



## Safe stacking of sawn timber and board materials

### Woodworking Sheet No 2 (Revised)

#### Introduction

This information sheet contains practical guidance on safe stacking and storage of sawn timber and board materials. It takes account of consultation with the woodworking industry, and the results of HSE-commissioned research into stacking of sawn timber, and banding of sawn timber packs.<sup>1,2</sup> It is aimed at all premises where timber or board material is stacked and stored, not just woodworking premises.

The main legal requirements covering stacking and storage are the Health and Safety at Work etc Act 1974, the Management of Health and Safety at Work Regulations 1999,<sup>3</sup> and the Workplace (Health, Safety and Welfare) Regulations 1992.<sup>4</sup>

This sheet does not deal with stacking on vehicles or stacking of round timber (logs).

#### The accident record

Nearly 20% of fatal injuries and 13% of major injuries in woodworking are caused by being struck by falling and flying objects, for example timber falling from stacks. A similar number of fatal and major injuries are caused by people falling from height, including falls from stacks.

Because timber and board materials are heavy, when accidents occur they tend to be serious. Approximately 50% of all stacking accidents investigated by HSE have resulted in the injured person suffering major injuries (eg fractures, dislocations, amputations). A high proportion (38%) of investigated accidents involve propped up board materials or doors, for example when the mass of boards or doors topple over as an attempt is made to withdraw a single board or door.

#### What can you do to prevent these accidents?

Your risk assessment made under the Management of Health and Safety at Work Regulations 1999<sup>3</sup> should cover the hazards and risks from stacking and storage activities in your workplace. It should cover both your employees and those who may also be affected, for example members of the public, or contractors visiting your premises.

Most accidents could be prevented by devising and following safe working practices and ensuring the stacking/storage area is well organised with appropriate racking systems where necessary. Make sure everybody who is involved in stacking is adequately trained and appropriately supervised. Safe stacking and unstacking procedures should always be used and supervisors should check regularly to ensure they are being followed.

#### Stack stability factors

Consider the following as part of your risk assessment.

##### **Ground and environmental conditions**

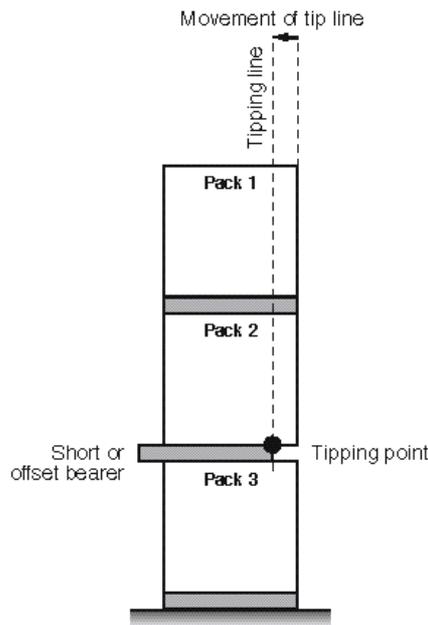
- Prepare the ground carefully where stacks are to be assembled. It should be flat and even with a slope of no more than 2°, ideally with a top surface of asphalt, tarmac or concrete, and well maintained with no potholes.
- The ground should be strong enough to withstand the load of both stacks and machinery, be well consolidated, and its stability should not be affected by weather conditions such as heavy rain. Good drainage should be provided.
- Clear any obstacles such as waste timber or unused bearers from the stacking area as they may make stacks unstable.
- Stacks which are outside may be affected by wind, so where possible construct them so a small cross-section is facing the prevailing wind direction. Check external stacks after high winds. Securely attach any protective sheeting.

##### **Bearers**

Bearers support packs of timber, keeping them off the ground and allowing space for fork-lift trucks to lift the pack. They also support the timber within the pack.

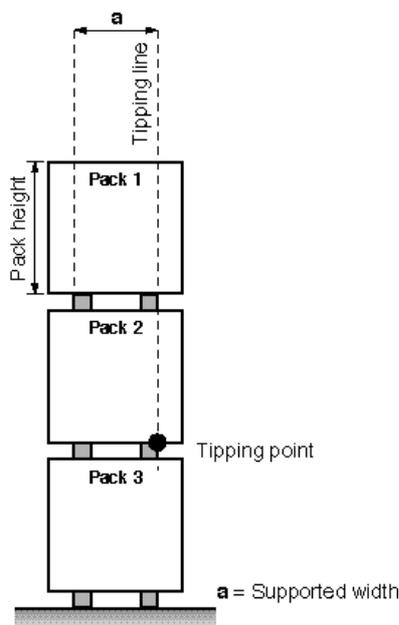
- Select bearers carefully. Ideally they should be straight and identical in length and cross-section (preferably square). If they are rectangular in section they are most stable when the long edge is horizontal.
- The length of the bearer should be equal to the width of the pack. If too long they protrude, encouraging climbing of the stack, or can be easily struck by passing vehicles. Short or offset bearers do not fully support the pack above and increase the load on banding.
- Bearers should be in good condition and should be destroyed if rotten, damaged or split. They should be made of a material strong enough to withstand the environment where the stack is constructed.
- Position bearers carefully to prevent timber in the supported pack from sagging and to avoid offsets in the stack. Figure 1 shows the effect of a short or

offset bearer. The tip line of the stack moves inwards from the edge since part of the width of the stack is not supported.



**Figure 1** Schematic showing the movement of the tip line and tip point due to a short or offset bearer

- The same problem occurs if bearers are placed to run the length of the pack as shown in Figure 2. In this case the supported width of the pack is from the outside edge to outside edge of the bearers and the stack is less likely to be stable.



**Figure 2** Supported width

### Banding

HSL Research Report ME/98/21<sup>2</sup> gives full details about banding of sawn timber and these are summarised in the following points:

- Before banding look at the requirements of the band and what will happen to the banded pack.

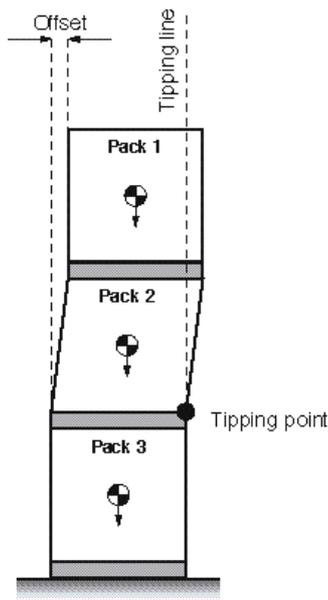
Consider whether the timber is likely to expand or contract due to the surrounding storage conditions or treatment (ie timber with a high moisture content will shrink and the banding may come loose and need to be reapplied).

- Select a banding material that is suitable for the demands to which it will be subjected. For example, 12 mm wide polypropylene banding should not be used to band timber packs with cross-sections of greater than 0.5 m<sup>2</sup> and masses greater than 400 kg. Use polyester or steel instead.
- To ensure a tight and secure pack is achieved, assemble packs carefully, minimising the space between timber.
- Take care when applying bands. Apply them squarely (ie parallel to the plane of the end face) close to columns of sticks within the pack. They should be tight to the face of the pack and not be applied over the ends of protruding sticks or bearers. Banding fasteners also need to be suitable for the pack and banding material.
- Wear eye protection when banding is being removed. When cutting tensioned metal banding, use safety cutters.
- Periodic inspection will highlight deficiencies in the banding, for example, loose bands and loss of pack shape. If problems are detected, the packs concerned should be rebanded or the banding retensioned. If the same problems occur on a regular basis, the type of banding being used should be reviewed, for example, a stronger band may be needed or a different type of fastener.

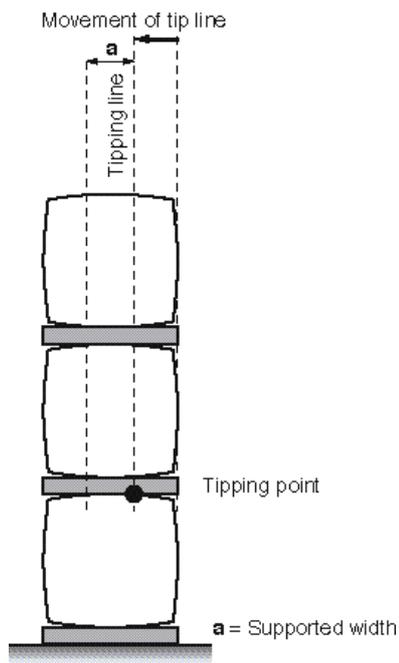
### Pack characteristics

Individual packs of sawn timber are the building blocks of the stack. Generally, good packs make good stacks.

- Where possible the timber in the pack should all be of the same cross-section and length. Do not leave timber protruding from the end faces of the pack for the purpose of climbing the stack.
- Out-of-square or lozenge-shaped packs affect the stability of the stack and cause an increase in tension in the banding material. Figure 3 shows how a lozenge pack shifts the centre of gravity of packs above.
- Packs can also ball or roll (Figure 4), moving the tipping line inwards, having the effect of reducing the width of the pack (ie only part of the width of the pack is supported). This makes the stack far less stable.
- Do not stack collapsed or partially collapsed packs or transport them off site - reassemble them. If identified in a stack, remove and rectify them using an established safe system of work.
- Keep the tops of packs level which will help to form a vertical stack. If the top row is not complete, any bearer placed on top should be flat and supported by timbers placed at the edge of the pack.



**Figure 3** The effect of out-of-shape packs on stability - lozenged packs



**Figure 4** The effect of out-of-shape packs on stability - balled packs

- Separating sticks (dunnage) can be beneficial within the pack, helping to form a tight square pack and preventing balling or rolling. Like bearers, stick length should equal pack width. Sticks may increase the tendency for the pack to lozenge and this should be monitored.

### **Stack height and stacking practices**

In an indoor environment, the maximum height of the stack should not be more than four times the shortest width of the pack (ie a ratio of 4:1). Outside where wind may affect the stack, the ratio should be reduced to 3:1.

These ratios are general guidelines - the actual stacking height should be determined after considering the results of your risk assessment. For example, where

there is a risk of vehicle strikes against the stack, the stack is on a slope of more than 2°, or there is frequent public access, then the ratios should be reduced to 3:1 indoors and 2:1 outside. However, if these and other risks are absent (eg in a tightly packed kiln or outside on level concrete in a sheltered area) these ratios may be increased.

Short or offset bearers, and balled or rolled packs, may result in the supported width of the stack being less than it appears and the stack height should be reduced. See the 'Bearers' and 'Pack characteristics' sections.

### **Safe working practices**

#### **Unstacking**

- Before unstacking, examine the stack to see how it was constructed and to check for signs of instability or faults such as broken bands, bearers or sticks, and pack balling. It is important to identify any packs which are bridging other stacks or packs.
- Take down packs tier by tier. Move only one at a time. Do not leave isolated single stacks. Do not remove individual pieces of timber from packs until they are on the ground and the working area is safe.
- If you need access to the top of the stack, use a mobile elevating work platform, suitable work platform on a fork-lift truck,<sup>5</sup> or secured ladder. It should not be necessary to work at height directly on top of the stack. If such work has to be done then it must be strictly controlled and only done when all other options are not reasonably practicable.

#### **Stacking timber and board material**

- Position centres of gravity of stacked packs directly above one another. Packs should not be offset so they protrude from the stack.
- Consider the size and shape of packs before stacking. Place smaller/lighter packs on top of larger/heavier packs. Packs should not bridge across two stacks or across other packs. Do not allow loose material on top of stacks.
- Stacks should not lean against or be supported by other stacks.
- If fork-lift truck or side-loader forks protrude beyond the load being lifted, they may strike packs behind. If this may happen, take steps to exclude people from all areas at risk from falling material.
- Ideally, store boards and similar flat articles (ie doors or windows) flat on a level surface. Use suitable pallets, wood or chipboard battens, or a purpose-built racking system.

- Never stack boards on edge without adequate support as they can tip out of control from a vertical position. It is common for boards that have just been delivered, and propped up temporarily, to topple before they are moved to the storage area. Staff, especially those receiving deliveries, should be told about the dangers of propping boards without support, and erecting warning signs in the delivery area may help.
- An alternative to storing the materials flat is the 'pigeon hole' or 'toast rack' system (Figure 5). Boards are stored in compartments preventing sideways movement and allowing the removal of individual boards.
- Fix racking securely to the floor, mark it with maximum load information and regularly check it for damage. Protect exposed corners at the ends of aisles with, for example, bollards or stanchions.

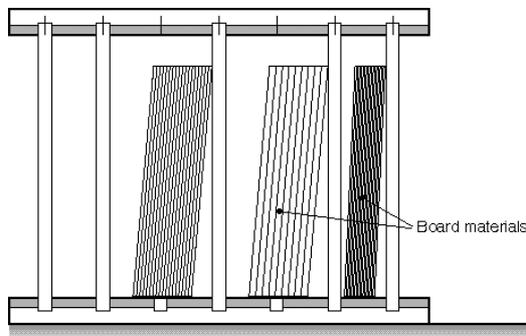


Figure 5 Pigeon hole stacking

### Public protection

Where there is a risk of public access to the stacking area, provide appropriate fencing to keep out children and other unauthorised people. Direct visitors by clear signs to a reception area close to the main entrance.

### Storage area management and layout

- Your risk assessment should consider how fork-lift trucks and other vehicles operate in and around the storage area.<sup>6</sup>
- Arrange storage areas to give good visibility for pedestrians and vehicles. It may be necessary to position mirrors around the area or provide extra mirrors on vehicles to reduce blind spots. Pedestrians should use designated walkways, segregated from vehicles where possible, and be excluded from active stacking areas. Stacking areas should have adequate lighting.
- A one-way traffic system and speed restrictions may add to site safety.
- Roadways or aisles should be clearly defined and strong enough to withstand the weight of loaded vehicles.

- Make sure roads/aisles are maintained, ie repair pot holes. Fit reversing alarms to vehicles with restricted rear vision.
- Stack condition should be regularly monitored by adequately trained staff who can identify stack faults.

### Personal protection

Helmets, gloves and safety footwear will normally be required to protect employees, as well as appropriate clothing for outside working. High-visibility clothing is required where there are frequent vehicle movements.

### References and further reading

- 1 *Safety of timber stacks - Stability of sawn timber* HSL Research Report ME/99/25. Published on HSE website.
- 2 *Safety of timber stacks - Banding of sawn timber packs* HSL Research Report ME/98/21. Published on HSE website.
- 3 *Management of health and safety at work. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice and Guidance L21* HSE Books 2000 ISBN 0 7176 2488 9
- 4 *Workplace health, safety and welfare. Workplace (Health, Safety and Welfare) Regulations 1992. Approved Code of Practice and Guidance L24* HSE Books 1992 ISBN 0 7176 0413 6
- 5 *Working platforms on fork-lift trucks* Guidance Note PM28 HSE Books 2000 ISBN 0 7176 1233 3
- 6 *Managing vehicle safety at the workplace* INDG199 HSE Books 1995

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

### Further information

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