

Low-Carbon Concrete For High-Rise Buildings

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SCOPE

Design a concrete mix for a new 20-story building in downtown Calgary. The mixture must have a compressive strength of 50MPa and a slump of 150mm or higher.

SUSTAINABILITY



SUPPLEMENTARY CEMENTITIOUS MATERIALS (SCMS)

Cement accounts for roughly 80% Portland of the CO₂ emissions in producing concrete. Replacing overall Portland Cement with SCMs reduces this high carbon impact can additionally increase strength and and lower water requirements in a concrete mix.

All our chosen SCMs are by-products which means incorporating in our mixes we have negative embodiment them of CO₂ emissions.

<u>Fly Ash</u> - A fine powder that is a by-product of burning coal. It is formed when the mineral impurities in the coal fuse together as it exits the combustion chamber and then cools and hardens.

<u>Slag</u> - Slag is a by-product of iron smelting. During the smelting process, slag forms as a molten liquid melt, a solution of silicates and oxides that solidifies upon cooling

<u>Silica Fume</u> - Silica fume is a by-product of silicon alloy production and is a highly pozzolanic material.











Figure 3: Volume Breakdown for Silica Fume

31%



Figure 5: Volume Breakdown for Slag 35, Silica Fume 15



Figure 4: Volume Breakdown for Fly Ash V2



Figure 6: Volume Breakdown for Slag 50, Silica Fume 10





Figure 10: Slump Values









Figure 8: Cost Breakdown for Material and Production

