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Repair of damaged steel beams composite with concrete deck using carbon fiber reinforced polymers (CFRP)

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Repair using carbon fiber reinforced polymers (CFRP) sheets and strips for damaged steel girders has been investigated in this study. An experimental program was devised to study the efficiency of CFRP strengthening of damaged composite steel beams with concrete decking. The flexural testing of five steel beams (HP 10 x 42) composite with concrete decks of (2½ ft x 4 in x 12 ft) and strengthened with CFRP was conducted. The steel-concrete composite beams had a simulated collision damage imposed before installing the CFRP strips. The collision damage was simulated by cutting a notch in the tension steel flange. A 4" CFRP laminate strip was applied to the bottom steel flange. Some repaired beams were wrapped with CFRP U-shaped strips at different locations to anchor the longitudinal CFRP strips. After the adhesives for the CFRP was cured and gained strength, the beams were loaded until failure. LVDTs and strain gages were mounted at mid-span to measure deflections and strains. A 100-kip [445 kN] displacement-controlled hydraulic actuator was used to apply static loading at mid-span. An automatic data acquisition system was used to record the loads, displacements and strains. Continuous visual inspection was also performed to determine if any possible de-bonding between the CFRP membranes and the steel beams occurred. Analysis of the experimental results was discussed and conclusions were drawn. The results indicated a restoration of capacity for the strengthened beam when compared to the control damaged beam without CFRP strengthening. The repair of pre-damaged beams with CFRP laminates restored their flexural capacity to reach a capacity greater than the load actuator.

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A comparative study between mechanical and physical properties of pozzolanic concrete due to effect of carbonation

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This paper deals with the accelerated carbonation of pozzolanic concrete for duration of 24 weeks. Carbonation of concrete, though considered a trouble for the steel reinforcement, there are no dearth in literature where the researchers have proved that it has greatly improved the mechanical properties of unreinforced concrete. For the present study, concrete with cement replaced by fly ash and ground granulated blast furnace slag are cured in an accelerated carbonation environment under controlled conditions of humidity and temperature for 24 weeks. The mechanical properties and durability are then studied and the results are compared with the standard concrete with no replacement. Mechanical properties that have been of keen interest are compressive strength, flexural strength and modulus of elasticity and durability tests comprised of depth of carbonation and permeable porosity. To comprehend the phase wise change of the value of pH and chemical kinetics of carbon dioxide ingress, tests are conducted for every 6 days of high CO2 exposure for 60 days.

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