Why a Frictionless Brake?

The use of Foundation Brakes for retardation

Foundation brakes are designed to fulfill 2 main requirements:

1. Maintain the vehicle in a stationary position for indefinite periods, i.e. Parking
2. Bring the vehicle to a standstill in the shortest possible distance without loss of control, i.e. Emergency Stops

Because of design & manufacturing limitations, Friction Brakes cannot effectively dissipate the temperatures reached when used repeatedly for extended periods of time.

Why are frictionless brakes a good idea?

What the U.S. Government and the Insurance Industry say about the benefits of frictionless brakes

"The benefits (of retarders) were:

1. Safety enhancement due to reduced probability of a runaway accident
2. Cost savings due to decreased brake wear and maintenance
3. Productivity gains due to decreased trip time"

Source: Insurance Institute for Highway Safety
What the US Government says…

What the U.S. Government and the Insurance Industry say about the benefits of frictionless brakes

“...from a benefit standpoint, retarders should be included in a vehicle’s set of braking equipment for almost all commercial vehicle applications.”

“In the case of savings on brake maintenance, the return on investment from retarders can be substantial.”

Source: Insurance Institute for Highway Safety

What the US Insurance Industry says…

What the U.S. Government and the Insurance Industry say about the benefits of frictionless brakes

“Data collected from Colorado, where about 70% of the vehicles operating on severe grades have retarders, suggest that commercial vehicles without retarders have a crash rate almost three times greater than vehicles equipped with retarders.”

Source: Insurance Institute for Highway Safety

Benefits: Enhanced Vehicle Safety & Economy

**Telma** improves vehicle braking & stopping ability while drastically extending brake life

**The hotter brake linings get, the faster they wear**

- Telma increases brake life by decreasing temperatures

**The hotter brake linings get, the less efficient they become**

- Telma keeps friction brakes cool & save them for when they are really needed: Emergency Stops

DEATH-INJURY / VEHICLE & PROPERTY DAMAGE / LAWSUIT
Benefits: Reduced Brake Temperatures

Telma Frictionless Brakes help keep friction brake temperatures down to a Safe and Economical level.

Benefits: Reduced Tire Temperatures

How Friction Brakes Heat affects Tire Life

Temperatures recorded on a 22,000 lb vehicle submitted to repeated braking (10 consecutive stops):

- Friction Brakes heat generated during braking radiates to the wheels and to the tires
- Heat causes tires to run hotter & wear faster
- At above temperatures, tires are likely to blow, and beads burn - preventing any possibility to recap them.

Benefits: Enhanced Vehicle safety

Telma improves vehicle braking & stopping ability

- The hotter brake linings get, the less efficient they become (up to 60% loss of performance above 520°F)
- Telma keeps service brakes cool and always ready to respond to emergencies with their full strength
- Telma reduces stopping distances under all road conditions (up to 50%)
**How does Telma work?**

- Electric current is sent to coils with alternate polarities, creating a variable magnetic field
- Eddy currents - generated as the discs pass through the magnetic field, slow the rotation of the discs, and thus the drive shaft
- Frictionless design: no contact between moving parts
- Self air cooled: heat generated inside the rotors is dissipated directly into the air
- Self regulating: heat absorbed equals heat dissipated

**How and Where is Telma mounted?**

- Telma “Axial” series units are Driveline/Chassis-mounted
- The Stator is fixed to the chassis rails of the vehicle, and a through shaft supports the Rotor

- Telma “FOCAL” series units are Axle or Transmission-mounted
- The Stator is fixed to the component housing, and the component Input or Output shaft supports the rotor
How is Telma Activated & Controlled?

- **Foot Control (Automatic)**
  - Pressure transducer or 4 position mechanical switch progressively activates Telma in the “Free Play” of the brake pedal
- **Combined Foot and Off Throttle control (Automatic)**
  - 25% to 85% of Telma activates as soon as the accelerator is released. The other 75% - 50% activate progressively as the driver depresses the brake pedal
- **Hand Control (Manual)**
  - Dashboard mounted 4 position switch progressively activates Telma at the driver’s request
- **Any Combination of the above 3 systems**
- **With all Controls:**
  - Instant activation/deactivation of the frictionless brake
  - Powerful yet smooth four stage braking modulation
  - Full retardation occurs prior to brake lining to drum and/or disc engagement
  - Light bar display mounted in dash shows at all times what level of retardation is in use
  - Automatic cut-off switch deactivates frictionless brake when vehicle comes to a stop

Telma Benefits: Brake Life Extension

- Telma handles 85% of all braking

  - 85% of all braking occurs in the .01g to .1g range (first 4 bars)
  - Telma is sized to provide .1g deceleration, supplying 85% of all braking needs
  - Telma keeps Friction Brakes cool, extending brake life 6 to 10 times

TELMA: Fully Integrated System

- **Automatic Foot Control**
  - Instantaneously and progressively activates TELMA when brake pedal is depressed
- **Frictionless Brake**
  - Provides powerful yet smooth frictionless braking to the vehicle
- **Light Display**
  - Indicates level of TELMA engagement
- **Control Module**
  - Distributes driver commanded level of power to TELMA
  - Instantaneously interrupts TELMA when ABS event is detected
  - Progressively reactivates TELMA to avoid new ABS logic events
  - Automatically disconnects TELMA when vehicle comes to a stop

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Telma Benefits: Less Brake Jobs

BRAKE LIFE COMPARISON

- **Brake Life:**
  - 3,500 to 7,000 Miles W/O Telma
  - 45,000 to 60,000 Miles W Telma

- **Loud Squealing Friction Brake NOISE:**
  - Developing @ 500 TO 1,000 Miles W/O Telma
  - Friction Brakes remain Quiet with TELMA

  - Telma increases brake life 8 to 12 times
  - Telma reduces friction brakes Noise

Source: Premier Las Vegas shuttle Bus Fleet

Telma Benefits: Extended Tire Life

Save on Tire Wear

<table>
<thead>
<tr>
<th></th>
<th>Without Telma</th>
<th>With Telma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Miles per Year per Bus</td>
<td>40,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Average Tire Maintenance Costs per Year per Bus</td>
<td>$1,600</td>
<td>$1,100</td>
</tr>
<tr>
<td>Tire Maintenance SAVINGS per Year per Bus:</td>
<td>$500</td>
<td></td>
</tr>
</tbody>
</table>

- Telma reduces tire operating temperatures, which contributes to:
  - Increased tread life (approximately 10%)
  - Suppression of tire blow outs
  - Elimination of burnt tire beads – permitting more retreads per tire

Source: Low weighted information provided by: OCTA, Orange, CA - AC Transit, Oakland, CA

Telma Benefits: Save on Vehicle Downtime

Brake-related Downtime Costs @ $17.00/Hr in Lost Revenue

<table>
<thead>
<tr>
<th></th>
<th>Without Telma</th>
<th>With Telma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear Brakes</td>
<td>$412</td>
<td>$50</td>
</tr>
<tr>
<td>Front Brakes</td>
<td>$226</td>
<td>$68</td>
</tr>
<tr>
<td>Total Downtime Costs per Year per Bus:</td>
<td>$688</td>
<td>$158</td>
</tr>
<tr>
<td>Downtime SAVINGS per Year per Bus:</td>
<td>$500</td>
<td></td>
</tr>
</tbody>
</table>

- Telma reduces vehicle downtime by a factor of 6 to 8 times

Source: Low weighted information provided by: OCTA, Orange, CA - AC Transit, Oakland, CA
Telma Benefits: Save on Road calls

When a bus full of passengers breaks down, it costs Transit Authorities...
... in immeasurable ways:
• Customers are irritated
• Driver morale & confidence in the vehicle are negatively affected

<table>
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<th>Without Telma</th>
<th>With Telma</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake related Road Call Costs per Year per Bus</td>
<td>$154</td>
<td>$77</td>
<td>$77.00</td>
</tr>
</tbody>
</table>

Road Call SAVINGS per Year per Bus: $77

Measurable expenses are the costs of the road call and vehicle downtime...
• Telma reduces brake related road calls by 50%

Source: Low weighted information provided by: OCTA, Orange, CA - AC Transit, Oakland, CA

Telma Benefits: Save on Vehicle Operating Costs

TELMA pays for itself several times over by reducing vehicle Friction Brakes maintenance, tire wear, road calls & vehicle downtime costs

<table>
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<th>Without Telma</th>
<th>With Telma</th>
<th>SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake Repairs</td>
<td>$2,280</td>
<td>$594</td>
<td>$1,686.00</td>
</tr>
<tr>
<td>Tire maintenance</td>
<td>$1,600</td>
<td>$1,100</td>
<td>$500.00</td>
</tr>
<tr>
<td>Downtime</td>
<td>$654</td>
<td>$158</td>
<td>$500.00</td>
</tr>
<tr>
<td>Road calls</td>
<td>154</td>
<td>77</td>
<td>$77.00</td>
</tr>
<tr>
<td>Total</td>
<td>$4,692</td>
<td>$1,929</td>
<td>$2,763.00</td>
</tr>
</tbody>
</table>

Total Annual SAVINGS per Bus: $2,763.00

Telma Benefits: R.O.I. - Brake Maintenance Savings

SUBJECT FLEET:
ANNUALIZED BRAKE USAGE INFORMATION:
No Telma
Brake Replacements Per Year: 4.80
Monthly Interval: 2.5
TELMA
Brake Replacements Per Year: 0.57
Monthly Interval: 21.1

Materials 915$
Brake shoes / parts / machining
Brake Life Multiplier: 8.42
Labor 420$
Internal shop rate

AVERAGE COST OF BRAKE JOB (Parts & Labor): $1,335
ANNUALIZED AVERAGE COST OF BRAKE REPLACEMENT
No Telma TELMA
NUMBER OF BRAKE JOBS PER YEAR: 4.80 0.57
COST PER BRAKE JOB: 1,335$ 1,335$
ANNUALIZED BRAKE MAINTENANCE COST: 6,408$ 761$
ANNUAL SAVINGS WITH TELMA 5,647$
AVERAGE LIFE SPAN OF VEHICLE CHASSIS: 10 Years
LIFE SPAN BRAKE MAINTENANCE COSTS: 64,080$ 7,610$
LIFE SPAN BRAKE COSTS - WITHOUT TELMA 64,080$ 6,408,000$
LIFE SPAN BRAKE COSTS - WITH TELMA 7,610$ 761,045$
TELMA NET IMPACT IN REDUCING COSTS 56,470$ 5,646,955$

1.9378% USD http://www.telmaUSA.com
CORPORATE RETURN ON INVESTMENT

TELMA INVESTMENT ANALYSIS
Premier Waste Collection Company (Actual)

R.O.I.
NUMBER OF VEHICLES
BREAKEVEN POINT {STATED IN YEARS}
Does not include downtime, road calls or other brake related costs!
Telma Benefits: Environmentally Friendly

**Cleaner Air:**
Telma reduces the amount of brake dust particles released in the atmosphere by vehicle friction brakes

**Better Environment:**
Telma does not require periodic changes of contaminated oil or transmission fluids

**No Pollution:**
Telma helps prevent friction brake noise
Telma is silent in operation

Telma = Safer Vehicles & Reduced Operating Costs

High level of braking torque: smooth, level adjustable, and available on demand

Nearly constant braking torque at the wheels: completely independent of vehicle speed, engine or driveline RPM, transmission gear or torque converter mode – Performance typically 2 x Engine HP: Higher brake savings, better R.O.I., increased safety

Designed to provide 85% of vehicle braking needs: keeps foundation brakes cool - preventing brake fade and extending brake life 6x on average

Permanently connected to the vehicle drive wheels: dramatically shortens stopping distances - up to 50% - Provides an independent back-up braking system - available, even if the foundation brakes, engine or transmission fail

160 milliseconds average response time “Off” - only retarder technology which is fully compatible with ABS – Acceleration needed – Avoid fuel waste

120 milliseconds average response time “On” - retarder almost instantly on for Maximum Brake Savings & Safety

What's Stopping You?

Thank you for your time and for giving us the opportunity to present TELMA

- http://www.TelmaUSA.com
- http://store.telmausa.com/
- E-mail: engineering@telmacse.com
- 800-797-7714