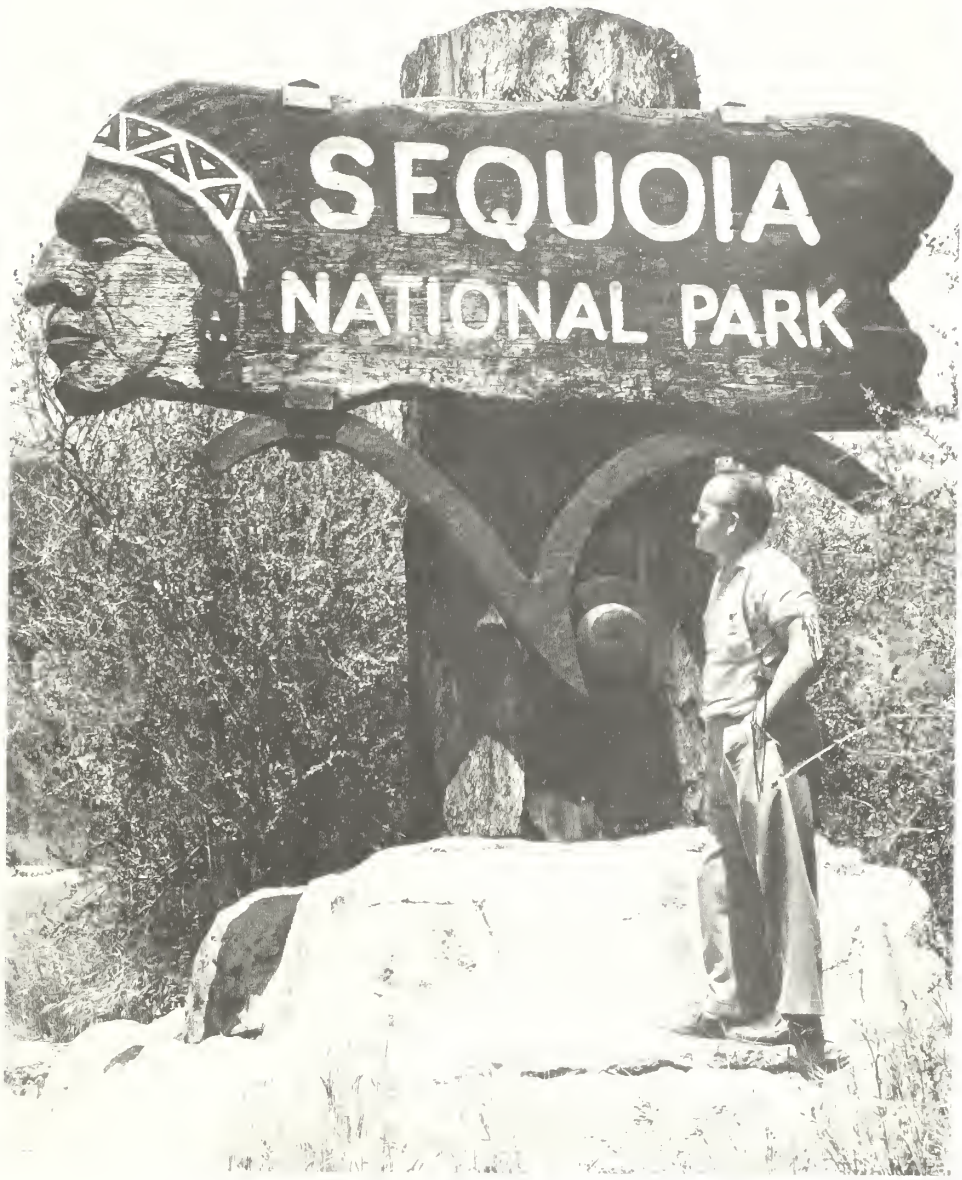
Road Character Guidelines

Sequoia & Kings Canyon National Parks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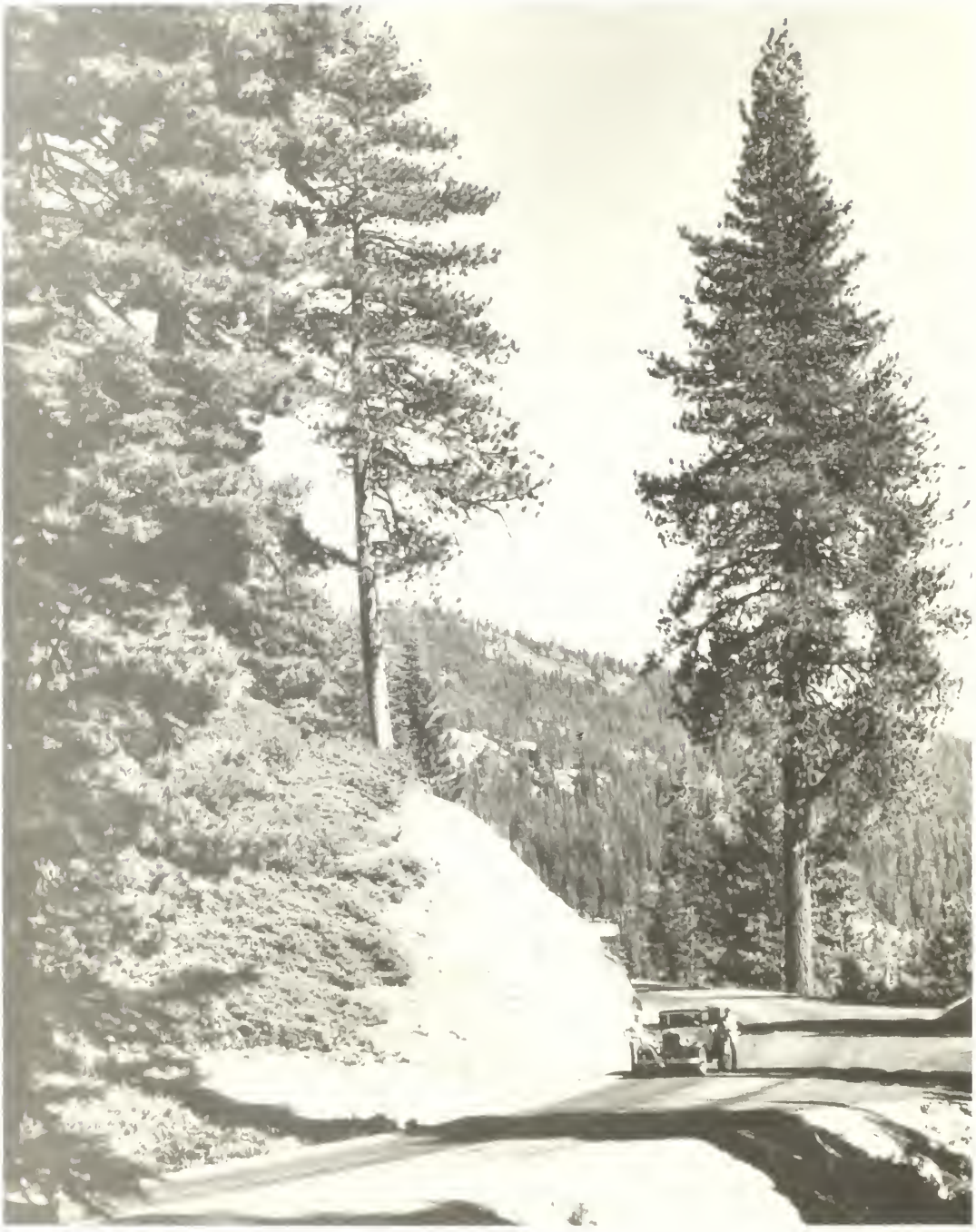

Road
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Guidelines

April 1990

SEQUOIA & KINGS CANYON NATIONAL PARKS

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National parks are special places – so much so that they have been set aside by Congress to preserve their unique characteristics and spectacular features. Experiences in national parks are also special and are an integral part of the park concept. Perpetuating the parks as special places has been the keystone of the national park management since the inception of the National Park Service in 1916, and nowhere has the challenge been greater than in the design and construction of park developments. Developments in a national park must complement the natural or historic setting, blending in as though a part of it, but at the same time they must be distinctive to emphasize the special nature of the place. To achieve this, developments must have consistent design elements and details that are easily recognizable and reflect the unique character of the park.

In the early years of park development these design principles were expressed by the Park Service in the form of rustic design. Natural materials were used to the greatest extent possible, and particular attention was paid to scale and form. Likewise, great care was taken to site structures so that they were harmonious with the environment. This was most evident in the wood and stone buildings constructed during this era, but the same rustic principles were applied in road construction. To blend in with the environment, roads were designed to lie gently on the landscape, following contours to avoid large cuts and fills. Walls, curbs, culverts, and other support structures were made from native materials and were, for the most part, at a scale that did not overpower the environment. Vegetation was left undisturbed along roads so that visitors could experience the natural setting. As a result, park roads had a distinctively

The Four Guardsmen on the Generals Highway announce the entrance to Giant Forest in a dramatic way. This photograph is indicative of how roads in Sequoia-Kings Canyon were designed to lie gently on the land to create an experience for visitors much different from that on urban roadways.

different character from roads outside the parks. The character of and experience afforded by some of these early roads was so noteworthy that several, like Going to the Sun Road and Trail Ridge Road, have since been listed on the National Register of Historic Places.

As the management of parks became more complex in the post-World War II era, park managers and designers began to move away from the early design principles and toward more expedient solutions. Roads were forced onto the landscape to achieve higher design speeds and began to look much like urban highways. Road details were constructed of steel and concrete rather than natural materials. The result was a gradual loss of continuity in design character and detail in many parks.

In recent years there has been a return to the traditional design principles that guided early development in parks. Park Service managers have realized that today, as in the past, visitors perceive national parks as special places and expect them to be different – a step back – from the modern cities and towns of their origin. Creating a distinctive park image based on the principles of rustic design and a continuity of design details is now a primary goal of the National Park Service.

Road Character (continued)
Sequoia and Kings Canyon
National Parks

Park roads are for leisurely driving only. If you are in a hurry, you might do well to take another route now, and come back when you have more time.

At one time this message was in brochures handed out to all visitors at park entrances. Within this simple quote lies the heart of the complex philosophy that has directed the design and construction of park roads. Park roads serve a distinctively different purpose from most other roads and highways, and they should be as special as the parks that surround them.

National park roads are constructed only where necessary – and only as necessary – to provide access for the protection, use, and enjoyment of the resources of the national park system. They are planned for leisurely sightseeing, are located with sensitive concern for the environment, and are designed with extreme care. They are often narrow, winding, and hilly – characteristics that contribute to their appeal.

In contrast to more conventional highways, park roads are often ends in themselves. For some visitors, the handicapped for example, these roads may provide the only means for viewing the park and its resources. Thus, the location and design of park roads must continue to be in accord with the philosophy that how people view a park is as significant as what they see.

Statement of Purpose

The purpose of this guideline is to establish a design style and theme for road-related details in Sequoia and Kings Canyon National Parks that is based on the principles of rustic design. Returning to rustic principles and creating a distinctive park image is especially critical in these parks. Many of the aging roads and buildings are deteriorating rapidly. For environmental reasons whole developed areas are going to be moved. Years of planning have established a direction for the redevelopment of the parks, and virtually every road and major developed area will be affected in the next 20 years. Although no major road alignment changes will be made that alter the basic character of the roads, it is important that the details that create the distinctive image for Sequoia-Kings Canyon be established now. This has already been accomplished for the parks' buildings in the *Architectural Character Guidelines* produced in 1989. This guideline provides similar direction for the parks' roads.

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Sequoia and Kings Canyon National Parks are in the south-central Sierra Nevada. Access to the parks is by California State Highways 198 from the southwest and 180 from the northwest. Both highways connect to Highway 99, a four-lane freeway, and ultimately to the rest of the California freeway and interstate system (see the Vicinity map). This is significant because it puts millions of potential visitors from the Los Angeles and San Francisco Bay areas within a 4- to 5-hour drive of the parks.

Highways 198 and 180 are two-lane, rural roads, and as they approach the parks, their alignments and paved widths are very similar to those of the park roads. Thus, they serve to "acclimatize" visitors to the types of roads they will encounter in the parks. In addition, as the highways pass through the agricultural lands of the San Joaquin Valley and into the Sierra Nevada foothills, the environment becomes similar to that in the lower elevations of the parks, with rolling terrain and dryland vegetation. Highway 198 follows the Kaweah River, and views of the river become more impressive closer to the parks. Highway 180 climbs steeply up the foothills and enters Kings Canyon National Park at Grant Grove. The Generals Highway, which runs through the western side of Sequoia National Park and the detached portion of Kings Canyon, links the two state highways, providing a loop drive through the parks.

Vicinity

The road system within the parks is relatively simple, consisting of one main road, the Generals Highway, and a number of secondary roads to visitor attractions and administrative areas. The Cedar Grove road into Kings Canyon, the Mineral King road into Sequoia, and other minor spur roads are dead-end destination roads that are only open seasonally (see Overview map).

Overview

The Generals Highway is featured in this discussion of road character because it provides the main driving experience for most park visitors. In addition, because more than 90 percent of the two parks is roadless wilderness and is used by only a small percentage of visitors, the park experience for the vast majority of people is focused on resources adjacent to the Generals Highway and secondary access roads. This increases the importance of understanding the existing road character and applying traditional principles in all future road design.

The Generals Highway was originally constructed as a park road between 1920 and 1935, but the most significant period in the development of its character was from 1933 to 1939, when the Civilian Conservation Corps (CCC) was active in the parks. The following information was taken from historic crew chief reports. They are recommended reading for all designers working on road-related details in Sequoia-Kings Canyon and are available in the Technical Information Center of the Denver Service Center.

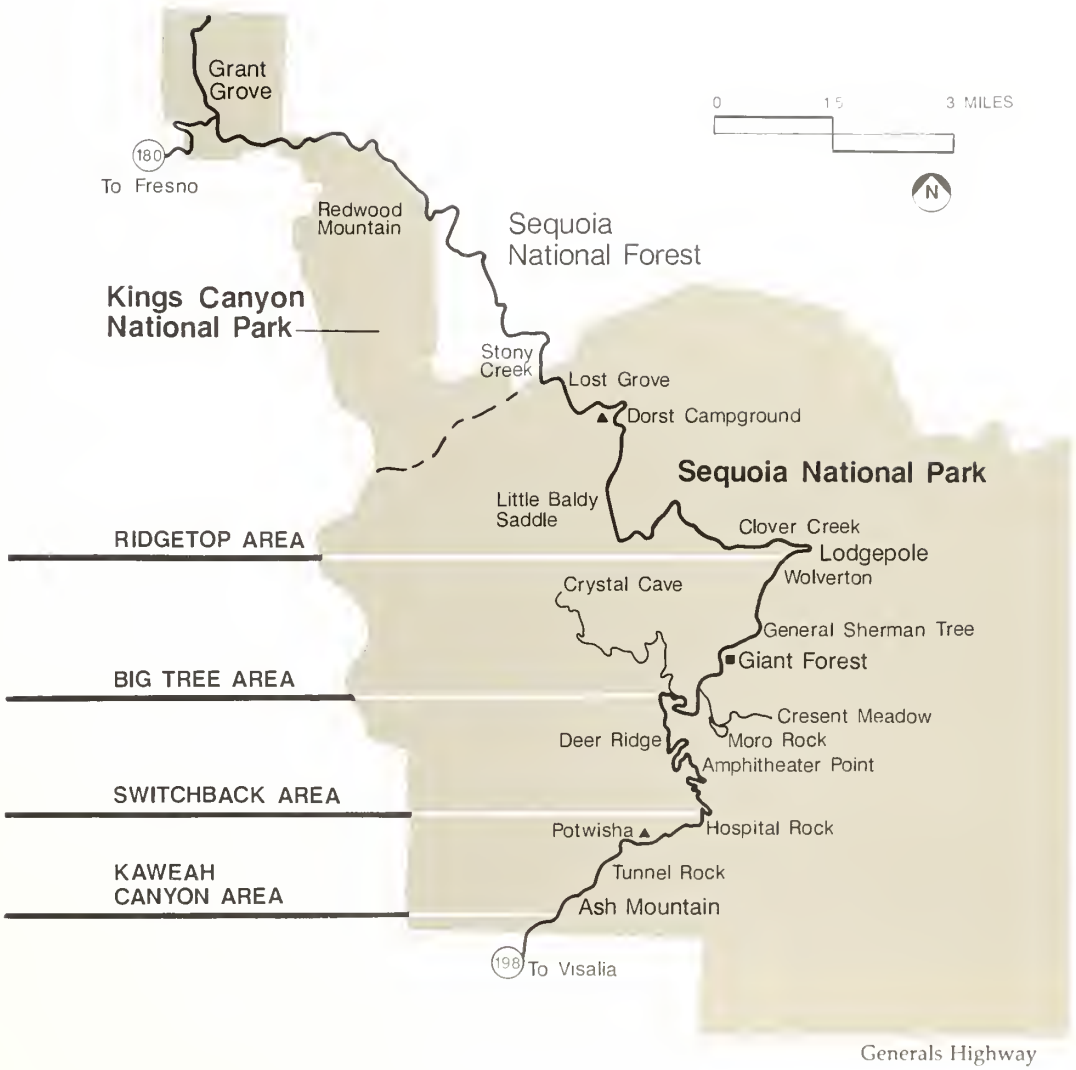
Historic before-and-after photos of CCC work near headquarters.

CCC work camps were established throughout Sequoia and Kings Canyon during the 1930s, and for the most part the foremen and crews were former park employees or others who had the known skills to perform the work. Reports document the cleanup, stonework, retaining wall, shoulder-building, and site projects performed by the crews. Stone guardwalls, stone-lined ditches, culvert headwalls, cut stone curbs, and stone/timber retaining walls were added to the basic road. Fill slopes were widened and shoulders were made more uniform and revegetated. Slopes on hairpin curves were laid back to improve sight distance and aesthetics. Hospital Rock was developed with a stone-curbed parking area and granite stairs to the rock. The Ash Mountain

Historic photo of Generals Highway in the 1930s near Ash Mountain.

headquarters, Tunnel Rock, Amphitheater Point, and Deer Ridge sites were finished in a similar manner. In response to the needs of the vehicles of the era, several watering stations were developed at springs along the highway. It was also during this time that the famous Indian Head entrance sign was constructed. From the reports it can be concluded that the CCC crews took the roughly laid-in road – an engineering marvel in itself for the times – and added the finishing touches that gave the road its character as a special place within the parks.

The map below shows the Generals Highway from Ash Mountain in the south to Grant Grove in the north. There are four distinct areas along the road – each with a different character and different visitor experiences.



Generals Highway

KAWEAH CANYON

In the Kaweah Canyon area from the Ash Mountain entrance to Hospital Rock the road is constructed on a bench cut from the north wall of the canyon. The road is narrow and winding, and driving requires considerable concentration. Scenic viewing is mixed with appreciation of history along this portion of the road. There are several spectacular views of the Kaweah River as well as distant views of Moro Rock and the Sierra Crest. The vegetation is xeric and in several places has a rock garden appearance on the steep side slopes. Watering stations, some of which are still functional, remind visitors of the road's early days and the vehicles that once traveled it. Numerous CCC-era features can be seen in the canyon, including stone curbing, stone-lined ditches, culvert headwalls, guardwalls, and retaining walls. Most of these features are constructed of schist stone. In several locations weathering-steel retaining walls remain from flood damage repairs constructed during the 1960s.

SWITCHBACK

In the switchback area between Hospital Rock and Giant Forest the Generals Highway makes the most dramatic elevation gain. In a distance of 10.5 miles, the road gains 3,600 feet in elevation or approximately 350 feet for every mile climbed. There are some 200 curves and 23 major switchbacks. The road continually changes direction to stay with the contours of the landscape. Its serpentine character challenges motorists, and the driving experience heightens both the anticipation and the sense of achievement upon arriving at the big tree forest. Many examples of CCC work also exist along this portion of the road, most built of schist and some, nearer the top, of granite. Stone guardwalls outline several turnouts and highlight watering stations. There are also stone curbs, headwalls, and retaining walls.

BIG TREE AREA

In the big tree area from Giant Forest to Lodgepole the road character and experience change. The experience is dominated by the sequoia groves. The road is slightly wider and the curves more gentle, allowing drivers to concentrate less on the road and appreciate the resources more. Like the lower road sections, which fold into the steep and difficult terrain, this upper section of road blends into the landscape, with more sweeping curves suited to the gently rolling terrain. Examples of CCC-era rustic details are plentiful here but found mostly around developed areas. The stonework is constructed of granite, usually in large blocks.

RIDGETOP

In this area, extending from Lodgepole to Grant Grove, the highway generally follows the ridge and reflects the less severe terrain. This portion of the road has gentler curves, a wider paved surface, and is much easier to drive than the lower areas. A few places on the top of the ridge provide views of the San Joaquin Valley and Kings Canyon. There are some sequoia groves in this area, but it is dominated by mixed conifer forest, and the experience is primarily that of winding through the forest and granite outcrops en route to other destinations. For several miles the road is in Sequoia National Forest or on the boundary of it, but the road itself is under Park Service jurisdiction. Design details in this area are generally limited to developed areas and are constructed of granite.

This section presents examples of road-related details in the parks. Nearly all of the details have been evaluated, with particular emphasis on those with a style and character worth emulating. For the most part, the details considered important to maintain or perpetuate are of rustic design and natural materials. It has been encouraging to discover that many of the original details that contribute to the character of Sequoia and Kings Canyon are still in relatively good condition. Examples of all types of details are included here to be used as guidelines for future designers.

The Generals Highway has the most examples of rustic site details. The design recommendations in the final section of this guideline should be applied to all roads when they are improved to establish continuity of design throughout the park.

MATERIALS

The historic CCC-era detail work in the parks is almost exclusively of natural materials. Furthermore, the materials were usually obtained from the immediate area of the construction. For instance, rust-colored schist rock is prevalent in the lower elevation Kaweah Canyon area, and most stone details in that area are built of schist. The switchback area above the canyon contains schist and the sierra white granite common in higher elevations; details here are of both types of rock. In the big tree and ridgetop areas, granite is the predominant rock and is used in most details. Although the use of different materials in different parts of the parks may seem inconsistent, the color and texture of the stones used blend well with the local environment, reinforcing the sense of place.

Wood is also a common material in CCC-era rustic details. Most of the directional and informational signs in the parks from that era are routed wood. The most prominent signs – the entrance signs – have simple block lettering and minimally worked wood. In the heavily forested big tree and ridgetop areas wood is also used for fencing.

For the last 40 to 50 years, as details have been replaced and repaired, new materials have been introduced. Weathering steel has been used almost exclusively for guardrails in recent times. It has also been used in retaining walls to repair slide damage in the canyon and switchback areas. Concrete has replaced stone in curbs and drainage features and has been used for sidewalks in some developed areas. Metal sign boards with reflective lettering have replaced aging routed wood signs.

WALLS

There are two basic types of walls in the parks – guardwalls, which outline parking areas or road edges, and retaining walls, which support parking areas and roads. Most of these walls date from the CCC era, but some are from more modern times. Although other materials have occasionally been used, schist or granite is the predominant element in these walls.

Guardwalls are a dominant design feature in the Kaweah Canyon and switchback areas, primarily because of the steep terrain. They are predominantly of rubble construction, incorporating small schist stones, with no foundation or structural core. Because smaller stones have been used, these walls rarely have stones the full width of the wall and seem to have deteriorated more quickly than other walls in the parks.

Rubble schist guardwall at Amphitheater Point

Large block granite wall in ridgetop area

Guardwalls are not as prevalent in the big tree and ridgetop areas because the terrain is less severe. The few that exist are associated with developments and turnouts along the roads. In these areas the walls are constructed of full-width, unmortared granite blocks and are much more structurally sound than the schist guardwalls at lower elevations. The full-width stones with fewer joints do not allow water to seep into the structures as readily as it does in the schist walls.

Numerous slides and other rain damage have occurred in the Kaweah Canyon area. Repairs have usually included construction of large retaining walls. Historically, timber was the material of choice, but during the 60s the timber retaining walls were all replaced with weathering-steel bin walls. Because the road is winding in the canyon, these walls are quite visible. Their rusty brown color generally blends well with the colors of the rocks and vegetation, but the sharp lines and patterns of the bin members tend to draw attention to the walls. This is softened somewhat by surrounding vegetation. However, because of their near-vertical faces, little or no vegetation grows on the walls themselves.

Weathering-steel bin wall in Kaweah Canyon area

All of the rest of the retaining walls in the parks are constructed of stone or stone veneer. In the switchback area the CCC constructed dry-laid retaining walls of native schist stone, primarily to stabilize steep cut slopes. This treatment of otherwise bare slopes contributes to the rustic character of the road.

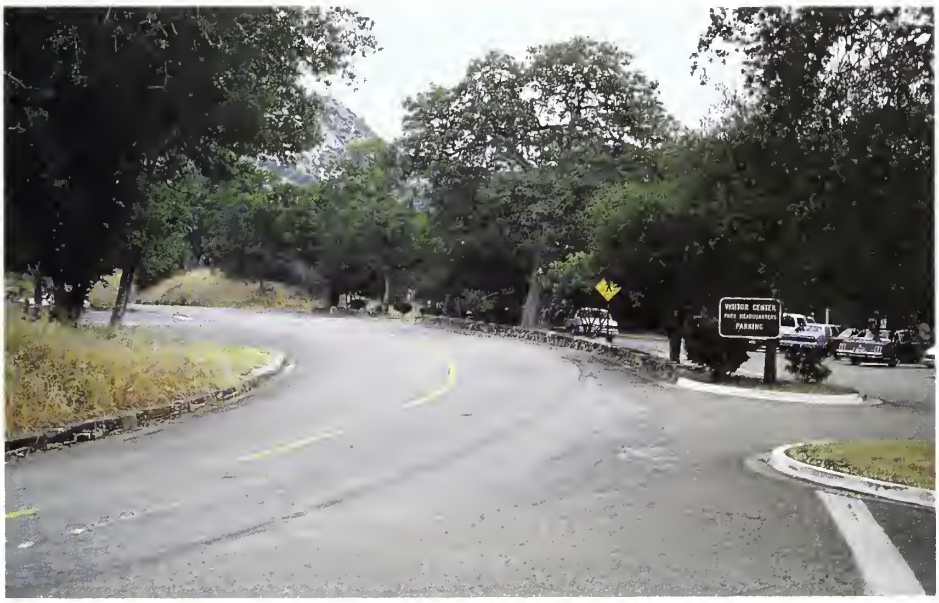
In the big tree area of the Generals Highway dry-laid granite stone walls were constructed to reduce the impacts on sequoia trees and reduce the size of cuts. These walls range in height from a single course of stone to about 20 feet high. The color, texture, and scale of the granite material used in these walls blend well with the environment.

Typical CCC rubble dry-laid walls in the switchback and big tree areas

This is a good example of dry-laid stone walls used to reduce the impact on sequoia trees. Ideally, the road should not have been placed this close to the tree. However, given its location, this is an effective way to mitigate the disturbance of road construction and potential erosion. Future road work should avoid any such disturbance of sequoias.

CURBS

There are several different types of curbing material in Sequoia-Kings Canyon. Most of the curbing, dating from the 1930s CCC era, is stone and constructed of local materials. In the canyon and switchback areas the stone is primarily schist; in the higher elevations it is primarily granite. As curbing has been replaced or new curbing has been needed, concrete and/or asphalt has been used. At several sites two or three types of material have been used, which has diminished the continuity of design.



Rock and painted concrete curb at visitor center

DRAINAGE FEATURES

Perhaps the most impressive CCC-era stonework in the parks is associated with drainage features. Stone-lined ditches, drop inlets, culvert headwalls, and bridges represent some of the best quality stonework. Details such as stone arches in bridges and headwalls and the functional design of drop inlets attest to the quality of craftsmanship involved.

Most of these features are still in relatively good condition. Unfortunately, much of this quality work is seldom seen or appreciated because it is below grade, off to the side of the road, or obscured by vegetation. Nonetheless, these features are major contributors to the rustic character of the park roads.

Where grades were adequate, the CCC constructed stone-lined swales or ditches along the road edge. This was done primarily to reduce the maintenance and erosion involved with ditches, but it also added to the rustic character of the road. These ditches are still functional.

Historic before-and-after photos show how stone-lined ditches looked in the 1930s. Note how this technique gives a finished look to the road edge. The photo below shows how a stone-lined ditch looks today. Note how the color blends well with the local environment and the road edge is sottened by the texture of the stone.

Some of the more creative CCC drainage features are the stone drop inlets in Kaweah Canyon near Ash Mountain. These open, stone wells add to the road's rustic character and continue to serve a drainage function. However, the protruding stones and open holes constitute a roadside hazard.

Culverts are a basic element of road drainage design. This is particularly important at Sequoia-Kings Canyon because of the terrain and the climate.

Historic photo of culvert headwall constructed by the CCC.

Another typical stone headwall. Note how the texture and scale of the structure blend into the environment, making it almost disappear.

Stone drop inlet/ditch combination in front of the visitor center at Ash Mountain.

Another CCC culvert headwall today, after 50 years.

During the 1930s the CCC spent considerable time replacing and extending culverts in the parks. On virtually all of the culverts they constructed stone headwalls to protect against backwash erosion, support a wider roadbed, and perpetuate the rustic character of park roads. The CCC culverts are usually half steel arches with concrete floors. The headwalls have a characteristic stone arch over the pipe and stone wing walls. The stone on the headwall face is usually carried into the pipe to give it a more finished look. Most of the walls have a semi-ashlar appearance.

More elaborate than drainage culverts are box culverts – an appropriate alternative in drainage design between a culvert pipe and a bridge. Several box culverts exist in the parks.

This culvert headwall is obviously not of the same vintage as the headwalls in the previous photos because it lacks the characteristic arch. Earlier culverts also generally had arched pipe rather than the round pipe shown here, with stone laid inside the pipe, further concealing it.

This is a photo of the same culvert from the upstream side. It has obviously been altered since its original construction, and there is no design continuity in materials. The headwall is constructed of granite from the local area.

Box culvert with rock veneer wing walls.

BRIDGES

Bridges can make a dramatic architectural statement on a roadway. They can be spectacular or simply functional. Sequoia-Kings Canyon has both types of bridges. The Marble Fork and Clover Creek bridges, built in the early 1930s by a contractor, are excellent examples of spectacular bridges – and they are both on the National Register. They exhibit the kind of construction that visitors have come to expect in national parks, and they exemplify rustic design and character. The native stone blends in with surrounding creek beds, rock outcrops, and vegetation. The graceful arches work with the terrain rather than competing with it. These bridges are two of the best examples of human elements complementing the natural environment of the parks. Their design will be appropriate in the park setting over time.

The Marble Fork bridge near Lodgepole

The Clover Creek bridge near Lodgepole

The Potwisha bridge, on the other hand, is typical of the technology during the late 1960s. The plain, straight lines of the bridge are simple and functional, but the bridge has no distinctive character. The materials clash with each other and with the surrounding natural setting. The weathering steel used for the rails softens the appearance but is in sharp contrast to the uncolored concrete in the abutments and curbs and eventually stains the concrete. The straight beam design is functional and economical to build, but it does not complement the rolling terrain. The bridge looks forced into the environment and is not in keeping with other bridges in the parks.

Historically, logs or timbers were used as structural members or for rails on small bridges in the parks. The wood was used as solid pieces or as veneer. None of these bridges remain in the park today.

The Potwisha bridge over the Marble Fork of the Kaweah River

Log bridge in Lodgepole constructed 1932

GUARDRAIL

According to the latest inventory data, Sequoia contains about 6,000 feet of guardrail, and Kings Canyon none. All but about 700 feet of the guardrail is in the steep terrain of the canyon and switchback areas. Three types of rail are currently used: weathering-steel W-beam, painted galvanized W-beam, and painted galvanized C-beam. Most is supported by wood posts.

The rust color of the weathering-steel W-beam blends well with the vegetation and schist rock colors in the lower elevations of Sequoia. It also blends well with the reddish colors of sequoia tree trunks but not with the understory vegetation or rock outcrops in the higher elevations. The brown color of the painted guardrail is also compatible but requires an inordinate amount of maintenance. The C-beam rail is an old style and is seldom used any more because of the enhanced safety design of the W-beam rail.

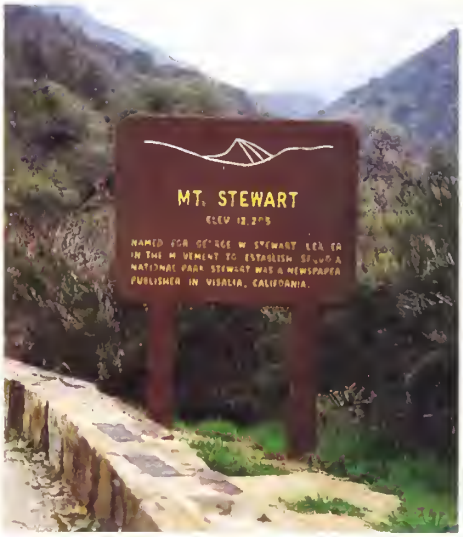
Section of weathering-steel W-beam guardrail in the Kaweah Canyon area

SIGNS

There are two types of road-related signs in Sequoia-Kings Canyon – rustic signs from the early park days, and uniform, or standard, traffic signs from the 1970s. The rustic style characteristic of the 1920s through 1940s was initiated by local craftsmen using indigenous materials. Their work expressed the individual character of the park, keying on the two most prevalent natural features – granite outcrops and big trees. Major signs typically included carved wood signboards, a base constructed of large granite stones, and a section of a large tree trunk. The Indian head entrance sign at Ash Mountain is a classic example of early rustic signs.

Other less ornate examples of rustic signs exist throughout the parks. They typically have simple, routed block lettering on wood boards. The boards are painted brown and the lettering is yellow or white. They are usually mounted on wood posts, although some are on stone walls. Some of the larger signs that include interpretive messages have scrolls carved across the tops of the

The Indian head entrance sign, constructed by the CCC near Ash Mountain. This sign makes a statement about the character of the park, and it notifies visitors that they have entered a special place. It is listed on the National Register of Historic Places.



Interpretive sign at the Mount Stewart turnout

boards, and/or the silhouettes of the features interpreted are routed below the scrolls. These details are found only on signs in Sequoia; the Mount Stewart sign is a good example.

In the 1950s and 1960s the Park Service philosophy of sign design changed, primarily because increasing visitation required more traffic control. General guidelines were drafted, which still allowed a wide latitude for design creativity in reflecting park themes. Natural materials were still used, but geometric shapes and arrowhead logos began to be used more often.

The second style of road-related signs in the parks resulted from passage of the National Highway Safety Act in 1966. It established standards for federal roads, the sign portion of which is contained in the *Manual on Uniform Traffic Control Devices* (MUTCD). The Park Service revised their sign standards in 1972 and again in 1988 to be more in line with the national standards. The new standards promoted uniformity in design, allowing slightly less room for creativity. They also stressed safety. The use of international symbols became and still is common. In the interest of safety, the materials changed drastically – to metal signboards with reflective paint. The standards dictated the size, style, and color of signboards and lettering based on posted speed limits. As early signs wore out, they were replaced with the new standard signs until many parks lost all uniqueness and character in their park sign systems. Although this is nearly the case at Sequoia-Kings Canyon, the parks still have a more representative sample of the early rustic Park Service signs than most parks.

TURNOUTS AND PARKING AREAS

Based on the latest inventory information from FHWA, there are 225 turnouts on all routes in both parks. On the Generals Highway alone there are about 165 turnouts. These numbers include only the formal, paved turnouts. In the first 17 miles of the Generals Highway from Ash Mountain to Giant Forest there are an additional 65 "social," dirt turnouts. Most of the formal turnouts are planned facilities that provide interpretation and amenities. Many more, however, have simply developed over the years because of continued use of wide spots in the road prism. Some of these wide areas have been paved and are now included in the formal category.

The park considers this large number of turnouts important for traffic management and visitor experiences. There are frequent occurrences of disabled vehicles requiring places to get out of traffic and slower vehicles needing places to pull off so faster vehicles can pass. During the winter several turnouts on the way to higher elevations are also used as areas for putting on snow chains. From a visitor experience standpoint, one of the major purposes of park roads is to provide for leisurely driving experiences with ample opportunities to pull off and enjoy scenic vistas and significant resources. For all of these reasons the park is committed to maintaining the large number of turnouts on park roads, especially along the 17 miles of the Generals Highway between Ash Mountain and Giant Forest.

Typical turnout in Kaweah Canyon and switchback areas

There are a number of problems with the existing turnouts. Most, particularly in the canyon and switchback areas, are on the fill side of the road, and there is a need for more turnouts on the cut side. In addition, there is no consistency in the length or width of the turnouts or in the use of design details. Although some have stone walls, trash receptacles, interpretive signs, and other site details, many are simply wide bare spots.

There are a total of 37 parking areas in both parks. For the most part they function well, but they all have the common deficiency of not adequately providing for large vehicle parking. Two areas that will require special study because they do not function well are the Giant Forest Market and General Sherman Tree parking areas. Most areas have details such as curbing, walls, and fencing, but there is little consistency in use or materials.

OTHER SITE DETAILS

Often, the difference between a good job and a very good job is the attention paid to small details. Sequoia-Kings Canyon is replete with examples of special consideration given to otherwise ordinary details. This section deals with the miscellaneous details related to roadways, parking areas, and turnouts.

Sidewalks. Sidewalks are an integral part of a roadway or site. Most of the older walks and paved trails in Sequoia-Kings Canyon are constructed of asphalt; around the newer developments most are constructed of concrete. This has caused a lack of continuity in this design detail in the parks.

Asphalt sidewalk along Generals Highway in Giant Forest showing deterioration

Stairs. The terrain at Sequoia-Kings Canyon is such that there may be noticeable grade changes within sites. The common practice to accommodate use of these sites is to construct stairs or ramps. There are several examples of stairs that reflect CCC- era stone construction in the parks. The stone material, color and, texture blend well with the environment and link the natural and man-made settings.

Stairs in the Ash Mountain area

Stairs at Hospital Rock

Stairs in the Giant Forest area

Fences. It is often necessary to control the movements of pedestrians within an area for resource protection or other reasons. Low stone walls are frequently used to define sites and encourage certain circulation patterns. However, if it is necessary to completely restrict people from an area, such walls are a poor deterrent. This is often the situation in sequoia groves, so fencing is generally used for protection and is an important design detail at these sites.
Sequoia-Kings Canyon uses a split-rail fence design that is functional and aesthetically pleasing. The rustic, rough-hewn look complements the natural settings where it is used, and the color and texture blend well with the forested environments. Ideally, no fencing would be used in national parks, but the increasing number of visitors makes this unrealistic. For required fencing, the split-rail design that the park is now using is an excellent choice.

Fence around the Sentinel Tree in Giant Forest

Trash Receptacles. Another subtle, but sometimes very noticeable, site detail is the trash receptacle. Because the backcountry philosophy of "pack it out" is not practical in the frontcountry, trash receptacles are necessary in roadside turnouts and parking areas. They need to be convenient or they will not be used, but they do not need to dominate the scene. Sequoia-Kings Canyon uses both trash receptacles and dumpsters for solid waste disposal. Trash receptacles are used almost exclusively along roads. They are painted dark brown and have bear-proof lids. The lids increase the profile of the receptacles, making it more difficult to disguise them. In some places in the parks the trash receptacles are so prominent that they compete with the resources for the visitor's attention.

Trash receptacles sometimes compromise the entire scene, as shown in this photo at Hospital Rock.

Other Details. Sequoia-Kings Canyon has several design oddities – most notable are Tunnel Rock, Auto Log, and Tunnel Log, areas where visitors can drive through, under, or onto natural features. The philosophy in the Park Service regarding such "attractions" has changed, and they are no longer encouraged.

On a smaller scale the CCC constructed several site detail oddities. Some might be impractical to build today, but all existing details should be preserved and kept functional. The stone drinking fountains are one of the most unusual features in the parks, and they were built in various designs. They are mentioned because of their rustic character and contribution to the park's design heritage.

Drinking fountain at Hospital Rock

Drinking fountain in the visitor center complex

Bench in the Giant Forest complex

Another unusual CCC-era site detail are the carved wood benches in the parks. These benches are the epitome of rustic design and contribute in a small but significant way to the character of Sequoia-Kings Canyon.

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The roads in Sequoia-Kings Canyon National Parks have a special character largely because of the attention paid to details during early construction. The character of the roads was defined and developed primarily through the repetition of simple rustic design elements by the CCC in the 1930s. Their success was based in large part on the fact that the same group of workers, guided by the same philosophy, did all of the work in a relatively short period of time. What took 10 years to create, however, has gradually been eroded through 50 years of incremental replacement and repair guided by many philosophies and principles.

The upcoming road improvement program in the parks will provide an opportunity similar to that in the 1930s. In a relatively short period of time the fading sense of place that once individualized Sequoia-Kings Canyon can be re-created. Because of changes in technology, construction methods, and current standards, this work will undoubtedly depart from the handcrafted appearance of CCC-era construction, and a new generation of details will be born. However, great care has been taken to base the following recommendations on the same principles and philosophy of rustic design that guided the craftsmen of the 1930s.

A note to the users of this guideline: The recommendations are in no way intended to stifle creativity or produce "cookie cutter" details throughout the parks. On the contrary, every site in the parks has its own character, constraints, and requirements. All of the designers' skills will be needed to identify the appropriate combination of details and lay them out in a manner that complements each site. The intent of this guideline is to provide those involved with a consistent philosophy and design style. The ultimate goal is to eliminate the *discontinuity of design detail in the parks.*

After many years of planning and design, some road and building work has already begun in the parks. The Lodgepole market was developed in 1984, and work is currently underway at Clover Creek to replace overnight lodging to be removed from Giant Forest. The Dorst Creek campground is in the last phase of reconstruction. Consequently, many design details are already in place. These details were developed using the same rustic design principles identified in this guideline and are consistent with its recommendations. Actual details from as-built construction drawings for most of the recommendations are available from the Denver Service Center, Technical Information Center files.

The existing character of roads in Sequoia-Kings Canyon is based on rustic design principles, and these principles should continue to prevail. Native materials should always be used, and details should be constructed at a scale that does not overpower the natural elements of the scene. If a desired effect or function can be attained through grading and revegetation with little or no site disturbance, then no structure should be built. If a structure is required, it should be at a complementary scale.

Promoting continuity of detail throughout the parks should also be a major objective. The consistent and systematic use of details should permit visitors to identify individual functions and services and to differentiate between them. Likewise, a recognizable hierarchy of details should be established to distinguish subtle differences between similar functions. For example, stone walls and curbs, scrolled wooden signs, and trash cans should be visual cues that a turnout provides access to or interpretation of a resource of special interest. On the other hand, a turnout without these design details should be recognized simply as a place to pull out of traffic. A hierarchy of sign types should also be consistently used to give visitors cues. A large sign with an ornamental base should indicate a different function than a simple routed-wood sign on a wood post.

MATERIALS

Because all details should complement their sites – not intrude on them – materials the same as those occurring naturally in the local area should be used wherever possible. In the case of stone, the brown to reddish-colored schist common at lower elevations should generally be used in the Kaweah Canyon and switchback areas. In the big tree and ridgetop areas, sierra white granite should be used. In all cases the rock that is most prevalent at the specific site should be used.

Schist is a metamorphic rock that is well stratified and is relatively easy to work for the applications recommended in this guideline. It splits with a smooth face, which is appropriate for walls and lined ditches. Because of the stratification, however, care should be taken to ensure that the strata are laid on the horizontal plane. Granite, on the other hand, is an igneous rock with little stratification. This homogeneous rock tends to assume an almost cubical shape, which is favorable for use in all types of applications, and it can be oriented on any plane.

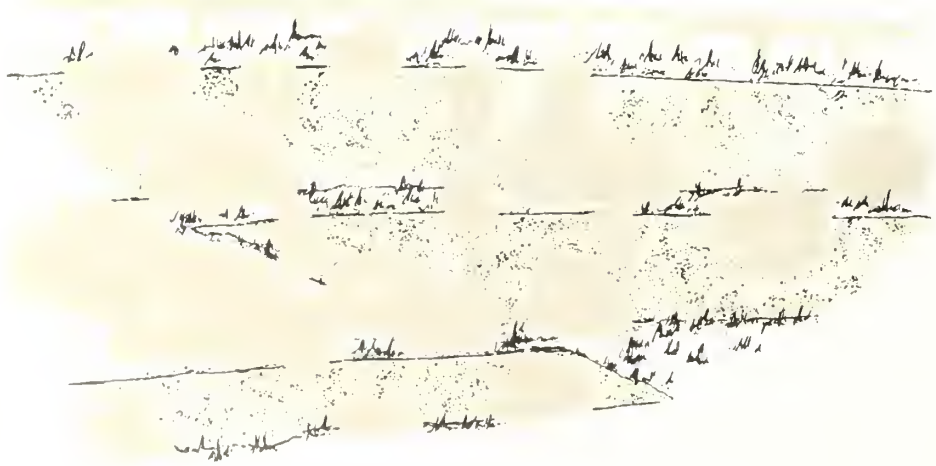
Wood should be used wherever possible for signs, signposts, site delineators, milepost markers, benches, fencing, and similar site details. (This recommendation differs from the NPS sign manual's recommendation for signpost material, which is weathering steel.) Depending on the tree species, the wood should be treated with CCA or ACZA with no incising (0.40 retention, AWPA standard C2-80 [AWBA LP-22] minimum). A treated or natural appearance is preferable to painting.

WALLS

Native rock similar to rock occurring naturally in the local environment should be the material of choice for all wall construction or reconstruction.

The only materials exception is in the Kaweah Canyon area where, for structural reasons, very high walls are required. Weathering-steel bin walls have already been extensively used, and the color and texture of the these walls blend well with the local environment. A study is being conducted to determine if technological advances in wall construction since the 1960s may make other techniques or materials more appropriate. To soften the appearance of any new or reconstructed walls, the faces of the walls should be battered – or otherwise stepped or terraced – to create planting pockets for native vegetation wherever possible. More acreage would have to be disturbed to construct a stepped wall. However, in the long term, the natural screening of vegetation would compensate for the additional disturbance. The ultimate goal for walls not constructed of native materials should be to use a color and texture that complement the specific site and to design and build them to encourage the growth of screening vegetation.

New stone retaining walls over 6 feet high should be avoided in cut slopes. Where grade differences require walls higher than 6 feet, two walls separated by a sloped terrace should be built. The terrace between the walls should be planted with native vegetation to reduce the visual impact of the walls.

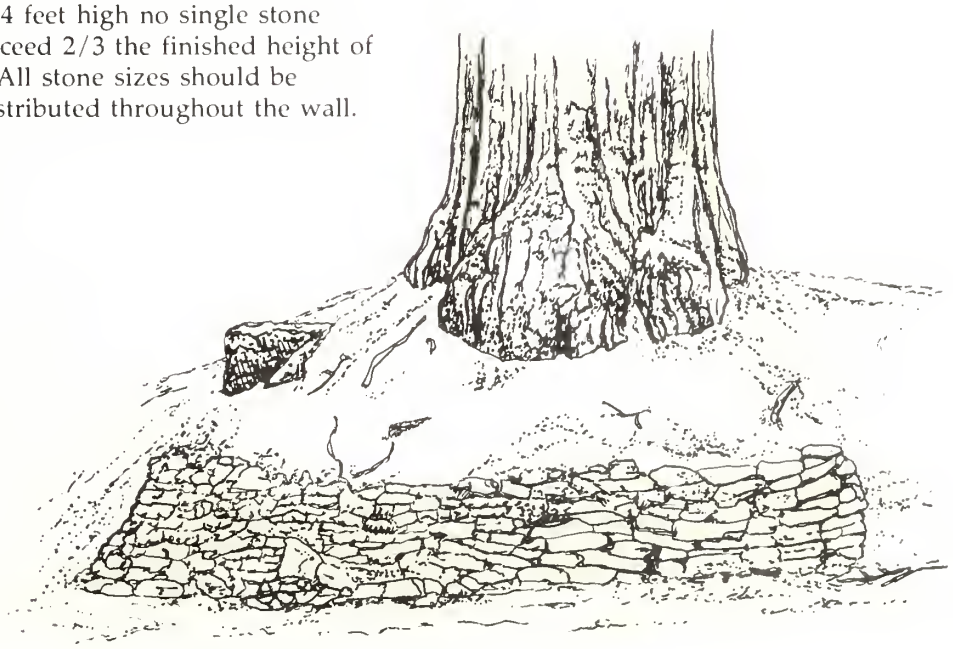


Dry-laid walls should be used to reduce the size and impact of cuts and to minimize the erosion associated with bare slopes. To achieve the greatest structural integrity, attention should be paid to the quality of the rock used, the craftsmanship of the mason, "floating" in backfill material between joints, and backfill compaction. The face of a dry-laid wall should be battered 3 to 6 inches back for every foot of height.

Some specifications require placing the largest stones in the lower part of dry-laid walls, which can result in a stratified look. To deliberately build a wall with the smallest stones in the upper portion can cause that portion to ravel and fall apart; therefore, this technique should be avoided. In walls over 3 to 4 feet high no single stone should exceed 2/3 the finished height of the wall. All stone sizes should be evenly distributed throughout the wall.

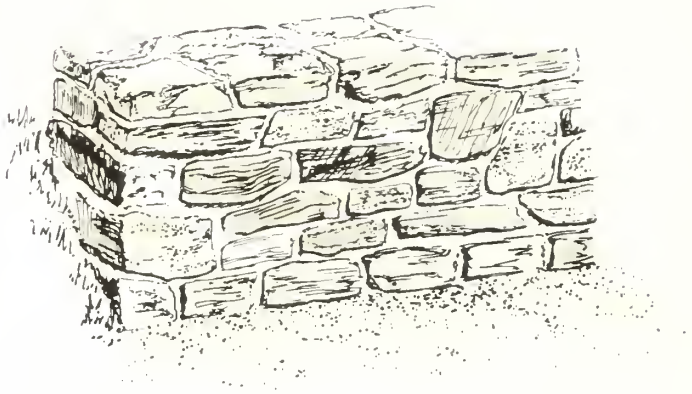
Dry-laid walls were recently constructed at the Dorst Creek campground and the Clover Creek development. They should be used as examples by designers to ensure continuity throughout the park.

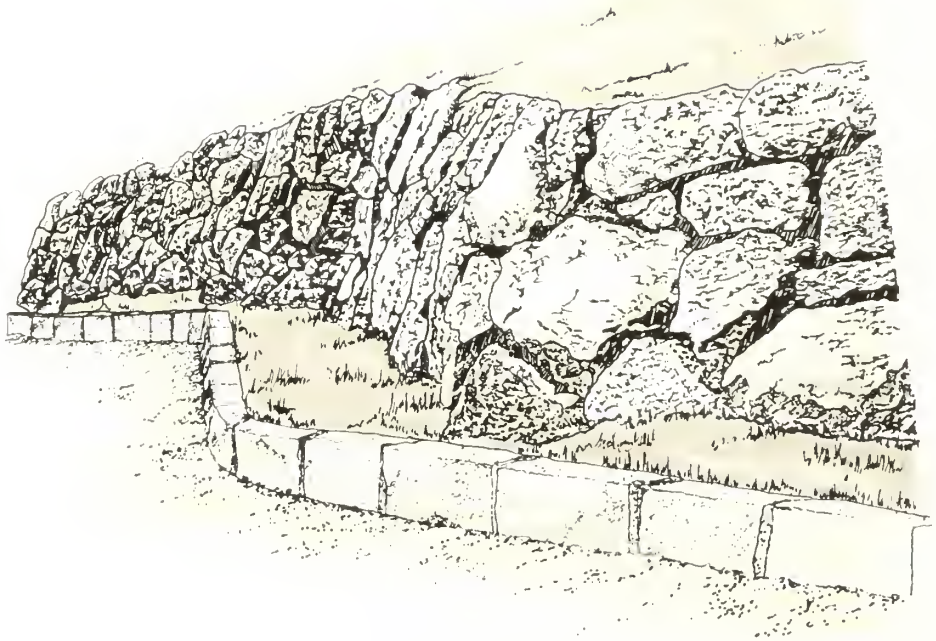
Because of the limited structural applications of dry-laid walls under today's design standards, walls that support the roadway (within an area created by a 45 degree angle from the pavement edge) should, where possible, be constructed of reinforced concrete with a stone veneer. The same is true for culvert headwalls and box culvert wing walls. Again, an exception could be made for very tall walls such as in the Kaweah Canyon area.



Because the intent of a veneer wall is to look like a solid stone wall, it is important that the ends, top, and back of the stem wall (if it will be exposed to viewing) also be veneered.

The finished appearance of a veneer wall depends greatly on the relief of the face and the joints. Individual stones should be staggered so joints do not line up. To avoid the look of uniform courses of stone and to help stagger the joints, individual stone sizes should be varied. The maximum space between contiguous stones should be 3 to 4 inches. Generally, joints between the plane of two adjacent stones should be a minimum of 3/4 and maximum of 2 inches. All joints should be raked deep enough to give the appearance of a dry-laid wall. However, a minimum of 75 percent of each stone should be held in place with mortar.





The existing stone guardwalls in the canyon and switchback areas of the Generals Highway contribute significantly to the rustic character of those areas. They also have some historic significance. Where these walls are adjacent to the roadway, they will likely be affected by road reconstruction. Because they are rubble walls with no structural elements and they do not meet current crash standards, these walls should be dismantled. Where this is necessary, a reinforced-concrete stem wall should be constructed, and the original stone used as veneer so that the new walls resemble the original walls as much as possible. This will be most applicable around turnouts.

The details for guardwalls are the same as those for stone veneer walls. However, since vehicles are more likely to strike these walls, the relief on the face should be kept to 2 inches or less. If the back side of a guardwall will be visible because of the curvature of the road, both sides of the wall should be veneered; if not, a textured concrete surface may be used. If a guardwall will outline a turnout and will not be immediately adjacent to the road, the same veneer method should be used, but a smooth face (less than 2 inches relief) is not as critical. Wherever possible, all guardwall ends should be flared into natural or man-made landforms and buried.

CURBS

Schist or granite of the same type found in the immediate area should be used for curbing in all places where visitors leave their vehicles, including interpretive/scenic turnouts, parking areas, entrance stations, developed areas, and to a limited degree campgrounds. Different curb materials should not be used in the same location. If asphalt or concrete curbing is already in place, it should be replaced with native stone for continuity. For economic reasons, existing curbs may not be replaced until they are sufficiently deteriorated.

Where islands in parking areas are curbed, vegetation should be planted in the island for safety and aesthetic reasons. This is especially true at higher elevations subject to heavy snows.

Where used, stone curb should be placed in a continuous bed of concrete with a backing. The stone and continuous-concrete bed curbing at the Dorst Creek campground is a good example.

When a curb is used as a drainage structure in an area other than a visitor use area, the use of stone is often cost-prohibitive. In these situations curb material (asphalt or colored concrete) that best complements the specific site should be used. Asphalt does not create a distinct and noticeable pavement edge against dark vegetation like light-colored concrete. Asphalt curbs are also easier to repair or replace than concrete. However, they are very susceptible to damage from snowplow operations.

Concrete curb can be colored to blend well with rock outcrops in a specific area. In either case, the use of curb as a drainage structure should be kept to a minimum throughout the park. Other design alternatives, such as increasing the crown of the road, stabilizing shoulders, etc., should be used wherever possible.

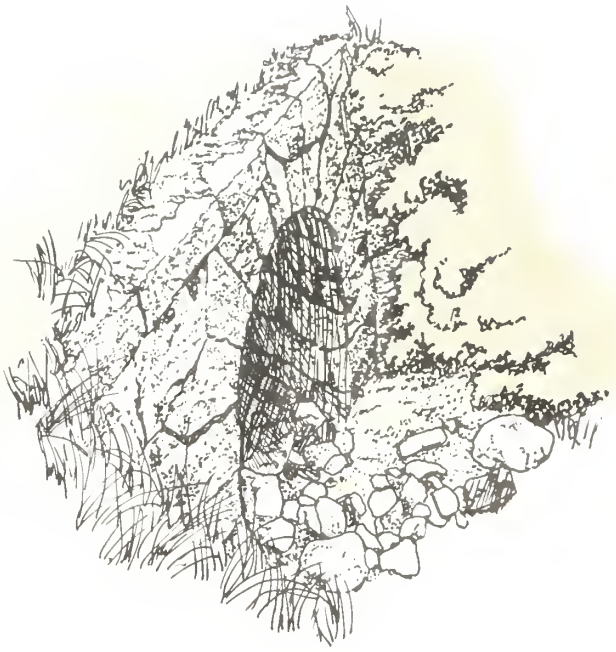
All curbs should be backfilled, and the disturbed area revegetated.

DRAINAGE FEATURES

Rock similar to that occurring naturally in the immediate area should be used as veneer on all headwalls, wing walls, and bridges, as described in the "Walls" section. For small bridges in heavily forested areas logs or timbers – often used historically – could be an appropriate alternative to native rock depending on specific site characteristics. In visitor use areas native rock rather than asphalt should be used to line ditches; in other areas asphalt-paved ditches are appropriate.

Bridge rails are essentially barrier walls, and the safety criteria for minimal relief on guardwalls also apply to these rails. The Marble Fork and Clover Creek bridges should be used as design guides for all future bridge work. The arch design used in those bridges is characteristic of rustic design in the parks and should be perpetuated.

Culverts should be constructed with stone headwalls, except if they cannot be seen from the roadway or a visitor use area. In those instances the pipe should be cut flush with the finished grade and sprayed with asphalt. Stone headwalls should have an ashlar appearance because the relief and shadow effects help blend the structures into the environment.



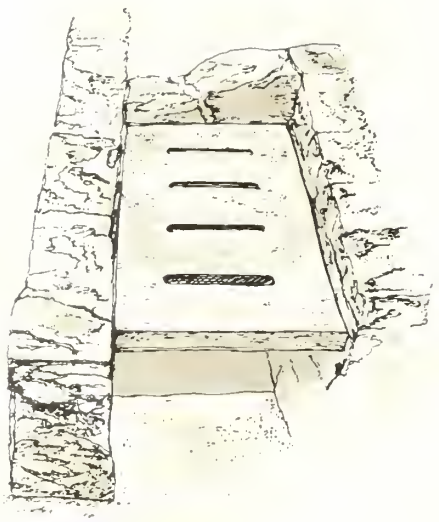
Most of the existing culverts in the parks, which date from the CCC era, have arch pipes and a stone arch over the opening in the headwall. The stone arch conceals the end of the metal pipe and improves the appearance of the culvert. During the post-war era new or replacement culverts generally had round pipe cut flush with the face of the stone headwall. The stone arch was not used, and the metal pipe was exposed. Recent work at Clover Creek has included a return to the arch pipe and the arch in the stone headwall design.

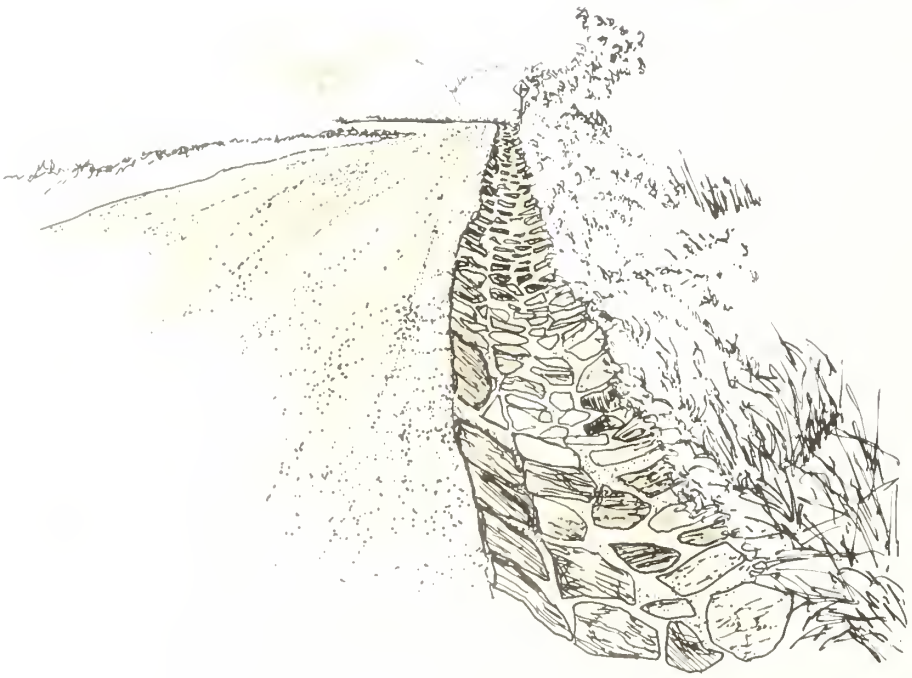
This design conforms most closely with rustic design and is consistent with existing CCC-era culverts. The Clover Creek culverts should be used as examples for future culvert designs throughout the parks.

All culverts should have the outfall armoured with rubble stone that matches the rock in the headwall and the immediate area to prevent erosion.

The stone drop inlets in the Kaweah Canyon area have been noted for their excellent craftsmanship and their contribution to the rustic character of the parks. However, they are also a safety hazard because of their large openings and protruding stones at the road edge. These features should be saved during any reconstruction, and if they still function well as drainage features, they should be modified to improve safety and retained for that purpose. Recommendations for safety modifications would include removing the protruding rocks and installing stone grates. If the schist stone used proves too fragile, it could be set over a steel plate.

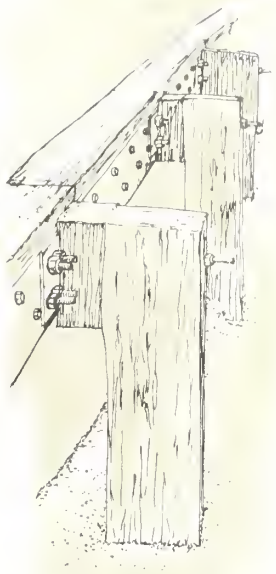
Stone-lined ditches or swales are highly visible and add significantly to the rustic character of the parks. They should be built only in visitor use areas where drainage is required and the slope is steep enough to promote self-cleaning and should be constructed of rock similar to that occurring in the immediate area. As with stone curbing, the stone-lined ditches should be installed in a continuous bed of concrete.





GUARDRAIL

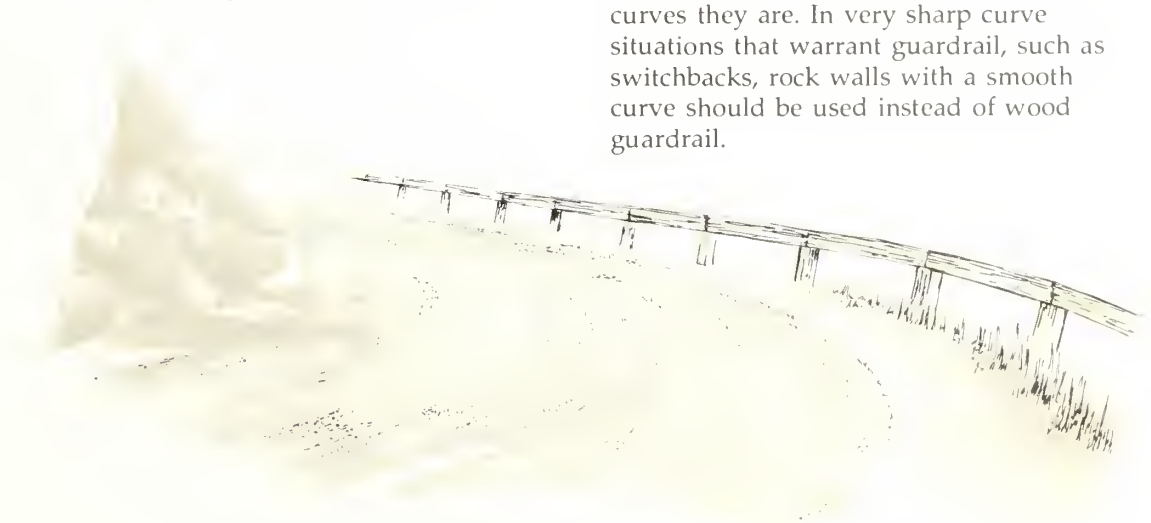
Guardrail should be used with discretion in any park, and particularly in Sequoia-Kings Canyon. The scenic views from the roadways constitute a major part of the visitor experience, and guardrail has definite negative impacts on that experience. At best, guardrail is an intrusion on the scene, at worst, it restricts or blocks views. However, there are proven safety benefits associated with guardrail that cannot be ignored. Besides its obvious protection from going off the road, it helps define the road edge, which is particularly important for night driving.



Although the weathering-steel guardrail in the Kaweah and switchback areas functions well and blends with the colors of those environments, it is not totally compatible with the big tree and ridgetop environments. A material is needed that suits all park areas and reflects the principles of rustic design. A timber rail with steel backing, which incorporates native materials and blends well with all park environments, has been crash-tested and approved for roads within Sequoia-Kings Canyon. This timber guardrail should be used wherever appropriate throughout the parks.

There are established standards for installation of guardrail in terms of blockouts from posts and flares. This guideline recommends that, wherever possible, rails terminate in natural or man-made landforms. Also, where space is limited on an existing bench, longer posts rather than sliver fills should be used to get enough soil behind the posts for support.

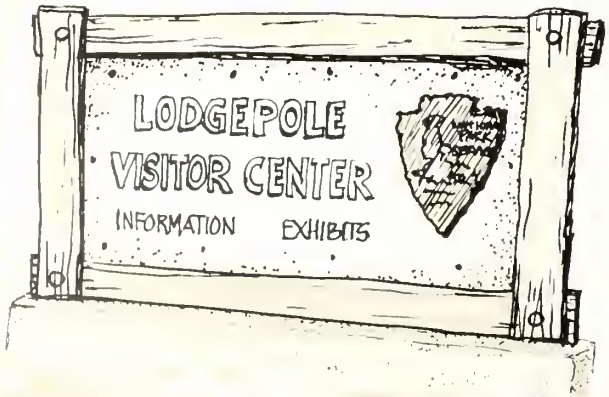
Wood rail does not bend, so on sharp curves chords (short straight sections) must be used. On gentle curves the chords are not noticeable, but on sharp curves they are. In very sharp curve situations that warrant guardrail, such as switchbacks, rock walls with a smooth curve should be used instead of wood guardrail.



SIGNS

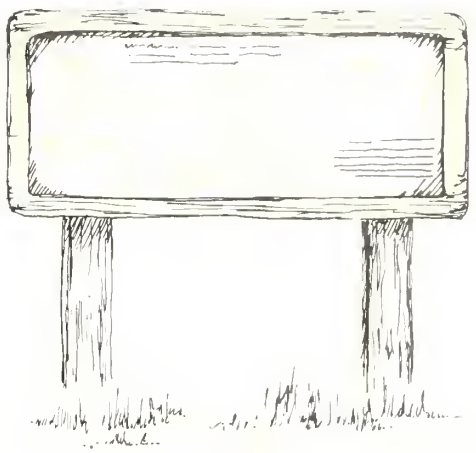
As a general rule, all signs should be kept to the minimally acceptable size. Because of the slow travel speeds on most park roads, large signs that can be read from great distances are not required. The number of signs should also be kept to a minimum to preserve the intimate character of park roads and avoid detracting from visitor experiences. All signs, except regulatory signs, should use native materials and have a distinctive, traditional character that is consistent throughout the parks.

There should be a uniform hierarchy of signs throughout the parks. Large wood routed signs with stone bases should be used at all park entrances and developed areas so that visitors can easily identify them as major stopping points or attractions. The Indian head entrance sign at Ash Mountain should be used as an example. The Lodgepole visitor center sign is an appropriate modern expression of the concepts used in designing the Indian head sign.



All interpretive and scenic turnouts and parking areas should have routed wood signs of a uniform design. The signs should be less dramatic and ornate than entrance signs but more than simple slabs of wood with messages. The interpretive messages should be routed on these signs, and the lettering style should be consistent. All lettering on interpretive signs should be painted yellow. The Mount Stewart sign is the best example of this type of sign in the parks and should be used as a guide. The routed outline of the main interpretive feature is a design detail that is characteristic of Sequoia-Kings Canyon and should be carried through on all new signs. These signs should be mounted in a consistent manner throughout the parks.

Routed wood interpretive signs do not always provide sufficient graphic detail to meet interpretive needs, and photos are often useful in interpretation. Where this is the case, porcelain enamel metal signs of the same size, shape, color, and lettering style as routed wood signs are appropriate. These signs should also be mounted in a manner appropriate to the site.



Informational and directional signs along roadways should be simple square or rectangular routed wood signs with the same lettering style. These signs should have white lettering. To improve their visibility, glass beads should be used when the lettering is painted. They should also be mounted in a consistent manner.

Traffic control signs should be standard metal signboards with reflective lettering. They can be mounted on metal or wood posts, but wood is preferable. The backs of all metal signs should be painted a brown color that blends with the local environment. Details for these and directional signs can be found in the *Manual for Uniform Traffic Control Devices* (MUTCD). When the current testing of routed wood traffic control signs produces results that meet acceptable standards, these signs should be considered for use in Sequoia-Kings Canyon.

TURNOUTS AND PARKING AREAS

Efforts should be made to maintain as many turnouts as possible along the Generals Highway, and additional turnout sites on the cut side of the road should be explored and developed, particularly in the canyon and switchback areas. These additional turnouts will be primarily for traffic management, not for scenic viewing or interpretation. An average distance between turnouts of 1/4 mile or less is optimum, although this may not be possible in all areas.

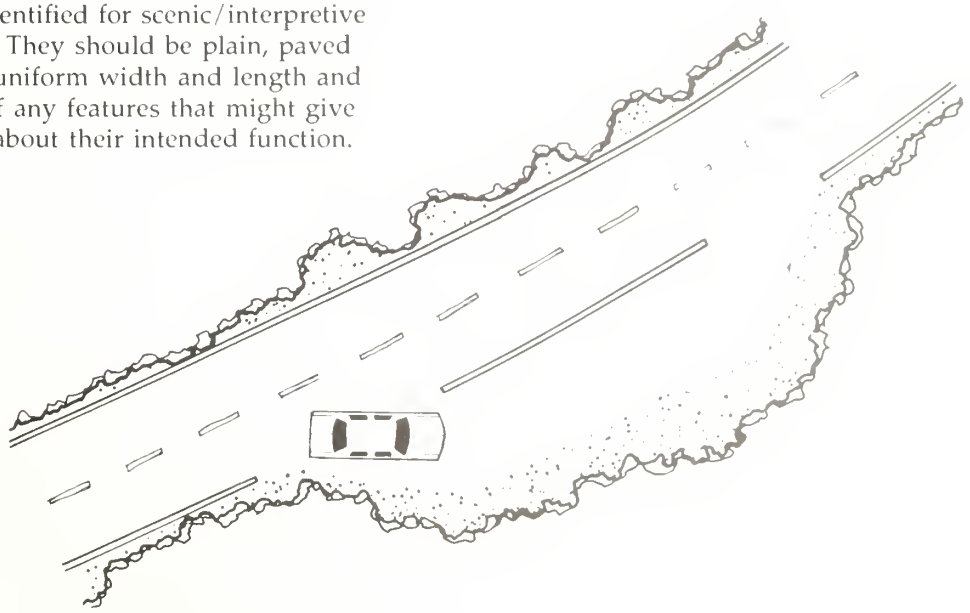
All informal, dirt turnouts that are not converted to formal turnouts should be obliterated; if necessary, landforms (mounds, berms, etc.) should be built at these sites to discourage future use. If existing formal turnouts are going to be abandoned, they should also be modified to discourage use.

If possible, some uniformity of width and length should be established for turnouts, depending on their intended function. Most existing turnouts are between 10 and 20 feet wide, but some are less than 10 feet wide. Ideally, all turnouts should be a minimum of 15 feet wide to allow vehicles enough room to get completely off the road and open doors. Turnouts where visitors are encouraged to leave their vehicles should be wide enough for large vehicle (RV) parking. Most existing turnouts are between 105 and 158 feet long, but several in Sequoia are only 52 feet long. (These figures include areas where the turnout tapers in and out of the main stopping area.) Available space on the benches, particularly in the canyon and switchback areas of the Generals Highway, will ultimately dictate both length and width of turnouts, but some uniformity of length is desirable. If visitors are to be encouraged to use traffic management turnouts for slow-moving vehicle passing, they must be able to rely on the turnout being at least a certain length; therefore, these turnouts should be a minimum of 150 feet long, if possible. Interpretive/scenic turnout lengths are less critical, and available space and demand should dictate length.

Sight distance and safety should be carefully considered at all turnouts. The design standard for sight distances on most park roads is roughly between 400 and 450 feet. Based on that standard, FHWA studies indicate sight distance problems on 50 to 75 percent of the turnouts in the lower 17 miles of the Generals Highway. Every effort should be made to mitigate these problems at existing turnouts and avoid them at new turnouts while maintaining the 1/4-mile or less average distance between the turnouts. Many existing and potential sight distance problems can be mitigated by managing brush along the road sides.

There should be a hierarchy of turnout designs for visitor identification purposes. All interpretive/scenic turnouts should have stone walls and curbs, the appropriate type of sign, sidewalks if possible, and a trash receptacle. In addition, since there is limited space available at many turnouts for islands to separate them from the road, the edge of the roadway should be delineated. A possible solution is a stone delineator installed flush with the pavement to give a visual and auditory indication of the road edge.

Turnouts that are intended for traffic management should not have any of the details identified for scenic/interpretive turnouts. They should be plain, paved areas of uniform width and length and devoid of any features that might give miscues about their intended function.



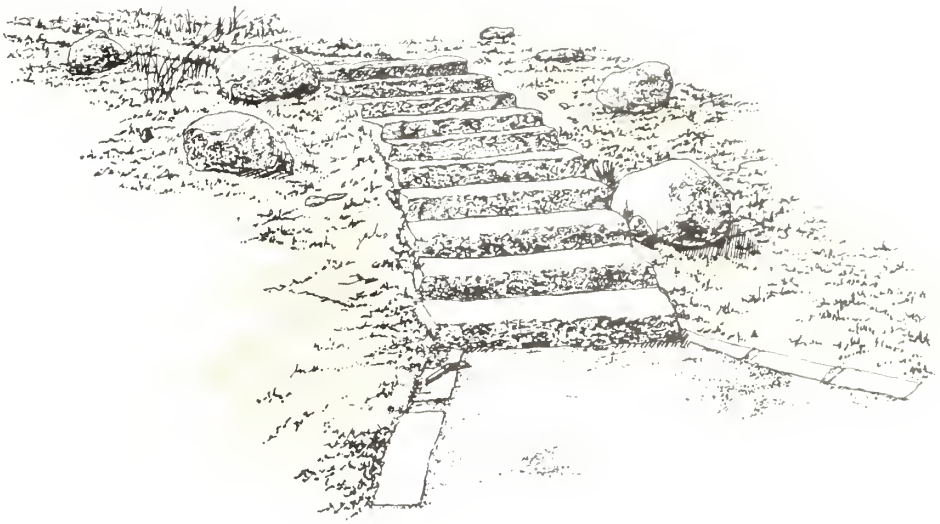
Since the primary function of these turnouts is to allow traffic to pass slow-moving vehicles, it would be desirable, wherever possible, if no parking was allowed.

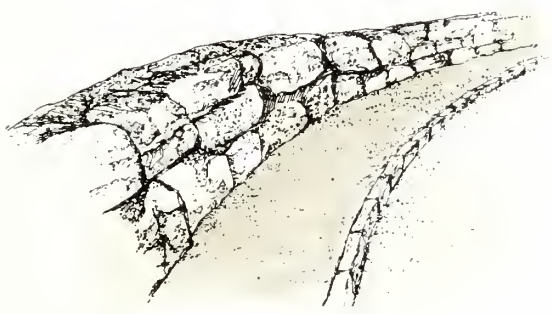
All turnouts should have advance warning signs. Interpretive turnouts should have advance signs in both directions that indicate the turnout names; these signs should be rectangular, routed wood signs mounted on low wood posts of a uniform height. Traffic management turnouts should have signs only on the same side of the road; these signs should be routed into low wood posts of a uniform height. The turnout symbol illustrated on this page should be prominently displayed on all traffic management turnout signs. In addition, signs containing the symbol and a multilingual explanatory message should be placed at the top of the switchback area, the bottom of the canyon area, and perhaps somewhere in between. This advance signing will help visitors distinguish between interpretive turnouts and traffic management turnouts and will somewhat mitigate the safety problems associated with the narrow, winding roads and limited sight distances.

Parking areas should be evaluated on a case-by-case basis as they are rehabilitated or reconstructed. Curbs, sidewalks, walls, fences, pavement, and functional characteristics should all be looked at, and details should be replaced or repaired if necessary. The concept of uniformity should be considered. If incompatible materials exist, such as concrete curbs, they should be replaced. Wherever possible, parking areas should be redesigned to accommodate large vehicle parking, as this is a common deficiency in all parking areas in the parks. The only known parking areas with other obvious operational deficiencies are at the Giant Forest market and General Sherman Tree. A special design analysis is needed at both areas to resolve functional, operational, and traffic conflict problems.

OTHER SITE DETAILS

Steps. There are at least three styles of stone steps in the parks. The differences are primarily in the finish detail. The steps at Giant Forest are the most appropriate to use as a guide because they are between the rough shape and texture used at Hospital Rock and the more ornamental steps at Ash Mountain. If they are an appropriate detail for the site, they should be included in new designs.



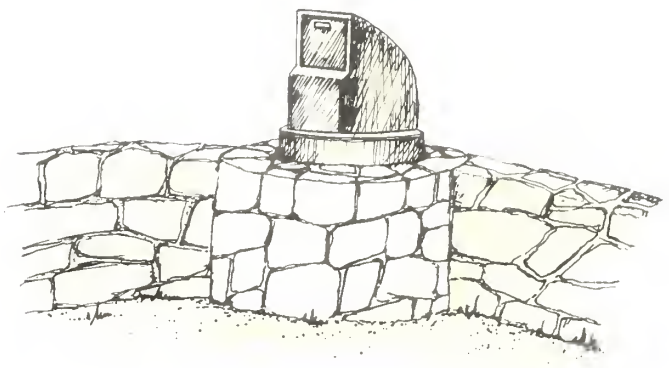


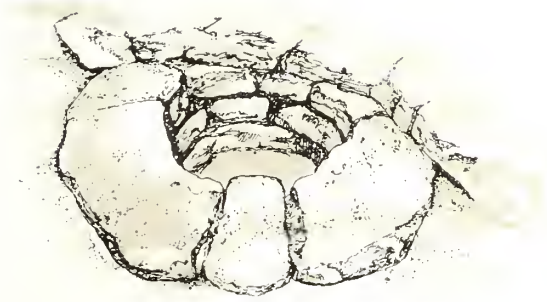
Sidewalks. Two basic materials have been used for the existing sidewalks in the parks – asphalt and concrete. Asphalt is most common at roadside areas and in Giant Forest. The Ash Mountain, Lodgepole, and Grant Grove areas have mostly concrete sidewalks. In developed areas with a dominant architectural theme, concrete is generally more visually compatible. Concrete is more durable and can be colored to match any environment. However, it has a slightly higher initial cost, is difficult to match when replacing, and is more susceptible to deterioration under heavy

snow conditions. Asphalt is easier and cheaper to initially install and easier to match when replacing. The reasons for using two different materials for walls and curbs have already been established. For the same reasons, both concrete and asphalt are appropriate materials for sidewalks depending on the site. Generally, colored concrete should be used at lower elevations and heavily developed sites, and asphalt should be used at higher elevations where development is limited, such as roadside parking areas. The surface treatment for both materials should be compatible with the local natural environment. For instance, in areas dominated by granite a light-grey colored concrete with a heavily textured surface is most appropriate. When concrete is used at higher elevation sites subject to snow conditions, a strong mix (i.e., 10 sack) should be used for durability.

Fences. The rough texture and natural color of the split-rail fencing currently used in the parks meets all of the criteria for rustic design. This type of fence should be used in all heavily visited areas in the parks. Appropriate locations for use would be in sequoia groves along trails, at individual trees along the roadway, and in parking areas to control pedestrian movements to a greater degree than stone walls would. Attention should be paid to matching the details of existing fencing. The rails should be alternately stacked between two upright posts, and dowels consistent with their rustic character should be used to hold them in place.

Trash Receptacles. Trash receptacles should only be placed at locations where visitors are encouraged to leave their vehicles. They should be convenient for use but should not dominate or intrude on the scene (for example, be placed next to interpretive signs in turnouts or near entrances/exits of parking areas). They should also be concealed to the extent possible by design treatment. The following comment, taken from a CCC crew chief report, describes how trash receptacles were concealed in the 1930s and offers a possible solution for the problem today. "[R]eceptacles for trash cans were constructed. This receptacle consists of low rock curb large enough to contain the can with space around it for easy removal and to allow air space for combustion. . . . This can then only protrudes above this curb about half its height. The type of rock used was determined by the surroundings and other developments in the area. They have proven to be quite satisfactory, as the cans stay put and cannot be easily overturned by animals."





If the same receptacles the park is using now continue to be used in the future, the wells described above could be incorporated into the stone walls around all scenic/interpretive turnouts and parking areas. The well created for the receptacle should be deep enough so that only the top of the receptacle and the bear-proof lid are visible. Drainage in the well should also be considered. If the receptacles recommended in the *Solid Waste Management Plan* are used, the same siting criteria would apply but the concealing design treatment would have to be modified. If no wall is available, a rock work facade may still be possible. At some specific sites rough-sawn wood may also be appropriate. The emphasis should be on concealment in a consistent manner.

Milepost Markers. Wood 4x6 posts about 2 feet above grade and off the road shoulder should be installed, with the milepost numbers routed into both sides facing the traffic.

Other Details. Existing drinking fountains and benches contribute greatly to the rustic character of the parks, and their use is strongly recommended wherever they are feasible and cost-effective to build. Construction would be a labor-intensive but worthwhile endeavor.

Since snow plowing is a major winter operation in the higher elevations of the parks, the installation of snow pole sleeves at curbs and islands is recommended. A detail is available that uses pipe to create a hole in the pavement; the hole may also be core-drilled.

Wherever practical and appropriate, natural and man-made landforms should be used instead of structures. One example is the use of mounds or false cuts at the ends of guardrail instead of large, unsightly end sections. In some cases false cuts can be built rather than short sections of guardrail. In areas where road alignments are moved away from existing rockcuts, soil should be sloped against the base of the rock cuts with or without toe walls and revegetated to conceal the scar. Where turnouts are to be obliterated, berms that blend into the natural contours can be used to discourage future use. Designers should continue to seek alternatives to structural solutions and should look for appropriate situations to apply these techniques.

Another grading technique that has limited application at Sequoia-Kings Canyon but may be appropriate in some situations is slope rounding. In most instances retaining walls will be the most appropriate choice to reduce the size of cuts, but there will be situations where a new cut or increasing an existing cut will be necessary. In these instances, the slope should be a maximum of 1-1/2:1 or less. Slopes this steep are difficult and expensive to revegetate, but it can be done successfully. Less steep 3:1 slopes are better but require more disturbance. The characteristics of the individual site should dictate the slope. The top of the slope should be rounded to prevent raveling. Rounding the top of cut slopes requires disturbance of more area initially, but the long-term benefits of providing a stable slope for revegetation outweigh the short-term visual impacts. Numerous examples of bare slopes with raveling "brows" and devoid of vegetation exist in many parks. These slopes are unsightly and only accentuate the scars. If 20 to 50 years ago they had been sloped to promote revegetation and rounded to eliminate the creation of a brow, by now the scar would have a near natural appearance and blend into the environment. A general slope-rounding detail can be found in most road-related plans and specifications.

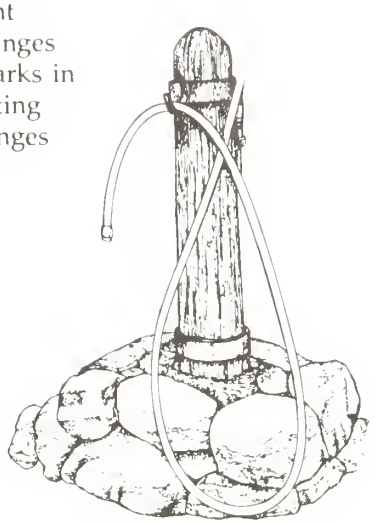
In areas where the terrain is rolling and road work requires frequent shifts from cuts to fills, the transitions can be softened by laying back the slopes more at the ends of the cuts than in the middle and warping the slopes into the fill. This is a variation of the slope rounding technique.

Revegetation is the key to a good road construction job in a national park. From an aesthetic standpoint, it can make the difference between whether a job is perceived as good or bad. For numerous reasons revegetation efforts are being strongly encouraged and currently pursued in all road projects. Steps have already been taken at Sequoia-Kings Canyon to ensure that revegetation is an integral part of the road rehabilitation program. The resource staff at the park has published guidelines for revegetation, which should be closely followed. The key to a good revegetation effort is planning and preparation. To have viable planting stock of proper genetic integrity, the effort must start a minimum of two years before construction. The objective of revegetation is to stabilize disturbed soils to prevent erosion and sedimentation and provide a medium for native plants. A mix of successional stage species should be used to leave the disturbed area looking much like the adjacent natural environment. Revegetation should be used for more than just soil stabilization. Landscape planting for function and form can be an effective means of facilitating traffic and screening selected areas.

Another consideration closely related to revegetation is vegetation management. Since most visitors experience Sequoia-Kings Canyon from their vehicles, every effort should be made to provide scenic vistas through vista clearing during road construction projects. During the design efforts for all projects surveys of the project areas should be done specifically to identify vista points. Plans should be developed specifying how to create the desired vistas and the work items to be included in the road contract or performed by the park staff. Sequoia-Kings Canyon has a vegetation management operations guide that addresses these requirements.

After the vistas have been established, a plan should identify how the vistas are to be maintained in the future so they remain open. Photographs of the newly created vistas should be taken and annotated with instructions of what to cut and when to cut it. This documentation should be kept by resource management and the maintenance staff and outlined in a timeline fashion so that the required work can be scheduled in a timely manner. With photographic documentation, the original and desired vistas can be easily re-created. This method should also be used for roadside brush removal to maintain sight distances. If the work is organized and scheduled, it will likely be done in a timely manner. A vegetation/vista management plan was recently prepared for Sol Duc Road in Olympic National Park. This plan would serve as an excellent example for a similar plan at Sequoia-Kings Canyon.

The study team recommends that park managers consider actively interpreting the Generals Highway itself. There is a fascinating story to be told about the original construction of the road and its early motoring history. Numerous artifacts from that era still exist that would strengthen the interpretive theme. Interpretation of the Generals Highway would also provide opportunities to describe the philosophy behind park roads and why they are so different from other public roads. Many changes are programmed to occur in the parks in the next 10 to 20 years, and educating the visiting public about these changes could have significant benefits.



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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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