

# HOSP WIP Report

## NPS Retaining Wall Inventory Program Hot Springs National Park



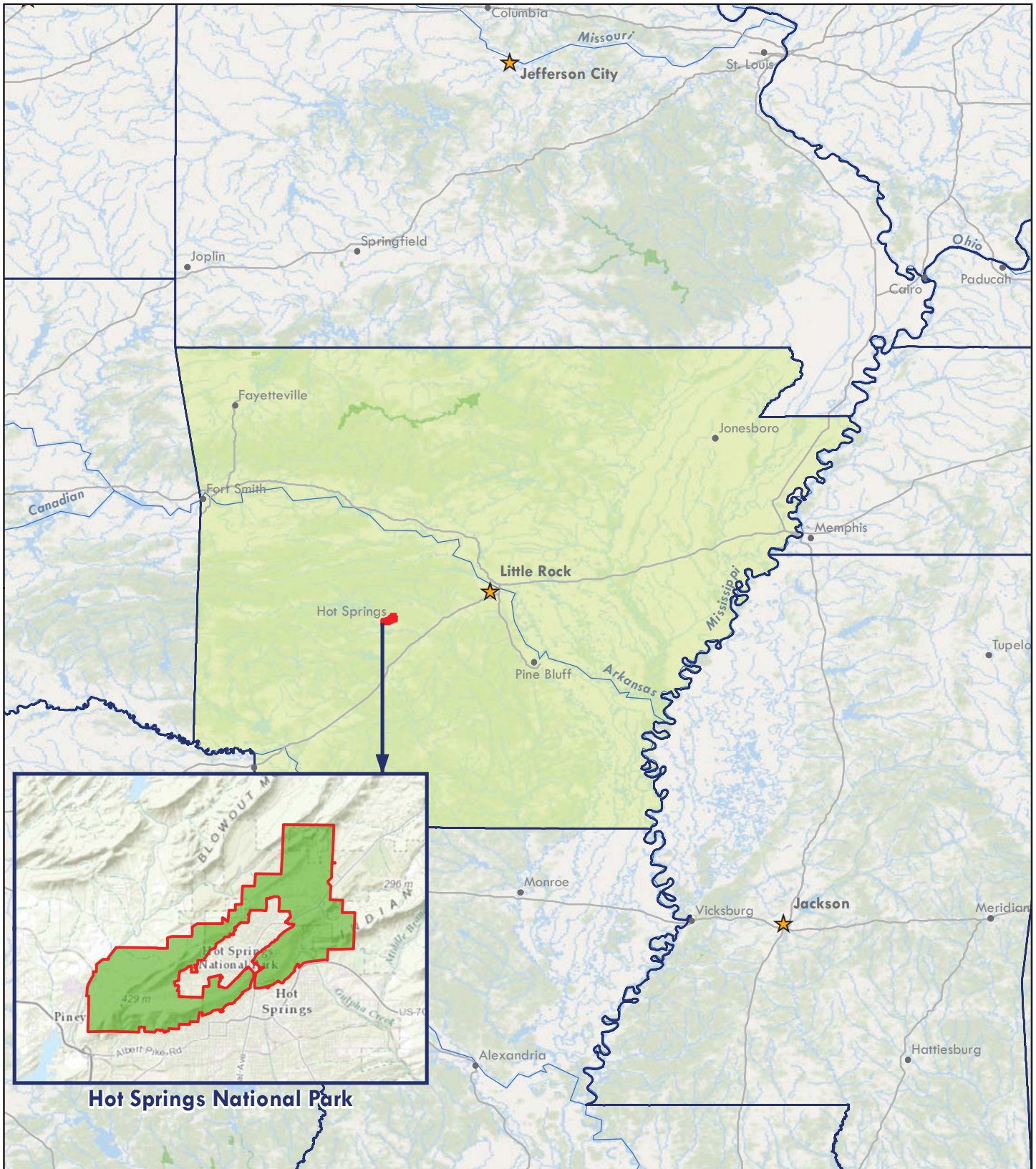
**Federal Lands Highway  
Road Inventory Program**

### Prepared By:

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

Data Collection Date: April 2007  
Report Date: October 2015

# Hot Springs National Park in Arkansas



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



Hot Springs 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



Hot Springs National Park

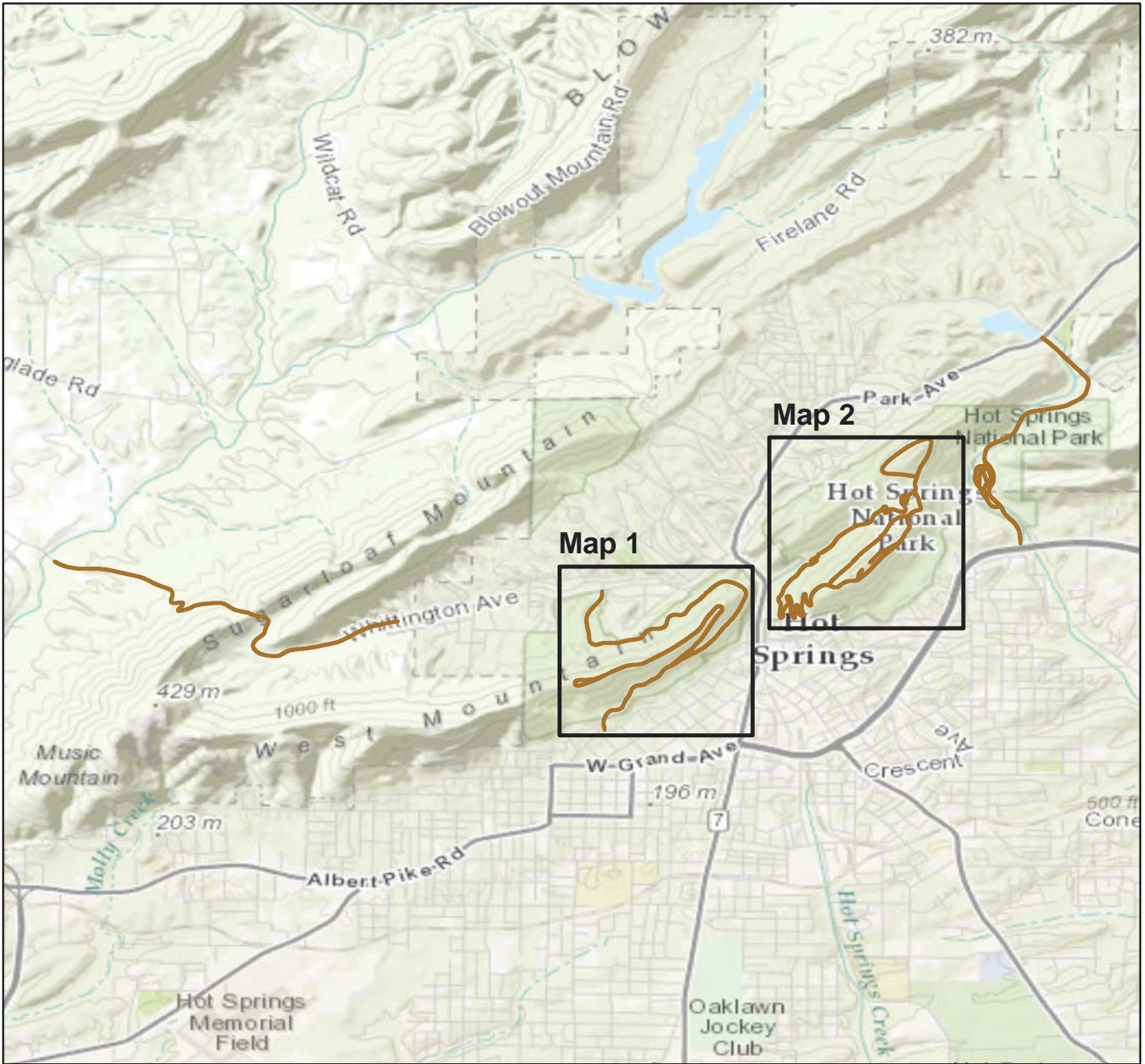


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# Hot Springs National Park

## 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

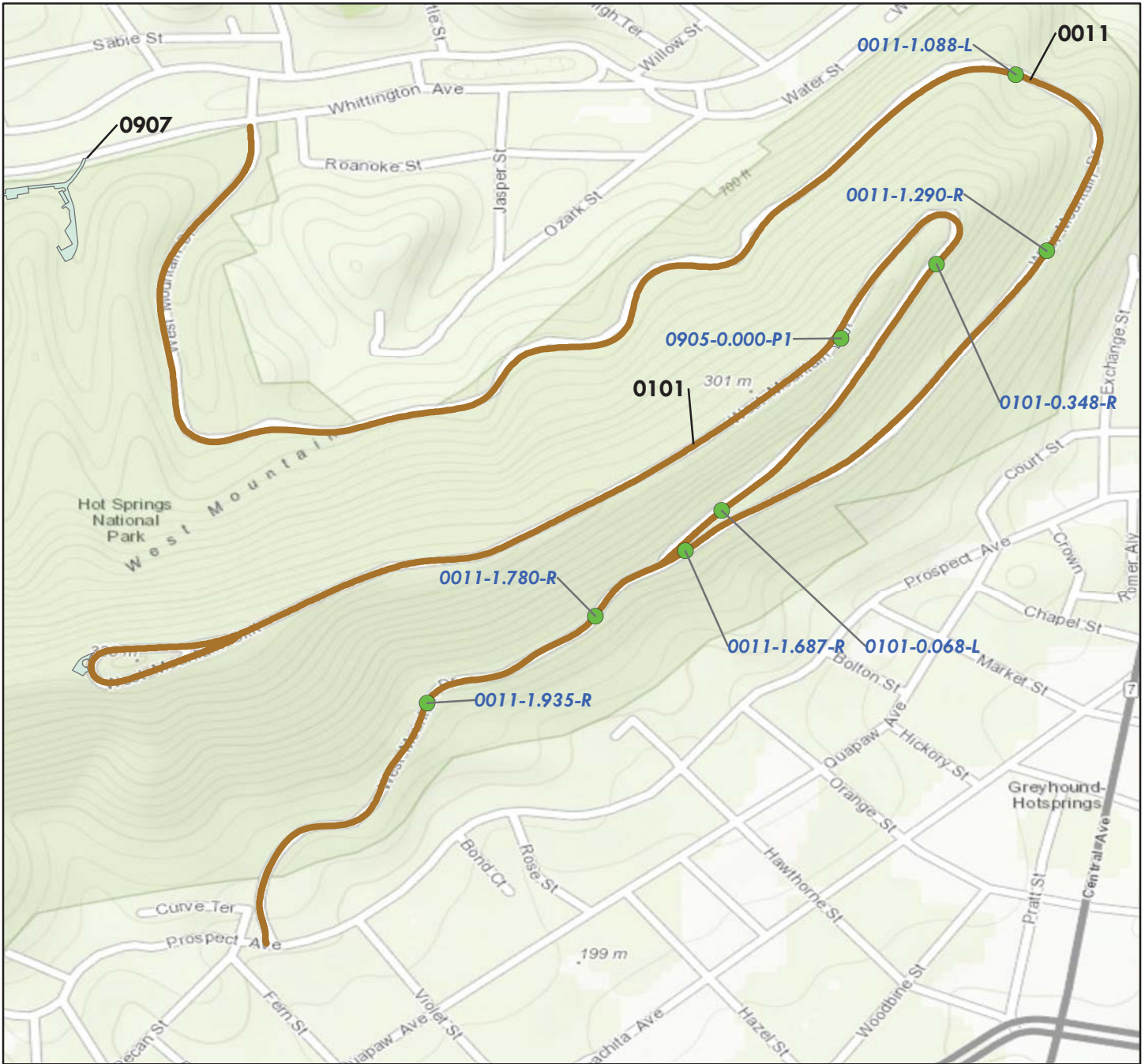
 RIP Collected Routes



# Hot Springs National Park

## WALL LOCATION MAP

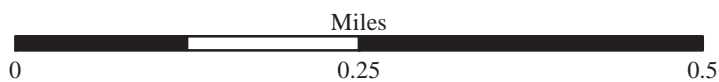
### Map 1



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

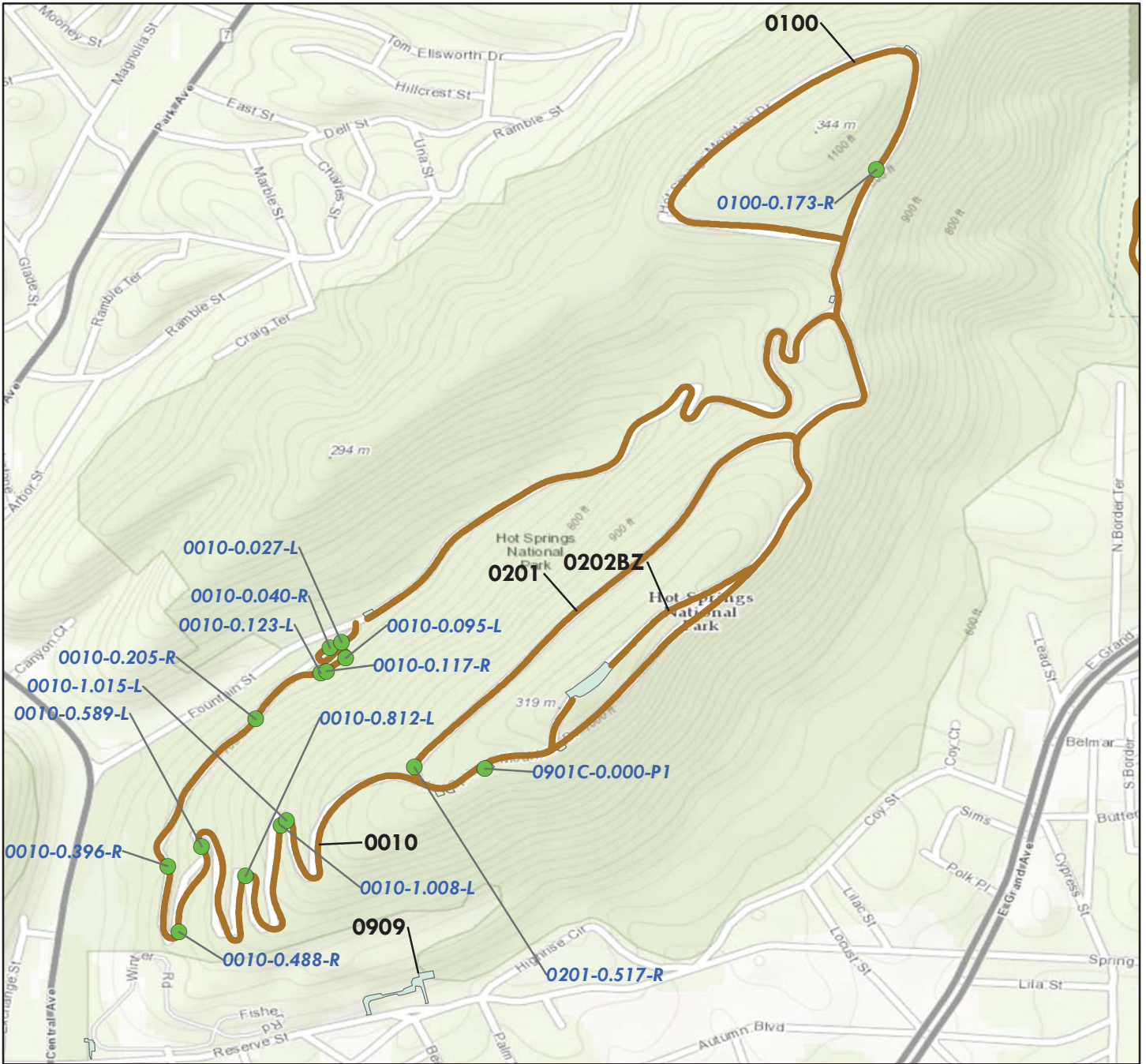




# Hot Springs National Park

## 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



Hot Springs National Park



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## Parkwide Summary: Hot Springs National Park

Initial retaining wall inspections were conducted at Hot Springs 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.

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, 23 walls were inventoried on the routes listed below.

**Table 1: Number of Walls by Route**

Route Number	Route Name	No. of Walls
0010	HOT SPRINGS MOUNTAIN DRIVE	12
0011	WEST MOUNTAIN DRIVE	5
0100	NORTH MOUNTAIN LOOP ROAD	1
0101	SUMMIT ROAD	2
0201	TOWER RETURN ROAD	1
0901C	HOT SPRINGS MOUNTAIN PICNIC AREA PARKING C	1
0905	WEST MOUNTAIN PICNIC AREA 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	10
FW - Fill Wall	10
HW - Head Wall	2
SW - Switchback Wall	1

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
GD, Gravity - Dry Stone	7
GM, Gravity - Mortared Stone	16

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	23
Monitor	\$0	0
Maintenance	\$0	0
Repair Elements	\$0	0
Replace Elements	\$0	0
Replace Wall	\$0	0
<b>Totals</b>	<b>\$0</b>	<b>23</b>

\*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**

<b>Cost Range*</b>	<b>No. of Walls</b>
\$0	23
\$1 - \$25,000	0
\$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
<b>Total Number of Walls</b>	<b>23</b>

\*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 Hot Springs 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.

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 Hot Springs 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**

<b>Wall Identification</b>	<b>Failure Consequence<sup>(1)</sup></b>	<b>Wall Rating<sup>(2)</sup></b>	<b>Recommended Action<sup>(3)</sup></b>	<b>2007 Repair Costs<sup>(4)</sup></b>
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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



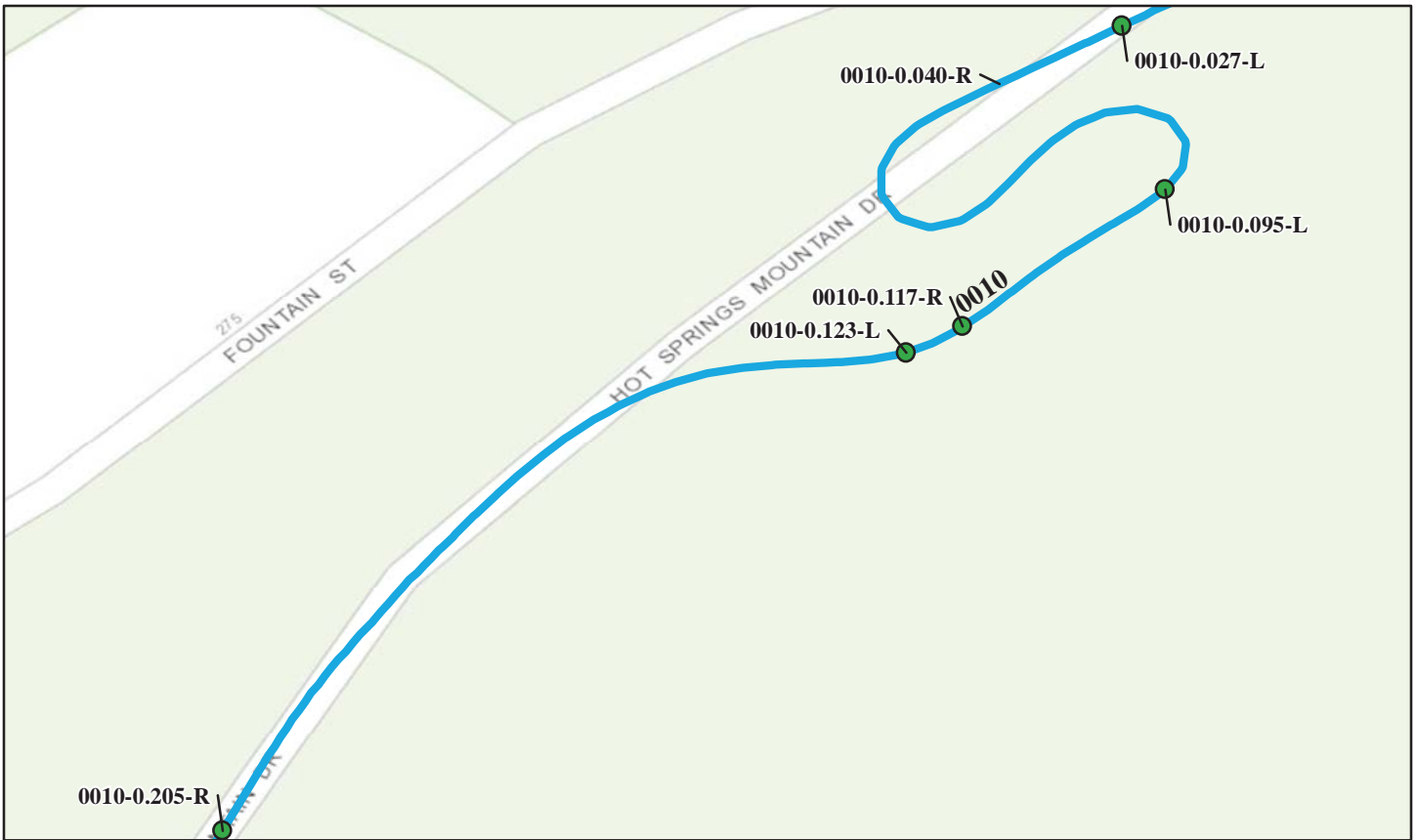
Hot Springs National Park



Federal Lands Highway  
Road Inventory Program

# Hot Springs National Park

## ROUTE 0010: HOT SPRINGS MOUNTAIN 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

### Retaining Wall Condition Legend – Wall Condition Rating

**Critical / Poor (0 - 49)**

**Fair (50 - 69)**

**Good to Excellent (70 - 100)**

**No Data**

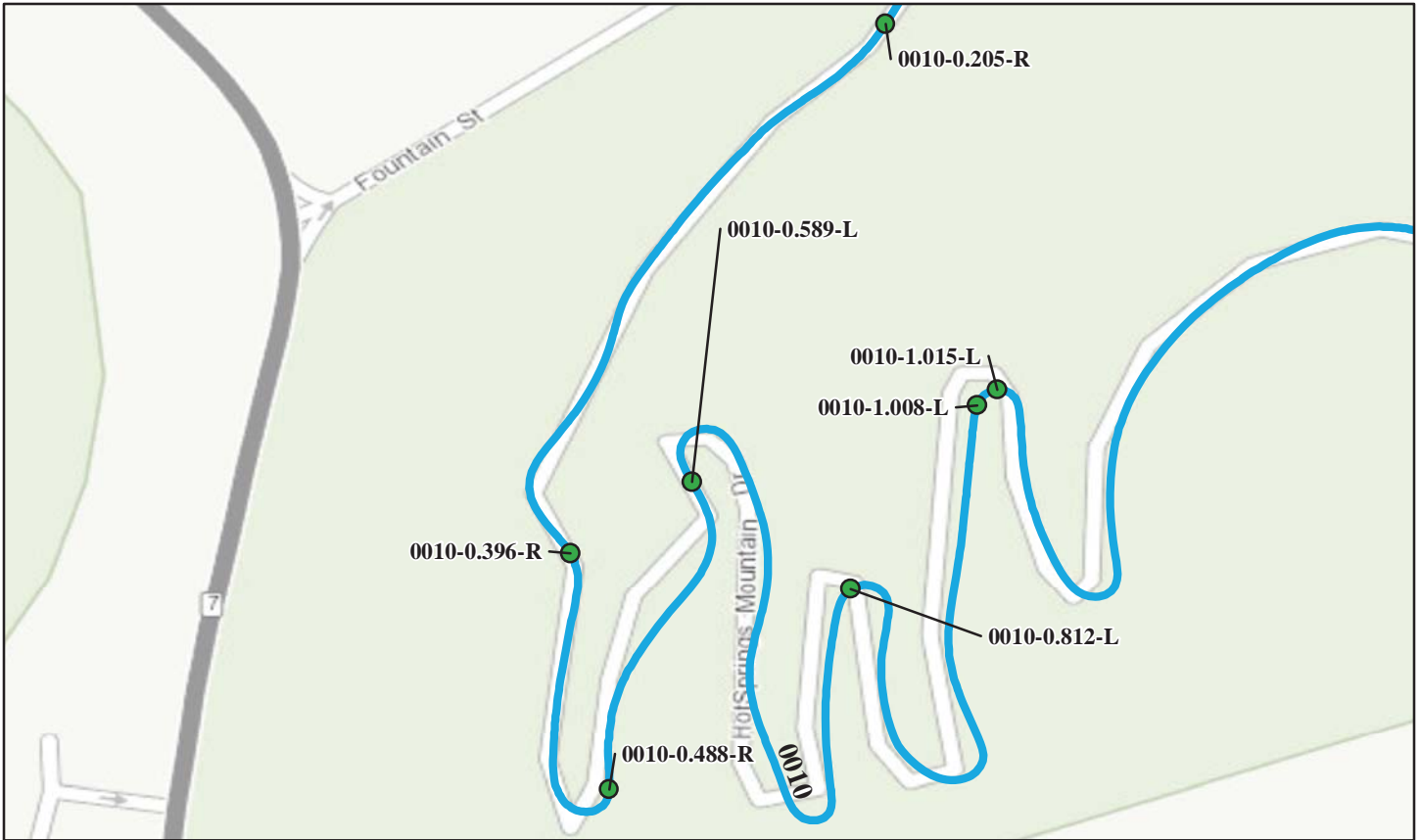
Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
HOSP-0010-0.027-L 4/25/2007	470	67	Gravity - Mortared Stone	Switchback Wall	75	\$0.00
HOSP-0010-0.040-R 4/25/2007	1,710	171	Gravity - Mortared Stone	Fill Wall	61	\$0.00
HOSP-0010-0.095-L 4/25/2007	341	62	Gravity - Mortared Stone	Cut Wall	81	\$0.00
HOSP-0010-0.117-R 4/25/2007	800	80	Gravity - Mortared Stone	Fill Wall	80	\$0.00
HOSP-0010-0.123-L 4/25/2007	1,500	429	Gravity - Mortared Stone	Cut Wall	78	\$0.00

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



# Hot Springs National Park

## ROUTE 0010: HOT SPRINGS MOUNTAIN 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

### Retaining Wall Condition Legend – Wall Condition Rating

**Critical / Poor (0 - 49)**

**Fair (50 - 69)**

**Good to Excellent (70 - 100)**

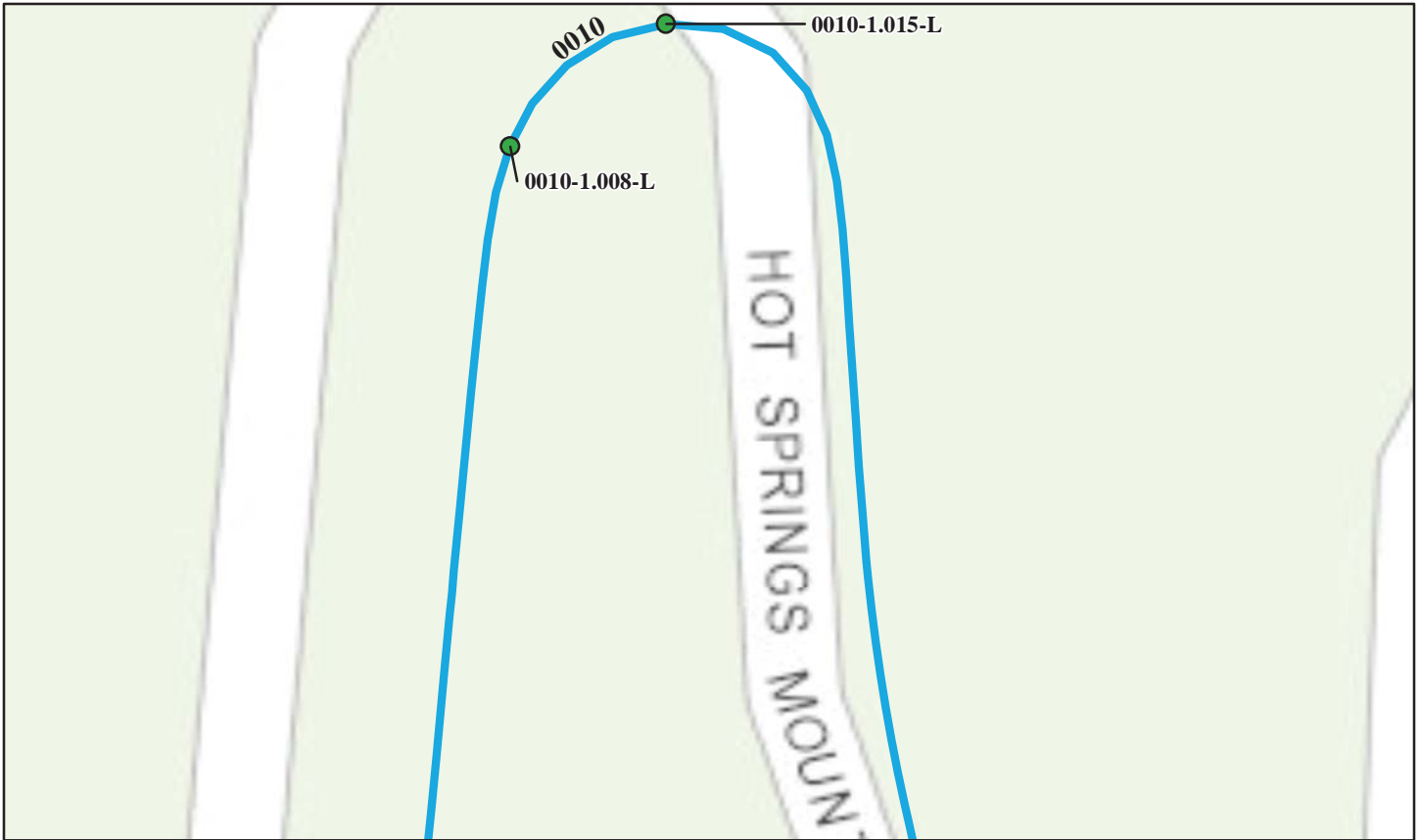
**No Data**

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
HOSP-0010-0.205-R 4/25/2007	540	54	Gravity - Mortared Stone	Head Wall	82	\$0.00
HOSP-0010-0.396-R 4/25/2007	100	18	Gravity - Mortared Stone	Head Wall	83	\$0.00
HOSP-0010-0.488-R 4/25/2007	700	175	Gravity - Mortared Stone	Cut Wall	89	\$0.00
HOSP-0010-0.589-L 4/25/2007	800	108	Gravity - Mortared Stone	Fill Wall	72	\$0.00
HOSP-0010-0.812-L 4/25/2007	630	140	Gravity - Mortared Stone	Cut Wall	78	\$0.00

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

# Hot Springs National Park

## ROUTE 0010: HOT SPRINGS MOUNTAIN 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

### Retaining Wall Condition Legend – Wall Condition Rating

**Critical / Poor (0 - 49)**

**Fair (50 - 69)**

**Good to Excellent (70 - 100)**

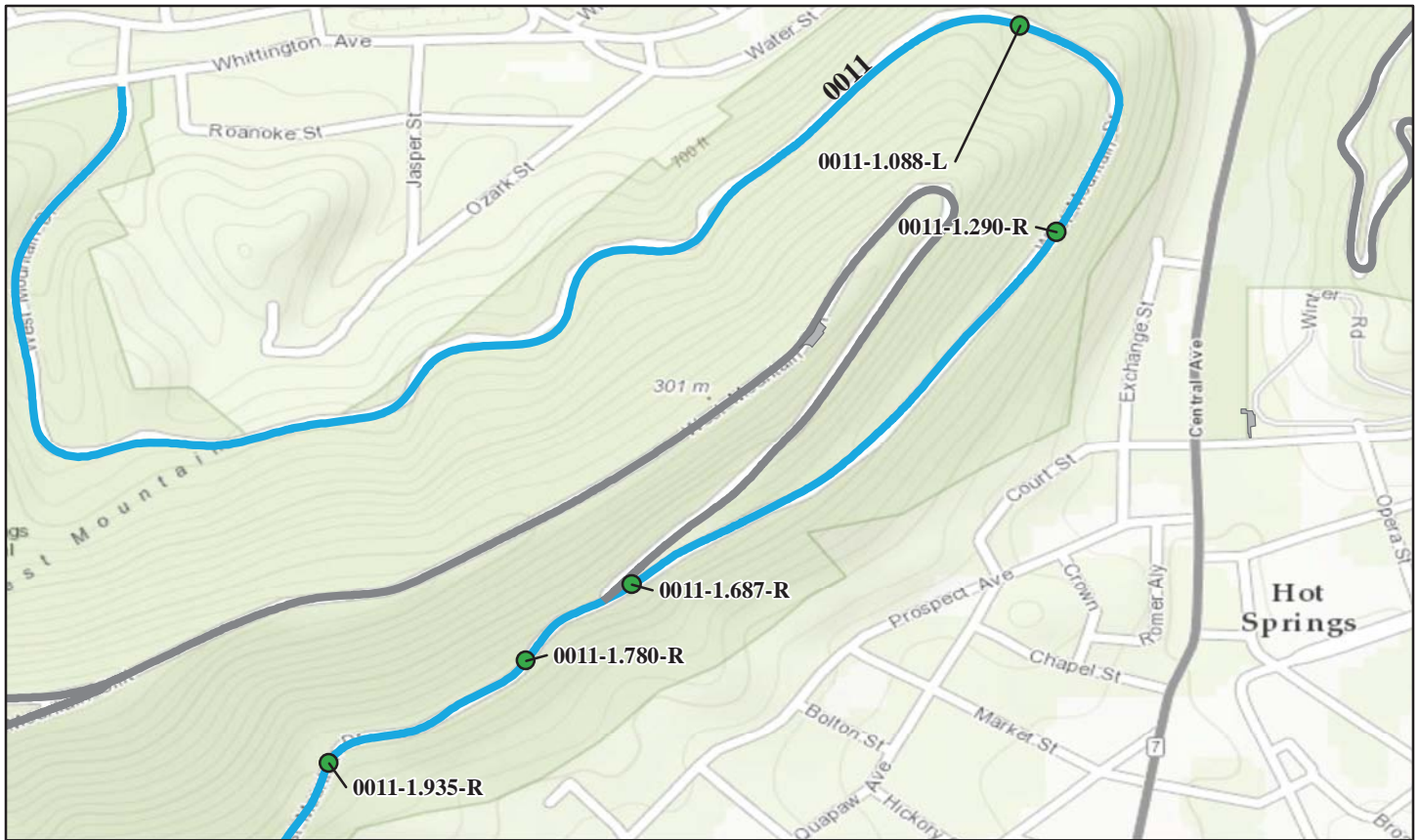
**No Data**

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
HOSP-0010-1.008-L 4/25/2007	180	30	Gravity - Mortared Stone	Fill Wall	74	\$0.00
HOSP-0010-1.015-L 4/25/2007	720	180	Gravity - Mortared Stone	Cut Wall	85	\$0.00

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

# Hot Springs National Park

## ROUTE 0011: WEST MOUNTAIN 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

### Retaining Wall Condition Legend – Wall Condition Rating

Critical / Poor (0 - 49)

Fair (50 - 69)

Good to Excellent (70 - 100)

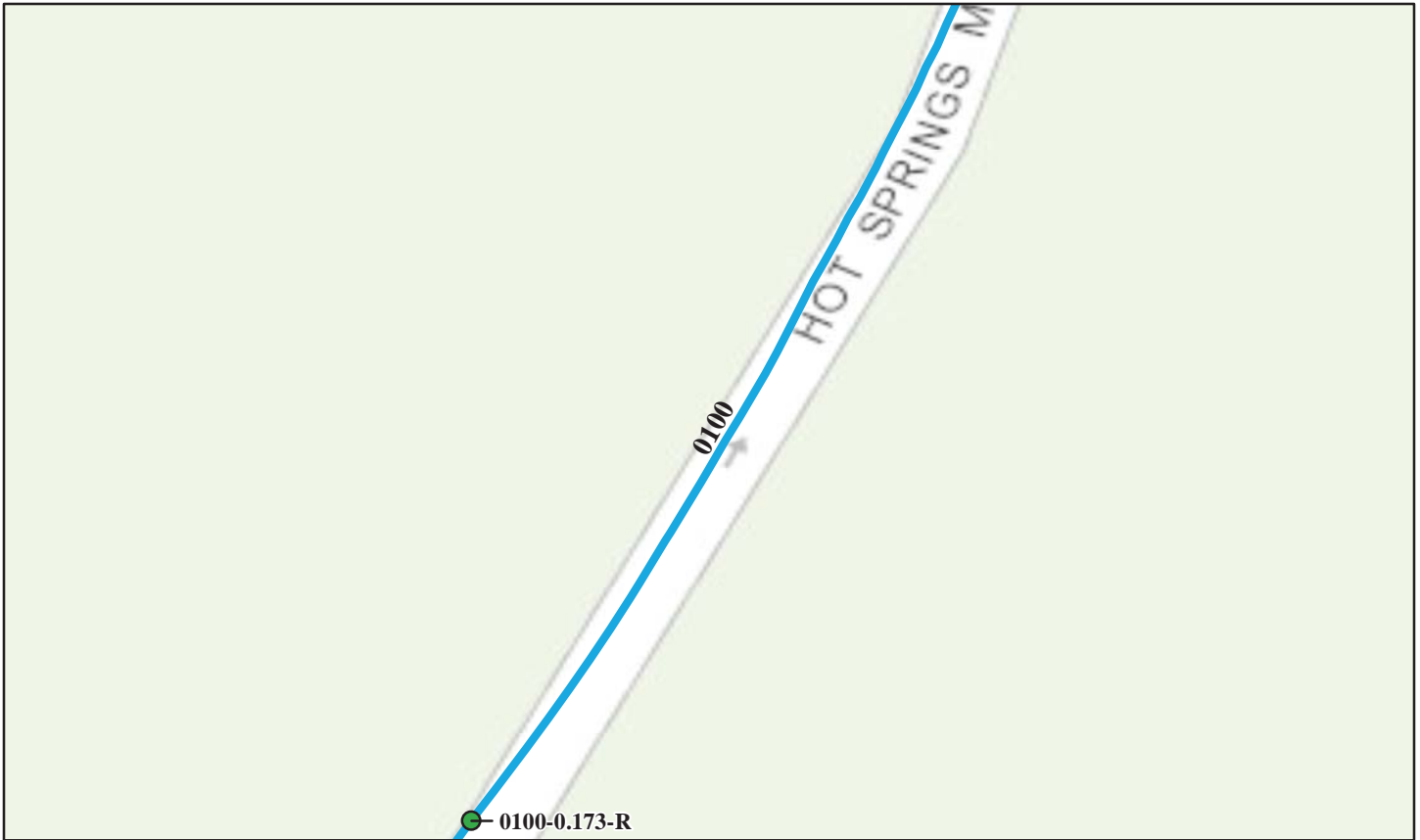
No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
HOSP-0011-1.088-L 4/24/2007	1,500	145	Gravity - Mortared Stone	Fill Wall	88	\$0.00
HOSP-0011-1.290-R 4/24/2007	7,875	1,575	Gravity - Dry Stone	Cut Wall	84	\$0.00
HOSP-0011-1.687-R 4/24/2007	2,125	425	Gravity - Dry Stone	Cut Wall	80	\$0.00
HOSP-0011-1.780-R 4/24/2007	662	147	Gravity - Dry Stone	Cut Wall	83	\$0.00
HOSP-0011-1.935-R 4/24/2007	1,143	254	Gravity - Dry Stone	Cut Wall	84	\$0.00

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

# Hot Springs National Park

## ROUTE 0100: NORTH MOUNTAIN LOOP 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)

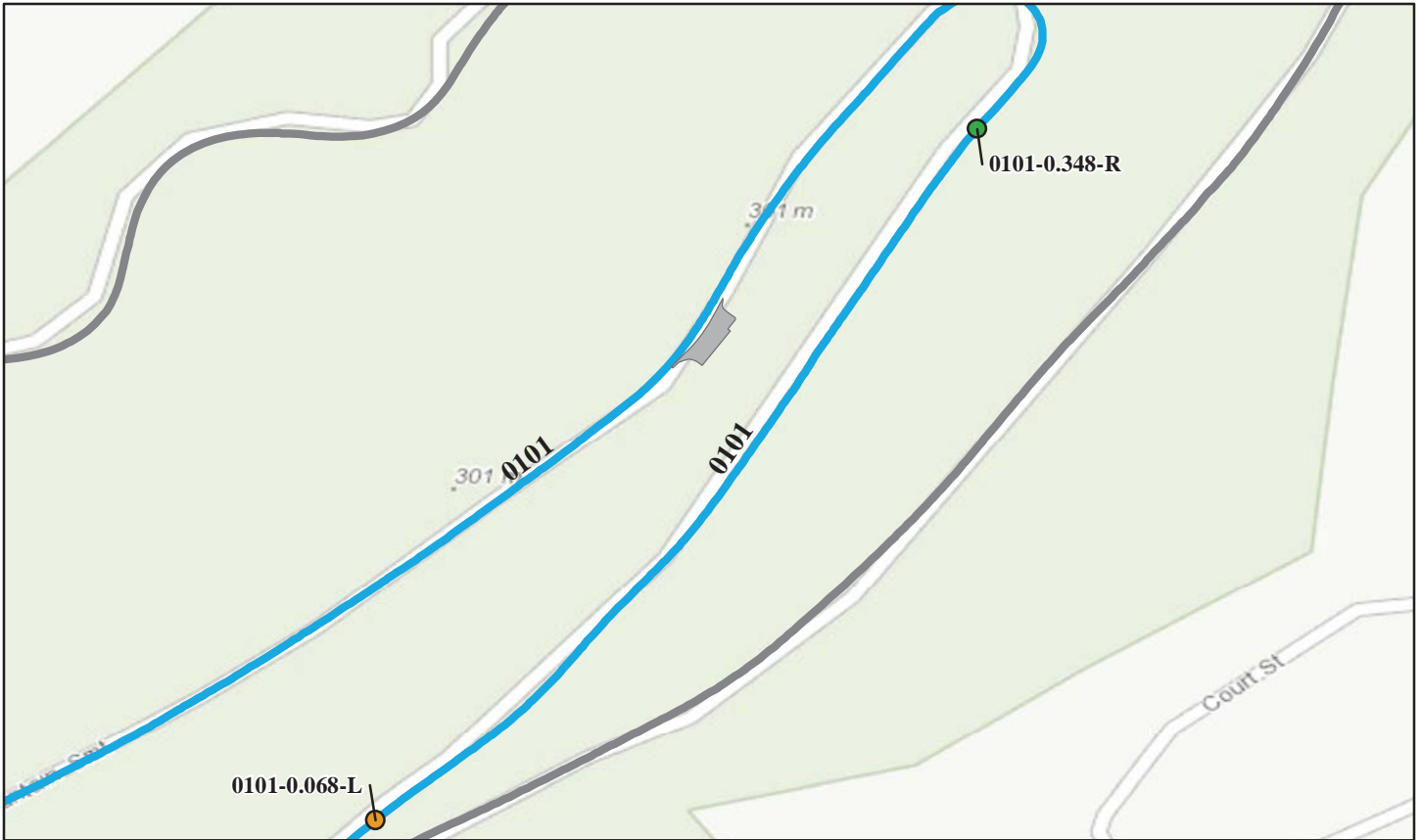
No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
HOSP-0100-0.173-R  4/25/2007	1,900	237	Gravity - Mortared Stone	Fill Wall	80	\$0.00

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

# Hot Springs National Park

## ROUTE 0101: SUMMIT 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)

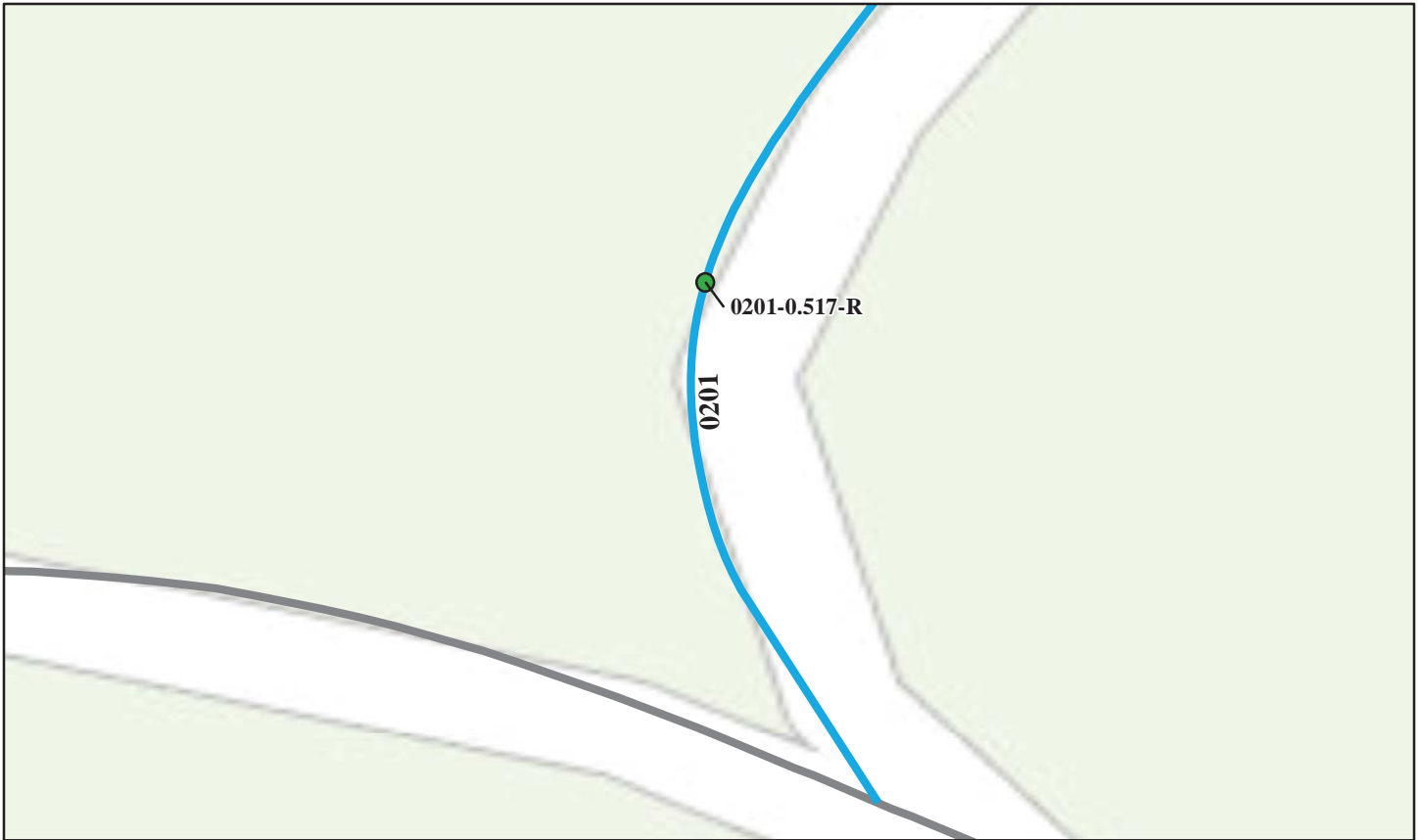
No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
HOSP-0101-0.068-L 4/24/2007	621	117	Gravity - Dry Stone	Cut Wall	67	\$0.00
HOSP-0101-0.348-R 4/24/2007	860	215	Gravity - Dry Stone	Fill Wall	80	\$0.00

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

# Hot Springs National Park

## ROUTE 0201: TOWER RETURN 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)**

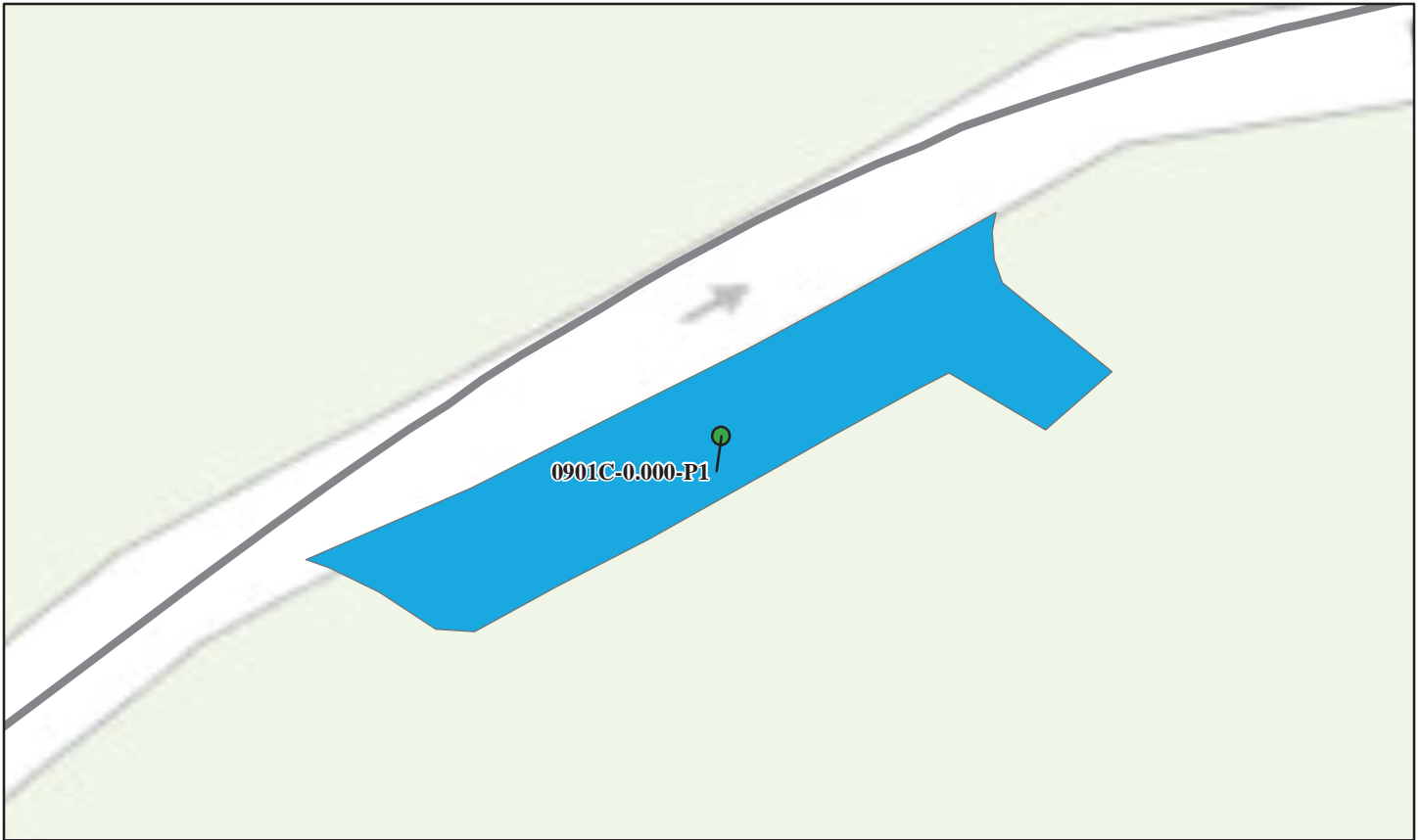
**No Data**

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
HOSP-0201-0.517-R 4/25/2007	200	38	Gravity - Dry Stone	Fill Wall	73	\$0.00

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

# Hot Springs National Park

## ROUTE 0901C: HOT SPRINGS MOUNTAIN PICNIC AREA PARKING C



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)

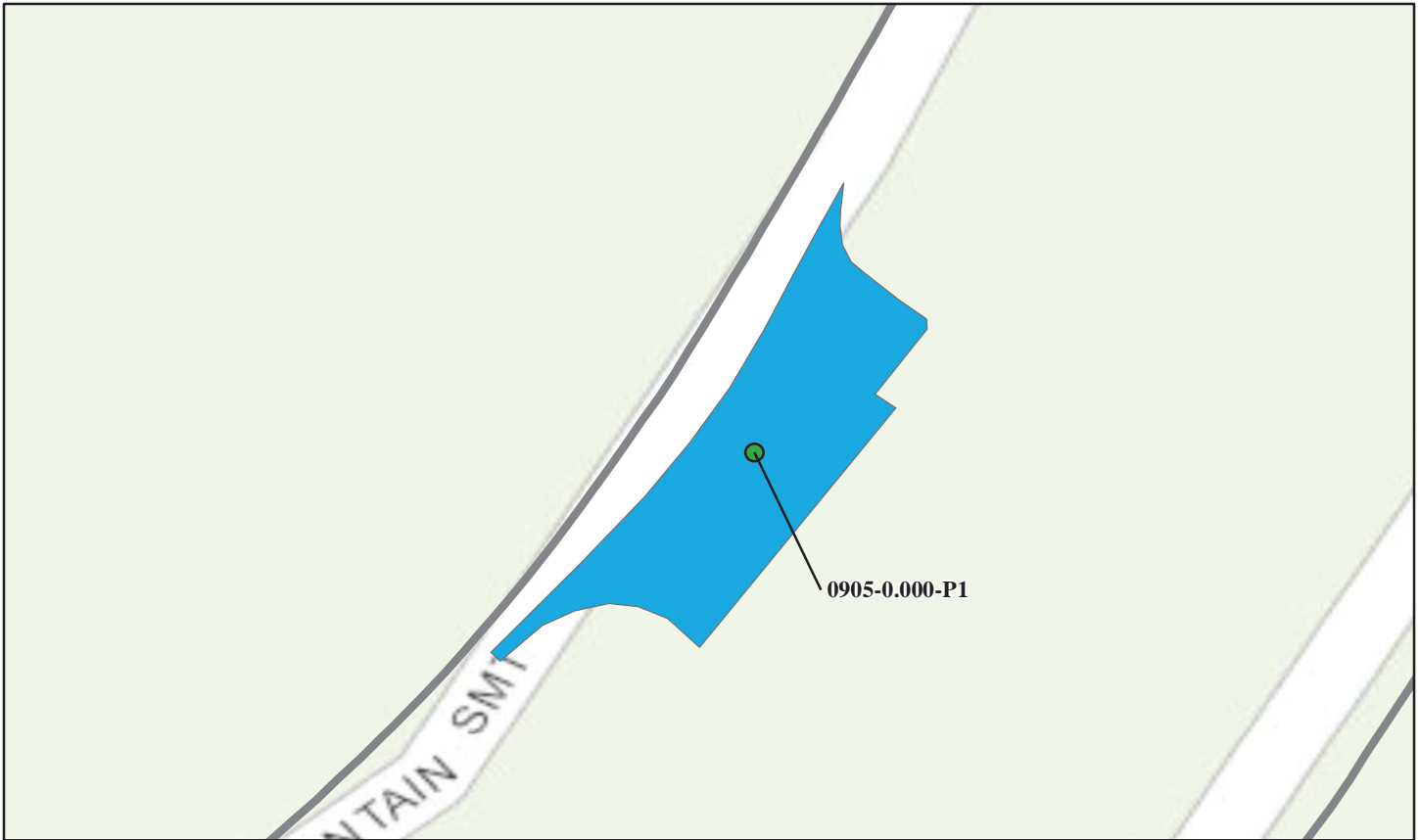
No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
HOSP-0901C-0.000-P1 4/25/2007	425	90	Gravity - Mortared Stone	Fill Wall	90	\$0.00

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

# Hot Springs National Park

## ROUTE 0905: WEST MOUNTAIN PICNIC AREA 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
HOSP-0905-0.000-P1 4/24/2007	600	154	Gravity - Mortared Stone	Fill Wall	87	\$0.00

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



# Tier 3 Retaining Wall Details



Hot Springs National Park



Federal Lands Highway  
Road Inventory Program

<b>Wall ID:</b>	HOSP-0010-0.027-L		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	75	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Switchback Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	Gravity - Dry Stone
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared wall on switchback measured on outside (left side), dry stacked repair at wall start		

### Wall Measurements

<b>Wall Length (ft.):</b>	67	<b>Face Area (sq.):</b>	470
<b>Average Wall Height (ft.):</b>	7	<b>Face Angle (deg.):</b>	85
<b>Maximum Wall Height (ft.):</b>	9	<b>Vertical Offset (ft.):</b>	4

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition, performing as intended, no guardwall, some repairs made	7
WALL FOUNDATION MATERIAL 8.00	No signs of distress or settlement	8
MORTAR 8.00	Minor cracking, 1/8-1/4-inch gaps, minor spalling	7
PLACED STONE 8.00	Non-weathered rock, none missing, one displaced	7
LATERAL SLOPE 0.50	Minor repair at wall start with dry stacked section, gentle at wall end	8
ROAD/SIDEWALK/SHOULDER 0.50	Road- older concrete pavement, some cracks but not related to wall	8
CURB/BERM/DITCH 0.50	Ditch, no signs of displacement or cracks on ditch	9
DOWNSLOPE 0.50	2H:1V short segment, some trees, no erosional features	9
WALL DRAINS 0.50	Drains observed, no signs of water-related problems	9

### Repair Recommendations

<b>Failure Consequence:</b>	HIGH
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.027\_L\_1.jpg**



**HOSP\_0010\_0.027\_L\_2.jpg**

<b>Wall ID:</b>	HOSP-0010-0.040-R		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	61	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	Gravity - Dry Stone
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared fill wall flanked by dry stack wall at each end		

### Wall Measurements

<b>Wall Length (ft.):</b>	171	<b>Face Area (sq.):</b>	1710
<b>Average Wall Height (ft.):</b>	10	<b>Face Angle (deg.):</b>	85
<b>Maximum Wall Height (ft.):</b>	14	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Fair, some repair in the form of dry stacked rock made at each end of the older stone masonry wall and near the highest section of wall vertical cracking, outward movement is evident at the highest wall section near the vertical crack, needs to be monitor	6
WALL FOUNDATION MATERIAL 8.00	No signs of displacement or movement	8
MORTAR 8.00	Large up to 3-inch opening entire height of wall near center, poor condition, old tree removed from this location (which could have been supporting a portion of the wall), appears as if minor spot repairs have been made, outward movement at the highest wa	4
PLACED STONE 8.00	Sound durable rock, non-weathered	8
DOWNSLOPE 0.50	Relatively flat with landscaped grass below (park), channelized drain at the base across half of the wall length	8
LATERAL SLOPE 0.50	Good condition, channelized drain on one side, no signs of distress	8
WALL DRAINS 0.50	None observed, no signs of water-related problems with the wall	8
ROAD/SIDEWALK/SHOULDER 1.00	Road- older rigid pavement with low to moderate block cracks	5
VEGETATION 5.00	Some adverse vegetation causing cracking in the mortar	3

### Repair Recommendations

<b>Failure Consequence:</b>	HIGH
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.040\_R\_1.jpg**



**HOSP\_0010\_0.040\_R\_2.jpg**

<b>Wall ID:</b>	HOSP-0010-0.095-L		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	81	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared cutwall		

### Wall Measurements

<b>Wall Length (ft.):</b>	62	<b>Face Area (sq.):</b>	341
<b>Average Wall Height (ft.):</b>	5	<b>Face Angle (deg.):</b>	86
<b>Maximum Wall Height (ft.):</b>	6	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition, wall performing as intended	8
WALL FOUNDATION MATERIAL 8.00	Founded on rock ditch, no signs of settlement or displacement	9
MORTAR 8.00	Old, but only a few 1/8 to 1/4-inch wide minor cracks, no spalling, occasional gaps	7
PLACED STONE 8.00	No loose or missing elements, occasional partially loose caprock, durable stone	8
ROAD/SIDEWALK/SHOULDER 0.50	Road older rigid pavement with occasional block cracking not associated with wall movement	8
CULVERT 0.50	18-inch PVC, draining well, no observed distress associated with wall	9
CURB/BERM/DITCH 0.50	Rock-lined ditch, no missing rock, minor sedimentation, no associated distress related to wall	9
LATERAL SLOPE 0.50	Ties into bedrock outcrop on both ends	9
UPSLOPE 0.50	2H:1V slope, good vegetation, no erosion observed	9

### Repair Recommendations

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.095\_L\_1.jpg**

<b>Wall ID:</b>	HOSP-0010-0.117-R		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	80	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	Gravity - Dry Stone
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared fill wall with dry stack stones at the uphill end of wall (11 ft)		

### Wall Measurements

<b>Wall Length (ft.):</b>	80	<b>Face Area (sq.):</b>	800
<b>Average Wall Height (ft.):</b>	10	<b>Face Angle (deg.):</b>	82
<b>Maximum Wall Height (ft.):</b>	11	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition, minor cracking, put performing as intended	8
WALL FOUNDATION MATERIAL 8.00	Good condition, sound material, no signs of distress or settlement	9
MORTAR 8.00	Occasional mortar repairs at cap rock, fair condition with occasional gaps, repairs functioning well	7
PLACED STONE 8.00	Good condition, hard durable rock, no broken or missing pieces, stacked rocks added at the end of the wall also in good condition	8
LATERAL SLOPE 0.50	Good condition, ties in with 1.5H:1V to 2H:1V slopes and pathway stairs (minor cracking)	8
ROAD/SIDEWALK/SHOULDER 0.50	Road has minor cracking not associated with the wall, unpaved shoulder has no distress observed but relatively soft materials	8
CULVERT 0.50	4 ft wide x 5 ft high rock-lined culvert, good condition, functioning as intended, with rock-lined drainage outlet, no signs of distress	9
WALL DRAINS 0.50	None observed, no indication of water-related issues with the wall	9
DOWNSLOPE 1.00	Varies from 1H:1V to flat, minor cracking, fair to moderate condition	7

### Repair Recommendations

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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



**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.117\_R\_1.jpg**



**HOSP\_0010\_0.117\_R\_2.jpg**

<b>Wall ID:</b>	HOSP-0010-0.123-L		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	78	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared cut wall, constructed in 3 sections.		

### Wall Measurements

<b>Wall Length (ft.):</b>	429	<b>Face Area (sq.):</b>	1500
<b>Average Wall Height (ft.):</b>	3	<b>Face Angle (deg.):</b>	82
<b>Maximum Wall Height (ft.):</b>	5	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good, performing as intended. Minor repairs made in older section.	8
WALL FOUNDATION MATERIAL 8.00	Good condition. Founded on firm soil or rock. No indication of settlement or displacement.	9
MORTAR 8.00	Fair condition. Recent repairs in minor location, occasional cracking, brittle.	6
PLACED STONE 8.00	Durable, some openings built in for planting purposes not affecting wall performance.	8
LATERAL SLOPE 0.50	relatively flat, well vegetated, no erosion observed.	8
ROAD/SIDEWALK/SHOULDER 0.50	Road. Occasional block cracks, not associated with wall.	8
UPSLOPE 0.50	Gentle slope, 3:1 to 2:1 well vegetated.	8
WALL DRAINS 0.50	No signs of drainage related issues.	8
CURB/BERM/DITCH 0.50	Ditch. Stone mortared ditch in good condition.	9

### Repair Recommendations

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.123\_L\_1.jpg**



**HOSP\_0010\_0.123\_L\_2.jpg**

<b>Wall ID:</b>	HOSP-0010-0.205-R		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	82	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Head Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared headwall		

### Wall Measurements

<b>Wall Length (ft.):</b>	54	<b>Face Area (sq.):</b>	540
<b>Average Wall Height (ft.):</b>	10	<b>Face Angle (deg.):</b>	86
<b>Maximum Wall Height (ft.):</b>	13	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good, performing as intended.	8
WALL FOUNDATION MATERIAL 8.00	Good condition, no signs of distress.	9
MORTAR 8.00	Some cracks. Occasional spalling, up to 1/2" gaps.	7
PLACED STONE 8.00	Occasional cracks and missing rock. Overall rock in sound durable condition.	9
CULVERT 0.50	4' (w) X 5.5' (H) stone mortared culvert. No cracks or missing rock.	9
DOWNSLOPE 0.50	Gentle, well vegetated ivy.	9
WALL DRAINS 0.50	None observed. No signs of drainage related issues.	9
ROAD/SIDEWALK/SHOULDER 1.00	Road and shoulder. One transverse crack above culvert not affecting wall performance. One erosional feature on the shoulder.	6
LATERAL SLOPE 1.00	Over steepened at wall start. Well vegetated at wall end.	7

### Repair Recommendations

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.205\_R\_1.jpg**



**HOSP\_0010\_0.205\_R\_2.jpg**

<b>Wall ID:</b>	HOSP-0010-0.396-R		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	83	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Head Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared headwall		

### Wall Measurements

<b>Wall Length (ft.):</b>	18	<b>Face Area (sq.):</b>	100
<b>Average Wall Height (ft.):</b>	6	<b>Face Angle (deg.):</b>	90
<b>Maximum Wall Height (ft.):</b>	7	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition. Functioning as intended. Minor mortar spalling.	8
WALL FOUNDATION MATERIAL 8.00	Good condition, no signs of distress. Good soil base. Good condition. No indication of settlement or displacement.	8
MORTAR 8.00	Occasional cracks, recent repairs, good condition.	8
PLACED STONE 8.00	Occasional cracking, overall sound durable rock, no missing pieces.	9
DOWNSLOPE 0.50	Gentle, grassy, no signs of erosion.	8
LATERAL SLOPE 0.50	Well vegetated on one side, pathway on the other side.	8
ROAD/SIDEWALK/SHOULDER 0.50	Road. Some block cracks but not associated with wall.	8
CULVERT 0.50	2.6' (W) X 3.5' (H) stone mortared arched culvert. Good condition, no missing rock or cracks.	9
WALL DRAINS 0.50	None observed. No signs of drainage related issues.	9

### Repair Recommendations

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.396\_R\_1.jpg**



**HOSP\_0010\_0.396\_R\_2.jpg**

<b>Wall ID:</b>	HOSP-0010-0.488-R		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	89	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared cut wall		

### Wall Measurements

<b>Wall Length (ft.):</b>	175	<b>Face Area (sq.):</b>	700
<b>Average Wall Height (ft.):</b>	4	<b>Face Angle (deg.):</b>	85
<b>Maximum Wall Height (ft.):</b>	4	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good, performing as intended.	9
WALL FOUNDATION MATERIAL 8.00	Good condition. Founded on good soil or rock. No indication of settlement or displacement.	9
MORTAR 8.00	Minimal and occasional cracks, good condition, appears fresh.	9
PLACED STONE 8.00	Good, sound, durable rock. Occasional loose cap rock.	9
CURB/BERM/DITCH 0.50	Ditch. Good condition. No missing rock or cracks.	8
ROAD/SIDEWALK/SHOULDER 0.50	Road. Minor longitudinal and transverse cracks. Not affecting performance of the wall.	8
UPSLOPE 0.50	2:1 to 1.5:1 slope. Well vegetated. No erosion observed.	9
WALL DRAINS 0.50	None observed. No signs of drainage related issues.	9
LATERAL SLOPE 1.00	Good on one side. Over steepened upslope, minor erosion.	7

### Repair Recommendations

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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



**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.488\_R\_1.jpg**

<b>Wall ID:</b>	HOSP-0010-0.589-L		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	72	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared fill wall on outside curve above trail.		

### Wall Measurements

<b>Wall Length (ft.):</b>	108	<b>Face Area (sq.):</b>	800
<b>Average Wall Height (ft.):</b>	7	<b>Face Angle (deg.):</b>	90
<b>Maximum Wall Height (ft.):</b>	10	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Fair to good, mortar may need some future repair.	7
WALL FOUNDATION MATERIAL 8.00	No sign of settlement, minor erosion.	8
MORTAR 8.00	Up to 1" gaps, displacement at cracks, several repairs made.	5
PLACED STONE 8.00	Sound, durable rock.	9
DOWNSLOPE 0.50	Gentle slope. Peak Trail below, no signs of distress.	8
LATERAL SLOPE 0.50	2:1 to 1.5:1 slope. Some vegetation present.	8
WALL DRAINS 0.50	None observed. No signs of drainage related issues.	8
ROAD/SIDEWALK/SHOULDER 1.00	Road and shoulder. Moderate block cracks not affecting wall performance. Soft shoulder. One erosional feature present.	6

### Repair Recommendations

<b>Failure Consequence:</b>	HIGH
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.589\_L\_1.jpg**



**HOSP\_0010\_0.589\_L\_2.jpg**

<b>Wall ID:</b>	HOSP-0010-0.812-L		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	78	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared cut wall on outside curve.		

### Wall Measurements

<b>Wall Length (ft.):</b>	140	<b>Face Area (sq.):</b>	630
<b>Average Wall Height (ft.):</b>	4	<b>Face Angle (deg.):</b>	80
<b>Maximum Wall Height (ft.):</b>	6	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good, performing as intended. No missing elements.	8
WALL FOUNDATION MATERIAL 8.00	Founded partially on rock ditch. No sign of distress.	8
MORTAR 8.00	1/8" to 3/8" gaps, some cracks.	6
PLACED STONE 8.00	Good, sound, durable rock.	9
CURB/BERM/DITCH 0.50	Rock mortared ditch in good condition, minor cracks, no rock missing.	8
LATERAL SLOPE 0.50	Wall ties into newer existing wall at start, gentle slope at wall end.	8
WALL DRAINS 0.50	None observed. No signs of drainage related issues.	8
UPSLOPE 0.50	Gentle, well vegetated.	9
ROAD/SIDEWALK/SHOULDER 1.00	Road. Some transverse cracks, some block cracks, minor stripping.	7

### Repair Recommendations

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_0.812\_L\_1.jpg**

<b>Wall ID:</b>	HOSP-0010-1.008-L		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	74	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared wall on outside of curve.		

### Wall Measurements

<b>Wall Length (ft.):</b>	30	<b>Face Area (sq.):</b>	180
<b>Average Wall Height (ft.):</b>	6	<b>Face Angle (deg.):</b>	90
<b>Maximum Wall Height (ft.):</b>	8	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good. Overall. Poor lateral slopes. Some repairs on wall end cap.	7
WALL FOUNDATION MATERIAL 8.00	No indication of settlement or displacement.	7
MORTAR 8.00	No crack or spalling.	8
PLACED STONE 8.00	Hard, sound rock.	8
DOWNSLOPE 0.50	Moderate steepness, no erosion or displacement.	8
LATERAL SLOPE 1.00	Over steepened. Loose soil.	4
WALL DRAINS 0.50	None observed. No signs of drainage related issues.	8
ROAD/SIDEWALK/SHOULDER 1.00	Road and shoulder. Moderate block cracks, soft shoulder.	6

### Repair Recommendations

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_1.008\_L\_1.jpg**



**HOSP\_0010\_1.008\_L\_2.jpg**

<b>Wall ID:</b>	HOSP-0010-1.015-L		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1911
<b>*Wall Rating:</b>	85	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared cut wall.		

### Wall Measurements

<b>Wall Length (ft.):</b>	180	<b>Face Area (sq.):</b>	720
<b>Average Wall Height (ft.):</b>	4	<b>Face Angle (deg.):</b>	80
<b>Maximum Wall Height (ft.):</b>	5	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good, performing as intended.	8
WALL FOUNDATION MATERIAL 8.00	Good condition. Founded on good soil or rock. No indication of settlement or displacement.	9
MORTAR 8.00	Good condition, minor isolated cracking (1/8"). No spalling or missing rock.	8
PLACED STONE 8.00	Good, sound, durable rock.	9
CURB/BERM/DITCH 0.50	Ditch. Minor cracks in rock mortared ditch. No missing rock or erosion.	8
ROAD/SIDEWALK/SHOULDER 0.50	Road. Moderate block cracks and stripping. Not affecting wall performance.	8
LATERAL SLOPE 0.50	Bedrock at wall start. Wall ties in with gentle slope at wall end. Good transition.	9
UPSLOPE 0.50	2:1 slope, well vegetated and no signs of erosion.	9
WALL DRAINS 0.50	No signs of drainage related issues.	9

### Repair Recommendations

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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



**Hot Springs National Park**  
**ROUTE 0010: HOT SPRINGS MOUNTAIN DRIVE**

**Retaining Wall Condition Photos**



**HOSP\_0010\_1.015\_L\_1.jpg**

<b>Wall ID:</b>	HOSP-0011-1.088-L		
<b>Route Name:</b>	WEST MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 24, 2007	<b>Approximate Year Built:</b>	1950
<b>*Wall Rating:</b>	88	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortar fill wall at the toe of a slope adjacent to the Oak Trail below		

### Wall Measurements

<b>Wall Length (ft.):</b>	145	<b>Face Area (sq.):</b>	1500
<b>Average Wall Height (ft.):</b>	10	<b>Face Angle (deg.):</b>	80
<b>Maximum Wall Height (ft.):</b>	15	<b>Vertical Offset (ft.):</b>	56

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition with no signs of distress, no indication of problems or history of remediation	9
WALL FOUNDATION MATERIAL 8.00	No observed distress or settlement, no bulging or signs of movement	9
MORTAR 8.00	1/8 to 3/16 inch gaps in occasional locations, intact , no observed spalling, functioning as intended	8
PLACED STONE 8.00	No observed distress, no signs of loose or fractured rock, no observed weathering	9
ROAD/SIDEWALK/SHOULDER 0.50	Road shows no signs of distress above wall	9
WALL DRAINS 0.50	None observed, no indication of poor drainage or drainage issues	9
DOWNSLOPE 0.50	Well vegetated, no signs of creep or slope movement, trees upright, blends with adjacent slopes	10
LATERAL SLOPE 0.50	Well vegetated, no signs of creep or slope movement, trees upright, blends with adjacent slopes	10
UPSLOPE 0.50	Well vegetated, no signs of creep or slope movement, trees upright, blends with adjacent slopes	10

### Repair Recommendations

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

# Hot Springs National Park

ROUTE 0011: WEST MOUNTAIN DRIVE

## Retaining Wall Condition Photos



HOSP\_0011\_1.088\_L\_1.jpg



HOSP\_0011\_1.088\_L\_2.jpg

<b>Wall ID:</b>	HOSP-0011-1.290-R		
<b>Route Name:</b>	WEST MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 24, 2007	<b>Approximate Year Built:</b>	1935
<b>*Wall Rating:</b>	84	<b>Maintenance Action:</b>	No Action

**Wall Description**

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Dry Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone dry stacked cut wall above existing rock ditch		

**Wall Measurements**

<b>Wall Length (ft.):</b>	1575	<b>Face Area (sq.):</b>	7875
<b>Average Wall Height (ft.):</b>	5	<b>Face Angle (deg.):</b>	72
<b>Maximum Wall Height (ft.):</b>	7	<b>Vertical Offset (ft.):</b>	0

**Assessed Elements**

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition, performing as intended, no missing rock or signs of distress	8
WALL FOUNDATION MATERIAL 8.00	No evidence of settlement or displacement, founded on existing rock ditch	9
PLACED STONE 8.00	No weathering or cracked stone, burrows present but not affecting wall performance	8
CURB/BERM/DITCH 0.50	Rock ditch, no signs of distress	9
LATERAL SLOPE 0.50	No signs of distress, well vegetated, 2H:1V slope	9
ROAD/SIDEWALK/SHOULDER 0.50	No roadway distress associated with the wall	9
UPSLOPE 0.50	Well vegetated which stabilizes the slope, 2H:1V slope	9
WALL DRAINS 0.50	None visible, no signs of drainage related problems	9

**Repair Recommendations**

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

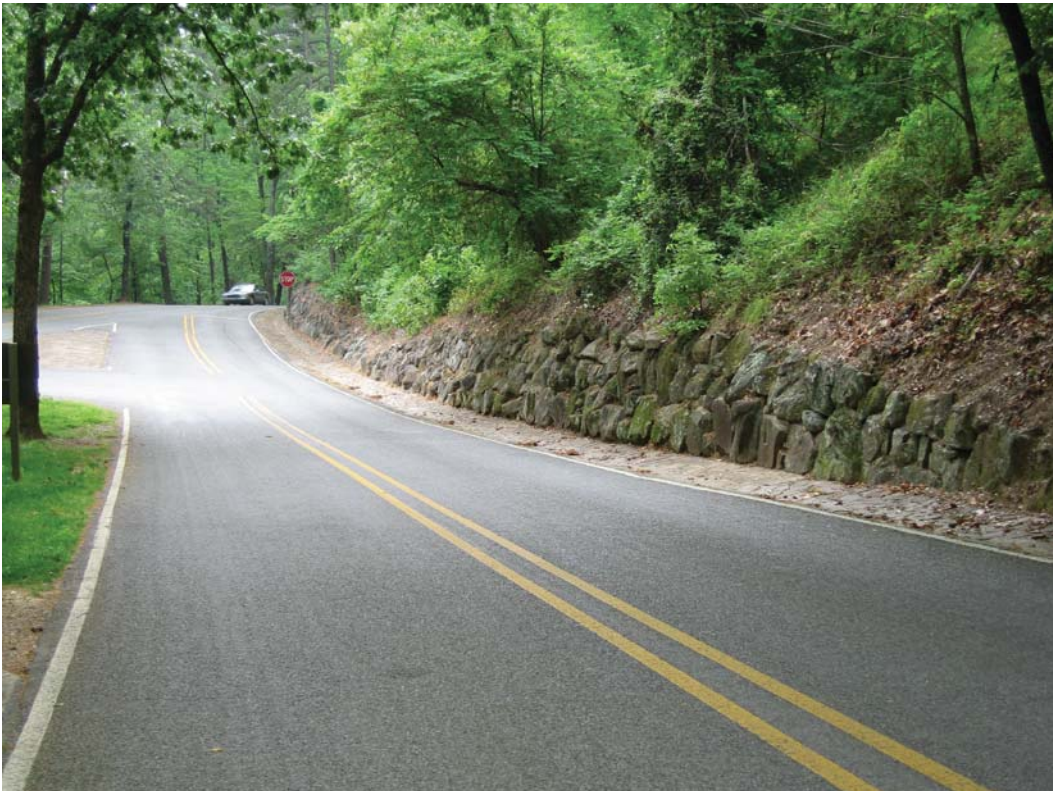
# Hot Springs National Park

ROUTE 0011: WEST MOUNTAIN DRIVE

## Retaining Wall Condition Photos



HOSP\_0011\_1.290\_R\_1.jpg



HOSP\_0011\_1.290\_R\_2.jpg

<b>Wall ID:</b>	HOSP-0011-1.687-R		
<b>Route Name:</b>	WEST MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 24, 2007	<b>Approximate Year Built:</b>	1935
<b>*Wall Rating:</b>	80	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Dry Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone dry stack cutwall at the intersection with Summit Road (the first 1/2 wall length is along Summit Road)		

### Wall Measurements

<b>Wall Length (ft.):</b>	425	<b>Face Area (sq.):</b>	2125
<b>Average Wall Height (ft.):</b>	5	<b>Face Angle (deg.):</b>	70
<b>Maximum Wall Height (ft.):</b>	7	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition, functioning as intended, no signs of distress	8
WALL FOUNDATION MATERIAL 8.00	No signs of distress or movement, performing as intended	9
PLACED STONE 8.00	Occasional burrows and voids, occasional fracturing at the surface, occasional movement and missing small rocks	7
ROAD/SIDEWALK/SHOULDER 0.50	Road - no observed distress in pavement related to wall, some cracking seams unrelated to wall	8
LATERAL SLOPE 0.50	2H:1V to 3H:1V slope, heavy vegetation which stabilizes the slope, no signs of distress	9
UPSLOPE 0.50	2H:1V to 3H:1V slope, heavy vegetation which stabilizes the slope, no signs of movement or creep, trees are vertical	9
VEGETATION 0.50	Occasional grasses between boulders, which stabilizes the soil matrix, wall performance not affected by grasses	9
WALL DRAINS 0.50	Non observed, no signs of erosion (2 drop-inlets below, no distress, independent of wall)	9
CURB/BERM/DITCH 1.00	Ditch- few repairs made, few replaced blocks (stone-mortared lined), 2 generations of mortar indicating past repairs	6

### Repair Recommendations

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

# Hot Springs National Park

ROUTE 0011: WEST MOUNTAIN DRIVE

## Retaining Wall Condition Photos



HOSP\_0011\_1.687\_R\_1.jpg



HOSP\_0011\_1.687\_R\_2.jpg

<b>Wall ID:</b>	HOSP-0011-1.780-R		
<b>Route Name:</b>	WEST MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 24, 2007	<b>Approximate Year Built:</b>	1935
<b>*Wall Rating:</b>	83	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Dry Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone dry stacked cutwall above rock ditch on inside curve going downhill.		

### Wall Measurements

<b>Wall Length (ft.):</b>	147	<b>Face Area (sq.):</b>	662
<b>Average Wall Height (ft.):</b>	4	<b>Face Angle (deg.):</b>	70
<b>Maximum Wall Height (ft.):</b>	6	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good- no significant signs of distress, performing as intended	8
WALL FOUNDATION MATERIAL 8.00	No signs of distress, bulging, or displacement	9
PLACED STONE 8.00	Good condition, no cracking or spalling, occasional burrows, no missing stones	8
LATERAL SLOPE 0.50	1.5H:1V to 2H:1V slope, no signs of erosion or impact to wall	8
CURB/BERM/DITCH 0.50	Rock mortared ditch - good condition, no patching or mortar replacement	9
ROAD/SIDEWALK/SHOULDER 0.50	Roadway - no signs of distress related to roadway	9
WALL DRAINS 0.50	None observed, no signs of water-related distress to wall	9
UPSLOPE 1.00	Small slump (approximately 5-ft by 3-ft), 1.5H:1V slope, minor slope movement not impacting wall performance	7

### Repair Recommendations

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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



# Hot Springs National Park

ROUTE 0011: WEST MOUNTAIN DRIVE

## Retaining Wall Condition Photos



HOSP\_0011\_1.780\_R\_1.jpg

<b>Wall ID:</b>	HOSP-0011-1.935-R		
<b>Route Name:</b>	WEST MOUNTAIN DRIVE		
<b>Inspection Date:</b>	April 24, 2007	<b>Approximate Year Built:</b>	1935
<b>*Wall Rating:</b>	84	<b>Maintenance Action:</b>	No Action

**Wall Description**

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Dry Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone dry stacked cutwall above rock ditch on inside curve going downhill		

**Wall Measurements**

<b>Wall Length (ft.):</b>	254	<b>Face Area (sq.):</b>	1143
<b>Average Wall Height (ft.):</b>	4	<b>Face Angle (deg.):</b>	70
<b>Maximum Wall Height (ft.):</b>	6	<b>Vertical Offset (ft.):</b>	0

**Assessed Elements**

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition, no significant signs of distress , performing as intended	8
WALL FOUNDATION MATERIAL 8.00	No signs of distress, bulging, or displacement	9
PLACED STONE 8.00	No signs of distress, no missing blocks, no burrows, no weathering, no cracking or spalling	8
CURB/BERM/DITCH 0.50	Stone mortared ditch in front of cutwall, good condition with no patching or mortar replacement observed	9
LATERAL SLOPE 0.50	2H:1V slope, well vegetated which stabilizes the slope, no signs of slumps or erosion	9
ROAD/SIDEWALK/SHOULDER 0.50	Road- no signs of distress related to wall	9
UPSLOPE 0.50	2H:1V slope, well vegetated which stabilizes the slope, no signs of slumps or erosion	9
WALL DRAINS 0.50	None observed, no signs of water-related issues associated with the wall	9

**Repair Recommendations**

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

# Hot Springs National Park

ROUTE 0011: WEST MOUNTAIN DRIVE

## Retaining Wall Condition Photos



HOSP\_0011\_1.935\_R\_1.jpg

<b>Wall ID:</b>	HOSP-0100-0.173-R		
<b>Route Name:</b>	NORTH MOUNTAIN LOOP ROAD		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	2000
<b>*Wall Rating:</b>	80	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared fill wall with no guardwall and fairly recent (2000?) construction.		

### Wall Measurements

<b>Wall Length (ft.):</b>	237	<b>Face Area (sq.):</b>	1900
<b>Average Wall Height (ft.):</b>	8	<b>Face Angle (deg.):</b>	79
<b>Maximum Wall Height (ft.):</b>	9	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good, wall performing as intended.	8
WALL FOUNDATION MATERIAL 8.00	No sign of distress or settlement.	9
MORTAR 8.00	Discontinuous mortar, fair condition.	7
PLACED STONE 8.00	Sound, durable rock. Some missing rock.	8
ROAD/SIDEWALK/SHOULDER 0.50	Road. Minor longitudinal cracks.	8
VEGETATION 0.50	Vines, no adverse effect on wall.	8
CULVERT 0.50	Two recently placed culverts, functioning as intended.	9
DOWNSLOPE 0.50	3 to 5 ft. bench at base of wall. No distress observed.	9
WALL DRAINS 0.50	Small drains present at base. No signs of drainage related issues.	9

### Repair Recommendations

<b>Failure Consequence:</b>	MODERATE
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0100: NORTH MOUNTAIN LOOP ROAD**

**Retaining Wall Condition Photos**



**HOSP\_0100\_0.173\_R\_1.jpg**



**HOSP\_0100\_0.173\_R\_2.jpg**

<b>Wall ID:</b>	HOSP-0101-0.068-L		
<b>Route Name:</b>	SUMMIT ROAD		
<b>Inspection Date:</b>	April 24, 2007	<b>Approximate Year Built:</b>	1940
<b>*Wall Rating:</b>	67	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Cut Wall	<b>Primary Wall Type:</b>	Gravity - Dry Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	Gravity - Dry Stone
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	2-Tiered dry stack wall, primarily cut wall with upper tier added later as slope protection in a slope slump area		

### Wall Measurements

<b>Wall Length (ft.):</b>	117	<b>Face Area (sq.):</b>	621
<b>Average Wall Height (ft.):</b>	5	<b>Face Angle (deg.):</b>	65
<b>Maximum Wall Height (ft.):</b>	9	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good to fair condition, should monitor slump are for erosion that could impact the wall and roadway below	7
WALL FOUNDATION MATERIAL 8.00	Lower tier - no distress observed Upper tier- foundation on loose, uncompacted soil, but no distress observed, functioning as intended	6
PLACED STONE 8.00	Lower tier- large rocks probably built with roadway, good condition Upper tier- placed secondarily with smaller rock, not as good construction, no weathering, occasional voids, loose at the top, occasional missing stones, good performance overall	7
CURB/BERM/DITCH 0.50	Ditch - occasional small missing pieces, fractured mortar, performing as intended	8
LATERAL SLOPE 0.50	1.5H:1V slope, steep but no signs of additional slumping	8
ROAD/SIDEWALK/SHOULDER 0.50	Road - no distress from wall observed	9
WALL DRAINS 0.50	None observed, no indication of wall distress or erosion from water-related issues	9
UPSLOPE 1.00	Some slump still active at top of slope/ over steepened brow at 1.5H:1V	5

### Repair Recommendations

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

# Hot Springs National Park

ROUTE 0101: SUMMIT ROAD

## Retaining Wall Condition Photos



HOSP\_0101\_0.068\_L\_1.jpg



HOSP\_0101\_0.068\_L\_2.jpg

<b>Wall ID:</b>	HOSP-0101-0.348-R		
<b>Route Name:</b>	SUMMIT ROAD		
<b>Inspection Date:</b>	April 24, 2007	<b>Approximate Year Built:</b>	1940
<b>*Wall Rating:</b>	80	<b>Maintenance Action:</b>	No Action

**Wall Description**

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Dry Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	Gravity - Mortared Stone
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Mortared stone gravity wall at pullout over dry-stacked wall		

**Wall Measurements**

<b>Wall Length (ft.):</b>	215	<b>Face Area (sq.):</b>	860
<b>Average Wall Height (ft.):</b>	4	<b>Face Angle (deg.):</b>	72
<b>Maximum Wall Height (ft.):</b>	6	<b>Vertical Offset (ft.):</b>	0

**Assessed Elements**

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition, no significant signs of distress, performing as intended	8
WALL FOUNDATION MATERIAL 8.00	Good condition, no visible slumping or distress, on berm with landscaped grassy face	9
MORTAR 8.00	Cracked and spalling in places, local raveling, coarse concrete mix	7
PLACED STONE 8.00	Good condition, minor weathering, none missing, no cracking or spalling	8
LATERAL SLOPE 0.50	1.5H:1V to 2H:1V grass transitions to natural vegetation, no signs of distress	8
ROAD/SIDEWALK/SHOULDER 0.50	Sidewalk at top in good condition, no cracking or spalling, minor unlevel locations, functioning as intended	8
TRAFFIC BARRIER/FENCE 0.50	Guardwall at top of wall, added as secondary wall (mortared), performing as intended	8
DOWNSLOPE 0.50	Man-made berm 1.5H:1V landscaped grassy (well-established), no signs of distress	9
WALL DRAINS 0.50	No distress observed due to drainage issues	9

**Repair Recommendations**

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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



# Hot Springs National Park

ROUTE 0101: SUMMIT ROAD

## Retaining Wall Condition Photos



HOSP\_0101\_0.348\_R\_1.jpg



HOSP\_0101\_0.348\_R\_2.jpg

<b>Wall ID:</b>	HOSP-0201-0.517-R		
<b>Route Name:</b>	TOWER RETURN ROAD		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1950
<b>*Wall Rating:</b>	73	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Dry Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Dry stacked fill wall with culvert and trail below.		

### Wall Measurements

<b>Wall Length (ft.):</b>	38	<b>Face Area (sq.):</b>	200
<b>Average Wall Height (ft.):</b>	5	<b>Face Angle (deg.):</b>	57
<b>Maximum Wall Height (ft.):</b>	9	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good condition. Minor loose rock and minor erosion at sides.	7
WALL FOUNDATION MATERIAL 8.00	Good condition, no indication of settlement or movement.	8
PLACED STONE 8.00	Good, sound, durable rock. Occasional loose rock with minor movement out of face.	7
DOWNSLOPE 0.50	Trail immediately below. Good condition.	8
VEGETATION 0.50	Minor. May slightly help stability. Minor brush. No adverse affect of vegetation.	8
WALL DRAINS 0.50	None observed. Drainage and water not impacting wall performance.	9
LATERAL SLOPE 1.00	Minor erosion at both ends. No vegetation. Minor creep.	6
CULVERT 1.00	18" clay pipe at base of wall. Broken end but functioning good.	7
ROAD/SIDEWALK/SHOULDER 1.00	Road. Occasional transverse cracks, not impacting road. Loose, soft shoulder.	7

### Repair Recommendations

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

# Hot Springs National Park

ROUTE 0201: TOWER RETURN ROAD

## Retaining Wall Condition Photos



HOSP\_0201\_0.517\_R\_1.jpg



HOSP\_0201\_0.517\_R\_2.jpg

<b>Wall ID:</b>	HOSP-0901C-0.000-P1		
<b>Route Name:</b>	HOT SPRINGS MOUNTAIN PICNIC AREA PARKING C		
<b>Inspection Date:</b>	April 25, 2007	<b>Approximate Year Built:</b>	1989
<b>*Wall Rating:</b>	90	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Stone mortared fill wall at picnic area with guardwall adjacent to parking.		

### Wall Measurements

<b>Wall Length (ft.):</b>	90	<b>Face Area (sq.):</b>	425
<b>Average Wall Height (ft.):</b>	4	<b>Face Angle (deg.):</b>	78
<b>Maximum Wall Height (ft.):</b>	6	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Very good, performing as intended.	9
WALL FOUNDATION MATERIAL 8.00	Good condition, no signs of distress. Good soil base.	9
MORTAR 8.00	Good condition, minor cracking (1/8").	9
PLACED STONE 8.00	Sound, durable rock, none missing.	9
LATERAL SLOPE 0.50	Flat at one end and gentle slope at the other. No observed erosion.	9
WALL DRAINS 0.50	None observed. Drainage and water not impacting wall performance. None observed. No signs of drainage related issues.	9
DOWNSLOPE 0.50	Relatively flat with grass.	10
ROAD/SIDEWALK/SHOULDER 1.00	Sidewalk. Minor displacement (vertically) possibly due to wall. Not affecting wall performance.	7

### Repair Recommendations

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

# Hot Springs National Park

ROUTE 0901C: HOT SPRINGS MOUNTAIN PICNIC AREA PARKING C

## Retaining Wall Condition Photos



HOSP\_0901C\_0.000\_P1\_1.jpg

<b>Wall ID:</b>	HOSP-0905-0.000-P1		
<b>Route Name:</b>	WEST MOUNTAIN PICNIC AREA PARKING		
<b>Inspection Date:</b>	April 24, 2007	<b>Approximate Year Built:</b>	1940
<b>*Wall Rating:</b>	87	<b>Maintenance Action:</b>	No Action

### Wall Description

<b>Wall Function:</b>	Fill Wall	<b>Primary Wall Type:</b>	Gravity - Mortared Stone
<b>Surface Treatment:</b>		<b>Secondary Wall Type:</b>	Gravity - Mortared Stone
<b>Secondary Surface Treatment:</b>		<b>Architectural Facing:</b>	
<b>General Description:</b>	Gravity mortared wall with two (2) generations of construction and/or rock types.		

### Wall Measurements

<b>Wall Length (ft.):</b>	154	<b>Face Area (sq.):</b>	600
<b>Average Wall Height (ft.):</b>	3	<b>Face Angle (deg.):</b>	80
<b>Maximum Wall Height (ft.):</b>	8	<b>Vertical Offset (ft.):</b>	0

### Assessed Elements

<b>Element (Weighting Factor)</b>	<b>Narrative</b>	<b>Condition Rating (0 - 10)</b>
PERFORMANCE 8.00	Good, performing as intended. No missing elements.	9
WALL FOUNDATION MATERIAL 8.00	Good condition, no erosion, slumping, or displacement on footing, good ground.	9
MORTAR 8.00	Good condition, minor cracking, minor separation with new patching.	8
PLACED STONE 8.00	Minor weathering, no cracking or missing pieces.	9
LATERAL SLOPE 0.50	2.5:1 to 2:1 slope. No erosion observed.	8
ROAD/SIDEWALK/SHOULDER 0.50	Sidewalk in good condition, minor cracking or spalling, minor changes in elevation.	8
TRAFFIC BARRIER/FENCE 0.50	No distress observed related to poor drainage. No scour.	8
DOWNSLOPE 0.50	3:1 gentle slope, grassy.	9
WALL DRAINS 0.50	6" PVC partially buried but functioning. No distress observed related to poor drainage. No scour.	9

### Repair Recommendations

<b>Failure Consequence:</b>	LOW
<b>Recommendation Narrative:</b>	None
<b>Repair Cost:</b>	\$0

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

**Hot Springs National Park**  
**ROUTE 0905: WEST MOUNTAIN PICNIC AREA PARKING**

**Retaining Wall Condition Photos**



**HOSP\_0905\_0.000\_P1\_1.jpg**



**HOSP\_0905\_0.000\_P1\_2.jpg**

# Appendix A

## Summary of WIP Definitions



Hot Springs 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  $\geq 4$  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**

<b>Design Criteria</b>	Measure of how well current design criteria are satisfied: <b>None</b> - Does not meet any known standards. <b>Non-AASHTO</b> - Does not meet AASHTO, but is consistent with other structures of its type/period with good performance. <b>AASHTO</b> - Apparently meets current AASHTO Geometric, Design, Materials, and Construction Standards.
<b>Consequence of Failure</b>	<b>Low</b> - No loss of roadway, no to low public risk, no impact to traffic during wall repair/replacement <b>Moderate</b> - Hourly to short-term closure of roadway, low-to-moderate public risk, multiple alternate routes available <b>High</b> - Seasonal to long-term loss of roadway, substantial loss-of-life risk, no alternate routes available
<b>Action</b>	Select from: <b>No Action, Monitor, Maintenance, Repair Elements, Replace Elements, and Replace Wall</b>
<b>Weighting Factor</b>	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.
<b>Data Reliability</b>	Estimate of how well observed conditions represent wall performance, and if additional investigations may be warranted. <b>1-Poor</b> 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. <b>2-Good</b> Observed conditions are sufficient to rate the conditions of wall element(s); however, additional investigations would be useful to better understand element performance. <b>3-Very Good</b> 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.

<b>9-10 (Excellent)</b>	-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.
<b>7-8 (Good)</b>	-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.
<b>5-6 (Fair)</b>	-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.
<b>3-4 (Poor)</b>	-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.
<b>1-2 (Critical)</b>	-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

<b>Performance</b>	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><b>Good to Excellent</b> - 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><b>Fair</b> - 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><b>Poor to Critical</b> - 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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