Laying the foundations to safely reuse timber in Europe

Policy and standards to support the reuse, remanufacture, and recycling of structural timber

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Summary

Timber is a high-value, renewable bio-based construction material with diverse uses in construction. Its increased use in new buildings and renovation is encouraged as part of the drive towards net-zero. Unfortunately, the increasing demand for timber across many sectors is placing an increasing strain on sustainable productive forestry and accelerating forest degradation, with the conversion of primary and old-growth forests into low-biodiversity plantations. High demand also contributes to illegal trade of timber and to deforestation. These pressures undermine the vital functions of forest ecosystems for biodiversity and for people. Forests play a fundamental role in climate regulation, biodiversity preservation, water filtration, soil stability, and many other functions.

Approximately 100 million m³ of sawn wood is produced annually in the EU,[1] of which the majority is assumed to be used in construction.[2] Current research suggests that 25% of the wood from buildings with load-bearing timber structures could be technically recoverable for reuse in structural applications.[3] The reuse and recycling of timber reclaimed from buildings and structures at end-of-life offers a valuable complement to the use of primary wood, supporting the transition to a circular economy while easing the pressure on forest ecosystems. By extending the lifespan of harvested wood, the construction sector can also mitigate the embodied carbon of buildings (if transport emissions are limited), while maximising carbon storage in timber construction.

Due to its versatility and easy processing, there are already well-established reuse and recycling options for wood. However, aside from particle and fibre wood-based wood products, the framework for supporting safe use of reclaimed timber as structural construction products is far behind its potential. Non-destructive assessment methods and adapted standards can support quality assurance for reused load-bearing wood. However, many aspects are still open research questions, and there is limited experience from practice.

Structural timber reuse requires careful assessment of the condition, properties, and performance of the reclaimed construction products. It can be supported by a combination of new standards and training in specialised skills to adapt and repurpose the material effectively. Above all, building safety is paramount and the reputation of timber as a construction material requires that use of reclaimed timber for structural work is done under a robust framework with accountability. That said, it is also necessary to ensure that this framework is proportionate to the actual risk, the intended uses, and the commercial situation.

A lot of useful structural timber reuse will happen at small-scale and with relatively low risk uses and simple buildings. There are, however, certain situations where there is a market need for standards and regulation, including European harmonised standards - just as there are for new structural timber. It is especially important, as new reuse markets develop and grow, for standards to support these situations, where regulation is needed or already applies without imposing unnecessary burdens for situations where it is not.

This paper explores the opportunities from policies and standards to maximise timber reuse and recycling in structural applications as a means to enhance the environmental and economic value add of the construction sector. In particular, it explores the different forms of regulation and standards (including European harmonised standards) which can support or create unwanted barriers to achieving the goals. It does not cover the already well-established recycling route to particle and fibre-based wood panels, although it is recognised that these are important products for the circular economy, and an excellent ultimate cascade destination for reclaimed wood.

Policy recommendations to enable a framework for safe and sustainable timber reuse

There is real momentum to support structural timber reuse in Europe: researchers and industry actors are developing practical guidance and nascent standards to enhance the safe and environmentally optimal reuse of reclaimed timber components. EU policymakers must support these efforts by providing an enabling regulatory environment and encouraging international collaboration.

Clarify the framework for reuse in the implementation of the CPR

The entry into force of the new EU Construction Products Regulation (CPR) provides a new but still unclear framework for reuse and recycling of construction products. The European Commission DG GROW should provide additional guidance regarding **definitions of terms related to circular construction products**. Legal definitions such as 'used', 'remanufactured, and 'recycled' products, have different implications for the application of rules, such as record keeping, the conduct of tests and CE marking. It is essential that the new CPR does not create unnecessary barriers to circularity.
For more detail, refer to: Enabling reuse under the new Construction Products Regulation.

Build a European standardisation framework based on emerging research and ensuring synergies with national efforts

The specifics of a **standardisation request for structural timber reuse** must be carefully crafted to avoid creating unwanted impediments to the market, as inadequate harmonised standards would create requirements that induce unnecessary costs and material waste related to testing and other procedures. Research is still ongoing to set the right path for safe and sustainable timber reuse; it is important this research can progress to provide a firm foundation to guide standards development.

- For more context, refer to: Safe timber reuse requires specific new guidelines and standards

DG GROW should follow the process for a standardisation request, but with a **focus on what is currently most needed at the harmonised** level, and what can be written based on the current state of knowledge. This would set a framework to which compatible national and industry standards can be developed, and later adapted into the harmonised system if appropriate. The work should begin with updating the supporting standards, e.g. testing, so they are compatible with reclaimed timber.

- For further discussion, see: Charting the path for necessary standards

We identify several possible roles for a Europe-wide standardisation framework, achieved by revising existing supporting standards, and creating new European standards:

- Common rules regarding testing and measurement, calculation of properties, terminology, classification and limits for damage.
- Introducing a new set of strength classes for reclaimed timber, or a system of defining and naming strength classes that allows greater flexibility for reclaimed timber (including new profiles of secondary properties, and adjustment factors).
- European harmonised standards could already be developed for specific reclaimed timber products and scenarios, such as regrading of untreated strength graded sawn timber of known species, growth area and prior strength grading.
- European harmonised standards can set general requirements underpinning the further development of other standards (European, national or industry) for testing and assessment methods, such as visual grading rules for reclaimed timber.
- The EAD route can provide a valuable streamlined voluntary path to CE marking for specific products and resources that are too local/narrow, to warrant inclusion in a harmonised standard.

The new **harmonised standard(s)** can be wide in potential scope, but initially **focus on restrictions on species, prior grading, and other factors** set by clauses within the standard or by a supporting standard. As knowledge and need develops, their range of application can be widened under the same standardisation request by updating the clauses. This would allow progress in harmonised standards, and enable them to be used in situations where there is sufficient current knowledge, without them imposing barriers to new markets and smaller scale producers. Meanwhile, markets and producers would have some foresight for future standardisation.

Research and development is underway, and so far mostly focused on national and industry standards. This should be encouraged as it allows work focused on national concerns, emerging value chains, and more well-defined and realistic contexts. This work nevertheless requires **coordination to avoid discrepancies between different** approaches and embedding conflicting systems that will be difficult to integrate into European standards in future.

Standards can provide practical guidance that will help decision-making regarding testing, strength grading, and reuse applications, but they must be developed with an appropriate balance of testing requirement and conservativeness, according to the situations that reclaimed timber will be used for. **Applying the same strict requirements** as used for new timber, which may be placed on the market for critical applications, where failure could lead to serious injury, loss of life, or major economic or environmental damage, would likely be **unnecessary for most typical structural uses of reclaimed wood**. Requiring, by default, high testing and factory production control costs would restrict market development and further consolidate the market towards making lower-value products from reclaimed wood, e.g. non-structural uses and chip-based products, preventing better cascading use. Standards and regulations addressing structural timber reuse need to uphold the goal of balancing testing costs (both destructive and non-destructive) with output value and context. This may require restricting use in the harmonised standard, but is more usefully achieved via more conservative declaration of properties.

In summary, new European standards, harmonised or not, should meet the following requirements:

- **Support cascading use and higher-value reuse** by enabling the safe reuse of timber in structural applications, avoiding premature conversion to chip and fibre-based products.
- **Avoid unnecessary barriers to market development** by ensuring testing and certification requirements are proportionate to the actual risk and intended use of the reclaimed timber.
- **Minimise reliance on destructive testing** to reduce material losses and costs, wherever feasible.
- **Provide clear and practical guidance** for low-cost, accessible approaches to assessment, e.g. through visual inspection methods and minimally complex testing.
- **Build on existing systems** by adapting or extending established methods, such as visual grading rules, rather than creating entirely new systems that would require retraining.
- **Ensure sufficient reliability in strength grading** for structural applications where safety is critical, without defaulting to the stringent requirements used for new timber in high-risk applications.
- **Encourage compatibility and coherence** with emerging national and industry standards, to enable their future integration into harmonised European standards.
- **Enable flexible application of harmonised standards** by using restrictions, e.g. on species, prior grading or product type, within the standards, allowing them to evolve as knowledge and experience grow.

Support testing research and creation of standard measurements and databases of test results that can be shared across projects.

Testing reclaimed timber is often expensive and time-consuming, especially when projects work in isolation and use different methods. By **sharing data**, the too small **databases within individual projects can be enhanced to a more useful level**, and costs of repeated testing can be avoided. A shared data infrastructure would help avoid repeated testing, increase confidence in safe reuse practices, and accelerate the development of relevant standards.

To enable this, European and national initiatives should support the creation of **standardised recording methods** for visual features such as knots and damage, as well as **harmonised protocols for non-destructive testing.** Funding should also be directed towards knowledge exchange networks that bring researchers and industry stakeholders together. Mobility grants for joint workshops, training, and short exchanges would strengthen cooperation and ensure practical relevance and uptake of research across Europe.

Create an enabling wider policy framework for circularity in construction

A real transition towards circular construction requires a wider policy shift, with a clear hierarchy that prioritises **maintaining existing buildings**, **reusing building components**, and **recycling materials**. This requires strong alignment across economic, regulatory, and procurement instruments.

A key objective should be to create supportive policy frameworks and targeted incentives to help develop nascent markets for reclaimed construction timber. **Pre-demolition audits** should be mandatory, as is already the case in Denmark,4 Austria,5 and the Belgian province of Flanders.[6] This measure can help mainstream the assessment of available materials and elements for reuse or recycling in buildings slated for deconstruction and thereby increasing the supply of secondary resources. **Green public procurement** should reward the use of non-virgin materials in public projects, and **financial incentives** such as tax rebates, reduced VAT, and improved insurance or loan conditions can help shift business models towards reuse. At the same time, **subsidies for wood incineration should be phased out**.

For new buildings, policy should promote **design for disassembly** and the use of **digital product passports** to support future circularity. **Extended producer responsibility** schemes for construction products can also help align incentives. Finally, **investment support** is needed for production facilities that can process both reclaimed and new timber, including those developing glued-laminated wood products.

Introduction

The EU construction sector counts for 50% of all material extraction and 35% of all waste generated. and of greenhouse gas emissions from materials. Embodied emissions from buildings, which relate to the emissions stemming from the extraction of materials, manufacturing of construction products and assembly of buildings represent up to 12% of total national GHG emissions.[7] Building structures are the most impactful elements of constructions in terms of mass and embodied emissions, notably due to the energy intensity of related industries, in particular steel and concrete.[8] Timber has been identified as a lower-impact material than traditional concrete and steel structures. However, timber demand is soaring and supply is limited.[9] Forests are under pressure from climate change impacts, pests and pathogens, and cannot sustain ever increasing harvests.

The transition to a circular and regenerative bioeconomy is a matter of environmental and social health as much as economic competitiveness for Europe. Building structures' lifespans can be enhanced with good maintenance, renovation, and refurbishment, delaying the time when deconstruction takes place. When structures are eventually deconstructed, new uses can be found for structural elements.

When it comes to timber structures, particular care is needed to ensure that wood components are properly dismantled, appropriately stored, and that they can be safely and profitably reused in new constructions. Decisions for structural reuse need to be taken given specific project circumstances, favouring local and safe reuse solutions. Structural reuse remains a powerful solution for circularity and cascading use of timber, and there is a real industry demand for a framework to support structural reuse which meets these criteria.

A new generation of technical standards can offer solutions if developed carefully, in line with industry needs, and supported by research and legislation. Standards for structural timber support the industry in ensuring building safety and other basic requirements,[10] while also facilitating trade. While standards can remove barriers and provide opportunities, they might also introduce barriers to the development of new markets. This paper explores how European standards could be developed to support structural timber reuse.

Context, opportunities, challenges of timber reuse

Structural timber reuse answers multiple environmental objectives

Timber reuse and recycling in structures is the highest cascading use of wood biomass - it can significantly lengthen wood products' lifespan and reduce the use of primary materials. Structural timber components, e.g. sawn timber posts and beams, glue-laminated timber assemblies, and modules can last decades or centuries, and they can be extracted from existing buildings during deconstruction. The timber component can sometimes be reused just as it is, but it may also need to be processed, remanufactured, or recycled into a new product to fit the same or different function.

The demand for harvested wood products is projected to increase in the coming decades beyond levels that are sustainable for forest ecosystems to continue providing essential ecosystem functions.[11] Only a reduction in virgin wood demand across sectors can ensure the achievement of EU land-related emission targets. By reusing or recycling timber to reduce sourcing primary timber from forest harvests, circular timber construction projects can contribute to:

- Enhancing forest ecosystems, including their biodiversity, health and resilience.
- Avoiding the greenhouse gas emissions of intensive forestry operations (including soil disturbances).
- Delaying the release of greenhouse gases from incineration or decomposition of timber products.

There is a large and untapped **opportunity to reduce demand for primary timber** by enabling the recovery and requalification of structural timber elements at end-of-life. Approximately 100 million m³ of sawn wood is produced annually in the EU,[12] of which the majority is assumed to be used in construction.[i] Current research suggests that 25% of the wood from buildings with load-bearing timber structures could be technically recoverable for reuse in structural applications, especially where damage-free testing methods and adapted standards can support quality assurance for reused load-bearing wood.[13] For specific buildings the reuse potential can be 80% or more.[14]

In the EU, **most wood reaching end-of-life is incinerated for energy, often after a single-use phase.**[15] Even a modest diversion of wood from incineration towards structural reuse, supported by better sorting, classification, and damage assessment technologies, could **support reducing the ecological footprint of the construction sector**. This shift would not only enhance resource efficiency but also help meet circular economy goals and reduce reliance on virgin timber in a context of increasing demand and pressure on forests.

Timber circularity can complement strategies to protect primary and old-growth forests. Primary and old-growth forests are still not adequately identified and protected in many EU countries despite the clear mandate from the EU Biodiversity Strategy for 2030[16] to ensure their strict protection and repeated calls from scientists and civil society.[17] There is evidence that these ecosystems are being logged in European countries where few primary and old-growth forests still exist.[18] [19]

Timber sourcing traceability and the credibility of claims remains a major issue in the European market, which still imports illegal wood with false claims on origin. Although Russian timber is sanctioned in the EU, an analysis of timber imports showed that **up to 50% of the timber claimed to originate from EU Member States was found to be illegal**.[20]

These continuing and **major threats to timber market sustainability** require the rapid implementation of the EU Deforestation Regulation.

Safe timber reuse requires specific new guidelines and standards

Current standards for timber products and structures are designed for new timber and cannot be viably adapted to cover also used timber (see Annex I - List of barriers in current standards). For this reason, strength grading and product manufacture with reclaimed timber requires new standards. Structural reuse of reclaimed timber must ensure safety of use in the new structure, which can be supported by standards at various levels from national voluntary guides to mandatory European harmonised standards.

As with all construction products, timber is exposed to processes during construction, service and deconstruction, that can alter its properties and performance. These include environmental conditions, such as moisture, temperature and UV radiation, and mechanical actions such as creep, duration of load effect, and fracture, as explained in Box 1 below. While there are some specific situations in which it is **safe to apply the current standards on reclaimed timber** (such as re-applying visual grading to undamaged reclaimed timber as if it was new timber) **these circumstances need to be specified in reuse standards.** There must also be no risk of confusion in markets and users between formally strength graded timber, and timber with informal grading intended only for low risk uses.

i According to the European Commission, approximately 70% of the wood (including sawn wood and wood-based panels) in the EU is used in construction and furnishings. See

Box 1 Assessing the suitability of reclaimed timber for structural reuse

Because timber is a natural and organic material, environmental exposure and mechanical stresses during use tend to introduce greater variability in its condition, compared to other common construction materials. This variability does not, however, preclude its reuse or recycling. Assessing reclaimed timber differs from new timber and must be adapted to capture key factors, such as:

- Prolonged exposure to mechanical stresses, including duration of load effects and creep, can lead to microstructural changes in timber that reduce load-bearing capacity. These changes must be accounted for when assessing suitability for reuse.
- Reclaimed timber may have been subjected to fluctuating humidity levels, leading to cycles of swelling and shrinkage. This can cause internal stresses, cracks, or warping, and may affect strength and dimensional stability.
- Infestation or degradation caused by insects or fungi, especially in high moisture or poor ventilation conditions; common in buildings with reduced occupancy approaching end-of-life. Assessment must include screening for biological damage to ensure safe reuse and avoid spread.
- Species and growth area may not be known, and may also be more mixed than for new timber.
- Old timber may be different from modern timber because it was grown under different conditions.

In addition, the way timber is used brings consequences for reuse:

- Different shapes and sizes of timber not typically found on modern standardised markets, possibly challenging testing procedures. Reclaimed timber may outright fail to meet minimum requirements of current standards for new timber despite being reusable in practice – perhaps even because of desirable features, such as large wane on visually appealing old beams.
- Testing the mechanical properties of timber often involves destructive tests that induce a loss of the material Destructive testing will diminish an already limited supply of reclaimed wood and should therefore be minimised.
- Residual fasteners such as nails and screws, or the holes and local damage left behind, can reduce strength, especially in tension zones, and may complicate mechanical testing or structural integration in a new application.
- Previous treatments, including paints, preservatives, fire retardants, as well as residual adhesives, can interfere with strength grading, gluing, mechanical joining, or present health and safety concerns.
- Old timber structural elements might not be compatible with modern standards, such as the use of certain adhesives, and fastener spacing.
- Lack of homogeneity and uncertain statistical distribution of the reclaimed timber population due to possible prior grading, sorting, and resource mixing.

The development of **standards for assessing reclaimed timber** has already started, and research projects are pressing the field ahead towards **pragmatic solutions to support safe reuse.** A few of these national research projects and standards are discussed in Annex II – Review of research and national standards that prepare the ground for harmonised reuse approaches.

Harmonised standards and smart regulatory and standardisation frameworks can emerge from national efforts, so that laws and standards support the market in **optimising reclaimed timber** utilisation in structural applications, maximising environmental benefits, safety, and market potential.

Assessment and classification costs must be optimised to mitigate material losses from destructive testing as well as costs related to data collection and processing. **High testing costs are a real barrier to reuse**: they can drive the use of cheaper primary timber products or even non-timber materials, as

well as lead reclaimed timber markets towards the lower steps of the cascade, such as chipping for use in wood-based panels, or for incineration and energy recovery. The reuse or recycling of structural timber in non-structural applications, e.g. making benches from large beams or decorative elements cut from structurally sound wood in spite of high structural potential, is another undesirable outcome. Non-structural use of reclaimed timber can be sensible when environmental and safety risks exceed the benefits of structural reuse,[21] or the climate impacts of transport do not justify structural reuse.

Enabling reuse with the new Construction Products Regulation

This section outlines how **the revised Construction Products Regulation (CPR) affects the development and use of standards**, particularly in relation to reclaimed timber. It highlights the possible legal pathways, points out the lack of clarity in the legal terminology, and identifies opportunities and challenges in aligning standardisation with circular construction goals.

The newly revised Construction Products Regulation (CPR),[22] which entered into force in January 2025, opens possibilities for mainstreaming the sustainability of construction products. For the first time, EU construction products legislation explicitly includes environmental and circularity aspects alongside safety and performance requirements. This creates a legal basis for setting harmonised rules on topics such as durability, reuse, recyclability, and the use of secondary materials. If implemented ambitiously, the revised CPR can help steer the market towards more sustainable products and practices while supporting innovation and creating a more level playing field across Europe.

To understand how reclaimed or reused construction products might be brought to market under the CPR, it is necessary to understand **how the regulation interacts with standards and national legislation.** There are four routes under which a product may be placed on the EU market:

1. Compulsory CE marking via a harmonised European standard.
2. Voluntary CE marking via a European technical assessment (ETA).
3. Mutual recognition (no CE marking).
4. An Article 14 exemption from the Construction Products Regulation (no CE marking).

When a harmonised standard exists for a product, route (1) is mandatory, unless one of the Article 14 exemptions applies. These exemptions are limited to products made for a specific construction project or for use in heritage restoration. In such cases, CE marking is not legally required, but in practice, national authorities or clients may still expect the harmonised standard to be followed.
This regulatory context has important implications for reclaimed timber. Further clarification and guidance will be essential to avoid unnecessary barriers to reuse and to ensure that sustainability objectives can be met without compromising safety.

Many European standards indirectly become compulsory through their reference in harmonised standards. Supporting standards are generally considered voluntary, but when referenced by harmonised standards, they are effectively made part of the required compliance pathway. Even when not legally binding, these supporting standards often shape market expectations and practise, making them difficult to avoid in reality.

A major update of both harmonised and supporting standards is required to implement the revised CPR. To coordinate this, the European Commission's DG GROW has initiated the CPR Acquis process, bringing together an expert group to identify the necessary updates. This process will lead to the development of new specifications and standardisation requests, which will be contracts for CEN (replacing the old "mandates"). The actual drafting will then take place within CEN technical committees, with opportunities for public input during the enquiry phase.

New standards will require a strong evidence base, and the reuse of structural timber is a particularly challenging case. Given that harmonised standards are legal requirements for products they cover, it is essential that they are aligned with market needs and do not create unnecessary barriers to innovation or uptake. Yet these standards are slow to revise and hard to adapt once published. In this context, poor initial drafting can lock in unhelpful requirements for years.

For reclaimed timber in structural applications, well-conceived **harmonised standards could greatly help build confidence and market uptake**, but only if they are grounded in sound research and clear understanding of the product's behaviour and risks.

Time is a critical factor. The European Commission has set a tight deadline of 18 months for the preparation of new and revised standards aligned with the CPR, leaving little room for extensive research or corrections following public comment. If harmonised standards for structural reuse of timber are to be developed, the relevant standardisation request will need to be issued by 2026. Missing this window could delay progress for many years, depending on when the next round of requests becomes possible. Targeted research should be prioritised now, both to support timely development of standards and to inform practical and policy decisions in the longer term.

The revised CPR introduces definitions that diverge from terminology more commonly used in practice; something which may lead to confusion among stakeholders. For example, what qualifies as a reused or remanufactured product differs from typical engineering interpretations, particularly when it comes to materials like timber that are transformed through relatively minor processes (see Box 2 below for details). Given these discrepancies, it is essential that the European Commission provides clear and accessible guidance on the legal interpretation of CPR terminology. This will help ensure that standards developers, manufacturers, and regulators apply the regulation consistently and correctly across Europe.

Box 2 Interpreting the consequences of the new CPR for reclaimed timber.

Some of the difference in terminology between the CPR and common uses stems from the differences between timber and man-made engineering materials. A used construction product is one that has not undergone any transformative process that changed its essential requirements. Reuse can follow processes like checking, cleaning, and repairing, but planing would go beyond this limit since it changes the cross-section size. The application of a new strength grading process to reclaimed wood would change its new properties (or the same ones applied anew), and therefore fit under the definition of remanufacturing, or perhaps even recycling. A new strength grading step is likely essential in most cases since wood properties can change in service.

Charting the path for necessary standards

What changes are needed in standards?

This section focuses specifically on **standards related to strength grading of reclaimed timber**, and **standards related to product manufacture from reclaimed timber**.[ii] In addition to the standards related to in-situ condition assessment, disassembly and direct reuse, this requires standards parallel to the current system for new timber, which in relation to sawn timber-based products, are:

- **EN 14081-1** *Timber structures - Strength graded structural timber with rectangular cross section.*
- **EN 15497** *Structural finger jointed solid timber.*
- **EN 14080** Timber structures - *Glued laminated timber and glued solid timber.*
- **EN 16351** *Timber structures - Cross laminated timber*, and **EAD 130005-00-0304** which serves as the current route to CE marking.

These are the most relevant standards to reuse and recycling of structural timber, excluding downcycling to chip and fibre-based products.[iii] This current system for new timber is being updated also under the CPR Acquis process described in the previous section, and some likely aspects of that revision will have benefit also for reclaimed timber. These aspects include strength grading of roundwood, rectangular timber with large wanes, profiled products such as structural decking boards, and more scope for hardwoods in glued laminated products. Additionally, there is need to develop a hybrid approach of visual and machine strength grading now that more sophisticated machine measurements are available for strength grading under the control of a trained visual grader. The situation for reclaimed timber is sufficiently different (see Box 1) that it will be necessary to create dedicated standards parallel to the ones listed above, but these could still refer to parts of the standards for new timber, so long as they are revised with this possibility in mind.

Supporting standards are needed to **establish common rules on reclaimed timber** for testing and non-destructive measurement, calculation of properties, terminology, classification and limits for damage, and special strength classes. These aspects could be incorporated into existing supporting standards:

- **EN 336** ***Structural timber*** *- Sizes, permitted deviations,* can be revised with new tolerance classes more suited to reclaimed timber.
- **EN 338 Structural timber** - *Strength classes* and **EN 384 Structural timber** - *Determination of characteristic values of mechanical properties and density,* can be revised to incorporate new strength classes, secondary properties profiles and adjustment factors for reclaimed timber.
- **EN 408** ***Timber structures*** *- Structural timber and glued laminated timber - Determination of some physical and mechanical properties* can be revised to give destructive testing rules suitable for the shorter lengths of reclaimed timber, and new rules for non-destructive measurement such as dynamic modulus of elasticity from acoustic time of flight or resonance.
- **EN 14358** ***Timber structures*** *- Calculation and verification of characteristic values* may also need to be updated to provide more strictly non-parametric calculation methods, to deal with the greater variability and inconsistency of reclaimed timber.

Updating these supporting standards needs to be done in the first phase of revision, as they will not be easy to update once the new generation of harmonised standards is published (due to the need for constantly up-to-date dated references), even if there are no harmonised standards for reclaimed timber.

[ii] Standards are also needed for upstream strategies, e.g. "design for disassembly" (DfD), but the focus here is downstream design actions after disassembly.
[iii] This is not an exhaustive list as there are numerous other types of timber products and components.

What level of standardisation is really needed?

Timber reuse occurs in a diversity of situations, mainly differing according to the **pathway to market** and the **product type** at hand. These two dimensions will in turn impact the necessary **level of standardisation.**[iv] In this section we develop a rationale for different levels of standardisation, and argue for a harmonised standard.

If there were only **local markets, direct relationships and special purpose products**, standards set at national level, or by industry directly, would be appropriate. These could be kept relatively simple in application and optimised for localised interests.

By contrast, **more general uses and cross-border markets** would require European-level standards. For **relatively small volume markets and special use products**, this could operate on the basis of mutual recognition, without CE marking, for which non-harmonised European standards would provide a voluntary basis. As with strength grading of new timber, these European standards could be supported by compatible national and industry standards that are adapted to local resources and markets.

It is likely, however, that **many markets will expect CE marking**, which requires either the voluntary route through European Assessment Document (EAD or compulsory CE marking via one or more harmonised European standards. The EAD route is more appropriate for **small volume markets and when there are only a few producers**. Even with the EAD and harmonised standards routes, there would need to be supporting standards at the normal European standard level, and perhaps also compatible national and industry standards.

The viable choices of standardisation level for reused timber therefore falls into three main options:

1. Reclaimed structural timber products are handled only by European, national, and industry standards, outside of the CE marking system, but specific kinds of products covered by voluntary EADs, as required.
2. Harmonised European standards are aimed for in the future, but only once a system of non-harmonised European standards, national, and industry standards is developed and experience has been gained in practice. Specific types of products can be covered by voluntary EADs as required.
3. Harmonised European standards are created as soon as possible, but initially only sets general overarching principles, and common methods, for national and industry standards; giving space for optimisation to localised markets. The applicability of the harmonised standards is initially very limited by current knowledge and market needs. This allows time for new markets and economic operators to grow, but there remains still the option of voluntary EADs for specific kinds of products, outside of what the harmonised standards cover, for manufacturers that need CE marking.

A harmonised standard (3) would strongly emphasise **the importance of the circular economy for timber construction.** Without a harmonised standard, timber risks being left behind by other non-renewable materials. Nevertheless, proceeding with including one or more harmonised standards for reclaimed structural timber in the current standardisation request needs to be decided with due consideration of the pros and cons (read Annex IV – Reviewing the pros and cons of harmonised standards for timber reuse for a detailed discussion).

[iv] For a detailed overview of the three dimensions, see Annex III – Market pathways, product types, and standardisation level.

Committing to having harmonised standards, and deciding what they should cover, needs to involve all stakeholders: policymakers, standards writers, researchers active in this field, safety regulators and crucially, actors from the value chain from reclamation to end users.

While current knowledge and experience may not yet support the creation of **fully comprehensive harmonised standards for reused structural timber**, there is a solid foundation on which to build a framework. The process for developing harmonised standards would make it possible to mobilise expertise from across Europe, something which is not feasible for national or industry standards alone, or even through European Assessment Documents (EADs). It would help ensure that building safety is properly addressed and that the reputation of structural timber is not undermined by poor practice in the reuse sector. Moreover, it could serve as a focal point for guiding future national developments and research, offering a clear route to impact for recent and ongoing European projects in this field.

What is the best scope for the first harmonised standard for reclaimed structural timber?

The first harmonised standard for reclaimed structural timber should focus on strength-graded sawn structural timber. This represents a pragmatic starting point, as such elements are common in reclaimed timber flows and relatively simple to assess. The new standard would mirror the role of EN 14081-1 for new timber, operating in parallel and referring to many of the same supporting standards.

The characteristics declared for strength graded reclaimed timber need to cover the same list of properties, expressed in the same ways**.** Reclaimed timber would not need to have identical performance to new timber, but performance would be quantified in the same way to ensure compatibility with design codes and building regulations. However, the basis by which those properties are calculated and assured would need to differ to account for the differences between new and reclaimed timber (see Box 1).

Compatibility with design codes may mean that more conservative material partial safety factors for reclaimed timber are embedded into the declared values - so that design can be done without necessarily knowing if the timber will be new or reclaimed, or by which method it was strength graded.[v]

A new harmonised standard would need to be relatively restricted in application at first and given current limitations in practical experience and scientific knowledge, the diversity of the reclaimed timber resource, and the compressed timescale for developing the standard. It would need to focus on the situations that current knowledge can support, and that are also commercially most relevant in the near future. This approach ensures that the introduction of a harmonised standard does not unintentionally exclude smaller operators or stifle newly developing markets. As knowledge advances and markets mature, the scope of application can be expanded within the framework of the same standardisation request. Having a waypoint harmonised standard in place, albeit initially limited, can help **guide national standardisation efforts towards a common goal**, focus relevant research, and give foresight to economic operators.

Limiting the application of a harmonised standard by restrictions that are not fundamentally part of the scope is not unusual. For instance, the standards for structural finger jointed timber, glulam and cross-laminated timber are restricted to certain specific species for reasons to do with the state of knowledge.

[v] Similarly to how the system for new timber deals with the difference between visual and machine grading.

An initially restricted **harmonised standard for strength graded reclaimed timber** could be limited to:

- Timber that has been previously strength graded to EN 14081-1, or a recent standard that can be mapped to it.
- For which the grading history is fully known (including method and grade combinations)
- With no subsequent sorting that might have affected the safety of the previous grading.
- Which has no major damages or deteriorations that cannot be accounted for.
- With no treatments other than preservative against biological attack, details of treatment known.

It could also be restricted to specific sources of reclaimed timber, such as:

- Timber used in construction (part of the building or temporary works).
- Excess construction timber, returned from site.
- New or used timber that has been processed beyond the size change limit and lost original grading validity.

The standard might also give rules for strength grading reclaimed timber in good condition, that was not previously strength graded, and is of known species and growth area. The standard might also be able to cover new timber for which EN 14081-1 is not appropriate, for example small batch of atypical species or growth conditions for which there is some information about properties, but not enough to enable visual or machine grading.
Such a standard could contain clauses covering:

- The information requirement regarding prior grading, species and growth area.
- Checking for damage and deterioration.
- For visual strength grading, clarification of reapplication of visual strength grading rules.
- For machine strength grading, how to account for previous strength grading and treatment.
- Confirmation of density and stiffness via NDT measurement.
- Confirmation of strength by proof testing or destructive testing of a sample.
- Adjustment factors for prior use, e.g. duration of load.
- Rules enabling more conservative declaration of properties, according to restricted lower consequence uses, and how include information about restricted uses in the documentation.
- Rules for declaring a subset of properties if there is a specific end-use, that needs only that subset.
- Rules for the competency and qualifications of persons involved in the strength grading, record keeping, and other aspects of the factory production control.
- Rules on ensuring disassembly, storage, cleaning, reprocessing and repairing do not degrade the timber.
- Requirements for national standards that contain the grading rules (similar to how EN 14081-1 sets high level requirements for visual grading rules), which are mostly published as national standards optimised for the local resources and markets.

Developing strength classes for reclaimed wood

The essential characteristics for structural timber design include various types of strength, stiffness and density. These are usually declared with reference to industry familiar sets of levels known as “strength classes”. Despite the name, these are not classes in the definition of the CPR, as **they are not mandatory requirements but rather designation codes**.

For new timber, most, but not all, are listed in EN 338. These strength classes generally fit well to mainstream, long-established, timber species, but it is usually only one of the three primary properties (strength, stiffness and density) that limits the strength grading.
Their convenience for general trade outweighs the problem that, for some timber resources, the declared properties are much lower than the actual properties. For example, when limited by density, the actual strength of the timber might be significantly higher than the design value.

When convenience of general trade is not so desired, user defined strength classes have been created that are better fitted to the properties of the particular resource. **This flexibility of strength classes will also be vital for reused timber.**

Because reclaimed timber will most likely need to be more conservative in its strength assessment, the ratios of strength, stiffness and density will be different. **This is one argument for creating a new set of strength classes for reclaimed timber, or a system of defining and naming classes that allows still greater flexibility to work better for local resources.** There are also several other 'secondary' design properties based on the three grade determining properties of strength, stiffness and density. Likely there will also need to be at least one new secondary properties profile for use with reclaimed wood, with more conservative values for some of the properties.

New timber is strength graded almost entirely on the basis of either major axis bending or tension strength, but the system already has more flexibility for specific uses, which may offer advantages for structural use of reclaimed wood strength graded for specific product types, such as compression members, (such as posts) and minor axis bending members, e.g. structural flooring. This aspect of the current framework can be made use of with relatively little adjustment.

Strength classes are not everything since **reaction and resistance to fire** also depends on species type, and can potentially be affected by reclaimed timber aspects such as holes and aging. This is one aspect that needs more research, and until the results are available there will need to be some restrictions on the cautious side.

Biological durability and preservative treatment can be declared (as for new timber), provided they can be identified.

Annex I - List of barriers in current standards

Standard and relevant part(s)	Barriers to reuse
EN 14081 all parts	The harmonised standard for strength graded timber requires known species and growth area. These are often difficult, or impossible, to know for reclaimed timber. The reason they need to be known is fundamental to the way the standard works.
EN 14081-1:2016 Cl 5.1.1	The harmonised standard for strength graded timber does not allow regrading unless the effect of the original grading is accounted for. It is not explained how to do this. In many cases reclaimed wood will have been graded previously, but the exact nature of that grading is likely not knowable. The reason why previous grading needs to be accounted for is fundamental to the way the standard works.
EN 14081 All parts	The harmonised standard for strength graded timber has separate frameworks for visual strength grading and machine strength grading. While visual strength grading can include machine made measurements, such as density, it is unclear how to frame strength grading that works with the visual part and machine part both having a high level of influence. This hybrid combination of visual and machine is often put forward as the most appropriate way forward for reclaimed timber.
EN 14081-1 Scope	The harmonised standard for strength graded timber does not allow grading of treated timber (other than by preservative against biological attack). Some kinds of reclaimed wood will have been treated with, for example, fire treatments. The concern is that these treatments could potentially affect wood properties. Even in the case of preservative treatment this is usually done after the strength grading and presence of preservative during grading can affect some kinds of strength grading process.
EN 14081-1 scope, Table 1 and Annex A	The harmonised standard for graded timber is only for uniform rectangular cross-section and has quite strict limits on wane. These are too restrictive for some markets for reclaimed timber. Limits on distortion and fissures are also likely to be too restrictive.
EN 1995-1-1:2014+A2:2014 Cl 3.2	EN 1995 requires timber strength graded to EN 14081-1
EN 1995 and supporting standards	Design to Eurocode has no clear rules about how to deal with duration of load effects arising from previous use so these adjustments would need to be incorporated into the grading standards and declaration of performance..
EN 16351 Scope	EN 16351 for CLT says reused wood is not allowed (does not say why)
	EN 16351 for CLT requires strength grading to EN 14081-1
EN14080:2013 Cl 5.1.2	EN 14080 for glulam requires strength grading to EN 14081-1
EN15497:2014 Cl 5.1.2	EN 15497 for finger jointing structural timber requires timber strength graded to EN 14081-1
EN 14080:2013 Cl 5.5.2 EN 16351:2021 Cl 4.1.3.1 EN 15497:2014 Cl 5.2.2	EN 14080, EN 16351 and EN 15497 have restrictions on the species that can be used, and the ways in which they can be mixed. For reclaimed wood, species may not be identifiable with sufficient confidence.
EN 336:2013	EN 14081-1 scope refers to EN 336, which contains rules for permitted cross-section deviations (tolerance class) that are probably not appropriate for many kinds of reclaimed wood.
EN 384 and EN 408	EN 384 and EN 408 have requirements about testing that may not be possible to meet for reclaimed wood due to it commonly having shorter lengths.
EN 384 Cl 5.4	There is insufficient research data to confirm that the adjustment equations in EN 384 for moisture content and modulus of elasticity are suitable for reclaimed wood.
EN 338 and EN 384	The standard strength classes in EN 338 have properties profiles that likely do not match well to reclaimed wood, due to the need to be more conservative about the strength assessment than the stiffness and density. The system allows use of “user-defined” strength classes but there is lack of research data to confirm that the secondary properties equations in EN 384 are suitable for reclaimed wood. There are also potential concerns about other properties, such as brittleness.

Annex II – Review of research and national standards that prepare the ground for harmonised reuse approaches

The Forest and Wood products Australia developed an industry-owned draft standard on **Recycled Timber - Visually Stress Graded Recycled Timber for Structural Purposes**[23] which went to public comment in 2024, and is based on research underway since 2007.[24] The draft standard presents, in a simple manner, the variable characteristics which can be visually assessed in reclaimed timber and how to ensure product performance for structural reuse applications. The standard thus provides guidelines on how to assess its condition and determine adequate use of the reclaimed timber accordingly. This was written for the Australian market and is tailored to their timber and building practice, but the basic approach could be adapted for the European system.

The **NS 3691 series** ***Evaluation of Recycled Wood***[25] is a set of Norwegian standards developed by Standard Norge and the SirkTRE project[26] to support the evaluation and reuse of reclaimed timber in construction. The standard series is particularly relevant for assessing timber reclaimed from Norwegian demolition or renovation projects, ensuring that reclaimed wood can be safely and effectively reintegrated into new building applications. The standard series is currently composed of three parts:

NS 3691-1: Evaluation of Reclaimed Timber – Part 1: Terminology and General Rules

- Establishes standardised terminology and general provisions for evaluating reclaimed wood intended for reuse, whether as solid wood components or as raw material for wood-based products.

NS 3691-2: Evaluation of Reclaimed Timber – Part 2: Purity

- Outlines procedures for identifying and evaluating impurities in reclaimed wood, such as nails, screws, adhesives, and surface treatments. It can help determine the suitability of reclaimed timber for various applications.

NS 3691-3: Evaluation of Reclaimed Timber – Part 3: Visual Strength Sorting

- Provides guidelines for visually assessing the structural integrity and strength of reclaimed timber beams and elements, facilitating the classification of reclaimed timber based on visual indicators.

There are plans for additional parts covering further topics including competency. NS 3691-3 provides rules for the visual strength grading re-evaluation of reclaimed Nordic and Baltic grown spruce (*Picea abies*) and pine (*Pinus sylvestris*) timber within Norway. It introduces a new set of strength classes for recycled timber, “R-classes”, with reduced strength when the reuse-related defects (such as notches and mechanical damage) are beyond certain limits. In its current form, there is no adjustment for duration of load.

This standard is adapted to the Norwegian situation where a relatively homogeneous timber resource has been used (in terms of species and growth area) and with a long-standing history of strength grading practice with few changes over the years. This is not the case for much of Europe, and so the Norwegian approach is not readily transferable to other countries. However it could be adapted for a specific set of the most mainstream species with a wider geographical range. The use of special strength classes for reclaimed timber is a useful approach that can be further developed

The StructuralReuse project led by the Danish Technical University is developing a set of ***Guidelines for reuse assessment of structural timber components***. The guidelines will be published as a national Danish standard and will form part of national efforts to develop guidance adapted to new Danish rules which require building demolition audits since July 2024.

The rules stipulate that buildings over 250 square meters slated for demolition undergo a pre-demolition audit, involving a comprehensive assessment of the materials present in the structure and identifying those suitable for reuse or recycling.[27]

In February 2025, researchers from the Karlsruhe Institute of Technology published a detailed study on the ***Preparation for the reuse of certain wood and steel construction products***, with a focus on load-bearing elements.[28] The study finds that visual grading methods used for new timber can also apply to reclaimed timber, provided it is undamaged. This aligns with the above mentioned Norwegian standard NS3691. The study concludes that prior load history has minimal impact on timber's structural performance, though it recommends a reduction in assessed strength for permanent loads depending on first use duration.

For indefinite reuse the reduction factors take inspiration from the Australian Standard. For non-permanent loads, damage accumulation is considered negligible, but they do also encourage reuse scenarios suitable for reduced shear strength, and tensile strength perpendicular to grain. The study introduces minimally invasive procedures for reclassifying and reprocessing reused components and provides guidelines for their safe structural reuse. For instance, it addresses glulam reuse, offering methods to assess its properties depending on the known history of the element. These include recommendations for adapted design rules and structured procedures based on pre-demolition inventories and limited testing or processing. They advocate for limited destructive testing, focusing on those pieces considered weakest.

Ongoing and new international research projects, such as Ti-ReX[29] are starting to combine national test programmes for reclaimed wood into large enough datasets to make meaningful progress at European scale, with the intended goal of providing a basis for European level standardisation.[30]

Annex III – Market pathways, product types, and standardisation level

The appropriate type and level of standardisation for reclaimed structural timber depends on:

1. Market pathway dimension

How the reclaimed timber is reused or traded, and the regulatory complexity that follows. As market pathways expand in scale and scope, the need for formal and widely recognised standards increases.

- Project-specific reuse: Reclaimed timber used structurally in specific, one-off construction projects without being placed on the market.
- Localised resale for low-risk use: Reclaimed timber is placed on the market for general structural use in low-consequence applications, including domestic DIY.
- Domestic open-market resale: Reclaimed timber is resold on the open market for structural use, but within localised markets, e.g. single countries and aligned with national regulations.
- Regional open-market resale: Reclaimed timber is resold across borders within regions with similar market conditions.
- Pan-European open-market resale: Reclaimed timber is placed on the market for general structural use anywhere in Europe.
- Input to other products: Reclaimed timber is placed on the market as a raw material for further transformation into engineered wood products or assemblies, e.g. glulam, CLT, or wall panels, which then follow their own market pathways.

2. New product type dimension

The form in which reclaimed timber is returned to use. Some products are niche or specialised, some are intended for widespread application, requiring stronger standardisation.

- High-value elements: uncommon species and character material such as aged beams, often reused for aesthetic or specialist applications.
- Defined-use elements: Products designed for specific structural functions, e.g. bracing elements or structural flooring.
- Engineered assemblies and laminated products: Reclaimed timber used to manufacture products, e.g. light timber frame walls, trussed rafters, glulam, or cross-laminated timber.
- General-purpose materials: High-volume, standardised structural timber intended for widespread structural use.

3. Standardisation level dimension

The appropriate level of standardisation depends on the market pathway and product type. More open and transnational markets, and more general-purpose products, demand more formal and harmonised standards to ensure regulatory compliance, safety, and market confidence.

- National or regional guidelines and standards: Published by national standard bodies, companies or trade associations; non-mandatory and do not lead to CE marking, but support mutual recognition or Article 14 exemptions.
- European standards (non-harmonised): Voluntary, non-mandatory standards developed at European level; do not enable CE marking but may support mutual recognition across borders and Article 14 exemptions.
- European Assessment Documents (EAD) : Voluntary route to CE marking for innovative or non-standard products; well-suited to small markets or specialised products.
- Harmonised standards: Enable CE marking, are required for placing products on the market under CPR; most suitable for products with widespread, high-volume use across Europe and which require a high level of compliance for building safety.

Annex IV – Reviewing the pros and cons of harmonised standards for timber reuse

Harmonised standards are mandatory requirements for products they cover. This risks being too burdensome for SMEs to develop new markets, both in terms of the costs to implement the standards, and also the costs of accessing the harmonised standards and numerous supporting standards. The standards tend to be more complicated, lengthy, and numerous than industry and national standards.

While there can be simplified guides, National Standards Bodies that are CEN members would not be permitted to publish any documents that contradict or shortcut the harmonised standards. Several countries outside the European Economic Area use European standards, and would probably benefit from standards for structural timber reuse, but harmonised standards tend to be more confusing and complicated, with no advantage in those markets compared to normal European standards.

Structural timber reuse is a field of rapid development in terms of scientific knowledge, experience, value chains, markets and products. The nature of harmonised standards means they are not easy to regularly update and they would very likely not keep pace with market needs and the state-of-the-art. It may be possible to create them in such a way that allows some adaptability through setting more stable overarching requirements for supporting standards that are not normative references.

European standards (including harmonised standards) are written by committees of experts and representatives of standard users, supported by national mirror committees of the National Standards Bodies, and involve stages of public comment that are open to everyone. However, what expertise there currently is, is mostly academic and industry players most interested in reuse are small and unlikely to have the time and resources to interact in a meaningful timely way with the standardisation process. Larger companies that are more active in standards development may have more interest in maintaining business as usual. This could inhibit progress towards circular economy compared to more localised standards development at national, industry body, or even company level.

Work on harmonised standards may also take resources or motivation away from initial standards development at more local level, reducing opportunities for more diverse ideas and approaches to be tested prior to harmonisation taking effect. It is also the case that a single harmonised approach might not ever be appropriate for the diversity and scale of the reuse market in Europe.

However, starting the process for harmonised standards as early as possible allows better awareness of what needs to be changed in the supporting standards and in the harmonised standards for new timber - to make them compatible with a pathway for reuse and remanufacturing of reclaimed timber. The supporting standards need to be revised in advance of the harmonised standards because of the need to always maintain valid dated references in harmonised standards within the regime of the new Construction Products Regulation. This requirement is for legal certainty, but it will make it difficult to update the supporting standards in future, when they are referenced by multiple other standards. Waiting for a future window to create new standardisation requests could be problematic when the reuse standards would need to be so connected to the other standards.

A clear path for harmonisation will also help avoid newly developing national and industry standards becoming too diverse and incompatible, preventing future harmonisation. It is also an opportunity to develop a common language and terminology across Europe. This would also be true of non-harmonised European Standards, the importance of harmonised standards for compliance with the Construction Products Regulation means harmonised standards would provide valuable foresight and stability for companies to invest in developing new products based on reclaimed timber.

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