Østerport Station

Copenhagen, Denmark (2017)

PRODUCT USED:

Maturix® Smart Concrete® Sensors

CONTRACTOR:
CG Jensen A/S

POST-TENSIONING CONSTRUCTION SPECIALIST:
CCL Scandinavia A/S

BACKGROUND

The Østerport Station in Copenhagen contained several prestressed floors that were going to be used in a multi-story project. However, before tensioning, each floor required the concrete to reach minimum strength development. To determine if the concrete had reached its required strength, the contractor conducted crush tests, which involved leaving cast concrete cylinders on-site before having their compressive strength tested.

Such tests assume that these small concrete cylinders will have the same strength as the mass concrete element. However, the internal temperatures of the cylinders are actually different from the temperatures found in concrete that's been placed in volume. More specifically, the mass concrete's heat of hydration is different, so its strength development will also differ from the concrete cylinders' strength development.

However, contractors involved with tensioning need to be certain that the concrete has reached the required strength targets to avoid having the tensioning fail, which can cause delays, increase construction costs, and even injure construction workers. This concern makes the differences in temperature between the concrete cylinders and the concrete pour a problem. Additionally, until the concrete cylinders are tested, contractors have no idea how well the concrete's strength is developing. To mitigate the issue, most contractors wait for a couple of weeks before testing the cylinders to be certain they have reached their strength targets.

As the saying goes, however, time is money, so the Østerport Station's construction team decided to trial an alternative to their previous compressive strength tests: Maturix Smart Concrete Sensor technology. In turn, they soon found that this technology would help them understand the strength development of their concrete pour in real time and provide them with valuable insight that would allow them to make informed decisions.

SOLUTION

To start the trial, the Østerport Station construction team installed type K thermocouple wires in seven critical locations and then plugged the wires into the reusable Maturix® Sensors.

KRYTON®
SMART CONCRETE®

Kryton International Inc.
1645 East Kent Avenue, Vancouver, BC, Canada, V5P 2S8 | T 1.604.324.8280 | F 1.604.324.8899 | W kryton.com | E info@kryton.com

Østerport Station

Copenhagen, Denmark (2017)

PRODUCT USED:

Maturix® Smart Concrete® Sensors

Afterwards, they placed self-compacting C-35 concrete, containing an 80/20 ratio of rapid cement and fly ash, between 7:46 am and 11:23 am. The sensors then wirelessly sent out reports on the concrete's temperature every 10 minutes to the Maturix cloud-based software. With this information, the software then calculated the concrete's strength in real time based on the maturity curve of the concrete's mix design.

In turn, the construction team was able to access this information from anywhere using digital devices connected to the Internet. As a result, they no longer needed to solely rely on the concrete cylinders to determine strength development. Instead, alerts were set up to notify the team as to when the concrete reached its target strength.

One of the surprising results of this trial was the difference in curing conditions across different sections of the floor. The construction team realized that due to the positioning of a heater, some areas of the floor hit the required concrete strength 18 hours before other areas. This would not have been discovered without monitoring the concrete in real time, and it highlighted the importance of gaining a better understanding of what happens with a concrete pour as it develops.

By 6:28 am, on the third day of curing, all seven sensors indicated that the concrete floors had reached the strength of the 20 MPa (2,901 psi) needed to post-tension. Knowing this allowed the construction team to confidently post-tension earlier than scheduled and place the heaters in a way that could speed up their construction on the following floors.

KRYTON®
SMART CONCRETE®

Kryton International Inc.

1645 East Kent Avenue, Vancouver, BC, Canada, V5P 2S8 | T 1.604.324.8280 | F 1.604.324.8899 | W kryton.com | E info@kryton.com