NIVITEX FIBREGLASS & RESINS

Tests

DS-11-LB

(Dust Suppressant 11 Lignin Base)

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Tests

1. INTRODUCTION

Skid resistance is a standard measure of road safety. Slippery road surfaces are a major cause of accidents on any type of road. Skid resistance is determined by the interaction of the road surface, the vehicle and environmental factors. The tests compared the skid distance of different vehicles at different speeds on a typical mine gravel haul road. The road surface was not a variable in this test; different sections of the same road were treated with water, Calcium Liquid Sulphate (CLS) in a standard application, and CLS in an overdose application. The results were compared to the test control section, an untreated standard gravel surface.

The skid resistance test indicates which treatment has the greater effect on skid resistance.

2. SKID RESISTANCE

Skidding occurs when the wheels of a vehicle lock due to sudden braking. The wheels jerk, caused when the frictional resistance offered is too low. To come to a safe halt within a certain distance, the friction that can be mobilized must be greater than the decelerating force. If the friction is lower, the vehicle will skid out of control.

Skid resistance is considered to be a road surface property, as it is the force that prevents a tyre from rotating along the road surface. The opposite property in terms of road surface is slipperiness.

- **Factors affecting Skid Resistance**
  Different road surfaces have different levels of skid resistance. Asphalt surfaces have better skid resistance than gravel. The macro texture of asphalt provides superior drainage, and affects the deformation of the tyres to improve friction.
- **Water and Tyres**
  Water lowers the skid resistance of any surface.

  The contact surface is generally divided into 3 zones:

  Zone 1: bulk displacement of water
  Zone 2: water carries a portion of the load
  Zone 3: where the tyre is in contact with the surface

  The pattern of the tyres and their thread depth also influences skid resistance. Tyre wear lowers the displacement of water, which in turn affects skid resistance. Tyres with deeper grooves displace water more effectively.

  There are two components that affect the development of friction between the tyre and the road surface:

  Adhesion – this is caused by the shear force created by the tyre – road interface
  Hysteresis – caused by the deformation of the tyre when it is in contact with the surface
- **Remedies**
  The composition of the road surface, displacement and drainage of water and the application of binding agents can improve the skid resistance of a road surface. While binding agents are applied to improve road stability, a compromise between skid resistance and dust generation will at some point need to be reached.

3. Test Procedure

Although restricted due to limited availability of vehicles and road use due to ongoing site activity, the tests achieved adequate results using the Skid Resistance Test Protocol.

a. The tests were conducted in a section of gravel road on the main access road. This section was similar along the selected stretch of road in terms of structure, preparation and slope.

b. The vehicles tested represent vehicles used regularly at mines: a Komatso 370E, CAT 773 and a Toyota LDV.

c. Surface preparation

i. Section 1 – Normal gravel road (control)
No additional preparation was done on the test control section

ii. Section 2 – Water only
Water was applied to the surface 15 minutes prior to the tests being conducted, sprayed with a water browser

iii. Section 3 – Standard CLS (0.25% dosage)
The CLS was applied 24 hours before the test, as in a standard application, and again 15 minutes before the test.

iv. Section 4 – Overdose CLS (100% solution)
The solution was sprayed onto this section 15 minutes before the test was conducted.

d. Traffic cones were used to indicate to the driver of each vehicle at which point in the section they should apply brakes.

e. The length of the skid mark of each vehicle, at different speeds, was measured in each section of road.

f. Safety

Prior to testing, a full risk assessment was conducted. All necessary precautions were taken, and an ER24 emergency services unit was present for the duration. Traffic was limited while the tests were being conducted. All standard mine safety regulations were adhered to.

g. Third party confirmation

An independent third party was present during the tests. This third party was familiar with the test protocol and confirmed the recorded results.

h. Equipment

The skid distances were recorded using a standard distance measuring wheel.

4. Test Results

The results, upon the successful completion of the test, yielded data that produced a clear and definite trend, allowing an accurate conclusion to be drawn.

More thorough testing is unlikely to affect the results, except in terms of the percentage difference in the different test sections.

5. Test Data

Date: 20 March 2012

Time: 11h45am

Place: Main haul road to mining pit

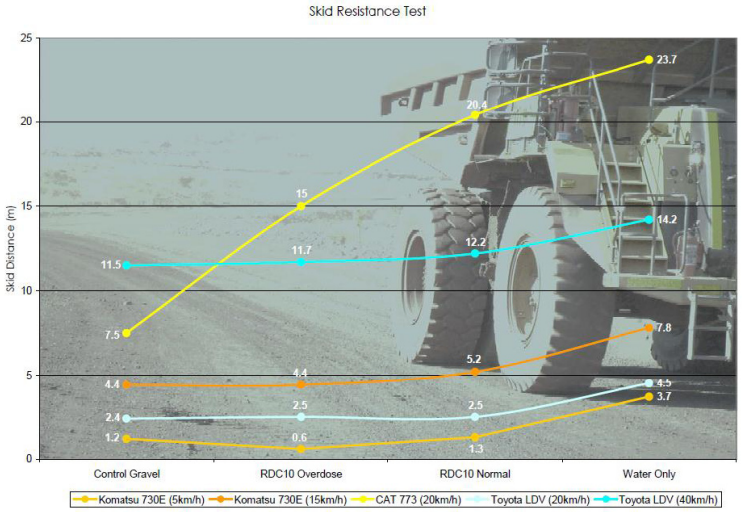
Weather: Sunny & Dry

Road condition: Good, Recently graded gravel, slight down slope (<10%), smooth surface with negligible loose debris

Soil calcification: silt gravel/sand mixture

4.1 TEST DATA

Skid Distance (meters)				
Test Vehicle & Speed	**Control Gravel**	**Overdose**	**Normal**	**Water Only**
Komatsu 730E (5km/h)	1.2	0.6	1.3	3.7
Komatsu 730E (15km/h)	4.4	4.4	5.2	7.8
Cat 773 (20km/h)	7.5	15	20.4	23.7
Toyota LDV (20km/h)	2.4	2.5	2.5	4.5
Toyota LDV (40km/h)	11.5	11.7	12.2	14.2
Skid Distance Increase % on Control (Gravel)				
Komatsu 730E (5km/h)	100%	-50.00%	+8.33%	+208.33%
Komatsu 730E (15km/h)	100%	0.00%	+18.18%	+77.27%
Cat 773 (20km/h)	100%	+100.00%	+172.00%	+216.00%
Toyota LDV (20km/h)	100%	+4.17%	+4.17%	+87.50%
Toyota LDV (40km/h)	100%	+1.74%	+6.09%	+23.48%
Skid Resistance against Water (% Improvement)				
Komatsu 730E (5km/h)	1.2m	+258.33%	+200.00%	3.7m
Komatsu 730E (15km/h)	4.4m	+77.27%	+59.09%	7.8m
Cat 773 (20km/h)	7.5m	+116.00%	+44.00%	23.7m
Toyota LDV (20km/h)	2.4m	+83.33%	+83.33%	4.5m
Toyota LDV (40km/h)	11.5m	+21.74%	+17.39%	14.2m




Road Preparation


Toyota LDV (Gravel – Control)


RDC10 (Normal)


RDC10 (Overdose)


Hauler (Gravel – Control)


Skid Measurement


Data Collection


Skid Line

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6. Conclusion

a. Water only

Applying only water to gravel road surfaces significantly increases the skid distance when emergency braking is performed. All the vehicles performed the worst on the water only section.

b. Untreated (control)

This surface yielded the best results, although there was no significant difference between this surface and the CLS overdose application.

c. CLS overdose

In one test, this surface performed better than the untreated control surface, and performed exactly the same with another test.

d. CLS standard

The surface treated with a standard application of CLS (10% dosage), performed on average over 80% better than the water only section. Skidding distances were not significantly further than those measured on the untreated control section.

Using only water for dust control on haul roads reduces safety, as the skid resistance for all tested vehicles on this surface was significantly lower.

The application of a CLS product allows for dust control while binding loose debris and effectively reducing water pooling on the road surface.

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