

17 October 2022

Jessie Evans
Director, Resource Assessments
Department of Planning, Industry and Environment
4 Parramatta Square, 12 Darcy Street
PARRAMATTA NSW 2150

Dear Jessie,

SANCROX QUARRY EXPANSION (SSD 7293) – RESPONSE TO FURTHER REQUEST FOR INFORMATION (FLYROCK ASSESSMENT)

We refer to your correspondence, dated 22 March 2022, requesting a response to the issues identified in the Department of Planning and Environment's (DPE's) assessment of the proposed Sancrox Quarry Expansion Project (SSD-7293).

Hanson submitted a response to this request for further information in relation to Crown Road issue raised by the Department on 8 April 2022. In this letter Hanson noted that the flyrock issues raised by the Department were being further assessed through updated blast modelling, which was being carried out by Orica.

The purpose of this further submission is to provide a detailed response to the Department issues in relation to the implied reference that the Maximum Instantaneous Charge (MIC) has on flyrock generation and to supply the requested updated flyrock assessment for the project.

In particular, we note the following DPE comments within the flyrock RFI (dated 22/03/2022):

...the predicted throw distances in the Buffer Zone Assessment were based on blast design parameters that appear inconsistent with those used as the basis of the noise and vibration assessment for the project. For example, the Buffer Zone Assessment assumed a Maximum Instantaneous Charge (MIC) of 87 kilograms (kg), whereas the noise and vibration assessment undertaken for the project has assumed an average MIC of 164 kg and a maximum MIC of 299 kg (based on blasting undertaken at the quarry between 2015 and 2020).

Hanson wishes to clarify that the Maximum Instantaneous Charge (MIC) is for purposes of vibration and overpressure management, therefore is not relevant to flyrock (page 6, Buffer Zone Assessment Report, Orica 2022).

Issue raised: The Department requests an updated flyrock assessment for the project that includes predicted throw distances and proposed measures such as blast design, buffer zones and any other relevant measures to mitigate flyrock impacts.

By way of response, Orica has now completed its Flyrock Exclusion Zone Analysis, which is attached. Orica undertook a review of the Buffer Zone Assessment Report (which was prepared by SKM in 2009 and formed the basis of current blasting practices at the Sancrox Quarry), and documents additional blast modelling completed to determine the appropriate blast characteristics to be applied in order to ensure safe throw distances and protect off-site receptors for the proposed quarry expansion.

The concept of Scaled Depth of Burial (SDOB) detailed in the exert below (**Figure 1**) demonstrates the relationship that SDOB has on influencing flyrock and the effects of SDOB on the bench surface with flyrock generation from cratering (page 4 - 5, Buffer Zone Assessment Report, Orica 2022). The SDOB was based on cratering experiments that found that flyrock is affected by the depth of burial or stemming length ('St'), and the length of explosives directly below the stemming as dictated by the charge length factor ('m'). The second part of Figure 1

shows the expected surface expression of a range of SDOB. SDOB of 0.92 – 1.4 is typically targeted for blast fragmentation.

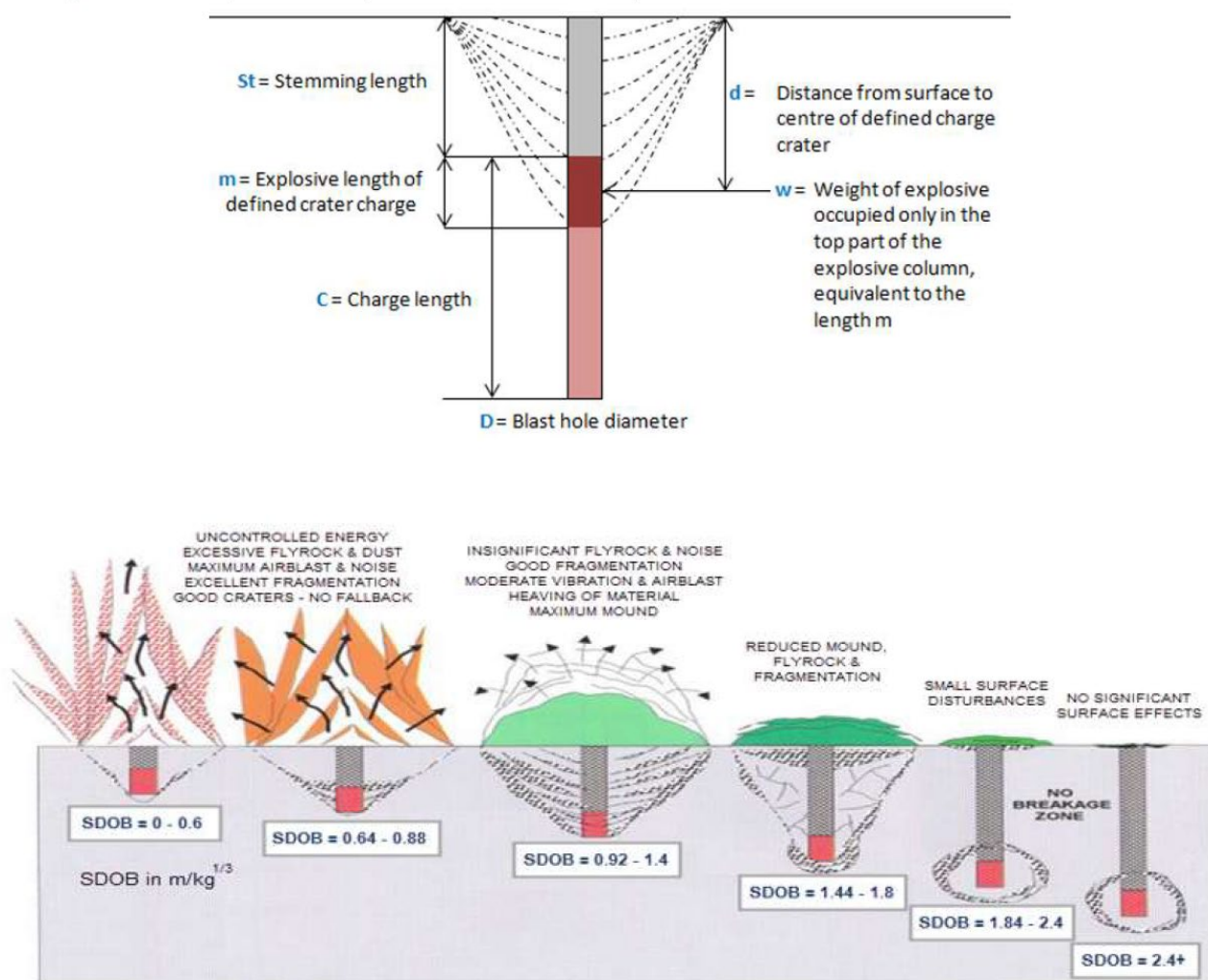


Figure 1: Exert from the Sancrox Quarry Buffer Zone Assessment Report (Orica, 2022) detailing the concept of scaled depth of burial - the relationship between stemming length and length of explosives directly below influencing flyrock impacts during a blast (Page 4-5, Buffer Zone Assessment Report, Orica 2022).

To mitigate the risk of flyrock from face burst, Orica has recommended orientating the free face of blasts away from the northern boundary and that opposing walls are utilised to attenuate the risk of face burst (page 11, Buffer Zone Assessment Report, Orica 2022).

Mitigating the risk of cratering, and as shown in **Table 1**, Orica has identified the following design parameters and variables for current and future drill and blast parameters to achieve the exclusion zones from flyrock potential shown in **Figure 2** (page 12, Buffer Zone Assessment Report, Orica 2022). This illustrates that increasing stemming heights of blastholes reduces the size of the required exclusion zones.

Table 1 – Recommendations for 89mm diameter blasthole

Stemming length – 89mm diameter blastholes	Scaled depth of burial - SDOB	Factor of safety 1	Factor of safety 2 – plant & equipment	Factor of safety 4 – personnel
2.2m	1.4	74m	148m	295m
3.5m	2.16	22m	44m	88m
4.4m	2.66	12m	24m	49m

Noted in **Table 1**, 2.2m stemming, with a SDOB of 1.4 and 295m exclusion zone ultimately produces insignificant flyrock and noise, good fragmentation, moderate vibration and airblast, and heaving of material to maximum mound. This option is optimal to the Sancrox operation due to increased blasting and production efficiencies and reduction in production costs.

As indicated by Orica in the Sancrox Quarry Buffer Zone Assessment Report, the recommended blast design parameters are:

- Face Burden: 3.1m – 3.7m
- Stemming length: 2.2 – 4.4m
- Bench height: 12- 18m
- Front hole angle: 5-20 degrees
- Hole angle: 10-14 degrees

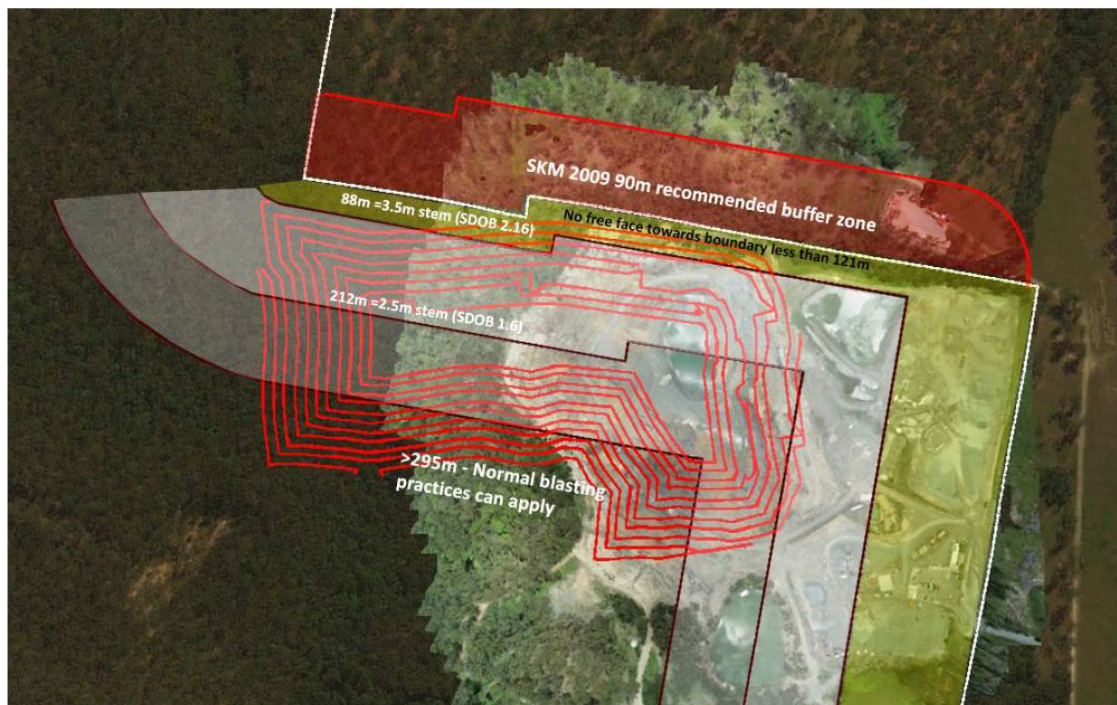


Figure 2: Recommended blast controls for 89mm blastholes, and where they are to be used in relation to the proposed Stage 1 extraction limit of the Sancrox expansion project (Figure 12, Buffer Zone Assessment Report, Orica 2022).

Figure 3 illustrates the exclusion zone required using two different drill and blast design parameters and areas of the proposed extraction area in which they are applicable, as follows:

- A1 uses 2.2m of stemming and requires a 295m exclusion zone in all directions.
- A2 uses 3.5m of stemming, has a free face orientated away from the northern boundary to achieve an exclusion zone of 88m to the rear and side of the blast point and an exclusion zone of 121m in front of the free face.



Figure 3: Recommended exclusion zone required for two different drill and blast design parameters (with 89mm blastholes). The two scenarios indicate that increase stemming heights of blastholes reduces the required size of the blasting exclusion zone (Figure 13, Buffer Zone Assessment Report, Orica 2022).

Orica also identified that the exclusion zone is to be extended as far as practicable into the neighbouring land, as can be agreed with the neighbour. The report has identified various blasting zones based on the implementation of a 90m buffer zone extending over the neighbouring land.

Hanson has committed to applying all of the controls and recommendations documented in the Orica Flyrock Exclusion Zone Analysis, and has negotiated an agreed management approach with the neighbour in relation to the 90m buffer zone. Details of the agreement include that Expressway Spares will accept temporary blast exclusion zones as described below and illustrated on the attached plan:

- For approved Lots 41 & 42 for 5 years from the date of approval of SSD 7293, as shown blue in the plan.
- For approved Lots 43 & 44 for 10 years from the date of approval of SSD 7293, as shown red in the plan.

For approved Lots 41, 42 and 43 this equates to a temporary blast exclusion zone of approximately 100m on the Expressway Spaces site, and for Lot 44 equates to a temporary blast exclusion zone of approximately 120m. These blast exclusion zones exceed the recommendations made by Orica in the Flyrock Exclusion Zone Analysis.

We trust that the information provided above is suitable to address the issues raised by DPE in relation to flyrock. If you have any question in relation to the additional information provided, please contact me on 0450 133 453 or at tward@ethosurban.com.

Regards

T. Ward

Tim Ward
Ethos Urban
Director, Planning (Environmental Assessment)