AUSTRALIAN BULK HANDLING REVIEW

www.BulkHandling.com.au

Volume 20 No 4 September/October 2015

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Figure 1: BHPBIO Mooka East and West tracks.

Meridian moves to bolt-on load cells

In a first for the company, industrial weighing specialist Meridian Engineers has used bolt-on load cells for its high speed weigh bridge systems.

Since 2005, industrial weighing specialist Meridian Engineers has supplied eight of what it describes as its "Rolls Royce" high speed weighbridges (HSWB) to the iron ore industry.

These weighbridges have eight weighing points and they can weigh a train in motion at up to 80 kph. According to Dr Anthony Pruiti, managing director of Meridian Engineers, they can readily achieve NMI Class 0.5 total train weighing and NMI Class 2 individual wagon weighing between 20 and 80 kph.

"The first systems were built in the Meridian workshop with strain gauges bonded directly to the rail. These HSWBs have proven to be reliable and long lasting, however when a strain gauge fails through a lightning strike, repair work in the field is tedious and time consuming," explained Dr Pruiti. "The old gauge needs to be removed and a new one needs to be bonded to the rail. All this takes place 200mm above ground level."

A move to bolt-on load cells

When BHP Billiton Iron Ore (BHPBIO) ordered two new high speed weighbridges for its Mooka Staging Facility under the Port Hedland Inner Harbour Project, Meridian was keen to promote bolt-on load cells.

"Replacing damaged load cells becomes quick and efficient," said Dr Pruiti. "The design was accepted by the client. One HSWB was located on the East track and one on the West track." (See Figure 1).

The HSWBs were placed into service at the start of June 2015. With over 250 million tonnes per annum of iron ore now being railed by BHPBIO, the weighbridges are called on to weigh thousands of wagons every day. To protect this major investment in infrastructure assets, it is extremely important these weighbridges are highly dependable and accurate at main line train speeds.

Glencore Collinsville Coal split weighbridges

When Collinsville decided to upgrade its wagon loading system it chose Honeywell to provide a PLC system for gate control. Loading control was to be volumetric-based with early warning gross weighbridge feedback to reduce bogie overloading. With the low coal price, Collinsville was keen on economical solutions and Meridian was happy to supply a tare and gross weighbridge. Meridian offered two 'split' weighbridges.

"Meridian's new split design has no significant performance difference from our proven regular weighing system for train speeds under 10kph," said Dr Pruiti. "However the new design has the major advantage of not requiring sleeper relocation or track foundation disturbance. It is estimated that it is $10,000 cheaper to install with a half day of installation time saved.

"The new split weighers were found to match well with the nearby Queensland Rail Collinsville overload detector weighbridge with total train weight matching comfortably within ±0.5%."

BHPBIO Mining Area C train loading mass control system

In 2003 Meridian installed a bin weight monitoring system at Mining Area C (MAC). The bin straddles the rail track and is used to load wagons. In 2010 some of the electronic hardware was upgraded to modernise the system. The original 2003 load cells on the columns have never been replaced and they continue to operate well today.

In early 2014 MAC approached Meridian for information on its train weighbridges and train loading mass control systems (TLMCS). MAC was seeking improved efficiency with wagon loading. The TLMCS can be retrofitted to existing bins and in this case the bin weighing system was included in the new works as one of the important components.

The basic concept of the Meridian TLMCS system is described as follows.

A train enters the loading facility crossing the Meridian tare weighbridge first. Here the train consist is automatically determined and an initial starting weight for each wagon recorded. A Radio Frequency Identification System (RFID) system is also used at the tare weighbridge to record the wagon identification number.

As each wagon approaches the loading chute, the Meridian speed and position system provides responsive, real time updates of the wagon's speed and position to the master controller. This information is used to determine an accurate opening position for the loading chute.

MAC train load out.

ME-TrackWeigh-2D gross weighbridge.

Instrumented rails 8.3m long.

Whaleback rail in a concrete channel.

Cover plates.

Dual weighpoint gross weighbridge.

Once the loading chute is opened, real time data from the Meridian bin weight indication system and the conveyor feed weightometer allows the TLMCS system to calculate in real time the mass of material falling into the wagon.

The master controller is therefore able to issue a close-gate signal to target the required gross wagon load. The wagon then proceeds to be weighed by the outbound gross weighbridge where the system checks for target load and load eccentricity. Minor feedback can then be made by the system or the operator to improve loading performance.

The system was completed in March 2015 with the assistance of Honeywell to modify the interface between Meridian and BHPBIO systems. "Wagons are now loaded under mass control at a significantly reduced variance around the target load. This has ultimately allowed the site to increase wagon loads since installation of the Meridian TLMCS," said Dr Pruiti.

BHPBIO multiple train weighbridge upgrades

After reviewing its train weighbridge needs for the future, BHPBIO chose in early 2015 to install new Meridian weighbridges at all of its load out sites. Some of these load out sites were concrete tunnels such as Yandi and Whaleback, others were bin load outs such as Eastern Ridge and Jimblebar.

The common feature for all loading stations was that BHPBIO chose a ME-TrackWeigh®-1D for the tare weighbridge and a ME-TrackWeigh®-2D for the gross weighbridge. All weighbridges have bolt-on load cells. BHPBIO has increased its focus on axle and bogie loads to maximise ore transported to port and at the same time to do it in a safe manner.

"The 2D gross weighbridge has two weighing points and is more accurate that the 1D," said Dr Pruiti. "It also has a greater level of redundancy as it is able to revert back to a highly respectable ME-Trackweigh-1D system should an incident occur that results in damage to a weighbridge bay."

New, 8.3m lengths of rail were supplied to Meridian by BHPBIO. Each pair of rails had a specific hole schedule drilled in them, prior to delivery to Meridian's workshop. The rail-mounted equipment was then installed by Meridian.

Trackside junction boxes containing electronic equipment were largely the same at each site but each had unique mounting solutions. Controllers and software varied from site to site in order to match and interface with existing BHPBIO systems. All electronic equipment was assembled and tested in Meridian's workshop in Perth. All software was developed by Meridian.

"In comparison, bin load out installations were much easier to implement than tunnel installations. At bin load outs, one has easy access to the track, one can work in daylight and the work is on normal rail track. In a tunnel, the environment is much more demanding. Both sites require track closures," explained Dr Pruiti.

Meridian explained some aspects of the tunnel work:

- There is a greater sense of urgency. Crews work 24 hours a day to achieve the goals of the shutdown. Meridian had three engineers/technicians on site working eight hour shifts to supervise the work.
- There is no natural light or ventilation.
- In tunnels, access is along the tunnel only, so measures must be implemented to allow vehicles to travel along the tunnel while the work is undertaken.
- Each rail in the Whaleback tunnel was set in a channel in a thick concrete slab.

At all sites during the shutdown, 8.3m lengths of existing rail were removed; rail support spans were adjusted at the weighbridges; conduits were located in the ground or in the concrete slabs; new instrumented rail was installed; new junction boxes were mounted and cables were drawn and terminated.

In tunnels, BHPBIO wanted the rail-mounted equipment to be protected from vehicle traffic. Robust cover plates were installed that would allow a 27.5 tonne suction truck to cross the weighbridge.

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