



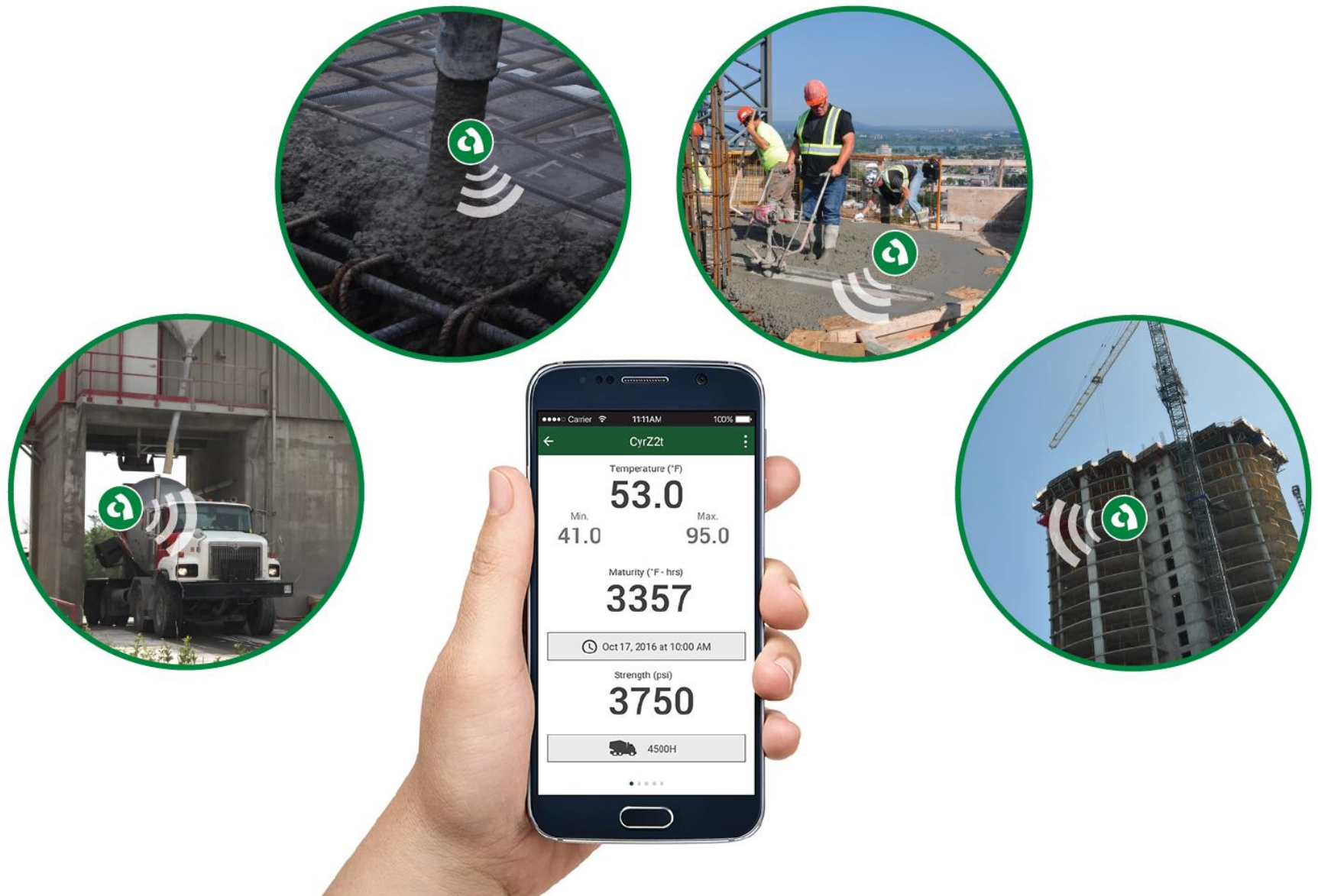
Wireless Concrete Sensors as IoT Solutions for Construction Industry

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Concrete:

- Second most consumable material after water on the planet
- The most economical material for construction
- Concrete production: 1 m³ per capita
- Change properties after mixing over time
- Ambient temperature and humidity impact its properties after pouring
- Lack of concrete quality results in structural failure

Industry Challenge:



Sensing challenges in concrete industry:

- Wires: Safety issues
- Battery life: 50 to 100 years
- RF wireless signal: Obstacles/wet media
- Ease-of-use: Smartphone connectivity
- Aggressive environment: High pH, high water
- Reliability: Structural integrity
- Memory: Storage capacity for long-term

Important characteristics of concrete

Measurement/sensing the following characteristics of concrete required for quality control or optimization of critical operations such as:

- Flowability (slump)
- Air content
- Water content
- Setting time (solidification time)
- Strength
- Temperature
- Humidity
- Strain
- Vibration
- pH
- Chloride content



Concrete Production

Early-age construction

Service life of structures

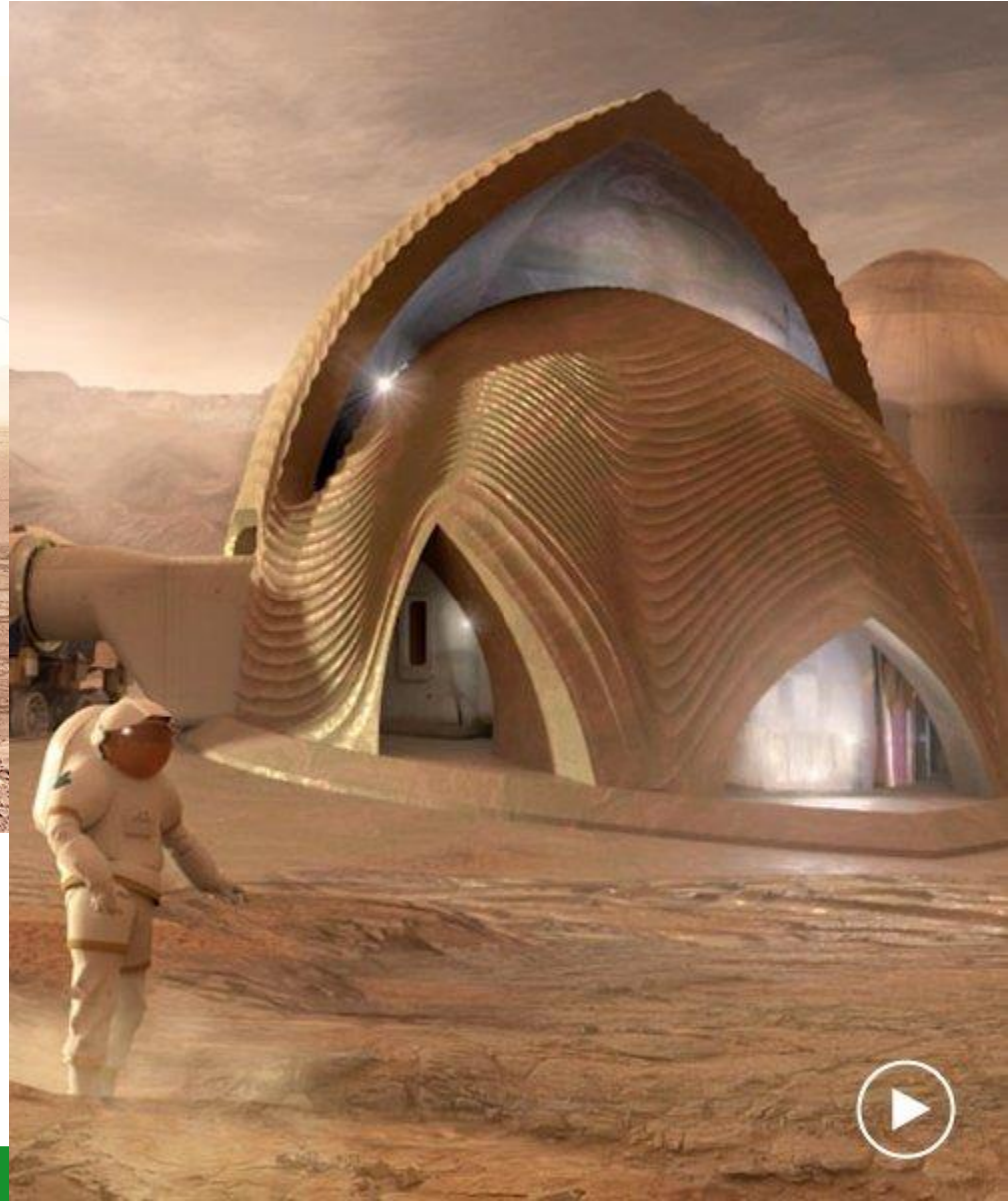
Flowability (slump)



Concrete Sensing in 3D Print



3D Print in Space (Mars/Moon)



Success Case: Strength of Concrete

Strength of concrete is required for optimization of critical operations such as:

- Formwork removal
- Post-tensioning
- Heat curing optimization
- Saw cutting
- Opening traffic on concrete pavement
- Speed of Nozzle in 3D printing

Industry Problem



Field-cured or
CIPPOC specimens



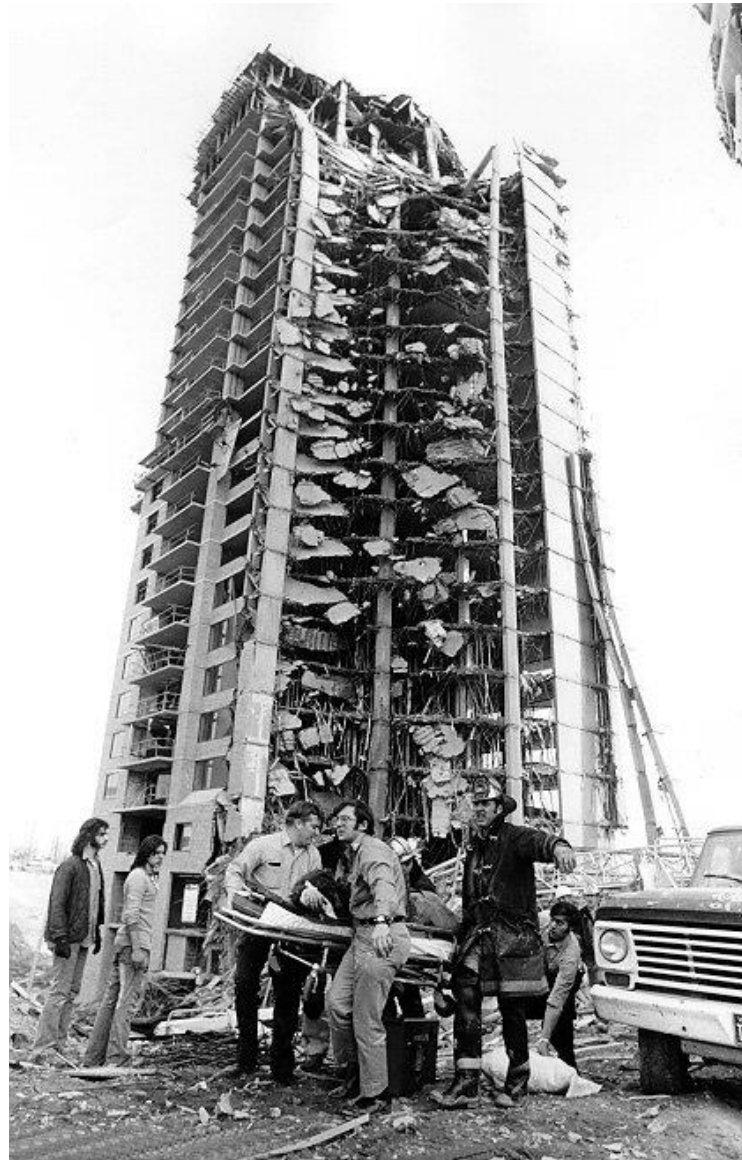
Formwork removal
Post-tensioning

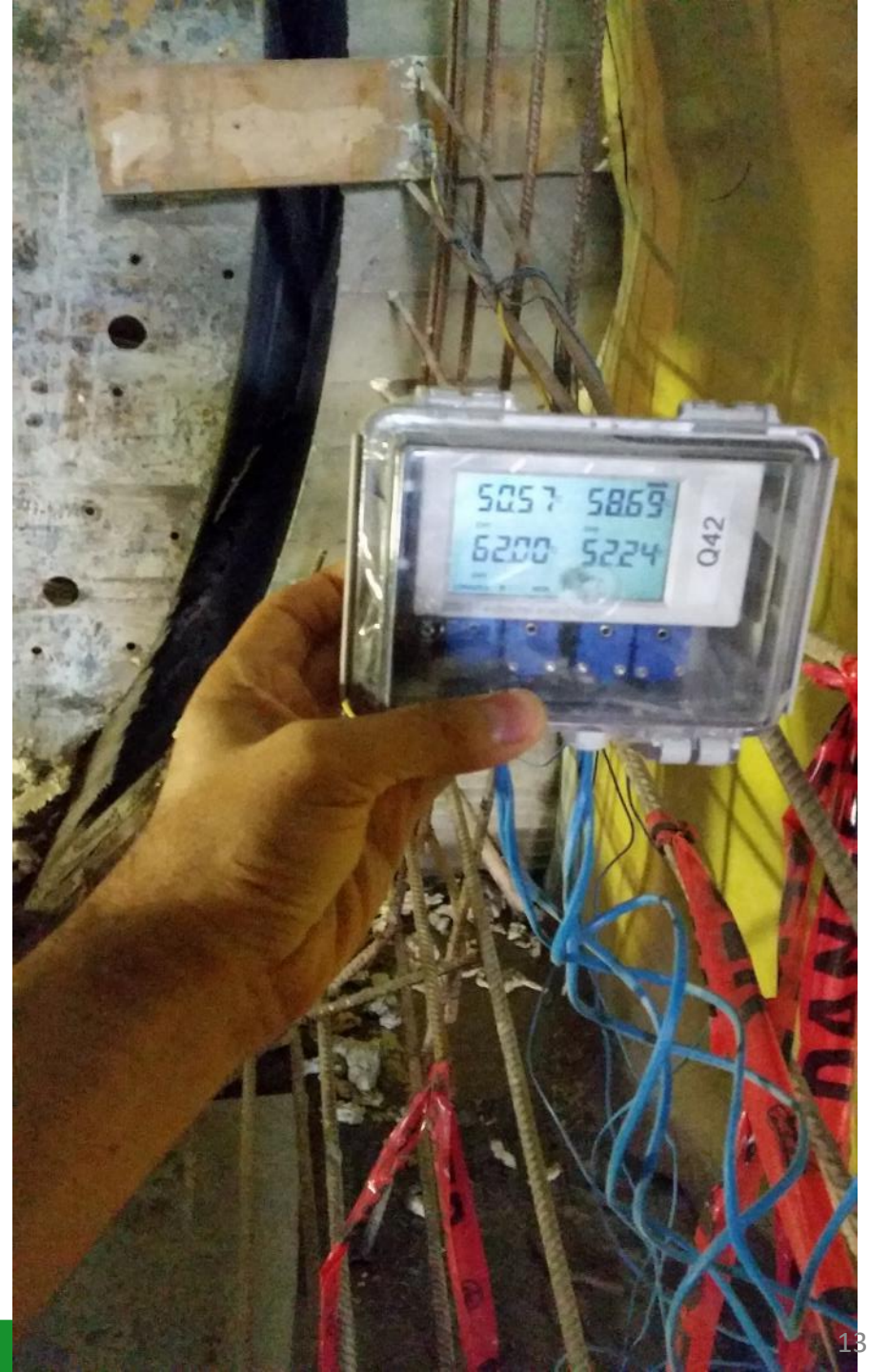


Structure failure due to inadequate concrete strength!



Structure failure due to early formwork removal!





SmartRock™ | Measurement of Temperature & Strength

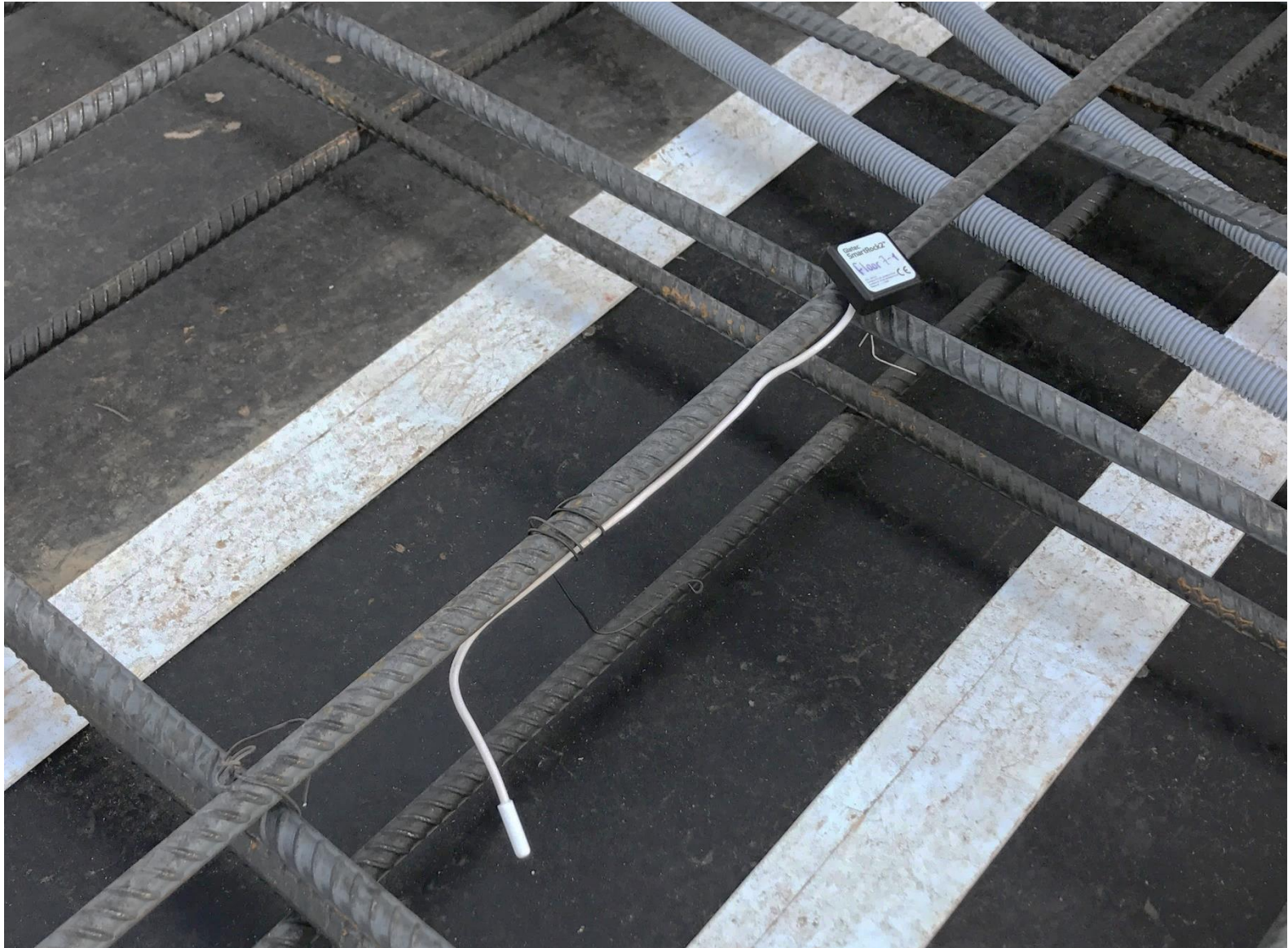


Sensor Technology

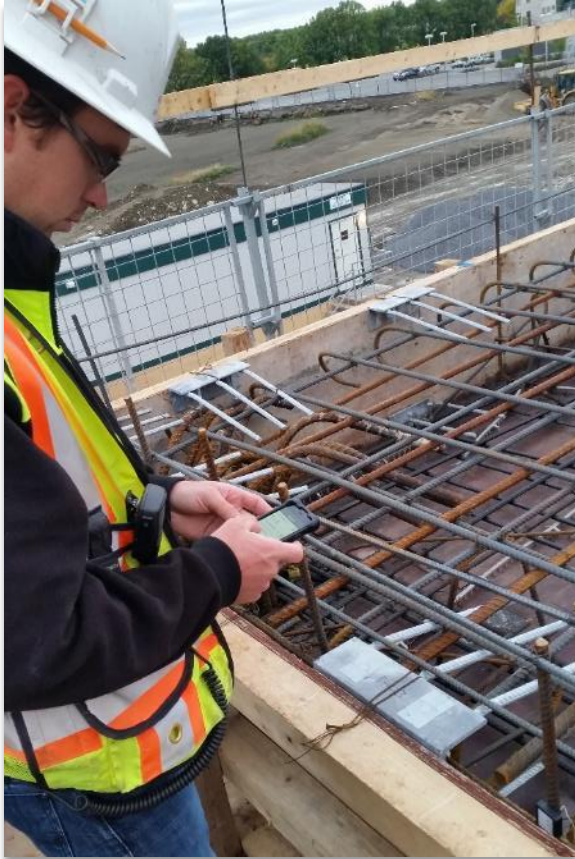
- Long-range low-power Bluetooth: BLE5
- Rugged & water proof
- Coin-cell battery
- 6-month operation life
- Up to 3 inches installation depth
- 10 m communication range



SmartRock™ | Contractor Experience



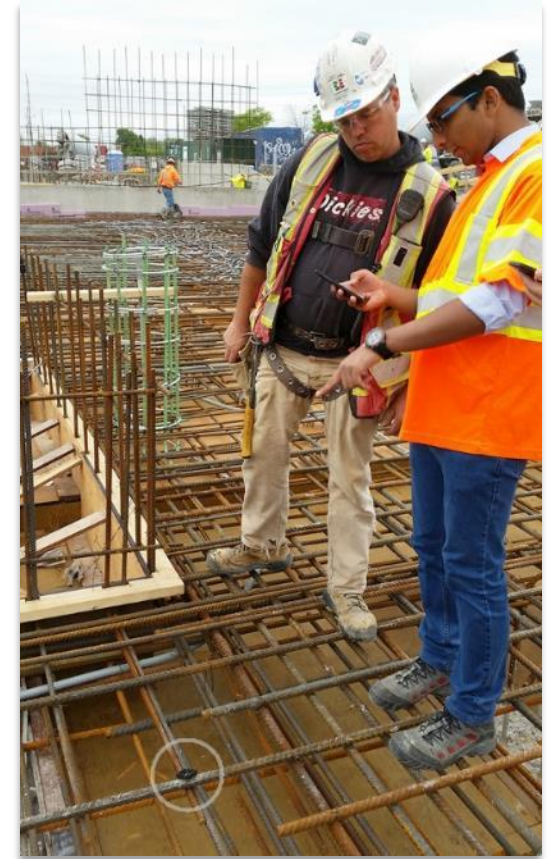
SmartRock™ | In-situ application



Broccolini



OLRT

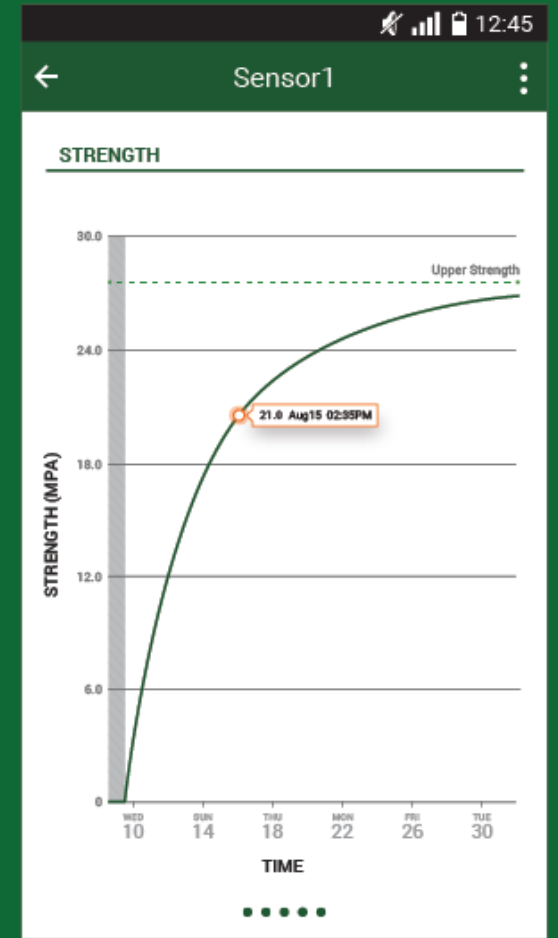
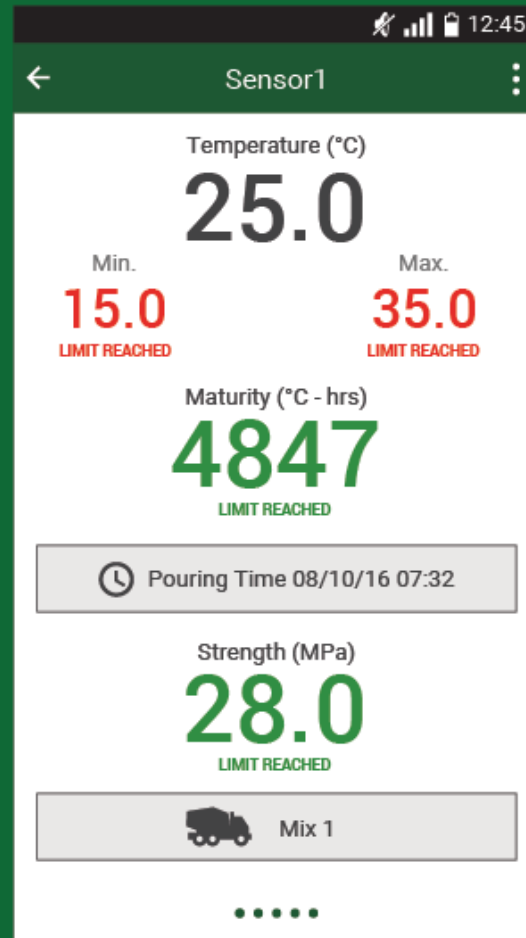
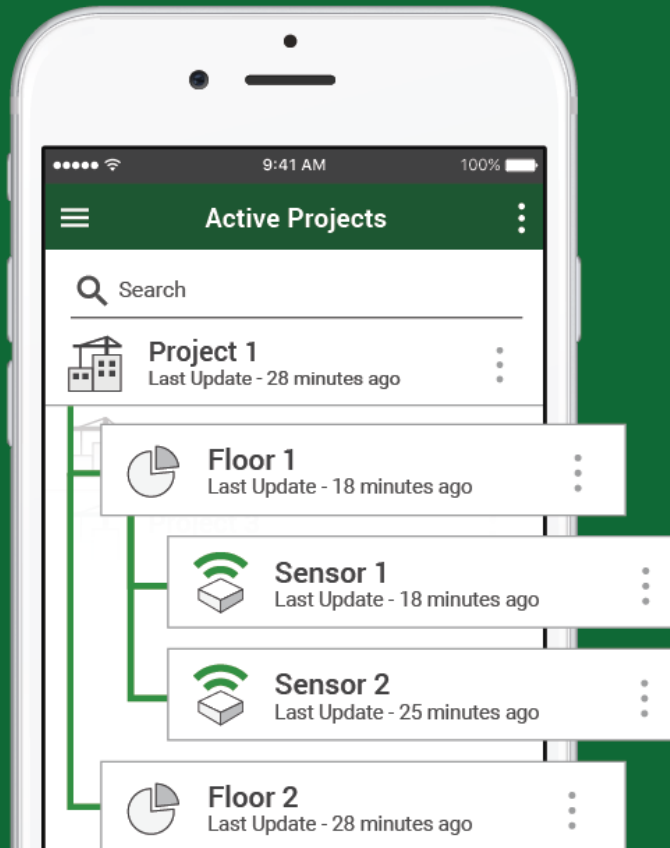


Bellai

SmartRock™ | In-situ application



SmartRock™ | Mobile App (iOS and Android)



SmartRock™ | Contractor Experience



Current challenges:

- Limited communication range in concrete
- Limited operation life/battery life
- Looking for a “passive wireless sensor technology” to address these challenges.





Smart Concrete Sensing Technologies™

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