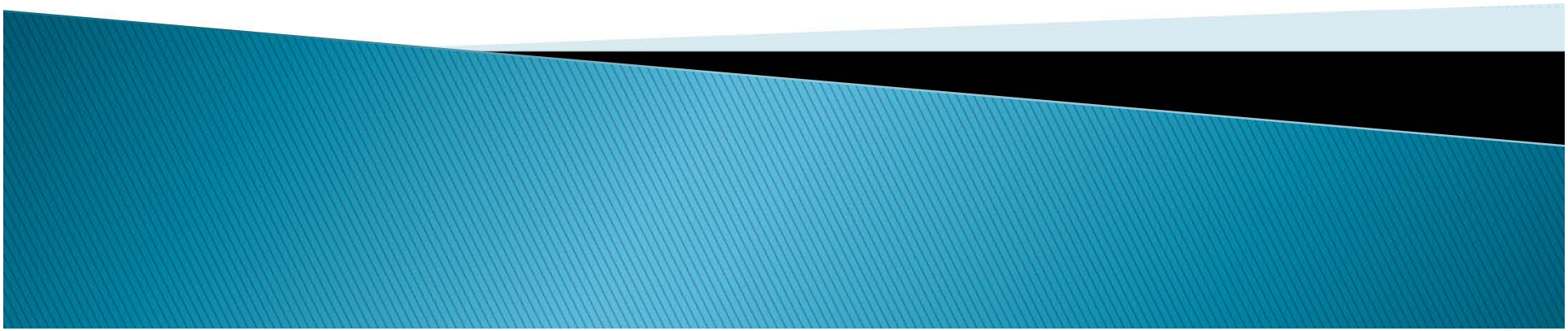
# Alternative to Paving (Upgraded Gravel Surface)

Russ Huotari
Richland County, Montana
( Sidney )



# Oil Development


OCT 12 2004


HALLIBURTON
OCT 12 2004


OCT 26 2007


15

# Testing

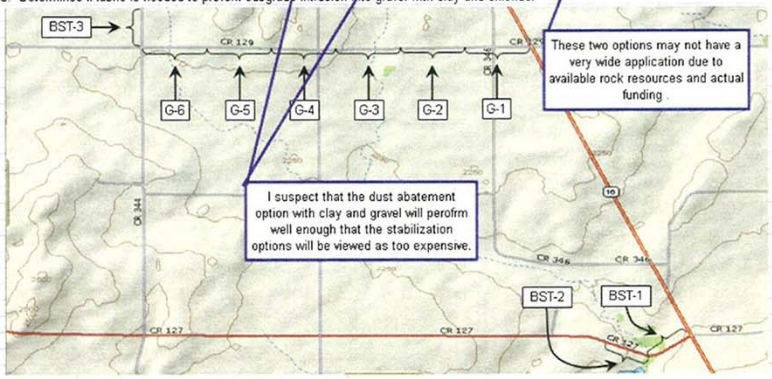
- DCP  translates to CBRs  ( 3 – 35 )
- Traffic Counts  ( infrared unit )
- Local By-Products
  - Fly Ash,  Bottom Ash
  - Sugar Beet Lime
  - Bankrun Clay
- Gravel Gradations
  - % Fracture from rock ( 5/8” )
- Roadbed Gradation

# Draft #4 Test Section Design

**Proposed Richland Co Test Sections ~ August & September 2010 (Draft #4)**

| Road Number | Road 127 | | Road 129 | | | | | | Road 344 |
|---|---|---|---|---|---|---|---|---|---|
| Section Number | BST-1 | BST-2 | G-1 | G-2 | G-3 | G-4 | G-5 | G-6 | BST-3 |
| Section Length, Feet | 1300 | 1300 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 1320 |
| Section Type | BST & Thick Base | | Gravel over Chemical Treatment | | | | Gravel over Fabric | Gravel over Subgrade | BST over Cement Treated SG |
| Driving Surface Type | 2P & Clean | Otta Seal (HFE & Base Rock) | Gravel with Clay & Chloride Stabilization | | Gravel with Clay & Chloride Dust Treatment | | | | Otta Seal (HFE & Base Rock) |
| Base or Gravel, | 10" | | 4" | 4" | 4" | 4" | 6" | 6" | 0" |
| Separation Fabric | Yes | | No | No | No | No | Yes | No | No |
| Subgrade | Standard Subgrade Reconstruction Method | | 8" Cement Treated | 8" Fly Ash Treated | | 8" Cement Treated | Standard Subgrade Reconstruction Method | | 8" Cement Treated |
| $1,000/mile | 173 | 164 | 126 | 92 | 81 | 117 | 159 | 140 | 99 |
| Relative Traffic, 1000 ESAL | 50 | 50 | 100 | 70 | 70 | 100 | 40 | 20 | 100 |
| Cost/ESAL | $3.45 | $3.27 | $1.27 | $1.31 | $1.16 | $1.16 | $4.00 | $7.00 | $0.99 |

BST-1 & 2: Compares Otta seal with standard BST design for 2009 and 2010
BST-3: Determined if Otta seal has difficulty adhering to Cement treated clay-gravel road surface
G-1 & G-4 versus G-2 and G-3: Determines if there is any significant difference between Cement and fly ash treated subgrade
G-1 & G-2 versus G-3 and G-4: Compares higher cost chloride stabilization with lower cost chloride dust abatement
G-5 & G-6: Determines if fabric is needed to prevent subgrade intrusion into gravel with clay and chloride.




**Bituminous Surface Treatment Sections to Consider Instead of G-5 and G-6**

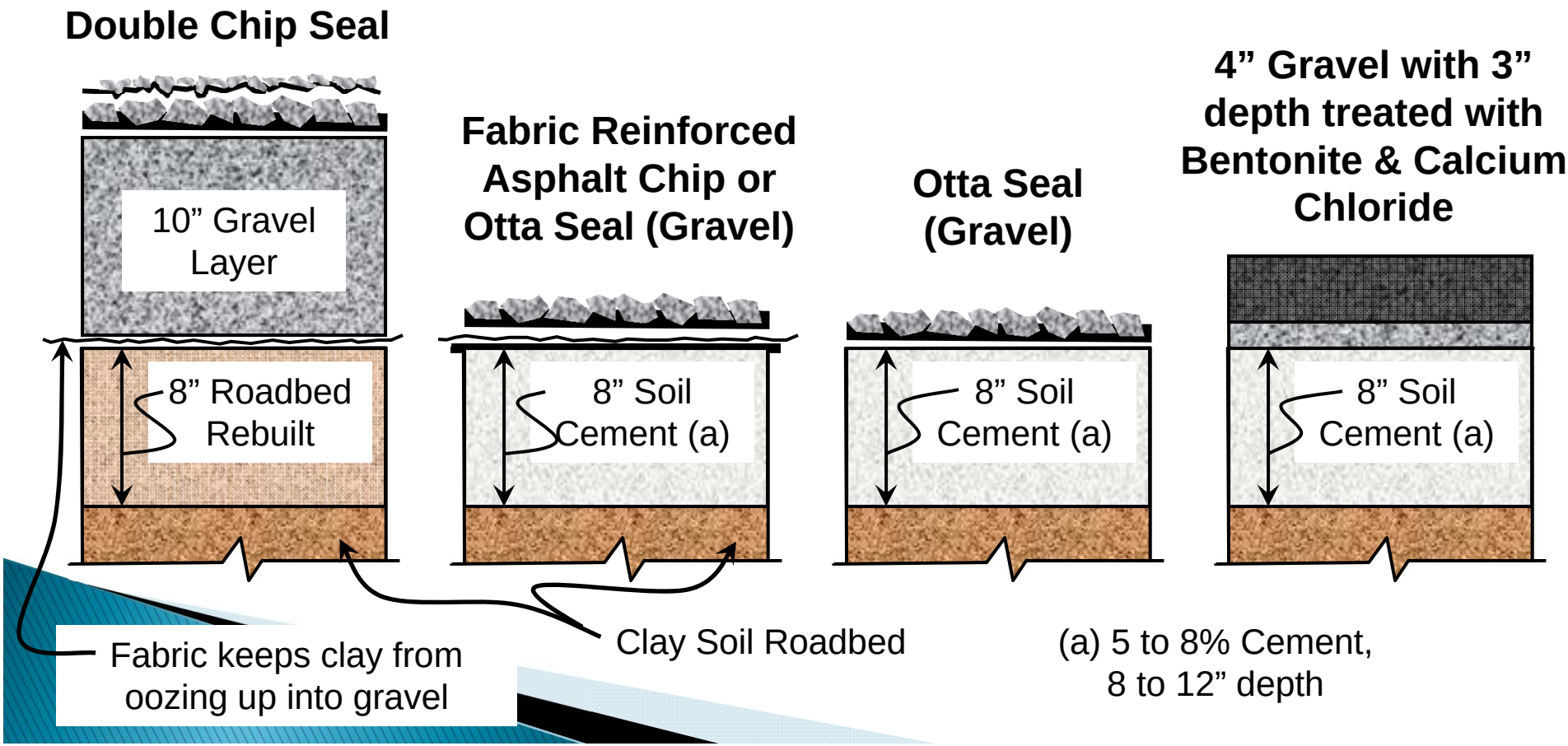
| Alt. Option Set | Option A | | Option B | | Option C | |
|---|---|---|---|---|---|---|
| Section Number | BST -4 | BST-5 | BST -4 | BST-5 | BST -4 | BST-5 |
| Section Length, Feet | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| Section Type | AC BST | | AC BST with Geotextile Reinforcement | | BST over Stabilized Subgrade | |
| Driving Surface Type | AC & Two Sizes of Clean Chips | | AC & Two Sizes of Clean Chips | | Otta Seal (HFE & Base Rock) | |
| Base or Gravel, Inches | 0" | | 0" | | 0" | |
| Separation Fabric | No | | No | | No | |
| Subgrade | 8" Fly Ash Treated | 8" Cement Treated | 8" Fly Ash Treated | 8" Cement Treated | 8" Fly Ash Treated | 8" Cement Treated |
| $1,000/mile | 58 | 94 | 86 | 122 | 64 | 99 |
| Relative Traffic, 1000 ESAL | 70 | 100 | 70 | 100 | 70 | 100 |
| Cost/ESAL | $0.83 | $0.94 | $1.23 | $1.22 | $0.91 | $0.99 |

**Questions**
Do we have clean enough chips for AC treatment
Will strabilized surface be shaped well enough for BST construction directly on surface?
Will BST stick well enough to stabilized surface?

**Concerns**
We may have to change thicknesses after lab tests are available for strengths of stabilized subgrade
Relative traffic is Steve's best guess - this & economics may change significantly after tests completed
Will construction contract be flexible enough to accommodate changes in several weeks.

# 2010 Thin Asphalt Road Designs

## Which Option is More Cost Effective?

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# BST Road Options

Enter data in gray cells - other cells are protected

| Designed by: Steve Monlux | 07/13/10 |
|---|---|
| Programmed by: Shane Forsythe | |

| Project and Cost Data ~ See Background Information in Other Worksheets | |
|---|---|
| Width of Road Surface (feet): | 24 |
| Rock Haul distance (miles): | 25 |
| Rock Haul Cost $/Ton mile: | $0.15 |
| Gravel (no additives) $/Ton | $5.00 |
| PASS & CRS-2P with Clean Chips | $42,424 |
| Otta Seal (HFE & Gravel) | $33,306 |
| Geogrid, $/SY | $3.50 |
| Separation Fabric, $/SY | $1.20 |

| Other BST Options | Cost, $ |
|---|---|
| AC BST with Clean Chips | $27,872 |
| Geotextile Reinforcement | $28,000 |
| 1.5% $CaCl_2$ Stabilization, $/in/mile | #REF! |
| 3% Bentonite Stabilization, $/in/mile | #REF! |
| 3% Bent & 1.5% $CaCl_2$ Stab $/in/mile | #REF! |
| Bentonite, $/Ton Delivered | $90 |
| Blading Maintenance, $/mile | $300 |

| Subgrade Reconstruction | Cost, $ |
|---|---|
| Subgrade Reconst. (95% Std Density), $/in/mile | $1,621 |
| Subgrade Reconst. (95% Mod Density), $/in/mile | $2,000 |
| **Subgrade Treatments (8", 12" & 16" depths)** | Cost, $ |
| Fly Ash Stabilization $/in/mile | $3,775 |
| Lime-Fly Ash Stabilization $/in/mile | $6,864 |
| Portland Cement Stab. $/in/mile | $8,237 |
| Enzyme Stabilization, $/in/mile | $0 |
| $CaCl_2$ @ 1% (Compaction Aid), $/in/mile | #REF! |

☑ Check box if option is desired

Cost data is from links to other worksheets

| Proposed Test Section Number | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Options | | | $/mi | | $/mi | | $/mi | | $/mi | | $/mi | | $/mi | | $/mi |
| Existing Subgrade Reconstruction Depth | 95% Std, inches | 8 | $12,965 | 0 | $0 | 0 | | 0 | | 0 | | 0 | | 0 | |
| | 95% Mod, inches | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Gravel without Additives | Thickness, inches | 10 | $38,770 | 3 | $9,692 | 0 | | 0 | | 0 | | 0 | | 0 | |
| | Haul Cost | ☑ | $58,154 | ☑ | $13,510 | ☑ | $0 | ☑ | $0 | ☐ | | ☑ | $0 | ☑ | $0 |
| BST Options | PASS & CRS-2P with Clean Chips | ☑ | $42,424 | ☑ | $42,424 | ☑ | $42,424 | ☐ | | ☐ | | ☐ | | ☐ | |
| | Otta Seal (HFE & Gravel) | ☐ | | ☐ | | ☐ | | ☑ | $33,306 | ☑ | $33,306 | ☐ | | ☐ | |
| Geo-Synthetics | Geogrid | ☐ | | ☐ | | ☐ | | ☐ | | ☐ | | ☐ | | ☐ | |
| | Separation Fabric | ☑ | $20,416 | ☐ | | ☐ | | ☐ | | ☐ | | ☐ | | ☐ | |
| Other BST Options | AC w Clean Chip | ☐ | | ☐ | | ☐ | | ☐ | | ☐ | | ☑ | $27,872 | ☑ | $27,872 |
| | Fabric Underseal | ☐ | | ☐ | | ☐ | | ☐ | | ☐ | | ☐ | | ☑ | $28,000 |
| Subgrade Treatments | $CaCl_2$ Stabilization, inches | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| | Bentonite Stabilization, inches | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| | Bentonite & $CaCl_2$ Stabilization, inches | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| | Fly Ash Stabilization, inches | 0 | | 8 | $30,202 | 8 | $30,202 | 8 | $30,202 | 0 | | 0 | | 0 | |
| | Lime-Fly Ash Stabilization, inches | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| | Portland Cement Stabilization, inches | 0 | | 0 | | 0 | | 0 | | 8 | $65,894 | 8 | $65,894 | 8 | $65,894 |
| | Enzyme Stabilization, inches | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| | $CaCl_2$ Compaction Aid, inches | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| **Total Initial Cost for the Alternative** | | | $172,729 | | $95,828 | | $72,626 | | $63,508 | | $99,200 | | $93,767 | | $121,767 |
| Relative Design Traffic, ESALs | | | 50,000 | | 80,000 | | 70,000 | | 70,000 | | 100,000 | | 100,000 | | 100,000 |
| $/ESAL | | | $3.45 | | $1.20 | | $1.04 | | $0.91 | | $0.99 | | $0.94 | | $1.22 |

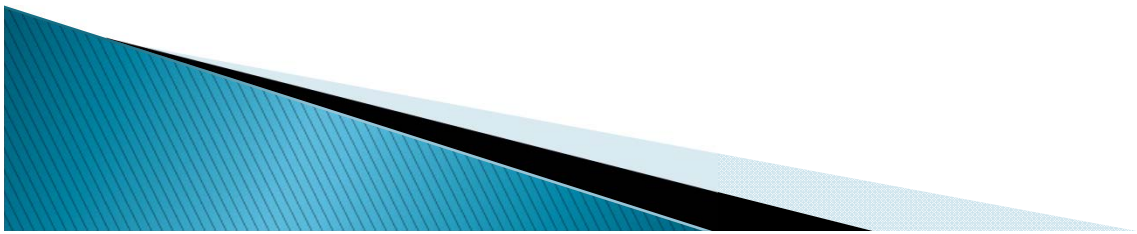
| Annual Mtc & Rock Replacement | | Cost/mile per yr, $ | | Cost/mile per yr, $ | | Cost/mile per yr, $ | | Cost/mile per yr, $ | | Cost/mile per yr, $ | | Cost/mile per yr, $ | | Cost/mile per yr, $ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Bladings per year | 8 | $2,400 | 4 | $1,200 | 4 | $1,200 | 4 | $1,200 | 2 | $600 | 2 | $600 | 2 | $600 |
| Chloride Dust Treatments per year | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.8 | $257,443 | 0.7 | $225,263 | 0.8 | $257,443 |
| Rock Replacement ~ estimated life, yrs | 2 | $64,616 | 3 | $7,734 | 3 | #VALUE! | 5 | #VALUE! | 10 | #VALUE! | 10 | #VALUE! | 10 | #VALUE! |
| **Total Annual Cost for Alternative** | | $67,016 | | $8,934 | | #VALUE! | | #VALUE! | | #VALUE! | | #VALUE! | | #VALUE! |

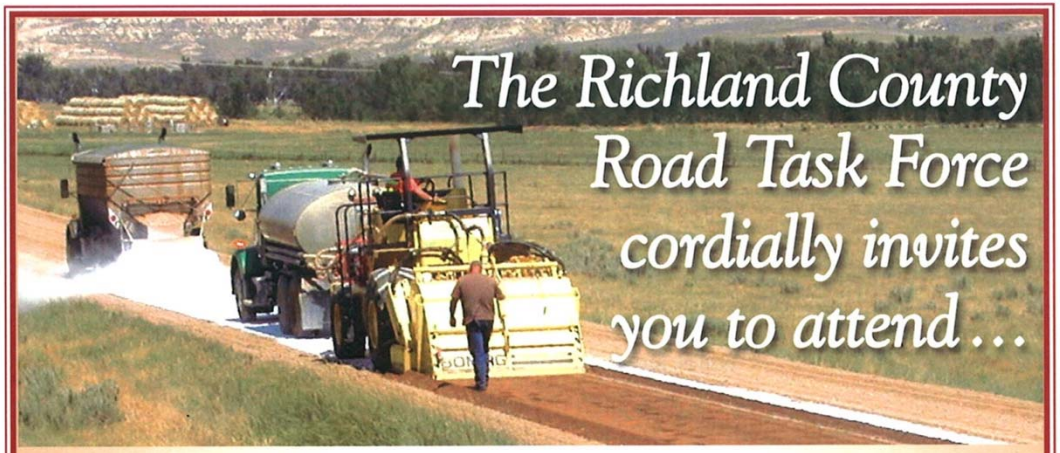
# Preliminary Costs / Mile

- 5 inch – asphalt $800k
- 10 " gravel/Fabric/Blotter $350k

- 8" Soil cement 90-120k
- Blotter or Otta Seals 55- 75k
- 4" CaCl + Bentonite 85- 95k

- Soil Cement / Blotter $145k
- Soil Cement / CaCl+Bent $177k





# The Richland County Road Task Force cordially invites you to attend...

Tuesday evening, June 29th, 6:00pm in Sidney, Montana

A Complimentary Supper and Symposium on

## "Low Volume Gravel Road Maintenance"

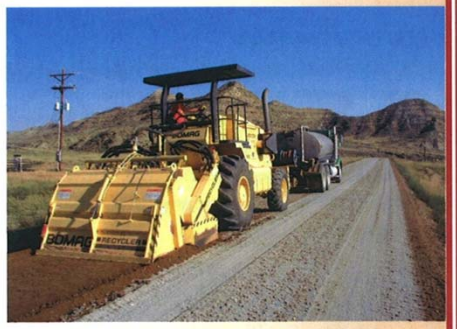
Noted gravel road authorities Ken Skorseth, South Dakota LTAP and Steve Monlux, P.E., as well as other industry representatives will be available for an evening of sharing ideas on gravel road maintenance.

Wednesday, June 30, 2010 in Sidney, Montana ~ An All Day Event

## "Surface Gravel Stabilization Demonstration Project"

We will be experimenting with a variety of bentonite and chloride combinations to determine their impact on clean surfacing gravel.

### AGENDA




TUESDAY, JUNE 29TH • 6:00 PM

*"Low Volume Gravel Road Maintenance"*

*Supper and Symposium*

This event will be held at the Sidney Country Club, (406) 433-1894, Hwy 16 N., located next door to the Dept. of Public Works shop.

WEDNESDAY, JUNE 30TH • 8:00 AM

Transportation provided to the

*"Surface Gravel Stabilization Demonstration Project"*

where we will witness the operation in action.

Meet at the the Road Department Public Works Facility, (406) 433-2106, located at 2140 W. Holly St., Sidney. From the junction of Hwy 200 and 16 ( Holly St.), head west just past the fairgrounds. The Facility will be on your left. *(See map on back.)*