

Case study



Heavy concrete replaces rock anchoring

MagnaDense heavy concrete aggregate provides the density needed

LKAB Minerals

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Täby is a suburb north of the Swedish capital city of Stockholm. It is known locally as the “city on the countryside”. The old municipal building was demolished in 2018 and has been replaced by a modern and stylish 15,000m² building.

Täby Kommunhus houses a diverse range of businesses and activities, as well as being the municipal City Hall.

It expresses the municipality’s desire to be a pioneer and is an important piece of the puzzle for the whole of Täby’s development.



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The carpark level in Täby Kommunhus is below the groundwater level, which means that the groundwater exerts an uplift force that would lift the structure if it were not heavy enough or anchored in the bedrock.

Innovation vs conventional

The conventional solution to this problem is rock anchoring. In this case, the construction engineers and contractor chose an innovative but unproven solution using heavy concrete. Their choice means a shorter construction time and lower cost.

Peter Hniopek, the Engineering Project Manager at Sweco, explains, “Since the foundation is below the groundwater level, the groundwater exerts an upward pressure on the entire structure. The building’s upper office level has a wider span than the two car park levels, which means that there is not enough dead weight on two column lines on the car park floor.”

The Sweco Engineering Project Manager went on to say, “At high groundwater level, the foundation pad will lift along these two lines. To counteract this, the concrete in the column footings has been replaced with the right volume of heavy concrete.”

An alternative to the norm

The normal procedure in a similar case is to use rock anchoring which the contractor had proposed at the outset, but this would have been made complicated by the fact that wells for ground-source cooling had been drilled under the pad. However, a member of the project team at Sweco had previous experience of heavy concrete.

“We realised that heavy concrete gave the desired dead weight without excessive concrete volume and, furthermore, that this is a faster construction method, which means we could meet the agreed delivery time.”

*Peter Hniopek,
Engineering Project Manager, Sweco*

Like casting a large boat

Daniel Kedland, Skanska’s production manager for the foundation work, explains, “The foundation pad and walls are cast below the groundwater level. It’s like casting a large boat. We decided that by casting two ‘loaves’ under the foundation we could create sufficient dead weight to counteract the upward force of the groundwater.”



Heavy concrete flows in the same way as standard concrete and can be placed using standard equipment.

LKAB Minerals markets MagnaDense, a natural iron ore product that has been adapted not only for this type of use but also as loose ballast in structures throughout the world.

Daniel says the aim was to achieve a concrete density of 3.57mt/m³ (35kN) to meet the specifications and that normal concrete has a density of about 2.3mt/m³. Achieving a higher weight with the same volume required a high-density aggregate for the concrete.



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Specifications met with ease

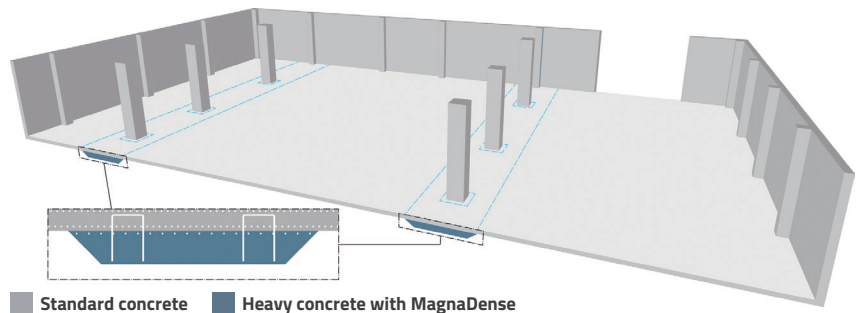
With a specific gravity that can exceed 5mt/m³ and being available in 0 - 2 mm, 0 - 8 mm and 2 - 20 mm fractions, this product is ideal for making heavy concrete. The finished concrete cast by Skanska had a density of 3.7mt/m³, which met the specifications by a good margin.

Flowing like normal concrete

“I had never worked with heavy concrete before. I was concerned that the concrete would be very stiff, that it would be difficult to get a good slump flow and we would have to work it a lot. But it was like normal concrete. It worked very well.”

*Daniel Kedland,
Production Manager, Skanska*

As a result of using heavy concrete with MagnaDense as an aggregate the chosen design could be realised without the need for rock anchoring. In addition, the heavy concrete could be handled in the same way as normal concrete, which meant that project delivery times could be met and that the solution was economically advantageous.



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**PROJECT FACTS:
Täby Kommunhus**

Architects: White Arkitekter

Construction engineering: Sweco

Foundation contractor: Skanska

Foundation work: 2014

Heavy concrete: 200m³, density 3.7t/m³

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LKAB Minerals is part of the Swedish company LKAB, one of the world's leading producers of highly upgraded iron ore products and a major supplier of mineral products for other industrial sectors.

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