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
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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 asphalt pavement)

- Pavement is made of clean $\frac{3}{4}$" 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 $\frac{3}{4}$ 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.
To get the best results, it is necessary to cut into the surface, ideally to the **bottom of the deepest ruts or potholes**
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

or slope to *both* sides…
Forming a shape known as a...

“crown”

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 $7\frac{1}{2}''$ 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 ½” stone) until road firms up; cheaper than ¾ 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 a 77% flake by hand or by push spreader.
Or as 35% liquid mixed with water

- 0.3 gal/sq yd first year application
- 0.2 gal/sq yd follow up
Water turnouts:

• holes through whatever is obstructing flow at the side of the road
• get water *away* from the road.
• grader berm or a stone wall (be careful of these.)
• Because they carry water away from the road, the more turnouts, the better.
• 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

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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:

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 A Ditch In Time.

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)
### Training Calendar

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Details</th>
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<tbody>
<tr>
<td>Jun 10</td>
<td>Leadership Webinar Series Module 9: On the Balcony - Art of the Debrief</td>
<td>Credits: 1 Supervisory, Location: 11:00 AM - 12:00 PM EST, Registration: Individual</td>
</tr>
<tr>
<td>Jun 10</td>
<td>Lunch 'n Learn: Social Media &amp; Public Works</td>
<td>Credits: 1 Supervisory, Location: 11:00 AM - 12:00 PM EST, Registration: Individual</td>
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<tr>
<td>Jun 10</td>
<td>Basic Pavement Management for Local Agencies - Part 2</td>
<td>Credits: 2 Technical, Location: 12:00 PM - 4:00 PM EST, Registration: Individual</td>
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<tr>
<td>Jun 10</td>
<td>Evaluation of Precast Concrete Pavement Systems Webinar</td>
<td>Credits: 1 Technical, Location: 12:00 PM - 1:15 PM EST, Registration: Individual</td>
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</table>

View all upcoming training [here](https://t2.unh.edu).
The Road Steward…

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Front Runner®
the versatile grading and cleanup tool

- 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…
DUBBLYA
DUBBLYA
DUBBLYA
DUBBLYA
Rule #1
THE END
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.

Keeping Your Home's Feet Dry
How to dry out existing basements and keep new basements from ever getting wet

A Ditch In Time
An owner's manual for those who live and travel on dirt and gravel roads