Baldwins Aggregates, Mobile-Fixed – "Hybrid" crushing plant.

Summary of Proposed Presentation by Cobus van Vuuren for consideration by Awards Committee.

The assets of Baldwins Quarry Ltd was purchased by Higgins Aggregates Ltd on the 11th October 2012 and a new company, called Baldwins Aggregates Ltd was registered.

Baldwins Aggregates Ltd is an unique Quarry that commands a niche market section which supplies the roading industry with high PSV sealing chip and Asphalt chip.

The challenge given to the Aggregates Division was to install a plant that would fit into the very narrow footprint available, and allow us to continue to service the market without interrupting supply. On the face of it this would be easy as we could use the existing mobile equipment to maintain supply while we installed the new plant.

After considering a number of designs, a layout was decided and we went to market to get quotations. Unfortunately, the fixed plant required to meet the

quality and demand was priced between $3,5 million and $7,5 million. This was not a financial option that was attractiveor viable.

Some innovation was required and it became clear to me that the only way forward was to use the crushers and screens we had, as this would substantially reduce the capital cost and installation cost. The challenge of remaining in production meant using the mobile plant, reconfigure layout byusing some items of new and used fixed plant, remove bottle necks, and apply the now available electrical installation to be the primary energy source and drive the mobile crushers. The energy savings projected with the initial costly design was available to this option if we electrified the mobile crushers. This concept was presented to Management using the substantial capital savings as the primary financial justification and the project got the nod to go ahead. We, being I, Kerry Reilly and Brightwater Engineering then proceeded to finalise the plant design and layout.

It was going to be a ‘hybrid’ plant, with fixed and mobile components, the latter being incorporated at the last moment to allow us productive capacity to the point when the plants were married. The mobile plants were not to be altered in this processwhen they became part of the fixed plant. They had toremain available for mobile crushing if there were more pressing need for mobile crushing units elsewhere in the group, or when a full fixed plant could be justified to replace the mobile components.

An noteworthy innovation of this design was the implementation of a square box feed hopper, which would enable the Mobile LT100 jaw crusher to be driven into position below the hopper once installed.

(Photo: LT 100 being positioned)

This allowed us to feed the plant with our dumpers directly rather than double handling, dumpingand feeding the product with an excavator into the plant as before. This option is still obviously available. There were some doubt by the original suppliers of the crusher as to whether the feeder would cope with a full load in the hopper, but some basic calculations convinced me that this would not be a problem, and we boxed on. (No pun intended.) The operational savings from this by itself was substantial, i.e. one 20 tonne excavator at $120 an hour all up for fuel, labour and owning/operating cost would save $240 000 over a 2000 hour operational year.

The project schedule and plant layout adopted, was done in such a way that we would be able to install all the fixed plant items first, and then in a final change over, drive the mobiles into position and commission. The bottlenecks in the mobile plant layout that was used before were recognised and addressed. The biggest of these were the size of the PAP screen on the LT1100 cone and the washing ability of the small MorgensonSizer. The redesigned plant layout took care of this by changing the application of this screen into a tertiary chip sorting function and using a new and much bigger horizontal twin shaft screen to be the PAP screen earlier in the circuit. This was followed by a double deck washing screen to ensure the product was delivered squeaky clean to the tertiary and quaternary screens. A rebuild Barmac crusher running of a VSDtogether with a number of interlinking conveyors was installed. (Photo below)

A feed surge bin was incorporated to take care of surges between the primary and secondary crusher.We also changed our idea of using tilt slabs as retaining walls and used an interlocking block system. This gave us the flexibility to change the concrete walls if required as we get more space in future. The scenario was set to bring in the mobile crushers. Only a short 1,5 m linking conveyor extension wasrequired to be installed once the mobile units were in position. The whole change over period took approximately 5 working days and the plant was ready to go. At this stage the electrical conversion was still on hold and the plant continued to work integrated with both diesel driven and electrical driven units working together.

The plant was now working to capacity, with an increase in throughput from about 110-120 tonne per hour to a consistent 180 tonnes per hour.

The next part of the innovationwas to remove the remaining large fuel burners out of the circuit i.e. convert the LT 100 and LT 1100 to electrical prime movers. There were at least two ways to achieve this.The primary objective was to not significantly alter mobile units through electrification. That meant that the electric motors could be added on and we could use new belt drives to drive the pumps and crushers directly and only disconnect the diesel motors from the gearboxes leaving them in position. Alternatively we could replace the diesel motors and gearboxeswith a pure electrical drive. Both options meant we could drive the units using a generating set if required. In the end the latter option was taken as being surgically clean, although there was potentially more downtime than with the first option.

Completed LT 100 electrification installation below:

The results were pleasing with a range of benefits some which were not included in the original financial justification. In summary these were:

1. Fuel savings(down from average $50k/month to $22k/ month.)
2. Diesel engine maintenance cost, servicing, filters, oils, mechanics time etc.
3. Time and manpower lost during refuelling.
4. Noise levels substantially down.
5. Carbon emissions greatly reduced.
6. Electrical interlocking with fixed plant elements a lot easier.
7. Reduced capital cost by reusing the crushers as is.

The project delivered as we expected it to do with savings as projected in both operational and running cost adding value to the assets and to the company bottom line.

This project would not have been possible without a number of key people and I wish to recognise the efforts of all the players in this project, apologies to those inadvertently not mentioned:

1. Higgins Management trusting me with total control of the project.
2. Kerry Reilly and his team going the extra mile.
3. Higgins Aggregates Engineering Team.
4. Brightwater Engineering.
5. Palmerston North Electrical. (Craig McKeghnie.)
6. QMI. Colin Welsch.
7. Interbloc Retaining Wall Systems
8. Dept. of Corrections.
9. A number of smaller contractors for ad hoc supplementary work.

The paper will expand on some of the challenges, show some of the justifications in terms of fuel savings, include a progression of slides and will be scoped to take approximately 25 minutes. It could be condensed to cover a 15 minute slot if required.

Cobus van Vuuren

9th March 2015