



# SURVEY REPORT

**IT-OT convergence** 

The future of digital railways might hinge on the rise of asset management



#### Executive summary

In an ideal world, railway operators would know the health of their rolling stock and infrastructure in order to optimize maintenance, avoid failures and improve reliability. Asset monitoring systems are becoming more widely available, and railways are investing in stand-alone systems such as measuring trains, onboard systems to report the health and status of components or entire vehicles, and devices to monitor the health of fixed assets such as switches.

Such equipment generates huge amounts of data, but is the data being consolidated, analyzed, and applied correctly - to examine the correlation between rates of inspection, failures, and the criticality of the asset? Is the data really helping railway operators to implement their asset management strategies? All too often the data is being assessed by individual departments within a railway operator so that the data ends up in silos - denying the organization the opportunity to produce a broader view of the overall health of assets in support of an asset management strategy. With the shift toward predictive and prescriptive capabilities across asset-intensive industries, and the availability of data that is critical to business performance, railway operators should seek to include this information as key performance indicators (KPIs) on strategy or operational dashboards.

"Railway operators already have many different systems generating and storing data: from supervisory control and data acquisition (SCADA) systems, to inspection documentation systems, to problem reporting and work order management systems, but they struggle to leverage all that data to improve both strategic and operational decision making," says Mr. Steven Hagner, Industry Solution Executive, Enterprise Software product group within ABB. "Part of the reason for this is that these different systems have not been connected, even though capability to do this is becoming increasingly available."

"Increasingly, railway operators are starting to evaluate their options. Some have recognized that the best solution will be to acquire offthe-shelf software systems to support asset performance management (APM). The market for such solutions is evolving quickly, leveraging lessons learned in other industries."

In order to get a better understanding of where railway operators are in terms of developing asset management strategies, and whether convergence between information technology (IT) and operational technology (OT) is progressing in today's digital world, ABB and Microsoft® conducted a survey in February 2016 of senior railway managers and engineers, and railway equipment suppliers around the world.

Railway operators are struggling to improve asset management, in part, because the systems that generate and store data are not connected – even though the capability exists. "If I've got thousands of kilometers of track out there, hundreds of thousands (approaching millions) of assets, what do I need to know this morning in order to make it work effectively tomorrow? We've got lots of components, but we haven't got the ability to draw it together in a picture which allows us to do it. And, that's where we see IT-OT going."

> Paul Barnes, Route Asset Management Team, Western Route Network Rail

IT-OT CONVERGENCE THE FUTURE OF DIGITAL RAILWAYS MIGHT HINGE ON THE RISE OF ASSET MANAGEMENT

70% of responses came from North America and Europe, with another 21% from Asia, reflecting the three main regions of railway activity.

### Respondent profile

Around 200 people took part in this rail industry survey. Just over 70% of responses came from North America and Europe, split almost equally between the two, with a further 21% of responses coming from Asia, reflecting the three main regions of railway activity. Almost 50% of responses were from organizations with an annual turnover in excess of \$1 billion, which means they are major railways, while 30% of responses were from companies with yearly revenue below \$100 million – pointing to suppliers.

Survey participants came from a wide range of disciplines. Around 15% each were engineers and operators, while planners and IT professionals accounted for roughly 12% each. Executives made up almost 10% of respondents, followed by maintenance and customer service personnel (around 5% each).





Figure 01 Importance of asset management compared to other business efforts

4







Figure 02

Change of asset

management importance over the past 12 months



# Asset management is growing in importance

When asked how important asset management is to their organizations compared with other business efforts, 55% indicated that it is a high priority and one-third a moderate priority, which means 88% of respondents believe it to be important, while only 2% regard asset management as unimportant (Figure 01). When operators consider predictive asset management as a priority, they start to realize improvements in reliability, enhanced stakeholder satisfaction (i.e., commuters, travelers, etc.), and bottom-line results. Predictive asset management drives bottom-line results, reliability and stakeholder satisfaction (i.e., commuters, travelers, etc.).

Two-thirds of respondents believe that asset management has become more important during the last 12 months, while 20% see no change. Only 14% say that it has become less important (Figure 02).

"The fact that 67% say that asset management is becoming more important is significant," says Hagner. "There is increasing pressure from transport ministries on railway operators to improve safety and reduce costs, which means greater focus on inspections and asset management."

Almost 60% say long-term capital planning is a high priority in their asset management efforts, with another guarter saying it is of medium priority (Figure 03). The fact that such a high majority consider it a priority is indicative of the realization that it can significantly impact management's KPIs. "Despite this, a lot of the people I talk to say their long-term planning is based solely on the age of their assets," says Hagner. "Unfortunately, lots of assets do not fail simply because of their age. They fail because of their condition, their intensity of use and the type of usage. Railway operators could significantly improve their long-term capital planning if they factored in the health of their existing assets, but in the past that has been very difficult to do. This is an ideal use case for the Internet of Things, Services and People (IoTSP). More and more sensors are generating up-to-date information which can be leveraged to provide guidance for long-term asset replacement planning."

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Figure 05 Group leading asset management strategy





When asked how much of a role engineering, operations, maintenance, planning, IT, customer service, executives and finance play in developing their organization's asset management strategy, the response was fairly evenly distributed across all these areas (Figure 04). This is unsurprising given that railway operators cover a wide range of disciplines with different people responsible for different assets. The trick is to pull a strategy together across all these departments.

"We have now started talking to transportation executives about the benefits of ABB Ability<sup>™</sup> Connected Asset Lifecycle Management<sup>™</sup> (CALM)," Hagner says. "By connecting different systems and different stakeholder groups, organizations are able to become more efficient and more effective at maintaining their assets."

CALM involves three elements: APM, mobile workforce management (MWFM), and enterprise asset management (EAM). These can be linked to real-time systems like SCADA as well as the primary equipment and other OT systems that provide the incoming data which has to be managed. ABB believes all elements must be integrated. "To get value you really need to look at these systems operating together," Hagner says. For example, automating track inspection will improve safety by getting people off the track, and it will also provide more accurate and detailed information more quickly and more cheaply.

When asked which group within their organization is leading the asset management strategy, only 20% thought it was the executive, while 25% believed it was maintenance, 17.5% operations, and 10% engineering, with the other disciplines fairly evenly divided (Figure 05). This indicates a lack of overall strategy planning leadership within most organizations, highlighting the need for change in order to realize the increasingly important benefits of asset management for railway operators worldwide.

The fact that 64% of respondents thought these disciplines were only working fairly well together or not well at all, with 75% believing that the disciplines are poorly connected, confirms that there is a problem that must be addressed (Figure 06).





Most respondents indicated that integration of IT-OT applications would be valuable (Figure 08). However, three-quarters do not believe these systems are well integrated today (Figure 09). This recognition of the value that integration can deliver compared with the current lack of integration within organizations should be a call to action.

"Organizations are not working together, and the systems are not even linked," Hagner says. "Interestingly, a recent study of the utility sector by the ENTSO-E<sup>1</sup> showed similar results. The large network operators also generate a lot of data in separate systems, but most are not integrated. People are beginning to understand that there are benefits to be gained by pulling this data together. They are looking for help to understand how to do it."

An interesting outcome of the survey is that respondents had difficulty ranking the importance of KPIs such as improved safety, increased reliability, better use of capital, more efficient operations and maintenance, increased staff productivity, better visibility across the organization, and improved long-term planning as benefits of IT-OT integration in relation to asset management. They also found it difficult to decide which factors would have the most impact in preventing such integration.

<sup>1</sup> "Strategic Asset Management Tools for TSOs" – 13 March 2015



No value Extremely valuable

3

4

0

Fairly well 42% 7



Paul Barnes Route Asset Management Team, Western Route Network Rail

# **Spotlight interview**

# What are the biggest changes you see coming for asset management in the next few years?

One of the reasons I got involved with ABB is that we are currently undergoing electrification of our main line, the first electrification program that's taken place in this country (UK) in quite some time. So that involves 1,000 km of new overheard line at 25,000 volts, and it's that challenge that is really the way ABB is involved with us in upgrading the routes. I've worked in a lot of asset-rich, regulated industries. That's where I made my living, as a consultant, contractor building them, and operator running them. The biggest changes I see coming are:

- We've now got much more disparate ownership of assets. Previously asset owners like municipal authorities, nationalized industries and large corporations had a pretty good view of what their own asset bases were, and they were all in relatively close proximity. Over the past few decades, the asset ownership, and franchising out of various asset operations increased. So now you've got much more disparate ownership of knowledge of how those asset management subsystems work. I think the biggest changes coming up are how we integrate and exchange information on all those subsystems and how we draw those platforms together. That requires collaborative working. It requires a recognition and respect for each other's individual talents in the asset area, as well as the hardware, software and mechanisms that allow us to draw things together and make decisions
- There's an absolute explosion in the amount of data coming in. Because we're now able to monitor and measure more, we do monitor and measure more. And, I don't think we properly understood how to extract the correct information from those processes.
- 3. One can always play games in funding assets. You can sweat the assets, you can extend their lifecycles, you can carry higher risks, but we now have techniques that allow us to understand those risks. Certainly where I first came across ABB was in the whole concept of total expenditure regulation, where you as a utility operator or asset management network operator are required to understand a lot more about your balance of capex and opex.

# How do you think railway operators can best prepare for the changes that are coming in this industry?

ISO 55000 gives a great framework around which you should prepare. A lot of it is quite common sense if you worked in asset-rich industries. Get the structure of your classification of assets correct; understand the relationship between those assets. Understand how you're going to manage the data flows between them. Get inside the cause/effect mechanisms in understanding exactly what drives the outputs from those systems.

In the case of the rail operations, if you're in a more fragmented industry, what you need to do is design the processes that bring those together on a common data platform in a way that respects the intellectual property and the commercial sensitivity of information to the parties within the rail system – but actually gets those people to buy into the fact that a common framework for understanding what that means is a good way to deliver more revenue and a higher return to the asset base. I recommend an understanding of where you sit within the system and where your value-added relationships are with those people around you – rather than guarding and protecting all your knowledge because that's not going to make the system work more effectively as a whole. That's where I see the changes coming up.

"... the way we use data on our assets and manage the assets is going to change as technology improves."

### What does your IT-OT integration for asset management look like today, and how do you see it evolving as more assets become connected?

The role I'm in is partially created by the demand for how do we bring IT and OT together. Let me look at this in the way the Western Route is working. So, as a route, we are an operational entity within the larger national business. The way we're doing the design on the Western Route for the new electrification systems, we've tried to incorporate in that design a little bit of IT-OT – in the sense that our electrification systems have intelligent devices in them, which will link to the management of operations' integrated mode – something in the past that was done through the signalers, through decision-making processes, which were more humanly based. So, as we've designed the upgrades on the Western Route in the electrification, signaling, comms, etc., etc., we have brought in more of this IT-OT integration. And, that's quite new for the industry.

What we find as an operator is that it is very difficult to stitch the processes and systems together. They're all very good individually, but when you're charged in the route with managing the system (that's the first place it comes together) we don't have the platforms that facilitate that. So, we still find we have multiple sources of data. We still find we have to use different pieces of hardware to bring it together.

So, the evolution of this is, you can use individual tools which give you much more information. But, what we lack is bringing that together to form intelligence on the whole system. It's bringing visualization together. It's "What is it I need to do? What is my predict-and-prevent regime?" If I've got thousands of kilometers of track out there, hundreds of thousands (approaching millions) of assets, what do I need to know this morning in order to make it work effectively tomorrow? We've got lots of components, but we haven't got the ability to draw it together in a picture which allows us to do it. And, that's where we see the IT-OT going.

Prepare for emerging technologies and processes with a unified asset management strategy.

#### In the context of your company's bigger picture, where does asset management fit in and how important is it as a strategic initiative?

Four of our company strategies are aided by asset management:

- 1. Reliable infrastructure
- 2. A technology-enabled future
- 3. Opening up a railway fit for the future
- 4. Reducing public subsidy

We can only do that by becoming more efficient and effective in the way we understand our asset information.

## Leveraging technologies to improve strategic asset management processes

In the context of the new digital economy, when asked how influential the internet of things (IoT), mobility, cloud technologies or big data and analytics, including machine learning, would be to their organization's asset management efforts, the answers were distributed fairly evenly across all four (Figure 12). Similarly when asked whether a strategy existed to adopt these technologies, answers were fairly evenly distributed between "yes," "no but planning to," "no plans" and "don't know."

One reason for such responses could be that while these are terms that people have heard of, they don't really understand what they entail or what they can do.

"People know that the internet of things, services and people and big data will lead to change, and that the cloud is out there and that it will have an impact, but what will it do?" Hagner observes. "The challenge for railway operators is to figure out how to leverage these technologies to improve their strategic asset management processes. Standards like the ISO 55000 Asset Management Standard can help them get a unified asset management strategy in place. These technologies then can help them achieve that strategy in innovative ways that they struggle to even imagine today."

Having a strategy in place will enable railway operators to take advantage of new systems when they become available. "One alternative for railway operators is to learn from the experiences operators in other industries have made," Hagner says. "Telecommunications and electricity transmission companies are also going through this process of discovering what these new technologies are making possible. Another alternative is to work directly with traditional OEMs, like ABB, that are rapidly expanding in these areas."

"It is vital for railway operators to get advice now about how these technologies are developing and the impacts that they can bring. There are many new technologies on the horizon. This is not a journey companies should be making on their own."



#### — Figure 11

Benefits of IT-OT integration for asset management (average ranking on a scale of 1 to 5)



Transit operators (bus, metro, light rail and commuter rail) all have public safety as one of the main tenets of their organizational mission statements. This can be demonstrated by the recent one-day complete shutdown of the Washington DC Metro system so that fire hazard inspections could be conducted in every metro station. Survey respondents may have had difficulty ranking the KPIs around safety, reliability, productivity and planning because they are so interrelated.

### Bottom line

The survey was conducted to get a better understanding of where railway operators are in terms of developing asset management strategies, and whether convergence between IT and OT is progressing (Figures 10 & 11). In both of these areas, the responses showed that railway operators recognize the need to improve, but they struggle to find the best way to move forward.

Asset management continues to increase in importance and is impacting almost all parts of the operator. Cooperation between these organizations, however, needs to improve.

Identifying a common asset management strategy and sharing data between these organizations will be critical for railway operators as they enhance their asset management strategies and capabilities. The convergence of IT and OT, as well as many other technology approaches are known, but there is too little experience with them. Railway operators should work with experienced EAM partners to help understand both the high-level strategy as well as the details of implementation of systems to be prepared for the next wave of railway asset management.





#### Next steps

Based on some of the trends that have been observed in the survey, ABB's Steve Hagner has some ideas:

- Get an asset management strategy in place and make sure it's based on the best practices of ISO 55000.
- 2. Survey the information that you can obtain from your systems and understand what insight you have already; from here rail information professionals can truly understand the opportunities for plugging in assets for deeper levels of analysis.
- Identify what information your executives need in order to make better decisions. Understanding what might be impacting the agility or performance of the network will provide a route that teams can use quickly to chart new and successful courses.
- 4. Embrace technology, think about the opportunities that the cloud, mobility and the IoTSP can offer to complement innovative and future-looking strategies.





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