12 Timber Upper Floors, Floor Coverings, Staircases and Ladders

12.1 Introduction

Suspended ground floors and floors above basements were dealt with in some detail in Sections 8.6 and 8.9. The principal defects found in upper floors and staircases will be dealt with in this chapter.

The usual type of timber floor consists of a single system of joists to which the floor boarding and other coverings are secured together with the ceiling material secured to the underside. This type of floor is suitable for domestic property and small commercial premises. However, where the span of the joists exceeds about 5 m or the load to be placed on the floors is heavy, the size of joists required would involve an uneconomical use of timber. In such cases the surveyor will no doubt find that the difficulty has been overcome by installing a double floor, that is, dividing the length of the room into bays by means of timber beams or rolled steel joists (RSJs).

As described in Chapter 9 the most serious defect that is likely to occur in a suspended floor is dry rot. However, upper floors are rarely attacked, but outbreaks often occur in pipe ducts and cupboards which, if not detected, will spread into the timber floors. There is little or no danger of dry or wet rot when joists are built into the inner leaf of a well built cavity wall.

Timber upper floors are supported in the following ways:

- Joists bear directly on the wall.
- Joists rest on a timber wall plate built into the wall.
- Joists supported on a mild steel (MS) or wrought iron (WI) bearing bar built into the wall.
- Joists may rest on a wall plate supported on WI or MS corbels built into the wall and are usually spaced at about 700 mm centre to centre.
- In more modern properties the joists are supported on galvanised steel hangers. This method is useful where the joists derive their support from a party wall.

Over the last century considerable attention has been paid to the problem of sound insulation, above or below the floor. The usual type of joist floor supporting floor boarding with a lath and plaster ceiling below, resembles a drain; and sounds of

Building Surveys and Reports, 4th Edition James Douglas and Edward A. Noy
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footsteps and other noises may be transmitted to the floor system. It would hardly be right to call this transmission of sound a defect in the floor, but owners of the premises may well consider it a nuisance and may wish to reduce the noise transmission level as much as possible. Noises often reach the room below either as airborne sound, such as conversation, or impact sound such as footsteps.

After removing some sections of the floor boarding it is fairly easy to recognise the various types of insulation to enable a report to be prepared. A simple method is a layer of slag wool about 75 mm thick resting on the ceiling below as shown on the left-hand side of Figure 12.1a. A better method which is often found in business premises is shown on the right-hand side of Figure 12.1a and consists of an air space above and below the wool. The wool is supported on boarding which is in turn secured to the joists by timber fillets. A third method is shown in Figure 12.1b and consists of a heavy plugging of sand on the ceiling with a resilient quilt draped over the joists known as a 'floating floor'. The principle underlying the design of a floating floor is its isolation from any other part of the structure. It is, therefore, important to ensure that the flooring is nailed to the battens to form a raft and not nailed through to the joists. The floor must also be isolated from the surrounding walls. These are points which require checking during the examination.

The surveyor will encounter many different types of staircases constructed of many different materials. Although timber staircases are satisfactory for domestic construction they do not meet the requirements of the Building Regulations regarding fire resistance for many blocks of flats and commercial and industrial buildings. Reinforced concrete stairs which have a higher resistance are commonly used where timber stairs would not satisfy the regulations. Stone stairs are rarely used today, but are often found as an entrance feature to buildings erected between the seventeenth and nineteenth centuries. Staircase defects will be considered in Sections 12.24, 12.25 and 12.26.

12.2 Structural timber floor defects

The surveyor will often find that the floors in unoccupied properties are fairly easy to examine. The removal of one or two boards in the centre of the floor and adjacent to the skirtings will give the surveyor a general idea of the construction. However, there are suspect areas around sanitary fittings and pipe ducts where wet rot defects are possible and should be carefully examined. Floors in occupied properties are often more difficult to examine due to permanent coverings such as fitted carpets or linoleum. Some occupiers will naturally object to large areas of their floor coverings being removed. In such cases it is advisable to look for areas where defects are possible and perhaps look for corners of the room where the lifting of the covering would not cause undue disturbance. Access to the interior of the floor can often be gained from access covers provided in the flooring for gas or electrical services. In cases where there are problems concerning access it is essential to mention the fact in the report.

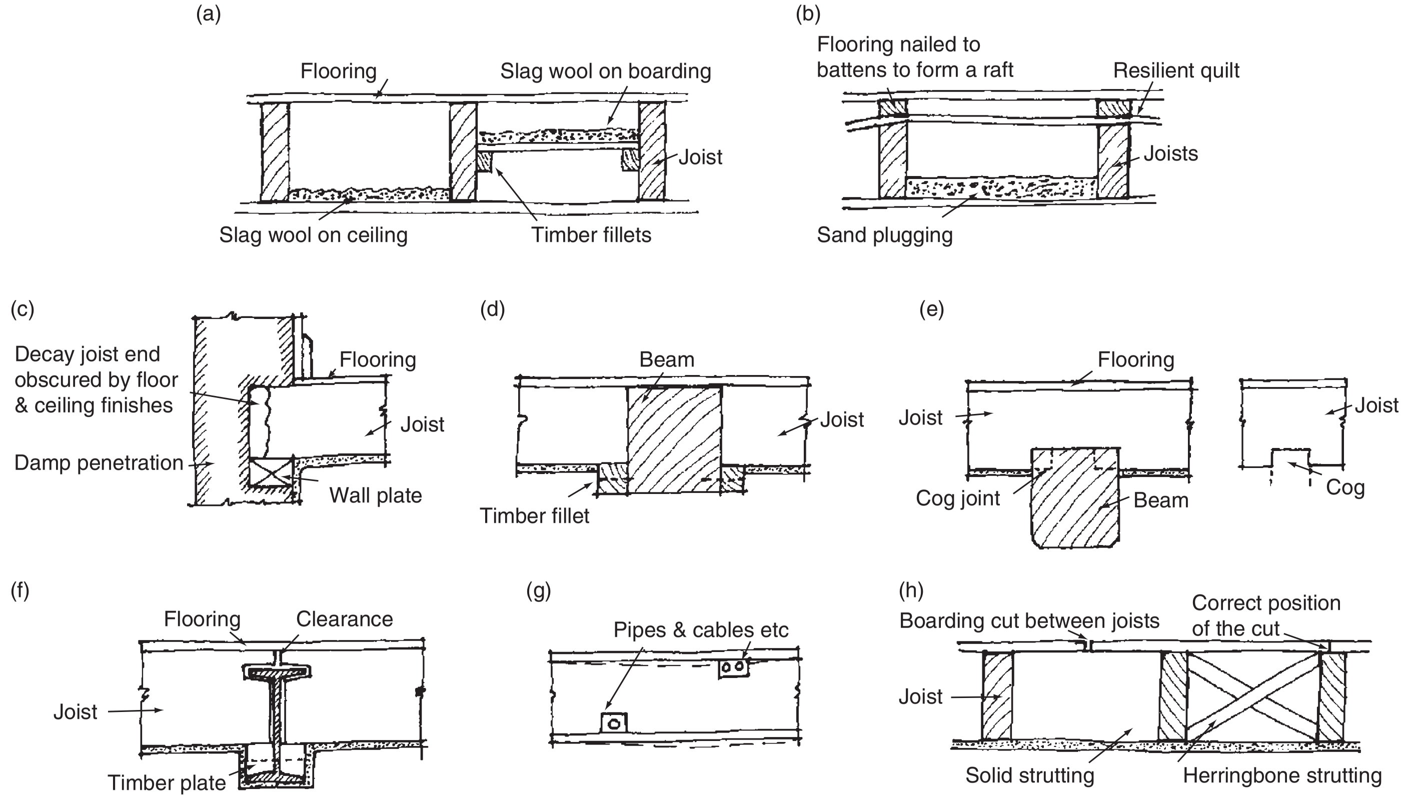

Figure 12.1 (a) Two methods of sound insulation between floors. (b) 'Floating floor' for sound insulation. (c) Joists built into solid wall without an air space. (d) Joist resting on fillets nailed to bottom edge of beam. (e) Method of cogging joists over timber beam. (f) Typical notching when RSJs are used. (g) Deflection due to excessive notching. (h) Floorboard jointing and strutting details

12.2.1 Common defects

The common defects are as follows:

(1) One of the principal defects in a timber upper floor is excessive vibration which is easily detected by bouncing under foot. Vibration is usually caused by decay at the ends of the joists and therefore weakening their bearing. Flexing or sagging may be caused by the original joists being too light for the span or by unequal settlement in the external walls or partitions. A floor may need strengthening, not because of any defect in itself, but because it is being made to carry a load greater than that for which it was designed. In such circumstances the floor may sag to a perceptible degree. When dealing with vibration or sagging joists it will be necessary to assess the precise cause of the failure and this can only be done by checking that the joist size and spacing are adequate for the span and load involved. An approximate guide to the depth of timber joists in inches is by using the rule of thumb method of span in metres over 24 plus 50 mm assuming that the thickness of the joists is 50 mm at approximately 400 mm centres. Alternatively, the sizes for domestic loadings can be checked with the spans and spacings given in the Building Regulations. The majority of these floors can be checked by one of these methods, but there are occasions when it is useful to be able to calculate the load that will rest on the members of a flooring system and the size of the joists necessary to carry the load safely.

(2) If the floor construction has been checked as described in (1) above and is found to be satisfactory then the cause of the defect must be sought elsewhere. A gap between the bottom of a skirting and floor board should be suspect. It is likely that there has been movement in the bearing ends of the joists. The next stage is to open up the floor adjacent to the bearing ends of the joists and ascertain the condition at the point of support. Timber joists or bressummer beams built into solid brick walls of old buildings can rot due to damp penetration. If the joists are built into a wall 225 mm thick without an air space around their ends, they may absorb moisture and, being unventilated, will rot at their seating, although the other parts of the joists may be sound (see Figure 12.1c). The decay usually affects the portion of the joist built into the wall which can be cut off and the ends of the joist picked up on metal joist hangers.

(3) As mentioned in Section 12.1 the joists in double floors rest on timber beams or RSJs to reduce the span and the manner in which they do so depends on the type of workmanship that has been put into the construction. A bad form of construction which is sometimes found in older buildings is a fillet nailed along the bottom edge of the beam with the joist resting on the fillet as shown in Figure 12.1d. In such cases the nails in the fillets are supporting the joists and if they should fail the joists would collapse. When carrying out an investigation to such a floor, it may be found that the nails have given a little, but not necessarily caused a dangerous condition. If this is so the floor

can be strengthened. It is better practice to cog the floor joists over the beam as shown in Figure 12.1e. Figure 12.1f shows a typical notching where the beam consists of a rolled steel joist. The timber joists are supported on timber plates secured to the web of the RSJ, but are kept clear of the rest of the RSJ to allow for expansion and contraction of the timber. In some cases the top of the joists are flush with the top of the RSJ causing the floorboard situated over the top flange to curl due to the fact that the only fixing is the tongue and groove in the jointing of the floorboard.

(4) A more serious problem is settlement in a brick or timber stud partition and this is often found in eighteenth and nineteenth century buildings. This defect arises when the partition runs parallel to the front and rear walls and supports the floor joists. The situation may be complicated due to the fact that it may be general throughout a number of floors on either side of the partition. In such cases it may be possible to jack the partition and floors back to their original positions and underpin the lower partition, but this could damage other parts of the building, particularly the roof. The whole problem should be carefully considered before reporting to the client, who would naturally require some detail of costs. Settlement can also occur in a partition that is supported on a single joist which is often too light in the first instance or the timber has deteriorated over the years. The remedial work might well consist of simply doubling the existing joist.

(5) The centre of the span should be checked for some form of strutting. Although strutting is usually fitted between joists, it may happen that in very old timber floors it has been omitted, in which case undue vibration will occur. This is due to the joist tending to tip sideways under movement, especially if the floorboards have not been nailed to every joist. Also the end wedges between the wall and the last joist may have been omitted or have fallen out. If this is the case, considerable improvement can be effected by taking up the flooring and inserting a row of solid strutting down the centre of the span (see Figure 12.1h).

(6) Another problem which could be attributed to deflection in old floor joists is that excessive notching of the joists may have been made to accommodate gas pipes, electrical cables or water pipes (see Figure 12.1g). If the surveyor feels uncertain on this point it is well to consult the British Standard Code of Practice BS 5268-2: 2002 which sets out rules concerning safe notching in joists.

(7) Trimming around stair wells and fireplace openings should be checked and in many cases, cracks in ceilings will be found following the line of the trimmers. The trimmers are usually 25 mm thicker than other joists and should be connected by a tusk tenon joint. However, the surveyor will often find that the joints are not always constructed in accordance with sound practice and if serious movement has taken place some repair work will be necessary. This operation will no doubt involve renewing portions of the ceiling below.

(8) In modern properties metal joist hangers have been used extensively. Unfortunately, recent surveys have found instances where the hangers or joists have failed due to one or more of the following causes (see Figures 12.2a and b).

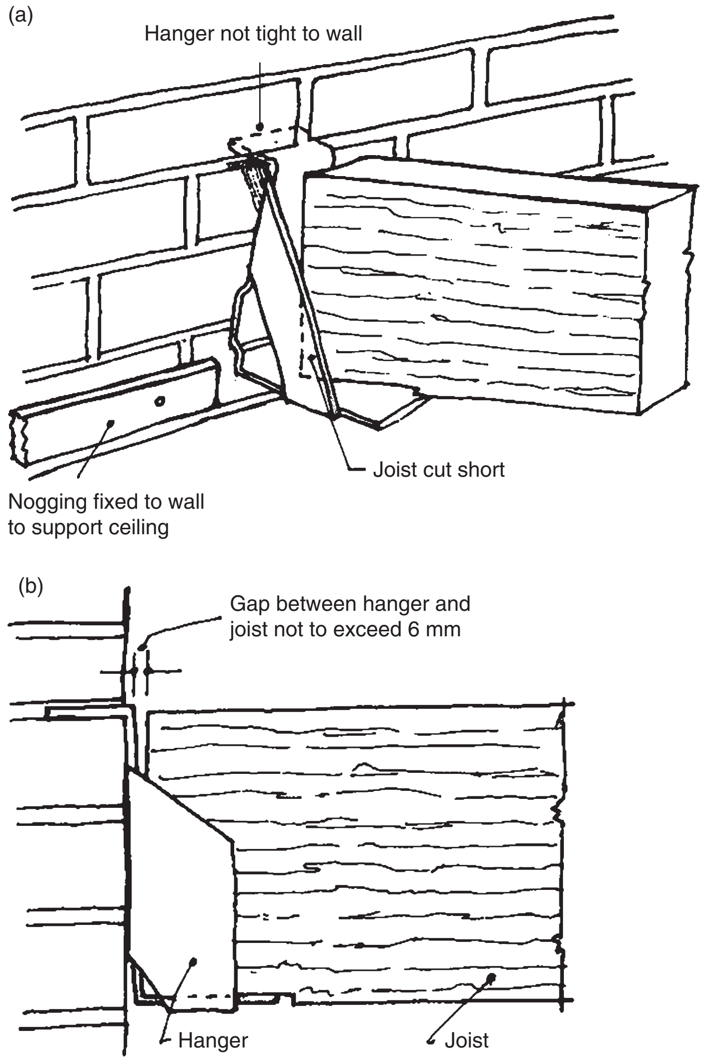

Figure 12.2 Use of metal joist hangers: (a) incorrect positioning; (b) correct positioning

- Hangers should be tight against the face of the masonry.
- Incorrect grade of hanger used. It is important that hangers are not used with masonry of lower strength than the hanger grade marking. Hangers should comply with BS 6178 Part 1 and are made for minimum masonry crushing strengths.
- Sometimes joists are cut short leaving a large gap between joists and back plate of hanger. This may cause hangers to move and the floor to settle.
- Check to ensure that no damaged or corroded hangers have been used.
- Check that the undersides of the joists are properly notched to accommodate the hanger flanges.

FLOOR COVERINGS

12.3 Introduction

There is a wide variety of floor finishes. Some are only suitable for domestic use; others for commercial situations or where subject to heavy traffic in industrial buildings and therefore only suitable for a concrete sub-floor. In the following several of the most common types are described which the surveyor will meet with during examination of ground and upper floors.

12.4 Boarded floors

This type of flooring is easily checked by inserting a sharp instrument such as a penknife into the joints to see whether they are tongue and groove or plain edge. The boards are usually 25 or 31 mm thick and 100–177 mm wide.

Where traffic over the floor is heaviest and keeps to a more or less definite path, such as at door openings, the top surface of the boarding will be worn more than in other parts of the room. If the wear is considerable the thinness of the boards will cause them to bend under the tread. In softwood flooring, the grain usually runs along the length of the boards, exposing expanses of softer wood divided by lines of hard grain. Foot traffic along the grain wears away these softer portions more quickly than it does the harder, so that the hard grain eventually stands up above the surface of the soft grain.

The surveyor will sometimes find that the ends of the boards meet between joists forming a cantilever as shown on the left-hand side of Figure 12.1h and will spring under weight. The cut should be made at the middle of the joists as shown on the right-hand side of Figure 12.1h.

Another condition that may arise is the curling upwards of the edges of the boards due to the fact that the timber swells when it absorbs moisture and shrinks when the moisture dries out. Thus the board is trying to reduce its width and as the upper surface is exposed to the warm air it dries more quickly than the under surface. Therefore, the board tries to reduce the width of the upper surface to a greater degree than its under-surface and the only way it can do this is by curling. When the boards are covered with linoleum or carpet, curling will cause ridges to appear which will wear the covering more quickly than in other parts. From this point of view the surveyor may consider curling to be a defect which can be remedied by planing or sanding of the raised edges.

12.5 Chipboard flooring

Chipboard flooring provides a satisfactory floor decking if the correct grade is used and the boards are securely fixed. However, several defects have been found during the past few years. The condition of the boards should be checked where practicable. The surveyor may well find it difficult to remove large panels of chipboard without causing damage, and it should be noted where this is not possible. As described above for boarded floors, the ends of the boards will sometimes be found to meet between joists forming a cantilever and will often 'spring' under weight. Particular attention should be given to chipboard floors in wet areas such as kitchens and bathrooms. Boards in these areas should be protected and be moisture-resistant and marked BS 5669 type 11/111. If the boards are permanently wet then expansion and loss of strength will occur.

12.6 Hardwood strip flooring

The boards are usually cut from one of the more decorative hardwoods and are in widths of 75–100 mm. When laid on a suspended timber floor, a strip flooring is not likely to suffer from the effects of damp, but if defects are noticed, they will probably be due to ordinary wear. However, if the flooring is laid on a solid floor at ground level, defects may be caused by damp rising from the ground and much will depend on the manner in which the fillets have been laid. Flooring in contact with a concrete base needs to be protected by a damp-proof membrane and many failures have occurred in older buildings due to the omission of such damp-proofing. It will often be found that ventilation has not been provided, as indeed it cannot be, if the fillets are embedded in the concrete or the spaces filled in with fine concrete. If on opening up the floor the fillets are found to be resting on top of the sub-floor without any filling and no form of ventilation, then a recommendation should be made in the report that small openings are cut out of the fillets at frequent intervals to allow air to pass under the floor. Gratings can be fitted in the skirtings or at the extreme edge of the floor to allow the air from the room to pass under the flooring. Should such flooring need to be taken up and relaid because of an outbreak of dry rot then this provision of ventilation should be made.

12.7 Wood block

Wood blocks may be laid in a variety of patterns, a very common one being the herringbone pattern, and they are available in several varieties of hardwood such as oak and teak.

Defects in wood block flooring are usually the result of long and hard wear, although a common defect is moisture penetration causing expansion of the blocks. The blocks are dry when laid and are, therefore, ready to absorb any moisture in the atmosphere or through failure to provide an adequate damp-proof membrane under the blocks. This causes the blocks to expand and if there is no room for expansion the flooring will lift and arch up. It is, therefore, important to investigate the base. The blocks should also be examined for any sign of fungal attack. It is also necessary to check that expansion joints have been provided, for example, a cork strip around the perimeter of the floor. The skirting or kicking fillet will cover the expansion joint.

12.8 Floor screeds

In order to apply the final floor finishes to a concrete floor it is necessary to have a smooth level surface and this is done by the application of a cement and sand screed. The screeds can be monolithic, that is, laid on the concrete base whilst it is still green, or superimposed after the concrete has dried. Problems can arise with the 'superimposed' screeds. As the screeds dry out they tend to shrink and if not restrained by a good key to the concrete base they will crack. Cracking is the most common fault experienced with all screeds, accompanied with hollowness. The problem can usually be detected by tapping after removing the loose tiles and timber flooring.

12.9 Granolithic paving

Where hardwearing qualities are essential granolithic paving is widely used, particularly in industrial premises. The usual mix is two parts Portland cement to five parts granite chippings. The surface is often treated with an application of sodium silicate to prevent dusting and carborundum is sprinkled over the surface to obtain a non-slip finish. As with the cement screed, granolithic requires to be well bonded to the concrete base. If the bond is inadequate, then cracking and lifting of the paving will occur. In extreme cases it may be necessary to recommend taking up all the old granolithic and replacing it with new.

12.10 Terrazzo

This is a special form of finish using coloured cement and crushed marble chippings. Terrazzo is easy to clean and has a high resistance to abrasion. However, the surveyor may find a few problems and the most common of these is crazing or cracking due to differential shrinkage in the screed base and the terrazzo. This defect is prevalent in terrazzo laid *in situ* and to avoid such problems there has been a greater use of terrazzo tiles.

12.11 Cork tiles

Cork tiles are manufactured by moulding cork granules compressed hydraulically under heat into tiles. They are bedded in an appropriate adhesive and treated with a sealer or wax polished. They have good wearing qualities but can be affected by grease. Lifting may occur on softwood flooring where an underlay of hardboard has been omitted.

12.12 Linoleum

In the past linoleum was by far the most commonly used floor covering particularly in domestic work, but during the past 50 years it has been largely superseded by carpets, PVC and vinyl asbestos tiles. Sheet linoleum should comply with BS 810 or BS 1863 for felt-backed linoleum, the latter type having a greater moisture stability. Defects found in linoleum are principally cracking and lifting, apart, of course, from wear due to long use. If the sub-floor is of timber boarding which tends to curl at the edges as described in Section 12.4, then the linoleum is forced up into ridges which soon crack and wear through under traffic. If the linoleum is laid on a cement and sand screed then it must be bonded to it; a damp-proof membrane is, therefore, essential. If damp reaches the surface the adhesive is affected, adhesion broken, and the linoleum will lift at the edges. In such cases a permanent cure cannot be expected unless the cause of dampness has been removed, or its effects prevented.

12.13 Rubber flooring

Rubber flooring should comply with BS 1171 and may be in sheet form or tiles. It is made in varying thicknesses and is fixed with an adhesive. Rubber flooring is vulnerable to grease, oil, fat and petrol. However, there are a number of synthetic rubber floorings which are resistant to these substances. Rubber has good wearing and sound absorption qualities. Troubles that may be found are the usual ones of lifting at the edges or general loosening. It is not easy to obtain good adhesion between rubber and a cement screed which is in the least damp. Any problem with rising damp through a concrete ground floor slab will cause moisture to collect between the top of the concrete and the underside of the rubber. This moisture will break down the adhesion and it is pointless to stick down the lifting edges of the rubber if the cause of the trouble has not been removed.

12.14 Thermoplastic, PVC and vinyl asbestos tiles

Thermoplastic floor tiles should comply with BS 2592 and PVC (vinyl) tiles with BS 3261. Thermoplastic tiles should be examined for any signs of deterioration due to being in contact with oil or grease. The PVC floor tiles are more resistant to oils and grease and to abrasion, but can be damaged by cigarette burns. Vinyl asbestos tiles should comply with BS 3260. They have reasonable resistance to oil and grease but can be marked by cigarette burns and any hot object placed on the tiling. However, given the health risks associated with asbestos, the surveyor should recommend that if these tiles are present, they should be overlaid or removed (by an approved specialist asbestos removal contractor).

All these finishes are usually applied to cement and sand screeds and the commonest cause of failure is due to moisture penetration passing through the screed.

The moisture contains alkalis derived from the concrete which attack the adhesives used to secure the tile flooring to the screed. Tiles are often more marked by rubber footwear or castors on the legs of furniture.

12.15 Clay floor tiles

Clay tiles are described in BS 1286 and should be laid in accordance with British Standard Code of Practice BS 5385-3:1989. Two types of tiles are specified in BS 1286: Type 'A' floor quarries and Type 'B' semi-vitreous and vitreous. Many failures are manifested by arching of the tiles due to the differential movement between the screed and the tile. Clay and concrete have different coefficients of thermal expansion which causes different movements with temperature changes. The worst conditions occur when the tiles are bonded direct to new screeds and insufficient time has been allowed for the screed to dry out. When dealing with such cases the surveyor may consider it advisable to recommend that the tiles should be replaced over a separating layer consisting of building paper or polythene sheeting. The purpose of the separating layer is to isolate the tiles and bedding from the screed and thus prevent stresses in the latter from affecting the floor tiles. An important point to ascertain is whether or not expansion joints have been provided around the perimeter of the tiled floors either between the tiles and wall or if a coved skirting has been installed between the tiles and cove.

12.16 Concrete tiles

Concrete tiles are made under pressure in moulds and are cured and dried under controlled conditions. The tiles usually have a wearing layer approximately 6 mm thick with a backing of fine concrete. For non-industrial use, fine pigmented mixtures are used to give a colourful appearance. For industrial use where a tough wearing surface is required, hard natural aggregates or metallic aggregates are often used. The tiles are laid on a bedding of mortar. In some cases, the surveyor will find that the tiles have lifted due to the fact that they have been bonded direct to the base without the provision of a separating layer such as building paper or polythene sheeting. The quality of the jointing should also be examined to ensure it is firm and completely filled.

12.17 Magnesite flooring

This type of flooring is not commonly used, but is not yet extinct and is often found in commercial and industrial buildings (Pye & Harrison, 1997). The material is a mixture of magnesium oxychloride and fillers such as sawdust, wood flour, ground silica, talc or powdered asbestos and should comply with BS 776. The flooring is available in various colours and in mottled or grained effects. The thickness varies from 10 mm for single coat work to 50 mm for two or three coat work. Magnesium oxychloride is particularly susceptible to moisture and will soon deteriorate if damp penetrates the finish from below. This defect will cause cracks and the breaking up of the surface, usually due to the omission of a damp-proof membrane. Magnesite floors also take up moisture from the air and thus have a tendency to sweat. Metal is liable to corrode when in contact with this type of flooring. The surveyor should carefully check service pipes for corrosion if in contact with magnesite flooring. In serious cases of disintegration it will be necessary to recommend complete replacement and for the service pipes to be protected with bitumen or coal-tar composition.

12.18 Mastic asphalt and pitch mastic paving

Mastic asphalt for flooring should comply with BS 1410 (natural rock asphalt), BS 1076 (limestone aggregate) or BS 1451 coloured mastic asphalt (limestone aggregate). Other grades are available for special industrial purposes such as acid resisting construction.

Mastic asphalt provides a jointless floor which is impervious to moisture. However, concentrated loads which are often found in commercial or industrial premises may cause indentations in the surface. It is, therefore, advisable to recommend supports for heavy point loads. This can be done by the use of hardwood blocks laid on the sub-floor and set in the paving. Mastic asphalt is also liable to soften with prolonged contact with oil, petrol or grease. Polishes containing oils are injurious and may cause softening and affect the colour. Pitch mastic paving should comply with BS 1450 for black pitch mastic paving or BS 3672 for coloured pitch mastic paving. The material is suitable for many conditions from domestic premises to heavy duty industrial paving. Treatment of the base and conditions generally are similar to those for mastic asphalt.

If the mastic asphalt or pitch mastic paving is badly cracked or has lifted from the sub-floor and requires renewing, then it is possible that there are problems with the concrete slab. In such cases it is advisable to seek the advice of an asphalt specialist, with regard to the preparation of the sub-floor and the right grade of asphalt to be used. Where the floors are liable to become hot, e.g. over boiler chambers, they tend to soften due to excessive heat. In such cases it may be necessary to recommend some form of insulation below the floor. All asphalt pavings should have an insulating membrane of black sheathing felt to overcome the effect of movement, especially on timber or porous bases.

12.19 Rubber latex cement flooring

This type of flooring is composed of hydraulic cement, aggregate or fillers of fine chippings, granules of cork or wood chips. Aggregates for harder grades consist of crushed marble or granite. The mixture is gauged on site with a stabilised aqueous emulsion of rubber latex and usually laid to give a thickness of about 6 mm. If mixed with high alumina cement the flooring has good resistance to attack by sulphates, weak acids and sugar solutions. The flooring may be laid on a timber base only if it is completely rigid. Any movement in the timber structure will result in cracking. This type of flooring requires regular cleaning and polishing.

12.20 Metal tiles

Metal tiles are usually about 300 mm square consisting of 10 gauge steel plates and are mainly used for heavy duty industrial floors. They are pressed into newly laid concrete. The tiles are hard wearing and resist all forms of abrasion and impact. Oil and grease may leave stains, but regular cleaning is all that is necessary. If repairs are required they are easily replaced, but in such cases the concrete subfloor may need some attention.

12.21 Slate

Natural slate for flooring can be cut to various sizes and thicknesses. Slates up to 380 mm square are usually 19–25 mm thick and are laid upon a screed bedded and jointed in cement mortar. Slate flooring is extremely hard wearing and requires the minimum upkeep. Dirt cannot penetrate the surface, but oil and grease leave stains upon the surface if not regularly cleaned. If some slates are loose it is usually due to shrinkage of the concrete base.

12.22 Marble in tile or slab form

Natural marble is usually 19–25 mm thick and tiles or slabs are up to 900 mm square and are laid as described above for slate. They are impervious to water and have good resistance to oil, fat and alkalis. They are obtainable in a wide range of colours and form a very durable surface. As for slates, if the slabs are loose it is usually due to shrinkage of the base.

12.23 Conclusion

The condition of all floor coverings should be clearly stated in the surveyor's report together with advice on any remedial measures which are considered necessary. Particular attention must be given to defects caused by damp penetration where floor coverings are attached to solid floors. The most important factor to be considered is to ensure that there is a link with the DPC (see Figure 8.2c). This is often omitted and has been the cause of damp problems in many post-war buildings. Underfloor heating systems often cause a high shrinkage rate which seriously increases the risk of cracking. This defect is prevalent where concrete tiles have been used. The surveyor will often find that the surfaces are covered with fine cracks. Granolithic can also be affected by underfloor heating if not laid monolithically.

STAIRCASES AND LADDERS

12.24 Timber staircases

Generally the best constructed piece of joinery in any building is the stair. They seldom develop any serious structural defect, repairs being confined to renewing or making good worn members. The majority of domestic staircases are constructed of timber. Generally, one string abuts against a wall, while the other, called the outer string, is tenoned to the newel posts which support the handrail. If the width of the stair is over 1 m an intermediate support should be inserted in the form of a carriage piece, to which are nailed brackets to support the centre of each tread. The treads and risers should be tongued and grooved together with their edges glued and screwed, although in cheaper work they are merely butted together and nailed. The ends of the treads and risers should be housed and securely wedged into the strings. The nosings are often supported by a scotia moulding housed into the tread or butted against its surface. To give additional rigidity to the treads all internal angles on the underside of a stair should be fitted with glued angle blocks. If the soffit of the staircase is open the surveyor will find that the construction is fairly easy to examine. Plaster soffits should be checked to ensure that there is proper adhesion to the underside of the staircase.

12.24.1 Common defects

The following points should be checked:

- Creaking in stairs is due to the rubbing of loose members and can generally be traced to loose or missing angle blocks between treads and risers. The wedges securing risers and treads let into the strings should be tight and glued and the glued angle blocks between the treads and risers should also be checked.
- The tongued joint between tread and riser should be screwed from below. If this joint is not secure there is a tendency for the stair to squeak.
- Damaged treads and nosings should be carefully examined and reported. Damaged nosings are particularly dangerous.
- Strings should be at least 40 mm thick and properly housed to the newel posts.
- Balustrades should be checked for stability. The main defects found are cracked or loose balusters and handrails. Newels are often found to be loose due to poor fixings to strings and aprons.
- Handrails fixed to wall surfaces are usually supported by metal handrail brackets plugged and screwed to the wall. The fixings should be checked for rigidity.
- The surveyor will often find that the bottom riser of a staircase in an old basement will be affected by dry rot or rising damp from the wall or floor. The bottom riser should be carefully examined with a bradawl or knife.

12.25 Metal staircases and ladders

These are usually found in industrial premises and are used as a means of access to roofs and other high places and as a means of escape. In most instances the design and erection is entrusted to special firms. As with structural frames the chief point of interest to the surveyor is the rigidity of the joints and the protection provided against corrosion. Care should be taken that all bolts are secure and that the method of protection is in accordance with the recommendations of the British Standard Code of Practice (BS 5395-1: 1977).

12.26 Reinforced concrete stairs

Reinforced concrete stairs which have a higher fire resistance are commonly used where timber stairs would not satisfy the regulations. The size and spacing of the reinforcement is calculated according to the required conditions of load and span. Defects in reinforced concrete have been dealt with in Chapter 7. Sometimes a small surface crack in a concrete stair need not give rise for concern, but if a step has cracked through it can be a sign of structural failure and will require investigation. It must first be examined to ascertain if it is spanning between walls or other supports as a beam. The stair should be relieved of its load by shoring up the underside. Damaged concrete can then be hacked away and the bars exposed for examination. The area should be carefully examined to see that the adhesion between steel and concrete has not been destroyed.

The back of the tread is usually covered with one of the materials mentioned under 'floor coverings' and finished at the front edge with an extruded aluminium nosing with non-slip inserts. The treads should be in good condition without excessive wear. Balustrades and handrails are usually of metal or plastic coated metal, and should be checked for stability and decorative condition.