8.0 Cost Estimating

"Do not estimate your cost or schedule by telephoning contractors and asking them for ballpark figures. The only kind of estimate that is worth anything is the one that is clearly defined on paper and bears the signature of the author. This type of time or cost estimate takes time to prepare. In general, the estimate will be worth what you pay for it."

J.S. Redpath (1980)

8.1 Introduction

Estimating for a mining company or engineering firm is the procedure whereby the cost of a proposed project is determined in advance. For a contractor competing against others, the estimate is normally the best price the company can afford to bid.

While some estimates may require scheduling, conceptual design, and development of procedures, a basic estimate simply includes take-off (quantity survey), pricing, extension, and summarization.

The quantity take-off can normally be done to good precision while the efficiency of labor (i.e. man-hours) is difficult to estimate accurately from one project to another. For this reason, it is commonly advised that labor-intensive estimates include an added contingency. The most difficult projects to estimate in hard rock mining are usually those prepared for rehabilitation of existing mine workings or equipment, mainly due to the fact that the quantity of work required can be difficult or impossible to measure accurately in advance.

Estimates usually are divided into direct and indirect costs. Estimating direct costs is a fundamental exercise; however, estimating indirect costs requires a project schedule, since indirect costs are mainly time dependent. For this reason, estimators are frequently schedulers as well.

In North America, the estimator is normally expected to be adept at quantity take-off, pricing, and scheduling. For large projects, specialists may perform the scheduling separately.

In this chapter, no actual cost tabulations will be found because rates and prices change with geography and can escalate rapidly in a short time frame. This chapter is devoted instead to relatively constant definitions, particulars of procedures, and tabulations of performances, etc.

8.2 Rules of Thumb

Cost of Estimating

- A detailed estimate for routine, repetitive work (i.e. a long drive on a mine level) may cost as little as 0.5% of the project cost. On the other hand, it may cost up to 5% to adequately estimate projects involving specialized work, such as underground construction and equipment installation. *Various Sources*

Cost of Feasibility Study

- The cost of a Detailed Feasibility Study will be in a range from 0.5% to 1.5% of the total estimated project cost. *Source:* Frohling and Lewis
- The cost of a detailed or "bankable" feasibility study is typically in the range of 2% to 5% of the project, if the costs of additional (in-fill) drilling, assaying, metallurgical testing, geotechnical investigations, etc. are added to the direct and indirect costs of the study itself. *Source:* R. S. Frew

Budget Estimates

- An allowance (such as 15%) should be specifically determined and added to the contractor's formal bid price for a mining project to account for contract clauses relating to unavoidable extra work, delays, ground conditions, over-break, grouting, dewatering, claims, and other unforeseen items. *Source:* Jack de la Vergne

Engineering, Procurement, and Construction Management

- The Engineering, Procurement, and Construction Management (EPCM) cost will be approximately 17% for surface and underground construction and 5% for underground development. *Source:* Jack de la Vergne

Overbreak

- The amount of over-break to be estimated against rock for a concrete pour will average approximately 1 foot in every applicable direction, more at brows, lips, and in bad ground. *Source:* Jack de la Vergne
- On average, for each 1 cubic yard of concrete measured from the neat lines on drawings, there will be 2 cubic yards required underground, due to overbreak and waste. *Source:* Jack de la Vergne

Haulage

- The economical tramming distance for a 5 cubic yard capacity LHD is 500 feet and will produce 500 tons per shift, for an 8-yard LHD, it is 800 feet and 800 tons per shift. *Source:* Sandy Watson
- Haulage costs for open pit are at least 40% of the total mining costs; therefore, proximity of the waste dumps to the rim of the pit is of great importance. *Source:* Frank Kaeschager

Miscellaneous

- Developing countries have labor costs per ton mined equal to approximately 80% of industrialized nations, considering pay scales, mechanization, education, and skill levels. *Source*: Kirk Rodgers
- The installed cost of a long conveyorway is approximately equal to the cost of driving the drift or decline in which it is to be placed. *Source*: Jack de la Vergne
- The total cost of insurance on a contract-mining job will be approximately 2% of the contract value (including labor). *Source*: Darren Small
- In a trackless mine operating around the clock, there should be 0.8 journeyman mechanic or electrician on the payroll for each major unit of mobile equipment in the underground fleet. *Source:* John Gilbert
- On average, for each cubic yard of concrete measured from the neat lines on drawings, approximately 110 Lbs. of reinforcing steel and 12 square feet of forms will be required. *Source:* Jack de la Vergne
- To estimate shotcrete (dry type) through the machine, add 25% to the neat line take-off to account for surface irregularity (roughness) and overbreak. Then add rebound at 17-20% from the back and 10% from the wall. *Source:* Baz-Dresch and Sherril
- The overall advance rate of a trackless heading may be increased by 30% and the unit cost decreased by 15% when two headings become available. *Source:* Bruce Lang
- The cost to slash a trackless heading wider while it is being advanced is 80% of the cost of the heading itself, on a volumetric basis. *Source:* Bruce Lang

Note

Refer to Chapter 23 for Rules of Thumb pertaining to electrical estimating.

8.3 Key Definitions and Abbreviations

- **Ball Park** = horseback = seat-of-the-pants = back of the envelope = a snap estimate.
- **Capex** = capital expenditure.
- **Direct Costs** = costs that are unique to a particular item of work. Direct costs usually include hands-on labor, lead hands, permanent materials, materials consumed in the work and equipment specifically used for work performance.
- **EPCM** = engineering, procurement, construction, and project management.
- **Indirect Costs** = Indirect costs can be further divided into cost dependent items (such as insurance and overheads) and time dependent items (such as supervision, maintenance/service personnel, equipment rentals, and utility billings).
- **Lump Sum Allowance** = A cost entered for an item of small value that is not yet specified or defined and therefore cannot be properly estimated.
- **Order of Magnitude** = conceptual = range = the second order of estimate.
- **Opex** = operating expenditure.
- **Pro Rata** = the rational division of one cost for inclusion into other applicable groups.