On site moisture protection: An unnoticed but essential basis for sustainable timber construction

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Abstract: Timber construction is gaining popularity in Germany due to its sustainability, versatility, and aesthetic appeal, but, as a biological material, it can develop issues when exposed to moisture. Wood-destroying fungi can significantly reduce durability and structural integrity. Adequate moisture protection during construction is crucial for the longevity and performance of timber structures. This paper examines moisture protection practices on German construction sites and emphasizes the importance of proper on-site moisture management for sustainable timber construction. Visits to sites using timber construction revealed the status of moisture mitigation practices in conjunction with timber construction in Germany. A mixed-methods approach included photo documentation and protocol completion, yielding data for analysis to understand the depth and effectiveness of moisture protection strategies. The findings reveal a gap between problem awareness in the scientific community and practical handling on construction sites. Many sites exhibited disorganized structures and deficiencies in moisture protection strategies. While self-adhesive weathering membranes were used in nearly half the sites visited, less than one-third of the sites demonstrated sufficient moisture mitigation practices that protected the construction throughout the entire assembly process. This underlines the need to step up efforts in this area to ensure durable and high-quality timber construction that will be less reliant on the experience of designers or craftsmen.

Keywords: Assembly processes; Moisture; Timber construction; Mixed methods; Protection concept; Rainwater penetration; Prefabrication.

Introduction

As a renewable resource, wood can contribute to the attempts to counteract climate change by accumulating carbon dioxide (CO_2) throughout the lifespan of the growing tree (Tupenaite et al. 2023). When used in construction, this wood functions like a battery, storing the carbon it has absorbed over its lifetime (Sathre and O'Connor 2010; Mergel et al. 2024). Timber as a building material has the potential to maintain this storage function for a long time. However, wood is a biological material that can be degraded under certain conditions by fungi and insects. In particular, fungal decay typically occurs when the wood moisture content lies between cell wall saturation (about 25%) and the fully waterlogged condition, whereas in anoxic, permanently submerged environments most fungi are unable to decompose wood (Schrader et al. 2025). Thus, moisture management during construction is essential, as repeated wetting combined with periods of elevated moisture content creates a significant risk of biological degradation (Kalbe et al. 2022).

In contemporary German timber construction, the durability of the material is primarily determined by wood-destroying fungi and to a lesser extent by insects. The time and temperature profile of kiln drying leads to a reduction in protein and vitamins, making the wood less attractive to wood-destroying insects (Schmidt 2023). Consequently, insects rarely infest the wood and thus do not play a significant role in contemporary timber construction. This is especially important in the context

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of new buildings being erected. The only exception in this respect are termites, which—although at the moment pose a significant challenge in southern Europe—are generally not native to Germany based on current climatic conditions and occur only locally to a small extent (Scheiding et al. 2021; Kutnik et al. 2020). Therefore, moisture is the primary factor influencing the durability of state-of-the-art timber construction that we consider in this paper.

Fungi are generally unable to use water bound in the cell wall structure of the wood because it is held too strongly within the cell wall. For deterioration to occur, free water is needed. Because of this, most fungi require a moisture content above the fiber saturation point (around 25%) (Schrader et al. 2025). However, some fungi, like the dry rot fungus (*Serpula lacrymans*), are able to colonize timber, even though the moisture content is below the fiber saturation point, because they can transport water throughout their mycelium from a local moisture source to create an environment suitable for deterioration (Schrader et al. 2025). As fungal spores are present everywhere in the air (Scheiding et al. 2021; Wang et al. 2018), the greatest danger is therefore posed by mold and wood-destroying fungi. For mold to colonize a material, parameters such as moisture, temperature, ventilation, and exposure time are the influencing factors determining the climate conditions under which the mold growth occurs (Qiao et al. 2024).

Wang et al. (2018) stated that high relative humidities (RH) ranging from 80% to 95% or even short-term wetting of timber can lead to colonization by mold fungi (Schmidt and Riggio 2019), while Qiao et al. (2024) determined that most mold fungi developed best under conditions with RH between 60% and 90% and temperatures ranging between 5°C and 35°C. They also stated that temperature had less effect on the development compared to the moisture content.

While mold does not measurably affect wood properties, it is of concern because it can cause discoloration and is a potential allergen (Imken et al. 2020; Wang et al. 2018).

Unlike mold, rot fungi reduce wood properties through cell wall degradation (Imken et al. 2020). Exposure to moisture and its accumulation can lead to decay, mold growth, structural instability, and reduced indoor air quality (Wang et al. 2018; Cowled et al. 2023). There is even a risk that components may need to be completely replaced (Weinisch 2019). Hence, ensuring the protection of timber construction is a challenging task, requiring adequate moisture protection measures both during construction and throughout the lifespan of the actual building (Tengberg and Bolmsvik 2021). In this regard, preventing structures from becoming damp before completion and use is of paramount importance. As Udele et al. (2024) point out, this area has not yet been thoroughly investigated.

While the behavior of timber structures under the influence of moisture has been well studied, there is very little research dedicated to how in-situ moisture protection can be implemented or has been implemented up to now. Schmidt and Riggio (2019) found that the severity of exposure (e.g., free water) was largely determined by precautions taken by the designer and/or contractor. These precautions are influenced by their awareness of the issue and potential solutions, as well as by the construction system, schedule, and site conditions themselves. Wang et al. (2018) pointed out that there are several stages in wood construction where moisture ingress theoretically should not occur, but in reality, often does, resulting in prolonged suitable conditions for fungal attack. This typically happens because structural components are not yet operating under the conditions for which they were designed (Schubert et al. 2024)—for instance, in the absence of a completed roof or before elements have been structurally connected. In addition, the building materials themselves are not yet in their final state of use; for instance, concrete may still be curing and can introduce further moisture into the structure. Also, the protection of construction is closely related to a diversity of factors, such as water absorption, entrapment, and drying potential of the components (Wang 2015; Heinicke and Kehl 2024). Bolmsvik et al. (2023) conducted a case study on the effects of full weather protection on construction, examining moisture behavior, the likelihood of fungal growth, and its impact on the work environment (Tengberg and Bolmsvik 2021). The entire site was fully covered by a tent offering full weather protection, meaning that there was no exposure to the weather except for sunlight that could shine through the tent's tarpaulin. They found that no samples inside the weather protected area exhibited any mold growth, whereas 75% of the samples outside the protection did. This led to the conclusion that the implementation of full weather protection measures can lead to a substantial reduction in the risk of fungal damage.

Various factors during the construction process may contribute to an increase in moisture levels within a structure. These include insufficient ventilation, improperly planned or executed joints, and excess water released during the hydration process of floor slabs. Additionally, inadequate drainage due to rain and other external sources can contribute to moisture accumulation. It is widely acknowledged in the literature that wetting of timber components due to exposure to free water during construction is an issue of great importance (Kalbe et al. 2022; Heinicke and Kehl 2024; Schubert et al. 2024). However, researchers have generally not agreed on how this should be dealt with. In Germany, DIN 68800-2:2022-02 Wood preservation – Part 2: Preventive constructional measures in buildings states that moisture content of timber should not change unfavorably during transport, storage, or assembly (Glauner et al. 2022). While the standard specifies that solid wood products are only allowed to have a moisture content of less than 20%, timber elements used in construction should not exceed a moisture content of 18% (Schmidt 2023). This implies the application of appropriate moisture control strategies throughout the construction process, but leaves much room for interpretation.

One effective way to document the moisture behavior of a building during the construction phase and beyond is to implement a monitoring system. This typically involves the use of either capacitive or sorption-based measurement techniques that directly (capacitive) or indirectly (sorption) measure wood moisture content (Flexeder et al. 2022). However, there are also a number of reasons why these systems are prone to error (Schmidt and Riggio 2019). Sensors can be affected by temperature and electromagnetic fields, as well as by losing contact inside the borehole. In addition, factors such as condensation or internal checking can also interfere with measurements, and these issues are often difficult to identify or isolate in practice (Schmidt and Riggio 2019).

Buildings in Canada and other regions have been equipped with sensor technology to track the moisture dynamics of mass timber components. These studies have shown that cross-laminated timber (CLT) elements, especially, tend to dry out much more slowly compared to how quickly they absorb moisture. This slow drying process can pose significant challenges, particularly for components that become inaccessible after construction, such as floors with concrete screed or encapsulated wall assemblies (Schmidt and Riggio 2019).

The aim of this paper is to provide insights into how moisture protection is organized on German construction sites. It seeks to contribute to the ongoing discourse about sustainable construction practices in Germany by addressing the significance of the problem associated with inadequate on-site moisture management. Proper moisture management throughout the building process, implemented and anticipated by all involved parties, will enhance durability, resilience, and long-term performance of timber structures in diverse environmental conditions.

Materials and methods

The aim of this study was to gain an overview of the extent to which contractors in Germany take weather protection into account during the construction phase. Therefore, a mixed-methods approach incorporating both qualitative and quantitative elements was used, involving on-site visits during the erection phase of timber construction projects. These visits were conducted using self-developed protocols and photo documentation. The observation checklist covered different phases of the construction process and included yes/no questions, multiple choice, and open-ended questions. There were two ways to complete the checklist: through direct observation or by gathering oral input from participants, such as foremen, architects, or craftsmen. This approach enabled direct observation and documentation of moisture mitigation practices and the conditions within real-world construction contexts.

Before the site visits, plans were requested from the respective design offices. Specifically, inquiries were made regarding everything related to moisture protection (e.g., planning documents indicating the extent of involvement in moisture protection and responsibilities, existing moisture protection concepts), detailed execution from wall to ceiling and foundation connections, as well as sections and views of the project. These data inquiries allowed attention to be focused on potential critical points during site visits. Anything that could not be understood on this basis was then clarified in a meeting with the foreman or site manager.

It was, however, not always possible to carry out moisture measurements on the wood components. On the one hand, access to the different sites was granted through different parties. Sometimes the access was made possible by the timber construction company, sometimes by the architect, and sometimes by the owner. This made it challenging to get permission for conducting moisture measurements. On the other hand, ensuring comparability would have required similar exposure conditions for the components, multiple measurement points, and repeated readings—ideally both before and after a rainfall event. Because our visits were non-repeating and not part of an ongoing monitoring program and the sites, systems, and buildings varied greatly (including differences in weather and season), we decided against moisture measurements.

The visits took place throughout Germany (Figure 1) when timber elements were assembled. The diversity of sites, construction methods, and handling practices observed allows the findings to be considered representative of a broad range of timber construction projects in the country. During each visit, systematic photo documentation was carried out to record on-site conditions and practices. The protocols were filled out to record the workflow as well as data concerning the construction form, methods, and other relevant information. Site visits

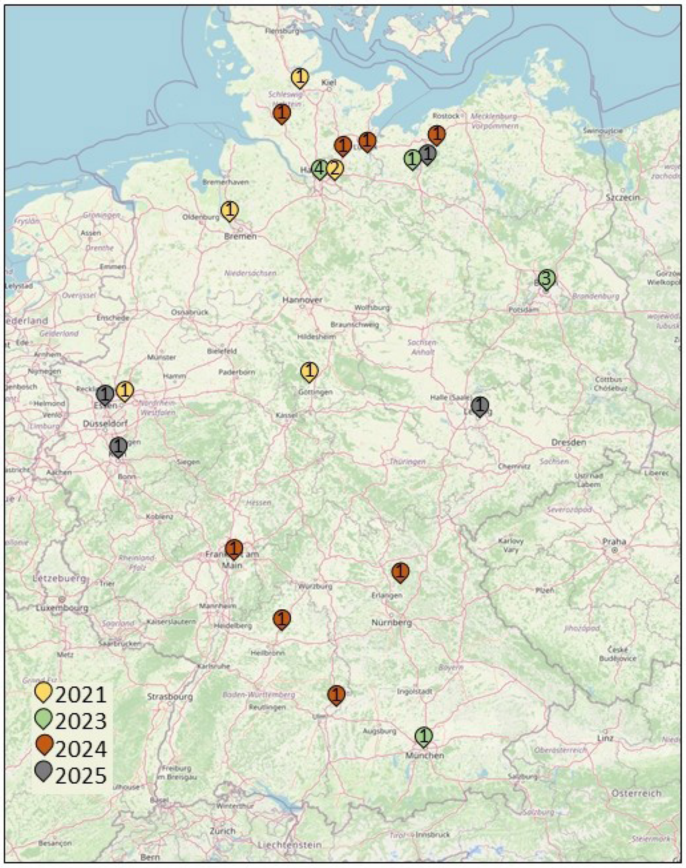

Figure 1. Map of construction sites visited. Map data © OpenStreetMap contributors, ODbL (openstreetmap.org/copyright).

were conducted once during the assembly phase, provided at least one of the following criteria were met:

a. The construction schedule was tight, the assembly process extended, or installation pauses were necessary—conditions under which exposure to rain was likely.

b. The project involved more than two residential units and/or more than two stories.

c. Special moisture protection efforts were employed, such as the use of a construction tent.

d. The construction was particularly sensitive to moisture, for example, glue-free assemblies or components with finished surfaces that are especially vulnerable to moisture exposure.

The protocols that were the primary data collecting instrument comprised eight topics. The topics covered fundamental aspects such as the building type, the place of prefabrication, and the construction site (I). They also addressed storage and shipping, focusing on how elements were transported, stored, and protected during these phases, as well as any inspections or tests conducted (II). Topics III to VI examined the structural system, the timber construction method, and the level of prefabrication. Finally, topics VII and VIII discussed special protection requirements and moisture mitigation concepts.

Every category (I-VIII) of the protocols was specified by subcategories This paper solely focuses on categories VII and VIII (Figure 2).

The data were analyzed to identify patterns, trends, and common practices in moisture protection during the assembly of timber construction. The protocols were designed to evaluate the extent to which the strategies were planned and executed.

In most cases, craftsmen were either not informed by their supervisors or unaware of the research objectives, and thus did not realize that moisture protection practices would be assessed. Consequently, it can be assumed that the sites were neither tidied up to create a better impression, nor did the craftsmen change their behavior concerning the handling of the elements.

Results and discussion

The findings presented in this article represent only the preliminary results of an ongoing investigation.

Assessment overview

The primary question when assessing construction sites in view of moisture protection was whether a clear and structured concept was evident or if the installation followed no discernible plan regarding weather protection.

Prior to the site visits, the building plans were thoroughly reviewed to determine whether weather protection measures had already been incorporated in the detailed planning phase. This preliminary step allowed for the completion of a significant portion of the assessment protocol in advance. Subsequently, the protocols were filled out according to the established order.

Through this assessment, insights were gained into the integration of protection measures within planning and execution, highlighting potential risks and best practices concerning moisture management throughout the construction process.

The assessment during site visits covered several fundamental and practical aspects relevant to moisture management and construction quality:

- **General exposure risks:** Evaluation of the construction method, where and how timber elements were at risk of moisture exposure, including the division of the site into construction phases to promote safer and more efficient substructures.
- **Storage methods:** Review of the different storage solutions. This included storage of components before

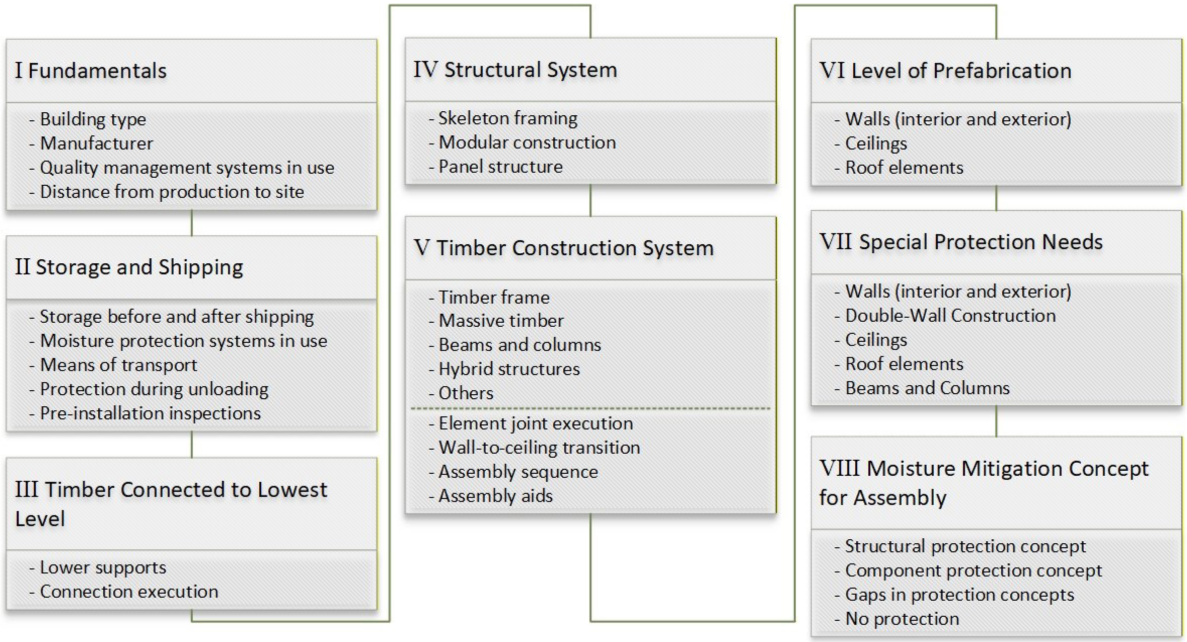

Figure 2. Site assessment protocol design.

and after transportation, including placement, elevation, and covering of materials to protect them from direct exposure to moisture. In addition, attention was paid to whether secondary materials, i.e., materials that were to be laid in a further work step, could hinder further protective measures due to their placement. For example, a pallet of bitumen sheets was placed on the roof without temporary weather protection underneath (Figure 3). That made it considerably more difficult for the craftsmen to carry out the protective measures before the roofer arrived. No crane was available at the later stages, so part of the roof stayed exposed to rain, which led to increased moisture levels in the connection joints of the ceiling components.

- **Adapting the installation conditions to the weather:** Analysis of how the sequencing of key tasks aligned with the weather, and whether unfavorable timing could increase risk of moisture ingress.
- **On-site handling of timber elements:** Observation of how timber components were transported, unloaded, and moved


Figure 3. Storage of construction materials for the roof prevented the implementation of temporary weather protection measures (author photograph).

around the site, with emphasis on practices that minimized surface wetting or damage. A typical question was whether or not the components were temporarily stored on the construction site or whether they were installed directly after shipment. Poorly planned or executed storage of construction components not only leads to a loss of quality during rainfall events, but also causes the entire construction site to become disorganized and cluttered (Figure 4). This can result in delays and errors.

- **Presence or absence of protective measures:** Documentation of weather protection strategies in use. Were weather protection strategies such as tents, tarpaulins, or temporary covers visible? This included identification of areas lacking adequate safeguards. These areas could be present because the work in question was either not (yet) carried out or not planned. Furthermore, it was necessary to evaluate whether protective measures for the components were carried out, even if these had not originally been included in the planning.
- **Protection during lifting and installation:** Assessment of procedures used when lifting and installing timber elements, ensuring these steps did not compromise material condition or introduce unnecessary moisture risks.
- **Communication and awareness:** Evaluation of the level of site awareness and communication regarding moisture-sensitive procedures, as well as training and involvement of all parties in maintaining protective measures.

This approach provided a comprehensive understanding of both planned and actual site practices, highlighting strengths and identifying potential areas for improvement in moisture protection and project execution.

Results

For this evaluation, protocol numbers VII and VIII were analyzed along with the documents provided by the planning offices. Subsequently, the photographic documentation was examined and included into the gatherings. As a result of this analysis, the scope of this examination does not include the entire process of manufacturing, storage, and shipping.

A total of 27 sites from different companies and design offices were evaluated. Identifying suitable sites for this research has presented a considerable challenge. Even though larger networks were willing to facilitate connections with their members, many larger timber construction companies appeared hesitant to permit external analysis of their projects. This reluctance may stem from concerns about disclosing operational inefficiencies or potential weaknesses, as well as a desire to protect competitive advantages by withholding insights into effective work strategies. Despite repeated inquiries, it often seemed that these companies sought to avoid the scrutiny associated with having their practices documented and evaluated. On the other hand, when we did gain access to sites, it was evident that, in numerous cases, the construction teams themselves did not appear particularly concerned about potential issues.

Figure 4. Disorganized construction site, inappropriate storing of mass timber elements (author photograph).

The on-site visits revealed a gap between problem awareness in the scientific community and the handling of components by the executing companies on site. It was striking how little attention was given to the possible consequences of inadequate or missing moisture protection measures, suggesting either a lack of awareness or a lower priority being placed on these critical aspects of construction. Structural-specific moisture protection, as discussed by Heinicke and Kehl (2024), seemed to be rare in Germany, as no construction sites with such a concept were found in this study. All sites that exhibited any form of conceptualization used the component protection concept (Heinicke and Kehl 2024).

Figure 5 summarizes a portion of the research results to date. It categorizes the sites based on the data evaluated. The evaluation aimed to identify where along this spectrum a site has to be located, with the following categorization:

- **No concept:** This refers to an absence of identifiable moisture protection strategies, resulting in a lack of logical order in the measures taken. For example, many sites used prefabricated CLT elements for ceilings that came with fully bonded membranes already applied at the factory, allowing for easy ordering from the manufacturer. However, if no additional measures were implemented to effectively manage and divert water away from the structure, it cannot be classified as a cohesive concept. Also, if these components with unprotected narrow sides were stored directly on the ground or left exposed to weathering without additional shielding, this demonstrated inadequate moisture protection. Proper intermediate storing measures are essential for preventing wetting and ensuring that the construction aligns with a comprehensive water management approach.
- **Planned but not implemented:** Analysis of the documents may reveal a defined concept through precise measures that were not applied on site, whether due to oversight, practical challenges or simply being overlooked. Non-application indicates a disconnect between planning and execution. The plans may showcase a clear strategy and a commitment to high-quality processes, yet the necessary information or the urgency to implement the measures was not effectively communicated from management to the installation team.

  For practical reasons or due to the sequence of work, there may be a bridging phase during which the measures cannot be carried out on site. (It is possible that there were time slots in which the elements were assembled; however, further application of measures had yet to be undertaken.). Nevertheless, it can be stated with certainty that in the absence of the prescribed measures for the site, there was a gap between the planned and actual outcomes. During a site visit where assembly had already progressed to the third and last floor, it quickly became apparent that not a single moisture protection measure intended in the planning to secure the intermediate construction stages had been implemented, apart from the application of membranes by the manufacturer in the factory.

  Although the ceiling element joints had been sealed to create a tight ceiling slab, water had intruded through the joints and stained the construction below. Additionally, the components had been improperly stored on the ground. By the time of the site visit several weeks of unsettled weather had passed, including heavy rain events, during construction from the ground level to the third floor.
- **Gaps in concept:** Indicated partial implementation, where certain aspects of moisture protection were in place, but significant areas of the construction were neglected. For instance, the lack of planned drainage for the ceilings throughout the entire building demonstrated a lack of comprehensive consideration for moisture management.

		2021						2023									2024								2025					
	Site Nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Σ:	%
No continuous protection	No concept					x	x				x	x			x							x						x	7	25.93
	Planned but not implemented							x	x								x												3	11.11
	Gaps in concept			x	x					x			x				x		x		x			x		x	x		10	37.04
	Full concept	x	x											x		x		x		x			x		x				8	29.63
	Particulary complex/ sensitive construction	x	x		x					x	x	x		x		x		x		x			x		x		x	x	14	51.85
	Simplified/resilient construction						x								x		x		x		x			x					6	22.22

Figure 5. Breakdown of projects following evaluation of overall moisture protection during construction.

This must be distinguished from accidentally forgotten work steps, which naturally arise during execution, whereas in our case, the lack of drainage reflected a deficiency in planning-compared to a single, unconnected drainage pipe.

- **Full concept:** This referred to a clearly structured and fully implemented moisture protection strategy. Each element followed a precise scheme, leading the water away from the structure. This ensured that water was captured, collected, and diverted, with all components protected from moisture intrusion throughout the installation process. The pathway for water was clearly defined at all times, ensuring comprehensive moisture management. The categorization was a structure based on organizational effort. Ultimately, moisture protection is a necessary organizational task that must be ensured by planners and producers. These three first rows and up to the sum of projects with: "No continuous protection". These were contrasted with sites where clear strategies were evident throughout the building process, labeled as "Full Concept".

To ensure comparability between construction sites, it was crucial to consider both conceptual differences and the complexity of the respective building projects. This approach was reflected in the last two rows of the table shown in Figure 5 (highlighted yellow), which categorized the sites into three groups:

- **Particularly complex/sensitive constructions:** Projects involving intricate or delicate structures that required enhanced protective measures during the construction phase to mitigate risks from environmental exposure. For instance, a hybrid ceiling constructed on site introduced specific challenges. The need to wire and place iron for concrete extended exposure times for walls beneath the ceiling to wind and weather. This contrasted with simpler scenarios, such as assembling prefabricated CLT elements, where the exposure period was significantly shorter.
- **Simplified/resilient constructions:** These projects were inherently robust or featured a lower degree of prefabrication, reducing their vulnerability to damage from rainwater. Such sites often demanded fewer resources for protective measures.
- **Ordinary constructions:** These were sites that fell between the extremes of complexity and simplicity or sensitivity and robustness. While they still required adequate moisture protection, the necessary measures aligned with standard practices rather than demanding extraordinary effort.

Figure 5 specifically highlights only the first two groups; the third group, ordinary constructions, is not explicitly shown. These sites were considered the residual category, encompassing all remaining projects after subtracting those classified as particularly complex or simplified. Their inclusion provided a holistic understanding of the spectrum of construction challenges and protection requirements. Classifying construction sites into these three groups made it evident that the level of protective effort required varied significantly based on the nature and complexity of each project. This classification highlighted the importance of tailoring moisture protection measures to the specific demands of each site.

Less than one-third (29.63%) of all sites had sufficient moisture mitigation practices and a complete concept. This means that, in the event of rain, the components were protected at every stage of construction, with the only exception being during their relocation by crane (Figure 6). This meant that a clear strategy of how the water was collected and diverted away from the structure was evident in the event of rain. There was no systematic gap where water could intrude on the construction other than by excessive rain events that could not be covered by state-of-the-art component protection measures. As Bolmsvik et al. (2023) highlighted, addressing this and other issues like crane relocation of elements, on site storage, wind deflection, or temperature control issues required a comprehensive structural protection concept. Interestingly, all of the sites found to have sufficient control over their processes had to deal with either particularly complex or vulnerable constructions. This included an office building constructed entirely with dowel-laminated timber (DLT), a method in which wooden panels are assembled using dowels instead of synthetic adhesives. Here, even minimal contact with moisture would automatically lead to warping and dimensional changes in the panels. It seems that the companies aware of the issue of moisture protection were developing greater expertise in handling such challenges. With growing awareness and skill, they may have felt more confident in tackling larger-scale or more complex projects. It could also be that these companies had previously faced moisture-related problems and were now more determined to prevent such failures in the future.

In 70.37% of projects, no continuous moisture protection was implemented. This meant that one of three situations existed: the planner did not include temporary moisture protection in the construction phase planning, the contractors on site did not recognize the need for moisture protection for building components, or the approach used did not cover all phases or did not include all parts of the construction.

Of the 70.37% (19 sites), 31.5% (6 sites) represented complex projects, of which only half (3 sites) had any conceptual approach. In 11.11% of cases, a specific moisture protection

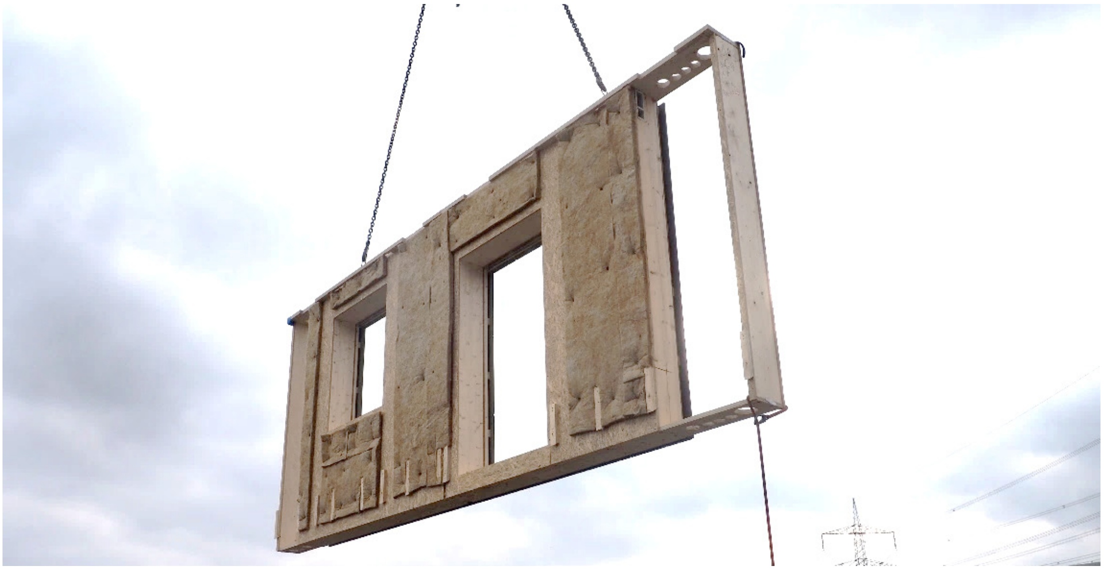

Figure 6. Element relocation by crane (author photograph).

strategy was planned for construction but somehow not executed. However, it does not seem that a connection existed between complexity and the enforcement of a planned concept. To draw any conclusions in this direction, further and more sophisticated studies would be needed, addressing more relevant factors and examining additional sites. Different reasons for the occurrence could, however, be found. In one instance, it was unclear what during erection led to the decision against implementing the planned measures. In another case, it was the lack of awareness regarding the conditions under which these specialized timber products could be used that contributed to the issue. In yet another case the responsibility for applying moisture protection was delegated to the client, who lacked the necessary expertise to implement a comprehensive protection strategy.

Two-thirds (66.67%, full concept + gaps in concept) of cases were found to have concepts in place, yet more than half of these concepts were incomplete by missing important components. This indicated that while moisture protection strategies were present in many cases, their implementation was often insufficient or incomplete. Further research and efforts, such as enhanced education, are necessary to ensure that future efforts are fully realized and effectively integrated into construction practices. Figure 7 shows a three-story semi-detached house with a low level of prefabrication. The concept involves fully covering all horizontal components. While the interior was sealed to prevent moisture from entering the cavities, the exterior was left open. This construction method requires a schedule that allows for drying measures before insulation is installed. Drying is possible due to the simplicity of the con-

Figure 7. Incomplete protection with possible entrapment of moisture (author photograph).

struction. Particularly critical in this case is the formation of troughs (red arrow) on one side of the structure to enable the waterproofing of the flat roof at the required height. Rainwater (during construction) not only drains poorly there but can also easily accumulate, while at the same time the moisture content is almost impossible to monitor.

As many as 25.93% of the sites surveyed to date had no systematic protection against moisture intrusion during assembly. Only two of these (seven in total) were especially simplified and resilient.

Until recently, timber construction in Germany was mainly limited to single-family or semi-detached houses. These projects were often completed within a "Schönwetterfenster"—a period where weather conditions were predictable and favorable for construction. This allowed for efficient execution within a narrow timeframe. However, the shift towards larger-scale timber construction projects, which demand extended assembly times, makes this approach less viable. There is a possibility that the mentality of adjusting construction schedules to the weather may not be as deeply ingrained in the minds of some workers. Larger and more complex projects requiring significantly longer assembly times mean that it is no longer an option to follow the same weather-dependent work patterns. The transition to larger projects with extended timelines may be presenting challenges for some workers, who are not yet accustomed to the level of planning and prolonged schedules these projects necessitate.

Conclusions

Our findings highlight the need for comprehensive moisture management in timber construction, from design to construction, to reduce the risk of decay, mold growth and structural instability. The number of uncontrolled situations, with constantly changing building standards and new requirements for quality and durability, make it clear that a new awareness and greater efforts are needed in the area of moisture protection. This research showed that timber construction is more than solely building with non-fossil materials, but a completely different approach to building.

While progress has been made, with some projects demonstrating robust moisture protection practices, a large portion of projects still lack adequate measures. Addressing these gaps will require a collaborative effort among designers, contractors, craftsmen, and the education sector to ensure that effective moisture protection strategies are integrated into every phase of wood construction. This collaborative approach is essential to overcoming existing challenges, as it allows for a more holistic understanding and application of construction methods, reducing the risk of moisture damage and ensuring the long-term durability of timber structures. Education plays a vital role in this process, as increasing awareness and knowledge among all stakeholders, from architects to builders, can help implement strategies that are tailored to the unique demands of timber construction.

In conclusion, ongoing research and industry efforts are crucial to enhancing moisture protection practices in wood construction, promoting more sustainable and resilient building practices that maximize wood's potential as a renewable and durable material.

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