

Appendix 3 to Item C2

Request for approval of details pursuant to conditions 4, 7, 8, 12, 17 and 27 of planning permission TM/88/1002 at Blaise Farm Quarry, Blaise Quarry Road, Kings Hill, West Malling, Kent ME19 4PN – TM/88/1002/RVARA (KCC/TM/0121/2020)

Appendix 3:

- **Appendix 3:** “Guidance on blasting at Ragstone Quarries in Kent” (KCC, May 2004).

GUIDANCE ON BLASTING AT RAGSTONE QUARRIES IN KENT MAY 2004

The Purpose of this Guidance Note

1. This Guidance Note has been prepared to explain the main issues relating to ragstone blasting in Kent to members of the public and others who may be interested.

Background

2. Kent County Council, as the Minerals Planning Authority (MPA), has responsibility for preparing a Minerals Development Framework and dealing with planning applications for mineral development. In some circumstances, mineral working may necessitate blasting. When dealing with applications for mineral working involving blasting the County Council will normally impose conditions that require blasting to be undertaken in a particular way and within specified limits. The County Council is then responsible for ensuring that any planning conditions are adhered to and for taking action to secure compliance should this be necessary and expedient. Where breaches of planning control are identified, the County Council has discretionary power to take enforcement action where this is in the public interest.
3. District / Borough Councils also have a role in the regulation of blasting at quarries. The relevant Environmental Health Department is responsible for ensuring that blasting operations give rise to no statutory nuisance. Although there is no legal definition of a statutory nuisance it is often taken to be something that would be prejudicial to people's health or unreasonably interfere with a person's legitimate use and enjoyment of land. In respect of blasting, it is unlikely that a claim of statutory nuisance could be substantiated where the terms of the relevant planning permission are being met. Kent County Council and the relevant District / Borough Councils work together to minimise any adverse effects of blasting.
4. In the past, blasting has been used at several ragstone quarries in Kent, but is currently only undertaken at Blaise Farm Quarry, Offham (Hanson Aggregates Ltd) and at Hermitage Quarry, Barming (Gallagher Aggregates Ltd). These are the only operational ragstone quarries in Kent. Blasting was previously used at the former ragstone quarries at Offham and Allington. It was also used to break up an ironstone layer in the sand quarry at Aylesford. Blaise Farm Quarry and Hermitage Quarry are both within Tonbridge and Malling, but the latter is close to Maidstone.

Why Blast?

5. Blasting is required to loosen the in-situ rock to facilitate its removal by mechanical excavators and dump trucks before it is crushed and processed prior to sale. Due to the costs involved in blasting, it is only undertaken where geological conditions make alternative extraction techniques either impossible or uneconomic, or where these alternatives would have worse environmental effects.

The Blasting Process

6. The use of explosives in quarries is controlled by The Quarries Regulations 1999. The blasting process requires a number of holes to be drilled behind the quarry face at a calculated distance and interval, as part of the blast design process, to release a particular amount of mineral. The holes are then charged with a predetermined

amount of explosive (charge weight) and a detonator and capped with inert material (stemmed). Each blast is carried out under strict guidelines.

Environmental Effects of Blasting

7. Blasting can have impacts which can be detected beyond the site boundary. These are Ground Vibration; Air Overpressure (i.e. airborne vibration); Noise; Dust and Flyrock. The main effects experienced in Kent are Ground Vibration and Air Overpressure. Due to the naturally fissured nature of ragstone and the smaller amounts of explosive used, the effects of blasting in Kent are generally less than those experienced elsewhere in the Country. All figures quoted in the following sections are sourced from Government Guidance and "The Environmental Effects of Production Blasting from Surface Mineral Workings" (DETR, 1998).

Ground Vibration

8. When blasting occurs, shock waves are generated causing very localised ground distortion and cracking immediately adjacent to the quarry face. Outside this immediate area, stress waves cause the ground to exhibit elastic properties whereby rock particles are returned to their original position as the stress waves pass. Ground vibration is always generated by blasting and will radiate away from the site, attenuating as distance increases. It is in the operator's interest to reduce both ground and airborne vibration from blasting to the minimum possible as this substantially increases the efficiency of the process.
9. Much investigation has been undertaken into the damage potential of blast induced ground vibration, resulting in an adopted method of monitoring. This allows for results to be obtained in terms of the peak particle velocity (ppv), which is measured in mms^{-1} (i.e. millimetres per second). Government Guidance, in the form of Mineral Planning Guidance Notes, recommend a ground vibration limit for hard rock blasting of between 6mms^{-1} and 12mms^{-1} at the nearest residential property as being acceptable.
10. Ground vibration can be affected by certain blast design parameters:-
 - The maximum instantaneous charge (or MIC), which is the amount of explosives fired at the same moment in time.
 - The number of individual small explosions within the blast and the time gap between them (known as the delay, in milliseconds).
 - The overall dimensions of the blast, which comprises the distance between each hole (the spacing), the distance between the hole and the quarry face (the burden) and the depth of the hole.
 - The geology between the blast site and the vibration sensitive location. As this is outside the control of the operator a blast design must be used that takes account of any geological effects. This is achieved by the operator monitoring all blasts and modifying design appropriately.
11. Ground vibration at the nearest vibration sensitive properties associated with blasting at Blaise Farm Quarry and Hermitage Quarry are controlled by planning conditions. With the exception of specific additional restrictions relating to the remains of the Chapel of St. Blaise (for Blaise Farm Quarry) and Maidstone Hospital (for Hermitage Quarry), the permitted vibration limits at vibration sensitive properties are a peak particle velocity of 6mms^{-1} in 95% of all blasts when measured over any period of one month and a maximum peak particle velocity of 12mms^{-1} at any time.

Property Damage

12. Research work has been undertaken by various independent Authorities around the world into vibration levels that are likely to induce damage in properties, both cosmetic and structural. Cosmetic damage could include hairline cracks or the growth of existing cracks in plaster, drywall surfaces or mortar joints. Structural damage relates to actual damage to the structural elements of buildings. The United States Bureau of Mines has reviewed all relevant research and produced safe blasting vibration criteria for houses. These indicated that:-
- Values in excess of 50mms^{-1} are necessary to produce appreciable structural damage.
 - The onset of cosmetic damage can be associated with levels of around 25mms^{-1} .

Independent research in the UK has indicated similar values. The limits adopted in Kent for blasting operations have been set well below these figures to allow a considerable factor of safety.

13. Normal domestic activities also produce vibration within buildings. Table 1 illustrates the vibration associated with domestic activities. Heat, moisture, settlement, occupational loads, pre-stressing forces, material creep and chemical changes all cause movement in buildings. These result in stress concentrations in structural elements. For example, daily changes in temperature and humidity can create stresses equivalent to vibration between 30 and 70mms^{-1} . British Standard BS 7385 “Evaluation and Measurement for Vibration in Buildings. Part 1: Guide for Measurement of Vibrations and Evaluation of Their Effects on Buildings” (1990) and “Part 2: Guide to Damage Levels from Groundborne Vibration” (1993) provide guidance on the effects of vibration on buildings.

Table 1: Vibration levels generated by everyday activities

Activity	Vibration Level
Walking, measured on a wooden floor	$1.0 - 2.5 \text{ mms}^{-1}$
Door slam, measured on a wooden floor	$2.0 - 5.0 \text{ mms}^{-1}$
Door slam, measured over a doorway	$12 - 35 \text{ mms}^{-1}$
Footstamp, measured on wooden floor	$5 - 50 \text{ mms}^{-1}$

Human Perception

14. Human perception levels are difficult to define precisely as they vary from person to person. The human body is very sensitive to vibration which can result in concern being expressed about levels well below the threshold of damage. A person will generally become aware of blast induced vibration at levels of around 1.5mms^{-1} and under some circumstances this can be as low as 0.5mms^{-1} , even though such vibration is routinely generated within any property and is entirely safe.
15. British Standard BS 6472: 1992 “Guide to Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)” provides a guide to the evaluation of human exposure to vibration in buildings. It specifically mentions blasting vibration. It recommends a satisfactory magnitude of 8.5mms^{-1} at a 90% confidence level with an absolute limit of 12.7mms^{-1} for up to three occurrences per day at residential properties. For planning purposes the Government recommends limits lower than these.

Air Overpressure

16. Quarry blasts also generate a series of pressure waves in the air, known as air overpressure. This is similar to a series of gusts of wind condensed into a very short period of time. Air overpressure can make doors and windows rattle and give the impression that the whole house is shaking.
17. The effects of air overpressure are controlled through blast design and health and safety legislation. In accordance with Government Guidance, there are no specific limits imposed on air overpressure in Kent.
18. The maximum pressure in these airborne waves is known as the peak overpressure and is normally measured in decibels (dB). Air overpressure can be affected by meteorological conditions such as wind speed and direction, temperature, cloud cover and humidity. It can induce forces into buildings that can be compared to those generated by the wind. Table 2 compares the level of air overpressure with various strengths of wind.

Table 2: Comparison between wind speed and air overpressure equivalents

Wind Speed	Equivalent air overpressure
Constant wind of 5ms^{-1} , Beaufort Scale 3, Gentle breeze	120 dB
Constant wind of 8ms^{-1} , Beaufort Scale 4, Moderate breeze	130 dB
Constant wind of 20ms^{-1} , Beaufort Scale 8, Gale	140 dB

Note that the decibel scale is logarithmic and that an increase of 10dB sounds twice as loud and exerts approximately 4 times the pressure. 130db is therefore 4 times stronger than 120db and 150db is 17.5 times stronger than 125dB. Wind speed is measured in metres per second (ms^{-1}).

Property Damage

19. Although it is possible that air overpressure could cause structural damage, those produced by routine blasting operations under normal atmospheric conditions are not likely to do so. Many air overpressure measurements undertaken over a wide range of conditions indicate that rarely do air overpressures exceed 125dB, and these levels are only recorded relatively close to the blast. Measurements for Blaise Farm Quarry and Hermitage Quarry are consistent with this.
20. The weakest parts of a structure that will be exposed to air overpressure are its windows, and so these are the most likely to suffer damage. Poorly mounted panes might be forced out of their frames while improperly mounted panes that are pre-stressed will be cracked and broken more easily. Air overpressure values of 150dB could be enough to crack badly mounted windows that are pre-stressed with most cracking at 170dB. Structural damage would not be expected at levels below 180dB.

Human Perception

21. Although structural damage is unlikely, air overpressure does play a most important role in the annoyance aspect of blasting. Relatively low levels can be sufficient to cause the rattling of loose ornaments or windows and hence give the impression of a significant ground vibration shaking the property.

22. Vibration levels as low as 0.5mms^{-1} can cause complaints when accompanied by such secondary noise effects. This is because the average person forms a judgement based largely on his or her perceptions, and is usually unaware of the important distinction between the characteristics of the motion alone and the sound effects that accompany it.

Noise, Dust and Flyrock

23. Environmental effects of noise associated with blasting may arise from the blast itself and from the secondary effects of air overpressure. The former would generally only be noticed infrequently and close to the quarry, whilst the latter could be experienced further away.
24. Environmental effects of dust and flyrock associated with blasting are not experienced outside the quarry. Due to the nature of blasting in Kent and the way the blasts are designed, these effects are generally limited to the area immediately surrounding the blast within the quarry.

Conclusion

25. This Guidance Note has shown why blasting is undertaken at ragstone quarries in Kent and the main steps taken to control unacceptable side-effects.

Complaints about Blasting in Kent

26. If you have any complaints about blasting in Kent please see "Procedure for dealing with complaints relating to blasting at Quarries in Kent" (KCC, May 2004).