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Compressive Strength and Bulk Density of Concrete Hollow Blocks (CHB) Infused with Low-Density Polyethylene (LDPE) Pellets

Alvin Joseph S. Dolores [a*], Jonathan David D. Lasco [b], Timothy M. Bertiz [a], Kimjay M. Lamar [c]

[a] *Department of Civil Engineering, University of the Philippines Los Baños, Laguna 4031, Philippines.*

[b] *Department of Civil and Environmental Engineering, Texas A&M University, College Station, Texas, United States.*

[c] *Department of Transportation-Philippine Railways Institute, Philippines.*

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Abstract

Infusing plastic waste to concrete and masonry structures is an increasingly common industry practice that has the potential to create an environment-friendly material that can improve some of the material's properties, craft a novel means to repurpose plastic waste, and reduce the need for mining aggregates in the environment. This concept has been studied extensively in different forms of concrete, as shown by several studies; however, there is a dearth of studies focusing on the incorporation plastic waste in Concrete Hollow Blocks (CHB). In this study, we aim to fill that gap by investigating on the effects of incorporating Low-Density Polyethylene (LDPE), a commonly used plastic material, to CHB on its compressive strength and bulk density. Samples of varying percentages of LDPE replacement by volume (0, 10, 20, 30 and 40%) were fabricated and tested. Results showed a general trend of decreasing compressive strength and bulk density upon increasing the amount of LDPE pellets in CHB, which was also observed in previous studies. However, the compressive strength of CHB increased at 10% LDPE replacement, a result similar to a previous study. It was inferred that the strength of the plastic material could have a direct contribution to the compressive strength of CHB at low percentage of aggregate replacement. Statistical analysis showed that the mix with 10% LDPE pellets as replacement to sand was the best among the samples tested. It was shown that CHB infused with LDPE pellets has a higher compressive strength than what is normally used in the Philippines. It was concluded that based on compressive strength and bulk density, LDPE pellets is a viable material to use as partial replacement to sand in non-load bearing CHB.

Keywords: Low Density Polyethylene; Compressive Strength; Bulk Density; Concrete Hollow Block.

1. Introduction

Waste generation is one of the major problems around the world. Factors such as population growth and socio-economic growth affect the production of waste [1]. In East Asia and the Pacific, the average urban per-capita waste generation is 0.95 kg/day. Moreover, the per capita waste generation is directly proportional to the area's level of income [2]. Among all types of wastes, plastic is one of the most generated worldwide. This commonly used material comprised approximately 10 percent of the total waste generated globally [2, 3]. Due to its non-biodegradable nature, plastic wastes accumulate either in landfills or on the environment [4]. In 2010, between 4.8 and 12.7 million metric

* Corresponding author: asdolores@up.edu.ph

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