CAVO
WIP Report

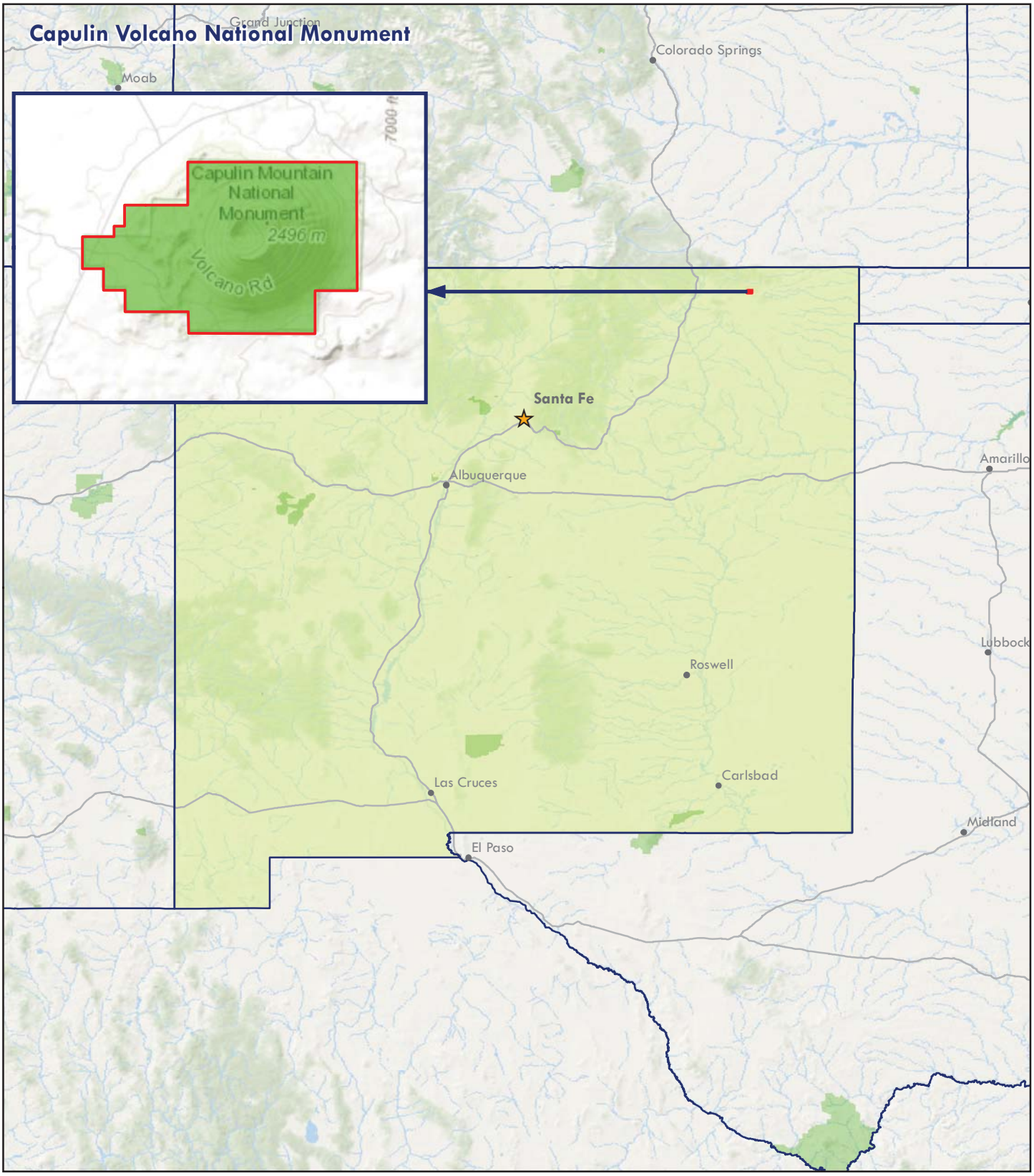
NPS Retaining Wall Inventory Program
Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

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

Data Collection Date: November 2006
Report Date: October 2015

Capulin Volcano National Monument
in
New Mexico



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

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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

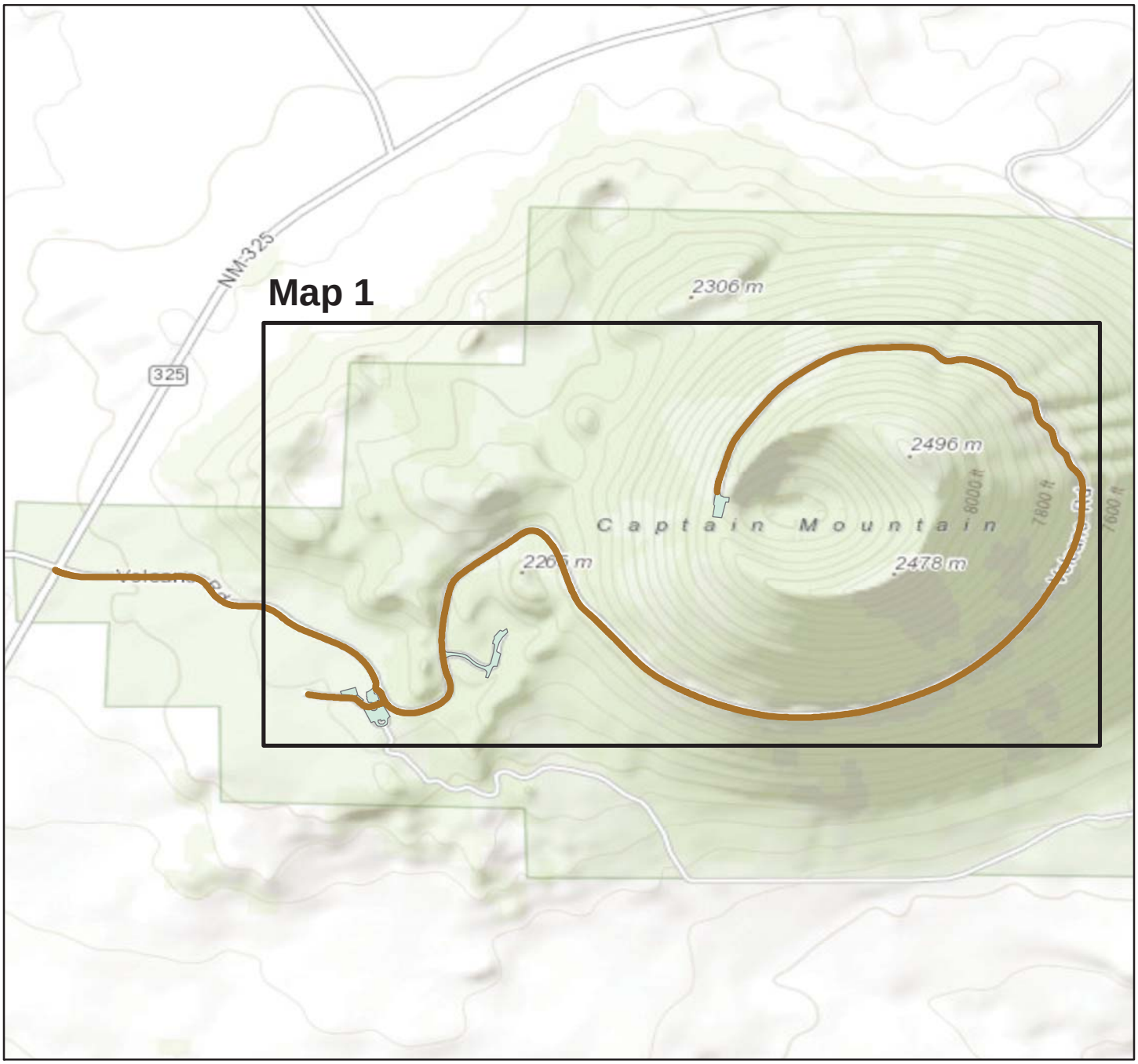
Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

Capulin Volcano National Monument

WALL LOCATION MAP

Key Map



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RIP Collected Routes

Miles

0 0.25 0.5

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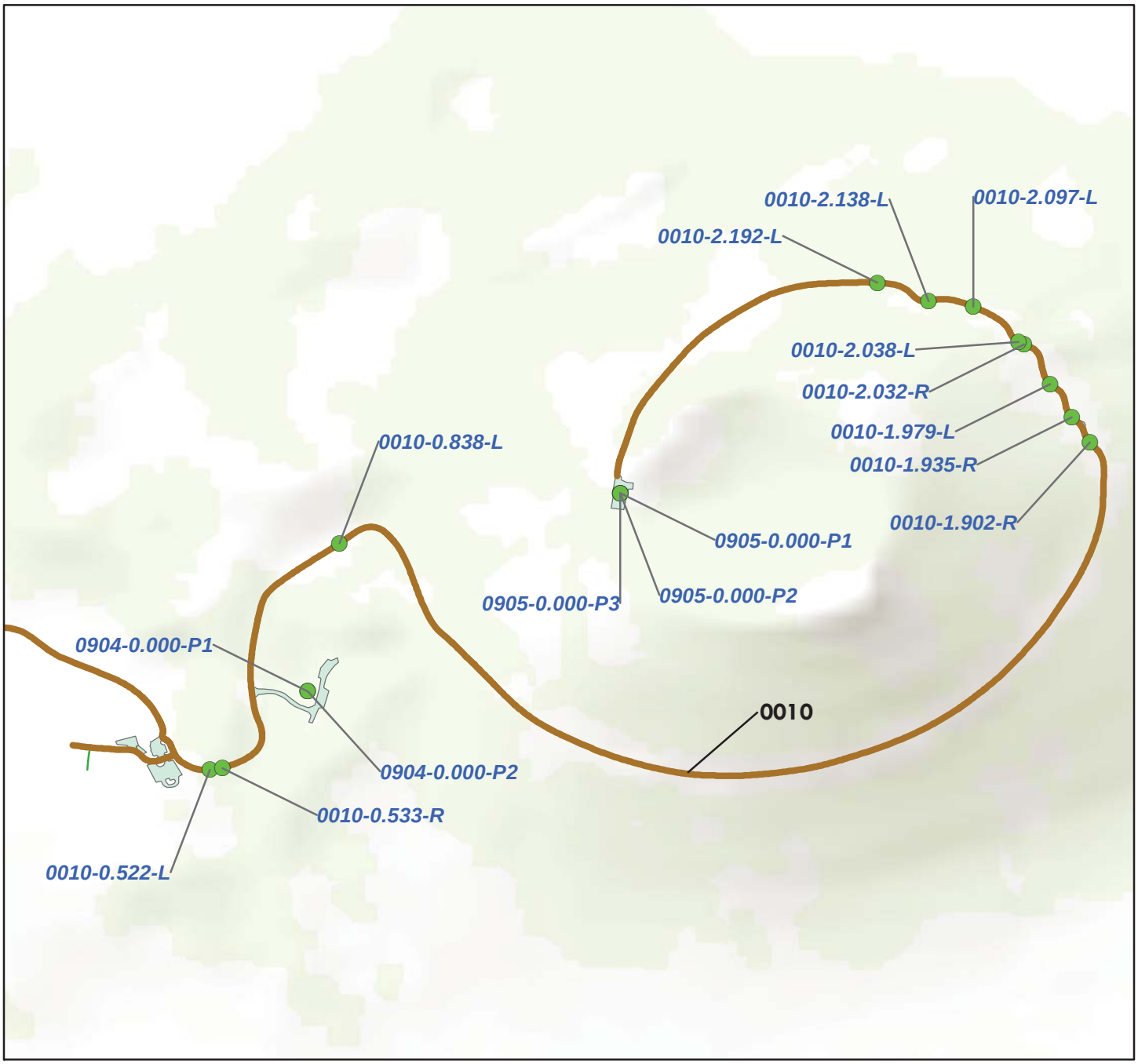
Capulin Volcano National Monument

WALL LOCATION MAP

Map 1



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Wall Locations

RIP Collected Routes

Miles

0 0.25 0.5

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Tier 1
Park Retaining Wall Overview

Capulin Volcano National Monument

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Parkwide Summary: Capulin Volcano National Monument

Initial retaining wall inspections were conducted at Capulin Volcano National Monument in 2006, and encompassed all known retaining wall structures associated with Park roadways - including 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, 16 walls were inventoried on the routes listed below.

Table 1: Number of Walls by Route

Route Number	Route Name	No. of Walls
0010	CAPULIN VOLCANO ROAD	11
0904	PICNIC AREA PARKING	2
0905	CRATER RIM PARKING	3

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

Table 2: Number of Walls by Wall Function

Wall Function	No. of Walls
CW - Cut Wall	10
FW - Fill Wall	6

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	16

The following table shows the number of walls by one of six categories of recommended action along with associated 2007 costs. 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	15
Monitor	$0	0
Maintenance	$0	0
Repair Elements	$2,420	1
Replace Elements	$0	0
Replace Wall	$0	0
Totals	**$2,420**	**16**

*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	15
$1 - $25,000	1
$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	**16**

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

Conducting routine inspections and performing the noted maintenance will greatly aid in the continued performance of all walls at Capulin Volcano National Monument. Work orders for walls needing maintenance generally include 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 include 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 mortor 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 Capulin Volcano National Monument 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)
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

Capulin Volcano National Monument

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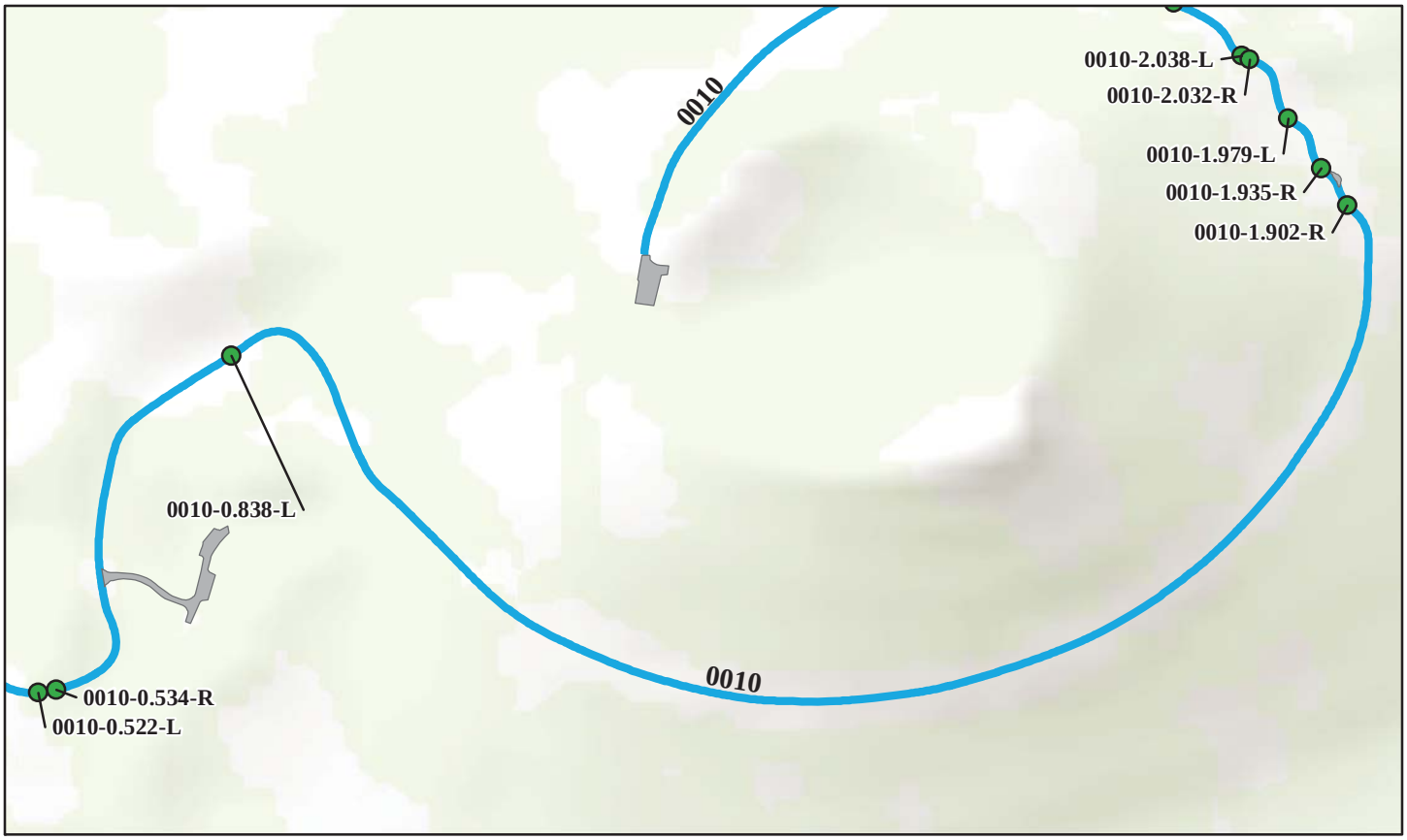
ROUTE 0010: CAPULIN VOLCANO ROAD



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Retaining Wall Condition Legend – Wall Condition Rating

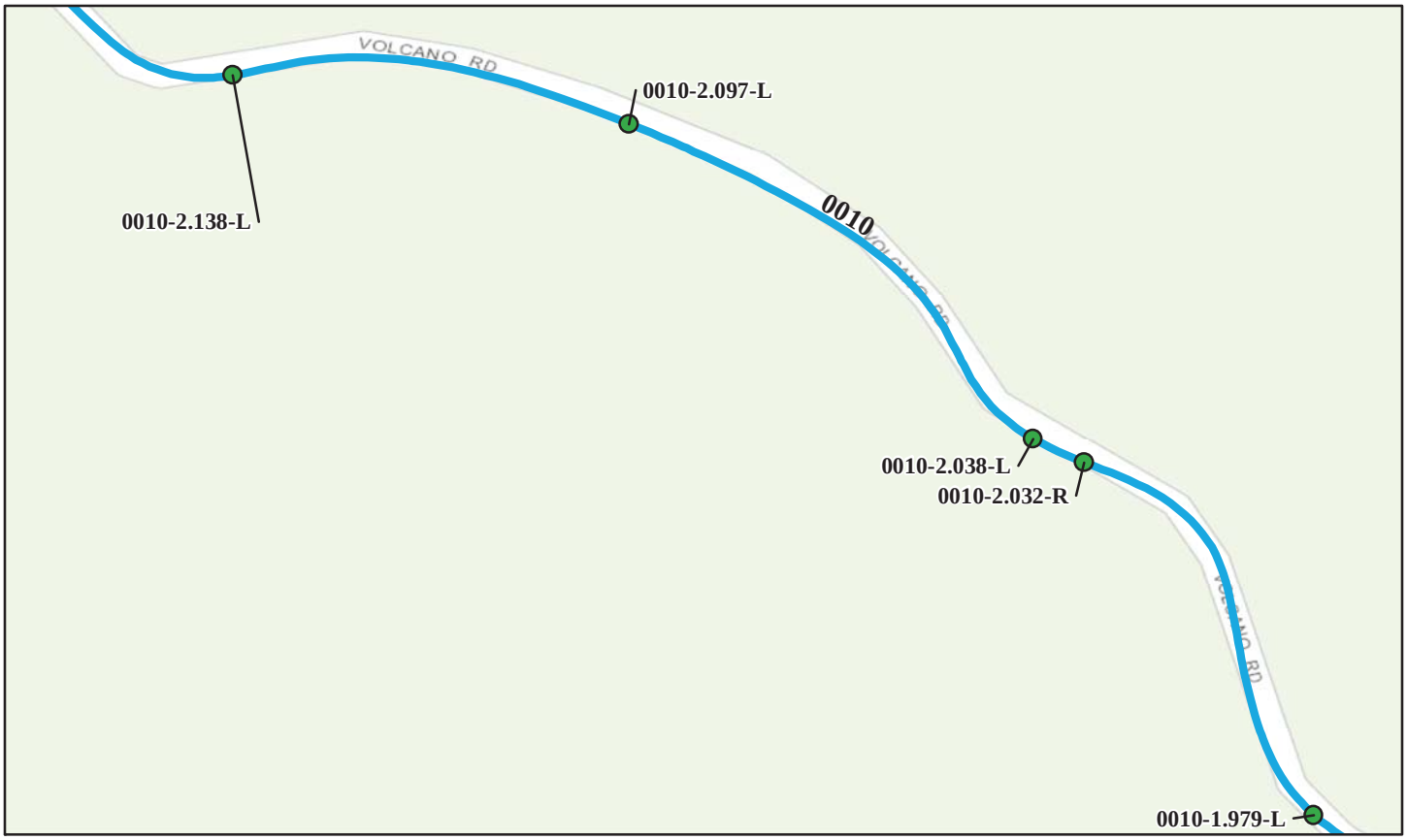
Critical / Poor (0 - 49)	Fair (50 - 69)	Good to Excellent (70 - 100)	No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
CAVO-0010-0.522-L 11/20/2006	900	300	Gravity - Mortared Stone	Cut Wall	100	$0.00
CAVO-0010-0.534-R 11/20/2006	756	252	Gravity - Mortared Stone	Fill Wall	100	$0.00
CAVO-0010-0.838-L 11/20/2006	-1	5,539	Gravity - Mortared Stone	Cut Wall	95	$2,420.00
CAVO-0010-1.902-R 11/20/2006	403	115	Gravity - Mortared Stone	Fill Wall	90	$0.00
CAVO-0010-1.935-R 11/20/2006	518	115	Gravity - Mortared Stone	Fill Wall	100	$0.00

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

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD



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Retaining Wall Condition Legend – Wall Condition Rating

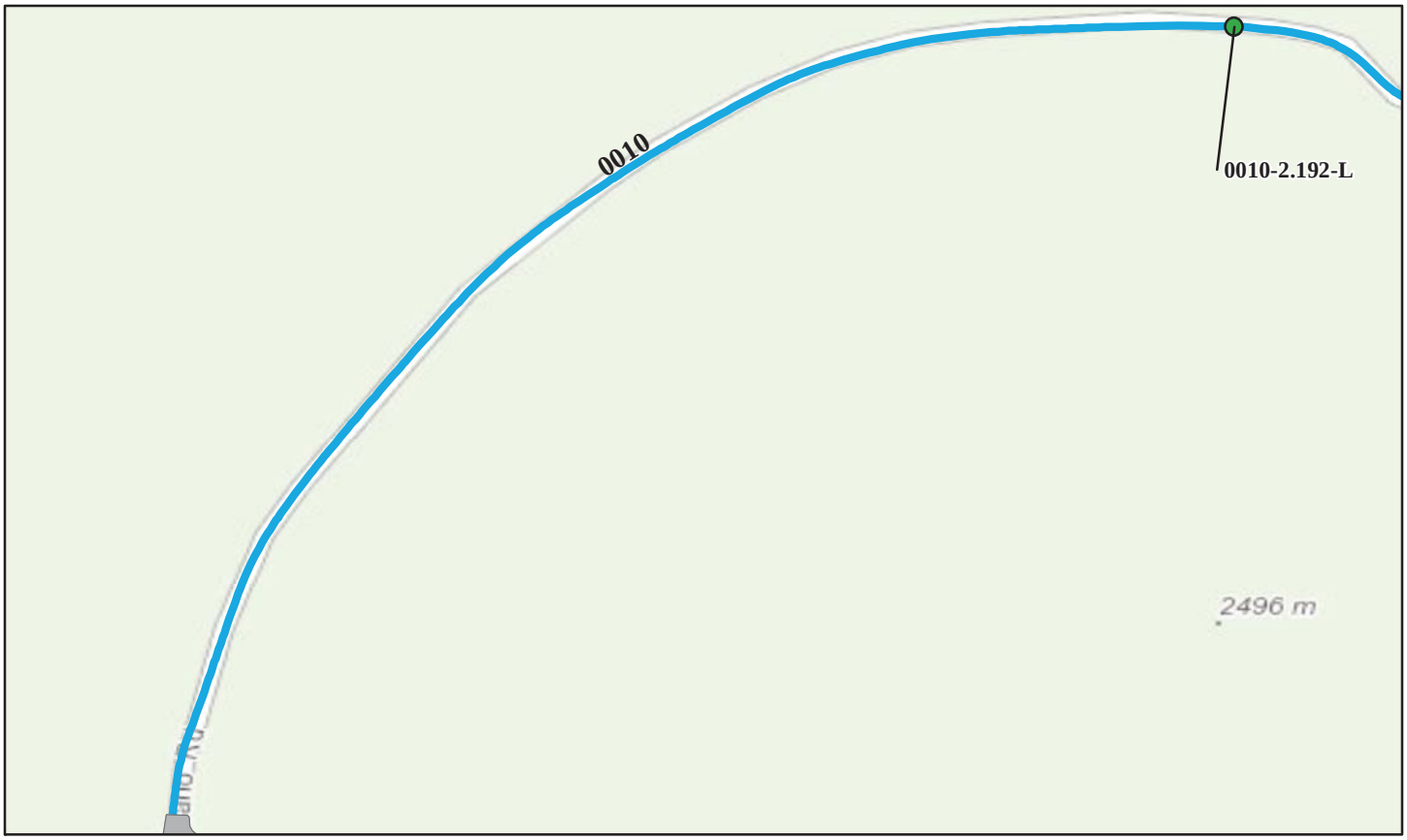
Critical / Poor (0 - 49)	Fair (50 - 69)	Good to Excellent (70 - 100)	No Data

Wall ID Inspection Date:	Wall Area (Sq. Ft.)	Wall Length (Ft.)	Wall Type	Wall Function	Overall Rating	Repair Cost
CAVO-0010-1.979-L 11/20/2006	1,750	175	Gravity - Mortared Stone	Cut Wall	94	$0.00
CAVO-0010-2.032-R 11/20/2006	380	95	Gravity - Mortared Stone	Fill Wall	100	$0.00
CAVO-0010-2.038-L 11/20/2006	302	67	Gravity - Mortared Stone	Cut Wall	98	$0.00
CAVO-0010-2.097-L 11/20/2006	315	30	Gravity - Mortared Stone	Cut Wall	100	$0.00
CAVO-0010-2.138-L 11/20/2006	1,820	182	Gravity - Mortared Stone	Cut Wall	100	$0.00

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

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD



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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
CAVO-0010-2.192-L 11/20/2006	20,200	2,020	Gravity - Mortared Stone	Cut Wall	93	$0.00

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

Capulin Volcano National Monument

ROUTE 0904: 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
CAVO-0904-0.000-P1 11/20/2006	788	197	Gravity - Mortared Stone	Cut Wall	100	$0.00
CAVO-0904-0.000-P2 11/20/2006	788	197	Gravity - Mortared Stone	Cut Wall	100	$0.00

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

Capulin Volcano National Monument

ROUTE 0905: CRATER RIM 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
CAVO-0905-0.000-P1 11/20/2006	1696	212	Gravity - Mortared Stone	Fill Wall	100	$0.00
CAVO-0905-0.000-P2 11/20/2006	338	75	Gravity - Mortared Stone	Cut Wall	100	$0.00
CAVO-0905-0.000-P3 11/20/2006	595	119	Gravity - Mortared Stone	Fill Wall	100	$0.00

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

Tier 3
Retaining Wall Details

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

Wall ID:	**CAVO-0010-0.522-L**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall. Photos: along wall length 2 wall face (typical).		

Wall Measurements

Wall Length (ft.):	300	**Face Area (sq.):**	900
Average Wall Height (ft.):	3	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	5	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	No significant distresses of any kind.	10
WALL FOUNDATION MATERIAL 8.00	Appears dense, drained, strong, and shows no signs of settlement or deformation.	10
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
CURB/BERM/DITCH 0.50	Concrete lined ditch is in excellent condition, showing little signs of cracking or distress.	9
ROAD/SIDEWALK/SHOULDER 0.50	Road in front of wall shows no signs of distress due to wall settlement or rotation.	10
UPSLOPE 0.50	Gentle, well-vegetated slope showing no signs of distress or significant erosion.	10

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.

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos

CAVO_0010_0.522_L_1.jpg

CAVO_0010_0.522_L_2.jpg

Wall ID:	**CAVO-0010-0.534-R**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**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:	Rock masonry wall with concrete buttresses every 50 ft (serving no apparent purpose). Photos: along wall length 2 wall face (typical) 3 along wall top line showing roadway.		

Wall Measurements

Wall Length (ft.):	252	**Face Area (sq.):**	756
Average Wall Height (ft.):	3	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	4	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	No significant distresses of any kind.	10
WALL FOUNDATION MATERIAL 8.00	Very gentle toe slope that appears dense, drained and very stable. No signs of settlement or wall deformation due to foundation failure.	10
CONCRETE 8.00	Concrete buttresses in excellent condition showing no signs of weathering, deterioration, cracking or distress. Not sure of the structural function of these structures.	10
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
DOWNSLOPE 0.50	Well-vegetated, gentle downslope showing no signs of slope failure, poor drainage, or significant erosion.	10
ROAD/SIDEWALK/SHOULDER 0.50	Roadway above the wall shows no signs of distress due to wall settlement or rotation.	10
TRAFFIC BARRIER/FENCE 0.50	A short section of the wall extends above roadway grade, and shows no signs of distress.	10

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.

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos

CAVO_0010_0.534_R_1.jpg

CAVO_0010_0.534_R_2.jpg

Wall ID:	**CAVO-0010-0.838-L**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	95	**Maintenance Action:**	Repair Elements

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall. Photos: far, up station end of the wall (minor damage area) 2 plugged drain 3 wall length 4 varying wall rock area.		

Wall Measurements

Wall Length (ft.):	5539	**Face Area (sq.):**	(1)
Average Wall Height (ft.):	9	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	12	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Excellent overall wall performance and stability. Only the very upstation end of the all needs any repair work done.	9
WALL FOUNDATION MATERIAL 8.00	Road in front of wall shows no sign of distress due to wall settlement or rotation.	10
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
WALL DRAINS 0.50	Generally clean, functioning and well-spaced along the wall. Only a few drains appear to be plugged right at the ditch line, requiring cleaning.	9
CURB/BERM/DITCH 0.50	Curb and ditch (including all concrete-lined sections) show little signs of distress and are well-maintained.	10
ROAD/SIDEWALK/SHOULDER 0.50	Road in front of wall shows no signs of distress related to wall performance.	10
LATERAL SLOPE 1.00	Upstation end of the wall subject to erosion behind the wall end, requiring repair. Wall elements are still sound.	7
UPSLOPE 1.00	Upslope is generally stable, showing only very isolated signs of shallow slope failure. Extensive surface erosion of volcanic cinder is evident along a majority of the wall. Does not impact performance.	7

Repair Recommendations

Failure Consequence:	MODERATE
Recommendation Narrative:	Clean drains: 2 hrs @ $55/hr = $110. Construct 2 cuyd rock masonry wall @ $1155/cuyd = $2310. Total = $2420.
Repair Cost:	$2,420

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

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos

CAVO_0010_0.838_L_1.jpg

CAVO_0010_0.838_L_2.jpg

Wall ID:	**CAVO-0010-1.902-R**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***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:	Rock masonry wall with guardrail. Photos: 1 along wall length 2 wall face (typical) 3 wall foundation.		

Wall Measurements

Wall Length (ft.):	115	**Face Area (sq.):**	403
Average Wall Height (ft.):	4	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	5	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Minor erosion around culvert at wall outlet, coupled with minor erosion across the entire downslope area. Wall is performing very well.	9
WALL FOUNDATION MATERIAL 8.00	Appears dense, drained, and strong, and generally shows no signs of settlement or deformation. Some erosion has occurred around the culvert pipe, but does not impact wall stability or long-term performance.	8
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little signs of cracking or deterioration.	10
CULVERT 0.50	Culvert appears to be fairly new and is working very well, carrying water away fro the base of the wall.	10
ROAD/SIDEWALK/SHOULDER 0.50	Roadway above wall shows no signs of settlement or cracking due to wall deformation.	10
TRAFFIC BARRIER/FENCE 0.50	Guardrail is straight and functioning as installed, showing no signs of distress due to wall instability or settlement.	10
DOWNSLOPE 1.00	Downslope is not well vegetated, allowing erosion to the angle of repose. Erosion is not impacting wall stability.	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.

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos

CAVO_0010_1.902_R_1.jpg

CAVO_0010_1.902_R_2.jpg

Wall ID:	**CAVO-0010-1.935-R**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**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:	Rock masonry wall with guardrail at top. Photos: 1 along wall length, 2 wall face (typical).		

Wall Measurements

Wall Length (ft.):	115	**Face Area (sq.):**	518
Average Wall Height (ft.):	4	**Face Angle (deg.):**	75
Maximum Wall Height (ft.):	6	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is functioning as designed, with no significant signs of distress to any element.	10
WALL FOUNDATION MATERIAL 8.00	Appears dense, drained, strong and stable, and shows no signs of settlement or deformation.	10
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
DOWNSLOPE 0.50	Minor erosion across a poorly vegetated downslope. No impacts to wall, and no signs of past or pending slope failure.	8
CULVERT 0.50	Existing culvert is clear, working very well, carrying water well away from the wall. No signs of distress around the culvert outlet.	10
ROAD/SIDEWALK/SHOULDER 0.50	Roadway above wall shows no signs of cracking, settlement, or distress due to wall instability.	10
TRAFFIC BARRIER/FENCE 0.50	Guardrail is functioning as intended, showing no signs of distress or deformation due to wall instability.	10

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.

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos

CAVO_0010_1.935_R_1.jpg

CAVO_0010_1.935_R_2.jpg

Wall ID:	**CAVO-0010-1.979-L**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	94	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall with integral tiered section for upslope run off control. Photos: 1 along wall length 2 wall face (typical) 3 tiered section 4 lateral slope erosion.		

Wall Measurements

Wall Length (ft.):	175	**Face Area (sq.):**	1750
Average Wall Height (ft.):	10	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	12	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is functioning as intended with no structural distress evident. Only minor erosion at the downstation end of the wall.	9
WALL FOUNDATION MATERIAL 8.00	Roadway at toe of wall shows no sign of distress due to wall settlement or rotation.	10
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no sign of cracking or deterioration.	10
CURB/BERM/DITCH 0.50	Curbing is generally in very good condition, showing only minor cracking. Functioning as intended.	8
WALL DRAINS 0.50	Open and functioning as intended, though some erosion has occurred around downstation wall end.	9
CULVERT 0.50	Culvert inlet at tiered wall section is in excellent condition, showing no signs of distress.	10
ROAD/SIDEWALK/SHOULDER 0.50	Road shows no signs of distress.	10
LATERAL SLOPE 1.00	Downstation end of wall is eroded behind lower corner. Does not impact wall function or stability, and does not warrant repair.	7
UPSLOPE 1.00	Largely unvegetated upslope with surface erosion dumping into tiered section, requiring seasonal cleaning.	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.

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos

CAVO_0010_1.979_L_1.jpg

CAVO_0010_1.979_L_2.jpg

Wall ID:	**CAVO-0010-2.032-R**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**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:	Rock masonry wall with culvert. Photos: 1 along wall length 2 wall face (typical).		

Wall Measurements

Wall Length (ft.):	95	**Face Area (sq.):**	380
Average Wall Height (ft.):	4	**Face Angle (deg.):**	75
Maximum Wall Height (ft.):	6	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is functioning as intended with no significant signs of distress to any wall element.	10
WALL FOUNDATION MATERIAL 8.00	Appears dense, drained, strong, and stable, showing no signs of settlement or deformation.	10
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no sign of cracking or deterioration.	10
CULVERT 0.50	Culvert outlet is clean, free-draining, and shows no signs of excessive erosion or distress. Pipe outlet could be further from the wall.	9
DOWNSLOPE 0.50	Gentle, poorly vegetated downslope showing minor surface erosion. No indications of slope failure or impacts to wall performance.	10
ROAD/SIDEWALK/SHOULDER 0.50	Road shows no signs of settlement, cracking or other distress due to wall deformation.	10
TRAFFIC BARRIER/FENCE 0.50	Guardrail is functioning as intended, showing no signs of distress due to wall settlement or deformation.	10

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.

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos

CAVO_0010_2.032_R_1.jpg

CAVO_0010_2.032_R_2.jpg

Wall ID:	**CAVO-0010-2.038-L**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	98	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry walls 3 tiered system. Photos: 1 along wall length 2 wall face (typical).		

Wall Measurements

Wall Length (ft.):	67	**Face Area (sq.):**	302
Average Wall Height (ft.):	4	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	4	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall system is functioning as intended, showing no significant signs of distress within any wall elements.	10
WALL FOUNDATION MATERIAL 8.00	Each tier's foundation appears dense, strong, stable, and well-drained, showing no signs of wall settlement or deformation due to foundation instability.	10
STONE MASONRY 8.00	Strong, unweathered rock, showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
LATERAL SLOPE 0.50	Lateral slopes are keyed to volcanic beds showing no signs of erosion or degradation at wall ends. Some upslope erosion is evident that is minimally encroaching on either end of the wall system.	8
UPSLOPE 0.50	Upslope is sparsely vegetated, showing signs of minor surface erosion.	8
ROAD/SIDEWALK/SHOULDER 0.50	Roadway shows no signs of wall system settlement or deformation.	10
CURB/BERM/DITCH 1.00	Curb has minor cracks, with some newly replaced sections evident.	7

Repair Recommendations

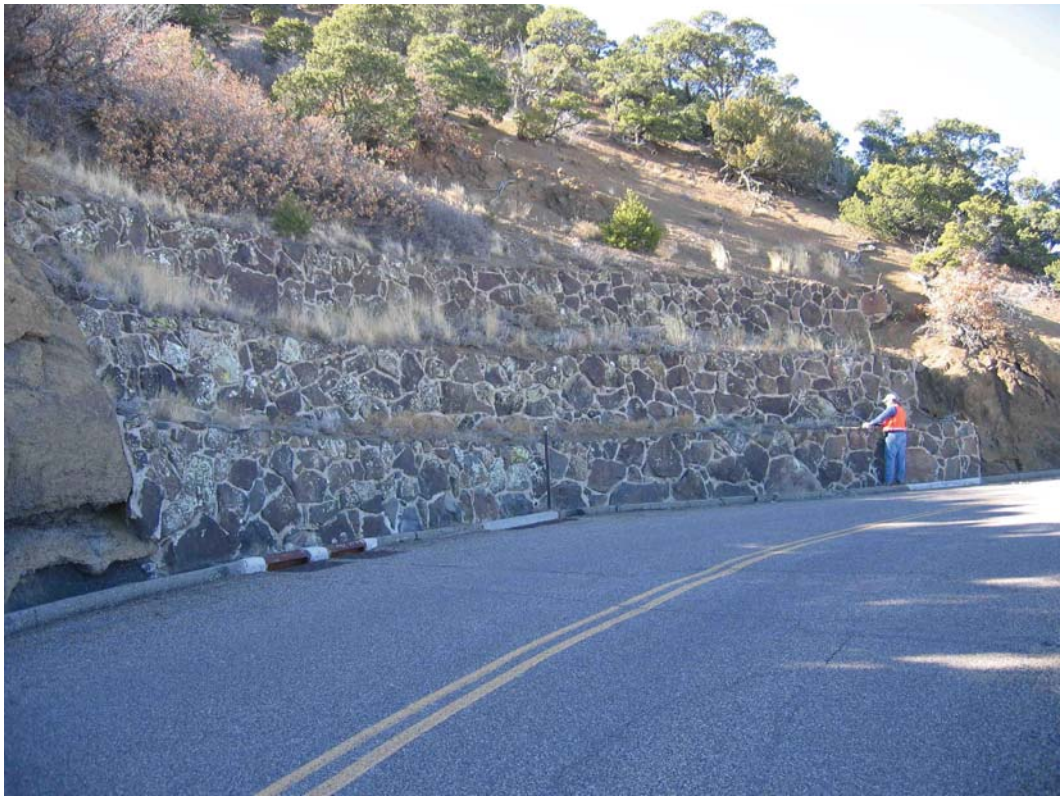
Failure Consequence:	MODERATE
Recommendation Narrative:	None
Repair Cost:	$0

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

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos



CAVO_0010_2.038_L_1.jpg

CAVO_0010_2.038_L_2.jpg

Wall ID:	**CAVO-0010-2.097-L**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall. Photos: 1 along wall length.		

Wall Measurements

Wall Length (ft.):	30	**Face Area (sq.):**	315
Average Wall Height (ft.):	10	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	12	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is functioning as intended, showing no significant signs of distress to any wall elements.	10
WALL FOUNDATION MATERIAL 8.00	Road below wall toe shows no signs of distress due to wall deformation, indicating foundation is strong, dense and well-drained.	10
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
CURB/BERM/DITCH 0.50	Curb is in very good condition, showing only minor cracking.	9
LATERAL SLOPE 0.50	Side slopes show minor surface erosion, but erosion does not impact wall in any way.	9
UPSLOPE 0.50	Gentle, well-vegetated upslope showing only minor surface erosion.	9
CULVERT 0.50	Drop inlet at toe of wall is in excellent working condition, showing no signs of settlement or distress.	10
ROAD/SIDEWALK/SHOULDER 0.50	Road shows no signs of distress due to wall instability.	10

Repair Recommendations

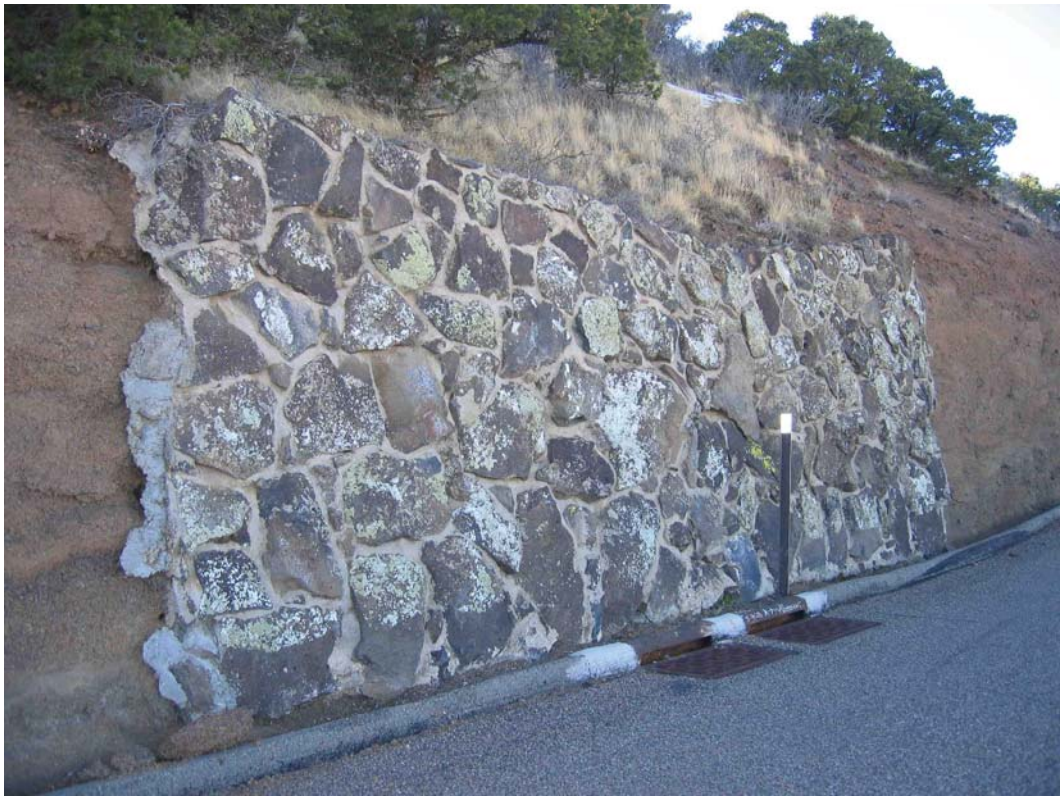
Failure Consequence:	MODERATE
Recommendation Narrative:	None
Repair Cost:	$0

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

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos



CAVO_0010_2.097_L_1.jpg

Wall ID:	**CAVO-0010-2.138-L**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall. Photos: 1 along wall length 2 wall face (typical).		

Wall Measurements

Wall Length (ft.):	182	**Face Area (sq.):**	1820
Average Wall Height (ft.):	10	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	15	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	No significant signs of distress to any wall element.	10
WALL FOUNDATION MATERIAL 8.00	Road at wall base shows no signs of distress due to wall settlement or deformation, indicating foundation is dense, strong, stable, and well-drained.	10
STONE MASONRY 8.00	Strong, unweathered rock, showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
CURB/BERM/DITCH 0.50	Curbing performing as intended, showing only minor cracking.	9
UPSLOPE 0.50	A majority of the upslope is very gentle and well-vegetated, showing no signs of erosion. A portion of the wall has a short section of exposed cut above the wall top, showing very minor erosion.	9
LATERAL SLOPE 0.50	Only minor erosion evident on lateral slopes.	10
ROAD/SIDEWALK/SHOULDER 0.50	Road shows no signs of distress due to wall settlement.	10

Repair Recommendations

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

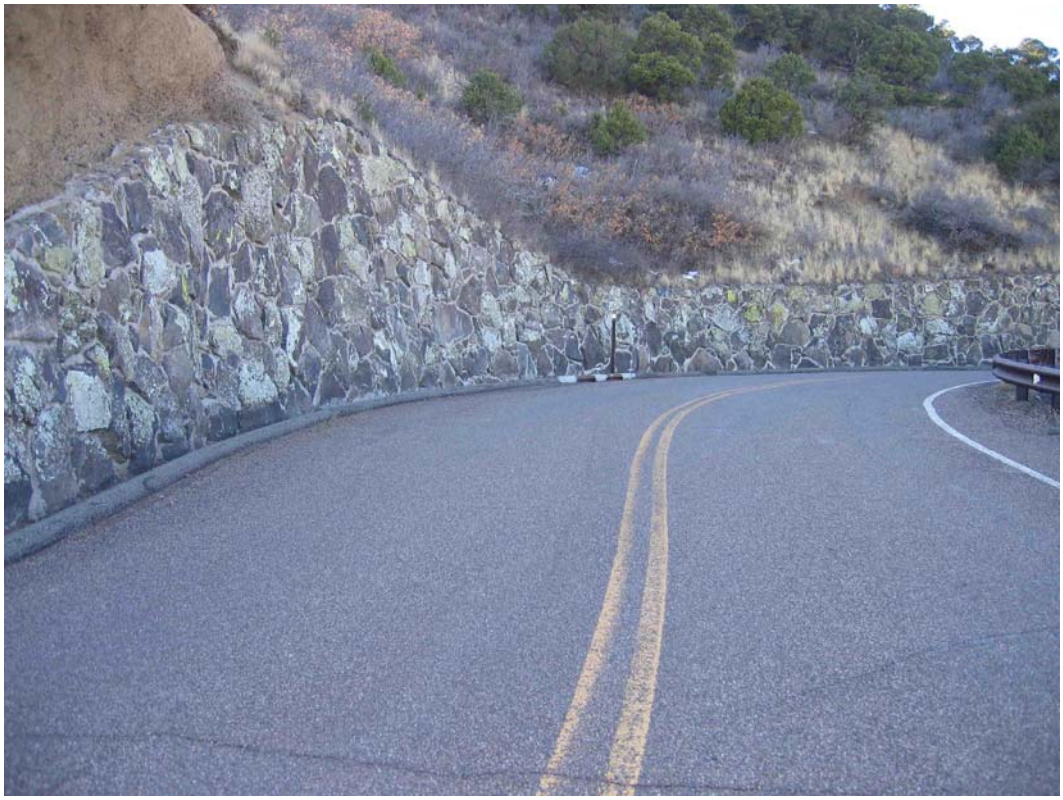
2007 cost estimate (ASTM Class D), preliminary for comparison to other repair costs only.

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos

CAVO_0010_2.138_L_1.jpg



CAVO_0010_2.138_L_2.jpg

Wall ID:	**CAVO-0010-2.192-L**		
Route Name:	CAPULIN VOLCANO ROAD		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	93	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall. Photos: 1 corner in parking area at wall end 2 along wall length 3 wall face (typical).		

Wall Measurements

Wall Length (ft.):	2020	**Face Area (sq.):**	20200
Average Wall Height (ft.):	10	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	12	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall is functioning as intended, showing minor distress to only the ditch line element.	9
WALL FOUNDATION MATERIAL 8.00	Foundation appears to be dense, strong, stable, and well-drained. Isolated areas of erosion under wall toe in ditch line.	9
STONE MASONRY 8.00	Strong, unweathered rock, showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
CURB/BERM/DITCH 0.50	Curbing is very good condition, showing only minor cracking. Ditch shows some erosion below the wall at isolated locations.	8
ROAD/SIDEWALK/SHOULDER 0.50	Road shows no signs of distress due to wall settlement or deformation.	10
UPSLOPE 0.50	Upslope is generally well-vegetated and shows no significant signs of erosion.	10
WALL DRAINS 0.50	Regularly distributed along the wall, open, and functioning as intended.	10

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.

Capulin Volcano National Monument

ROUTE 0010: CAPULIN VOLCANO ROAD

Retaining Wall Condition Photos

CAVO_0010_2.192_L_1.jpg

CAVO_0010_2.192_L_2.jpg

Wall ID:	**CAVO-0904-0.000-P1**		
Route Name:	PICNIC AREA PARKING		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall along picnic area access road (not in RIP database). No Visidata info is available. Milepoints are measured from roadway 0010. Photos: 1 along wall length wall face (typical).		

Wall Measurements

Wall Length (ft.):	197	**Face Area (sq.):**	788
Average Wall Height (ft.):	4	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	5	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	No significant distress of any kind.	10
WALL FOUNDATION MATERIAL 8.00	Appears dense, drained, strong, and shows no sign s of settlement or deformation.	10
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
LATERAL SLOPE 0.50	Minor side slopes.	8
WALL DRAINS 0.50	None present or apparently required.	8
ROAD/SIDEWALK/SHOULDER 0.50	Road in front of wall shows no signs of distress due to wall settlement or rotation.	10
UPSLOPE 0.50	Slope is essentially flat above the wall, well-vegetated and stable.	10

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.

Capulin Volcano National Monument

ROUTE 0904: PICNIC AREA PARKING

Retaining Wall Condition Photos

CAVO_0904_0.000_P1_1.jpg

CAVO_0904_0.000_P1_2.jpg

Wall ID:	**CAVO-0904-0.000-P2**		
Route Name:	PICNIC AREA PARKING		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall along picnic area access road (not in RIP database). No Visidata info is available. Milepoints are measured from roadway 0010. Photos: 1 along wall length 2 wall face (typical).		

Wall Measurements

Wall Length (ft.):	197	**Face Area (sq.):**	788
Average Wall Height (ft.):	4	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	5	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	No significant distress of any kind.	10
WALL FOUNDATION MATERIAL 8.00	Appears dense, drained, strong, and shows no signs of settlement or deformation.	10
STONE MASONRY 8.00	Strong, unweathered rock showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
ROAD/SIDEWALK/SHOULDER 0.50	Road in front of wall shows no signs of distress due to wall settlement or rotation.	10
UPSLOPE 0.50	Slope is essentially flat above the wall, well vegetated, and stable.	10

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.

Capulin Volcano National Monument

ROUTE 0904: PICNIC AREA PARKING

Retaining Wall Condition Photos

CAVO_0904_0.000_P2_1.jpg

CAVO_0904_0.000_P2_2.jpg

Wall ID:	**CAVO-0905-0.000-P1**		
Route Name:	CRATER RIM PARKING		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**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:	Rock masonry wall in parking area. No Visidata info available. Wall is on right side of parking area. Photos: 1 along wall length 2 mid-wall corner construction showing wall face (typical).		

Wall Measurements

Wall Length (ft.):	212	**Face Area (sq.):**	1696
Average Wall Height (ft.):	8	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	12	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall shows no significant signs of distress to any wall element.	10
WALL FOUNDATION MATERIAL 8.00	Appears dense, well-drained, strong, and stable, showing no signs of settlement or other distress.	10
STONE MASONRY 8.00	Strong, unweathered rock, showing no signs of cracking or degradation. Mortar is sound, durable, and shows little to no sign of cracking or deterioration.	10
CULVERT 0.50	Culvert is open and functioning as intended, with no erosion around the outlet.	10
DOWNSLOPE 0.50	Gentle, well-vegetated slope showing no signs of significant erosion or distress.	10
ROAD/SIDEWALK/SHOULDER 0.50	Road/parking area above the wall shows no signs of distress due to wall settlement or deformation.	10
TRAFFIC BARRIER/FENCE 0.50	Guardwall at top of wall is fully intact, shows no signs of rock or mortar cracking or deterioration, or any other signs of distress.	10
WALL DRAINS 0.50	Present and functioning as required.	10

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.

Capulin Volcano National Monument

ROUTE 0905: CRATER RIM PARKING

Retaining Wall Condition Photos

CAVO_0905_0.000_P1_1.jpg

CAVO_0905_0.000_P1_2.jpg

Wall ID:	**CAVO-0905-0.000-P2**		
Route Name:	CRATER RIM PARKING		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Cut Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall at end of parking area. No Visidata info available. Photos: 1 along wall length.		

Wall Measurements

Wall Length (ft.):	75	**Face Area (sq.):**	338
Average Wall Height (ft.):	4	**Face Angle (deg.):**	75
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 distress to any element.	10
WALL FOUNDATION MATERIAL 8.00	The parking area and sidewalk in front of the wall shows no signs of distress due to wall settlement or deformation.	10
STONE MASONRY 8.00	Strong, unweathered rock, showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration.	10
ROAD/SIDEWALK/SHOULDER 0.50	Sidewalk and parking area show no signs of distress due to wall deformation.	10
UPSLOPE 0.50	Well-vegetated flat area above wall showing no signs of settlement or drainage problems.	10

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.

Capulin Volcano National Monument

ROUTE 0905: CRATER RIM PARKING

Retaining Wall Condition Photos

CAVO_0905_0.000_P2_1.jpg

Wall ID:	**CAVO-0905-0.000-P3**		
Route Name:	CRATER RIM PARKING		
Inspection Date:	November 20, 2006	**Approximate Year Built:**	1965
***Wall Rating:**	100	**Maintenance Action:**	No Action

Wall Description

Wall Function:	Fill Wall	**Primary Wall Type:**	Gravity - Mortared Stone
Surface Treatment:		**Secondary Wall Type:**	Gravity - Mortared Stone
Secondary Surface Treatment:		**Architectural Facing:**	
General Description:	Rock masonry wall built atop short section of older rock masonry wall. Wall is located on left side of parking area. No Visidata info available. Photos: 1 along wall length 2 wall face (typical) 3 lower rock masonry wall.		

Wall Measurements

Wall Length (ft.):	119	**Face Area (sq.):**	595
Average Wall Height (ft.):	5	**Face Angle (deg.):**	80
Maximum Wall Height (ft.):	10	**Vertical Offset (ft.):**	0

Assessed Elements

Element (Weighting Factor)	Narrative	Condition Rating (0 - 10)
PERFORMANCE 8.00	Wall shows no significant signs of distress to any elements.	10
WALL FOUNDATION MATERIAL 8.00	Appears dense, drained, and very strong and stable, showing no signs of wall settlement or deformation.	10
STONE MASONRY 8.00	Strong, unweathered rock, showing no signs of cracking or degradation. Mortar is sound, durable, and shows little or no signs of cracking or deterioration. Lower, older wall is sound and shows no signs of distress.	10
DOWNSLOPE 0.50	Gentle, well-vegetated downslope shows no signs of slope failure or significant erosion.	10
ROAD/SIDEWALK/SHOULDER 0.50	Parking area and sidewalk show no signs of distress due to wall settlement or deformation.	10
TRAFFIC BARRIER/FENCE 0.50	Rock masonry guardwall at top of wall shows no signs of distress related to rock or mortar cracking or deterioration.	10

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.

Capulin Volcano National Monument

ROUTE 0905: CRATER RIM PARKING

Retaining Wall Condition Photos

CAVO_0905_0.000_P3_1.jpg

CAVO_0905_0.000_P3_2.jpg

Appendix A
Summary of WIP Definitions

Capulin Volcano National Monument

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 ≥ 45˚ (≥ 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

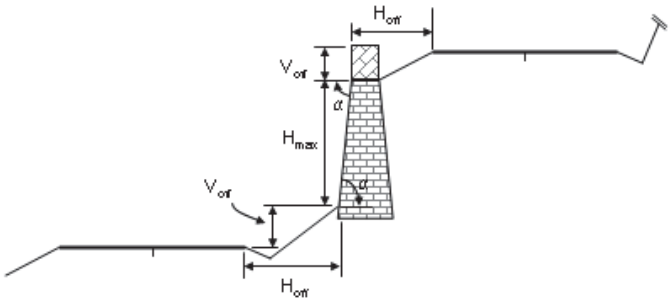
[**BV**] Brick Veneer	[**PF**] Planted Face	[**SS**] Simulated Stone
[**CO**] Cementitious Overlay	[**SC**] Sculpted Shotcrete	[**SV**] Stone Veneer
[**FF**] Fractured Fin Concrete	[**SH**] Shotcrete (nozzle finish)	[**TI**] Timber
[**FL**] Formlined Concrete	[**SM**] Steel/Metal	[**OT**] Other, User 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 *newly constructed or fabricated* 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.	**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.
		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.
		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.



H_{max}	Maximum exposed wall height, ft
V_{off}	Average vertical distance from pavement to cut wall toe or groundline at top of fill wall (+ above/ - below roadway), ft
H_{off}	Horizontal distance to wall face from edge of roadway, ft
α	Wall face angle measured from the horizontal, degrees
L	Maximum earth retaining length of the wall (excluding guardwalls). Wall length is the actual length of the structure, not simply the projected length along the roadway, ft