Federal Lands Highway

Road Inventory Program

Road Inventory and Condition Assessment

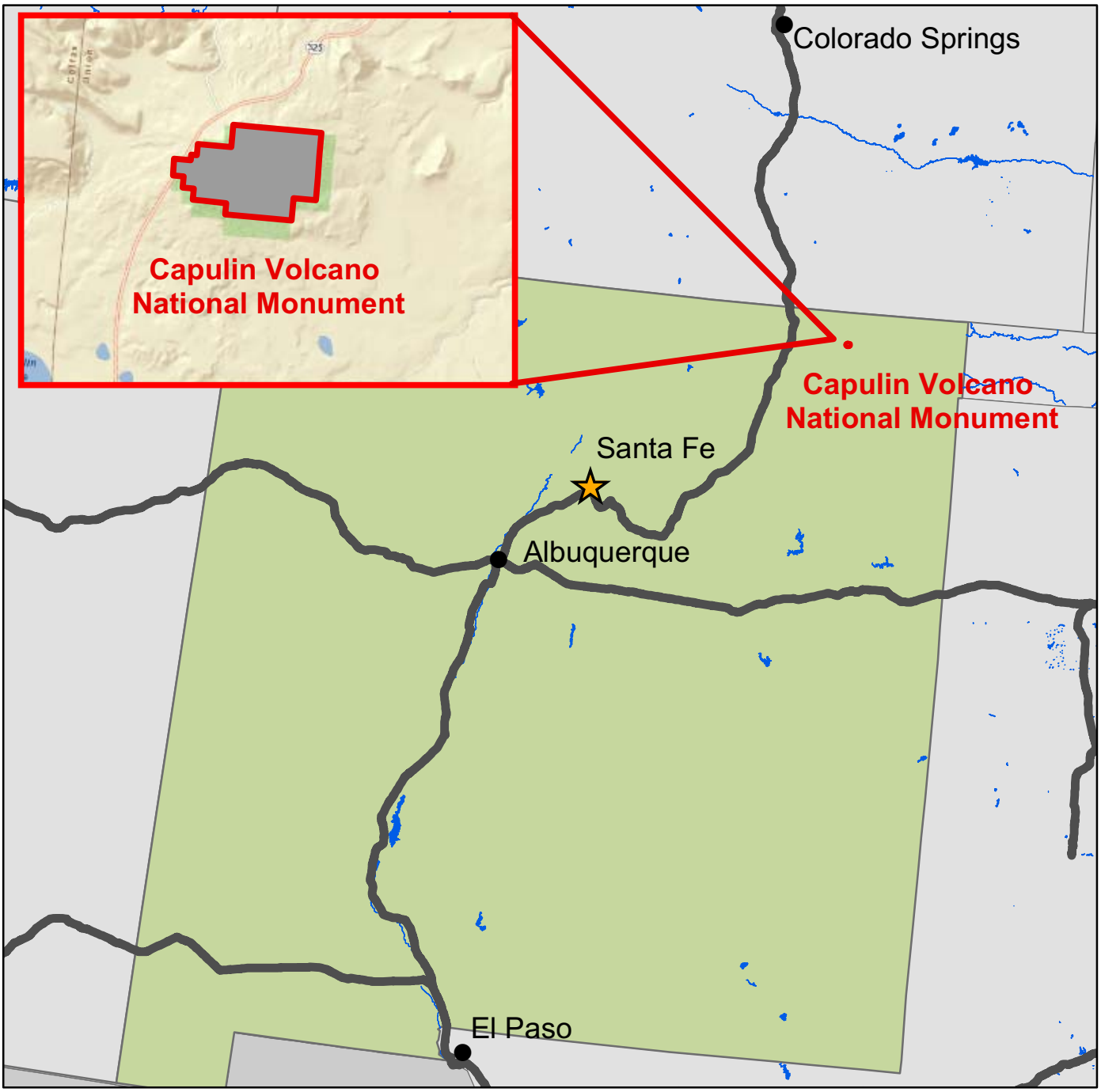
Capulin Volcano National Monument

CAVO – 7160

Cycle 5 Report

Prepared By: Federal Highway Administration
Road Inventory Program (RIP)
Data Collection Date: 05/2010
Report Date: 10/2011

Capulin Volcano National Monument
in
New Mexico



DCV = Data Collection Vehicle

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Section 1
Introduction

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

INTRODUCTION

The Federal Highway Administration, (FHWA), in the mid 1970s, was charged with the task of identifying surface condition deficiencies and corrective priorities on National Park Service (NPS) roads and parkways. Additionally, FHWA was tasked with establishing an integrated maintenance features inventory, locating features such as culverts, guardrails, and signs, among others, along NPS roads and parkways. As a result, in 1976 the NPS and FHWA entered into an MOA (Memorandum Of Agreement) which established the RIP (Road Inventory Program). This MOA was terminated and revised in 1980 to establish a new MOA aiming to update RIP data and develop a long-range program to improve and maintain NPS roads to designated condition standards and establish a maintenance management program.

The FHWA completed this initial phase of the RIP in the early 1980s. As a result of this effort, each NPS site included in the study received a RIP Report known as the "Brown Book" which included the information collected during this first RIP phase.

In the 1990s, the effort was again renewed to update and maintain the RIP data. By this time the computer age was upon us and a process was employed that relied heavily on electronic data collection and computer technology. A cyclical program was developed and the RIP completed two cycles of data collection from 1994 to 2001. Cycle 1, starting in 1994, was conducted in 44 "large parks" (parks containing 10 or more paved route miles). Cycle 2 began in 1997 and comprised 79 large parks and 5 small parks totaling 4,874 paved route miles. Each of these parks received a RIP Report known as the "Blue Book". Cycle 3, from 2001 to 2004, was conducted in all parks, large and small, that contained any paved routes, including parking areas and, again, each park received a RIP Report and associated electronic files.

Cycle 4 was initiated in the spring of 2006 covering 86 large parks and several associated small parks consisting of 5,553 paved route miles and 6,232 paved parking areas. Data collection has been completed for Cycle 4 and all data has been delivered to the NPS.

In 2005, the FHWA began implementing the use of a Pavement Management System (PMS) to assist the NPS in prioritizing Pavement Maintenance and Rehabilitation activities. The PMS used by FHWA is the Highway Pavement Management Application (HPMA) and this software has the ability to store inventory and condition data from RIP and forecast future performance using prediction models. Outputs include performance and condition reports at the National, Regional, Park, or Route level. A regional prioritized list and optimization have been produced for most regions and the Federal Highway Deferred Maintenance is calculated via the HPMA.

In an effort to improve the accuracy of treatment recommendations and pavement condition descriptions, an extensive study was completed throughout 2010 that has resulted in changes to the RIP condition reporting method, specifically the distresses and indexes that comprise the Pavement Condition Rating (PCR). It was determined that a better representation of PCR could

be achieved by modifying the relative impact certain distresses would have on the overall rating. The changes that were implemented were endorsed by management at both the FHWA and NPS in October 2010. These changes will allow greater use of RIP and HPMA data for not simply condition data reporting, but also as a reliable tool for project identification and selection. Because of these changes, the PCR Condition ratings reported in Cycle 5 do not directly relate to the condition ratings reported in previous cycle RIP Reports. For more detailed information about the changes, see Section 3 and Section 10 in this RIP Report.

Cycle 5 has launched in the summer of 2010 and will again comprise all parks, large and small, that are served by paved roads and/or parking areas. For Cycle 5, the decision was made to collect condition data in large parks on Functional Class 1, 2, and 7 paved routes only, as well as any new routes that were previously not collected. In small parks, all paved routes and parking areas will be collected. As a result, this will include 81 large parks with 4,459 paved route miles and 168 small parks with 529 paved route miles and associated paved parking areas.

Since 1984, the Road Inventory Program has been funded through the Federal Lands Highway Park Roads and Parkways (PRP) Program. Currently, coordination of the RIP with FLH is under the NPS Washington Headquarters Park Facility Management Division. The FLH Washington office coordinates policy and prepares national reports and needs assessment studies for Congress.

In 1998, the Transportation Equity Act for the 21st Century (TEA-21) amended Title 23 U.S.C., and inserted Section 204(a)(6) requiring the FHWA and NPS, to develop by rule, a Pavement Management System (PMS) applied to park roads and parkways serving the National Park System.

FLH is responsible for the accuracy of all data presented in this report. Any questions or comments concerning the contents of this report should be directed to the national RIP Coordinator located in Sterling, Virginia.

Respectfully,

FHWA RIP Team

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Section 2
Park Route Inventory

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

Cycle 5 NPS/RIP Route ID Report

Shading Color Key: White = Paved Routes, DCV Driven; Yellow = Unpaved Routes, DCV not Driven; Blue = All Paved Parking Areas; Green = All Unpaved Parking Areas; Grey = Paved Routes, DCV not Driven; Black = State, Local or Private non-NPS Routes; = Concession Route Flag ON

Red text denotes approx. mileage

*Unpaved route data was obtained from NPS and was not inventoried by the Road Inventory Program (RIP).

** DCV - Data Collection Vehicle NC - Not Collected

CAVO

CAPULIN VOLCANO NATIONAL MONUMENT

Rte. No.	Cycle Collected	FMSS No.	Concess Route	Route Name	Route Description From	Route Description To	Maint. District	Paved Miles	Un-Paved Miles	Total Route Length	Func. Class	Manual Rated SQ/FT	Surf. Type	Area Maps
0010	5	33563		CAPULIN VOLCANO ROAD	FROM STATE HIGHWAY 325	TO ROUTE 0905 (CRATER RIM PARKING)	N/A	2.55	0.00	2.55	1	0	AS	1
0200	NC	231012		MARROW RANCH ROAD	FROM STATE HIGHWAY 325	TO PARK BOUNDARY	N/A	0.00	0.06	0.06	4	0	GR	
0400	5	33586		MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD	FROM ROUTE 0010 (CAPULIN VOLCANO ROAD)	TO DEAD END	N/A	0.10	0.00	0.10	5	0	AS	1
0401	NC	92370		SEWER LAGOON ROAD	FROM ROUTE 0404 (CAVO SHOP ROAD)	TO SEWER LAGOON	N/A	0.00	0.10	0.10	6	0	GR	
0402	NC	92372		WATER TANK ROAD	FROM ROUTE 0010 (CAPULIN VOLCANO ROAD)	TO WATER RESERVOIR	N/A	0.00	0.11	0.11	6	0	NV	
0403	NC	92373		FIRE ROAD	FROM ROUTE 0901 (VISITOR CENTER OVERFLOW PARKING)	TO SOUTHEAST PARK BOUNDARY	N/A	0.00	2.30	2.30	6	0	NV	
0404	5	103505		CAVO SHOP ROAD	FROM ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)	TO MAINTENANCE SHOP	N/A	0.02	0.25	0.27	5	1,312	AS	1
0900	5	91299		VISITOR CENTER PARKING	FROM ROUTE 0010 (CAPULIN VOLCANO ROAD) ON RIGHT	TO ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)	N/A	0.00	0.00	0.00		6,600	AS	1
0901	5	68790		VISITOR CENTER OVERFLOW PARKING	FROM ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)	TO ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)	N/A	0.00	0.00	0.00		15,664	AS	1
0903	5	91301		ADMINISTRATIVE PARKING	ADJACENT TO ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD) ON RIGHT		N/A	0.00	0.00	0.00		879	AS	1
0904	5	91302		PICNIC AREA PARKING	FROM ROUTE 0010 (CAPULIN VOLCANO ROAD)	TO PARKING	N/A	0.00	0.00	0.00		22,340	AS	1
0905	5	91303		CRATER RIM PARKING	FROM END OF ROUTE 0010 (CAPULIN VOLCANO ROAD)	TO PARKING	N/A	0.00	0.00	0.00		12,452	AS	1
0906	5	91304		MAINTENANCE AREA	FROM ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)	TO PARKING	N/A	0.00	0.00	0.00		5,293	AS	1

Cycle 5 NPS/RIP Route ID Report

Shading Color Key:
Red text denotes approx. mileage

White = Paved Routes, DCV Driven | Yellow = Unpaved Routes, DCV not Driven | Blue = All Paved Parking Areas | Green = All Unpaved Parking Areas

Grey = Paved Routes, DCV not Driven | Black = State, Local or Private non-NPS Routes | = Concession Route Flag ON

*Unpaved route data was obtained from NPS and was not inventoried by the Road Inventory Program (RIP).

** DCV - Data Collection Vehicle NC - Not Collected

CAVO

CAPULIN VOLCANO NATIONAL MONUMENT

Rte. No.	Cycle Collected	FMSS No.	Concess Route	Route Name	Route Description From	Route Description To	Maint. District	Paved Miles	Un-Paved Miles	Total Route Length	Func. Class	Manual Rated SQ/FT	Surf. Type	Area Maps
0907	5	103619		VOLCANO ROAD PULLOUT	ADJACENT TO ROUTE 0010 (CAPULIN VOLCANO ROAD) ON RIGHT		N/A	0.00	0.00	0.00		872	AS	1

Cycle 5 NPS/RIP Route ID Report

Shading Color Key:
Red text denotes approx. mileage

White = Paved Routes, DCV Driven	Yellow = Unpaved Routes, DCV not Driven	Blue = All Paved Parking Areas	Green = All Unpaved Parking Areas
Grey = Paved Routes, DCV not Driven	Black = State, Local or Private non-NPS Routes	= Concession Route Flag ON	

*Unpaved route data was obtained from NPS and was not inventoried by the Road Inventory Program (RIP).

** DCV - Data Collection Vehicle NC - Not Collected

CYCLE 5 SUMMARY TOTALS FOR CAPULIN VOLCANO NATIONAL MONUMENT

CYCLE 5 ROUTE TOTALS

DCV Driven Route Miles	2.65
Manually Rated Route Miles	0.02
TOTAL PARK ROUTE MILES COLLECTED IN CYCLE 5	2.68
Manually Rated Routes (SQFT)	1,312
TOTAL UNPAVED PARK ROUTE MILES	2.82

CYCLE 5 CONCESSION TOTALS

Concession Paved Route Miles	0.00
Concession Unpaved Route Miles	0.00
TOTAL CONCESSION ROUTE MILES	0.00
Concession Paved Parking Area SQFT	0
Concession Unpaved Parking Area SQFT	0
TOTAL CONCESSION PARKING AREA SQFT	0
Concession Manually Rated Rotes SQFT	0

* CYCLE 5 PARKING AREA TOTALS

Paved Parking (SQFT)	64,100
Unpaved Parking (SQFT)	0
TOTAL PARKING (SQFT)	64,100

CYCLE 5 WEIGHTED AVERAGE PARK VALUES

DCV Driven PCR	82
**Manually Rated Routes PCR	73
**Parking PCR	48
***Total Equivalent Lane Miles	6.97

* - The Parking Area Totals SQFT value represents **all** parking areas collected in Cycle 5, both park and concessionaire.

** - Parking and Manually Rated Routes are assigned the following PCR values based on their observed condition: Construction=-1, Excellent=97, Good=90, Fair=73, and Poor=45.

*** - Equivalent Lane Miles are calculated by route using the following equations : DCV and Manually Rated Lines Routes=(PAVE_WIDTHxPAVED_MI)/11 foot lane. Parking Areas=SQ_FEET/5280/11. Manually Rated Polygons=SQ_FEET/5280/11.

Cycle 5 NPS/RIP Route ID Report

Shading Color Key:
Red text denotes approx. mileage

White = Paved Routes, DCV Driven	Yellow = Unpaved Routes, DCV not Driven	Blue = All Paved Parking Areas	Green = All Unpaved Parking Areas
Grey = Paved Routes, DCV not Driven	Black = State, Local or Private non-NPS Routes	= Concession Route Flag ON	

*Unpaved route data was obtained from NPS and was not inventoried by the Road Inventory Program (RIP).

** DCV - Data Collection Vehicle NC - Not Collected

General Park Road Functional Classification Table

Class 1 Principal Park Road/Rural Parkway (Public Roads) Roads which constitute the main access route, circulatory tour, or thoroughfare for park visitors. Route Numbers 1 - 99. Note: Rural parkways (e.g. Natchez Trace) are numbered 1 - 9. State Routes Inventoried for Park. Route Numbers 5000-5999

Class 2 Connector Park Road (Public Roads) - Roads which provide access within a park to areas of scenic, scientific, recreational or cultural interest, such as overlooks, campgrounds, etc. Route Numbers 100-199.

Class 3 Special Purpose Park Road (Public Roads) - Roads which provide circulation within public areas, such as campgrounds, picnic areas, visitor center complexes, concessionaire facilities, etc. These roads generally serve low-speed traffic and are often designed for one-way circulation. Route Numbers 200-299.

Class 4 Primitive Park Roads (Public Roads) - Roads which provide circulation through remote areas and/or access to primitive campgrounds and undeveloped areas. These roads frequently have no minimum design standards and their use may be limited to specially equipped vehicles. Route Numbers 200-299.
Note: Functional Classes 3 and 4 have the same route numbers because, historically, they were numbered similarly.

Class 5 Administrative Access Road (Administrative Roads) - All public roads intended for access to administrative developments or structures such as park offices, employee quarters, or utility areas. Route Numbers 400-499.

Class 6 Restricted Road (Administrative Roads) - All roads normally closed to the public, including patrol roads, truck trails, and other similar roads. Route Numbers 400-499.
Note: Functional Classes 5 and 6 have the same route numbers because historically they were numbered similarly and often there is little distinction between these routes. For example, because utility areas and employee housing are often closed to the public, this restriction would result in classification of FC 6 rather than FC 5.

Class 7 Urban Parkway (Urban Parkways and City Streets) - These facilities serve high volumes of park and non-park related traffic and are restricted, limited-access facilities in an urban area. This category of roads primarily encompasses the major parkways which serve as gateways to our nation's capital. Other major park roads or portions thereof, however, may be included in this category. Route Numbers 1-9.

Class 8 City Streets (Urban Parkways and City Streets) - City streets are usually extensions of the adjoining street system that are owned and maintained by the National Park Service. The construction and/or reconstruction should conform with accepted local engineering practice and local conditions. Route Numbers 600-699.

****

A park road system contains those roads within or giving access to a park or other unit of the NPS which are administered by the NPS, or by the Service in cooperation with other agencies. The assignment of a functional classification (FC) to a park road is not based on traffic volumes or design speed, but on the intended use or function of that road or route.

The historic route numbering system also included a 300 number series for interpretive roads, and a 500 series for one-way roads. There are approximately 250 roads nationwide which are designated by the 300 and 500 series. The numbers for these roads will be maintained for reporting consistency. However, since these interpretive and one-way routes are not as clearly tied to a specific functional class, the 300 and 500 series will be discontinued for future use.

5000 route numbers are assigned to Non-NPS Routes that are State, County or City owned which border, traverse, or provide access to Park Facilities or Assets. 5000 Routes are driven for GPS and Video Log only.

Surface Type Abbreviations:

AS - Asphaltic Concrete Pavement
CO - Portland Cement Concrete Pavement
BR - Brick or Pavers Road Bed
CB - Cobble Stone Road Bed
GR - Gravel Road Bed
SA - Sand Road Bed
NV - Native or Dirt Material Road Bed
OT - Other Materials Road Bed

ROUTE IDENTIFICATION CHANGES TO PAVED ASSESTS FROM PREVIOUS CYCLE - CAVO

ROUTES ADDED FROM PREVIOUS INVENTORY:

Route #	Route Name	Reason for Addition	Comments
0907	Volcano Road Pullout	OTHER	ADDED IN CY5.

ROUTES MODIFIED FROM PREVIOUS INVENTORY:

Route #	Route Name	Type of Modification	Comments
0010	Capulin Volcano Road	REALIGNED	ROUTE WAS DRIVEN DIFFERENTLY AT THE VISITOR CENTER.
0404	Cavo Shop Road	SURFACE TYPE CHANGE	PAVED PORTION ADDED IN CY5.
0903	Administrative Parking	OTHER	GPS RECOLLECTED TO MORE ACCURATELY REFLECT THE PARKING SHAPE.
0906	Maintenance Area	OTHER	GPS RECOLLECTED TO MORE ACCURATELY REFLECT THE PARKING SHAPE.

OTHER CHANGES FROM PREVIOUS INVENTORY:

Route #	Route Name	Type of Change	Comments
0900	Visitor Center Parking	ROUTES COMBINED	ROUTE 0900A AND 0900B WERE COMBINED TO MAKE ROUTE 0900 IN CYCLE 5.

Section 3
Park Summary Information

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

CAVO: PAVED ROUTE MILES AND PERCENTAGES BY FUNCTIONAL CLASS AND PCR

F.C.	Pavement Condition Rating (PCR)								TOTAL MILES
	Poor (0-60)		Fair (61-84)		Good (85-94)		Excellent (95-100)		
	MILES	%	MILES	%	MILES	%	MILES	%	
1	0.38	14.34%	1.11	41.89%	1.02	38.49%	0.04	1.51%	**2.55**
2									
3									
4									
5	0.02	0.75%	0.06	2.26%	0.02	0.75%	0.00	0.00%	**0.10**
6									
7									
8									
Totals	**0.40**	**15.09%**	**1.17**	**44.15%**	**1.04**	**39.24%**	**0.04**	**1.51%**	**2.65**

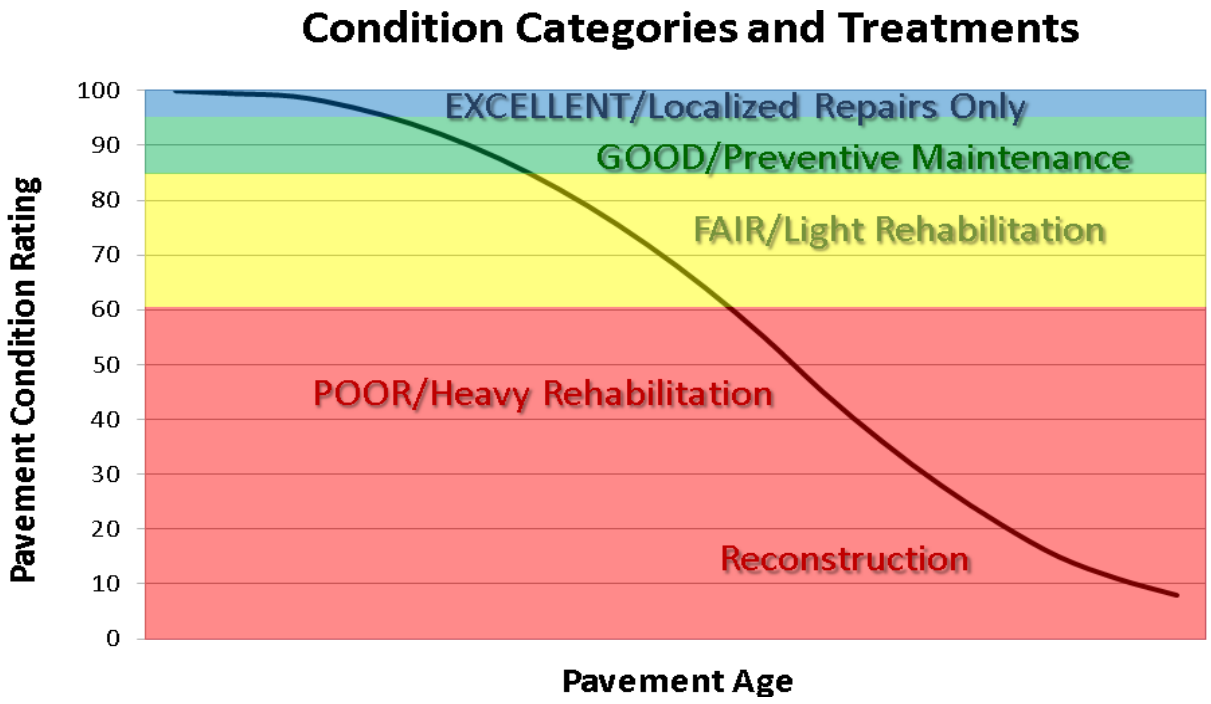
Note: **The information in this table is derived from the PMS_20 table in the Park database, which only contains processed data from routes collected with the Data Collection Vehicle (DCV). Information for Manually Rated Routes (MRR) and Parking Areas is not reported in this table. Only Functional Class 1, 2, & 7 routes, and any new routes not previously collected by RIP, are collected in Large Parks.**

Explanation of the Excellent, Good, Fair and Poor Condition Descriptions

In addition to the RIP Index changes that have been implemented in Cycle 5, we will also aim to provide greater assistance in translating excellent/good/fair/poor categories into pavement needs categories. The PCR can be used to indicate the place in the Pavement Life Cycle and the types of treatments that should be considered now and into the future.

- Excellent/New: PCR of 95-100. Pavements in this range will require only spot repairs
- Good: PCR of 85-94. Pavements in this range will likely be candidates for Preventive Maintenance. Examples include Chip and Slurry Seals, Micro Surfacing and Thin Overlays.
- Fair: PCR of 61-84. Pavements in this range will likely be candidates of Light Rehabilitation (L3R). Examples include single-lift overlays up to 2.5 inches in total thickness, milling and overlays.
- Poor: PCR of 0-60. Pavements in this range will likely be candidates of Heavy Rehabilitation or Reconstruction (H3R or 4R). Examples include Pulverization, Multiple Lift Overlays, and Reconstruction.

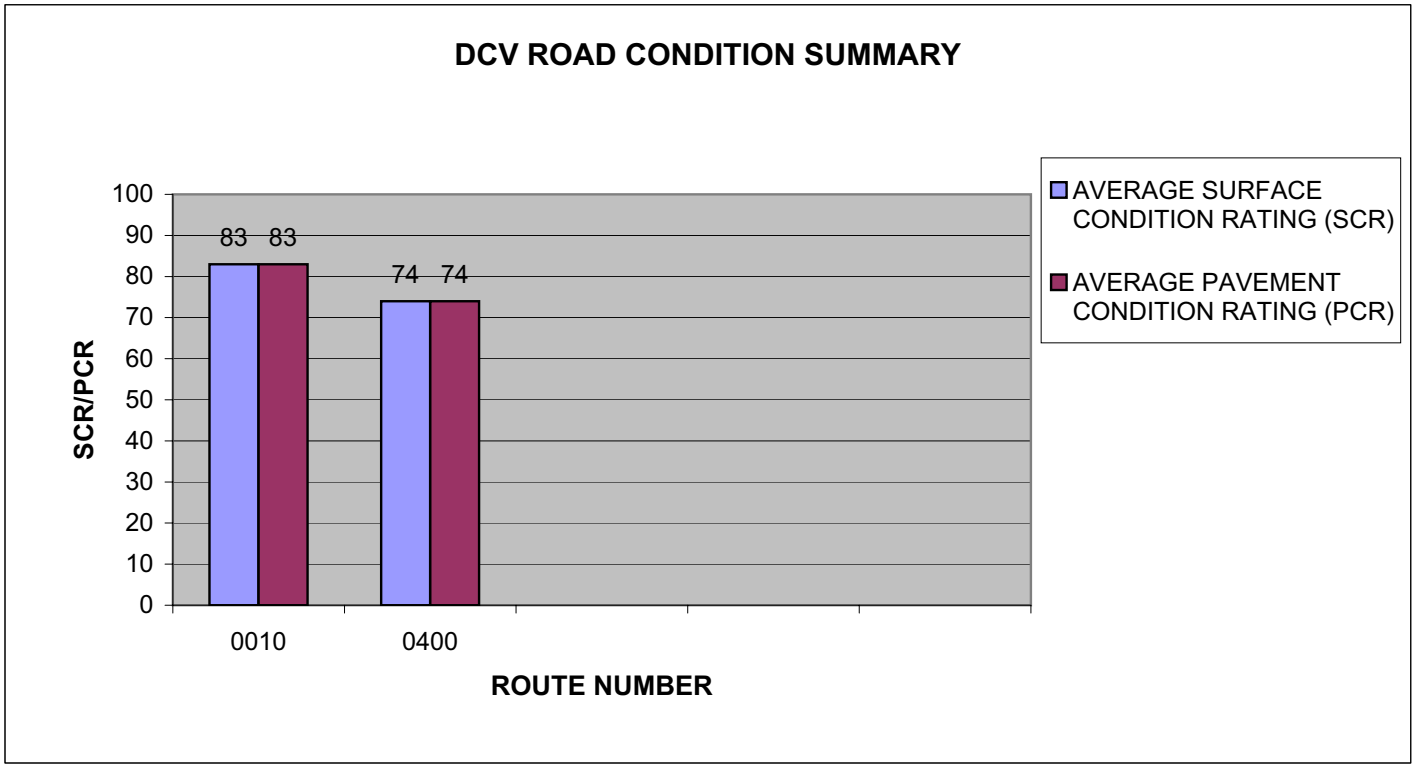
At this time, specific Maintenance and Rehabilitation activities should be evaluated and recommended at the project level. Site-specific conditions that influence treatment type should be determined based on performing a subsurface investigation and/or pavement condition survey, and not be based solely on RIP data. Additionally, RIP produces a snapshot of conditions the year in which the data was collected. For further information or to obtain additional Pavement Management System's data from our Highway Pavement Management Application (HPMA) please contact the Eastern Federal Lands pavement team.



CAVO: DCV ROAD CONDITION SUMMARY

DCV - Data Collection Vehicle

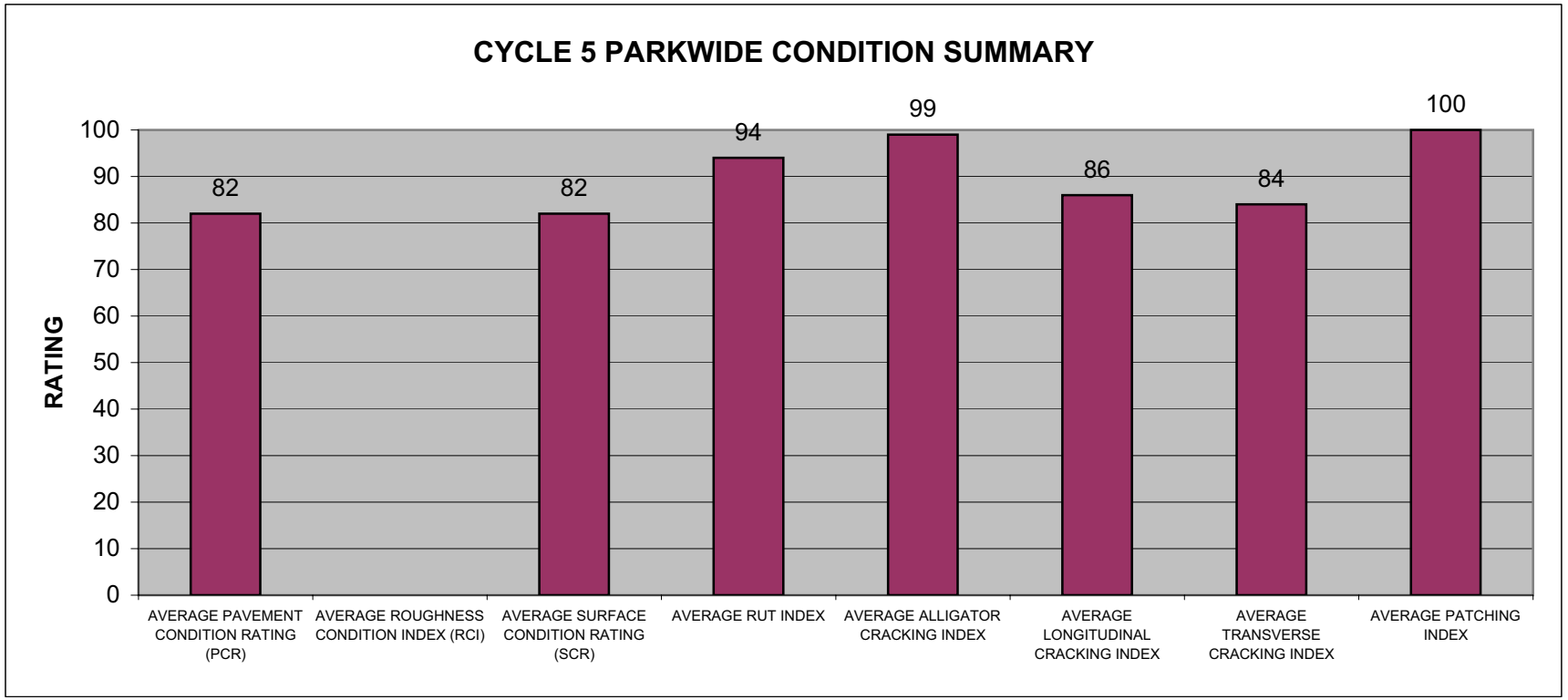
ROUTE NUMBER	ROUTE NAME	FUNCT CLASS	ROUTE LENGTH	SURFACE TYPE	AVERAGE SURFACE CONDITION RATING (SCR)	AVERAGE PAVEMENT CONDITION RATING (PCR)
0010	CAPULIN VOLCANO ROAD	1	2.55	ASPHALT	83	83
0400	MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD	5	0.10	ASPHALT	74	74



CAVO: PARKWIDE DCV CONDITION SUMMARY

AVERAGE PAVEMENT CONDITION RATING (PCR)	AVERAGE ROUGHNESS CONDITION INDEX (RCI)	AVERAGE SURFACE CONDITION RATING (SCR)	AVERAGE RUT INDEX	AVERAGE ALLIGATOR CRACKING INDEX	AVERAGE LONGITUDINAL CRACKING INDEX	AVERAGE TRANSVERSE CRACKING INDEX	AVERAGE PATCHING INDEX
82	-1	82	94	99	86	84	100

All Index values are based on Data Collection Vehicle (DCV) driven roads that were collected in Cycle-5.

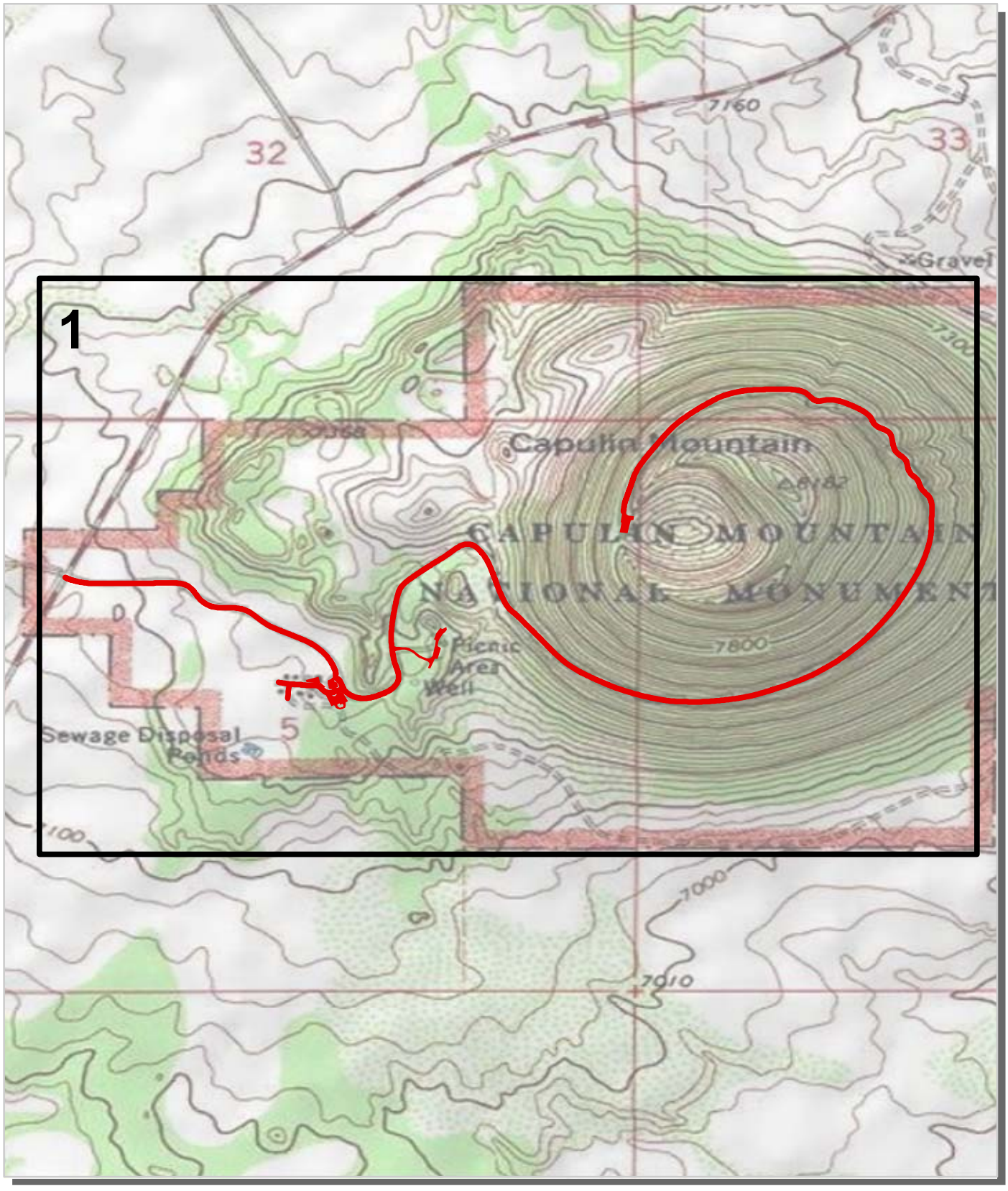


Section 4
Park Route Location Maps

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

Capulin Volcano National Monument
Route Location Map
Key Map

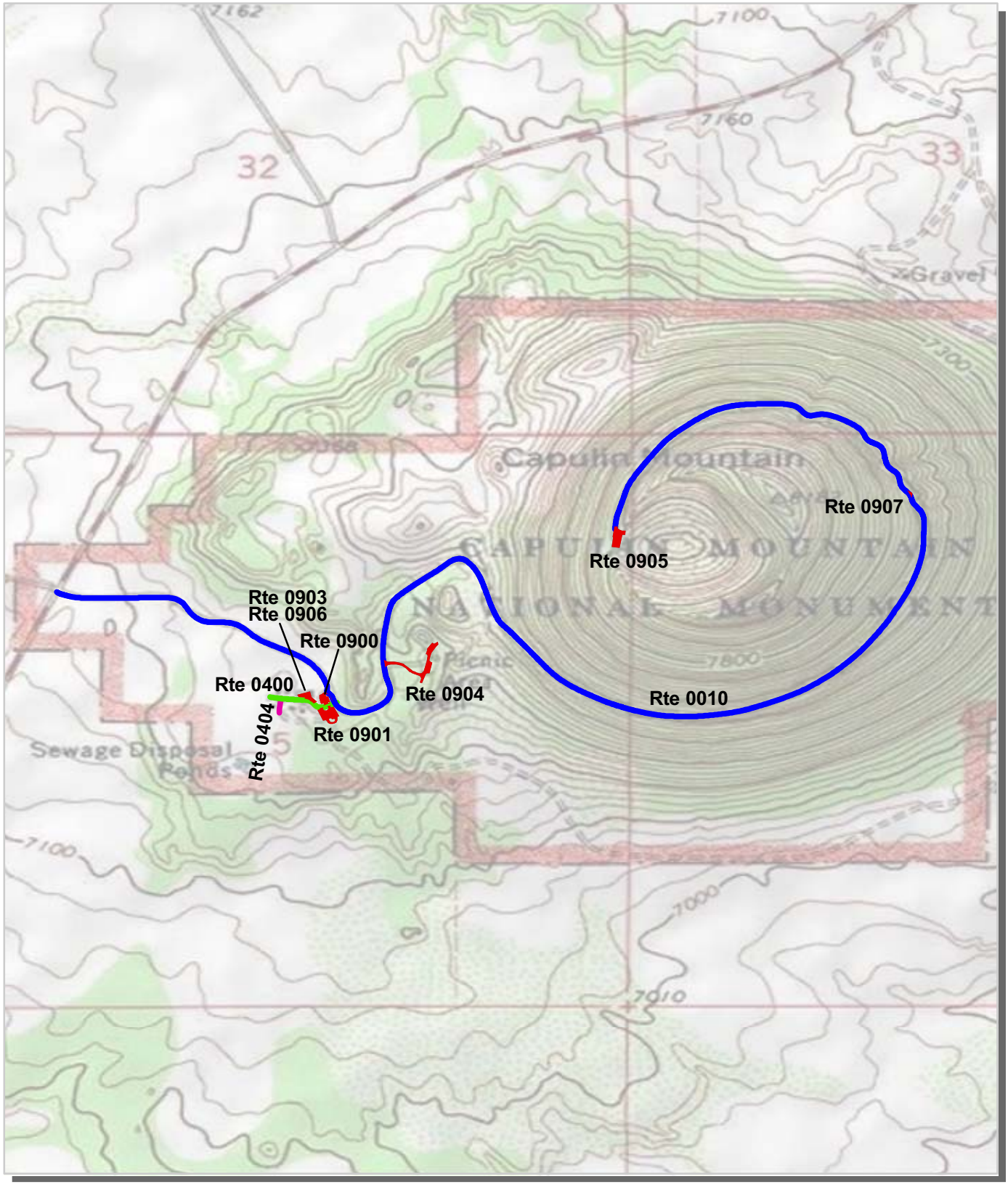


Cycle 5 Collected Routes

0.25 0.125 0 0.25
Miles

N

Capulin Volcano National Monument
Route Location Map
Area 1

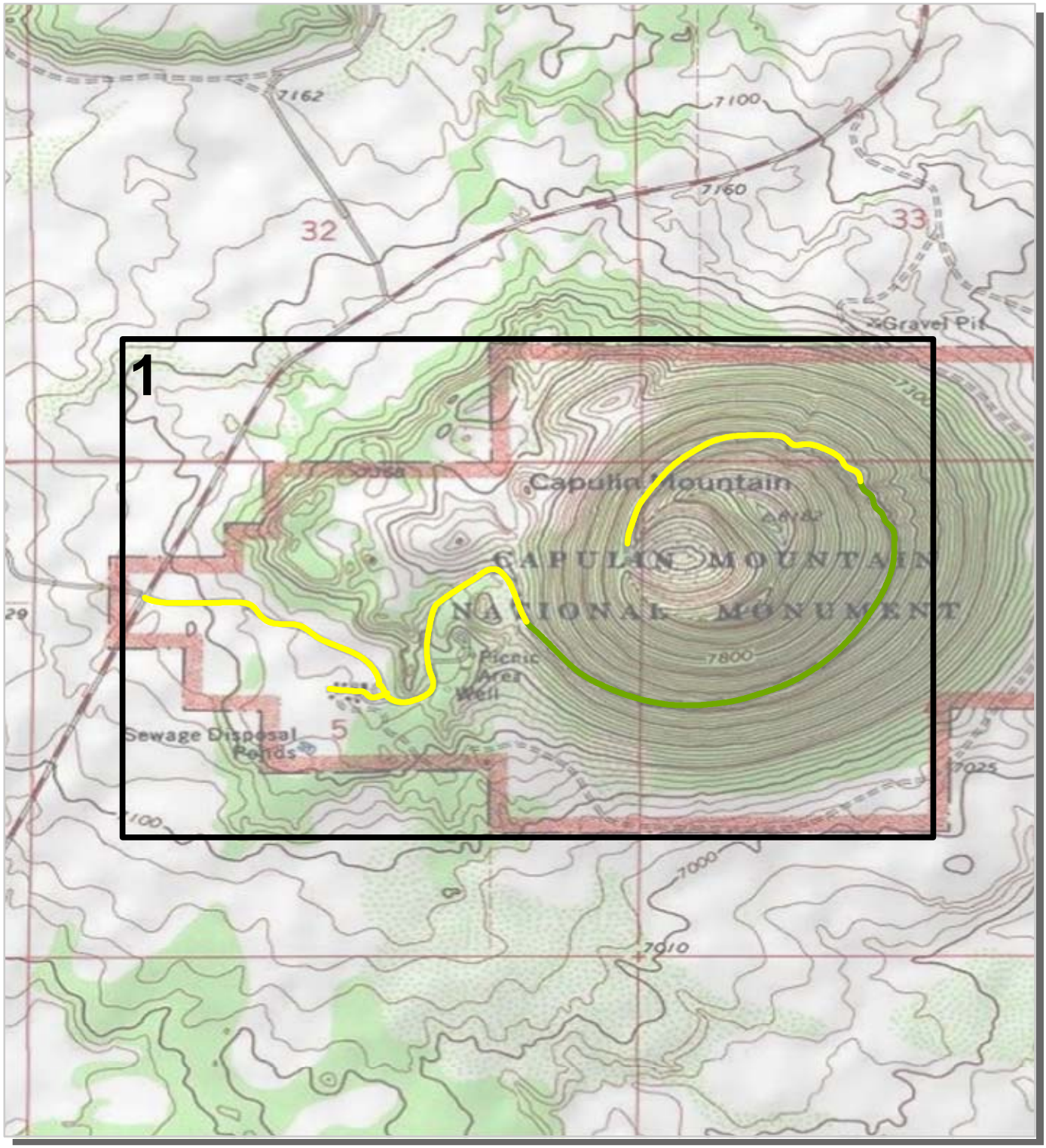


Unique colors used to differentiate routes

0.3 0.15 0 0.3 Miles

N

Capulin Volcano National Monument
Route Condition Map
PCR - Mile by Key Map



PCR	Poor	Fair	Good	Excellent	No Data
	(0 - 60)	(61 - 84)	(85 - 94)	(95 - 100)	

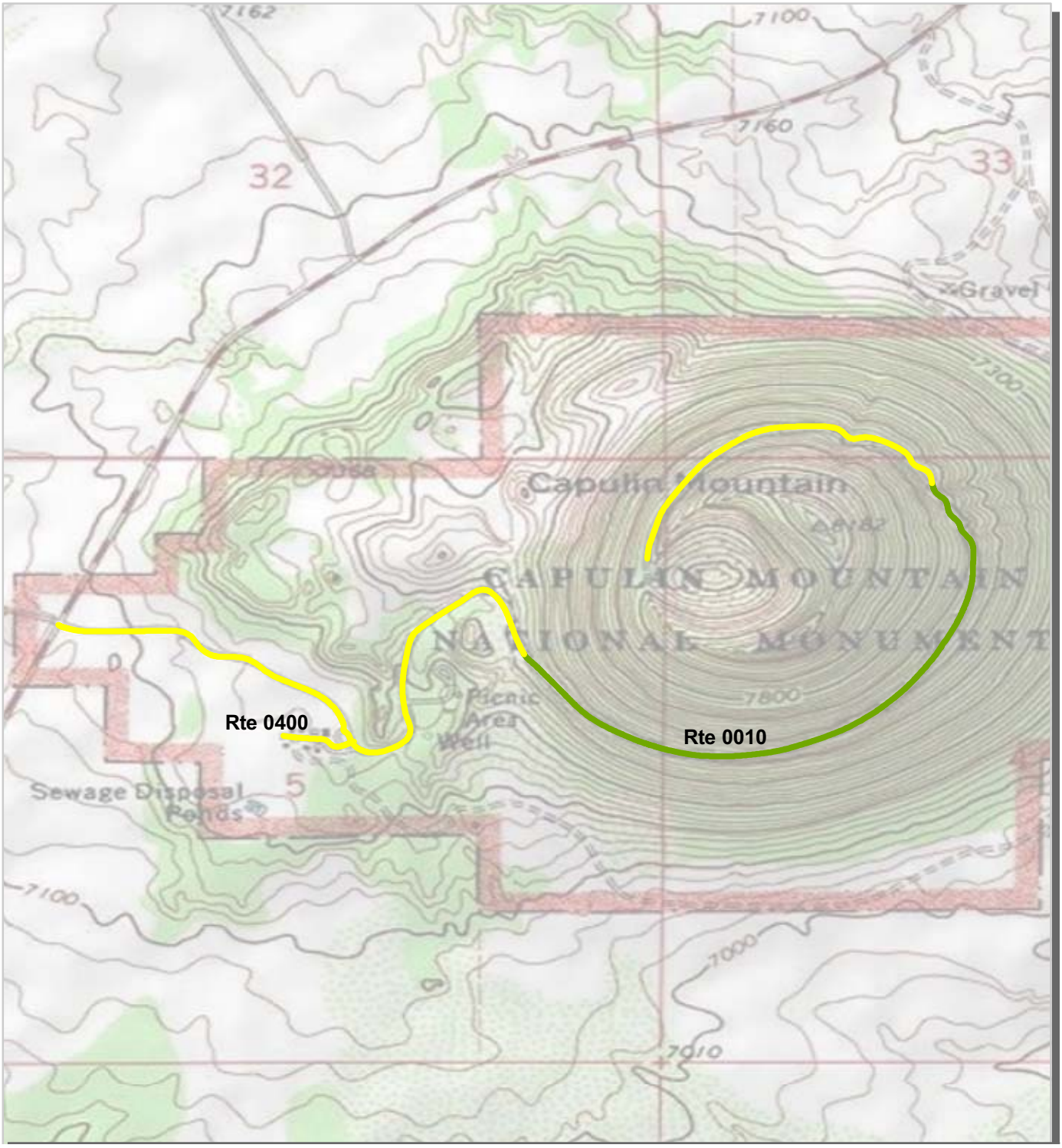
* If the PCR rating is not available for a section, the SCR rating will be displayed. See appendix for definitions and formulas.

Note: Only routes collected by the DCV in Cycle-5 are displayed.

0.25 0.125 0 0.25 Miles

N

Capulin Volcano National Monument
Route Condition Map
PCR - Mile by Mile
Area 1



PCR	Poor	Fair	Good	Excellent	No Data
	(0 - 60)	(61 - 84)	(85 - 94)	(95 - 100)	

* If the PCR rating is not available for a section, the SCR rating will be displayed. See appendix for definitions and formulas.

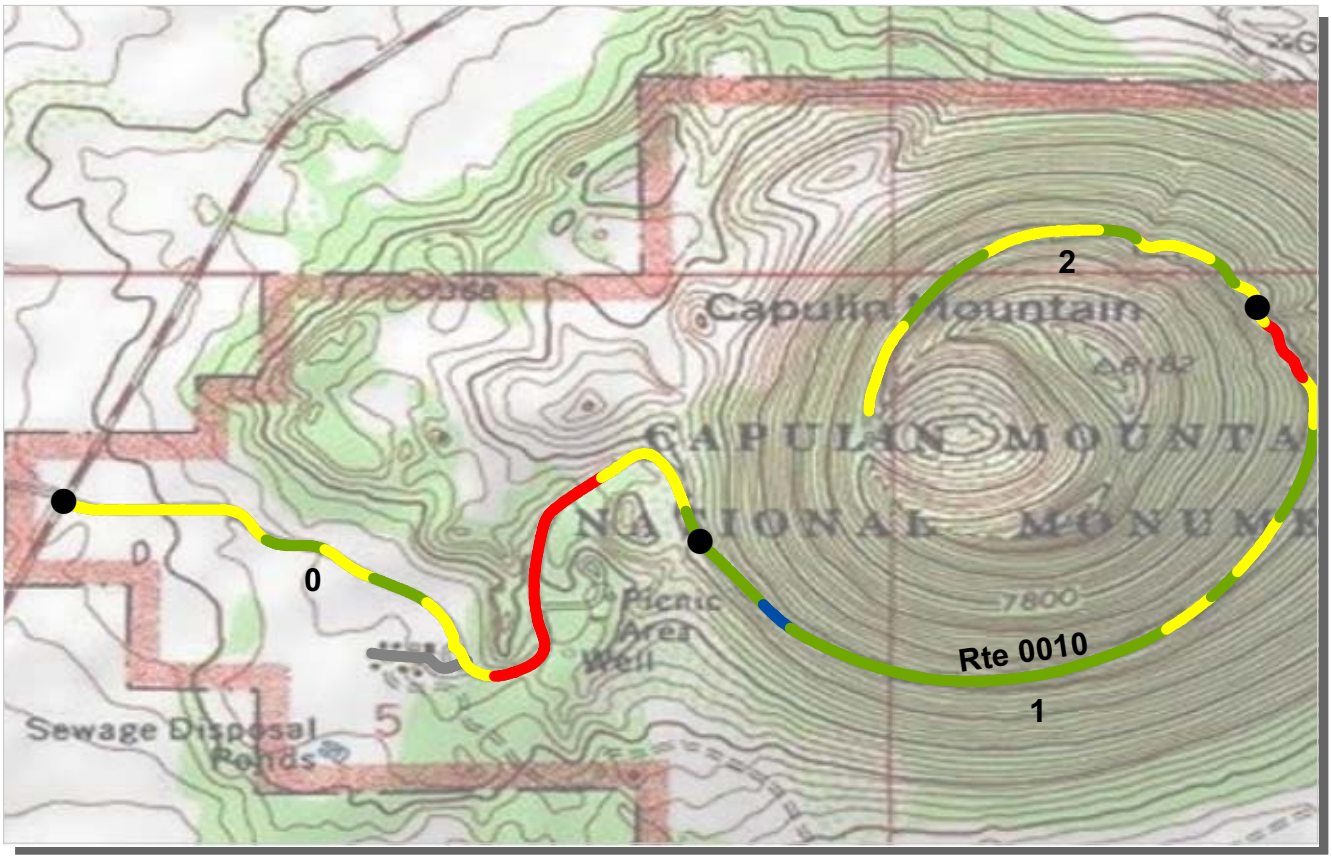
0.3 0.15 0 0.3 Miles

N

Section 5
Paved Route
Condition Rating Sheets

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program



PCR Poor (0 - 60) Fair (61 - 84) Good (85 - 94) Excellent (95 - 100) No Data

* If the PCR rating is not available for a section, the SCR rating will be displayed. See appendix for definitions and formulas.

ROUTE: 0010 CAPULIN VOLCANO ROAD
CAVO : CAPULIN VOLCANO NATIONAL MONUMENT

COLLECTED: 5/25/2010
INTERMOUNTAIN REGION **TOTAL LENGTH: 2.55 Miles**

Section Number	0	1	2		
Section Length (mi)	1.00	1.00	0.55		
Cross Section Information					
Number of Lanes	2	2	2		
Paved Width (ft)	23	25	27		
Lane Width (ft)	10	10	11		
Roadway Condition Information					
SCR (Surface Condition Rating)	78	87	84		
PCR (Pavement Condition Rating)	78	87	84		
Distress Index Values					
Structural Crack Index	78	91	90		
Transverse Cracking Index	81	87	84		
Patching Index	100	100	100		
Rutting Index	95	94	93		
Roughness Condition Index (RCI)	NC	NC	NC		

NOTES:
Structural Crack Index is a combination of the Longitudinal Cracking Index and Alligator Cracking Index.
See Section 10 for explanation of SCR, PCR, & all Distress Index Values.
NC - Not Collected N/A - Non Applicable

PCR Poor (0 - 60) Fair (61 - 84) Good (85 - 94) Excellent (95 - 100) No Data

* If the PCR rating is not available for a section, the SCR rating will be displayed. See appendix for definitions and formulas.

ROUTE: 0400 MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD
CAVO : CAPULIN VOLCANO NATIONAL MONUMENT

COLLECTED: 5/25/2010

INTERMOUNTAIN REGION **TOTAL LENGTH: 0.10 Miles**

Section Number	0				
Section Length (mi)	0.10				
Cross Section Information					
Number of Lanes	2				
Paved Width (ft)	17				
Lane Width (ft)	9				
Roadway Condition Information					
SCR (Surface Condition Rating)	74				
PCR (Pavement Condition Rating)	74				
Distress Index Values					
Structural Crack Index	91				
Transverse Cracking Index	74				
Patching Index	96				
Rutting Index	95				
Roughness Condition Index (RCI)	NC				

NOTES:
Structural Crack Index is a combination of the Longitudinal Cracking Index and Alligator Cracking Index.
See Section 10 for explanation of SCR, PCR, & all Distress Index Values.
NC - Not Collected N/A - Non Applicable

Section 6
Manually Rated Paved Route Condition Rating Sheets

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

CAPULIN VOLCANO NATIONAL MONUMENT

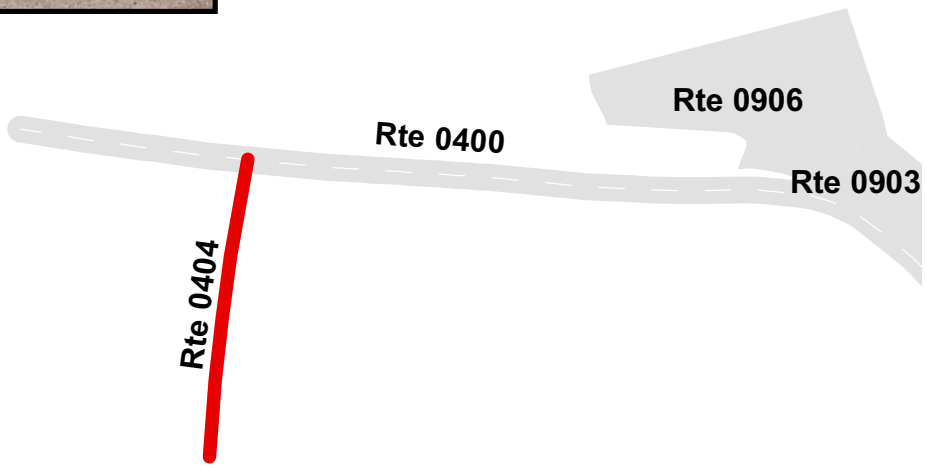
Route 0404

CAVO SHOP ROAD

FROM ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)
TO MAINTENANCE SHOP

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	MRL	
					Length (mi)	Width (ft)
0404	PUBLIC	5/25/2010	1,312	0.02	0.27	10.8
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**	**Surface Type**
0	0	0	NO CURB AND GUTTER	NO CURB	FAIR/73	AS

* Lane miles are based on 11' lane widths



Section 7
Parking Area
Condition Rating Sheets

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

CAPULIN VOLCANO NATIONAL MONUMENT

Route 0900

VISITOR CENTER PARKING

FROM ROUTE 0010 (CAPULIN VOLCANO ROAD) ON RIGHT
TO ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0900	PUBLIC	5/25/2010	6,600	0.11	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	1	0	CONCRETE CURB AND GUTTER	NO CURB	FAIR/73

* Lane miles are based on 11' lane widths

CAPULIN VOLCANO NATIONAL MONUMENT

Route 0901

VISITOR CENTER OVERFLOW PARKING

FROM ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)

TO ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0901	PUBLIC	5/25/2010	15,664	0.27	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	1	1	CONCRETE CURB AND GUTTER	NO CURB	POOR/45

* Lane miles are based on 11' lane widths

270 135 0 270

Feet

CAPULIN VOLCANO NATIONAL MONUMENT

Route 0903

ADMINISTRATIVE PARKING

ADJACENT TO ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD) ON RIGHT

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0903	NONPUBLIC	5/25/2010	879	0.02	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	NO CURB	POOR/45

* Lane miles are based on 11' lane widths

270 135 0 270 Feet

CAPULIN VOLCANO NATIONAL MONUMENT

Route 0904

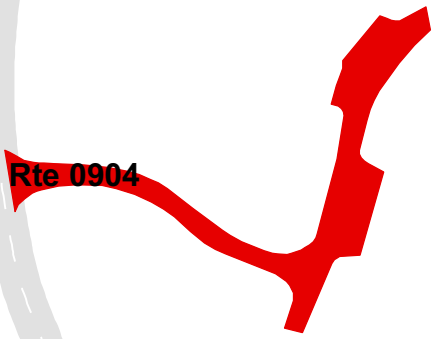
PICNIC AREA PARKING

FROM ROUTE 0010 (CAPULIN VOLCANO ROAD)

TO PARKING

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0904	PUBLIC	5/25/2010	22,340	0.39	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	NO CURB	POOR/45

* Lane miles are based on 11' lane widths



Rte 0010

410 205 0 410 Feet

N

CAPULIN VOLCANO NATIONAL MONUMENT

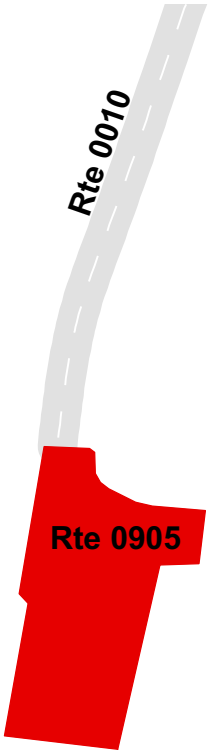
Route 0905

CRATER RIM PARKING

FROM END OF ROUTE 0010 (CAPULIN VOLCANO ROAD)
TO PARKING

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0905	PUBLIC	5/25/2010	12,452	0.21	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	2	0	CONCRETE CURB AND GUTTER	NO CURB	POOR/45

* Lane miles are based on 11' lane widths



270 135 0 270
Feet

N

CAPULIN VOLCANO NATIONAL MONUMENT

Route 0906

MAINTENANCE AREA

FROM ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)
TO PARKING

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0906	NONPUBLIC	5/25/2010	5,293	0.09	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	1	0	NO CURB AND GUTTER	NO CURB	POOR/45

* Lane miles are based on 11' lane widths

190 95 0 190 Feet

N

CAPULIN VOLCANO NATIONAL MONUMENT

Route 0907

VOLCANO ROAD PULLOUT

ADJACENT TO ROUTE 0010 (CAPULIN VOLCANO ROAD) ON RIGHT

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0907	PUBLIC	5/25/2010	872	0.02	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	ASPHALT CURB	FAIR/73

* Lane miles are based on 11' lane widths

140 70 0 140 Feet

N

Section 8
Parkwide/Route
Maintenance Features Summaries

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

CAVO: PARKWIDE MAINTENANCE FEATURES SUMMARY
Includes DCV, MRL, MRP & PKG routes collected in Cycle-5

Notice: Culverts and drop inlets were NOT marked by NPS in Cycle 5 along DCV driven routes, therefore the culvert and drop inlet counts below reflect only on Manually Rated Routes and Paved Parking areas in Cycle 5.

FEATURE	LINEAR FEET	COUNT
BARRIER	1,642	--
BOLLARD	0	--
BRIDGE	--	0
CABLE	0	--
CATTLE GUARD	--	1
CULVERT	--	0
CURB	10,395	--
DROP INLET	--	5
GATE	--	3
GUARD/GUIDE RAIL	797	--
GUARD/GUIDE WALL	845	--
INTERSECTION	--	20
LOW WATER CROSSING	0	0
MILE MARKER	--	0
OVERPASS	--	0
OVERHEAD SIGN	--	0
PARK BOUNDARY	--	0
PAVED DITCH	2,074	--
PULLOUT	243	2
RAILROAD CROSSING	--	0
RETAINING WALL	8,454	8
SIGN	--	35
STATE BOUNDARY	--	0
TEMPORARY BARRIER	0	--
TRAFFIC LIGHT	--	0
TUNNEL	0	0

CAVO: DCV ROUTE MAINTENANCE FEATURES SUMMARY

FEATURE	ROUTE 0010 CAPULIN VOLCANO ROAD	ROUTE 0400 MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD		UNIT
BARRIER	1,642	0		LINEAR FEET
BOLLARD	0	0		LINEAR FEET
BRIDGE	0	0		EACH
CABLE	0	0		LINEAR FEET
CATTLE GUARD	1	0		EACH
CULVERT	0	0		EACH
CURB	10,263	132		LINEAR FEET
DROP INLET	0	0		EACH
GATE	2	0		EACH
GUARD/GUIDE RAIL	797	0		LINEAR FEET
GUARD/GUIDE WALL	845	0		LINEAR FEET
INTERSECTION	11	9		EACH
LOW WATER CROSSING	0	0		EACH
LOW WATER CROSSING	0	0		LINEAR FEET
MILE MARKER	0	0		EACH
OVERHEAD SIGN	0	0		EACH
OVERPASS	0	0		EACH
PARK BOUNDARY	0	0		EACH
PAVED DITCH	2,074	0		LINEAR FEET
PULLOUT	2	0		EACH
PULLOUT	243	0		LINEAR FEET
RAILROAD CROSSING	0	0		EACH
RETAINING WALL	8	0		EACH
RETAINING WALL	8,454	0		LINEAR FEET
SIGN	28	7		EACH
STATE BOUNDARY	0	0		EACH
TEMPORARY BARRIER	0	0		LINEAR FEET
TRAFFIC LIGHT	0	0		EACH
TUNNEL	0	0		EACH
TUNNEL	0	0		LINEAR FEET

Notice: Culverts and drop inlets were NOT marked by NPS in Cycle 5. However a culvert could appear below if it has a BIP structure number associated with it.

STRUCTURE LIST

No data available for this section.

Section 9
Route Maintenance Features
Road Logs

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

CAVO: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0010: CAPULIN VOLCANO ROAD

Notice: Culverts and drop inlets were NOT marked by NPS nor inventoried by RIP in Cycle 5 on the DCV driven routes. Therefore no culverts or drop inlets are reported in Section 9, unless a culvert has a BIP structure number attached to it.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
0.000	0.000	ROUTE BEGIN	N/A	FROM STATE HIGHWAY 325
0.000	0.000	INTERSECTION	N/A	ROUTE 0200 (MARROW RANCH ROAD)
0.000	0.000	INTERSECTION	RIGHT	PAVED ROUTE (STATE HIGHWAY 325 / NON NPS)
0.000	0.000	SIGN	LEFT	REGULATORY, STOP
0.000	0.000	SIGN	N/A	GUIDE, UNABLE TO READ FROM VIDEO
0.000	0.000	INTERSECTION	LEFT	PAVED ROUTE (STATE HIGHWAY 325 / NON NPS)
0.011	0.011	CATTLE GUARD	N/A	N/A
0.013	0.045	CURB	RIGHT	N/A
0.013	0.046	PULLOUT	RIGHT	N/A
0.016	0.045	CURB	LEFT	N/A
0.051	0.051	SIGN	RIGHT	GUIDE, VISITOR CENTER 0.5 MI
0.090	0.090	SIGN	RIGHT	REGULATORY, SPEED LIMIT 20
0.144	0.144	SIGN	RIGHT	WARNING, GRAPHIC SIGN NO TEXT
0.335	0.335	SIGN	LEFT	WARNING, GRAPHIC SIGN NO TEXT
0.406	0.406	SIGN	RIGHT	GUIDE, PLEASE STOP AT VISITOR CENTER ENTRANCE FEE $5.00/VEHICLE
0.440	0.466	CURB-AND-GUTTER	N/A	N/A
0.441	0.441	INTERSECTION	LEFT	ROUTE 0010 (CAPULIN VOLCANO ROAD) OPPOSITE LANE
0.441	0.441	SIGN	N/A	REGULATORY, GRAPHIC SIGN NO TEXT
0.441	0.441	SIGN	N/A	REGULATORY, KEEP RIGHT
0.451	0.459	CURB-AND-GUTTER	RIGHT	N/A
0.462	0.462	INTERSECTION	RIGHT	ROUTE 0900 (VISITOR CENTER PARKING)
0.465	0.465	INTERSECTION	LEFT	ROUTE 0010 (CAPULIN VOLCANO ROAD) OPPOSITE LANE
0.465	0.465	SIGN	LEFT	GUIDE, STOP PAY FEES AT VISITOR CENTER THANK YOU
0.466	0.482	CURB-AND-GUTTER	RIGHT	N/A
0.472	0.472	SIGN	LEFT	GUIDE, EXIT VISITOR CENTER
0.473	0.514	CURB	LEFT	N/A
0.473	0.514	PAVED DITCH	LEFT	N/A
0.483	0.483	INTERSECTION	RIGHT	ROUTE 0400 (MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD)
0.487	0.499	CURB-AND-GUTTER	RIGHT	N/A

CAVO: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0010: CAPULIN VOLCANO ROAD

Notice: Culverts and drop inlets were NOT marked by NPS nor inventoried by RIP in Cycle 5 on the DCV driven routes. Therefore no culverts or drop inlets are reported in Section 9, unless a culvert has a BIP structure number attached to it.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
0.512	0.512	SIGN	LEFT	WARNING, SLOW
0.513	0.513	SIGN	RIGHT	GUIDE, PARK IS CLOSED AT 4:00 PM
0.513	0.513	SIGN	RIGHT	GUIDE, ROAD CLOSED TO PEDESTRIANS & BICYCLES FROM 8:00 AM- 4:00 PM
0.514	0.572	RETAINING WALL	LEFT	N/A
0.515	0.515	SIGN	LEFT	WARNING, UNABLE TO READ FROM VIDEO
0.515	0.515	SIGN	RIGHT	WARNING, UNABLE TO READ FROM VIDEO
0.515	0.515	SIGN	LEFT	REGULATORY, GRAPHIC SIGN NO TEXT
0.515	0.515	GATE	N/A	N/A
0.521	0.536	GUARD/GUIDE WALL	RIGHT	N/A
0.534	0.534	SIGN	RIGHT	WARNING, GRAPHIC SIGN NO TEXT
0.571	0.620	RETAINING WALL	RIGHT	N/A
0.572	0.771	CURB	LEFT	N/A
0.583	0.624	PAVED DITCH	RIGHT	N/A
0.596	0.596	SIGN	LEFT	WARNING, GRAPHIC SIGN NO TEXT
0.622	0.622	SIGN	RIGHT	GUIDE, BOCA TRAIL
0.622	0.622	SIGN	RIGHT	GUIDE, PICNIC AREA
0.635	0.635	INTERSECTION	RIGHT	ROUTE 0904 (PICNIC AREA PARKING)
0.641	0.786	GUARD/GUIDE WALL	RIGHT	N/A
0.641	0.802	PAVED DITCH	RIGHT	N/A
0.647	0.647	SIGN	LEFT	GUIDE, PICNIC AREA
0.647	0.647	SIGN	LEFT	GUIDE, BOCA TRAIL
0.676	0.676	GATE	N/A	N/A
0.679	0.679	SIGN	LEFT	REGULATORY, SPEED LIMIT 20
0.771	0.809	RETAINING WALL	LEFT	N/A
0.816	0.816	INTERSECTION	LEFT	ROUTE 0402 (WATER TANK ROAD)
0.827	0.977	PAVED DITCH	LEFT	N/A
0.827	1.885	RETAINING WALL	LEFT	N/A
0.945	0.945	SIGN	RIGHT	REGULATORY, SPEED LIMIT 20
0.978	2.546	CURB	LEFT	N/A

CAVO: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0010: CAPULIN VOLCANO ROAD

Notice: Culverts and drop inlets were NOT marked by NPS nor inventoried by RIP in Cycle 5 on the DCV driven routes. Therefore no culverts or drop inlets are reported in Section 9, unless a culvert has a BIP structure number attached to it.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
1.018	1.018	SIGN	RIGHT	WARNING, FALLING ROCKS
1.851	1.851	SIGN	RIGHT	WARNING, GRAPHIC SIGN NO TEXT
1.892	1.914	GUARD/GUIDE RAIL	RIGHT	N/A
1.916	1.929	PULLOUT	RIGHT	N/A
1.916	1.929	CURB	RIGHT	N/A
1.920	1.920	INTERSECTION	RIGHT	ROUTE 0907 (VOLCANO ROAD PULLOUT)
1.930	1.954	GUARD/GUIDE RAIL	RIGHT	N/A
1.970	2.010	GUARD/GUIDE RAIL	RIGHT	N/A
1.980	2.000	RETAINING WALL	LEFT	N/A
2.024	2.054	GUARD/GUIDE RAIL	RIGHT	N/A
2.038	2.047	RETAINING WALL	LEFT	N/A
2.128	2.163	GUARD/GUIDE RAIL	RIGHT	N/A
2.138	2.166	RETAINING WALL	LEFT	N/A
2.205	2.546	RETAINING WALL	LEFT	N/A
2.217	2.217	SIGN	LEFT	WARNING, GRAPHIC SIGN NO TEXT
2.550	2.550	INTERSECTION	N/A	ROUTE 0905 (CRATER RIM PARKING)
2.550	2.550	ROUTE END	N/A	TO ROUTE 0905 (CRATER RIM PARKING)

CAVO: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0400: MAINTENANCE SHOP ACCESS/ RESIDENTIAL ROAD

Notice: Culverts and drop inlets were NOT marked by NPS nor inventoried by RIP in Cycle 5 on the DCV driven routes. Therefore no culverts or drop inlets are reported in Section 9, unless a culvert has a BIP structure number attached to it.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
0.000	0.000	ROUTE BEGIN	N/A	FROM ROUTE 0010 (CAPULIN VOLCANO ROAD)
0.000	0.000	INTERSECTION	LEFT	ROUTE 0010 (CAPULIN VOLCANO ROAD)
0.000	0.000	INTERSECTION	RIGHT	ROUTE 0010 (CAPULIN VOLCANO ROAD)
0.007	0.007	SIGN	LEFT	WARNING, UNABLE TO READ FROM VIDEO
0.007	0.007	SIGN	RIGHT	REGULATORY, AUTHORIZED PERSONNEL ONLY
0.010	0.010	INTERSECTION	LEFT	ROUTE 0901 (VISITOR CENTER OVERFLOW PARKING)
0.011	0.011	INTERSECTION	RIGHT	ROUTE 0900 (VISITOR CENTER PARKING)
0.012	0.012	SIGN	LEFT	GUIDE, OVERSIZE VEHICLE PARKING NO TRAILERS ON VOLCANO ROAD
0.017	0.023	CURB-AND-GUTTER	LEFT	N/A
0.019	0.033	CURB-AND-GUTTER	RIGHT	N/A
0.024	0.024	INTERSECTION	LEFT	ROUTE 0901 (VISITOR CENTER OVERFLOW PARKING)
0.028	0.033	CURB-AND-GUTTER	LEFT	N/A
0.030	0.030	SIGN	RIGHT	GUIDE, ADMINISTRATIVE OFFICE MAINTENANCE AREA RESIDENTIAL AREA
0.030	0.030	SIGN	RIGHT	REGULATORY, YIELD
0.032	0.032	SIGN	LEFT	REGULATORY, SPEED LIMIT 10
0.032	0.032	SIGN	LEFT	WARNING, SLOW CHILDREN AT PLAY
0.039	0.039	INTERSECTION	RIGHT	ROUTE 0903 (ADMINISTRATIVE PARKING)
0.052	0.052	INTERSECTION	RIGHT	ROUTE 0906 (MAINTENANCE AREA)
0.083	0.083	INTERSECTION	LEFT	ROUTE 0404 (CAVO SHOP ROAD)
0.102	0.102	INTERSECTION	N/A	DEAD END
0.102	0.102	ROUTE END	N/A	TO DEAD END

Section 10
Appendix

Capulin Volcano National Monument

Federal Lands Highway
Road Inventory Program

Explanation of Changes to the RIP Index Equations and Determination of PCR

In 2005, the FHWA began implementing the use of a Pavement Management System to assist the National Park Service in prioritizing Pavement Maintenance and Rehabilitation activities. The PMS used by FHWA is the Highway Pavement Management Application (HPMA) and this software has the ability to store inventory and condition data from RIP and forecast future performance using prediction models. Outputs include performance and condition reports at the National, Region, Park, or Route level. A regional prioritized list and optimization have been produced for most regions and the Federal Highway Deferred Maintenance is calculated via the HPMA as well.

In an effort to improve the accuracy of treatment recommendations and pavement condition descriptions vis a vis the distresses and indexes that comprise the Pavement Condition Rating (PCR), an extensive study was completed throughout 2010 that has resulted in changes to the Road Inventory Program condition reporting method and specifically, the calculation of PCR. It was determined that a better representation of PCR could be achieved by modifying the relative impact certain distresses would have on the overall rating.

Through the use of HPMA data, it was noted that false failure indicators existed with the existing PCR model, and that it would be necessary to reduce their impact. The distresses affected in this way were Rutting and Roughness. Conversely, experience showed that roadways with extensive cracking present were often shown to have a high PCR. Therefore, the crack index models were adjusted to be more sensitive to changes in crack severity or quantity. It was also determined that these issues were not due to a problem with data acquisition (i.e. the RIP "van"), but with the way the collected data was processed. The final change was to provide guidance on when to use the Roughness Condition Index (RCI) in the PCR calculation. Roughness data is of little value to determining overall condition on routes that, due to their length or geometrics, have lower vehicle operating speeds. Therefore, in Cycle 5, only routes that have lengths of one half mile or greater and posted speed limits of 25 mph or greater will have RCI reported and included in the PCR calculations.

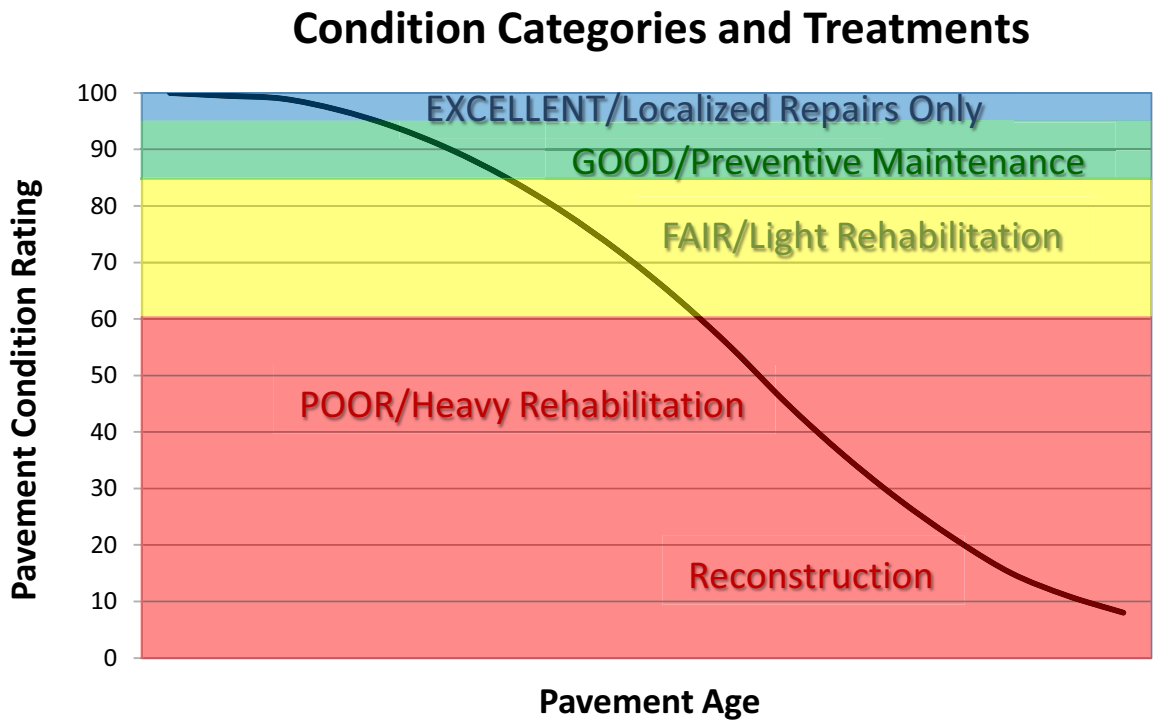
The changes that were implemented were endorsed by management at both the FHWA and NPS. In order to show the effectiveness of these changes, several sites were ground truth tested to ensure that an improvement was achieved between the relationship of PCR and the actual Maintenance and Rehabilitation needs that were represented. The changes will allow greater use of RIP and HPMA data for not simply condition data reporting, but also as a reliable tool for project identification and selection.

Explanation of the Excellent, Good, Fair and Poor Condition Descriptions

In addition to the RIP Index changes that will be implemented in Cycle 5, we will also aim to provide greater assistance in translating good/fair/poor categories into pavement needs categories. The PCR can be used to indicate the place in the Pavement Life Cycle and the types of treatments that should be considered now and into the future.

- Excellent/New: PCR of 95-100. Pavements in this range will require only spot repairs
- Good: PCR of 85-94. Pavements in this range will likely be candidates for Preventive Maintenance. Examples include Chip and Slurry Seals, Micro Surfacing and Thin Overlays.
- Fair: PCR of 61-84. Pavements in this range will likely be candidates of Light Rehabilitation (L3R). Examples include single-lift overlays up to 2.5 inches in total thickness, milling and overlays.
- Poor: PCR of 60 or below. Pavements in this range will likely be candidates of Heavy Rehabilitation or Reconstruction (H3R or 4R). Examples include Pulverization, Multiple Lift Overlays, and Reconstruction.

At this time, specific Maintenance and Rehabilitation activities should be evaluated and recommended at the project level. Site-specific conditions that influence treatment type should be determined based on performing a subsurface investigation and/or pavement condition survey, and not be based solely on RIP data. Additionally, RIP produces a snapshot of conditions the year in which the data was collected. For further information or to obtain additional Pavement Management System's data from our Highway Pavement Management Application (HPMA) please contact the Eastern Federal Lands pavement team.



DESCRIPTION OF RATING SYSTEM

The Federal Highway Administration (FHWA), Road Inventory Program (RIP) for the National Park Service (NPS), collects roadway condition data on paved surfaces (asphalt, concrete, brick, and cobblestone) on roads, parkways, and parking areas in national parks nationwide. The road surface condition data is collected using an automated Data Collection Vehicle (DCV). Roads having brick or cobblestone surfacing are not normally surveyed with the DCV, but are manually rated for condition rating.

The FHWA RIP is implemented based on the premise that an accurate pavement surface condition assessment can be accomplished using automated crack detection technology as applied to digital images. Various methods of pavement condition assessment have been developed over the years with varying degrees of accuracy and acceptance. The use of digital photography to record pavement images and subsequent crack detection and classification has undergone continuous improvements over the past decade. Digital cameras with increasingly superior resolution and high definition have become more affordable, and the proprietary programming code and algorithms have been improved in crack detection software.

With the use of quality digital photography and automated crack detection software, FHWA RIP is tasked with executing a pavement condition assessment on about 5000 miles of National Park Service roads and parkways. Foremost in setting up the basis of pavement distress identification is employing the distress identification protocols used by FHWA. There is no single distress identification system that is universal among entities conducting a program of distress identification. For the purpose of the NPS RIP, FHWA employs distress identification protocols that are specific to this program.

FHWA has referenced the "*Distress Identification Manual for the Long-Term Pavement Performance Program", Publication No. FHWA-RD 03-031, June 2003,* as the point-of-reference for distress types on NPS pavement. In truth, the FHWA RIP distress types are similar to those described in the LTPP manual with some modifications. This document, "*Distress Identification Manual for the NPS Road Inventory Program, Cycle 5, 2010-2013"* was developed using the "*Distress Identification Manual for the Long-Term Pavement Performance Program"* as a guideline. Definitions of severity levels based on crack width contained in this document adhere to the LTPP Distress ID Manual. Modifications have been made to the definition of Alligator and Longitudinal Cracking and determination of Alligator Cracking severity. This manual also addresses Rutting and Roughness and its application to RIP.

In 2010, FHWA RIP began the fifth cycle of data collection in national parks. For Cycle 5, data will be collected in approximately 81 large parks (10 or more paved route miles) on Functional Class 1, 2, and 7 routes plus any new routes or parking areas previously not collected, totaling an estimated 4,459 paved route miles. Additionally, 168 small parks will be collected comprising approximately 529 paved route miles and associated paved parking areas. The data is used to support the National Park Service road maintenance program and Pavement Management System (PMS) developed and maintained by FHWA.

This **"*Distress Identification Manual for the NPS Road Inventory Program, Cycle 5, 2010-2013*"** will be used as a reference resource in crack detection and classification, determination of distress severity and extent, and in the calculation of distress index values for the FHWA RIP Cycle 5.

SURFACE DISTRESSES

Surface Condition Rating - SCR

Surface distresses are measured in the primary lane only. In the classification and measurement of all paved surface condition data, results will be reported in the database in record intervals of 0.02 miles (105.6 feet) (smallest granularity) along the route.

Surface distresses determined from digital images

- Transverse Cracks
- Longitudinal Cracks
- Alligator Cracks
- Patching/Potholes

Surface distress measured by DCV (Data Collection Vehicle) LRMS (Laser Rut Measuring System)

- Rutting

Each of the five surface distresses is assigned a computed surface distress index

- Transverse Crack Index
- Longitudinal Crack Index
- Alligator Crack Index
- Patching/Pothole Index
- Rutting Index

Surface distress data are classified as listed above, measured for severity, and quantified for extent. Classification, severity, and extent of these five surface distresses comprise the three main elements for calculation of SCR (Surface Condition Rating).

In addition to the five surface distresses, a **Structural Crack Index** is computed, which is a combination of the Longitudinal Crack Index and the Alligator Crack Index. The Structural Crack Index is then used in lieu of the LC and AC indices to compute SCR.

Roughness Condition Index - RCI

Additional condition data measured by DCV (lasers and accelerometers)

- Roughness (IRI)

Roughness is measured by FHWA's DCV and reported as International Roughness Index (IRI) in inches/mile. Using IRI, the Roughness Condition Index (RCI) is computed.

Pavement Condition Rating - PCR

Using the SCR (computed from the five surface distresses) and the RCI, an overall Pavement Condition Rating (PCR) is computed. The formula for PCR is:

Asphalt PCR = (0.60 * SCR) + (0.40 * RCI)
Concrete PCR = RCI

A detailed description of each distress index formula, roughness index formula, SCR and PCR is provided in this document beginning on page 23.

Each classified surface distress will fall into one or more s*everity*…LOW, MEDIUM, or HIGH based on criteria listed. For each severity, an e*xtent* is established based on the measured quantity of the distress within that severity. Within each *severity* individual distresses are assigned a *Maximum Allowable Extent* (MAE). For example, LOW severity transverse cracking may be allowed up to 21.1 cracks within a 0.02 interval before it reaches MAE and fails.

The index formulas are based on a scale of 0-100. A PCR index value of 100 would indicate a "new" road with no measurable distresses or rough ride. A PCR value of 60 is determined to be *terminable serviceability* and the road is considered failed. The range of index values with condition descriptors is:

POOR (<=60), FAIR (61 - 84), GOOD (85 - 94), EXCELLENT (95 - 100)

Index values are generally computed based on cumulative deducts of the measured severities. As shown in the index formulas below, as any single severity reaches or exceeds MAE, the index computes to a value of 60 or less, and the road fails for that 0.02 interval.

> **Note:** As a result of a unique combination of measured surface distresses and IRI, index values occasionally compute to less than 0 or greater than 100. In this instance, an index value < 0 defaults to 0. Index values > 100 default to 100. For all indices, a higher value indicates a better road condition, and a lower value indicates a poorer road condition.

On the following page, Table 1 summarizes the different types of distresses measured.

TABLE 1: Distress Summary

ASPHALT-SURFACED PAVEMENT DISTRESS TYPES with RUTTING and ROUGHNESS				
DISTRESS TYPE	**UNIT OF MEASURE…**	**…CONVERTED TO**	**DEFINED SEVERITY LEVELS?**	**MEASURED BY**
Alligator Cracking	**Square Feet**	**Percent of Lane Per 0.02 Mile**	**Yes**	**Digital Image Crack Detection Software**
Transverse Cracking	**Linear Feet**	**Number of Cracks Per 0.02 Mile**	**Yes**	**Digital Image Crack Detection Software**
Longitudinal Cracking	**Linear feet**	**Percent of Lane Length Per 0.02 Mile**	**Yes**	**Digital Image Crack Detection Software**
Patching/Potholes	**Square Feet**	**Percent of Lane Per 0.02 Mile**	**No**	**Digital Image Crack Detection Software**
Rutting	**Inches**	**Rut Depth Per 0.02 Mile**	**Yes**	**DCV – Laser Rut Measuring System (LRMS)**
Roughness	**IRI**	***RCI Per 0.02 Mile**	**No**	**DCV – Lasers /Accelerometers**

***Note: Roughness is measured on concrete roadways, but surface distresses and rutting are not measured. For concrete, PCR = RCI**

ALLIGATOR CRACKING

Description

Alligator cracking is considered a combination of fatigue and block cracking. It is a series of interconnected cracks in various stages of development. Alligator cracking develops into a many-sided pattern that resembles chicken wire or alligator skin. It can occur anywhere in the road lane. Alligator cracking must have a quantifiable area.

Severity Levels

LOW
An area of cracks with no or very few interconnecting cracks and the cracks are not spalled. Cracks are <= 0.25 in (6mm) in mean width. Cracks in the pattern are no further apart than 1 foot (0.328 m). May be sealed cracks with sealant in good condition and a crack width that cannot be determined.

MEDIUM
An area of interconnected cracks that form a complete pattern. Cracks may be slightly spalled. Cracks are >0.25 in. (6 mm) and <= 0.75 in. (19 mm) or any crack with a mean width <= 19 mm and adjacent low severity cracking. Cracks in the pattern are no further apart than 6 in. (150 mm).

HIGH
An area of interconnected cracks forming a complete pattern. Cracks are moderately or severely spalled. Cracks are >0.75 in (19mm) or any crack with a mean width <= 0.75 in (19mm) and adjacent medium to high severity random cracking.

A combination of observed crack width and crack pattern is used to determine overall severity of alligator cracking. Based on above description of each severity, the highest level of crack width and crack pattern determines overall severity. Table 2 illustrates this.

TABLE 2: Alligator Crack Severity Levels

ALLIGATOR CRACKING SEVERITY LEVELS		Crack Pattern		
		LOW	**MED**	**HIGH**
Crack Width	**LOW**	L	M	H
	MED	M	M	H
	HI	H	H	H

LONGITUDINAL CRACKING

Description

Longitudinal cracking occurs predominantly parallel to the pavement centerline. It can occur anywhere within the lane. Longitudinal cracks occurring in the wheelpath may be noteworthy.

Severity Levels

LOW
Cracks with a mean width of < 0.25 in. (6 mm). Sealed cracks with sealant in good condition and a width that cannot be determined.

MED
Cracks with a mean width > 0.25 in. (6 mm) and <= 0.75 in. (19 mm). Also, any crack with a mean width < 0.75 in. (19 mm) and adjacent random low severity cracking.

HIGH
Cracks with a mean width > 0.75 in. (19 mm). Also, any crack with a mean width < 0.75 in. (19 mm) and adjacent random medium to high severity cracking.

TRANSVERSE CRACKING

Description

Transverse cracking occurs predominantly perpendicular to the pavement centerline. It can occur anywhere within the lane.

Severity Levels

LOW
Cracks with a mean width of < 0.25 in. (6 mm). Sealed cracks with sealant in good condition and a width that cannot be determined.

MED
Cracks with a mean width > 0.25 in. (6 mm) and <= 0.75 in. (19 mm). Also, any crack with a mean width < 0.75 in. (19 mm) and adjacent random low severity cracking.

HIGH
Cracks with a mean width > 0.75 in. (19 mm). Also, any crack with a mean width < 0.75 in. (19 mm) and adjacent random medium to high severity cracking.

PATCHING AND POTHOLES

Description

Patching is an area of pavement surface that has been removed and replaced with patching material or an area of pavement surface that has had additional patching material applied. Patching may encompass partial lane or full lane width On full lane width patching; the total, contiguous length of patch may not exceed 0.30 mi. (0.48 km). (Any full-lane patch exceeding 0.30 mi. in length is considered a pavement change). Patching must have a quantifiable area.

Potholes are bowl-shaped holes of various sizes occurring in the pavement surface.

Severity Levels

There are no stratified severities for Patching/Potholes. They either are present or they are not.

RUTTING

Description

Rutting is a longitudinal surface depression in the wheelpath.

Severity Levels

LOW
Ruts with a measured depth ≥ 0.20" and ≤ 0.49"

MED
Ruts with a measured depth ≥ 0.50" and ≤ 0.99"

HIGH
Ruts with a measured depth ≥ 1.00"

Ruts < 0.20" are not included in the distress calculations.

ROUGHNESS

Description

Roughness is the measurement of the unevenness of the pavement in the direction of travel. It is measured in units of IRI (International Roughness Index), inches per mile, and is indicative of ride comfort.

Severity Levels

There are no stratified severity levels for roughness. The roughness (or smoothness) of a road surface can be defined by IRI in the following table.

TABLE 3: IRI

IRI Descriptions	
Type of Road	**Typical IRI (in/mile)**
New Road, no noticeable roughness	<90
Small level of roughness	90 – 126
Road of average roughness	126 – 190
Road with above average roughness	190 – 253
Road with severe roughness	253 – 380
Nearly impassable	>380

INDEX FORMULAS

Note**:** All index formulas listed below contain MAE applicable to 0.02 mile (105.6 feet) interval.

Alligator Crack Index

AC_INDEX = 100 – 40 * [(%LOW / 35) + (%MED / 15) + (%HI / 5)]

Where:

The values *%LOW*, *%MED* and *%HI* report the percentage of the observed pavement (0.02 mile, primary lane) that contains alligator cracking within the respective severities. These values range from 0 to 100.

%LOW = Percent of total area (primary lane, 0.02 in length), low severity
%MED = Percent of total area (primary lane, 0.02 in length), medium severity
%HI = Percent of total area (primary lane, 0.02 in length), high severity

Percent of total area is computed as:

$$\frac{\text{square foot area of alligator crack severity}}{\text{0.02 mile * lane width}}$$

In AC_INDEX, the denominators 35, 15, and 5 are the Maximum Allowable Extents (MAE) for each severity. In other words, we will allow up to 35% of low severity alligator cracking for a 0.02 interval before failure, 15% for medium severity, and so on. As you can see, if any single severity reaches MAE the resulting index value is 60, or failure.

Longitudinal Crack Index

LC_INDEX = 100 – 40 * [(%LOW / 175) + (%MED / 75) + (%HI / 25)]

Where:

The values *%LOW*, *%MED*, and *%HI* report the length of longitudinal cracking within each severity as a percent of the section length (0.02 mile, primary lane).
These values are ≥ 0 and can exceed 100.

%LOW = Percent of interval length (primary lane, 0.02 in length), low severity
%MED = Percent of interval length (primary lane, 0.02 in length), medium severity
%HI = Percent of interval length (primary lane, 0.02 in length), high severity

Percent of interval length is computed as:

$$\frac{\text{length of respective longitudinal cracking}}{\text{0.02 mile (105.6 feet)}}$$

In LC_INDEX, the denominators 175, 75, and 25 are the Maximum Allowable Extents (MAE) for each severity. In other words, we will allow up to 175% of low severity alligator cracking for a 0.02 interval before failure, 75% for medium severity, and so on. As you can see, if any single severity reaches MAE the resulting index value is 60, or failure.

Structural Crack Index

SC_INDEX = [100 - ((100 - AC_INDEX) + (100 - LC_INDEX))]

Structural Crack Index is a combination of Alligator Cracking and Longitudinal Cracking, and is used in the SCR formula in lieu of AC and LC separately.

Transverse Crack Index

TC_INDEX = 100 – 40 ***** [(LOW / 21.1) + (MED / 4.4) + (HI / 2.6)]

Where:

The values *LOW*, *MED* and *HI* report a count of the total number of transverse cracks (reported to three decimals) within each severity level, where one transverse crack is equal to the lane width. These values are ≥ 0.

LOW = Number of cracks in interval (primary lane, 0.02 in length), low severity
MED = Number of cracks in interval (primary lane, 0.02 in length), medium severity
HI = Number of cracks in interval (primary lane, 0.02 in length), high severity

Number of cracks is computed as:

$$\frac{\text{Total length of transverse cracks}}{\text{Lane width}}$$

In TC_INDEX, the denominators 21.1, 4.4, and 2.6 are the Maximum Allowable Extents (MAE) for each severity. In other words, we will allow up to 21.1 low severity transverse cracks for a 0.02 interval before failure, 4.4 cracks for medium severity, and so on. As you can see, if any single severity reaches MAE the resulting index value is 60, or failure.

Patching Index

PATCH_INDEX = 100 – 40 * (%PATCHING / 80)

Where:

The value *%PATCHING* reports the percentage of the observed pavement (0.02 mile, primary lane) that contains patching/potholes. This value ranges from 0 to 100.

%PATCHING = Percent of total area (primary lane, 0.02 in length)

Percent of total area is computed as:

$$\frac{\text{square foot area of patching/potholes}}{\text{0.02 mile * lane width}}$$

There are no severity levels for patching. It either exists or does not.

In PATCH_INDEX, the denominator 80 is the Maximum Allowable Extent (MAE) for each severity. In other words, we will allow up to 80% patching for a 0.02 interval before failure. As you can see, if patching/potholes reaches MAE the resulting index value is 60, or failure.

Rutting Index

RUT_INDEX = 100 – 40 * [(%LOW / 535) + (%MED / 205) + (%HI / 40)]

Where:

20 rut depth measurements are taken per 0.02 interval for each of 2 wheel paths (left and right), resulting in a total of 40 measurements taken for both wheel paths. *Each wheelpath is analyzed independently for rut severities.* The values *%LOW*, *%MED* and *%HI* are a *total percentage* of left wheelpath percentage and right wheelpath percentage added together for the respective severity. These values range from 0 to 200.

%LOW = Percent of LOW ruts in left wheelpath based on 20 ruts, plus percent of LOW ruts in right wheelpath based on 20 ruts.
%MED = Percent of MED ruts in left wheelpath based on 20 ruts, plus percent of MED ruts in right wheelpath based on 20 ruts.
%HI = Percent of HI ruts in left wheelpath based on 20 ruts, plus percent of HI ruts in right wheelpath based on 20 ruts.

Percent of rut measurements within each severity can also be computed as:

$$\frac{\text{total number of ruts within each severity in both wheelpaths}}{20} * 100$$

In RUT_INDEX, the denominators 535, 205, and 40 are the Maximum Allowable Extents for each severity. In other words, the formula allows up to 535% low severity

ruts for a 0.02 interval before. However, since 200 is the highest measurable percentage allowed, 535% is unattainable and therefore, no amount of LOW severity rutting will cause the RUT_INDEX to fail a road. Similarly, since the MAE for MED severity rutting is 205, no amount of MED severity rutting will cause the RUT_INDEX to reach 60 and fail the road. As you can see, LOW severity rutting reaches MAE the resulting index value is 60, or failure. This formula was intentionally designed to minimize the impact of LOW and MED severity rutting on RUT_INDEX.

Roughness Condition Index (Asphalt)

RCI = 32 * [5 * (2.718282 ^ (-0.0041 * AVG IRI))]

Where:

The value *AVG IRI* reports the average value of the Left IRI and Right IRI measurements for the interval (0.02 mile, primary lane). This value can range from approximately 40 to 999.0.

Average IRI is computed as:

$$\frac{\text{Left wheelpath IRI + Right wheelpath IRI}}{2}$$

There is no applicable threshold for failure for this index.

Roughness Condition Index (Concrete)

RCI = $-0.0012(IRI^2) + 0.0499(IRI) + 99.542$

For concrete, PCR = RCI

Surface Condition Rating Index

SCR = *Lowest* Index Value Of: [SC_INDEX, TC_INDEX, PATCH_INDEX, RUT_INDEX]

Note: *The modified SCR equation above combines AC_INDEX and LC_INDEX, and considers that a single AC/LC index value of the Structural Crack Index (SC_INDEX). The lowest of the four computed index values (SC_INDEX, TC_INDEX, PATCH_INDEX, or RUT_INDEX) becomes the SCR.*

Where:

See above for determinations of SC_INDEX, TC_INDEX, PATCH_INDEX and RUT_INDEX.

The threshold for failure for this index is SCR = 60.

Data Collection Vehicle Subsystems

Data on paved roads in Cycle 5 is collected by FHWA using a Pathway Services Inc. Data Collection Vehicle (DCV), called PathRunner. The DCV is driven in the primary-direction lane at posted speed limits and less.

CAMERAS

Forward-facing and rear-facing video is collected as .jpg digital imagery at a frequency of 26.4 feet.

Two forward-facing cameras are mounted above the vehicle cab, one pointed straight ahead and the other to the right shoulder providing seamless 120 degree viewing.

CAMERA SPECIFICATIONS **Two Forward/ One Rear Facing**	
Camera lens/type	FUJINON CCTV LENS H16x10B-Y41
Focal length	10 mm – 160 mm
Image size	8.8 mm x 6.6mm
Image format	*.jpg
Image resolution	HD 2000 X 1200
Image pixel size	depends on distance
Zoom ratio	16x
Max Relative Aperture	1:2.5
Iris range	F25-T800 (Equivalent to F800)

Pavement images are created using a Laser Scan Imaging System. This system is composed of a single high resolution line-scan camera and two lasers configured to image an approximate 11-foot wide lane with 1 mm resolution.

CAMERA SPECIFICATIONS **Pavement Line Scan**	
Image size	4280 pixels/line
Image width	4 meters (3950 mm nominal)
Laser class	3B
Power	250W
Vehicle speed limitations	62 mph
Environment	Dry pavement, day or night
Sensor size (approx)	300 mm(H) x 375 mm(L) x 200 mm(D)
Image frame length	26.4 feet

DMI (Distance Measuring Instrument)

The DMI (Distance Measuring Instrument) obtains road length measurements that are accurate to 0.1% for speeds up to 60 mph. The DMI is connected to the hub of the rear wheel on the driver's side, and is calibrated to the revolutions of the rear vehicle axle on a regular basis.

ROUGHNESS (IRI)

The collection system includes a South Dakota type laser profiler manufactured based on active Class 1 ASTM E950 standards. The dynamic profile of the pavement surface is collected from which the IRI roughness data is computed. The sensors include one accelerometer on each wheelpath, one height sensor (laser) on each wheelpath, and a distance transducer.

IRI SPECIFICATIONS	
Reported IRI units	Inches/mile
Vehicle speed limitations	12-62 mph
IRI equipment certification	Texas Transportation Institute (TTI)
Wavelengths accommodated	6 in. – 300 feet
IRI computed & reported	World Bank Technical Paper Number 46
Environment	Dry pavement, day or night, above 32 degrees F
Adherence to specifications	ASTM E950-98 (2004), ASTM E 1926-08, AASHTO MP 11-08, AASHTO PP 49-08

RUTTING

Rutting depths are measured using an INO Laser Rut Measurement System (LRMS). This system is a transverse profiling device that detects and characterizes pavement rutting. The LRMS can acquire full 4 meter width profiles of a pavement lane at normal traffic speeds and uses two laser profilers that digitize transverse sections of the pavement.

RUTTING SPECIFICATIONS	
Reported rut depth units	Inches
Vehicle speed limitations	Up to 62 mph
Sampling rate	30-150 profiles/second
Transverse resolution	1280 points/profile
Transverse field-of-view	4 m
Depth accuracy (nominal)	+/- 1 mm
Environment	Dry pavement, day or night, above 32 degrees F
Adherence to specifications	ASTM E1703M-95 (reapproved 2005)

GPS & INERTIAL SYSTEMS

GPS is collected by an onboard system employing Omnistar real time correction and a gyroscope Inertial Measuring Unit (IMU) to provide accurate positioning data in instances of satellite obstruction. All GPS coordinates are tied to image and linear distance measurements.

GPS SPECIFICATIONS	
Static accuracy	Sub-meter
Dynamic accuracy	2-3 meters
Receiver	12 satellite tracking
Coordinate system	Lat Lon WGS 84
Environment	Day or night
Cross-slope	+- 0.1 degrees
Grade	+- 0.1 degrees

GPS on Manually Rated Roads (MRR)

Parking areas, some roads, and other paved areas that are not fully drivable with the DCV are collected manually by field technicians. GPS is collected for these routes using portable Trimble GPS backpack units.

Geodatabase – Background and Metadata

In addition to this park report, a ***geodatabase*** containing both tabular and spatial data specific to this park has been provided. All data disseminated in the preceding report has been obtained from the tables and fields within said geodatabase. The geodatabase can be referenced for tabular data via Microsoft Access or for both tabular and spatial data via ESRI's ArcGIS Suite of software which consists of; ArcMap, ArcCatalog and ArcExplorer. Consolidating the RIP data into one database creates a seamless relationship of tables and geographic data. It will allow RIP to facilitate easier updates and enhancements in the future.

A geodatabase can be thought of as simply a database containing spatial data. Many different tables are contained with the park's geodatabase. A complete and thorough description of the tables and fields contained within this geodatabase can be found in the ***metadata***. The metadata is attached directly within the geodatabase and can be accessed via ESRI's ArcCatalog.

GLOSSARY OF TERMS AND ABBREVIATIONS

TERM OR ABBREVIATION	DESCRIPTION OR DEFINITION
AC	Alligator Cracking
CRS	Condition Rating Sheets (Section 5)
DCV	Data Collection Vehicle
Excellent	Excellent rating with an index value of 95 to 100
Fair	Fair rating with an index value from 61 to 84
FUNCT_CLASS	Functional Classification (see Route ID, Section 2)
Good	Good rating with an index value from 85 to 94
IRI	International Roughness Index
Lane Width	Width from road centerline to fogline, or from centerline to edge-of-pavement when no fogline exists
LC	Longitudinal Cracking
MRR	Manually Rated Route
MRL	Manually Rated Line
MRP	Manually Rated Polygon
N/A	Not Applicable
NC	Not Collected
PATCH	Patching and Potholes
Paved Width	Width from edge-of-pavement to edge-of-pavement
PCR	Pavement Condition Rating
PKG	Parking Area
Poor	Poor rating with an index value of 0 to 60
RCI	Roughness Condition Index
SC	Structural Cracking
SCR	Surface Condition Rating
TC	Transverse Cracking