Recommended Installation/Placement Method for TephraLite – Red Basalt

Jacques Whitford Lab, which was acquired by Stantec Consulting, was retained by CanLava Mining for determination of the ideal installation/placement and compaction methodology for TephraLite – Red Basalt. Based upon Jacques Whitford's experience and from the results of testing the methods described below are recommended for the installation/placement of TephraLite – Red Basalt.

- Dry lightweight aggregate should be placed onto the prepared surface. The prepared surface should be free of debris and disturbed materials. If the surface is soft, organic, or fine grained as compared to the aggregate being placed, a separation layer should be placed over the subgrade before placing the aggregate. Woven geotextile is well suited as a separation material, as it is resistant to tearing but flexible, to allow the aggregate fill to match the underlying contour.
- The aggregate should be placed in maximum 300 mm (12 inch) lifts, unless poured into deep excavations where compaction, spreading, and further manipulation would be impractical or impossible. By limiting lift thickness, the light compaction techniques (recommended below) will be able to influence the entire lift thickness. Greater thickness may be difficult to adequately compact or spread, without excessive force and as such breakage would ensue.
- Compaction should be performed using only light equipment, such as a 500-lb plate compactor. A maximum of three slow passes of the compactor over the surface of each lift should be undertaken. Note, two passes equal there and back. The goal of such compaction is to settle the material into place, reducing void space without crushing material, and achieve an interlocking of particles. Excessive compactive effort, such as oversized equipment (e.g. heavy drum roller), should be avoided, as it will lead to particle breakage and an increase in fines content, without any significant gain or benefit from increased density.
- Alternatively, instead of compaction with equipment, the material could be poured from a minor height to achieve reasonable densities. As demonstrated by laboratory tests, a pour height of 1.37 m (4.5 ft) will achieve reasonable densities. In fact, even with compaction, it is recommended that the material be poured from that height, so that an initial level of compaction is achieved, and that the material does not get placed in an overly loose condition.

- The actual densities achieved during placement of the lightweight fill can not be easily measured during construction. Nuclear density techniques will be difficult to implement (e.g. pushing probe into vesicular basalts will be difficult, and could damage the probe), and will likely produce highly variable results. Alternative methods for assessing in situ density could involve using the balloon test, or, a simple estimate of density based on volume of material excavated and mass of aggregate

placed; however, these methods are not expected to be overly accurate. Provided that the material is placed in the above-recommended lifts, and compacted as described, the achieved density will likely be adequate for the intended purpose.

In summary, the main philosophy for compacting lightweight aggregates is to work in relative thin layers, lightly compacting each. Unlike conventional fills, thick or oversized lifts cannot be compensated for by extra compactive effort. Over compaction of a thick lift of lightweight aggregate will not effectively transmit energy to lower portions of the fill, but rather, be dissipated in the upper portions when particle breakage occurs. Placed and compacted as recommended, the performance of our lightweight aggregate should be similar to conventional fills, but with the added benefit of less weight and improved drainage.

Yours Truly,
Jacques Whitford Limited

Original(s) signed by:

Carl M. Kelman, M.Eng., P.Eng.
Engineer, Geotechnical Group

Nigel P. Denby, M.Eng., P.Eng.
Manager, Geotechnical Group