

## Operational Excellence in Mining

### Leading Global Gold Mine: Open Pit through Mill Operations

#### Situation

Implementation Engineers partnered with a client on its Continuous Improvement Program. The partnership began with the development of a Balanced Scorecard system to give the leadership team visibility to their operation's key performance indicators including gaps between current and planned performance. These gaps represented a valuable opportunity in that the client, and Implementation Engineers, introduced Six Sigma as a means to capture some of this lost value. But first a Value Stream Analysis of the Mine, Mill and Exploration departments was needed to validate existing metrics, define the operation's true capability, and delineate a plan to close the gap between the two.

#### Approach

The objective was to assist and mentor the client with their newly introduced Continuous Improvement Program.

Implementation Engineers' *enCompass<sup>SM</sup>* model is a holistic implementation program that works to define and then execute a company's vision for improvement. Included in the *enCompass<sup>SM</sup>* model is the use of the traditional DMAIC approach (Define, Measure, Analyze, Improve, and Control). We used this method at the highest level of deployment for the Balanced Scorecard Development and Value Stream Analysis, down through the individual projects carried out by the Six Sigma teams. The DMAIC model was critical for ensuring that the client's projects were data-driven and linked to the organization's overall strategy for performance improvement.

Our *enCompass<sup>SM</sup>* methodology consists of four primary dimensions. As they are deployed, they will work in tandem to enable the client leadership to keep the Continuous Improvement Program moving forward and upward. The four dimensions are:

- Implementation Engineering<sup>SM</sup>
  - Organizational Engineering
  - Operational Engineering (including Value Stream Analysis)

- Implementation Planning & Readiness
- Implementation Execution (Project Deployment)
  - Work Stream & Project Execution
  - Training & Skills Development (including Lean Six Sigma Training)
  - Performance Analytix<sup>SM</sup> (including Balanced Scorecard)
  - Improvement Operating System
  - Organizational Development
  - Behavior Change
- Sustainability

### Performance Analytix<sup>SM</sup>: (Balanced Scorecard)

Implementation Engineers began developing a reporting structure for the client. The client leadership defined several high-level areas of the operation that they monitor to track operational performance. These areas included: Safety & Environment, Mine, Mill, Maintenance, Cost, People, Supply Chain, Continuous Improvement, and Projects. The team assembled a Balanced Scorecard of these areas using a visually coded (red/green) trending mechanism that tracked against supporting Key Performance Indicators (KPIs) and existing baseline data. This tool gave Client leadership “at a glance” visibility to operational performance and enabled them to see where they had gaps. See Figure 1.

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KPI Area	YTD KPI Performance	Trend Graphs	Project Status
<a href="#">SAFETY &amp; ENVIRONMENT</a>		<a href="#">Graph</a>	
<a href="#">MINE</a>		<a href="#">Graph</a>	
<a href="#">MILLING</a>		<a href="#">Graph</a>	
<a href="#">MAINTENANCE</a>		<a href="#">Graph</a>	
<a href="#">COST</a>		<a href="#">Graph</a>	
<a href="#">PEOPLE</a>		<a href="#">Graph</a>	
<a href="#">SUPPLY CHAIN</a>		<a href="#">Graph</a>	
<a href="#">CONTINUOUS IMPROVEMENT</a>		<a href="#">Graph</a>	
<a href="#">PROJECTS</a>		<a href="#">Graph</a>	

Figure 1: Balanced Scorecard

These scorecards drill down into various levels of metrics that would later be validated during the Value Stream Analysis. See set of four in Figure 2.

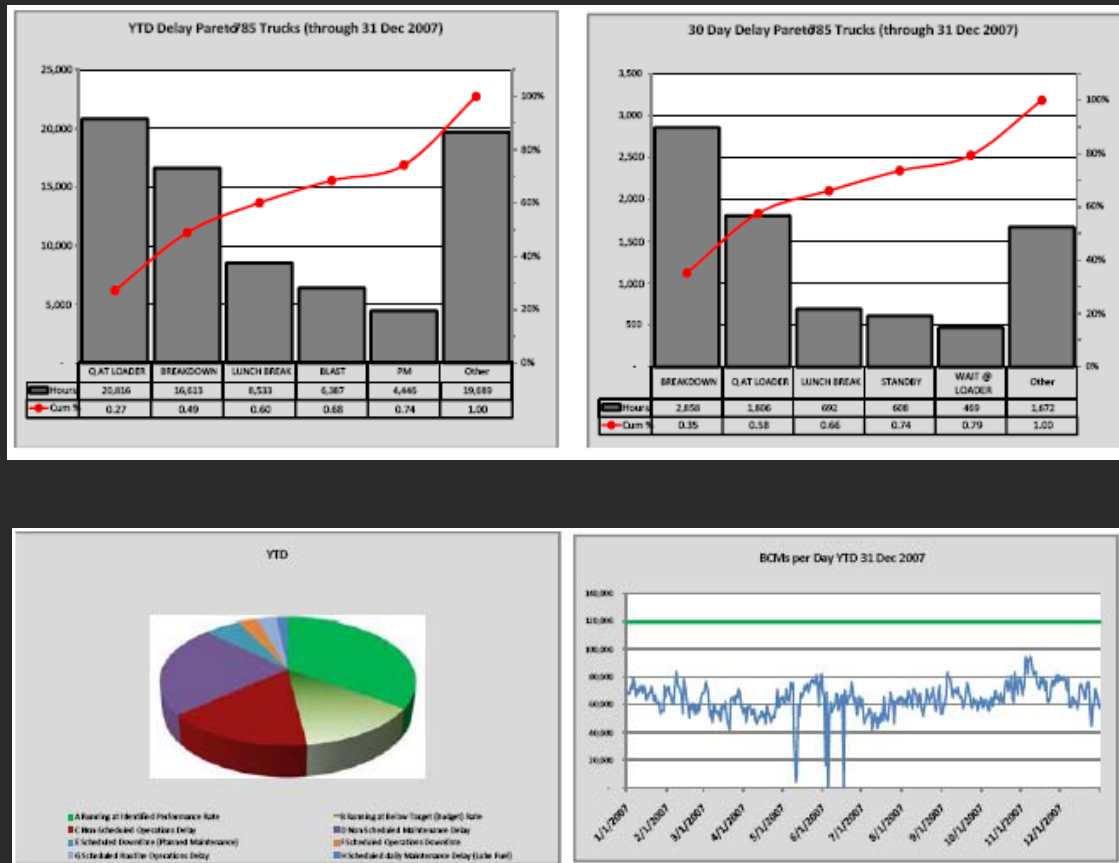


Figure 2: Balanced Scorecard Metrics Drill Down

With the Balanced Scorecard giving definition to the opportunities at hand, the client leadership became interested in the Six Sigma methodology for capturing some of the valued improvements. But before they could make an investment in the Six Sigma toolkit and begin attacking the issues, they needed a defined plan and a business case to support it.

### Implementation Engineering<sup>SM</sup> (in this case Value Stream Mapping)

A high-level, value stream analysis was conducted to validate existing data and metrics and to begin to understand what could be attained if the site were operating at 100%. Furthermore, the client leadership would use the information

to set a realistic operational goal, or 170,677 BCMs if the site could achieve 77% OEE.

Value stream maps of the three targeted areas (Mine, Mill, and Exploration) showed the high impact areas for effectiveness and efficiency improvement projects. See Figure 3.

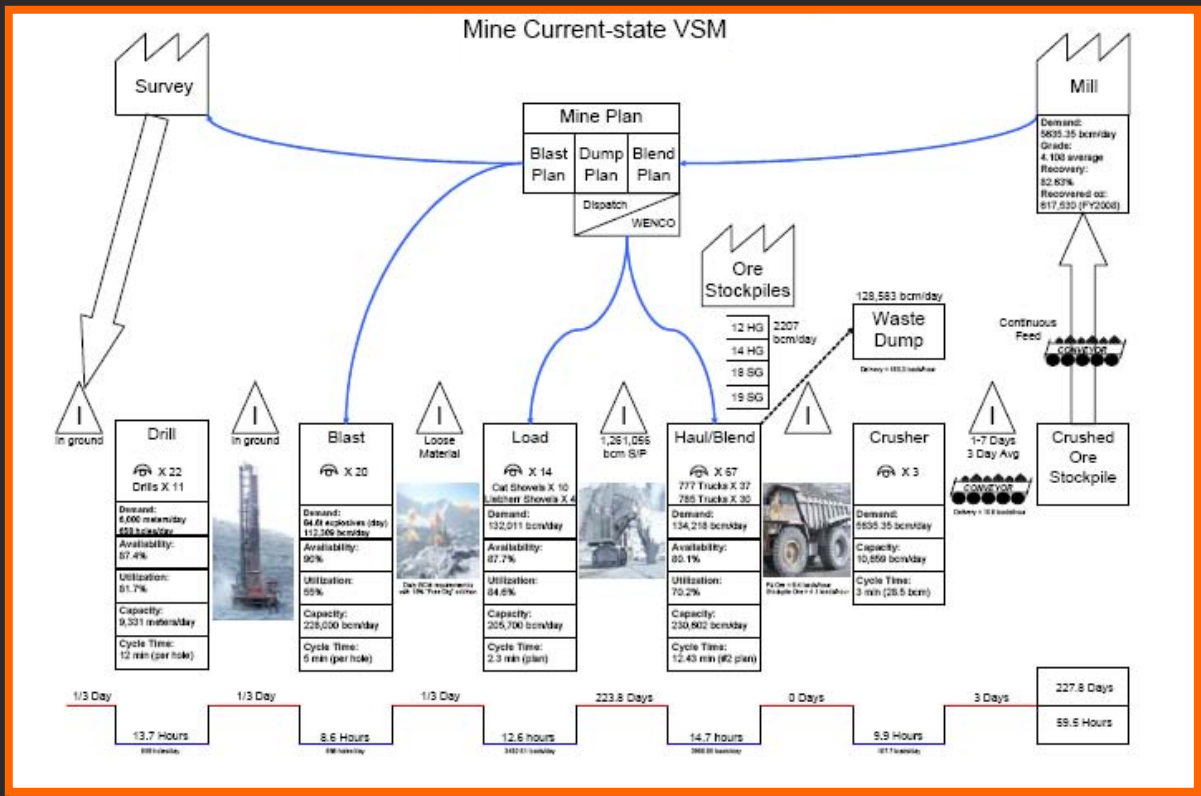


Figure 3: Value Stream Map

For each step in the value stream, the team looked at the manning, equipment, current demand, availability and utilization to determine lost capacity when not operating at 100%. Using these numbers the team was able to narrow down the larger targets to the individual steps in the process that were preventing the site from reaching its target performance level and that would have the biggest financial impact. Using the Mine as an example, Blast, Shovel and Haul represented the biggest constraints.

## Results

To date, over 30 of the projects identified during the Value Stream Analysis have been completed with an overall benefit of over \$50 million from increased revenues and cost savings. Additional benefits are expected from “in process” projects that are currently on-going.

## Summary

From now and beyond, the Implementation Engineers team has been working side by side with client personnel to support and accelerate the Continuous Improvement Program.

The experience, while physically challenging, has proven to be a successful venture in both the results attained and the mutual respect that has developed among the joint team. We look forward to maintaining the momentum through the launch and execution of projects, including:

- Safety: Vehicle Accident Reduction
- Drill – Blasting: Delay Reduction External
- Mill Flotation 1: Increased Recovery
- Mill Energy Savings
- Mine Maintenance: Decreased Premature Engine Failure
- Drill – Blasting: Blast Stem Quality & Improvement
- Mine Maintenance: Reduce PM Cycle Time
- Mine Operations: Mine Blast Delay – Shovel Improvement
- Drill – Blasting: Delay Reduction Internal
- Drill – Blasting: Drill Time Optimization

We are proud to be a part of this ongoing effort to improve and will continue to help the Client to effectively approach, execute and sustain its performance improvement.