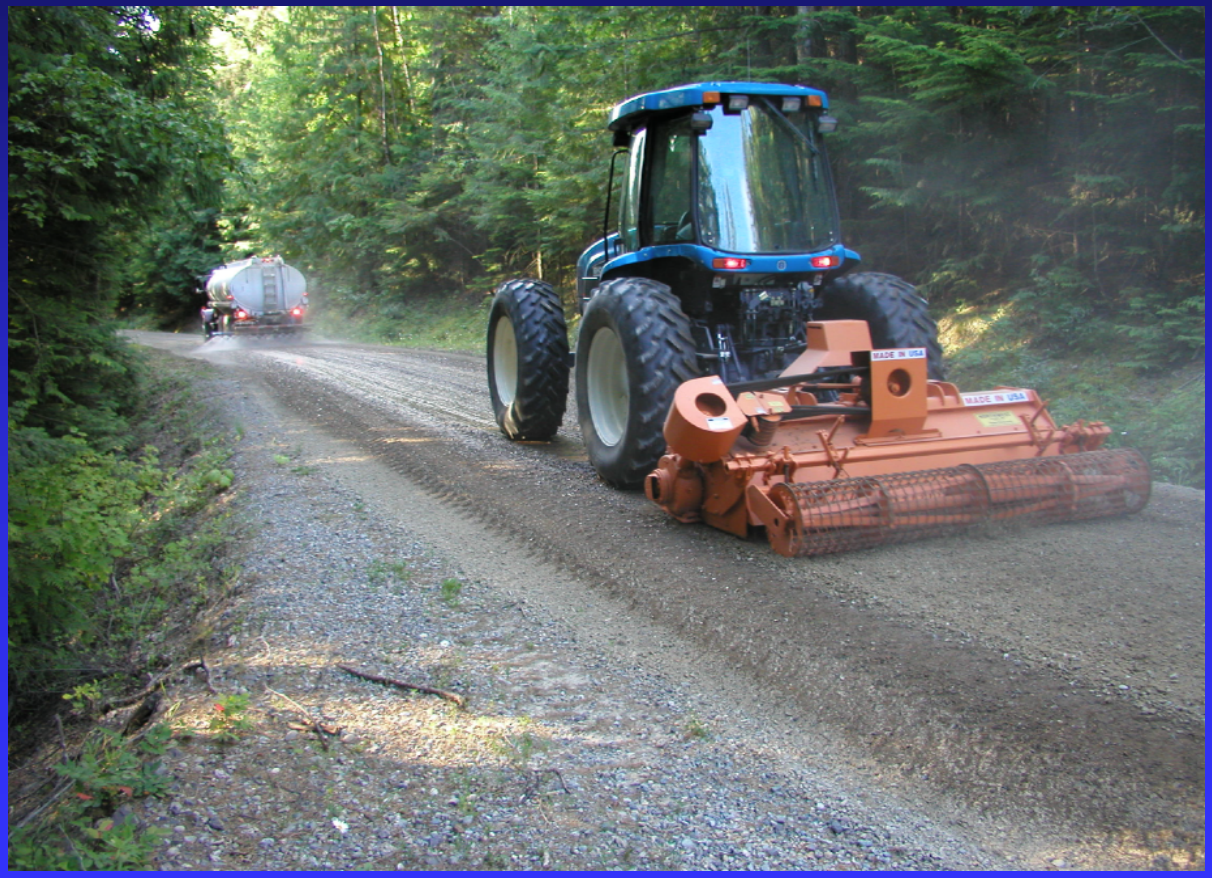
USDA Forest Service

San Dimas Technology and Development Center

Unpaved Road Stabilization with Chlorides



Unpaved Road Stabilization with Chlorides

- 3 Year Project, FY 2002 - 2004
- Completion Date: 9/2004
- The goal of this project is to evaluate different chloride products, applied at different application rates, using different construction methods as stabilizing agents for aggregate surfaced roads.

Project Details

- 12 Project Sites
  - Each project site has 4 to 12 test sections, 800 feet long
  - Minimum of 2” of crushed aggregate surfacing
- 39 Treated Sections
  - 4 chloride products
    - Liquid Magnesium Chloride & Calcium Chloride
    - Solid Calcium Chloride, flakes and pellets
  - 2 chloride application rates, 1.5% and 2.0%
  - 2 different types of mixing, blade and tilling
  - Chloride mixed with the top 2” of surfacing
- 40 Untreated Sections
  - 18 normally bladed and 22 untreated control sections

Project Site Locations

- Oregon 4 Projects
- Washington 1 Projects
- Idaho 4 Projects
- Montana 3 Projects

Map of Project Area

Project Construction

- Construction on all 12 projects was completed by 7/15/2003
- Construction and materials cost (cost per mile for 22 foot wide road)
  - $8000 to $10000 per mile

Project Construction Sequence

- Road Preparation
- Chloride Application
- Mixing
- Quality Assurance
- Compaction
- Chloride Surface Application

Road Preparation - Watering

Road Preparation - Blading and Shaping

Chloride Application - Dry Product

Chloride Application - Liquid Product

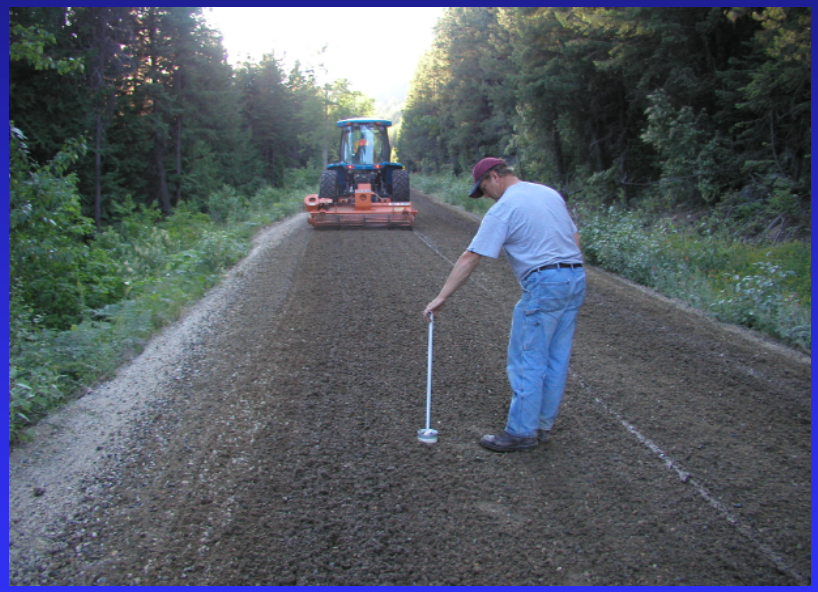
Tiller Mixing Dry Chloride

Blade Mixing Dry Chloride

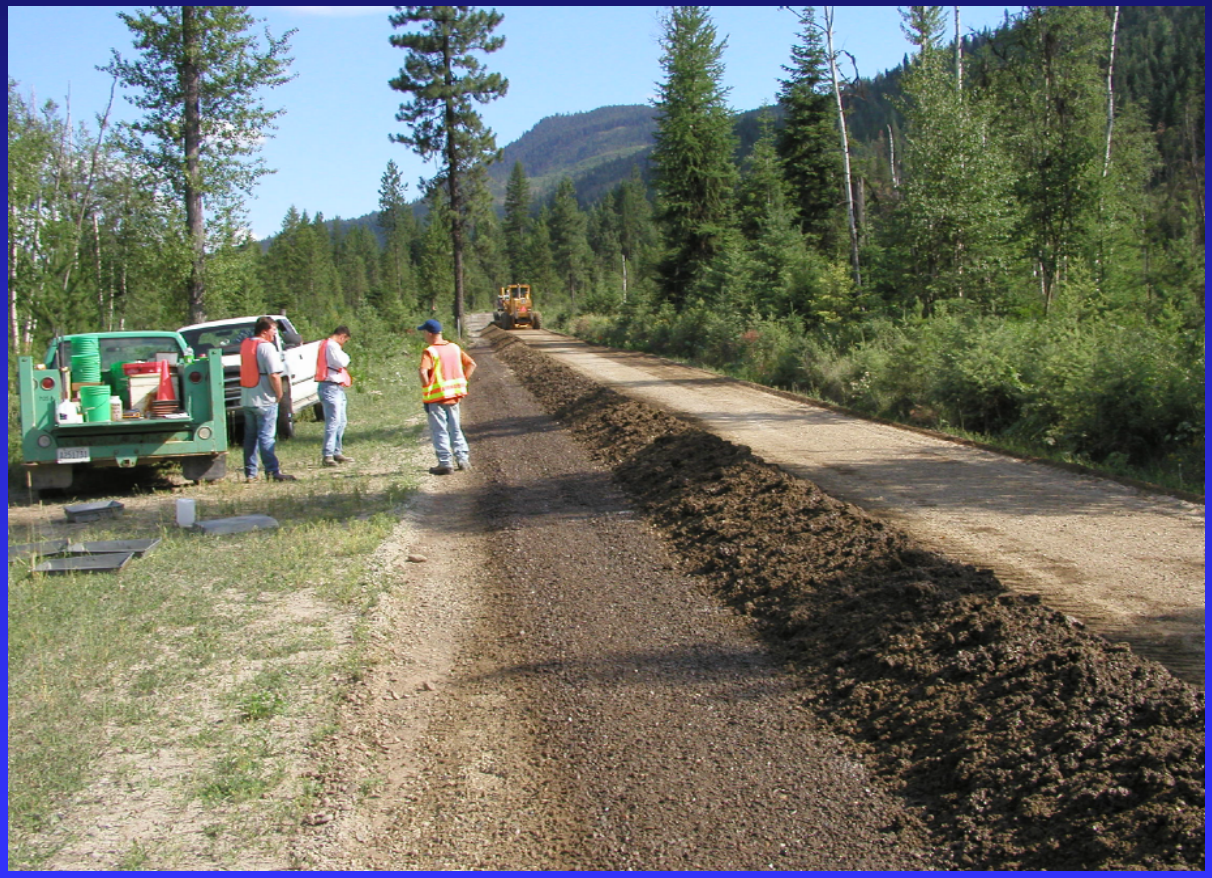
Tiller Mixing - Liquid Chloride

Blade Mixing Liquid Chloride

Quality Assurance - Tiller Mixing Depth Checks



Quality Assurance - Windrow Sizing During Blade Mixing



Quality Assurance - Windrow Measurement & Mixing Consistency

Compaction - Watering

Compaction with Water Truck

Chloride Surface Application

Test Section Photos

Test Section Photos

Monitoring Items

- Performance – Dust, Loose Aggregate, Washboards, Rutting, Potholes and Speed
- Weather – Temperature, Humidity, Rainfall
- Traffic
- Testing of Aggregate & Chlorides
- Vegetation Damage, Stream Water Contamination, Migration in Soil
- Costs – Construction, Maintenance, User Costs, Aggregate Loss

Performance Rating System

- US Army Corps of Engineers “Rating Unsurfaced Roads”
- Measurement intensive process for 100 foot long segment of each test section
- Measured defects are converted to deducts, which are subtracted from 100 to get Condition Index
- Some system modifications made to improve process

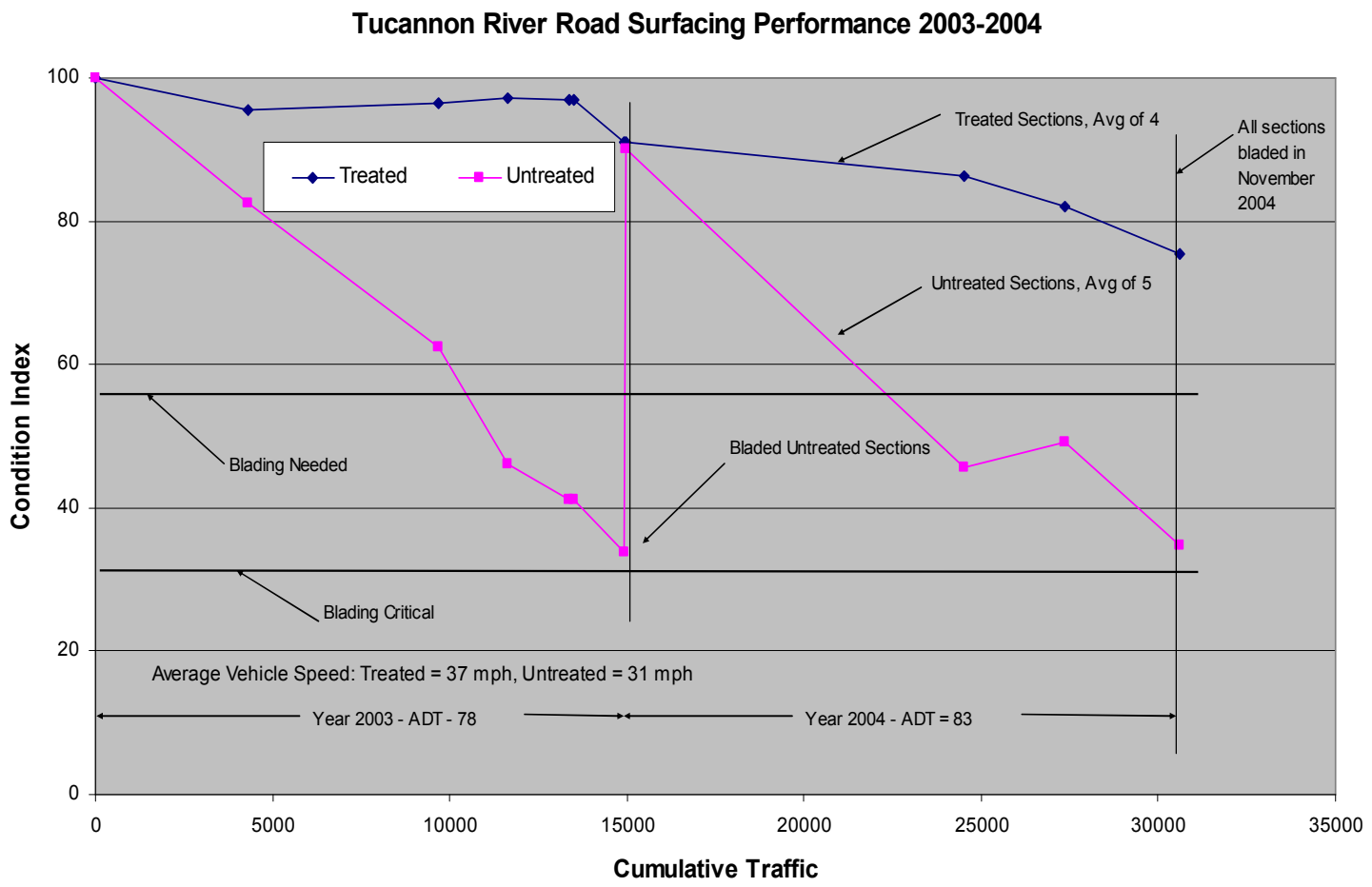
Loose Aggregate & Washboards – Untreated Section

Loose Aggregate – Treated Section

Rutting

Potholes

Performance Curves



General Observations

- All 40 untreated sections needed blading 95% of the time during the first season
- 13 of 39 treated sections needed blading once during the first two seasons
- Dry chloride has advantages over liquid chloride
- Tiller mixing has advantages over blade mixing
- Projects using dry chloride that are tiller mixed had the lowest construction cost

Report - Performance

- Treated segments
  - Needed blading after 22000 vehicles (About 2 to 3 years)
  - Very few defects - potholes, loose aggregate
- Untreated segments
  - Needed blading after 3000 vehicles (About 1 month)
  - Numerous defects most of the time

Report - Environmental Impacts
(Before and After Samples)

- Vegetation - 200 samples on 4 projects, no significant impacts
- Migration in Soil - 96 samples on 12 projects, no significant impacts
- Stream Water Contamination - 8 composite samples on one project, no increase in chloride levels

Final Report - Costs

- Construction Costs: $8,000 to $10,000 per mile
  - Costs are recovered by savings during first 3 years
  - Annual spring blading with water truck and roller extends effective life to 10 years.
- Maintenance Savings: $500/mile/year
- User Costs Savings: $900/mile/year
- Aggregate Loss Savings: $1900/mile/year

Report - Intangible Benefits

- Sedimentation - significantly reduced
- Aggregate Resource - conserved
- Road User Safety - improved
- Dust Health Hazard - significantly reduced
- Public Relations - improved

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