Trackside Axle Counting Network
Cardiff area signalling renewal project

Westermo®

Robust Industrial Data Communications
– Made Easy

Westermo line extenders and switches help manage train movements from Cardiff Central

New trackside axle counting system being introduced as part of the Cardiff Signalling Renewal project required the installation of an IP-based network. Paul Carney, Engineering Manager at Atkins describes how technology and services from Westermo are providing a robust and resilient platform for data communications

The Cardiff Area Signalling Renewal (CASR) project is a major scheme to replace life-expired signalling and associated power and distribution equipment across 192 route miles of track between Newport and Port Talbot, covering the Vale of Glamorgan and Valleys areas. Network Rail awarded the signalling and power distribution contracts to Atkins who are delivering this comprehensive signalling project through five separate phases and carefully managed stage works to minimise passenger and freight disruptions.

The CASR project is a technically challenging project and one of the first major schemes to use the latest innovations such as plug couplers

Integrator:

ΛTKINS

End customer:

NetworkRail

and new train detection technology to help save time and money. The Frauscher digital axle counters (FAdC) chosen by Atkins for train detection, require an IP-based network supporting Network Rails national engineering strategy which is to move towards IP based systems which have lower installation costs and are easier to install. In addition, IP-based solutions are easier to integrate with ground system data networks and are easy and straightforward to maintain.

To support the use of this new technology, Atkins needed a data communications company that could not only supply robust products that had the necessary approvals, but could also provide technical support and installation advice for this difficult application.

Atkins was familiar with Westermo as a supplier of high performance communication products and had previously used its modems on a number of systems and projects. For the Vale of Glamorgan line, which had very basic signalling and no communications network, Atkins selected Westermo Wolverine DDW-225 line extenders to provide the basis of a robust and resilient IP- based communications network.

In total, Westermo is supplying over 170 line extenders for the CASR project. These are being installed in trackside signal location cabinets near to the FAdCs to provide information on rail movements and enable access to diagnostics from the FAdCs and the power supplies.

Westermo line extenders already had Network Rail acceptance for telecommunications applications and it was a simple procedure for this to be extended to cover signalling applications. Used to overcome the 100 metre limitation for Ethernet cabling, they meet the requirements of EN50121-4 for railway trackside use and are constructed to resist the toughest operating conditions. For example, in this application they are housed in stainless steel signal location cabinets that have no air

Application
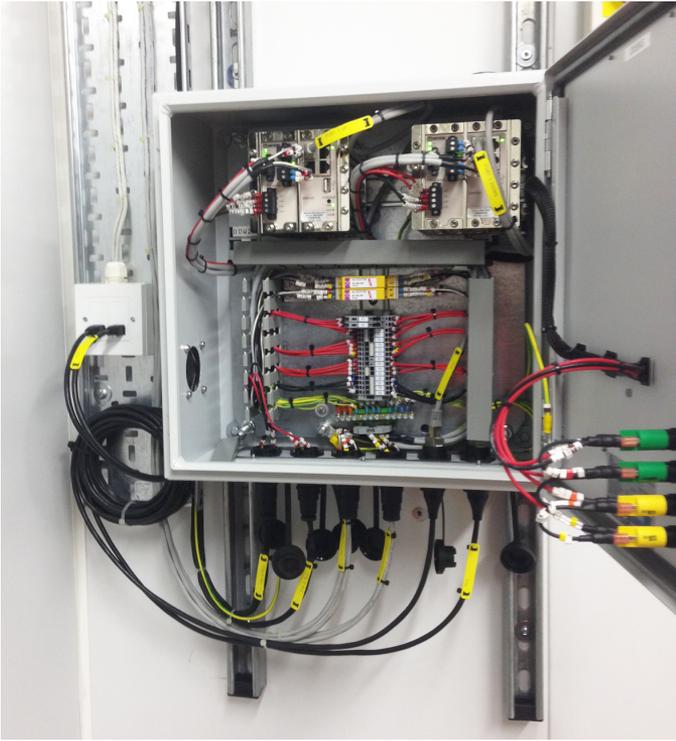
conditioning or fan and therefore need to cope with a large annual temperature range. As well as matching the operating specification of the digital axle counters, the Westermo devices are unaffected by extreme temperatures making them ideal for this trackside application.

A key element to the overall train detection system was to design a completely novel transmission communications network/system to transmit data from the axle counters. The FAdCs wheel sensors are fitted to the rail using a clamp and they replace the traditional 'short circuit' detection method to provide data on a trains location. Unlike traditional short circuit detection methods, axle counters are less affected by environmental conditions and offer greater reliability and availability. FAdC wheel sensors are clamped to the rail at specific points to prove that section of track is 'clear' for a train to proceed. A 'track section' needs at least 2 wheel sensors, but can more wheel sensors in complex areas.

Working with Westermo, Atkins produced a basic architecture for a fully distributed system that tied in where possible with the existing

fixed telecoms network (FTN) nodes for the scheme. Westermo evaluated the system architecture design and provided advice on commissioning and configuring the devices.

The DDW-225 line extenders form the basis of the Ethernet network which links the signal location cabinets together at various distances depending on where the signals are located. SHDSL (Single-pair high-speed digital subscriber line) technology enables the DDW-225 to support long distance transmission over a mixture of new and legacy copper cabling. The DDW-225 uses the Westermo WeOS operating system that provides the unit with advanced switching and routing functionality. With consistent user interfaces and guaranteed interoperability, WeOS devices provide a reliable and future proof solution.

At each end of the network, and at various points along the 25 miles of track of the CASR Phase 1 area , the Ethernet network connects to the control room using the existing FTN to provide redundancy. Should there be a device failure, or a section of the Ethernet network becomes damaged or is removed through theft, the data from the sensor can be re-routed via the FTN network back round to the adjacent sensor via the ring formed by the remaining cable and FTN. This is made possible using Westermo's unique FRNT (Fast Recovery of Network Topology) technology which enables a 20ms recovery time.

Train movement and diagnostic data is being transmitted to the control room at Wales Regional Operations Centre (WROC) via the FTN. Within the control room, Westermo Lynx switches and DDW-225 line extenders are being used to optimise network performance and manage the network delivering data to the SCADA system.

The Lynx 210-F2G managed Ethernet switches are designed for use in demanding applications. Also powered by WeOS (Westermo operating system), they provide a stateful inspection firewall, static and dynamic IP routing and IPsec VPN support for more advanced networks.
In addition the Lynx 210-F2G meets railway trackside standards.

Following a trial period, the systems and communications networks are operating successfully, providing accurate and reliable data on train movements from the trackside locations to the WROC in Cardiff. Phases 1, 2 and 3 are already complete and the project will be fully commissioned during late 2015.

Lynx

Product/Art. no	Description
L210-F2G 3643-0105 **L210-F2G-EX** 3643-5105	Managed Ethernet Switch with Routing Functionality 8 x 10/100 Mbit/s, Ethernet TX, RJ-45 2 x 100/1000 Mbit/s, pluggable connections transceivers supported. Ethernet FX or TX, SFP. 1 x Digital I/O. 1 x 2.5 mm jack, console. Operating voltage: 19 to 60 VDC. Operating temperature: –40 to +70°C (–40 to +158°F).

Wolverine

Product/Art. no	Description
DDW-225 3642-0240 **DDW-225-EX** 3642-5240	Ethernet extender with serial support Ethernet extender with serial support 4 x 10/100 Mbit/s, Ethernet TX, RJ-45. 1 x 300 bit/s to 115.2 kbit/s, RS-232, 9-pin D-sub (male). 2 x 32 kbit/s to 15.3 Mbit/s, SHDSL 2-position detachable screw terminal. 1 x Digital I/O, 4-position detachable screw terminal. 1 x USB. 1 x 2.5 mm jack, Console. Operating voltage: 16 to 60 VDC. Operating temperature: –40 to +70°C (–40 to +158°F).