CRLA

GIP Report

NPS Guardwall/Rail Inventory Program
Crater Lake National Park

Federal Lands Highway
Road Inventory Program

Prepared By:
Federal Highway Administration
Eastern Federal Lands Highway Division
Road Inventory Program (RIP)

Data Collection Date: July 2010
Report Date: December 2015

Crater Lake National Park
in
Oregon

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
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Introduction

In support of the NPS Facility Management Software System (FMSS) asset management program, FHWA- contracted staff completed the Guardwall/Rail Inventory Program (GIP) inspections within selected National Park Service (NPS) units between 2010 and 2011. This inventory provides static information to FMSS regarding barrier characteristics such as height, length and location, as well as dynamic information about the condition of the barrier. In addition, when barrier deficiencies were identified, repair recommendations and estimated costs, suitable for use as FMSS work orders, were generated to bring the barrier back to its "new" condition.

In over 30 parks, numerous crashworthy barriers inspected maybe in poor condition by simply applying a new overlay of asphalt without milling previous layers. In instances such as this, basically the critical element of barrier height decreased as the elevation of the roadway increased. Resulting work orders were drafted to raise w-beam barriers or to remove and reset stone masonry barriers to their original design height.

This inventory provides static information and a condition assessment of each barrier inventoried. In addition, when barrier deficiencies were identified, repair recommendations and estimated costs were drafted to bring the barrier back to its "new" condition.

Drafted work orders have been classified as being either deferred maintenance or capital improvement. This classification is based on the type of work recommended, as defined below.

- *Deferred Maintenance* can be classified as repair or replace in kind. Work done to the barrier does not include any upgrading.
- *Capital Improvement* can be classified as upgrading part of or the entire existing barrier. Typically the upgrade will be from a non-crashworthy to a crashworthy device. Other examples of capital improvements would be the addition of a curb to improve drainage.

Care was taken to maintain the cultural significance of historic barriers located in the NPS. While historic traffic barriers likely would not withstand current crashworthiness performance criteria, they are considered by the NPS to be important resources for the historic and/or cultural value. Historic barriers may be "character defining features" that contribute to the cultural significance of historic roadways. As such, these barriers have resource value in and of themselves which may be somewhat independent from their functionality as barriers as previously defined. The consideration of both the crashworthiness and resource value of historic barriers was a significant challenge for the NPS and the FHWA when designing the GIP, to the point that for historic stone masonry barriers, the barrier height had to be more than 6-in below its design height before any work would be considered to deal with height issues. To preserve historic stone masonry barriers, typical drafted work orders for historic barriers were to remove and reset the barrier to the barrier's original design height on a concrete footer, as compared to replacing it with a similar crashworthy barrier.

This report is organized in a tiered approach from the broad park overview perspective (Tier 1) to a route overview perspective (Tier 2), then down to the details of each barrier (Tier 3). Tier 1 presents park barrier location maps and an overall park-specific summary narrative of the results of the guardwall/rail inventory program. Tier 2 presents route overview maps with associated barrier summary information. Tier 3 presents individual barrier information in a one-page detailed format, including a photograph of each barrier. Appendix A provides a condensed summary of guardwall/rail inventory definitions and assessment categories to assist in reading this report.

Park Barrier Location Maps

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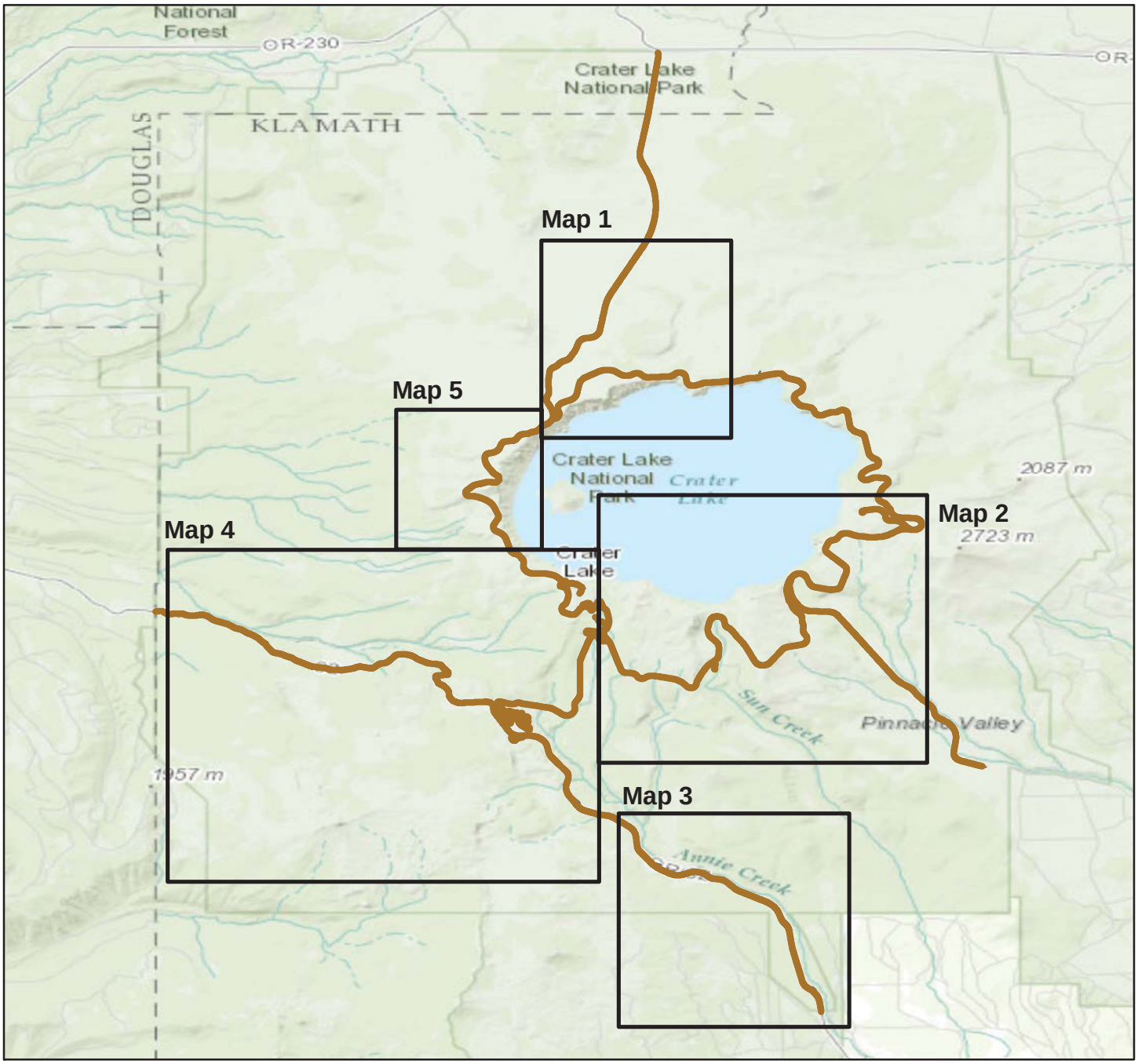
BARRIER LOCATION MAP

Key Map



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

RIP Collected Routes

Miles

0 2.5 5

N

Crater Lake National Park

BARRIER LOCATION MAP

Map 1

Barrier Locations

RIP Collected Routes

Miles

0 0.5 1

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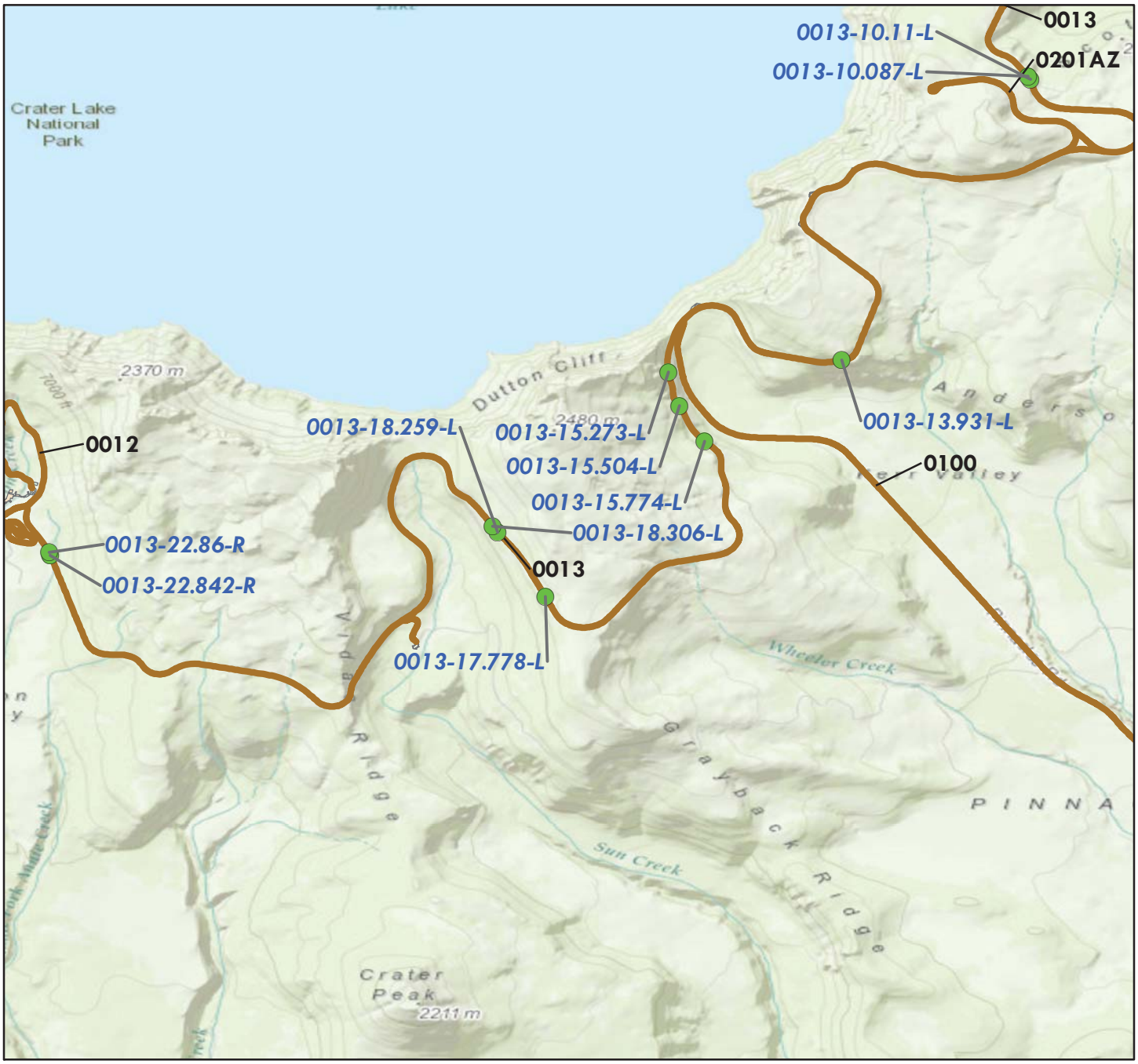
Crater Lake National Park

BARRIER LOCATION MAP

Map 2



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier Locations

RIP Collected Routes

Miles

0 0.5 1

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Crater Lake National Park

BARRIER LOCATION MAP

Map 3

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier Locations

RIP Collected Routes

Miles

0 0.5 1

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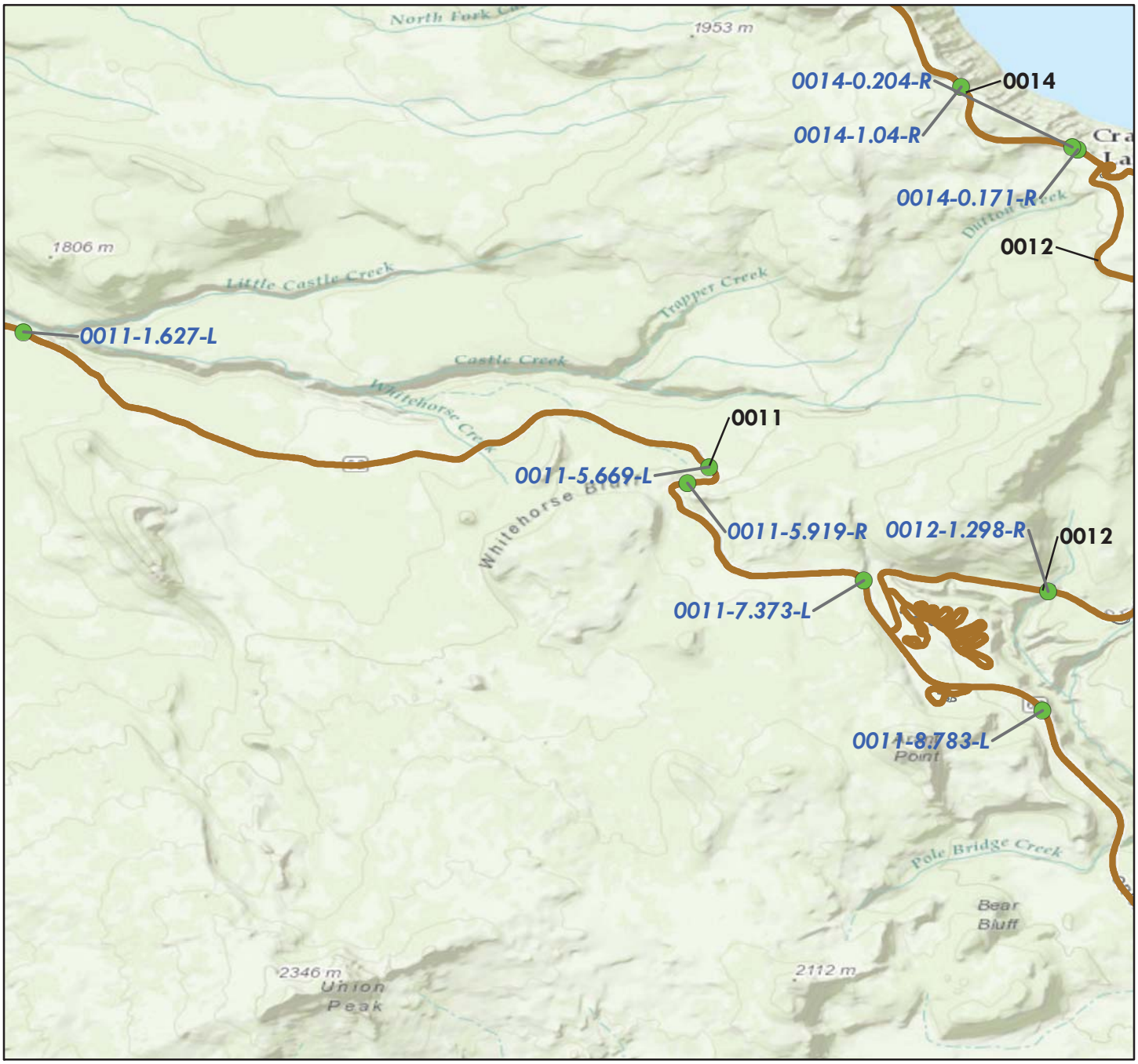
Crater Lake National Park

BARRIER LOCATION MAP

Map 4



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier Locations

RIP Collected Routes

Miles

0 0.5 1

N

Crater Lake National Park

BARRIER LOCATION MAP

Map 5

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier Locations

RIP Collected Routes

Miles

0 0.5 1

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Tier 1
Park Barrier Overview

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Parkwide Summary: Crater Lake National Park

Initial barrier inspections were conducted at Crater Lake National Park in 2010, and encompassed all known barriers associated with Park roadways. In general, walls are not included in this assessment, but were inspected for Crater Lake National Park in 2007 under a separate effort as part of the Retaining Wall Inventory Program (WIP). A report for WIP is available under separate cover.

All paved roadways and parking areas listed in the RIP Route Identification Report were inspected for barriers.

The following tables provide an overview of the findings of this inspection and assessment effort. In all, 51 barriers were inventoried on the routes listed below.

Table 1: Number of Barriers by Route

Route Number	Route Name	No. of Barriers
0011	CRATER LAKE HIGHWAY	9
0012	MUNSON VALLEY ROAD	1
0013	EAST RIM DRIVE	24
0014	WEST RIM DRIVE	13
0904	THE CORRALS	2
0909	PUMICE DESERT	1
0916	ANNIE FALLS PICNIC AREA	1

Due to the different GIP assessment criteria of barriers based on their intended use, barriers were classified as being either traffic barriers or non-traffic barriers.

- *Traffic* barriers are physical devices intended to keep vehicles or people from straying into dangerous or off-limits areas. For the purpose of this inventory, a traffic barrier is categorized as roadside hardware placed longitudinally, excluding pedestrian railing and fencing.

- *Non-traffic* barriers provide a physical delineation between public access areas and restricted or protected areas in locations such as a parking lot, viewpoint or turnout. **Non-traffic barriers which inhibit access of vehicles are included in this report; non-traffic barriers which only inhibit access of pedestrians or bicyclists are not included. For the purpose of this inventory, non-traffic barriers are guidewalls and guiderails. Note: rocks, stones, boulders, fences or curbs were excluded from this inventory.**

There are instances in parks where a single barrier can switch between being classified as a traffic barrier and a non-traffic barrier. Such instances typically occur at pullouts, where a traffic barrier along the road will continue through the pullout without interruption. In such instances, the traffic barrier and non-traffic barrier were assessed using different criteria. Due to the different criteria, the GIP database was designed to record the traffic barrier and non-traffic barrier as multiple distinct barriers, even though to the eye, they appear as one barrier. Other instances where a single barrier is split into multiple barriers would be when the barrier is placed continuously along two legs of an intersection, so that one portion of the barrier may be on one road and the remaining portion of the barrier is on a different road.

Table 2: Number of Barriers by Function

Barrier Function	No. of Barriers
NON-TRAFFIC	26
TRAFFIC	25

The following table shows the barrier types that were inventoried and assessed.

Table 3: Number of Barriers by Type

Primary Barrier Type	No. of Barriers
Stone Masonry Crenellated Without Core Wall	31
W-Beam Weak Post	3
W-Beam Strong Post	7
Stone Masonry Without Concrete Core Wall	5
Other: Timber Rail On Timber Posts	1
Other: Log Rail On Stone Posts	4

The following table shows the number of barriers by one of four categories of recommended action along with associated work order costs and the number of barriers that are in each recommended action. All work order information is presented for individual barriers, even though some work orders were not accepted by the Park. Some work orders were later combined to simplify route deferred maintenance requests.

Table 4: Number of Barriers by Recommended Action and Associated 2008 Cost

Recommended Action	Repair Costs*	No. of Barriers
No Action	$0	17
Monitor	$0	8
Repair	$628,206	26
Replace	$0	0
Totals	**$628,206**	**51**

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

The following table categorizes the number of barriers that fall into one of ten cost ranges, based on the prepared work orders. The locations, work descriptions, and cost of the recommended repairs for these barriers are listed by individual barrier in Tier 3 of this report.

Table 5: Number of Barriers Grouped by Associated 2008 Cost

Cost Range*	No. of Barriers
$0	25
$1 - $25,000	23
$25,001 - $50,000	1
$50,001 - $100,000	0
$100,001 - $250,000	1
$250,001 - $500,000	1
$500,001 - $1,000,000	0
$1,000,001 - $2,000,000	0
$2,000,001 - $3,000,000	0
$3,000,001 - $4,000,000	0
Total Number of Barriers	**51**

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Data for end terminals was collected on the GIP data collection form and indicates if an end terminal meets current crashworthiness standards. End terminals are specially designed barrier ends that attenuate impacts to the ends of barriers. This is supplemental information that WASO designed into the inventory program.

A total of 12 end terminals were found on barriers at the Park. There are generally a greater number of end treatments than actual barriers because end treatments are located at both the beginning and end of each barrier.

Tier 2
Route Barrier Overview

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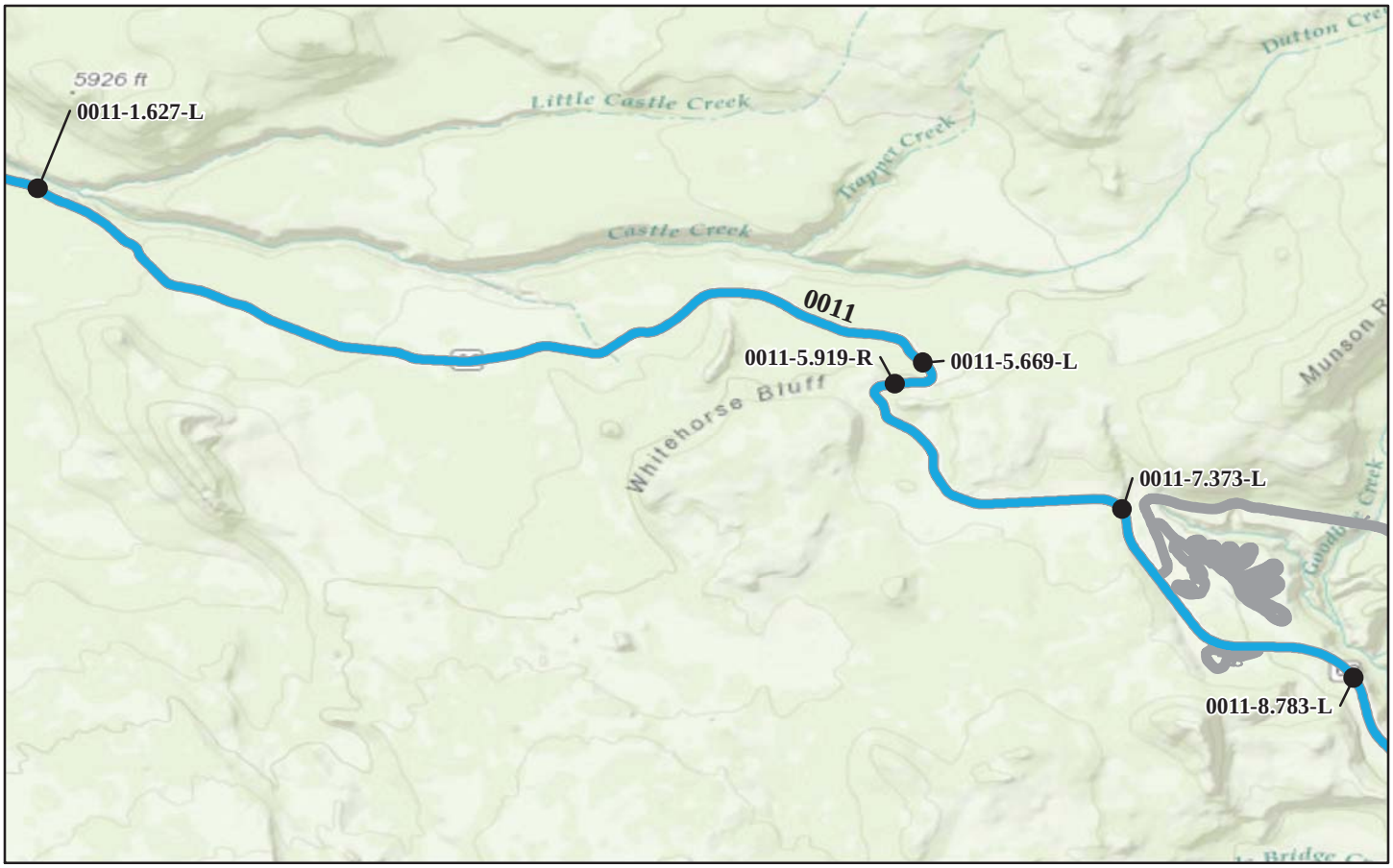
ROUTE 0011: CRATER LAKE HIGHWAY



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment Begin	 End	*Repair Cost
CRLA-0011-1.627-L 7/16/2010	40	W-BEAM WEAK POST	NONE	NONE	$2,920.00
CRLA-0011-5.669-L 7/16/2010	780	W-BEAM STRONG POST	W-BEAM FLARED 350 COMPLIANT	W-BEAM FLARED 350 COMPLIANT	$7,508.00
CRLA-0011-5.919-R 7/16/2010	268	W-BEAM STRONG POST	W-BEAM FLARED 350 COMPLIANT	W-BEAM FLARED 350 COMPLIANT	$2,282.00
CRLA-0011-7.373-L 7/16/2010	1108	W-BEAM STRONG POST	W-BEAM FLARED 350 COMPLIANT	W-BEAM FLARED 350 COMPLIANT	$8,574.00
CRLA-0011-8.783-L 7/18/2010	63	STONE MASONRY WITHOUT CONCRETE CORE WALL	NONE	NONE	$132.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0011-12.026-L 7/18/2010	250	W-BEAM STRONG POST	W-BEAM BURIED END	W-BEAM BURIED END	$2,678.00
CRLA-0011-13.680-L 7/18/2010	185	W-BEAM STRONG POST	NONE	W-BEAM BURIED END	$5,164.00
CRLA-0011-13.798-L 7/18/2010	266	W-BEAM STRONG POST	NONE	W-BEAM BURIED END	$4,053.00
CRLA-0011-15.395-L 7/18/2010	190	W-BEAM STRONG POST	W-BEAM BURIED END	W-BEAM BURIED END	$2,348.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

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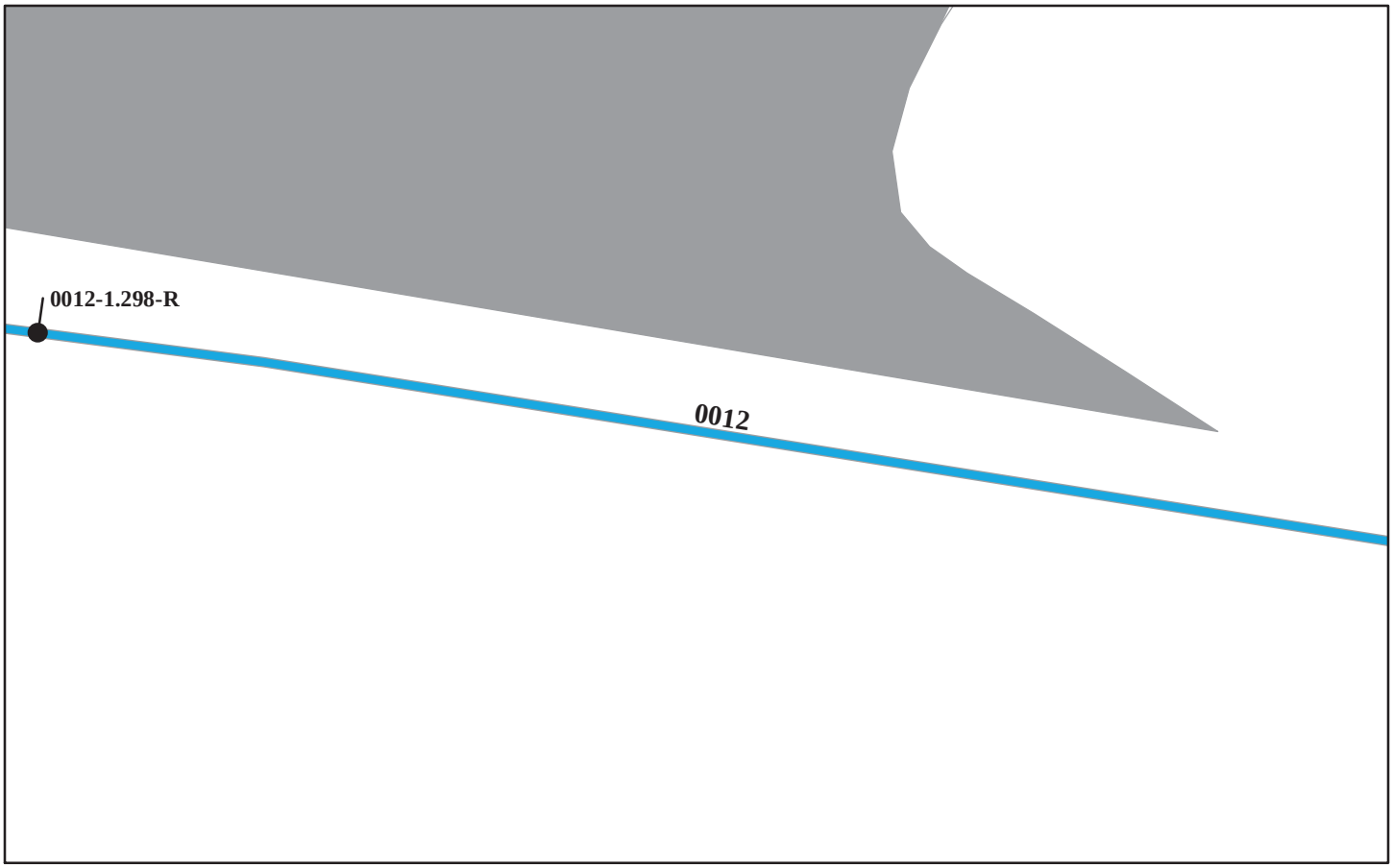
ROUTE 0012: MUNSON VALLEY ROAD



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Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0012-1.298-R 7/16/2010	30	STONE MASONRY WITHOUT CONCRETE CORE WALL	NONE	NONE	$32,395.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

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ROUTE 0013: EAST RIM DRIVE

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment Begin	 End	*Repair Cost
CRLA-0013-2.646-R 7/17/2010	231	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-2.780-R 7/17/2010	112	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-3.284-R 7/17/2010	440	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-3.674-R 7/17/2010	285	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-3.773-R 7/17/2010	143	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

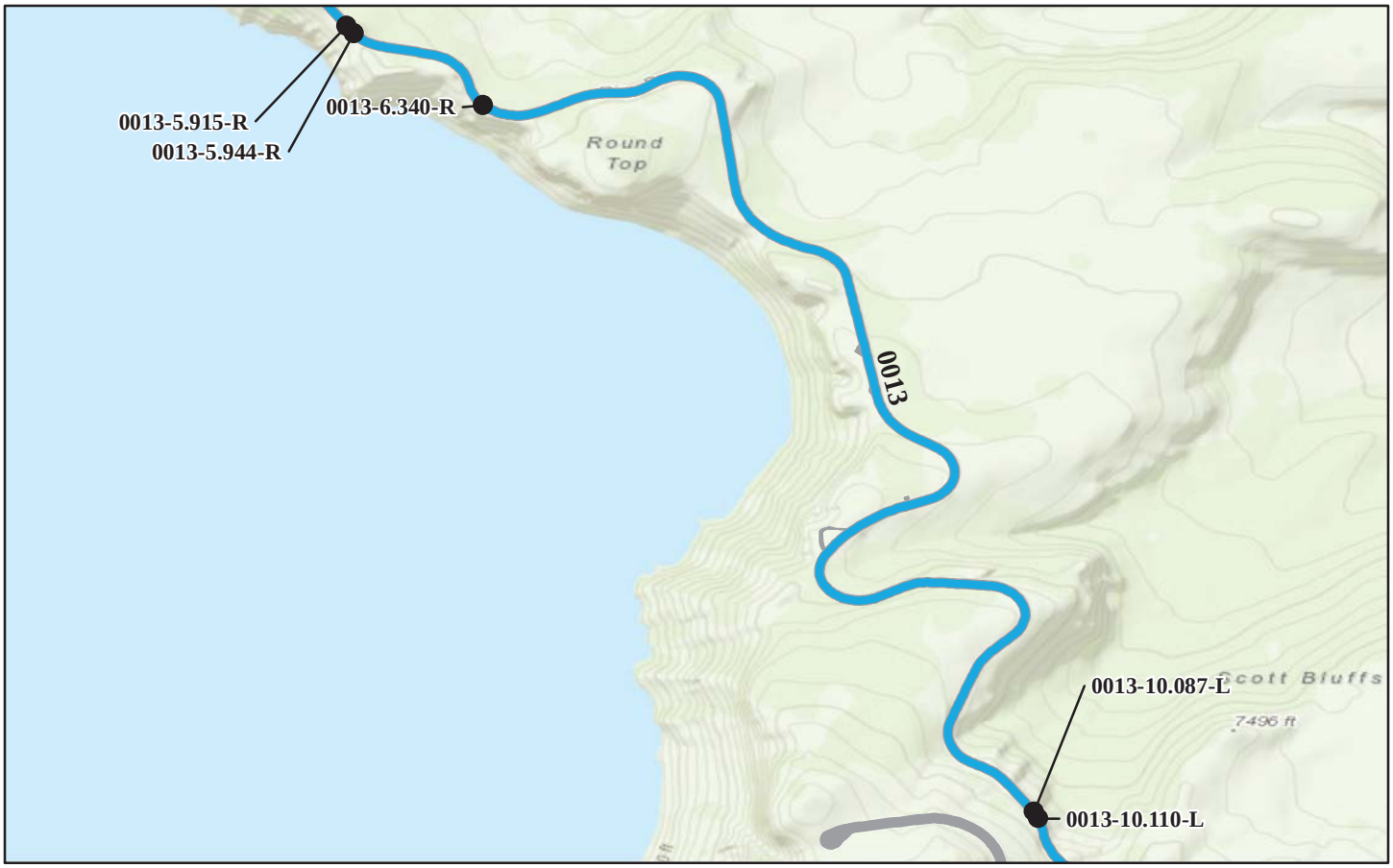
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment Begin	 End	*Repair Cost
CRLA-0013-3.933-R 7/17/2010	145	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-4.211-R 7/17/2010	251	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-4.567-R 7/17/2010	204	W-BEAM WEAK POST	NONE	NONE	$9,256.00
CRLA-0013-4.731-R 7/17/2010	340	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-4.803-R 7/17/2010	65	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE



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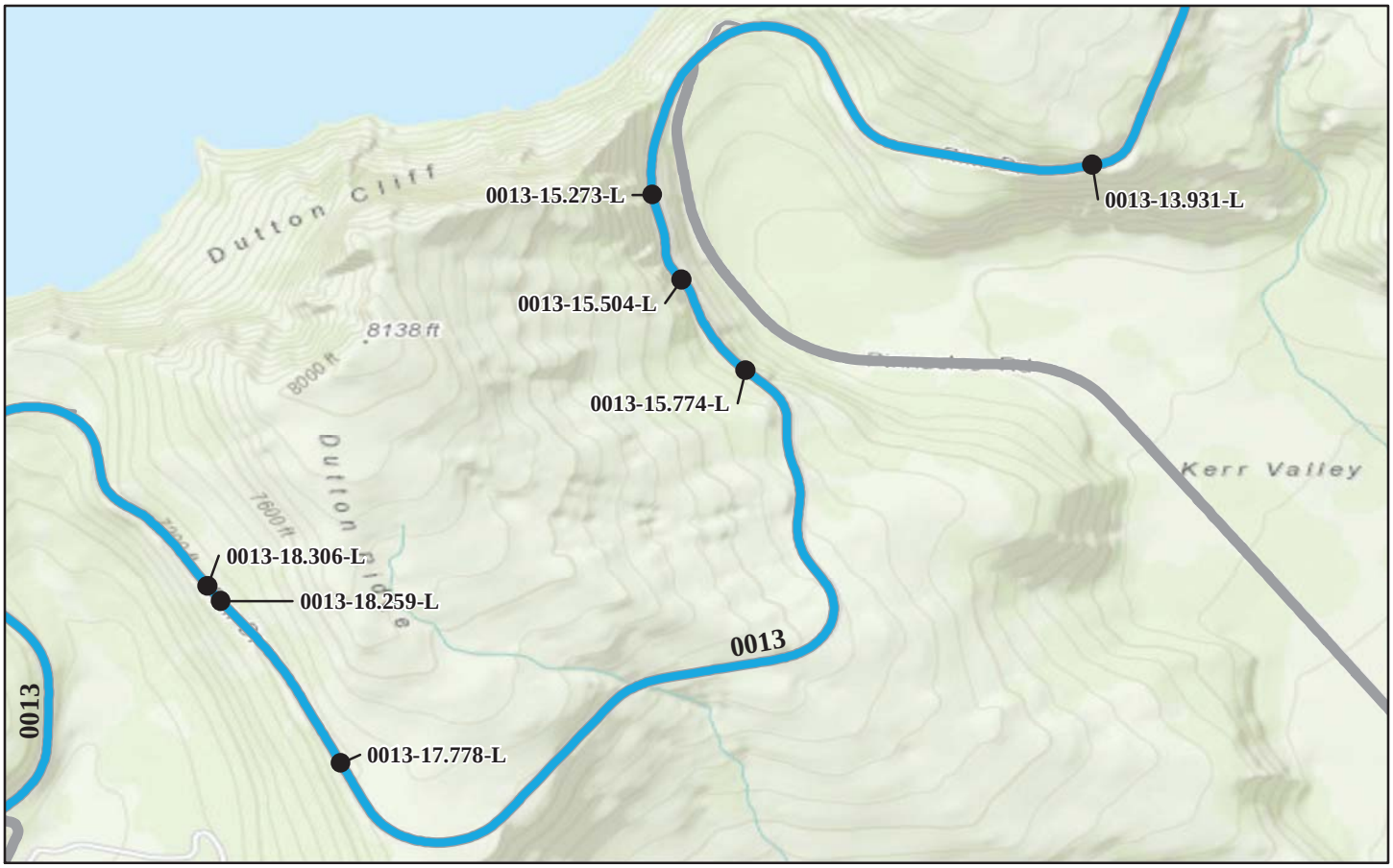
Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0013-5.915-R 7/17/2010	184	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-5.944-R 7/17/2010	102	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-6.340-R 7/17/2010	358	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-10.087-L 7/17/2010	420	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-10.110-L 7/17/2010	140	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE



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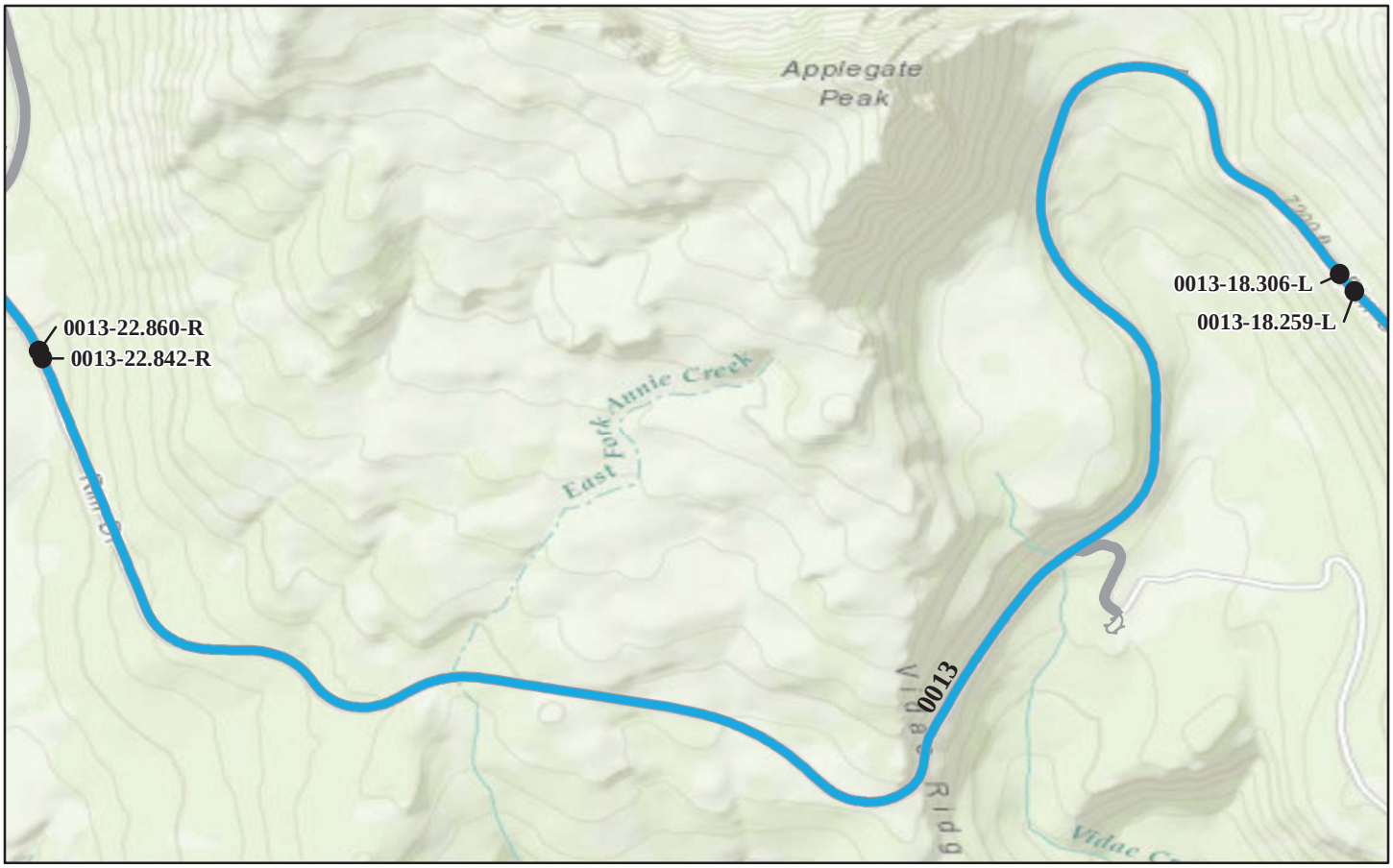
Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0013-13.931-L 7/17/2010	216	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0013-15.273-L 7/18/2010	820	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$187,385.00
CRLA-0013-15.504-L 7/18/2010	1490	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$313,456.00
CRLA-0013-15.774-L 7/18/2010	240	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$920.00
CRLA-0013-17.778-L 7/18/2010	1018	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$1,100.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE



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Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0013-18.259-L 7/18/2010	270	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$4,262.00
CRLA-0013-18.306-L 7/18/2010	2060	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$6,110.00
CRLA-0013-22.842-R 7/18/2010	112	OTHER: LOG RAIL ON STONE POSTS	NONE	NONE	$0.00
CRLA-0013-22.860-R 7/18/2010	36	OTHER: LOG RAIL ON STONE POSTS	NONE	NONE	$0.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

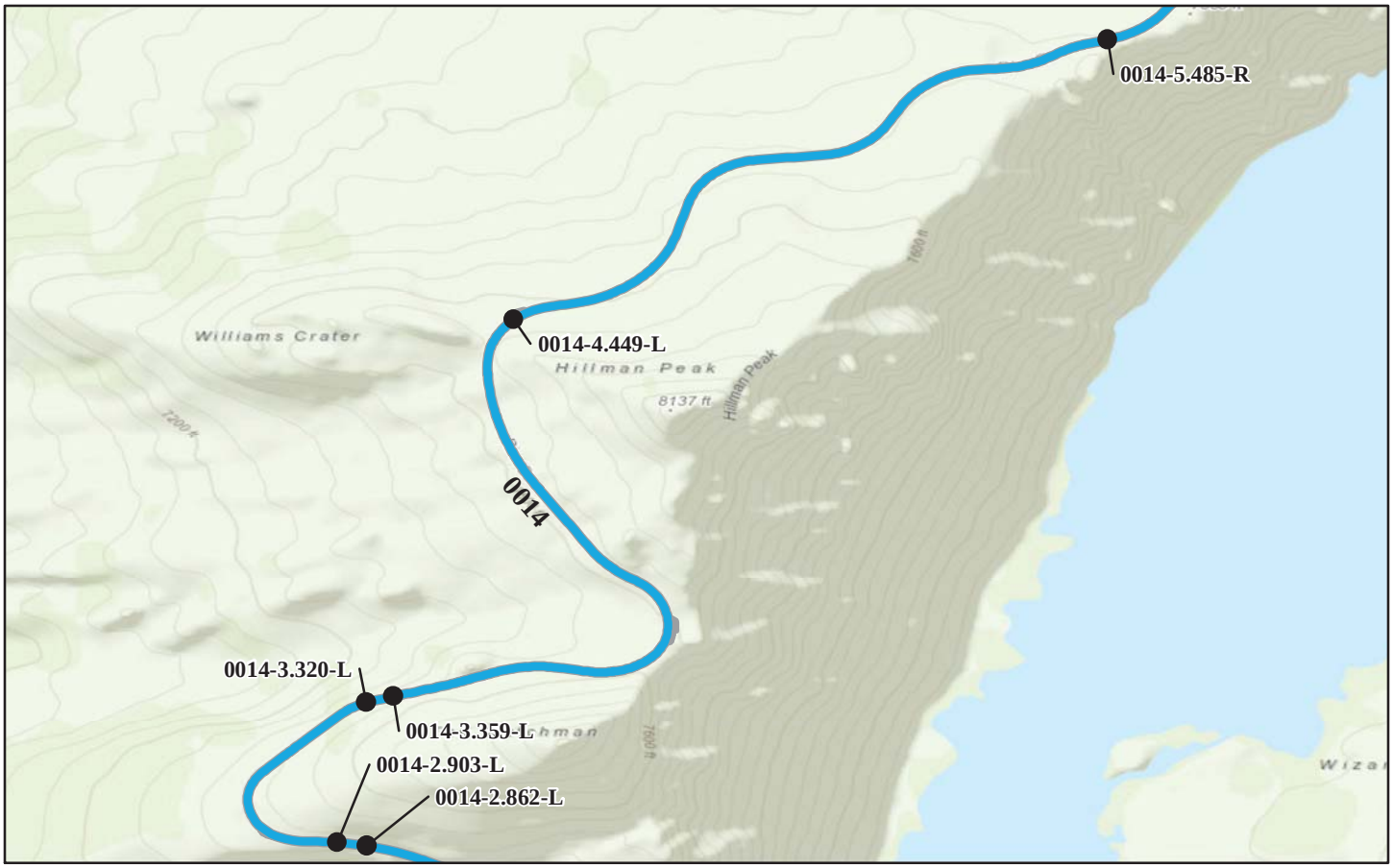
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0014-0.171-R 7/16/2010	82	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$2,513.00
CRLA-0014-0.204-R 7/16/2010	57	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0014-1.040-R 7/16/2010	420	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0014-2.187-R 7/16/2010	234	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$3,008.00
CRLA-0014-2.862-L 7/16/2010	125	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$7,122.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE



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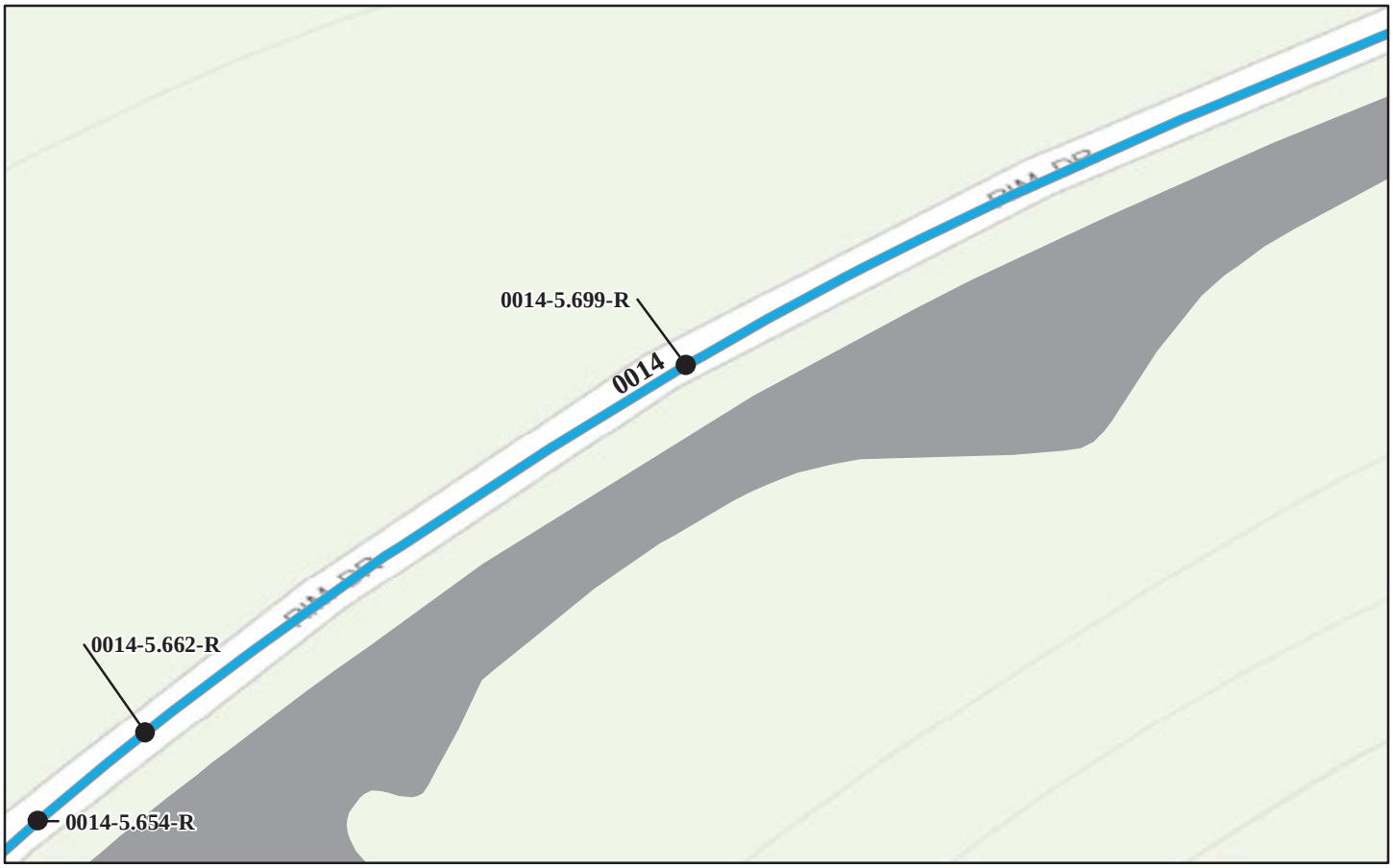
Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0014-2.903-L 7/16/2010	535	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0014-3.320-L 7/16/2010	160	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00
CRLA-0014-3.359-L 7/16/2010	320	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$2,393.00
CRLA-0014-4.449-L 7/16/2010	168	STONE MASONRY WITHOUT CONCRETE CORE WALL	NONE	NONE	$0.00
CRLA-0014-5.485-R 7/16/2010	320	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$0.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment Begin	 End	*Repair Cost
CRLA-0014-5.654-R 7/16/2010	42	STONE MASONRY WITHOUT CONCRETE CORE WALL	NONE	NONE	$0.00
CRLA-0014-5.662-R 7/16/2010	46	STONE MASONRY WITHOUT CONCRETE CORE WALL	NONE	NONE	$0.00
CRLA-0014-5.699-R 7/16/2010	217	STONE MASONRY CRENELLATED WITHOUT CORE WALL	NONE	NONE	$2,244.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0904: THE CORRALS

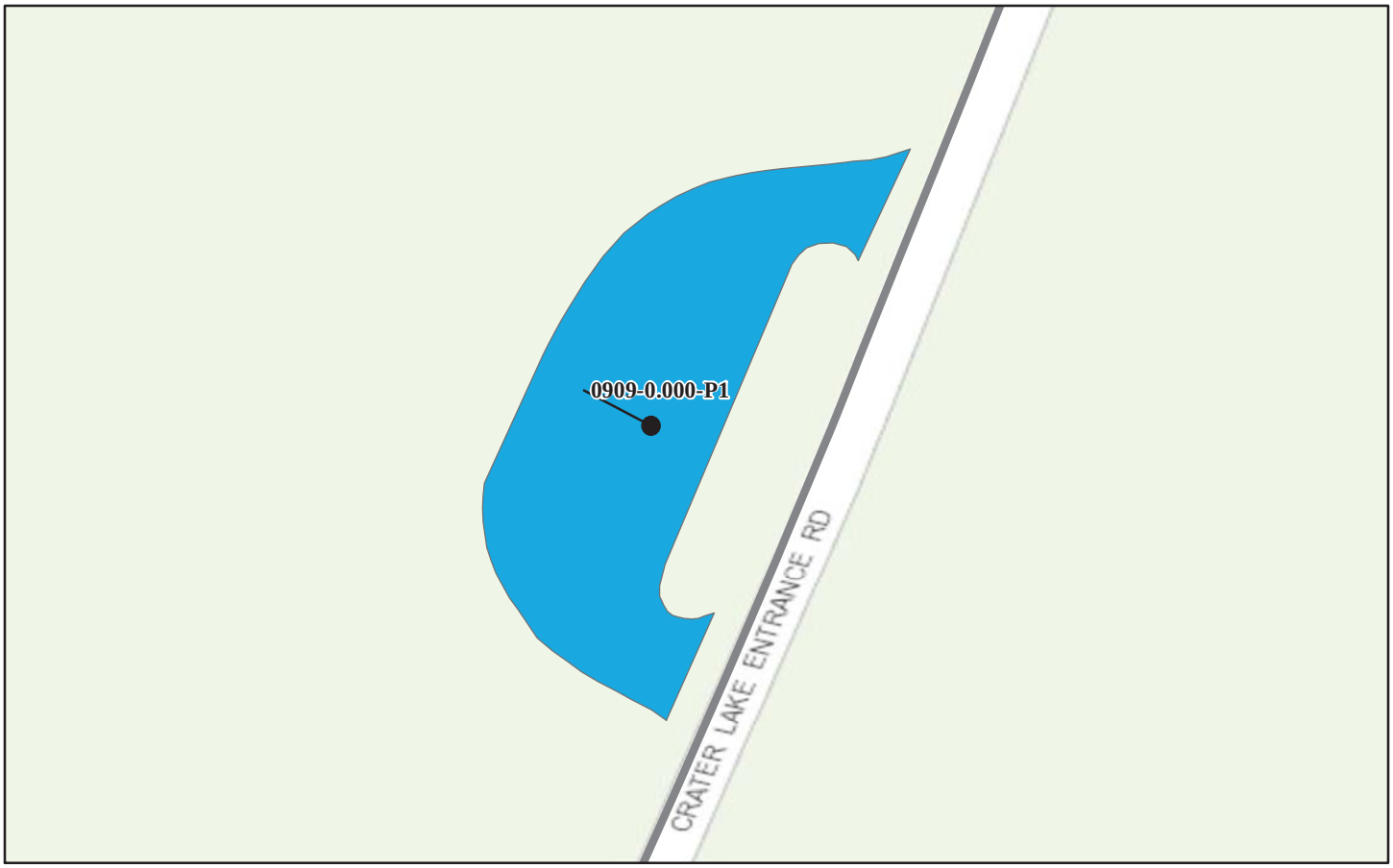
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0904-0.000-P1 7/17/2010	150	OTHER: LOG RAIL ON STONE POSTS	NONE	NONE	$902.00
CRLA-0904-0.000-P2 7/17/2010	22	OTHER: LOG RAIL ON STONE POSTS	NONE	NONE	$198.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0909: PUMICE DESERT



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0909-0.000-P1 7/19/2010	272	OTHER: TIMBER RAIL ON TIMBER POSTS	NONE	NONE	$5,258.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0916: ANNIE FALLS PICNIC AREA

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Barrier ID Inspection Date	Barrier Length (Ft.)	Barrier Type	Barrier End Treatment		*Repair Cost
			Begin	End	
CRLA-0916-0.000-P1 7/18/2010	140	W-BEAM WEAK POST	NONE	NONE	$14,025.00

*2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Tier 3
Barrier Details

Crater Lake National Park

Federal Lands Highway
Road Inventory Program

Barrier ID:	**CRLA-0011-1.627-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/16/2010	**Barrier Rating:**	25.70

Barrier Description

Type:	W-BEAM WEAK POST	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	WEATHERING STEEL/CORTEN	**Post Material:**	WOOD
Blockout Type:	N/A	**Length (ft.):**	40
Speed Limit (MPH):	45	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	150.0
Height (In.):	20.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	The height of the barrier is roughly 7-in lower than the design height of 27-in. The end of the barrier is twisted and the post is bent.
	Breaking and Cracking:	Posts are cracked through the bolt hole.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	The rail is weathered and corroded. It needs to be painted.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0011-1.627-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/16/2010	**Barrier Rating:**	25.70

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$2920
Brief Workorder:	Reset and paint W-beam guardrail.				
Workorder:	Adjust Guardrail at $10- per -Lin. Ft. for 40 LF = $400. Adjust entire rail to design height of 27-in. Replace Post at $100- per -Each for 2 Post(s) = $200. Replace 2 posts. Labor at $60- per -Hour for 8 Hrs = $480. 8 hours labor to prep and paint rail. Paint at $100- per - for 1 = $100. Primer and paint. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. One day traffic control to reset barrier.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Barrier Condition Photos

CRLA_0011_1.627_L_1.jpg

Barrier ID:	**CRLA-0011-5.669-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/16/2010	**Barrier Rating:**	40.90

Barrier Description

Type:	W-BEAM STRONG POST	**Barrier Function:**	TRAFFIC
Barrier Material:	WEATHERING STEEL/CORTEN	**Post Material:**	WOOD
Blockout Type:	WOOD	**Length (ft.):**	780
Speed Limit (MPH):	45	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	MEDIUM		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	TL-3	**Is Barrier Crashworthy?:**	YES
Beg. End Trtmt Type:	W-BEAM FLARED 350 COMPLIANT	**Is Beg. End Trtmt Crashhworthy?:**	YES	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	W-BEAM FLARED 350 COMPLIANT	**Ending End Trtmt Crashhworthy?:**	YES		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	75.0
Height (In.):	29.0	**Lateral Offset (In.):**	58.2	**Road Grade (%):**	4.00

Physical Condition

Barrier	**Alignment and Height:**	Alignment and high are acceptable.
	Breaking and Cracking:	The barrier had three 12-ft sections of damaged rail. The sections need to be replaced.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	Some corrosion on rail though not serious.
End Treatments	**Alignment and Height:**	Alignment and height are OK.
	Breaking and Cracking:	End treatment damaged replace 38-ft
	Missing Elements:	None observed.
	Corrrosion and Weathering:	Slight weathering.

Barrier ID:	**CRLA-0011-5.669-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/16/2010	**Barrier Rating:**	40.90

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$7508
Brief Workorder:	Replace end terminal and 74 l.f. of rail on W-beam.				
Workorder:	Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. Replace Rail at $25- per -Lin. Ft. for 74 LF = $1850. Replace 74-ft of rail in two sections first section is 36-ft; second section is 38-ft. W-beam flared 350 compliant at $3500- per -Each for 1 Unit(s) = $3500.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Barrier Condition Photos

CRLA_0011_5.669_L_1.jpg

Barrier ID:	**CRLA-0011-5.919-R**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/16/2010	**Barrier Rating:**	23.70

Barrier Description

Type:	W-BEAM STRONG POST	**Barrier Function:**	TRAFFIC
Barrier Material:	WEATHERING STEEL/CORTEN	**Post Material:**	WOOD
Blockout Type:	WOOD	**Length (ft.):**	268
Speed Limit (MPH):	45	**Placement with Respect to Road:**	TANGENT
Hazard Behind Barrier:	MEDIUM		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	TL-3	**Is Barrier Crashworthy?:**	YES
Beg. End Trtmt Type:	W-BEAM FLARED 350 COMPLIANT	**Is Beg. End Trtmt Crashhworthy?:**	YES	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	W-BEAM FLARED 350 COMPLIANT	**Ending End Trtmt Crashhworthy?:**	YES		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	75.0
Height (In.):	27.6	**Lateral Offset (In.):**	45.5	**Road Grade (%):**	3.80

Physical Condition

Barrier	**Alignment and Height:**	Alignment and high are acceptable.
	Breaking and Cracking:	Two rails bend; replace two 12-ft sections.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	No corrosion observed.
End Treatments	**Alignment and Height:**	No deviations.
	Breaking and Cracking:	None observed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	None observed.

Barrier ID:	**CRLA-0011-5.919-R**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/16/2010	**Barrier Rating:**	23.70

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$2282
Brief Workorder:	Replace 24 l.f. of W-beam rail.				
Workorder:	Replace Rail at $25- per -Lin. Ft. for 24 LF = $600. Replace two 12-ft sections of rail. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. One day to replace 24-ft of rail.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Barrier Condition Photos

CRLA_0011_5.919_R_1.jpg

Barrier ID:	**CRLA-0011-7.373-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/16/2010	**Barrier Rating:**	39.50

Barrier Description

Type:	W-BEAM STRONG POST	**Barrier Function:**	TRAFFIC
Barrier Material:	WEATHERING STEEL/CORTEN	**Post Material:**	WOOD
Blockout Type:	WOOD	**Length (ft.):**	1108
Speed Limit (MPH):	45	**Placement with Respect to Road:**	BOTH INSIDE AND OUTSIDE
Hazard Behind Barrier:	MEDIUM		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	TL-3	**Is Barrier Crashworthy?:**	YES
Beg. End Trtmt Type:	W-BEAM FLARED 350 COMPLIANT	**Is Beg. End Trtmt Crashhworthy?:**	YES	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	W-BEAM FLARED 350 COMPLIANT	**Ending End Trtmt Crashhworthy?:**	YES		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	75.0
Height (In.):	28.6	**Lateral Offset (In.):**	38.2	**Road Grade (%):**	2.70

Physical Condition

Barrier	**Alignment and Height:**	400-ft of rail needs to be reshaped. (Looks like plow has flattened the rail section.) 75-ft of rail needs to be replaced.
	Breaking and Cracking:	None observed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	None observed.
End Treatments	**Alignment and Height:**	All rail in end terminal nearest to milepoint 7.580 needs to be replaced (38-ft).
	Breaking and Cracking:	Replace one post.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	None observed.

Barrier ID:	**CRLA-0011-7.373-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/16/2010	**Barrier Rating:**	39.50

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$8574
Brief Workorder:	Replace 75 l.f. of guard rail and 38 l.f. of damaged rail sections; reshape 400 l.f. of W-beam.				
Workorder:	Replace Rail at $25- per -Lin. Ft. for 75 LF = $1875. Replace 75-ft damaged rail. Replace Post at $100- per -Each for 1 Post(s) = $100. Replace one wooden post. Replace Rail at $25- per -Lin. Ft. for 38 LF = $950. Replace 38-ft of end terminal rail. Labor at $60- per -Hour for 32 Hrs = $1920. 32-hrs of labor to reshape 400-ft of rail. Low Speed Traffic Control at $1475- per -Day for 2 Day(s) = $2950. 1 day to replace rail sections 1 day to reshape 400-ft of rail.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Barrier Condition Photos

CRLA_0011_7.373_L_1.jpg

Barrier ID:	**CRLA-0011-8.783-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	17.20

Barrier Description

Type:	STONE MASONRY WITHOUT CONCRETE CORE WALL	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	63
Speed Limit (MPH):	45	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	24	**Width (In.):**	18.2	**Post Spacing (In.):**	0.0
Height (In.):	22.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	No deviation in horizontal and vertical alignments. 27-ft of barrier was more than 3-in below design height (24-in). Barrier was designed to rise from a low height of 18-in on both ends to a maximum height of 24-in at its center.
	Breaking and Cracking:	No cracking or breaking observed.
	Missing Elements:	One missing element observed -- small stone missing from back face of barrier approximately 1-ft x 1-ft.
	Corrrosion and Weathering:	No weathering or corrosion observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0011-8.783-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	17.20

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$132
Brief Workorder:	Regrout missing stone.				
Workorder:	Labor at $60- per -Hour for 2 Hrs = $120. 2-hrs required to regrout missing stones.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Barrier Condition Photos

CRLA_0011_8.783_L_1.jpg

Barrier ID:	**CRLA-0011-12.026-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	30.80

Barrier Description

Type:	W-BEAM STRONG POST	**Barrier Function:**	TRAFFIC
Barrier Material:	WEATHERING STEEL/CORTEN	**Post Material:**	WOOD
Blockout Type:	WOOD	**Length (ft.):**	250
Speed Limit (MPH):	45	**Placement with Respect to Road:**	INSIDE OF CURVE
Hazard Behind Barrier:	MEDIUM		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	TL-3	**Is Barrier Crashworthy?:**	YES
Beg. End Trtmt Type:	W-BEAM BURIED END	**Is Beg. End Trtmt Crashhworthy?:**	YES	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	W-BEAM BURIED END	**Ending End Trtmt Crashhworthy?:**	YES		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	75.0
Height (In.):	27.0	**Lateral Offset (In.):**	19.2	**Road Grade (%):**	2.80

Physical Condition

Barrier	**Alignment and Height:**	Post are plumb. Rail has some flattening from snow removal.
	Breaking and Cracking:	80-ft of rail has been flattened and does not touch the top of the block by 1 to 3-in. Six blocks twisted.
	Missing Elements:	Six posts and blocks need to be tightened; approximately 50-linear-ft. No missing elements observed.
	Corrrosion and Weathering:	The rail is corroded. Recommend monitoring.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0011-12.026-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	30.80

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$2678
Brief Workorder:	Reshape flattened W-beam tighten bolts and repair twisted blockouts.				
Workorder:	Labor at $60- per -Hour for 8 Hrs = $480. 8-hrs labor to reshape 80-ft of rail. Labor at $60- per -Hour for 4 Hrs = $240. 4-hrs labor to tighten bolts. Labor at $60- per -Hour for 4 Hrs = $240. 4-hrs labor to repair twisted blocks. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. One day low speed traffic control.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Barrier Condition Photos

CRLA_0011_12.026_L_1.jpg

Barrier ID:	**CRLA-0011-13.680-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	30.80

Barrier Description

Type:	W-BEAM STRONG POST	**Barrier Function:**	TRAFFIC
Barrier Material:	WEATHERING STEEL/CORTEN	**Post Material:**	WOOD
Blockout Type:	WOOD	**Length (ft.):**	185
Speed Limit (MPH):	45	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	MEDIUM		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	TL-3	**Is Barrier Crashworthy?:**	YES
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	W-BEAM BURIED END	**Ending End Trtmt Crashhworthy?:**	YES		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	75.0
Height (In.):	26.7	**Lateral Offset (In.):**	50.0	**Road Grade (%):**	3.90

Physical Condition

Barrier	**Alignment and Height:**	Posts are plumb. The rail is flattened. Rail not tight to blocks.
	Breaking and Cracking:	Some minor cracking on posts and blocks.
	Missing Elements:	None observed. All hardware blocks and posts in place.
	Corrrosion and Weathering:	The rail does show signs of corrosion.
End Treatments	**Alignment and Height:**	The buried end is at design height (27-in).
	Breaking and Cracking:	No cracking or breaking.
	Missing Elements:	No missing elements observed.
	Corrrosion and Weathering:	Rail corroded.

Barrier ID:	**CRLA-0011-13.680-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	30.80

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$5164
Brief Workorder:	Replace 100 l.f. of corroded W-beam tighten bolts and reshape 40 l.f. of W-beam.				
Workorder:	Replace Rail at $25- per -Lin. Ft. for 100 LF = $2500. Remove 100-ft of corroded rail and replace with new rail. Labor at $60- per -Hour for 4 Hrs = $240. 4-hrs labor to tighten bolts. Labor at $60- per -Hour for 8 Hrs = $480. 8-hrs labor to reshape 40-ft of flattened rail. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. One day to complete all work.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Barrier Condition Photos

CRLA_0011_13.680_L_1.jpg

Barrier ID:	**CRLA-0011-13.798-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	36.70

Barrier Description

Type:	W-BEAM STRONG POST	**Barrier Function:**	TRAFFIC
Barrier Material:	WEATHERING STEEL/CORTEN	**Post Material:**	WOOD
Blockout Type:	WOOD	**Length (ft.):**	266
Speed Limit (MPH):	45	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	MEDIUM		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	TL-3	**Is Barrier Crashworthy?:**	YES
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	W-BEAM BURIED END	**Ending End Trtmt Crashhworthy?:**	YES		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	75.0
Height (In.):	27.0	**Lateral Offset (In.):**	44.0	**Road Grade (%):**	3.90

Physical Condition

Barrier	**Alignment and Height:**	50-ft of rail is flattened. Posts and blocks are plumb. 75-ft of rail is flattened slightly.
	Breaking and Cracking:	Minor cracking in posts and blocks.
	Missing Elements:	Two missing blockouts. No missing hardware or posts.
	Corrrosion and Weathering:	Rail looks corroded.
End Treatments	**Alignment and Height:**	No deviation in end terminal height or alignment.
	Breaking and Cracking:	No breaking or cracking observed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	The rail looks corroded.

Barrier ID:	**CRLA-0011-13.798-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	36.70

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$4053
Brief Workorder:	Replace 50 l.f. of corroded rail tighten bolts reshape 72 l.f. of slightly flattened rail and monitor entire W-beam for corrosion.				
Workorder:	Replace Rail at $25- per -Lin. Ft. for 50 LF = $1250. Replace 50-ft of corroded rail. Labor at $60- per -Hour for 8 Hrs = $480. 8-hrs labor to tighten bolts. Labor at $60- per -Hour for 8 Hrs = $480. 8-hrs labor to reshape 72-ft of slightly flattened rail. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. One day to complete all work.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Barrier Condition Photos

CRLA_0011_13.798_L_1.jpg

Barrier ID:	**CRLA-0011-15.395-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	29.30

Barrier Description

Type:	W-BEAM STRONG POST	**Barrier Function:**	TRAFFIC
Barrier Material:	WEATHERING STEEL/CORTEN	**Post Material:**	WOOD
Blockout Type:	WOOD	**Length (ft.):**	190
Speed Limit (MPH):	45	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	MEDIUM		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	TL-3	**Is Barrier Crashworthy?:**	YES
Beg. End Trtmt Type:	W-BEAM BURIED END	**Is Beg. End Trtmt Crashhworthy?:**	YES	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	W-BEAM BURIED END	**Ending End Trtmt Crashhworthy?:**	YES		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	75.0
Height (In.):	26.2	**Lateral Offset (In.):**	36.0	**Road Grade (%):**	2.90

Physical Condition

Barrier	**Alignment and Height:**	The horizontal and vertical alignments are OK no deviations observed. Three posts have 3-in shims to maintain alignment. Height is within 1-in of design height (27-in).
	Breaking and Cracking:	One section of rail damaged. Some minor cracking on posts 1/8-in no problem noted. Four broken blockouts.
	Missing Elements:	Several missing bolts. Loose bolts noted.
	Corrrosion and Weathering:	No corrosion observed.
End Treatments	**Alignment and Height:**	No deviations observed.
	Breaking and Cracking:	No cracking or breaking observed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	None observed.

Barrier ID:	**CRLA-0011-15.395-L**		
Route Name:	CRATER LAKE HIGHWAY		
Inspection Date:	07/18/2010	**Barrier Rating:**	29.30

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$2348
Brief Workorder:	Replace 12 feet of W-beam replace four blockouts replace missing hardware and tighten bolts.				
Workorder:	Replace Block at $30- per -Each for 4 Block(s) = $120. Replace four blockouts. Replace Rail at $25- per -Lin. Ft. for 12 LF = $300. Replace one 12-ft section of rail. Labor at $60- per -Hour for 4 Hrs = $240. 4-hrs to tighten bolts and replace missing hardware. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. One day to complete all work.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0011: CRATER LAKE HIGHWAY

Barrier Condition Photos

CRLA_0011_15.395_L_1.jpg

CRLA_0011_15.395_L_2.jpg

Barrier ID:	**CRLA-0012-1.298-R**		
Route Name:	MUNSON VALLEY ROAD		
Inspection Date:	07/16/2010	**Barrier Rating:**	44.90

Barrier Description

Type:	STONE MASONRY WITHOUT CONCRETE CORE WALL	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	30
Speed Limit (MPH):	35	**Placement with Respect to Road:**	TANGENT
Hazard Behind Barrier:	HIGH		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	24	**Width (In.):**	18.0	**Post Spacing (In.):**	0.0
Height (In.):	16.0	**Lateral Offset (In.):**	103.6	**Road Grade (%):**	0.40

Physical Condition

Barrier	**Alignment and Height:**	Wall is straight and plumb. Height is 8-in lower than design height of 24-in.
	Breaking and Cracking:	None observed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	None observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0012-1.298-R**		
Route Name:	MUNSON VALLEY ROAD		
Inspection Date:	07/16/2010	**Barrier Rating:**	44.90

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$32395
Brief Workorder:	Remove and reset stone masonry barrier				
Workorder:	Remove & Reset Stone Masonry Guardwall at $250- per -Cu. Ft. for 90 CF = $22500. (30) x (24/12) x (18/12) = 90 CF. Structural Concrete at $1000- per -Cu. Yd. for 4 CY = $4000. [(30) x (8/12) x (18/12)] / 27 = 1.1 CY. Low Speed Traffic Control at $1475- per -Day for 2 Day(s) = $2950. One day to remove one day to rebuild.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0012: MUNSON VALLEY ROAD

Barrier Condition Photos

CRLA_0012_1.298_R_1.jpg

Barrier ID:	**CRLA-0013-2.646-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	231
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.0	**Post Spacing (In.):**	0.0
Height (In.):	18.7	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	The entire length of barrier is plumb no deviations in horizontal or vertical alignments. The height is consistent and slightly above the design height of 18-in.
	Breaking and Cracking:	No visible cracking observed.
	Missing Elements:	No missing elements observed. There is erosion at back face of barrier. Monitor erosion.
	Corrrosion and Weathering:	The stone exhibits no weathering.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-2.646-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Repair Recommendations

Repair Action:	MONITOR	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	Monitor back side of barrier for erosion.				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_2.646_R_1.jpg

Barrier ID:	**CRLA-0013-2.780-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	12.80

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	112
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.0	**Post Spacing (In.):**	0.0
Height (In.):	20.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Horizontal and vertical alignments show no deviation. Barrier is stable. Height is slightly above design height of 18-in.
	Breaking and Cracking:	None observed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	Stone shows no signs of wear or weathering.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-2.780-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	12.80

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_2.780_R_1.jpg

Barrier ID:	**CRLA-0013-3.284-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	24.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	440
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.0	**Post Spacing (In.):**	0.0
Height (In.):	17.6	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	The barrier is in correct alignment. No stability problems. Height varies from being 2-in above design height (18-in) to 3-in below design height (18-in).
	Breaking and Cracking:	No observed cracking in grout or stones.
	Missing Elements:	No missing stones or grout.
	Corrrosion and Weathering:	No weathering observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-3.284-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	24.20

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_3.284_R_1.jpg

Barrier ID:	**CRLA-0013-3.674-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	24.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	285
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	18.2	**Post Spacing (In.):**	0.0
Height (In.):	18.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Barrier in correct horizontal and vertical alignment. No stability issues. Height is within 1-in of design height (18-in) and is consistent.
	Breaking and Cracking:	None observed in grout or stone.
	Missing Elements:	No missing elements observed.
	Corrrosion and Weathering:	No weathering observed in grout or stone.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-3.674-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	24.20

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_3.674_R_1.jpg

Barrier ID:	**CRLA-0013-3.773-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	143
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	18.7	**Post Spacing (In.):**	0.0
Height (In.):	18.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Barrier is stable. No deviation in horizontal or vertical alignments. At barrier's lowest height measurement height was within 1-in of design height (18-in).
	Breaking and Cracking:	No cracking of stone or mortar observed.
	Missing Elements:	No missing elements were observed.
	Corrrosion and Weathering:	No weathering of stone or mortar observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-3.773-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_3.773_R_1.jpg

Barrier ID:	**CRLA-0013-3.933-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	145
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	20.2	**Post Spacing (In.):**	0.0
Height (In.):	19.2	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Barrier has correct alignment; no stability issues. Height is no more than 2-in lower than design height (18-in).
	Breaking and Cracking:	Minor cracking in mortar packed with dirt and organic debris (pine needles).
	Missing Elements:	No missing stone or grout observed.
	Corrrosion and Weathering:	No weathering or stone or mortar observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-3.933-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Repair Recommendations

Repair Action:	MONITOR	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	Monitor mortar cracking and clean grouted areas.				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_3.933_R_1.jpg

Barrier ID:	**CRLA-0013-4.211-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	24.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	251
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.0	**Post Spacing (In.):**	0.0
Height (In.):	19.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Barrier is stable no deviations in horizontal or vertical alignments. Height is within 1-in of design height (18-in) at lowest point.
	Breaking and Cracking:	Sporadic minor cracking of mortar. Widest observed cracks were 1/8-in in width and ranged from 3 to 4-in.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	Some weathering of the grout was observed; an extension of the cracking.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-4.211-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	24.20

Repair Recommendations

Repair Action:	MONITOR	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	Monitor grout for cracking.				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_4.211_R_1.jpg

Barrier ID:	**CRLA-0013-4.567-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	40.00

Barrier Description

Type:	W-BEAM WEAK POST	**Barrier Function:**	TRAFFIC
Barrier Material:	OTHER: STEEL	**Post Material:**	WOOD
Blockout Type:	N/A	**Length (ft.):**	204
Speed Limit (MPH):	20	**Placement with Respect to Road:**	INSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-1	**Barrier Test Level:**	TL-2	**Is Barrier Crashworthy?:**	YES
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	150.0
Height (In.):	20.0	**Lateral Offset (In.):**	38.2	**Road Grade (%):**	3.30

Physical Condition

Barrier	**Alignment and Height:**	Barrier has correct alignment; no settling issues. Height of the barrier ranges from 5 to 9-in below design height (27-in).
	Breaking and Cracking:	No cracking or breaks in rail sections. Some minor cracking in posts 1/8-in by 18-in at worst.
	Missing Elements:	No missing elements observed.
	Corrrosion and Weathering:	Posts were weathered but in acceptable condition; very minor wear. Rails need to be painted.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-4.567-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	40.00

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$9256
Brief Workorder:	Raise 204 l.f. of guardrail to 27" design height and paint W-beam.				
Workorder:	Adjust Guardrail at $10- per -Lin. Ft. for 204 LF = $2040. Adjust barrier height to 27-in design height for entire run. Paint at $100- per - for 1 = $100. Paint and primer for barrier. Labor at $60- per -Hour for 80 Hrs = $4800. 8-hrs labor to repaint barrier. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. 1 day traffic control to raise and paint barrier.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_4.567_R_1.jpg

Barrier ID:	**CRLA-0013-4.731-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	41.50

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	340
Speed Limit (MPH):	35	**Placement with Respect to Road:**	INSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.7	**Post Spacing (In.):**	0.0
Height (In.):	17.0	**Lateral Offset (In.):**	132.0	**Road Grade (%):**	1.90

Physical Condition

Barrier	**Alignment and Height:**	Barrier is stable and at correct vertical and horizontal alignments. Height is a maximum of 3-in below design height (18-in).
	Breaking and Cracking:	No cracking observed in stone or grout.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	No weathering or corrosion observed in stone or masonry.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-4.731-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	41.50

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_4.731_R_1.jpg

Barrier ID:	**CRLA-0013-4.803-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	27.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	65
Speed Limit (MPH):	35	**Placement with Respect to Road:**	TANGENT
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	20.0	**Post Spacing (In.):**	0.0
Height (In.):	16.0	**Lateral Offset (In.):**	70.0	**Road Grade (%):**	0.30

Physical Condition

Barrier	**Alignment and Height:**	Barrier is stable. No deviation in horizontal or vertical alignments. Height is 2-in below design height (18-in).
	Breaking and Cracking:	None observed in stone or mortar.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	No cracking or weathering of stone or mortar.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-4.803-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	27.20

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_4.803_R_1.jpg

Barrier ID:	**CRLA-0013-5.915-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	44.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	184
Speed Limit (MPH):	35	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	18.7	**Post Spacing (In.):**	0.0
Height (In.):	19.7	**Lateral Offset (In.):**	100.5	**Road Grade (%):**	0.30

Physical Condition

Barrier	**Alignment and Height:**	No deviations in horizontal and vertical alignments. Barrier stable. Height at or in excess of design height (18-in).
	Breaking and Cracking:	No cracking of stone or mortar.
	Missing Elements:	No missing elements observed.
	Corrrosion and Weathering:	No corrosion or weathering of stone or grout observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-5.915-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	44.20

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_5.915_R_1.jpg

Barrier ID:	**CRLA-0013-5.944-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	102
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	18.7	**Post Spacing (In.):**	0.0
Height (In.):	19.2	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	No deviations in horizontal or vertical alignments. Height is in excess of design height (18-in).
	Breaking and Cracking:	No breaking or cracking of stone or grout observed.
	Missing Elements:	No missing elements observed.
	Corrrosion and Weathering:	No weathering of stone or mortar observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-5.944-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_5.944_R_1.jpg

Barrier ID:	**CRLA-0013-6.340-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	47.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	358
Speed Limit (MPH):	35	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	18.7	**Post Spacing (In.):**	0.0
Height (In.):	18.0	**Lateral Offset (In.):**	128.3	**Road Grade (%):**	1.80

Physical Condition

Barrier	**Alignment and Height:**	Barrier is stable; no deviation in horizontal or vertical alignment. Height is within 1-in below design height (18-in).
	Breaking and Cracking:	No cracking or breaking of stone or mortar observed.
	Missing Elements:	No missing elements.
	Corrrosion and Weathering:	Stone and grout are not weathered.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-6.340-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	47.20

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_6.340_R_1.jpg

Barrier ID:	**CRLA-0013-10.087-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	50.00

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	420
Speed Limit (MPH):	35	**Placement with Respect to Road:**	INSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.7	**Post Spacing (In.):**	0.0
Height (In.):	19.2	**Lateral Offset (In.):**	57.7	**Road Grade (%):**	6.60

Physical Condition

Barrier	**Alignment and Height:**	The barrier is in correct alignment horizontally and vertically. The height of the barrier is above the design height (18-in).
	Breaking and Cracking:	Very minor cracking of grout in a few spots; monitor.
	Missing Elements:	No missing elements in stone or grout.
	Corrrosion and Weathering:	No weathering observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-10.087-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	50.00

Repair Recommendations

Repair Action:	MONITOR	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	Monitor drainage along front face of barrier and mortar cracking.				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_10.087_L_1.jpg

Barrier ID:	**CRLA-0013-10.110-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	140
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.7	**Post Spacing (In.):**	0.0
Height (In.):	17.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Barrier stable and exhibiting no deviations of vertical or horizontal alignment. Height is within 3-in of 18-in design height.
	Breaking and Cracking:	No cracking or breaking observed.
	Missing Elements:	No missing elements observed.
	Corrrosion and Weathering:	No weathering of stone or mortar observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-10.110-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	21.30

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_10.110_L_1.jpg

Barrier ID:	**CRLA-0013-13.931-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	25.70

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	216
Speed Limit (MPH):	35	**Placement with Respect to Road:**	INSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.7	**Post Spacing (In.):**	0.0
Height (In.):	24.0	**Lateral Offset (In.):**	50.7	**Road Grade (%):**	5.30

Physical Condition

Barrier	**Alignment and Height:**	No deviation in vertical or horizontal alignment. Barrier is stable. Height is above design height (18-in).
	Breaking and Cracking:	No cracking or breaking observed.
	Missing Elements:	No missing elements observed.
	Corrrosion and Weathering:	No weathering of grout or stones.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-13.931-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/17/2010	**Barrier Rating:**	25.70

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_13.931_L_1.jpg

Barrier ID:	**CRLA-0013-15.273-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	57.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	820
Speed Limit (MPH):	35	**Placement with Respect to Road:**	INSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.8	**Post Spacing (In.):**	0.0
Height (In.):	18.1	**Lateral Offset (In.):**	64.1	**Road Grade (%):**	5.00

Physical Condition

Barrier	**Alignment and Height:**	46-ft of barrier have been impacted by rock-fall. Several areas of barrier have stones that are loose and the barrier is out of alignment. Height was within 3-in of 18-in design height.
	Breaking and Cracking:	Total of 56-linear-ft of barrier needs to be regrouted on the front face only. Back side of barrier is not exhibiting breaking or cracking.
	Missing Elements:	Evidence (anchor bolts sticking out of retaining wall) suggest that two 100-ft sections that do not have barrier did have barrier at one time. Total of 227-ft of barrier is missing. Replace with new barrier in kind.
	Corrrosion and Weathering:	No weathering of stone grout observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-15.273-L**				
Route Name:	EAST RIM DRIVE				
Inspection Date:	07/18/2010		**Barrier Rating:**	57.20	

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$187385
Brief Workorder:	Replace missing sections of barrier (227 l.f.) that were removed by rock-falls repoint other sections of barrier.				
Workorder:	Re-Point Masonry Barrier at $140- per -Sq. Yd. for 10 SY = $1400. [(56-ft x 1.5ft)/9] = 9.3 SY. Round to 10 SY. Remove & Reset Stone Masonry Guardwall at $250- per -Cu. Ft. for 115 CF = $28750. (46-ft) x (18-in/12-in) x (20-in/12-in) = 115 CF. Stone Masonry Crenellated w/o Concrete Core at $500- per -Lin. Ft. for 227 LF = $113500. (108-ft) + (108-ft) + (3-ft) + (8-ft) = 227 L.F. Structural Concrete at $1000- per -Cu. Yd. for 9 CY = $9000. [(46-ft + 227-ft) x (20-in/12-in) x (6-in/12-in)]/27 = 8.44 CY. Round to 9 C.Y. Low Speed Traffic Control at $1475- per -Day for 12 Day(s) = $17700. 2-days removal 10-days installation.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_15.273_L_1.jpg

CRLA_0013_15.273_L_2.jpg

Barrier ID:	**CRLA-0013-15.504-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	58.50

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	1490
Speed Limit (MPH):	35	**Placement with Respect to Road:**	BOTH INSIDE AND OUTSIDE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	20.0	**Post Spacing (In.):**	0.0
Height (In.):	20.3	**Lateral Offset (In.):**	103.0	**Road Grade (%):**	6.60

Physical Condition

Barrier	**Alignment and Height:**	Barrier impacted by rockfall. Total of 103-linear-ft of barrier was leaning or had stones loose. Height is above 18-in design height.
	Breaking and Cracking:	Sections of barrier were hit by rocks. 72-linear-ft of barrier has 1/4-in cracks and needs to be repointed.
	Missing Elements:	Total of 336-linear-ft of barrier was missing. Several stones missing in other sections.
	Corrrosion and Weathering:	No weathering of stone was observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-15.504-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	58.50

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$313456
Brief Workorder:	Replace missing barriers sections(336-ft) replace missing stones and repoint stone masonry barrier.				
Workorder:	Stone Masonry Crenellated w/o Concrete Core at $500- per -Lin. Ft. for 336 LF = $168000. Remove & Reset Stone Masonry Guardwall at $250- per -Cu. Ft. for 286 CF = $71500. (103-ft) x (20-in/12-in) x (20-in/12-in) = 286 CF. Re-Point Masonry Barrier at $140- per -Sq. Yd. for 14 SY = $1960. [(72-ft) x (21-in/12-in)]/9 = 14 SY. Structural Concrete at $1000- per -Cu. Yd. for 14 CY = $14000. [(440-ft) x (6-in/12-in) x (20-in/12-in)] / 27 = 13.58-CY. Round to 14 CY. Assumed footer depth of 6-in and 20-in wide. Low Speed Traffic Control at $1475- per -Day for 20 Day(s) = $29500. Repoint: 1 day remove: 1 day reset: 4 days install new barrier: 14 days.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_15.504_L_1.jpg

CRLA_0013_15.504_L_2.jpg

Barrier ID:	**CRLA-0013-15.774-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	12.80

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	240
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	20.0	**Post Spacing (In.):**	0.0
Height (In.):	21.2	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	No deviations in horizontal or vertical alignment. Barrier height is in excess of design height (18-in).
	Breaking and Cracking:	Minor cracking of grout. 25-linear-ft needs to be repointed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	No weathering of stones or grout.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-15.774-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	12.80

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$920
Brief Workorder:	Repoint 25 l.f. of stone masonry guardwall.				
Workorder:	Re-Point Masonry Barrier at $140 per Sq. Yd. for 6 SY = $840. [(25-ft) x (24-in/12-in)]/9 = 6 SY. Since barrier is in a pullout no traffic control is required.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_15.774_L_1.jpg

Barrier ID:	**CRLA-0013-17.778-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	50.00

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	1018
Speed Limit (MPH):	35	**Placement with Respect to Road:**	BOTH INSIDE AND OUTSIDE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.0	**Post Spacing (In.):**	0.0
Height (In.):	19.6	**Lateral Offset (In.):**	104.5	**Road Grade (%):**	6.00

Physical Condition

Barrier	**Alignment and Height:**	Stones were in proper alignment horizontally and vertically. Barrier height was at or above design height (18-in).
	Breaking and Cracking:	Did not observe cracking of grout or stones.
	Missing Elements:	No missing elements were observed.
	Corrrosion and Weathering:	No weathering of stones or mortar were observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-17.778-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	50.00

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$1100
Brief Workorder:	Remove excess material in front of barrier				
Workorder:	Grader at $125- per -Hour for 8 Hrs = $1000. 8 hrs grading to remove excess material in front of barrier.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_17.778_L_1.jpg

Barrier ID:	**CRLA-0013-18.259-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	21.50

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	270
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	20.0	**Post Spacing (In.):**	0.0
Height (In.):	20.2	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Vertical and horizontal alignment has no deviations. Height is consistent and 2-in above design height (18-in).
	Breaking and Cracking:	One 4-ft stone cracked in half (longitudinally). Needs to be replaced with new stone. No other cracking observed.
	Missing Elements:	No missing elements observed.
	Corrrosion and Weathering:	No weathering of stones or grout observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-18.259-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	21.50

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$4262
Brief Workorder:	Replace one longitudinally cracked 4 l.f. stone.				
Workorder:	Remove Stone Masonry at $100- per -Lin. Ft. for 4 LF = $400. Replace one 4-ft section of stone cracked longitudinally. Stone Masonry Crenellated w/o Concrete Core at $500- per -Lin. Ft. for 4 LF = $2000. Install 4-ft section of barrier. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. 1 day to complete all work.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_18.259_L_1.jpg

CRLA_0013_18.259_L_2.jpg

Barrier ID:	**CRLA-0013-18.306-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	37.00

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	2060
Speed Limit (MPH):	35	**Placement with Respect to Road:**	BOTH INSIDE AND OUTSIDE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	20.0	**Post Spacing (In.):**	0.0
Height (In.):	20.1	**Lateral Offset (In.):**	68.9	**Road Grade (%):**	5.70

Physical Condition

Barrier	**Alignment and Height:**	The horizontal and vertical alignments showed no deviations. Barrier height was consistently at or above design height (18-in) with the exception of a 10-ft run that was 14-in high.
	Breaking and Cracking:	Observed several areas of cracking grout; in same area as missing grout. 60-linear-ft showed cracks ranging from 1/4 to 1/2-in wide.
	Missing Elements:	Observed several areas of missing grout. Total length of 60-linear-ft. Grout missing on tope and front of barrier.
	Corrrosion and Weathering:	A few of the stones were spalling on top. Observed six stones total; approximately 25-linear-ft.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-18.306-L**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	37.00

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$6110
Brief Workorder:	Repoint stone masonry barrier and use grader to remove debris and gravel from in-front of barrier.				
Workorder:	Re-Point Masonry Barrier at $140- per -Sq. Yd. for 22 SY = $3080. [(60-ft) x (20-in/12-in + 20-in/12-in)] /9 = 22.2 SY. 20-in for front face of barrier and 20-in for top side of barrier. Grader at $125- per -Hour for 8 Hrs = $1000. 8 hrs of grader to remove stones and debris in front of barrier. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. 1 day to complete all work.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_18.306_L_1.jpg

Barrier ID:	**CRLA-0013-22.842-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	8.50

Barrier Description

Type:	OTHER: LOG RAIL ON STONE POSTS	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	LOG/TIMBER/WOOD	**Post Material:**	OTHER: STONE
Blockout Type:	N/A	**Length (ft.):**	112
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	27	**Width (In.):**	24.0	**Post Spacing (In.):**	144.0
Height (In.):	27.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Newly installed barrier. No deviation in horizontal or vertical alignments. Height is consistent at 27-in to the top of the log rail (assumed design height is 27-in).
	Breaking and Cracking:	There is some cracking of the grout. Cracks up to 1/8-in were recorded. Recommend monitoring the cracks.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	No weathering of logs or stone.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-22.842-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	8.50

Repair Recommendations

Repair Action:	MONITOR	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	Monitor cracks in grout.				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_22.842_R_1.jpg

Barrier ID:	**CRLA-0013-22.860-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	8.50

Barrier Description

Type:	OTHER: LOG RAIL ON STONE POSTS	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	LOG/TIMBER/WOOD	**Post Material:**	OTHER: STONE
Blockout Type:	N/A	**Length (ft.):**	36
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	27	**Width (In.):**	24.0	**Post Spacing (In.):**	84.0
Height (In.):	27.7	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Newly installed barrier. No deviation in horizontal or vertical alignments. Height is consistent no more than 1-in above assumed design height (27-in).
	Breaking and Cracking:	Observed one shrinkage crack in the grout. Crack measured 1/8-in wide and 4-in long. No other cracking observed.
	Missing Elements:	No missing elements.
	Corrrosion and Weathering:	No weathering observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0013-22.860-R**		
Route Name:	EAST RIM DRIVE		
Inspection Date:	07/18/2010	**Barrier Rating:**	8.50

Repair Recommendations

Repair Action:	MONITOR	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	Monitor grout for further cracking.				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0013: EAST RIM DRIVE

Barrier Condition Photos

CRLA_0013_22.860_R_1.jpg

Barrier ID:	**CRLA-0014-0.171-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	44.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	82
Speed Limit (MPH):	35	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	18.2	**Post Spacing (In.):**	0.0
Height (In.):	13.6	**Lateral Offset (In.):**	70.0	**Road Grade (%):**	2.70

Physical Condition

Barrier	**Alignment and Height:**	All height is below 18-in. Entire run of barrier is lower than 15-in (3-in lower than 18-in design height). Alignment is good.
	Breaking and Cracking:	1/4 to 1/2-in cracks in mortar observed over 30-ft of barrier only on the front side. 5-ft of downstream end is cracked and needs to be reset.
	Missing Elements:	None. All elements present.
	Corrrosion and Weathering:	None. No weathering noted.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-0.171-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	44.20

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$2513
Brief Workorder:	Repoint 30 l.f. and reset 5 l.f. of stone masonry barrier				
Workorder:	Re-Point Masonry Barrier at $140- per -Sq. Yd. for 4 SY = $560. [(30-ft) x (14-in/12-in)]/9 = 3.8 SY. Round to 4 S.Y. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. 1 day to complete work. Remove & Reset Stone Masonry Guardwall at $250- per -Cu. Ft. for 1 CF = $250. [(5-ft) x (14-in/12-in) x (18-in/12-in)] / 9 = 0.97 CF.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_0.171_R_1.jpg

Barrier ID:	**CRLA-0014-0.204-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	35.70

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	57
Speed Limit (MPH):	35	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	18.0	**Post Spacing (In.):**	0.0
Height (In.):	15.3	**Lateral Offset (In.):**	113.5	**Road Grade (%):**	2.10

Physical Condition

Barrier	**Alignment and Height:**	Minimum height of barrier was measured at 15-in which is 3-in lower than the design height of 18-in.
	Breaking and Cracking:	None. All barrier is in excellent condition.
	Missing Elements:	None. All barrier is in excellent condition.
	Corrrosion and Weathering:	None. All barrier is in excellent condition.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-0.204-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	35.70

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_0.204_R_1.jpg

Barrier ID:	**CRLA-0014-1.040-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	24.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	420
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.0	**Post Spacing (In.):**	0.0
Height (In.):	17.7	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Alignment acceptable. Height was within 3-in of the 18-in design height.
	Breaking and Cracking:	Very minor cracking in mortar but still good.
	Missing Elements:	No missing elements.
	Corrrosion and Weathering:	No weathering noted.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-1.040-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	24.20

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_1.040_R_1.jpg

Barrier ID:	**CRLA-0014-2.187-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	27.80

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	234
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	18.7	**Post Spacing (In.):**	0.0
Height (In.):	16.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	The height of the barrier was within 3-in of the 18-in design height. Horizontal alignment shows no deviation. Barrier all vertical.
	Breaking and Cracking:	There is some minor cracking in the mortar for less than 1/4-in wide along 60-ft of the roadside face of the barrier.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	Mortar is in new condition.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-2.187-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	27.80

Repair Recommendations

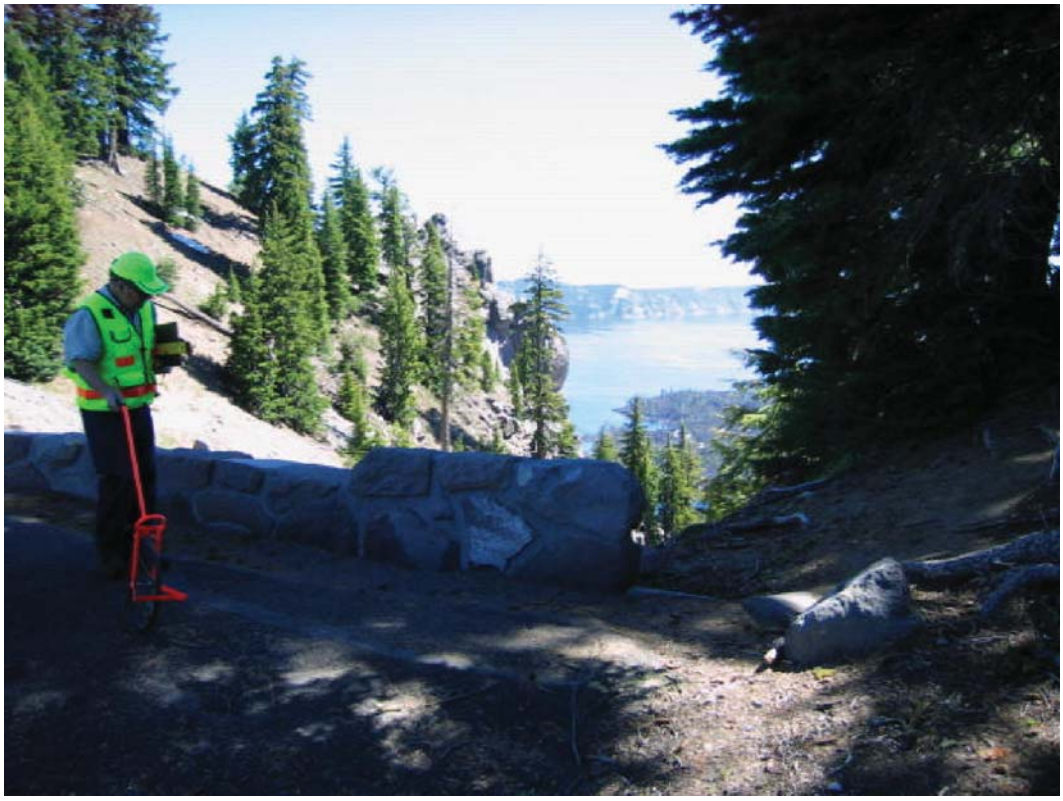
Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$3008
Brief Workorder:	Repoint stone masonry barrier.				
Workorder:	Re-Point Masonry Barrier at $140- per -Sq. Yd. for 9 SY = $1260. [(60-ft) x (16-in/12-in)]/9 = 8.9 SY. Round to 9 S.Y. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. One day to complete work.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos



CRLA_0014_2.187_R_1.jpg

Barrier ID:	**CRLA-0014-2.862-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	48.50

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	125
Speed Limit (MPH):	35	**Placement with Respect to Road:**	INSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.0	**Post Spacing (In.):**	0.0
Height (In.):	17.6	**Lateral Offset (In.):**	23.2	**Road Grade (%):**	3.50

Physical Condition

Barrier	**Alignment and Height:**	Alignment acceptable. Height was within 3-in of the 18-in design height.
	Breaking and Cracking:	None observed
	Missing Elements:	10-ft of the barrier is missing. Replace.
	Corrrosion and Weathering:	None observed
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-2.862-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	48.50

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$7122
Brief Workorder:	Replace 10 l.f. section of stone masonry barrier.				
Workorder:	Stone Masonry Crenellated w/o Concrete Core at $500- per -Lin. Ft. for 10 LF = $5000. Replace missing section of barrier to match existing height of adjacent barrier. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. One day to install new section of barrier.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_2.862_L_1.jpg

Barrier ID:	**CRLA-0014-2.903-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	54.40

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	535
Speed Limit (MPH):	35	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.2	**Post Spacing (In.):**	0.0
Height (In.):	18.0	**Lateral Offset (In.):**	34.5	**Road Grade (%):**	3.90

Physical Condition

Barrier	**Alignment and Height:**	Height of barrier is no more than 3-in from design height of 18-in. 40-ft of barrier leaning but stable. Rest of barrier is ok with/ regards to alignment.
	Breaking and Cracking:	Nothing observed
	Missing Elements:	No missing elements
	Corrrosion and Weathering:	Stone is stable. No corrosion or weathering noted.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-2.903-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	54.40

Repair Recommendations

Repair Action:	MONITOR	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	Monitor 40 l.f. section of barrier that is leaning and investigate water runoff.				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_2.903_L_1.jpg

Barrier ID:	**CRLA-0014-3.320-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	45.70

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	160
Speed Limit (MPH):	35	**Placement with Respect to Road:**	TANGENT
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	20.0	**Post Spacing (In.):**	0.0
Height (In.):	18.7	**Lateral Offset (In.):**	17.6	**Road Grade (%):**	3.70

Physical Condition

Barrier	**Alignment and Height:**	Alignment acceptable. Height was within 3-in of the 18-in design height.
	Breaking and Cracking:	20-ft section of very minor grout cracking.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	None observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-3.320-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	45.70

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_3.320_L_1.jpg

Barrier ID:	**CRLA-0014-3.359-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	42.90

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	320
Speed Limit (MPH):	35	**Placement with Respect to Road:**	TANGENT
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	NCW	**Is Barrier Crashworthy?:**	NO
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	18.0	**Post Spacing (In.):**	0.0
Height (In.):	17.2	**Lateral Offset (In.):**	50.7	**Road Grade (%):**	3.40

Physical Condition

Barrier	**Alignment and Height:**	Alignment acceptable. Height was within 3-in of the 18-in design height.
	Breaking and Cracking:	5-ft section of rocks is lose and needs to be repointed
	Missing Elements:	None observed
	Corrrosion and Weathering:	None observed
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-3.359-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	42.90

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$2393
Brief Workorder:	Repoint 30 l.f. section of stone masonry barrier.				
Workorder:	Re-Point Masonry Barrier at $140- per -Sq. Yd. for 5 SY = $700. [(30) x (16/12)]/9 = 4.4 SY. Round to 5 S.Y. Low Speed Traffic Control at $1475- per -Day for 1 Day(s) = $1475. One day to complete work.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_3.359_L_1.jpg

Barrier ID:	**CRLA-0014-4.449-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	21.30

Barrier Description

Type:	STONE MASONRY WITHOUT CONCRETE CORE WALL	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	168
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	MEDIUM		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	24	**Width (In.):**	19.0	**Post Spacing (In.):**	0.0
Height (In.):	16.7	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	No deviations in horizontal or vertical alignment. Height is consistent but typically 6 in under 24 in design height.
	Breaking and Cracking:	None observed
	Missing Elements:	None observed
	Corrrosion and Weathering:	None observed
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-4.449-L**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	21.30

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_4.449_L_1.jpg

Barrier ID:	**CRLA-0014-5.485-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	24.20

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	320
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.7	**Post Spacing (In.):**	0.0
Height (In.):	18.2	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Alignment acceptable. Height was within 3-in of the 18-in design height.
	Breaking and Cracking:	None observed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	None observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-5.485-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	24.20

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_5.485_R_1.jpg

Barrier ID:	**CRLA-0014-5.654-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	21.30

Barrier Description

Type:	STONE MASONRY WITHOUT CONCRETE CORE WALL	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	42
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	24	**Width (In.):**	24.0	**Post Spacing (In.):**	0.0
Height (In.):	19.2	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Barrier is in correct alignment. Height is lower than design height of 24-in by 3-6 in.
	Breaking and Cracking:	None observed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	None observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-5.654-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	21.30

Repair Recommendations

Repair Action:	NO ACTION	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	N/A				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_5.654_R_1.jpg

Barrier ID:	**CRLA-0014-5.662-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	8.50

Barrier Description

Type:	STONE MASONRY WITHOUT CONCRETE CORE WALL	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	46
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	24	**Width (In.):**	26.7	**Post Spacing (In.):**	0.0
Height (In.):	24.2	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Correct alignment and height. No deviations.
	Breaking and Cracking:	None observed.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	None observed. There are small voids in back side of barrier; recommend monitoring.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-5.662-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	8.50

Repair Recommendations

Repair Action:	MONITOR	**FMSS Work Type:**	N/A	**Repair Cost:**	$0
Brief Workorder:	Monitor voids caused by erosion on back side of barrier.				
Workorder:					

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_5.662_R_1.jpg

Barrier ID:	**CRLA-0014-5.699-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	12.80

Barrier Description

Type:	STONE MASONRY CRENELLATED WITHOUT	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	STONE	**Post Material:**	N/A
Blockout Type:	N/A	**Length (ft.):**	217
Speed Limit (MPH):	35	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	18	**Width (In.):**	19.7	**Post Spacing (In.):**	0.0
Height (In.):	20.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Vertical and horizontal alignment are OK. The height of the barrier is within 3-in of the design height of 18-in.
	Breaking and Cracking:	Mortar cracked in 1/4-in gaps along 20-ft of the backside of barrier.
	Missing Elements:	None observed.
	Corrrosion and Weathering:	Some erosion on backside foundation; not affecting stability but should be monitored.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0014-5.699-R**		
Route Name:	WEST RIM DRIVE		
Inspection Date:	07/16/2010	**Barrier Rating:**	12.80

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$2244
Brief Workorder:	Install structural concrete to fix erosion under part of barrier and repoint 20 l.f. of barrier.				
Workorder:	Re-Point Masonry Barrier at $140- per -Sq. Yd. for 4 SY = $560. [(20ft) x (20/12)]/9 = 3.7 sq yd. Round to 4 S.Y. Structural Concrete at $1000- per -Cu. Yd. for 1 CY = $1000. Structural concrete is used to fix erosion problem. Labor at $60- per -Hour for 8 Hrs = $480. 8 hrs labor to install structural concrete. No traffic control required since barrier is in pullout.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0014: WEST RIM DRIVE

Barrier Condition Photos

CRLA_0014_5.699_R_1.jpg

Barrier ID:	**CRLA-0904-0.000-P1**		
Route Name:	THE CORRALS		
Inspection Date:	07/17/2010	**Barrier Rating:**	0.00

Barrier Description

Type:	OTHER: LOG RAIL ON STONE POSTS	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	LOG/TIMBER/WOOD	**Post Material:**	OTHER: STONE
Blockout Type:	N/A	**Length (ft.):**	150
Speed Limit (MPH):	20	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-1	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	24	**Width (In.):**	18.0	**Post Spacing (In.):**	144.0
Height (In.):	24.5	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	No problem or deterioration with the vertical or horizontal alignments. Barrier height varied between 24 and 25-in. Since no standard could be found three typical sections were measured to determine that a indesign height" of 24-in was used.
	Breaking and Cracking:	One stone in one pad is lose and needs to be regrouted. No other cracking or breaking observed.
	Missing Elements:	No missing elements. Some nuts were only placed on the bolts and never tightened and several bolts were lose.
	Corrrosion and Weathering:	Log rail new; no weathering. Stone beds are older but showed no signs of corrosion or weathering.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0904-0.000-P1**		
Route Name:	THE CORRALS		
Inspection Date:	07/17/2010	**Barrier Rating:**	0.00

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$902
Brief Workorder:	Repoint masonry support for log rail barrier and tighten bolts				
Workorder:	Re-Point Masonry Barrier at $140- per -Sq. Yd. for 5 SY = $700. [(18/12) x (3)]/9 = 4.5 SY. Round to 5 SY. Labor at $60- per -Hour for 2 Hrs = $120. Labor hrs to tighten bolts on barrier.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0904: THE CORRALS

Barrier Condition Photos

CRLA_0904_0.000_P1_1.jpg

Barrier ID:	**CRLA-0904-0.000-P2**		
Route Name:	THE CORRALS		
Inspection Date:	07/17/2010	**Barrier Rating:**	0.00

Barrier Description

Type:	OTHER: LOG RAIL ON STONE POSTS	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	LOG/TIMBER/WOOD	**Post Material:**	OTHER: STONE
Blockout Type:	N/A	**Length (ft.):**	22
Speed Limit (MPH):	20	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-1	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	24	**Width (In.):**	18.0	**Post Spacing (In.):**	120.0
Height (In.):	24.0	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Rail newly installed. Stone pads are stable. No deviation in horizontal or vertical alignments. Height was at assumed 24-in design height.
	Breaking and Cracking:	None observed.
	Missing Elements:	Most bolts securing log to stone pads are loose; need to be tightened.
	Corrrosion and Weathering:	None observed.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0904-0.000-P2**		
Route Name:	THE CORRALS		
Inspection Date:	07/17/2010	**Barrier Rating:**	0.00

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$198
Brief Workorder:	Tighten bolts on log barrier				
Workorder:	Labor at $60- per -Hour for 3 Hrs = $180. 3 hrs labor to tighten all bolts				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0904: THE CORRALS

Barrier Condition Photos

CRLA_0904_0.000_P2_1.jpg

Barrier ID:	**CRLA-0909-0.000-P1**		
Route Name:	PUMICE DESERT		
Inspection Date:	07/19/2010	**Barrier Rating:**	15.80

Barrier Description

Type:	OTHER: TIMBER RAIL ON TIMBER POSTS	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	LOG/TIMBER/WOOD	**Post Material:**	WOOD
Blockout Type:	N/A	**Length (ft.):**	272
Speed Limit (MPH):	45	**Placement with Respect to Road:**	NON-TRAFFIC BARRIER
Hazard Behind Barrier:	N/A		

Barrier Crashworthiness

Appropriate Test Level:	TL-2	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	15	**Width (In.):**	0.0	**Post Spacing (In.):**	96.0
Height (In.):	12.3	**Lateral Offset (In.):**	0.0	**Road Grade (%):**	0.00

Physical Condition

Barrier	**Alignment and Height:**	Posts are plumb but not at a consistent height. The rails are set 4-in below the top of the posts making the height of the barrier vary from 1 to 6-in below the assumed design height of 15-in.
	Breaking and Cracking:	Rails and posts are cracked. Two rails broken into two separate pieces. The posts have minor cracking 1/8 to 1/4-in wide and 4-in long.
	Missing Elements:	50-percent of bolt hardware is loose. Barrier is missing bolts and washers.
	Corrrosion and Weathering:	The rails show weathering of wood drying and cracking. The posts show minor weathering.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0909-0.000-P1**		
Route Name:	PUMICE DESERT		
Inspection Date:	07/19/2010	**Barrier Rating:**	15.80

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$5258
Brief Workorder:	Replace 160 l.f. of broken or cracked wooden rail.				
Workorder:	Replace Rail at $25- per -Lin. Ft. for 160 LF = $4000. Replace 160-ft of broken and cracked rail. Labor at $60- per -Hour for 8 Hrs = $480. 8-hrs labor to tighten bolts and replace missing hardware. Base Course at $75- per -Cu. Yd. for 4 CY = $300. [(150-ft) x (3-ft) x (3-in/12-in)] / 27 = 4.16 CY. Round to 4 C.Y. No traffic control required since barrier is in pullout.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0909: PUMICE DESERT

Barrier Condition Photos

CRLA_0909_0.000_P1_1.jpg

Barrier ID:	**CRLA-0916-0.000-P1**		
Route Name:	ANNIE FALLS PICNIC AREA		
Inspection Date:	07/18/2010	**Barrier Rating:**	43.90

Barrier Description

Type:	W-BEAM WEAK POST	**Barrier Function:**	NON-TRAFFIC
Barrier Material:	OTHER: STEEL	**Post Material:**	WOOD
Blockout Type:	N/A	**Length (ft.):**	140
Speed Limit (MPH):	25	**Placement with Respect to Road:**	OUTSIDE OF CURVE
Hazard Behind Barrier:	EXTREME		

Barrier Crashworthiness

Appropriate Test Level:	TL-1	**Barrier Test Level:**	N/A	**Is Barrier Crashworthy?:**	N/A
Beg. End Trtmt Type:	NONE	**Is Beg. End Trtmt Crashhworthy?:**	N/A	**Approach Transition Type:**	NONE
Ending End Trtmt Type:	NONE	**Ending End Trtmt Crashhworthy?:**	N/A		

Average Measurements

Design Height (In.):	27	**Width (In.):**	0.0	**Post Spacing (In.):**	150.0
Height (In.):	19.2	**Lateral Offset (In.):**	28.7	**Road Grade (%):**	4.40

Physical Condition

Barrier	**Alignment and Height:**	Rail has slipped to ground for 70-ft of 140-ft run. Wood posts are too short to keep rail a design height (27-in).
	Breaking and Cracking:	Woods posts are cracked.
	Missing Elements:	Several missing bolts.
	Corrrosion and Weathering:	Rail is corroded.
End Treatments	**Alignment and Height:**	
	Breaking and Cracking:	
	Missing Elements:	
	Corrrosion and Weathering:	

Barrier ID:	**CRLA-0916-0.000-P1**		
Route Name:	ANNIE FALLS PICNIC AREA		
Inspection Date:	07/18/2010	**Barrier Rating:**	43.90

Repair Recommendations

Repair Action:	REPAIR	**FMSS Work Type:**	DEFERRED MAINTENANCE	**Repair Cost:**	$14025
Brief Workorder:	Remove 140 l.f. of barrier (entire run) and replace with new W-beam and new end terminals.				
Workorder:	Remove Guardrail at $10- per -Lin. Ft. for 140 LF = $1400. Remove 140-ft of barrier (entire run). W-beam tangent 350 compliant at $3500- per -Each for 2 Unit(s) = $7000. Install two tangent end terminals. W-Beam Strong Post at $35- per -Lin. Ft. for 40 LF = $1400. Install 40-ft of W-beam strong post. Low Speed Traffic Control at $1475- per -Day for 2 Day(s) = $2950. Two days to complete all work.				

2008 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Crater Lake National Park

ROUTE 0916: ANNIE FALLS PICNIC AREA

Barrier Condition Photos

CRLA_0916_0.000_P1_1.jpg

Appendix A
Summary of GIP Definitions and Assessment

Crater Lake National Park

Federal Lands Highway
Road Inventory Program

Appendix A:
Guardwall/Rail Inventory Program (GIP)
EXPLANATION OF REPORT TERMS

The Guardwall/rail Inventory Program (GIP) was commissioned by WASO to identify deferred maintenance related to barriers in National Parks that have more than one mile of guardwall or guardrail. GIP was designed jointly by the NPS and FHWA and the inventory process records both static characteristics of the barrier (e.g., length, height, etc.) as well as dynamic information about the condition of the barrier.

Barriers that traverse bridges are not included in this inventory, these barriers are covered in FHWA's Bridge Inventory Program (BIP); however, barriers that are approaches to bridges were part of this inventory.

The following discussion highlights each of the elements found in the reports.

Static Barrier Characteristics

BARRIER TYPE

Refers to both the design and the construction materials used:

- W-Beam, Strong Post
- W-Beam, Weak Post
- Thrie Beam/Modified Thrie Beam
- Box Beam
- Steel-Backed Timber, w/ Blockout
- Steel-Backed Timber, w/o Blockout
- Steel-Backed Log Rail
- High Tension Cable
- Three-Strand Cable
- Stone Masonry, w/o Concrete Core Wall
- Stone Masonry, w/ Concrete Core Wall
- Random Rubble Cavity Wall
- Concrete Barrier
- Concrete, with Simulated Stone Face
- W-Beam (Double Face), Strong Post
- Steel-Backed Timber (Double Face)
- Other: *Completed by field crew*

BARRIER MATERIAL

The type of material of which the barrier is composed:

- Cable
- Concrete
- Galvanized Steel
- Log/Timber/Wood
- Steel-Backed Timber/Log
- Weathering Steel/Corten
- Stone
- Other: *Completed by field crew*

LENGTH

The longitudinal distance between the beginning and end of the barrier. It should include the length of end treatments in the overall length of the barrier. For roadside barriers, this can be calculated from the start and end locations.

BARRIER FUNCTION: Traffic or Non-Traffic Barrier.
Due to the different GIP assessment criteria of barriers based on their intended use, barriers were classified as being either traffic barriers or non-traffic barriers.

> *Traffic barriers* are physical devices intended to keep vehicles or people from straying into dangerous or off-limits areas. For the purpose of this inventory and assessment, a traffic barrier is categorized as roadside hardware placed longitudinally, excluding pedestrian railing and fencing.
>
> *Non-traffic barriers* provide a physical delineation between public access areas and restricted or protected areas in locations such as a parking lot, viewpoint or turnout. Non-traffic barriers which inhibit access of vehicles are included in this report; non-traffic barriers which only inhibit access of pedestrians or bicyclists are not included. For the purpose of this inventory, non-traffic barriers are guidewalls and guiderails. Note: rocks, stones, boulders, fences or curbs were excluded from this inventory.

There are instances in parks where a single barrier can switch between being classified as a traffic barrier and a non-traffic barrier. Such instances typically occur at pullouts, where a traffic barrier along the road will continue through the pullout without interruption. In such instances, the traffic barrier and non-traffic barrier were assessed using different criteria. Due to the different criteria, the GIP database was designed to record the traffic barrier and non-traffic barrier as two distinct barriers, even though to the eye, they appear as one barrier. Other instances where a single barrier is split into multiple barriers would be when the barrier is placed continuously along two legs of an intersection, so that one portion of the barrier may be on one road and the remaining portion of the barrier is on a different road.

POST MATERIAL
The type or material that the barrier's supporting posts are made of:

- Galvanized Steel
- Wood
- Corten
- Other: *Completed by field crew*
- N/A

BLOCKOUT TYPE

The type of blockout or of what it is comprised:

- Wood
- Plastic
- Steel
- N/A

BARRIER PLACEMENT WITH RESPECT TO ROADWAY
To identify the roadway alignment the barrier is located upon:

- Tangent
- Inside of Curve
- Both Inside and Outside of Curve
- Outside of Curve

POSTED SPEED LIMIT
The posted speed limit of the roadway section.

HAZARD BEHIND BARRIER

A qualitative description of the severity of the hazard behind the barrier:

- Low
- Medium
- High
- Extreme

APPROPRIATE TEST LEVEL (TL) FOR ROAD

Based on the posted speed limit, the NCHRP 350 Crashworthiness test level appropriate for the roadway.

- TL-1, 30 mph and lower
- TL-2, 35-45 mph
- TL-3, 50 mph and higher

BARRIER TEST LEVEL (TL)

A traffic barrier is crashworthy if it was successfully crash tested under *NCHRP Report 350* at speeds along the park road or parkway or if it was accepted through analysis by FHWA, based on similarity to other crashworthy critical design element features. Non-traffic barriers are classified at N/A.

- TL-1
- TL-2
- TL-3
- No
- N/A – Non-Traffic Barrier

IS BARRIER CRASHWORTHY

This compared the appropriate crashworthy test level required for the posted speed limit to the barrier's test level.

- Yes
- No

BEGINNING END TREATMENT TYPE

An end treatment is safety hardware that mitigates impacts to the ends of a barrier. Most common end treatments are for w-beam systems. Note that stonemasonry barriers typically do not have end treatments.

The beginning end treatment is based on the travel lane closest to the barrier. A vehicle traveling in the lane closest to the barrier will encounter the barrier's beginning end treatment first. It is not based on the RIP primary direction. Identifies the barrier's beginning end treatment type:

- W-Beam Flared 350 Compliant
- W-Beam Tangent 350 Complaint
- W-Beam Buried End
- W-Beam Trailing End/CRG
- W-Beam BCT, Flared
- W-Beam, Turn Down
- SBT/Log, Flared
- SBT/Log, Buried
- Median Treatments
- Box Beam
- Cable
- Crash Cushions/Attenuator
- Other: *Completed by field crew*
- None

IS BEGINNING END TREATMENT CRASHWORTHY

Identifies if the barrier's beginning end treatment (based on direction of travel for the travel lane closest to barrier) is crashworthy, based on NCHRP-350.

- Yes
- No
- N/A

APPROACH TRANSITION TYPE

A transition is safety hardware designed to be placed between two different types of barrier. Most common transition types are between bridge rail and w-beam systems.

This identifies the barrier's transition type:

- Bridge Rail, W-Beam
- Bridge Rail, SBT
- Rigid W-Beam, W-Beam
- Rigid SBT (Wall), SBT
- Concrete/Masonry, W-Beam
- Concrete/Masonry, SBT
- Concrete/Masonry, Thrie Beam
- Other: *Completed by field crew*
- None

ENDING END TREATMENT TYPE

The ending end treatment is based on the travel lane closest to the barrier. A vehicle traveling in the lane closest to the barrier will encounter the barrier's ending end treatment last, after passing the rest of the barrier. It is not based on the RIP primary direction. Identifies the barrier's ending end treatment type:

- W-Beam Flared 350 Compliant
- W-Beam Tangent 350 Complaint
- W-Beam Buried End
- W-Beam Trailing End/CRG
- W-Beam BCT, Flared
- W-Beam, Turn Down
- SBT/Log, Flared
- SBT/Log, Buried
- Median Treatments
- Box Beam
- Cable
- Crash Cushions/Attenuator
- Other: *Completed by field crew*
- None

IS ENDING END TREATMENT CRASHWORTHY

Identifies if the barrier's ending end treatment (based on direction of travel for the travel lane closest to barrier) is crashworthy, based on NCHRP-350.

- Yes
- No
- N/A

BARRIER DESIGN HEIGHT

Identifies the barrier's original "as-built" design height:

- 27-in, W-beam, Steel-Backed Timber, Stone Masonry w/ Concrete Core Wall
- 24-in, Stone Masonry w/o Concrete Core Wall, Log on Log
- 20-in, Timber on Wood Posts, Timber on Concrete Posts, Timber on Granite Posts
- 18/24-in, Crenellated Stone Masonry Barrier
- 18/24-in, Dry Stack Stone Wall
- 31-in, Steel-Backed Log
- 32-in, Jersey Barrier

AVERAGE MEASUREMENTS

Minimum of three measurements taken on each barrier.

First measurement approximately 50-ft from the beginning of the barrier, measured from the extreme ends of the barrier's end treatment/transition. Do not take a measurement along the end treatment
Measure and record measurement every 200-ft thereafter for the run of barrier

Last measurement approximately 50-ft from the end of the barrier. Do not take a measurement along the end treatment
If a barrier is less than 300-ft, even say 45-ft, a minimum of three measurements were still taken.

AVERAGE WIDTH

The width of the barrier. Only recorded for guardwalls; not guardrail.

AVERAGE POST SPACING

The spacing of the barrier's (not the end treatments') posts. Only recorded for guardrails; not guardwalls or non-traffic barriers.

AVERAGE BARRIER HEIGHT

The average barrier height. If the barrier has crenellations, the height is measured in the non-crenellated sections of the barrier. If the average lateral offset is less than or equal to 4-ft, average barrier height is measured from the roadway; if the average lateral offset is greater than 4-ft, average barrier height is measured at the barrier face.

AVERAGE LATERAL OFFSET

Determine the average distance between the barrier and the edge of roadway. If a white edgeline is present on the roadway, average lateral offset is measured from the outside edge of the white line to the barrier face. If no white edgeline is present, average lateral offset is measured from the edge of pavement to the barrier face.

AVERAGE ROAD GRADE and UPHILL OR DOWNHILL

Determine an average roadway grade at each barrier location, based on the direction of travel in the lane closest to the barrier.

DYNAMIC BARRIER CHARACTERISTICS – CONDITION ASSESSMENT NARRATIVES

Field crews were directed to write a narrative of the barrier's physical condition. To keep consistency between field crews, all narratives were based on severity and distress criteria, which were developed jointly by the NPS and FHWA. Condition assessments were based on barrier type and can be found directly after this description of report elements.

BARRIER ALIGNMENT/HEIGHT

Narrative completed by field crew describing the barrier's alignment and height. Height comments are based on the barrier's original "as-built" design height.

BARRIER BREAKING/CRACKING

Narrative completed by field crew describing any barrier breaking or cracking found during the inspection.

BARRIER MISSING ELEMENTS

Narrative completed by field crew describing any barrier missing elements encountered during the inspection.

BARRIER CORROSION/WEATHERING

Narrative completed by field crew describing and corrosion or weathering issues associated with the barrier.

END TREATMENTS ALIGNMENT/HEIGHT

Narrative completed by field crew describing the barrier end treatment's alignment and height, when present. Height comments are based on the end treatment's original "as-built" design height.

END TREATMENTS BREAKING/CRACKING

Narrative completed by field crew describing any barrier end treatment's breaking or cracking found during the inspection.

END TREATMENTS MISSING ELEMENTS

Narrative completed by field crew describing any barrier end treatment missing elements encountered during the inspection.

END TREATMENTS CORROSION/WEATHERING

Narrative completed by field crew describing and corrosion or weathering issues associated with the barrier's end treatments.

BARRIER PHOTOGRAPHS

During the inspection, the field crews photographed the beginning end (based on the closest lane's direction of travel) of each barrier. Additional photographs were taken of any unusual deficiencies encountered. Up to two photographs of the barrier are included in this report.

CONDITION AND SEVERITY DISTRESS TABLES

Due to the extreme number of possible conditions of the barrier, transition and end treatment, the following descriptions and matrices are guidelines created to help classify the condition of the element. While the distinction between good and fair is needed, the distinction between fair and poor is much more important since this is the threshold that defines if the element is slightly compromised or is not functional.

In all likelihood, according to these guidelines different portions of an element (most likely a barrier) may be classified differently; however, a single classification will need to be provided for the element. The survey team will use their professional judgment to determine this single classification. The single classification of each element should be considered an index value that provides a general indicator of overall performance, but not necessarily indicate that a specific treatment is warranted. The specific work order that is prepared based on the observed deficiencies will be a much more definitive indicator of the appropriate treatment based on existing distresses. The overall condition will be used as part of the risk assessment tool to evaluate the risk to driver safety associated with the physical condition of the barrier.

GOOD

The barrier performs as intended. The barrier is in fairly straight alignment but may have some small amount that is slightly out of alignment. While the height of the barrier may vary over its run, the height is relatively consistent and is close to its original "as-built" design height. Minor cracks may be visually observed on some the posts, though these cracks are neither long nor deep and the only hardware missing are isolated nuts and bolts. Minor surface corrosion on small portions of the surface is visible but there is no decay associated with connections.

The end treatment performs as intended. The end treatment is in good alignment and tension is acceptable. While the end treatment may exhibit some dents, there are no cracked rails, posts, blocks or any missing elements. Corrosion and erosion, while present, are at a minimum.

In general, all distresses observed, either in isolation or in combination, do not seriously affect the ability of the element to serve the intended functions of protecting drivers from a roadside hazard and/or contributing to the cultural value of the roadway corridor. Keep in mind that "intended function" is a relative term. In many cases, older designs were "intended" to protect drivers but would not be considered fully functional in that regard by today's standards.

FAIR

The barrier is slightly compromised. The barrier is noticeably out of alignment and the height along the run of barrier varies considerably. Cracks and broken elements are visible from the roadside. The barrier may be missing elements, such as nuts, bolts, blockouts or even a post. Surface corrosion is visible on a fair amount of the barrier but connections will still provide element interlock. Decay and minor erosion, while not always visible, may begin to reduce element strength and individual post stability.

The end treatment is slightly compromised. The end treatment may be somewhat out of alignment, have low cable anchor tension or isolated broken or cracked rail, posts or blocks. Corrosion and erosion are evident.

In general, the distresses observed, either in isolation or combination, may generate unpredictable outcomes related to the functions of the element stated above.

POOR

The barrier is not functional. The barrier will not function as intended. Any of the following could mean that the barrier is in poor condition: The barrier has fallen out of alignment or its height varies greatly from the designed height. Cracks and broken elements are visible from the roadside. The barrier is missing several elements, such as nuts, bolts, blockouts or consecutive posts. Corrosion, causing structural compromise is significant and obvious. Erosion around posts will reduce the barrier's strength and capacity.

The end treatment is not functional. The end treatment does not function as intended. There is no tension in the cable anchor. A significant portion of the end treatment has broken, cracked or dented elements. Elements are missing and corrosion or erosion is significant.

In general, the distresses observed clearly illustrate the inability of the element to perform the intended functions.

CONDITION AND SEVERITY DISTRESS TABLES – BARRIERS

Condition and Severity Distress Table for Semi-Rigid Barriers (including barriers with posts, rail elements and blocks).

	GOOD	FAIR	POOR
Alignment/Design Height			
	• Alignment off by less than 6”	• Alignment off by 6”-12”	• Alignment off by more than 12”
	• Within 1” of ***design height***	• Less than 3” lower than ***design height***	• Greater than 3” lower than ***design height***
Breaking/Cracking, an member, post or rail – due to impact loading			
	• Metal – no twisting/bending, tears or cracking	• Metal – no cracking or tearing (but minor twisting/bending is ok)	• Metal – any cracks or tears
	• Wood – no impact related cracking	• Wood – maybe cracked but retains original cross section	• Wood – cracks or tears that deform original section
	• Isolated broken blocks	• Two Consecutive broken blocks	• Consecutive broken blocks (three or more consecutive)
Missing Elements			
	• No bolts and nuts missing	• One or two bolt/nut missing at one rail/rail connection	• Three or more bolts/nuts missing at one rail/rail connection
	• n/a	• Two consecutive missing blocks	• Three or more consecutive missing blocks
	• n/a	• n/a	• One missing rail element or post
Corrosion/Decay/Weathering, all posts, rails and blocks – due to aging			
	• Loss of 5% or less of cross section	• Loss of 5% to 50% of cross section	• Loss of 50% or more of cross section
	• Erosion (less than 8” of post exposed below original groundline)	• Erosion around posts (8” or more of post exposed below original groundline) for one	• Erosion around consecutive posts (more than 8” of post exposed below original groundline)

Condition and Severity Distress Table for Rigid Concrete Barriers (including pre-cast).

	GOOD	FAIR	POOR
Alignment/Design Height			
	• Alignment off by less than 6”	• Alignment off by 6”-12”	• Alignment off by more than 12”
	• Within 1” of *design height*	• Less than 3” lower than *design height*	• Greater than 3” lower than *design height*
Breaking/Cracking– due to impact loading			
	• Minor cracks (less than ¼”) present	• Cracking present ¼” or greater but no displacement or discontinuity in face	• Barrier displaced and/or discontinuous
	• n/a	• Pieces broken from barrier 3” deep or less without exposing rebar	• Cracking exposes rebar
	• n/a	• n/a	• Pieces broken from face greater than 3” deep
Missing Elements			
	• n/a	• n/a	• n/a
Corrosion/Decay/Weathering – due to aging			
	• Surface corrosion on less than 5% of the run	• Surface corrosion on between 5-25% of the run	• Surface corrosion on more than 25% of the run
	• n/a	• Spalling 3” deep or less without exposing rebar	• Spalling greater than 3” deep
	• Erosion (less than 8” below groundline) around base	• Erosion (8” or more below groundline) around base	• Erosion (8” or more below groundline)
	• n/a	• Less than 50% undermined (less than half barrier width)	• 50% or more undermined (less than half barrier width)

Condition and Severity Distress Table for Rigid Stone/Masonry Barriers (including all types of stone or masonry barriers).

	GOOD	FAIR	POOR
Alignment/Design Height			
	• Alignment (off by less than 6”)	• Alignment (off by 6”-12”)	• Alignment (off by more than 12”)
	• Within 3” of *design height*	• Between 3.1 - 6” lower than *design height*	• Greater than 6.1” lower than *design height*
Breaking/Cracking – due to impact loading			
	• Minor cracks (less than ¼”) present	• Cracks, less than ½” present	• Cracks greater than ½” present
		• Stones broken/displaced extending less than 1/3 of width of barrier	• Stones broken/displaced extending 1/3 width or more through the barrier
Missing Elements			
	• n/a	• n/a	• n/a
Corrosion/Decay/Weathering – due to aging			
	• Cracks in mortar joints 1/4” or less and/or single loose or missing stones	• Mortar joints deteriorated resulting in two - three loose or missing adjacent stones (without impact)	• Mortar joints deteriorated resulting in more than three continuous/adjacent loose or missing stones (without impact)
	• Erosion (less than 8” below groundline) around base	• Erosion (8” or more below groundline) around base	• Erosion (8” or more below groundline)
	• n/a	• Less than 50% undermined (less than half barrier width)	• 50% or more undermined (less than half barrier width)

Condition and Severity Distress Table for Flexible Barriers, (including cable barriers and weak-post systems designed without blocks).

	GOOD	FAIR	POOR
Alignment/Tension/Design Height			
	• No bent posts	• Bent posts; one to three consecutive posts	• Bent posts; four or more consecutive posts
	• Cable has tension	• Cable under-tensioned/sagging	• No cable tension
	• Less than 1” too low	• 1-3” too low	• Greater than 3” too low
Breaking/Cracking			
	• No cracked or broken posts	• One to three isolated broken posts	• Four or more consecutive broken posts
	• n/a	• Cable frayed	• Cable broken or severed
Missing Elements			
	• No bolts and nuts missing at anchors	• n/a	• Bolts and nuts missing or loose at anchors
	• n/a	• n/a	• Any missing posts or cable for any length of run
Corrosion/Decay/Weathering – due to aging			
	• Loss of 5% or less of cable cross section	• Loss of 5% to 15% of cable cross section	• Loss of 15% or more of cross section
	• Erosion (less than 8” of post exposed below original groundline)	• Erosion around one post (8” or more of post exposed below original groundline)	• Erosion around consecutive posts (more than 8” of post exposed below original groundline)

CONDITION AND SEVERITY DISTRESS TABLES – END TREATMENTS

Condition and Severity Distress Table for Flexible End Treatments, (including cable end terminals).

	GOOD	FAIR	POOR
Alignment/Tension			
	• Alignment off by less than 4”	• Alignment off by 4”-8”	• Alignment off by more than 8”
	• Adequate cable tension	• Low cable anchor tension	• No cable anchor tension
Breaking/Cracking – due to impact loading			
	• No broken or cracked elements	• Minor cable fraying but still with adequate tension	• Broken or cracked cables or posts
	• No damage to posts, cable or anchor	• Slight damage to posts without cracking or tearing (*but minor twisting/bending on isolated posts is OK)*	• Cable broken or severed on any cable
Missing Elements			
	• No bolts and nuts missing at anchors; No missing cables	• n/a	• Any missing element (post, cable, bolts, nuts, or anchor)
Corrosion/Decay/Weathering – due to aging			
	• Loss of 5% or less of cable cross section	• Loss of 5% to 15% of cable cross section	• Loss of 15% or more of cross section
	• Connections weathered but still provide element interlock on less than 5% of the end treatment	• Connections weathered but still provide element interlock on between 5% to 15% of the end treatment	• Connections weathered but still provide element interlock on more than 15% of the end treatment

Condition and Severity Distress Table for Semi-Rigid End Treatments, including Flared and Tangent

	GOOD	FAIR	POOR
Alignment/Tension			
	• Alignment of flares and offsets off by less than 4”	• Alignment of flares and offsets off by 4”-8”	• Alignment of flares and offsets off by more than 8”
	• Within 1” of *design height*	• Less than 3” lower than *design height*	• Greater than 3” lower than *design height*
For *Aesthetic Barriers* (i.e. – SBT and SBL guardrail) that do not have crashworthy terminals:	• Approach barrier terminals are buried, anchored, and flared away from the travel lane	• Approach barrier terminals are buried, anchored, and flared away from the travel lane	• Approach barrier ends are NOT buried, anchored, nor flared away from the travel lane
Breaking/Cracking – due to impact loading			
	• Metal – no twisting/bending, tears or cracking	• Metal – no cracking or tearing (but minor twisting or bending is ok)	• Metal – any cracks or tears
	• Wood – no impact related cracking	• Wood – maybe cracked but retains original cross section	• Wood – cracks or tears that deform original section
	• No broken blocks	• One broken block	• Two consecutive broken blocks
Missing Elements			
	• No missing elements, including breakaway cables and struts	• Isolated bolts, nuts, or blocks loose on non-consecutive posts	• Any missing element, including blocks, rails, posts cables, or struts
	• No bolts, nuts, or blocks missing or loose	• Breakaway strut present but vertical height off by more than 2”	• Missing nuts / bolts on consecutive posts
Corrosion/Decay/Weathering – due to aging			
	• Surface corrosion / decay / connections weathered with a loss of 5% or less of cross section of interlocking elements	• Surface corrosion / decay / connections weathered with between 5-25% loss of cross section along transition interlocking elements	• Surface corrosion / decay / connections weathered with more than 25% loss of cross section along transition interlocking elements
	• Erosion (less than 8” of post exposed below original groundline)	• Erosion around 1 post (8” or more of post exposed below original groundline)	• Erosion around consecutive posts (8” or more of post exposed below original groundline)

SPECIFIC RISK ELEMENTS

The potential risk to a motorist after a vehicle impacts a traffic barrier depends on the crashworthiness of the traffic barrier as well as traffic exposure factors. Variables relating to the roadside, the traffic barrier's crashworthiness and traffic data include the following:

ADT. The number of vehicles (in both directions) that travel the roadway on which the traffic barrier is located.

Barrier Crashworthy. A traffic barrier is crashworthy if it was successfully crash tested under NCHRP Report 350 at speeds along the park road or parkway or if it was accepted through analysis by FHWA, based on similarity to other crashworthy critical design element features. If crashworthy, the appropriate test level also needs to be recorded. For crashworthy barriers, the barrier test level will be compared to the test level appropriate for the roadway (based solely on posted speed limit). The intent is to record situations in which a crashworthy barrier of a lower test level is installed on a roadway which should have a barrier of a higher test level.

Barrier Height. Determined from barrier height as collected in the physical condition assessment. The database will compare this value to the NCHRP test level height that is appropriate for the posted speed of the road and barrier type.

End Treatment Crashworthy. An end treatment is crashworthy if it has been successfully crash tested. This is for the approach end treatment, which is defined as the end treatment which a vehicle will first pass when traveling on the same side of the road as the barrier.

Existing Roadway Features. The list of roadway features is limited to the following, all of which have a documented history of reducing the number of crashes, and are found later in the GIP as possible countermeasures.

Centerline pavement markings	Grooved pavement surface
Edgeline pavement markings	Delineators on curve and tangent
Wider centerline	Chevrons
Wider edgeline	Warning sign
Centerline rumble strips	Flashing beacon on warning sign
Shoulder rumble strips	Lighting
Barrier reflectors	Speed feedback sign

Factored Crash Rate. The average annual number of crashes (on the overall road and by barrier segment), over the last 5 years. If the road has an ADT of less than 1000, evaluate a minimum of
7 to 10 years of crash data, if available.

Lateral Offset of Barrier from Edge of Traveled Way. The distance from the edge of traveled way to the face of the barrier is useful for determining impact to asset during different types of construction. Two or three measurements will be taken – beginning, middle and end of barrier run (not including the end treatments) – and the average will be used.

Posted Speed Limit. The posted speed limit(s) of the roadway section.

Roadway Grade and Uphill or Downhill. Is refers to the grade of the roadway, in the direction of travel closest to the barrier.

Severity of the Hazard behind Barrier. A rating system based on photos will be used to rate the severity of the hazard behind the barrier. Choices include:

- Low
- Medium
- High
- Extreme

RISK ASSESSMENT AND RISK SCORE

The following table shows the variables relating to the overall roadway safety in the vicinity of barriers. In addition, the table illustrates the range of values considered for each variable and associated levels of risk. For categorization purposes, variables have been placed into one of three categories: segment, site or barrier variables. The "Associated Risk" column identifies the relative risk posed by each variable. This looks at the relative risk of the each variable itself and is only a cursory evaluation.

A Risk Score or Rating ("Barrier Rating" on Tier 3 Barrier page) was created for each barrier based on the table values. The level of risk tolerated is dependent on the category of road, which will be discussed in subsequent pages.

Once the inventory has been conducted, a total risk value can be assigned to each barrier. A comparison of the relative risk to an acceptable risk threshold will be performed in order to analyze the overall risk of a given barrier.

Variable and Associated Levels of Risk

VARIABLE	RANGE	ASSOCIATED RISK
SEGMENT VARIABLES		
ADT	0 – 1000	0.0
	1001 – 4000	2.9
	4001 – 8000	5.7
	8001 – 20,000	7.1
	20,001 and greater	8.6
Crash Factor	0	0.0
	0.1 – 5.0	4.2
	5.1 – 20.0	8.7
	20.1 – 30.0	17.1
	30.1 – 75.0	25.8
	75.1 and greater	34.2
Posted Speed Limit	15 – 25 mph	0.0
	30 – 40 mph	4.3
	45 and higher	8.6
SITE VARIABLES		
Barrier Placement w/ Respect to Roadway Geometry	Tangent	0.0
	Inside of curve	2.9
	Both inside and outside of curve	8.6
	Outside of curve	8.6
Severity of Hazard behind the Barrier	Low severity	2.6
	Medium severity	5.1
	High severity	6.9
	Extreme severity	8.6
Longitudinal Length of Barrier	1 – 250-ft	0.0
	251 – 750-ft	2.9
	751 – ft and greater	5.7
Lateral Offset of Barrier from Edge of Traveled Way	4.1 – ft and greater	0.0
	2 – 4-ft	2.9
	less than 2-ft	5.7
Roadway Grade	Uphill/level/downgrade less than 3%	0.0
	Mild downgrade (3 – 6%)	4.3
	Steep downgrade (greater than 6%)	8.6
BARRIER VARIABLES		
Actual Barrier Height (compared to test level height)	0 – 1-in lower	0.0
	1.1 – 4-in lower	4.4
	4.1 – 7-in lower	12.9
	7.1 – 12-in lower	19.4
	12.1-in and greater lower	21.5
Dynamic Barrier Condition Rating (based on design height)	0 – 25	0.0
	26 – 200	4.4
	201 – 400	8.6
	401 – 600	12.9
	601 – 800	17.1
	801 and above	21.5
Barrier Conformance with Current Crashworthiness Criteria	Yes	0.0
	No	5.7
	Maximum Total Possible Risk Score	**100**

REPLACEMENT/REPAIR STRATEGIES

Information is integrated by combining static data on barrier type, materials, dimensions, etc. with the condition and risk assessments, and the asset management roadway categories (which include cultural and historic resource considerations) to come up with actionable repair strategies for barriers. In addition, repair costs are accounted for so that estimates can be made for repair actions identified. Costed repair estimates, or work orders, then form the basis for estimating deferred maintenance associated with roadside barriers.
Repair recommendations generated by this assessment are intended to provide an estimated cost of deferred maintenance of barriers. As such, the evaluation is not rigorous and may be changed when a more detailed review and assessment at a project level is completed. In addition, any repairs or replacements that are recommended by this inventory and assessment process must be vetted through a project selection, planning and design process, including compliance with the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA).

Many park barriers are located in harsh environments where freeze-thaw cycles, avalanche impacts, surface erosion, rockfall and vehicle impacts damage them; consequently, they are showing signs of fatigue, at times serious. Whenever possible, historic barriers are repaired or rehabilitated in place so that the historic significance can be preserved; however, removal or reconstruction, which is typically the least preferred alternative, is at times necessary.

Barrier deficiencies can generally be categorized into one of two categories:

- Barriers that pose an unacceptable risk to the traveling public (as determined by the risk assessment methods described in Chapter Seven and including standards found in NCHRP Report 350), or
- Damaged barriers, due to either crash impacts, other loadings (e.g., snow / avalanche, etc) or deteriorated parts (from age / weathering).

Outside of the national park system, barriers that do not meet NCHRP Report 350 crashworthiness standards are typically removed and a barrier of a crashworthy design is constructed in its place. However given the sensitive natural and cultural environments found within the national park system, deficient barriers not meeting national crashworthiness standards may warrant no action, particularly where risk is low.

The type of repair strategy is often dependent on the barrier deficiency and its cultural context. Typically barriers that do not meet current crashworthiness criteria may be replaced while damaged or deteriorated barriers can be repaired. However, under unique situations found in certain national parks and as evaluated using the risk assessment and asset management roadway categories, some barriers that do not meet current crashworthiness criteria may warrant no action being taken for their replacement or repair.

Risk assessment and asset management roadway categories are integrated in the following table, which establishes different risk thresholds within each roadway category. In essence, a higher level of risk will be tolerated in Asset Management Roadway Category A, as demonstrated by the higher risk threshold (90), while less risk will be tolerated in Roadway Category B (70) and even less risk in Roadway Category C (50).

Asset Management Roadway Categories, Risk Thresholds and Treatment Recommendations.

ASSET MANAGEMENT ROADWAY CATEGORY	RISK THRESHOLD	PROGRAM-LEVEL TREATMENT RECOMMENDATION
A	90-100	1. Identify measures other than barrier replacement that could be taken to reduce risk (including engineering countermeasures). 2. Corrective action (including reconstruct/replacement, if necessary) needed to reduce risk below 90.
	Below 90	1. Identify measures that could be taken to reduce risk (including engineered countermeasures). 2. Identify repairs needed to improve physical condition/maintain historic integrity. 3. When condition is good and risk is acceptable, no action is necessary.
B	70-100	1. Identify measures that could be taken to reduce risk (including engineered countermeasures). 2. Corrective action (including reconstruct/replacement, if necessary) needed to reduce risk below 70.
	Below 70	1. Identify measures that could be taken to reduce risk (including engineered countermeasures). 2. Identify repairs needed to improve physical condition/maintain historic integrity. 3. When condition is good and risk is acceptable, no action is necessary.
C	50-100	1. Identify measures that could be taken to reduce risk (including engineered countermeasures). 2. Corrective action (including reconstruct/replacement, if necessary) needed to reduce risk below 50.
	Below 50	1. Identify measures that could be taken to reduce risk (including engineered countermeasures). 2. Identify repairs needed to improve physical condition/maintain historic integrity. 3. When condition is good and risk is acceptable, no action is necessary.

Fourteen engineering countermeasures have been specifically selected for use with the GIP risk assessment tool, and are show in the next table. This is an all-inclusive list of available countermeasures for the risk assessment toll; countermeasures not on the list should not be considered.

The concept of employing countermeasures is evident with barriers that have a risk score just above the risk threshold. For such barriers, installing countermeasures should reduce the future number of crashes by a given amount, based on the countermeasure. Depending on the factored crash rate, reducing the number of crashes will lower the overall risk score. Thus, barriers that were classified as “reconstruct/replace” may be able to be reclassified as “repair”.

The decision to include any of the engineering countermeasures can be done only when the risk score is over the risk threshold by three points or less. When countermeasures are employed to reduce the risk score, they must be based on engineering judgment. The GIP database will allow the user to select up to three countermeasures to reduce the risk score under the threshold, based on crash reduction factors from the FHWA publication “Desktop Reference for Crash Reduction Factors” FHWA-SA-07-015.

Proposed Countermeasures.

COUNTERMEASURE	CRASH REDUCTION FACTOR
Speed Feedback Signs	0.46
Flashing Beacons On Warning Signs	0.30
Centerline Pavement Marking	0.30
Lighting	0.25
Chevrons	0.20
Warning Signs	0.20
Barrier Reflectors	0.16
Grooved Pavement Surface	0.15
Edgeline Pavement Marking	0.12
Shoulder Rumble Strips	0.12
Delineators on Curve and Tangent	0.05
Centerline Rumble Strips	0.04
Wider Edgeline	0.02
Wider Centerline	0.02

Maintaining Barriers As Is

Individual barrier elements and roadside conditions are interrelated. Sometimes, barrier deficiencies will be obvious and the best course of action is apparent; however, in context sensitive environments barrier deficiencies may be marginal and a decision will be based on judgment.

If risk is low (as determined by the assessment of variables such as traffic speeds, volumes), it may be acceptable for an historical or culturally significant barrier that does not meet current crashworthiness standards to remain until changes in risk factors would require an upgrading.

If the maintaining barrier as is alternative is the preferred choice through this approach, low cost mitigation measures may be considered to improve safety, such as improving roadside delineation (e.g., pavement markings / rumble strip(e)s, etc.), improving visibility (e.g., advance warning signs, increased sign size, etc.), upgrading the roadway shoulder, or improving skid resistance of the road surface. Although these measures will not reduce crash severity of an errant vehicle impact, these improvements have been tried or proven to reduce the frequency or probability of a vehicle striking the barrier.

Barrier Repair

If a barrier has been damaged due to a crash or there are parts that have deteriorated due to age or weathering but the majority of the barrier meets current crashworthiness standards and is functionally sound, repairing the system can be considered a viable option. Examples of these improvements include replacing damaged timber rail, removing a corroded, weathered steel post and replacing with new, upgraded guardrail blockouts to meet standards on high speed facilities or repointing, resetting or replacing loose or missing stones on the concrete corewalls of stone masonry guardwalls. Pursuing a repair approach should be the first consideration for Roadway Category A and B road assets.

For barriers that do not meet crashworthiness criteria but are functionally sound and have been determined good candidates to be maintained as-is based on the risk assessment and application of asset management roadway categories, repair could include measures such as repointing deteriorated masonry, re-setting or replacing loose, broken or missing stones, restoring walls to their original height (by adding a concrete footing, for example), restoring or improving drainage through or under walls or restoring wall foundations. Alterations to improve safety may also be considered, such as adding or changing end treatments or other mitigation measures as mentioned above.

For historic, stone masonry barriers that have a risk score below the threshold, it is possible that portions of the barrier need to be removed and reset in order increase the height of the barrier. The following guidelines are provided to assist in determining when this should be done and to what height the barrier should be rebuilt:

1. If all or a portion of stone masonry guardwall has a deficient height based upon the Severity Description Charts, that is, at worst, within the fair category, do not raise it. (Other work besides raising the barrier can be specified.)

2. If a portion of a stone masonry guardwall has a deficiency in height based upon the Severity Description Charts, considered "poor" (assumed typically to be less than 18-in) write a work order to raise the poor segment to the height of the adjacent barrier with a non-poor height.

3. If the entire stone masonry guardwall is in poor condition due to height based upon the Severity Description Charts– write a work order to raise the entire segment to its design height (assumed typically to be 24-in).

For aesthetic barrier systems used on many park roads and parkways, there is not a sufficient bid history database for estimating costs to repair or replace individual elements of the system, such as posts or rail. Usually repair of an aesthetic barrier system, such as steel-backed timber guardrail consists of removing and resetting the post or rail section or raising the guardrail to meet standard height requirements.

Barrier Replacement/Reconstruction

If the risk analysis, including the application of asset management roadway categories, indicates the barrier poses an unacceptable safety risk, the first step should be an analysis to determine if there are mitigating measures that can be applied to reduce the risk to an acceptable level without the need to reconstruct the barrier. A second step is to determine if the barrier is needed. If it is practical to eliminate the shielded hazard (by removal, relocation or redesign) removal of the barrier should be considered. However, if the shielded hazard cannot be eliminated or if it is determined inappropriate to remove the barrier (e.g., it is historically significant and/or contributes to the historical or aesthetic significance of the associated road, district or landscape), reconstruction or replacement of the barrier to meet current criteria for crashworthiness may be the appropriate recommended treatment.

The typical reconstruction option used by the NPS for stone masonry guardwalls is to document then dismantle the existing barrier, construct a concrete core and build a stone masonry veneer around the concrete core using the original wall materials and using stone masonry designs that are compatible with the historic road, district or landscape. A number of concrete core stone masonry barrier types have been designed for use in national parks, including 18-in, 22-in, 24-in and 27-in barriers; however, not all have been crash tested or otherwise determined to meet current criteria for crashworthiness.

WORK ORDERS

Work order preparation is essentially determining and documenting the repair actions needed to correct the deficiencies observed during the condition assessment. Barriers are relatively simple structures so this determination can be made by trained inspectors. Keep in mind that this is not a design environment and that more rigorous analysis (if needed) may change the work that is actually performed. The intent of this effort is to prepare a credible estimate of deferred maintenance that may or may not be directly actionable. Simple repairs and/or those that require no compliance with environmental policies (which may be a large percentage of the work orders) can probably be executed without modification.

Once a repair strategy is determined, a cost must be developed for the proposed action. Work orders will be classified as being either deferred maintenance or capital improvement. This classification is based on the type of work recommended, as defined below.

Definition: *Deferred Maintenance* can be classified as repair or replace in kind. Work done to the barrier does not include any upgrading.

Definition: *Capital Improvement* can be classified as upgrading existing barrier. Typically the upgrade will be from a non-crashworthy to a crashworthy device. Other examples of capital improvements would be the addition of a curb to improve drainage or the inclusion of any countermeasure.

There are four types of work:

- No Action
- Monitor
- Repair
- Replace

"No Action" – if risk is low (based on the GIP risk score), a barrier that does not meet current crashworthy performance standards may be acceptable to remain until changes in risk factors would require upgrading.

"Monitor" – if risk is low (based on the GIP risk score), a barrier that does not meet current crashworthy performance standards may be acceptable to remain until changes in risk factors would require upgrading, however, if conditions exist that the park should monitor (e.g., erosion), then "monitor" can be selected as a recommended action.

"Repair" – considered when a barrier damaged by impact deteriorated due to age/weathering and the barrier is functionally sound in a low risk environment. The goal is to bring the barrier back to its "new" condition.

"Replacement/Reconstruction" – when a barrier poses an unacceptable safety risk:

1. If the risk score is less than 3 points above the risk threshold, determine if countermeasures can reduce risk so the barrier can be repaired.
2. Determine if the barrier is warranted and either shielded hazard or barrier itself can be removed (only when barrier NOT considered historically/culturally significant)

For all barrier repair/replace/reconstruction recommendations, the NPS will vet the recommendations through a project selection, planning and design process, including compliance with:

National Historic Preservation Act (NHPA)
National Environmental Policy Act (NEPA)

Aesthetic barriers are commensurate with an approved crashworthy design for the specific conditions at the barrier site as the basis for selecting a crashworthy structure. Types of barriers are generally selected based on emulating the existing types of barriers in the park.