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Experimental analysis of RC beams in flexure reinforced with CFRP sheets

Background: **Strength, stiffness (deformation) and the load carrying capacity of reinforced concrete (RC) beams are always the primary topics which have been specified in many existing design codes and guidelines. There is no doubt that such considerations should also be given to RC beams when retrofitted with advanced fibre reinforced plastics (FRP) particularly when incorporated into existing structures. The effectiveness of different carbon fibre lay-out on the loading capacity of the reinforced concrete beams and the suitability of structural deformation analysis based on the modelling of classic composite beam theory and some provisional design codes are two main objectives in this research.**

Methodology: Experimental and structural stress analysis.

Modelling analysis ← **Specimens with CFRP Sheets** → Experimental test

Analysis:
(1) Design codes: Eurocode and ACI guide
(2) Classical Bernoulli analysis

Assumptions:
(a) Perfect bonded connection
(b) Linear elastic deformation

Technical Information:
Strain------stress----
loading capacity

Materials composition and properties

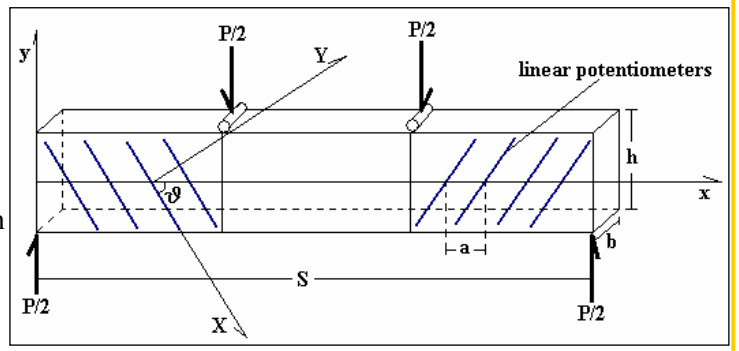
Concrete: Water: cement: sand: aggregate= 0.73:1: 2.92: 4.38
Concrete strength: 27Mpa after 28days
Reinforced steel bars: 2 No.10 high yield steel bar with E=210 GPa and strength 300MPa, reinforced ratio: 0.019

Specimen dimension: $S \times h \times b = 1200 \times 125 \times 75$mm

CFRP sheet: Thickness 0.165mm; tensile strength 3.43MPa elastic modulus 230 GPa

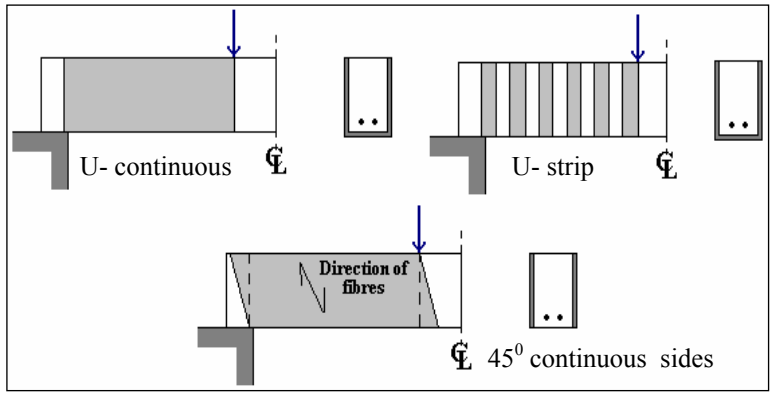
Specimen preparations

Four-point bending (Ultimate P=25kN of the beam without CFRP!)

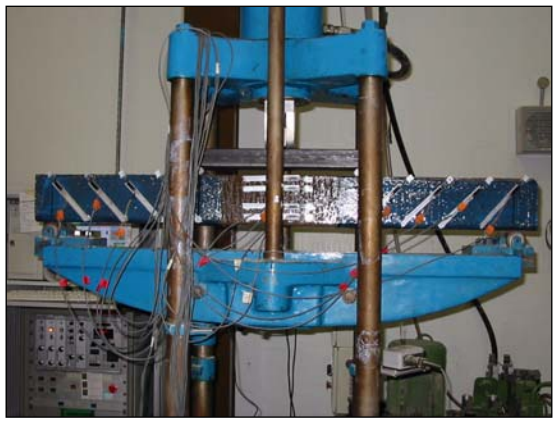


The potentiometers were placed at a spacing a=100mm

Three kinds of CFRP reinforcement configurations



Testing machine



Results and Conclusions

(1) Loading capacity increases 50% averagely
(2) U-strip is the most appropriate design
(3) All existing modelling analyses are unable to predict the maximum loading.
(4) New theoretical modelling is required

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