PINCOCK Perspectives

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CALENDAR

- ***12th Brazilian Mining Congress and EXPOSIBRAM 2007***
  September 24 – 27, 2007
  EXPOMINAS
  Belo Horizonte, Brazil
  e-mail: ibram@ibram.org.br

- ***XXVII International Mining Congress and Exhibit 2007***
  October 10 – 13, 2007
  World Trade Center Veracruz
  Veracruz, Mexico
  e-mail: reservaciones@turycon.com.mx

- ***The Geological Society of America***
  October 28 – 31, 2007
  Colorado Convention Center
  Denver, Colorado
  e-mail: gsaservice@geosociety.org

- ***Mining the Americas***
  October 29 – 30, 2007
  Doral Golf Resort 7 Spa
  Miami, Florida
  e-mail: iiconf@iiconf.com

- ***Runge North American Professional Development Courses***

  Mining for Non Miners
  Denver: November 12
  Calgary: November. 23

  Dragline Mining Systems
  Denver: November 13–14

  Mining Economics
  Denver: November 15–16
  Calgary: November 19–20

For additional information or to register, please contact Marcie Schmidt at 403-217-4981 or mschmidt@runge.com.au

See How They Run (Project Cost and Schedule Overruns)

But Mouse, you are not alone,
In proving foresight may be vain:
The best laid plans of mice and men
gang aft agley,
And leave us nought but grief and pain for promised joy!

Robert Burns

Here at Pincock, Allen & Holt (PAH), we are occasionally asked to prognosticate on project cost and schedule overruns, to give our opinion on how much extra the projects might cost and how much longer they may take to complete than has been estimated. One might presume that all of this has been thoroughly assessed by the project estimators and schedulers, and it probably has, but, alas, as most of us well know, Burns' famous words too frequently ring true.

Factors Contributing to Cost Overruns

We see numerous projects at PAH and there are probably fewer than 10 percent that are completed within budget and schedule. The other 90 percent run the spectrum from close to the projected values to an outside limit of about double the budget and double the schedule. Is this the result of incompetence on the part of the estimators and schedulers? Unequivocally, the answer is "No!" Why, then, does it happen? There are, of course, other factors affecting estimates and schedules, other than contemplative and rational deliberation, measurement, and calculation, and they are as follows:

1. Pressure from owners to minimize costs and schedules. This is not inappropriate: where money and time are limited, people can be very innovative and, conversely, where money and time are unrestricted, people have a tendency to be profligate.

2. Intentionally tight project budgets and schedules, designed to "pressurize" project management in hopes of minimizing project costs and schedules, often accompanied by financial incentives for the contractors.

Assessing whether estimated costs and schedules are excessively tight can, to a large degree, be determined by comparison with other similar projects and by comparing the values with those in cost-estimating handbooks.

It might also seem that the larger the project, the more likely it will overrun, but, in reality, large projects are no more vulnerable than small projects; it is just that large projects are more visible, especially if they are massive civil projects such as bridges and tunnels.

3. Contractors that estimate and bid low are more likely to win work; accordingly they are so inclined. Still, this does put them under pressure to achieve the accepted values.

4. Lack of knowledge or insufficient knowledge. If a project incorporates a significant part or parts of it related to lack of knowledge, there is a tendency for things to go awry. When the level of knowledge is low, determining likely overruns is then primarily a matter of determining where knowledge is lacking and making allowances for it, recognizing that one unit of uncertainty equals about two units of vulnerability.

The Three Blind Mice

Is there any way to judge the vulnerability of a project to cost and schedule overrun and to quantify how much more it might cost and how much longer it will take to complete? There certainly seems to be a relation between overruns and the following factors, all of them related to lack of knowledge or insufficient knowledge, what might be termed the three blind mice of projects:

- Remoteness
- Unconventionality
- Earthwork

Remoteness

Remoteness is certainly a factor in making a project subject to cost and schedule overruns. When projects are in remote locations the efficiency of logistics, the availability of services, and the efficiency of construction come into play. Remoteness applies primarily in the following areas:

- High elevation, usually accompanied by severe weather
- Arctic, also accompanied by severe weather
- Third world, accompanied by poor infrastructure and political instability

It is difficult for estimators and schedulers to properly assess these factors and include them in preparing cost estimates and

THREE BLIND MICE

Remoteness

schedules, perhaps because they are not familiar with them. How much allowance should be made for remoteness? PAH suggests adding 50 percent to both cost and schedule for the most extreme circumstances and ratio it down from there.

Unconventionality

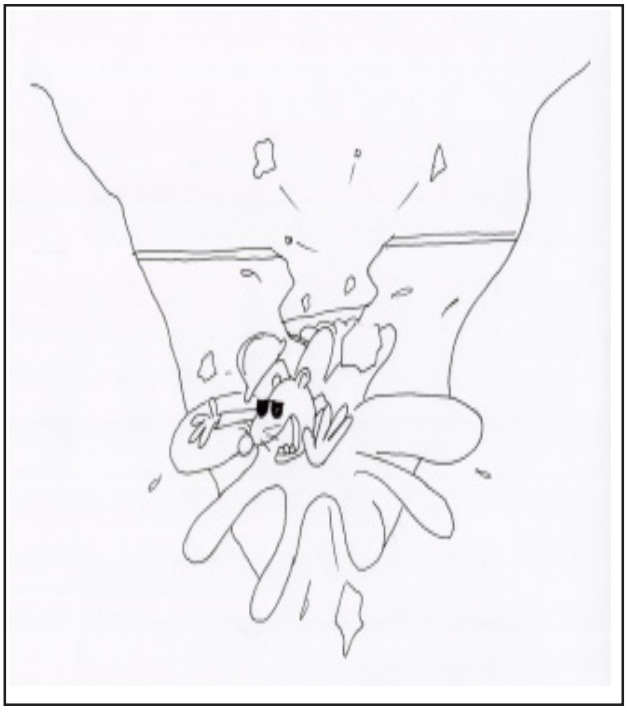
Unconventionality is certainly a factor in cost and schedule overruns. While incorporating new processes and methods is sometimes essential to even make a project viable, it does increase vulnerability. This applies to those processes and methods that have been applied to a limited extent elsewhere, as well as those that are completely new. Of course, when new processes or methods are incorporated they are generally well tested and well thought out, but, even so, they have a tendency to go awry, often as a result of unexpected interactions with other well-established processes and methods. No mouse is an island! With unconventionality, engineering and construction usually proceeds normally until plant startup; it is getting the project up to intended production rates and efficiency that add cost and delays. We suggest adding 50 percent to both cost and schedule in the most extreme circumstances and ratio it down from there.

One process that might be considered quasi-unconventional is heap leaching, though it is a fairly commonly applied process. There is often a considerable amount of uncertainty associated with such projects and this lack of knowledge leads to vulnerability. As stated in the previous paragraph, projects incorporating unconventional processes usually proceed normally until startup; similarly, heap leach projects usually follow this pattern and then often struggle to reach projected production rates and efficiency. Perhaps it is more appropriate to discount projected production rates for these projects and assume increased operating costs, rather than add to the capital costs and schedule to achieve them.

Earthwork

Time and time again we see earthwork estimates being

Unconventionality



Earthwork

exceeded, with costs for this item often exceeding 100 percent of the estimated value. In contrast to earthwork, estimating the rest of a project is not that problematical: quantities and costs for concrete, steel, machinery, pipe, and cable can be closely estimated; there are few unknowns in these areas. Fortunately for most projects, the amount of money in the earthwork account is less than 10 percent, so an increase in earthwork costs by 100 percent results in a total project cost increase of 10 percent, which is not that critical. Some projects, however, have much more than 10 percent of the project in the earthwork account, especially if they incorporate water-retention dams and/or underground workings.

It seems that, no matter how extensive and how sophisticated the geotechnical investigations, surprises occur. Yet some responsibility also lies with the earthwork design and some with the construction. Perhaps, by its very nature, it is impossible to be more precise; accordingly, recognition of this we suggest adding an overrun estimate of 100 percent to the earthwork estimate of practically any project.

Schedule Overruns

Schedule overruns are usually closely related to cost overruns, but this is not always the case; it seems that schedule overruns occur even where cost overruns do not occur. Schedules do not incorporate contingencies, they are set to follow projected work sequences and equipment deliveries, and including extra time for possible upsets and delays is not rational. But delays usually occur; if they are minor it is often possible to catch up, usually by working extra time; but just as often the cumulative effect of delays is such that it is not possible to catch up, and most projects exceed the projected time by about 10 percent as a matter of course. Such delays, unrelated to specific problems related in previous paragraphs, also add cost, generally about one percent of the project total cost per month of delay.

Conclusion

Cutting off the tails of the three blind mice does not seem to help. One must make allowances for them so that, when plans do go agley, we are not particularly surprised or disconsolate, as Burns suggests we often are, in the final verse of his famous ode to the mouse:

> *Still you are blest, compared with me!*
> *The present only touches thee:*
> *But oh! I backward cast my eye on prospects drear!*
> *And forward, though I cannot see, I guess and fear!*

While we may yet, at times, have reason to be fearful, healthy skepticism and anticipation of possible disaster can make us, perhaps, a little less so.

This month's article was provided by Dick Addison, P.E., and Principal Process Engineer who delights in trapping blind mice and is ever reluctant to set them free.
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The cartoons were drawn by Aaron McMahon, Geologist, and mouseketeer extraordinaire.

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Pincock, Allen & Holt is a consulting and engineering firm serving the international mineral resource industry. Your comments and suggestions are always welcome. Contact Pincock, Allen & Holt • 165 S. Union Blvd., Suite 950, Lakewood, Colorado 80228 • TEL 303.986.6950 • FAX 303.987.8907 • www.pincock.com. Pincock Perspectives is published as a free information service for friends and clients.

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