DOV lezingenavond 15 september 2022, 19.00 – 20.30 uur

NDC Den Hommel, Kennedylaan 9, 3533 KH Utrecht
Broodmaaltijd: 17.45 uur
Aanvang lezingenavond: 19.00 uur

Lex van der Meer, ABT

Developing a CUR-CROW guideline for permanent steel fibre reinforced underwater concrete floors

ABSTRACT
In a building pit below the groundwater level, concrete is poured under water to create a temporary floor. After the concrete has set, the building pit is drained. Hopefully cracking of and leakage through the underwater concrete is limited. A separate and permanent structural floor is often created on top of the underwater concrete. But this is a waste of material. More sustainable options are integration of the underwater concrete with the structural floor or, even better, use the underwater concrete as the permanent floor.

In the case of permanent underwater concrete, crack control and limiting leakage becomes even more important. Especially the control of (thermal) shrinkage cracking in the long direction of the building pit is a challenge. Examples exist from building practice where through-and-through cracks developed in unreinforced underwater concrete, resulting in a lot of leakage and difficult repair measures. But examples without significant cracking or leakage exist as well, particularly when steel fibres are used to reinforce the underwater concrete. Design guidelines on how to design permanent, steel fibre reinforced underwater concrete are currently under development in a CROW workgroup. The focus of the presentation will be on the modelling of restraint thermal shrinkage in DIANA and the validation of these models.
Keywords: Underwater concrete, hydration heat, shrinkage, SFRC, cracking, leakage, nonlinear FEA, CROW, CUR

Ewa Krysiak, Arcadis

Assessment of failure mechanisms in the existing bridge by means of non-linear analyses

ABSTRACT
The A10 crosses the Amstel River with the Rozenoord bridge that was built in 80’s. After the discovery of cracks in the cross beams of the bridge a monitoring program was started which follows the development (length, width) of cracks in the cross beams. In the past years, the Rozenoord bridge was subject of reassessments because of future changes in the use of the bridge. It was found that the Rozenoord bridge did not meet the required structural reliability.
The assessment plan of failure mechanisms was established. It was based on series or linear and non-linear analyses conducted in DIANA FEA. It allowed to consider each possible failure mechanism by artificially preventing the occurrence of other mechanisms. That yielded to appearance of the next

mechanism that could be assessed separately from the previous one. Each performed analysis required manual assessment in sensitive places and eventual adjustments to better reflect the real structural behaviour. The analysis proved that with well-designed strengthening measures the bridge can bear the loads with sufficient structural safety for another 10 years until its replacement. As a result, 2 3D trusses and 2 supporting columns were constructed under the cross beams and activated using hydraulic jacks. Additional calamity supports under the main girders are still subject to design and execution. The presentation focuses on the phased nonlinear analyses, including our approach to find all relevant mechanisms.

Keywords: Non-linear analyses, reassessment analyses, failure mechanisms, reassessment of existing bridge, strengthening measures, calamity analysis

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Experimental and numerical assessment of historical steel-concrete composite bridge decks without mechanical connectors

ABSTRACT

In old Dutch cities like Amsterdam a large number of steel-concrete bridge decks built between 1880 and 1960 remain in service nowadays and currently need assessment of their bearing capacity. A significant number of this decks were design without any shear studs in the interface between concrete and steel. Therefore, only chemical bond is expected to transfer the interface stresses. Moreover, the decks were designed with only shrinkage reinforcement on the top layer of concrete. No transverse reinforcement was placed to ensure proper distribution of loads. In order to study the bearing capacity of this elements, two specimens of an existing bridge deck were removed and tested in the lab until failure. In this work, first the experimental results of the test are presented. Then, finite element models including nonlinear behavior of materials and the interface are presented. Contrast of the experimental and numerical results is done. Finally, conclusion about the structural behavior of this structural typologies are drawn.

Keywords: Steel-concrete-composite bridge deck; Interface behavior; NL-FEM