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Total Life Cycle Cost and Life Cycle Assessment of Mass Timber Buildings in the US

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Abstract : With current worldwide trend in designs to have net-zero emission buildings to mitigate climate change, widespread use of mass timber products, such as Cross Laminated Timber (CLT), or Nail Laminated Timber (NLT) or Dowel Laminated Timber (DLT) in buildings have been proposed as one approach in reducing Greenhouse Gas (GHG) emissions. Consequentially, mass timber building designs are being adopted more and more by architectures in North America, especially for mid- to high-rise buildings where concrete and steel buildings are currently prevalent, but traditional light-frame wood buildings are not. Wood buildings and their associated wood products have tended to have lower environmental impacts than competing energy-intensive materials. It is common practice to conduct life cycle assessments (LCAs) and life cycle cost analyses on buildings with traditional structural materials like concrete and steel in the building design process. Mass timber buildings with lower environmental impacts, especially GHG emissions, can contribute to the Net Zero-emission goal for the world-building sector. However, the economic impacts from CLT mass timber buildings still vary from the life-cycle cost perspective and environmental trade-offs associated with GHG emissions. This paper quantified the Total Life Cycle Cost and cradle-to-grave GHG emissions of a pre-designed CLT mass timber building and compared it to a functionally-equivalent concrete building. The Total life cycle Eco-cost-efficiency is defined in this study and calculated to discuss the trade-offs for the net-zero emission buildings in a holistic view for both environmental and economic impacts. Mass timber used in buildings for the United States is targeted to the materials from the nation's sustainable managed forest in order to benefit both national and global environments and economies.

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