Reducing Carbon Through Innovative Technology

Leveraging Holcim's Digital Innovation To Reduce Carbon

NRMCA Concrete Innovations – October 18, 2023
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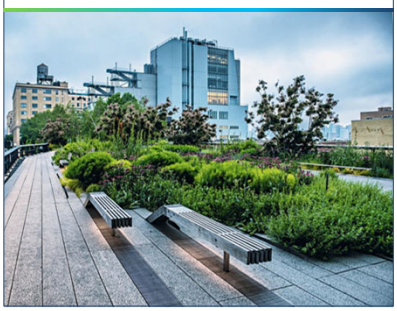
HOLCIM US: DRIVEN BY OUR PURPOSE
BUILDING PROGRESS FOR PEOPLE AND THE PLANET

MAKING CITIES GREENER
from foundation to rooftop with low carbon solutions



EMPOWERING SOCIETY WITH SMARTER INFRASTRUCTURE
from green mobility and renewable energy to essential sanitation

IMPROVING LIVING STANDARDS FOR ALL
with affordable and sustainable solutions

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AT THE FOREFRONT OF GREEN BUILDING SOLUTIONS

13 cement plants	**~250** RMX, aggregate, asphalt sites	**+7,000** employees	**43** states	**Leading** US **Cement** producer
Net Zero pledge	**SBTi** validated 2030 targets	**ESG Rankings** from MSCI to Sustainalytics	**Green Solutions** 1/3 of our sales	**Leading** the way in **sustainability**
Circular Economy	**50 million tons** materials recycled annually	**Alternative fuels** diverting materials from landfills	**Geocycle & Systech** reduce and recycle	**Innovating** to build **more with less**

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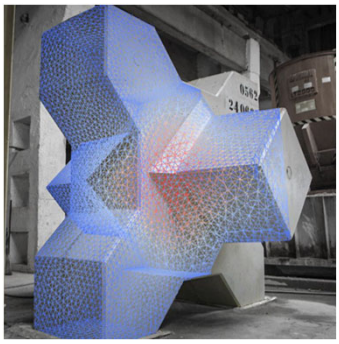
SMART READY-MIX CONCRETE SOLUTIONS

Leveraging digital technologies to enable informed data driven decisions

PUMPING SIMULATOR

MATURITY MONITORING

THERMAL - CURING TEMPERATURE



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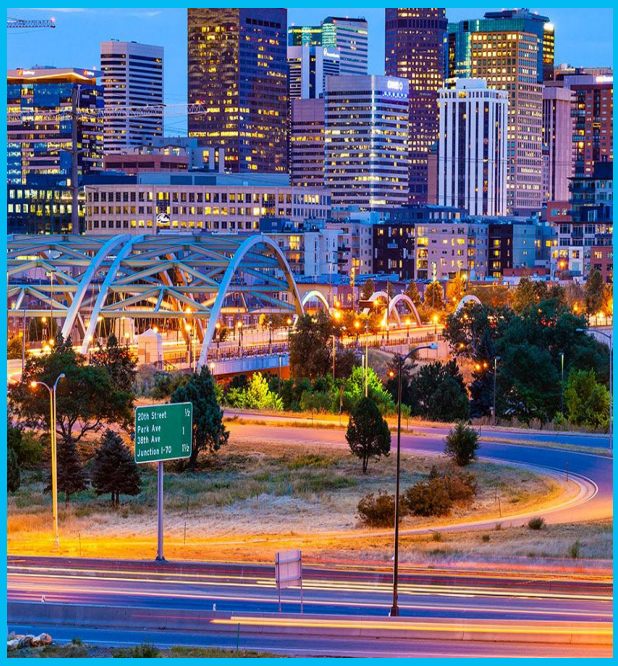
SMARTFLOW - SUCCESS IN COLORADO



CONCRETE PUMPING PREDICTION TOOL - SMARTFLOW

Long distance, vertical and horizontal pumping simulation

- ➔Ensure pumping feasibility in complex situations
- ➔Assist in selection of the most suitable pump
- ➔Optimize mix design to reduce pump pressure and GWP
- ➔Typical segments: High Rise & Infrastructure

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A US FIRST AT A COLORADO DISTRIBUTION CENTER PROJECT

Using SMARTFLOW Technology to optimize concrete pumpability and CO2

Place:
Northern CO

Building type:
e-commerce distribution center with robotic slabs

Date:
2022-2023

Height:
5 floors

Pumping distance:
300' to 700' horizontal - up to 75' vertical

Volume:
97,000
Approx. CY

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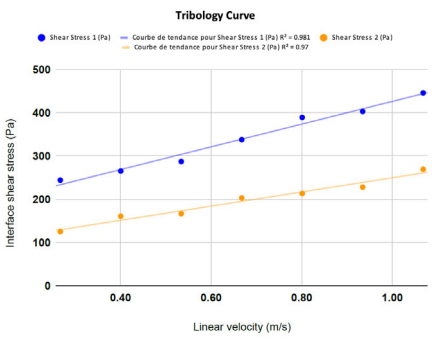
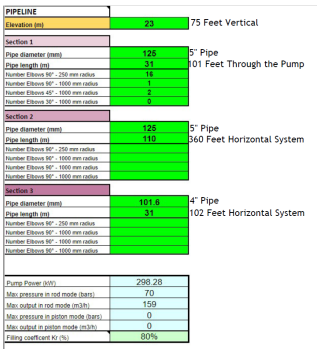
A US FIRST AT A COLORADO DISTRIBUTION CENTER PROJECT

Tribometer study step-by-step

Tribometer to perform measurements with the actual concrete mix



Output ⇒ key parameters for prediction



Web based platform for concrete and pump selection

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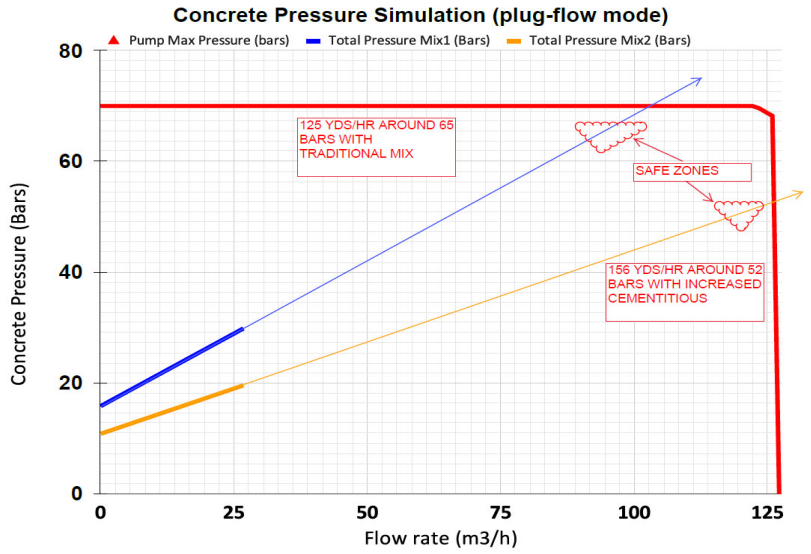
A US FIRST AT A COLORADO DISTRIBUTION CENTER PROJECT
Pumpability results



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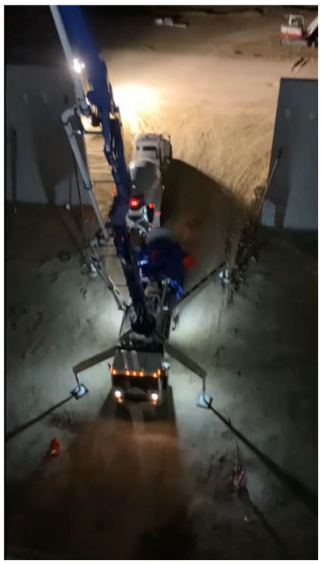
A US FIRST AT A COLORADO DISTRIBUTION CENTER PROJECT
Using SMARTFLOW Technology to optimize concrete pumpability and CO2



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A US FIRST AT A COLORADO DISTRIBUTION CENTER PROJECT

Initial vs. final mix design

Application: Slab on Metal Deck (pumped)

Structural Macrofibers 7.5 lbs/yd

Fly ash 15%

Volume = 25,000 cy to date

ENGINEER'S PROPOSED MIX

611 lbs cementitious

GWP = 320 kgCO2eq/m3

FINAL APPROVED MIX AFTER TRIBOMETER STUDY

535 lbs cementitious

GWP = 288 kgCO2eq/m3 (-10%)

CO2 savings = 612 t CO2 eq

77 homes' energy use for one year

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SMARTCAST-PIONEERED IN COLORADO

CONCRETE STRENGTH PREDICTION TOOL - SMARTCAST

Concrete Strength and Temperature Monitoring Service

- Utilizing current and next generation tech to accurately predict in-situ strength
- Critical when utilizing low carbon mix designs
- Eliminates human error when evaluating mix performance
- Typical segments: High Rise & Infrastructure

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Low Carbon Concrete – Denver's Populus Hotel

Using SMARTCAST Technology to Meet Stringent Construction Schedules

Place:
Denver CO

Building type:
Hotel

Date:
2022-2023

Height:
14 floors

GWP Reduction:
30% Reduction

Volume:
7,875
Approx. CY

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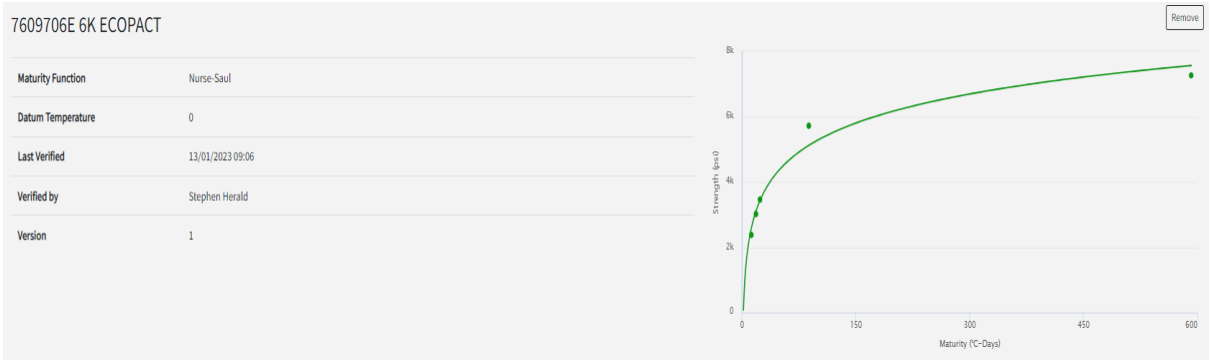
Low Carbon Concrete – Denver's Populus Hotel
Using SMARTCAST Technology to Meet Stringent Construction Schedules



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Low Carbon Concrete – Denver's Populus Hotel
Using SMARTCAST Technology to Meet Stringent Construction Schedules

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Low Carbon Concrete – Denver's Populus Hotel
Using SMARTCAST Technology to Meet Stringent Construction Schedules

Application: Structural Slabs on Deck (pumped) 6K PSI

Fly ash 33%

Volume = 3,100 cy

TRADITIONAL MIX

750 lbs cementitious

GWP = 422 kgCO2eq/m3

FINAL APPROVED MIX AFTER MATURITY STUDY

750 lbs cementitious (33% Class F FA)

GWP = 302 kgCO2eq/m3 (-29%)

CO2 savings = 284 t CO2 eq

36 homes' energy use for one year

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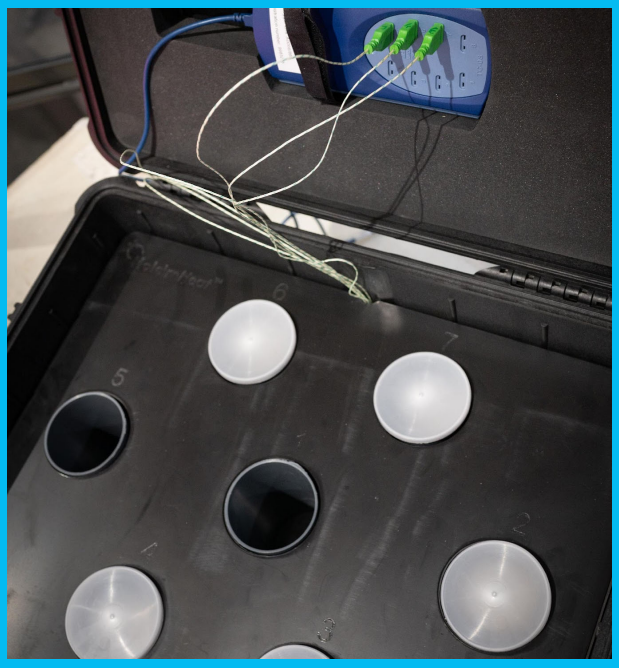
SMARTHERM-THERMAL PREDICTION



SMARTherm BY HOLCIM – BENEFITS

OPTIMIZE MIX DESIGNS
Finding the best mix to comply with all temperature specifications whilst minimizing costs

REDUCE RISKS
Less problems related to heat of hydration, e.g. crack formation or early freezing

REDUCE COSTS
No waste for potential real-size mockup to test temperatures in mass concrete elements

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SMARTHERM BY HOLCIM – SCOPE OF SERVICE

1
Characterize the binder's heat of hydration

2
Based on the binder's heat of hydration, derive the specific «thermal fingerprint» of the mix

3
Virtual simulation of the temperature development

4
Depending on complexity two-dimensional or three-dimensional assessment can be conducted

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All results are summarized in an easy-to-read, comprehensive report

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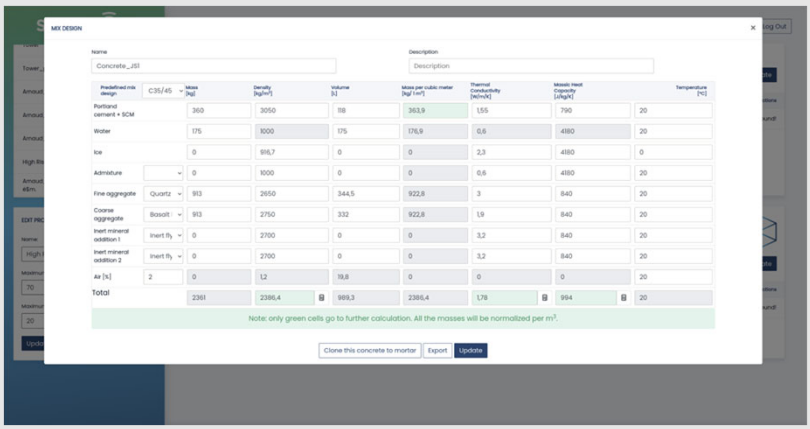
STEP 1: CONCRETE MIX DESIGN



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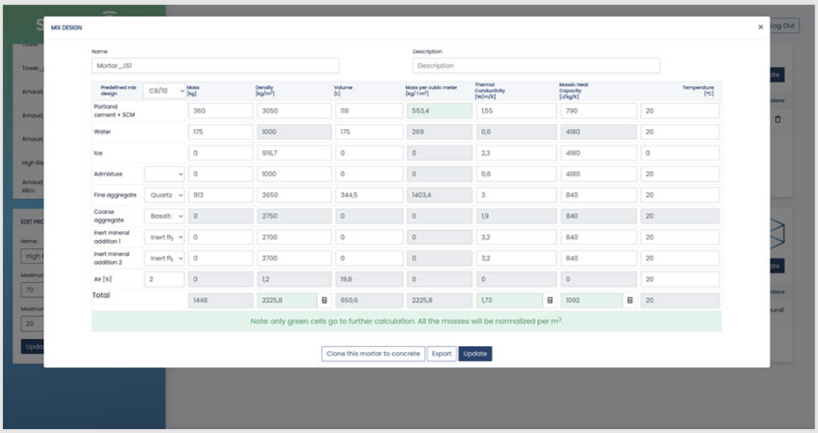
STEP 2: MORTAR MIX DESIGN FOR HOLCIM-HEAT TEST



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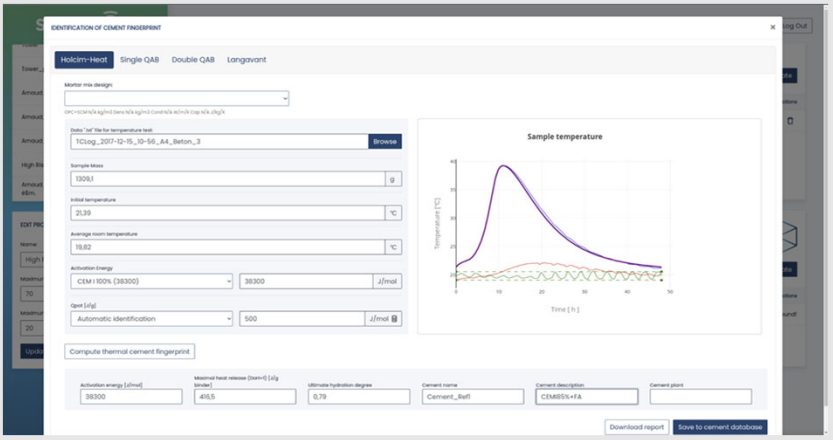
STEP 3: THERMAL FINGERPRINT IDENTIFICATION



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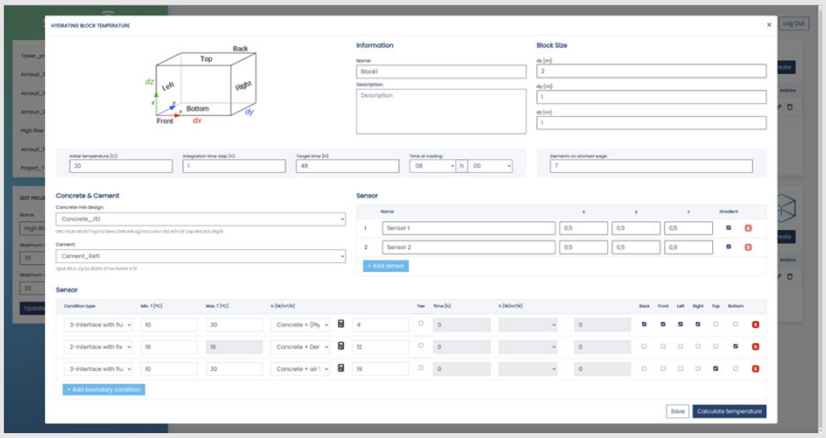
STEP 4: THERMAL PREDICTION



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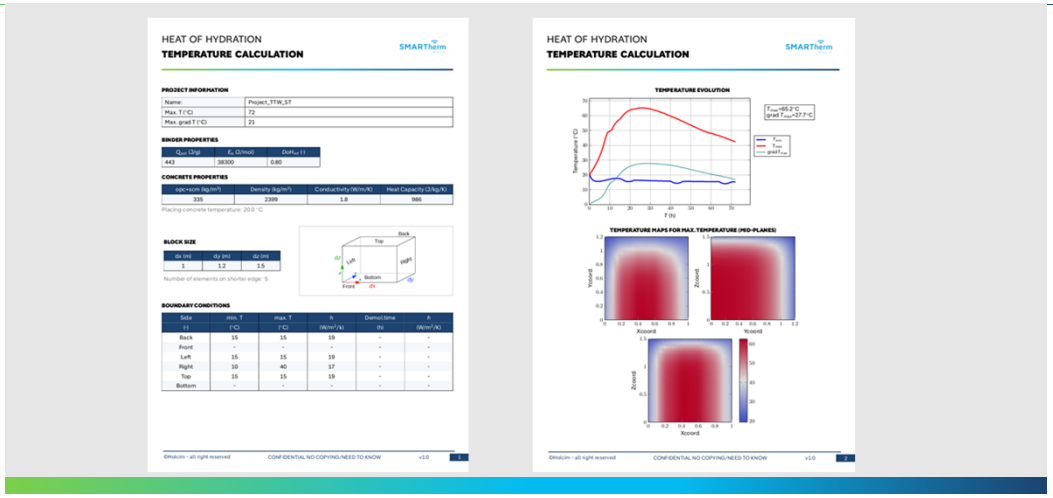
STEP 4: THERMAL PREDICTION



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https://www.holcim.us/concrete