

# VELOCITY

FRICTION MANAGEMENT 2024 SPECIAL ISSUE

NEWS FROM L.B. FOSTER FRICTION MANAGEMENT

# WE BELIEVE IN SAFER, QUIETER, EASIER JOURNEYS.

THIS ISSUE: QUIET RAILS: FRICTION MANAGEMENT REDUSES NOISE **POLUTION FOR RESIDENTIAL** AREAS

**CUTTING EDGE FRICTION MANAGEMENT TECHNOLOGY** LOWERS RAILWAY NOISE, ENHANCES URBAN LIVING

INNOVATIVE FRICTION MODIFIERS LEAD THE WAY IN NOISE MITIGATIO

**REVOLUTIONISING RAILWAYS:** FRICTION MANAGEMENT SOLUTIONS DRAMATICALLY **REDUCE NOISE POLLUTION** 



WE ARE WORLD LEADERS IN THE DEVELOPMENT AND DEPLOYMENT OF INNOVATIVE FRICTION MANAGEMENT SYSTEMS AND SERVICES FOR THE GLOBAL TRANSIT AND FREIGHT RAIL MARKETS.

TOTAL FRICTION MANAGEMENT (TFM<sup>™</sup>) IS HOW WE SYSTEMATICALLY ASSESS, IMPLEMENT AND MONITOR FRICTION CONTROL.

WE HAVE DEVELOPED A WIDE RANGE OF PROPRIETARY SYSTEMS TO MANAGE FRICTION BETWEEN THE WHEEL AND RAIL FOR TRANSIT AND FREIGHT RAIL APPLICATIONS.

OUR INSPIRATIONAL FRICTION MANAGEMENT PRODUCTS AND DELIVERY SYSTEMS PROVIDE SUBSTANTIAL, MEASURABLE BENEFITS BY MAXIMIZING EQUIPMENT PERFORMANCE AND MINIMIZING THE COST OF IMPLEMENTING AND RUNNING A FRICTION MANAGEMENT PROGRAM.

L.B. FOSTER'S INDUSTRY-LEADING FOCUS ON EMERGENT NEW TECHNOLOGY OPTIONS GIVES OUR CUSTOMERS INCREDIBLE FRICTION MANAGEMENT SOLUTIONS COUPLED WITH STATE OF THE ART MONITORING CAPABILITIES.

# QUIET RAILS, HAPPY NEIGHBOURS: TRANSFORMING URBAN LIVING WITH FRICTION MANAGEMENT

AS THE WORLD BECOMES INCREASINGLY URBANIZED, THE CACOPHONY OF CITY LIFE GROWS LOUDER. ONE OF THE MOST PERSISTENT CULPRITS? RAILWAY NOISE. FOR MILLIONS LIVING NEAR BUSY RAIL LINES, THE SCREECHING, CLATTERING, AND RUMBLING OF TRAINS CAN TURN A PEACEFUL HOME INTO A STRESS-FILLED ZONE. THIS RELENTLESS NOISE POLLUTION NOT ONLY INTERRUPTS DAILY ROUTINES BUT ALSO POSES SERIOUS HEALTH RISKS, FROM DISTURBED SLEEP AND CARDIOVASCULAR ISSUES TO COGNITIVE IMPAIRMENTS IN CHILDREN. THE CHALLENGE OF QUIETING THE RAILS HAS NEVER BEEN MORE PRESSING, AND INNOVATIVE SOLUTIONS ARE URGENTLY NEEDED.

IN THIS ISSUE, WE DELVE INTO THE CUTTING-EDGE WORLD OF FRICTION MANAGEMENT (FM) TECHNOLOGY, A GAME-CHANGER IN THE BATTLE AGAINST RAILWAY NOISE. DISCOVER HOW ADVANCED FRICTION MODIFIERS ARE BEING DEPLOYED TO SIGNIFICANTLY REDUCE THE SQUEAL AND GRIND OF TRAIN WHEELS, BRINGING MUCH-NEEDED TRANQUILITY TO AFFECTED NEIGHBOURHOODS. WE EXPLORE REAL-WORLD CASE STUDIES, INCLUDING THE TRANSFORMATIVE IMPACT OF FM SOLUTIONS OUTSIDE LEEDS STATION, AND REVEAL HOW THESE INNOVATIONS ARE NOT ONLY IMPROVING THE QUALITY OF LIFE FOR RESIDENTS BUT ALSO SETTING NEW STANDARDS FOR URBAN LIVING. JOIN US AS WE UNCOVER THE FUTURE OF QUIETER, MORE HARMONIOUS CITIES.

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# NOISY TRAMS GET THE SILENT TREATMENT

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# Introducing Total Friction Management.

L.B. Foster Rail Technologies is a world leader in the development and deployment of innovative friction management systems and services for the global rail transit and freight markets.



Total Friction Management (TFM™) is how we systematically assess, implement and monitor friction control. Our Total Track Monitoring (TTM™) creates a smart interface between conventional rail products and intelligent performance monitoring digital technologies, delivering always-on data that improve asset performance, drive cost efficiencies, enhance safety and assist security. This achieves short and long-term performance benefits for rail operators and network owners.

We have developed a wide range of proprietary systems to control friction between the wheel and rail for transit and freight rail applications. Our inspirational friction management products and delivery systems provide substantial measurable benefits by maximising equipment performance and minimising the cost of implementing and running a friction management programme.

We are a new technology-driven L.B.Foster, giving our customers incredible friction management solutions, alongside state of the art monitoring solutions.

For more information contact Joel VanderMarel jvandermarel@lbfoster.com Tackling high traffic friction and lubrication issues underground and overground on the Crossrail project in London is one aspect of L.B. Foster Rail Technologies' involvement supplying solutions to ATC, a consortium of Alstom, TSO and Costain, which won the €350 million railway systems fit-out contract.

# Tackling friction on Crossrail

Our engineering team in Sheffield has created a new, wall-mounted friction management solution, specifically for installation in the new tunnels.

Fifty-two specially designed, high capacity PROTECTOR® IV electric lubricators have been specified by ATC to manage friction and rail lubrication on the project.

Jon Paragreen, General Manager at L.B. Foster Rail Technologies (Europe), leads the team behind the new product development. He explains: "ATC adopted a 'belt and braces' approach to friction management, with both on-board and trackside solutions working together to deliver best in class performance.

"Our high capacity PROTECTOR® IV solution has been re-engineered to meet these exacting specifications. Whereas our standard wall-mounted solution has a capacity of 80 litres; this new specification is to accommodate 230+ litres of grease or KELTRACK™. That's an increase of nearly 300 per cent.

"Making the size modifications to the cabinet was relatively straightforward. We have a proven track record of this kind of development. Where the real challenge lay was in designing the system to be able to cope with the high volumes of traffic, whilst ensuring a minimal space envelope was utilised.

"We developed a modular solution specifically for tunnel applications. The modular design future proofs the system, with the capability to retro-fit new control boxes with enhanced functionality post installation. The control box module simply unbolts, with no need to uncouple the motor or pump." Jon Paragreen continues: "Our new control box fitted to the PROTECTOR® IV is preconfigured to the project's performance requirements. It is also equipped with Remote Performance Monitoring (RPM) capabilities, allowing friction management equipment to be monitored from a central location. This provides network managers with essential operational data and advanced warning of situations that may affect the optimum performance of friction management equipment. It is more efficient, more controllable and more configurable - all key requirements of the system."

"A further operational consideration of the new system was the capability to refill in under 15 minutes. Our bespoke solution was a high capacity hose and a barrel mounted system, dispensing product at a rate of 25 litres per minute.

"The end benefit of the increased tank capacity, remote performance monitoring, quick fill capability is that the maintenance cycle is significantly increased to every four weeks and minimal time at the unit is required. This is critical in today's operating environment where transit systems are being pushed to operate 24/7, minimizing time available to conduct routine maintenance"

The technology described above is customizable for any transit system.

For more information contact Joel VanderMarel ivandermarel@lbfoster.com

Dr. Jon Paragreen jparagreen@lbfoster.com



"Our high capacity PROTECTOR® IV solution has been re-engineered to meet the exacting specifications set by Crossrail."





# Working together to keep your world moving

Introducing the L.B. Foster / FUCHS Lubricants Partnership

L.B. Foster has formed a strategic partnership with FUCHS Lubricants, the world's largest independent lubricant manufacturer. This partnership combines L.B. Foster's renowned expertise in the development and implementation of railroad friction management technologies with FUCHS's world-class lubricant manufacturing capabilities.

L.B. Foster continues to lead innovation in friction management lubricant products that in turn is driving considerable savings to our global railway customers through rail and wheel wear reductions, improved operating / maintenance efficiencies, and optimized safety of network operations. FUCHS Lubricants is a global company that develops, produces, and distributes lubricants and related specialties. This strategic partnership has facilitated global production of L.B. Foster and FUCHS co-branded greases within several key international market regions.

L.B. Foster has combined its extensive knowledge of wheel / rail interface dynamics with rigorous scientific analysis and on-track field testing in collaboration with FUCHS Lubricants to co-develop a portfolio of high performance rail curve greases. Our cobranded greases are formulated to maximize grease lubricity and film durability supporting optimum rail protection, noise abatement, and coverage extent benefits.

L.B. Foster has successfully collaborated directly with FUCHS Lubricants in the United States, Australia, Brazil and China to establish local manufacturing of rail curve greases. This initiative recognizes and responds to the strong demand for a domestically produced, high performance and cost-effective rail curve grease for commercial distribution within these market regions.

This achievement showcases the successful partnership between L.B. Foster and FUCHS Lubricants and the promise of future

collaborative projects of similar type moving forward that will continue to deliver industryleading benefits to railway networks globally.

For more information contact Dr. Louisa Stanlake Istanlake@lbfoster.com



An emerging trend in the rail industry is to transition track-based friction management technology to on-board rolling stock. In response to this trend, L.B. Foster's industry leading water-based friction modifier is now available for onboard applications.

# **KELTRACK** moves on-board

### What is KELTRACK On-Board (KOB)?

L.B. Foster 's next innovation in the rail friction management sector is KELTRACK On-Board (KOB). KOB is a spray system that dispenses a water-based friction modifier fluid, KELTRACK, from on-board the rail vehicle. KELTRACK is the industry leading water-based friction modifier with a global user-base and over 20 year legacy of exceptional performance.

### Benefits to moving on-board

The move to an on-board setting enjoys many benefits, including:

# > Maintenance

Activities move from trackside (dangerous and disruptive to network operation) to vehicle depots.

### > Efficiency

Product is applied directly where it needs to be effective (wheel rail interface), increasing efficiency versus trackside application systems. Additionally, the vehicle is the mechanism for conditioning the network which enables vast sections of the network to have product application from only one system.

# > Cost

Significant savings on unit quantity and maintenance cost versus trackside equipment. Residual benefits without the need to apply to 100% of the fleet.

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### > Adaptable

Application strategies can be changed with relative ease, a static trackside system only conditions one fixed section of track. On-board applications can be time-based, distance-based, or locationbased (via RFID, GPS or TCMS).

# > Safety

Specific to KELTRACK, vehicle traction and braking are not impacted by applying this product to the railhead

# > Intelligence

The system contains several built-in health checks to help maintain uptime and flag any preventative maintenance events. Systems can also remotely communicate their status (optional RPM module) or send status/ warning to TCMS.

# What is KELTRACK AP EX?

L.B. Foster's KELTRACK AP EX is a top-ofrail friction modifier specifically designed for on-board spray application.

KELTRACK AP EX is an all-season product that has a wide operating temperature range, and negates the requirement for heated tanks, hoses, and nozzles in an on-board spray system. It is a water-based engineered composite of inorganic solids, polymers and friction modifying additives that provides excellent protection in the wheel/rail interface without the use of oils.



When applied, KELTRACK AP EX dries under passing wheels to form a thin film of friction modifier material that creates the ideal conditions of intermediate and positive friction. The intermediate coefficient of friction reduces the wear and rolling contact fatigue (RCF) on the wheel and rail without affecting vehicle traction and braking performance, while the positive friction eliminates the stickslip oscillations that result in top-of-rail squealing noise and corrugation. Application of KELTRACK AP EX will reduce energy/fuel consumption and extend infrastructure lifetime. KELTRACK AP EX has exceptional product stability and does not separate in the on- board equipment storage tanks.

Furthermore, KELTRACK AP EX has a very low environmental impact, is stable, nonvolatile and non-flammable. For further information contact Mat Holland mholland@lbfoster.com

Dr. Jon Paragreen jparagreen@lbfoster.com

KELTRACK On-Board (KOB)							
Air	Power	Spray nozzle	Dispensing & control	Electrical & HMI	Tank volume	Signal interface	Approvals
6-10 bar 500L/min (max) IS08573-1	24 VDC (125W)	Dimensions 140mm (w) 140mm (d) 150mm (h) Mass 1.8kg	Dimensions 385mm (w) 610mm (d) 335mm (h) Mass 50kg	Dimensions 316mm (w) 205mm (d) 296mm (h) Mass 10kg	20L	Speed Braking* Sanding* Direction* Location*	EN61373 EN13749 EN44545-2 EN50121-3-2 EN60068 EN50125-1

\* Can be managed by TCMS to give clearance to spray

# **PROTECTOR®X** the new standard in friction management

It's not every day that a new standard in trackside friction management is introduced to market, but that's exactly what L.B. Foster Friction Management has achieved with the launch of its groundbreaking PROTECTOR®X.

PROTECTOR X system provides unsurpassed performance, reliability, and ease of maintenance in both gauge face and top of rail friction management applications. Its unique, steep-walled, conical product compartment design enasures first-in, first-out product utilization.

Joel VanderMarel, P.Eng., is L.B. Foster's Global FM Product Manager – Trackside Solutions. He explains: "The PROTECTOR X system's extraordinary design is optimised to deliver up to 100% product utilization before cavitation. That's a figure we're confident will outperform any trackside friction management dispensing solutions currently on the market. "Our innovative control system uses proprietary compensation algorithms to ensure a consistent application rate regardless of changing operating conditions. So that means you can be assured that PROTECTOR X will keep on performing whatever the weather throws at it."

PROTECTOR X features a large, high capacity compartment available in three sizes:

- > 50 USG/400 lbs (190 L/180 kg)
- > 100 USG/800 lbs (380 L/360 kg)
- > 160 USG/1250 lbs (610 L/570 kg).

VanderMarel continues: "When designing the PROTECTOR X we really wanted to find smart ways to make installing and maintaining the system as simple and straightforward as possible. The new units are designed specifically to reduce track access requirements for installation, maintenance and refilling. Plus we've designed in a special double wall that meets strict Environment Protection Agency secondary containment requirements."

An optional Remote Performance Monitoring (RPM) system, developed by L.B. Foster, allows users to monitor the status of trackside systems remotely. The RPM system gives equipment owners the capability to maximize operating uptime of units, optimizing the deployment of maintenance resources.

# For more information contact Joel Vandermarel jvandermarel@lbfoster.com

Zoë Loveday zloveday@lbfoster.com



07 VELOCITY Operators of the Prague Metro are big believers in the inservice benefits of our friction management solutions. That's because they have seen firsthand a real reduction in hunting and corrugation problems, as well as reduced tread wear, further extending wheel life.

The Prague Metro is the sixth busiest in Europe. It features 60km of track with 57 stations and serves around 620 million passengers a year.

Metro M1 is a Czech type of metro train used on Line C of the Prague Metro. These Metro trains were made by ČKD, Siemens and ADTranz and were developed especially for Prague. Each train is a five car unit with powered bogies and equipped with:

- L.B. Foster's LCF (Low Coefficient of Friction) Solid Stick on-board lubricant system on the wheel flange of three axles (out of 20 axles)
- L.B. Foster's HPF (High Positive Friction) Solid Stick on-board friction modifier on the wheel tread on five axles (out of 20 axles).

Jifi Hofschnaidr, Project Manager Full Service Metro M1 for Siemens, says: "Due to tread wear, rail corrugation and vehicle 'hunting' on Line C of the Prague Metro, we introduced L.B. Foster's HPF for test purposes in 2001, with fleet fit completed by mid 2002.

"The application of HPF has reduced hunting and corrugation problems. It has also reduced tread wear, further extending wheel life. Currently, wheel life on Line C trains is expected to last approximately 1.5 million kilometres.

"The effectiveness of HPF was further underlined when we removed all HPF from the fleet for a six month period. During this time significant wear of the wheel tread took place."

Prague Metro operates three lines - A,B and C. Our LCF sticks were introduced on Line B in 1996 and Lines A and C in 1997.

According to Prague Metro and Siemens,



# Prague Metro keeps moving

wheel life has been extended on all lines following the application of LCF.

David Tichota is Project Manager Deputy Full Service Metro M1 at Siemens. He adds: "The in-service performance of L.B. Foster's HPF Solid Stick solutions has demonstrated clear returns in terms of extended asset life performance and associated cost benefits. We recommend the use of HPF on other train fleets."

For more information contact Ron Hui rhui@lbfoster.com

Dr. Jonathan Paragreen jparagreen@lbfoster.com "The in-service performance of L.B. Foster's HPF Solid Stick solutions has demonstrated clear returns in terms of extended asset life performance and associated cost benefits. We recommend the use of HPF on other train fleets."

# Extending switch life with KELTRACK friction modifier

We are market leaders in friction management for the rail and transit markets. Researching innovative applications for our friction modifiers has led to new thinking about how to increase network asset life and reduce costly track maintenance.

Switches and crossings are an integral part of rail infrastructure, which rail vehicles use to change from one track to another. As safety critical assets it's vital they are well maintained and suffer minimal damage.

In general terms, a switch represents a location of a geometrical track deviation (compared with plain line). A vehicle responds to a track deviation with an angle of attack (AOA) at the leading wheelset of each bogie, resulting in the generation of lateral forces and possible flange contact.

Switch blades can suffer from plastic flow leading to fatigue (RCF) crack formation, due to excessive flange contact in an area about 2-5m from the switch tip. Repair welding is required to repair defects. These costly repairs can only be repeated a number of times, leading to premature replacement of switch blades.

# **Nuneaton Cemetery Junction**

A study was undertaken of a switch at Nuneaton Cemetery Junction where the switch life was significantly reduced due to fatigue failure approximately 2m from the tip. Between 2004 and 2012 the high-rail half-set has been replaced every 15-18 months, with intermediate weld repairs about every four months.

# **Causes of the damage**

It was clear from the initial observation of the defect that the lateral loading of the switch was excessive and that this was a fatigue issue

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Extending switchblade life Protecting critical assets Saving costs



Discussions within Network Rail revealed that this is a known issue at a number of sites and that it was thought to be a design issue with RT60/NR60 layouts.

The damage issues normally arise when trains are travelling in the trailing direction. The radius of curvature reduces on the approach to the switch tip so the reduction in the angle of attack is insufficient to counteract the reduced cross sectional area of the switch rail resisting the lateral loads.

The increasing load caused by the contact forces between the wheel/flange and switch rail create a fatigue cycle leading to a horizontal failure approximately 15mm below the top of the switch rail. Once the crack has initiated, it grows horizontally and turns to the vertical at the end of the crack closest to the switch tip. The horizontal growth continues away from the switch tip until the top of the switch rail breaks off.

# A permanent solution

L.B. Foster's KELTRACK top of rail (TOR) friction modifier system was positioned to ensure that the friction modifiers covered the approach to WN572A so the steering of the wheelsets was optimised through the whole switch. Since installation WN572A was defect free for 26 months until after one month of no friction modifier application (four months in total where there had been no treatment since the new switch blade was installed), the first S/053 inspection Hazard 4 failure was reported. Since the repair was undertaken and the installation has been maintained there have been no further failures of Hazard types 1, 2 or 4.

### **Benefits at Nuneaton**

The key benefit of using KELTRACK top of rail friction modifier at Nuneaton include:

- The halt of the repeated failure of the equipment
- net value savings of approximately £40,000
- reduction in repairs including 650 per cent increase in asset life
- switch life increase from 18 months to 11 years
- > less inspection time
- > fewer man hours on track

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- reduced delays
- > payback time estimated at 11 months.

# **Benefits for the network**

Since the first installation, a number of other sites have been identified as having similar repair issues to Nuneaton and have been treated using KELTRACK TOR friction modifier. These are Crewe Coal Yard, Reading West Curve and Birmingham Proof House.

As Network Rail moves from CP5 to CP6, with a greater focus on efficiency, TOR friction modifiers could be of benefit to the wider network. Nuneaton is demonstrating returns of  $\pounds$ 12,000 pa and Reading an estimated  $\pounds$ 100,00 pa.

# Conclusion

KELTRACK TOR friction modifier system can give a significant improvement in the life of switches. It is expected that the improvement would be at least 650 per cent, as demonstrated at Nuneaton.

This is achieved by reducing the angle of attack between the wheel and the rail through the switch so that the contact forces are greatly reduced or eliminated entirely.

For more information contact Dr. Jonathan Paragreen jparagreen@lbfoster.com

# Leaves on the line

Is the issue of 'leaves on the line' a myth perpetuated by the press or a mission critical challenge for the rail network? Now our Traction Gel Applicator (TGA) and expertise in friction management are attracting attention from network operators and owners alike, with the goal of managing the impact of these slippery customers.

Wet leaves are sucked onto railway lines by the turbulence created from passing trains. This is a particular problem for the rail sector in autumn, when trees shed their leaves. Leaf fall is compressed by the weight of train wheels, depositing a thin, black layer of leaf residue on the rail. When this comes into contact with rain it becomes incredibly slippery, giving rise to the much derided issue of 'leaves on the line'.

The resulting impact of leaves on the line on rail services is lengthy delays and costly cancellations, as trains have to accelerate more slowly and decelerate over greater distances.

So what can be done to alleviate this issue? Dr. Jon Paragreen, General Manager at L.B. Foster Rail Technologies, explains: "Adhesion between vehicle wheels and rail is dictated by top of rail surface conditions and contamination.

Our Traction Gel Applicator (TGA3) distributes traction enhancing material directly to the position on the rail where it is required. "Where you have an issue of low adhesion, such as leaves on the line, it results in braking and traction problems. This leads to potential signal failures caused by loss of track circuit detection, as well as station overruns and insufficient traction on inclines and declines.

"We have had unprecedented orders for our TGA3 from Network Rail for installation at locations across the UK. These are in readiness for all that the adverse autumn weather has to throw at the network. "Furthermore, our team of friction management experts has developed ALLEVIATE<sup>®</sup>, a unique, traction enhancing material that combats both seasonal and all year round adhesion issues. In the autumn, loss of traction from seasonal leaf fall creates a slippery surface on running rails.

"Throughout the year there are certain areas of track where traction is an issue; for example, wet rail syndrome or where vehicles have to travel up inclines/ declines. Both these adhesion issues can result in train delays, operational disruption and wheel damage."

ALLEVIATE® has been developed for use in the L.B. Foster Rail Technologies' TGA3, as well as other systems such as Multi-Purpose Vehicles (MPVs). The formulation of ALLEVIATE® is supported by extensive analysis at all stages of the development project, including field trials, laboratory study and performance testing on the SUROS twin disk machine at the University of Sheffield. New to market is a special, high performance, low temperature formula called ALLEVIATE® LT. This is specifically for use in environments subject to extreme temperatures, as low as minus 15 degrees Celsius.

For more information contact Dr. Louisa Stanlake Istanlake@Ibfoster.com

Dr. Jon Paragreen jparagreen@lbfoster.com



# Remote performance monitoring

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![](_page_12_Picture_3.jpeg)

![](_page_12_Figure_4.jpeg)

L.B. Foster is leading the way, thanks to comprehensive research and in-field testing undertaken by our team of friction management experts at our global centre of excellence in Vancouver. Working closely with L.B. Foster's software solutions team in the UK, we have created a new, sectorleading, data-driven monitoring solution that is now delivering on the promise of intelligent performance monitoring.

Remote Performance Monitoring (RPM)is part of our Anatomy suite of intelligent software solutions. RPM provides invaluable insight into the current status of customers' friction management programs. Joel VanderMarel, P.Eng., is L.B. Foster's Global FM Product Manager - Trackside Solutions. He says: "RPM provides the capability to deep dive into the performance data nuances of each individual asset located in the field. It's about implementing tools that allow you to predict the future state of your system, giving you the ability to know when your tank will run empty, so you can plan pre-emptive maintenance, optimising future work cycles and preventing asset downtime.

"If you want to achieve the most from your friction management program, your systems need to operate at maximum uptime. Dispensers and applicators need to apply an optimised amount of product and you need to minimise the costs associated with running your overall friction management program.

> "Currently, the market is dominated by solutions that deliver incoming data from systems. When you begin to manage a large number of assets it can become very resource intensive to sort through the data manually. This adds to the cost portion. Also, there's the fundamental tenet of 'if you don't measure it, you can't manage it'. So systems that aren't actively measuring or calculating uptime aren't

giving you the tools needed to manage or maximize uptime."

# Network Rail

In the UK, Network Rail sees the ability to 'monitor' its assets as an immediate costbenefit. The main cost saving is the ability to track potential issues to avoid delays and disruption. According to Network Rail: "To date we have more than 12,000 assets live on the Intelligent Infrastructure system (points, track circuits, signal power supplies). The benefits so far have been 153,000 delay minutes avoided saving c£4.66m, with benefits expected to rise to c£14m per annum.

"As infrastructure owners, efficient and timely maintenance interventions are essential to ensure trains operate to the published timetable without delays or interruptions to service. The challenge, therefore, is being able to monitor key assets with real-time information.

The benefits of a successfully implemented and maintained friction management program include extended rail life, reduced track damaging forces, reduced rolling contact fatigue and improved fuel economy. VanderMarel concludes: "Introducing RPM to your friction management program means you can make informed decisions about your maintenance cycle, ensuring field assets perform at their best, protecting track and wheel wear.

"RPM is changing the way network owners and operators think. It is a major leap forward that promises improved return on investment, better performance and enhanced decision making."

For more information contact Joel VanderMarel jvandermarel@lbfoster.com

Achieving the best performance and cost return on trackside assets is an aspiration of network owners and operators around the world. Obtaining meaningful, real-time performance data on assets, often located in remote parts of the network, is a holy grail that has eluded the rail industry. That is until now.

# 

![](_page_13_Picture_1.jpeg)

Wear is an International Journal on the Science and Technology of Friction, Lubrication and Wear. A thought leadership paper co-authored by L.B. Foster friction management experts looks at the effects of friction management materials on rail with pre existing rolling contact fatigue surface damage.

Management of rolling contact fatigue (RCF) risk is a critical maintenance activity in railway operations. Practical means of RCF mitigation involve:

- Preventative and corrective grinding to remove RCF cracks.
- Management of wheel and rail profiles to minimize peak contact pressures
- > A selection of appropriate rail metallurgy.

In addition, reduction of traction forces by the application of dry film Top of Rail friction modifiers (FM) has recently been shown to reduce crack growth and extend grinding intervals.

Hydro-pressurisation and crack face lubrication are processes by which liquid materials (e.g. water), enter pre-existing RCF cracks and under wheel/rail contact pressure and cause accelerated crack growth, leading to spalling and shelling on rail and wheels.

Any liquid material added deliberately to the wheel/rail interface should be considered carefully in terms of the potential for aggravating RCF damage. The study compares the impact on hydro-pressurisation and crack face lubrication of different types of materials designed for application to the top of rail using twin disc testing.

One type of FM material is water-based, providing solid particles to the rail-wheel contact areas. Two other types are oil or oil-plus-water-based (hybrid material) that do not naturally dry and have been introduced more recently to the market. In addition, a commonly used gauge face lubricant (grease) was evaluated.

Out of all the products tested, only application of the water-based friction modifier resulted in a reduction in wear coupled with no acceleration of surface damage and cracking.

For a copy of the full paper contact Dr. Xin Lu Lu@lbfoster.com

Tony Makowsky tmakowsky@lbfoster.com L.B. Foster Rail Technologies is leading the way with breakthrough research and development in the field of friction management.

# World leading research facilities

Investment in a ground-breaking Global Friction Management Laboratory in Vancouver, Canada is much more than a centre of excellence for commercial product development; it's expanding new technical capabilities that are firmly positioning L.B. Foster Rail Technologies as a world leader in the fundamental understanding and management of friction at the wheel/rail interface. The laboratory is equipped with specialized equipment to drive forward advancements.

Our customers push us to create value by not only developing consumable products which optimize the wheel/rail friction level, but which are easier to implement and manage in their respective operations."

Dr. Louisa Stanlake, Global Product Manager - Consumables at L.B. Foster Rail Technologies, says: "Understanding the complex nature of what goes on in the third body layer is crucial. Our customers push us to create value by not only developing consumable products which optimize the wheel/ rail friction level, but which are easier to implement and manage in their respective operations."

Friction management is an issue that is coming more and more to the fore. Among other things, it is driven by the need to extract full-life value from network assets, such as switches and rail, as well as from communities and network users demanding quieter infrastructure and safer, smoother journeys.

"Successful product development activities in this global business requires relevant and timely knowledge, which can encompass the many different facets of the wheel/rail interface," explains John Cotter, Comercial Manager - Americas. One of the keys to L.B. Foster's success is being open to collaboration with leading universities, industry groups and partners to generate this new knowledge. Most recently university partners include:

- > University of British Columbia (Canada)
- > University of Sheffield (UK)
- > Southwest Jiaotong University (China).

Our recent collaboration with the University of Sheffield has resulted in a new paper, co-authored with Professor Roger Lewis and published in Wear (an International Journal on the Science and Technology of Friction, Lubrication, and Wear). The paper discussed the effects of friction management materials on rail with pre-existing rolling contact fatigue surface damage.

For more information or a copy of the full paper from Wear, contact: Dr. Louisa Stanlake Istanlake@lbfoster.com

![](_page_14_Picture_16.jpeg)

# Solutions for Brazil's dual gauge track

L.B. Foster is developing a costeffective friction management solution for dual gauge track applications.

Brazilian railroads operate mainly on two different track gauges:

- broad gauge (1.60 m)
- > meter gauge (1.00 m).

In some areas, the different tracks overlap and produce a 'dual gauge' track. A dual gauge track consists of three rails, allowing the passage of trains of two different track gauges.

Today in Brazil there is 515 km of dual gauge track, divided between different operators.

Two 'gauge' rails are positioned close together (one for each gauge) and a third 'common' rail further away. This means two different gauge trains can operate on the same track, avoiding the need to transfer the cargo to another train or a different mode of transport.

As friction management programs continue to expand in Brazil, local railroads have recognized the need to install gauge face and top of rail trackside friction management systems in dual gauge track territories.

Renata do Carmo Santoro, L.B. Foster's Regional Sales Manager for South America explains: "We worked in partnership with these two railroads to understand their need for a unit which can lubricate three rails per track, as well as precisely identify which gauge to lubricate at which time. As a result, we have applied our technical engineering excellence to re-engineer our existing equipment to meet the customers needs."

Our unique Dual Gauge Trackside System project is the result of this close collaboration, with almost 40 systems now in operation. This system can quickly switch product flow from one gauge rail to the other, while reducing the power draw of the additional control and actuating components. Costs and development time can be significantly reduced by reconfiguring existing components for sensing and product distribution.

For more information contact Joel VanderMarel jvandermarel@lbfoster.com

![](_page_15_Picture_14.jpeg)

![](_page_15_Picture_15.jpeg)

16 2024 FM SPECIAL ISSUE Railroads often struggle in achieving a high friction management program uptime. This can limit the railroad's ability to realize the maximum benefit and return on investment of the program.

Internet of Things (IoT) technology enables railroads to simultaneously maximize the benefits of friction management programs, while reducing the costs associated with operating the program. This includes the ability to easily monitor the uptime of application systems, optimizing application rates and improving insight into the operational status of application systems. It also reduces the track time required to troubleshoot systems, eliminating return visits to systems for maintenance, and reduces the management resources required to effectively run the friction management program.

Beginning in 2017, state-of-the-art remote asset monitoring equipment was installed on 287 trackside application systems (both gauge face lubrication and top of rail friction management) along a 1,400-mile segment of Class 1 heavy haul track. Using monitoring equipment, data analytics and predictive maintenance algorithms, the program efficiently identified, prioritized and scheduled service work. In 2018, the aggregated uptime for this friction management program was 95%.

VanderMarel's paper concludes that using IoT technology, specifically remote monitoring of equipment in rail friction management programs, the program's maximum benefit and return on investment can be realized.

IoT technology allows friction management program operators to continuously monitor the status of their assets, achieve a high aggregated system operational uptime, and minimise costs through efficient use of management and field service resources.

For a copy of the full paper contact Joel VanderMarel jvandermarel@lbfoster.com

![](_page_17_Picture_7.jpeg)

# **Internet of Things** How IoT Optimizes Friction Management in Heavy Haul Track

The benefits of a successfully implemented friction management program for the heavy haul railroad include extended rail life, reduced track damaging forces, reduced rolling contact fatigue, and improved consist fuel economy.

# Silent running

VELOCITY

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# REDUCING RAIL NOISE SPECIAL FEATURE

Pollution from railways is a growing concern in many communities worldwide, as the constant din from trains can severly impact the quality of life for nearby residents. This persistent noise, often caused by rail squeal, wheel-rail contact, and other mechanical interactions, not only disrupts daily activities but also poses significant health risks.

As urban areas expand and more people live closer to railway lines, finding effective solutions to mitigate this noise pollution has become increasingly urgent.

# Managing rail noise at Leeds station

World Health Organisation (WHO) noise guidelines for Europe strongly recommend reducing noise levels produced by railway traffic below a daytime, evening and night average of 54dB. Noise above this level is associated with adverse health effects including annoyance, sleep disturbance, cardiovascular disease and impairment of cognitive performance in children. The WHO also recommends reducing nocturnal rail noise levels to below 44dB, as night-time railway noise above this level is associated with adverse effects on sleep<sup>1</sup>.

Jackie Butterfield, Lead Application Engineer, L.B. Foster Rail Technologies talks about our solution.

<sup>1</sup> Source: International Railway Journal

Building on our reputation for excellence in friction management, Network Rail got in contact to determine if our expertise could be applied to help with persistent noise issues at Leeds station, the fourth busiest interchange outside London with over 30 million passengers each year.

![](_page_19_Figure_6.jpeg)

The key challenge for Network Rail was to deploy effective interventions to reduce noise levels caused by wheel squeal as inbound and outbound trains passed through curves outside the station.

We undertook a series of noise measurements to establish the size of the issue, involving recordings of over 30 different passenger trains entering and leaving the station. This provided a benchmark on which to measure the success of our recommended interventions and future noise reduction strategy.

Four L.B. Foster PROTECTOR IV Top of Rail (TOR) units are already installed trackside outside the station. Three units protect the inbound measurement site, whilst the fourth protects line D in the outbound direction. Leeds station is the terminus of the Leeds branch of the East Coast Main Line (on which London North Eastern Railway provides high speed inter-city services to London King's Cross every half hour from the station) and is an important stop on the Cross Country Route between Scotland, the Midlands and South West England connecting to major cities such as Birmingham, Glasgow, Edinburgh, Derby, Bristol, Exeter, Plymouth and Penzance. There are also regular inter-city services to major destinations throughout Northern England including Manchester, Liverpool, Newcastle and Sheffield. It is also the terminus for trains running on the scenic Settle to Carlisle Line. Future expansion will link the station to the proposed High Speed 2 (HS2) network.

For more information contact Jackie Butterfield jbutterfield@lbfoster.com

# Taking it to the street

The TOR applicator dispenses KELTRACK water based friction modifier to resolve noise issues. St. Kilda Road is the busiest tram corridor in the world, with headways almost every minute during peak hours.

Melbourne's Yarra Tram

network is the largest in the

world and arguably the most

iconic feature of a city known

for its culture. food and wine.

events and multiculturalism.

![](_page_20_Picture_3.jpeg)

Melbourne has more than 1,750 tram stops and carries more than 200 million passengers every year across its 450-strong fleet of trams. Keolis Downer is the current custodian of the world's largest tram network, with 250km of double track.

Thinking like a passenger, Yarra Trams installed an embedded track wayside Top-of-Rail (TOR) applicator to tackle the issue of severe tram wheel squeal noise problems on St. Kilda Road in south of Melbourne CBD. The TOR applicator dispenses KELTRACK water based friction modifier to resolve this issue. St. Kilda Road is the busiest tram corridor in the world, with headways almost every minute during peak hours.

Tony Makowsky is Regional Manager - Australasia Field Service & Customer Support at L.B. Foster: "The high-density traffic conditions in the St. Kilda Road area includes road, tram, pedestrian and bicycle traffic. It demanded a unique, non-obtrusive and environmentally friendly solution to resolve the squeal issue.

"Yarra Trams worked with L.B. Foster Rail Technologies to incorporate a customdesigned L.B. Foster PROTECTOR® IV (PIV) DC solar-electric TOR application system. We built this into the existing bitumen surface and crushed rock with concrete slab embedded track structure, so that the track structure design integrity and operating symmetry with all other local traffic types was effectively and safely maintained."

Once installed, the TOR application system was programmed to dispense a small quantity of KELTRACK Trackside Transit (KTT) friction modifier product in advance of each tram. KTT is a water-based friction control product that has been successfully deployed by several transit railways globally to mitigate wheel squeal and other track-based problem noise conditions.

On the St Kilda Road TOR site, subsequent noise monitoring results confirmed a significant reduction in problem noise events following the installation of the TOR wayside equipment. This was combined with positive feedback from residents in the area. With wheel squeal generation mechanisms being comparable to those precipitating accelerated rail wear, rolling contact fatigue (RCF) and corrugations, similar positive abatement results are expected for these problem conditions within the same St. Kilda Road curves receiving TOR friction control.

For more information contact Joel VanderMarel jvandermarel@lbfoster.com

# Reaching for the sky

The Vancouver SkyTrain is a fullyautomated, driverless, light rapid transit system with three integrated routes serving the Metro Vancouver area. The service is operated by TransLink, Metro Vancouver's transportation network. Unusually high noise levels on SkyTrains were raising concerns about whether it might be harmful to the health of passengers and nearby residents.

The SkyTrain system's steel wheels on steel rails were creating noise levels which, in some areas, exceeded 90 dBA in residential neighborhoods.

In response to noise concerns from residents, TransLink completed a SkyTrain Noise Study to assess current noise levels along the SkyTrain system and to evaluate possible noise-mitigation options.

Noise levels were assessed through extensive measurements in 10 study areas along the Expo and Millennium lines. The results were used to create a detailed sound model, which highlighted sources of noise that exist in the SkyTrain system and areas most in need of noise mitigation measures. SkyTrain pass-by noise levels of 75 dBA or less are generally considered acceptable inside typical residential façades with windows closed.

Six noise mitigation measures were studied, including:

- Improvements to switch maintenance practices
- Investigation of harder rail steel as a measure to improve long-term rail condition
- Re-introduction of top of rail friction modifiers (TORFM) to improve longterm rail condition
- Improvements to rail grinding practices to improve long-term rail condition
- Rail dampers to reduce noise radiated from the rails and reduce overall noise
- Creation of guidelines for new developments near SkyTrain.

# Our solution

L.B. Foster KELTRACK water-based drying friction modifier was successfully tested as mitigation measure #3. For this test, the study meticulously measured corrugation (rail roughness) over three years to control for seasonal environmental factors. Baseline corrugation was present in both curved and tangent track. The curved track area was 450m (1500ft) in radius. Annual tonnage was 18 MGT and track speed was 80 kph (50 mph).

### The results

Without the use of TORFM, SkyTrain pass-by noise levels would rise by about 8 dBA over three months above best case conditions after grinding. They would then rise further from that level over the next three months, by about 1-2 dBA. Grinding was being conducted every three months to limit the total increase to below 10 dBA.

With the use of KELTRACK Friction Modifier, SkyTrain pass-by noise levels rose almost not at all in the first three months, and then only by about 5 dBA or less over the next three months. The end result was that noise levels were 8-9 dBA quieter three months after grinding, and 5-7 dBA quieter six (6) months after grinding. Due to the dramatic reduction in noise levels with the use of KELTRACK Friction Modifier, combined with the large potential savings from reduced grinding requirements, the Noise Study recommended that L.B. Foster Friction Modifiers should be implemented networkwide. This could be achieved in two forms. One with KELTRACK being applied in liquid form to specific areas of track, and the other with KELTRACK being applied in solid "stick" form directly to the wheels.

Both methods are successful at introducing KELTRACK Friction Modifier into the wheel-rail interface. This treatment can reduce rail wear and slow down the growth of rail corrugation. To get the most benefit from friction modifiers, rail grinding to remove corrugations is also required

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![](_page_22_Picture_21.jpeg)

AMERIC RETURN DANKS

Noisy trams get the silent treatment on set of UK's top TV drama

23 ELOCITY

# The cast of Coronation Street, the world's longest-running soap opera, no longer face daily disruption from tram noise following the installation of an innovative new trackside friction management solution by L.B. Foster Rail Technologies.

The interrupting high pitched sound of metal-on-metal was generated as trams on the new £350m Trafford Park Metrolink line in Manchester negotiated tight curves in front of the ITV Studios. Installed trackside, our embedded Top of Rail (TOR) friction modifier system is the first commercial installation of its kind in Europe using our unique new TOR Foam Bar.

**Mat Holland**, Global Product Manager - On-Board Spray, L.B. Foster Rail Technologies, explains: "Coronation Street is full of firsts. It holds the title for the first TV soap opera to reach the age of 50. Now it's benefiting from the first application of our new TOR Foam Bar."

We worked on the project with MPT, a joint venture of Laing O'Rourke, Thales and VolkerRail, on behalf of Transport for Greater Manchester. The project required two modified PROTECTOR® IV units, installed and commissioned by L.B. Foster, with a 15-month support package. The Trafford Park Metrolink line connects the Trafford Centre to the existing network.

Andrew Biddulph is Mechanical Engineer, L.B. Foster Rail Technologies (UK) : "Transport for Greater Manchester requested a cabinet design in keeping with the local urban environment. We developed a new cabinet design that offers a clean, street-friendly alternative to our standard PROTECTOR® IV. All cable and hose connections are made through the base of the cabinet. The system comprises all the standard PROTECTOR® IV components, with the addition of a new vibration sensor that can be adjusted on-site to suit the installation environment.

L.B. Foster Rail Technologies' PROTECTOR® systems are sited on pavements or at road junctions for In-street applications and are enclosed in vandal-proof steel cabinets for security and protection.

Distribution bars are placed below ground in steel enclosures, which are then embedded in the road. The distribution bars are accessible via the steel enclosure tops for routine maintenance and inspection. The in-street PROTECTOR® system provides a tamper-proof solution to rail friction management, whilst still providing road vehicles with an unobstructed route of travel through urban environments.

For more information contact **Richard Steel** rsteel@lbfoster.com

![](_page_24_Picture_10.jpeg)

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![](_page_25_Picture_31.jpeg)