

concrete sensors BY HILTI

GRANITE SOUTHLAKE
CASE STUDY

Move Faster, Save Money, and
Reduce the CO_2 Impact of Concrete

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LEVERAGING IN-PLACE CURING CONDITIONS



Introduction

DPR delivered the Granite Southlake building that won the *Outstanding Building of the Year* (TOBY) award in 2022. The Dallas/Fort Worth area building has 143,500 square feet of class-A office space. It has a current ENERGY STAR rating of 97.

This project poured 4,540 cubic yards of concrete for elevated decks in the summer in Texas. As concrete cures, heat is generated & large structural elements get hot. With expected high ambient temperatures leading to high concrete temperatures, high early concrete strength was likely.

Considering the conditions, DPR was able to safely use a standard concrete mix that had less cement than a high-early (fast setting) mix. To measure the in-place concrete temperatures and estimate in-place concrete strength, DPR's team used Hilti Concrete Sensors on this project.

Sensor technologies enabled DPR to optimize the cast in place concrete on this project which allowed the project team to **move faster**, **save money**, and **reduce the CO2 impact** of the concrete.

DPR CONSTRUCTION

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THE RESULTS



Productivity

Achieving target strength at the target time is critical to scheduling. HCS sensors provide updated in-place strength estimation every 15 minutes; allowing for faster decisions and avoiding unnecessary delays.

In order to stress tendons, specifications require cast in place concrete to achieve a minimum strength. Traditionally, field cylinder breaks were the method of estimating in-situ concrete compressive strength. Compared to “cast in place” structural concrete, cylinder break results do not reflect in-place strength due to different geometries, different curing conditions, and often different curing locations. While concrete cylinder break results ensure the correct concrete is placed, cylinders are not a good indication of in-place strength.

> *“Typically we relied solely on the cylinder break results. Concrete Sensors allowed us to stress PT tendons and release formwork a lot sooner.”*
>
> –**Braulio Galarza**, Project Manager at DPR

Sustainability

Implementing sustainable practices in construction projects involves a multifaceted approach, from improved resource efficiency and enhanced energy performance to advanced end-of-life management for maximized resource value. The construction sector's most substantial emissions are derived from the consumption of resources, particularly steel and concrete.

The standard concrete mix used at Granite Southlake has 170 fewer pounds of cement (supplemented by fly ash) per yard of concrete poured, and still exceeds design requirements, thereby reducing the needed cement by about 770,000 pounds. This estimated 24% cement reduction was achieved through the strategic selection of concrete mixes and the integration of the HCS solution. These sensors offer vital data on concrete maturity and timeline, aiding DPR in selecting the most suitable mix for their project, avoiding waste.

Reduction of 170 pounds of cement mix per yard is a significant milestone considering each pound of cement contributes about 0.90 pounds of CO2 emissions according to **Materials Economics**. Without changing mix designs and deploying concrete sensors, the project would have seen an additional 690,000 pounds of CO2 emissions. The **Canadian Office of Energy Efficiency** equates this much CO2 reduction to removing the annual emissions of approximately 95 passenger vehicles.

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Cost Savings

This project used a standard concrete mix that was averaging about $6 less per yard than a high-early mix netting up to about **$27,000** in concrete materials savings.

$6 less per yard than a high-early mix

$27,000 in material savings



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HILTI CONCRETE SENSORS



Job sites can be more efficient while reducing emissions. HCS solutions harness innovation and digital technology to assist our customers in optimizing concrete operations.

The adoption of such sensor technologies constitutes a substantial stride towards a more sustainable construction industry.

Hilti Concrete Sensors offers unique services, hardware, and software that monitor concrete in real-time. The system follows ASTM C1074 to estimate concrete strength using the maturity method. This technique is ACI approved for determining concrete strength for performing critical operations.

Lab services characterize mixes by developing a strength-maturity relationship in accordance with C1074 §8.

The HCS lab experimentally determines the concrete Q-value by testing at 4 temperatures in accordance with C1074 §X1. Materials characterization is performed with materials sourced from the ready-mix plant local to the project.

HCS provides a verification service, that satisfies ASTM C1074 §9.5.4, to check concrete strengths estimated from HCS maturity sensors are consistent with the concrete in the structure. Verification brings confidence to the project team and engineers that the correct concrete is delivered, and the sensors system is reliable.

You should get in touch. Here's why.

- We're the leaders in concrete sensor technology that will help you save money and improve productivity.
- We're trusted by many of the largest GCs and engineering firms in the world.
- Our in-house concrete lab and database provide the most accurate data in the industry.
- The ROI is immediate and impactful.

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