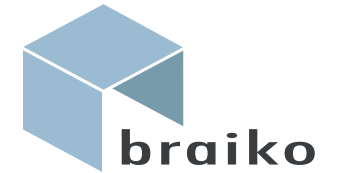


BRAIKO™ X

LOCKABLE SLOTTED HOLES

CONTENT



ADJUSTABLE BRACKETS	2
EXAMPLE OF FORCES ACTING ON BRACKET	3
SLOTTED HOLE LOCKING OPTIONS	4-10
ON-SITE WELDING	4
INJECTION MORTAR	5
STEEL NAILS	6
GROOVED DOWEL PINS	7
INSERTS	8
BRAIKO™ S - SERRATIONS	9
BRAIKO™ X - SERRATIONS	10
HOW DOES BRAIKO™ X WORK?	11-12
FAQ	13
COMPARISON	14
COST CHART	15
STRUCTURAL PERFORMANCE OF BRAIKO™ X	16

ADJUSTABLE BRACKETS

Adjustable brackets bridge the gap between a precise structure (e.g. facade) to a less precise one (e.g. concrete slab).

Such a bracket must allow for adjustments and transfer of loads from the secondary structure to the primary structure.

This can be achieved by means of:

- slotted holes
- cast-in channels
- threaded connections
- cut/drill/weld to size connections on site

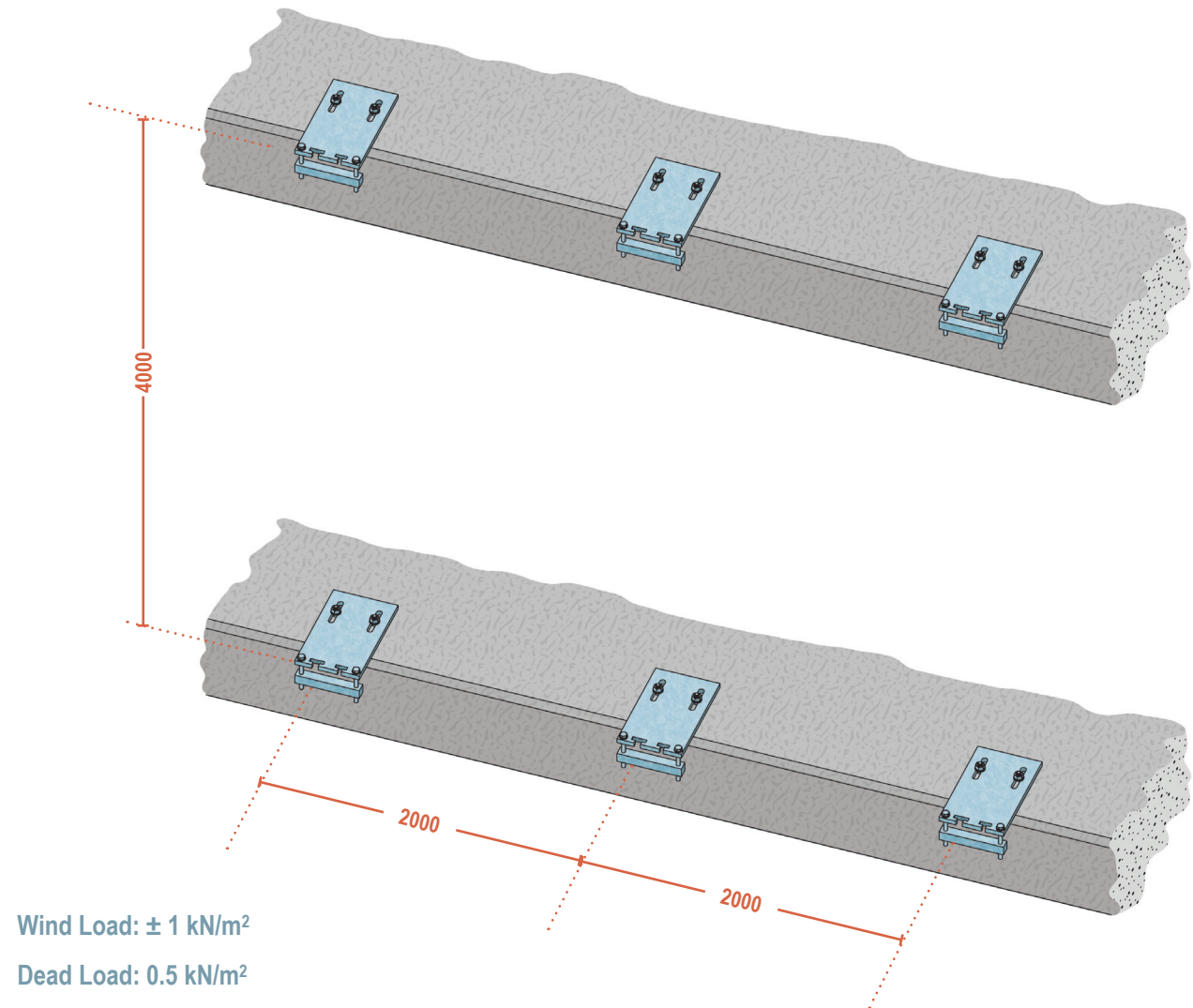
Our presentation will focus on slotted holes and their locking.



FORCES ACTING ON BRACKET

In our next considerations we will use a standard unitised cladding bracket.

Cladding units span usually up to 4000 mm and have a width of up to 2000 mm.



DESCRIPTION

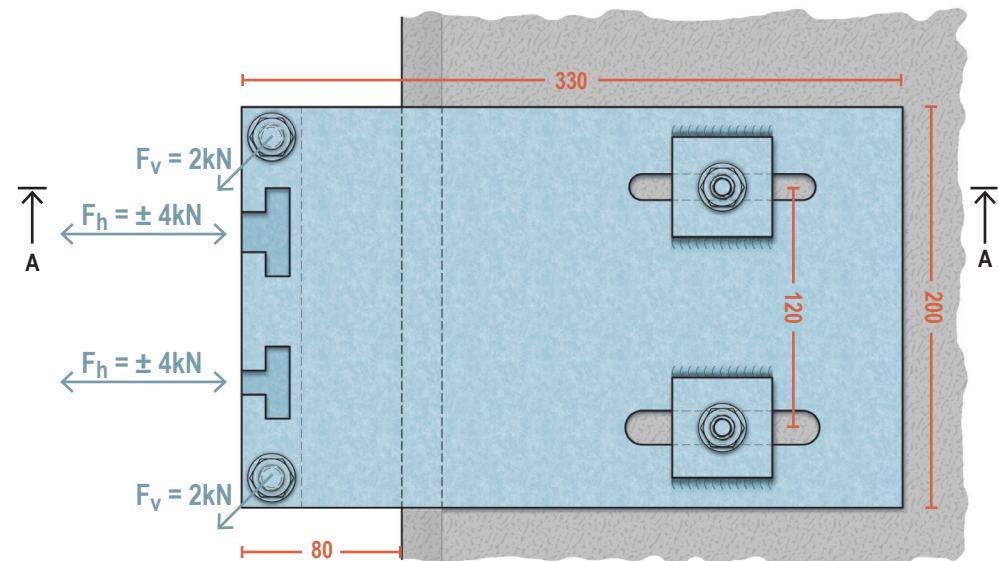
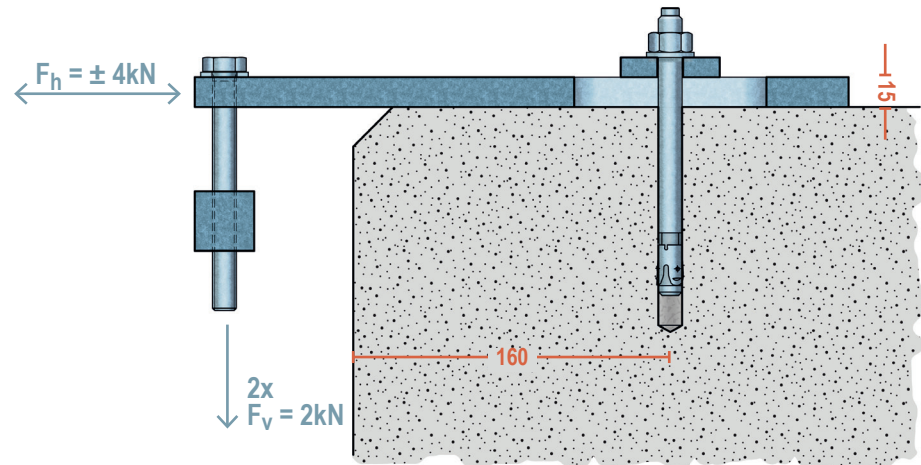
After adjustment, the bracket and the corresponding steel counter plate are fixed on site by putting torque on the anchor. Due to friction, the bracket is held in place. After installation of the bracket is completed, the coating around the counter plate is ground off and a site weld is applied. After cooling, the coating is restored to the area around the weld.

ADVANTAGES

- Easy and economical manufacturing of the components
- Fine adjustment possible

DISADVANTAGES

- Anchor is bent
- Readjustment very difficult
- Locking of the bracket postponed
- Quality assurance difficult
- Special tool required
- Safety/Fire protection issues - not accepted on many sites
- Electricity required
- Special personnel required
- Adjacent work must be protected
- Coating of the bracket damaged



INJECTION MORTAR

DESCRIPTION

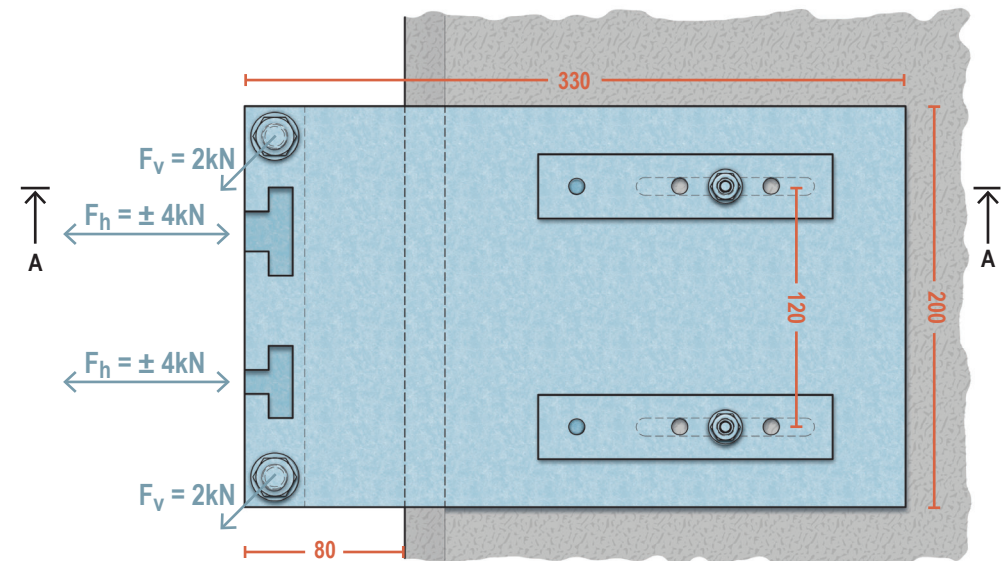
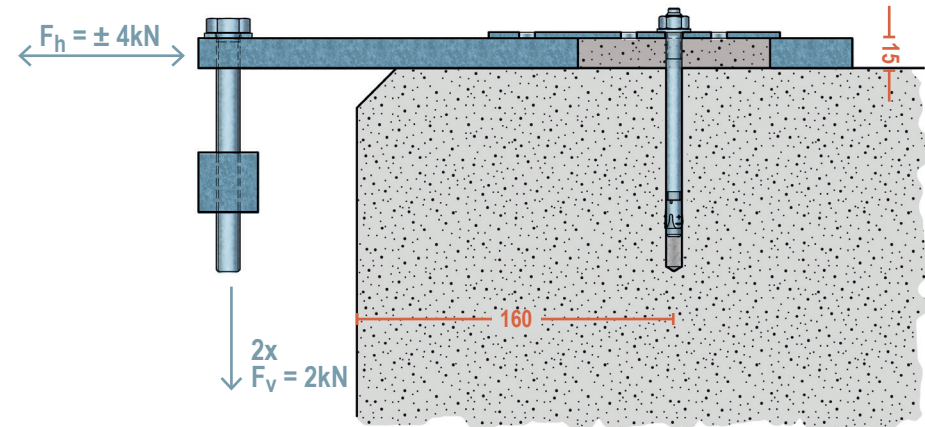
After adjustment, the bracket and the corresponding steel counter plate are fixed on site by putting torque on the anchor. Due to friction, the bracket is held in place. After installation of the bracket is completed, injection mortar is pressed through the the slotted hole, thereby fixing the position of the bracket.

ADVANTAGES

- Easy and economical manufacturing of the components
- Fine adjustment possible
- The height of the bracket and the fixing is reduced by 6 mm
- Anchor is sheared

DISADVANTAGES

- Readjustment very difficult
- Locking of the bracket is postponed
- Quality assurance difficult
- Special tool required
- Expensive
- Doesn't work at the ends of the slotted hole



STEEL NAILS

DESCRIPTION

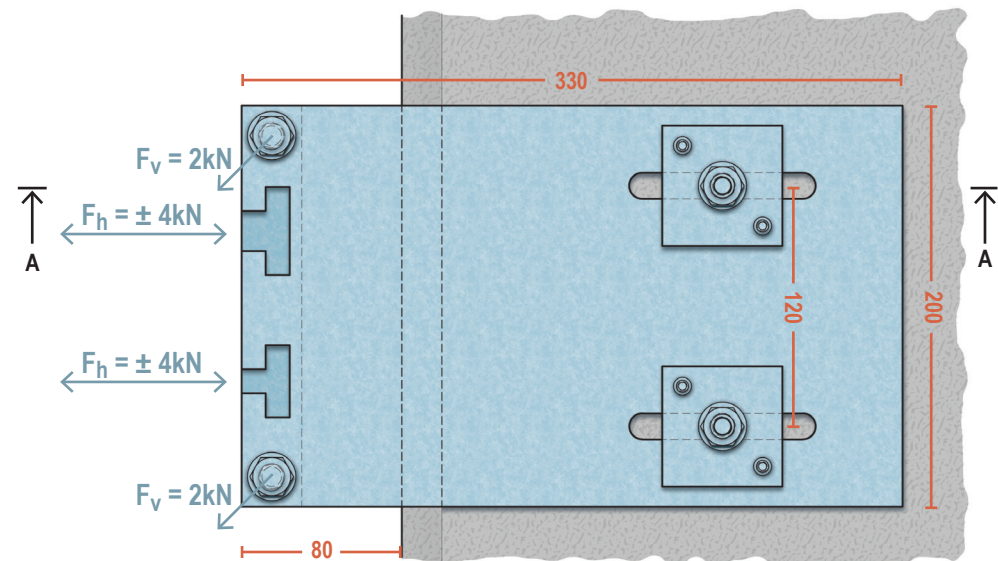
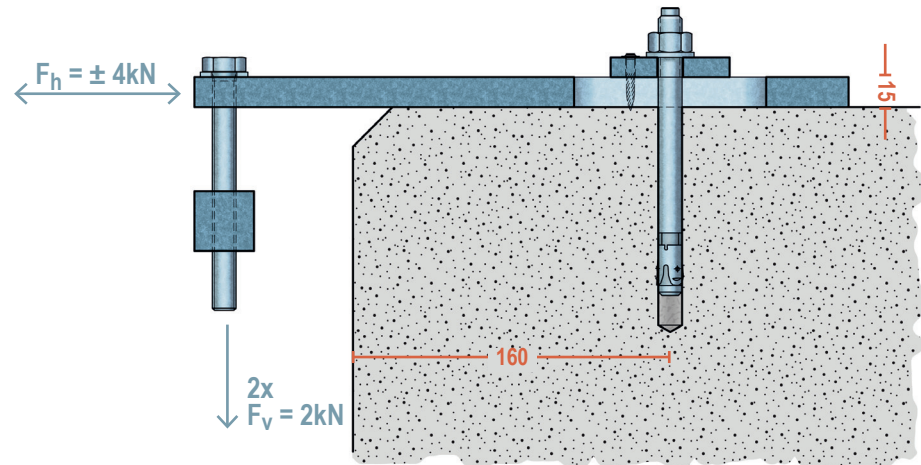
After adjustment, the bracket and the corresponding steel counter plate are fixed on site by putting torque on the anchor. Due to friction, the bracket is held in place. After installation of the bracket is completed, two steel nails are driven through additional holes in the counter plate into the bracket. The counter plate is thereby locked in place and the bracket is fixed in position.

ADVANTAGES

- Easy and economical manufacturing of the components
- Fine adjustment possible
- Relatively fast installation on site

DISADVANTAGES

- Anchor is bent
- Readjustment very difficult
- Locking of the bracket is postponed
- Quality assurance difficult
- Special tool required
- Noisy
- Safety/Fire protection issues - not accepted on many sites
- Special personnel required



GROOVED DOWEL PINS

DESCRIPTION

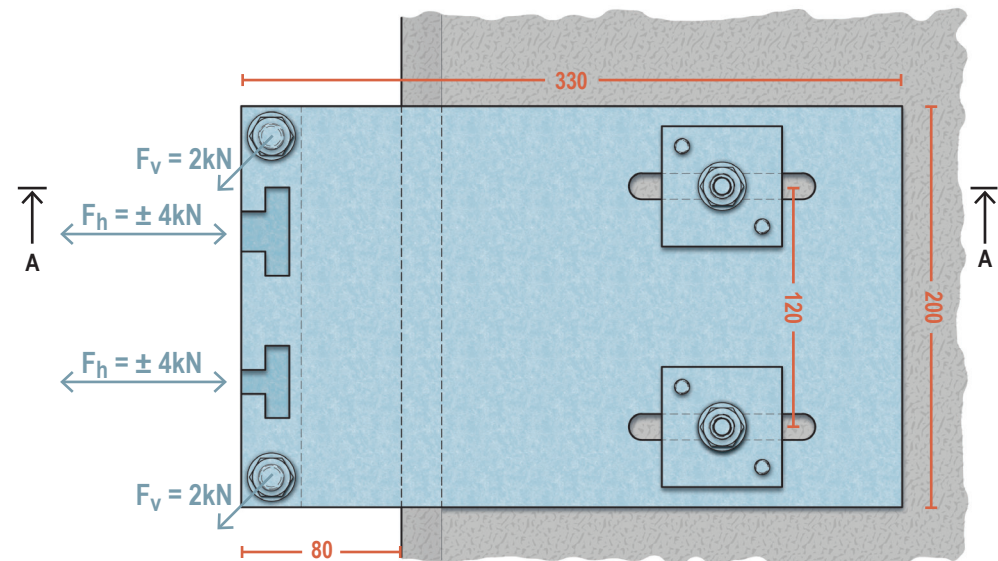
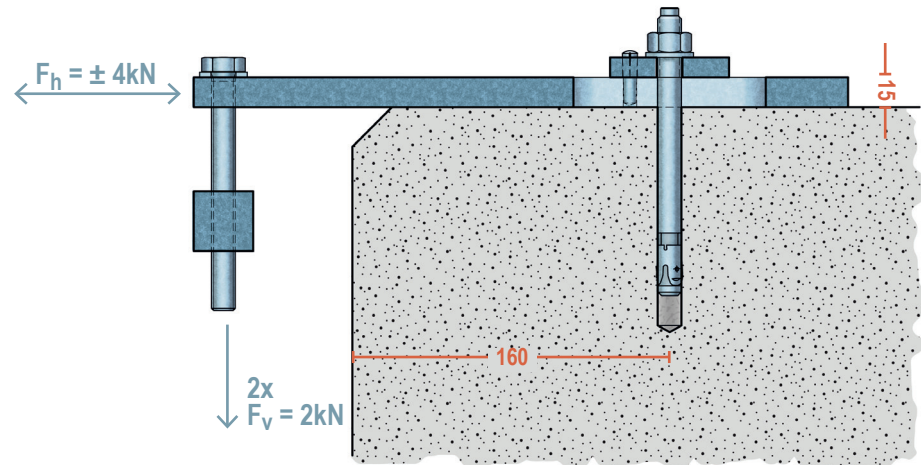
After adjustment, the bracket and the corresponding steel counter plate are fixed on site by putting torque on the anchor. Due to friction, the bracket is held in place. After installation of the bracket is completed, two holes are drilled in the bracket through the corresponding holes in the counter plate. Grooved dowel pins are then inserted, locking the counter plate in place and fixing the bracket in position.

ADVANTAGES

- Easy and economical manufacturing of the components
- Fine adjustment possible

DISADVANTAGES

- Anchor is bent
- Readjustment very difficult
- Locking of the bracket postponed
- Quality assurance difficult
- Special tool required
- Electricity required
- Coating of the bracket damaged due to drilling on site
- Overall a very expensive solution



INSERTS

DESCRIPTION

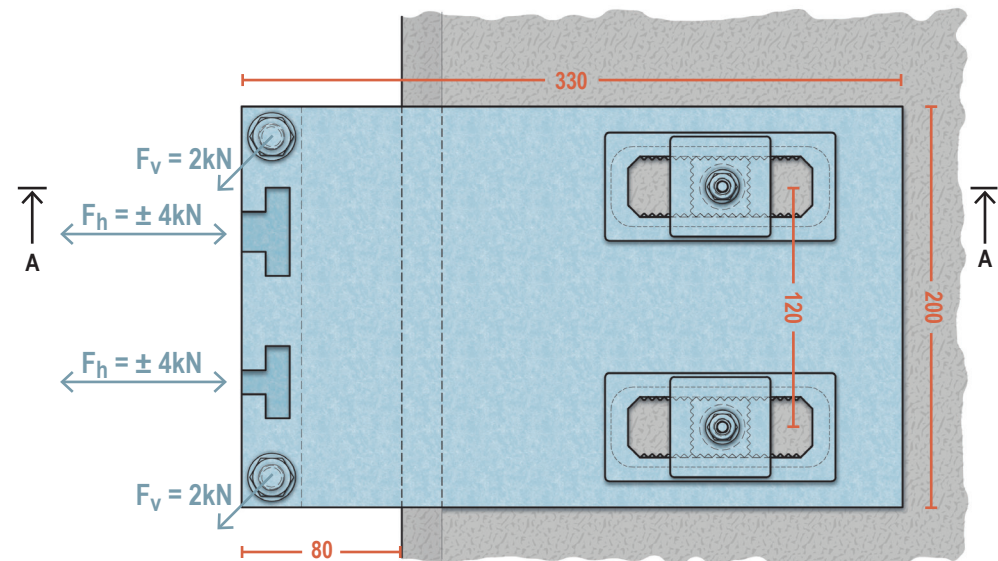
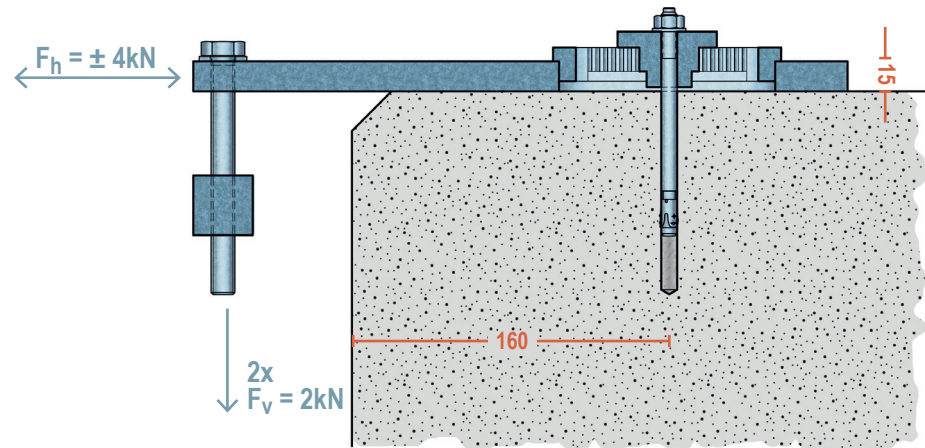
A specific oversized slotted hole is manufactured. Afterwards an insert with vertical serrations is put in place. During installation, a second insert is put in the first one, locking the slotted hole and the bracket in position.

ADVANTAGES

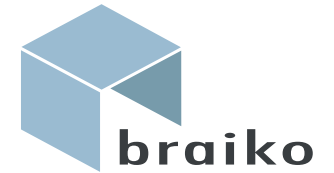
- Easy and economical manufacturing of the bracket
- Standard loads can be used in structural calculations
- Easy quality assurance
- Readjustment possible
- Slotted hole is locked during installation
- Anchor is sheared
- Quality assurance simple

DISADVANTAGES

- Limited to one slotted hole geometry
- Large oversize hole in the bracket required
- Expensive solution



BRAIKO™ S - SERRATIONS



DESCRIPTION

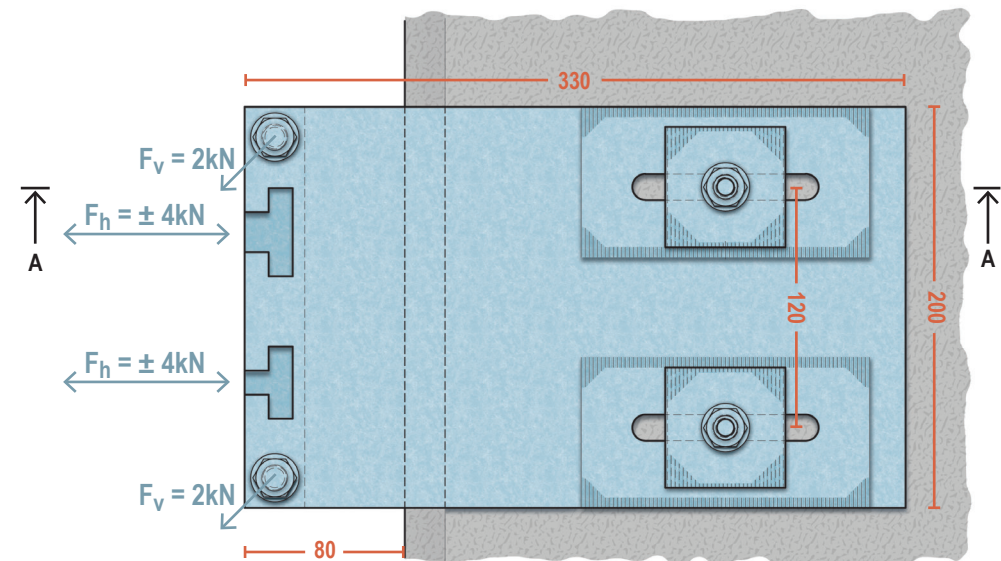
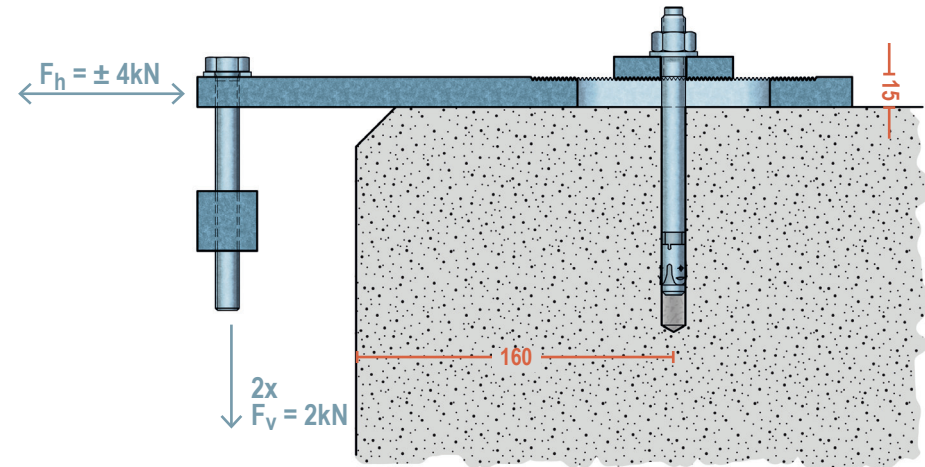
A slotted hole is manufactured with horizontal serrations. During installation, a BRAIKO™ S element with corresponding serrations is put in the correct position and locked by applying torque on the anchor. The slotted hole is immediately locked and the bracket is fixed in position.

ADVANTAGES

- Fine adjustment (1 mm steps) possible
- Readjustment possible
- Easy quality assurance
- Coating of the bracket intact
- Slotted hole is locked during installation

DISADVANTAGES

- Expensive solution
- Anchor is bent



BRAIKO™ X - SERRATIONS



DESCRIPTION

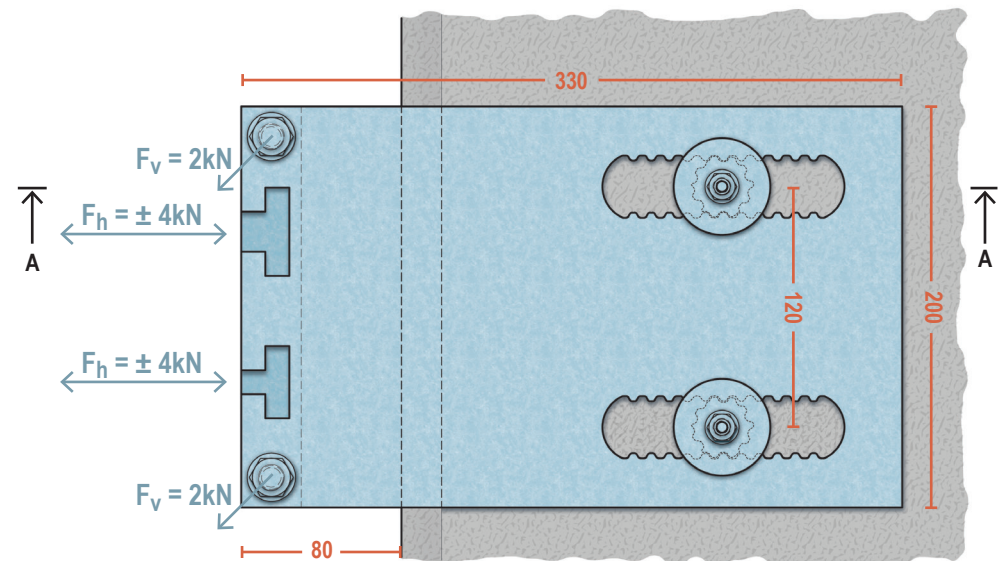
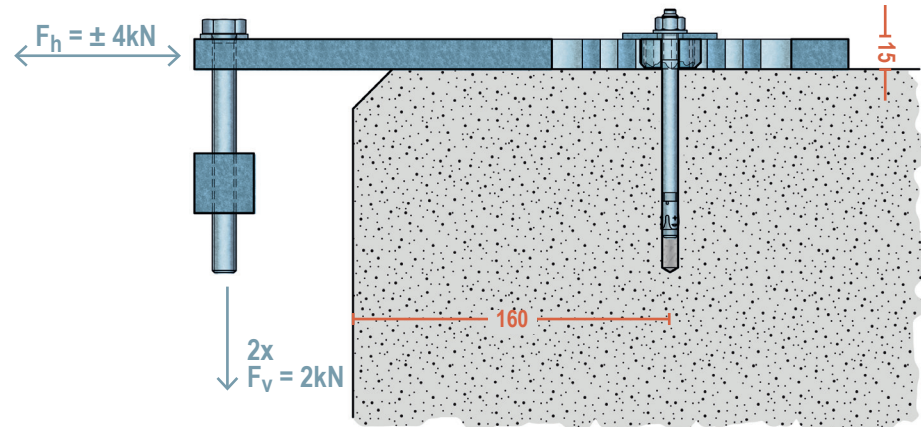
A slotted hole is manufactured with vertical serrations. During installation, a Braiko™ X (patent pending) element is rotated to the correct position and then inserted into the slotted hole. The slotted hole is locked immediately.

ADVANTAGES

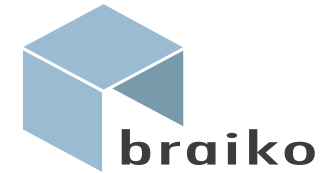
- Easy and economical manufacturing of the bracket
- Serrations in the slotted hole have a large pitch (e.g. 9 mm). Therefore it's possible to produce them by laser or plasma cutting
- Large teeth can transfer high loads
- Different coatings can be applied
- Coating of the bracket intact
- Readjustment possible
- Easy quality assurance
- Slotted hole is locked during installation
- Fixing anchor is sheared

DISADVANTAGES

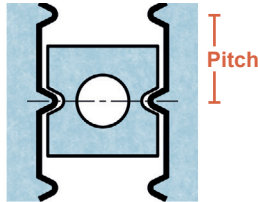
- Quality assurance of the slotted hole with serrations is necessary
- Fender washer ISO 7093 is necessary



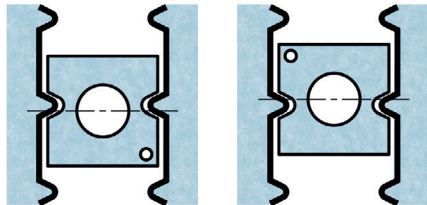
HOW DOES BRAIKO™ X WORK?



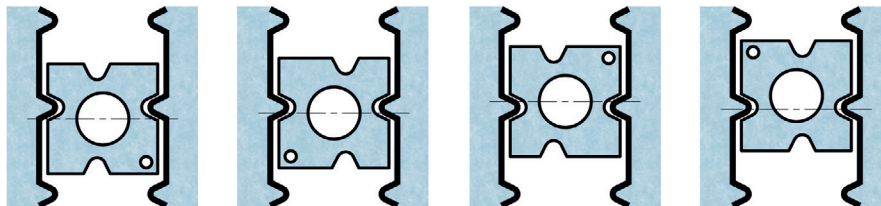
Possible precision
Pitch / 1



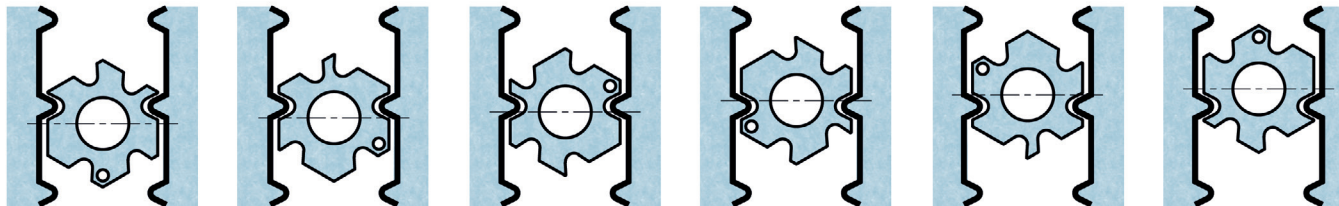
Possible precision
Pitch / 2



Possible precision
Pitch / 4



Possible precision
Pitch / 6



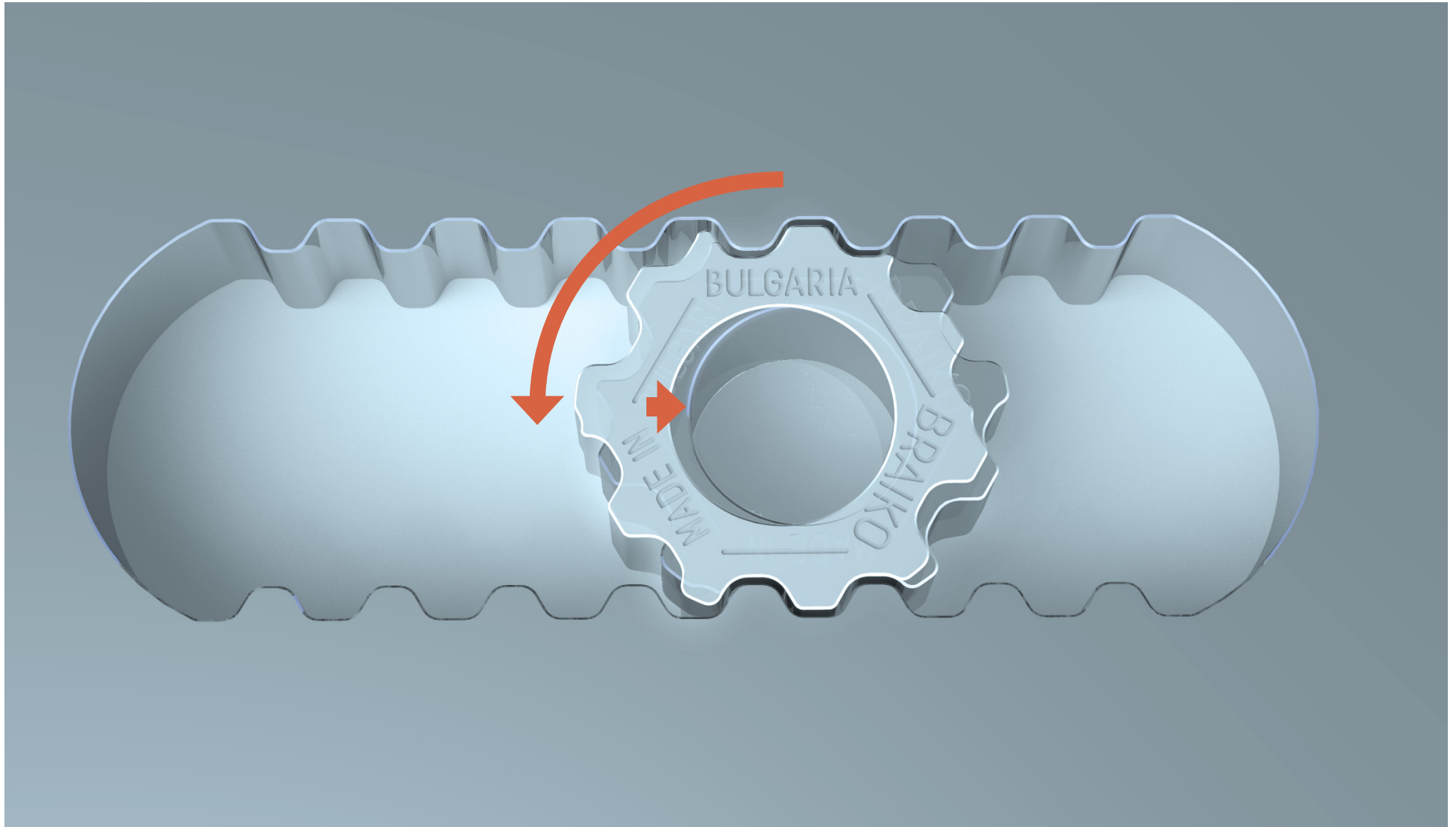
Slotted holes and inserts with vertical serrations are common in the construction industry. Serrations with a large pitch:

- can be economically manufactured
- are suitable for construction sites
- can transfer high loads
- can be coated by most common processes

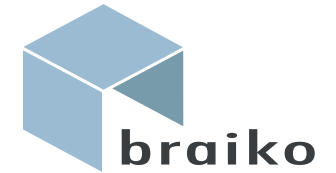
Until now serrations with a large pitch were associated with coarse adjustability.

BRAIKO™ X Inserts are designed in such a way that slotted holes with serrations with large pitches can be adjusted in much smaller steps than the pitch itself.

HOW DOES BRAIKO™ X WORK?



FREQUENTLY ASKED QUESTIONS (FAQ)



	ON-SITE WELDING	INJECTION MORTAR	STEEL NAILS	GROOVED PINS	INSERTS	BRAIKO™ S	BRAIKO™ X
IS THE ANCHOR SHEARED?	✗	✓	✗	✗	✓	✗	✓
HOW PRECISELY CAN I IT BE ADJUSTED?	+/- 0 mm	+/- 0 mm	+/- 0 mm	+/- 0 mm	+/-2 mm	+/- 1.0 mm	+/- 0.5 mm *
ARE THE COMPONENTS OF THE BRACKET EASY TO MANUFACTURE?	✓	✓	✓	✓	✓	✗	✓
IS THE COATING INTACT AFTER INSTALLATION?	✗	✓	✓	✗	✓	✓	✓
IS IT EASY TO INSTALL?	✗	✗	✗	✗	✓	✓	✓
CAN I INSTALL WITH A STANDARD HAND TOOL?	✗	✗	✗	✗	✓	✓	✓
CAN I ADJUST AND LOCK IN ONE GO?	✗	✗	✗	✗	✓	✓	✓
CAN I READJUST ONCE THE SLOTTED HOLE IS LOCKED?	✗	✗	✗	✗	✓	✓	✓
IS QUALITY ASSURANCE EASY?	✗	✗	✗	✗	✓	✓	✓

* If a 9 mm pitch for the serrations is used

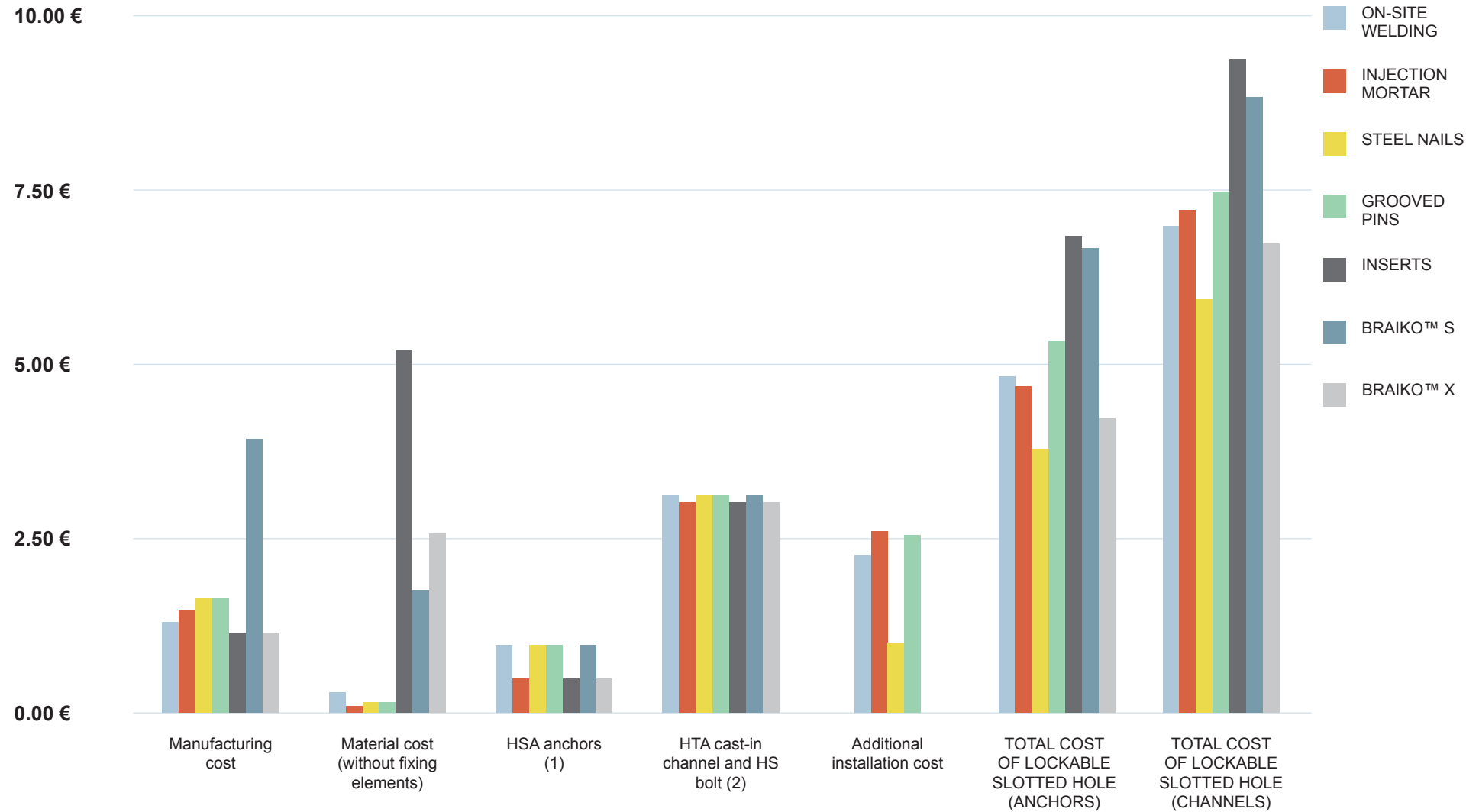
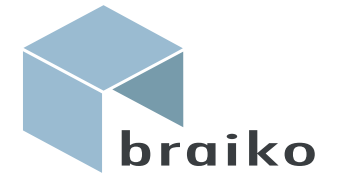
COMPARISON



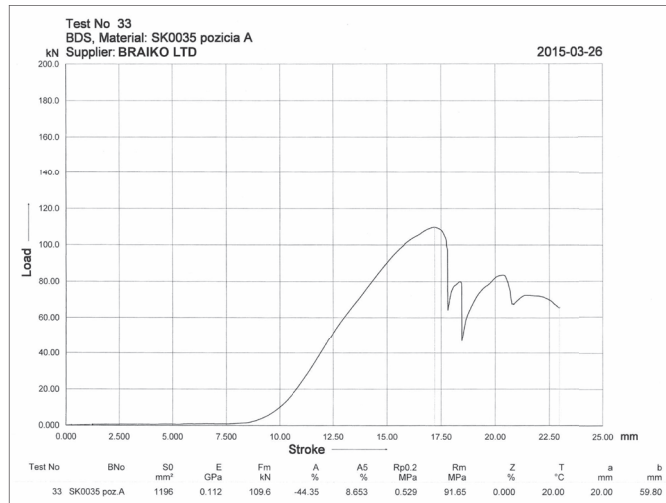
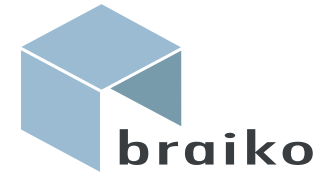
	ON-SITE WELDING	INJECTION MORTAR	STEEL NAILS	GROOVED PINS	INSERTS	BRAIKO™ S	BRAIKO™ X
Positioning accuracy	+/- 0,00 mm	+/- 0,00 mm	+/- 0,00 mm	+/- 0,00 mm	+/- 2,00 mm	+/- 1,00 mm	+/- 0,50 mm*
Structural properties (cracked concrete C20/25)	✓✓	✓✓✓✓✓	✓✓	✓✓	✓✓✓✓✓	✓✓	✓✓✓✓✓
Required anchor / utilisation	HST M12X145/50 60%	HST M8X115/50 68%	HST M12X145/50 60%	HST M12X145/50 60%	HST M8X115/50 68%	HST M12X145/50 60%	HST M8X115/50 68%
Required HTA channel / utilisation	HTA-CE 38/17 - FV - 250 /2 48%	HTA-CE 38/17 - FV - 250 /2 48%	HTA-CE 38/17 - FV - 250 /2 48%	HTA-CE 38/17 - FV - 250 /2 48%	HTA-CE 38/17 - FV - 250 /2 48%	HTA-CE 38/17 - FV - 250 /2 48%	HTA-CE 38/17 - FV - 250 /2 48%
Required HS bolt / utilisation	HS 38/17 M 12 x GV-S 8.8F 37%	HS 38/17 M 10 x GV-S 4.6 48%	HS 38/17 M 12 x GV-S 8.8F 37%	HS 38/17 M 12 x GV-S 8.8F 37%	HS 38/17 M 10 x GV-S 4.6 48%	HS 38/17 M 12 x GV-S 8.8F 37%	HS 38/17 M 10 x GV-S 4.6 48%
Manufacturing	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓	✓✓✓✓✓
Installation	✗	✓✓	✓	✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓
Readjustment	✗	✗	✗	✗	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓
Quality assurance	✗	✗	✓✓	✓✓	✓✓✓✓✓	✓✓✓✓✓	✓✓✓✓✓
Manufacturing cost	1.30 €	1.53 €	1.63 €	1.63 €	1.15 €	3.93 €	1.15 €
Material cost (without fixing elements)	0.29 €	0.10 €	0.16 €	0.16 €	5.20 €	1.75 €	2.58 €
HSA anchors (1)	0.98 €	0.49 €	0.98 €	0.98 €	0.49 €	0.98 €	0.49 €
HTA cast-in channel and HS bolt (2)	3.13 €	3.00 €	3.13 €	3.13 €	3.00 €	3.13 €	3.00 €
Additional installation cost	2.25 €	2.63 €	1.39 €	2.55 €			
TOTAL COST OF LOCKABLE SLOTTED HOLE (ANCHORS)	4.82 €	4.74 €	4.16 €	5.32 €	6.84 €	6.66 €	4.22 €
TOTAL COST OF LOCKABLE SLOTTED HOLE (CHANNELS)	6.97 €	7.25 €	6.31 €	7.47 €	9.35 €	8.81 €	6.73 €

* Pitch of teeth 9 mm, 17 mm hole for M16 bolt

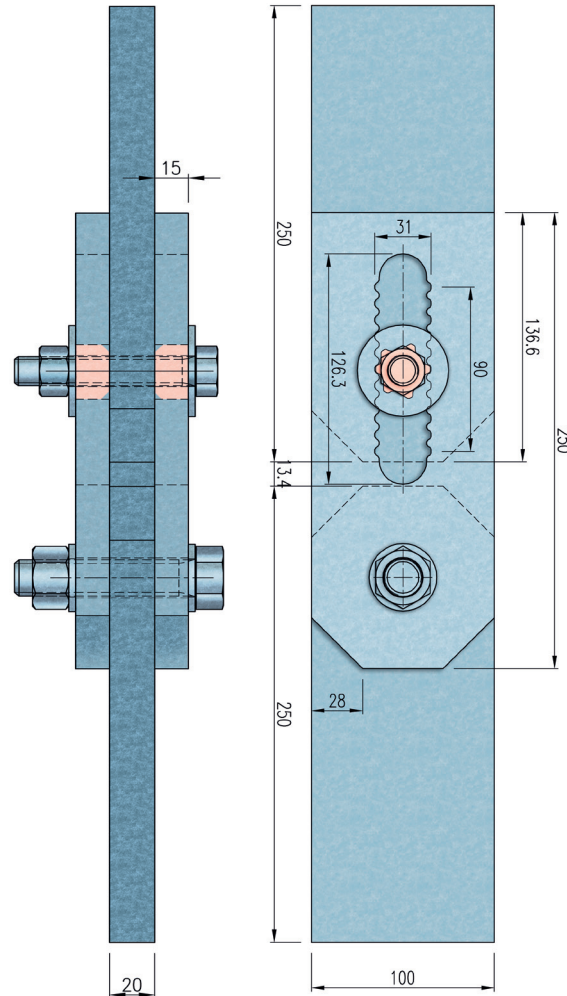
COST CHART

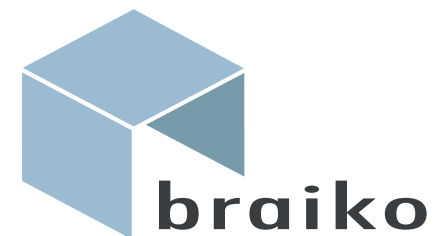


STRUCTURAL PERFORMANCE OF BRAIKO™ X



BRAIKO™ X Insert; 14.5mm; p=9.00mm; S355JR
Base plate 15mm; S235JR





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BRAIKO™ X

LOCKABLE SLOTTED HOLES

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