Federal Lands Highway

Road Inventory Program

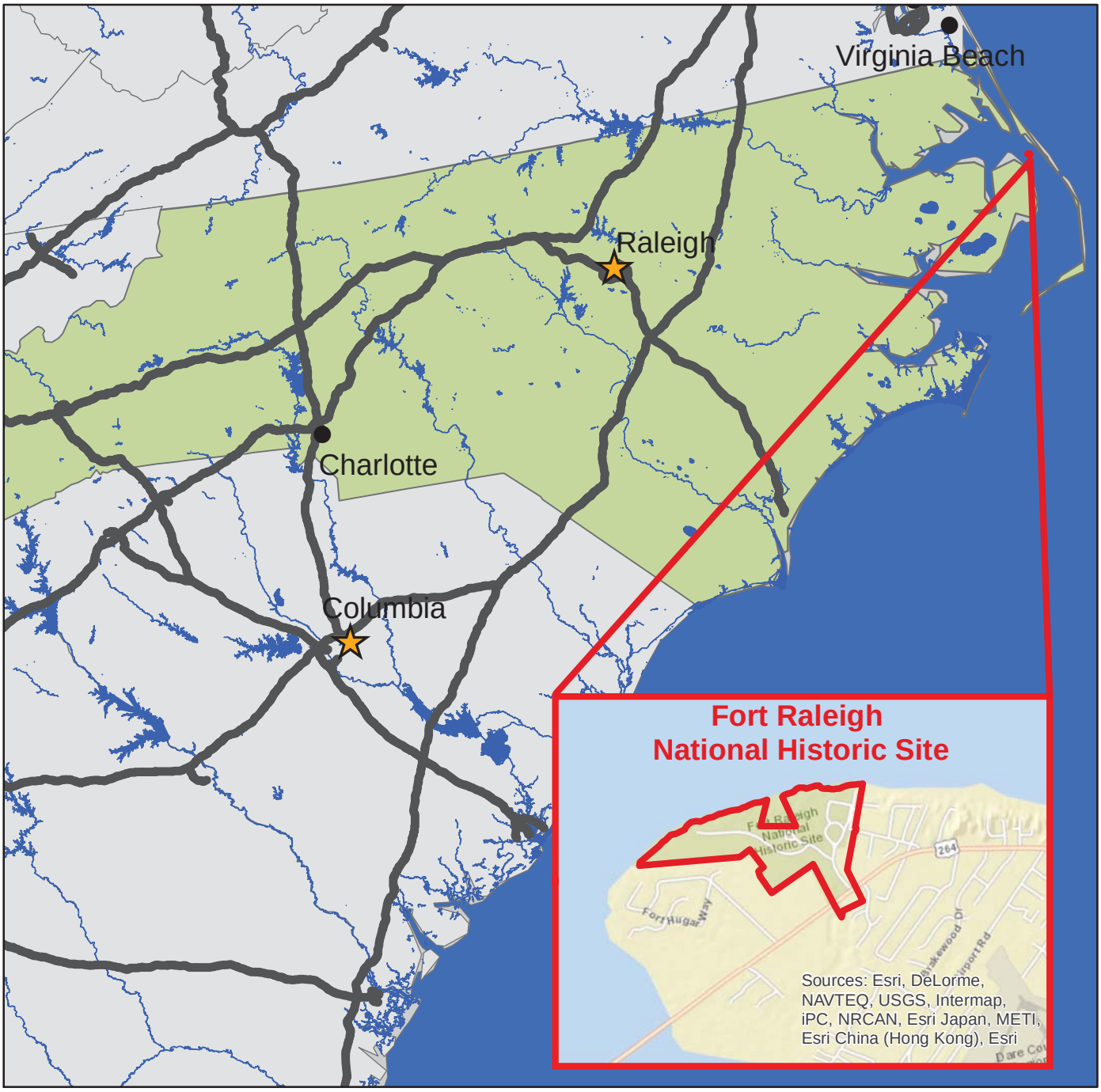
Road Inventory and Condition Assessment

Fort Raleigh National Historic Site
FORA

Cycle 5 Report

Prepared By: Federal Highway Administration
Road Inventory Program (RIP)
Data Collected: 01/2014
Report Date: 06/2014

Fort Raleigh National Historic Site
in
North Carolina



DCV = Data Collection Vehicle

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Introduction

Fort Raleigh National Historic Site

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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 231 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

Fort Raleigh National Historic Site

Federal Lands Highway
Road Inventory Program

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

FORA

FORT RALEIGH NATIONAL HISTORIC SITE

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	29869		FR RD FORT RALEIGH ROAD	FROM ROUTE 5064 (U.S. HIGHWAY 64)	TO END OF LOOP	FORT RALEIGH	0.50	0.00	0.50	1		AS	1
0011	5	29868		FR RD NATIONAL PARK DRIVE	FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)	TO END OF LOOP	FORT RALEIGH	0.30	0.00	0.30	1		AS	1
0400	5	104977		FR RD THEATER ACCESS ROAD	FROM ROUTE 0903 (FR RD THEATER PARKING)	TO BEGINNING OF ROUTE 0405 (FR RD THEATER BACKSTAGE ACCESS ROAD)	FORT RALEIGH	0.11	0.00	0.11	6		AS	1
0401	5	29866		FR RD PEAR PAD ROAD	FROM ROUTE 0011 (FR RD NATIONAL PARK DRIVE)	TO END OF LOOP	FORT RALEIGH	0.55	0.00	0.55	5		AS	1
0404	5	29831		FR RD WATER TOWER ROAD	FROM ROUTE 0401 (FR RD PEAR PAD ROAD)	TO END AT SHED ON LEFT	FORT RALEIGH	0.14	0.00	0.14	6		AS	1
0405	NC	104940		FR RD THEATER BACKSTAGE ACCESS ROAD	FROM END OF ROUTE 0400 (FR RD THEATER ACCESS ROAD)	TO THEATER BACKSTAGE	FORT RALEIGH	0.00	0.05	0.05	6		GR	
0900ZZ	5	104946		FR RD VISITOR CENTER PARKING AREAS	FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)	TO ROUTE 0010 (FR RD FORT RALEIGH ROAD)	FORT RALEIGH	0.00	0.00	0.00		21,402	AS	1
0901	5	93047		FR RD GROUP HEADQUARTERS PARKING	FROM ROUTE 0011 (FR RD NATIONAL PARK DRIVE)	TO ROUTE 0011 (FR RD NATIONAL PARK DRIVE)	FORT RALEIGH	0.00	0.00	0.00		11,751	AS	1
0902	5	93046		FR RD MAINTENANCE AREA PARKING	FROM ROUTE 0401 (FR RD PEAR PAD ROAD)	TO MAINTENANCE AREA	FORT RALEIGH	0.00	0.00	0.00		31,930	AS	1
0903	5	89488		FR RD THEATER PARKING	FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)	TO ROUTE 0900ZZ (FR RD VISITOR CENTER PARKING AREAS)	FORT RALEIGH	0.00	0.00	0.00		191,717	AS	1
0904	5	93048		FR RD ELIZABETHAN GARDEN PARKING	ADJACENT TO ROUTE 0011 (FR RD NATIONAL PARK DRIVE)		FORT RALEIGH	0.00	0.00	0.00		16,189	AS	1
0905	5	104950		ELIZABETHAN GARDEN MAINTENANCE FACILITY	FROM ROUTE 0401 (FR RD PEAR PAD ROAD)	TO MAINTENANCE FACILITY	FORT RALEIGH	0.00	0.00	0.00		1,404	AS	1
0907	NC	104741		FR RD FREEDMAN'S COLONY PARKING	FROM U.S. HIGHWAY 64	TO PARKING	FORT RALEIGH	0.00	0.00	0.00		22,500	GR	

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).

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FORA

FORT RALEIGH NATIONAL HISTORIC SITE

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
0908	5	113565		MRC PARKING LOT	FROM ROUTE 0902 (FR RD MAINTENANCE AREA PARKING)	TO PARKING	FORT RALEIGH	0.00	0.00	0.00		3,030	AS	1
5064	5			U.S. HIGHWAY 64	FROM PEARCE ROAD	TO OLD NORTH CAROLINA ROUTE 345	FORT RALEIGH	0.76	0.00	0.76			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	

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** DCV - Data Collection Vehicle NC - Not Collected

CYCLE 5 SUMMARY TOTALS FOR FORT RALEIGH NATIONAL HISTORIC SITE

CYCLE 5 ROUTE TOTALS

DCV Driven Route Miles	1.60
Manually Rated Route Miles	0.00
TOTAL PARK ROUTE MILES COLLECTED IN CYCLE 5	1.60
Manually Rated Routes (SQFT)	0
TOTAL UNPAVED PARK ROUTE MILES	0.05

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 Routes SQFT	0

* CYCLE 5 PARKING AREA TOTALS

Paved Parking (SQFT)	277,423
Unpaved Parking (SQFT)	22,500
TOTAL PARKING (SQFT)	299,923

CYCLE 5 WEIGHTED AVERAGE PARK VALUES

DCV Driven PCR	91
**Manually Rated Routes PCR	N/A
**Parking PCR	48
***Total Equivalent Lane Miles	7.42

* - 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:
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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	

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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 Locations. 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

NPS/RIP Subcomponent Details for FORA

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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).

FORA

FORT RALEIGH NATIONAL HISTORIC SITE

Rte. No.	FMSS No.	Cycle Collected	Route Name	Route Description From	Route Description To	Concess Route	Func. Class	Paved Miles	Un-Paved Miles	Total Route Length	Manual Rated SQ/FT
0900ZZ	104946	5	FR RD VISITOR CENTER PARKING AREAS	FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)	TO ROUTE 0010 (FR RD FORT RALEIGH ROAD)			0.00	0.00	0.00	21,402

FORA-0900ZZ Subcomponent Breakdown

Rte. No.	FMSS No.	Cycle Collected	Route Name	Route Description From	Route Description To	Concess Route	Func. Class	Paved Miles	Un-Paved Miles	Total Route Length	Manual Rated SQ/FT
0900AZ	104946	5	FR RD VISITOR CENTER LOOP PARKING A	FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)	TO ROUTE 0010 (FR RD FORT RALEIGH ROAD)			0.00	0.00	0.00	9,512
0900BZ	104946	5	FR RD VISITOR CENTER LOOP PARKING B	FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)	TO ROUTE 0010 (FR RD FORT RALEIGH ROAD)			0.00	0.00	0.00	8,017
0900CZ	104946	5	FR RD VISITOR CENTER LOOP PARKING C	ADJACENT TO ROUTE 0010 (FR RD FORT RALEIGH ROAD)				0.00	0.00	0.00	3,873

ROUTE IDENTIFICATION CHANGES TO PAVED ROUTES FROM PREVIOUS CYCLE - FORA

ROUTES ADDED FROM PREVIOUS INVENTORY:			
Route #	**Route Name**	**Reason for Addition**	**Comments**
0908	MRC PARKING LOT	OTHER	PARKING AREA ADDED TO INVENTORY IN 2008 ALIGNMENT.
5064	U.S. HIGHWAY 64	OTHER	NON-NPS ROAD ADDED TO INVENTORY IN CYCLE 5.

OTHER CHANGES FROM PREVIOUS INVENTORY:			
Route #	**Route Name**	**Type of Change**	**Comments**
0400	FR RD THEATER ACCESS ROAD	FUNCTIONAL CLASS CHANGE	FUNCTIONAL CLASS CHANGED FROM 5 TO 6 BECAUSE IT HAS RESTRICTED ACCESS.
0404	FR RD WATER TOWER ROAD	FUNCTIONAL CLASS CHANGE	FUNCTIONAL CLASS CHANGED FROM 5 TO 6 BECAUSE IT HAS RESTRICTED ACCESS.

Section 3
Park Summary Information

Fort Raleigh National Historic Site

Federal Lands Highway
Road Inventory Program

FORA: 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			0.04	2.50%	0.22	13.75%	0.54	33.75%	**0.80**
2									
3									
4									
5			0.02	1.25%	0.08	5.00%	0.45	28.13%	**0.55**
6	0.14	8.75%	0.03	1.88%	0.08	5.00%			**0.25**
7									
8									
Totals	**0.14**	**8.75%**	**0.09**	**5.63%**	**0.38**	**23.75%**	**0.99**	**61.88%**	**1.60**

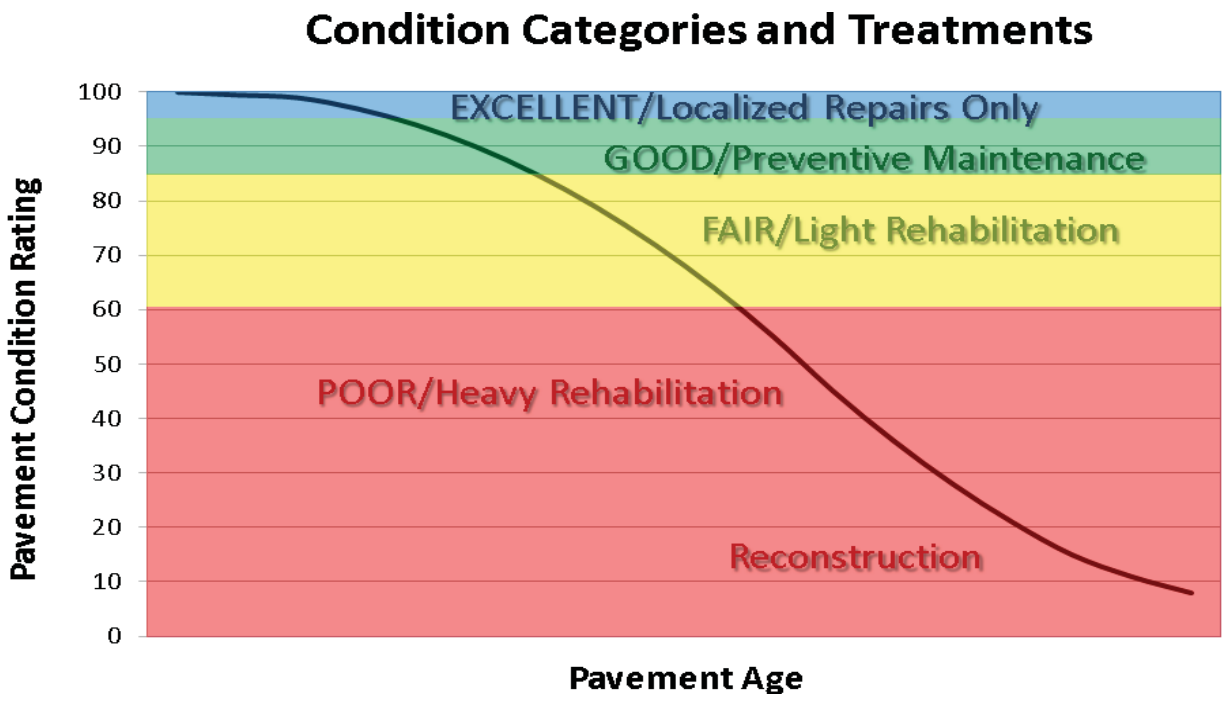
Note: **The information in this table is derived from the PMS_20 table in the Park database, which only contains processed data from routes collected with the Data Collection Vehicle (DCV). Information for Manually Rated Routes (MRR) and Parking Areas is not reported in this table. Only Functional Class 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.

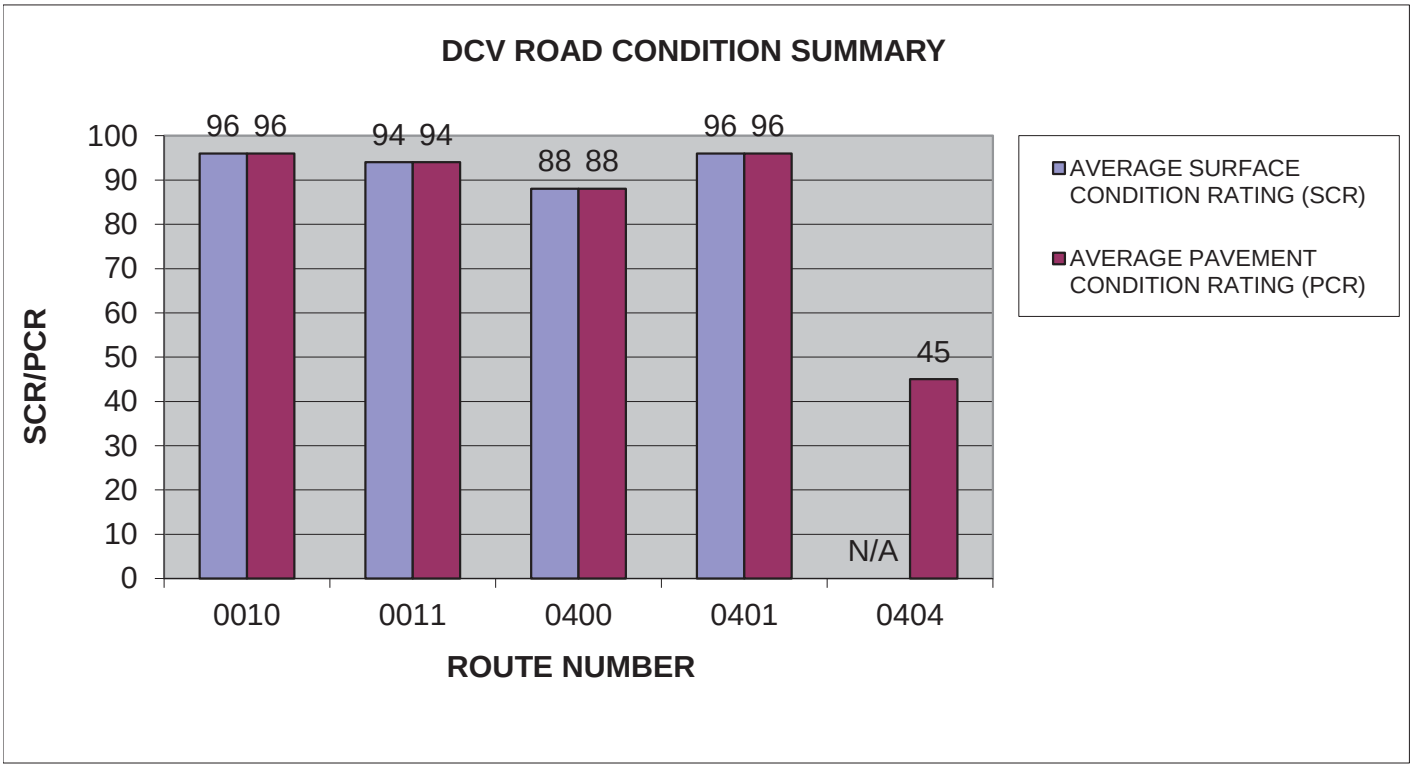
At this time, specific Maintenance and Rehabilitation activities should be evaluated and recommended at the project level. Site-specific conditions that influence treatment type should be determined based on performing a subsurface investigation and/or pavement condition survey, and not be based solely 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.



FORA: DCV ROAD CONDITION SUMMARY

DCV - Data Collection Vehicle

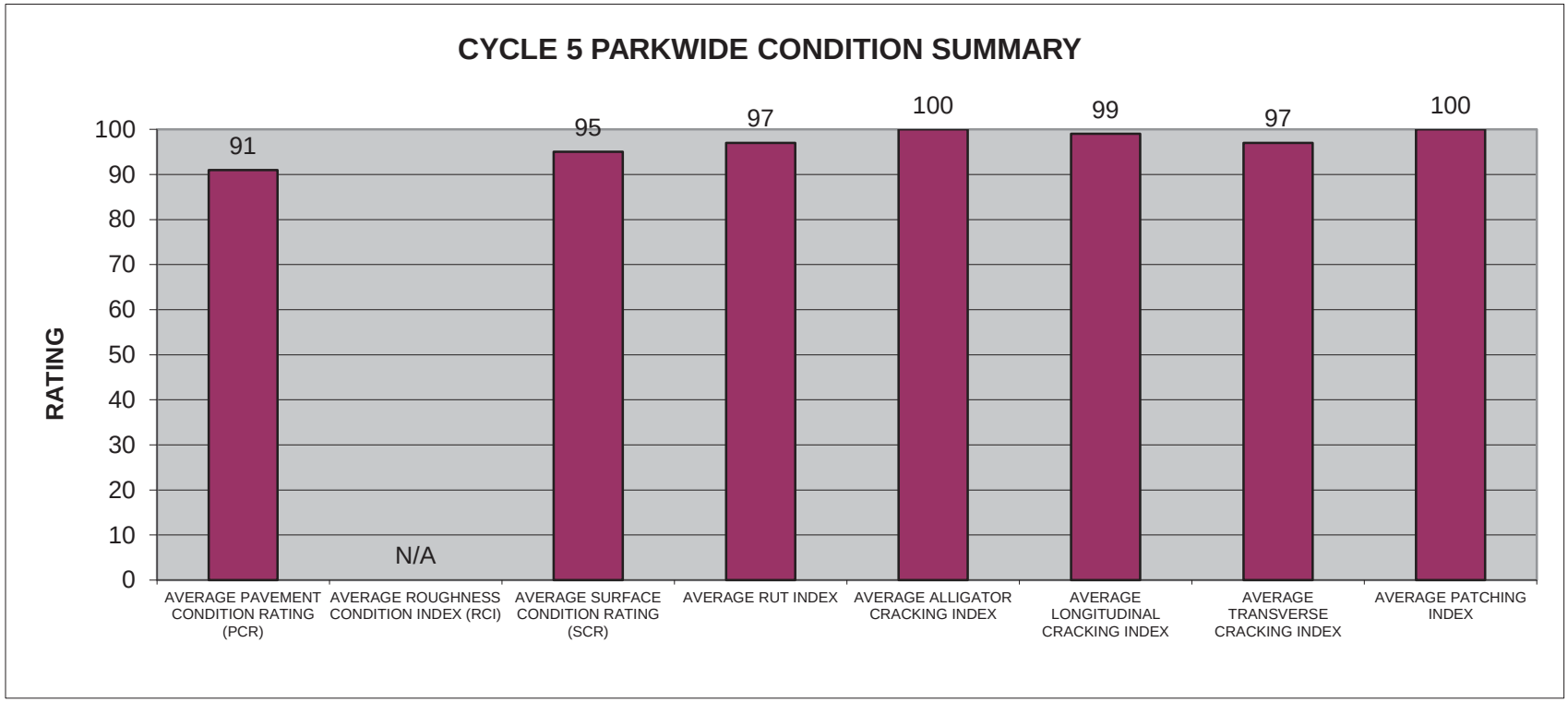
ROUTE NUMBER	ROUTE NAME	FUNCT CLASS	PAVED LENGTH	SURFACE TYPE	AVERAGE SURFACE CONDITION RATING (SCR)	AVERAGE PAVEMENT CONDITION RATING (PCR)
0010	FR RD FORT RALEIGH ROAD	1	0.50	ASPHALT	96	96
0011	FR RD NATIONAL PARK DRIVE	1	0.30	ASPHALT	94	94
0400	FR RD THEATER ACCESS ROAD	6	0.11	ASPHALT	88	88
0401	FR RD PEAR PAD ROAD	5	0.55	ASPHALT	96	96
0404	FR RD WATER TOWER ROAD	6	0.14	ASPHALT	N/A	45



FORA: 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
91	N/A	95	97	100	99	97	100

All Index values are based on Data Collection Vehicle (DCV) driven roads that were collected in Cycle-5.
Roughness data is only collected on routes with lengths greater than 0.5 miles and a posted speed limit of 25 MPH or greater.

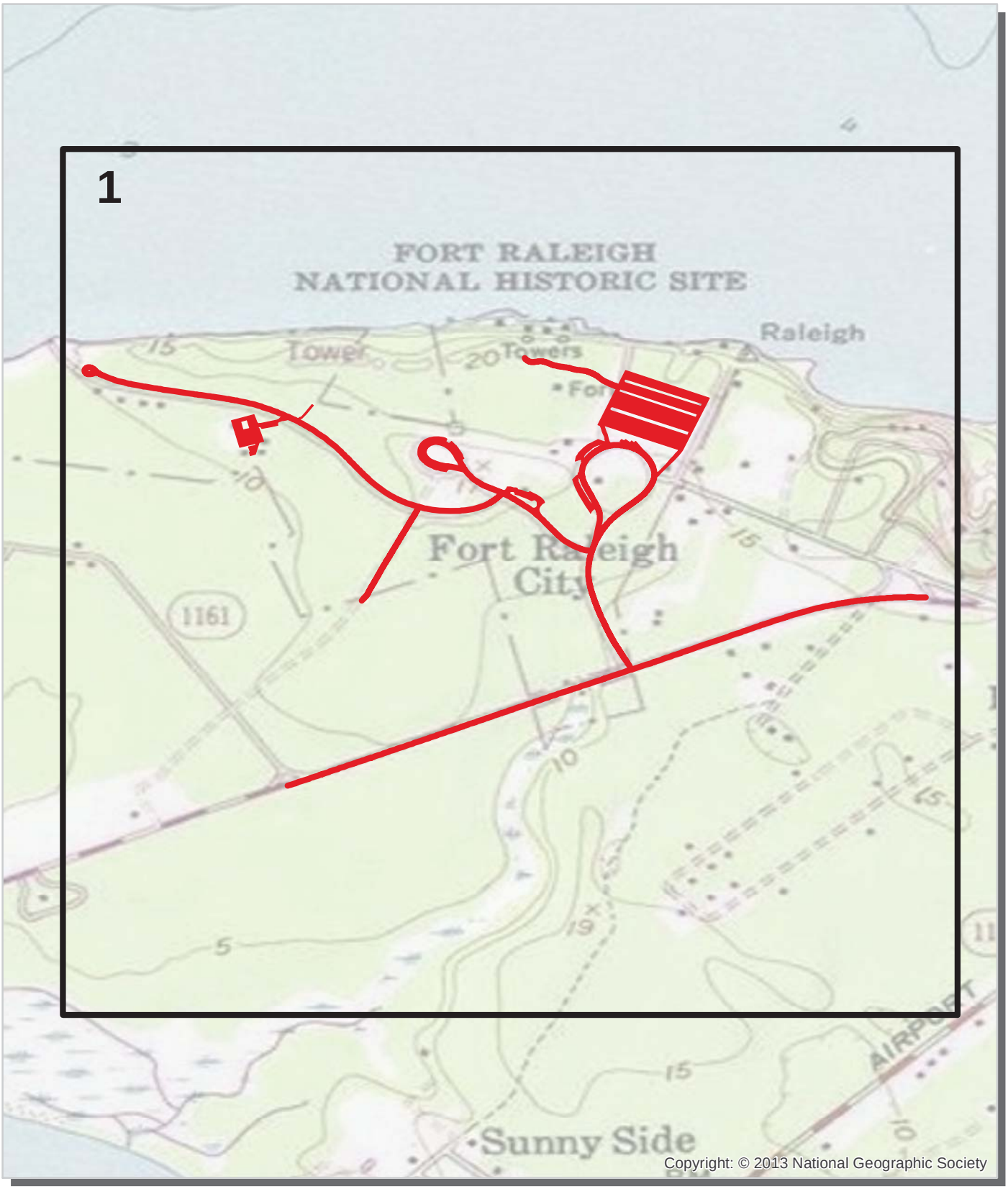


Section 4
Park Route Location Maps

Fort Raleigh National Historic Site

Federal Lands Highway
Road Inventory Program

Fort Raleigh National Historic Site
Route Location Map
Key Map



Cycle 5 Collected Routes

0.2 0.1 0 0.2
Miles

N

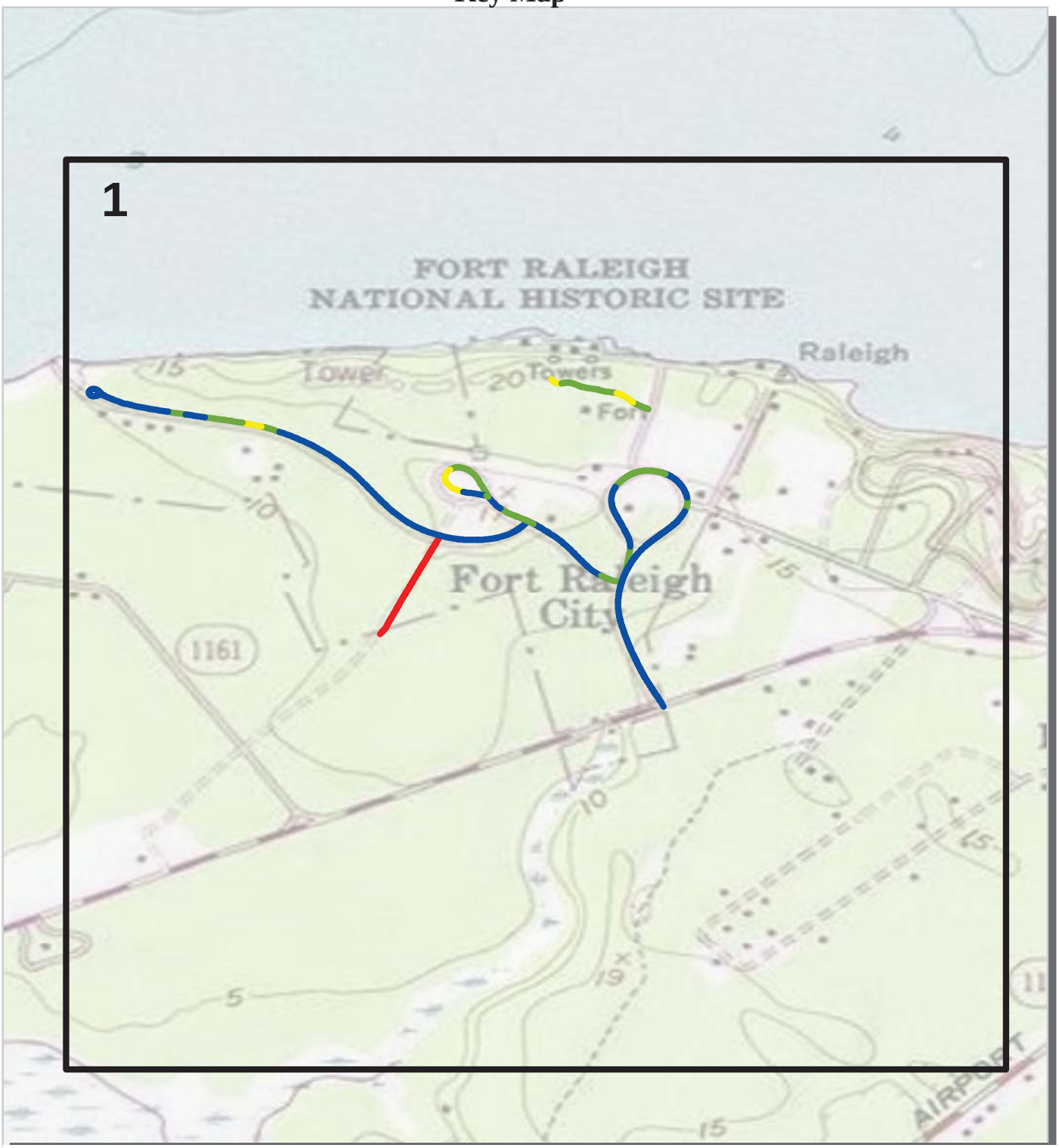
Fort Raleigh National Historic Site
Route Location Map
Area 1

Unique colors used to differentiate routes

0.2 0.1 0 0.2
Miles

N

Fort Raleigh National Historic Site
Route Condition Map
PCR - Mile by Mile
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.

0.2 0.1 0 0.2 Miles

N

Fort Raleigh National Historic Site
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.

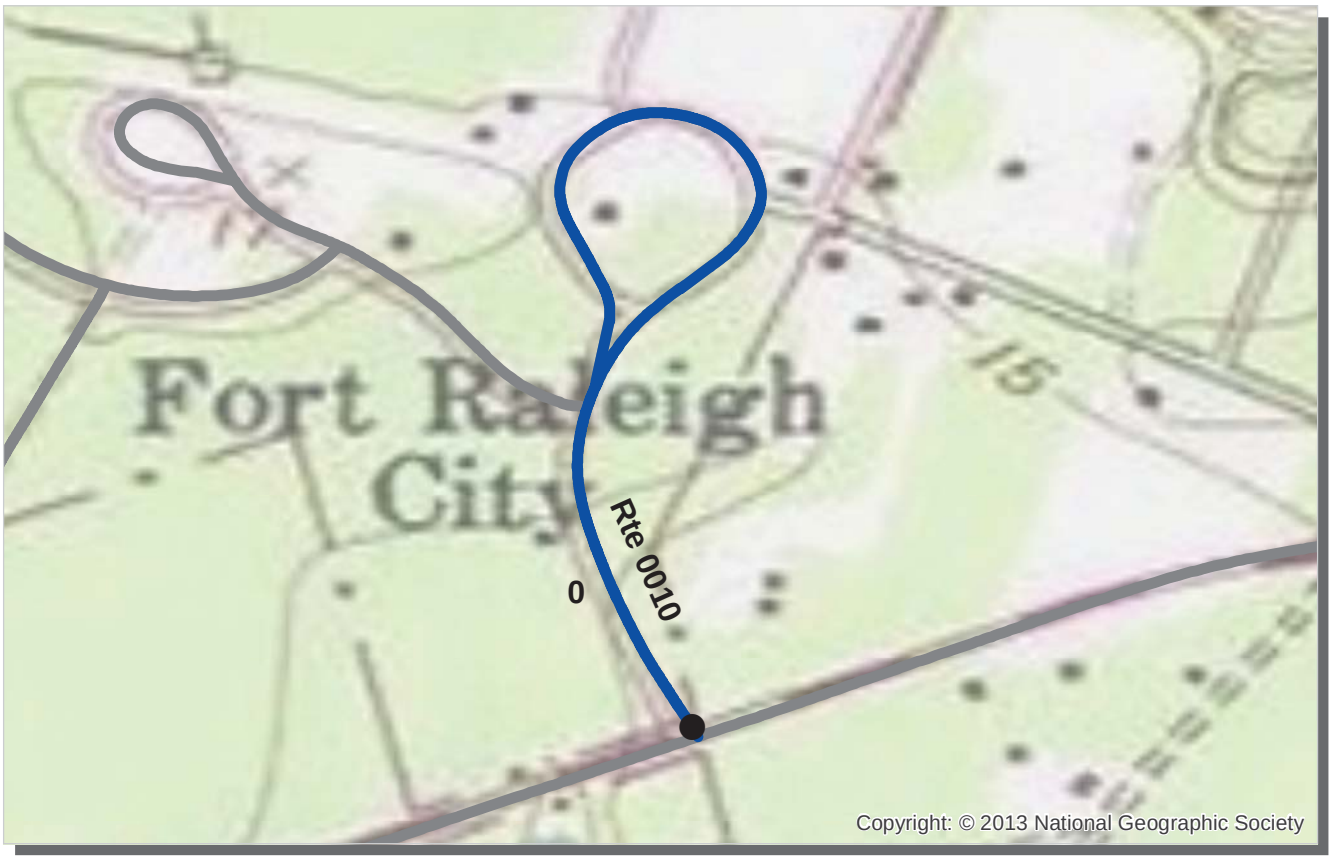
0.2 0.1 0 0.2 Miles

N

Section 5
Paved Route
Condition Rating Sheets

Fort Raleigh National Historic Site

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 FR RD FORT RALEIGH ROAD
FORA : FORT RALEIGH NATIONAL HISTORIC SITE

COLLECTED: 1/21/2014

SOUTHEAST REGION **TOTAL LENGTH: 0.50 Miles**

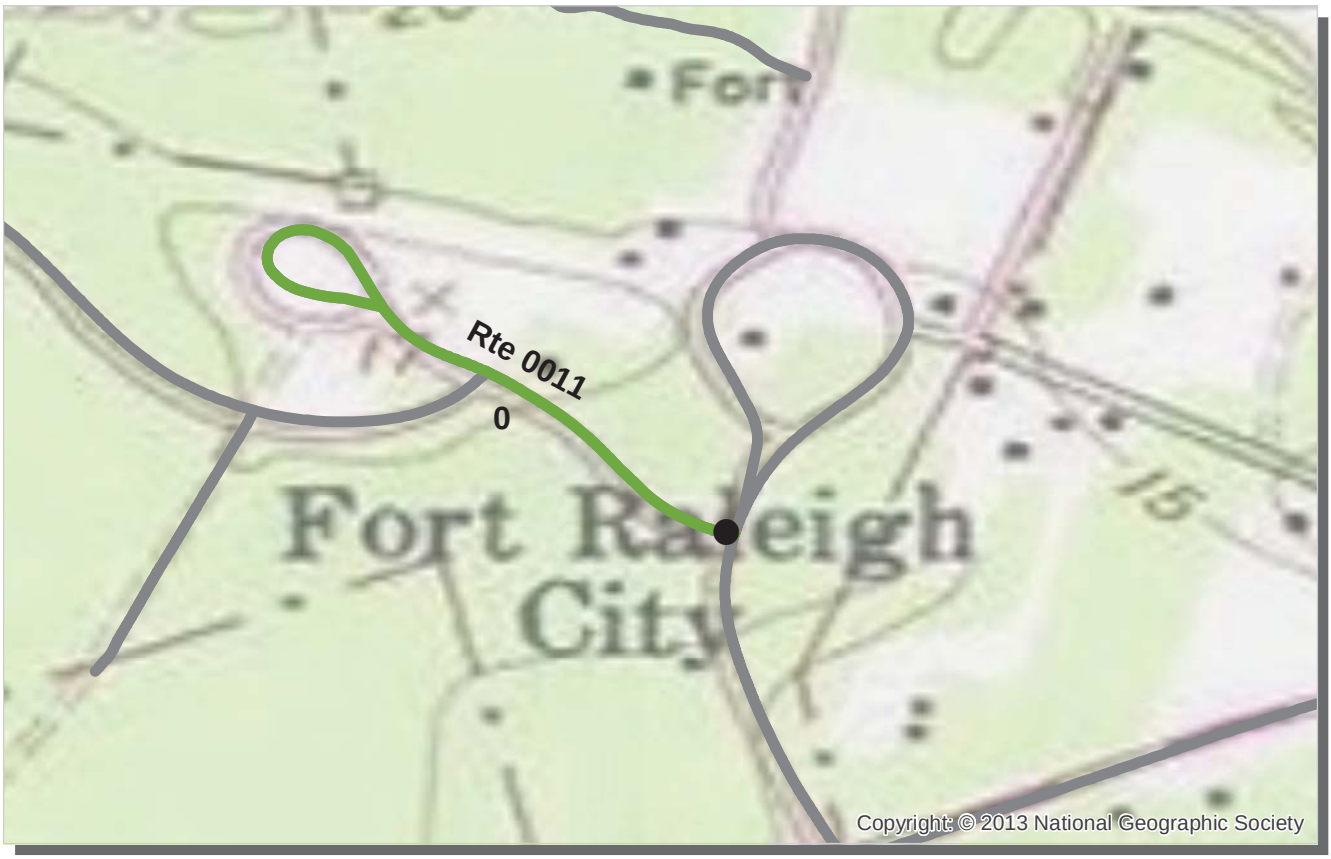
Section Number	0				
Section Length (mi)	0.50				
Cross Section Information					
Number of Lanes	1				
Paved Width (ft)	22				
Lane Width (ft)	17				
Roadway Condition Information					
SCR (Surface Condition Rating)	96				
PCR (Pavement Condition Rating)	96				
Distress Index Values					
Structural Crack Index	99				
Transverse Cracking Index	96				
Patching Index	100				
Rutting Index	99				
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 - Not 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: 0011 FR RD NATIONAL PARK DRIVE
FORA : FORT RALEIGH NATIONAL HISTORIC SITE

COLLECTED: 1/21/2014

SOUTHEAST REGION **TOTAL LENGTH: 0.30 Miles**

Section Number	0				
Section Length (mi)	0.30				
Cross Section Information					
Number of Lanes	2				
Paved Width (ft)	19				
Lane Width (ft)	8				
Roadway Condition Information					
SCR (Surface Condition Rating)	94				
PCR (Pavement Condition Rating)	94				
Distress Index Values					
Structural Crack Index	97				
Transverse Cracking Index	94				
Patching Index	99				
Rutting Index	99				
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 - Not 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 FR RD THEATER ACCESS ROAD
FORA : FORT RALEIGH NATIONAL HISTORIC SITE

COLLECTED: 1/21/2014
SOUTHEAST REGION **TOTAL LENGTH: 0.11 Miles**

Section Number	0				
Section Length (mi)	0.11				
Cross Section Information					
Number of Lanes	1				
Paved Width (ft)	12				
Lane Width (ft)	12				
Roadway Condition Information					
SCR (Surface Condition Rating)	88				
PCR (Pavement Condition Rating)	88				
Distress Index Values					
Structural Crack Index	99				
Transverse Cracking Index	99				
Patching Index	99				
Rutting Index	88				
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 - Not 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: 0401 FR RD PEAR PAD ROAD
FORA : FORT RALEIGH NATIONAL HISTORIC SITE

COLLECTED: 1/21/2014
SOUTHEAST REGION **TOTAL LENGTH: 0.55 Miles**

Section Number	0				
Section Length (mi)	0.55				
Cross Section Information					
Number of Lanes	2				
Paved Width (ft)	18				
Lane Width (ft)	10				
Roadway Condition Information					
SCR (Surface Condition Rating)	96				
PCR (Pavement Condition Rating)	96				
Distress Index Values					
Structural Crack Index	99				
Transverse Cracking Index	99				
Patching Index	100				
Rutting Index	96				
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 - Not 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: 0404 FR RD WATER TOWER ROAD
FORA : FORT RALEIGH NATIONAL HISTORIC SITE

COLLECTED: 1/21/2014

SOUTHEAST REGION **TOTAL LENGTH: 0.14 Miles**

Section Number	0				
Section Length (mi)	0.14				
Cross Section Information					
Number of Lanes	1				
Paved Width (ft)	8				
Lane Width (ft)	8				
Roadway Condition Information					
SCR (Surface Condition Rating)	NC				
PCR (Pavement Condition Rating)	45				
Distress Index Values					
Structural Crack Index	NC				
Transverse Cracking Index	NC				
Patching Index	NC				
Rutting Index	NC				
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 - Not Applicable

Section 6
Manually Rated Paved Route Condition Rating Sheets

Fort Raleigh National Historic Site

Federal Lands Highway
Road Inventory Program

MANUALLY RATED ROUTE CONDITION RATING SHEETS

No data available for this section.

Section 7
Parking Area
Condition Rating Sheets

Fort Raleigh National Historic Site

Federal Lands Highway
Road Inventory Program

FORT RALEIGH NATIONAL HISTORIC SITE

Route 0900ZZ

FR RD VISITOR CENTER PARKING AREAS

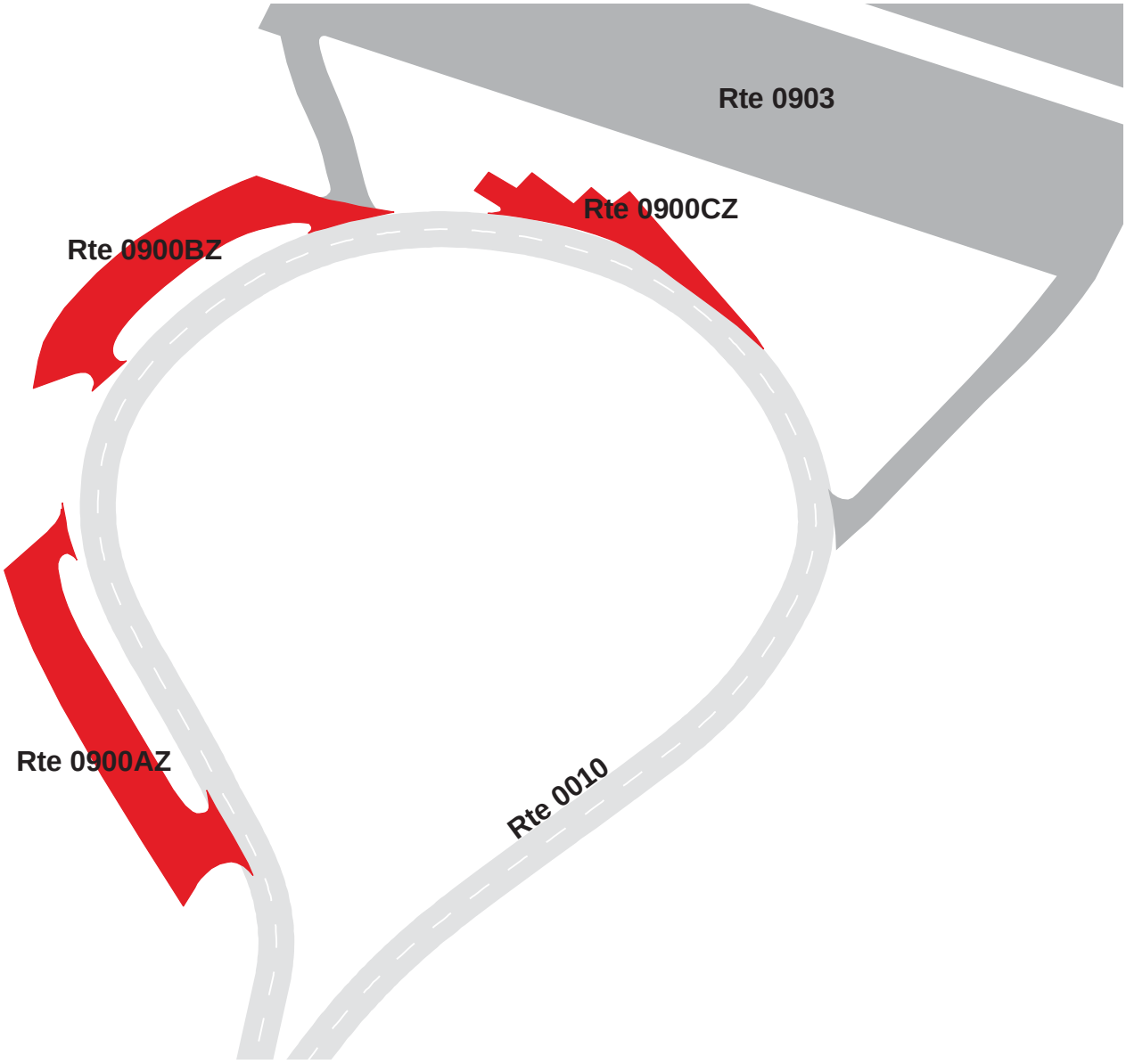
FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)

TO ROUTE 0010 (FR RD FORT RALEIGH ROAD)

Summary Record

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0900ZZ	PUBLIC	2/5/2013	21,402	0.37	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	CONCRETE CURB	SUMMARY/63

* Lane miles are based on 11' lane widths



FORT RALEIGH NATIONAL HISTORIC SITE
Route 0900AZ

FR RD VISITOR CENTER LOOP PARKING A

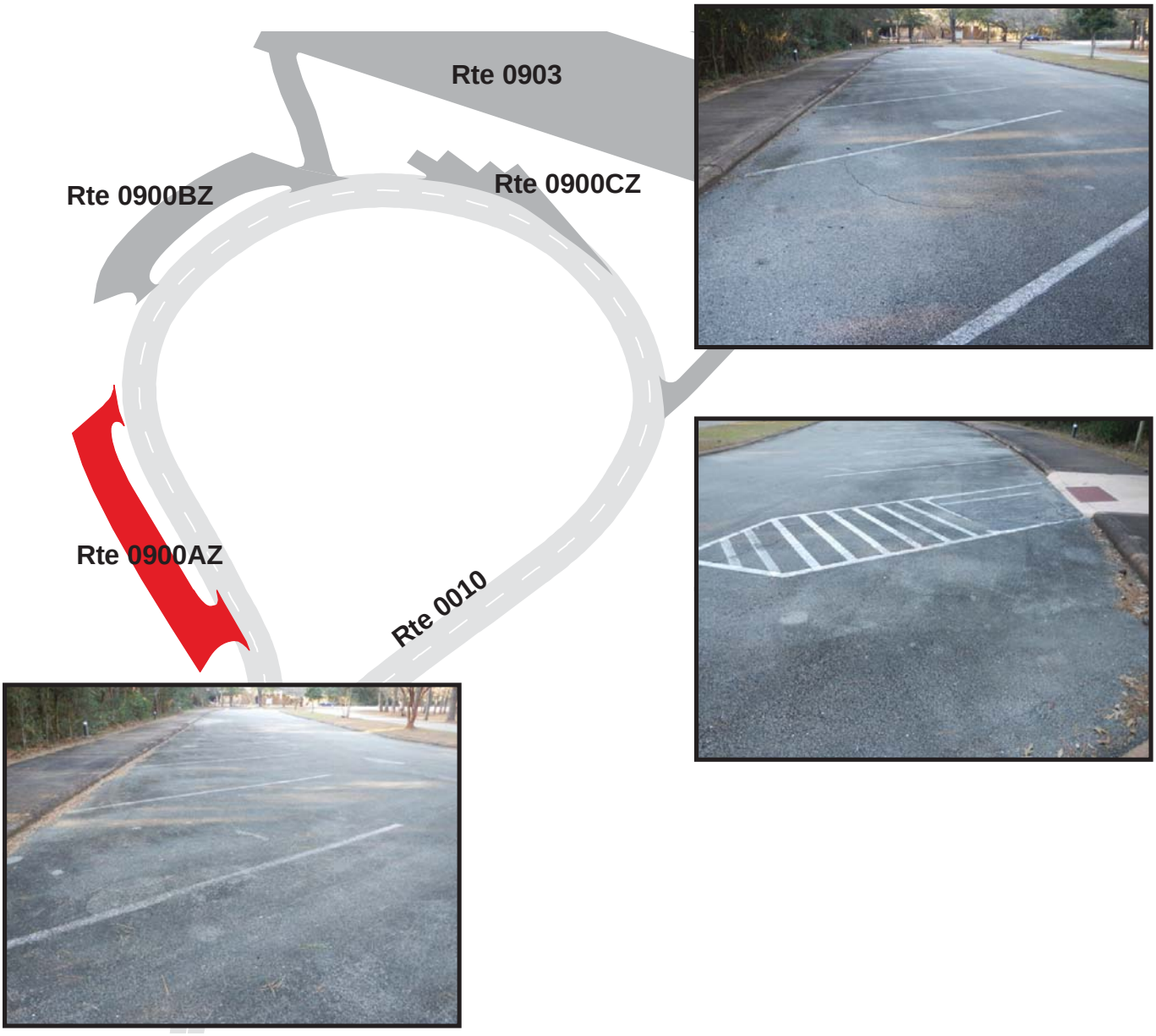
FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)

TO ROUTE 0010 (FR RD FORT RALEIGH ROAD)

Subcomponent Record

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0900AZ	PUBLIC	2/5/2013	9,512	0.16	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	CONCRETE CURB	FAIR/73

* Lane miles are based on 11' lane widths



360 180 0 360 Feet

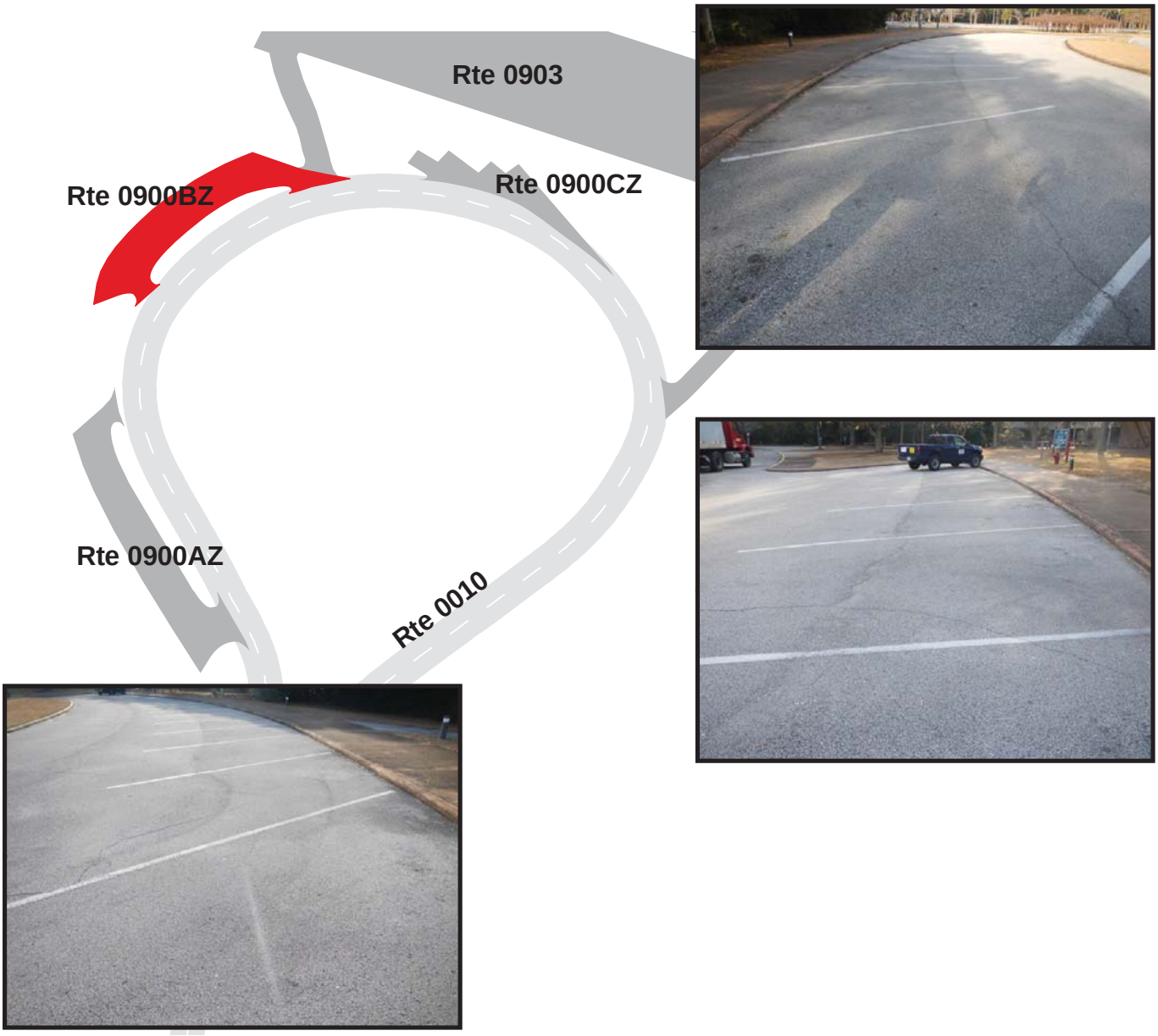
N

FORT RALEIGH NATIONAL HISTORIC SITE
Route 0900BZ

FR RD VISITOR CENTER LOOP PARKING B
FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)
TO ROUTE 0010 (FR RD FORT RALEIGH ROAD)
Subcomponent Record

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0900BZ	PUBLIC	2/5/2013	8,017	0.14	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	CONCRETE CURB	POOR/45

* Lane miles are based on 11' lane widths



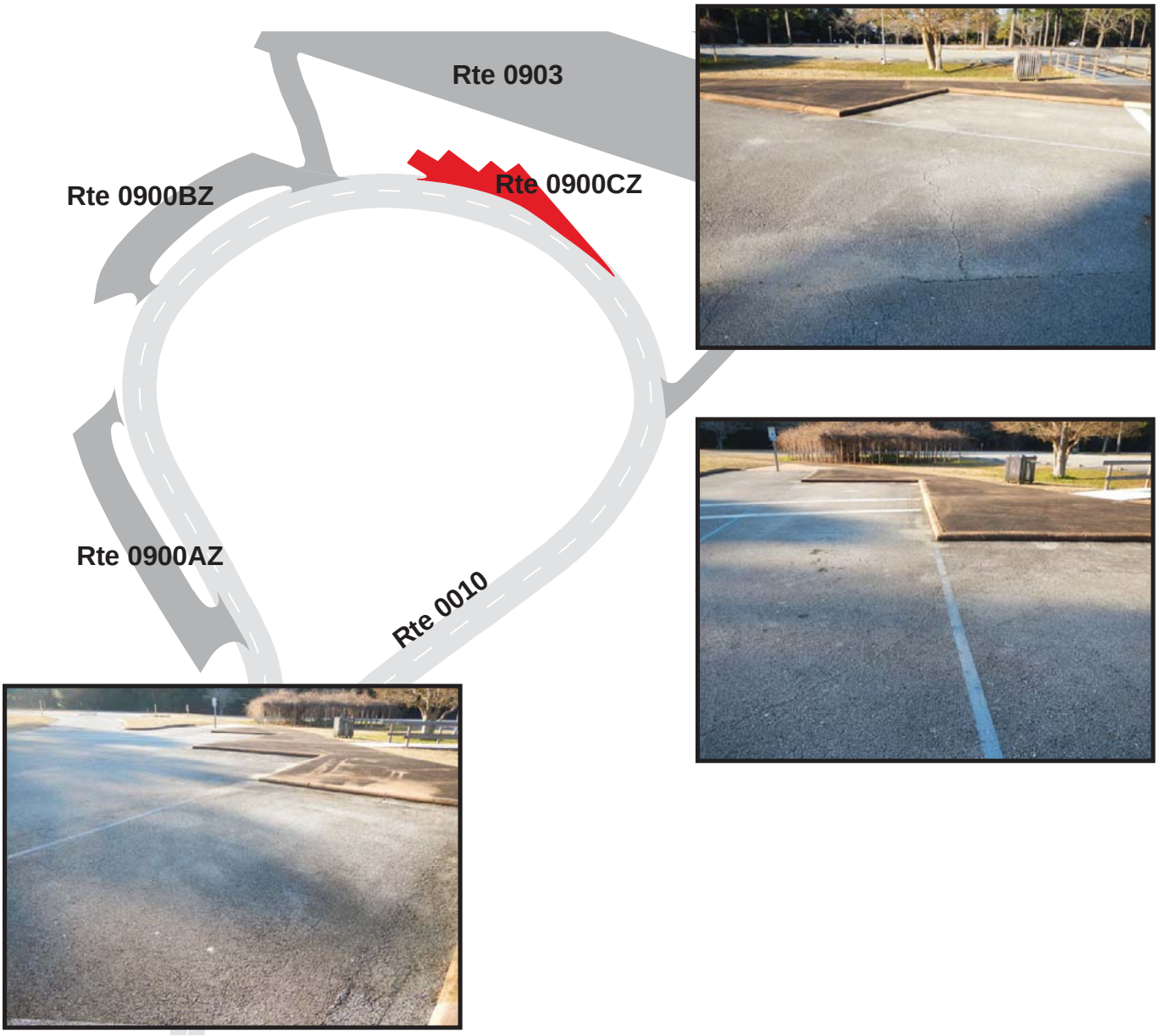
360 180 0 360
Feet

FORT RALEIGH NATIONAL HISTORIC SITE
Route 0900CZ
FR RD VISITOR CENTER LOOP PARKING C
ADJACENT TO ROUTE 0010 (FR RD FORT RALEIGH ROAD)

Subcomponent Record

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0900CZ	PUBLIC	2/5/2013	3,873	0.07	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	CONCRETE CURB	FAIR/73

* Lane miles are based on 11' lane widths

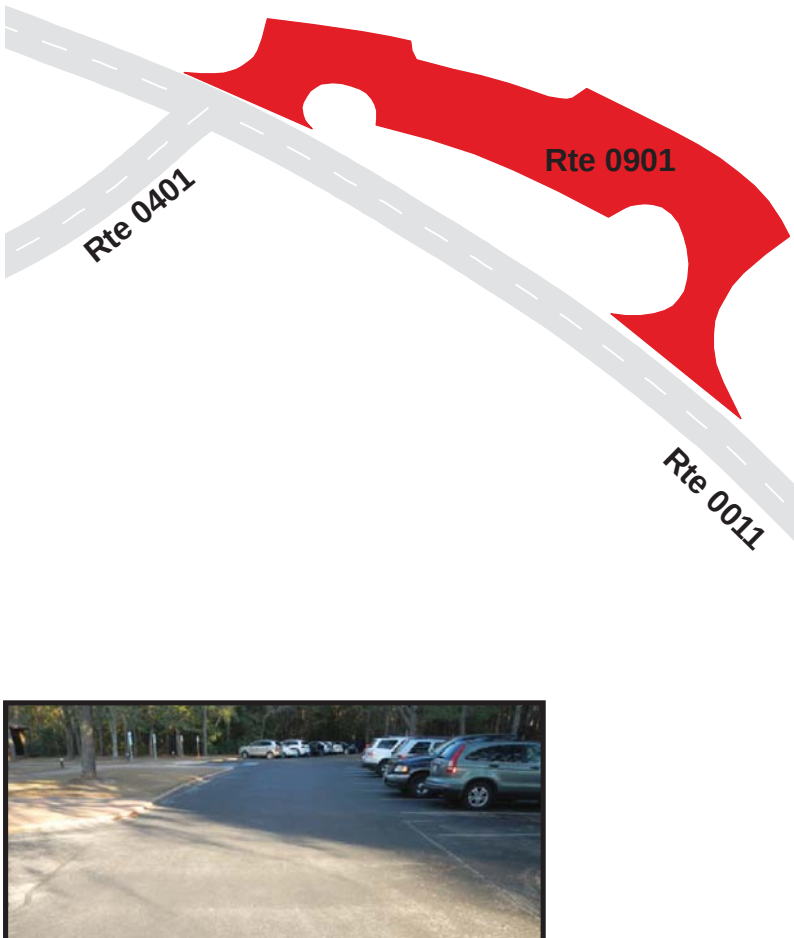


360 180 0 360
Feet

FORT RALEIGH NATIONAL HISTORIC SITE
Route 0901
FR RD GROUP HEADQUARTERS PARKING
FROM ROUTE 0011 (FR RD NATIONAL PARK DRIVE)
TO ROUTE 0011 (FR RD NATIONAL PARK DRIVE)

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0901	NONPUBLIC	2/5/2013	11,751	0.20	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	CONCRETE CURB	FAIR/73

* Lane miles are based on 11' lane widths



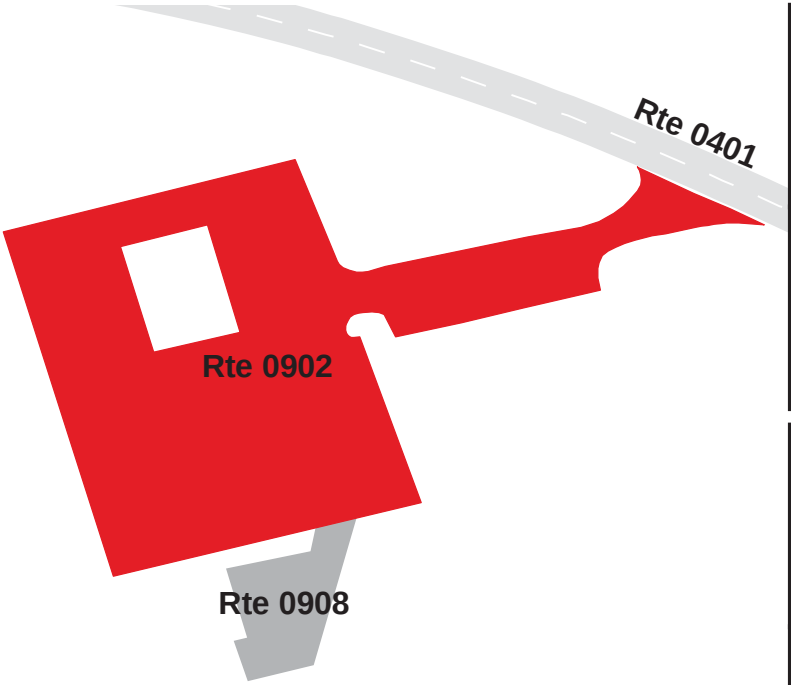
210 105 0 210 Feet

N

FORT RALEIGH NATIONAL HISTORIC SITE
Route 0902
FR RD MAINTENANCE AREA PARKING
FROM ROUTE 0401 (FR RD PEAR PAD ROAD)
TO MAINTENANCE AREA

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0902	NONPUBLIC	2/5/2013	31,930	0.55	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	1	NO CURB AND GUTTER	NO CURB	POOR/45

* Lane miles are based on 11' lane widths

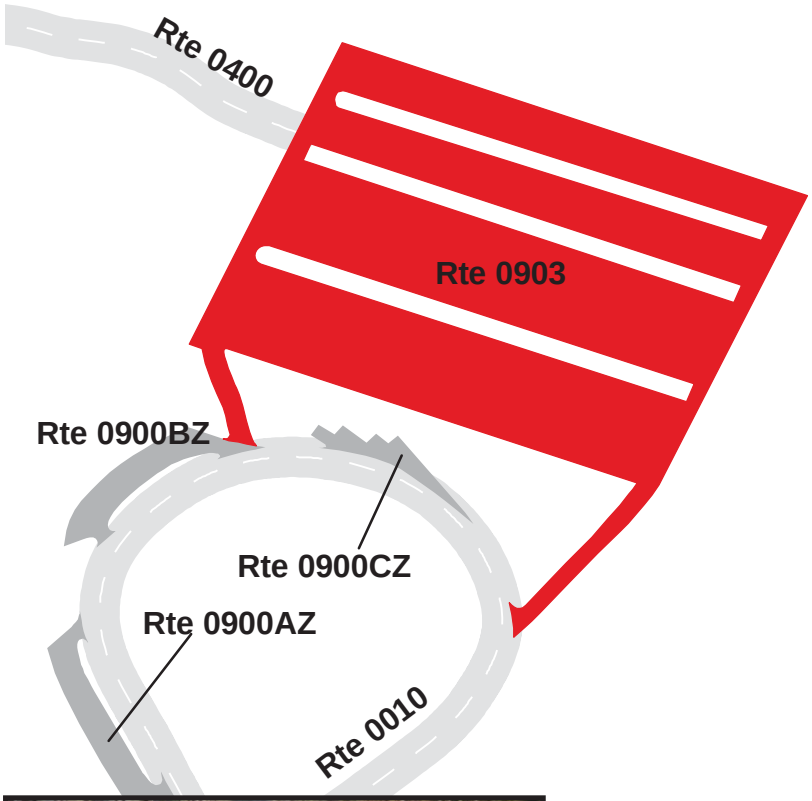


230 115 0 230
Feet

FORT RALEIGH NATIONAL HISTORIC SITE
Route 0903
FR RD THEATER PARKING
FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)
TO ROUTE 0900ZZ (FR RD VISITOR CENTER PARKING AREAS)

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0903	PUBLIC	2/5/2013	191,717	3.30	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	CONCRETE CURB	POOR/45

* Lane miles are based on 11' lane widths



540 270 0 540
Feet

FORT RALEIGH NATIONAL HISTORIC SITE
Route 0904
FR RD ELIZABETHAN GARDEN PARKING
ADJACENT TO ROUTE 0011 (FR RD NATIONAL PARK DRIVE)

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0904	PUBLIC	2/5/2013	16,189	0.28	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	0	NO CURB AND GUTTER	CONCRETE CURB	POOR/45

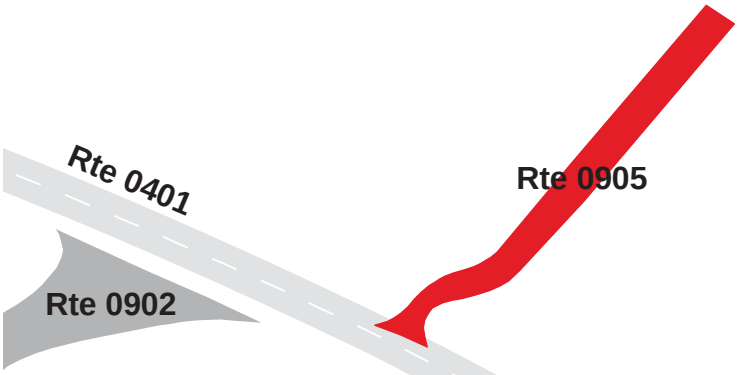
* Lane miles are based on 11' lane widths

210 105 0 210 Feet

FORT RALEIGH NATIONAL HISTORIC SITE
Route 0905
ELIZABETHAN GARDEN MAINTENANCE FACILITY
FROM ROUTE 0401 (FR RD PEAR PAD ROAD)
TO MAINTENANCE FACILITY

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0905	NONPUBLIC	2/5/2013	1,404	0.02	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	1	NO CURB AND GUTTER	NO CURB	POOR/45

* Lane miles are based on 11' lane widths



FORT RALEIGH NATIONAL HISTORIC SITE

Route 0908

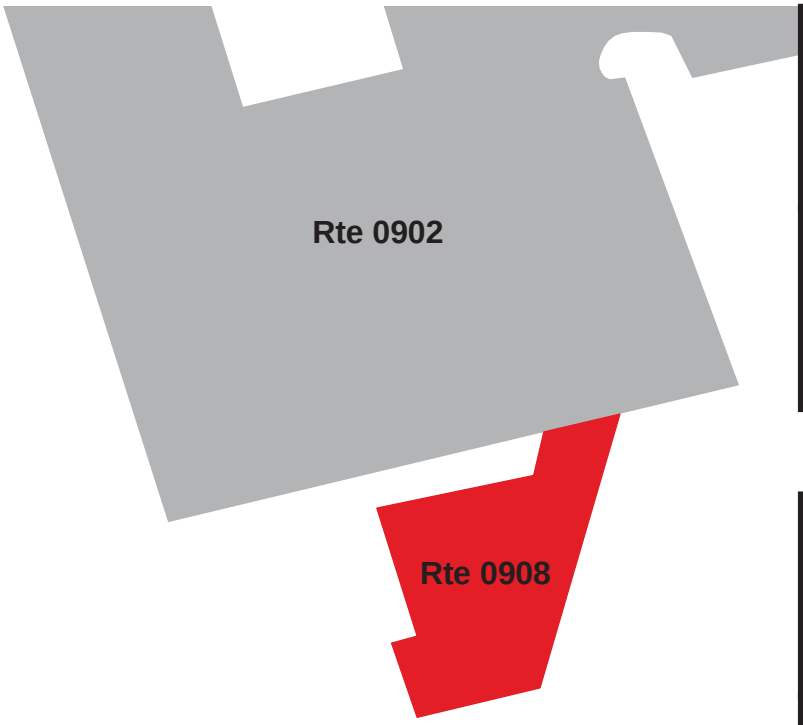
MRC PARKING LOT

FROM ROUTE 0902 (FR RD MAINTENANCE AREA PARKING)

TO PARKING

Route Number	Public / NonPublic	Date Visited	Area (sq ft)	Lane Miles *	Surface Type
0908	NONPUBLIC	2/5/2013	3,030	0.05	AS
Culverts	**Drop Inlets**	**Gates**	**Curb & Gutter**	**Curb**	**PCR**
0	0	1	NO CURB AND GUTTER	NO CURB	GOOD/90

* Lane miles are based on 11' lane widths



125 62.5 0 125 Feet

N

Section 8
Parkwide/Route
Maintenance Features Summaries

Fort Raleigh National Historic Site

Federal Lands Highway
Road Inventory Program

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

Notice: Culverts and drop inlets were marked by NPS and inventoried by RIP in Cycle 5 on all DCV driven routes. Culverts and drop inlets were also collected on all Manually Rated Routes and Paved Parking areas. Those totals are reflected below.

FEATURE	LINEAR FEET	COUNT
BRIDGE	--	0
CATTLE GUARD	--	0
CULVERT	--	5
CURB	1,356	--
DROP INLET	--	0
GATE	--	4
GUARD/GUIDE RAIL	0	--
CABLE	0	--
NON-CABLE	0	--
GUARD/GUIDE WALL	0	--
BOLLARD	0	--
TEMPORARY BARRIER	0	--
NON TEMP/BOLLARD	0	--
INTERSECTION	--	44
LOW WATER CROSSING	0	0
MILE MARKER	--	0
OVERPASS	--	0
PARK BOUNDARY	--	0
PAVED DITCH	0	--
PULLOUT	0	0
RAILROAD CROSSING	--	0
RETAINING WALL	0	0
SIGN	--	43
STATE BOUNDARY	--	0
TRAFFIC LIGHT	--	0
TUNNEL	0	0

FORA: DCV ROUTE MAINTENANCE FEATURES SUMMARY

Notice: Culverts and drop inlets were marked by NPS and inventoried by RIP in Cycle 5.

FEATURE	ROUTE 0010 FR RD FORT RALEIGH ROAD	ROUTE 0011 FR RD NATIONAL PARK DRIVE	ROUTE 0400 FR RD THEATER ACCESS ROAD	ROUTE 0401 FR RD PEAR PAD ROAD	ROUTE 0404 FR RD WATER TOWER ROAD		UNIT
BRIDGE	0	0	0	0	0		EACH
CATTLE GUARD	0	0	0	0	0		EACH
CULVERT	2	1	0	2	0		EACH
CURB	912	444	0	0	0		LINEAR FEET
DROP INLET	0	0	0	0	0		EACH
GATE	0	0	0	0	1		EACH
GUARD/GUIDE RAIL	0	0	0	0	0		LINEAR FEET
CABLE	0	0	0	0	0		LINEAR FEET
NON-CABLE	0	0	0	0	0		LINEAR FEET
GUARD/GUIDE WALL	0	0	0	0	0		LINEAR FEET
BOLLARD	0	0	0	0	0		LINEAR FEET
TEMPORARY BARRIER	0	0	0	0	0		LINEAR FEET
NON TEMP/BOLLARD	0	0	0	0	0		LINEAR FEET
INTERSECTION	18	9	5	9	3		EACH
LOW WATER CROSSING	0	0	0	0	0		EACH
LOW WATER CROSSING	0	0	0	0	0		LINEAR FEET
MILE MARKER	0	0	0	0	0		EACH
OVERPASS	0	0	0	0	0		EACH
PARK BOUNDARY	0	0	0	0	0		EACH
PAVED DITCH	0	0	0	0	0		LINEAR FEET
PULLOUT	0	0	0	0	0		EACH
PULLOUT	0	0	0	0	0		LINEAR FEET
RAILROAD CROSSING	0	0	0	0	0		EACH
RETAINING WALL	0	0	0	0	0		EACH
RETAINING WALL	0	0	0	0	0		LINEAR FEET
SIGN	20	9	3	8	3		EACH
STATE BOUNDARY	0	0	0	0	0		EACH
TRAFFIC LIGHT	0	0	0	0	0		EACH
TUNNEL	0	0	0	0	0		EACH
TUNNEL	0	0	0	0	0		LINEAR FEET

STRUCTURE LIST

No data available for this section.

Section 9
Route Maintenance Features
Road Logs

Fort Raleigh National Historic Site

Federal Lands Highway
Road Inventory Program

FORA: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0010: FR RD FORT RALEIGH ROAD

Notice: Culverts and drop inlets were marked by NPS and inventoried by RIP in Cycle 5 on all paved routes.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
0.000	0.000	ROUTE BEGIN	N/A	FROM ROUTE 5064 (U.S. HIGHWAY 64)
0.000	0.000	INTERSECTION	RIGHT	ROUTE 5064 (U.S. HIGHWAY 64)
0.000	0.008	CURB	RIGHT	N/A
0.000	0.000	INTERSECTION	LEFT	ROUTE 5064 (U.S. HIGHWAY 64)
0.002	0.002	CULVERT	N/A	N/A
0.004	0.006	CURB	LEFT	N/A
0.005	0.005	SIGN	LEFT	REGULATORY, STOP
0.014	0.014	INTERSECTION	LEFT	ROUTE 0010 (FR RD FORT RALEIGH ROAD) SPUR
0.017	0.017	SIGN	LEFT	GUIDE, ISLAND FARM WILDLIFE REFUGES VISITOR CENTER
0.017	0.017	SIGN	LEFT	GUIDE, ROANOKE ISLAND
0.021	0.021	INTERSECTION	RIGHT	ROUTE 0010 (FR RD FORT RALEIGH ROAD) SPUR
0.032	0.032	SIGN	LEFT	REGULATORY, GRAPHIC SIGN NO TEXT
0.034	0.034	SIGN	RIGHT	GUIDE, NATIONAL PARK SERVICE
0.048	0.048	SIGN	LEFT	WARNING, GRAPHIC SIGN NO TEXT
0.064	0.064	SIGN	RIGHT	REGULATORY, SPEED LIMIT 20
0.127	0.127	SIGN	RIGHT	GUIDE, ELIZABETHAN GARDENS FT. RALEIGH VISITOR CENTER THE LOST COLONY
0.158	0.158	SIGN	LEFT	REGULATORY, SPEED LIMIT 20
0.165	0.165	INTERSECTION	LEFT	ROUTE 0011 (FR RD NATIONAL PARK DRIVE)
0.167	0.167	SIGN	LEFT	GUIDE, ELIZABETHAN GARDENS FT. RALEIGH VISITOR CENTER THE LOST COLONY
0.168	0.168	SIGN	LEFT	GUIDE, UNABLE TO READ FROM VIDEO
0.168	0.168	SIGN	LEFT	GUIDE, UNABLE TO READ FROM VIDEO
0.188	0.188	SIGN	LEFT	GUIDE, ELIZABETHAN GARDENS
0.195	0.195	SIGN	N/A	REGULATORY, ONE WAY
0.196	0.196	INTERSECTION	LEFT	ROUTE 0010 (FR RD FORT RALEIGH ROAD)
0.196	0.497	ONE-WAY	N/A	N/A
0.197	0.209	CURB	LEFT	N/A
0.216	0.216	INTERSECTION	LEFT	ROUTE 0010 (FR RD FORT RALEIGH ROAD) SPUR
0.217	0.222	CURB	LEFT	N/A
0.228	0.228	INTERSECTION	LEFT	ROUTE 0010 (FR RD FORT RALEIGH ROAD) SPUR

FORA: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0010: FR RD FORT RALEIGH ROAD

Notice: Culverts and drop inlets were marked by NPS and inventoried by RIP in Cycle 5 on all paved routes.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
0.260	0.260	CULVERT	N/A	N/A
0.282	0.282	SIGN	RIGHT	GUIDE, THEATER PARKING & BOX OFFICE VISITOR CENTER CIVIL WAR MARKER
0.293	0.293	INTERSECTION	RIGHT	ROUTE 0903 (FR RD THEATER PARKING)
0.320	0.339	CURB	RIGHT	N/A
0.324	0.324	SIGN	RIGHT	WARNING, SLOW PEDESTRIAN CROSSING
0.341	0.341	INTERSECTION	RIGHT	ROUTE 0900CZ (FR RD VISITOR CENTER LOOP PARKING C)
0.352	0.363	CURB	RIGHT	N/A
0.367	0.367	SIGN	RIGHT	GUIDE, UNABLE TO READ FROM VIDEO
0.368	0.368	INTERSECTION	RIGHT	ROUTE 0900BZ (FR RD VISITOR CENTER LOOP PARKING B)
0.372	0.398	CURB	RIGHT	N/A
0.376	0.376	SIGN	RIGHT	REGULATORY, DO NOT ENTER
0.402	0.402	INTERSECTION	RIGHT	ROUTE 0900BZ (FR RD VISITOR CENTER LOOP PARKING B)
0.403	0.418	CURB	RIGHT	N/A
0.419	0.419	INTERSECTION	RIGHT	ROUTE 0900AZ (FR RD VISITOR CENTER LOOP PARKING A)
0.423	0.460	CURB	RIGHT	N/A
0.466	0.466	INTERSECTION	RIGHT	ROUTE 0900AZ (FR RD VISITOR CENTER LOOP PARKING A)
0.467	0.487	CURB	RIGHT	N/A
0.470	0.470	INTERSECTION	LEFT	ROUTE 0010 (FR RD FORT RALEIGH ROAD) SPUR
0.474	0.474	SIGN	LEFT	REGULATORY, KEEP RIGHT
0.474	0.479	CURB	LEFT	N/A
0.479	0.479	SIGN	LEFT	REGULATORY, UNABLE TO READ FROM VIDEO
0.481	0.481	INTERSECTION	LEFT	ROUTE 0010 (FR RD FORT RALEIGH ROAD) SPUR
0.483	0.496	CURB	LEFT	N/A
0.497	0.497	INTERSECTION	LEFT	ROUTE 0010 (FR RD FORT RALEIGH ROAD)
0.497	0.497	INTERSECTION	N/A	ROUTE 0010 (FR RD FORT RALEIGH ROAD)
0.497	0.497	ROUTE END	N/A	TO END OF LOOP

FORA: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0011: FR RD NATIONAL PARK DRIVE

Notice: Culverts and drop inlets were marked by NPS and inventoried by RIP in Cycle 5 on all paved routes.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
0.000	0.000	ROUTE BEGIN	N/A	FROM ROUTE 0010 (FR RD FORT RALEIGH ROAD)
0.000	0.000	INTERSECTION	LEFT	ROUTE 0010 (FR RD FORT RALEIGH ROAD)
0.000	0.000	INTERSECTION	RIGHT	ROUTE 0010 (FR RD FORT RALEIGH ROAD)
0.000	0.000	SIGN	N/A	GUIDE, 64 EXIT TO HWY 64 WATERSIDE THEATRE VISITOR CENTER
0.000	0.079	CURB	RIGHT	N/A
0.005	0.005	SIGN	LEFT	REGULATORY, STOP
0.024	0.024	SIGN	RIGHT	REGULATORY, SPEED LIMIT 20
0.080	0.080	INTERSECTION	RIGHT	ROUTE 0901 (FR RD GROUP HEADQUARTERS PARKING)
0.087	0.087	SIGN	RIGHT	GUIDE, OUTER BANKS GROUP SUPPORT OFFICE ELIZABETHAN GARDENS
0.091	0.091	CULVERT	N/A	N/A
0.122	0.122	INTERSECTION	RIGHT	ROUTE 0901 (FR RD GROUP HEADQUARTERS PARKING)
0.123	0.123	INTERSECTION	LEFT	ROUTE 0401 (FR RD PEAR PAD ROAD)
0.128	0.128	SIGN	LEFT	GUIDE, PEAR PAD
0.128	0.128	SIGN	LEFT	GUIDE, UNABLE TO READ FROM VIDEO
0.157	0.157	SIGN	LEFT	REGULATORY, SPEED LIMIT 20
0.184	0.184	INTERSECTION	LEFT	ROUTE 0011 (FR RD NATIONAL PARK DRIVE)
0.184	0.301	ONE-WAY	N/A	N/A
0.219	0.221	CURB	RIGHT	N/A
0.220	0.220	SIGN	LEFT	GUIDE, UNABLE TO READ FROM VIDEO
0.223	0.223	SIGN	RIGHT	GUIDE, THE ELIZABETHAN GARDENS OPEN DAILY 10AM - 4 PM
0.244	0.244	INTERSECTION	RIGHT	ROUTE 0904 (FR RD ELIZABETHAN GARDEN PARKING)
0.288	0.291	CURB	RIGHT	N/A
0.301	0.301	INTERSECTION	LEFT	ROUTE 0011 (FR RD NATIONAL PARK DRIVE)
0.301	0.301	INTERSECTION	N/A	ROUTE 0011 (FR RD NATIONAL PARK DRIVE)
0.301	0.301	ROUTE END	N/A	TO END OF LOOP

FORA: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0400: FR RD THEATER ACCESS ROAD

Notice: Culverts and drop inlets were marked by NPS and inventoried by RIP in Cycle 5 on all paved routes.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
0.000	0.000	ROUTE BEGIN	N/A	FROM ROUTE 0903 (FR RD THEATER PARKING)
0.000	0.000	INTERSECTION	LEFT	ROUTE 0903 (FR RD THEATER PARKING)
0.000	0.000	INTERSECTION	N/A	ROUTE 0903 (FR RD THEATER PARKING)
0.000	0.000	INTERSECTION	RIGHT	ROUTE 0903 (FR RD THEATER PARKING)
0.038	0.038	INTERSECTION	RIGHT	UNPAVED ROAD
0.073	0.073	SIGN	LEFT	GUIDE, TICKET OFFICE PARKING LOT VISITOR CENTER
0.088	0.088	SIGN	RIGHT	REGULATORY, UNABLE TO READ FROM VIDEO
0.107	0.107	SIGN	LEFT	GUIDE, UNABLE TO READ FROM VIDEO
0.114	0.114	INTERSECTION	N/A	ROUTE 0405 (FR RD THEATER BACKSTAGE ACCESS ROAD)
0.114	0.114	ROUTE END	N/A	TO BEGINNING OF ROUTE 0405 (FR RD THEATER BACKSTAGE ACCESS ROAD)

FORA: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0401: FR RD PEAR PAD ROAD

Notice: Culverts and drop inlets were marked by NPS and inventoried by RIP in Cycle 5 on all paved routes.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
0.000	0.000	ROUTE BEGIN	N/A	FROM ROUTE 0011 (FR RD NATIONAL PARK DRIVE)
0.000	0.000	INTERSECTION	LEFT	ROUTE 0011 (FR RD NATIONAL PARK DRIVE)
0.000	0.000	INTERSECTION	RIGHT	ROUTE 0011 (FR RD NATIONAL PARK DRIVE)
0.000	0.000	INTERSECTION	N/A	ROUTE 0901 (FR RD GROUP HEADQUARTERS PARKING)
0.005	0.005	SIGN	LEFT	REGULATORY, STOP
0.006	0.006	SIGN	RIGHT	GUIDE, SERVICE ROAD RESIDENCE AREA
0.042	0.042	CULVERT	N/A	N/A
0.057	0.057	SIGN	RIGHT	REGULATORY, SPEED LIMIT 15
0.057	0.057	SIGN	RIGHT	WARNING, SLOW CHILDREN AT PLAY
0.096	0.096	INTERSECTION	LEFT	ROUTE 0404 (FR RD WATER TOWER ROAD)
0.138	0.138	SIGN	RIGHT	WARNING, SLOW PEDESTRIAN CROSSING
0.178	0.178	SIGN	LEFT	WARNING, SLOW PEDESTRIANS CROSSING
0.281	0.281	INTERSECTION	RIGHT	ROUTE 0905 (ELIZABETHAN GARDEN MAINTENANCE FACILITY)
0.283	0.283	SIGN	RIGHT	REGULATORY, DELIVERIES
0.283	0.283	SIGN	RIGHT	REGULATORY, UNABLE TO READ FROM VIDEO
0.296	0.296	INTERSECTION	LEFT	ROUTE 0902 (FR RD MAINTENANCE AREA PARKING)
0.326	0.326	CULVERT	N/A	N/A
0.516	0.516	INTERSECTION	LEFT	ROUTE 0401 (FR RD PEAR PAD ROAD)
0.516	0.546	ONE-WAY	N/A	N/A
0.546	0.546	INTERSECTION	LEFT	ROUTE 0401 (FR RD PEAR PAD ROAD)
0.546	0.546	INTERSECTION	N/A	ROUTE 0401 (FR RD PEAR PAD ROAD)
0.546	0.546	ROUTE END	N/A	TO END OF LOOP

FORA: ROUTE MAINTENANCE FEATURES ROAD LOG

ROUTE 0404: FR RD WATER TOWER ROAD

Notice: Culverts and drop inlets were marked by NPS and inventoried by RIP in Cycle 5 on all paved routes.

FROM MILEPOST	TO MILEPOST	FEATURE	SIDE	COMMENT
0.000	0.000	ROUTE BEGIN	N/A	FROM ROUTE 0401 (FR RD PEAR PAD ROAD)
0.000	0.000	INTERSECTION	LEFT	ROUTE 0401 (FR RD PEAR PAD ROAD)
0.000	0.000	INTERSECTION	RIGHT	ROUTE 0401 (FR RD PEAR PAD ROAD)
0.000	0.141	DEBRIS ON ROAD	N/A	N/A
0.006	0.006	GATE	N/A	N/A
0.006	0.006	SIGN	LEFT	GUIDE, UNABLE TO READ FROM VIDEO
0.010	0.010	SIGN	LEFT	GUIDE, CLOSED
0.010	0.010	SIGN	RIGHT	GUIDE, CLOSED
0.141	0.141	INTERSECTION	N/A	DEAD END
0.141	0.141	ROUTE END	N/A	TO END AT SHED ON LEFT

Section 10
Appendix

Fort Raleigh National Historic Site

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 in relation to the distresses and indexes that comprise the Pavement Condition Rating (PCR), an extensive study was completed throughout 2010 that 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.

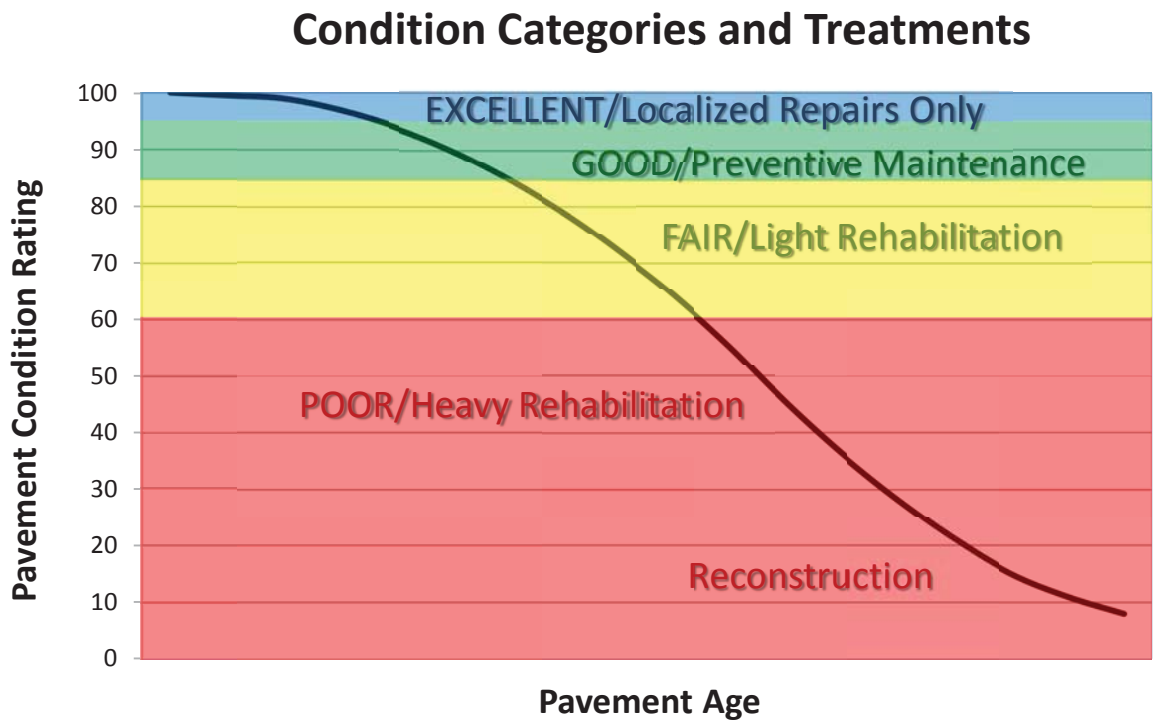
The changes that were implemented were endorsed by management at both the FHWA and NPS. In order to show the effectiveness of these changes, several sites were ground truth tested to ensure that an improvement was achieved between the relationship of PCR and the actual Maintenance and Rehabilitation needs that were represented. 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.

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

In addition to the RIP Index changes that were implemented in Cycle 5, we will 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.

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), National Park Service Road Inventory Program (NPS-RIP), collects condition data on paved roads, parkways, and parking areas in park units nationwide. Road surface condition data is collected using an automated Data Collection Vehicle (DCV). Roads having brick, cobblestone, or wood surfaces are not normally surveyed with the DCV, but are manually rated for the purpose of assigning a condition rating. Unpaved roads, parkways, and parking areas are not currently being evaluated for condition. Paved campground pads and driveways are also not currently being evaluated for condition.

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 high 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. The FHWA RIP distress types are similar to those described in the LTPP manual with some modifications. The 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 NPS-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, 231 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 8.

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 a patch may not exceed 0.30 mi. (0.48 km). Any full-lane width patch exceeding 0.30 mi. in length is considered a pavement change, not a patch for the purposes of distress analysis. 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 $\geq$ 0.20" and $\leq$ 0.49"

MED
Ruts with a measured depth $\geq$ 0.50" and $\leq$ 0.99"

HIGH
Ruts with a measured depth $\geq$ 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 (spin-type) to provide accurate positioning data (pitch/roll/heading) 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	+- 0.5 degrees
Grade	+- 0.5 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. Paved campground pads and driveways are not typically included in the inventory or GPS.

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 tabular 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. The metadata portion of the geodatabase also includes data dictionary report functionality that formats the metadata into an easy to read report.

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