A Ditch In Time Gravel Roads Maintenance Workshop







So you think you've got a wicked driveway



1600' driveway with four switchbacks and 175' of elevation change (11% grade)



Road erosion is inconvenient unsightly and expensive to repair, but what's the greater danger?



Runoff carries sediment & nutrients into surface waters



It's easy to see the sediment ...



But what about those invisible nutrients?

Phosphorous is...

- a natural element found in soil and rock
- the 12th most common element found in the earth's crust
- an important nutrient needed to sustain both plant and animal life

Sources of Phosphorous

in the environment:

- Contributed in concentrated form as fertilizer, detergents, sewage, & manure
- Occurs naturally in soil and organic material

It's that middle number on a fertilizer bag



How does that affect us?

- Microscopic plants and algae feed on phosphorous
- Algae multiply in the presence of elevated concentrations of phosphorous
- Algae mature and die in massive quantities and fall to the lake bottom
- Decay processes deplete dissolved oxygen levels in the water
- Depleted dissolved oxygen levels at the lake bottom make available additional phosphorous trapped in bottom sediments
- An algae bloom uses up dissolved oxygen
- The natural balance of life in the lake is disrupted, many species of fish and other aquatic life are suffocated
- Algae bloom results in a thick green soupy mass floating in the water

Water becomes unpleasant to swim in or drink

 Recreational potential and property value are adversely affected



NH Trails



1.0 Why are gravel roads such a problem compared to construction sites?

Gravel roads are seldom, if ever, surrounded by "silt fence" or other siltation control devices

unlike construction projects that have many silt control devices installed by law.



But gravel roads remain unprotected by grass, mulch or pavement for their entire existence.

To our benefit...

The same techniques used to improve the road surface to reduce erosion also make the road easier and smoother to travel on.

This helps to **make allies** of all road users, helping to win their confidence when we strive to perform other upgrades to reduce sedimentation. The three most important rules to remember when designing, building and maintaining a road:

#1. Drainage: get the water off the surface of the road

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- #2. Drainage: keep the water out of the base of the road
 - #3. Drainage: get the water safely away from the road

Water is the enemy of the road!



A road should be like a house:



- A strong foundation to provide support
- A roof to shed water to keep the inside dry

How strong should it be?



One big truck = 10,000 cars!

The road base

- Mix of sand and rock for strength
- Minimum of "fines" for drainage

Road surface materials

The road surface...

- Lots of small aggregate (stones) to provide strength with a shape that will lock stones together to support wheels
- Sufficient "fines," the binder that will lock the stones together, to keep the stones from moving around

The difference between:

- Crushed bank run gravel
- Ledge Pack or
- Hard Pack
- Rotten Rock
- Recycled Asphalt

The best material starts as solid rock that is drilled & blasted...



Then crushed into smaller pieces and screened to produce specific size aggregate



 Besides producing "aggregate" that is uniform in size and, occasionally, in content of fines versus stone, this process makes stone that is much more angular than that made just from screening bank run gravel



 Rotten Rock- traditional surfacing material in the Mt Washington Valley and a few other places; packs hard, but breaks down under heavy traffic

RAP (recycled aspalt pavement)

- Pavement is made of clean ³/₄" and smaller material with no fines
- Hot asphalt provides the "glue" that holds it together instead of fines
- Asphalt starts at the plant at 360 degrees, is laid down at 275 degrees
- Works well for low volume, flat areas or as base material DOES NOT USUALLY PACK

Recycled concrete
"Dirty" gravel packs but does not drain
"Clean" gravel drains but does not pack

Does an unpaved road return more water to the ground than a paved road?

 A proper combination of correctly sized broken rock, sand and silt/clay soil materials will produce a road surface that hardens into a strong and stable crust that forms a reasonably impervious "roof" to our road

Sample of local ³/₄ ledge pack



Note how strong it is



Good surface gravel, properly graded and compacted should not allow any water through it but should shed it as well as pavement!!!

What is "Gravel"

- Architects and engineers call it one thing
- Folks in dump trucks usually call it another
- For our purposes, GRAVEL is a mix of stones, sand, and "fines" CRUSHED STONE is washed & graded stone only (no sand & fines)

Be careful what you order!

The optimum gravel road surface for most situations:

3/4" or 1" MINUS which means the largest aggregate is $\frac{3}{4}$ " or 1" and the mix contains every size below that including sand, silt and clay



Road surface problems, the causes and how to fix 'em

Potholes:

The result of water and traffic on a *flat* road surface

When a rut or pothole is filled in with loose material, the new material soon compacts down and fills with water in the next rain



Passing traffic splashes water and soil out to reopen the pothole

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Just a few potholes here and there, not enough to tear up the whole road to fix?

It can be OK to fill potholes in this case, follow these rules:

• OVERFILL the potholes just like an auto body repairman overfills a dent in the car

 Compact the gravel with the truck that's hauling the gravel or

• Let traffic compact it

A bump (the overfilled pothole) will not get larger as will a pothole filled with water

Washouts: usually on hills and slopes:

- caused by poor surface material and/or
- inadequate pitch to get water off to the side and, too often,
- by wheel ruts caused by cars driving in the same place every time



Double ruts



Wheel tracks allowed to become washouts

Simple fix: Regular maintenance at first sight of wheel tracks starting to turn to ruts, especially on hills.

Also try to get folks to drive all over the road instead of in the same ruts all the time

Don't drive in the ruts!



The technique we use to get water off the surface of the road:

Slope the surface of the road to one side or the other so that water cannot *sit* on it and soak *into* it



or slope to *both* sides...

Forming a shape known as a..



Where water is forced from the surface of the road to the ditch line (if there is one) on each side of the road

But doesn't a crown usually look like:



Yup! But that doesn't make it right!



A rounded crown leads to a problem with the center of the road because it's the only part of the road not pitched to one side or the other. And it often gets more traffic than either side! (2x as much)

Here's what happens to a road with a rounded crown:



Example of proper crown slope at left only and flat at right; same road, different slope on each side



How much slope should there be for a proper crown?

$\frac{1}{2}$ " to $\frac{3}{4}$ " per foot

Put another way, this is 5" to 7¹/₂" per 10' of lane width To measure this: carpenter's level and 10' straight stick



How often should a road be graded?

 It depends totally on conditions, usually dictated by rainfall, or sometimes lack of it.

• There is no set rule for how often

Ideal conditions for grading

 Springtime after most frost has left-Road may still be soft but FrontRunner can help dry it out if not too wet

When to grade

 Late Spring or Summer after road is fully stable- just after rain to soften the surface

Stay off of it... When too dry:

- extra effort to grade if possible at all
- road material will not repack
- excessively dusty

When too wet:

possible to make more soup than already exists

Drying up a muddy road
Deep mud (early Spring)



Use larger (1 $\frac{1}{2}$ " stone) until road firms up; cheaper than $\frac{3}{4}$ stone and stronger

Add geotextile (road fabric)



Geotextiles keep the gravel on top from being pushed down into the soil underneath, compensating for a poor road base

Geotextiles cost less than

- The price of the equivalent amount of gravel to get the same effect (much less)
- The cost of hauling the gravel OR
- The cost of spreading the gravel

According to one report, a layer of geotextile costs about the same as one inch of gravel

 Subsurface drains





Maintenance tips

Trees help keep a road from drying out and create a nice canopy, but leaf build-up on the road can make it harder to maintain and lead to washouts in the traveled way as water flows around them.



Get rid of leaves when they have just fallen with a backpack or walk behind leaf blower

Grader berms

Note ditch at left, water traveling in road



The results can be the same with the ice dams that form at the sides of the roads during icy winters.





And even worse when Spring rains are more intense than usual (4/05)

Road ditch under snow

Ice dam-



(This emergency called for some quick FrontRunner work to redirect the stream back to the ditch)



Breaking ice dams is difficult



Getting rid of grader berms much easier, just as important



Snowplow digs in soft road

Repair: Regrade Better still, avoid by plowing carefully or use a FrontRunner!



Or, stay off the road until snow melts



Washboard:

Lack of fines, good locking stone, and/or moisture

- Regrade,
- Top with good gravel,
- Add CaCl

Dust, road surface fines blowin' in the wind

- Apply Calcium or Magnesium Chloride in moderate amounts to settle dust
- In heavier amounts to also harden the road surface to save on maintenance

CaCl can be applied as as 77% flake by hand or by push spreader



Or as 35% liquid mixed with water

- .3 gal/sq yd first year application
- .2 gal/sq yd follow up



Water turnouts:

- holes through whatever is obstructing flow at the side of the road
- get water <u>away</u> from the road.
- grader berm or a stone wall (be careful of these.)

Because they carry water away from the road, <u>the more turnouts</u>, <u>the better</u>.

 Make turnouts as far as possible from water bodies so that silt can be deposited before it reaches the water

(see Camp Roads Manual)

Paving as an alternative:

- On steepest hills
- Road must be ready:
- Strong, well drained base
- Adequate drainage away

Or Else!





Spring of 2019







QUICK TIPS: THINGS THAT CAN BE DONE NOW TO IMPROVE YOUR GRAVEL ROAD OR DRIVEWAY © copyright 2007 Russ Lanoie, Conway, NH

Every private road should have a steward, someone to watch out for the things that can cause greater problems if not taken care of NOW! If it's your own driveway, YOU are the steward. Knowing when to take action yourself or to notify whoever can take action might save a road or driveway from disappearing needlessly.

As a steward you should watch:

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Water drainage patterns on the surface of the road. If water is beginning to flow where it should not, even a hasty scratch mark with a hoe, shovel, stick or heel of a boot to redirect water to where it *should* go might divert disaster. Catching this in time is the key. Hence the title of <u>A Ditch In Time</u>.

Culvert inlets and outlets as well as ditches to be sure they are not blocked. A stick or two across a culvert or a ditch can dam water flow just like a beaver dam, especially if other debris snags on and builds up. The dammed water will find another path across or out into the road, most likely causing a washout. When you are out for a walk, throw those errant branches back into the woods.



Water bars (sometimes known as "rolling dips.") Be sure they are not losing their shape due to mechanical damage from snowplows or normal wear and tear and therefore allowing water to jump over and run down the wheel tracks in the road. A little handwork can often make them serviceable once again.

Water turnouts and grader berms. Keep turnouts open and look for areas where more turnouts might be added. Cut slots through grader or snowplow berms to let water off the roadbed, especially on hills. This is true even for paved roads with regards to snowplow berms.

Impact of increased development on existing road systems:

- Fewer places to safely dispose of water
- More water to dispose of
- More traffic

- One inch of rain on one acre = over 27,000 gallons of water
- Roofs and blacktop drives heat up in sun, transfer heat to rainwater
- Fish don't like hot water

Maine DEP has a GUIDE TO FORMING ROAD ASSOCIATIONS available for download at their website

(see web address in Ditch inTime)


The Road Steward...

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- Heavy duty grader/rake system mounts easily in place of snowplow
- Uses existing snowplow hoist and angling controls
- Natural forward facing operation enhances the digging action to cut out potholes, ruts, & bumps and clear debris ahead of vehicle
- Simple wheel adjustments provide true crowning action
- Truck remains fully serviceable for other applications while ready to go to work maintaining roads
- Takes advantage of the truck's suspension system for faster and smoother operation than any other construction vehicle



Summer road maintenance from the seat of your plow truck!

The Perfect Crown

I think that I will never see...























Rural Home Technology

Presented By Russ Lanoie

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Road and Driveway Maintenance

Wet Basements

Septic Systems

Alternative Energy

Water Well Construction

Sharing over a half century of experience and innovation at solving soil and water related issues for rural homes and businesses...

Welcome to this site where Russ Lanoie shares much of what he's learned during his fifty plus years of innovative problem solving in New Hampshire's White Mountains. Russ has done extensive writing and produced several videos on soil and water related issues and, as his career slowly winds down, offers this information to anyone whom it may help solve their own problems. Russ welcomes questions and feedback and will respond as time permits.



LP

I've just been visiting your wonderful website! What generous sharing of helpful and thorough information!

J.S., FRYEBURG, MAINE,

I went to your website and spent an educational hour or more surfing! You have certainly taken a great deal of care is putting useful information

great deal of care in putting useful information great dear or care in putting useful mormation out to educate your consumers.



How to dry out existing basements and keep new basements from ever getting wet



An owner's manual for those who live and travel on dirt and gravel roads