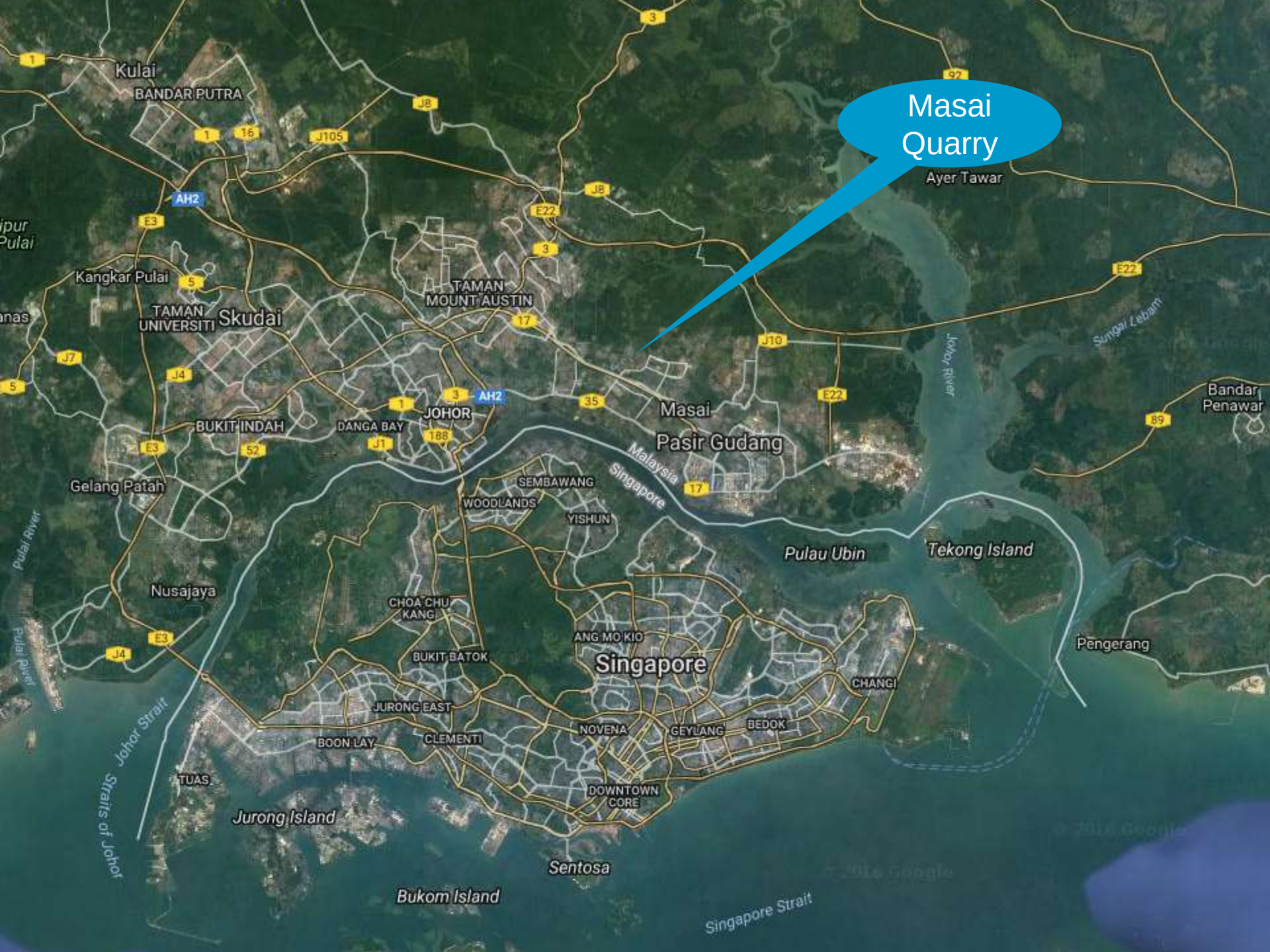
RISK MANAGEMENT AT MASAI QUARRY

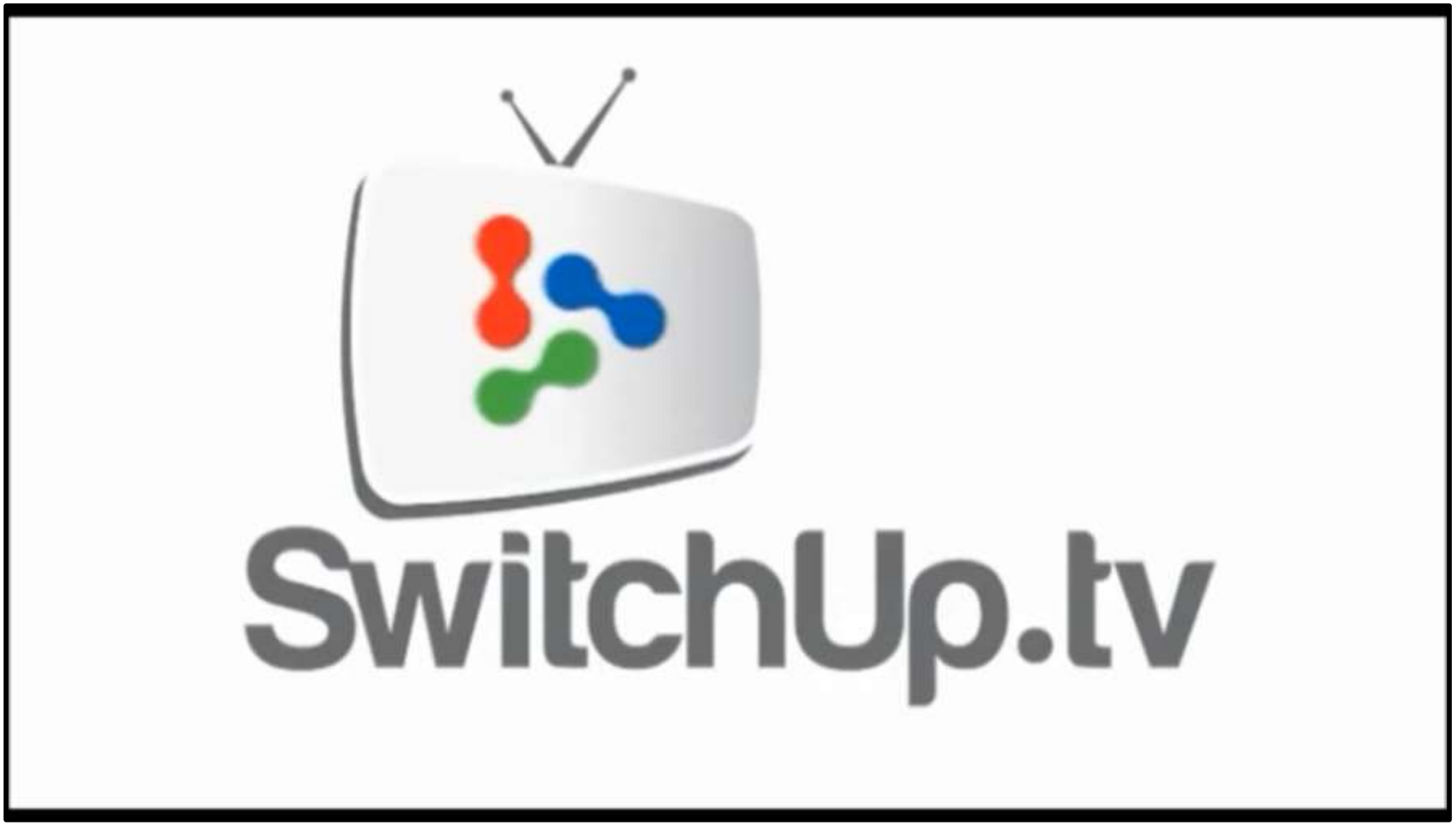
November 2016

Martin Adam Manager Global Technical Excellence


Masai Quarry
Kulai
BANDAR PUTRA
Ayer Tawar
Kangkar Pulai
TAMAN UNIVERSITI
Skudai
TAMAN MOUNT AUSTIN
JOHOR
DANGA BAY
BUKIT INDAH
Gelang Patah
Masai
Pasir Gudang
Malaysia
Singapore
SEMBAWANG
WOODLANDS
YISHUN
Pulau Ubin
Tekong Island
Bandar Penawar
Sungai Lebam
Johor River
Pulai River
Nusajaya
CHOA CHU KANG
ANG MO KIO
BUKIT BATOK
Singapore
Pengerang
CHANGI
JURONG EAST
NOVENA
GEYLANG
BEDOK
BOON LAY
CLEMENTI
TUAS
DOWNTOWN CORE
Jurong Island
Sentosa
Bukom Island
Johor Strait
Straits of Johor
Singapore Strait

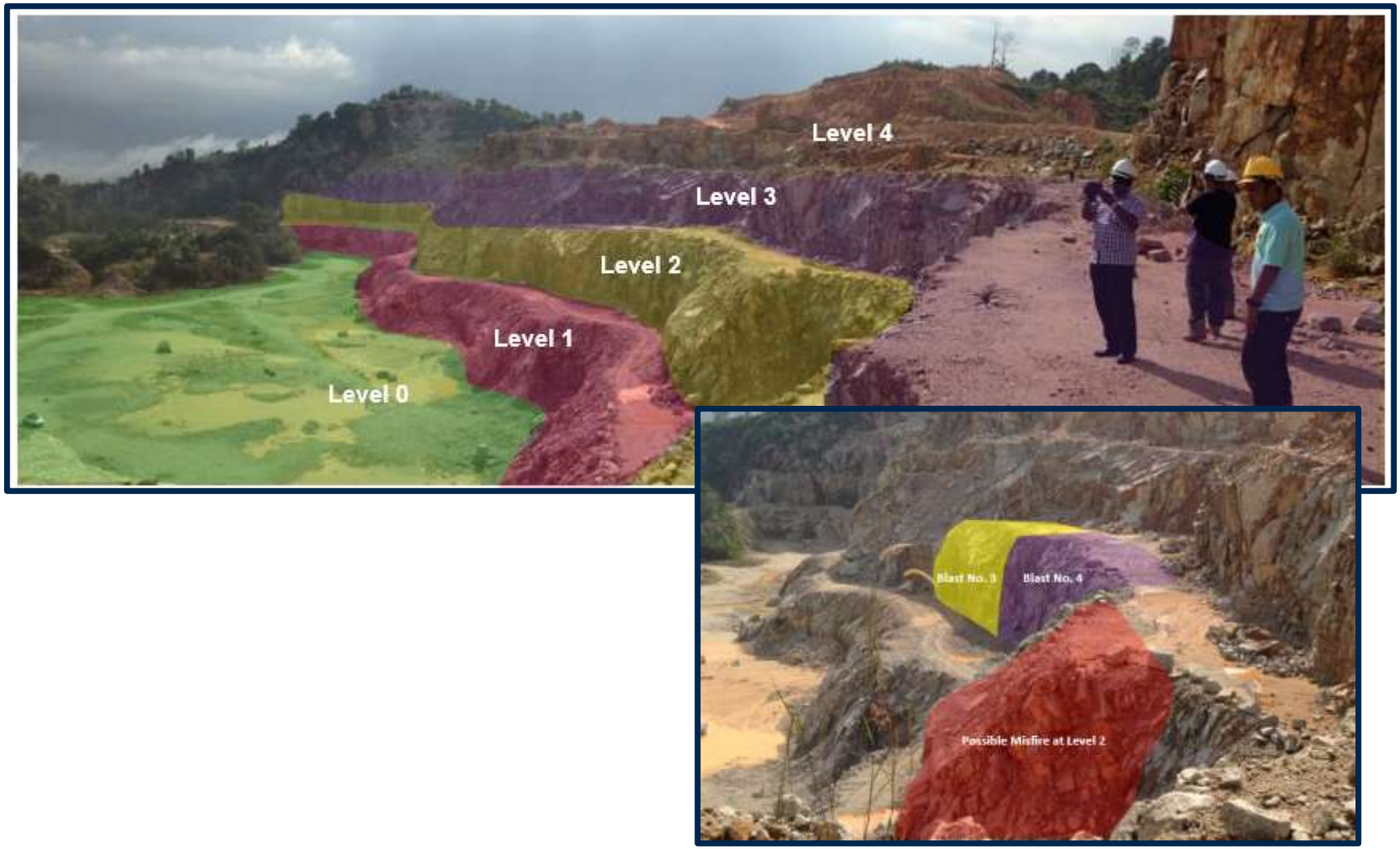
PROXIMITY TO NEAREST NEIGHBOURS

19 JULY 2013



19 JULY 2013

PLANNING THE RESTART



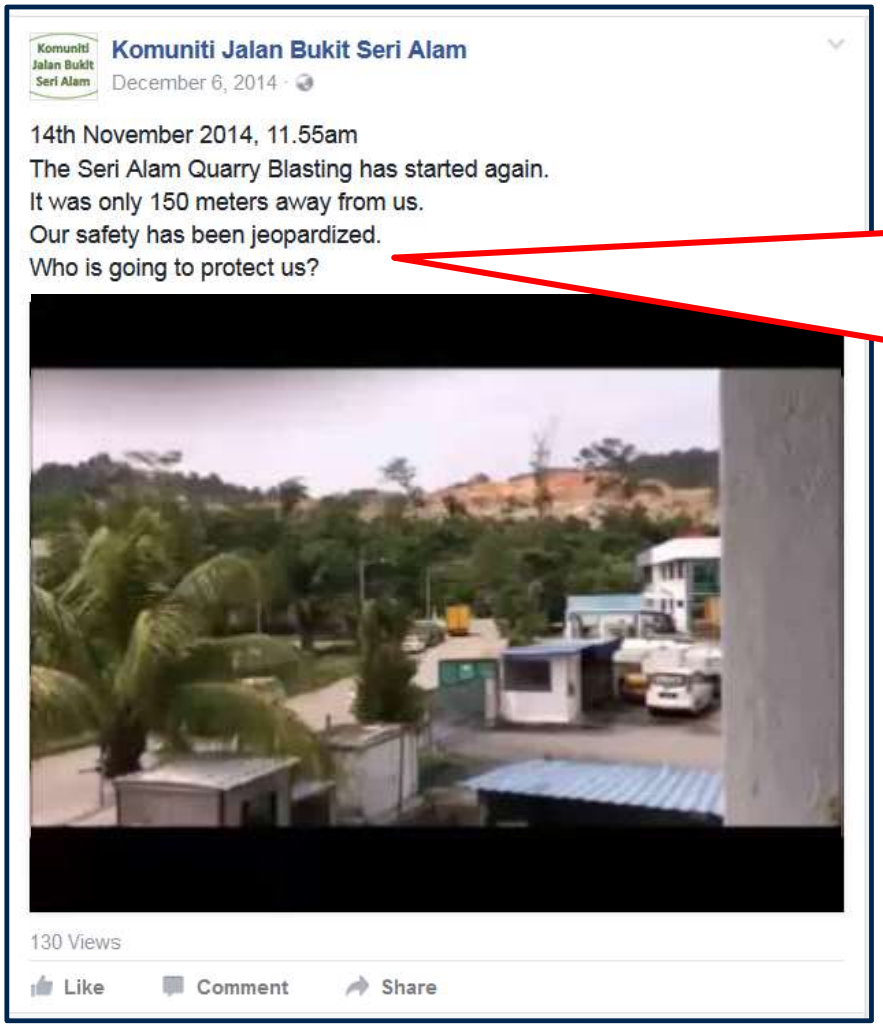
TYPICAL MALAYSIAN GRANITE QUARRY

ADVERSE JOINTING

DEMONSTRATION BLAST OBJECTIVES

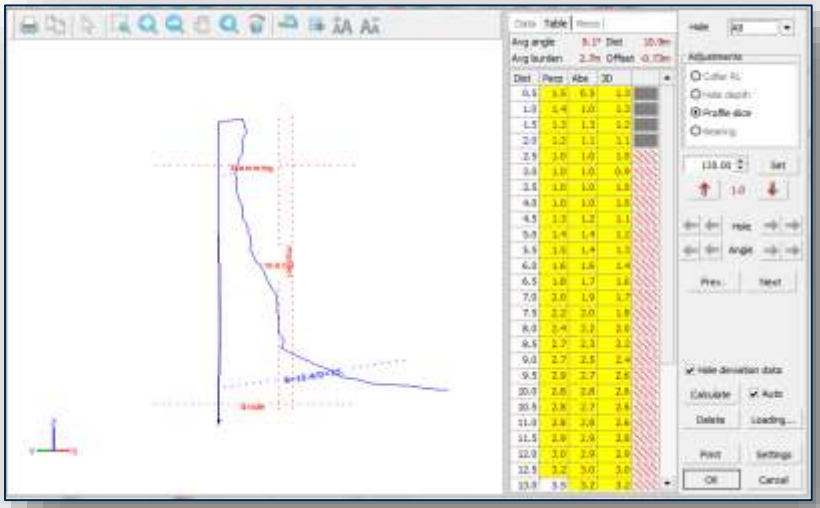
- Test powder factor and vibration assumptions
- Demonstrate Orica's ability to manage the whole process
- Test community response to the restart.

BLASTING RESTARTS NOV 2014



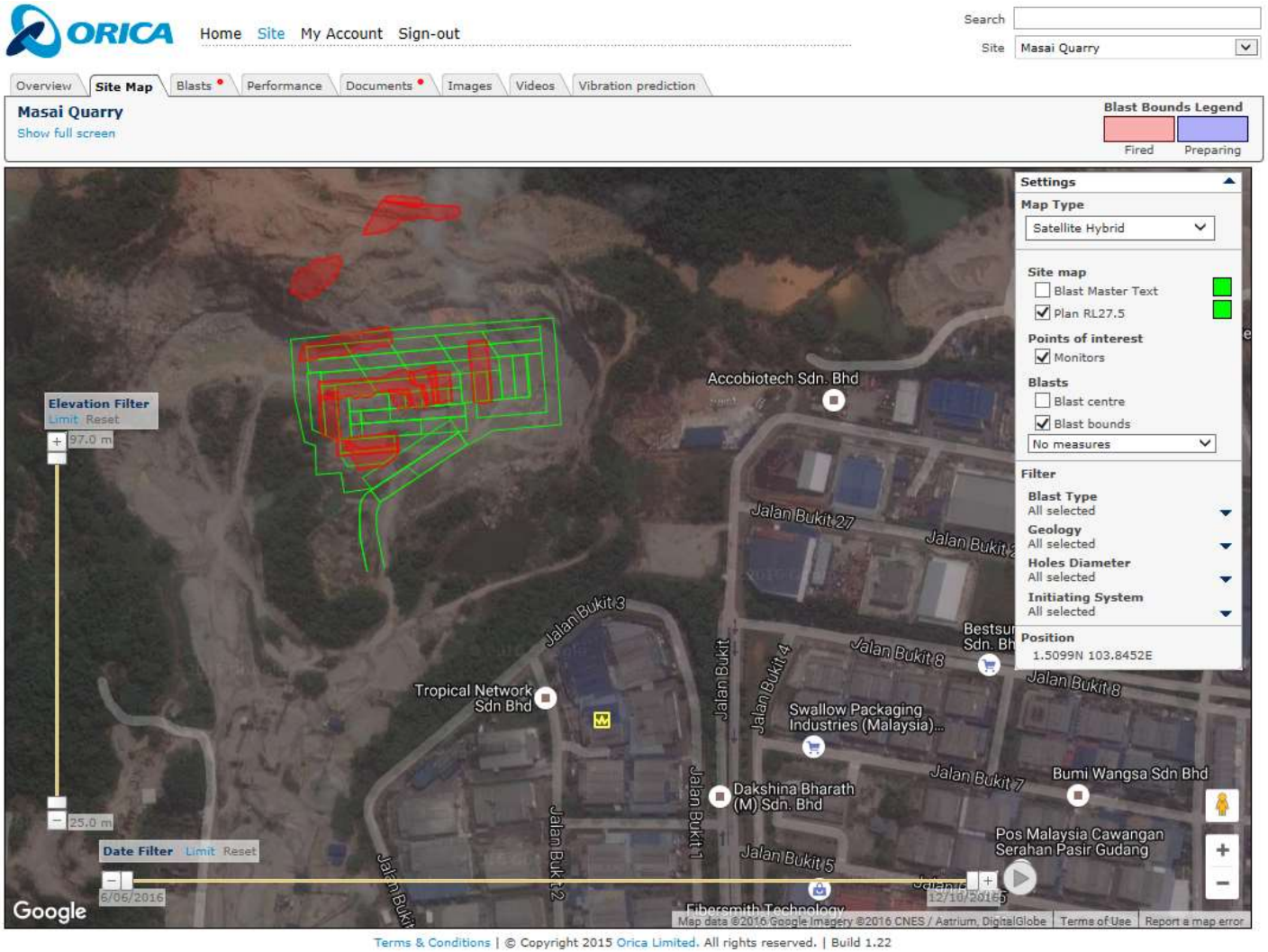
14th November 2014, 11.55am
The Seri Alam Quarry Blasting has started again.
It was only 150 meters away from us.
Our safety has been jeopardized.
Who is going to protect us?

BLASTING RESTARTS NOV 2014



COMPLIANCE MONITORING

BLAST IQ – BLAST DATABASE ONLINE



MASAI COMPILIATION

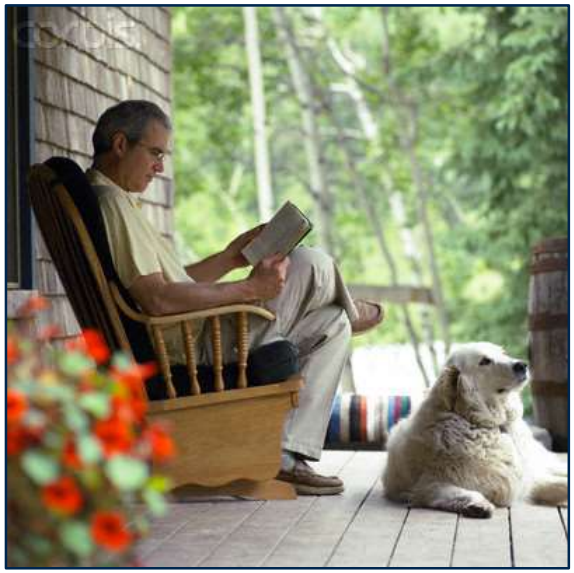
18 MONTHS ON…

FLYROCK RISK ASSESSMENT

	BTQ Masai Blasting Risk Assessment (Flyrock)	Value	Weighting	Score
Blast Number Date of Assessment				
Conditions	Wet Holes (1) = Wet holes expected	1	8.0%	8%
	Geology (1) = Transitional Rock	0	8.0%	0%
	Damage (1) = Visible prior blast damage	0	8.0%	0%
Face	Free face (1) = no free face	0	8.0%	0%
	Face direction (1) = South or East, (0) = North or West	1	8.0%	8%
	Bench Ht (value in metres)	15	1.0%	15%
Trajectory	Bench Elevation (m)	20	0.2%	4%
	Distance from Grochem (m)	200	5.0%	25%
		Risk Factor		**60%**

WHY IS VIBRATION A PROBLEM?

Human Comfort (Freedom from fear)



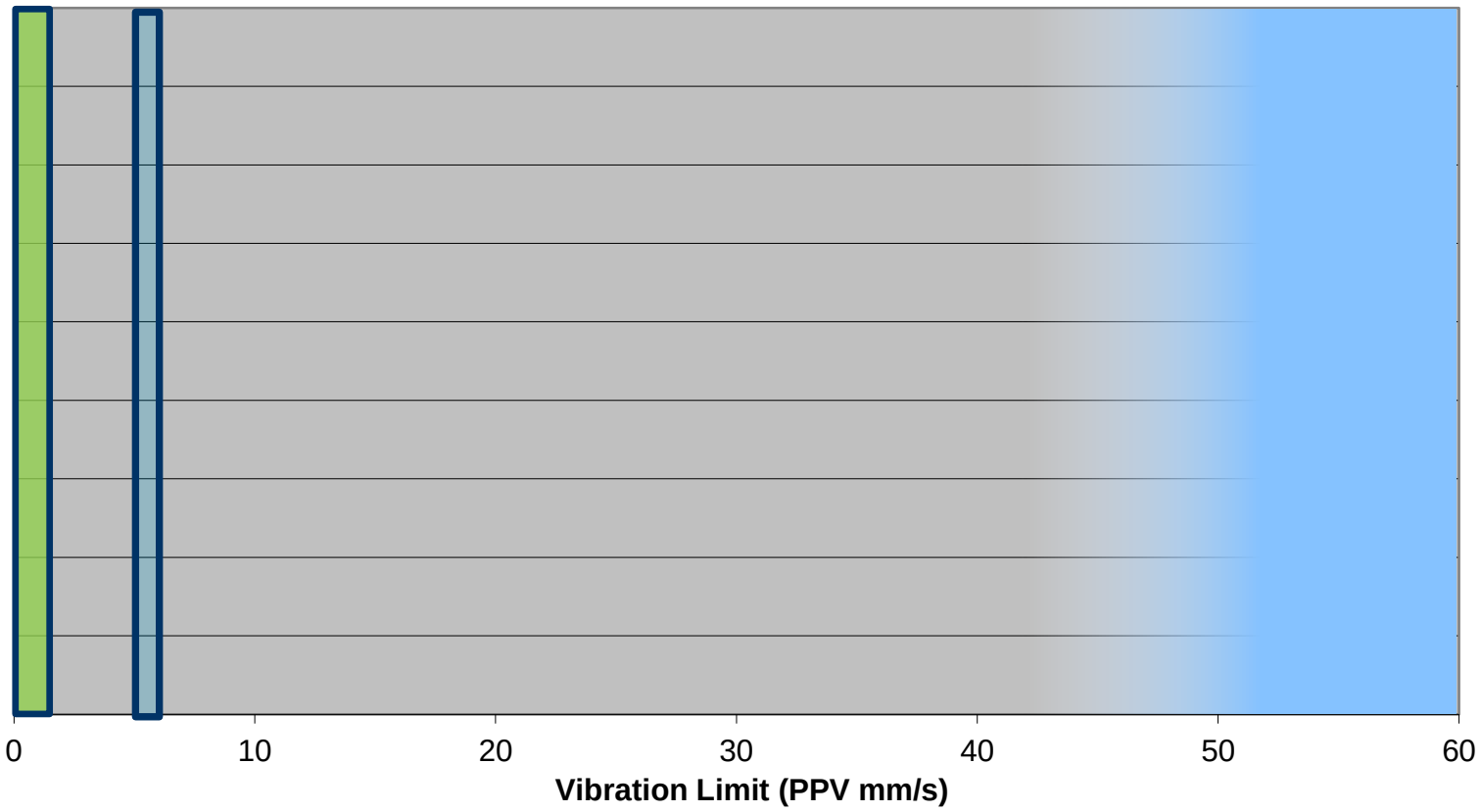
Property Damage (or the perception of)

CLAIMED EFFECTS

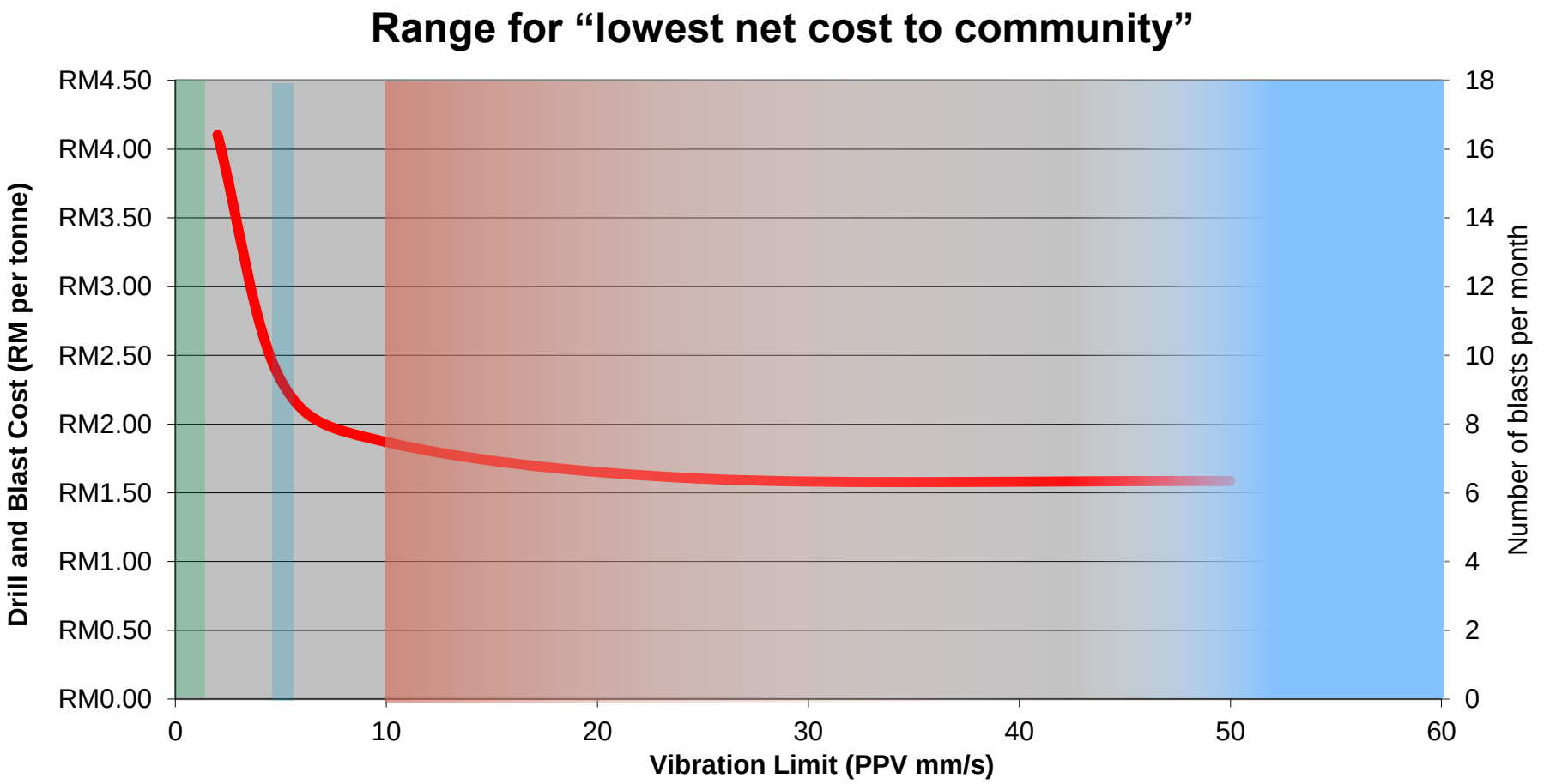
WHAT IS BEST TIME TO BLAST?

Not Business Hours!

WHAT IS THE BEST VIBRATION LIMIT?



WHAT IS THE BEST VIBRATION LIMIT?



COMPLIANCE MONITORING

Only measures one value
at one point in time and space;

Velocity is not directly correlated with damage;

No information on

- ENERGY RELEASE
- DURATION
- RESPONSE

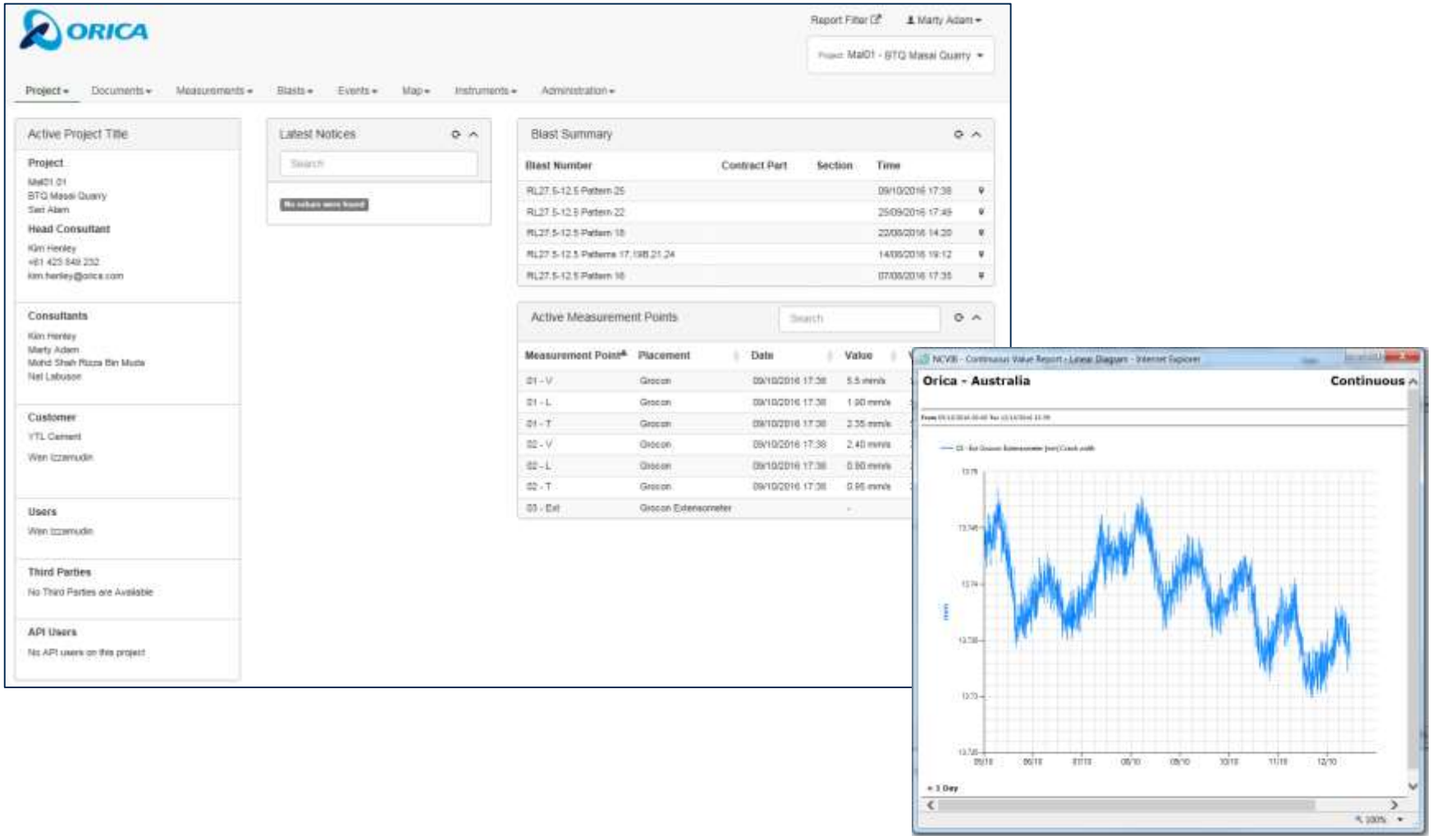
HURRICANE VS SNEEZE

- Both peak velocity >200 km/h

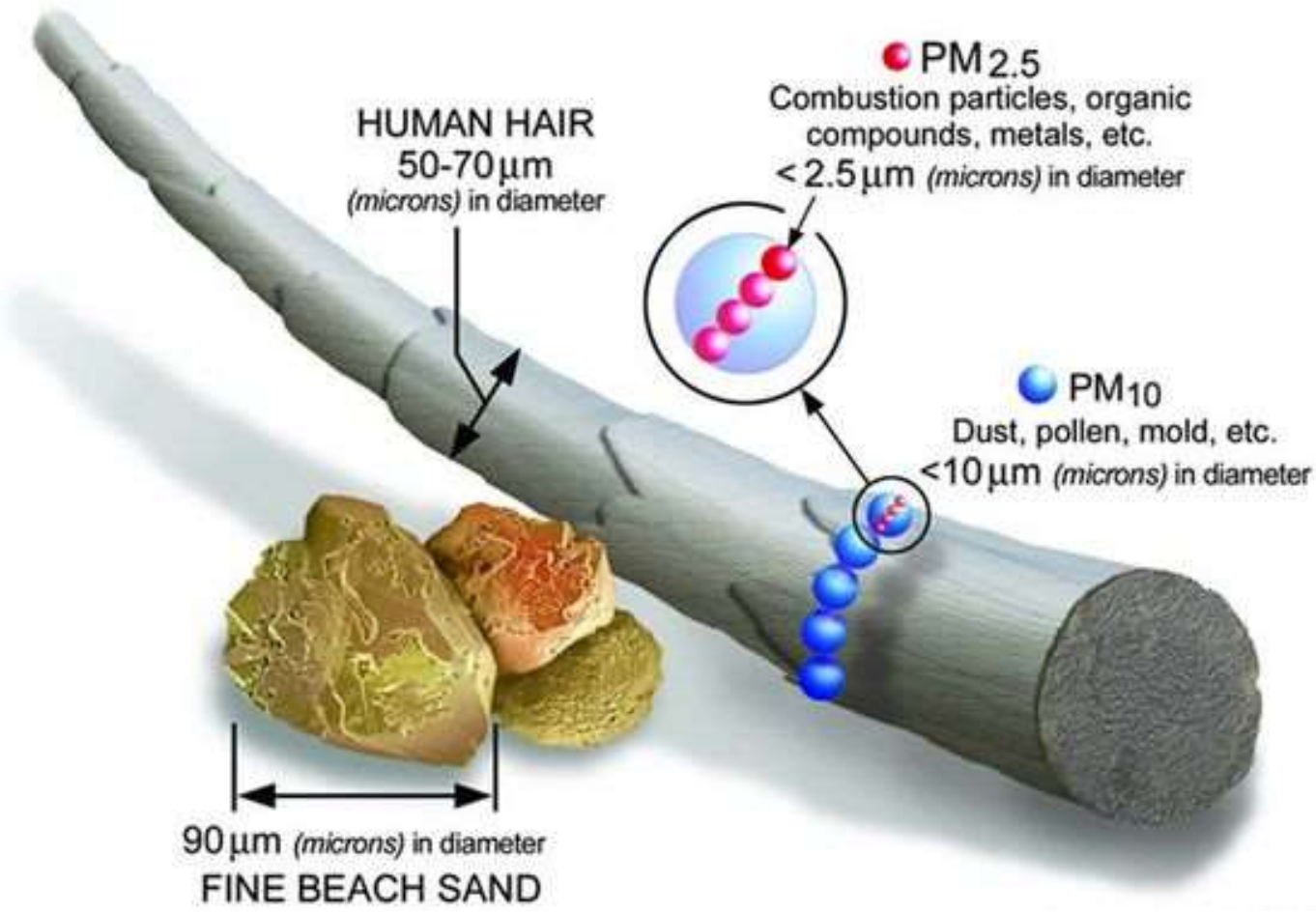
- Which one causes more damage?

ENGINEERING BLAST MONITOR

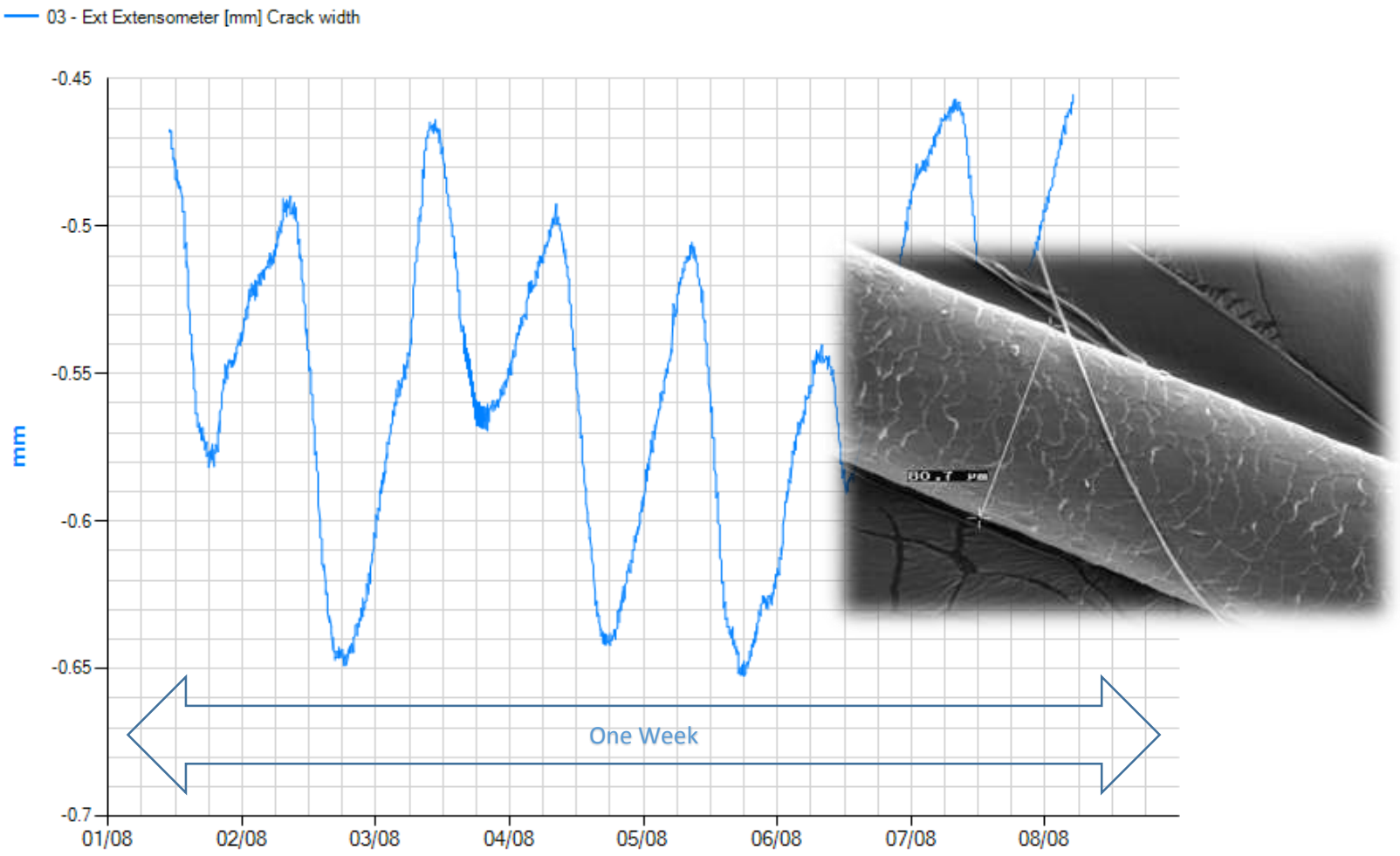
NCVIB – VIBRATION RESULTS ONLINE



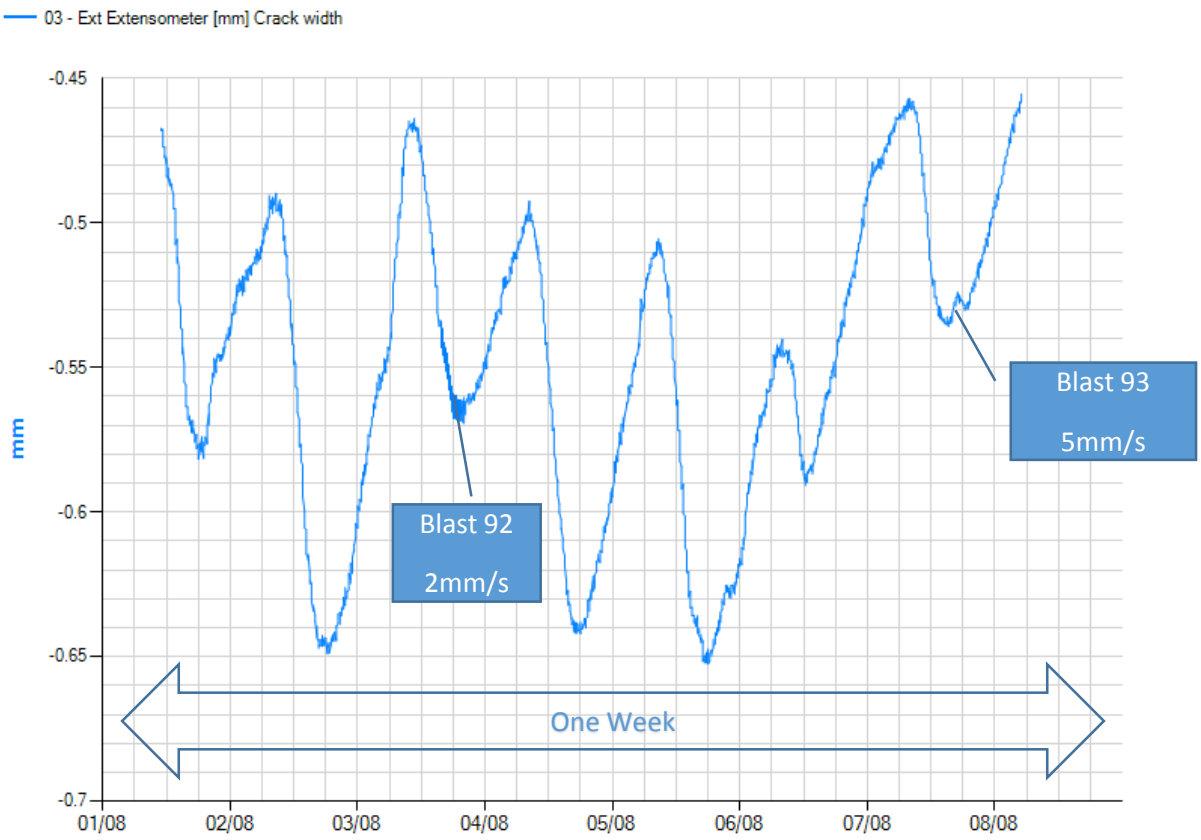
LESS THAN A SMOKE PARTICLE



EXTENSOMETER RESULTS

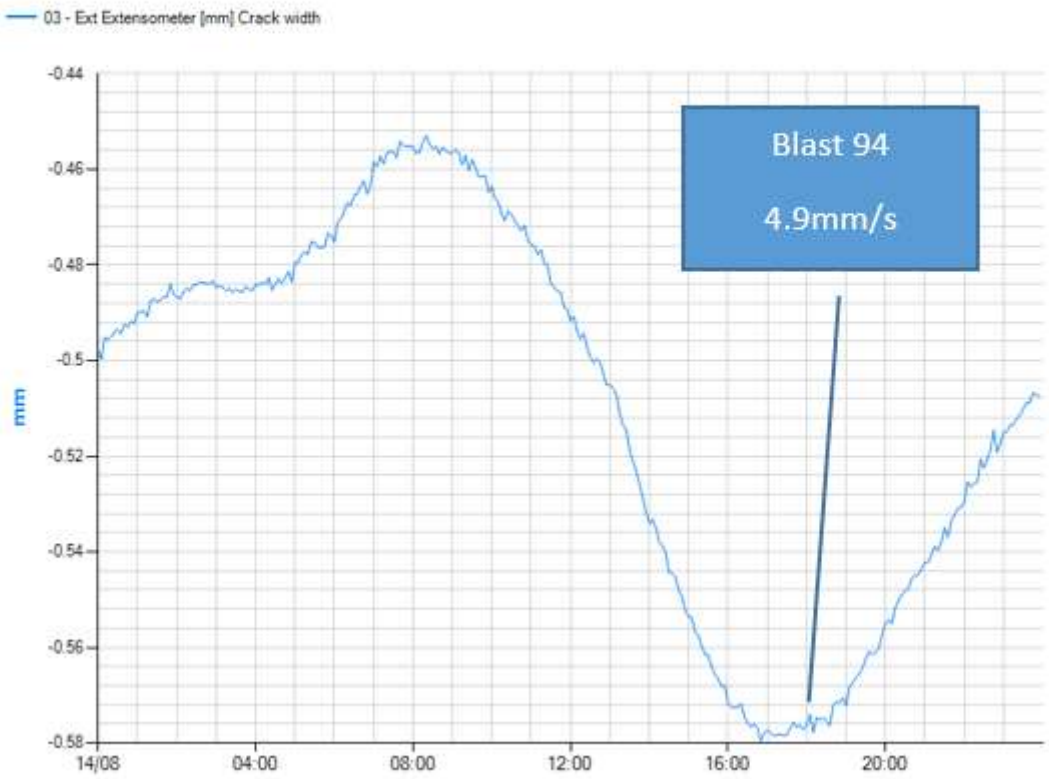


EXTENSOMETER RESULTS



Orica - Australia **Continuous**

From 14/08/2016 00:00 **To:** 14/08/2016 23:59



< 1 Day

Orica - Australia **Continuous**

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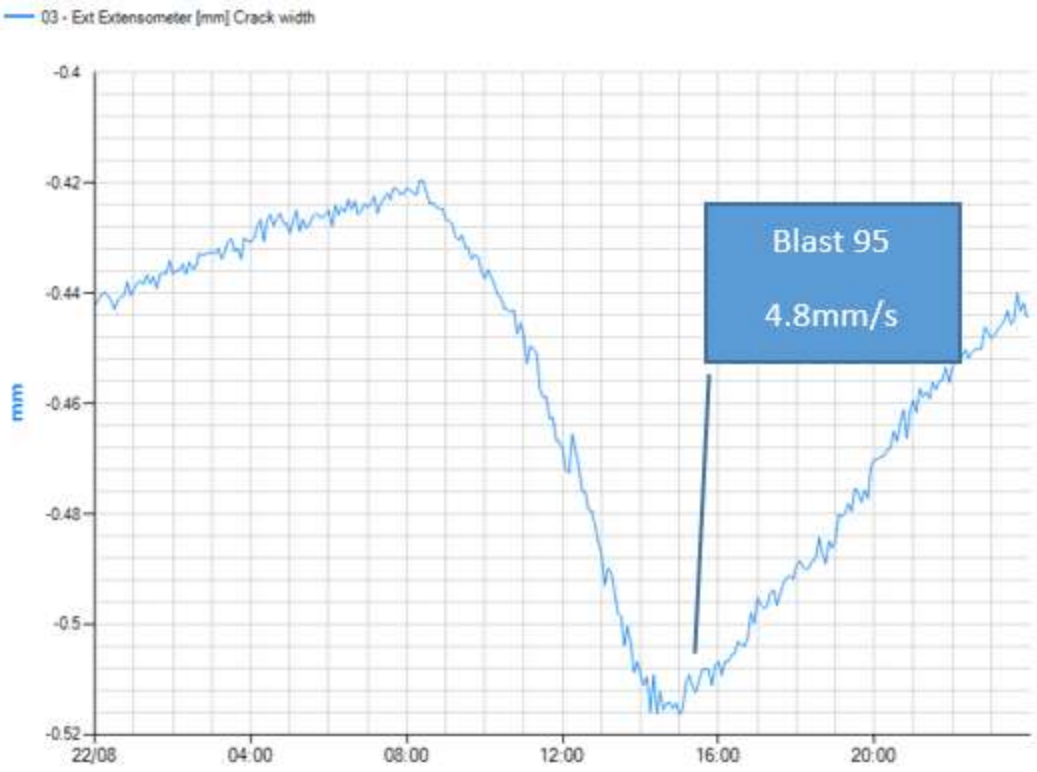
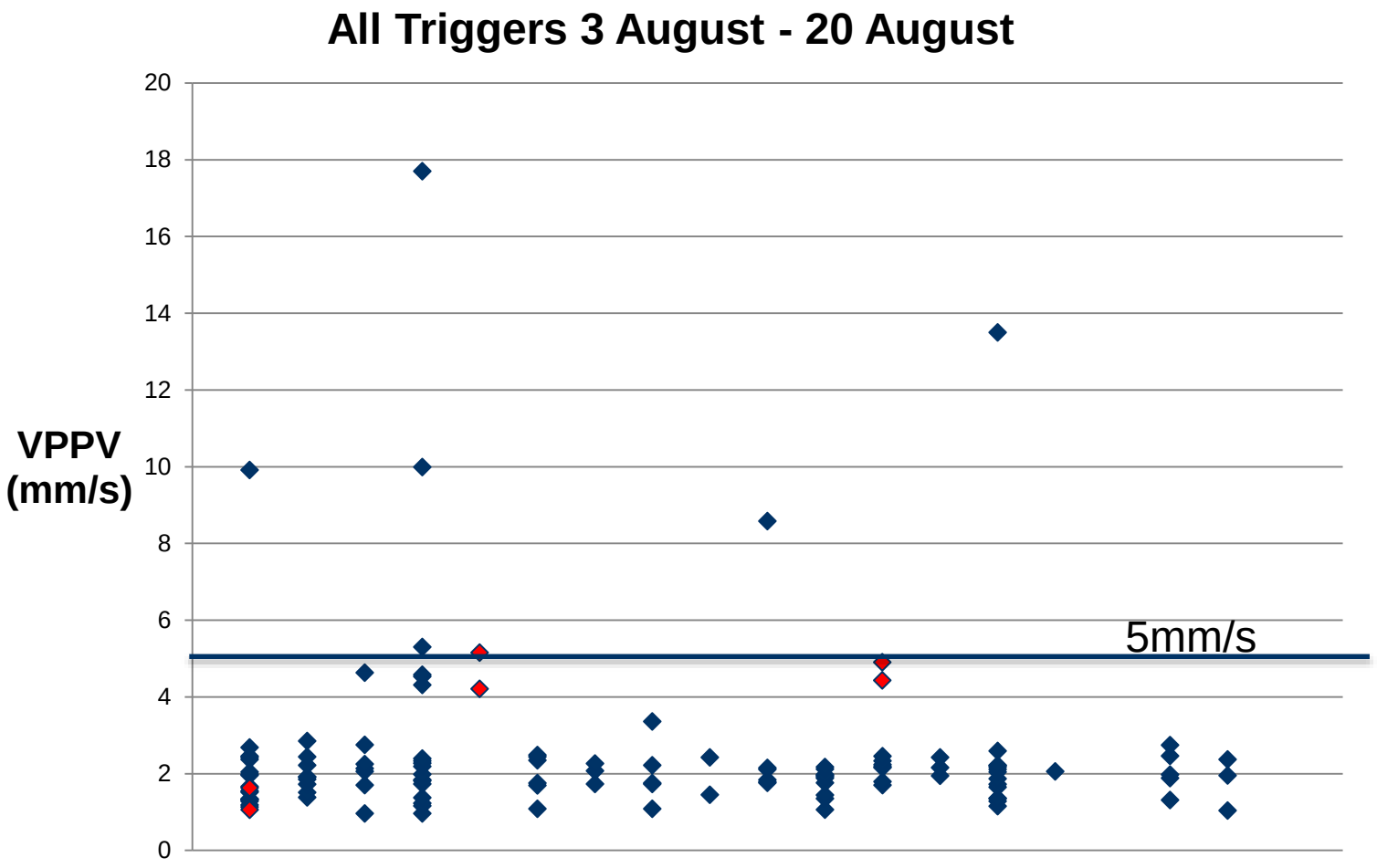


EVENTS THAT WEREN'T BLASTS



CONCLUSIONS

- “Least harm” strategies may contradict traditional ideas
- Blasting vibration management has two faces
- Blasts at 5mm/s produce tiny movement

Solution

- Adopt a “least harm” strategy
- Fire large blasts, less often = reduced frequency of blasting
- Engineering monitors can be used to prove this is safe to structures