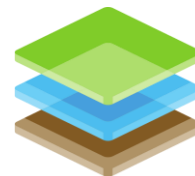


Instructions for use

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

Date: April 2022



terra
infrastructure

Information concerning the use instructions

These instructions allow for the safe and efficient handling of the E+S double slide rail shoring system. The instructions are part of the system and must be stored in the immediate vicinity of the shoring location in a location, which is accessible to personnel at all times.

Personnel must have read these instructions carefully and understood them before beginning any works. Compliance with all of the safety information and handling instructions in these instructions is a prerequisite for safe working.

In addition, the local health and safety regulations and general safety regulations for the field of application of the system apply.

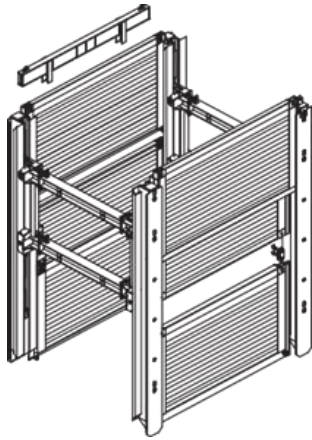
All safety-related dimensions conform with German safety and accident prevention regulations and German standards. The respective state-specific regulations are to be checked and applied before the works start.

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1 System overview

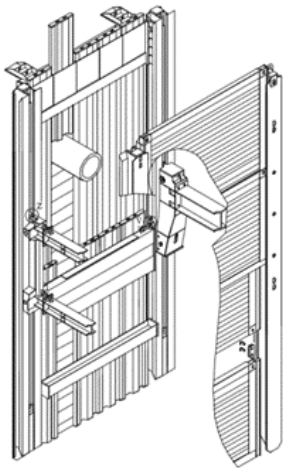
Double slide rail linear shoring (RD)



Module length	2.25 m - 6.50 m
Slide rail length	5.13 m - 9.13 m
Panel height	1.32 m / 2.32 m
Pipe culvert height	variable

DSGN. for slide rail system X in accordance with EN 13331-1:
e.g.: RD - X - FR - F - 6.13 - 0.90 / max. - 1.35 / max.

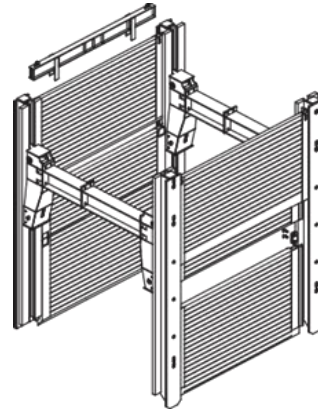
Double slide rail inner-city linear shoring (RD)



Module length	3.70 m
Slide rail length	5.13 m - 9.13 m
Sheet pile element height	1.00 m
Sheet pile length (KD VI / 8)	variable

DSGN. for slide rail system X in accordance with EN 13331-1:
e.g.: RD - X - FR - F - 6.13 - 0.90 / max. - 1.35 / max.

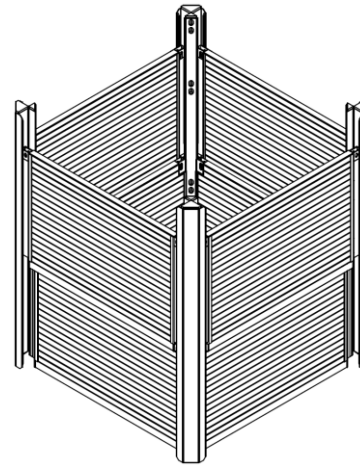
Double slide rail linear shoring with U-type strut cart (RD)



Module length	2.25 m - 6.50 m
Slide rail length	5.13 m - 9.13 m
Panel height	1.32 m / 2.32 m
Pipe culvert height	variable

DSGN. for slide rail system X in accordance with EN 13331-1:
e.g.: RD - X - FR - F - 6.13 - 0.90 / max. - 1.35 / max.

Double slide rail corner shoring



Module length	2,25 m - 6,50 m
Slide rail length	5,13 m - 6,13 m
Panel height	1,32 m / 2,32 m
Shoring width	1,89 m – 6,14 m

DSGN. for slide rail system X in accordance with EN 13331-1:
e.g.: RD - X - FR - F - 6,13 - 0,90 / max. - 1,35 / 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 as 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 area 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 paint (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 Double slide rail linear shoring

3.1 Installation instructions 6.13 m guide frame with rectangular strut cart

All safety instructions in the chapter “Occupational safety and general information in accordance with DIN EN 13331-1/-2” must be observed before the beginning of works (see chapter 2 Occupational safety and general information in accordance with DIN EN 13331-1/-2 on page 3)!

The guide frame is fully pre-assembled horizontally in a sufficiently large area which is as even as possible.

Use square timber!

In order to make assembly easier – particularly on uneven terrain – all components should be placed on square timber.

Determining the size of the pre-assembly area

The size of the pre-assembly area depends on the size of the trench to be shored up and the module lengths used.

Guideline:

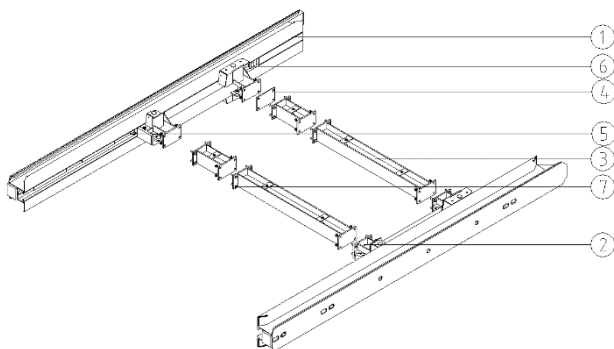
Size of the pre-assembly area = (length of the longest linear shoring support + 2 m) x (maximum shoring width + 2 m) + area for storing the shoring panels + area for storing the rest of the material.

Example:

- Length of the longest linear shoring support = 8.13 m
- Shoring width = 3 m

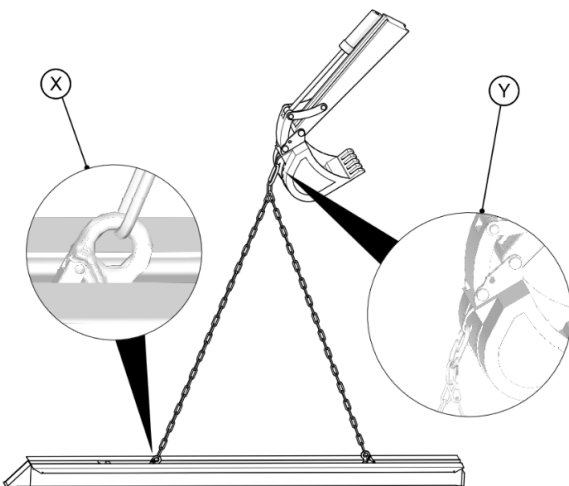
Pre-assembly area size = 10 m x 5 m = 50 m² + area for storing the shoring panels + area for storing the rest of the material.

1. Guide frame system overview



- (1) Linear shoring support / slide rail
- (2) Strut cart
- (3) Extension bar
- (4) Distance plate
- (5) Pin
- (6) Strut cart stop/end point
- (7) Connection screws

2. Position the linear shoring support on the ground

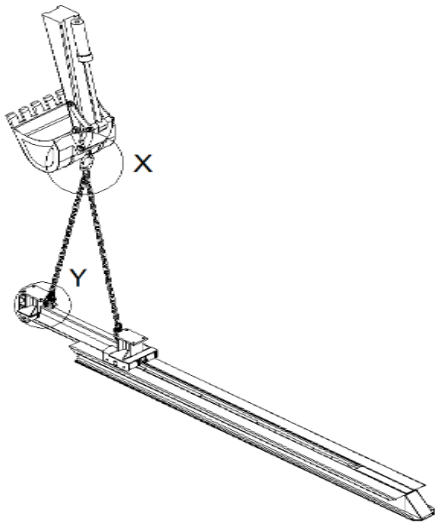


The linear shoring support must be positioned on the ground.

Attach the linear shoring support to the transport lugs on the lifting device intended for this purpose (detail X and Y).

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

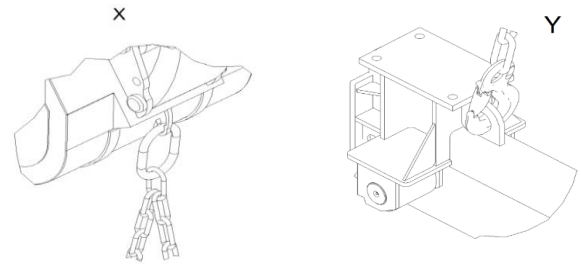
3. Insert the strut cart



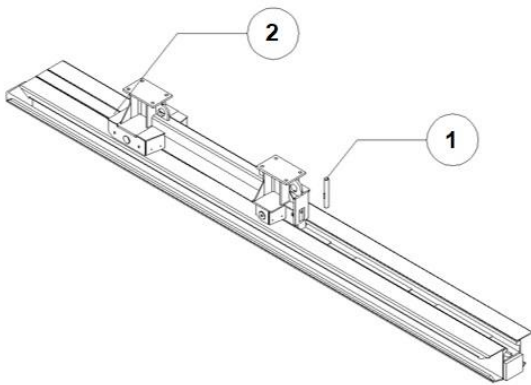
A strut cart should be inserted on each linear shoring support.

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

Insert into the linear shoring support with the compensating roller forward to the lower attachment point.



4. Pin the strut cart

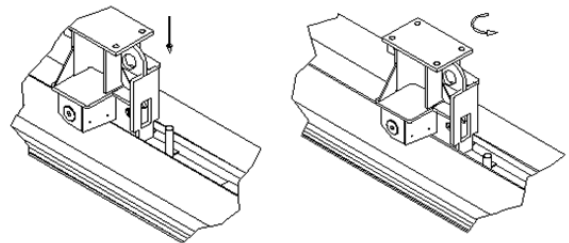


The strut cart should be secured in the linear shoring support in both directions. This is done by inserting a pin (1) into the mounting hole provided in the upper section of the support, above the strut cart.

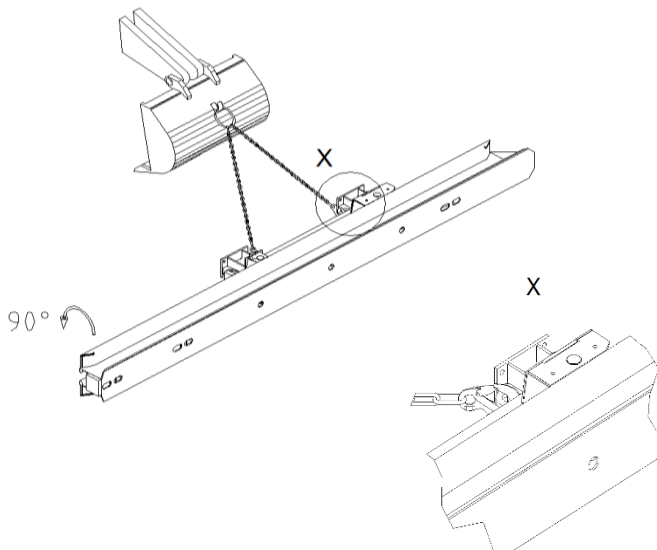
In the lower part of the linear shoring support, a fixed stop limits the downward movement of the strut cart (2).

Insert the bolt.

Turn the bolt through 180°.



5. Turn the linear shoring support over



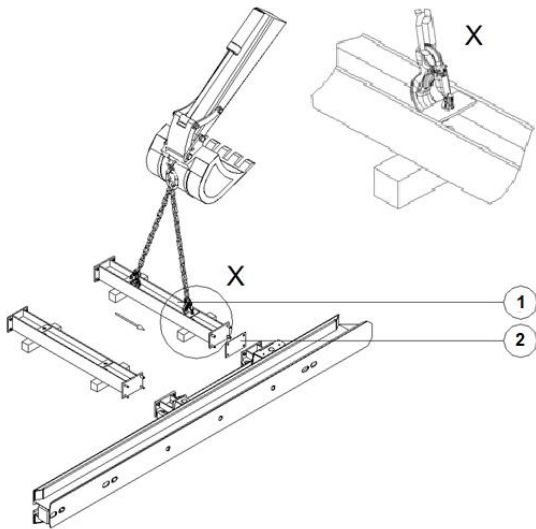
The linear shoring support must be turned through 90° on the side.

Attach the linear shoring support to the two suspension points on the strut cart (detail X).

Turn the linear shoring support through 90° on the side.

The turned linear shoring support must be secured against tipping over.

6. Assembly with non-reinforced extension bars



The extension bars are positioned and screwed together with the linear shoring strut cart.

Attach the extension bar (1) to the suspension loops.

Introduce the extension bar (1) into the strut cart's connection plate.

Insert the distance plate (2) between the lower connection joint pointing towards the pointed end of the support. This results in the A position required for installation of the frame.

Screw the components together with the appropriate screws and nuts.

Only tighten the screws by hand to begin with in order to make the assembly of further extension bars easier where applicable.

In order to make assembly easier, we recommend laying square timber underneath the extension bars.

7. Alternative: assembly with reinforced extension bars

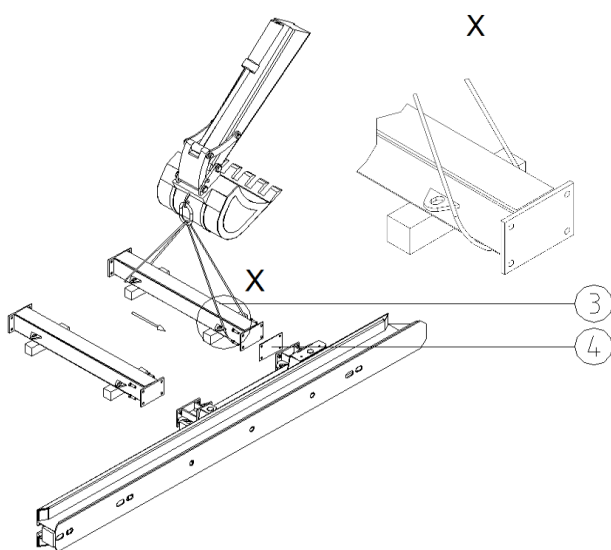
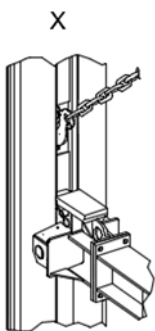
⚠ DANGER

Danger owing to improper use of transport systems!

Improper securing for transportation results in an immediate danger to the life and health of personnel.

The lugs which are attached to one side of the reinforced extension bars are only for transportation of the individual extension bars.

- Do not use the attachment point on the strut cart to lift the entire frame.
- Do not transport the entire frame on the extension bar lugs.
- Do not raise the mounted strut cart on the extension bar lugs.
- Only use the attachment points in the rail for lifting the frame (details X).



Attach the reinforced extension bars using rope or a lifting belt (GS approval). The mounting steps can then be carried out as for non-reinforced extension bars.

Work steps:

Attach the extension bar (3) to the suspension loops using rope or a lifting belt (GS approval) (detail X).

Introduce the extension bar (3) into the strut cart's connection plate.

Insert the distance plate (4) between the lower connection joint pointing towards the pointed end of the support. This results in the A position required for installation of the frame.

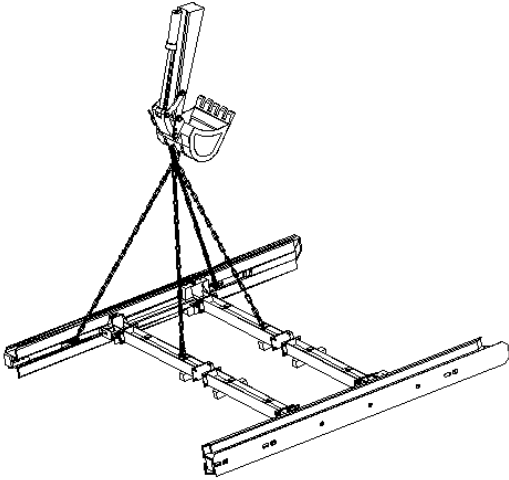
Screw the components together with the appropriate screws and nuts.

Only tighten the screws by hand to begin with in order to make the assembly of further extension bars easier where applicable.

Assembly of the 2nd half of the guide frame

Repeat steps 2 to 7 (first half of the guide frame) for assembly of the second half of the guide frame.

8. Assemble of the complete guide frame



The pre-assembled halves of the frame are put together.
The complete guide frame is assembled.

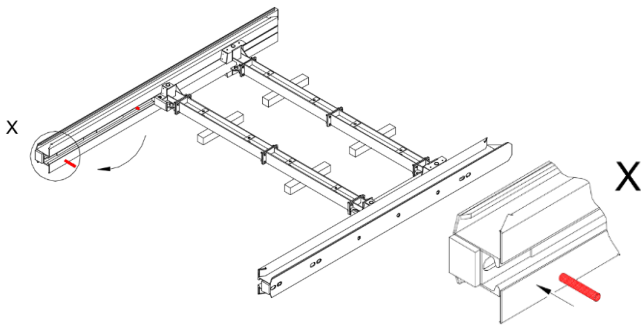
Attach half of the frame using a 4-strand chain.

Introduce half of the frame to the second frame.

Connect the extension bar joints with screws and nuts.

Then tighten all screw connections.

9. Move the pin



The pin must be moved in order to prevent the strut cart from pulling out of the rail.

Insert the pin into the uppermost pinning option in the linear shoring support (details X)

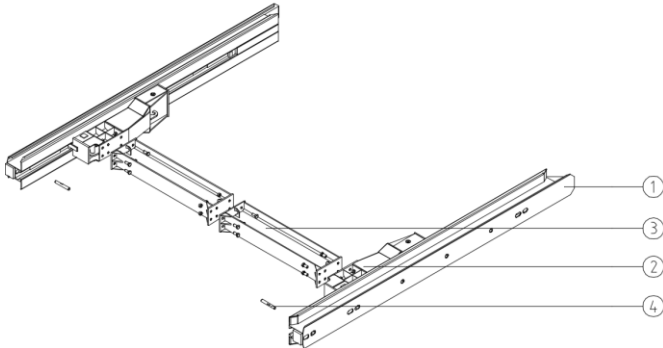
Turn the pin through 180°.

Assembly of the 2nd guide frame

Repeat the assembly preparations and work steps 2 to 9 (guide frame assembly) to assemble the second guide frame.

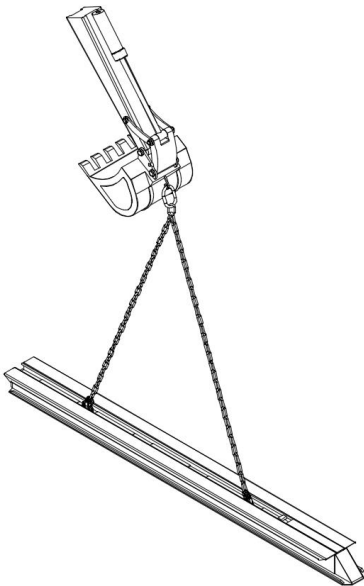
3.2 Installation instructions 6.13 m guide frame with U-type strut cart

1. System overview guide frame



- (1) Linear shoring support / slide rail
- (2) U-type strut cart
- (3) Extension bar
- (4) Locking pin

2. Positioning the linear shoring supports on the terrain

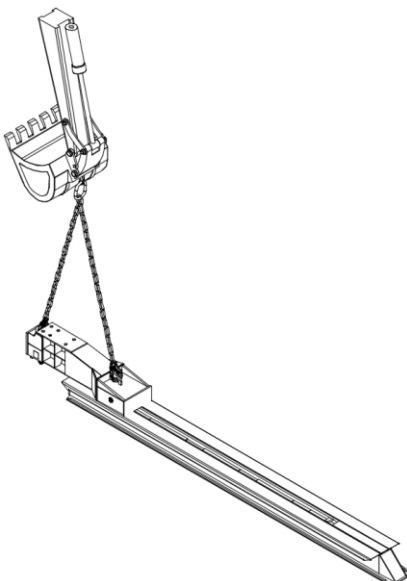


The linear shoring supports must be positioned on the terrain.

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

Place the linear shoring supports on level, sufficiently stable terrain with the back panel facing down.

3. Insert strut cart

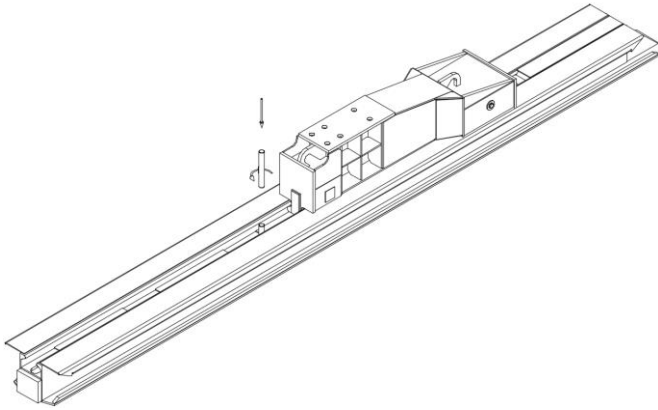


One strut cart must be inserted on each linear shoring support.

Attach the strut cart to the two attachment points.

With the pendular roller first insert into the linear shoring support until the bottom attachment point.

4. Bracing strut cart



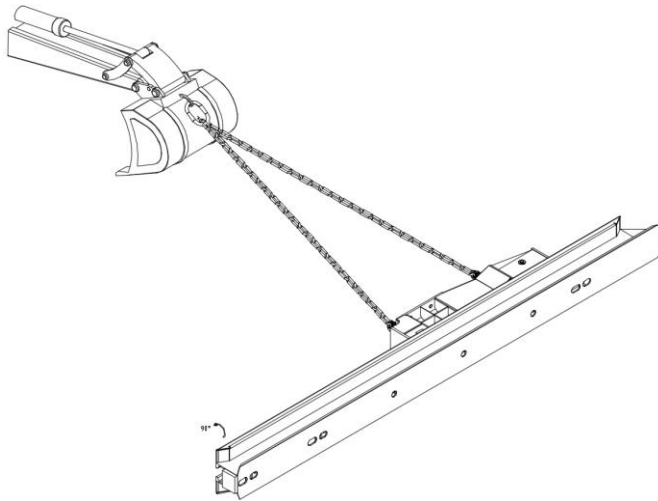
The strut cart must be secured in the linear shoring support in both directions. This is done by inserting a locking pin into the provided location hole in the upper part of the beam, above the strut cart.

In the lower part of the linear shoring support, a fixed stop serves to fix the strut cart downwards.

Insert pin.

Turn pin by 180°.

5. Turning linear shoring support



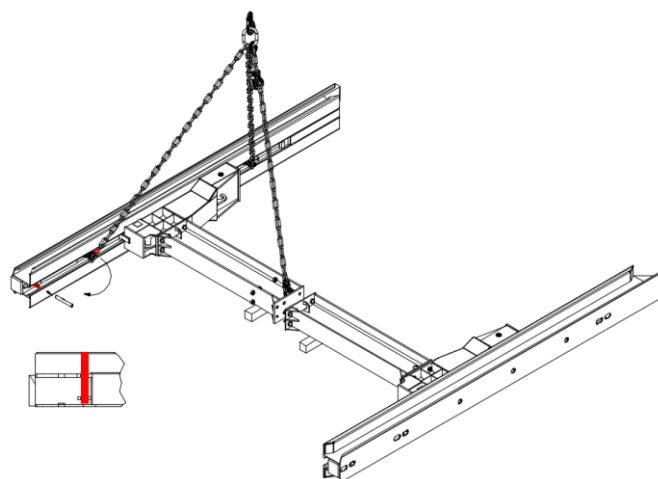
The linear shoring support must be turned 90° to the side.

Fasten the linear shoring support to the strut cart at the two attachment points.

Turn the linear shoring support 90° to the side.

The turned linear shoring support must be secured against tipping over.

6. Installation of the complete guide frame



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

Fasten half of the frame with a 4-strand chain.

Move half of the frame to the second half.

Connect the joints of the spacers with screws and nuts.

Finally, tighten all screw connections.

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

Insert the locking pin in the topmost locking possibility of the linear shoring support.

Turn locking pin by 180°.

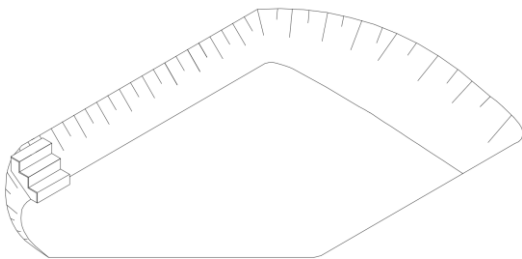
3.3 Installation instructions 8.13 m guide frame with two rectangular strut carts

The installation of the 8.13 m guide frame with two rectangular strut carts takes place in the same way as the installation of the 8.13 m guide frame in section 4.4 without installing the head end shoring adapter and the spacers.

3.4 Assembly instructions double slide rail linear shoring

Before starting the work, it is obligatory to observe all safety precautions from section "Occupational health and safety and general remarks according to DIN EN 13331-1/-2" (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 from page 3)!

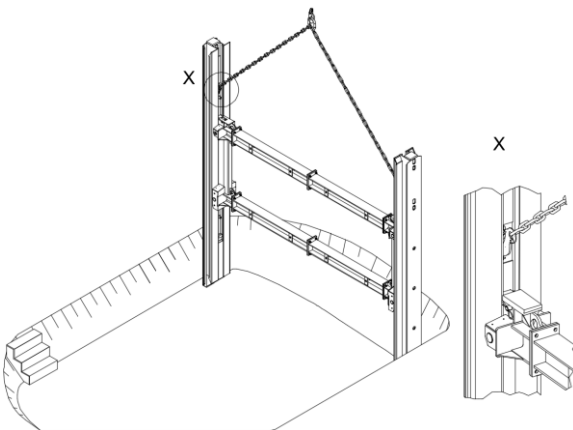
1. Advance excavation



The advance excavation is carried out depending on the stability of the soil. In Germany, the maximum depth for unobstructed trenches with sufficiently rigid soils is 1.25 m.

The advance excavation is not important for securing the first guide frame, as it is secured by suitable lifting gear.

2. Setting the first guide frame

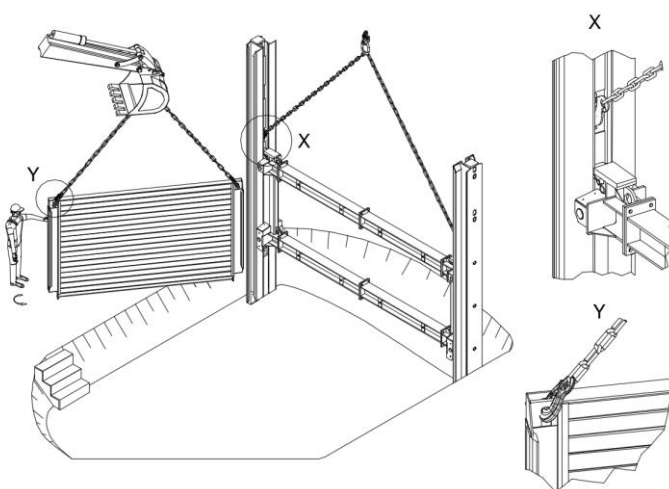


The chains must be attached at the top suspension point of the linear shoring support. The attachment points of the strut cart must not be used to lift the guide frame.

Lifting the frame until it is vertically upright.

Lifting the guide frame into the appropriate place in the trench. Important: The frame remains attached to the lifting gear until the outside shoring panels are positioned on both sides.

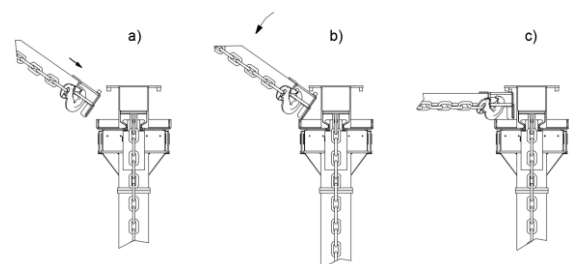
3. Inserting the outside base panel (phase 1)



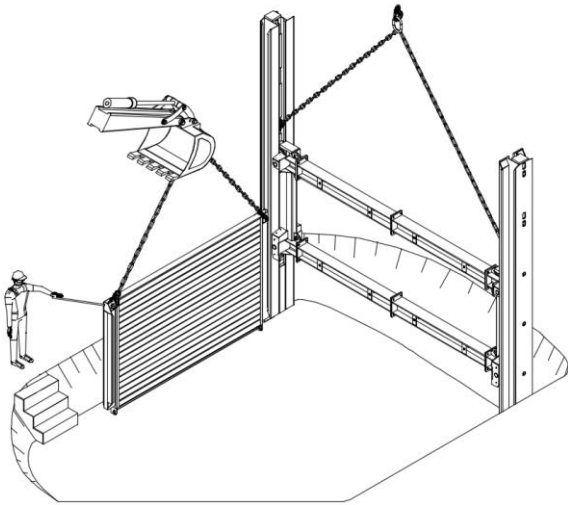
The outside base panels are swiveled into the support profile using lifting gear (see image a, b, c).

The shoring panels can be swiveled into the linear shoring support at any height. For practical reasons and with regard to occupational safety, this should be done at floor level.

Ensure that the square on the rear of the shoring panels (1) engages behind the square in the linear shoring support (2).

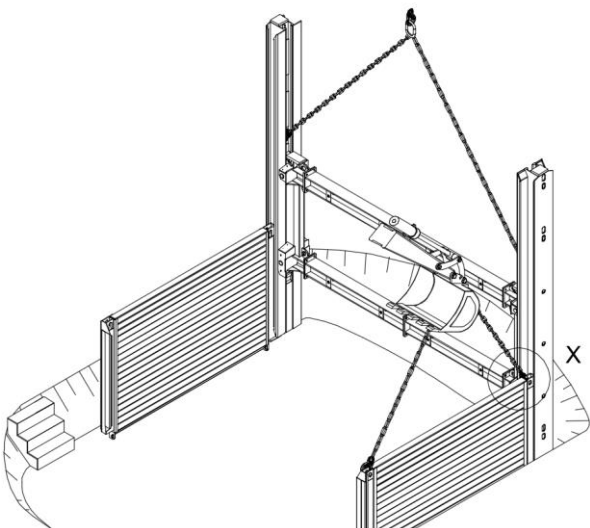


4. Inserting the outside base panel (phase 2)



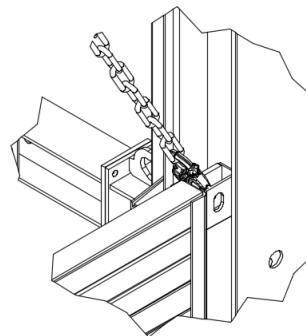
After being swiveled in, the shoring panels are adjusted to the bottom of the trench. When the chains are unloaded, they can be unhinged.

5. Inserting the second outside base panel

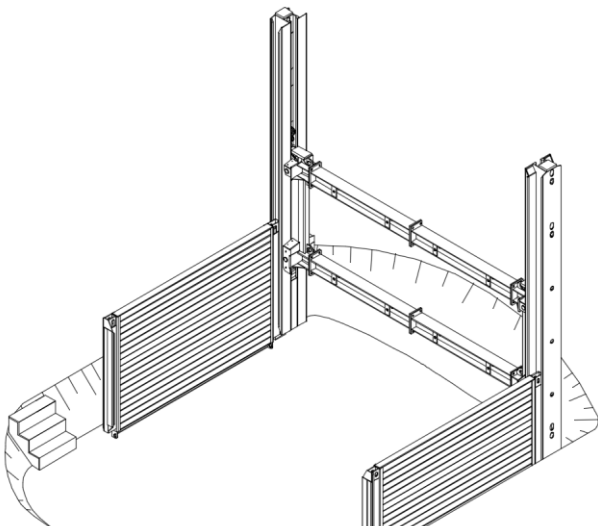


The second plate is inserted in the same way as the first plate (see points 3 and 4).

X



6. Unhinging the chain

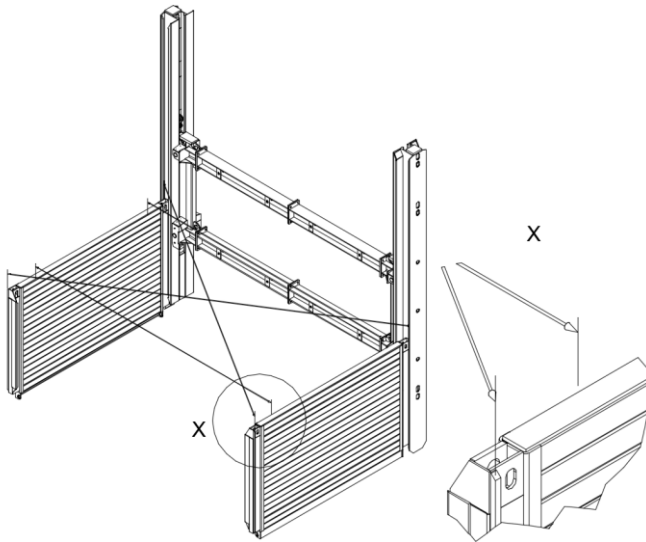


After adjusting the shoring panels, the chain can be unhinged to secure the 1st guide frame.

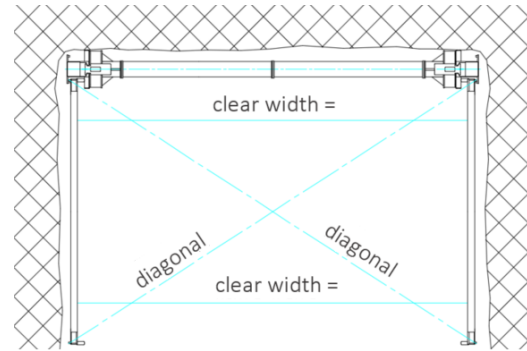
The chain must be unhinged depending on the ground conditions.

If the frame threatens to tilt due to poor ground conditions, the chain must not be unhinged. In this case, the excavator must secure the first frame during the complete installation phase.

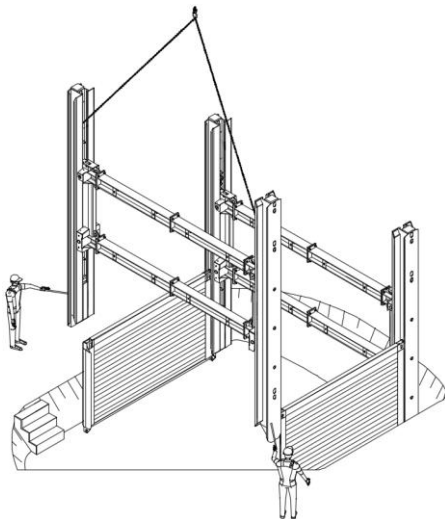
7. Alignment of the shoring panels



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.



8. Setting the second guide frame

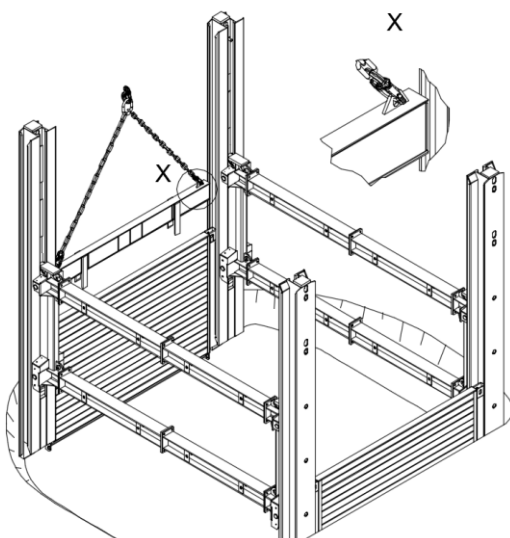


The second frame is hooked into the upper attachment points of the rail. The frame is then guided over the free-standing guide profiles of the base panels and adjusted to the bottom of the trench.

After adjustment, the chains can be unhinged.

The shoring field should be aligned again as described in work step 7, as this makes it easier to install and remove the subsequent shoring fields.

9. Positioning the pressure beam

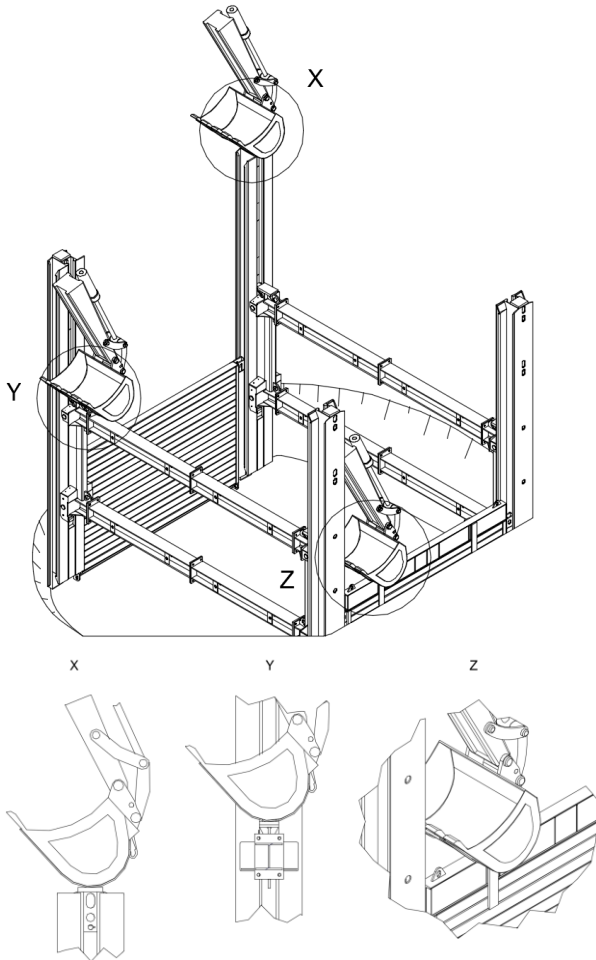


The pressure beam is attached to the welded-on lifting eyes and placed on the shoring panels using lifting gear. The longer guide bracket of the pressure beam serves as a stop to facilitate the mounting.

To ensure that the shoring is guided correctly, the cavity between trench wall and shoring panel must be filled with suitable material during lowering.

If during Installation, e. g. for positioning the strut cart, an additional locking pin is inserted underneath the strut cart, it must absolutely be removed before lowering.

10. Lowering the shoring field



Now the lowering of the shoring can begin. To do this, alternately lift the soil inside the shoring and then press the shoring down with the excavator bucket.

To lower the panels, place the pressure beam on the plate and press it down with the bucket (detail Z).

The linear shoring supports can be pressed directly with the bucket, as they have a reinforced top plate (detail X).

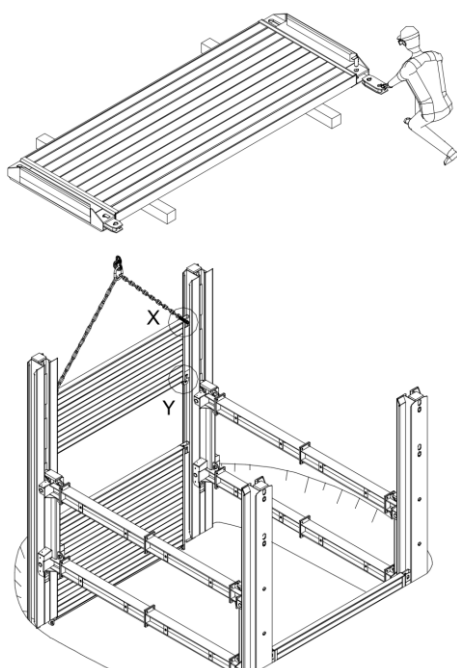
The strut carts are pressed over the pre-assembled impact plate (detail Y).

Lowering of the respective shoring elements is carried out in turn. Never press the spacers of the strut cart with the bucket. This leads to damage and can cause the shoring to fail.

The depth of the excavation under the cutting edge of the shoring panels depends on the inherent stability of the soil and must be adjusted on site and during the excavation. The advance excavation is usually between 10 and 30 cm.

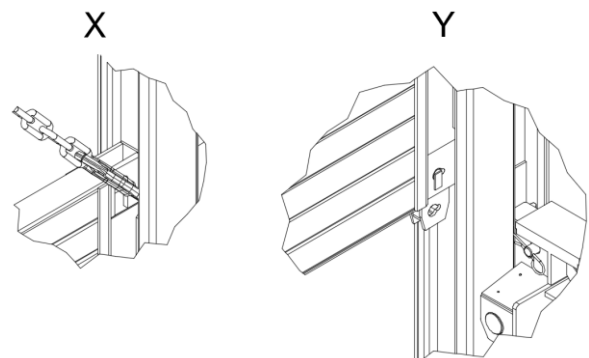
All shoring components must be inserted under pressure and under no circumstances by knocking or hammering. When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

11. Inserting and lowering the top panel outside (phase 1)

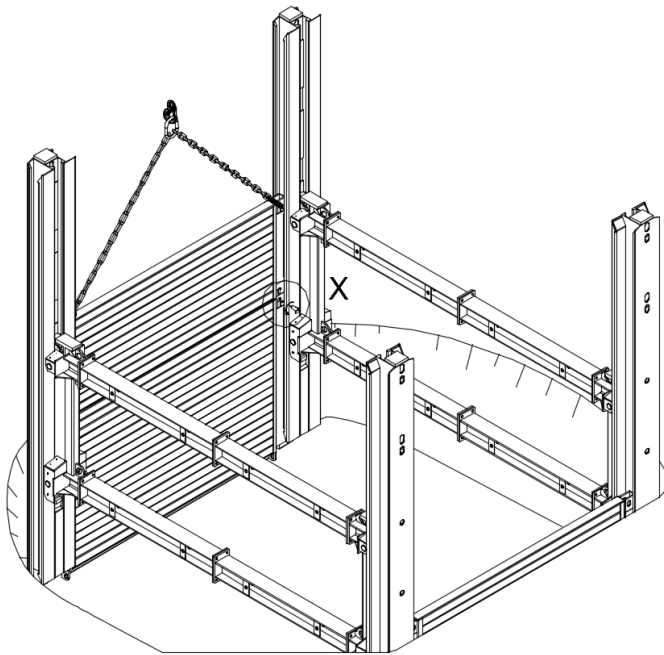


Depending on the required trench depth, after lowering the outside base panels to the temporary bottom of the trench, the outside top panels are inserted into the beam guides from above.

The stanchions connecting the base and top panel must first be inserted into the corresponding stanchion pockets on the lower edge of the top panel. The stanchions are attached by means of stanchion pins. This is to be turned 90° after insertion for safety reasons.

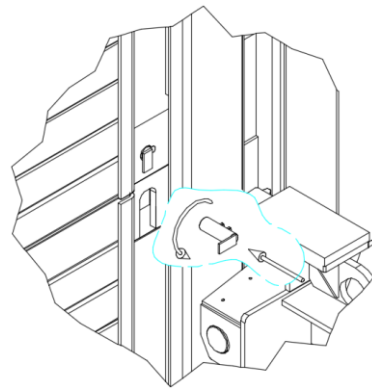


12. Inserting and lowering the top panel outside (phase 2)

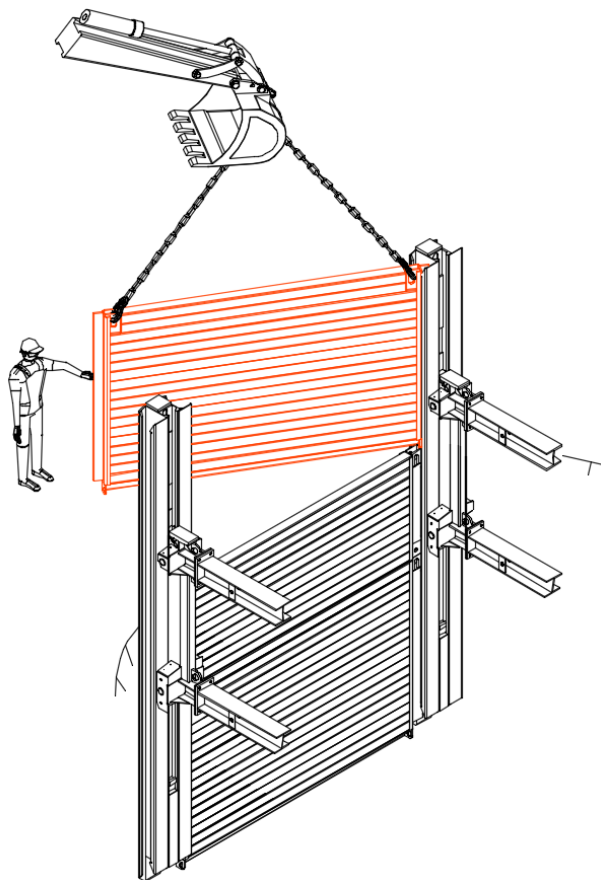


After the top panel is seated on the base panel, the second pin must be inserted into the stanchions and secured by turning it 90°.

X

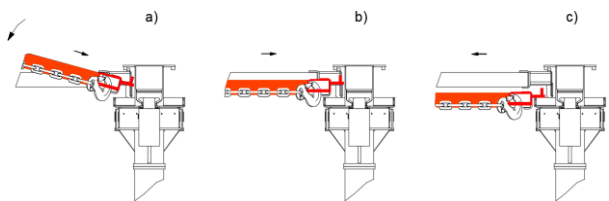


13. Inserting the inside base panels (phase 1)

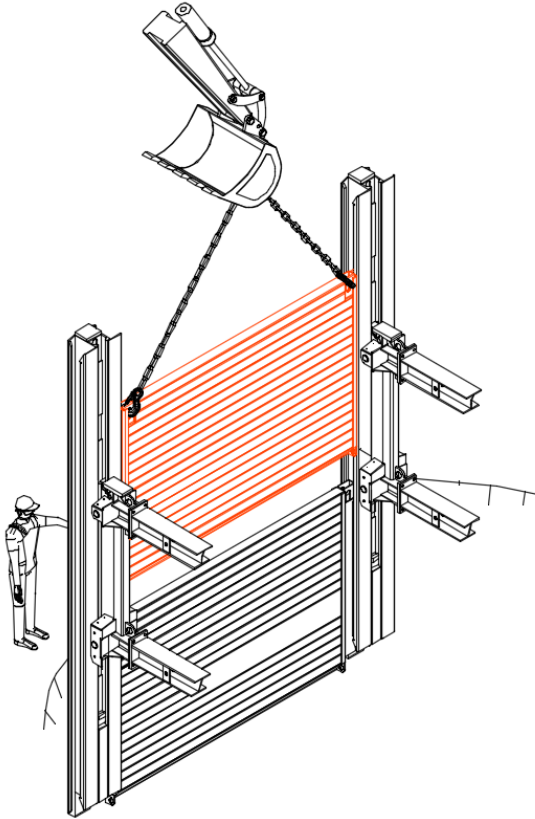


The shoring must be lowered until the outside panels project by about 10 cm from the outside natural soil. Now the time has come to swivel in the inside base panels. The process is identical to the swiveling in of the outside panels.

The inside base panels are swiveled between the guide frames as shown in image a), b) and c), guided in the U-shaped guide rails of the outside panels and lowered to the bottom of the trench.

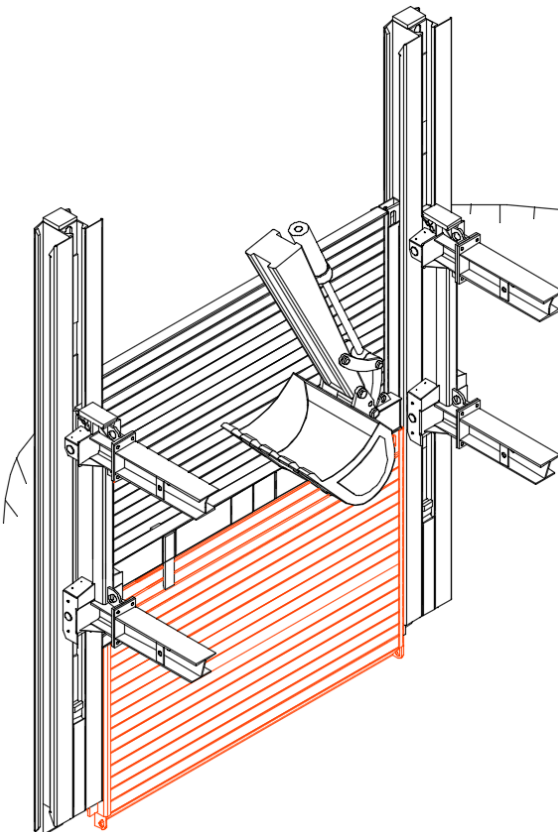


14. Inside base panels (phase 2)



The inside base panel is lowered to the bottom of the trench. The chains can then be unhinged.

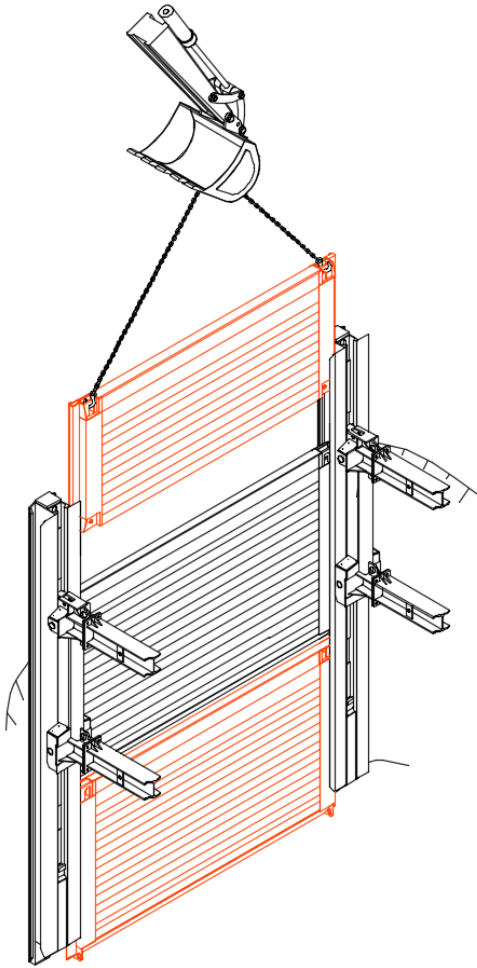
15. Lowering the inside base panels



Further trench excavation is carried out by lowering the inside base panels, the guide frames and the strut carts. When lowering the system, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.

The inside panels and linear shoring supports of the shoring are lowered in the further course. The outside panels remain in position.

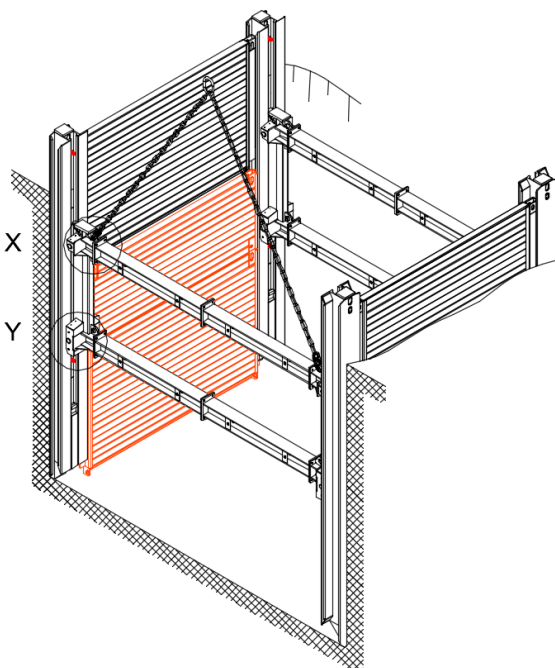
16. Inside top panel



A further adjustment of the shoring depth can be achieved by inserting the inside top panels. The installation is carried out in the same way as for the base panels.

The inside base and top panels are connected in the same way as the outside base and top panels by using stanchions and stanchion pins.

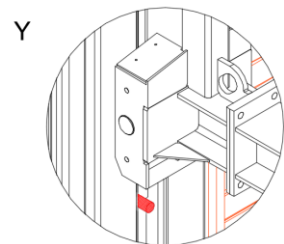
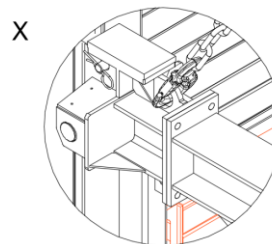
17. Pulling the strut carts and inserting the lower locking pin



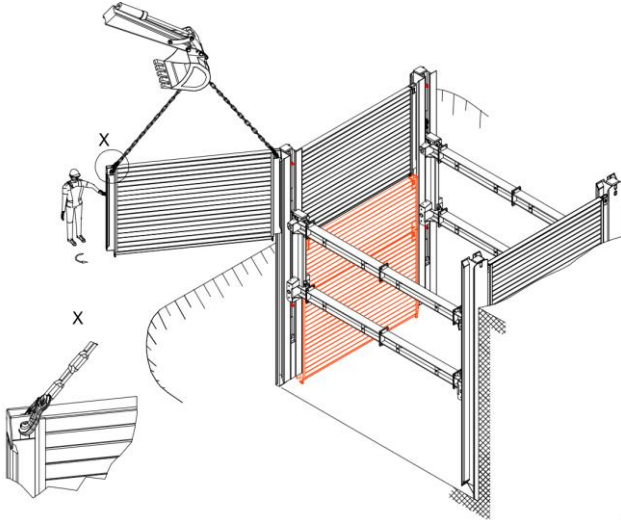
The next shoring field is installed as soon as the previous field has been fully lowered to the bottom of the trench and the strut carts are positioned and fixed vertically in accordance with the static requirements.

To pull the strut cart, use the corresponding lifting eyes on the strut cart (detail X).

The strut carts are secured in the linear shoring supports by inserting a locking pin (detail Y) into the location hole provided in the support. After insertion, the pin must be turned by 180°.

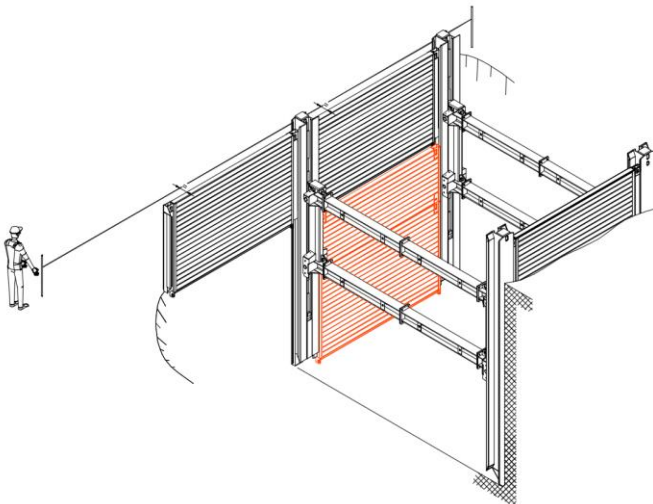


18. Setting the next shoring field



For the other shoring fields, the installation steps are repeated that were already necessary for creating the first field (see installation steps 3 to 17). First the third guide frame must be pre-assembled (see “Installation of first guide frame”). Then the outside panels are placed on the second guide frame and swiveled in.

19. Measuring the alignment

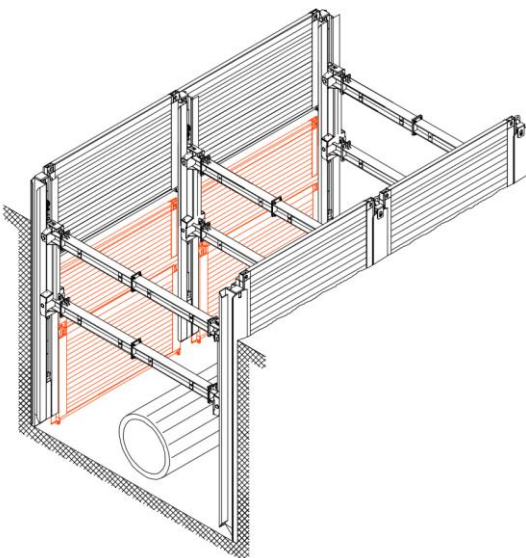


The panels of the second field must again be aligned parallel and in alignment with the panels of the first field. Then the third guide frame can be pushed over the panels.

After filling the cavity between the slabs and the natural soil, the second field can now be lowered analogous to the first field and / or the trench can be excavated to the target depth.

Before each use of the shoring elements, all screw connections must be checked for tightness and retightened if necessary.

20. 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.

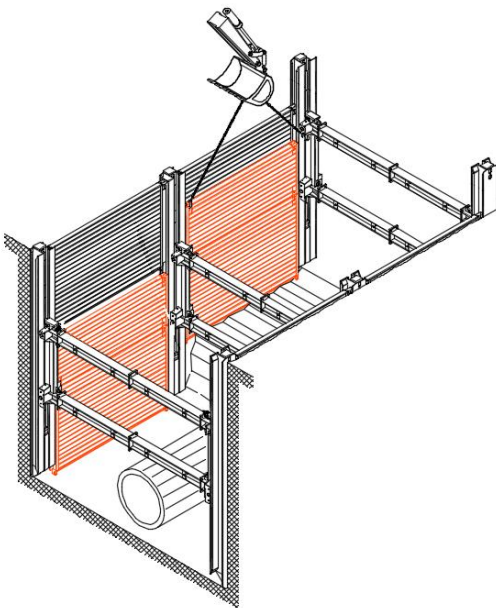
3.5 Instructions for removing double slide rail linear shoring

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 previously inserted is compacted against the existing soil. A two-strand chain at least 19 mm thick must be used to pull the shoring. The pulling eyes at the individual attachment points are dimensioned and designed for the permissible load on the chain. Alternatively, pulling adapters and shoring pullers can be used to make it easier to pull the shoring panels and supports.

Lifting slings may only be attached to the provided attachment points, as was previously the case during installation.

Before starting the work, it is obligatory to observe all safety precautions from section "Occupational health and safety and general remarks according to DIN EN 13331-1/-2" (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 from page 3)!

1. Pulling the inside base and top panels in the rear field, backfilling and compacting

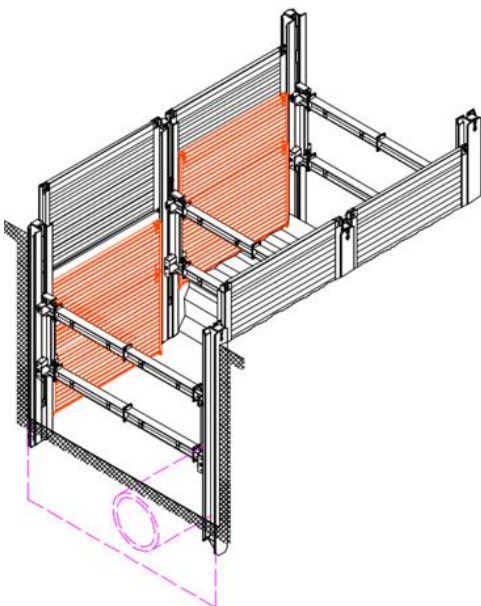


When removing, the inside shoring panels and the guide frames are pulled first.

In contrast to the installation of the shoring panels, the inside base and top panels are initially pulled together during removal. The stanchion connection is only released later.

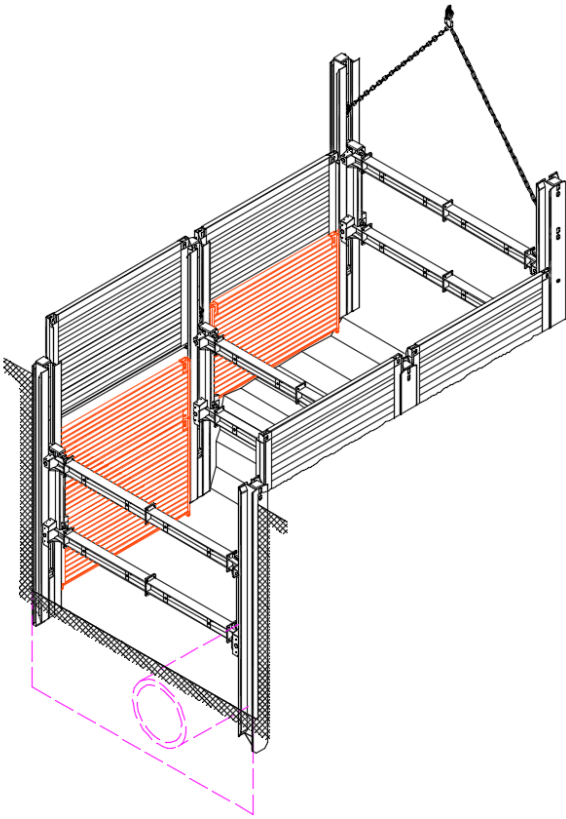
Following the drawing process, the space beneath the shoring units must be backfilled and compacted.

2. Pulling the inside base and top panels in the front field, backfilling and compacting



Alternate pulling of the shoring elements.

3. Remove top panel. Pulling the base panel in the rear field, backfilling and compacting

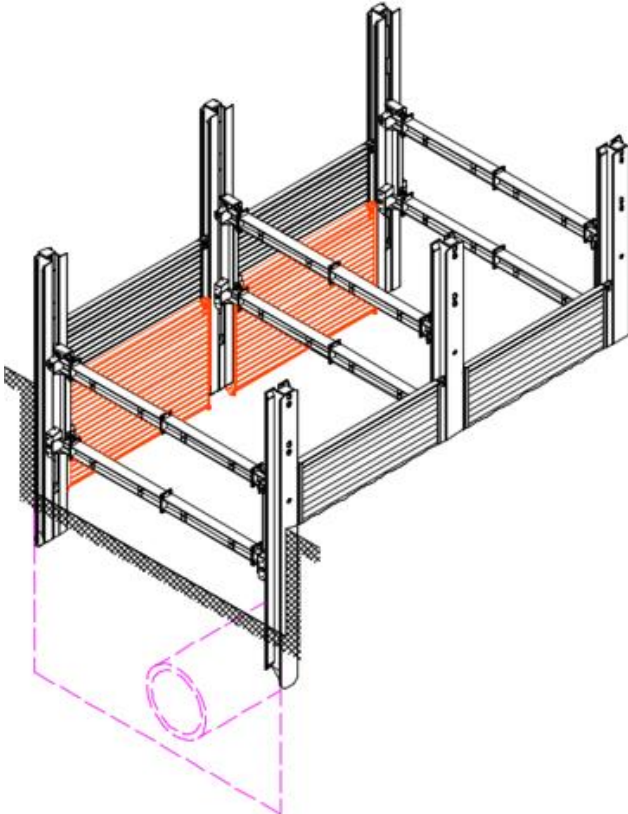


As soon as the inside top panels have been pulled so far that they are covered by the outside panels, the stanchions and pins of the inside plate combination can be removed again.

To do this, the lower pins, which were mounted in the base panel during installation, must be turned 90° and removed. The stanchion is now only connected to the top panel.

The top panel can be removed subsequently.

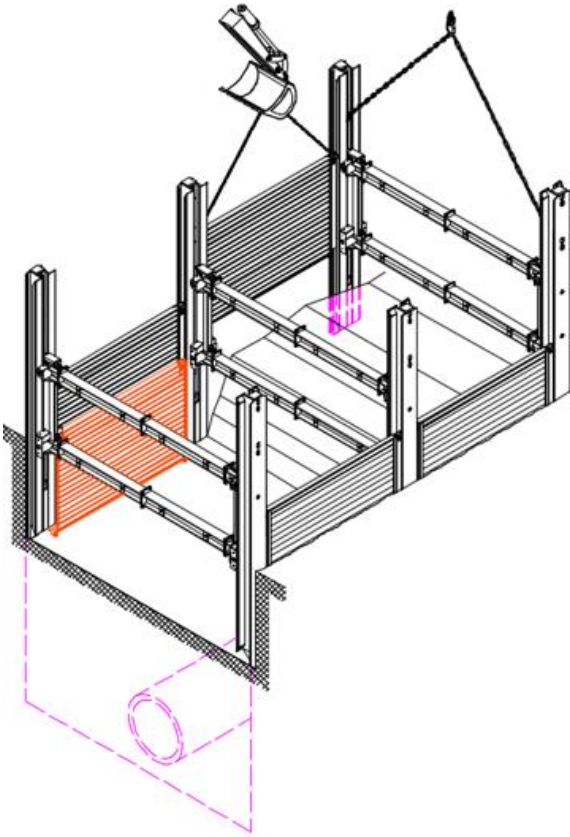
4. Remove top panel. Pulling the base panel in the front field, backfilling and compacting



The shoring is now removed by alternately pulling back the inside base panels and the guide frames.

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

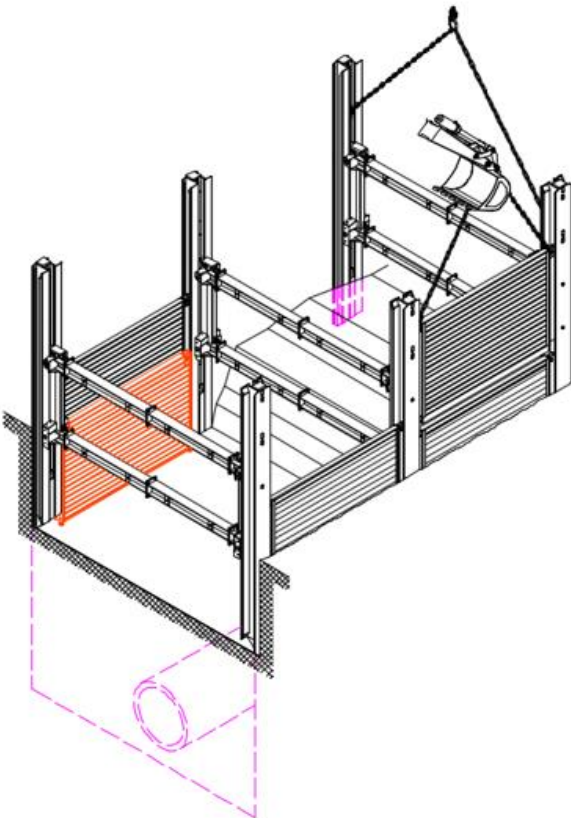
5. Removing the outside shoring panels (phase 1)



Once the inside panels have been taken off, removal can be continued with taking off the outside shoring panels. For this purpose it is absolutely necessary that the guide frame which is now becoming free is first secured by a suitable lifting device.

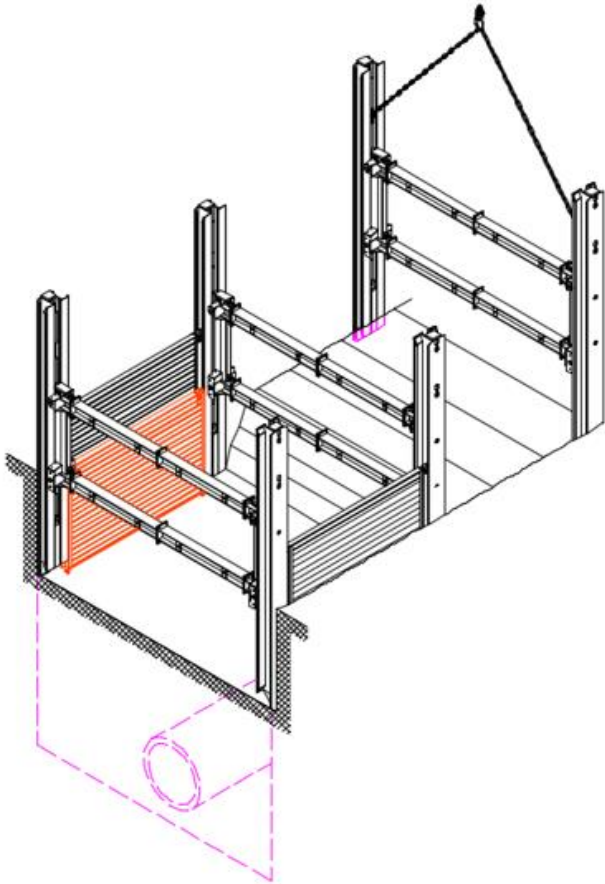
During all dismantling steps it must always be ensured that the previously placed backfill material is compacted layer by layer against the existing soil.

6. Removing the outside shoring panels (phase 2)



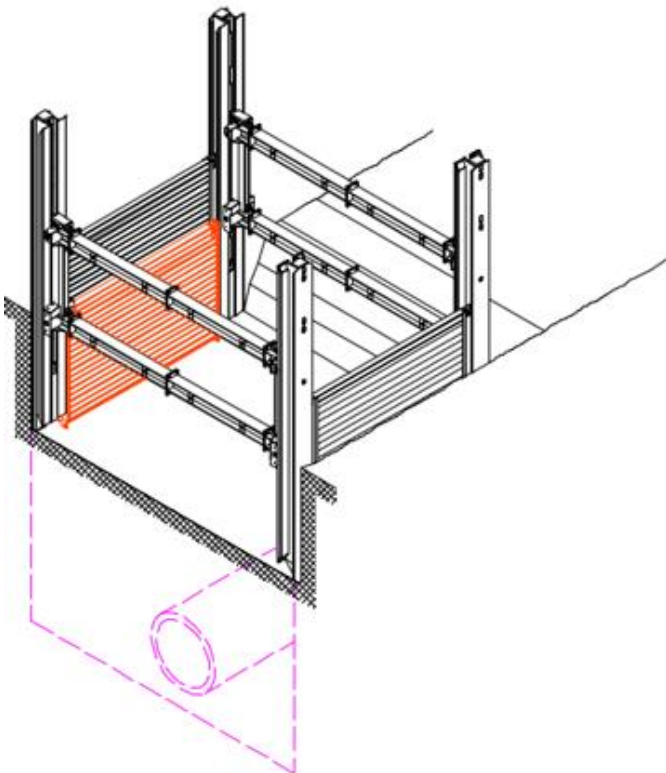
Now the outside base panel of the opposite side of the shoring field can be removed.

7. Removing the guide frame



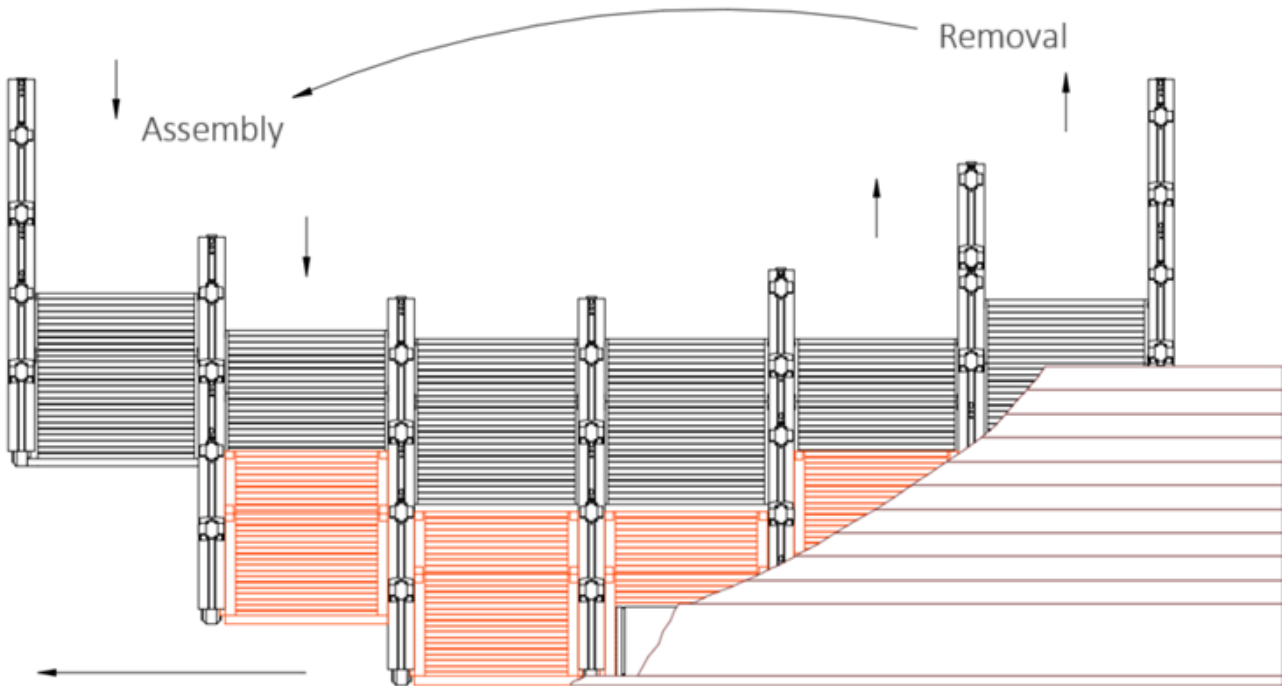
Once all the shoring panels of the first field have been removed, the guide frame can be removed and placed on a suitable base.

8. Removal of the legal shoring



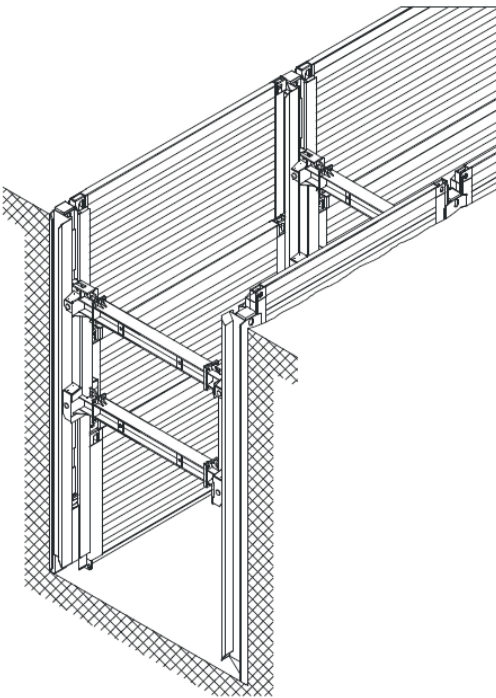
Each additional shoring field is now removed in the same way as described above in the removal instructions.

9. Principle sketch



Bottom trench support / use of in-situ concrete

1. Insert the shoring



When laying large diameter lines and/or constructing in-situ concrete sewers, additional support for the guide frame is often required at the trench bottom for static reasons.

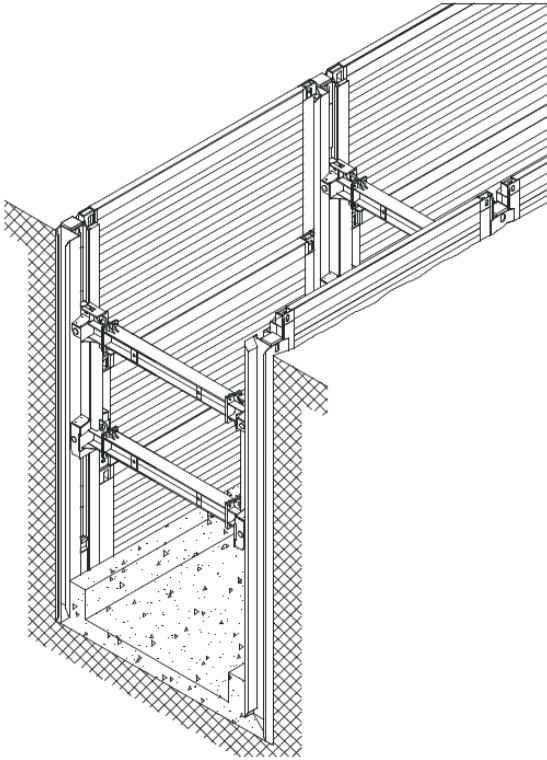
Here, the shoring is first inserted in accordance with the installation instructions ("Double slide rail linear shoring installation instructions" section, work steps 1 to 10) and the bottom of the trench is prepared in accordance with the requirements.

Any trench bottom support which may be required is based on the static calculations and is implemented as steel or reinforced concrete struts. For in-situ concrete sewers, the bottom of the sewer can be used to support the trench bottom where applicable.

The trench bottom support must be implemented such that there is a sufficiently large supporting surface for the vertical support.

The trench bottom support must be designed in accordance with the static requirements. The setting time must be taken into account for a trench bottom support made from in-situ concrete.

2. Construct trench bottom support



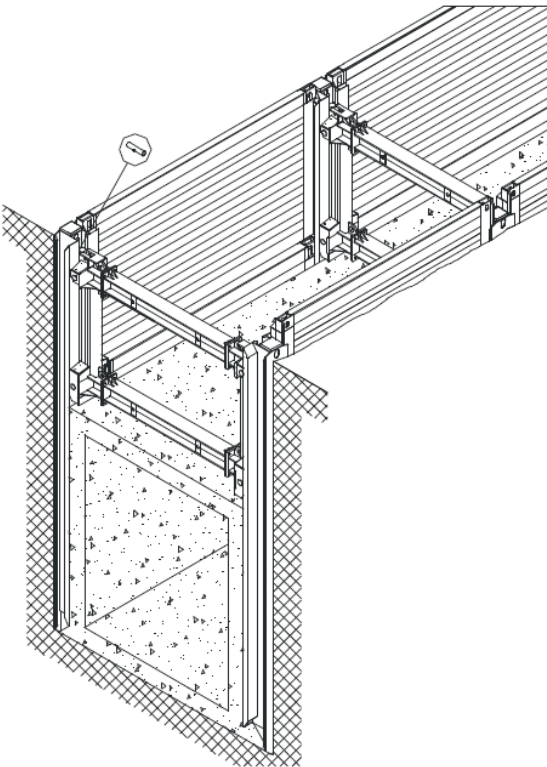
After construction of the trench bottom support, the strut cart can be pulled to the permissible pipe culvert height in order to complete the full in-situ concrete structure. In this position, the strut cart must be secured using chains or pins.

During pulling, the strut cart must always be secured against sliding upward off the vertical support (pin, see "Guide frame installation instructions" section, work step 9).

If the shoring should also serve as formwork for an in-situ concrete construction, then the open strut cart guides in the vertical supports must be sealed with locking plates to be obtained from Emunds+Staudinger. A continuous, smooth surface is thus produced in combination with the shoring panels. Insertion of an intermediate layer (e.g. hard foam boards, film) between the shoring and the in-situ concrete wall is essential for smooth removal.

Penetration of concrete or cement mortar between the steel shoring elements and into the connector and bolt connection areas must be prevented necessarily.

3. Removal of the shoring system



Once the concrete walls have set, the shoring is removed in accordance with the specifications in the "Double slide rail linear shoring removal instructions" section. If the cavity which is left behind between the in-situ concrete structure and the soil must be backfilled, shoring panels and supports with integrated injection openings through which a mixture of sand, water and cement or insulating material can be introduced into the cavities must be used. After injection and removal, all shoring elements, in particular the injection openings, must be cleaned immediately.

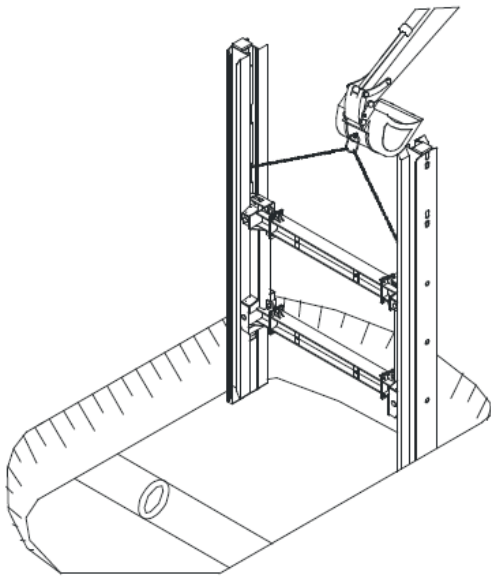
3.6 Double slide rail inner-city linear shoring installation instructions

All safety instructions in the chapter “Occupational safety and general information in accordance with DIN EN 13331-1/-2” must be observed before the beginning of works (see chapter 2 Occupational safety and general information in accordance with DIN EN 13331-1/-2 on page 3)!

1. General

For inner-city linear shoring, sheet piles are guided in so-called outside and inside sheet pile elements (outside and inside walers). It is thus possible, particularly in inner-city areas with dense building development, to flexibly reconfigure lines or installations which run transverse to the trench for structural and constructional adjustments to lines which cross the trench, while at the same time supporting and securing the trench walls.

2. Place the 1st guide frame



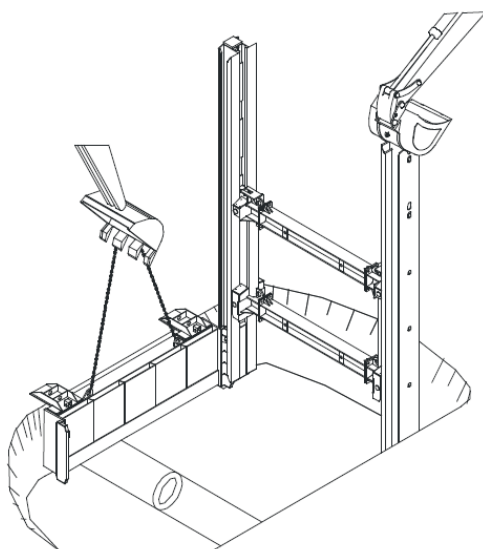
After calibration of the trench line, initial excavation for the 1st shoring field is done according to the instructions of the construction supervisor.

Width: required clear trench width + approx. 0.70 m

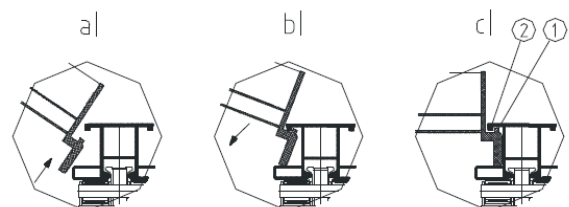
Length: module length + approx. 0.50 m
(or length of the inside panels + approx. 1.00 m)

The first guide frame is positioned centrally to the trench axis and at a right angle to the line of the trench using a hoist and a suitable sling (GS approval). Here, the strut cart sits on the stops which are permanently welded only the linear shoring support at the bottom and is secured to the guide frame at the top with a pin (see assembly instructions). Where necessary, the frame must be locked in a vertical position (e.g. using a second hoist).

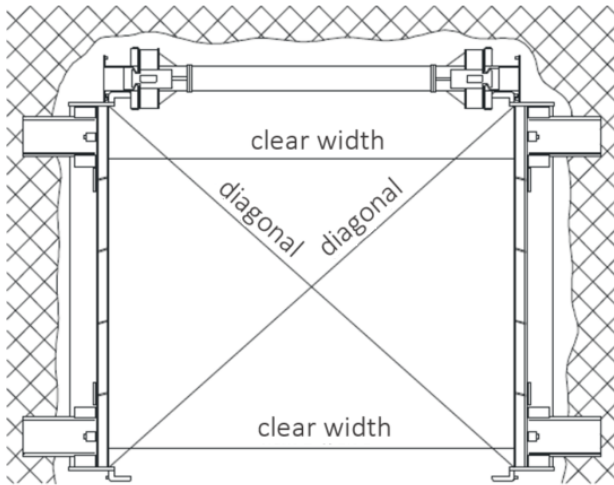
3. Place the outside walers



The outside walers are swiveled into the support profile of the linear shoring support (see images a, b, c). Care must be taken here to ensure that the rear square of the outside walers (1) catches behind the square in the linear shoring support (2). Once the support brackets have been installed and bolted as holding points, the walers are positioned at the bottom of the trench. The lower pin must always be removed before the linear shoring frame is lowered.



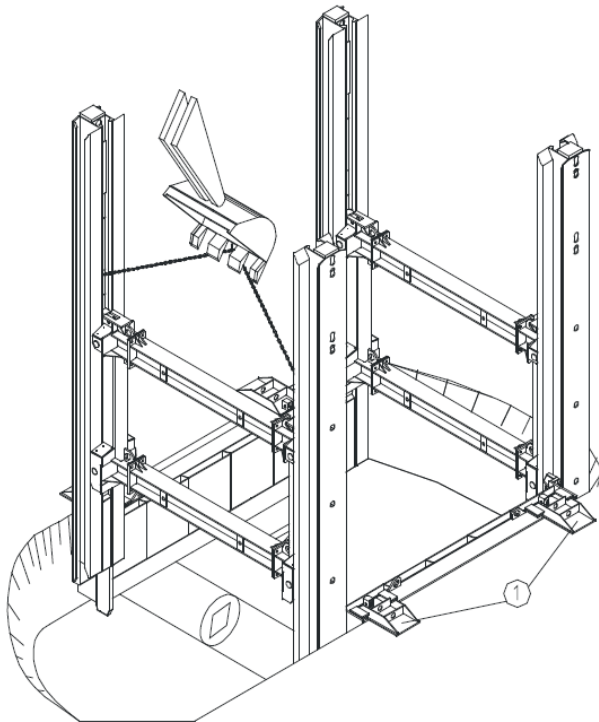
4. Align the outside walers



The alignment of the first shoring field is crucial for establishing precise shoring which runs parallel to the axis of the trench.

To this end, the clear distance between the outside walers at both ends on the one hand and the measurement across the two diagonal axes of the shoring field on the other must match.

5. Place the 2nd guide frame

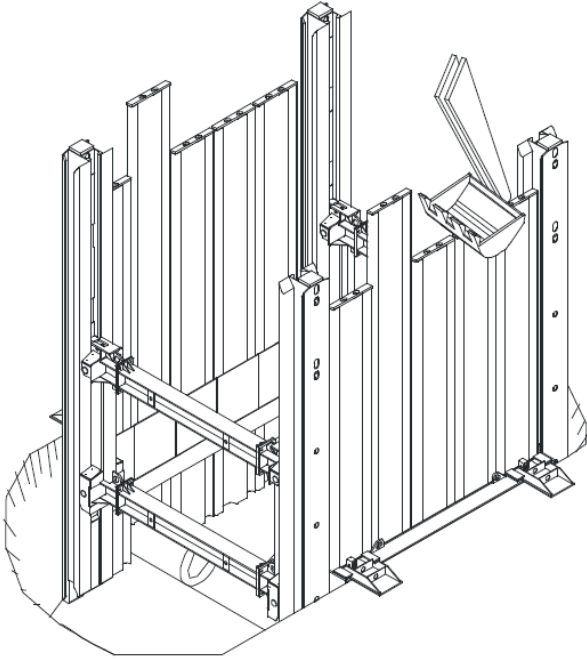


The second frame is guided over the free-standing guide profile of the outside walers using a hoist and positioned in the bottom of the trench.

After positioning, the shoring field should be aligned again because this makes the installation and removal of the subsequent shoring fields easier.

The cavity between the soil and the outside waler must be backfilled and compacted.

6. Insert the sheet piles

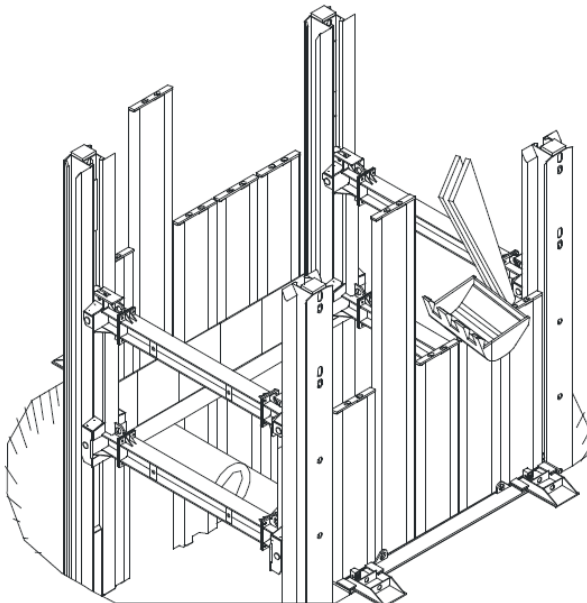


After positioning of the sheet piles in the two opposite outside walers, further trench excavation is done underneath the linear shoring supports and the sheet piles according to the instructions of the on-site construction supervisor with alternating pushing and/or application of pressure to the sheet piles and the linear shoring supports. All shoring components must be introduced using pressure, and never using impacts or pounding.

The outside walers remain fixed in their position.

When lowering the shoring system, it is essential that the strut cart is positioned in a vertical direction in accordance with the static specifications (observe cantilever lengths).

7. Lower the shoring field

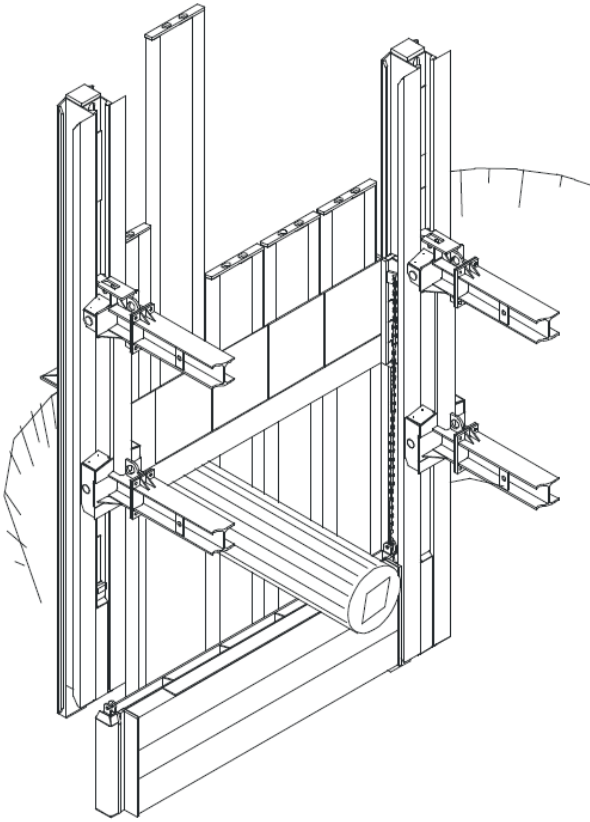


Further trench excavation and alternating pushing of the sheet piles and the guide frame is now done. Here, the outside walers remain in their position and are held by the support brackets (pos. 1).

The soil is excavated underneath the linear shoring supports before the lowering process according to the instructions of the construction supervisor.

The permissible vertical support cantilever lengths must be observed during lowering of the shoring system.

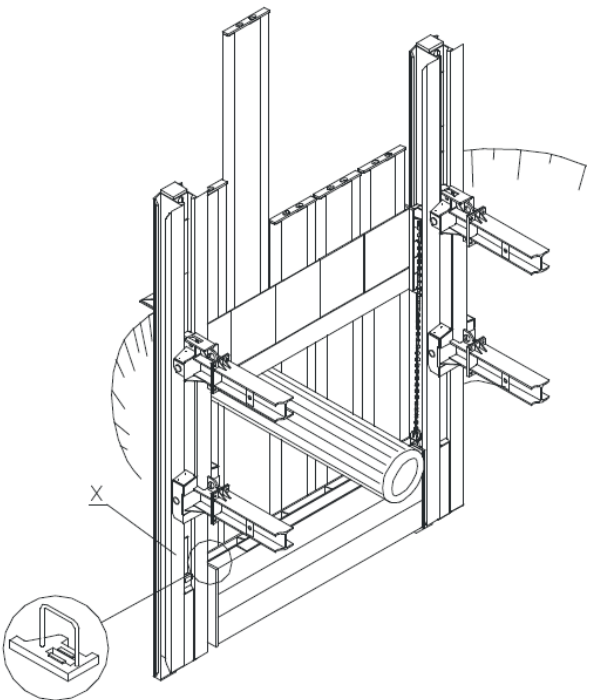
8. Insert the inside walers



After exposing the line which crosses the trench, the inside walers must be inserted on both opposite sides of the shoring in accordance with the static specifications. One end of the inside walers is pushed into the open guide of a linear shoring support. The linear shoring support pair located at the other end of the walers may not be lowered to the bottom of the trench (see adjacent drawing). Only in the next work step (work step 9) is this linear shoring support pair pushed over the guide profile on the inside waler standing on the bottom of the trench.

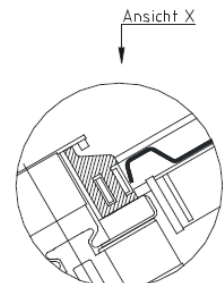
Through insertion of the inside waler, the cantilever length of the outer sheet piles is reduced and the piles are prevented from “moving inward” into the trench.

9. Apply pressure to the support pair

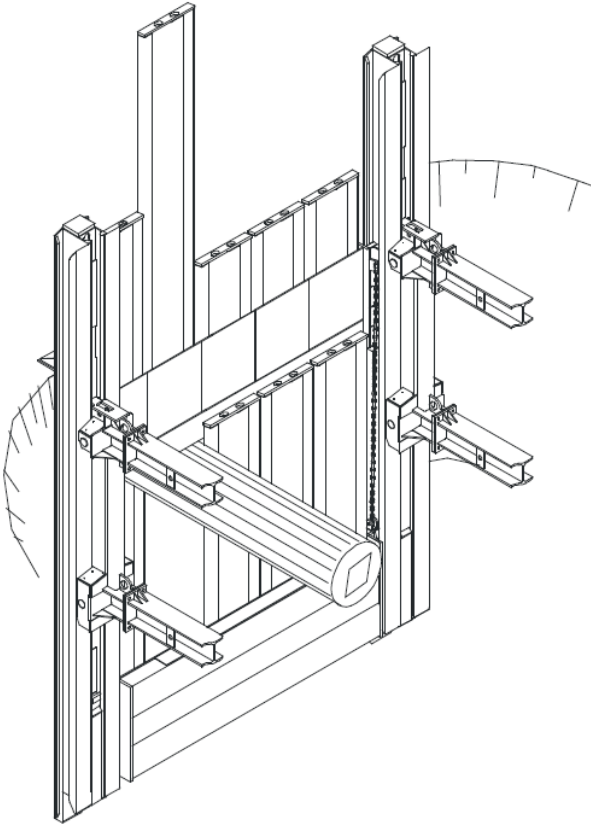


Once the guide frame has been lowered, the inside waler is connected with the linear shoring support guides on both sides. In this position, the inside waler must be locked using suspension chains. The chains engage with the lifting lugs provided on the front wall of the outside waler and on the top of the inside waler. The chain can be shortened using shortening hooks such that the waler is positioned at the desired height. A locking mechanism (detail X) must then be put in place and bolted on the right and the left.

Only now is pressure applied to the sheet piles guided in the outside waler. Care must be taken to ensure that there is a frictional connection between the inside waler and the sheet piles.



10. Insert the inside sheet piles and lower to the final depth

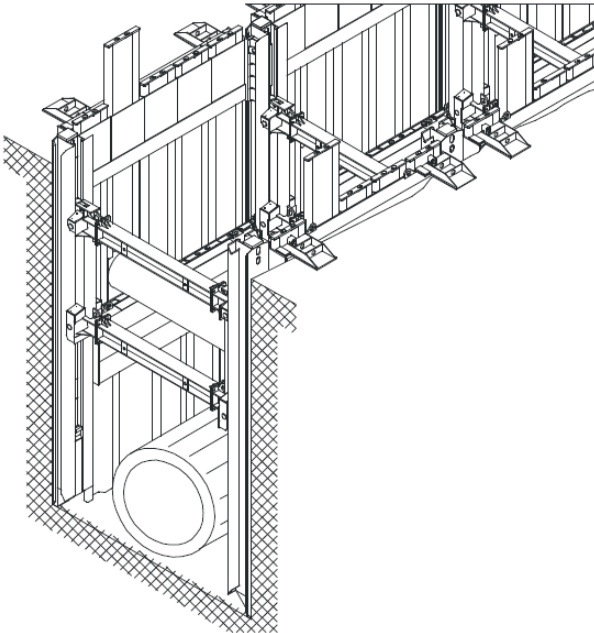


The sheet piles are not inserted into the guide slots.

Continuing trench excavation with further lowering of the shoring up to the final depth is done solely through application of pressure to the sheet piles guided in the inside waler. The maximum permissible cantilever lengths for the sheet piles correspond to the static calculations. Additional waler supports for the inside and the outside waler should be used where applicable in order to reduce the cantilever lengths.

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 have been positioned in a vertical direction in accordance with the static specifications. Installation is done in accordance with the work steps 1 to 10 previously described. Further fields are aligned with the precisely installed first field. The clear trench width and the diagonal distance work step 4 must be checked during insertion of the shoring elements for each subsequent field.

11. Pipe laying



Once the desired length of shoring has been fully and completely lowered, pipe laying work can begin.

The strut carts must be positioned in a vertical direction in accordance with the static specifications and secured using pins or chains.

For removal, see explanations in the “Double slide rail linear shoring removal instructions” section.

4 Head end shoring with trench sheets

4.1 Installation instructions 6.13 m guide frame with rectangular strut cart, adapter head end shoring and spacers

All safety instructions in the chapter “Occupational safety and general information in accordance with DIN EN 13331-1/-2” must be observed before the beginning of works (see chapter 2 Occupational safety and general information in accordance with DIN EN 13331-1/-2 on page 3)!

The guide frame is fully pre-assembled horizontally in a sufficiently large area which is as even as possible.

Use square timber!

In order to make assembly easier – particularly on uneven terrain – all components should be placed on square timber.

Determining the size of the pre-assembly area.

The size of the pre-assembly area depends on the size of the trench to be shored up and the module lengths used.

Guideline:

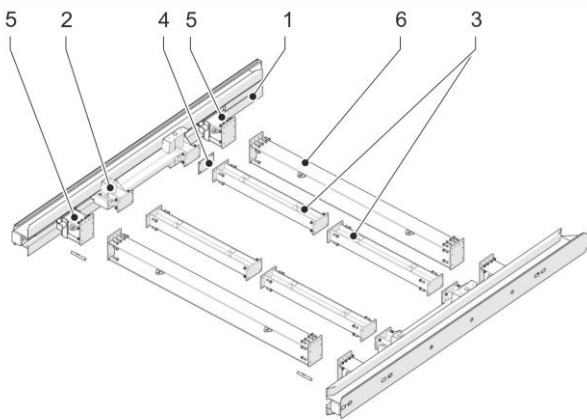
Size of the pre-assembly area = (length of the longest linear shoring support + 2 m) x (maximum shoring width + 2 m) + area for storing the shoring panels + area for storing the rest of the material.

Example:

- Length of the longest linear shoring support = 8.13 m
- Shoring width = 3 m

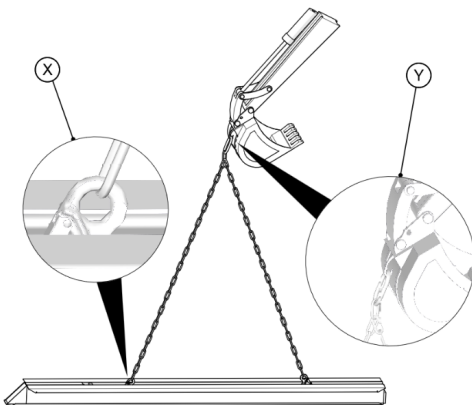
Pre-assembly area size = 10 m x 5 m = 50 m² + area for storing the shoring panels + area for storing the rest of the material.

1. Guide frame system overview



- (1) two linear shoring supports
- (2) two strut carts (with compensating rollers)
- (3) two extension bar combinations
- (4) one distance plate
- (5) four head end shoring adapter pieces
- (6) two head end shoring extension bars

2. Position the linear shoring support on the ground

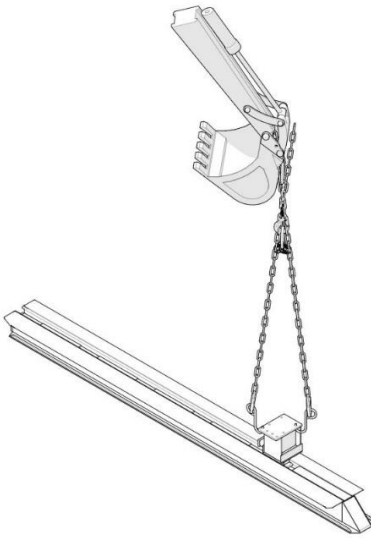


The linear shoring support must be positioned on the ground.

Attach the linear shoring support to the transport lugs on the lifting device intended for this purpose (detail X and Y).

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

3. Insert the head end shoring adapter pieces and strut carts

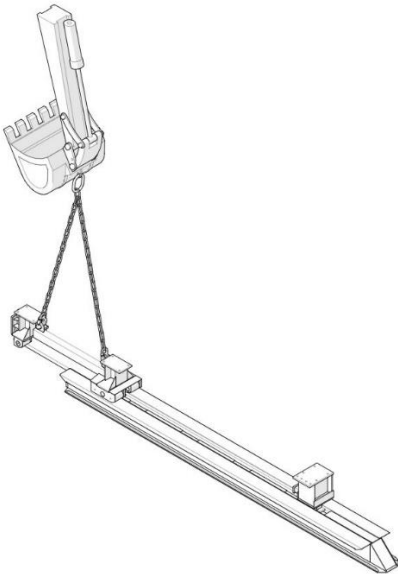


In the first step, a head end shoring adapter piece must be inserted on each linear shoring support.

Attach a head end shoring adapter piece to each of the two attachment points.

Insert the head end shoring adapter piece into the linear shoring support to the lower attachment point.

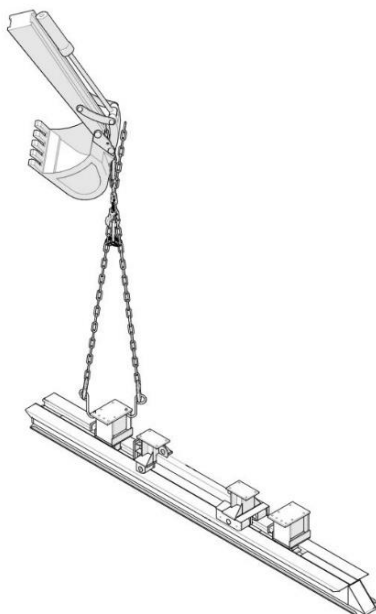
In order to ensure frictional locking on the sheet pile contact surfaces, the load attachment plates on the adapter must all point in the same direction.



In the second step, a strut cart must be inserted.

Attach a strut cart to each of the two attachment points.

Insert a strut cart with compensating roller into the linear shoring support to the head end shoring adapter piece.

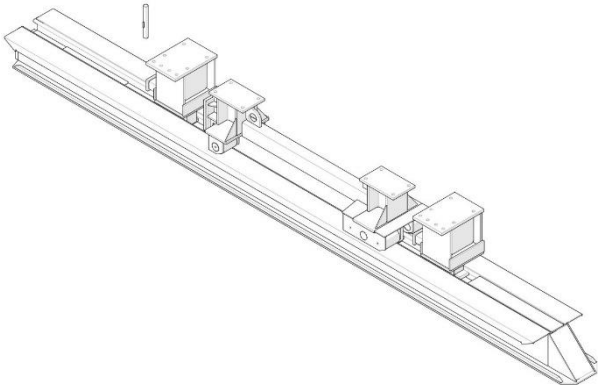


In the second step, the second head end shoring adapter piece must be inserted.

Attach a head end shoring adapter piece to each of the two attachment points.

Insert the head end shoring adapter piece into the linear shoring support to the strut cart.

4. Pin the strut cart



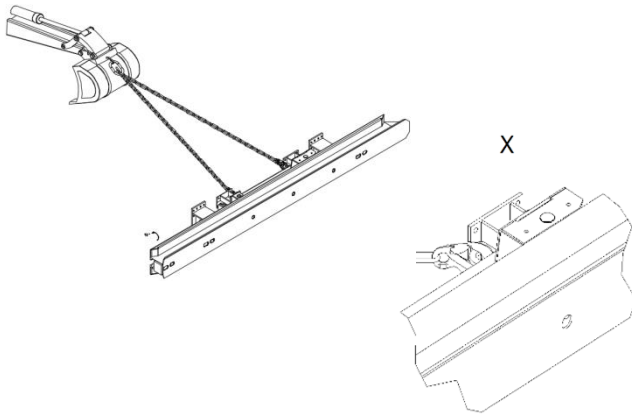
Securing of the strut cart in the linear shoring support is done by inserting a pin into the mounting hole provided in the upper section of the support, above the strut cart.

In the lower part of the linear shoring support, a fixed stop limits the downward movement of the strut cart.

Insert the bolt.

Turn the bolt through 180°.

5. Turn the linear shoring support over



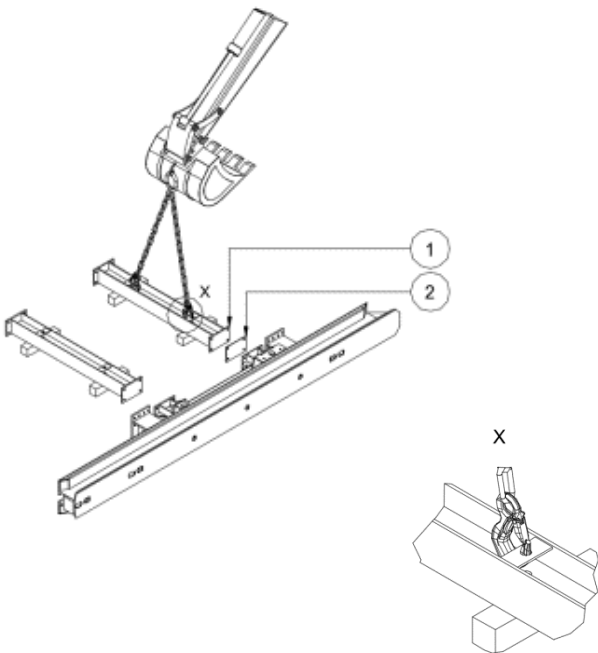
The linear shoring support must be turned through 90° on the side.

Attach the linear shoring support to the two suspension points on the strut cart (detail X).

Turn the linear shoring support through 90° on the side.

The turned linear shoring support must be secured against tipping over.

6. Assembly with non-reinforced extension bars



The extension bars are positioned and screwed together with the linear shoring strut cart.

Attach the extension bar (1) to the suspension loops.

Introduce the extension bar (1) into the strut cart's connection plate.

Insert the distance plate (2) between the lower connection joint pointing towards the pointed end of the support. This results in the A position required for installation of the frame.

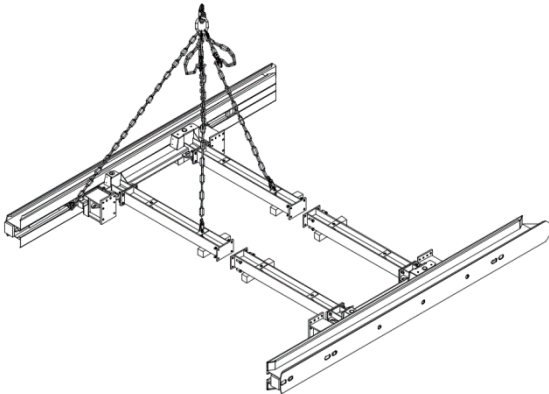
Screw the components together with the appropriate screws and nuts.

Only tighten the screws by hand to begin with in order to make the assembly of further extension bars easier where applicable.

Assembly of the 2nd half of the guide frame

Repeat steps 2 to 6 (first half of the guide frame) for assembly of the second half of the guide frame.

7. Assemble of the complete guide frame



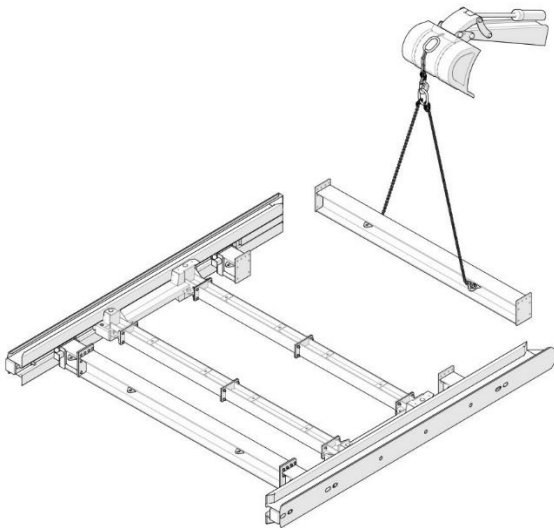
The pre-assembled halves of the frame are put together. The complete guide frame is assembled.

Attach half of the frame using a 4-strand chain.

Introduce half of the frame to the second frame.

Connect the extension bar joints with screws and nuts.

8. Assembly of the head end shoring extension bars



Next, the head end shoring extension bars are now assembled. To this end, the corresponding extension bars are introduced, using a suitable lifting device, to the connecting flanges of the adapter and screwed together with the appropriate screws and nuts.

In order to make assembly easier, particularly on uneven terrain, we recommend placing all components on square timber.

Tighten all screw connections.

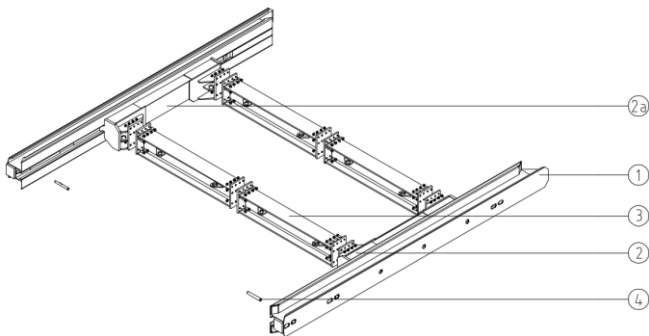
Assembly of the 2nd guide frame

Two fully assembled guide frames are required to construct a shoring field with head end shoring.

Repeat the assembly preparation and all work steps (guide frame assembly) to assemble the 2nd guide frame.

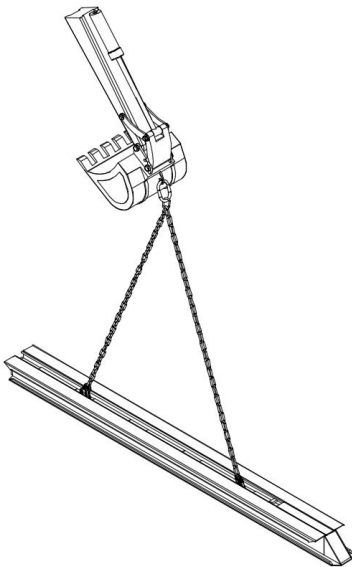
4.2 Installation instructions 6.13 m guide frame with head end shoring strut cart

1. System overview guide frame



- (5) Linear shoring support / slide rail
- (6) Head end shoring strut cart left
- (2a) Head end shoring strut cart right
- (7) Spacer
- (8) Locking pin

2. Positioning the linear shoring supports on the terrain

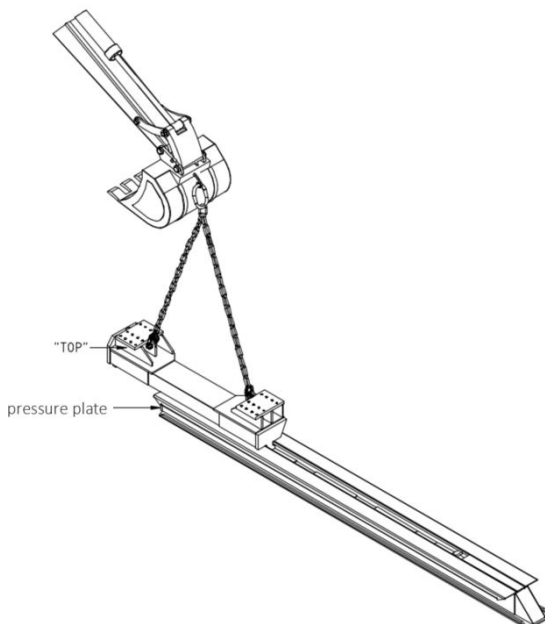


The linear shoring supports must be positioned on the terrain.

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

Place the linear shoring supports on level, sufficiently stable terrain with the back panel facing down.

3. Insert strut cart

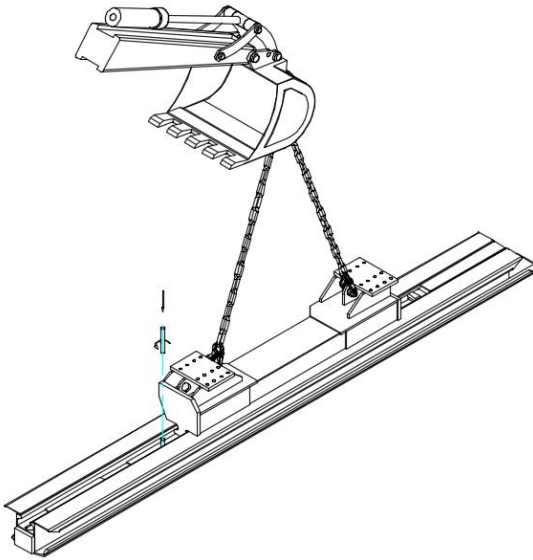


One strut cart must be inserted on each linear shoring support.

Attach the strut cart to the two attachment points.

With the pendular roller first insert into the linear shoring support until the bottom attachment point.

4. Bracing strut cart



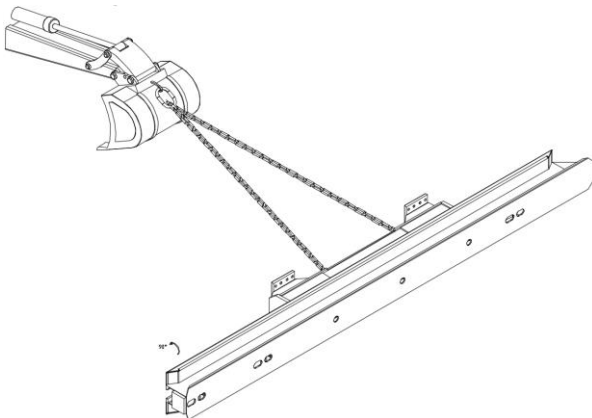
The strut cart must be secured in the linear shoring support in both directions. This is done by inserting a locking pin into the provided location hole in the upper part of the beam, above the strut cart.

In the lower part of the linear shoring support, a fixed stop serves to fix the strut cart downwards.

Insert pin.

Turn pin by 180°.

5. Turning linear shoring support



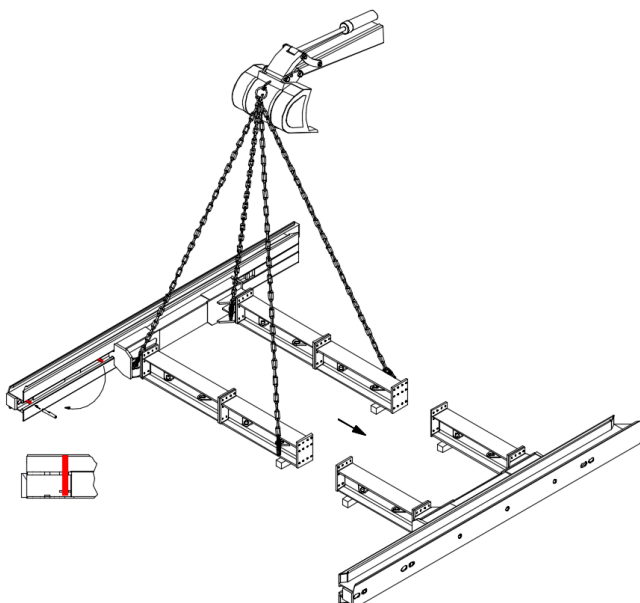
The linear shoring support must be turned 90° to the side.

Fasten the linear shoring support to the strut cart at the two attachment points.

Turn the linear shoring support 90° to the side.

The turned linear shoring support must be secured against tipping over.

6. Installation of the complete guide frame



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

Fasten half of the frame with a 4-strand chain.

Move half of the frame to the second half.

Connect the joints of the spacers with screws and nuts.

Finally, tighten all screw connections.

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

Insert the locking pin in the topmost locking possibility of the linear shoring support.

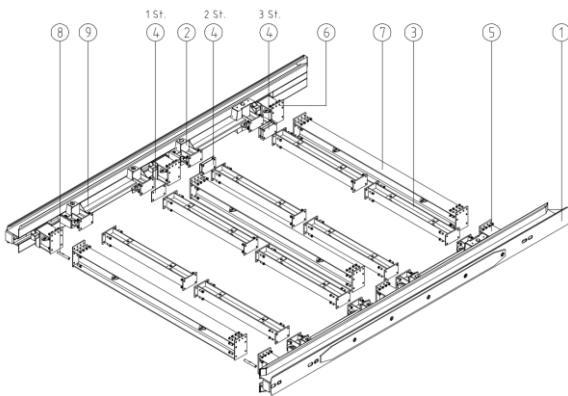
Turn locking pin by 180°.

4.3 Installation instructions 7.13 m guide frame with rectangular strut cart, adapter head end shoring and spacers

Installation of the 7.13 m guide frame with rectangular strut cart, head end shoring adapters and spacers is assembled as described in section 4.1.

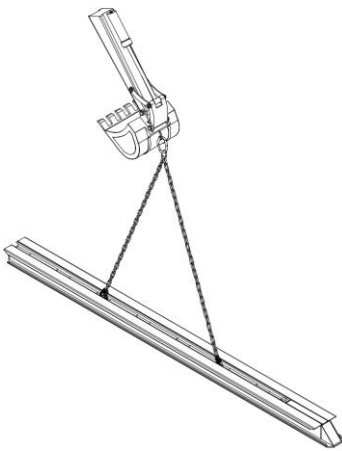
4.4 Installation instructions 8.13 m guide frame with rectangular strut carts, adapter head end shoring and spacers

1. System overview guide frame



- (1) Linear shoring support / slide rail
- (2) Rectangular strut cart with pendular roller
- (3) Spacer strut cart
- (4) Distance plate
- (5) Adapter right
- (6) Adapter left
- (7) Spacer Reichel
- (8) Locking pin
- (9) Rectangular strut cart

2. Positioning the linear shoring supports on the terrain

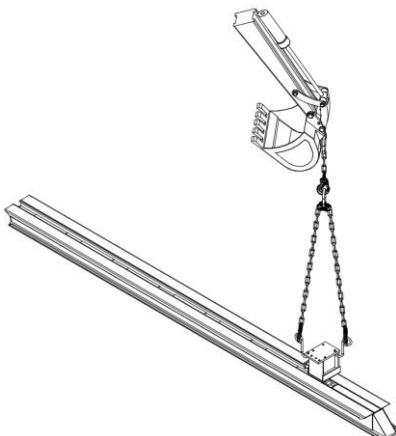


The linear shoring supports must be positioned on the terrain.

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

Place the linear shoring supports on level, sufficiently stable terrain with the back panel facing down.

3. Head end shoring adapter pieces and strut cart

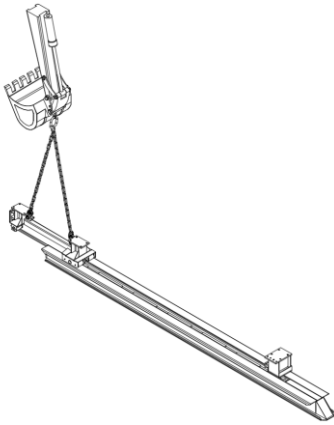


In the first step, a head end shoring adapter piece must be inserted into each linear shoring support.

Attach the head end shoring adapter piece to the two attachment points.

Insert the head end shoring adapter piece into the linear shoring support until the bottom attachment point.

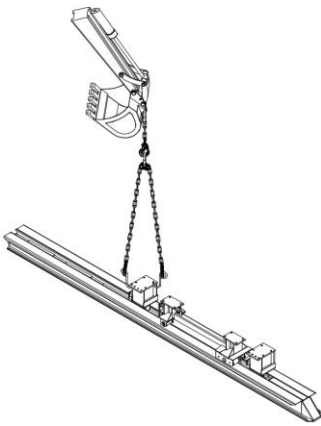
In order to ensure a force-fitted contact surface of the trench sheets, the flange plates of the adapters must all point in one direction.



In the second step, the rectangular strut cart with pendular roller must be inserted.

Attach the strut cart to the two attachment points.

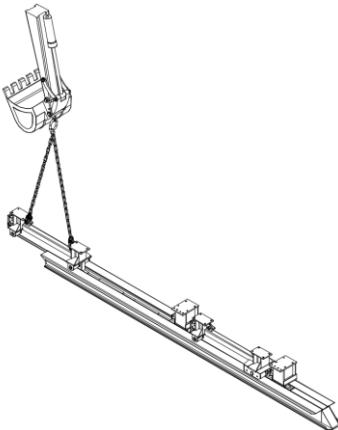
With the pendular roller first insert the strut cart into the linear shoring support until the head end shoring adapter piece.



In the third step, insert the second head end shoring adapter piece.

Attach the head end shoring adapter piece to the two attachment points.

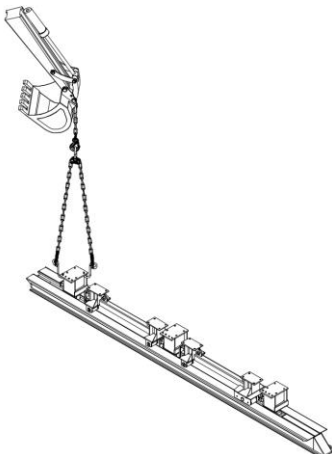
Insert the head end shoring adapter piece into the linear shoring support close to the strut cart.



In the fourth step, the second strut cart must be inserted.

Attach the strut cart to the two attachment points.

With the pendular roller first insert the strut cart into the linear shoring support close to the head end shoring adapter piece.

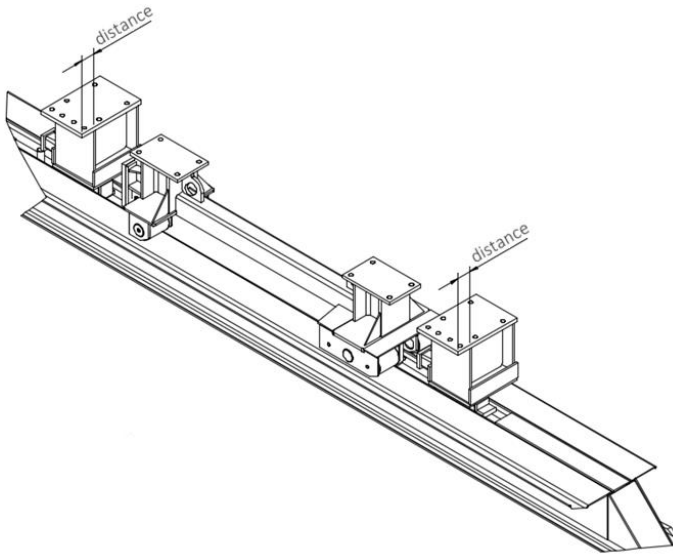


In the fifth step, insert the third head end shoring adapter piece must be inserted.

Attach the head end shoring adapter piece to the two attachment points.

Insert the head end shoring adapter piece into the linear shoring support close to the strut cart.

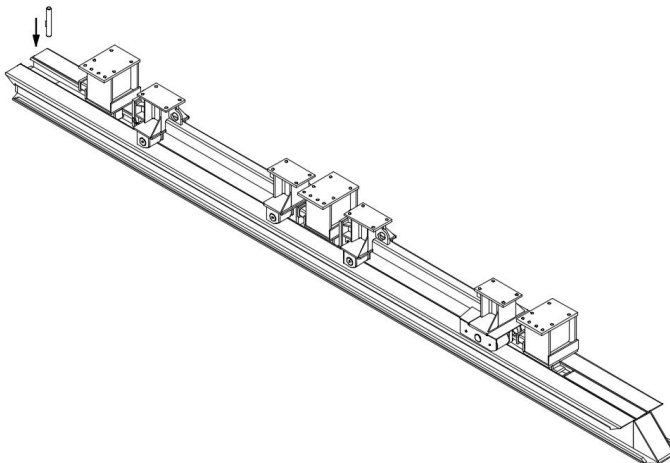
4. Aligning the head end shoring adapter pieces



The head end shoring adapter piece must be mounted inwards.

The pressure piece of the head end shoring adapter pieces must point towards the top of the linear shoring support.

5. Bracing strut cart



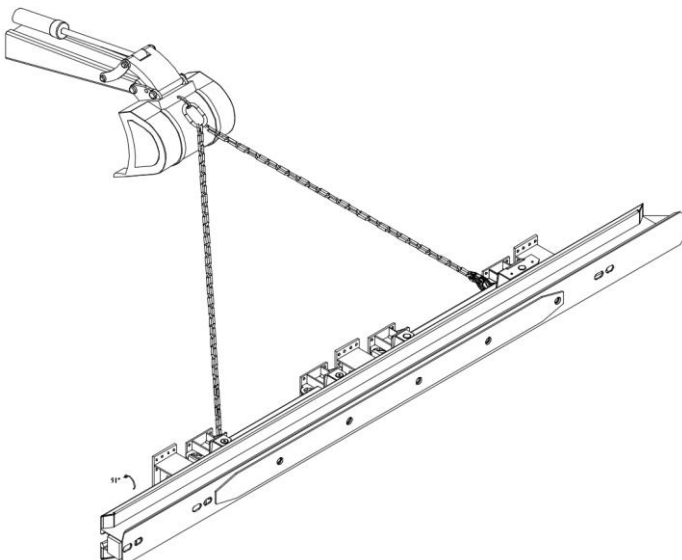
Securing the strut cart in the linear shoring support is done by inserting a locking pin into the provided location hole in the upper part of the beam, above the second strut cart.

In the lower part of the linear shoring support, a fixed stop serves to fix the strut cart downwards.

Insert pin.

Turn pin by 180°.

6. Turning linear shoring support



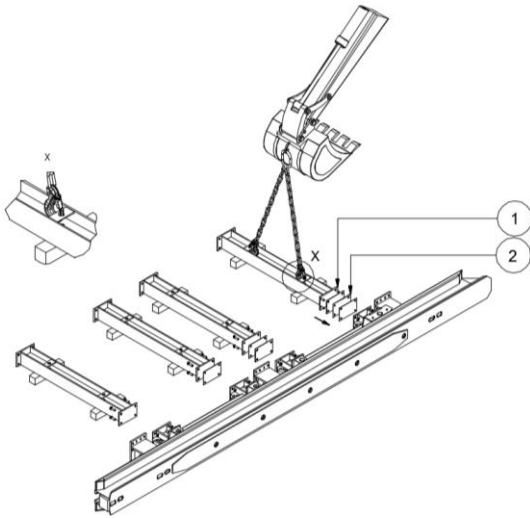
The linear shoring support must be turned 90° to the side.

Fasten the linear shoring support to the strut cart at the two attachment points.

Turn the linear shoring support 90° to the side.

The turned linear shoring support must be secured against tipping over.

7. Installation of the strut cart spacers



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

Attach the spacer (1) to the suspension brackets.

Bring the spacer (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.

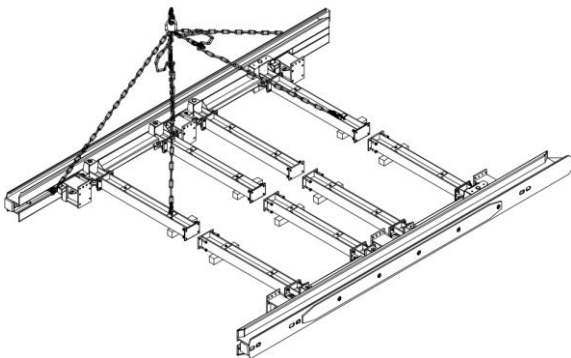
Screw components together with the appropriate screws and nuts.

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

Installation the second half of the guide frame

Repeat the steps 2 to 6 (first half of the guide frame) to mount the second half of the guide frame.

8. Installation of the complete guide frame



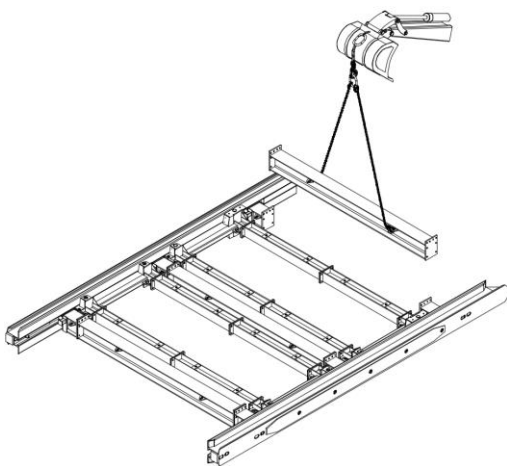
The pre-assembled frame halves are brought together. The complete guide frame is mounted.

Fasten the second half of the frame with a 4-strand chain.

Move the second half of the frame to the first half.

Connect the joints of the spacers with screws and nuts.

9. Installation of the head end shoring spacers



Finally, the head end shoring spacers are mounted. For this purpose, the corresponding spacers are brought up to the connecting flanges of the adapters using a suitable lifting device and screwed together with the corresponding screws and nuts.

To facilitate installation, especially on uneven ground, it is recommended that all components be placed on squared timber.

Tighten all screw connections.

Installation of the second guide frame

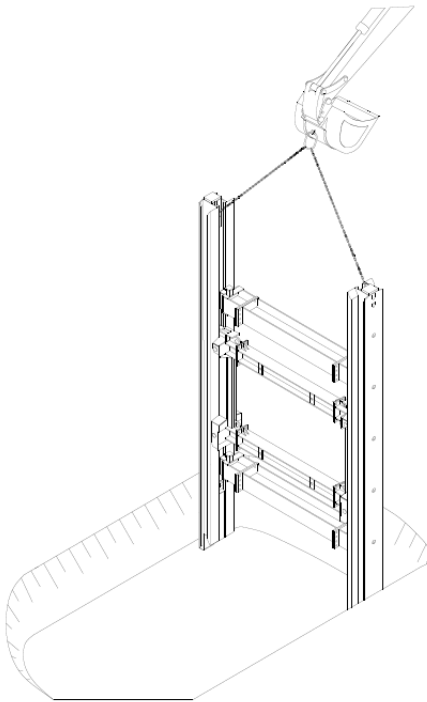
Two fully mounted guide frames are required to create a shoring field with head end shoring.

Repeat the installation preparation and all work steps (installation of guide frame) to install the second guide frame.

4.5 Assembly instructions head end shoring with rectangular strut cart, adapter head end shoring and spacer

All safety instructions in the chapter "Occupational safety and general information in accordance with DIN EN 13331-1/-2" must be observed before the beginning of works (see chapter 2 Occupational safety and general information in accordance with DIN EN 13331-1/-2 on page 3)!

1. Place the 1st guide frame



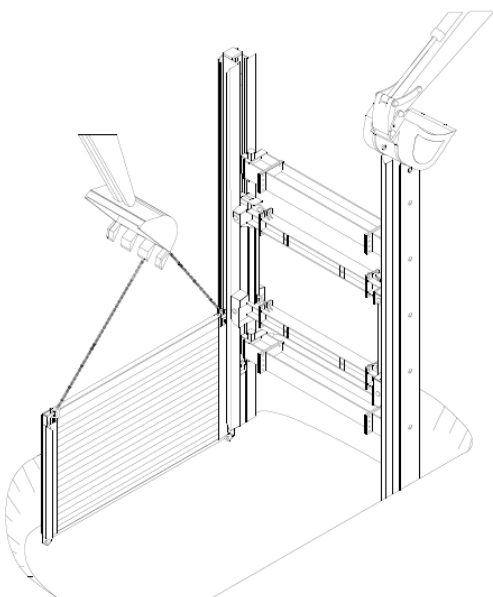
After calibration of the trench line, initial excavation for the 1st shoring field is done according to the instructions of the construction supervisor.

Width: required clear trench width + approx. 0.70 m

Length: module length + approx. 0.70 m
(or length of the outside panels + approx. 1.00 m)

The first guide frame is positioned centrally to the trench axis and at a right angle to the line of the trench using a hoist and a suitable sling (GS approval). The strut cart and head end shoring adapter pieces sit on the stops which are permanently welded only the linear shoring support at the bottom and are secured at the top with a pin (see assembly instructions). Where necessary, the frame must be locked in the vertical (e.g. using a second hoist).

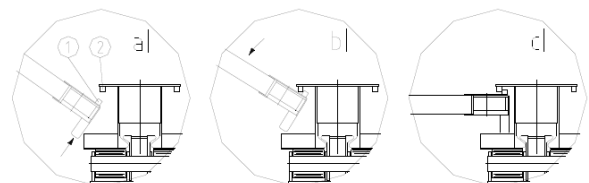
2. Insert the outside base panels



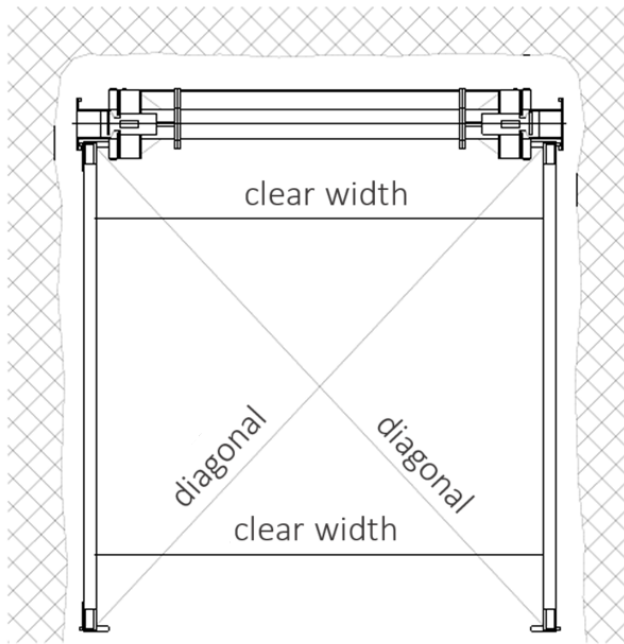
The outside base panels are swiveled into the support profile using a lifting device (see images a, b, c). Care must be taken here to ensure that the rear square of the shoring panels (1) catches behind the square in the linear shoring support (2).

Once swiveled in, the shoring panels are positioned in the bottom of the trench.

The lower pin, where previously additionally inserted to secure the strut cart, must always be removed before the linear shoring frame is lowered.

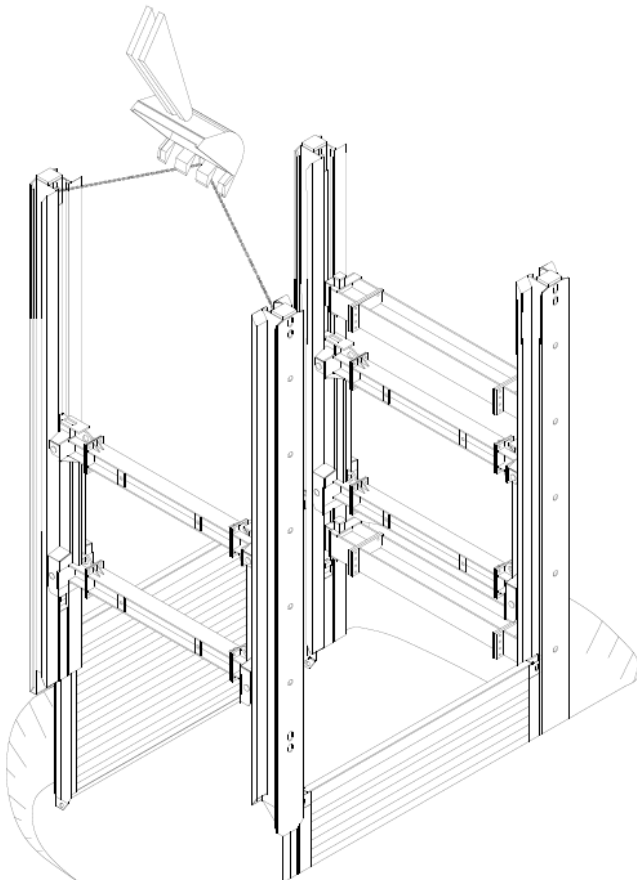


3. Align the shoring panels



The alignment of the first shoring field is crucial for establishing precise shoring which runs parallel to the axis of the trench. To this end, the clear distance between the shoring panels at both ends of the panels on the one hand and the measurement across the two diagonal axes of the shoring field on the other must match.

4. Place the 2nd guide frame

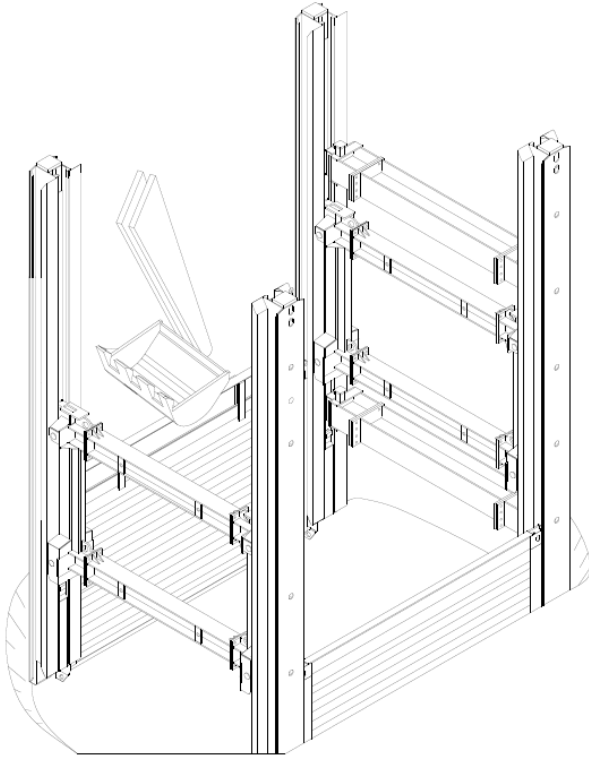


The second frame is guided over the guide profile of the outside panels, which is still free-standing, and positioned in the bottom of the trench.

After positioning, the shoring field should be aligned again, as described under work step 3, because this makes the installation and removal of the subsequent shoring fields easier.

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

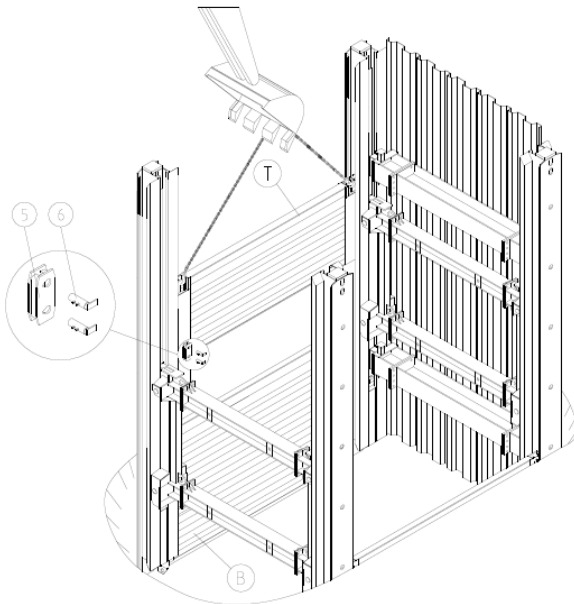
5. Lower the shoring field



Before the actual lowering process, the soil underneath the shoring panels is excavated according to the instructions of the construction supervisor. The vertical supports, shoring panels and strut cart are pressed down alternately, whereby pressure beams should be used in particular for the shoring panels and pressure plates should be used in particular for the shoring supports. All shoring components must be introduced using pressure, and never using impacts or pounding.

When lowering the system, it is essential that the strut cart is positioned in a vertical direction in accordance with the static specifications (observe cantilever lengths).

6. Insert the outside top panels and position the sheet piles

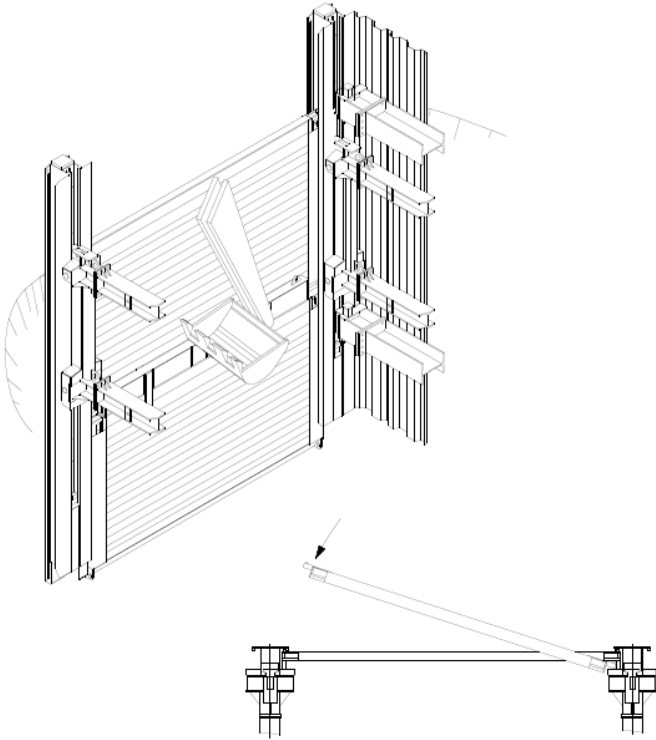


Depending on the required trench depth, the top panels (T) are inserted into the support guides after complete lowering of the outside base panels (B).

The base and top panels must be connected using connectors (5) and bolts (6).

The sheet piles are placed and lowered at the head end. The statically specified cantilever lengths must be complied with here too.

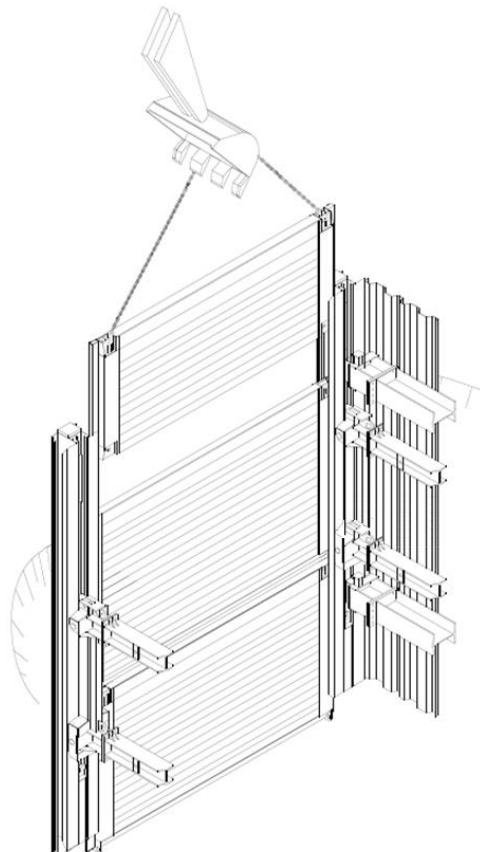
7. Insert the inside base panels



The inside base panels are swiveled between the guide frame, guided into the U-shaped guide rails on the outside panels and lowered to the bottom of the trench. Further trench excavation is done through lowering of the inside base panels, the guide frame and the strut cart.

When lowering the system, it is essential that the strut cart is positioned in a vertical direction in accordance with the static specifications (observe cantilever lengths).

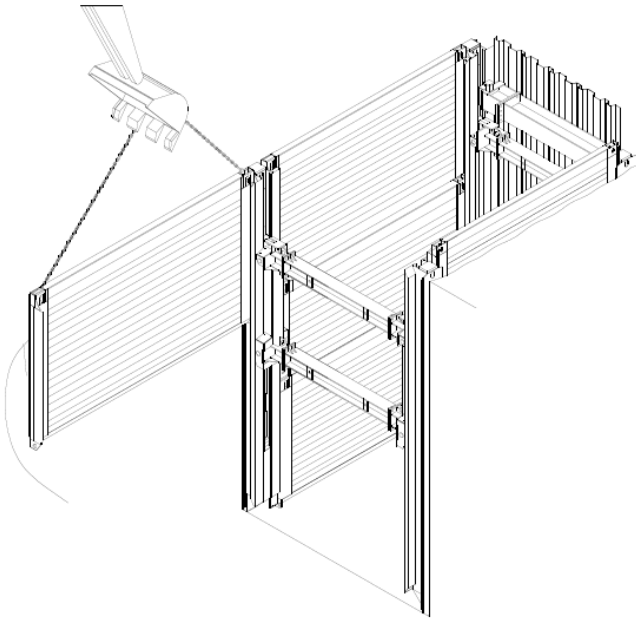
8. Insert the inside top panels



According to the information under work step 6, further adjustment of the height of the shoring wall can be done through insertion of the inside top panels (T).

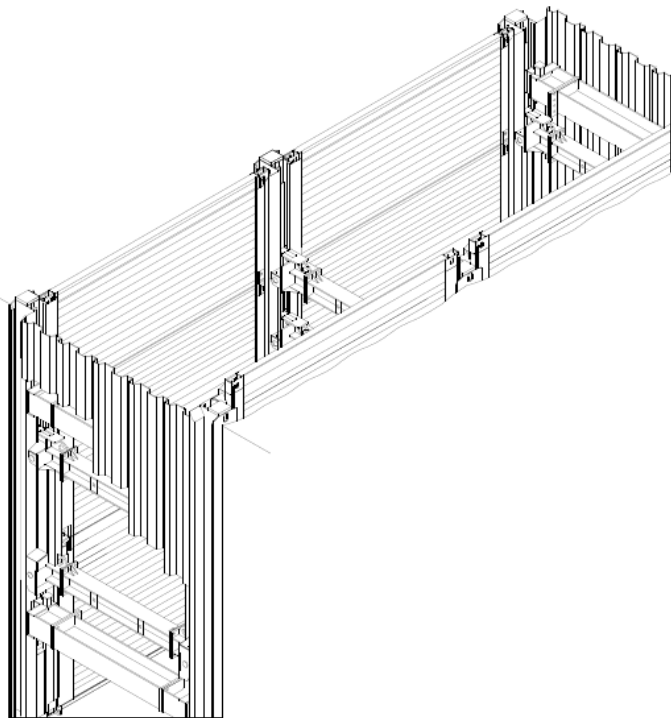
The base and top panels must be connected using connectors (5) and bolts (6).

9. Install the next shoring field and place the second head end shoring



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 have been positioned and fixed in a vertical direction in accordance with the static specifications. Installation is done in accordance with the work steps 1 to 8 previously described. Further fields are aligned with the precisely installed first field. The clear trench width and the diagonal distance (work step 3) must be checked during insertion of the shoring panels for each subsequent field.

10. Beginning of the pipe laying work



Once the desired length of shoring has been fully and completely lowered to the bottom of the trench, pipe laying can begin.

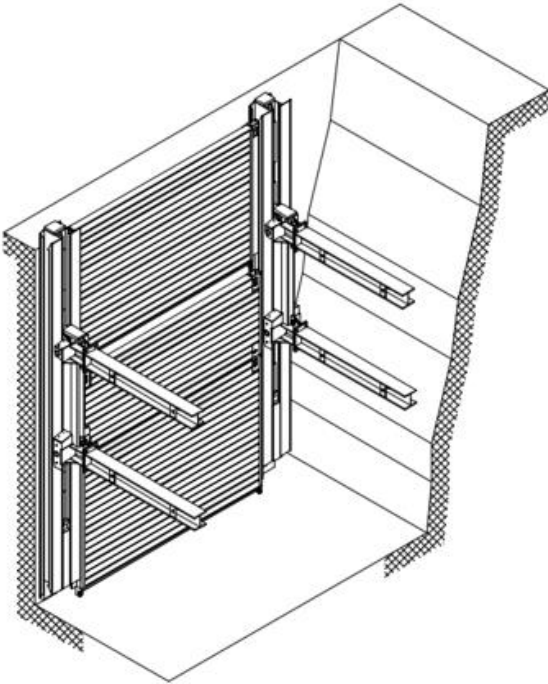
The strut carts must be positioned and fixed in a vertical direction in accordance with the static specifications.

4.6 Assembly instructions HEB beam at head end

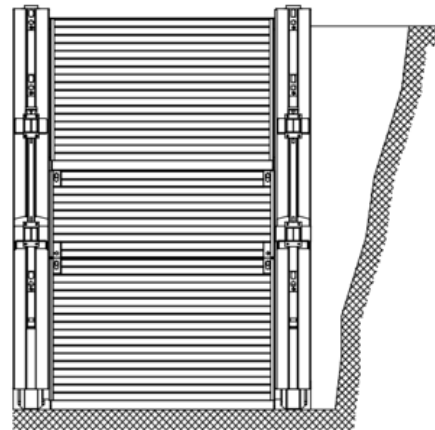
Before starting the work, it is obligatory to observe all safety precautions from section "Occupational health and safety and general remarks according to DIN EN 13331-1/-2" (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 from page 3)!

For stable soils and in accordance with the instructions of the site management, the HEB beams and trench sheets can be installed after and / or at the same time as the shoring is lowered. For this purpose, the side at the head end should be sloped as much as possible.

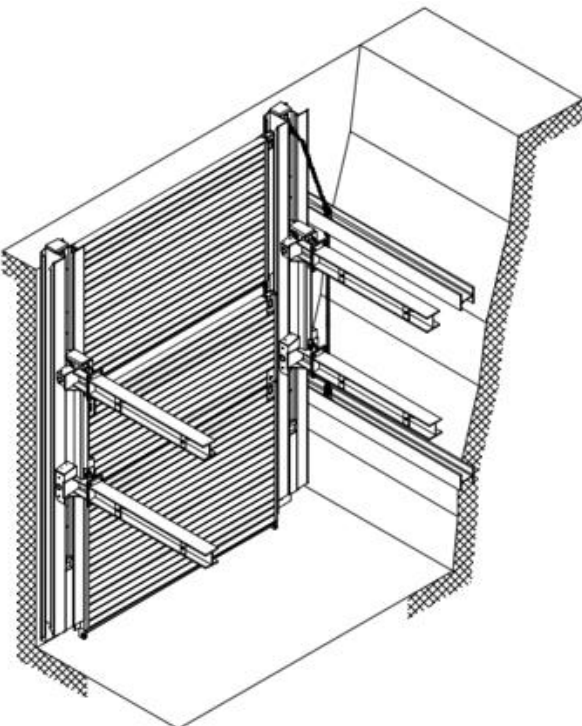
1. Lowering the shoring



The shoring is lowered to its final depth in accordance with the instructions of the local site management.



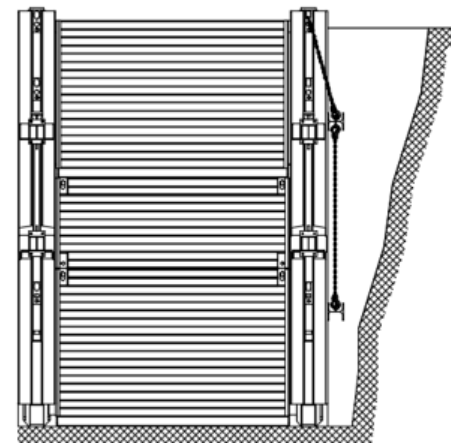
2. Inserting the HEB beams



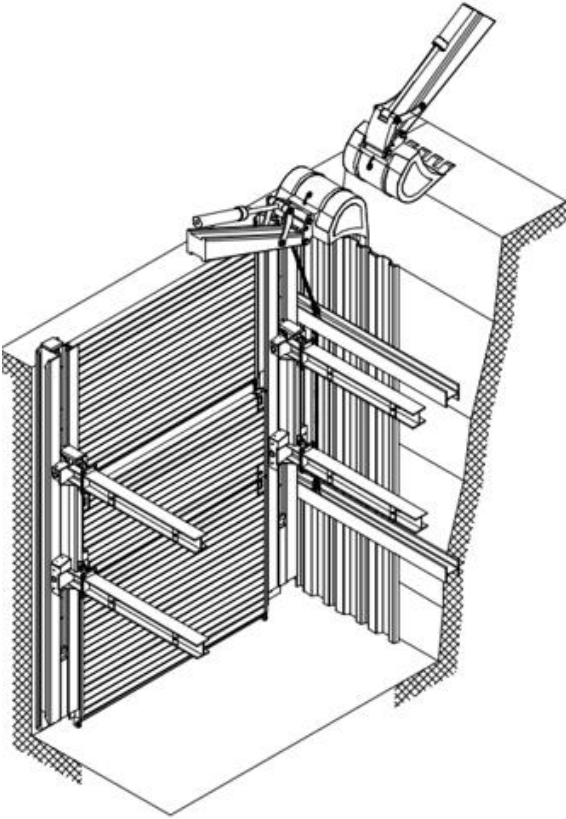
After lowering the shoring, the HEB beams are inserted.

Position one HEB beam each above and below the strut cart by means of suspension chains and secure in position. The exact positioning of the HEB beams is carried out according to static specifications.

The HEB beams rest against the outer side of the linear shoring supports.



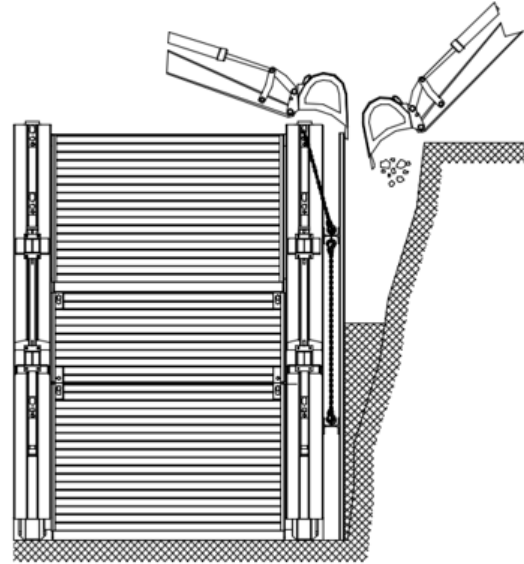
3. Inserting the trench sheets (phase 1)



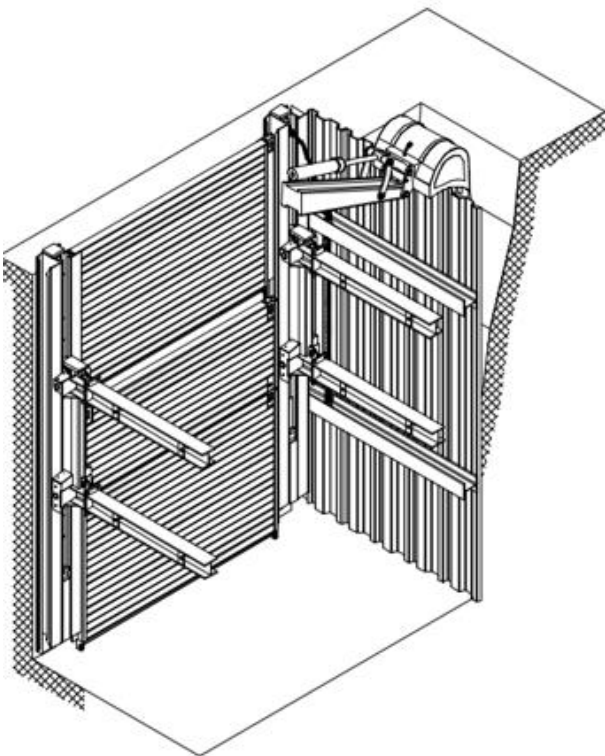
Place the trench sheets against the HEB beams from the outside.

Hold trench sheets in position using an excavator bucket.

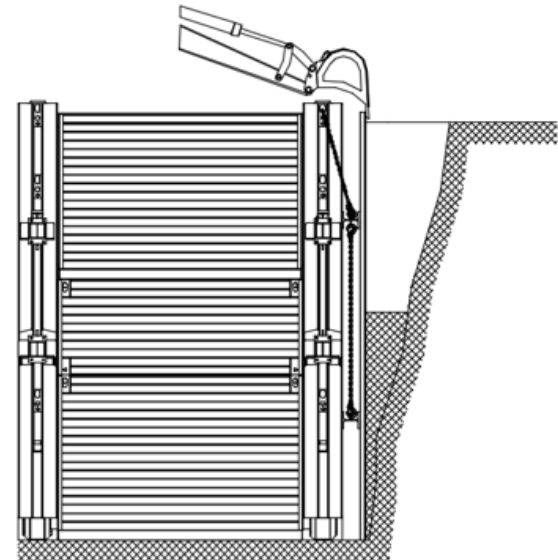
Filling and compacting the cavity between trench sheets and the natural soil by a second excavator.



4. Inserting the trench sheets (phase 2)



Inserting further trench sheets and filling and compacting the cavity in the same way as in phase 1.

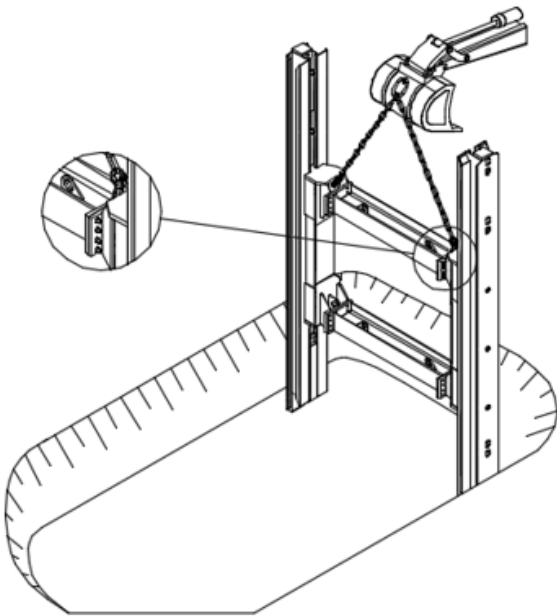


4.7 Assembly instructions head end shoring strut cart

Before starting the work, it is obligatory to observe all safety precautions from section “Occupational health and safety and general remarks according to DIN EN 13331-1/-2” (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 from page 3)!

For soils with limited stability and in accordance with the instructions of the site management, the HEB beams and trench sheets can be installed after lowering the shoring to the final depth. For this purpose, the side at the head end should initially be sloped.

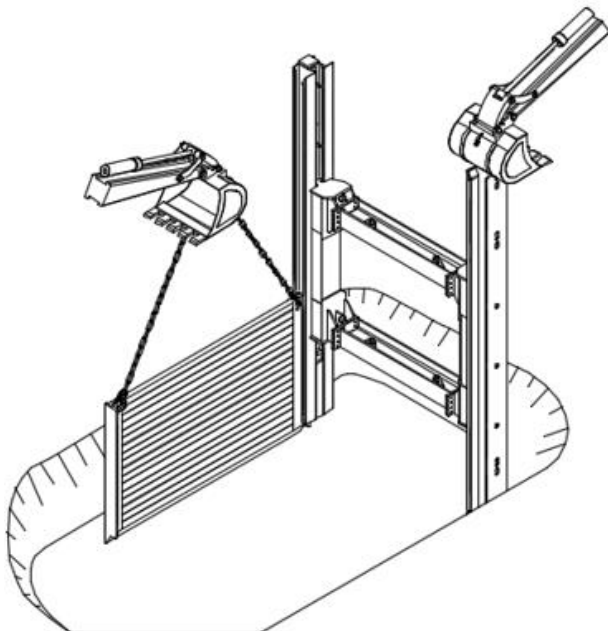
1. Setting the first guide frame



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

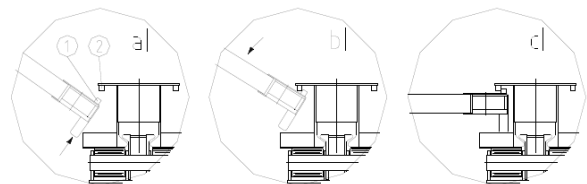
The first guide frame is adjusted by means of lifting gear and suitable sling gear (GS approval) in the center of the trench axis and at right angles to the alignment in the trench. The end cap strut cart rests at the bottom on the stops permanently welded into the linear shoring supports and is secured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

2. Inserting the outside base panels

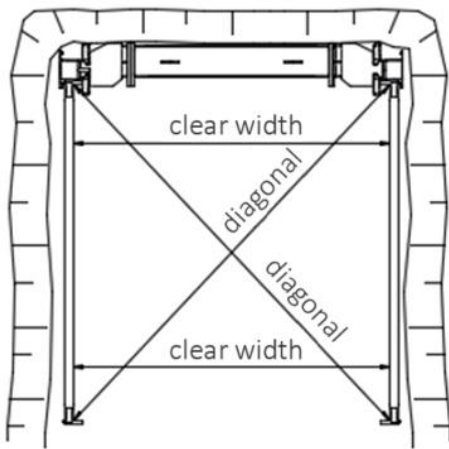


The outside base panels are swiveled into the support profile using lifting device (see image a, b, c). Ensure that the square on the rear of the shoring panels (1) engages behind the square in the linear shoring support (2).

After being swiveled in, the shoring panels are adjusted to the bottom of the trench.

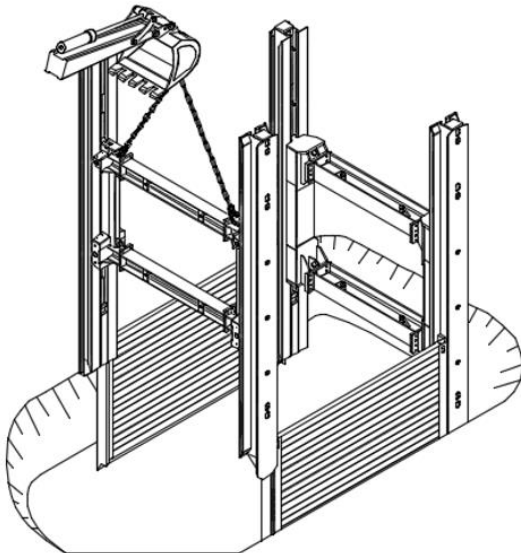


3. Alignment of the shoring panels



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

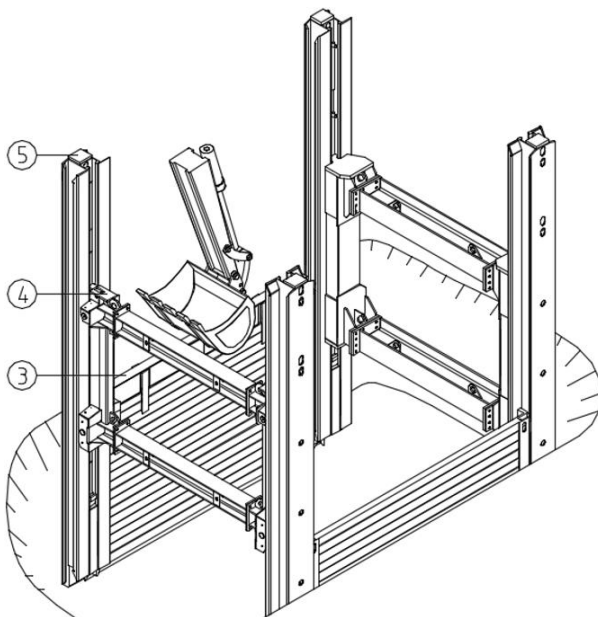


The second frame is guided over the still free guide profiles of the outside panels and adjusted to the bottom of the trench.

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 filled and compacted.

5. Lowering the shoring field

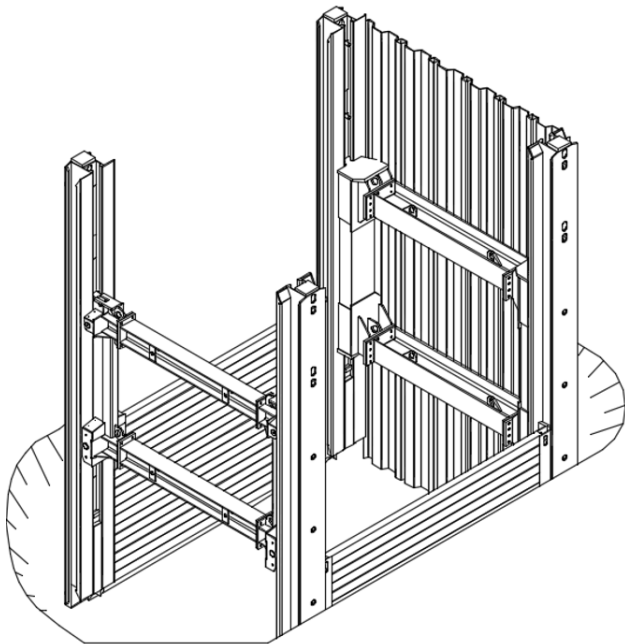


Before the actual lowering procedure, the soil beneath the shoring panels is excavated in accordance with the instructions of the site management. Vertical beams (5), shoring panels and strut carts (4) are pressed down alternately, pressure beams (3) being used in particular for the shoring panels and 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).

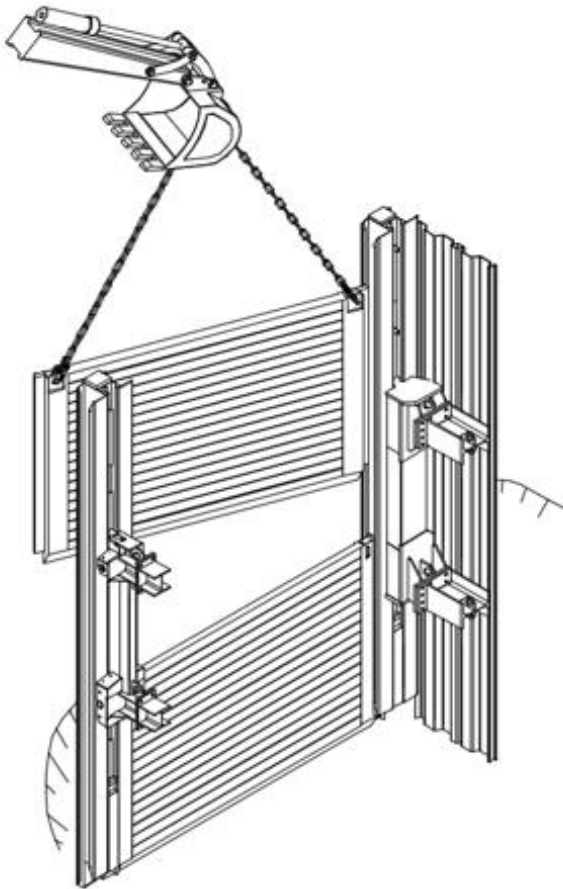
Before lowering the linear shoring frames, it is essential to remove the bottom locking pin, if previously inserted in addition to securing the strut cart.

6. Inserting the trench sheets



The trench sheets are attached and lowered at the head end. Here too, the statically specified cantilever arm lengths must be observed.

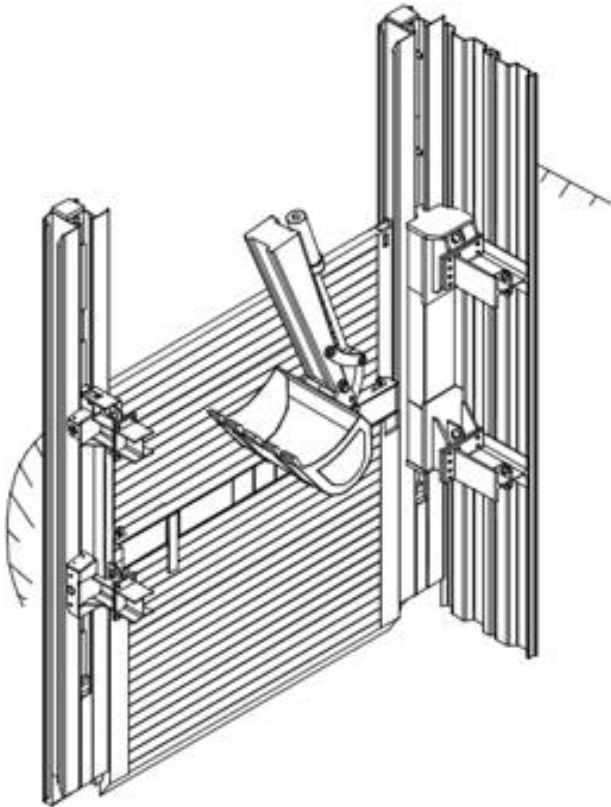
7. Inserting the outside top panels



Depending on the required trench depth, after complete lowering the outside base panels the outside top panels are inserted into the shoring supports.

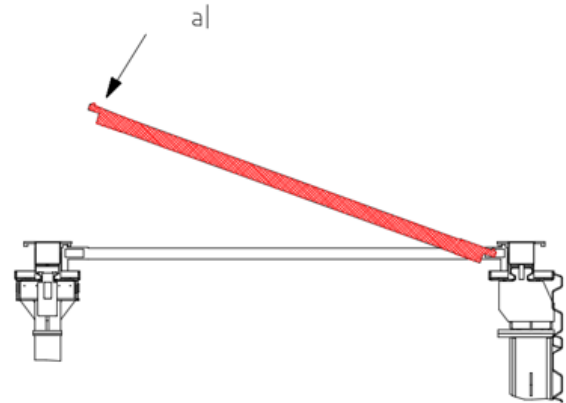
Base and top panels are to be connected by stanchions and pins.

8. Inserting the inside base panels

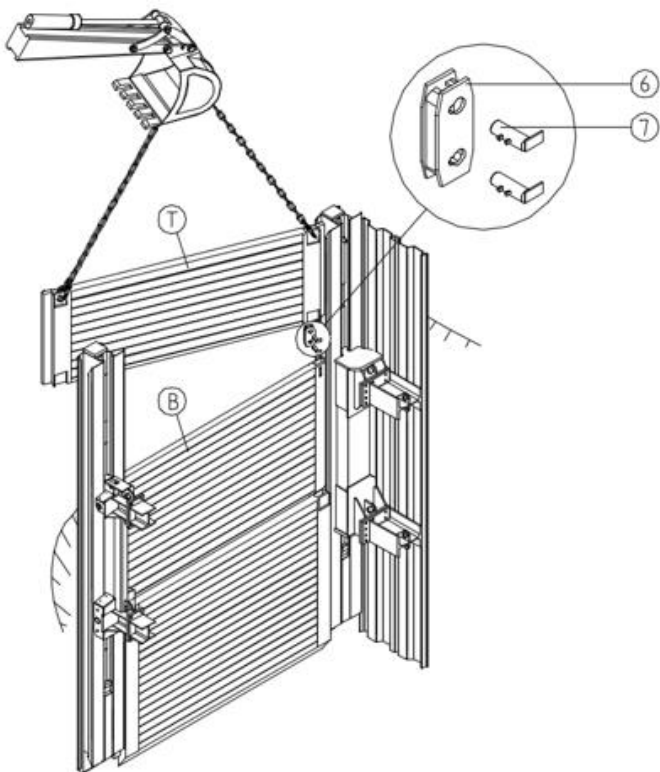


The inside base panel is swiveled between the guide frames in the U-shaped guide rails of the outside panels and lowered to the bottom of the trench. Further trench excavation is carried out by lowering the inside base panels, the guide frames and the strut carts.

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).



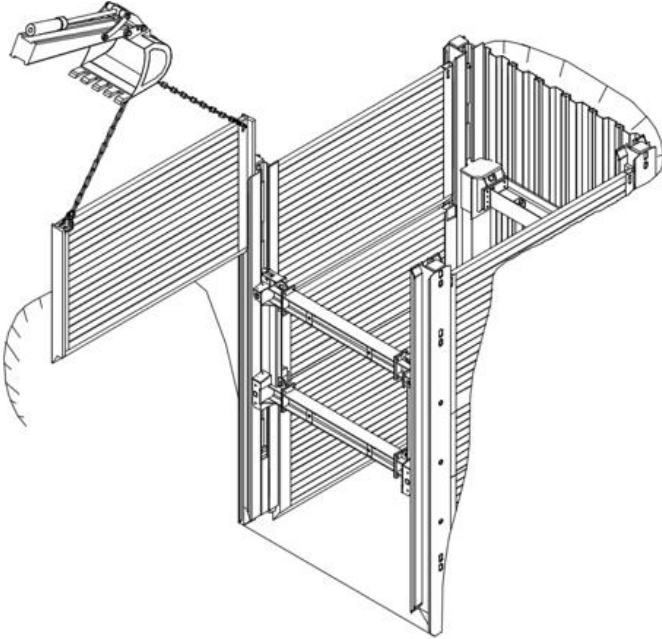
9. Inserting the inside top panels



As described in work step 6, the height of the shoring wall can be further adjusted by inserting the inside top panels (T).

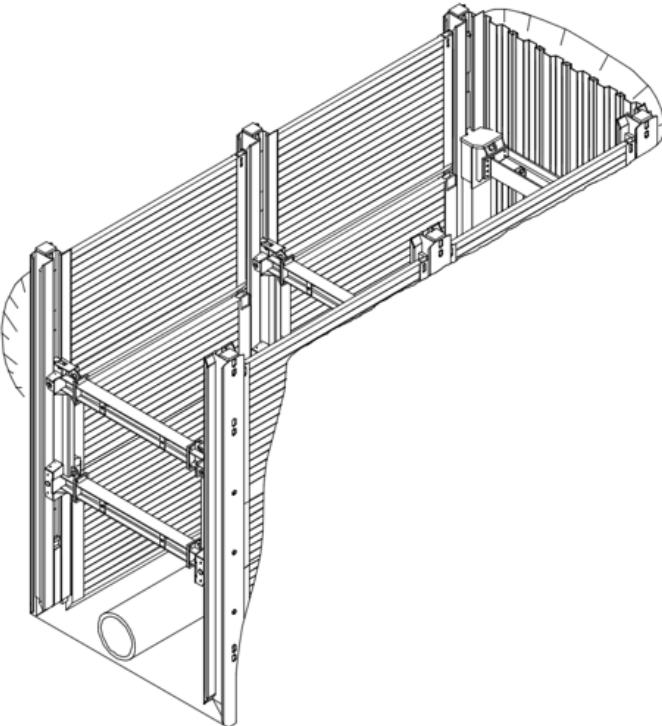
Base and top panels are to be connected by stanchions (6) and pins (7).

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 and fixed vertically in accordance with the static requirements. The installation is carried out according to the described work steps 1 to 8. The other fields are aligned with the precisely installed first field. When inserting the shoring panels, the clear trench width and diagonal dimension (work step 3) should be checked for each subsequent field.

11. 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.

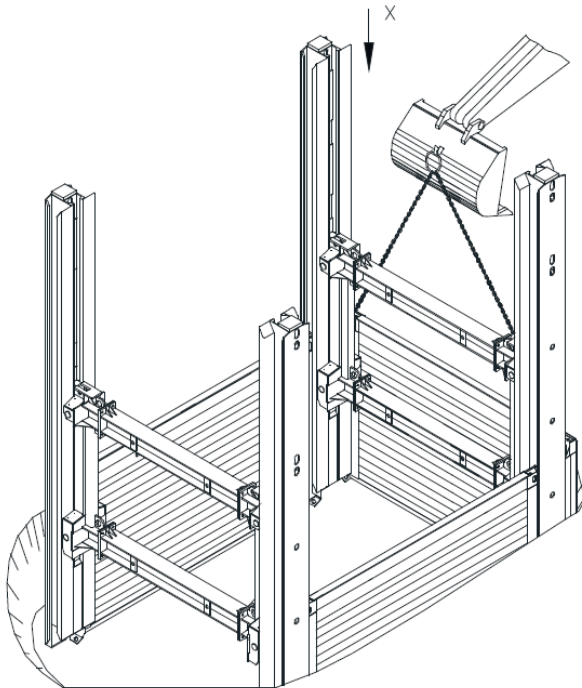
The strut carts must be positioned and fixed vertically in accordance with the static requirements.

5 Head end shoring with slide rail panels

5.1 Assembly instructions head end shoring

All safety instructions in the chapter “Occupational safety and general information in accordance with DIN EN 13331-1/-2” must be observed before the beginning of works (see chapter 2 Occupational safety and general information in accordance with DIN EN 13331-1/-2 on page 3)!

1. Insert the head end shoring base panel

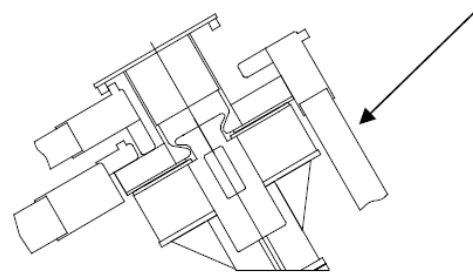


Assembly of the linear shoring frame should be taken from section 5. Only the installation of the head end shoring panels is set out below.

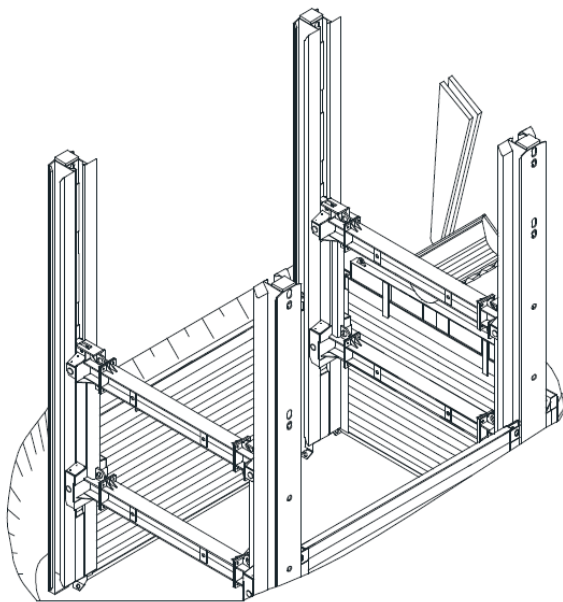
The process for lowering the linear shoring field should be taken from the “Double slide rail linear shoring installation instructions” section.

The head end shoring base panel is placed into the support profile of the linear shoring support using a hoist and suitable sling (GS approval) (view X).

View X Head end shoring base panel



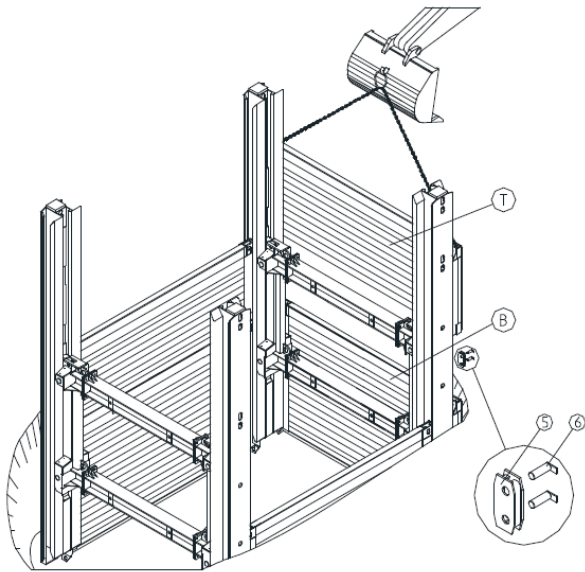
2. Lower the head end shoring base panel



The head end shoring base panel (B) is then positioned in the bottom of the trench with the help of pressure plates.

All shoring components must be introduced using pressure, and never using impacts or pounding.

3. Insert and lower the head end shoring top panel



The height of the head end shoring wall can be first adjusted through positioning of the head end shoring top panel (T).

The base and top panels must be connected using connectors (5) and bolts (6).

Here too, care must be taken to ensure that the top panels are inserted using pressure and never using impacts or pounding.

6 Installation window

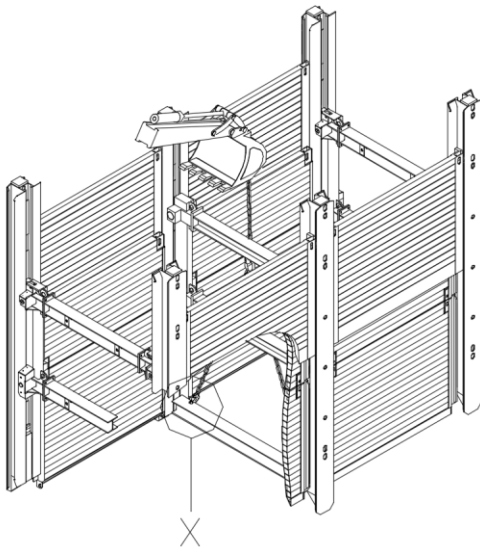
6.1 Assembly instructions installation window with waler beam attachment GEWI

Before starting the work, it is obligatory to observe all safety precautions from section "Occupational health and safety and general remarks according to DIN EN 13331-1/-2" (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 from page 3)!

1. General

For large clear pipe culvert lengths for the insertion and / or lowering of e. g. long pipes, prefabricated structures or drill press machines, larger installation clearances must often be available. Cross bracings of the shoring by strut carts with spacers are then an obstacle. For this purpose, "installation windows" are provided which, depending on the static calculation, may extend over two or more linear shoring fields.

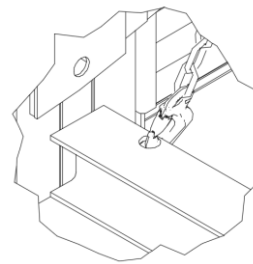
2. Inserting the trench bottom support



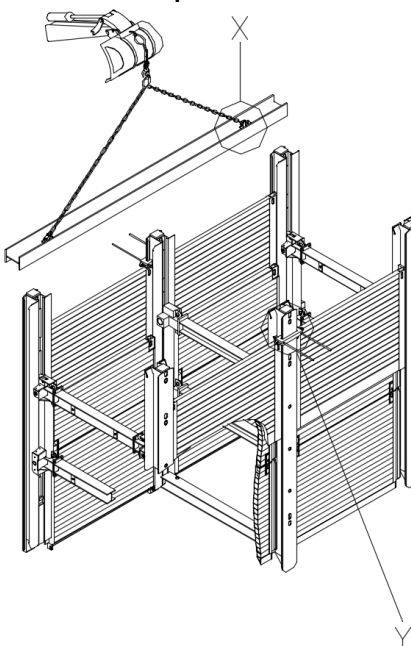
The trench bottom support depends on the static calculation and is designed as a steel or reinforced concrete strut (X).

The trench bottom support is installed after the shoring has been lowered completely.

X



3. Swiveling the longitudinal waler beams towards each other (phase 1)



At the same time as the trench bottom support, the external longitudinal waler beams are swiveled towards the shoring. The longitudinal waler beams are attached to the eyelets (X) provided by means of a 2-strand chain.

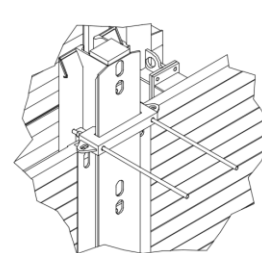
The waler beam attachment is mounted to the beam pair the strut cart of which is to be pulled. It consists of 2 claws, 4 threaded rods, 2 sheet metal blanks and 4 nuts per side.

In the first step, the bottom claw is attached to the linear shoring support with the bottom threaded rods (Y).

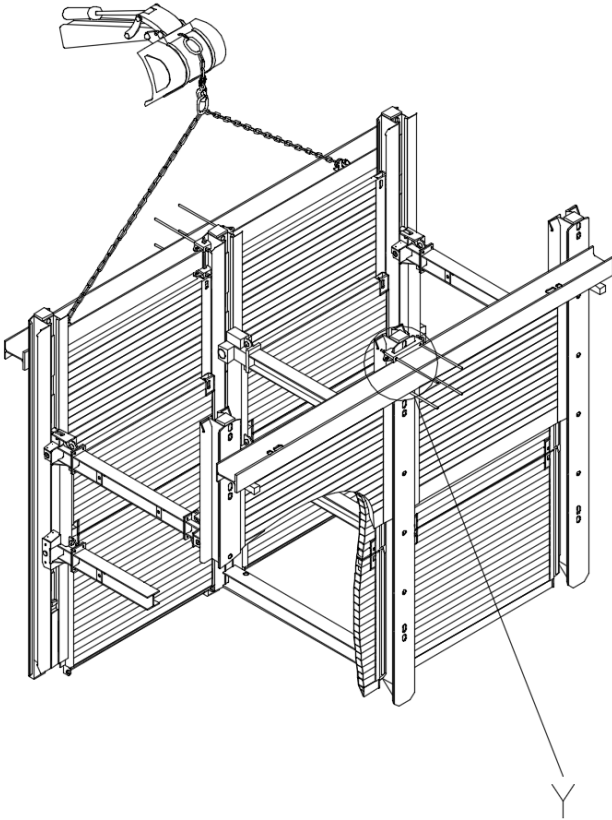
X



Y

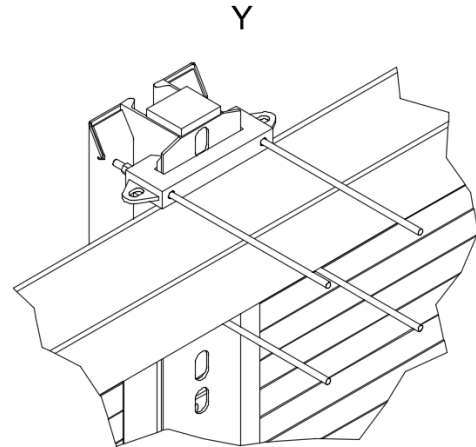


4. Swiveling the longitudinal waler beams towards each other (phase 2)

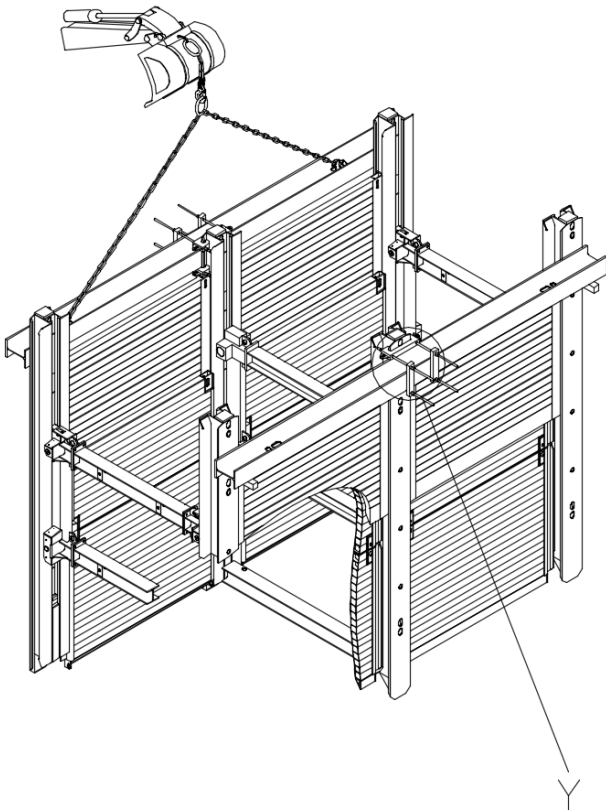


The longitudinal waler beams are placed next to the shoring, e. g. on assembly timbers to protect against soiling.

Then the second claw is attached to the vertical beam above the longitudinal waler beam with threaded rods (Y).

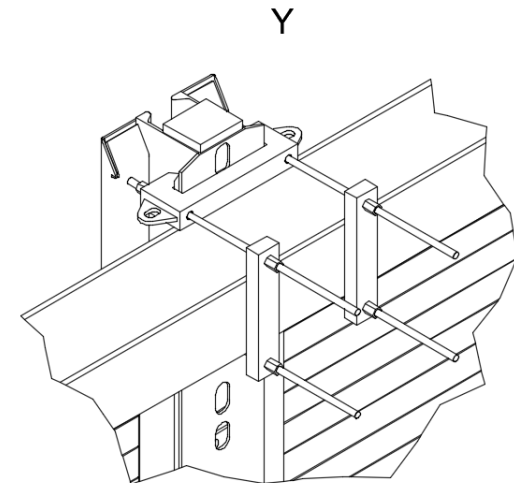


5. Creating a force-fitted connection

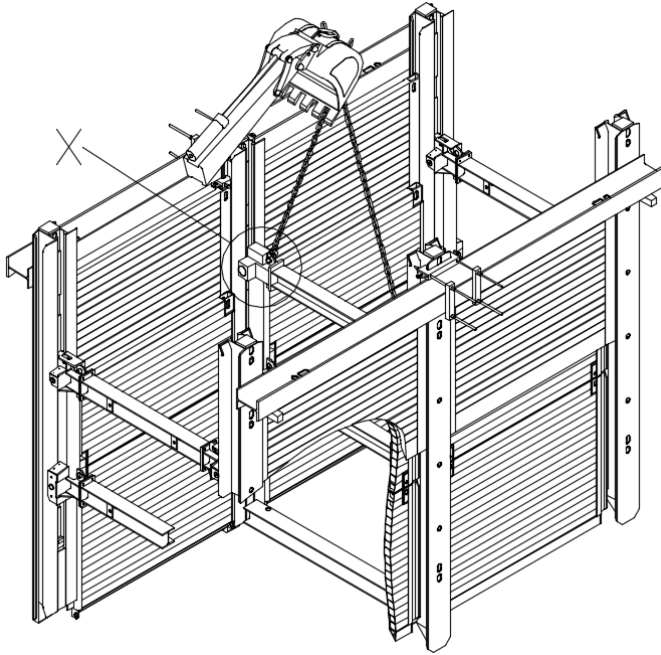


Now the threaded rods and the longitudinal waler beams are connected to each other by means of sheet metal blanks and nuts.

This creates a force-fitted connection to the linear shoring.

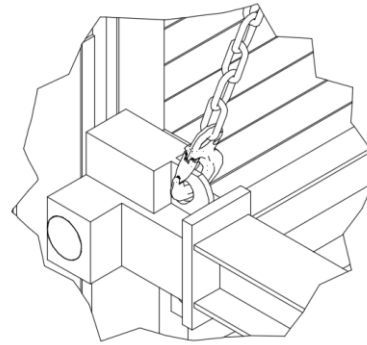


6. Pulling the center strut cart (phase 1)

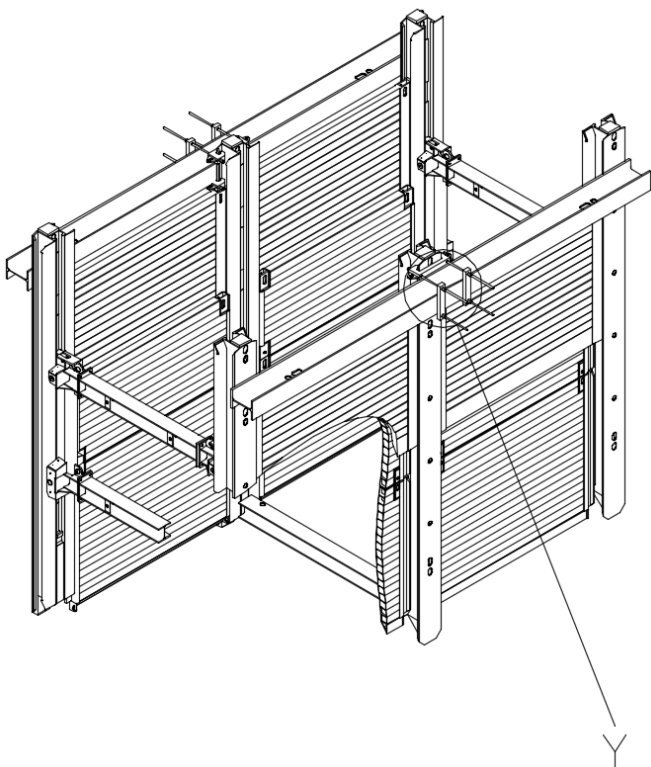


After the longitudinal waler beams with force-fitted connection to the vertical beams have been fitted, the center strut cart can be pulled (X).

X

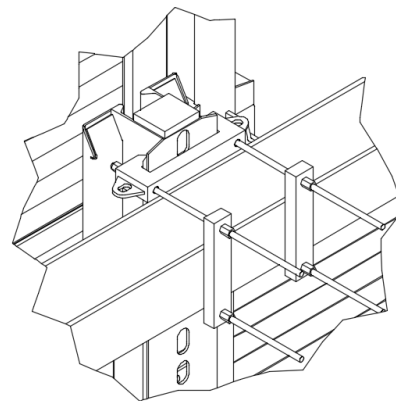


7. Pulling the center strut cart (phase 2)



After pulling the center strut cart, work can begin inside the shoring.

Y



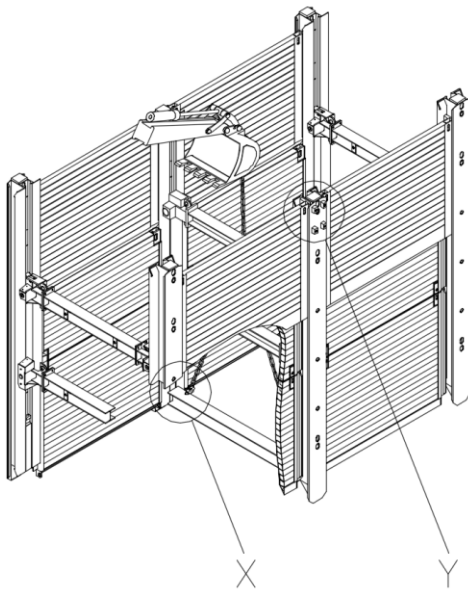
6.2 Assembly instructions installation window with waler beam attachment M 36

Before starting the work, it is obligatory to observe all safety precautions from section "Occupational health and safety and general remarks according to DIN EN 13331-1/-2" (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 from page 3)!

1. General

For large clear pipe culvert lengths for the insertion and / or lowering of e. g. long pipes, prefabricated structures or drill press machines, larger installation clearances must often be available. Cross bracings of the shoring by strut carts with spacers are then an obstacle. For this purpose, "installation windows" are provided which, depending on the static calculation, may extend over two or more linear shoring fields.

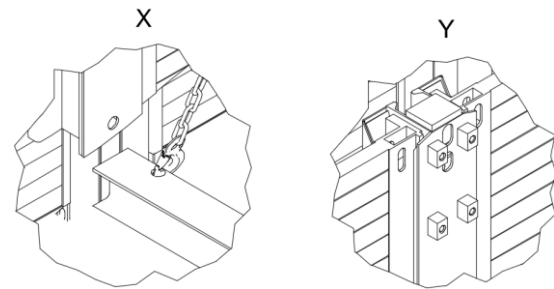
2. Inserting the trench bottom support



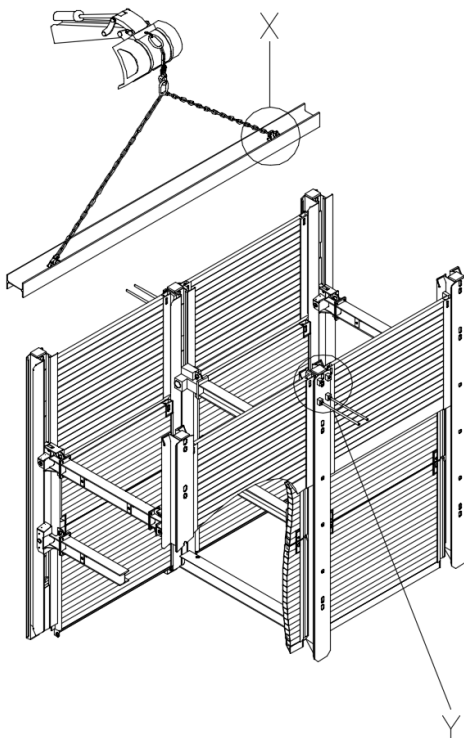
The trench bottom support depends on the static calculation and is designed as a steel or reinforced concrete strut (X).

The trench bottom support is installed after the shoring has been lowered completely.

To mount the waler beam attachment M36, special vertical beams with attachments for the threaded rods must be mounted on the middle beam pair (Y).



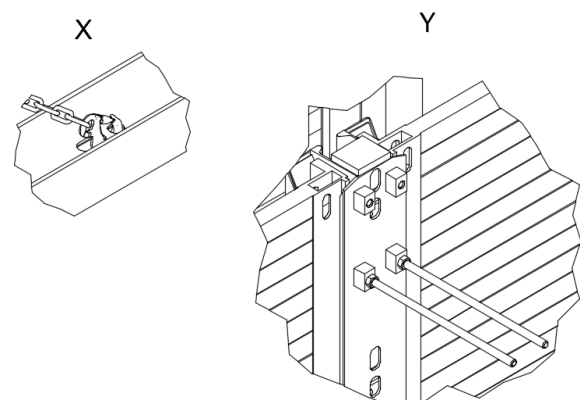
3. Swiveling the longitudinal waler beams towards each other (phase 1)



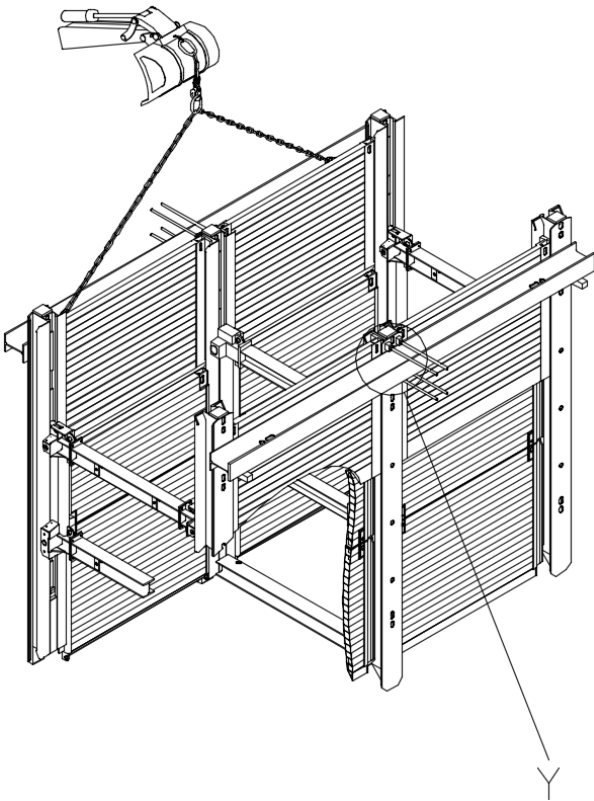
At the same time as the trench bottom support, the external longitudinal waler beams are swiveled towards the shoring. The longitudinal waler beams are attached to the eyelets (X) provided by means of a 2-strand chain.

The waler beam attachment is mounted to the beam pair the strut cart of which is to be pulled.

In the first step, the two bottom threaded rods are mounted to the attachments at the linear shoring support (Y).



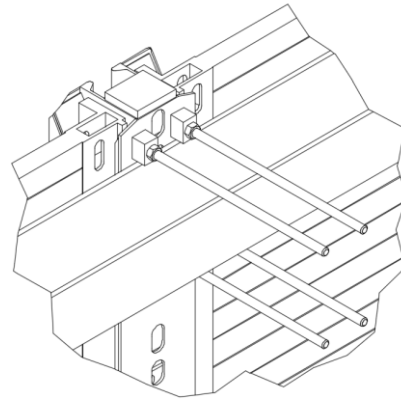
4. Swiveling the longitudinal waler beams towards each other (phase 2) and making a force-fitted connection



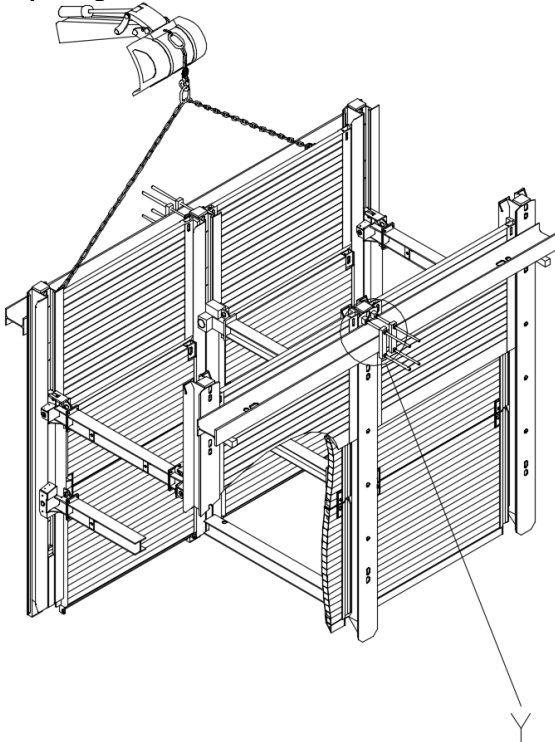
The longitudinal waler beams are placed next to the shoring, e. g. on assembly timbers to protect against soiling.

Then the second threaded rods are attached to the vertical beam above the longitudinal waler beam.

Y



5. Making a force-fitted connection and pulling the center strut cart

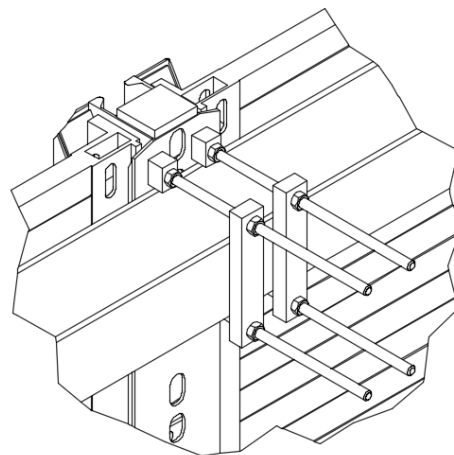


Now the threaded rods are screwed together with fixing plates and nuts (Y).

This creates a force-fitted connection to the linear shoring.

After the longitudinal waler beams with force-fitted connection to the vertical beams have been fitted, the center strut cart can be pulled.

Y



7 Double slide rail corner shoring

7.1 Double slide rail corner shoring installation instructions

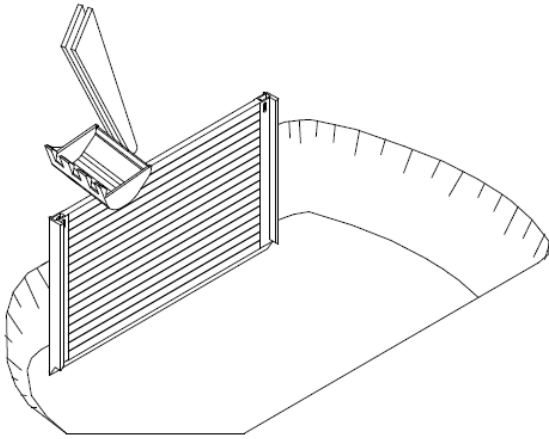
All safety instructions in the chapter "Occupational safety and general information in accordance with DIN EN 13331-1/-2" must be observed before the beginning of works (see chapter 2 Occupational safety and general information in accordance with DIN EN 13331-1/-2 on page 3)!

1. General

Corner rail shoring is a special shoring solution for shaft structures, as well as for trench shoring with combined trench end fields. Implementation as shaft shoring removes the need for special bracing systems. All forces are then absorbed by the shoring panels. It can be implemented with the appropriate supports as single rail or double slide rail shoring.

Realization of rectangular trenches in a variety of sizes is possible through the use of different panel lengths in pairs.

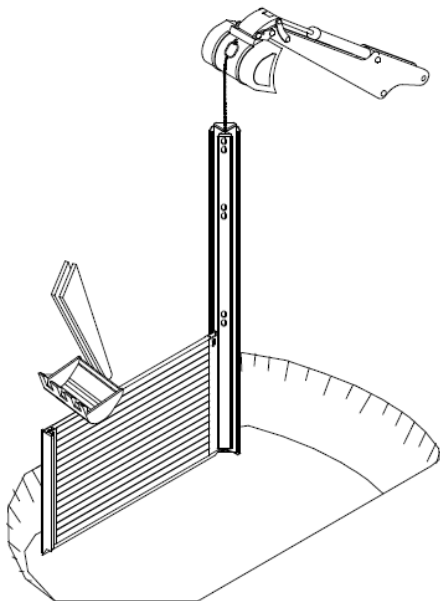
2. Install the outside base panels



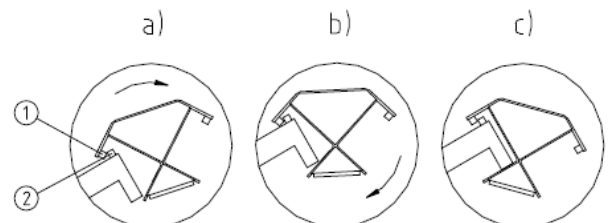
After measuring of the trench, initial excavation for the shaft is done, depending on the panel lengths used, according to the instructions of the construction supervisor and the applicable DIN standards.

The first shoring panel (outside base panel) is positioned and fixed in the trench using a hoist and suitable sling (GS approval).

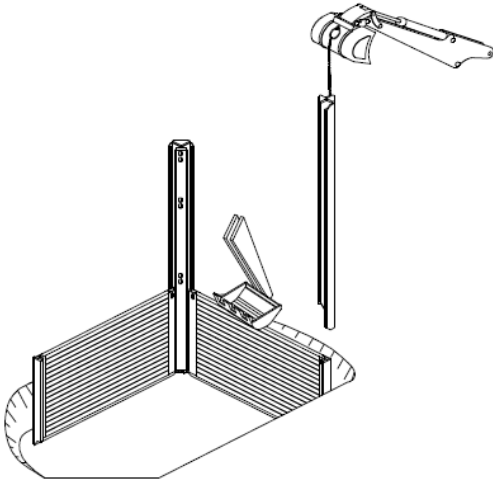
3. Install the corner rail



The corner rail can be swiveled in with the help of a second hoist (see images a, b, c) or pushed over from above. Care must be taken here to ensure that the rear square of the corner rail (1) catches behind the square of the shoring panel (2).

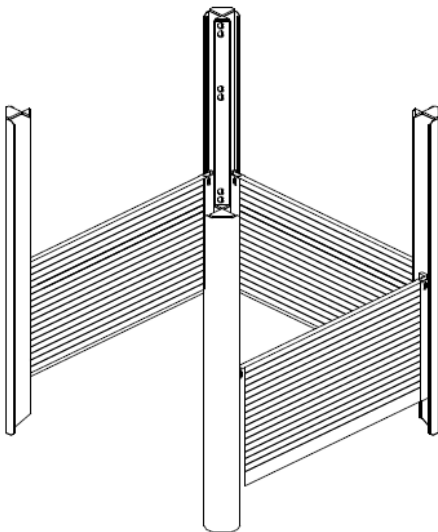


4. Install the other elements



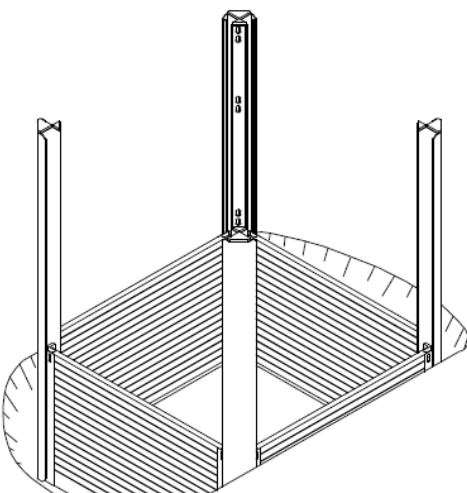
All other elements should be installed in the manner described above.

5. Align the shoring



Alignment of the shoring is required so that the last shoring wall can also be positioned without any problems. To this end, the clear distance between the shoring panels at both ends of the panels on the one hand and the measurement across the two diagonal axes of the shoring field on the other must match.

6. Lower the shoring

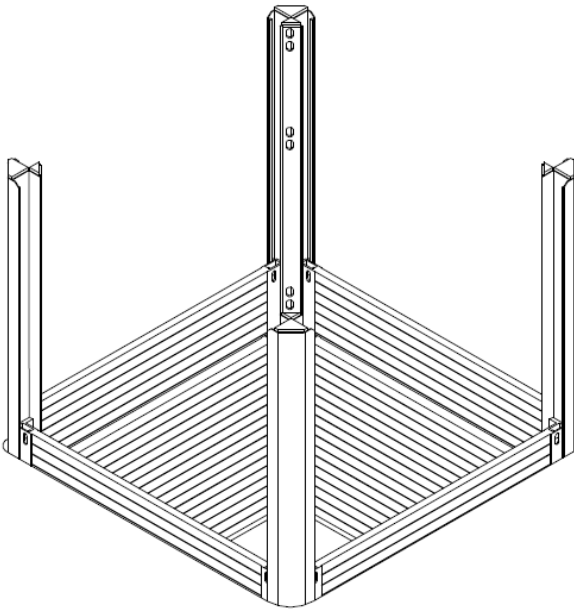


Once the fourth base panel has been positioned, the angularity of the shoring must be checked again. The cavity between the soil and the shoring panel must then be backfilled and compacted.

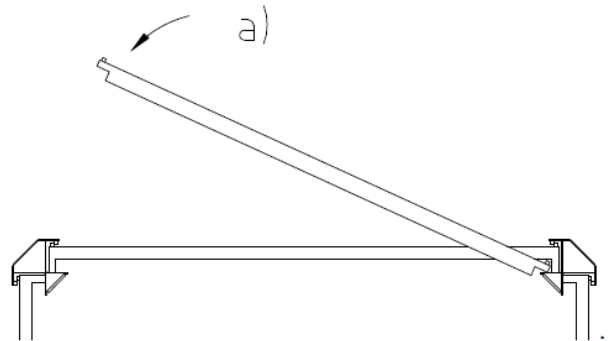
Before the actual lowering process, the soil underneath the shoring panels and supports is excavated according to the instructions of the construction supervisor. The vertical supports and shoring panels are pressed down alternately, whereby pressure beams should be used in particular for the shoring panels.

All shoring components must be introduced using pressure, and never using impacts or pounding.

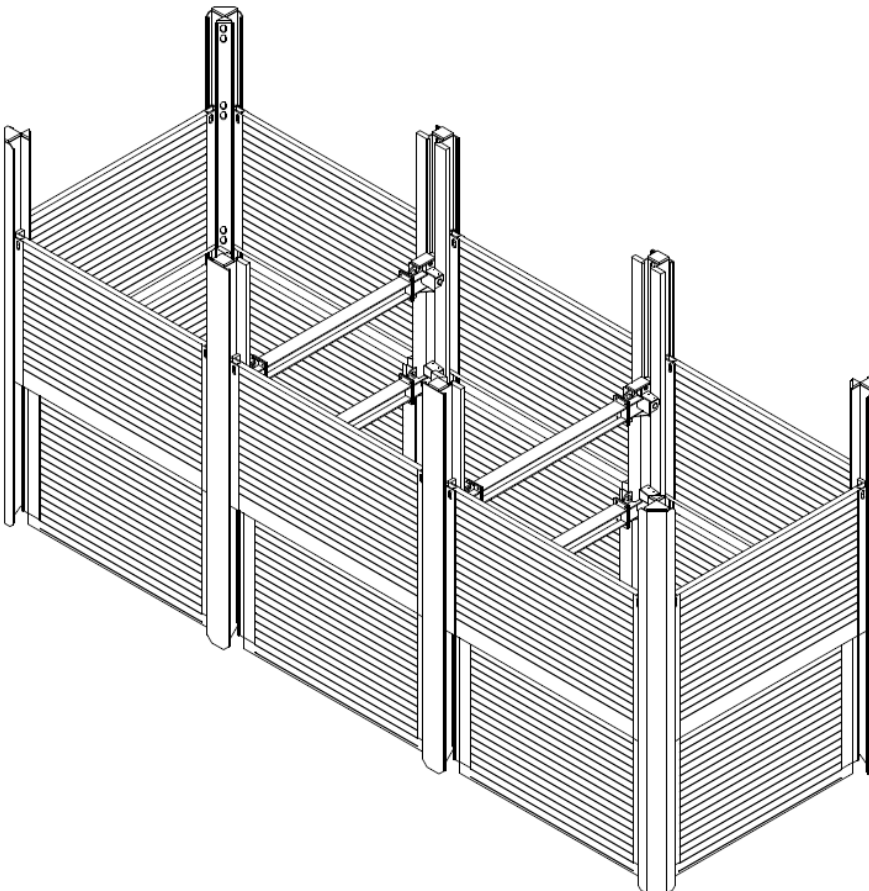
7. Install the inside base panels



The inside base panels are swiveled between the guide frame in accordance with image a), guided into the U-shaped guide rails on the outside panels and lowered to the bottom of the trench. Further trench excavation is done through lowering of the inside base panels and the guide supports



8. Installation example for a trench end field



“Double slide rail linear shoring” and “double slide rail corner shoring” can be combined without any problems. This results in trenches and excavations with continuous shoring.

8 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 h_c [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 \varnothing , 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)

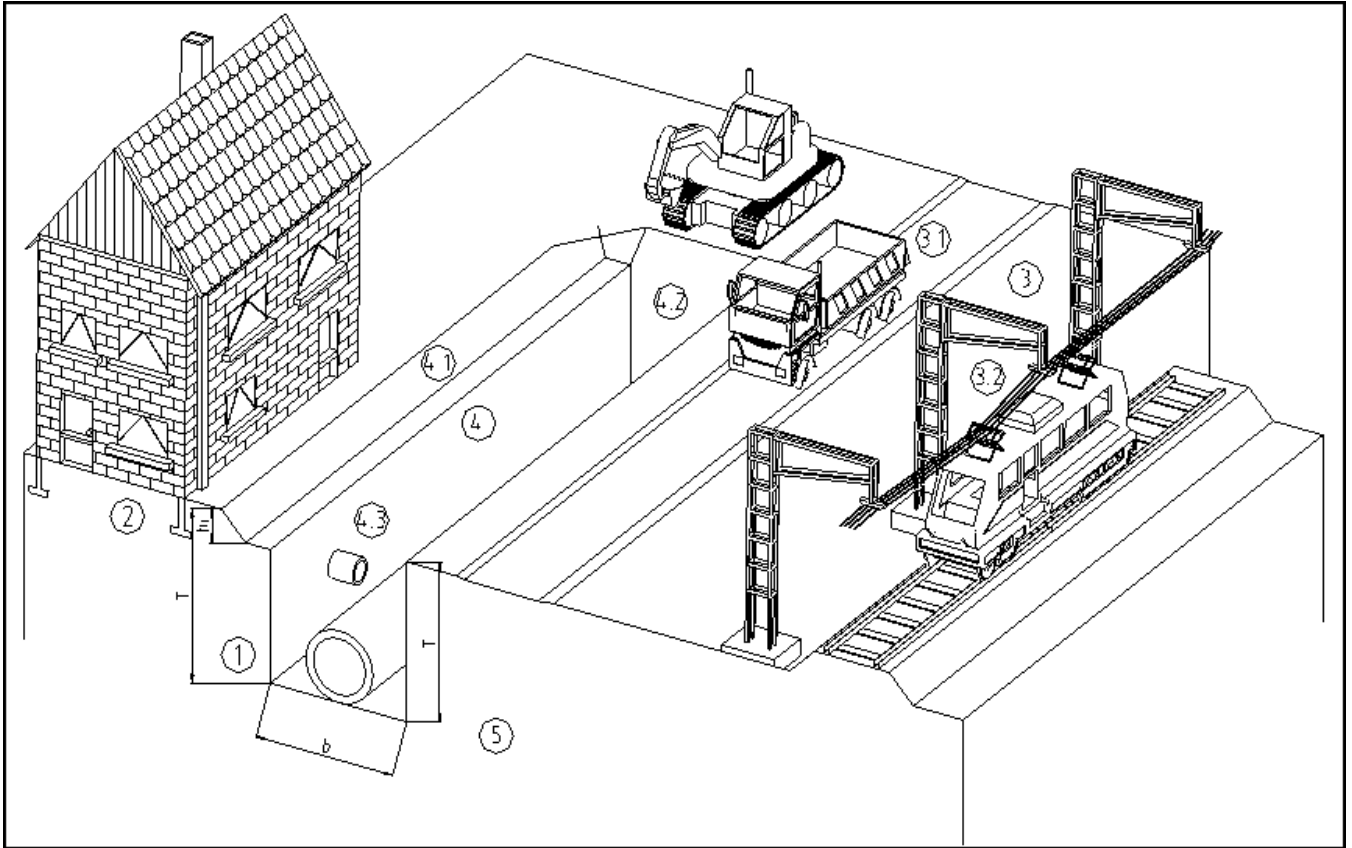
5.1 Site plan yes no

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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