BIG DATA ANALYTICS

How to Use Data to Protect Your Assets and Grow Efficiencies: A Primer for Freight Railroads, Asset Owners, and Their Customers

SECTION 1

INFORMATION IS THE OIL OF THE 21ST CENTURY

> “Railroads are especially amenable to the advantages of analytics and Big Data because they are generally closed systems that involve sophisticated processing of large volumes of data.”

“Information is the oil of the 21st century,” said Peter Sondergaard, senior vice president of Gartner Research, “and analytics is the combustion engine.” But just as oil requires refining, so does data, in order to fully access its utility and richness.

When it comes to freight rail, big data analytics has countless applications, from locating products in transit to eliminating waste to preventing damage to valuable assets. Swedish researchers noted that railroads are “especially amenable to the advantages of Analytics and Big Data because they are generally closed systems that involve sophisticated processing of large volumes of data.”

That data can come from a seemingly endless array of sources:

- Geographic positioning system (GPS) devices
- Mobile and stationary assets
- Weather and census data from government resources
- Radio-Frequency Identification (RFID) systems
- Car Location Message (CLM) systems
- Track and facility data

Companies like Lat-Lon, a BSM Technologies Company, provide remote asset tracking and monitoring devices as well as communication technologies (wired and wireless) used to collect rail fleet information. Lat-Lon customers collect more than 13 billion messages a year from data sources like those above. This translates into 3.3 terabytes of collective rail industry data pulled into master databases for secure access by customers.

FIGURE 1: A "heat map" created using Tableau, has colors that change based on an array of variables, including the force of impact.
Source: Lat-Lon

Rail industry professionals are increasingly collecting and using such massive amounts of data to protect their assets and increase efficiency. That's because data analysis can help answer an array of questions for freight rail companies, shippers, and asset owners: In what condition is my rail car? What is the condition of the product I am shipping? How many miles has the rail car carrying my product traveled? How many impacts has my rail car experienced in the yard? When was the last time my car was in the shop? When are my rail cars going to arrive at their destination?

Dig in to Data Analysis

Rail industry professionals analyze collected data through a range of web and mobile applications, including Excel, Tableau, Chartio, Logi Analytics, Phocas, and InsightSquared, as well as similar tools from SAP, Oracle, and IBM.

Lat-Lon often employs Tableau to analyze this kind of data. A "heat map" created using Tableau, see Figure 1, has colors that change based on an array of variables, including the force of impact, which are gathered from a GPS-enabled vehicle- and equipment-monitoring unit. Green areas show light impacts, while red shows places with strong impacts.

> “Just as Google Earth lets you drill down to see your driveway, rail users can use data visualization to single out a line within the rail yard.”

Just as Google Earth lets you drill down to see your state, your street and even your house and driveway, data visualization allows users to single out a specific line within the rail yard. If you drill down further into the Figure 1 heat map, for example, you can see impacts at the railyard level, as shown in Figure 2.

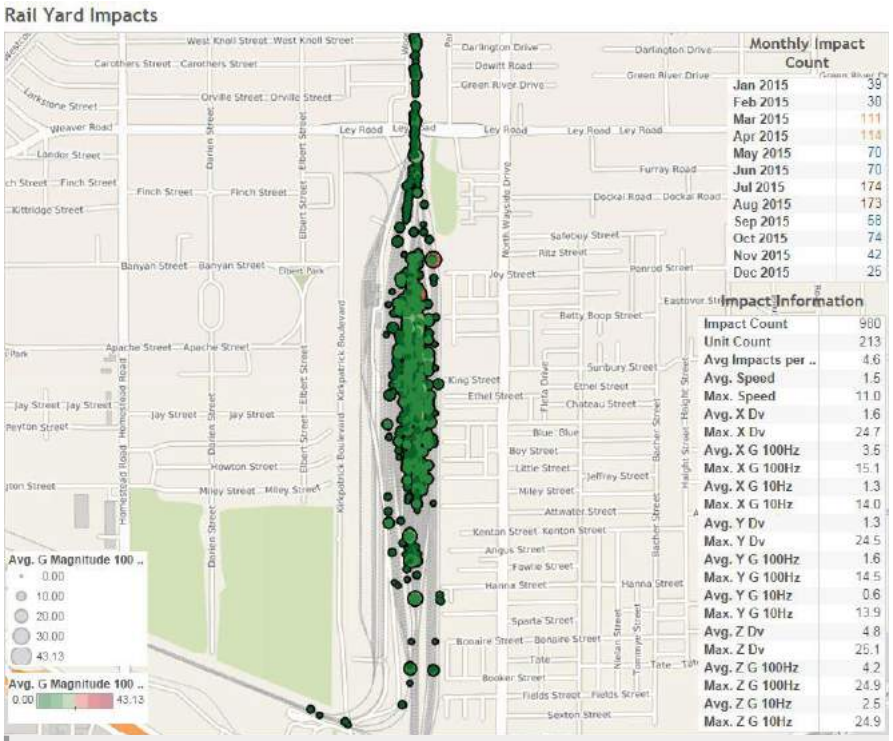

FIGURE 2: Because so much data is being gathered and analyzed, users can drill down into the Figure 1 heat map and see impacts at the railyard level. *Source: Lat-Lon*

SECTION 2

APPLICATIONS IN RAIL

3.3 TERABYTES

Combined amount of rail data gathered from GPS devices, RFID tags and more by Lat-Lon customers

The 3.3 terabytes of combined rail industry data collected by Lat-Lon customers is being analyzed and put to good use today. From discovering malfunctions to detecting fraud to reducing waste, Big Data analytics is providing answers to often expensive questions that were going unanswered.

Discovering Malfunctions

Regarding rail car impact data, Lat-Lon recently worked with a customer who had impact accelerometers on all its rail cars. In the process of analyzing impact data in a heat map, the customer noticed cars were experiencing a lot of impacts in one particular railyard. Drilling down more deeply, the customer isolated the large numbers of incidents to cars on Track No. 4.

The customer took the data to the railroad operating the yard and the railroad conducted an investigation. It discovered that the problem was a decimal point in the wrong place in the automated braking system algorithm serving Track No. 4.

Pneumatic brakes on the track were supposed to slow cars to less than four miles per hour prior to coupling. But, due to a data entry error, the cars were coupling at much higher speeds. That fact would not have come to light without the aid of Big Data analytics.

Detecting Fraud

In another case, a Lat-Lon customer was shipping frozen goods in a car that needed to maintain a temperature below 32 degrees Fahrenheit. But, repeatedly, when the

product reached its destination, the receiving customer would make damage claims, indicating that the frozen product had thawed in transport. A Houston-based FDA inspector supported those claims.

Lat-Lon's customer installed equipment monitoring devices on the cars and started receiving historical data reports through those devices. The customer was able to prove the cars were maintaining temperatures below freezing throughout transit, and the receiving customer was fraudulently claiming damages where there were none. The data allowed the Lat-Lon customer ultimately to prove that the receiving customer was committing fraud: It had paid off the FDA inspector to support its damage claims and engaged in black-market sales of the "damaged" product. The data doesn't lie.

Reducing Fuel Waste

When one considers that fuel costs are the second biggest operating cost of Class I railroads after employee compensation and benefits, cutting locomotive fuel usage is a major industry priority. Big Data analytics are helping meet that priority in a big way.

According to an April 2016 white paper issued by the Association of American Railroads, U.S. freight railroad volume in 2014 was twice what it was in 1980, but trains' fuel consumption was lower, amounting to a fuel efficiency increase of 101 percent. The increased fuel efficiency is due in large degree to new Tier 4 locomotives coming online. These new, complex machines are essentially rolling computers running ultra sophisticated applications. Some Tier 4 locomotives come with more than 200 onboard sensors and the ability to process one billion instructions per second.

VOLUME.
VARIETY.
VELOCITY.

The three components of Big Data analytics, according to the Gartner IT Glossary. *Volume* refers to the total amount of data. *Variety* refers to the number of types of data, such as numbers, dates, and strings of unstructured data like video. *Velocity* refers to the speed of data processing; the faster the pace, the more data that can be analyzed.

DATA ANALYSIS

Dozens of data analysis tools are available, including Tableau, Chartio, InsightSquared, Microsoft Excel, and similar tools from SAP, Oracle, and IBM.

Using a line graph produced using Tableau (shown in Figure 3), a Lat-Lon customer was able to see the gallons of fuel that individual locomotives burned over a year-long period, presented in month-by-month format. The blue line in the graph shows the amount of fuel burned each month, while the red line shows locomotive idle time. The purple line shows locomotive work time. The second graph (Figure 4) shows the relationship between distance a locomotive has traveled and the amount of fuel burned.

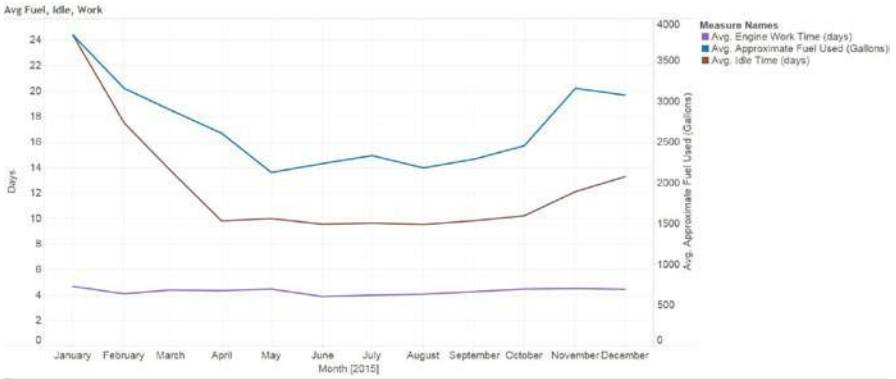

FIGURE 3: This chart shows gallons of fuel burned over time. The blue line is the amount of fuel burned each month, the red line is locomotive idle time, and the purple line is locomotive work time. *Source: Lat-Lon*

The data showed that locomotives were burning more fuel in winter, yet were not actively working anymore days in winter than during the rest of the year. In fact, in

some cases the locomotives were working only 5 days per month and idling 24 days per month in winter.

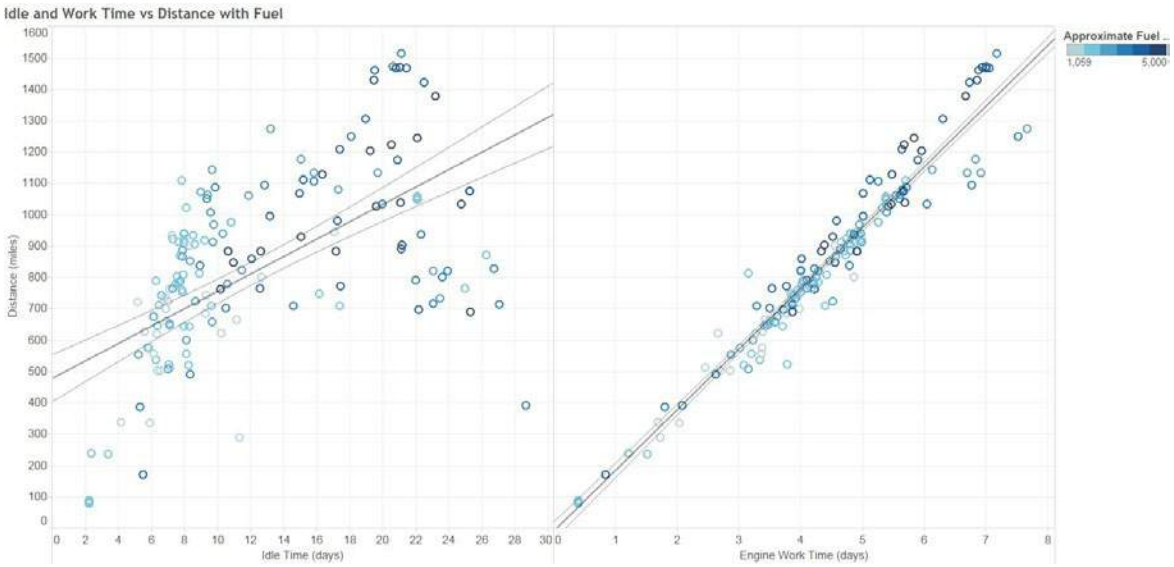

FIGURE 4: This Scatter Graph shows the relationship between the distance a locomotive has traveled and the amount of fuel burned. *Source: Lat-Lon*

It turned out the railroad's engineers were leaving locomotives idling in the winter months to keep the locomotives warm. At the ends of their shifts, they were not engaging the stop-start systems that had been installed to prevent fuel waste. Such idle-reduction technologies can result in fuel-use savings of up to 8,000 gallons per locomotive per year, according to AAR.

The railway realized it needed to conduct additional training and education for engineers using the stop-start system and on the need to reduce fuel waste. Use of automatic stop-start systems can reduce fuel usage by as much as 300 percent, and given that fuel costs represent a huge area of spending for shippers, understanding opportunities for fuel savings is critical.

SECTION 3

ALL SEGMENTS BENEFIT

>13 BILLION

Number of rail messages collected annually that can be analyzed to benefit freight railroads, asset owners, shippers and their customers

By employing Big Data analytics, all parts of the rail and shipping industry can benefit. Freight railroads, asset owners, shippers, and their customers can use data to uncover opportunities to increase efficiencies, reduce costs, grow the top line, and increase customer satisfaction. Here are other ways that companies can benefit from collecting data and analyzing it:

- Uncovering malfunctions
- Assessing utilization of assets
- Calculating idle time for locomotives
- Locating vehicles to more accurately predict ETA of product to customers
- Realizing fuel rebates and off-road fuel tax savings by analyzing fuel usage and savings
- Reducing and identifying fuel theft
- Assessing vehicle downtime and set up alerts for excessive downtime
- Uncovering potential fraud
- Determining idling trends and reducing average idle time

SECTION 4

BIG DATA'S NEXT STEP

Tracking and monitoring devices can now make decisions on their own with the help of smart tracking technology from Lat-Lon called Adaptive Device Configuration, or ADC.

Lat-Lon has introduced a new adaptable product that makes use of the next step in data automation: "if-then" logic that allows a monitoring device to react to data.

"All these years, companies like ours have been collecting all this data, and humans have typically analyzed it to understand what it all means and how to use it to drive company or industry change," says Dave Baker, President of Lat-Lon. "Now, however, Lat-Lon has developed Adaptive Device Configuration technology that can itself analyze the data it is creating and collecting, and change its reporting based on real-time input."

Adds Baker, "The natural progression of the Internet of Things is to add a layer of feedback to the units in the field so that they can automatically reconfigure based on changing conditions. Those conditions can be local to the units, such as temperature or impact force, or business operational considerations delivered from a central source."

For example, a customer could place a geo-fence around a manufacturing facility that they know is secure and that may only require data reports once an hour. Once the train car with an ADC monitoring device leaves the plant, the tracking unit will automatically update its reporting to every 10 minutes in order to improve security. That same geo-fence also can trigger alerts to assist in the prompt loading and unloading of cargo.

Similarly, a customer could use such smart tracking technology in coordination with an accelerometer to determine when a train car is entering a yard and is likely to

experience impacts. This way, the monitoring device could increase the parameter of impact detection in the rail yard and decrease it once the device senses that the car has left the yard. Also, an accelerometer normally wouldn't detect an impact unless it's above 1 G of force. But because impacts in a yard are much more likely, a customer might want to know how many impacts the car experiences at 0.7 or 0.8 G. ADC allows the change to be made in real time.

Lat-Lon's goal in creating ADC was to take out the manual steps in the configuration process. This is beneficial for customers because they reduce their work load, and increase their productivity, and receive more timely data more quickly.

Getting Started with Big Data

Whether you are shipping sensitive products, or targeting operating cost reductions, data analytics can deliver quantitative results. To get started using Big Data in your rail shipping, consider the major goals of your organization and division, and what data would be needed to be evaluated. This will help you determine the type of data collection devices you need, and what type of data analysis might be beneficial.

If you are interested in learning more about Lat-Lon Solar-powered Tracking Units, Locomotive Tracking, or Connected Rail Solutions, contact us info@lat-lon.com or 877-300-6566. ■

About Lat-Lon

Lat-Lon, LLC was founded in 1999 in Denver, Colorado and provides wireless GPS tracking and monitoring solutions for assets. Find out more at www.lat-lon.com. Lat-Lon is owned by BSM Technologies Inc. (Toronto, ON) Stock Symbol: TSX-V:GPS.

Lat-Lon's key products include a solar-powered GPS monitoring system (STU) for railcars and trailers that allows fleet managers to know the condition and location of their assets at any given time, a compact tracking unit (CTU) for track and trace capabilities, and a locomotive monitoring unit (LMU).