terra infrastructure

Instructions for use

E+S single slide rail linear shoring and single slide rail inner-city linear shoring

Date: April 2022

terra infrastructure

Information about the instructions for use

These instructions enable the safe and efficient use of E+S single slide rail linear shoring. The instructions are part of the systems and shall be kept in close proximity of the shoring site, accessible to the personnel at all times.

The personnel must read and understand these instructions thoroughly before starting to work. Prerequisite for safe work is observance of all safety precautions and work instructions specified in these instructions.

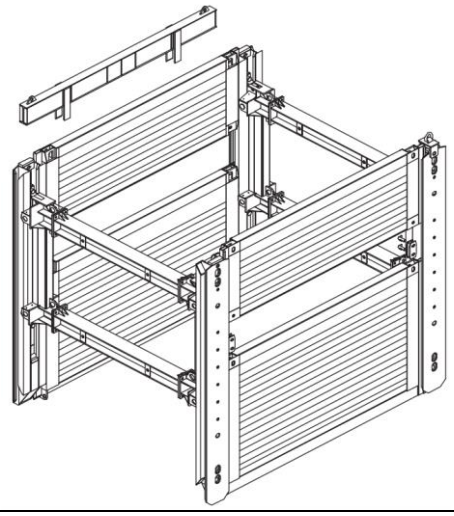
In addition, local occupational health and safety regulations and general safety regulations for the area of use apply.

All safety-related dimensions conform with German safety and accident prevention regulations and German standards. The respective state-specific regulations are to be checked and applied before the works start.

Contents

1 System overview

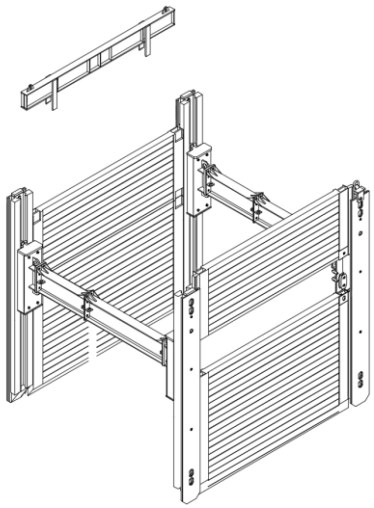
Single slide rail linear shoring



Module length	2.13 m – 6.38 m
Linear support length	4.13 m
Panel height	1.32 m / 2.32 m
Pipe culvert height	variable

Designation for slide rail system X according to EN 13331-1:
e. g.: RS – X –FR – F – 4.13 – 0.90 / max. – 0.90 / max

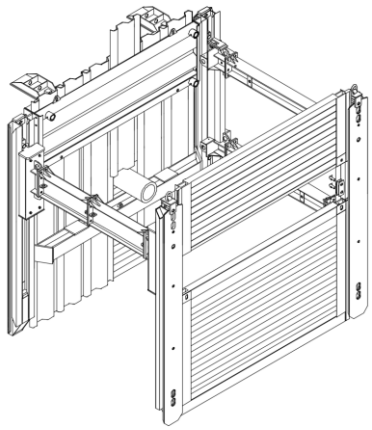
Single slide rail linear shoring with U-type strut cart



Module length	2.13 m – 6.38 m
Linear support length	4.13 m
Panel height	1.32 m / 2.32 m
Pipe culvert height	variable

Designation for slide rail system X according to EN 13331-1:
e. g.: RS – X –FR – F – 4.13 – 0.90 / max. – 0.90 / max

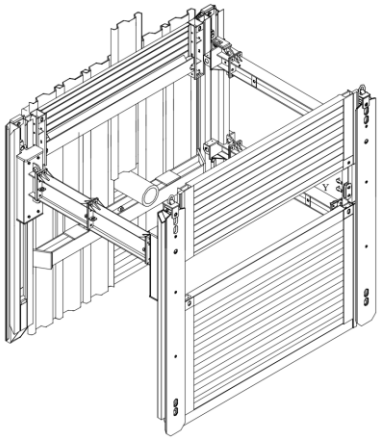
Single slide rail inner-city linear shoring (DKU)



Module length	2.84 m – 4.38 m
Linear support length	4.13 m
Height piling frame element	1.00 m
Trench sheet length (KD VI / 8)	variable

Designation for slide rail system X according to EN 13331-1:
e. g.: RS – X –FR – F – 4.13 – 0.90 / max. – 0.90 / max

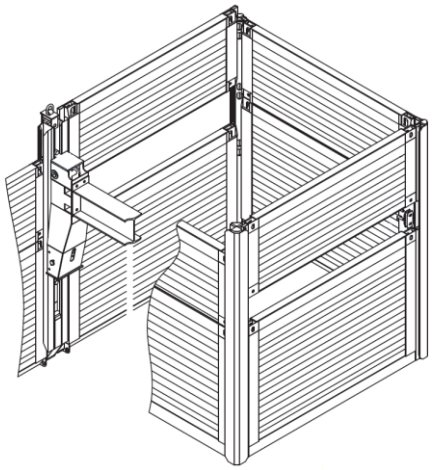
Single slide rail inner-city linear shoring (DKE)



Module length	3.88 m – 4.13 m
Linear support length	4.13 m
Height piling frame element	1.00 m
Trench sheet length (KD VI / 8)	variable

Designation for slide rail system X according to EN 13331-1:
e. g.: RS – X –FR – F – 4.13 – 0.90 / max. – 0.90 / max

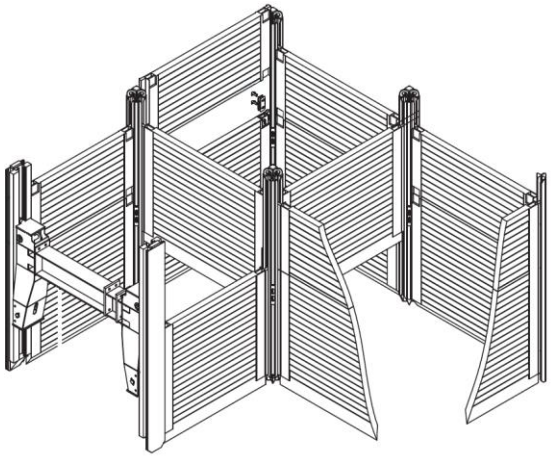
Single slide rail corner shoring



Module length	2.13 m – 6.38 m
Linear support length	2.30 m / 4.13 m
Panel height	1.32 m / 2.32 m
Shoring width	1.75 m – 6.00 m

Designation for slide rail system X according to EN 13331-1:
e. g.: RS – X –FR – F – 4.13 – 0.90 / max. – 0.90 / max

Single slide rail linear shoring – X rail



Module length	2.13 m – 6.38 m
Linear support length	4.13 m
Panel height	1.32 m / 2.32 m
Shoring width	1.75 m – 6.00 m

Designation for slide rail system X according to EN 13331-1:
e. g.: RS – X –FR – F – 4.13 – 0.90 / max. – 0.90 / max

2 Occupational safety and general information in accordance with DIN EN 13331-1/-2

2.1 Symbols in these instructions

Safety information

The following occupational safety symbols are on all occupational safety information which indicates a danger to the life and limb of personnel and are identified by a pictogram, a signal word and a signal color.
You can find explanations of the dangerous situations at the relevant points in the documentation.
Observe this information at all times!
Observe the applicable local safety and accident prevention regulations at all times!

All the following dimensions conform with German safety regulations.

⚠ DANGER

Type and source of danger
This symbol warns of an immediate danger to the life and health of personnel.
Failure to observe these warnings results in serious repercussions for health, culminating in life-threatening injuries and extensive property damage.
Action which must be refrained from so that the danger does not occur

⚠ WARNING

Type and source of danger
This symbol warns of an imminent danger to the life and health of personnel, and of environmental and property damage.
Failure to observe these warnings may result in serious repercussions for health, culminating in life-threatening injuries and/or extensive environmental and property damage.
Action which must be refrained from so that the danger does not occur

⚠ CAUTION

Type and source of danger
This symbol warns of an imminent danger to the health of personnel and of environmental and property damage.
Failure to observe these warnings may result in moderate or slight repercussions for health, culminating in injuries and/or extensive environmental and property damage.
Action which must be refrained from so that the danger does not occur

NOTE

Type and source of machine and/or system damage
This symbol warns of a dangerous situation and serves to indicate a note on the handling of the trench shoring.
Failure to observe these warnings may result in extensive property damage.
Action which must be refrained from so that the damage does not occur

Tips and recommendations

This symbol highlights useful tips and recommendations, as well as information for efficient and fault-free operation. Action which must be refrained from so that the danger does not occur

Other markings

The following markings are used to highlight instructions, results, lists, references and other elements in these instructions:

Marking	Explanation
1., 2., 3. ...	Step-by-step instructions
	Results of actions
•	Lists with no fixed order

2.2 Dangers

When working on and in excavations and trenches, the following dangers with the potential to cause serious injuries or death arise, among others:

- Being buried under volumes of soil or gravel which slip
- Being buried as a result of failure of the shoring
- Personnel falling
- Being affected by falling or tipping parts
- Tripping, slipping, falling
- Forced postures in confined working spaces
- Crushing of hand and feet during loading and unloading, transportation, assembly and disassembly, and installation and removal of the shoring elements

2.3 General safety information and measures for reduction of risks

Please note that an appropriate risk assessment must be generated for the specified work step before assembly, installation and removal and disassembly of the shoring system.

Compliance with the technical specifications and safety information in these use instructions is required at all times.

⚠DANGER

Risk of death or injury owing to insufficient safety measures on the construction site and for adjacent installations / trades!

Insufficient safety measures on the construction site and for adjacent installations / trades result in a risk of death or injury, as well as a risk of property damage to the shoring!

- Attention must be paid to overhead lines during transportation and during installation and removal of the shoring.
- On sloping or uneven ground, the shoring must set up at as close to a right angle to the slope as possible.
- The use instructions must be present of the construction site.
- When using the shoring system, the maximum permitted loads as specified in these use instructions may not be exceeded.
- Shoring systems may only be used in ground which is not susceptible to slippage; water table drawdown measures must be taken where applicable.
- The stability of the shoring must be ensured in all installation and removal, assembly and disassembly states.
- The shoring must be installed in a horizontal position.
- Only put up shoring units on solid and even surfaces and secure against falling where applicable – possible factors which may affect stability, e.g. site incline, wind loads, vibrations from traffic loads and/or work tools, soil condition, etc., must be taken into account.
- Take traffic safety measures us trenches are established in the vicinity of public roads or if the establishment affects traffic. Consult with the relevant authorities.
- The shoring must reach to the bottom of the trench. In minimum stiff, cohesive soils, the shoring for construction operations which will be finished in a few days may end up to 0.50 m above the bottom of the trench if there are no exceptional influences and no earth pressure is to be absorbed from building loads.
- Throughout the construction phase, the front area must be secured through frictional connection and/or battered in accordance with the national regulations.
- Shoring elements placed on top of one another must be frictionally connected to one another at all points provided for in the design.
- Cavities should be filled immediately in a force-fitting manner.
- In order to ensure the safe execution of works, material transportation, and in particular the rescue of injured personnel, minimum working area widths in accordance with DIN 4124 must be complied with (minimum working are width for excavations/trenches ≥ 0.6 m); the appropriate national regulations must be applied where applicable.
- All parts of the shoring must always be inspected after heavy rainfall, in the event of significant changes to the loading, at the onset of a thaw, after a long interruption in the works, after extraordinary stresses (e.g. owing to impacts or vibrations) or after blasts.
- Removal of the shoring must be done in conjunction with backfilling.

TIP

- The safety of vehicles and persons on site must be ensured by means of cones, warning tape or security personnel specially deployed for this purpose.
- The construction site must be sufficiently marked as such using warning signs, for example.

2.4 Protection against falls and falling parts

⚠DANGER

Risk of death or injury owing to falls or falling parts!
Falls or falling parts result in a risk of death or injury, as well as a risk of property damage to the machine and/or system! The following measures must be implemented, depending on the construction site.

- Transitions are required for trenches with a width of > 0.80 m; the transitions must be at least 0.50 m wide.
- At a trench depth of > 1.00 m, the transitions must be equipped with a three-part side guard on both sides to protect against falling.
- At a trench depth of > 1.25 m, steps or ladders must be used for access.
- In order to protect against falling parts or against excavated soil slipping back in, the shoring must have an overhang over the top edge of the trench – at trench depths of 2.0 m this must be min. 5 cm, at trench depths of greater than 2.0 m it must be min. 10 cm.
- The front sides of the trenches or excavations must either be secured using appropriate shoring systems or, depending on the soil condition, battered accordingly.
- At the top edge, a protective strip which is at least 0.60 m wide must be kept free from loads and in particular from construction machinery and vehicles.
- Fall protection systems must be installed in excavations and trenches with a possible fall height of greater than 2 m.
- For activities for which the installation of effective fall protection is generally not possible (e.g. during installation of the shoring, during excavation, during cable laying or during backfilling), this must be reviewed and justified within the risk assessment.

2.5 Storage, transportation and lifting operations

Storage

⚠DANGER

Risk of death or injury owing to incorrect storage!
Incorrect storage results in a risk of death or injury, as well as a risk of property damage to the machine and/or system!

- The shoring elements may only be stored on solid, even ground.
- In the event that shoring panels are stored in stacks, the maximum permitted stack height must be observed – rule of thumb: max. stack height [m] = 4 x width of the narrow side [m].
- Care must be taken to ensure that the shoring panels are aligned perpendicular with one another during storage and transportation; support staves and non-slip mats or similar must be used where applicable in order to ensure safe storage and safe transportation.
- The prescribed safety distances from trench and excavation walls (see 2.3) must always be complied with for storage.

Transportation and lifting operations

DANGER

Risk of death or injury owing to suspended, hauled or towed loads!
Loads may swing out and fall during lifting operations. Hauled or towed loads may tip over. There is a risk of death or injury, as well as a risk of property damage to the shoring!

- Assembly of the guide frame may only be done in a horizontal position. Assembly in vertical alignment is EXPRESSLY prohibited!
- For transportation, the use of cranes or hydraulic excavators using hoisting operation is preferred; during transportation with forklifts, attention must be paid to the fact that the ground on a construction site is frequently uneven. This may lead to the load slipping or falling – additional safety measures are required where applicable for transportation with forklifts.
- Hydraulic excavators using hoisting operation must be equipped with an overload warning system and a line-break safety device; the overload warning system must be switched on in hoisting operation.
- The lifting gear, load handling attachment and sling must be chosen according to the load; the dynamic loads, e.g. when pulling boxes (removal), must also be taken into account here in addition to the static loads.
- All lifting gear, load-handling attachments and slings must be tested and approved.
- Do not pull shoring elements through the trench (exception: dragboxes).
- When using slings, the use of edge protection is required if the sling is routed against sharp edges.
- Only load hooks with safety catches may be used in order to prevent unintentional unhooking of the load during lifting, pulling or transportation; in the event that the safety catch does close owing to the design, the use of hackles or round slings as connectors is required.
- The shoring elements may only be attached and transported using the intended attachment points.
- The loads must be attached such that the shoring elements are in a horizontal position; pendulum movements must be reduced to a minimum during transportation; diagonal pulls are not permitted.
- The angle of inclination between the sling and the notional vertical at the attachment point may not exceed 60°.
- Transportation must be done as close to the ground as possible.
- Never carry the load over personnel.
- Attached loads must be guided with guide lines/guide rods; always walk behind the load and do not walk backwards.
- The accompanying persons for guiding the load and slingers must always remain within the machine operator's field of vision off the track and outside the danger area.
- Accompanying persons for guiding the load and slingers must have safe footing; never stand between a suspended load and a fixed abutment (risk of crushing!).
- Care must be taken to ensure that fingers are always free during lifting, guiding and set down; never guide loads using the sling.
- The applicable national rules and regulations must be observed and complied with.

2.6 Criteria for the inspection, repair and withdrawal of worn or damaged components

- Shoring elements must be subjected to functional testing and a visual inspection for obvious defects, e.g. on struts, top layers of the panels, welding seams, stabilizers, attachment points, by supervisors before each use.
- If defects which reduce the load capacity are found, in particular damaged struts, cracked welding seams or excessively deformed, cracked or worn out attachment points, the shoring elements may only be used again after professional repairs by the manufacturer.
- Furthermore, missing parts such as nuts, screws, connectors, bolts and stabilizers, or broken parts such as spindles, bolts and spreader systems result in withdrawal of individual system elements.
- Defecting parts must be replaced or repaired before use. The elements may only be used again after approval by the manufacturer.
- In the event of significantly deformed or warped parts or in the event of holes, e.g. in the panel body, the manufacturer must always be consulted before the shoring element is used.

- Small repairs may be carried out by the user himself where applicable – however this may only be done in consultation with the manufacturer.
- Only original parts from the manufacturer may be used.
- The manufacturer provides no warranty for repairs which are improperly performed and for the use of parts which are not original parts.
- Before each (repeated) use and after reassembly of the shoring elements or after exceptional disturbances (see chapter 2.2), the tightness of all screw connections must be checked and they must be tightened where necessary.
- If there is any doubt about the usability of the shoring elements, and in the event of defects and damage, the manufacturer must be contacted.
- Soil which has adhered to the shoring elements must be cleaned off after use.
- In order to increase the service life, regular renewal of the pain (rust protection, top coat) is recommended.

2.7 The following, as amended, apply in particular:

Regulations issued by the BG [German Employers' Liability Insurance Association] – Civil Engineering Technical Committee

- DIN 4124 "Excavations and trenches"
- DIN EN 13331 Part 1 – Product specifications, Part 2 – Assessment by calculation or test
- General safety information and the Industrial Safety Regulation

Our products bear the "tested for safety" GS mark.

2.8 Personal protective equipment (PPE)

Personal protective equipment serves to protect personnel against health and safety risk while working.

In principle, the necessary personal protective equipment for the activities is the result of your risk assessment.

We recommend the following PPE for loading and unloading activities, assembly and disassembly, transportation/lifting operations, maintenance and repair, and for activities in the area with shoring:

PROTECTIVE CLOTHING	
	Protective clothing is tight-fitting workwear which tears easily, with tight sleeves and with no protruding parts.
SAFETY HELMET	
	Safety helmets protect the head against falling objects, swinging loads and impacts against fixed objects.
PROTECTIVE GLOVES	
	Protective gloves protect the hands against friction, abrasions, deeper injuries.
SAFETY SHOES	
	Safety shoes protect the feet against crushing, falling parts and slipping on slippery surfaces. Furthermore, S3 safety shoes are puncture-resistant and thus protect against injuries to the feet resulting from nails, metal chips, etc.

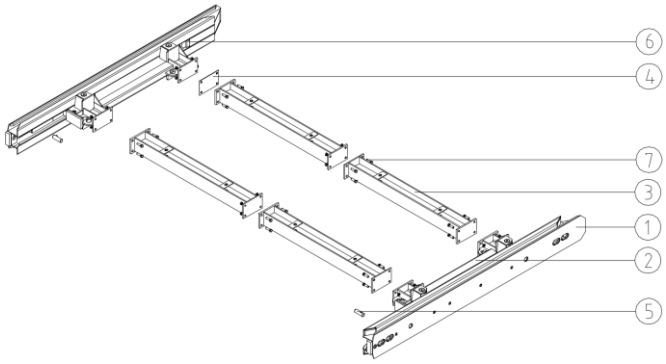
2.9 Technical data of the shoring elements

The technical data of the shoring elements used can be found in the current version of the technical manual. The technical manual is available at https://www.terra-infrastructure.com

3 Single slide rail linear shoring and single slide rail inner-city linear shoring

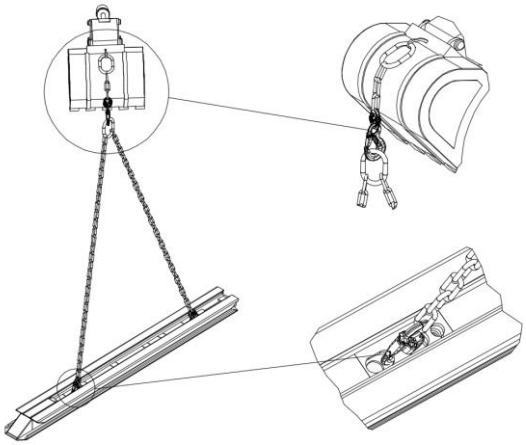
3.1 Installation instructions guide frame for single slide rail linear shoring and single slide rail inner-city linear shoring

1. Guide frame system overview



(1) Linear shoring support
(2) Strut cart
(3) Extension bar
(4) Distance plate
(5) Locking pin
(6) Strut cart stop/end point
(7) Connecting screws

2. Position the linear shoring support on the ground

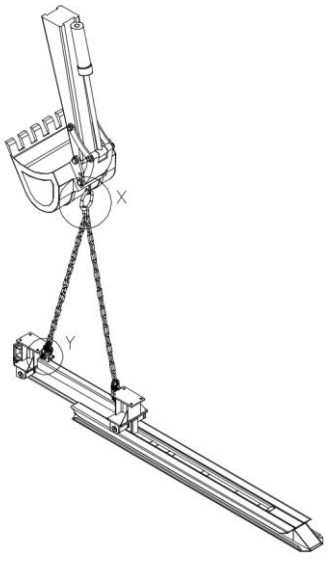


The linear shoring support must be positioned on the ground.

Attach the linear shoring support to the lifting device using the provided transport lugs.

Place the linear shoring support on an even, sufficiently stable area of ground with the back panel facing down.

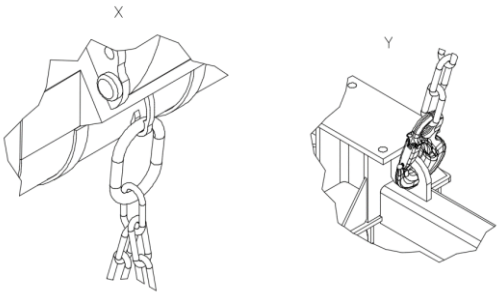
3. Insert the strut cart



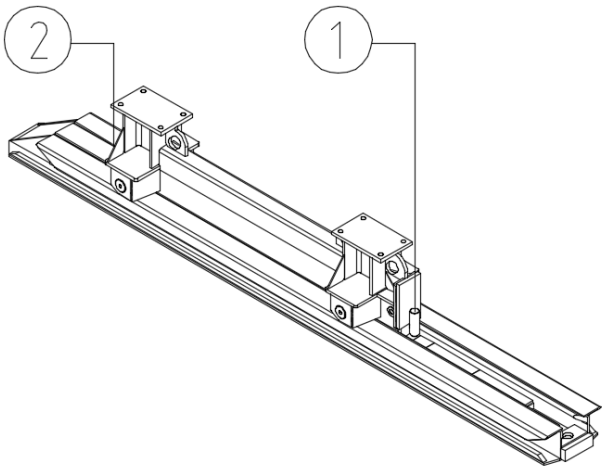
One strut cart must be inserted on each linear shoring support.

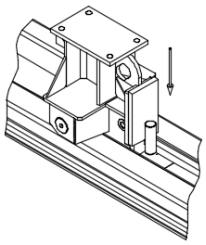
Attach the strut cart to the two attachment points (detail X and detail Y).

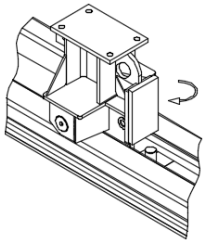
First insert the pendular roller into the linear shoring support close the bottom attachment point.



4. Pin the strut cart







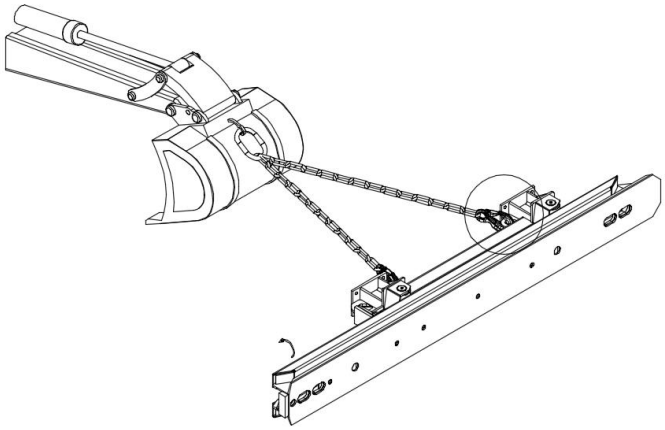
The strut cart must be secured in the linear shoring support in both directions. This is done by inserting a locking pin (1) into the provided location hole in the upper area of the beam, above the strut cart.

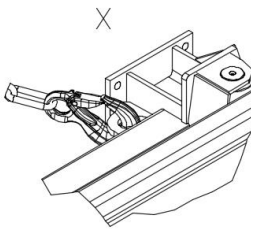
In the lower area of the linear shoring support, a fixed stop serves to fix the strut cart downwards (2).

Insert the bolt.

Turn the bolt 180°.

5. Turn the linear shoring support over



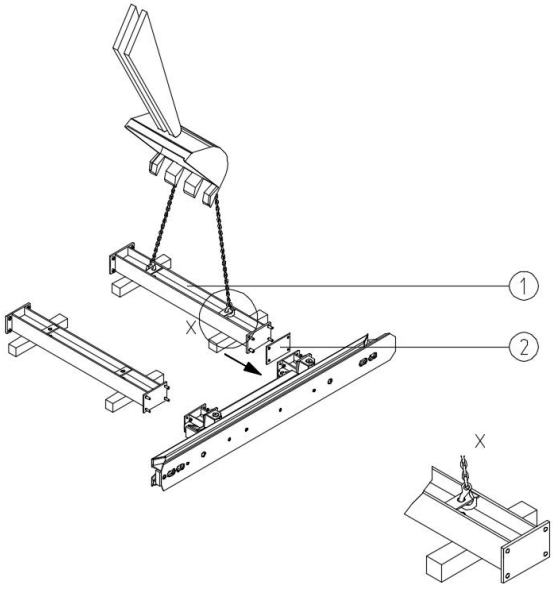


The linear shoring support must be turned 90° to the side.

Fasten the linear shoring support to the strut cart at the two attachment points (detail X).

Turn the linear shoring support 90° to the side.

6. Assembly with non-reinforced extension bars



The extension bars are positioned and bolted to the linear shoring strut cart.

Work steps:

Attach the extension bars (1) to the suspension brackets.

Bring the extension bars (1) up to the connecting plate of the strut cart.

Insert the distance plate (2) between the lower connection joint pointing towards the tip of the beam. This creates the A-position necessary for the installation of the frame.

Screw components together with the appropriate nuts and screws.

Tighten the screws only hand-tight at first to make it easier to fit further spacers if necessary.

To facilitate installation, we recommend that the extension bars should be underlaid with square timber.

7. Alternatively: assembly with reinforced extension bars

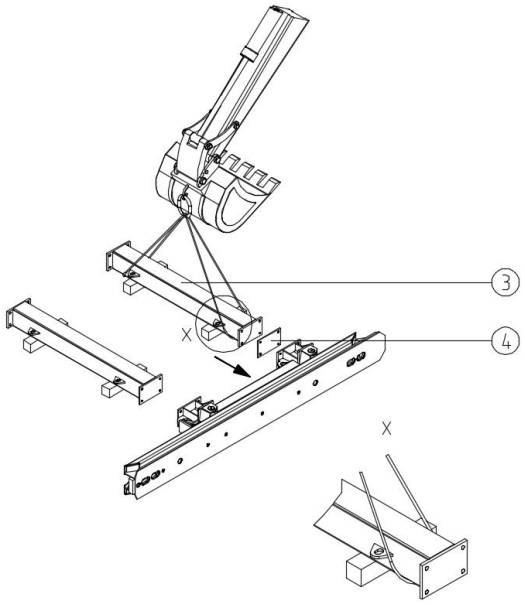
⚠DANGER

Risk due to incorrect use of transport devices

Incorrect transport securing poses an immediate danger to the life and health of persons.

The eyelets on one side of the reinforced spacers are only used to transport the individual spacers.

- Do not use the attachment points of the strut cart to lift the entire frame.
- Do not transport the entire frame by the spacer eyelets.
- Do not pull up the installed strut carts by the spacer eyelets.
- Use only the attachment points in the rail to lift the frame (detail X)



Reinforced spacers are attached by means of a rope or lifting gear (GS approval). The assembly steps are then to be carried out as for non-reinforced spacers.

Work steps:

Attach the spacer (3) to the suspension brackets using a rope or lifting belt (GS approval) (detail X).

Bring the spacer (3) up to the connecting plate of the strut cart.

Insert the distance plate (4) between the lower connection joint pointing towards the tip of the beam. This creates the A-position necessary for the installation of the frame.

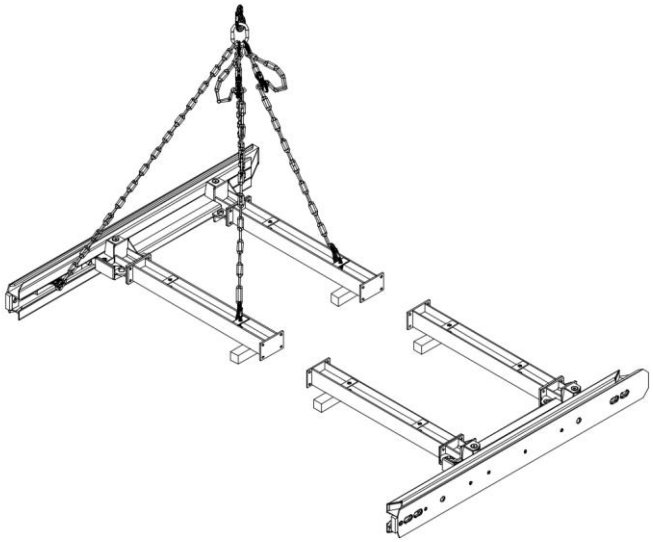
Screw components together with the appropriate screws and nuts.

Tighten the screws only hand-tight at first to make it easier to fit further spacers if necessary.

Installation of the 2nd half of the guide frame

Repeat steps 2 to 7 to install the second guide frame.

8. Assembly of the complete guide frame



The pre-assembled frame halves are brought together. The complete guide frame is mounted.

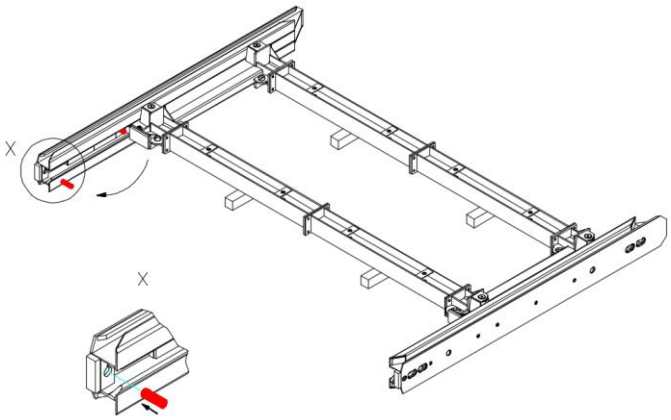
The first half of the frame is fastened with a 4-strand chain.

The first half of the frame is moved to the second half.

Connect the joints of the spacers with screws and nuts.

Finally, tighten all screw connections.

9. Moving the locking pin



The locking pin must be moved to prevent the strut cart from being pulled out of the rail.

Insert the locking pin in the uppermost locking point of the linear shoring support (detail x).

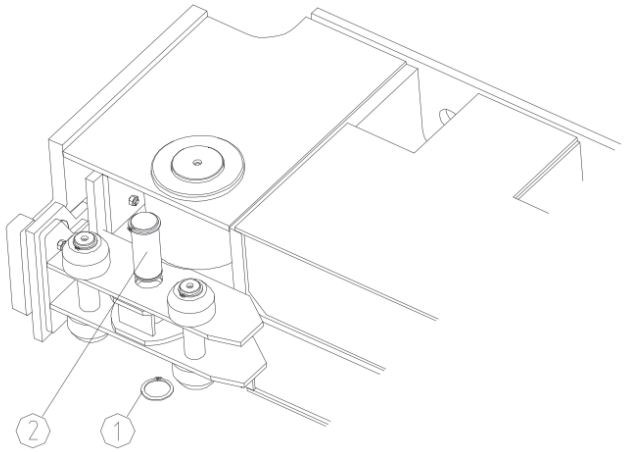
Turn locking pin by 180°.

Installation of the 2nd guide frame

Repeat the installation preparation and the work steps 2 to 9 to install the second guide frame.

3.2 Modification of the U-type strut cart (part no. 832 205) for use in single slide rail linear shoring and single slide rail inner-city linear shoring

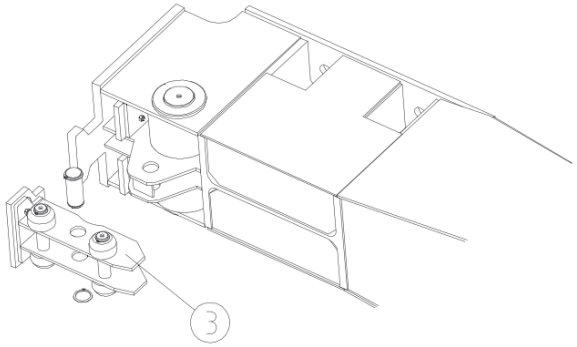
1. Disassembly of the safety elements



To be able to use the U-type strut cart in single slide rail linear shoring, it is necessary to remove the traction anchorage. For this purpose, the circlip (pos. 1) is removed using a suitable tool (pliers or chisel).

The pin (pos. 2) must then be pulled out.

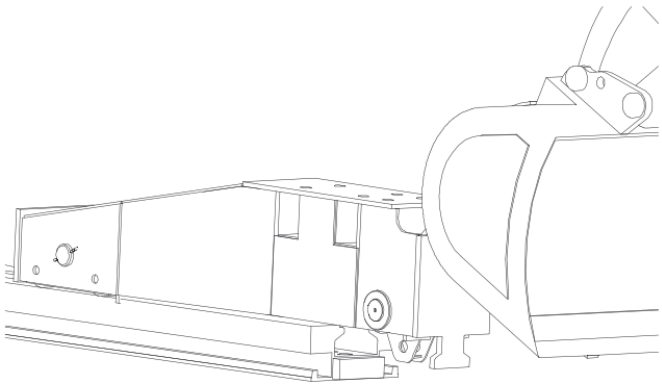
2. Removal of the drawbar roller



The drawbar roller (pos. 3) can now be removed.

All parts must be stored, as they will be needed again if the strut cart may be used in the double slide rail.

3. Strut cart installation



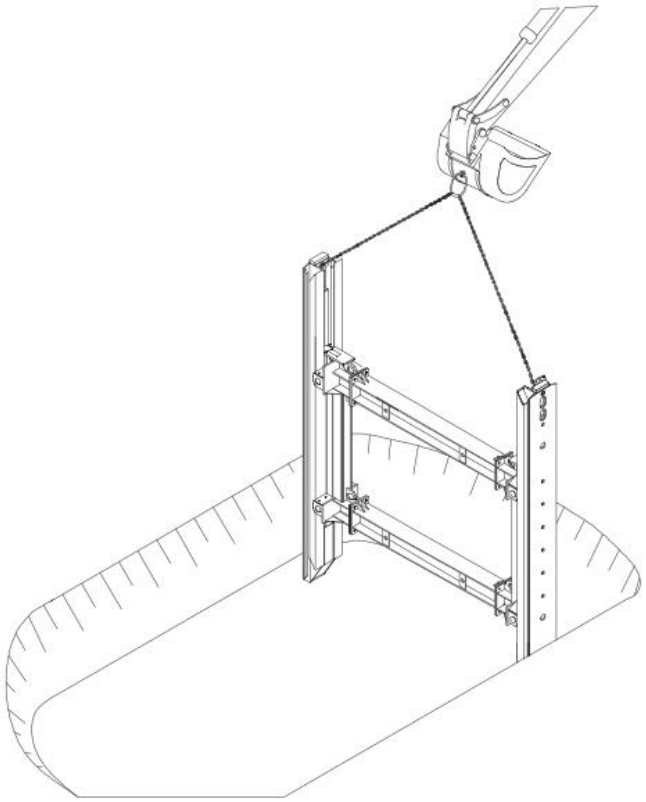
The strut cart is now pushed into the linear shoring support as shown.

For all other work steps, please refer to the instructions for use of single-rail linear shoring and / or single-rail inner-city linear shoring.

(see sections “Assembly instructions single-rail linear shoring” and “Assembly instructions single-rail inner-city linear shoring”)

3.3 Assembly instructions single slide rail linear shoring

1. Setting the first guide frame



After the trench alignment has been measured, advance excavation for the 1st shoring field takes place in accordance with the instructions of the site management.

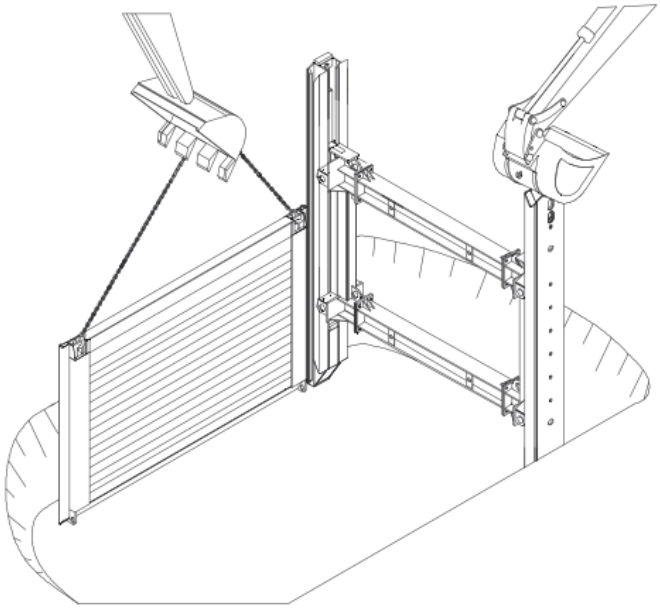
Width: required clear trench width + approx. 0.40 m

Length: module length + approx. 0.60 m (and / or length of the panels + approx. 1.00 m)

The first guide frame is adjusted by means of lifting gear and suitable sling gear (GS approval) in the center of the trench axis and at right angles to the alignment in the trench. The bottom of the strut cart rests on the stops welded into the linear shoring supports and is secured at the top by a locking pin in the guide frame (see Installation instructions).

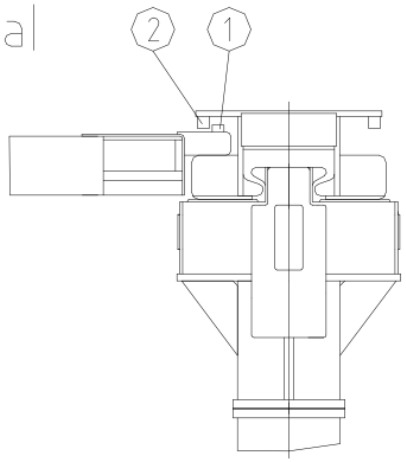
If necessary, the frame should be locked in vertical position (e. g. using a second lifting gear).

2. Inserting the base panels

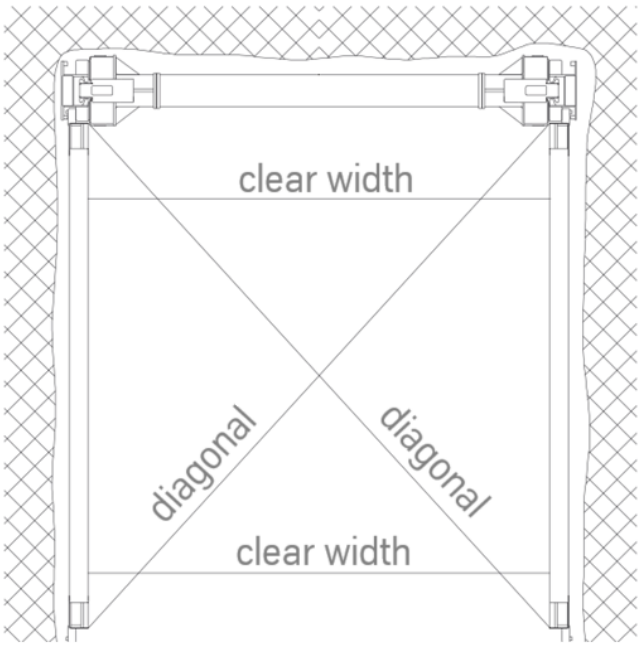


The base panels are inserted into the support profile from above using the lifting gear (see image a). Ensure that the square on the rear of the shoring panels (1) engages behind the square in the linear shoring support (2). After being inserted, the shoring panels are adjusted to the bottom of the trench.

Before lowering the linear shoring frames, it is essential to remove the bottom locking pin if it has been inserted to set a different pipe culvert height.

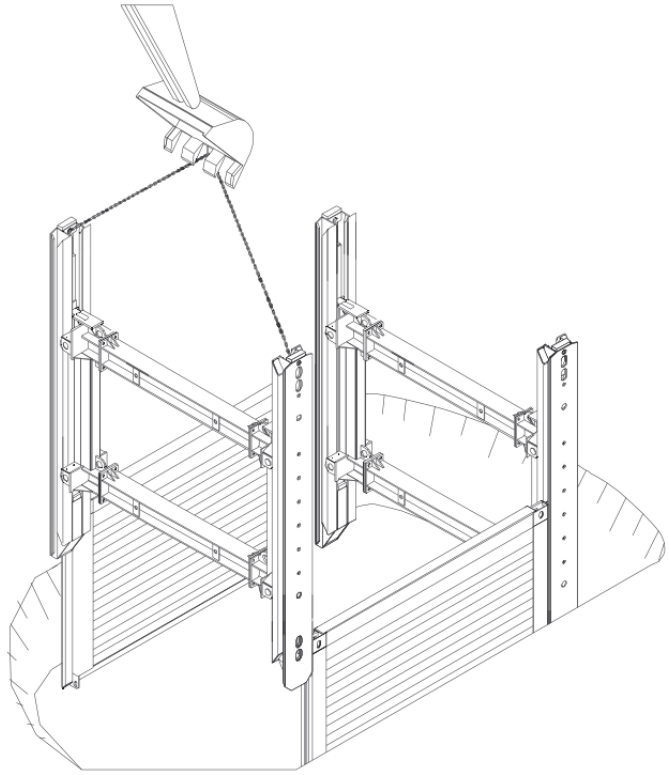


3. Alignment of the shoring panels



The alignment of the first shoring field is decisive for the creation of an exact shoring field running parallel to the trench axis. For this purpose, on the one hand the clearance between the shoring panels at both panel ends and on the other hand the dimension across the two diagonal axes of the shoring field must be the same.

4. Setting the second guide frame

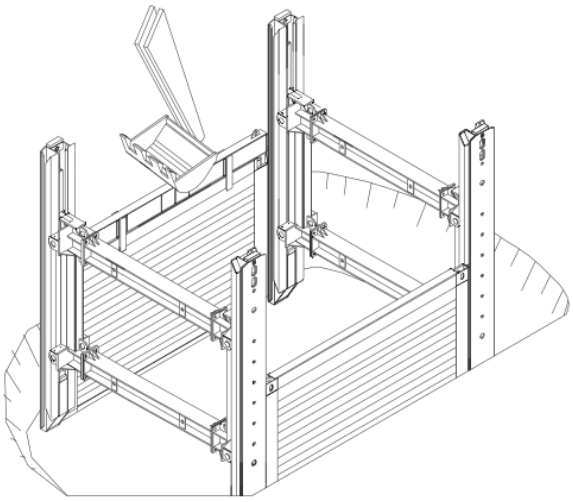


The second frame is guided over the free-standing guide profiles of the base panels and adjusted to the bottom of the trench.

After adjusting the shoring field should be aligned again as described in work step 3, as this makes it easier to install and remove the subsequent shoring fields.

The cavity between the soil and the shoring panel must be backfilled and compacted.

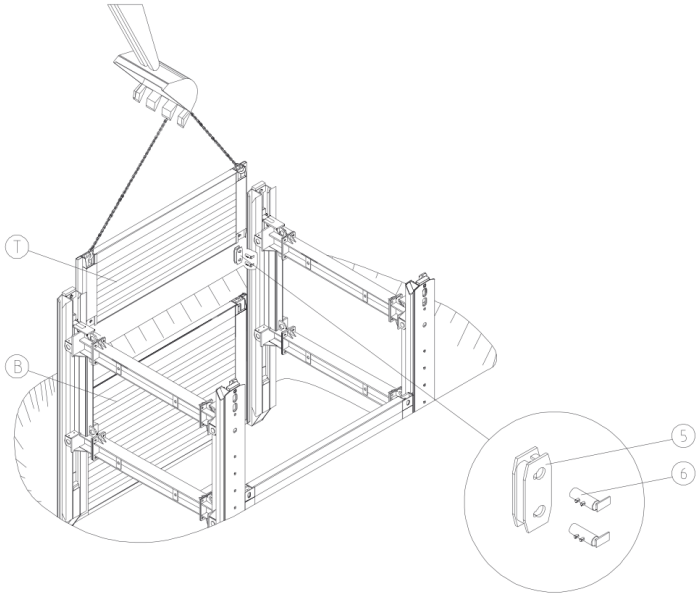
5. Lowering the shoring field



Before the actual lowering procedure, the soil beneath the shoring panels is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, pressure beams being used in particular for the shoring panels and pressure panels for the shoring beams. All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

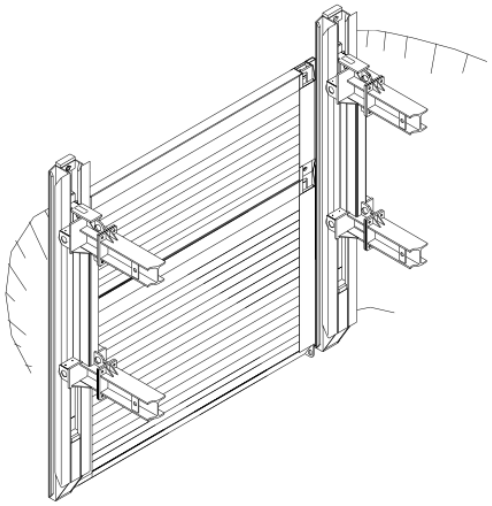
6. Top panels



Depending on the required trench depth, after complete lowering the base panels (B) the top panels (T) are inserted into the beam guides.

Base and top panels are to be connected by stanchions (5) and pins (6).

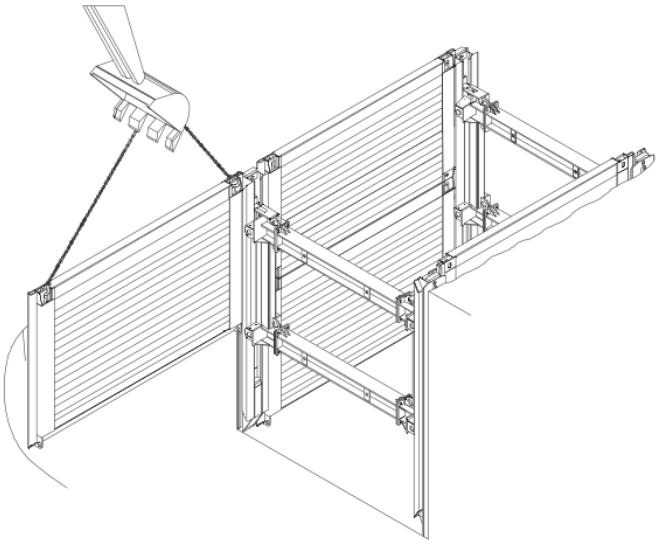
7. Lowering to final depth



After insertion of the top panels, the shoring field is lowered to the required installation depth in accordance with the instructions of the site management under further advance soil excavation.

Here, too, the strut cart must be positioned vertically in accordance with the static requirements (note cantilever arm lengths).

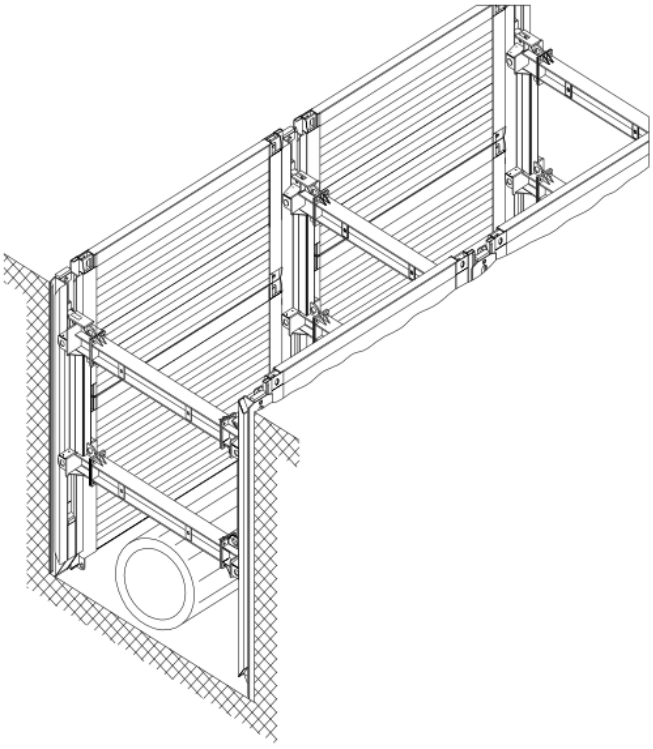
8. Installation of the next shoring field



The next shoring field is installed as soon as the previous field has been fully lowered to the bottom of the trench and the strut carts are positioned and fixed vertically in accordance with the static requirements.

The installation is carried out according to the described work steps 1-7. The other fields are aligned with the precisely installed first field. When inserting the shoring panels, the clear trench width and diagonal dimension (section 3) should be checked for each subsequent field.

9. Pipe laying

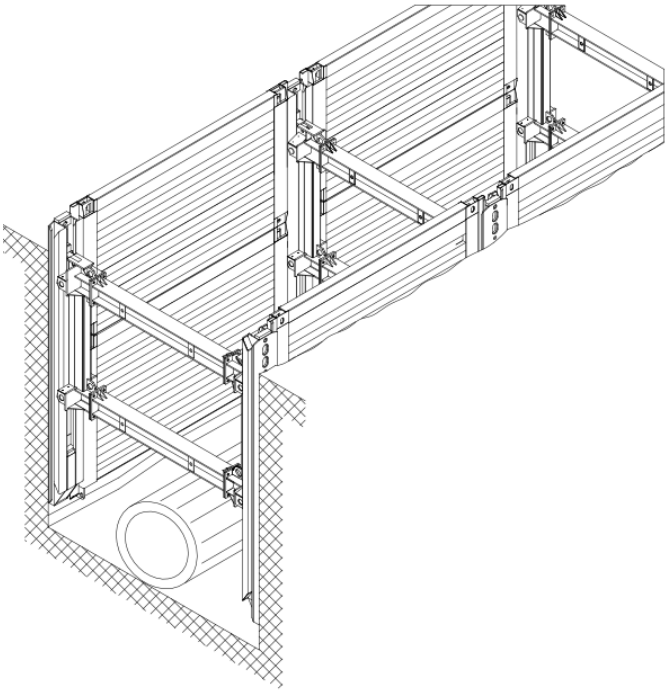


Once the shoring has been lowered completely and without gaps to the bottom of the trench to the required length, pipe laying can begin.

The strut carts must be positioned and fixed vertically with pins in accordance with the static requirements.

3.4 Instructions for removing single slide rail linear shoring

Removing, backfilling and compacting



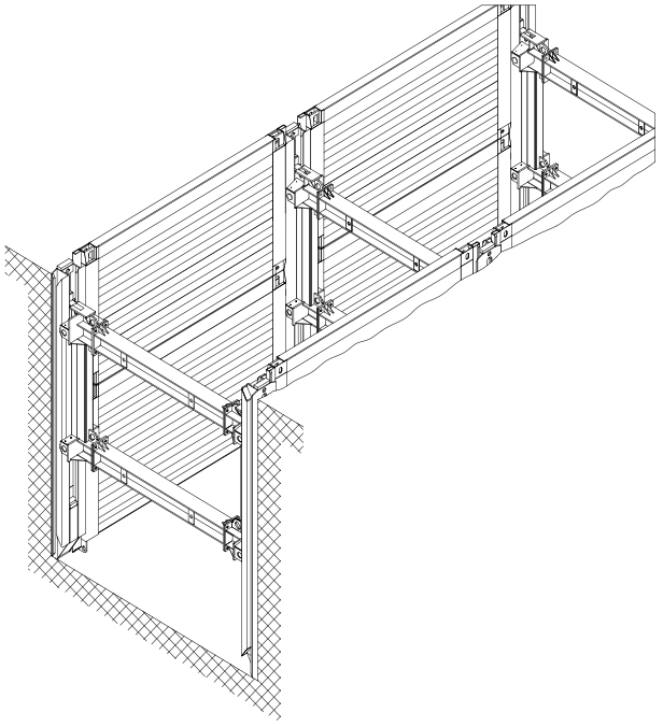
After completing the pipe-laying work the shoring is removed with layer-by-layer backfilling and compacting. The shoring is pulled in stages according to the instructions of the local site management and / or in accordance with the expert's specifications and the backfilling material is then compacted against the existing soil.

To pull the shoring, a two-strand chain at least 19 mm thick with a load capacity of 11.2 t must be used at an angle of inclination of ≤ 60°. The pulling eyes at the individual attachment points are dimensioned and designed for the permissible load on the chain.

Lifting slings may only be attached to the provided attachment points.

3.5 Bottom trench support / use of in-situ concrete

1. Insert the shoring



When laying large pipe diameters and / or constructing in-situ concrete ducts, additional support of the guide frames at the support base is often required for static reasons.

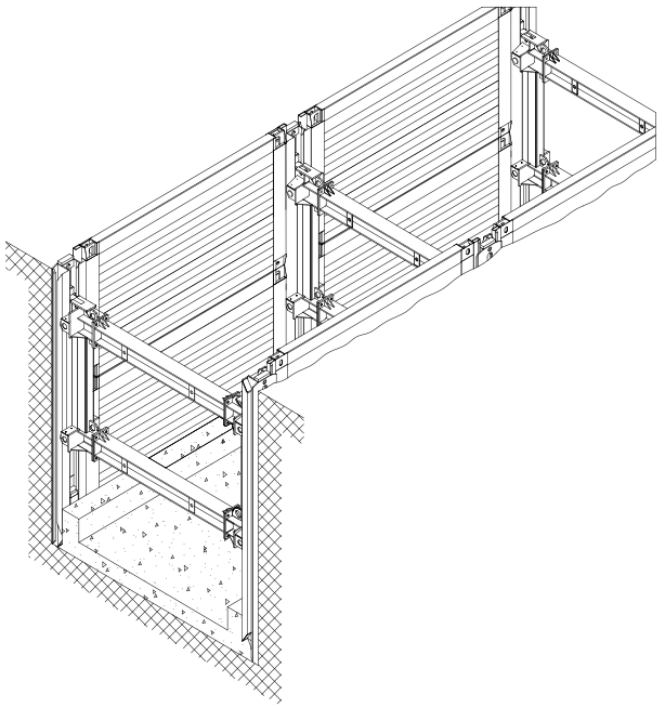
The shoring is first inserted in accordance with the assembly instructions and the bottom of the trench is prepared in accordance with the requirements.

A possibly required trench bottom support depends on the static calculation and is designed as a steel or reinforced concrete strut. In the case of in-situ concrete ducts, the sewer base can be used as a trench bottom support, if necessary.

The trench bottom support must be designed in such a way that there is a sufficiently large bearing surface for the vertical beam.

The load capacity of the trench bottom support must be ensured by a static proof.

2. Construction trench bottom support

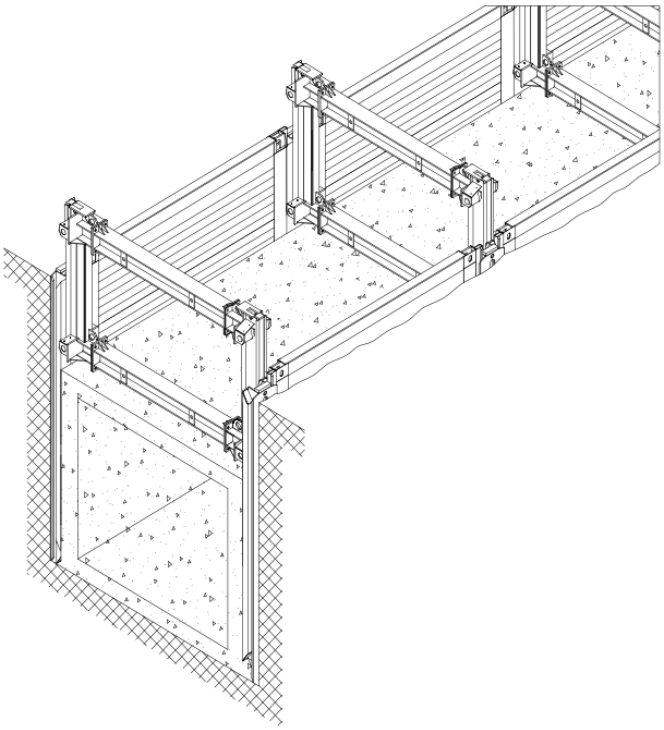


Once the trench bottom has been created, the strut cart can be pulled up to the permissible pipe culvert height in accordance with the static calculation for completion of the complete in-situ concrete structure. In this position, the strut cart must be secured by means of chains or locking pins.

During pulling, the strut cart must be secured against sliding upwards out of the vertical beam (locating pin, see section “Installation instructions guide frame”, work step 3).

If the shoring is also to be used as formwork for an in-situ concrete structure, the open strut cart guides in the vertical beams must be closed off with cover plates. Together with the shoring panels, this creates a smooth surface throughout. An intermediate layer (e. g. rigid foam panels, foil) must be inserted between the shoring and in-situ concrete wall to ensure smooth removal.

3. Removal of the shoring system



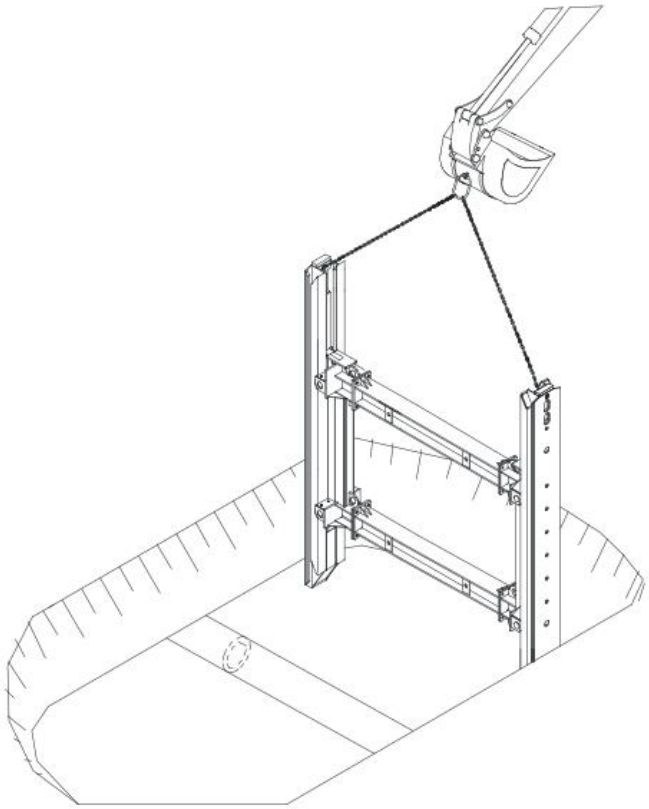
After the concrete walls have set, the shoring is removed in accordance with the instructions in the section “Instructions for removing single-rail linear shoring”. If the remaining cavity between the in-situ concrete structure and the soil has to be backfilled, shoring panels and beams with integrated injection openings must be used through which a sand-water-cement mixture can be inserted into the cavities.

3.6 Assembly instructions single slide rail inner-city linear shoring

1. General

In inner-city linear shoring, sheet piles are guided in so-called piling frame elements. For structural and constructive adaptation to crossing pipes, especially in densely built-up inner-city areas, pipes or fixtures running crosswise to the trench can thus be flexibly modified while simultaneously supporting and / or securing the trench walls.

2. Setting the first guide frame



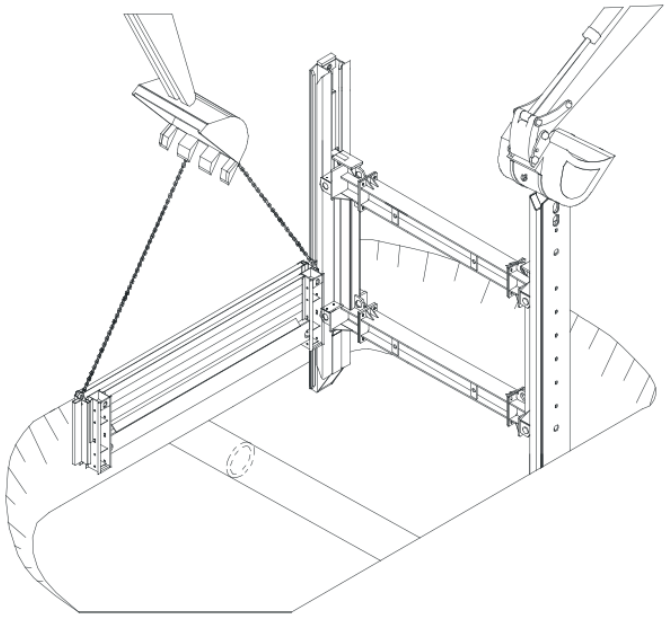
After the trench alignment has been measured, advance excavation for the 1st shoring field takes place in accordance with the instructions of the site management.

Width: required clear trench width + approx. 0.40 m

Length: module length + approx. 0.60 m (and / or length of the inner panels + approx. 1.00 m)

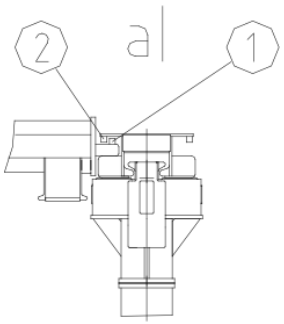
The first guide frame is adjusted by means of lifting gear and suitable sling gear (GS approval) in the center of the trench axis and at right angles to the alignment in the trench. The bottom of the strut cart rests on the stops welded into the linear shoring supports and is secured at the top by a locking pin in the guide frame (see Installation instructions). If necessary, the frame should be locked in vertical position (e. g. using a second lifting gear).

3. Insertion of the piling frame element

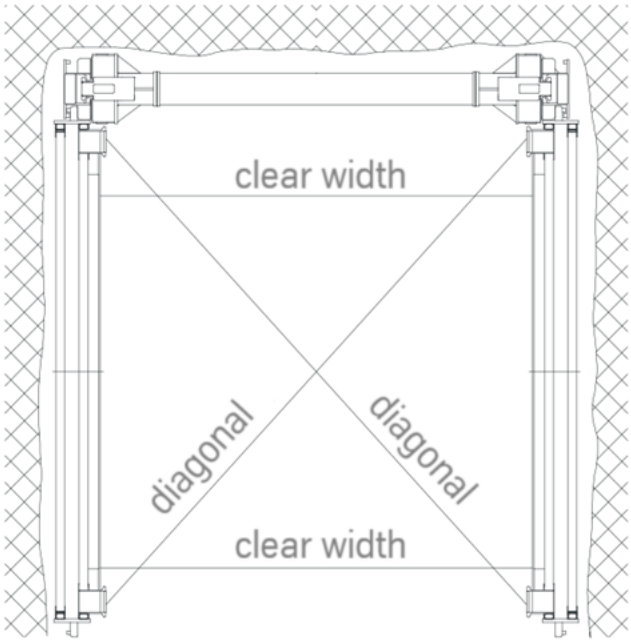


The piling frame element is inserted into the support profile from above (see image a)). Ensure that the square on the rear of the piling frame element (1) engages behind the square in the linear shoring support (2).

Before lowering the linear shoring frames, it is essential to remove the bottom locking pin if it has been inserted to set a different pipe culvert height.



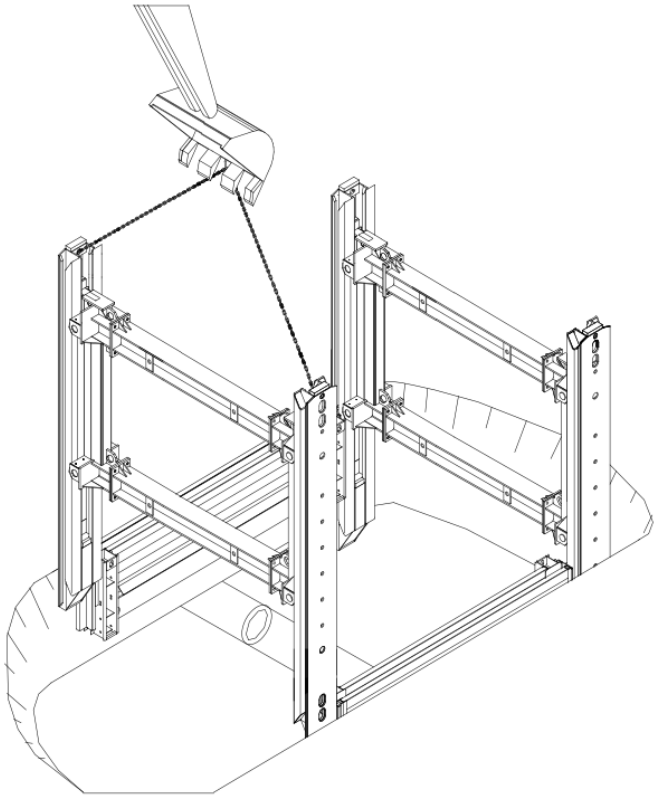
4. Alignment of the piling frame elements



The alignment of the first shoring field is decisive for the creation of an exact shoring field running parallel to the trench axis.

For this purpose, on the one hand the clearance between the piling frame elements at both ends and on the other hand the dimension across the two diagonal axes of the shoring field must be the same.

5. Setting the second guide frame

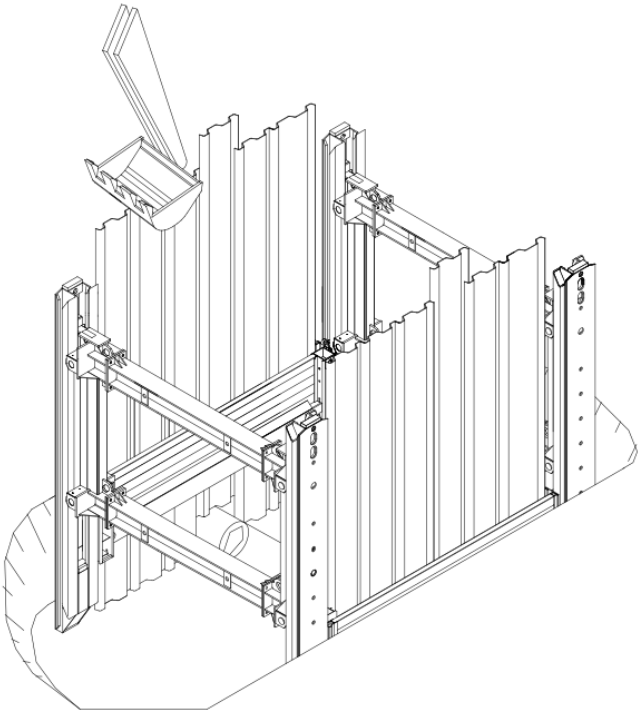


The second frame is guided over the free-standing guide profiles of the piling frame element by means of lifting gear and adjusted to the bottom of the trench. Particularly in the case of unstable soils, the piling frame elements must be secured against lowering with suspension chains.

After adjusting the shoring field should be aligned again as this makes it easier to install and remove the subsequent shoring fields.

The cavity between the soil and the piling frame element must be backfilled and compacted.

6. Insertion of the sheet piles and lowering of the shoring field

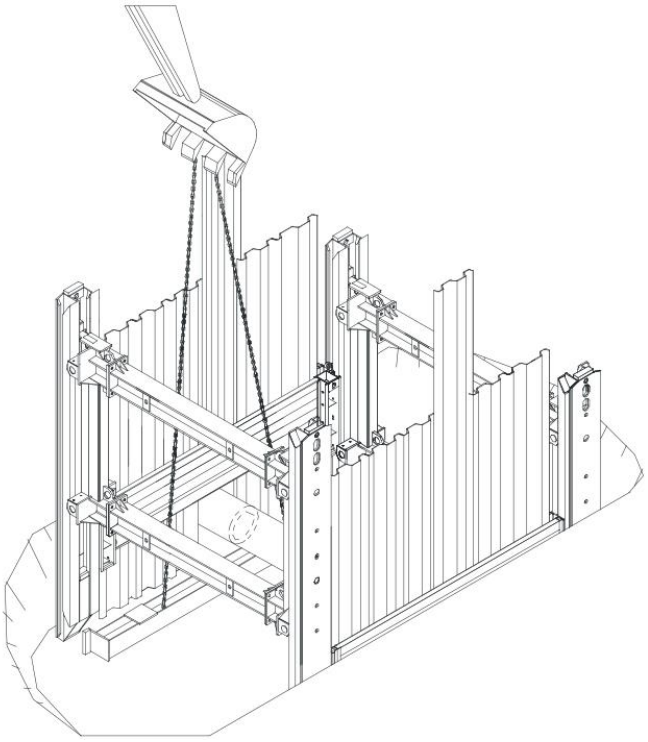


After inserting the sheet piles into the two opposite piling frame elements, further trench excavation is carried out beneath the linear shoring supports and sheet piles in accordance with the instructions of the local site management, with alternating pushing and / or pressing of the sheet piles and linear shoring supports. All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

The piling frame elements must be fixed in position.

When lowering the shoring system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (cantilever arm lengths according static requirements).

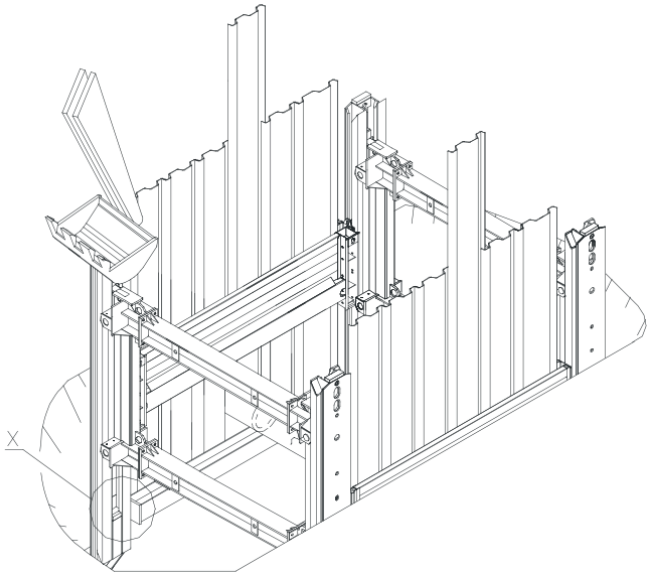
7. Insertion of the E+S waler beams



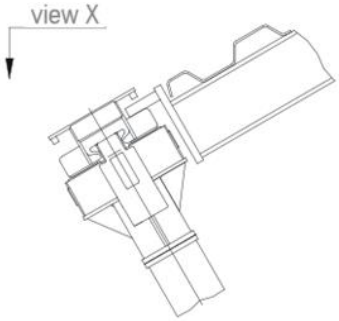
Depending on the static requirements, E+S waler beams must be inserted on both opposite shoring sides after exposing the crossing pipe. The waler beams are pushed with one end into the open guide of a linear shoring support. The pair of linear shoring supports at the other end of the waler beams must not be lowered to the bottom of the trench as shown in the adjacent sketch. Only in the next operation (work step 8) is this pair of linear shoring supports pushed over the guide profile of the inner belts lying on the bottom of the trench.

By inserting the waler beams, the cantilever arm length of the sheet piles is reduced and “dropping inside” of the sheets into the pit is prevented.

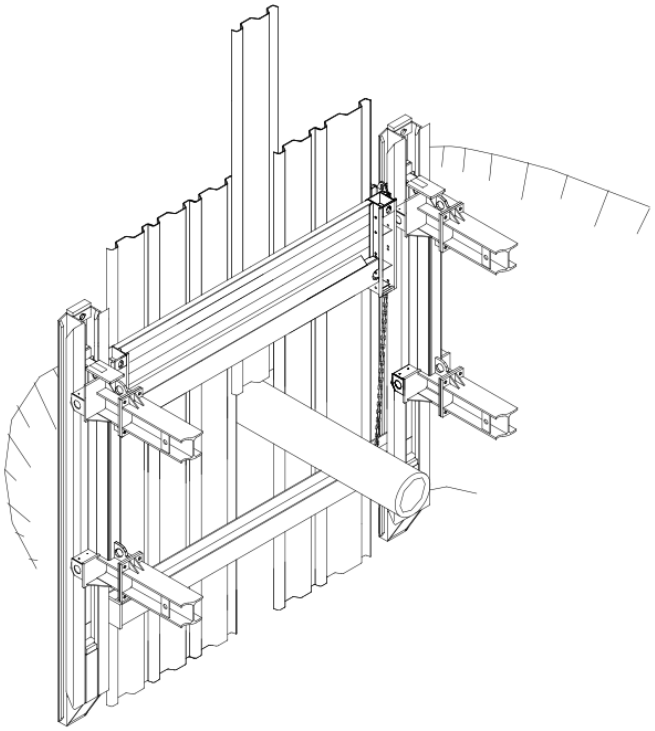
8. Pressing the beam pair and lowering the shoring



After lowering the pair of linear shoring supports, the waler beams are positioned on both sides in the open guides of the linear shoring supports. Now the sheet piles are being pressed. Care must be taken to ensure that there is a force-fitted structure between the waler beams and sheet piles. If it is necessary to lower the waler beams, they must be secured against unintentional sliding out of the slide rail beams, e. g. by means of a suspension chain.

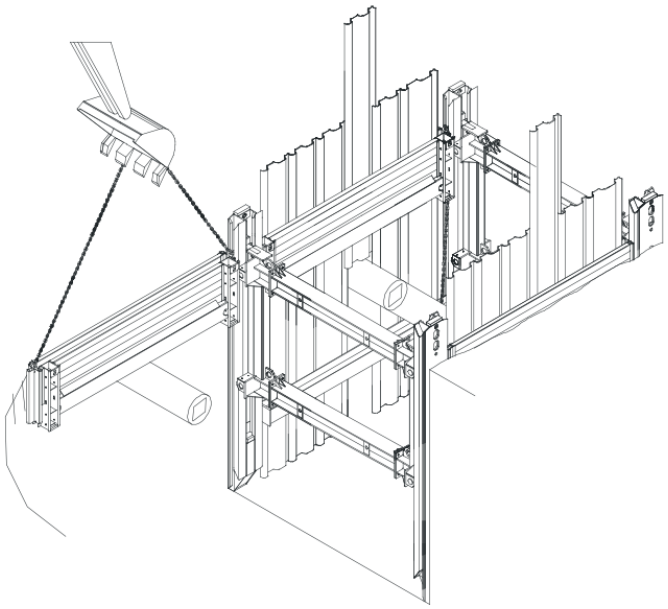


9. Lowering to final depth



The shoring unit is lowered to the required installation depth under advance soil excavation in accordance with the specifications of the local site management. The waler beams must be locked in the statically prescribed horizontal height position by means of suspension chains (GS mark). Here, too, the strut cart must be positioned vertically in accordance with the static requirements (note cantilever arm lengths).

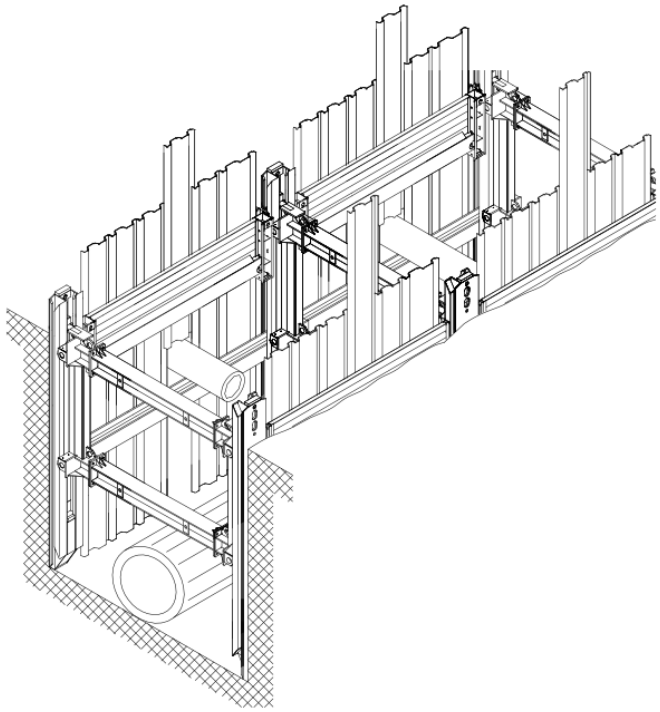
10. Installation of the next shoring field



The next shoring field is installed as soon as the previous field has been fully lowered to the bottom of the trench and the strut carts are positioned vertically in accordance with the static requirements. The installation is carried out according to the described work steps 1 to 9.

The other fields are aligned with the precisely installed first field. When inserting the piling frame elements, the clear trench width and diagonal dimension (work step 4) should be checked for each subsequent field.

11. Pipe laying

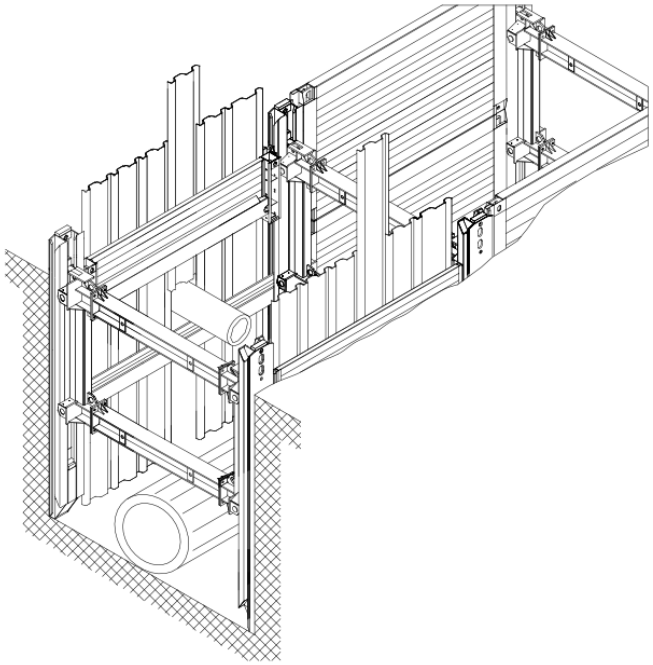


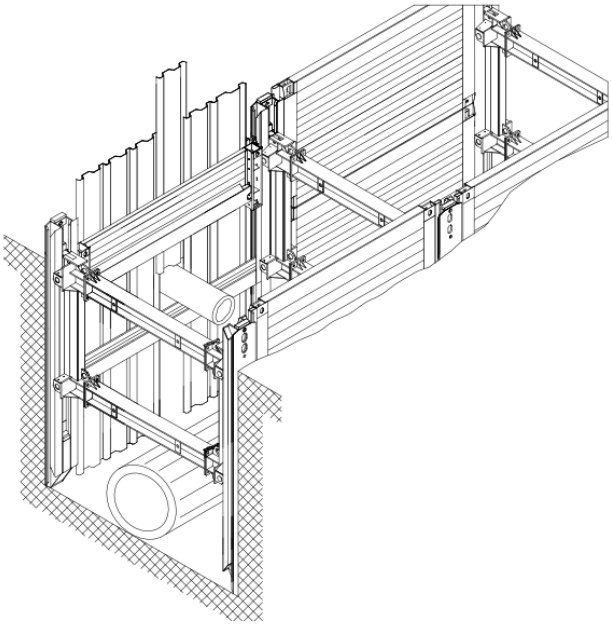
Once the shoring has been lowered completely and without gaps to the required length, pipe laying work can begin.

The strut carts must be positioned and fixed vertically in accordance with the static requirements and must be secured with locking pins or chains.

For removal, see the remarks in section “Instructions for removing single-rail linear shoring”.

12. Installation example





The combination of “single-rail linear shoring” and “single-rail inner-city linear shoring” is easily possible.

If, for example, crossing house connection lines end in the middle of the trench, it may be more economical to use GLS large-area shoring panels on the opposite side of the trench and sheet frame elements and sheet piles on one side only.

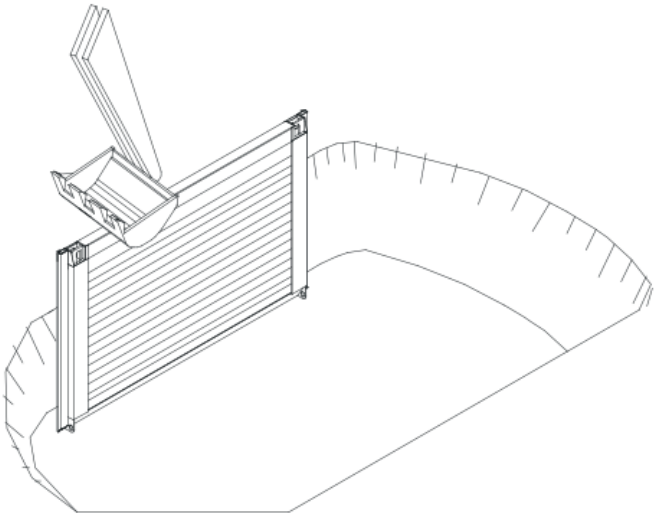
4 Assembly instructions single slide rail corner shoring

1. General

Corner rail shoring is a special shoring solution for shaft structures, as well as for trench shoring with combined head fields. Special stiffening systems are not required for shaft shoring. All forces are then absorbed by the shoring panels. It can be designed with the corresponding beams as single-rail or overlapping shoring.

The use of different panel lengths in pairs makes it possible to create rectangular pits of different sizes.

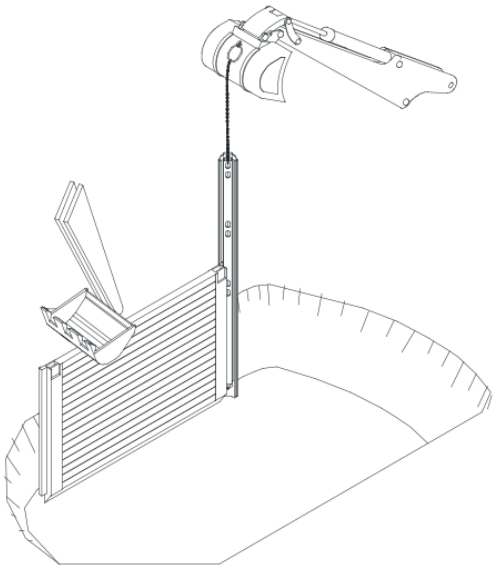
2. Installation of the base panels



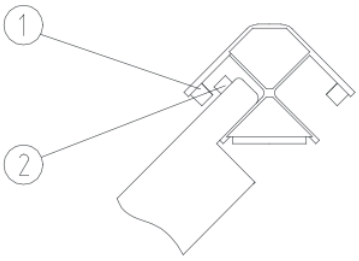
After the pit has been measured, the advance excavation for the shaft is carried out, depending on the plate lengths used, according to the specifications of the site management and the applicable DIN standards.

The first shoring panel (inner base panel) is inserted and fixed in the pit using lifting gear and suitable lifting slings (GS approval).

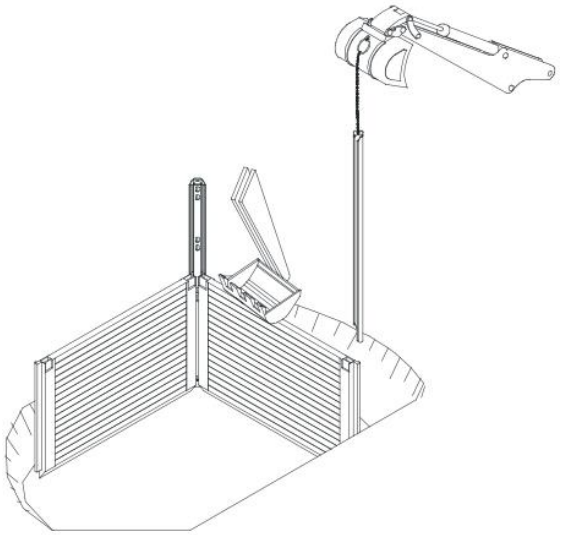
3. Installation of the corner rail



With the aid of a second hoist, the corner rail can now be pushed over from above. Ensure that the square on the rear of the corner rail (1) engages behind the square in the shoring panel (2).

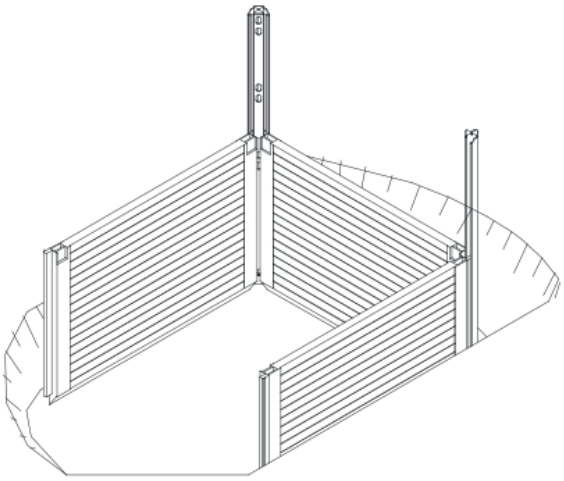


4. Installation of the other elements



All other elements are to be inserted as described above.

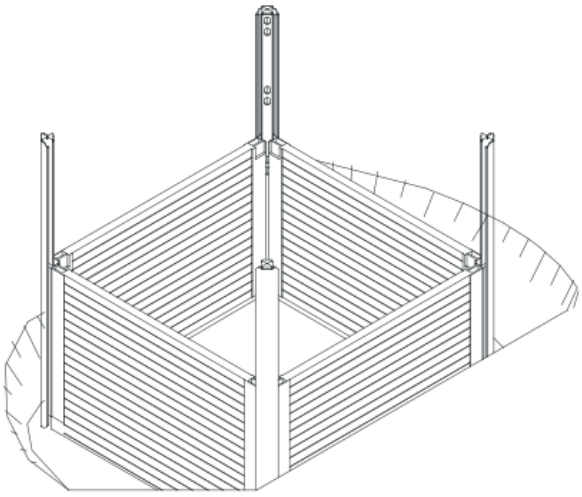
5. Alignment of the shoring



To ensure that the last shoring wall can be inserted without difficulty, the shoring must be aligned.

For this purpose, on the one hand the clearance between the shoring panels at both panel ends and on the other hand the dimension across the two diagonal axes of the shoring field must be the same.

6. Lowering the shoring

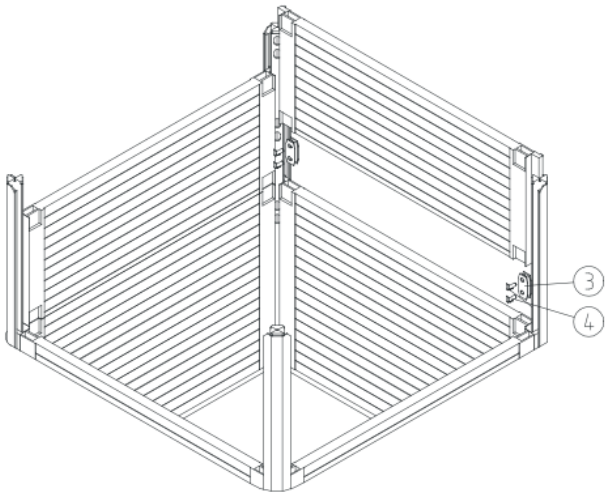


After the fourth base panel has been inserted, the squareness of the shoring must be checked again. Afterwards the cavity between the soil and the shoring panel must be backfilled and compacted.

Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams and shoring panels are pressed down alternately, pressure beams being used in particular for the shoring panels.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

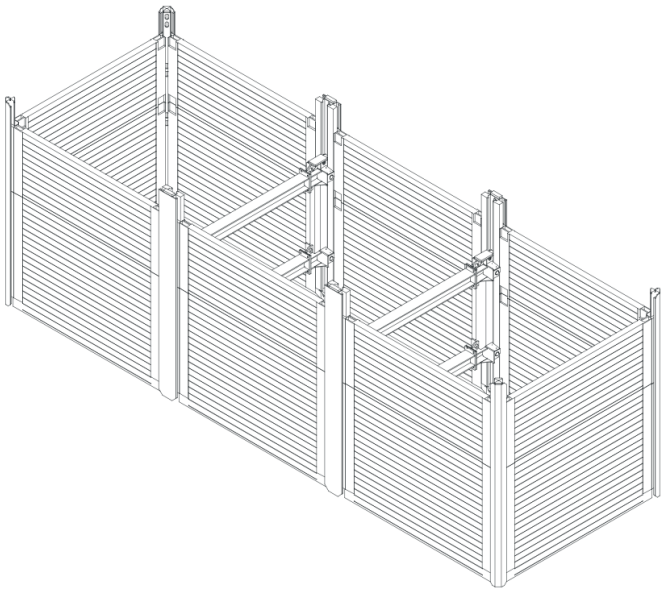
7. Inserting the inner top panels



Depending on the required trench depth, after lowering the inner base panels to the temporary bottom of the trench, the inner top panels are inserted into the beam guides.

Base and top panels are to be connected by stanchions (3) and pins (4).

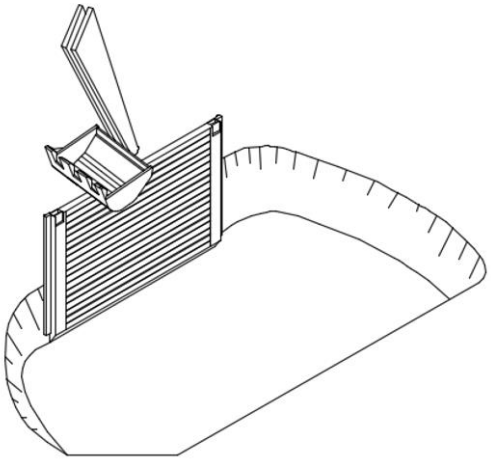
8. Installation example for a head field



The combination of “single-rail corner shoring” and “corner shoring” is easily possible. In this way pits without gaps are created.

5 Assembly instructions linear shoring – X rail

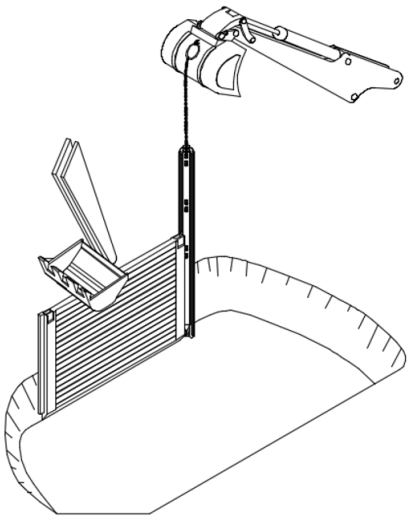
1. Installation of the base panels



After the pit has been measured, the advance excavation for the first shoring field is carried out, depending on the plate lengths used, according to the specifications of the site management and the applicable DIN standards.

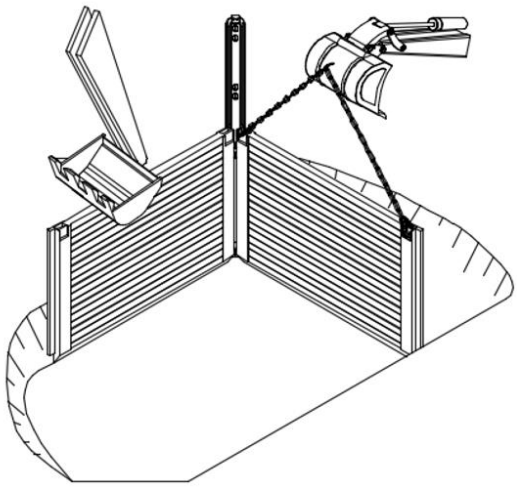
The first shoring panel (inner base panel) is inserted and fixed in the pit using lifting gear and suitable lifting slings (GS approval).

2. Installing the first X rail



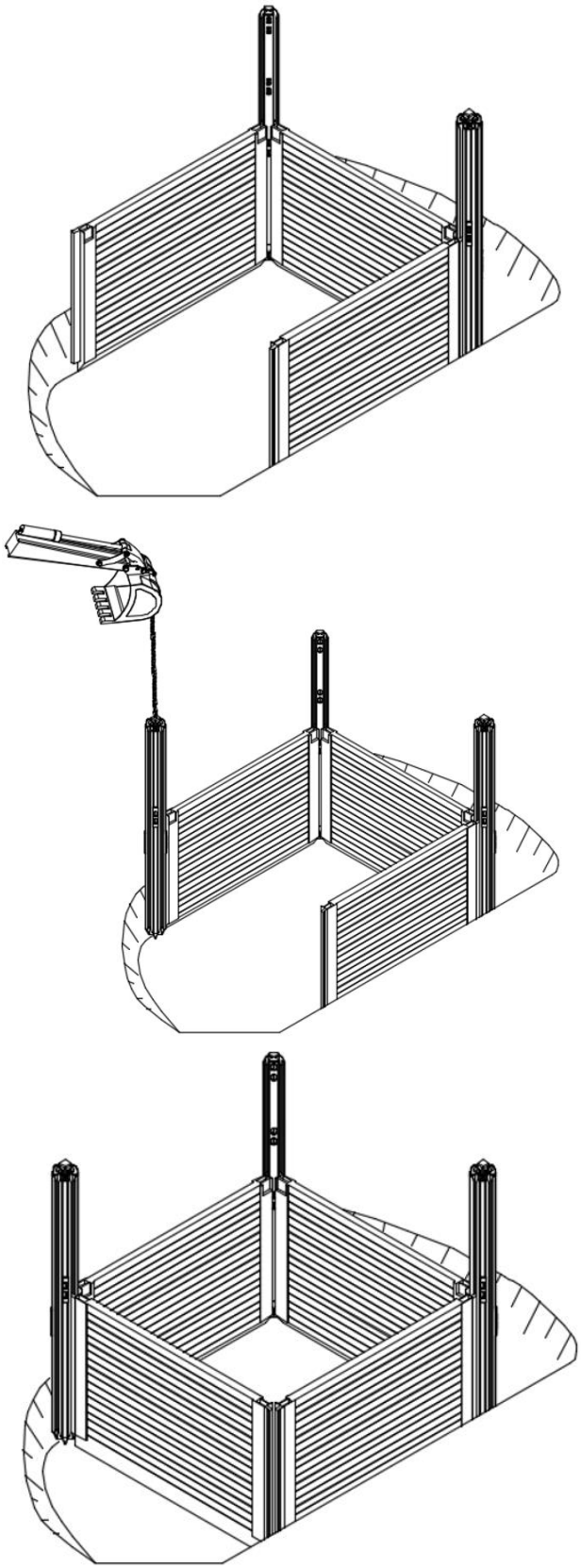
With the aid of a second hoist, the corner rail can now be pushed in from above.

3. Installation of the other elements



All other elements are to be inserted as described above. The installation of panels and crossbars takes place in constant alternation.

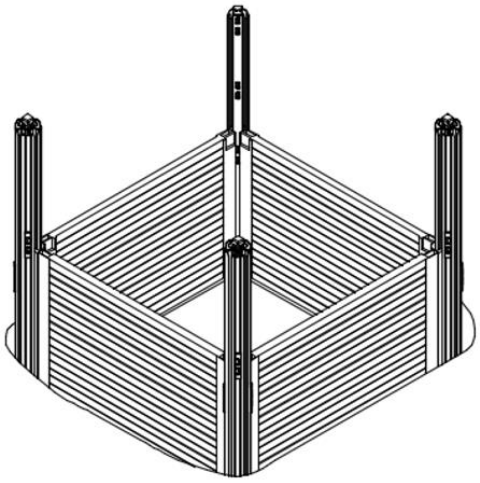
4. Alignment of the shoring and installation of the further base panels



To ensure that the last shoring wall can be inserted without difficulty, the shoring must be aligned.

For this purpose, on the one hand the clearance between the shoring panels at both panel ends and on the other hand the dimension across the two diagonal axes of the shoring field must be the same.

5. Lowering the shoring

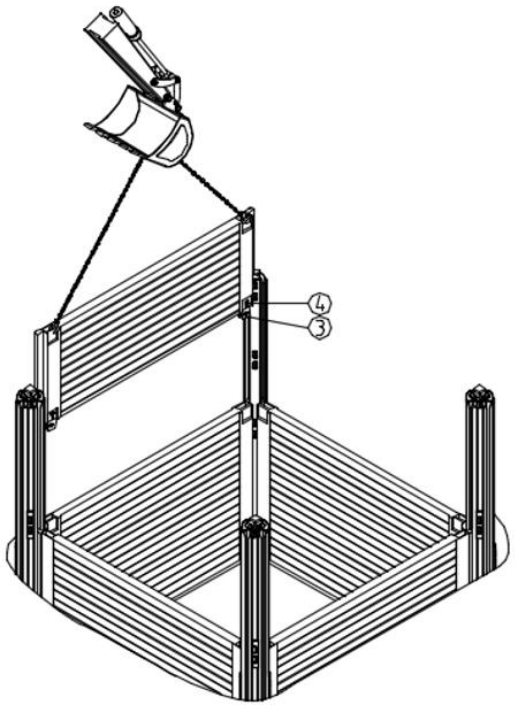


After the fourth base panel has been inserted, the squareness of the shoring must be checked once again. Afterwards the cavity between the soil and the shoring panel must be filled and compacted.

Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. X-rails and shoring panels are pressed down alternately, pressure beams being used in particular for the shoring panels.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

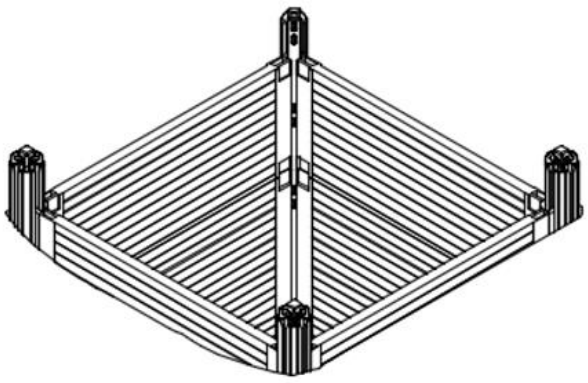
6. Inserting the inner top panels



Depending on the required trench depth, after lowering the inner base panels to the temporary bottom of the trench, the inner top panels are inserted into the beam guides.

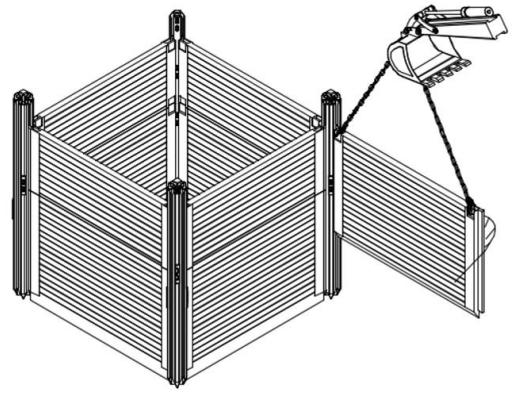
Base and top panels are to be connected by stanchions (3) and pins (4).

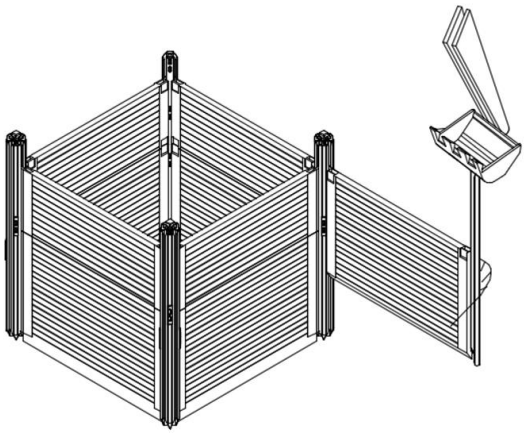
7. Lowering to final depth

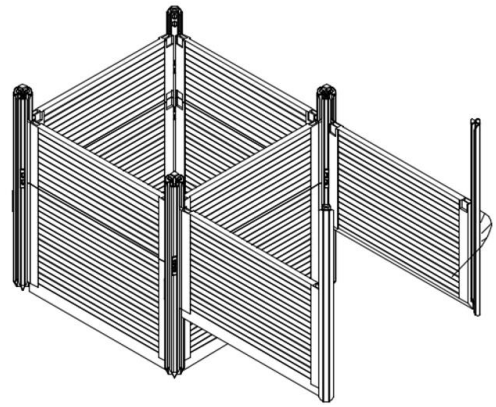


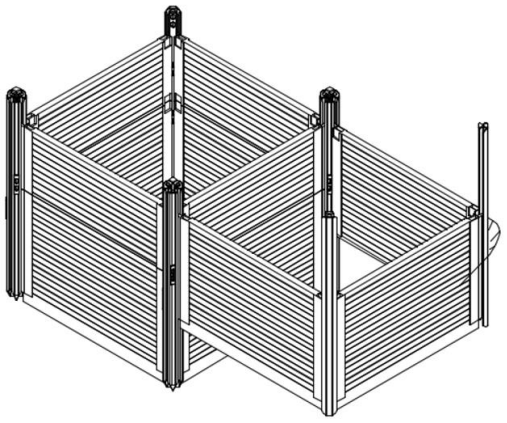
The first shoring field is fully lowered to the planned final depth. Only after the first shoring field has been fully installed can the next shoring field be started.

8. Installation of the next shoring field



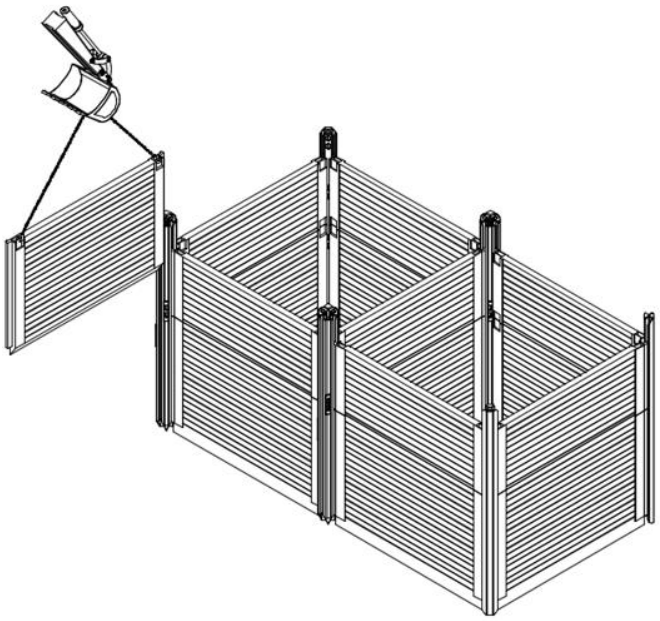




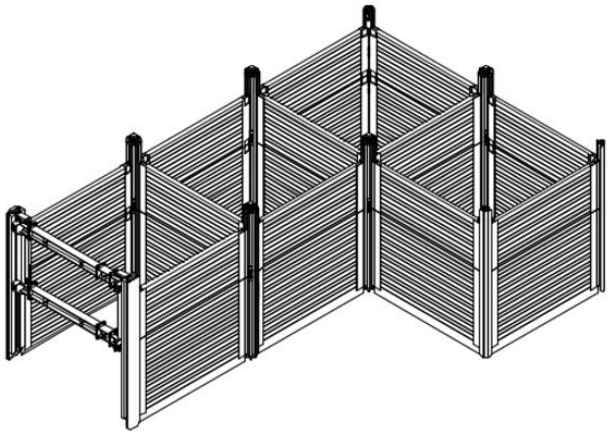


The next shoring field is installed in the same way as the first shoring field. The correct alignment of the panels to each other must be checked regularly.

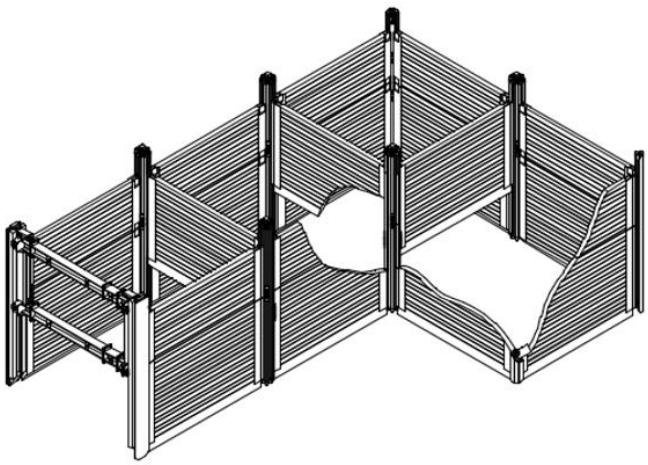
9. Installation example

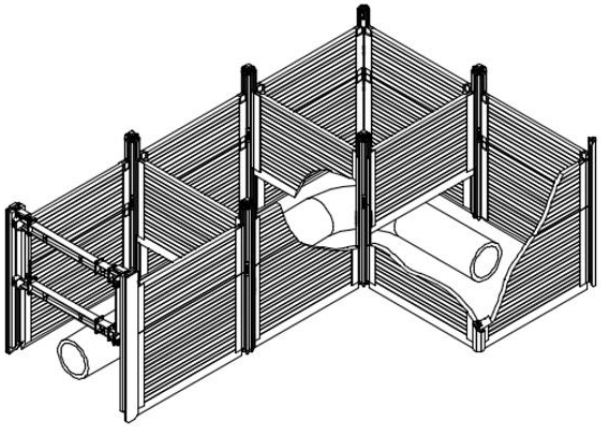


The x-rail ensures the greatest possible flexibility on the construction site.



By raising shoring panels in accordance with the static requirements, sufficiently high pipe culvert heights can be realized.





6 Statics questionnaire

terra infrastructure GmbH can carry out a static calculation on the basis of multiple requirements.

Company: _____ Quote/order no: _____

Construction project: _____

Contact person: _____ Mobile: _____

Tel.: _____ Fax: _____

Email: _____ Shoring system: _____

Shoring material dimensions: _____

(e.g. panel or box length and height, module length, etc.)

1. Trench/excavation dimensions:

Trench depth T [m]	Trench width b [m]	Clear shoring width b_c [m]
Pipe culvert height hc [m]	**Pipe length l [m]**	**Pipe diameter DN [mm]**

2. Building impact:

yes ☐ no ☐

Distance between building and trench edge [m]: _____

Number of floors: _____

Foundation depth (lower edge of foundation) [m]: _____

3. Traffic loads:

3.1 Site traffic

yes ☐ no ☐

3.2 Excavators

yes ☐ no ☐

Type/weight: _____

Distance between vehicle and trench edge [m]: _____

Vehicle position: alongside trench ☐

head ends of trench ☐

3.3 Road traffic (load model 1) in accordance with DIN EN1991-2

Yes ☐ no ☐ Distance between vehicle and trench edge [m] ☐

Vehicle position alongside trench ☐

head ends of trench ☐

3.4 Rail traffic in accordance with DIN EN 1991-2

yes ☐ no ☐ Type of rail traffic ☐

Distance between axis and trench edge [m] ☐

3.5 Crane

yes ☐ no ☐ Type/weight ☐

Dimensions of support brackets [m] ☐

Center distance of support brackets [m] ☐

Max. support load per bracket [kN] ☐

4. General information:

4.1	Can be sloped	yes ☐	no ☐	Berm height h_1 [m]:	☐
4.2	Head end shoring	yes ☐	no ☐	with:	☐
4.3	Lines crossing the trench	yes ☐	no ☐	Pipe Ø, height of bottom of pipe	☐
4.4	Concrete floor (building concrete)	yes ☐	no ☐		

5. Soil-mechanical parameters

(please forward appropriate information from the geological survey, core samples or soil characteristics)

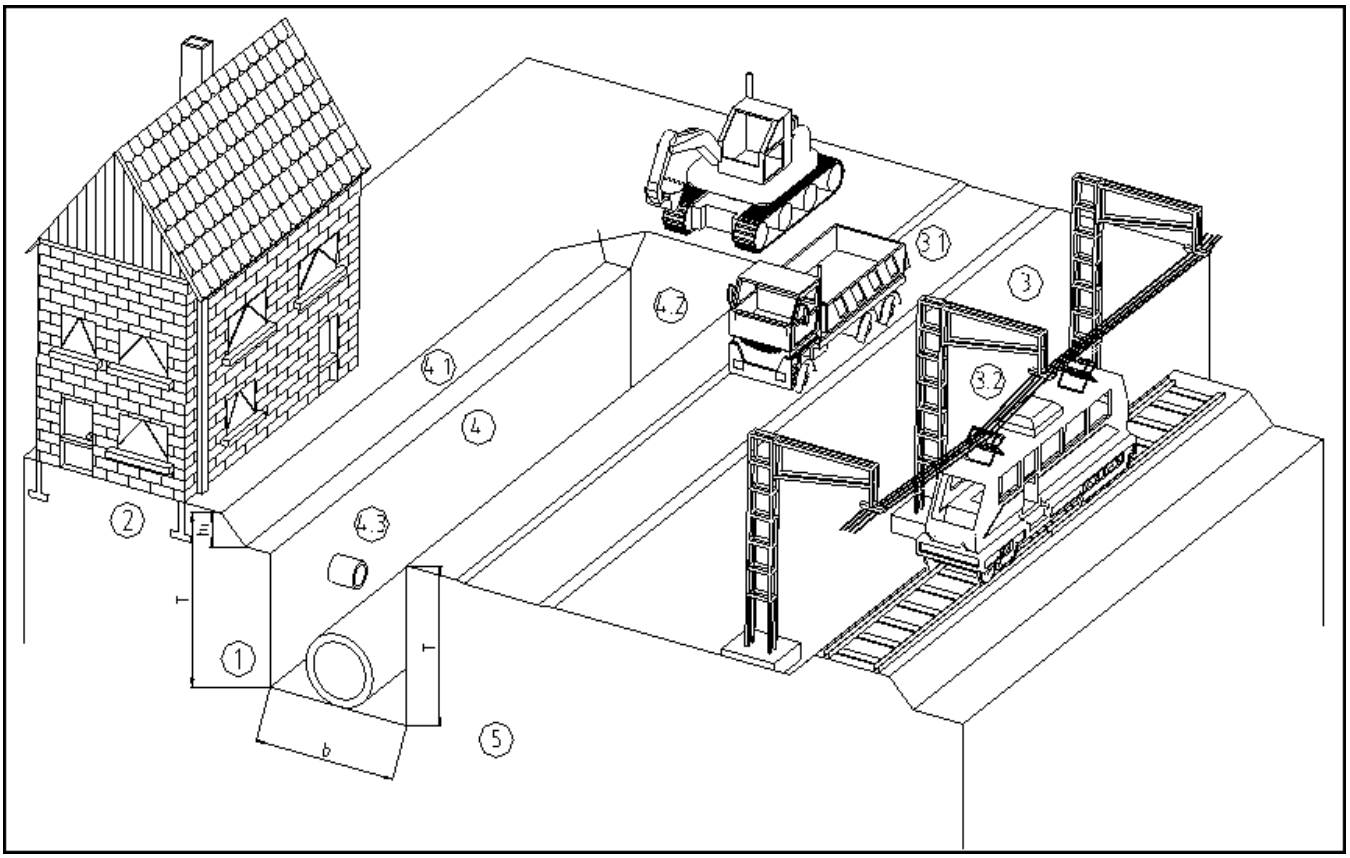
5.1	Site plan	yes ☐	no ☐				
5.2	Geological survey	yes ☐	no ☐				
5.3	Soil characteristics	φ ☐		γ ☐		c ☐	

6. Other: _____

_____

_____

7. Drawing



Place, date

Signature

terra infrastructure

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