



PRODUCT BROCHURE

FRICITION**MANAGEMENT**

For Passenger Railroads





WE INNOVATE TO SOLVE GLOBAL INFRASTRUCTURE CHALLENGES

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1.0 Total Friction Management Philosophy

L.B. Foster is the market leader in the application of **Total Friction Management® (TFM)** solutions for freight railroads. With over 40 years of industry experience and expertise, L.B. Foster is recognized as the global leader in Friction Management (FM) at the wheel/rail interface. We leverage our core values of integrity, innovation, and teamwork to bring complete solutions to rail operators around the world.

What is Total Friction Management?

We find the best outcomes are achieved in a collaborative environment that focuses on teamwork and respect.

Total Friction Management is working together to systematically assess, implement, validate, and maintain an optimized friction management program that meets the goals of your railroad.

Our mission is to work with you, the agencies, operators, designers, and suppliers, to understand the real advantages of friction management and identify how it can achieve your key goals. Benefits of a properly implemented FM program include:

Extend rail and wheel life

Control squeal and flanging noise

Reduce rail defects and corrugation

Reduce grinding and milling costs

Improve fuel economy and associated reductions in greenhouse gas (GHG) emissions

Reduce derailment potential (wheel climb)

Reduce lateral forces

Better ride quality or improve steering

Our world-leading expertise, equipment, consumables, and support services deliver solutions that maximize the Return on Investment for any budget.

Your "One Stop Shop" for Friction Management Needs

L.B. Foster is positioned to the passenger rail market as the only single source provider of a complete portfolio of products and services that address the needs for friction control.

FUCHS Partnership

Our partnership brings similar core values, expert people, a best-in-class support mentality and a shared vision to advance innovation.

Together, we bring the widest available, market leading portfolio of lubrication solutions and services from a single dedicated source, delivering rail lubrication around the world.



2.0 Understanding Friction Management

Lubricants

L.B. Foster has a complete portfolio of **Rail Curve Greases** for trackside application to the rail gauge face. These products reduce the friction to very low levels between the wheel and rail. These low friction conditions help to reduce rail and wheel wear, flanging noise, derailment potential, and fuel consumption.

Friction Modifiers

L.B. Foster's **KELTRACK®** water-based drying friction modifiers are applied to the top-of-rail via trackside or on-board application. These products create an intermediate friction level and positive friction conditions between the wheel and the rail. These features help to reduce rail wear, fuel requirements, squeal noise, lateral forces, rolling contact fatigue formation, and rail defects. L.B. Foster manufactures a complete line of **KELTRACK®** Friction Modifiers for the rail market.

Traction Enhancers

L.B. Foster's **ALLEVIATE® Traction Enhancers** are applied to the top-of-rail. They increase the friction between the wheel and the rail to ensure maximum traction and braking performance. These products can be used seasonally or year-round to enhance friction in areas where traction or braking performance is critical.



Trackside or On-Board?

L.B. Foster has developed a comprehensive range of both trackside and on-board solutions for applying friction management materials. As the global FM experts, we can work with you to implement friction management anywhere it is required in a manner that provides the best return on investment. Our commitment to making a solution work for you is what makes L.B. Foster the market leader.

Trackside Application Systems

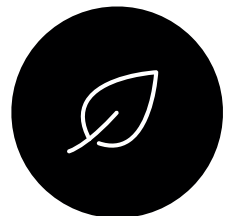
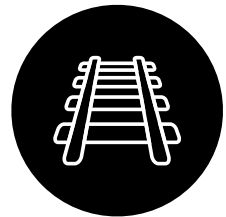
L.B. Foster's broad portfolio of state-of-the-art electric **PROTECTOR®** and **Traction Gel Applicator (TGA)** systems are the industry standard, with decades of proven in-field performance and reliability. All L.B. Foster trackside systems can be equipped with our **Remote Performance Monitoring (RPM)** platform, allowing railroad owners and system maintainers to remotely manage their assets and gain insight into their operation. This technology helps to maximize uptime and minimize the operating costs and track time associated with maintaining an FM program.

On-Board Application Systems

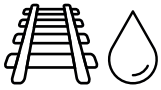
On-board application systems are installed on the rolling stock. L.B. Foster pioneered the **Solid Wheel Flange Lubricant Stick** and the **Solid Wheel Tread Friction Modifier Stick** application system that continues to set the benchmark for quality and performance today. We have also developed a **KELTRACK On-Board® (KOB)** liquid spray system for customers that want the benefits of broad top-of-rail FM coverage while eliminating the track access requirements of a trackside friction management program.

Safety and Sustainability

L.B. Foster is committed to improving sustainability performance, both internally and by helping our customers achieve their safe operations and carbon goals. Friction Management is a proven method of reducing noise pollution, derailment potential, locomotive fuel consumption, and can play a key role in reducing operational greenhouse gas emissions in track infrastructure. Furthermore, L.B. Foster has a complete portfolio of contamination retention products and consumables with environmental attributes, including biodegradable greases, to meet our customer needs.



3.1 Trackside Friction Management



Innovation and integrity are core values at L.B. Foster, and we continue to combine our in-house state-of-the-art wheel/rail interface testing facility with rigorous scientific analysis and on-track field testing to bring you the next generation of trackside friction management products. This pursuit of excellence highlights our core objective of providing our customers with the world's most advanced friction management products that will consistently and reliably protect the wheel/rail interface.

Trackside Application Systems

Built on over 40 years of in-service experience and continuous technological innovation, L.B. Foster's **PROTECTOR®** systems are known to be:

- > Exceedingly reliable
- > Easy to maintain
- > Consistent and precise in their application rate. Our innovative control system uses proprietary compensation algorithms to seamlessly adapt to changing operating conditions and consistently outputs the correct amount of lubricant or friction modifier.

PROTECTOR X

L.B. Foster's all new **PROTECTOR X** system provides unsurpassed performance, reliability, and ease of maintenance in both gauge face and top of rail friction management applications.

Key Design Features:

- > A steep-walled, conical product compartment ensures first-in, first-out product utilization and can provide up to 100% product utilization before refilling.
- > Large electrical and product compartments make maintenance and filling quick and easy.

PROTECTOR X is available in a Slimline 90 litre (SL90) size, as well as larger 400#, 800# (100 Gal) and 1,250# (156 Gal) configurations – both single and dual track.

PROTECTOR IV

Our legacy **PROTECTOR IV** is available in 160#, 200# (25 Gal), 800# (100 Gal), 1250# (GF only), and 200 Gal (TOR only) tank capacities with multiple configurations, including dual track, to custom fit your track and traffic conditions. A Slimline 300 litre (SL300) size is also available.

Applicator Bars

L.B. Foster's patented applicator bars are the industry standard, combining effective placement of greases or friction modifiers to the wheel/rail interface with long life cycle value.

For gauge face application, our next-generation short **MC-5 Gauge Face Applicator Bar**, combined with our **GREASEGUIDES®**, maximize grease pick-up and carry-down while reducing waste.

For top-of-rail application, our **TOR foam bars** maximize friction modifier placement to the wheel flange / top-of-rail interface.



3.2 Remote Performance Monitoring



L.B. Foster's **Remote Performance Monitoring (RPM)** system provides immediate, intuitive insight into the operating performance of friction management assets. We know that a successful friction management program comes down to three key tenets:

1. Maximize system uptime
2. Optimize application rates
3. Minimize the cost of running the program

Our **RPM** platform is built specifically around helping railroads achieve these goals. As the global Friction Management experts, our **RPM** system is filled with tool sets that makes managing your FM program easy.

RPM provides high level insight into the performance of entire territories, while allowing you to drill down and troubleshoot problems at the system level.

With RPM you can easily:

- > Check system uptime for both individual units and territory performance
- > Optimize maintenance activities and minimize track access requirements
- > Troubleshoot systems remotely
- > Turn systems on and off remotely
- > Monitor key system parameters including product levels, power levels, temperatures, product application rates, and many more
- > Be notified immediately of system alarms, problems, or key operational information



Stand-Alone RPM Device

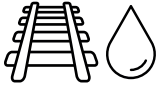
L.B. Foster is introducing the Stand-Alone RPM device, a new product capable of easily adding RPM to existing trackside application systems without the need to replace existing control systems.

The Stand-Alone RPM device is compatible with both L.B. Foster and competitor trackside systems, allowing FM programs consisting of multiple equipment types to all be managed by a single portal.

RPM can help you improve scheduling of maintenance activities, reduce track access requirements, and get the most out of your investment.



3.3 Trackside Consumables



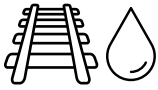
Gauge Face Lubricants

Our gauge face grease portfolio starts with **SYNCURVE® Transit**, an exceedingly durable all-season rail curve lubricant giving the customer flexibility of either employing a lower application rate for existing spaced lubricators (up to 50% lower) or increasing lubricator spacing using current application rates. **SYNCURVE Transit** provides excellent protection in the wheel flange/gauge face interface and is ultimately biodegradable.

Along with **SYNCURVE Transit**, we also provide a full range of high-performance and environmentally friendly gauge face lubricants including:

- > **ALLCURVE®** is a cost-effective all-season petroleum grease that meets adhesion, pumpability and load carrying requirements at all operating temperatures. **ALLCURVE** eliminates the need to inventory both summer and winter grades as part of your gauge face lubrication program
- > **DURACURVE® PRO** is a highly durable rail curve grease that has extended carry distances and excellent wear protection. **DURACURVE PRO** has been formulated to optimize the pumpability, adhesion and water resistance required in the wheel/rail environment. **DURACURVE PRO** is currently available in a summer grade.
- > **BIOCURVE® LB2** is a premium quality, all-season, readily biodegradable rail curve grease formulated with vegetable oils. **BIOCURVE LB2** has exceptional product stability and lower propensity for bar clogging compared to other biodegradable greases. This product is recommended for locations requiring the highest level of biodegradability, such as near waterways or other environmentally sensitive areas.





Top-of-Rail Friction Modifiers

A good friction management program is not complete without top-of-rail friction modifier application. L.B. Foster's line of water-based **KELTRACK®** friction modifiers products are proven to help achieve benefits of **Total Friction Management**.

Rail and wheel wear is associated with damage to surfaces, which usually involves progressive loss of material, RCF and/or plastic flow. The application of top-of-rail products reduces creepage forces, improves the steering behaviour of the vehicle, and reduces locomotive fuel and energy requirements. The optimized coefficient of friction on the top-of-rail reduces wheel tread/rail head wear, wheel flange/rail gauge face wear, mitigates noise, and extends the time to formation of corrugations and RCF damage. Wear and RCF reductions can be directly translated into extension of rail grinding, wheel truing cycles as well as overall rail and wheel life.

High lateral forces are known to cause track structure degradation and high rates of wheel/rail wear besides other unwanted effects. Flange climb derailments are also a direct result of the lateral force becoming proportionately too high. The magnitude of lateral forces can be influenced by many factors, such as track geometry and wheel/rail profiles, but also friction conditions. Application of top-of-rail friction modifier products directly reduce lateral forces by providing an intermediate coefficient of friction and improving steering behaviour. This effect can be seen in curves and at features such as switches and crossings.

The **KELTRACK** product line of friction modifiers are true water-based products, that contain no oil or grease. The products are non-flammable, non-volatile and environmentally friendly. After application to the top-of-rail the water will evaporate to form a thin film of friction modifying solids, resulting in an intermediate friction level on the top-of-rail. This intermediate friction level will provide the friction management benefits without negatively impacting vehicle braking or traction or track signalling systems. L.B. Foster's top-of-rail product line is outlined below:

- > **KELTRACK Transit EX** is a premium, all-season, top-of-rail friction modifier with extended carry-down capabilities for use in the passenger rail environment. With this innovative product, L.B. Foster took our world leading **KELTRACK Trackside Transit** friction modifier technology and developed an enhanced formulation that provides increased coverage at all operating temperatures while continuing to provide excellent protection in the wheel/rail interface. **KELTRACK Transit EX** has been designed to have enhanced film durability, improved corrosion resistance, and an exceptionally low freezing point.
- > **KELTRACK Trackside Transit** is a durable top-of-rail friction modifier which provides excellent wear protection and effective carry down in the passenger rail environment.



3.3 Trackside Consumables



Trackside Traction Enhancement

Adhesion between vehicle wheels and rails is dictated by top of rail surface conditions/contamination. This contact surface is critical for transmitting braking and traction forces and can be adversely affected by several phenomena, such as morning dew, damp weather, the onset of light rain, and the seasonal problem of autumn leaf fall. Fallen leaves are drawn on to the track and are subsequently compacted by vehicle wheels creating a very slippery surface which is particularly exaggerated in the presence of moisture. It has also been found that in some situations, the compacted leaf layer electrically isolates the wheels from the rails resulting in false signalling readings/reports.

L.B. Foster's line of rail traction enhancers are designed to improve adhesion conditions at the wheel/rail interface. **ALLEVIATE® Rail Traction Enhancer** is designed for use on all locations and at all times of the year where loss of traction could be an issue. As **ALLEVIATE** is a water-based gel, it can be applied directly on to the rail head and is proven not to interfere with track signalling. It achieves this by a combination of abrasive action to weaken and remove hardened leaf layers and placement of sand particles directly on the rail head to provide grip between wheel and rail. The range of **ALLEVIATE** products are as below

- > **ALLEVIATE** is a water-based rail traction enhancer that consists of an engineered composite of abrasive solids. The freezing point of **ALLEVIATE** is 21 °F (-6 °C) and can be used in most locations for leaf fall adhesion issue mitigation.
- > **ALLEVIATE LT** is the low temperature version of the **ALLEVIATE** with an improved freezing point of 3.2 °F (-16 °C) for use in colder climates.



Other Track Protection Consumables:

- > **L.B. Foster Switch Lubricant** is a premium quality, clean, synthetic lubricant that can be easily applied manually, using spray equipment, or L.B. Foster's Switch Plate Lubrication system. **L.B. Foster Switch Lubricant** has been formulated to have excellent low temperature properties and can be used in all seasons. The oil-based product is water insoluble and will not be washed away by rain or melting snow. Unlike solvent-based switch lubricants, **L.B. Foster Switch Lubricant** is not flammable or self-igniting and is inherently biodegradable, resulting in minimal environmental impact.
- > **Kolligeeen SP MS** is an all-weather switch plate lubricant, that is a suspension of highly lubricious graphite and special stabilizing agents in a quick-drying carrier. Unlike grease or oil, **Kolligeeen SP MS** will not hold dirt, dust, or scale. The dried coating is non-corrosive and capable of withstanding considerable periods of rain, snow, ice and abrasion while maintaining its lubricity and anti-stick characteristics. **Kolligeeen SP MS** is an exceptionally effective and durable lubricant for exposed metal-to-metal contact areas commonly found in the railroad industry. **Kolligeeen SP MS** has the additional benefit of a significantly higher flash point than conventional xylene-based switch plate lubricants.



3.4 Environmental Products



Track Mats

L.B. Foster track mats address the problems of ground and ballast contamination, providing a simple and cost-effective solution for maintaining a clean, safe site. All L.B. Foster track mats have excellent durability and are highly resistant to ultraviolet deterioration, solvents, puncture, excessive temperatures, moisture, and high-volume traffic.

L.B. Foster's **GTPlus75** mats are made of an engineered geocomposite comprised of polymeric fibers needle-punched into a stable fabric capable of retaining large amounts of bulk and dissolved hydrocarbons before they reach the ground surface yet permits water to pass through.

Key features include:

- > Permits water to pass through while retaining greases and absorbing any oils or other hydrocarbons
- > Highly durable triple-layer construction
- > Designed to maintain strength when saturated for easy removal and disposal
- > Fast and easy installation and removal. Resistant to installation damage
- > Custom widths and lengths available

L.B. Foster's **GTPlus75** track mats are suitable for both trackside FM system sites and locomotive refuelling and ready-station sites.



At trackside FM system sites, **GTPlus75** track mats are placed over the ties, protecting the soil and ballast from contamination.

Used in railroad locomotive refuelling applications and ready-station sites, **GTPlus75** provide effective leak and drip control underneath most types of rolling stock and track maintenance equipment.



MATMATE BARTENDER Grease Collection Trays

The **MATMATE BARTENDER** grease collection tray provides an effective solution to control grease contamination that collects around rail-mounted applicators at lubrication sites. Excess grease can be an environmental and safety concern as well as a nuisance to those responsible for the maintenance of these applicators. Grease accumulation is more concentrated at the rail-mounted applicators than anywhere else at the site. To help keep sites cleaner and safer, L.B. Foster Rail Technologies offers the **MATMATE BARTENDER** grease tray to facilitate easy collection and disposal of excess grease. It is a simple, low-cost supplemental device for trackside lubrication sites that use **GTPlus75** track mats and is not intended as a stand-alone appliance. It fits standard and extended length applicator bars, is made from **100% recyclable materials**, and is easily disposable.

- > Light weight, made from 100 % polypropylene recyclable corrugated plastic with UV stabilization
- > Resistant to most oils, solvents, and water; Will perform under adverse weather conditions

4.0 KELTRACK On-Board



With over 25 years of proven performance in the field, L.B. Foster's **LCF solid stick systems** are installed on over 35,000 passenger cars in the world today. Use of L.B. Foster's lubricant solid stick **LCF** is proven to extend wheel life by reducing wheel flange wear. Coupled with a premium solid lubricant, our patented interlocking design maintains optimal levels of lubrication and wheel flange protection with little or no waste while lasting substantially longer (up to 7x longer) than competitor sticks. L.B. Foster also supplies an alternative lubricant stick **LCF-S2**, that provides a balance between cost and performance. The solid sticks have a high temperature resistance and high lubricant film durability with a corresponding low coefficient of friction. The solid sticks are also non-toxic and not considered flammable.

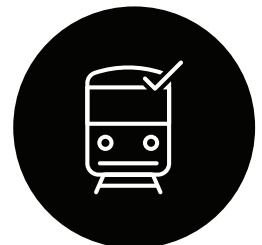
Key benefits of L.B. Foster's **LCF** include:

- > **Greater than 40% savings in wheelset replacements and wheel truing costs**
- > **Extending wheel replacement intervals by greater than 2.5 times**
- > **Extension of wheel truing intervals by greater than 1.5 times**
- > **Payback of wheel flange lubrication implementation is often less than 1 year**

Other advantages of **wheel flange lubrication** are:

- > **Extends rail gauge life**
- > **Reduces risk of low-speed wheel climb derailments**
- > **Reduces energy consumption**
- > **No effect on vehicle traction or braking**

L.B. Foster has standard hardware designs for many train OEM models, or can provide custom designed hardware to fit specific rolling stock.



5.0 Wheel Tread Treatment



L.B. Foster's **HPF (High Positive Friction)** solid stick system is an on-board friction modifier designed to reduce tread wear, corrugation, and noise.

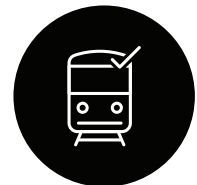
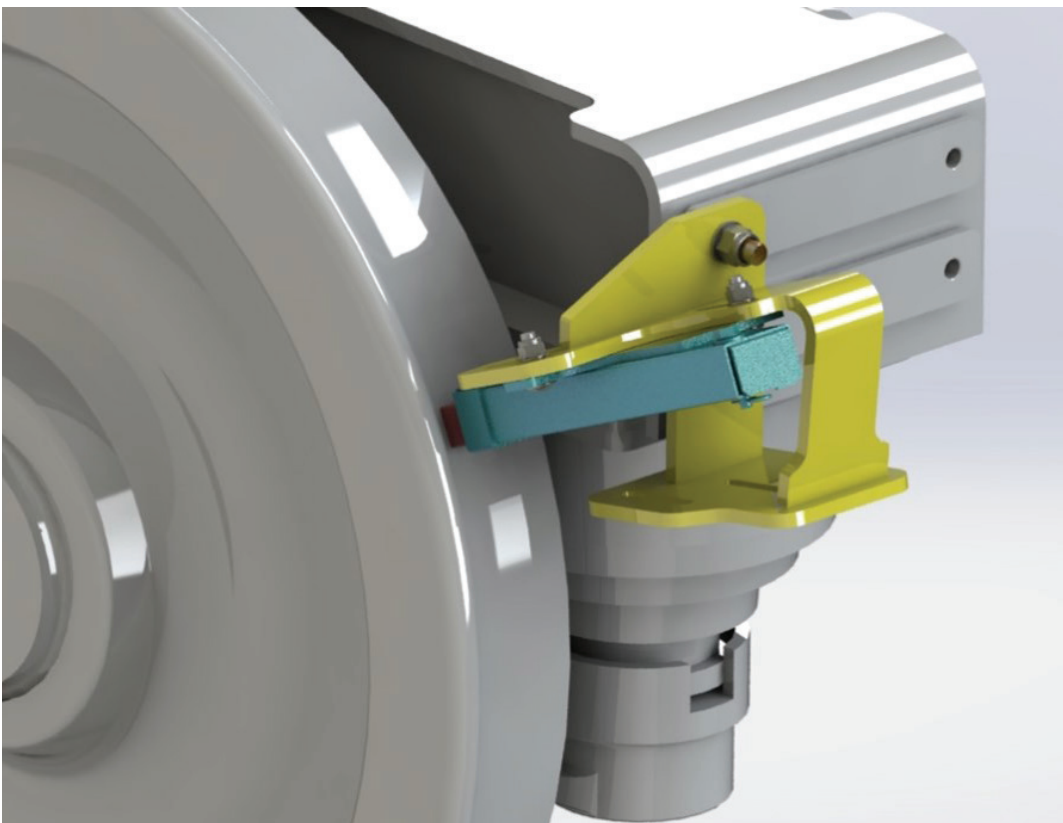
The **HPF** material creates a micron-thin film layer between the wheel tread and the top of rail, providing an intermediate friction level at the wheel/rail interface.

In addition to reducing tread wear, application of HPF helps to control wheel squeal noise and reduce the onset of short pitch corrugations after grinding.

Unlike traditional lubricants, such as oil and grease, HPF has no detrimental impact on braking or traction.

Key benefits:

- > **Reduces wheel tread wear and wheel hollowing**
- > **Reduces short pitch corrugations**
- > **Reduces rail replacement costs**
- > **Reduces lateral forces**
- > **Reduces energy consumption**
- > **Environmentally clean and safe**
- > **No reduction in performance at high speed.**



6.0 KELTRACK On-Board



KELTRACK On-Board (KOB) SL is a vehicle mounted top-of-rail spray application system that dispenses an atomized stream of **KELTRACK** friction modifier (**KELTRACK AP EX**) to the top-of-rail to control the friction between top-of-rail and wheel tread at an intermediate level. It is the only commercially available system specifically optimised to apply **KELTRACK AP EX**.

Benefits include:

- > Greater than 30% extension in rail life
- > Field proven to prevent the onset of RCF, reduce lateral forces, noise, and corrugation
- > Field proven to lower energy and fuel consumption by 2-8%
- > Does not compromise traction or braking performance
- > Does not compromise track signalling

The KOB SL delivers extremely accurate media output and control across the full operating velocity range of the vehicle with output volumes set to a per distance basis. The system can communicate its operational status directly to a Train Control and Management System (TCMS). Early maintenance alarms facilitate preventative maintenance which maximises system uptime. A range of application strategies can be employed, tailored to the specific location and operating conditions of the vehicle. Spray activations can be triggered via a range of input options such as GPS/GSM module (optional extra to base system), trackside tag readers, or the TCMS.

The L.B. Foster dispensing nozzle, designed and engineered specifically for the application of **KELTRACK AP EX**, ensures product transfers efficiently and consistently to the railhead across a wide range of operating velocities and conditions with only the minimum of maintenance required.

KELTRACK AP EX is a premium water-based top-of-rail friction modifier, that contains no oil and provides intermediate friction levels between the wheel and rail. It has a very low environmental impact, using latest technology in environmentally friendly raw material components.

Key Design Features:

- > Highly accurate control system ensures consumable usage is efficient and operator costs are fully optimised
- > Able to interface with a wide range of activation inputs to suit operator requirements
- > Improved safety for maintenance personnel through migration of maintenance activities to workshop environment
- > Output volumes adjust to vehicle speeds to provide consistent and highly accurate application control
- > Intelligent refilling system (quick connect and auto-stop) to reduce maintenance times



7.0 Field Applications and Services



L.B. Foster's Field Applications and Service Team

offers wide range of both pre and post friction management program implementation services to ensure the best possible program benefits and Return on Investment. L.B. Foster's team of field services professionals currently service all makes and models of equipment.

Our field services include:

- > Equipment installation and commissioning
- > Equipment maintenance and repairs
- > On-site training for trackside and on-board equipment maintainers
- > Bulk filling solutions
- > On-site and on-call support

Additional field applications services include:

- > Friction Management placement studies and implementation proposals
- > Preliminary track and trackside equipment inspections
- > Equipment and consumable trials
- > Cost-Benefit Analysis and FM Program recommendations to ensure programs provide Total Cost of Ownership and Internal Rates of Return that meet customer expectations
- > Precise measurement of friction, noise, rail wear, and wheel wear
- > Ongoing data analysis and monitoring to ensure FM programs are running optimally

Why Bulk Fill?

L.B. Foster's philosophy is that a properly executed FM program can deliver **sustainable, measurable benefits** such as wheel and rail wear reduction, RCF reduction, and fuel savings. A bulk filling program can be a critical component in a friction management program. It can be a **cost-effective solution** that will help to fully capture these benefits by **increasing operating efficiencies, improving safety performance, and optimizing a critical friction management program.**





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