

Formwork



INTRODUCTION	3
DESIGN REQUIREMENTS.....	4
FACTORS RELATING TO FORMWORK	6
HIGH WALL FORMWORK	6
Timber Framed Formwork.....	7
SHEATHING	8
WALL TYING SYSTEMS	8
CONSTRUCTION JOINTS.....	9
SLIPFORM	10
CLIMBING OR JUMP FORMS.....	10
Formwork Striking	11
Standards relating to formwork	12
ERECTION FOR COLUMNS, BEAMS, SLABS AND STAIRS.....	13
Columns.....	13
Column Formwork Construction	13
Column forms and joints	14

Column forms and joints	15
Erection of formwork for columns	17
Column formwork construction stages	18
BEAM AND SUSPENDED SLAB FORMWORK	19
Design and construction of beam formwork.....	19
Marking out and setting heights for falseworks.....	20
Construct and erect side walls and beam soffit	20
SUSPENDED SLABS.....	21
Design and construction of slab formwork	21
Determining The Bearer Spacing.....	22
Erecting Bearers And Joists	22
PROPRIETARY FORMWORK	23
FALSEWORK	24
Setting up falsework:.....	24
STAIR FORMWORK	25
Stair Formwork construction.....	25
TREADS, NOSINGS, BALUSTRADING	26
STRIKING, MAINTENANCE, STORAGE OF FORMWORK	27

INTRODUCTION

A number of fundamental principles apply to all formwork.

Consideration must be given to:

Acceptable tolerances permitted;

Use of appropriate materials;

Standards of workmanship;

Construction for ease of erection and stripping;

Care and maintenance of the formwork, so that the maximum number of re-uses can be achieved.

Formwork is a temporary construction; however care must be taken to prevent damage to permanent work. Three general principles govern formwork design and construction:

Quality accuracy of the concrete shape and the final finished surface quality.

Safety strength of the formwork structure. Personal safety of people, both carpenters and the public.

Economy The structural frame is usually the most significant cost component, a dominant and critical factor in the time of construction.

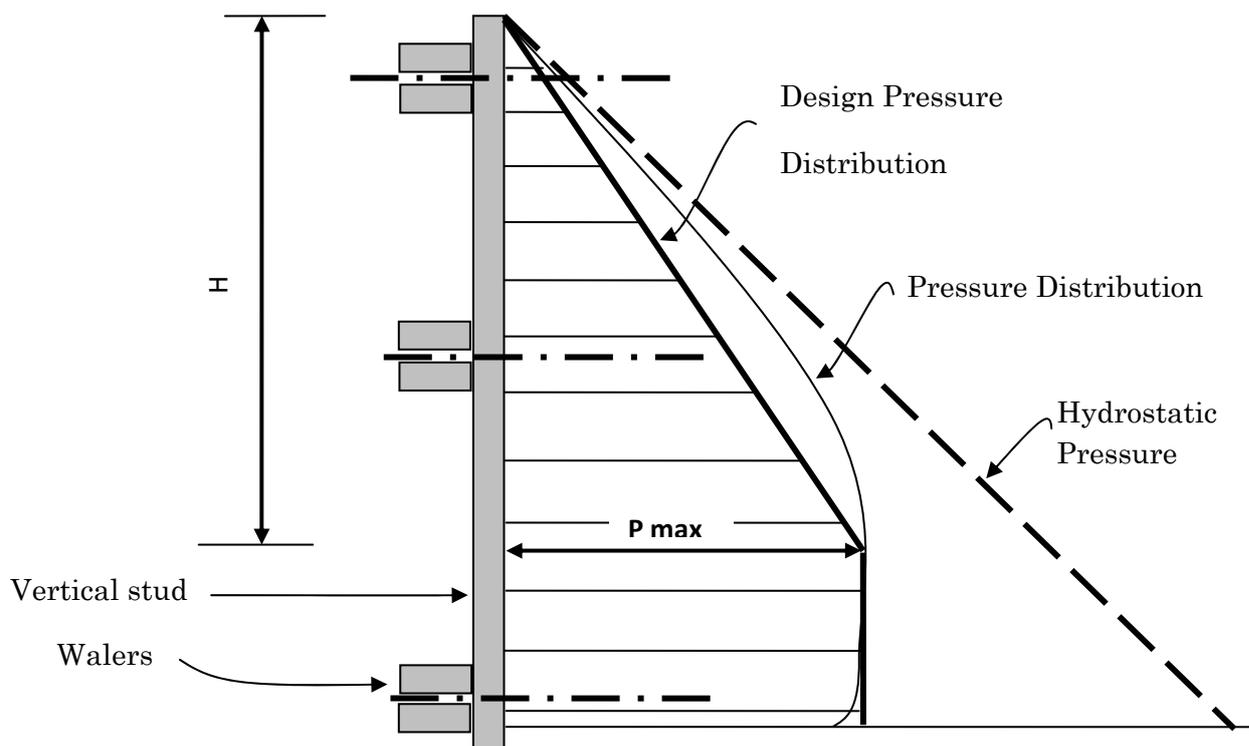
DESIGN REQUIREMENTS

When designing formwork, consider the following:

1. Strength: Forms and shutters have to be designed to support dead weight, live load and hydrostatic pressure. Sheathing must be rigid enough to resist bulging.

Formwork for vertical concrete elements i.e. columns and walls are subject to pressures on the form face. This is caused by the fluid action of the fresh concrete. The pressure of the fluid concrete on the vertical faces increases proportionately with the depth of concrete. The maximum pressure being at the bottom of the form. This maximum pressure for the full depth fluid concrete is the hydrostatic pressure for concrete and usually occurs when the concrete is placed very quickly.

It should not be possible for the bracing to be dislodged by impact, or wind, acting from any direction. Refer to illustration below.



2. Speedy erection and dismantling: The formwork design and the methods of assembly must be as simple as possible to reduce time spent in erection and dismantling. The formwork should be simple to remove without causing damage to the concrete.
3. Tightness of joints: The liquid retaining properties of the formwork must be adequate to prevent leakage of cement and fine aggregate from the concrete.

4. **Rigidity:** Brace formwork and support to ensure no movement may take place under wind pressure, or when the concrete is being placed and vibrated. The shutters must be rigid enough to keep the concrete member within the allowable tolerances.

5. **Reuse:** Design for unit construction, if possible, so that you can strike and reuse as soon as possible. Use clamps, wedges, and similar devices to hold sections of formwork in place. Avoid nailing as much as possible, nail holes and bruising of the timber will spoil formwork for further use. The formwork material must be durable and capable of producing a good surface finish.

6. **Ease of handling:** Forms and shutters must be of a size and weight that can be handled by the labour and plant available on site.

Adjustment: Arrange all props, shores, and struts so that they can be properly adjusted. They must bear on sole plates, so that the load is safely distributed on to the structure below.

Removal of debris: Provide all formwork with special cleanout holes to allow for the removal of sawdust, shavings, and other debris from the bottom of the formwork before the pour begins.

Formwork Tolerances and variations in alignment

Columns	Up to 3m high	6 mm
Piers	3m to 6m	10 mm
Walls	Above 6 m	18 mm
Variations from level	6 mm in 6m	10 mm max.
Variations from plan position	6 m bay	12 mm
	over 6m bay	25mm
	Not to encroach over boundary.	
Variations in size and position of openings, sleeves		6 mm
Variations in cross-sectional size	Up to 600mm	+ 6mm or – 3 mm
	Over 600 mm	± 6 mm
Variations in footings		+ 25mm or – 12mm
	Thickness	0.05 of dimension
Variations in consecutive steps		
	Rise	1.5 mm
	Tread	3 mm

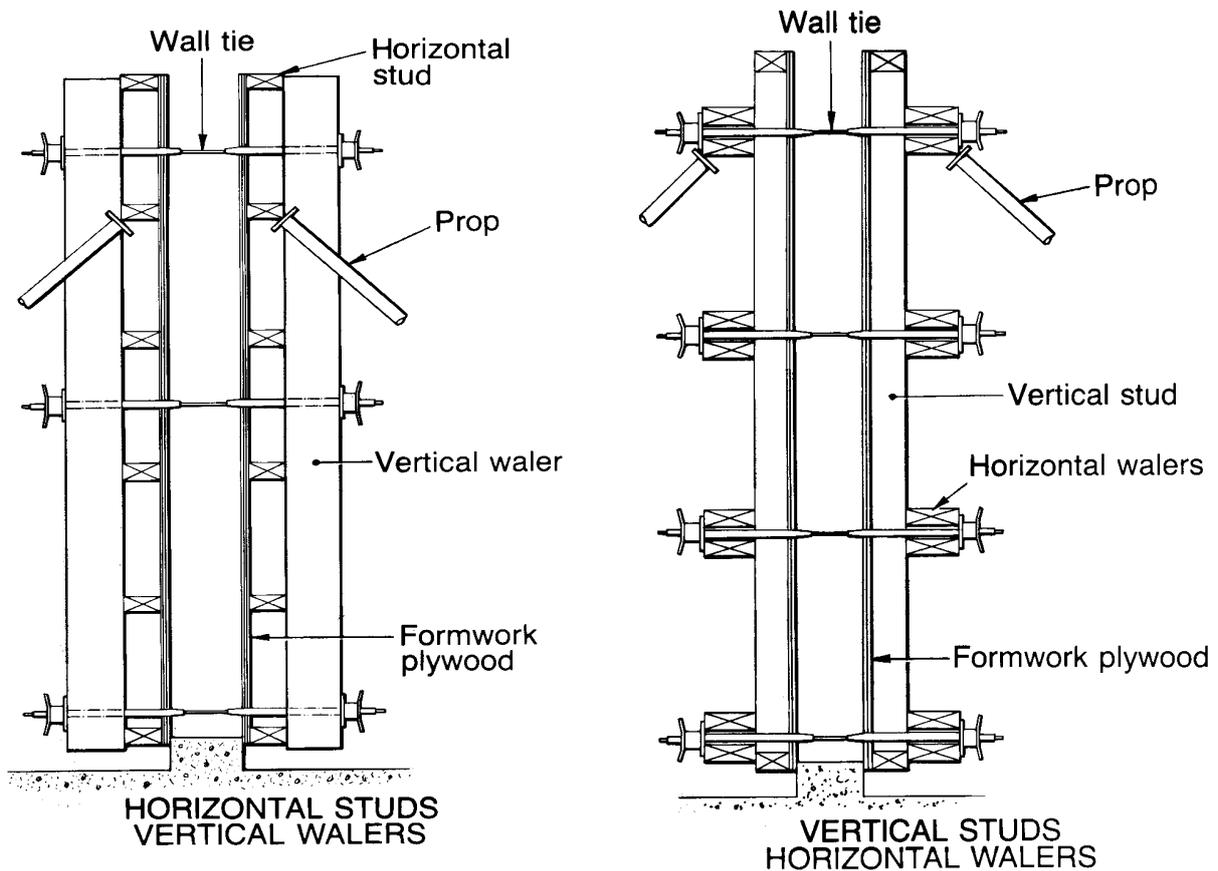
FACTORS RELATING TO FORMWORK

To design and construct satisfactory formwork an appreciation of the types of loads and combinations of loads that act on the formwork is required.

The heaviest load on forms usually occurs when the concrete is being placed. As well as the weight of the concrete itself, (i.e. dead load), allowance for the concreting gang and their gear must be considered, (i.e. live load). Depositing wet concrete in heaps creates uneven pressure on the formwork. It is important to evenly place the concrete in layers, distributing loads equally on the formwork. In walls, wet concrete exerts horizontal bursting pressures on the vertical soffit. The pressure is reduced as the semi-liquid concrete hardens and becomes self supporting. Formwork construction must be able to withstand the loads imposed.

HIGH WALL FORMWORK

There are two types of wall formwork. One type is for walls requiring only one face of formwork, e.g. for basement walls. The other is double faced formwork for free standing walls in a structure.



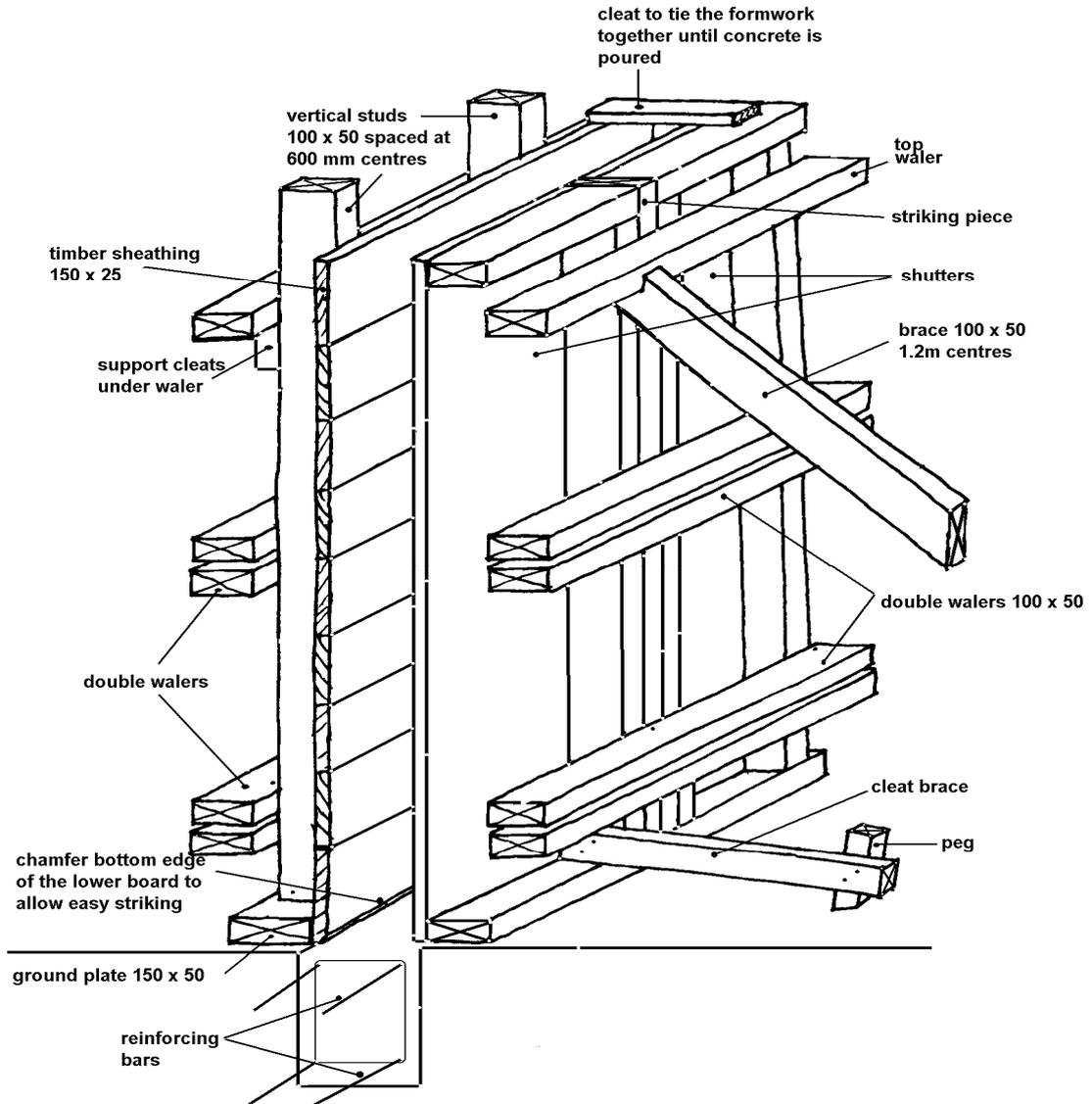
Acknowledgement to the Australian Government Publishing Service for the use of their Wall formwork illustrations.

Timber Framed Formwork.

The wall formwork frame is constructed using either:

Vertical studs and horizontal walers.

Horizontal walers and vertical soldiers with the sheathing (sheeting) fixed at right angles.



The spacing and size of studs and walers is determined by the loads imposed on the formwork. The height of the wall, thickness of the wall, and the thickness of the sheathing used must be able to withstand the loads placed on the formwork.

SHEATHING

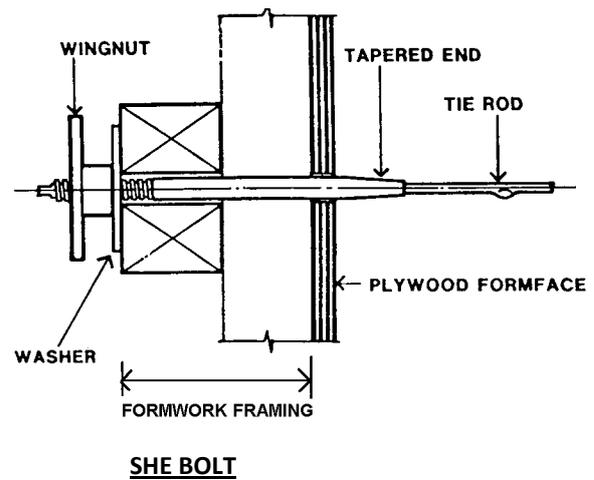
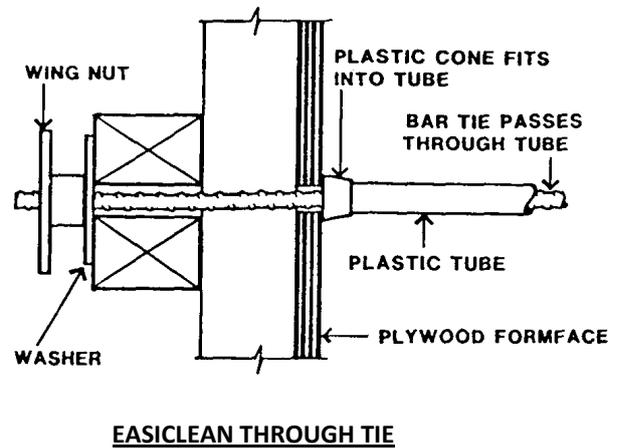
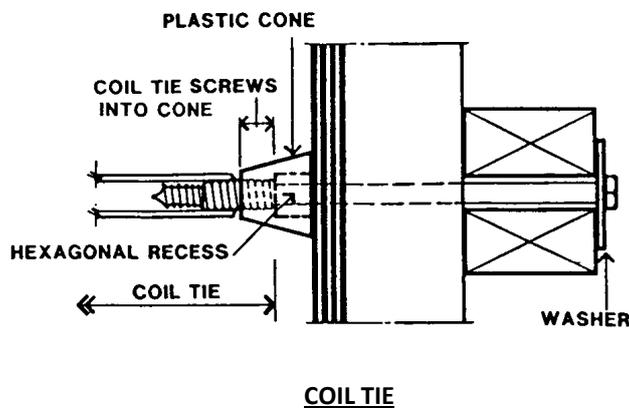
There are various types sheathing available. The appropriate sheathing must be selected to obtain the specified finish required. Options include:

- Sawn or planed timber - edges may be square cut or tongue and grooved, to prevent grout leakage. An alternative is a foam strip inserted between the boards.
- Plywood - exterior grade or “formply” are available in various thickness. The grain on the outer face must be parallel with the span of the wall formwork framing.
- Tempered hardboard - produces a good finish, however, is less resistant to damage and multiple use.
- Plastic linings give a good finish, however, it must have a solid backing.
- Rubber linings are sometimes used for textured finish.
- Glass fibre or other similar moulds maybe used for various architectural features on wall or window panels.

WALL TYING SYSTEMS

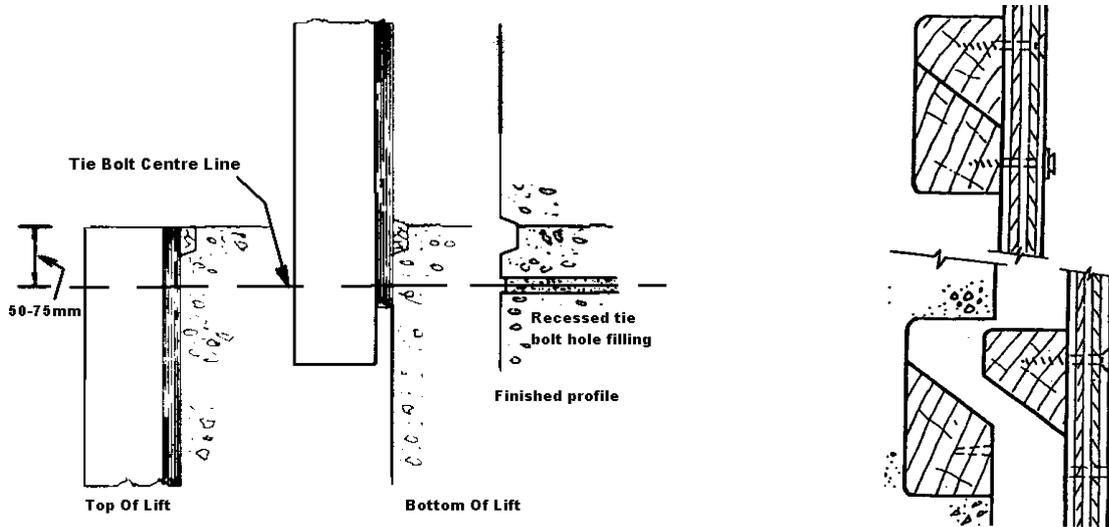
The function of formwork tying systems is to connect the two faces of the double faced forms together and effect the balance of the forces between them. The spacing of the ties and the forces they have to resist, is determined by the wall to be built and the framing system adopted. When considering ties for wall forms, selection is made on the basis of:

- tie capacity,
- grout loss at the tie holes,
- ease of installation,
- final appearance



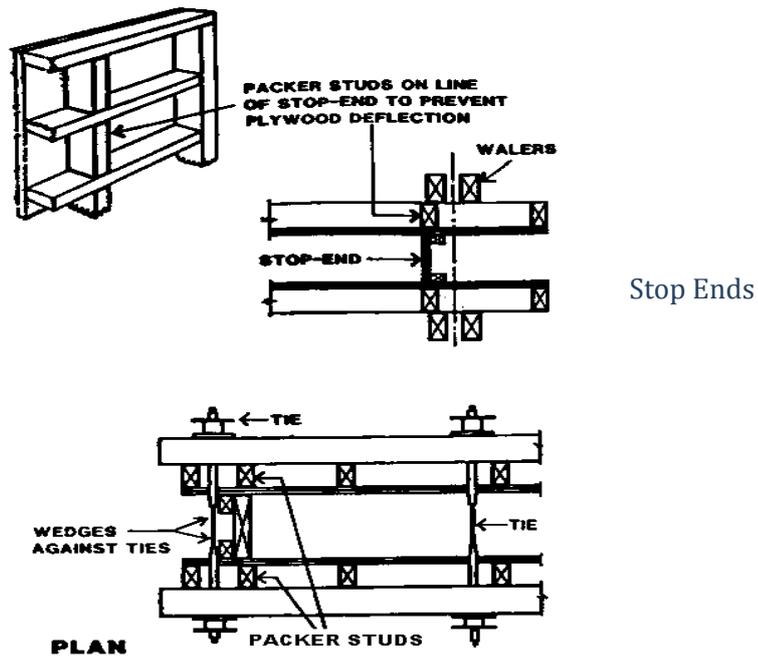
CONSTRUCTION JOINTS

Stop ends and construction joints must always be formed at right angles to the concrete pour. If keyed stop ends are required, use an angled fillet or a split insert for a parallel sided slot. Construction joints at the top of a pour may require a batten fixed to the formwork to finish the concrete in a straight line.



Horizontal Construction Joint

Split insert for parallel sided slot



Stop Ends

At the ends of walls and at the planned positions of construction joints, stop- ends must be constructed. Due to reflection and rebound of the energy of vibration from the face of the stop-end, the concrete pressure acting on it can exceed that generally acting on the form face.

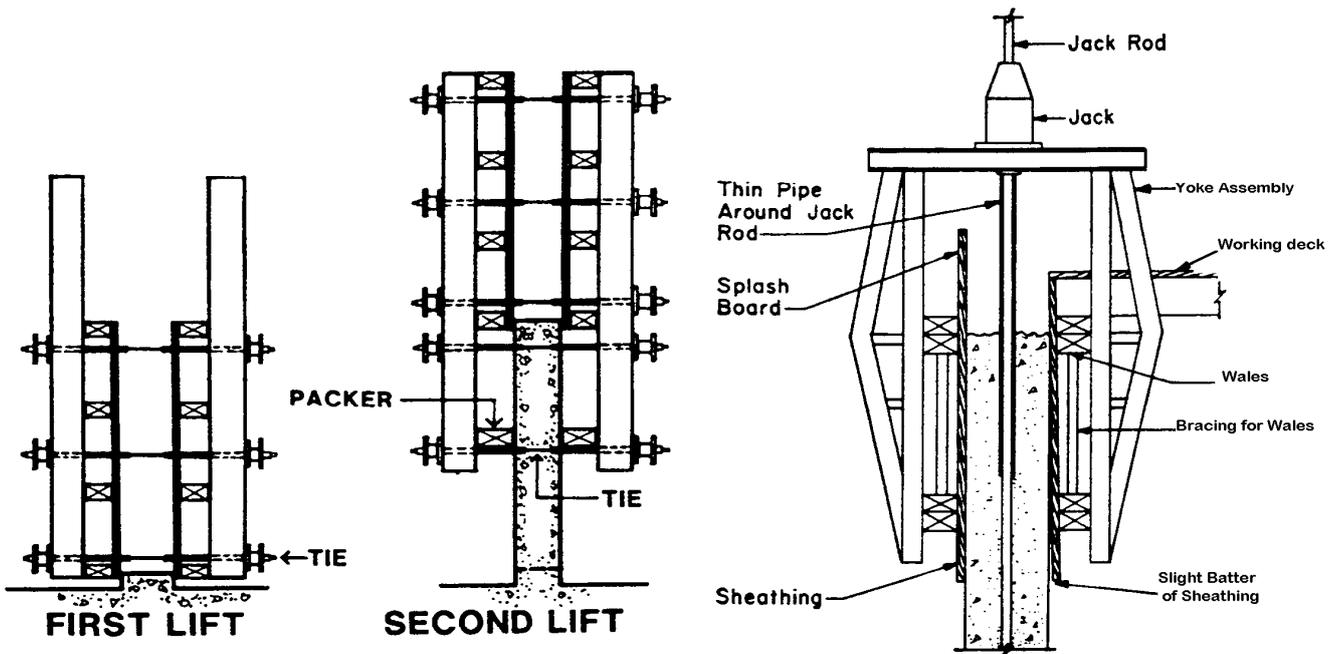
In most cases the studs of the formwork do not coincide with the stop-end and as a result, the plywood deflects under the concrete pressure and grout and water escapes past the stop-end.

A common method of resisting the forces on the stop end is by wedging it off the wall ties.

SLIPFORM

This is a form which is continually being moved upwards, or sideways, as the concrete is being poured. The rate of movement is regulated so that the forms leave the concrete only after it is strong enough to retain its shape and support the weights imposed on it.

Vertical structures such as chimneys (Huntly Power Station) and cooling towers (Ohaaki Thermal Power Station) are often done this way. Kerbing and channelling can also be slipformed. Jacking of the forms can be done by screw, electric, pneumatic, but usually hydraulic.



typical jump form

typical slip form

CLIMBING OR JUMP FORMS

This type of formwork is designed for constant floor height and layout for multi-storey buildings. The formwork is “jumped” up from one floor to the next floor above. The system is raised vertically for consecutive lifts. Anchor points or ties used near the top of the formwork are reused for the bottom of formwork when it is lifted.

Sky tower in Auckland used a 4m high jump form for the construction of the 500mm thick, 12m diameter main tower achieving a pour about every 9 days.

Formwork Striking

The process of removing the formwork. The earliest time this can be done is when the concrete has developed sufficient strength. Reinforced concrete structural elements need to be able to carry themselves and any other superimposed loads over their intended spans. Stripping transfer parts or loads to concrete structure should be gradually transferred. Consideration should be given to:

- Specification requirements, check
- site documents for the concrete
- strength required and stripping times.

The concrete age and minimum

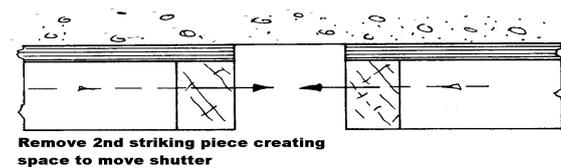
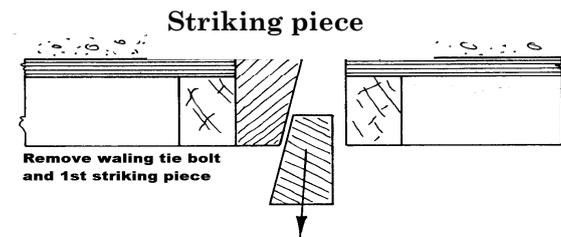
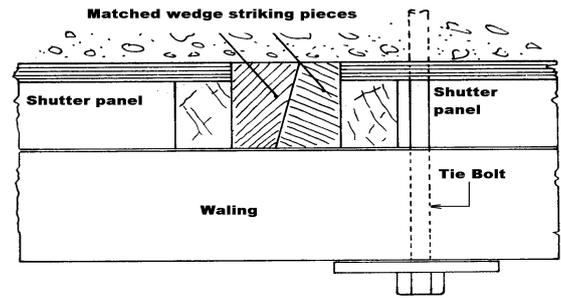
strength at the time of stripping.

The method and sequence of stripping.

Limits on the loads to be placed on the structure.

Remove formwork components with minimum damage.

The condition of the components will determine the reuse and costs.



Standards relating to formwork

NZS 3109:1997

Concrete construction

- provides minimum requirements for the construction of reinforced concrete, unreinforced concrete, prestressed concrete or a combination in elements of any building or civil engineering structure.

Section 5 of the standard covers requirements for:

the design of formwork,

surface finish,

tolerances,

removal of forms and shores,

embedded sleeves, conduits and pipes

construction joints.

NZS 3124:1987

Specification for concrete construction for minor works

- provides minimum requirements for the construction of reinforced and unreinforced concrete in minor works including buildings of light timber frame construction within the scope of NZS 3604. Also concrete masonry construction within the scope of NZS 4229:1999

Concrete masonry buildings not requiring specific engineering design

- The standard however does not provide specific requirements for concrete construction that are subjected to aggressive environments.

ERECTION FOR COLUMNS, BEAMS, SLABS AND STAIRS

Columns

The function of column formwork is to enable the construction of columns that have the specified surface quality and are acceptably accurate in shape and position with good alignment to other adjacent columns, walls and building facades. Columns are often constructed with the column reinforcement extending well above the form. This is done so it can lap with the reinforcement of the next column or floor to be constructed above.

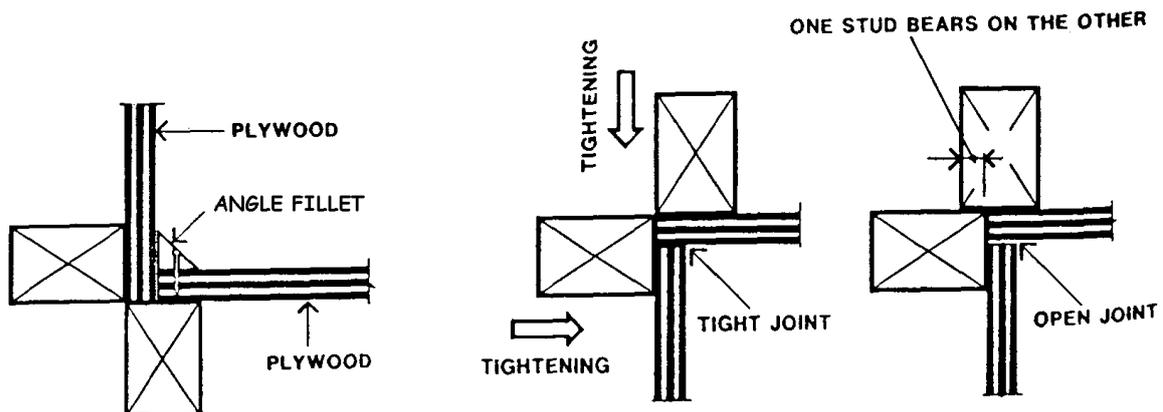
The accuracy requirements for columns vary according to their position in the building. The tolerances, which are the maximum permitted deviations, are normally specified in the project documentation.

Column Formwork Construction

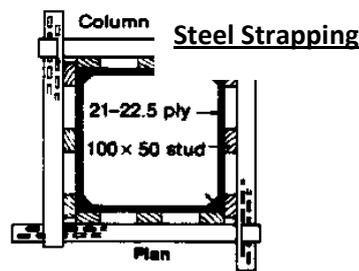
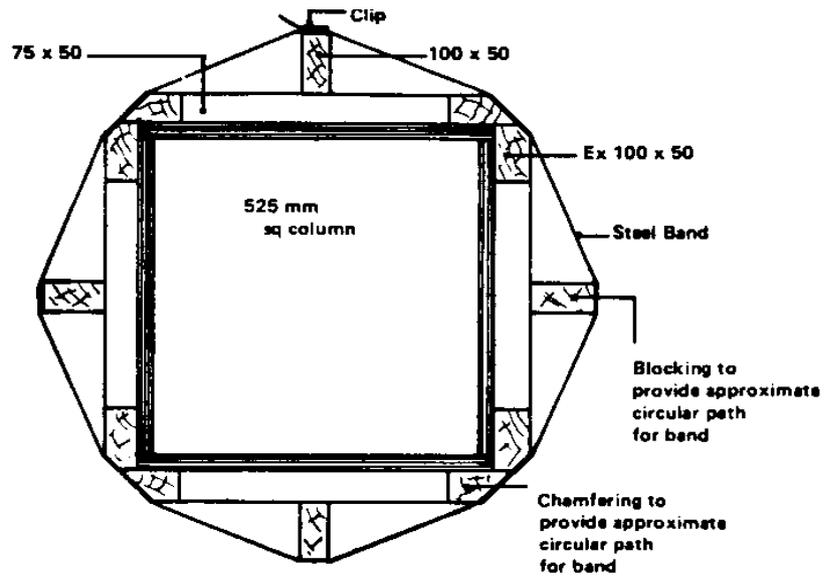
To avoid plywood joints, it is normal practice to cut the sheets length wise in widths to match the column faces.

Most column forming methods use plywood to form faces. The corner junctions of the plywood must be detailed to achieve the maximum tightening action from the column clamps.

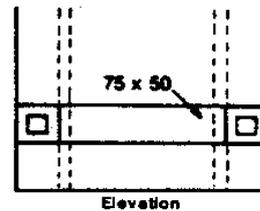
The corners of the form are usually formed to have a 45 degree arris. Timber angle fillets are used to form the arris. Care must be taken to align the fillet inside the column form.



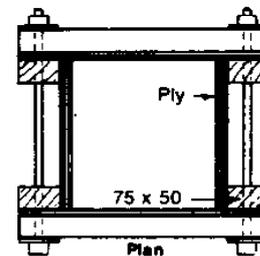
Column forms and joints



Vertical stud column.

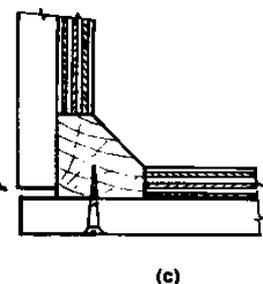
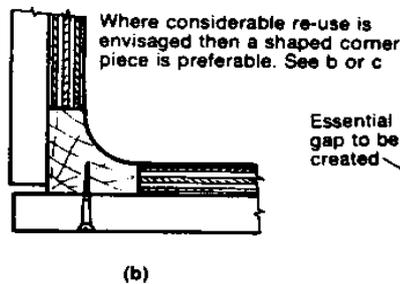
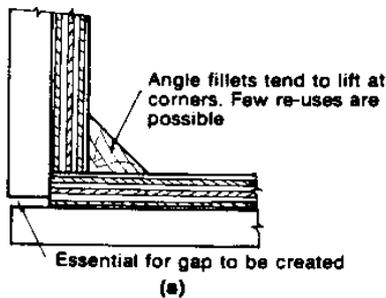


Elevation



Plan

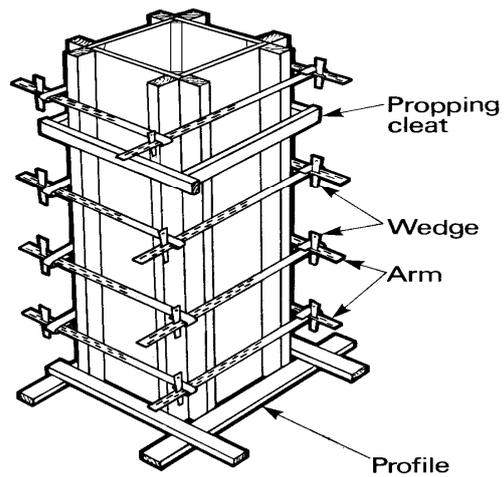
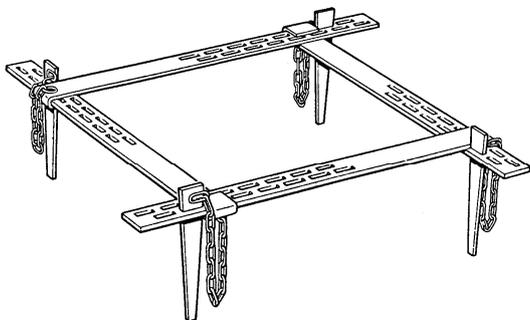
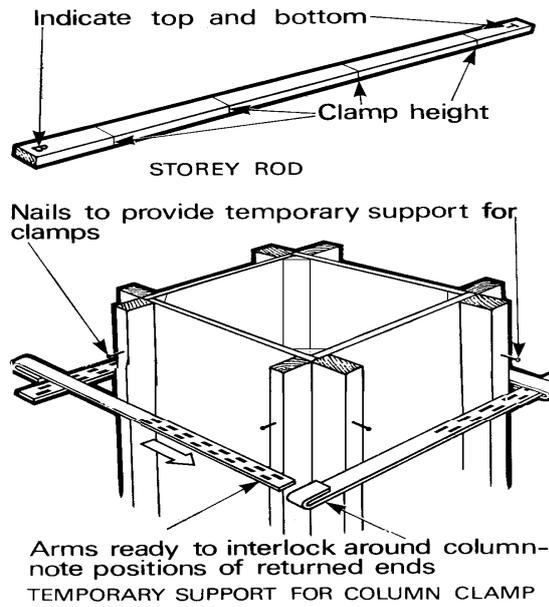
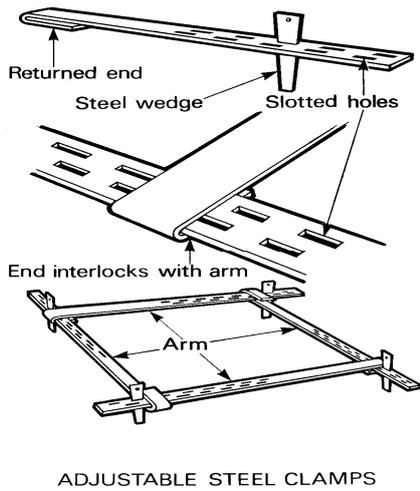
Small column box < 300mm.



Adjustable steel clamps

Bolts through timber yokes

Column forms and joints



Adjustable steel column clamp

Acknowledgement to the Australian Government Publishing Service for the use of their Column illustrations.

CIRCULAR AND OCTAGONAL COLUMNS

Circular column formwork

Fabricated steel, usually two piece, and often with a hinge.

Fibre cement pipes which are left in place as permanent formwork.

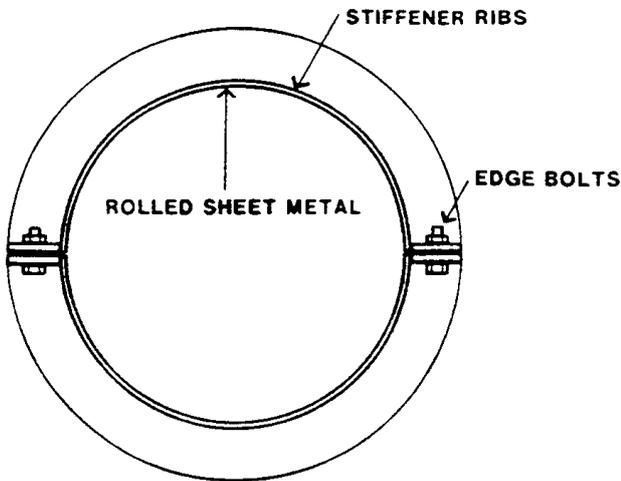
Cardboard tube. "One off" formwork, available in a range of diameters, used with timber strong backs. Cut to waste after concrete is poured.

Plastic tube. Used in a similar way to cardboard.

Octagonal column formwork

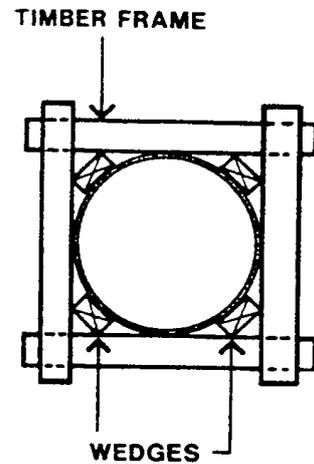
Timber sheathing tied with standard column clamps. Corners need to have infill pieces. Alternatively, metal strap can be used without the need for corner infills.

Timber sheathing with alternating column clamps, for larger columns.

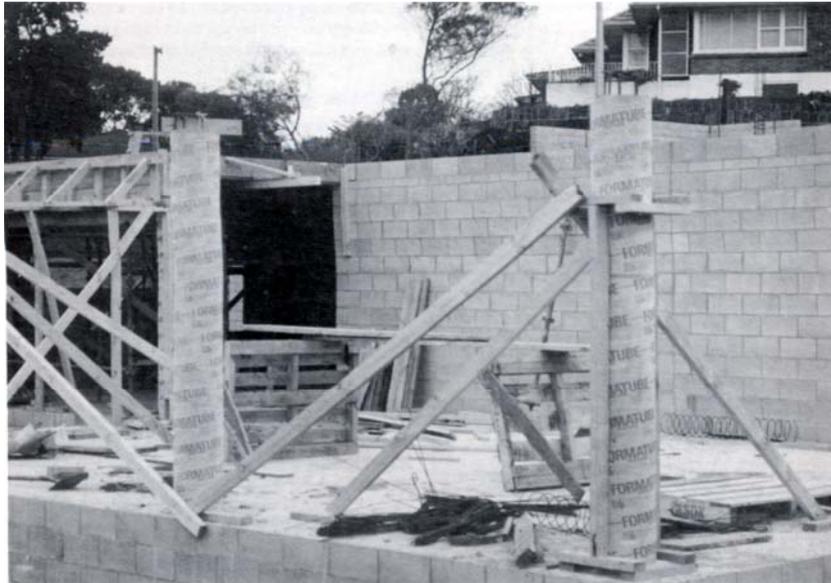


Fabricated steel with bolted joints.

Vertical steel two piece form column



Vertical Timber sheathing column



Erection of formwork for columns

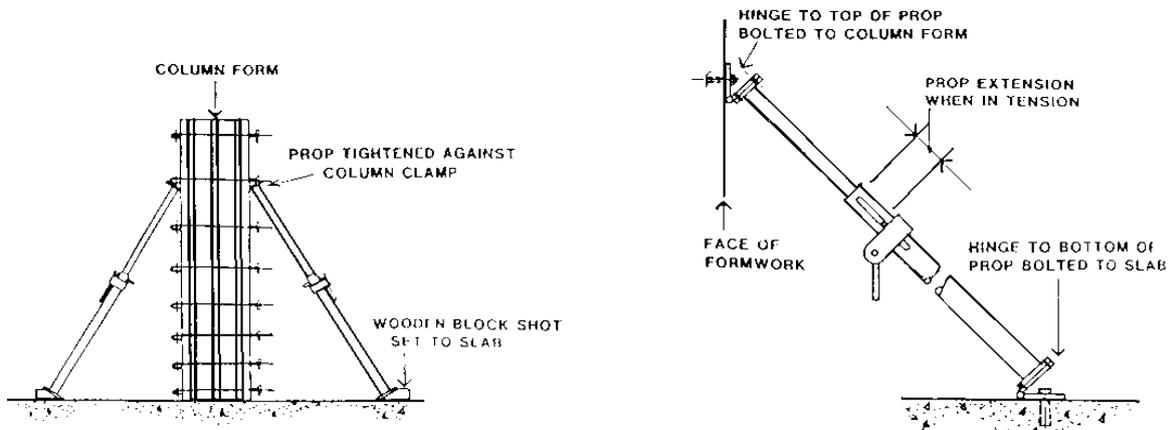
Before erecting column formwork, apply a release agent to all internal surfaces. If specified, fix any required edging, metal corners, arris pieces or casted inserts.

Prior to the erection of formwork for structural members, it is important to check the exact location of grids relating to the structural member being formed. The location, size of column, height, and specified finish should be clarified from site documentation. Often hurdles restrict the positioning of grid locations, therefore offsets may be required. It is the contractor's responsibility prior to the erection to check site documentation for the exact position of the structural member you are working on.

- Erection sequence for a column
- Prior to positioning column formwork check that steel for the column has been inspected and cleared for casting.
- Position formwork for the column from predetermined grids.
- Plumb formwork both ways and securely support using adjustable steel props.
- The propping angle should be 45° to the floor.
- Ensure the steel props are safely secured to the column formwork and the floor, and that adjustment for pushing and pulling is operational.
- Set out the positions of column clamps from a storey rod.
- Transfer the column clamp positions from the storey rod onto column formwork.
- Use nails to support the arms of column clamps while wedging.
- Position and wedge the bottom, middle and top clamps sets.
- Check the formwork at the top for square.
- Position and wedge the remainder of the column clamps.
- Using a plumb bob suspended from a gauge block plumb the column.
- When all the column formwork is securely propped a final check must be made for plumb and column alignment before and immediately after the concrete has been poured and vibrated.

Column formwork construction stages

- Column formwork bracing
- Column formwork bracing performs two functions:
 - It must maintain the accuracy of the column form position and plumb so that it is within tolerance.
 - With stand results of forces acting on either the column formwork or the bracing. The forces may be wind or impact. These impact forces can occur from the collision of concrete buckets or cranes hoisting materials.

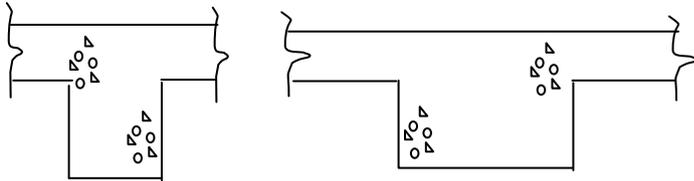


Braced column

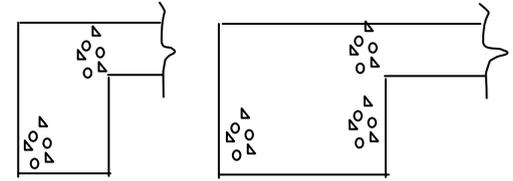
BEAM AND SUSPENDED SLAB FORMWORK

In a typical reinforced concrete building frame, the slabs are the primary load carrying element. They transfer their load to secondary elements such as walls or beams.

Beams can be grouped in two categories. When located in the interior of the structure they are usually TEE Beams and when on the perimeter are L Beams.



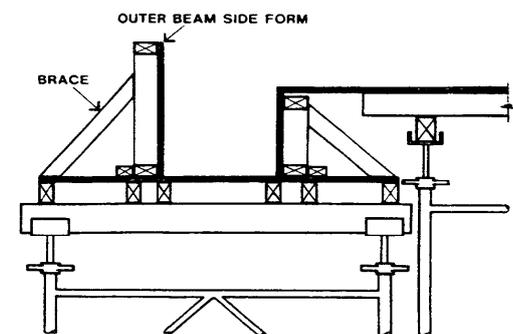
TEE BEAMS



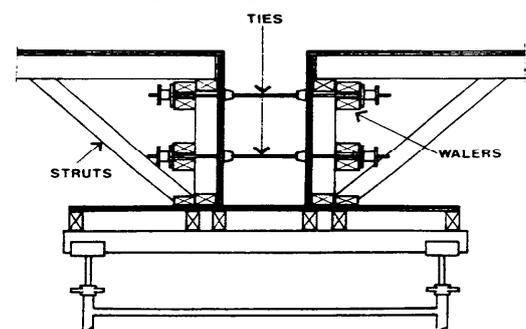
"L" BEAMS

Design and construction of beam formwork

- Beam soffit must be thickened timber or strengthened plyw
- Beam sides 18mm plywood or 25mm boards, with studs (cle 500 to 600mm centres).
- Deep beams (over 600mm) should have walers and ties.
- Props or falsework must be placed under the headtree, or under the bearers, and must be spaced to suit the weight of concrete.
- Use angle fillets in the beam side to soffit joint where possible.
- Allowance must be made for height adjustment of the props or falsework.
- Erection sequence for constructing beam formwork includes:
 - Position of sole plates;
 - Marking out and setting heights for falseworks;
 - Assemble and position props, adjustable head jacks, falseworks, bearers and Spreaders;
 - Construct and erect side walls and beam soffit.
 - Position of sole plates



Typical edge beam formwork



Deep beams with two rows of ties

The purpose of a sole plate is to transfer vertical load from one vertical support member to the foundation. The vertical support requires a base plate fitted to help distribute the load to the sole plate, which is usually a sleeper. If the sole plate is positioned on natural ground, it is important the ground is graded and consolidated to a level surface.

The objective is to achieve maximum bearing beneath the sole plate.

Once sole plates are positioned and firmly bedded they should be checked for level.

Marking out and setting heights for falseworks

- Mark out the position of props and other false work supports on the top of the sole plates.
- Measure the height from the sole plate to the top of the column and mark the height onto a storey rod.
- Deduct the thickness of beam soffit depth of joist and the depth of bearer from the overall height. This provides the height to set steel props and other false work support systems.
- Adjust the false work systems to lengths determined from the story rod.
- Assemble and position props, adjustable head jacks, falseworks, bearers and spreaders
- This task normally involves working in pairs. It is important to bear in mind the safety required to assemble props and temporary support systems. Often continuous or mobile scaffolding are used to help erect the falsework system.
- Lay out lengths of bearers on each side of the columns. Joints should be staggered.
- Position the scaffold at each end of the bearer.
- Carefully position bearers into the centre of prop or falsework 'U' head. Use centralising packers nailed to "U" head.
- Repeat this procedure on the other side.
- Plumb supports both ways and nail spreaders at each end hard against the column face. This is to prevent movement.
- Secure props and false work at "U" head and sole plate.
- Place spreaders in position at required spacing.
- Position, plumb and fix intermediate props.

Construct and erect side walls and beam soffit

- From working drawings the joist length can be determined by developing a full size or scaled set-out drawing of a cross section of the beam being constructed. Allow for formwork and bracing required in the development.
- Mark out a pattern joist from your set-out drawing.
- Mark out the required number of joists from the pattern. Beam joists should then be fixed in position across the bearers.
- Fix the soffit. The width of the soffit can be determined from your full size set-out.
- Use a string line to accurately position the panels used to form the soffit between columns. Support the edge of the soffit panels by placing an extra joist under the end edge of panels.
- Obtain stud heights for walls from full size set-out.
- Construct the timber frame wall panels in sections.
- Erect the wall frames to each edge of the soffit lining adjust each panel for plumb and line using braces.
- Fix walers, kickers cleats and bracing plate.
- Fix tie bolts as specified.

SUSPENDED SLABS

Suspended floor slabs can be constructed using cast in- situ, precast units or a combination of both. Whichever method is used, it is important to support the proposed method of construction using a combination of timber or steel bearers and adjustable shoring. The spacing and type of support system required is determined by the load imposed during the construction process. Manufacturers provide tables to assist in the selection and spacing of adjustable shoring systems.

The erection sequence for constructing a suspended floor slab includes:

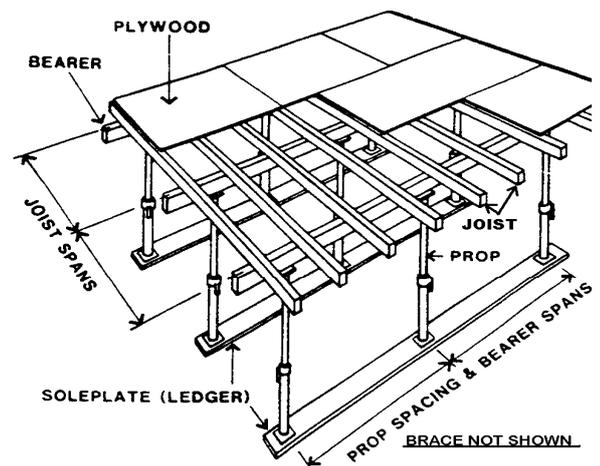
- Determining the bearer spacing;
- Erecting bearers and joists;
- Fixing the sheeting;
- Preparation for concrete.

Design and construction of slab formwork

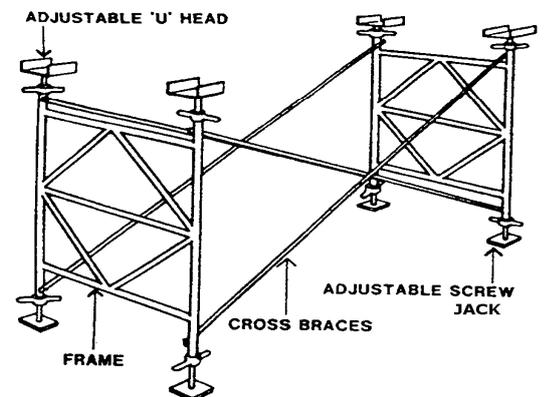
As a number of collapses have occurred when pouring suspended slabs, careful attention must be given to the overall support system. Unless using a proprietary or well proven system, engineer design is required. Decking will probably be plywood sheets or shutters, but boards and joists could be used. Thick sheets of fibre cement are also suitable. Props and other falsework must be perfectly plumb at the time of pouring the concrete.

All props and falsework must be tied together and braced.

Proprietary bearers in timber or steel are often used as their bearing capacity is easily determined. Consideration must be given to the order of striking, and the installation of permanent or back propping.



Standard slab formwork



Typical falsework for slab formwork

Determining The Bearer Spacing

To calculate the bearer spacing measure the span between the supporting walls. Divide the span by the recommended bearer spacing. This will determine the number of spaces between bearers. Divide the span by the number of calculated spaces. This will establish the centre to centre spacing of bearers.

Erecting Bearers And Joists

Bearers

Positioning bearers for a suspended slab are the same as for a beam however: it is important that sole plates are firmly bedded on either compacted ground or level concrete. Bearer supports must be adequately braced. Extra bearers may be required to support joists and sheeting either side of major penetrations.

Check the following:

- bearers are positioned and set in line and adjusted to the correct level.
- sole plates are bedded firmly and positioned central to the bearer.
- all bearer supports are plumb.
- bearer joins are supported.
- bearers are seated centrally in “U” heads.
- supports spaced as specified and are firmly fixed at the head and bearing plate.
- all supports are horizontally and diagonally braced.

Joists

The position of joists is determined by the sheet length and the centre-to-centre spacing of the intermediate joists. Check with the specifications of the sheeting material being used. Determine the perimeter support required, laying pattern and whether the face grain is to run parallel or at 90 degrees to the joists. This will effect the joist arrangement.

Mark out the joist spacing on the side walls clearly identifying the joists at the end of each sheet.

Sheeting edges must fall on the centre of a joist.

Cut required number of joists to length.

Position the joists centrally over the set-out lines.

Fixing The Sheeting

- If using formply for sheeting, it is important to avoid damaging the edges of sheets.
- By sealing the edges of sheets you will prevent swelling.
- Position the first row of sheeting straight and square, this will make fitting the remainder simpler.
- Fix intermediate sheeting.
- Nail off sheets, seal and install any bevelled trim required to external and internal corners.
- Some specifications require surface tape to be applied over butt joints.
- Check that joints are sealed, level and tight.
- Intersections at edge beam formwork are planed flat.
- Sheeting is fixed as specified.

- Joints are watertight.
- Any panels cut to accommodate penetrations or openings are the correct shape and dimension and in the required position.
- All joints of sheets are fully supported.

Preparation For Concrete

Tasks to be completed before the concrete is cast include:

- Clearing the decking of all debris;
- Marking out for reinforcing;
- Apply a release agent to sheeting;
- Check site documentation and with subcontractors to accommodate sleeves, penetrations and conduit for services;
- Fix reinforcing steel in accordance with structural details;
- Final clean and inspection required.

PROPRIETARY FORMWORK

Proprietary formwork Systems are supplied by companies such as Boral Acrow, and Rapid Metal Developments in NZ, and for specific projects are often supplied by overseas companies.

Boral Acrow supplies:

“ U Form (Universal): for walls, columns, beams, and slabs with various accessories for scaffolding support. Shutters are joined with snap ties.

"Flexible form": for curved structures, and can be combined with "U form".

For some projects, special formwork is designed and constructed, often working in conjunction with an overseas company.

TEMPORARY PROPPING (SHORING)

As early striking of beam and slab soffit formwork is desirable for early re use, some form of temporary support is generally needed.

Although of a temporary nature, it is often called permanent propping, with temporary propping being used while concrete is poured.

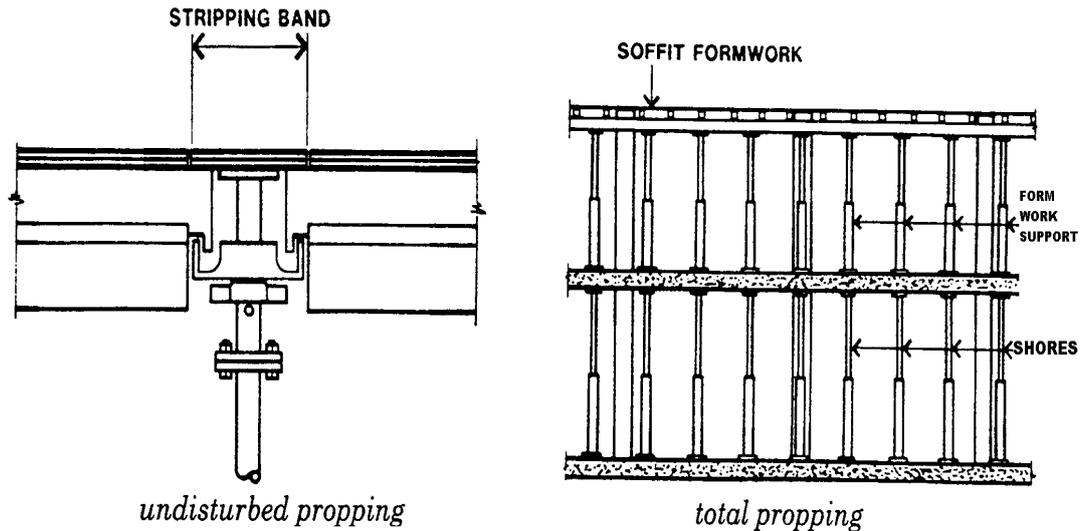
Typical permanent shoring or propping

Undisturbed: Forms are struck without disturbing the props that are to be left in place. Proprietary systems allow this.

Secondary: Props are placed in designed locations before disturbing any of the existing props.

Partial: The soffit formwork is struck shutter by shutter and new props are placed progressively.

Total: The complete soffit is struck and re propped before any construction work commences above.



FALSEWORK

Falsework is temporary structure or framework used in construction to support materials, equipment, or formwork. (See OSH Safety in Construction Guide No 7)

Most falsework is vertical, supporting beams and slabs. Falsework must be engineer designed.

As well as supporting the weight, allowance must be made for sideway pressures such as wind, stacks of materials causing eccentric loading, props out of plumb, formwork being

struck by machinery or crane loads.

Falsework can be:

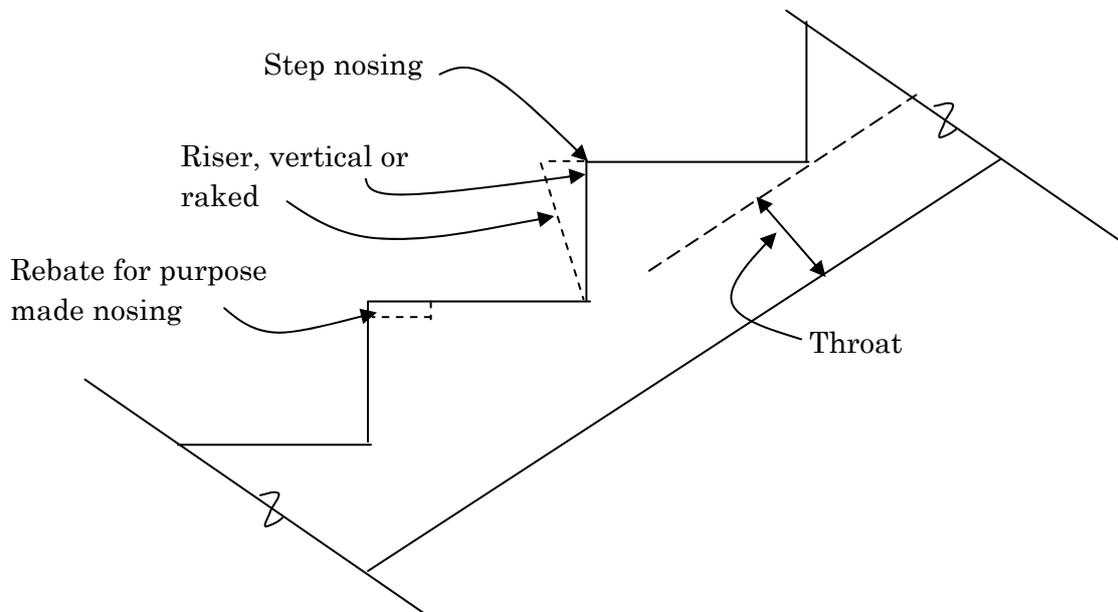
- timber;
- scaffold tube with adjustable screw jacks, top or bottom, or both;
- proprietary prop such as Acrow prop;
- proprietary braced frame such as Acrow shore;
- proprietary floor centre (a telescopic beam);
- proprietary beam clamps such as Acrow beam clamp which combines formwork and falsework.

Setting up falsework:

- Base must be level and firm. A sole plate is preferable;
- Props and frames must be placed as per design;
- Place props centrally under members;
- Brace falsework in two directions;
- Floor centres must have full bearing for the end tongues;
- Beams must be centred over props to prevent eccentric (out of line) loading.

STAIR FORMWORK

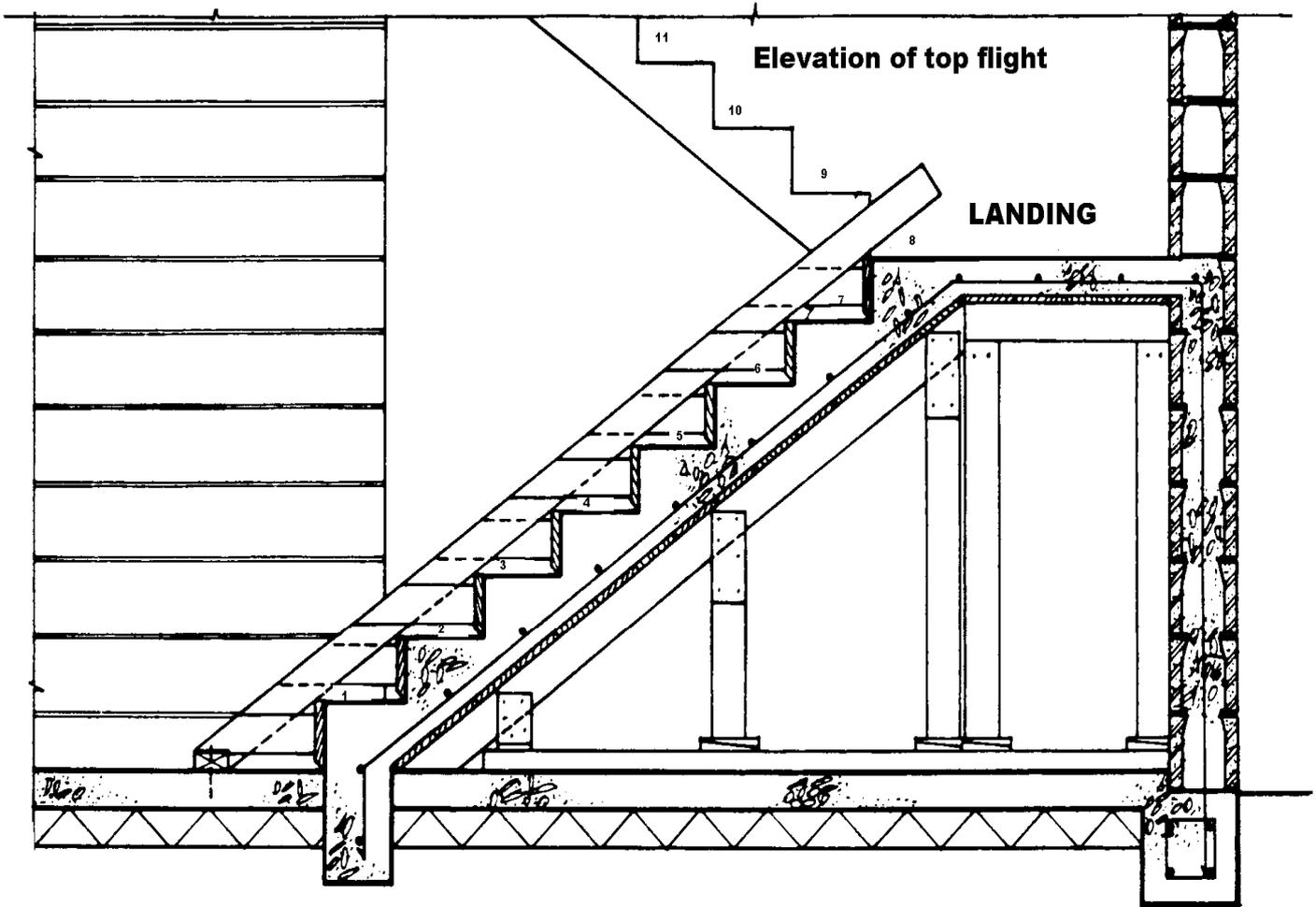
- Points to consider when designing stair form work
- Stair formwork must support the weight of concrete. The weight of the throat of the stair and the steps will have to be supported.
- Because of the slope of the stair, some of the force is transmitted sideways. All formwork must be well tied together to prevent sideways movement.
- Consider the finish of the stair treads and type of nosing. Space may have to be left for purpose made nosing.



The design of the stair must conform to the stair design regulations e.g. residential or commercial. Refer to the Building Code D1 for stair design and regulations.

Stair Formwork construction

- Sheathing can be dressed boards laid across or longitudinally or use sheet material such as plywood or particle board.
- Dressed boards may have sheet material fixed on top to prevent loss of grout.
- Joists and bearers must be spaced to avoid undue sagging of any part of the structure. Select timber carefully to avoid weaknesses caused by knots or cross grain.
- Vertical struts must have a means of height adjustment and be very securely fixed to the bearers to prevent sideways movement.
- Place and fix riser boards accurately. For safety all steps must be the same size.
- Ensure that all reinforcing steel is placed exactly as shown on the drawings. Misplacing the steel, particularly in depth, can alter the strength of the finished stair. Ensure adequate cover on exterior stairs.
- Place inserts for balusters and nosing pieces as required.

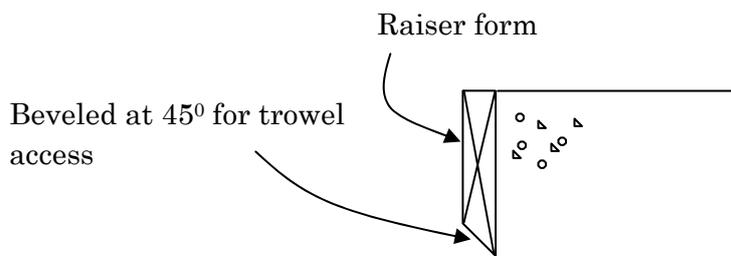


CROSS SECTION OF STAIR FORM WORK

TREADS, NOSINGS, BALUSTRADING.

Treads

It is very difficult to put a high quality finish on the surface of insitu poured steps because of the difficulty in getting under and around the riser boards and strongbacks. It is generally better to allow for later plastering or covering of the steps with tiles etc.



Nosings

Concrete nosings are very prone to chipping. It is common practice to reinforce the corner with a purpose made nosing such as:

Vinyl, aluminium, ceramic, etc. Nosings also help to make the steps non slip.

Balustrading

Provision must be made for fixing balustrading unless it is to be fixed at the surface using masonry bolts. Balustrading can be made from galvanised wrought iron, galvanised pipe, aluminium, stainless steel, etc., most of which is site measured after steps have been poured.

Balustrading acts as a guard railing. It must be strong enough to resist a person falling against it and be least 900mm to 1m high.

Precast stairways

In many buildings and in particular in multi-storey buildings, there are often a greater number of identical stair flights. In these cases the advantages of precasting the stairs merit consideration.

STRIKING, MAINTENANCE, STORAGE OF FORMWORK

Striking

As column and beam side formwork will be removed before beam and slab soffit formwork, provision must be made for easy removal and in the correct order.

If beam and slab soffit formwork is to be removed before the concrete has achieved working strength, permanent propping or shoring is required.

Take care to avoid damage to formwork which is to be re used. Eight or more uses may be obtained from timber formwork.

Maintenance

Clean forms with stiff brush and clean cold water.

Use scrapers only as a last resort.

Keep forms well oiled to prevent delamination of plywood or rusting of steel and always oil the edges.

Storage of forms

Any formwork with steel components should be stored in the dry.

Avoid direct sunlight on timber forms.

Store clear of the ground without twist or bend, and keep free of dirt.