

NEWTHORPE QUARRY

METHOD OF WORKING WITH REGARD TO IMPACTS ON THE RAILWAY LINE

1 INTRODUCTION

- 1.1 The two planning permissions for the Quarry (ROMP C8/59/43/PA and Phase 5 C8/2017/1230/CPO) carry two identical conditions each which relate to working near the railway line which passes the northern boundary of the Phase 5 area. Conditions 18 (C8/2017/1230/CPO) and 20 (C8/59/43/PA) state:

"Prior to the commencement of extraction in the area permitted under this permission a detailed Method of Working, that shall include details regarding how free face of workings shall be orientated away from the railway to reduce the risk of material being projected onto railway property as a result of blasting operations and a plan denoting the 200m from the railway boundary 'safe system of work' zone within the quarry and details of how that would be indicated on site, shall be submitted to and agreed in writing by the County Planning Authority prior to extraction within any part of that zone. Thereafter, the development shall proceed only in strict accordance with the agreed Method of Working unless an amended Method is subsequently submitted to and agreed in writing by the County Planning Authority."

Condition 33 (C8/2017/1230/CPO and C8/59/43/PA) states:

"The proposals hereby approved shall be carried out in accordance with the supporting Assessment of Environmental Blasting (ref: R17.9299/1/DW), and ground vibration levels resulting from blasting shall not exceed a peak particle velocity of 12mm/second at the railway boundary. The developer shall monitor vibration levels and air over pressures resulting from blasting if requested to do so in writing by the County Planning Authority and shall forward the details of such monitoring to the County Planning Authority within seven days of carrying out the monitoring. Blasting shall be limited to 3 times per day – as per British Standard 6472-2."

- 1.2 In addition, by agreement with Network Rail, the Operator has agreed to submit the Method of Working as part of an Approval In Principle (AIP) document to Network Rail. The AIP includes the following Appendices which form the background to this Method of Working:

Appendix 1 Stability Analysis Phase 5 North Wall Resource Stand-off.

Appendix 2 Hydrological and Hydrogeological Impact Assessment, SMF September 2017.

Appendix 3 Assessment of Environmental Impact of Blasting, Vibrock June 2016, email from Vibrock to MWP Planning dated 30 April 2018, and letter from ARP to MWP Planning dated 24 May 2018.

- 1.3 This Method of Working has been prepared by MWP Planning Principle C J Ballam BSc Hons (Geology and Geography), MPhil (Remote Sensing) and Fellow of the Institute of Quarrying, who has over 40 years experience in the fields of mineral working and waste management.
- 1.4 Drawing 10132B/50 shows the current layout of the quarry with the Phase 5 area in the central northern portion of the Quarry and moving west to east, the current working area within Phase 2, the as yet unworked Phase 3, the worked out Phase 1 and the unworked Phase 4 at the eastern end of the planning permission area. The sequence of working will be to complete Phase 2, and then to move into Phase 5, then Phase 3 and finally Phase 4. The limits of excavation are shown on the drawing.
- 1.5 The 200m limit of Safe Working Zone in relation to the railway line is shown as encompassing most of Phase 5, a small part of the northern area of Phase 2 which is largely worked out and the north eastern section of Phase 4. A no blasting zone denoted as being 63m from the rock face on the northern side of the railway line is also shown on the drawing.
- 1.6 Phase 5 has been largely cleared of vegetation ready for extraction to start in late 2020. The area of Phase 4 within the 200m limit is unlikely to be reached before 2026 at the earliest.
- 1.7 Newthorpe Quarry is established in the Cadeby Formation, formerly known as the Lower Magnesian Limestone, which extends across the surrounding area for several kilometres in all directions. There are no recorded deposits of superficial materials above the limestone. A survey of the quarry site has confirmed the geological mapping and the absence of any superficial cover above the limestone. The Cadeby Formation in the area varies in thickness between 30 and 80m and rests unconformably on sandstone, siltstone and mudstone of the underlying Upper Coal Measures.
- 1.8 Topographic survey of the quarry confirms that the minimum elevation of the current workings is approximately 37m AoD (Phase 1 & 2) which equates to a depth of approximately 25m below ground level. Visual survey of quarry faces confirms that the limestone dips gently to the east with variable and relatively thin bedding and sub-vertical jointing.

2 STABILITY ASSESSMENT

- 2.1 The ARP Stability Analysis on the Phase 5 North Wall (Appendix 1) concluded that the proposed a 20m minimum stand-off from the top of excavation to the network Rail boundary fence, which had already been incorporated in the planning permission drawings, as shown on drawing 10132B/50. The Report also recommended a maximum cut angle of 80 degrees for the north wall.
- 2.2 The Report also recommended a standoff zone should be maintained at the base of the slope, within the bounce range of rocks, calculated previously to be within a 5m offset from the toe of the slope. A crest standoff should be maintained, marked by the presence of a soft earth bund approximately 1m high, at an offset from the crest of at least a metre.
- 2.3 To maintain face stability in the long term, drainage management should be maintained and the planting of deep rooted vegetation avoided.
- 2.4 The recommendations from the Stability Assessment have been incorporated into this Method of Working.

3 HYDROLOGICAL AND HYDROGEOLOGICAL IMPACT ASSESSMENT

- 3.1 The SMF Associates Assessment (Appendix 2) concluded that Newthorpe Quarry is established above the local groundwater level and has always been a free-draining site with no off-site discharge of surface water and no records of inundation from rising groundwater. To establish local hydrogeological conditions at the site, four new groundwater monitoring boreholes were established in 2017. Borehole locations are shown on 10132B/50. All four boreholes encountered groundwater within the Cadeby Formation. The boreholes terminated within the Cadeby Formation and extended to a minimum of 5m below rest groundwater level.
- 3.2 All rainfall, and any internal rainfall runoff, is contained within the quarry boundary and directed to the quarry excavation from where drainage to the underlying limestone occurs naturally. Incident rainfall within the Quarry workings will continue to be managed by internal containment and drainage with no direct discharge to the surface water system. The Phase 5 area will operate on the same principle with rainfall and internal runoff directed to quarry excavations to the south.
- 3.3 In accordance with current planning conditions, the quarry floor should remain above the groundwater level in the Cadeby Formation. The elevation of groundwater therefore acts as a limit on potential maximum depth of the development. Compliance with this condition will prevent any sub-water table development or any requirement

for abstraction or management of groundwater. The Quarry therefore has no potential for direct physical impact on local groundwater levels or flow.

- 3.4 The Cadeby Limestone has high infiltration capacity, indicating that the primary drainage route for incident rainwater will be vertical via fracture flow in the joints and fractures in the limestone. Surface run-off is therefore unlikely to occur with the result that erosion of the quarry faces by surface water flow is also unlikely.
- 3.5 Within the Quarry excavation drainage to a sump at the lowest point to the east of the quarry will be maintained as a permanent feature both during the period of working and following restoration. Positive drainage will not be required outside the excavation area.

4 BLAST VIBRATION ASSESSMENT

- 4.1 The Vibrock Assessment of Environmental Impact of Blasting (Appendix 3) concluded that rail tracks are relatively vibration insensitive. Network Rail has previously applied a limit of 12 mms^{-1} at items of rail infrastructure, such as the rail bridge over the previous site access road to the north east of the Quarry. A maximum instantaneous charge weight of 20 kg could be used 183 metres from such infrastructure whilst complying with the recommended vibration criterion. The allowable maximum instantaneous explosive charge weights are detailed in the Report.
- 4.2 Vibrock recommended that when blasting at the closest approach of operations to the railway boundary, the following approach should be taken:
- The separation distance between the blast and the rail infrastructure shall be established; and
 - The appropriate maximum instantaneous explosive charge weight from Table 4.1 selected in order to comply with the recommended vibration criterion.
- 4.3 At the closest approach of blasting operations to the rail bridge, a most likely vibration level of 6.7 mms^{-1} and a maximum likely vibration level of 10.4 mms^{-1} is predicted, well within the criterion of 12 mms^{-1} .
- 4.4 The Vibrock recommendations were applied in more detail to the close approach of the Phase 5 working area, by setting out the maximum instantaneous charges for separations below the 150m shown in Table 3.2 of the Assessment Report. The table attached to the Vibrock email of 30 April 2018 (Appendix 3) gives the maximum instantaneous charge weights for separations down to 45m, in order to achieve a maximum vibration level of 12 mms^{-1} . The charge weights from this table are to be

regarded as very much the maximums that should be used. In every day practice, the weights used should be kept as far below these levels as is practicable given the need for efficient blasting..

- 4.5 As further reassurance, Newthorpe Aggregates Ltd has agreed to establish a no-blasting zone as shown on drawing 10132B/50. The reason for the no-blasting zone is detailed in the letter from ARP dated 24 May 2018 (Appendix 3).
- 4.6 Network Rail had expressed concerns about the impact of quarry blasting on the rock face on the north side of the railway line facing the Phase 5 working area. ARP used the recommendations contained in the Vibrock report and email to assess the potential for damage to occur to the rock face.
- 4.7 ARP concluded that in the original submission of planning for the quarry's Phase 5, it was noted that blasting would occur up to 3 times a day. It is acknowledged by Newthorpe Aggregates Ltd that blasting is likely to be less frequent and at working capacity, such blasts would be undertaken at an average of 5 per month. This is in accordance with the historical need for blasting at the quarry.
- 4.8 Vibrations from the recommended targeted blasting will be in compliance with the 12mms^{-1} vibration criteria. 12mm s^{-1} in vibrations will have a minimal effect on the slope as the discontinuities present do not generate topple blocks or wedge blocks that could be at risk of shaking from the slope. In effect, a blast producing this magnitude of response will have a similar effect on the slope to that of a passing train, if compliance with standoff is maintained.
- 4.9 However, to assist with allaying concern, and to reduce the impact further from blasting, it is recommended that a further standoff distance of 8m (approximately 15% increase) is added to the required standoff distance. A 15% buffer is added as this will provide a dissipation band that will result in a standard deviation decrease at this distance. In total, the blasting standoff distance from the slope in question will now be 63m.
- 4.10 A reduction in vibration transfer towards the Network Rail asset will, in essence, mean that with the infrequency of blasting, the recommended targeted blasting practice and mechanical ripping of rock and spoil in the areas nearest to the rail in Phase 5, the effect of blasting at the quarry for Phase 5 works will have a negligible effect on the rail slope and its inherent stability. The presence of the anchored mesh on the rock face, assuming satisfactory installation, will add further stability to the rail slope over time. It is also recommended that, if the quarry uncovers a variation in

geology not otherwise known, that this assessment is reviewed as it may change the ability of the rocks to transfer vibrations.

4.11 The recommendations arising from the Vibrock and ARP reports, email and letter have been incorporated into this Method Statement.

5 SAFE METHOD OF WORKING

5.1 Approach to the railway boundary in Phase 5 within the Safe Working Zone

- The No-blasting and Safe Working Zones will be marked out on the ground using wooden posts standing 1m proud of the ground surface and painted red. They will be spaced at 5m separations. The ends of the boundaries will be marked on the areas to be left undisturbed with large stone blocks, also painted red. The stone boundary markers will remain when the wooden posts are removed as excavation proceeds.
- The quarry faces will be formed parallel to the railway boundary so that any accidental release of flyrock will be projected out into the quarry and not towards the railway boundary.
- Calculation of the maximum instantaneous charge for each blast will use the measured distance between the shot holes and Table 1 following (as set out in the Vibrock email dated 30 April 2018. The maximum instantaneous charge to be used will be 20 Kg.
- There will be no blasting within the No-blasting Zone, with the stone excavated by mechanical means.
- All blasts, which are expected to be limited to 5 per month, will be monitored at the railway boundary fence. Monitoring will be carried out using a proprietary digital instrument sat on a concrete block or solid rock.
- The results of blast vibration monitoring will indicate whether or not there is compliance with the vibration criteria and they can also be used to continually update the regression analysis and thus provide valuable input to the design of future blasts.
- Action and trigger levels will be set at 8mms^{-1} and 10mms^{-1} measured in any of the three planes of measurement.
- The results of all blast monitoring will be made available to Network Rail within 4 weeks. All incidences where action and trigger levels are breached will be notified within 24 hours.

- Two weeks advance notice of blasting to be given to Network Rail with final confirmation on the previous day. Blasting can be delayed for various reasons; hence the final confirmation.

5.2 Working within the Safe Working Zone in Phase 4. At the closest approach, the maximum excavation boundary will be 168m to the railway bridge and 123m to the railway boundary fence.

- The Safe Working Zone will be marked out on the ground using wooden posts standing 1m proud of the ground surface and painted red. They will be spaced at 5m separations. The ends of the boundaries will be marked on the areas to be left undisturbed with large stone blocks, also painted red. The stone boundary markers will remain when the wooden posts are removed as excavation proceeds.
- The Quarry face will be worked in an easterly direction so that any accidental release of flyrock will be projected out into the quarry and not towards the railway boundary
- Calculation of the maximum instantaneous charge for each blast will use the measured distance between the shot holes and Table 1 following (as set out in the Vibrock email dated 30 April 2018. The maximum instantaneous charge to be used will be 20 Kg.
- All blasts, which are expected to be limited to 5 per month, will be monitored at a point adjacent to the nearby railway crossing. Monitoring will be carried out using a proprietary digital instrument sat on a concrete block or solid rock.
- The results of blast vibration monitoring will indicate whether or not there is compliance with the vibration criteria and they can also be used to continually update the regression analysis and thus provide valuable input to the design of future blasts.
- Action and trigger levels will be set at 8mms^{-1} and 10mms^{-1} measured in any of the three planes of measurement.
- The results of all blast monitoring will be made available to Network Rail within 4 weeks. All incidences where action and trigger levels are breached will be notified within 24 hours.
- Two weeks advance notice of blasting to be given to Network Rail with final confirmation on the previous day. Blasting can be delayed for various reasons; hence the final confirmation.

Table 1 Allowable Maximum Instantaneous Charge Weight (Kg) for Blast/ Receiver Separation (m). NOTE - the maximum charges taken from the table should not be exceeded under any circumstances. The objective should be to use the smallest charge necessary for efficient blasting.

Blast/Receiver Separation Distance (metres)	Allowable Maximum Instantaneous Charge Weight, kg to comply with 12 mms⁻¹ at 95% confidence level
45	1.2
50	1.5
55	1.8
60	2.1
65	2.5
70	2.9
75	3.3
80	3.8
85	4.3
90	4.8
95	5.4
100	6.0
105	6.6
110	7.2
115	7.9
120	8.6
125	9.4
130	10.1
135	10.9
140	11.7
145	12.6