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Kloof MU4

45/65 Wide Raise System

Agenda

- Objective
- Project details
- Stope layout
- Support
- Drilling pattern
- Challenges
- Video clip
- The way forward - Opportunities

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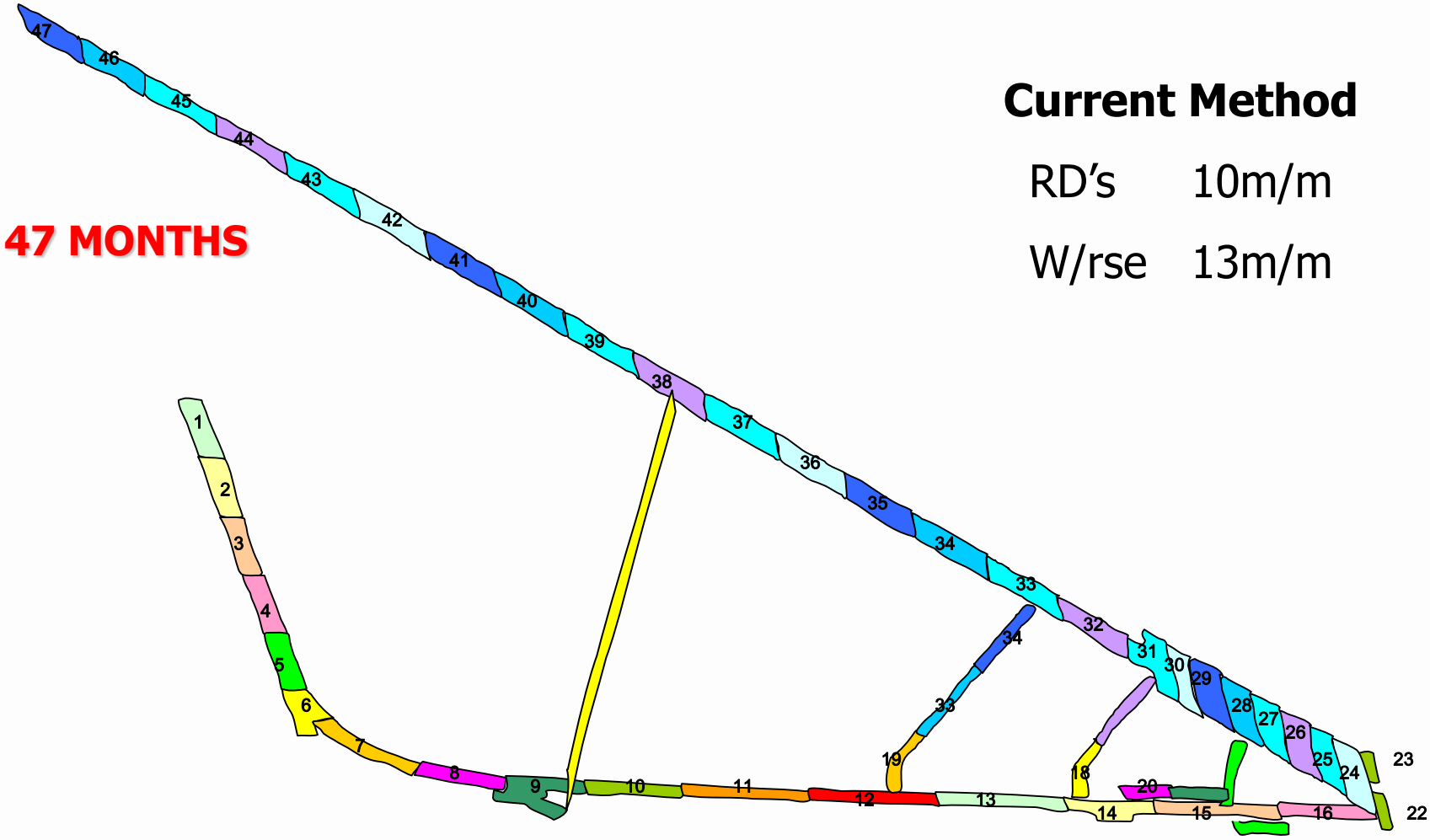
Objective

47 MONTHS

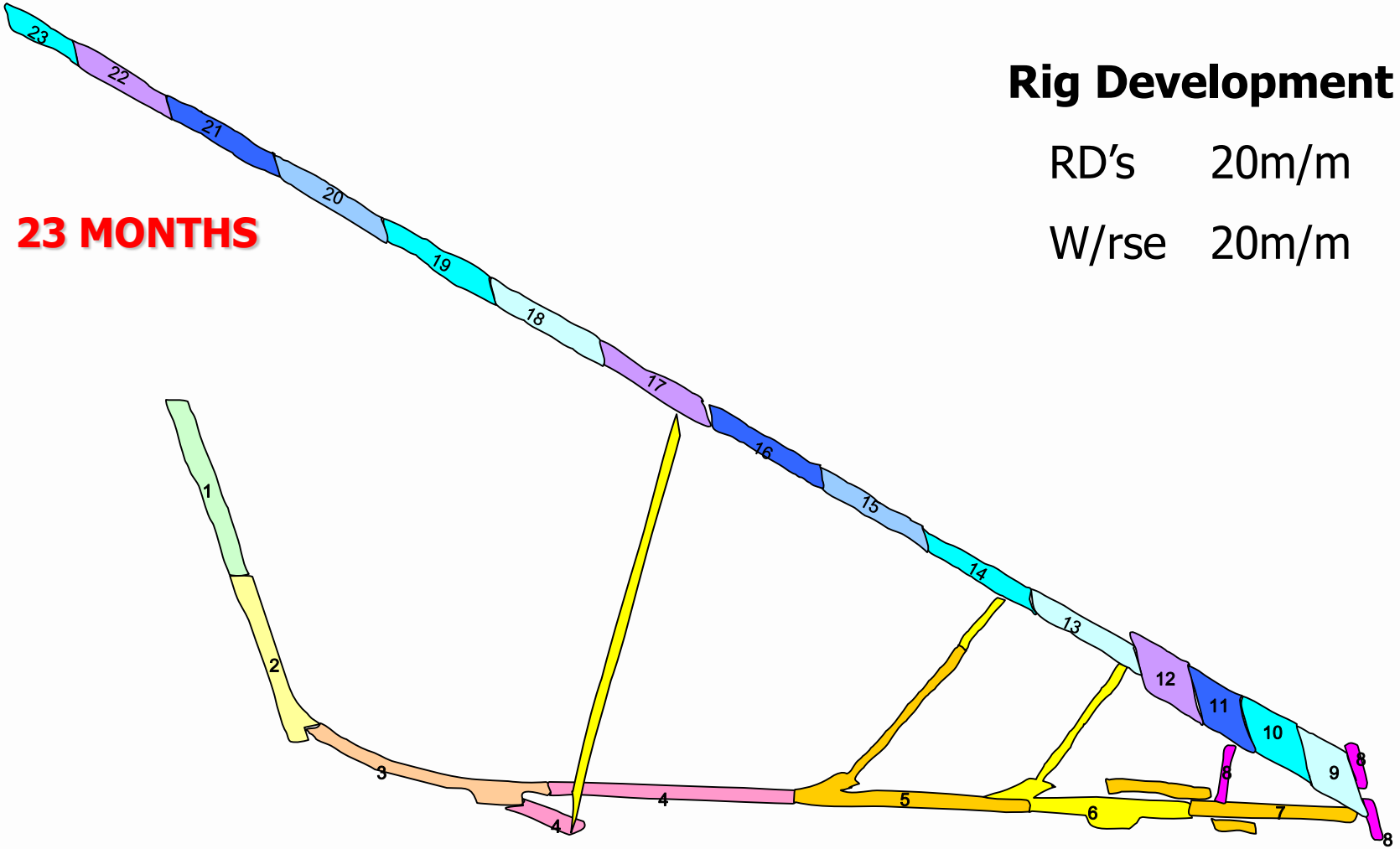


Current Method

RD's	10m/m
W/rse	13m/m

New Technology

23 MONTHS



Rig Development

RD's	20m/m
W/rse	20m/m

Project Details

- **Project start-up**
  - ✓ OCT 2014 developing x/cut and finger raise up to first box hole
  - ✓ FEB 2015 rail installation started
  - ✓ MAR 2015 rig installation commences
  - ✓ APR 2015 first blast

- **Rig specifications**
  - ✓ hydro-powered
  - ✓ suspended from mono rail system attached to hanging wall
  - ✓ 3 main building blocks :
    - drive and brake system
    - operator cabin
    - arm and boom

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Rig Specification

Rig

- Single boomer
- Drills 7,75 m wide T-cut
- Length = 10.2 m
- Height = 1.8 m
- Width = 0.96 m
- Weight = 2,5 ton
- Travel speed = 1.3 km/h

Transporter

- Carry capacity = 2,5 ton
- Tray size = 1 m x 3 m

Installation

- **Rig installation method**

  - ✓ H/held development until past first box hole
  - ✓ Hang rails from entrance to first switch
  - ✓ Rig transported disassembled to x/cut
  - ✓ Rig assembly in 4 stages
    1. Drive units hung on rail
    2. Operator cabin suspended
    3. Attach arm and boom to cabin
    4. Connect & test hoses & valves

Productivity

- **Face time**
  - ✓ 2.5 hrs per 7.75 m wide T (install rail, drill support, gully & T)
  - ✓ 15.5 m wide double T – estimate 5 hrs
- **Development rates**
  - ✓ 1.0 m advance / blast
  - ✓ 15.5 centares / blast (15.5 m x 1.0 m advance)
- **Performance to date**
  - ✓ 100 m of raise line completed
- **Safety**
  - ✓ Zero incidents

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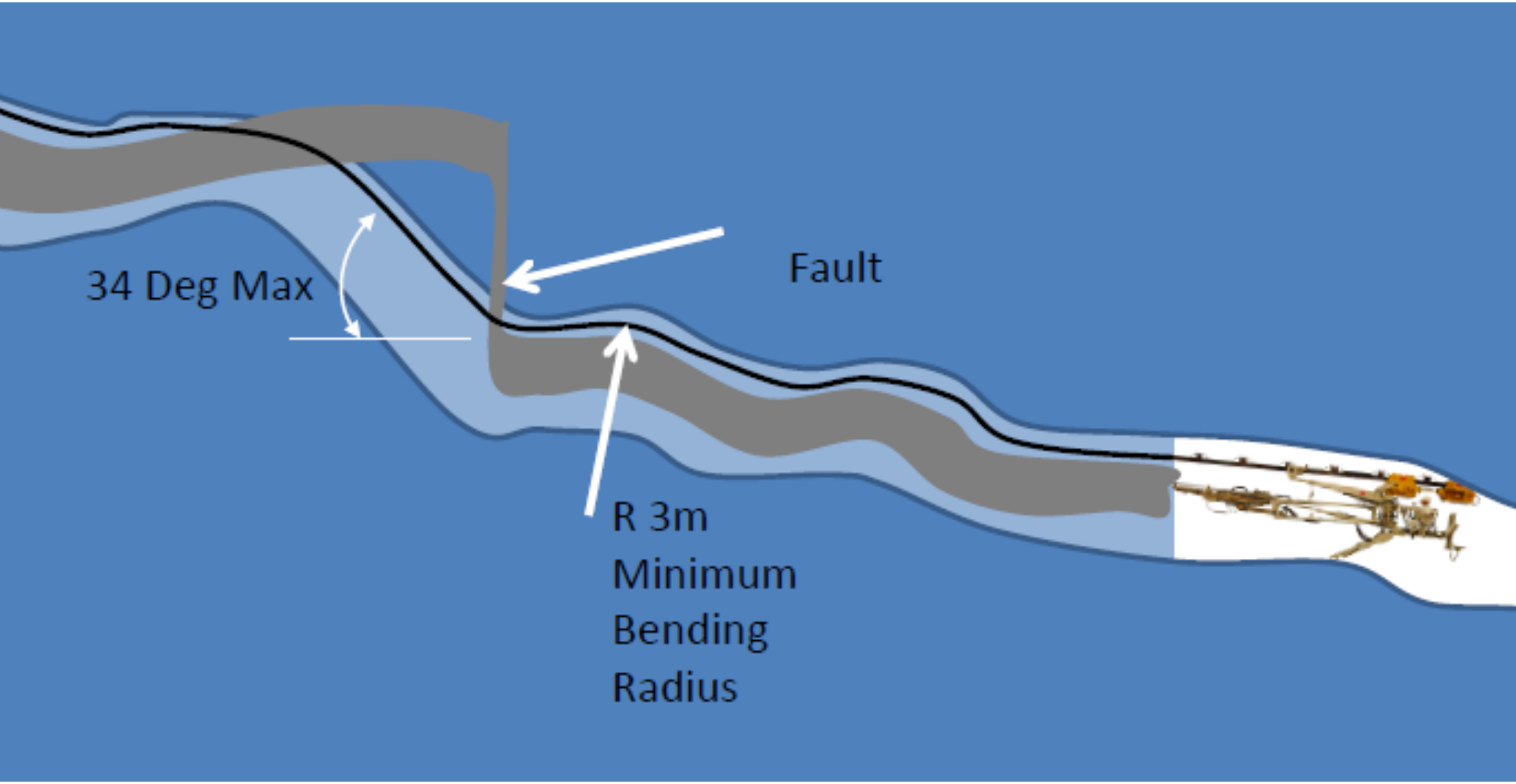
Navigating Faults & Rolls



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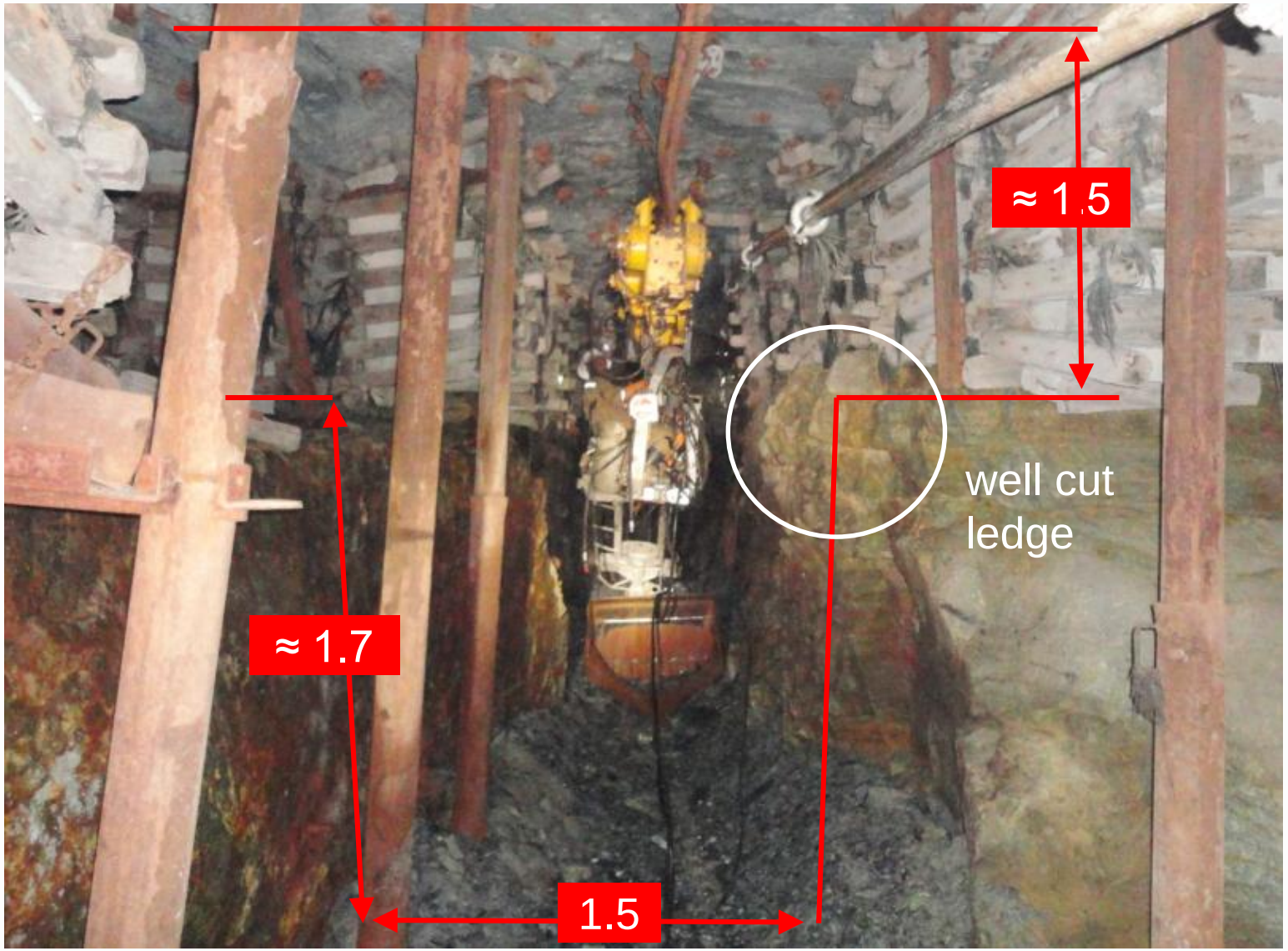
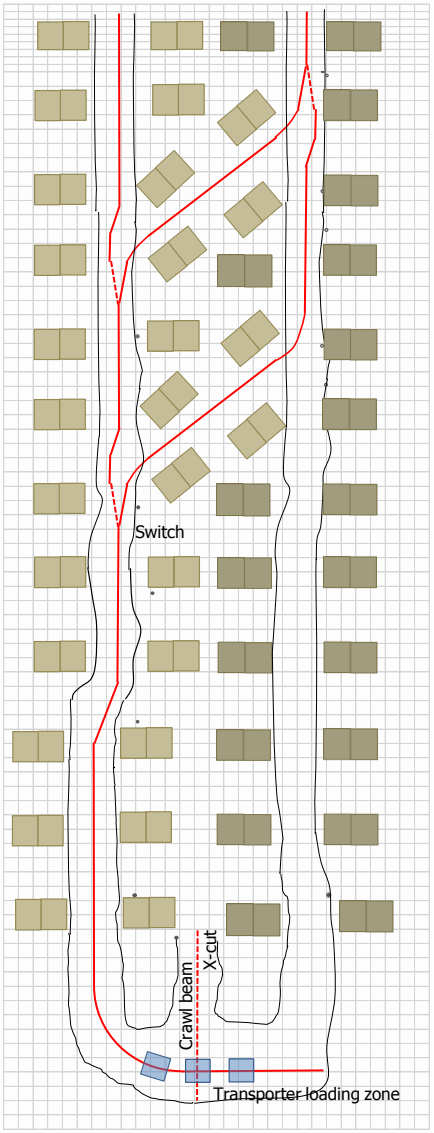
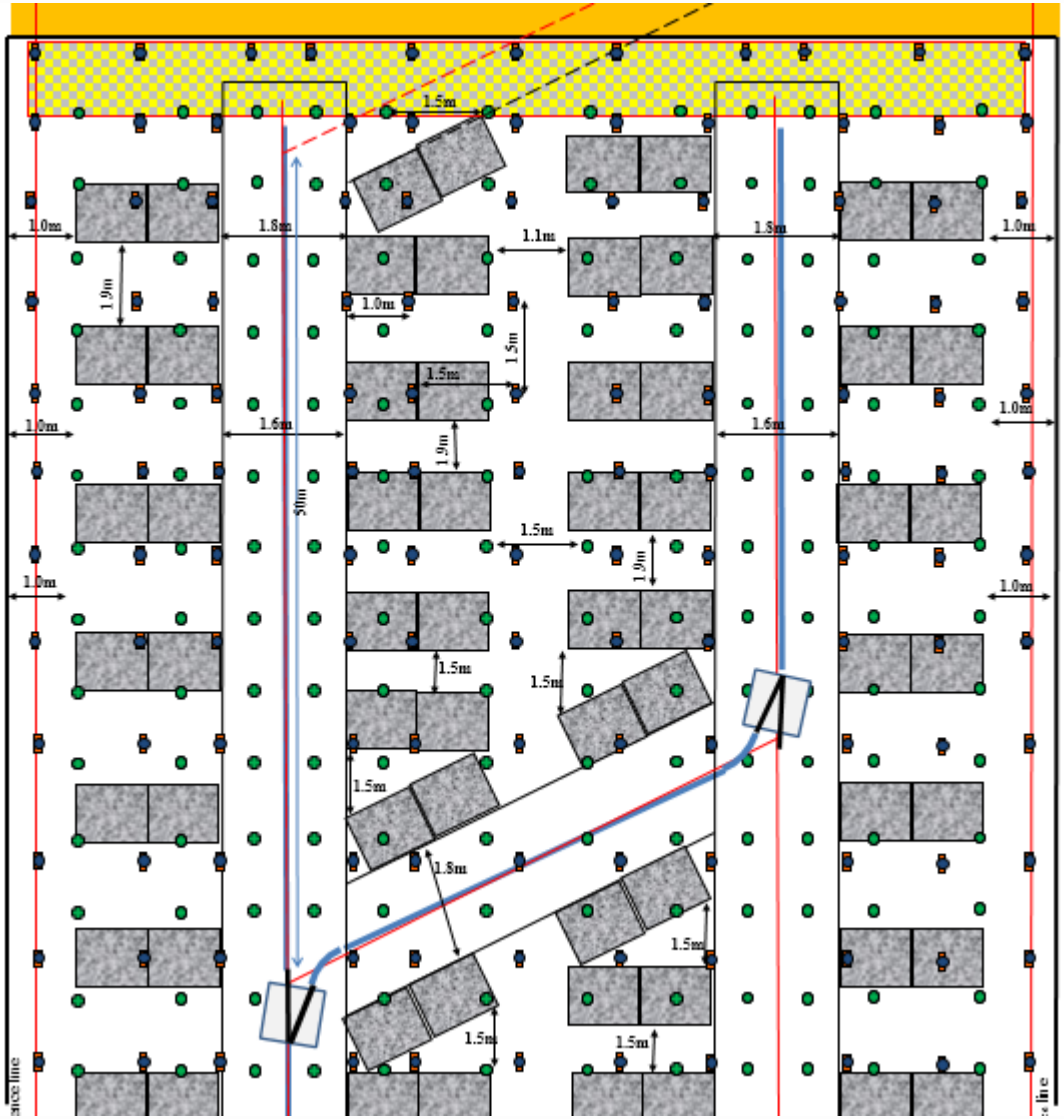
Excellent Pre Ledging



Stope Layout





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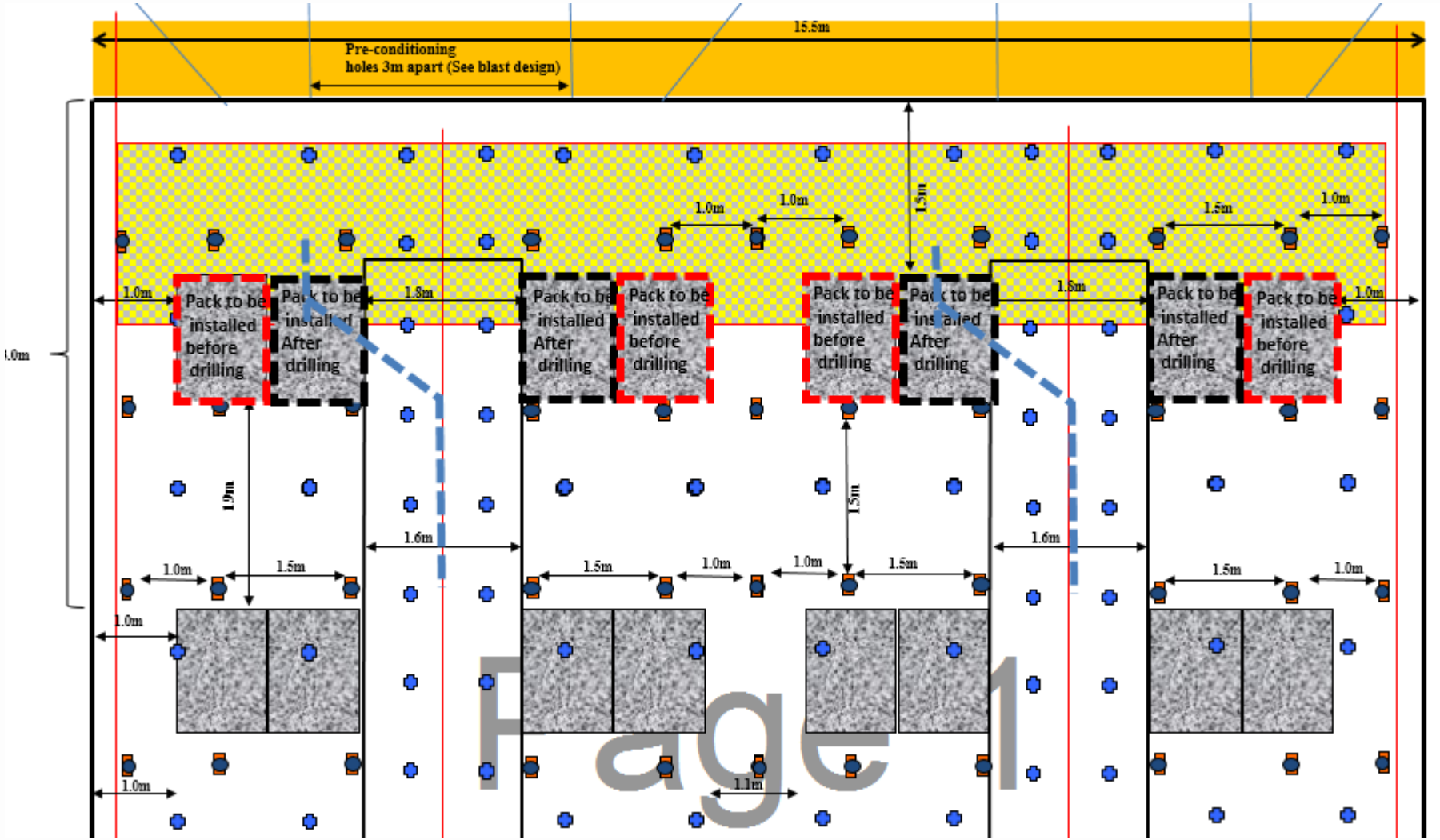
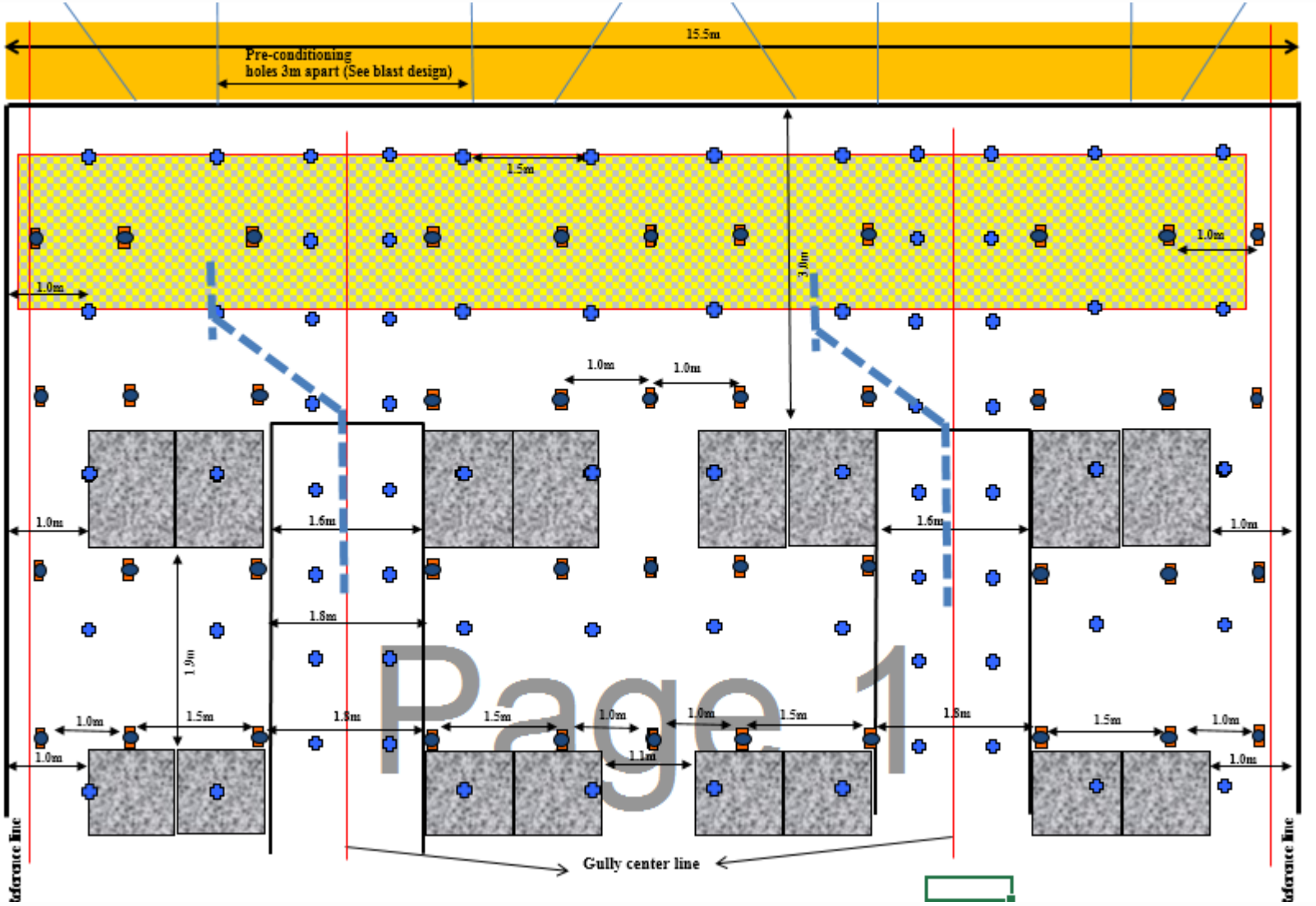
Support – day 1



Support – day 2



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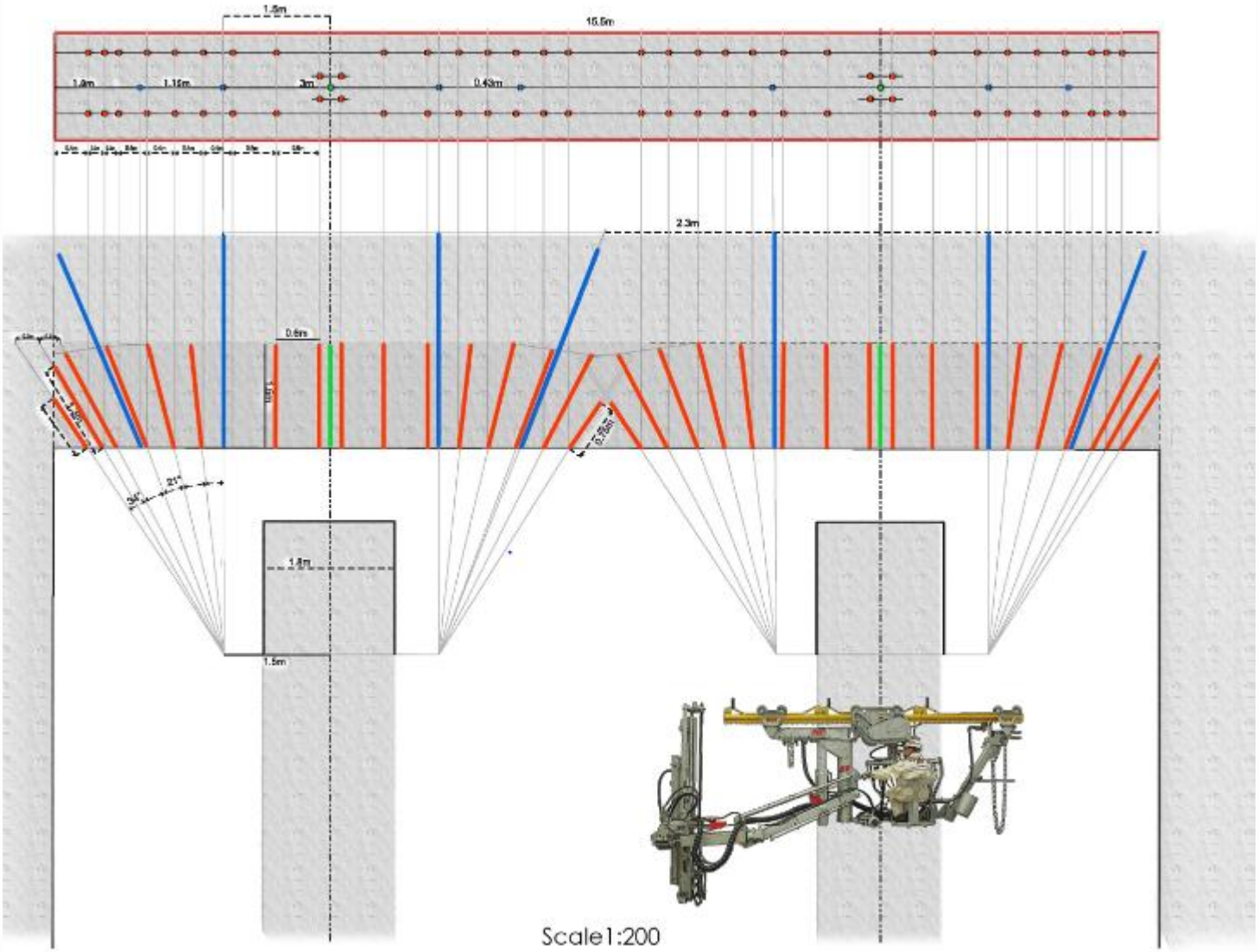
Drilling Pattern



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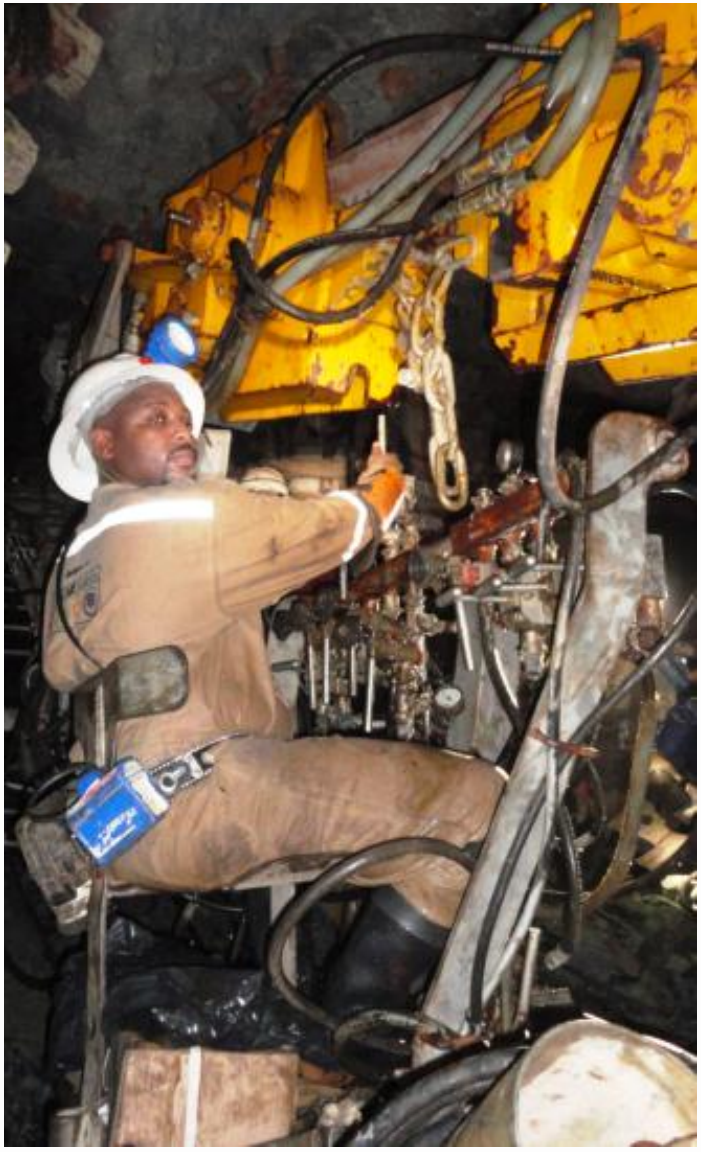
Raise Line Views

Tramming

Switch

Drilling Roof & Suspension Bolts



Face Drilling

Challenges – 13 Key Learnings

#	Issue	Learning
1	Transporting rig to site	Break up into smaller modules to fit vent doors
2	Hanging & turning rig into position	Needs rigger .. in future, need a more compact rig design
3	Rail installation	Need multiskilled crew or dedicated resource
		Solid training needed to ensure correct installation in bends
		Use correct grout formulation & management thereof
4	Loading area at reef intersection	Rail too high, space too tight
5	Pack prevents rig navigating corners	Mining must adhere to compound bend layout & excavation sizes
6	Rig boom can't dip down far enough when reef roles abruptly	Need to manually re-adjust boom
7	Spares availability	Establish underground stores / service exchange units
8	Rig (especially hoses, fittings & controls) covered in stoff from use of sweeping tool	Return rig to park bay .. proper hose down & flushing pre start-up
		Ensure box hole in operation before start up of rig
9	Cleaning stoff	Need rhythm .. no drilling unless face & gully clean
		Need platform to hang rails as working at height
10	Gully not blasted deep enough	Adhere to mining standards
11	Operator has poor visibilty of face	Use spotter .. in future, retrofit lights
12	Mine crew taking ownership	Incentivize crew .. and remove all hand held drills
13	Loading packs / materials into load tray of transporter	set-up must allow for easy roll on / off from cars into load tray

Video clip 45/65 wrs

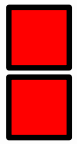
The way forward - Opportunities

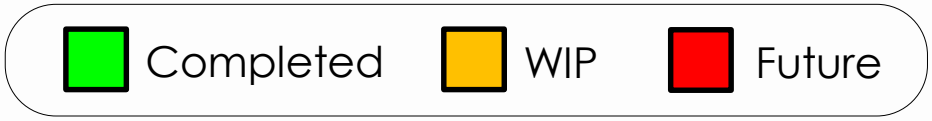
Mk 2 – in development

- Add lights → improved visibility & eliminate spotter
- Reduce rig length & weight → easier handling
- More compact boom → easier positioning for drilling
- Incorporate roof-bolter → drill all support holes under "T"
- Remote control → enhance visibility, safety & productivity

Under consideration

- Increase round lengths to 2 m → increase face advance
- Incorporate water jet guns with booms → for assisted cleaning





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End

Questions ?