

BlockAid[®]

BAR CHAIRS for BLOCK WORK

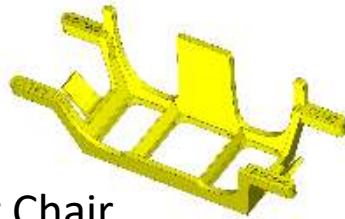
**THE ROLE OF BAR CHAIRS IN ACHIEVING
COMPLIANCE OF REINFORCED MASONRY**

Prepared by BlockAid Pty Ltd

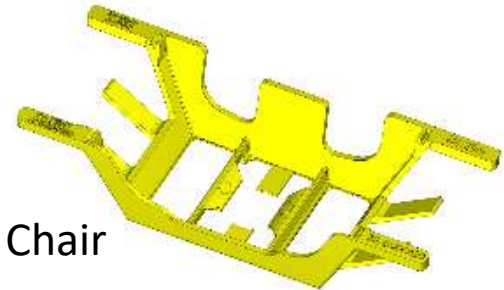
ABOUT BLOCKAID

BlockAid is a Maitland based company that has designed an innovative range of plastic bar chairs.

BlockAid has bar chairs for 150 series, 200 series and 300 series blocks.



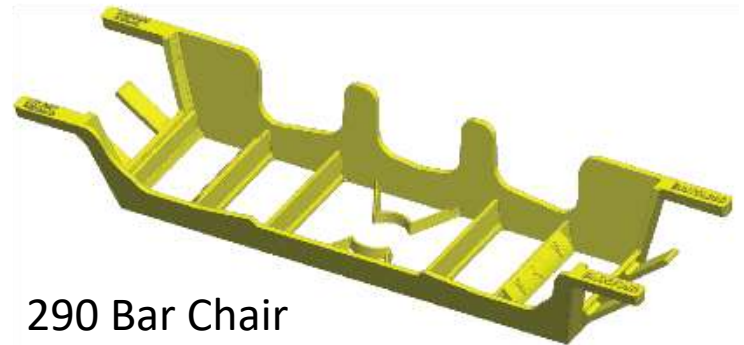
150 Bar Chair



190 Bar Chair

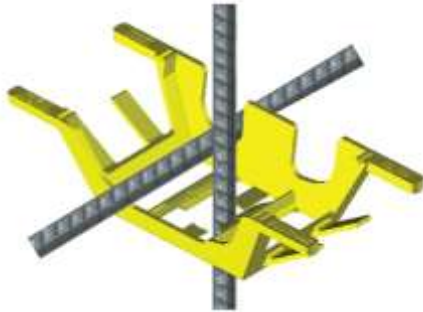


190 Bar Chair



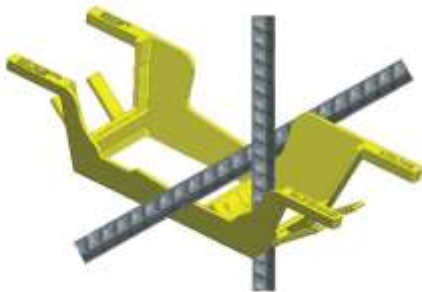
290 Bar Chair

INCEPTION OF BLOCKAID BAR CHAIRS



BlockAid set about designing bar chairs to provide a simple means to achieve compliance.

All other concrete structures use bar chairs.



BlockAid bar chairs are designed to locate the horizontal as each course is laid.

WHY CONSTRUCTION METHODS NEED IMPROVEMENT

These pictures are from of a multi storey masonry construction in Newcastle in March 2021 where the vertical reinforcement should be central in the core.



**THESE WALLS WILL NOT
ACHIEVE THE DESIGN LIFE
OF MASONRY AND WILL
START TO DEGRADE
FROM DAY ONE!**



THE COST OF NON-COMPLIANT CONSTRUCTION







The Sydney Morning Herald article “Towers of Trouble” from 1 December 2001 raised the issue of building defects and failures in Sydney apartment blocks.

The British Standards Committee report on the Durability of Reinforced Concrete found that the **incorrect placement of reinforcement in concrete structures** was costing the United Kingdom **1.5 million pounds per day in 1999**.

[Durability of Reinforced Concrete By Chris Shaw CEng FICE FIET MStructE MCMI Consultant, and Chairman, British Standard 7973 committee]

A study conducted by BlockAid of Reinforced Masonry walls using a *Profoscope Rebar Detector and Covermeter*, failed to find any masonry walls with compliant reinforcement.

EXAMPLES OF NON-COMPLIANT CONSTRUCTION

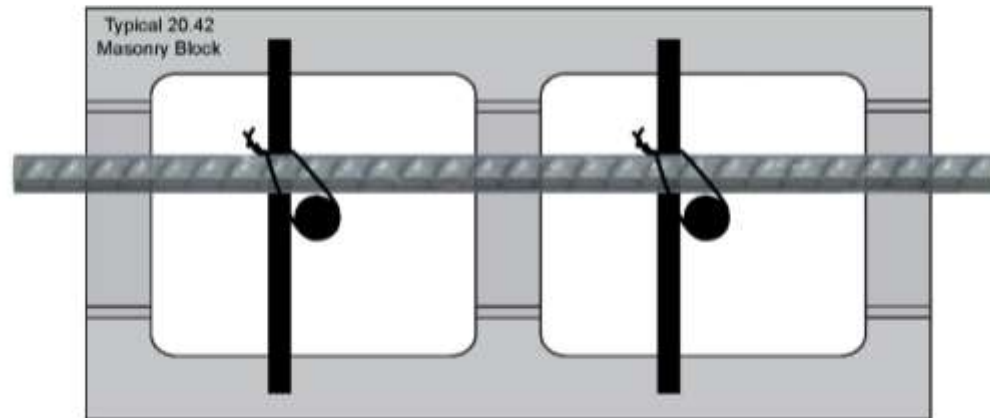
RM WALL IMAGE	PROFOSCOPE READING	DETAILS OF RM WALL STRUCTURE
		<p>Soul Tower, Surfers Paradise Basement Car Park Wall less than 1 kilometre from the surf beach - Severe Marine Environment The required distance from exposed block face to vertical reinforcement is a minimum of 62mm</p> <p>Actual distance from block face to reinforcement measured at 44mm, therefore non-compliant</p>
		<p>Gold Coast Convention & Exhibition Centre Basement Car Park Wall less than 1 kilometre from the surf beach - Severe Marine Environment The required distance from exposed block face to vertical reinforcement is a minimum of 62mm</p> <p>Actual distance from block face to reinforcement measured from 41mm to 44mm, therefore non-compliant</p>
		<p>Pacific Fair Shopping Centre, Surfers Paradise Car Park Wall less than 1 kilometre from the surf beach - Severe Marine Environment The required distance from exposed block face to vertical reinforcement is a minimum of 62mm</p> <p>Actual distance from block face to reinforcement measured from 32mm to 36mm, therefore non-compliant</p>

CONSTRUCTION METHODS

AS3700:2018 requires the vertical reinforcement to be central in the core.

NCC:2019 requires the use of 6mm round bar cross ties to rate as RM.

**VERTICAL REINFORCEMENT TO BE LATERALLY RESTRAINED
IN BOTH DIRECTIONS WITH 6mm ROUND BAR CROSS TIES**



CONSTRUCTION METHODS

NCC:2019 states “All reinforcement must be firmly fixed in place to prevent it moving during concreting operations.”.

Currently, compliance relies on the diligence of the masonry contractor to correctly install and secure the reinforcement.

BlockAid Bar Chairs give the mason a means to ensure the horizontal reinforcement is correctly placed and the vertical reinforcement can be inserted through the bar chairs in one length, and held secure.



CONSTRUCTION METHODS

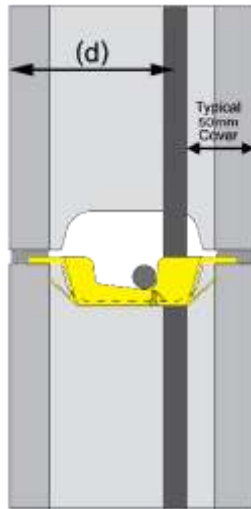


Another common method of construction is to insert the vertical reinforcement into the block core after grout filling.

The accuracy of the vertical is dependent on the position of the horizontal bars.

Without locating the horizontal in each course, the main reinforcement is unlikely to be compliant.

CONSTRUCTION METHODS



Due to these unsatisfactory construction methods, the expected load capacity of the reinforced masonry in compression may not be achieved.

When the reinforcement is against the block shell face, the durability of the structure is significantly reduced.

In reinforced masonry under out-of-plane loading, the placement of the horizontal steel is critical to achieve grout cover.

BAR CHAIRS PASS THE TEST



Testing by the Queensland University of Technology (QUT) found that BlockAid Bar Chairs make the construction of Reinforced Masonry walls more efficient.

The QUT tests show that BlockAid Bar chairs are a **Deemed to Satisfy Solution** that meets the **Performance Requirements** of Reinforced Masonry under NCC:2019.

Additionally, masons will save up to 20% in construction time when using bar chairs.

QUT VALIDATION OF BLOCKAID BAR CHAIRS



The QUT tests compared walls built with BlockAid bar chairs to walls built with 6mm cross ties.

The tests proved that BlockAid bar chairs ensure the straightness and secure positioning of the reinforcement.

BlockAid bar chairs performed equally to 6mm round bar cross ties.

Under eccentric compression, the tensile strain in bars was much lower in the BlockAid bar chair wall than the 6mm cross tie wall.

The mason took considerably longer to build the 6mm cross tie walls than to build the BlockAid bar chair walls.

The QUT test results determined that BlockAid bar chairs provide a safety factor of 2.6 times the calculated compressive strength.

BlockAid bar chairs expedite construction of Reinforced Masonry.

UON VALIDATION OF BLOCKAID BAR CHAIRS



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

The University of Newcastle (UON) conducted a time and motion study that found by using BlockAid bar chairs in masonry construction, a time saving of 10% was achieved over Conventional Practice.

The use of BlockAid bar chairs was of significant assistance in achieving the correct location of both horizontal and vertical reinforcement.

BAR CHAIR ENDORSEMENT

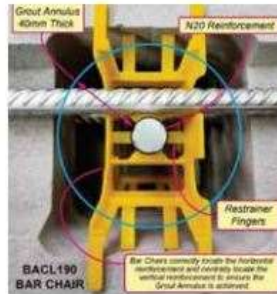


Site Practices and Quality – Positioning in Reinforced Masonry Step 3 of Reo Quality Chain

Masonry Construction should also use bar chairs & spacers for locating reo accurately. AS 3700 refers to Clause 17.2.5 of AS 3600 which states:

- ➔ “Bar chairs and spacers used for this purpose shall conform with AS/NZS 2425 and be specified with a strength grade and spacing, to support the mass of reinforcement and applied construction loads.”

Below is a proprietary example of acceptable practice to maintain bars in correct position. Quality construction with a grout annulus $\geq 2d_b$ dia. (Clause 3.5, AS 3700) is crucial if the reinforcement has been included as providing additional compressive capacity.



Non-complaint bar locations

Plastic spacer example as an alternative to 6 mm round bar 'cross ties' in AS 3700 (images from BlockAid marketing materials)



BAR CHAIR ENDORSEMENT



“The use of bar chairs in masonry construction is an effective tool to ensure steel reinforcing positioning.”

AS 3700 (2018) 'MASONRY STRUCTURES' REINFORCED MASONRY UNDER COMPRESSION

AS 3700 (2018) states that the vertical reinforcement must be surrounded by an annulus of grout of at least two times the diameter of horizontal reinforcement

This provision is extremely important to adhere to the construction practise, and products such as bar chairs, spacers and/or tie wires can assist in achieving this.

BAR CHAIR ENDORSEMENT

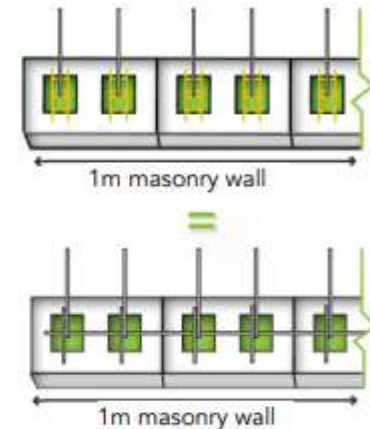


DESIGN OPTIONS

When designing for a reinforced masonry element as depicted in the images below, practitioners can adopt the following approaches.

OPTION 4: DESIGN AS REINFORCED MASONRY ELEMENT (WITH BAR CHAIRS)^[2]

- Achieves required capacity based on research; and
- Design as a performance solution through expert judgment.
 - **Requires certification by Professional Engineer**
- Cost-effective and time-saving option



Reference

- [1] Dhanasekar, M 2017, 'An Investigation of the Effectiveness of the Vertical Steel In Reinforced Masonry under Compression', Queensland University of Technology.
[2] Zahra, T 2020, 'Influence of BlockAid Chairs on Compression & Out-of-Plane Behaviour of Reinforced Masonry Walls', Queensland University of Technology.

BAR CHAIR ENDORSEMENT

Masonry Bar Chairs have received testimonials from a number of builders and engineers involved in masonry block wall construction:

Evan Graham Master Builder

Rabin Chand, BDEA Consulting

Graeme Holmes, Forum Consulting Engineers

Hancock & Owen Services

NON-COMPLIANT CONSTRUCTION



The effect of non-compliant construction is passed along the line of all stakeholders of reinforced masonry.

The masonry block layer

The building surveyor

The builder

The design engineer

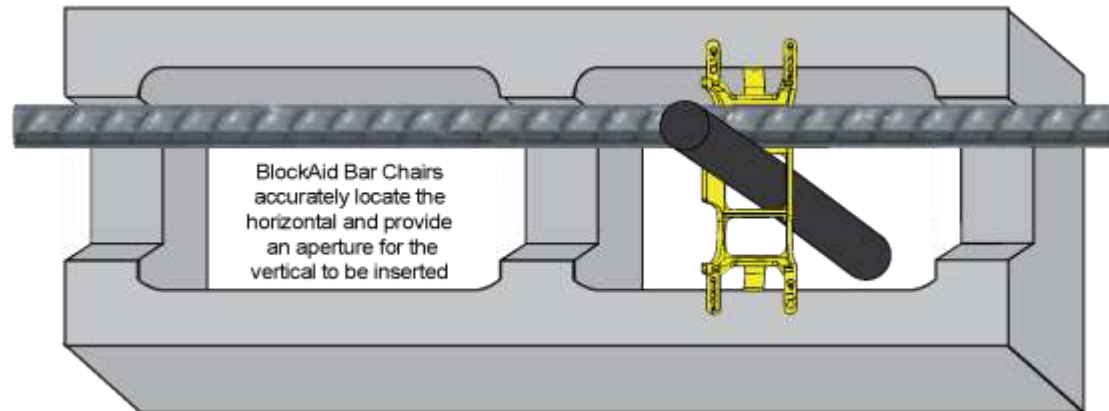
The customer or ultimate owner of the masonry structure



BlockAid bar chairs are available for four applications:

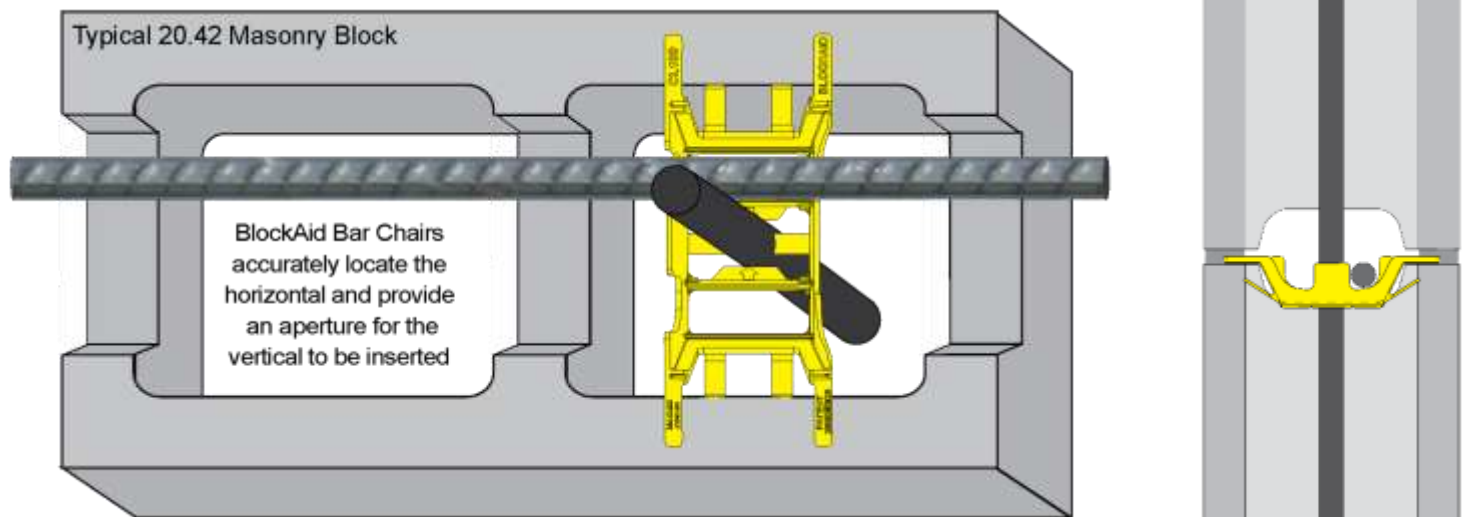
BACL140 BLOCKAID BAR CHAIRS **("CL" DENOTES CENTRALLY LOCATED)**

The BACL140 bar chair locates the horizontal and vertical reinforcement for masonry under a compression load where the vertical steel must be central and surrounded by an annulus of grout 2 times the diameter of the reinforcing steel.



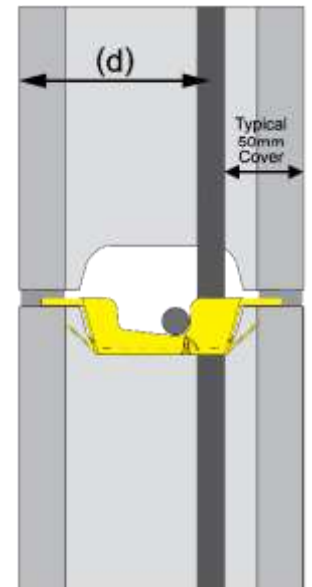
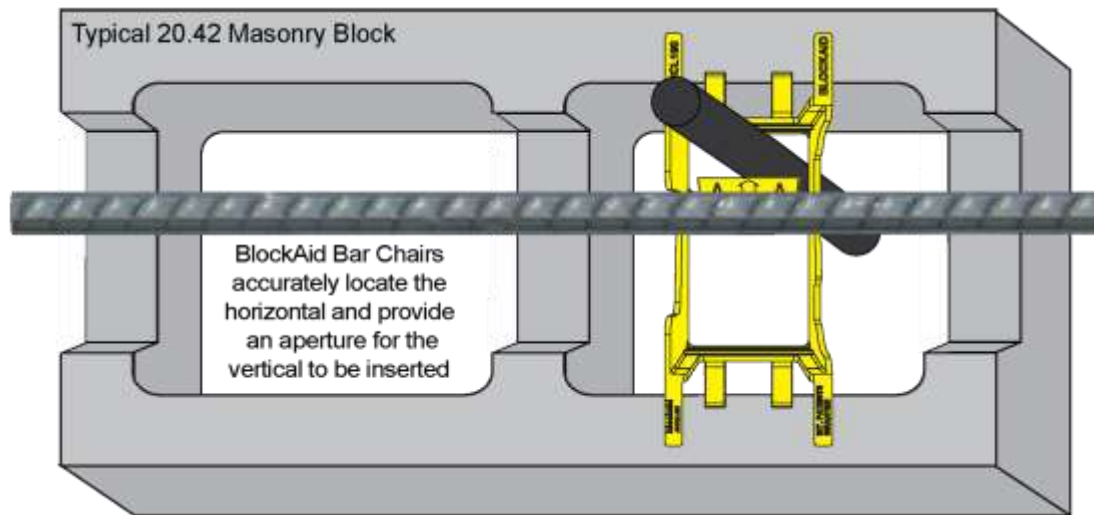
BACL190 BLOCKAID BAR CHAIRS ("CL" DENOTES CENTRALLY LOCATED)

The BACL190 bar chair locates the horizontal and vertical reinforcement for masonry under a compression load where the vertical steel must be central and surrounded by an annulus of grout 2 times the diameter of the reinforcing steel.



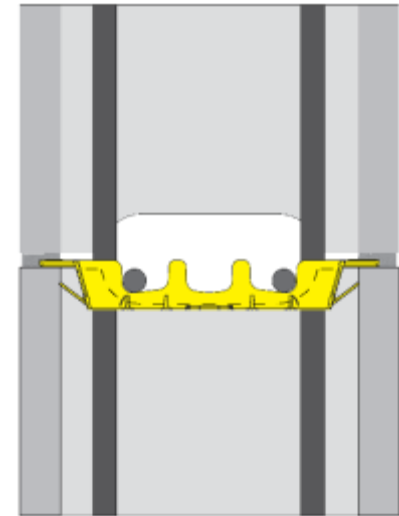
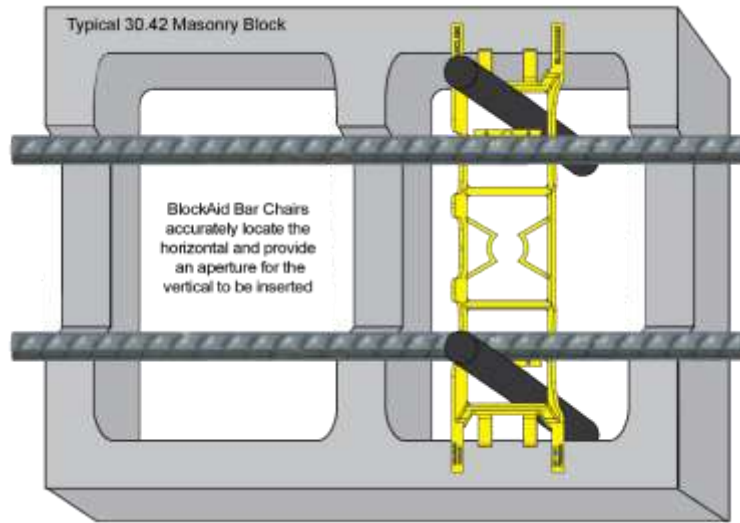
BANCL190 BLOCKAID BAR CHAIRS ("NCL" DENOTES NON-CENTRALLY LOCATED)

The BANCL190 bar chair locates the horizontal and vertical reinforcement for masonry under Out-of-Plane loads where the vertical steel needs to be placed to achieve the effective depth (d) as specified.



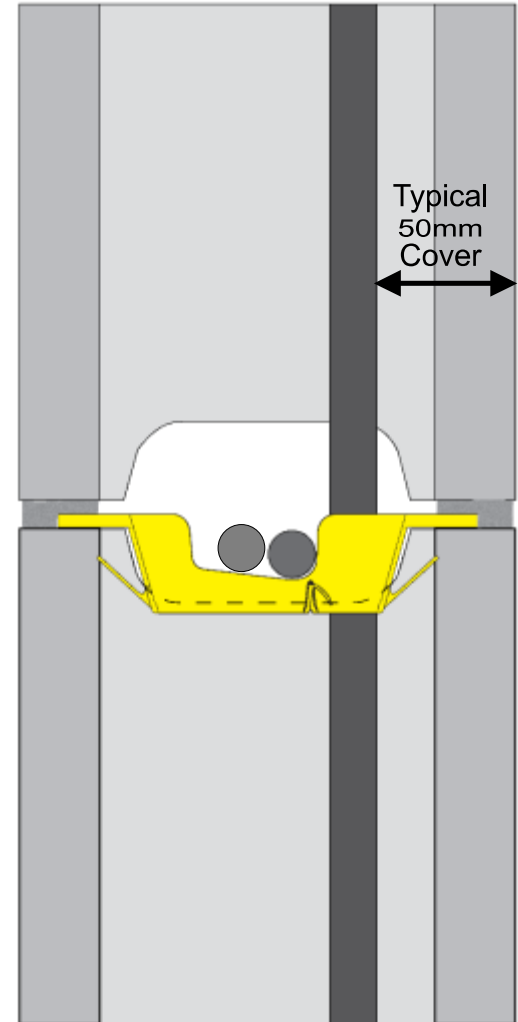
BANCL290 BLOCKAID BAR CHAIRS **(“NCL” DENOTES NON-CENTRALLY LOCATED)**

The BANCL290 bar chair for 300 series blocks locates the horizontal and vertical reinforcement for masonry under Out-of-Plane loads where the vertical steel needs to achieve the effective depth as prescribed.



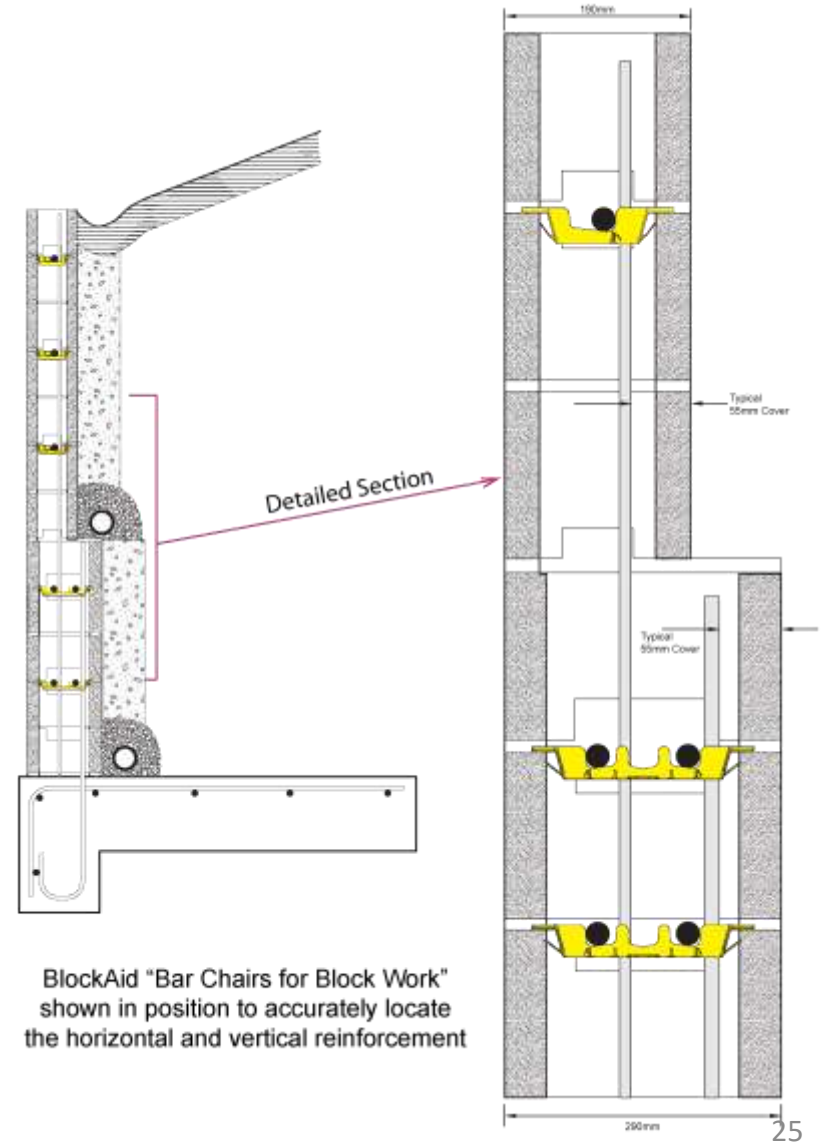
BLOCKAID BAR CHAIR INSTALLATION

BlockAid bar chairs support the horizontal off the web to ensure full grout cover around the horizontal, when using closed end blocks. It is recommended to invert the block above the reinforcement as shown.



TYPICAL REINFORCED MASONRY RETAINING WALL

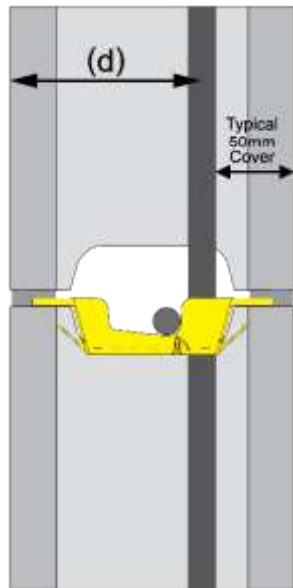
BlockAid bar chairs BANCL190 and BANCL290 combine together to provide compliant retaining walls when using 200 and 300 series blocks.



BLOCKAID BAR CHAIRS



The use of BlockAid bar chairs will provide contractors the ability to ensure the vertical steel is positioned centrally, as intended by the designer.



It is equally important with masonry under out-of-plane loads to use bar chairs to ensure the “d” value for bending and shear design is attained.

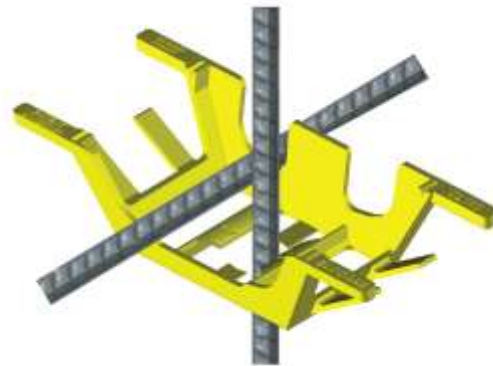
The guaranteed positioning of the steel can provide greater confidence in the long-term durability of the structure.

ADOPTING BLOCKAID BAR CHAIRS

Builders we've spoken to are receptive to the use of bar chairs, especially in NSW, since designers and builders are required to sign a declaration under the new Design & Building Practitioners Act 2020, that became effective from 1 July 2021.

Feedback from builders is that bar chairs need to be specified in the plans by engineers or design practitioners in order for the builders to be able to insist that their masonry contractors use bar chairs.

BlockAid is seeking the support of the Engineering Profession to recognise the benefits of specifying bar chairs.



ADOPTION OF BLOCKAID BAR CHAIRS



In a further move to promote the use of bar chairs in reinforced masonry construction and to reduce non-compliant construction, BlockAid has drafted a proposal to the Standards Australia BD-004 Committee to include the use of bar chairs in the Commentary to AS3700.

THE BENEFITS OF COMPLIANCE ARE FAIRLY OBVIOUS

Building Owners can be assured the reinforced masonry in their structure achieves compliance.

Federal, State and Local Governments will raise the compliance rates of all government approved construction.

Building Certifiers can readily verify the placement of the steel with 100% confidence.

Insurance Companies will see a reduction in claims.

Structural Engineers can specify the use of BlockAid bar chairs.

Block Layers & Construction Companies can eliminate the risk of failing inspection.

CONCLUSION

To conclude, BlockAid identified risks with the current method of masonry construction in Australia and designed a product to overcome those risks.

QUT research confirmed that bar chairs successfully restrain the reinforcement during core filling.

The adoption of bar chairs will bring about much needed improvement to the construction method.

I thank the Association of Consulting Structural Engineers (ACSE) for the opportunity to inform about our bar chairs.

I hope that ACSE members now recognise the importance of bar chairs.

Owners of buildings with reinforced walls are entitled to compliant masonry.

BAR CHAIR SPECIFICATION....

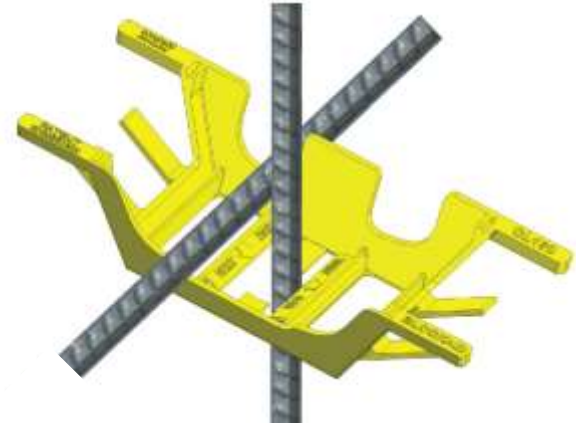
We recommend installing the plastic bar chairs at every intersection of the horizontal and vertical reinforcement.

The recommended Core Fill Grout Specification is:

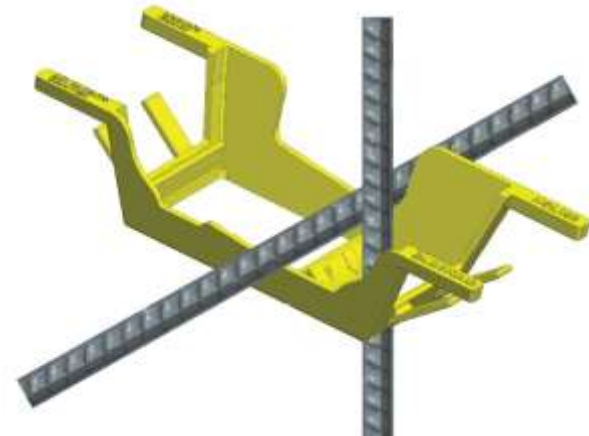
Minimum Slump 250mm

Aggregate 7mm - 10mm

Vibrate to Common Practice



**BACL190 BLOCKAID BAR CHAIR
("CL" CENTRALLY LOCATED)**



**BANCL190 BLOCKAID BAR CHAIR
("NCL" NON-CENTRALLY LOCATED)**

Thank you for your time and I hope you found this informative.

Please visit our website – blockaid.com.au if you would like any more information or contact me directly.



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