

Estimating Quantities

- Count the number of corners (both internal and external combined).
- Divide the wall height by 300mm and round up to the nearest whole number - this provides the number of courses.
- Multiply the number of courses by the number of corners - this will give you the total number of corner blocks (half will be left hand and half will be right hand blocks).
- Determine the total perimeter length including openings (P) in metres.
- Multiply the number of corners by 1.05 and subtract this from the perimeter length (P-C).
- Multiply this by the height of the wall - this provides the area of the wall ignoring openings (A_s).
- Calculate the area of the openings (O).
- To find the actual area of the wall, subtract the area of the openings from A_s ($A_w = A_s - O$)
- Multiply A_w by 2.77(blocks/m²) to determine the total number of straight blocks (we suggest adding 5-10% for wastage particularly if this is your first project.)

Helpful information:

Face Area of Straight Blocks = 0.36m²

Face Area of Corner Blocks = 0.315m²

The concrete volume can be calculated using the values below:

190 Series	0.036m ³ per block
250 Series	0.056m ³ per block
300 Series	0.072m ³ per block

Handling Instructions

Care must be taken at all times when handling Ambionse blocks, with particular attention given to not damaging the tongues or grooves or corner blocks. In order to contain the concrete and concrete moisture when pouring, clean, snug fitting joints are required. Damaged blocks should only be used in the top course, as the pressure from the concrete is not great. Ensure that the gaps in these blocks are well sealed with an adhesive expanding foam.

Do not allow solvents or hydrocarbon-based materials to come in contact with the Ambionse blocks, as they can cause permanent damage.

The blocks can be cut in any direction with a knife, handsaw, electric chain saw, jigsaw, or hot wire tool.

Getting Started

It is easier to work from the inside of the walls (on the slab) rather than from the outside, so it is a good idea that all tools and materials are placed on the slab, clear of the intended wall location. Because the product is bulky, make sure you have left enough space to store the packages on site.

The straight blocks are delivered unassembled in bags of eight blocks (16 sides) with the bridges in a separate bag. One bag of bridges will be enough for one bag of blocks. The corner blocks are delivered unassembled in bags of two blocks (2 inner and 2 outer sides) with the correct number of bridges included. One person can easily handle these bags.

Adhesive Expanding Foam

Non-solvent adhesive expanding foams can help speed up construction by eliminating extra fixing down of the blocks. These foams add very little cost to your job and may even save you money by saving you time. Adhesive expanding foam suitable for use with Ambionse is available from Styrobeck Plastics.

Expanding foam should be used for the following applications:

- Bottom course - to hold the alignment of the blocks during construction and seal the base of the wall during concrete placement.
- Service penetrations - to secure and seal service penetrations.

- Cut joints - to stop any movement of the blocks or parts of blocks where the blocks are cut and the tongues and grooves do not match.

It is suggested that with the exception of the first course and where impractical, sealing of the blocks with expanding foam be done on completion of the stacking of the blocks at least a couple of hours before the concrete pour. This allows simplified correction of the wall alignment.

Assembling the blocks

Moulded into the polystyrene sides of the straight Ambionse blocks are eight bridge holders. These are the connection points for the bridges and the length of the bridge determines the width of the Ambionse block. The 90mm bridge produces the 190mm Series, the 150mm bridge creates the 250 Series block and the 200mm bridge creates the 300 Series. (The side panels of all the series are the same.)

To assemble the blocks place a pair of block sides facing each other with the open end of the bridge holder upwards. Push the correct bridges, with the arrows pointing down, into the holders. They need to be pushed all the way into both sides at the same time until distinct "clicks" are heard indicating a tight fit. Insert the bridges into the end holders first to make sure that the remaining holders line up correctly.

For the corner blocks, follow the basic method described above but the 190 Series block requires five (5) bridges while the 250 Series block has four (4) bridges. The outside panel is interchangeable for both Series, but the inside panel is unique to each Series. There are no corner blocks available for the 300 Series.

Foundation

The crucial first step is getting the foundation correct as a level foundation will avoid having to pack or trim the blocks to get a level wall. Spend an extra 10 minutes to get the footings correct and it will save countless hours later on. For house construction, this is easily achieved by building the Ambionse wall on top of a concrete floor slab with starter bars installed. The slab can then also be used as an anchor for the bracing system.

For other walls, the footings should be level and smooth. This is basic good practice because getting this right will save you time and potential problems during the wall installation.

Footings

Strip footings can be formed with Ambionse blocks. Simply create a header block by trimming 100mm from the top of one of the sides of an Ambionse block. These header blocks should be 300mm high to ensure that the bridges are complete and are able to withstand the forces exerted by the concrete. The top of the foundation pad should be a multiple of 300mm from the top of the slab. The CAD drawings show full details.

Where the ground is sloping, the best approach is to step the footings in increments of 300mm, so the blocks can then be placed horizontally. It is not acceptable to place the blocks on an angle for the footing. Ensure that the top surface of the foundation concrete is smoothed off to avoid having to trim the blocks in order to get a level wall.

First Course

Before laying the blocks, it is a good idea to mark out on the slab the locations of the door, windows and other openings for future reference. This can be helpful when laying out the first course particularly in showing you where cuts are required. Make sure the area where the walls are to be placed is clear of dirt and debris.

Always start placing the blocks at a corner and cutting the straight blocks as necessary at the door opening as each side meets. It may pay to have a couple of attempts at laying out the wall to minimise cutting and wastage. To construct a square and level wall, it is the first two courses that are the most important. Once those two courses are in place, level them up to the highest point in the slab, packing

with wedges as appropriate. Ensure the blocks are straight and true (check with a level) and use the adhesive expanding foam to seal and fix to the footing/slab. (Sand/cement mortar has been used in the past, but experience has shown that it is not the most effective).

Cutting and Trimming

Cut only the straight blocks; do not cut the corner units. This is because the pressure from the concrete is greatest at the corners and the blocks need to be complete to contain the concrete.

When cutting or trimming an Ambionse block try not to allow the shavings to fall into the cavity as this can weaken the joint between the wall and the floor/footings. Wherever you need to cut the blocks, seal the joint to prevent the concrete from leaking. On the outside of the blocks are vertical ridges. Use these to line up the vertical cuts. When a vertical cut is more than 75mm away from a flange, the block may need extra bracing or strapping to contain the concrete pressure.

Do not immediately throw away an off-cut as it could be used in another section of the wall particularly if it has at least one bridge remaining. When the specification requires the cutting of a lot of the blocks horizontally (such as non-modular height), it is recommended that a table saw be used for a consistent cut. However, a handsaw will serve the purpose just as well, although it may be more work. A handsaw is therefore more suited for small sections that require horizontal cuts. Vertical cuts can be made with a handsaw or easily trimmed with a knife. If using a circular saw, it is recommended to reverse the saw blade as a safety tip to prevent the saw catching on the bridge of the block.

As the wall builds up, try to maintain the same laying pattern. This will make the locations of cuts in all courses be in the same general location. This will help with fixing of claddings and linings to the blocks and the construction of the wall easier. It will also allow you to brace the wall in the location of the cuts as these can be potential weak spots. Major changes in the location of the cuts as you are stacking could cause the walls to go out of square and become uneven.

Building the Rest of the Wall

To build the second and successive courses align the female groove on the bottom of the block onto the male tongue on the top of the block. The blocks should fit together snugly and do not require any adhesive. The groove on the bottom of the blocks should be clear of debris and not damaged because this could make joining the course difficult. Start at the same corner as in the first course by placing the opposite corner block on top as shown in the picture alongside. This will force the correct offset between courses. The blocks should be stacked up in a running bond pattern with vertical joints staggered by at least 150mm as allowed by the castellations in the tongue.

Routinely check the wall with a level to confirm it is square and true. Push each course of the Ambionse blocks down snugly into the previous course. This will ensure that there is no creep in wall height causing delays to trim the top course.

The maximum recommended height an Ambionse wall can be built to before pouring is 3.3m (11 courses). The wall should be built up to full height and the concrete poured in a number of lifts (usually two), with each lift being a maximum of 1500mm. Allow at least 30 minutes between lifts to allow the concrete to begin to set-up, reducing the pressure on the bottom courses. Typically once the first lift is poured around the entire job, there has been sufficient time to start on the next lift.

Some choose to stack the blocks up to 1500mm and pour the concrete, then complete the wall after the first stage has cured. This will create a horizontal construction joint that may or may not be critical to the design, so always check first with the designer. When using this method it is a good idea to finish the pour 100mm below the top of the blocks. This helps to allow a snug joint to the next course of blocks.

Reinforcing Steel

Place all the required vertical and horizontal reinforcing steel in accordance with the design and tie at intersections or joints. Placing horizontal bar in the first course and tying it to the starter rods will ensure the wall base blocks are firmly held to the foundation. The reinforcing bars should be placed

securely in the scallops within the polypropylene bridge and as close to the centre of the concrete cavity as possible. All reinforcing steel should be placed in accordance with NZS 3109:1997.

Bracing

Once the concrete has cured, the wall cannot be adjusted or straightened, so it is crucial that bracing is in place prior to the concrete pour. Braces designed specifically for the Ambionse wall are available for hire. These braces have a strong vertical channel section that can attach to the wall at multiple locations, and an angled prop support. The vertical section should be screw-fixed to the wall at least at every second course. The bottom two courses (at each pour level) should be screw-fixed at the top and bottom of the blocks, but the remaining courses only need one screw. This double fixing helps prevent localised rolling of the blocks during the concrete pour

Normally the braces are installed after the third or fourth course of blocks. We suggest placing the braces at no more than 1200mm centres along the wall, but this spacing should be reduced for long walls. Place the vertical channel against the wall and attach with screws into the flanges. Do not attempt to fix to the polystyrene. Because the blocks can settle during the concrete pour, place the screws in the top of the slot in the strongback and do not over-tighten the screws. This will allow the wall to settle and not get stuck on the braces.

Securely fix the brace to the floor slab with concrete screws or anchors. When fixing to the slab, drill the hole extra deep so that when removing the braces, the anchor bolt can be driven home leaving the surface flush. The prop is designed to allow for fine adjustment of the wall alignment.

When building over 3m high we recommend installing a horizontal strongback along the top course prior to fixing the vertical supports. This helps keep the wall straight and the top in line with the bottom. Once again check the wall and make sure it is braced square.

When building a retaining or other wall not on top of a concrete slab, it may be easier to use build a timber frame in the same style described above to brace the wall.

Non 90° corners, short walls, corners within 1m of openings, cut blocks and steps in floor level require extra attention. These areas potentially can be problems and need to be braced well (i.e. at closer centres and/or using plywood).

Blank Ends

Where the wall is required to finish with a vertical edge (such as opening or end of a wall), install blank ends to hold back the concrete. It is a good idea to extend the blocks past the blank end and install one more bridge. This will keep the blocks from expanding out at the end, forcing a bulge in the wall and possible concrete leakage. The extra polystyrene can be trimmed off later after the concrete has cured.

Window & Door Openings

There are many ways to form the openings in an ICF wall and this method is the simplest that we have discovered. Full details for forming the openings can be found in the CAD details in Section 9. All timber used in contact with the wet concrete should be preservative treated.

Cut the blocks as the construction progresses and install blank ends as detailed previously. (Cutting the opening out once the wall is ready for the concrete pour is best suited for smaller openings for services and the like). Also install timber blank ends in the jamb at the top and bottom and at a maximum of 600mm centre spacings. These are to provide structural fixing locations for the timber rebate. Install skewed and/or bent galvanised nails in the timber to set into the concrete.

Use the Ambionse Sill Block to form the sloping sill and the rebate into which the window can be fixed. Simply cut the Sill Block to suit the length of the opening. After the concrete is poured, but not cured, place the Sill Block in position and fix with adhesive expanding foam along both the front and back. Install timber blocks in the holes in the Sill Block and attach to the wet concrete with some skewed and bent galvanised nails. These blocks are to provide a structural connection between the joinery and the concrete core of the wall.

To prevent buckling of the lintels, use the braces at closer centres and attach timber to the channel section of the braces to support the head formwork. This formwork can also form the head rebate in the concrete.

Lintels

Lintels should be formed with a reinforcing cage as per the design. The continuous reinforcing along the top of the wall can be considered to be the top lintel bar if it exceeds the size of the required top lintel bar.

Install the bottom bar with stirrups attached then place the top Ambionse block over. Tie the stirrups to the top reinforcing bar in order to locate the lintel cage. The reinforcing must extend a minimum of 400mm beyond the edge of the opening or as specified.

Arches

Arches can easily be formed using thin plywood or steel. The Drawing CWO-AO in Section 9 has full details. Form a rectangular opening in the usual manner with the head level with the bottom of the start of the arch. Mark out and cut the Ambionse blocks to suit the curve of the arch and remove but do not discard the off-cuts. Place the steel or plywood at the top of the curve and replace the polystyrene crescent shape to support it and support the crescent with timber attached to the braces in the usual manner. Once the concrete has been cured, the plywood/steel can be removed leaving a perfect arch.

Services & Penetrations

In some instances electrical, plumbing, ventilation and other services are required to penetrate right through the wall. The maximum allowable non-specific dimension of such openings is 400mm x 400mm (should larger holes be required, refer to specific engineering design as reinforcing will be required). Holes should be cut into both sides of the polystyrene and a sleeve placed through prior to placing the concrete. This will create voids where services can be passed through at a later date. Seal around the opening with an adhesive expanding foam. Make sure that when finishing, these penetrations are watertight to prevent concrete leakage.

Electrical and other wiring along with piping for various services if under 40mm diameter can be notched out of the polystyrene sides after the concrete has been poured and cured, and if required, fixed in the chase cut with adhesive expanding foam. All switchboxes should be installed flush with the surface of the polystyrene. If they are placed before the concrete is poured, ensure that there are no holes from which concrete could leak.

Service ducts can also be installed within the concrete core. Obviously this needs to be done before pouring the concrete. For maintenance reasons however, it is not wise to run plumbing pipes within the concrete core. Install these in chase cuts only. All electrical wiring intended to run in chase cuts in the polystyrene should be compatible with EPS otherwise housed within conduits.

Curved Walls

To create curves, sections of the polystyrene on the inside of the curve need to be cut out (see diagram alongside). All cuts should be evenly spaced along the block but avoiding the flanges and bridges.

Regardless of the radius specified, the vertical tongue and groove joint on the ends of the blocks may require additional sealing and support. Since the block integrity is reduced by the cuts, the curves will require additional bracing to resist the concrete pressure during the pour. Ensure that the curve is fully sealed and braced before pouring the concrete.

Intersecting Walls

Where two Ambionse walls intersect, the blocks should be stacked together with the polystyrene side on the continuous wall cut to allow the concrete to flow into the adjoining wall. The reinforcement should be placed as designed, as this is the key support. The outside of the junction also needs to be

supported with a brace, as the pressure from the concrete typically is high at this point. The vertical joint should be sealed against concrete leakage.

Gable Ends

To form a gable end, trim the edge of the Ambionse blocks to match the required slope and place a full row of Ambionse blocks on the top. Fix this course of blocks down with adhesive expanding foam and ensure that sufficient fixings to the braces are available. This top sloped course allows for continuous reinforcing along the top of the gable. Support the edge of the trimmed blocks with timber and install plywood where necessary to help hold the concrete in. Once the concrete has cured, the timber can be removed.

Preparation for Pouring

Prior to pouring concrete the stacked blocks must be checked that they are even and tightly fit, perfectly plumb, straight and have no holes for concrete to escape during pouring. Attach the required stringer or ribbon plates etc before pouring. Apply tape the top of the wall to protect the top of the Ambionse block from being covered in concrete. This creates a clean surface making it easy to begin the next level or finishing off.

If required, push the brick ties for the stone or brick veneer through the polystyrene into the core before the concrete pour. Make sure there is sufficient length of tie exposed for embedding into the concrete.

Check that all bracing is fixed and aligned. Ensure that all supports around openings are lined up with the wall. Resist pouring the walls before you're really ready. If the job is large, consider adding one day to the date you think you'll be ready. It is better to spend an extra day to have everything completed straight and level than to be rushed around.

Concrete

We recommend a 20MPa, 10mm aggregate pump mix with a 120-150mm slump for an Ambionse wall. Do not add water to the concrete or attempt to pour concrete that is too wet or you will increase your chances of having a leakage.

Begin placing the concrete below window openings by placing the concrete through the sill until the concrete has filled the section under the window. Then pour on either side of the openings from the top of the wall, but not closer than 600mm to a corner. Pour the walls in lifts not exceeding 1500mm. It's important to pour carefully to avoid any voids in the walls, so pay careful attention around window and door areas. Voids in the concrete can create holes for the sound to "leak" through, dramatically reducing the sound insulation effectiveness (not to mention the structural impact a void can have).

When pumping, the flow of concrete should be directed onto the horizontal steel thus reducing the pressure on the sides of the Ambionse blocks. The concrete should never be aimed directly into a corner. Slowly work your way around the wall in a consistent direction. Once the entire wall has been filled to the specified lift height, and the allocated time has elapsed, begin on the next pour, repeating the same steps as many times as necessary to fill the wall.

During pouring continually check that the wall does not go out of alignment. Slight adjustments can be made to the braces as necessary. Do not use a vibrator to compact the concrete as this can damage the Ambionse blocks, causing a leakage. Concrete must only be worked by rodding and tapping.

After Pouring

A very important and often overlooked step is realigning the walls immediately after the pour. It is possible for the walls to move a little during the pour even with bracing. Make sure that the walls are not only vertical, but straight along the footing line. Check that the top of the Ambionse wall is free from concrete debris.

If the wall is constructed in two separate lifts, the concrete should not be finished smooth. In fact, it is better to leave the top half of the Ambionse block unfilled in order to have the bridge partly exposed. This helps create a good bond between the successive lifts of concrete, and makes it easier to lay the most course of blocks.

When the wall is filled to its completed height, the concrete needs to be finished or smoothed off. For a retaining or other wall that is left exposed, the concrete can simply be finished flat. For house construction, normally a top plate is required to connect the floor or roof members to the wall. This top plate is fixed into the concrete typically with anchor bolts. This should be fixed into the top of the wall while the concrete is still wet. Refer to the Design for full connection details.

To prevent thermal bridging, the top plate can be installed between the polystyrene sides of the wall. To create a suitable void in the top of the concrete for this top plate, make a trowel of plywood with a section of the top plate attached to the bottom. The plywood will act as a guide along the top of the wall and the plate creates a void of the perfect dimensions into which can be placed the top plate as shown in the diagram alongside. Anchor bolts need to be installed as required by the Design.

The bracing can be removed when the concrete has cured sufficiently (usually 3-4 days), and if you've followed all of the installation steps the next floor walls should go up without any problems.

Before returning the hired braces ensure that the threads on the braces are free of concrete and the turnbuckle is at its midpoint. Check that the turnbuckle can easily move on the thread. Also spray a lubricant on the thread to reduce the likelihood of rusting.

Internal Linings

The New Zealand Building Code requires that polystyrene be protected from the internal living space by a 10-minute flame barrier. The simplest method of achieving this is with Gib® Plasterboard of at least 10mm mechanically fixed to the Ambionse flanges. Glue fixing alone is not suitable, as there is no guarantee that the adhesion will last the specified time. However, adhesive is suitable in conjunction with screw fixing as it will reduce the "drumminess" of the wall.

At the time of print we are not aware of any other products that are suitable for lining the internal face of an Ambionse wall. Please consult the manufacturers' information, should you wish to use a product other than plasterboard.

Heavy Objects

Heavy objects such as kitchen cabinets should not be hung directly from screws simply fixed through the plasterboard into the plastic flanges. This will put undue strain on a few flanges and create a potential hazard.

One method to fix heavy objects is to use the same thickness plywood in lieu of the plasterboard in those areas covered by the object. Alternatively, make chase cuts into the polystyrene and install timber sections and fix with concrete anchor-type connectors. The cabinetry can simply be fixed to these sections as normal. All it takes is a little planning ahead. For extreme cases, install a sheet of 2-3mm steel under the plasterboard in the general area of the object to be fixed. When fixing through this metal, the load is spread across a number of flanges and the plasterboard. By spreading the load this way also provides unlimited fastening locations.

External Finishing

For ease of construction the Ambionse wall should be protected soon after installation otherwise a yellowish powder on the exposed surface tends to form due to ultraviolet radiation. However, this is only critical when applying adhesives or plaster coatings. Simple brushing or washing can remove this powder. When using mechanical fasteners (screw fixing), the powder doesn't have to be removed, as it has no detrimental effects on the claddings or linings.

Modified acrylic plaster can be applied to the Ambionse wall in the same manner as with proprietary EIFS claddings for timber frame buildings. Refer to the manufacturer for full installation information.

Masonry, brick or stone veneers can be fixed to the Ambionse wall in two ways. The first method is to use concrete brick ties that are inserted through the EPS sides of the block into the void. The concrete will form around these securely fixing them in place. Care should be taken because the ties are unforgiving and stick out from the wall and can cause injuries. The other method is to screw fix ties into the flanges. Refer to the manufacturers' instructions for the preferred approach.

Manufactured weatherboards and the like can also be fixed to the wall by screw fixing to the plastic flanges. Timber weatherboards should not be used due to the uneven movement that can be experience.. For proprietary products, refer to the manufacturer for full installation requirements.

Connection to midfloors

When installing the stringer or ribbon plate, cut openings in the Ambionse blocks at the fixing locations of the stringer or ribbon plates. This allows for the installation of the concrete ties/bolts. Cut the opening in the blocks at a 45°angle inside to reduce the shear stress in the concrete. Either install the stringer before the concrete is poured and use rag bolts or block off these openings and install the stringer at a later time with drilled fixings. Install a moisture barrier such as DPC between the timber stringer and the concrete as per normal construction practice.