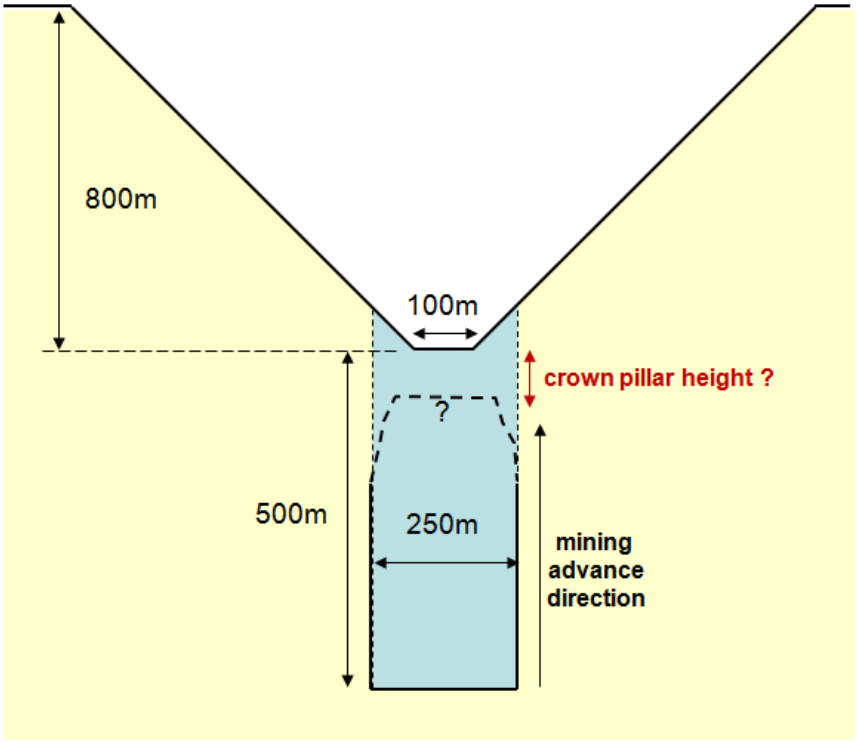
Open-Ended Design Problem #3

Note - This section should be written up as a short consulting report to be handed in separately from the Lab Answer Sheet that is also due for this lab.

An open pit copper mine that has been operating for 30 years is nearing the pit bottom and the end of its life. Projections for the price of copper, being favourable, have led to the decision to begin mining underground beneath the pit. However, because some underground mine infrastructure (e.g. ventilation shaft) will be located in the pit and ramp scavenging will take place in the pit during underground mining operations, the question to answer here is how thick a crown pillar should be left between the pit floor and underground excavation for safety (i.e. the danger being if the pit floor collapses into the underground mine void).



The open pit is approximately 800 m deep and 100 m wide at the bottom with 45° slopes. Exploration drilling indicates that the ore body is vertical, 250 m wide (centred with the pit floor bottom) and continues to depths of more than several hundred metres below the pit bottom. Plans are to sink a 1300m deep shaft, and to mine the ore body upwards until reaching the bottom of the crown pillar (which is for you to determine).

In situ stress measurements showed conflicting results. One set of measurements indicated a K ratio of 0.5, whereas a second set indicated a K ratio of 1.5.

The geology involves a jointed dolerite, with 3 orthogonal joint sets resulting in a blocky rock mass with fair to good joint conditions. The intact rock itself is strong with a uniaxial compressive strength estimated to be 150 MPa. For the pre-feasibility design required, it is assumed that the minimum pillar thickness (and therefore the maximum extraction) can be assessed treating the rock mass as an equivalent continuum, which maintains a Strength Factor 1.1.