

A photograph of a dirt road in a forest. The road is heavily eroded, with a large pile of sediment and rocks on the right side. The background shows a dense forest of trees.

**Improving and Maintaining
Roads to Reduce Impacts on
Erosion and Water Quality**

Common Problems

Road Prism Erosion

Road surface rills and sheet erosion, in-board ditch erosion, fill slope erosion at crossings, cut bank sloughing



Unstable Fills

Roads close to streams or intercepting groundwater, “perched” fills on steep slopes, un-compacted fills



Often these problems are due to poor road location and cannot be solved without road re-location or major re-construction.

Poor Drainage

The ultimate cause of most road-related problems



Through cut roads are like troughs that cannot drain

Potholes are caused when roads are too flat to drain

Gullies

They are always associated with a drainage problem and cannot be solved by “filling the hole”



Both of these gullies originated at points of road drainage discharge

Deficient Stream Crossings or Culverts



Inadequate Cross Drains



Cross drains are culverts or rolling dips that intercept and “relieve” ditch flow. They may be inadequately sized or spaced. As a result, ditches may erode or excessive runoff may be diverted down the road, causing rills and gullies.

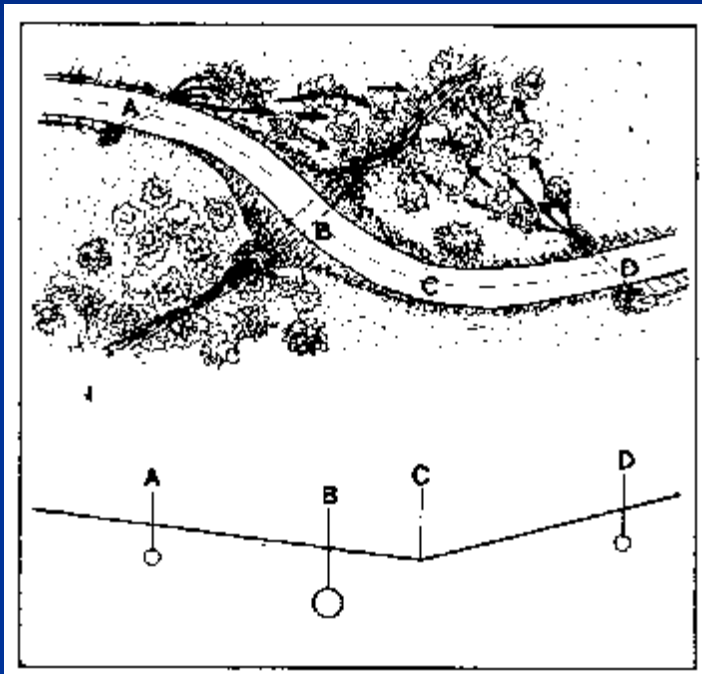
Upgrading Existing Roads

Improving Drainage

- Out-sloping where appropriate
- Increasing the frequency or size of cross drains
- Replacing deficient stream crossings
- Eliminating stream diversion potential



Eliminating Diversion Potential - ensuring that if a crossing is plugged or overtopped, flow will return to the channel and not go down the road



Sufficiently sized stream crossing is placed at “B”. “C” is critical dip axis. “A” and “D” are cross drains placed to intercept road runoff and disperse it over land instead of into the stream.

Upgrading Existing Roads

Improving Stability

- Stabilizing failing or vulnerable fill slopes
- Eliminating causes of gully erosion and protecting drainage outfall sites



Upgrading Existing Roads

Reduce Fine Sediment Production and Delivery



Usually involves surfacing and reducing “hydrologic connectivity”

Eliminating Connectivity

- The goal is to intercept and disperse road runoff and sediment before it enters the stream.
- Can be accomplished with cross drains or out-sloping that disperses runoff onto vegetated slopes.



Upgrading Existing Roads

Additional Treatments



Trash racks placed above stream crossings.



Water bars on temporary or seasonal roads.

Maintaining Roads

Annual Tasks

- Inspect your roads BEFORE the winter hits, and then during and after major storms.
- Clear debris and sediment from culvert inlets. Check upstream for accumulated debris. Check for erosion at outlets.
- Inspect rolling dips (if applicable) or cross drains to determine that they are functioning and that no erosion is occurring at outlets.
- Avoid frequent grading. Use a shovel to clear inboard ditches. Avoid grading ditches.
- Inspect cut and fill slopes for signs of instability.
- Keep records of problem sites. Mark these in the field for easy identification during storms.

The single most important thing to do is to keep crossings and culverts clear



Road and Stream Crossing Decommissioning

Definitions and Approaches

Definitions*

“Activities that result in the stabilization and restoration of unneeded roads (and stream crossings) to a more natural state.” (USFS, parentheses added)

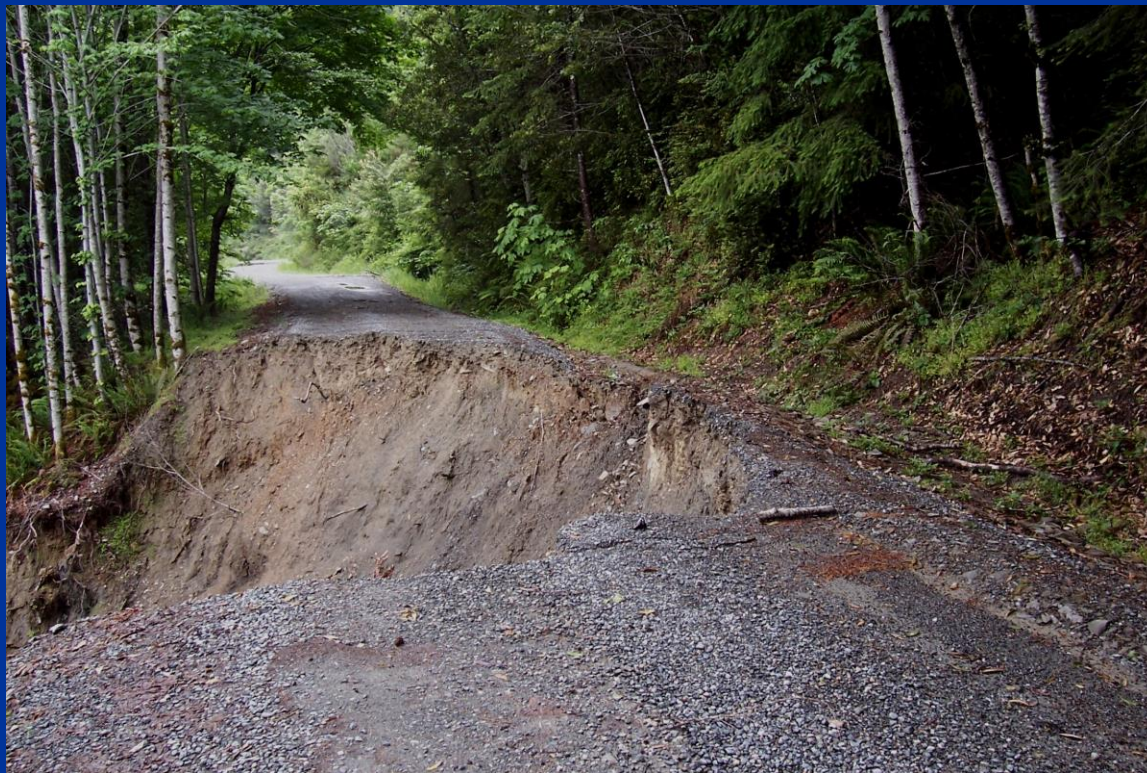
“The physical treatment of a roadbed to restore the integrity of associated hillslopes, channels, and flood plains and their related hydrologic, geomorphic, and ecological processes and properties” (Keith Guenther)

“Procedures that permanently close a road in a manner that prevents erosion, maintains hillslope stability, and re-establishes natural drainage patterns” (CAL FIRE 2007).

*Thanks to Bill Weaver, Pacific Watershed Associates for much of the information and several pictures included here.

When Should a Road be Eliminated?

Roads that are poorly located, chronic sources of sediment, unneeded or likely to fail catastrophically are candidates for elimination



Decommissioning Roads

- Eliminating a road does not mean just closing it
- Road “decommissioning” may entail
 - Reducing its potential for failure during stressing weather events
 - Restoring natural drainage by removing crossings and treating the road surface
 - Re-vegetation of road surface and cut and fill slopes

- Total decommissioning of roads and crossings means restoring the natural terrain and streams
 - This can be extremely expensive and disruptive
 - It is usually not necessary unless there are over-riding aesthetic objectives



Technical Standards

- Stream crossing side slopes: Excavated and sloped at 2:1 or to the grade of natural side slopes above and below the crossing
- Stream crossing channel profile: Excavated at natural channel grade through the crossing with no abrupt grade changes at the top or the bottom of the excavation – the standard is to exhume original channel bed
- Stream crossing channel width: Excavated to match or exceed the natural channel width outside of the influence of the crossing; the design standard is the 100-year flow width
- Road approaches and all road reaches: Hydrologically disconnected to minimize direct runoff into the crossing or into nearby streams
- Road related fill slope landslides: Fillslope landslides with potential for sediment delivery are excavated and removed

Common Techniques Applied

- Rip to reduce compaction and increase permeability
- Install cross drains or outslope to disperse concentrated runoff
- Excavate unstable fill slopes
- Pull stream crossing structures and associated fill
- Endhaul excess spoil to disposal site
- Revegetation of road prism

Measures of Success

- Overall goal is to eliminate the potential for sediment delivery from the road prism or crossing and make the road hydrologically invisible.
- Excavated stream crossings should exhibit less than five percent, preferably less than two percent, loss of erodible fill volume
- The frequency and delivery of sediment from road fill failures should be minimized
- Less than five percent of the former road should be hydrologically connected to watercourses.

Ripping the Road Surface to Increase Permeability



Outsloping to Disperse Runoff



Re-contouring and Re-vegetation



Fully Decommissioned Stream Crossing



Fully Decommissioned Stream Crossing and Road



Packing Decommissioned Road with Slash to Impair Access



Problems Commonly Encountered

- Decommissioning is expensive
- Total excavation of fill slopes and upstream stored sediment is problematic
- Clearing and construction can cause short-term impacts
- Excavation can reveal unforeseen problems



A gravel road winds through a forest. On the left, there is a steep, exposed embankment of soil and roots. The road surface is composed of loose gravel and dirt, with visible tire tracks. The surrounding forest is dense with tall, thin trees. The lighting is somewhat dim, suggesting a shaded area or overcast conditions.

Thank You!