Cutting costs by design

Dr Michael Riese discusses how design optimisation for fabrication and manufacturing can improve project viability by reducing capital expenditure.

The 2008 Global Financial Crisis has seen investments and venture capital in the resources industry significantly dry up and only projects that promise quick yields, low risks and high return on investment are attracting substantial funding from third parties.

This has led to a postponement of some smaller and medium-sized ventures – once considered very viable – purely due to a lack of funding.

One of the major costs generally faced by the resources industry is the development of infrastructure and plant to process the ore.

This infrastructure can take multiple years before a return on investment is achieved and is directly driven by the engineering and process specifications generated at the front end. However, it is rarely understood by stakeholders what implications this has on the future cost of the project.

The manufacturing industry shows that the engineering design component only incurs a small portion of the project cost, but has a massive influence downstream. While the actual percentages will vary, the same proportional trends also apply to capital expenditure and plant development in the resources industry.

To reduce downstream costs and prevent them from growing in an uncontrolled manner, it is important to optimise engineering designs for manufacturing and fabrication. This can be maximised by the early involvement of suppliers and third party specialists.

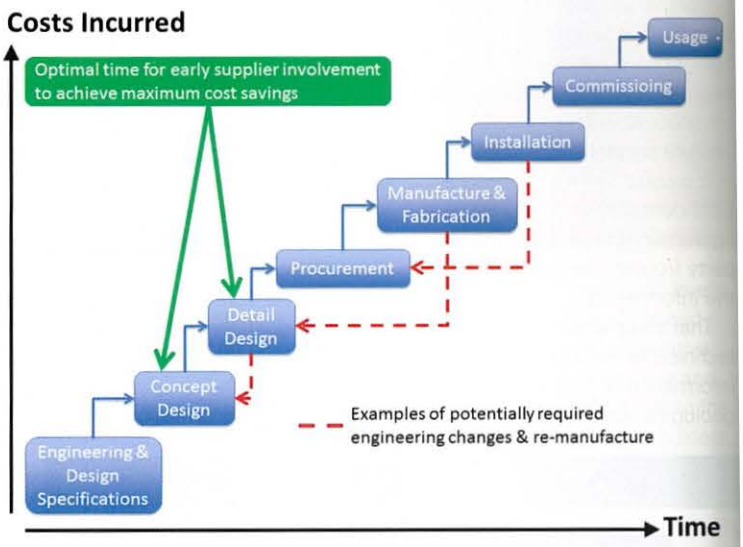
This approach of early supplier involvement leverages off the fact that mining companies and EPCM contractors generally have experts on staff who specialise in the design for function aspects of the project, but are rarely familiar with modern and current manufacturing techniques for one-off, small volume projects.

A simple example can be found when looking at an item made from equal angle, containing a few holes and two notches. The assumptions can be made that required tolerances of the item are so big that it can be manufactured by using simple shop and hand tools; that the cost for a skilled individual undertaking this work is around $100 per hour; and that one hour on a modern laser cutter or CNC brake press is charged at $200.

The traditional method of manufacturing involves ensuring the material is in stock, cutting to size, marking out by hand, adding holes and cutting the notches out using an angle grinder. With some deburring and cleaning up, this will take a good tradesman around 60 minutes or the equivalent of $100.

If there were a number of these angles the time to manufacture each one would roughly be the same, with some small efficiencies gained by setting up a mini production cell.

One simple alternative is to laser cut the angle out of flat sheet and then fold it on a brake press. For a one-off unit this would involve around 55 minutes of set-up time plus five minutes of actual processing, again leading to 60 minutes of total manufacturing



time, though at a higher hourly cost, resulting in a total item cost of $200. However, independent of the number of articles, the above set-up time will remain constant and unit costs rapidly decline with an increase in unit numbers, to a fraction of the unit cost of the traditional design.

While this is a simplified example, a few points are worth discussing further. It is irrelevant where the actual features lie on the piece of angle or how long it is. The key point is the similarity of the overall shape which reduces set-up requirements.

By using modern 3D CAD systems, it is easy to generate flat patterns and to program the CNC machinery for the items to be fabricated, further reducing the overhead costs incurred by set-up requirements.

By designing items to mirror off-the-shelf material, simple substitutions can be made on site if required, further decreasing time delays that may occur from damaged or missing items.

It is important to know that the reduction of capital expenditure when it comes to the design of plant and infrastructure has to be an overarching and inclusive approach which involves the key decision makers, engineers, accountants, procurement officers and supplier representatives.

Manufacturing, fabrication and construction techniques are ever changing. By including respective experts at an early stage significant savings to the end client can be realised, while often at the same time simplifying designs and reducing lead times.

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