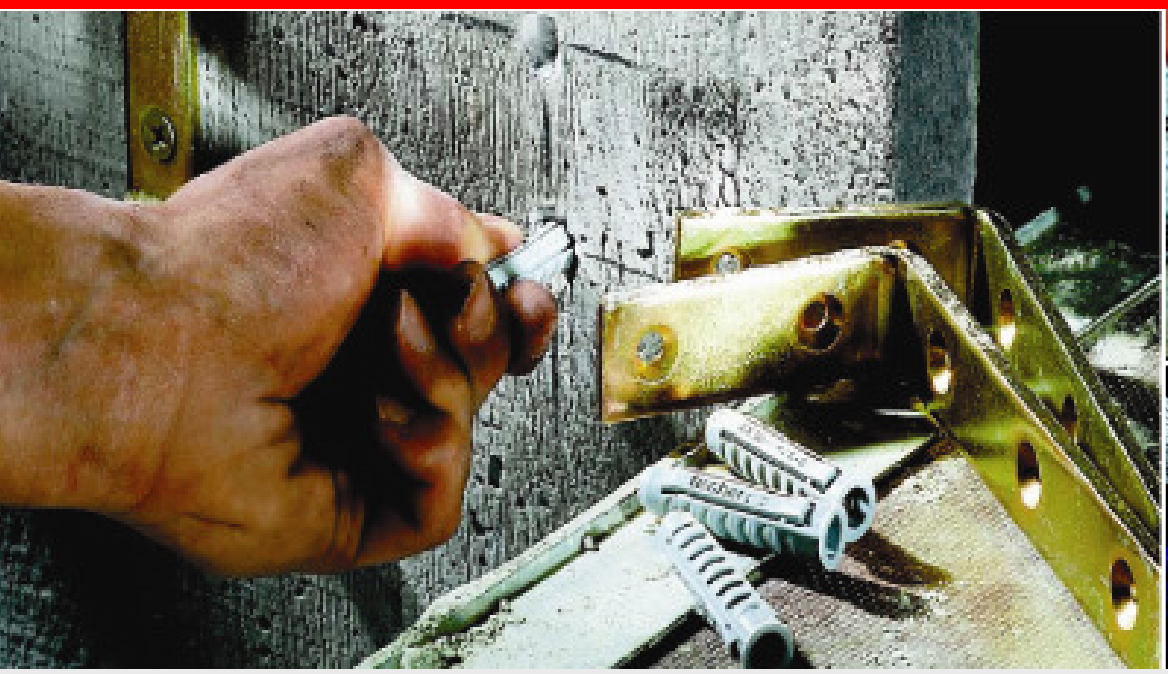
fischer Test Report



Fixing Tests for Multi-Core block

Topblock

fischer
FIXING SYSTEMS

Topblock

Tarmac Topblock Limited
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Dave Hanrahan
Arthur Fischer (UK) Ltd
Hithercroft Road
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OX10 9AT

27-Feb-02

Dear Sirs

Fischer Fixing Systems

We confirm that the tests detailed in your document titled 'Fixings Test Report for Topblock' were carried out at Artur fischer UK and that the tests were carried out into single Topcrete multi-core 7N blocks, and the results are a true record of the tests.

Therefore we recommend that the fixings described are suitable for use with the fore mentioned Topblock product up to the safe working loads stated.

Yours faithfully

T.V Holl
Technical Advisor.

Testing on Topcrete Multicore Block

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Appendices

A. Presentation blocks

2 Test Parameters

fischer fixings have been working alongside Tarmac Topblock to discover what type of fixings and what kind of loads would be suitable for their new Topcrete multicore block. The block is manufactured using dense aggregates and has preformed circular voids. The face size is 440 x 215mm and a thickness of 140mm and is of 7Nmm^2 compressive capability. The block is available in three grades, standard, paint quality and fair faced; and we tested the paint quality grade, which were single units not in a wall arrangement.

Fischer initially introduced six fixings ranging from lightweight to heavy-duty fixings, the fixings range from the simplest lightweight SX nylon plug to a more complex heavy-duty resin anchor. All the fixings were tested in the centre of the preformed circular voids, where the web thickness was at its minimum being just 25mm.

The test results for all the fixings tested show a good variation in ultimate loads. This allows the engineer/architect/end user to have a broad range of anchor to choose from depending on both function and load performance.

The test were carried out at:

fischer Fixings (UK) Limited
Hithercroft Road
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Oxfordshire
OX10 9AT

All tests were carried out using a Hydrajaws calibrated tensile tester with a 0-5KN AND 0-20KN gauge, in conjunction with an aluminum 150mm load spreading bridge and M8, M10, and M12 open ended test adapters. To conform to CFA (construction fixing association) guidelines each fixing was tested six times.

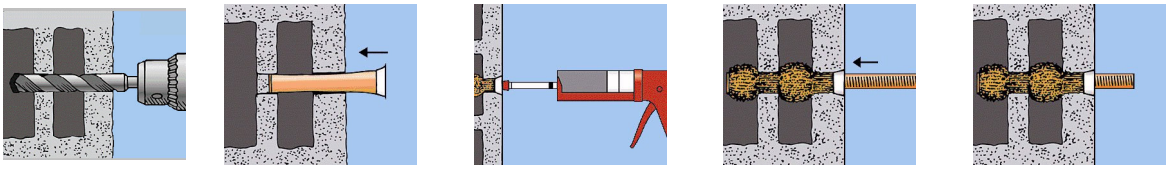
As part of the project we also manufactured three demonstration blocks high lighting the six fixings we would be testing, these were distributed to the three Tarmac regional offices around the U.K. for presentation. See appendix A.

3 Fixing Products Tested

3.1 fischer FIS V 360 S & FIS net with steel Threaded rod

Material: Resin: Vinyl ester hybrid resin
Rod: M10 Zinc plated grade 5.8
Sleeve: Plastic Frame with flexible nylon netting
Range: M8-M30

The fischer FIS V injection anchor contains a styrene-free, quick setting, high quality hybrid resin mortar, which is characterized by its universal suitability for many applications. This resin can be used solo or in conjunction with an anchor sleeve dependent on application and substrate. When fully cured this resin produced a form type locking in hollow material and friction type locking in solid material, allowing the application to be a stress free fixing.

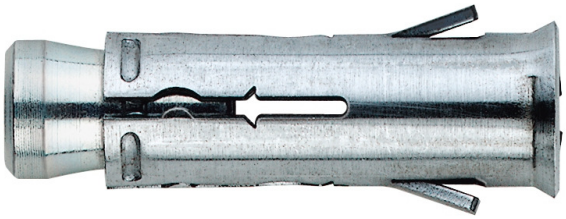


3 Fixing Products Tested

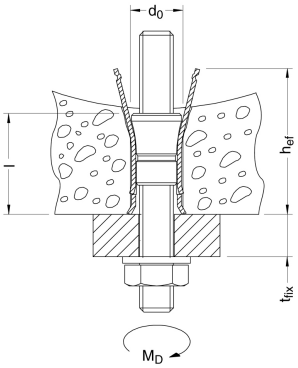
3.2 fischer FHY Expansion Anchor

Material: Metal, bright zinc plated or stainless steel

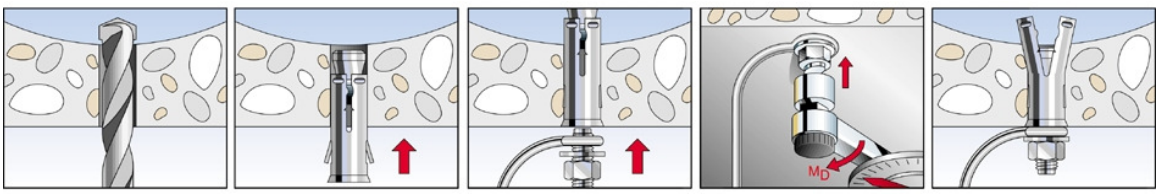
Range: M6 – M10



The fischer FHY expansion anchor is the newest anchor from the fischer range. The FHY is designed specifically for hollow-ceiling slabs. The taper section has a continuos internal thread, which permits use with both bolts and threaded rod. The high expansion capacity of the anchor makes it suitable for both solid and hollow-ceiling slabs with a thickness greater than 25mm. The shield of the anchor is 40mm long with sections cut from the shield 21mm



from the anchor collar allowing maximum expansion; it is at this point where the anchor is in contact with the concrete. The shield is divided into four segments so that the load is evenly distributed onto the walls of the hollow section. It is with these characteristics that the anchor expands creating friction and form locking.



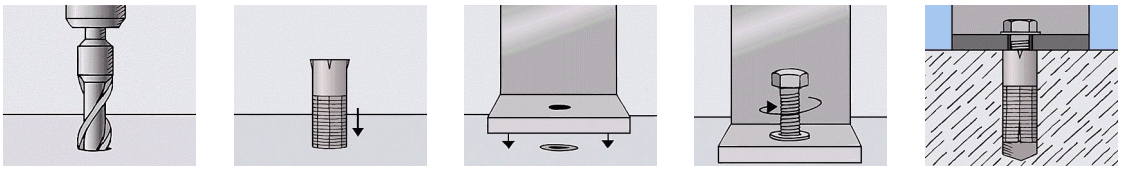
3 Fixing Products Tested

3.3 fischer Nylon M Unit M10

Material: Glass reinforced nylon (polyamide 6) with brass cone

Range: M5 – M16

The fischer M Unit is a glass reinforced nylon expansion anchor with an integral internally threaded brass cone. The M Unit expands like a conventional 'Wall Bolt,' but due to the walls of the M Unit being glass reinforced nylon the expansion forces are less aggressive preventing the substrate from crushing during installation. The glass reinforced nylon also reduces noise caused by vibration of pipes, for Mechanical & Electrical applications.



3 Fixing Products Tested

3.4 fischer FFS Self Tapping Screw

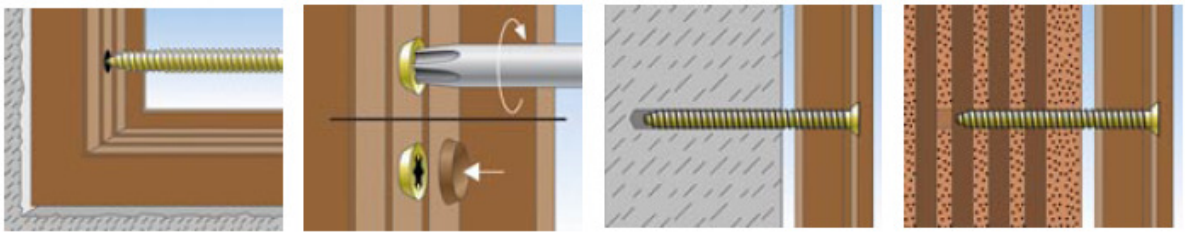
Material: Metal zinc plated, passivated to 5 microns

Range: 7.5mm Diameter

The fischer FFS allows a stress free 'through fixing' into most substrates. A pre-drilled 6mm hole is required into the concrete; the FFS is then driven into the concrete with ease this is due to the tapered lead-in thread which has a smooth hardened screw surface and slim thread pitch. The minimum embedment into concrete is 20mm, which is perfect when fixing into multi core hollow blocks as the web thickness is 25mm.

The FFS has many advantages over other fixings:

- Drill hole diameter is only 6mm
- Installation using a machine with torx 30 bit is very quick
- Immediate loading
- Through fixing, easy for numerous fixing points i.e. battens or insulation
- Cover caps available for aesthetic finish



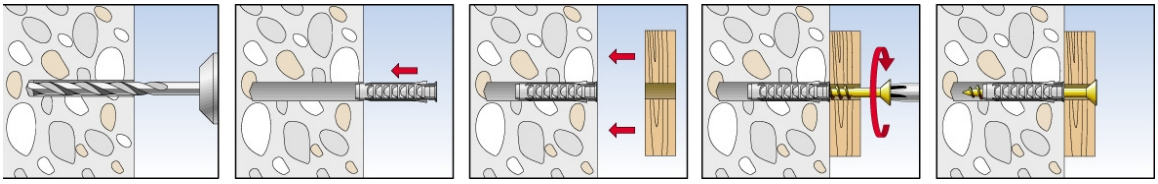
3 Fixing Products Tested

3.5 fischer SX10 with 7mm Safety screw

Material: Nylon (polyamide 6)
Metal screw grade 5.8

Range: SX4 to SX16

The fischer SX plug has a fourfold nylon plug expansion which form locks with the substrate. This action guarantees maximum load bearing characteristics. The area of application ranges from solid materials through to hollow or perforated materials.

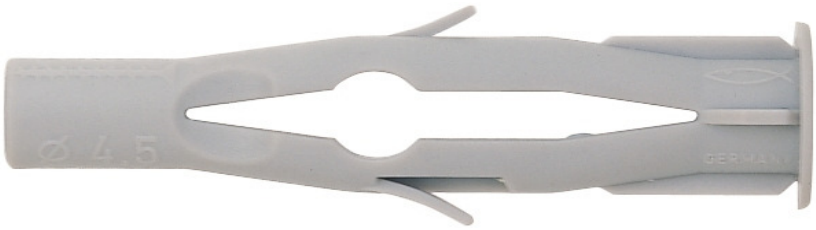


3 Fixing Products Tested

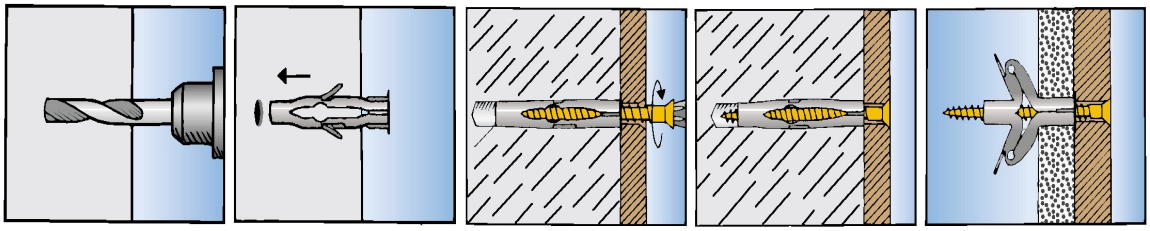
3.6 fischer FU Universal Plug with 7mm Safety Screw

Material: Nylon (polyamide 6)
Metal screw grade 5.8

Range: FU6 to FU10



This all round fixing can be installed into almost any kind of substrate, its unique design allows the fixing to expand or to be permanently deformed dependant on the substrate, when installing into a cavity. The rim at the head of the fixing is to prevent it from falling through; the plug is suitable for wood and or chipboard screws.



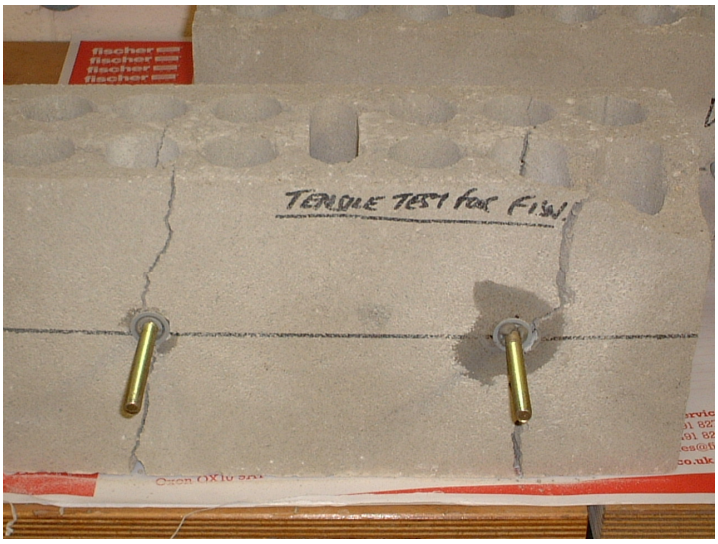
4 Test Results

4.1 FISV 360 S & FIS H 18x85 N with M10 Threaded rod

Material: Resin:Vinylester hybrid resin
Rod: M10 zinc plated grade 5.8
Sleeve: plastic frame with nylon netting

Test No	Free Edge	Axial Space	Load Achieved KN	Remarks
1	110	220	12KN	bridge used concrete fail around fixing
2	110	220	11KN	bridge used concrete fail around fixing
3	110	220	11KN	Bridge used block split in one third
4	110	220	13KN	Bridge used block split in one third
5	220	220	12.5KN	Bridge used block split in half

Average ultimate load **=11.9KN**
Using a global safety factor of 4, safe working load in tension **=3KN**



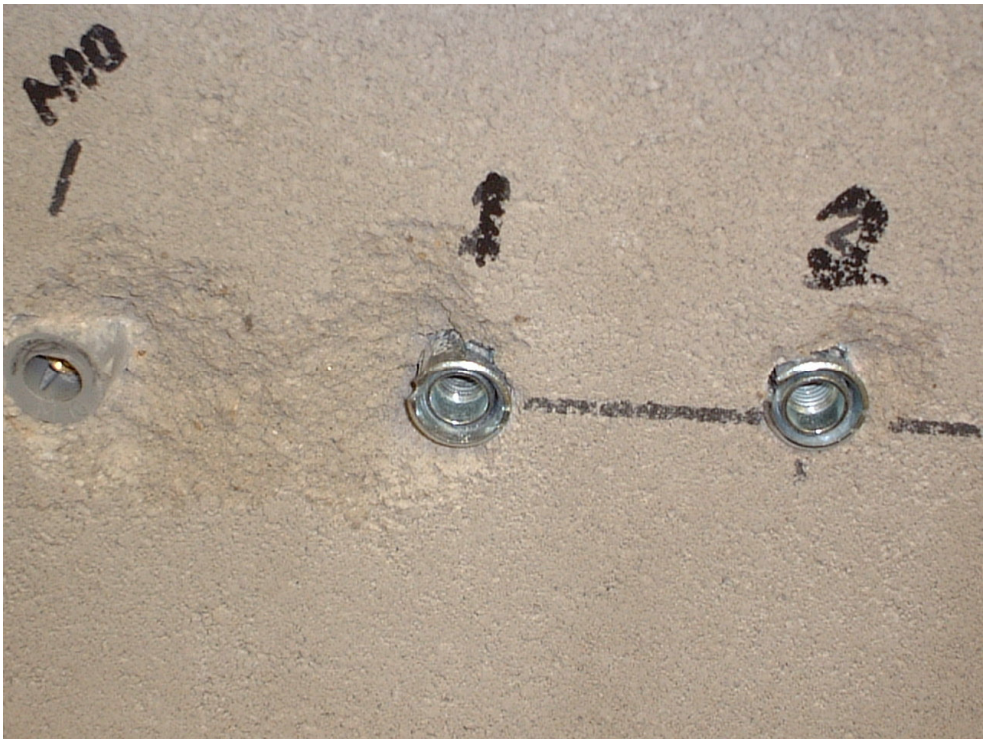
4 Test Results

4.2 FHY M10 Expansion Anchor

Material: Metal bright zinc plated

Test No	Free Edge	Axial Space	Load Achieved KN	Remarks
1	40	70	1.6KN	Tensile slip
2	110	70	1.8KN	Tensile slip
3	170	70	1.2KN	Tensile slip
4	170	70	1.4KN	Tensile slip
5	110	70	1.2KN	Tensile slip
6	40	70	1.2KN	Tensile slip

Average ultimate load **=1.4KN**
Using a global safety factor of 4, safe working load in tension **=0.35KN**



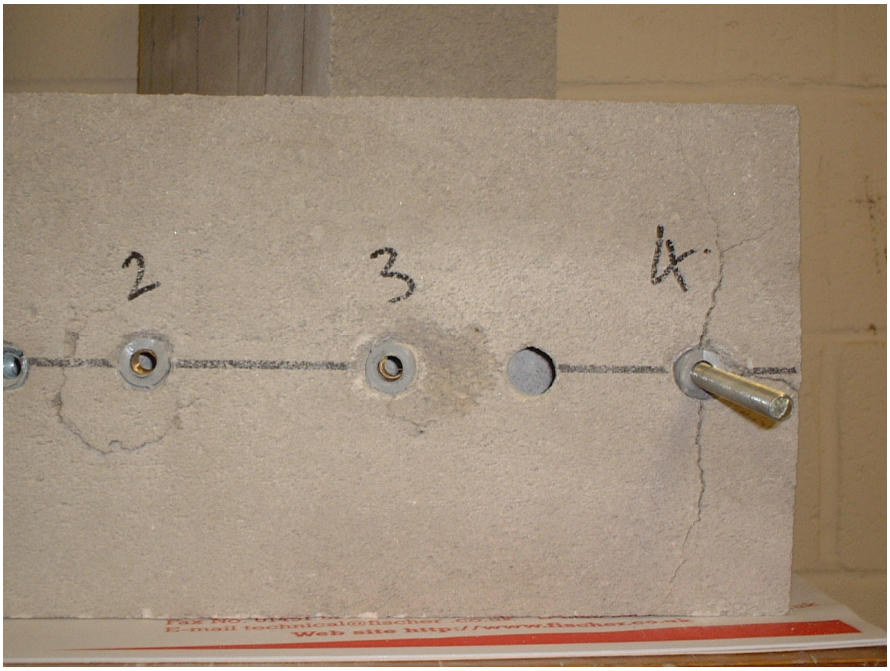
4 Test Results

4.3 Nylon M Unit M10

Material: Glass reinforced nylon (polyamide 6) with brass cone

Test No	Free Edge	Axial Space	Load Achieved KN	Remarks
1	40	70	2.3KN	Cone failure
2	110	70	3.0KN	Cone failure
3	170	70	2.6KN	Cone failure
4	40	70	3.1KN	Cone failure, block cracked
5	110	70	3.0KN	Cone failure
6	40	70	2.2KN	Cone failure

Average ultimate load **=2.7KN**
Using a global safety factor of 7, safe working load in tension **=0.38KN**



4 Test Results

4.4 FFS Self Tapping Screw

Material: Metal zinc plated, passivated to 5 microns

Test No	Free Edge	Axial Space	Load Achieved KN	Remarks
1	40	70	0.1KN	Tensile Slip
2	110	70	0.1KN	Tensile Slip
3	170	60	0.2KN	Tensile Slip
4	170	60	0.2KN	Tensile Slip
5	110	70	0.1KN	Tensile Slip
6	40	70	0.1KN	Tensile Slip

Average ultimate load **=0.13KN**
Using a global safety factor of 4, safe working load in tension **=0.03KN**

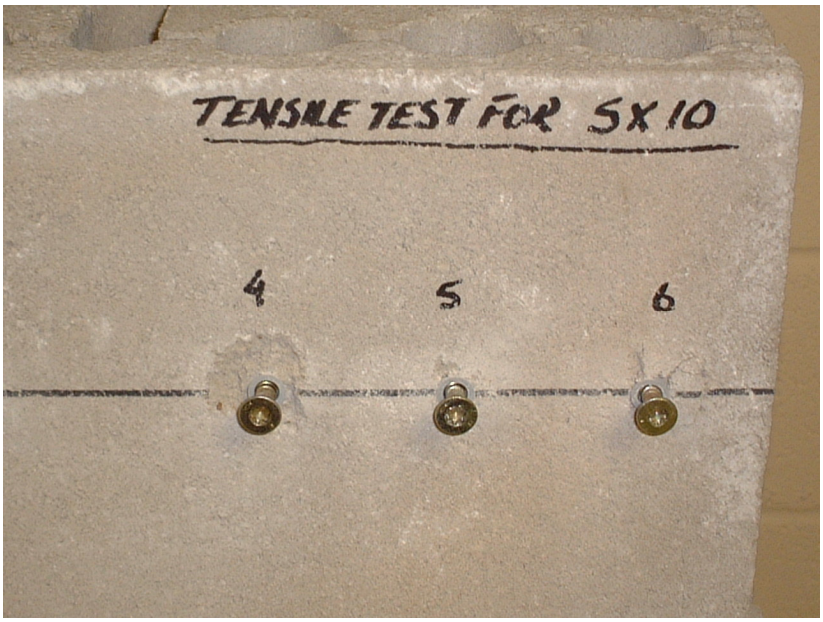
4 Test Results

4.5 SX10 with 7mm safety screw

Material: Glass reinforced nylon (polyamide 6)
Metal screw grade 5.8

Test No	Free Edge	Axial Space	Load Achieved KN	Remarks
1	40	70	2.0KN	Tensile slip
2	110	70	2.3KN	Tensile slip
3	170	70	1.8KN	Tensile slip
4	170	70	2.3KN	Tensile slip
5	110	70	2.3KN	Tensile slip
6	40	70	2.7KN	Tensile slip

Average ultimate load **=2.2KN**
Using a global safety factor of 7, safe working load in tension **=0.31KN**



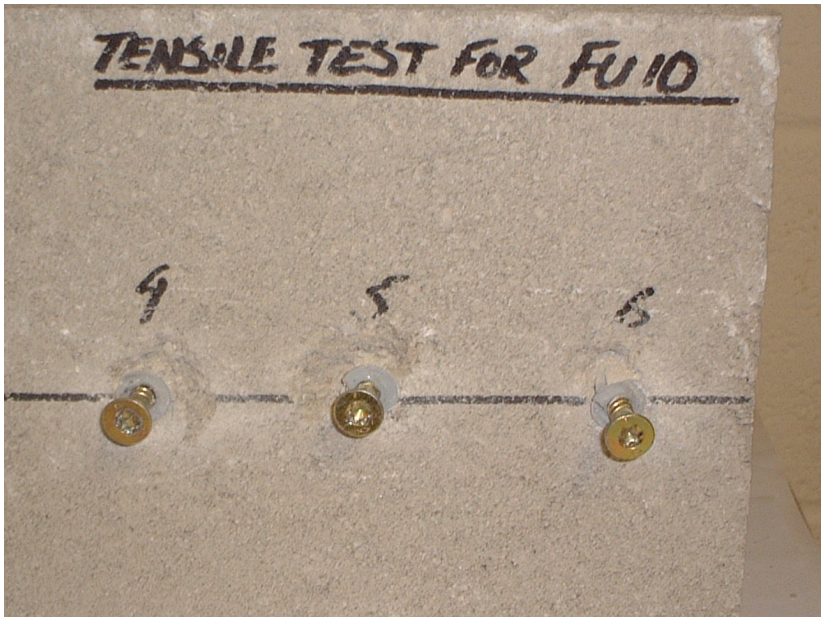
4 Test Results

4.6 FU Universal plug with 7mm safety screw

Material: Glass reinforced nylon (polyamide 6)
Metal screw grade 5.8

Test No	Free Edge	Axial Space	Load Achieved KN	Remarks
1	40	70	3.2KN	Tensile slip
2	110	70	3.4KN	Tensile slip
3	170	70	3.8KN	Tensile slip
4	170	70	3.8KN	Tensile slip
5	110	70	3.1KN	Tensile slip
6	40	70	2.8KN	Tensile slip

Average ultimate load **=3.3KN**
Using a global safety factor of 7, safe working load in tension **=0.47KN**



5 Results summary

The table below show the safe working loads of all the anchor tested into Topcrete multi-core block a product of Tarmac Topblock.

The Topcrete multi-core block has a concrete web thickness of 25mm and a minimum compressive strength of 7Nmm^2.

Product tested	Average ultimate load	Safe working load	Characteristics Axial spacing	Remarks
FISV 360 S Injection resin with net	11.9KN	2.9KN	220	Tendency to crack the block if high loads applied
FHY M10 Metal expansion anchor	1.4KN	0.35KN	70	Very difficult to set, substrate too soft
M UNIT M10 Nylon expansion anchor	2.7KN	0.38KN	70	Slightly better than FHY, more safety factor required as the fixing is nylon
SX Plug Nylon plug with safety screw	2.2KN	0.31KN	70	Quick, easy and cheap. A good around fixing
FU 10 Nylon plug with safety screw	3.3KN	0.47KN	70	Also quick, easy and cheap. Capable of high loads than the SX Plug

6 Conclusion

Six fixings were selected for their potential suitability in these types of blocks and the test results collated into a summary table see section 5
All the fixing was installed in accordance with the manufacture guidelines.

FIS V 360 S
The application was very simple and the Topcrete block easy to drill, with the resin cured the fixing is stress free. There was no visible slip before block failure occurred. As block failure was observed it would be safe to assume that the loads achieved were limited by the strength of the block, therefore this is the max load attainable in these blocks.

FHY Expansion Anchor
The second fixing tested was the fischer FHY expansion anchor, where the larger M10 was used. Although the anchor only works well in material of a wall thickness of 25mm and above the Topcrete block was to soft and produced great difficulty in setting the anchor. We found that the inner collar could be pulled through the body of the anchor. This fixing could be used but there would always be an inherent risk with over tightening and crushing the block during installation.

M Unit
The third fixing tested was the nylon M Unit, this glass reinforced nylon expansion anchor has similar fixing properties than the FHY and like the FHY anchor there can be some problems when setting the anchor. We noticed that due to the large hole diameter required to install the anchor, the substrate was not robust enough to prevent the anchor from turning in the hole when a torque loading was applied making collapsing the anchor very difficult. Fixing performed well in tension but there was some problem involved with the functioning of the anchor.

FFS Self Tapping Screw
The fourth fixing tested was the FFS self-tapping screw. Due to the substrate being to soft the course thread was unable to cut a deep enough thread into the substrate, so when a load was applied the screw could be pull straight out**.** Therefore we would only suggest this fixing be used in a shear application.

SX Plug
The fifth fixing tested was the SX plug; this is a universal fixing and works well in most substrates. Although this fixing is not capable of high loads it is still a reasonable option due to its size and axial spacing.

FU Universal Plug
The sixth fixing tested was the FU universal plug. This, like the SX plug, is a universal fixing and works well in majority of substrates. We found this fixing gave us high loads compared with the price, resulting in a light –mid weight solution with A good safety margin.

As you can see from the test result, this substrate is rather unique. This is due to the use of dense aggregates in a thin walled block configuration, which could potentially cause problems when fixing. Additional testing of the other product ranges may be required to bridge the gap between the fischer FU and FISV.

Appendix A
Presentation Blocks

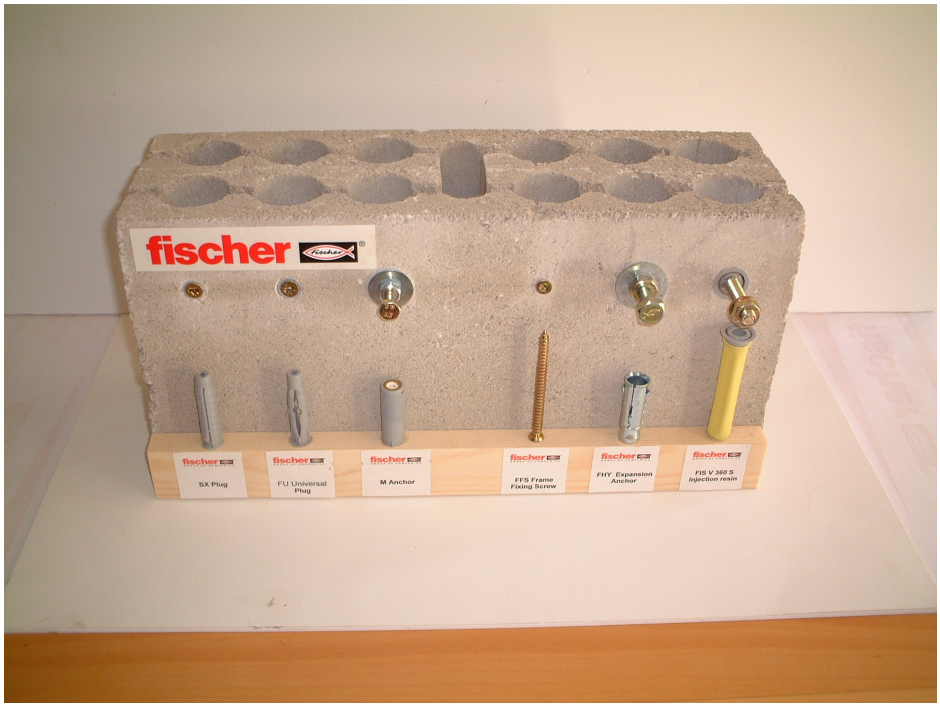


Plate 1

Plate 2

Presentation Blocks

Plate 3

Plate 4