Introduction to Anchors

Stuart Wellington
Senior Project Engineer

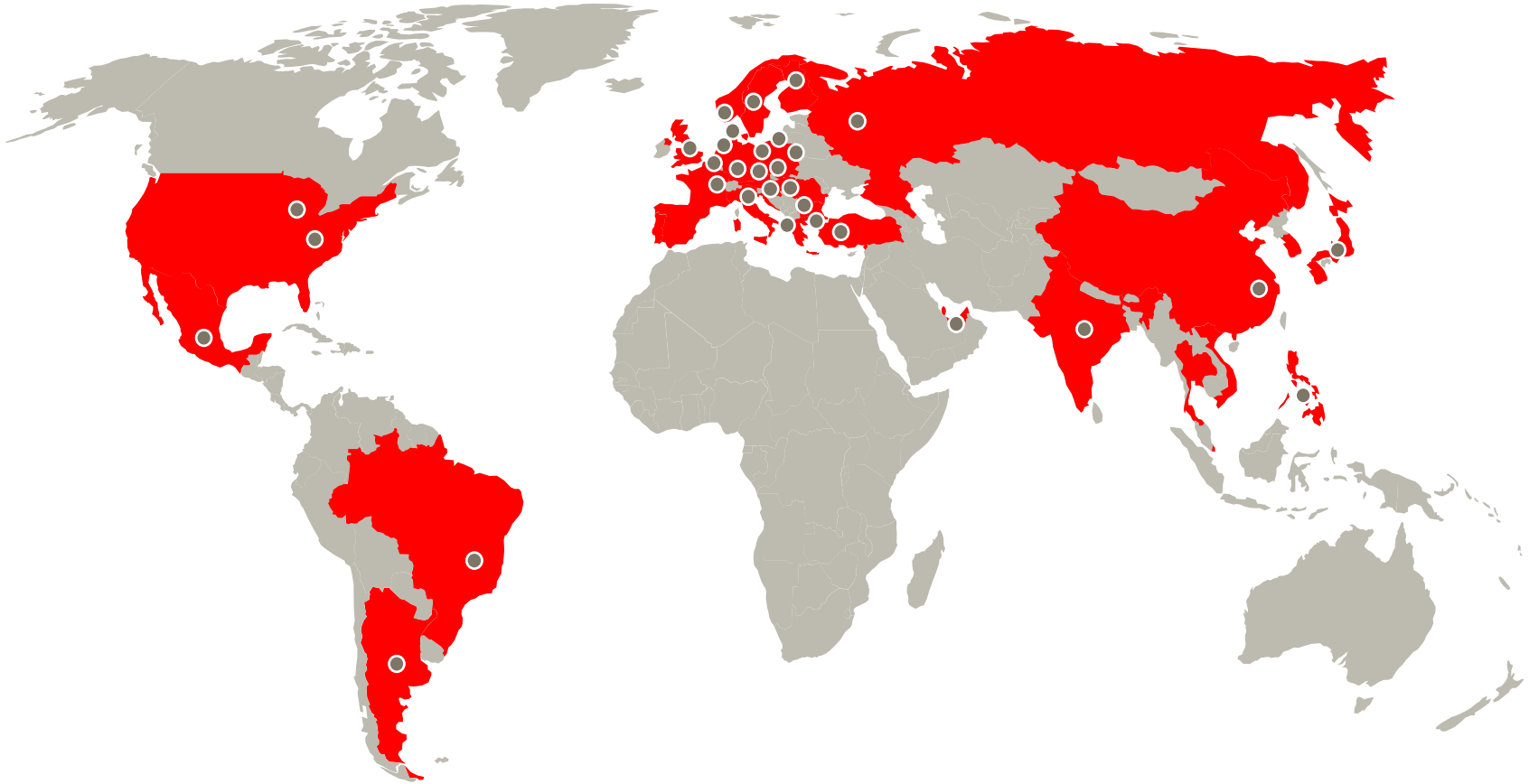


Training Seminar Feedback

Fischer Group



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Offices in over 38 countries

Manufacturing plants in Europe, Americas and Asia

Over 5,600 employees

Global turnover > €1.3bn

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Fischer Group



Fischer Installation Systems

- Support systems for building services including pipe, ventilation and cable systems
- Solutions for lightweight and heavy duty requirements

Fischer Group



Fischer FireStop Systems

- Large range of passive fire protection that cover a wide range of applications
- Solutions for both building services and facades to ensure building compartmentation is achieved

Fischer Group



Fischer Façade Systems

- SFS system for ventilated facades
- ETA approved range of undercut anchors for stone façade panels
- Design and specification services available

Fischer Group



Fischer Cast-In Channels

- Addition of Cast-In Channels to product range to offer more options for anchor connections
- Extensive range of channel sizes and lengths
- All ETA approved & Fire-Rated
- Addition of Channel Fix design tool to Fischer's Fixperience design suite

Fischer Group



Fischer Post-Installed Anchors

- Largest range of European safety approved and fire rated post-installed anchors

Fischer Group

Fischer Post-Installed Anchors



Fischer Fixperience Design Suite



Importance of Anchors

Big Dig Case Study





Importance of Anchors



Importance of Anchors



- Anchors low cost item and often left to last to be considered for an application
- However applications utilising anchor will not function as expected if anchors are not given the consideration they require

Importance of Anchors

- Late 1980s, central expressway through downtown was way past capacity
- Ten hours of traffic resulting in major lost productivity



Importance of Anchors



- Solution to build new 10 lane expressway under the city
- Additional new tunnel under the harbour providing better access to Boston International Airport

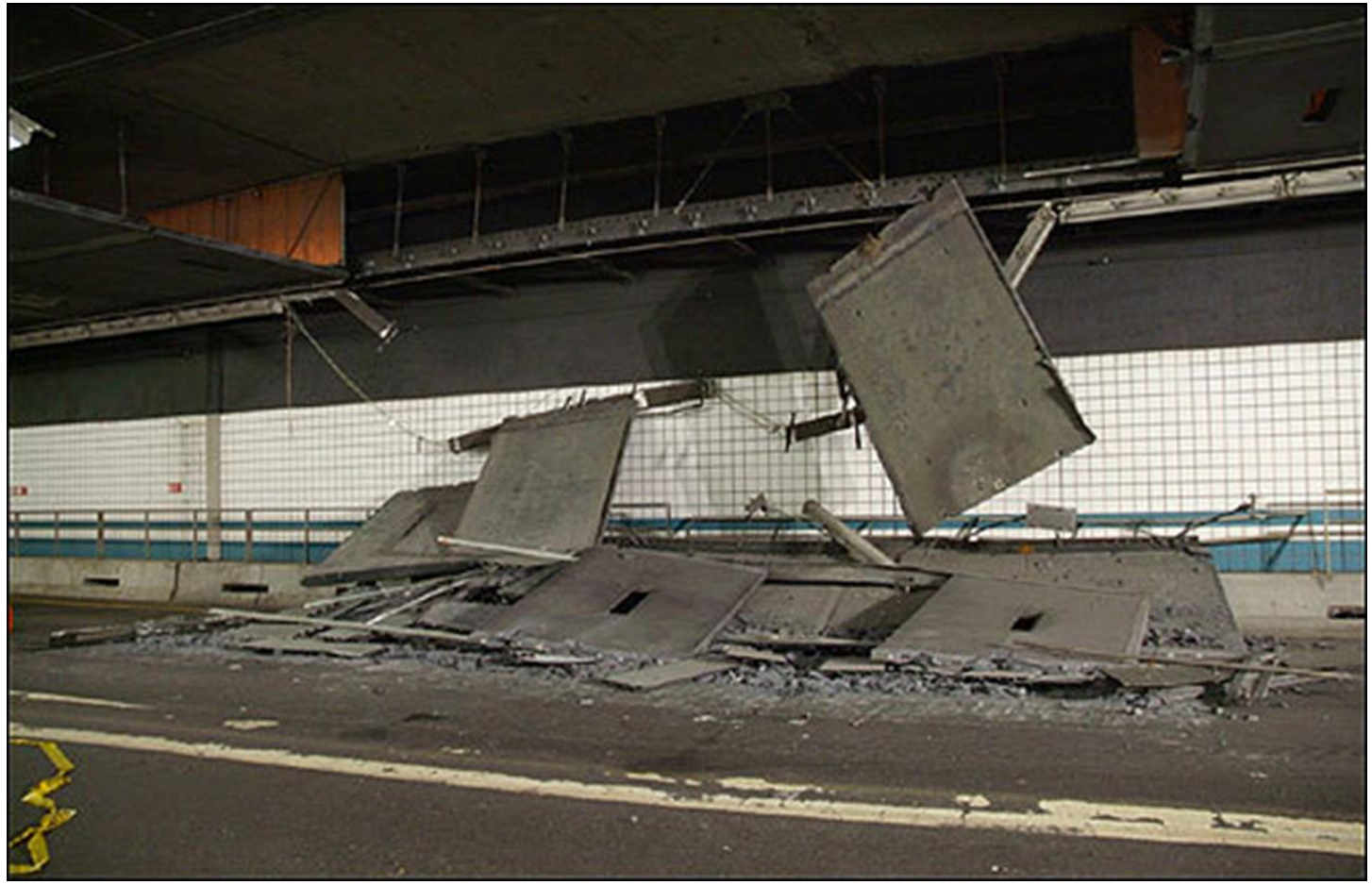
Importance of Anchors



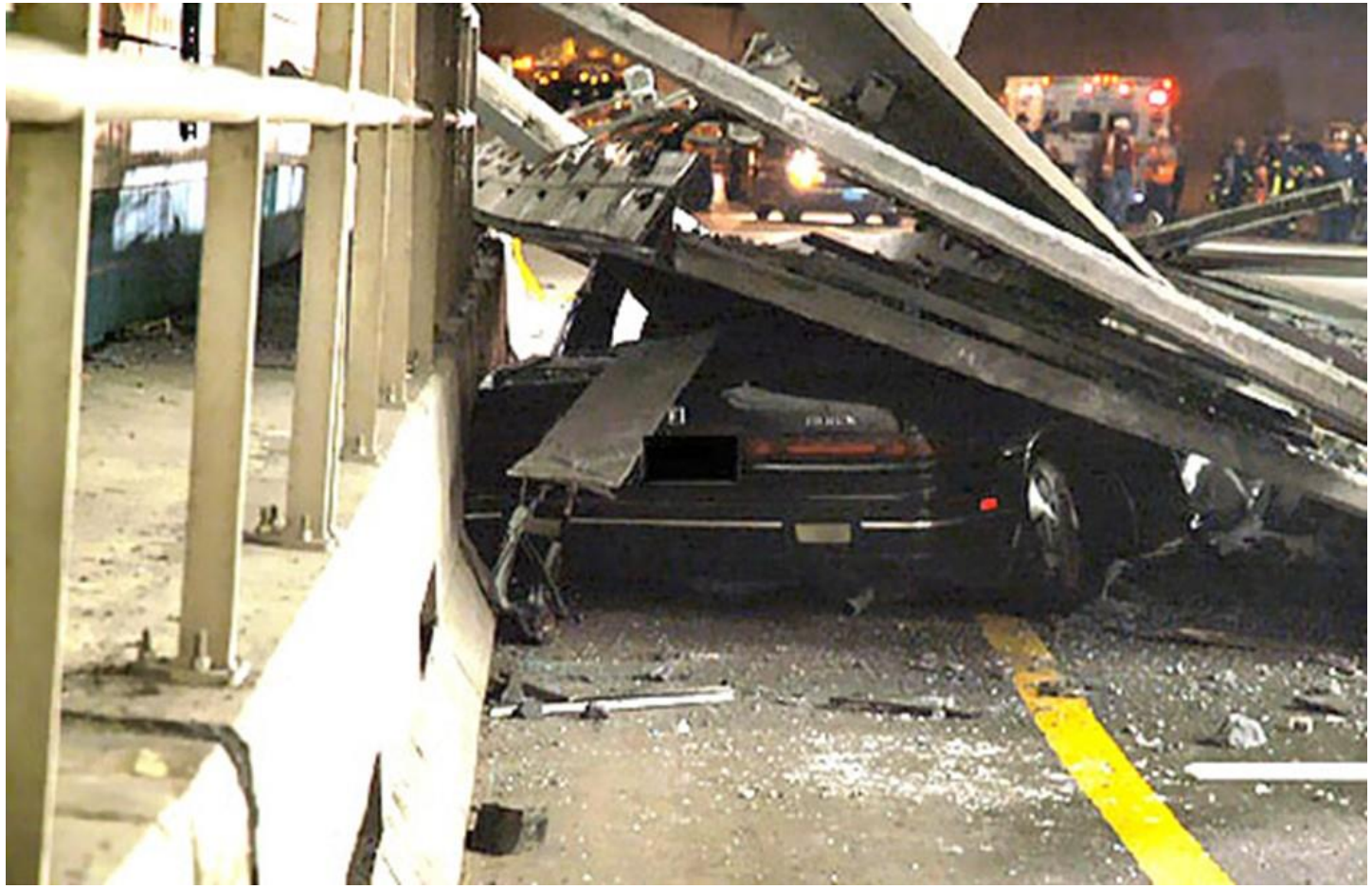
- Largest infrastructure project in North America during its construction
- Project began in 1991
- 5000+ people on site at it’s peak
- Total of 12 million cubic meters of earth excavated

Importance of Anchors

- In July 2006 within the Ted Williams tunnel under the harbour
- 20 chemical anchors supporting concrete ceiling failed in a progressive collapse
- 23 tonnes of concrete crashed down onto the roadway



Importance of Anchors

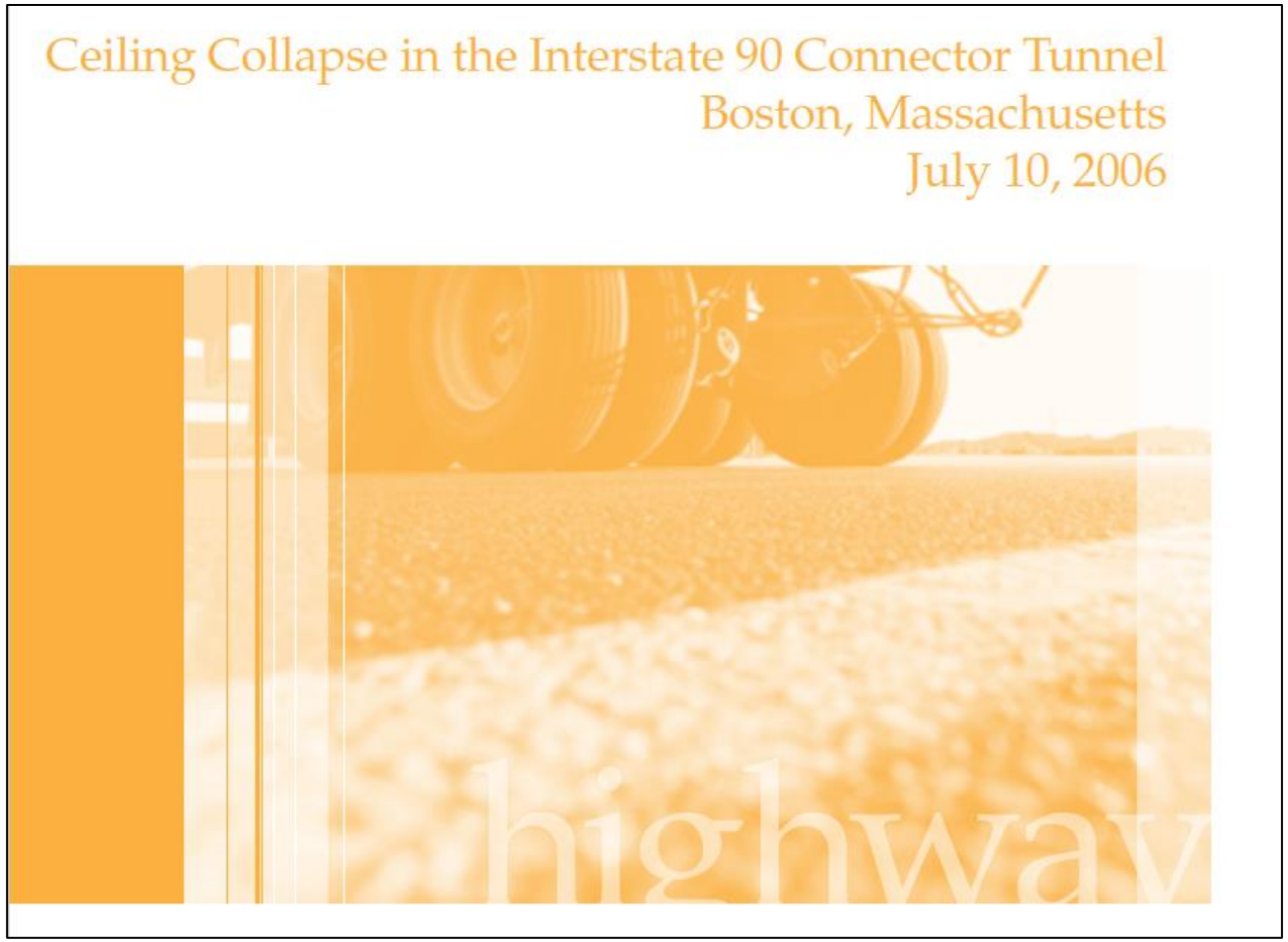


- The concrete panels fell onto the car of a husband who was driving his wife to the airport.
- The front right of the car was completely crushed, fatally injuring the wife.
- The driver was rescued alive but severely injured.

Importance of Anchors

Big Dig Collapse – NTSB Investigation

- National Transport Safety Board report published in 2007
- Excess of 130 pages and identified many errors, bad judgements and incorrect actions



Importance of Anchors

Big Dig Collapse – NTSB Investigation

- Loss of life was entirely avoidable
- Action could have been taken at multiple opportunities prior to failure to prevent it

HIGHWAY
Accident Report

CONCLUSIONS

Findings

1. By July 2006, a significant portion of the adhesive anchors used to support the D Street portal ceilings had displaced to the extent that, without corrective action, several of the ceiling modules in the three portal tunnels were at imminent risk of failure and collapse.

Importance of Anchors

Big Dig Collapse – NTSB Investigation

- First observation failed anchors had not been installed correctly

HIGHWAY
Accident Report

CONCLUSIONS

Findings

2. Although it is unlikely that all the D Street portal adhesive anchors were installed in a manner that would ensure maximum anchor performance, improper or deficient anchor installation procedures or practices alone would not account for all of the anchor failures that were observed before and after the accident.

- ***Installation of anchors was not carried out correctly***

Importance of Anchors

Big Dig Collapse – NTSB Investigation

- Large areas of failed anchors which had no epoxy bonded to them, not enough injected
- Discolouration of epoxy suggested chemical components hadn't been sufficiently mixed prior to injection
- Evidence of epoxy bonding with drill hole dust, anchor drill holes not cleaned out sufficiently
- All reduce load bearing capacity of anchors

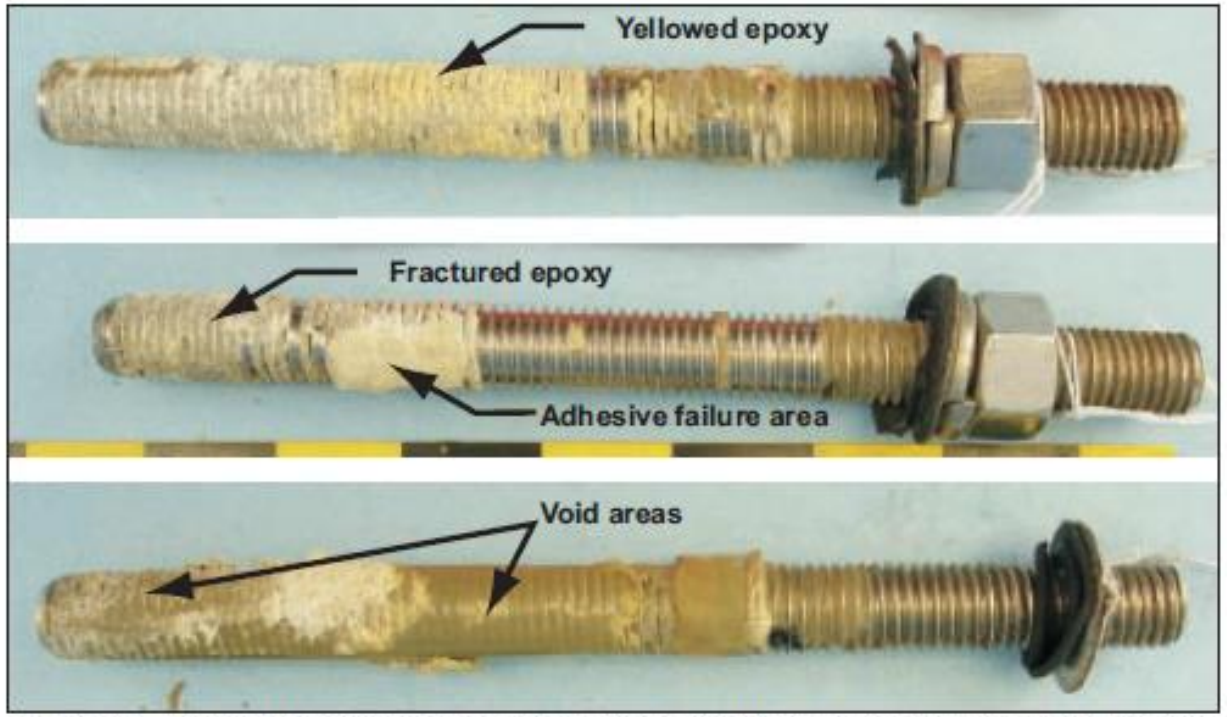


Figure 13. Three of the 20 failed anchors from the accident site illustrating epoxy features found on some of the anchors.

Importance of Anchors

Big Dig Collapse – NTSB Investigation

- Installation issues alone not sole reason for catastrophic failure
- Chemical anchors suspect to creep if subjected to sustained load over working life
- Contractor selected a fast-set epoxy chemical anchor that was for short-term loading only due to poor creep resistance

HIGHWAY
Accident Report

CONCLUSIONS

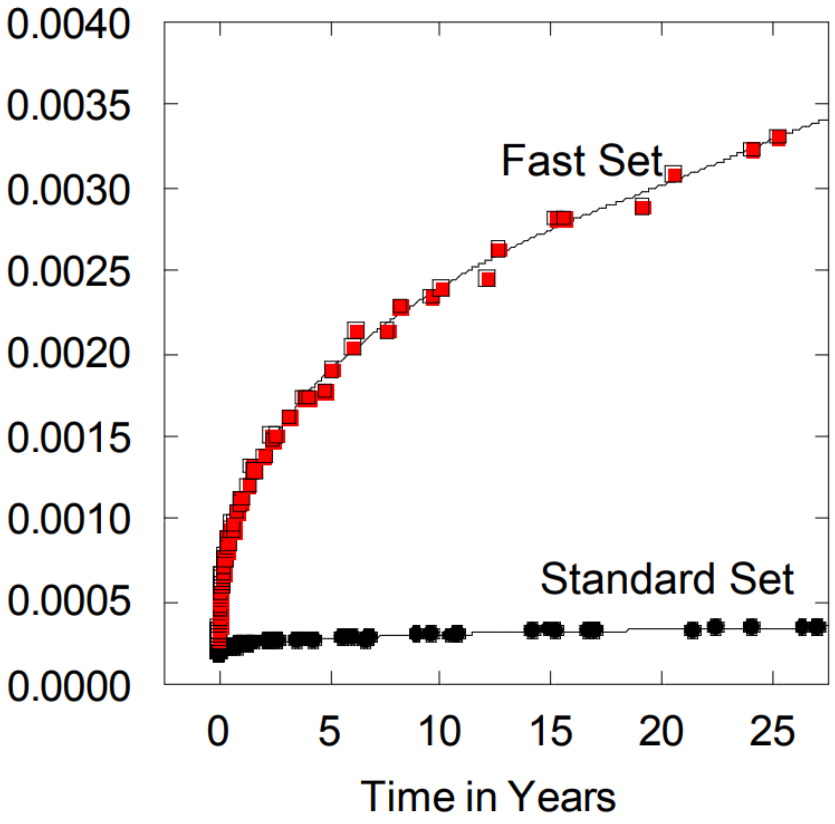
Findings

7. The source of the anchor displacement that was found in the D Street portal tunnels and that precipitated the ceiling collapse was the poor creep resistance of the Power-Fast Fast Set epoxy used to install the anchors.

- ***Contractor's selection of anchor was unsuitable***

Importance of Anchors

Big Dig Collapse – NTSB Investigation



- Engineer checking selection of Fast-Set epoxy chemical anchor failed to identify potential issue with poor creep resistance
- This was despite having literature from manufacturer which did detail this issue
- Initial design specification recommended epoxy chemical anchor
- Assumption made that any epoxy chemical anchor would do
- Anchor selected on price

Importance of Anchors

Big Dig Collapse – NTSB Investigation

Executive Summary

HIGHWAY
Accident Report

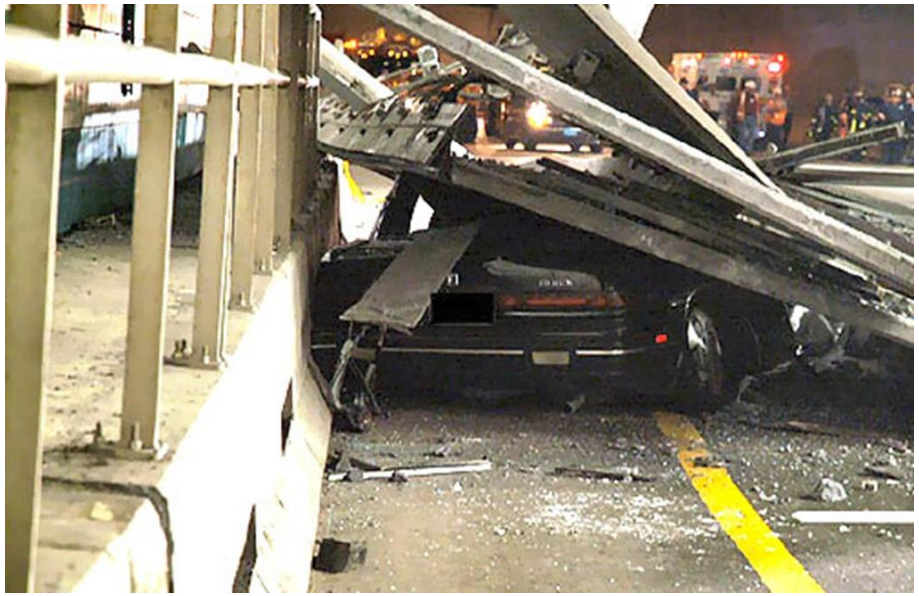
The safety issues identified during this investigation are as follows:

- Insufficient understanding among designers and builders of the nature of adhesive anchoring systems;
- Lack of standards for the testing of adhesive anchors in sustained tensile-load applications;
- Inadequate regulatory requirements for tunnel inspections; and
- Lack of national standards for the design of tunnel finishes.

- ***Insufficient understanding of anchoring systems***

Importance of Anchors

- Questions and discussion





Building Safety Act 2022

Overview



- New Building Safety Act is now in effect
- Dubbed “the biggest piece of legislation in the construction for over 50 years”
- The act will have a far reaching effect on approaches within construction

Building Safety Act 2022

Overview

- The Building Safety Act is a direct response to the Grenfell Tower Tragedy
- The disaster proved that too often safety and accountability were not at the forefront of decisions

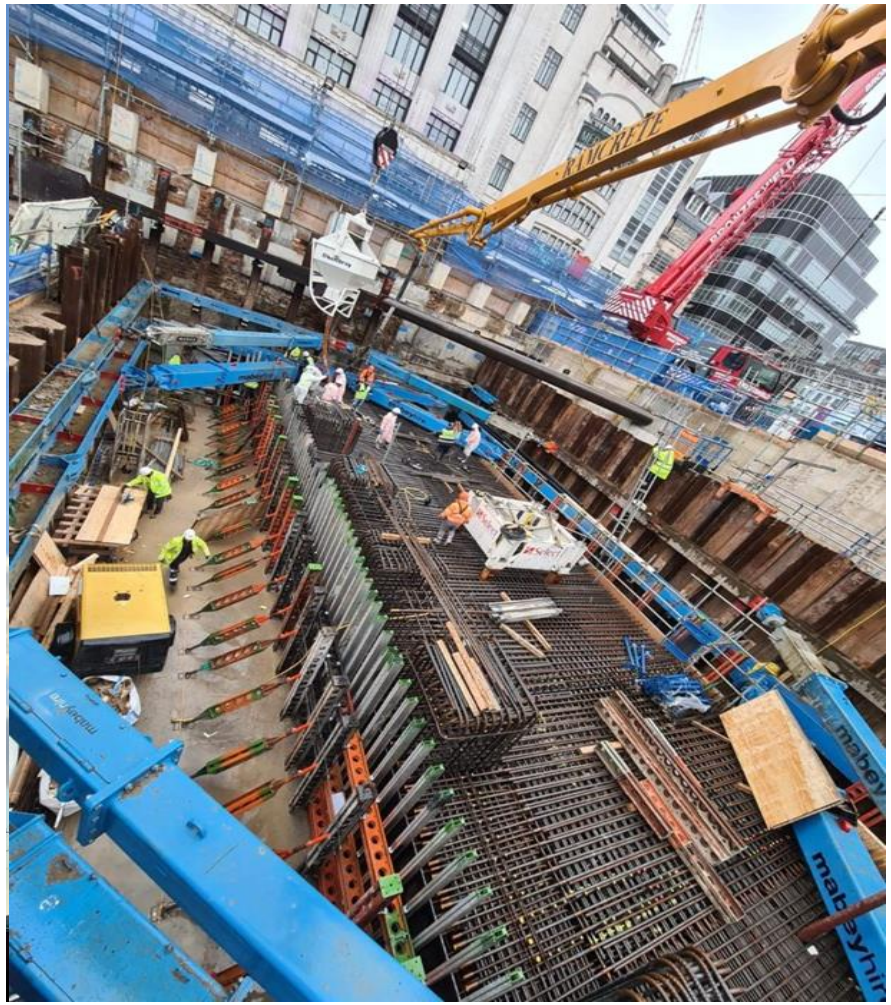


Building Safety Act 2022

Overview

Building Safety Act 2022

Applies to All Buildings



Building Safety Act 2022

Overview

Building Safety Act 2022

Stricter Regime for
High Risk Buildings



Building Safety Act 2022

Overview – High Risk Buildings

- Buildings that are either;
  - 7 stories or higher
  - 18 meters or higher



Building Safety Act 2022

Overview – High Risk Buildings



- Also covers hospitals and care homes

Building Safety Act 2022

Overview

Building Safety Act 2022

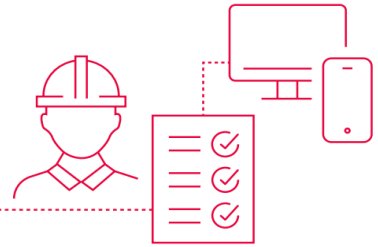
- Recommendations made were incorporated into the new building safety act

DUTY HOLDERS

BSI Flexi 8670



THE GOLDEN THREAD



PROJECT GATEWAYS



All Buildings

High Risk Buildings

Building Safety Act 2022

Overview

Building Safety Act 2022

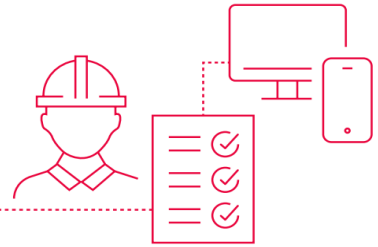
- A key focus on improvement of;
  - Competency of duty holders
  - Collation and archiving of information regarding a building's safety
  - Management of design work and specification

DUTY HOLDERS

BSI Flexi 8670



THE GOLDEN THREAD



PROJECT GATEWAYS



All Buildings

High Risk Buildings

Building Safety Act 2022

The Golden Thread



- A key recommendation is the creation of a single source for all information relevant to a building's safety over all phases of the project through to final occupation

GATEWAY 1
PRE-PLANNING STAGE

GATEWAY 2
PRE-CONSTRUCTION STAGE

GATEWAY 3
PRE-OCCUPATION STAGE

OCCUPATION PHASE
FINAL
OCCUPATION STAGE

GOLDEN THREAD OF INFORMATION: Must be stored digitally and will be based on the information & data required through the gateway points and through the building regestration process and safety case

Building Safety Act 2022

Project Gateways



- The project gateways are intended as be checkpoints in a project's lifecycle and came into effect in October 2023



Building Safety Act 2022

Duty Holder Competency



- The Client
- The Designers
- The Contractors



Building Safety Act 2022

Duty Holder Competency – BSI Flexi 8760



- Provides core building safety criteria for built environment competency framework for all duty holders

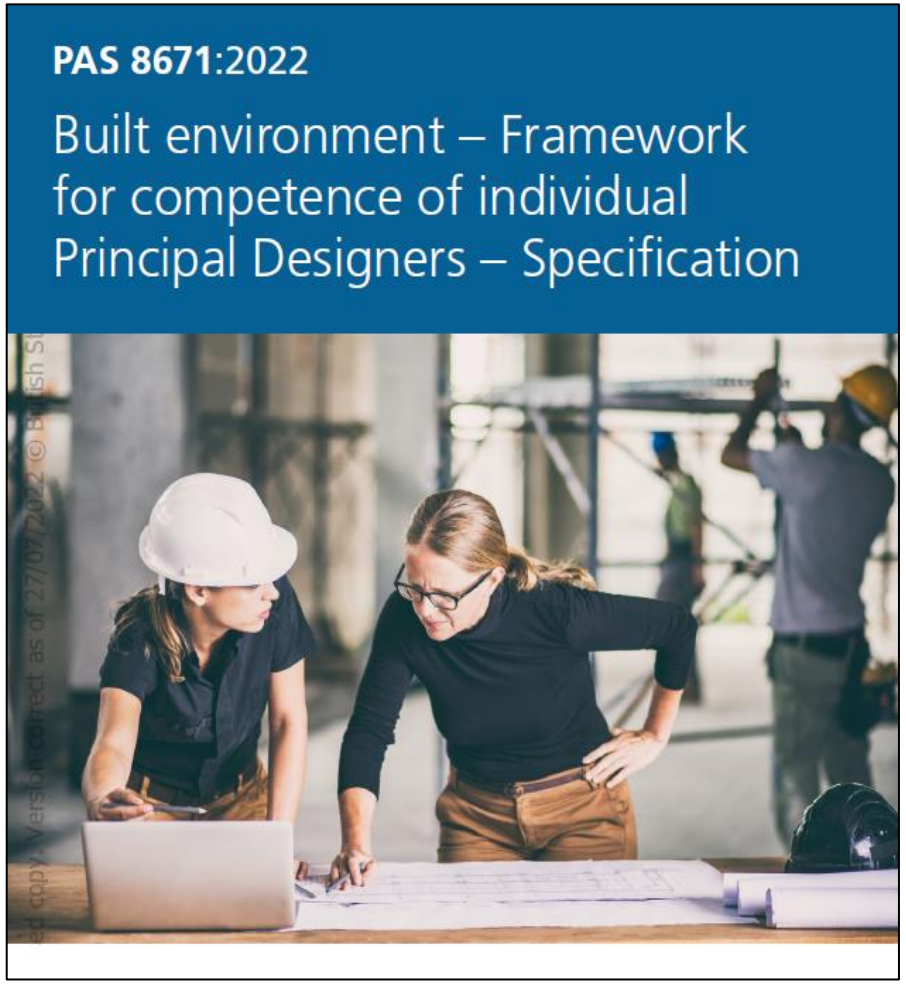


Building Safety Act 2022

Duty Holder Competency – Principal Designers



- Management of all design work for a project
- Management of design work compliance of all designers
- Assisting provision of information to other duty holders to ensure design work compliance



Building Safety Act 2022

Duty Holder Competency – Principal Contractors



- Management and supervision of building work by adopting best practice
- Management of competencies of all working on construction of project
- Management of the Golden Thread and changes to approved design during construction phase



Building Safety Act 2022

Duty Holder Competency – Construction Products



BSI Flex 8760

NOTE *The "core criteria for building safety" in BSI Flex 8670 are set out under the following headings:*

a) fire safety, structural safety, and public safety;

b) managing building safety;

c) knowledge management and communication; and

d) buildings as systems, building systems, and construction products and materials.

Building Safety Act 2022

Duty Holder Competency – Construction Products

- *From BSI Flex 8760 – Section 6.5 Table 5*

Core competence criteria	Scope
a) Coordinate building design, management or construction activities to ensure holistic building safety	1) Appropriate selection for intended use so that construction products and building systems function individually and together to maintain building safety and consider buildings as holistic systems. 2) Impact of installation quality on construction product and building system performance and need for quality assurance and quality management processes. 3) Requirements for construction product durability over time taking building use into account. 4) Consideration of location and context in construction product performance and selection, e.g. proximity to boundary, boundary conditions (fire resistance, water resistance) size, distance, environmental conditions, geometry.

Building Safety Act 2022

Duty Holder Competency – Construction Products

Core competence criteria	Scope
b) Understand construction products, and building system characteristics, and utilise testing, assessment and maintenance information and procedures to minimize risks to safety throughout the building lifecycle	1) Use of construction product or building system testing information including certification, classification and industry approved or recognized standards (alongside as-built design and construction information on existing buildings), to inform design, specification, construction, installation and management decisions. 2) Maintenance requirements for construction products and building systems through the building lifecycle, including planning, procuring, monitoring, undertaking or managing maintenance of building fabric, fire protection or life safety systems. 3) Replacement (and safe disposal) of construction products and buildings systems at the end of their lifecycle to maintain building safety. 4) Notification of building operators, suppliers and manufacturers where defects or maloperation issues are found in construction products or building systems which impact on building safety.

Building Safety Act 2022

Duty Holder Competency – Construction Products



Building Safety Act's required competencies for designers and contractors regarding construction products

- All construction products will need to be selected following defined processes
- All construction products will need to be designed to their relevant standards
- All construction products will need to be installed as per their manufacturer's instruction

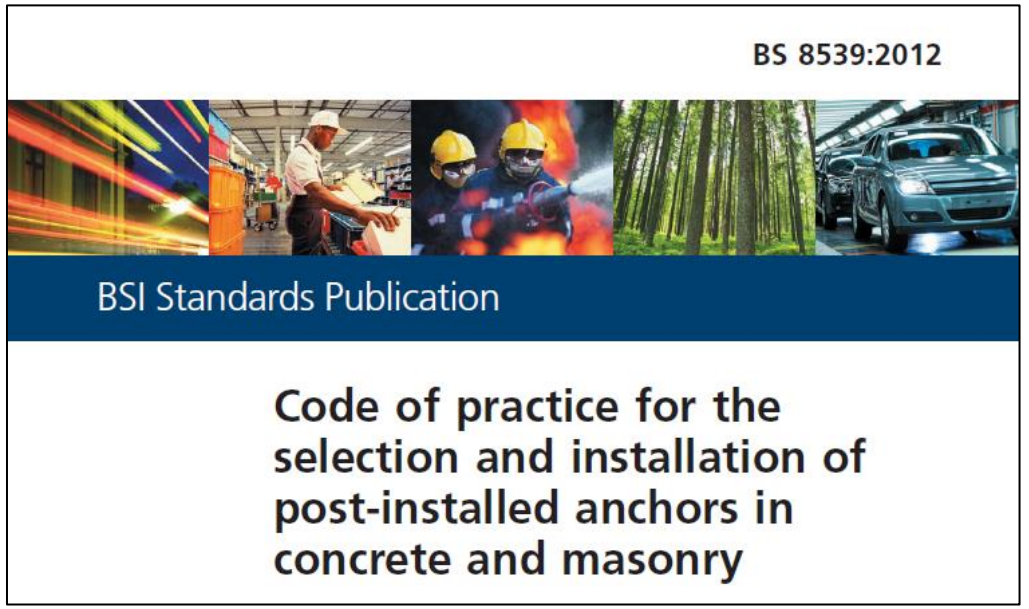
In doing so all parties will adhere to their competency requirements

Building Safety Act 2022

Duty Holder Competency – Construction Products



British Standard 8539



Best Resource for Achieving these Competencies

Building Safety Act 2022

- Questions and discussion





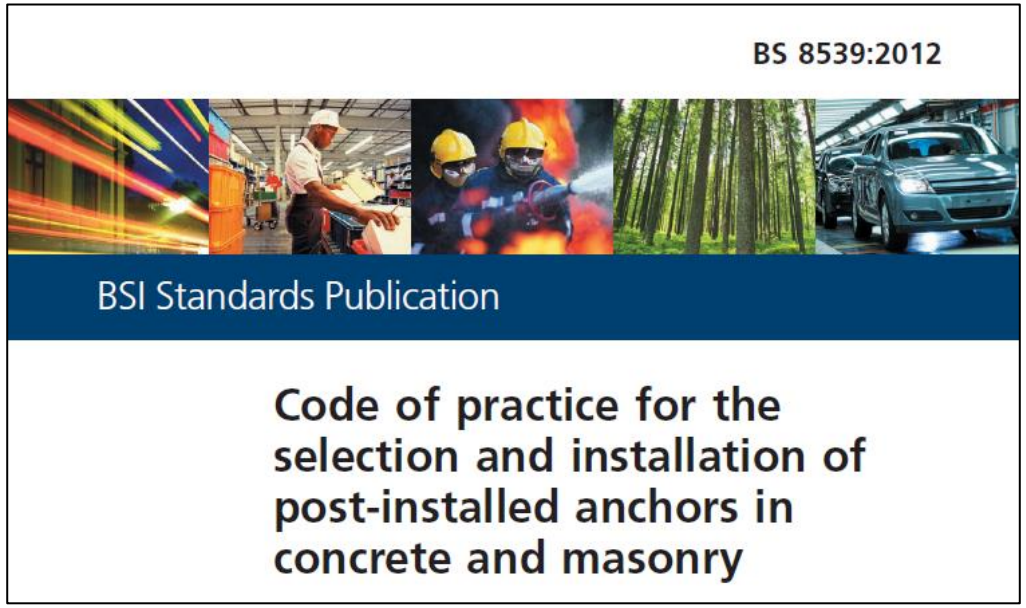


fischer

British Standard 8539

Overview – Aims Of Standard

- Correct specification & installation of anchors
- Definition of responsibilities of all duty holders
- Guidance on how to fulfil those responsibilities



British Standard 8539

Key Duty Holders



The Specifier



The Contractor



The Installer



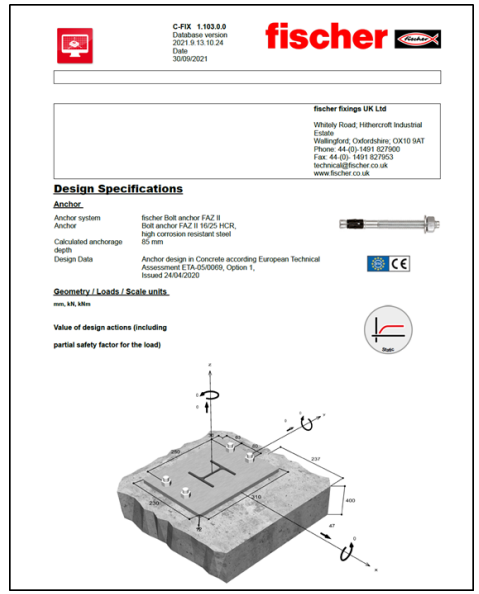
British Standard 8539

Key Duty Holders

Points relevant for all key duty holders

- Anchors with an ETA approval should be used for all safety critical applications
- Anchor connections should be designed to the appropriate design method
- Any change in the selection, design or installation of specified anchors needs to be agreed by original specifier or other responsible engineer
- Duty holders should be aware of the information they are required to provide other duty holders





British Standard 8539

Key Duty Holders

The Specifier



- Key responsibility of the specifier is to determine the most appropriate anchor for the application
- This achieved by;
  - Following the anchor type selection process given within BS 8539
  - Design the connection point utilising an appropriate design method

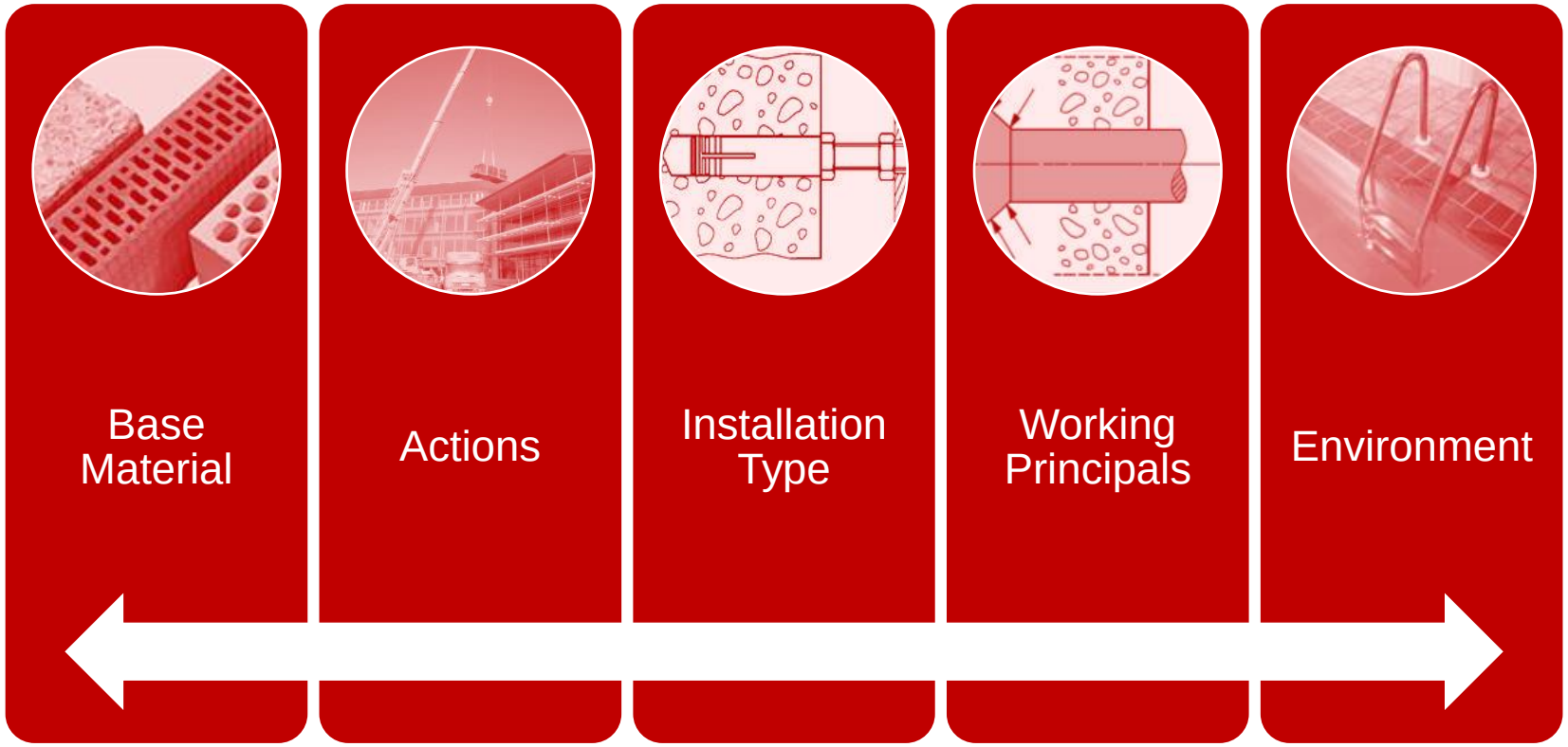
British Standard 8539

Key Duty Holders – Specification



The Specifier

- The selection process will focus on initial design considerations to identify the best type of anchor for the application



British Standard 8539

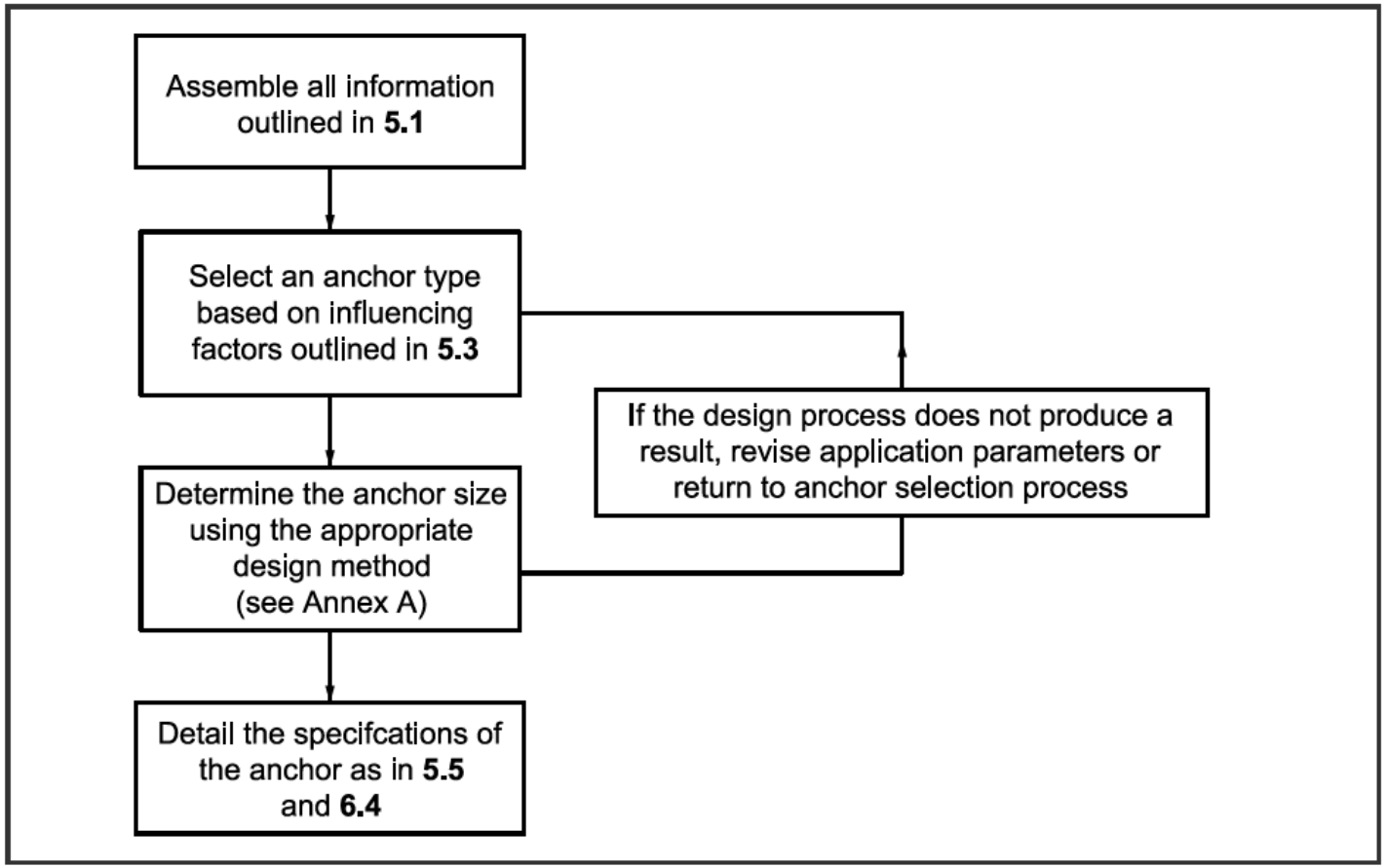
Key Duty Holders – Specification



The Specifier

- Full details of selection proces available within BS 8539

Figure 2 — *Flowchart for selection process*



British Standard 8539

Key Duty Holders – Specification



The Specifier

- Comprehensive list of information required for accurate selection of anchor for design

5.1 Information to be assembled

In order to undertake the anchor selection process, a minimum amount of information should be assembled beforehand by the specifier. This should include:

- project details;
- the design actions applied to the anchor and their nature (static/dynamic etc.);
- details of the base material type, thickness and likely strength at the time of installation, including condition of the concrete in the area of anchorages, i.e. cracked or non-cracked;
- preferred edge distance and centre spacings;
- details of the base plate, material and thickness, and proposed hole diameter;
- possible need for shims or grouting;
- environmental conditions including elevated temperatures or fire rating requirements, corrosion conditions and required durability, likely temperature at time of installation (only if resin bonded anchors are being considered);
- details of the type of anchor being considered;
- the European Technical A1 Assessment A1 (ETA) of the anchor, in its most up to date edition, if it has one;
- manufacturer's software for the selection of the anchor being considered;
- manufacturer's technical catalogue if no ETA or software is available;
- the results of the preliminary design considerations (see 5.2).

Anchoring Substrate

- Anchors need to be selected, designed and approved according to their base material which must be clearly defined by the responsible party







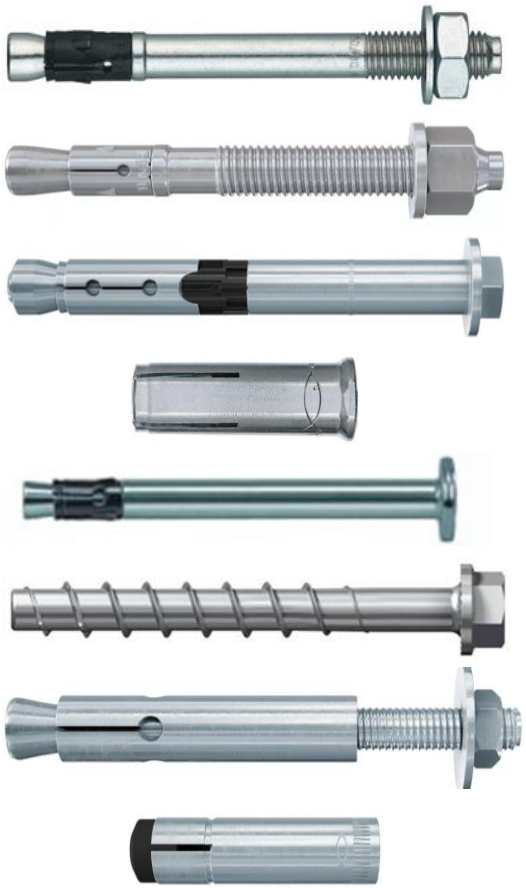



Anchoring Substrate

Concrete



- Fischer anchors which have ETA approval for use in concrete
  - ***FAZ II***
  - ***FBN II***
  - ***FH II***
  - ***EA II***
  - ***FNA II***
  - ***FBS II***
  - ***FZA***
  - ***FZEA***

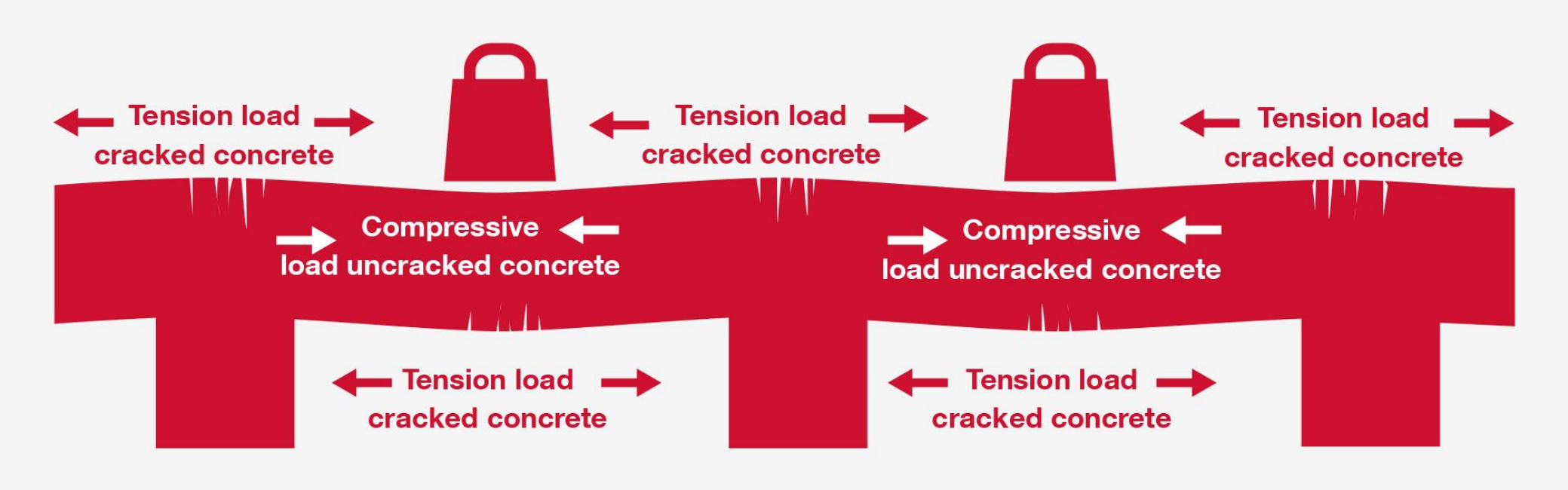


  - ***FIS VL***
  - ***FIS V Plus***
  - ***FIS Superbond***
  - ***FIS EM Plus***
  - ***FIS Highbond***
  - ***SXRL***



Anchoring Substrate

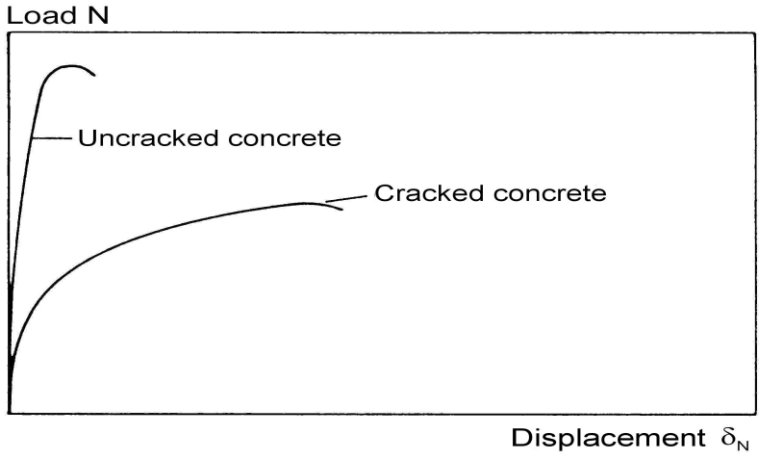
Cracked Concrete



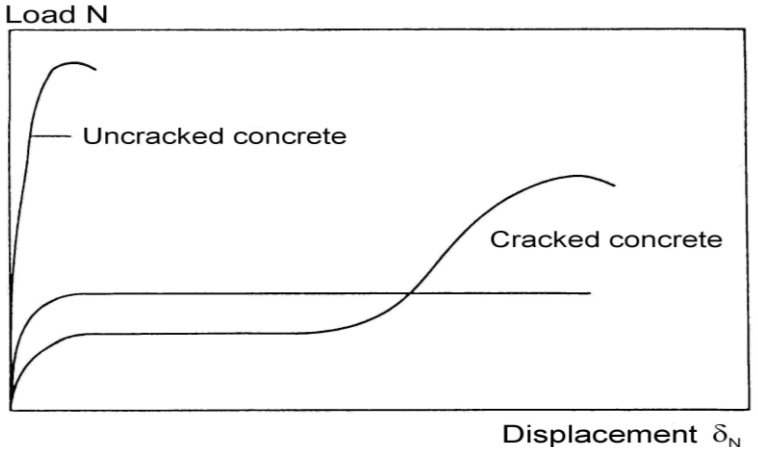
Anchoring Substrate

Cracked Concrete

- Concrete should always be assumed to be cracked
- Utilising anchors without the appropriate ETA result in unpredictable load behaviour within cracked concrete
- If a slab is to be considered uncracked then it needs to be assessed as per EC 2 Part 4 Section 4.7



Anchors suitable for use in Cracked Concrete



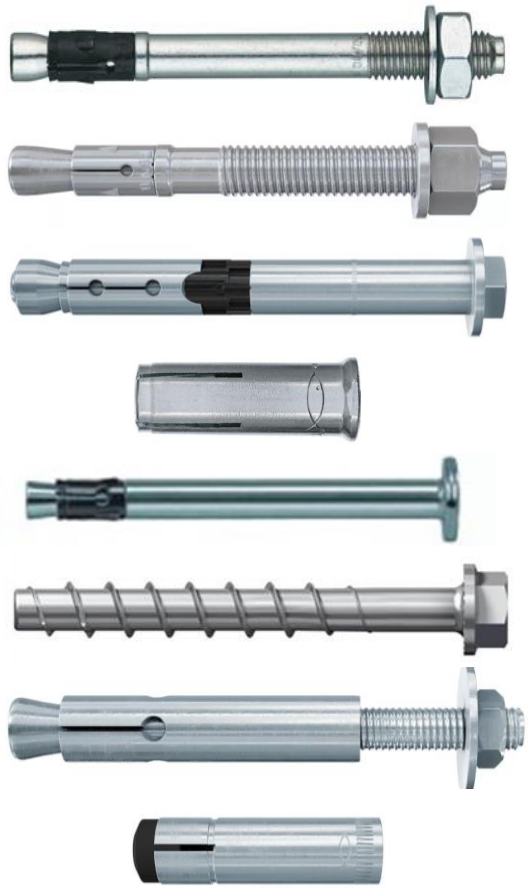
Anchors NOT suitable for use in Cracked Concrete

Anchoring Substrate

Cracked Concrete



- Which anchors have ETA Option 1 for cracked concrete
  - ***FAZ II***
  - ***FBN II***
  - ***FH II***
  - ***EA II***
  - ***FNA II***
  - ***FBS II***
  - ***FZA***
  - ***FZEA***



  - ***FIS VL***
  - ***FIS V Plus***
  - ***FIS Superbond***
  - ***FIS EM Plus***
  - ***FIS Highbond***
  - ***SXRL***



Anchoring Substrate

Cracked Concrete



- Which anchors have ETA Option 1 for cracked concrete
  - ***FAZ II*** 
  - ***FH II*** 
  - ***FBS II*** 
  - ***FZA*** 
  - ***FZEA*** 
  - ***FIS VL*** 
  - ***FIS V Plus*** 
  - ***FIS Superbond*** 
  - ***FIS EM Plus*** 
  - ***FIS Highbond*** 

Anchoring Substrate

Cracked Concrete



- Anchors without ETA Option 1 for cracked concrete?

- ***FBN II***  → ***ETA for use in Non-Cracked Concrete***

- ***EA II*** 

- ***FNA II***  → ***ETA for Multiple Use in Concrete***

- ***SXRL***  → ***ETA for Multiple Use in Concrete and Masonry***

Anchoring Substrate

Concrete - Multiple Use



- Which anchors have Option 1 Part 6 approval *only* for multiple use?

- ***FAZ II 8***
  (h_{ef} < 40mm)



- ***FBS II 6***



- ***EA II***



- ***FNA II***

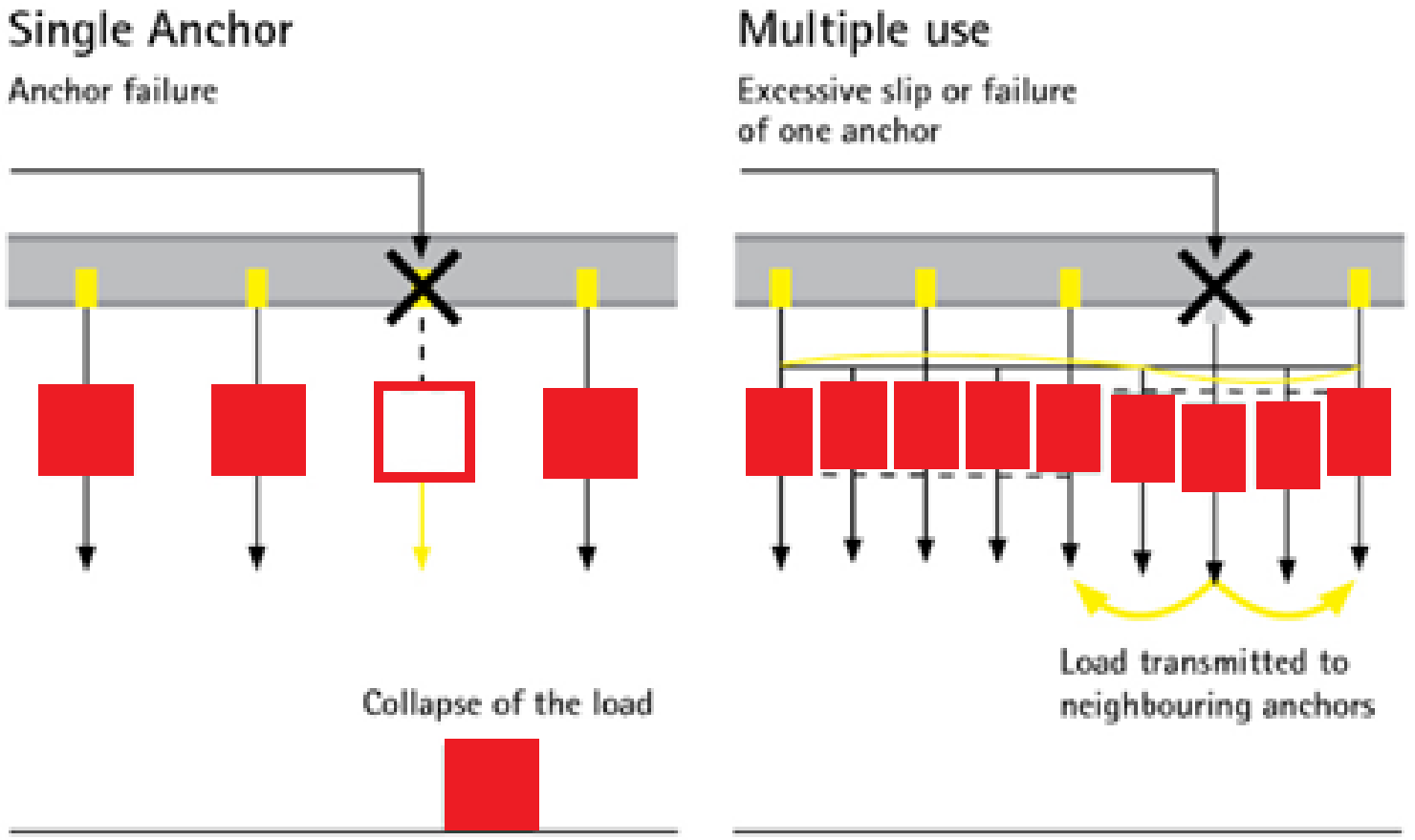


As per Eurocode 2 Part 4 anchors capable of being embedded at depths less than 40mm can only be used for non-structural applications

Anchoring Substrate

Concrete - Multiple Use

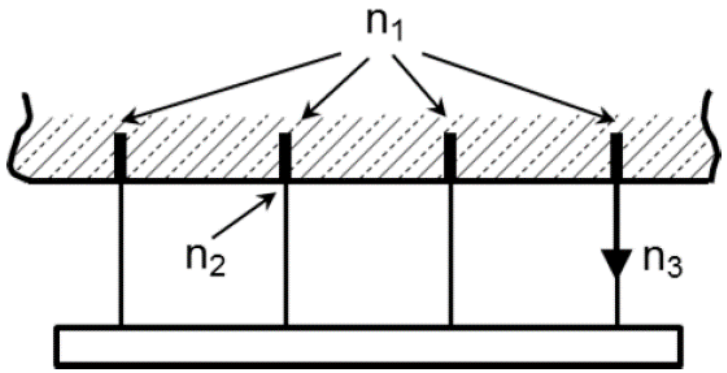
- If one fixing point fails then the others can pick up the slack
- This guards against progressive collapse

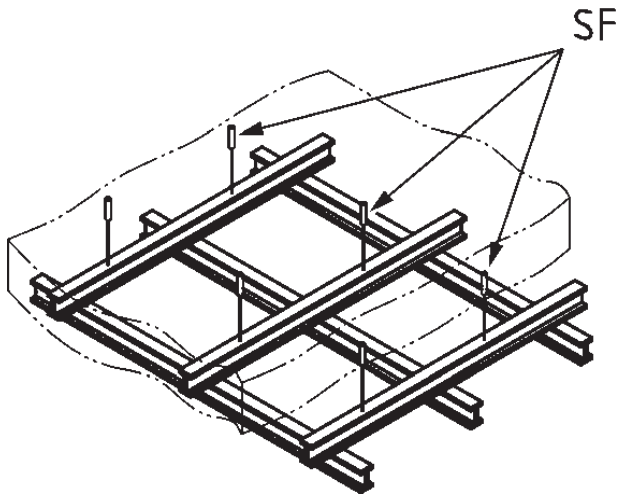


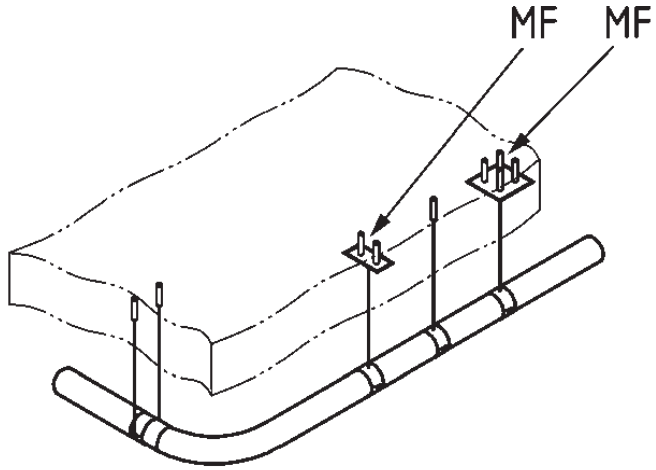
Anchoring Substrate

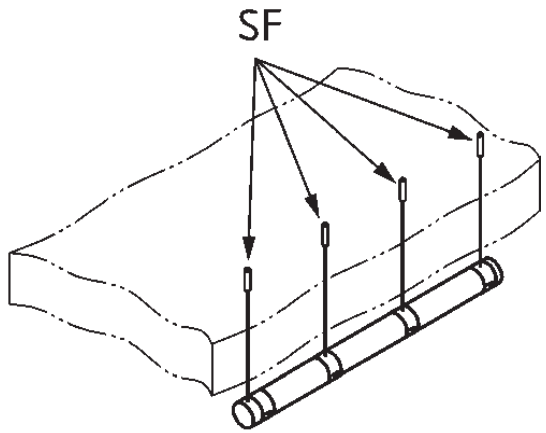
Concrete - Multiple Use

- A redundant system requires a minimum of 3 anchor points
- Each anchor point must comprise of at least a single anchor









Anchoring Substrate

Concrete - Multiple Use

- A redundant system requires a minimum of 3 anchor points
- Each anchor point must comprise of at least a single anchor
- Max load per anchor point is limited to allow for redundancy

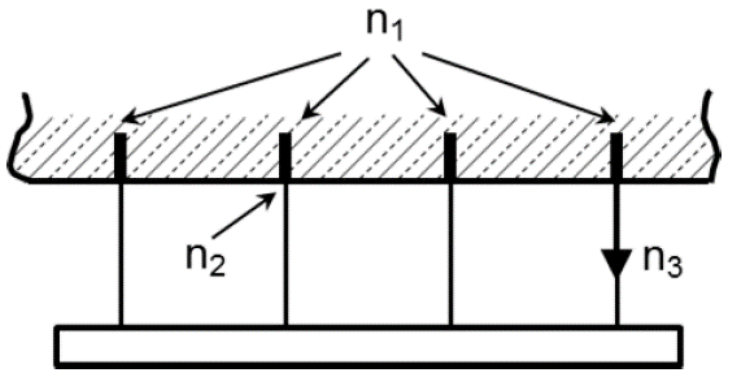


Table 4.1 — Recommended values for $F_{Ed,lim}$, n_1 and n_2

number of fixing points n_1	number of fasteners per fixing point n_2	limiting design action $F_{Ed,lim}$
≥ 4	≥ 1	3,0 kN
3	≥ 1	2,0 kN

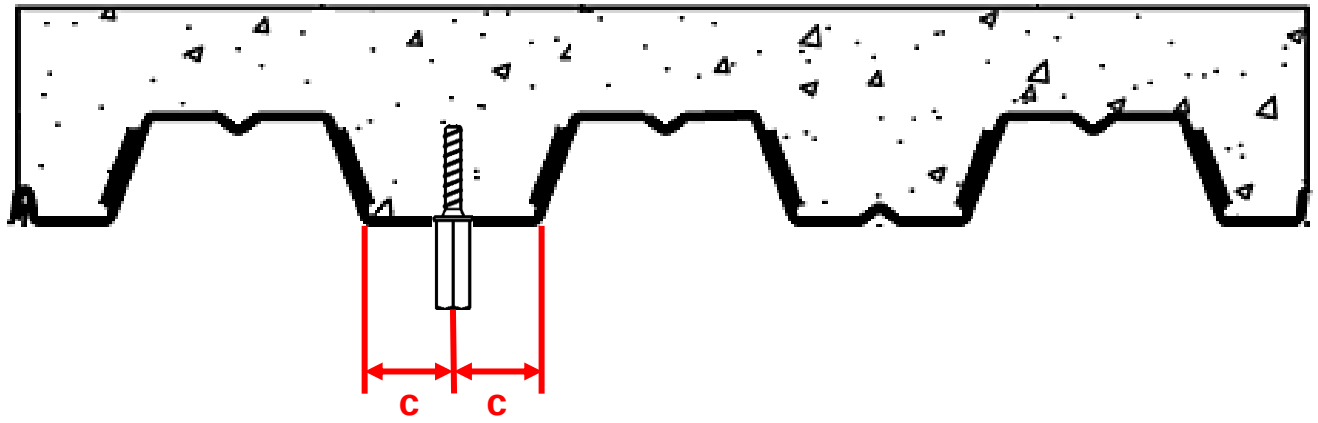
Anchoring Substrate

Concrete - Ribbed Deck

- When installing into rib, where concrete transitions to the base of the deck these must be considered as a free edge

- For an anchor to achieve it’s max load capacity in concrete it usually requires a distance to a free edge of 1.5x it’s embedment depth

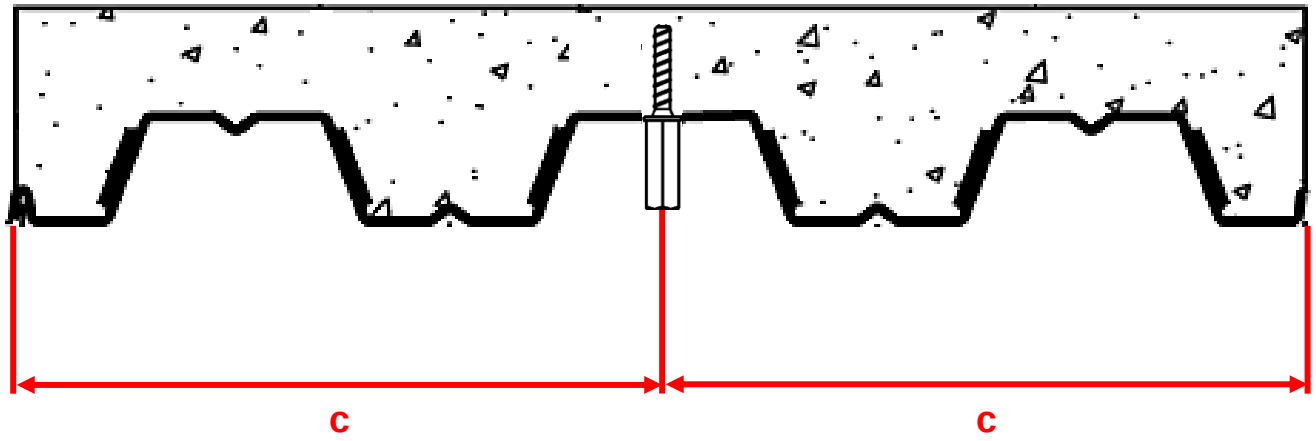
- Also all anchors have a minimum allowable edge distance defined within its ETA



Anchoring Substrate

Concrete - Ribbed Deck

- When installing into the base of the decking, the edge distances then become the edge of the actual slab
- This allows for a wider range of anchors that could be used for the application



Anchoring Substrate

Masonry





- The range of anchors suitable for masonry is much more limited
  - ***FBS II*** 
  - ***FIS V+*** 
  - ***FIS VL+*** 
  - ***SXRL*** 

Anchoring Substrate

Masonry





- The range of anchors suitable for masonry is much more limited
  - ***FBS II*** 
  - ***FIS V+*** 
  - ***FIS VL+*** 
  - ***SXRL*** 

Force required for installing steel expansion anchors would result in irreparable damage to most masonry

Anchoring Substrate

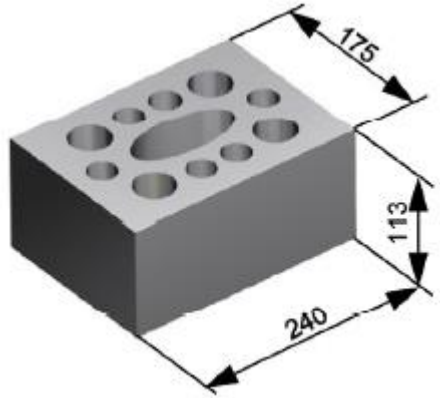
Masonry





- All can also be used in hollow or perforated masonry
  - ***FBS II*** 
  - ***FIS V+*** 
  - ***FIS VL+*** 
  - ***SXRL*** 

Limited to a single perforated brick type



Anchoring Substrate

Masonry

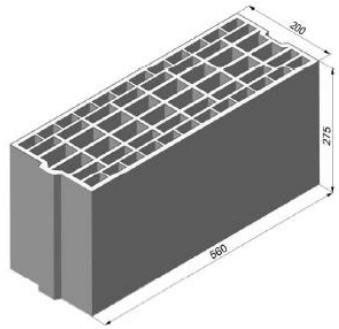


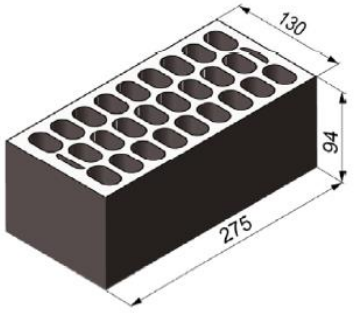
- All can also be used in hollow or perforated masonry
  - ***FBS II***



  - ***FIS V+***









  - ***FIS VL+***



  - ***SXRL***



Wide range of hollow and perforated masonry

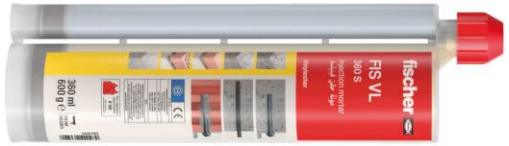
Anchoring Substrate

Masonry



- Chemical anchors require sleeves for use in hollow and perforated masonry
  - ***FIS V+***
  - ***FIS VL+***









- ***SXRL***



To ensure the resin stays centered around the threaded bar resin sleeves are required

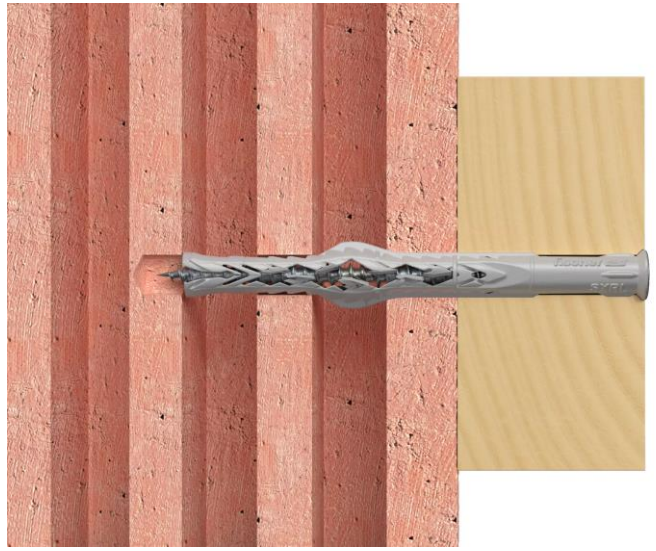
Anchoring Substrate

Masonry



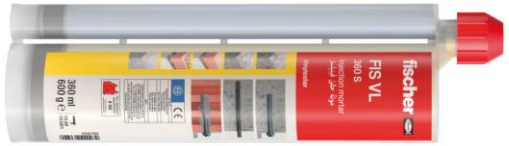
- Where as SXRL frame fixing can be installed as is
  - ***FIS V+***







  - ***FIS VL+***



  - ***SXRL***





Deforms during installation between perforations to keep anchor in place

Anchoring Substrate

Hollowcore Concrete



- Hollowcore is considered to be a different substrate to concrete, so different selection of anchors are suitable for use in it;
  - ***FBS II***



  - ***EA II***



  - ***FHY***



  - ***FIS V+ / VL +***



Anchoring Substrate

Hollowcore Concrete



- Even amongst most anchors with ETA approval, only certain versions are approved
  - ***FBS II 6***



  - ***EA II 25s***



  - ***FHY***



  - ***FIS V+ / VL +***



Anchoring Substrate

Hollowcore Concrete



- Even amongst most anchors with ETA approval, only certain versions are approved
  - ***FBS II 6***
  - ***EA II 25s***
  - ***FHY***
  - ***FIS V+ / VL +***











ETA for Multiple Use in Concrete

Environment



Internal



External

Environment

High Exposure Conditions



Environment

Corrosion Class

For ETA Approvals

Corrosion class according to EN ISO 12944-2

According to DIN EN ISO 12944-2	Descriptions	Corrosion class
C1	Internal, non exposed and dry environment.	Very low
C2	Rural surroundings, as well as light industrial and urban areas, typically over 500 m away from heavy industry fall out and away from all environmental influences listed below.	Low
C3	Industrial areas characterised by pollution precipitation from adjacent designated industrial environments or where small industries lead to significant pollution. Also mild marine areas min. 1000 m away from marine environment, characterised by a noticeable salt smell.	Average
C4	Heavy industry characterised by high emissions. Perceptible chemical odour, e.g. sulphur and acid. Includes factory buildings and buildings with moderate internal humidity and/or expected moderate corrosion due to the technical and chemical conditions. Also includes the marine environment between 100 and 300 m from the shore in an inland direction.	High
C5 I	Heavy industrial areas or chemical industry, characterised by strong emissions from chimneys and strong chemical odours, e.g. sulphur and acids. Extremely high corrosion rates inside and outside the building can usually be expected here.	Very high
C5 M	Marine areas, including off shore applications, as well as any building less than 100 m from the coast or the surf line.	Very high

→ ***Zinc Plated & Passivated***

→ ***Hot Dipped Galvanized***

→ ***A2/A4 Stainless Steel***

} ***HCR Stainless Steel***

Environment

Corrosion Class

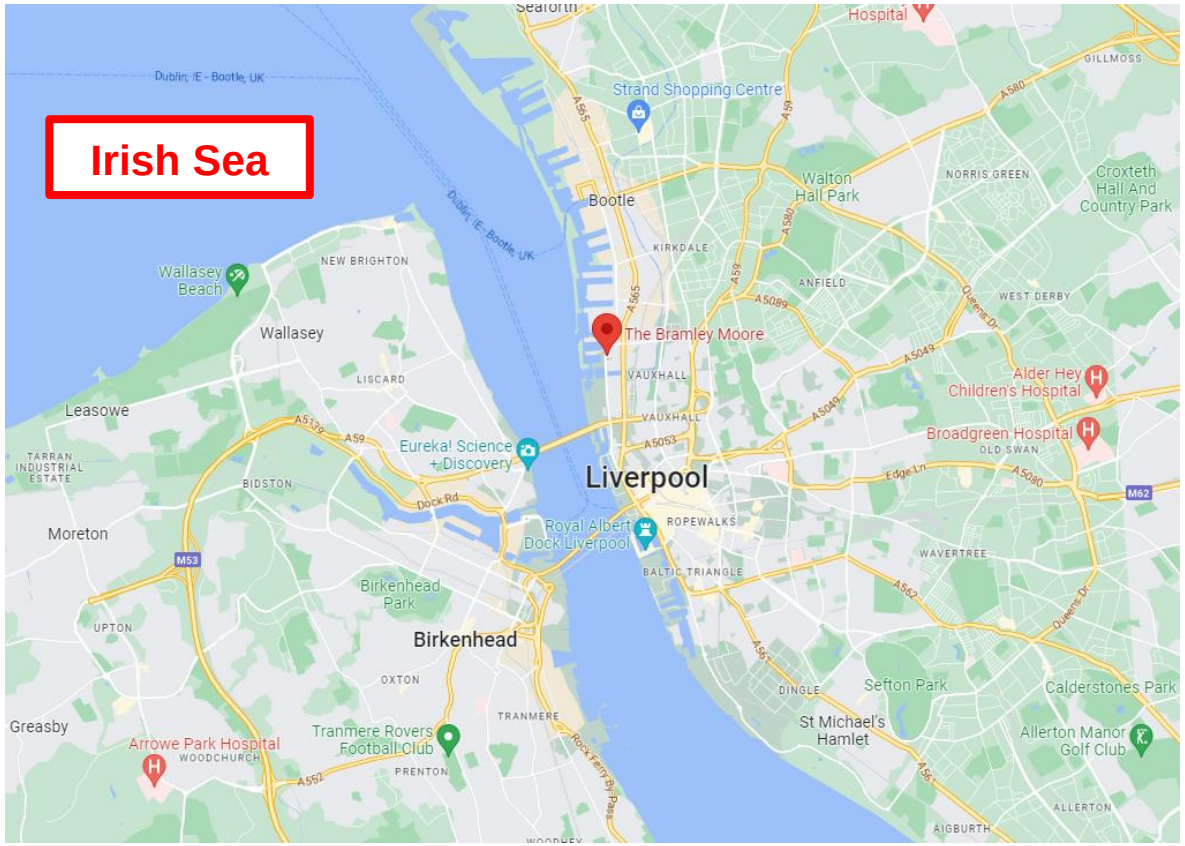
- Challenges of selecting suitable anchors are at the forefront with projects such as Bramley Moore Dock Stadium



Environment

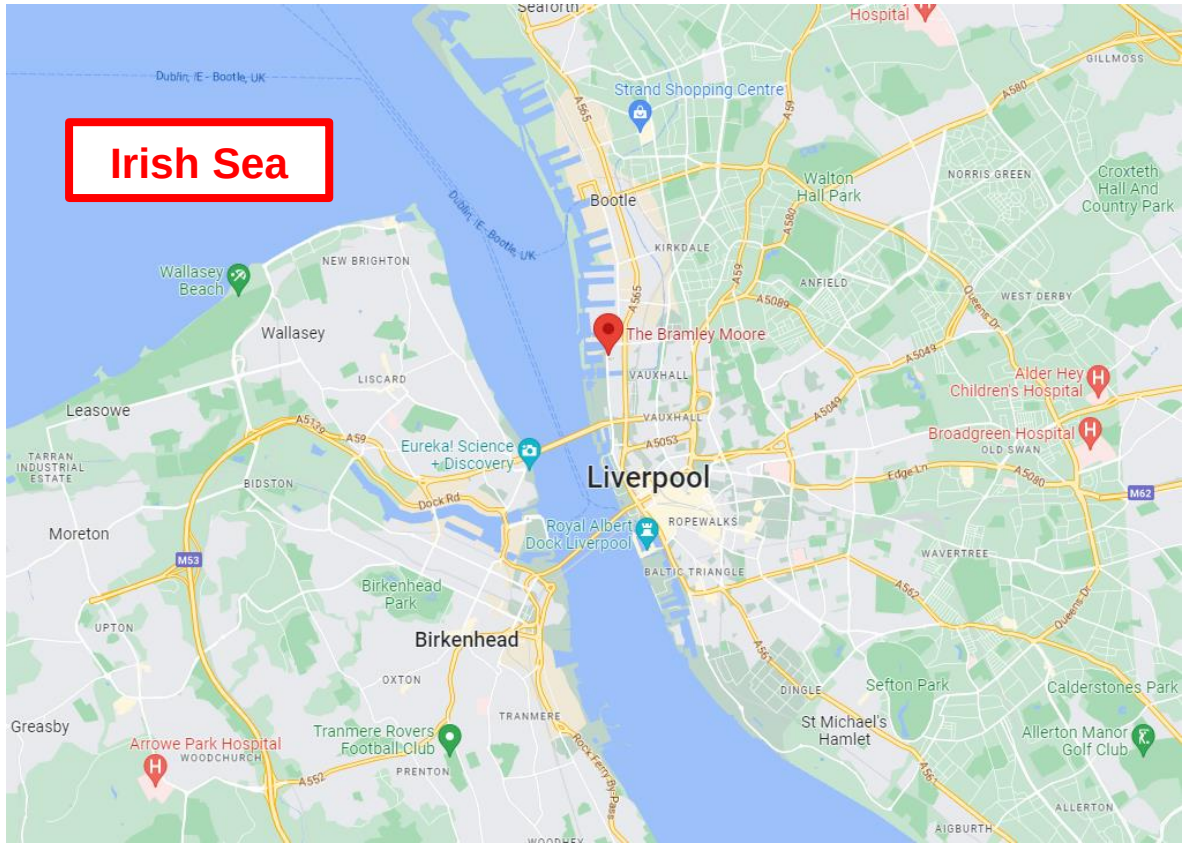
Corrosion Class





Environment

Corrosion Class



- Stadium is located on the estuary of the River Mersey where it meets the Irish Sea
- Meaning the external environment is classed as a minimum as C4 due to the sodium chloride in the atmosphere

Environment

Corrosion Class





Environment

Corrosion Class



- Many internal areas will be exposed to the external environment on match days
- As a result areas must be classed as C4 in accordance with EN ISO 12944-2

Environment

Corrosion Class







- Effect of corrosion on HDG supports after 10 years of C4 environment exposure

Environment

Corrosion Class



fischer

fischerwerke GmbH & Co. KG – Postfach 11 52 – 72178 Waldachtal

Contact person: Dr. Falko Vogler
Phone: +49 7443 12-6902
Email: falko.vogler@fischer.de

To whom it may concern

Waldachtal, 13th of September 2023

Use of EA II R for installations at Everton Stadium

Dear Sir or Madam,

we hereby confirm that fischer Hammerset anchor EA II R are suitable for the fixing in the Everton Stadium.

All installations which are carried out according to ETA-07/0135 and ETA-07/0142 are safe in respect to the given performance data. EA II R have a service life of at least 25 years in this application since a regular cleaning regime can be assumed.

i. V. Dominik Rothfuß
Head of Product Management
Business Unit Steel and
Heavy Duty Fixings

i.V. Dr. Falko Vogler
Manager Research & Development
Business Unit Steel and
Heavy Duty Fixings

Environment

Corrosion Class

- Challenge for M&E applications was that support brackets are not available in HCR finish
- As a result the working life of the applications were reduced to allow for A4 material finishes
- ETA approval requires a minimum working life of 50 years to be achieved
- Fischer can provide confirmation use of anchors in corrosive environments with a reduced working life after assessment



fischer

fischerwerke GmbH & Co. KG – Postfach 11 52 – 72178 Waldachtal

To whom it may concern

Contact person: Dr. Falko Vogler
Phone: +49 7443 12-6902
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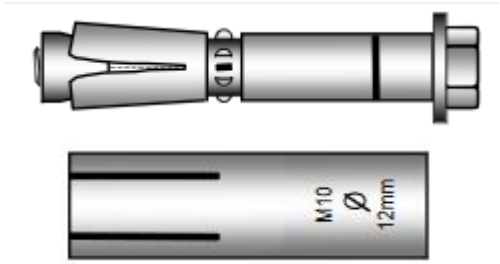
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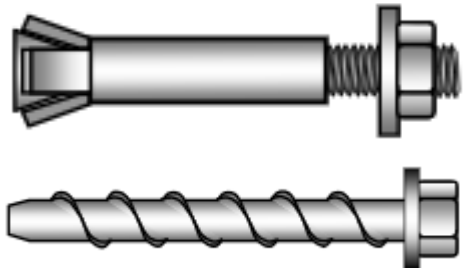
i.V. Dr. Falko Vogler
Manager Research & Development
Business Unit Steel and
Heavy Duty Fixings

Anchor Types



Expansion Anchors

Friction working principal



Interlock Anchors

Keying working principal

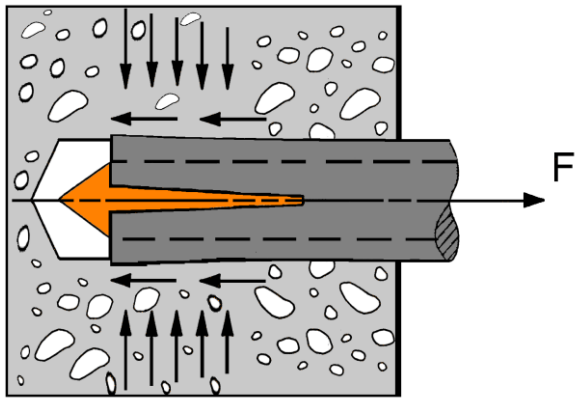


Chemical Anchors

Bonding working principal

Anchor Types

Expansion Anchors



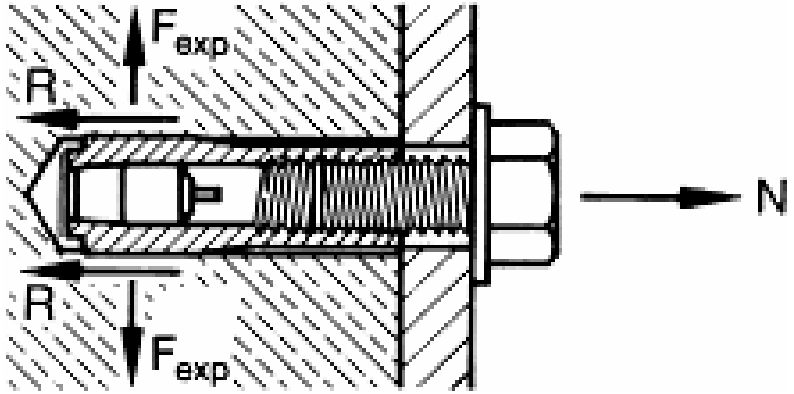
Torque Controlled Expansion Anchors

FAZ II Plus



FH II





Displacement Controlled Expansion Anchors

EA II

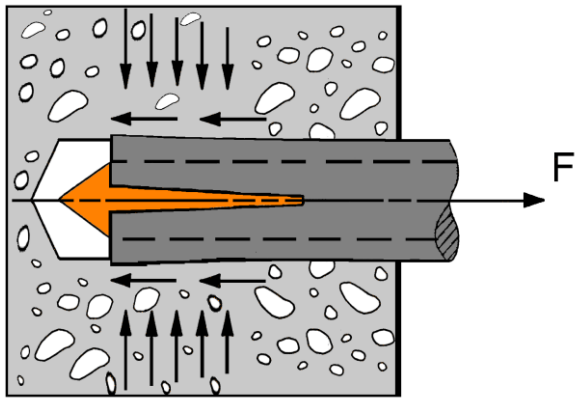


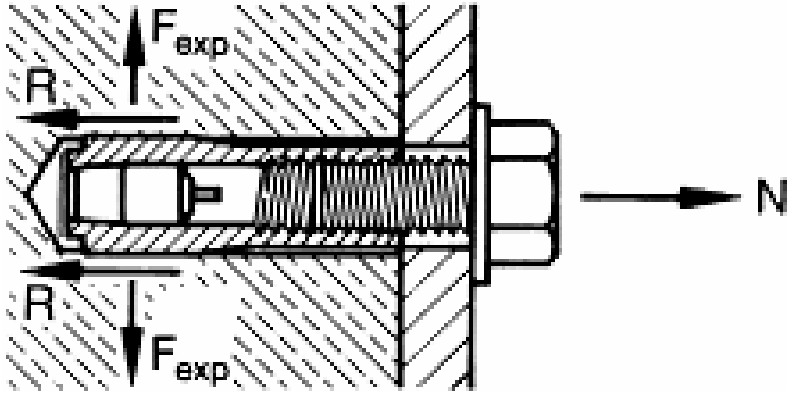
FNA II



Anchor Types

Expansion Anchors





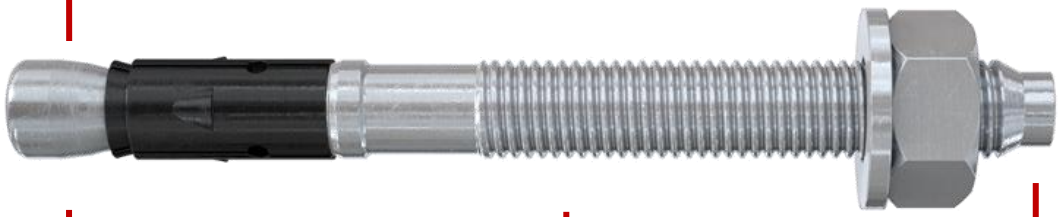
- The expansion puts compressive forces into the base material so that extraction is resisted by a friction
- There are numerous types of expansion anchors on the market all with large ranges, offering great design flexibility
- The drawback are the stresses introduced into the surrounding substrate by the expansion of the anchors
- As a result, these anchors cannot be places too close to each other or to free edges due to risk of substrate failure under load

Bolt anchor FAZ II Plus.
For highest demands. Powerful and flexible.

The new ETA confirms the use of the FAZ II Plus for **dynamic loads for diameters M16-M24**.

High material strengths for **increased steel factors** Nrk,s; Vrk and M0rk,s

Report confirms the service life of anchorages up to 120 years **perfectly suited for large, long-lasting construction projects.**



Quick and easier assembly **without the need for drill hole cleaning.**

With the new ETA the tensile strengths increase decisively. As a result, **fewer fixing points and anchors are required.**

Allows the **absorption of high seismic loads of performance category C1 and C2** with and without the use of the filling disc FFD at installation.

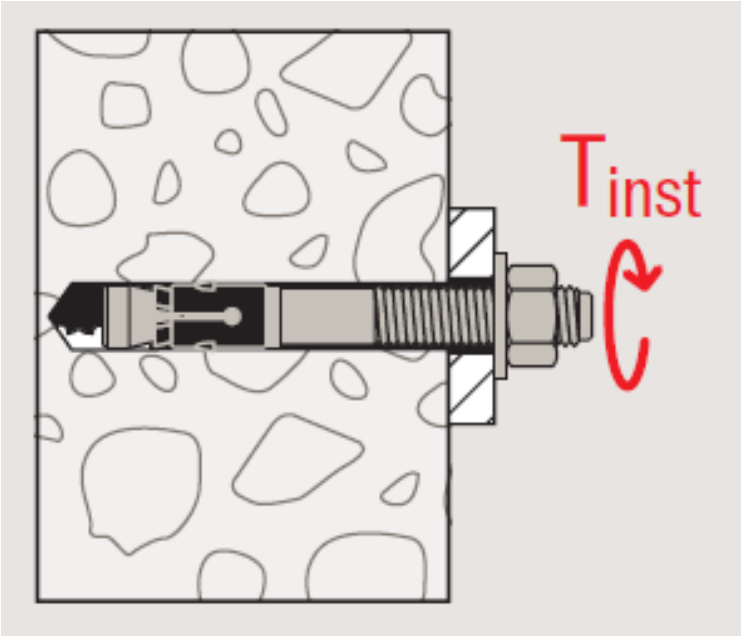
Numerous approval certificates for different substrate materials **increase the number of applications and fields of use.**

Anchor Types

Expansion Anchors – Torque Controlled Anchors

Type	Material/ surface[2)]	Effective anchorage depth h_{ef} [mm]	Minimum member thickness h_{min} [mm]	Instal-lation torque T_{inst} [Nm]
FAZ II 10	gvz	40	90	45
	gvz	60	110	45
	R	40	90	45
	R	60	110	45
FAZ II 12	gvz	50	100	60
	gvz	70	120	60
	R	50	100	60
	R	70	120	60
FAZ II 16	gvz	65	140	110
	gvz	85	140	110
	R	65	140	110
	R	85	140	110





Anchor Types

Expansion Anchors – Torque Controlled Anchors

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	R	70	120	60
FAZ II 16	gvz	65	140	110
	gvz	85	140	110
	R	65	140	110
	R	85	140	110



- Require exact installation torque, dependant on anchor type and size
- Torque to be applied utilising a calibrated torque wrench

Anchor Types

Expansion Anchors – Torque Controlled Anchors

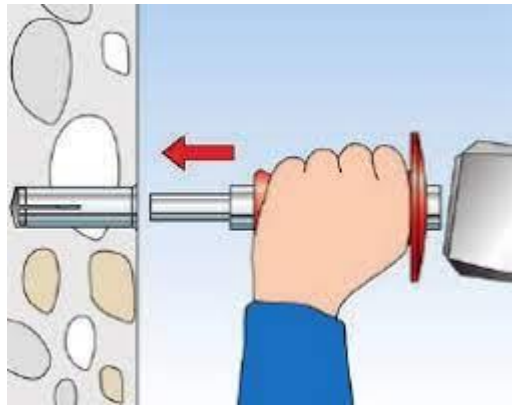
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FAZ II 16	gvz	65	140	110
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	R	85	140	110





Anchor Types

Expansion Anchors – Displacement Controlled



EA II

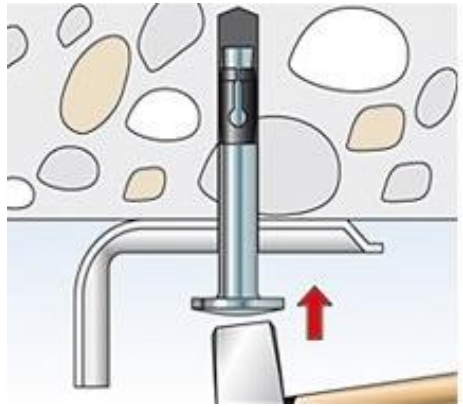


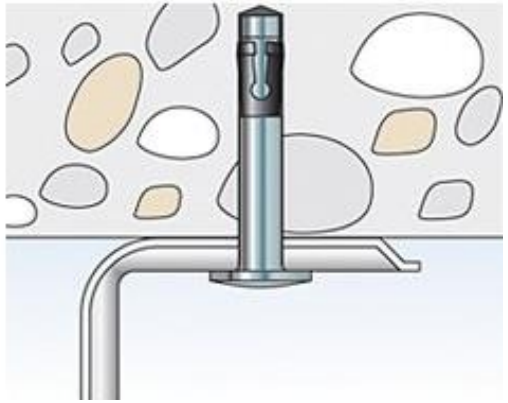
FNA II

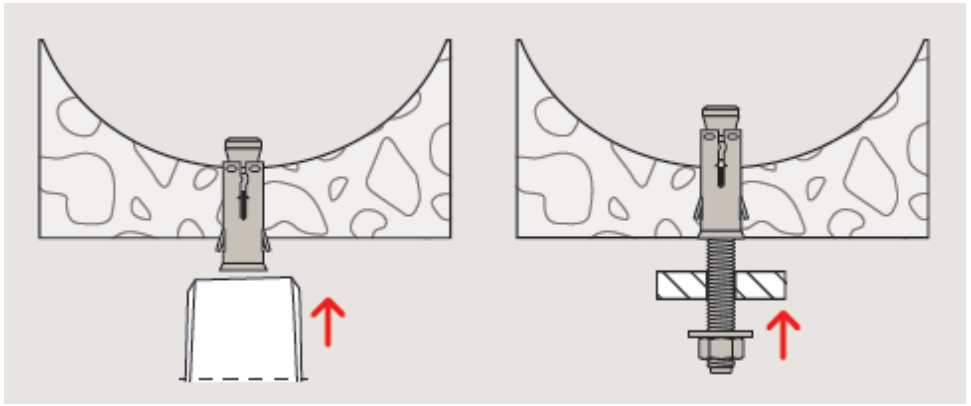


FHY



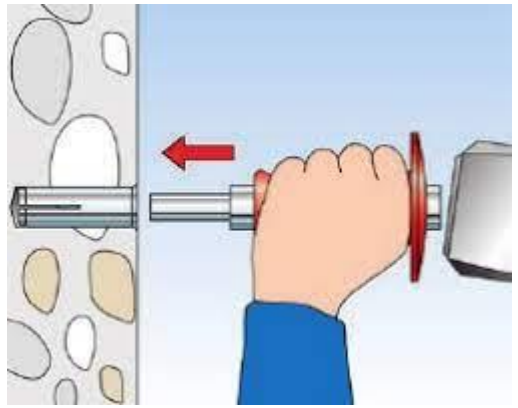






Anchor Types

Expansion Anchors – Displacement Controlled



EA II



FNA II



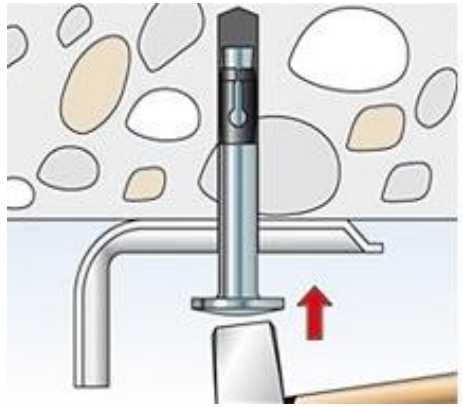
FHY

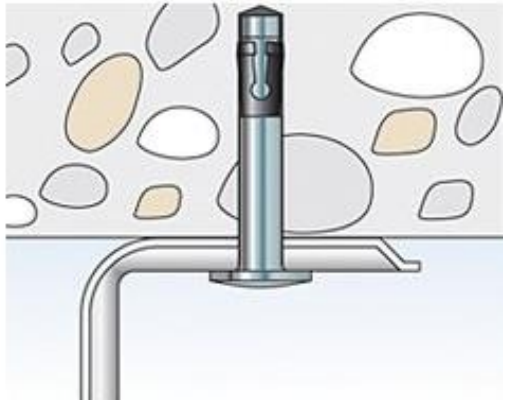


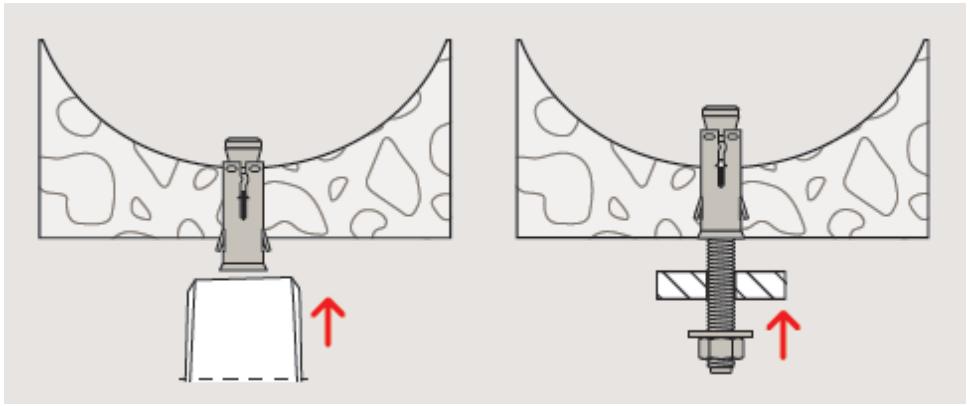
ETA-18/0242
EAD 330747-00-0601

Multiple use for non-structural applications in concrete

ETA for Multiple Use

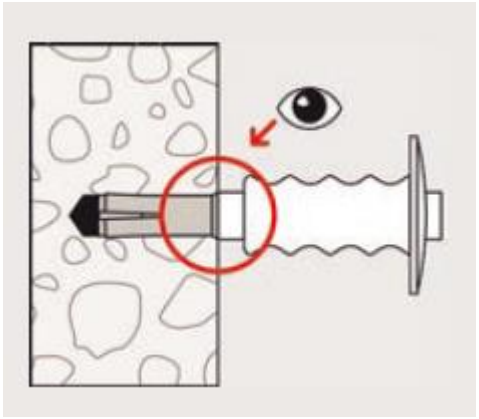




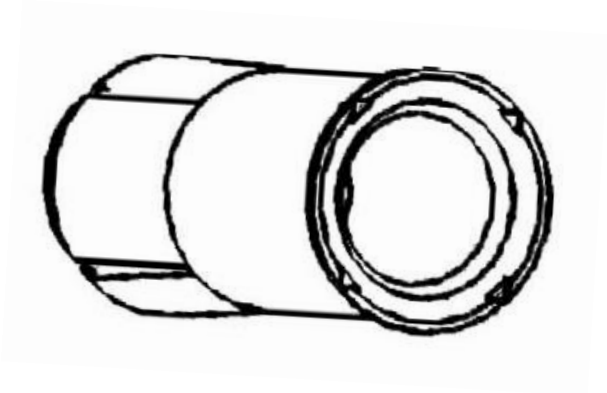


Anchor Types

Expansion Anchors – EA II Hammerset Anchor









Hammerset Anchors

Bad Practice



Collapsed Air Conditioning Unit



Fischer Hammerset Anchors

Bad Practice







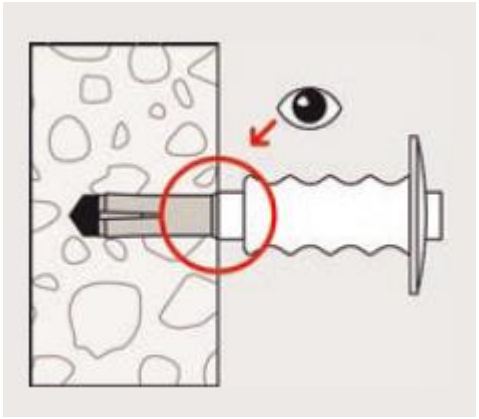
What was the cause of this failure?

Wrong Setting Tool

An example of ***incorrect anchor installation***

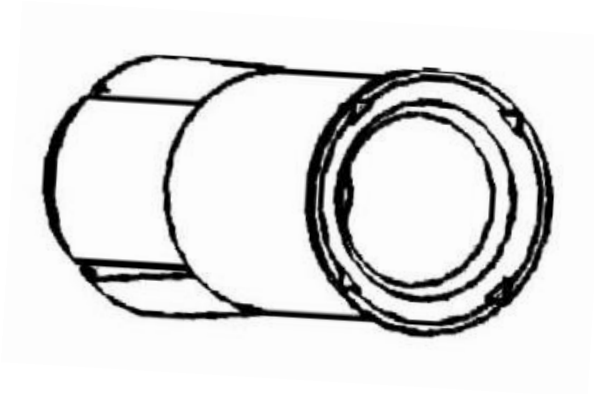
Anchor Types

Expansion Anchors – EA II Hammerset Anchor









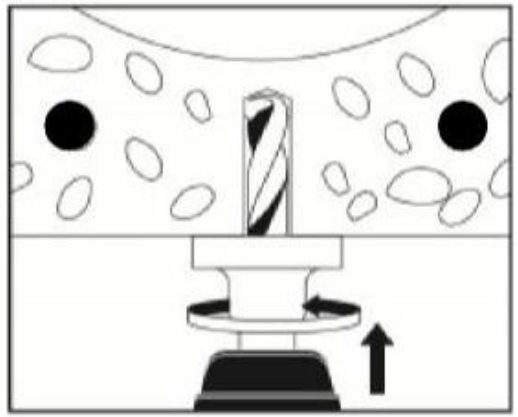
Item	Match
EHS M 6 x 25/30 Plus	EA II M 6 x 25, EA II M 6 x 30
EHS M 8 x 25/30 Plus	EA II M 8 x 25, EA II M 8 x 30
EHS M 8 x 40 Plus	EA II M 8 x 40
EHS M 10 x 25/30 Plus	EA II M 10 x 25, EA II M 10 x 30
EHS M 12 x 25 Plus	EA II M 12 x 25
EHS M 10 x 40 Plus	EA II M 10 x 40
EHS M 12 x 50 Plus	EA II M 12 x 50, EA II M 12 x 50 D

EHS Plus Setting Tool

Anchor Types

Expansion Anchors – EA II Hammerset Anchor

Hollow Core



Stop drill	For anchor size
EBB 8x25 EBB 8x30	EA II M6x25 EA II M6x30
EBB 10x25 EBB 10x30	EA II M8x25 EA II M8x30
EBB 10x40	EA II M8x40
EBB 12x25 EBB 12x30	EA II M10x25 EA II M10x30
EBB 12x40	EA II M10x40
EBB 15x25	EA II M12x25
EBB 15x50	EA II M12x50



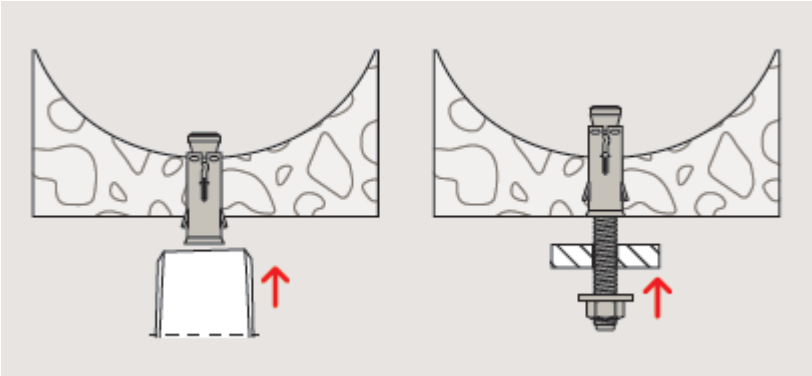
EBB Sop Drill Bit

Anchor Types

Expansion Anchors – FHY Hollow Core



Specifically Designed for Hollowcore





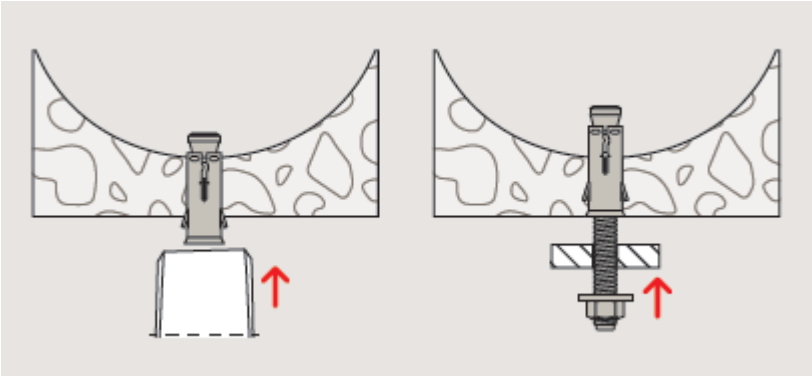
Anchor Types

Expansion Anchors – FHY Hollow Core



Base materials:

- Compacted reinforced and unreinforced normal weight concrete without fibres (cracked and uncracked) according to EN 206-1:2013+A1:2016
- Strength classes ≥ C20/25 according to EN 206-1:2013+A1:2016
- Prestressed hollow core slabs, where the cavity width does not exceed 4,2 times the web width ($b_H \leq 4{,}2 \times b_{St}$) with strength classes ≥ C45/55

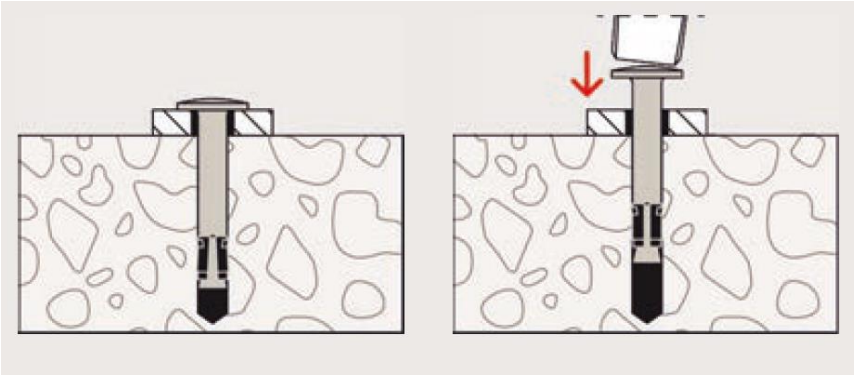


Performance in solid concrete comparable to EA IIs

Anchor Types

Expansion Anchors – FNA II Nail Anchor





Suitable for all Corrosion Classes

	Zinc-plated steel Item No.	Stainless steel Item No.	Highly corrosion resistant steel Item No.
Item	gvz	R	HCR
FNA II 6 x 25/5	044121 [1)]	–	–
FNA II 6 x 30/5	044115 [1)]	044122	–
FNA II 6 x 30/5	–	–	044124
FNA II 6 x 30/15	530419	–	–
FNA II 6 x 30/30	044116	044123	–

Anchor Types

Expansion Anchors - FAZ II Plus

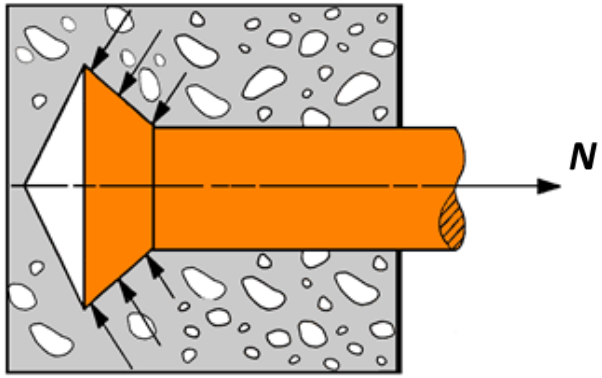


Suitable for all Environments

	Zinc-plated steel Item No.	Stainless steel Item No.	Highly corrosion resistant steel Item No.
Item	gvz	R	HCR
FAZ II 10/10	094981	501403	–
FAZ II 10/10	–	–	501430
FAZ II 10/20	094982	–	–
FAZ II 10/20	–	501406	–
FAZ II 10/30	094983	–	–
FAZ II 10/30	–	501407	–
FAZ II 10/30	–	–	503185
FAZ II 10/50	094984	501409	–

Anchor Types

Interlock Anchors



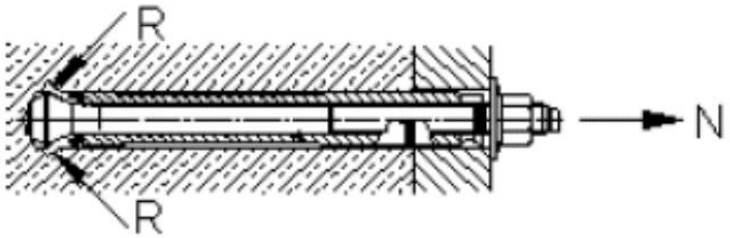
Undercut Anchors

FSU



FZEA II





Self Taping Concrete Screws

FBS II



Anchor Types

Interlock Anchors – FBS II Concrete Screw

FBS II

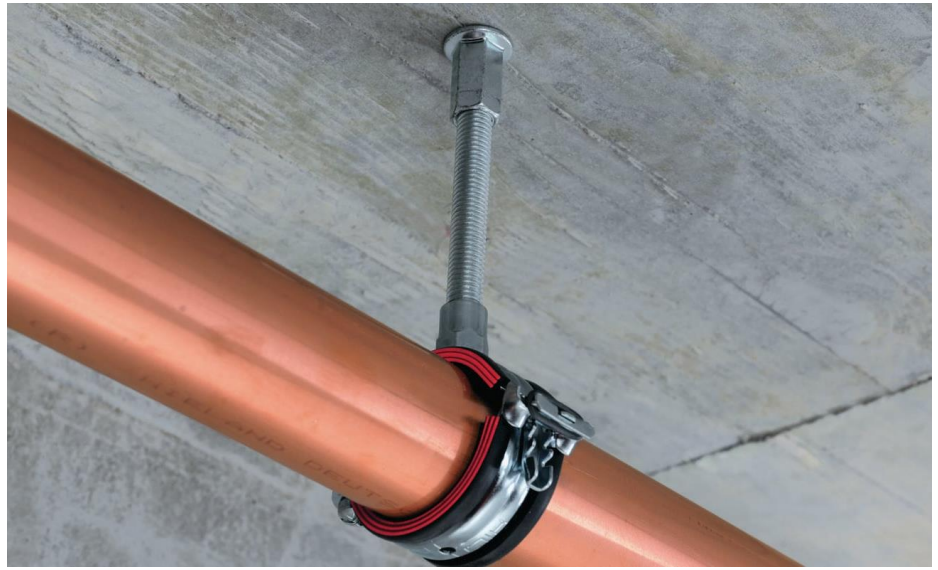


FBS II 6









Anchor Types

Interlock Anchors – FBS II Concrete Screw

FBS II



FBS II 6



Type	Material/ surface	Screw-in depth h_{nom} [mm]	Minimum member thickness h_{min} [mm]	Instal-lation torque $T_{imp, max}$ [2)] [Nm]	Cracked concrete: Permissible tension (N_{perm}) ar minimum spacing (s_{min}) and e with reduced loads N_{perm} [3)] [kN]	V_{perm} [3)] [kN]
FBS II 6	gvz	40	80	450	1.2	4.3
	gvz	45	90	450	1.7	4.3
	gvz	50	90	450	1.9	4.3
	gvz	55	100	450	2.4	6.3
FBS II 8	gvz / CP	50	100	600	2.9	4.1
	gvz / CP	65	120	600	5.7	9.0
FBS II 10	gvz / CP	55	100	650	4.3	4.6
	gvz / CP	65	120	650	5.7	11.9
	gvz / CP	85	140	650	9.2	16.6



Anchor Types

Interlock Anchors – FBS II 6 Concrete Screw

FBS II



FBS II 6

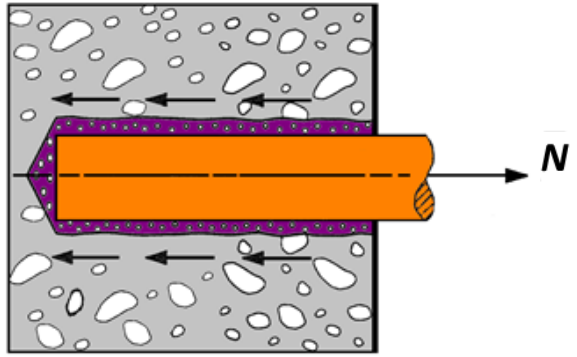


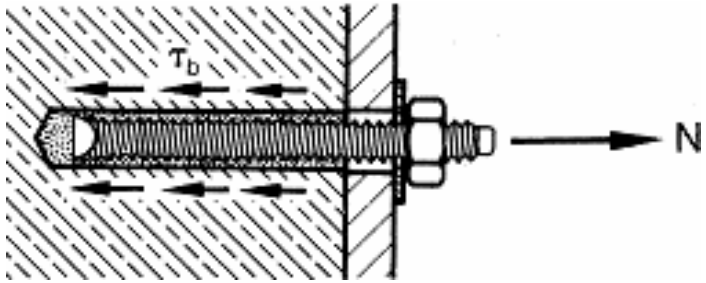
Type	Material/ surface	Screw-in depth h_{nom} [mm]	Minimum member thickness h_{min} [mm]	Instal-lation torque $T_{imp, max}$ [2)] [Nm]	Cracked concrete: Permissible tension (N_{perm}) ar minimum spacing (s_{min}) and e with reduced loads N_{perm} [3)] [kN]	V_{perm} [3)] [kN]
FBS II 6	gvz	40	80	450	1.2	4.3
	gvz	45	90	450	1.7	4.3
	gvz	50	90	450	1.9	4.3
	gvz	55	100	450	2.4	6.3
FBS II 8	gvz / CP	50	100	600	2.9	4.1
	gvz / CP	65	120	600	5.7	9.0
FBS II 10	gvz / CP	55	100	650	4.3	4.6
	gvz / CP	65	120	650	5.7	11.9
	gvz / CP	85	140	650	9.2	16.6

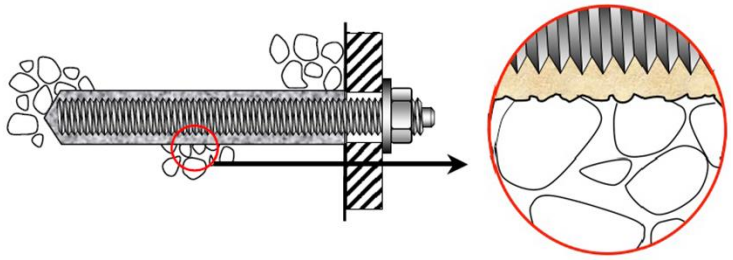


Anchor Types

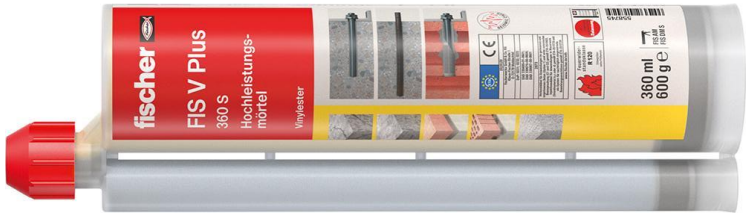
Chemical Anchors







Injected Chemical Anchors



FIS V Plus



FIS A

Resin Capsule Chemical Anchors



RSB



RGM

Anchor Types

Chemical Anchors – Capsule vs Injection

Table B9.2 **Maximum processing** time of the mortar and **minimum curing** time (During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature)

Temperature at anchoring base [°C]	Maximum processing time t_{work}			Minimum curing time [1] t_{cure}		
	FIS VW Plus High Speed	FIS V Plus	FIS VS Plus Low Speed	FIS VW Plus High Speed	FIS V Plus	FIS VS Plus Low Speed
-10 to -5 [2]	-	-	-	12 h	-	-
> -5 to 0 [2]	5 min	-	-	3 h	24 h	-
> 0 to 5 [2]	5 min	13 min	-	3 h	3 h	6 h
> 5 to 10	3 min	9 min	20 min	50 min	90 min	3 h
> 10 to 20	1 min	5 min	10 min	30 min	60 min	2 h
> 20 to 30	-	4 min	6 min	-	45 min	60 min
> 30 to 40	-	2 min	4 min	-	35 min	30 min

[1] In wet concrete or water filled holes the curing times must be doubled
[2] Minimal cartridge temperature +5°C

- Main difference between injection and capsules systems are the curing time of the anchors

Anchor Types

Chemical Anchors – Capsule vs Injection

Table B5.4: Minimum curing time

(During the curing time of the mortar the concrete temperature may not fall below the listed minimum temperature; minimal capsule temperature -15 °C)

Concrete temperature [°C]	Minimum curing time t_{cure}
-15 to -10	30 h
> -10 to -5	16 h
> -5 to 0	10 h
> 0 to 5	45 min
> 5 to 10	30 min
> 10 to 20	20 min
> 20 to 30	5 min
> 30 to 40	3 min

- Main difference between injection and capsules systems are the curing time of the anchors

Anchor Types

Chemical Anchors – FIS V Plus Vinyl Ester











- Latest formulation of hybrid vinyl-ester chemical anchors, with both improved loadings and ETAs for use in all concrete and masonry

Anchor Types

Chemical Anchors – FIS V Plus Vinyl Ester



- In addition to standard threaded bar, approvals included use of internally threaded sockets in uncracked concrete and solid masonry
- Two mesh sleeve options for using in both hollow masonry and hollow core slabs

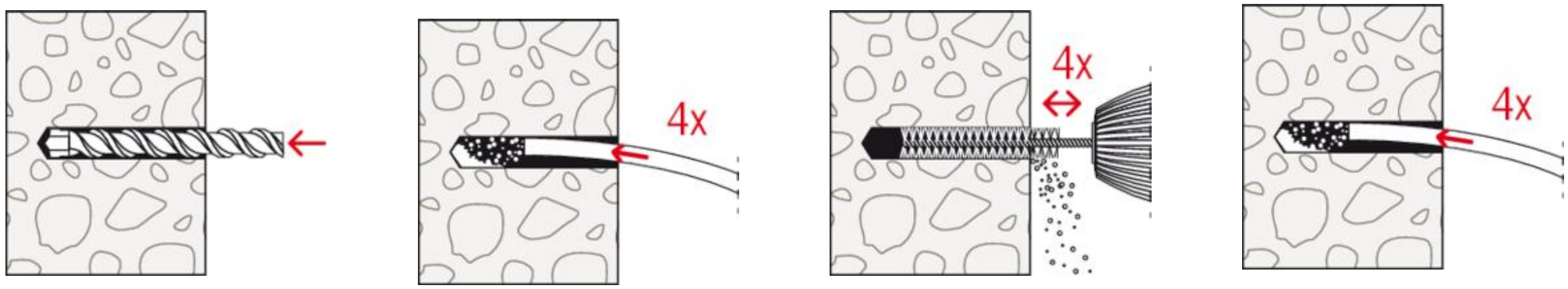
Anchor Types

Chemical Anchors – Drill Hole Cleaning

- As with all injection resin systems, cleaning of the drill hole as per manufacturers guidance is essential

- Max load bearing capacity of resin systems are greatly reduced if drill hole cleaning is not carried out correctly

FIS V Plus / FIS VL – For drill holes <18mm



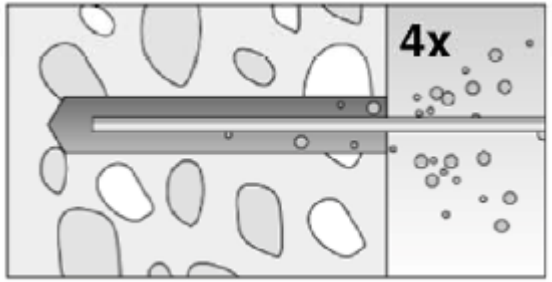
Anchor Types

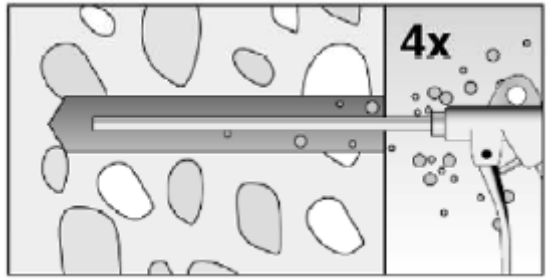
Chemical Anchors – Drill Hole Cleaning

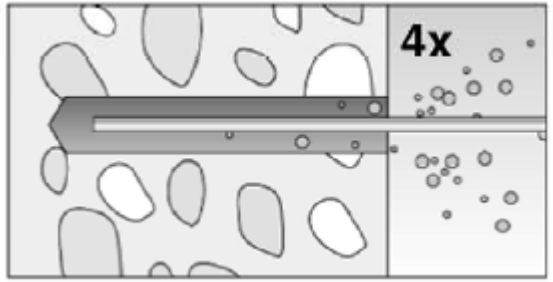
- Also important to note, drill hole cleaning requirements are not universal

- Different chemical anchors require different drill hole cleaning procedures, and for some anchors this method changes dependent on installation parameters

FIS V Plus / FIS VL – For drill holes >18mm







Compressed air gun required

Anchor Types

Chemical Anchors – Drill Hole Cleaning



Example – Biomass Plant Silos

- M24 anchor bolt w/ FIS EM resin
- Design load = 74kN
- Proof Test Load = 111kN

Anchor Types

Chemical Anchors – Drill Hole Cleaning





Anchor failed at 14.9kN

Fischer Product Range

Fischer Vs Hilti

fischer

HILTI

■ ETA ■ Fire Resistance Classification

Hammerset Undercut Anchors	**FZEA II** ■ ■	**HSC** ■ ■	
	FZEA II FZEA II R FZEA II C	HSC-I HSC-IR	
Heavy Duty Anchors	**FH II** ■ ■	**HSL-4** ■ ■	
	FH II -S	HSL-4	
	FH II -B	HSL-4-G	
	FH II -H	-	
	FH II -SK/SKR	HSL-4-SK/SKR	
	-	HSL-4-B (torque head)	
	FH II -S R	HSL-3-R	
	FH II-I	-	No alternative
Throughbolts For Cracked concrete	**FAZ II** ■ ■	**HST3** ■ ■	
	FAZ II GS	HST3 BW	
	FAZ II FAZ II -R FAZ II -C FAZ II H	HST3 HST3 - R HST3 - HCR -	 No alternative

Fischer Product Range

Fischer Vs Hilti

fischer

HILTI

■ ETA ■ Fire Resistance Classification

Drop in Anchors	**EA II** ■ ■	**HKD** ■ ■	
	EA II EA II R -	HKD HKD-SR HKD-ER (Without lip)	
	EA-N no approval	HKV no approval	
Concrete Screws	**FBS II** ■ ■	**HUS4** ■ ■	
	FBS II US FBS II CP US FBS II SK FBS II 6 P - FBS II 6 M8/M10 I	HUS4 –H HUS4-HF HUS4 – C HUS3 - P / PL HUS4-A HUS3-I 6	
Nail anchor	**FNA II** ■ ■	**HFB** ■ ■	
	FNA II FNA II M6 (M8) FNA II - OE FNA II - H	HFB - - -	

Fischer Product Range

Fischer Vs Hilti

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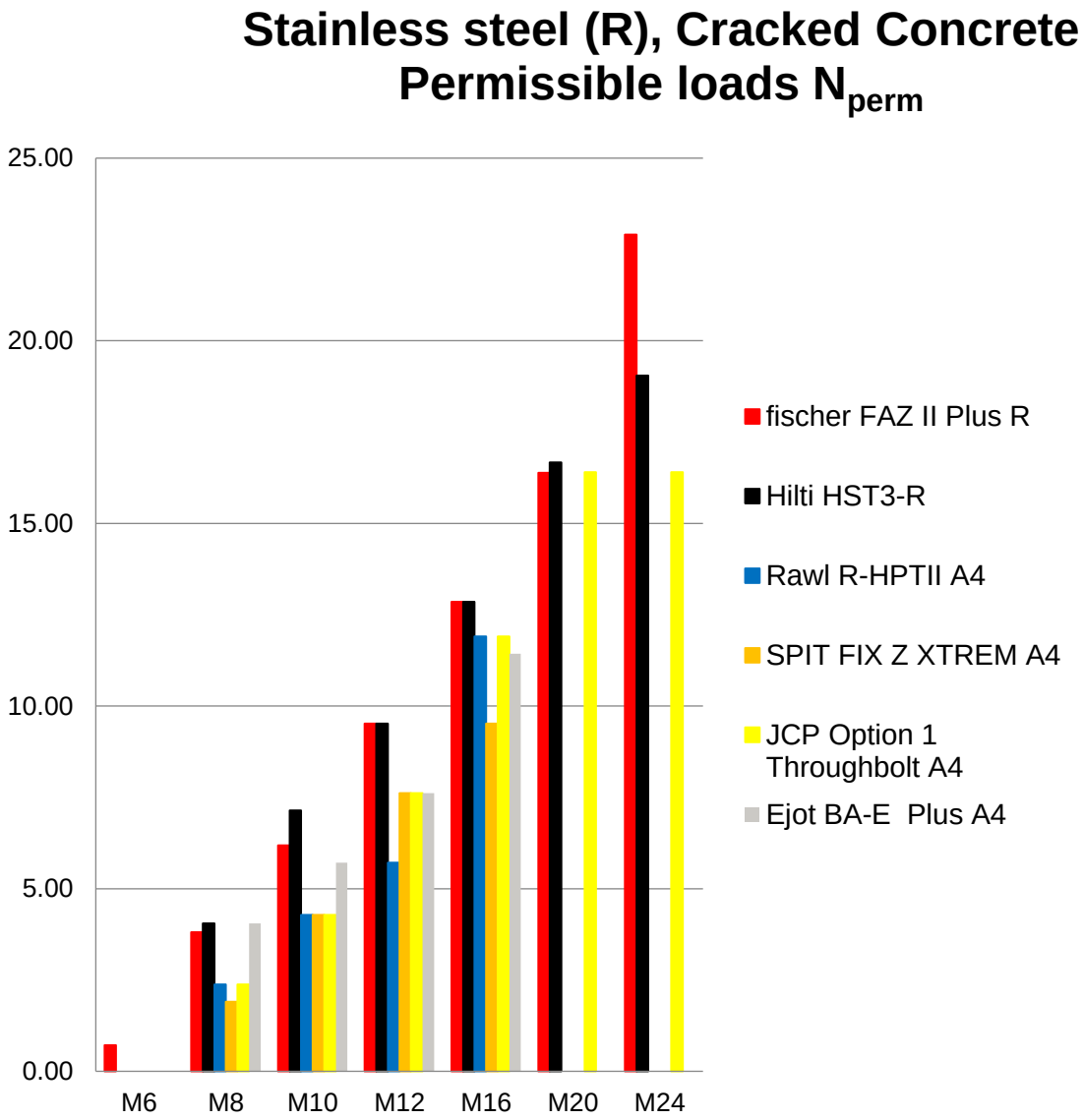
HILTI

■ ETA ■ Fire Resistance Classification

Resin Anchors Superbond 	**FIS SB** ■■ FIS SB 390 S (330, 500, 1400ml) RSB capsule	**HIT-HY** ■■ HIT-HY 200-A (330, 500ml) HIT-HY 170 (330, 500ml) -	
Resin Anchors 	**FIS EM Plus** ■■ FIS EM PLUS 390 S (390, 585, 1500ml)	**HIT-RE 500** ■■ HIT-RE 500 V4 (330, 500, 1400ml)	
Resin Anchors 	**FIS V Plus** (10-25% cement) ■■ FIS V Plus 360 S (300 T, 360ml) FIS VS 150 C (100, 150, 300ml) FIS VW Plus 360 S (FIS VW 300 T, 300ml) FIS VS 300 T FIS VL 410 C (2,5-10% cement) (300 T, 410ml) -	**HIT-HY** ■■ HIT-HY 200 (330, 500ml) HIT-HY 170 (330, 500ml) HIT-HY 270 (330, 500ml) (Masonry only) HIT-1 (300ml) HIT-MM Plus (330, 500ml) HIT-CT1 (500ml)	

Fischer Product Range

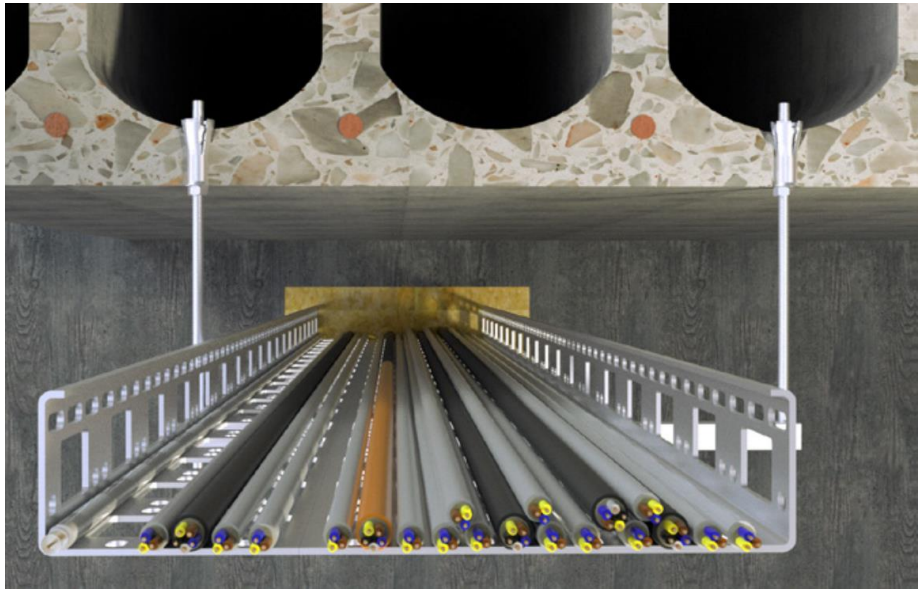
Fischer Vs Hilti



Anchor Selection & Types

- Questions and discussion





British Standard 8539

Key Duty Holders

The Specifier



- Key responsibility of the specifier is to determine the most appropriate anchor for the application
- This achieved by;
  - Following the anchor type selection process given within BS 8539
  - *Design the connection point utilising an appropriate design method*

British Standard 8539

Key Duty Holders – Specification



The Specifier

- The appropriate design methods for an anchor can be found within its ETA approval
- *Specification of Intended Use* will list which design method should be used

Deutsches Institut für Bautechnik DIBt

Member of EOTA www.eota.eu

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment **ETA-19/0520 of 24 May 2023**

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	fischer Bolt Anchor FAZ II Plus, FAZ II Plus R, FAZ II Plus HCR
Product family to which the construction product belongs	Mechanical fasteners for use in concrete

Specifications of intended use

Design:

- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and concrete work
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.)
- Design of fastenings according to EN 1992-4:2018 and EOTA Technical Report TR 055
- For effective embedment depth h_{ef} < 40 mm only statically indeterminate fixings (e.g. light-weight suspended ceilings with internal exposure) are covered by the ETA

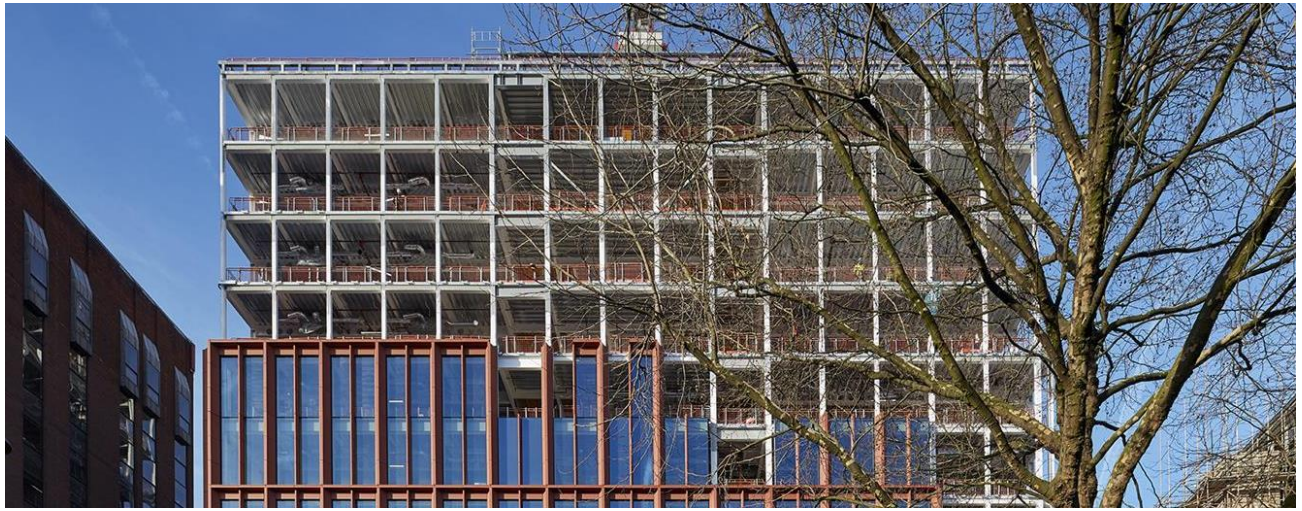
fischer Bolt Anchor FAZ II Plus, FAZ II Plus R, FAZ II Plus HCR	**Annex B 1**
Intended Use Specifications	

British Standard 8539

Key Duty Holders – Specification

fischer *FAZ II Plus*





BS EN 1992-4:2018



BSI Standards Publication

Eurocode 2. Design of concrete structures

Design of fastenings for use in concrete

Specifications of intended use

Design:

- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and concrete work
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the anchor is indicated on the design drawings (e.g. position of the anchor relative to reinforcement or to supports, etc.)
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fischer Bolt Anchor FAZ II Plus, FAZ II Plus R, FAZ II Plus HCR	**Annex B 1**
Intended Use Specifications	

Anchor Connection Design

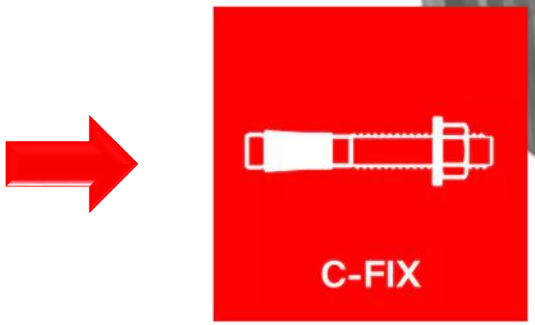
Fischer C-Fix Design Tool

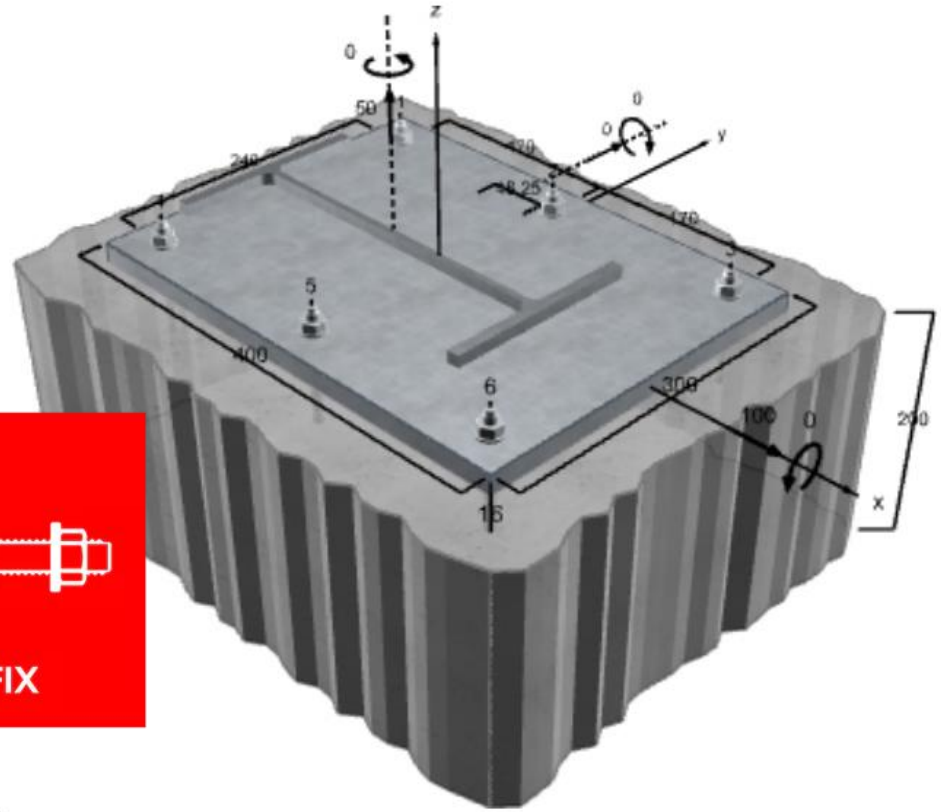
fischer *FAZ II Plus*



- Fischer anchors with ETA approval available for design within C-Fix design tool







Building Safety Act 2022

Designer Competency – Design Work Compliance

C-FIX Online 1.1.58.0
Database version 1.1.59.0
Date 28/11/2023

fischer

Deutschland

fischer fixings UK Ltd
Whitely Road; Hithercroft Industrial Estate
Wallingford; Oxfordshire; OX10 9AT
technical@fischer.co.uk

Design specifications

Anchor

Anchor system	fischer bolt anchor FAZ II Plus
Fixing element	FAZ II Plus 10/10, gvz
Anchorage depth	53 mm
Anchor stiffness	21000 kN/m
Design data	ETA-19/0520 (24.05.2023)



Units of Measurement

Geometry	mm
Design action values	kN, kNm

C-FIX Online 1.1.58.0
Database version 1.1.59.0
Date 28/11/2023

fischer

Input Data

Design method	EN 1992-4:2018
Base material	Normal weight concrete, C20/25, EN 206:2013
Concrete condition	Cracked, Dry hole
Temperature range	24 °C Long term temperature, 40 °C Short term temperature
Reinforcement	No or standard reinforcement, No edge reinforcement, With reinforcement to control splitting
Drilling method	Hammer drilling
Installation type	Push-through installation
Annular gap	Not filled
Type of loading	Static or quasi-static
Base plate location	Base plate flush installed on base material
Base plate geometry	250 mm x 250 mm x 12 mm
Profile type	HEAA 100

- C-Fix's design report defines both ETA characteristic data and design method used for anchor connection design

Building Safety Act 2022

Designer Competency – Design Work Compliance

C-FIX Online 1.1.58.0
Database version 1.1.59.0
Date 28/11/2023

fischer

Concrete cone failure



$$N_{Ed} \le N_{Rd,c} = \frac{N_{Rk,c}}{\gamma_{Mc}}$$

$$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec,N} \cdot \psi_{M,N} \quad (7.1)$$

$$N_{Rk,c} = 13.29\,kN \cdot \frac{95481\,mm^2}{25281\,mm^2} \cdot 1.000 \cdot 1.000 \cdot 0.572 \cdot 1.000 = 28.68\,kN$$

$$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1.5} = 7.7 \cdot \sqrt{20.00\,N/mm^2} \cdot (53\,mm)^{1.5} = 13.29\,kN \quad (7.2)$$

$$A^0_{c,N} = s_{cr,N} \cdot s_{cr,N} = 159\,mm \cdot 159\,mm = 25281\,mm^2 \quad (7.3)$$

$$\psi_{s,N} = \min\left(1; 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}}\right) = \min\left(1; 0.7 + 0.3 \cdot \frac{\infty\,mm}{80\,mm}\right) = 1.000 \le 1 \quad (7.4)$$

$$\psi_{re,N} = 1.000 \quad (7.5)$$

$$\psi_{ec,N} = \frac{1}{1 + \frac{2 \cdot e_N}{s_{cr,N}}} \Rightarrow \psi_{ec,Nx} \cdot \psi_{ec,Ny} = 0.572 \cdot 1.000 = 0.572 \le 1 \quad (7.6)$$

$$\psi_{ec,Nx} = \frac{1}{1 + \frac{2 \cdot 60\,mm}{159\,mm}} = 0.572 \le 1 \qquad \psi_{ec,Ny} = \frac{1}{1 + \frac{2 \cdot 0\,mm}{159\,mm}} = 1.000 \le 1$$

$$\psi_{M,N} = 1.000 \quad (7.7)$$

$N_{Rk,c}$ kN	γ_{Mc}	$N_{Rd,c}$ kN	N_{Ed} kN	$\beta_{N,c}$ %
28.68	1.50	19.12	16.35	85.5

C-FIX Online 1.1.58.0
Database version 1.1.59.0
Date 28/11/2023

fischer

Input Data

Design method	EN 1992-4:2018
Base material	Normal weight concrete, C20/25, EN 206:2013
Concrete condition	Cracked, Dry hole
Temperature range	24 °C Long term temperature, 40 °C Short term temperature
Reinforcement	No or standard reinforcement, No edge reinforcement, With reinforcement to control splitting
Drilling method	Hammer drilling
Installation type	Push-through installation
Annular gap	Not filled
Type of loading	Static or quasi-static
Base plate location	Base plate flush installed on base material
Base plate geometry	250 mm x 250 mm x 12 mm
Profile type	HEAA 100

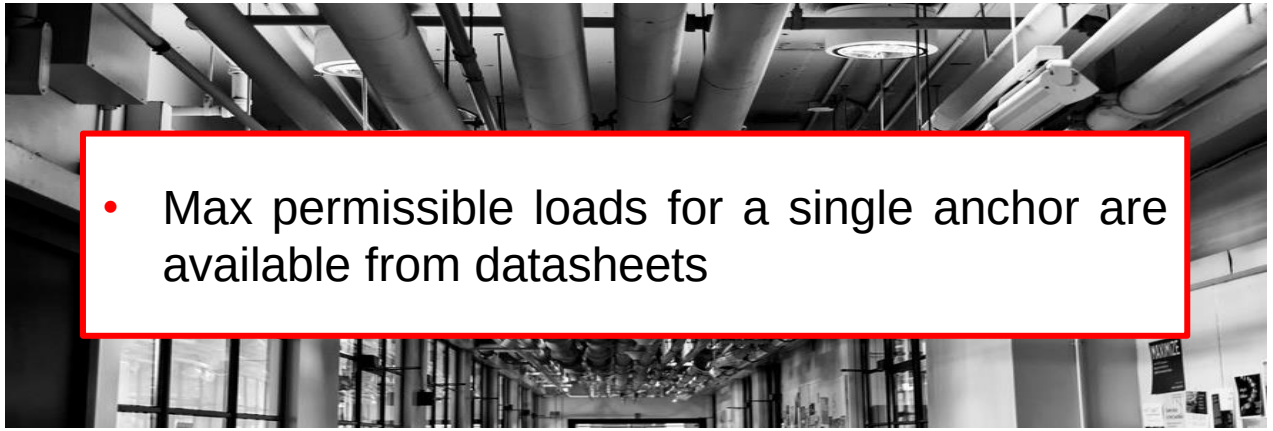
- C-Fix design reports also provide full breakdown of calculations for failure modes

Building Safety Act 2022

Designer Competency – Design Work Compliance

fischer *FBS II 6 UltraCut*





- Max permissible loads for a single anchor are available from datasheets

Concrete screw UltraCut FBS II 6

Permissible loads for a single anchor[1] for multiple use of redundant non-structural applications* in normal concrete C20/25. For the design the complete current assessment ETA - 18/0242 has to be considered.

					Cracked concrete			
	Material/ surface	Screw-in depth	Minimum member thickness	Maximum installation torque	Permissible tension (N_{perm}) and shear loads (V_{perm}); minimum spacing (s_{min}) and edge distances (c_{min}) with reduced loads			
Type		h_{nom} [mm]	h_{min} [mm]	$T_{inst,max}$[2] [Nm]	N_{perm}[3] [kN]	V_{perm}[3] [kN]	s_{min}[3] [mm]	c_{min}[3] [mm]
FBS II 6	gvz	25	80	≤ 5	0.7	1.8	35	35
	gvz	30	80	≤ 5	1.2	2.3	35	35
	gvz	35	80	≤ 5	1.7	4.3	35	35
	gvz	40	80	≤ 10	2.4	4.3	35	35
	gvz	45	90	≤ 10	2.9	4.3	35	35
	gvz	50	90	≤ 10	3.6	4.3	35	35
	gvz	55	100	≤ 10	4.0	6.3	35	35

Specifications of intended use

Design:

- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and concrete work
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the screw is indicated on the design drawings (e.g. position of the screw relative to reinforcement or to supports, etc.)
- Design of fastenings according to EN 1992-4: 2018 and EOTA Technical Report TR 055

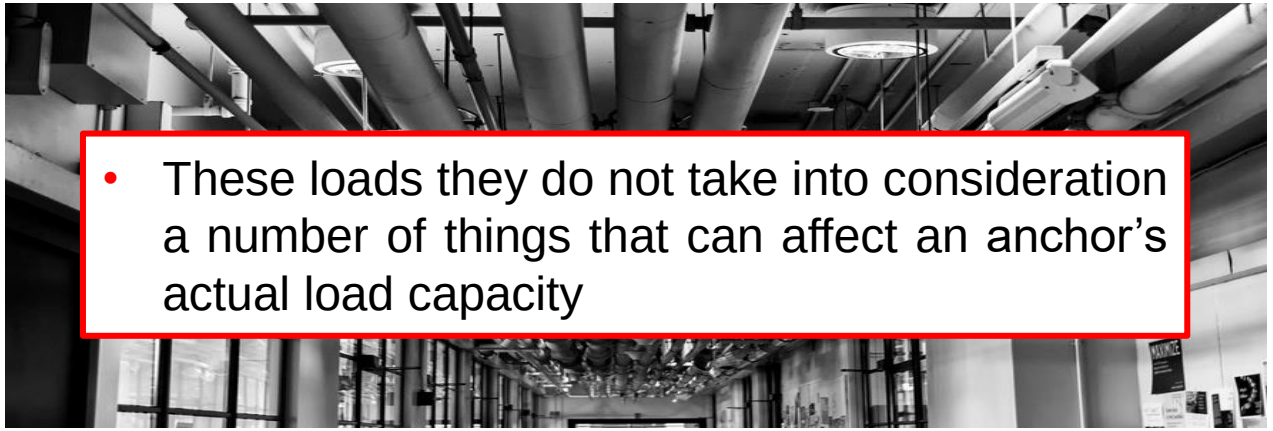
fischer concrete screw ULTRACUT FBS II	**Annex B 1**
Intended Use Specifications	

Building Safety Act 2022

Designer Competency – Design Work Compliance

fischer *FBS II 6 UltraCut*





- These loads they do not take into consideration a number of things that can affect an anchor's actual load capacity

Concrete screw UltraCut FBS II 6

Permissible loads for a single anchor[1] for multiple use of redundant non-structural applications* in normal concrete C20/25. For the design the complete current assessment ETA - 18/0242 has to be considered.

					Cracked concrete			
	Material/ surface	Screw-in depth	Minimum member thickness	Maximum installation torque	Permissible tension (N_{perm}) and shear loads (V_{perm}); minimum spacing (s_{min}) and edge distances (c_{min}) with reduced loads			
Type		h_{nom} [mm]	h_{min} [mm]	$T_{inst,max}$[2] [Nm]	N_{perm}[3] [kN]	V_{perm}[3] [kN]	s_{min}[3] [mm]	c_{min}[3] [mm]
FBS II 6	gvz	25	80	≤ 5	0.7	1.8	35	35
	gvz	30	80	≤ 5	1.2	2.3	35	35
	gvz	35	80	≤ 5	1.7	4.3	35	35
	gvz	40	80	≤ 10	2.4	4.3	35	35
	gvz	45	90	≤ 10	2.9	4.3	35	35
	gvz	50	90	≤ 10	3.6	4.3	35	35
	gvz	55	100	≤ 10	4.0	6.3	35	35

Specifications of intended use

Design:

- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and concrete work
- Verifiable calculation notes and drawings are to be prepared taking account of the loads to be anchored. The position of the screw is indicated on the design drawings (e.g. position of the screw relative to reinforcement or to supports, etc.)
- Design of fastenings according to EN 1992-4: 2018 and EOTA Technical Report TR 055

fischer concrete screw ULTRACUT FBS II	**Annex B 1**
Intended Use Specifications	

Building Safety Act 2022

Designer Competency – Design Work Compliance

fischer *FBS II 6 UltraCut*





- These load tables should be used for guidance only, not in place of a full design

Concrete screw UltraCut FBS II 6

Permissible loads for a single anchor[1] for multiple use of redundant non-structural applications[2] in normal concrete C20/25
For the design the complete current assessment ETA - 18/0242 has to be considered

				Cracked concrete			
	Material/ Surface	Screw-in depth	Minimum member thickness	Maximum installation torque	Permissible tension (N_{perm}) and shear loads (V_{perm})[3] minimum spacing ($s_{cr,N}$) and edge distances ($c_{cr,N}$) with reduced loads			
		h_{nom}	h_{min}	$T_{inst,max}$[4]	N_{perm}[3]	V_{perm}[3]	$s_{cr,N}$[3]	$c_{cr,N}$[3]
Type		[mm]	[mm]	[Nm]	[kN]	[kN]	[mm]	[mm]
FBS II 6	gvz	25	80	≤5	0.7	1.8	35	35
	gvz	30	80	≤5	1.2	2.5	35	35
	gvz	35	80	≤5	1.7	4.3	35	35
	gvz	40	80	≤10	2.4	4.3	35	35
	gvz	45	80	≤10	2.9	4.3	35	35
	gvz	50	80	≤10	3.6	4.3	35	35
	gvz	55	100	≤10	4.0	6.3	35	35

≠

Specifications of intended use

Design:

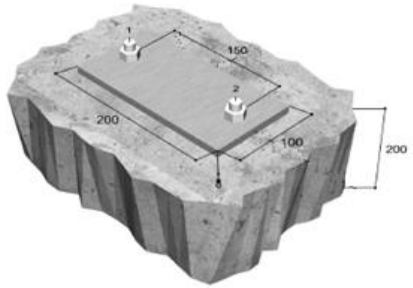
- Anchorages are to be designed under the responsibility of an engineer experienced in anchorages and concrete work
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- Design of fastenings according to EN 1992-4: 2018 and EOTA Technical Report TR 055

fischer concrete screw ULTRACUT FBS II	**Annex B 1**
Intended Use Specifications	

Building Safety Act 2022

Designer Competency – Anchor Connection Design Methods

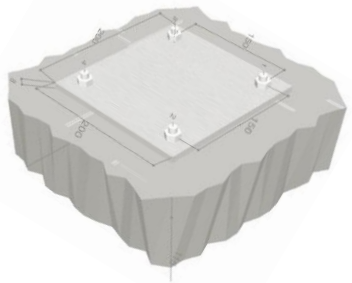
Concrete



European Commission

- ***Eurocode 1992-4***
  - *Method A, Method B and Method C*
  - *Dynamic & Seismic Loading*
  - *Fire Exposure*
    - ***CEN Technical Report 17079***
      - *Anchor redundancy*

Masonry

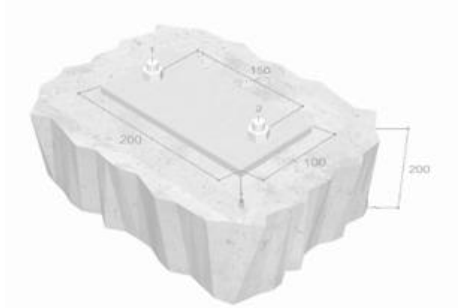


- ***Fischer ENSO***
  - *Based upon FIB Bulletin 58*

Building Safety Act 2022

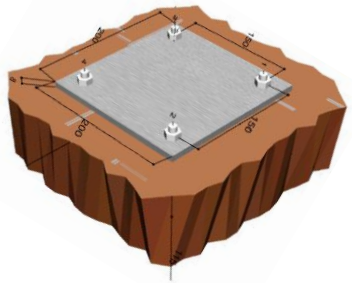
Designer Competency – Anchor Connection Design Methods

Concrete



European Commission

Masonry



EOTA
European Organisation for Technical Assessment

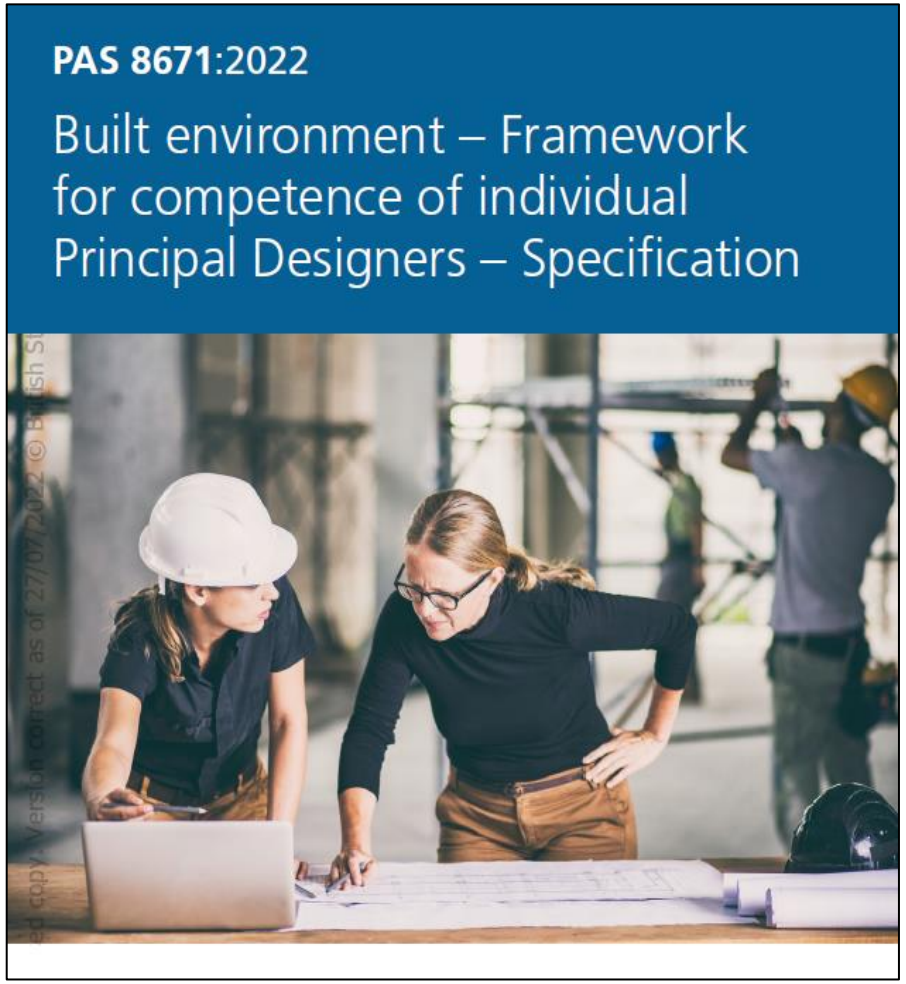
- ***Technical Report 054***
  - *Chemical Anchors*
  - *Screw Anchors*
  - *Fire Exposure*

Building Safety Act 2022

Duty Holder Competency – Principal Designers



- Management of all design work for a project
- *Management of design work compliance of all designers*
- Assisting provision of information to other duty holders to ensure design work compliance



British Standard 8539

Key Duty Holders – Procurement & Installation

The Contractor



- The contractor key responsibilities are ensuring the specified anchor is procured and installed correctly
- This achieved by;
  - Following the Specifier’s specification and anchor connection design
  - Ensuring that the installers are fully trained and have all necessary equipment and information

British Standard 8539

Key Duty Holders – Procurement & Installation



The Contractor





The Specifier

- To aid the contractor the Specifier must provide them with the following information
  - *Fully detailed design and drawings of the anchor connection*
  - *Detailed specification for both the anchor and required installation accessories for procurement*
  - *Installation instruction from the anchor manufacturer*

British Standard 8539

Key Duty Holders – Procurement & Installation



The Contractor

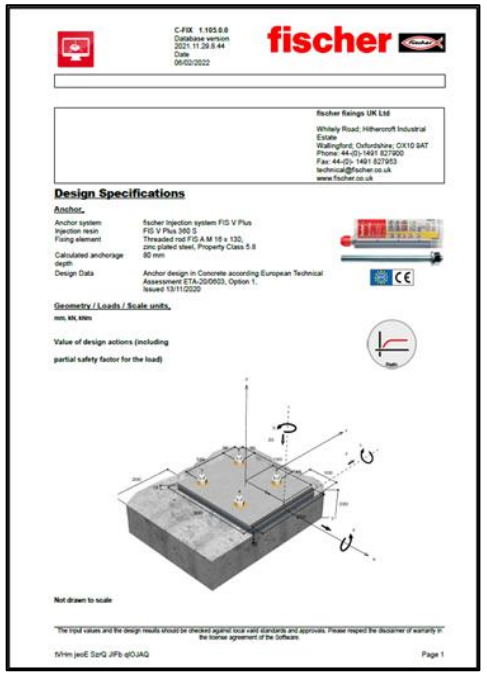




The Specifier



- Easiest way for the specifier to supply this information is by providing a Fischer C-Fix design report and the ETA approval



C-FIX 1.105.0.0
Database version
2021.11.29.8.44
Date
06/02/2022

fischer

fischer fixings UK Ltd
Whitely Road; Hithercroft Industrial Estate
Wallingford, Oxfordshire; OX10 9AT
Phone: 44-(0)-1491 827900
Fax: 44-(0)- 1491 827953
technical@fischer.co.uk
www.fischer.co.uk

Design Specifications

Anchor

Anchor system	fischer Injection system FIS V Plus
Injection resin	FIS V Plus 360 S
Fixing element	Threaded rod FIS A M 16 x 130, zinc plated steel, Property Class 5.8
Calculated anchorage depth	80 mm
Design Data	Anchor design in Concrete according European Technical Assessment ETA-20/0503, Option 1, Issued 13/11/2020

Geometry / Loads / Scale units,

mm, kN, kNm

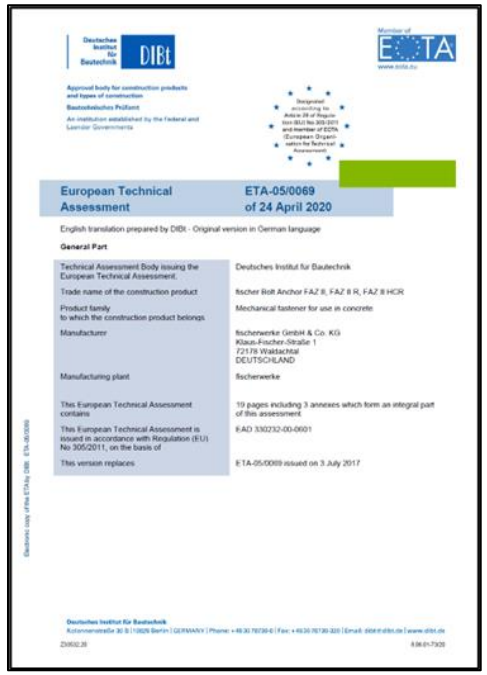
Value of design actions (including partial safety factor for the load)

Not drawn to scale

"The input values and the design results should be checked against local valid standards and approvals. Please respect the disclaimer of warranty in the license agreement of the software.

fVHn jeoE SzQ JFb qlOJAQ

Page 1



Deutsches Institut für Bautechnik

DIBt

Member of EOTA

www.eota.eu

Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment **ETA-05/0069 of 24 April 2020**

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment	Deutsches Institut für Bautechnik
Trade name of the construction product	fischer Bolt Anchor FAZ II, FAZ II R, FAZ II HCR
Product family to which the construction product belongs	Mechanical fastener for use in concrete
Manufacturer	fischerwerke GmbH & Co. KG Klaus-Fischer-Straße 1 72178 Waldachtal DEUTSCHLAND
Manufacturing plant	fischerwerke
This European Technical Assessment contains	19 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330232-00-0601
This version replaces	ETA-05/0069 issued on 3 July 2017

Deutsches Institut für Bautechnik

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British Standard 8539

Key Duty Holders – Procurement & Installation



The Contractor





The Specifier



- Fischer C-Fix design reports detail the anchor, the required installation equipment and specific details regarding the installation

Anchor

Anchor system	**fischer Injection system FIS V Plus**	
Injection resin	FIS V Plus 360 S (other cartridge sizes available)	Art.-No. 558746
Fixing element	Threaded rod FIS A M 16 x 130 R, stainless steel	Art.-No. 44975
Accessories	FIS MR Plus	Art.-No. 545853
	Dispenser FIS DM S	Art.-No. 511118
	Compressed-air cleaning tool	Art.-No. 93286
	compressed air (oil-free), min. 6 bar	By job site.
	Cleaning brush BS 16/18	Art.-No. 78181
	SDS Plus-V II 18/150/200	Art.-No. 531836
	or alternatively	
	FHD 18/320/450	Art.-No. 546600
	Hammer drilling with or without suction	



British Standard 8539

Key Duty Holders – Procurement & Installation



The Contractor





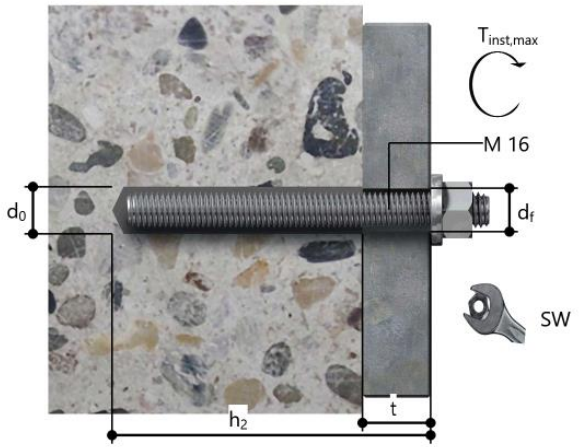
The Specifier



- Fischer C-Fix design reports detail the anchor, the required installation equipment and specific details regarding the installation

Installation details

Thread diameter	M 16
Drill hole diameter	d_0 = 18 mm
Drill hole depth	h_2 = 88 mm
Calculated anchorage depth	h_{ef} = 80 mm
Installation depth	h_{nom} = 80 mm
Drilling method	Hammer drilling
Drill hole cleaning	4 times blowing, 4 times brushing, 4 times blowing required activities according the given instruction in the approval No borehole cleaning required in case of using a hollow drill bit, e.g. fischer FHD.
Installation type	Push-through installation
Annular gap	Annular gap not filled
Maximum torque	$T_{inst,max}$ = 60.0 Nm
Socket size	24 mm
Base plate thickness	t = 8 mm
Total fixing thickness Tfix,max	t_{fix} = 8 mm
Volume of resin per drill hole	12 ml/6 scale divisions



British Standard 8539

Key Duty Holders – Procurement & Installation



The Contractor





The Specifier



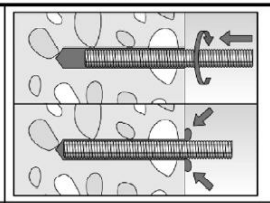
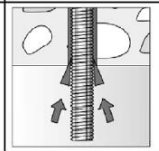
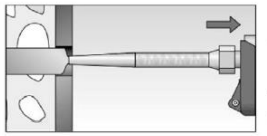
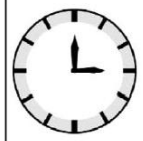
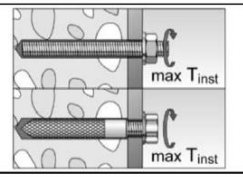
- While the ETA approval contains the required installation steps

Installation instructions part 2

Preparing the cartridge

Installation instructions part 3

Installation of anchor rods or fischer internal threaded anchors RG MI

9		Only use clean and oil-free metal parts. Mark the setting depth of the metal part. Push the anchor rod or fischer internal threaded RG MI anchor down to the bottom of the hole, turning it slightly while doing so. After inserting the metal parts, excess mortar must be emerged around the anchor element.
		For overhead installations support the metal part with wedges (e.g. fischer centering wedges) or fischer overhead clips.
		For push through installation fill the annular gap with mortar
10		Wait for the specified curing time t_{cure} see **table B9.2**
11		Mounting the fixture max T_{inst} see **tables B3.1 and B6.1**
	hole with mortar. Always begin from the bottom of the hole and avoid bubbles	For drill hole depth ≥ 150 mm use an extension tube	holes (h_0 > 250 mm) or drill hole diameter (d_0 ≥ 40 mm) use an injection adapter

Change Management Procedure

Original design has specified a Hilti HST 24/30 which has ETA Option 1 for cracked concrete, close to a free edge.

Hilti don't have any of this size in stock so the contractor now requires an alternative.

Which anchor would be an acceptable replacement?

fischer *FAZ II*



RAWL FIXINGS *R-HPT II*



spit *FIX Z*



All these anchors have ETA Option 1

While FAZ II has an equal minimum edge distance, other factors must be checked and the design recreated

fischer

British Standard 8539

Change Management Procedure – Bad Practice



Juliette balcony installation in masonry



Contractor opted to switch resin from specified vinyl-ester resin to polyester due to price

Both resin types had an ETA for use in masonry

British Standard 8539

Change Management Procedure

- BS 8539 acknowledges the necessity to change the specification of an anchor

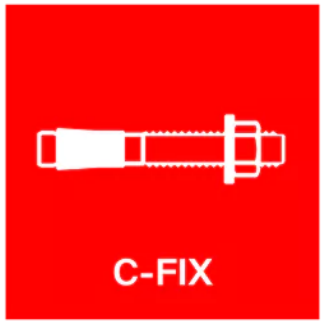
> **10 Change management – alternative anchors**
>
> *Some typical reasons for changing specifications include:*
>
> - *unavailability of the specified anchor;*
> - *contractor has a preferred supplier;*
> - *a change in the design loading information leading to inappropriate anchor specification;*
> - *economic reasons.*

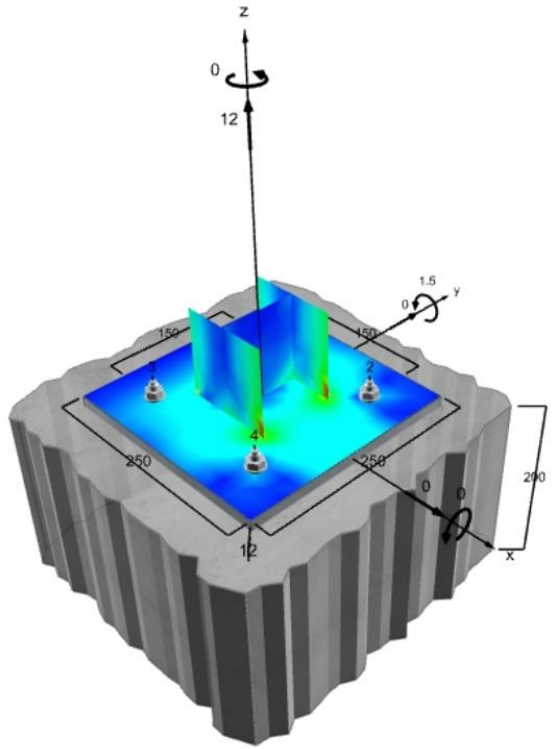
Alternative specification should be determined by original specifier or responsible engineer who has access to original design data

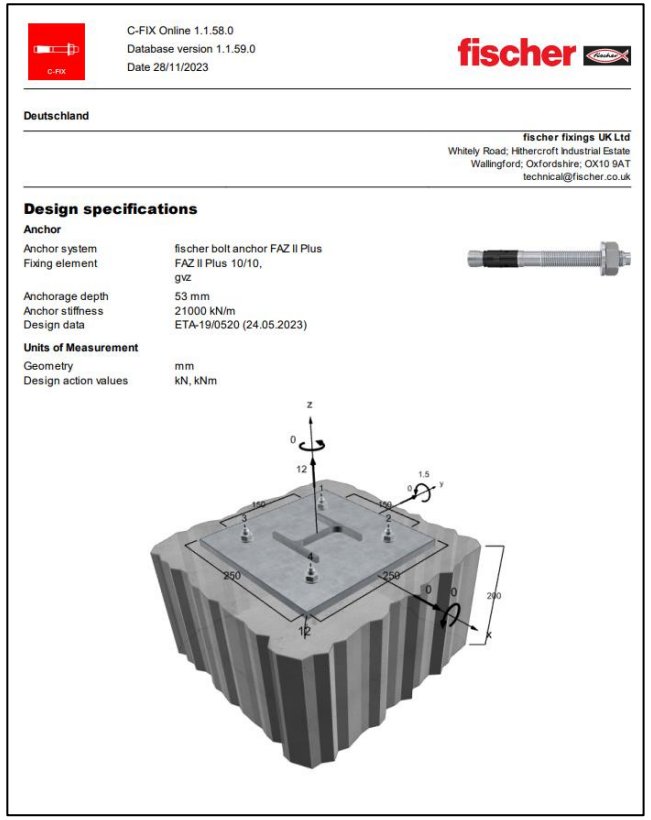
British Standard 8539

Change Management Procedure

- Quickest way to carry out a procedure is to recreate the anchor connection design within our C-Fix design tool







C-FIX Online 1.1.58.0
Database version 1.1.59.0
Date 28/11/2023

fischer

Deutschland

fischer fixings UK Ltd
Whitely Road; Hithercroft Industrial Estate
Wallingford; Oxfordshire; OX10 9AT
technical@fischer.co.uk

Design specifications

Anchor

Anchor system	fischer bolt anchor FAZ II Plus
Fixing element	FAZ II Plus 10/10, gvz
Anchorage depth	53 mm
Anchor stiffness	21000 kN/m
Design data	ETA-19/0520 (24.05.2023)

Units of Measurement

Geometry	mm
Design action values	kN, kNm

British Standard 8539

Change Management Procedure



The Contractor





The Specifier

- If the contractor makes any changes to the specification without providing an alternative connection design

The Contractor will take on engineering responsibility for the anchor design

BS 8539 – Specifier Duties

- Questions and discussion





fischer

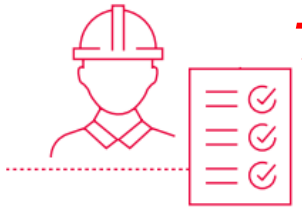
British Standard 8539

Key Duty Holders – Installation



The Contractor





The Installer

- In order to ensure the installation goes as plan the contractor is responsible for providing the following to the installer
  - Training on the installation of the anchor via toolbox talk
  - Provision of all necessary installation equipment to correctly install the anchor

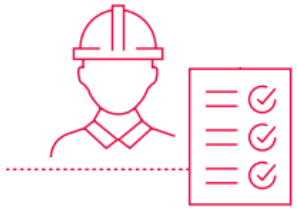
British Standard 8539

Key Duty Holders – Installation



The Contractor





The Installer

- If the installer doesn't install the anchors as per the manufacturer's instruction and the specifier's design

The Installer will take on engineering responsibility for the anchor design

British Standard 8539

Key Duty Holders – Installation



The Contractor

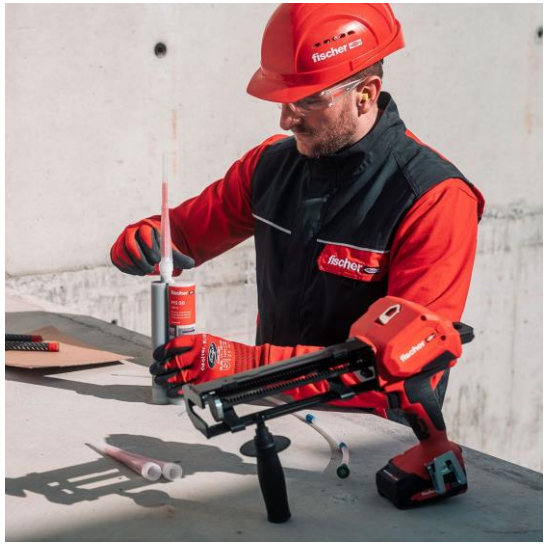




The Installer



- Fischer can provide support with both these responsibilities
  - Supply of any installation accessories
  - Provision of toolbox talks for installation





Building Safety Act 2022

Duty Holder Competency – Principal Contractors



- Management and supervision of building work by adopting best practice
- *Management of competencies of all working on construction of project*
- Management of the Golden Thread and changes to approved design during construction phase



Building Safety Act 2022

Duty Holder Competency – Contractors



The Contractor





The Installer



- Fischer can provide accredited toolbox talk for installers



Building Safety Act 2022

Duty Holder Competency – Contractors



The Contractor





The Installer



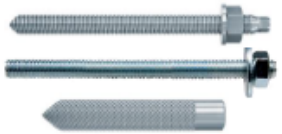
- Detailed method statements for specific installations

fischer Fixings UK Limited
Technical Department

Method Statement for installation of fischer Injection resin FIS SB into solid concrete with fischer threaded rod RG M, FIS A M and internally threaded socket RG M I







Accessories: fischer Threaded rod RG M or FIS A M, and internally threaded socket RG M I
Injection Resin FIS SB 390 S + dispenser : (FIS AM, FIS DM S)
Cleaning brush BS
Compressed-air gun ABP (Oil Free ≥ 6 Bar) or hand blow-out pump ABG
Extension tubes, injection adapters (where applicable)

Installation:

- Anchor should be installed by appropriately trained personnel in accordance with ETA–12/0258
- Drill correct Ø hole to the required depth on centreline of fixing position using SDS hammer drill. **(fig 1)**. If using fischer hollow drill **FHD** and dust extraction system **FVC**, or equivalent, the next stage, cleaning, can be omitted **(fig 2)**
- Remove any debris from the hole using ABP compressed air cleaning gun (see Note below) and metal brush BS (Ø ≥ 30mm, use power drill). Manual blow ot pump ABG is approved only in non-cracked concrete

Building Safety Act 2022

Duty Holder Competency – Contractors



The Contractor

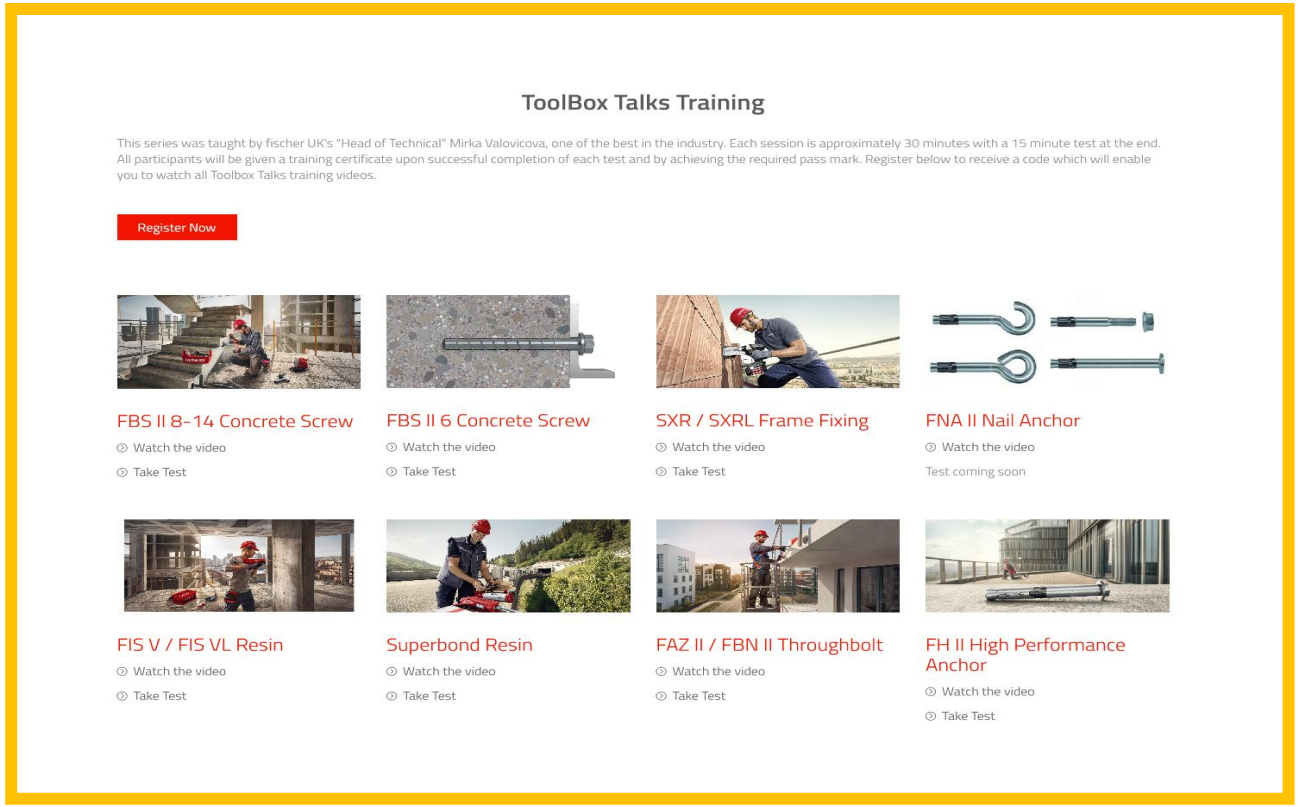




The Installer



- Online training portal for contractors & installers



British Standard 8539

Key Duty Holders – Manufacturer Support



- Fischer have a responsibility to provide all necessary general information to allow key duty holders to fulfil their responsibilities
- Fischer are the experts on post-installed anchors, anchor design theory and BS 8539
- We are the best resource and support when it comes to post-installed anchors, and the other technical products we offer

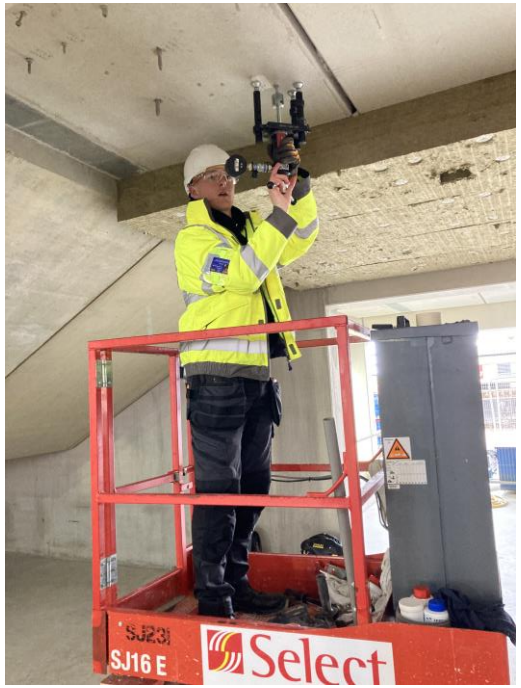
British Standard 8539

Key Duty Holders – Anchor Testing

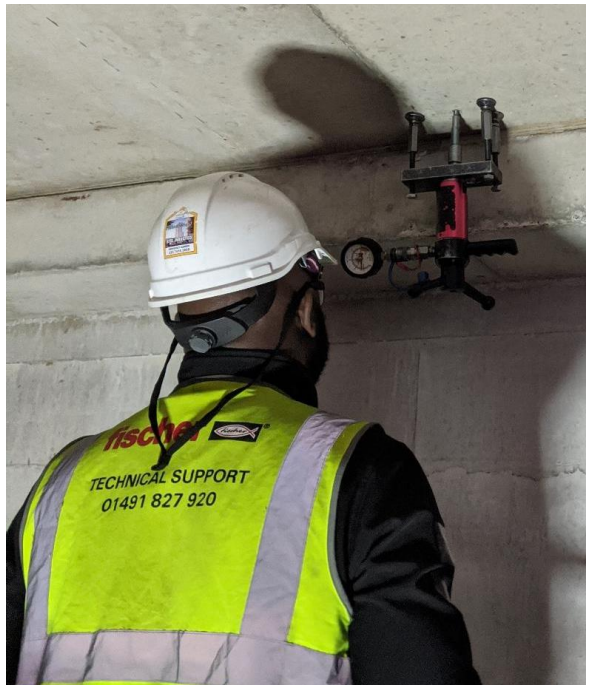
fischer

The Tester

- As Fischer also provide anchor testing services, so we also assume the role of *The Tester* duty holder







British Standard 8539

Key Duty Holders – Anchor Testing



The Tester

- The specifier and contractor take overall responsibility for anchor testing
- There are two reasons for requesting anchor testing



The Specifier → ***Suitability Testing*** →

- Determine the max allowable resistance of an anchor when the substrate is a relative unknown



The Contractor → ***Proof Testing*** →

- Check that the anchors have been installed correctly

Fischer Technical Services

Overview



- **Fischer Fixperience**

  The software to design fixings and systems



- **Fischer Technical Services**

  Specialist advice for your projects



- **Fischer Akademie**

  Training courses and seminars

fischer

Training Seminar Feedback