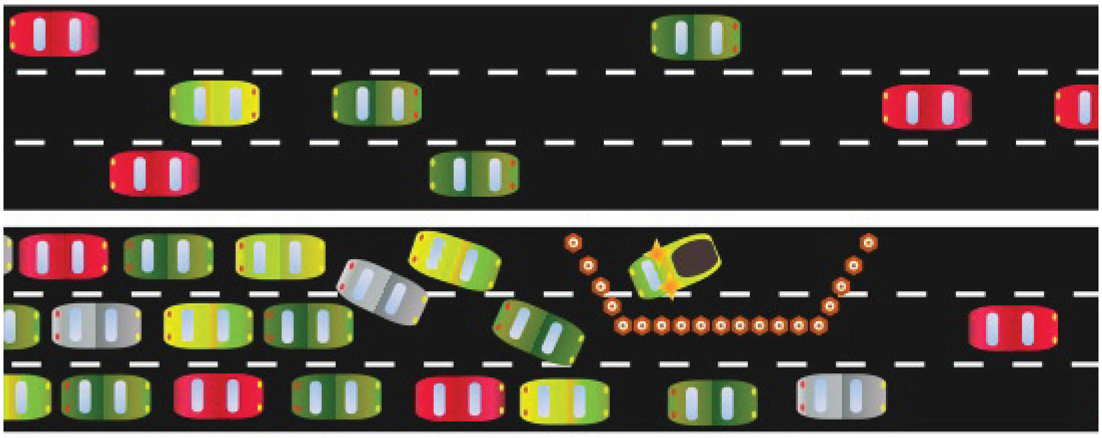
George Handley MBA Management Consultants

Bottlenecks in cement plants



As with any industrial process, inefficiencies in production lines and/or supply chains can lead to lost profit-making opportunities. In this article, George Handley of MBA Consultants outlines a number of cost effective means to address and eliminate bottlenecks in cement manufacture, therefore opening up opportunities to add value and increase profit margins.

Contrary to popular belief, it is possible to remove bottlenecks and quickly increase profits without spending large sums of money on a new plant. Bottlenecks are usually caused by mechanical failures, although they can be the result of problems within other areas of a plant's supply chain. When a process is slowed by a bottleneck, no more cement can be produced until the issue is addressed and resolved. In a plant with over 100 pieces of equipment, it may be only one or two items that are causing the whole site to bottleneck, thus limiting production.

Why bottlenecks are critical

Bottlenecks can be a major cause of profit loss because any extra production carried out within a year contributes directly to a plant's profitability once the site has passed the breakeven point. So if a tonne of cement sells for US$120, and the cost of materials, energy and transport is US$70, the remaining US$50 goes straight to the bottom line. In other words, the added value is all profit, since all other costs of running the site have already been paid for in that time period.

However, due to the fact that cement prices are not standardised and each different cement product is sold to different customers at different prices, there can be significant variations in profit contributions. Bottlenecks stop all production processes, therefore resulting in profit losses.

How to find bottlenecks

A simple exercise can find bottlenecks within a few hours:

- On a large piece of paper draw a box for every process or operation that represents an individual part of the cement-making process. You will have a diagram of perhaps 80-100 different tasks;
- For every box write down the number of hours per year that the task is operating at 100% efficiency. (In one year the maximum is 8736 hours minus any downtime for routine maintenance);
- Mark every box that is operating at the maximum possible in red, and every box that has spare capacity in green;

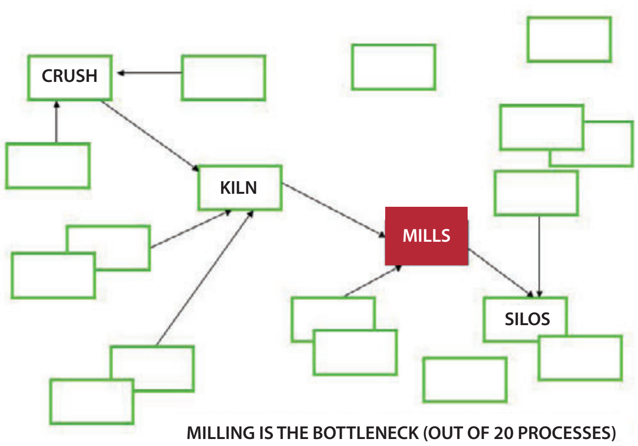
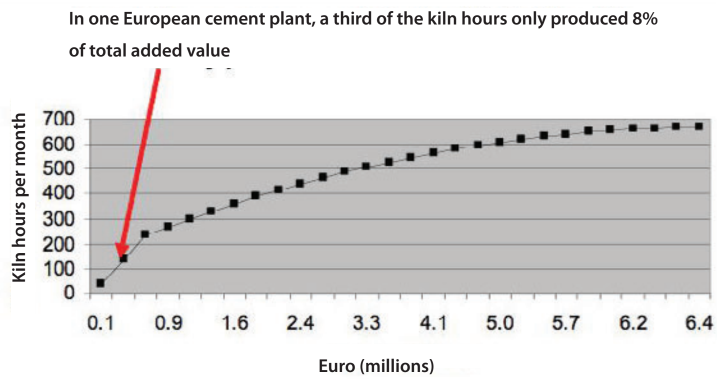


Figure 1 (left): A simplified sample diagram of critical path planning.



Graph 1 (right): The graph highlights the inefficiency of a European cement plant's kiln activity.

- Join all the boxes up in the sequence of operation. This is the critical path.

It is also possible to produce a ranked list of the same data. The overall efficiency of the plant is the sum of (hours per year running x replacement cost of plant)/(sum of (8736 x replacement cost of plant) for every piece of plant equipment on the site. In other words, if a simple pump costing US$25,000 only runs for 2500h/y that is not a serious problem, as it may not be integral to the plant's overall operation. However, if a mill costing US$5m only works 2500 hours out of a possible 8736 hours, that is a serious problem. On the critical path any red boxes control the speed of the critical path. These are the bottlenecks.

How to remove bottlenecks

The first answer may appear obvious – replace the problematic equipment. However, this often merely moves the bottleneck elsewhere in the process and the full value of the investment is never realised.

The best solution is rather more subtle, costs almost nothing and is often much more effective. If a cement-producing site has bottlenecks, then once discovered, it is possible to remove the poor products and even poor customers that can be causes of bottlenecks. For instance, if a site has a kiln and two mills, and the mills are 'full,' a new mill could be bought for US$5m, although this may not be the most effective method of solving the problem. In order to determine the profit impact of the new mill the following exercise should be undertaken:

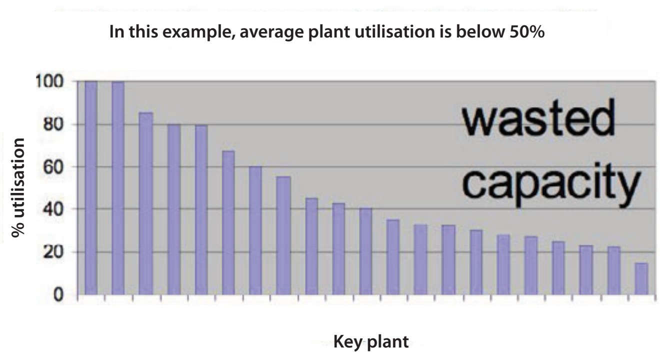
1. Make a list of all the customers who buy product from the site, no matter how large or small;
2. For each customer calculate the 'added value' of the entire sum of all the products they buy. (Added value is the selling price minus the total costs of materials, energy and transport of the delivered final product);
3. Calculate the number of hours that each customer currently 'uses' in the bottleneck process. How many bottleneck hours does each customer buy?;
4. For each customer, divide customer added value by customer bottleneck hours;
5. Rank the added value per bottleneck hour for all customers.

Usually the best customer will have added value per bottleneck hour of around US$5000, and the worst customer will have US$500. In other words the best customer is 10 times more profitable on the bottleneck than the worst.

The logic for investing in the bottleneck process is….

Investments in the bottleneck are paid for by the least profitable users of that process. Fill the existing bottleneck capacity with the most profitable customers first. Because the process is a bottleneck, there will be excess demand. There will be customers who cannot fit into the current capacity. These are the 'worst' customers. Now calculate the return on the new investment based on the profit from the worst/marginal customers. Normally the extra investment cannot be justified.

Instead of buying a new plant, it is possible to remove the worst users of that plant. Do not just justify the investment using the average profitability of customers.



Graph 2 (right): A graph highlighting the wasted production capacity in a cement plant

The June edition of *Global Cement Magazine* will feature another article by Mr Handley, explaining how to greatly increase the profitability of a group of cement manufacturing sites. Although calculations are more complex, one can reduce the cost of production and distribution across the whole group by 10%-20% within a few months with no monetary investment. If customer profitability is analysed, this can also be increased. Parts of a group's capacity are paid for by the worst customers in the group. For more information on cement plant optimisation, George Handley can be contacted at georgehandley@mbaopt.com.