Reusing Timber for a Circular, Low-Carbon Future: Challenges and the Path Forward

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Load-bearing timber is usually not reused in a second structural application after its first service life, not due to proven inadequacy, but largely because prevailing standards recognize only first-use material. When buildings are dismantled, the recovered timber is typically routed toward energy recovery, re- or down-cycling, or disposal, while functionally equivalent components for new construction are manufactured from newly harvested logs. The current regulatory framework favors virgin timber, even where reused elements could technically perform the same structural functions. Therefore, one of the primary barriers to structural timber reuse is the absence of codified pathways for qualification, certification, and market acceptance.

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The Opportunity

The building and construction sector generates more waste than any other sector. In addition to other materials, this waste consists of a large volume of timber that is structurally sound but is not treated as a reusable structural resource. Even partial substitution of newly sawn timber with verified reused elements would yield disproportionate environmental benefits, given the high material intensity of primary wood processing. This directly interrupts the otherwise linear flow from forest to mill to waste or energy recovery.

Often only a small volume of each harvested log can be converted into structural products. Reusing timber can preserve not just material volume, but the embodied effort already invested in harvesting, transport, sawing, drying, and strength grading. Therefore, each verified reused element can offset a cascade of upstream processes that would otherwise be repeated for new supply. While the scale of these benefits varies with species, processing paths, and application, the underlying principle is that verified structural reuse of timber can reduce demand for new material and associated emissions, making reuse one of the most effective options for a circular construction value chain.

The Challenge

Reused timber presents real technical challenges. Dimensions and mechanical properties are variable, prior service conditions may be unknown, and hidden defects are possible (Derikvand and Fink 2023). However, these challenges are increasingly manageable. Advances in non-destructive testing, probabilistic grading approaches, and

selective deconstruction techniques demonstrate that structural reuse is technically feasible at scale.

The major barrier is regulatory rather than technical. Current strength-grading and product standards are explicitly written for new timber, where they rely on statistical property distributions tied to known species, growth regions, and production control. Reused timber does not fit this framework as it is often mixed in species and origin, inconsistently documented, or previously graded under outdated rules. As a result, structurally sound timber is systematically excluded from high-value structural reuse. Currently, there is no codified route for reused timber to be strength-graded and CE-marked. In the absence of such routes, reused timber faces significant barriers to circulation in mainstream markets, regardless of its demonstrated performance (Derikvand and Khoshroodi 2025). This reflects procedural constraints and until standards explicitly accommodate this, reuse will remain marginal by design.

The Path Forward

Unlocking structural timber reuse requires targeted standardization. In the short term, existing supporting standards could be adapted to recognize reused timber through defined adjustment factors, tolerance classes, and approved non-destructive testing routes. Such measures would enable qualification of reused elements within familiar regulatory structures and provide immediate pathways to market entry.

In parallel, a harmonized standard addressing strength-graded reused timber may be necessary. Without harmonization, reuse could remain fragmented, localized, and confined to low-risk or non-structural applications. Several research initiatives have already demonstrated viable grading methodologies for reused timber (Pasca *et al*. 2025). The main limiting factor is not knowledge, but codification. Integrating reused timber into strength-grading standards would place it on equal regulatory footing with new wood.

Public procurement must also evolve. Life-cycle assessment frameworks and Environmental Product Declarations should explicitly credit documented reuse to ensure that verified reuse is visible and competitive in sustainability scoring. Without such recognition, economic incentives will continue to favor primary production despite higher environmental costs.

Finally, waste and construction policy must draw a clear operational distinction between reuse, recycling or down-cycling, and energy recovery. Prioritizing reuse as a higher-value recovery route, combined with training for designers, graders, and regulators, would build the trust and traceability required for second-life structural timber applications.

From Niche to Mainstream

The structural reuse of timber has the potential to convert what is often treated as a low-value material into a reliable construction resource. Beyond carbon savings, reuse can also preserve cultural value, when timber recovered from historic buildings is re-embedded in contemporary structures.

However, reuse will not scale through advocacy alone. It requires explicit recognition in standards, procurement rules, and certification systems. Without these systems in place, by default, structurally sound timber will continue to be excluded from primary load-bearing applications regardless of its verified capacity. With new or revised systems, structural reuse of timber can move from a niche practice to a normalized component of a circular construction future.

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