Safety enhancement of water-filled road safety barrier using interaction of composite materials

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Abstrak

Road safety barriers are used to redirect traffic at roadside work-zones. When filled with water, these barriers are able to withstand low to moderate impact speeds up to 50kmh-1. Despite this feature, there are challenges when using portable water-filled barriers (PWFBs) such as large lateral displacements as well as tearing and breakage during impact, especially at higher speeds. In this study, the authors explore the use of composite action to enhance the crashworthiness of PWFBs and enable their use at higher speeds. Initially, we investigated the energy absorption capability of water in PWFB. Then, we considered the composite action of a PWFB with the introduction of a steel frame to evaluate its impact on performance. Findings of the study show that the initial height of impact must be lower than the free surface level of water in a PWFB for the water to provide significant crash energy absorption. In general, impact of a road barrier that is 80% filled is a good estimation. Furthermore, the addition of a composite structure greatly reduces the probability of tearing by decreasing the strain and impact energy transferred to the shell container. This allows the water to remain longer in the barrier to absorb energy via inertial displacement and sloshing response. Information from this research will aid in the design of next generation roadside safety structures aimed to increase safety on modern roadways.