Maturix Concrete Sensor

Concrete maturity sensor and alert system

Manufacturer	Maturix
GT Business Department	Highways
Site of testing	A303 Sparkford to Ilchester
Testing period	Jan 23-March 23
Cost	£390 per Gaia Unit, £65 for 10 units Thermocouple, £15 per month Maturix Software and connectivity

The Maturix Concrete Sensor is a two part system, with a Thermocouple sitting within a concrete pour, reading concrete temperature and providing this data to the Gaia Transmitter attached outside of the concrete, which then reports every 15 minutes to the online software, calculating concrete strength and maturity (Which is the correlation between temperature and time). This method is compliant with the ASTM C1074 standard. The trial was undertaken across 2 pours on the A303 Dualling project both using 5 Gaia's within the pour as well as two in cubes (one site cured and one bath cured) to provide control data to measure against. The data then reported every 15 minutes to the online Maturix portal, allowing us to view strength gain over time, and understand the metric in more detail than allowed through cube crushing.

Key Findings and Recommendations

- Easy and efficient to install with limited technical experience, with the sensors reading earlier maturity than cube crushing alone
- The reusability of the Gaia handset provides benefit above and beyond the Hilti equivalent, meaning these can be reused across multiple projects
- Having the sensor in both the site and bath cube's allowed for a much more meaningful comparison than a previous trial with Hilti, with this acting as a control and supporting the evidence that the concrete was curing quicker than mere crushing would suggest
- Moving forward, we hope to work with National Highways to formulate a Designated Funds bid, investigating the widescale usage of these sensors across the various A47 projects, in the hope that we can reduce reliance on cube crushing, benefiting project programme

Mix Calibration for Strength Calculations

Calibration represents the relationship between maturity hour and strength based on cube crushing tests, performed in a controlled environment and uploaded into the Maturix Online portal. This allows the web portal to calculate strength development in the pours themselves, based on temperature development and maturity.

Installation

The thermocouple wire is attached to a position within the pour i.e. rebar, and then attached to the transmitter highlighted in the image below. The concrete pour is undertaken, with the embedded sensor tip within the structure, taking temperature readings. The monitoring is initiated from within the online portal or phone app, and then the temperature, maturity and strength are reported every 15 minutes, until the 28 days have passed

Details

After a small-scale trial in December 2022, a larger scale trial was undertaken within the one of the Diaphragm and deck pours for the Steart Hill structure on the A303, with 5 sensors in place on site, and 2 in cubes – both water bath and onsite. Placing the sensors in the cubes as well as the pours allowed us a baseline to compare to, and also meant we could evidence the accuracy of the sensors, as when the cubes were crushed on the 7th, 14th and 28th day, the resulting strength was also what was shown in the sensors.

Part of the trial was a targeted investigation of the ability to set 'alerts' to let us know when certain strengths had been reached. Alerts are sent to the users via email or text and also through the app. As can be seen on the graph overleaf, a target of 15MPA for each support pour was set –Target strengths were set to allow the safe removal of landing guides in the opposite Diaphram. Setting this target meant that as soon as it was achieved, we could remove the guides, and reduce risk of cracking. This worked well, once the alert had been received the site team crushed a cube to evidence that the strength reading was accurate, and then removed the landing guides.

The ability to understand concrete strength in a much more dynamic manner than cube crushing alone allows for the site team to strike shutters early, speeding up programme where suitable, and reducing risks such as those mentioned above, saving time and money on site.

As shown on the following page, the element that took the longest to cure, and reached the lowest strength (although still within spec) was the deck. This was because it was the smallest volume section of the pour and therefore would not generate the heat from a larger and thicker diaphragm so was therefore expected.

All data can be exported out of the system in Excel files and loaded into GT Health and Safety folders for record keeping. At the 28 day mark, the Diaphragm pours were found to sit around 70MPA, but reached minimum strength well before crushing alone would have proved.

Jonathan Blott, Technical Engineer A303

The Maturix concrete monitoring has been a great success here on the A303 project. Being able to demonstrate that the site pours reach a higher strength quicker than site cured cubes has may benefits to the construction industry.

You will be able to demonstrate that you can strike shuttering before the recommended durations outlined in SHW and therefore speed up construction programmes and potentially save the project money.

Further more with the real time monitoring anyone involved in the project no matter where in the world will be able to see how the concrete is curing allowing everyone to be kept informed even if they are not on site.

Conclusions

The ability to set specific targets for alert was incredibly useful, allowing us to remove the landing guides earlier than we would have if we were just reliant on cubes, minimising cracking risk and improving programme pace, was incredibly valuable and something that sets this product apart from others in the market.

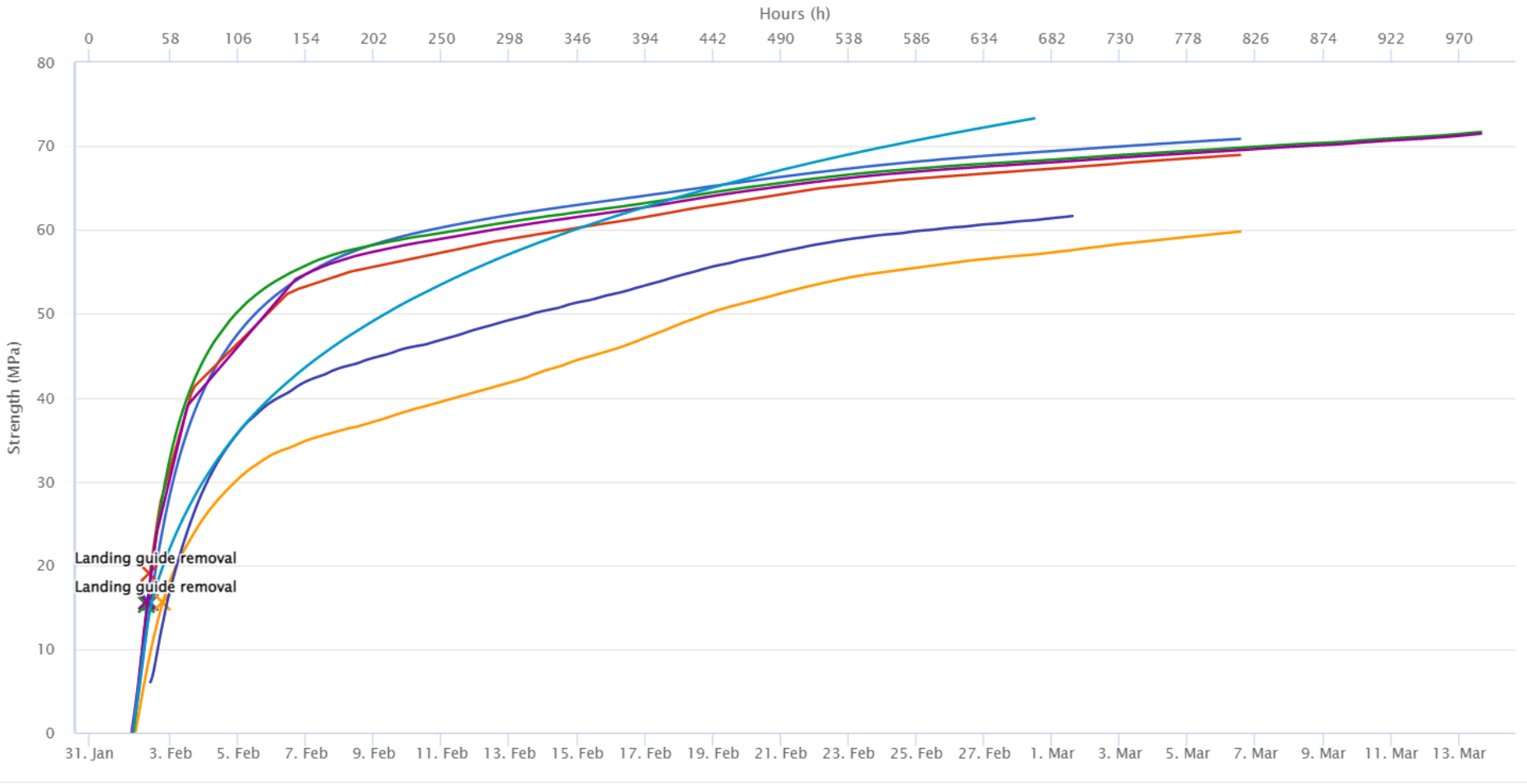
There is the potential for this product to be taken forward through a Designated Funds bid with National Highways who have shown interest in the potential to reduce reliance on cube crushing, influencing new concrete specifications in major highways projects.

For more information please see: https://maturix.com/sensors/gaia-200/

GallifordTry | www.gallifordtry.co.uk

Strength

Collapse



	Monitoring Description	Strength	Targets		
—	BTM South East corner	70.86 MPa	Landing guide removal **15 MPa**	100 % ✓	☑
—	BTM South West Corner	68.94 MPa	Landing guide removal **15 MPa**	100 % ✓	☑
—	Deck	59.8 MPa	Landing guide removal **15 MPa**	100 % ✓	☑
—	Top North East	71.69 MPa	Landing guide removal **15 MPa**	100 % ✓	☑
—	Top North West	71.48 MPa	Landing guide removal **15 MPa**	100 % ✓	☑

	Monitoring Description	Strength
—	Site Cube	61.65 MPa
—	Bath Cube	73.3 MPa