Network Rail recently awarded a contract to Fugro for survey and design works to support its high output track renewal programme in Scotland. The deal saw Fugro use its train-mounted RILA and RILA 360 laser scanner to deliver critical rail infrastructure information; a new technology and approach to data collection that fits perfectly into the building information modelling (BIM) way of thinking.

Building information modelling

BIM is the means by which everyone can understand a building or asset through the use of a model. Fugro’s approach to the collection of essential rail information is based on a similar philosophy enabling users to share information on assets over their entire life cycle. Fugro RailData director, Nick van den Hurk, explained the concept of BIM by comparing survey information with LEGO blocks.

‘In the conceptual and feasibility stages of a project, engineers may use airborne survey techniques represented by the larger DUPLO blocks. These rough blocks enable us to make a basic model, quickly and cost-effectively over long linear distances.’

As the project enters the detailed design and engineering stage, a more detailed model is required. In this case, normal and technical LEGO is used. ‘The technical LEGO creates the form and function of the structure and so the process continues throughout the life cycle of the asset, from whole-life maintenance to renewal,’ added van den Hurk. ‘We can apply this analogy to the rail industry, where Fugro’s innovative technologies act like LEGO blocks, enabling us to choose the right RILA sensors and products for the appropriate phase in the railway asset life cycle.’

Data collection

It all starts with collecting the right data for the project; Fugro’s RILA sensors can be mounted independently or together to survey the entire rail corridor (figure 2). The RILA system measures absolute track position and geometry to engineering specification accuracy, incorporating georeferenced video to record track assets. Compact and transportable, it connects to the rear of a regular passenger train in less than two minutes and surveys the rail tracks at line speed.

The RILA 360 uses two laser scanners, rotating at 200 Hz and recording one million points per second, per scanner and provides ultra-high density LiDAR point cloud data of the route. The position of the point cloud data from the RILA 360 can be referenced using the highly accurate RILA track position data, providing an absolute position accuracy of 1.5 centimetres horizontally and vertically (1 sigma), a level of precision not normally possible using conventional mobile mapping platforms. From this georeferenced point cloud it’s possible to work in all the post feasibility phases of the BIM process.

Detailed design phase

The considerable advantage of Fugro’s latest survey technology is that it allows very detailed data to be collected in the design phase, which can then be reused many times throughout the life cycle of the asset. For example, the point cloud data can be used to make a digital terrain model (DTM) that provides a rough model of the topography.

The engineer uses this to work out his first conceptual thoughts. From this, the initial design calculations are developed, which require a more detailed model of some areas. Using the same point cloud data, objects such as track, poles, platforms or bridges can be extracted. The engineering team is able to bring the different disciplines together and add more information to the BIM model as the project progresses.

Construction phase

In the construction phase of the asset the BIM model is used as a workflow for the contractor. Critical elements like time and costs can be included, as well as monitoring information of surrounding objects (bridges, buildings...
and tunnels); track deterioration; or the impact of improvements associated with construction activity. Once the asset is constructed, as-built information, such as the track, poles or overhead wires, can be added.

**Whole-life maintenance phase**

The operation and maintenance phase of the BIM requires the biggest investment of time and money. In this phase, the absolute location of the asset is fixed so the focus is on the asset’s condition. With different RILA sensors, Fugro is able to produce a highly accurate 3D model of the railway corridor, giving designers greater access to full scale information, video or extracted features. This model can be used to analyse trackside assets, critical clearance issues and areas obscured from airborne systems.

Pre-renewal, RILA can be used to screen for any anomalies or stability issues with the existing track that can be addressed during reconstruction. Post-renewal, it can deliver high accuracy data for all-important quality assurance – to check that any pre-existing issues with the trackbed or geometry have been resolved, and to troubleshoot any non-alignment or non-conformities.

**Subsurface information**

The whole model becomes more valuable to the client if subsurface information, such as drilling and cone penetration information, cables or other objects, is added. Fugro’s ground penetrating radar (GPR) technology provides a complementary view of track infrastructure.

Imaging the subsurface to about a metre below the rails, GPR scanning is becoming a routine element in the asset data collection mix and technology is getting quicker and more modular for use on a wide range of locomotives. Common applications of GPR scanning are the assessment of trackbed thickness and condition and the detection of buried services. *Figure 3* shows how subsurface objects can be added to the complete BIM model, making it possible to evaluate subsurface clash detection prior to the construction phase.

**The next step**

Having met demands for more integrated solutions, the next step is to share this information via a cloud-based platform. Fugro is in the process of developing the RILA web service, through which engineers and managers can remotely investigate and monitor their network, bringing the real world to their desktop.

Becoming an integral part of the BIM process, Fugro can also act as geo-information manager, taking responsibility for the life cycle of clients’ assets. The integrated solution is not just about putting data sets together, it’s about adding asset information to the model – for example, knowing where assets are by using their coordinates to create the model.

Fugro’s RILA solution means that all stakeholders can rely on one platform for sharing information, collecting data once, using it multiple times to support the integrity of assets, and driving future efficiencies.

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