

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Great Smoky Mountains National Park
Gatlinburg, Tennessee

Recommendations for Trail Location
and
Recommendations for Trail Construction
For All Trails Within the Park Area

Compiled by the Landscape & Engineering Depts

Dated: April 12, 1935

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
GREAT SMOKY MOUNTAINS NATIONAL PARK
GATLINBURG, TENNESSEE.

RECOMMENDATIONS FOR TRAIL LOCATION.

Because of the importance of trail flagging, and to prevent faulty trail location, which has been evident in the past, the following recommendations have been compiled for use of the men active on location projects.

These recommendations apply to both foot and horse trails except that the maximum grade for foot trails is considered as 20%, although an extreme of 30% may be used in unusual cases to avoid obstacles. It would be well to flag foot trails location on a 16 or 17% grade to afford latitude in construction.

1.- All flagging locations should reasonably follow the locations as shown on the project maps sent to each camp superintendent, and he should report for approval any departure from this location that he has to suggest which in his opinion would improve the location.

2.- The Engineering and Landscape departments shall give approval in writing to the project superintendent before construction is begun on any flagged locations.

3.- Flagging shall be done by representatives of both Landscape and Engineering Departments where possible, but all locations shall be checked on the ground by representatives of the Landscape and Engineering Departments. It will facilitate matters greatly if each camp has one or more men, experienced in trail construction, who can do much of the flagging. This can be checked by representatives of the Landscape and Engineering Departments. The experienced trail constructor usually is a good locator and on his locations he should be accompanied by one familiar with the territory in which he is working.

The following are some instructions that all trail locators should bear in mind. Locations should not be hurried. The locator should familiarize himself with the area, through which the proposed trail will pass, by a study of the topographic maps and by walking over the area. There are usually certain control points such as gaps, points on ridges where outstanding views are to be had, fords or stream crossings, bridge sites and points of interest on streams or places where natural formations of interest appear, through which the trail should pass. From a study of the topographic maps, the locator can determine the approximate length of the trail between these control points, and the difference in elevation, which information will aid him in determining the grade to use on his preliminary line. Should the locator find that on approaching a control point, his line is running considerably above or below he should not abruptly change his grade in order to make the control. This will put an undesirable pitch in the grade. In such cases he should flag over the entire line using an adjusted grade more nearly like that required between the two points, or he should go back on his line far enough so that change in grade will be gradual and not an abrupt change.

4.- A trail should always be flagged through to its objective before construction is begun, or it should be carried to some definite control point where the certainty exists that no difficulty will be encountered in the location ahead.

5.- If two possible routes suggest themselves in any portion of the location, each route should be run out before determining the proper route.

It is often the case, where two possible routes exist, that the easier route is chosen, whereas the more difficult one may be the better. The locator should investigate all possible routes, so that the Landscape and Engineer Inspector may determine whether the advantages offered by the more difficult location would justify its adoption, rather than the easier and less costly way.

6.- Where the location is along a ridge or divide it should follow the top, wherever possible, without excessive grades. Where the top of the ridge cannot be followed on account of excessive grades, the trail should be flagged from gap to gap. At no time should a trail be flagged just below the top of the divide where the view on one side is obstructed. In some cases it is desirable to increase the grade in order to stay on the ridge top where desirable views are to be had. When this method is adopted the grades should not exceed 20% and that grade maintained only for short distances. Representatives of the Landscape and Engineering Departments will approve grades over 15%. Similarly, on routes following streams, a location within sight of the stream is better than one just far enough away to lose the view entirely. It gives variety to a trail following a ridge to occasionally follow the opposite side. An occasional crossing of a stream will give variety to the trail; Also the fords serve as watering places for horses.

7.- Each trail has its starting point and its objective. It is not desirable to make the distance between these points unnecessarily long, but if the distance is shortened by means of excessive grades a very objectionable feature is introduced. The use of switch-backs is the easiest method of getting up a grade and requires less study on the part of the locator. Usually where switch-backs are employed, the locator has not thoroughly familiarized himself with the area or he has not take the trouble to investigate the adjacent territory, and spread his location over a great enough area. He may have had in mind primarily the general direction of his objective, confined his location to one side of a steep hill in a limited area, and worked toward his objective by means of switch-backs. He should have continued around the other side of the hill even though at times he was traveling away from his objective. Put the necessary distance in the location to make the difference in elevation on a good grade. By doing this he can approach the objective in such a manner that abrupt changes in direction are, in most cases eliminated. Often these abrupt changes in directions are the only objectionable feature in a well located trail. Where the topography requires a change in direction, every effort should be made to find a location, comparatively level or on an easy grade, where a wide turn can be made. If this turn is so located that the inside area contains rock masses or natural growths arranged so that as one approaches the turn he does not see the portion of the trail above the turn, some of the objections to the turn are removed.

8.-Every effort should be made to keep trail grades within the limits adopted by the National Park Service. For horse trails the maximum grade adopted is fifteen (15%) percent with an extreme of 20% allowable in extreme cases when avoiding obstacles. For foot trails see paragraph on page one which establishes grades.

9.- The trail entrance should receive attention and be so located that it will be attractive. The start of the trail should not pitch suddenly up or down, but work gradually into the proposed grade. There should be good reason for an abrupt change in grade as well as for a grade that rises to a point and then loses elevation on a down slope. Such conditions are sometimes justified and the locator should have his reasons for these conditions to explain to the one making the inspection.

The following information in regard to stream crossing may apply more to the construction of the trail than to the location but must be appreciated by the locator in choosing locations for such crossings. Fords are preferable, as a rule, to bridges. Care must be taken in the selection of ford crossings and in the grade in and out of them, or the person doing the construction will encounter difficulties in following the flag line. The ford should be so located that the builder will be able to make a descending grade into the ford from both sides. It is well to remember that at practically all ford crossings foot bridges should be built for foot traffic. The ford should be so selected that this bridge can be located below the ford in order not to interfere with the view up the stream, which is always the most interesting. When constructing a ford crossing it is usually desirable to work up and down the stream and remove obstacles that tend to concentrate the water in narrow, swift channels, and to spread out the water at the crossing to slow it up. The locator must decide upon the approximate grade of the crossing in order to flag the grade in and out of the ford. Streams are among the most attractive features on trails and crossings and should be chosen with this in mind. The locator should not flag for a horse bridge unless the stream is of such size that horses will not be able to cross at high water, or unless the stream banks are too high to afford construction of a ford without considerable damage to the surrounding territory. Decisions should be made on location and construction of bridges by Landscape and Engineering representatives at the time of inspections. It is recommended that all bridges be designed by the Landscape department.

10.- At stream crossings and at draws and hollows where water flows continually or intermittently, flagging should provide for a dip in the grade to prevent the water from flowing down the trail.

11.- On approaching and leaving a stream crossing and, where flagging over difficult areas, it is well to ease the grade somewhat since the constructor may, when he builds the trails, depart slightly from the location and the grade. If he leaves the location on a stiff grade it will be impossible for him to get back into the flag line again without an excessive grade.

12.- Where the locator encounters large trees, boulders or other obstacles, he must decide if he will go above, below or through that obstacle. If he flags below such an obstacle and later the constructor finds that he must go above it, there may be a difference of five or six feet in elevation. If the point is on a steep side slope. This condition will cause difficulty in returning to the flag line and may require considerable reflagging. When flagging below trees recommendation should be made for a wall which will protect the roots on the lower side. The above noted factors continually encountered in trail location show the advantages of employing a locator who has had trail building experience.

13.- It is desirable that there should be water for drinking purposes, both for men and horses, at intervals along the trail. This factor may determine a portion of the location. The locator should be on the lookout for any attractive view or other desirable feature along the trail and locate the trail to take advantage of these wherever possible.

14.- Locations on very steep side slopes cause the most conspicuous scars. These can sometimes be avoided by a careful locator.

15.- Trails in a National Park serve the double purpose of making the territory accessible to tourists and to the fire protection organization. In certain localities they may be essentially one or the other, but both factors usually must receive consideration in location work.

16.- Poor drainage is probably the most destructive element to the life of a trail. Where there is on the location neither a slope to the right nor to the left, it is difficult to divert water from the trail, and to prevent it from running down the trail and washing it out. Sometimes the locator may have the choice of locating where there is some side slope which will facilitate drainage greatly. It is often desirable to follow old road locations in trail flagging since such locations do not create a new scar; however a trail located in an old sunken, washed out road bed will be extremely difficult to drain. It may be advisable, in some cases, to select an entirely new location rather than follow the old road.

17.-In trail location care should be taken to see that the trail is kept below falls and cascades so that the view is available into the falls or cascades rather than over them. In the event that these features are in a series it is well to locate the trail so that it passes through the area, in order that varied views are possible at interesting places.

18.- Cliffs present an excellent opportunity to develop spectacular sites and interesting places in the trail location. The trail should pass over the top of the cliff, close to the edge or else directly under it. Rock outcroppings should have particular study in the trail location. Attention should be given to bringing out the interesting feature whether it be stratification, moss or growth formations, shape, size or extent of the out-crop. In any event it is well to bring the locations as close as possible to the outcroppings.

19.- Care should be taken wherever possible to make the trail location pass as many of the fine natural growths and features in the watershed, such as areas of particular plant beauty, springs, caves, rock formations and places of geological interest.

Recommendations for Trail Construction.

The following recommendations have been compiled from notes and reports and are presented for the convenience of the trail construction foreman in the field.

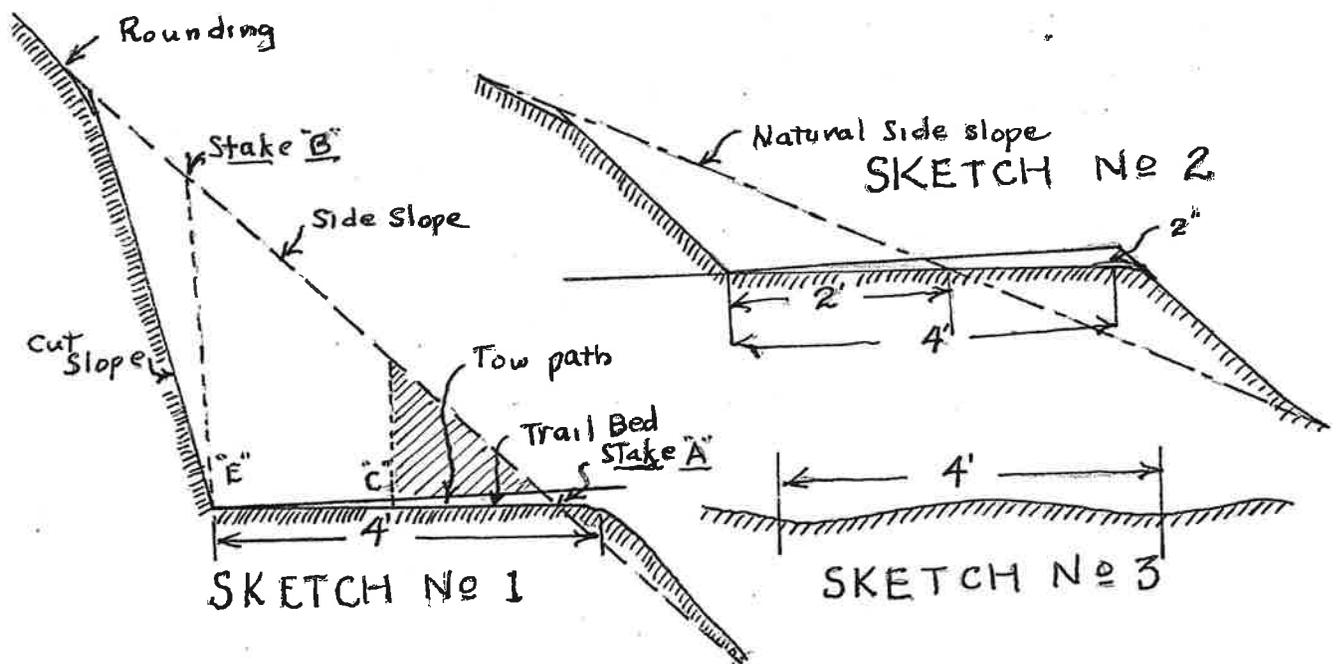
Starting construction.

Construction should not be started on a trail until the line has been flagged through to its destination (or to a definite control) and approved by the Landscape and Engineering Departments.

METHOD OF PROCEDURE.

The following method of lining out construction ahead is followed by several of the best trail builders in the Park with satisfactory results. Always keep well ahead of construction, lining out the trail with stakes as shown in Sketch No. 1.

Stake "A" is at the trail grade where the cut section begins. Stake "B" is at the inside edge of the trail floor. The distance between these stakes will vary according to the steepness of the side-slope. On 1 to 1 slopes or slopes steeper than 1 to 1, the width on solid earth should be three and one-half feet (See sketch No. 1); as the cross slopes approach a 3 to 1 slope the width on solid approaches two feet (See sketch No. 2). Trails built in places where no side slope exists should be built in accordance with Sketch No.3.



Clearing or swamping out of existing growth is not permitted until the exact location of the trail is determined and then is done only for the width of the trail floor plus the distance to the top of the cut. Later it may be necessary to clear wider spaces, but the plity of clearing ahead on the flag line often results in taking out considerable growth that could have been saved if the exact location had been staked out in advance.

In staking this location the foreman should closely follow the flag line but may depart from it a few feet occasionally since he is in position to give the location much more detailed study than was given by the locator when the line was flagged.

Stakes should be spaced closely along the line so those doing the excavation can follow from one to another easily. On curves, stakes should be placed very close together so that there will be no variation from the alignment set.

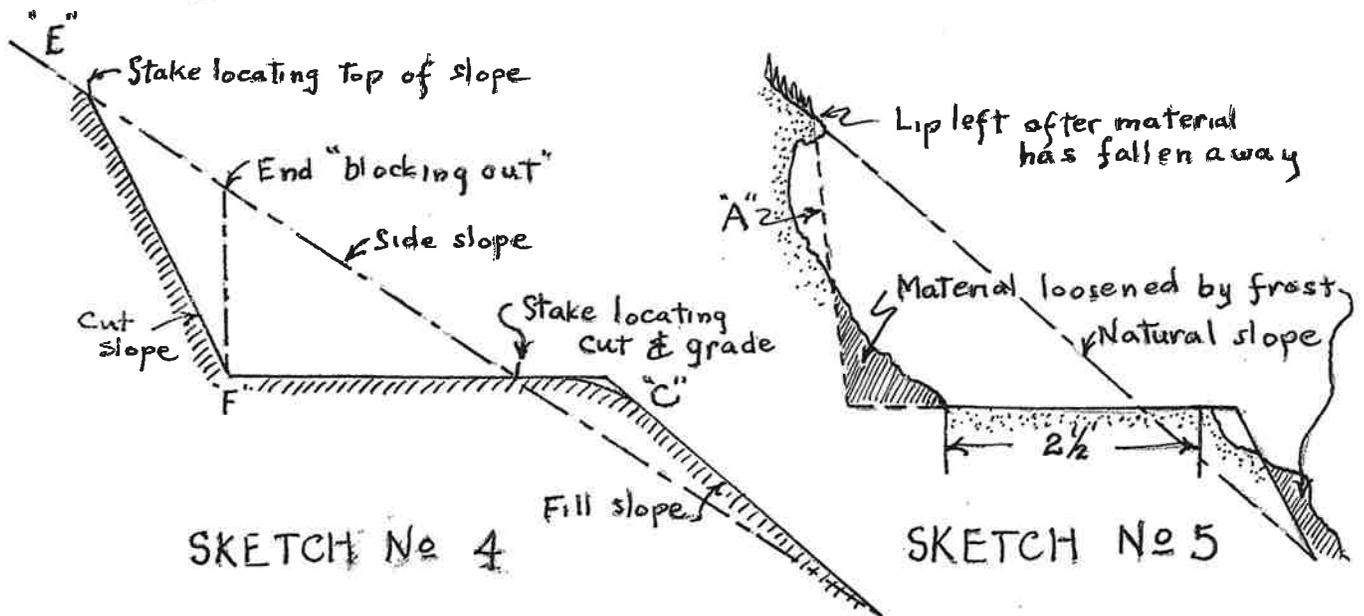
Methods of starting the excavation differ with various foreman but the following is recommended:

A narrow tow path, about 18" wide is worked out at the base of the cut along line "A" and excavated back to "C". This tow path is kept well ahead of construction. (See sketch No. 1) This narrow trail then establishes the line of excavation on the trail and the grade of the trail. In the event that it is necessary to alter the grade or the location, this can be done with less loss of time and money than if the entire floor of the trail were graded. This narrow trail acts as a lead for others to follow and should be done by capable men.

The next operation consists of excavating the trail back to its full width. This is best done by spacing men 15 or 20 ft. apart who excavate to the back edge of the trail floor at "E" (See sketch No.1) The bank "E"- "B" is left straight up at this stage of the work.

Following these graders are others sloping banks. The top of the slope, point "E", sketch No. 4, should be marked or staked on the grounds and the slope cut straight from "E" to "F".

Following these graders are two or three men selected as good finishers who round over the sharp edge at "E", put finishing touches on the cut slope, finish the trail bed with a slope of 1/2" to the foot toward the outside, (2" in 4' round over the edge at "G", and dress down the filled slope drawing it well down and feathering it out into the natural grade.



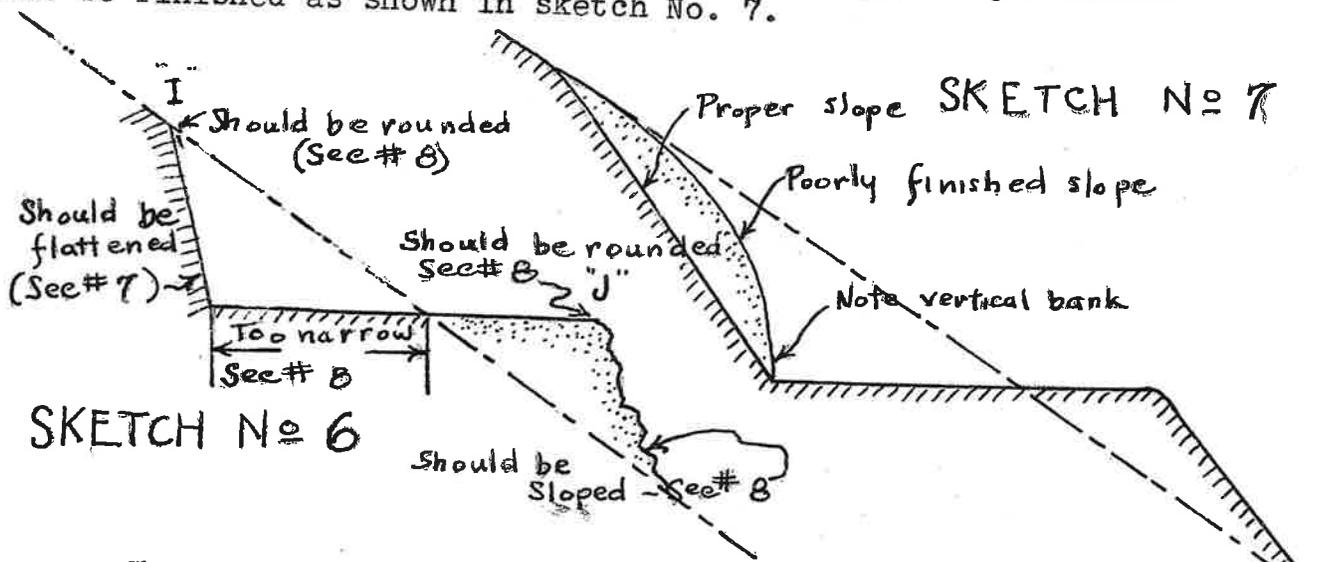
BANK SLOPING.

Contrary to the general conviction that bank sloping is purely a beautification project there are two primary objects in sloping of trail and truck trail banks: (1) It is a particular aid to the control of erosion in that it establishes slopes that are more nearly natural, thus enabling growths of various types to catch quickly and cover the new cut and fill surfaces; (2) It eliminates materially the possibility of having the trail narrowed by earth loosened through the action of frost and rain water. (Sketch No. 5 shows the action of frost on a poorly constructed trail). The combined action of water and frost at "A" loosens the material which drops to the trail, in some cases to such an extent that the trail is impassable. This is aside from the fact that as this action goes on from time to time the trail appears more and more ragged and less attractive.

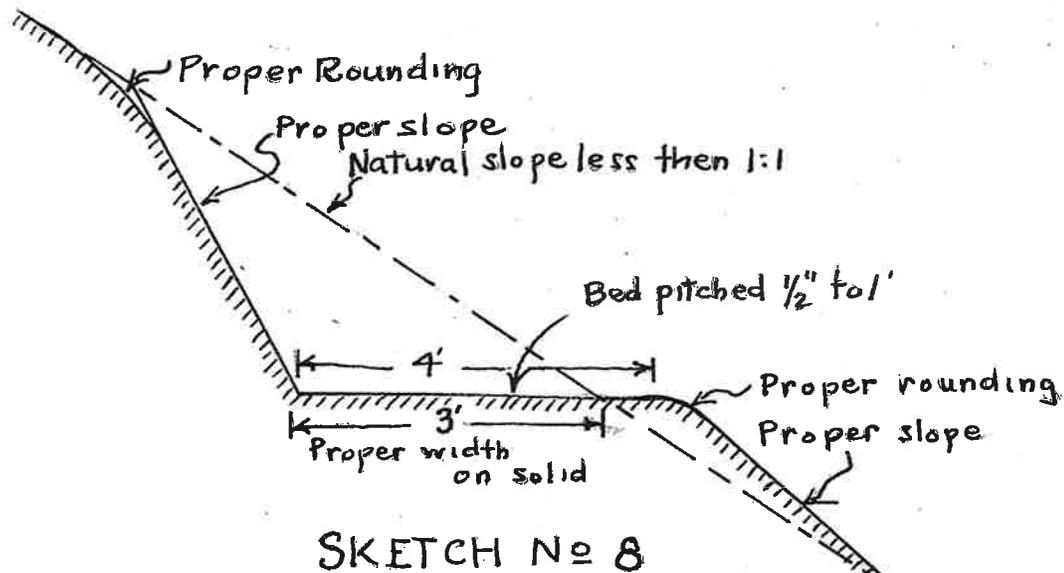
Putting off sloping operations is merely delaying operations which will have to be done later in construction and at a higher cost.

Sketch No. 6 illustrates a section of a poorly finished trail. The filled edge at "J" will soon be washed down the hillside by storm water

leaving the narrow bed of the trail on solid ground. In this case the builder did not go far enough into the side slope to get the required amount of trail floor on solid earth. Earth should never be finished to corners as at "I" and "J" but should be rounded over to meet the existing grade above and below the trail. Cut slopes should never be finished as shown in sketch No. 7.



Sketch No. 8 illustrates an ideal trail section, well finished, with banks and trail bed properly sloped and corners of cuts and fills properly rounded.



The question of how far to cut back a slope (or bank) is often a problem. Where the cross slope is easy the bank may be taken back on a 2 to 1 slope. that is, two feet back for each foot in height. A 1-1/2 to 1 slope is good, and a 1 to 1 slope is about as steep as earth will lie on a slope. The 1 to 1 slope should be regarded as a maximum slope to give a bank except in the situations where it would be necessary to grade 30 or 40 ft. up a steep bank to get this 1 to 1 slope. This would require removing much established growth and of course is not to be considered. Such situations should be solved by the staking of the top of the cut bank to get the best solution possible. Trail foremen should call for the advice of landscape and engineering technicians on problems of this type.

WALL CONSTRUCTION.

A natural slope is preferable to wall construction on trails where an earth slope can be made. A slope is a more natural condition and will cover over with a natural growth. However, walls are necessary in many situations.

Great care should be taken in their erection. Generally one must depend on the stone that is available nearby for this construction. Nevertheless, it is worth while to go to some trouble in selecting stone that is adaptable. Stone with a weathered face, if it can be obtained, is better than stone that is broken. There should be sufficiently large rock used so that the wall will tie into the slope. Generally, there is not enough chipping or shaping of stone, to make it fit on trail construction. A better result would be obtained if this were done. Stones should not be laid up in a haphazard way as they are handed to the builder; they should be selected to fit the position in the wall that they are to occupy and should be rejected if not of the right shape and size.

To assure solid construction and good appearance the following rule should be followed in the selection and setting of rock: Start the construction with proportionately large rock at the bottom of the wall; grade the size to smaller rock in the center section and again increase the size toward the top of the wall. The top course of the wall should be of rock sufficiently large to be solid.

The following method of wall construction has been used with good results in various sections of the Park during the past year:

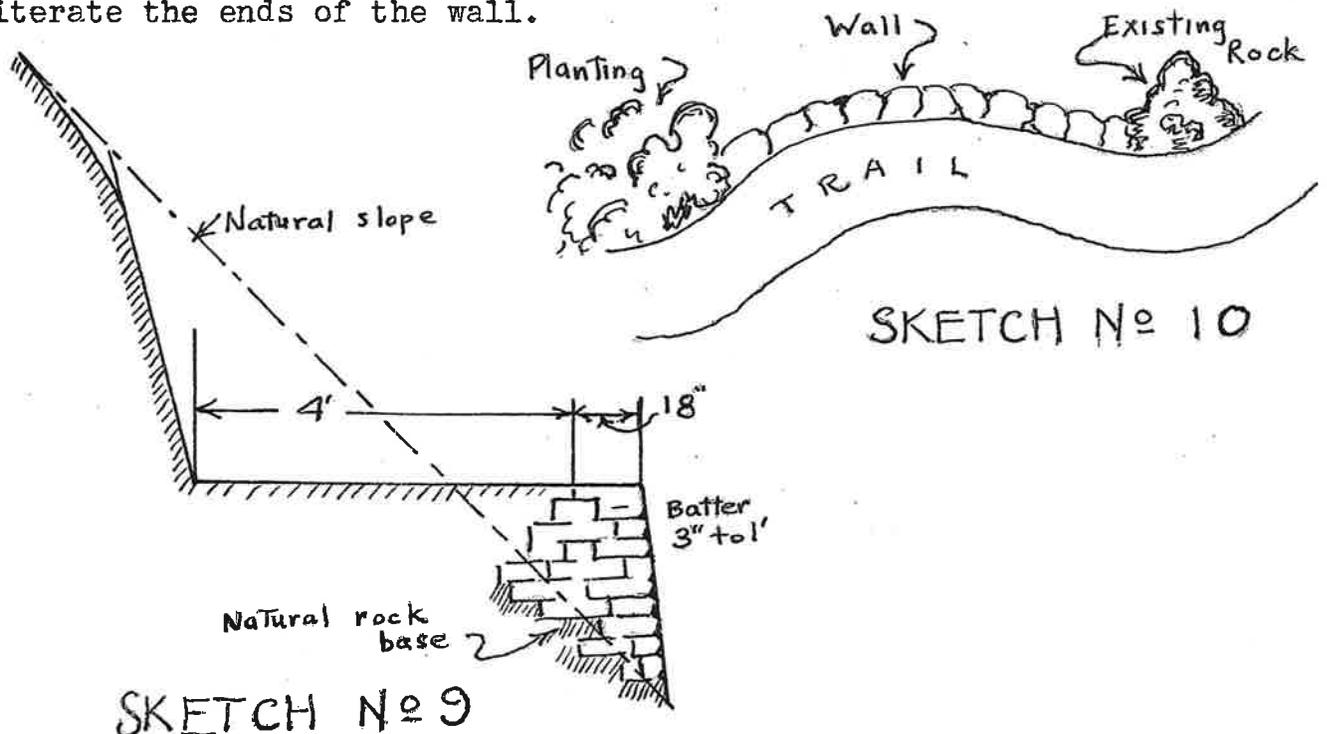
1.- The outside edge of the base of the wall is carefully staked on the alignment.

2.- Batter boards are set at intervals along this line at the proper slope. It has been found advisable to allow about two inches of clearance between the batter board and the wall surface. Care should be taken in placing the batter boards to see that the top of the wall is located sufficiently far out to give the proper width of trail when finished.

3.- After the batter boards are set, excavation is started. Wherever possible walls should be built on rock base; however, if rock is not present excavation should be made to solid earth before any wall construction is begun. Never build walls on filled earth bases.

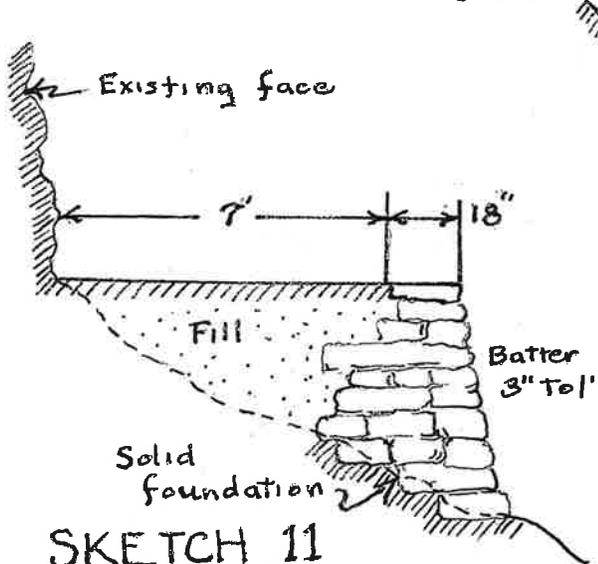
4.- Where the trail is built of earth-fill back of the rock wall, the wall should be built to the following dimensions: The base of the wall should approximately equal one-half of the height. The front face of the wall should be battered 3" to the foot in all cases. The back of the wall should be built in steps starting at the bottom and finishing at the last stone course with a width of wall at least 18" (See Sketch No. 9)

5.- Particular care should be given to locating the beginning and ending of the wall. Wherever possible the wall should begin and end in some natural formation leaving no sharp ends exposed above the natural surface. Where this is not possible, arrangements should be made for planning to obliterate the ends of the wall.

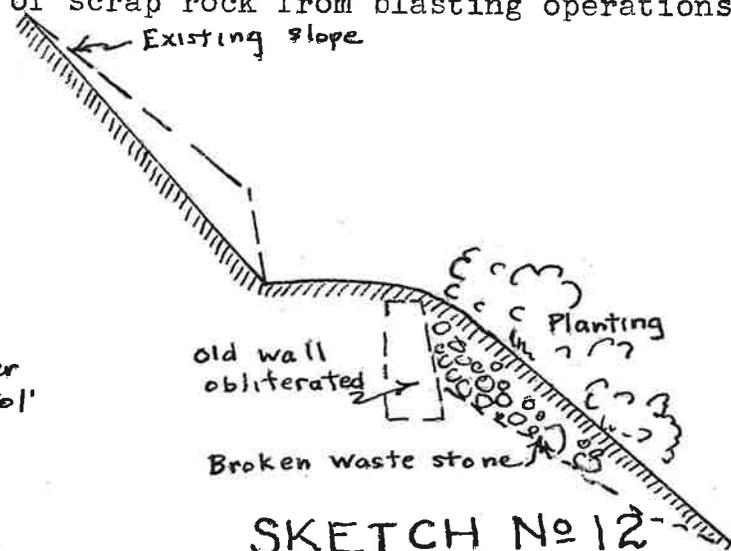


Sketch No. 11 is a typical walled section where the entire trail width is obtained without going into the side slope and creating a large scar. This is particularly useful on the very steep cross slopes and in places where outcroppings of rock must be avoided.

Sketch No. 12 indicates a treatment that is practical when the trail is over an old railroad or road grade on which walls have been built that must be obliterated. This method creates an opportunity for the disposal of waste rock after blasting operations since it can be placed below the existing wall and covered with earth which will soon grow over and present a natural appearance. In new trail construction it is sometimes well to use this method for the disposal of scrap rock from blasting operations.



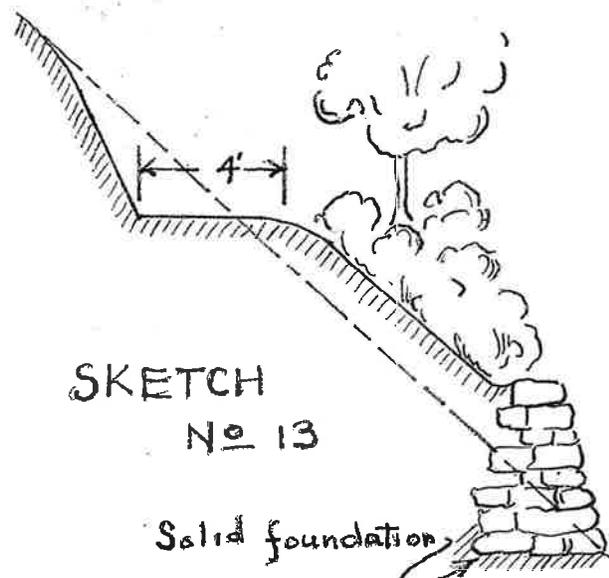
SKETCH 11



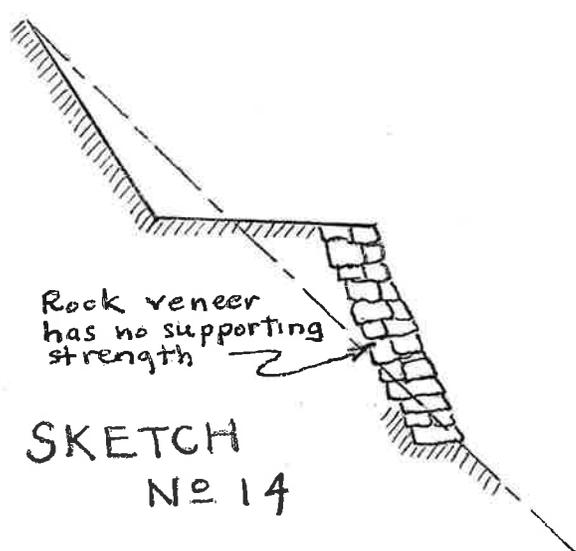
SKETCH No 12

Sketch No. 13 illustrates a type of wall used where it is necessary to drop below the line of the trail to find firm foundations for wall construction. The slope between the top of the wall and the trail grade is built similar to the fill slope on the trail in ordinary circumstances. Care should be taken to leave a small ditch for drainage above the wall.

Sketch No. 14 indicates a type of wall that has been used in the past but is not practical and has been washed out or turned over by frost action. It is merely a rock veneer and cannot be depended upon to retain a fill where there is pressure against it.



SKETCH No 13



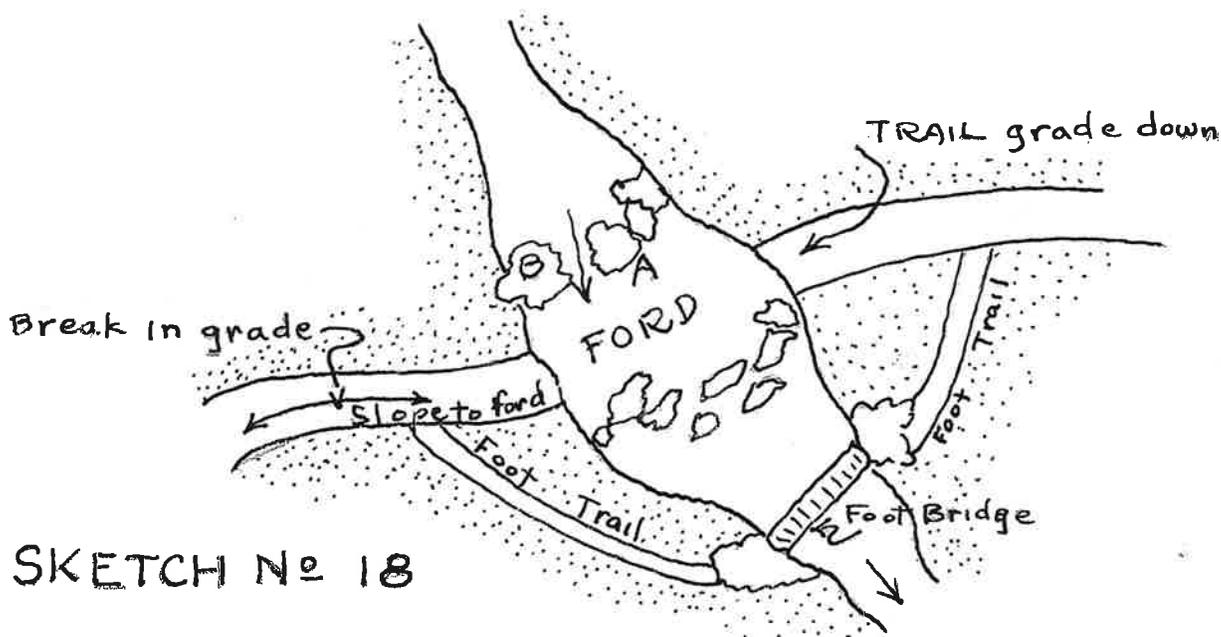
SKETCH No 14

Sketch No. 15 indicates a wall on the cut side of the trail serving to retain loose earth and rock above the trail floor. This may be justified in a few exceptional cases but, as a rule, wall construction above the bed of the trail should be avoided, as well as any laid up job above a trail such as veneer construction to eliminate a hole in the upper bank where a stump has been removed. Where it is necessary to retain a bank above a trail it may be done by placing the rock in such a manner that it gives the appearance of a natural out cropping or formation. This area should be planted in a natural manner. The natural condition should prevail down to the trail edge.

The ford crossing is preferable because it is more natural and permanent and offers facilities for watering horses. The trail grade should dip at the ford to prevent water from flowing down the trail when the stream is in flood; however, this grade should not pitch sharply up or down at the approach or when leaving the ford, but should gradually rise to the normal grade.

At ford crossings, if the current is swift, the stream should be slowed and widened to prevent washing out the ford. (See sketch No. 18) this may be done by removing the obstructions above the proposed ford that tend to force the water into narrow channels or divert the water in the wrong direction. Thus in sketch No. 18, "A" may be a group of boulders that force the water between it and another boulder at "B". If these obstructions can be removed without marring the site it should be done.

In most cases it is necessary to build up the lower edge of the ford to make the trail crossing more nearly level. This should be done by placing weathered boulders at the edge of the ford at "C" in a natural manner and not in a definite wall. This so slows the water that gravel is deposited and any fill that is made will not be washed out. These stones when properly selected will serve as stepping stones for pedestrian traffic except on the occasions when the water is exceptionally high. Foot logs and foot bridges are not recommended except where the stream is sufficiently large to justify them.



SKETCH No 18

Where foot lots are used they should be placed below the ford, adjacent to it and close enough that they can be easily seen and used by passing pedestrians. In construction of foot bridges any natural formation that is available should be used to make the structure fit into the surrounding country. Existing boulders and rock formations make excellent abutments for use in bridge construction. In the absence of these natural formations, abutments should be built of native stone to appear as nearly natural as possible. The advice of Landscape and Engineering representatives should be obtained in determining the location of all bridges and no construction started until plans for the structure are presented.

Horse bridges will be recommended only for those stream crossings which are too large for convenient fords, in places where the stream banks are too high for ford construction and in places where ford construction would cause much damage to the immediately adjacent area. All horse bridges will be designed by the Branch of Plans and Design and approved by the Engineering Department before construction is started.

DRAINAGE.

No factor in trail construction is of more importance than proper drainage on trails, since erosion caused by run-off of storm water is probably the most destructive element in the life of a trail. When crossing hollows where water may at times flow, the foreman should adjust his grades so the water will flow directly across the trail or provide for a culvert if this is

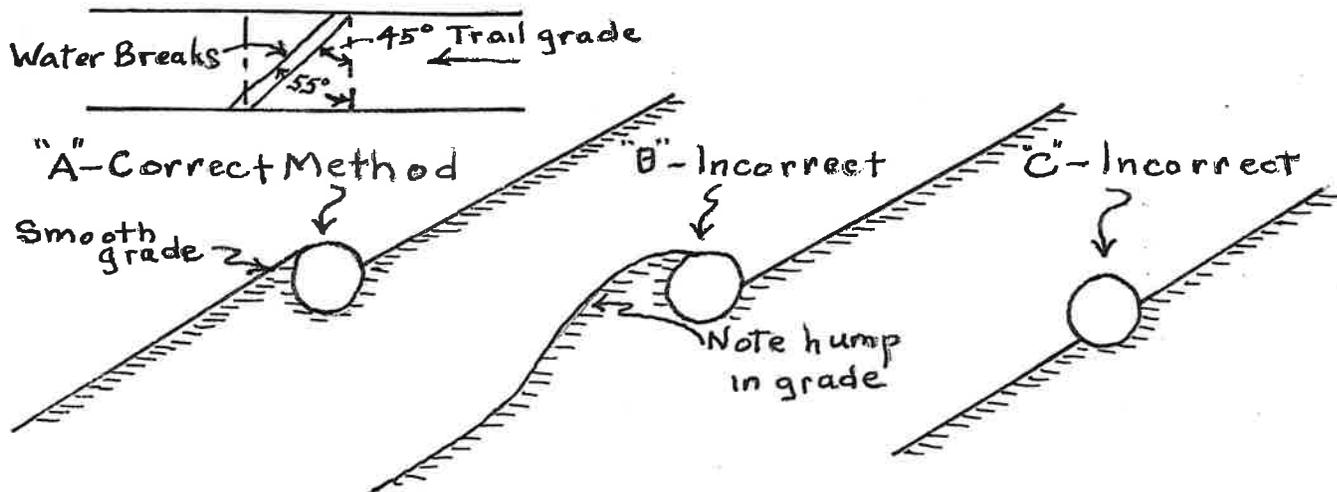
the best solution. Where water flows continually across the trail, the grade should be dipped and the trail grade on the lower side of the crossing maintained sufficiently high to be above flood water. If this is not done flood water will flow down the trail and wash out sections of it. At the dip in the grade it may be necessary to reinforce the bed of the trail with large rock to prevent washing. It is usually better to grade for surface drainage across the trail, if conditions permit, than to construct a culvert since the latter may become obstructed.

Culverts should be built of rock, with ample opening to carry the maximum flow of water and the trail width above should be six to seven feet with culvert walls sloped back where this is possible.

WATER BREAKS.

The distance apart to set waterbreaks is governed by the extent of the drainage area above the trail and the steepness of the trail grade. Run-off will be swifter on steep trails and therefore, will do more damage. For this reason, breakers should be set closer together on steep grades. As a rule, 75 feet apart is the maximum distance to set breakers on slopes; however, this distance should be reduced on steep trail grades and where there is evidence of much run-off. Breakers should not necessarily be set at regular intervals. Three particular locations in which waterbreaks should be used are as follows: (1) Where there is a depression or wash, breaker should be set below, (2) On sharp curves, breaker should be set at the uphill entrance of the curve, and (3) at changes in the trail grade, breaker should be set just above the break in grade.

On steep grades the flow of water will be swifter and the breaker should be set at a more acute angle, since swift water will flow over a breaker that is set sharply across the trail. Breakers should be set at angles of from 45 degree to 55 deg, the 45 degree angle on grades in excess of 12%. A 45 deg. angle may be easily marked out on the ground by marking off a square and placing the breaker from corner to corner. (See sketch No.19)



SKETCH No 19

In sketch No. 19 "A", "B" and "C" indicate three methods of setting breakers. "A" is the correct method with the grade below the breaker finishing flush with the top of the log. When setting it is better to fill rather full back of the breaker and then tamp the soil well to prevent settling and the consequent exposure of the breaker. The grade above and below the breaker should feather nicely into the grade of the trail and not leave a "bump" as shown in "B". When breakers are set in this manner they are secure and, since the grade at the lower side rides the breaker, these are not visible when one looks up the trail.

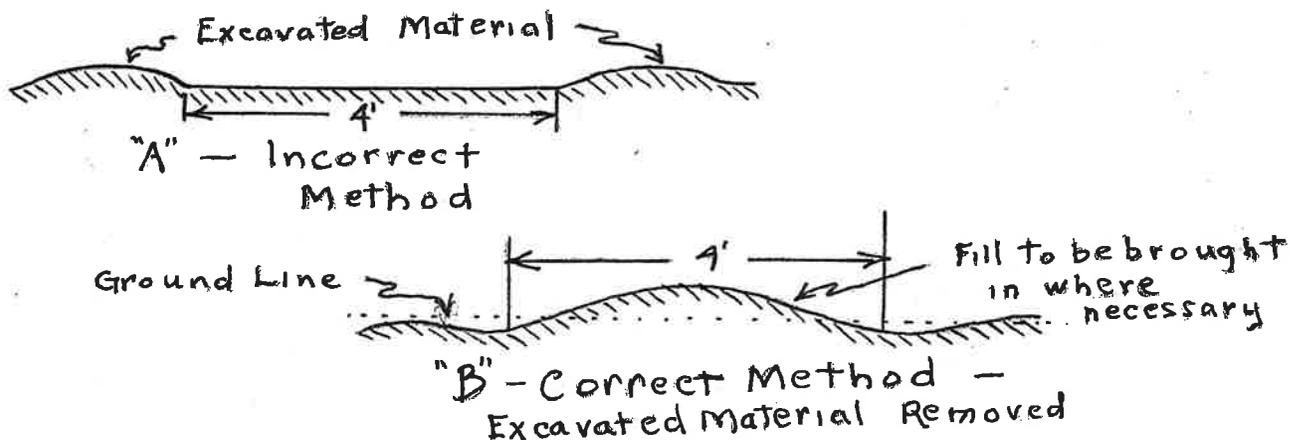
"C" indicates a method not desirable. It is not as secure, is more noticeable and forms a greater obstruction to stumble over.

The following are conditions, frequently encountered, that require careful study to secure proper drainage.

On ground where there is no appreciable cross slope, the trail is frequently built as shown in "A" of sketch No. 20. Turf is cut from the trail bed and raked off to the sides creating piles that confine water to the trail and wash it out. On such locations the proper method of construction will usually be to work out shallow, rounded depressions, not ditches, at the sides, and the good soil from these excavations used to slightly raise the

trail bed forming a dry, well drained trail bed in wet weather. In some cases it will be necessary to gather additional fill from another section to raise the trail bed. "B" in sketch No. 20 indicates the correct method of construction in this type of topography.

Water should be directed away from these drainage depressions wherever conditions will permit.



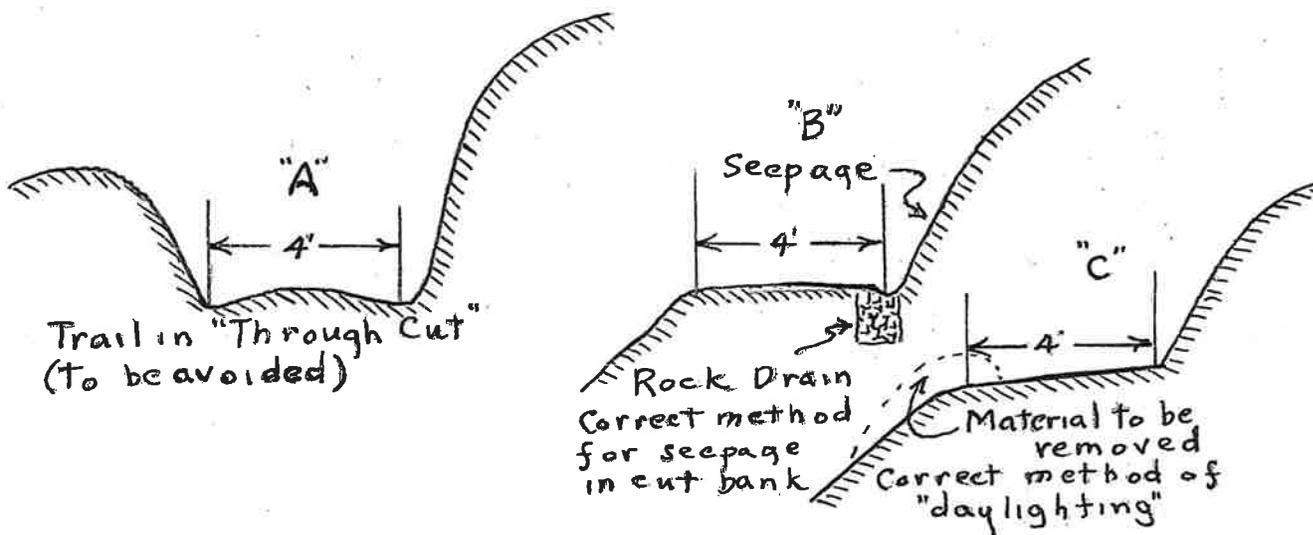
SKETCH No 20

Sketch No. 21 indicates types of construction used when trails follow old road or railroad grades.

"A". This sketch indicates the method used in "through cut" sections. It is not a desirable solution, however, and should be avoided wherever possible.

"B". This shows a condition frequently encountered where there is a seepage of water for some distance from the bank above the trail which will keep the trail bed continually wet if the water is not disposed of satisfactorily. Here the trail bed is raised and the seepage caught in a rock fill, or blind drain which should extend along the trail for the distance that the seepage exists, and from there connect with a culvert or waterbreak.

Mounds of earth similar to those shown in "C" should be graded off, or "daylighted", when they exist on an old road location that is being converted into a trail or truck trail.



SKETCH No 21

REMOVAL AND OBLITERATION OF SCARS MADE BY CONSTRUCTION.

The ideal trail is one that appears to be old, with natural conditions prevailing along the sides and no signs of construction such as axe marks, freshly broken stones, rock walls, freshly cut stumps and raw banks exposed to view. Also one that has but little construction work visible such as rock walls, etc. While time itself will eliminate or obliterate many of these signs of artificial work as is shown on some of the existing railroad grades that have grown over, this should not be used for an excuse, as it often has, for leaving disorderly conditions along newly constructed trails. It is the desire of the Park Service to hasten the healing process by sloping banks, and in every way create conditions that will assist nature in restoring natural conditions. For this reason broken rock and debris should be removed, covered over or laid flat on the ground where it can be easily concealed by natural growth.

A careful foreman will not turn loose all the rock that is taken from the trail excavation but will use this in fills below the trail as part of the trail construction.

SECURING FIRM TRAIL BED.

Trails should not be built on top of peat or leaf mould beds. When this condition is encountered as is the case many times when passing through heavy growths of Rhododendron, the entire depth of soft material should be excavated to make a solid bed that is well drained and will remain solid. The leaf mould and peat removed should be used as topsoil on other parts of the trail and for planting operations.

PLANTING.

Some planting may be done by the foreman (during his construction) with the material he takes out of the right of way when he is clearing. Good plants should be carefully taken up when clearing and planted naturally in places that are bare or they may be used to conceal signs of construction. In all planting the guiding policy should be to create a condition that is as nearly natural as possible. Now planting should be so placed that when finished it will not be evident that the planting has been artificially set out. To accomplish this it is necessary to use likevarieties and each variety in a like proportion as it is found growing naturally in the area. Leaves and leaf mould may be scattered over the ground around new planting for protection and to assist in catching natural growths in new construction areas. Planting is best done during the fall and winter months, yet one should not neglect the deciduous (non-evergreen) types in his planting. The result of using a solid evergreen planting may be the creation of a solid belt of new material along the trail that is quite different from the nearby natural growths.

LANDSCAPE FEATURES ADJACENT TO TRAIL.

Foremen, in their enthusiasm, often depart from the trail location and attempt to landscape nearby areas such as springs, streams, etc., and cut side trails to nearby features. These side features are important but they should not be attempted without consulting a representative of the Landscape Department. If a landscape foreman is not present in the camp, a request by the Project Superintendent will be immediately recognized.

CLEARING THE RIGHT OF WAY AND TRAILSIDE CLEANUP.

The instructions given by the representative of the Branch of Forestry should be followed in the disposal of material cut from the trail and in the cutting of dead timber.

The Landscape Department is principally interested in this operation in areas immediately adjoining the trail and at particular locations where there may be more attractive views. In such cases the Landscape and Forestry representatives will jointly work out a satisfactory solution.

The following is a set of instructions issued by the Branch of Forestry for Road and Trailside Cleanup:-

- 1.- On a strip 100 ft. wide on both sides of the road or trail, dead and down timber shall be placed flat to the ground and parallel to the contour. At least five (5) dead trees suitable for wildlife shall be left per acre.
- 2.- In case of extreme concentration a portion of the down timber may be removed in order to place the remainder flat on the ground.
- 3.- All limb wood should be removed from the boles of the trees and either burned or scattered.
- 4.- Burning shall be done in the road or trail.
- 5.- When limbwood is scattered it shall be carried beyond the 100 ft. strip.
- 6.- Do not remove the forest litter or ground cover.
- 7.- Treatment in the past has been too intensive.
- 8.- The treatment is fire hazard reduction rather than cleanup. (The term is misleading.)

The time that this cutting is done, in relation to procedure, however is of great importance. It will facilitate trail construction greatly if this cleanup is done in advance of construction, since it has been proven in many cases that where cleanup follows construction, walls are knocked down by falling trees and finished slopes and trail beds are torn up with the result that much work must be done over. If for any reason this cleanup must be delayed or is not done at the time of trail construction, the foreman should cut those trees that are likely to fall on the trail.

Postponing trailside cleanup until after construction is a wasteful, poorly planned method of procedure.

TRAIL FINISHING.

The question of how far to go on trail finishing is frequently asked. It is not practical to do such refined grading as will not stand up under the relatively small amount of maintenance that those trails will probably receive in the future. The best answer to this question is that trail finishing should be carried to such a point that erosion will be discouraged and natural growth will be encouraged. Such finishing can be justified from the practical standpoint. All trails will require occasional maintenance work in the future to keep them in good condition. Finishing them so that this upkeep will be kept to a minimum, is one of the guiding factors in trail construction. When banks are not properly sloped, walls not well built, and drainage not properly provided there will be a constant maintenance job necessary with the resulting increase in cost of upkeep.

DYNAMITE.

Care should be taken in the use of dynamite to see that all surrounding vegetation is properly protected from possible scarring by flying chips of rock. This can best be done by wrapping of small growths and by the use of mats in places where large areas might be scarred.

Where blasted and broken rock can be concealed without much additional work or damage to adjacent vegetation this should be done. Otherwise the fragments should be scattered so as to appear naturally placed rather than appearing as though placed by hand.

In blasting, it is well to use in some way all of the rock that is blasted in order to eliminate the scar unless the remnant is of such size that further blasting operations will be necessary to make the remaining pieces small enough to handle with the available equipment.

Approved: J.R. Eakin, Supt.