Building and Construction

Handle, prepare and store building materials

Learner Guide

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Safe work practices - General

Developing and maintaining safe work practices reduces the risk of injury. Examples of safe work practices for bricklayers include:

- the two key elements influencing the physical workload of bricklayers are the weight of the bricks and the posture of the bricklayer. Examples of work practices to reduce the time spent stooping or over stretching are:
    - maximise the time spent laying bricks between knee and shoulder height by altering the height of the working platform when working from a scaffold whenever this is practicable;
    - raise the mortarboard to reduce the time spent in a stooped posture; and
    - always complete cutting work etc at approximately hip height;
- to avoid injury to muscles, ligaments and other soft tissues, do warm up/stretching exercises at the beginning of the work day and cool down/stretching exercises at the end of the work day;

- do not manually lift or move anything if there is any uncertainty that it can be done safely;
- use mechanical lifting and handling equipment when and as required (see above for examples of the equipment);
- always use the lightest tools/equipment for the job; and
- always seek assistance if necessary.

Safe work practices - Moving materials

Materials need to be moved around site. The loads can be very heavy and in some cases awkward to move. Some solutions include:

- generally never move wheelbarrows or trolleys over uneven terrain and always make sure that there is a clear access/egress. As a minimum there must be planks or other suitable alternatives in place;
- always use wheelbarrows and trolleys designed for moving heavy loads, for example a two-wheeled wheelbarrow. Consideration should be given to a motorised barrow, which can be used as a wheelbarrow and a trolley; and

Handling and Storing Materials

Where practicable, unload materials mechanically and directly to a prepared, level, hard base. Leave banding or wrapping in place and take care to minimise chipping, soiling or breakage, particularly with bricks of special shapes. Protect from rain, splashing by vehicles and other materials in use.

Unload bagged cement and lime to a prepared store, without damaging the bags. Protect them from rain, frost and damp ground and walls.

Store sand on a prepared, hard, clean base from which water can drain. Protect from rain, especially if the sand is likely to freeze. Prevent different types of sands intermixing and protect from contamination.

Proper storage of materials is vital. Always follow manufacturer's instructions in order to avoid distortion, and deterioration of materials and components such as lintels, wall ties, DPC adhesives, movement joint fillers and sealants and mesh reinforcement.

Manual handling

Careless lifting, pushing and carrying can cause strains, sprains and breaks. Injuries like sprains accumulate so they can become a form of permanent damage.

Do this... ...to avoid this.

You should bend your knees when lifting anything heavy.

Do this... ...to avoid this.

Always check that your path is not slippery.

Do this... ...to avoid this.

Check that there is no obstacle in your way.

Do this... ...to avoid this.

Keep your back as straight as possible when pushing a heavy load.

Here is a diagram of how to lift, carry and lower a load safely.

Manual handling means using your body to exert force to handle, support or restrain any object, including people or animals.

It is not just lifting or carrying heavy objects; it includes: lifting, pushing, pulling, holding, lowering, throwing, carrying, packing, typing, assembling, cleaning, sorting and using tools.

The term is not limited to handling heavy objects – pruning plants, stacking items onto a shelf, helping a patient into a bath and even using a keyboard are all examples of manual handling.

Hazardous manual tasks can put stress on the body and cause serious injury. These tasks involve lifting, lowering, carrying, pushing, pulling, holding or restraining. Hazardous manual handling involves:

- repetitive or sustained application of force, awkward postures or movements
- tasks that people would find difficult due to the degree of force applied (high force)
- exposure to sustained vibration

- manual handling of live people or animals
- manual handling of unstable loads that are difficult to grasp or hold.

Some examples of hazardous manual tasks:

Repetitive force - using force repeatedly over a period of time to move or support an object

Sustained force - occurs when force is applied continually over a period of time.

High force – may be exerted by the back, arm or leg muscles or by the hands and fingers.

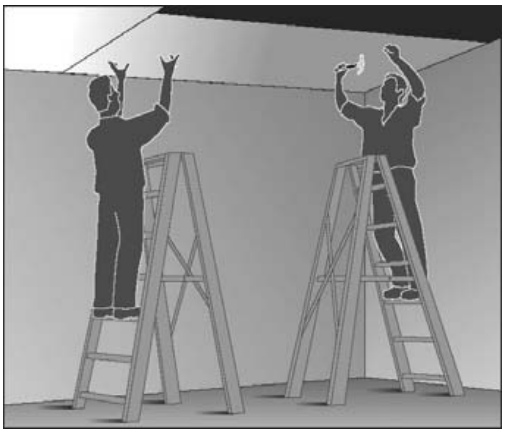
High force occurs in any tasks that:

a worker describes as very demanding physically
a worker needs help to do because of the effort it requires
require a stronger person or two persons to do the task.

Sudden force – jerky or unexpected movements while handling an item or load are particularly hazardous because the body must suddenly adapt to the changing force.

Tasks where force is applied suddenly and with speed also generates high force.

Sustained posture – where part of or the whole body is kept in the same position for a prolonged period.

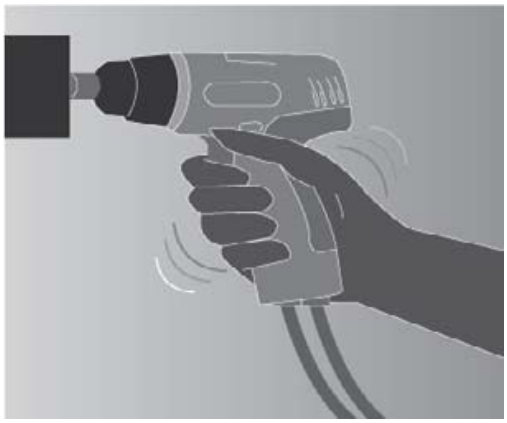


Awkward posture – where any part of the body is in an uncomfortable or unnatural position, such as:

postures that are unbalanced or asymmetrical
postures that require extreme joint angles or bending and twisting.

Whole body vibration occurs when vibration is transmitted through the whole body, usually via a supporting surface, such as a seat or the floor in heavy vehicles or machinery. This may result in lower back pain, degeneration of the lumbar vertebrae and disc herniation.

Hand-arm vibration occurs when vibration is transferred through a vibrating tool, steering wheel or controls in heavy machinery to the hand and arm. This can disrupt blood circulation in the hand and forearm and damage nerves and tendons. Localised vibration contributes to 'vibration-induced white finger' and 'carpal tunnel syndrome' through the gripping force needed to hold the vibrating tools (the tighter the grip, the more vibration is absorbed) and the repetitive shock loads of some tools.



Manual handling is any activity that involves lifting, lowering, carrying, pushing, pulling, holding or restraining. It may also include stretching, bending, sustained and awkward postures, and repetitive movements.

Manual handling is one hazard that arises in the majority of workplaces. It occurs in numerous activities and is indentified as a problem across most industry sectors.

Every year in New South Wales, approximately 17,000 people are seriously injured or suffer from illness related to manual handling.

This represents about 37 per cent of all injuries in NSW and costs NSW workplaces $373 million with an average cost of $22,000 per injury. When the hidden costs of injury are considered that figure is more than $1,491 million.

Never Take a Chance with Safety

Injuries caused by manual handling and slips, trips and falls continue to represent over half of all workplace injury claims in Victoria. To combat these injuries WorkSafe is urging all workers, supervisors and managers to never take a chance with safety.

Performing tasks in the safest way possible, rather than taking shortcuts or risks, should be a priority in every workplace.

Legal Duties

Employers

As an employer, you have a general duty to make your workplace safe, as well as specific duties in relation to hazards such as manual handling.

You must identify any tasks that involve hazardous manual handling. If these tasks pose a risk of musculoskeletal disorder, you must eliminate the risk.

If it's not reasonably practicable to eliminate the risk, you must reduce the risk, as far as reasonably practicable, by:

- changing the workplace layout, the workplace environment or the systems of work
- changing the objects used in the task; or
- using mechanical aids**.**

If there is still a risk after using these methods, you should control it by providing information, training or instruction.

You must review (and, where necessary, revise) your risk controls if things change, if there is a report of a MSD in the workplace, or at the request of a health and safety representative.

Employees

Your employer is required to protect you from manual handling injuries.

At the same time, you have a general duty to take reasonable care for your own health and safety, and that of others who may be affected by your work, and to cooperate with your employer's efforts to make the workplace safe.

This may include:

- using manual handling equipment properly
- following workplace policies and procedures (e.g. using trolleys, team lifting)
- attending health and safety training; and
- not taking any shortcuts that could increase manual handling risks.

You can also help your employer make the workplace safer by notifying them of any hazardous manual handling tasks that you become aware of.

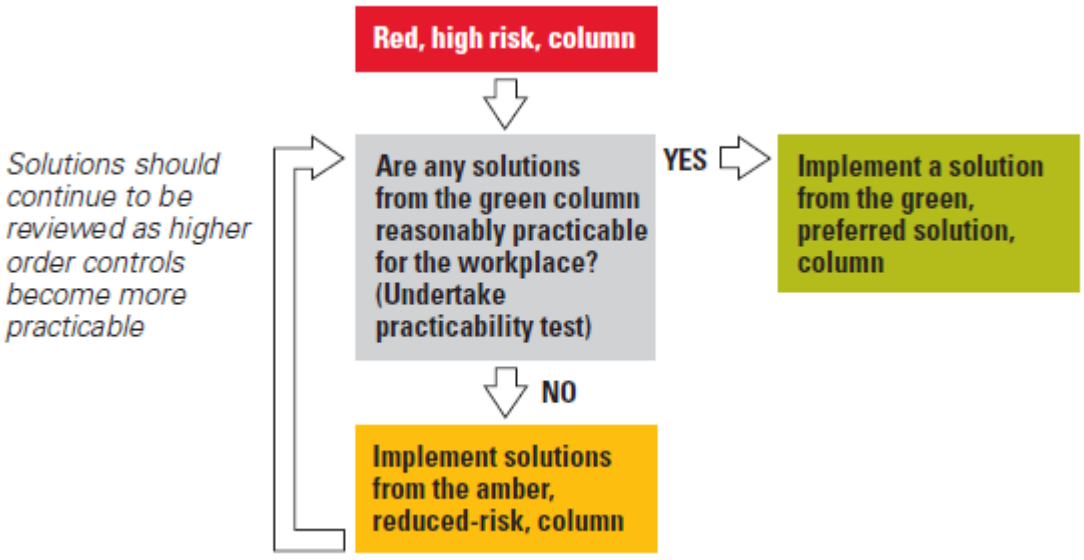
GENERAL

• Postures, movements and forces known to be associated with MSD should be eliminated from the workplace wherever possible.
• Employees should not be required to routinely work above their shoulder height, below their knees or at full reach distance.
• Physical changes to workplace design, layout and plant are more effective than administrative risk controls.
• To accommodate different people and tasks, workstations should be easy to adjust.

If high-risk practices are followed in your workplace, you should determine if you can use the green solutions. If this isn't practicable, put in place a comparable amber practice as a reduced-risk solution.
In the amber and green columns, the solutions listed first are preferred and will generally be more effective than solutions towards the bottom of the column.

The amber and green manual handling solution sections in this guide provide some different options because the tasks, and the risks, vary according to the specifics at your workplace. It is important to ensure any controls you implement address the risk factors in the task.

RED (HIGH RISK)	AMBER SOLUTION	GREEN SOLUTION
The practices in the red column should not be used in workplaces; an employer who allows these practices to be used is likely to be in breach of OHS legislation.	The solutions in the amber column are less effective in reducing risk than those in the green column, and should be regularly reviewed with the aim to move towards higher order solutions (green).	The solutions in the green column are the most effective at reducing risk and should be regarded as the target for all workplaces.



How to Comply

There are many solutions for controlling risk in hazardous manual handling tasks that can readily implemented in the workplace.

Where solutions are not obvious, employers should use a process to help them determine the most effective control measures for the manual handling risks they find.

Consultation is the first stage in developing your risk controls.

Consult

Employees' expertise can make a significant contribution to improving workplace health and safety.

Regular, proactive consultation can help identify issues in the workplace and build a strong commitment to health and safety by including all views in the decision-making process.

Under the WHS Act, employers must consult with employees when identifying hazardous manual handling tasks and making decisions about risk control.

'Employees' includes independent contractors (and any employees of the independent contractor/s) who perform work which the employer has, or should have, control over.

If employees are represented by health and safety representatives, the consultation must involve those representatives.

Review

It's important to review your manual handling risk controls regularly to ensure they are implemented correctly and to monitor their effectiveness**.**

You need to review (and, if necessary, revise) your risk controls whenever any changes are made to the workplace that could increase manual handling risks, such as changes to the way work is done or to the tools or equipment used**.**

A review is also necessary if a musculoskeletal disorder is reported, if you become aware of any new information about any hazardous manual handling tasks in the workplace, or if a health and safety representative requests one.

Fix

Work through the following list to control manual handling risks at your workplace. In many instances, a combination of approaches will result in the best solution.

1. Eliminate the manual handling risk
The best option is to remove the hazard completely, so you should always try to do this first.

Example: Get in the appropriate equipment to do the work mechanically, and train staff in its use.

2. Change the workplace, the objects used or the way the job is done
If you can't remove the hazard, minimise the risk by changing the workplace layout, environment or work methods, replacing the objects used in the task, or using mechanical equipment or aids.

Example: Provide trolleys and adjustable workbenches and seating; break loads into smaller quantities or use team lifting.

3. Provide training
If the other methods will not totally solve the problem, or if they're not suitable, you can use information and training to show employees how to do manual handling tasks with least risk.

Example: Train people involved in team lifting.

Risk Controls

There is a range of information available to help you develop risk controls appropriate to your workplace

Forces, postures, movements and vibration usually affect each other to increase the risk. For example, more force has to be exerted to pick up a box from the floor compared with picking it up from a bench at thigh height.

The longer these tasks are done, the greater the risk.

Environmental factors such as heat, cold and lighting levels can also increase the risk.

How much should you lift?

Neither Part 4.2 of the Work Health and Safety Regulation 2011 (PDF, 2.70 MB) or the *Hazardous Manual Tasks Code of Practice 2011* specify weight limits for lifting. This is because there are many factors that impact on the risk, not just the weight of the item being handled.

The Hazardous Manual Task Regulation states that a 'person conducting a business or undertaking must manage risks to health and safety relating to a musculoskeletal disorder associated with a hazardous manual task'.

When determining the control measures to implement to manage the risks associated with hazardous manual tasks, all relevant factors that may contribute to a sprain or strain must be considered, including:

- the postures, movements, forces and vibration relating to the task
- the duration and frequency of the task

- workplace environmental conditions that may affect the task or the worker performing the task
- the design of the work area
- the layout of the workplace
- the systems of work used
- the nature, size, weight or number of persons, animals or things involved in carrying out the task.

Lifting & Carrying Techniques

Technique for Lifting Heavy Objects

Many back problems occur not because the object is too heavy but rather because of the way it was lifted.
Most people go through life leaning forward to lift ... and the spine takes the full brunt of the force!

It doesnt matter how young or old you may be. Its important everyone uses safe techniques to prevent strain to your back.

Here are a few things to remember next time you offer to move something.

- The first step to lifting a heavy object safely is to get as close to it as you can. Ideally, the object should be underneath you.

- Next, take a wide stance. Legs should be wider than shoulders, with your weight anchored firmly into the ground or floor.

- Try different foot positions until you find the one that feels the most stable and comfortable. Try putting your left foot front, then your right. Or keep them parallel, but widen your stance. Once you have found your comfort level, get ready to use that position.

- Bend your knees and lift the object from underneath. You will be using the muscles in your hips and legs to do the heavy work. Avoid bending at the waist, which can cause you to injure a disk or strain your back.

- If you are lifting an unwieldy object, like a heavy bag of soil, get someone to help you. Taking a chance on lifting it is not worth the risk to your back.

- A trick for making sure you're lifting objects safely: Keep a long spine. Think about a line that goes from your head through your spine all the way down to your coccyx bone. Your body should stay in that position when lifting.
- One way to prepare your spine and find "the line" easily is to do the cat-cow yoga stretch. It will take you through arching and rounding your spine, warming it up and helping you to become more aware of the position of your back.

- Keeping your arms close to your body can help ensure that you're lifting an object safely. This will help keep the lifting efficient, helping you avoid shoulder, arm and back strain.

- When lifting your object, keep your knees in line with your toes. This will help you avoid knee strain, now that you are using hips and knees instead of your back. Don't let your knees drop inward or outward -- this will help your body stay aligned during the movement.

STEPS

Step 1

Check or clear the area you will be carrying the object in

Step 2

Check the load to make sure it is safe to handle

Step 3

Size up the load to check weight and stability Place your feet in proper position, with front foot beside the object facing direction of travel and back foot behind the object. Feet should be approximately hip width apart.

Step 4

Bend your knees!!! This will ensure you are using your leg muscles and not your back muscles.

Step 5

Obtain a proper hold of the item, with hands diagonally opposite and using your whole hands and fingers

Step 6

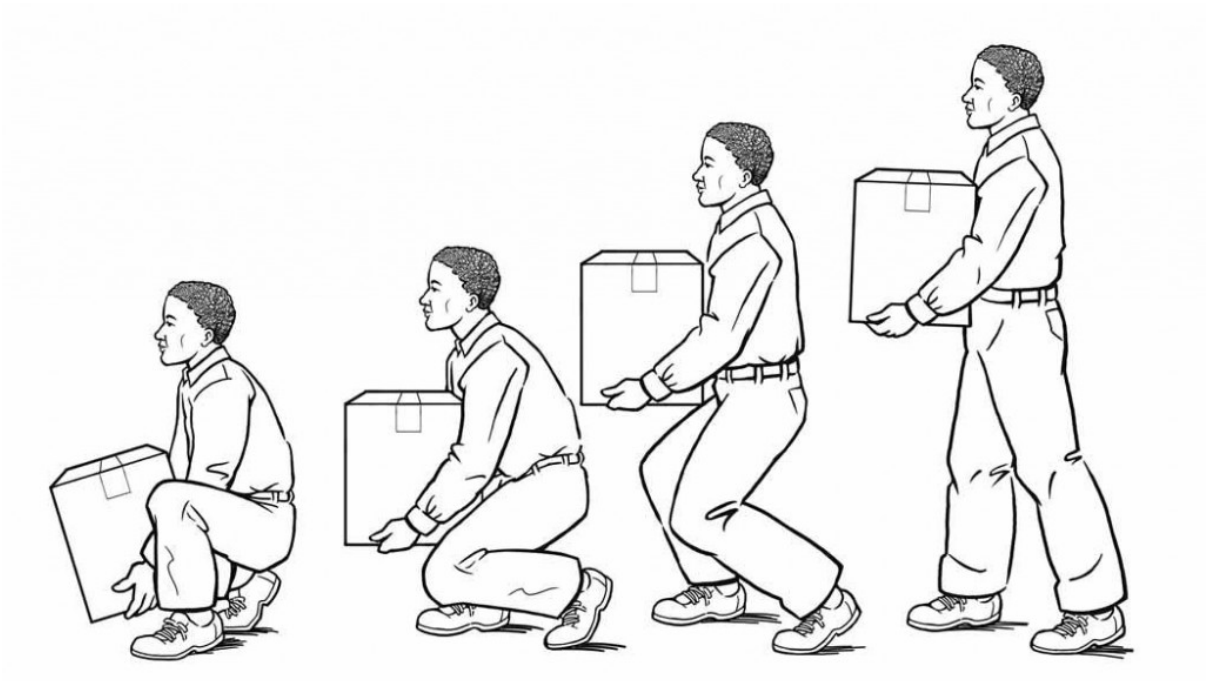
Make sure your back is straight as possible and as close to vertical as possible

Step 7

Finally always use your leg muscles. While lifting and carrying the load you should not turn or twist your body. Putting the load down is simply a reverse of the lifting procedure.

Step 8

Always remember: never lift anything that is too big, heavy or awkward.



Risk Controls in Manual Handling

Managing risks

A person conducting a business or undertaking (PCBU - the new term that includes employers) must manage the risks to health and safety arising from hazardous manual tasks. They should consider the:

- nature, size, weight and number of people, animals or objects involved
- environmental conditions that may affect the task or the worker
- postures, movements, forces and vibration relating to the task
- environmental conditions that may affect the task or the worker
- design and layout of the work area and workplace
- duration and frequency of the task
- systems of work used.

These control measures are outlined in the *Work Health and Safety Regulation 2011* (WHS Regulation).

Person conducting a business or undertaking

A 'person conducting a business or undertaking' (PCBU - the new term that includes employers) may be an individual person or an organisation conducting a business or undertaking.

Examples of PCBUs who are individuals include:

- partners in partnerships
- sole traders and self employed people
- individual trustees of trusts (as with some family businesses)
- committee members of unincorporated associations if they employ someone.

Examples of PCBUs that are organisations include:

- public companies
- private companies
- trustees that are companies
- cooperatives that are companies
- government departments and authorities
- incorporated associations if they employ someone
- local authorities (municipal corporations or councils)
- independent schools
- universities.

A health and safety duty is owed by a PCBU if it:

- arranges, directs or influences work to be done
- contributes something towards the work being done.

This duty also applies to:

- principals, contractors and sub contractors within the supply chain such as in the construction and transport industries
- franchisors and the franchisees that use the franchisors' business systems such as fast food outlets.

A PCBU is not the individual worker or officer and does not apply to purely social, domestic or recreational activities.

Volunteer associations
A volunteer association (such as a community group) that does not employ any person to do work will not be a 'person conducting a business or undertaking' (PCBU).

For example, a sporting club, charity or other community organisation that relies entirely on volunteers and does not employ anyone is not a PCBU.
Call 13 10 50 for more information about persons conducting a business or undertaking (PCBUs).

Working with Pallets (Loading and Unloading)

What is the problem?

Manually loading or unloading objects onto or from pallets is a common task in many industries. Often the pallet is located on the floor; placing objects on it or taking them off involves frequent awkward postures (bending, twisting and reaching) and repetitively exerting force to lift or lower the objects.

What is the risk?
Handling items while in bent, reaching or twisted postures increases the risk of musculoskeletal injuries of the shoulder, lower back and knees.

These injuries can occur suddenly when lifting heavy objects, particularly in awkward postures. They also occur over time through wear and tear on joints and other body components when doing this sort of work.

What is a solution to this problem?
Implement the following measures in the workplace:

Equipment
1. Provide a scissor lift with a pallet ring turntable similar to the type shown in Figure 1 overleaf.
2. If the scissor lift mechanism is pneumatically powered, ensure that the scissor mechanism is guarded against creating a shearing or crushing space.

Systems of work
3. Ensure that the pallet level is adjusted so that the handling of objects is set at waist height for each level of the pallet.
4. Ensure that the pallet ring turntable can rotate through 360 degrees so that employees can keep the pallet load point in closest proximity to them.

5. Locate the pallet lifter in a position that allows adequate space for the employee to place items on the pallet without twisting. It is recommended that the pallet be located at least one metre from the place the objects are located, eg conveyors, tables or other surfaces. This leads employees to turn and step with the object, eliminating back twisting and reaching movements.
6. Ensure that the appropriate load-shifting equipment is used to remove the pallet from the lifter when full.

Access to the work area
7. Implement a traffic management system for load shifting equipment and pedestrians to prevent vehicles or people coming into contact with the scissor lift or operator.

Maintenance, examination and testing
8. Develop and implement maintenance procedures that ensure the scissor lift with turntable is used, inspected and maintained in accordance with the manufacturer's instructions.

Training and supervision
9. Ensure that all employees who use the scissor lift or work in the area are trained in the safe operation of the machinery and in the systems of work for its safe use, including the traffic management systems.
10. Ensure that employees understand hazards and risks in manual handling, why the risk controls are required and the company's requirements for the use of the controls.

Repetitive twisting the back and reaching sideways.

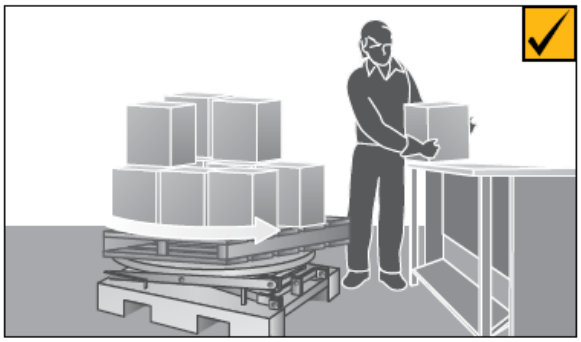
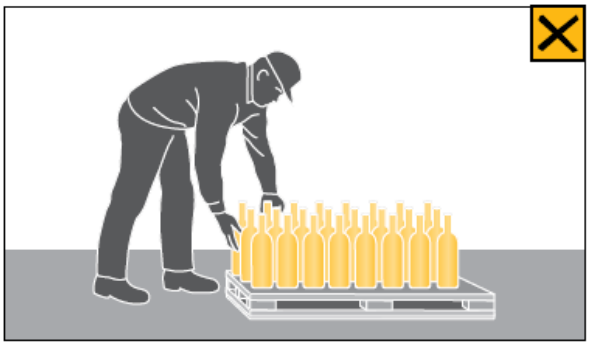


Figure 1. Turntable with pneumatic scissor lift.



Frequent forward bending of the back more than 20°.

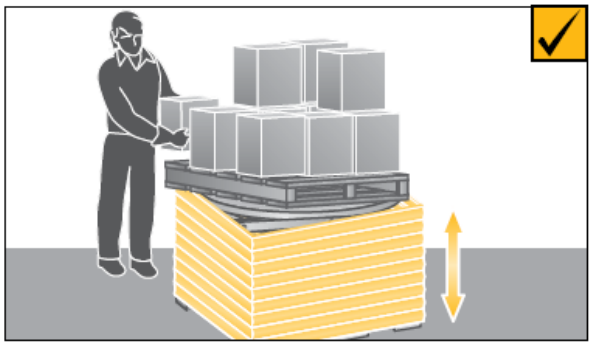
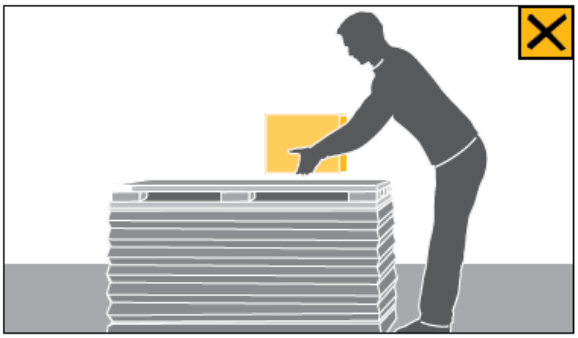


Figure 2. Pneumatic scissor lift with accordian safety skirting.



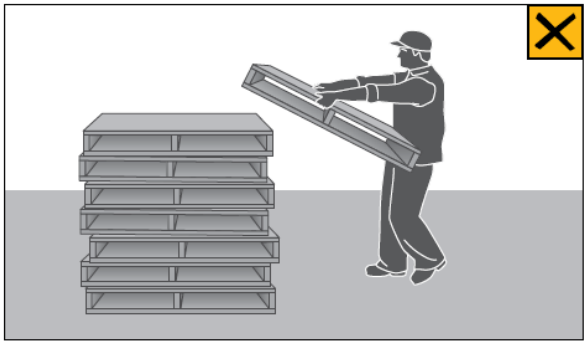
Repetitive forward reaching more than 30cm from the body.

Working with Pallets (Handling Empty Pallets)

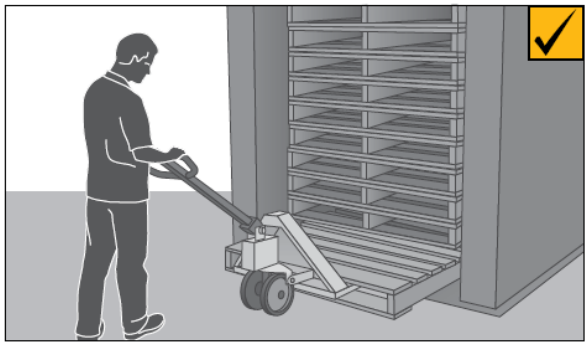
What is the problem?
Workers having to handle and stack empty wooden pallets.

What are the risks?
Manually handling and stacking empty pallets requires high forces and poor postures and movements. This can cause musculoskeletal injuries, particularly to the back, shoulders, wrists and forearms. Injuries can occur suddenly or develop gradually over time.

What is a solution to the problem?
The risk of musculoskeletal injuries can be reduced by:
• installing a mechanical pallet stacker
• using forklifts, overhead cranes or other mechanical aids such as a wide straddle pallet mover and lifter.
If these controls aren't practicable, consider using:
• hand pallet jacks
• lighter weight softwood or plastic pallets
• a hook to pull lighter weight pallets up to vertical.



Handling empty wooden pallets often results in injuries.



Use a mechanical pallet stacker to eliminate the manual task of handling and stacking empty pallets.

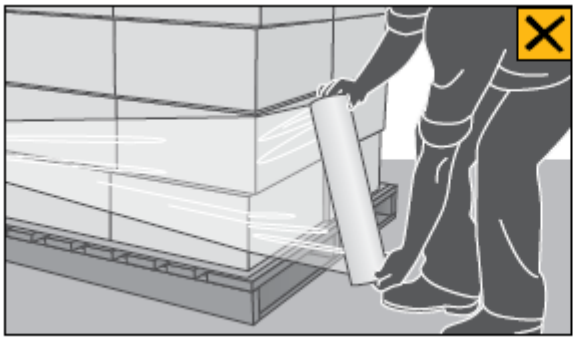
Working with Pallets (Stretchwrapping)

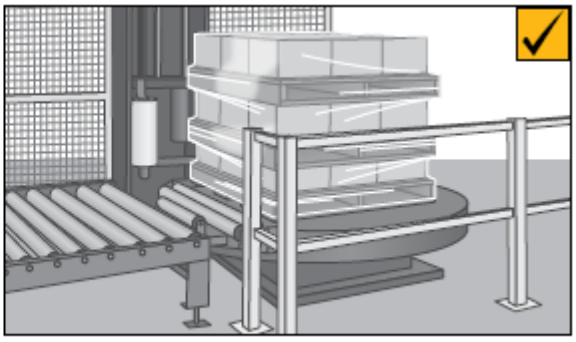
What is the problem?
Workers having to manually stretchwrap pallets.

What are the risks?
Manually stretchwrapping pallets requires poor postures and movements and often high force.
This can cause musculoskeletal injuries, particularly to the back, shoulders, knees, wrists, fingers and
forearms. Injuries can occur suddenly or develop gradually over time.

What is a solution to the problem?
The risk of musculoskeletal injuries can be reduced by:
• installing an automatic pallet wrapper
• using a semi-automatic stretchwrapping machine
• using a vacuum-sealing or shrink-wrapping device.

If these controls aren't practicable, consider using:
• a raised automated scissor lift and turntable to improve posture and movements
• an alternative packing product such as tape-wrapping.


Workers shouldn't have to manually stretchwrap pallets.


Use an automated stretchwrapper.

Working with Pallets (Preventing working above shoulder height)

What is the problem?
Manually loading/unloading multiple items to and from overstacked pallets.
What are the risks?
Handling items above shoulder height increases the risk of musculoskeletal disorders, particularly of shoulders, arms, neck and back.

Introducing mechanical aids, such as scissor lifters, to assist can also result in more work above shoulder height.

What is a solution to the problem?
The risk of musculoskeletal disorders can be reduced by introducing methods to effectively reduce the height.

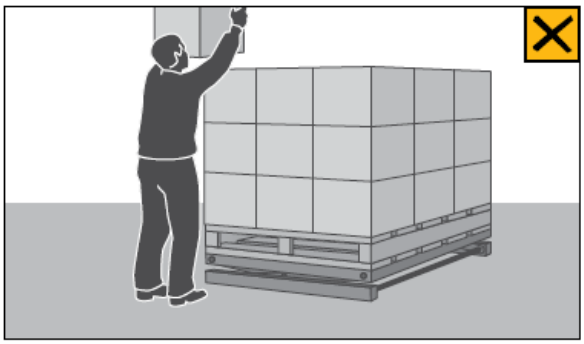
If workers load or unload pallets with items that are above shoulder height, consider lowering the maximum height of the pallet by:
• reducing the layers of product stacked on pallets

• ensuring suppliers do not stack their pallets as high
• using low profile lifters
• providing workers with a platform to stand on
• recessing the adjustable scissor lifter below floor level in order to reduce the pallet height.

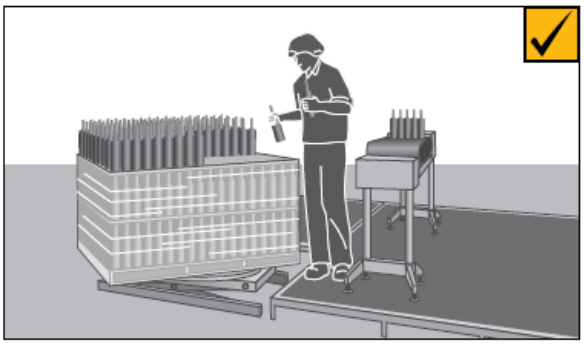
To ensure a new hazard is not created – such as crushing or nip points – use guard curtains on scissor lifters and ensure any work platform is suitable for its purpose and edges are marked to avoid falls.

Ensure all employees who use the equipment or work in the area are trained in its safe operation and in the systems of work for its safe use and maintenance, including the traffic management systems. Also make sure equipment is rated and appropriately maintained.

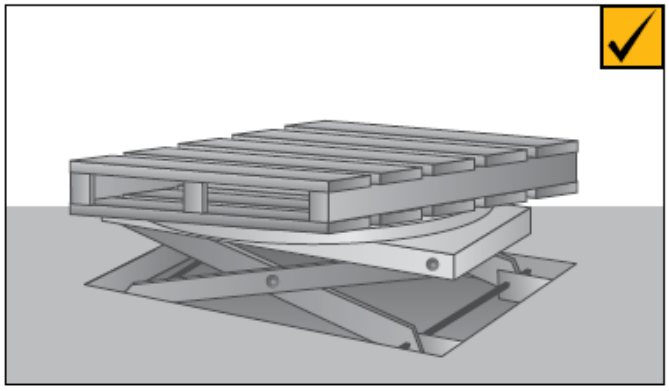
Talk to your suppliers to determine whether this solution is most practicable for you.



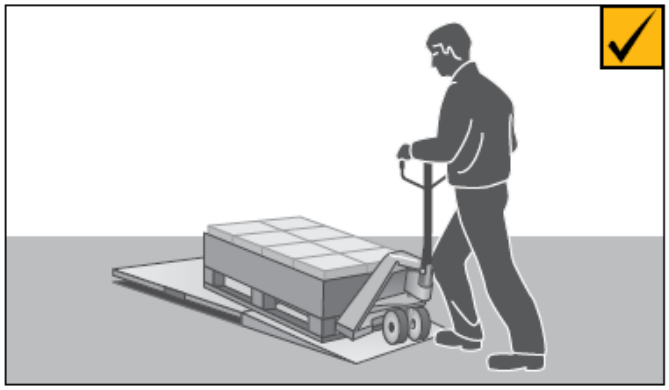
Worker trying to load top of pallet that is too high on a pallet lifter.



Platform around employee workstation compensates for height of pallet lifter.



Cut concrete floor to allow for height-adjustable lifters.



Low profile lifter.

Working with Pallets (Unloading items – using a bulk delivery method)

What is the problem?
Manually unloading items from pallets, which are often on the floor, can involve frequent awkward postures and repetitive exertion of force to lift and lower the items. Emptying products into vats and hoppers can also involve sustained awkward postures.

What are the risks?
Handling items while bending, twisting and reaching increases the risk of musculoskeletal disorders to the shoulders, lower back, abdomen and knees.

These injuries can occur when lifting heavy objects (particularly in awkward postures), but they can also occur over time through wear and tear on the body.

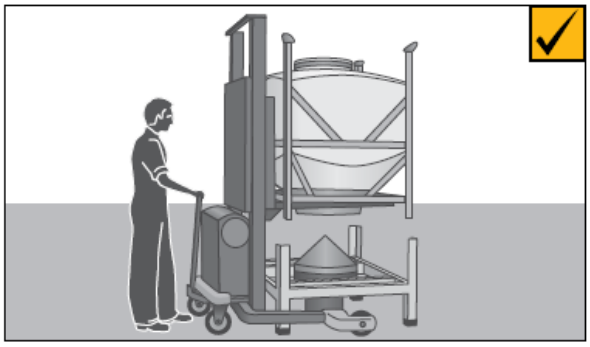
What is a solution to the problem?
The risk of musculoskeletal disorders can be reduced or eliminated by receiving products in bulk as many liquids and bagged products are suitable to be received in bulk (note this is one solution, see the other Health and Safety Solutions about loading and unloading items to and from pallets for more options).

For example, instead of pallets of 20kg bags of product, receive a 1-tonne bulk bag and use a vacuum or screw conveyor, or have products delivered in an intermediate bulk container (IBC) and install a system to measure or weigh the product as required.

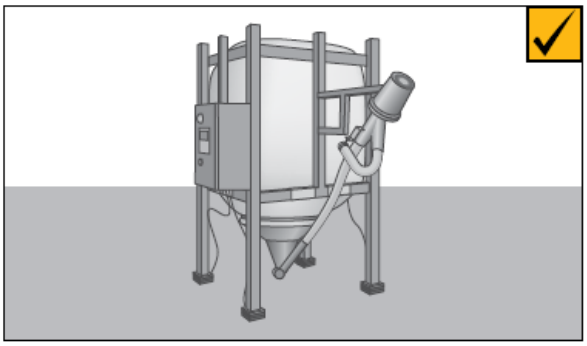
Generally, costs for bulk products are less than for individual packages. Talk to your suppliers to determine whether this solution is most practicable for you.

Worker unloading bags.

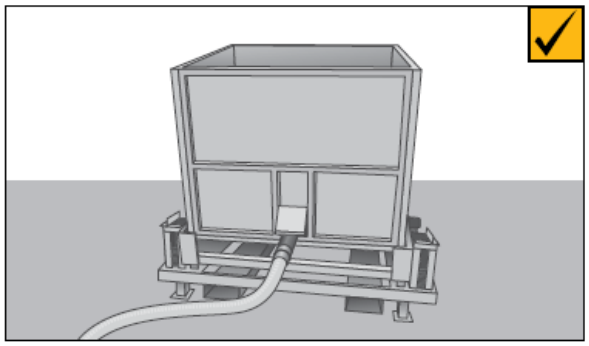
Bulk bag vacuum feed.



Intermediate bulk container.



Bulk delivery system that also weighs and delivers products.



IBC on a tilt mechanism with pump attachment.

Working with Pallets (Loading and unloading items – using vacuum lifters)

What is the problem?
Manually loading/unloading items to and from pallets, which are often on the floor, involves frequent awkward postures and repetitive exertion of force to lift and lower items.

What are the risks?
Handling items while bending, twisting and reaching increases the risk of musculoskeletal disorders to the shoulders, lower back, abdomen and knees.

These injuries can occur when lifting heavy objects (particularly in awkward postures), but they can also occur over time through wear and tear on the body.

What is a solution to the problem?
The risk of musculoskeletal disorders can be reduced by using a vacuum lifter to effectively reduce the force (note this is one solution, see the other Health and Safety Solutions about loading and unloading items to and from pallets for more options).

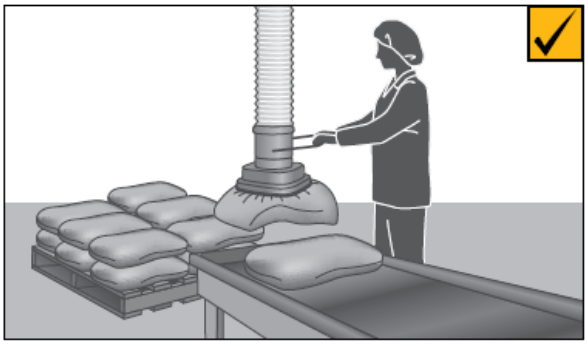
Vacuum lifters reduce the force required to handle an item – and its handle design can minimise any
awkward postures to pick up objects from the bottom, top and centre of a pallet.

The most common products to be lifted using vacuum lifters are boxes, bags and flat objects.
However, many materials can be lifted by vacuum lifters. While vacuum lifters reduce the manual
handling risk, they do not eliminate it.

Make sure equipment has a sufficient rated capacity for the load being suspended and is appropriately maintained.

Care must also be taken to ensure materials lifted by a vacuum lifter are not suspended over people and that loads are fully supported before releasing the vacuum. Ensure that all employees who use the equipment or work in the area are trained in its safe operation and in the systems of work for its safe use and maintenance, including traffic management systems. Talk to your suppliers to determine whether this solution is most practicable for you.

Worker unloading bags.



Worker using a vacuum lifter.

Using Trolleys

Trolleys are often pushed manually to transfer packs of green or dry timber into areas where they can be mechanically removed.

High force is often required to initiate the movement of the full trolleys. Some factors that may need to be addressed when controlling the risk are:
• Traffic management issues – separation of pedestrians from forklifts

• Using mechanical aids to do the work
• Implementing effective administrative procedures if mechanical aids are not practicable
• Limiting the distances over which the trolleys are pushed
• Appropriate trolley and castor selection
• Implementing effective maintenance procedures for trolleys, castors. and housekeeping

Trolleys are a type of material handling aid on wheels designed to hold and transport products, tools or supplies and reduce or eliminate the need for lifting. Manual handling a trolley potentially requires the capacity to lift, lower, push, pull, move, hold and restrain.

Depending on the types of materials to be transported trolleys can be plastic, metal or wooden; be flat topped, multi level or designed for a specialised purpose. They may or may not have handles. Wheel type and size can also vary depending on the types of terrain the trolley is traveling over, the work environment and whether they need to be lockable.

Some common types of trolleys available include:

- baggage trolleys
- cleaning trolleys
- freight trolleys
- linen trolleys - bag style for dirty linen and shelf style for folded clean linen
- flat topped trolleys with one or multiple shelves including variable handle designs
- tool trolleys that can hold tools and ladders, with either draw or cabinet style storage
- garment hanging trolleys
- legal or document trolleys for transferring large amounts of paper files
- mobile waste trolleys to assist with transferring bins
- sack style trolleys with foldable or adaptable shape models available for transfer of a wide range of items
- chair trolleys for shifting stacks of chairs
- keg trolleys
- commercial kitchen trolleys such as cold and cook units, bain-marie's, meal delivery trolleys, ingredient bin trolleys or food waste trolleys
- tub style trolleys with or without inbuilt height adjustment
- order picking trolleys which can include ladders for multi-height access
- mail delivery trolleys
- component storage trolleys
- foldable trolleys such as those used for holding a laundry basket
- piano trolleys
- tables on wheels
- industrial style trolleys with height adjustment requiring pumping of the handle to adjust height.

Powered trolleys are also available:

- industrial style trolleys with powered height adjustment capacity with models including tilt capacity or ball transfer units for ease of loading/unloading
- motorised or powered trolleys operated by push button reducing need to push or pull
- powered scooter type attachments powered by rechargeable battery that can be used to allow one person to efficiently collect large amounts of trolleys such as; shopping trolleys or luggage trolleys at airports
- detachable motorised units which can be wheeled under a heavy or awkward trolley or hospital bed and operated by push button to eliminate the pushing force required to move the object. These use a rechargeable battery
- permanent powered attachments which are fixed onto trolleys that cause significant pushing difficulties and are operated by push button.

Workplace solutions and adjustments

For people with disability that restricts lifting or carrying, a wide range of trolleys are available to assist with transporting either the tools required to undertake work tasks or the products or stock used to complete tasks.

When choosing an appropriate trolley, consideration needs to be given to the type and style of items to be transported, terrain over which the trolley will be pushed, any particular hygiene requirements of the workplace, space available for trolley movement, the need for height adjustment and whether a manual or powered trolley would be of most benefit.

It is recommended the provision of lifting and moving equipment such as trolleys, be part of an integrated, organisational approach to occupational health and safety, and used to complement other manual handling hazard control methods.

Trolleys should be serviced regularly to ensure that they are in proper working order as a trolley that is difficult to maneuver and poorly maintained can lead to injuries.

HIGH RISK		REDUCED RISK SOLUTION	PREFERRED SOLUTION
Action	**Potential source of risk**		
High force	Heavy, fully stacked trolley Various sources of risk as outlined in following table	Team handling – ie two employees assigned for the task, adequately trained and capable with standard size packs on trolleys, or on a dolly on wheels	Use an overhead gantry to move packs Using a mechanical aid  *The use of a 'tug' to move trolleys, above and below.* 
	Poor work practices allowing trolleys to become overloaded and heavier	Work practices allow for more frequent clearing of trolleys or packs Provide a sufficient number of trolleys	A system is in place to ensure forklifts or other mechanical aids are available when needed

ISSUES THAT AFFECT THE FORCE REQUIRED TO MANUALLY MOVE TROLLEYS

	POTENTIAL HAZARD SOURCE	RISK CONTROL
Trolley design and number	Poor trolley design results in a high centre of gravity	A height adjustable spring or scissor trolley will allow loading at a good height and provide a low centre of gravity for stability when pushing
	No handles provided or the handles provided are too low	Good handles provided, eg vertical
	Insufficient trolleys resulting in over stacking the available ones	Sufficient number of trolleys also allows for maintenance
Caster choice	Flat tyres or flat spots make the trolley difficult to get moving	Solid tyres or ones with adequate tyre pressure
	Small diameter castors	Low resistance bearings Large diameter castors
Floor surfaces	Cracks, uneven or non smooth floors can make the trolleys harder to move by increasing the pushing forces	Inspections and regular maintenance to keep floor surfaces clear and well maintained
	Steep gradients on ramps	Ensure trolleys are handled on flat or low gradient surfaces
Housekeeping	Dirty floors or tracks due to sawdust, wood, mud or stone make it harder to move the trolley	Regular housekeeping results in work areas kept clean and free of obstructions and trip hazards For example: implement a programme to conduct additional housekeeping during breakdowns
Maintenance	Damaged trolleys and castors make it harder to move the trolley	Immediate removal of damaged trolleys Implementation of a systematic preventative maintenance system for trolleys and castors

HAND TRUCK (2-WHEEL TROLLEY)

- Load weight should be within the Rated Load (RL) of the particular trolley.
- Load should be stable and have a centre of gravity not higher that handle height.
- Keep the centre of gravity low by placing heavier items below the lighter ones.
- Load height should be such that the operator has clear visibility in the direction of travel.
- Place the load so that it will not slip, shift or fall, and secure it with straps if they are provided.
- Always wear safety footwear when using this equipment to move items.
- Distance to be travelled should not be greater than 35m without a break.
- Total distance travelled with a load should not exceed 100m.
- Path should be free of obstacles and be at least 1m wide.
- Load weight of one-person handling should not exceed 100kg so that for a load weighing 100 to 200 kg, two persons should handle the 2-wheel trolley.
- Push the load so that the weight will be carried by the axle and not the handle.
- Tip the load slightly forward so that the tongue of the hand truck goes under the load and then push the tongue of the hand truck all the way under the load.
- Do not walk backward with a hand truck unless going up stairs or ramps.

• When going down an incline, keep the hand truck in front of you so it can be controlled at all times.
• Move hand trucks at a walking pace.
• Hand truck should not be used by an employee more than 200 times per day.
• Store hand trucks with the tongue under a pallet, shelf or table.

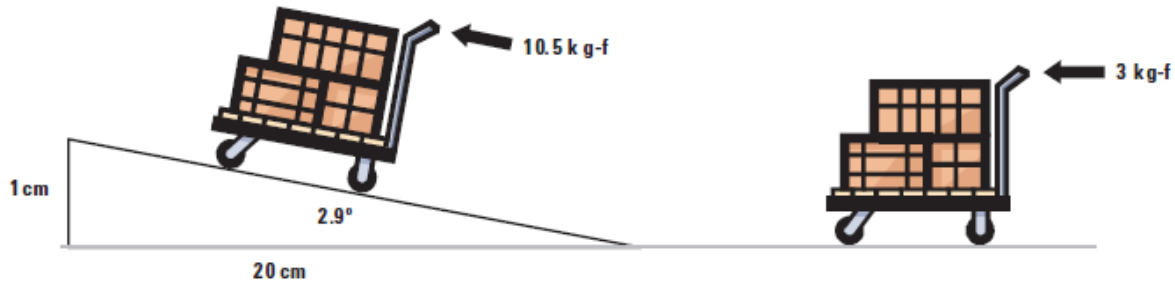
HAND TROLLEY (3-, 4-, 5-, 6- WHEEL TROLLEY)
• Load weight should be within the RL of the particular trolley.
• Use a trolley that is designed in accordance with ergonomic guidelines.
• For 3-wheel trolleys, the load should be stable and have a centre of gravity not higher than handle height.
• Place the load so that it will not slip, shift or fall, and secure it with straps if they are provided.
• Always wear safety footwear when using this equipment to move items.
• Load height should be such that the operator has clear visibility in the direction of travel–if the view is obstructed, get a second person to assist.
• Load length should be such that the trolley and load are easily manoeuvrable, and can be readily stopped. Consider the use of two persons to handle trolley loads longer than 4m to minimise the risk of injury from the high force required to stop the load suddenly and maintain its stability should it come into contact with other persons, or fixtures or items.
• Total distance travelled with a load should not exceed 400m.
• Path should be free of obstacles and have good clearance for the trolley.
• Do not walk backward with a hand trolley unless going up ramps.
• When going down an incline, keep the trolley in front of you so it can be controlled at all times.
• Use a trolley fitted with brakes if required to stop on a ramp or regularly use a ramp.
• Move hand trolleys at a walking pace.
• Hand trolleys should not be used by an employee more than 200 times per day.
• Keep the starting forces below the range 17–21kg-force (kg-f).
• Ensure the rolling force does not exceed 12kg-f if the trolley is pushed more than 3m.
• Emergency stopping forces of more than 36kg-f should not be needed to bring the trolley to a stop within 1m.
• If trolleys are pushed up a slope, the load should be reduced so that the recommended rolling force limit is not exceeded. Table 1 shows calculated pushing force increases per 100kg of laden trolley weight on various slopes.

These must be added to the pushing force needed on a level surface.

Increase in pushing force on various slopes

SLOPE GRADIENT	PUSH FORCE INCREASE PER 100 KG OF LADEN TROLLEY WEIGHT
1 in 10 (5.7°)	10.0 kg-force (kg-f)
1 in 15 (3.8°)	6.7 kg-f
1 in 20 (2.9°)	5.0 kg-f
1 in 30 (1.9°)	3.3 kg-f
1 in 50 (1.1°)	2.0 kg-f

Example: If a trolley with a laden weight of 150kg requires a pushing force of 3kg-f on a level surface, it will require a force of 10.5kg-f (3+ 5(150/100)) to push it up a gradient of 1 in 20.



HAND PALLET JACK

• Load weight should be within the RL of the particular hand pallet jack.
• Load height should be such that the operator has clear visibility in the direction of travel. If the view is obstructed, get a second person to assist.
• Secure the load on a pallet or place it in a stillage so that it will not slip, shift or fall.
• Distance to be travelled should not be greater than 35m.
• Path should be free of obstacles and be at least 1.3m wide.
• If a T-handle is used, it should be long enough to protect the employee's feet from being struck by the pallet during pulling activities.
• If hand pallet jacks are pushed up a slope, the load should be reduced so that the recommended rolling force limit is not exceeded. The table above shows calculated pushing force increases per 100kg of laden trolley weight on various slopes.

These must be added to the pushing force needed on a level surface.
• Do not walk backward with a hand pallet jack unless going up ramps.
• When going down an incline, keep the pallet jack in front of you so it can be controlled at all times.
• Use a hand pallet jack fitted with brakes if required to stop on a ramp or regularly use a ramp.

• Move hand pallet jacks at a walking pace.
• Start and stop the pallet jack gradually to prevent the load from slipping.
• Hand pallet jack should not be used by an employee more than 200 times per day.
• Keep the starting forces to the range 17-21kg-f or less.
• Ensure the rolling force does not exceed 12kg-f if the jack is pushed more than 3m.
• Emergency stopping forces of more than 36kg-f should not be needed to bring the hand pallet jack to a stop within 1m.
• Due to the wheel design, do not use hand pallet jack on gravel, damaged, or uneven surfaces.
• Always wear safety footwear when using this equipment to move these items.
• Never ride on hand pallet jacks.

Trolley Selection Guide

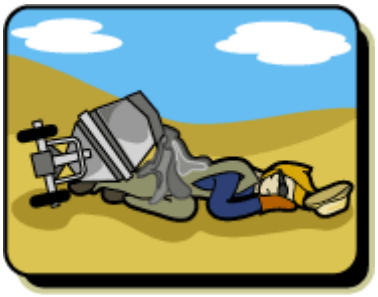
An ergonomically designed trolley loaded to its RL will have a starting force not exceeding 21kg-f, a rolling force not exceeding 12kg-f, and an emergency stopping force not exceeding 36kg-f on a flat level surface.

TYPE OF ERGONOMICALLY DESIGNED TROLLEY	MAXIMUM LBA LOAD (KG)	MAXIMUM TRANSPORT DISTANCE (M)	MAXIMUM FREQUENCY OF USE IN 8H SHIFT	NUMBER OF PERSONS TO HANDLE TROLLEY
Two – Wheel hand truck	100	100	200	1 2 if poor visibility
Two – Wheel hand truck	200	35	50	2
Three – Wheel hand truck	RL	400	200	1 2 if poor visibility
Four – Wheel hand trolley or Five – Wheel hand trolley or Six – Wheel hand trolley	RL	400	200	1 2 if poor visibility 2 if long item
Hand pallet jack		35	200	1 2 if poor visibility
Electric pallet jack	RL	100	400	1
Electric walkie stacker	RL	100	400	1
Forklift	RL	400	400	1
Powered ride-on pallet mover	RL	400	400	1

Using concrete mixers

Loaded mixers

- Make sure that you stabilise the mixer.
- Check all guards are in place.
- Do not overload.
- Never place any object like a shovel or trowel into the turning bowl of a mixer.



A falling mixer can cause a serious accident.

Electric mixers

- Make sure your mixer is protected with a residual current device (RCD).
- Electrical leads must be inspected every three months and 'tagged' by an electrician.
- Don't leave electric leads lying in water.

Damaged or wet leads can cause electrocution.

Petrol driven mixers

If you need to use a petrol driven mixer, do not use it in an enclosed space such as a garage or a basement.

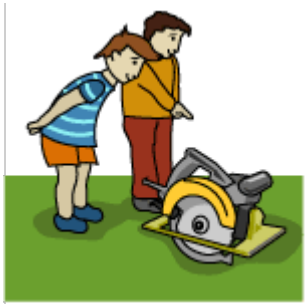
Using petrol in an enclosed space can result in a build up of carbon monoxide fumes.

General worksite safety

It is very important to keep a worksite as tidy as possible to avoid accidents.

Always check that safety caps are on starter bars.

Check whether other workers want to work in the same place as you.

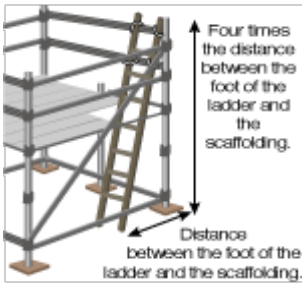


Lock away dangerous tools at the end of the day.

Use scaffolding if you are working above shoulder height.

Unfilled holes and openings in floors should have a warning sign or fence.

Before using scaffolding, check that it is complete, stable and strong enough to carry the load you want to put on it.



Ladders should have a rise to base ratio of 4 to 1. This means that the distance a ladder reaches up a wall should be about four times the distance that the foot of the ladder is from the base of the wall.

Ladders should be placed on stable ground and, if possible, they should be tied at the top to the structure you are climbing. If it is not possible to tie the ladder you should have someone holding the base of the ladder.

All rubbish should be removed from walkways and areas where people are working.

Safe work practices - Loading and unloading work vehicles

Heavy, awkward equipment, such as mixers need to be loaded and unloaded on a daily basis. To decrease the manual handling consider the following:

- use mechanical assistance such as a winch or hiab to load/unload the equipment;
- modify the tailgate so it is mechanically lifted and lowered; and/or
- have a vehicle with removable tailgate and sides.

Safe work practices - Mixing mortar

Strategies to minimise the physical workload associated with shovelling sand and moving bags of cement include:

- always use a trolley/wheelbarrow to move bags of cement rather than carrying them;
- never try to carry multiple bags of cement at one time;
- use both long and short handled shovels that best suit the task/person, eg use a long handled shovel if there is a large reach involved; and
- take regular breaks from continuous shovelling. If possible intersperse continuous digging with alternative tasks.

Working safely with cement and lime

Lime and cement are highly alkaline. Like acids, alkaline materials can burn. Contact with lime and cement can cause severe burning or drying of the skin and therefore they should be handled carefully.

Some points to remember.

- Always wear gloves and safety goggles while mixing these materials.
- Always use a trowel or small tool to apply mortar.
- Keep the handles of tools and the back of trowels clear of mortar to avoid contact with your hands.
- If you get cement or lime on your skin, wash it off immediately and dry the skin.
- Each time you take a break, wash your hands well in warm soapy water.
- Use a barrier cream daily to prevent your skin from drying out and cracking.

Eye contamination

Lime is very caustic and extreme care should be taken to avoid contact with the eyes. If lime gets in your eyes:

- do not rub the eyes
- wash eyes immediately with lots of flowing water from a tap or hose until any pain/discomfort goes away (at least 10 minutes)
- if pain/discomfort continues see a doctor
- notify your supervisor or your teacher.

Note: Lime putty is very caustic and can cause severe burns. If lime putty is splashed into your eyes, wash them thoroughly and see a doctor straight away.

Good housekeeping

All workers involved in all trades on site have a responsibility for maintaining site tidiness. Routine, regular cleanups should be scheduled as part of the workday. Working on a tidy, well-maintained site makes the job easier and safer.

Team lifting

Training must be provided for all bricklayers and labourers involved in team lifting. The lift needs to be coordinated by a “leader”. Remember team lifting should not be considered an adequate long-term control. Team lifting in inherently dangerous and alternative solutions should be considered.

Vibration hazards

Extensive use of tools or machinery which vibrate at high frequencies such as pneumatic hammers, concrete breakers, drills and chipping hammers, can lead to an injury called 'vibration white finger'.

Symptoms include the following.

- Tingling and numbness in the fingers, even after the machinery has been switched off.
- One fingertip temporarily turns white and may start to ache.
- The finger turns white with increasing frequency.
- Other fingers (though not usually the thumb) begin turning white. After several fingers turn white, the disease is probably irreversible.
- Increasingly frequent, painful attacks occur at any time.

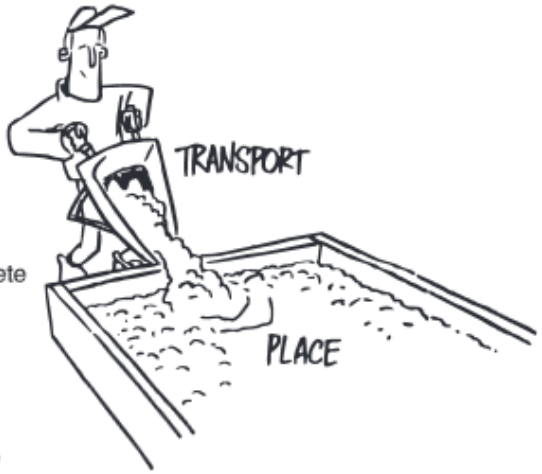
In extreme cases, the person may eventually lose their fingers. To avoid this injury:

- use vibration insulators on tools and equipment
- take regular breaks from using this type of equipment eg alternate with other kinds of work
- wear special gloves designed to insulate the hands from vibrations.

Transporting and Placing

When transporting and placing concrete, avoid:

DELAYS
SEGREGATION and
WASTAGE.



TRANSPORTATION The method used to transport concrete depends on which one is the most cost effective and easiest for the job size and site.

Transport methods include: a concrete truck, a concrete pump, a crane and bucket, a chute, a conveyor or a hoist. For small jobs on which concrete cannot be placed directly from the truck chute, a wheelbarrow is the easiest way to transport it.

Always transport concrete as little as possible on site to reduce problems of segregation and wastage.

PLACING When placing concrete be careful not to damage or move the formwork and reinforcement.

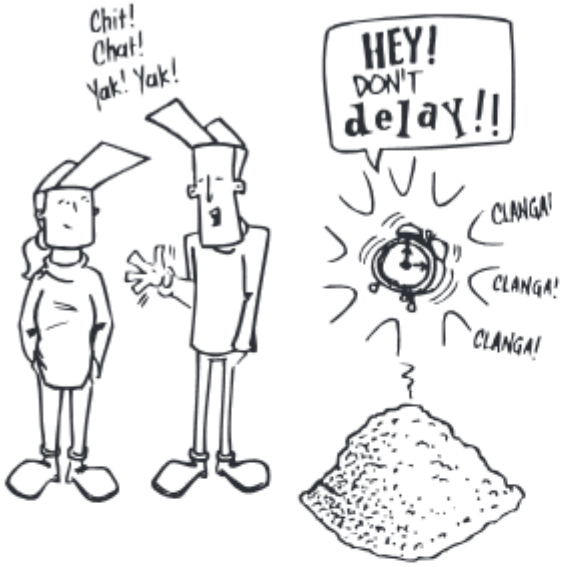
Place concrete as near to its final position as possible.

Start placing from the corners of the formwork or, in the case of a sloping site, from the lowest level.

IMPORTANT SAFETY INFORMATION
When handling and using cement or fresh concrete, avoid skin contact. Wear suitable protective clothing.

DELAYS Delays can cause the concrete to dry-out and stiffen.

Delays are more of a problem on hot and/or windy days when the concrete will dry-out and stiffen more quickly.



To avoid delays plan ahead. Check that all labour, tools and containers are ready and that all preparations for placing have been done before the concrete is delivered.

NEVER just add water to the concrete to make it more workable.

SEGREGATION Segregation is when the coarse and fine aggregate, and cement paste, become separated. Segregation may occur when the concrete is mixed, transported, placed or compacted.

Segregation makes the concrete:

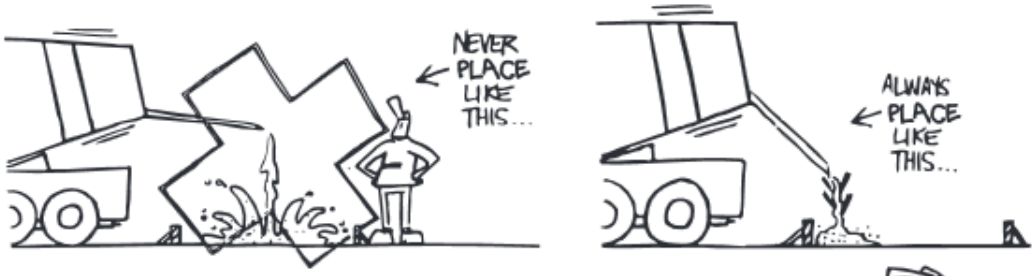
WEAKER,
LESS DURABLE,
and will leave A POOR SURFACE FINISH.

To avoid segregation:

Check the concrete is not 'too wet' or 'too dry'.

Make sure the concrete is properly mixed. It is important that the concrete is mixed at the correct speed in a transit mixer for at least two minutes immediately prior to discharge. The concrete should be placed as soon as possible. When transporting the mix, load carefully.

If placing concrete straight from a truck, place vertically and never let the concrete fall more than one-and-a-half metres.



Always place new concrete into the face of concrete already in place.

When compacting with a poker vibrator be sure to use it carefully.

Never spread concrete sideways with a poker vibrator as this may cause segregation of the mix.

Always be sure to vibrate concrete evenly.

WASTAGE Wastage can be costly, especially on small jobs. To minimise wastage; mix, load, transport and place carefully.

Safe Handling Procedures and Safety Data[1]

Bricklaying Tools

Whatever the type or purpose of the tools you are using, you must keep them in good repair and safely stored.

1. Keep tools clean. Wash off any materials or dirt at the end of each day.
2. Maintain tools carefully - especially electrically-driven tools. These should be inspected and tagged by an electrician every three months.
3. Lock tools away at the end of the day - especially those that are dangerous.

Cutting and shaping Tools

Bolster

A bolster is made of steel and is usually 100 mm wide. It is used with a lump hammer to cut masonry and bricks accurately.

It is also used for removing tiles and bricks.

Check that the shaft and blade are straight and clean.

[1] Source: Boral, as at http://www.boral.com.au/product_index/material_safety_data_sheets.asp, as on 1st February, 2014

Brick hammer

This is a small hammer that has a sharp end (as well as the striking end). The sharp end is used by masons and bricklayers to cut masonry and bricks roughly.

Masonry saw

This is a motor-driven power tool. It is especially useful for making accurate cuts in masonry and bricks.

Lump hammer or Mash hammer

This solid hammer is used with cutting tools like bolsters and chisels.

Check:

- the head is strongly fixed on and can't fly off
- the handle isn't splintered or broken.

Tinsnips

Tinsnips are like strong scissors. They are used for cutting thin strips or sheets of metal.

Applying and flattening Tools

Raking tool

This has an adjustable pin on two small wheels and you use it to rake out joints. The adjustable pin means you can rake to a specific depth.

Round iron jointer

These jointers leave a recessed (concave) joint. They are used for facing concrete blocks.

Trowel - Large

These have steel blades and wooden handles. They are available in many shapes and sizes and are used by bricklayers, plasterers and masons. This is a very useful tool. It can be used for spreading mortar or plaster, tapping things into place and pointing.

Trowel - Pointing

Pointing trowels also come in various sizes. They are used for quality pointing work.

Trowel - Finger

This is a thin, narrow trowel (also called a caulking trowel) with a steel blade and a wooden handle. It is used to smooth out joints and for caulking and filling mortar joints.

Measuring, aligning and levelling Tools

<u>One metre folding rule</u>

This handy rule is used to measure short distances. It is sometimes called a 'zigzag' rule. It is made of plastic or boxwood and folds to a length of 250 mm.

Gauge rod

This is used by bricklayers to work out courses. It is usually two to three metres long and is made of timber or aluminium. It is marked off in required vertical measurements, such as the height of window sills or door heads. It can be used, for example to make sure the courses are a regular height at the main corners of a building.

Bevel

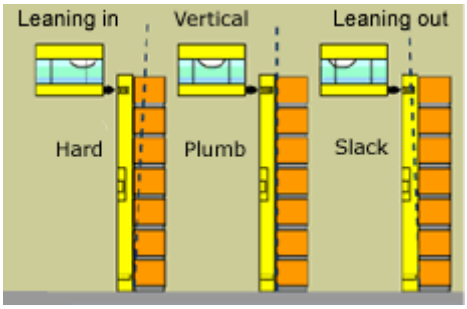
A bevel has a 250 mm adjustable blade, which is useful if you have to cut materials at an angle other than 90º.

Steel compass

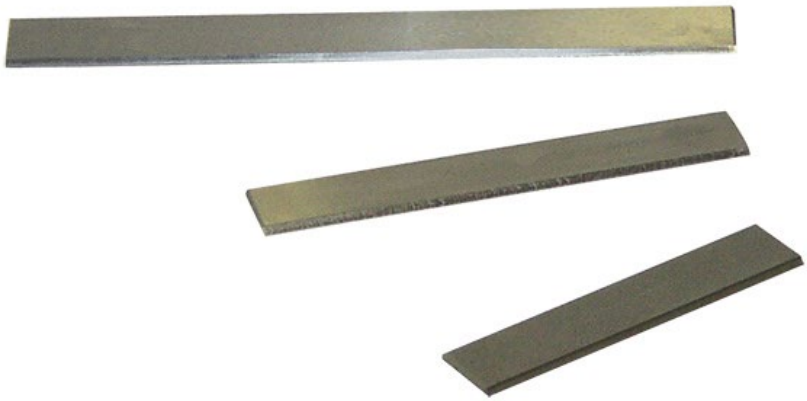
This is used to mark off a series of measurements.

Spirit level

A spirit level is used to check the level of a horizontal or vertical surface. For example, it can be used to make sure corners and walls are aligned vertically. Spirit levels are 450 to 1200 mm long.

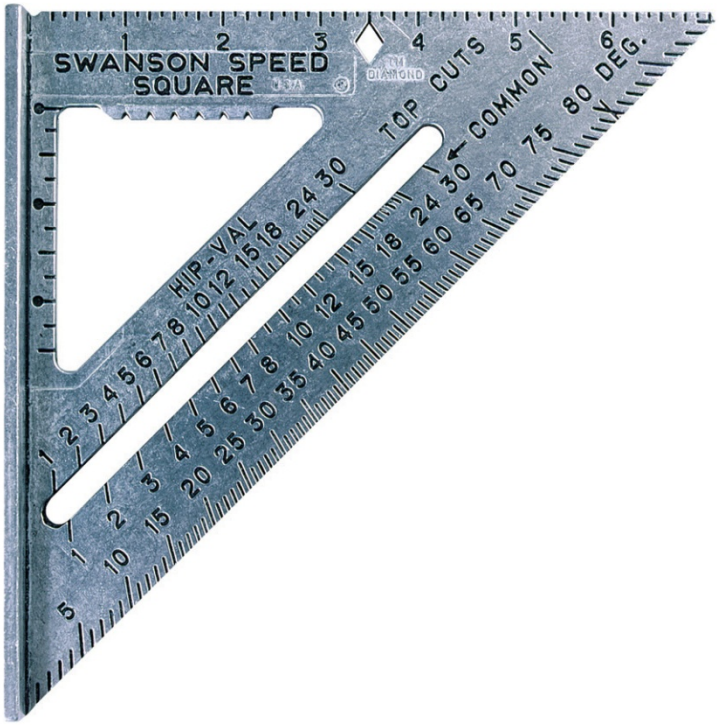


Long straight edge



These vary in size. A typical one might be three metres long. You use them with spirit levels to check levels. It is usually used in building trades for setting out.

Large square



You can use this tool to set out the right angle corners, especially of a large structure like a building. It is made of battens 75 x 25 mm with sides around 1200 mm long.

Plumb rule and bob

This is a string with a weight on the end. The weight is usually about 1.3 kg. It is used to show the direction of the vertical. You use the plumb and bob to check the vertical alignment of walls and so on.

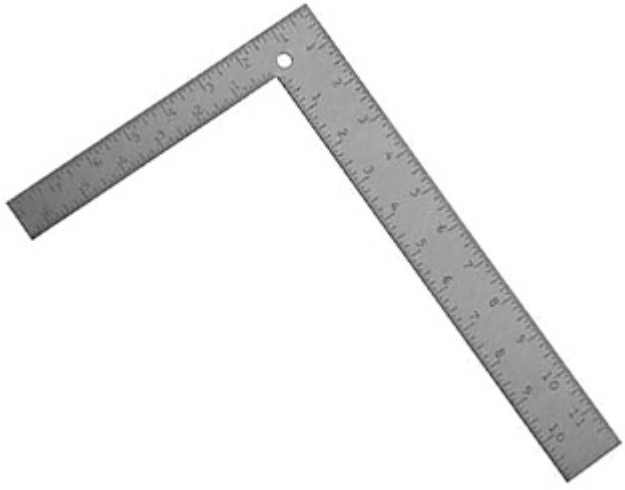
Line pins and lines

These are used by bricklayers to align the brick courses. The line is stretched tight between the pins, which are held in the mortar joints. The bricks are laid to the line.

Line blocks

These are used by bricklayers as an alternative to pins to hold the lines. They are made of wood or plastic and attach the line to the corner of the profile. (A profile is a temporary structure that helps the bricklayer align the bricks.)

Steel square



A steel square can be used to set out or test small right angle corners.

Steel tape

Steel tapes are between 3 to 30 metres long. You can use them to measure bigger distances, such as when you are setting out and checking wall and building sizes.

General equipment

Concrete mixer

This may be electric or petrol-driven. It is used to mix large amounts of material such as mortar or concrete.

Extension/power leads

These are used to connect electrically-driven power tools to the power source. They must be regularly inspected to make sure they are safe and serviceable.

Hoses

Hoses can of course be used for cleaning but are also needed for connecting to clean water supplies for mixing some materials.

Wheelbarrow

Wheelbarrows are used for moving heavy materials, removing debris and for mixing smaller quantities of things such as mortar and concrete.

Check:

- the wheelbarrow is big enough and strong enough for the job (it can tip over if the things you carry in it are too big)
- the wheel is turning correctly and the tyre is inflated.

Mortar board

Mortar boards are used by bricklayers for 'working' the already mixed mortar before laying the bricks.

Elevating and holding

Scaffolding

Scaffolding allows workers to work at height safely. Scaffolding above four metres can only be erected or dismantled by a person who has a scaffolding certificate.

Broom

A broom is an essential piece of equipment. A tidy worksite involves keeping areas swept clean of mud, dirt and rubble.

Soft hand broom

A small soft broom is used for sweeping extra materials off surfaces such as timber and bricks.

Hammering and fixing Tools

Claw hammer

The 'claw' is used to grip nails and then lever them out.

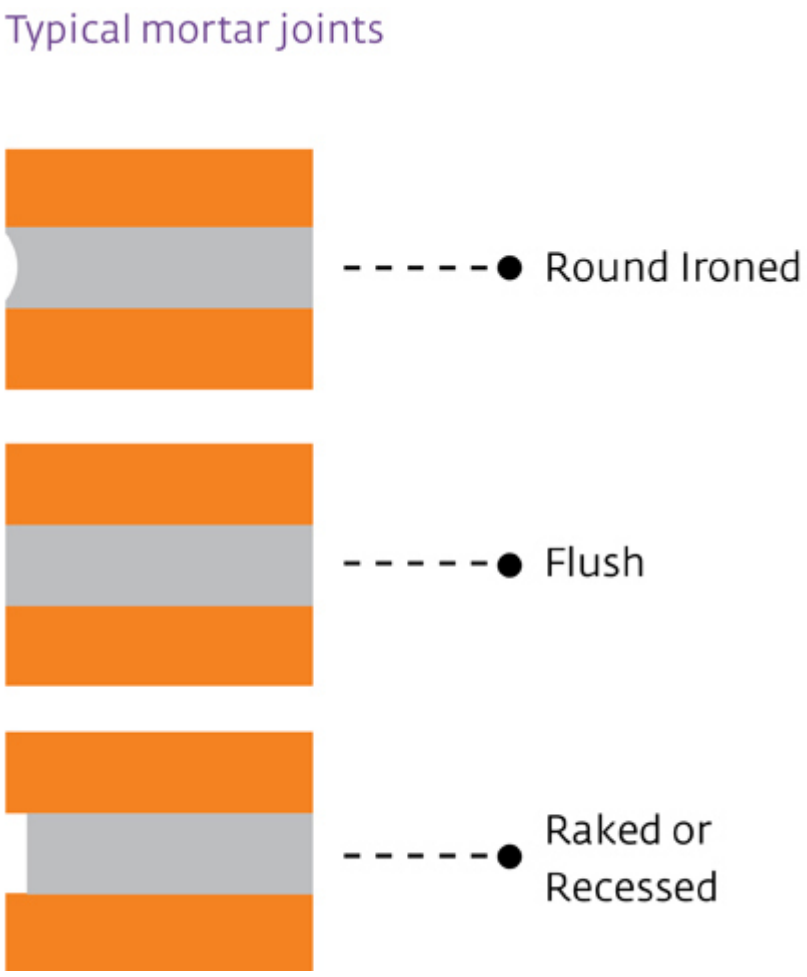
The claw hammer can also be used for hammering nails, and hitting other tools (like chisels and bolsters) lightly.

Claw hammers used in dry wall plastering have a convex head to reduce the chance of damaging the face of the plaster sheets. They also give a concave indent to the plasterboard so that the nail can be easily concealed with plaster.

Check:

- the head is strongly fixed on and can't fly off
- the handle is not splintered or broken.

Note: The above tools are used to finish the mortar joints in a range of ways as follows:



Batching the mortar in a mixer[2]

Batching the mortar means mixing the mortar. Here's how it is done in a concrete mixer.

Step 1

Pour $^{2}/_{3}$ of the water into the mixer. Use a bucket for measuring. It is more accurate than a shovel.

Step 2

Add any additives that the specifications require, such as water proofer, plasticiser or liquid colouring.

Step 3

Add about $^{1}/_{3}$ of the sand.

Step 4

Add the cement and lime and powder colouring if it's required.

Step 5

Mix all these till the mortar is a ‘slurry'.

Step 6

Add the rest of the sand and any water that you think is still needed. Mix all this for at least three minutes.

[2] Source: Cement Australia, as at http://www.cementaustralia.com.au/wps/wcm/connect/website/packaged-products/home/hints-and-tips/FAQ-Working-with-Concrete/, as on 2nd February, 2014.

What mix ratio should I use for a path or driveway?

For concrete made for paths & driveways, mix 1 part Cement Australia Builders Cement with 2 parts sand and 3 parts aggregate. Approximately 16 x 20kg bags of Builders Cement are required per cubic metre of finished concrete.

CONCRETE, MORTAR & RENDER
VOLUME BATCHING MIX TABLE

APPLICATION	CEMENT	SAND	AGGREGATE	20kg BAGS OF CEMENT PER m^3
CONCRETE Improved water tightness High strength	1	1.5	3	17
Paths, driveways, patios, floors	1	2	3	16
Foundations, footings	1	3	3	13
MORTAR General purpose	1	4	–	15
Improved workability	1	6	+1 Hydrated Lime	8
RENDER	1	3	–	20

✔ Always use clean drinking water in precise quantity specified
✔ Always use an accurate volume measure like a bucket or gauge box

✗ Excess mixing water can ruin good concrete, mortar and render

What Personal Protective Equipment (PPE) is required when handling cement based products?

Always wear the correct protective clothing when handling any product containing cement as it is an alkaline substance in a fine powder form:

- Gloves - to guard against skin irritation
- Face mask - to prevent dust inhalation
- Eye protection - to prevent dust from getting in to eyes
- Long pants and sleeves - to guard against skin irritation

- Safety boots - to prevent injuries to your feet when handling heavy items or using potentially hazardous tools

Always separately wash clothes that may be splashed with cement-based products at the end of each day.

How many bags of pre-mixed Concrete Mix are required to fill a cubic metre?

Approximately 110 x 20kg Concrete Mix bags are required.

What does the term MPa mean?

MPa is the metric unit for pressure or stress called megapascal (MPa). The term is used in concrete as the common unit for compressive strength. If you have a project which requires a defined strength of concrete - i.e. 20MPa to set the posts for a raised deck - then its time to call in the experts and have concrete delivered from a ready mixed truck – it's the only way to guarantee the structural strength in the concrete.

You may also see concrete requirements expressed as 'N20/10' - this is where N means normal class concrete, 20 refers to 20MPa of strength and 10 refers to it containing a maximum aggregate size of 10mm.

Does the temperature of the air on the day affect the use of concrete products?

The ambient temperature can affect the setting times of all types of concrete. If the temperature is less than 10^{o}C, wait until the day becomes warmer and if its over 35^{o}C then postpone the job until it is cooler.

How do you cure freshly laid concrete?

It is important to moisten the surface and edges of the slab for up to 7 days. This provides a continuous supply of moisture to provide a better surface quality. Curing occurs to ensure that the hardened surface abrasion is developed and dusting is reduced.

Protection should start as soon as the final surface finish is produced and not the next day.

This can also be achieved by covering the slab with black plastic. Care should be taken to ensure that covering the slab does not mark the freshly poured concrete. Protection of coloured concrete slabs must be considered. If polythene sheets are in direct contact with the concrete variable colour of the surface due to hydration staining may occur and this is not possible to correct at a later stage.

Alternatively, mist spray the slab at least twice daily for up to 7 days as it is important that the slab does not dry out before the cement has fully hydrated.

What is the difference between cement and concrete?

While the terms cement and concrete are often used interchangeably, it is important to note that cement is actually an ingredient of concrete. Cement is the powder added to concrete that provides the basis for the glue that holds the concrete together. Concrete is a mixture of aggregates (stones) and sand and the paste is water and cement. Through a process called hydration the cement and a portion of the water will undergo a chemical reaction and harden into a rocklike mass.

Contrary to popular belief, concrete “sets” or “hardens” as a result of the chemical reaction between the cement and the water – it doesn’t just dry out.

Why should a shovel not be used to measure concrete or mortar materials?

Cement is a dry product and is free flowing whereas damp sand tends to clump together. Cement tends to lie flat on the shovel and has less volume than the sand. Using a shovel does not ensure that materials are measured equally and it is recommended that proportions of raw materials are measured with a container such as a bucket.

Always use an accurate measure to add your water too as the most common mistake made when mixing concrete, render or mortar is to add to much water.

Too much water ruins the strength of concrete, mortar and render.

How quickly will Rapid Set Concrete harden?

Rapid Set Concrete contains cement, sand and aggregate and an additive which causes an initial hardening to happen within 15 minutes of water being added.

In warm temperatures, this hardening is accelerated and can be as fast as 5 minutes!

Never mix Rapid Set Concrete in a vessel like a bucket or a wheelbarrow as it will set hard and ruin it before you can remove the product. Rapid Set Concrete is designed to be added to clean water in the hole that you wish to fill with concrete.

What mix ratio should I use for foundations or footings?

For concrete made for foundations or footings, mix 1 part Cement Australia Builders Cement with 3 parts sand and 3 parts aggregate. Approximately 13 x 20kg bags of Builders Cement are required per cubic metre of finished concrete.

What is the procedure for laying a concrete surface?

This process is referred to as the placing and finishing of the concrete and there are four steps:

1. **Screeding** - which is the initial levelling of the placed concrete using a straight length of wood, aluminium straight edge or a portable power screed for larger jobs.

2. **Bleedwater accumulation** - where the concrete is left for 1 to 2 hours after screeding to allow bleedwater to accumulate on the surface and then to evaporate.
3. **Final floating** - occurs when the bleedwater has evaporated and the top surface is firm to touch and is completed with a wooden or magnesium float.
4. **Final trowelling** - occurs when the concrete surface becomes firm and is often carried out in several passes at intervals of 30 minutes where the concrete receives its final surface finish.

2.3 Mortar mixes

The durability and strength of mortar are controlled by a classification system given in AS 3700, comprising grades M1, M2, M3 and M4. Typical mix proportions to achieve these grades are given in Table 10.1 of AS 3700.

Mortar proportions are always expressed as the proportion of cement to lime to sand ... and always in that order. Table 6 shows a range of mixes with the corresponding grade according to AS 3700, and comments on their applications.

Table 6. Mortar mixes

Grade	Composition	Application
M4	1:0:4	This cement mortar is very durable and is often specified to contain lime for added workability that may otherwise be very poor. In severe marine environments or below DPC in aggressive soils and saline water M4 mortar must be used with bricks of Exposure Grade.
M4	1:0.25:3 1:0.5:4.5	These are the strongest and least permeable composition mortars. In severe marine environments or below DPC in aggressive soils and saline water M4 mortar must be used with bricks of Exposure Grade. Because of its high durability this is the preferred mortar for producing fade-resistant pigmented mortar.
M3	1:1:6	This is the common general-purpose mortar found in most specifications and can be used in all areas except where an M4 mortar is required. It is usually specified when the properties of the brick to be used are unknown. This mortar suits the majority of building applications and brick types.
M2	1:2:9	This lime-rich composition mortar is most suitable for internal brickwork, brickwork above a damp-proof course and with General Purpose bricks when used in cottage construction in non-marine environments. This is a forgiving mortar with a good balance between strength, flexibility and permeability. It is not suitable for colouring with pigments as it is prone to apparent fading. This is the preferred mortar for fireplaces and barbecues.
M1	0:1:3	This is a straight lime mortar that sets slowly. It develops very little early strength. This mortar can only be used when repairing historic masonry originally built using lime mortar. In most cases a 1:3:12 mortar is preferable.
M1	1:3:12	This mortar has most of the flexibility of straight lime mortar and can be used for restoration and matching existing construction only.

2.4 Mortar quantities

Table 7 gives an estimate of the amount of mortar used in laying 1000 bricks, including an allowance for 25 percent wastage. This assumes the perforations are completely filled (the amount of loss will vary depending on size of the perforations) and typical site wastage. These estimates are the upper bound limit of the mortar volume required.

Table 7. Estimated quantities of cement, lime and sand per 1000 bricks with 25 percent brick perforation

AS 3700 code	Mortar composition (C:L:S)	No of 20 kg bags of cement	No of 20 kg bags of lime	Cubic metres of sand	Tonnes of damp sand
M4	1:0.5:4.5	17.3	3.2	0.55	1.04
	1:0.25:3	25.9	2.4		
M3	1:1:6	12.9	4.8		
M2	1:2:9	8.6	6.4		
M1	1:3:12	6.5	7.2		
M1	0:1:3	–	9.7		

Batching the mortar in a wheelbarrow[3]

Summary

Batching the mortar means mixing the mortar. You may only want to mix a small amount, so you would do it manually.

Step 1

Measure the sand and put it all into the wheelbarrow.

Step 2

Add the cement and lime and powder colouring if it's required.

Step 3

Make a hole in the middle of these dry ingredients and pour in the water and liquid colouring if it's required.

Step 4

Mix all the ingredients with your shovel until it is a workable mixture.

[3] Source: Family Handyman, as at http://www.familyhandyman.com/masonry/pouring-concrete/how-to-properly-mix-concrete/view-all, as on 2nd February, 2014.

Overview: Materials and Tools

1 of 1

Safety gear

Protect your skin and eyes! The cement in concrete is caustic and can cause burns if it gets on your skin.

Mixing bags of concrete isn't complicated. You add some water, stir it up and pour it out. But to get the most strength from the concrete, you have to recognize when it has just the right amount of water mixed in. Too little water and the particles in the mix won't stick together. Too much water weakens the concrete. In this article, we'll show you what the perfect mix looks like. We'll also show you a mixing technique that will ensure thoroughly mixed concrete with a minimum of effort.

For most small jobs around the home, bagged concrete mix is the most convenient and least expensive way to go. You can use it for fence post footings, deck footings and even small concrete pads. For jobs requiring more than about 30 bags, consider ordering “ready-mix” concrete from a truck instead.

Sixty- or 80-lb. bags of concrete mix are readily available at home centers, lumberyards and hardware stores. Don't confuse concrete mix with sand mix or mortar mix. They don't contain the aggregate (stones or gravel) that's necessary to make a pour thicker than about 3/4 in. You're likely to find more than one kind of concrete mix on the shelf, including “fast setting,” “high early strength” and “fiber reinforced.” But for most jobs, standard concrete mix is fine. Read the recommendations on the bags or check manufacturers' Web sites to find out if one of the special mixes would work better for your project.

Whether you handmix concrete in a plastic tub, homemade mixing tub or wheelbarrow, the technique is the same. However, it's easier to move and dump concrete that's mixed in a wheelbarrow. For larger jobs, you could rent a mixer ($35 per day), but it may be more economical to simply order ready-mix concrete. In addition to a mixing container, you'll

need a sturdy hoe and a large bucket as well as a stiff-bristle scrub brush to clean the equipment. Wear waterproof gloves and safety glasses because the cement in the concrete mix is caustic and can burn skin. Wash it off with water if it gets on your skin.

Step 1: Add water to the dry mix

Photo 1: Slice and dump the bag

Set the bag of concrete mix in one end of the wheelbarrow and slice it open with your hoe. Dump the mix from the bag and pull out the paper bag.

Photo 2: Add a measured amount of water

Fill a bucket with the specific amount of water recommended on the bag (amount varies with bag size). For future reference, mark the water level with a permanent marker. Pour the water into the opposite end of the wheelbarrow, reserving about 4 cups to add later if needed.

Photo 3: Gradually wet the mix

Pull a small amount of the dry mix into the water with a hoe and mix it completely. Continue pulling and mixing until all of the powder is wetted and the mix is piled at your end of the wheelbarrow. Continue mixing by going to the other end of the wheelbarrow and pulling the mix back toward you.

One of the most common mistakes beginners make is to add too much water and end up with concrete that's thin and soupy. Here are a few tips to avoid the problem.

First, pour a measured amount of water into the mix from a bucket rather than squirting it in with a hose (Photo 2). Continue mixing for a few minutes after all the water is absorbed because the concrete will often get soupier as you mix. If you add more water right away, it may end up runnier than you'd like. Finally, keep at least a few cups of dry concrete mix handy just in case your mix gets too thin.

A hoe makes a great mixing tool. A flat shovel or spade works too. Whichever you choose, it's best to add the water to one end of the wheelbarrow or mixing tray and pull the dry mix into it a little at a time (Photo 3). This method ensures that all the dry particles are completely wetted.

Mixing Technique

Use a sturdy wheelbarrow to mix your concrete. And make sure it's on a level surface. Brace the wheelbarrow with your knee when you're mixing from the side.

Mix thoroughly

Work it to the perfect consistency

Photo 4: Too dry

Drag the hoe through the mix to make a trough. The mix is too dry if the sides of the trough are crumbly and the concrete falls in chunks when you disturb it. Add water one cup at a time, mixing between each addition.

Photo 5: Too runny

Add more dry concrete if the mix is too wet and soupy and sags into the trench.

Work it to the perfect consistency

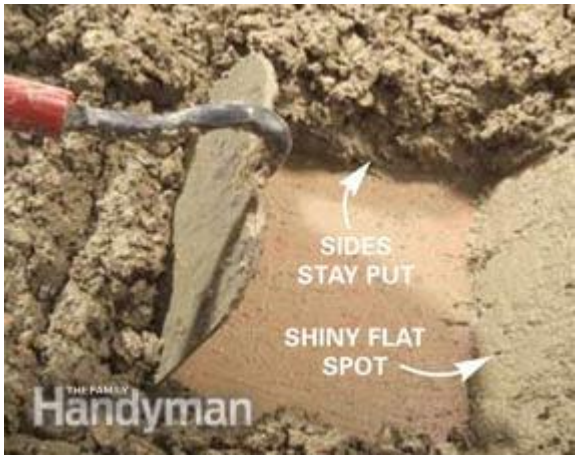


Photo 6: Just right

The mix is just right when the sides of the trough stand and the ingredients are thoroughly wetted. A hoe patted against the concrete will leave a slightly shiny surface.

If the mixed concrete looks like the mix in Photo 6, it's ready to pour. Otherwise, mix in additional dry mix or water until you get the right consistency.

It's tempting to just squirt water into the dry concrete mix with a hose and mix up a soupy batch of concrete. After all, it's quicker and the runny concrete is easier to pour. The trouble is, soupy concrete is only about half as strong as a proper mix and is more likely to crack. That's why we recommend spending a little extra time measuring the water into a bucket

first, and adding only as much as is needed. Even though the thicker mix is a little harder to place, it'll be worth the extra effort.

Step 3: Clean up promptly

1 of 1

Photo 7: Wash your tools

Scrub the wheelbarrow and tools with a stiff-bristle brush before the concrete starts to harden. Rinse well.

Remember to clean your equipment right away (Photo 7). Once the concrete hardens, it's a bear to get off. Scrape excess concrete from the wheelbarrow and pile it on a piece of plastic. If it's a big pile, break it up into manageable chunks before it fully hardens. Dump the rinse water in an inconspicuous corner of your lot (it can kill grass). You can even dig a depression to contain the water and then cover the residue after the hole drains.

Avoiding a weak mortar

You don't want to have to knock down what you have built. If you don't mix the mortar properly that could happen!

Not mixing correctly means you will end up with a weak mortar.

What causes a weak mortar?

👎 Insufficient mixing time.

👎 Incorrect amount or type of additives.

👎 Not enough cement.

How to avoid a weak mortar

 Job specifications often detail exactly the mix required. Follow them precisely.

 If it is not specified, then as a good bricklayer, you should know the correct mortar for the type of job you are doing.

 Be careful with your measuring. Don't use a shovel to measure the mixture proportions. A shovel is a very inaccurate way to measure. Use a bucket to gauge the mix of sand, cement and lime.

 Be careful with the timing. Mix for at least three minutes in a mixer.

Cleaning up excess mortar

Excess mortar or drops of mortar must be removed before it dries.

- Sometimes the mortar oozes out of the joints. You can remove this mortar with a large trowel or a pointing trowel.
- Use a soft brush to remove drops of mortar on the face of the bricks.
- Wash any mortar off window panes and door frames. Use a soft brush or cloth. Be careful not to scratch the glass - or it will have to be replaced.