



Streamlining a Transitional Shelter Design: A DfMA-driven Approach for Efficient Design and Assembly

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Abstract

The rapid and effective provision of transitional shelters is of paramount importance in disaster response and humanitarian aid efforts. This study focuses on the development of an innovative, structurally sound, and economical transitional shelter design in the Philippines using the Design for Manufacturing and Assembly (DfMA) concept. Though several existing shelter designs were already introduced in the country, these designs raised concerns about their adequacies to withstand hazards and constructability. This paper then explored DFMA principles and developed a framework as applied in a cold-formed steel-based shelter design to ensure ease in the assembly of the components, simplifying the construction, and at the same time achieving structural stability. The findings of this study significantly enhance the Philippines' disaster response by improving the existing shelters in terms of cost-efficiency, ease of construction, and structural stability.

Keywords: transitional shelters; design for manufacturing and assembly; cold-formed steel, light gauge steel

1 Introduction

Transitional shelters are post-disaster shelters built to facilitate the transition of the affected population by natural disasters to a more durable shelter [1]. These shelters are essential in the recovery program of the government and humanitarian organizations after a calamity as they grant safety and discretion, safeguard from climate, and promotion of good health to the victims of natural disasters [1], [2]. Due to its geographical location, the Philippines is a disaster-prone country constantly hampered by typhoons and earthquakes. In 2022, five tropical cyclones made landfall causing massive damage to 2.3 million houses and displacing 8.39 million of the population [3]. With these frequent occurrences of

natural disasters, the provision of shelters for the victims is a crucial factor in their recovery, leading to the development of shelter design guidelines. According to the International Federation of Red Cross (IFRC), transitional shelters must be designed to minimize the risk of the occupants against natural hazards and reusable for other purposes or recyclable for reconstruction [4]. These shelters could also take several mechanisms of construction, which could vary from prefabricated structures, flat-packed structures, or a combination of different salvaged and donated materials constructed by the residence owner [5]. In the case of the Philippines, two transitional shelter designs have been published by IFRC and these were constructed through traditional methods using conventional materials such as