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UNH TECHNOLOGY TRANSFER CENTER provides training and services to municipal employees, public and private road associations, and citizens regarding new technologies and the management of roads and bridges.



*Typical Gravel Road in the Fall in New Hampshire*

## Unpaved Roads: Best Management Practices

*by Jonathan Coulp-Yu, UNH Technology Transfer Center*

Unpaved roads are a timeless part of the New England landscape. Common in rural communities, they provide a scenic escape from their paved counterparts. Like paved roads, unpaved roads are subject to similar issues and require routine maintenance to keep them safe and passable.

With some thought and consideration, an unpaved road can provide lower construction costs, require less equipment and skilled operators, and generate lower speeds. Integrating Best Management Practices (BMP's) into the decision process can lengthen the lifetime of the road and improve the surrounding environment.

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## EVERY DAY COUNTS INITIATIVES 2012

*by Amy I. Terry, Kentucky LTAP*

The Federal Highway Administration (FHWA) has rolled out a second wave of innovations for its Every Day Counts (EDC) initiative.

In the next two years, FHWA will promote the following 13 innovations to state, local and regional transportation agencies, as well as to the design and construction industries.

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# Unpaved Roads: Best Management Practices

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## WHAT ARE BMP'S AND WHY USE THEM?

BMP's are structural, nonstructural and managerial techniques that are recognized to be the most effective and practical means to prevent and reduce nonpoint source pollutants. BMP's are intended to improve the surrounding water quality as well as improve the function and safety of unpaved roads. An unpaved roadway, if left unmanaged, will contribute significantly to the quality of the surrounding watersheds. Erosion and runoff pose as a nonpoint source of pollution that all could be mitigated using various BMP 's. As in many cases, a dirt roadway are found adjacent to rivers or streams or through major watersheds and it is important to preserve the quality of those watersheds for the organisms that use them. In addition, and perhaps more importantly, the implementation of BMP's provide a safer driving surface to the user. Addressed in more detail later on in this article, it is important to have a routine maintenance plan that ensures the roadway will provide safe passage for the vehicles using it. Lastly, with the proper BMP's in place, it will reduce the maintenance costs by doing preventative maintenance instead of major repairs as necessary.

## CHOOSING A BMP

Typically the first thing that comes to mind when considering roadway BMP's are structural ones (culverts, surface and subsurface materials...). However the most cost effective means of unpaved roadway maintenance is through nonstructural BPM's such as frequent inspections, good site planning and routine maintenance.

Even with the best maintenance plans it may be necessary to implement structural BMP's to mitigate a situation. To start one must first identify the problem. Next a cause of the problem must be identified, then the appropriate BMP solution to fix it. It is common to use multiple BMP's along a stretch of roadway to achieve the desired results.

When selecting a BMP, it is important to understand the uses and limitations of each. While some can serve multiple purposes, often they only accomplish



*Gravel Road*

one task. It is because of this that it is important to use multiple BMP's to achieve that desired results.

When selecting the most appropriate BMP, it is important to ask the following questions:

- What are the physical site constraints such as ledge, property lines or steep slopes?
- Are there important natural resources such as drinking water wells, flood plains, wetlands, or endangered species habitat areas that would require a redesign?
- Is the future maintenance of the proposed BMP acceptable and can it be done within the current budget or resources and manpower?
- Will site planning or nonstructural BMP's satisfy the issue in the future?

## FACTORS AFFECTING THE LIFE OF AN UNPAVED ROAD

**Water-** the majority of roadway problems are attributed to the presence of water. It softens the load carrying capacity of subgrade and shoulders. It carries away fines and deposits them in and other debris in roadside ditches and culverts. However it is necessary for proper compaction.

**Traffic Loads-** typically depends on number of heavy trucks, not lighter vehicles.

**Maintenance-** Unpaved roads require routine and preventative maintenance on a regular basis. This prevents having to do costly major repair work.

**Subgrade Quality-** Unpaved roads require good subgrade materials to support heavy traffic, while allowing for proper drainage.

## NONSTRUCTURAL BMP'S

Proper planning and maintenance is often the best approach to managing an unpaved roadway. Nonstructural BMP's can typically come before structural approaches. They often are more cost effective in both capital cost and future cost, making them an ideal starting place when looking to manage an unpaved surface.

**Careful Planning:** A carefully thought out project is key to mitigating nonpoint source pollution. With proper planning the project will have less construction cost, require less material, and will shorten the duration of the project.

**Maintain Structural BMP's:** Maintaining structural BMP's is essential for them to function properly. Often they are forgotten about and left to deteriorate. The maintenance for a particular BMP should be considered in the decision process and include the future cost of maintenance and potentially the equipment and personnel to conduct said maintenance.

**Maintain Natural Vegetation:** Natural vegetation is an excellent way to stabilize soils. It provides natural absorption of water and adds to the rustic aesthetics of an unpaved roadway. Large trees provide extensive root systems that trap soil and should be maintained during any planned roadwork.

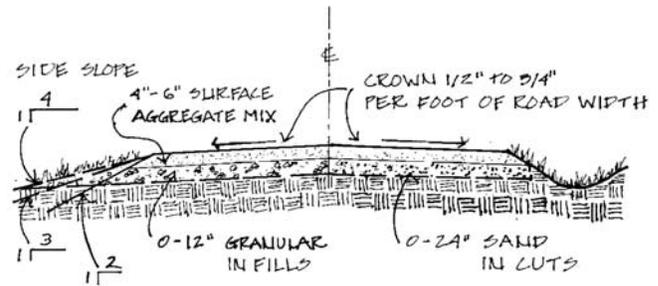
**Maintain Natural Buffers:** A natural buffer is an undisturbed distance between the roadway and a body of water or wetland. These are important because they provide an area for any sediment or pollutants to settle out before it reaches the body of water or wetland. It is essential to maintain the stability of these areas so as not to increase erosion. This is best mitigated through natural vegetation.

## ROAD SURFACES

Unpaved roadways typically are used by locals and often have a lower traffic volume. Even with a lower usage rate it is important to maintain the road surface. An unpaved road surface should provide many of

the same characteristics of a paved surface. It should be smooth to provide riding surface, shaped, and compacted. It should also provide a way for any storm water to quickly be conveyed to established drainage ways.

Similar to a paved roadway, the surface of an unpaved roadway should be impervious and convey the water to the sides. It is essential for the surface to have no standing water. Standing water promotes deterioration of the surface, ice buildup and erosion problems.



*Diagram of Gravel Road BMP*

## SURFACE PROFILE AND GRADING

A good profile is essential to the conveyance of storm water off the road surface. Often times it is necessary to reestablish the roadway surface in the spring after the last frost or after a period of sustained heavy rains. This can be accomplished in one of two ways, blading or grading. Grading reshapes the road surface by cutting into the road surface crust and redistributes material across the surface. This method is often used in conjunction with major repairs such as heavy corrugations or potholes. Blading or dragging is another method where the material is pulled for the sides of the roads to fill in small irregularities. This method should only be used for minor repairs and avoided during dry periods to prevent the loss of fine aggregate. With either method, it is important to reestablish the crown and avoid disturbing the vegetation or rock stabilization on the sides.

## SURFACE MATERIAL

As stated before, for an unpaved surface to shed water properly, it should be compact and impervious. This requires that the material contain a higher percentage of fines, far more than what is found in the subgrade of asphalt pavements. These "fines" act as a binder that locks the larger aggregate together. In time the fines wash away or are carried away by wind

or traffic and the surface is left with larger aggregate creating potholes and corrugation.

Light applications can be added periodically to maintain the smoothness and fill in small pot holes and corrugations; this can often be spread out by blading. Larger applications of an inch or more should be spread using a grader and compacted with a steel roller.

A good mix consists of a uniformly graded mix with approximate sizes of: Fines (<.074 mm), Sand

### GRADING BMP'S

- Grade road as soon as last frost while ground is still moist
- Minimize the work area to what can be stabilized by the end of a work day.
- Grade when gravel is moist and heavy rain is not in the forecast
- When possible compact entire roadway with a steel roller
- Regravel every 4 to 5 years, with all expenses of the operation incorporated into the roadway budget.
- Be sure not to leave a gravel or sod berm between the road and ditch slope.
- Add approximately 2 to 3 inches of material to correct faults.

(.074-2.0 mm) and aggregate (2-25.4 mm)

### DRAINAGE

Drainage is important to the health of a roadway. The largest contributor to roadway degradation is the presence of water. Water can be conveyed in a number of ways. It can either be moved via vegetated swale or under the roadway through a culvert. All have methods have their own design and maintenance considerations, however a common factor among all of them is to prevent further erosion and maintain the health of the road. If too much water is present, the load carrying capacity is reduced.

With the proper BMP's in place, the number of costly repairs can be reduced and in some cases prevented.

### SEASONAL CONSIDERATIONS

The focus on maintaining an unpaved road changes seasonally. In the spring and summer it is important to remove any brush, leaves or other debris for the ditches

### DRAINAGE BMP'S

- Ensure that ditches and swales are properly lined to prevent erosion. Ditches work by controlling, slowing, and filtering road runoff through vegetation or rock lining.
- Perform regular maintenance to keep ditches clear.
- Inspect culverts on a regular basis. Properly sized and installed culverts can reduce erosion by controlling the volume and velocity of discharges.
- Protect inlets and outlets by marking their location, stabilizing entry and exit zones, and maintaining ditch linings to prevent erosion.
- Water should outlet to areas with moderate slopes and vegetative buffers before entering surface waters. This type of outlet, often referred to as daylighting, allows most sediments and other pollutants to be removed before runoff enters surface waters.
- Avoid slopes steeper than 2H:1V unless stabilization methods are employed. A stable ditch or swale will not become an erosion problem.
- Preserve and maintain a proper road crown for good drainage. Free water cannot be allowed to stand in ruts or potholes or it will soak into the surface.
- Keep the road surface tight with regular grading.
- The natural buffer between the road and waterway or wetland helps reduce the velocity of runoff and removes some of its sediments.

and ensure they can properly drain. The road surface should be maintained and inspected on a regular basis. It is important to check the culverts for any damage sustained during the winter.

In the winter, critical sections should be free from snow and ice. Culverts should be marked and flow maintained with any ice dams removed. When possible, culverts should be thawed during periods of warmer weather. A courser aggregate material may be

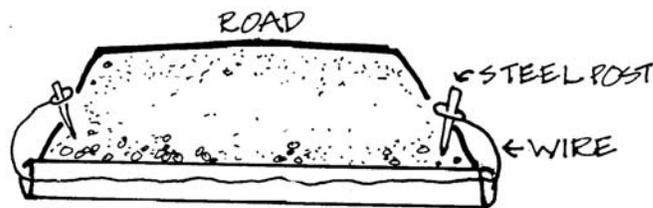


Diagram of Gravel Road BMP

added to maintain traction, however proper surface gradation should be reestablished in the spring.

A method of thawing out a culvert is described in the Maine road drainage manual. "John's Welder" method is intended for culverts that experience repeat blockage from ice. A 1/4" wire is suspended through



*Sample soil and gravel mixture*

the culvert. In the event of a blockage, a welder is attached to the wire and melts the surrounding ice. This is done enough to reestablish flow. The flowing water will continue to melt the ice and prevent more build up.

### CONSIDERING MAKING A PAVED ROAD INTO AN UNPAVED ROAD?

As discussed before there are a few advantages to unpaved roads. However, the advantages all depend on the situation and condition the road is in. Listed below are some advantages and disadvantages of converting a paved road to an unpaved road.

#### Pros:

With proper planning it is possible to reduce the

maintenance cost. The amount of specialized equipment needed and experienced workers to maintain an unpaved road is most likely already owned by a municipality.

**Cons:** While a paved road still has the same issues associated with an impermeable surface, eg. Drainage and erosion, a paved surface will not experience the same loss of binder that an unpaved surface. An unpaved surface relies on the presence of “fines” to hold together the coarser aggregate. While this does not mean that asphalt pavement will not degrade, it just means that it will take longer to reach the same level of disrepair.

If considering turning a paved road into an unpaved road, it is important to know that the base material for a paved road is not adequate for an unpaved surface. As discussed before, the material under a paved road contains a greater amount of large aggregate. If the asphalt were simply removed, the remaining material would be too porous and quickly form pot holes and corrugation.

One possible solution is to reclaim the asphalt in place. Reclaimed asphalt is asphalt pavement that is ground up to a specified gradation. Since the resulting mixture still contains the asphalt binder, when compacted, still provides some binding characteristics. It may be necessary to blend the mix to attain the desired gradation. Using the in place material will reduce the amount of material that is needed to be



*Grader Training with UNH Technology Transfer Center*