



cost control

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Mine management cost reports are prepared on a monthly or four weekly period basis. Management cost reports are prepared to assist managers in delegating responsibilities, evaluating results and taking action on an ongoing basis. Such reports are different from the historical accounts prepared by accountants usually on an annual basis to satisfy corporate and legal reporting requirements.

Historical accounting was developed in the middle ages by the Italians who invented double entry bookkeeping to control their trade enterprises. It involves keeping accurate financial records of transactions so that all those involved including employees, suppliers, management and government can receive proper compensation from the enterprise. The financial statements are usually prepared annually and audited by external accountants. All mines must be able to provide this form of accounting at least on an annual basis. However such a report is useless for the day to day management of the operation.



Cost Reporting

Cost reports are used to make decisions about the management of the mine. For example, the development of a new area of the mine, replacement of a production machine or employment of additional labour. Planning and investment decisions all involve cost benefit analysis for which accurate information must be available. Depending on the application, costs may be expressed per unit of time, per tonne of ore, or per cubic metre of material moved or excavated. Usually the total monthly or periodic costs are reported, with other cost measures derived from them.

A multi level cost code system is essential. In a modern mine this must involve the use of computers and often specially developed software. The sub division of costs should focus managers attention on the specific controllable costs and variation from plan over which they have control.

Key considerations are:

- Management accounting is a dynamic management tool rather than a static reporting system.
- Management prepares plans for daily, weekly, monthly and annual performance; standards of performance are incorporated into the accounting system.
- The financial data reflects underlying physical results.
- Actual and plan performance are compared regularly.
- Reports make allowance for the cost of ore at various stages in the mining cycle.
- Variances from plan are highlighted.
- Measurable resources provided by service groups are charged to the departments on a usage basis as an incentive to cost control.
- Planned and actual costs reported in each responsibility area are those over which the manager has effective control. Activities or costs that are entirely controlled by others are not included.
- Managers are encouraged to explain variances and to take action to improve performance.
- The success or failure of achieving / improving

performance is monitored.

In many mine accounting systems the objectives for historical and management accounting are confused with the result that needs are not all met effectively.



Participation and Commitment

Cost reports are only as good as the data recording system. There is a cost involved in recording information both in planning and implementation. It requires dedication from supervisors and management to ensure that allocations are accurately made and the data is properly collected and processed. Some mines have moved from a paper based system to a substantially computer based system. For example, Peak Gold Mine has computer terminals in shiftboss rooms and underground workshops and crib rooms so that cost and performance data and stores movements can be entered as they occur.

The reporting system must be developed in close co-operation with the people who will put it into practice. Any system imposed from the top down is likely to be remote from day to day management.



Cost Areas

It is usual for a mine to develop its own cost reporting system so that no two mines have exactly the same format. However the following general divisions apply:

- Division by departments including administration, geology, mining, metallurgy and engineering.
- Division of each cost category into operating labour, operating supplies, maintenance labour, maintenance supplies, contracts and possibly power.

Often the engineering department costs are collected under engineering and then allocated out to each of the other departments. This may also be done with services such as electric power, water and compressed air. An example cost breakdown for an underground mine is given in [Table 1](#).



Variable and Fixed Costs

For budgeting and control purposes it is important to differentiate between variable and fixed costs. To do this one should ask the following questions.

- Does the cost vary relative to production or another measure of through put? If so, this cost tends to be a variable cost. For example in the case of cost such as stope labour or explosives, they will tend to vary directly with the tonnage produced in a stope and may be budgeted and controlled on this basis.
- Does the cost vary on a step basis at threshold levels of production increase? For example the total supervision salary cost. This is a semi fixed cost and would normally be treated as fixed over the budget period. Alternatively, a specific increase in budget allowance can be provided when the threshold level is reached.
- Does the cost vary only over the long term when annual planning decisions are being made. For example the number of planning engineers. This is cost tends to be a fixed cost and can be treated as such for control purposes.

A spreadsheet model of the operation which is based on fixed, semi fixed and variable costs is an extremely powerful tool in predicting the outcome of various management alternatives. Sometimes variable costs are referred to as direct costs and fixed costs as indirect costs. Obviously the larger the proportion of costs can be categorised as variable then the greater the control can be achieved on the month to month basis.



Timing Variations

Fluctuations in total and unit costs may be caused by the timing of the recorded costs or by the timing and phasing of mining activities. The following are examples.

- Variations in consumable costs such as explosives or rockbolts because costs are recorded at delivery to the mine rather than upon allocation from the mine's store.
- Breaking different tonnages in the stope than are loaded and hauled for example with shrinkage stoping.
- Mining ore from a different mix of stopes or benches than originally planned.
- Milling different quantities of ore than were mined (stockpile variation).
- Moving different quantities of waste than were planned when costs are reported per tonne of ore.
- Mining different grades or experiencing different metallurgical recoveries where cost are report per ounce of gold produced, or per tonne of concentrate.



Fixed Costs

There is a wide variation in the way that mines handle fixed costs. Some are kept under the administration department while others are allocated out to the individual departments pro rata to their activities. For example;

- Labour on costs should be allocated out to the departments because they are a part of the total labour costs and are controllable in so far as the amount of labour is controllable.
- Training should be dealt with similarly. There seems little purpose in allocating all training back to a common administration account other than the need for annual reporting of training under the training guarantee scheme.
- Electric power and water should be allocated out as far as possible as should diesel fuel.

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Realistic formulae should be used to make these allocations fair. When a user reduces his usage (which is desirable) then the recording method must be sufficiently responsive to reflect that in the reported costs. Nothing is more demoralising to the operator than carefully rationing the use of resources and then getting saddled with a higher monthly in cost allocation for some obscure accounting reason.

Comparison of Mining Costs				
Mining Method	Description	Uphole Retreat	Alimak Vein Mining	Cut and Fill
Crosscuts (Waste)	Metres	165	17	345
	Tonnes	7,755	800	16,215
Sublevels (Ore)	Metres	990	260	260
	Tonnes	19,800	5,200	5,200
Stopes (Ore)	Tonnes	59,400	59,800	74,000
Raises (Ore)	Metres	100	1,875	100
	Tonnes	0	15,000	800
Total Ore	Tonnes	80,000	80,000	80,000
Diamond Drilling	Metres	1,702	1,702	1,000
Total Ore Reserve	Tonnes	485,000	463,500	585,000
	Grade	14	15	12
Annual Gold in Mill Feed	Ounces	37,222	38,971	30,868
Annual Cost (\$)				
Geology				
Diamond Drilling		129,787	129,787	76,250
Grade Control		258,000	258,000	258,000
Sub Total		387,787	387,787	334,250
Development				
Ore Drives		1,060,290	278,460	278,460
Cross Cuts		207,900	21,420	434,700
Ladder Raises		37,000	0	0
Alimak Raises		0	2,062,500	110,000
Sub Total		1,305,190	2,362,380	823,160
Long Hole Stoping				
Drilling		309,524	311,308	0
Blasting		103,356	104,052	0
Mucking		99,792	100,464	0
Ground Support		72,468	72,956	0
General		237,600	239,200	0
Sub Total		822,740	827,980	0
Cut and Fill Stoping		0	0	166,500
Truck Loading		111,200	111,200	111,200
Trucking		158,837	146,248	174,149
Stope Filling		0	0	120,000
Services				

Mine Drainage	318,964	318,964	318,964
Electric Power	353,683	353,683	353,683
Ventilation	135,688	135,688	135,688
Air and Water	26,400	26,400	26,400
Light Vehicles	140,261	140,261	140,261
Road Maintenance	16,000	16,000	16,000
Rescue and Safety	32,438	32,438	32,438
General	221,585	221,585	221,585
Sub Total	1,245,019	1,245,019	1,245,019
Supervision			
Supervision	804,000	804,000	804,000
Technical Services	144,000	144,000	144,000
Sub Total	948,000	948,000	948,000
Total Mining Cost			
	4,978,773	6,028,614	3,922,278
Cost Per Tonne of Ore			
	62	75	69
Cost Per Ounce (90% Mill Recovery)			
	134	155	179

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