

E02D

FOUNDATIONS; EXCAVATIONS; EMBANKMENTS (specially adapted for hydraulic engineering [E02B](#)); UNDERGROUND OR UNDERWATER STRUCTURES {(tunnels, tunnelling, mining [E21](#))}

Definition statement

This place covers:

Methods, devices and machinery for making foundations;

Engineering with the ends of making foundations or underground structures involving the disturbance of the ground surface.

Investigation of foundation soil in situ;

Improving soil or rock;

Structural elements adapted to foundation engineering and equipment and methods of placing or removing them;

Preventing excavation walls or embankments from collapsing;

Keeping dry of foundation sites in the ground;

Caissons and the joining of caissons;

Testing, repairing, straightening, lowering or lifting foundation structures.

Relationships with other classification places

[E02F](#) covers soil-shifting and dredging independent from the purpose of foundations;

[E21B](#) covers drilling of earth or rock in general and without the intent of making foundations;

[G01N](#) covers investigating or analysing materials by determining their chemical or physical properties;

[G01V](#) covers geophysics in general and prospecting;

[E02B](#) covers hydraulic engineering.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Foundation means specially adapted for overhead structures, e.g. gantries	E01F 9/696
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E02D 1/00

Investigation of foundation soil in situ (investigation involving boring or specially adapted to earth drilling [E21B 25/00](#), [E21B 49/00](#); investigating or analysing materials by determining their chemical or physical properties, in general [G01N](#), e.g. sampling [G01N 1/00](#))

Definition statement

This place covers:

Any investigation of a soil with respect to envisaged activities of building foundations on surface of that soil or partially or completely embedded in that soil covered by the investigation.

The investigations may be carried out before or after work for making the foundation is being done.

Investigations may also be done while the foundation work is in progress.

The investigations may comprise evaluation of physical properties, e.g. Young's modulus, compressibility, density, water saturation, weight, bearing capacity, pore-water pressure, permeability etc.

The investigation may comprise evaluation of chemical properties e.g. ph value.

The investigation distinguishes between soil itself and the fluids circulating in it.

The investigation in situ.

Sampling of probes like soil or water for off-site investigation.

The group covers the devices for exerting the investigation work as well as the method.

Relationships with other classification places

[E21B](#) covers drilling of earth or rock in general;

[G01N](#) covers investigating or analysing materials by determining their chemical or physical properties.

[G01V](#) covers geophysics in general and prospecting.

References

Limiting references

This place does not cover:

Apparatus for obtaining or removing undisturbed cores, e.g. core barrels, core extractors	E21B 25/00
Containers for collecting substances in boreholes or wells	E21B 27/00
Testing the nature of borehole walls; sampling of soil or fluids	E21B 49/00
Devices for testing in situ the hardness or other properties of minerals	E21C 39/00
Sampling involving an extraction tool, e.g. core bit	G01N 1/08
Suction devices for sampling of fluids, e.g. pumps	G01N 1/14
Investigating characteristics of particles or permeability, pore volume etc.	G01N 15/00
Investigating or analyzing materials by use of ultrasonic, sonic or infrasonic waves	G01N 29/00

Prospecting using seismology	G01V 1/00
Prospecting using optical means	G01V 8/00

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Foundation soil	Soil wherein or whereon a foundation for e.g. a building will be erected on
In situ	At the place and in the state of the occurrence of the soil

E02D 3/00

Improving or preserving soil or rock, e.g. preserving permafrost soil (securing of slopes or inclines [E02D 17/20](#); damming or interrupting passage of underground water [E02D 19/12](#); improving soil for agricultural purposes [A01](#); soil stabilisation for road building or like purposes [E01C 21/00](#), [E01C 23/10](#); setting rock anchoring bolts [E21D](#))

Definition statement

This place covers:

Improving of soil by adding or mixing with materials such as fibres, filaments, open mesh, stones, lost bodies, water, sand, gravel, chemical agents like grout or cement.

Improving of soil by compacting using mechanical, thermal, electrical or electro-chemical means.

Mechanical means include rolling, tamping, vibrating etc. of the soil on its surface or by penetrating the soil.

Relationships with other classification places

[A01](#) covers soil working in agriculture or forestry;

[E01C](#) covers paving of roadway surface;

[E21D](#) covers rock anchoring in tunnels or mining pits.

References

Limiting references

This place does not cover:

Securing of slopes or inclines	E02D 17/20
Placing or applying sealing substances	E02D 19/16
Wheels or wheel attachments designed for increasing traction	B60B 15/00
Machines, tools or auxiliary devices for preparing or distributing paving materials, for working the placed materials, or for forming, consolidating, or finishing the paving	E01C 19/00
Apparatus or processes for surface or soil stabilisation for road building or like purposes, e.g. mixing local aggregate with binder	E01C 21/00
Auxiliary devices or arrangements for constructing, repairing, reconditioning, or taking-up road or like surfaces	E01C 23/00

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Improving or preserving	Improving a foundation soil shall in this context be understood as increasing its load bearing capacity by excluding disadvantages such as high content of water or lack of compaction.
Trench roller	Compaction roller designed to be operated on the bottom of a trench
Slope roller	Compaction roller designed to be operated on a slope or on a largely non-limited area
To vibrate	To move or cause to move forth and back rapidly
To tamp	To force or pack down firmly by repeated blows

E02D 5/00

Bulkheads, piles, or other structural elements specially adapted to foundation engineering (engineering elements in general [F16](#))

Definition statement

This place covers:

Sheet piles made of steel and their locking forms;

Sheet piles of concrete and their locking forms;

Bulkheads made of concrete in situ, of prefabricated parts and concrete in situ;

Piles made of timber, steel or concrete;

Prefabricated piles or piles cast in position, e.g. concrete piles;

Concrete piles cast in position with or without the use of mould-pipes or moulds;

Mould-pipes or moulds for making piles or bulkheads;

Pile shoes;

Means for anchoring piles or bulkheads.

References

Limiting references

This place does not cover:

Foundation slots (made of concrete)	E02D 17/13
Structural elongated elements designed for load-supporting	E04C 3/00
Pegs, stakes or the like	E04H 15/62
Drilling rods or pipes	E21B 17/00
Anchoring-bolts for roof, floor	E21D 21/00

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Bulkhead	A Wall or partition built to hold back earth or water
In situ	Fabricated at the place of the intended use
Mould-pipe	A Pipe used as the mould for the pile, normally a concrete pile cast in situ

E02D 7/00

Methods or apparatus for placing sheet pile bulkheads, piles, mouldpipes, or other moulds (for both placing and removing [E02D 11/00](#); {accessories for coupling driver to piles or the like [E02D 13/10](#); for trees or other plants [A01G 17/16](#); placing posts [E04H 17/26](#)})

Definition statement

This place covers:

Inserting sheet piles, piles or mould-pipes for purpose of foundation into a soil.

Specifying the process of placing the above elements which may be done by driving, by vibrating, by pressure or pulling power, by screwing down, by using fluid jets, by using several means simultaneously, by means arranged inside a hollow pipe or mould pipe.

Machines and equipment for exerting these operations.

Relationships with other classification places

[E21B](#) covers earth drilling, e.g. deep drilling per se. In contrast, this class is aiming to insert a foundation element such as a pile or to inject e.g. grout in a soil to form a foundation element like a pile.

[E04H](#) covers sockets for posts and how to insert them in a ground.

References

Limiting references

This place does not cover:

For both placing and removing	E02D 11/00
Sockets or holders for posts driven into the ground	E04H 12/2215
Sockets or holders for posts driven into the ground by screwing	E04H 12/2223
Devices for erecting or removing fences	E04H 17/26
Earth drilling, e.g. deep drilling	E21B

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

To drive	To force or bring down a foundation element by means other than by vibrating, by pressure or pulling power, by screwing down, by fluid jets, or by means arranged inside the pile.
To vibrate	To move or cause to move forth and back rapidly

E02D 9/00

Removing sheet piles bulkheads, piles, mould-pipes or other moulds {or parts thereof} (for both placing and removing [E02D 11/00](#))

Definition statement

This place covers:

Removing the top section of piles,

Removing by withdrawing,

Removing by cutting-off an element under water

Relationships with other classification places

[E02D 7/00](#) covers the placing of sheet piles, piles, mould-pipes or other moulds;

[E21B](#) is about earth drilling including the withdrawal of the equipment.

References

Limiting references

This place does not cover:

Methods or apparatus for both placing and removing sheet pile bulkheads, piles, or other mould-pipes	E02D 11/00
Devices for erecting or removing fences	E04H 17/26
Derricks or masts for drilling machines	E21B 15/00

E02D 11/00

Methods or apparatus {specially adapted} for both placing and removing sheet pile bulkheads, piles, or mould-pipes (features relating to placing only [E02D 7/00](#), to removing only [E02D 9/00](#) {; placing apparatus which without special provisions, can be operated to remove, e.g. vibrating drivers [E02D 7/00](#)})

Definition statement

This place covers:

Methods or apparatus equally suitable for placing and removing foundation elements such as sheet piles, piles or mould-pipes. In contrast, [E02D 7/00](#) only covers the placing of foundation elements, [E02D 9/00](#) only covers the removing of such elements.

Relationships with other classification places

see [E02D 7/00](#)

References

Limiting references

This place does not cover:

Methods or apparatus for only placing sheet pile bulkheads, piles, mouldpipes, or other moulds	E02D 7/00
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Methods or apparatus for only removing sheet pile bulkheads, piles, mouldpipes, or other moulds	E02D 9/00
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E02D 13/00

Accessories for placing or removing piles or bulkheads {, e.g. noise attenuating chambers}

Definition statement

This place covers:

Accessories adapted to remove bulkheads, enabling control during the process of placing, removing of obstacles, follow-blocks and guide devices assisting in placing foundation elements.

Relationships with other classification places

[E21B](#) covers earth drilling in general

References

Limiting references

This place does not cover:

Accessories for drilling tools	E21B 12/00
Derricks; masts	E21B 15/00
Automatic control systems specially adapted for drilling operations	E21B 44/00
Survey of boreholes or wells	E21B 47/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Components for drivers	E02D 7/14
Scaffolds (as components for drivers)	E02D 7/16

E02D 15/00

Handling building or like materials for hydraulic engineering or foundations ({soil-shifting [E02F](#);} conveying or working-up concrete or similar masses in general [E04G 21/02](#))

Definition statement

This place covers:

Handling materials when used for hydraulic engineering or for foundations;

Handling of bulk concrete including filling into shuttering, mould-pipes, pile tubes, bore-holes or narrow shafts and under water;

Sinking workpieces into water;

Placing gravel or light material under water.

Relationships with other classification places

[E02F 1/00](#) covers general working methods with dredgers or soil-shifting machines;

[E04G 21/00](#) covers preparing, conveying, or working-up building materials or building elements in situ;

[E02B](#) covers hydraulic engineering.

References

Limiting references

This place does not cover:

Concrete piles cast in position by making use of mould-pipes or other mould	E02D 5/38
Concrete piles cast in position by making use of mould-pipes or other mould in open water	E02D 5/40
Placing of hollow pipes or mould pipes by means arranged inside the pile or pipe	E02D 7/28
Devices for applying linings on banks or the water bottom	E02B 3/121
Banks of the bodies of water	E02B 3/122
Lining canals	E02B 5/02
Conveying or working-up concrete or similar masses in general	E04G 21/02

E02D 17/00

Excavations; Bordering of excavations; Making embankments (soil-shifting apparatus [E02F](#); earth drilling [E21](#))

Definition statement

This place covers:

Pits for foundations and their borderings;

Narrow shafts or ditches and trenches for foundation;

Stiffening or bordering the sides of ditches or trenches by using travelling trench shores and shoring struts;

Covering and back-filling of those trenches;

Machines for making foundation slots, i.e. diaphragm walls;

Securing of slopes or inclines, e.g. to counter erosion, by flexible securing means e.g. geotextiles, prefabricated modular blocks or by sheet piles and piles.

Relationships with other classification places

[E02F](#) covers general working methods with dredgers or soil-shifting machines;

References

Limiting references

This place does not cover:

Concrete diaphragms per se	E02D 5/18
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Limiting references

Foundations for dams	E02D 27/40
Protection like protecting fences against snowslide or avalanches	E01F 7/04 , E01F 15/00
Stream regulation, e.g. breaking up subaqueous rock, cleaning the beds of waterways, directing the water flow and removing of sediment or solid rock	E02B 3/02
Soil shifting apparatus unless used for making foundations, e.g. diaphragm wall	E02F 1/00
Dredgers or soil shifting machines with equipment for back-filling trenches or ditches	E02F 5/12
Dredgers or soil shifting machines for making embankments	E02F 5/22

E02D 19/00**Keeping dry foundation sites or other areas in the ground (sheet piles or bulkheads [E02D 5/02](#))****Definition statement**

This place covers:

Protecting areas, particularly foundation areas like foundation pits, from the entry of water;

Water may arise as open water or underground water;

Lining sumps when in trenches, ditches or other foundation pits.

The methods comprising the building of coffer-dams, making open ditches or trenches, lowering the level of ground water, e.g. by pumping, interrupting the waters passage by freezing, damming, making sealing aprons or forcing out the water by e.g. compressed air.

References**Limiting references**

This place does not cover:

Consolidating soil by placing solidifying or pore-filling substances in the soil	E02D 3/12
Sheet piles or sheet pile bulkheads	E02D 5/02
Pneumatic caissons to keep of the water	E02D 23/04
Permanent sheet piling boxes	E02D 27/30
Collecting drinking water	E02B 3/00
Sealing or joints in connection with hydraulic engineering when correcting rivers or streams	E02B 3/16
Freezing the soil when sinking shafts, e.g. mining shafts	E21D 1/12

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Sealing aprons	Diaphragms made from bituminous or clay material in contrast to diaphragm wall which is widely understood a concrete wall.
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E02D 23/00

Caissons; Construction or placing of caissons (tunnels submerged into or built in open water [E02D 29/063](#) {; moles, piers, quays, breakwaters incorporating caissons [E02B 3/06](#); foundation formed by caissons [E02D 27/18](#) - [E02D 27/22](#); caisson-like artificial islands [E02B 17/00](#)})

Definition statement

This place covers:

Caissons and pneumatic caissons, their use involving bringing materials and persons in there;

Particularities of the use of such caissons comprising lowering and sinking, increasing lowering, jointing caissons to the foundation soil, solving problems such as skin friction while lowering.

References

Limiting references

This place does not cover:

Foundation formed by caissons	E02D 27/18 - E02D 27/22
Tunnels submerged into or built in open water	E02D 29/063
Breakwaters incorporating caissons	E02B 3/06
Caisson-like artificial islands	E02B 17/00
Sinking mine shaft	E21D 1/00
Air locks in mines	E21F 1/14

E02D 25/00

Joining caissons, sinkers, or other units to each other under water

Definition statement

This place covers:

Underwater connection of elements used for foundation underwater such as caissons, sinkers, or other units

References

Limiting references

This place does not cover:

Jointing caissons to (uneven) foundation soil	E02D 23/16
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E02D 27/00

Foundations as substructures

Definition statement

This place covers:

Foundations when flat on the foundation soil, deeply embedded foundations such as pile foundations;

Definition statement

Foundations for special purposes, e.g. in earthquake territories, in frozen ground, in moors, for masts or machines;

special type of fixing the foundation to the ground such as anchoring or building underneath existing buildings for their recovery.

References

Limiting references

This place does not cover:

Consolidating foundation soil in general	E02D 3/02 - E02D 3/12
Sinking worpieces into water or soil	E02D 15/08
Equipment for dwelling or working under water	B63C 11/00
Tanks per se	B65D 88/00
Foundations for railway sleepers	E01B
Foundations for paving of roads	E01C 3/00
Bridges for supporting conduits	E01D 18/00
Dams per se	E02B 3/10 , E02B 7/04
Elevated canals	E02B 5/005
Arrangements or adaptations of tanks for water supply	E03B 11/00
Making of a new substructure subsequent to lifting or moving of buildings	E04G 23/06
Building constructions with protection arrangements against earthquakes	E04H 9/02
Sockets or holders for poles or masts per se	E04H 12/22
Special lay-out of foundations with respect to the particularities of the machines to be supported	F16M 9/00

E02D 27/34

Foundations for sinking or earthquake territories (building constructions with protection arrangements against earthquakes [E04H 9/02](#))

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Building constructions with protection arrangements against earthquakes	E04H 9/02
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Special rules of classification

Looping references between [E02D 27/34](#) and [E04H 9/02](#) have been identified. Until this inconsistency is resolved, the current classification practice in CPC is as follows: both references should be treated as informative.

E02D 29/00

{Independent} underground or underwater structures (underground tanks [B65D 88/76](#); hydraulic engineering, e.g. sealings or joints, [E02B](#); underground garages [E04H 6/00](#); underground air-raid shelters [E04H 9/12](#); burial vaults [E04H 13/00](#)); Retaining walls

Definition statement

This place covers:

Underground or underwater structures as independent buildings or constructions, e.g. retaining or protecting walls, caverns, tunnels, siphons;

Tunnels for conduits;

Manhole shafts and covers therefore;

Joints in constructions and their arrangement;

Retaining walls

References

Limiting references

This place does not cover:

Details of ground anchors	E02D 5/80
Securing of slopes or inclines	E02D 17/20
Submerged foundations	E02D 27/52
Shafts for underground tanks	B65D 90/10
Lifting devices for covers in general	B66F 19/005
Pontoons or floating bridges	E01D 15/14
Arrangements for absorbing or reflecting air-transmitted noise from road or railway traffic	E01F 8/00
Arrangements for absorbing or reflecting air-transmitted noise from road or railway traffic using gabions	E01F 8/025
Piers or quay walls	E02B 3/06
Joints for hydraulic engineering in general	E02B 3/16
Siphon weirs	E02B 7/18
Design and layout of power plants	E02B 9/00
Tunnels for pressure water conduits	E02B 9/06
Shafts for sewerage	E03F 5/02
Gully gratings	E03F 5/06
Siphons for sewerage	E03F 5/20
Sealing of joints not restricted to foundation structures	E04B 1/68
Layout of tunnels in general	E21D 9/14
Large underground chambers or caverns made only by underground methods	E21D 13/00
Siphons in general	F04F 10/00

Tunnels for cables	H02G 9/02
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E02D 31/00

Protective arrangements for foundations or foundation structures {(protective casings for piles [E02D 5/60](#))}; Ground foundation measures for protecting the soil or the subsoil water, e.g. preventing or counteracting oil pollution (spillage retaining means for tanks [B65D 90/24](#))

Definition statement

This place covers:

Protecting foundations from harmful influence such as water, humidity, noxious gases, corrosion by soil or water, transmission of vibrations, soil pressure, upward hydraulic pressure or frost heave.

References

Limiting references

This place does not cover:

Anchored foundations	E02D 27/50
Sealings for hydraulic engineering in general	E02B 3/16
Sealings for building structures in general	E04B 1/66

E02D 33/00

Testing foundations or foundation structures (testing methods and apparatus, see the relevant subclasses of class [G01](#); testing structures or apparatus as regards function, in general, [G01M](#); testing or determining chemical or physical properties, in general [G01N](#))

Definition statement

This place covers:

Testing of foundation structures such as piles or other foundation structure

References

Limiting references

This place does not cover:

General testing of structures and apparatus with respect to their function	G01M
Testing or determining chemical or physical properties in general	G01N

E02D 35/00

Straightening, lifting, or lowering of foundation structures or of constructions erected on foundations {(foundations for sinking territories with incorporated means for remedying settlement [E02D 27/34](#); lifting or moving buildings [E04G 23/06](#)}}

Definition statement

This place covers:

Altering the level of a foundation

References

Limiting references

This place does not cover:

Foundations for sinking territories with incorporated means for remedying settlement	E02D 27/34
Repair of damaged foundations	E02D 37/00
Lifting or moving buildings	E04G 23/06

E02D 37/00

Repair of damaged foundations or foundation structures {(renewing piles [E02D 5/64](#); roads [E01C 11/005](#); bridges [E01D 22/00](#); repairing buildings [E04G 23/02](#)}}

Definition statement

This place covers:

Repairing improper foundations

References

Limiting references

This place does not cover:

Foundations for sinking territories with incorporated means for remedying settlement	E02D 27/34
Straightening, lowering, lifting foundation structures	E02D 35/00
Lifting or moving buildings	E04G 23/06