Implats – Impala Rustenburg operations

THE ADOPTION JOURNEY FOR THE PERMANENT WORKFACE AREAL MESH TRIAL AT IMPALA RUSTENBURG

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MINERALS COUNCIL
SOUTH AFRICA

CONTENTS

INTRODUCTION – IMPALA WESTERN LIMB OPERATIONS

- Locality: 145 km North-West of Johannesburg

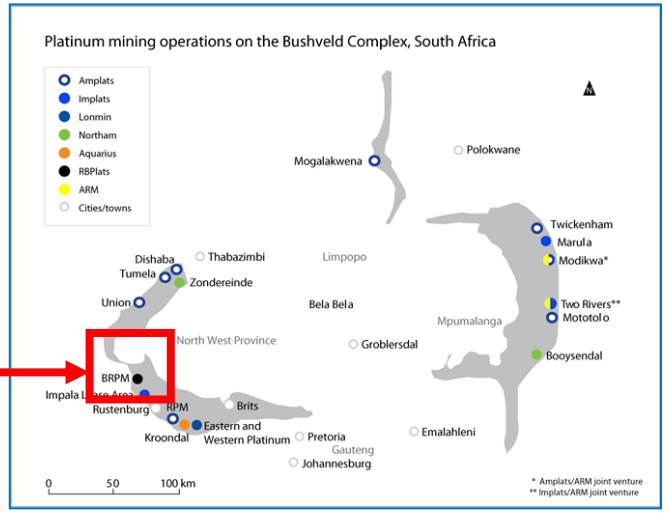
- Shafts: Thirteen (13) operational shafts (including Bafokeng)

- Reefs mined: UG2 & Merensky

- Mining Methods: mining: Conventional scattered breast & trackless mining

- Mining Depth: 30m – 1500m below surface

- Employees: +-49 000 (including Bafokeng)



We are here

- Annual ounce output: +-1 800 000 oz
- No of stoping crews: 816 crews

ZERO HARM - IMPLATS - 8 POINT SAFETY PLAN

IMPALA
Member of the Implats Group

Immediate Actions (1 Month)

01 GM Comms Drive

- Safety stand – "No one dies under our watch"
- "Talk to your GM" roll out
- Mass meeting to create awareness

02 Management Routines

- Sign-off work calendar aimed at getting leaders underground
- Specify minimum underground shift for leaders and supervisors

03 High Risk Work Focus

- FOG
- TMM
- Equipment and Material Handling
- Slip and Falls
- Holling Compliance

04 Early Entry Exam

- VFL and Early shifts to address EEE shortcomings.
- Focus on safe start of each shift

zero Fatalities

Medium Term Actions (6 Months)

05 FRCP Implementation

- Accelerate full implementation of the FRCP programme
- Complete Bow-ties for all FRCPs
- Monitor and track Critical Controls.

06 Critical Skills Turnover

- Address the high turnover of Managers and supervisors
- Capacity Building

07 Critical Safe Behaviours

- Determine critical safe behaviours for every job category
- 10 Non-negotiable rules for life
- Safety accountability framework

08 Planning

- Improve planning methodology and quality of planning sessions
- Adherence to production cycles

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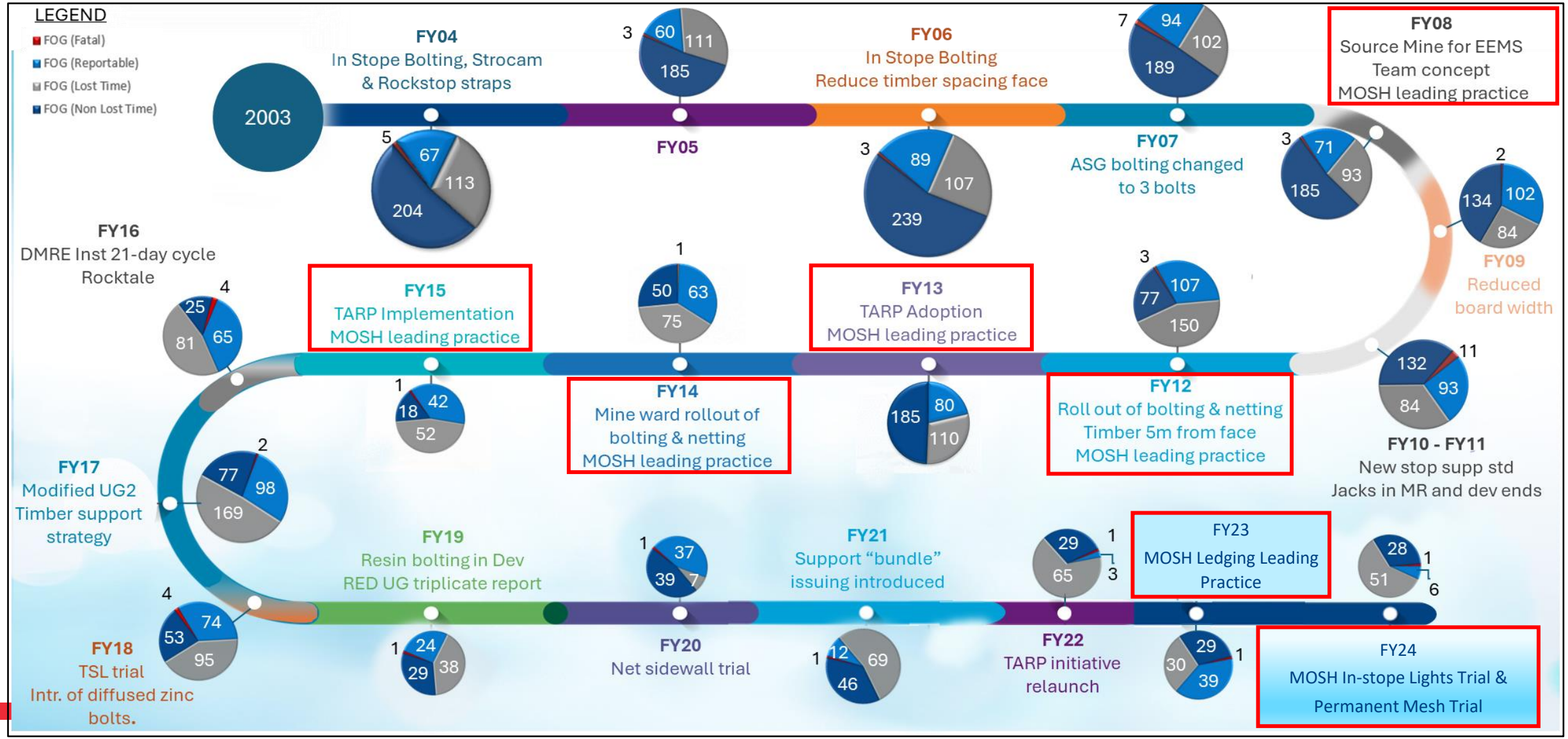
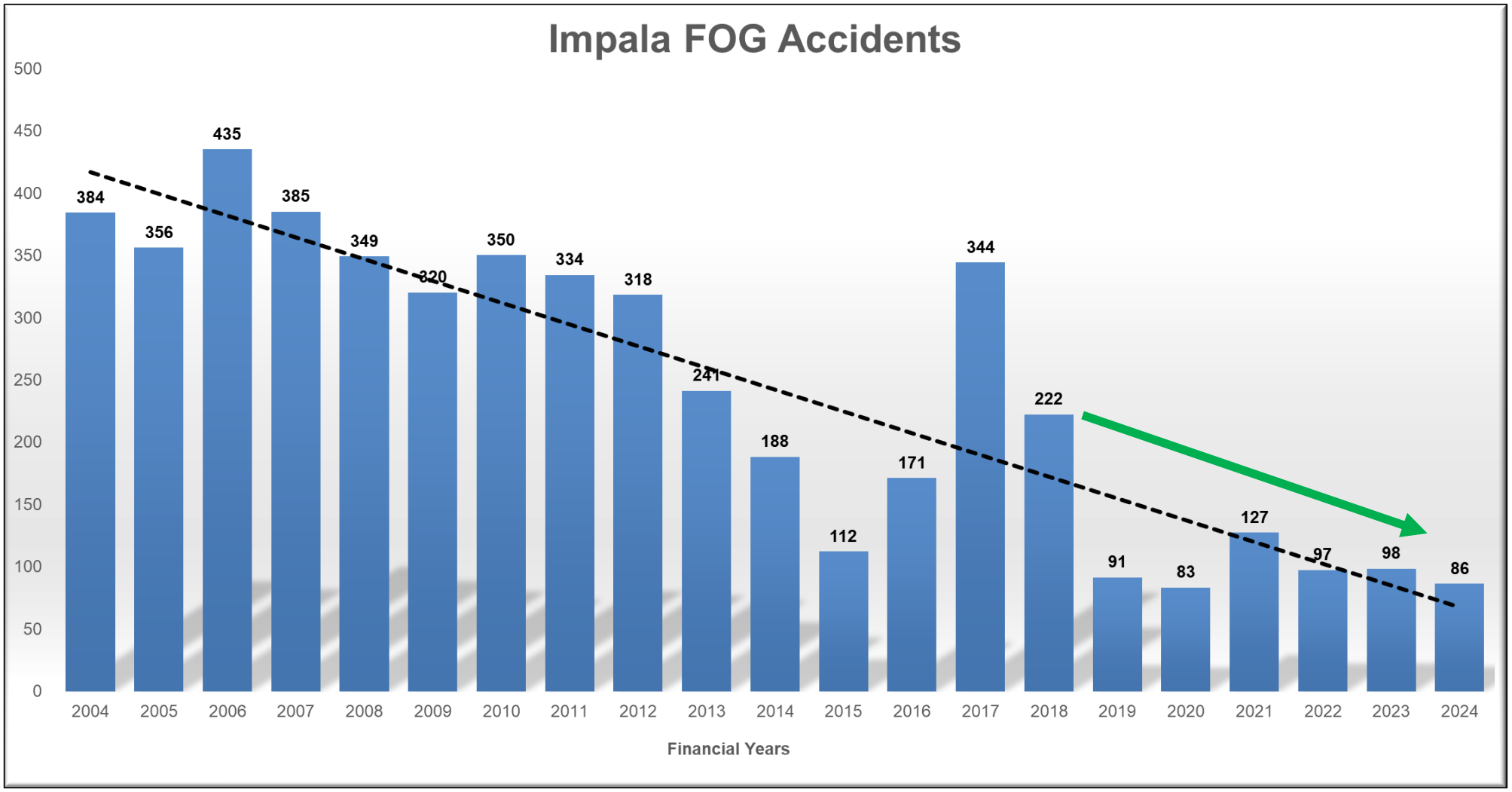
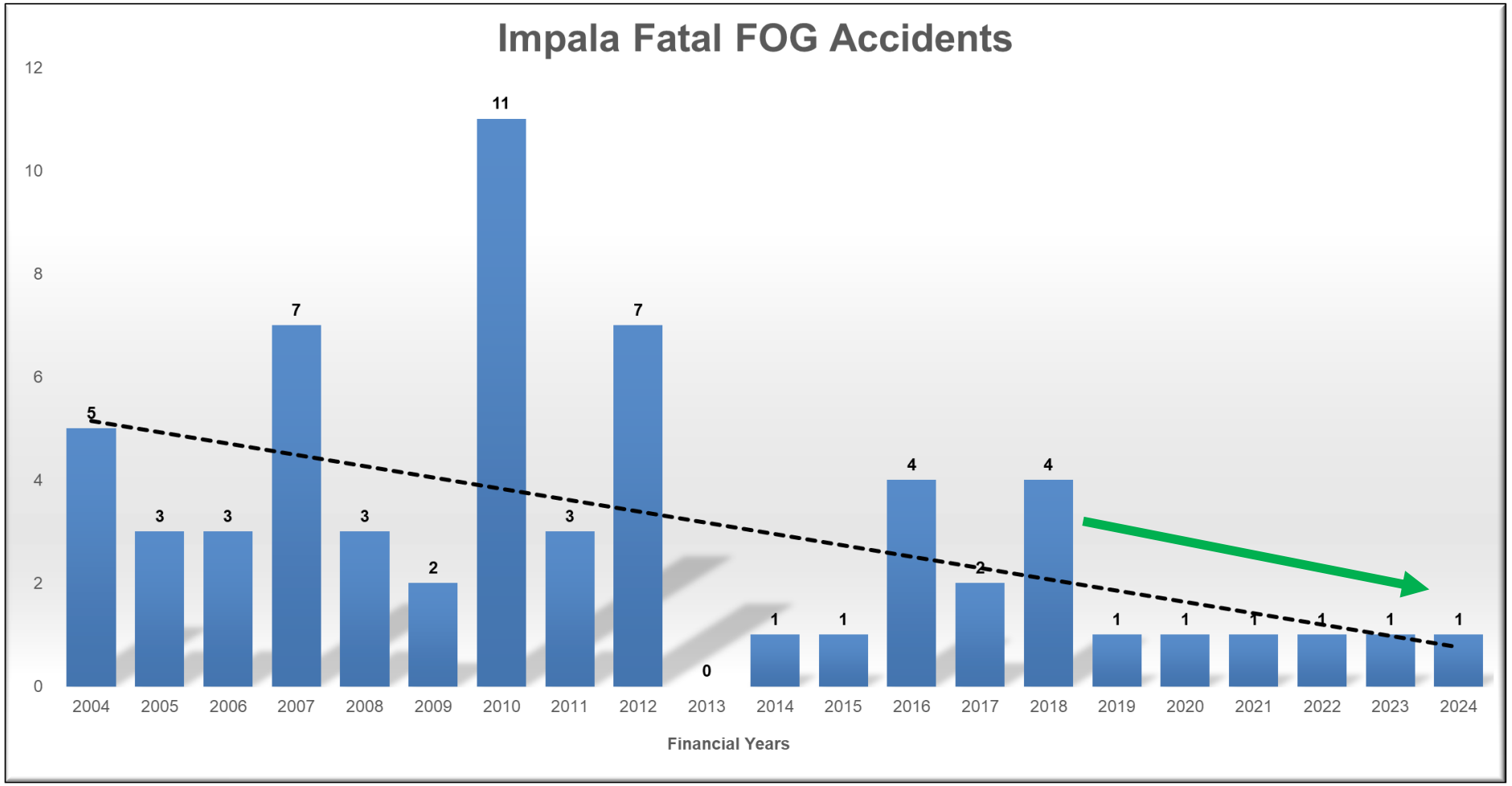
JOURNEY OF INITIATIVES & IMPACT ON FOG INCIDENTS



IMPALA FALL OF GROUND ACCIDENT SUMMARY 2004 – 2024



IMPALA FALL OF GROUND FATAL SUMMARY 2004 – 2024



LESSONS LEARNT FROM OTHER ADOPTING MINES

Learnings from adopting mines

- Mesh **design** is critical;
- **Engagement** with all **stakeholders** at the **start**;
- During trials, if any **sub-standard installation**, **poorly suspended mesh** or inadequate linking of mesh **creates** a **false sense of security**;
- **Adopting mines** have **realized** a **reduction** in **FoG injuries** and **severity**;
- **Additional** support time and **cost** requirement **outweighed** by **safety benefit**;
- **Production** was **sustained** and **worker morale improved**.

Mponeng (Gold)

Sibanye Stillwater (PGM)

Bambanani (Gold)

Masimong (Gold)

MOSH ADOPTION PROCESS FOR PERMANENT MESH TRIAL

Project Initiation
- CE, COO & GMs commissioned the investigation

Investigation into permanent mesh
- Design Specifications
- Industry RFI
- Drop Tests
- Cost Evaluation

Stakeholder Engagement
- Engagement with both branch and shaft HSE & Union structures

Risk Assessments & Permission to Trial
- Shaft Issue Based Risk Assessments
- Permission to trial documents sign-off
- MOSH adoption sign-off
- Trial site selection

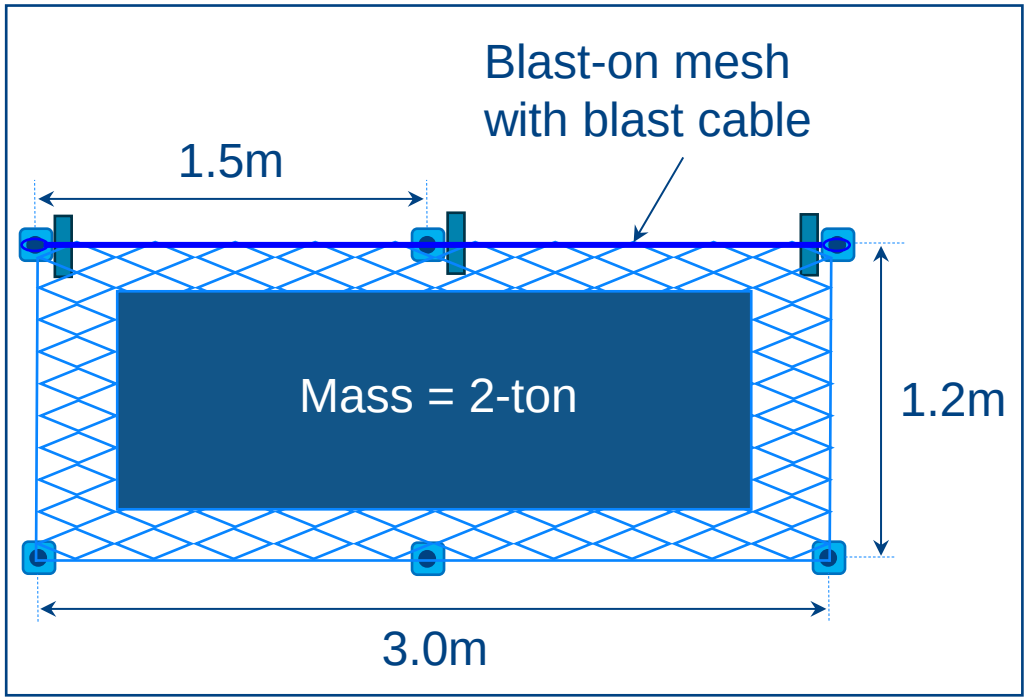
Trial & setup
- Product ordering
- Supplier delivery
- Onboarding of OEM instructors onto shafts

Training & Operating Procedure
- OEM instructors trained the crews, line supervision concurrently with Impala Technical trainers
- Operating Procedure will be adopted for implementation

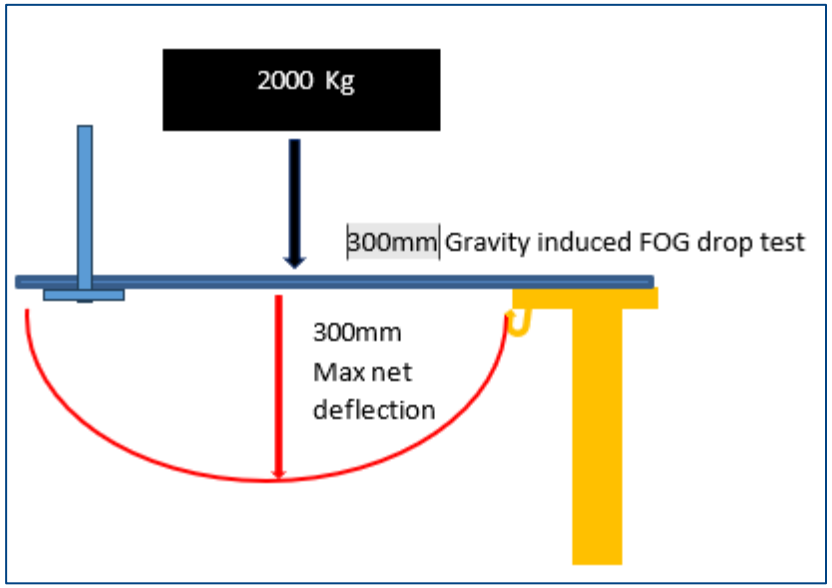
Standard Review & Monitoring
- Ongoing monitoring and reviews are conducted with weekly feedback reports

Rollout and training

DESIGN REQUIREMENTS

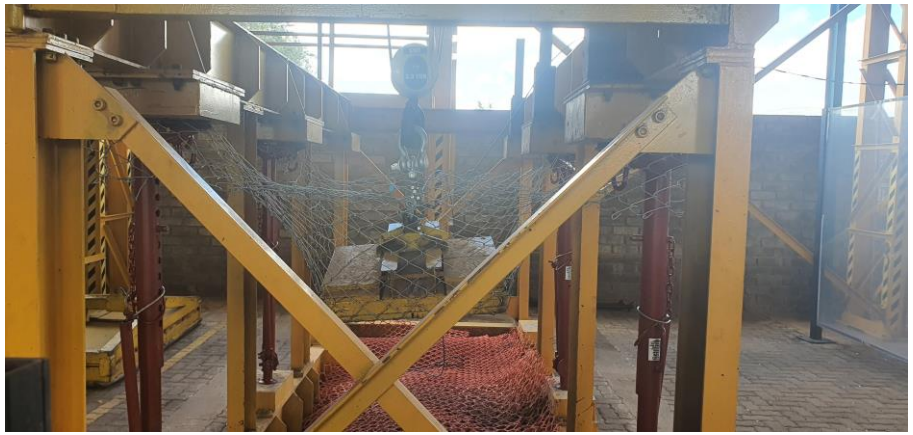


- **Mesh dimensions conform** to Impala **support type** and **spacing**
- Mass to be supported: **2-ton mass** for stoping,
- **Drop Height**: **100mm** above net.
- **Maximum deflection** after drop: **300mm** from original position of net.

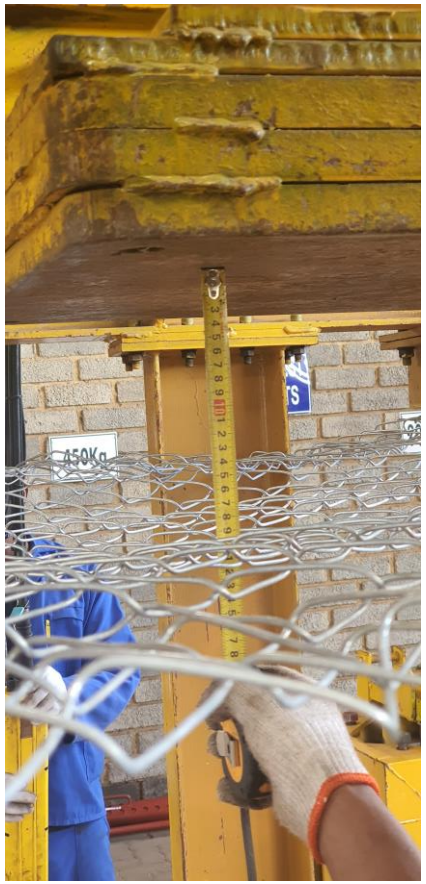


DROP TEST CONDUCTED ON VARIOUS PRODUCTS

2 Ton Drop Test



Drop Height 100mm



Max Allowable Sag 300mm deflection

- Drop tests conducted on various products
- Various test configurations:
  - Prop to Prop
  - Prop to Bolt
  - Bolt to Bolt
- Supplier product development to meet design specifications

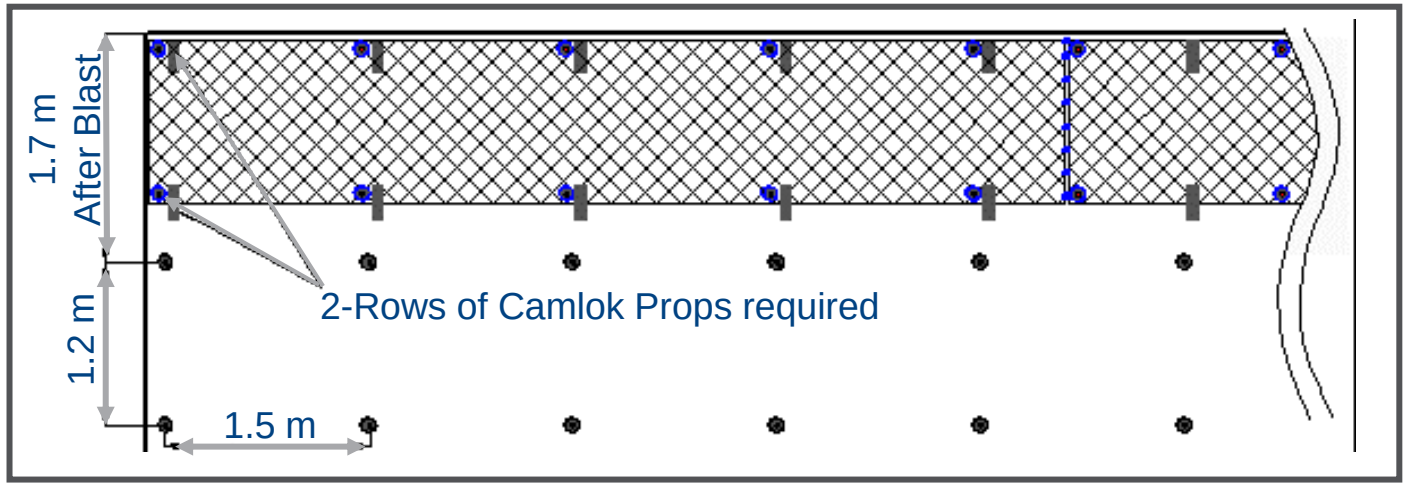
CRITERIA FOR THE TRIALS

- **Mesh** must be able to **contain key blocks** up to **2 tons**, with **acceptable deformation** (“survival zone”).
- **Support accessories** must be **compatible** with **current support system**.
- **Mesh** installation must **integrate** into the **current mining cycle without affecting crew productivity**.
- **Labour compliment** of the crew must be **suitable** for the **mesh installation**.
- **Logistical** and **storage** (surface and underground) requirements must be **adequate**.

2-ton drop test: permanent mesh

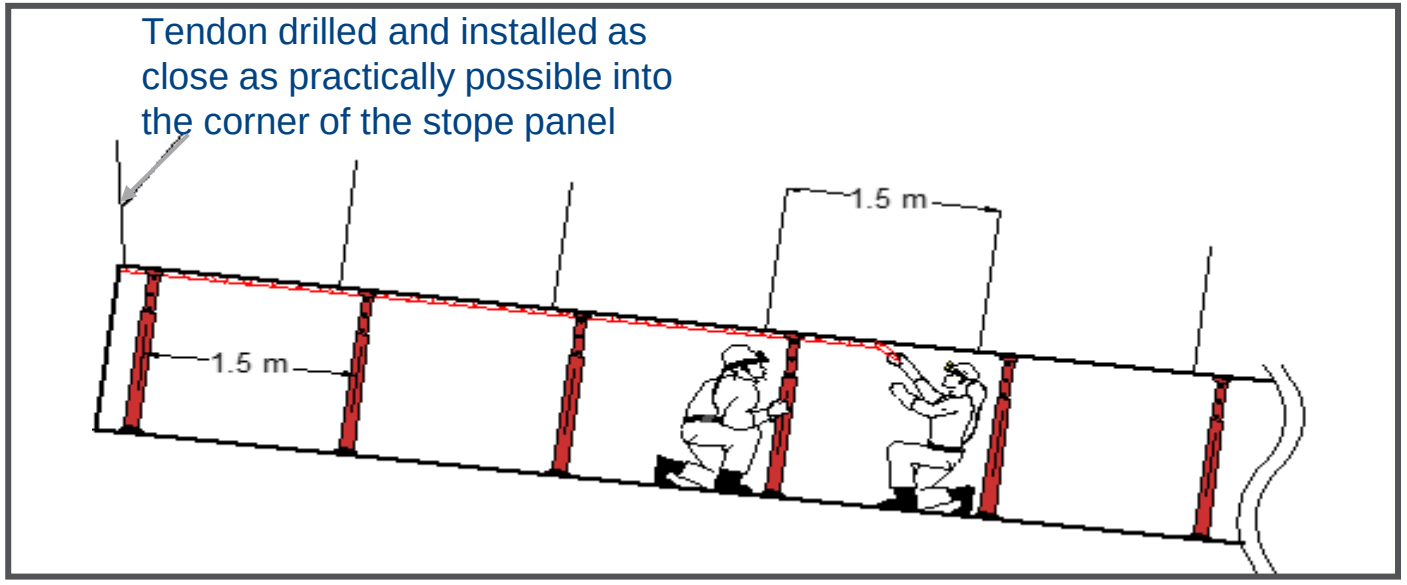
DROP TESTS SIMULATIONS

INSTALLATION SEQUENCE



LEGEND:

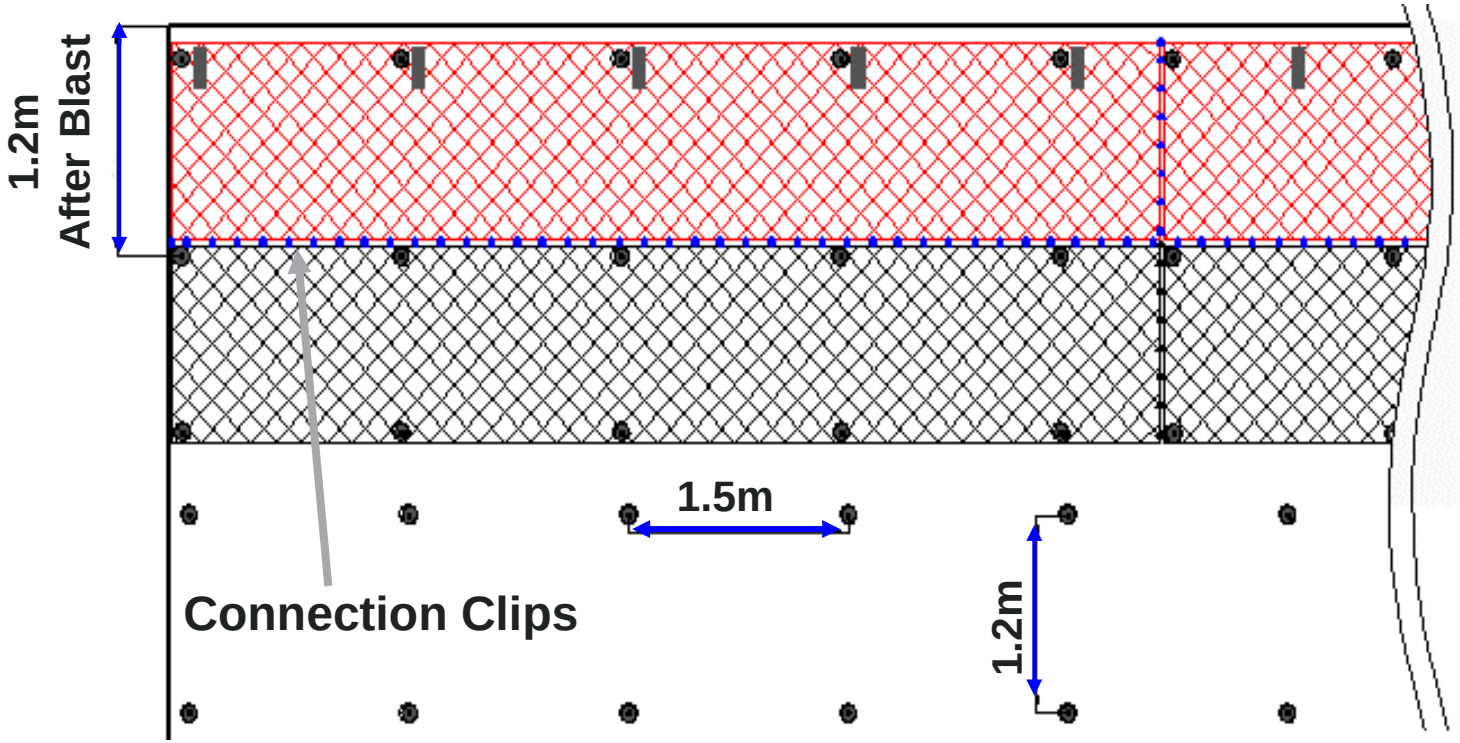
- Temporary support units
- New tendon support units
- Tendon support units
- Blast-on mesh



SHIFT 1: DRILLING

1. To install the **first row of blast-on mash** in the stope panel, it will be necessary to **install 2-rows of Camlok props** to clamp the blast-on mesh to the hanging wall,**1 row** along the **front** and **1 row along the back end** of the blast-on mesh.
2. It is important to note that the first row of permanent blast-on mash will **also require two rows of tendon support** units to pin the mesh to the hanging wall.
3. **After the blast** the **next line of blast-on mesh** will **only require 1-row of Camlok props** and **1-row of tendon support** units installed in the immediate face area.

INSTALLATION PROCEDURE OF BLAST-ON MESH IN STOPE PANELS



Cutting Tool

Spike Plate

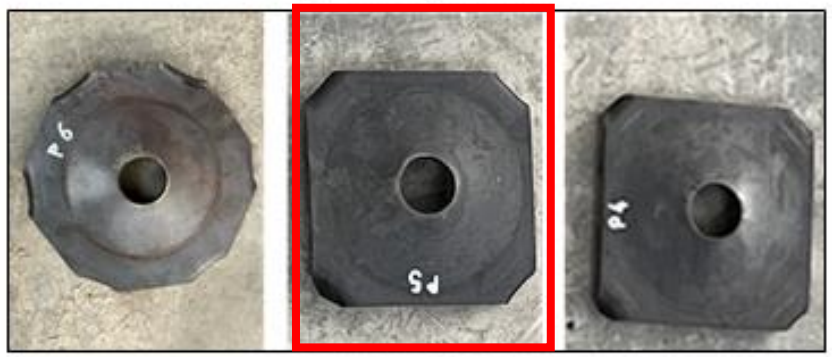
Seven connection clips are installed per running metre of the mesh

MESH COMPONENTS

Spike plate

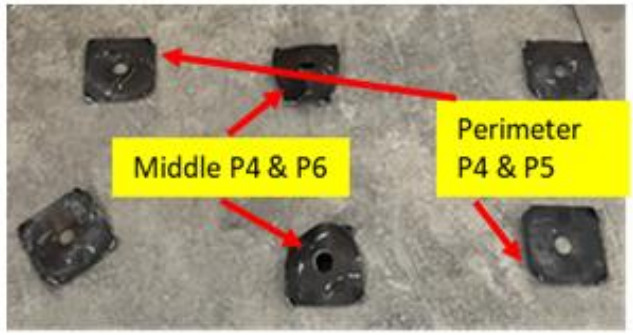
Current Washer

Prototype – Spike Plate / Washer

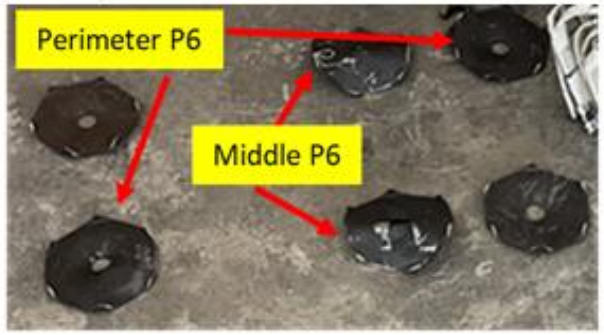


Clip

Deformation of



Prototype – Spike Plate / Washer



- **Mesh** is **supplied with spike plates** and **connecting cli**ps
- **Spike plates not suitable** for current support **tendon**
- New **porotype washers compatible** with **all mesh** supplier were **developed**
- **Tests conducted on** various **protype options** and **currently** available and **in use** for operations

FEEDBACK FROM JOINT TEAM VFL INSPECTION VISITS

- The vast majority **crews** are **positive** about the concept of permanent mesh;
- Some **panel advances** were found to be **less than 1.0m** per blast resulting in **large** mesh **overlaps** and wastage;
- **Crews reported** that size of mesh roll make **installation difficult** and **requires** as many as **4 people** to handle;
- **Smaller mesh sizes** are **easier to handle** and install
- The **quality of mesh installation** varied but seems to **improve with constant coaching and experience**.

No.16 shaft

Impala and Minerals council team inspection of 16 shaft mesh trial site

KEY NOTES - PROGRESS UPDATE

- **Adoption** commenced in **September 2023**;
- **Three suppliers** were **identified** through consultation with various stakeholder forums;
- **Initial drop tests unsuccessful**, **suppliers told to redesign** to match current safety net performance;
- **New tests** in February 2024 were **successful** and underground **trials** were **approved**;
- **Trials** currently underway **on all (10x) Impala Rustenburg** shafts (at least 1 trial site per shaft).
- **+-17 000 mesh segments installed** to date **translates to 38 000 m^2** of **hangingwall covered** by mesh
- **Trial extended** to the **(3x) Bafokeng operations**.

BLAST-ON MESH TRIALS LEARNINGS

- Mesh **roll dimensions** are critical, should **match** in-stope **bolt spacing** and blast advance to minimise wastage.
- **Logistics** and **storage** capacity envisaged as a challenge during full roll out.
- **Proper tensioning** required to **minimise damage** from blasting and/or scraping activities.
- Mesh "**mass**" versus "**strength**" versus "**cost**" trade offs.

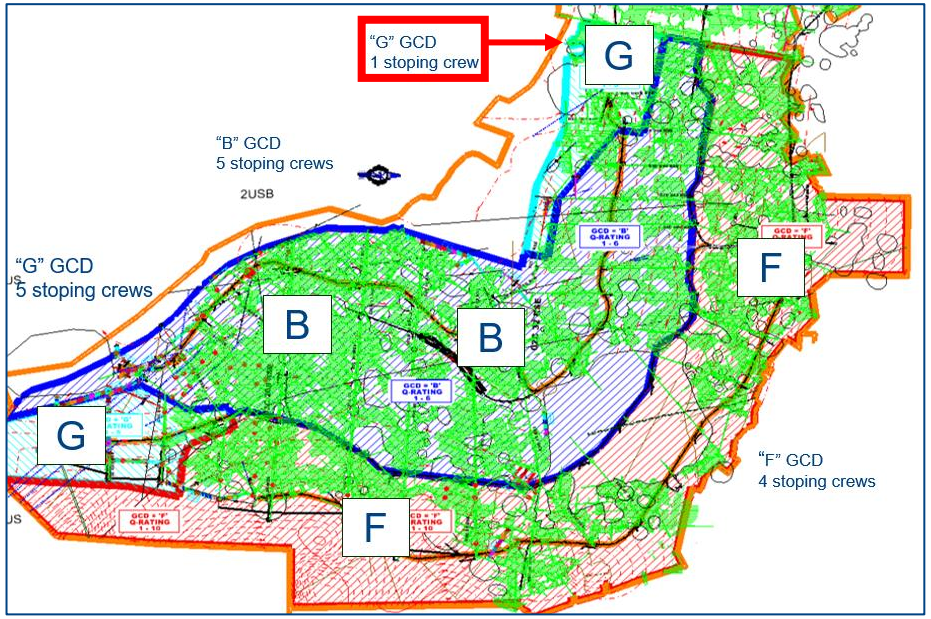
Technical benefits:

- **Reduced area** to be examined and made safe.
- Back area **fully covered.**
- **No removal** of the temporary nets required.
- Rock mass failure (FoG) **risk** is **minimized.**

CREW 0554D - E&F SHAFT SUCCESS STORY

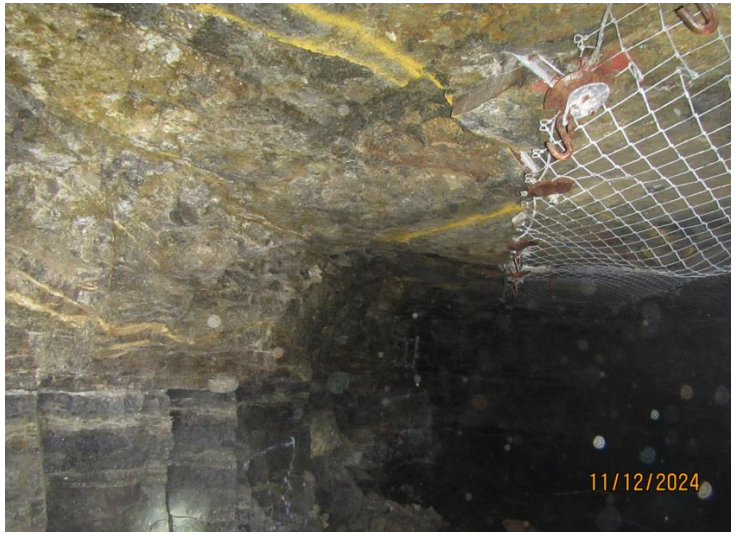
GEOTECHNICAL CONDITIONS AT E&F – **GCD "G" :**

- **Rockmass** characterized by **blocky** with **keyblock** features.
- The intersection of the **joints, fault, dykes** etc affects the stability of the hanging wall.
- **Lateral faulting** between the **triplets** and the top contact of UG2 reef. Triplets in **close proximity** to top **UG2 reef contact** (50cm to 100cm).
- **Near-surface weathering** (30 – 100 metres below surface).
- Surface **water dripping**.
- Many **blocks** were **abandoned** in the past due to the conditions.
- **Area re-assessed** to be mined **with Permanent mesh**.



QUALITY OF INSTALLATION

- ✓ Total coverage & flush against hangingwall
- ✓ Well tensioned
- ✓ Excellent joining of mesh segments
- ✓ Minimal mesh damage
- ✓ Neat with minimal loose strands

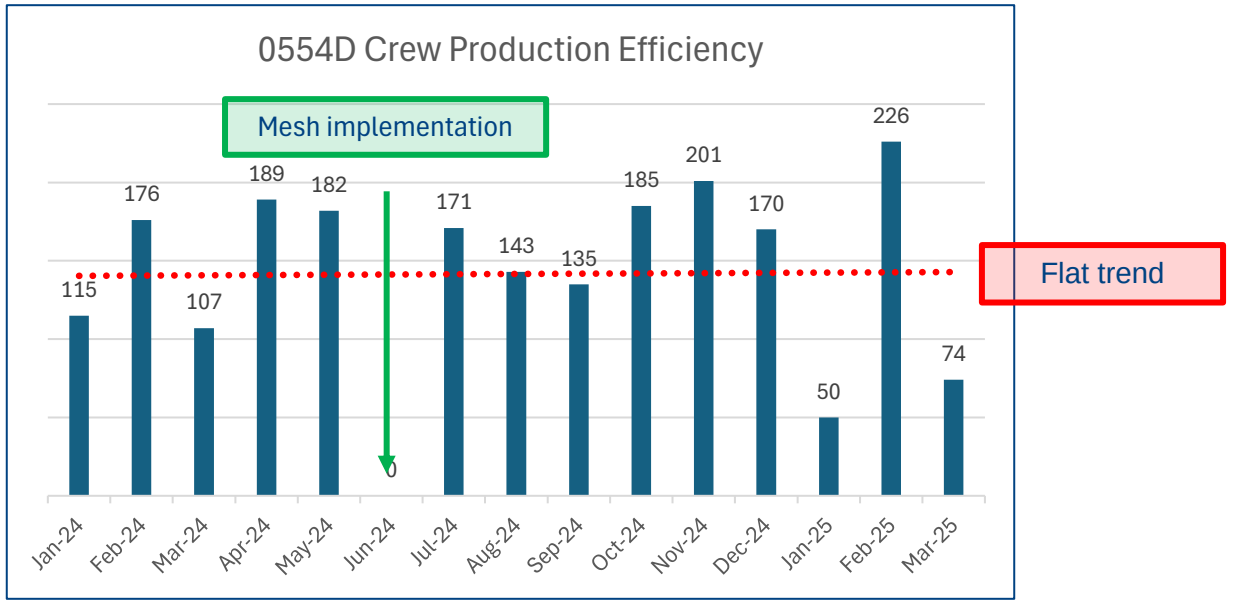


LARGE FALL CAUGHT BY PERMANENT MESH

- In September 2024, the **morning shift** crew **discovered** a **FoG** at 2C45 P4EC **within** the **face area after** the **blast.**
- The **FoG** is believed to have **occurred** at the **during** the **blast**.
- The **FoG** was **successfully contained by** the **permanent mesh** within the face area installed.
- The **FoG** was observed to **only occur between** the **last permanent mesh row** and **face** (newly exposed hangingwall face area).
- The **size of the rocks** was measured to be approximately **4.0m** in **length**, **2.5m** in **width** and **0.7m** in fall out **thickness**. The total mass of the FoG is **approximately 18 tonnes.**

CREW 0554D - E&F SHAFT SUCCESS STORY

- **Began installing** permanent mesh since **June 2024**.
- The crew's **production performance** before & during the trail was **sustained** (flat trend).
- The crew has demonstrated an excellent adoption to the mesh and have an exceptional installation quality.
- A decision was taken by management team to recognize and reward the team with T-shirts, certificates & a braai.



WAY FORWARD

- **Complete trials** on all shafts **by June 2025**.
- **Finalise operating model,** inclusion in **COP**, **draft Standards & Procedures**.
- **Quantify impact** on **human effort** to **transport** and **install permanent mesh**.
- **Firm-up** on the **roll out strategy** – Current thinking: **Geotechnical Area** and **Risk-based** approach.
- It carries a **high intensity cost** – a risk based roll out strategy will be employed.
- The **replacement** of the **temporary safety nets** with **permanent mesh** will **partially offset** the **cost**.
- The **cost benefit** from the **lives saved** would **outweigh** the **expense** associated with **mesh implementation.**

PHOTOS OF MESH INSTALLATIONS

Trackless Bord & Pillar

Conventional Panels

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THANK YOU

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