

In Transit

Infrastructure Upgrades Offer Unique Opportunities for Rail Industry

Matthew Jaster, Senior Editor

The average travel time to work in the United States is 25.4 minutes, according to the U.S. Census Bureau.

This number is probably low if you factor in a traffic accident in New York City, light rain in Chicago or it's simply Tuesday in Los Angeles. It's safe to say 25.4 turns into 45 minutes in many areas of the country at seven o'clock in the morning.

"This is 45 minutes that commuters have to focus on the road and nothing but the road," said Anant Bhat, industry manager rail at Schaeffler. "We see an opportunity where employees can become more efficient by working during their commutes instead of focusing on the transportation itself."

These business models have worked in Europe and Asia and there continues to be a great deal of investment from both state and federal government to build a similar rail infrastructure here in the United States, according to Bhat.

Case in point: Amtrak signed a contract with Alstom in August 2016 to produce 28 next-generation high-speed train sets that will replace the equipment used to provide Amtrak's premium Acela Express service. The

new train sets will allow for increased service including half-hourly service between Washington D.C. and New York City during peak hours, and hourly service between New York City and Boston.

The contract is part of \$2.45 billion investment on the heavily traveled Northeast Corridor. These high-speed trains will operate initially at speeds up to 160 mph and will later be capable of speeds up to 186 mph; taking full advantage of future infrastructure improvements.

In addition to high-speed train projects, several U.S. cities are planning light rail upgrades including New York, Chicago and Seattle. And smaller cities are beginning to develop more efficient light rail systems (some 170 billion in public transit funding was approved on Election Night). This is vital if the United States continues to pursue a mass high-speed rail initiative in the future.

The key to the success of high-speed rail in the United States will be to upgrade light rail systems in the smaller U.S. cities to feed them into high-speed train networks in the larger cities, according to Bhat.

On the global front, BMI Research re-


leased a report recently claiming mass transit, high speed rail and freight are all steadily experiencing an infrastructure boom in urban areas in order to make cities much more sustainable.

"As population centers continue to grow, the need for alternative forms of transportation for both freight and public transit will be needed," said Greg Gerardi, business development railway at SKF. "Efficiency of travel will always be most important to the public and our transit network will need to provide seamless transport without inconveniencing passengers or delaying the delivery of goods. This means less downtime and better reliability of our rail network."

A Systematic Approach

In order for future rail projects to succeed, a systematic approach is necessary. It goes far beyond just a bearing installation, according to Schaeffler's Bhat. It's no surprise that companies like Schaeffler, Timken and SKF have the engineering expertise and diverse product catalog to reach this market.

"Traction motor bearings, gearboxes, axlebox bearings, housings and condition monitoring equipment all



Timken developed an AP-2 bearing design with internal geometry specifically designed to reduce bearing torque and increase bearing load rating (photo courtesy of Timken).

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play a significant role in these applications,” Bhat said. “Schaeffler’s X-life bearings have extended rating life and longer operating time through superior surface quality and optimized internal design which makes them suitable components for rail. The company also offers traction motor bearings that are insulated to provide protection against electrical currents.”

Bhat added that Schaeffler’s anti-corrosion coating and surface treatments offer several durability benefits to bearings used in rail applications.

“Imagine you’re traveling on a light rail in San Francisco which is very humid due to the moisture in the atmosphere. The bearings could get rusty and begin breaking apart. This is where an impact corrosion coating can protect the bearing and offer a greater life-cycle,” Bhat said.

SKF offers journal bearing designs for the global rail market that utilize synthetic greases, low friction sealing solutions, logarithmic roller profiles, and polymer cage technology.

“The culmination of these compo-

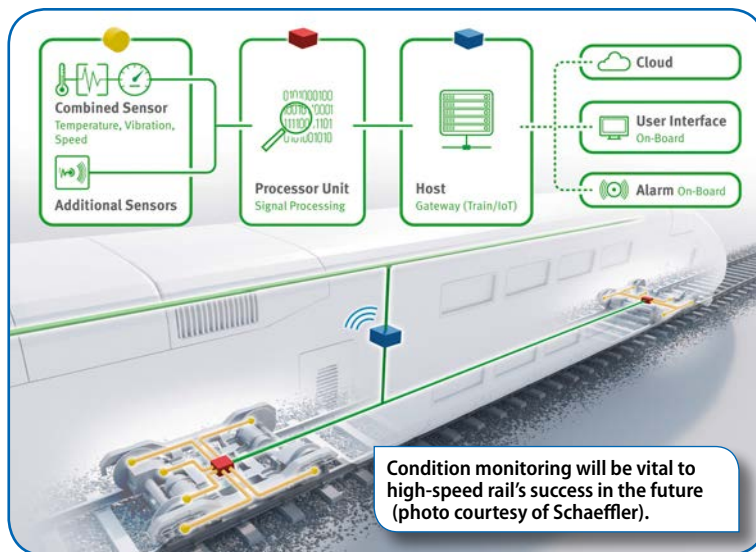
nents creates a bearing with lower operational temperatures and less wear, which ultimately increases bearing life and performance,” Gerardi said.

Polymer cage technology offers a safety factor not found in conventional bearings.

“In a situation where the bearing may become starved for lubrication, the polymer acts as a self-lubricating

component as it starts to melt, giving the train operator the extra critical time it may need to bring the train to a stop before catastrophic failure occurs,” Gerardi added.

On the transit side, SKF offers turn-key solutions for non-drive axle assemblies on light rail vehicles and axlebox/bearing solutions for most passenger rail applications.



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Difficult drive system service found on many rail platforms today requires a robust cage and roller design. SKF utilizes unique material and design combinations to satisfy these harsh requirements. "Our patented INSO-COAT technology protects the bearing from stray electrical current damage, improving the overall life and performance of the bearings, motor, and gear box," Gerardi said.

Timken developed its AP-2 Short G bearing with rail applications in mind.

"One of the high-focus areas for iron ore miners seeking to optimize their operations is the need to move larger loads more efficiently along the rail link that transports ore from mine to port," said Alan Buchanan, chief engineer for rail, at Timken. "The axle journal roller bearings are directly affected by the increased car-loading desired by operators. The bearings become one of the critical rail wagon components that influence the overall reliability of the system."

Timken recognized that the current roller bearing design could be enhanced and introduced the AP-2 Short G bearing concept.

"Timken developed an AP-2 bearing design with internal geometry specifically designed to reduce bearing torque and increase bearing load rating while maintaining the same envelope space as the currently used "short" G bearing. This bearing provides greater levels of performance and reliability, while allowing operators to continue using the existing bogie, side frame, and wheelset," Buchanan added.

Proactive vs. Reactive Analysis

Structural impact, temperature fluctuations and environmental concerns all factor into machine and component health in rail applications. Engineers welcome the opportunity to plan rail maintenance in advance and know exactly what's happening within these systems before failures occur.


"We presented an innovative condition monitoring system at InnoTrans (Berlin, Germany) where data evaluation serves the purpose of achieving higher average speeds, greater operating performance as well as longer maintenance intervals for future train

generations while also improving reliability," Bhat said.

Compact sensor units specially developed for rail applications are used to measure structure borne sound, temperatures and speeds on the axle-box bearings, which permits the detection of damage such as rolling bearing damage and out of balance on the wheel rims. In addition, the drive motor and the gearbox can be monitored on a motorized bogie frame using vibration measurement.





Axle bearing and housing for rail application (photo courtesy of Schaeffler).




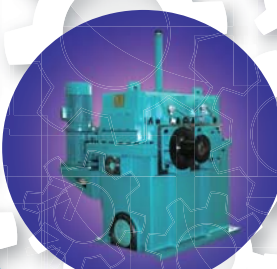
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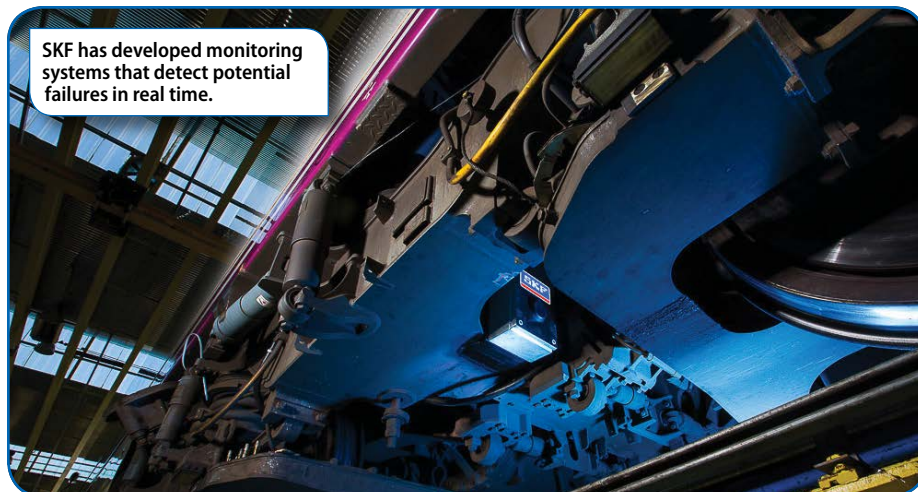


"The customer is not required to have vibration-specific expertise or to perform manual evaluations. The operator or maintenance technician is connected to the Cloud and can monitor the condition of individual axlebox bearings and even entire axleboxes and bogies," Bhat added.

With safety and interoperability being key concerns of every rail operation, SKF has developed systems that not only monitor for potential mechanical failures but also for safety conditions such as component cracks and derailment. SKF has dedicated a considerable amount of resources in developing condition based maintenance platforms that can detect potential failures in real time.

"Our IMx-B system has the capability to monitor any rolling element for vibration and temperature anomalies and alert train operations of a potential problem, giving the operator the ability to schedule a repair rather than having unplanned downtime," Gerardi said.

Timken's Brister said that general freight rail journal bearing applications



are typically monitored by trackside detection systems both for temperature and acoustic signatures. These systems monitor the bearings for their safety and reliability in service.

Crossover Potential

Many of the bearing technologies utilized in rail applications have been adapted from other industrial segments. Buchanan cites an original Hydrodynamic Labyrinth (HDL) seal

development at Timken that started in the automotive and heavy truck applications, and was modified for use in rail journal bearings.

"Similarly, I believe what Timken develops relative to FE designs, specifically as related to heat generation and torque, could apply to rail bearings. These may be especially beneficial in applications such as high-speed gearboxes," Buchanan said.

SKF polymer cage technology was

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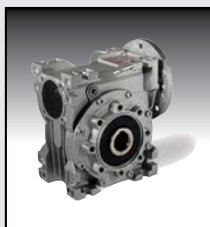
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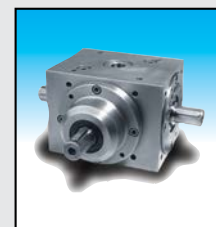
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adopted for rail from the automotive industry. Its performance capabilities were realized early on and introduced into rail almost 20 years ago. "Likewise, the same condition monitoring technology we use in rail has seen much success in other industries such as wind energy, pulp and paper, and offshore oil platforms," said Gerardi.

Schaeffler exchanges information about its bearing technology to other industrial segments. "For example, insulated coating bearings can be applied to e-motors or wind generators. We can apply the same knowledge to bearings across a large range of industrial segments where temperature, corrosion, and environmental elements play a role in determining the lifespan of the equipment," Bhat said.

"With the increased spending on infrastructure and new equipment, the United States is heading in the right direction. It's an exciting time for the passenger rail industry."

— Anant Bhat,
The Schaeffler Group

Schaeffler's proprietary Mancrodur rolling bearing material, in combination with carbonitriding (a case hardening process that uses carbon and nitrogen), has already proved very successful in wind turbines that are subjected to high loads as well as in steel mills. With its High-Capacity TAROL Class K (HCT-K) tapered roller bearing that is used in heavy freight railway traffic; Schaeffler is currently expanding the range of applications for this high-performance steel. Initial Mancrodur bearings have been undergoing rigorous testing under actual operating conditions since April 2016.

All in all, the rail bearing operating environment can be especially challenging. "There can be high levels of shock and vibration and climate extremes. Lessons learned relative to component design and performance can be transferred to other industries," Timken's Buchanan added.

2017 Market

These components are better equipped for rail systems at a time when many cities around the world are looking to expand and renovate mass transit. Transportation is an area that will always have growth potential in terms of energy efficiency, sustainability, smart cities and personal mobility.

InnoTrans 2016 (a trade show specifically-focused on the global railway industry) featured more than 2,955 exhibitors from 60 countries. The Out-

door Display featured 127 innovative vehicles with several international product debuts. The show attracted 144,470 trade visitors from more than 140 countries to Berlin.

The InnoTrans Convention featured eleven events in the five main forums, dealing with mobility issues now and in the future. For example, at the Dialog Forum the focus was on digitalization in rail passenger and freight transport, and on the technology for digital services.

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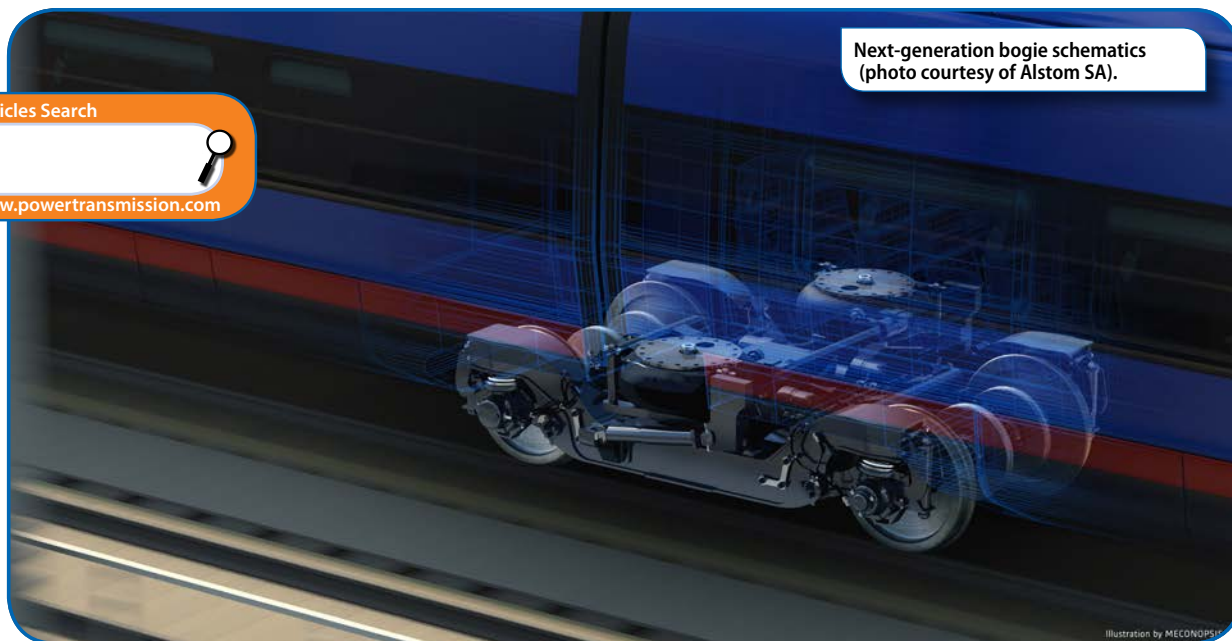
at www.powertransmission.comNext-generation bogie schematics
(photo courtesy of Alstom SA).

Illustration by MECONOSP

"The massive potential of the industry, and its future prospects, were very evident at InnoTrans 2016," said Jürgen Fenske, president of the Association of German Transport Companies (VDV). "These impressions were confirmed time and again during the course of the event. It has shown that rail transport around the world is an efficient, modern and ecological form of transport for the future."

Bhat sees great promise for new rail projects here in the United States. "The passenger rail network is well estab-

lished in Europe, especially Germany. With the increased spending on infrastructure and new equipment, the United States is heading in the same direction. It's an exciting time for the rail industry."

As the rail industry expands and develops here in the States, the emphasis moving forward will be on safer, quieter and more efficient components and systems. It's an area to keep an eye on for future business in power transmission. **PTE**

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A next generation train set in Washington D.C. (photo courtesy of Alstom SA).