

# Bear Mountain Appalachian Trail Relocation

## Trail Construction Documents - Part 3 Upper East Face Section - Old Scenic Drive to Summit

### Construction Specifications and Typical Drawings

Prepared for  
**Bear Mountain Appalachian Trail Partnership**  
(Bear Mountain State Park (PIPC), Appalachian Trail Conservancy,  
NY-NJ Trail Conference, National Park Service)

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**APPALACHIAN NATIONAL SCENIC TRAIL  
BEAR MOUNTAIN STATE PARK  
Trail Construction Specifications**

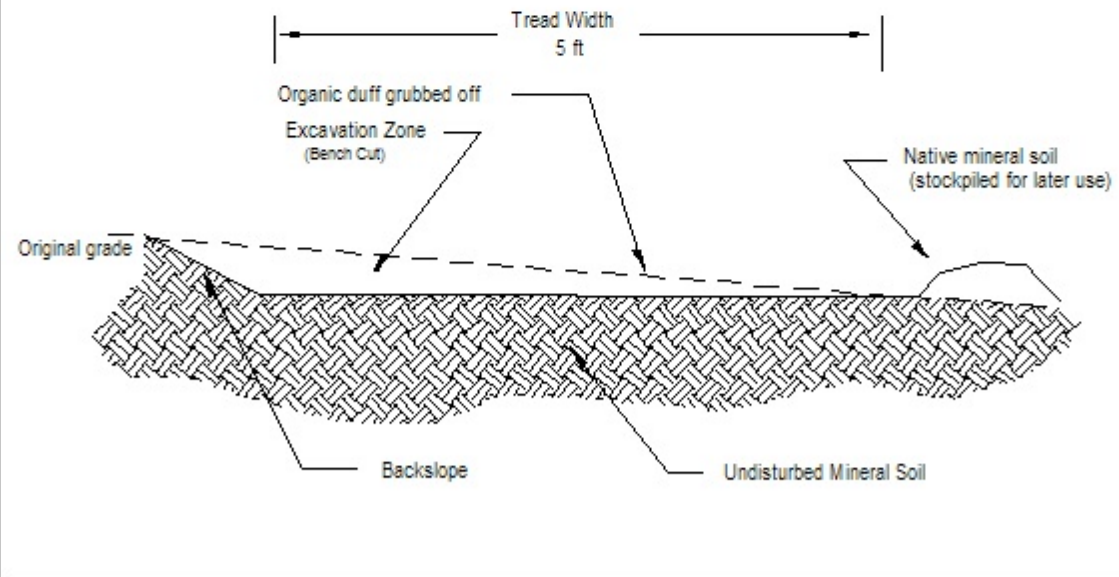
<b>ITEM: 1.1 - Trail Clearing</b>	<b>QUANTITY</b> <b>CALCULATION:</b> Lineal feet
<b>DESCRIPTION:</b> Clearing of the trail and the corridor surrounding the trail treadway.	<b>MATERIALS:</b> Not Applicable
<p><b>SPECIFICATIONS:</b></p> <p><u>Trail Corridor</u> - This is the area within which the trail treadway is located. It is typically described as a certain number of feet on either side of the treadway centerline. The trail corridor for this project varies from a width of 5 to 7 feet.</p> <p><u>Clearing width</u> - The vegetation which is within the trail corridor which will hinder trail construction must be removed. <b>NOT ALL VEGETATION MUST BE REMOVED.</b> Judgement needs to be made regarding live trees which are over 4 inches in diameter. If in doubt about a particular tree leave it - it can always be removed during tread construction. Stand and down dead trees should be removed.</p> <p><u>Clearing height</u> - Tree branches which hang into the trail corridor and are within 12 feet above the planned tread elevation should be removed. Proper pruning methods (no branch stubs or damage to branch collars (cuts or tears) must be used with hand saws or pole saws. Branches originating outside the trail corridor may be pruned back to the first branch junction outside the corridor boundary or removed completely, whichever is more aesthetically pleasing.</p> <p><u>Disposal of materials</u> - All cut material should be disposed of away from and out of site of the trail. The cut ends should face away from the trail to reduce their visibility when walking into the woods from the trail.</p> <p><u>Hazard trees</u> - Dead trees which are leaning excessively toward or over the trail corridor but are located outside the trail corridor should be removed before tread construction starts. This will reduce possible damage to trail structures in the future. <b>ONLY SAWYERS EXPERIENCED WITH HAZARD TREE REMOVAL SHOULD UNDERTAKE THE CUTTING OF THESE TREES.</b></p> <p><u>Stumps</u> - Trees cut within the trail treadway should have 3 to 4 foot tall stumps to aid in their removal (leverage) with winches. Trees cut outside the treadway must be flush cut and all cut material disposed of below the trail.</p>	

**APPALACHIAN NATIONAL SCENIC TRAIL  
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<b>ITEM: 2.1 - Full Bench Cut</b>	<b>QUANTITY</b> <b>CALCULATION:</b> Lineal feet
<b>DESCRIPTION:</b> Construction of full bench cuts creates the base on which the trail surface can be applied. Used where the side slope is not excessive and damage to uphill tree roots will not occur.	<b>MATERIALS:</b> Not applicable
<b>SPECIFICATIONS:</b>	
<p><b>INSTALLATION:</b> Installation of full bench cuts will be done according to the following guidelines (see typical drawings and photos for examples):</p> <p><u>Bench cut</u> - Determine and lay out the outer edge of the bench cut (also known as the outer hinge point), then lay out the inner edge of the bench cut. Excavate the tread to the desired elevation, grade, and cross slope. Compact once all excavation is complete.</p> <p><u>Back slope</u> - The back slope angle should not exceed a 2:1 slope. The upper end should be blended into the natural slope above the cut.</p>	
<p><b>USE AND DISPOSAL OF EXCAVATED MATERIAL:</b> Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.</p> <p><u>Leaf Litter:</u> Removal of leaves, sticks, branches, etc. may be necessary before installing a full bench cut.. Leaves should be raked off and stockpiled for use elsewhere. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.</p> <p><u>Organic Duff:</u> Remove all duff and debris from within the full bench cut area including the area which will be under the trail treadway and stockpile for later use elsewhere. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically displeasing along the trail as well as restrict water flow off of the trail.</p> <p><u>Mineral Soil:</u> Excavate mineral soil to the necessary depth for full bench installation. Stockpile excess mineral soil for later use. Mineral soil may be placed at the base of crib wall sections where there is a desire to build up the slope due to excessive wall height. If placed, the mineral soil shall be compacted so that it remains in place.</p> <p><u>Roots:</u> Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.</p> <p><u>Rocks:</u> Stone which is excavated shall be stockpiled, crushed, and used as backfill in stone cribbing to provide adequate drainage.</p>	



Trail surfacing could be added on this trail and finished on the right with native mineral soil.



**Full Bench Tread Construction  
(Typical)**

Bear Mountain Appalachian Trail Relocation      Not to Scale      March 2006

**APPALACHIAN NATIONAL SCENIC TRAIL  
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Trail Construction Specifications**

<b>ITEM: 2.2 - Stone Steps</b>	<b>QUANTITY</b> Total rise divided by 7 inch <b>CALCULATION:</b> average height.
<b>DESCRIPTION:</b> Steps are installed to protect the trail environment from erosion of the natural slope over which trail	<b>MATERIALS:</b> Sound stone free of cracks which may or may not have been imported (of similar stone), cut from local stone, or occur naturally.
<p><b>SPECIFICATIONS:</b></p> <p><u>Stone size</u> - Stone steps will range from 3 to 5 feet in width depending on the location. Steps which are less than 4 feet wide must be one stone wide. Steps wider than 4 feet may be constructed with stones which are no less than 2 feet in width.</p> <p><u>Tread size</u> - The tread surface shall be a minimum of 14 inches and a maximum of 18 inches. Where steps spiral or curve, the minimum tread width shall be measured at the center of the step.</p> <p><u>Step rise</u> - Each step shall range from 6 to 8 inches tall. The height of each step may vary up to 1 inch from one side of the step to the other. Step heights may not vary more than 1 inch from one step to the next. <u>Miscellaneous</u> - Steps may be pitched slightly left or right to drain water. Loose bits of stone on the step tread surface shall be removed..</p>	
<p><b>INSTALLATION:</b> Installation of stone steps will be done according to the following guidelines (see typical drawings and photos for examples):</p> <p><u>Foundation steps</u> - The first “step” to be installed shall be installed flush with the tread surface so as to provide a solid base for subsequent steps. Installed flush to the tread will serve as a wear resistant feature.</p> <p><u>Stacked stone stairway</u> - Steps installed using this method must have a minimum overlap of 2 inches. Steps shall not be supported along their front bottom edge with small stones, slivers of stone, or any other mineral or organic materials. Each step must be set so that it is supported at the front on the step below and shall have at least 2 solid points of contact at or near the back of the stone step.</p> <p><u>Stone cribbed stairway</u> - Steps installed with stone cribbing on one or both sides shall conform to the stone cribbing specifications outlined in the stone cribbing section. These steps shall also adhere to the guidelines detailed in the stacked stone stairway section above.</p> <p><u>Pinned stone steps</u> - Steps installed in contact with ledge must be pinned using ½ inch stainless steel rod. Where multiple steps are in contact with ledge every third or fourth step must be pinned. The pins should be located in such a way that they hold the step firmly in place and are not visible to trail users. Where water can enter the lower drill hole, an epoxy or grout shall be used to prevent water from entering and freezing. The minimum hole size for grout/epoxy application is 7/8 inch.</p> <p><u>“Toothed” stone risers</u> - This style of step will only work where there is sufficient depth of soil or loose rock. Stones must be set so that the center of gravity of the stone is behind the base of the stone. These steps may be set as a top step in a stacked stone stairway. If they are, then the gap between the “toothed” step and the step below shall be filled with stone shards to ensure a solid connection between the two steps. If using multiple stones, see guideline below.</p> <p><u>Multi-stone steps</u> - If steps are constructed using 2 stones, the front joint created must touch so as to create a continuous plane across the top front and face of the step. Because of the smaller nature of such stones, extra care will be needed in setting such steps. Solid points of contact must be maintained. Extra overlap of the next step is strongly encouraged.</p>	

**USE AND DISPOSAL OF EXCAVATED MATERIAL:** Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.

Leaf Litter: Removal of leaves, sticks, branches, etc. may be necessary before installing stone steps. Leaves should be raked off and stockpiled for use (replacement around the steps) once the step section has been completed. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.

Organic Duff: Remove all duff and debris from within the stone step area and stockpile for later use around steps, if needed, or along the base of stone crib walls. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically displeasing along the trail as well as restrict water flow off of the trail.

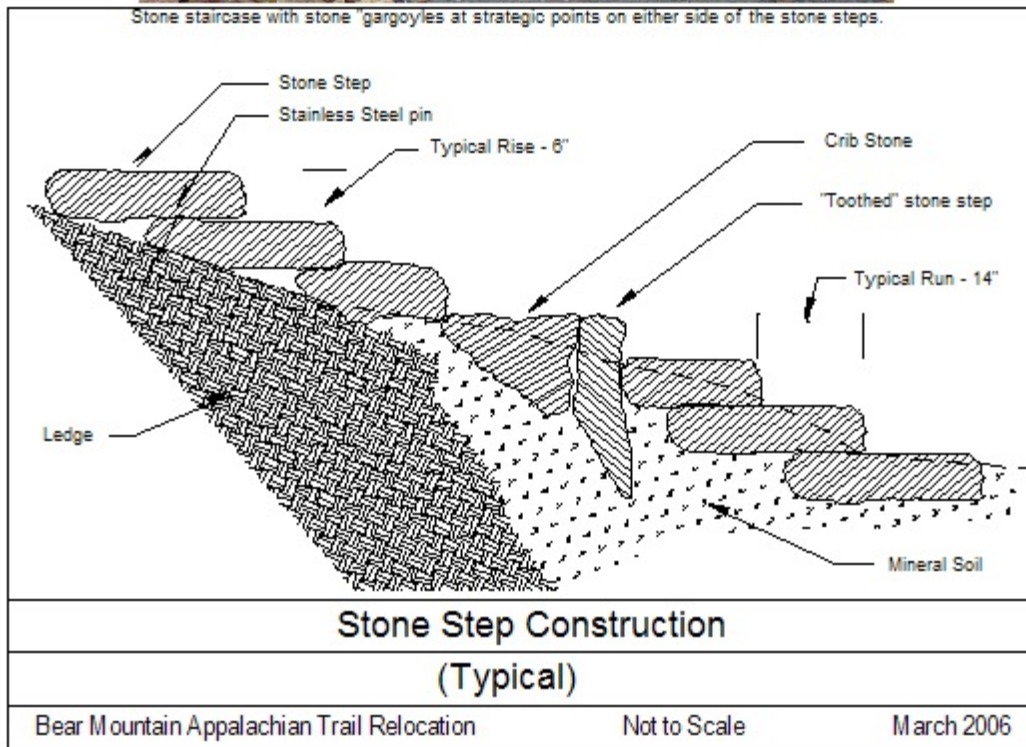
Mineral Soil: Excavate mineral soil to the necessary depth for step installation. Stockpile excess mineral soil for later use (general fill behind stone cribbing, filling low areas, filling in front of stone cribbing, behind stone steps, etc.). If mineral soil is used adjacent to steps it shall be compacted so that it remains in place.

Roots: Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.

Rocks: Stone which is excavated and not used as part of the stone step construction shall be stockpiled and used as backfill elsewhere along the trail. See specifications for Stone Cribbing for details.



Stone staircase with stone "gargoyles" at strategic points on either side of the stone steps.



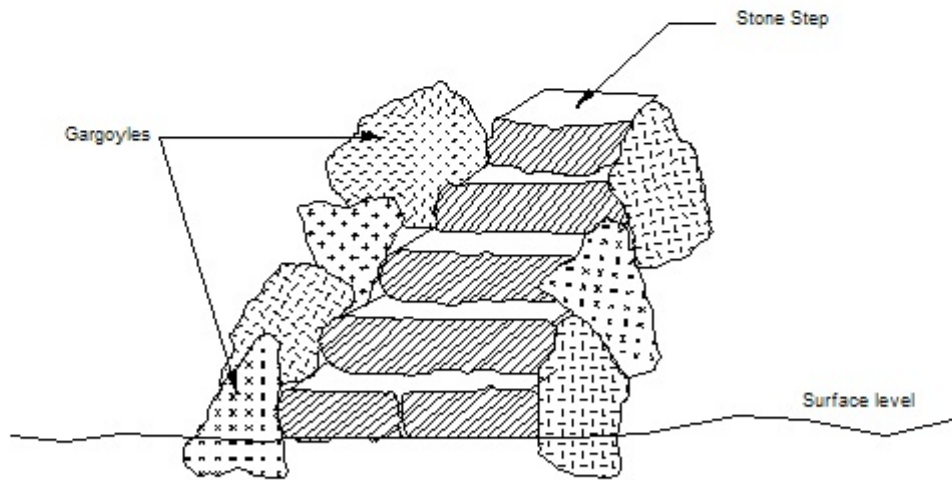


**APPALACHIAN NATIONAL SCENIC TRAIL  
BEAR MOUNTAIN STATE PARK  
Trail Construction Specifications**

<b>ITEM: 2.3 - Gargoyles</b>	<b>QUANTITY</b> <b>CALCULATION:</b> Each
<b>DESCRIPTION:</b> Gargoyle stones are stones set on one or both sides of stone steps to prevent trail users from straying off the stone steps.	<b>MATERIALS:</b> Sound stone free of cracks which may or may not have been imported (of similar stone), cut from local stone, or occur naturally.
<p><b>SPECIFICATIONS:</b></p> <p><u>Stone Size</u> - Rounded or angular stones which weigh 200 to 500 pounds.  <u>Stone Orientation</u> - Each stone should be placed so that there is not a flat step surface facing up. The purpose of the stone is to present an unpleasant surface on which to step.  <u>Stone height</u> - Each stone must project at least 10 inches above the step next to which it is installed.  <u>Stone Stability</u> - Each stone must be solidly set so that if stepped on it will not move.</p>	
<p><b>INSTALLATION:</b> Installation of gargoyles will be done according to the following guidelines (see typical drawings and photos for examples):</p> <p><u>“Toothed” gargoyles</u>- This style of gargoyle will only work where there is sufficient depth of soil or loose rock. Stones must be set so that the center of gravity of the stone is behind the base of the stone. Each stone should be in contact with the stone step for support.  <u>Pinned gargoyles</u> - If sufficient soil depth is not present then the gargoyle stone may need to be pinned to the ledge below or into one or more stone steps. Stainless steel ½ inch pins are sufficient for this. Drill holes and pins should not be visible if at all possible.</p>	
<p><b>USE AND DISPOSAL OF EXCAVATED MATERIAL:</b> Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.</p> <p><u>Leaf Litter:</u> Removal of leaves, sticks, branches, etc. may be necessary before installing gargoyles. Leaves should be raked off and stockpiled for use elsewhere. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.  <u>Organic Duff:</u> Remove all duff and debris from within the gargoyling area and stockpile for later use elsewhere. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically displeasing along the trail as well as restrict water flow off of the trail.  <u>Mineral Soil:</u> Excavate mineral soil to the necessary depth for gargoyle installation. Stockpile excess mineral soil for later use. Mineral soil may be placed at the base of crib wall sections where there is a desire to build up the slope due to excessive wall height. If placed, the mineral soil shall be compacted so that it remains in place.  <u>Roots:</u> Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.  <u>Rocks:</u> Stone which is excavated and not used as part of the gargoyle installation shall be stockpiled, crushed, and used as backfill in stone cribbing to provide adequate drainage.</p>	



Stone staircase with stone gargoyles at strategic points on either side of the stone steps.



**Gargoyle Installation  
(Typical)**

Bear Mountain Appalachian Trail Relocation

Not to Scale

March 2006

**APPALACHIAN NATIONAL SCENIC TRAIL  
BEAR MOUNTAIN STATE PARK  
Trail Construction Specifications**

<b>ITEM: 2.4 - Stone Cribbing</b>	<b>QUANTITY CALCULATION:</b> Length X Height X Width (from 12" below grade)
<b>DESCRIPTION:</b> Stone cribbing is installed to retain the treadway across a side slope where a full bench cut cannot be installed due to terrain slope .	<b>MATERIALS:</b> Sound stone free of cracks which may or may not have been imported (of similar stone), cut from local stone, or occur naturally.
<p><b>SPECIFICATIONS:</b></p> <p><u>Stone size</u> - Cribbing stones will range from large stones (2 - 3 cubic feet) to small stones (several pounds). Stones should have angular edges for ease of construction. Generally a crib wall will not be less than 1 foot thick.</p> <p><u>Back fill</u> - Fill material behind a crib wall must be of a porous nature (see separate spec.) such as broken stone (crush/fill) and compacted. Crushed stone must extend 6 to 12 inches behind the back of the stone cribbing to allow for adequate drainage.</p> <p><u>Crib batter</u> - Stone cribbing is built so that it leans (batter) into the slope and is expressed as a ratio. Short cribs (2 ft. or less can be battered up to 5:1 (rise over run), taller cribs must be no steeper than 2:1).</p> <p><u>Stone joints</u> - Where successive courses of stone are used, "running joints" must be avoided. Stones placed in one course must overlap two or more stones in the course below.</p>	
<p><b>INSTALLATION:</b> Installation of stone cribs and crib walls will be done according to the following guidelines (see typical drawings and photos for examples).</p> <p><u>Dry Stack Construction</u> - This type of construction relies on building courses of stone one upon another. This technique is used where the height of the wall is greater than any one stone available. Care and patience are required to properly fit stones together to create a strong, stable mass of stone to support a load from above or retain a load from behind (or both). The "grain" of all the stones in a crib wall should be oriented so that it is all the same. This will result in a more visually pleasing wall.</p> <p><u>Base stones</u> - Upon starting a crib wall, a row of base stones must be installed which are set in 12 or more inches below the existing grade. The stones set must be some of the larger stones to provide stability to the wall. These stones may be boulder shaped or may be "toothed" into place to gain height. Setting base stones on ledge will require pinning if the ledge does not have inslope or an insloped shelf cannot be cut into the ledge. Pins should be located in such a way that they hold the base stone firmly in place and are not visible to trail users. Where water can enter the drill hole, an epoxy or grout shall be used to prevent water from entering and freezing. The minimum hole size for grout/epoxy application is 7/8 inch.</p> <p><u>Building stones</u> - Stones which have an obvious "face" which will be placed in a wall and be exposed for viewing. Stone shapes include: blocks, rectangles, and triangles. Generally the best building stones are twice as long or longer than their height and width. This allows the stone to project into the wall for both stability and strength.</p> <p><u>Tie stones</u> - These are stones which tie beyond the back of the building stones by a factor of 2 or more. Generally long stones are reserved for this use and sometimes called "deadmen".</p> <p><u>Cap stones</u> - Dry stack construction requires the use of larger stones at the top of a wall to tie and hold the lower stone courses in place. These stones must be large enough to withstand hiking traffic and to limit any temptation of tampering.</p>	

Coping stones - Larger blocks of stone set into the top of a wall (can be in place of cap stones) to serve as a “guard rail” and generally protrude a foot or more above the trail treadway. These stones are generally spaced about 6 to 8 inches apart to allow water to drain between them and should not encourage sitting. “Toothed crib stones” - Larger, flatter stones can be used for cribbing which only needs to be 1 course high by “toothing” the stone into the ground and leaning it into the slope (see batter). An effort should be made to have 75 to 100 percent contact between each stone.

**USE AND DISPOSAL OF EXCAVATED MATERIAL:**

Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.

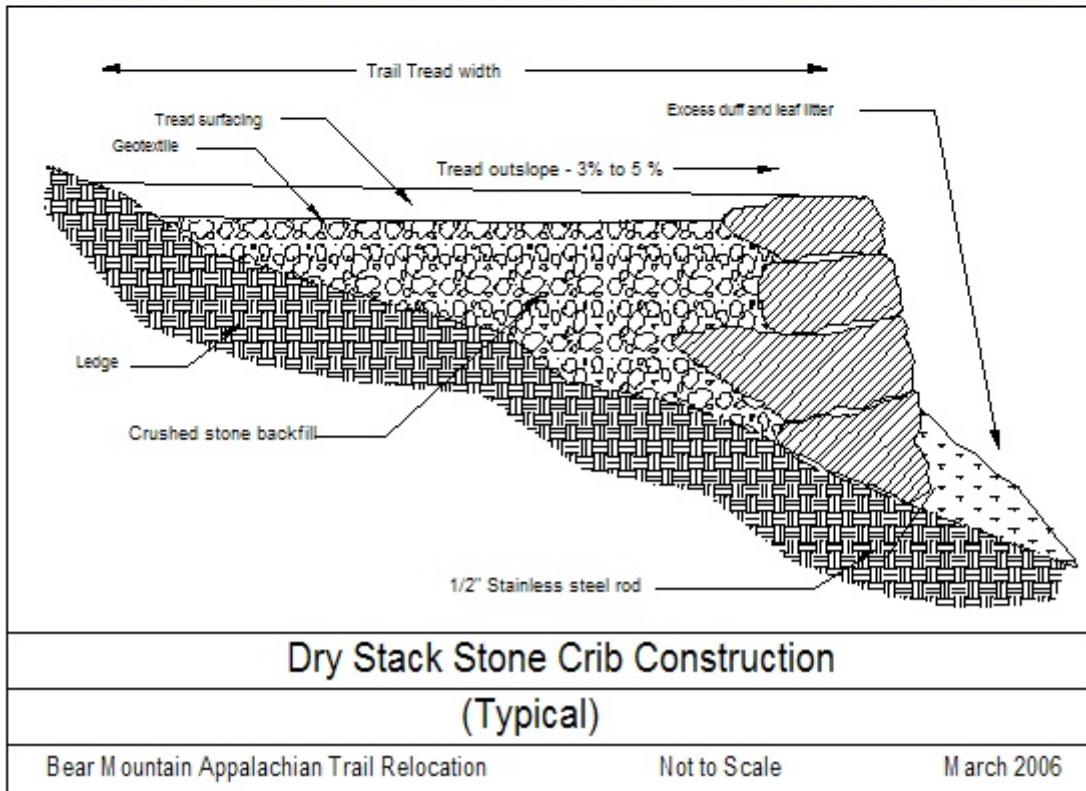
Leaf Litter: Removal of leaves, sticks, branches, etc. may be necessary before installing stone cribs. Leaves should be raked off and stockpiled for use (replacement at the base of a crib wall) once the section has been completed. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.

Organic Duff: Remove all duff and debris from within the cribbing area including the area which will be under the trail treadway and stockpile for later use at the base of the crib wall, if needed. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically unpleasing along the trail as well as restrict water flow off of the trail.

Mineral Soil: Excavate mineral soil to the necessary depth for base stone installation. Stockpile excess mineral soil for later use. Mineral soil may be placed at the base of crib wall sections where there is a desire to build up the slope due to excessive wall height. If placed, the mineral soil shall be compacted so that it remains in place.

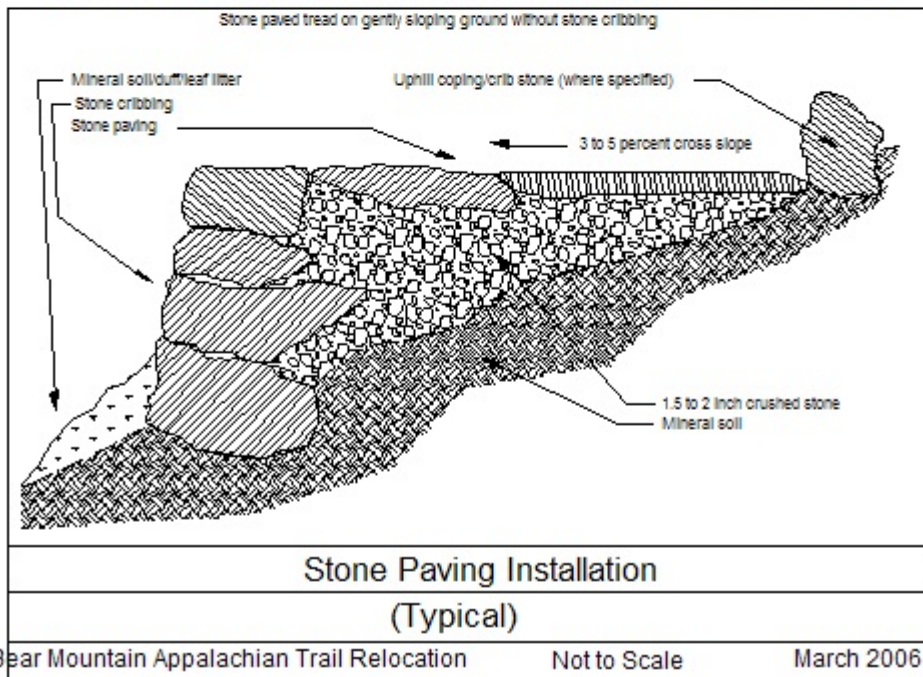
Roots: Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.

Rocks: Stone which is excavated and not used as part of a crib wall shall be stockpiled, crushed, and used as backfill behind the wall to provide adequate drainage.



**APPALACHIAN NATIONAL SCENIC TRAIL  
BEAR MOUNTAIN STATE PARK  
Trail Construction Specifications**

<p><b>ITEM: 2.5 - Stone Paving</b></p>	<p><b>QUANTITY CALCULATION:</b>      Length X Width</p>
<p><b>DESCRIPTION:</b> Stone paving is installed where the tread surface requires extreme durability. In most cases this is where intermittent flows of water occur.</p>	<p><b>MATERIALS:</b> Sound stone free of cracks which may or may not have been imported (of similar stone), cut from local stone, or occur naturally.</p>
<p><b>SPECIFICATIONS:</b>  <u>Stone joints</u> - An effort must be made to install stones so that joints are as tight as possible. Water must be shed by all the joints installed. Minimizing joints is strongly encouraged.  <u>Back fill</u> - Fill material between and under stones must be a good grade of gravel (see separate spec. for trail surfacing) which can be compacted. It will be necessary to seal the stonework.</p>	
<p><b>INSTALLATION:</b> Installation of stone paving will be done according to the following guidelines (see typical drawings and photos for examples):</p> <p><u>Stone pavement</u> - Stone paving is typically done with multiple stones placed so that joints are reasonably tight and provide smooth water flow. Each stone will be locked in place by the next and the joints will be filled with a good grade of crushed gravel. Upon filling, the joints will be compacted with a narrow tool which fits into the joint space.  <u>Pavement on stone cribs</u> - In this situation, the paving stones must interlock with the cap stones on the stone crib. Joints must be as tight as possible and be filled as described above and compacted .</p>	
<p><b>USE AND DISPOSAL OF EXCAVATED MATERIAL:</b> Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.</p> <p><u>Leaf Litter:</u> Removal of leaves, sticks, branches, etc. may be necessary before installing stone paving. Leaves should be raked off and stockpiled for use elsewhere. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.  <u>Organic Duff:</u> Remove all duff and debris from within the stone paving area including the area which will be under the trail treadway and stockpile for later use elsewhere. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically unpleasing along the trail as well as restrict water flow off of the trail.  <u>Mineral Soil:</u> Excavate mineral soil to the necessary depth for stone paving installation. Stockpile excess mineral soil for later use. Mineral soil may be placed at the base of crib wall sections where there is a desire to build up the slope due to excessive wall height. If placed, the mineral soil shall be compacted so that it remains in place.  <u>Roots:</u> Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.  <u>Rocks:</u> Stone which is excavated and not used as part of the stone paving shall be stockpiled, crushed, and used as backfill in stone cribbing to provide adequate drainage.</p>	



**APPALACHIAN NATIONAL SCENIC TRAIL  
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<p><b>ITEM: 2.6 - Coping Stones</b></p>	<p><b>QUANTITY</b> <b>CALCULATION:</b>        Each</p>
<p><b>DESCRIPTION:</b> Coping stones are used on top of taller stone cribbing as a “guardrail” to keep trail users back from drop-offs.</p>	<p><b>MATERIALS:</b> Only sound stone may be used for these stones.</p>
<p><b>SPECIFICATIONS:</b></p> <p><u>Stone size</u> - Rounded or angular stones which weigh 500 to 600 pounds.  <u>Stone orientation</u> - Each stone should be placed so that there is not a flat top surface. The purpose of the stone is to prevent reasonable access and not create a seat on which to sit.  <u>Stone height</u> - Each stone must project at least 12 inches above the tread surface.  <u>Stone stability</u> - Each stone must be solidly set so that if stepped on or pushed it will not move.  <u>Stone spacing</u> - The spacing between stones will range between 6 and 8 inches to allow for tread drainage.</p> <p><b>INSTALLATION:</b> Installation of coping stones will be done according to the following guidelines (see typical drawings and photos for examples).</p> <p><u>Setting methods</u> - Coping stones may be set with a flat side down, built into a stone crib wall, “toothed” in place, or pinned to larger subsurface stones or ledge.  <u>Flat set stones</u> - Stones which have a flat side may be set onto that side for stability. If this method is used, then the stone must be imbedded at least 4 inches into the tread surfacing.  <u>Crib wall stones</u> - If built into a crib wall, coping stones are treated like any other crib stone. The only difference is that the stone stands above the cap stones. Generally, this technique requires larger stones which will extend down into the crib wall.  <u>“Toothed” stones</u>- This style of coping stone will only work where there is sufficient depth of soil or loose rock in which to embed the stone.  <u>Pinned stones</u> - If sufficient soil depth is not present then the coping stone may need to be pinned to the ledge below. Stainless steel 1 inch pins should be used for this. Drill holes and pins should not be visible if at all possible.</p>	



**USE AND DISPOSAL OF EXCAVATED MATERIAL:** Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.

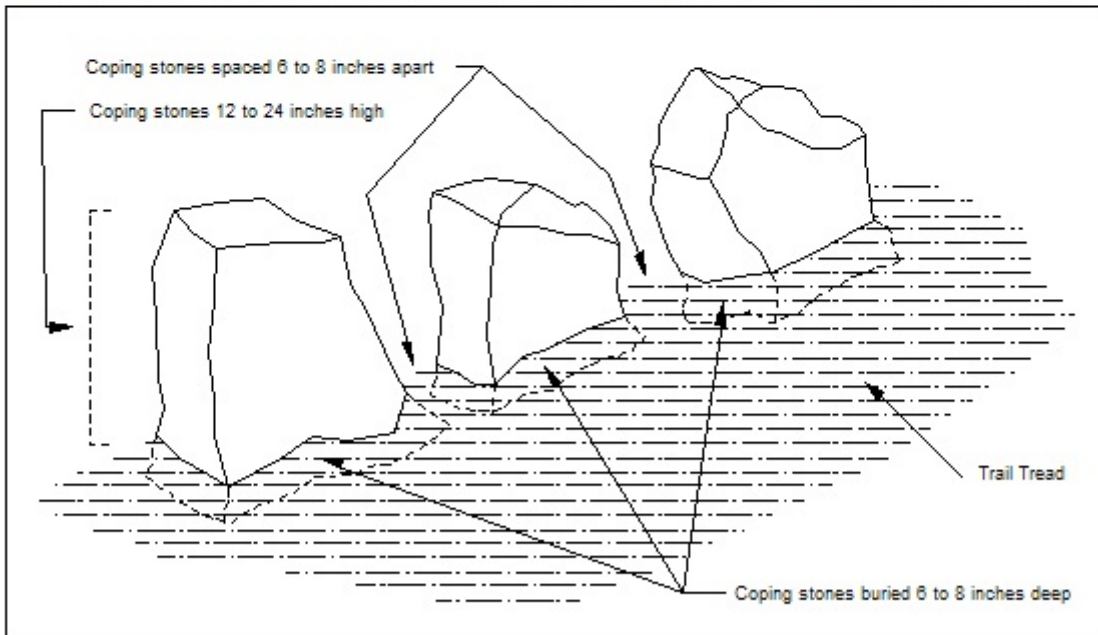
Leaf Litter: Removal of leaves, sticks, branches, etc. may be necessary before installing a coping stone. Leaves should be raked off and stockpiled for use elsewhere. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.

Organic Duff: Remove all duff and debris from within the installation area including the area which will be under the trail treadway and stockpile for later elsewhere. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically displeasing along the trail as well as restrict water flow off of the trail.

Mineral Soil: Excavate mineral soil, if any, to the necessary depth for coping stone installation. Stockpile excess mineral soil for later use. Mineral soil may be placed at the base of crib wall sections where there is a desire to build up the slope due to excessive wall height. If placed, the mineral soil shall be compacted so that it remains in place.

Roots: Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.

Rocks: Stone which is excavated shall be stockpiled, crushed, and used as backfill in stone cribbing to provide adequate drainage.



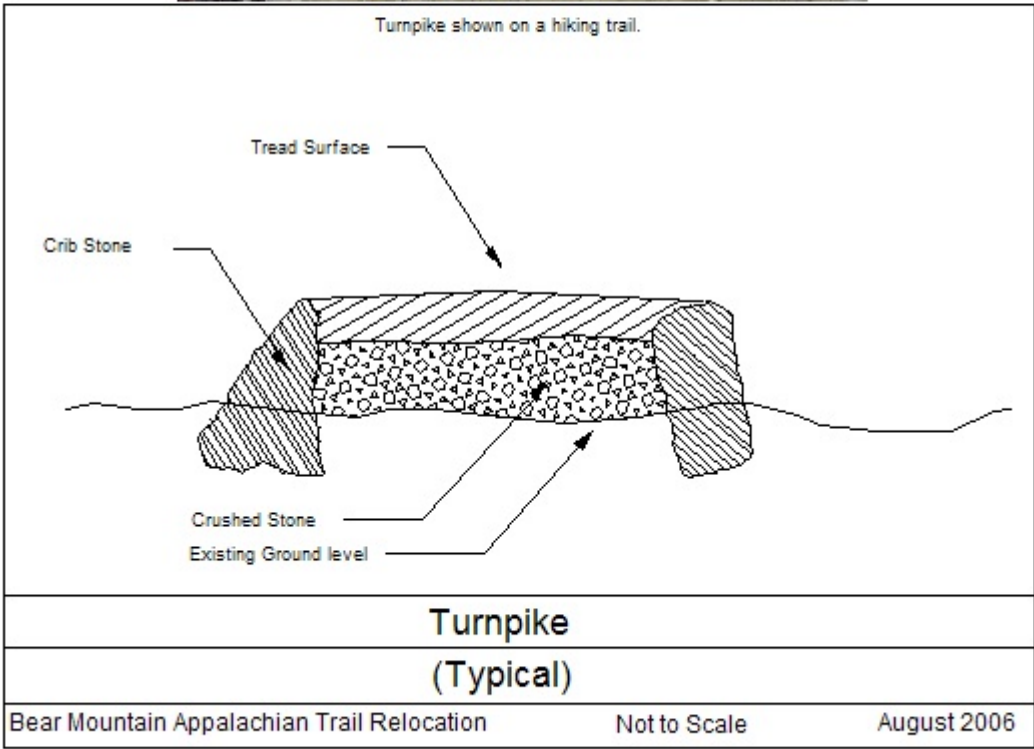
**Coping Stone Installation  
(Typical)**

Bear Mountain Appalachian Trail Relocation

Not to Scale

March 2006

<b>ITEM: 2.7 - Turnpike</b>	<b>QUANTITY</b> Length X Height X Width <b>CALCULATION:</b> (from 12" below grade)
<b>DESCRIPTION:</b> Turnpike is installed to elevate the treadway across low or wet areas and is constructed with stone on both sides of the treadway to retain the trail surface.	<b>MATERIALS:</b> Sound stone free of cracks which may or may not have been imported (of similar stone), cut from local stone, or occur naturally.
<b>SPECIFICATIONS:</b> <u>Stone size</u> - Turnpike stones will range from large stones (2 - 3 cubic feet) to smaller stones (1 to 2 cubic feet). Stones should have angular edges for ease of construction. <u>Back fill</u> - Fill material in a turnpike must be of a porous nature (see separate spec.) such as broken stone (crush/fill) and compacted. <u>Stone joints</u> - Joints between stones must be tight in order to retain surface material.	
<b>INSTALLATION:</b> Installation of turnpikes will be done according to the following guidelines (see typical drawings and photos for examples).  <u>“Toothed stones”</u> - Larger, flatter or blocky stones can be used for turnpike which only needs to be 1 course high by “toothing” the stone into the ground and leaning it in toward the center of the treadway. An effort should be made to have 75 to 100 percent contact between each stone. <u>Coping stones</u> - Larger blocks of stone set so that they protrude a foot or more above the treadway grade. These stones are generally spaced about 6 to 8 inches apart to allow water to drain between them and should not encourage sitting. (See the separate spec. on this item.)	
<b>USE AND DISPOSAL OF EXCAVATED MATERIAL:</b> Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.  <u>Leaf Litter:</u> Removal of leaves, sticks, branches, etc. may be necessary before installing turnpikes. Leaves should be raked off and stockpiled for use (replacement at the sides of the turnpike) once the section has been completed. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction. <u>Organic Duff:</u> Remove all duff and debris from within the turnpike area and stockpile for later use. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically unpleasing along the trail as well as restrict water flow off of the trail. <u>Mineral Soil:</u> Excavate mineral soil to the necessary depth for stone installation. Stockpile excess mineral soil for later use. Mineral soil may be placed at the base of turnpike stones where there is a desire to build up the slope due to excessive wall height. If placed, the mineral soil shall be compacted so that it remains in place. <u>Roots:</u> Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view. <u>Rocks:</u> Stone which is excavated and not used as part of a turnpike shall be stockpiled, crushed, and used as backfill within the turnpike to provide adequate drainage.	



**APPALACHIAN NATIONAL SCENIC TRAIL  
BEAR MOUNTAIN STATE PARK  
Trail Construction Specifications**

<b>ITEM: 2.9 - Duff Removal</b>	<b>QUANTITY</b> <b>CALCULATION:</b> Lineal feet
<b>DESCRIPTION:</b> Duff is the material located under the leaf litter a forest floor. It may also be the accumulated organic matter in open areas.	<b>MATERIALS:</b> None needed.
<b>SPECIFICATIONS:</b>  <u>Duff</u> - Remove all duff and debris from within the treadway area.	
<b>INSTALLATION:</b> Implementation of duff removal will be done according to the following guidelines:  <u>Depth of removal</u> - Duff must be removed to sound mineral soil or ledge.  <u>Width of removal</u> - Duff must be removed to the specified tread width to accommodate installation of trail surfacing such as mineral soil or gravel.	
<b>USE AND DISPOSAL OF EXCAVATED MATERIAL:</b> Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.  <u>Leaf Litter:</u> Removal of leaves, sticks, branches, etc. may be necessary before duff removal proceeds. Leaves should be raked off and stockpiled for use elsewhere. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.  <u>Organic Duff:</u> Removed duff and debris from within the treadway area will be stockpiled for later use elsewhere. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically displeasing along the trail as well as restrict water flow off of the trail.  <u>Roots:</u> Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.  <u>Rocks:</u> Stone which is excavated and not used shall be stockpiled, crushed, and used as backfill in stone cribbing to provide adequate drainage.	

**APPALACHIAN NATIONAL SCENIC TRAIL  
BEAR MOUNTAIN STATE PARK  
Trail Construction Specifications**

<p><b>ITEM: 3.1 - Stone Culvert</b></p>	<p><b>QUANTITY CALCULATION:</b>      Length X Height</p>
<p><b>DESCRIPTION:</b> Stone culverts are designed to convey water under the trail treadway using natural materials.</p>	<p><b>MATERIALS:</b> Only sound stone may be used for side wall, top and bottom construction of these drainage features.</p>
<p><b>SPECIFICATIONS:</b>  <u>Stone joints</u> - An effort must be made to install stones so that joints are as tight as possible. Water must be shed by all the joints installed. Minimizing joints is strongly encouraged.  <u>Back fill</u> - Fill material behind and under stone culvert stones must be a good grade of gravel (see separate spec. for trail surfacing) which can be compacted. It will be necessary to seal the stonework around the culvert.</p>	
<p><b>INSTALLATION:</b> Installation of stone culverts will be done according to the following guidelines (see typical drawings and photos for examples).</p> <p><u>Side wall stones</u> - Culvert side walls must be constructed of stone so that water flows through culvert effortlessly. Each side may be constructed of one single stone or multiple stones. If more than one stone is used then the joint between the stones must be constructed to shed water. Side wall stones may be thin sheets of stone or blocks of stone. Each stone must have at least one third of its height buried when the bottom of the culvert is stone paved (see below). The side wall stones must be backfilled with good grade of gravel and compacted so that water cannot erode it and undermine the sidewall stones.</p> <p><u>Stone paved bottom</u> - The bottom of the culvert must be stone paved to prevent water from eroding the side wall stones. The stone paving may be done with one stone (if possible) or multiple stones. The stones must be placed so that joints are reasonably tight and provide smooth water flow. Each stone will be locked in place by the next and the joints will be filled with a good grade of crushed gravel. Upon filling, the joints will be compacted with a narrow tool which fits into the joint space.</p> <p><u>Cap Stone</u> - Upon installation of the side walls and stone paved bottom, a cap stone is fitted over the top. The cap stone must span the entire width of the culvert. The cap stone must be free of any visible cracks or fissures and must be of sufficient thickness to span the culvert opening.</p> <p><u>Inlet</u> - The inlet to the culvert should be constructed to reduce collection of debris. If the inlet is steep, then it must be stone paved up slope to the point specified in the plans or field located. If room allows, a sediment basin should be constructed in front of the inlet to collect sediment and other debris.</p> <p><u>Outlet</u> - The outlet from the culvert should allow the water to freely move away from the culvert opening. If there is a drop off at the culvert exit, then stone must be installed down slope of the culvert exit to slow the flow of water (energy dissipation). Stones used for this purpose may be “toothed” into the ground to better anchor them.</p>	

**USE AND DISPOSAL OF EXCAVATED MATERIAL:** Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.

Leaf Litter: Removal of leaves, sticks, branches, etc. may be necessary before installing a stone culvert. Leaves should be raked off and stockpiled for use elsewhere. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.

Organic Duff: Remove all duff and debris from within the culvert area including the area which will be under the trail treadway and stockpile for later elsewhere. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically displeasing along the trail as well as restrict water flow off of the trail.

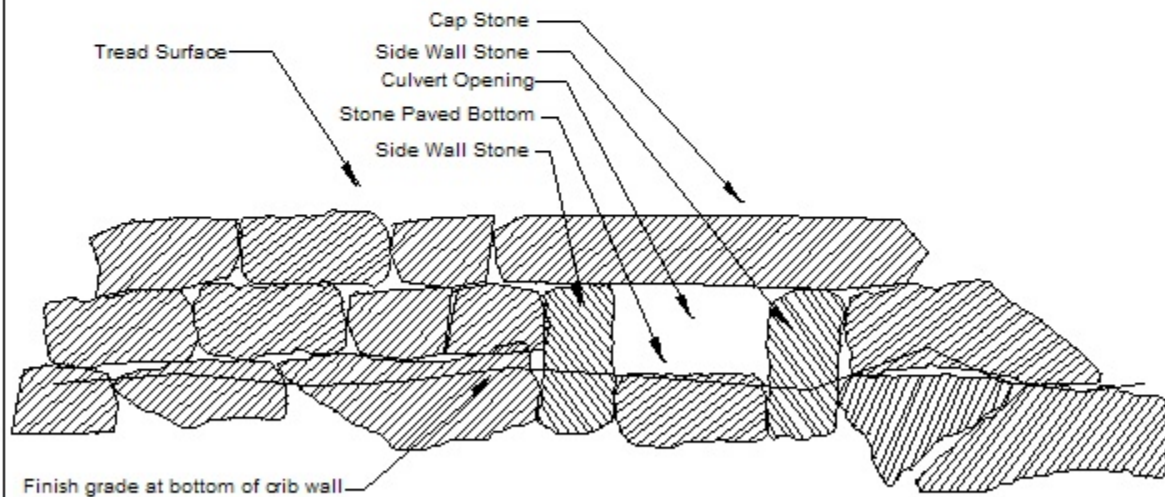
Mineral Soil: Excavate mineral soil to the necessary depth for culvert installation. Stockpile excess mineral soil for later use. Mineral soil may be placed at the base of crib wall sections where there is a desire to build up the slope due to excessive wall height. If placed, the mineral soil shall be compacted so that it remains in place.

Roots: Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.

Rocks: Stone which is excavated and not used as part of a culvert shall be stockpiled, crushed, and used as backfill in stone cribbing to provide adequate drainage.



The above stone culvert was installed under a stone staircase - a stone step served as the cap stone on the culvert.



## Stone Culvert (Typical)

Bear Mountain Appalachian Trail Relocation

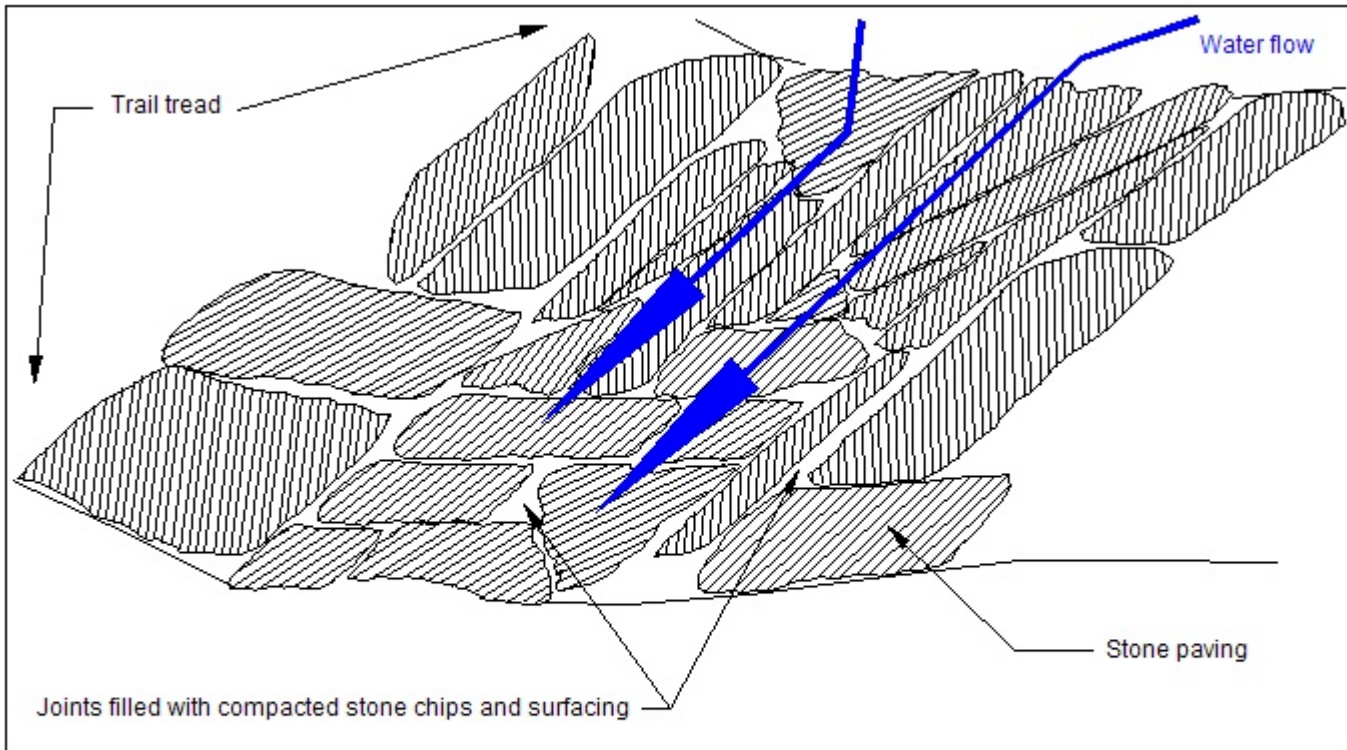
Not to Scale

March 2006



**APPALACHIAN NATIONAL SCENIC TRAIL  
BEAR MOUNTAIN STATE PARK  
Trail Construction Specifications**

<b>ITEM: 3.2 - Stone Paved Cross Drains</b>	<b>QUANTITY CALCULATION:</b> Length X Width
<b>DESCRIPTION:</b> Cross Drains allow small flows of intermittent storm water or spring seeps to flow across the trail.	<b>MATERIALS:</b> Only sound stone closely matching the local stone may be used for “paving” the bottom of cross drains.
<p><b>SPECIFICATIONS:</b></p> <p><u>Stone joints</u> - An effort must be made to install stones so that joints are as tight as possible. Water must be shed by all the joints installed. Minimizing joints is strongly encouraged.</p> <p><u>Back fill</u> - Fill material between and under stones must be a good grade of gravel (see separate spec. for trail surfacing) which can be compacted. It will be necessary to seal the stonework.</p>	
<p><b>INSTALLATION:</b></p> <p><u>Stone pavement</u> - The cross drain must be stone paved to prevent water from eroding the trail treadway. The stone paving may be done with one stone (if possible) or multiple stones. The stones must be placed so that joints are reasonably tight and provide smooth water flow. Each stone will be locked in place by the next and the joints will be filled with a good grade of crushed gravel. Upon filling, the joints will be compacted with a narrow tool which fits into the joint space.</p> <p><u>Inlet</u> - The inlet to the cross drain should be constructed to reduce collection of debris. If the inlet is steep, then it must be stone paved up slope to the point specified in the plans or field located.</p> <p><u>Outlet</u> - The outlet from the cross drain should allow the water to freely move away from the trail. If there is a drop off at the cross drain exit, then stone must be installed down slope of the culvert exit to slow the flow of water (energy dissipation). Stones used for this purpose may be “toothed” into the ground to better anchor them.</p>	
<p><b>USE AND DISPOSAL OF EXCAVATED MATERIAL:</b> Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.</p> <p><u>Leaf Litter:</u> Removal of leaves, sticks, branches, etc. may be necessary before installing a cross drain. Leaves should be raked off and stockpiled for use elsewhere. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.</p> <p><u>Organic Duff:</u> Remove all duff and debris from within the cross drain area including the area which will be under the trail treadway and stockpile for later use elsewhere. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically displeasing along the trail as well as restrict water flow off of the trail.</p> <p><u>Mineral Soil:</u> Excavate mineral soil to the necessary depth for cross drain installation. Stockpile excess mineral soil for later use. Mineral soil may be placed at the base of crib wall sections where there is a desire to build up the slope due to excessive wall height. If placed, the mineral soil shall be compacted so that it remains in place.</p> <p><u>Roots:</u> Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.</p> <p><u>Rocks:</u> Stone which is excavated and not used as part of a cross drain shall be stockpiled, crushed, and used as backfill in stone cribbing to provide adequate drainage.</p>	



**Stone Paved Cross Drain Construction  
(Typical)**

Bear Mountain Appalachian Trail Relocation

Not to Scale

March 2006

**APPALACHIAN NATIONAL SCENIC TRAIL  
BEAR MOUNTAIN STATE PARK  
Trail Construction Specifications**

<b>ITEM: 3.3 - Drainage Lenses</b>	<b>QUANTITY</b> <b>CALCULATION:</b> Length X Width X Depth
<b>DESCRIPTION:</b> Drainage lenses allow small amounts of storm water or spring seeps to flow under the trail treadway.	<b>MATERIALS:</b> Non-woven geotextile as well as 1.5 to 2 inch crushed stone are used in the construction of these structures.
<p><b>SPECIFICATIONS:</b></p> <p><u>Stone</u> - An effort must be made to install stones so that joints are as tight as possible. Water must be shed by all the joints installed. Minimizing joints is strongly encouraged.</p> <p><u>Geotextile</u>- Non-woven, 4 ounce geotextile with at least a grab tensile strength of 110 pounds and a puncture strength of 65 pounds or more must be used.</p>	
<p><b>INSTALLATION:</b></p> <p><u>Excavation</u> - Preparation of the area will be necessary before installing the drainage lense. Leaf litter and organic duff material must be removed as well as mineral soil to accommodate the lense.</p> <p><u>Lay Geotextile</u> - Use fabric which is 12.5 feet wide and cut to length (length of drainage lense + 3 feet on either end). Lay fabric so that the center line of the fabric (6.25 feet) is on the centerline of the trail.</p> <p><u>Stone filling</u> - Install the crushed stone (as specified above) to the specified width and depth. Shape (smooth and level) and compact the stone.</p> <p><u>Fold Geotextile</u> - Fold over the two ends of the fabric. Then fold the lower side of the fabric over onto the stone. Lastly, fold the upper side of the fabric over onto the stone. If the fabric from one side does not overlap the fabric from the other side by 6 inches or more, cut another strip of fabric to cover the fabric joint.</p> <p><u>Finishing</u> - Install trail surfacing on top of the fabric, place porous material on the upper and lower sides as needed to completely cover the fabric ( the fabric will break down with exposure to sunlight) to a depth of 3 inches minimum. Finish by distributing organic duff and leaf litter over the porous material.</p>	
<p><b>USE AND DISPOSAL OF EXCAVATED MATERIAL:</b> Conserve and use all suitable material for specified work. Conserve excess excavated stone suitable for specific project work and use in place of imported materials if needed.</p> <p><u>Leaf Litter:</u> Removal of leaves, sticks, branches, etc. may be necessary before installing a drainage lense. Leaves should be raked off and stockpiled for use elsewhere. Leaves provide an important part in soil biota and will also serve to enhance the aesthetics after trail construction.</p> <p><u>Organic Duff:</u> Remove all duff and debris from within the lense area including the area which will be under the trail treadway and stockpile for later use elsewhere. Upon final placement, do not obstruct drainages or create piles, berms, or windrows which will be aesthetically unpleasing along the trail as well as restrict water flow off of the trail.</p> <p><u>Mineral Soil:</u> Excavate mineral soil to the necessary depth for lense installation. Stockpile excess mineral soil for later use. Mineral soil may be placed at the base of crib wall sections where there is a desire to build up the slope due to excessive wall height. If placed, the mineral soil shall be compacted so that it remains in place.</p> <p><u>Roots:</u> Roots should be cut out using anvil style loppers or, if larger, then a sharp hand saw. Roots cut during excavation shall be dispersed away from the trail and hidden from view.</p> <p><u>Rocks:</u> Stone which is excavated and not used as part of a lense shall be stockpiled, crushed, and used as backfill in stone cribbing to provide adequate drainage.</p>	

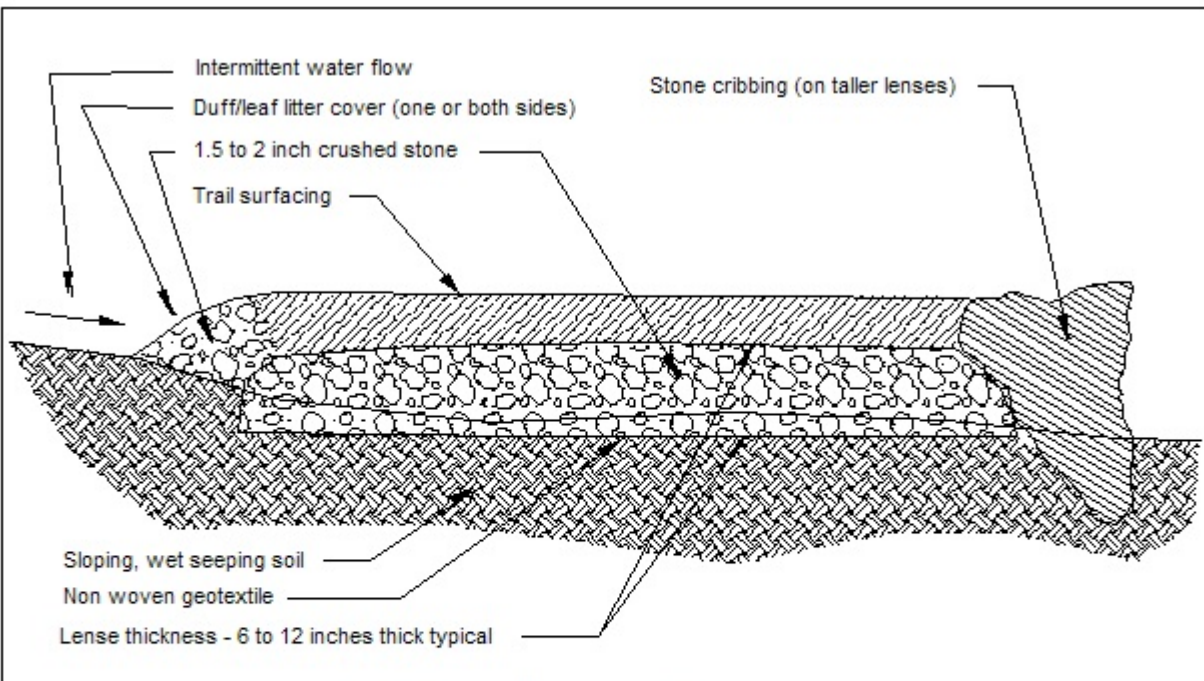
Stage 1



Stage 2



Stage 3



### Drainage Lense Construction

(Typical)

Bear Mountain Appalachian Trail Relocation

Not to Scale

March 2006

**APPALACHIAN NATIONAL SCENIC TRAIL  
BEAR MOUNTAIN STATE PARK  
Trail Construction Specifications**

<b>ITEM: 4.1 - Tread Surfacing</b>	<b>QUANTITY</b> <b>CALCULATION:</b> Length X Width X Depth																																										
<b>DESCRIPTION:</b> Mineral material placed on the surface of the trail which provides a compact, stable surface on which to walk	<b>MATERIALS:</b> ½ inch minus crushed rock derived from hard rock processed in a quarry. Particle sizes range from ½ inch to dust.																																										
<b>SPECIFICATIONS:</b> <u>Surfacing</u> - The surface material shall consist of the following gradation:																																											
<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Sieve Size</th> <th style="text-align: left; border-bottom: 1px solid black;">% Passing</th> <th style="text-align: left; border-bottom: 1px solid black;">Acceptable Percentage range</th> </tr> </thead> <tbody> <tr><td>½"</td><td>99.5</td><td>95 - 100</td></tr> <tr><td>3/8"</td><td>89.0</td><td>85 - 95</td></tr> <tr><td>1/4"</td><td>70.2</td><td>60 - 75</td></tr> <tr><td>#4</td><td>61.7</td><td>35 - 65</td></tr> <tr><td>#8</td><td>44.8</td><td></td></tr> <tr><td>#10</td><td>41.7</td><td></td></tr> <tr><td>#16</td><td>33.6</td><td>20 - 40</td></tr> <tr><td>#30</td><td>26.5</td><td></td></tr> <tr><td>#40</td><td>23.8</td><td></td></tr> <tr><td>#50</td><td>21.6</td><td>15 - 30</td></tr> <tr><td>#60</td><td>20.6</td><td></td></tr> <tr><td>#100</td><td>17.6</td><td></td></tr> <tr><td>#200</td><td>13.3</td><td>10 - 15</td></tr> </tbody> </table>		Sieve Size	% Passing	Acceptable Percentage range	½"	99.5	95 - 100	3/8"	89.0	85 - 95	1/4"	70.2	60 - 75	#4	61.7	35 - 65	#8	44.8		#10	41.7		#16	33.6	20 - 40	#30	26.5		#40	23.8		#50	21.6	15 - 30	#60	20.6		#100	17.6		#200	13.3	10 - 15
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The Acceptable Percentage Range provides potential suppliers with some flexibility in providing a viable ½ inch minus stone product.																																											
<u>Surface thickness</u> - Surfacing shall be applied to a thickness no less than 4 inches compacted.																																											
<b>INSTALLATION:</b>																																											
<u>Tread preparation</u> - Smooth mineral soil on tread, flatten/compact any stone in tread, and apply geotextile, if specified.																																											
<u>Surfacing application</u> - Install surfacing evenly across the specified width of the trail tread and compact. Ensure that the tread has an out slope of 3 to 5 percent (this works out to be a 1.8 inch to 3 inch drop in 5 feet - a 2.5 inch block attached on the bottom of one side of a 5 foot straight edge with a level attached is a convenient tool to quickly check the cross slope - if the bubble indicates level the cross slope falls within the specified range (about 4 percent). Add surfacing where needed and compact. Measure cross slope again. Repeat process as necessary until cross slope is in the acceptable range.																																											
<u>Surface compaction</u> - Applied surfacing must be compacted using an 8X8 hand tamper or vibratory plate compactor. The material must be compacted with sufficient moisture content to bind together.																																											