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FLEET MAINTENANCE & COMMUTER RAIL

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THE 'CONNECTED' TRAIN GROWS ACROSS EUROPE

BUILDING CORE REDUNDANCY TO INCREASE RELIABILITY

GAINING APPROVAL FOR RAILHEAD CONDITIONING

IN RECENT YEARS, A GROWING NUMBER OF TRAM AND RAILWAY OPERATORS HAS BEEN TESTING AND IMPLEMENTING A SEPARATING AGENT ON THE RAILHEAD TO PREVENT THE NUISANCE THAT IS CURVE SQUEAL. AND RESULTS ACHIEVED TO DATE SHOW MEASURABLE SUCCESS.

To overcome curve squeal, the vibration excitation between wheel and track caused by the stick-slip effect must be reduced or prevented. This is achieved by reducing the difference between static and dynamic friction. And the product used is the friction modifier. If possible, the latter should be capable of preventing the stick-slip effect between wheel and track over an extended period of time. In this context, the product is referred to as a 'conditioner.'

PREREQUISITES FOR THE CONDITIONER

The product must be applied at a specified **location** (in- or outside rail on the curve, railhead/rail flank), at a specified **time** (hour/day), and in a controlled **quantity**. These are the minimum requirements for a properly functioning lubrication system, and can be used to consider existing situation-dependent constraints (line layout, frequency of traffic, position of curves, curve radii, operating type, city transport, etc.).

The functionality of such a lubrication system must guarantee that all railway operation requirements are fulfilled. This especially relates to compliance with the specified stopping distance in all weather conditions, and includes reliable application, ease of use, and meeting environmental criteria.

Nozzle position

CONDITIONER REQUIREMENTS

A lubricant becomes a conditioner when its effect extends over a long period of time, or for a large number of rolling stock units. With regards to its properties, it must exhibit a high degree of pressure capacity, as well as good adhesion and a water-repellent effect. Biodegradability and the spread effect are desirable characteristics, too.

The conditioner for spray systems used by the Swiss company Igralub has a solid lubricant content of more than 30%. The correct choice of particle size for the solid lubricant used is also an important aspect for successful conditioning of the rail surface. Greases and oils that fail to meet these criteria need to be used in greater quantities in order to achieve successful results, yet this produces significant contamination.

WIDESPREAD APPLICATION IN GERMANY

In 2012, an operator in North Germany procured a series of tram vehicles from Bombardier with mobile spraying systems for conditioning the railhead, by REBS Zentralschmiertechnik; the objective being to eliminate curve squeal from its entire route network. The quantities of lubricant sprayed are distributed across a geographically predetermined railhead surface area, and guarantee the uniform desired coefficient of friction. The quantity sprayed in so doing can be calculated as follows:

Width of treated surface: approx. 30mm
Speed of vehicle in curve: 30km/hr
Duration of spray: 8 seconds
Quantity per nozzle: 0.5cm^3
Length of lubricating film: approx. 67m (8s at 30km/hr)
Total surface area treated: 2m^2
Film thickness (theoretical): 0.25µm

The process begins before the start of the curve and distributes the amount determined by the spraying system onto the interior railhead of the curve for six to eight seconds

Coefficient of friction measurements (rubber tyre sections were used as friction bodies on the railhead)

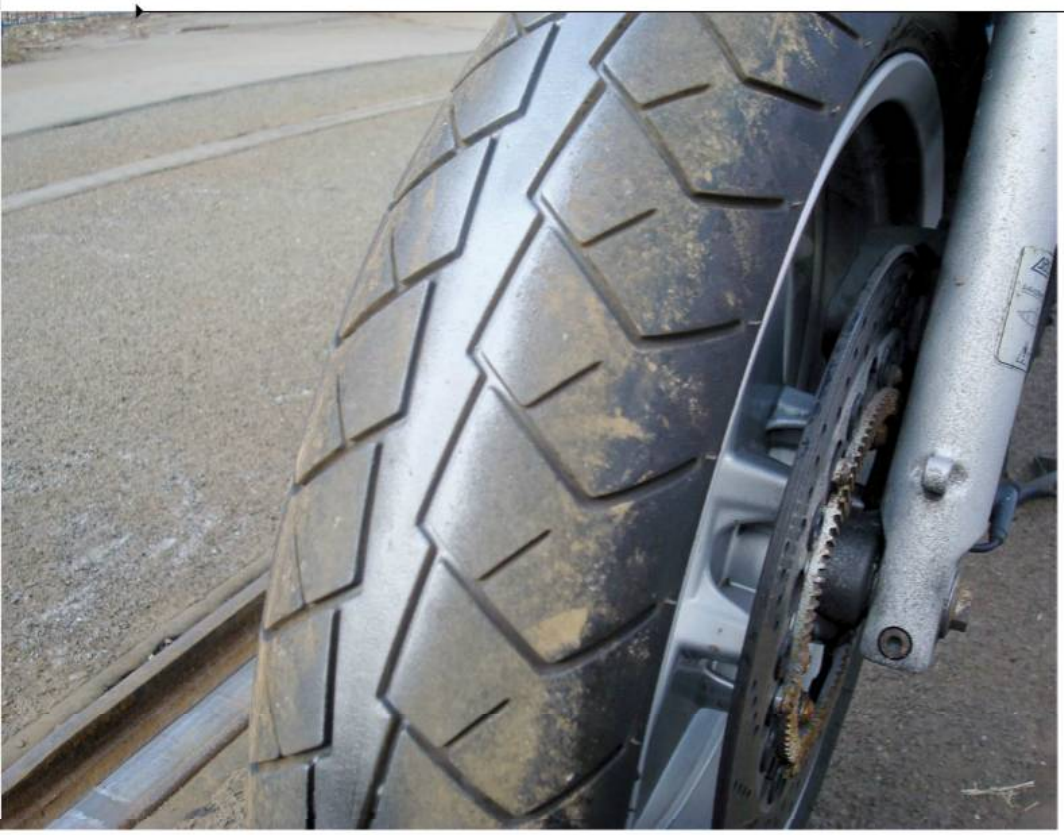
The process begins before the start of the curve and distributes the amount determined by the spraying system onto the interior railhead of the curve for six to eight seconds. The spraying process is repeat-tion recognition, among other things, mobile spraying systems are efficient and reliable. It is also possible to pre-set the temporal application and thus suspend application in rainy weather, during sanding, or at times when the tram is running below the minimum speed.

Operation of these lubrication systems in vehicles is subject to a regulatory approval procedure. In 2011, the operator commissioned DEKRA-Industrial in Halle, Germany, to perform the necessary testing activities.

FIRST BRAKING TEST PROCEDURE FOR TWO-WHEELED VEHICLES

Because of the driving physics of two-wheeled vehicles, it is very difficult to furnish proof of safety for private transport as regards the use of a railhead conditioning system. The narrow contact surface of a motorcycle wheel (approximately 25mm) (and which needs to travel across various materials such as tracks and asphalt) leads to various discontinuities that are critical, and thus inappropriate for measurements. For this reason, DEKRA-Automobil, which was charged with performing this special test process, recommended friction coefficient tests pursuant to VDI 2700. It used a corresponding measurement technology, which still needed to be adapted for 'tyres/tracks' and 'tyres/asphalt' test configurations.

Roll-over of conditioned curve section



Directly treated tyres

By measuring the coefficient of friction, it is possible to determine the change in road grip on the rail once the conditioner has been applied. This coefficient determines the possible deceleration. The brakes were not to be engaged on the rail. Instead, the wheels were to be wetted with the maximum possible amount of friction modifier. The braking test was then conducted on the adjacent asphalt. The results of the driving test are only reproducible within very narrow guidelines and are dependent on the driving behaviour of the test driver.

Both of the test variants conducted (coefficient of friction measurements and braking) come with advantages and disadvantages. For this reason, using both is reasonable and meaningful.

The friction modifier used was the biodegradable product Headlub, by Igralub. It has already been successfully applied to real railheads worldwide.

TEST RESULTS FOR TRAM OPERATION & TWO-WHEELED VEHICLES

Even at 10 x single-rail spraying, the measured results fell within the acceptable range for both tram braking and friction measurements. The braking decelerations recorded with the motorcycle (with the same number of sprays) tended to be slightly better than before once the friction modifier had been rolled in by the tram wheels.

Even when the friction modifier was applied directly to the tyre tread, there was only a 13% reduction in braking deceleration compared to the initial reference measurement. This leads us to conclude that when a mobile spraying system is used by trams, no danger is posed to other road users by conditioning the railhead using Headlub as the friction modifier.

At the end of 2012, the Swiss Federal Office of Transport (FOT) granted a permit for railhead conditioning based on measurements performed by Swiss transport operator BernMobil, using the same spraying system and friction modifier.

MANY YEARS OF PRACTICAL EXPERIENCE

Igralub has been working to reduce curve squeal for over 20 years. They started with track service vehicles that treated the railhead on certain routes and at certain times of the day. The large-scale use of mobile spraying systems is possible thanks to the electronic control system.

Based on operator Essener Verkehrs-AG's (EVAG) many years of experience using mobile railhead conditioning systems in scheduled service, the effect of friction modifiers is ascertainable in terms of modifying the coefficient of friction after the first application, yet has no impact on the braking distance of the tram for up to five treatments.

Igralub possesses worldwide know-how in the implementation of railhead conditioning systems and acts as a total services provider both in project implementation and in conducting testing for the regulatory approval process.

THE FUTURE OF RAILHEAD CONDITIONING BY RAILWAY COMPANIES

Since 2009, Dutch rail infrastructure manager ProRail

has been working on a new concept for decreasing noise caused by wheel-rail contact. In addition to reduced noise pollution, reduced noise levels also mean reduced infrastructure wear and reduced wear on train wheelsets of trains. The wheel-rail conditioning project dispenses with stationary systems and relocates application of Headlub to the train. An electronic system measures the constant grip of the wheel on the rail, and evaluates results.

In order to ensure safety in all operating conditions, trains equipped with the railhead conditioning system also have measurement boxes installed. This box performs permanent monitoring of dispensing. The parameters can be configured by a control centre, and all important train information is available online. Among other features, dosing can be interrupted once the coefficient of friction drops too low. The latter is derived from the current flow of the traction motors and serves to alert the occurrence of slipping. A sudden change in current consumption is a reliable indicator of the interruption of wheel-rail contact. The adopted lower limit is a friction coefficient of 0.2 (friction when starting from standstill). No rail conditioning with the friction modifier is performed below this value. This means that safety is ensured at all times. Conditioning takes place at friction coefficients of between 0.2 and 0.4.

Experiences gained in field testing are thus generalised so that applicability as well as the cost-benefit ratio of the railhead conditioning system can be predicted. Moreover, based on feedback by ProRail, a working group at the UIC (International Union of Railways) began investigating the railhead conditioning system at the end of 2011. As the chair of the pilot studies, ProRail will monitor the process closely and continue professionalising it, together with experts and tribologists in Europe and China (Railmagazine No. 289, November 2011).

FLEET MANAGEMENT SYSTEM – AN INNOVATION FOR RAIL & TRAM OPERATORS

Igralub will soon be offering an electronic fleet management system (IFM) for the complete control and monitoring of the railhead conditioning system.

The system enables successful implementation of a railhead conditioning system. In addition to reducing curve squeal and wheel/track wear, driving safety is also be enhanced. By setting IFM control functions, the use of a friction modifier can be monitored and optimised at all times for the entire fleet and its route network.

Web-compatible, the IFM performs central monitoring of all data relevant to the railhead conditioning system. It communicates and executes immediate change commands (as a result of weather, route, or itinerary changes at short notice) to existing railhead conditioning system-dependent systems and facilities. A smartphone can be employed to optimise use of the system and to issue commands to the affected systems in the vehicles or to stationary systems from any location.

An operational lubrication system, the IFM monitors and manages all the important lubrication functions of the railhead conditioning system – a computer and corresponding software, along with specially developed sensors that can easily be deployed at the appropriate locations. The time-consuming checks and rules to which existing lubrication systems in vehicles or on tracks are subject are thereby reduced.
The Igralub Group has filed for patent protection for IFM ■

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