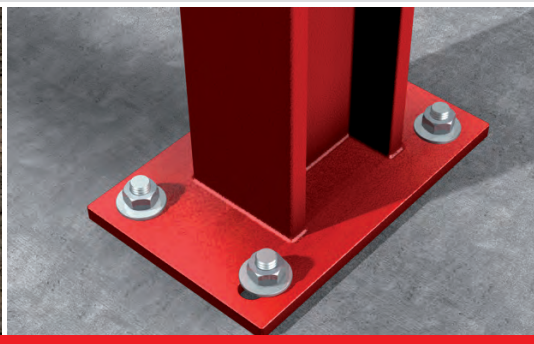


fischer
Systems and solutions for buildings in seismic zones









fischer
innovative solutions



A brand and its promise to perform

fischer
innovative solutions

Customers who choose fischer get more than just a range of secure fixing products. Our goal is to ensure that we always offer our customers the best solutions with real added value.



In addition to innovative and outstanding products, this primarily includes user-oriented advice and benefit-oriented services. fischer is a leading brand in which engineering experts throughout the world place their trust.

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With more than 40 national subsidiaries and more than 100 importers, fischer has a global network with a strong presence. The advantages for you as a project customer are clear. There'll always be a competent technical or sales partner in your vicinity and a high level of product availability is also guaranteed.



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Our technical support service provides cost-effective, legally compliant advice for all questions relating to fastening systems. Services that you can access include test installations, pull-out tests, individual designs, comparative calculations, and the development of special solutions. Around the world, more than 130 engineers support you with their concentrated fastening expertise. We're happy to give you advice – at our fischer Academy, at your office or at the construction site itself.

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We offer you a wide range of fastening solutions from the fields of chemical resins, steel and plastics. We cover a very broad application spectrum with our standard products as well as project-based solutions and customer-specific special developments. All of these are based on our know-how and experience gleaned during more than 60 years in anchoring technology. You can depend on it.



Services for seismic construction.

Research & development



We have our own research and development teams for chemical resins, steel and plastics. This allows our own research results, market trends and customer requirements to be quickly embraced and converted into market-ready products. In addition to the capability and quality of our products, safe and fast installation is also vital. This pays off by saving you time, money and labour.

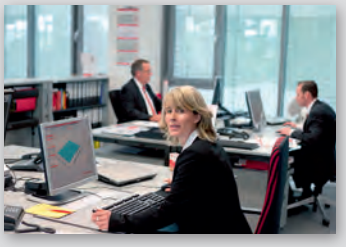
Production

With research and development, tool-making, special machine construction and production facilities for chemistry, steel and plastics, the entire production process of our products takes place in-house. Our quality management system is certified in accordance with DIN EN ISO 9001.



Through the fischer Process System (fPS), we continuously optimise our processes and adapt flexibly to customer requirements. In this way, we ensure that you can rely on innovative products with a constantly high level of quality.

Design software



Our new modular design software suite is called „Fixperience". It offers safe and reliable design along with top processing comfort. The relevant design standards (ETAG 001 and EC2), national application documents and extensive choice of all conventional load and measurement units make the software suitable for international use. A free „live update" is available at all times at: www.fischer.de/fixperience

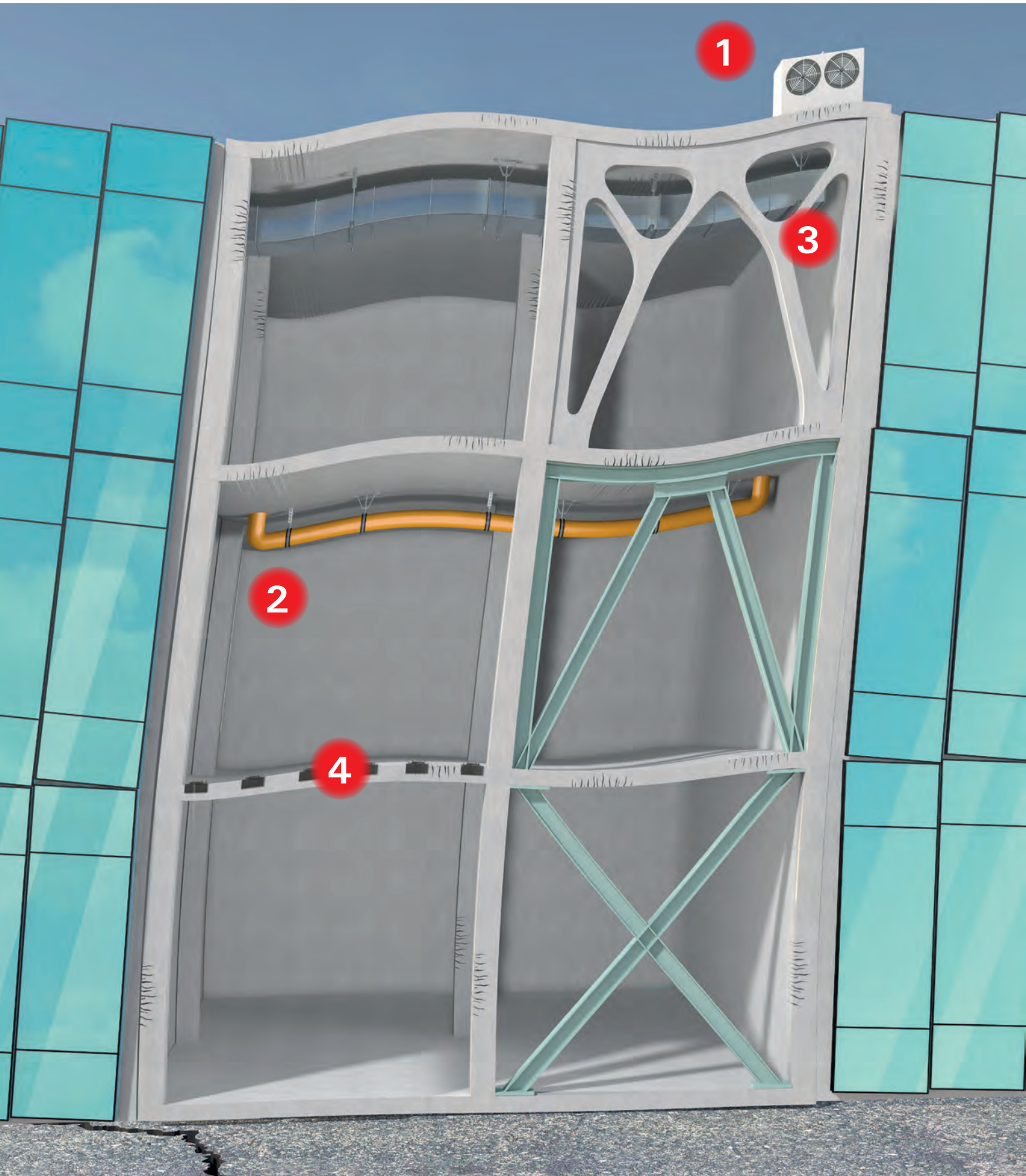
Certifications

We don't compromise on the safety of our products. We take part in the leading international, standard-setting councils in the fastening technology sector, thus contributing our knowledge to their work. Many of our products are characterised by thorough, up-to-date, international approvals, technical certifications and expert reports. For you, this means safety that you can rely on.

The environment

We actively consider the aspect of sustainable construction. Our environmental management system is certified in accordance with DIN EN ISO 14001. A growing number of our products have an Environmental Product Declaration (EPD) from the Bauen und Umwelt e.v. (IBU) institute, which constitutes the data basis for an ecological building evaluation. And our greenline product range is already based on more than 50% sustainable raw materials – certified in accordance with DIN CERTCO/TÜV Rheinland.

Structural and non-structural applications.





General equipment:

1

Nonstructural components like roof top mechanical units, water heaters, shelves, modular partitions, computer equipment, switch cabinets, emergency power systems, e.g. become hazards to life safety when they slide, break, or fall during an earthquake. They may injure occupants or block exits from the room or building.



HVAC applications:

2

The correct anchoring and bracing of non- structural components and systems is crucial in structures intended to handle the emergency, so that these services can continue even after an earthquake.



Structural strengthening:

3

Strengthening of RC structures with steel bracing systems or RC bracings are highly efficient and economical methods to resist horizontal forces in a frame structure. The braces are usually placed in vertically aligned spans and allows so an increased stiffness with a minimal added weight.



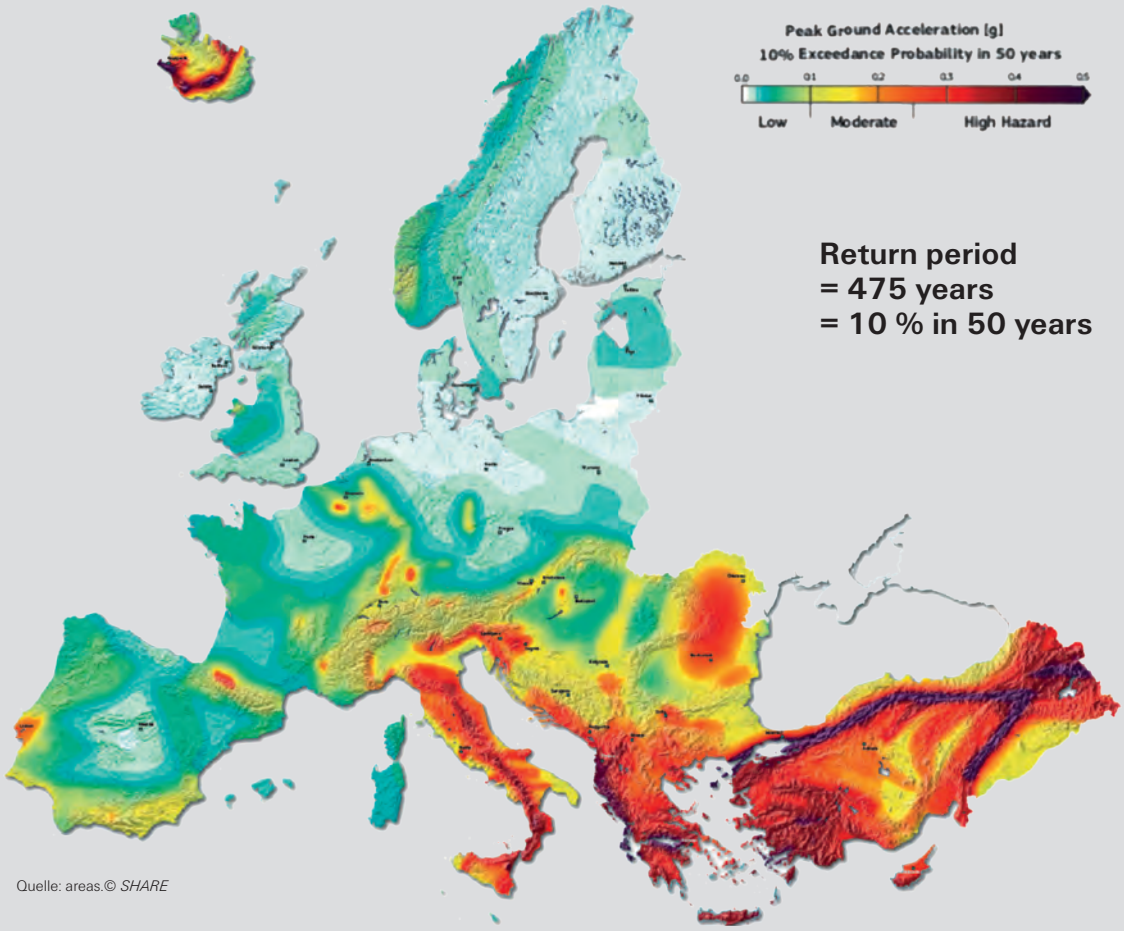
Facade:

4

Earthquake damage to facade systems undoubtedly poses a large threat to life. Sub-frames and brackets for curtain wall systems must be anchored safe to the structure to ensure a proper load transfer of dead loads and horizontal loads caused by life loads and seismic forces.

European seismic regulations.

Seismic activity can have a natural cause, such as tectonic stresses in the crust. Also, stress changes as a consequence of human influences, such as gas exploration, geothermal activities can occur, which results in so-called induces earthquakes. Since, especially in regions of high seismicity and dense population, ground-shaking can cause large human and economic losses, seismic hazard analysis is an important issue.



Quelle: areas.© *SHARE*

On a European level, general guidelines for building codes with respect to earthquakes have been defined in Eurocode 8, denoted in general by EN 1998: "Design of structures for earthquake resistance" and covers the design and construction of buildings and civil engineering works in seismic regions.
It covers common structures and, although its provisions are of general validity, special structures, such as nuclear power plants, large dams or offshore structures are beyond its scope. Its seismic design should satisfy additional requirements and be subject to complementary verifications.

The objectives of seismic design in accordance with Eurocode 8 are explicitly stated - Its purpose is to ensure that in the event of earthquakes:

- Human lives are protected;
- Damage is limited; and
- Structures important for civil protection remain operational.

No-collapse requirement:

- Withstand the design seismic action without local or global collapse.
- Retain structural integrity and residual load bearing capacity after the event.

Damage limitation requirement:

- Withstand a more frequent seismic action without damage.
- Avoid limitations of use with high costs.

Seismicity		Importance Class acc. to EN 1998-1: 2004 4.2.5			
	$a_g \cdot S$ [2]	I	II	III	IV
Very low[1]	$a_g \cdot S \leq 0{,}05$ g	ETAG 001 Part 1 to Part 5			
Low[1]	$0{,}05\ g < a_g \cdot S \leq 0{,}1$ g	C1	C1 [3] or C2 [4]		C2
	$a_g \cdot S > 0{,}1$ g	C1	C2		

1) Definition according to EN 1998-1:2004, 4.2.5

2) $ag = \gamma^1 \cdot a_{gR}$ Design ground acceleration on type A ground
(Ground types as defined in EN 1998-1:2004, Table 3.1)
γ^1 importance factor (see EN 1998-1:2004, 4.2.5)
a_{gR} reference peak ground acceleration on type A ground (see EN 1998-1:2004, 3.2.1)
$S =$ Soil factor (see EN 1998-1:2004, 3.2.2)

3) C1 for fixing non-constructal elements to structures

4) C2 for fixing constructal elements to structures

In Europe, anchor design is generally carried out according to Annex C of the ETAG 001 until the implementation of the CEN/TS 1992-4 as Part 4 of the Eurocode 2 is completed.

With the amendment for the assessment of metal anchors under seismic actions, ETAG 001, Annex E: "ASSESSMENT OF METAL ANCHORS UNDER SEISMIC ACTION" in 2013 the seismic pre-qualification of anchors has been regulated.

The seismic performance of anchors subjected to seismic loading is categorized by performance categories C1 and C2.

The value of a_g or that of the product a_g·S used in a Member State to define thresholds for the seismicity classes may be found in its National Annex of EN 1998-1 and may be different to the values given as in table Table 1.

Furthermore, the assignment of the seismic performance categories C1 and C2 to the seismicity level and building importance classes is in the responsibility of each individual Member State.

The importance classes are defined as follows:

Importance I:
Buildings and structures that normally are not subject to human occupancy **(e.g., equipment storage sheds, barns, and other agricultural buildings)** and that do not contain equipment or systems necessary for disaster response or hazardous materials.

Importance II:
Most buildings and structures of ordinary occupancy **(e.g., residential, commercial, and industrial buildings)** except those buildings contained in other categories.

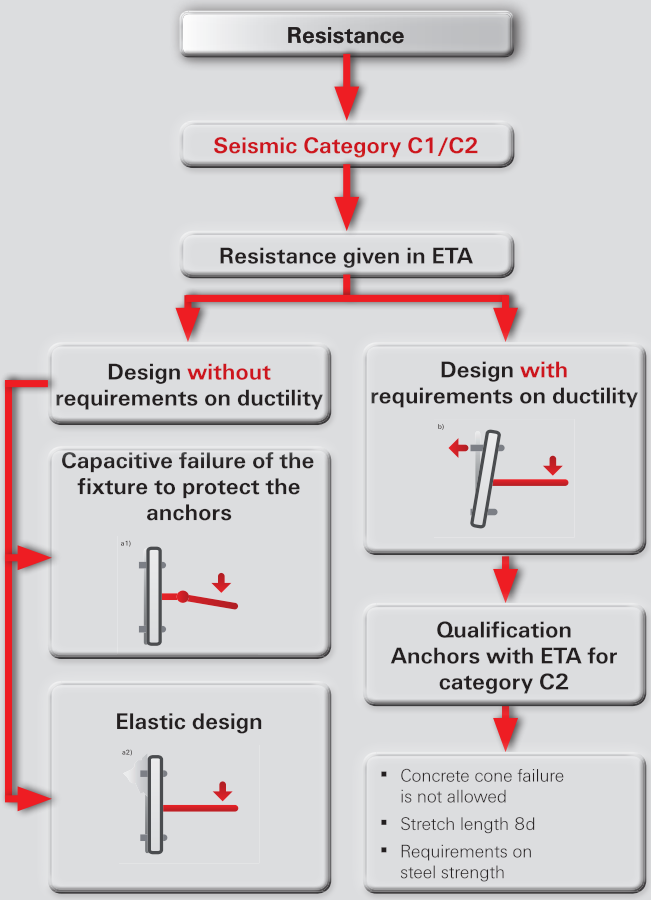
Importance III:
Buildings and structures that:

- Have large numbers of occupants **(e.g., high-rise office buildings, sports arenas, and large theaters),**
- Shelter persons with limited mobility **(e.g., jails, schools, and some healthcare facilities)**;
- Support lifelines and utilities important to a community's welfare; or
- Contain materials that pose some risk to the public if released.

Importance IV:
Buildings and structures that:

- Are essential to post-earthquake response (e.g., hospitals, police stations, fire stations, and emergency communications centers) or
- House very large quantities of hazardous materials.

For an exact seismic design please use our new fixperience software.



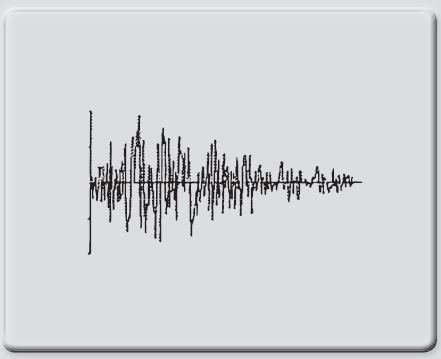
Anchor qualification

Performance category C1 provides anchor capacities in terms of strength (forces), while performance category C2 provides anchor capacities in terms of both strength (forces) and deformations. In both cases, the effect of concrete cracking is taken into account. The maximum crack width considered in C1 is Δw = 0,5 mm and in C2 it is Δw = 0,8 mm.

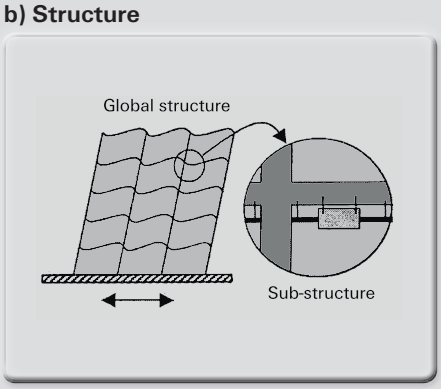
Qualification of anchors for category C1 comprises tests under pulsating tension load and tests under alternating shear load.

Qualification of anchors for category C2 includes reference tests up to failure, tests under pulsating tension load, tests under alternating shear load as well as tests under crack cycling. In these tests forces and displacements are measured either continuously or at certain intervals. Qualification of anchors for category **C2 places higher demands** on the performance of anchors under seismic action as compared to category **C1**.

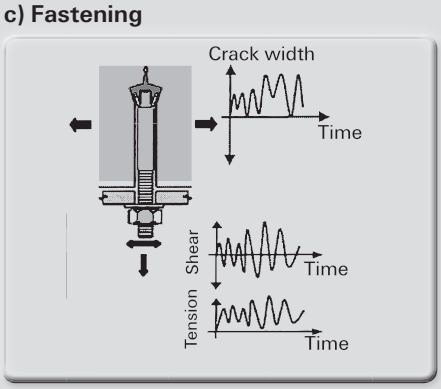
a) Environment



b) Structure



c) Fastening



Source: Anchorage in Concrete Construction; Eligehausen, Mallee, Silva

Seismic design.

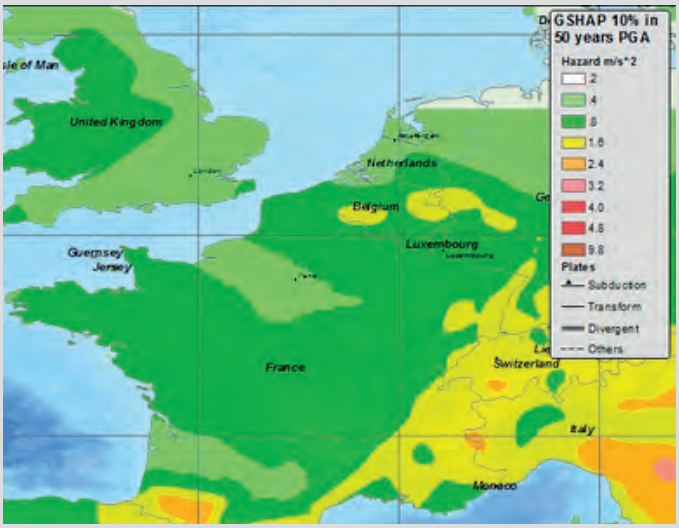
Design

The design of post installed anchors shall be in accordance with the design method given in the Technical report TR045 unless the implementation of the CEN/TS 1992-4 as Part 4 of the Eurocode 2 is completed.
The forces in the anchor shall be derived using appropriate combinations of actions for seismic design situations on the anchorage as recommended in EN 1990.
In cases of very low seismicity according to EN 1998-1 it shall be permitted to design as for static loading situations, if for the following situations a simplified verification may be carried out as stated:

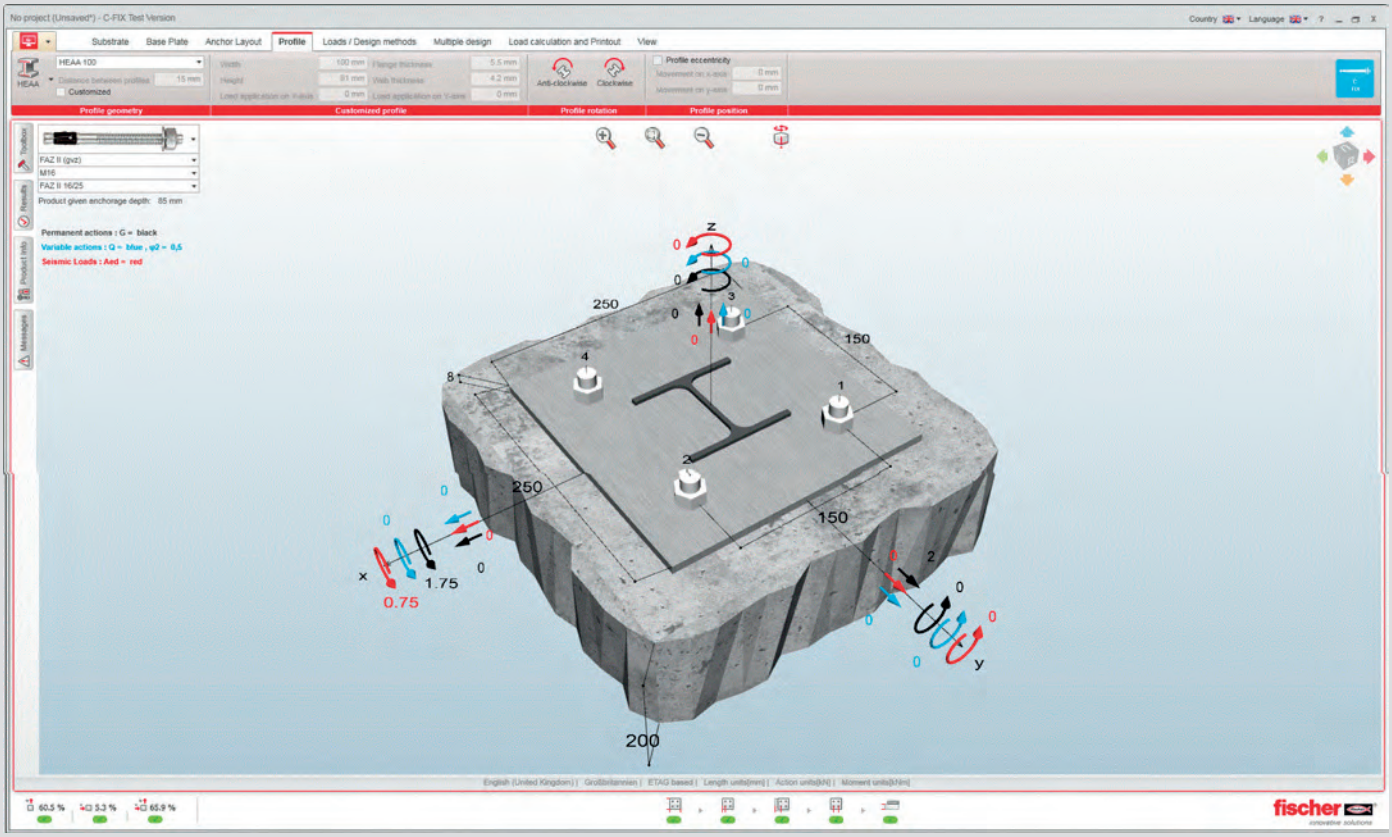
Ratio of seismic tension component of the design force to the total design tensile force to a single anchor or a group of anchors or ratio of seismic shear component of the design force to the total design shear force to a single anchor or a group of anchors:

⇨ ≤ 20 % : static design (ETAG 001 Annex C or EOTA TR029)
⇨ > 20 % : seismic design (EOTA TR 045)

To calculate the resistance of the anchor element the seismic category must be known. To find the right category the buildings importance (I,II,III or IV) and the ground acceleration ag as well as the soil factor S must be known.
These data's can be taken from national risk maps (Soil maps and earthquake zones)



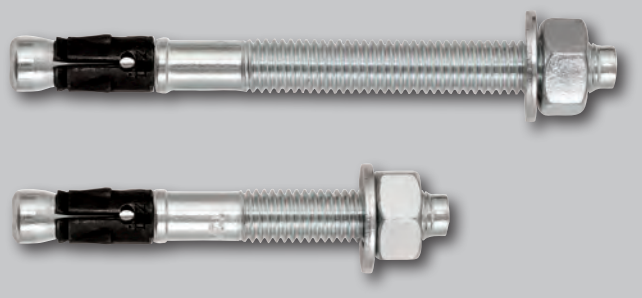
This picture shows the seismic zones of France.



High performance steel anchors.

ETA Seismic performance categories C1 and C2

FAZ II



ETA-05/0069
ETAG 001
Option 1 for cracked concrete
seismic performance category C1, C2

ESR-2948
See ICC-ES Evaluation Report at www.icc-es.org

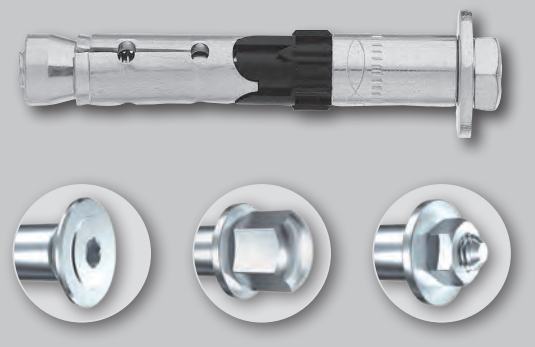
Fire resistance classification R 120

SEISMIC

- While having the widest product range the international approvals guarantee maximum safety and the best performance. Applications in earthquake regions with highest requirements (Seismic C1 + C2) like connections between structural elements are also covered by these approvals.
- The tried-and-trusted expansion clip makes large load-bearing capacities possible even under high seismic requirements, so fewer fixing points and smaller anchor plates are feasible.
- The reduced anchorage enables considerably shorter drill-hole depth. This means 27 % less drilling effort compared with the standard version, so providing a noticeable faster installation.

ETA Seismic performance categories C1

FH II



ETA-07/0025
ETAG 001-2

ESR-2691
See ICC-ES Evaluation Report at www.icc-es.org

Fire resistance classification R 120

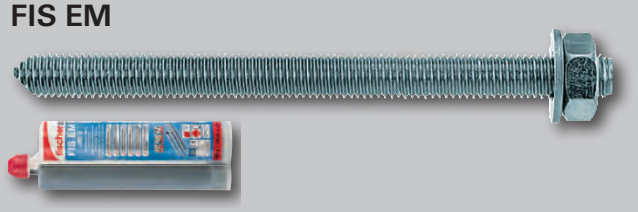
SEISMIC

- The international approvals guarantee maximum safety and the best performance. Applications to attachments of non-structural elements in earthquake regions (Seismic C1) are also covered by these approvals.
- The known FH II geometry minimizes the setting energy to a few hammer taps and thus ensures power-saving assembly.
- The anchor design enables different head shapes for fixing points with as sophisticated design.
- The excellent expansion behavior ensures functioning in seismic regions and enables flexible applications in cracked concrete.

High performance chemical fixings.

ETA Seismic performance categories C1and C2

FIS EM



ETA-10/0012
ETAG 001-5
Option 1 for cracked concrete
seismic performance category C1, C2

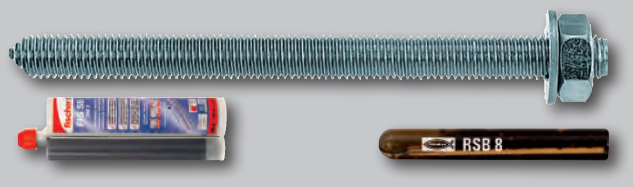
ICC ES ESR-1990 — See ICC-ES Evaluation Report at www.icc-es.org

Fire resistance classification R 120

SEISMIC

- The international approvals guarantee maximum safety and the best performance. Applications in earthquake regions with highest requirements (Seismic C1 + C2) like connections between structural elements are also covered by these approvals.
- Variable anchorage depths from 4x to 20x the threaded rod diameter allow for ideal adaptation to the load to be applied, and ensure an optimised installation time and use of materials.
- High bond strengths and minor mortar shrinkage allow maximum load application in cracked and non-cracked concrete, even with large threaded rod diameters of up to M30.
- FIS EM is also approved for diamond drilled and water-filled drill holes, thus ensuring more flexibility on the construction site.

Superbond (Anchor rod FIS A /RG M)



ETA-12/0258
ETAG 001-5
Option 1 for cracked concrete
seismic performance category C1, C2

ICC ES ESR-3572

Fire resistance classification R 120

SEISMIC

- The Superbond system is a combined capsule and injection system for cracked and non-cracked concrete. The injection mortar FIS SB and resin capsule RSB perform the same. This gives the installer maximum flexibility.
- Approved for seismic applications (performance category C1 + C2) as well as in waterfilled and diamond drilled holes (capsule only - C1) ensures safety even in extreme conditions.
- Maximum application temperatures of up to +150 °C and minimum temperatures of -30 °C open up new areas of use for bonded anchors.

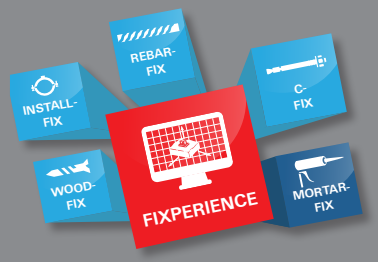
Structural strengthening





See for further information: www.fischer.de

fischer FIXPERIENCE.
The new design and information software suite.



- The new modular design program includes engineering software and application modules.
- The software is based on international design standards (ETAG 001 and EC2, such as EC1, EC3 and EC5), including the national application documents. All common force and measurement units are available.
- Incorrect input will be recognized and the software gives tips to get a correct result. This ensures a safe and reliable design every time.
- The graphical display can easily be rotated through 360°, panned, tilted or zoomed as required.
- The 3 D display gives a detailed and realistic image.
- The "live update" feature helps to keep the program up to date ensuring you are always working with the latest version.
- Free download and updates at www.fischer.de/fixperience-en

Our service to you.



We are available to you at any time as a reliable partner to offer technical support and advice:

- Our products range from nylon anchors to steel anchors through to chemical resin systems.
- Competence and innovation through own research, development and production.
- Global presence and active sales service in over 100 countries.
- Qualified technical consulting for economical and compliant fastening solutions. Also on-site at the construction site if requested.
- Training sessions, some with accreditation, at your premises or at the fischer ACADEMY.
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