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Timber Urbanism: Assessing the Carbon Footprint of Mass-Timber, Steel, and Concrete Structural Prototypes for Peri-Urban Densification in the Hudson Valley's Urban Fringe

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Abstract : The current fossil-fuel based urbanization pattern and the estimated human population growth are increasing the environmental footprint on our planet's precious resources. To mitigate the estimated skyrocketing in greenhouse gas emissions associated with the construction of new cities and infrastructure over the next 50 years, we need a radical rethink in our approach to construction to deliver a net zero built environment. This paper assesses the carbon footprint of a mass-timber, a steel, and a concrete structural alternative for peri-urban densification in the Hudson Valley's urban fringe, along with examining the updated policy and the building code adjustments that support synergies between timber construction in city making and sustainable management of timber forests. By quantifying the carbon footprint of a structural prototype for four different material assemblies—a concrete (post-tensioned), a mass timber, a steel (composite), and a hybrid (timber/steel/concrete) assembly applicable to the three updated building typologies of the IBC 2021 (Type IV-A, Type IV-B, Type IV-C) that range between a nine to eighteen-story structure alternative—and scaling-up that structural prototype to the size of a neighborhood district, the paper presents a quantitative and a qualitative approach for a forest-based construction economy as well as a resilient and a more just supply chain framework that ensures the wellbeing of both the forest and its inhabitants.

Keywords : mass-timber innovation, concrete structure, carbon footprint, densification
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