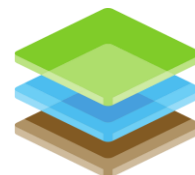


# Instructions for use

E+S trench boxes

Date: April 2022



terra  
infrastructure

## Information about the instructions for use

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

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

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

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

---

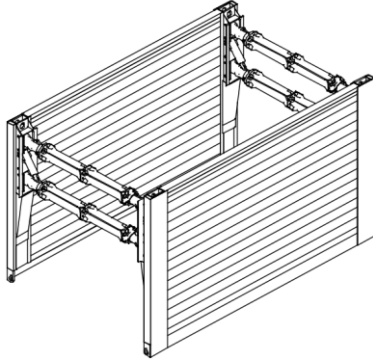
## Contents

1	System overview	2
2	Occupational safety and general information in accordance with DIN EN 13331-1/-2	4
2.1	Symbols in these instructions	4
2.2	Dangers	5
2.3	General safety information and measures for reduction of risks	5
2.4	Protection against falls and falling parts	6
2.5	Storage, transportation and lifting operations	6
2.6	Criteria for the inspection, repair and withdrawal of worn or damaged components	7
2.7	The following, as amended, apply in particular:	8
2.8	Personal protective equipment (PPE)	8
2.9	Technical data of the shoring elements	8
3	Installation instructions extension bars	9
4	Assembly instructions for edge- and center-supported shoring systems	10
5	Instructions for removing for edge- and center-supported shoring systems	14
6	Installation instructions linear box	15
7	Assembly instructions linear box	17
8	Instructions for removing linear box	18
9	Assembly instructions piling frame shoring	19
10	Assembly instructions drag box shoring	21
11	Statics questionnaire	24

---

# 1 System overview

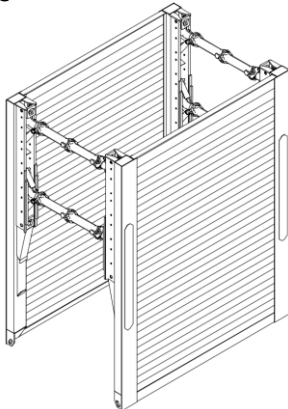
## Lightweight shoring



Shoring length	2.00 m – 3.50 m
Height base unit	1.60 m / 1.95 m / 2.25 m / 2.40 m
Height top unit	0.96 m / 1.32 m
Pipe culvert height	0.81 m / 1.16 m / 1.19 m / 1.34 m
Weight	745 kg – 1,540 kg

**Designation for basic module B according to EN 13331-1:**  
 ES – B – SV – C – XX – 2.00 / 3.50 x 1.60 / 1.95 / 2.25 / 2.40 x  
 0.08 – 0.64 / 4.38 – 0.81 / 1.34 – 17.5 / 23.0 – 0.75 / 1.54

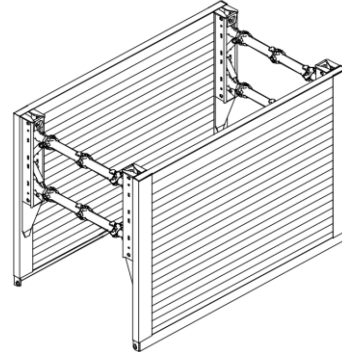
## Magnum shoring



Shoring length	2.00 m – 6.84 m
Height base unit	3.15 m / 4.00 m
Height top unit	1.32 m / 1.44 m / 2.00 m
Pipe culvert height	1.75 m / 2.00 m / 2.46 m
Weight	1,860 kg – 7,130 kg

**Designation for basic module B according to EN 13331-1:**  
 ES – B – SV – C – XX – 2.00 / 6.84 x 3.15 / 4.00 x 0.08 / 0.16  
 – 0.78 / 4.62 – 1.75 / 2.46 – 25.8 / 34.1 – 1.86 / 7.13

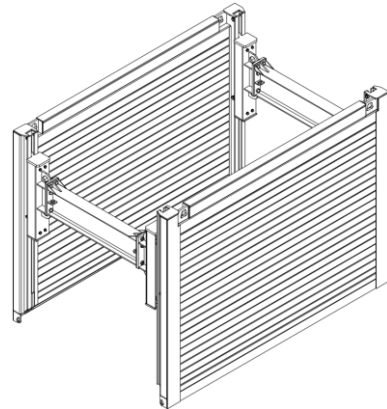
## Medium shoring



Shoring length	2.00 m – 4.50 m
Height base unit	2.60 m
Height top unit	1.32 m / 2.00 m
Pipe culvert height	1.45 m
Weight	1,460 kg – 2,780 kg

**Designation for basic module B according to EN 13331-1:**  
 ES – B – SV – C – XX – 2.00 / 4.50 x 2.60 x 0.09 / 0.10 – 0.78 /  
 4.52 – 1.45 – 34.1 – 1.46 / 2.78

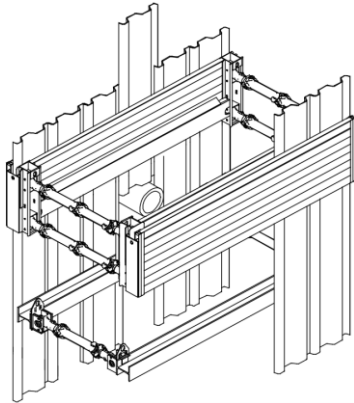
## Linear box



Shoring length	3.40 m / 3.70 m / 4.00 m / 4.50 m
Height base unit	3.00 m
Height top unit	1.32 m / 2.00 m
Pipe culvert height	variable
Weight	2,050 kg – 2,940 kg

**Designation for basic module B according to EN 13331-1:**  
 ES – B – SN – F – XX – 3.40 / 3.70 / 4.00 / 4.50 x 3.00 x 1.00 –  
 0.94 / 3.14 – variable – 34.10 – 2.05 / 2.94

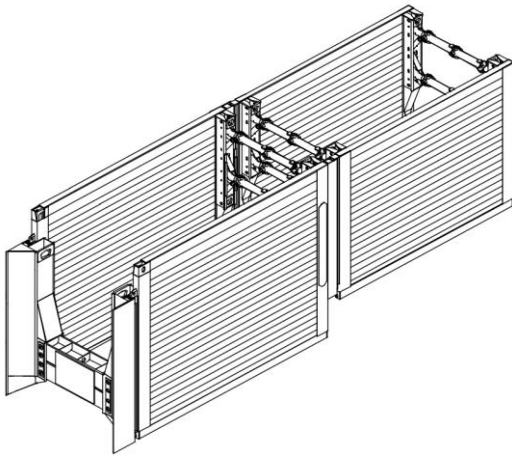
### Piling frame element DKE



Shoring length	3.64 m / 4.03 m
Height piling frame element	0.97 m
Pipe culvert height	variable
Weight	1,884 kg – 2,163 kg

**Designation for basic module B according to EN 13331-1:**  
GV – B – SV – C – XX – 3.40 / 3.63 / 4.03 x 0.97 x 0.30 – 0.78 / 4.25 - variable – 1.88 / 2.16

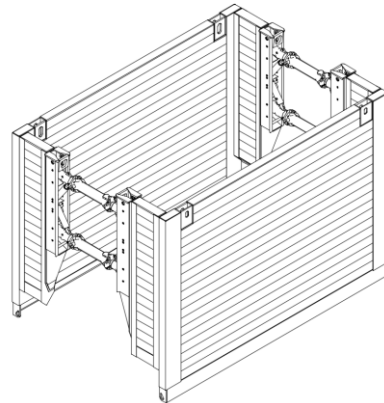
### Drag box



Shoring length	3.70 m / 4.25 m / 5.08 m
Height base unit	3.00 m / 3.15 m
Drag panel module height	2.60 m
Pipe culvert height	max. 2.00 m
Weight	2,745 kg – 3,790 kg

**Designation for basic module B according to EN 13331-1:**  
DB - B - SN - F - XX - 3.70 / 4.25 / 5.08 x 3.00 / 3.15 x 0.1 / 0.12 - 1.00 / 4.30 - 2.00 - 34.10 - 2.75 / 3.79

### Manhole



Shoring length	2.50 m / 3.00 m / 3.50 m
Height base unit	2.50 m
Height top unit	1.50 m
Pipe culvert height	1.45 m
Weight	2,260 kg – 2,710 kg

**Designation for basic module B according to EN 13331-1:**  
ES – B – SV – F – XX – 2.50 / 3.00 / 3.50 x 2.60 x 0.10 – 1.69 / 5.43 – 1.45 – 34.10 – 2.26 / 2.714

## 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!

Observe the applicable local safety and accident prevention regulations!

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.

### DANGER



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

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

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

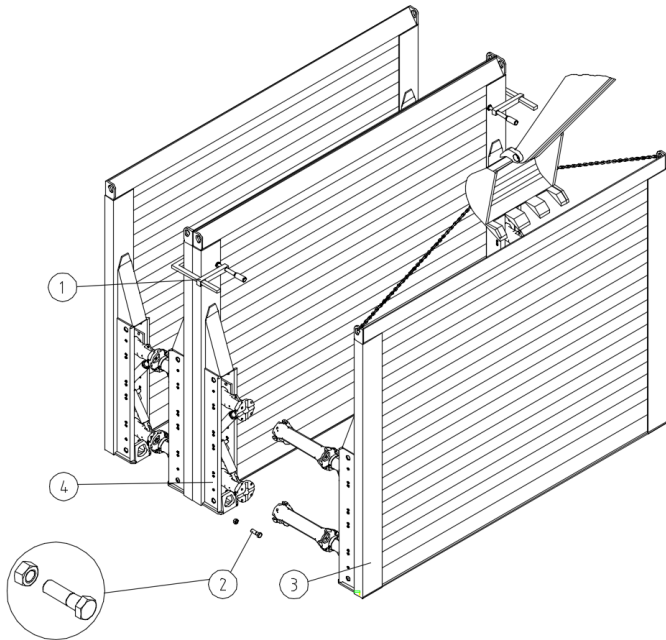
## 2.9 Technical data of the shoring elements

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 Installation instructions extension bars

#### Installation of the intermediate pipes



Two trench boxes are securely clamped together, e. g. with screw clamps (1). Dismantling of the two panels by loosening the spreading connection screws M 16 x 55 (2) is only carried out when the unsecured panel is held by means of lifting gear and suitable lifting slings (GS approval) (3). The free panel is now placed with the flat side on the ground and each spreader is screwed to the selected and pre-assembled intermediate pipe combination.

(Connecting means intermediate pipes / spreaders: 4 x screw M 16 x 55-8.8-DIN 933 VZ and nut M 16-8-DIN 934 VZ (2)).

The panel equipped with intermediate pipes is swiveled against the second, upright and secured panel (4) by means of lifting gear and lifting slings in such a way that the intermediate pipes can again be connected to the spreaders using the specified number of screws M 16 x 55-8.8-DIN 933 and nuts M 16-8-DIN 934 (2) according to the list of accessories.

Cast iron pipes and HEB beams must not be installed in combination and must not be subjected to bending loads. Only normal forces are transmitted.

Persons must not enter trenches with a trench depth > 1.25 m without shoring or slope. It is also prohibited to stay or to work with heavy machinery in the area of risk e.g. the edge of the trench. For all work, observe the applicable regulations from DIN, EN, UVV [German accident prevention regulations] and *BGBau* [German employers' liability insurance association for the construction industry].

## 4 Assembly instructions for edge- and center-supported shoring systems

Note: In accordance with DIN EN 13331, edge-supported shoring systems are abbreviated with the abbreviation ES and center-supported shoring systems with the abbreviation CS.

### 1. Insertion process

#### 1.1. Preconditions

In the insertion process, trench shoring units are inserted into a section of trench which has already been excavated to its final depth. The insertion process is only permissible if the following preconditions have been fulfilled:

- temporarily firm ground
- vertical trench walls
- same trench width for the entire length of the shoring unit
- no stepping on the trench before the trench shoring unit is set
- no pipes, buildings or other structures and / or traffic areas within the range of the trench
- acceptable degree of anticipated settlement, loosening and displacement of soil within the range of the trench

The ground is considered temporarily firm if no major crumbling is noted in the period from the start of excavation until the insertion of the shoring.

Centrally supported systems may only be installed in the insertion process and as a pair.

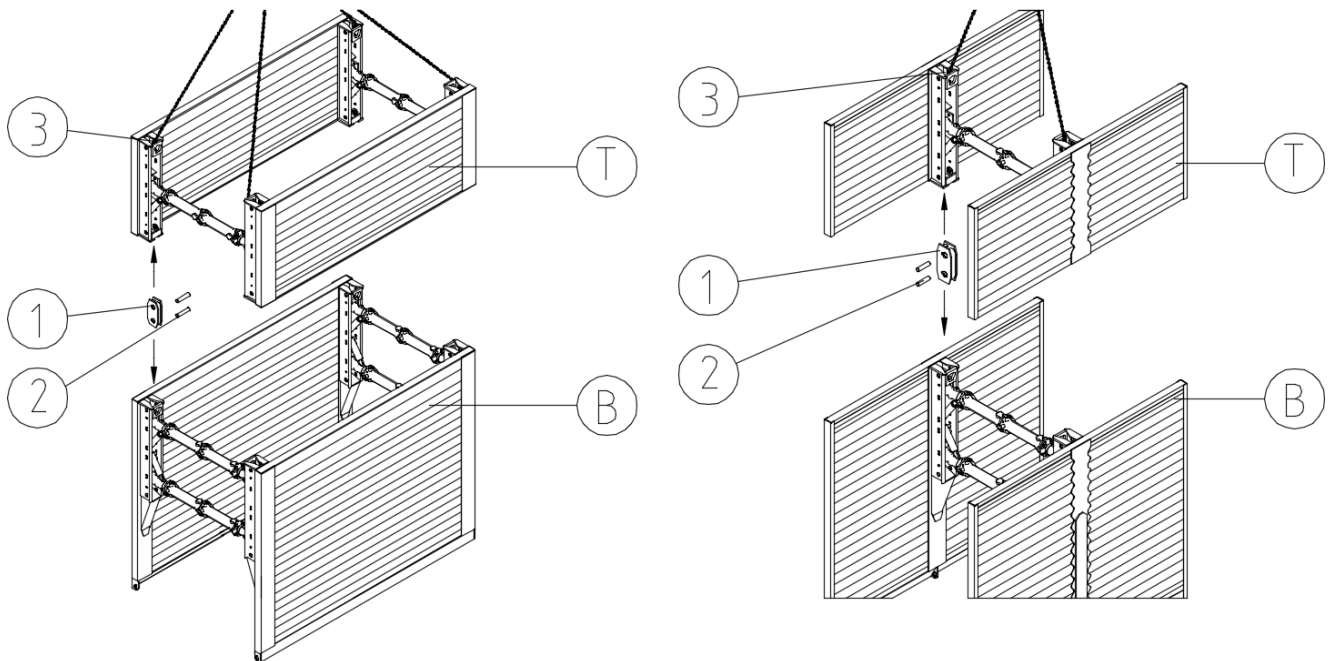
#### 1.2. Use of top panels (edge- and center-supported shoring systems)

In the setting procedure, the base (B) and top module (T) must be assembled outside the trench and the system must be set as a whole in the trench if shoring boxes with top boxes are required to secure deeper trenches.

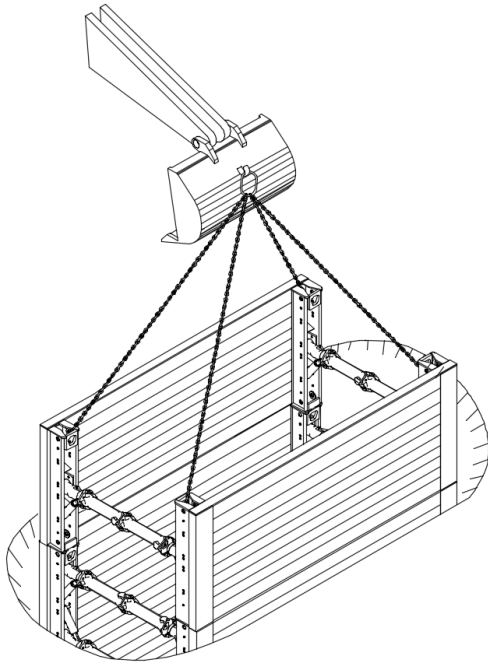
Base and top modules are connected by stanchions (1) and pins (2) (with medium and magnum shoring additionally with spring cotters).

The system is assembled by using a lifting gear and suitable lifting slings (GS approval).

The lifting slings must be hooked exclusively and at at least four points (ES) and / or two points (CS) into the lifting eyes (3, erector heads) provided for this purpose.



### 1.3. Installation (edge- and center-supported shoring systems)



The shoring system prepared outside the pit is inserted with lifting gear and suitable and lifting slings (GS approval) into the trench which has been excavated in the final depth for the length and width of a shoring box. The length of the excavated and unsecured trench section must be limited to a length required for the insertion of one single trench shoring unit. The gap between the trench wall and the inserted shoring unit must be backfilled right up to the top. In addition, the shoring unit should be pressed against the trench wall by boring the struts.

The permitted load values in accordance with the technical data of the shoring system employed must be observed at all times. For details concerning the trench width, refer to DIN 4124.

## 2. Lowering procedure

### 2.1. General

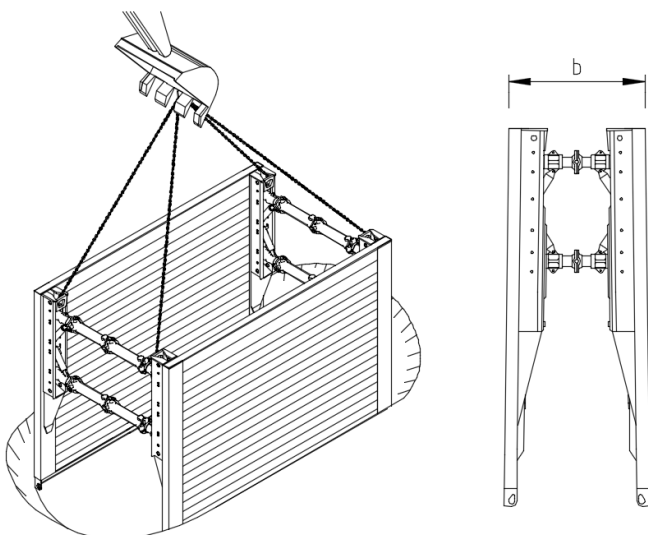
In the lowering procedure, trench shoring units or parts thereof are pressed vertically into the ground.

The lowering procedure is only permitted for edge-supported shoring systems. Centrally supported trench shoring systems must not be used in the lowering procedure!

### 2.2. Pre-adjustment of the shoring systems

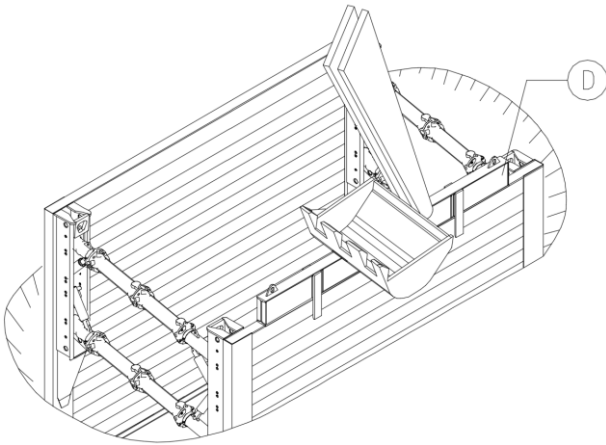
Before inserting the applicable shoring system, its struts must be adjusted with the spindles until the distance between the shoring panels of one shoring unit is greater at the bottom than on top. This so-called A-form is achieved by extending the spindles in the bottom strut by approx. 20 mm / per meter of box height more than the spindles in the top strut.

### 2.3. Advance excavation, insertion and alignment of the shoring unit



After the trench alignment has been measured, advance excavation for inserting the 1st shoring unit is carried out in accordance with the instructions of the site management and in compliance with the provisions of DIN 4124. This is adjusted and aligned centrally and parallel to the trench axis by means of lifting gear and lifting slings (GS approval, lifting eyes). After adjusting the shoring, all screw connections must be retightened.

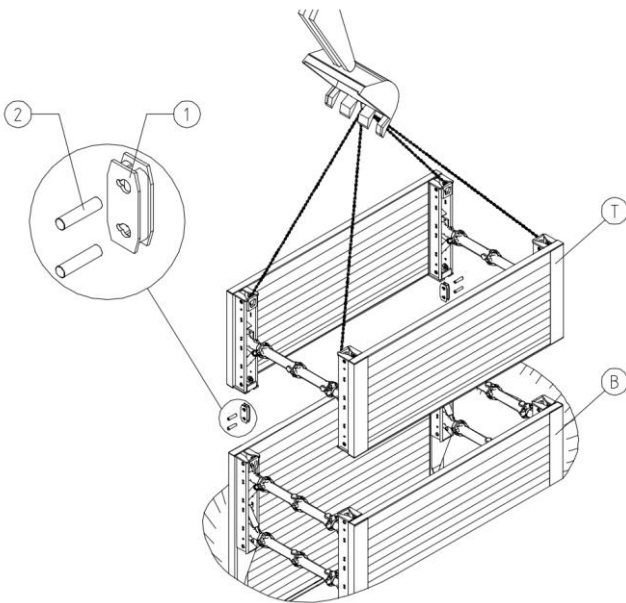
## 2.4. Lowering the shoring system



Lowering takes place alternately with the soil excavation. During the lowering process, the advance soil excavation underneath the panels must not exceed 0.50 m, depending on the soil conditions. During the mutual pushing of the shoring walls, care must be taken to ensure that the inclination of the shoring struts does not exceed  $\delta = \pm 8^\circ$ .

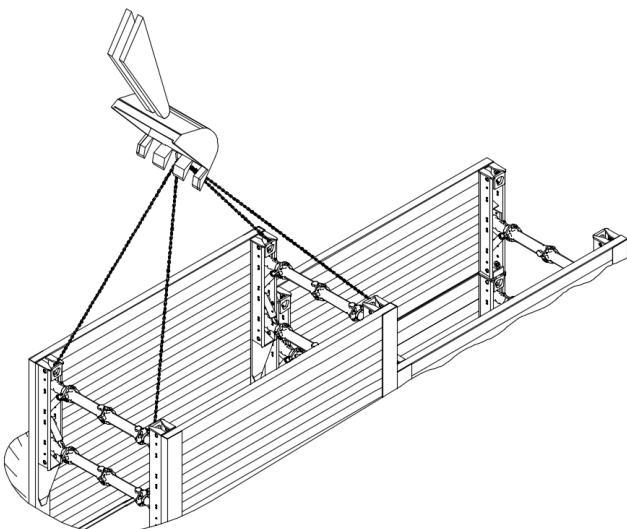
Pressure plates and / or pressure beams (D) must be used for the lowering process. Care must be taken to ensure that the shoring panels are not used as "chisel". Solid obstacles (e. g. unnatural fillings, rock) must be removed manually if necessary. To avoid subsidence on the surface, the backfilling of the panels with soil must be ensured.

## 2.5. Top panel



Depending on the required trench depth, top modules (T) are mounted on the base modules (B). Base and top modules are to be connected by stanchions (1) and pins (2). Here too, pressure plates and / or pressure beams must be used for the further lowering process.

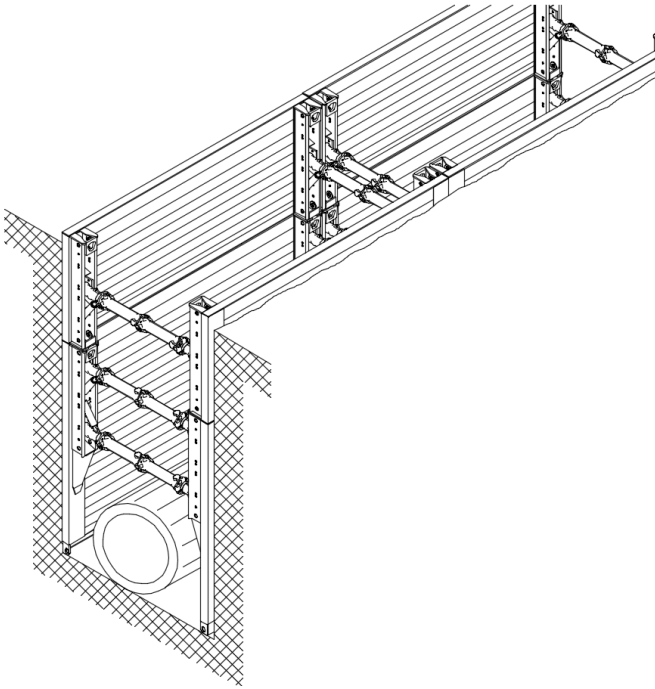
## 2.6. Installation of the next shoring field



The next shoring unit is installed as soon as the previous system has been fully lowered to the bottom of the trench. The installation is carried out according to the previously described points.

The shoring must be complete. Wall sections that cannot be secured with shoring units, e. g. pipes that cross each other under certain conditions, must be installed separately.

## 2.7. Pipe laying



Once the shoring has been installed in accordance with the above specifications, pipe-laying work can begin, taking into account the specifications of the pipe manufacturer.

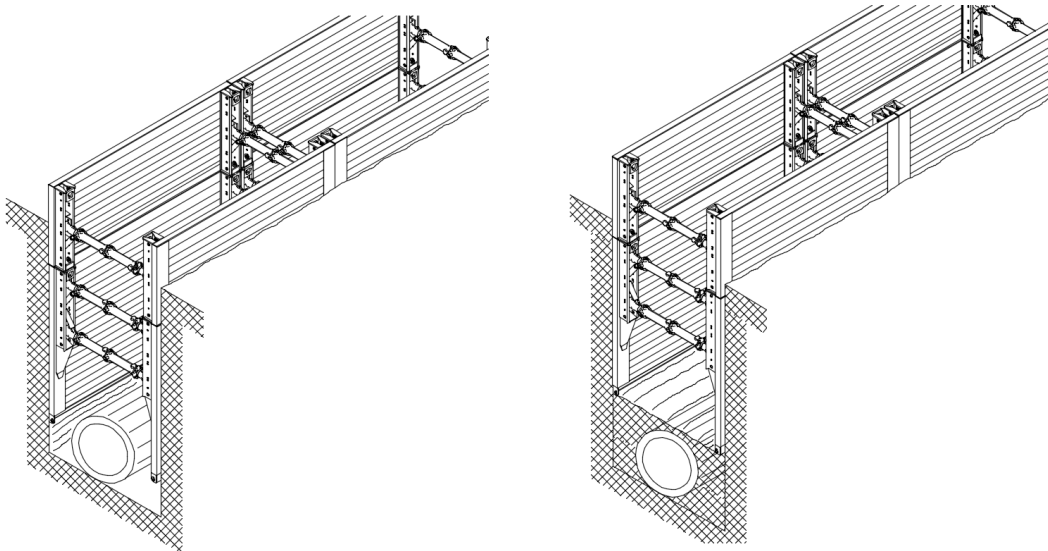
## 5 Instructions for removing for edge- and center-supported shoring systems

### 1. Removing, backfilling, compacting

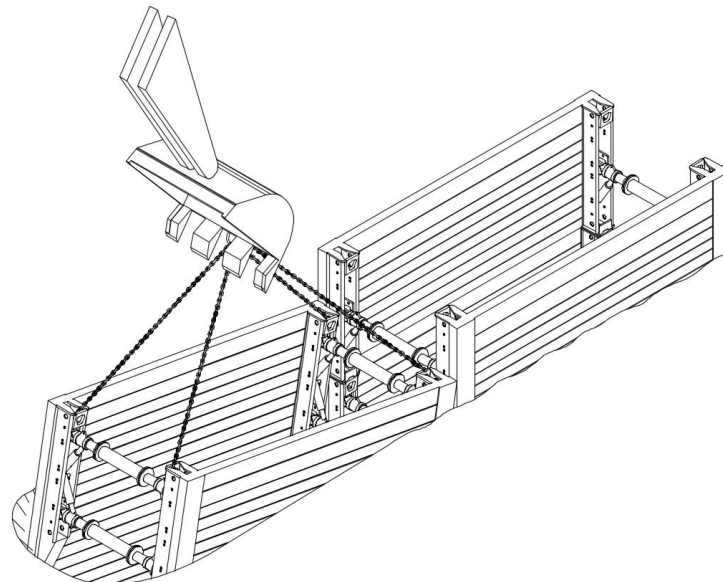
After completing the pipe-laying work the shoring is removed with layer-by-layer backfilling and compacting. To this end, the shoring is extracted step-by-step in accordance with the instructions of the local site management, and the expert's specifications and the backfilling material returned to the trench is compacted against the existing soil.

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

Even during removal, the inclination of the shoring struts must not exceed  $\delta = \pm 8^\circ$ .



To prevent damage to the shoring system during removal, the shoring must always be pulled vertically. Pulling out the shoring at an angle will damage the edge profiles.



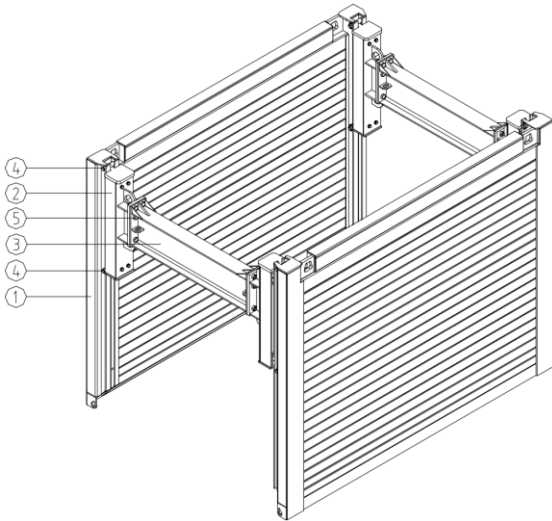
### 2. Service and maintenance

All shoring components must be checked for proper functioning before they are used in subsequent shoring fields. Defective parts must be replaced and / or repaired. Minor repairs can be carried out by the user after consultation with the manufacturer. Only use original spare parts from the manufacturer! No warranty for improperly performed repairs and use of non-original parts.



## 6 Installation instructions linear box

### 1. System overview linear box reinforced

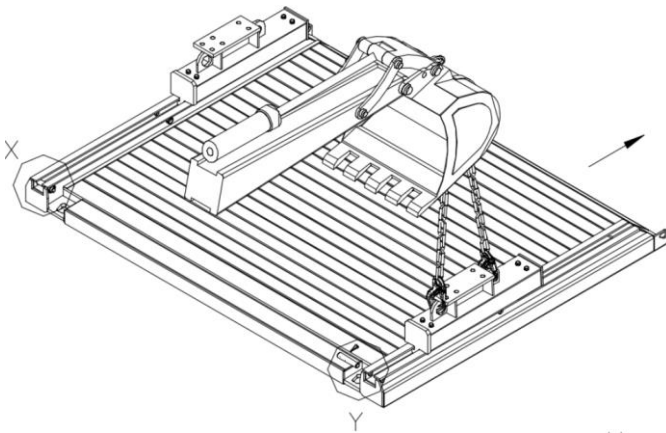


1. Panel half
2. Roller unit
3. Extension bar
4. Locking pin
5. Screws

### 2. Roller unit installation

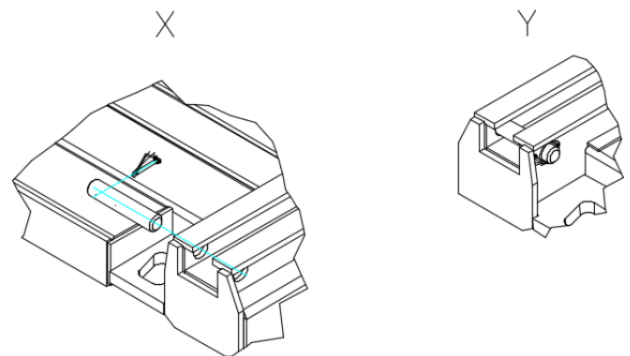
Depending on the type of strut cart used, there are different assembly steps. In the following, the assembly steps for the U-type roller unit linear box (832 226) and the U-type roller unit linear box reinforced (832 232) are shown.

#### 2.1. U-type roller unit 1,20 m linear box reinforced

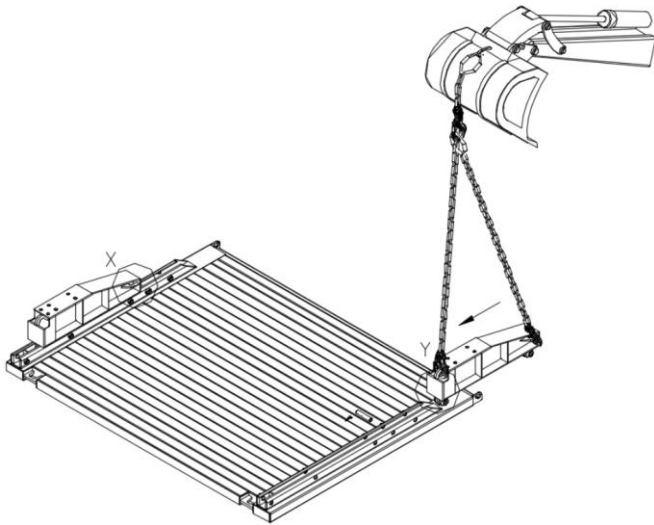


Two strut carts are inserted into the panel halves of the reinforced linear box from above using lifting gear and suitable lifting slings (GS approval).

The strut carts are secured in the linear box by inserting the locking pins (detail X, Y) into the upper boring of the traverse. After insertion, the pins must be secured with a spring cotter.

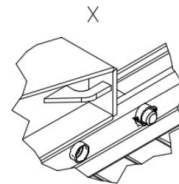
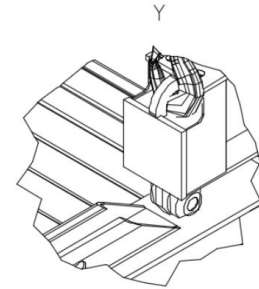


### 2.2. U-type strut cart linear box

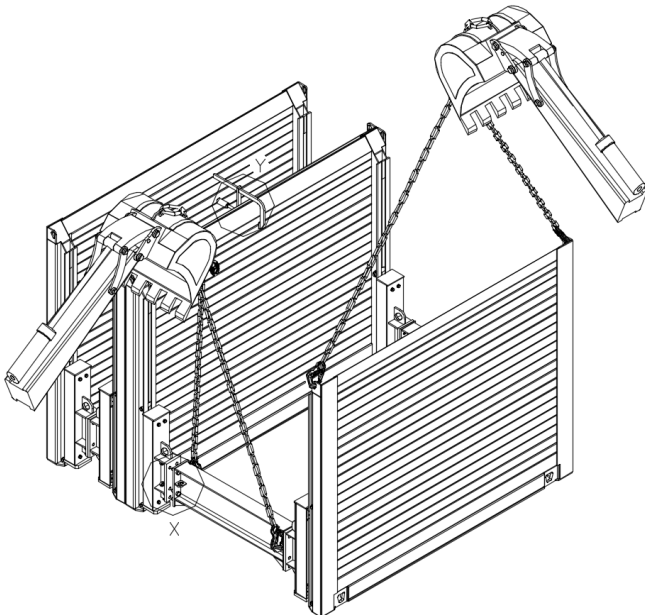


Two strut carts are inserted into the panel halves from below using lifting gear and suitable lifting slings (GS approval).

The strut carts are secured in the linear box by inserting the locking pins (detail X). The safety pins are inserted into the second boring of the traverse, seen from the lower end of the panel. After insertion, the pins must be secured with a spring cotter.



### 3. Installation of the complete linear box



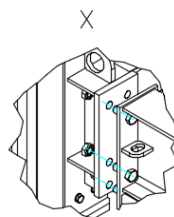
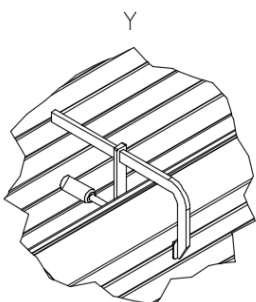
The first panel half, pre-assembled with the strut cart, is set up and secured against tipping over.

The second panel half is pre-assembled in the same way as the first panel half and additionally equipped with the required number of extension bars.

The second panel is then swiveled against the first, upright and secured panel using lifting gear and suitable lifting slings (GS approval) in such a way that the extension bars can be connected to the strut cart by the specified number of screws and nuts (X).

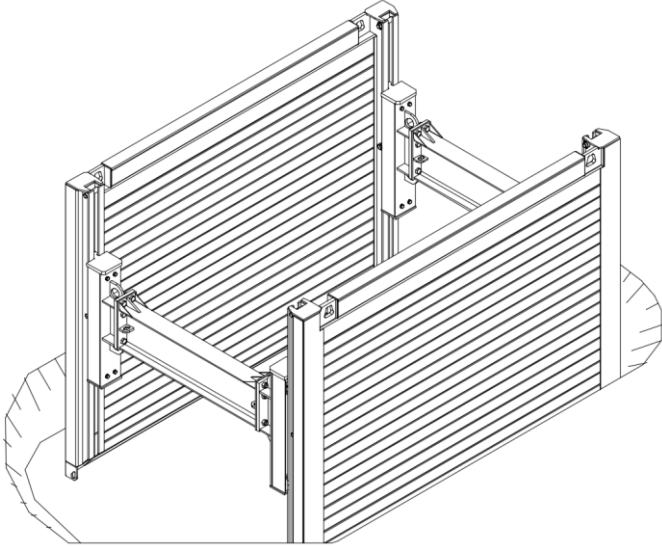
For the installation of further linear boxes, it is recommended to securely connect one half of the plate to a fully assembled box, e. g. using screw clamps (Y). The second half of the panel is then swiveled against the secured panel half using lifting gear and suitable lifting slings (GS approval) and connected.

The strut cart must be locked in the lower position in the rail during installation.



## 7 Assembly instructions linear box

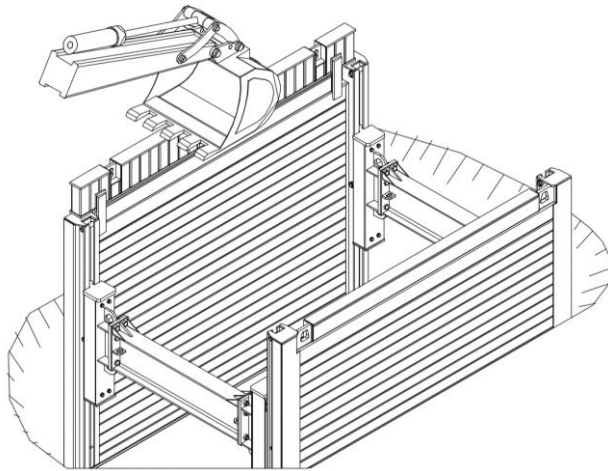
### 1. Advance excavation, insertion and alignment of the shoring unit



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

This shoring unit is adjusted and aligned centrally and parallel to the trench axis by means of lifting gear and lifting slings (GS approval, lifting eyes). After adjusting the shoring, all screw connections must be retightened.

### 2. Lowering the shoring field



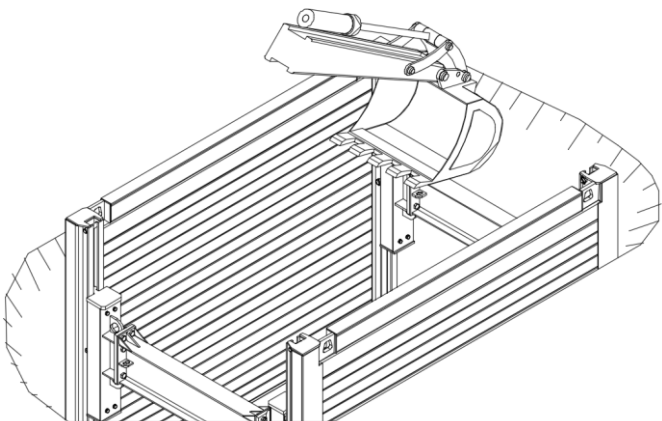
Before the actual lowering procedure, the soil beneath the shoring panels is excavated in accordance with the instructions of the site management. Shoring panels and roller units are pressed down alternately.

Care must be taken to ensure that the strut carts are positioned at the bottom when lowering.

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

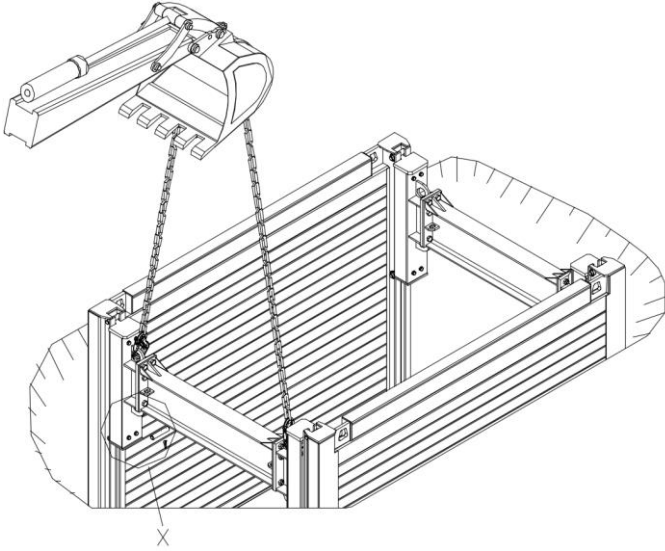
When lowering the system, it is essential to ensure that the roller units are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

Only after the shoring has been lowered completely is the roller unit pulled to the required pipe culvert height and pinned.



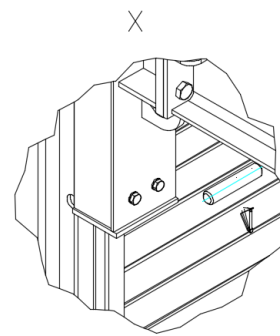
## 8 Instructions for removing linear box

### 1. Advance excavation, insertion and alignment of the shoring unit



After completing the pipe-laying work the linear box is removed with layer-by-layer backfilling and compacting. To this end, the shoring is extracted step-by-step in accordance with the instructions of the local site management, and the expert's specifications and the backfilling material returned to the trench is compacted against the existing soil.

Lifting slings may only be attached to the provided attachment points (detail X).

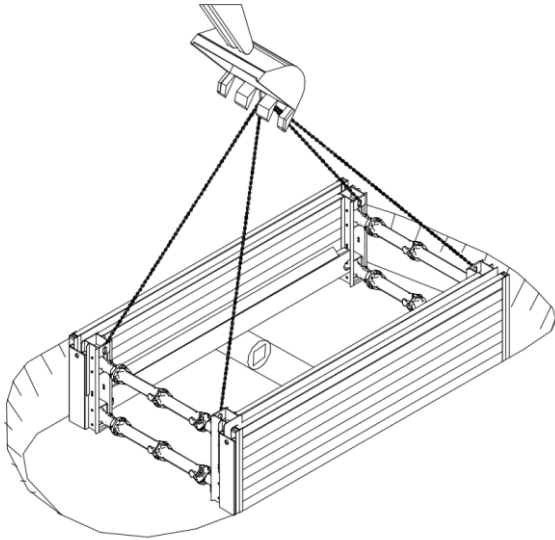


## 9 Assembly instructions piling frame shoring

### 1. General

The piling frame shoring is a universal and economical shoring method in inner-city areas, especially for crossing pipes. The two opposite piling frame elements, supported against each other with struts, serve as upper guides for trench sheets to be inserted vertically into the ground. The trench sheets can be inserted by static pressing with an excavator bucket or by vibration method. Installation and presetting of the piling frame element is carried out in the same way as for edge-supported shoring systems.

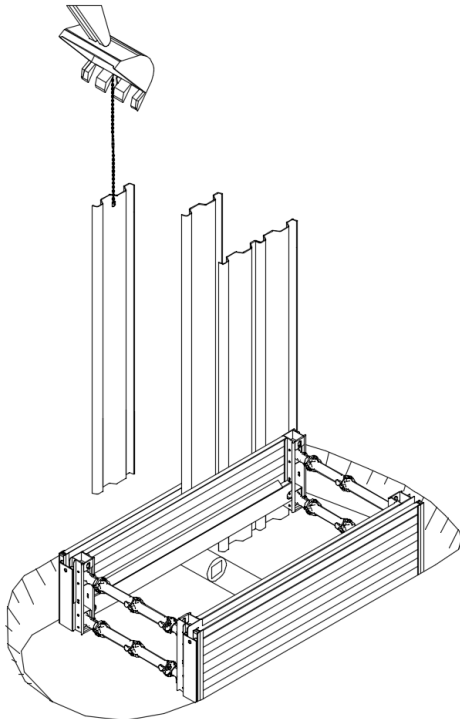
### 2. Advance excavation, insertion and alignment of the shoring unit



After the trench alignment has been measured, advance excavation for inserting the piling frame element is carried out.

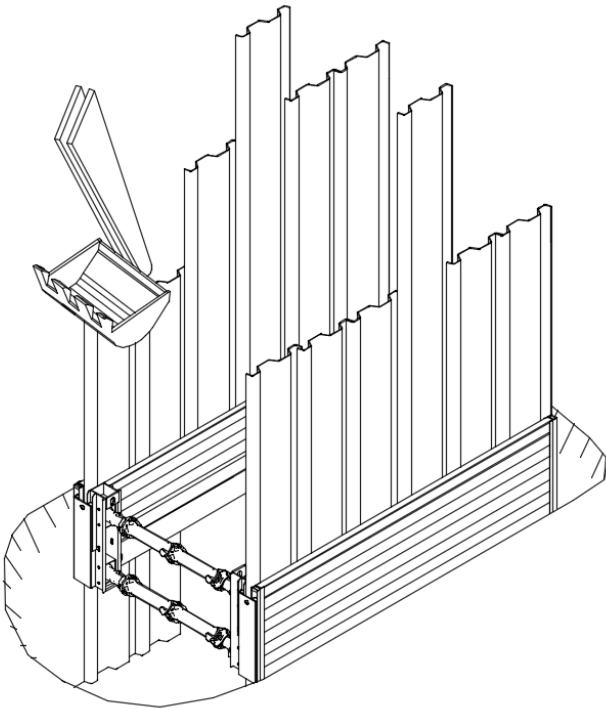
As a rule, the piling frame element is installed with the top edge flush with the working level, the advance excavation is then approx. 1 m. The gap between the trench wall and the piling frame element must be filled up to its full height. In addition, the piling frame element must be pressed against the trench wall by spinning the struts.

### 3. Inserting the trench sheets



Now the trench sheets can be inserted into the slotted double panel walls of the piling frame elements and pressed into the ground with the excavator bucket. To facilitate work, especially with trench sheets over 4 m in length, the use of trench sheet pliers is recommended. The basic equipment of piling frame elements by E+S does not include a vertical guide for the trench sheets. This has the advantage that the piles can be inserted in any required position. It is also possible to overlap the piles. However, a frame for vertical guidance of the piles can be supplied on request. Lightweight profiles KD VI/8 are used as trench sheets.

### 4. Lowering the shoring system



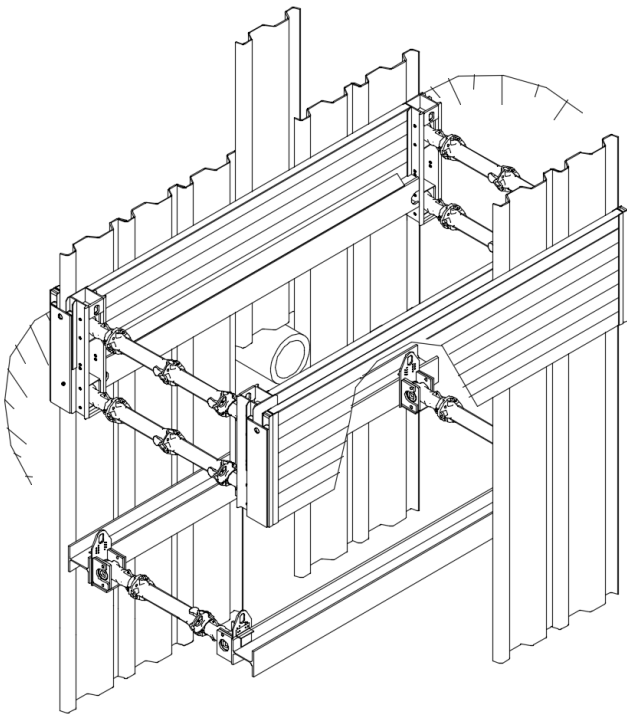
After adjusting the trench sheets, lowering is carried out alternately with the soil excavation.

During the lowering process, the advance soil excavation underneath the trench sheets must not exceed 0.50 m, depending on the soil conditions. Any pipes that may be crossing must be exposed beforehand and the trench sheet above it must be secured against further sinking. The use of shorter trench sheets is advantageous here.

The area below the crossing pipe must be conventionally secured with horizontal timber shoring. The adjacent trench sheets can also be used as an aid.

Care must be taken to ensure that the trench sheets are not used as "chisel". Solid obstacles (e. g. unnatural fillings, rock) must be removed manually. To prevent subsidence, backfilling of the elements and trench sheets must be ensured with soil. In the case of well drivable soils, the trench sheets can be inserted to their final depth. The soil is then subsequently excavated with grab equipment or backhoe.

## 5. Additional walers



Depending on the required trench depth, measures to ensure the stability of the shoring system may be required for static reasons. As with all trench shoring systems, a site-related static proof is required in accordance with DIN 4124.

Longitudinal waling beams must be installed at a depth of approx. 2 m from the top edge of the terrain. These must be secured against sinking on the piling frame element with suspension chains and supported against each other with e+s waling struts. These waling beams must be lowered simultaneously with the trench sheets to the statically required depth.

The next shoring unit is installed as soon as the previous system has been fully lowered to the bottom of the trench. Depending on site conditions, this can be another piling frame element or another shoring system. After laying the pipes, the removal of the system takes place in reverse order.



## 10 Assembly instructions drag box shoring

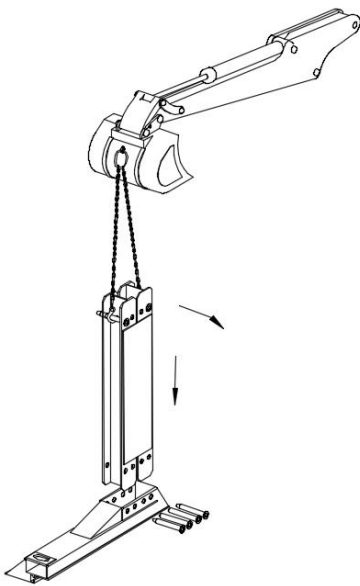
### 1. General

The drag box is a special shoring system that can be carried along by the excavator in the trench as the excavation progresses due to the cutting shoe construction mounted in the front area.

It consists of the cutting shoe construction, the drag box coupled to it and as a rule another drag box coupled to it. The elements are coupled by means of special panel connectors that allow vertical displacement against each other. Depending on the requirements, a combination of drag boxes of different lengths is possible.

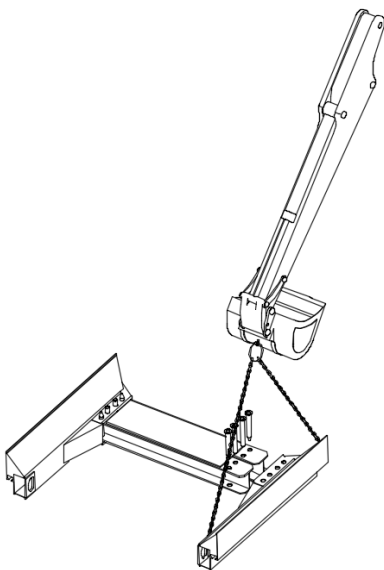
The use is particularly interesting for pipeline construction with long supports without crossing pipes at shoring depths of up to approx. 3.50 m.

### 2. Inserting the drag box beam



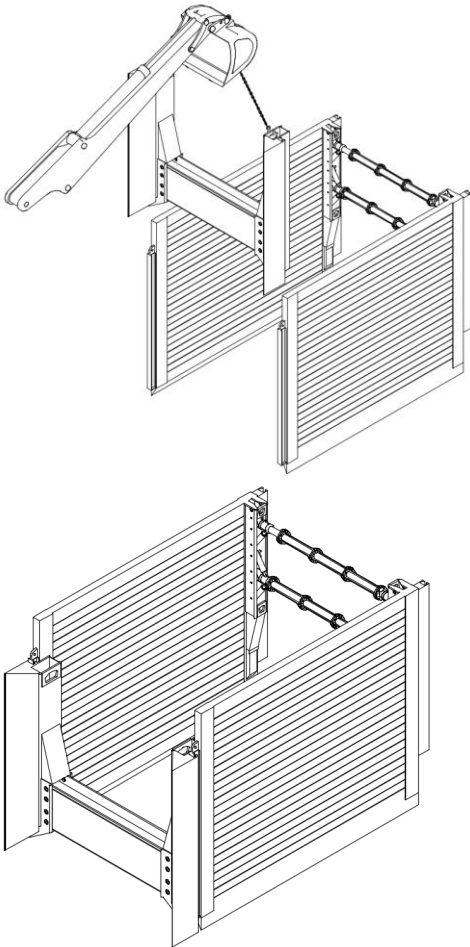
The cutting shoe construction is pre-assembled by inserting the drag box beam into the cutting shoe lying horizontally on the ground. A stable connection is created by hammering in the pins, first 2 pins with cones if possible (to center the hole patterns). The pins must be secured with cotter pins.

### 3. Installation of the cutting shoe



After turning this construction over - the drag box beam is brought into a horizontal position - the other cutting shoe can be placed on the crosshead and bolted as shown.

#### 4. Installation of the shoring



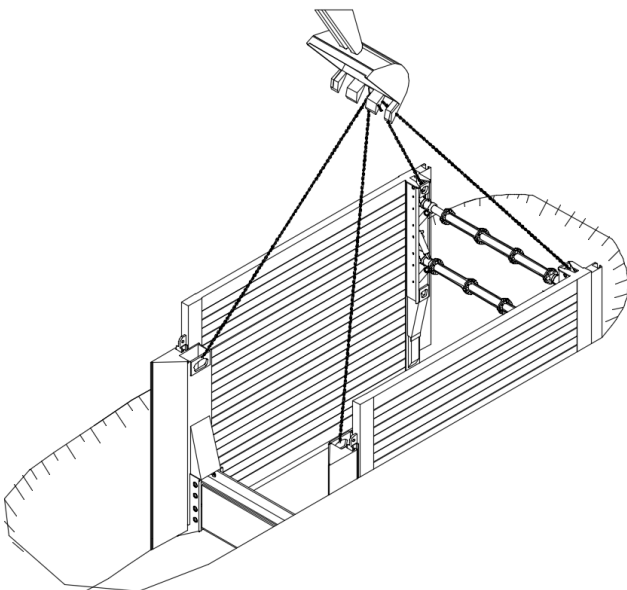
For the installation of the drag box shoring system, the drag boxes with the required extension bars are first adjusted to the required trench width (see also section “Installation instructions extension bars”).

The drag box prepared for shoring width is now brought into the installation position (cutting edge down) and the cutting shoe construction can be put off from above.

Finally, the struts are spindled out to the A-form (see section “Assembly instructions for edge- and center-supported shoring systems”, step 2.2).

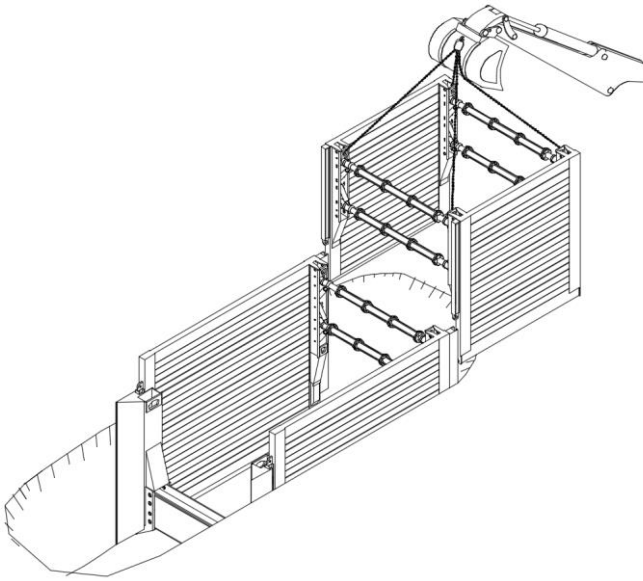
The trench width of the shoring box should also taper by 10 mm/m shoring length from the cutting shoe to the rear. This allows the frictional forces to be reduced when pulling the shoring system in the longitudinal direction of the trench.

#### 5. Adjusting the shoring



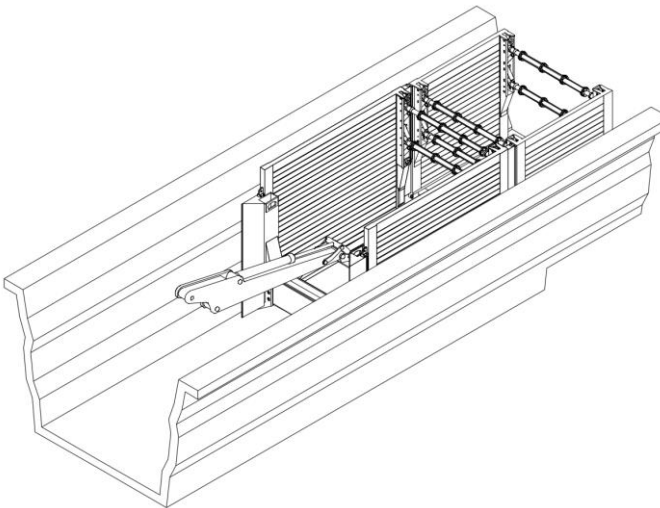
The shoring system prepared outside the pit is inserted with lifting gear and suitable and lifting slings (GS approval) into the trench which has been excavated in the final depth for the length and width of a shoring box. The length of the excavated and unsecured trench section must be limited to a length required for the insertion of one single trench shoring unit.

## 6. Coupling the drag panel



In the following operation the drag panel is inserted from above and coupled to the drag box panel by means of the panel connectors. As before with the drag box, the struts of the drag panel are brought into a slight A-form here as well. The drag panel is then lowered and / or inserted into the previously excavated trench.

## 7. Coupling the drag panel



By excavating the trench profile in front of the cutting shoe, the entire construction can now be moved in the trench. To do this, the excavator pulls the system with the bucket on the bolt of the cutting shoe in the pipe laying direction.

The backfilling and compacting of the filling soil against the trench wall takes place in the protection of the drag box, which is dismantled by the amount of the backfilling. The drag box remains at the bottom of the trench.

For crossing lines and in the shaft area, the drag boxes are lifted out of the trench and reinstalled behind the obstacle.

# 11 Statics questionnaire

terra infrastructure 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 Diggers

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  $\varphi$    $\gamma$    $c$

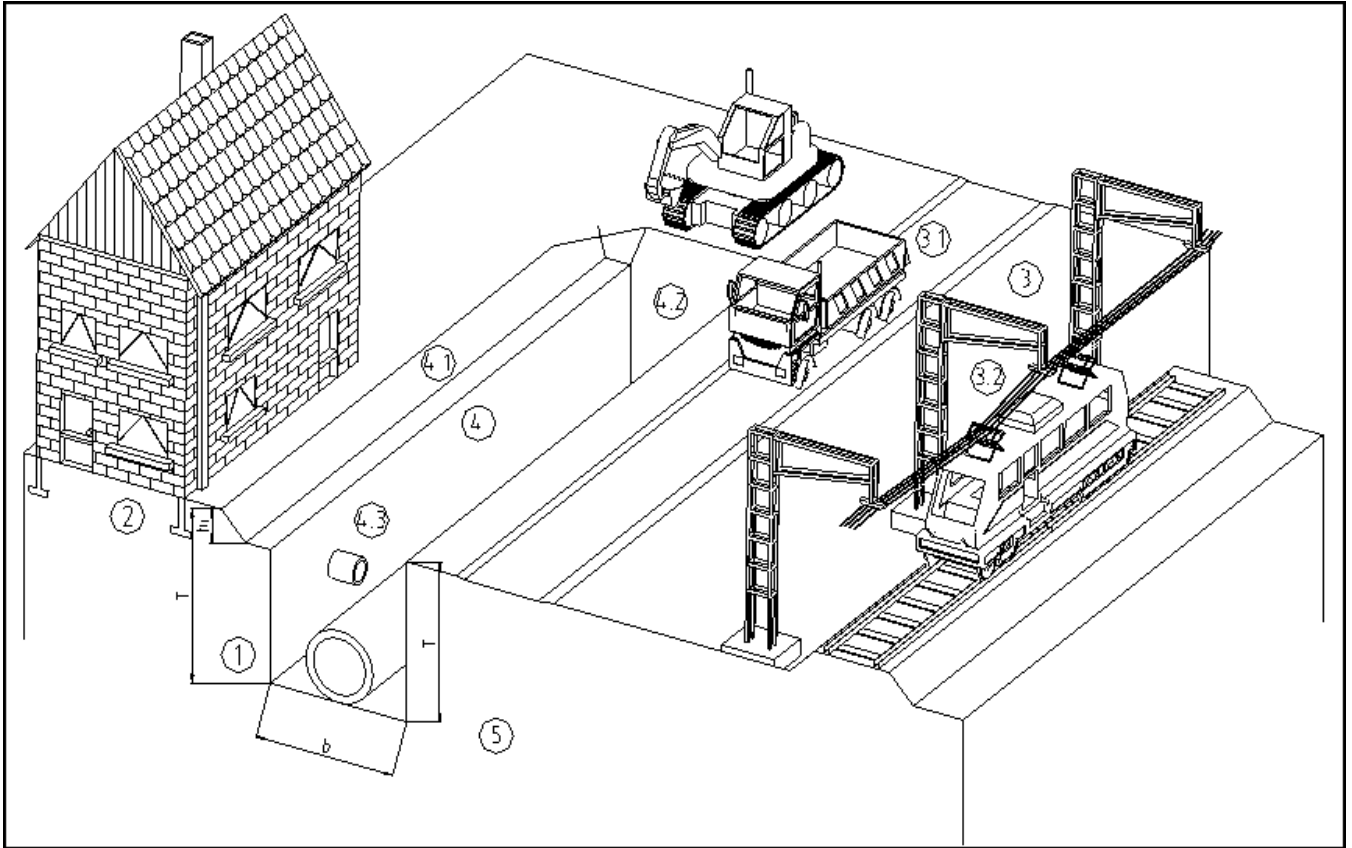
**6. Other:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### 7. Drawing



Place, date

Signature



## terra infrastructure

terra infrastructure GmbH  
Hollestraße 7a  
45127 Essen, Germany  
T: +49 201 844-562313  
F: +49 201 844-562333  
info@terra-infrastructure.com  
www.terra-infrastructure.com

### **Trench Shoring**

terra infrastructure GmbH  
Ottostr. 30  
41836 Hückelhoven, Germany  
P: +49 2433 453-0  
F: +49 2433 453-100  
trenchshoring@terra-infrastructure.com