AUSTRALIAN SCAFFOLD

WORK SAFER - FASTER - SMARTER

SCAFFOLDING OVERVIEW
Scaffolding basics terminology

Scaffolding – Australian Standards 1576
This Australian Standard specifies performance requirements and methods of structural and general design for access and working scaffolds. In general these requirements also apply to other types of working scaffolds.

The purpose of a working scaffold is to provide a safe place of work with safe access suitable for the work being done. The Australian Standard sets out performance requirements for working scaffolds. The standard is intended to be used as the basis for enquiry and design.

Materials
The basic materials for scaffold are Standards (uprights), ledgers (horizontal), tubes, couplers and boards. Materials are either steel or aluminium. If they are steel they are either 'black' or galvanised. The scaffold components come in a variety of lengths and are a standard diameter of 48.3 mm. The chief difference between the steel and aluminium is the lower weight of aluminium tubes (1.7 kg/m as opposed to 4.4 kg/m) and also a greater flexibility and so less resistance to force. Tubes are generally bought in 6.5 m lengths and can then be cut down to certain typical sizes.

Boards provide a working surface for users of the scaffold. Traditionally they are seasoned wood and come in three thicknesses (38 mm (usual), 50 mm and 63 mm) are a standard width (225 mm). The timber board ends are protected by metal plates called hoop irons or sometimes nail plates. Timber Scaffold boards in Australia should comply with the requirements of AS 1576.

As well as timber, steel or aluminium decking is used. In recent years there has been a trend away from timber to steel or aluminium on account of timber boards rotting from the inside and is undetectable. Australian Scaffold does not use timber boards. As well as boards for the working platform there are sole boards which are placed beneath the scaffolding to spread the load over a greater area. An engineer's report may be required if the ground is soft or has recently been filled.

Couplers are the fittings which hold the tubes together. The most common are called scaffold couplers, there are three basic types: *right-angle couplers*, *putlog couplers* and *swivel couplers*. To join tubes end-to-end *joint pins* (also called spigots) or *sleeve couplers* are used, or both together. Only right angle couplers and swivel couplers can be used to fix tube in a 'load bearing connection'. Single couplers are not load bearing couplers and have no design capacity.

Other common materials include base plates, ladders, ropes, anchor ties, reveal ties, gin wheels, sheeting, etc.

Basic scaffolding

The key elements of a scaffold are standards, ledgers and transoms. The standards, also called uprights, are the vertical tubes that transfer the entire mass of the structure to the ground where they rest on a square base plate to spread the load. The base plate has a shank in its centre to hold the standard and is sometimes pinned to a sole board. Ledgers are horizontal tubes which connect between the standards. Transoms are placed next to the standards, they hold the standards in place and provide support for boards; intermediate transoms are those placed between the main transoms to provide extra support for boards. In Canada this style is referred to as "English". "American" has the transoms attached to the standards and is used less but has certain advantages in some situations. Since scaffolding is a physical structure, it is possible to go in and come out of scaffolding.

As well as the tubes at right angles there are *cross braces* to increase rigidity, these are placed diagonally from ledger to ledger, next to the standards to which they are fitted. If the braces are fitted to the ledgers they are called ledger braces. To limit sway a *facade brace* is fitted to the face of the scaffold every 3rd bay or so at an angle of 35°-55° running right from the base to the top of the scaffold and fixed at every level.

Of the couplers previously mentioned, right-angle couplers join ledgers or transoms to standards, putlog or single couplers join board bearing transoms to ledgers - Non-board bearing transoms should be fixed using a right-angle coupler. Swivel couplers are to connect tubes at any other angle. The actual joints are staggered to avoid occurring at the same level in neighbouring standards.

The spacing of the basic elements in the scaffold is fairly standard. For a general purpose scaffold the maximum bay length is 2.4 m, for heavier work the bay size is reduced to 2 or even 1.8 m while for inspection a bay width of up to 3.0 m is allowed.

The scaffolding width is determined by the width of the boards, the minimum width allowed is 450 mm but a more typical four-board scaffold would be 870 mm wide from standard to standard. More heavy duty scaffolding can require 5, 6 or even up to 8 board's width. Often an *inside board* is added to reduce the gap between the inner standard and the structure.

The lift height, the spacing between ledgers, is 2 m. The diagram above also shows a kicker lift, which is just 150 mm or so above the ground.

Transom spacing is determined by the thickness of the boards supported, 38 mm boards require a transom spacing of no more than 1.2 m while a 50 mm board can stand a transom spacing of 2.6 m and 63 mm boards can have a maximum span of 3.25 m. The minimum overhang for all boards is 50 mm and the maximum overhang is no more than 4x the thickness of the board.

Foundations

Good foundations are essential. Often scaffold frameworks will require more than simple base plates to safely carry and spread the load. For surfaces like pavements or tarmac base plates are necessary. For softer or more doubtful surfaces sole boards must be used, beneath a single standard a sole board should be at least 1,000 cm² with no dimension less than 220 mm, the thickness must be at least 35 mm. For heavier duty scaffold much more substantial baulks set in concrete can be required. On uneven ground steps must be cut for the base plates, a minimum step size of around 450 mm is recommended.

A working platform requires certain other elements to be safe. They must be close-boarded, have double guard rails and toe and stop boards. Safe and secure access must also be provided.

Tube & coupler scaffolding showing required protection of a working platform with maximum dimensions. Butt-board not visible, no couplers shown.

Ties

Scaffolds are only rarely independent structures. To provide stability for a scaffold, ties are generally fixed to the adjacent building / steelwork.

General practice is to attach a tie every 4m on alternate lifts (traditional scaffolding). The ties are coupled to the scaffold as close to the junction of standard and ledger (node point) as possible.

Due to the different nature of structures there are a variety of different ties to take advantage of the opportunities.

Through ties are put through structure openings such as windows. A vertical inside tube crossing the opening is attached to the scaffold by a transom and a crossing horizontal tube on the outside called a bridle tube. The gaps between the tubes and the structure surfaces are packed or wedged with timber sections to ensure a solid fit.

Box ties are used to attach the scaffold to suitable pillars or comparable features. Two additional transoms are put across from the lift on each side of the feature and are joined on both sides with shorter tubes called tie tubes. When a complete box tie is impossible an l-shaped *lip tie* can be used to hook the scaffold to the structure, to limit inward movement an additional transom, a *butt transom*, is place hard against the outside face of the structure.

Sometimes it is possible to use *anchor ties* (also called *bolt ties*), these are ties fitted into holes drilled in the structure. A common type is a ring bolt with an expanding wedge which is then tied to a node point.

The least 'invasive' tie is a *reveal tie*. These use an opening in the structure but use a tube wedged horizontally in the opening. The reveal tube is usually held in place by a reveal screw pin (an adjustable threaded bar) and protective packing at either end. A transom tie tube links the reveal tube to the scaffold. Reveal ties are not well regarded, they rely solely on friction and need regular checking so it is not recommended that more than half of all ties be reveal ties.

If it is not possible to use a safe number of ties *rakers* can be used. These are single tubes attached to a ledger extending out from the scaffold at an angle of less than 75° and securely founded. A transom at the base then completes a triangle back to the base of the main scaffold.

Putlog scaffold

As well as putlog couplers there are also putlog tubes, these have a flattened end or have been fitted with a blade. This feature allows the end of the tube to be within or rest upon the brickwork of the structure. They can be called a bricklayer's scaffold and as such consist only of a single row of standards with a single ledger, the putlogs are transoms - attached to the ledger at one end but integrated into the bricks at the other. Spacing is as general purpose scaffold and ties are still required.