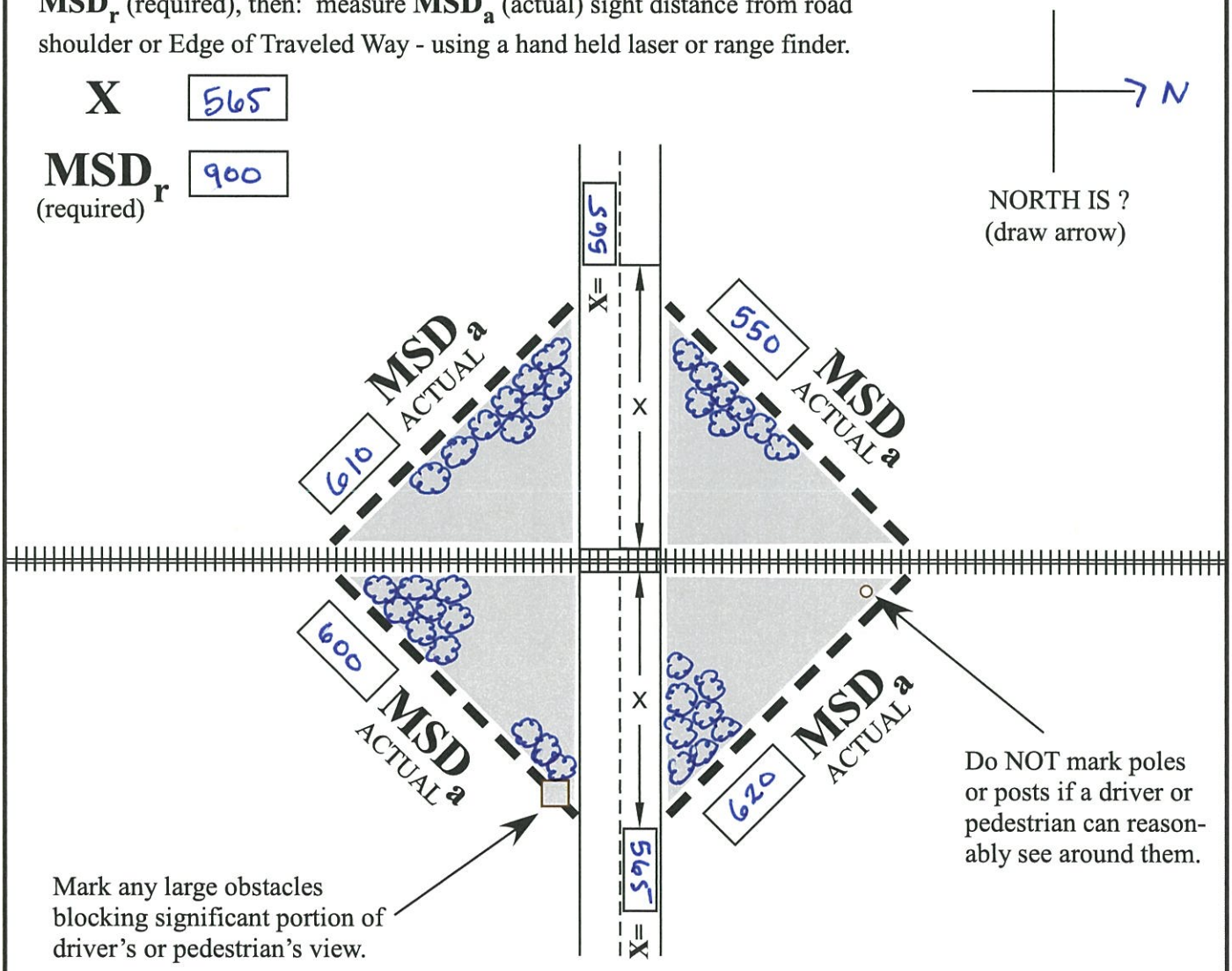
Desired Distances from Table C

Roadway Posted Speed 55 **mph** **Maximum Approved Train Speed** 59 **mph**

See **Sight Distance Table C** for value of **X** (distance to measure from) and **MSD_r** (required), then: measure **MSD_a** (actual) sight distance from road shoulder or Edge of Traveled Way - using a hand held laser or range finder.

X 565

MSD_r (required) 900



This is CASE I, Alaska Policy on RR/Hwy crossings, 1988.

All distances in feet.

DO NOT WALK along tracks or measure along RR Right of Way.
ALL measurements can be taken from road shoulder.

State of Alaska DOT/PF Central Region

SIGHT DISTANCE TABLE C

SIGHT DISTANCE TRIANGLE TABLES Distances in FEET Based on the Alaska Policy on Railroad / Highway Crossings 1988

SD_r

STOPPED SD_r = minimum Sight Distance required **Vehicle Stopped**

TRAIN SPEED (mph)	5	10	15	20	25	30	35	40	45	50	55	60
SDr	120	240	360	480	600	720	840	960	1080	1200	1320	1440

OR

MOVING **Vehicle Moving**

X

ROAD* SPEED	X Distance along Highway from Track to Measure From (ft)														
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
X	25	45	70	100	135	175	225	275	340	410	490	565	660	750	865

*ROAD SPEED is the Roadway's Posted Speed Limit

MSD_r

MSD_r = Required Sight Distance

TRAIN SPEED (mph)	ROAD POSTED SPEED (mph) 5	10	15	20	25	30	35	40	45	50	55	60	65	70
5	140	110	120	150	190	240	280	350	420	500	570	670	760	870
10	250	170	160	180	210	250	300	360	430	510	580	680	770	880
15	370	240	210	210	240	280	320	380	450	520	600	690	780	890
20	490	300	260	250	270	310	350	400	470	540	620	710	800	910
25	610	380	310	300	310	340	380	430	500	570	640	730	820	930
30	730	450	370	340	350	380	410	470	530	600	670	760	850	960
35	850	520	430	390	390	420	450	500	560	630	700	790	880	990
40	970	590	480	440	440	460	490	540	600	670	740	830	910	1020
45	1090	660	540	490	480	500	530	580	640	710	780	870	950	1060
50	1210	730	590	540	530	550	580	630	680	750	810	910	990	1100
55	1330	810	650	590	580	590	620	670	720	800	860	950	1030	1140
60	1450	880	710	640	630	640	670	710	770	840	900	990	1080	1190

Sight Triangle Definitions

MOVING Case I: Both vehicle and train moving at maximum speed. (Vehicle at Posted Speed Limit, train at Max Approved Speed.)

STOPPED Case II: Vehicle stopped at crossing, and train moving at Max Approved Speed.

Case I is desired for ungated, unsignalized crossings. If Case I cannot be achieved, STOP signs or gates & flashers are required.

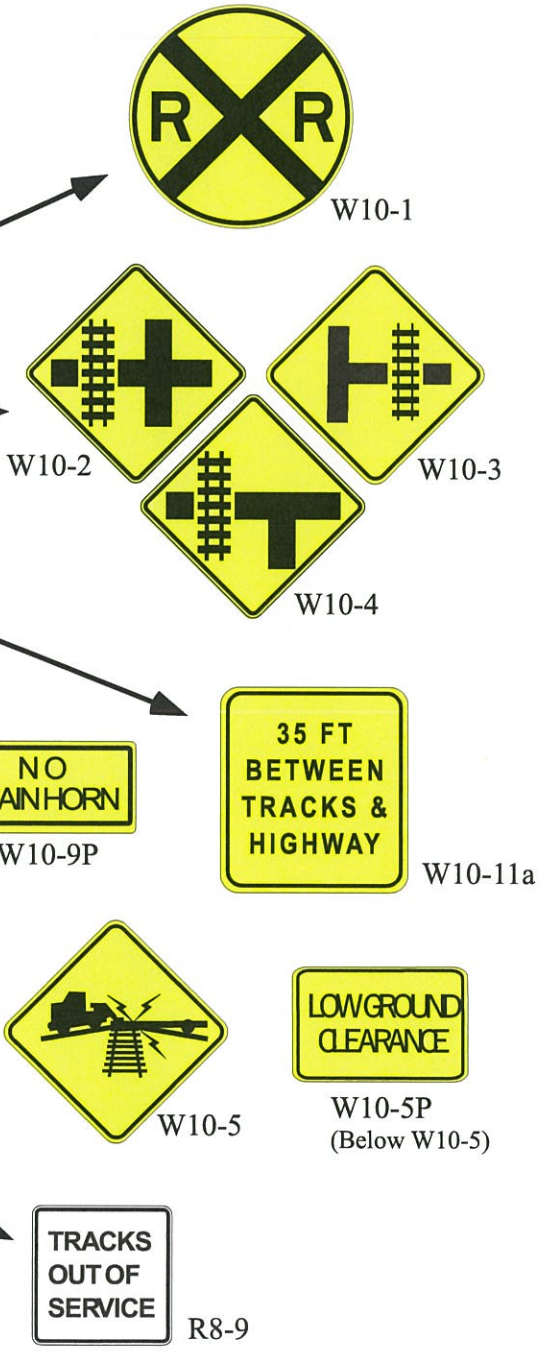
Case II is required for ALL crossings, except for industrial tracks and areas. If it can't be met, flagging or other interim mitigation is required.

RR 2.0 1/24/20

ADVANCE WARNING SIGNS
TYPICALLY REQUIRED

See the bottom of this page for the few exceptions to using Railroad Advance Warning Signs.

	East bound	West bound	ROAD APPROACH DIRECTION
			Checklist:
8B.06 AK Policy	X	X	**Advance warning sign (W10-1), is almost always used unless adjacent parallel roadway is less than 100 ft away;**
8B.06	N/A	N/A	**THEN use W10-2, 3 or 4 series warning sign, with the correct;**
8B.06	N/A	N/A	**W10-11 series distance sign on the same post. These are always used with the W10-2, 3 or 4 signs**
Std.Plan S-30	N/A	N/A	**Frangible post base, or maximum of 2.5" PST post**
8B.21	N/A	N/A	**No train horn sign if in a Quiet Zone.** (Below W10 signs)
8B.23 AK Policy	N/A	N/A	**Low grade clearance (graphic) sign (and text sign for 3 years), if crossing vertical profile could hang up long vehicles**
8B.06	N/A	N/A	**Advance warning sign(s) placed sufficiently in advance, see Table 2C-4, attached**
8B.10	N/A	N/A	**Tracks out of service sign, for tracks that are not in use, but not removed from roadway**
8C.12	N/A	N/A	**If a circular intersection is within 200 ft, was a design study done, to review queuing to the tracks?**



W10-series, Railroad Advance Warning Signs may ONLY be omitted:
1) On the approaches from a parallel highway edge of less than 100 feet to the tracks.
2) On low-speed low-volume roads where users are advised by personnel on the ground when not to enter the crossing,
3) In business or commercial areas where active devices are in use,
4) Or where physical conditions do not permit an even partially effective display of the signs.

All references are to the 2016 ATMS & 2009 Manual on Uniform Traffic Control Devices.

06 Signs and plaques larger than those shown in Tables 2C-2 and 2C-3 may be used (see Section 2A.11).

Guidance:

07 *The minimum size for all diamond-shaped warning signs facing traffic on exit and entrance ramps should be the size identified in Table 2C-2 for the mainline roadway classification (Expressway or Freeway). If a minimum size is not provided in the Freeway Column, the Expressway size should be used. If a minimum size is not provided in the Freeway or the Expressway Column, the Oversized size should be used.*

Section 2C.05 Placement of Warning Signs

Support:

01 For information on placement of warning signs, see Sections 2A.16 to 2A.21.

02 The time needed for detection, recognition, decision, and reaction is called the Perception-Response Time (PRT). Table 2C-4 is provided as an aid for determining warning sign location. The distances shown in Table 2C-4 can be adjusted for roadway features, other signing, and to improve visibility.

Guidance:

03 *Warning signs should be placed so that they provide an adequate PRT. The distances contained in Table 2C-4 are for guidance purposes and should be applied with engineering judgment. Warning signs should not be placed too far in advance of the condition, such that drivers might tend to forget the warning because of other driving distractions, especially in urban areas.*

Table 2C-4. Guidelines for Advance Placement of Warning Signs

Posted or 85th-Percentile Speed	Advance Placement Distance[1]								
	Condition A: Speed reduction and lane changing in heavy traffic[2]	Condition B: Deceleration to the listed advisory speed (mph) for the condition							
		0[3]	10[4]	20[4]	30[4]	40[4]	50[4]	60[4]	70[4]
20 mph	225 ft	100 ft[6]	N/A[5]	—	—	—	—	—	—
25 mph	325 ft	100 ft[6]	N/A[5]	N/A[5]	—	—	—	—	—
30 mph	460 ft	100 ft[6]	N/A[5]	N/A[5]	—	—	—	—	—
35 mph	565 ft	100 ft[6]	N/A[5]	N/A[5]	N/A[5]	—	—	—	—
40 mph	670 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	—	—	—	—
45 mph	775 ft	175 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	—	—	—
50 mph	885 ft	250 ft	200 ft	175 ft	125 ft	100 ft[6]	—	—	—
55 mph	990 ft	325 ft	275 ft	225 ft	200 ft	125 ft	N/A[5]	—	—
60 mph	1,100 ft	400 ft	350 ft	325 ft	275 ft	200 ft	100 ft[6]	—	—
65 mph	1,200 ft	475 ft	450 ft	400 ft	350 ft	275 ft	200 ft	100 ft[6]	—
70 mph	1,250 ft	550 ft	525 ft	500 ft	450 ft	375 ft	275 ft	150 ft	—
75 mph	1,350 ft	650 ft	625 ft	600 ft	550 ft	475 ft	375 ft	250 ft	100 ft[6]

[1] The distances are adjusted for a sign legibility distance of 180 feet for Condition A. The distances for Condition B have been adjusted for a sign legibility distance of 250 feet, which is appropriate for an alignment warning symbol sign. For Conditions A and B, warning signs with less than 6-inch legend or more than four words, a minimum of 100 feet should be added to the advance placement distance to provide adequate legibility of the warning sign.

[2] Typical conditions are locations where the road user must use extra time to adjust speed and change lanes in heavy traffic because of a complex driving situation. Typical signs are Merge and Right Lane Ends. The distances are determined by providing the driver a PRT of 14.0 to 14.5 seconds for vehicle maneuvers (2005 AASHTO Policy, Exhibit 3-3, Decision Sight Distance, Avoidance Maneuver E) minus the legibility distance of 180 feet for the appropriate sign.

[3] Typical condition is the warning of a potential stop situation. Typical signs are Stop Ahead, Yield Ahead, Signal Ahead, and Intersection Warning signs. The distances are based on the 2005 AASHTO Policy, Exhibit 3-1, Stopping Sight Distance, providing a PRT of 2.5 seconds, a deceleration rate of 11.2 feet/second^2, minus the sign legibility distance of 180 feet.

[4] Typical conditions are locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are Turn, Curve, Reverse Turn, or Reverse Curve. The distance is determined by providing a 2.5 second PRT, a vehicle deceleration rate of 10 feet/second^2, minus the sign legibility distance of 250 feet.

[5] No suggested distances are provided for these speeds, as the placement location is dependent on site conditions and other signing. An alignment warning sign may be placed anywhere from the point of curvature up to 100 feet in advance of the curve. However, the alignment warning sign should be installed in advance of the curve and at least 100 feet from any other signs.

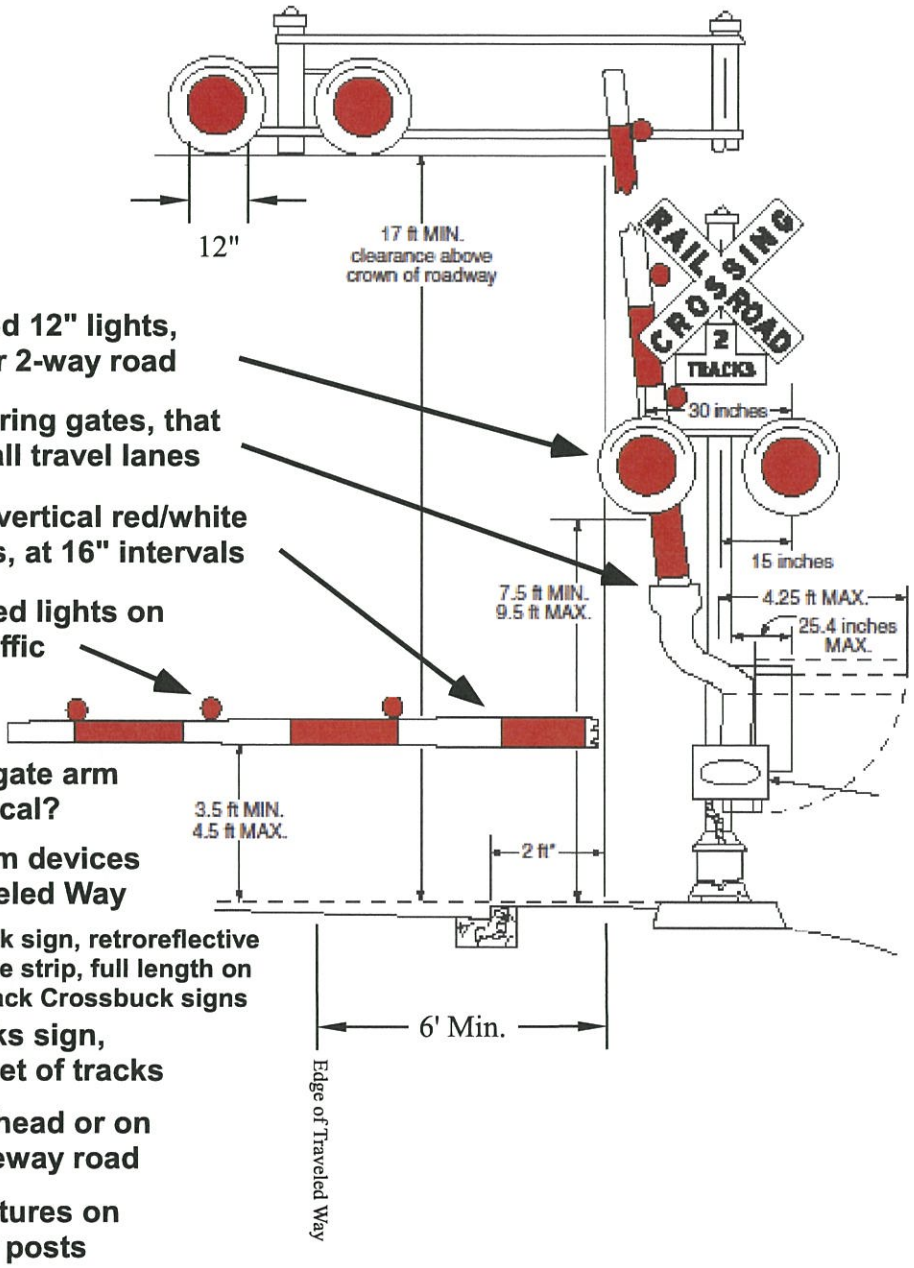
[6] The minimum advance placement distance is listed as 100 feet to provide adequate spacing between signs.

ACTIVE DEVICES
Flashing Lights & Gates

ROAD APPROACH DIRECTION →

Checklist:

	East bound	West bound	
8C.04	X	X	Dual flashing red 12" lights, back to back for 2-way road
8C.04	X	X	Automatic lowering gates, that extend across all travel lanes
8C.04	X	X	Retroreflective vertical red/white stripes on gates, at 16" intervals
8C.04	X	X	Minimum of 3 red lights on gates facing traffic
8C.04	X	X	Does lowering gate arm rest nearly vertical?
	X	X	6' minimum from devices to Edge of Traveled Way
8B.03 8C.02	X	X	Railroad Crossbuck sign, retroreflective front & min. 6" wide strip, full length on back, or back to back Crossbuck signs
8C.01	N/A	N/A	Number of tracks sign, if more than 1 set of tracks
8C.02	X	X	Red lights overhead or on left side for Oneway road
8C.02	X	X	Overhead structures on non-breakaway posts
8B.18	X	X	Emergency notification sign present
8C.06	N/A	N/A	4 quadrant gate system used where vehicles may try to short-cut through the gates?
8C.06	N/A	N/A	Median barriers used between the lanes for the same reason?



All references are to the 2016 ATMS & 2009 Manual on Uniform Traffic Control Devices.

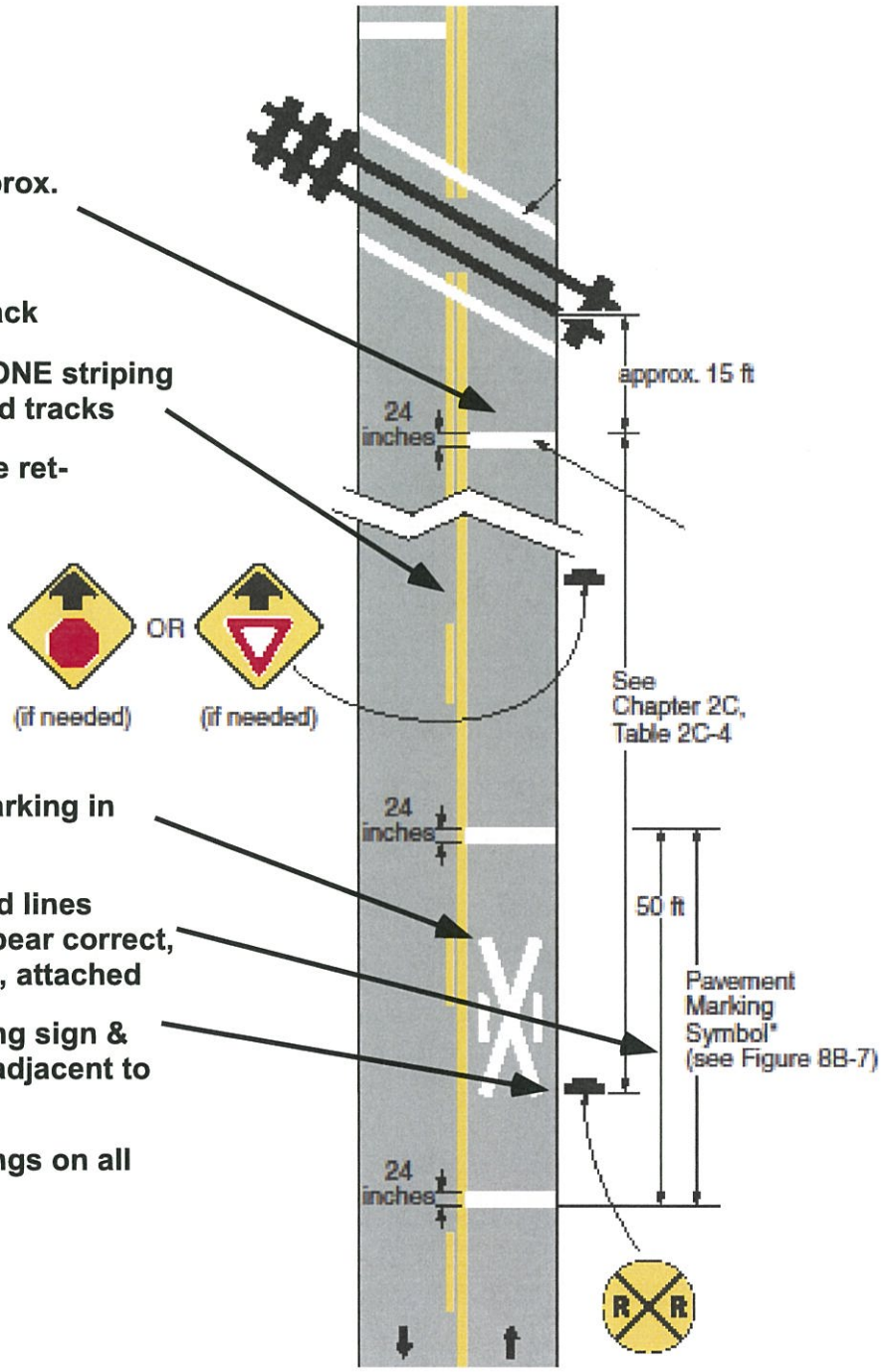
PAVEMENT MARKINGS

ROAD APPROACH DIRECTION

	East bound	West bound	Checklist:
8B.28	X	X	Stop Bar, at approx. 8' from gate
8B.28	X	X	OR approx. 15' from edge of track
8B.27	X	X	NO PASSING ZONE striping between "X" and tracks
8B.27	X	X	All markings are retroreflective

ROAD APPROACH DIRECTION

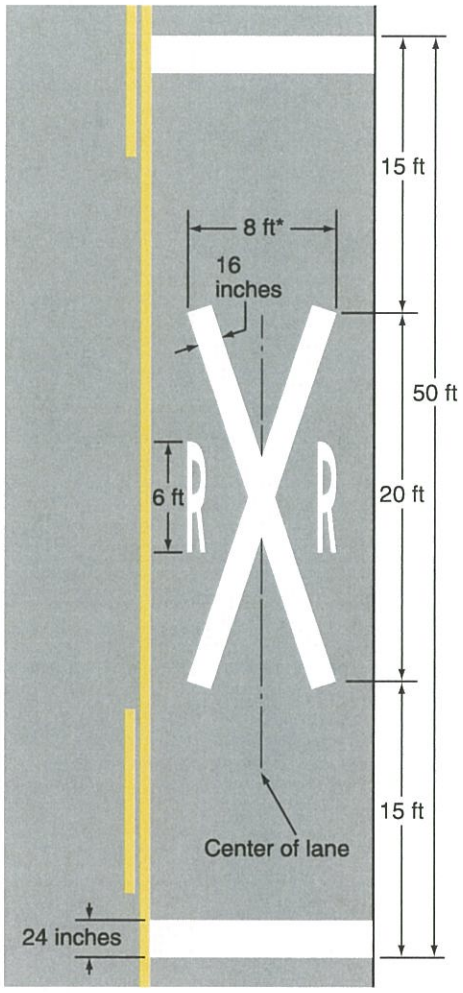
	East bound	West bound	
8B.27	X	X	Elongated X marking in roadway
8B.27	X	X	Elongated X and lines dimensions appear correct, per Figure 8B-7, attached
8B.06	X	X	Advance warning sign & Elongated "X" adjacent to each other
8B.27	X	X	Identical markings on all approach lanes



All references are to the 2016 ATMS and 2009 Manual on Uniform Traffic Control Devices.

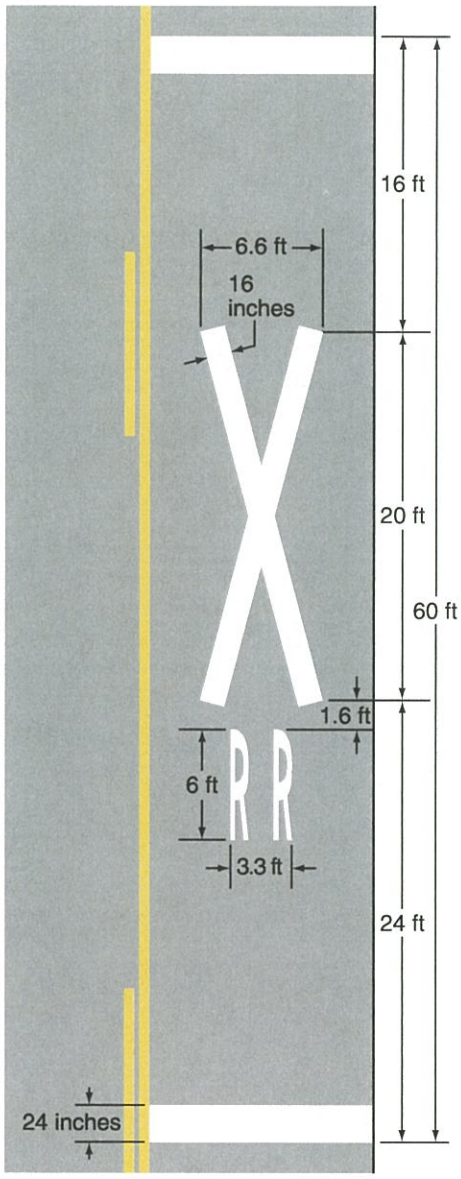
Figure 8B-7. Grade Crossing Pavement Markings

A - Grade crossing pavement marking symbol



*Width may vary according to lane width

B - Grade crossing alternative (narrow) pavement marking symbol



Note: Refer to Figure 8B-6 for placement

Section 8B.28 Stop and Yield Lines

Standard:

01 **On paved roadways at grade crossings that are equipped with active control devices such as flashing-light signals, gates, or traffic control signals, a stop line (see Section 3B.16) shall be installed to indicate the point behind which highway vehicles are or might be required to stop.**

Guidance:

02 *On paved roadway approaches to passive grade crossings where a STOP sign is installed in conjunction with the Crossbuck sign, a stop line should be installed to indicate the point behind which highway vehicles are required to stop or as near to that point as practical.*

03 *If a stop line is used, it should be a transverse line at a right angle to the traveled way and should be placed approximately 8 feet in advance of the gate (if present), but no closer than 15 feet in advance of the nearest rail.*

APPENDIX E

Design Memos

Design Decisions Technical Memorandum
Guardrail Analysis Report (Submitted under separate cover)

TECHNICAL MEMORANDUM

Date:	November 23, 2021
To:	Chris Bentz, P.E. - DOT&PF Project Manager
From:	Susan Acheson, P.E. – Lounsbury Project Civil Engineer
Through:	Joseph Taylor, P.E. – Lounsbury Project Manager
Subject:	HSIP: CR Guardrail Inventory and Upgrade Project No.: CFHWY00564 / 0001665 Design Decisions Memorandum

1.0 Introduction and Purpose

The Department of Transportation and Public Facilities (DOT&PF) conducted a field assessment of the condition of all runs of guardrail, guardrail end terminals (GET's), and associated hardware on highspeed roadways (50 mph or greater) in the Central Region during the 2020 field season. The field inspection focused on documenting damage and adherence to current DOT&PF and Federal Highway Administration (FHWA) standards, including the Manual for Assessing Safety Hardware (MASH) standards.

The field inspection focused on documenting three classifications for the condition of guardrail, GET's and hardware. Specifically:

1. Guardrails, GET's and hardware that are ***UNACCEPTABLE*** or ***NOT FUNCTIONAL*** according to current standards.

2. Guardrails, GET's and hardware that meet current standards but are in a ***DAMAGED BUT FUNCTIONAL*** condition.

3. Guardrails, GET's and hardware that are in an ***ACCEPTABLE*** or ***FUNCTIONAL*** condition.

Approximately 3000 discreet entities were field inspected, inventoried and photo documented. Field inspection rating guides, damage codes and results are contained in DOT&PF's Guardrail Analysis Report (GAR), appended to the Draft Design Study Report (DSR) (November 2021).

This Technical Memorandum has two purposes. The first is to document and describe the guardrails, GET's and hardware that are ***UNACCEPTABLE*** or ***NOT FUNCTIONAL*** according to current standards and thus ***Require Upgrade to MASH*** standards.

The second purpose is to make recommendations to ***Upgrade to MASH*** standards certain guardrails, GET's and hardware that were found to be in ***Damaged but Functional*** condition.

2.0 Prioritizing Work by Damage Assessment

Damage of any kind can affect the performance of the barrier, however there are some types of outdated installations or damage that can lead to a complete failure of the barrier and put motorist at greater risk. Other damages can leave the guardrail system functional to varying degrees. The Guardrail Field Inspection Rating Guide created by CR DOT&PF describes damage codes with letter grades from A – F. Codes of A, B or C represent an acceptable condition, D codes represent types of damage that leave the overall system in a functional state, and F damage codes are not functional and require replacement. This can be found as Appendix A.

The Guardrail Field Inspection Rating Guide is based on the National Cooperative Highway Research Program (NCHRP) publication No. 656 Criteria for Restoration of Longitudinal Barriers, 2010. The NCHRP report gathered information on the various damages that could be present on guardrail and end terminals, performed testing and simulations on guardrail and end terminals with that damage, and then used the results to develop recommendations for repair.

The damages are given a priority for repair from high to low. High priority damages are areas where a second hit in that location would cause the guardrail or end terminal to have an unacceptable safety performance. The high priority damages are equivalent to the F damage codes in the Field Inspection Rating Guide. The medium priority damages, when hit a second time, would result in a safety performance that was degraded but not unacceptable. Low priority damages, when hit a second time, would be expected to result in a safety performance that was not different from an undamaged barrier. The low and medium priorities are equivalent to D damage ratings.

NCHRP's priority ratings can be used to prioritize work, focusing on high priority elements first and proceeding through medium and low priority elements as routine M&O budget allows.

2.1 Guardrail Priority by Damage Assessment

For guardrail, high priority damage codes include F-HGT, F-MISS-RAIL, F-DEFL, F-MISS-POST, F-VERT-TEAR, F-HOLES, F-EMBD, F-IMPR-SPLC and F-SPLC-BOLTS. The medium priority codes include D-DEFL, D-FLAT-RAIL, D-SEP-POST, D-MISS-BLKT, D-SPLC BOLT, and D-HORIZ-TEAR. Low priority ratings include D-REFL and D-TWST-BLKT.

The code D-SHORT-TRANS was not included in the NCHRP priority ranking but was not found to be a determining code during the field inspection, so it is omitted from Table 1 below.

Table 1 shows the NCHRP's priority for relevant damage codes and our recommendations for each code.

Damage Codes	NCHRP 656 Priority	Recommendations
F Damage Codes	High	Requires upgrade
D-DEFL	Medium	Upgrade to MASH
D-FLAT-RAIL	Medium	Upgrade to MASH
D-SEP-POST	Medium	Upgrade to MASH
D-HORIZ-TEAR	Medium	Upgrade to MASH
D-MISS-BLKT	Medium	Maintenance Repair
D-SPLC-BOLT	Medium	Maintenance Repair
D-TWST-BLKT	Low	Monitor
D-REFL	Low	Monitor

Table 1: Recommendations for Guardrail by Damage Code

The codes recommended for replacement include all high priority F Damage Codes. The codes recommended for upgrade to MASH include D-DEFL, D-FLAT-RAIL, D-SEP-POST, and D-HORIZ-TEAR. These medium priority codes involve replacing or reattaching lengths of rail, and generally are beyond the scope of routine maintenance repair work. The codes D-MIS-BLKT and D-SPLC-BOLT are medium priority damages that can be addressed with maintenance activities. The codes D-TWST-BLKT and D-REFL are low priority that can be monitored and replaced as budget allows.

2.2 GET Priority by Damage Assessment

For GET's, the high priority damage codes include FT-HIT-TERM, FT-DEND-POST, FT-HGT, FT-MISS-CBL, FT-NO-BRGPL, FT-TERM-OFFSET, FT-MFR-INSTR, FT-MOD, FT-LAG, FT-NO-BRDG, FT-NO-TRANS, and F-OTHER.

Medium priority damage codes include DT-STRUT, DT-CBL-SLK, DT-CBL-ANCHR, and DT-BRG-PLT. DT-BRDGEGAP and DT-FLARE were not included in NCHRP's priority rankings however were identified by DOT and FHWA through statewide inspections of actual projects and thus included as a criterion for assessment. We recommend that DT-BRDGEGAP be assigned a medium priority and DT-FLARE be assigned a low priority. F-LON describes GET's assigned D ratings during the field inspection that were found to fail to meet LON requirements as described in Section 3.

Table 2 shows the NCHRP's priority for relevant damage codes, our recommended priority if there was not one, and our recommendations for each code.

Damage Codes	NCHRP 656 Priority/ Recommended Priority	Recommendations
F Damage Codes	High	Requires upgrade
F-LON	N/A - High	Requires upgrade
F-REFL	N/A - Low	Maintenance Repair
DT-STRUT	Medium	Upgrade to MASH
DT-BRDGEGAP	N/A - Medium	Upgrade to MASH
DT-CBL-SLK	Medium	Maintenance Repair
DT-CBL-ANCHR	Medium	Maintenance Repair
DT-BRG-PLT	Medium	Maintenance Repair
DT-FLARE	N/A - Low	Monitor

Table 2: Recommendations for GET by Damage Code

The codes for recommended replacement include all high priority F damage coded except F-REFL. F-REFL requires adding a reflector within 50 feet of the end terminal and is a feasible routine maintenance item. The entire end terminal does not need to be replaced.

The codes recommended for upgrade to MASH include DT-STRUT and DT-BRDGEGAP. While these are medium priority codes, DT-STRUT is recommended for upgrade to MASH because repair would work similar or equivalent to replacing the end terminal, including removal and reinstallation of post tubes. DT-BRDGEGAP is recommended to upgrade to MASH because the only way to repair is to replace the entire run. To fix the gap, the bridge connection would need to be reinstalled which would cause the need to replace the guardrail to accommodate changes in length, which would subsequently require end terminal replacement.

DT-CBL-SLK, DT-CBL-ANCHR and DT-BRG-PLT are medium priority damage codes that are recommended for maintenance repair as the work generally consists of replacing or tightening cables, bolts and hardware.

DT-FLARE is recommended to be a low priority damage code. This damage code was assessed at six locations, four of which were in conjunction with F damage codes so these end terminals will be upgraded along with the associated pavement widening. The other 2 locations, an approaching end on an on-ramp on the Glenn Highway, near the beginning of the ramp and one in the median on the Glenn Highway, should be monitored and included in a future project.

3.0 Summary of Unacceptable/Not Functional Guardrail, GET's and Hardware – Requires Upgrade

Table 3 quantifies the guardrail and GET's that are ***UNACCEPTABLE*** or ***NOT FUNCTIONAL*** by failing to meet standards criteria. Maps depicting the location of the failed GET's by milepoint, milepost, and coordinate, as well as tables and calculations describing the existing and required LON are included with the GAR.

Guardrail – Failed on Inspection: There are 368,558 linear feet of guardrail that failed to meet standards and require replacement based on the results of the field inspection and condition assessment. Typical causes of failure included hit rails, missing rails, horizontal or vertical tears, insufficient heights, improper post embedment, or improper splices or holes in the rail.

GET's – Failed on Inspection: There are 1,041 GET's that received F grades in the field and therefore failed to meet current standards requiring replacement based on the results of the field inspection and condition assessment. The GAR includes the Length of Need (LON) required to replace each GET.

GET – Failed on Length of Need: Length of Need (LON) was not a field inspected or determining factor for assigning an unacceptable condition assessment. However, there were GET's that were found to be in damaged but functional condition (D rated) but suspected of failing to meet LON requirements.

An initial evaluation of these end terminals was made using Google Earth and photos available from the field assessment. It was determined that 156 end terminals should be further investigated to determine if the calculated LON requirement was met. Based on field survey data and the LON calculations, 42 of the end terminals in this category failed to meet the calculated LON requirement and should be replaced.

Item	Quantity
Failed Guardrail	368,558 Linear Feet
Failed GET's (Field Inspection)	1,041 Each
Failed GET's (Length of Need)	42 Each

Table 3: Failed Guardrail and End Terminals, Upgrade Required

4.0 Summary of Damaged but Functional Guardrail, GET's, and Hardware - Recommended for Upgrade

Table 4 quantifies the guardrail and GETs in Damaged but Functional condition that are recommended for upgrade to MASH standards. The specific recommendations are included by route in the table Appended to this memorandum.

Item	Quantity
Guardrail	138,436 Linear Feet
GET's	55 Each

Table 4: Damaged but Functional Guardrail and End Terminals, Upgrade Recommended

5.0 Recommendations

We recommend the following:

1. Upgrade guardrails, GET's and hardware that fail to meet standards except for those that can be brought to standard by routine maintenance activities.

2. Upgrade to MASH standards guardrails, GET's and hardware that are of a medium priority where work required is beyond the scope of routine maintenance.

3. Perform routine maintenance on remaining guardrails, GET's and hardware of a medium priority.

4. Monitor or perform routine maintenance on low priority guardrails, GET's and hardware.

Table 5 summarizes and provides quantities for recommendations 1 and 2.

	F Damage, Upgrade Required	D Damage, Upgrade Recommended	F-LON not met	Total
End Terminals	1,041*	55	42	1,159
Guardrail Systems	429	188	N/A	627
Guardrail Segments (Feet)	368,558	138,436	11,500	518,494

Table 5: Summary Recommendations

*Note: 191 F damage GET's do not meet LON requirements, resulting in 233 discreet sites that require additional LON. This does not include any D damage sites

APPENDIX A

Guardrail Field Inspection Rating Guide

FIELD INSPECTION RATING GUIDE FOR EXISTING GUARDRAIL

2020

CONTENTS

EXISTING GUARDRAIL FIELD INSPECTION GRADING

CONTENTS

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

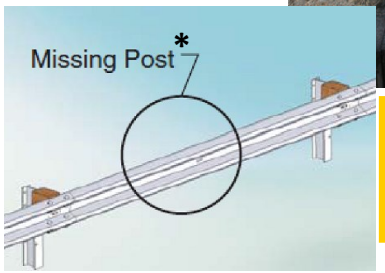
Missing Guardrail

- 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



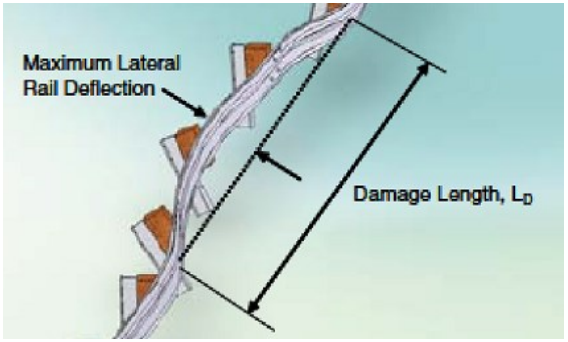
*Exception: Std Plan G-29 with 3 CRT posts each side

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

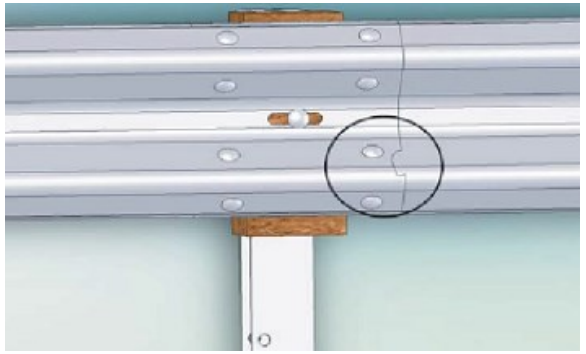
- Splice not consistently located at posts for older 29" guardrail. (≤29'' Height)
- Allowed at 3' midspan only for 31" guardrail per Std Plan G-05 as of 2018 forward, Not < 3' off adjacent post

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

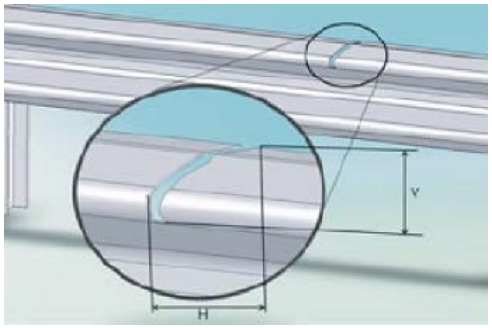
Loss of post embedment

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

F-VERT-TEAR

Vertical Tear

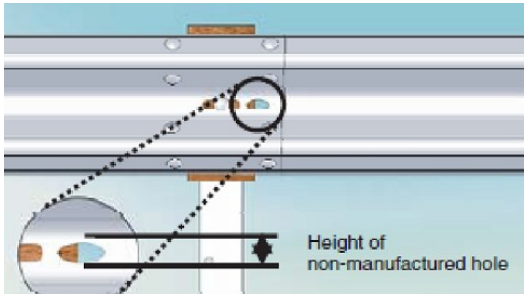
Any length vertical (transverse) tear



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

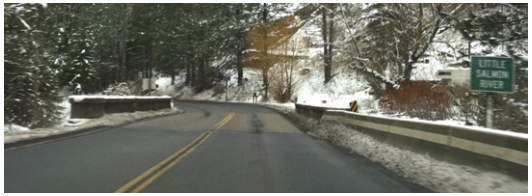
Guardrail transition not stiffened with increasing post density prior to rigid guardrail barrier/wall/ bridge connection

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.

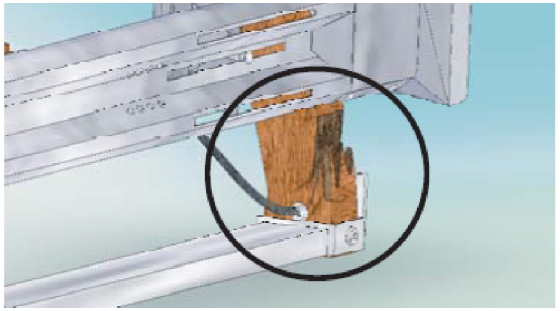
May be older bridges – preexisting designs at the time. New standards may require opposing direction treatment.



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

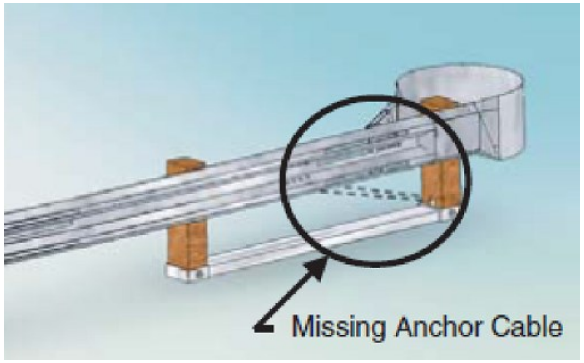
BCT's have no extruding head, no horizontal guardrail and no ground strut slotted

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).

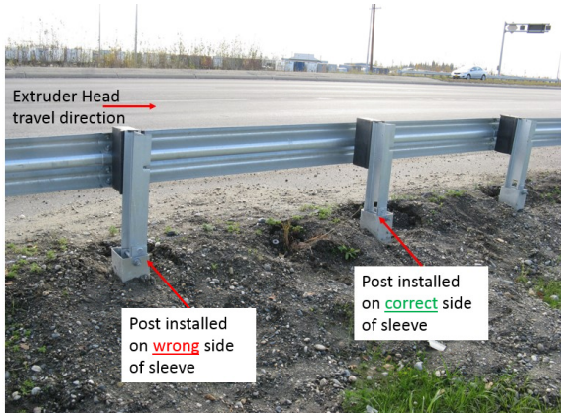


FT-MFR-INSTR

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

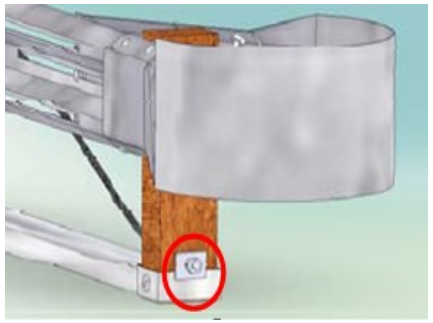
See G-20

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

FT-NO-BRGPL

Missing

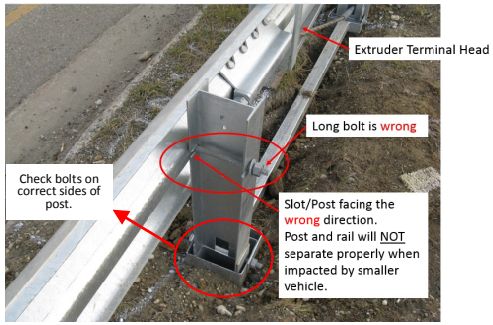
Missing bearing plate behind square washer cable bolt on end post. (See illustration page 26)



FT-MFR-INSTR

Incorrect Terminal Installation

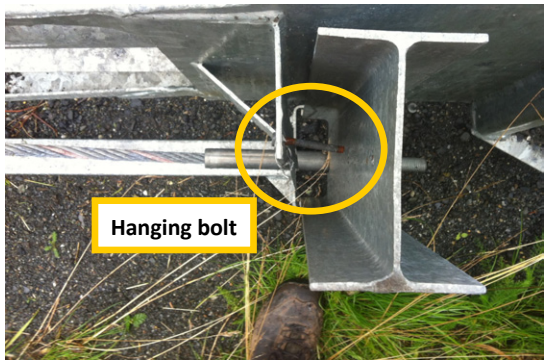
Post or guardrail slots facing wrong way to give way on impact. Long bolts where short bolt required. Review manufacturer's installation instructions for alignment and their checklist.

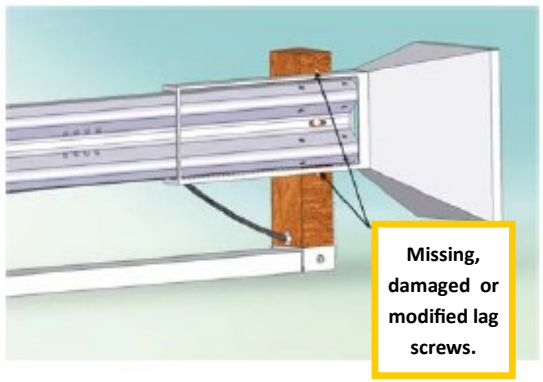


FT-LAG

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.

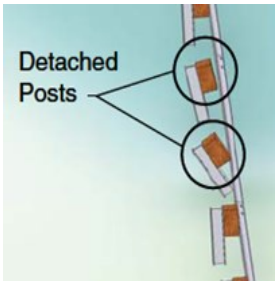




GRADE D RAIL: Damaged - Medium repair schedule

D-POST-SEP

Posts separated from rail



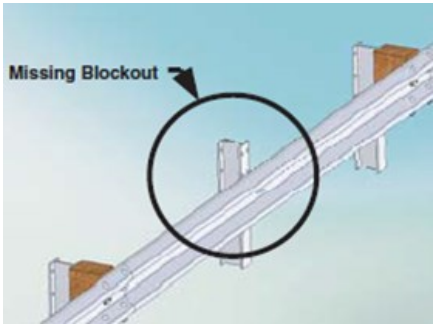
- 2 or more posts with block out attached with a post/rail separation less than 3''.
- 1 or more posts with a post/ rail separation which exceeds 3''.

- 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.

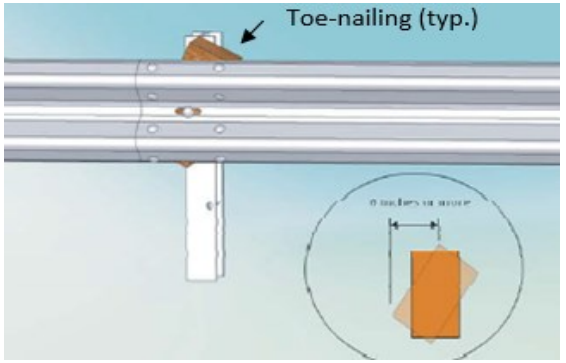


D-TWST-BLKT

Twisted blockouts

Note: Repairs of twisted blockout are relatively quick and inexpensive

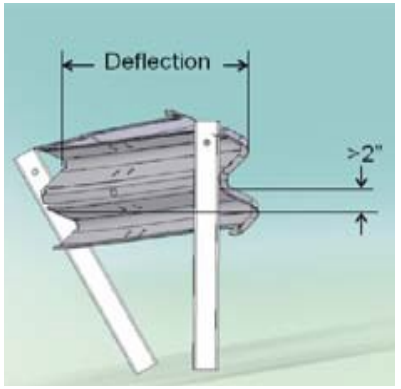
(Missing galvanized 8d toe-nails may be the cause of rotation in the case of wood posts and wood blockouts)



D-DEFL

Post and Rail Deflection ≤ 9”

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

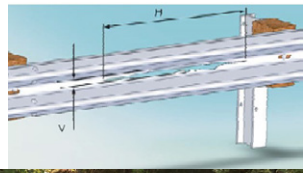


D-HORIZ-TEAR

Horizontal Tear

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

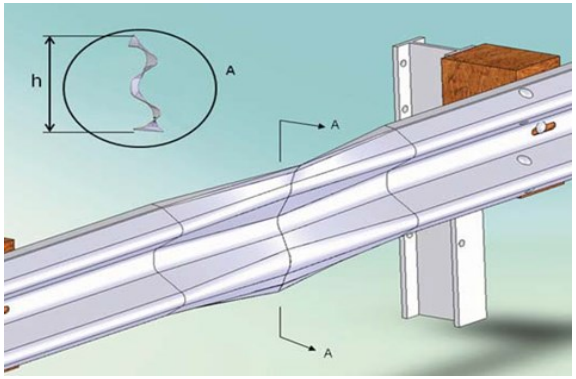
Note: for horizontal tears less than 12'' in length or less than 0.5'' in height, use the non manufactured holes guidelines



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)

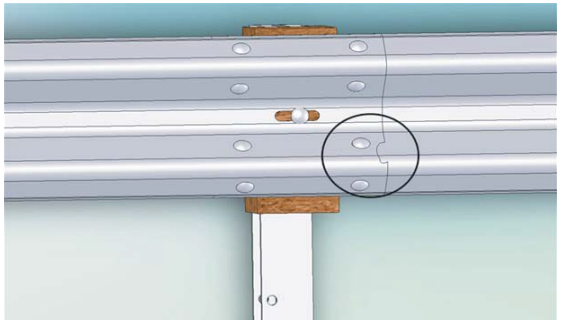


D-SPLIC-BOLT

Damage at guardrail splice (only one bolt damaged)

1 splice bolt

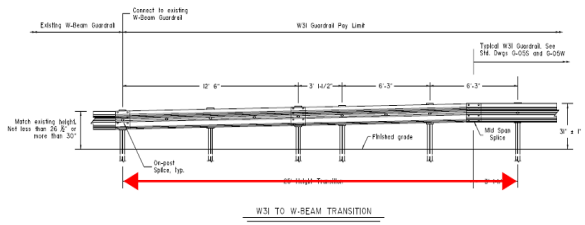
- Missing
- Damaged
- Visibly missing any underlying guardrail
- Torn through guardrail



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

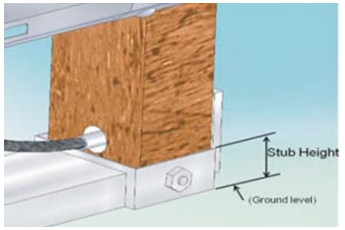
Stub Height or "Floating Strut"

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

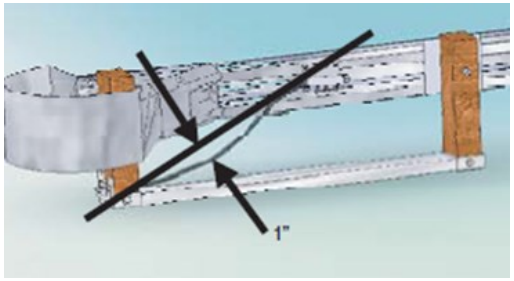
Improper flare pad or approach cross slope (proper flare shown).

See Std Plan G-20

DT-CBL-SLK

Anchor Cable

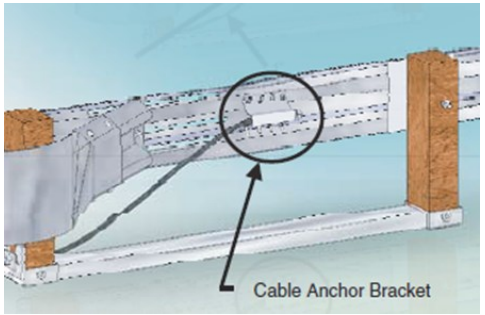
More than 1'' of movement when pushed down by hand



DT-CBL-ANCHR

Cable Anchor Bracket

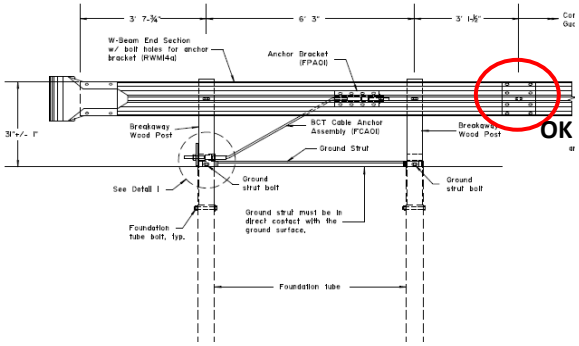
Loose or not firmly seated in guardrail



DT-ANCHR-SPLIC

W31 End Anchor Splice incorrect

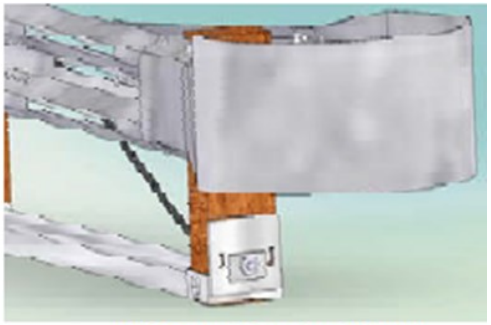
Splice needs to be mid span after second post



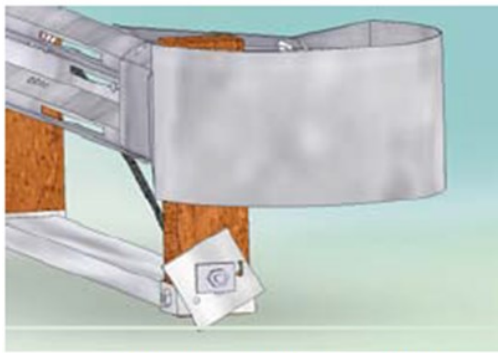
DT-BRG-PLT

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 +)**

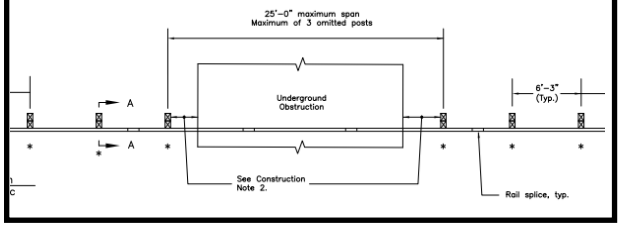
See Std Plan G-29

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

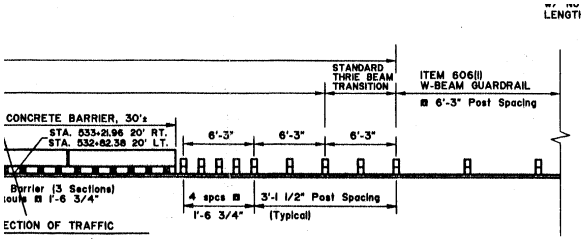
Nested guardrail

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)

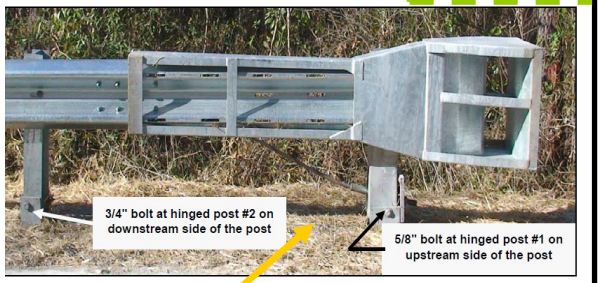
Barrier Systems Inc.

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

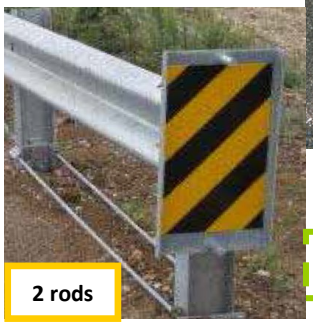
X-TENSION (350)

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.

APPENDIX B

D Damage Upgrade Recommendation Tables

Bogard Road Guardrail Recommendations

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendation
10.6	LT	GET	ET-PLUS	DT-STRUT, DT-CBL-SLK		Upgrade end terminal
10.6	LT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
10.7	LT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT	40’ (Ex.) 175’ (Req.) Power Pole (Ob.)	Upgrade end terminal
10.7	LT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
10.7	LT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
10.8	LT	GET	ET-PLUS	DT-STRUT		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
2.5	LT	GET	BRIDGE CONNECTION	FT-DEND-POST		Upgrade end terminal
2.5	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL, D-DEFL		Upgrade guardrail
2.5	LT	GET	SRT-350	DT-CBL-SLK		Damaged but functional
2.5	RT	GET	SRT-350	FT-HIT-TERM		Upgrade end terminal
2.5	RT	GR	Wood Post W-Beam	D-REFL, D-TWST-BLKT, D-HORI-TEAR		Upgrade guardrail
2.5	RT	GET	BRIDGE CONNECTION			Repair/Replacement not Required

NO D DAMAGE CODES RECOMMENDED FOR UPGRADE ON THIS ROADWAY.

NO D DAMAGE CODES RECOMMENDED FOR UPGRADE ON THIS ROADWAY.

NO D DAMAGE CODES RECOMMENDED FOR UPGRADE ON THIS ROADWAY.

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
0.6	Divided highway, in median	GET	ET-PLUS	FT-DEND-POST, F-REFL		Upgrade end terminal
0.6		GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
0.7		GET	ET-PLUS	FT-DEND-POST, FT-REFL		Upgrade end terminal
0.7	LT	GET	FT-SLPD-END	FT-HGHT		Upgrade end terminal
0.8	LT	GR	Steel Post W-Beam	D-TWST-BLKT, D-DEFL		Upgrade guardrail
0.8	LT	GET	ET-PLUS	FT-HIT-TERM		Upgrade end terminal
1.6	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
1.7	RT	GR	Steel Post W-Beam	D-REFL, D-POST-SEP, D-TWST-BLKT, D-MISS-BLKT		Upgrade guardrail
1.7	RT	GET	BRIDGE CONNECTION	FT-OTHER, FT-REFL		Upgrade end terminal
1.7	RT	GET	ET-PLUS	DT-STRUT		Upgrade end terminal
1.7	RT, on ramp or access road	GR	Steel Post W-Beam	F-HOLES, D-POST-SEP, D-TWST-BLKT,		Upgrade guardrail
1.8	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
2.8	RT	GET	X--LITE	DT-CBL-SLK, DT-CBL-ANCHR		Damaged but functional
3	RT	GR	Steel Post W-Beam	F-DEFL, D-MISS-BLKT, D-FLAT-RAIL, D-TWST-BLKT, D-LOOSE-HARDWARE		Upgrade guardrail
3.2	RT	GET	FT-BCT	DT-CBL-SLK, DT-BRG-PLT		Upgrade end terminal
3.6	RT	GET	X--LITE	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
3.9	RT	GR	Steel Post W-Beam	D-TWST-BLKT, D-FLAT-RAIL, D-POST-SEP		Upgrade guardrail
3.9	RT	GET	FT-BCT	DT-BRG-PLT, DT-CBL-SLK		Upgrade end terminal
4.7	RT	GET	SKT	FT-LAG		Upgrade end terminal
4.8	RT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
4.8	RT	GET	BRIDGE CONNECTION	FT-MFR-INSTR		Upgrade end terminal
4.8	Divided highway, in median	GET	TAU II-R	FT-HIT-TERM		Upgrade end terminal
4.8		GR	Wood Post Thrie Beam	NONE		
4.8		GR	Wood Post Thrie Beam	NONE		
4.8		GET	TAU II-R	NONE		
4.8	RT	GET	BRIDGE CONNECTION	FT-OTHER		Upgrade end terminal
4.8	RT	GR	Wood Post W-Beam	D-TWST-BLKT, D-FLAT-RAIL, D-POST-SEP		Upgrade guardrail
4.8	RT	GET	FT-BCT			Upgrade end terminal
5.4	RT	GET	ET-PLUS	DT-STRUT, DT-CBL-SLK		Upgrade end terminal
5.4	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-POST-SEP		Upgrade guardrail
5.5	RT	GET	FT-BCT			Upgrade end terminal
9.7	LT	GET	FT-BCT	DT-BRG-PLT, DT-CBL-SLK		Upgrade end terminal
10	LT	GR	Steel Post W-Beam	F-DEFL, D-DEFL		Upgrade guardrail

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
10	LT	GET	SKT	DT-CBL-SLK, DT-BRG-PLT	0' (Ex.) 212.5' (Req.) Pathway (Ob.)	Upgrade end terminal
10.1	LT	GET	ET-PLUS	FT-HGHT, DT-FLARE		Upgrade end terminal
10.3	LT	GR	Steel Post W-Beam	F-HGT, F-DEFL, D-REFL, S-POST-SEP		Upgrade guardrail
10.2	LT	GET	ET-PLUS	DT-FLARE, DT-CBL-SLK	100' (Ex.) 150' (Req.) Slope (Ob.)	Upgrade end terminal
10.2	RT	GET	SKT	DT-CBL-SLK		Damaged but functional
10.3	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
10.4	RT	GET	FT-BCT	DT-CBL-SLK		Damaged but functional
12.1	RT	GET	BRIDGE CONNECTION	FT-OTHER		Upgrade end terminal
12	RT	GR	Steel Post W-Beam	D-HORI-TEAR, D-TWST-BLKT		Upgrade guardrail
12.1	RT	GET	SKT	DT-CBL-SLK		Damaged but functional
12.7	LT	GET	FT-BCT	FT-HGHT, FT-TERM-OFFST		Upgrade end terminal
12.7	LT	GR	Steel Post W-Beam	F-HGT, F-VERT-TEAR, D-DEFL, D-TWST-BLKT, D-FLAT-RAIL		Upgrade guardrail
12.8	LT	GET	ET-PLUS	DT-CBL-SLK, DT-BRG-PLT	115' (Ex.) 200' (Req.) Slope (Ob.)	Upgrade end terminal
14	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
14	RT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL, D-POST-SEP		Upgrade guardrail
14.7	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-SEP-POST		
14.7	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
14	LT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade end terminal
14	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL, D-TWST-BLKT, D-HORI-TEAR		Upgrade guardrail
14.1	LT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
15.5	LT	GET	FT-BCT	FT-MFR-INSTR, FT-MISS-CBL		Upgrade end terminal
15.5	LT	GR	Steel Post W-Beam	F-EMBD, D-MISS-BLKT, D-REFL		Upgrade guardrail
15.5	LT	GET	SKT	DT-STRUT	50' (Ex.) 262.5' (Req.) Slope (Ob.)	Upgrade end terminal
15.7	LT	GET	FT-BCT	FT-HIT-TERM, FT-HGHT		Upgrade end terminal
15.7	LT	GR	Steel Post W-Beam	F-HGT, F-MISS-POST, F-DEFL, D-FLAT-RAIL, D-TWST-BLKT, D-DEFL		Upgrade guardrail
16	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
15.9	Divided highway, in median	GET	ET-PLUS	FT-HGHT, FT-DEND-POST		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
15.9		GR	Steel Post W-Beam	D-SEP-POST, D-TWST-BLKT		Upgrade guardrail
16		GR	Steel Post Thrie Beam	D-FLAT-RAIL		Upgrade guardrail
16	LT	GET	BRIDGE CONNECTION	FT-HGHT		Upgrade end terminal
16	Divided highway, in median	GR	Steel Post W-Beam	NONE		
16.1		GR	Steel Post W-Beam	D-POST-SEP, D-MISS-BLKT		Upgrade guardrail
16.1		GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
15.9	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
15.9	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-DEFL		Upgrade guardrail
16	RT	GET	BRIDGE CONNECTION			
16	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
16.1	LT	GR	Steel Post W-Beam	F-MISS-POST, F-HGT, D-TWST-BLKT, D-DEFL		Upgrade guardrail
16.1	LT	GET	ET-PLUS	DT-STRUT, DT-CBL-SLK		Upgrade end terminal
19.6	LT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
19.7	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
19.7	LT	GET	BRIDGE CONNECTION			
19.8	LT	GET	BRIDGE CONNECTION			
19.8	LT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
19.8	LT	GR	Steel Post W-Beam	D-DEFL		
19.8	LT	GET	SKT	DT-CBL-SLK	70’ (Ex.) 212.5’ (Req.) Light Pole (Ob.)	Upgrade end terminal
20.3	Divided highway, in median	GET	ET-PLUS	DT-CBL-SLK, DT-FLARE		Damaged but functional
20.3		GR	Steel Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT, D-SEP-POST		Upgrade guardrail
20.4		GR	Steel Post Thrie Beam	NONE		
20.4	Divided highway, in median	GET	BRIDGE CONNECTION	NONE		
20.4		GR	Steel Post W-Beam	NONE		
20.4		GET	FT-BCT	FT-TERM-OFFST		Upgrade end terminal
20.3	LT	GET	FT-BCT	FT-HGHT, FT-REFL		Upgrade end terminal
20.3	LT	GR	Steel Post W-Beam	D-TWST-BLKT, D-REFL, D-FLAT-RAIL		Upgrade guardrail
20.4	LT	GET	BRIDGE CONNECTION	NONE		
20.4	Divided highway, in median	GET	BRIDGE CONNECTION	NONE		
20.5		GR	Steel Post W-Beam	D-DEFL, D-POST-SEP		Upgrade guardrail
20.5		GET	ET-PLUS	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal
21.4	Divided highway, in median	GET	FT-BCT	FT-DEND-POST, FT-MISS-CBL		Upgrade end terminal
21.5		GR	Steel Post W-Beam	F-IMPR-SPLC, F-MISS-POST		Upgrade guardrail

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
21.5		GET	ET-PLUS	DT-STRUT, DT-CBL-SLK		Upgrade end terminal
22.6	RT	GET	ET-PLUS	FT-HIT-TERM		Upgrade end terminal
22.6	RT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
22.7	RT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
22.6	LT	GET	FT-BCT	FT-TERM-OFFST		Upgrade end terminal
22.7	LT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
22.7	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
22.7	LT	GET	BRIDGE CONNECTION	NONE		
22.8	LT	GR	Wood Post W-Beam	D-POST-SEP		Upgrade guardrail
22.8	LT	GET	ET-PLUS	FT-HGHT, FT-TERM-OFFST		Upgrade end terminal
22.9	LT	GET	FT-OTHER	FT-OTHER		Upgrade end terminal
22.9	LT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
22.9	LT	GET	ET-PLUS	DT-BRG-PLT, DT-CBL-SLK	60’ (Ex.) 300’ (Req.) Slope (Ob.)	Upgrade end terminal
23.9	LT	GET	FT-BCT	FT-DEND-POST, FT-MISS-POST		Upgrade end terminal
23.9	LT	GR	Steel Post W-Beam	F-HGT, D-TWST-BLKT, D-DEFL		Upgrade guardrail
24.1	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
24.1	Divided highway, in median	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
24.1		GR	Steel Post W-Beam	F-HGT		Upgrade guardrail
24.1		GET	FT-BCT	FT-NO-BRGPL, FT-HGHT		Upgrade end terminal
24	RT	GET	ET-PLUS	FT-MFR-INSTR, DT-CBL-SLK		Upgrade end terminal
24	RT	GR	Steel Post W-Beam	F-HGT, F-MISS-POST, D-DEFL, D-FLAT-RAIL		Upgrade guardrail
24.1	RT	GET	BRIDGE CONNECTION	DT-OTHER, DT-BRDGEGAP		Upgrade end terminal
24.1	RT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		
24.2	RT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
24.2	RT	GET	FT-BCT	FT-MISS-CBL, FT NO TRANS		Upgrade end terminal
25.2	LT	GET	BRIDGE CONNECTION	NONE		
25.5	LT	GR	Steel Post W-Beam	D-MISS-BLKT		Damaged but functional
25.6	LT	GET	SKT	DT-CBL-SLK	55’ (Ex.) 212.5’ (Req.) Light Pole (Ob.)	Upgrade end terminal
25	RT	GET	SKT	FT-HIT-TERM		Upgrade end terminal
25	RT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
25.3	RT	GET	BRIDGE CONNECTION	NONE		
25.5	RT	GR	Steel Post W-Beam	F-HOLES, D-TWST-BLKT, D-MISS-BLKT		Upgrade guardrail
25.6	RT	GET	SKT	DT-CBL-SLK		Damaged but functional
25.1	LT	GET	SKT	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
25.2	LT	GR	Steel Post W-Beam	F-IMPR-SPLC		Upgrade guardrail
25.2	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
25.8	RT	GET	SKT	DT-BRG-PLT		Damaged but functional
25.8	RT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
25.9	RT	GET	SKT	DT-CBL-SLK		Damaged but functional
28.1	RT	GET	ET-PLUS	FT-HGHT, DT-BRG-PLT		Upgrade end terminal
28.1	RT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL, D-TWST-BLKT, D-POST-SEP		Upgrade guardrail
28.3	RT	GET	ET-PLUS	FT-MFR-INSTR, DT-CBL-SLK		Upgrade end terminal
28.2	RT	GET	SKT	FT-HIT-TERM		Upgrade end terminal
28.2	RT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
28.3	RT	GET	SKT	DT-BRG-PLT, DT-CBL-SLK		Damaged but functional
28.3	RT	GET	ET-PLUS	DT-STRUT, DT-CBL-SLK		Upgrade end terminal
28.5	RT	GR	Steel Post W-Beam	F-HGT, D-REFL, D-POST-SEP		Upgrade guardrail
28.5	RT	GET	ET-PLUS	FT-REFL, DT-CBL-SLK		Damaged but functional
28.5	RT	GET	SKT	DT-CBL-SLK	130’ (Ex.) 162.5’ (Req.) Light Pole (Ob.)	Upgrade end terminal
28.6	RT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
28.7	RT	GET	BRIDGE CONNECTION			Damaged but functional
28.6	LT	GET	SKT	DT-CBL-SLK	-25’ (Ex.) 0’ (Req.) Slope (Ob.)	Upgrade end terminal
28.7	LT	GR	Steel Post W-Beam	D-REFL		
28.7	LT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
28.7	LT	GET	BRIDGE CONNECTION	NONE		
29	RT	GET	BRIDGE CONNECTION			
29.1	RT	GR	Steel Post W-Beam	D-DEFL, D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
29.2	RT	GET	SKT	FT-REFL, DT-CBL-SLK		Damaged but functional
29	LT	GET	BRIDGE CONNECTION			Damaged but functional
29.3	LT	GR	Steel Post W-Beam	D-REFL, D-DEFL		Upgrade guardrail
29.3	LT	GET	SKT	FT-REFL		Damaged but functional
29.4	LT	GET	SKT	FT-LAG, DT-CBL-SLK		Upgrade end terminal
29.6	LT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
29.6	LT	GET	SKT	DT-CBL-SLK	85’ (Ex.) 187.5’ (Req.) Light Pole (Ob.)	Upgrade end terminal
30.6	Divided highway, in median	GET	BRIDGE CONNECTION	FT-DEND-POST, FT-REFL		Upgrade end terminal
30.7		GR	Steel Post W-31	D-REFL, D-TWST-BLKT, D-POST-SEP		Upgrade guardrail
30.7		GET	ET-PLUS	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
30.8	LT	GET	SKT	FT-REFL		Damaged but functional

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
30.8	LT	GR	Steel Post W-Beam	D-REFL, D-DEFL, D-FLAT-RAIL		Upgrade guardrail
30.6	LT	GET	BRIDGE CONNECTION			
32.7	RT	GET	X--LITE	DT-CBL-SLK	165' (Ex.) 275' (Req.) Light Pole (Ob.)	Upgrade end terminal
32.7	RT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
32.8	RT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
32.8	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
32.8	LT	GR	Steel Post W-Beam	D-FLAT-RAIL		
32.9	LT	GR	Steel Post W-Beam	D-REFL, D-POST-SEP, D-FLAT-RAIL		Upgrade guardrail
32.9	LT	GET	ET-PLUS	DT-STRUT, DT-CBL-SLK		Upgrade end terminal
33	RT	GET	X--LITE	FT-REFL	100' (Ex.) 237.5' (Req.) Light Pole (Ob.)	Upgrade end terminal
33	RT	GR	Steel Post W-Beam	D-POST-SEP, D-REFL, D-DEFL		Upgrade guardrail
33.1	RT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
33.6	LT	GET	X--LITE	DT-CBL-SLK		Damaged but functional
33.6	RT	GR	Steel Post W-Beam	D-REFL, D-DEFL		Upgrade guardrail
33.7	RT	GET	BRIDGE CONNECTION	FT-REFL		Damaged but functional
33.8	LT	GET	BRIDGE CONNECTION	NONE		Damaged but functional
33.8	LT	GR	Steel Post W-Beam	D-DEFL, D-REFL		Upgrade guardrail
34	LT	GET	CRT	DT-CBL-SLK		Damaged but functional
35.1	LT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
35.2	LT	GR	Steel Post W-Beam	F-DEFL, D-REFL, D-FLAT-RAIL		Upgrade guardrail
35.2	LT	GET	ET-PLUS	FT-REFL, DT-CBL-BLKT	30' (Ex.) 275' (Req.) Slope (Ob.)	Upgrade end terminal
35.7	LT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
35.8	LT	GR	Steel Post W-Beam	D-REFL, D-SEP-POST		Upgrade guardrail
35.8	LT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
35.9	RT	GET	ET-PLUS	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal
35.9	RT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
36.1	RT	GR	Steel Post W-Beam	D-DEFL, D-TWST-BLKT		
36.1	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
43.9	LT	GET	SKT	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
43.9	LT	GR	Steel Post W-Beam	D-REFL, D-TWST-BLKT, D-DEFL		Upgrade guardrail
44.2	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
47	RT	GET	SKT	FT-MFR-INSTR, FT-REFL		Upgrade end terminal
47	RT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
47.1	RT	GET	SKT	DT-STRUT		Upgrade end terminal
48.8	LT	GET	SKT	DT-CBL-SLK		Damaged but functional

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
48.9	LT	GR	Steel Post W-Beam	D-REFL, D-DEFL, D-TWST-BLKT		Upgrade guardrail
49.4	LT	GET	SKT	FT-MFR-INSTR, DT-CBL-SLK		Upgrade end terminal
60.7	RT	GET	ET-PLUS	DT-CBL-SLK	25' (Ex.) 200' (Req.) Drop Off (Ob.)	Upgrade end terminal
60.7	RT	GR	Steel Post W-Beam	F-IMPR-SPLC, F-MISS-POST, F-IMPR-SPLC		Upgrade guardrail
60.8	RT	GET	ET-PLUS	FT-REFL		Damaged but functional
60.9	RT	GET	ET-PLUS	FT-DEND-POST, DT-STRUT		Upgrade end terminal
60.9	RT	GR	Steel Post W-Beam	D-REFL, D-DEFL, D-TWST-BLKT, D-MISS-BLKT		Upgrade guardrail
61	RT	GET	ET-PLUS	DT-CBL-SLK, DT-OTHER		Damaged but functional
70.6	RT	GET	BRIDGE CONNECTION	FT-REFL		Damaged but functional
70.6	RT	GR	Wood Post W-Beam	D-POST-SEP, D-REFL		Upgrade guardrail
70.6	RT	GET	CRT	DT-CBL-SLK		Damaged but functional
81.5	LT	GET	ET-PLUS	DT-BRG-PLT		Damaged but functional
81.5	LT	GR	Wood Post W-Beam	D-POST-SEP, D-REFL, D-TWST-BLKT		Upgrade guardrail
81.5	LT	GET	BRIDGE CONNECTION			
84.5	LT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
84.6	LT	GR	Steel Post W-Beam	D-TWST-BLKT, D-REFL, D-DEFL		Upgrade guardrail
84.6	LT	GET	ET-PLUS	FT-HIT-TERM, DT-CBL-SLK		Upgrade end terminal
94.4	RT	GET	ET-PLUS	FT-REFL	80' (Ex.) 150' (Req.) Slope (Ob.)	Upgrade end terminal
94.4	RT	GR	Wood Post W-Beam	D-REFL		Damaged but functional
94.5	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
94.5	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
94.5	RT	GR	Wood Post W-Beam	D-REFL		
94.8	RT	GR	Wood Post W-Beam	D-REFL, D-POST-SEP		Upgrade guardrail
94.8	RT	GET	ET-PLUS	FT-REFL		
98.4	LT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
98.5	LT	GR	Wood Post W-Beam	D-REFL, D-POST-SEP		Upgrade guardrail
98.5	LT	GET	BRIDGE CONNECTION	NONE		
98.7	RT	GET	FT-OTHER	FT-HGHT, FT-MOD		Upgrade end terminal
98.7	RT	GR	Wood Post W-Beam	F-MISS-POST, D-REFL, D-TWST-BLKT		Upgrade guardrail
98.7	RT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
100.6	RT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
100.6	RT	GR	Wood Post W-Beam	D-REFL, D-TWST-BLKT, D-MISS-BLKT		Damaged but functional
100.7	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
103.6	LT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
103.7	LT	GR	Steel Post W-Beam	D-REFL, D-MISS-BLKT, D-TWST-BLKT		Damaged but functional
103.7	LT	GET	ET-PLUS	FT-HIT-TERM		Upgrade end terminal
103.6	RT	GET	ET-PLUS	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
103.6	RT	GR	Steel Post W-Beam	D-REFL, D-DEFL, D-TWST-BLKT		Upgrade guardrail
103.7	RT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
104.9	LT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
104.9	LT	GR	Steel Post W-Beam	D-REFL, D-TWST-BLKT		Damaged but functional
104.9	LT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
107.2	RT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
107.2	RT	GR	Steel Post W-Beam	D-REFL, D-TWST-BLKT		Damaged but functional
107.2	RT	GET	ET-PLUS	FT-DEND-POST		Upgrade end terminal
108.7	RT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
108.7	RT	GR	Steel Post W-Beam	D-REFL, D-TWST-BLKT, D-MISS-BLKT		Damaged but functional
108.7	RT	GET	SRT-350	DT-CBL-SLK		Damaged but functional

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
0.9	LT	GET	SKT	FT-MFR-INSTR		Upgrade end terminal
1	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
1	LT	GET	SKT	FT-REFL		Damaged but functional
1.6	LT	GET	SKT			Damaged but functional
1.6	LT	GR	Steel Post W-Beam	D-REFL		
1.8	LT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
1.8	LT	GET	SKT	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
2	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
2	LT	GR	Steel Post W-Beam	D-REFL		
2.1	LT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
2.1	LT	GET	SKT	FT-DEND-POST, FT-LAG		Upgrade end terminal
2	RT	GET	SKT	FT-MFR-INSTR		Upgrade end terminal
2	RT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
2	RT	GR	Steel Post W-Beam	D-REFL		
2.1	RT	GR	Steel Post W-Beam	D-FLAT-RAIL		
2.1	RT	GET	SKT	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendation
0.8	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
0.9	RT	GR	Wood Post W-Beam	D-POST-SEP, D-DEFL		Upgrade guardrail
0.9	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
1.2	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
1.2	RT	GR	Wood Post W-Beam	D-REFL, D-FLAT-RAIL		Upgrade guardrail
1.3	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
1.9	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
1.9	RT	GR	Wood Post W-Beam	D-REFL, D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
2.3	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
3	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
3	RT	GR	Steel Post W-Beam	D-DEFL, D-FLAT-RAIL, D-HORI-TEAR		Upgrade guardrail
3.4	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
4.4	RT	GET	FT-BCT	FT-HGHT, DT-CBL-SLK		Upgrade end terminal
4.5	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-HORI-TEAR		Upgrade guardrail
4.5	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
5.3	RT	GET	FT-BCT	FT-HGHT, DT-CBL-SLK		Upgrade end terminal
5.3	RT	GR	Wood Post W-Beam	D-HORI-TEAR, D-FLAT-RAIL		Upgrade guardrail
5.4	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
6.5	RT	GET	ET-PLUS	FT-LAG		Upgrade end terminal
6.5	RT	GR	Wood Post W-Beam	D-HORI-TEAR, D-DEFL		Upgrade guardrail
6.6	RT	GET	ET-PLUS	FT-LAG		Upgrade end terminal
6.9	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
6.9	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
7.1	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
7.8	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
7.8	RT	GR	Wood Post W-Beam	D-HORI-TEAR, D-FLAT-RAIL		Upgrade guardrail
7.9	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
9.3	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
9.3	RT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
9.5	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
9.9	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
9.9	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
10	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
10.2	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
10.2	RT	GR	Wood Post W-Beam	D-TWST-BLKT, D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
10.4	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
11	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
11	RT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
11.1	RT	GET	FT-BCT			Upgrade end terminal
12.1	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
12.1	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
12.2	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
12.3	RT	GET	FT-BCT	FT-HIT-TERM, FT-HGHT		Upgrade end terminal
12.3	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
12.4	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
12.3	LT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
12.4	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-HORI-TEAR		Upgrade guardrail
12.4	LT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
12.6	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
12.6	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
12.9	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendation
12.8	LT	GET	FT-BCT	FT-HGHT, DT-CBL-SLK		Upgrade end terminal
12.8	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
12.9	LT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
13	LT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
13	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
13	LT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
13.3	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
13.3	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
13.4	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
13.6	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
13.6	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
13.6	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
13.7	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
13.7	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
13.8	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL, D-HORI-TEAR		Upgrade guardrail
13.9	RT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
13.8	LT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
13.9	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
13.9	LT	GET	FT-BCT	FT-HGHT		Upgrade end terminal
14.1	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
14.1	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL, D-HORI-TEAR		Upgrade guardrail
14.3	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
14.5	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
14.6	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
14.6	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
14.9	RT	GET	FT-BCT	FT-HGHT, DT-CBL-SLK		Upgrade end terminal
14.9	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
14.9	RT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
1.7	RT	GET	SKT-TL3	DT-CBL-SLK	45’ (Ex.) 175’(Req.) Slope (Ob.)	Upgrade end terminal
1.7	RT	GR	Steel Post W-Beam	D-TWST-BLKT		Damaged but functional
1.7	RT	GET	BRIDGE CONNECTION	NONE		Repair/Replacement not Required

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
2.5	LT	GET	ET-PLUS	FT-REFL, DT-CBL-SLK	0' (Ex.) 175' (Req.) Slope (Ob.)	Upgrade end terminal
2.5	LT	GR	Wood Post W-Beam	F-HGT, D-TWST-BLKT		Upgrade guardrail
2.6	LT	GET	ET-PLUS	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
14.1	RT	GET	CRT	DT-CBL-SLK		Damaged but functional
14.2	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
14.2	RT	GET	ET-PLUS	FT-LAG		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
21.8	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
21.8	RT	GR	Wood Post W-Beam	F-HOLES, D-FLAT-RAIL		Upgrade guardrail
22	RT	GET	ET-PLUS	FT-HIT-TERM		Upgrade end terminal
21.9	LT	GET	ET-PLUS	NONE		
22	LT	GR	Wood Post W-Beam	D-REFL, D-DEFL, D-TWST-BLKT		Upgrade guardrail
22	LT	GET	ET-PLUS	FT-HIT-TERM		Upgrade end terminal
28.7	LT	GET	CRT	DT-CBL-SLK		Damaged but functional
28.8	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-MISS-BLKT		Upgrade guardrail
28.8	LT	GET	ET-PLUS	FT-HGHT		Upgrade end terminal
31.5	LT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
31.5	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-DEFL, D-REFL		Upgrade guardrail
31.5	LT	GET	FT-BCT	DT-CBL-SLK		Upgrade end terminal
32.2	LT	GET	FT-BCT	FT-HIT-TERM		Upgrade end terminal
32.2	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
32.2	LT	GET	FT-BCT	DT-CBL-SLK		Upgrade end terminal
35.4	LT	GET	FT-BCT	FT-HGHT, DT-CBL-SLK		Upgrade end terminal
35.4	LT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
35.4	LT	GET	FT-BCT	FT-HGHT, DT-CBL-SLK		Upgrade end terminal
38.2	LT	GET	BRIDGE CONNECTION	FT-HGHT		Upgrade end terminal
38.2	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
38.2	LT	GET	FT-BCT	DT-CBL-SLK		Upgrade end terminal
38.1	RT	GET	FT-BCT	FT-HIT-TERM, FT-MISS-CBL		Upgrade end terminal
38.1	RT	GR	Wood Post W-Beam	D-TWST-BLKT, D-FLAT-RAIL		Upgrade guardrail
38.1	RT	GET	BRIDGE CONNECTION	FT-HGHT, FT-NO-BRDG		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
12.2	RT	GET	ET-PLUS	FT-MFR-INSTR, DT-CBL-SLK		Upgrade end terminal
12.3	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT, D-POST-SEP, D-MISS-BLKT		Upgrade guardrail
12.5	RT	GET	ET-PLUS	FT-DEND-POST		Upgrade end terminal
14.8	LT	GET	ET-PLUS	FT-HGHT, FT-MFR-INSTR		Upgrade end terminal
14.9	LT	GR	Steel Post W-Beam	D-REFL, D-TWST-BLKT, D-DEFL		Upgrade guardrail
14.9	LT	GET	CRT	DT-CBL-SLK		Damaged but functional
16	LT	GET	ET-PLUS	FT-REFL, DT-STRUT		Upgrade end terminal
16.1	LT	GR	Wood Post W-Beam	NONE		
16.1	LT	GR	Steel Post W-Beam	D-REFL, D-TWST-BLKT		Damaged but functional
16.1	LT	GR	Steel Post W-Beam	D-TWST-BLKT		
16.1	LT	GET	CRT	FT-HIT-TERM, DT-CBL-SLK		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
0.3	LT	GET	SRT-350	DT-STRUT, DT-CBL-SLK		Upgrade end terminal
0.3	LT	GR	Steel Post W-31	D-FLAT-RAIL, D-TWST-BLKT, D-REFL		Upgrade guardrail
0.9	LT	GET	SRT-350	FT-MFR-INSTR, DT-CBL-SLK		Upgrade end terminal
1	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
1.1	LT	GR	Steel Post W-31	D-FLAT-RAIL, D-REFL		Upgrade guardrail
1.2	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
7	LT	GET	FT-BCT	FT-HGHT, DT-FLARE		Upgrade end terminal
7	LT	GR	Steel Post W-Beam	D-DEFL, D-TWST-BLKT		Upgrade guardrail
7	LT	GET	FT-BCT	FT-MISS-CBL		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
0.5	RT	GET	SRT-350	FT-REFL	53’ (Ex.) 87.5’(Req.) Abutment (Ob.)	Upgrade end terminal
0.5	RT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
0.5	RT	GET	BRIDGE CONNECTION			Repair/Replacement not Required
0.5	RT	GET	BRIDGE CONNECTION	FT-HGHT		Upgrade end terminal
0.5	RT	GET	SRT-350	DT-CBL-SLK	85’ (Ex.) 175’ (Req.) Abutment (Ob.)	Upgrade end terminal
1.9	LT	GET	SRT-350	FT-MFR-INSTR		Upgrade end terminal
2	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
2	LT	GET	BRIDGE CONNECTION	DT-OTHER		Damaged but functional
2	LT	GET	BRIDGE CONNECTION	FT-REFL		Damaged but functional
2	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
2.1	LT	GET	SRT-350	FT-HIT-TERM		Upgrade end terminal
1.9	RT	GET	SRT-350	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal
2	RT	GR	Steel Post W-Beam	D-MISS-BLKT, D-FLAT-RAIL		Upgrade guardrail
2	RT	GET	BRIDGE CONNECTION	NONE		Repair/Replacement not Required

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
13	RT	GET	ET-PLUS	DT-STRUT, DT-CBL-SLK	102' (Ex.) 187.5' (Req.) Culvert (Ob.)	Upgrade end terminal
13.1	RT	GR	Wood Post W-Beam	F-DEFL, D-REFL, D-MISS-BLKT		Upgrade guardrail
13.2	RT	GET	CRT	DT-CBL-SLK		Damaged but functional
13.4	RT	GET	CRT	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
13.6	RT	GR	Wood Post W-Beam	F-HGT		Upgrade guardrail
13.6	RT	GR	Wood Post W-Beam	F-HGT		Upgrade guardrail
13.6	RT	GR	Wood Post W-Beam	F-HGT, F-DEFL		Upgrade guardrail
13.6	RT	GET	CRT	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
13.8	RT	GET	CRT	DT-CBL-SLK		Damaged but functional
14.1	RT	GR	Wood Post W-Beam	D-REFL, D-TWST-BLKT, D-DEFL		Upgrade guardrail
14	RT	GET	CRT	NONE		
15	LT	GET	ET-PLUS	FT-DEND-POST		Upgrade end terminal
15.1	LT	GR	Wood Post W-Beam	F-DEFL		Upgrade guardrail
15.4	LT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
15.9	RT	GET	CRT	FT-HIT-TERM, DT-DEND-POST		Upgrade end terminal
15.9	RT	GR	Wood Post W-Beam	F-MISS-POST, F-DEFL		Upgrade guardrail
15.9	RT	GR	Wood Post W-Beam	D-TWST-BLKT		
15.9	RT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
17.3	RT	GET	ET-PLUS	FT-HGHT		Upgrade end terminal
17.3	RT	GR	Wood Post W-Beam	D-REFL, D-POST-SEP		Upgrade guardrail
17.4	RT	GET	ET-PLUS	NONE		

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
3.1	RT	GET	CRT	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal
3.1	RT	GR	Wood Post W-Beam	NONE		
3.2	RT	GR	Steel Post W-Beam	D-TWST-BLKT, D-DEFL		Upgrade guardrail
3.2	RT	GET	SKT	FT-MFR-INSTR, DT-CBL-SLK		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
0	Divided highway, in median	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
0		GET	BRIDGE CONNECTION	FT-HIT-TERM		Upgrade end terminal
0		GR	Steel Post W-Beam	F-HGT		Upgrade guardrail
0		GET	X--LITE	DT-STRUT, DT-CBL-SLK		Upgrade end terminal
0	LT	GET	BRIDGE CONNECTION	FT-HGHT		Upgrade end terminal
0.1	LT	GR	Steel Post W-Beam	D-REFL, D-POST-SEP, D-TWST-BLKT		Upgrade guardrail
0.1	LT	GET	X--LITE	DT-CBL-SLK		Damaged but functional
0.2	RT	GR	Steel Post W-Beam	D-REFL, D-DEFL		Upgrade guardrail
0.2	RT	GET	X--LITE	FT-MFR-INSTR, FT-NO-BRGPL		Upgrade end terminal
2.4	LT	GET	X--LITE	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
2.4	LT	GR	Steel Post W-Beam	D-REFL, D-TWST-BLKT, D-DEFL		Upgrade guardrail
2.4	LT	GET	X--LITE	FT-HIT-TERM		Upgrade end terminal
2.6	RT	GET	BRIDGE CONNECTION	NONE		Damaged but functional
2.6	RT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
2.7	RT	GET	X--LITE	DT-STRUT		Upgrade end terminal
2.6	Divided highway, in median	GET	X--LITE	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
2.6		GR	Steel Post W-Beam	D-POST-SEP		Upgrade guardrail
2.6		GET	BRIDGE CONNECTION	FT-MFR-INSTR		Upgrade end terminal
3.9	Divided highway, in median	GET	X--LITE	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
3.9		GR	Steel Post W-Beam	D-POST-SEP, D-REFL, D-TWST-BLKT		Upgrade guardrail
4.1		GET	FT-OTHER	FT-REFL, F-MFR-INSTR		Upgrade end terminal
4.2	LT	GET	BRIDGE CONNECTION	NONE		
4.3	LT	GR	Steel Post W-Beam	D-REFL, D-DEFL, D-TWST-BLKT		Upgrade guardrail
4.4	LT	GET	ET-PLUS	DT-CBL-SLK, DT-STRUT		Damaged but functional
23	LT	GET	SRT-350	FT-NO-BRGPL, FT-TERM-OFFSET		Upgrade end terminal
23	LT	GR	Wood Post W-Beam	D-SPLC-BOLT, D-POST-SEP, D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
23	LT	GET	CRT	DT-CBL-SLK		Damaged but functional
26.4	LT	GET	CRT	FT-DEND-POST		Upgrade end terminal
26.4	LT	GR	Wood Post W-Beam	D-REFL, D-TWST-BLKT, D-DEFL, D-POST-SEP		Upgrade guardrail
26.6	LT	GET	ET-PLUS	DT-FLARE, DT-CBL-SLK	100' (Ex.) 200' (Req.) Slope (Ob.)	Upgrade end terminal
27	LT	GET	SRT-350	FT-HIT-TERM, F-REFL		Upgrade end terminal
27	LT	GR	Steel Post W-Beam	D-TWST-BLKT, D-REFL		Damaged but functional
27	LT	GET	SRT-350	DT-STRUT, DT-CBL-SLK		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
39.3	LT	GET	ET-PLUS	FT-MFR-INSTR, DT-CBL-ANCHR		Upgrade end terminal
39.3	LT	GR	Steel Post W-Beam	D-DEFL, D-REFL		Upgrade guardrail
39.3	LT	GET	BRIDGE CONNECTION	FT-NO-BRDG, FT-REFL		Upgrade end terminal
89.2	RT	GET	SKT	NONE		
89.2	RT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
89.3	RT	GET	SKT	DT-STRUT		Upgrade end terminal
90.4	LT	GET	SKT	FT-MISS-CBL		Upgrade end terminal
90.4	LT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
90.5	LT	GET	SKT	NONE		
90.7	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
90.8	LT	GR	Steel Post W-Beam	D-REFL, DT-TWST-BLKT		Damaged but functional
90.8	LT	GET	SKT	DT-CBL-SLK, DT-STRUT		Upgrade end terminal
97.4	RT	GET	SKT	FT-MFR-INSTR		Upgrade end terminal
97.4	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
97.5	RT	GET	BRIDGE CONNECTION	FT-LAG, FT-MFR-INSTR		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
3.2	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade entire segment
3.2	LT	GET	SRT-350	DT-CBL-SLK, DT-BRG-PLT	75’ (Ex.) 187.5’ (Req.) Abutment (Ob.)	
3.1	RT	GET	SRT-350	DT-CBL-SLK	75’ (Ex.) 200’ (Req.) Abutment (Ob.)	Upgrade entire segment
3.1	RT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		
3.5	RT	GET	SRT-350	DT-CBL-SLK	75’ (Ex.) 200’ (Req.) Abutment (Ob.)	Upgrade end terminal
3.5	RT	GR	Steel Post W-Beam	F-VERT-TEAR, D-FLAT-RAIL		Upgrade guardrail
3.5	RT	GET	BRIDGE CONNECTION	FT-HIT-TERM		Upgrade end terminal
4.1	LT	GET	BRIDGE CONNECTION	FT-HIT-TERM		Upgrade end terminal
4.1	LT	GET	SRT-350	DT-CBL-SLK	75’ (Ex.) 200’ (Req.) Abutment (Ob.)	Upgrade end terminal
4.1	RT	GET	SRT-350	FT-DEND-POST		Upgrade end terminal
4.1	RT	GET	BRIDGE CONNECTION	NONE	75' (Ex.) 200' (Req.) Abutment (Ob.)	Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
8.6	LT	GET	SRT-350	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
8.6	LT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
8.6	LT	GET	BRIDGE CONNECTION	FT-OTHER, FT-REFL		Upgrade end terminal
8.6	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
9.2	LT	GR	Wood Post W-Beam	F-EMBD, F-HGT, F-MISS-POST, F-DEFL, D-FLAT-RAIL, D-REFL, D-DEFL, D-TWST-BLKT, D-POST-SEP		Upgrade guardrail
9.2	LT	GET	SRT-350	FT-HIT-TERM		Upgrade end terminal
8.6	RT	GET	SRT-350	DT-STRUT	20’ (Ex.) 162.5’ (Req.) Slope (Ob.)	Upgrade end terminal
8.6	RT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
8.6	RT	GET	BRIDGE CONNECTION	NONE		
8.6	RT	GET	BRIDGE CONNECTION	NONE		
8.6	RT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
8.6	RT	GET	SRT-350	FT-DEND-POST		Upgrade end terminal
12.3	RT	GET	SRT-350	DT-CBL-SLK, DT-OTHER		Damaged but functional
12.3	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-DEFL		Upgrade guardrail
12.4	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-DEFL, D-TWST-BLKT		
12.4	RT	GET	SRT-350	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal
12.5	RT	GET	SRT-350	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
12.5	RT	GR	Wood Post W-Beam	D-MISS-BLKT, D-FLAT-RAIL, D-HORI-TEAR		Upgrade guardrail
12.5	RT	GET	SRT-350	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal
12.7	RT	GET	SRT-350	FT-HIT-TERM		Upgrade end terminal
12.8	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-DEFL, D-TWST-BLKT		Upgrade guardrail
12.8	RT	GET	SRT-350	FT-DEND-POST		Upgrade end terminal
14.7	LT	GET	SRT-350	FT-TERM-OFFST		Upgrade end terminal
14.8	LT	GR	Wood Post W-Beam	D-TWST-BLKT, D-FLAT-RAIL		Upgrade guardrail
14.8	LT	GET	SRT-350	FT-TERM-OFFST		Upgrade end terminal
15.2	LT	GET	SRT-350	FT-TERM-OFFST		Upgrade end terminal
15.2	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL, D-DEFL		Upgrade guardrail
15.4	LT	GR	Wood Post W-Beam	D-MISS-BLKT, D-DEFL, D-FLAT-RAIL		Upgrade guardrail
15.4	LT	GET	CRT	FT-HGHT, DT-CBL-SLK		Upgrade end terminal
15.3	RT	GET	SRT-350	DT-CBL-SLK	70’ (Ex.) 150’ (Req.) Culvert (Ob.)	Upgrade end terminal
15.3	RT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
15.4	RT	GR	Wood Post W-Beam	D-FLAT-RAIL		
15.4	RT	GET	SRT-350	FT-REFL, DT-CBL-SLK		Damaged but functional
15.9	RT	GET	SRT-350	DT-CBL-SLK		Damaged but functional
15.9	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
16	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-SPLC-BOLT		

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
16	RT	GET	SRT-350	DT-CBL-SLK, DT-OTHER	45' (Ex.) 75' (Req.) Culvert (Ob.)	Upgrade end terminal
16.3	RT	GET	SRT-350	DT-CBL-SLK		Damaged but functional
16.3	RT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
16.3	RT	GET	SRT-350	DT-CBL-SLK		Damaged but functional
16.4	RT	GET	SRT-350	DT-CBL-SLK, DT-OTHER		Damaged but functional
16.4	RT	GR	Wood Post W-Beam	D-DEFL, D-FLAT-RAIL		Upgrade guardrail
17	RT	GR	Wood Post W-Beam	D-MISS-BLKT, D-DEFL, D-TWST-BLKT, D-POST-SEP		
17	RT	GET	BRIDGE CONNECTION	NONE		Repair/Upgradement not Required
22.6	LT	GR	Wood Post W-Beam	F-EMBD, F-HOLES, F-MISS-POST, F-HGT, F-DEFL, D-DEFL, D-FLAT-RAIL, D-SPLC-BOLT		Upgrade guardrail
22.7	LT	GR	Wood Post W-Beam	D-TWST-BLKT, D-DEFL, D-FLAT-RAIL		
22.7	LT	GET	ET-PLUS	DT-STRUT, DT-CBL-SLK	60' (Ex.) 150' (Req.) Power Pole (Ob.)	Upgrade end terminal
22.8	LT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
22.8	LT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL		Upgrade guardrail
22.9	LT	GET	ET-PLUS	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal
22.9	RT	GET	SKT	FT-REFL, FT-MFR-INSTR		Upgrade end terminal
22.9	RT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL		Upgrade guardrail
22.9	RT	GET	BRIDGE CONNECTION	FT-MFR-INSTR		Upgrade end terminal
22.9	LT	GET	ET-PLUS	FT-REFL		Damaged but functional
22.9	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
22.9	LT	GET	BRIDGE CONNECTION	FT-MFR-INSTR		Upgrade end terminal
24.7	LT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
24.7	LT	GR	Steel Post W-Beam	D-TWST-BLKT, D-DEFL, D-FLAT-RAIL		Upgrade guardrail
24.8	LT	GET	ET-PLUS	FT-REFL		Damaged but functional
24.8	RT	GET	BRIDGE CONNECTION	DT-OTHER		Damaged but functional
25	RT	GR	Steel Post W-Beam	D-REFL, D-DEFL		Upgrade guardrail
25	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
24.8	LT	GET	FT-BCT	DT-STRUT		Upgrade end terminal
24.8	LT	GET	BRIDGE CONNECTION			Repair/Upgradement not Required
25.2	RT	GET	BRIDGE CONNECTION	FT-MFR-INSTR		Upgrade entire segment
25.2	RT	GR	Steel Post W-Beam	F-DEFL, F-SPLC-BOLTS-F-MISS-POST, D-REFL, D-FLAT-RAIL		
25.4	RT	GR	Steel Post W-Beam	F-SPLC-BOLTS, F-DEFL, F-MISS-POST, D-FLAT-RAIL		
25.8	RT	GR	Steel Post W-Beam	F-HGT, F-MISS-POST, F-VERT-TEAR, D-DEFL, D-FLAT-RAIL		

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
25.8	RT	GET	ET-PLUS	FT-REFL, DT-CBL-SLK	20' (Ex.) 125' (Req.) Slope (Ob.)	Upgrade end terminal
26.9	RT	GET	ET-PLUS	DT-CBL-SLK	35' (Ex.) 187.5' (Req.) Slope (Ob.)	Upgrade end terminal
26.9	RT	GR	Steel Post W-Beam	F-HGT, F-DEFL, D-POST-SEP, D-FLAT-RAIL		Upgrade guardrail
27.2	RT	GR	Steel Post W-Beam	F-SPLC-BOLTS, F-VERT-TEAR, F-HOLES, D-DEFL, D-FLAT-RAIL, D-HORI-TEAR		
27.2	RT	GET	SRT-350	FT-LAG, DT-CBL-SLK		Upgrade end terminal
35.9	RT	GET	ET-PLUS	FT-LAG		Upgrade end terminal
35.9	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
36	RT	GET	ET-PLUS	FT-DEND-POST		Upgrade end terminal
35.9	LT	GET	ET-PLUS	FT-DEND-POST, FT-LAG		Upgrade end terminal
36	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
36	LT	GET	ET-PLUS	FT-LAG, DT-BRG-PLT		Upgrade end terminal
51	RT	GET	ET-PLUS	FT-REFL, DT-CBL-SLK		Damaged but functional
51.1	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL, D-HORI-TEAR, D-DEFL		Upgrade guardrail
51.1	RT	GET	ET-PLUS	FT-DEND-POST, FT-REFL		Upgrade end terminal
51.7	RT	GET	ET-PLUS	FT-REFL		Damaged but functional
51.7	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
51.8	RT	GET	ET-PLUS	FT-REFL		Damaged but functional
51.7	LT	GET	ET-PLUS	FT-REFL, FT-HIT-TERM		Upgrade end terminal
51.8	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
51.8	LT	GET	ET-PLUS	FT-HGHT, FT-REFL		Upgrade end terminal
52.5	RT	GET	ET-PLUS	FT-DEND-POST, FT-TREFL		Upgrade end terminal
52.5	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
52.6	RT	GET	ET-PLUS	FT-REFL, DT-CBL-SLK		Damaged but functional
53.7	LT	GET	ET-PLUS	FT-REFL		Damaged but functional
53.7	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
53.7	LT	GET	ET-PLUS	FT-REFL		Damaged but functional
54	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
54.1	LT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
54.1	LT	GET	SKT	FT-LAG, DT-CBL-SLK		Upgrade end terminal
54.2	RT	GET	SKT	FT-REFL		Damaged but functional
54.2	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL, D-TWST-BLKT		Upgrade guardrail
54.4	RT	GET	SKT	FT-HGHT, FT-REFL		Upgrade end terminal
56	LT	GET	BRIDGE CONNECTION	DT-OTHER		Damaged but functional
56	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-DEFL		Upgrade guardrail
56	LT	GET	SKT	FT-REFL, DT-CBL-SLK		Damaged but functional
57.8	LT	GET	SKT	FT-REFL		Damaged but functional
57.9	LT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL		Upgrade guardrail
58	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		
58.1	LT	GET	SKT	DT-STRUT, DT-CBL-SLK		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
59.7	RT	GET	SKT	FT-REFL, DT-CBL-SLK	130' (Ex.) 187.5' (Req.) Creek (Ob.)	Upgrade end terminal
59.7	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
59.7	RT	GET	SKT	FT-REFL, DT-CBL-SLK		Damaged but functional
59.7	LT	GET	SKT	FT-LAG, FT-DEND-POST		Upgrade end terminal
59.8	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-DEFL, D-HORI-TEAR		Upgrade guardrail
59.8	LT	GET	SKT	FT-DEND-POST, FT-LAG		Upgrade end terminal
60.5	LT	GET	SKT	FT-HIT-TERM, FT-REFL		Upgrade end terminal
60.5	LT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL		Upgrade guardrail
60.6	LT	GET	BRIDGE CONNECTION	FT-HIT-TERM		Upgrade end terminal
60.6	LT	GET	BRIDGE CONNECTION	FT-LAG, DT-BRDGEGAP		Upgrade end terminal
60.7	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-DEFL, D-MISS-BLKT		Upgrade guardrail
60.7	LT	GET	SKT	FT-REFL, DT-CBL-SLK		Damaged but functional
60.5	RT	GET	SKT	FT-MFR-INSTR		Upgrade end terminal
60.5	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
60.6	RT	GET	BRIDGE CONNECTION			Repair/Upgradement not Required
62.1	RT	GET	SKT	FT-HIT-TERM		Upgrade end terminal
62.1	RT	GR	Steel Post W-Beam	F-IMPR-SPLC, F-HGT, F-VERT-EAR, D-FLAT-RAIL, D-TWST-BLKT, D-DEFL		Upgrade guardrail
62.4	RT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
62.5	RT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
62.5	RT	GR	Steel Post W-Beam	D-REFL		Damaged but functional
62.5	RT	GET	SKT	FT-REFL		Damaged but functional
62.5	LT	GET	BRIDGE CONNECTION	NONE		Repair/Upgradement not Required
62.5	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL, D-TWST-BLKT		Upgrade guardrail
62.5	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
65.1	RT	GET	SKT	FT-LAG, DT-CBL-SLK		Upgrade end terminal
65.1	RT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
65.2	RT	GET	SKT	FT-REFL, DT-CBL-SLK		Damaged but functional
66.3	LT	GET	SKT	FT-LAG, DT-CBL-SLK		Upgrade end terminal
66.3	LT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
66.3	LT	GET	SKT	FT-DEND-POST, FT-LAG		Upgrade end terminal
72.5	LT	GET	SKT	FT-REFL, DT-CBL-SLK		Damaged but functional
72.5	LT	GR	Wood Post W-Beam	D-REFL, D-DEFL		Upgrade guardrail
72.6	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, DT-TWST-BLKT, D-DEFL		
72.6	LT	GET	SKT	FT-DEND-POST, FT-LAG		Upgrade end terminal
89.7	LT	GET	BRIDGE CONNECTION	FT-HIT-TERM, FT-REFL		Upgrade end terminal
89.8	LT	GR	Wood Post W-Beam	D-REFL, D-TWST-BLKT, D-POST-SEP		Upgrade guardrail
90.4	LT	GR	Wood Post W-Beam	D-REFL, D-TWST-BLKT		

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
90.5	LT	GET	CRT	FT-HIT-TERM, DT-CBL-SLK		Upgrade end terminal
90.8	RT	GET	SRT-350	FT-DEND-POST, FT-TERM-OFFST		Upgrade end terminal
90.9	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
90.9	RT	GET	SRT-350	FT-HGHT, DT-CBL-SLK		Upgrade end terminal
94.4	LT	GET	CRT	FT-HIT-TERM, FT-LAG		Upgrade end terminal
95.1	LT	GR	Wood Post W-Beam	D-REFL, D-POST-SEP		Upgrade guardrail
95.1	LT	GET	BRIDGE CONNECTION	FT-REFL		Damaged but functional
95.1	RT	GET	BRIDGE CONNECTION	FT-HIT-TERM, FT-REFL		Upgrade end terminal
95.1	RT	GR	Wood Post W-Beam	D-POST-SEP, D-DEFL		Upgrade guardrail
95.1	RT	GR	Wood Post W-Beam	D-REFL, D-MISS-BLKT, D-TWST-BLKT		
95.1	RT	GET	CRT	FT-LAG, DT-CBL-SLK		Upgrade end terminal
97.8	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
98	LT	GR	Steel Post W-Beam	D-REFL, D-DEFL		Upgrade guardrail
98	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
97.8	RT	GET	SKT	NONE		Repair/Upgradement not Required
98	RT	GR	Steel Post W-Beam	D-REFL, D-MISS-BLKT, D-DEFL		Upgrade guardrail
98	RT	GET	SKT	FT-DEND-POST		Upgrade end terminal
98.4	LT	GET	SKT	NONE		Repair/Upgradement not Required
98.9	LT	GR	Steel Post W-Beam	D-REFL, D-TWST-BLKT, D-DEFL		Upgrade guardrail
98.9	LT	GET	SKT	NONE		Repair/Upgradement not Required
107.6	LT	GET	ET-PLUS	DT-STRUT, DT-CBL-SLK		Upgrade end terminal
107.6	LT	GR	Wood Post W-Beam	D-REFL, DT-TWST-BLKT		
109.1	LT	GR	Wood Post W-Beam	F-MISS-POST, F-SPLC-BOLTS, F-HOLES, F-VERT-TEAR, F-DEFL, D-MISS-BLKT, D-REFL		Upgrade guardrail
109.1	LT	GET	ET-PLUS	FT-MISS-CBL		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
0.5	RT	GR	Wood Post W-Beam	D-REFL, D-MISS-BLKT, D-DEFL		Upgrade guardrail
0.5	RT	GET	FT-BCT	DT-CBL-ANCHR		Damaged but functional
0.5	RT	GET	FT-BCT	FT-MISS-CBL		Upgrade end terminal
1.6	LT	GET	SKT	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal
1.6	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-TWST-BLKT		Upgrade guardrail
1.6	LT	GET	SRT-350	DT-CBL-SLK		Damaged but functional
2.8	LT	GET	BRIDGE CONNECTION	DT-OTHER		Damaged but functional
2.8	LT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
2.8	LT	GET	SKT	FT-DEND-POST, DT-CBL-SLK		Upgrade end terminal
2.8	RT	GET	BRIDGE CONNECTION			Repair/Replacement not Required
2.8	RT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
2.8	RT	GET	SKT	DT-CBL-SL, DT-BRG-PLT		Damaged but functional
3.2	LT	GET	ET-PLUS	FT-MFR-INSTR, DT-CBL-SLK		Upgrade end terminal
3.2	LT	GR	Wood Post W-Beam	D-TWST-BLKTD-FLAT-RAIL, D-DEFL		Upgrade guardrail
3.2	LT	GET	ET-PLUS	FT-LAG, F-REFL		Upgrade end terminal
3.2	RT	GET	ET-PLUS	FT-HGHT, DT-STRUT		Upgrade end terminal
3.2	RT	GR	Wood Post W-Beam	D-POST-SEP, D-TWST-BLKT, D-FLAT-RAIL		Upgrade guardrail
3.2	RT	GET	ET-PLUS	FT-LAG, DT-CBL-SLK		Upgrade end terminal
4	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
4	LT	GR	Wood Post W-Beam	D-MISS-BLKT, D-FLAT-RAIL		Upgrade guardrail
4.1	LT	GET	SKT	FT-HIT-TERM		Upgrade end terminal
3.9	RT	GET	SRT-350	FT-TERM-OFFST		Upgrade end terminal
3.9	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL, D-TWST-BLKT, D-MISS-BLKT		Upgrade guardrail
3.9	RT	GET	BRIDGE CONNECTION	FT-HIT-TERM		Upgrade end terminal
4	RT	GET	BRIDGE CONNECTION			Repair/Replacement not Required
4	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
4.1	RT	GET	SKT	FT-REFL, DT-BRG-PLT		Damaged but functional
3.9	RT	GET	SRT-350	FT-TERM-OFFST		Upgrade end terminal
3.9	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL, D-TWST-BLKT, D-MISS-BLKT		Upgrade guardrail
3.9	RT	GET	BRIDGE CONNECTION	FT-HIT-TERM		Upgrade end terminal
4	RT	GET	BRIDGE CONNECTION			Repair/Replacement not Required
4	RT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
4.1	RT	GET	SKT	FT-REFL, DT-BRG-PLT		Damaged but functional
5.6	LT	GET	SRT-350	DT-CBL-SLK		Damaged but functional
5.6	LT	GR	Wood Post W-Beam	D-TWST-BLKT, D-FLAT-RAIL		Upgrade guardrail
5.7	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL, D-DEFL		
5.8	LT	GET	SRT-350	FT-HGHT		Upgrade end terminal
6.9	LT	GET	SKT	FT-HIT-TERM		Upgrade end terminal
6.9	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
7.1	LT	GR	Wood Post W-Beam	D-TWST-BLKT, D-FLAT-RAIL, D-DEFL		
7.2	LT	GET	SKT	FT-LAG, DT-CBL-SLK		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
16	LT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
16	LT	GR	Steel Post W-Beam	D-DEFL, D-FLAT-RAIL, D-MISS-BLKT		Upgrade guardrail
16.1	LT	GET	BRIDGE CONNECTION	NONE		Repair/Replacement not Required
21.1	LT	GET	ET-PLUS	FT-MFR-INSTR		Upgrade end terminal
21.1	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
21.4	LT	GR	Steel Post W-Beam	D-POST-SEP		
21.6	LT	GR	Steel Post W-Beam	NONE		
21.6	LT	GET	SKT	FT-LAG		Upgrade end terminal
21.8	RT	GET	SKT	DT-CBL-SLK		Damaged but functional
21.8	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
21.9	RT	GR	Steel Post W-Beam	D-FLAT-RAIL		
21.9	RT	GET	SKT	FT-LAG, DT-CBL-SLK		Upgrade end terminal
82.5	RT	GET	SKT	FT-HGHT, FT-LAG		Upgrade end terminal
82.5	RT	GR	Steel Post W-Beam	NONE		
82.6	RT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL		Upgrade guardrail
82.6	RT	GET	SKT	DT-CBL-SLK		Damaged but functional
83.8	LT	GET	SKT	FT-HGHT		Upgrade end terminal
83.9	LT	GR	Steel Post W-Beam	D-DEFL, D-REFL		Upgrade guardrail
83.9	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
85.9	RT	GET	SKT	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
85.9	RT	GR	Steel Post W-Beam	D-DEFL, D-TWST-BLKT		Upgrade guardrail
86	RT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		
86	RT	GET	SKT	DT-CBL-SLK		Damaged but functional
87.2	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
87.2	LT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL		Upgrade guardrail
87.2	LT	GET	SKT	FT-MFR-INSTR		Upgrade end terminal
88.1	RT	GET	SKT	FT-MFR-INSTR		Upgrade end terminal
88.1	RT	GR	Steel Post W-Beam	D-REFL, D-FLAT-RAIL		Upgrade guardrail
88.3	RT	GET	SKT	DT-CBL-SLK		Damaged but functional
88.6	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
88.7	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
88.7	LT	GET	SKT	FT-MFR-INSTR		Upgrade end terminal
90.7	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
90.7	LT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
90.7	LT	GET	SKT	FT-LAG, DT-CBL-SLK		Upgrade end terminal
91	LT	GET	SKT	DT-CBL-SLK		Damaged but functional
91.1	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
91.1	LT	GET	SKT	FT-REFL		Damaged but functional
91.6	LT	GET	SKT	DT-STRUT, DT-CBL-SLK		Upgrade end termianl
91.8	LT	GR	Steel Post W-Beam	F-IMPR-SPLC		Upgrade guardrail
91.8	LT	GET	SKT	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
99.1	RT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
99.1	RT	GR	Steel Post W-Beam	D-REFL		
99.4	RT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
99.4	RT	GET	X--LITE	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
101.3	RT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
101.4	RT	GR	Steel Post W-Beam	D-DEFL, D-REFL		Upgrade guardrail
101.4	RT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
101.5	LT	GET	X--LITE	FT-REFL		Damaged but functional
101.6	LT	GR	Steel Post W-Beam	NONE		Repair/Replacement not Required

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
101.6	LT	GET	X--LITE	FT-REFL, DT-CBL-SLK	130' (Ex.) 162.5' (Req.) Culvert (Ob.)	Upgrade end terminal
103.2	LT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
103.2	LT	GR	Steel Post W-Beam	NONE		
103.4	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-DEFL		Upgrade guardrail
103.4	LT	GET	X--LITE	FT-HIT-TERM		Upgrade end terminal
103.6	RT	GET	X--LITE	FT-MFR-INSTR, FT-REFL		Upgrade end terminal
103.6	RT	GR	Steel Post W-Beam	D-DEFL, D-REFL		Upgrade guardrail
103.8	RT	GR	Steel Post W-Beam	D-DEFL		
103.8	RT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
103.7	LT	GET	SKT	FT-REFL, DT-CBL-SLK		Damaged but functional
103.8	LT	GR	Steel Post W-Beam	D-TWST-BLKT, D-DEFL		Upgrade guardrail
103.8	LT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
104.1	LT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
104.3	LT	GR	Steel Post W-Beam	D-DEFL		Upgrade guardrail
104.3	LT	GET	X--LITE	FT-NO-BRGPL, FT-REFL		Upgrade end terminal
107.5	RT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
107.5	RT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
107.7	RT	GR	Steel Post W-Beam	D-REFL		
107.7	RT	GET	X--LITE	DT-CBL-SLK		Damaged but functional
109.3	RT	GET	X--LITE	FT-REFL	0' (Ex.) 175' (Req.) Slope (Ob.)	Upgrade end terminal
109.3	RT	GR	Steel Post W-Beam	NONE		Repair/Replacement not Required
109.4	RT	GET	X--LITE	FT-REFL, DT-CBL-SLK		Damaged but functional
110.1	LT	GET	FT-BCT	FT-REFL, DT-CBL-SLK	50' (Ex.) 162.5' (Req.) Slope (Ob.)	Upgrade end terminal
110.1	LT	GR	Steel Post W-Beam	D-FLAT-RAIL		Upgrade guardrail
110.1	LT	GET	FT-BCT	DT-CBL-SLK, DT-BRG-PLT		Damaged but functional
110.8	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP, DT-OTHER		Upgrade end terminal
111	LT	GR	Steel Post W-Beam	F-HGT, F-DEFL, F-MISS-POST, D-FLAT-RAIL		Upgrade guardrail
111	LT	GET	FT-BCT	FT-HGHT, FT-REFL		Upgrade end terminal
111.1	RT	GET	FT-BCT	FT-OTHER		Upgrade end terminal
111.1	RT	GR	Steel Post W-Beam	D-TWST-BLKT, D-FLAT-RAIL, D-DEFL		Upgrade guardrail
111.3	RT	GET	FT-BCT	DT-CBL-SLK, DT-BRG-PLT		Upgrade end terminal
111.1	LT	GET	FT-BCT	DT-CBL-SLK		Upgrade end terminal
111.2	LT	GR	Steel Post W-Beam	D-FLAT-RAIL, D-REFL		Upgrade guardrail
111.2	LT	GET	FT-BCT	DT-CBL-SLK		Upgrade end terminal
119.2	LT	GET	SRT-350	FT-HIT-TERM		Upgrade end terminal
119.3	LT	GR	Wood Post W-Beam	D-FLAT-RAIL, D-MISS-BLKT, D-DEFL		Upgrade guardrail
119.3	LT	GET	SRT-350	FT-HGHT, FT-REFL		Upgrade end terminal
120.5	LT	GET	CRT	FT-HGHT, DT-CBL-SLK		Upgrade end terminal
120.5	LT	GR	Wood Post W-Beam	D-FLAT-RAIL		Upgrade guardrail

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
120.5	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
120.5	LT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
120.5	LT	GR	Wood Post W-Beam	F-HGT		Upgrade guardrail
120.5	LT	GET	ET-PLUS	FT-HGHT, FT-DEND-POST		Upgrade end terminal
120.5	RT	GET	ET-PLUS	FT-HGHT, FT-LAG		Upgrade end terminal
120.5	RT	GR	Wood Post W-Beam	F-HGT, D-REFL		Upgrade guardrail
120.5	RT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
120.5	RT	GET	BRIDGE CONNECTION	DT-BRDGEGAP		Upgrade end terminal
120.5	RT	GET	CRT	FT-HGHT		Upgrade end terminal
126.8	LT	GET	ET-PLUS	NONE		Repair/Replacement not Required
126.8	LT	GR	Wood Post W-Beam	F-HGT, F-HOLES, F-MISS-POST, D REFL, D-FLAT-RAIL		Upgrade guardrail
126.9	LT	GR	Wood Post W-Beam	D-TWST-BLKT, D-FLAT-RAIL, D-MISS-BLKT		
126.9	LT	GET	ET-PLUS	DT-CBL-SLK, DT-BRG-PLT	50’ (Ex.) 175’ (Req.) Slope (Ob.)	Upgrade end terminal

NO D DAMAGE CODES RECOMMENDED FOR UPGRADE ON THIS ROADWAY.

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
0.8	RT	GET	ET-PLUS	FT-LAG, DT-CBL-SLK		Upgrade end terminal
0.8	RT	GR	Steel Post W-Beam	D-POST-SEP, D-REFL		Upgrade guardrail
0.9	RT	GET	ET-PLUS	FT-DEND-POST, FT-HGHT		Upgrade end terminal

Approx. MPT	Direction	Feature	Feature Type	Damage Type	LON	Recommendations
26.2	RT	GET	ET-PLUS	DT-CBL-SLK		Damaged but functional
26.3	RT	GR	Steel Post W-Beam	D-REFL, D-DEFL		Upgrade guardrail
26.3	RT	GET	ET-PLUS	FT-HIT-TERM		Upgrade end terminal
30.7	LT	GET	CRT	FT-HIT-TERM, FT-MFR-INSTR		Upgrade end terminal
30.8	LT	GR	Steel Post W-Beam	D-REFL, D-DEFL		Upgrade guardrail
30.8	LT	GET	ET-PLUS	FT-HIT-TERM		Upgrade end terminal