PRODUCT BROCHURE

Friction Management

For Shortline, Industrial & Regional Railroads


LBFoster

INNOVATING TO SOLVE GLOBAL INFRASTRUCTURE CHALLENGES

CONTENTS

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 railway owners and operators, 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:

- **Extended rail and wheel life**
- **Improved fuel economy and associated reductions in greenhouse gas (GHG) emissions**
- **Reduced derailment potential (wheel climb)**
- **Avoidance of rolling contact fatigue (RCF)**
- **Reduction or mitigation of rail corrugation growth**
- **Reduced lateral forces**
- **Reduction of squeal and flanging noise**
- **Better ride quality or improved 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 freight 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

Trackside 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, lateral forces, rolling contact fatigue formation, and rail defects. L.B. Foster manufactures a complete line of **KELTRACK®** Friction Modifier liquids for the freight 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 **Anatomy Asset Intelligence™ (formerly 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** 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 Application Systems

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 multiple tank sizes and configurations:

- **Single Track Application**
  - **240** (115 L / 30 Gal / 240 lb / 110 kg)
- **Single or Dual Track Application**
  - **400** (190 L / 50 Gal / 400 lb / 180 kg)
  - **800** (380 L / 100 Gal / 800 lb / 360 kg)
  - **1250** (610 L / 160 Gal / 1250 lb / 560 kg)

PROTECTOR IV

Our legacy **PROTECTOR IV** system is available in our standard **200 lb, 800 lb**, **1250 lb**, and **200 Gal** (TOR only, 755 L) tank capacities with multiple configurations, including dual track, to custom fit your track and traffic conditions.

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** or our long **MC-4XL Applicator Bars**, 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.

TGA3

L.B. Foster's **TGA3 Traction Gel Applicator** system works with our ALLEVIATE® Rail Traction Enhancer to deliver reliable adhesion enhancement in all operating environments - from year-round low adhesion trouble spots to autumn's treacherous leaf fall.

The **TGA3** combines a 75 L (20 Gal) tank, dual peristaltic pump assemblies, and specifically designed applicator bars to ensure even product distribution to each rail.

3.2 Anatomy Asset Intelligence

Anatomy Asset Intelligence

L.B. Foster's **Anatomy Asset Intelligence™** system provides immediate, intuitive insight into the operating performance of friction management assets. Formerly known as **Remote Performance Monitoring (RPM)**, L.B. Foster is combining all in-house remote asset management platforms under the **Anatomy** brand.

We know that a successful friction management program comes down to three key tenets:

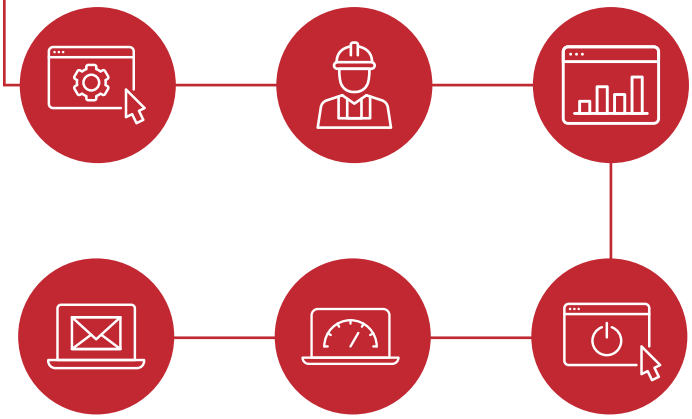
1. **Maximize system uptime**
2. **Optimize application rates**
3. **Minimize the cost of running the program**

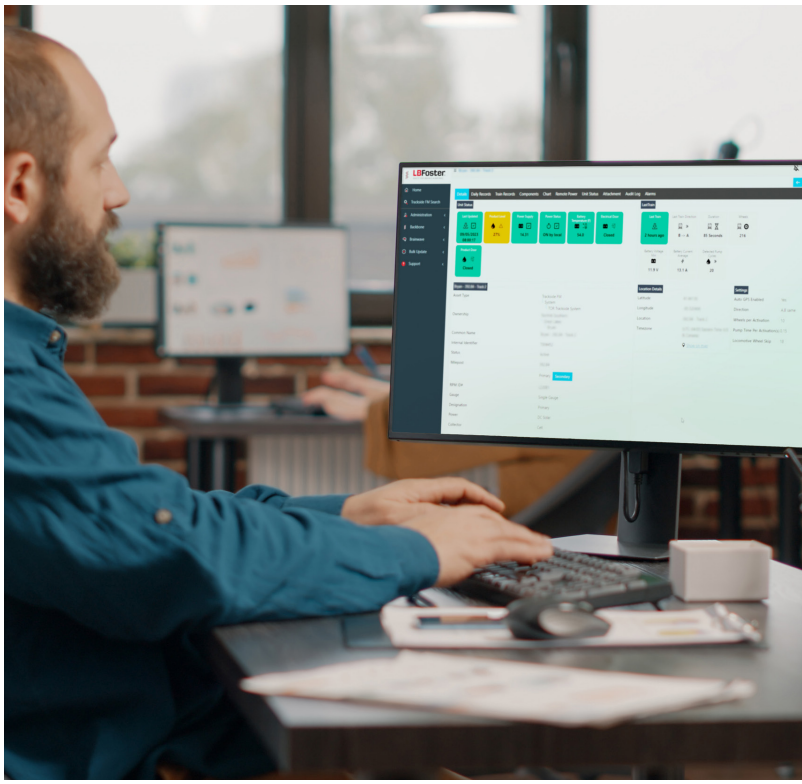
Our **Anatomy** platform is built specifically around helping railroads achieve these goals. As the global Friction Management experts, our **Anatomy** system is filled with tool sets that make managing your FM program easy.

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

With **Anatomy** 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 **Anatomy** 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.

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

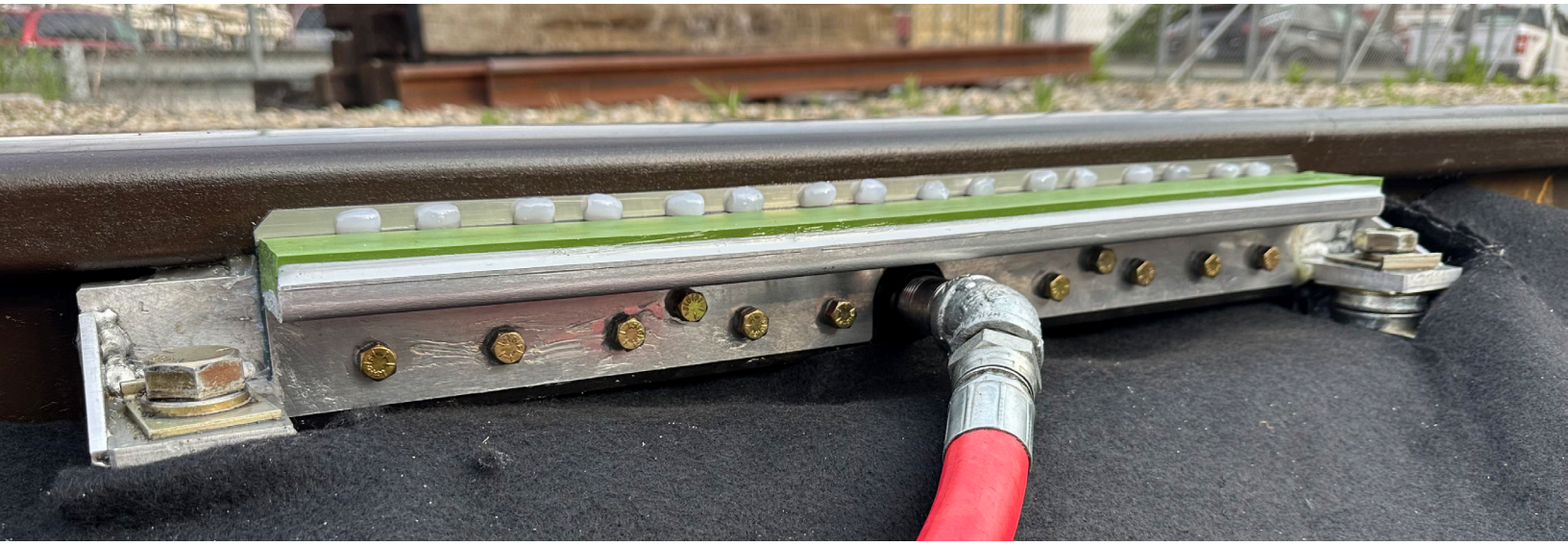
3.3 Trackside Consumables

Gauge Face Lubricants

Our gauge face grease portfolio starts with **SYNCURVE®**, 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** provides excellent protection in the wheel flange/gauge face interface and is ultimately biodegradable.

Along with **SYNCURVE**, 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.
- **DURACURVE® CE** is a grease specifically designed to provide good wear protection, weather resistance, and effective carry-down at an economical cost. **DURACURVE CE** is currently available in a summer and winter 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 or oil-based **INFINITRACK®** 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, Rolling Contact Fatigue (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. This intermediate friction level will provide the friction management benefits without negatively impacting vehicle braking/traction or track signalling systems. L.B. Foster's top-of-rail product line is outlined below:

- **KELTRACK ER Plus** is a premium, all-season, top-of-rail friction modifier with extended carry-down capabilities for use in the freight environment. With this innovative product, L.B. Foster took our world leading **KELTRACK ER** 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 ER Plus** has been designed to have enhanced film durability, improved corrosion resistance, and an exceptionally low freezing point.
- **KELTRACK ER** is a durable top-of-rail friction modifier which provides excellent wear protection and effective carry down in the freight environment. **KELTRACK ER** has exceptional product stability and is available in a summer grade.
- **INFINITRACK** is an exceedingly durable oil-based, all-season TOR lubricant which provides excellent protection in the wheel/rail interface. **INFINITRACK** has been proven to carry for over 8 miles under heavy haul conditions. Developed for territories without significant grades, **INFINITRACK** can help significantly reduce the cost of a Friction Management Program while delivering all the benefits.

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 or using spray equipment. **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.
- **Kolligeen 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, **Kolligeen 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. **Kolligeen SP MS** is an exceptionally effective and durable lubricant for exposed metal-to-metal contact areas commonly found in the railroad industry. **Kolligeen SP MS** has the additional benefit of a significantly higher flash point than conventional xylene-based switch plate lubricants.
- **ROLLCONTROL** is an oil-based lubricant specifically formulated to manage friction for rail car wheels at classification and hump yard locations. **ROLLCONTROL** provides a consistent low coefficient of friction to control rolling behavior, reducing car stalls and speed-inhibiting high friction levels. **ROLLCONTROL** drastically reduces "shorts" - cars stopping short of their intended class track destination - which mitigates the time-consuming switching moves needed by yard crews to correct a short. **ROLLCONTROL** is water insoluble and will not be washed away by rain or melting snow. It is not flammable or self-igniting and is inherently biodegradable, resulting in minimal environmental impact. **ROLLCONTROL** is compatible with typical yard application systems.

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.

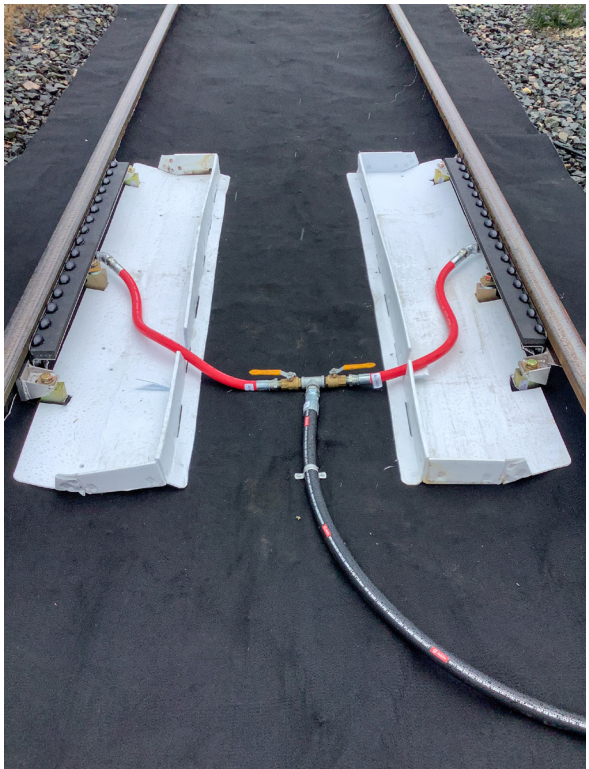
Key features include:

- **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 Wheel Flange Lubrication

With over 25 years of proven performance in the field, L.B. Foster's **FLCF solid stick systems** are installed on over 2,000 locomotives and freight cars in the world today. Use of L.B. Foster's locomotive lubricant solid stick **FLCF-HP** 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 freight lubricant stick **FLCF-EC**, 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. Application of L.B. Foster's **FLCF-HP** will provide savings:

- **Greater than 40% savings in locomotive wheelset replacements and wheel truing costs**
- **Extending locomotive wheel replacement intervals by greater than 2.5 times**
- **Extension of locomotive 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 GE, EMD and Progress Rail, or we can custom design the hardware to fit your specific locomotives.

5.0 Other Lubricants

LOCOLUB TMGG 516 and 512

Lithium Thickened Traction Motor Gear Grease

LOCOLUB TMGG 516 and **512 (TRACTION MOTOR GEAR GREASE)** are lithium-thickened grease designed to meet the needs of severe lubricant requirements demanded of locomotive traction motor gears. Both lubricants provide excellent protection against heavily loaded locomotive traction motor gears and resist oxidation at high temperatures resulting in outstanding viscosity stability leading to extended service intervals.

- **Provides higher levels of protection and longer service life**
- **Wide operating temperature range**
- **Superior metal wear control**
- **Low drag formula minimizes transmission losses**

LOCOLUB TMGG SODIUM

Sodium Thickened Traction Motor Gear Grease

LOCOLUB TRACTION MOTOR GEAR GREASE (TMGG) SODIUM is a sodium-thickened grease designed to meet the needs of severe lubricant requirements demanded of traction motor gears. As the horsepower per traction motor has increased, the operating loads per gear set have also increased. L**OCOLUB TMGG SODIUM** provides protection against high load and shock load conditions and resists thickening due to oxidation at high temperatures, resulting in outstanding viscosity leading to extended service intervals

- **Ideal for yard and switching service**
- **Wide operating temperature range**
- **Superior metal wear control**

RENOLIT UNIWRL

High-Performance Greases for Heavy Duty Applications

RENOLIT UNIWRL Series are lithium complex, thickened greases formulated from highly refined paraffinic base oils and a robust extreme pressure, anti-wear, rust, and oxidation additive system which give them the utmost in protection for a wide variety of heavy-duty applications. **RENOLIT UNIWRL** Series are very shear stable and retain their consistency which provides for extended equipment life over long lubrication intervals.

Applications:

- **Automotive wheel bearings, chassis, wheel hub assemblies, CV-Joints, U-Joints and other miscellaneous automotive hardware**
- **Heavy duty industrial, construction, and mining, quarry applications such as: kingpins on buckets, crushers, bearings, shaker screens, conveyor bearings, and yard equipment lubrication**
- **Anywhere a high performance, multi-purpose grease, extreme pressure grease is required**

6.0 Field Applications and Services

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