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Effect of Building Morphology on Energy and Structural Performance of High-Rise Office Buildings

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Abstract
The civil engineering and architectural communities are highly focused, these days, on designing buildings that maximize utilization of energy available from natural resources. This dissertation presents a quantitative study of the effect of high-rise office building morphology on energy and structural performances for the major climates. The parameters of the building morphologies are varied - the building footprint shape, the placement of the structural core/walls, and the building orientation. The energy analysis is performed using Autodesk Ecotect Analysis 2011; while using SAP2000 for the structure analysis and design. The key observations are: 1) the building morphology has a significant effect on the annual energy consumption, 2) placement of the structural core/walls in the east and west sides significantly improve the energy performance, 3) the tradeoff in the cost of placing the structural core/walls to maximize operating energy efficiency is too great, 4) for built to code buildings the energy demand may be considered marginally sensitive to changes in

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aspect ratio, and 5) high quality thermal properties of code-built envelope systems offer more flexibility to designers with regard to the building site planning without creating negative impacts on total energy demand.

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