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**Maximise your project value
Discover the best strategy at the start**

In-pit Crushing and Conveying (IPCC)

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Recent Snowden IPCC Studies

Snowden (in conjunction with Sandvik Mining and Construction (Sandvik)) has completed 18 IPCC studies in the last 3 years:

- Scoping studies:

- El Morro
- Los Bronces
- Antamina (2 studies)
- Olympic Dam
- Tarkwa
- Collahuasi
- Sheba's Ridge (2 studies)
- Cerrejon (coal)
- Wahana (coal)
- Spinifex Ridge
- Penyasquito
- Pisolite Hills

- Pre-feasibility studies:

- Elkview (coal)
- Antamina

- Feasibility studies:

- Antamina

- Study updates:

- Antamina
- Olympic Dam

• Snowden and Sandvik have also run five IPCC workshops and have presented and published a number of papers on IPCC.

Let me tell a story – Part 1

- Recently we complete a short scoping study (~2 weeks) for a rather large open pit in Australia
- We got a good result – We could have done better if we had more time – But we were happy
- The client was not! They spend the next six months using multiple consultants to disprove the work
- They found fault in places but not in the savings
- The company had a rethink
- Perhaps IPCC is the way to go
- Why? It solves a couple of big problems
- Let me explain

Let me tell a story – Part 2

- Mining companies don't like change – They want truck and shovel because they are familiar with it – So IPCC is unwelcome
- But they have a problem:
 - ✓ They will have to go underground in the future and they don't like that even more
 - ✓ They have to get their accident rate down and most accidents involve trucks
 - ✓ They just cannot get people
- They are starting to like IPCC because:
 - ✓ It has a lower incremental cost and allows the pit to go deeper , much deeper – They can avoid going underground
 - ✓ IPCC need less trucks
 - ✓ IPCC needs less people

Why are we interested in IPCC?

- Diesel fuel prices remain at historical highs
- Labour shortages and need to keep manning levels low
- Tyre supply and costs
- The potential impact of emissions and carbon trading
- Changes to the design of semi-mobile IPCC components
- But, IPCC needs a reliable (and low cost) electricity supply

After many studies I can say:

- If the truck cycle time is greater than 25 minutes then IPCC will work

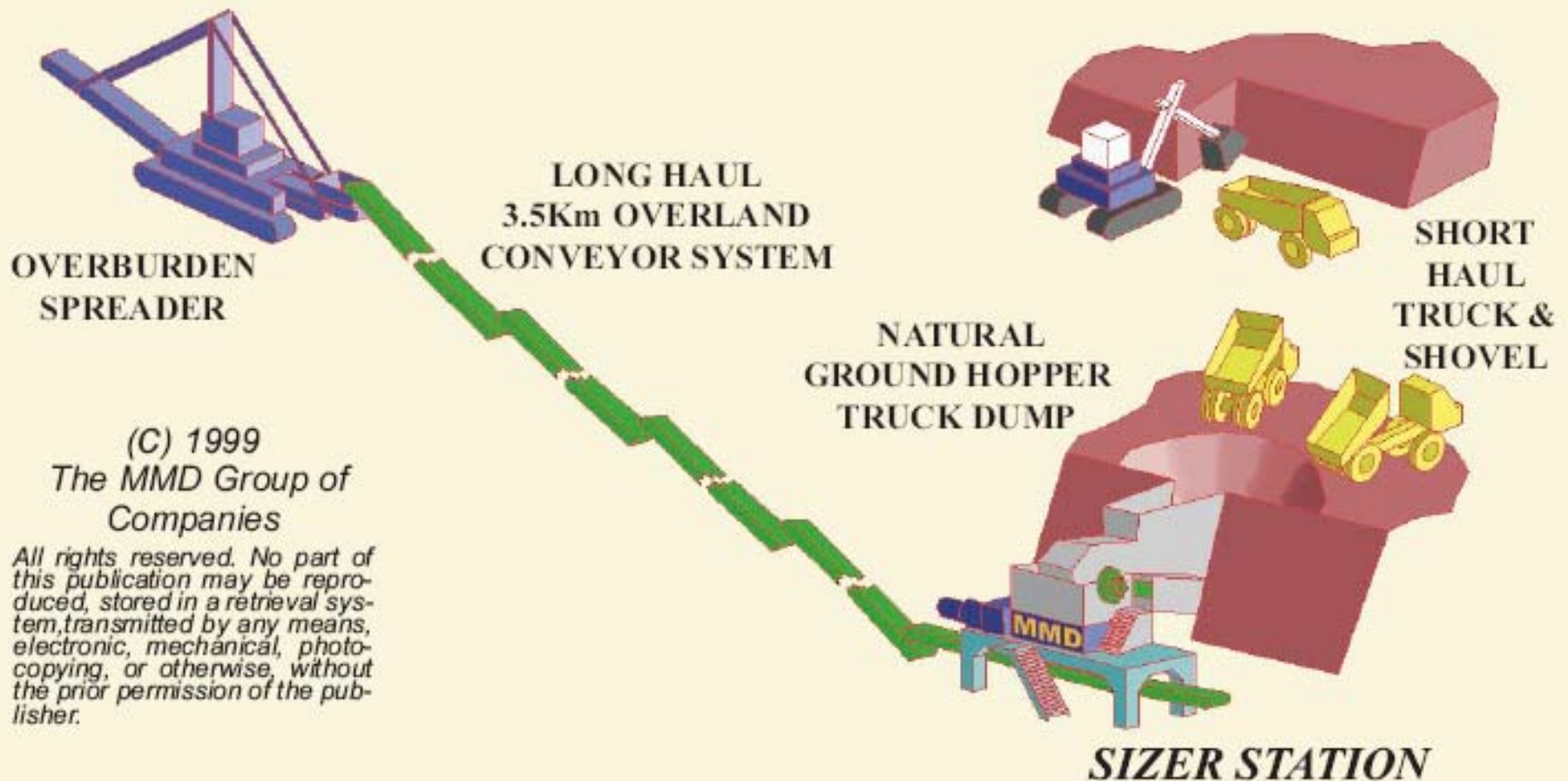
What types of IPCC systems are there?

There are three types of IPCC system strategies that could be developed. These are:

1. Semi-fixed (or fixed),
 2. Fully mobile, and
 3. Semi-mobile.
- Fixed systems are typically ex-pit and are designed to reduce haulage distances to the waste dump (or plant for ore). Semi-fixed may be in-pit but fixed within a pit stage.
 - Fully mobile systems are based on sizers and limited to softer rocks and the shovel capacity (~5,000tph).
 - Semi-Mobile systems are suited to harder rocks and higher capacities (up to 10,000tph).

We will focus on the retrofit of IPCC to existing hard rock open pits

The Main IPCC Components (image curtsey of MMD)



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Source: http://www.mmdsizers.com/downloads/20000TPH_Sizer.pdf

Sandvik/MMD Semi-Mobile Sizers 5500tph at Mae Moh Mine, Thailand

- Bridge type feeder for 5500TPH Sandvik structure using MMD sizer – 4 units at Mae Moh coal mine in Thailand
- 5500tph capacity
- twin 190 tonne truck tiphead



A 20,000tph Slewable Spreader



How should the conveyor exit the pit

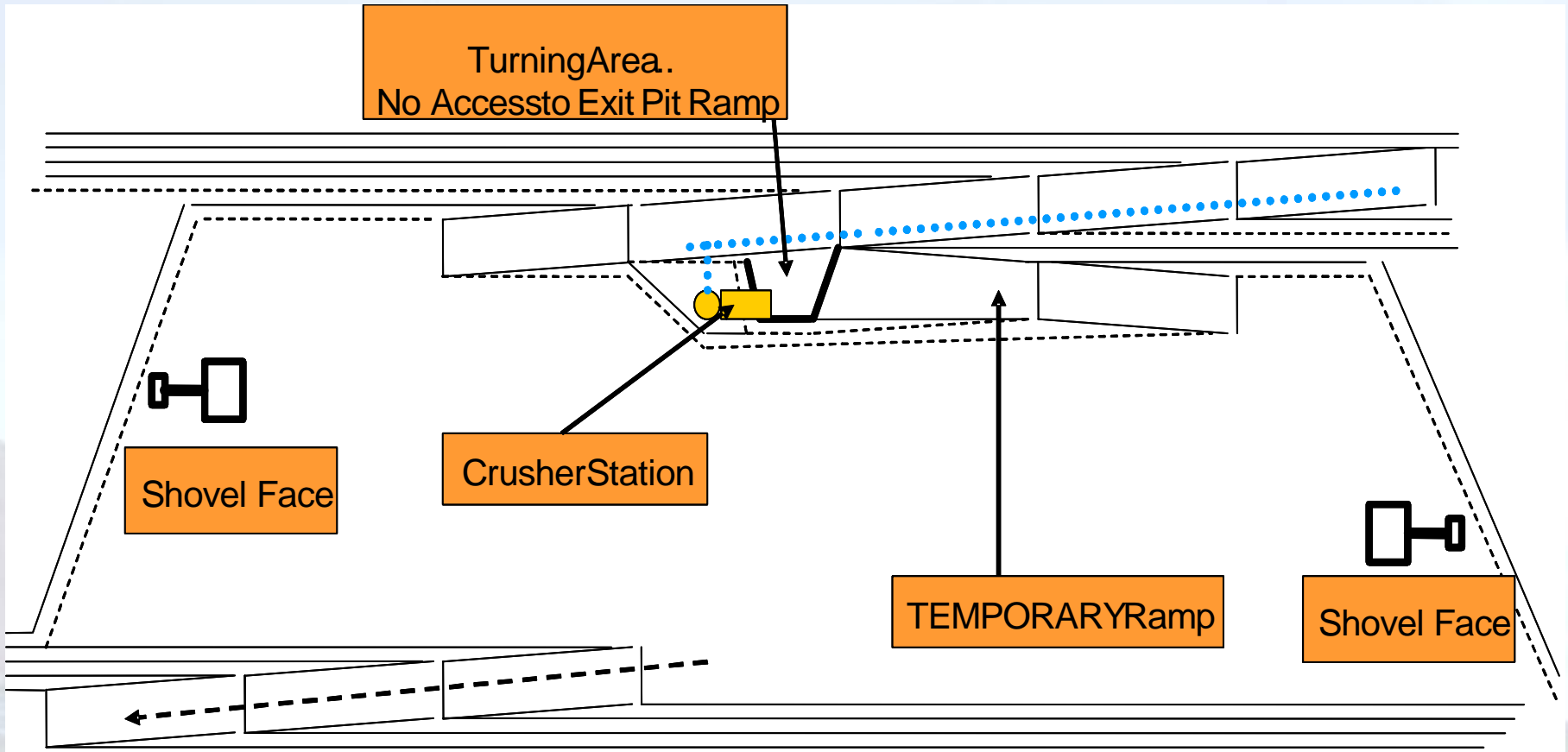
For each of the IPCC system options there are three ways the conveyor can exit the pit:

1. A tunnel,
2. A dedicated (generally steep) conveyor ramp, or
3. An existing haul road.

- Generally we have found that for most situations the conveyors should be designed to exit the pit by the haul roads.
- We have not found a simple or practical way to integrate (advance) dedicated conveyor ramps into pit stage designs.

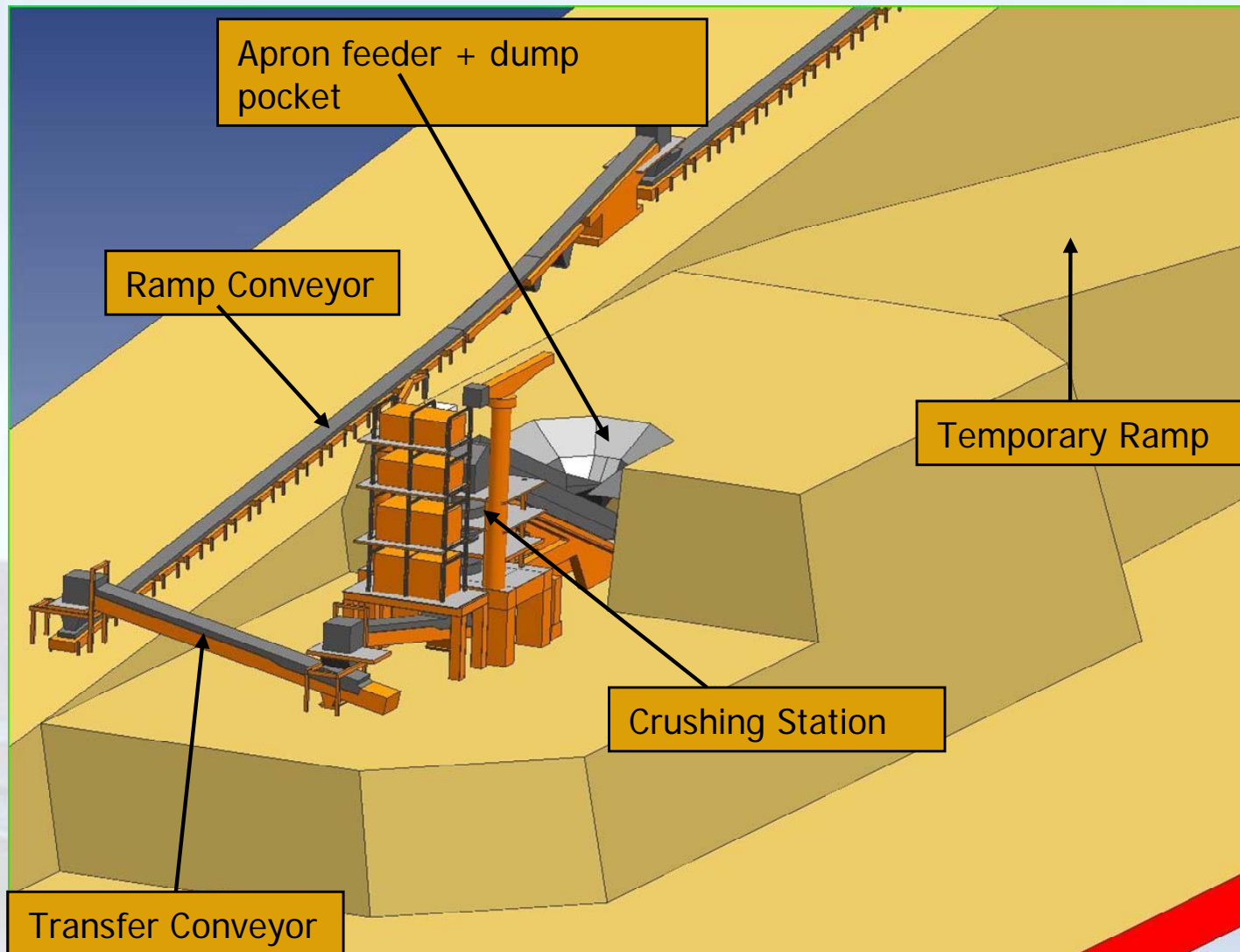
Semi-Mobile Crusher Access

Semi-Mobile IPCC using temporary access ramp.



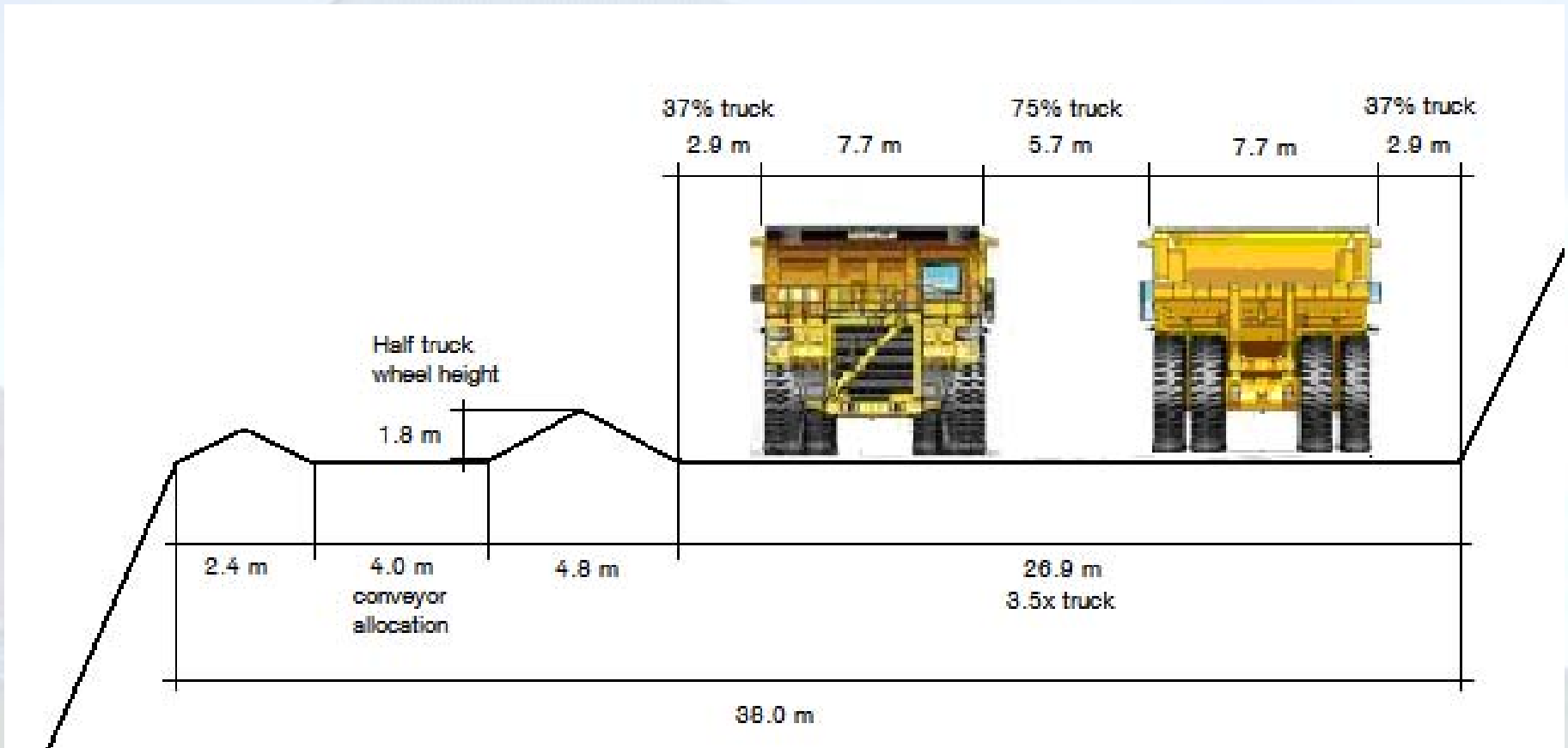
Semi-Mobile Crusher Access

Semi-Mobile IPCC using temporary access ramp.



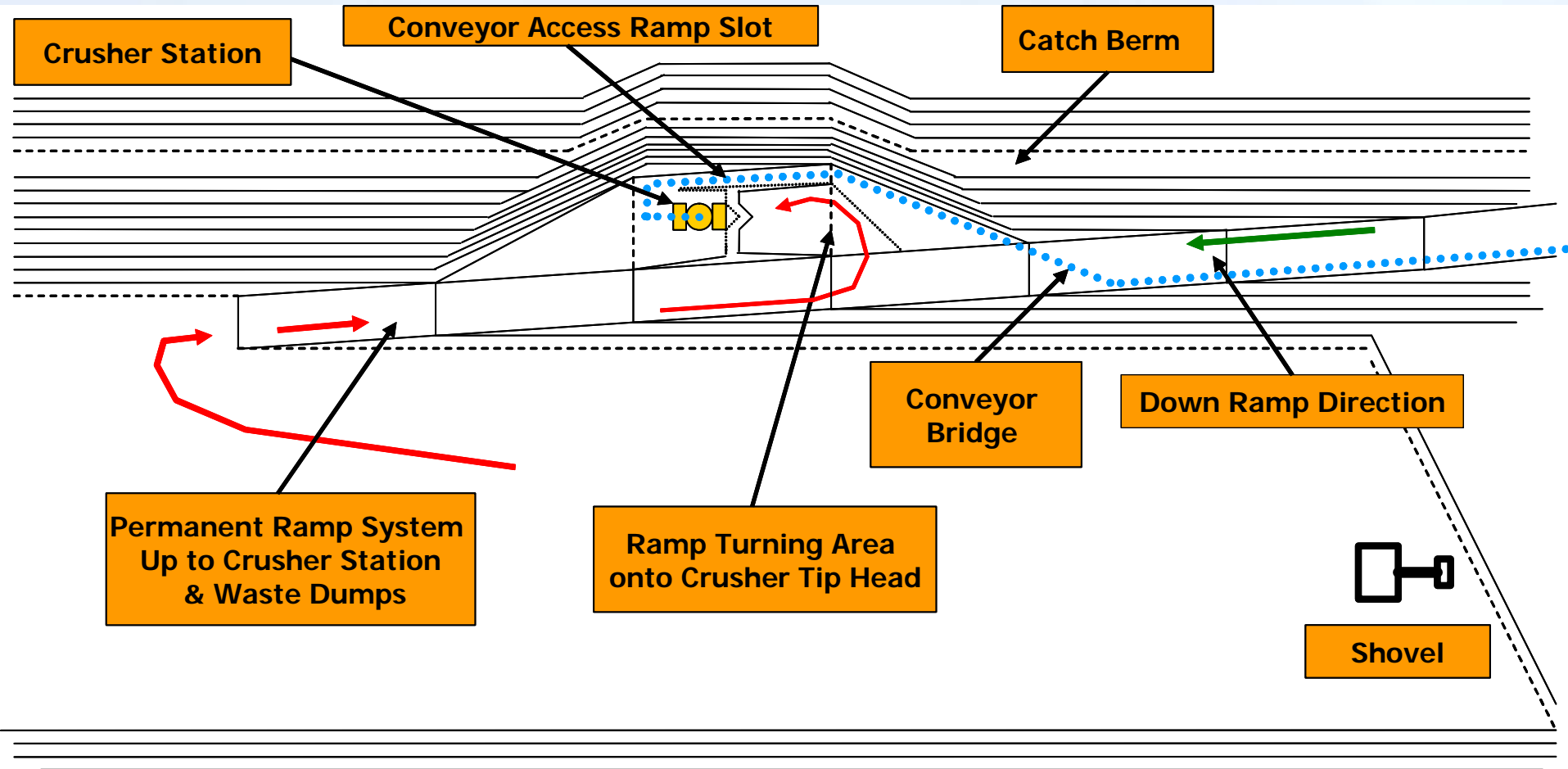
Haul Road Considerations

Minimum practical two way haul road width including a conveyor

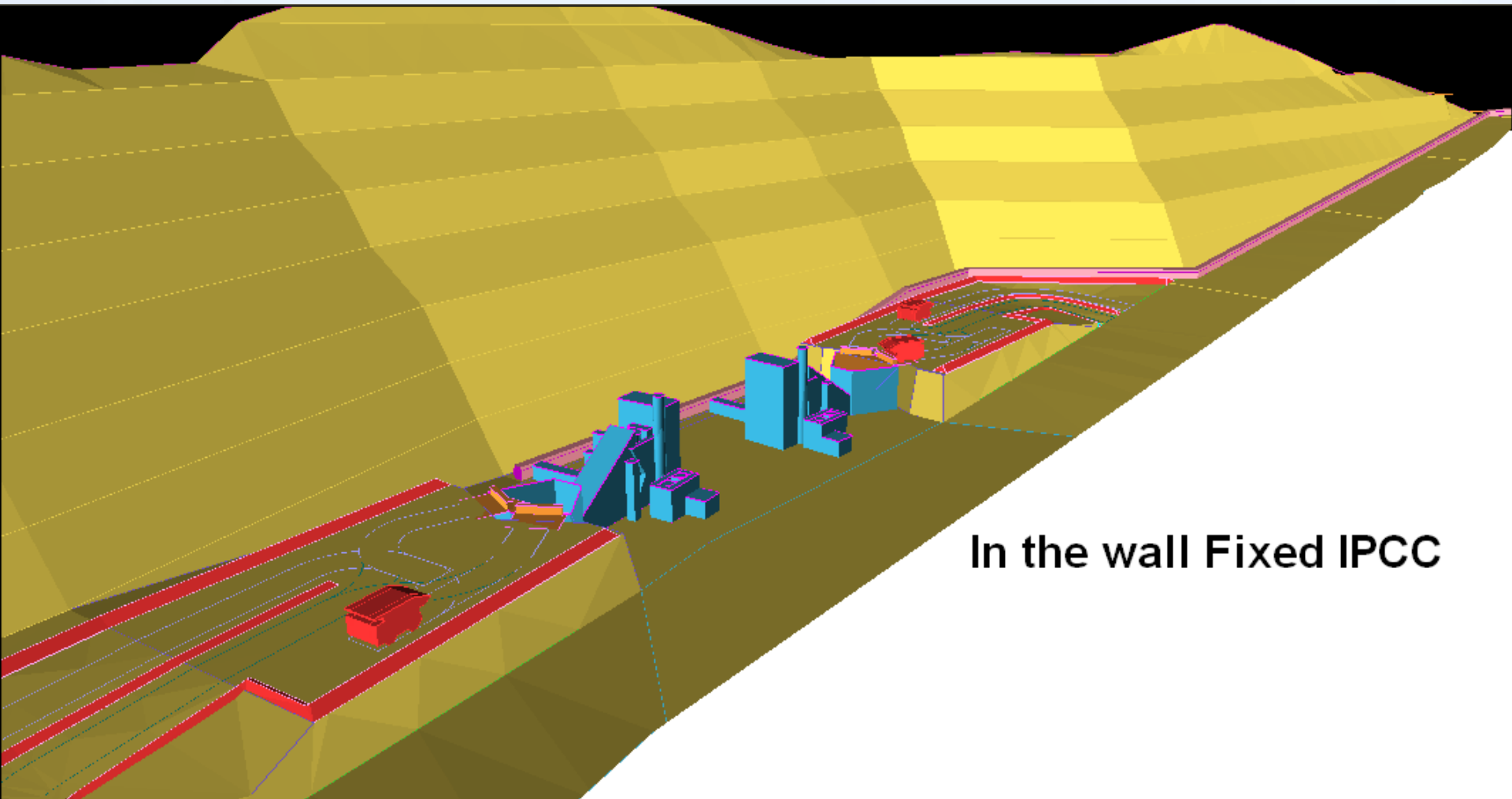


Semi-Mobile Crusher Access

Semi-Mobile IPCC using a permanent location on the haul road.



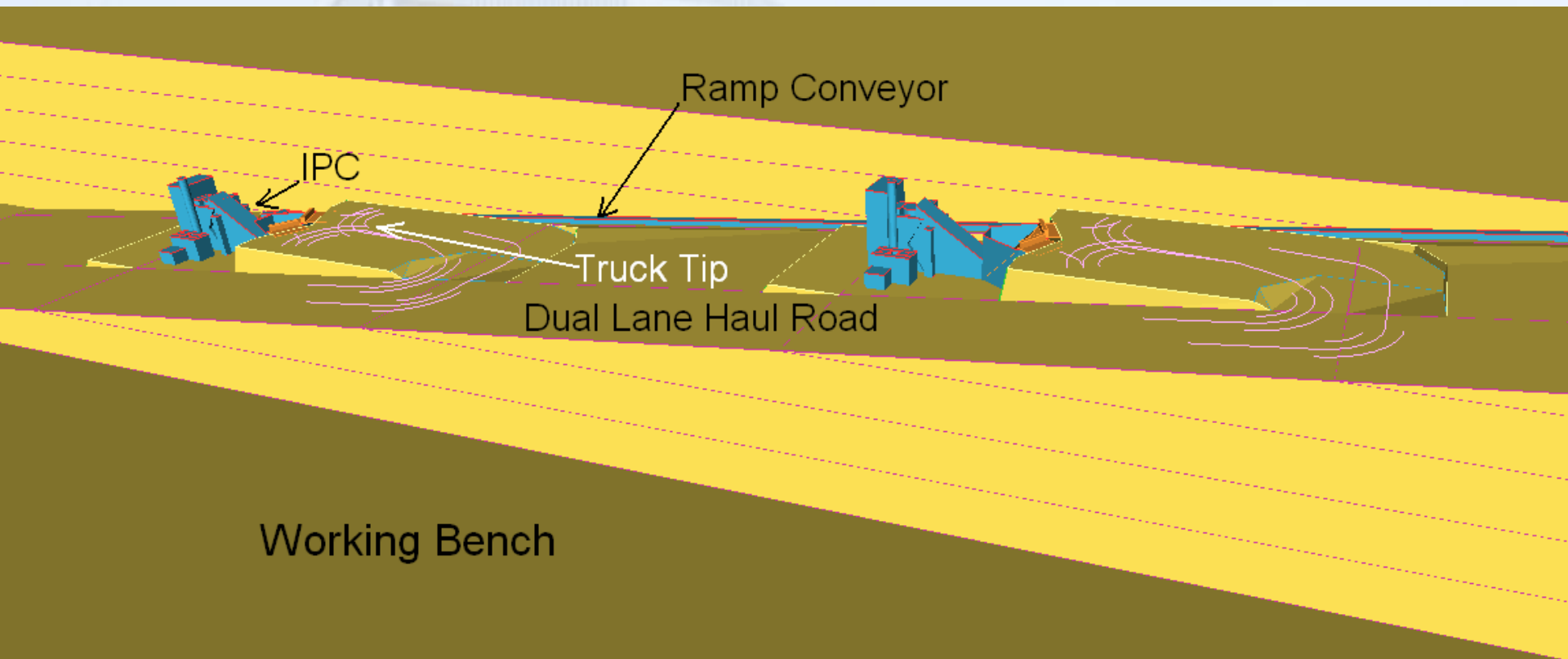
Semi-Mobile Crusher Access



In the wall Fixed IPCC

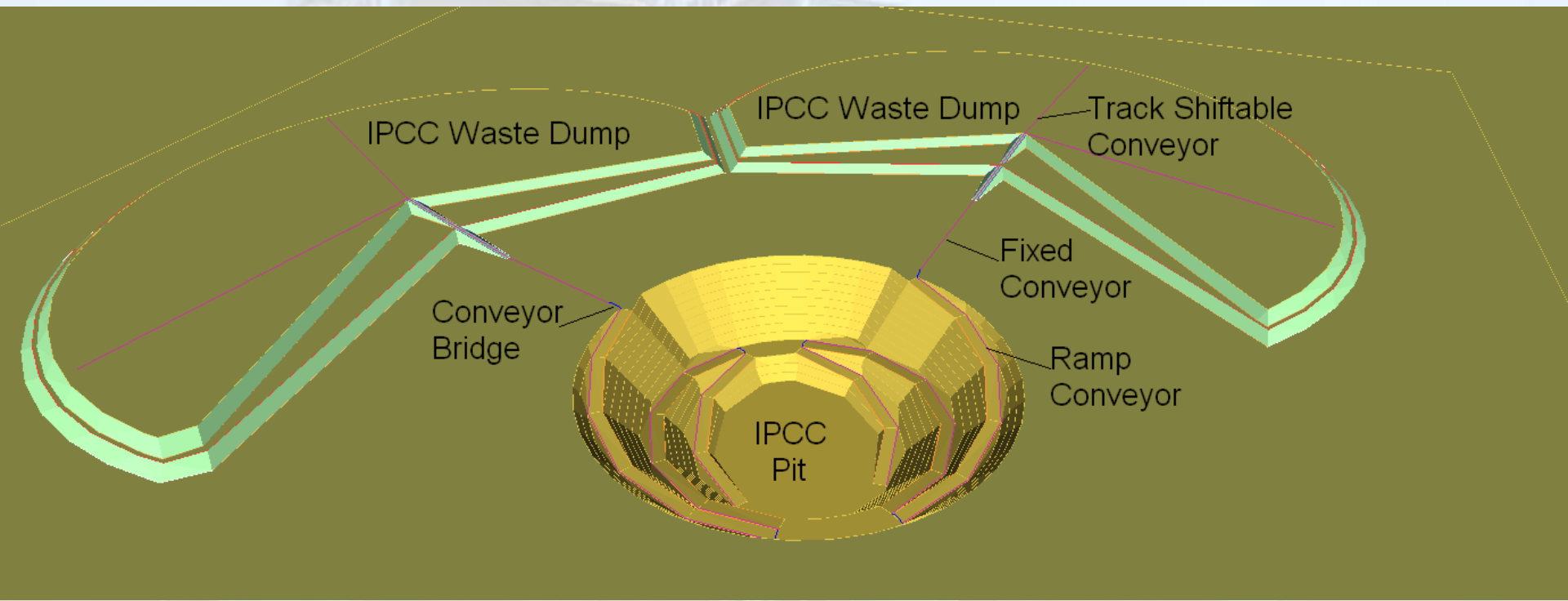
Big Pit - Semi-Mobile IPCC

Semi-Mobile IPCC using a wide haul road.



Big Pit - Semi-Mobile IPCC

Semi-Mobile IPCC using a wide haul road.



High Level IPCC Strategy for Hard Rock Metalliferous Mines

Two Stage Approach

Stage 1:

- Retrofit/Adapt IPCC to the existing open pit operation
- Co-exist with Truck and Shovel
- Focus on high tonnages
- Focus on waste only

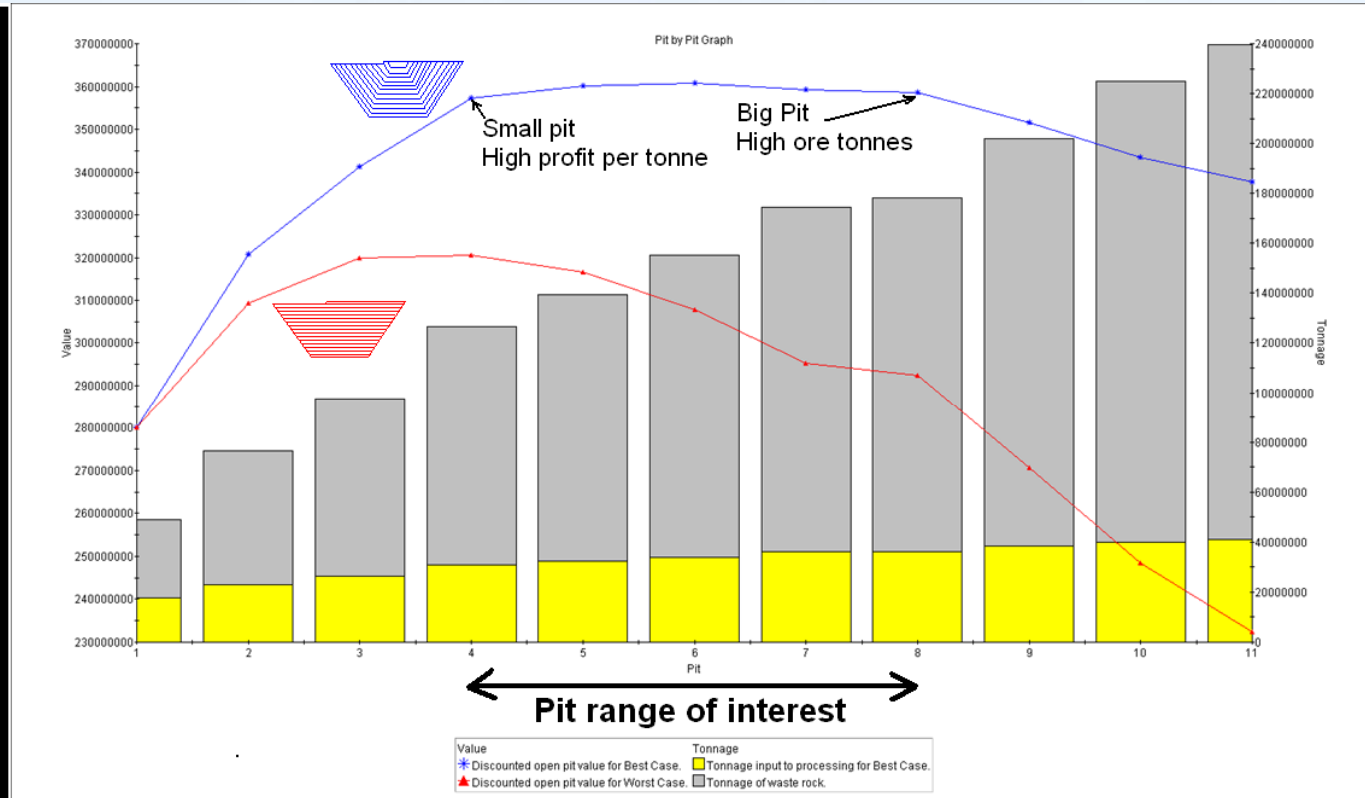
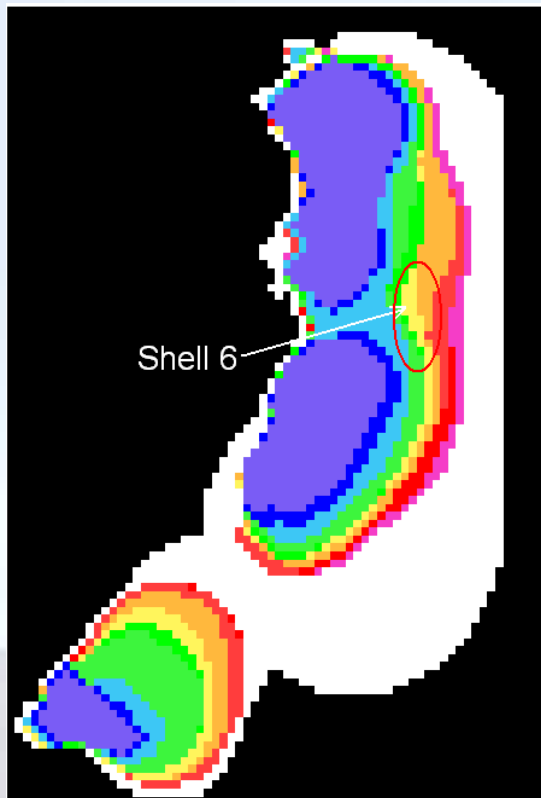
High Level IPCC Strategy for Hard Rock Metalliferrous Mines

Two Stage Approach

Stage 2 - Adapt/Optimise future cut backs to better suit IPCC:

- Straighten walls
- Enlarge cut-backs
- Consider other crusher assess options
- Consider ore conveying

Mine Planning Heresy – Ignore Whittle



- We do not need to follow the Whittle shells religiously
- We can straighten the walls and merge the shells to make bigger cut backs

Waste Dump Development

IPCC waste dumps differ from truck waste dumps in a number of respects:

- The location of the dump does not need to be immediately adjacent to the pit exits as the incremental haulage costs of conveyors are minimal.
- In general, there is no dump (construction) height restriction due to the risk of crest failure as the spreader can stand far back from the dump edge.
- Dumps are often, but not necessarily, developed in semi-circular arcs with track shiftable conveyors.

Waste Dump Development

Semi-circular waste dump development



Another short story

IPCC is sneaking in the backdoor:

- In nearly all the studies we do now, the process people know that the primary crusher should be moved from the plant to the pit edge
- This is what we call the Ex-Pit Crushing and Conveying (EPCCC)
- It will not take them long to discover that even more savings can be made by moving the crusher 80-100 m down the main pit ramp

Thank you - Questions

**Semi-Mobile IPCC coming to a pit near you!
Please consider IPCC in your next study
It may save you money**



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