

DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
GRAND CANYON NATIONAL PARK
GRAND CANYON, ARIZONA.

M. J. Taylor
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REPORT ON

TRAIL MAINTENANCE

in

GRAND CANYON NATIONAL PARK

January 24, 1938.

C. M. Carrel,
Park Engineer.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

GRAND CANYON NATIONAL PARK
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January 13, 1938.

Report On
TRAIL MAINTENANCE
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Prepared by C. M. Carrel, Park Engineer.

TRAILS MAINTAINED: The Bright Angel Trail from the South Rim of the Canyon at Headquarters to the Colorado River, a distance of approximately eight miles. The Kaibab Trail from the South Rim of the Canyon at Yaki Point to the North Rim of the Canyon near the North Rim Headquarters area, a distance of 20.6 miles. The River Trail from its junction with the Bright Angel Trail at the Colorado River, to its junction with the Kaibab Trail, about a quarter of a mile above the Suspension Bridge over the Colorado River, a distance of one and three quarters miles.

DESCRIPTION OF THE TRAILS: The Bright Angel leaves the Rim thru the Kaibab Formation on a descending grade, follows along and over slopes to the Coconino Sand Stone Formation where it passes thru a short tunnel of solid rock and enters a series of switch backs across a fan shaped talus slope. From here it follows slopes at the base of the Coconino to the Supai Sand Stone Formation, where it passes over broken ledges and talus slopes to the Blue Lime Formation. A series of switch backs takes it thru the Blue Lime to Garden Creek which it follows past Indian Gardens thru the Tapeats Formation along the southeast wall of Garden Creek to the top of the Granite. From here it follows blasted out ledges and slopes to Pipe Creek, along the bed of which it follows to the Colorado River. With the exception of the section in Pipe Creek, the trail averages about 4 feet in width, has a varying gradient between one and seventeen per cent, and is protected by low, outside dry rubble masonry walls. The tread is of mixed rock, shale and earth, and drainage is taken care of by water breaks, or dips, across the trail. There are two short tunnels thru solid rock, one approximately twenty feet in length, one quarter of a mile down from the Rim; and the other about 30 feet long, one mile down from the Rim. Reconstruction work was completed in 1931.

The Kaibab Trail leaves the South Rim at Yaki Point, winds down thru nine short switchbacks in the Kaibab Formation, across slopes and thru ledges to the top of the Supai Formation at Cedar Ridge, from which place the trail skirts along the north and east wall of a ridge, to a short mesa above the Blue Lime Formation. From here it winds down thru nineteen switch backs blasted from solid rock, to slopes which

extend to the Tonto Platform, the South Rim of the inner gorge of the Colorado River. Here the trail dips down, traversing side walls of solid rock and slopes thru the Granite and Shist to the Suspension Bridge. The south approach to the Bridge is thru a tunnel which is one hundred and seven feet in length.

The crossing of the River is made via the 440-foot span suspension bridge, erected in 1928 by Park Service forces. Width of tread is five feet and is an emulsified asphalt surface.

From the bridge the trail follows along the north bank of the Colorado for approximately one quarter of a mile to the east bank of Bright Angel Creek, which it follows for about two miles past Phantom Ranch to the first crossing of the stream. One half a mile farther, the trail again crosses the stream to the east side of the boxed-in canyon, and follows the meanderings of the Creek for about two and one-half miles, benching into cliffs and cutting across slides, making two more crossings of the creek bed before emerging from the boxed-in canyon. From here the trail is constructed over rolling ground for about one mile to Ribbon Falls where it again crosses the creek and follows along the west bank for a quarter of mile. Another crossing is made here, and the trail leaves the creek on the west and follows over rolling hills, past Cottonwood Camp to Manzanita Creek and the Union Pacific power house, approximately eight and one-half miles from Phantom Ranch. The seventh and last crossing of the Bright Angel Creek is made at this point, and the trail rises on a twelve and fourteen per cent grade over rolling slopes of shale to the base of the Blue Lime, following the general contour of the northwest slope of Roaring Springs Canyon. From this point, for the next one and one-half miles, the trail is benched in and half tunnelled thru solid rock ledges with short sections of fifteen and eighteen per cent grades. Here the trail crosses to the southeast side of the canyon and winds up thru several switchbacks thru ledges of the Supai Formation, at the top of which is a twenty-foot tunnel. A few hundred feet above the upper portal of the tunnel, the trail recrosses the canyon and follows the contours of the slopes of mixed material to the base of the Coconino Sand Stone. A series of switch backs constructed thru broken down ledges of the sand stone, carries the trail to the top of the same. From here to the Rim, the trail is constructed over dirt slopes thru fir and aspen. Gradient varies on this trail from one to twenty per cent. Construction work was completed in 1928.

The River Trail leaves the Bright Angel Trail where Pipe Creek empties into the Colorado River. The first half mile is constructed thru the irregular cliffs of the south bank of the Colorado, benches along the shear cliff face, approximately one hundred feet above the surface of the river, to sand and talus slopes which extend for the next half mile. From here to the junction with the Kaibab Trail, the trail is benched in along the face of the shear cliffs. Maximum grade on this trail is seven per cent. Construction work was completed in 1936.

MAINTAINER ORGANIZATION: These three major trails, totaling thirty and one-half miles of four foot tread, require continuous maintenance during

the tourist season, May to November, and for the entire year on all but the upper seven miles of the Kaibab Trail on the North Rim Section. Until the advent of the CCC organization in 1933, full time maintainers were employed as follows: one on section between the South Rim and Indian Gardens; one on the section between Indian Gardens and the Colorado River, on the Bright Angel Trail; one on the section between the South Rim and the Tip-Off (top of the South Rim of the inner gorge); and one on the section between the Tip-Off and the upper end of the Bright Angel Creek Box, on the Kaibab Trail. Two seasonal maintainers were employed for maintaining the trail between the upper end of the Bright Angel Creek Box and the North Rim. Since which time there is employed but two full-time maintainers; one located at Indian Gardens on the Bright Angel Trail and one at Yaki Point for the Kaibab Trail.

With the establishment of CCC camps here considerable trail maintenance is being done by the enrollees under the leadership of the regular maintainers. On the North Rim, the North Rim Section of the Kaibab Trail, from the rim to the Power House, during the working season--May to November--has been regularly maintained by the enrollees. Emergency work, such as snow removal, extensive slides and clean-up after severe storms is handled by CCC forces.

MAINTENANCE INVOLVED: The Kaibab and Bright Angel trails each carry an average annual traffic count of 18,000, or 50 per day. This, of course, means a concentrated heavy volume of traffic during the tourist season with abnormal wear of the trail tread. Another contributory factor to trail destruction are the torrential rains during July and August, which cause erosion of the slopes, with incidental slides, washing of the loose trail tread, leaving bare the ledge or bench on which the trail was constructed. Freezing and thawing also cause huge sections of the cliffs above the trail to drop and roll, carrying accumulated debris in their downward path across the trail, destroying the tread and outside wall. Thoughtless hikers also contribute to necessary maintenance by taking short cuts thru switch backs, dislodging rocks and causing slides to drift into the trail.

DUTIES OF MAINTAINERS: Each maintainer is required to be on his trail five and one-half days per week and subject to call for emergency work at all times. During the tourist season, he is continuously going over his section cleaning out slides, ditching, repairing worn places in the tread and replacing wall rocks. After the tourist season is over he concentrates on those stretches which have worn down to the bare rocks, replacing the tread from side borrow where possible, and where it is impossible to get material adjacent to the trail, he packs it in boxes on his mule. Inside ditches are thoroughly cleaned, and water breaks are repaired to allow free access of drainage water and spring run-off from melting snows.

DRAINAGE: Adequate drainage is of vital importance in maintaining a trail; inside ditches should be of sufficient area to care for normal run-off, without excessive cutting in on the traveled portion of the tread. Diversion of water across the trail by means of water-breaks should be made at intervals sufficiently close to prevent over-flowing and excessive

erosion. The frequency of these is determined primarily by the gradient of the trail, and local conditions. The practice in this park is to place a waterbreak not farther than one hundred feet on grades from ten to twenty per cent, and on lighter grades, not to exceed 250 feet. Drainage at switch backs is discharged at the upper end and never carried around.

EQUIPMENT: Equipment used by the maintainer consists of a mule; pack and riding saddles; halter and bridle; saddle pads; shovels; picks; bars; wheelbarrows; rock hammers; short drill steel; rakes and dirt boxes. Occasionally it is necessary to use dynamite on large boulders, too heavy to be moved otherwise. This is done, when possible, by "Plastering" rather than by drilling, because the plastering method shatters and breaks down the rock, leaving it in the trail where it can be handled without damage to a lower section of the trail.

VIEWS: The attached pictures are appended hereto in order that a better understanding may be had of the character of the terrain over which the major trails in this park are constructed, the type, and maintenance problems involved.

Respectfully submitted,

C. M. Carrel

C. M. Carrel,
Park Engineer.



Looking north through the Suspension Bridge across the
Colorado River on the Kaibab Trail.



Section through the Bright Angel Creek Box on the Kaibab Trail.



Along the North Rim Section of the Kaibab Trail near the top of the Blue Limestone Formation.



Reconstructing a water break on the Kaibab Trail.



Series of switch backs and ledges just above Pipe Creek
on the Bright Angel Trail.



A section of the Bright Angel Trail below Indian Gardens.
Note water break in foreground.



Switch backs above Pipe Creek on the Bright Angel Trail.



A section of the Bright Angel Trail below Indian Gardens,
near top of switch backs above Pipe Creek.



A short section of the Bright Angel Trail near Indian Gardens.



Removing an exposed surface rock from the trail tread on the Bright Angel Trail.



Maintainer repairing damaged wall on the Kaibab Trail in the Bright Angel Creek "Box".



Maintainer cleaning out inside ditch. North Rim section of the Kaibab Trail.



Section of the Bright Angel Trail across cliff faces
above Pipe Creek.



Looking into the south portal of the tunnel approach to
the Suspension Bridge on the Kaibab Trail.