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The Use of Foamed Concrete for Void Filling

Foamed concrete is a perfect void filling material, because of its placement characteristics. Foamed Concrete:

- Does not settle, hence requires no compaction.
- Lightweight...does not impose large loadings.
- Free flowing...spreads to fill all voids.
- Excellent load spreading characteristics.
- Once placed requires no maintenance.
- Excellent resistance to freeze-thaw cycle.
- Does not impose lateral loads.
- Low water absorption over time.
- Highly cost effective.
- Non-hazardous.

Void filling jobs fall into two categories - planned and emergency.

Planned Void Filling

Typical "planned" work includes the filling of:

1. old underground fuel tanks, which would otherwise have to be dug out, cut up, hauled away and scrapped, which is time consuming and potentially dangerous work;
2. redundant sewers, pipelines, culverts and tunnels;
3. (in a sewer re-lining job) the gap between the old sewer wall and the new insert pipe within it;
4. any large open "hole" to enable the area to be redeveloped - typical examples of such work include swimming pools, water reservoirs, surface mine workings and mine shafts;
5. hidden, irregular, unexplored underground voids which threaten subsidence;
6. cavities in structures - service ducts in bridges; cellars and basements in old buildings ...

In some cases there is no obvious alternative method of filling the void, though other ways of dealing with the situation may exist. Sometimes alternative filling methods do exist, (empty reservoirs could, for example, be used as a dumping ground for builders rubble or even household rubbish, whilst traditional compacted hardcore could also be used to fill them). The advantage of the foamed concrete method is often self evident. Speed of completion, reliability, the ability to accurately calculate the cost in advance, are all key factors for choosing foamed concrete.

Several technical advantages also make foamed concrete indispensable as a void filling material, especially in the case of those underground:

1. The fact that foamed concrete is fluid and can be placed through narrow openings, by gravity or by ordinary concrete pumps, means that the job can be tackled without too much disruption at the surface.
2. By selecting a suitable mix design it can be made free flowing, ensuring that every nook and cranny is reached and filled, even in the most inaccessible places.

3. But perhaps the feature which is of greatest importance is the fact that correctly made foamed concrete does not collapse after placement as it sets.

It is most important that a fill material should maintain its volume after placement, without collapsing or shrinking significantly. Otherwise the problem of the void will not have been solved. This is easily achievable with foamed concrete in contrast with what happens with simple sand/water slurry, which is the chosen method employed in the mining industry of at least one country where we work. In that case the water drains away, the sand settles, and the roof collapses into the resulting void.

Emergency Repairs - void filling and support

These usually arise because something, some structure, starts to show signs of collapsing, or when a previously unknown underground void comes to light and is seen to present a risk to whatever is above it or close by.

In such circumstances it is essential to work quickly and with utmost regard for safety. Alternative methods to foamed concrete are often impractical - ...

... there may not be sufficient time to erect supporting structures;

... use of compacted earth or loose fill material would take too long and may not be possible in any event.

Notably, one cannot compact loose fill sideways, so underground passages and the concave sides of 'holes in the ground' cannot be supported by such traditional means.

The obvious solution is to use foamed concrete, and deal with the emergency as the first priority, after which one can take one's time to decide what to do to achieve a long term solution to the problem.

In some cases the foamed concrete can be left and will act as a permanent foundation under any subsequent construction. Alternatively, it may be necessary to re-excavate the emergency fill material, in which case foamed concrete is again seen in an advantageous light. Because of its cellular structure foamed concrete is easy to break up and lift out in pieces, hence re-excavation is relatively easy.

Examples

A list and brief details of actual void filling contracts is given below. The first two on the list (the Heathrow tunnel, and the under-road cavity in Lublin, Poland) are examples of emergency situations resolved by the use of foamed concrete.

EXAMPLES OF VOID FILLING USING FOAMED CONCRETE

1. Heathrow Railway Tunnel

During tunnelling for a new underground railway link to Heathrow airport using an innovative technique involving reinforced sprayed concrete but no traditional supports, part of the construction collapsed, causing a large chasm to open up at the surface. Although, fortunately, there was no immediate disaster, one of Heathrow's major buildings was threatened with collapse, being close to the opening in the ground.

The first priority was to ensure that the tunnel collapse did not spread and bring down that building.

2000 readymix truckloads of foamed concrete were poured into the tunnel as an emergency measure to stabilise the situation.

2. Undermined Road in Lublin, Poland

A recently constructed roadway built over a previously inadequately compacted trench reinstatement was in danger of collapse when heavy rains washed away the ground beneath it. A large void was created under the roadway which remained suspended in mid air over a distance of 30 metres. Using traditional methods the repair would have taken 3 weeks to complete, including the dismantling and re-assembly of the road structure, which consisted of paviers bedded in mortar. Using foamed concrete the whole job was completed and the road re-opened in 48 hours.

3. Replacement of Sewerage System in Lublin, Poland

Running along the length of a major, inner city road, an old sewer had to be made safe prior to a new pipe being laid on top of it. The work also involved filling several inspection chambers associated with the old sewer.

4. Basement Fill

An old house was at risk of collapse. It was decided to support it by filling its basement with concrete. Normal dense concrete could not be used because one outside wall was above ground level, as the house was built on the side of a hill with a road running alongside the exposed wall. The pressure from a basement-full of dense concrete would have pushed out the wall causing the building to fall. Foamed concrete was used instead since it exerts low lateral pressure.