Mine – Quarry Planning

Mines are not quarries
and quarries are not mines.

BUT;
They share a lot in common and have a lot to offer each other.

For the quarry industry;
1) How much and what kind of planning should be done?
2) Who should be involved and responsible for the plan?
3) How do you implement in today’s working environment?
Mine – Quarry Planning

Elements of a Mine Plan:

• Creation and maintenance of a production plan

• Right material (ore/stone spec.)

• Delivered at right time (scheduling)

• At lowest possible cost per unit of product (process)

• Fulfill the business targets of the company (ROI)
Mine – Quarry Planning

For the quarry industry;

1) How much and what kind of planning should be done?

No more, nor less then that which is now required to achieve the safety and profit outcomes required by the “new normal”.
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The “New Normal”…. What is it demanding of us?

Flawless Execution to an new economic standard.
Climax Mine - Colorado

47,000 Tons Ore/day

Climax Mine - Colorado
With mines, waste is a physical material quantity to be measured and handled.
With quarries, with the exception of soil overburden, the entire deposit is product.
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For quarries, waste is more a by-product of production, not so much a component of extraction.
Planning, especially long term combines:

• Objective issues of physical resources
  • Deposit location, size, shape, structure, quality
  • Manpower & equipment
  • Mining & operations management methods

• Subjective issues of company standards and culture
  • Working assumptions
  • Safety standards
  • ROI and site deposit life
  • Social contract/franchise obligations
Mine – Quarry Planning

Stripping Drilling Blasting Loading Hauling Crushing Sizing

Profit

Safety

$S$ $D$ $B$ $L$ $H$ $C$ $S$

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Profit

Safety

$S$ $D$ $B$ $L$ $H$ $C$ $S$
second drill rod must be considered when purchasing the less expensive drill having the shorter mast.

**Drill Hole Size:** The size of the holes drilled for blasting in surface quarries are typically 3 to 7 in. in diameter. Many operators begin production using one size hole and, over a period of time, change to a different size hole as varying geologic conditions are encountered and different types of explosives are employed. Usually, larger diameter holes result in less total drilling and blasting costs. Lower overall costs can result from an increase in the size of drill hole with a resultant decrease in the number of holes required. The larger holes contain a greater quantity of blasting agent and cause fragmentation of a greater tonnage of rock. The most cost-effective choice of hole diameter and blasting agent is determined only by experimentation in the field. For this reason, drilling contractors are often employed in the early phases of development to allow experimentation with drill types and hole sizes before equipment is purchased.

**Optimizing Blasting:** Initial selection of a combination of drill and explosive may be most cost-effectively accomplished utilizing the expertise and computer programs available from drill and explosive manufacturers and suppliers. These programs estimate the overall cost of various alternatives at accuracy levels approximately proportionate to the reliability of the geological data available. The software used in this type of analysis is generally the property of the blasting or explosive company and is normally not for sale but can be obtained by hiring the company on a contract basis. The benefits derived from use of these programs are normally part of the total blasting service. Companies that have blasting computer programs include the follow-

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An important concept to remember is that fragmentation of rock by primary blasting is more cost effective than fragmentation by mechanical crushing or secondary breaking.
Partitioned tasking and responsibility inevitability leads to disconnected realities and behavior in the absence of process awareness.
Mine – Quarry Planning

(a) Mine plan as projected in 1990.
(b) Mine plan as projected in 1992.
(c) Mine plan as projected in 1998.
(d) Mine plan as projected in 2020.
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**Design:**

Pencil - pen & paper

vs.

AutoCad Civil/Gemcom-Surpac/Maptek-Vulcan 3D, etc.

**Scheduling:**

Spreadsheets

Solvit – RKM Mining – MineMax, etc.
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Understand, quantify, and work with your geology.

- Slope Stability
- Pit Expansion
- Blasting Direction

Maximize reserve recovery at the pit limits.
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Project and observe current excavation in light of geometry effect as pit goes back and deeper. Avoid irregular and tight pit bottoms.
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Survey Control – use it!
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Design your pit to maximize benefit for loading and haulage efficiency and safety.

Maintain even floor elevation & haul road smoothness.

Design your ramp grade and haulage distances – optimize the gear ratio/rimpull of your trucks.
Budget and schedule for overburden stripping.
Select the drill and hole size to handle the geologic rock conditions and support optimal energy distribution.

Balance production capacity with site conditions to maximize safety and total process economy.
Balance safety, production, and offsite vibration issues with fragmentation influence on productivity and total economy.

“Value” Moment
Optimize loader/truck sizing.

Design & manage pit geometry to maximize equipment efficiency.
Optimization of design to maximize flexibility, throughput efficiency, and power minimization while achieving requisite product quality.

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“Value” Moment 2 3 4
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• The “New Normal” market demands suggest that a combination of old standards and methods, combined with new tools and daily operations practice based on metrics will be needed increasingly for economic success.

• Operations will need to be responsible not only for production, but also economic efficiency to secure sufficient profit for the organization.

• The pit and the plant will need to be brought together to assure that optimal profit is achieved in the product stockpile.
Mine – Quarry Planning
For the Quarry Industry;

How much and what kind of planning should be done?

   Enough to insure that profit is built into production.

2) Who should be involved and responsible for the plan?

   Operations and management.

3) How do you implement in today’s working environment?

   Process focus with metrics and cost accounting that tracks and
   demonstrates production dynamics.

Stripping Drilling Blasting Loading  Hauling Crushing Sizing
How to get the most out of your group:

1) Training never stops, even in combat.

2) Rank should never get in the way of mission success.

The principals in this book show why the USAF is the best in the world and how your organization can pattern itself after it’s success.
“Checklist Manifesto: How to Get Things Right”

Surgeon and journalist, Atul Gawande

Checklists require planning.

There are 2 types of errors:

1) Ignorance (mistakes we make because we don’t know enough),

2) Ineptitude (mistakes we make because we don’t make proper use of what we know).

Failure in the modern world, he writes, is really about the second of these errors.
Planning and going to the moon:

Dr. Wernher Von Braun & President Kennedy

John Houlbolt
Planning and going to the moon: July 21, 1969
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