



Wood Protection Association



Wood Selection Guide

A guide to selecting suitable wood and wood-based construction products

Fire retardant treated wood

Naturally durable wood

Preservative treated wood

Modified wood

Wood-based sheet materials and engineered wood products



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Foreword

As designers look increasingly to wood as a low carbon construction material the WPA is committed to providing guidance on the best ways to ensure wood is fit for the purpose intended. This Guidance Note is one of a number of publications designed to offer impartial, generic information about wood with appropriate protection for its application:

For more resources visit the website: www.thewpa.org.uk

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1. Introduction

Wood is an excellent construction material – light, strong and easily worked. It can be obtained readily from verifiable legal and sustainable sources. It is the material that ticks all the boxes in terms of its whole life environmental impact and scores highly in green guides comparing wood with alternative materials such as concrete, steel and plastic. It is the material of choice in many construction projects and for many end uses whether as round or sawn solid wood, as wood-based sheet materials such as plywood, MDF or OSB, or as engineered wood products such as glulam, LVL, I-beams etc.

For many end uses, wood or wood based materials will require further treatment or modification to make it suitable for use. This is the case where protection against fire or biological degradation (decay or insect attack) is required. This guide serves as an introduction to the treatments or materials available for designers, specifiers and builders in the UK, and covers the following types:

- **Fire retardant treated wood**
- **Naturally durable wood**
- **Preservative treated wood**
- **Modified wood**
- **Wood-based sheet materials and engineered wood products**

Comparison between these materials is not always straightforward as their properties may not be measured in the same way, so choosing between them is not clear cut.

This WPA Guidance Note is offered to help construction professionals choose an appropriate wood material, and in each case this guide directs the reader to further sources of information and in particular the WPA manuals indicated in each section, which complement this publication with detailed recommendations for most end uses and allow accurate specifications to be made.

2. Protection against fire

WPA manual: *Industrial Flame Retardant Treatment of Solid Timber and Panel Products* (ref WPA/FRSM).

Wherever protection against fire is a requirement (e.g. to comply with Building Regulations), wood and wood-based products usually require enhanced reaction-to-fire ratings. For almost all wood and wood-based products this can be conferred by the application of flame retardants or, for example for MDF, by the incorporation of flame retardant chemicals during manufacture.

3. Protection against decay and insect attack

WPA manual: *Industrial Wood Preservation - Specification and Practice* (Ref:WPA/WPSM)

The sapwood of all wood species and the heartwood of many are not sufficiently durable to be used without being enhanced by processing the wood or wood-based materials in various ways. Where the heartwood of a species has sufficient natural durability and it is economically viable to remove the sapwood before use, then these species can be used without further processing. The durability requirements for wood will depend on the end use conditions of the wood and the performance requirements.

Use classes

The requirements for biological durability of wood will vary according to the environment in which the wood is exposed. Five durability use classes (BS EN 335-1, Durability of wood and wood-based products – Definitions of use classes – Part 1: General) define the service environments for wood (see Table 1). These use classes do not align directly with service classes in Eurocodes (see note to Annex Table 1).

3.1 Risk and consequence of failure

Although different components may fall into the same use class, the risk of failure or consequence of failure may be quite different. These considerations are very important when deciding what product type and durability rating is appropriate. Annex Table 2 lists four service factors used to describe variations in risk and consequence of failure.

3.2 Service life

The benchmark for service life of wood in construction is set in BS8417 Preservation of Wood - Code of Practice. Three service life categories are available: 15, 30 and 60 years. For each end use of wood in construction the WPA assigns a typical service life and the benchmark reflects that. For details see the WPA manuals where the options for longer service life are shown.

The prediction of service life is not precise; service lives are not guarantees of performance but indications of the expectation against which the durability performance benchmarks are set, assuming good design and normal conditions of use. Other factors, such as mechanical damage or failure of other elements of the construction, could limit the life of the complete commodity.

Further information on the way that the durability of wood and wood products is measured is given in section 4 of this document.

Table 1 summarises the durability requirements for the most common wood product types used in the UK.

Table 1:

Performance Benchmarking (Durability)

USE CLASS	SERVICE FACTOR	EXAMPLE USES	PRODUCT TYPE			
			NATURALLY DURABLE ² (Heartwood only)	PRESERVATIVE TREATED ³	MODIFIED WOOD ⁴	WOOD-BASED SHEET AND ENGINEERED WOOD PRODUCTS
1 ¹	A	Interior joinery, floors ⁵ , (risk of insect attack)	Heartwood of species graded D for Anobium	Treated with preservatives type N	Durability grade D for Anobium	Products with non-durable* laminates thicker than 5 mm require treatment with type N preservatives.
2 ^{1,6}	D	Tiling battens, external timber frame walls ⁷	Heartwood of species graded 2 or better and D for Anobium	Treated with preservatives classified for UC2 and type N	Durability grade 2 or better	Products containing non-durable* wood require treatment with UC2 and type N preservative
3 coated ^{1,8}	C	Windows	Heartwood of species graded 3 or better	Treated with preservatives classified for UC3 (coated)	Durability grade 3 or better	Products containing non-durable* wood require treatment with UC3 (coated) preservative
	C	Cladding, deck boards	Heartwood of species graded 2 or better	Treated with preservatives classified for UC3 (coated)	Durability grade 2 or better	Products containing non-durable* wood require treatment with UC3 (coated) preservative
3 uncoated ^{1,8}	C	Deck boards, fence rails	Heartwood of species graded 2 or better	Treated with preservatives classified for UC3 (uncoated)	Durability grade 2 or better	Products containing non-durable* wood require treatment with UC3 (uncoated) preservative
4 ^{1,9}	D	Fence posts	Heartwood of species graded 2 or better	Treated with preservatives classified for UC4	Durability grade 2 or better	Products containing non-durable* wood require treatment with UC4 preservative
4 ^{1,10}	D	Posts for decks, earth retaining structures, river embankments, motorway fencing	Heartwood of species graded 1	Treated with preservatives classified for UC4	Durability grade 1	Products containing non-durable* wood require treatment with UC4 preservative
5 ¹¹	D	Harbour and wharf structures in the sea	Heartwood of species graded 1 and D for marine organisms	Treated with preservatives classified for UC5	Durability grade 1 and D for marine organisms	Products containing non-durable* wood require treatment with UC5 preservative

*non-durable means wood with natural durability less than that indicated in column 4 (Naturally Durable)

Notes to table

1. If resistance to termites is required BS EN 350-1 grade D (termites) or treatment with preservative (WPA manual Type T) is required
2. Natural durability classifications from BS EN 350-2 and suitability for use from BS 8417. Where natural durability is indicated in the standard as a range, the highest number (i.e. lowest durability) should be taken as the classification for assessing suitability for use.
3. Preservative types listed in WPA manual Industrial Wood Preservation - Specification and Practice

4. Natural durability classifications and insect resistance assessed and graded according to BS EN 350-1. Manufacturers of modified wood products may provide additional information on durability to fungi to provide more confidence in long-term performance in service to back up these grades based on laboratory tests
5. For specialist floors (e.g. industrial, commercial and ballroom) hardness, and in some cases stability, is important – check the WPA manual Modified Wood Products – Properties, Performance and Specification for suitable modified wood products. Check individual species characteristics for suitable naturally durable types
6. To give 60 year service life required to conform with the Construction Products Directive

7. Sole plates for external timber frame walls are use class 2 but they require increased protection due to their position and vulnerability and the durability benchmark for these is as for use class 3 (uncoated)
8. To give 30 year service life
9. To give 15 year service life. 30 and in some cases 60 year life can be specified. Check WPA manuals for details. Natural durability grade 1 required.
10. To give 30 year service life. In some cases a 60 year life can be specified for preservative treated and modified wood
11. To give 15 year service life

Further information

1. Natural durability: BS EN 350-2 Durability of wood and wood-based products – Natural durability of solid wood – Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe.
2. Wood-based sheet materials: Wood Panel Industries Federation (WPIF) Panel Guide
3. Engineered wood: TRADA Choose and Use sheet – Engineered Wood.

4. How is durability measured?

4.1 Naturally durable wood

Different wood species vary in their resistance to attack by wood-destroying organisms such as fungi, insects and marine borers. The term naturally durable is, however, commonly used only to refer to the resistance of each wood's heartwood to attack by wood-destroying fungi when placed in contact with the ground.

High level cladding:
Use Class 3 (uncoated) application, service factor C (replacement of timber or remedial action is difficult and expensive). Durability essential.

*Photo courtesy:
Riven Street Studios*



The durability classifications of woods of commercial importance within Europe based on this method are listed in BS EN 350-2 and are used to indicate suitability for use classes 2, 3 and 4 (against fungal attack only). BS 8417 gives guidance on appropriate levels of natural durability for different end use and desired service life combinations.

DURABILITY - IMPORTANT NOTES

- 1 Durability classifications are typically based on the performance of the heartwood of virgin forest material and are the highest durability ratings that can be expected from individual species. Faster grown plantation material might not achieve these grades and this should be borne in mind particularly for safety-critical end uses and long service life requirements.*
- 2 For new wood species coming into commercial use, laboratory tests designed to test the effectiveness of wood preservatives against wood-rotting fungi may be used to allocate a provisional durability classification to the heartwood (BS EN 350-1 Durability of wood and wood-based products – Natural durability of solid wood – Part 1: Guide to the principles of testing and classification of the natural durability of wood). These classifications should not, however, be used to assess the suitability of such species for the end use and service life combinations in this guide.*

Where natural durability against insect or marine borer attack is required, a suitable wood species should be chosen from BS EN 350-2, using the additional classifications for durability against these organisms. The classification of resistance to attack by insects (wood-boring beetles and termites) is obtained from laboratory tests originally designed to test the effectiveness of wood preservatives (BS EN 350-1).

The classification of resistance to marine borers is obtained from tests in the sea lasting normally at least five years.

4.2 Preservative treated wood

The efficacy of individual preservative formulations is assessed in a range of tests set out in BS EN 599-1 Durability of wood and wood-based products – Efficacy of preventive wood preservatives as determined by biological tests – Part 1: Specification according to use class. For each use class (see Table 1) the standard requires a particular combination of tests to be carried out.

For use classes 1, 2 and 3 and 4, the sapwood of a softwood (Scots pine) and/or the sapwood of a hardwood (beech) are impregnated with the formulation under test and exposed to attack by a range of wood-destroying fungi and, if required, wood-boring beetles and/or termites. The resistance to attack by these organisms is assessed in comparison with untreated samples of the same woods to determine the amount of preservative required to protect the wood.

Roofing Timbers:
Durability required for use class 1 and 2 applications

*Photo courtesy:
Arch Timber
Protection*



For wood to be used in weather-exposed situations (use class 3) and in contact with the ground or fresh water (use class 4) additional field tests with larger wood samples exposed in simulations of service conditions provide more confidence in preservative performance. The WPA recommends that only preservatives with field test data be used for use class 4 situations. For use class 3 situations field test data is advisable.

Timber decks and boardwalks:
Preservative treated softwood durability for use class 3 and 4 applications.

*Photo courtesy:
John Brash*



For use class 5, efficacy is assessed in a combination of laboratory tests with fungi and large-scale tests with wood in the sea exposed to marine borers for at least five years.

Use Class 5 Marine:
Use class 5 is the classification for wood used in marine/salt water environments.

*Photo courtesy:
Arch Timber Protection*



4.3 Modified wood

Wood modification processes include physical, chemical and biological processes that change the nature of wood to improve or change its natural characteristics. Modified wood that has been produced by chemical processes differs from preservative treated wood in that the chemicals used have no direct effect on fungi or insects.

Cladding and steps:

Modified wood has emerged as a durable, dimensionally stable material for a wide range of applications where enhanced durability is required.

*Photo courtesy:
Accsys Technologies*



For use classes 1, 2 and 3 the durability of modified wood is assessed in laboratory tests as if it were a naturally durable species (BS EN 350-1). For use class 4 a provisional durability class can be allocated using the laboratory tests but this will be noted in the product entry in the WPA modified wood manual and the manufacturer will have begun field tests with his product that will eventually verify the provisional classification or alter it. For use class 5, durability can only be classified after field tests in the sea.

IMPORTANT NOTE

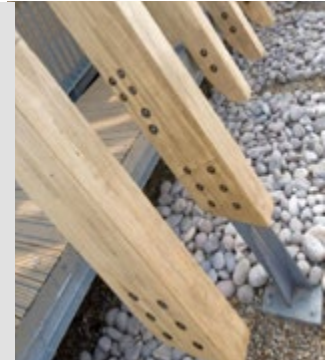
The suitability of naturally durable wood for each use class and service life combination based on the classification in EN 350-2 against fungi is always measured in ground contact tests. This is not universally applicable to modified wood as some modified woods may perform well out of ground contact but poorly in ground contact. Thus suitability of modified wood for use classes 1, 2 and 3 is always based on laboratory tests supplemented by service experience where this is available.

4.4 Wood-based sheet materials and engineered wood

In principle, the durability of these materials is linked to the durability of the wood species used for their manufacture. Since durability in use classes 2 to 5 is a function of exposure to water, the ability of such materials to maintain their physical integrity when wet will determine their use in the higher use classes. Check with manufacturers for the suitability of their products for the relevant use class and for their compatibility with preservative treatment if required.

Engineered laminated beams:

*Photo courtesy:
Accsys Technologies*



OSB/MDF:

Rehearsal room at Copenhagen opera house lined with fire retardant "Meditate" panels.

*Photo courtesy:
Coillte Panel Products*



Table 2: Use Classes¹

USE CLASS	SERVICE SITUATION	PRINCIPAL BIOLOGICAL AGENCY	TYPICAL SERVICE SITUATION
1 ²	Above ground, covered. Permanently dry.	Insects	Internal, with no risk of wetting.
2	Above ground, covered. Occasional risk of wetting.	Fungi / Insects	Internal, with risk of wetting.
3	Coated ³ Above ground, protected, e.g. by a coating. Exposed to frequent wetting. If wood becomes wet, drying out may be delayed by a coating. Uncoated. Above ground, not protected. Exposed to frequent wetting.	Fungi ⁴ Fungi ⁴	External, above damp proof course (dpc)
4 ⁵	In contact with ground or fresh water. Permanently exposed to wetting.	Fungi ⁴	Timbers in permanent contact with the ground or below dpc. Timbers in permanent contact with fresh water. Cooling tower packing. Timbers exposed to the particularly hazardous environment of cooling towers.
5	Permanently exposed to wetting by salt water.	Marine borers, Fungi	All components in permanent contact with sea water.

Notes to table 2

1. Eurocode service classes are only useful for wood in or on buildings and do not equate directly with use classes. Service class 1 includes use class 1; Service class 2 may include some use class 1 conditions and some use class 2 conditions; Service class 3 may include some use class 2 conditions and all use class 3 conditions and above.
2. UK Building Regulations require preservative treatment of softwood roof timbers in the Hylotrupes area. UK government climate change criteria are expected to indicate an increased risk of insect attack in use class 1 in all parts of the UK.
3. Some preservatives are only recommended for use class 3 when protected by a coating.
4. BS EN 335-2 includes insects as a risk factor in use classes 3 and 4 but this is not, under present conditions, recognised as a significant risk for timbers in these situations in the UK.
5. BS EN 335-2 has two sub-classes in use class 4 but the difference in biological hazard is not recognised as sufficiently different for timbers in these situations in the UK and durability benchmarking in this guide is based on a single use class for timber in ground or freshwater contact.

Table 3: Service Factors

SERVICE FACTOR CODE	DESCRIPTION OF RISK AND CONSEQUENCES OF FAILURE
A	Negligible risk of failure
B	Where risk of failure is low and use of materials with enhanced durability can be regarded as an insurance against cost of repairs, and/or where replacement of timber or remedial action is not difficult or expensive.
C	Where risk of failure is high and/or where replacement of timber or remedial action is difficult and expensive.
D	Where risk of failure is very high and/or where failure of timber components would result in serious danger to structure or persons

Support the work of the WPA

The WPA is a not for profit trade association focused on the development and promotion of wood protection technology to support the use of wood as a cost effective, sustainable and low environmental impact construction material.

The WPA acts as a technical advisor to British and European Standards setters on wood preservation, modified wood and the fire protection of wood. On the Regulations governing wood protection, the WPA enjoys lead body status with agencies like the Health & Safety Executive, Environment Agency, Scottish Environmental Protection Agency, the Department for Environment, Food & Rural Affairs and the Highways Agency.

The WPA operates Benchmark quality approval schemes for preservatives, flame retardants and modified wood – providing valid independent assessment and verification. Designed to further assure products and processes are fit for purpose.



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