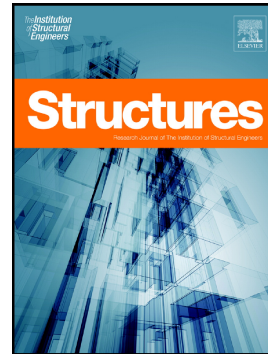


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A Low-Cost Housing Solution: Earth Block Catenary Vaults

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ABSTRACT

The United Nations currently estimate that 860 million people live in slums, which is 12% of the world's population. The issue is usually focussed on a lack of funds, with individuals and governments. Thus, a need to develop low-cost housing alternatives is apparent, to make housing more affordable to the poor. The project described in this paper is the design of a low-cost home, that incorporates sustainable materials and shell vaults. The materials used to construct the home are cement stabilized earth blocks (CSEB), and blocks constructed of recycled building rubble. The walls of the home are dry-stacked (no mortar), to reduce material cost and enable rapid construction. The roof of the structure comprises two catenary shaped arches, which eliminate the need of roofing materials and doubles the living space. The design of the arches are given in detail, using a segmental equilibrium method of analysis. The segmental equilibrium method predicts the thrust-line for different combinations of loads, which are kept within the middle third of the vault walls. Various other aspects of the design are also described, such as the foundations, floor slab and the support system at the base of the arch.

KEY WORDS: Low-cost housing, cement stabilized earth blocks, dry-stack construction, shells, catenary vaults

INTRODUCTION

Housing is a basic need of humankind. Every nation has the inherent responsibility to ensure that its people have housing that is safe, robust, durable and promotes healthy living. It is the responsibility of engineers, architects and policy makers to make these basic needs a reality.

South Africa is a developing country, and similar to other developing countries, is faced with housing issues that appear insurmountable. According to the Department of Human Settlement [1], the backlog in housing is approximately 2.2 million homes. This figure is based on the number of households who currently live in informal settlements. These dwellings, known locally as shanties, are inferior in construction and have no services such as running water, sewage systems, roads or electricity. Ablutions are usually drawn from communal streams, which are far from sanitary. Fortunately, South Africa has been engaged in housing construction programs since 1994. The current delivery is about 100 000 homes per year, which is significant but does not keep pace with population growth (in 1994, the dearth in housing was approximately 1 million). Internationally, the housing problem is just as bleak. UN Habitat [2] has recently reported that approximately 860 million families in the world are living in slums—this is up from 725 million in the year 2000. In the UN's Global

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