ELASTOMERIC POLYURETHANE: FOR RETROFITTING APPLICATION OF CONCRETE STRUCTURES UNDER DYNAMIC LOADINGS

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Abstract

Failures and damages of concrete structures along with losses of lives due to extreme dynamic events such as blast, high impact and high intensity earthquake are predominant threat, since the most existing concrete structures are not designed to withstand such dynamic loadings. This research was formulated to organize a feasible technique to improve the dynamic resistance and enhance the energy absorption capability of concrete structures, through an innovative approach of providing elastomeric polyurethane (PU) coating onto the structural element. This papers reports the findings of the experimental investigation conducted using scaled concrete samples, to evaluate the contribution of PU coatings in enhancing the dynamic mechanical response of the specimens. Concrete specimens with dimensions of 160 mm × 40 mm × 40 mm were constructed, and total 5 different configurations were obtained by coating PU on both tension and compression faces of the concrete specimen with the thicknesses of 2.5% and 5% to the concrete specimen depth, including the bare specimen. Dynamic loading condition was simulated by conducting three point bending test under intermediate strain rate (0.067 s-1), in comparison to quasi-static (strain rate of 0.00033 s-1) loading conditions. The effectiveness of the proposed retrofitting technique was assessed, and the influence of the coating thickness was evaluated in terms of maximum flexural stress, failure strain and strain energy density. Findings clearly showed that the failure strain, and strain energy density were enhanced by factors of 2.9-4.6, and 3.0-5.1 respectively with a marginal enhancement in the maximum flexural stress under dynamic conditions compared to the dynamic response of un-coated concrete specimens. In addition, it was noted that the response of concrete specimens were improved when the thickness of the PU coating was increased.

Keywords: dynamic loadings, concrete, retrofitting, polyurethane.

1. INTRODUCTION

Interruptions or failure critical infrastructure would highly impact and spread to the other sectors due to their interdependent nature of the services and industries. The protection of these