DenCity: Zero Energy Lightweight Construction for Urban Densification

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KEYWORDS

Roof stacking, Vertical extension, Decision support, Timber construction,

INTRODUCTION

Due to population and economic growth, globalisation and European integration, and land price and inner city problems, rapid urbanisation and urban sprawl phenomena have occurred (EEA, 2006; Vasili, 2013). This has resulted in an increasingly large urban footprint and higher levels of CO_2 emissions. New urban agendas have promoted the development of urban spatial frameworks. These frameworks adopt an approach toward sustainable land use management based on appropriate compactness, polycentrism, and mixed use through infill development or planned extension strategies, which prevents urban sprawl and marginalisation (United Nations, 2017). Accordingly, multiple approaches are followed to achieve compactness and urban densification, such as infill development and roof extensions

AIM & OBJECTIVES

This research aims to provide a model for decision support aid to increase density in the built environment through roof stacking.

- It sets criteria to measure and map that potential in terms of location and added floors (Figure 3).
- It provides a guide line for designers and architects to choose the most suitable building configurations according to site conditions (Figure 1, 2 & 4).
- It develops a method for a multi-criteria optimization that involves energy consumption and building performance.

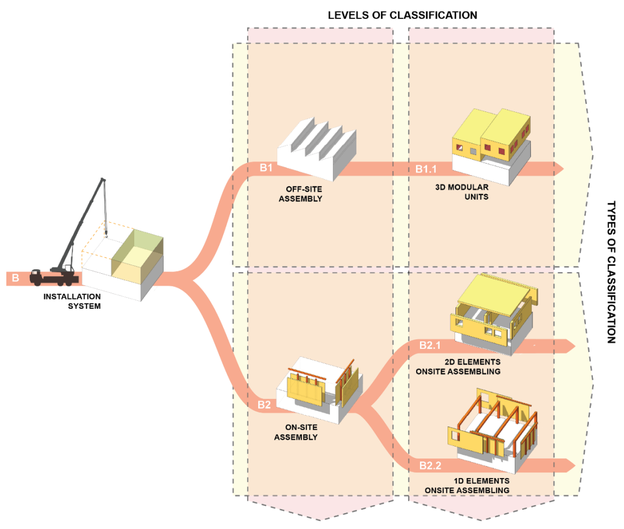

Fig.1: Roof stacking methods

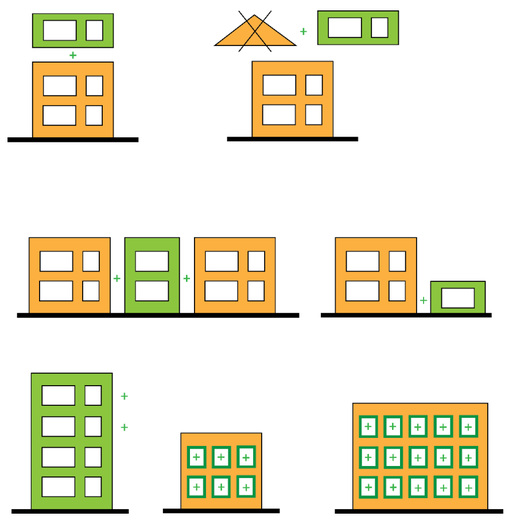

Fig.2: Densification methods

METHODOLOGY

The methodology developed in this paper aims to provide a generic approach for decision making pertaining to the roof stacking potential in European cities. Three main approaches have been followed to acquire data and model it: GIS Data for urban scale configurations, extensive survey and interviewing practitioners, and validation through design and monitoring real case study in Brussels as a proof of concept for the developed multi-criteria optimization method for roof stacking projects.

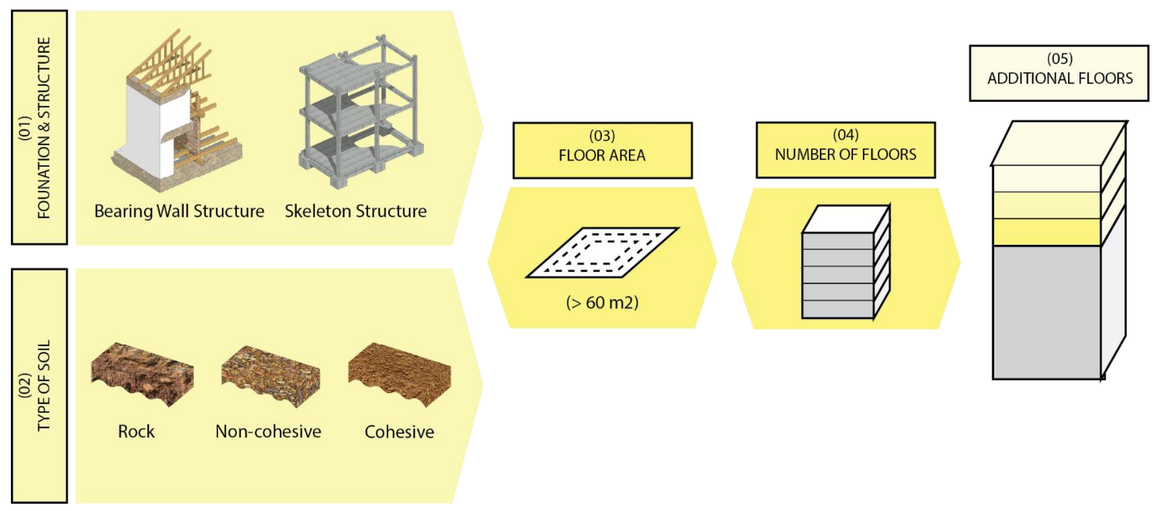

Fig.3: A map for the potential for urban densification through roof stacking

OUTCOMES

This research developed an integrated methodology for mapping and quantifying the potential for increasing urban density through roof stacking at different urban levels. This method is based on the combination of three consecutive levels of decision making for roof stacking: urban regulation, engineering, and architectural levels. This three-level approach secures the inclusion of the applied policies at the city level (top-bottom approach), technical support by specialists in the fields of urban planning, architecture, and civil engineering (intermediate level), and the participation of society (grass roots approach) in the decision making process. We strongly note the need to adapt current urban policies and regulations in a reasonable way to encourage roof stacking project and promoting its financial, social, and environmental benefits at both the individual and societal scale.

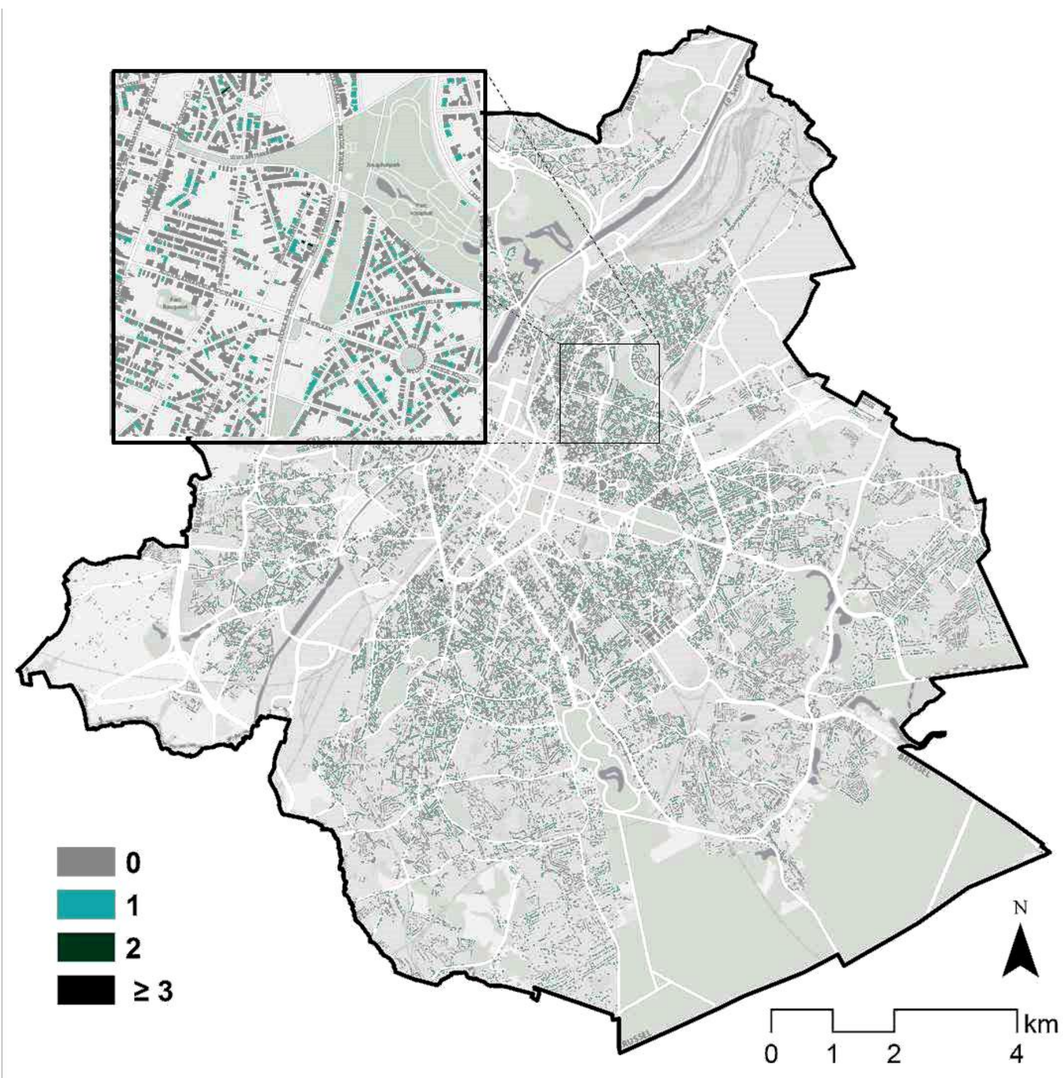

Fig.4: A map for the potential for urban densification through roof stacking

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