Impact Performance Of Bfrp-reinforced Precast Segmental Beams Made Of Geopolymer And Portland Cement Concrete

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To achieve net zero emissions and enhance the durability of structures, adopting green geopolymer concrete (GPC) and non-corrodible basalt fibre-reinforced polymer (BFRP) bars in construction is a promising solution. Nonetheless, no research efforts have been made to investigate the performances of precast/prefabricated segmental concrete beams (PSCBs) constructed with GPC and BFRP bars under impact loading. This study experimentally investigates the impact responses of PSCBs cast with GPC and ordinary Portland cement concrete (OPC) to evaluate the performances of the GPC structure with respect to the OPC counterpart. The effects of impact locations (at joints vs middle of segments) on the responses of PSCBs are also investigated. The test results showed that the GPC beams had a similar impact performance compared to the OPC counterparts. Excessive joint opening resulted in concrete spalling at the joints and failure of the PSCBs. No sign of damage was observed in the BFRP bars after the impact test. Therefore, GPC and BFRP bars can be used to build durable and sustainable segmental structures against impact loading. PSCBs also exhibited excellent energy absorption capability owing to the opening and sliding of the joints especially when the impact loads were directly applied to the joints. Consequently, the impact-induced damage to the PSCB was less severe when the joint was impacted as compared to the case where impact loads were applied in the middle of the segment. However, directly impacting the joint produced higher beam deflection and lower impact forces than impacting the middle of the segment.