

BRCA WIP Report

NPS Retaining Wall Inventory Program Bryce Canyon National Park



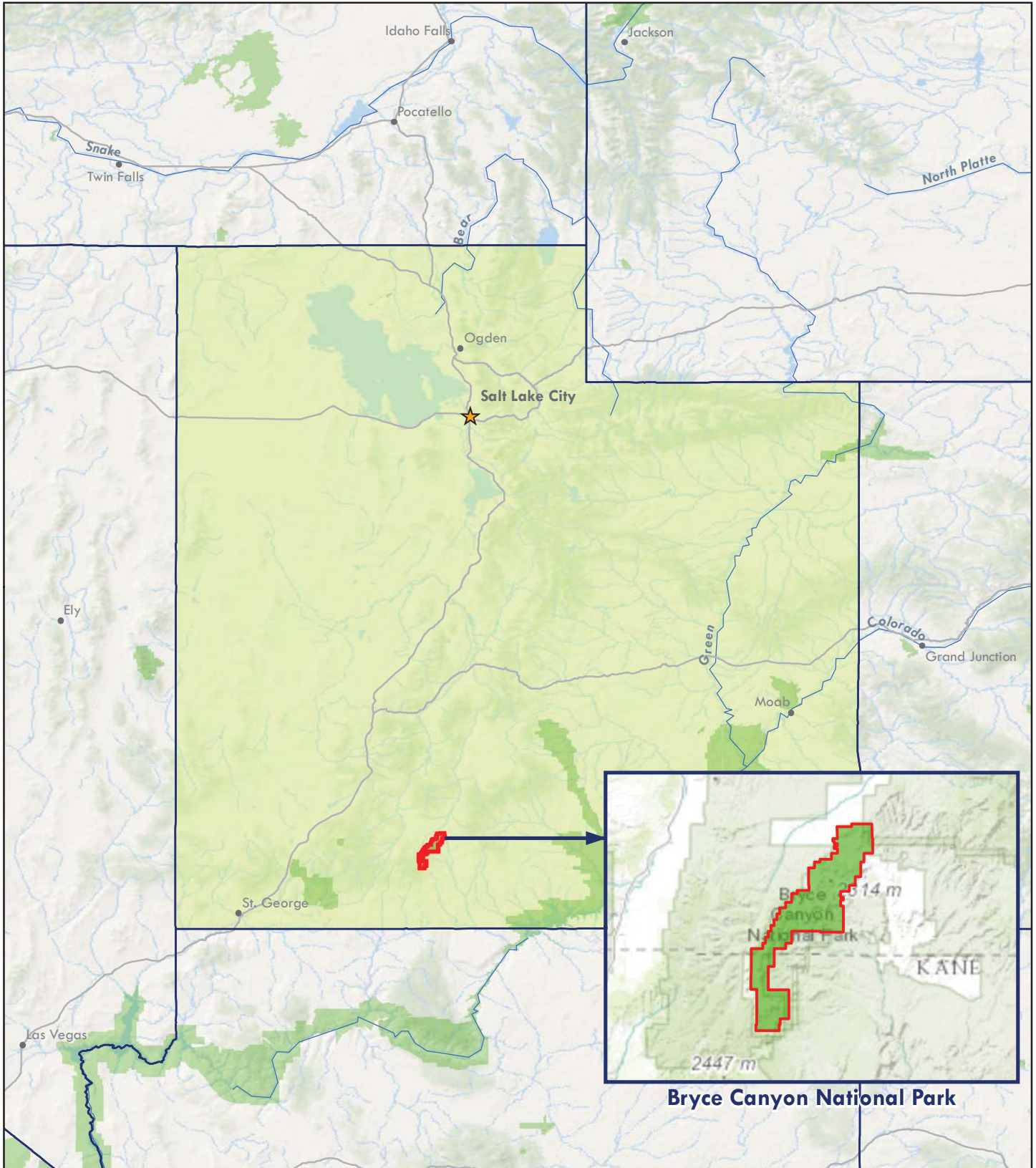
**Federal Lands Highway
Road Inventory Program**

Prepared By:

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

Data Collection Date: April 2007
Report Date: October 2015

Bryce Canyon National Park in Utah



Bryce Canyon National Park

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



Bryce Canyon National Park



**Federal Lands Highway
Road Inventory Program**

Introduction

The Federal Lands Highway Division (FLH) of the Federal Highway Administration (FHWA), in partnership with the National Park Service (NPS), has conducted a retaining wall inventory and condition assessment as part of the NPS Retaining Wall Inventory Program (WIP). This inventory provides information to the NPS Facility Management Software System (FMSS) regarding such things as type, size and location of retaining structures, as well as the condition of these facilities and consequences of failure. In addition, when wall and/or adjacent element deficiencies are identified, repair recommendations and estimated costs are also provided, suitable for use as FMSS work orders.

The main intent of this effort is to determine the backlog of needs associated with retaining wall assets – equipment features ascribed to the “parent” roadway asset. Inventory and condition assessments (pavement only) for the roads themselves are conducted under the NPS Road Inventory Program (RIP). Prior to development of the WIP, the vast majority of retaining walls were not accounted for in FMSS. Based on WIP inventory work to date, NPS wall assets are valued at well over \$400M. A second and equally important intent of this effort is to inform and improve project selection, prioritization, and development activities and processes at NPS regions/parks, FLH Division offices and the NPS Denver Service Center.

In support of WIP, a comprehensive procedures manual (available at the following link: <http://www.cflhd.gov/programs/techDevelopment/geotech/WIP/>) was developed to document the data collection and management process, wall attribute and element definitions, and team member responsibilities for conducting retaining wall inventories and condition assessments. This manual was used for nearly 3,500 wall assessments initially conducted between 2007 and 2008 within 34 national parks. WIP is supported by several key components described in the procedures manual, including a comprehensive training program for field inspectors, an Oracle-based database for long-term data management, unique data collection forms, a supporting field guide, and a wall repair/replace cost estimate guide.

Ultimately, condition assessments for retaining wall structures are expressed as deferred maintenance costs, which are then divided by current year replacement costs to arrive at a “Facility Condition Index” (FCI). Coupling this condition prioritization index with an “Asset Priority Index” (API), which measures the feature’s importance to the mission of the park, capital asset investments are made more efficiently. This approach appropriately focuses maintenance and construction priorities on value, rather than solely on cost. Wall inventory condition and cost data are transferred from the WIP database to FMSS, the primary asset documentation, management and planning platform maintained at each park. In addition, wall data are also provided to the Road Inventory Program to update equipment assets associated with the parent roadway asset.

Initial inventories were conducted based on RIP Cycle 3 data, but future planning has ensured updates to WIP will occur simultaneously with RIP. For long-term data management purposes, the WIP database will be linked to the larger, parent RIP database and be updated under the responsibility of the RIP Database Administrator.

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 wall (Tier 3). Tier 1 presents park wall location maps and an overall park-specific summary narrative of the results of the wall inventory program. Tier 2 presents route overview maps with associated wall summary information. Tier 3 presents individual wall information in a three-page detailed format, including a photograph of each wall. Appendix A provides a condensed summary of wall inventory definitions and assessment categories to assist in reading this report.

Park Retaining Wall Location Maps



Bryce Canyon National Park

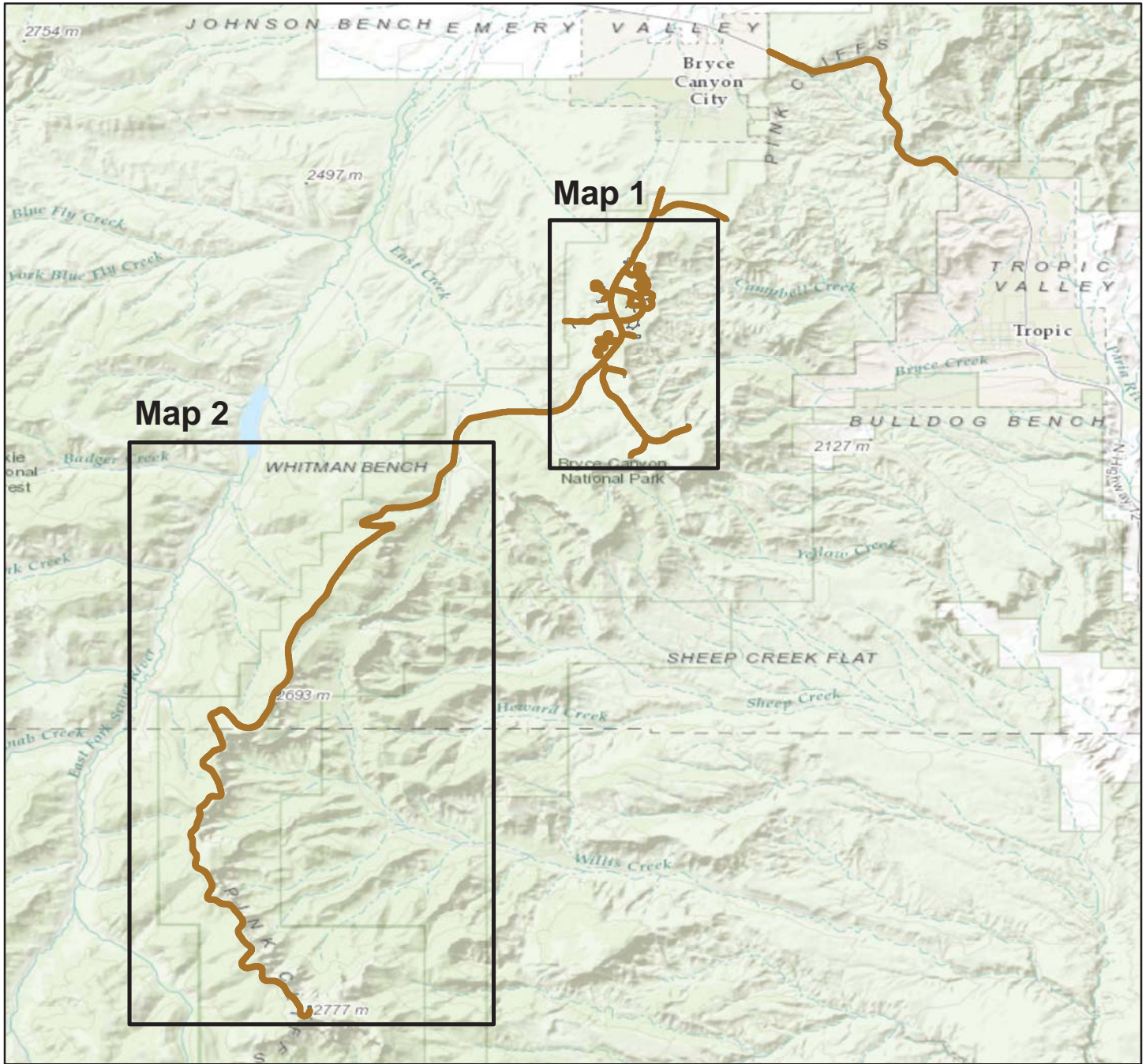


**Federal Lands Highway
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Byrce Canyon National Park

WALL 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

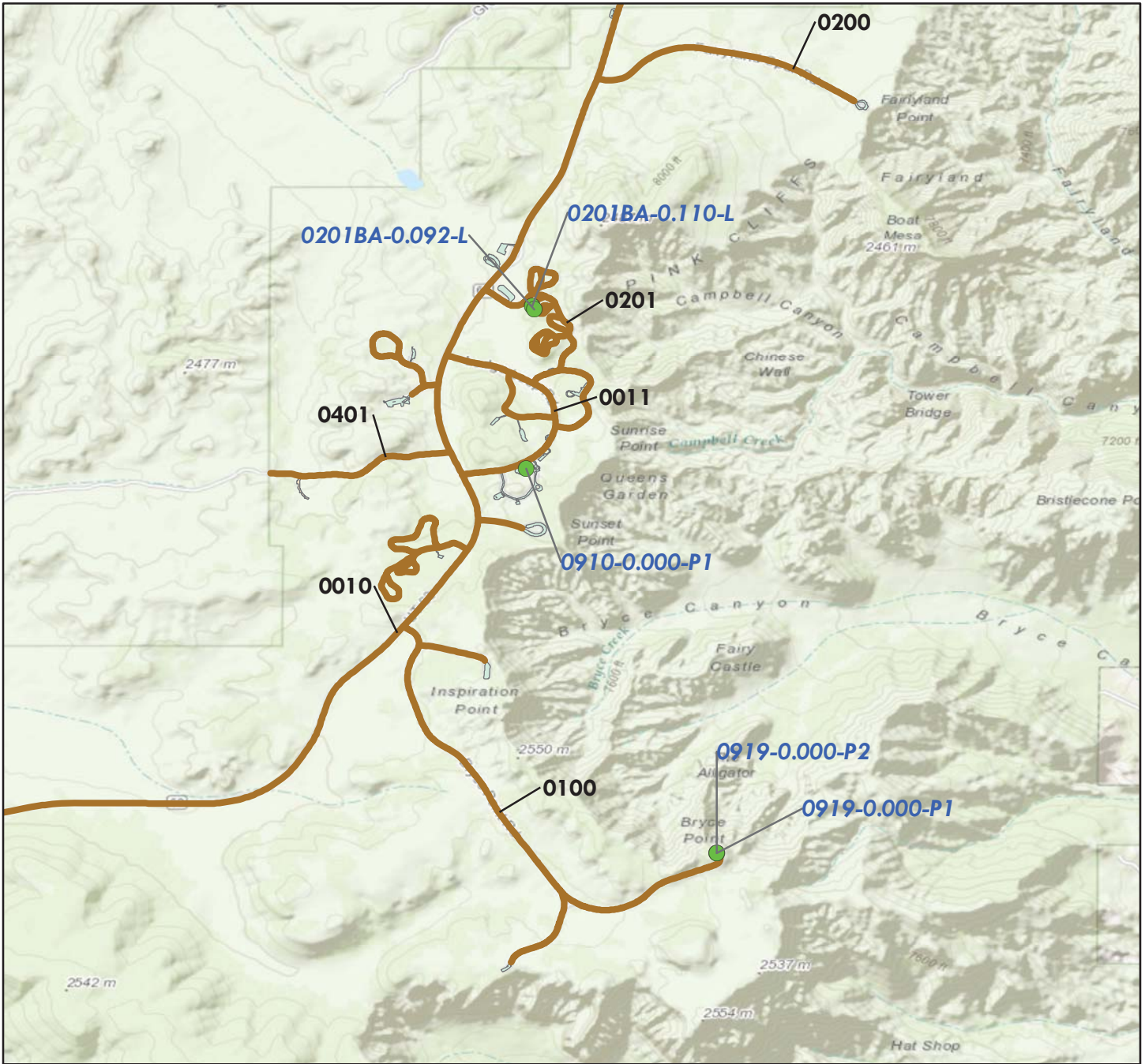
 RIP Collected Routes



Bryce Canyon National Park

WALL LOCATION MAP

Map 1



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

● Wall Locations

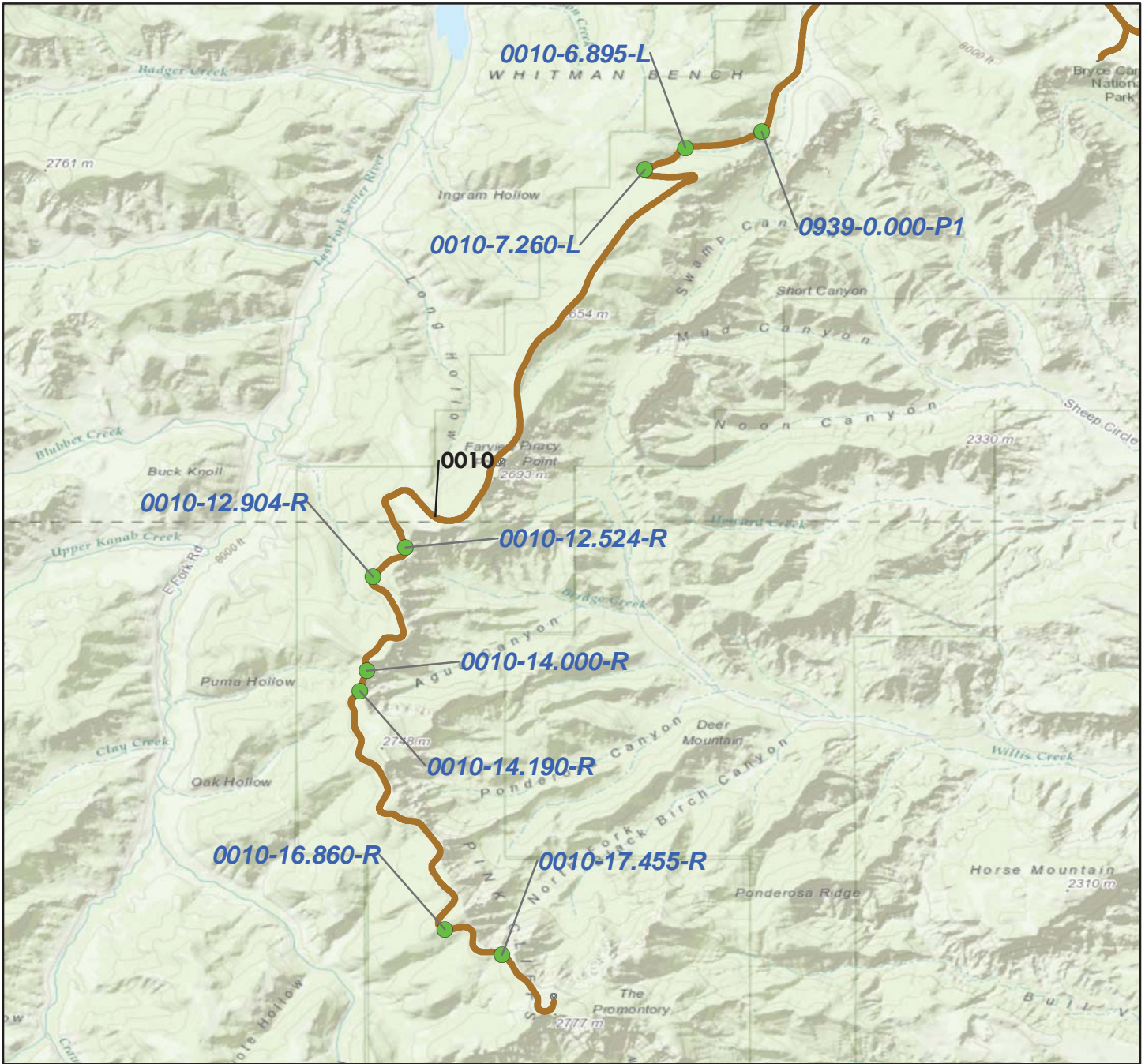
— RIP Collected Routes



Bryce Canyon National Park

WALL 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

● Wall Locations

— RIP Collected Routes



Tier 1 Park Retaining Wall Overview



Bryce Canyon National Park



**Federal Lands Highway
Road Inventory Program**

Parkwide Summary: Bryce Canyon National Park

Initial retaining wall inspections were conducted at Bryce Canyon National Park in 2007, and encompassed all known retaining wall structures associated with Park roadways - including structure's retaining cuts and fills, as well as qualifying headwalls at culverts. For the purposes of the assessment, walls must be a minimum of 4 feet in maximum height of retained earth and greater than 6 feet in maximum height for culvert headwalls. This does not include the height of parapet or guardwall above a retaining wall. In general, guardwall or parapets are not included in this assessment, but were inspected for Bryce Canyon National Park in 2010 under a separate effort as part of the Guardwall/Rail Inventory Program (GIP). A report for GIP is available under separate cover.

All paved roadways and parking areas listed in the RIP Route Identification Report were inspected for walls. Occasionally, unpaved routes not in RIP were inventoried due to their future programmatic addition at the park, which was a decision made on site specific to each park.

The following tables provide an overview of the findings of this inspection and assessment effort. In all, 14 walls were inventoried on the routes listed below.

Table 1: Number of Walls by Route

Route Number	Route Name	No. of Walls
0010	MAIN PARK ROAD	8
0201BA	NORTH CAMPGROUND LOOP ROAD B, OUTERLOOP	2
0910	LODGE PARKING	1
0919	BRYCE POINT PARKING	2
0939	SWAMP CANYON PARKING	1

The following table shows the number of walls broken out by seven possible categories of basic wall function.

Table 2: Number of Walls by Wall Function

Wall Function	No. of Walls
CW - Cut Wall	1
FW - Fill Wall	13

The following table shows the primary wall types that were inventoried and assessed. There are 24 possible primary wall types, which are summarized in Appendix A.

Table 3: Number of Walls by Primary Wall Type

Primary Wall Type	No. of Walls
GM, Gravity - Mortared Stone	5
MS, MSE - Segmental Block	4
MW, MSE - Welded Wire Face	5

The following table shows the number of walls by one of six categories of recommended action along with associated 2007 costs and the number of walls that are in each recommended action category. The majority of walls have a recommendation of *No Action* or *Monitor*; work orders were created for all other recommended actions.

Table 4: Number of Walls by Recommended Action and Associated 2007 Cost

Recommended Action	2007 Repair Costs*	No. of Walls
No Action	\$0	12
Monitor	\$0	0
Maintenance	\$310	2
Repair Elements	\$0	0
Replace Elements	\$0	0
Replace Wall	\$0	0
Totals	\$310	14

*2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

The following table categorizes the number of walls 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 walls are listed by individual wall in Tier 3 of this report.

Table 5: Number of Walls Grouped by Associated 2007 Cost

Cost Range*	No. of Walls
\$0	12
\$1 - \$25,000	2
\$25,001 - \$50,000	0
\$50,001 - \$100,000	0
\$100,001 - \$250,000	0
\$250,001 - \$500,000	0
\$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 Walls	14

*2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Routine inspection and performing the noted maintenance will greatly aid in the continued performance of all walls at Bryce Canyon National Park. Work orders for walls needing maintenance generally included items such as replacing missing stones, replacing mortar, filling voids at the top or bottom of fill walls, and clearing vegetation.

Work orders for walls needing localized element repairs generally included items such as adding riprap protection to the wall foundation, replacing missing sections of dry stone walls, replacing culverts, grouting voids in walls, and patching/restoring roadway pavement. While decaying mortar generally does not threaten wall stability in the near term, grout repair will extend the life of these walls significantly.

Work orders for walls needing major repairs (replace elements or replace wall) generally include items such as foundation repair or replacement, fill voids, repair roadway shoulder, replace or extend retaining wall in either height or length, rebuild failed segments of walls, repair elements across 50% or more of the wall, remove and recompact backfill material, add scour protection (typically with riprap, concrete, or rock fill), and remove/reset culvert headwalls. Due to the large unit items associated with major repairs, recommendations vary by specific wall and are presented in Tier 3 of this report.

WIP identified 55 critically deficient walls nationally based on wall ratings less than 49 (poor/critical overall condition). The following table presents the walls in Bryce Canyon National Park that are on this list and have been elevated to the Park Regional Coordinators in a Regional Park Summary Memorandum. Generally, these are walls with major repair element recommendations that may be a priority for repair work in your park.

Table 6: Number of Walls by Route

Wall Identification	Failure Consequence⁽¹⁾	Wall Rating⁽²⁾	Recommended Action⁽³⁾	2007 Repair Costs⁽⁴⁾
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No critically deficient walls.

Notes: 1) Low consequence of failure and/or no recommended action may indicate repairs are not needed.

2) Wall ratings listed range from 0-49 (Poor/Critical).

3) Information was prepared for project planning purposes only. Actual repair work order scopes and actual costs will need to be evaluated based on current pay item unit prices for specific locations.

4) 2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Tier 2 Route Retaining Wall Overview



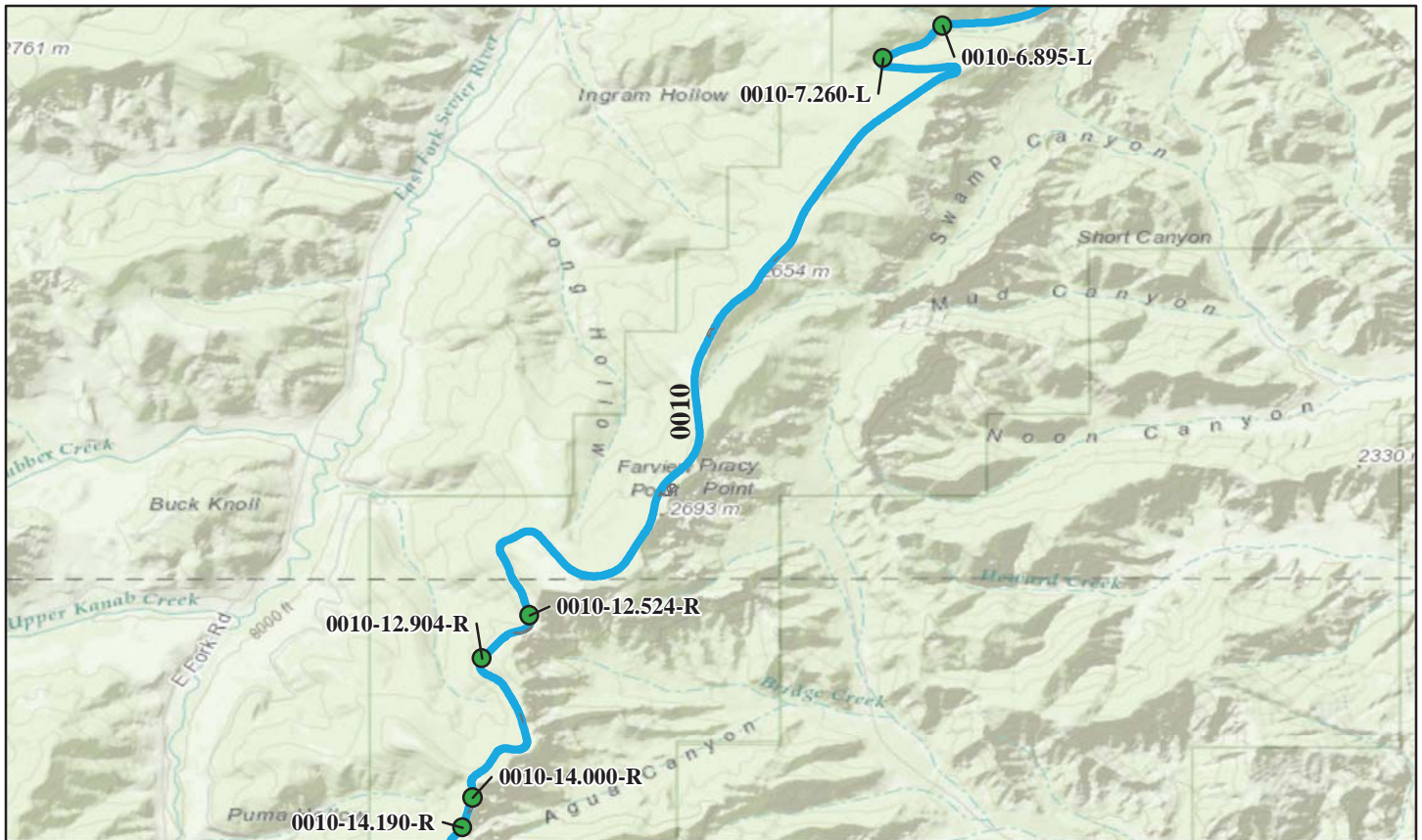
Bryce Canyon National Park



**Federal Lands Highway
Road Inventory Program**

Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD



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

Retaining Wall Condition Legend – Wall Condition Rating

Critical / Poor (0 - 49)

Fair (50 - 69)

Good to Excellent (70 - 100)

No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
BRCA-0010-6.895-L 4/17/2007	7,800	1,116	MSE - Welded Wire Face	Fill Wall	91	\$0.00
BRCA-0010-7.260-L 4/17/2007	270	65	MSE - Segmental Block	Fill Wall	97	\$0.00
BRCA-0010-12.524-R 4/17/2007	9,420	570	MSE - Segmental Block	Fill Wall	96	\$0.00
BRCA-0010-12.904-R 4/17/2007	3,168	396	MSE - Welded Wire Face	Fill Wall	90	\$0.00
BRCA-0010-14.000-R 4/17/2007	16,430	777	MSE - Segmental Block	Fill Wall	90	\$0.00

*2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD



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

Retaining Wall Condition Legend – Wall Condition Rating

Critical / Poor (0 - 49)

Fair (50 - 69)

Good to Excellent (70 - 100)

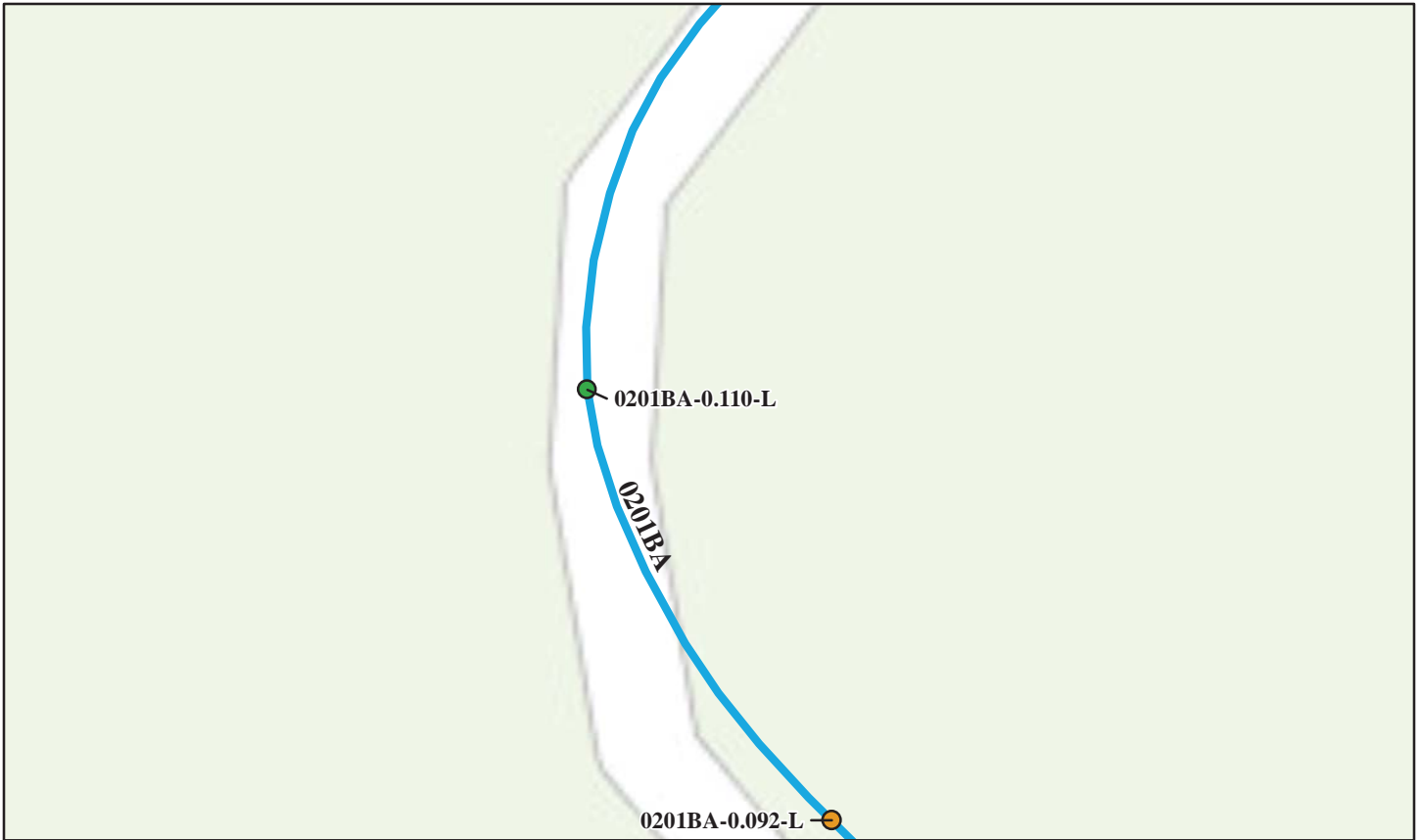
No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
BRCA-0010-14.190-R 4/17/2007	1,785	255	MSE - Welded Wire Face	Fill Wall	87	\$0.00
BRCA-0010-16.860-R 4/17/2007	750	250	MSE - Welded Wire Face	Fill Wall	86	\$0.00
BRCA-0010-17.455-R 4/17/2007	1,990	290	MSE - Welded Wire Face	Fill Wall	87	\$0.00

*2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0201BA: NORTH CAMPGROUND LOOP ROAD B, OUTERLOOP



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

Retaining Wall Condition Legend – Wall Condition Rating

Critical / Poor (0 - 49)

Fair (50 - 69)

Good to Excellent (70 - 100)

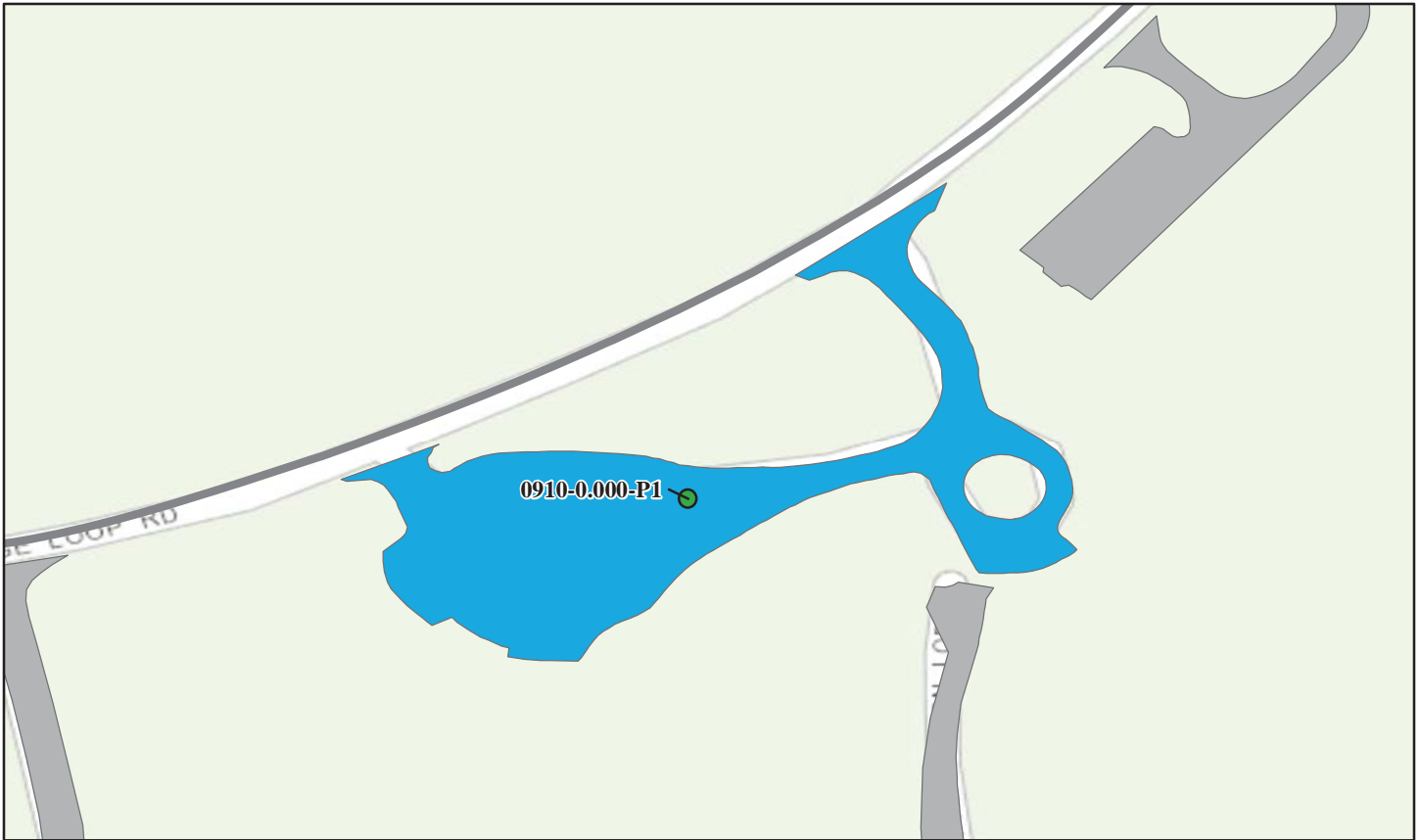
No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
BRCA-0201BA-0.092-L 4/17/2007	250	49	Gravity - Mortared Stone	Fill Wall	69	\$185.00
BRCA-0201BA-0.110-L 4/17/2007	180	45	Gravity - Mortared Stone	Fill Wall	76	\$0.00

*2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0910: LODGE PARKING



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

Retaining Wall Condition Legend – Wall Condition Rating

Critical / Poor (0 - 49)

Fair (50 - 69)

Good to Excellent (70 - 100)

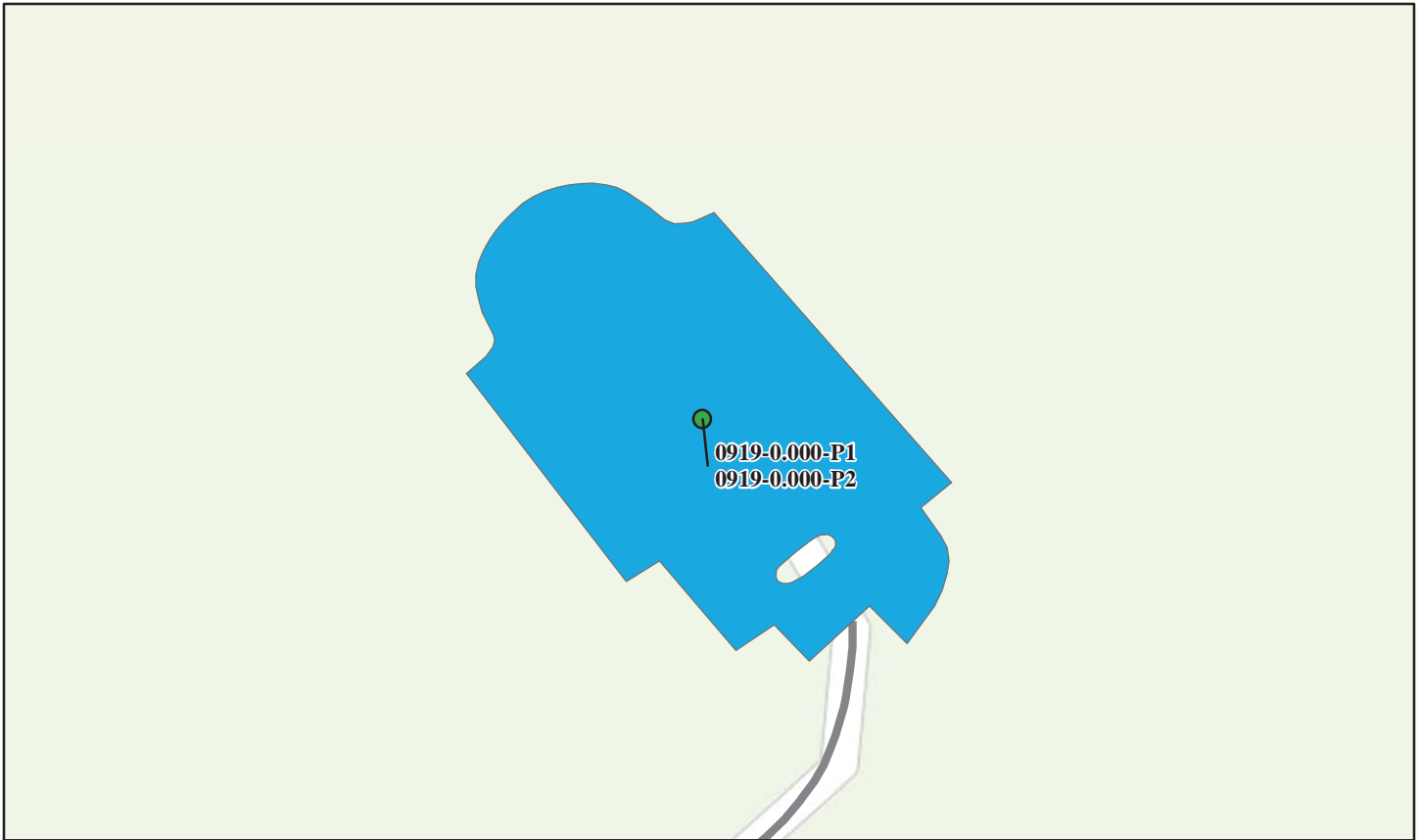
No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
BRCA-0910-0.000-P1 4/17/2007	950	210	Gravity - Mortared Stone	Fill Wall	90	\$0.00

*2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0919: BRYCE POINT PARKING



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

Retaining Wall Condition Legend – Wall Condition Rating

Critical / Poor (0 - 49)

Fair (50 - 69)

Good to Excellent (70 - 100)

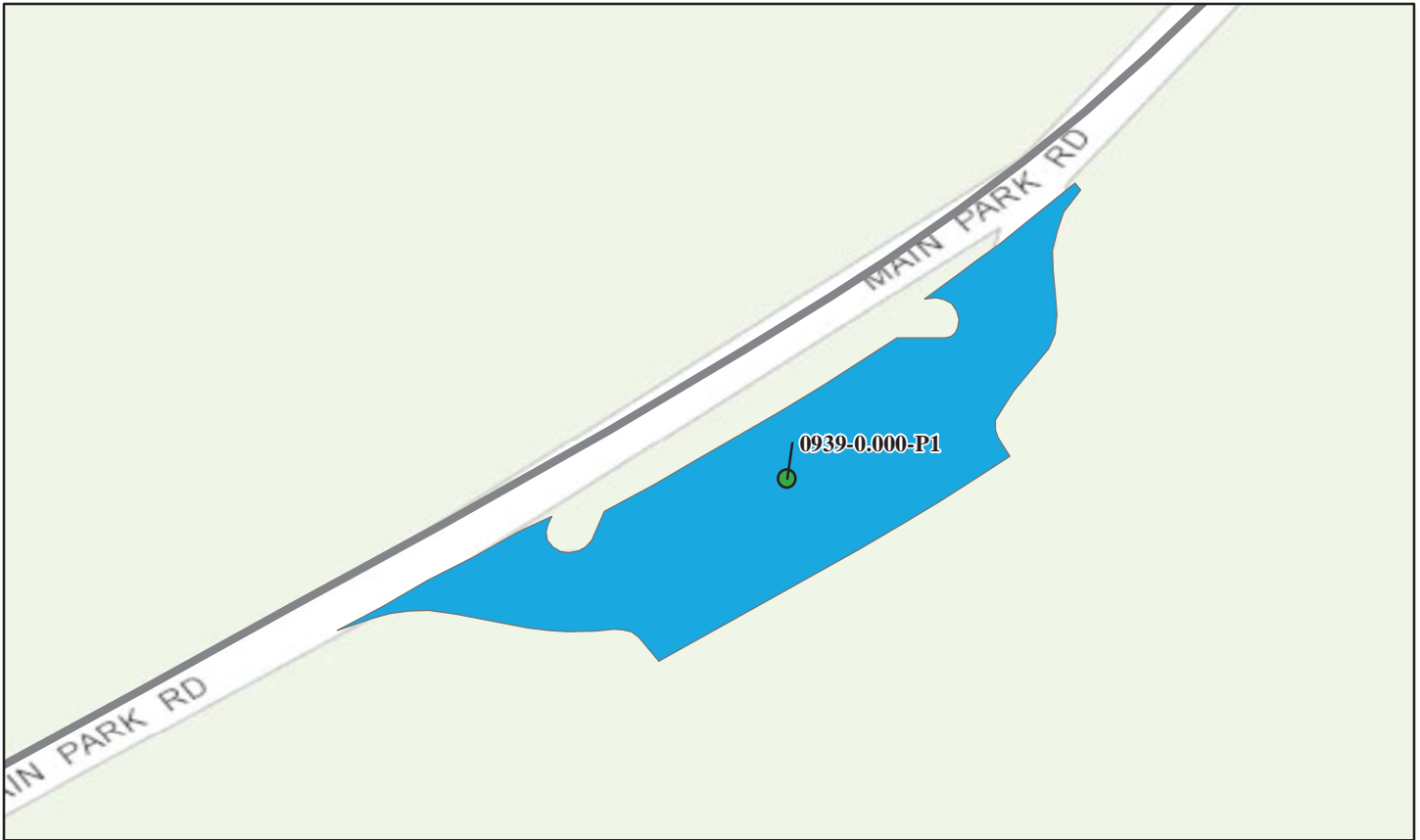
No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
BRCA-0919-0.000-P1 4/17/2007	3670	318	Gravity - Mortared Stone	Fill Wall	90	\$0.00
BRCA-0919-0.000-P2 4/17/2007	1040	310	Gravity - Mortared Stone	Cut Wall	90	\$125.00

*2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0939: SWAMP CANYON PARKING



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

Retaining Wall Condition Legend – Wall Condition Rating

Critical / Poor (0 - 49)

Fair (50 - 69)

Good to Excellent (70 - 100)

No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
BRCA-0939-0.000-P1 4/17/2007	1645	251	MSE - Segmental Block	Fill Wall	96	\$0.00

*2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Tier 3 Retaining Wall Details



Bryce Canyon National Park



Federal Lands Highway
Road Inventory Program

Wall ID:	BRCA-0010-6.895-L		
Route Name:	MAIN PARK ROAD		
Inspection Date:	April 17, 2007	Approximate Year Built:	2002
*Wall Rating:	91	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	MSE - Welded Wire Face
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Hilfiker welded wire MSE wall.		

Wall Measurements

Wall Length (ft.):	1116	Face Area (sq.):	7800
Average Wall Height (ft.):	6	Face Angle (deg.):	82
Maximum Wall Height (ft.):	10	Vertical Offset (ft.):	-2

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Performing as a new construction - no signs of any distress.	9
WALL FOUNDATION MATERIAL 8.00	No signs of distress. Good foundation soils.	9
WIRE/GEOSYNTHETIC FACING 8.00	No signs of corrosion. Facing wires are bulging in some locations due to basket settlement and wires loading each other. Wall face functioning well despite this construction flaw.	9
TRAFFIC BARRIER/FENCE 0.50	No signs of wall-related distress.	9
WALL DRAINS 0.50	Drains are present throughout the wall, and are all functioning as intended.	9
CURB/BERM/DITCH 0.50	Concrete curb shows no signs of cracking or displacement - looks like new.	10
DOWNSLOPE 0.50	Gentle downslope showing no signs of distress. No slope supporting vegetation (recent construction).	10
LATERAL SLOPE 0.50	No signs of any distress.	10
ROAD/SIDEWALK/SHOULDER 0.50	New condition, showing no cracking or other signs of distress.	10

Repair Recommendations

Failure Consequence:	HIGH
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD

Retaining Wall Condition Photos



BRCA_0010_6.895_L_1.jpg



BRCA_0010_6.895_L_2.jpg

Wall ID:	BRCA-0010-7.26-L		
Route Name:	MAIN PARK ROAD		
Inspection Date:	April 17, 2007	Approximate Year Built:	2002
*Wall Rating:	97	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	MSE - Segmental Block
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Decorative segmental block MSE wall on inside curve at drainage.		

Wall Measurements

Wall Length (ft.):	65	Face Area (sq.):	270
Average Wall Height (ft.):	4	Face Angle (deg.):	82
Maximum Wall Height (ft.):	8	Vertical Offset (ft.):	-2

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is like new - functioning as intended.	10
WALL FOUNDATION MATERIAL 8.00	No signs of bulging, erosion, seepage - excellent condition.	9
MANUFACTURED BLOCK/BRICK 8.00	Blocks look like new, with no signs of distress.	10
CULVERT 0.50	Pipe and concrete headwall like new, showing no signs of distress.	10
DOWNSLOPE 0.50	Gentle, well-vegetated slope, showing no signs of distress.	10
LATERAL SLOPE 0.50	No signs of distress.	10
ROAD/SIDEWALK/SHOULDER 0.50	New condition, showing no cracking or other signs of distress.	10
TRAFFIC BARRIER/FENCE 0.50	Wood guardrail shows no signs of wall-related distress (like new).	10
WALL DRAINS 0.50	Regular drainage noted - functioning like new.	10

Repair Recommendations

Failure Consequence:	HIGH
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD

Retaining Wall Condition Photos



BRCA_0010_7.260_L_1.jpg

Wall ID:	BRCA-0010-12.524-R		
Route Name:	MAIN PARK ROAD		
Inspection Date:	April 17, 2007	Approximate Year Built:	1994
*Wall Rating:	96	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	MSE - Segmental Block
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Keystone segmental block MSE wall with geogrid reinforcement. Adjacent to Natural Bridge Overlook. Two tiered wall with 14.5 ft max. height top wall and 17.5 ft max. height lower wall.		

Wall Measurements

Wall Length (ft.):	570	Face Area (sq.):	9420
Average Wall Height (ft.):	16	Face Angle (deg.):	84
Maximum Wall Height (ft.):	18	Vertical Offset (ft.):	-3

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall looks new, with no signs of element or global distress.	10
WALL FOUNDATION MATERIAL 8.00	No signs of distress on either tier of the wall.	9
MANUFACTURED BLOCK/BRICK 8.00	In excellent, like-new condition, showing no signs of weathering, cracking, or displacement.	10
TRAFFIC BARRIER/FENCE 0.50	No wall-related distress.	8
DOWNSLOPE 0.50	Well-vegetated downslope showing no signs of erosion or slumping.	9
ROAD/SIDEWALK/SHOULDER 0.50	No signs of distress in the roadway.	9
CULVERT 0.50	Performing as intended, with no signs of seepage around the pipe, erosion below the outlet, or displacement of the pipe due to wall settlement.	10
CURB/BERM/DITCH 0.50	Colored concrete curb looks new - showing no signs of cracking or displacement.	10
LATERAL SLOPE 0.50	No signs of distress. Fully intact slope, well-vegetated.	10

Repair Recommendations

Failure Consequence:	HIGH
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD

Retaining Wall Condition Photos



BRCA_0010_12.524_R_1.jpg



BRCA_0010_12.524_R_2.jpg

Wall ID:	BRCA-0010-12.904-R		
Route Name:	MAIN PARK ROAD		
Inspection Date:	April 17, 2007	Approximate Year Built:	1994
*Wall Rating:	90	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	MSE - Welded Wire Face
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Welded wire MSE wall (Tensar Sierrascap design).		

Wall Measurements

Wall Length (ft.):	396	Face Area (sq.):	3168
Average Wall Height (ft.):	8	Face Angle (deg.):	85
Maximum Wall Height (ft.):	10	Vertical Offset (ft.):	-2

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is performing as intended, showing no signs of global distress.	9
WALL FOUNDATION MATERIAL 8.00	No signs of distress. Foundation soils are intact.	9
WIRE/GEOSYNTHETIC FACING 8.00	No signs of wire corrosion or weathering of facing rock. Minor bulging of some baskets, but connectors and struts are all intact.	9
DOWNSLOPE 0.50	Gentle slope, moderately vegetated, showing no signs of distress.	8
LATERAL SLOPE 0.50	No signs of distress. Slopes are fully intact.	9
ROAD/SIDEWALK/SHOULDER 0.50	Recent chip seal, with no signs of cracking or distress.	9
TRAFFIC BARRIER/FENCE 0.50	No wall-related signs of distress in the timber guardrail.	9
WALL DRAINS 0.50	Performing as intended - no signs of distress.	9

Repair Recommendations

Failure Consequence:	HIGH
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD

Retaining Wall Condition Photos



BRCA_0010_12.904_R_1.jpg



BRCA_0010_12.904_R_2.jpg

Wall ID:	BRCA-0010-14-R		
Route Name:	MAIN PARK ROAD		
Inspection Date:	April 17, 2007	Approximate Year Built:	1994
*Wall Rating:	90	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	MSE - Segmental Block
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Keystone segmental block MSE wall with geogrid reinforcements.		

Wall Measurements

Wall Length (ft.):	777	Face Area (sq.):	16430
Average Wall Height (ft.):	21	Face Angle (deg.):	86
Maximum Wall Height (ft.):	30	Vertical Offset (ft.):	-3

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is functioning as intended with no signs of element or global distress.	9
WALL FOUNDATION MATERIAL 8.00	No signs of distress. Modestly vegetated and fully intact.	9
MANUFACTURED BLOCK/BRICK 8.00	No significant signs of weathering or cracking. Minor bleaching of some cap pieces.	9
ROAD/SIDEWALK/SHOULDER 0.50	Recent chip seal. No signs of cracking or distress.	8
CURB/BERM/DITCH 0.50	Colored concrete curb shows no signs of cracking or displacement.	9
DOWNSLOPE 0.50	Gentle downslope with well-established vegetation.	9
LATERAL SLOPE 0.50	No signs of distress. No erosion.	9
TRAFFIC BARRIER/FENCE 0.50	No wall-related distress to the timber/stone barrier.	9
WALL DRAINS 0.50	Functioning as intended, with no signs of distress.	9

Repair Recommendations

Failure Consequence:	HIGH
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

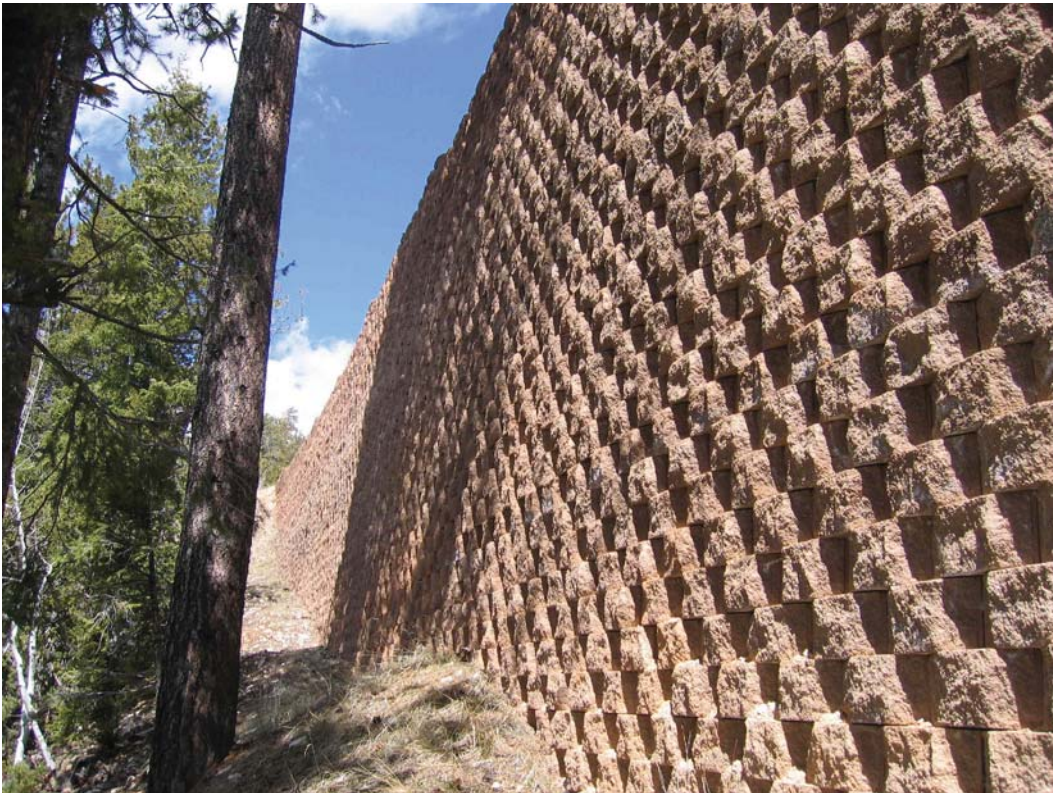
Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD

Retaining Wall Condition Photos



BRCA_0010_14.000_R_1.jpg



BRCA_0010_14.000_R_2.jpg

Wall ID:	BRCA-0010-14.19-R		
Route Name:	MAIN PARK ROAD		
Inspection Date:	April 17, 2007	Approximate Year Built:	1994
*Wall Rating:	87	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	MSE - Welded Wire Face
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Welded wire MSE wall (Tensar Sierrascape design).		

Wall Measurements

Wall Length (ft.):	255	Face Area (sq.):	1785
Average Wall Height (ft.):	7	Face Angle (deg.):	85
Maximum Wall Height (ft.):	8	Vertical Offset (ft.):	-2

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall performing as intended, with no signs of global distress.	9
WALL FOUNDATION MATERIAL 8.00	No signs of distress. Only minor isolated erosion occurring at wall face.	8
WIRE/GEOSYNTHETIC FACING 8.00	No signs of wire corrosion or face element bulging. Facing rock is fresh and intact, with no signs of material loss.	9
DOWNSLOPE 0.50	Moderate, stable slope, well-vegetated. Some minor signs of erosion.	8
ROAD/SIDEWALK/SHOULDER 0.50	Recent chip seal. No cracking or signs of distress.	8
CURB/BERM/DITCH 0.50	Colored concrete curb shows no signs of cracking or displacement.	9
LATERAL SLOPE 0.50	No signs of distress.	9
TRAFFIC BARRIER/FENCE 0.50	Guardrail shows no signs of wall-related distress.	9
WALL DRAINS 0.50	Appear to be functioning as intended, with no signs of distress.	9

Repair Recommendations

Failure Consequence:	HIGH
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD

Retaining Wall Condition Photos



BRCA_0010_14.190_R_1.jpg



BRCA_0010_14.190_R_2.jpg

Wall ID:	BRCA-0010-16.86-R		
Route Name:	MAIN PARK ROAD		
Inspection Date:	April 17, 2007	Approximate Year Built:	1994
*Wall Rating:	86	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	MSE - Welded Wire Face
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Welded wire MSE wall (Tensar Sierrascape design).		

Wall Measurements

Wall Length (ft.):	250	Face Area (sq.):	750
Average Wall Height (ft.):	3	Face Angle (deg.):	90
Maximum Wall Height (ft.):	6	Vertical Offset (ft.):	-2

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is performing as intended with no signs of global distress.	9
WALL FOUNDATION MATERIAL 8.00	No signs of distress. Minor signs of erosion, though moderately vegetated.	8
WIRE/GEOSYNTHETIC FACING 8.00	No signs of corrosion, bulging, or loss of facing material.	9
LATERAL SLOPE 0.50	No signs of distress.	9
TRAFFIC BARRIER/FENCE 0.50	No signs of wall-related distress (some minor paint peeling on timbers).	9
WALL DRAINS 0.50	Appear to be functioning as intended.	9
DOWNSLOPE 1.00	Moderate to steep (difficult to walk), with no signs of significant distress. Minor erosion, soft soils, yet to vegetate well.	7

Repair Recommendations

Failure Consequence:	HIGH
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD

Retaining Wall Condition Photos



BRCA_0010_16.860_R_1.jpg



BRCA_0010_16.860_R_2.jpg

Wall ID:	BRCA-0010-17.455-R		
Route Name:	MAIN PARK ROAD		
Inspection Date:	April 17, 2007	Approximate Year Built:	1994
*Wall Rating:	87	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	MSE - Welded Wire Face
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Welded wire MSE wall (Tensar Sierrascape design).		

Wall Measurements

Wall Length (ft.):	290	Face Area (sq.):	1990
Average Wall Height (ft.):	6	Face Angle (deg.):	82
Maximum Wall Height (ft.):	9	Vertical Offset (ft.):	-2

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is performing as intended with no signs of significant distress.	9
WALL FOUNDATION MATERIAL 8.00	No signs of distress.	9
WIRE/GEOSYNTHETIC FACING 8.00	No signs of corrosion or significant bulging. Minor deflection of baskets at top of wall at four limited locations.	8
CURB/BERM/DITCH 0.50	Colored concrete curb with no signs of cracking or displacement.	9
DOWNSLOPE 0.50	Moderately well vegetated, with no signs of distress.	9
LATERAL SLOPE 0.50	No signs of erosion or bulging. Moderately well vegetated.	9
ROAD/SIDEWALK/SHOULDER 0.50	Recent chip seal. No signs of distress.	9
WALL DRAINS 0.50	No signs of distress - functioning as intended.	9

Repair Recommendations

Failure Consequence:	HIGH
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0010: MAIN PARK ROAD

Retaining Wall Condition Photos



BRCA_0010_17.455_R_1.jpg



BRCA_0010_17.455_R_2.jpg

Wall ID:	BRCA-0201BA-.092-L		
Route Name:	NORTH CAMPGROUND LOOP ROAD B, OUTERLOOP		
Inspection Date:	April 17, 2007	Approximate Year Built:	Unknown
*Wall Rating:	69	Maintenance Action:	Maintenance

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	Gravity - Mortared Stone
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Mortared sandstone masonry rock wall located at campground site No.39 (failure would impact adjacent roadway).		

Wall Measurements

Wall Length (ft.):	49	Face Area (sq.):	250
Average Wall Height (ft.):	5	Face Angle (deg.):	86
Maximum Wall Height (ft.):	6	Vertical Offset (ft.):	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Missing mortar and opening gaps between stone blocks at south end of wall suggests wall is rotating out slightly.	7
WALL FOUNDATION MATERIAL 8.00	No distress. Fully intact, moderate slope. Minor evidence of erosion.	8
MORTAR 8.00	0.25-in gaps in mortar throughout the wall. 1-in gaps along the steps through the wall. Some mortar is missing near the steps.	6
STONE MASONRY 8.00	Sandstone blocks are only moderately weathered, with one capblock missing.	6
DOWNSLOPE 0.50	No signs of distress. Modestly vegetated.	9
LATERAL SLOPE 0.50	No signs of distress.	9
WALL DRAINS 0.50	No signs of drainage issues.	9

Repair Recommendations

Failure Consequence:	LOW
Recommendation Narrative:	Remove and replace damaged/missing mortar throughout the wall, particularly at the south end of the wall along the steps. 3 hrs general labor at \$55/hr = \$165. 2 bags of mortar at \$10/bag = \$20. Total = \$185
Repair Cost:	\$185

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0201BA: NORTH CAMPGROUND LOOP ROAD B, OUTERLOOP

Retaining Wall Condition Photos



BRCA_0201BA_0.092_L_1.jpg



BRCA_0201BA_0.092_L_2.jpg

Wall ID:	BRCA-0201BA-.11-L		
Route Name:	NORTH CAMPGROUND LOOP ROAD B, OUTERLOOP		
Inspection Date:	April 17, 2007	Approximate Year Built:	Unknown
*Wall Rating:	76	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	Gravity - Mortared Stone
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Mortared stone masonry wall.		

Wall Measurements

Wall Length (ft.):	45	Face Area (sq.):	180
Average Wall Height (ft.):	4	Face Angle (deg.):	83
Maximum Wall Height (ft.):	4	Vertical Offset (ft.):	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall shows no signs of significant global distress - functioning as intended.	8
WALL FOUNDATION MATERIAL 8.00	No signs of distress.	9
STONE MASONRY 8.00	Moderate weathering of the sandstone blocks. Missing one capstone.	6
MORTAR 8.00	Minor gaps in the mortar. Mortar is still hard, durable, and sound.	7
DOWNSLOPE 0.50	Gentle downslope showing no signs of bulging, slumping, or water problems.	9
LATERAL SLOPE 0.50	No signs of distress - functioning as built.	9
WALL DRAINS 0.50	No wall drains present, but no signs of wall drainage problems.	9

Repair Recommendations

Failure Consequence:	LOW
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0201BA: NORTH CAMPGROUND LOOP ROAD B, OUTERLOOP

Retaining Wall Condition Photos



BRCA_0201BA_0.110_L_1.jpg

Wall ID:	BRCA-0910-0-P1		
Route Name:	LODGE PARKING		
Inspection Date:	April 17, 2007	Approximate Year Built:	Unknown
*Wall Rating:	90	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	Gravity - Mortared Stone
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Mortared stone masonry fill wall.		

Wall Measurements

Wall Length (ft.):	210	Face Area (sq.):	950
Average Wall Height (ft.):	4	Face Angle (deg.):	84
Maximum Wall Height (ft.):	6	Vertical Offset (ft.):	-4

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is performing as intended, with no signs of distress.	9
WALL FOUNDATION MATERIAL 8.00	Concrete footer is visible at base of wall, and shows no signs of cracking or displacement. Slope is gentle, and shows no signs of distress.	9
MORTAR 8.00	Solid, intact, durable mortar showing no significant signs of weathering.	9
STONE MASONRY 8.00	Fresh cut sandstone, showing no signs of weathering or cracking.	9
DOWNSLOPE 0.50	Gentle downslope showing no signs of distress.	9
LATERAL SLOPE 0.50	No signs of distress.	9
UPSLOPE 0.50	Well-vegetated, gentle upslope showing no signs of settlement or other distress.	9
WALL DRAINS 0.50	Regular weep holes and drain pipe, all in very good condition - functioning as intended.	9

Repair Recommendations

Failure Consequence:	LOW
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0910: LODGE PARKING

Retaining Wall Condition Photos



BRCA_0910_0.000_P1_1.jpg



BRCA_0910_0.000_P1_2.jpg

Wall ID:	BRCA-0919-0-P1		
Route Name:	BRYCE POINT PARKING		
Inspection Date:	April 17, 2007	Approximate Year Built:	1994
*Wall Rating:	90	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	Gravity - Mortared Stone
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Mortared masonry stone wall.		

Wall Measurements

Wall Length (ft.):	318	Face Area (sq.):	3670
Average Wall Height (ft.):	11	Face Angle (deg.):	85
Maximum Wall Height (ft.):	15	Vertical Offset (ft.):	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is functioning as intended showing no signs of global distress. Only minor mortar cracking evident at some locations in the face.	9
WALL FOUNDATION MATERIAL 8.00	Footing is visible in one location due to minor erosion of the toe slope soils. No signs of settlement, bulging or cracking in the wall due to foundation soils.	9
MORTAR 8.00	0.125-in gap in some places, but overall the mortar is intact, fresh, and durable.	8
STONE MASONRY 8.00	Fresh sandstone blocks showing no signs of weathering or cracking.	10
WALL DRAINS 0.50	No signs of seepage through the wall blocks. No signs of drainage distress.	8
DOWNSLOPE 0.50	Gentle slope showing no signs of distress.	9
LATERAL SLOPE 0.50	No signs of distress.	9

Repair Recommendations

Failure Consequence:	MODERATE
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0919: BRYCE POINT PARKING

Retaining Wall Condition Photos



BRCA_0919_0.000_P1_1.jpg



BRCA_0919_0.000_P1_2.jpg

Wall ID:	BRCA-0919-0-P2		
Route Name:	BRYCE POINT PARKING		
Inspection Date:	April 17, 2007	Approximate Year Built:	1994
*Wall Rating:	90	Maintenance Action:	Maintenance

Wall Description

Wall Function:	Cut Wall	Primary Wall Type:	Gravity - Mortared Stone
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Mortared stone masonry cut wall above west side of parking lot.		

Wall Measurements

Wall Length (ft.):	310	Face Area (sq.):	1040
Average Wall Height (ft.):	3	Face Angle (deg.):	87
Maximum Wall Height (ft.):	5	Vertical Offset (ft.):	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Performing as intended, with no signs of global distress.	9
WALL FOUNDATION MATERIAL 8.00	Footing visible on north end of wall. No signs of distress or erosion.	9
STONE MASONRY 8.00	Fresh sandstone cut blocks with no signs of distress. One missing capblock, and one loose capblock.	8
MORTAR 8.00	Fresh mortar with no cracking or signs of significant distress.	10
UPSLOPE 0.50	Raveling cutslope above the wall. Loose soil and weathering rock, with no vegetation. Eroding slope is not affecting the wall.	8
LATERAL SLOPE 0.50	No signs of distress.	9
WALL DRAINS 0.50	No signs of drainage problems. Functioning PVC weep holes present at north end of wall.	9

Repair Recommendations

Failure Consequence:	LOW
Recommendation Narrative:	Minor maintenance required to replace missing caprock and mortar loose caprock. 1hr general labor at \$55/hr = \$55. 1 masoned stone block at \$50/block = \$50. Mortar (lpsm) = \$20. Total = \$125
Repair Cost:	\$125

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0919: BRYCE POINT PARKING

Retaining Wall Condition Photos



BRCA_0919_0.000_P2_1.jpg

Wall ID:	BRCA-0939-0-P1		
Route Name:	SWAMP CANYON PARKING		
Inspection Date:	April 17, 2007	Approximate Year Built:	2002
*Wall Rating:	96	Maintenance Action:	No Action

Wall Description

Wall Function:	Fill Wall	Primary Wall Type:	MSE - Segmental Block
Surface Treatment:		Secondary Wall Type:	
Secondary Surface Treatment:		Architectural Facing:	
General Description:	Segmental block MSE wall supporting parking area overlook.		

Wall Measurements

Wall Length (ft.):	251	Face Area (sq.):	1645
Average Wall Height (ft.):	6	Face Angle (deg.):	85
Maximum Wall Height (ft.):	11	Vertical Offset (ft.):	-1

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Minor crack in sidewalk suggests settlement, though Park personnel report minor winter-time heave occurring (water-related). Wall looks like new, showing no signs of distress.	10
WALL FOUNDATION MATERIAL 8.00	No signs of distress. Minor vegetation.	9
MANUFACTURED BLOCK/BRICK 8.00	No signs of distress - look like new.	10
DOWNSLOPE 0.50	Gentle downslope showing no signs of distress.	9
LATERAL SLOPE 0.50	No signs of distress.	9
TRAFFIC BARRIER/FENCE 0.50	Stone masonry guardwall shows no signs of wall-related distress (like new).	10
WALL DRAINS 0.50	Functioning as intended. No seepage through the block face. Visible drain at mid-wall.	10
ROAD/SIDEWALK/SHOULDER 1.00	Minor settlement/heave expressed as cracking in sidewalk. Sealed and functioning well.	7

Repair Recommendations

Failure Consequence:	MODERATE
Recommendation Narrative:	None
Repair Cost:	\$0

2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Bryce Canyon National Park

ROUTE 0939: SWAMP CANYON PARKING

Retaining Wall Condition Photos



BRCA_0939_0.000_P1_1.jpg



BRCA_0939_0.000_P1_2.jpg

Appendix A

Summary of WIP Definitions



Bryce Canyon National Park



**Federal Lands Highway
Road Inventory Program**

Appendix A

Summary of WIP Definitions and Assessment Categories

Wall Naming Convention

Unique “Wall Identification” names were assigned to the retaining walls that were inventoried. The Wall Identification includes the Park Name, the RIP Route Number (e.g., **0013**), the beginning milepoint of a wall (e.g., **0.622**) and the side of the road the wall is located on (e.g., **L.**) relative to the primary direction of travel (direction of increasing mileposts). Thus, a typical wall identified would have the following format: **YOSE-0013-0.622-L.**

For roadways not in RIP, park-supplied route numbers were used or the convention RRR#. Similarly, for parking areas not in RIP, the park-supplied parking area number or the convention PPP# was used. Also for parking areas, walls are numbered in ascending order as they are encountered when traveling counterclockwise around the parking area (most common direction of traffic flow). Parking area walls are designated P1, P2, P3, etc. as new walls are encountered.

- NPS Retaining Wall Inventory Program Field Guide (WIFG)-

Retaining Wall Acceptance Criteria

- *All classes of paved roadways and parking areas included in the RIP Route Investigation Report and/or identified by park staff.
- *Walls must reside within the constructed roadway/parking area prism.
- *Maximum wall height, including only that portion actively retaining soil and/or rock, must be ≥ 4 ft. (>6ft for culvert headwalls).
- *Consider known/verifiable wall embedment in determining maximum retaining wall height. Include fully buried retaining structures.
- *Walls have an internal wall face angle $\geq 45^\circ$ ($\geq 1H:1V$ face slope ratio).
- *Include all walls where the intent is to support/protect the travelway, and where failure would require replacement with a retaining wall.

Definitions

Design Criteria	Measure of how well current design criteria are satisfied: None - Does not meet any known standards. Non-AASHTO - Does not meet AASHTO, but is consistent with other structures of its type/period with good performance. AASHTO - Apparently meets current AASHTO Geometric, Design, Materials, and Construction Standards.
Consequence of Failure	Low - No loss of roadway, no to low public risk, no impact to traffic during wall repair/replacement Moderate - Hourly to short-term closure of roadway, low-to-moderate public risk, multiple alternate routes available High - Seasonal to long-term loss of roadway, substantial loss-of-life risk, no alternate routes available
Action	Select from: No Action, Monitor, Maintenance, Repair Elements, Replace Elements, and Replace Wall
Weighting Factor	Weighting Factor to be applied to the Condition Rating (CR). When indicated on the Condition Assessment Input Form: WF=0.5 for CR=8-10; WF=1.0 for CR=4-7; and WF=5 for CR=1-3.
Data Reliability	Estimate of how well observed conditions represent wall performance, and if additional investigations may be warranted. 1-Poor Conditions cannot be sufficiently observed to rate element(s), warranting additional investigations to better define element performance and/or to determine the cause(s) or poor performance. 2-Good Observed conditions are sufficient to rate the conditions of wall element(s); however, additional investigations would be useful to better understand element performance. 3-Very Good Observed conditions clearly describe wall performance. Additional investigations are not needed.

Wall Function Codes

[FW] Fill Wall	[BW] Bridge Wall	[SW] Switchback Wall
[CW] Cut Wall	[HW] Head Wall	[SP] Slope Protection [FL] Flood Wall

Wall Type Codes

[AH] Anchor, Tieback H-Pile	[CC] Crib, Concrete	[MG] MSE, Geosynthetic Wrapped Face
[AM] Anchor, Micropile	[CM] Crib, Metal	[MP] MSE, Precast Panel
[AS] Anchor, Tieback Sheet Pile	[CT] Crib, Timber	[MS] MSE, Segmental Block
[BC] Bin, Concrete	[GB] Gravity, Concrete Block/ Brick	[MW] MSE, Welded Wire Face
[BM] Bin, Metal	[GC] Gravity, Mass Concrete	[SN] Soil Nail
[CL] Cantilever, Concrete	[GD] Gravity, Dry Stone	[TP] Tangent/ Secant Pile
[CP] Cantilever, Soldier Pile	[GG] Gravity, Gabion	[OT] Other, User Defined
[CS] Cantilever, Sheet Pile	[GM] Gravity, Mortared Stone	[NO] None

Architectural Facing Type Codes

[BV] Brick Veneer	[PF] Planted Face	[SS] Simulated Stone
[CO] Cementitious Overlay	[SC] Sculpted Shotcrete	[SV] Stone Veneer
[FF] Fractured Fin Concrete	[SH] Shotcrete (nozzle finish)	[TI] Timber
[FL] Formlined Concrete	[SM] Steel/Metal	[OT] Other, User Defined
[PC] Plain Concrete (float finish or light texture)	[SO] Stone	[NO] None

Surface Treatment Codes

[BG] Bush Gun (tool-textured concrete)	[PS] Preservative	[WS] Weathering Steel
[CA] Color Additive	[SE] Silane Sealer	[OT] Other, User Defined
[GL] Galvanized	[ST] Stain	[NO] None
[PA] Painted	[TR] Tar Coated	

Condition Ratings

Condition Ratings apply to all Primary and Secondary Wall Elements, and are intended to assist in consistently defining element **severity**, **extent**, and **repair/replace urgency** of wall element distresses.

9-10 (Excellent)	-Any defects are minor and are within normal range for <i>newly constructed or fabricated</i> elements. -Defects may include those typically caused from fabrication or construction.
7-8 (Good)	-Low-to-moderate extent of low severity distress. -Distress present does not significantly compromise the element function, nor is there significantly severe distress to major structural components of an element.
5-6 (Fair)	-High extent of low severity distress and/or low-to-medium extent of medium to high severity distress. -Distress present does not compromise element function, but lack of treatment may lead to impaired function/elevated risk of element failure in the near term.
3-4 (Poor)	-Medium-to-high extent of medium-to-high severity distress. -Distress present threatens element function, and strength is obviously compromised and/or structural analysis is warranted. -The element condition does not pose an immediate threat to wall stability and road closure is not necessary.
1-2 (Critical)	-Medium-to-high extent of high severity distress. -Element is no longer serving intended function. Element performance threatening overall stability of the wall at the time of inspection.

Wall Performance Condition Ratings

Performance	Evaluation of overall wall performance as indicated by observations not necessarily captured by observed distresses for specific elements, including global wall distresses (rotation, settlement, translation, displacement, etc.) and/or evidence of prior repairs that may further indicate component problems.	<p>Good to Excellent - No observation of distresses not already captured by individual element condition assessment. No combination of element distresses indicating unseen problems or creating significant performance problems. No history of remediation or repair to wall or adjacent elements.</p> <p>Fair - Some observed global distress is not associated with specific elements. Some observation of element distress combinations that indicate wall component problems. Minor work on primary elements or major work on secondary elements has occurred improving overall wall function.</p> <p>Poor to Critical - Global wall rotation, settlement, and/or overturning is readily apparent. Combined element distresses clearly indicate serious stability problems with components or global wall stability. Major repairs have occurred to wall structural elements, though functionality has not improved significantly.</p>
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