Spiral Wrap Using CFRP Strip to Strengthen TSPC Column under Compression

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Abstract. This study investigates the compressive strength enhancement of TSPC column under spiral wrap orientation of CFRP strips in comparison with conventional transverse CFRP wrap on the TSPC circular column samples. The test samples were prepared by wrapping TSPC with 30 mm CFRP strip with 0.6^0 angular offsets from bottom and continuously wrapped until it reaches top of the TSPC column. The matrix employed was epoxy Sikadur 330-part A and B. Compression test was performed on unconfined TSPC (TSPC-UC), TSPC with transverse CFRP confinement (TSPC-CF) and TSPC with spiral CFRP strip confinement (TSPC-CS) with 1mm/ min of loading rate. The test results have revealed that the ultimate strengths are 59.19 MPa (TSPC-UC), 108.77 MPa (TSPC-CF) and 116.53 MPa (TSPC-CS). The corresponding compressive strain measured at ultimate compressive strength is 0.0300 (TSPC-UC), 0.0398 (TSPC-CF) and 0.0420 (TSPC-CS). Stress versus strain curve has shown that compared to TSPC-UC, TSPC-CF and TSPC-CS has provided strength enhancement and improvement of yield point indicate the confinement effect on the test samples. However, TSPC-CS has shown just little strength enhancement compared to TSPC-CF which reveals its incompatibility due to complexity of spiral wrap preparation process. Failure mode of TSPC-UC has shown shear crushing, TSPC-CF, delamination, and transverse fractured and TSPC-CS exhibit angular fractured. The results of this study have provided findings on the effect of spiral CFRP strip confinement on TSPC circular column sample in close expectation based on literature.

Keywords: TSPC; Spiral CFRP Confinement, Compression; Stress versus Strain; Failure Modes

Introduction

Polymer concrete (PC) has been an alternative for conventional cement concrete materials since more than 30 years back. The preference of PC over cement concrete is because it's more environmentally friendly as cement production cause carbon emission (Neville & Brooks, 2010). In addition to that, the existing and wider range of polymeric material strength in PC allows the application of many types of reinforcement especially waste materials such as metal slag (Wang, 2016). Tin slag polymer concrete (TSPC) is a new particulate reinforced composite material which prepared using tin slag (TS) waste from tin smelting industry. The TS particles were pre-treated by drying and crushing into fine particles of less than 1 mm in size. The fine TS particles were mixed with Unsaturated Polyester Resin (UPR) and 1% Methyl Ethyl Ketone Peroxide (MEKP) as catalyst. Wet TS mixture was then cast into PVC mold before cured for three days and results in short circular column sample named as TSPC column (Faizal et al. 2018). TSPC column compressive strength (40 MPa – 60 MPa) has achieved the strength of conventional cement concrete and indeed, Bedi et al. (2014) has reported that polymer