MAINTAINING PRIVATE ROADS

Maintenance and management of rural roads in Santa Cruz County

PRESENTATION OUTLINE

- Why we should care about our roads
- Anatomy of a typical road
- Factors that will degrade your road
- Common types of Failures
- Proper road drainage
- Maintenance considerations
WHY DO WE CARE ABOUT RURAL ROADS?

- **USABILITY & SAFETY**
  - Year round use and comfort?
  - During and after emergencies?

- **WATER QUALITY**
  - Poor designs, placement and installations create sediment issues both upstream and downstream

- **LIABILITY & ECONOMICS**
  - Poor conditions and neglected maintenance = higher long-term costs
  - Regulations, red-tags, and fines
  - Damage to other properties from uncontrolled runoff and/or sediment

ANATOMY OF A ROAD
COMMON PROBLEMS

- Degraded Surface (potholes, ruts, cracks)
- Flooding or ponding
- Erosion (ditch or gully)
- Slope failures
- High Maintenance Requirements

WHAT CAUSES ROAD PROBLEMS?

- Poor design or construction
- Use & Time
- Drainage related erosion
- Lack of maintenance
DRAINAGE SOURCES

- Direct rainfall onto road surface
- Surface flow (sheet runoff)
- Subsurface (shallow groundwater) intersected by a road
- Concentrated flows (Ditches, culverts, or stream crossings)

Hydromodification:

- Impervious surfaces increase rate and volume of runoff
- Diversion or concentration of flow within ditches will increase erosion
- Loss of floodplain storage will increase flood peaks

FLOW CONCENTRATION
Chronic erosion is continuous over time.

Episodic is a single event such as a plugged culvert that washed out the roads.

**EROSION: CHRONIC VS EPISODIC**

Fine sediments are generated as vehicles mechanically break down the road surface.
THIS IS WHAT HAPPENS TO THAT DUST WHEN IT RAINS

EPISODIC ROAD FAILURES

- Stream/culvert crossing failures
- Landslides
- Cutslope or fillslope failures
MANAGING ROAD DRAINAGE

- SURFACING AND BASE COURSES
- ROAD SHAPE OR GEOMETRY
- ROADSIDE DITCHES
- CROSS DRAINS

BASE COURSES AND SURFACING OPTIONS

- Concrete
- Asphalt
- Oil & Screen
- Baserock

SUB BASE

BASE ROCK
ROAD GEOMETRY

Alignment & Grade
Probably already established?

STEEP GRADES ARE DIFFICULT

<10% grade = easy

>15% grade, steep = hard

CROSS SECTION OPTIONS

CROWNED

DITCH

2.4%

INSLOPED

2.4%

OUTSLOPED

2.4%

NO DITCH
OUTSLOPING AND INSLOPING

TOP: Insloped with ditch and berm
  ▪ Increased hydrologic modification

BOTTOM: Outsloped with rolling dips and no ditch or berm
  ▪ Reduced hydrologic modification

SOME ISSUES WITH OUTSLOPING

Wheel ruts
Berms
OUTSLOPING

**Good for:**
- Paved or well rocked and maintained roads
- Moderately sloped roads

**Not good for:**
- Weak subgrade (wheel ruts decrease its effectiveness)
- High use roads
- Steep roads (safety)

INSLOPING: WITH OR W/OUT DITCH

**Good for**
- Wet roads,
- Poor soil conditions
- High use unpaved winter roads
- Steep roads (safety concerns)

**Limitations**
- Requires lots of culverts to drain properly
ROADSIDE DITCHES

- Armor or vegetate but DON’T lose capacity or divert flow into road
- Require frequent relief drains (knockouts or culverts)
- Require regular maintenance (vegetation & sediment)
- Great for drying the road surface or collecting distributed seeps

CROSS DRAIN TECHNIQUES

- SURFACE DRAINS
  - Rolling dips/reverse grade dips
  - “Knicks”
  - Waterbars
  - Berm breaks

- CULVERTS
1. Skew at 30 degrees
2. Reverse grade at 3% for 20 feet
3. Gentle approach trail
4. Accentuate the outlet of the dips
CULVERTS

Culverts are like bad pets.... once your get one, you own it!

DITCH RELIEF
GET LOCAL DRAINAGE OUT OF THE DITCHES AND SAFELY ACROSS THE ROADWAY

STREAM CROSSING
CONVEY CONCENTRATED FLOW FROM STREAMS SAFELY ACROSS THE ROADWAY
**DITCH RELIEF CULVERTS**

**THE BASICS**
- 18 inch diameter or greater, unless site conditions dictate otherwise
- Always install culvert on a slope steeper than the approach ditch to ensure sediment transport (minimum slope of 5%)
- Keep them closely spaced to avoid flow concentration
- Provide outlet protection
  - Energy dissipator
  - Slope drain extension
- Protect inlet protection
  - Headwall
  - Slough Wall
- Provide Locator stake: avoids crushed ends, facilitates cleaning

**INLET AT RISK OF PLUGGING**
**EROSION UNDERCUTTING FILL**
**FLUME ANCHOR TO PIPE**
**POOR**
**BEST**
**PIPE AT BASE OF FILL AND STEEPER THAN DITCH GRADE**

Always make sure pipe is steeper than profile of road – or it will plug

Place culverts at frequent spacing, low points in road profile, or at points of concentrated drainage
Flat culverts easily plug. "Shotgunned" culverts can cause fill slope failure.

**DITCH RELIEF DON'TS**

**STREAM CROSSINGS**
DESIGN CONSIDERATIONS

- Hydraulic Capacity (10-year, 100-year, etc.)
- Aquatic Organism Passage (where necessary)
- Debris loads
- Structural Requirements
- Site Geometric Constraints
- Cost

Best advice? Hire a professional with knowledge, experience, and insurance!

CULVERT HYDRAULICS: MATH SKILLS REQUIRED

CULVERT HYDRAULIC CAPACITY IS INFLUENCED BY:

- Head (available height of water over pipe inlet)
- Entrance geometry (flared, square headwall, etc.)
- Pipe size & type
- Pipe profile slope
- Downstream conditions
- Sediment and debris
PROBLEMS WITH CULVERTS

- Plugging
  - Stream diversion
  - Loss of road fill
- Corrosion of pipe
- Outlet erosion
- Channel incision
BIG PIPES ARE GOOD
NEVER USE SMALLER THAN 24” DIAMETER
ONE BIG PIPE IS TYPICALLY BETTER THAN TWO SMALL PIPES

- Cost effective way to protect your culverts/roads
- Design Considerations
  - Place upstream 2 x Dia.
  - Keep opening size to at least 1/3 of culvert Dia.
  - Provide safe overtopping flow path
- Clean often

DEBRIS RACKS
Sometimes a culvert doesn’t cut it. You may need a little bridge.

Or maybe a big bridge!
INSPECTION
- Install culvert markers (for maintenance, awareness, emergency location)
- Schedule
  - Seasonally - typically in the fall
  - Before and after large storms

- Clean ditches (sediment and vegetation)
- Clean culvert inlets and outlets, debris racks (sediment and vegetation)
- Regrade damaged dips or waterbars. Break berms
- Surface restoration
  - Sealing, repaving, adding rock
WHEN MIGHT YOU NEED PERMITS?

- Proximity of work to a waterway
- Size of drainage area
- Grading (volume or area of disturbance)
- Structures (retaining walls, bridges, etc.)
- Paving (increased impervious areas)
- Special status species

COMMONLY REQUIRED PERMITS

- CDFW (1600)
- Army Corps (404)
- RWQCB (401 or SWPPP)
- Coastal Commission (CDP)
- City or County (Env. Health, Grading, Riparian Exemption)
- Local Flood Control or Irrigation District
- USFWS (Incidental Take)

**UNDERSTAND YOUR LIABILITIES. DO GOOD WORK. AVOID FINDING OUT ABOUT PERMIT REQUIREMENTS TOO LATE**
CONSULTING WITH PROFESSIONALS

- Contractor
- Civil/Structural Engineer
- Hydrologist
- Geologist
- Geotechnical Engineer
- Land Surveyor
- Biologist
- Attorney
- Land use planner

SUMMARY

- Plan roads carefully
- Maintain roads dutifully

- Save money
- Increase usefulness
- Reduce environmental footprint
- Avoid liability