Construct Innovate
Built Environment Research Ireland

HOMEGROWN C16

Increasing the use of Irish home grown C16 timber in Housing Construction

Report Name	HOMEGROWN C16 – Increasing the use of Irish home grown C16 timber in Housing Construction
Document Number	CI-AHARDD03-Galway-R-01.01
Report Coordinators	Dr Patrick McGetrick, University of Galway
Authors	Patrick McGetrick (University of Galway)
Website	www.constructinnovate.ie

Dissemination Level	Public
Publication Date	4th February 2024
Cite As	McGetrick P (2024), 'HOMEGROWN C16 – Increasing the use of Irish home grown C16 timber in Housing Construction', Report No. CI-AHARDD03-Galway-R-01.01, Construct Innovate, University of Galway, 4th February 2024.

Revision	**Date**	**Modifications**
R00	29/11/23	First version
R01	10/01/24	Updated based on peer review

Table of Contents

1 Introduction

1.1 Project Summary

This report presents the outcomes of Project UA03/22 entitled “Increasing the use of Irish home grown C16 timber in Housing Construction”, funded by the Accelerated Housing Applied Research, Dissemination and Demonstration (AHARDD) Programme Fund 2023.

This short project led by the Timber Engineering Research Group (TERG) at University of Galway aims to provide a summary of solutions and recommendations that can promote an increase in the use of home-grown Irish timber in housing (low and high rise) and offsite construction in Ireland. This is based on recent industry reports, current market practice and trends and state of the art research on added-value engineered wood products. The project also includes a review of the technical and performance requirements for Irish sawn timber products, with limited site investigations carried out at two sawmills to study the impact of different exposure conditions on dimensional tolerances of sawn timber sections. The report includes a brief review of the challenges and barriers to the greater use timber in construction, including home-grown timber. Through ongoing engagement with key stakeholders in the construction, forestry and off-site manufacturing sectors, proposed solutions to barriers are also identified that are necessary to promote and sustain greater use of timber in general, which is expected to subsequently create an environment that is more conducive to use of Irish C16 timber. The research team at TERG consisted of Dr Patrick McGetrick, Mr Darren Kellegher and Mr Jack Kennedy.

The underlying demand in Ireland for new homes (ca 33,000 new dwelling completions required per annum at present), combined with the forecasted significant increase in supply of homegrown timber and the drive to reduce the carbon emissions from construction (key measures for the industry include low and zero carbon product substitution for construction materials wherever possible[1]) - together all present a significant opportunity and motivation to increase the level of home-grown timber in housing and off-site construction. However, despite trial timber frame assemblies highlighting the suitability of homegrown timber, which is typically graded to a strength class of C16, for the majority of frame components, including roof trusses, limited quantities of it are currently used in timber frame construction in Ireland. Imported grade C24 and TR26 timber is preferred by the industry and manufacturers are reluctant to switch for several reasons, including existing established supply chains, material availability and cost, and experience with the technical performance of the material. Furthermore, there is scope to increase the timber market share in new residential dwellings – this currently sits around 25% in Ireland for all timber frame construction[1] including houses and apartments. The latest reported figures from a members survey by the Irish Timber Frame Manufacturers Association (ITFMA) in 2021 show that this percentage is much higher when considering low-rise housing schemes alone - approximately 48% of these low-rise houses are constructed using timber frame, increased from 37% in 2019[2]. However, in recent years in Scotland, where homegrown timber has been promoted, the equivalent timber frame market share has reached 92% of *all* new residential dwelling units[3]. One of the reasons for this a longer tradition of using timber frame in Scotland[4], which creates an easier pathway for acceptance of homegrown timber, while other factors include government promotion of off-site manufacturing in social housing, and government strategies to increase the use of timber in construction and achieve embodied carbon reductions. However, -further analysis and evidence is required to gain a better understanding of the perceived issues with Irish homegrown timber

[1]Government of Ireland (2022), Climate Action Plan 2023, Department of the Environment, Climate and Communications
[2] https://constructionnews.ie/timber-frame-housing/
[3] UK Government (2023), Policy Paper: Timber in Construction roadmap, Department for Environment, Food and Rural Affairs
[4] Structural Timber Association (2022), Structural timber market research: residential sector, October 2022.

and identify suitable targeted actions for the Irish market and industry, noting that many of these issues likely face the use of timber in construction in general in Ireland, rather than being limited to homegrown timber.

In the short project timeline (3 months), the objectives of the project were designed to build upon existing collaborative work and are summarised below; relevant deliverables associated with each objective are also outlined; all are included in this report in the following sections.

1. Increase understanding of the behaviour, and technical performance requirements for the production of timber frame components and added-value engineered wood products from Irish Sitka Spruce

   Deliverable 1: Report on technical and performance requirements and recommendations of improvements to increase usage of Irish Sitka Spruce in construction. Due to the short duration of the project, this focused on:

   - Comparison of manufacturing facility storage (indoor, dry) versus outdoor site storage conditions for timber bales
   - Production samples of bales of timber boards from alternative sawmills to study timber sizes, distortion, moisture content, and associated characteristics when left open over different periods of time.

   The following related items are also briefly considered in Section 2 of this report:

   - Grading methods, quality control and certification
   - Kiln drying procedures
   - Engineered wood product fabrication procedures

2. Complete a review of barriers to the use and acceptance of home-grown timber in the Irish market including engagement with industry (manufacturers, producers, contractors, specifiers, building control) and stakeholder survey

   Deliverable 2: Report on same and recommendations of solutions and/or necessary actions for specific industry stakeholders to increase the market share of homegrown timber, including consideration of timber supply and cost, and wood flows in and out of Ireland

3. Support and engage with the development of a national working group on timber in construction, targeting the use of timber in buildings over 10 m in height with appropriate recommendations on compliance with the Building Regulations e.g. consideration of the removal of Clause 3.2.5.2 from TGD Part B.

1.1.1 Ongoing associated project objectives

This 3 month project started in September 2023 in parallel with the formation of (i) a thematic working group on Mass timber construction within Construct Innovate, and (ii) the Interdepartmental Working Group on Timber in Construction, which directly addresses Objective 3 of the project. The project coordinator chairs (i) and is a member of the steering committee of (ii). An additional two objectives from the original project proposal have been subsumed into these two groups and thus are ongoing activities with much broader input and are not reported on here. Delivery of these items is expected in 2024 and more direct industry impact is expected based on the membership of these groups:

- Complete review of international fire regulations, technical approvals and fire testing programmes pertaining to the use of timber in high rise construction, for both timber frame and mass timber with

recommendations for the Irish regulatory environment

- Development of a Technical Assessment Specification or prescriptive guidance for the use of timber in building structures with a height above 10 m in line with the current NSAI Agrément Certification process for products and building systems – a Road map for taller timber structures in Ireland

2 Behaviour and storage of homegrown C16 timber in Ireland

This section outlines the project activities associated with Objective and Deliverable 1, on increasing the understanding of the behaviour, and technical performance requirements for the production of timber frame components from Irish Sitka Spruce with consideration of the impact on added-value engineered wood products also. This work extends from a larger previous project, *HOMEGROWN HOMES*, led by Coillte and Forest Industries Ireland in partnership with Irish sawmills, timber frame manufacturers, Wood Knowledge Wales, University of Galway and Technological University Dublin. In that project, a detailed design review and trial manufacture and inspection was carried out for timber studs and boards used in the manufacture of a prefabricated roof truss. While the trial was a success, timber board measurements (dimensions, distortion and moisture content) were only taken immediately after the covered and strapped timber bales were opened indoors. While no issues were observed with the timber quality or fabrication, it was deemed necessary as part of this project to carry out periodic timber measurements over a longer period of time under both indoor and outdoor conditions. A common perception in the construction sector is that Irish Sitka Spruce timber (strength class C16) is more sensitive to environmental exposure than imported TR26 or C24 Spruce timber from elsewhere in Europe and the longer exposure time is intended to study this, to replicate, for example, a timber bale opened on site and left exposed to rainfall. Due to time limitations for site visits to different sawmills, this exposure time was limited to 1 week. The following sections outline the criteria being assessed and measurements taken at two large sawmills in Ireland in November 2023. It should be noted that for a comprehensive review of this behaviour, a study of this nature would typically need to be carried out at multiple site locations over the course of at least one year to account for seasonal variations. Alternatively, a variable climate chamber could be used to simulate seasonal variations but would not account for temperatures below 10^{o}C[5], or accommodate a significant volume of timber.

2.1 Technical requirements and standards for timber frame

2.1.1 Grading methods, quality control and certification

In Ireland timber frame construction is covered by Irish Standard I.S. 440 "*Timber frame construction, dwellings and other buildings*" which specifies requirements for timber frame dwellings and other buildings. These requirements include materials, design, manufacture, construction details, site work and services. The design of timber structures is governed by Eurocode 5, I.S. EN 1995[6]; a new generation of this standard is currently under development.

Irish Sitka Spruce boards to be used in timber frame construction in Ireland are typically machine graded in accordance with the harmonised standard EN 14081-1[7] which requires timber to be CE marked and have a Declaration of Performance. Systems such as the Goldeneye 702 by Microtec[8] are used in this type of grading; grading settings for Sitka Spruce and other species have been developed with the support of TERG as part of the WoodProps programme in recent years. This type of precision strength grading and classification relies on multi-sensor scanners combining scattering laser, 3D laser, colour, and X-ray. Once assigned to a strength class, characteristic properties for use in structural design can be obtained from I.S.

[5] https://www.universityofgalway.ie/terg/facilities/
[6] CEN (2005) EN 1995-1-1. Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings. Comité Européen de Normalisation, Brussels, Belgium.
[7] EN 14081-1: 2016 +A1:2019 Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements
[8] https://www.microtec.eu/en/products/goldeneye

EN 338 (2016)[9]. Further information on determination of characteristic values of mechanical properties and density for strength classes of machine graded structural timber can be found in I.S. EN 384[10]. Visual grading in accordance with I.S. 127 (2015) was not considered here. Irish Sitka Spruce is typically graded to strength class C16 with a bending strength of 16 N/mm^2 and hence can be used in any country where the aforementioned standards apply.

2.1.2 Kiln drying procedures

Alongside process efficiency and modern machine grading systems, Irish sawmills have invested significantly in kiln drying technology. Timber boards intended for use in construction are stacked in bales and weighed down in a specialist kiln in which temperature, humidity and airflow is controlled in order to set the drying rate for the timber and avoid distortion problems e.g. due to twist and/or shrinkage. Bales are dried over a number of days to a mean moisture content of 20% or less with no individual measurement exceeding 24%[11]. All boards assessed in this study have gone through this process prior to measurement.

2.1.3 Manufacturing versus site storage of timber bales

Following from the kiln-drying procedure, the risk of exposure to moisture remains in the Irish climate and kiln dried timber bales are typically strapped to restrain boards during lifting operations andto prevent distortion, and covered to reduce exposure to moisture. However, once opened for use, timber boards may distort if left exposed and unrestrained outdoors e.g. during on site construction. Prefabricated timber frame construction is typically an indoor process requiring a mean timber moisture content of 18% specified by I.S. 440, but this study intends to carry out an assessment of the sensitivity to different storage conditions of timber bales that may also be used in other types of timber frame construction. Production samples are outlined in Section 2.2 of this report.

2.1.4 Engineered wood product fabrication procedures

TERG are currently carrying out fabrication of cross laminated timber (CLT) panels using Irish Sitka Spruce as part of the MODCONS[12] research project. Figure 1 shows a CLT panel fabricated in November 2023 on the MODCONS project; this is the largest CLT panel fabricated in Ireland to date (2.4 m x 1.2 m x 0.12 m). Fabrication is being carried out in accordance with the product standard EN 16351[13] which details the requirements for CLT production, relating to the material and geometric constraints, manufacturing procedures, and tolerances, in addition to test protocols. It states that any timber laminations must be strength graded in accordance with EN 338. It also defines the board width and thickness which should be between 40–300 mm and 12–45 mm, respectively, and the required moisture content of the boards 12%. The common strength classes according to EN 338 are C24 for a homogeneous layup, C24 for longitudinal layers, and C16/C18 for the transverse layers in a combined layup, and there are products available on the market which utilise 100% C16 grade material. This is important in an Irish context as the most common structural grade timber grown in Ireland is C16. As a result, TERG are examining the potential to utilise C16 grade material grown in Ireland in the manufacture of CLT. At present, further drying of the timber boards in condition chambers is required to bring the moisture content down to 12% from the mean 20% moisture content achieved via kiln drying at the sawmills. To enable and promote use of Irish timber in engineering wood products such as CLT, greater reductions in moisture content are required in the kiln drying process.

[9] I.S. EN 338 (2016). Structural timber – Strength classes.
[10] I.S. EN 384:2016+A1:2018. Structural timber - Determination of characteristic values of mechanical properties and density
[11] EN 14081-1: 2016 +A1:2019 Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements
[12] https://www.universityofgalway.ie/terg/modcons/
[13] CEN (2015) EN 16351. Timber structures - Cross laminated timber - Requirements. Comité Européen de Normalisation, Brussels, Belgium. doi: 10.1520/E2019-03R13

Figure 1: Irish Sitka Spruce CLT panel fabricated on the TERG MODCONS project (2.4 m x 1.2 m x 0.12 m)

2.1.5 Preservative treatment

Pressure preservative treatment was not considered in this study – all samples assessed were untreated kiln-dried boards. However, future research is expected on this topic as it has become topical for end of life considerations and whole lifecycle assessment – depending on preservative treatment type and chemicals used, it can prevent reuse or recycling of the timber thereby reducing its capacity for further cascading uses.

2.2 Assessment Methodology

To assess the behaviour of Irish Sitka Spruce timber boards under different storage conditions, site visits at two sawmills were carried out in November 2023. At each site, two bales of kiln dried timber of the same cross section were initially assessed under the same conditions to provide baseline reference measurements. Subsequently, one bale was then strapped and stored indoors, and the other was unstrapped, uncovered and stored outdoors. The bales are summarised in Table 1 below, including board numbers and assessment dates which were scheduled approximately 1 week apart. Due to lack of daylight, only 6 samples were taken from Bale 1 Indoor at sawmill 1. Further analysis of measurements will be carried out by the project team Q1 and Q2 of 2024.

2.2.1 Site weather conditions

Weather conditions at each sawmill for the interval between assessments were referenced to the nearest MET Éireann weather stations. These stations are located approximately 7 km and 33 km from sawmills 1 and 2 respectively. Average maximum and minimum air temperatures are presented in Figure 2. The reference daily rainfall for each assessment interval is illustrated in Figure 3, with much higher rainfall occurring at sawmill 1 (25.5 mm in total over the 7 days) than sawmill 2 (5.2 mm in total over 10 days) despite the shorter interval between assessments.

Table 1 Timber bales assessment details

Sawmill	Board dimensions (mm)	No. Boards measured	Assessment dates	Photo
1	100 x 44 x 4800 (Finished size 97 x 42 mm)	Bale 1: 6 Bale 2: 12	Initial Assessment: 9th November 2023 • Average temperature: 7 °C • Humidity: 75% Second Assessment: 15th November 2023 • Average temperature: 8 °C • Humidity: 83%	Bale 1 (indoor):  Bale 2 (outdoor): 
2	100 x 44 x 3600 (pre-finished boards)	Bale 3: 8 Bale 4: 8	Initial Assessment: 20th November 2023 • Average temperature: 8 °C • Humidity: 83% Second Assessment: 29th November 2023 • Average temperature: 2 °C • Humidity: 90%	Bale 3 (indoor):  Bale 4 (outdoor): 

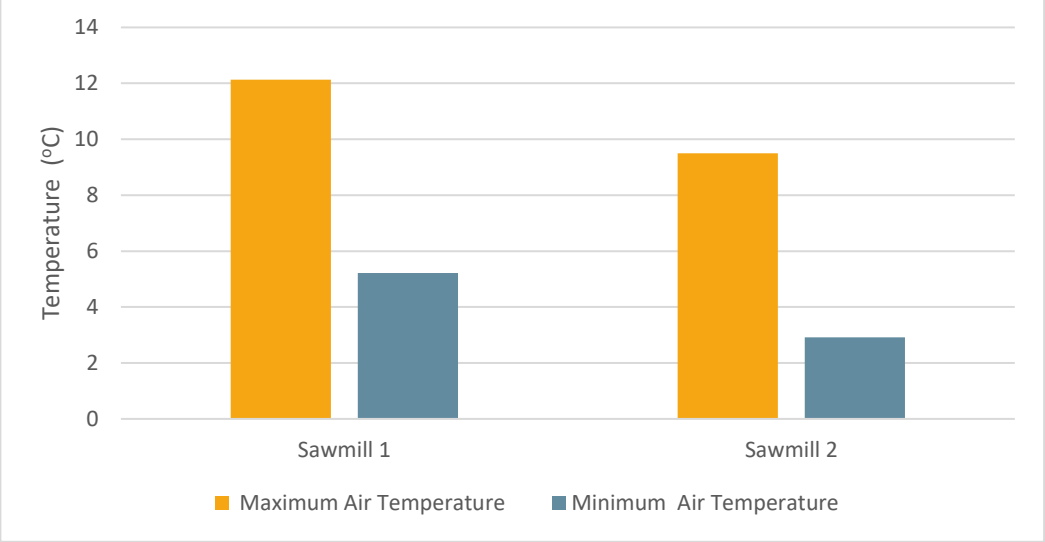

Figure 2 Reference average Air Temperature (°C) at each site during the assessment intervals

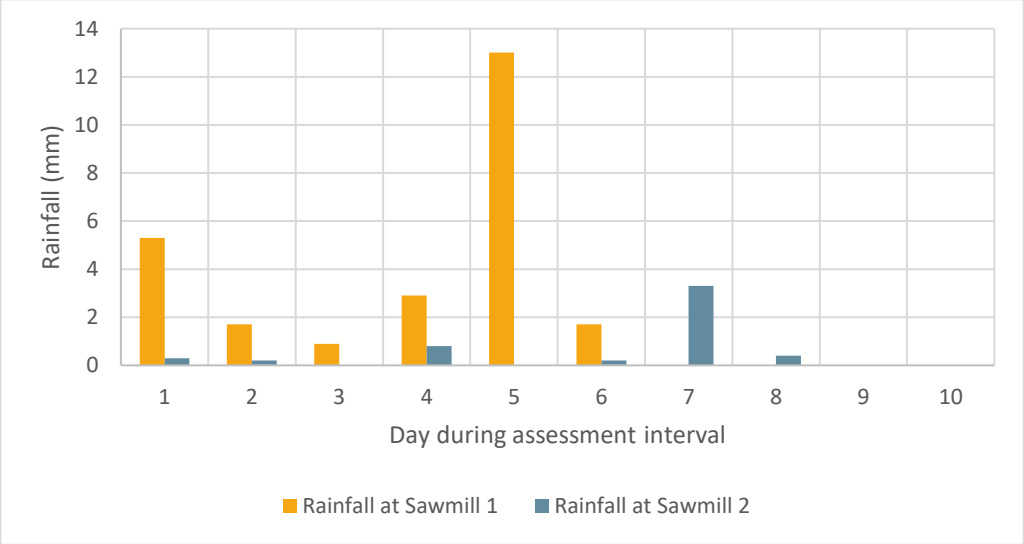

Figure 3 Reference rainfall at each sawmill during the assessment periods

2.2.2 Moisture content and board size measurements

Moisture content measurements were carried out by the electrical resistance (pin type) method in accordance with IS 13183-2[14]. As per the Homegrown Homes project, measurements were taken using both a Gann Hydromette HT 85 T (hereafter referred to as long pin or LP) with a ram in electrode (Figure 4) and a handheld Protimeter Timbermaster (Figure 5 - hereafter referred to as short pin or SP).

Measurements were taken at three locations in each board – at clear knot free sections approximately 300 mm in from each end of the board and at the midpoint along its length. Board dimensions at these locations were measured using digital calipers with precision of 0.01 mm. The distortion (bow, spring, twist etc) was assessed according to EN 1310 and EN 14081-1 using a straight edge and no board exceeded the limits therein.

[14] I.S. EN 13183-2:2002. Moisture content of a piece of sawn timber - Part 2: Estimation by electrical resistance method

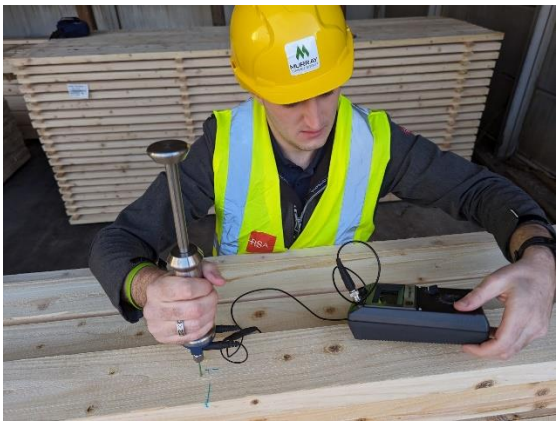

Figure 4: Taking moisture content measurement using Gann HT85 T with ram in electrode

Figure 5: Protimeter Timbermaster moisture metre

2.3 Results and Discussion

In terms of measured dimensions, the tolerance class for boards used in timber frame construction is TC2 specified in I.S. 440 in accordance with I.S. EN 336[15] i.e. the actual board sizes (thickness D and width or breadth B adjusted for 20% moisture content) should be within the limits indicated in Table 2 below, while the average of the actual board sizes (adjusted) should not be less than the target dimensions allowing for changes in size due to changes in moisture content. Figures 6 and 7 below show the measured locations marked on the timber bales assessed at sawmill 1 and 2 respectively. Tables 3 and 4 summarise the actual moisture content (MC) measurement results and sizes adjusted to 20% moisture content, at sawmills 1 and 2 respectively. MC measurements are reported for the long pin Gann metre only – the reason for this is explained later in this section (see Figure 6).

Table 2 Cross-sectional deviation values for tolerance classes in I.S. EN 336

	Tolerance Class 1 (TC1)	Tolerance Class 2 (TC2)
For thicknesses and widths ≤ 100 mm:	-1/+3 mm	-1/+1 mm
For thicknesses and widths >100 mm and ≤ 300 mm:	-2 /+4 mm	-1.5/+1.5 mm
For thicknesses and widths > 300 mm	-3/+5 mm	-2/+2 mm

[15] I.S. EN 336:2013 Structural timber - Sizes, permitted deviations

Based on Table 2 and a finished size (planed) of 97 x 42 mm cross section for the 100 x 44 mm boards at sawmill 1, to meet TC2, board thickness D should lie within 96-98 mm and board width B should lie within 41-43 mm. The average of actual adjusted sizes measured should not be less than the target board size. If the finished size is taken as the target size, then this clause is satisfied for the boards assessed in sawmill 1 (Bale 1 and 2 in Table 3), irrespective of the date and length of exposure; all average values lie within this range for D and B.

At sawmill 2, the timber boards were not planed thus the boards are assessed with respect to tolerance class TC1 rather than TC2 and the target size is taken as 100 x 44 mm. To meet TC1, board thickness D should lie within 99-103 mm and board width B should lie within 43-47 mm. Overall, the averages for bale no. 3 lie just on the upper limit of the range while for bale no. 4, the average D (= 109.6 mm) exceeds the limit. The moisture content for bale no. 4 was the highest of all assessed (average 28.7% initially) and it is likely that it experienced greater exposure to rainfall prior to the assessment as it was stored nearer the open entrance of the indoor area than bale no. 3 and a total of 52.2 mm of rainfall was recorded at the nearest weather station in the 7 days prior to testing. This would explain the deviation but also highlights the sensitivity of timber moisture content to storage conditions.

In terms of moisture content, overall a minor increase was experienced in the bales stored indoors (0.26% and 0.6% for bales 1 and 3 respectively), while the bale (no. 2) stored uncovered outdoors at sawmill 1 saw an increase of over 5% in 6 days, exceeding the maximum permitted 24% for timber construction. While this also reflects a period of rainfall between at sawmill 1 that didn't occur for sawmill 2, this highlights the need to store and cover timber appropriately on site in Ireland while not in use to ensure it meets the moisture content limits and tolerances required by timber design and construction standards.

The timber stored indoors did not vary significantly in size, with negative values in Table 3 indicating minor shrinkage which is to be expected. Timber bales at sawmill 2 (Table 4) experience similar minor increases in average moisture content, but small changes in dimensions for bale no. 4 stored outdoors compared to bale no. 3. This is partially due to the lower rainfall at this site between assessment periods (Figure 3), while the initial moisture content measurements indicate that this bale had excess moisture to lose by air drying; starting at 28.7% as mentioned earlier, with one board giving a reading over 42%.

Bale 1 indoors

1	2	3	4	5	6	7	8	9	10	11	12
					4			3			1
			2								
					6			5			

Bale 2 outdoors

1	2	3	4	5	6	7	8	9	10	11	12
1			2			22		3			4
						8					
				5			6			20	
21											
19											18

Figure 6: Measured locations in bales at sawmill 1

Bale 3 indoors

	1	2	3	4	5	6	7	8	9	10	11
1	1				2				3		4
2											
3			5				6				7
4											
5	8										
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
18											
19											
20											
21											

Bale 4 outdoors

	1	2	3	4	5	6	7	8	9	10	11
1				2				3			4
2						5			6		
3			7								
4											
5	8						1				
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
18											
19											
20											
21											

Figure 7: Measured locations in bales at sawmill 2

Table 3 Measurements at sawmill 1

Bale		Initial Assessment			Second Assessment			Change in average MC	Average change in dimensions (mm)	
		MC (%)	Adjusted Dimensions (mm)		MC (%)	Adjusted Dimensions (mm)				
			D	B		D	B		D	B
Indoor Bale 1	Average	20.7	96.9	42.4	21.0	96.9	42.1	+0.26%	-0.1	-0.2
	Minimum	17.9	91.6	41.5	18.3	91.9	41.3			
	Maximum	25.4	99.0	43.0	24	99.8	43.3			
	Standard deviation	2.1	1.9	0.5	1.7	1.7	0.6			
Outdoor Bale 2	Average	18.8	97.0	42.3	24.7	98.0	42.5	+5.87%	+1.3	+0.5
	Minimum	14.7	98.5	43.2	15.4	96.6	40.6			
	Maximum	24.3	95.8	41.1	34.5	101.0	45.1			
	Standard deviation	2.8	0.8	0.8	4.5	1.0	1.1			

Table 4 Measurements at sawmill 2

Bale		Initial Assessment			Second Assessment			Change in average MC	Average change in dimensions (mm)	
		MC (%)	Adjusted Dimensions (mm)		MC (%)	Adjusted Dimensions (mm)				
			D	B		D	B		D	B
Indoor Bale 3	Average	23.0	103.2	45.3	23.6	103.2	45.7	+0.6%	0	+0.2
	Minimum	18.3	100.6	41.9	19	100.8	44.9			
	Maximum	31.1	105.9	47.5	29.3	105.7	47.2			
	Standard deviation	3.2	1.2	1.2	2.7	1.2	0.6			
Outdoor Bale 4	Average	28.7	104.7	46.7	29.3	105.4	46.9	+0.6%	+0.6	+0.1
	Minimum	23.6	103.7	46.0	24.1	104.7	46.0			
	Maximum	42.7	109.6	49.6	36.7	109.3	49.8			
	Standard deviation	4.9	1.5	0.8	3.1	1.0	0.7			

Figure 8 is provided below to illustrate the trend of moisture content readings taken at all measured locations. As observed in previous testing campaigns, the moisture content recorded on the short pin Protimeter (SP) is consistently lower than the data recorded using the long pin Gann (LP), partially related to depth of measurement (10 mm). For this reason, only the measurements taken using the long pin Gann are used to determine the adjusted board sizes. The average of all the recorded measurements for the LP is 3.3% higher than that for the SP. It is worth noting that due to ease of use and cost, the SP metre is more likely to be used in practice and this difference should be considered in timber moisture content assessments, particularly in timber frame construction where the requirement is 18% (I.S. 440).

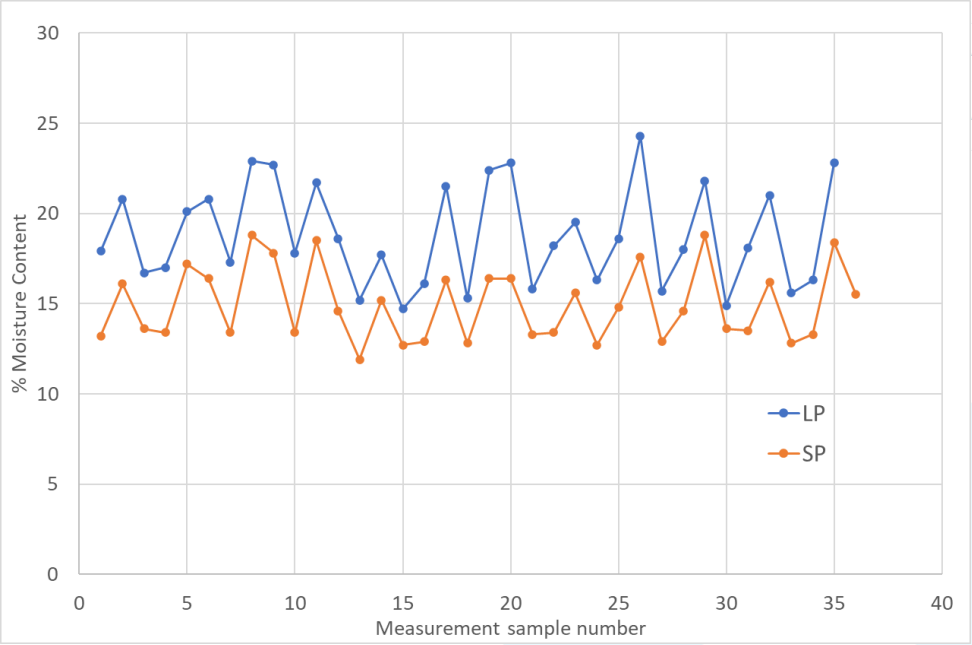

Figure 8: Trend in measured moisture content values using Gann (LP) and Protimeter (SP) moisture metres - Sawmill 1 Bale 2 outdoors Assessment 1

2.3.1 Conclusion

Overall, the site investigations confirm the result that is typically assumed in practice i.e. that the average moisture content of timber increases when exposed to rainfall. Furthermore, depending on the amount of rainfall, the moisture content can exceed the permitted maximum value of 24% after only 7 days which would cause boards to be rejected. This highlights the need for timber to be stored correctly for the exposure conditions. However, there was only a small change in board dimensions and no significant distortion was observed for the boards assessed in this study, partly due to an increase rather than decrease in moisture content. Changes in relative humidity without rainfall e.g. drying in summer with greater temperature variations, rather than rainfall alone, can cause more significant changes. Although humidity was reported at the sawmill sites by MET Éireann (Table 1), a significantly longer study would be needed to assess this impact fully and establish a comparison with imported timber over the same period.

Additional analysis is due to be carried out in future on this data to investigate variations within individual boards (maximum and minimum values) and assess the impact of board position in the bale over time. As mentioned above, further long term (at least 6 months but ideally 12 months+) studies are required to study the impact of MC variation and storage across all seasons in greater detail, alongside measurements of distortion. Suitable storage for this period of time can be a challenge and would need to be identified first. Further collaboration with timber frame manufacturers is required to identify current board rejection rates, both for prefabricated elements, and construction on site. If distortion of boards and/or board rejection based on moisture content limits being exceeded are occurring due to poor site storage, leading to wastage

and hence less use of Irish timber, this needs to be addressed by updated best practice guidelines.

Finally, greater engagement between designers, manufacturers, sawmills and timber wholesalers is required to highlight the feasibility of increasing the use homegrown timber in timber frame construction, particularly where large proportions of imported timber can be replaced by locally sourced timber.

3 Barriers and solutions for the use and acceptance of home-grown timber in the Irish market

This section summarises the latest findings of existing literature, research projects and industry engagement relating to barriers and solutions for the use and acceptance of homegrown timber in Ireland. As highlighted in Section 1, timber frame construction represents approximately 25%[16] of all new build housing units in Ireland and 48% of all low-rise scheme housing[17]. Other forms of timber construction, such as mass timber, currently have a negligible market share. The overall market share of timber frame has been increasing in recent years and this is expected to increase the share of homegrown timber also as cross section sizes typically used in timber frame construction can satisfy design requirements using C16 timber.

However, homegrown timber is still a low proportion of that specified and used due to reliance on imported timber supply chains. This partly stems from poor perceptions of Irish timber quality, although no published reports are available to support this *perception* of quality of homegrown Irish timber. The barriers to the use and acceptance of timber in general in the Irish construction market are mostly well understood;. recent reports published by Department of Agriculture, Food and the Marine (DAFM)[18] and research carried out by Coillte and Forest Industries Ireland in partnership with Irish sawmills, timber frame manufacturers, Wood Knowledge Wales, University of Galway and Technological University Dublin on the *HOMEGROWN HOMES* project. It is anticipated that addressing these barriers, while applicable to timber in general, will support an increase in the timber market share, provide better industry understanding of timber as a material and hence increase the viability and acceptance of homegrown Irish Sitka Spruce for use in construction. The key challenges and proposed solutions are summarised in Table 5 below.

Table 5 Barriers and proposed solutions to use and acceptance of home-grown timber

Barriers	Proposed solutions
Regulation and Alternative solutions • Part B of the Building Regulations is related to fire safety • Technical Guidance Documents (TGD's) provide guidance on their implementation - they are not the regulations themselves • 'Alternative solutions' to the TGD are permitted by Building Regulations which state that the TGD: ○ 'Shall not be construed as prohibiting compliance with a requirement of these Regulations by the use of any	TGD B Clause 3.2.5.2 should be removed, and fire design by scientific and engineering-based calculation approaches should be permitted. This clause currently prevents the use of non-combustible materials (i.e. timber) in buildings with a top storey at or above 10 m (e.g. max 4 storey timber framed buildings). Traditionally, we have imported our construction timber in Ireland didn't have a significant local supply of comparable quality. We now have a sufficient local supply for our needs but we don't build enough in timber to take advantage of this supply – amendment of TGD B would hence support greater use of our own resources.

[16] Government of Ireland (2022), Climate Action Plan 2023, Department of the Environment, Climate and Communications
[17] https://constructionnews.ie/timber-frame-housing/
[18] COFORD. 2022. Forests and wood products, and their importance in climate change mitigation: A series of COFORD statements. COFORD, Dublin.

other suitable material method of construction or specification'. However, where works are carried out in accordance with the TGD's, this will, *prima facie*, indicate compliance with Part B of the Building Regulations but accepted practice is to follow TGD B to comply with fire safety regulation Therefore, in practice, Building Control officers are reluctant to step outside the comfort zone of the TGD as there is a clear path to compliance for timber buildings. The DHLGH published supplementary guidance to Volume 2 of TGD B which has effectively made fire testing the only means of demonstrating fire resistance which now means that fire resistance calculations are not acceptable.	• The review of the responses submitted to the public consultation on the revised TGD B (April 2023) is ongoing and some associated amendments may be made here, although alternative provisions may be just as restrictive for timber structures, irrespective of where the timber is sourced from, which will limit opportunities for increased use of homegrown timber. • Industry and specifiers have discussed inclusion of an appendix specific to mass timber construction over 10 m - this would also address taller timber framed buildings, defining a permitted prescriptive approach similar to that followed for timber frame construction in compliance with I.S. 440 "*Timber frame construction, dwellings and other buildings*". Prescriptive details proposed must be assessed to ensure they do not negatively impact greater adoption of timber. Alternative Solutions • The use of alternative solutions or approaches such as testing, or calculation is commonly used in the UK and has allowed for performance-based fire design compliance to be demonstrated in accordance with Eurocode 5 (EN 1995-1-2 - European design standard for timber structures) • Alternative solutions are also accepted in countries such as Sweden where rapid build modular CLT (for housing) and high rise CLT are commonplace due to local building regulations that support and promote wood-first policy. They are gaining embodied carbon savings delivering net zero construction. • <u>Learn from best international practice:</u> Accepted approach internationally in general that can apply in Ireland: where a product or a technological advance is not specifically covered in the building regulations e.g. CLT, a fire engineering approach based on performance rather than prescription may also be used. This approach involves the use of scientific and engineering-based calculations and/or statistical information to demonstrate an adequate level of safety for a specific building, structure or installation.

<u>Policy & Regulation</u> – current lack of incentives promoting timber in construction or rewarding its use as a low carbon material. Whole life carbon reporting and lifecycle assessment is needed for all construction projects.	• Introduce a Wood first policy for new publicly funded building projects to promote the use of homegrown timber first and timber in general second, in construction
	  ○ Public demonstrator buildings need to be delivered by Government and local authorities.
	  ○ Similar policy incentives have worked well

	in countries such as Sweden. ○ This also aligns with new European Commission Green Public Procurement criteria for buildings. • Whole life carbon reporting is expected to be mandated by Government for public projects in the short term (< 3 years) and all construction projects in the medium term (5 years+). This is expected to support greater use of timber as a locally sourced low carbon structural material with the offset of transport emissions from imported timber • Encourage measures to increase the use of wood through the Climate Action Plan actions associated with construction and carbon emissions.
<u>Education, training, and public awareness</u> • Lack of knowledge, experience and competency in the use and benefits of timber across the construction sector ○ Training needs across the sector ○ E.g. "*poor knowledge of timber among designers*", irrespective of whether it is homegrown • Lack of awareness in general public of: ○ the role of local forests in producing timber and employment opportunities ○ timber as a viable option as a structural material in place of concrete and steel etc ○ the environmental and climate mitigation benefits of timber over traditional materials such as concrete and steel ○ Ireland is involved in the development of timber strength grading settings for the UK and Ireland, and at European level	• Introduce Government supported: (i) professional development training courses targeting design & construction professionals, product specifiers, fire safety officers, public authorities, etc including examples and workshops on best practice using locally sourced timber in design, detailing, construction, assembly and timber product specification (ii) Public awareness campaigns and materials at a national level – this is being partially addressed through DAFM funded research projects. • In terms of design professions, engineering degrees in Ireland need to introduce content on the structural design of timber and build familiarity with local timber resources to avoid project roadblocks in terms of design competency. University of Galway have introduced a new taught Civil Engineering Masters module in 2023-24 entitled "*Timber Engineering and Design of Timber Structures*" to address this, with 35 graduates expected in 2024. Similar applies to Quantity Surveying programmes in Ireland. Architecture courses tend to cover timber as a material option to a greater extent.
<u>Domestic supply chains dominated by imported timber,</u> grade C24 and TR26 from central Europe and Scandinavia, while over 75% of Irish timber products are exported	Engagement between DAFM, industry and third level institutions to incentivise greater use of Irish timber at a national level, learning from Scotland where homegrown timber market share is >85%, identifying opportunities to innovate and produce added-value timber products and/or improved off-site prefabricated solutions using homegrown timber. The formation of the new Interdepartmental Working Group on Timber in Construction is step to address this.
<u>Lack of a dedicated Centre of Excellence for timber engineering and the forestry sector</u>	Through Enterprise Ireland, Timber and forestry sectors, third level and other State institutions: Establishment of a centre of excellence in line with best international practice to promote industry-academic collaboration and encourage investment in

	market led product and system development. It would provide a central point for research, development, innovation and knowledge transfer in timber engineering and forestry and strengthen market development both national and internationally using homegrown resources.

Finally, insurance is also a significant barrier to wider adoption of timber, mass timber in particular. This has not been considered in the above table but is under review by the Interdepartmental working group for Timber in Construction.

3.2 Timber use in Ireland – survey

As part of this project, an industry survey was developed using Microsoft Forms to better understand current perceptions and recent trends in timber construction, targeting stakeholders across the forest and construction industries, including manufacturers, design professionals, and building developers. The survey is provided in Appendix A of this report. It was developed based on an earlier survey carried out by TERG as part of the WoodProps programme in 2019 and published at the World Conference in Timber Engineering (WCTE) in 2021: O'Ceallaigh C., Gil-Moreno D., Ridley-Ellis D., Harte A.M., (2021) Perception and Use of Timber in Construction: A Case Study of Ireland and the UK. In Proceedings of the World Conference on Timber Engineering (WCTE) 2021, Santiago, Chile 9-12 August. This publication can be accessed here: https://www.universityofgalway.ie/media/timberengineeringresearchgroup/Paper-WCTE2021-PERCEPTION-AND-USE-OF-TIMBER-IN-CONSTRUCTION-A-CASE-STUDY-OF-IRELAND-AND-THE-UK.pdf. Related stakeholder engagement and interviews also took place on the HOMEGROWN HOMES project, the results of which are mostly summarised under *Education, training, and public awareness* in Table 5 above.

Since the original survey was issued on the WoodProps programme, there has been an increase in the rate of movement towards specification of low carbon materials in construction in Ireland, in particular through the updates to the national Climate Action Plan[1] and as a result, further attention has been drawn to an increase in the use of timber[19,20]. Considering the increasing volume of timber that is becoming available from Irish forests and is also suitable for use in construction, it is important to capture the impact of changing trends in industry. The new survey is expected to be issued in Spring 2024 and will be kept open for at least 3 months with the results reported at the end of Q2 of 2024.

[19] Thompson, S. (2023). Can timber-framed homes using Irish timber be part of solution to reduce carbon emissions?, The Irish Timber, 4 May 2023. https://www.irishtimes.com/environment/climate-crisis/2023/05/04/can-timber-framed-homes-using-irish-timber-be-part-of-solution-to-reduce-carbon-emissions/.
[20] Kashyap, R. (2023). Why your new house should be a timber house. RTÉ Brainstorm, 10 July 2023. https://www.rte.ie/brainstorm/2023/0710/1393714-ireland-timber-houses-buildings-environmental-sustainability/.

4 Conclusion

This report has presented a brief overview of the current status of the use of Irish homegrown C16 timber in Housing Construction in Ireland. Through literature review and a limited site investigation, it has also provided a summary of ongoing challenges and proposed solutions to promote an increase in the use of homegrown timber in Ireland. The short site investigations confirm that appropriate timber storage is very important in terms of quality control on site and highlight a potential quality perception issue that could be caused by poor site practices - longer studies of at least 6-12 months are required to comprehensively review this. Further data will be obtained from industry engagement through the survey presented in Appendix A. However, the ongoing work of the Interdepartmental Work Group on Timber in Construction will be critical over the next 2 years in addressing the key challenges and solutions outlined here, including regulatory, policy and compliance roadblocks, supply chains, and education, training, and public awareness relating to timber in construction.

Appendix A – Timber Use in Ireland Survey

1. Which of the following best describes your role in the industry? *

- ◯ Sawmilling and Wood processing
- ◯ Manufacturing (including Timber Frame)
- ◯ Design (Product, buildings)
- ◯ Product supplier
- ◯ Forest owner
- ◯ Other

2. Please provide a brief explanation of your role in the industry *

3. How many years of experience have you in the timber industry? *

- ◯ 0-5 years
- ◯ 5-10 years
- ◯ 10-15 years
- ◯ 15-20 years
- ◯ 20+ years

4. Where do you primarily source your timber from? *

- ◯ Locally (Irish grown timber)
- ◯ Imported from the EU
- ◯ Imported from the UK
- ◯ I don't know
- ◯ Other

5. Please explain why you currently source your timber from the location indicated in your response above; provide further details as necessary e.g. specific countries if sourced outside Ireland *

6. Please explain why you prefer to use this timber. *

7. What is the breakdown of how timber is used in your activities? (eg 80/20 Structural framing/Carpentry & first fix or second fix) *

8. How do you store your timber post production and prior to purchase from customers? *

- ◯ Covered and indoors
- ◯ Covered and outdoors
- ◯ Uncovered indoors
- ◯ Uncovered outdoors
- ◯ Other (eg a mix of multiple methods)

9. If you selected "Other" above, please specify how you store timber prior to purchase from the customer. *

10. What testing, if any, do you carry out on your timber and why? *

11. How do you assess and compare the cost and quality of imported timber to that of Irish timber? *

12. In your experience, what are the barriers to using Irish grown timber in the construction industry? *

13. Do you see an opportunity for Irish grown timber being used within the 35,000 new dwelling completions that are required per annum in Ireland at present? Please explain your answer. *

14. Timber grown and harvested for construction in Europe, including Ireland, is typically graded to strength classes specified in the EN 338 standard. This allows graded timber to be used in design and construction in line with structural design codes. Are you familiar with this grading process and timber strength classes e.g. C16, C18, C24 etc? *

- ◯ Yes – both the grading process and strength classes
- ◯ Yes – grading process only
- ◯ Yes – strength classes only
- ◯ No

15. What do you believe needs to be done in order to change the way we use timber in Ireland, that might lead to greater use of Irish grown timber? For example, specific testing of Irish timber, more education and training aimed at using Irish timber, incentivisation etc. In your response, please also consider its potential suitability for use in place of materials such as concrete, steel and masonry block. *

TECHNOLOGY CENTRE
ENTERPRISE IRELAND
IDA IRELAND SUPPORTED

Ollscoil na Gaillimhe
University of Galway

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

UCD DUBLIN

IGBC
IRISH GREEN BUILDING COUNCIL

TU DUBLIN

In support of Project Ireland 2040 and the work of the Construction Sector Group Innovation and Digital Adoption Sub-Group