

CPC**COOPERATIVE PATENT CLASSIFICATION****E02D**

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

WARNING

The following IPC groups are not used in the CPC scheme. Subject matter covered by these groups is classified in the following CPC groups:

[E02D 29/09](#) covered by [E02D 29/06](#)

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](#))

E02D 1/02

. before construction work

E02D 1/022

.. { by investigating mechanical properties of the soil ([E02D 1/027](#) takes precedence)}

E02D 1/025

... { combined with sampling }

E02D 1/027

.. { by investigating properties relating to fluids in the soil, e.g. pore-water pressure, permeability (sampling of groundwater [E02D 1/06](#))}

E02D 1/04

.. Sampling of soil {([E02D 1/025](#) takes precedence)}

E02D 1/06

.. Sampling of ground water

E02D 1/08

. after finishing the foundation structure {(testing of piles [E02D 33/00](#))}

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](#))

E02D 3/005

. { Soil-conditioning by mixing with fibrous materials, filaments, open mesh or the like }

E02D 3/02

. Improving by compacting ([E02D 3/11](#) takes precedence; compacting soil locally before or while forming foundations [E02D 27/26](#), [E02D 27/28](#))

E02D 3/026

.. by rolling with rollers usable only for or specially adapted for soil compaction, e.g. sheepfoot rollers (rollers for soil working in agriculture [A01B 29/00](#); rollers for road paving, such rollers usable also for compacting soil [E01C 19/23](#))

E02D 3/0265

... { Wheels specially adapted therefor; Cleats for said wheels }

E02D 3/032

... Trench rollers

E02D 3/039

... Slope rollers

- E02D 3/046 .. by tamping or vibrating, e.g. with auxiliary watering of the soil ([E02D 3/026](#), [E02D 3/08](#) take precedence; generating or transmitting mechanical vibrations for performing mechanical work in general [B06B](#); tamping or vibrating apparatus for working ballast or railways [E01B 27/00](#), for consolidating paving materials [E01C 19/30](#), for consolidating concrete in general [E04G 21/06](#))
- E02D 3/054 ... involving penetration of the soil, e.g. vibroflotation
- E02D 3/061 ... Tampers with directly acting explosion chambers (pile drivers with explosion chambers [E02D 7/12](#))
- E02D 3/068 ... Vibrating apparatus operating with systems involving reciprocating masses ([E02D 3/054](#), [E02D 3/061](#) take precedence)
- E02D 3/074 ... Vibrating apparatus operating with systems involving rotary unbalanced masses ([E02D 3/054](#) takes precedence)
- E02D 3/08 .. by inserting stones or lost bodies, e.g. compaction piles (sand drains for soil compaction [E02D 3/10](#); stressing soil while forming foundations [E02D 27/28](#))
- E02D 3/10 .. by watering, draining, de-aerating or blasting, e.g. by installing sand or wick drains ([E02D 3/11](#) takes precedence; soil-penetrating vibrators with auxiliary watering [E02D 3/054](#); drainage of soil in general [E02B 11/00](#))
- E02D 3/103 ... { by installing wick drains or sand bags }
- E02D 3/106 ... { by forming sand drains containing only loose aggregates (sand piles [E02D 3/08](#)) }
- E02D 3/11 . by thermal, electrical or electro-chemical means (freezing soil for interrupting passage of underground water [E02D 19/14](#))
- E02D 3/115 .. by freezing
- E02D 3/12 . Consolidating by placing solidifying or pore-filling substances in the soil (making piles [E02D 5/46](#); soil-conditioning or soil-stabilising materials [C09K 17/00](#); consolidation of ground around boreholes or wells [E21B 43/025](#))
- E02D 3/123 .. { and compacting the soil ([E02D 3/126](#) takes precedence) }
- E02D 3/126 .. { and mixing by rotating blades }
- E02D 5/00 Bulkheads, piles, or other structural elements specially adapted to foundation engineering (engineering elements in general [F16](#))**
- E02D 5/02 . Sheet piles or sheet pile bulkheads {(foundations made with sheet pile bulkheads [E02D 27/30](#); cofferdams [E02D 19/04](#)) }
- E02D 5/03 .. Prefabricated parts { e.g. composite sheet piles }
- E02D 5/04 ... made of steel
- E02D 5/06 Fitted piles or other elements specially adapted for closing gaps between two sheet piles or between two walls of sheet piles
- E02D 5/08 Locking forms; Edge joints; Pile crossings; Branch pieces
- E02D 5/10 ... made of concrete or reinforced concrete {(moulds therefor [E02D 5/70](#)) }
- E02D 5/105 { of prestressed concrete ([E02D 5/12](#) takes precedence) }
- E02D 5/12 Locking forms; Edge joints; Pile crossings; Branch pieces
- E02D 5/14 .. Sealing joints between adjacent { sheet } piles (sealing joints not restricted to foundation piles [E04B 1/68](#))

- E02D 5/16 .. Auxiliary devices rigidly or detachably arranged on sheet piles for facilitating assembly {[as parts of driving or pulling apparatus E02D 7/00, E02D 13/00](#)}

- E02D 5/18 . Bulkheads or similar walls made solely of concrete in situ {(moulds therefor [E02D 5/68](#); making foundation slots [E02D 17/13](#); sealing diaphragms other than those made of concrete [E02D 19/18](#))}

- E02D 5/182 .. { using formworks to separate sections }
- E02D 5/185 .. { with flexible joint members between sections (joints in foundation structures [E02D 29/16](#); flexible joints in hydraulic engineering [E02B 3/16](#), in building [E04B 1/68](#))}

- E02D 5/187 .. { the bulkheads or walls being made continuously, e.g. excavating and constructing bulkheads or walls in the same process, without joints }

- E02D 5/20 . Bulkheads or similar walls made of prefabricated parts and concrete, including reinforced concrete, in situ

- E02D 5/22 . Piles (sheet piles, { i.e. elements shaped to mutually lock or mate }[E02D 5/02](#); { pile shoes [E02D 5/72](#); foundations on piles [E02D 27/12, E02D 27/20](#) })
- E02D 5/223 .. { Details of top sections of foundation piles ([E02D 5/54](#) takes precedence)}
- E02D 5/226 .. { Protecting piles (piles with protecting cases [E02D 5/60](#))}
- E02D 5/24 .. Prefabricated piles

NOTE

Documents covered both by [E02D 5/26](#) to [E02D 5/32](#) and by one or several of the groups [E02D 5/48](#) to [E02D 5/64](#) are classified in all relevant groups unless specific priority rules to the contrary are given

- E02D 5/26 ... made of timber with or without reinforcement; Means affording protection against spoiling of the wood (cases [E02D 5/60](#); impregnating agents [B27K 3/16](#)); Self-cleaning of piles placed in water

- E02D 5/28 ... made of steel { or other metals ([E02D 5/52](#) takes precedence)}
- E02D 5/285 { tubular, e.g. prefabricated from sheet pile elements (sheet pile boxes [E02D 27/30](#); concrete piles with metal casings [E02D 5/30](#))}

- E02D 5/30 ... made of concrete or reinforced concrete or made of steel and concrete {([E02D 5/50](#) takes precedence; assembled from segments [E02D 5/523](#); prestressed concrete [E02D 5/58](#))}

- E02D 5/32 ... with arrangements for setting { or assisting in setting } in position by fluid jets {(placing piers by using fluid jets in general [E02D 7/24](#))}

- E02D 5/34 .. Concrete or concrete-like piles cast in position; { Apparatus for making same ([E02D 5/50](#) takes precedence; moulds [E02D 5/665](#); placing, removing moulds [E02D 7/00](#) to [E02D 11/00](#); placing the concrete [E02D 15/04](#))}

- E02D 5/36 ... making without use of mouldpipes or other moulds

NOTE

Documents covered both by [E02D 5/34](#) to [E02D 5/46](#) and by one or several of the groups [E02D 5/48](#) to [E02D 5/64](#) are classified in all relevant groups unless specific priority rules to the contrary are given

| | | |
|------------|-------|--|
| E02D 5/38 | ... | making by use of mould-pipes or other moulds |
| E02D 5/385 | | { with removal of the outer mould-pipes (documents also covered by one or several of the groups E02D 5/40 to E02D 5/44 are classified in all the relevant groups)} |
| E02D 5/40 | | in open water |
| E02D 5/42 | | by making use of pressure liquid or pressure gas for compacting the concrete |
| E02D 5/44 | | with enlarged footing or enlargements at the bottom of the pile |
| E02D 5/445 | | { by application of pyrotechniques } |
| E02D 5/46 | ... | making in situ by forcing bonding agents into gravel fillings or the soil (consolidating soil in general E02D 3/12) |
| E02D 5/48 | .. | Piles varying in construction along their length, { i.e. along the body between head and shoe, e.g. made of different materials along their length (E02D 5/50 , E02D 5/52 take precedence)} |
| E02D 5/50 | .. | Piles comprising both precast concrete portions and concrete portions cast in situ {(E02D 5/523 takes precedence)} |
| E02D 5/52 | .. | Piles composed of separable parts, e.g. telescopic tubes { Piles composed of segments } |
| E02D 5/523 | ... | { composed of segments } |
| E02D 5/526 | | { Connection means between pile segments } |
| E02D 5/54 | .. | Piles with prefabricated supports or anchoring parts; Anchoring piles {(E02D 5/44 takes precedence; ground anchors E02D 5/80 ; anchored foundations E02D 27/50 } |
| E02D 5/56 | .. | Screw piles {(placing piles by screwing down E02D 7/22)} |
| E02D 5/58 | .. | Prestressed concrete piles {(segmental piles E02D 5/523)} |
| E02D 5/60 | .. | Piles with protecting cases |
| E02D 5/62 | .. | Compacting the soil at the footing or in { or along } a casing by forcing cement or like material through tubes |
| E02D 5/64 | .. | Repairing piles |
| E02D 5/66 | . | Mould-pipes or other moulds {(for plant use B28B)} |
| E02D 5/665 | .. | { for making piles } |
| E02D 5/68 | .. | for making bulkheads or elements thereof |
| E02D 5/70 | .. | for making sheet piles { not used } |
| E02D 5/72 | . | Pile shoes |
| E02D 5/74 | . | Means for anchoring structural elements or bulkheads (anchoring piles E02D 5/54 ; { anchored foundations E02D 27/50 } |
| E02D 5/76 | .. | Anchoring for bulkheads or sections thereof { in as much as specially adapted therefor } |
| E02D 5/765 | ... | { removable } |
| E02D 5/80 | .. | Ground anchors {(for galleries, tunnels or shafts E21D 21/00)} |
| E02D 5/801 | ... | { driven by screwing } |
| E02D 5/803 | ... | { with pivotable anchoring members } |
| E02D 5/805 | ... | { with deformable anchoring members } |

- E02D 5/806 . . . { involving use of explosives }
- E02D 5/808 . . . { anchored by using exclusively a bonding material }

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](#) })

- E02D 7/02 . Placing by driving {([E02D 7/18](#) to [E02D 7/24](#) take precedence)}
- E02D 7/04 . . Hand { (-actuated) } pile-drivers
- E02D 7/06 . . Power-driven drivers {(tampers [E02D 3/061](#))}
- E02D 7/08 . . . Drop drivers with free-falling hammer {([E02D 7/10](#) takes precedence)}
- E02D 7/10 . . . with pressure-actuated hammer, { i.e. the pressure fluid acting directly on the hammer structure ([E02D 7/12](#) takes precedence; vibrating drivers [E02D 7/18](#))}
- E02D 7/12 . . . Drivers with explosion chambers
- E02D 7/125 { Diesel drivers }
- E02D 7/14 . . . Components for drivers { inasmuch as not specially for a specific driver construction }
- E02D 7/16 Scaffolds { or supports } for drivers {(guide frames for the elements to be driven per se [E02D 13/04](#); supports of the artificial island type [E02B 17/00](#))}
- E02D 7/165 { of variable length, e.g. foldable or telescopic }
- E02D 7/18 . Placing by vibrating {(vibrators for soil compacting [E02D 3/046](#))}
- E02D 7/20 . Placing by pressure or pulling power
- E02D 7/22 . Placing by screwing down {(screw piles per se [E02D 5/56](#))}
- E02D 7/24 . Placing by using fluid jets {(prefabricated concrete piles with arrangements therefor [E02D 5/32](#))}
- E02D 7/26 . Placing by using several means simultaneously
- E02D 7/28 . Placing of hollow pipes or mould pipes by means arranged inside the piles or pipes {([E02D 13/08](#) takes precedence)}
- E02D 7/30 . . by driving cores

E02D 9/00 **Removing sheet piles bulkheads, piles, mould-pipes or other moulds** { or parts thereof } (for both placing and removing [E02D 11/00](#))

- E02D 9/005 . { removing the top of placed piles of sheet piles ([E02D 9/04](#) takes precedence)}
- E02D 9/02 . by withdrawing
- E02D 9/04 . by cutting-off under water

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](#) })

E02D 13/00 **Accessories for placing or removing piles or bulkheads,** { e.g. noise attenuating chambers }

[E02D 13/005](#) . { Sound absorbing accessories in piling }

[E02D 13/02](#) . specially adapted for placing or removing bulkheads

[E02D 13/04](#) . Guide devices; Guide frames {(as parts of the driver scaffold [E02D 7/16](#))}

[E02D 13/06](#) . for observation while placing

[E02D 13/08](#) . Removing obstacles

[E02D 13/10](#) . Follow-blocks of pile-drivers or like devices

NOTE

The IPC wording is replaced by the following wording: Devices adapted to, e.g. interposed on, the top of the pile to be driven, e.g. follow-blocks or the like caps, rings

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](#))

[E02D 15/02](#) . Handling of bulk concrete specially for foundation { or hydraulic engineering } purposes {(lining canals [E02B 5/02](#); banks of the bodies of water [E02B 3/121](#))}

[E02D 15/04](#) . . Placing concrete in mould-pipes, pile tubes, bore-holes or narrow shafts

[E02D 15/06](#) . . Placing concrete under water {(for surfacing the bottom of bodies of water [E02B 3/121](#))}

[E02D 15/08](#) . Sinking workpieces into water or soil { inasmuch as not provided for elsewhere }

[E02D 15/10](#) . Placing gravel or light material under water { inasmuch as not provided for elsewhere }

E02D 17/00 **Excavations; Bordering of excavations; Making embankments** (soil-shifting apparatus [E02F](#); earth drilling [E21](#))

[E02D 17/02](#) . Foundation pits

[E02D 17/04](#) . . Bordering { surfacing } or stiffening the sides of foundation pits

- E02D 17/06 . Foundation { **trenches** } ditches or narrow shafts
- E02D 17/08 .. Bordering or stiffening the sides of ditches { **trenches** } or narrow shafts for foundations
- E02D 17/083 ... { **Shoring struts** }
- E02D 17/086 ... { **Travelling trench shores** }
- E02D 17/10 .. Covering trenches for foundations
- E02D 17/12 .. Back-filling of foundation trenches or ditches {(apparatus therefor [E02F 5/12](#), [E02F 5/22](#))}

- E02D 17/13 . Foundation slots { **or slits** }; Implements for making these slots { **or slits** }

- E02D 17/16 . Loosening of soil or rock, under water (for correcting streams [E02B 3/02](#); by dredgers or excavators [E02F](#))

- E02D 17/18 . Making embankments, { e.g. dikes, dams } ([E02D 17/20](#) takes precedence; { foundations for dams [E02D 27/40](#) })

- E02D 17/20 . Securing of slopes or inclines {(by soil [E02D 3/12](#); protection against snowslides or avalanches [E01F 7/04](#), [E01F 15/00](#); securing banks or like surfaces facing on bodies of water [E02B 3/12](#))}
- E02D 17/202 .. { with flexible securing means }
- E02D 17/205 .. { with modular blocks, e.g. pre-fabricated }
- E02D 17/207 .. { with means incorporating sheet piles or piles }

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

- E02D 19/02 . Restraining of open water
- E02D 19/04 .. by coffer-dams { ,e.g. made of sheet piles (permanent sheet piling boxes [E02D 27/30](#))}

- E02D 19/06 . Restraining of underground water
- E02D 19/08 .. by employing open ditches arranged below the level of the water
- E02D 19/10 .. by lowering level of ground water {(installation for obtaining or collecting drinking water [E03B 3/00](#))}
- E02D 19/12 .. by damming or interrupting the passage of underground water
- E02D 19/14 ... by freezing the soil (in connection with sinking shafts [E21D 1/12](#))
- E02D 19/16 ... by placing or applying sealing substances ({ [E02D 19/18](#) takes precedence }; consolidating by placing solidifying or pore-filling pore-filling substances in the soil [E02D 3/12](#); { improving soil by chemical substances [C09K 17/00](#) })
- E02D 19/18 ... by making use of sealing aprons, { e.g. diaphragms made from bituminous or clay material } ({ concrete diaphragms [E02D 5/18](#) }; sealing or joints for { hydraulic } engineering work [E02B 3/16](#))
- E02D 19/185 { Joints between sheets constituting the sealing aprons }
- E02D 19/20 ... by displacing the water, e.g. by compressed air {(pneumatic caissons [E02D 23/04](#))}

- E02D 19/22
 - . Lining sumps in trenches { or other foundation pits }
- 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](#) to [E02D 27/22](#); caisson-like artificial islands [E02B 17/00](#) })
- E02D 23/02
 - . Caissons able to be floated on water and to be lowered into water in situ {(floating caisson foundations [E02D 27/06](#))}
- E02D 23/04
 - . Pneumatic caissons {(sinking of same [E02D 23/10](#))}
- E02D 23/06
 - .. bringing persons or material into or out of compressed air caissons {(air locks in mines [E21F 1/14](#))}
- E02D 23/08
 - . Lowering or sinking caissons {(sinking mine shaft [E21D 1/00](#))}
- E02D 23/10
 - .. Caisson filled with compressed air {([E02D 23/06](#) takes precedence)}
- E02D 23/12
 - .. inclined lowering
- E02D 23/14
 - .. Decreasing the skin friction while lowering
- E02D 23/16
 - . Jointing caissons to the foundation soil, specially to uneven foundation soil
- E02D 25/00**

Joining caissons, sinkers, or other units to each other under water
- E02D 27/00**

Foundations as substructures
- E02D 27/01
 - . Flat foundations
- E02D 27/013
 - .. { Shuttering specially adapted therefor }
- E02D 27/016
 - .. { made mainly from prefabricated concrete elements }
- E02D 27/02
 - .. Flat foundations without substantial excavation ([E02D 27/04](#), [E02D 27/08](#) take precedence)
- E02D 27/04
 - .. in water or on quicksand
- E02D 27/06
 - ... Floating caisson foundations
- E02D 27/08
 - .. Reinforcements for flat foundations { [E02D 27/48](#) takes precedence }
- E02D 27/10
 - . Deep foundations
- E02D 27/12
 - .. Pile foundations
- E02D 27/14
 - ... Pile framings, { i.e. piles assembled to form the substructure }
- E02D 27/16
 - ... Foundations formed of separate piles
- E02D 27/18
 - .. Foundations formed by making use of caissons
- E02D 27/20
 - .. Caisson foundations combined with pile foundations
- E02D 27/22
 - .. Caisson foundations made by starting from fixed or floating artificial islands by using protective bulkheads

- E02D 27/24 . Foundations constructed by making use of diving-bells (equipment for dwelling or working under water [B63C 11/00](#))
- E02D 27/26 . Compacting soil locally before forming foundations; Construction of foundation structures by forcing binding substances into gravel fillings (consolidating foundation soil in general [E02D 3/02](#) to [E02D 3/12](#); { for piles [E02D 5/02](#), [E02D 5/46](#) })
- E02D 27/28 . Stressing the soil or the foundation structure while forming foundations
- E02D 27/30 . Foundations made with permanent use of sheet pile bulkheads, walls of planks, or sheet piling boxes
- E02D 27/32 . Foundations for special purposes {(for paving of roads [E01C 3/00](#))}
- E02D 27/34 .. Foundations for sinking or earthquake territories (building constructions with protection arrangements against earthquakes [E04H 9/02](#))
- E02D 27/35 .. Foundations formed in frozen ground, e.g. in permafrost soil
- E02D 27/36 .. Foundations formed in moors or bogs
- E02D 27/38 .. Foundations for large tanks, e.g. oil tanks
- E02D 27/40 .. Foundations for dams across valleys or for dam constructions {(dams per se [E02B 3/10](#), [E02B 7/04](#))}
- E02D 27/42 .. Foundations for poles, masts or chimneys {(sockets or holders for poles or masts per se [E04H 12/22](#))}
- E02D 27/425 ... { specially adapted for wind motors masts (wind motors per se [F03D 1/00](#))}
- E02D 27/44 .. Foundations for machines, engines or ordnance (special lay-out of foundations with respect to machinery to be supported [F16M 9/00](#))
- E02D 27/46 .. Foundations for supply conduits or other canals {(bridges for supporting conduits [E01D 18/00](#); elevated canals [E02B 5/005](#); penstocks [E02B 9/06](#))}
- E02D 27/48 .. Foundations inserted underneath existing buildings or constructions {(making a new substructure subsequent to lifting or moving of buildings [E04G 23/06](#))}
- E02D 27/50 .. Anchored foundations
- E02D 27/52 .. Submerged foundations, { i.e. submerged in open water ([E02D 27/12](#) to [E02D 27/24](#) take precedence)}
- E02D 27/525 ... { using elements penetrating the underwater ground (sinking work pieces [E02D 15/08](#), sinking caissons [E02D 23/02](#))}

- 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
- E02D 29/02 . Retaining or protecting walls (piers or quay walls [E02B 3/06](#))
- E02D 29/0208 .. { Gabions }
- E02D 29/0216 .. { Cribbing walls }
- E02D 29/0225 .. { comprising retention means in the backfill }
- E02D 29/0233 ... { the retention means being anchors (details of anchors [E02D 5/80](#))}
- E02D 29/0241 ... { the retention means being reinforced earth elements }

- E02D 29/025 .. { made up of similar modular elements stacked without mortar }
- E02D 29/0258 .. { not used, see subgroups ([E02D 29/0208](#) to [E02D 29/025](#) take precedence)}
- E02D 29/0266 ... { made up of preformed elements }
- E02D 29/0275 ... { cast in situ }
- E02D 29/0283 ... { of mixed type }
- E02D 29/0291 ... { made up of filled, bag-like elements }

- E02D 29/04 . Making large underground spaces, e.g. for underground plants, { e.g. stations of underground railways }; Construction or layout thereof ([E02D 29/10](#) takes precedence; { water-supply or sewerage plants [E03](#) }; layout of water power plants [E02B 9/00](#); making large underground chambers by underground methods only [E21D 13/00](#))

- E02D 29/045 . Underground structures, e.g. tunnels or galleries, built in the open air or by methods involving disturbance of the ground surface all along the location line; Methods of making them

- E02D 29/05 .. at least part of the cross-section being constructed in an open excavation or from the ground surface, e.g. assembled in a trench

- E02D 29/055 ... further excavation of the cross-section proceeding underneath an already installed part of the structure, e.g. the roof of a tunnel

- E02D 29/06 . Constructions, or methods of constructing, in water {([E02D 15/00](#) takes precedence; submerged foundations [E02D 27/52](#))}

- E02D 29/063 . Tunnels submerged into, or built in, open water (construction or placing of caissons in general [E02D 23/00](#); joining caissons to each other under water, in general [E02D 25/00](#))

- E02D 29/067 .. Floating tunnels; Submerged bridge-like tunnels, i.e. tunnels supported by piers or the like above the water-bed (pontoons or floating bridges [E01D 15/14](#))

- E02D 29/07 .. Tunnels or shuttering therefor preconstructed as a whole or continuously made, and moved into place on the water-bed, e.g. into a preformed trench

- E02D 29/073 .. Tunnels or shuttering therefor assembled from sections individually sunk onto, or laid on, the water-bed, e.g. in a preformed trench (caisson-type sections lowered onto the water-bed [E02D 29/077](#))

- E02D 29/077 .. Tunnels at least partially built beneath the water-bed characterised by being made by methods involving disturbance thereof all along the location line, e.g. by cut-and-cover or caisson methods

- E02D 29/08 . Siphons (for sewerage [E03F 5/20](#); siphon weirs [E02B 7/18](#); { siphons in general [F04F 10/00](#) })

- E02D 29/10 . Tunnels or galleries specially adapted to house conduits, e.g. oil pipe-lines, sewer pipes (for pressure water conduits [E02B 9/06](#); { for cables [H02G 9/02](#); layout of tunnels or galleries in general [E21D 9/14](#); road kerbs with housings for pipes or the like [E01C 11/222](#) }); Making conduits in situ, e.g. of concrete (combined with digging of trenches or ditches [E02F 5/10](#); { making or lining tunnels or galleries [E21D](#); constructing tunnels or galleries in open excavations [E02D 29/045](#); in open water [E02D 29/063](#) }); Casings, { i.e. manhole shafts, access or inspection chambers } or coverings of boreholes or narrow wells (wells for drinking water [E03B 3/08](#); boreholes or wells formed by deep drilling [E21B](#); shafts [E21D](#))

- E02D 29/12 . Manhole shafts; Other inspection or access chambers; Accessories therefor (for underground tanks [B65D 90/10](#); for sewerage [E03F 5/02](#); { climbing irons or ladders [E06C 9/00](#) })
- E02D 29/121 .. { characterised by the connection between shaft elements, e.g. of rings forming said shaft }
- E02D 29/122 .. { Steps or handrails for shafts }
- E02D 29/124 .. { Shaft entirely made of synthetic material }
- E02D 29/125 .. { characterised by the lining of the shaft }
- E02D 29/127 .. { with devices for impeding fall or injuries of persons }
- E02D 29/128 .. { Repairs of manhole shafts }
- E02D 29/14 .. Covers for manholes or the like; Frames for covers {(gully gratings [E03F 5/06](#))}
- E02D 29/1409 ... { adjustable in height or inclination }
- E02D 29/1418 ... { with implements to assist in lifting, e.g. counterweights, springs (lifting devices for covers [B66F 19/005](#))}
- E02D 29/1427 ... { Locking devices (of bayonet type [E02D 29/14](#))}
- E02D 29/1436 ... { with overflow or explosion control means, e.g. check or relief valves }
- E02D 29/1445 ... { Tools for positioning or removing cover frames }
- E02D 29/1454 ... { Non-circular covers, e.g. hexagonal, elliptic }
- E02D 29/1463 ... { Hinged connection of cover to frame }
- E02D 29/1472 ... { Cover entirely made of synthetic material }
- E02D 29/1481 ... { Security devices, e.g. indicating unauthorised opening ([E02D 29/1427](#) takes precedence)}
- E02D 29/149 ... { Annular gaskets }
- E02D 29/16 . Arrangement or construction of joints in foundation structures {(for hydraulic engineering [E02B 3/16](#)); sealing joints not restricted to foundation structures [E04B 1/68](#))}
- 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](#))}**
- E02D 31/002 . { Ground foundation measures for protecting the soil or subsoil water, e.g. preventing or counteracting oil pollution (not used, see subgroups and [E02D 31/00](#))}
- E02D 31/004 .. { Sealing liners }
- E02D 31/006 .. { Sealing of existing landfills, e.g. using mining techniques }
- E02D 31/008 . { against entry of noxious gases, e.g. Radon }
- E02D 31/02 . against ground humidity or ground water {([E02D 31/06](#) takes precedence; arrangements other than according to [E02D 31/04](#); against hydraulic pressure of groundwater [E02D 31/10](#))}
- E02D 31/025 .. { Draining membranes, sheets or fabric specially adapted therefor, e.g. with dimples }

- E02D 31/04 . . Watertight packings for use under hydraulic pressure {([sealings for hydraulic engineering in general E02B 3/16](#); for building structures in general [E04B 1/66](#))}
- E02D 31/06 . against corrosion by soil or water
- E02D 31/08 . against transmission of vibrations or movements in the foundation soil {([E02D 27/34 takes precedence](#); foundations for machines, engines or ordnance [E02D 27/44](#); for road foundations [E01C 3/06](#))}
- E02D 31/10 . against soil pressure or hydraulic pressure {([anchored foundations E02D 27/50](#); joint sealings for use under hydraulic pressure [E02D 31/04](#))}
- E02D 31/12 . . against upward hydraulic pressure
- E02D 31/14 . . against frost heaves in soil
- 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](#))
- 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](#))}
- E02D 35/005 . { Lowering or lifting of foundation structures }
- 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](#))}
- E02D 2200/00** **Geometrical or physical properties**
- E02D 2200/11 . Height being adjustable
- E02D 2200/115 . . with separate pieces
- E02D 2200/12 . corrugated
- E02D 2200/13 . having at least a mesh portion
- E02D 2200/14 . resilient or elastic
- E02D 2200/143 . . helically or spirally shaped
- E02D 2200/146 . . Springs
- E02D 2200/15 . including at least a hinge
- E02D 2200/16 . Shapes
- E02D 2200/1607 . . round, e.g. circle
- E02D 2200/1614 . . . made from single element

- E02D 2200/1621 . . . made from multiple elements
- E02D 2200/1628 . . rectangular
- E02D 2200/1635 . . . made from single element
- E02D 2200/1642 . . . made from multiple elements
- E02D 2200/165 . . polygonal
- E02D 2200/1657 . . . made from single element
- E02D 2200/1664 . . . made from multiple elements
- E02D 2200/1671 . . helical or spiral
- E02D 2200/1678 . . triangular
- E02D 2200/1685 . . cylindrical
- E02D 2200/1692 . . conical or convex

- E02D 2200/17 . including an electric conductive element

E02D 2220/00 Temporary installations or constructions

E02D 2250/00 Production methods

- E02D 2250/0007 . using a mold
- E02D 2250/0015 . using extrusion
- E02D 2250/0023 . Cast, i.e. in situ or in a mold or other formwork
- E02D 2250/003 . Injection of material
- E02D 2250/0038 . using an auger, i.e. continuous flight type
- E02D 2250/0046 . using prestressing techniques
- E02D 2250/0053 . using suction or vacuum techniques
- E02D 2250/0061 . for working underwater
- E02D 2250/0069 . . Welding
- E02D 2250/0076 . . Drilling
- E02D 2250/0084 . . using pneumatical means
- E02D 2250/0092 . . using hydraulical means

E02D 2300/00 Materials

- E02D 2300/0001 . Rubbers
- E02D 2300/0003 . . Car tires
- E02D 2300/0004 . Synthetics

| | | |
|----------------|------|---|
| E02D 2300/0006 | .. | Plastics |
| E02D 2300/0007 | ... | PVC |
| E02D 2300/0009 | ... | PE |
| E02D 2300/001 | ... | PP |
| E02D 2300/0012 | ... | recycled |
| E02D 2300/0014 | ... | PU |
| E02D 2300/0015 | ... | HDPE |
| E02D 2300/0017 | ... | thermoplastic |
| E02D 2300/0018 | .. | Cement used as binder |
| E02D 2300/002 | ... | Concrete |
| E02D 2300/0021 | ... | Mortar |
| E02D 2300/0023 | ... | Slurry |
| E02D 2300/0025 | .. | Adhesives, i.e. glues |
| E02D 2300/0026 | . | Metals |
| E02D 2300/0028 | .. | Copper |
| E02D 2300/0029 | .. | Steel; Iron |
| E02D 2300/0031 | ... | in cast iron form |
| E02D 2300/0032 | ... | in sheet form, i.e. bent or deformed plate-material |
| E02D 2300/0034 | ... | in wire form |
| E02D 2300/0035 | .. | Aluminium |
| E02D 2300/0037 | . | Clays |
| E02D 2300/0039 | .. | mixed with additives |
| E02D 2300/004 | .. | Bentonite or bentonite-like |
| E02D 2300/0042 | ... | being modified by adding substances |
| E02D 2300/0043 | ... | with other ingredients |
| E02D 2300/0045 | . | Composites |
| E02D 2300/0046 | . | Foams |
| E02D 2300/0048 | .. | PU |
| E02D 2300/005 | .. | PE |
| E02D 2300/0051 | . | Including fibers |
| E02D 2300/0053 | .. | made from glass |
| E02D 2300/0054 | .. | made from plastic |
| E02D 2300/0056 | ... | PVC |
| E02D 2300/0057 | ... | PE |
| E02D 2300/0059 | ... | PP |
| E02D 2300/006 | ... | being recycled |
| E02D 2300/0062 | | Shredded car tires |

| | | |
|---------------------|------|---|
| E02D 2300/0064 | .. | made from metal |
| E02D 2300/0065 | .. | made from textile |
| E02D 2300/0067 | .. | made from cellulose |
| E02D 2300/0068 | .. | made from carbon |
| E02D 2300/007 | . | Resins including glasfibers |
| E02D 2300/0071 | . | Wood |
| E02D 2300/0073 | . | Explosives |
| E02D 2300/0075 | . | Textiles |
| E02D 2300/0076 | .. | non-woven |
| E02D 2300/0078 | .. | woven |
| E02D 2300/0079 | . | Granulates |
| E02D 2300/0081 | . | Ceramics |
| E02D 2300/0082 | . | Cellulose |
| E02D 2300/0084 | . | Geogrids |
| E02D 2300/0085 | . | Geotextiles |
| E02D 2300/0087 | .. | woven |
| E02D 2300/0089 | .. | non-woven |
| E02D 2300/009 | .. | with multi-layer structure |
| E02D 2300/0092 | ... | including a liquid tight layer |
| E02D 2300/0093 | | including bentonite |
| E02D 2300/0095 | | including a plastic membrane |
| E02D 2300/0096 | .. | with external friction enhancement features |
| E02D 2300/0098 | . | Bitumen |
| E02D 2450/00 | | { Gaskets } |
| E02D 2450/10 | . | Membranes |
| E02D 2450/101 | .. | permeable |
| E02D 2450/102 | ... | for liquids |
| E02D 2450/103 | ... | for gases |
| E02D 2450/105 | .. | impermeable |
| E02D 2450/106 | ... | for liquids |
| E02D 2450/107 | ... | for gases |
| E02D 2450/108 | .. | multi-layered |

E02D 2600/00

Miscellaneous

E02D 2600/10

- . comprising sensor means

E02D 2600/20

- . comprising details of connection between elements

E02D 2600/30

- . comprising anchoring details

E02D 2600/40

- . comprising stabilising elements