

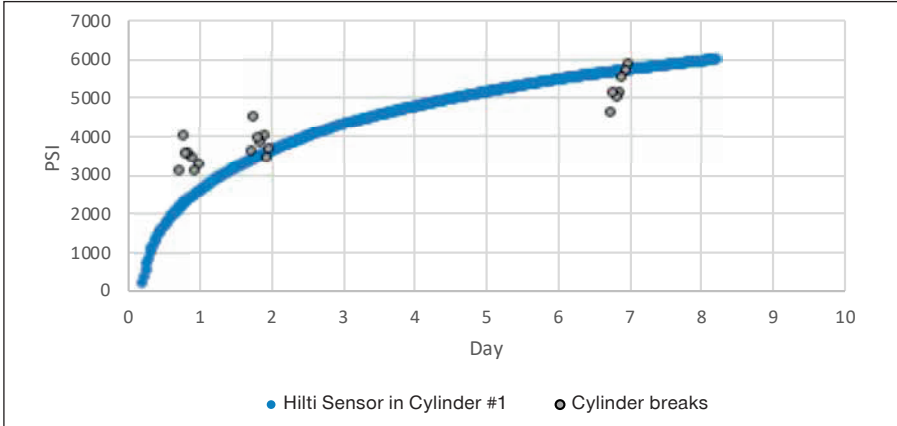


CONCRETE SENSORS:  
AN ACCURATE METHOD  
TO DETERMINE IN-PLACE  
CONCRETE STRENGTH  
AND RELATIVE HUMIDITY

# IN-PLACE CONCRETE STRENGTH

Concrete Sensors is a more accurate way of determining in-place concrete strength vs. cylinders.\*

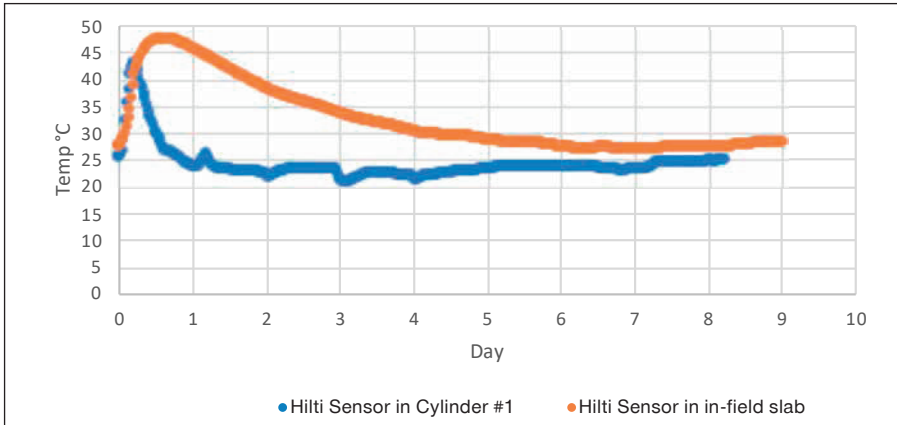
## Step 1: Compare concrete sensors and the cylinder break data



The local testing lab tested cylinders from the delivered mix. Hilti Sensor was put into a cylinder.

**The results:** Hilti Sensor data accurately measures the temperature and strength of the concrete it's placed in -- matching the field cylinder breaks.

## Step 2: Compare cylinder and the In-Place concrete temperatures

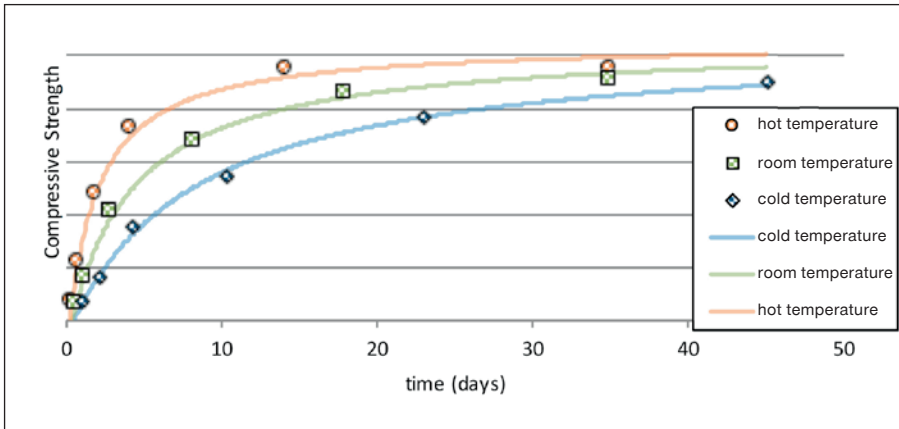


Field-cured or lab cured cylinders will not generate heat similar to larger volumes of concrete. The in-field concrete has much more mass, so it's going to generate and retain heat for longer than the cylinders.

**The results:** The cylinder temperatures are not reflecting what is actually happening with the in-place concrete.

\* Based on actual data from a Boston-based project comparing Hilti Concrete Sensors to a local testing lab's cylinder breaks. All our maturity method calculations conform to ASTM C1074

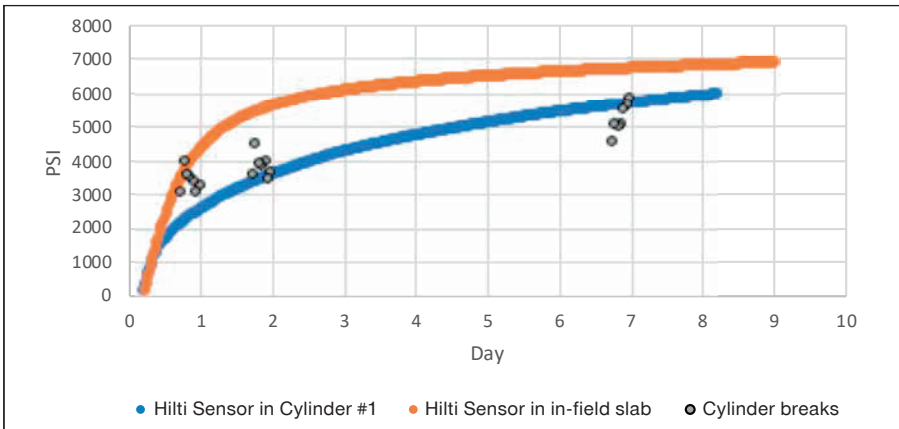
### Step 3: We test your mix: We know how your mix performs in the field



Concrete gains strength at various rates depending on the mix design and curing temperatures. We test your mix design and calculate strength over a wide temperature range using the ASTM C1074 approved equivalent age maturity method.

**The results:** As concrete gets hot, strength develops faster. Colder concrete gains strength more slowly. How much faster and how much slower is what thorough testing can provide.

### Step 4: The In-Place concrete gains strength much faster



As expected, the in-place concrete gains strength much faster than the cylinders.

**The results:** Cylinder strengths are not reflecting what is actually happening with the in-place concrete. Getting accurate strength data is critical in making decisions on the concrete process.

### Conclusion: Accurate strength data can provide real results

- Shave hours, days off pours
- Strip formwork sooner
- Tension, cut cables sooner
- Efficiently manage labor
- Optimize mix design



## IN-PLACE RELATIVE HUMIDITY

With the only 3-in-1 sensor in the industry, you get the most accurate relative humidity readings, alongside temperature measurements and strength calculations

### RH Installation best practices

- RH is a local measurement to a sensor.
- We recommend multiple sensors per slab.  
(Note: Your salesperson will help you determine the number needed based on the size of the slab).



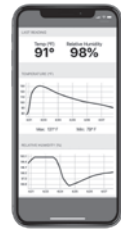
### The concrete drying process

- The rate at which concrete dries is affected by many conditions, such as temperature, humidity, air flow, slab thickness, mix design, and one-versus-two sided evaporation
- The RH of freshly poured concrete is at or near 100%
- For concrete that remains exposed to rain or moisture, the RH can remain near 100% for years
- In enclosed, climate-controlled conditions, there will typically be a noticeable drop in RH in 5-6 months
- The Hilti sensor data may not reflect overall slab RH if localized wetting/spills occur.

### Data Collection

It's easy to collect the data for RH:

- Simply go up to the sensors with your mobile app (up to 100ft), the sensors will connect automatically
- The data will be displayed in an easy to read graph
- Data is collected every 6 hours, and will continue up to the battery life of the sensors (up to 2 years)



### Customer Case Story

A top 10 General Contractor leveraged our RH measurements for this scenario:

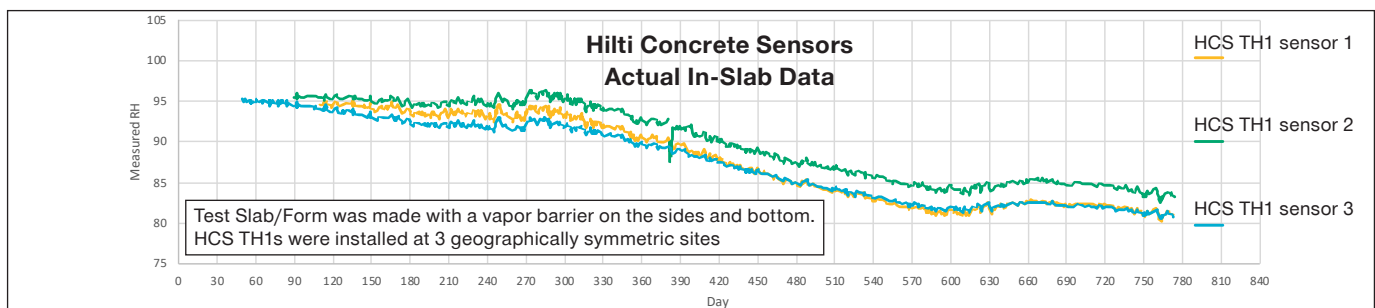
**The project:** Warehouse/lab.

**The issue:** Flooring contractor insisted flooring RH was 99%. Our customer challenged that statement using our RH data -- as the RH was actually in spec.

**The test:** A third party was called out to do a test which agreed with the Hilti Sensors' data.

**The results:** Our customer saved \$100K in mitigation costs

### Actual RH Data from a Slab Curing in a Conditioned Space



Results will vary on mix design and ambient conditions.



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