



Dust Control on Forest Roads

Webinar

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Project Background

Objective:

- Study the cost effectiveness of annual dust control treatments on the life of wearing course materials

Project Background

- Collaboration between FPInnovations, Adams Lake Division of Interfor Corporation, and the Engineering Branch of Ministry of Forests, Lands, and Natural Resource Operations (FLNRO)
- Literature review of gravel loss studies
- Five years of monitoring road performance and aggregate deterioration on test sections built on the Adams West Forest Service Road (FSR)

Content

- Why use dust control?
- Dust control versus stabilization
- Available products
- How hygroscopic products work
- Adams Lake site
- Treatment application
- Safety benefits
- Safety concerns
- Travel speeds
- Road performance (URCI)
- Gravel loss
- Aggregate gradation
- Maintenance
- Lifecycle costing
- Influence of gravel quality
- Application methodology
- Watering and grading practices
- Application recommendations
- Conclusions

Why Use Dust Control?

- Improve health and safety
 - Improve visibility and air quality
- Increase road surface density and cohesion
- Reduce aggregate loss
 - Raveling, wear, loss of fines, etc.
- Reduce grading requirements
- Improve transportation efficiency

Dust Control versus Stabilization

	Dust palliatives	Stabilizers
Reduces dust effectively	Yes!	Not all products will
Strength	No mechanical bonds between particles, little to no improvement in strength	Mechanical bonds between particles increases strength
Life span	Short (usually one season)	Medium to long, especially full depth reclamation
Cost	Lowest	Highest
Application	Usually easy to apply, often by topical spray	Some products can be applied as topical spray but most require mixing for better results
Quality control	Controlled application rate, moisture, road preparation and compaction is recommended	Most stabilizers require more attention (controlled moisture content, compaction in layers, mixing, etc.)
Rejuvenation	Reapplication or rejuvenation (water) may be required during late summer depending on traffic and climate	Reapplication or rejuvenation is sometimes required/recommended during summer depending a product
Road maintenance	Most products can be graded without losing effectiveness	Most will lose effectiveness (on the surface) following grading (bonds are broken)

Available Products

More than 400 products available commercially

Dust palliatives – dust suppression

- Hygroscopic salts
- Water and wetting agents
- Natural polymers
- Synthetic polymer emulsions
- Modified waxes
- Petroleum resins

Stabilizers – strength improvement

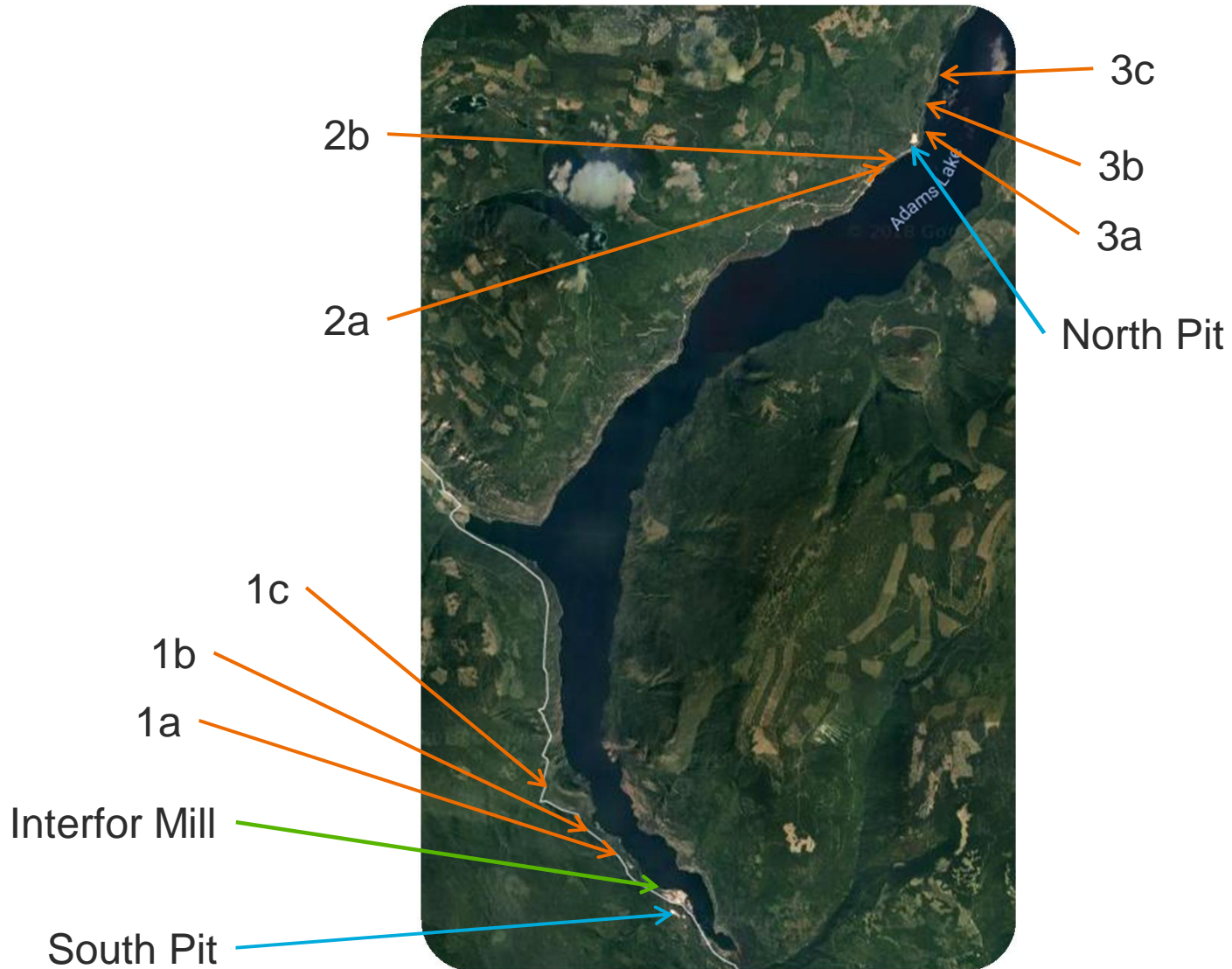
- Tars and bitumens
- Synthetic polymer emulsions
- Sulphonated oils
- Lime and cement
- Enzymes and biological agents

How Hygroscopic Materials Work

- Hygroscopic products attract moisture from the air to create a thin film of moisture and help keep the road surface dense and smooth



Study Site: Adams Lake



Treatment Application

- Application rate of 1 L/m² during late spring or early summer
- Year 1: material treated in two layers
 - Each lift 75 mm crushed aggregate
- Years 2 - 4: surface treated with topical spray/mix
- Section treatment regime
 - Annually
 - Biennially (every two years)
 - No treatment (control section)



Safety Benefits

- Conducted survey of 33 road users
- 88% believed safety has improved since dust control treatment
 - Tighter, smoother road surface+
- Visibility restored in 2-4 seconds on treated road sections
 - Up to 90 seconds on untreated

Low to moderate dust cloud on Test Section 2B in July 2013.



Safety Concerns

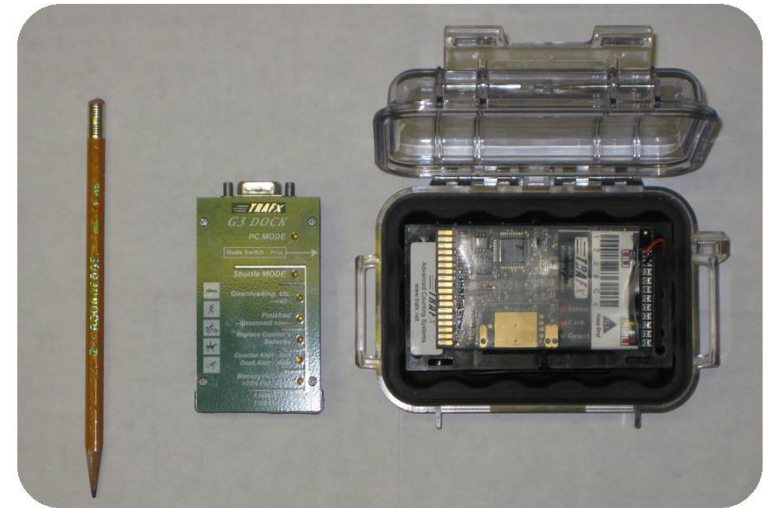
- Increased public traffic volume and speeds
 - Public do not possess two-way radios
- Treated road surface can become slippery when wet in sections with high fines content
 - No reported safety incidents yet
 - Must %drive to road conditions+



Light corrugations were recorded on most test sections (e.g. Section 3A in September 2014).

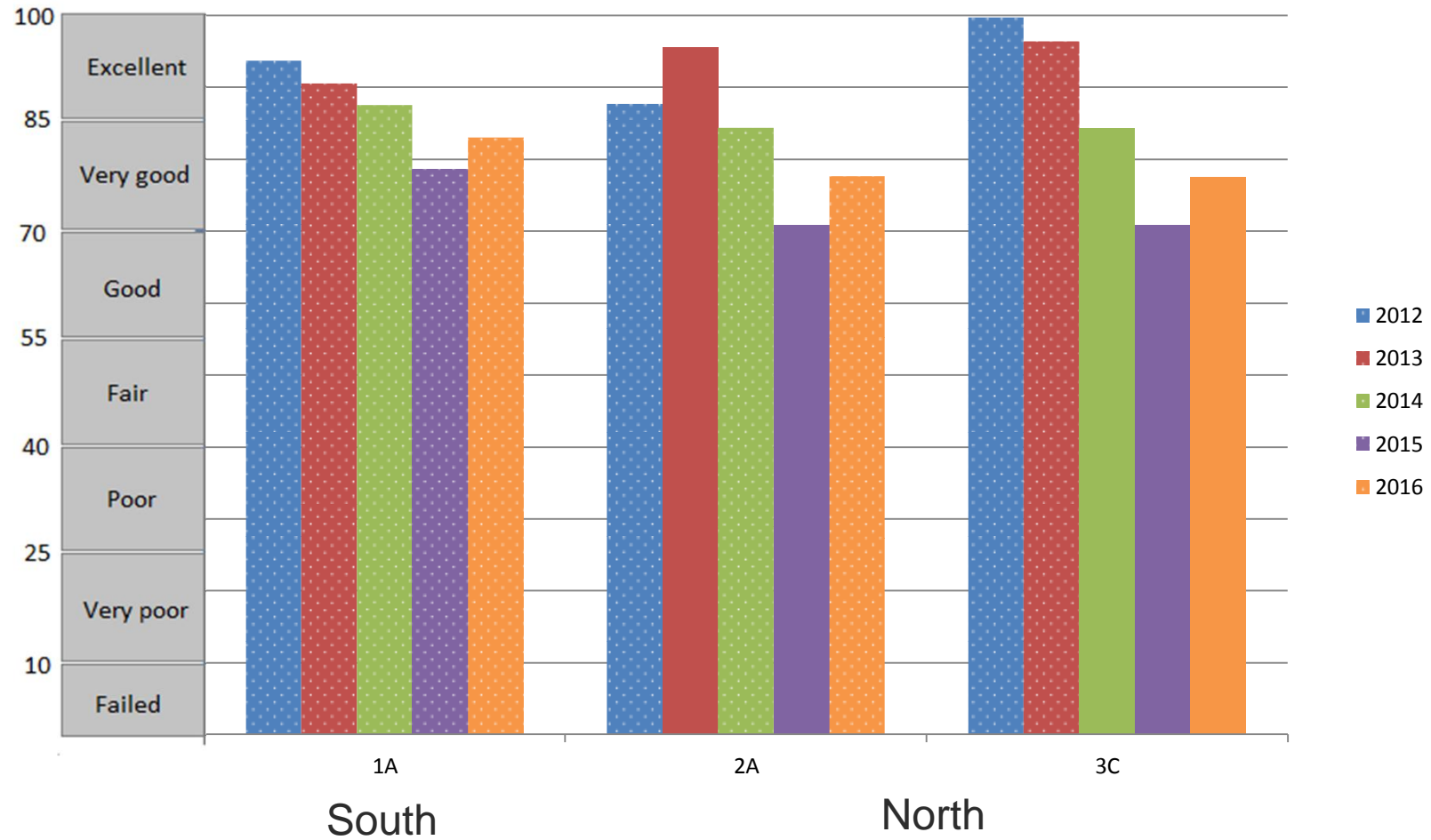
Travel Speeds

- Increased visibility and road surface condition promote faster travel
- Adams West - Treated
 - South: 5 km/h faster
 - North: 3.5 km/h faster
- Adams East - Treated
 - Speed increase of up to 10 km/h



TRAFx traffic counter device.

Unsurfaced Road Condition Index (URCI)

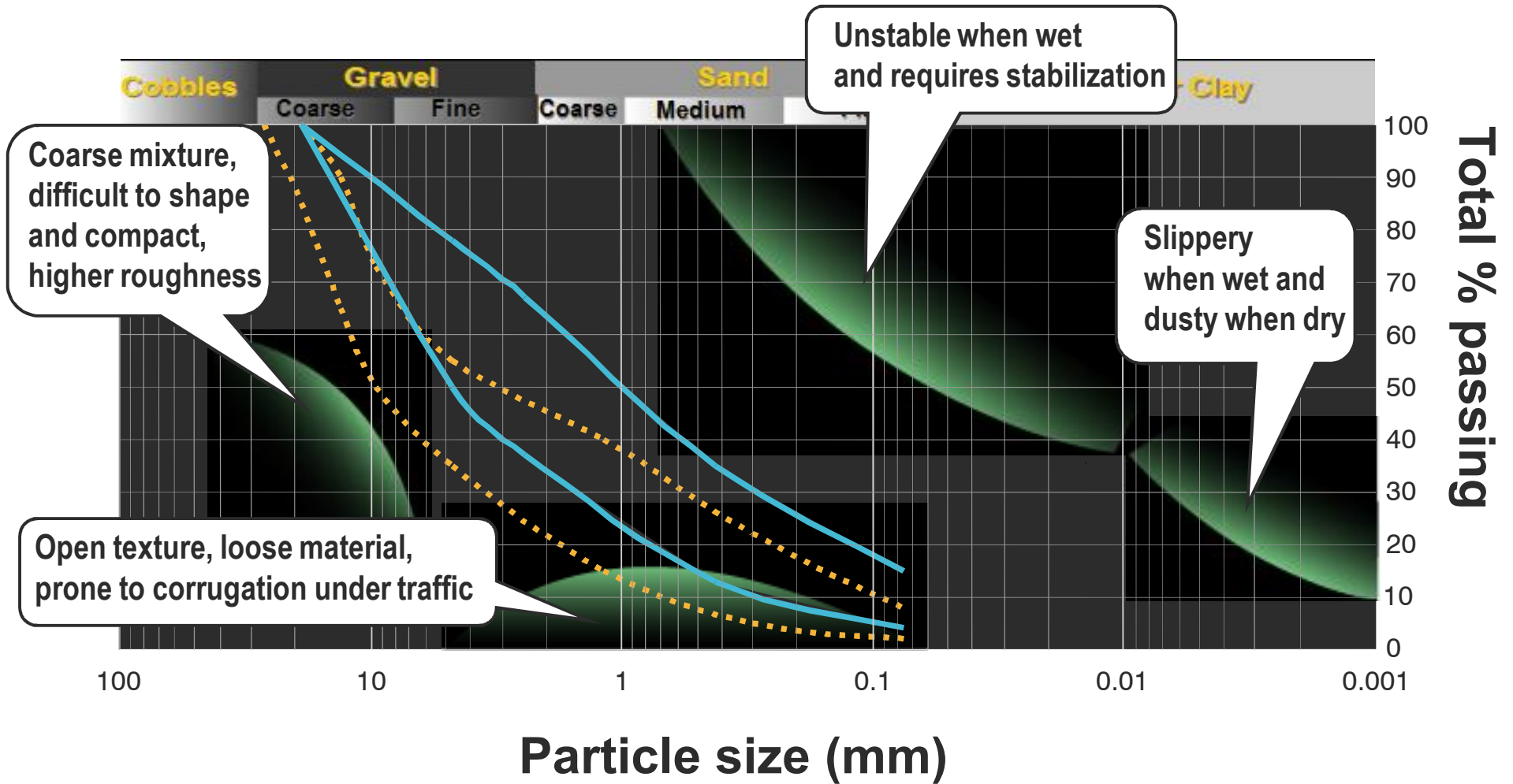


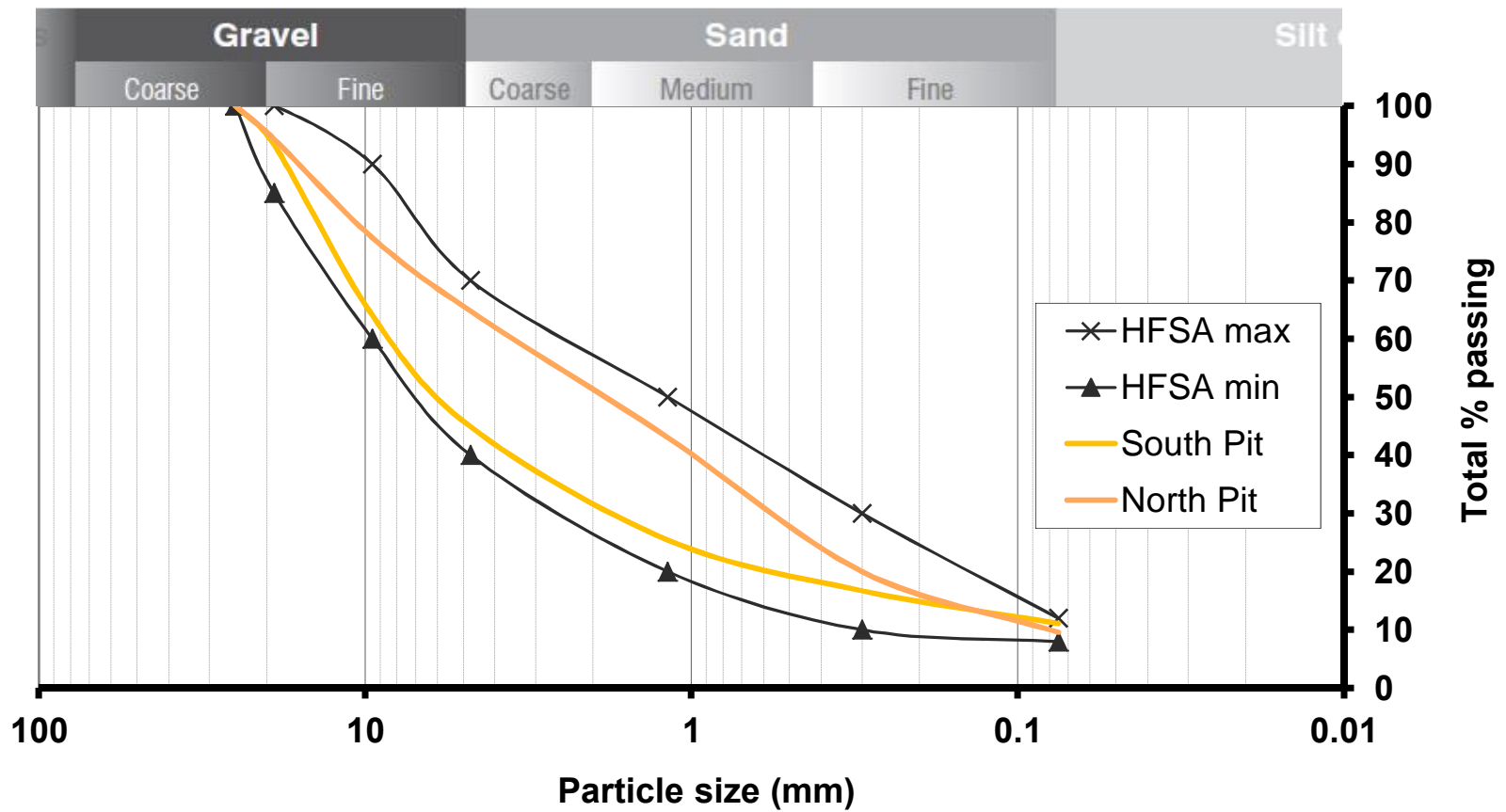
Gravel Loss (Surface Elevation)

- No notable difference in elevation change between treated and untreated road surfaces
- Gravel wear was not found to be reduced with road stabilization
 - Dust control may not prolong aggregate life



Recommended Wearing Course Gradation



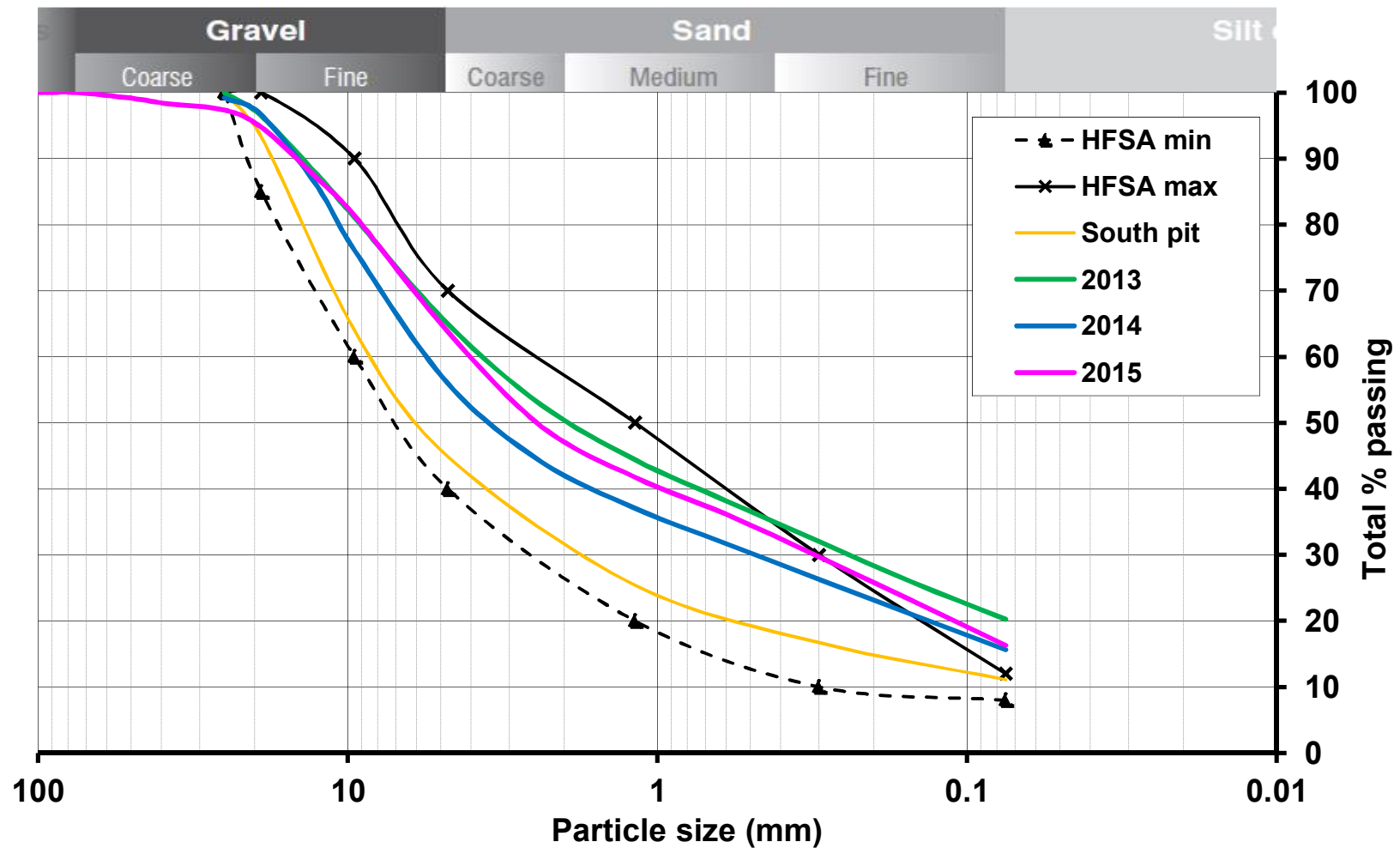


South versus North Pit Gradation

Initial gradation	
% fines	
% fine sand (passing 0.425 mm)	
Plasticity index	
Micro-Deval abrasion resistance (%)	

Area	
South	North
Excellent	Good
11.1	9.6
20	27
9	30
9	15

Evolution of Gradation Over Time – South Pit



Maintenance

- Grading triggered by presence of surface distress
- Direct correlation to traffic volume
- Did not see change in surface condition or grading frequency
- Grading shifted seasons after dust treatment
 - Less in summer, more in winter
 - Believed to have slowed freeze up, promoted thawing
 - Same number of grading interventions annually

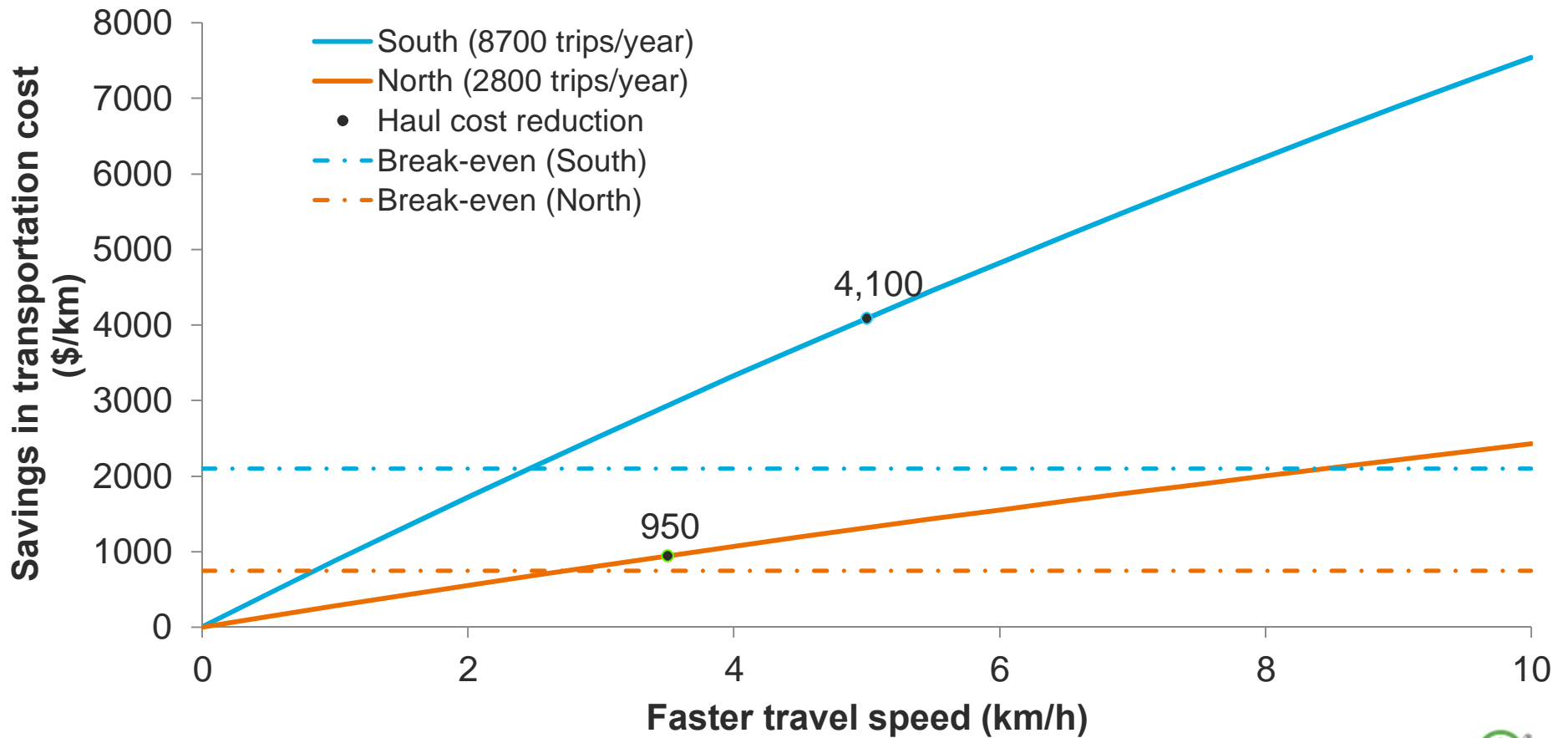
Lifecycle Costing



- Expected to see savings through reduced maintenance and longer gravel life
- Costs:
 - Dust control, maintenance, haul savings to reach neutral cost
- Can be cost-neutral on lower volume roads
- Can result in savings on higher traffic roads

Lifecycle Costing

- Annual savings in haul costs on Adams West:
South \$4100/km North: \$950/km

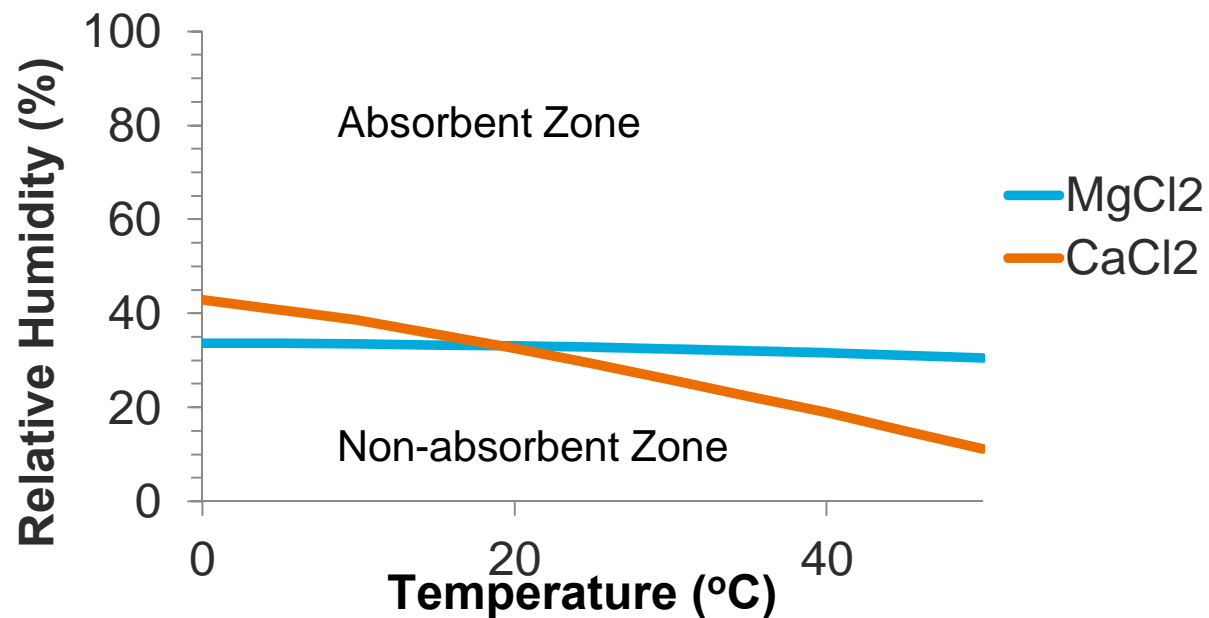


Lifecycle Costing

	Scenarios			
	A	B	C	D
Road upgrade cost (\$/km) (lasts 10 years)	-	\$25,000	\$25,000	\$25,000
Dust control cost (\$/km/year)	-	-	\$2,100	\$2,100
Aggregate quality	Good	Good	Good	Excellent
Average summer log hauling truck travel speed (km/h)	45	50	55	55
Annual road maintenance cost (\$/km/year)	\$8,000	\$6,000	\$6,000	\$5,000
10-year NPV transportation cost (includes log hauling and road maintenance costs) (\$/km)	\$783,537	\$729,024	\$674,303	\$651,526
10-year NPV transportation cost difference (taking Scenario A as a baseline) (\$/km)	-	-\$69,434	-\$106,485	-\$115,596

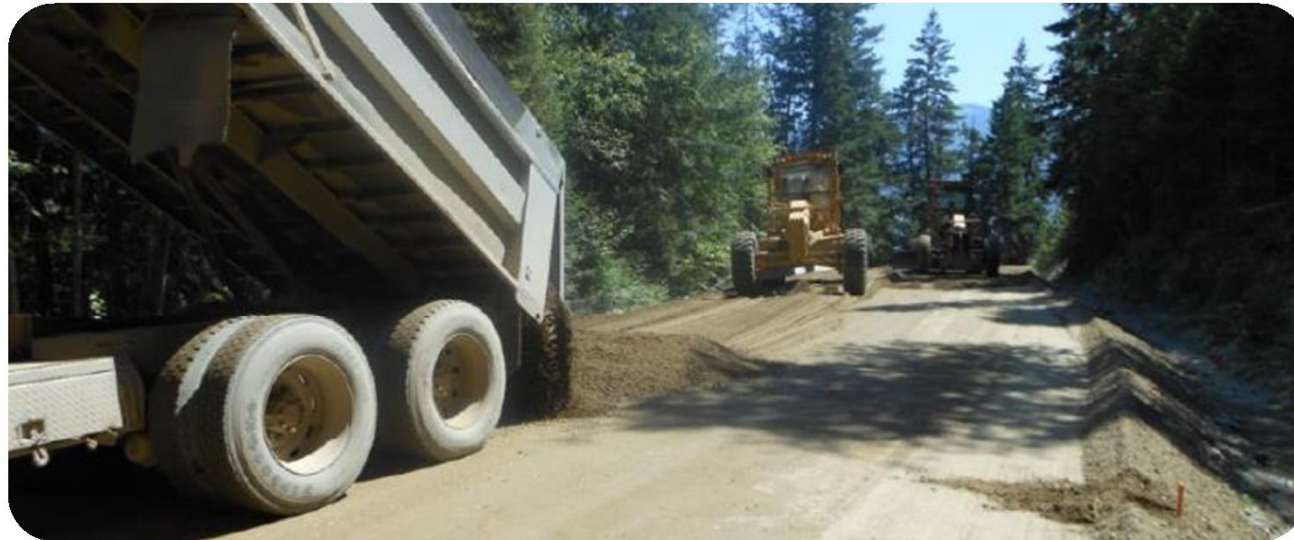
Application Methodology

- Application rate of 1 L/m²
- CaCl₂ and MgCl₂ can leach from road surface in heavy rain
Heavy watering not recommended
- Treatments also perform poorly in prolonged dry spells
Watering may be necessary



Watering and Grading Practices

- If road becomes dusty during dry period, rejuvenate treatment with water @ 0.45 to 0.9 L/m²
- Treated surface can be graded without losing effectiveness
- Multiple applications of water needed to make surface workable (@ 0.45 to 0.9 L/m²)



Application Recommendations

- Avoid application over poorly-graded material (insufficient fines content)
- Perform an effective grading (reshaping) prior to application
- Ensure thorough mixing (with grader)
- Adequate drainage (proper crown) a key factor of long-term results

Application Recommendations

- Follow the supplier's recommended application rate and double check with published specs
- Compaction recommended when possible
- After application, AVOID grading during dry periods
- Some products may require a cure period

Conclusions

- Road user safety
 - 88% of participants say road is safer
- URCl: no significant difference in condition measured
- No elevation difference measured between treated and untreated
- Reduction in gravel wear was not confirmed
- Travel speeds increased on treated roads

Conclusions

- Cost effectiveness

Estimated yearly savings due to speed increases:

- South: \$4100/km (high traffic)
- North: \$950/km (low traffic)

Savings of approx. \$115,000/km per 10 years using dust control, high quality aggregate, and road upgrading

- Higher quality aggregate may be more effective at improving road performance and prolonging road longevity than applying dust control
- Hypothesis that dust control can prolong road life by twofold could not be confirmed in the 5-year study



Thank you / Questions?

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