There are presently many solutions to dealing with aging or deteriorated structures. Depending on the state of the structure, it may need to be completely over-hauled, demolished and replaced, or only specific components may need rehabilitation. In the case of bridges, deterioration and maintenance of the decks are critical needs for infrastructure management. Viable rehabilitation options include replacement of decks with aluminum extrusions, hybrid composite and sandwich systems, precast reinforced concrete systems, or the use of pultruded fiber-reinforced polymer (FRP) shapes. A lot of research has been done with regards to using pultruded glass fiber-reinforced polymer (GFRP) decks. Earlier research examined the behaviour of the GFRP decks when subjected to various strength and serviceability loading conditions. Failure modes observed were specific to delamination of the flexural cross sections, local crushing under loading pads, web buckling and lip-separation. However certain failure mechanisms observed from in-situ installations differ from these results of previous laboratory tests, including behaviour of the connectors or system of connection, as well as the effect of cyclic loads on the connections.

This thesis specifically investigates the role of mechanical and non-mechanical connectors in the composite action and failure mechanisms of GFRP deck systems and components. There are many interfaces including top panel to I-beam, and deck panels to girder, and panel to panel. The research considers the behaviour and failure mechanisms of different connectors when subjected to shear, uplift, flexure, and cyclic loading. This is achieved through the use of different materials and test methods which would be explored in further detail. Finite element models are equally incorporated where applicable in this study. Results show that certain scenarios and connectors are more effective than others and recommends further research where necessary.

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