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

**Tucannon River Road Surfacing Performance 2003-2004**

- **Condition Index**
  - Treated Sections, Avg of 4
  - Untreated Sections, Avg of 5
  - Blading Needed
  - Bladed Untreated Sections
  - Blading Critical

- **Cumulative Traffic**
  - Year 2003 - ADT = 78
  - Year 2004 - ADT = 83

- **Average Vehicle Speed**
  - Treated = 37 mph
  - Untreated = 31 mph

- All sections bladed in November 2004
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
Michael R. Mitchell, PE

909-599-1267 ext 246
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mrmitchell@fs.fed.us