E-172

CRATERS OF THE MOON NM

road system evaluation

CRATERS OF THE MOON



NATIONAL MONUMENT • IDAHO

CRATERS OF THE MOON

NATIONAL MONUMENT

ROAD SYSTEM EVALUATION

SEPTEMBER, 1991

SUMMARY

Craters of the Moon National Monument is located in south central Idaho, 18 miles west of Arco. The monument preserves examples of basaltic volcanism that are part of the Great Rift volcanic rift system.

The road system consists of a main two-way park entrance road, a one-way scenic loop road, two two-way spur roads that lead to interpretive features, a campground road, and administrative roads to the park housing area, the boneyard (outdoor storage area), and the portion of the monument north of the highway. There are eleven parking areas that serve visitor facilities and interpretive features.

All roads are paved except for the administrative roads to the boneyard and the north access. All roads are functionally classified in accordance with the 1984 Park Road Standards. A change in functional classification of the scenic loop road from city streets to principle park road is proposed. Parking areas have been renumbered individually rather than all grouped under Route 900.

All the paved roads exhibit lateral cracking. This is primarily due to environmental factors (thermal cracking) and pavement age (lack of flexibility). The absence of an adequate road base could also be a contributing factor. The RSE proposes that as part of the normal design process an in-depth geotechnical investigation be conducted to determine the best solutions to these problems. Solutions should include consideration of a more flexible asphalt mat, imported aggregate base and fabric material. Long- and short-term solutions should also be considered. These should include chip-seals, overlays, crack sealing and reconstruction. For programming purposes the RSE presents cost estimates based on crack sealing, fabric and an overlay for the short term and recycling, imported aggregate base and a flexible asphalt mat for the long term. Neither of these construction options should be considered as firm proposals. They are presented for estimating and programming purposes only. The proposed geotechnical investigation during design will determine the final construction method.

All major two lane/way roads should be moderately widened to provide a shoulder area inside the curb for bicycles. Moderate curve-widening (1-2 feet), which currently does not exist, should be added to better accommodate large vehicles. The major two-lane/two-way roads are now 22 to 23 feet wide inside the curbs. These reconstructed roads should have an inside curb dimension of 25 feet. The one-lane/one-way loop road now averages 14.5 feet wide inside the curbs. This reconstructed road should have an inside curb dimension of 13 feet. Curbs should be used extensively.

The Caves parking area (Route 908) should be expanded. The other parking areas at the Visitor Center and interpretive features should be expanded, redesigned, and/or restriped to accommodate RVs and other large vehicles. Additional turnouts and interpretive pullouts should be added, striving for a frequency of one every quarter- to half-mile.

The geotechnical investigation during design will determine the final cost and need for phasing construction solutions. If a chip seal is proposed it would cost about $350,000 ($50,000 per mile). The crack seal and overlay alternative would cost about $1,400,000 ($200,000 per mile) and should be completed in two phases to minimize disruption of visitor use and park operations. The various long-term proposal options would cost about $3,500,000 ($500,000 per mile). They all involve reconstruction and could be very disruptive to visitor use and park operations. They should be considered to be done in two phases.

TABLE OF CONTENTS

SUMMARY	iii
INTRODUCTION	1
Purpose of the Study	1
Study Method	1
Planning Direction	2
EXISTING CONDITIONS	3
Location/Access/Circulation	3
Visitation/Traffic Volumes/Vehicle Type	6
Visitor Use/Experience	7
Accidents/Safety	7
Road Character/Architectural Details	8
Physical Condition of the Roads	8
Operational Problems	9
Maintenance	9
Borrow Sites	9
Natural Resources	10
Cultural Resources	12
EVALUATION RESULTS/RECOMMENDATIONS	13
Functional Classification	13
Design Standards	13
Construction Methods	16
Access and Circulation	17
Phasing and Costs	17
Revegetation	18
Road Character/Architectural Details	18
Compliance Documentation	19
ROUTE RECONNAISSANCE REPORTS	21
REFERENCES	62
STUDY TEAM/CONSULTATION/COORDINATION	63

LIST OF FIGURES

Location Map	4
Park Map	5
Functional Classification	14

LIST OF TABLES

Annual Visitation	6
Monthly Visitation	7

INTRODUCTION

The 1982 Surface Transportation Assistance Act, Public Law 97-424, was enacted to address deteriorating road systems throughout the nation. The Federal Lands Highway Program (FLHP) was created by this law specifically to address roads on federally administered lands. The legislation enables the National Park Service (NPS) to conduct a multi-year program of road improvements with funds to be obligated from the Highway Trust Fund.

Purpose Of The Study

In order to ensure the efficient expenditure of funds, FLHP requires advance planning. The NPS is systematically evaluating the roads in all areas under its jurisdiction. This Road System Evaluation (RSE) constitutes the advance planning for the Craters of the Moon National Monument (CRMO) road system. The purpose of this RSE is to inventory all the existing public and administrative roads at CRMO, evaluate the physical condition and operational characteristics of each road, and make improvement recommendations as warranted and consistent with approved planning direction and resource preservation.

Study Method

Representatives of CRMO, the NPS Pacific Northwest Regional Office, and the NPS Denver Service Center met several times to discuss specific problems and future development plans relating to the CRMO road system. During those meetings the goals and objectives for the road system were discussed and the following design criteria, in priority order, were established:

1. *Maintain the low speed (15 - 25 mph), meandering character of the existing road*
2. *Minimize new impacts to the greatest extent possible*
3. *Provide a facility which adequately handles projected traffic volumes*
4. *Accommodate, to the extent possible, the existing, increasing use of large RVs, tour busses, and bicycles*

A field review of the CRMO roads was conducted in June, 1990. The Road Inventory and Needs Study (RIP), prepared in 1980 by the FHWA, was used as base reference data. The RIP contains data on the structural and operational characteristics of the roads as well as mileage and locational information of road features. The information in the RIP was supplemented by collected data on the condition, road uses, operational characteristics, safety, adjacent resources, and character. The as-constructed plans for the latest road work completed in 1966 were also obtained and used as reference data.

Several design options to solve structural problems exist. An in-depth geotechnical investigation is needed prior to beginning design. The RSE recognizes these options are available. For programming purposes, however, the most costly option estimate was identified. Likewise, some design solutions can be completed in one construction season without undue disruption to visitor use and park operations but others cannot. The RSE recognizes this and identifies a two phase sequencing if it becomes applicable.

Planning Direction

Craters of the Moon National Monument was established by presidential proclamation on May 2, 1924. The proclamation recognized the monument as an area of unusual scientific value, general interest, and educational value. The monument is managed to protect the volcanic features for their scientific and educational values and to inform the public about the significance and fragility of the resources.

A General Management Plan (GMP) is being developed for CRMO. Until the GMP is approved, the monument is managed according to the objectives in the most recent Statement for Management, approved in October 1988. Those objectives that are related to this RSE are preservation of geological and natural resources, including air quality; to provide in the most environmentally suitable locations those developments necessary to serve the needs of the park visitor and park management; and to encourage compatible recreational uses by providing quality facilities for a more meaningful experience for the visitor.

The draft GMP addresses the congestion around the Visitor Center due to concentration of development and visitor use in a small area. It mentions road problems including tight turning radii, limited turnouts, structural cracks, and parking areas not being designed for buses and RVs. At this stage of GMP development, proposals to improve the road problems beyond the campground are common to all action alternatives. The Draft GMP presents several alternatives to resolve the traffic congestion problems at the visitor center and entrance station.

The GMP proposes to relocate visitor facilities about one-half mile east of the existing developed area. This would relieve the congestion by removing the visitor center function from the existing visitor/administrative/maintenance facilities area, and allow access to be designed properly. Short-term solutions to the short turning radii of the visitor center RV parking area and the lateral cracking of the roadway are presented in the text. They could be instituted until the GMP is approved and implemented.

EXISTING CONDITIONS

Location/Access/Circulation

CRMO is located in Butte and Blaine counties in south central Idaho, 18 miles southwest of Arco (see Figure 1).

Vehicle access is via US Routes 20/26/93. Access via the closest interstate highways is I-84 from the west to US 93 at Twin Falls (91 miles to CRMO); I-15 from the south at Pocatello to US 26 at Blackfoot (98 miles from Pocatello to CRMO); or I-15 from the east to US 20 at Idaho Falls (85 miles to CRMO). The closest major town to the north is Missoula, Montana, on I-90, approximately 300 miles from CRMO.

Access roads from the west, south, and east traverse relatively level open sagebrush-grassland interspersed with lava flows of varying ages from at least as far as the interstate highways. From the north, the terrain is more rolling, but is never mountainous within 50 miles of CRMO. All the access roads can be considered high speed thoroughfares.

Within the park the circulation system is relatively simple (see Figure 2). Route 10, the Entrance Road, begins at US 93 and continues about 2 miles to the beginning of Route 500. Route 10 is a two lane road with two way traffic. Within the first mile are the Visitor Center, maintenance areas, residential area (Route 400), fee station and campground (Route 200). All have parking areas and/or spur roads adjacent to or emanating from Route 10. Beyond the campground several turnouts and parking areas are adjacent to the road. Route 100, The Devils Orchard Road, is a two lane/two way spur road from Route 10. Route 500 is a one lane/one way traffic loop road from which most of the park attractions are accessible. There are also turnouts and parking areas adjacent to this road and the Tree Molds, Spatter Cone and Caves Roads (Routes 101, 102 and 103 respectively) are two lane/two way spur roads from it.

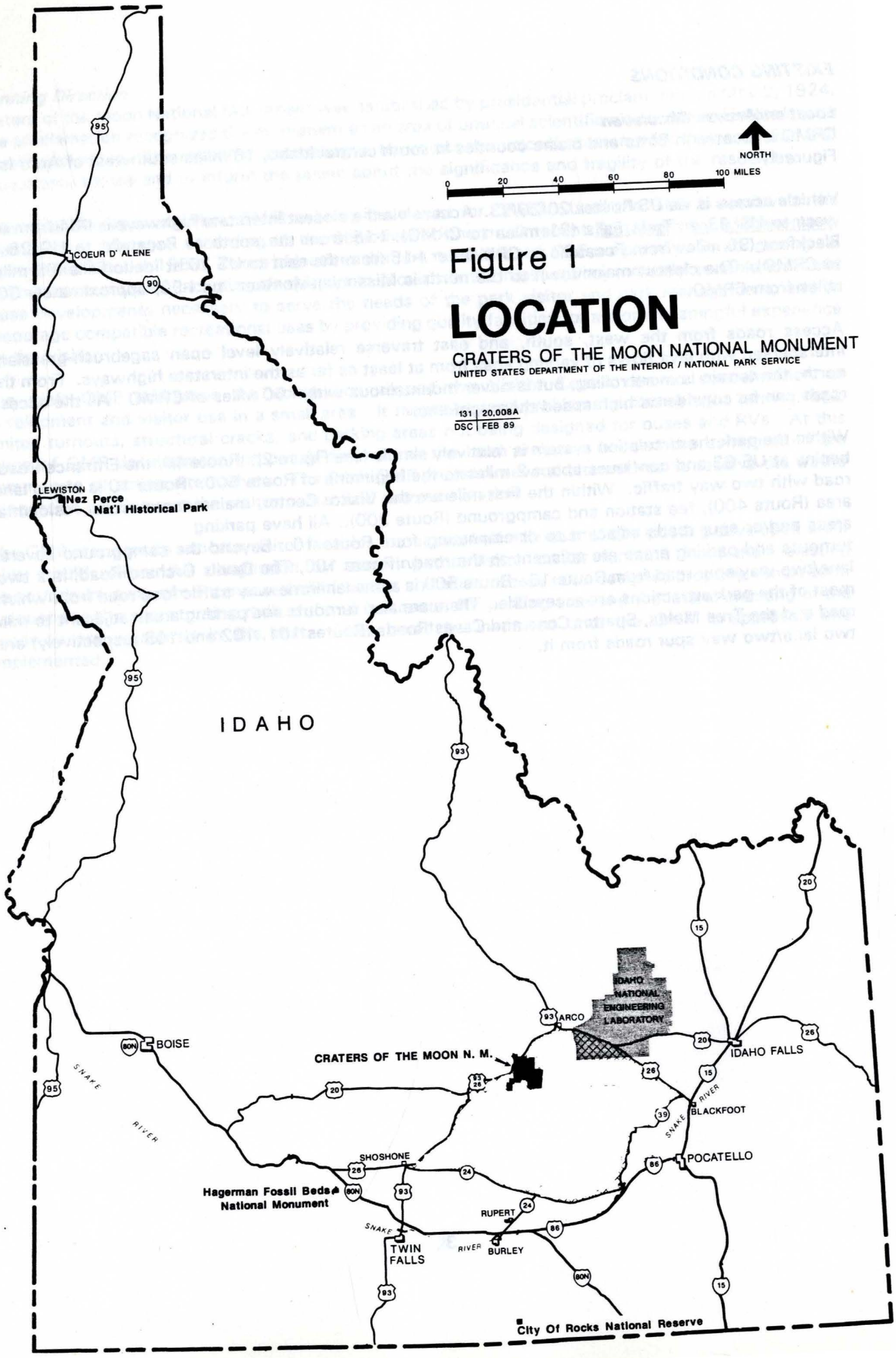


Figure 1

LOCATION

CRATERS OF THE MOON NATIONAL MONUMENT

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

131 | 20,008A
DSC | FEB 89

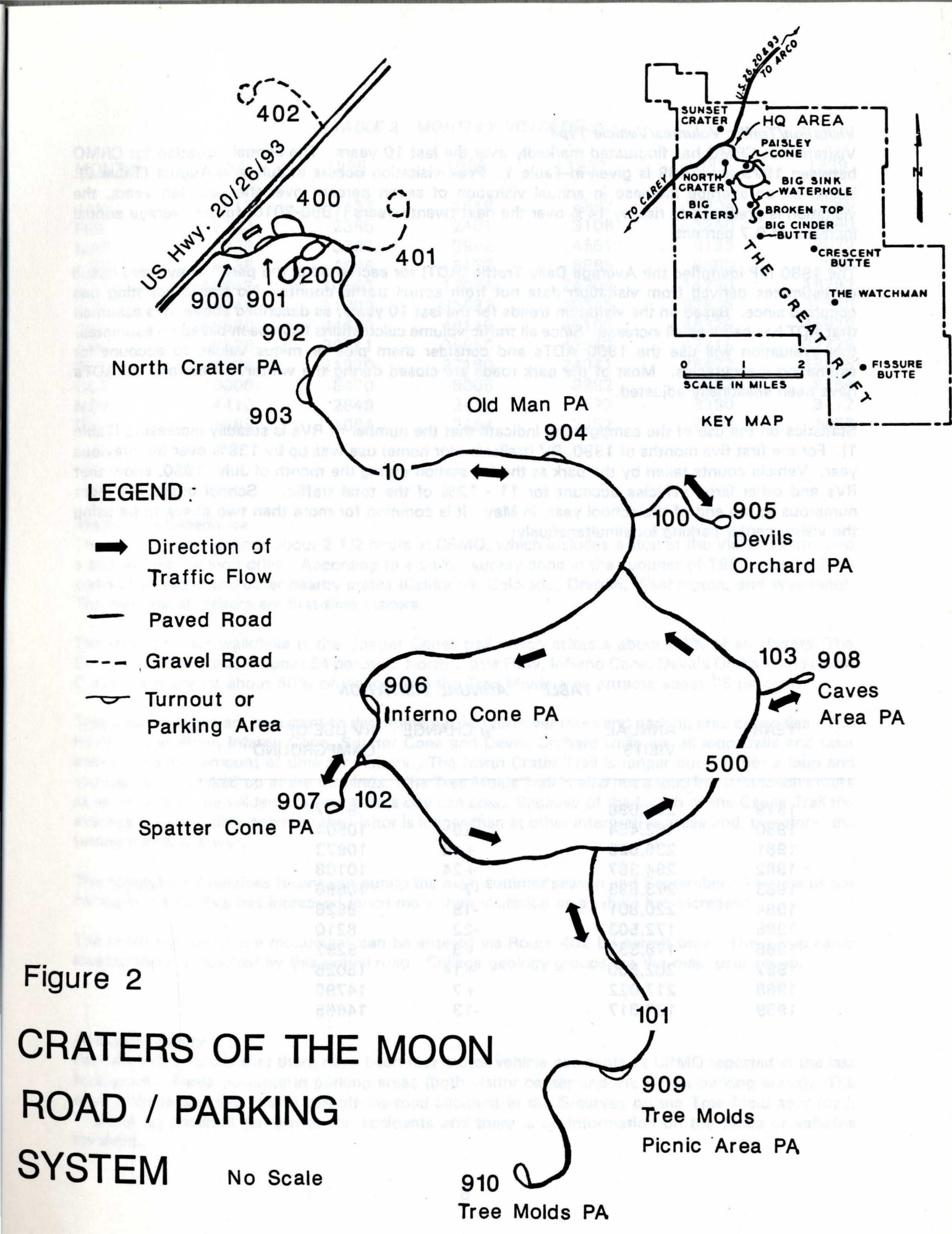


Figure 2

CRATERS OF THE MOON ROAD / PARKING SYSTEM

No Scale

Visitation/Traffic Volumes/Vehicle Type

Visitation at CRMO has fluctuated markedly over the last 10 years. The annual visitation for CRMO between 1979 and 1989 is given in Table 1. Peak visitation occurs in July and August (Table 2). Based on an average increase in annual visitation of seven percent over the past ten years, the visitation is predicted to rise by 14% over the next twenty years (1990-2010) for an average annual increase of 0.7 percent.

The 1980 RIP identified the Average Daily Traffic (ADT) for each road in the park. They were based on estimates derived from visitation data not from actual traffic counts. No traffic counting has occurred since. Based on the visitation trends for the last 10 years, as described above, it is assumed that ADT has had a small increase. Since all traffic volume calculations have been based on estimates, this evaluation will use the 1980 ADTs and consider them plus or minus values to account for estimating inaccuracies. Most of the park roads are closed during the winter. Therefore, all ADTs have been seasonally adjusted.

Statistics on the use of the campground indicate that the number of RVs is steadily increasing (Table 1). For the first five months of 1990, RV (trailer/motor home) use was up by 139% over the previous year. Vehicle counts taken by the park at the fee station during the month of July, 1990, show that RVs and other large vehicles account for 11 - 12% of the total traffic. School buses are most numerous at the end of the school year, in May. It is common for more than two buses to be using the visitor center parking lot simultaneously.

TABLE 1 - ANNUAL VISITATION

YEAR	ANNUAL VISITS	% CHANGE	RV USE OF CAMPGROUND
1979	220,698		9177
1980	162,454	-26	10504
1981	236,525	+46	10973
1982	294,387	+24	10168
1983	273,693	-7	10696
1984	220,801	-19	9926
1985	172,503	-22	8210
1986	178,332	+3	9292
1987	202,800	+14	15026
1988	217,022	+7	14796
1989	189,317	-13	14665

TABLE 2 - MONTHLY VISITATION

MONTH	1984	1985	1986	1987	1988	1989
JAN	819	1123	1519	3293	3906	3095
FEB	2233	2386	2401	3108	3240	1060
MAR	3929	3792	3962	4561	8135	2072
APR	4935	4596	5172	8885	9660	2540
MAY	17942	10503	12044	24209	14270	16782
JUN	31742	31990	32632	30345	37885	37390
JUL	58590	44679	48119	45105	46329	45920
AUG	56528	39711	35656	43942	42315	37729
SEP	28378	21320	22160	24041	28472	28875
OCT	10006	8470	9005	9982	11627	9284
NOV	4410	2849	2478	2877	3380	3112
DEC	1289	1084	3184	2452	7803	1458

Visitor Use/Experience

The typical visitor spends about 2 1/2 hours at CRMO, which includes a stop at the Visitor Center and a trip around the loop drive. According to a visitor survey done in the summer of 1988 most visitors come from Idaho and other nearby states (California, Colorado, Oregon, Washington, and Wyoming). The majority of visitors are first-time visitors.

The most popular walk/hike is the Spatter Cones trail which attracts about 80% of all visitors. The Caves Area trail attracts about 64 percent. North Crater Flow, Inferno Cone, Devil's Orchard and North Crater trails attract about 50% of visitors and the Tree Molds area attracts about 25 percent.

These percentages are important to determine parking turnover rates and parking area capacities. The North Crater Flow, Inferno Cone, Spatter Cone and Devils Orchard trails are all loop trails and take about the same amount of time for visitors. The North Crater Trail is longer but it is not a loop and visitors can be picked up at the terminus. The Tree Molds Trail is also not a loop but it functions more as an access to the wilderness area than a day use area. Because of the length of the Caves Trail the average length of time spent by the visitor is longer than at other interpretive areas and, therefore, the turnover rate is lower.

The campground receives heavy use during the main summer season and September. The use of the campground by RVs has increased much more than visitation as a whole has increased.

The north section of the monument can be entered via Route 402 by permit only. The group camp located there is reached by this gravel road. College geology groups are the main user group.

Accidents/Safety

Park records indicate that there have been four motor vehicle accidents at CRMO reported in the last four years. Three occurred in parking areas (both visitor center and the Caves parking areas). The other vehicle accident was a run-off-the-road accident in the S-curves on the Tree Mold spur road. There is no apparent pattern to the accidents and there is no information on the types of vehicles involved.

There have been two serious bicycle accidents neither of which involved a motor vehicle. They happened at the bottom of the steep Inferno Cone downgrade and resulted in one fatality and one with serious injuries.

Road Character/Architectural Details

The park road alignments are excellent examples of what the Park Service strives to achieve in road design. The curvilinear alignments continually change the views afforded the motorist heightening the appreciation of the significant park resources. The road follows the contours of the land without becoming an intrusion into the scene. Scars from cuts and fills are kept to a minimum. Slopes are gently rounded into the natural terrain. The roads adequately provide access to all the major features in the monument.

The black asphalt blends into the environment of CRMO better than in most parks because it matches the dark lava substrate. The asphalt curbing provides a neat yet non-disruptive delineation of the road. It also prevents visitors from randomly driving off the road creating distracting scars associated with vehicle use.

There are currently few consistently used architectural themes at CRMO for buildings or road details. The visitor center and administrative area feature Mission 66 building architecture. The dominant building material is earthtone bricks or cinder blocks. The most recent addition to the monument, the campground amphitheater, uses wooden shingles.

Tan colored concrete is used in sidewalks around the visitor center and at turnouts. An attempt was made to use a darker colored concrete on the amphitheater sidewalk but the color lightened substantially in the intense sun. Sign posts and backs throughout the monument have all been painted black to reduce visibility from a distance.

Physical Condition of Roads

The paved roads in the park are generally in fair physical condition except for excessive lateral cracking. The cracks are primarily the result of environmental factors. The expansion and contraction of the pavement caused by extreme temperature variations cause lateral cracks to form every 50 to 100 feet. The cracks traverse the full width of the pavement and reflect through the curbing, where present. Because the pavement is about 24 years old, it is dry and brittle and the cracks are becoming more frequent at closer intervals.

Since there is no vertical displacement of the pavement at the cracks and no evidence of extensive alligator cracking, it is believed that no major base failure has occurred yet. The road was originally built on native, cinder material which does not compact well. As water seeps through the cracks it washes out fines in the porous cinder material and eventually failure will occur. Traditional methods of crack sealing with liquid sealant have been tried by park maintenance crews but the material simply disappears in the porous cinders under the road. Several fabric materials have been used over the cracks with some success. They are intended to be used in conjunction with an overlay, however, and since no overlay has been placed, the fabric patches are beginning to fail.

The major roads in the park have 6-inch-high bituminous asphalt curbs, often on both sides of the road. The curbs provide an important drainage function. However, in several places erosion was noted around outlets, primarily because too much water was concentrated in one place. More outlets and/or drop inlets throughout the park would reduce this problem. This would also remove excess water from the roadway which would otherwise drain through the cracks.

Operational Problems

In general, there is insufficient or the absence of curve widening to accommodate large vehicles throughout the entire road system. Curve widening is the addition of width to the travel lanes in the curve with transitions back to the original lane width. During the field review a tour bus was video taped as it drove through the park providing documentation of which curves would need widening to keep the bus in its own lane. This problem is specific to large vehicles as passenger vehicles have no trouble staying in their lane. The problem is also specific to the two-lane/two-way roads.

Large vehicles also have trouble in all of the parking areas. They were not designed with sufficient turning radii or circulation patterns to accommodate large vehicles. Many of the parking areas lack designated parking spaces for large vehicles.

The curbs, particularly when present on both sides of the road, prevent vehicles from randomly pulling off the roadway. This has a positive effect of reducing resource damage and potential damage to vehicles. However, there are only a few turnouts throughout the park and opportunities to pull off are limited. Consequently, visitors frequently stop in the road, primarily on the one lane loop road. Bicycle use is increasing in CRMO. There is a strong potential for conflicts between bicyclists and large vehicles, particularly on the two lane/two way roads and in curves. There are insufficient shoulder area to accommodate this use and the curbs prevent bicyclists from being able to get off the road when being crowded by large vehicles.

There are several operational problems specific to individual roads and parking areas that are discussed in detail in the Route Reconnaissance Reports. The major problems worth noting in this general discussion are the congestion and confusion which occurs on Route 10 in front of the visitor center and the 18% grade at Inferno Cone on Route 500. The problem on Route 10 is a classic example of too much happening in a limited area combined with a backwards (left turns required) circulation pattern. The problem on Route 500 is that the 18% (signed for 10%) grade tends to intimidate drivers not used to mountain driving.

Maintenance

About $4,000 is spent annually on general road maintenance. The monument staff performs routine maintenance on all the monument roads. Maintenance includes snowplowing, clearing ditches and drainages, and patching of cracks and small pot holes. Striping and chip-sealing are contracted out. The State of Idaho performs snow removal on US 20/26/93.

In the winter, all roads are closed past the campground and groomed for cross country skiing. Snow removal to clear the road of drifts is required for seasonal opening. There is a need for snow pole sleeves throughout the monument along roads and in the parking areas to reduce the damage caused by snow removal equipment.

Borrow Sites

The 1966 plans for the road improvement show borrow sources located within the monument. Current NPS policy prohibits the use of borrow sources within the monument unless it can be determined, based on a written analysis, that economic factors make it totally impractical to import necessary material and if acceptable sources are identified in the resource management plan. The CRMO Resource Management Plan does not specify acceptable borrow sources within the monument. The original borrow pits as identified on the 1966 plans were used as sources of cinders. The road structural improvements recommended in this document require the use of aggregate rather than cinder. Commercial borrow sources exist in the area but are not close to CRMO. The quality of the borrow material available from these sources is unknown at this time.

Natural Resources

A more complete description of the natural and cultural environment can be found in the GMP. The following highlights elements that could influence roads and road design.

CRMO preserves features of very recent volcanic activity. The monument includes a portion of the Great Rift, a weak zone in the earth's crust that cracked open and allowed basaltic lava to pour out. Craters of the Moon NM contains volcanic features from one of four smaller rift zones that together make up the Great Rift. CRMO contains in a small area almost all the different types of volcanic features possible in basalt flows.

CRMO and the other parts of the Great Rift are most significant because of the young age of the lava flows. There were eight successive eruptive periods at CRMO, the oldest beginning about 15,000 years ago and the most recent occurring about 2,000 years ago.

The northern portion of the monument is comprised of about 4,000 acres of the foothills of the Pioneer Mountains. This area is a sagebrush grassland with patches of several different species of trees where conditions permit. It contains the only reliable surface water source in the monument, Little Cottonwood Creek, which disappears before reaching the highway. Except for isolated water holes in the lava flows, there are no other water sources in the monument.

The monument receives about 17 inches of annual precipitation at the headquarters. Most precipitation occurs as snow in December and January. Snow first falls in November and generally remains until at least April. The prevailing southwesterly winds cause the snow to drift. Drifts can be as high as 15 feet in places and can persist well into May. July and August are the driest months. The monthly average maximum temperatures range from 28.9°F to 83.7°F. Freezing temperatures can occur in any month.

That portion of the monument that is not wilderness is designated as a Class II Air Quality area. The Craters of the Moon Wilderness is a Class I area. Visibility is one of the most important resources at CRMO. The monument is used by the EPA as a baseline reference for total suspended particulates, a measure of visual quality.

There have been no soil surveys for those portions of the monument reached by road. Soils are primarily windblown loess or have developed from the underlying basalt. The majority of the monument is covered by lava flows to recent too have allowed time for soil development.

There are three basic types of volcanic material over which the road passes, pahoehoe lava, aa lava, and cinders. Pahoehoe lava has a relatively smooth surface and occurs as sheets, rope-like wrinkles, pleats, and folds. Aa lava flows have rough, jagged surfaces, and may occur as separate chunks. Cinders are small, vesicular pieces of lava that were ejected from vents and had fallen back into a pile. Cinders may occur as cones, or on slopes or in relatively level fields.

The description of vegetation concentrates on those types that occur primarily in the main portion of the monument, where the main paved roads are. The vegetation of the north end is mentioned although no road improvements are suggested for that part of the monument.

The density of vegetation at CRMO depends on the density of soil. Because the volcanic activity that formed CRMO was relatively recent, there are large areas of sparse or no vegetation where no soil has yet formed. In the newer lavas, vegetation occurs only where soil has blown into the cracks and crevices. Cinder cones and cinder fields support a different type of vegetation than the lavas. Cinder gardens are considered a distinct vegetation type. The gardens support a plant community that in its early successional stages produces a spectacular wildflower display. Typical wildflower species are

dwarf buckwheat, silverleaf phacelia, Douglas chaenactis, monkeyflower, dwarf onion, and bitterroot Lewisia. A shrub community dominated by antelope bitterbrush grows on cinder cones where soil develops. Where there is sufficient moisture, such as on north-facing slopes, limber pine occurs with the antelope bitterbrush. Where there has been enough time for soil to develop over the lavas, the dominant vegetation is shrubs (usually sagebrush and bitterbrush) and bunchgrasses, a combination termed a shrubsteppe. Rabbitbrush is a common shrub that lines the roadway in places where there is sufficient soil. Typical grasses that grow in various locations according to soil depth and available moisture include bluebunch wheatgrass, Sandberg bluegrass, needle-and-thread, squirreltail, Indian ricegrass, and Idaho fescue. The vegetation of the north end of the monument is dominated by shrubsteppe elements. There are patches of riparian vegetation and trees where conditions permit. Trees species include Douglas-fir and quaking aspen. Riparian areas support black cottonwood, willow, and mountain alder, with a dense layer of tall forbs.

The most commonly seen animals at CRMO are horned lizards, mourning doves, sage grouse, killdeer, magpies, ravens, Clark's nutcrackers, common nighthawks, mountain bluebirds, great horned owls, golden eagles, bats, rabbits, chipmunks, ground squirrels, pocket gophers, pack rats, coyotes, mule deer, and pronghorn antelope.

Mule deer are resident in the monument from April to November. The herd splits into two groups that migrate to different winter ranges. In the hot, dry summer, the deer are generally found in the cooler north end of CRMO. About three percent of the herd is killed annually by vehicles. Most of those kills occur during late summer when the deer in the north end cross the highway to forage on the visitor center lawns and to drink from the sprinkler overflows.

There are no federally or state listed, proposed, or candidate threatened or endangered plants known to occur within CRMO. There are several species of plants that occur close to the monument boundaries that are considered sensitive by the Natural Heritage Program of the Idaho Department of Fish and Game because of their rarity. Although the monument has not been surveyed for the presence of rare plants, it is very unlikely that any of the sensitive species occur close enough to the road corridor to be affected by any road work. A sensitive-plant survey would be made prior to any construction.

There are no federally or state listed, proposed, or candidate threatened or endangered animal species that occur at CRMO that would be affected by any road work. Chipmunks and golden-mantled ground squirrels are protected nongame species in Idaho. These species would be affected by disturbance during construction but there would be no permanent adverse effects on the populations as a whole.

Cultural Resources

CRMO has had only a cursory cultural resource survey. A parkwide archeological survey was conducted which focussed on only those locations thought to most likely have artifacts.

Archeology--Although there is evidence of human occupation in the vicinity of CRMO dating back 10,000 years, occupation of the monument itself has been sparse. CRMO was inhabited only seasonally, during spring and summer. Five types of sites have been recorded at CRMO: open sites, cave sites, rock structures, hunting blinds, and quarry sites. The larger open sites are probably camp sites. All the presumed camp sites are located on the northwestern sides of prominent geological features and thus sheltered from the prevailing winds. All are located near large lava sinks, which could have held water, or near intermittent streams. The distribution of sites, with larger sites in the northwestern section, is explained by easier travel in the foothills than the lava flows, and by more plentiful game and water to the north. Sites become smaller, fewer, and more scattered as one proceeds south into the lava flows.

History--The Northern Shoshone and Bannock Indians inhabited the Craters prior to the coming of the first Europeans, the fur trappers and traders, in the early 1800s. Beginning in the 1840s, Oregon-bound emigrants used Big Southern Butte, east of the monument, as a landmark. The emigrants avoided the lava fields by traveling around them to the south. Hostilities with the Indians in the 1860s forced the emigrants to use Goodale's Cutoff to the north to skirt the lava. The Cutoff was used as a stage road until 1906. None of the original cutoff remains in the monument boundaries. However, existing service roads roughly follow the alignment of the Cutoff.

Gold mining, a livestock industry, and farming developed around the Craters in the latter 1800s but very few people, including the Native Americans, ever ventured into the lava flows. Robert Limbert and a companion, W.L. Cole, first explored what is now part of the monument in 1921. Limbert's photographs and description of a fantastic world of shapes, textures, and colors was instrumental in getting Craters of the Moon National Monument established.

EVALUATION RESULTS/RECOMMENDATIONS

Functional Classification

The roads at CRMO were classified by function according to the criteria in the 1984 NPS Park Road Standards (see Figure 3). The existing classification is satisfactory for all roads except for Route 500, the scenic loop road. The loop road is inappropriately classified as "city streets." The correct classification should be Class I, Principal Park Road, because the loop constitutes the main circulatory tour for park visitors.

Currently, all the parking areas are grouped under Route 900 in the 1980 RIP. This RSE proposes to reclassify each area individually, including those at the end of spur roads, under the 900 series.

The Route Reconnaissance Reports reflect changes in the functional classification of roads and parking areas. Two of the turnouts identified in the RIP are herein reclassified as parking areas under the 900 functional classification--the North Crater Trail turnout (proposed as Route 903) and the Tree Molds picnic area (proposed as Route 908). Both of these "turnouts" are used for extended parking, not just as pullouts for faster traffic to pass. The North Crater Trail parking area is separated from the traffic lane by a painted island.

The GMP proposes that an interpretive trail be developed at Big Sink. If the plan is implemented and the existing turnout at Lava Cascades is used for Big Sink parking, that area should be classified under the 900 series.

Design Standards

The 1984 NPS Park Road Standards are the primary guidelines for design standards to be used at CRMO. They are based on actual use or ADT and suggest other design guidelines based on vehicle types. Table 3 is taken directly from the Park Road Standards. Application of these standards is subject to the specific design criteria established for CRMO. As stated in the Study Method section, the design criteria for CRMO are to maintain the existing character, minimize impacts and accommodate projected ADTs and vehicle types.

The Visitation/ Traffic Volume/ Vehicle Classification section of this study establishes the existing ADT on the main roads as 400 vehicles, plus or minus. That section also identifies a visitation growth trend of 14% over 20 years or 0.7% annually. This would make the projected ADT on the major park roads about 450. ADT is based on two way traffic. Consequently, the ADT on Route 500, the one way loop, would be one half that on the other major park roads.

The Park Road Standards differentiate between an ADT of 200-400 and one of 400-1000. Respective lane width on a two-lane/two-way road increases from 9 feet to 10 feet. Curve-widening (normally 0 to 3 feet for low speed roads) should be added to lane widths in sharp curves to accommodate large vehicles. An extra foot of lane width should be considered where tour busses are allowed. Shoulder width would increase from 2 to 3 feet as the ADT increases past 400 vehicles. The minimum total paved width recommended by the Park Road Standards for a road with an ADT of 450 would, therefore, be 26 feet.

At CRMO, the minimum roadway width of 26 feet would be 3 to 4 feet wider than the existing two-way road segments. Since the projected ADT is so close to the threshold between 9 and 10 foot lanes and 2 and 3 foot shoulders it is debatable as to whether the additional width is warranted. The minimum total width for an ADT of 200 to 400 would be 22 feet which is about the inside curb width of the existing roads. Because of the operational problems identified; the safety record for bicycles; and the realization that use will probably increase it is recommended that the minimum total width of

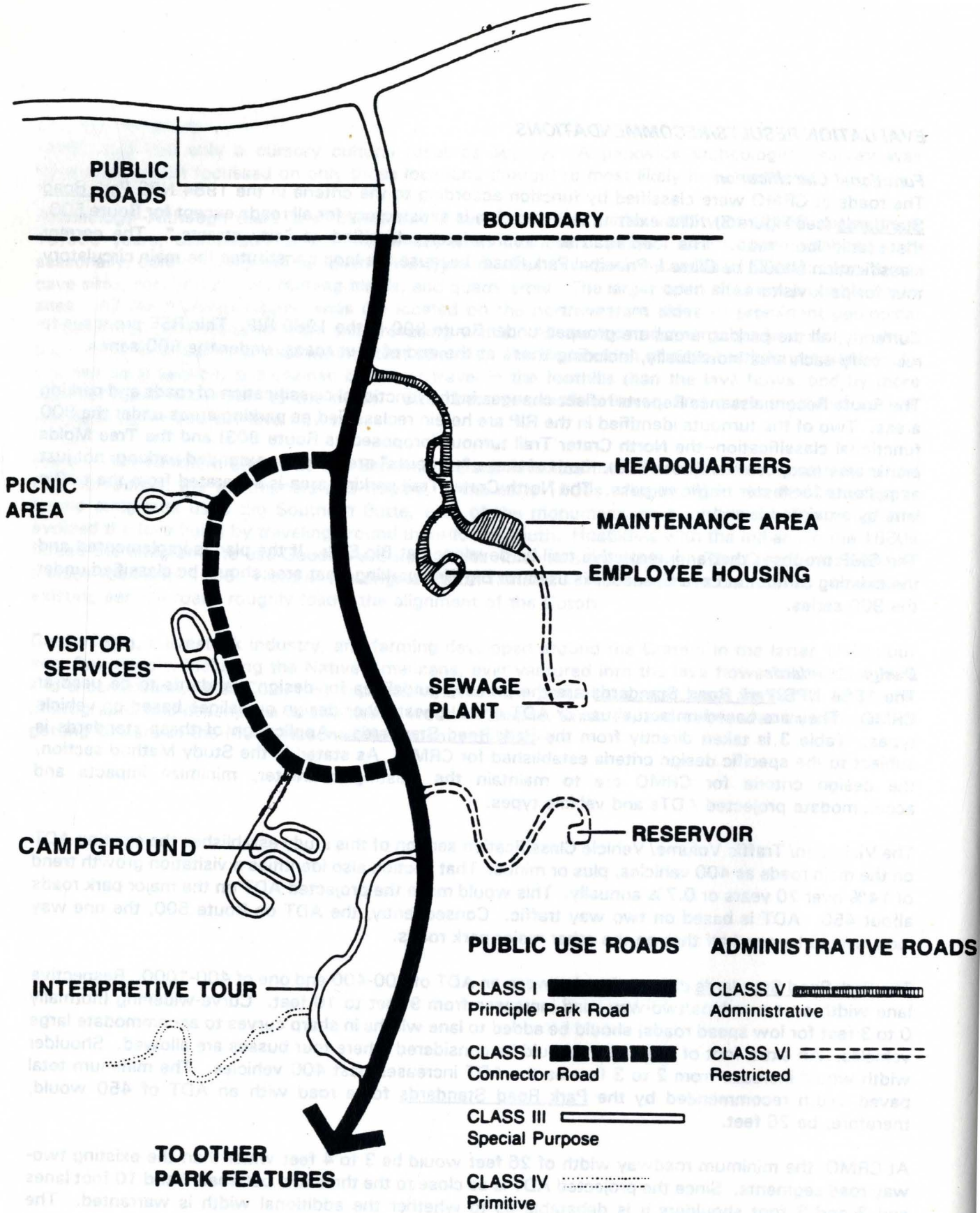


Figure 3

SCHEMATIC SHOWI
FUNCTIONAL
CLASSIFICATION
OF PARK ROADS
NATIONAL PARK SERVICE

TABLE 3 - PARK ROAD STANDARD DESIGN CRITERIA

Minimum Roadway Cross-Section Requirements

(Table 10)

Average Daily Traffic (ADT)	Number of Lanes	Lane Width Feet a/	Shoulder Width Feet/Side	Lane Surface Type(s)
50	2	8	1	Dirt/Gravel/Paved
50-200	2	9	1	Dirt/Gravel/Paved
200-400	2	9	2	Gravel/Paved
400-1000	2	10	3	Paved
1000-4000	2	11	3	Paved
4000-8000	2	11	4	Paved
8000	2	12	8 b/	Paved

a/ Widening of traffic lanes should be provided on the inside of sharp curves. Where tour buses are allowed or the proportion of recreational vehicles exceeds 5% of the design volume, an additional foot of lane width shall be considered, not to exceed 12 feet.

b/ Would only apply, as appropriate, to urban parkways.

Where guardrail is used, the graded width of shoulder should be increased to provide about 2 feet outside the guardrail posts to provide lateral support.

The total roadway width (including shoulders) for low volume, one-lane, one-way roads should not exceed 14 feet because of the tendency of drivers to use a wider facility as a two-lane road.

26 feet be used.

With shoulders and curve-widening the extra foot of lane width for buses would not be necessary. The 26 feet width would adequately accommodate all vehicle traffic. Curbing should be placed for drainage and to prevent driving off the shoulder. Curbing is about six inches wide at the base and when placed on the edge of the pavement the total paved width is one foot narrower. An effective paved width of 25 feet would still be adequate for all vehicles on all major two-lane/two-way roads at CRMO. Moderate curve widening of 1 to 2 feet on curves with a radii of less than 150 feet should be added. The intended 10 foot travelway would provide a 2 feet plus shoulder area for bicycles on each side.

The Park Road Standards state that the total width, including shoulders, for a one-lane/one-way road should not exceed 14 feet. Since the standard lane width for two-lane/two-way roads at CRMO has been established above at 10 feet, Route 500 should also have 10 foot lanes for consistency. Moderate curve widening (1 to 2 feet) should be added where curve radii of less than 150 feet exist. If the total paved width of Route 500 were 14 feet with a 10 foot lane and one foot lost to curbs, the shoulder area would be 3 feet. This would be adequate to accommodate large vehicles and bicycles. The existing paved width of Route 500 averages 14.5 feet inside the curbs.

The one- and two-way campground roads should apply the same standards as described above for travel way/lane widths. Because of the limited space in the campground and the low speeds involved paved shoulders would not be required and should not be installed. Curve widening should be included, however. Total paved width would be 20 feet on two-way roads and 14 feet on one-way roads.

The posted speed limit on CRMO roads is 15 or 25 mph. These are appropriate speeds to fulfill the intended function of roads in the park. The design speed for CRMO roads should not exceed 25 mph. This and the use of curve widening would maintain the curvilinear, rolling alignment which contributes significantly to the character of CRMO roads.

Unpaved roads in the park are primarily administrative or low use roads and are adequate as they are now. Routine maintenance and occasional resurfacing with gravel should maintain their adequacy until the function of the road changes. At that time the above standards would be applicable. Any new paved roads proposed in the future should utilize the above standards.

The above design standards are applicable to all paved roads in the park. They are discussed in more detail for specific roads in the Route Reconnaissance Reports following the narrative of this evaluation.

Construction Methods

The existing pavement on all the paved roads is old, dry, oxidated and brittle. Although there are no existing major problems other than the severe lateral cracking, problems can be anticipated in the near future due to the age of the pavement. There are early indications of incipient potholes in some places. An overlay or chip-seal would postpone the inevitable reconstruction, but such a treatment would do little to solve the more serious problem of lateral cracking. Before any design begins an in-depth geotechnical investigation should be conducted to determine the most effective and efficient construction method.

The lateral cracking is severe enough that a short-term solution is warranted in the next 2-5 years. The short-term solution is to patch the cracks and install a new surface. This surface could be a chip seal or an overlay depending on the results of the geotechnical investigation and available funds at the time. The use of fabric, as has been done on an experimental basis in the Visitor Center area, should

be evaluated. Cracks that have separated more than 1/2 inch or are cavitating should be cut out and compacted material and asphalt inserted before patching. More narrow cracks 1/8 to 1/2 inch wide should be sealed when they are at maximum separation. If a proper aggregate source can be located, a well-designed slurry seal may be used as both a crack-seal and a general seal for the entire roadway. This latter procedure would be faster than filling small cracks individually and would increase the stability of the surface. A proper aggregate is one that is graded. The size variation of the particles serves to increase the stability of the seal coat. The life expectancy of this treatment is between 5 and 10 years.

Reconstruction of the entire paved road system seems to be the only appropriate long-term solution to the cracking problem. The existing pavement could be recycled. It would be picked up, pulverized and rejuvenating oil or new asphalt added as a structural "black" base. A flexible asphalt mat should then be placed over the reconstructed base. The use of the recycled existing pavement as a base will reduce the need for imported borrow and keep the profile of the new road lower. The use of fabric should again be evaluated. Asphalt curbing, as exists now, should be installed and other drainage improvements made during reconstruction.

Access and Circulation

The congestion that exists in front of the Visitor Center is primarily due to the lack of parking for large vehicles. Although this is a problem in all of the parking areas, it is most noticeable at the Visitor Center because it occurs more often there. The GMP will propose a long-term solution to the problem. On a short-term basis, the park should re-design the parking area east of the Visitor Center with pull-through spaces. It is currently designed and striped for autos, but is used by large vehicles out of necessity. A suggested re-design would decrease the width of the existing island and improve the radii of the access points for large vehicles. The new design would be simple enough for construction by small contract or the park maintenance staff.

Phasing and Costs

Normally, projects are programmed according to how much work can logically be done in a construction season with a reasonable amount of funds. The construction season at CRMO is between April or May and October or November. Based on past FLHP programs, a reasonable amount of funds for the short term repairs proposed in this study would be about $700,000. A reasonable amount for the long term repairs would be about $2,000,000. The third factor that is considered when determining phasing is a logical sequence of work that can be accomplished without undue disruption to the park visitor and park operations.

Phasing should be considered if there is more work than can be accomplished in one project. Because of the circulation pattern in the park, Route 10 will essentially be a haul route for material and equipment used on Route 500. It is prudent to haul over Route 10 before improving it so as to avoid damaging new pavement. Therefore, if phasing is necessary, it is recommended that Route 500 and the associated spur roads and parking areas be improved first. Route 10 and associated roads and parking should be done as a second phase. This will also keep road work relatively isolated to reduce disruption to visitors and park operations. It may be necessary to close Route 500 during construction since half-width construction to pass traffic would be very difficult on a 14 foot wide road. This could be done at the end of the peak visitation season, if warranted, to reduce visitor inconvenience.

The cost estimates presented in this study are based on unit costs per mile as determined by completed projects in areas similar to CRMO. They include all elements of construction including patching, chip sealing, fabric and overlaying for short term work and recycling, earthwork, widening, fabric, overlay, curbs and parking area redesign for long term work. The estimates also include

construction engineering and supervision and a contingency factor. All estimates are in 1990 dollars. A unit cost of $50,000 per mile for chip sealing and $200,000 per mile for overlaying is used for short term work. Various reconstruction options would average about $500,000 for long term work.

There are about 7 miles of paved road in the park. Chip sealing would cost about $350,000 and overlaying about $1,400,000. Reconstruction would cost about $3,500,000. These estimates are for programming purposes only. More precise estimates will be available after a geotechnical investigation is done and the appropriate construction methods identified.

Revegetation

Revegetation at CRMO will be required for areas disturbed by construction. Revegetation is difficult because of the harsh climate, scarcity of water, and rocky substrate with little soil. The foreslopes of the existing road show little evidence of natural revegetation where cinders from borrow pits were spread. However, where soil has blown onto the cinders, annual plants are seen. If soil similar to that which is naturally deposited by wind in undisturbed areas were mixed with the cinders, the success rate of revegetation would be increased. Soil investigations should be scheduled as soon as possible. Seeds of naturally occurring plants should be used for revegetation. The park should begin experimenting soon with revegetation in anticipation of the road improvements. An effective revegetation program should be initiated two to three years prior to construction in order to ensure an adequate seed and/or plant supply. Experimentation prior to this is important in order to determine success rates, special methods required, preferred plants to use, etc.

Road Character/Architectural Details

The low speed, meandering character of the road should not appreciably change. Only the main two-lane/two-way roads would be widened and only by 3 to 4 feet. All widening would be on one side of the road to reduce new disturbance. The design speed would be such that the existing alignment would be used for the reconstructed road. The one-lane/one-way road (Route 500) would actually be narrowed by the recommendation from 14.5 feet to 13 feet. The most notable change in the visual character of the road as proposed by this study would be the addition of a white stripe to delineate the shoulder for bicycle use. Under current conditions the dark pavement blends well with the dark surrounding substrate making the road relatively unobtrusive. The white stripe would change this character element. The question is do the advantages to bicycle safety justify the change?

The current practice of painting the back of signs and posts black should continue consistently throughout the park. The current use of wooden shingles for roofing material as used at the campground amphitheater should be perpetuated throughout the park for kiosks, restrooms or other structures at interpretive areas. Building walls should utilize the block typical in the headquarters area. The current practice of using colored concrete for sidewalks and curbs in developed areas should be continued, also. Further experimentation with darker colors as tried with the amphitheater sidewalks should be pursued as the darker grey to black would be more appropriate than the tan to brown used now.

In addition to these current practices that should be continued other details should also be used consistently throughout the park. Currently the only walls in the park are for screening in the headquarters area and they are constructed of block material. There are several current situations in the park where walls to control pedestrian movements are warranted such as in front of the visitor center. Block walls would not be appropriate for this application. The use of rustic split rail wooden fences or volcanic rock veneer walls would be. Where retaining walls are used to reduce cut or fill disturbance they too should have a veneer of volcanic rock. They should be used at interpretive area parking areas and around the visitor center to control pedestrians. When interpretive displays are not

mounted to the rock walls described above they should be mounted to an appropriately scaled, rock veneer base. Native volcanic material should also be used to armor drainage outfalls and prevent erosion.

Finally, all curbs throughout the park should be backfilled to the top of the curb with volcanic material to match naturally occurring material. This gives a finished appearance and blends the structure into the environment better. It also has positive drainage advantages.

Compliance Documentation

The impacts of improving the CRMO roads are addressed at a general level in the EA that accompanies the GMP. If the scope of work for the improvements is such that there would be no impacts outside of the existing disturbed corridor, including the existing parking areas, the project would meet the criteria for a Categorical Exclusion (CE). Implementing the recommendations of this study for the long-term solution of the cracking problem, widening the curves, or adding width to the road prism involve work that would create some impacts outside the existing disturbed area. In that case, a supplemental EA to update the general treatment in the GMP/EA may be required prior to construction once the road improvement work is actually scheduled and funded.

There has been only a preliminary archeological reconnaissance done at CRMO. Archeological surveys would be required prior to any ground-disturbing activities. No major sites are expected to be found in close proximity to the road corridor or near the parking areas. If sites are found that would be adversely impacted by road work, mitigation in consultation with the Idaho state historic preservation officer would be required for compliance with Section 106 of the National Historic Preservation Act.

A determination on the potential significance of the two historical log buildings in the campground and the boneyard needs to be made prior to any disturbance of the buildings. No disturbance to the campground log comfort station is anticipated based on the proposals of this RSE. If a new entrance road is designed to use the existing boneyard road, the log building adjacent to the road be disturbed. Disturbance would require consultation with the state historic preservation officer as described above.

ROUTE RECONNAISSANCE REPORTS

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 10 Entrance Road

PURPOSE/FUNCTION: Main park entrance from Highway 20/26/93 to the beginning of Route 500 -- Loop Rd. Provides access to the visitor center, administrative area, campground and interpretive areas.

FUNCTIONAL CLASSIFICATION: Class I Principal Park Road

ROUTE INFORMATION:

Total Length: 1.94 miles
Total Width: 22 - 23 feet
No. of Lanes: 2
Lane/Shoulder Width: 11/0 (no stripe)
Surface Type: Asphalt
Posted Speed: 15 & 25 mph
Existing ADT: 400
Projected ADT: 450
Terrain: Rolling
Overall Condition: Fair to Poor

PHYSICAL CONDITION: The 1980 RIP rated this road as good. Since then the lateral cracking has increased dramatically (every 25-50 feet). Cracks span the entire width and reflect through curbs where present. No severe displacement of the cracks has been noticed yet overall. In front of the visitor center some crack displacement and alligator cracking exists.

OPERATIONAL PROBLEMS: It is a short distance from the highway to the visitor center. All in- and outbound traffic must pass through the two-lane section in front of the visitor center. When there are numerous vehicles wanting to enter or depart the park, any indecision creates stacking problems in an already congested area. Traffic conflicts are compounded by vehicles having to make left-hand turns into the visitor and administrative facility parking areas. A better circulation design would utilize right-hand turns. At the fee station, about a quarter mile from the visitor center, there is no stacking lane and all incoming traffic is halted. This often adds to the congestion in the general area.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present near the road. An archeological survey is needed except near the developed area. The developed area was surveyed and no sites were found. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

Route # 10 Entrance Road

NEEDS: A structural base, drainage improvements, curve widening, and a striped shoulder inside the curb useable by bicycles.

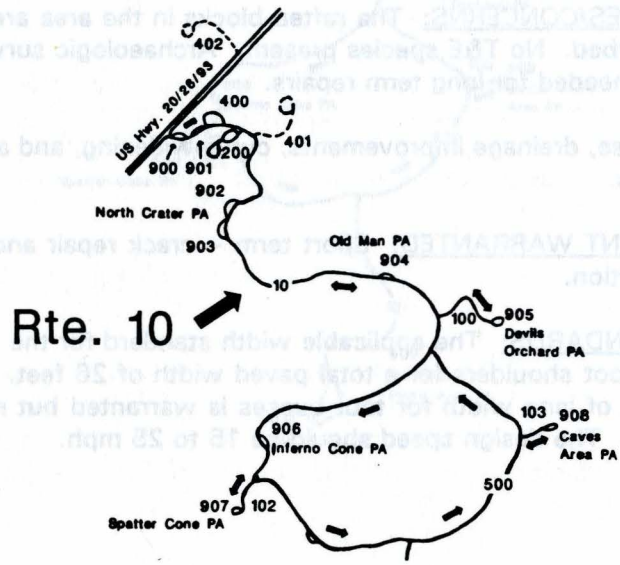
TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and a new surface treatment. Long term -- Reconstruction.

1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is 10 foot lanes and 3 foot shoulders for a total paved width of 26 feet. Curve widening should be applied. The extra foot of lane width for tour busses is warranted but not necessary due to curve widening and shoulders. The design speed should be 15 to 25 mph.

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant during the hottest time of the year or with an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; chip seal or overlay on existing alignment at existing width; replace curbs as needed. Needed in 2 to 5 years. Long term -- Grind up existing pavement and shape subgrade; apply curve widening of 1-2 feet on the existing alignment shifting all widening (centerline) from side to side to reduce new disturbance; add asphalt or rejuvenating oil to ground asphalt as a black, structural base; lay flexible asphalt and install curbs and additional drainage outfalls as needed. Needed in 5 to 10 years.

COSTS: Short term -- $100,000 or $400,000 Long term -- $1,000,000

PRIORITY: II -- If phasing is warranted this road should be done in Phase II since this will be the haul road for work on the Loop Drive it should be done last. Also, this gives time for final decision on relocated visitor center and funding/implementation.



CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 100 Devils Orchard Road

PURPOSE/FUNCTION: Access road to an interpretive trail head in Devil Orchard.

FUNCTIONAL CLASSIFICATION: Class II Connector Park Road

ROUTE INFORMATION:

Total Length: 0.35 miles
Total Width: 22 - 23 feet
No. of Lanes: 2
Lane/Shoulder Width: 11/0(no stripe)
Surface Type: Asphalt
Posted Speed: No sign(25 mph)
Existing ADT: 400
Projected ADT: 450
Terrain: Rolling/Flat
Overall Condition: Fair

PHYSICAL CONDITION: 1980 RIP rated this road as good. Since then lateral cracking has increased (25-50 feet). Cracks span entire width and reflect through curbs where present. No severe displacement of cracks noticed yet.

OPERATIONAL PROBLEMS: None

ENVIRONMENTAL ISSUES/CONCERNS: The rafted blocks in the area are unusual volcanic features and should not be disturbed. No T&E species present. Archaeologic survey needed. CE needed for short term repairs. EA needed for long term repairs.

NEEDS: A structural base, drainage improvements, curve widening, and a striped shoulder inside the curb useable by bicycles.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and a new surface treatment. Long term -- Reconstruction.

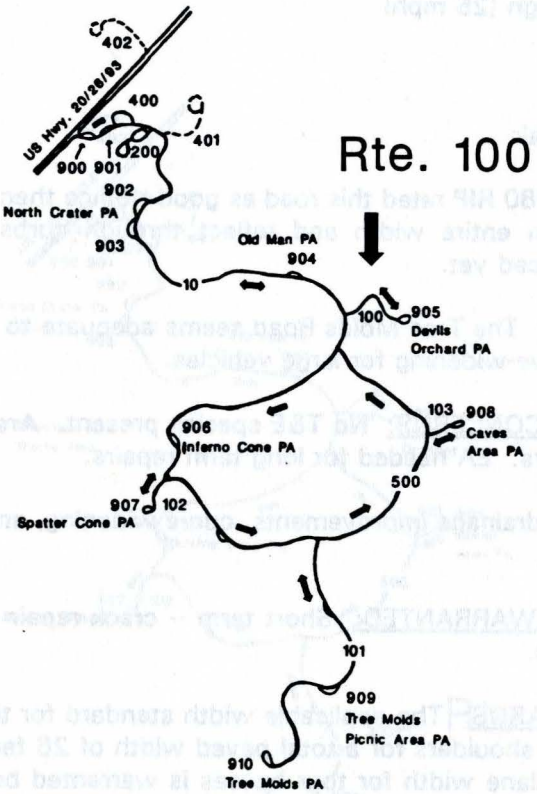
1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is 10 foot lanes and 3 foot shoulders for a total paved width of 26 feet. Curve widening should be applied. The extra foot of lane width for tour busses is warranted but not necessary due to curve widening and shoulders. The design speed should be 15 to 25 mph.

Route # 100 Devils Orchard Road

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant during the hottest time of the year or with an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; chip seal or overlay on existing alignment at existing width; replace curbs as needed. Needed in 2 to 5 years. Long term -- Grind up existing pavement and shape subgrade; apply curve widening of 1-2 feet on the existing alignment shifting all widening (centerline) from side to side to reduce new disturbance; add asphalt or rejuvenating oil to ground asphalt as a black, structural base; lay flexible asphalt and install curbs and additional drainage outfalls as needed. Needed in 5 to 10 years.

COSTS: Short term -- $17,500 or $70,000 Long term -- $175,000

PRIORITY: II -- If phasing is warranted this road should be done in Phase II.



CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 101 Tree Molds Road

PURPOSE/FUNCTION: Access to Big Sink and Lava Cascades interpretive features and trailhead for Tree Molds area and other wilderness areas.

FUNCTIONAL CLASSIFICATION: Class II Connector Park Road

ROUTE INFORMATION:

Total Length: 1.20 miles
Total Width: 22 - 23 feet
No. of Lanes: 2
Lane/Shoulder Width: 11/0 (no stripe)
Surface Type: Asphalt
Posted Speed: No sign (25 mph)
Existing ADT: 400
Projected ADT: 450
Terrain: Rolling/Flat
Overall Condition: Fair

PHYSICAL CONDITION: 1980 RIP rated this road as good. Since then lateral cracking has increased (25-50 feet). Cracks span entire width and reflect through curbs where present. No severe displacement of cracks noticed yet.

OPERATIONAL PROBLEMS: The Tree Molds Road seems adequate to accommodate traffic with the exception of little or no curve-widening for large vehicles.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species present. Archaeologic survey needed. CE needed for short term repairs. EA needed for long term repairs.

NEEDS: A structural base, drainage improvements, curve widening, and a striped shoulder inside the curb useable by bicycles.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and a new surface treatment. Long term -- Reconstruction.

1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is 10 foot lanes and 3 foot shoulders for a total paved width of 26 feet. Curve widening should be applied. The extra foot of lane width for tour busses is warranted but not necessary due to curve widening and shoulders. The design speed should be 15 to 25 mph.

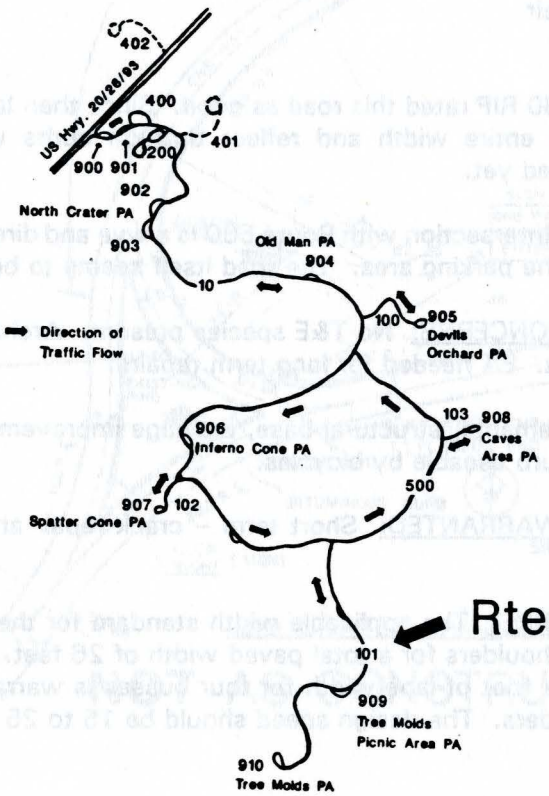
Route # 101 Tree Molds Road

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant during the hottest time of the year or with an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; chip seal or overlay on existing alignment at existing width; replace curbs as needed. Needed in 2 to 5 years. Long term -- Grind up existing pavement and shape subgrade; apply curve widening of 1-2 feet on the existing alignment shifting all widening (centerline) from side to side to reduce new disturbance; add asphalt or rejuvenating oil to ground asphalt as a black, structural base; lay flexible asphalt and install curbs and additional drainage outfalls as needed. Needed in 5 to 10 years.

COSTS: Short term -- $60,000 or $240,000 Long term -- $600,000

PRIORITY: I -- If phasing is warranted this road should be done in Phase I.

PLANNING NOTE: The draft GMP recommends development of an interpretive trail at the Big Sink area which would require trail head parking on Route 101. At this time it is not known where the trail would be located. An increased traffic volume on the road and parking demand for a new or existing parking area could be expected following development of the trail.



CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route #102 Spatter Cone Road

PURPOSE/FUNCTION: Access to Spatter Cone interpretive area and terminus of North Crater Trail.

FUNCTIONAL CLASSIFICATION: Class II Connector Park Road

ROUTE INFORMATION:

Total Length: 0.10 mile
Total Width: 22 feet
No. of Lanes: 2
Lane/Shoulder Width: 11/0
Surface Type: Asphalt
Posted Speed: No Sign (25 mph)
Existing ADT: 400
Projected ADT: 450
Terrain: Rolling
Overall Condition: Fair

PHYSICAL CONDITION: 1980 RIP rated this road as good. Since then lateral cracking has increased (25-50 feet). Cracks span entire width and reflect through curbs where present. No severe displacement of cracks noticed yet.

OPERATIONAL PROBLEMS: Intersection with Route 500 is a wye and directs most motorists onto this road and subsequently into the parking area. The road itself seems to be adequate.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species present. Archaeologic survey needed. CE needed for short term repairs. EA needed for long term repairs.

NEEDS: Intersection improvements, structural base, drainage improvements, curve widening, and a striped shoulder inside the curb useable by bicycles.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and a new surface treatment. Long term -- Reconstruction.

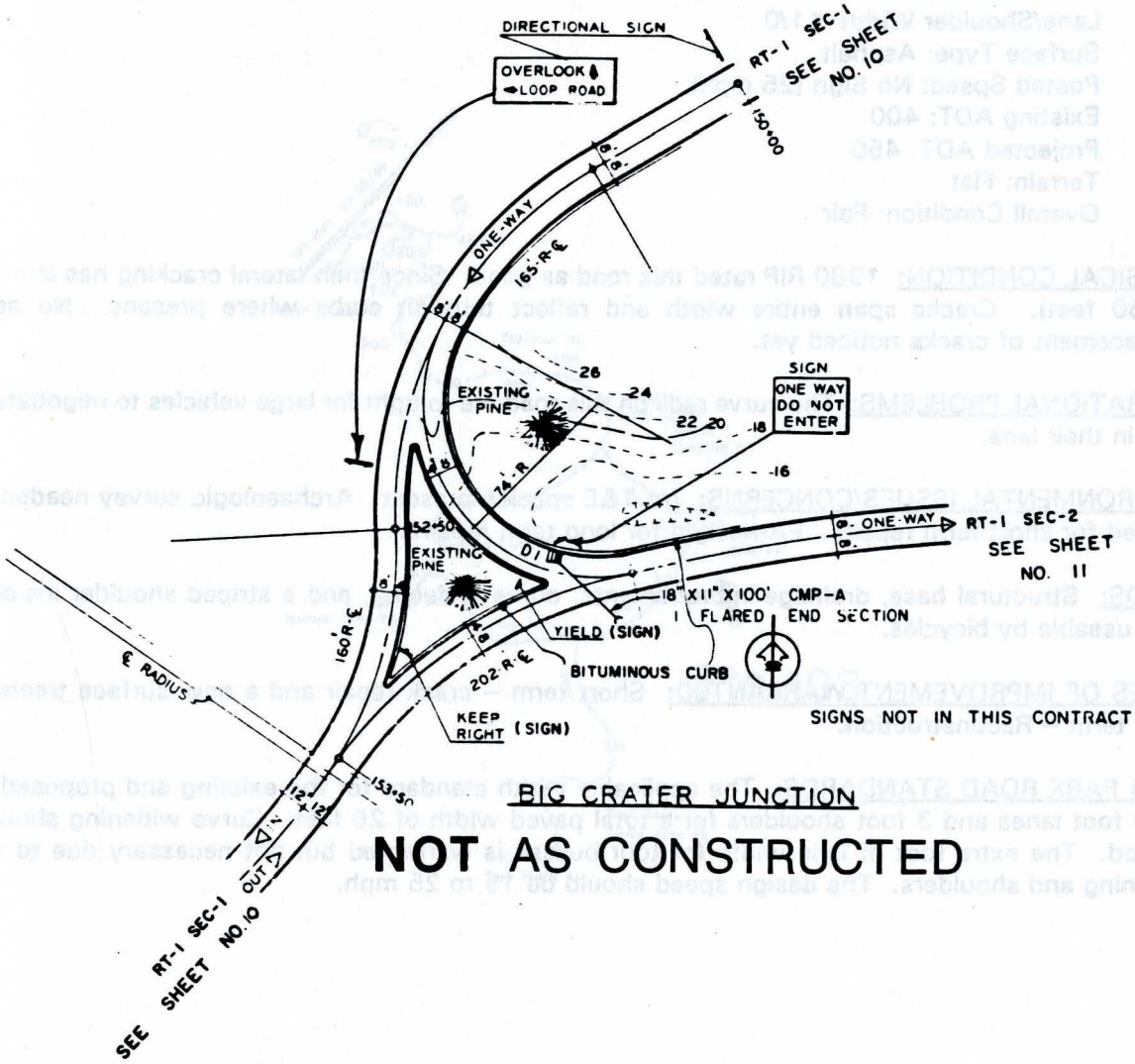
1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is 10 foot lanes and 3 foot shoulders for a total paved width of 26 feet. Curve widening of 1-2 feet should be applied. The extra foot of lane width for tour busses is warranted but not necessary due to curve widening and shoulders. The design speed should be 15 to 25 mph.

Route # 102 Spatter Cone Road

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant during the hottest time of the year or with an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; chip seal or overlay on existing alignment at existing width; replace curbs as needed. Needed in 2 to 5 years. Long term -- Grind up existing pavement and shape subgrade; apply curve widening of 1-2 feet on the existing alignment shifting all widening (centerline) from side to side to reduce new disturbance; add asphalt or rejuvenating oil to ground asphalt as a black, structural base; lay flexible asphalt and install curbs and additional drainage outfalls as needed. Needed in 5 to 10 years.

COSTS: Short Term -- $5,000 or $20,000 Long Term -- $50,000

PRIORITY: I -- If phasing is warranted this road should be done in Phase I.



BIG CRATER JUNCTION

NOT AS CONSTRUCTED

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 103 Caves Road

PURPOSE/FUNCTION: Access to the Caves Area interpretive trail.

FUNCTIONAL CLASSIFICATION: Class II Connector Park Road

ROUTE INFORMATION:

Total Length: 0.18 mile
Total Width: 22-23 feet
No. of Lanes: 2
Lane/Shoulder Width: 11/0
Surface Type: Asphalt
Posted Speed: No Sign (25 mph)
Existing ADT: 400
Projected ADT: 450
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: 1980 RIP rated this road as good. Since then lateral cracking has increased (25-50 feet). Cracks span entire width and reflect through curbs where present. No severe displacement of cracks noticed yet.

OPERATIONAL PROBLEMS: The curve radii on this road are to tight for large vehicles to negotiate and stay in their lane.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species present. Archaeologic survey needed. CE needed for short term repairs. EA needed for long term repairs.

NEEDS: Structural base, drainage improvements, curve widening, and a striped shoulder inside the curb useable by bicycles.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and a new surface treatment. Long term -- Reconstruction.

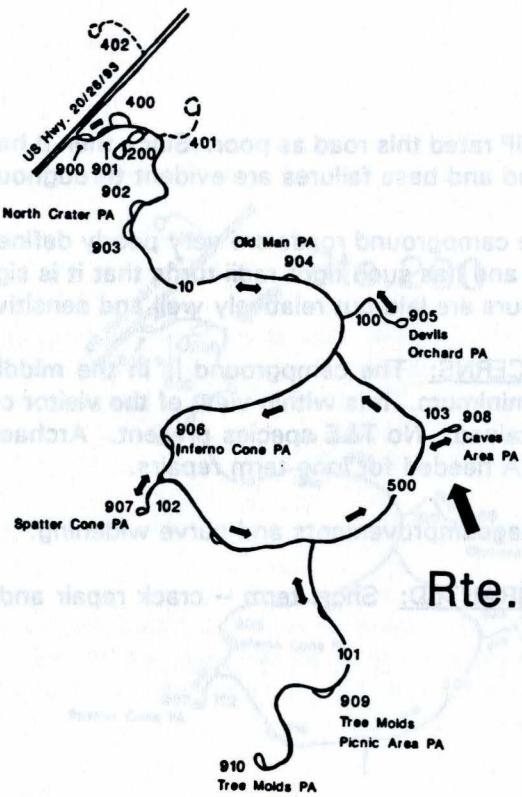
1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is 10 foot lanes and 3 foot shoulders for a total paved width of 26 feet. Curve widening should be applied. The extra foot of lane width for tour busses is warranted but not necessary due to curve widening and shoulders. The design speed should be 15 to 25 mph.

Route # 103 Caves Road

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant during the hottest time of the year or with an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; chip seal or overlay on existing alignment at existing width; replace curbs as needed. Needed in 2 to 5 years. Long term -- Grind up existing pavement and shape subgrade; apply curve widening of 1-2 feet on the existing alignment shifting all widening (centerline) from side to side to reduce new disturbance; add asphalt or rejuvenating oil to ground asphalt as a black, structural base; lay flexible asphalt and install curbs and additional drainage outfalls as needed. Needed in 5 to 10 years.

COSTS: Short Term -- $9,000 or $36,000 Long Term -- $90,000

PRIORITY: I -- If phasing is warranted this road should be done in Phase I.



CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 200 Campground Road

PURPOSE/FUNCTION: Provide access to and circulation within the campground.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose Road

ROUTE INFORMATION:

Total Length: 0.45 miles
Total Width: 18-20 two-way / 10-14.5 one-way
No. of Lanes: 1/2
Lane/Shoulder Width: Not stripped
Surface Type: Asphalt
Posted Speed: No sign (15 mph)
Existing ADT: 50
Projected ADT: 57
Terrain: Rolling
Overall Condition: Poor

PHYSICAL CONDITION: 1980 RIP rated this road as poor. Since then it has cracked and deteriorated more. Edges are severely ravelled and base failures are evident throughout.

OPERATIONAL PROBLEMS: The campground roads are very poorly defined and hard to follow. The most westerly loop is so narrow and has such tight radii turns that it is signed for no trailers or large RVs. The individual campsite spurs are laid out relatively well and sensitively for the environment.

ENVIRONMENTAL ISSUES/CONCERNS: The campground is in the middle of a lava flow and new disturbance should be held to a minimum. It is within view of the visitor center but nicely screened -- that screening should be maintained. No T&E species present. Archaeologic survey needed. CE needed for short term repairs. EA needed for long term repairs.

NEEDS: A structural base, drainage improvements and curve widening.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and a new surface treatment. Long term -- Reconstruction.

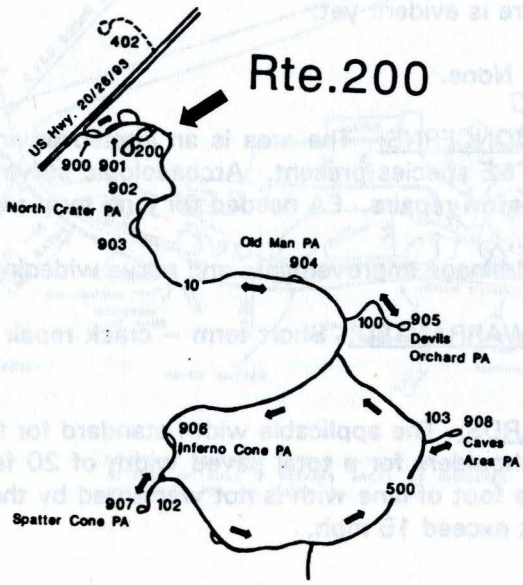
Route # 200 Campground Road

1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is 9 foot lanes and 1 foot shoulders for a total paved width on the two-lane/two-way segments of 20 feet. The PRS state that one-lane/one-way roads should not exceed 14 feet of total paved width. Curve widening should be applied. The extra foot of lane width is warranted for the large RVs but not necessary due to curve widening and low speeds. The design speed should not exceed 15 mph.

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant during the hottest time of the year or with an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; chip seal or overlay on existing alignment at existing width; replace curbs as needed. Needed in 2 to 5 years. Long term -- Grind up existing pavement and shape subgrade; apply curve widening of 1-2 feet on the existing alignment shifting all widening (centerline) from side to side to reduce new disturbance; add asphalt or rejuvenating oil to ground asphalt as a black, structural base; lay flexible asphalt and install curbs and additional drainage outfalls as needed. Needed in 5 to 10 years.

COSTS: Short term -- $22,500 or $60,000 Long term -- $150,000

PRIORITY: II -- Do with Route 10 (not eligible for FLHP funding)



Route # 400 Residence Road

PURPOSE/FUNCTION: Provides access to and circulation within the NPS housing area.

FUNCTIONAL CLASSIFICATION: Class V Administrative Road

ROUTE INFORMATION:

Total Length: 0.13 miles
Total Width: 22 feet
No. of Lanes: 2
Lane/Shoulder Width: 11/0 (no stripe)
Surface Type: Asphalt
Posted Speed: No sign (15 mph)
Existing ADT: 50
Projected ADT: 57
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: The 1980 RIP rated this road as good. Since then the lateral cracking has increased. No displacement of cracks is evident yet. The pavement is old, oxidated, and brittle but no noticeable structural failure is evident yet.

OPERATIONAL PROBLEMS: None.

ENVIRONMENTAL ISSUES/CONCERNS: The area is an altered environment with lawns and other domestic landscaping. No T&E species present. Archaeologic survey was done and no sites were found. CE needed for short term repairs. EA needed for long term repairs.

NEEDS: A structural base, drainage improvements and curve widening.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and a new surface treatment. Long term -- Reconstruction.

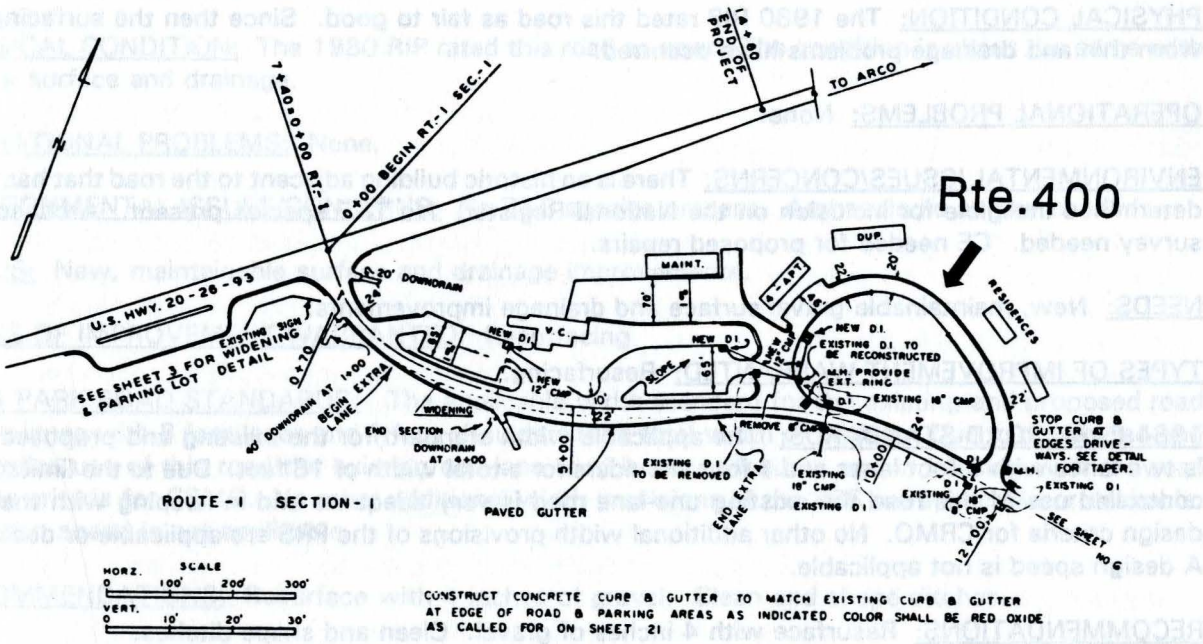
1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is 9 foot lanes and 1 foot shoulders for a total paved width of 20 feet. There are no curves that warrant widening. The extra foot of lane with is not warranted by the vehicle types using the road. The design speed should not exceed 15 mph.

Route # 400 Residence Road

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant during the hottest time of the year or with an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; chip seal or overlay on existing alignment at existing width; replace curbs as needed. Needed in 2 to 5 years. Long term -- Grind up existing pavement and shape subgrade; apply curve widening of 1-2 feet on the existing alignment shifting all widening (centerline) from side to side to reduce new disturbance; add asphalt or rejuvenating oil to ground asphalt as a black, structural base; lay flexible asphalt and install curbs and additional drainage outfalls as needed. Needed in 5 to 10 years.

COSTS: Short term -- $6,500 or $25,000 Long term -- $65,000

PRIORITY: II -- Do with Route 10 (not eligible for FLHP funds)



CRATERS OF THE MOON
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 401 Boneyard Service Road

PURPOSE/FUNCTION: Provides access to maintenance storage area.

FUNCTIONAL CLASSIFICATION: Class V Administrative Road

ROUTE INFORMATION:

Total Length: 0.27 miles
Total Width: 12 feet
No. of Lanes: 1
Lane/Shoulder Width: N/A
Surface Type: Gravel
Posted Speed: No sign
Existing ADT: 10
Projected ADT: 10
Terrain: Flat
Overall Condition: Fair/Poor

PHYSICAL CONDITION: The 1980 RIP rated this road as fair to good. Since then the surfacing has worn thin and drainage problems have occurred.

OPERATIONAL PROBLEMS: None.

ENVIRONMENTAL ISSUES/CONCERNS: There is an historic building adjacent to the road that has been determined ineligible for inclusion on the National Register. No T&E species present. Archaeologic survey needed. CE needed for proposed repairs.

NEEDS: New, maintainable gravel surface and drainage improvements.

TYPES OF IMPROVEMENT WARRANTED: Resurfacing.

1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is two lanes with 8 foot lanes and 1 foot shoulders for a total width of 18 feet. Due to the limited and controlled use of this road the existing one-lane road is very adequate and in keeping with the road design criteria for CRMO. No other additional width provisions of the PRS are applicable or desirable. A design speed is not applicable.

RECOMMENDATIONS: Resurface with 4 inches of gravel. Clean and shape ditches.

COSTS: $5,000

PRIORITY: III -- Not an essential project to maintain adequate public access. ***NOTE:*** May be involved in a GMP proposal.

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 402 North Access Road

PURPOSE/FUNCTION: Provides access to the water reservoir, group camp, researchers camp, and Little Cottonwood Creek and Springs.

FUNCTIONAL CLASSIFICATION: Class V Administrative Road

ROUTE INFORMATION:

Total Length: 2.62 miles
Total Width: 12 feet
No. of Lanes: 1
Lane/Shoulder Width: N/A
Surface Type: Gravel
Posted Speed: No sign
Existing ADT: 10
Projected ADT: 10
Terrain: Rolling/Mountainous
Overall Condition: Poor

PHYSICAL CONDITION: The 1980 RIP rated this road as poor. The condition is about the same with a poor surface and drainage.

OPERATIONAL PROBLEMS: None.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species present. Archaeologic survey needed.

NEEDS: New, maintainable surface and drainage improvements.

TYPES OF IMPROVEMENT WARRANTED: Resurfacing

1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is two lanes with 8 foot lanes and 1 foot shoulders for a total width of 18 feet. Due to the limited and controlled use of this road the existing one-lane road is very adequate and in keeping with the road design criteria for CRMO. No other additional width provisions of the PRS are applicable or desirable. A design speed is not applicable.

RECOMMENDATIONS: Resurface with 4 inches of gravel. Clean and shape ditches.

COSTS: $30,000

PRIORITY: III -- Not an essential project to maintain adequate public access.

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 500 Scenic Loop Drive

PURPOSE/FUNCTION: Primary visitor access to scenic and interpretive features, including Tree Molds Road and wilderness access.

FUNCTIONAL CLASSIFICATION: Class I Principal Park Road

ROUTE INFORMATION:

Total Length: 2.77 miles
Total Width:14.5 feet
No. of Lanes: 1
Lane/Shoulder Width: No stripe
Surface Type: Asphalt
Posted Speed: 25 mph
Existing ADT: 200
Projected ADT: 225
Terrain: Rolling
Overall Condition: Fair/Poor

PHYSICAL CONDITION: The 1980 RIP rated this road as good. Since then the lateral cracking has increased dramatically (every 25-50 feet). Cracks span the entire width and reflect through curbs where present. No severe displacement of the cracks has been noticed yet overall.

OPERATIONAL PROBLEMS: There are several tight curves that are difficult for large tour busses to negotiate. The road design (alignment and superelevation) at the entrance to the Spatter Cones parking area is such that visitors are essentially directed to enter the Spatter Cones parking area. The road has a steep 18.8% downgrade on the southwest side of Inferno Cone that begins at approximately m.p. 1.26. The grade is signed at 10%. Some visitors are very apprehensive about this grade and have turned around on the one-way road, or required the services of the park staff to drive their vehicle down the grade. There is a 0.03 mile-long turnout at the top of the steep grade which helps alleviate this problem but it also serves as the Big Sink View parking area (per the 1966 road plans) and can be crowded at times. There is a draft GMP proposal to create a new Big Sink trail head parking area which could help. Another separate but related problem in the same area is that visitors stop in the road prior to the turnout to get photographs of the Spatter Cones, creating a hazard and traffic backups. A new turnout or parking area prior to the turnout at the top of the grade, which is too far past the best scenic spot, would improve the situation and the visitor experience.

ENVIRONMENTAL ISSUES/CONCERNS: Road goes through or is adjacent to the most notable volcanic features in the park and new disturbance should be held to a minimum. No T&E species are present near the road. An archeological survey is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base, drainage improvements, curve widening, and a striped shoulder inside the curb useable by bicycles.

Route #500 Scenic Loop Drive

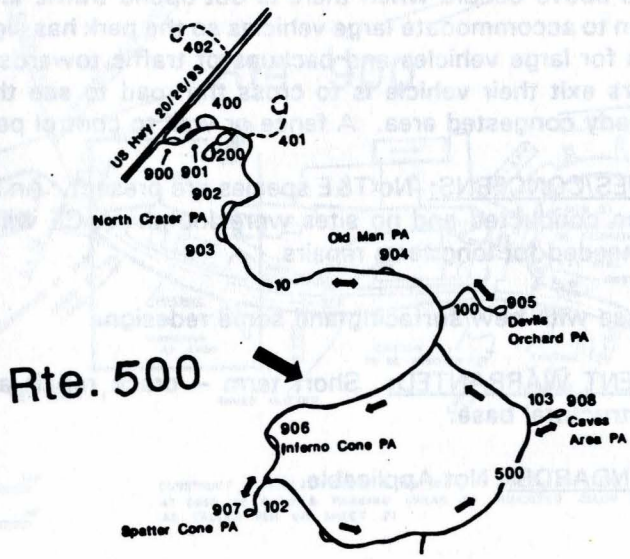
TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and a new surface treatment. Long term -- Reconstruction.

1984 PARK ROAD STANDARDS: The applicable width standard for the existing and proposed road is not to exceed 14 feet for a one-lane/one-way road. Curve widening of 1-2 feet should be applied. The extra foot of lane width for tour busses is warranted but not necessary due to curve widening and a shoulder. The design speed should be 15 to 25 mph.

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant during the hottest time of the year or with an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; chip seal or overlay on existing alignment at existing width; replace curbs as needed. Needed in 2 to 5 years. Long term -- Grind up existing pavement and shape subgrade; apply curve widening of 1-2 feet on the existing alignment shifting all widening (centerline) from side to side to reduce new disturbance; add asphalt or rejuvenating oil to ground asphalt as a black, structural base; lay flexible asphalt and install curbs and additional drainage outfalls as needed. Needed in 5 to 10 years.

COSTS: Short term -- $138,500 or $335,000 Long term -- $830,000

PRIORITY: I -- Primary visitor use route. Should be reconstructed first to avoid haul damage to Route 10 if phasing is warranted.



CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 900 West Visitor Center Parking

PURPOSE/FUNCTION: Provide parking for auto and pick-up size vehicles at a primary visitor attraction.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 7,000 square feet
Capacity: 32 auto & 2 handicapped spaces
Surface Type: Asphalt
Terrain: Flat/Rolling
Overall Condition: Poor

PHYSICAL CONDITION: Severe cracks (every 25-50 feet) span the entire width and reflect through curbs. Some crack displacement and alligator cracking exists.

OPERATIONAL PROBLEMS: The entrance to this parking area is very close to the approach to Hwy. 23/20/93. Any indecision or hesitation by motorists at the entrance can cause a backup of traffic towards the highway. Most users of the visitor center are in-bound park visitors which means they must make a left turn to enter the parking area. Since there is no channelization for the left turn the same problem described above occurs when there is out-bound traffic impeding the left turn. This parking area is not design to accommodate large vehicles so the park has signed it for autos only, often causing great confusion for large vehicles and backups of traffic towards the highway. A common occurrence when visitors exit their vehicle is to cross the road to see the volcanic features. This further congests an already congested area. A fence or wall to control pedestrians would help.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present. An archeological survey of the developed area has been conducted and no sites were found. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and some redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and overlay. Long term -- Reconstruction with a structural base.

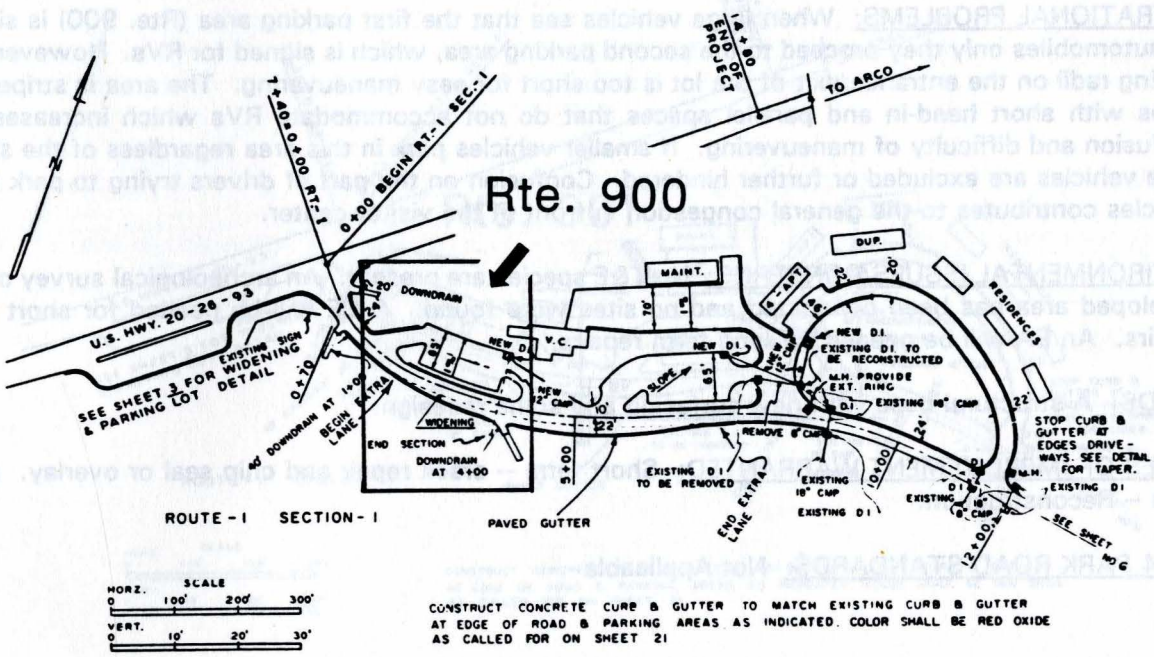
1984 PARK ROAD STANDARDS: Not Applicable.

Route # 900 West Visitor Center Parking

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- The draft GMP has a proposal to relocate the visitor center which would resolve the current operational problems this parking area is experiencing. If that proposal is dropped or will realistically not happen prior to road reconstruction channelization and/or moving the entrance further east is warranted. An architecturally appropriate wall or fence should also be constructed between the parking area and the road. Stripe and sign for autos only. Needed in 5 to 10 years.

COSTS: Short term -- $10,000 Long term -- $25,000

PRIORITY: II -- Do with Route 10



CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 901 East Visitor Center Parking

PURPOSE/FUNCTION: Provides parking for RVs, tour busses and other large vehicles at a primary visitor attraction.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 7,000 square feet
Capacity: 13 auto & 8 RV
Surface Type: Asphalt
Terrain: Flat
Overall Condition: Fair/Poor

PHYSICAL CONDITION: Cracks span the entire width and reflect through curb. Some minor alligator cracking noticed.

OPERATIONAL PROBLEMS: When large vehicles see that the first parking area (Rte. 900) is signed for automobiles only they proceed to the second parking area, which is signed for RVs. However, the turning radii on the entrance/exit of the lot is too short for easy maneuvering. The area is striped for autos with short head-in and parallel spaces that do not accommodate RVs which increases the confusion and difficulty of maneuvering. If smaller vehicles park in this area regardless of the signs, large vehicles are excluded or further hindered. Confusion on the part of drivers trying to park large vehicles contributes to the general congestion in front of the visitor center.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present. An archeological survey of the developed area has been conducted and no sites were found. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and some redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and chip seal or overlay. Long term -- Reconstruction.

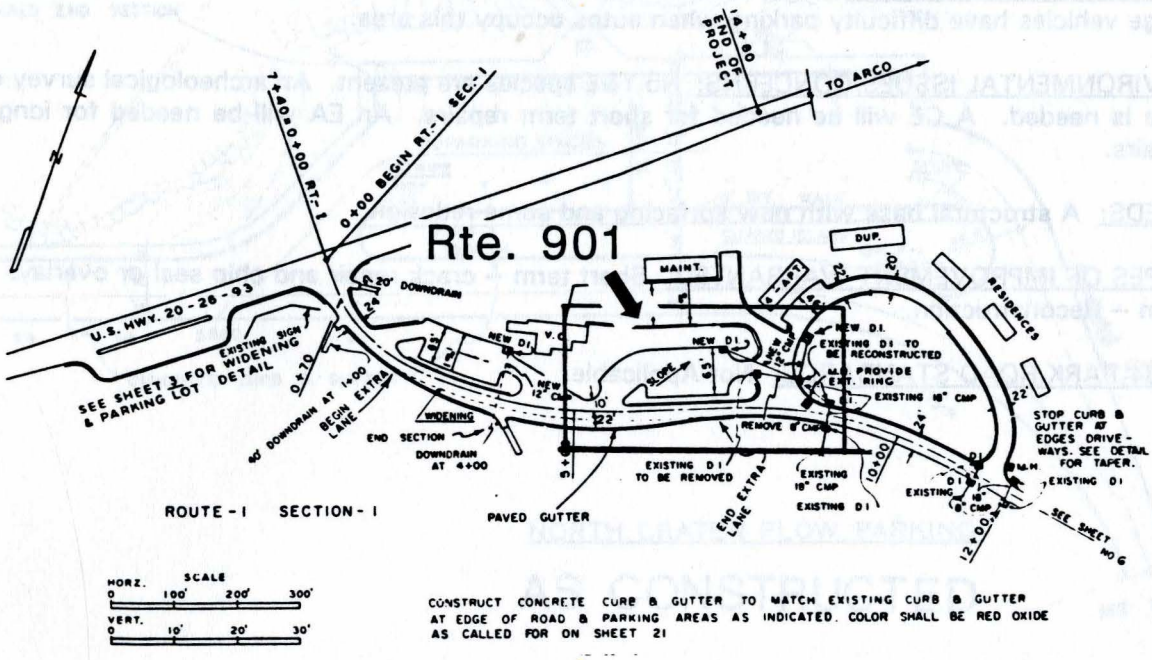
1984 PARK ROAD STANDARDS: Not Applicable

Route # 901 East Visitor Center Parking

RECOMMENDATIONS: Short term -- At a minimum the area should be restriped to accommodate large vehicles. A better solution would require modification of the existing island to improve access and maneuvering turn radii in conjunction with restriping. Seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- If the above redesign has not been accomplished it should be at this time. Reconstruct. Stripe and sign for large vehicles only. Needed in 5 to 10 years.

COSTS: Short term -- $10,000 Long term -- $25,000

PRIORITY: II -- Do with Route 10



CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 902 North Crater Flow Parking

PURPOSE/FUNCTION: Provide parking for North Crater Flow interpretive loop trail.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 12,000 square feet
Capacity: 22 auto & 4 RV
Surface Type: Asphalt
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: Cracks span entire width of area.

OPERATIONAL PROBLEMS: RV spaces are actually auto parallel spaces and are not signed for RVs. Large vehicles have difficulty parking when autos occupy this area.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present. An archeological survey of the area is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and some redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and chip seal or overlay. Long term -- Reconstruction.

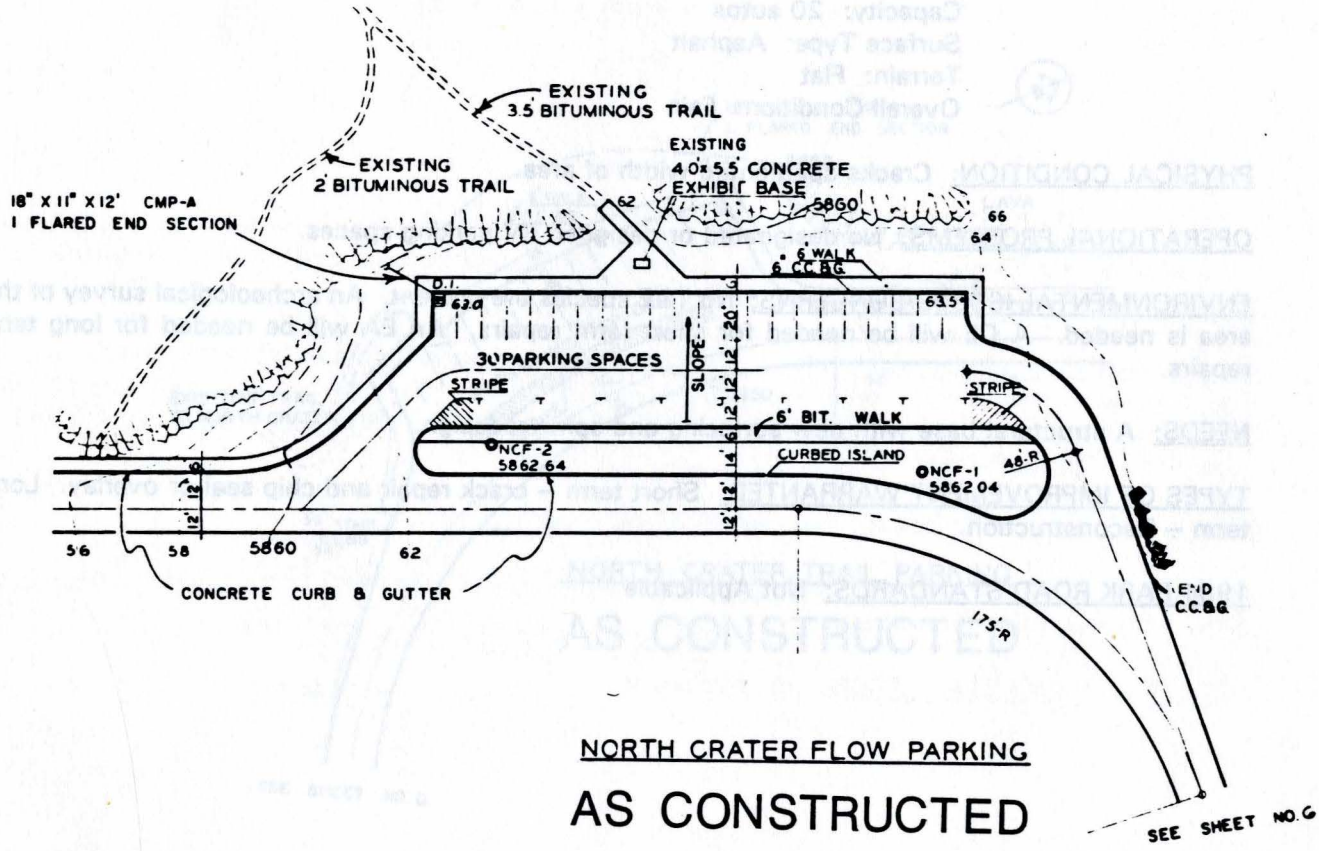
1984 PARK ROAD STANDARDS: Not Applicable.

Route # 902 North Crater Flow Parking

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- Reconstruction. Stripe for autos and large vehicles. Needed in 5 to 10 years.

COSTS: Short term -- $17,000 Long term -- $44,000

PRIORITY: II -- Do with Route 10.



NORTH CRATER FLOW PARKING

AS CONSTRUCTED

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 903 North Crater Trail Parking

PURPOSE/FUNCTION: Provide parking for the North Crater Trail which terminates at the Spatter Cones parking area (Rte. 907).

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 9,000 square feet
Capacity: 20 autos
Surface Type: Asphalt
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: Cracks span entire width of area.

OPERATIONAL PROBLEMS: No designated or designed RV parking spaces.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present. An archeological survey of the area is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and some redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and chip seal or overlay. Long term -- Reconstruction.

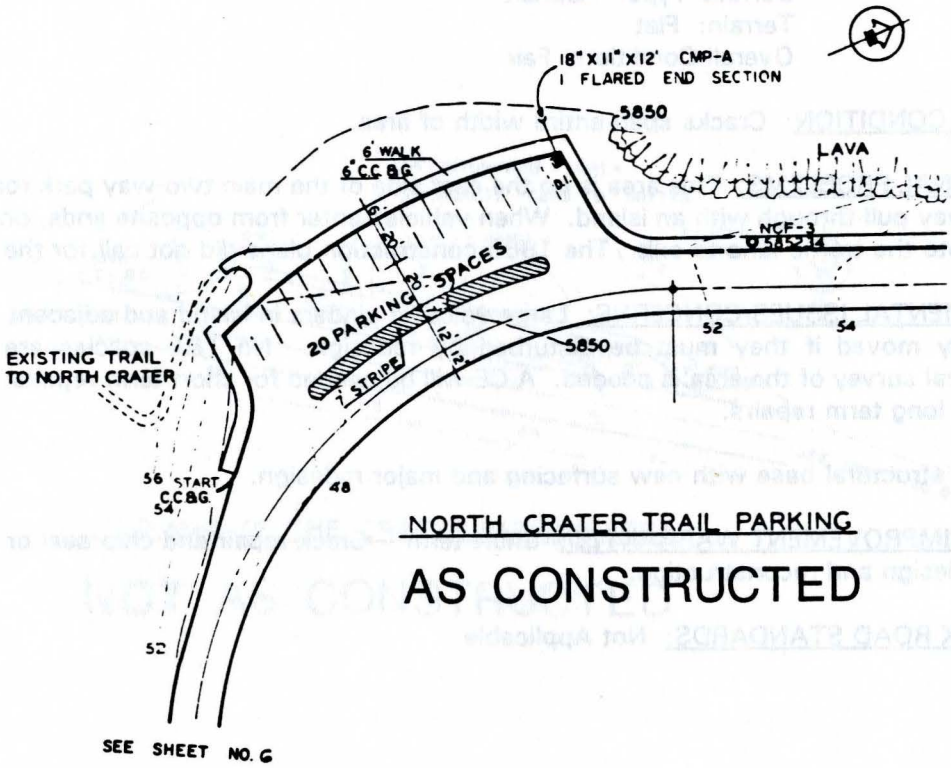
1984 PARK ROAD STANDARDS: Not Applicable

Route # 903 North Crater Trail Parking

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- Reconstruction. Stripe and sign for autos only. Needed in 5 to 10 years.

COSTS: Short term -- $13,000 Long term -- $33,000

PRIORITY: II -- Do with Route 10.



NORTH CRATER TRAIL PARKING

AS CONSTRUCTED

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 904 Old Man of the Craters Parking

PURPOSE/FUNCTION: Provide parking for interpretive area but often used as a slow moving vehicle passing turnout.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 1,800 square feet
Capacity: 4 autos maximum (no delineation)
Surface Type: Asphalt
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: Cracks span entire width of area.

OPERATIONAL PROBLEMS: This area is on the east side of the main two-way park road. It is a one-lane/two-way pull-through with an island. When vehicles enter from opposite ends, one vehicle must back out into the traffic lane to exit. The 1966 construction plans did not call for the island.

ENVIRONMENTAL ISSUES/CONCERNS: Large volcanic cinders in island and adjacent to area should be carefully moved if they must be disturbed by redesign. No T&E species are present. An archeological survey of the area is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and major redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- Crack repair and chip seal or overlay. Long term -- Redesign and reconstruction.

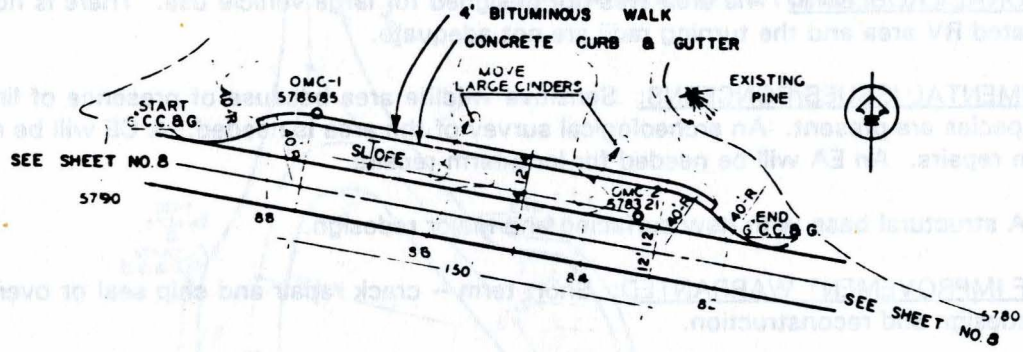
1984 PARK ROAD STANDARDS: Not Applicable

Route # 904 Old Man of the Craters Parking

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- Redesign area to provide two-lane/two-way circulation and a parking area with the same capacity. Reconstruction. Stripe and sign for autos only. Needed in 5 to 10 years.

COSTS: Short term -- $3,000 Long term -- $15,000

PRIORITY: II -- Do with Route 10.



OLD MAN OF THE CRATER PARKING AREA

NOT AS CONSTRUCTED

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 905 Devils Orchard Parking

PURPOSE/FUNCTION: Provide parking for Devils Orchard interpretive trail.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 13,000 square feet
Capacity: 7 parallel/13 angle for autos
Surface Type: Asphalt
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: Cracks span entire width of area.

OPERATIONAL PROBLEMS: The area was not designed for large vehicle use. There is no designed or designated RV area and the turning radii are not adequate.

ENVIRONMENTAL ISSUES/CONCERNS: Sensitive wildlife area because of presence of limber pine. No T&E species are present. An archeological survey of the area is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and major redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and chip seal or overlay. Long term -- Redesign and reconstruction.

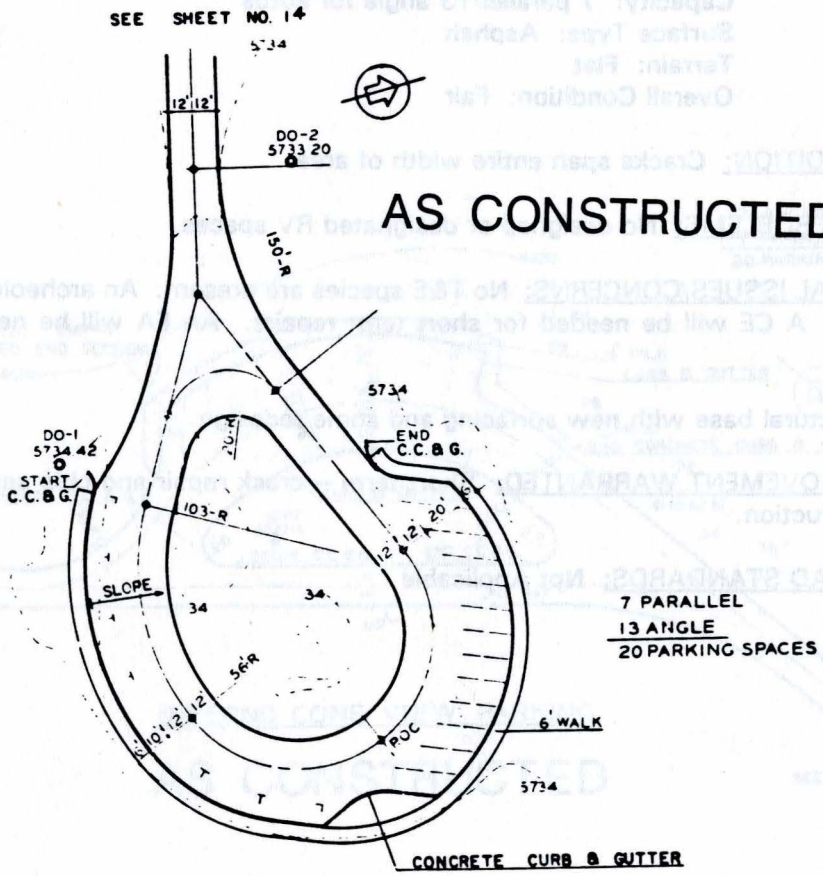
1984 PARK ROAD STANDARDS: Not Applicable

Route # 905 Devils Orchard Parking

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- Redesign to improve radii and provide for large vehicle parking. Reconstruction. Stripe and sign for autos and large vehicles. Needed in 5 to 10 years.

COSTS: Short term -- $22,000 Long term -- $50,000

PRIORITY: II -- Do with Route 10.



DEVILS ORCHARD PARKING AREA

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 906 Inferno Cone Parking

PURPOSE/FUNCTION: Provide parking for Inferno Cone interpretive trail.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 8,500 square feet
Capacity: 7 parallel/13 angle for autos
Surface Type: Asphalt
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: Cracks span entire width of area.

OPERATIONAL PROBLEMS: No designed or designated RV spaces.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present. An archeological survey of the area is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and some redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and chip seal or overlay. Long term -- Reconstruction.

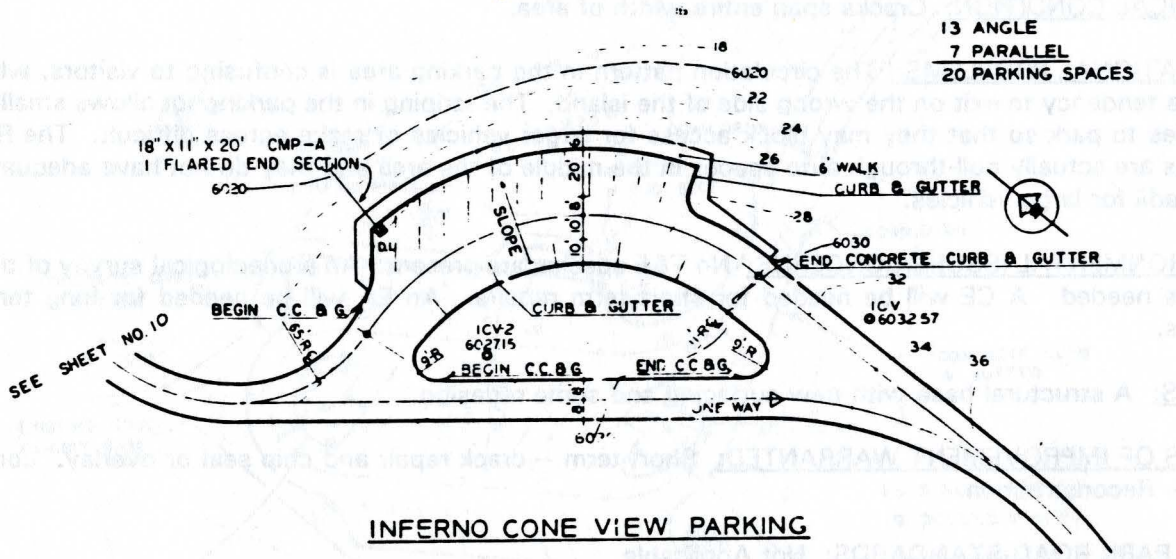
1984 PARK ROAD STANDARDS: Not Applicable

Route # 906 Inferno Cone Parking

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- Redesign to provide large vehicle spaces along island. Reconstruction. Stripe for autos and large vehicles. Needed in 5 to 10 years.

COSTS: Short term -- $13,000 Long term -- $35,000

PRIORITY: I -- Do with Route 500.



INFERNO CONE VIEW PARKING

AS CONSTRUCTED

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 907 Spatter Cone Parking

PURPOSE/FUNCTION: Provide parking for Spatter Cone interpretive area and south terminus of North Crater Trail.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 15,000 square feet
Capacity: 26 auto & 9 RV
Surface Type: Asphalt
Terrain: Rolling
Overall Condition: Fair

PHYSICAL CONDITION: Cracks span entire width of area.

OPERATIONAL PROBLEMS: The circulation pattern in the parking area is confusing to visitors, who have a tendency to exit on the wrong side of the island. The striping in the parking lot allows smaller vehicles to park so that they may block access for larger vehicles or make egress difficult. The RV spaces are actually pull-through auto spaces in the middle of the area and they do not have adequate turn radii for large vehicles.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present. An archeological survey of the area is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and some redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and chip seal or overlay. Long term -- Reconstruction.

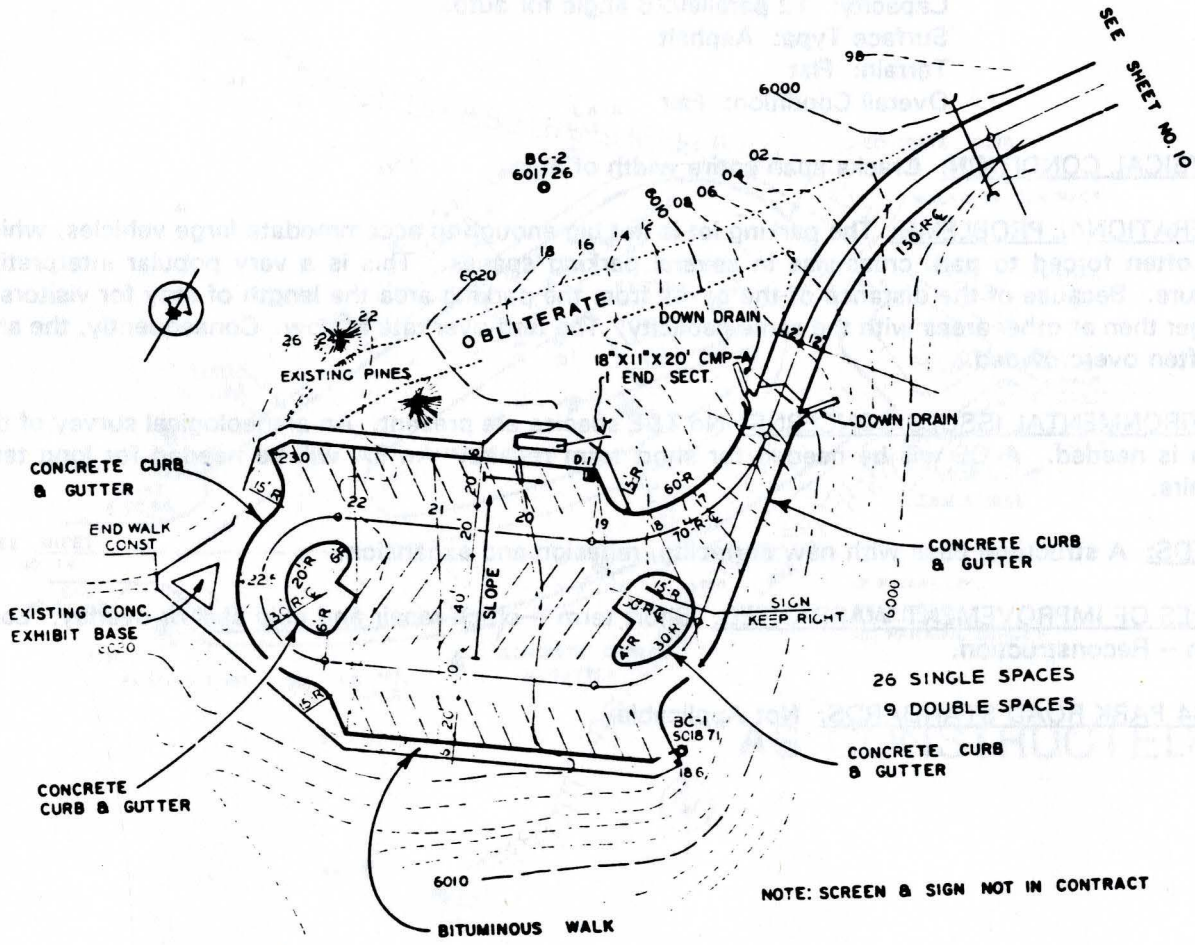
1984 PARK ROAD STANDARDS: Not Applicable

Route # 907 Spatter Cone Parking

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed; restripe to reduce confusion and better accommodate large vehicles. Needed in 2 to 5 years. Long term -- Redesign to better accommodate large vehicles. Reconstruction. Stripe for autos and large vehicles. Needed in 5 to 10 years.

COSTS: Short term -- $22,000 Long term -- $60,000

PRIORITY: I -- Do with Route 500.



AS CONSTRUCTED

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 908 Caves Area Parking

PURPOSE/FUNCTION: Provide parking for Caves Area interpretive trails.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 25,000 square feet
Capacity: 12 parallel/28 angle for autos
Surface Type: Asphalt
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: Cracks span entire width of area.

OPERATIONAL PROBLEMS: The parking lot is not big enough to accommodate large vehicles, which are often forced to park crosswise in several parking spaces. This is a very popular interpretive feature. Because of the distance of the caves from the parking area the length of stay for visitors is longer then at other areas with the same capacity. The turn-over rate is slow. Consequently, the area is often overcrowded.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present. An archeological survey of the area is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing, redesign and expansion.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and chip seal or overlay. Long term -- Reconstruction.

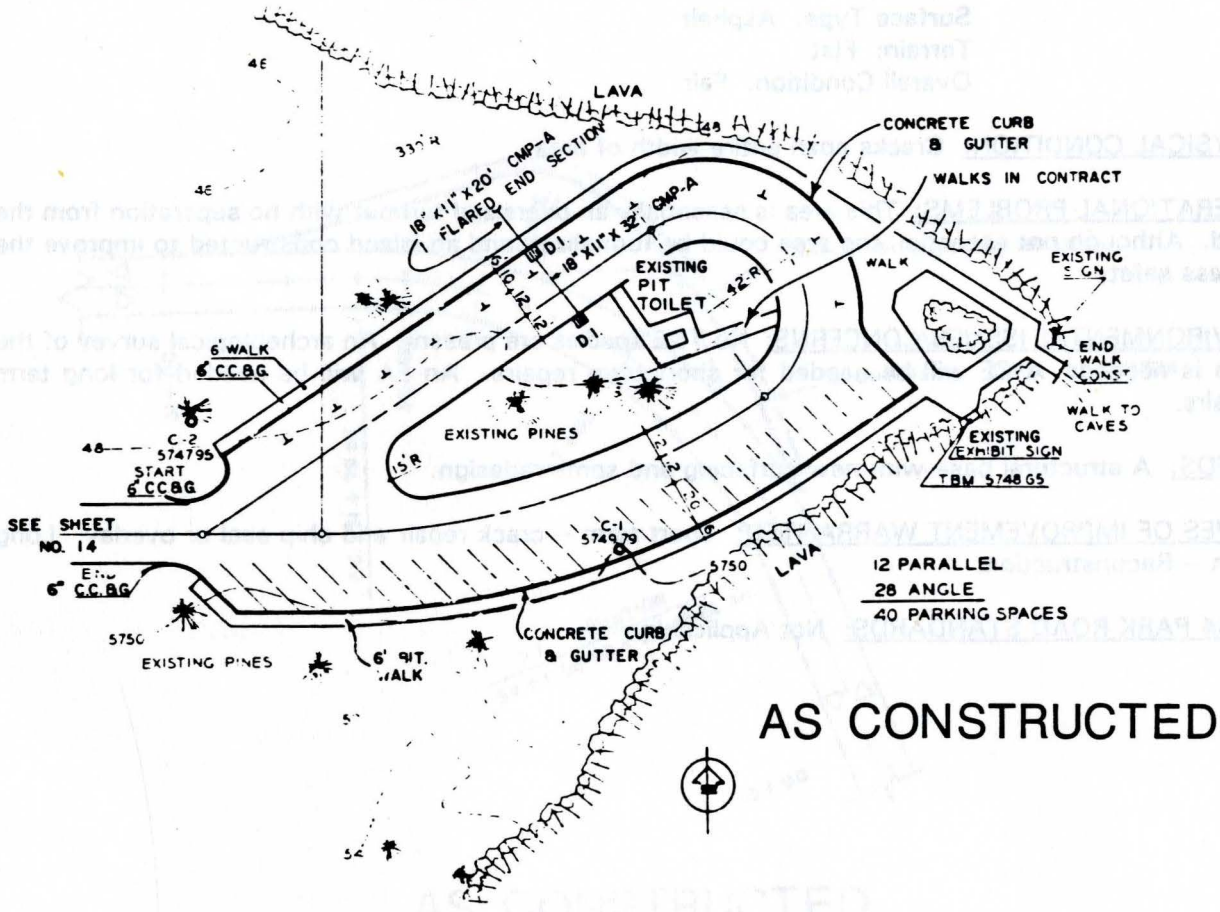
1984 PARK ROAD STANDARDS: Not Applicable

Route # 908 Caves Area Parking

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- Redesign area to better accommodate large vehicles and expand overall capacity by 5 to 10 spaces. Reconstruction. Stripe for autos and large vehicles. Needed in 5 to 10 years.

COSTS: Short term -- $37,000 Long term -- $100,000

PRIORITY: I -- Do with Route 500.



CAVE AREA PARKING

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 909 Tree Molds Picnic Area Parking

PURPOSE/FUNCTION: Provide parking for roadside picnicking.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 5,000 square feet
Capacity: 6 autos maximum (not delineated)
Surface Type: Asphalt
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: Cracks span entire width of area.

OPERATIONAL PROBLEMS: This area is essentially an oversized turnout with no separation from the road. Although not essential, the area could be formalized and an island constructed to improve the access safety.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present. An archeological survey of the area is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and some redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and chip seal or overlay. Long term -- Reconstruction.

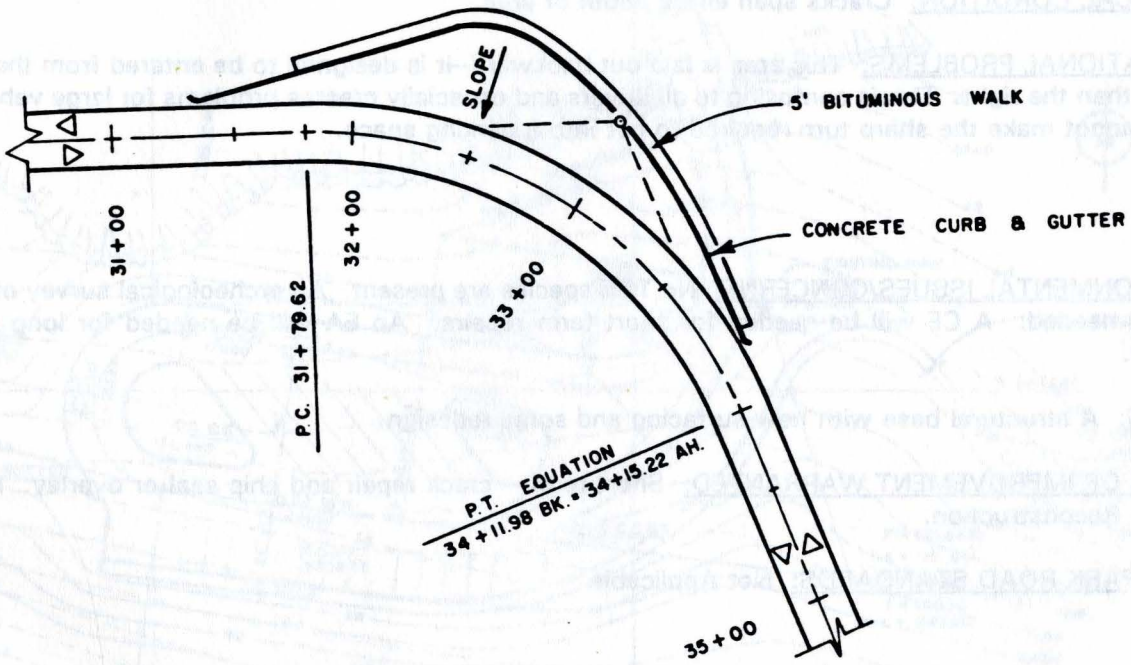
1984 PARK ROAD STANDARDS: Not Applicable

Route # 909 Tree Molds Picnic Area Parking

RECOMMENDATIONS: Short term -- seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- Reconstruction. Needed in 5 to 10 years.

COSTS: Short term -- $8,000 Long term -- $20,000

PRIORITY: I -- Do with Routes 500 and 101.



AS CONSTRUCTED

CRATERS OF THE MOON MN
ROAD SYSTEM EVALUATION
ROUTE RECONNAISSANCE REPORT

Route # 910 Broken Top (Tree Molds) Parking

PURPOSE/FUNCTION: Provide parking for Tree Molds and other wilderness areas trail.

FUNCTIONAL CLASSIFICATION: Class III Special Purpose

ROUTE INFORMATION:

Total Area: 20,000 square feet
Capacity: 18 auto & 7 RV
Surface Type: Asphalt
Terrain: Flat
Overall Condition: Fair

PHYSICAL CONDITION: Cracks span entire width of area.

OPERATIONAL PROBLEMS: This area is laid out backward--it is designed to be entered from the left rather than the right. This is confusing to all drivers and especially creates problems for large vehicles who cannot make the sharp turn required to get into a parking space.

ENVIRONMENTAL ISSUES/CONCERNS: No T&E species are present. An archeological survey of the area is needed. A CE will be needed for short term repairs. An EA will be needed for long term repairs.

NEEDS: A structural base with new surfacing and some redesign.

TYPES OF IMPROVEMENT WARRANTED: Short term -- crack repair and chip seal or overlay. Long term -- Reconstruction.

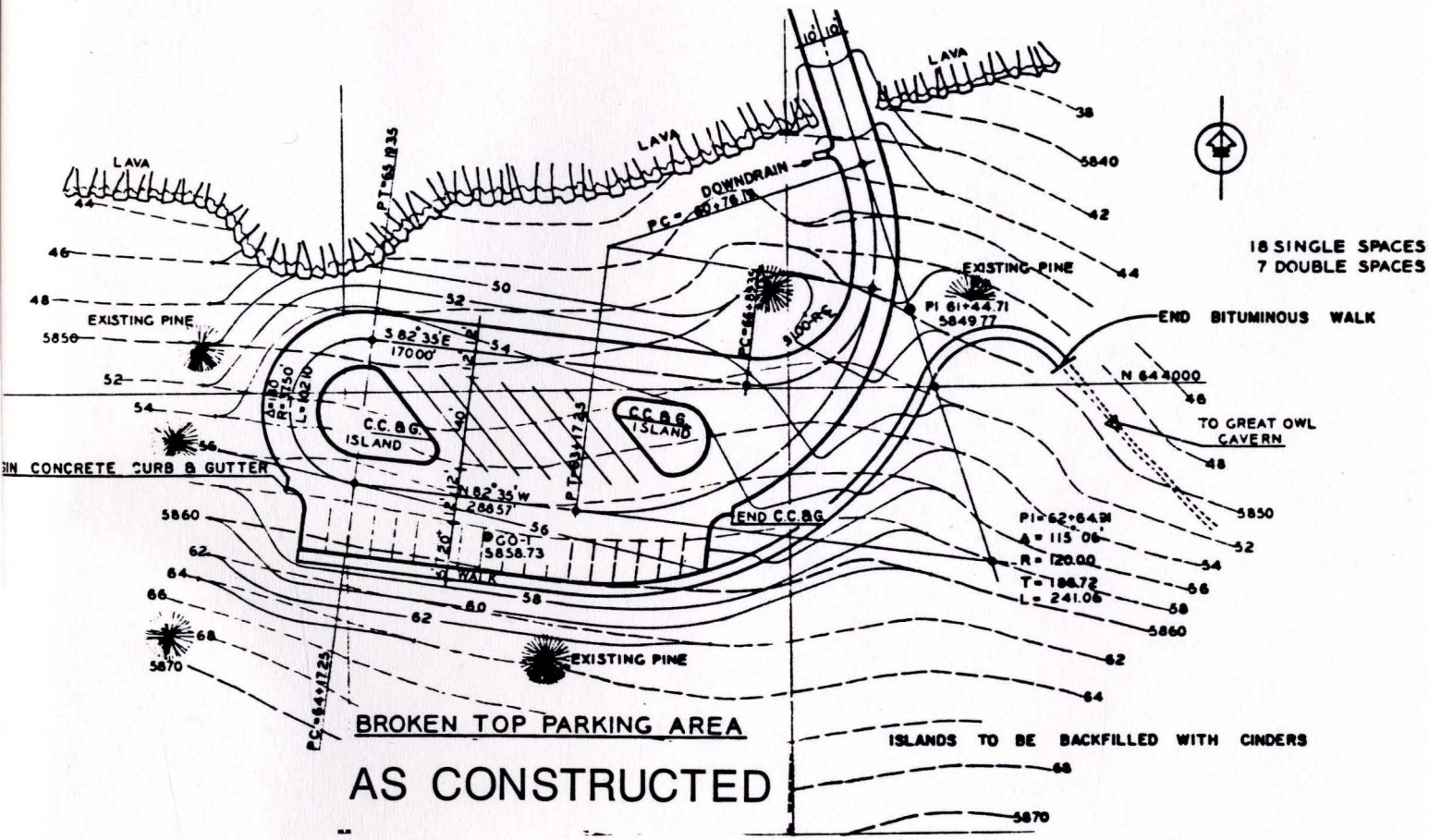
1984 PARK ROAD STANDARDS: Not Applicable

Route # 910 Broken Top (Tree Molds) Parking

RECOMMENDATIONS: Short term -- The striping on the long center spaces should be reversed to match the direction of traffic flow. The park has indicated that there is low demand for parking here and the temporary loss of some capacity would not create a problem. Seal existing cracks less than 1/2 inch wide with crack sealant or an aggregate slurry; cut out larger cracks and backfill with aggregate and asphalt; cover with chip seal or overlay; replace curbs as needed. Needed in 2 to 5 years. Long term -- The parking lot should be redesigned so the islands are aligned correctly and to better accommodate large vehicles. Reconstruction. Stripe for autos and large vehicles. Needed in 5 to 10 years.

COSTS: Short term -- $30,000 Long term -- $75,000

PRIORITY: I -- Do with Routes 500 and 101.



REFERENCES

Day, T. A., and R. G. Wright. 1985. The Vegetation Types of Craters of the Moon National Monument. Forest, Wildlife and Range Experiment Station, Bulletin No. 38, University of Idaho, Moscow.

Kuntz, M.A., D. E. Champion, R, H, Lefebvre, and H.R. Covington. 1988. Geologic map of the Craters of the Moon, Kings Bowl, and Wapi lava fields, and the Great Rift volcanic rift zone, south-central Idaho. U.S. Geological Survey, Misc. Investigations Series, Map I-1632.

U.S. Department of the Interior, National Park Service. 1984. Park Road Standards.

USDI, NPS and USDT, FHWA. 1986. Road System Evaluation Study. Nez Perce National Historical Park, Idaho.

U.S. Department of Transportation, Federal Highway Administration. 1980. Road inventory and needs study for Craters of the Moon National Monument. Denver, Colorado.

STUDY TEAM/CONSULTATION/COORDINATION

Study Team
Jim Ellis, Geotechnical Highway Engineer, Denver Service Center
Terry Goodrich, Park Road Planning Coordinator, Denver Service Center
Aida Parkinson, Natural Resource Specialist, Denver Service Center

Consultation/Coordination
Robert Scott, Superintendent, CRMO
Shelley Sparhawk, Natural Resource Specialist, CRMO
Kent Campbell, Chief of Maintenance, CRMO
Clark Crane, Engineer, Formerly Pacific Northwest Regional Office