CHAPTER 2: Materials

CONTENTS

FUNCTIONAL REQUIREMENTS

2.1 TIMBER

Workmanship

i. All workmanship must be within the tolerances defined in Chapter 1 of this Manual.
ii. All work is to be carried out by a technically competent person in a workmanlike manner.

Materials

i. All materials should be stored correctly in a manner that will not cause damage or deterioration of the product.
ii. All materials, products and building systems shall be appropriate and suitable for their intended purpose.
iii. External timber should be adequately treated or finished to resist insect attacks. Timber treatment should be in accordance with relevant British Standards and Codes of Practice.
iv. The structure shall, unless specifically agreed otherwise with the Warranty provider, have a life of not less than 60 years. Individual components and assemblies, not integral to the structure, may have a lesser durability, but not in any circumstances less than 15 years.
v. Timber used in the dwelling to provide support to the structure must be appropriately seasoned to prevent excessive shrinkage and movement.

Design

i. The design and specifications shall provide a clear indication of the design intent and demonstrate a satisfactory level of performance.
ii. Structural elements outside the parameters of regional Approved Documents must be supported by structural calculations provided by a suitably qualified expert.
iii. The materials used for construction must meet the relevant Building Regulations.
iv. Specialist works must be provided and supported by structural calculations completed by a suitably qualified engineer where necessary.
v. Any engineered beams/posts manufactured off-site must have structural calculations endorsed by the manufacturer.

Limitations of Functional Requirements

i. The Functional Requirements are limited by the recommendations applied to the specific areas covered in this chapter.
ii. These Functional Requirements do not and will not apply to create any policy liability for any remedial works carried out by the contractor or otherwise, nor to any materials used in those remedial works.

2.1.1 Storage

Timber should be stored correctly to ensure it does not deteriorate. It should be kept dry and covered in cold conditions to prevent surface freezing, and should be kept off the ground and spaced to allow air to move around freely. Timber should be kept flat to prevent warping or twisting.

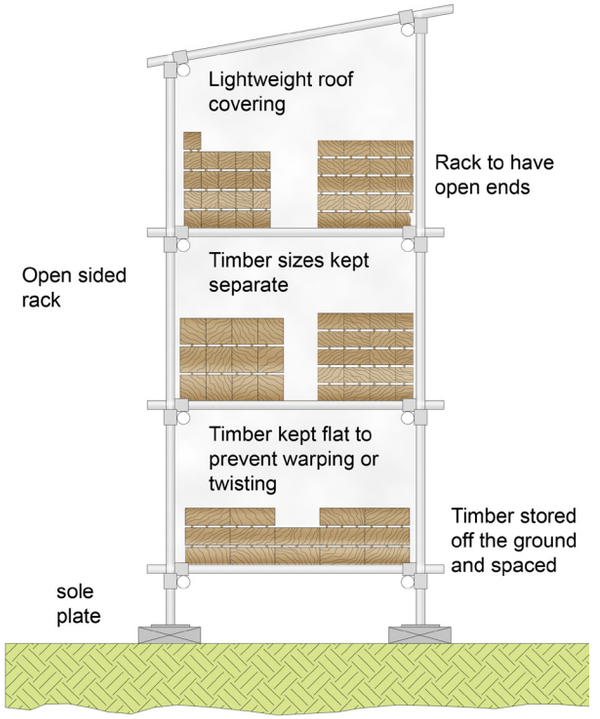


Figure 1: Storage of timber on-site

2.1.2 Timber durability

Timber should be appropriately treated to resist insect attacks. Some timber species have a natural ability to resist attack; Table 1 identifies various species of timber and typical durability. Please refer to BS 8417 to determine the need for preservative treatment depending on the 'use class' of the timber component.

2.1.3 Timber grading

Timber should be of the appropriate strength classification in order to meet its design intention. For timber that is to be used for structural purposes, e.g. floor joists, rafters and ceiling joists, the strength classification should be assumed to be C16 unless it is appropriately stamped with its specific strength classification. This is outlined on the next page.

Durability class	Timber type	Species	Variety	Typical strength grade*
Very durable	Softwood	None		
	Hardwood	Opepe		D50
		Padauk-Andaman		N/A
		Afromosia		N/A
		Greenheart		D70
		Guarea		N/A
		Iroko		D40
		Jarrah		D40
		Okan		N/A
		Pyinkado		N/A
		Teak	Malaysian	D40
		Kapur	Sabah	D60
			Burma	D60
		Padauk	White	N/A
		Peroba		N/A
Durable	Softwood	Cedar	Western Red (non-UK)	C18
	Hardwood	Besralocus		N/A
		Ekki		D70
		Chestnut	Sweet	N/A
		Karri Kampas		D50
		Louro	Red	N/A
		Oak	American White	D50
			European	D30
		Mahogany	American	N/A
Moderately durable	Softwood	Pine	Caribbean Pitch	C24
			American Pitch	N/A
		Cedar	Western Red (UK)	C18
		Fir	Douglas (North America)	C16-C24
			Douglas (UK)	C18
			Dunkeld (UK)	N/A
		Larch	European	C16-C30
			Hybrid	C16-C30
			Japanese	C16-C30
			Tamarack	C16-C30
			Western	C16-C30
			Maritime	C16-C30
	Hardwood	Keruing	Sabah	D50
			Malaysian	D50
		Oak	Tasmanian	N/A
			Turkey	N/A
		Mahogany	African	N/A
Slightly durable	Softwood	Fir	Noble	C16-C24
			Silver	C16-C24
			Balsam	C16-C24
			Grand	C16-C24
		Pine	Canadian Red	C16
			Corsican	C16
			Jack	C16
			Parana	C16
			Ponderosa	C16
			Radiata	C16
			Scots	C16-C24
			Southern	C16-C30
			Western White	C16
			Yellow	N/A
			Lodgepole	N/A
		Redwood	European	C16-C24
		Hem-fir	USA and Canada	C16-C24
		Spruce	Eastern Canadian	C16
			Engelmann	C16
			European (whitewood)	C16
			Sitka	C16
			Western White	C16
		Spruce-pine-fir	Canada	C16-C24
	Hardwood	Elm	Dutch	N/A
			English	N/A
			White	N/A
			Rock	N/A
			Wych	N/A
		Oak	American Red	D40
		Beech	Silver	D35-D40
Not durable	Softwood	None		
	Hardwood	Alder		N/A
		Beech	European	D35-D40
		Birch	Silver	N/A
			European	N/A
			Paper	N/A
			Yellow	N/A
		Chestnut	European Horse	N/A
		Lime		N/A
		Sycamore		N/A

*** Denotes typical strength grade and is for guidance purposes only.**

Table 1: Characteristics of timber species

2.1.4 Timber treatment

Timber should ideally be preserved in a factory environment; it is accepted, however, that this is not always possible. Timber treatments should be approved according to the relevant Code of Practice or British Standard, or have third-party accreditation. Careful consideration should be given to Health and Safety when applying timber treatment products. It is important that any pre-treated timber be re-treated if it is cut to expose untreated end grain. The treatment should be coloured so it can be proven that the end grain has been treated.

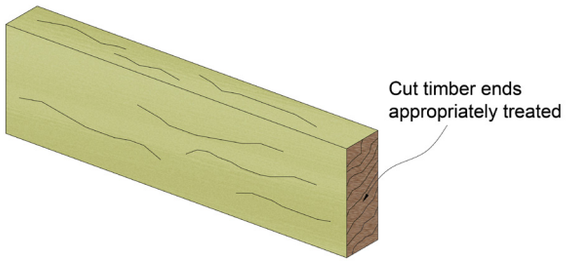


Figure 2: Pre-treated timber exposing untreated end grain

2.1.5 Metal fixings

Metal components should be galvanised where they are to be fixed or used adjacent to treated timber.

2.1.6 Standards referred to

- BS EN 1912: 2012 Structural timber-strength classes – Assignment of visual grade and species
- BS EN 1995 1 1: 2004 & 2008 Eurocode Design of timber structures
- BS 8417:2011 Preservative of wood – code of practice
- BS EN 335:2013 Durability of wood and wood based products

FUNCTIONAL REQUIREMENTS

2.2 CONCRETE

Workmanship

i. All workmanship must be within the tolerances defined in Chapter 1 of this Manual.
ii. All work is to be carried out by a technically competent person in a workmanlike manner.
iii. Concreting shall not take place during cold weather periods or where ground conditions are frozen.

Materials

i. All materials should be stored correctly in a manner that will not cause damage or deterioration of the product.
ii. All materials, products and building systems shall be appropriate and suitable for their intended purpose.
iii. The structure shall, unless specifically agreed otherwise with the Warranty provider, have a life of not less than 60 years. Individual components and assemblies, not integral to the structure, may have a lesser durability, but not in any circumstances less than 15 years.

Design

i. The design and specifications shall provide a clear indication of the design intent and demonstrate a satisfactory level of performance.
ii. Structural elements outside the parameters of regional Approved Documents must be supported by structural calculations provided by a suitably qualified expert.
iii. The materials used for construction must meet the relevant regional Building Regulations.
iv. Reinforced concrete elements must be supported by structural calculations and details produced by a suitably qualified Structural Engineer.
v. Precast structural elements must have structural calculations that prove their adequacy, as endorsed by the manufacturer.

Limitations of Functional Requirements

i. The Functional Requirements are limited by the recommendations applied to the specific areas covered in this chapter.
ii. These Functional Requirements do not and will not apply to create any policy liability for any remedial works carried out by the contractor or otherwise, nor to any materials used in those remedial works.

2.2.1 Cold weather working

To meet the functional requirements of this chapter, the minimum working temperature should not fall below 2°C. It is important that during cold weather periods, regular temperature readings should be taken. Thermometers should be placed away from direct sunlight, preferably in a shaded area. When assessing the temperature, it is also important to consider wind chill and weather exposure, and make the necessary allowances for sites that have a higher level of exposure.

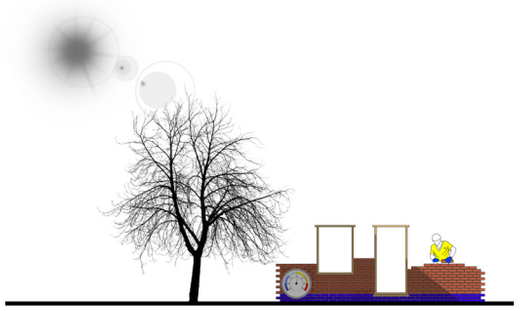


Figure 3: Cold weather working

2.2.2 Ready mixed concrete

It is a requirement of BS 8500 and BS EN 206-1 that the temperature of fresh concrete shall not be below 5°C at the time of delivery. Measures should also be put in place to ensure immature concrete is prevented from freezing before sufficient strength has been achieved.

2.2.3 Site mixed concrete

Site mixing is acceptable at low temperatures, provided:

- The minimum temperature is no less than 2°C.
- The concrete is appropriately protected during curing.
- Ground conditions are not frozen.

2.2.4 Concreting of foundations and oversite

Concrete should not be poured if the ground is frozen; frozen ground can change in stability and volume during thawing, and therefore may cause damage to the recently poured concrete.

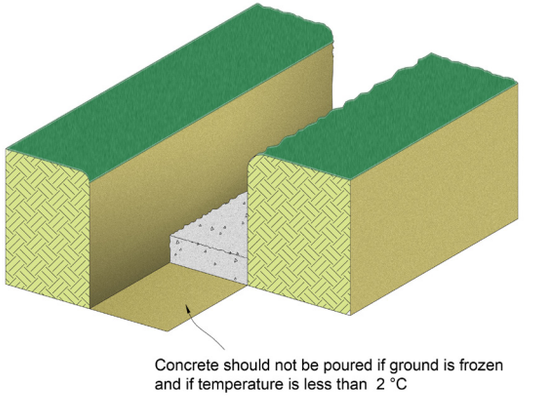


Figure 4: Concrete pouring in cold weather conditions

During cold weather it may be appropriate to cover the ground to prevent freezing and, in some extreme cases, heating of the ground may be required.

Other concreting: Concrete reinforcing and formwork should not be frozen and be free from snow and ice.

2.2.5 Curing of concrete

Concrete may take longer to cure in cold conditions, and an additional six days may be required in extreme cases. Concrete may be covered with a rigid insulation to prevent freezing during curing periods. This is particularly useful for oversized slabs.

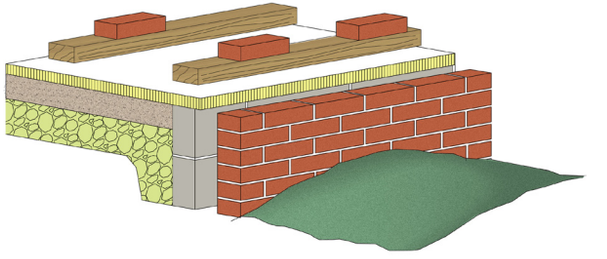


Figure 5: Concrete curing in cold weather conditions

2.2.6 Concrete suitability

Concrete of the appropriate durability and strength should be used in all circumstances. Table 2 gives details of the correct concrete for varying applications.

Application	Ready mixed concrete	Site mixed concrete	Consistence class
Substructure Blinding (unreinforced) Backfilling	GEN1	N/A	S3
Substructure (unreinforced) Structural blinding Strip, trench and mass filled foundations Concreting of cavity walls to ground level	GEN1	N/A	S3 / S4
Floor (dwellings unreinforced and unsuspended)			
With screed added or other floor finish	GEN1	N/A	S2
Floor slab as finish (e.g. power float)	GEN2	N/A	S2
Garage floors (unreinforced and unsuspended)	GEN3	N/A	S2
Reinforced slabs (dwellings and garages suspended or unsuspended)	RC35	N/A	S2
Superstructure	As specified by a Structural Engineer	N/A	As specified by a Structural Engineer
External works			
Pathways	PAV1	ST5	S2
Bedding for paving slabs	GEN1	ST1	S1

Table 2: Concrete suitability

2.2.7 Concrete mixes

2.2.7.1 Ready mixed concrete

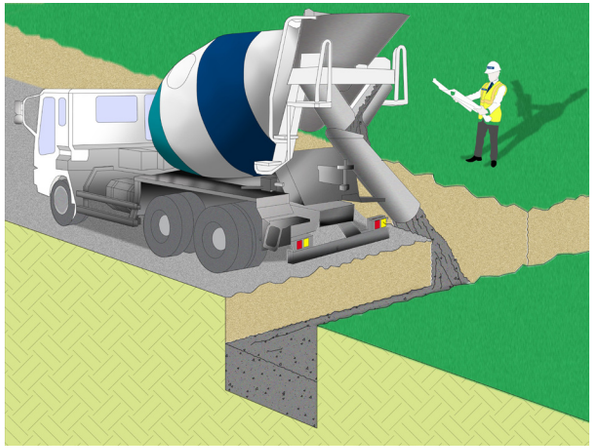
Concrete must be mixed using the correct proportions of cement, sand, aggregate and water. Ready mixed concrete should be delivered as close as possible to the site works and should be poured immediately to prevent settlement or separation of the mix. Ideally, ready mixed concrete should be poured within two hours of the initial mixing at the concrete plant.

Ready mixed concrete should only be sourced from a supplier who has a quality control system in place to ensure the correct standard of concrete is delivered. The quality control scheme should be either QSRMC (Quality Scheme for Ready Mixed Concrete) or a relevant British Standard Kite mark scheme.

It is important to pass all design specifications of the concrete to the ready mixed supplier to ensure that the delivered concrete meets the design intention.

Delivery notes should be kept and made available for inspection if required.

Additional water should not be added to the concrete on-site; nor should the ready mixed concrete be poured into water-filled trenches unless the concrete has been specifically designed for this purpose.



2.2.7.2 Site mixed concrete

Site mixed concrete should generally be avoided unless it is for non-structural applications, e.g. backfilling or bedding of paving slabs, etc. There may be exceptional circumstances where site mixing is unavoidable. Where this is the case, extra caution must be taken to ensure that the correct mix proportion is used; delivery notes should be provided if necessary, and a provision for testing may be required.

2.2.8 Reinforcing

Reinforcing bars and mesh should be clean and free from loose rust and any other contaminants that may cause deterioration of the reinforcing material or the durability of the concrete.

Reinforcing bars and mesh should be placed in accordance with structural drawings; bars that are to be bent should be done so using the correct tools for the job.

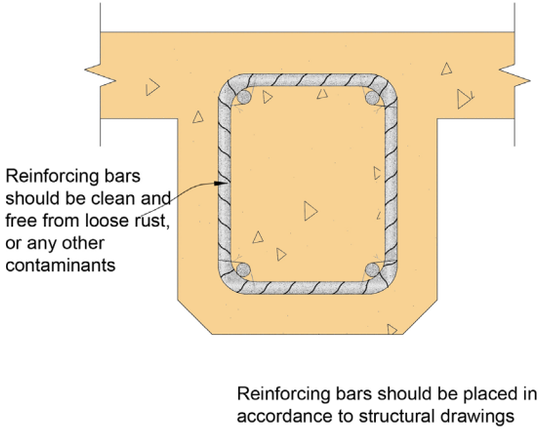


Figure 7: Reinforcing bars in concrete beam

Reinforcing bars should be correctly positioned, ensuring there is appropriate concrete cover, and reinforcing mesh placed in the right direction (main bars parallel to span).

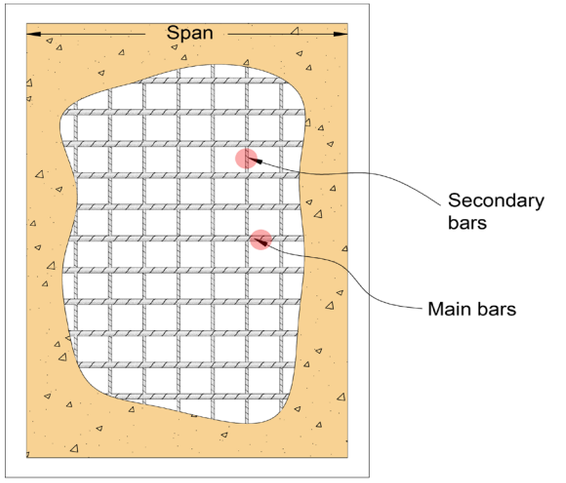


Figure 8: Position of bars on reinforced concrete slab

2.2.8.1 Reinforcing cover

An appropriate level of concrete cover should be provided to the reinforcing; the cover thickness will depend on the exposure of the concrete and its application. Concrete cover should be specified by a qualified Structural Engineer, or alternatively by using Table 3.

Application (concrete position)	Minimum cover (mm)
Concrete in direct contact with the ground	75
All external applications e.g. shuttered walling	50
Floor slabs and other applications where concrete is cast onto a membrane	40
Concrete over blinding concrete	40
Internal conditions	25

Table 3: Minimum concrete reinforcing cover

Reinforcing should be supported by proprietary chairs or spacers, and can be made of concrete, plastic or steel. The thickness and depth of a concrete spacer should not exceed 50mm x 50mm. Spacers should be placed at a maximum of 1m centres, and when supporting mesh should be staggered.

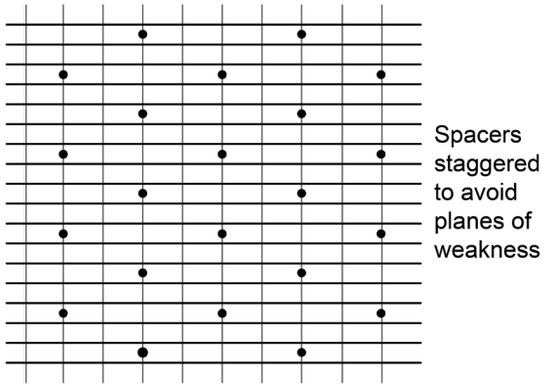


Figure 9: Position of spacers

2.2.9 Admixtures

Admixtures should only be used if stipulated as part of the original design specification. If an admixture is to be proposed where it was not intended as part of the design, a Structural Engineer must confirm that the admixture is appropriate and required.

It is important that the appropriate amount of admixture is applied to any mix. Any overdosing may cause concrete deterioration or poor workability.

Common admixtures

- **Plasticisers** – improve the workability of concrete, especially when pumped; they can also improve concrete adhesion, which is particularly enhanced when concrete is reinforced.
- **Air entraining agents** – increase the air void volume of concrete, which in turn produces a surface more resilient to cold weather, and is therefore ideally suited to outdoor conditions where cold weather exposure is high, such as pathways or roads.
- **Accelerators** – provide an improved curing time, but caution should be taken to allow for reasonable time to 'finish' the concrete.

Admixtures in cold weather

Admixtures may be used in cold weather, but usually will not assist in preventing concrete from freezing; therefore, they should not be relied upon to compensate for freezing conditions. The guidance for cold weather working should be followed in these circumstances.

Admixtures and reinforcing

Admixtures containing chloride will cause corrosion to occur, meaning they should not be used in concrete containing reinforcing.

2.2.10 Expansion/movement joints

Joints in concrete should be provided to prevent cracking caused by shrinkage; shrinkage will be less significant if the concrete is reinforced.

A larger number of expansion joints should be provided to concrete where weak spots may occur. This could include a narrowing width of floor slab for example.

2.2.11 Vibration and compaction of concrete

Reinforced concrete should be compacted using a vibrating poker, but care must be taken to ensure the concrete is not over-compacted and the concrete mix separated. Tamping of floors by hand is acceptable for floor slabs that do not exceed 150mm in thickness.

2.2.12 Curing of concrete

Concrete should be adequately cured before loads are applied. It is acceptable that masonry walls may be built up to Damp Proof Course (DPC) on a foundation that is not fully cured; however, care must be taken to prevent any damage to the foundation. The concrete should be at least durable enough to carry the masonry.

The speed at which concrete mixes cure depends on the mix ratio and whether there are any additives within the concrete. Where curing time is critical, such as cast in-situ upper floors, curing times should be indicated as part of the design and formwork struck, as advised by a Structural Engineer.

To prevent concrete curing too rapidly after initial drying, exposed concrete should be covered with hessian, polythene or sand. This prevents the surface drying too quickly and protects the concrete. This level of protection is particularly critical in hot or adverse weather conditions.

2.2.13 Standards referred to:

- BS 8110 Structural use of concrete
- BS EN 1992 – 1-1 Design of concrete structures, general rules and rules for buildings (incorporating UK National Annex to Eurocode)
- BS 8500 Concrete – Complementary British Standard to BS EN 206-1
- BS EN 206-1 Concrete. Specification, performance, production and conformity
- BS EN 12620 Aggregates for concrete
- BS EN 197 Cement. Conformity evaluation

FUNCTIONAL REQUIREMENTS

2.3 OTHER COMPONENTS

Workmanship

i. All workmanship must be within the tolerances defined in Chapter 1 of this Manual.
ii. All work is to be carried out by a technically competent person in a workmanlike manner.

Materials

i. All materials should be stored correctly in a manner that will not cause damage or deterioration of the product.
ii. All materials, products and building systems shall be appropriate and suitable for their intended purpose.
iii. The design of the structure shall, unless specifically agreed otherwise with the warranty provider be based on an intended life of 60 years, save that, and for the avoidance of doubt, nothing in this Technical Manual creates expressly or implicitly any ongoing responsibility for roof coverings in this design life requirement. This is dealt with further in Chapters 7.6, 7.9, 7.10, 7.11 and 7.12 relating to Roof Performance Standards.

Design

i. The design and specifications shall provide a clear indication of the design intent and demonstrate a satisfactory level of performance.
ii. Structural elements outside the parameters of regional Approved Documents must be supported by structural calculations provided by a suitably qualified expert.
iii. The materials used for construction must meet the relevant Building Regulations.

Limitations of Functional Requirements

i. The Functional Requirements are limited by the recommendations applied to the specific areas covered in this chapter.
ii. These Functional Requirements do not and will not apply to create any policy liability for any remedial works carried out by the contractor or otherwise, nor to any materials used in those remedial works.

2.3.1 Cold weather working

To meet the functional requirements of this chapter, minimum working temperatures should not fall below 2°C when working with masonry. It is important that during cold weather periods, regular temperature readings should be taken.

Thermometers should be placed away from direct sunlight, preferably in a shaded area. When assessing the temperature, it is also important to consider wind chill and weather exposure and make necessary allowances for sites that have a higher level of exposure.

2.3.1.1 Protection of materials

Covers should be provided to protect materials from frost, snow and ice, particularly bricks, blocks, sand and cement. Frozen materials should never be used under any circumstances.

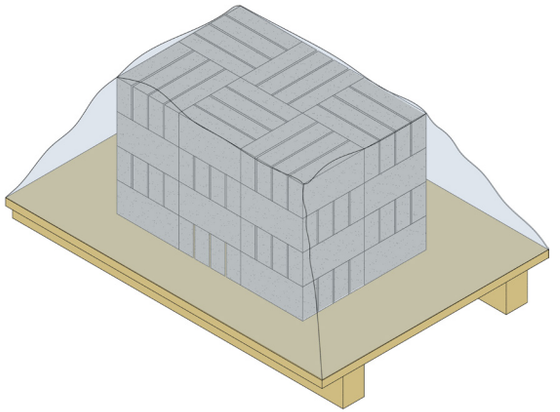


Figure 10: Protection of blockwork

2.3.1.2 Protection of masonry

Any new walls or other masonry construction will require protection against frost where temperatures are expected to drop below 2°C. Ideally, all masonry should be protected with polythene or hessian. If temperatures are expected to fall to an extremely low level, insulation boards may be required, and heating may even be considered.

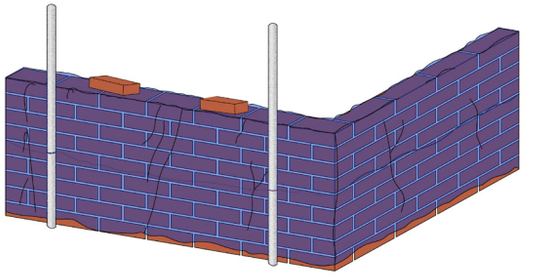


Figure 11: Protection of masonry walls

2.3.1.3 Finishes including rendering, plastering and screeds

Rendering should only be completed if the outside temperature is at least 2°C; there should be no frost within the construction that is to be rendered and, where possible, rendering should not take place where freezing weather conditions are anticipated prior to adequate curing.

No plastering or screeding should take place unless the building is free from frost. It is acceptable to use internal heating to warm the building effectively; however, it is important to ensure that heaters do not emit excessive vapour into the dwelling. Adequate ventilation should be provided to allow moist air to escape. The dwelling should be appropriately pre-heated before plastering, and continue to be heated whilst the plaster dries.

2.3.2 Masonry

2.3.2.1 Bricks

Bricks should be of an appropriate durability to meet the design intention. The type of brick to be used will affect the specification of the mortar. Bricks with greater durability should be used where there is a higher potential for saturation or severe exposure to wind-driven rain.

Durability (BS 3921)	EN 771-1		Comments
	Freeze/thaw resistance	Active Soluble salts content	
FL	F2	S2	Freeze / thaw resistant durable in all uses
FN	F2	S1	
ML	F1	S2	Moderately freeze / thaw-resistant durable except when saturated and subject to repeated freezing and thawing
MN	F1	S1	
OL	F0	S2	Not freeze / thaw-resistant Bricks liable to be damaged by repeating freezing and thawing. For internal use only
ON	F0	S1	
Note: Calcium silicate and concrete bricks contain no soluble salts			

Table 4: Practical equivalents of durability designations of clay brickwork

Use	Clay Brick type	Notes on mortar
Foundation to DPC: Low risk of saturation (well drained site)	F1/F2, S1/S2	M12,M6,M4**
High risk of saturation (poorly drained site & without freezing)	F1/F2, S1*/S2	M12,M6
High risk of saturation (poorly drained site with freezing)	F2,S1* / S2	M12,M6
Foundation to DPC: (sulphates in soils)	As above	Where sulphate conditions exist, the use of sulphate resisting Portland cement is required.
Un-rendered external walls more than 150mm above ground level (Low risk of saturation i.e. protected by roof overhangs, sills and claddings designed to shed water clear of brickwork)	F1/F2, S1/S2	M12,M6,M4
Un-rendered external walls (High risk of saturation i.e. Brickwork inadequately protected and saturated by water run off)	F2,S1 F2,S2	M12,M6*** M12,M6***
Rendered external walls(other than parapet walls & chimney stacks) All exposures	F1/F2,S1 F1/F2,S2	M12,M6,M4 **** M12,M6,M4
Copings, capping's and sills	F2,S1/S2	M12
Internal walls	F1/F2, S0/S1/S2	M12,M6,M4

Notes:
- *** Where S1 units are used in Class M6 mortar; sulphate resisting Portland cement should be used in the mortar.**
- **** Monitoring of batching is required to ensure the correct amount of cement is used to achieve mortar strength class M4**
- *****Use Sulphate resisting Portland cement.**
- ****** Sulphate resisting Portland cement is recommended in the mortar and (where in areas of severe exposure) in the render undercoat as well.**
- **Manufacturers recommendations should be check to confirm suitable for the conditions proposed.**

Table 5: Suitability of brickwork in masonry

CHAPTER 2: Materials

Use	Designation (BS EN 998-3)	Proportion by volume			Minimum compressive strength (N/mm^2) [a]
		Portland cement: lime: sand	**Air-entrained Portland cement: sand**	**Masonry cement: sand**	
Mortar for internal and external use above DPC	(iii)	1:1:5-6	1:5-6	1:4-5	2.5
General purpose to BRE Digest 362		Air-entrained with plasticiser Portland cement: lime: sand 1:1:5.5 by volume			2.5
High durability mortar for A) Use below or near external ground level B) in parapets and chimneys C) External walls with high risk of saturation due to severe weather exposure	(ii) [b]	1:0.5:4-4.5 [c]	1:3-4 [c]	1:2.5-3.5 [c]	5.0
	If type N clay bricks are to be used, or for all chimneys use sulphate resisting cement				
Low permeability jointing mortar including copings, cappings and sills	(i) [d]	1:0.25:3 Use a Type S sand to BS 1200	N/A	N/A	10.0
Load-bearing masonry designed to BS 5628:1		Air entrained with plasticiser, Portland cement: lime: sand 1:1:5.5 by volume			As specified

Notes:
[a] Minimum compressive strength1 of site mixed mortars at 28 days (N/mm^2)
[b] For concrete or calcium silicate brick use a designation (iii) mortar
[c] Where soil or ground-water sulphate levels are appreciable (Class 3 or higher) use sulphate resisting Portland cement.
[d] For concrete or calcium silicate bricks use designation (ii) mortar

Table 6: Suitability of mortar

2.3.3 Standards referred to

- BS 6399 Loadings for buildings
- BS 8103 Structural design of low rise buildings
- BS 187: 1978 Specification for calcium silicate (sand lime and flint lime) bricks
- BS 3921:1985
- BS 5628 Parts 1, 2 and 3 Code of Practice for use of masonry
- BS EN 771-1:2011
- BS EN 998 Specification for mortar for masonry
- BS EN 1996 – 1 Design of masonry structures

2.3.4 (This section has been removed)

2.3.5 Suitability of materials

It is important to ensure materials used in construction:

- Meet the requirements of British Standards or Codes of Practice or equivalent European Standards current at the time of application
- Have approval from an independent third-party technical approval body which is accepted by the Warranty provider. This would either be a UKAS or European equivalent accredited organisation, such as ILAC (International Laboratory Accreditation Co-operation). Details of the testing body accreditation will need to be supplied, as well as the certification document.

In addition:

- The independent third-party testing information must recognise UK Building Regulation requirements and additional Warranty standards. Details of the performance and the limitations of use of the material/product or system tested must be provided.
- Where bearing a CE marking in accordance with the Construction Products Directive, this shall be supported by evidence of the testing carried out on the product.

Construction products that do not meet the requirements of this Technical Manual may not be acceptable for Warranty approval. It is advised that the design team must approach the Warranty provider early in the design stage to discuss the viability of the use of such a material, and determine what further independent third-party testing may be required in advance of the final design proposal.

2.3.6 Corrosion protection of steelwork

Guidance for the protection of structural steel is given in BS EN ISO 12944 ‘Paints and varnishes. Corrosion protection of steel structures by protective paint systems’ and BS EN ISO 14713 ‘Protection against corrosion of iron and steel in structures’.

All metals must have a suitable protective coating to minimise or prevent corrosion during its life and be selected to comply with the appropriate standards and with the corrosion category described in the table below.

The classification of environmental corrosion conditions below has been taken from BS EN ISO 9223 Table 4 and BS EN ISO 12944-4 Table 1. This provides a verbal description of the corrosion categories. Note: To determine the corrosion rates for aluminium, copper, steel and zinc, please refer to the standards listed above.

CHAPTER 2: Materials

Corrosion Category C	Corrosion Level	Indoor Environment -	Outdoor Environment
C1	Very Low	Heated spaces with low relative humidity and insignificant pollution, e.g. offices, schools museums	Dry or cold zones with a very low pollution environment or times of wetness
C2	Low	Unheated spaces with varying temperature and humidity, low pollution and where condensation may occur e.g. storage depots, light industry, sports halls	Temperate zones to dry or cold zones with a low pollution environment e.g. Rural areas and small towns more than 10km from the coast or an estuary
C3	Medium	Spaces with moderate frequency of condensation and pollution from production processes e.g. Residencies, Food processing plants, laundries, breweries, dairies.	Temperate zones with a medium pollution environment or small effects from chlorides, e.g. Urban and industrial areas with moderate sulphur dioxide pollution, coastal areas and estuaries with low salinity (approximately 5-10km)
C4	High	Spaces with a high frequency of condensation and pollution from production processes e.g. Boatyards, industrial processing plants and swimming pools	Temperate zones, atmospheric environment with medium pollution and medium effects from chlorides e.g. polluted urban areas, industrial areas, coastal areas and estuaries with moderate salinity (approximately 1-5km) and areas exposed to de-icing salts
C5	Very High	Spaces with very high frequency of condensation and pollution from production processes, e.g. Buildings with high levels of pollution and condensation	Temperate to sub-tropical zones, high pollution area or a substantial effect from chlorides, e.g. Industrial areas, coastal areas (approximately 500m-1km), sheltered positions on the coastline (without salt spray)
CX	Extreme	Spaces with almost permanent condensation or periods of exposure to extreme humidity effects and with a high concentration of pollution	Tropical zones with high sulphur dioxide pollution including the effects of chlorides, e.g. industrial areas with high humidity and an aggressive atmosphere, coastal (approximately 0-500m) and offshore areas with high salinity (occasional salt spray)

Table 7: Reproduced from BS EN ISO 9223 Table 4 and BS EN ISO 12944-4 Table 1.

For Warranty purposes:

- Steel used on sites with an atmospheric corrosivity of C4 or C5 to BS EN ISO 12944, including sites within 500m from a coastal shoreline (See Chapter 13), should be galvanised to a rate of 710 g/m2.
- Decorative finishes must be compatible with the protective coat specification. Refer to BS EN 12944 ‘paints and varnishes: corrosion protection of steel structures by protective paint systems’ and the manufacturers recommendations.
- Any section of previously galvanised or other protected steel which is then cut or drilled must be provided with appropriate remediation to the exposed parts of steel to ensure adequate corrosion protection is maintained.
- The designer should specify the protective coating system where any steelwork is to be welded.
- Surface preparation should be to BS EN 12944-4.
- The use of Intumescent paint for achieving fire protection should be compatible with any corrosion protective coating applied and the manufacturer’s guidance should be followed.
- In coastal locations (see Chapter 13) Steel lintels, used in both leaves of an external wall should be austenitic stainless steel and in addition, protected by a separate damp proof system / cavity tray (as described in Chapter 7).