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Sonoma Mine, Reducing the risk of overwatering

Leighton Contractors

The Problem

Poor or inconsistent watering practices have contributed to a number of truck slides within our business. The consequence of these truck slides has ranged from a minor loss of control to events where a truck was ‘uncontrolled’ for a considerable distance. During the 2011 and 2012 period, our business experienced an average truck slide frequency rate of 5.2 per million man hours (this excludes truck slide incidents associated with wet weather).

The Solution

Not quite an overnight success!

The solution began to take shape approximately 2-3 years ago within our business with the initial deployment of the Leighton smart water system.

The Leighton smart water system provides engineering controls to assist the operator in controlling the application rate of water onto the road surface based on travel speed. The focus of the system is to assist in controlling water application rates for slower speed water application areas such as:

- Ramps;
- Intersections; and
- Tight corners and bends.

These areas along with the control mechanisms within the system have been selected from analysis of truck slide incidents within the Leighton mining business and the wider industry.

The system has evolved over time with the incorporation of operator feedback, information collected from Vericom friction testing studies, and information collected during physical field testing to determine true water application rates from the smart water system. In addition, the system has been combined with a comprehensive training package, an operator re-training program and a program that focuses on road conditions and operator behaviours associated with appropriate water application to our road surfaces.

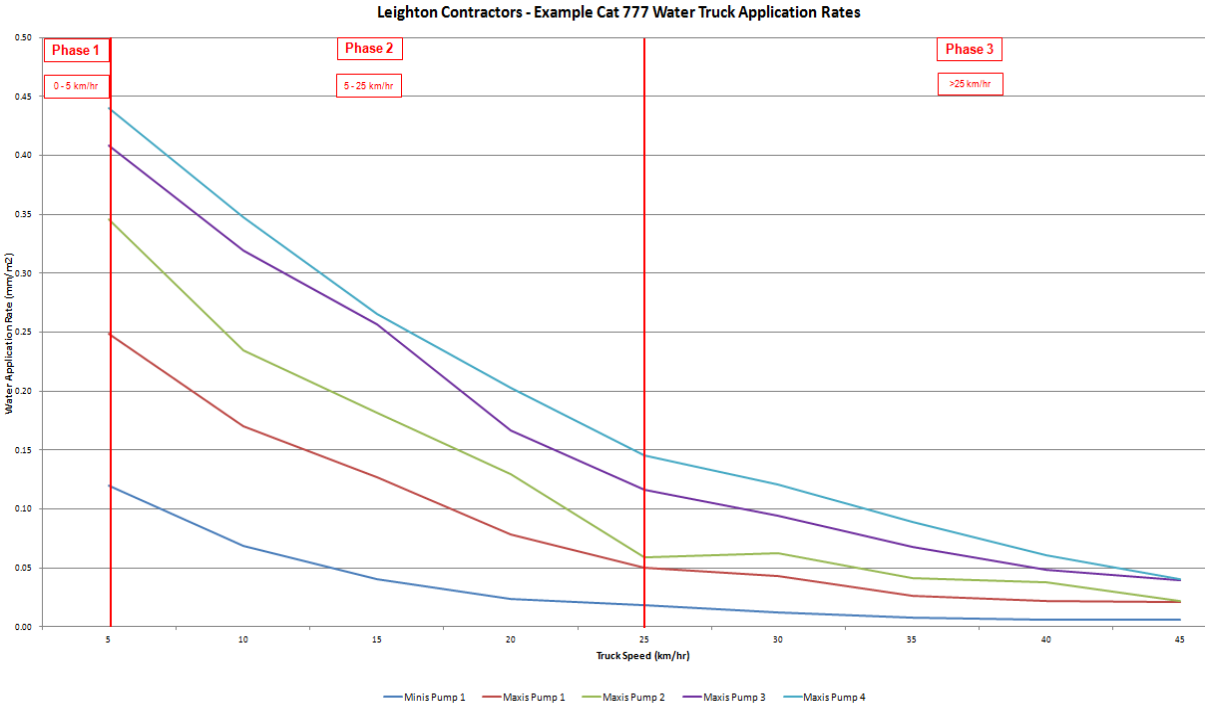
The current (version 3) description of the system is as follows:

The primary system logic control settings are based on three phases; each of these is associated with pre-determined trigger speeds that ensure water application rates are controlled in slower speed water application areas as described above. These logic settings are as follows:

	Phase 1	Phase 2	Phase 3
Trigger Speed	0 - 5 km/hr	5 - 25 km /hr	> 25 km/hr
Spray Heads Available	No Sprays	Mini Sprays Only	Maxi Sprays or Mini Sprays (if mini override switch and mini spray head switches are selected)
Pump Speed Settings Available	No Pump	Pump Speed 1	Pump Speeds 1 - 4
Number of Spray Heads	None	2 Mini Heads – Optimised pattern	2 Maxi heads (or 2 Mini Heads if selected) – Optimised pattern

The system also incorporates a foot pedal override functionality that utilises logic to prevent operator misuse in areas where the intent was to assist the operators in controlling water application rates (i.e. specifically ramps). The foot pedal override functionality will only operate below 15 km/hr; the intent of this was for use around very slow speed environments such as dig and dump areas or during major road maintenance activities (wetting up material for mixing etc).

Calibration testing was performed on the system to determine true water application rates across the full speed range and water system setting options. The average results are summarised in the following graph:



The information captured during the calibration testing (performed on 3 different water trucks) was utilised to verify a number of the system settings with the following results:

- The phase 2 to phase 3 transition speed trigger change to 25km/hr (version 1 was previously set at 15km/hr) was validated
- The normal/summer key controlled setting switch that was added to the system in version 2 was discontinued
- Operating all 3 spray heads across the spray bar resulted in water pattern overlap and increased water application rates in that overlap zone. The spray heads were reduced from 3 to 2 across the spray bar

More emphasis was placed on optimising the spray pattern for the version 3 deployment; the results are as follows:

- The centre spray heads were removed from the spray bars
- The aperture rings were re-seated flush against the flange to preserve the correct aperture height
- The aperture heights were set to the minimum height setting available on the aperture ring (~4-5mm for the mini heads and ~6-8mm for the maxi heads)
- The aperture openings were rotated to achieve an even pattern distribution across the road surface with little or no centre overlap

Light Bulb Moment!

Around the same time that the system was evolving from version 2 to version 3, coefficient of friction studies were occurring throughout the Bowen Basin. These studies gave us an indication of appropriate water application rates for various road material types within our operations. The light bulb moment occurred when we realised that we should calibrate our watering system.

The regulation of water without an understanding of how much water enabled a safe running surface (coefficient of friction studies) or the coefficient of friction studies without an understanding of the regulation of water are pointless exercises when not combined.

The calibration testing information can be combined with road surface friction testing information to determine maximum water application rates and applicable system settings for various road surfaces on the mine site.

Benefits

By combining the Leighton smart water system with Vericom friction testing studies, physical field testing of the system, a comprehensive training package and operator re-training program and a program that focuses on road conditions and operator behaviours we have seen a dramatic decrease in the amount of truck slide events across our business. The 2011 and 2012 period average truck slide frequency rate of 5.2 has reduced to 1.2 for 2013 year to date period.

Transferability

The introduction of this new technology through a variety of versions and system trials has given Leighton an opportunity to work out what has worked and continually improve not only its watering practices but its change management approach.

To enhance our consultative approach we have only used one trainer/assessor to embed the technology, but by and large his approach has enabled Leighton to influence the very people who can help control this risk.

The set up of the watering system and performance of field testing is easily achieved. However embedment and acceptance of the system and changing operating behaviours is were true outcomes are achieved.

In addition to the system modifications, a training package was developed to amplify the existing competency based training package. This was provided as a machine specific insert and incorporated into the training plan. When an operator undergoes training, the following components form the training package:

- RIIMPO206B Conduct Bulk Water Truck Operations
- Machine Specific Insert Topic – for the type of water truck

- Machine Specific Insert – Smart Water System

In addition to providing a thorough explanation of the system intent, settings and controls, the Machine Specific Insert – Smart Water System document incorporates information on operator behaviours around identifying and determining correct water application rates.

Innovation

Provision of engineering controls to assist water truck operators in controlling the application rate of water onto the road surface for slower speed water application areas such as ramps, intersections, and tight corners and bends. In addition the engineering solution has been combined with Vericom friction testing studies, physical field testing of the system, a comprehensive training package and operator re-training program and a program that focuses on road conditions and operator behaviours to decrease the amount of truck slide events across our business

Approximate Cost

The cost of deploying a version 3 smart water system onto a water truck is in the order of $80-90k. Additional costs are incurred for operator re-training, and ongoing costs associated with friction testing and monitoring.