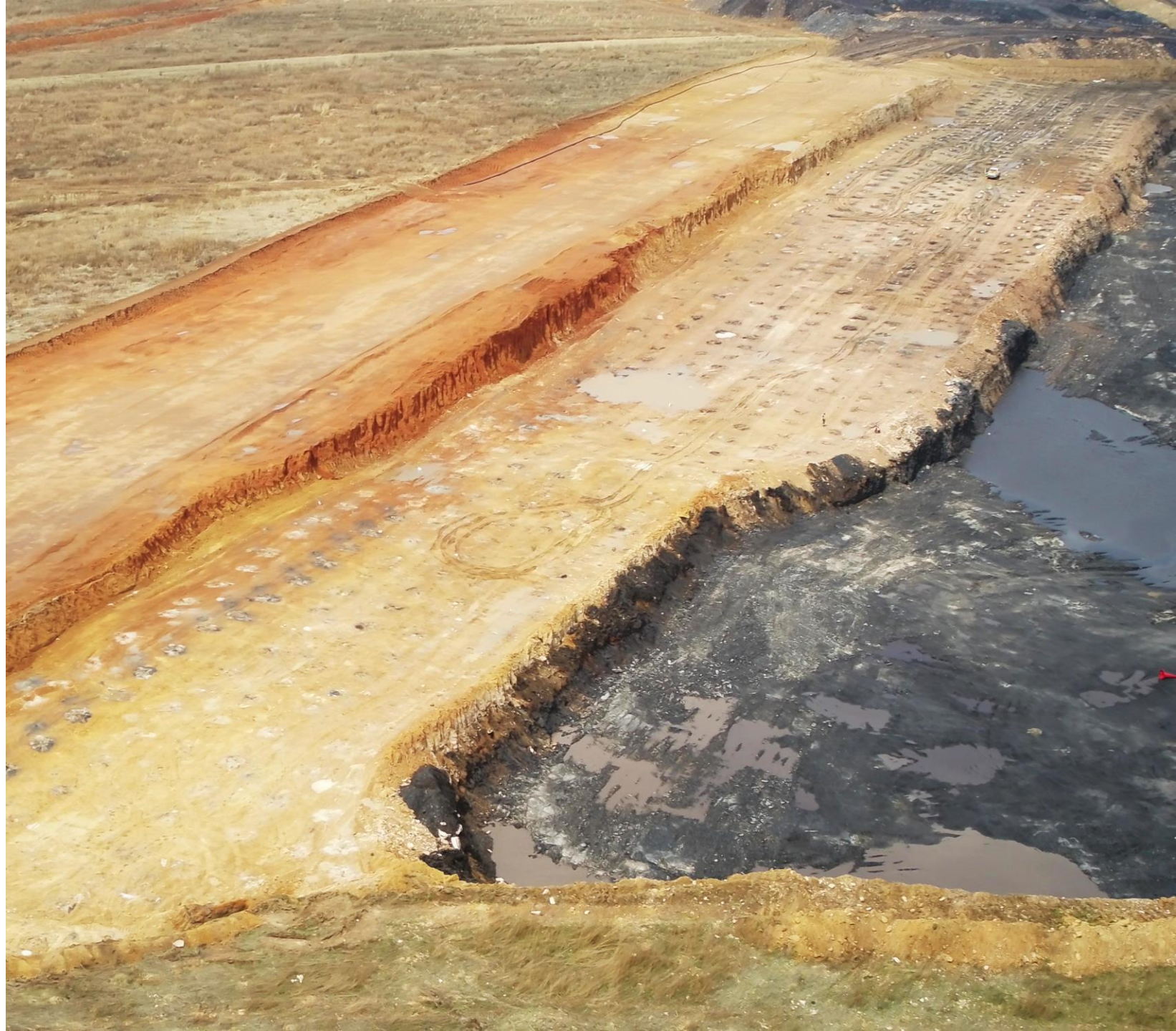




# Varistem® Stemming Plugs Trial

Feedback Report

**Flyrock Reduction**



# EXECUTIVE SUMMARY



- The intent of the Varistem® trial at Coal Mine X was to retain blast energy so as to minimize flyrock, noise and airblast. The trial block is situated in close proximity to a neighboring farm that falls within the 500m blast radius.
- Using actual drilling and charging data for individual holes, the Scaled Depth of Burial (SDoB) was calculated in order to understand what the expected levels of flyrock should be under normal circumstances (without using Varistem®).
- The average SDoB for the trial block was 0.53 - which based on theory should have resulted in the vast majority of holes producing violent flyrock.
- Contrary to the expected violent flyrock, the actual blast result showed excellent energy retention (in context of the very low SDoB value), with the furthest visible flyrock estimated to have reached no further than 100m away from the blast.
- Given the challenging nature of the block (average hole depth of 2m and average stemming height of 1m, with drill chippings as stemming), the blast result is highly satisfactory and indicative of the Varistem® plugs offering great assistance in terms of mitigating violent flyrock.

# TABLE OF CONTENTS

## 1. Trial Setup

- Blast Block
- Information & Scaled Depth of Burial

## 2. Results

- Blast Progression - Block Movement
- Flyrock Velocity & Travel Distance
- Scaled Depth of Burial "Sample Holes"

## 3. Conclusions & Recommendations



# TRIAL SETUP



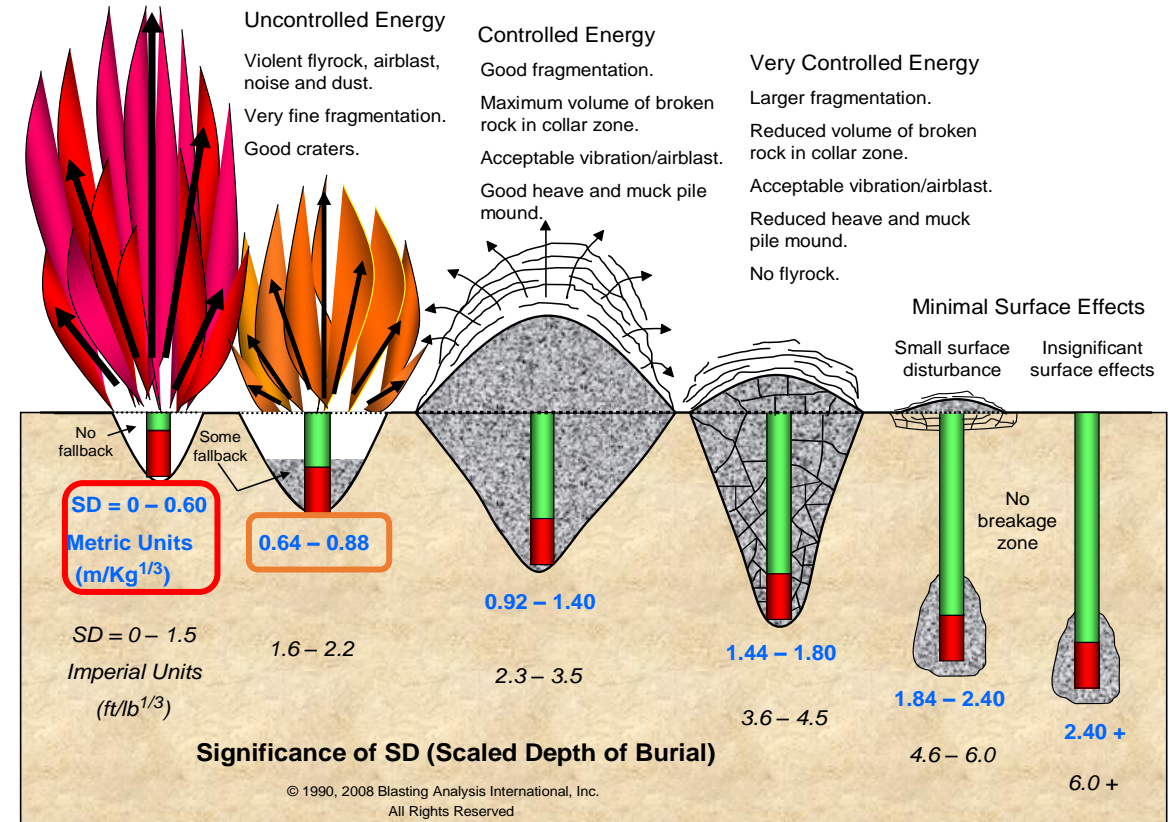
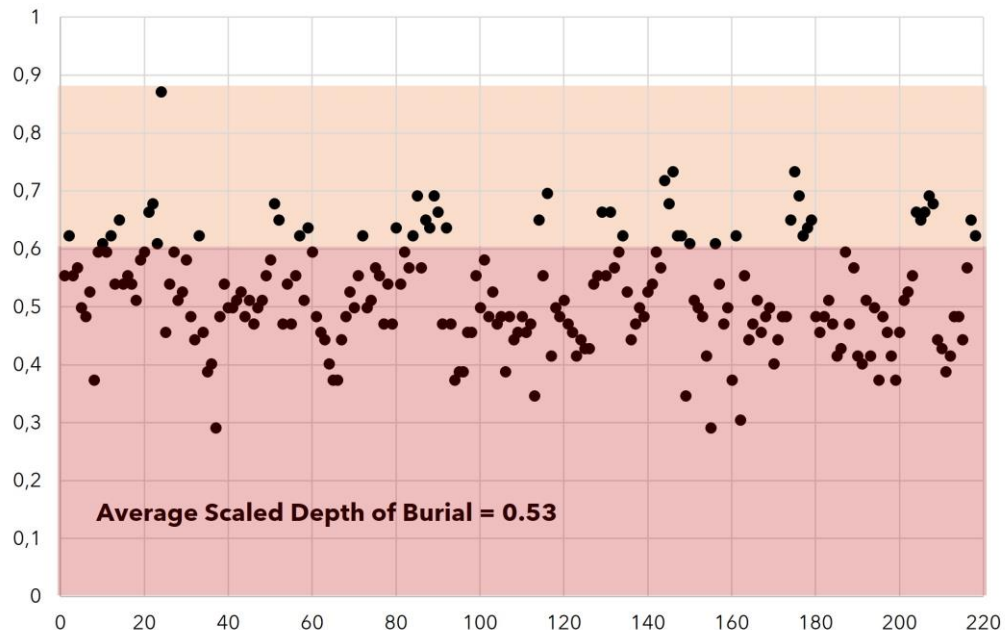
# TRIAL SETUP | BLAST BLOCK

218 x holes using  
171mm Varistem®  
blast stemming plugs

# TRIAL SETUP | INFORMATION & SCALED DEPTH OF BURIAL

Number of holes: 218  
 Average drill depth: 2.08m [shortest hole 0.4m]  
 Average stemming height: 1.04m  
 Hole Diameter: 171mm  
 Average scaled depth of burial: 0.53

Scaled Depth of Burial - Trial Blast (218 holes)



Based on the scaled depth of burial values, the expectation would be that a large number of holes during this trial blast will produce violent flyrock.

**Note:** SDoB values were calculated using actual charging and drilling data. For access to the calculation sheet, please contact us.

# RESULTS

# RESULTS | BLAST PROGRESSION-BLOCK MOVEMENT

Initiation hole





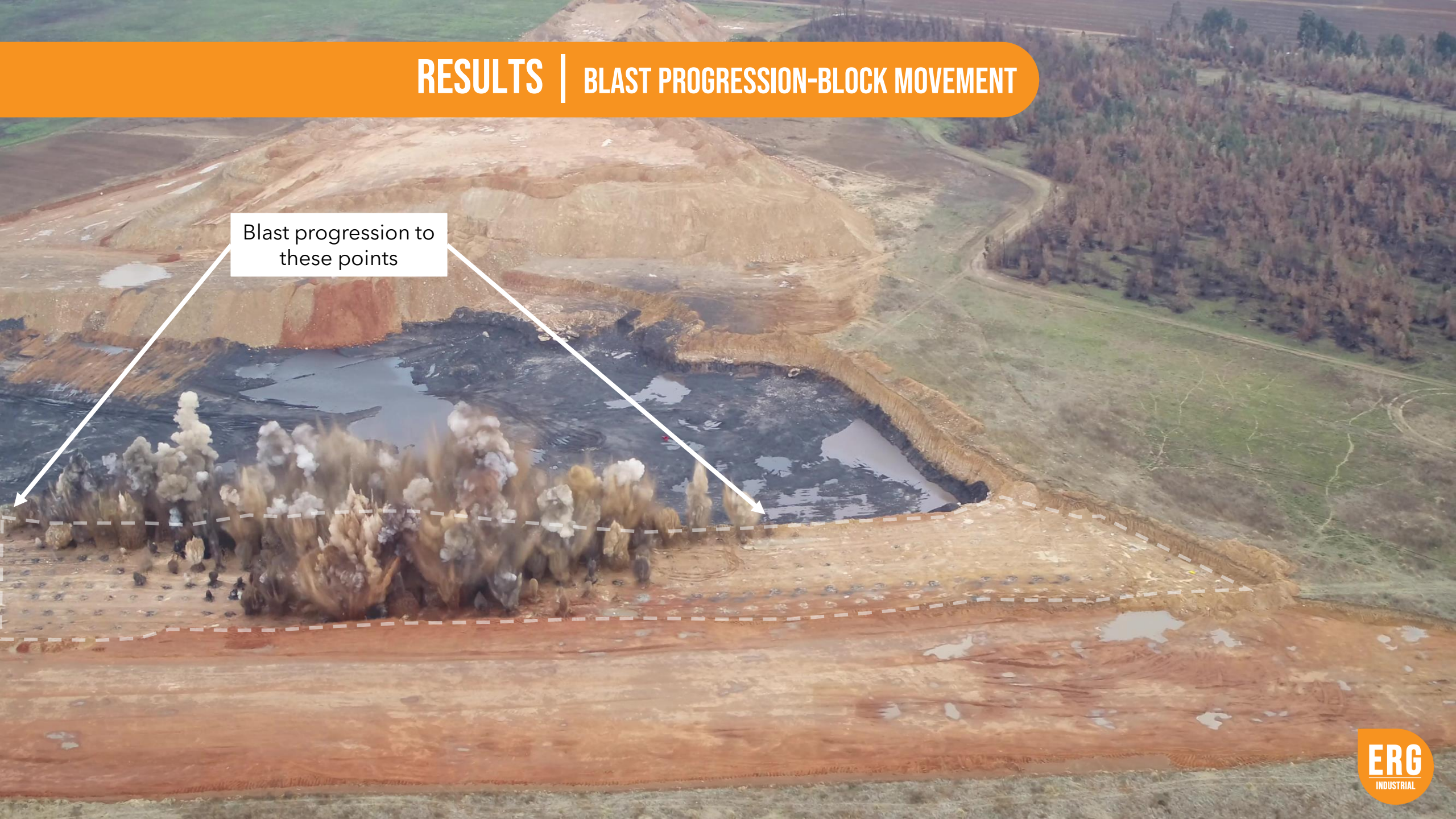
# RESULTS | BLAST PROGRESSION-BLOCK MOVEMENT



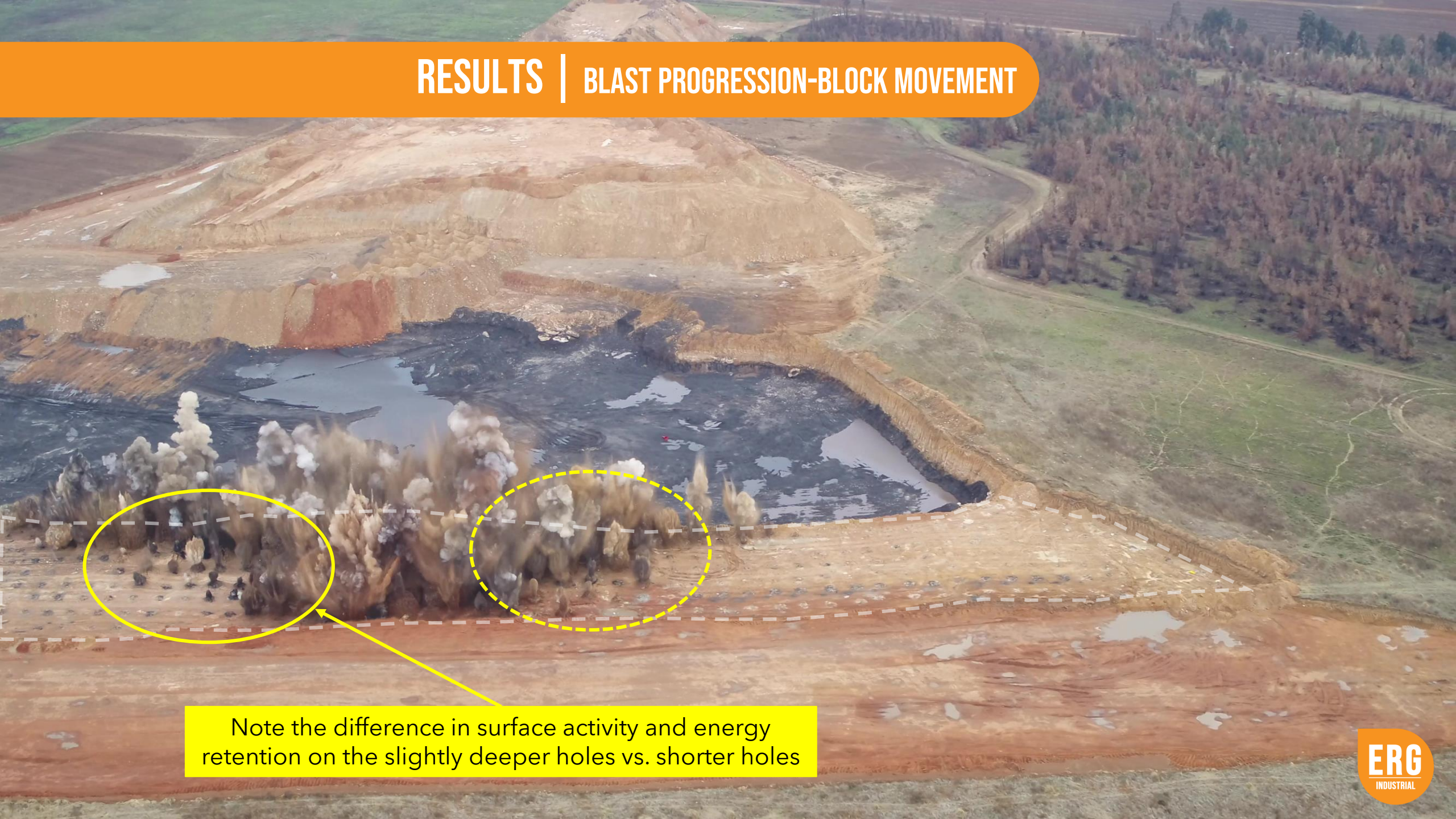
Blast progression to these points

# RESULTS | BLAST PROGRESSION-BLOCK MOVEMENT

Blast progression to these points



# RESULTS | BLAST PROGRESSION-BLOCK MOVEMENT



Note the difference in surface activity and energy retention on the slightly deeper holes vs. shorter holes

# RESULTS | BLAST PROGRESSION-BLOCK MOVEMENT



Blast progression to this point

# RESULTS | BLAST PROGRESSION-BLOCK MOVEMENT



Blast progression to this point

# RESULTS | BLAST PROGRESSION-BLOCK MOVEMENT



Blast progression to this point

# RESULTS | FLYROCK VELOCITY AND TRAVEL DISTANCE

Radius Indication

80m

60m

40m

20m

# RESULTS | FLYROCK VELOCITY AND TRAVEL DISTANCE



Note the landing marks and distance from blast

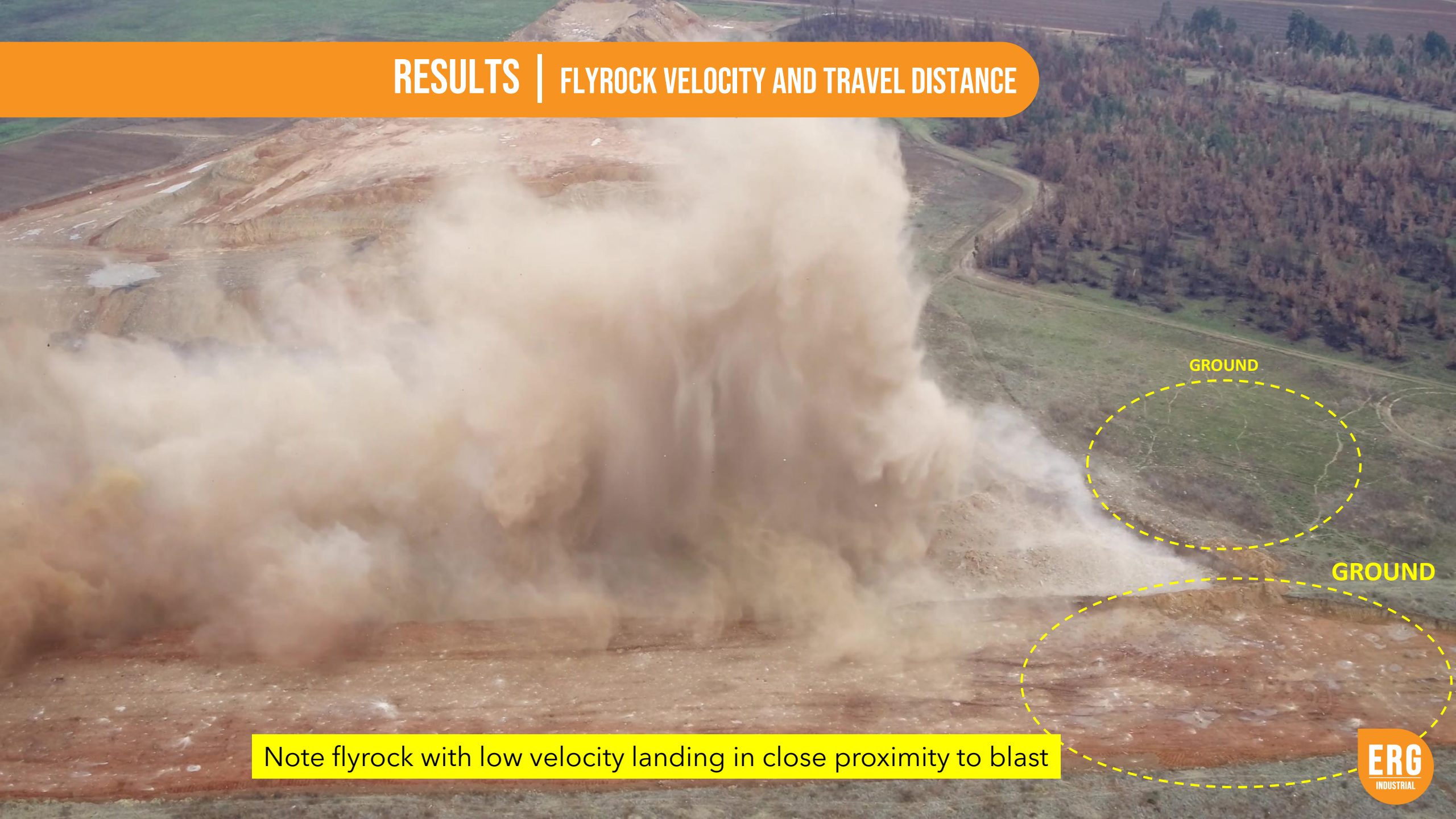


## RESULTS | FLYROCK VELOCITY AND TRAVEL DISTANCE

Note flyrock in the air with low velocity. Majority of flyrock trajectory is upright.

AIR

# RESULTS | FLYROCK VELOCITY AND TRAVEL DISTANCE



Note flyrock with low velocity landing in close proximity to blast

# RESULTS | FLYROCK VELOCITY AND TRAVEL DISTANCE



Radius Indication

80m

60m

40m

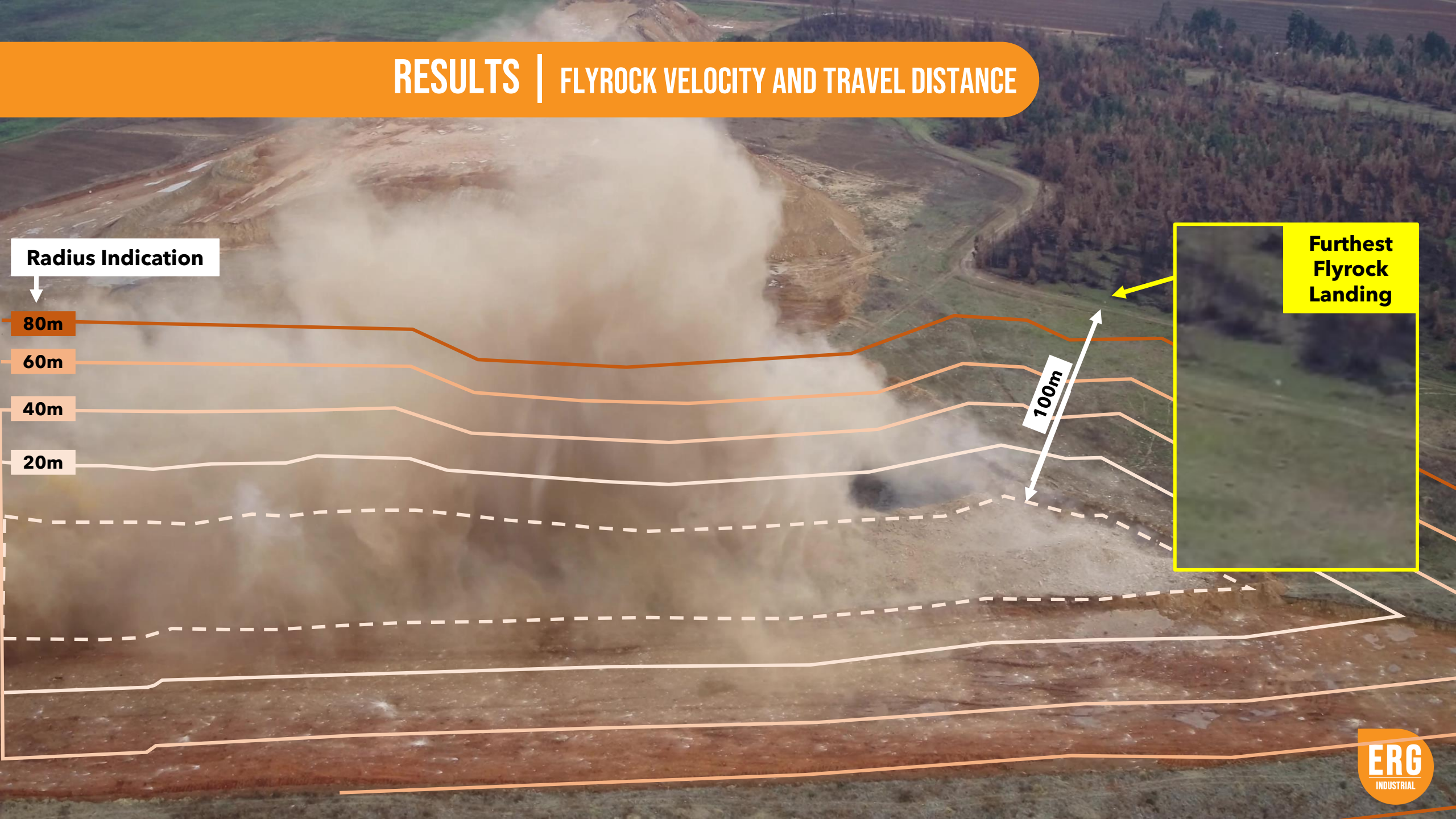
20m

20-80m Radius

20-70m Radius



# RESULTS | FLYROCK VELOCITY AND TRAVEL DISTANCE



Radius Indication

80m

60m

40m

20m

Furthest Flyrock Landing

100m

# RESULTS | SCALED DEPTH OF BURIAL "SAMPLE" HOLES

On these sample holes, it can be seen that - although violent flyrock was expected - the holes display more of a "violent heave", producing no flyrock of significant size or velocity.

**Hole D51**  
Scaled Depth of Burial = **0.47**  
*Violent flyrock expected*

**Hole C51**  
Scaled Depth of Burial = **0.48**  
*Violent flyrock expected*

**Hole B51**  
Scaled Depth of Burial = **0.48**  
*Violent flyrock expected*

**Hole A51**  
Scaled Depth of Burial = **0.55**  
*Violent flyrock expected*

# CONCLUSIONS

# CONCLUSIONS

- Based on the calculated SDoB values and the accompanying theory, violent flyrock from the vast majority of holes in the trial block was expected.
- Reviewing the footage shows, contrary to the expectation of violent flyrock, that there were relatively low levels of flyrock throughout the entirety of the block (with the furthest flyrock estimated to have reached approximately 100m away from the block).
- Taking a closer look at the block footage and the mechanism of blast propagation for individual holes, it can be seen that the holes produced more of a “violent heave” than violent flyrock, with no flyrock of significant size or velocity visible.
- Based on the above, it can be concluded that the use of the Varistem® plugs contributed to the reduction of flyrock, and effectively increased the SDoB values by retaining more energy inside the rock mass.
- However, it must be noted that more definitive conclusions can be drawn if we are able to compare this trial blast result to a block with similar characteristics (not using Varistem®).
- In summary, the team at ERG Industrial is highly satisfied with the trial outcome and believe that the objective was achieved and Varistem®’s capabilities demonstrated on a challenging blasting block.



# THANK YOU

**Contact Us**

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