

Tall Building Transit-Oriented Development (TB-TOD) and Energy Efficiency in Suburbia: Case Studies, Sydney, Toronto, and Washington D.C.

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Abstract : As the world continues to urbanize and suburbanize, where suburbanization associated with mass sprawl has been the dominant form of this expansion, sustainable development challenges will be more concerned. Sprawling, characterized by low density and automobile dependency, presents significant environmental issues regarding energy consumption and Co2 emissions. This paper examines the vertical expansion of suburbs integrated into mass transit nodes as a planning strategy for boosting density, intensification of land use, conversion of single family homes to multifamily dwellings or mixed use buildings and development of viable alternative transportation choices. It analyzes the spatial patterns of tall building transit-oriented development (TB-TOD) of suburban regions in Sydney (Australia), Toronto (Canada), and Washington D.C. (United States). The main objectives of this research seek to understand the effect of the new morphology of suburban tall, the physical dimensions of individual buildings and their arrangement at a larger scale with energy efficiency. This study aims to answer these questions: 1) why and how can the potential phenomenon of vertical expansion or high-rise development be integrated into suburb settings? 2) How can this phenomenon contribute to an overall denser development of suburbs? 3) Which spatial pattern or typologies/ sub-typologies of the TB-TOD model do have the greatest energy efficiency? It addresses these questions by focusing on 1) energy, heat energy demand (excluding cooling and lighting) related to design issues at two levels: macro, urban scale and micro, individual buildings—physical dimension, height, morphology, spatial pattern of tall buildings and their relationship with each other and transport infrastructure; 2) Examining TB-TOD to provide more evidence of how the model works regarding ridership. The findings of the research show that the TB-TOD model can be identified as the most appropriate spatial patterns of tall buildings in suburban settings. And among the TB-TOD typologies/ sub-typologies, compact tall building blocks can be the most energy efficient one. This model is associated with much lower energy demands in buildings at the neighborhood level as well as lower transport needs in an urban scale while detached suburban high rise or low rise suburban housing will have the lowest energy efficiency. The research methodology is based on quantitative study through applying the available literature and static data as well as mapping and visual documentations of urban regions such as Google Earth, Microsoft Bing Bird View and Streetview. It will examine each suburb within each city through the satellite imagery and explore the typologies/ sub-typologies which are morphologically distinct. The study quantifies heat energy efficiency of different spatial patterns through simulation via GIS software.

Keywords : energy efficiency, spatial pattern, suburb, tall building transit-oriented development (TB-TOD)

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