Rapid Return

A project in England sets a new standard in railway renewal.

The highly traveled section between Warrington and Preston of the UK's West Coast Mainline rail corridor required the renewal of three miles (five km) of track among four major junctions. In an intensive, nine-day continuous spell, the Innovation Team at Network Rail completed the work almost 16 months earlier than proposed—and avoided disrupting rail travel. More importantly, Network Rail, the organization that runs, maintains and develops Britain's rail systems, achieved this considerable feat by grading the sites with machine control; reduced tamping runs using real-time data; shared all data across work processes; and monitored and recorded track movement data via video. What's more, the work set a new standard in the UK for switch and crossing renewal: at the time of handback, or return to service, trains could operate at 130 km/h (80 mph), a 60-percent increase over the normal 80 km/h (50 mph) handback speed.

As a long-term user of machine control for rail work, Track Engineer Colin McAteer applied a single-mast 3D Trimble GCS900 3D Grade Control System on site dozers—a relatively new way to work in switch and crossing and line renewal. McAteer and his team were confident that the single-mast system would be sufficient for the dozer operators to dig the formation and place ballast at +/-15mm (0.6 in) precision using GNSS or at +/- 5mm (0.2 in) with a Trimble Universal Total Station (UTS). The switch from antenna to prism could be made in just 10 minutes. The single-mast systems were run off a single Trimble GNSS base station, which kept costs down. "The quality of the GNSS positioning meant that we could position the rail panels within 15 millimeters of final position and, in fact, only needed to tamp once, saving us much-needed time," McAteer stated.

Trimble's GEDO Vorsys pre-measurement system also reduced tamping runs. The solution utilizes two track-mounted trolleys working together, one with a Trimble S-Series total station and the other with the prism and control unit. The trolley sensors measure the gauge (distance between the running edge of the rails) and the cant (superelevation of the track), and continually transfer the data wirelessly to a Trimble TSC3 Controller. GEDO Vorsys field software running on the TSC3 combines the data from the sensors with 3D positions from the total station to enable real-time data to be displayed live in the field. This solution provides the high level of accuracy required by the railway industry with operational speed and flexibility.

Measurements are made using georeferenced control points positioned along the track. Since the full track design geometry is stored in the TSC3, GEDO Vorsys field software can calculate and display the lift and slew values to final design, the cant and gauge information, and all the significant points where the track geometry changes—a substantial time and accuracy advantage over manual recording.

"Trimble Vorsys doubled our sampling rate and halved our survey time," McAteer explained. "We could sample every 5 meters (16 ft) compared to every 10 meters (33 ft) with pegs. We were therefore easily surveying 500- to 600-meter (1600- to 1900-ft) stretches in just 40 minutes rather than the half-day-plus it would have taken with traditional methods."

Additionally, the speed raiser report, which included horizontal and vertical tolerances along with twist and gauge parameters, provided an extra level of confidence that allowed the handback engineer to open the track at 130 km/h (80 mph).

"The ballast and formation data is prepared in Trimble Business Center software as is the root data that goes into Vorsys," McAteer explained. "TBC also allowed us to visualize the design beforehand with the drive-through function, which enabled us to spot issues on the DTM."

This combination of interchangeable technologies proved to be ideal on Network Rail's corridor job. "Our engineers are all working from the same design data and using the same software interface whether they are carrying out a grade check or an as-built survey," McAteer said. "This brings familiarity, which means the team can skip between tasks seamlessly. There is no additional training required and that cuts site downtime and improves the quality of work.

The precise efforts and rail work process advancements allowed construction to wrap up quickly. After the track reopened, independent monitoring provided a clear indication that the track was behaving normally under load—a prime consideration in the decision to go with an 80-mph opening. The track achieved full operating speeds of 110 mph (180 kph) in just 7 days. "We pushed the barriers," McAteer said, "and thanks to a combination of great systems, great people and great teamwork, we delivered the UK's first-ever 80-mph handback."

See the article in xyHt, October 2014. www.xyht.com