Full-scale load tests of Pearl-Chain arches

A full-scale load test is made of two Pearl-Chain (PC) concrete arches in order to evaluate the structural response and assess the design safety. Pearl-Chain structures and Pearl-Chain arches are invented and patented at the Technical University of Denmark. PC-Arches consist of specially designed, pre-fabricated, composite, lightweight, concrete deck elements (SL-Decks), that are post-tensioned together into an arch shape. The two Pearl-Chain arches, each with a span of 13m and a rise of 1m, were placed on a post tensioned bearing plate prepared in advance. The arches are tested with load control by applying a gravity load to a quarter point of the span since a single load in the quarter point is found to be the decisive load case for an analytical design of such relatively short bridges. The test is completed in two tempi in order to determine the behavior of an arch formed with SL-Decks: First an investigation of the system's elastic response (maximum load of 648kN), and second a demonstration of its collapse mechanism and ultimate capacity (maximum load of 970kN). The full-scale test showed formation of plastic hinges and clear warning signs are observed at 84% of the failure load. The ultimate, experimental load capacity is 14% higher than the calculated mainly due to the assumed static system used for the calculation. In addition to the full-scale test bridge the first ever permanent PC-Bridge is erected in Denmark in 2015.

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