



Four-X Hint

Tuning Revenue Factors



This hint is part of a semi-regular series 'published' on the Whittle User's Email Discussion Group

VISIONARY EARTH
SCIENCE PTY LTD
TRADING AS IMAGEO

100 Mary Avenue
Wheelers Hill, Vic 3150
Australia

Phone: (+61-3) 9561 4936
Fax: (+61-3) 9562 5068
Email: imageo@bigpond.com

The Revenue Factors [they are set in the Optimization Tab under the Pit Shells node] used in Four-X to drive the design of multiple pits, is pretty easy to understand. If the revenue factor is set to 2 you will generate twice the revenue of your base case. [in the simplest terms it could be a doubling of price, but it can be any other combinations of parameters which altogether leads to a doubling of revenue]. This will be a larger pit, than your base case. If the revenue factor is 0.5 Four-X will design a pit assuming only half the revenue of your base case. This will be a smaller pit. The higher the revenue factor the larger the pit.

WINK #1 Positive Aspects for Consultants

Even when a project is a real dog, a good consultant can always design a pit if he sets the revenue factor high enough. Hopefully the client will be happy that he has a big pit, the only problem is it is not feasible at current prices ;)

This can be exploited if you have a really massive model (lots of blocks) and for some reason you do not want to reblock it [to run your optimisation with larger blocks, without doubt this would be a simpler solution to speeding up your optimisation] You can trim off parts of your model that will never have any impact on the design by first running a pit design with big revenue factor numbers and using this to trim your model to only block inside this shape. [I have found this generally gets rid of about two thirds of the blocks in a complete model, and this can save a lot of disk reading time and virtual memory]

HINT #1 Use High Revenue Factor to trim off un-necessary blocks

This hint will take a while to set up and run, but it can save a lot of time for really big models, when you need to run a few different optimisations. Firstly import your massive complete small block model and set up a simple optimisation using a simple range of revenue factors like starting at 1, and then stepping one to say 10. [You might like considering also flattening the slope a bit as well]. When the optimisation finishes [it could be very slow] you should look at the Output Tab on the Pit Shells node and look at the pit size as indicated by total Rock and Ore Tonnes. You might see that they have stabilized or a lot of revenue factors produce the same shape. This is where Four-X has mined everything that is significantly mineralised. Anything outside that shape is never likely to be economic [assuming of course it has been adequately sterilized by drill testing!] and can be safely left out of the optimisation.

Trimming off this unnecessary waste is easier than you might think. Whilst still on the Pit Shells node, right click the mouse and look under the tools sub-menu and find the Export Pitshells to Model option. A small dialogue box appears, in which you can specify the export directory and the exported model file name. The important setting is to click on the bottom option, "strip off bigger than pit". Enter the largest pit you have designed [ie. it might be 10 from the case above]. Run this, only those blocks in this pit and small pits are exported. Next you need to import this file as a new model and you are ready to go with a significantly smaller model.

Getting back to more mundane issues. I have noticed the biggest problem most people have with Revenue Factors is figuring out what are the best revenue factor to use. Well it is difficult, because each resource and set of economic assumptions will produce a different set of pits.

Four-X Hint **Tuning Revenue Factors**

The default set of revenue factors 0.3 to 2.0 in steps of 0.02 are a reasonable start. However with this sequence you will probably end up with a lot of designs larger than your optimum pit but only a few shells inside your optimum shape. This will reduce your ability to select good pushbacks when you come to defining your scheduling options [With fewer pushbacks you might feel your choice will be easier, but you can just as easily be missing a really good pushback hidden part way between these shells]

HINT #2 Magic Starting Revenue Factors

What you really need is more detail on the inner shells and less on the outer shells.

This is easy to achieve with multiple ranges of revenue factors, with increasing step sizes in each successive range. I find the following ranges are a fairly robust universal starting set.

0.2 to 0.5 steps of 0.01
0.52 to 1.0 steps of 0.02
1.1 to 2.5 in steps of 0.1

Sometimes you will find big steps between successive pits, even with more inner shells.

HINT #3 Tune Your Revenue Factors before Scheduling

This last hint is a place where a lot of extra value can be found for your designs. I have found that determining where these natural jumps in pit designs occurs can be very important to sound pushback selection. Frequently these “jumps” will straddle places where the inner pit designs bottom in little “treasure chests” [high value parts of the ore body]. Of course, in NPV terms, these are better to mine early rather than leave in the ground. It is therefore important to keep refining where these steps occur and I can only offer the suggestion of doing some trial and error designs.

For example if I can see a big jump in pit size between revenue Factor = 0.56 and 0.58, then I should insert 9 more revenue factors using a 0.001 step

0.2 to 0.5 steps of 0.01
0.52 to 0.56 steps of 0.02
0.561 to 0.569 steps of 0.001
0.57 to 1.0 steps of 0.02
1.1 to 2.5 in steps of 0.1

[Notice I have had to add two extra ranges of revenue factors by splitting the second range and then inserting the finer range in between]

There will always be a finite limit of how much detail is possible, largely controlled by the number of significant figures available in the revenue factor, normally 4. It may not be possible to totally smooth out the jumps but it is important to refine them as much as possible. It is sure to make a big difference to the NPV of your life of mine schedule.

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