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Automating concrete and mortar elastic modulus test reports

Whilst the severity of the recession in the construction sector seems never ending, new testing technologies can represent the key to the future.
Ideally the elastic modulus is measured directly on concrete specimens under compression by recording the load-deformation curve. However, this is not always easy: the procedure up till now is quite complicated and time-consuming when compared to normal compressive strength tests. Laboratory Managers may not like to admit it, but reporting on concrete testing is not nearly as fast as producing concrete. That's why many laboratory managers will be interested in a new technology that increases testing precision and decreases report times.

The relevant international Standards for Elastic Modulus (EM) test on concrete are essentially the ISO 6784 of 1982, the BS 1881:121 of 1983, the ASTM C469 of 1994, the DIN 1048:1 of 1978, the Nord Test Build 205 of 1984 and the UNI 6556 of 1976. Actually there is not a EN Standard but a dedicated technical committee is working on one. For the mortar sector the recent EN 13412 of 2007 is well known and used.

Basically all the above Standards are the same with respect to the specimen dimensions giving the possibility to use cylindrical or cube specimens. For the specimen deformation measurement the Standards require the use of two, three or four sensors to be fixed on the sides of the cubes or cylinders. The Standards prefer the calculation of the EM after a specified number of cycles.

The cycle amplitude, to be performed between a minimum and a maximum stress, is defined referring to the compressive strength, estimated as the average value testing three other specimens having the same mix. The cycles are a common point of all the Standards: the reason seems evident due to the stabilization of the EM value after the second cycle, whilst it is very low if calculated on the first cycle. The aim of the Standards is therefore to obtain a stabilization of the specimen and therefore of the EM.

Increase precision and decrease testing time

Controls, the Italian based manufacturer of laboratory testing equipment, has recently introduced the new 55-C0222/F magnetostrictive linear position sensors for specimen deformation measurement as an excellent alternative to the traditional strain gauges. So much time and great attention has to be paid during the gluing and welding of each strain gauge. A common inconvenience during the test is the propagation of microcracks across the strain gauges causing their failure and the loss of the measurements.

The 55-C0222/F sensors do not have this problem: the main user benefit is the simple and quick set up as well as the high sensitivity and accuracy of this new technology.
The fixing to the surface of the sample is via two elastic straps which apply a slight pressure and a pair of conical points made of hardened steel which prevent any slippage The aluminium and steel structure that houses the displacement transducer provides friction-free movement between the fixed and mobile parts in any test condition. The structure acts as a mechanical full scale device and stops the transducer being activated beyond its full scale.
The sensors are connected to the MCC8 servo hydraulic console, and allow highly accurate measurements of axial deformations both on concrete specimens and mortar specimens whilst saving time given its rapid and easy set up. In a few minutes two or more, depending on the Standard, sensors can be positioned and fixed to the sample and be ready for the test.
The sample deformation is the signal used by the MCC8 servo-hydraulic console to acquire the deformations data to automatically calculate the EM value.
The oil flow is accurately controlled by the servo valve reacting immediately to small variations which are corrected instantaneously, so as to provide a linear distribution throughout the test cycles without sharp fluctuations, which are typical problems using other solutions such as an integrated inverter electric motors.
Servo valve systems allow the control of both the direction and quantity of the oil flow and thus, the load exerted on the specimen, based on its stiffness.

Software package for quick and easy test reports

The manufacturer also offers E-Module, a Windows-based software package desi-

Fig. 1: Concrete and mortar specimens fitted with high precision 55-C0222/F sensors for EM test

Fig. 2: MCC8 servo-hydraulic automatic control unit

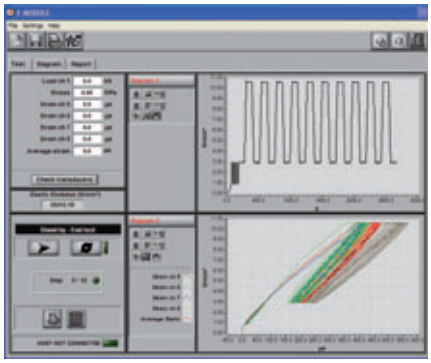

Fig. 3: Main window of the E-Module software for the automatic determination of the Elastic Modulus.

gned to help speed and organize the EM testing of concrete and mortar specimens. The software allows the remote control from PC of the command console and the automatic determination of EM. It's easy to download and upload the calibration settings for each of the eight channels available, four for pressure transducers or load cells and four for strain or displacement transducers, potentiometers or LVDTs.
This software allows the laboratory technician to assign specimen ID and job numbers and enter a variety of field data in preset fields, including supplier information, mix design, date and time, placement location, temperature, slump, air content, and other factors. Generating specimen schedules can be a big help with specimen management. When it's time to test the specimens, the software reduces overall test cycle time by importing setting data from the MCC8 servo-hydraulic console via the RS232 serial port. Both paper and electronic test reports, including stress-time and stress-strain plot (hysteresis cycles), which can be customized to meet different customers' needs, can be generated immediately.

The program can also be set to automatically post electronic reports to a password-protected web portal where project personnel, onsite or in the office, can view the data using a Web browser. This feature alone can save days in the testing cycle and reduce postage or other delivery costs. It also eliminates data entry errors.

Employing testing systems that automatically perform the tests according to specifications, calculate results and seamlessly communicate with other computers and programs running on their corporate network, ensures consistency within and amongst laboratories creating a distinctive product and leading straight to success.

Literature

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FURTHER INFORMATION

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