



GROUNDWORK
ENGINEERED SYSTEMS

The Corriform Permanent Shuttering System

Technical Index

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Groundwork Engineered Systems has grown over a number of years to become a leading innovator of concrete foundation formwork systems.

Originally formed in 1997, as Corriform Ltd by current Director Bill Winter, to supply the construction industry with an original and unique method of forming reinforced concrete building foundations. Over time we have added various other on site problem solving products. These have been taken up by Groundworks and Construction companies.

Groundwork Engineered Systems have supplied corriform products on many prestigious projects both in the UK and abroad.

The following are a few examples of historic UK projects using the Corriform Permanent Shuttering System:

- Loch Lomond Golf Club, Scotland
- Fulham Football Club, London
- The Westfield Shopping Development, Bradford, Yorkshire
- The Shard, London
- Hull Kingston Rovers R.L.F.C, Hull

About Corriform

Cost Benefit Comparisons

- Does not require skilled labour to install.
- There is no waste, as with timber, block work and other traditional methods.
- Corriform can be fabricated to form most foundation element shapes.
- Corriform is light and easy to transport.
- Corriform is cheaper, easier to install, and offers built in protection against sub soil gasses, soil contamination and high water table.
- Corriform is easily stored on and off-site taking up less space than other formwork systems.
- Corriform completely out performs it's competitors at every turn.



About Corriform

Traditional Shuttering Methods Analysis

Reinforced Concrete Foundation Forming using: Re-usable Timber Shuttering Method

Using timber to form concrete foundations requires forward planning, due to the many differing dimensions of foundation design. If the shutter panels are to be re-usable they must be of robust construction so the initial labour and material cost can be expensive. Timber can be re-used a number of times but must be treated with sufficient care to enable good surface finish to the concrete.

Therefore: COST

1. The excavated trench has to be much wider, than when using Corriform due to the fact it gets more foot traffic building and dismantling the shuttering.

Therefore: COST

2. Concrete blinding will be required to form a base mat.

Therefore: COST

Foundation shuttering manufactured on-site = A cost of approximately: £32 / M²

Note: Although good re-use is possible, further and continuing costs are attached as follows:

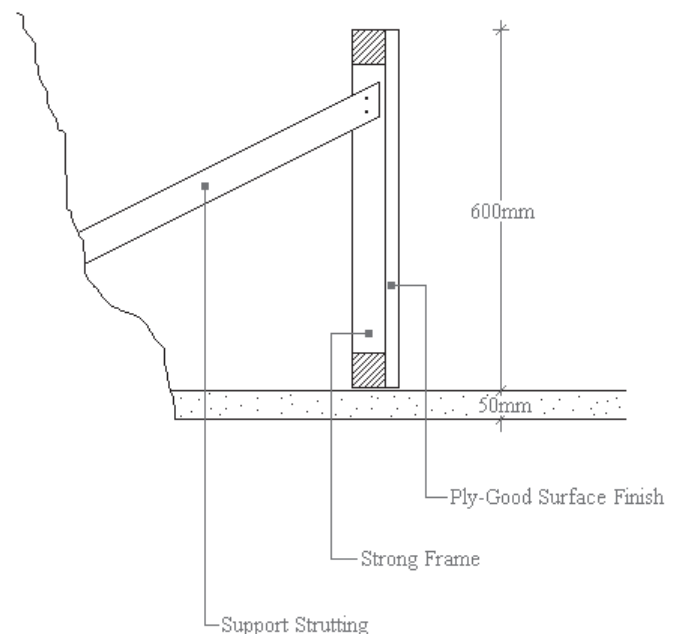
- Erecting the shutter
- Dismantling the shutter
- Cleaning and repairing the shutter
- Transporting and storing the shutter

Therefore: COST

Timber Method = £32 x 1.2 (2 sides @ 600mm high) = £38.40 + £5 Blinding = £43.40 per linear metre.

Note: The above processes are repeated throughout the project.

Traditional Timber Cost: £43.40 per linear metre

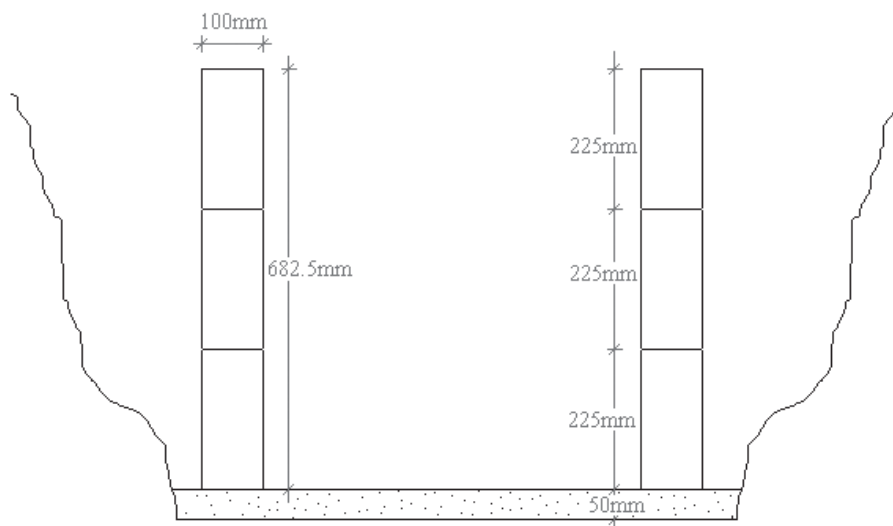


About Corriform

Traditional Permanent Block Work Shuttering Analysis

Reinforced Concrete Foundation Formed using:
Permanent Block Work Shuttering

1. Building block form work, is sacrificial, using common block sizes of 450mm x 225mm to form a 600mm x 600mm ground beam @ a rate of £27/M2 would cost: £36.45.



Base of Trench concrete Blinding:

2. Example

Mike Boobyer Ltd of Taunton laid 77 linear metres of concrete to a trench base 1000mm wide to an approximate thickness of 50mm @ a material cost of £350 which equates to £4.54/M2. If we add 10% to this cost i.e. labour materials = £5.00 M2. The total installation cost of blinding and block work to form one linear metre would be £41.45.

Note: Remember that this is a sacrificial method and cannot be used again.

**Traditional Block Work Cost:
£41.45 per linear metre**

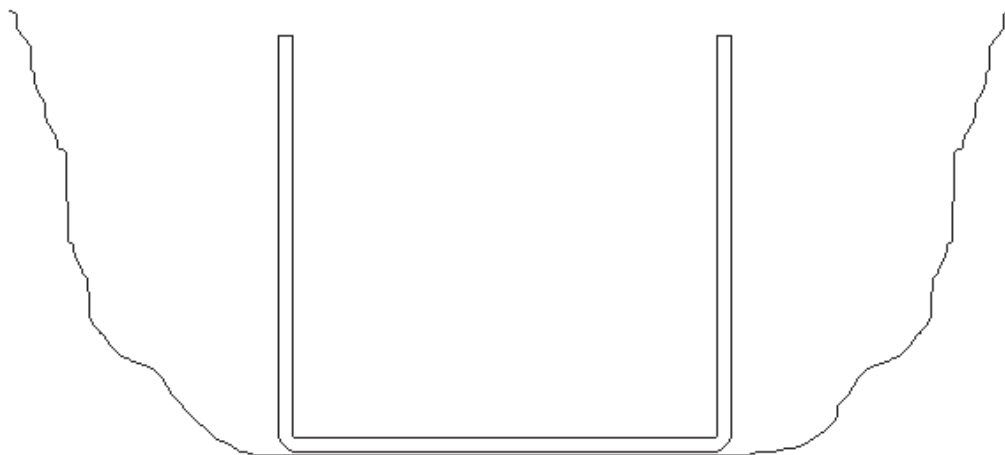


About Corriform

The Corriform Permanent System Cost

Two men of Mike Boobyer Ltd laid 77 linear metres of Corriform U-shape shuttering @ 600mm high x 600mm wide in 4 hours. This equates to a square metre figure of 34.65M2 per hour.

With a labour rate of £20.00 per hour labour cost would total £1.155 per M2. Add the material cost of Corriform of £7.00 per M2, this would show a comparison cost of Corriform System Cost: £13.75 per linear metre.



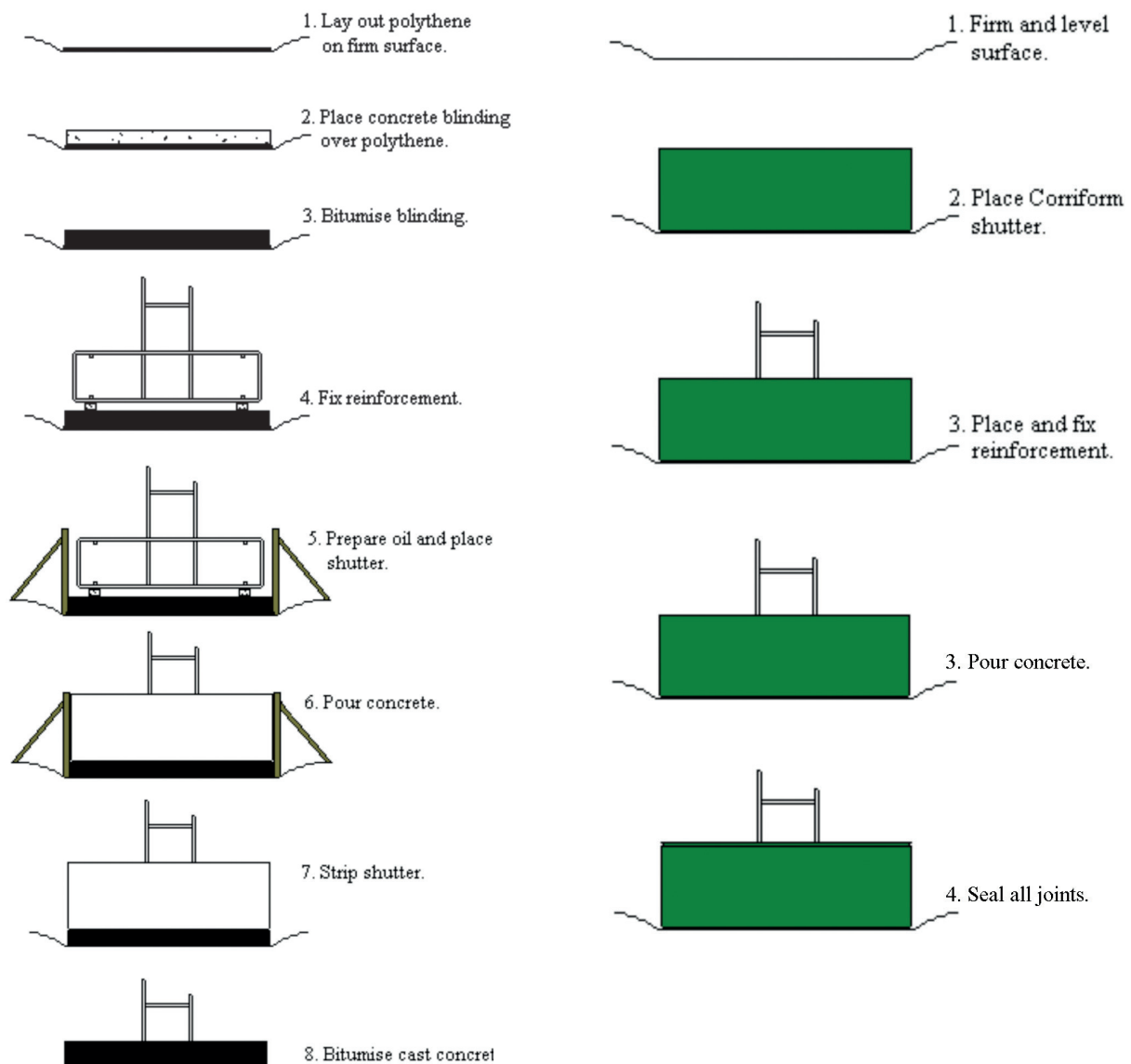
Note: The fact that base blinding is always a cost factor, but by using the Corriform System can eliminate this procedure and show a definite material cost saving e.g. 500mm high x 500mm deep section concrete beam of up to 28%.

**The Corriform System Cost:
£13.75 per linear metre**

About Corriform

Comparing Typical Foundation Construction - M.E.

The following example shows a traditional method of constructing a foundations in a middle eastern country, the soil being extremely aggressive, therefore concreting methods are strictly controlled using steel or wooden shutters to form the foundations. As this comparison proves using CORRIFORM gives proven savings in the production cycle along with the required element of protection. (see 'The Protective Element Of Polypropylene' page 43-44)





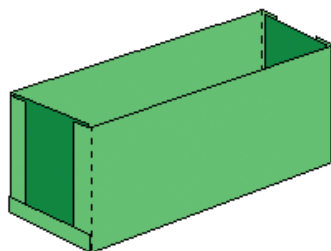
About Corriform Merits and Benefits of our Services

- We read your construction drawings.
- To quantify your on-site requirements.
- We Design and fabricate each foundation shape.
- We deliver it to site.
- Installation guidance.
- All spacers and fixing accessories.

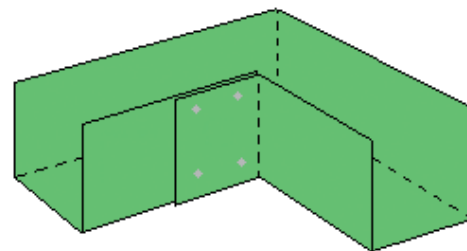
**Typical on-site installation
guidance is available.**



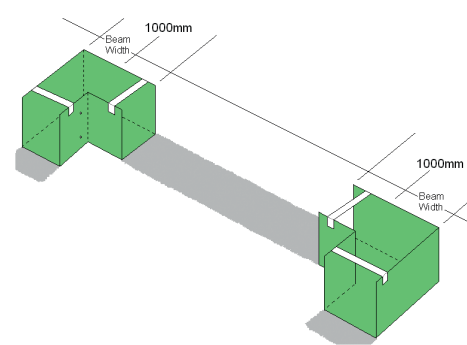
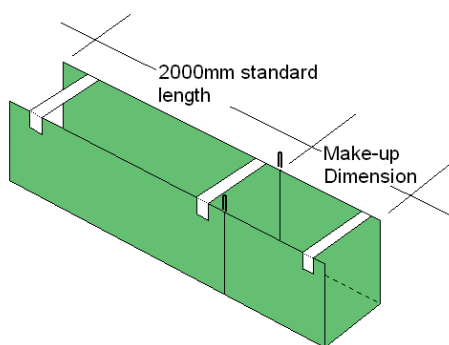
Tying Detail



2 Pile Cap fully encapsulated.



Completed Corner Unit



Corriform standard 2000mm lengths are complimented by the correct length The Corriform System is complete in every way. Corriform make-up piece can be cut along the flutes on-site.

Set out corner unit as diagram above.

Delivered in time | Palletised | Referenced and ready to use.

Anti-Con Project Examples Proofed against Water, Mineral & Gas Attack



BRADFORD PARADE CITY CENTRE
Retail shopping and office developments
waterproofed due to high watertable.



ABU DHABI HOUSING PROJECT
Pile caps and ground beams installation
Proofed to resist sulphate attack.



**ROB ROYSTON, SCOTLAND 5 STOREY
OFFICE DEVELOPMENT**
Attaching gas membrane starter strip
to ground beam.

The Corriflex System

- Is tailor made for each project.
- Send us your drawings - we will design a solution.
- Corriflex is the answer to forming your foundations.

The Corriflex System can be

- Gas proofed
- Contamination proofed.
- Waterproofed against high water table.



About The Corriform

Quantification, Design & Fabrication

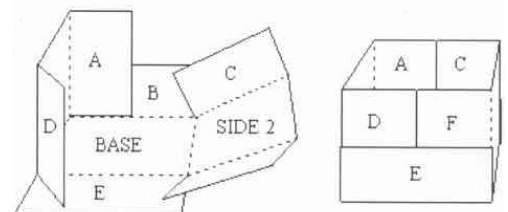
Pile Caps come in a wide variety of shapes and sizes, each of these require consideration on both design and installation. The basic problem is the ability to handle the Corriform Sheets to form the envelope in which the steel reinforcement is placed. Where possible Corriform design the shutter to be assembled using as few sheets as possible, where this is not possible other options are available, these require adopting a slightly different method. As with the Corriform Ground Beam Shutter, two methods of installation can be employed- prefabricated and in-situ.

If drawings are submitted Groundwork will design a scheme for installation along with an appropriate quotation.

Where more than one sheet is required to create the shutter, each constituent part will be referenced at time of manufacture to enable on-site identification of said. An exploded 3-D diagram will accompany each different pile cap type for ease of assembly.

Normal jointing and fabrication hints apply where they need connecting to ground beams, other pile caps or shuttering.

Note: When placing spacers to retain consistent cover to the steel, concentrate spacer placing on the top and central areas of the bar. Base and corners are quite strong and will resist normal backfill pressure.



About Corriform

Methods of Manufacturing and Testing Corriform Sheet

The main benefit of the Corriform ground beam former is the unique method of manufacture. Corriform is machine creased across the extruded flute, this method allows the (fluted polypropylene) to fold along a line created by feeding the material through male and female rollers, this effectively compresses the material at this point. The method has been tested proving to be three times stronger than by cutting part way through achieves the same bending effect. We originated the polypropylene ground beam system in 1997 European patent 0866'196) and have continued to develop and improve the system for the benefit of our customers.

Corriform instigated a series of tests to prove “creasing” and not “cutting” is the most effective method of forming a “U” shaped, permanent ground beam shutter using fluted polypropylene.

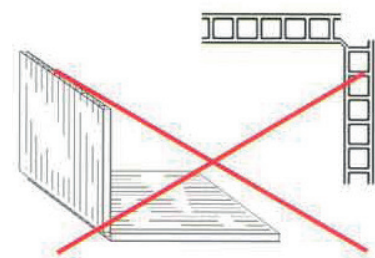
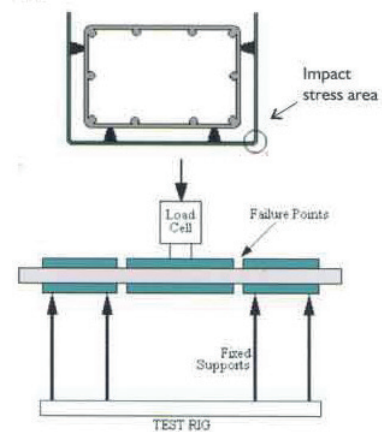
Burst Strength Test

Purpose: To determine which method of folding the polypropylene sheet will give the greatest burst strength on impact.

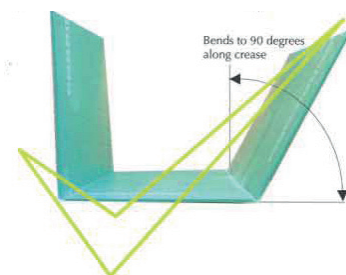
Test Equipment: A houndsfield H1 OKM Universal test machine. The test rig was designed to clamp the sheet while testing to failure.

Important Design Factor: The design of any product from twin wall sheet must take into account the profile's strengths and weaknesses. Because of its structure the sheet can tear relatively easily along the flute line, whereas tearing across the flutes is almost impossible. Therefore in the design of ground beam shuttering where the fold is along the flute line, should a side force be applied to the end of a section, tearing along the fold line can easily occur, whereas a fold across the flute will not tear!

Conclusion of Test: Sheet folded (creased) across the flutes is approx. 3 times stronger on impact than cut sheet which is folded along or across the flute. The above tests have proven conclusively that the practice of cutting halfway through the fluted polypropylene board is not in the best interests of the designer, builder or client, as it is obvious that this can lead to the potential problem of having beam foundations which when constructed will not conform to the designed width dimensions. This can only lead to the detriment of the final structure.



One skin cut to accommodate bend



Pre-creased Corriform is 3 times stronger



Installation

Installation Guidance

Installation of the Corriform Permanent Shuttering System can be achieved using a variety of methods, but are reliant on: Site conditions, Construction method, Steel reinforcement design, Site accessibility.

All of these variants need consideration, as to which is the most effective in allowing this unique system to perform to its maximum.

The following installation guides will give the installer insight to what is possible.

Further guidance is available by contacting Groundwork Engineered Systems Technical, through the contact details on the back cover of this Technical Index.

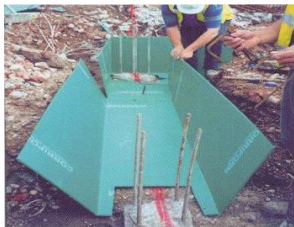
Groundwork Engineered Systems products are guaranteed against defective materials and manufacture and are sold subject to its standard conditions for the supply of goods and services, copies of which may be obtained on request. Whilst Groundwork Engineered Systems endeavours to ensure that any advice, recommendation, specification of information it may give is accurate and correct it cannot, because it has no direct or continuous control over where or how its products are applied, accept any liability either directly or indirectly arising from the use of its products, whether or not in accordance with any advice, specification, recommendation of information given by it.



Installation

Corriform Ground Beam Setting Out

When installing Corriform, it must be remembered that it is not self supporting and therefore important that it is correctly supported off the internal steel reinforcement. The following instructions will assist the contractor. The Corriform Permanent Ground Beam Shutter System ('U' shape) can be installed on-site in 2 ways; A: Part pre-fabricated or B: In-situ. The decision on which of these methods is selected, will be due to on-site space, weather conditions, work progress and also the contractor or steel fixer's preference. Here we show an overview. The comparisons in the two methods are listed below;



A. Pre-fabricated – Out of Trench

- Make up corner unit (cut hole for pile entry in base).
- Prepare trench, rake the base flat, place opposite corner units into position in trench.
- Measure length of intermediate beam, calculating length between corner units to enable correct length of beam fabrication.
- Make up Corriform pre-creased 'U' shape to correct length.
- Select correct spacer pattern and place spacers on the reinforcement cage, tie Corriform sides firmly to the reinforcement, tie wire through butted joints and secure using Corripins.
- Lift beam length into position (splicing bars are placed inside cage).
- When prefabricated beams are complete and installed into the trench the final fix of steel can be completed.
- Backfill carefully level with the top spacers.
- Pour concrete, vibrate as normal.

B. Ground Beam Former in situ

- Make up corner unit (cut hole for pile entry in base).
- Prepare trench, rake the base flat, place opposite corner units into position in trench.
- Place pre-creased 'U' shape into trench, butt up to corner units, insert Corripins down flutes to give continuity by tying beam lengths together.
- Install steel reinforcement cage onto 'U' shaped Corriform and tie side panels to the steel reinforcement using ties supplied, (spacers will have been placed on cage prior to placing in 'U' shape). Select correct spacer pattern.
- When all Corriform and steel is installed, final fix all steel.
- Backfill carefully level with the top spacers.
- Pour concrete, vibrate as normal.

Accessories supplied to install the Corriform System include spacers, ties, corripins, self tapper screws and shuttering tape.



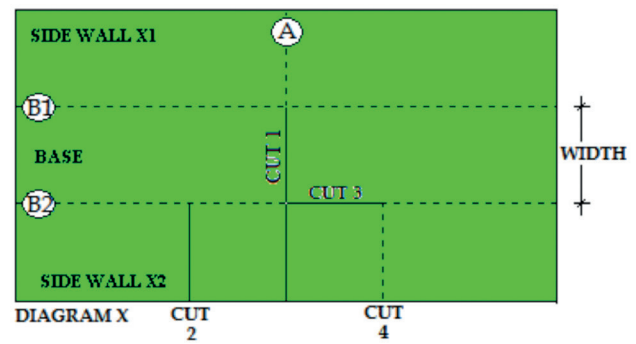
Installation

Corriform Corner Cutting Instructions

Groundwork Systems Ltd machine crease a 2000mm Corriform Board to the specified profile, i.e. width and height of ground beam. This crease is across the longitudinal flutes (at 90 degrees). Looking in plan at Diagram 'X' the board will require 4No cuts (using a skill knife) to form a corner unit.

CUT 1

Find the centre line 'A' (1000mm from either side). Stand on the board and fold side wall 'X1' up towards you, using the skill knife cut through the underside of the board only (one skin), along the flute from the top of the board to 'B1' (creased line). Lay the side wall 'X1' flat on the floor again. Continue cutting down the centre line 'A' through the board from crease line 'B1' along the flute to the bottom and outside edge of side wall 'X2'.



CUT 2

Measure from centre line 'A' by the width of creased beam base and cut through the board from crease line 'B2' to outer edge along with the flute to the bottom and outside edge of side wall 'X2'.

CUT 3

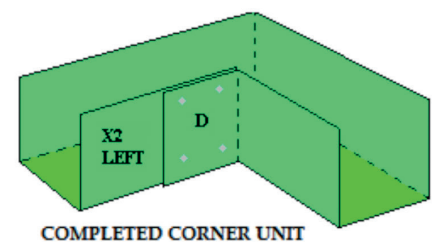
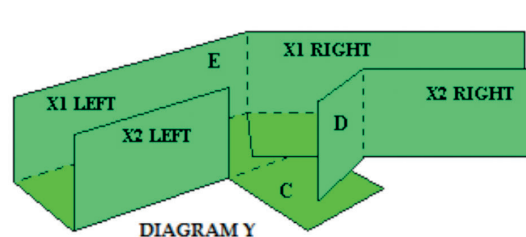
Cut along crease line 'B2' from 'A' line to the measured base line width.

CUT 4

Cut through 'top skin' only! From crease line 'B2' from the end of 'Cut 3' to the outer edge of side wall 'X2'.

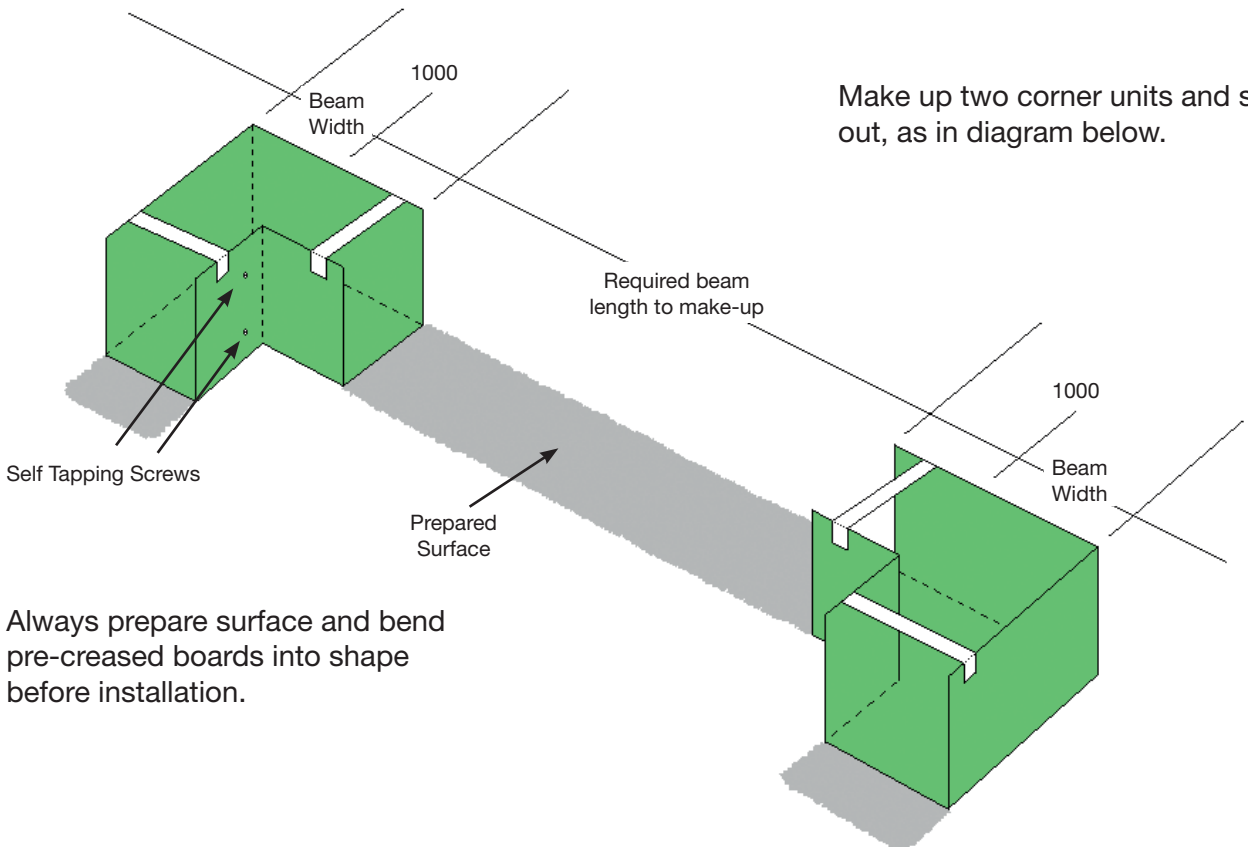
FORM CORNER UNIT

Fold as in diagram 'Y' to completed corner unit and secure using self tapping screws.



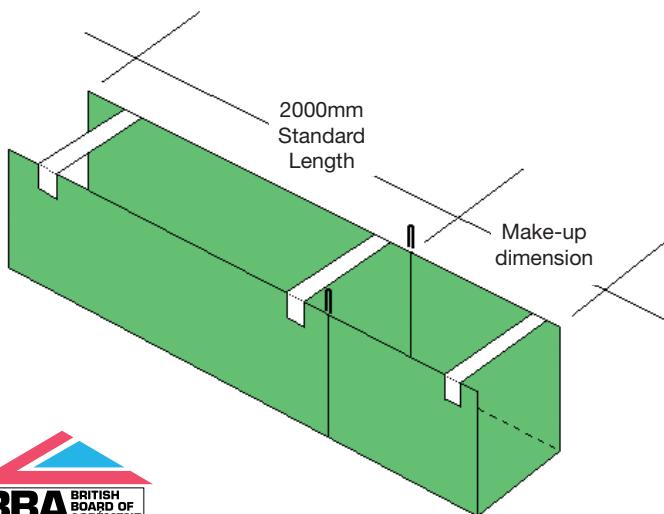
Installation

Installing Ground Beam Method



Make up two corner units and set out, as in diagram below.

Always prepare surface and bend pre-creased boards into shape before installation.



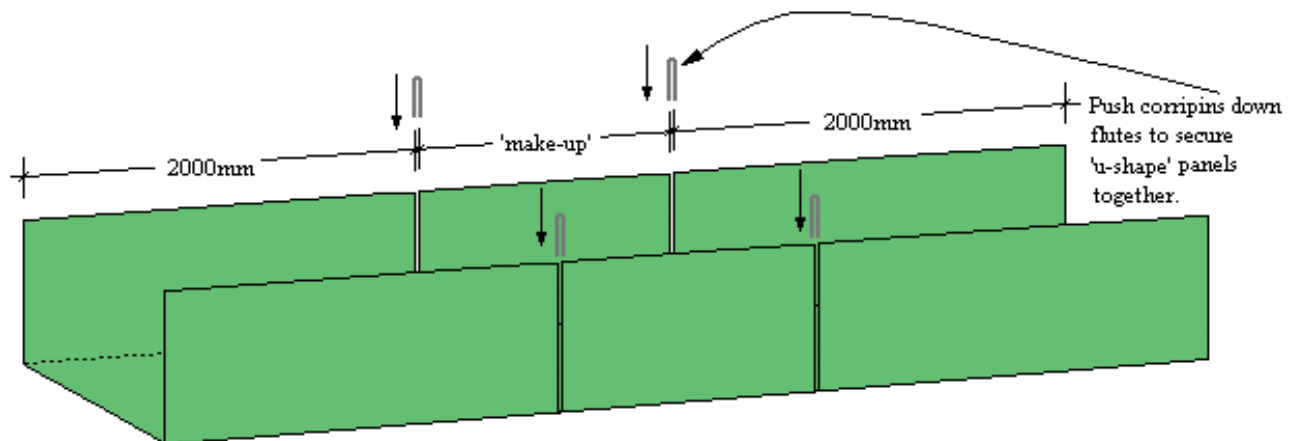
Make up beam length to suit required dimension and place between installed corner units.

Hold beam shape with shuttering tape.

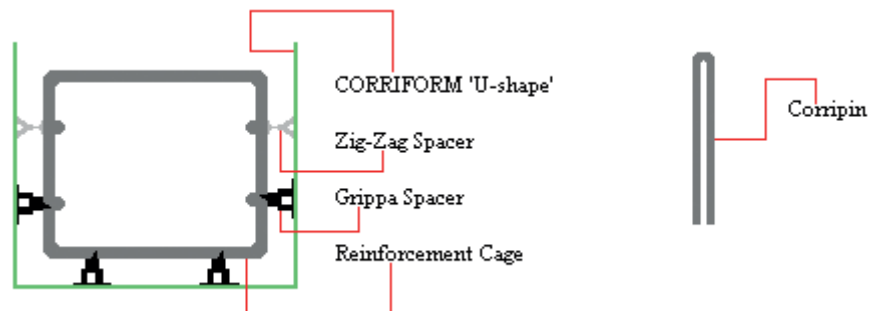


Installation

Calculating and Fixing Ground Beam Shutter



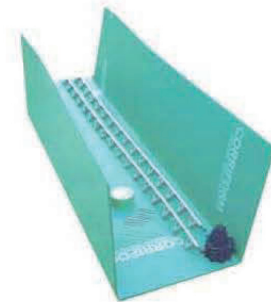
1. Calculate Beam Length
2. Place CORRIFORM on a flat surface.
3. Butt standard length and make-up in beam length.
4. Place pre-fabricated steel reinforcement cage onto CORRIFORM.
(Note: Place Grippa spacers to cage bottom first.)
5. If using continuous spacers, tie wire to pre-fabricated reinforcement cage.
Alternative fix Grippa type spacers as per CORRIFORM instructions, to cage.
6. Fold up sides of CORRIFORM secure using ties or wire, either side of the join of two abutting panels.
7. Push Corripins down flutes to secure length.
8. Measure and cut out shutter base for pile entry.
9. Rake trench base flat and place prepared beam in position.
10. Cut 'windows' into pile cap formers and fix steelwork, then secure CORRIFORM.



Installation

Installation Advice and Spacer Placement

When installing the Corriform Permanent Shuttering System a little pre-planning will help you avoid any potential pitfalls. When using this innovative system of shuttering, just remember that Corriform is a thermo plastic and not the usual traditional wood or steel, and therefore must be treated a little different. The following information will assist a competent and professional installation.



The Package

The Corriform delivered to site service, includes a full accessory pack to allow correct on-site installation of ground beam, pile cap or other types of concrete foundation shutters. Each pallet will be delivered along with assembly instructions for each particular type of shutter. The instructions will be either attached to the pallet or in an enclosed envelope addressed to the relevant site person. The following criteria must always be considered when installing Corriform: **Site conditions, type of backfill, spacer placement and method of support.**

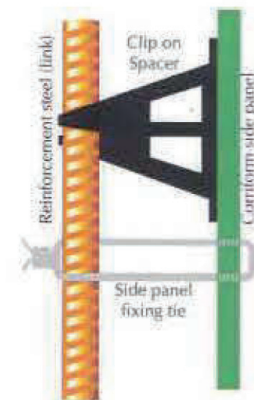


The Corripin

This is used to mechanically connect the Corriform sheets. The Corripin is pushed firmly down the flutes. Make sure the pin is slightly sprung to create tension.

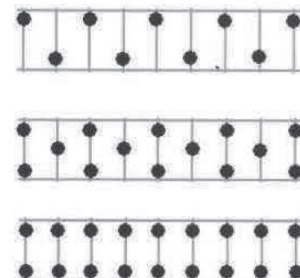
Side Panel Fixing Tie

This is supplied to tie the Corriform side panels to the steel reinforcement keeping the Corriform shutter in shape until backfill is placed. Punch 2 holes 20mm apart through the Corriform side panel using a Bradawl. The tie is more effective near to the clip on spacer (see diagram). Nip the tie around the steel reinforcement firmly.



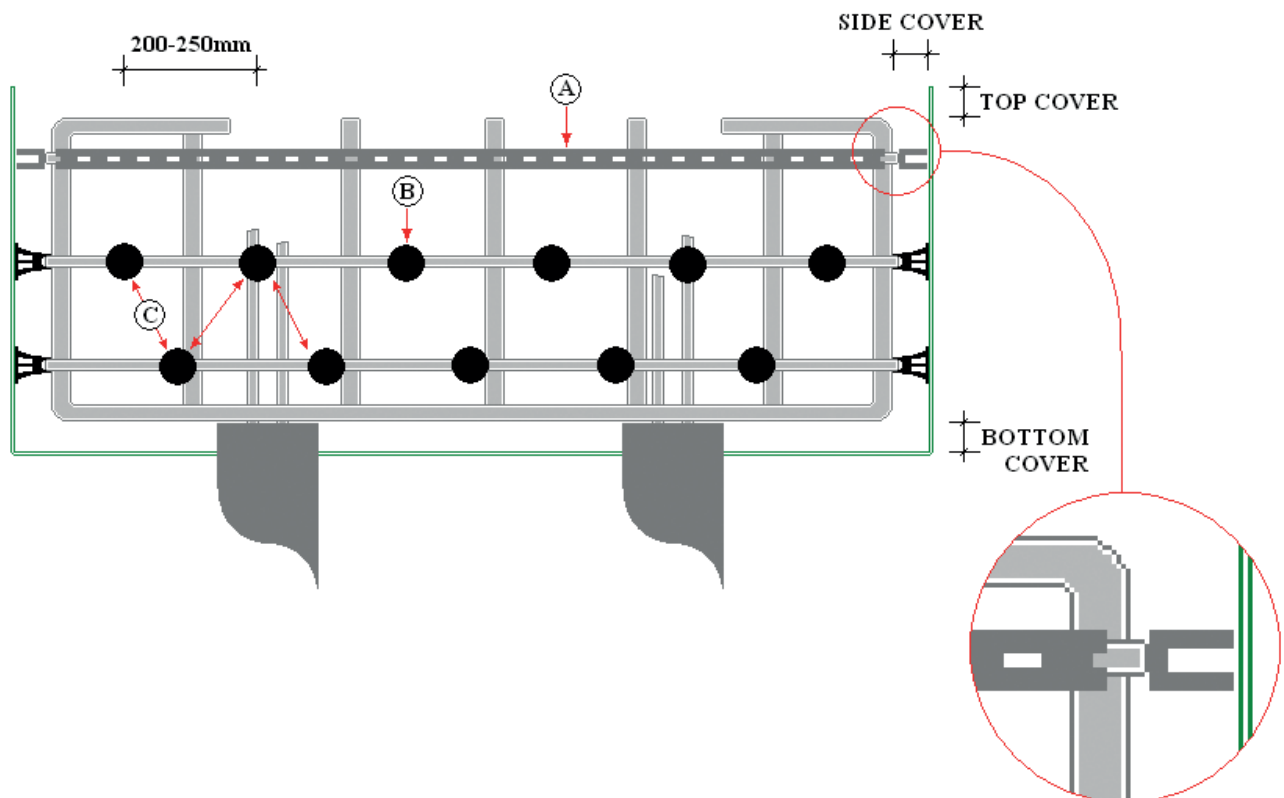
Spacer Placement

The Corriform Permanent Shuttering System is not self supporting, therefore the pattern of placing spacers is quite important. To allow the correct and consistent cover to the steel reinforcement always adapt a spacer pattern that will best support the weight and type of backfill being used. See diagrams. **Continuous type spacers linear**, are also readily available on request from Groundwork Engineered Systems Ltd.



Installation

Spacer Placement Advice on Pile Cap Reinforcement



1. Tie appropriate cover Linear Spacer (A), high around cage as diagram.
2. Grippa Type Spacers (B), spaced around mid area of cage. Approximately 200-250mm apart.
3. The lower part of the creased former (up to 200mm from base) will not deflect easily when backfilled, therefore fewer spacers are required. This also applies near vertical corners.
4. Cage can be supported by heavy duty spacers / concrete block / or the pile collar concrete, to the bottom cover dimension.
5. To gain better resistance to backfill pressure at the sides, form a zig-zag pattern (C) using grippa spacers as diagram.

Note: The general information above can also be applied to ground beams.

Installation

Cutting a 'T Junction' into Ground Beam Shutter

Groundwork Engineered Systems machine crease a 2000mm Corriform Board to the specified profile, i.e. width and height of ground beam. This crease is across the longitudinal flutes (at 90 degrees). Looking in plan at Diagram 'X' the board will require 4No cuts (using a skill knife) to form a 'T-Junction'. This fabrication can be carried out either in situ or as the diagrams indicate prior to installation. The instructions are the same

CUT 1

Find the centre of the incoming beam 'T'. Mark this centre and cut down /along the flute to the bottom (in plan as diagram 'X').

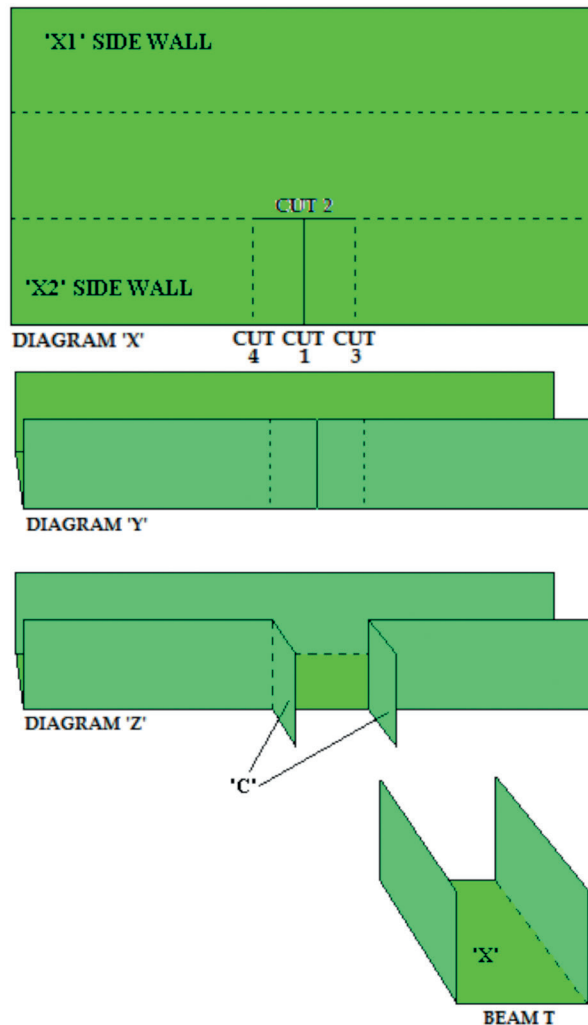
CUT 2

Measure outward from this cut (both ways), half of the beam width, to cut a 'T' shape. This cut runs along the machined crease line.

CUTS 3 and 4

Cut through one skin only along the flute on the inside of the beam profile. Open these 'flaps' and they will accept the beam 'T'. These can be secured using corripins and self tapping screws.

Accessories supplied to install the Corriform System include spacers, ties, corripins, self taper screws and shuttering tape.





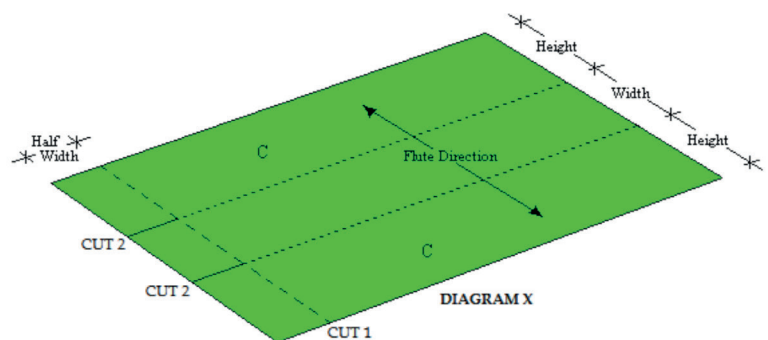
Installation

'Stop Ending' Ground Beam Shutter

Groundwork Engineered Systems machine crease a 2000mm Corriform board to the specified profile i.e. width and height of the ground beam. This crease is across the longitudinal flutes (at 90 degrees) B1 and B2. Looking in plan at diagram X the board will require 3No cuts (using a skill knife) to form a stop end.

CUT 1

Using a skill knife cut through the bottom skin of the Corriform along the flutes. This cut being half the width of the 'U' shape base dimension.

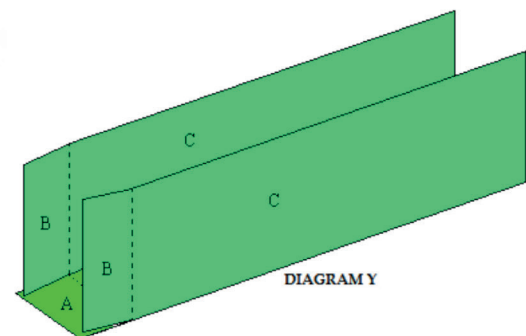


CUT 2

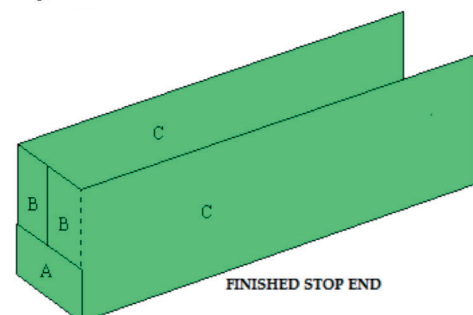
From this 'knicked' / cut, cut along the crease lines to the outer edge of the board.

FOLDS

Fold up Corriform 'U' shape sides C, then fold in end 'flaps' B and bottom 'flap' A. Finally using corripins and self tapping screws secure tightly.



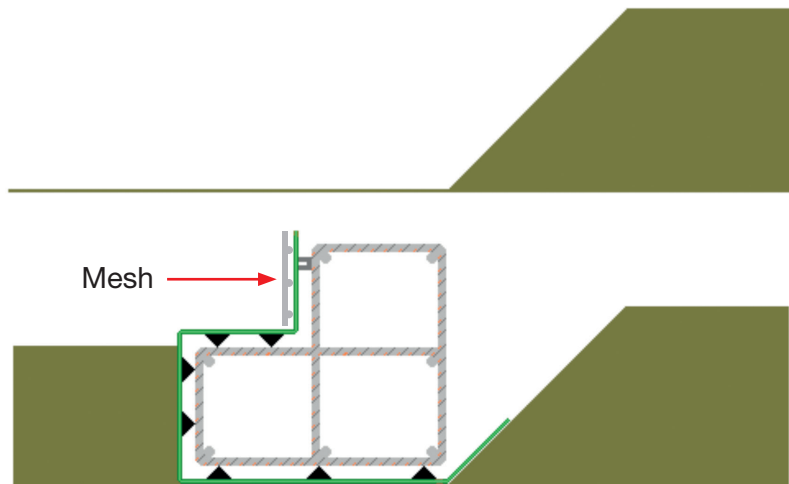
If the backfill is not placed against this fabrication the alternative methods are required to tie through to the reinforcement, to hold the to be poured live concrete.



Installing the One-Form System

1. Dig out trench to the required level forming batter as required. Level base using coarse sand or stone.

2. Place Corriform preformed shutter to building line, installing steel reinforcement and securing the Corriform to the reinforcement with fixing accessories supplied.



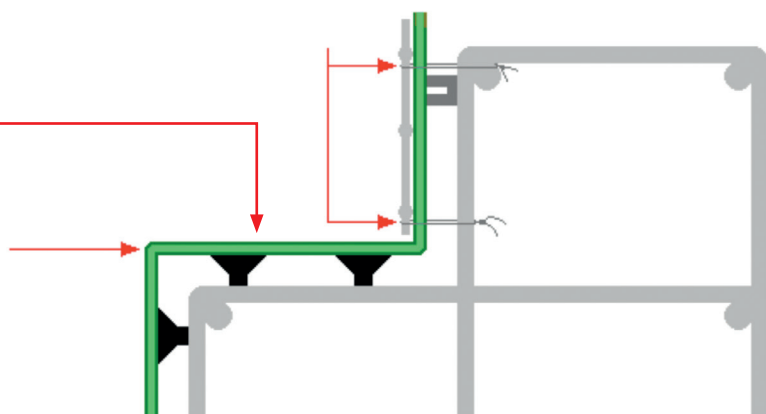
Note: spacers must be fixed to give concrete cover to reinforcement.

3. Backfill up to level of top of boot, as diagram.
4. Use strips of steel mesh, to secure the Corriform to the reinforcement.

Mesh secured through Corriform tied to reinforcement.

Holes (flaps) can be cut through the horizontal area to allow vibration of concrete during pour.

Please ask for further information on the 'One Form' use and installation.

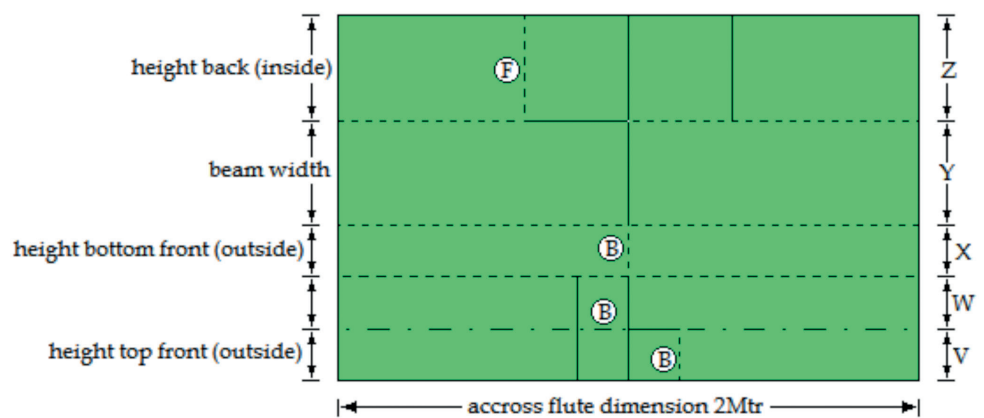




Installation

Instructions to Cut and Form a One Form Corner

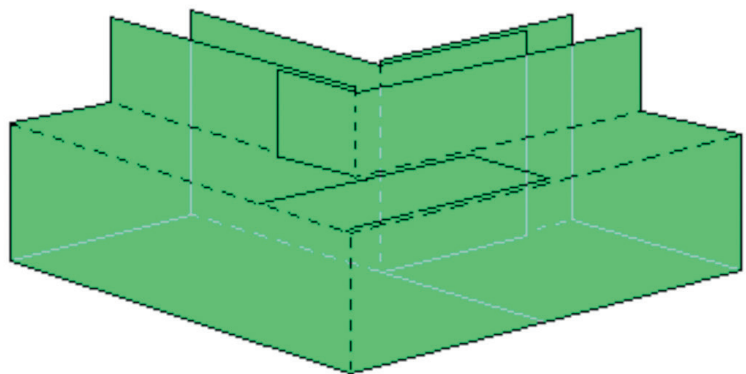
The diagram below shows a 'One Form' corner unit in flat board form. The board dimensions in this instance are: 2 metre across the flute and 3 metre along the flute. The flute length varies according to the profile.



1. Solid lines show cuts through.
2. Broken horizontal lines are machine creased.
3. Broken vertical lines are cuts down the flute on front and back.

As the beam dimensions vary, then it follows that the V, W, X, Y, Z dimensions will vary according to the profile.

Accessories supplied to install the Corriform System include spacers, ties, corripins, self-tapping screws and shuttering tape.



Installation

Forming a Dual Width Ground Beam Corner

Groundwork Engineered Systems machine crease a blank sheet to form a 'U' shape to the widest of the two converging beams. From this 'U' shaped form the dual width former is fabricated by hand. The diagram below shows the pattern and sequence of cuts which create the narrower beam width.

CUT 1

Measure across the flutes to find centre line. Cut half way through the back of the board (with the flutes) from 'A1' to 'A2' and completely through from 'A2' to 'A3'.

CUT 2

Measure from the centre line 'A' the width dimension of the wider beam and mark 'B'. Cut through along the line of flute to the new narrower beam width 'B1'.

CUT 3

From 'B1' turn board over and half score along and across the flutes to form the new beam width. This scored line goes from 'B1' to 'C'.

CUT 4

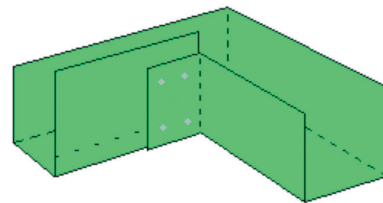
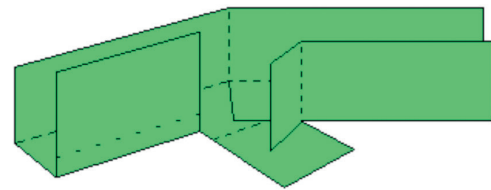
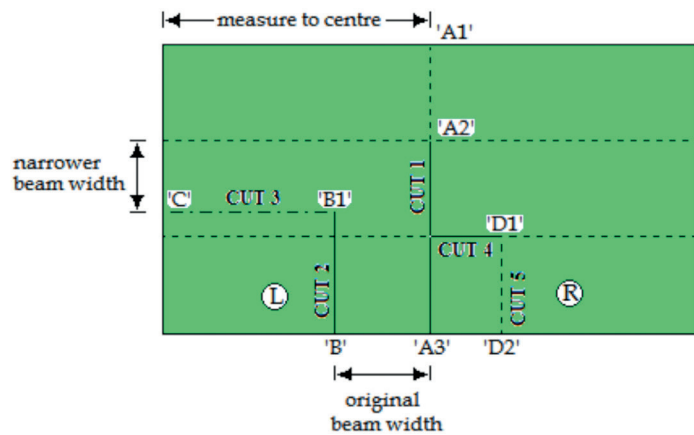
From the 'A' line measure along the machine creased original beam width the dimension of the new narrower beam width and cut through from 'A' to 'D1'.

CUT 5

Score along the top face (board up) of the board and along the flute line from 'D1' to 'D2'.

FORM CORNER UNIT

Lay board flat onto the floor and standing on the left hand side pull the right hand side towards you folding the unit as the 'standard' corner unit and secure using self tapping screws.



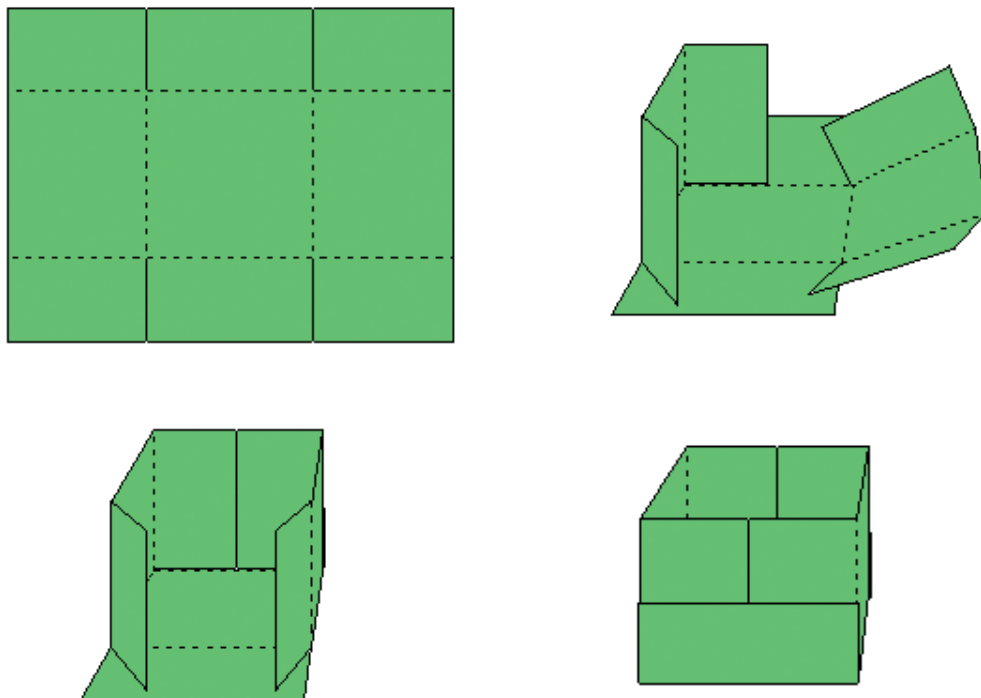


Installation

Typical Pile Cap Fabrication

Fully encapsulated Pile Cap Former with base (small version)

Groundwork Engineered Systems will design and fabricate a flat packed Pile Cap or Pad Former, to install on-site either prefabricated (out of the ground) or in-situ. The former will be delivered flat packed along with the appropriate components and 3D installation instructions.

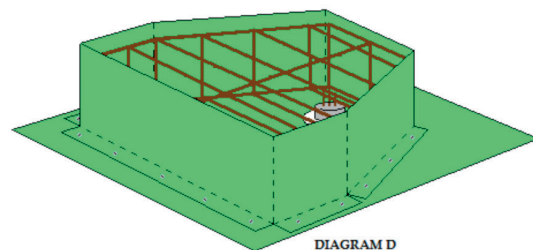
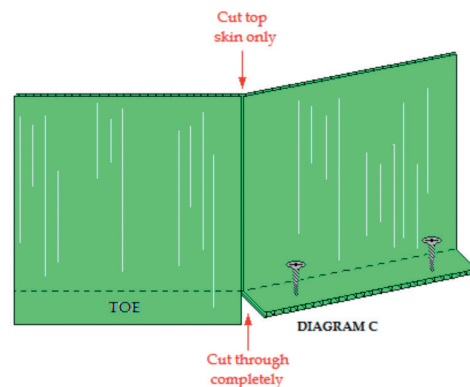
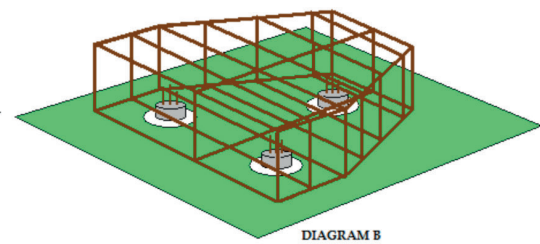
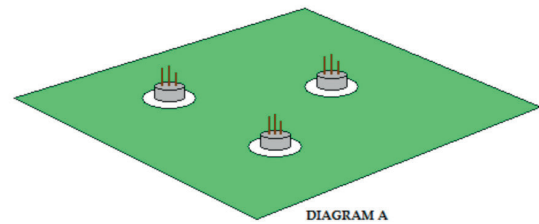


Accessories supplied to install the Corriform System include spacers, ties, corripins, self taper screws and shuttering tape.

Installation

3 Pile Cap Installation

1. Place base pad over piles and measure positions, mark material and cut holes as diagram 'A'. Place Base Pad into position giving a clean working surface.
2. Place reinforcement cage onto pile heads.
3. Measure number of 'L' shaped side shutters required and prepare by cutting and knicking as Diagram C. Secure toe of the side panels to base pad using self tapping screws. The side panels wrap completely around the reinforcement cage. Continue securing with screws and side panel ties until complete.
4. Diagram D shows a completed pile cap shutter. Place spacers between steel and shutter to complete. Take care when backfilling, to allow good concrete pour.



Note: If situated on contaminated soil proofing sealants will be required.

Please requested Anti-Con guidance.



Installation of Anti-Con The Contamination Solution

Methane (gas) barrier Installing membrane starter strips



Cement to seal pile head
e.g. Proofex WG or equivalent



Fosroc 'Engage' installed under slab



Hydromat sheet connected inside corriform formwork to proof high water table



The Corriform Systems are totally unique!

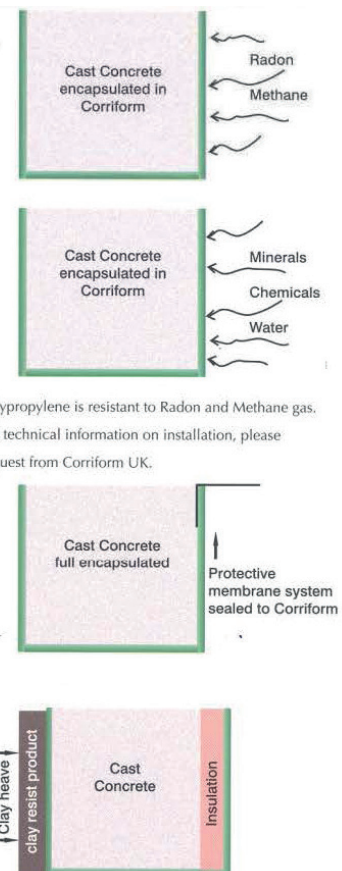
Basic Technical Facts On the Anti-Con System

The Corriform Permanent Shuttering System is designed to form steel reinforced concrete building foundations. The material (fluted polypropylene) is shaped to create a three dimensional concrete member. To fold into shape it is creased by the use of metal rollers, allowing the material to bend but still retain it's physical integrity. The benefits of the system are threefold;

- The design and manufacture of the shutter is carried out by Groundwork Engineered Systems giving the building contractor a ready made method of shuttering to form his foundations, which enables vast on-site savings of labour and material.
- The encapsulating polypropylene material gives life long protection to the cast concrete elements in aggressive soil conditions. This eliminates the on-site application of bitumen protection or the use of sulphate resistant concrete.
- It is possible to protect the cast concrete foundations from the ingress of aggressive aqueous solutions, in high water table areas. Forming the concrete substructure in-situ and thus giving lifelong protection in both wet and dry conditions.

Chemical Resistance: Polypropylene has outstanding chemical resistance, the best of all the thermoplastics to organic chemicals. Polypropylene is also extremely resistant to inorganic environments. It is not affected by aqueous solutions of inorganic salts, nor by most mineral acids and bases, even when concentrated. The chemical resistance of Polypropylene to various substances is summarised in technical bulletin pp2.2 chemical resistance data for shell polypropylene.

Water Absorption: In sheet form, Polypropylene is totally waterproof, but when fabricated the sealing of joints must be carried out with care and the use of the recommended sealants is essential to ensure water tightness. When building under European type conditions, normal sealing of shuttering is by the use of PVC shuttering tape, but where waterproofing and gas resistance is required, the use of more aggressive and robust models supersede this. Groundwork Systems design and will manufacture permanent shuttering with both clay resistant or thermal insulation boards bonded to the inside or outside of the pre-creased shutter.





Installation

Installation Advice on Proofing Anti-Con System

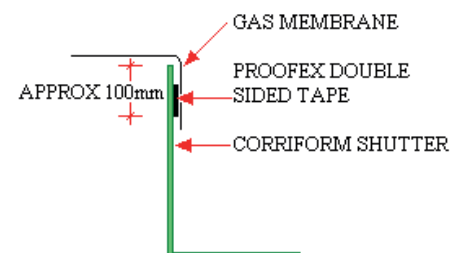
Installation Of The System

To achieve a totally gas, contamination and water proof foundation, the following proofing technologies have been joined:

1. The Corriform Permanent Shuttering System BBA certificate No 06/4342.
2. The Proofex Total Gas Proofing System, by FOSROC: BBA certificate No 01/3850 and BS8102: 1990 for protection of structures against water from the ground.

Installation Procedure

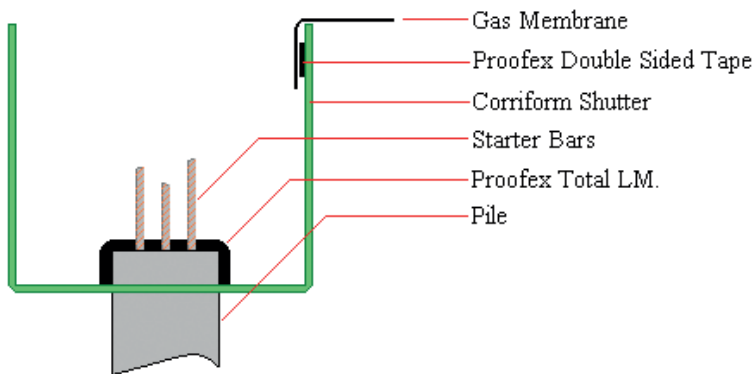
- Quantify the number of 'U'-shaped (2Mtr long) pre-creased Corriform shutters required to make up each individual beam in-situ. **Note:** These will require preparation as follows, before they can be installed.
- Remove the pre-creased Corriform shutters from the pallet and fold each one into the 'U'-shape, this re-affirms the crease memory into the shutter and assists easy installation. (See diagram) **Note:** Maintain this 'U'-shape by securing PVC Tape across the top of the shutter.
- After identifying whether the shutter is for external or internal installation on the ground arrangement drawing, apply Total Tape (double sided) to the inside, top edge of the 'U'-shape shutter. (See diagram) **Note:** All internal beams will require Total Tape to both inside top edges and all external beams to the inside edge top only.
- Form up the corner units if the beam being constructed is an outside beam and apply Total Tape as installation guides IG07 and IG13.
- Prepare the trench i.e. level using sand or fine stone, cut off and tidy pile heads.
- Set out and install the corner units in-situ in the trench base.



Installation

Proofing Benefits (Anti-Con)

Proofing Against Contamination, Gas and Water



Built in Benefits

- The Corrifform Permanent Shutter System is manufactured bespoke to each project specification.
- The Corrifform shuttering material (polypropylene) is the most effective thermo plastic in resisting attack by contaminating chemicals and minerals.
- The Corrifform shuttering material is non permeable and therefore can be effectively sealed, using proprietary sealants against gasses and water.
- Concrete additives are not required to resist sub-soil contaminates.
- The polypropylene material is fluted (having cavities which lock air), therefore it has an insulation value.
- The Corrifform shutter is made project specific, has installation instruction supplied, is quicker to install, therefore less man hour costs.
- The Corrifform shuttering material is light (weighing approx 1500g/M2), easier to transport to and on site.
- The core material of Corrifform is extruded Polypropylene, the end product of oil, not wood! Therefore more environmentally friendly.
- Due to flat pack benefit, the Corrifform shuttering material requires less storage space, in the factory, in transit and on site (therefore less carbon fuel usage).
- The Corrifform Permanent Shuttering System is fully compatible with the Proofex / Total Gas System and together

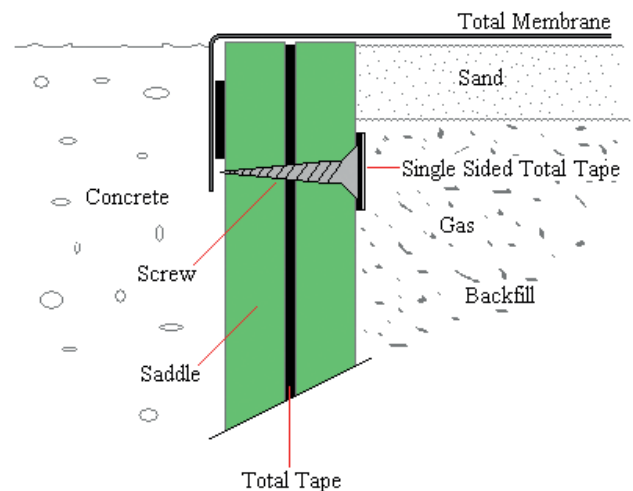
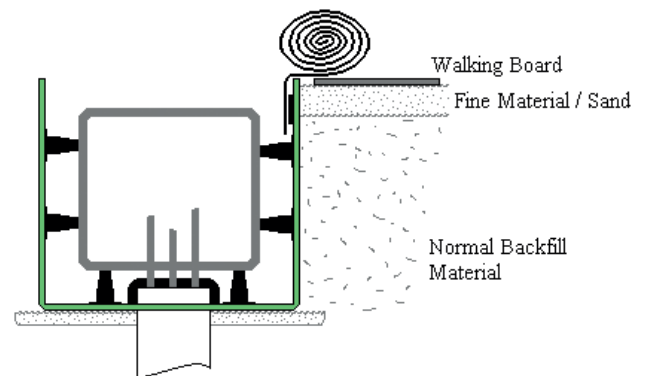


Installation

Proofing Method (Anti-Con)

After completion of the Corriform installation the 'Total Gas Membrane' can be fitted as follows:

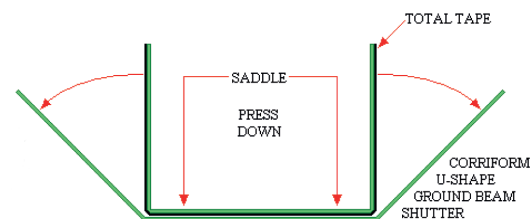
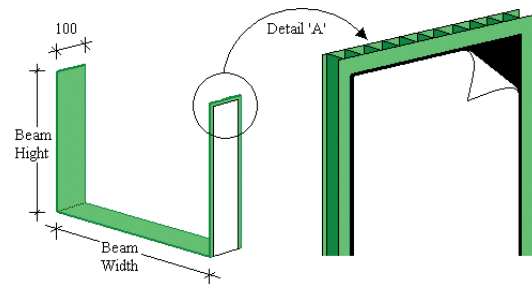
- When attaching the Total gas membrane it is advisable to use walking boards or some other means to avoid compressing the backfill material against the Corriform shutter, which can very easily decrease the cover dimensions. (See diagram)
- The Total gas membrane comes in 2Mtr x 25Mtr rolls. This could be stuck to the Corriform, as soon as the steel fixing is completed, then attached further upon completion of backfilling. (See diagram)
Note: Where Pile Caps, Lift Shaft Bases or any other special or non-standard element is to be installed, Groundwork Engineered Systems will supply installation advice at the time of delivery.
- Installation of the Formwork System is made easy due to the pre-made shutters being delivered flat packed and palletised to each building site, along with the correct fixing accessories and where required plastic laminated installation diagrams, to aid installation.



Installation

Pile Head and Joint Proofing (Anti-Con)

- If pile heads protrude into the corner units, cut entry holes and seal neatly as directed in installation guide IG16 and 13.3 'Jointing Procedure' BBA No 06/4342.
- Apply Total Tape to the inside top edges of the corner units.
Note: Do not remove the protective backing paper from the Total Tape until all beams are completely installed and ready for the attachment of the Total gas membrane.
- Prepare the correct size of internal saddle by applying Total Tape to the outside surface. (See diagram)
Note: Do not remove the protective backing paper until ready for installation.
- Place each 2Mtr length 'U'-shaped shutter into the trench. Butt the first shutter (2Mtr) up to the corner unit and place the prepared internal saddle onto the joint, press firmly and secure mechanically, using self tapping screws, as installation guide IG12. (See diagram)
Note: Remember to screw from the outside and cover screw head using single sided Corriseal.
- Continue placing the 2Mtr long 'U'-shaped shutters and sealing each butted joint, by using the internal saddles supplied. **Note:** It is good practice to work inwardly from opposing corners or 'T'-junctions to arrive at a central point in the beam, where a make-up length can be installed. This can be cut from one of the standard 2Mtr lengths.



Installation

Pile Head and Joint Proofing (Anti-Con)

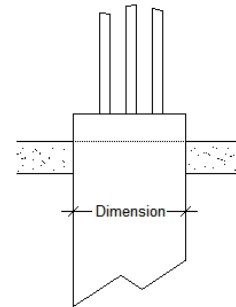
1. Measure size and shape of pile head.

2. Cut pad to fit over pile head, showing 150mm of material around hole.

(As Detail 'A'):

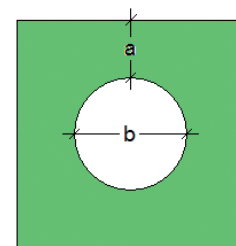
b = Circumference dimension of pile.

a = Minimum 150mm wide collar.



3. Cut oversize pile entry hole in base of Corriform shutter unit (ground beam or pile cap).

4. Apply Total double sided tape around collar.
(See Detail 'B')

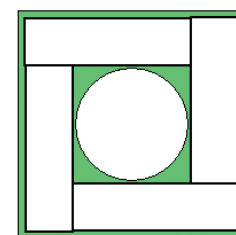


Detail 'A'

5. Fit collar down and around pile head.

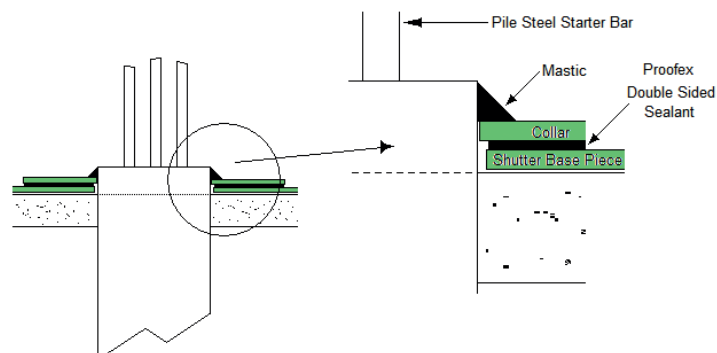
Press firmly to seal.

Note: A gun applied mastic, from the Fosroc range 'Proofex Plastiseal' can be applied to give better sealing, where required.



Detail 'B'

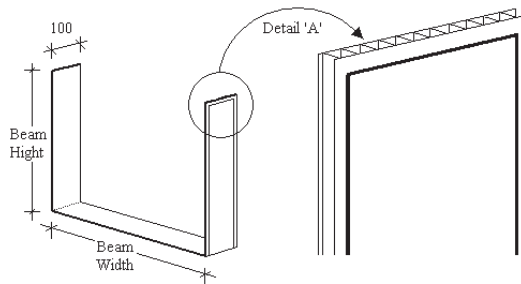
Accessories supplied to install the Corriform System include spacers, ties, corripins, self tapper screws and shuttering tape.



Installation

Further Proofing Advice (Anti-Con)

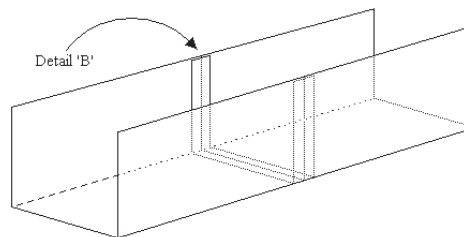
1. Apply Proofex / Total double sided tape to outside surface of preformed jointing saddle.
(See Detail 'A')



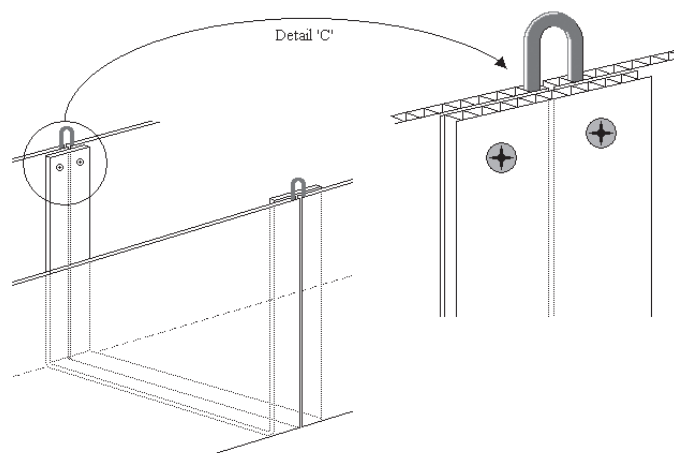
2. Remove protection paper.

3. Butt-joint Corriform ground beam.

4. Sit saddle into ground beam, pressing firmly into position, to form a sealed joint.
(See Detail 'B')



5. Secure using self tapping screws and ensure Corripins are sprung and pushed firmly down the adjoining flutes.
(See Detail 'C')

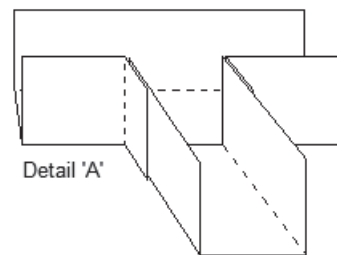


Accessories supplied to install the Corriform System include spacers, ties, corripins, self tapper screws and shuttering tape.

Installation

Proofing Beam Junctions (Anti-Con)

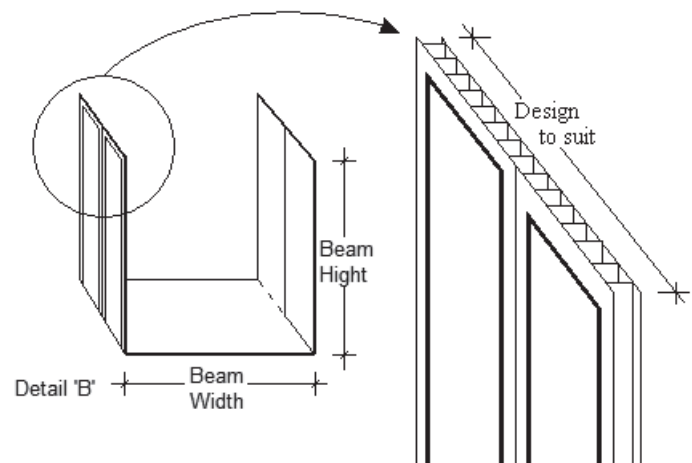
1. Position ground beam 90 degrees to other ground beam side after cutting and bending open entry panels. Secure mechanically using Corripins. (As Detail 'A')



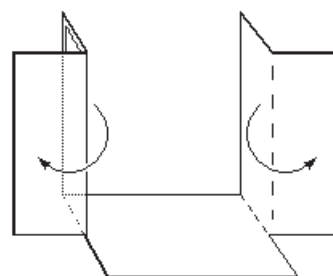
2. Apply Total Tape to pre-creased jointing saddle.

3. Crease and cut where required and fold back corner uprights, then remove protective paper from saddle.

4. Sit saddle into position, pressing firmly, to bond Total Tape to the jointing position, thus forming a gas proof joint.



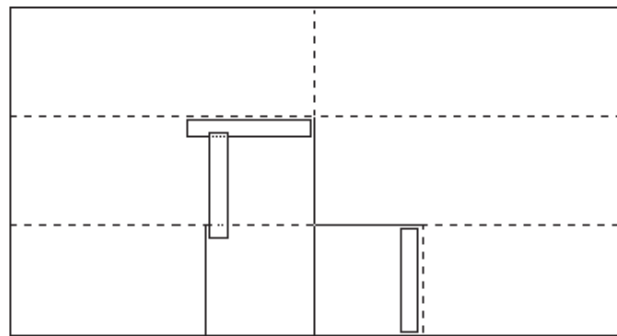
Accessories supplied to install the Corriform System include spacers, ties, corripins, self taper screws and shuttering tape.



Installation

Proofing a Ground Beam Corner Unit (Anti-Con)

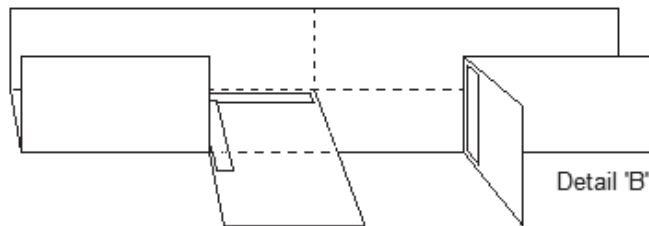
1. Lay pre-creased / cut board flat and apply Proofex / Total Tape. (As detail 'A')
2. Fold corner unit into U-shape. (As detail 'B')
3. Remove protection paper from Proofex / Total Tape and fold corner unit, to form 90 degree angled ground beam.



Detail 'A'

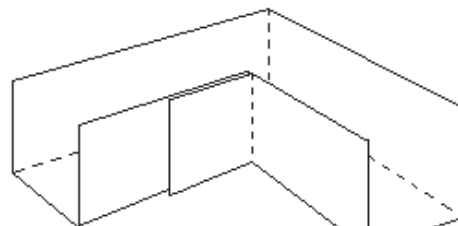
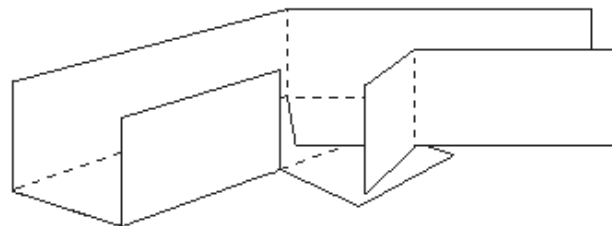
4. Press firmly on all taped joints and secure corner unit using self tapping screws and corripins.

Note: Where self tapping screws penetrate Corriform, seal over head using tape.



Detail 'B'

Accessories supplied to install the Corriform System include spacers, ties, corripins, self tapper screws and shuttering tape.



Detail 'C'



Installation

Proofing a Stop End Ground Beam (Anti-Con)

1. Form Stop End, as installation guide Ref: IG06.

2. Fold in Stop End 'doors' and secure using Corripin.

3. Apply Total Tape to inside surface of Stop End support flap. (See Detail 'A')

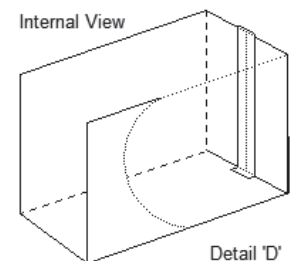
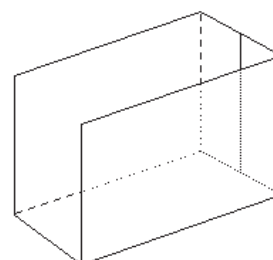
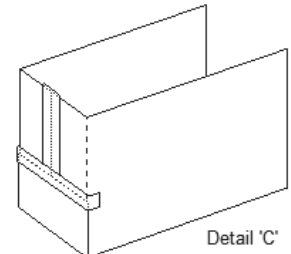
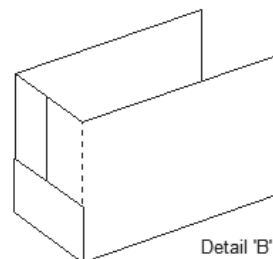
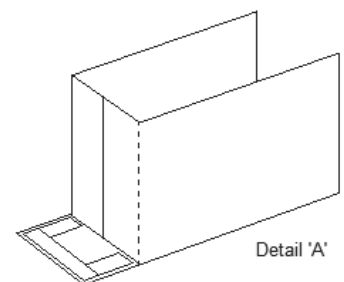
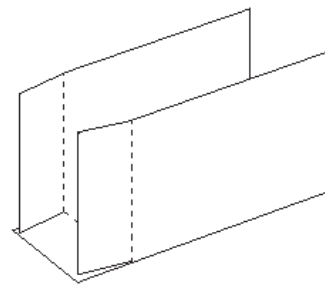
4. Remove protection paper.

5. Fold up support flap. (See Detail 'B')

6. Apply Corriseal single sided sealant to joints on outer surface of Stop End. (See Detail 'C')

7. Apply Corriseal single sided to inner joint of the Stop End 'doors'. (See Detail 'D')

Accessories supplied to install the Corriform System include spacers, ties, corripins, self tapper screws and shuttering tape.



Installation

Advice on Installing Ground Beam Panel System

The option chosen by the contractor to use a 'Side Panel System', as opposed to a complete encapsulation, if correctly installed can provide a positive result.

When installing Corriform, it must be remembered that it is not self supporting and therefore it is important that it is correctly supported off the internal reinforcement. It is to be assembled as per the assembly instruction supplied to each project. The following instructions will assist the contractor, when installing this system.

When using this method of forming ground beams, pile caps or other concrete foundations, care must be taken that the design profile is not compromised. This can happen where adequate resistance to the backfill pressure is not present, due to the lack of support along the panel base line. See diagram 'A'.

Diagram 'B' shows a better option of resisting the backfill pressure, by forming a strengthening rib, by way of an 'L' shape. This can be just as effective turned out or in. See (B) and (C).

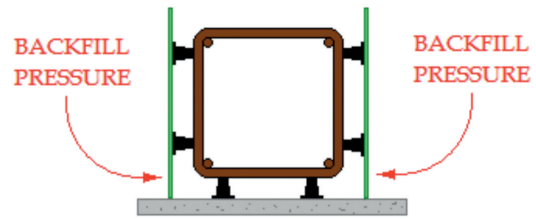


Diagram A

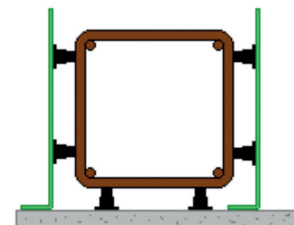


Diagram B

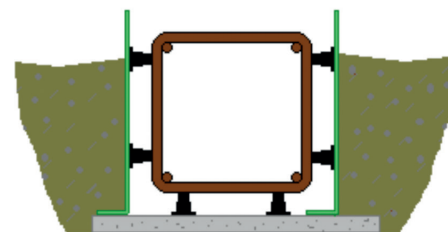


Diagram C

General Installation Advice

- Check correct quantity delivered before commencement.
- Check correct height of panel has been delivered.
- Load panel and accessories as close to installation as possible.
- Use the correct spacer pattern and of course the correct cover spacer.
- Start at corners (external and internal) or difficult junctions 'T', Stop Ends etc.
- Backfill carefully and no higher than indicated in diagram.

Note: There is no reason to overlap join Corriform, use of the Corripin pushed down the vertical flutes allows for butt jointing.



Installation

Typical Formwork Accessories

Linear Spacers, Grade Plate Spacers, Concrete Square Bar, Wire High Chairs, Tie-Bars, Wing Nuts, Waler Plates, Tie Wire, Bolt Boxes, Frost Blankets, DPM, Mesh, Fixing Tape, Mesh Spacers, Dowel Bars and Sleeves, Setting out Pins, Plastic Sleeves, Plastic Cones, Self Tapping Screws, Corripins, SPF Ties, Rubber Stoppers, Rebar I.D. Caps, etc...



Please ask if other accessories are required.

Technical Data

The Corriform & Anti-Con Shutter Data Sheet

High performance, waterproof, gasproof and sulphate resistant permanent formwork system

Permanent formwork system designed to form concrete foundations, to both form the foundation concrete and protect it against water, gas and other soil contaminants

- Foundation ground beams
- Pile caps

As a polypropylene permanent shutter. Corriform remains in-situ when concrete is cast, encapsulating around the beam within a permanent gas impervious layer. Corriform is then bonded to other gasproof membranes at ground level, creating a complete gasproof layer beneath your structure

Advantages

- Provides radon, methane and sulphate protection
- Compatible with gas resistant membranes
- Compatible with 'Waterproofing membranes
- Water, mineral and chemical resistant
- Sulphate resistant
- Can be installed in-situ or pre-fabricated prior to placing
- No blinding needed
- Quick and easy to install
- Permanent system requires no cleaning

Description

Corriform is a range of extruded fluted plastic boards based on polypropylene/ethylene copolymer. It comprises of flat polypropylene fluted boards which are pre-creased to specific project requirements. Supplied as bespoke panels, it is chemically inert. For applications in hot climates, a white coloured board can be supplied upon request.

Standard compliances

Independently certified performance, BBA Certificate (No. 06/14342).



Technical Data

Corriform Shutter Data Sheet

Typical properties

Nominal wall thickness:	0.7mm	
Overall board thickness:	9mm	(this can alter)
Board length:	2000mm	
Max board width:	3000mm	
Weight:	1500g/m ²	(this can alter)
Tensile strength:	27N/mm ²	(this can alter)

Standard tolerances

Thickness:	± 0.1mm
Weight:	± 1.0%
Width:	± 1.0mm
Quantity: (sheets per pallet)	± 0.1%
Length (standard)	± 1.5.0mm - 0.0mm
(hand trim)	± 1.0mm

The trench is excavated to accommodate the desired size of formwork. The bottom of the excavation should be level, even and properly compacted

Installation

The “U” sections should be butted up to the corner end pieces and mechanically secured with 2 Corripins in the flute of the boards. Continue the installation inwardly until the final length is to be put in place. The required length should be measured and a “U” sections cut to the correct length to fill the gap.

Joints should be sealed with Proofex Total Tape to prevent grout loss. The reinforcement cage is placed in the formwork with spacers attached to the cage. (When fabricating out of the trench, the sides should be tied temporarily to the reinforcement). Holes for pile caps should be cut out of the base.

Please ask for other weights or thicknesses of board if required.

Technical Data

Corriform Shutter Data Sheet

The pre-creased boards may be made up in-situ or outside the excavation and lifted into place together with the reinforcement. The trench is then backfilled up to the level of the top spacers or within 100mm of the top of the formwork, whichever is the highest. Compaction must be 30cm away from the Corriform Shutter Edge. Checks should be made to ensure that the correct cover to the reinforcement is maintained. The concrete is poured and vibrated according to normal practice.

Additional procedures for gasproof applications

Joins between adjacent boards should be made by butting together and securing with 2 Corripins. An internal saddle 100mm wide is then positioned centrally over the joint and sealed with Proofex Total Tape. Where pile caps penetrate the base an additional piece of Corriform should be stuck with Proofex Total Tape giving a minimum overlap of 150mm all round. All corners, ends and exposed flutes should be sealed with Proofex Total Tape. Pile caps should be sealed with either Proofex LM or Proofex WG as required.

Estimating

Proofex Corriform

Board length: 3000mm
Board width (max): 2000mm

Proofex TOTAL Tape

Tape width: 50mm
Tape length: 30m
Storage: Store in original unopened packaging, in cool dry conditions, away from direct sunlight.

Precautions

Health and safety

There are no known health hazards associated with Corriform in normal use.
For further information on ancillary products refer to appropriate Product Safety Data Sheet.



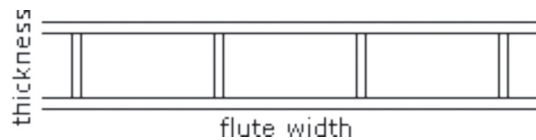
Technical Data

Polypropylene Physical Properties

Standard Nomenclature

Thickness/Weight
i.e. 4.0/700 = 4.0mm thick
x 700 gms/sq.m

Size i.e. 1000 x 1500
1000 = width across flutes
1500 = length of flutes



Range of flute widths available

Product Performance

The polypropylene used for the manufacture of Corriform has the following typical properties:

Physical Properties	method	unit	value
Density	ISO	g/cm ³	0.9
1183			
Mechanical Properties	method	unit	value
Flexural modulus	ISO	g/cm ³	1350
178			
Tensile strength	ISO	N/mm ²	27
Yield	R527		
Elongated at yield	ISO	%	8
R527			
Izod impact	ISO	Kj/m ²	40
(notched at 23°C)	180		
(notched at 20°C)	ISO	Kj/m ²	8
180			
Hardness Shore D	ISO	points	68
868			
Thermal Properties	method	unit	value
Vicat softening point	ISO	c	152
306/A			
HDT (0.46Mpa)	ISO	c	100
75/B			
Thermal expansions 1.05x10 ⁻⁴ mm/mm/c			

Standard Tolerances

Thickness		+ / - 0.5mm
Weight		+ 1.0%
Width		+ 1.0mm
Quantity (sheets per pallet)		+ 0.1%
Length (standard)		+15.0mm
	(hand trim)	- 0.0mm
Off Square (standard)		+ 1.0mm
Cross		15.0mm
Corners (hand trim)		1.0mm

Weathering

Corriform requiring extended life must be UV stabilised. Assuming normal weather conditions for the UK, stabilised Corriform will last from 5 to 7 years.

Filled Grades

Limestone (CaCo₃) filled for a cheaper and more ductile sheet. Talc filled greater rigidity and thermal stability.

Print Treating

Where Corriform is going to be printed on or glued to, it is necessary to etch both surfaces. This is done by Crona treating the surfaces during the extrusion. We guarantee a dyne level of 40 dynes/cm.

Conductive Corriform

Supplied in black only. Surface resistivity 10⁴ OHMS.

Anti-Static Corriform

Supplied in any grade, any colour. Surface resistivity 10¹⁰ OHMS.

Flame Retardant Grade

Corriform extruded with flame retardant additives and controlled by our ISO9002 procedures. Complies with:
- UL 94 method VO
- LPS 1207: Issue 1 – Fire requirements for protective covering materials LPCB Certificate No 341 a/01.

Technical Data

The Protective Element of Polypropylene

The base material (P.P.P.F.) is used in other applications, to act as a protective element where aqueous or mineral contaminants are present. CORRIFORM being manufactured from polypropylene has the same properties, which a positive benefit to the C.F.P.S.S. The following tests, carried out by Montel Chemicals, show the potential for the permanent shuttering system.

Leachate Sample - Chemical Analysis

Laboratory: Geochem Analytical Services (NAMAS Testing No 1291)

Date of receipt of sample 09/01/96.

CHEMICAL	UNITS	DETECTION METHOD	DETECTION LIMITS	DETECTION
Calcium	ppm	icp	< 0.05	98.87
Cadmium	ppm	icp	< 0.05	< 0.05
Chromium	ppm	icp	< 0.05	0.13
Copper	ppm	icp	< 0.05	< 0.05
Iron	ppm	icp	< 0.05	1.15
Mercury	ppm	icp	< 0.05	< 0.05
Magnesium	ppm	icp	< 0.05	137.20
Manganese	ppm	icp	< 0.05	0.60
Nickel	ppm	icp	< 0.05	0.15
Lead	ppm	icp	< 0.05	< 0.05
Zinc	ppm	icp	< 0.05	0.09
Chemical Oxygen Demand	ppm	Spectro	<10.00	3,299.00
Total Organic Nitrogen	ppm	Spectro	< 3.00	179.00
Biochemical Oxygen Demand	ppm	5 Day ATU	< 0.50	179.00
Ammoniacal Nitrogen In Water	ppm	Colour	< 0.01	860.00
Potassium	ppm	Flame P	< 3.00	328.00
Sodium	ppm	Flame P	< 3.00	2,802.00
Total Organic Carbon In Water	ppm	IR	< 1.00	868.00
Chloride	ppm	KONE	< 5.00	800.00
Nitrate	ppm	KONE	< 0.01	0.09
Nitrate	ppm	KONE	< 0.50	1.60
Sulphate	ppm	KONE	< 3.00	177.00
Electrical Conductivity	ms/cm	Meter	< 0.001	18.08
Ph Value In Water	-	Meter	< 0.01	7.52
Alkalinity Total	ppm(CaCO3)	Titration	< 1.00	8,760.00



Technical Data

The Protective Element of Polypropylene

CHEMICAL COMPATIBILITY OF F.P.P.- LIQUID IMMERSION @ 30°C (30 Days) SATISFACTORY

Acetic Acid (Glacial)	Chloroacetic Acid (25%)	Potassium Bi-Chromate (20%)
Acetic Anhydride (97%)	Citric Acid (33%)	Potassium Chloride (27%)
Acetone	Cupric Chloride (50%)	Potassium Hydroxide (50%)
Acrylonitrile	Di-Butyl Phthalate	Potassium Iodide (57%)
Aluminium Sulphate (38%)	Di-Octyl Phthalate	Potassium Phosphate (17%)
Ammonia Water (conc)	Ethyl Alcohol (Denatured)	Potassium Sulphate (11%)
Ammonium Chloride (30%)	Ferric Chloride (15%)	Propanol
Ammonium Nitrate (50%)	Ferric Sulphate (17%)	Sodium Chloride (25%)
Ammonium Phosphate (Monobasic)(20%)	Furfural	Sodium Hydroxide (46.5%)
Ammonium Phosphate (Di-Basic) (24%)	Glycerine	Sodium Hypochlorite (20%)
Ammonium Sulphate (43%)	Hydrochloric Acid	Sodium Nitrate (43%)
Amyl Alcohol	Hydrofluoric Acid (40%)	Sodium Phosphate (monobasic) (43%)
Aniline	Magnesium Chloride	Sodium Sulphate (40%)
Barium Chloride (27%)	Methyl Alcohol	Sodium Thiosulphate (45%)
Barium Hydroxide (20%)	Nickel Chloride (33%)	Sulphuric Acid (61.5%)
Benzyl Alcohol	Nickel Sulphate (50%)	Tannic Acid (10%)
Boric Acid (5%)	Nitric Acid (38%)	Tartaric Acid (20%)
Calcium Chloride (50%)	Oxalic Acid (10%)	Tin Chloride (62.5%)
	Phenol	Triethanolamine
	Phosphoric Acid (85%)	

NOT RECOMMENDED

Amyl Acetate	Formic Acid (99%)	Oil ASTM No. 2
N-Butanol	Iso-Butyraldehyde	Oil ASTM No. 3
Butyraldehyde	Iso-Propyl Ether	Propyl Ether
Chloroform	Linseed Oil	N-propyl nitrate
Chlorosulphonic Acid (98%)	Methyl Acetate	Pyridine
Chromic Acid (50%)	Methyl Ethyl Ketone	Sulphuric Acid (96%)
Cresol (Meta)	Methyl Isopropyl Ketone	Tetralin
Cyclohexane	Methyl Methacrylate	Toluene
Cyclohexanol	Nitric Acid (65%)	Tri-Butyl Phosphate
Decalin	Nitrobenzene	Vaseline Oil
Di-Ethyl Ether	N-n-Di-Methyl Formamide	Oleum
Ethyl Acetate	Oil ASTM No. 1	

Technical Data

Health and Safety

Hazard Summary

Corriform is a range of extruded fluted plastic boards based on Polypropylene/ethylene copolymer. Various grades of sheet may contain traces of process residues and may also contain minor amounts of materials such as antioxidants, anti-static, agents and UV additives. Special boards can contain large amounts of additives and the general comments made will also apply to these materials. Polypropylene has been safely used in large quantities and in a wide variety of applications since the early 1960s.

Corriform is chemically unreactive and is generally regarded as being biologically inert. There is no release of any noxious fumes from Corriform at ambient temperatures. Although Corriform is inert and can be regarded as harmless, certain boards do contain additives which could be harmful and any ingestion should be avoided. Corriform is not considered to be a skin sensitiser, but being fairly hard, cut edges can have an abrasive effect on the skin.

Coloured Grades

The pigments are totally encapsulated in the Corriform and thus the material does not present any unusual handling hazard.

When Corriform is heated in air, melting will occur at 165/170°C and decomposition will commence at about 330°C with the release of volatile, lower molecular weight hydrocarbons. These can be ignited by a flame or radiant heat source. Once ignition occurs, sufficient heat will be generated to continue decomposition and provided sufficient oxygen is present, burning

will continue, accompanied by the release of flaming, molten droplets of polymer.

Like many other organic materials, Corriform will burn to produce carbon monoxide, carbon dioxide, water and carbon (soot) along with a considerable number of breakdown and oxidation products normally in very low concentrations. These can include certain aldehydes such as formaldehyde and acrolein.

Should a fire involving Corriform occur, any commonly available extinguisher may be used. Powder extinguishers are very effective in quenching flames. Water sprays are especially effective in rapid cooling and damping down a fire.

Filled Grades

The fillers are totally encapsulated in the Corriform and thus the material does not present any unusual hazard.

Chemical resistance

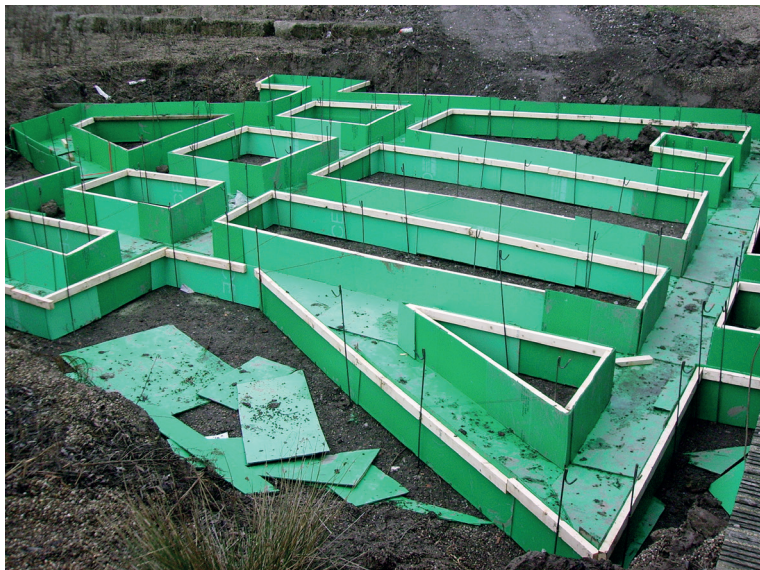
Not attacked by aqueous solutions of salts, acids and alkalis. Fats, oils and waxes cause only slight swelling. Up to 60 degrees C it is resistant to very many solvents: at higher temperatures it is dissolved by aromatic and halogenated hydrocarbons. It is not resistant to strong oxidising agents such as nitric acid, fuming sulphuric acid and halogens.



Technical Data

The Project Specific Systems

Unique shaped island



One Form

'Novel' shaped out of ground foundation. Slab edge toe beam.



Housing beam showing perfect stop end.



Portable building base showing out of ground installation without steel reinforcement.



GROUNDWORK
ENGINEERED SYSTEMS



Contact our technical department on
Telephone: 01457 863 444
Email: admin@groundworkeng.co.uk
