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W.M. Sebastian

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Fibre Waviness in Pultruded Bridge Deck Profiles : Geometric Characterisation and Consequences on Ultimate Behaviour

W.M. Sebastian [1]

[1] *Department of Civil, Environmental and Geomatic Engineering, University College London, Chadwick Building, Gower Street, London WC1E 6BT, UK*

ABSTRACT

Conventional tests cannot be used to establish the important influence of fibre waviness, a manufacturing legacy at the flange-web joints (FWJs) of pultruded GFRP bridge decks, on the local ultimate behaviour of such decks. Hence a novel, simple and reliable three-step experimental scheme for that purpose is presented herein, using one pultruded deck profile as an exemplar. First, for the given profile, the different individual and bonded deck-deck joint geometries which must be targeted for testing are identified. Second, an effective manual method is put forward to map this waviness at the FWJs. Third, a quasi-static test setup is introduced which enables statically determinate loading of one joint at a time, while also ensuring continuity between this joint and the remaining deck so that the real load paths within the deck are preserved. During the tests failure always occurred by fracture of the wavy fibre-resin interfaces within the FWJs, with a distinct inverse correlation between fibre waviness and failure load, and with the influence of bonding on joint failure behaviour depending on the local flange-web layout. It is concluded that this simple test is sufficiently reliable for extension to assessing local fatigue behaviour at the joints.

KEYWORDS : GFRP ; Bridge decks ; Mechanical testing; Pultrusion ; Fibre Waviness

[1] Corresponding Author, Email Address : W.Sebastian@ucl.ac.uk

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