

## SECTION E — FIXED CONSTRUCTIONS

### E02 HYDRAULIC ENGINEERING; FOUNDATIONS; SOIL-SHIFTING

#### E02D FOUNDATIONS; EXCAVATIONS; EMBANKMENTS (specially adapted for hydraulic engineering E02B); UNDERGROUND OR UNDERWATER STRUCTURES [6]

##### Note(s)

1. This subclass covers underground structures made by foundation engineering, i.e. involving disturbance of the ground surface.
2. This subclass does not cover underground spaces, made by underground mining methods only, i.e. not involving disturbance of the ground surface, which are covered by subclass E21D.

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| <p><b>1/00 Investigation of foundation soil <u>in situ</u></b> (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)</p> <p>1/02 • before construction work</p> <p>1/04 • • Sampling of soil</p> <p>1/06 • • Sampling of ground water</p> <p>1/08 • after finishing the foundation structure</p> <p><b>3/00 Improving or preserving soil or rock, e.g. preserving permafrost soil</b> (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)</p> <p>3/02 • Improving by compacting (E02D 3/11 takes precedence; compacting soil locally before or while forming foundations E02D 27/26, E02D 27/28) [3]</p> <p>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) [3]</p> <p>3/032 • • • Trench rollers [3]</p> <p>3/039 • • • Slope rollers [3]</p> | <p>3/046 • • by tamping or vibrating, e.g. with auxiliary watering of the soil (E02D 3/026, E02D 3/08 take precedence; tamping or vibrating apparatus for working ballast on railways E01B 27/00, for consolidating paving materials E01C 19/30, for consolidating concrete in general E04G 21/06) [3]</p> <p>3/054 • • • involving penetration of the soil, e.g. vibroflotation [3]</p> <p>3/061 • • • Tampers with directly acting explosion chambers (pile drivers with explosion chambers E02D 7/12) [3]</p> <p>3/068 • • • Vibrating apparatus operating with systems involving reciprocating masses (E02D 3/054, E02D 3/061 take precedence) [3]</p> <p>3/074 • • • Vibrating apparatus operating with systems involving rotary unbalanced masses (E02D 3/054 takes precedence) [3]</p> <p>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)</p> <p>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) [3]</p> <p>3/11 • by thermal, electrical or electro-chemical means (freezing soil for interrupting passage of underground water E02D 19/14) [3]</p> <p>3/115 • • by freezing [3]</p> |
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- 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)

**5/00 Bulkheads, piles, or other structural elements specially adapted to foundation engineering**  
(engineering elements in general F16)

- 5/02 • Sheet piles or sheet pile bulkheads
- 5/03 • • Prefabricated parts
- 5/04 • • • made of steel
- 5/06 • • • • Fitted piles or other elements specially adapted for closing gaps between two sheet piles or between two walls of sheet piles
- 5/08 • • • • Locking forms; Edge joints; Pile crossings; Branch pieces
- 5/10 • • • made of concrete or reinforced concrete
- 5/12 • • • • Locking forms; Edge joints; Pile crossings; Branch pieces
- 5/14 • • Sealing joints between adjacent piles (sealing joints not restricted to foundation piles E04B 1/68)
- 5/16 • • Auxiliary devices rigidly or detachably arranged on sheet piles for facilitating assembly
- 5/18 • Bulkheads or similar walls made solely of concrete in situ
- 5/20 • Bulkheads or similar walls made of prefabricated parts and concrete, including reinforced concrete, in situ
- 5/22 • Piles (sheet piles E02D 5/02)
- 5/24 • • Prefabricated piles
- 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
- 5/28 • • • made of steel
- 5/30 • • • made of concrete or reinforced concrete or made of steel and concrete
- 5/32 • • • with arrangements for setting in position by fluid jets
- 5/34 • • Concrete or concrete-like piles cast in position
- 5/36 • • • making without use of mould-pipes or other moulds
- 5/38 • • • making by use of mould-pipes or other moulds
- 5/40 • • • • in open water
- 5/42 • • • • by making use of pressure liquid or pressure gas for compacting the concrete
- 5/44 • • • • with enlarged footing or enlargements at the bottom of the pile
- 5/46 • • • making in situ by forcing bonding agents into gravel fillings or the soil (consolidating soil in general E02D 3/12)
- 5/48 • • Piles varying in construction along their length
- 5/50 • • Piles comprising both precast concrete portions and concrete portions cast in situ
- 5/52 • • Piles composed of separable parts, e.g. telescopic tubes
- 5/54 • • Piles with prefabricated supports or anchoring parts; Anchoring piles
- 5/56 • • Screw piles
- 5/58 • • Prestressed concrete piles
- 5/60 • • Piles with protecting cases
- 5/62 • • Compacting the soil at the footing or in a casing by forcing cement or like material through tubes
- 5/64 • • Repairing piles
- 5/66 • Mould-pipes or other moulds

- 5/68 • • for making bulkheads
- 5/70 • • for making sheet piles
- 5/72 • Pile shoes
- 5/74 • Means for anchoring structural elements or bulkheads (anchoring piles E02D 5/54)
- 5/76 • • Anchorings for bulkheads or sections thereof
- 5/80 • • Ground anchors

**7/00 Methods or apparatus for placing sheet pile bulkheads, piles, mould-pipes, or other moulds** (for both placing and removing E02D 11/00)

- 7/02 • Placing by driving
- 7/04 • • Hand pile-drivers
- 7/06 • • Power-driven drivers
- 7/08 • • • Drop drivers with free-falling hammer
- 7/10 • • • with pressure-operated hammer
- 7/12 • • • Drivers with explosion chambers
- 7/14 • • • Components for drivers
- 7/16 • • • • Scaffolds for drivers
- 7/18 • Placing by vibrating
- 7/20 • Placing by pressure or pulling power
- 7/22 • Placing by screwing down
- 7/24 • Placing by using fluid jets
- 7/26 • Placing by using several means simultaneously
- 7/28 • Placing of hollow piles or mould-pipes by means arranged inside the piles or pipes
- 7/30 • • by driving cores

**9/00 Removing sheet pile bulkheads, piles, mould-pipes, or other moulds** (for both placing and removing E02D 11/00)

- 9/02 • by withdrawing
- 9/04 • by cutting-off under water

**11/00 Methods or apparatus 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)

**13/00 Accessories for placing or removing piles or bulkheads**

- 13/02 • specially adapted for placing or removing bulkheads
- 13/04 • Guide devices; Guide frames
- 13/06 • for observation while placing
- 13/08 • Removing obstacles
- 13/10 • Follow-blocks of pile-drivers or like devices

**15/00 Handling building or like materials for hydraulic engineering or foundations** (conveying or working-up concrete or similar masses in general E04G 21/02)

- 15/02 • Handling of bulk concrete specially for foundation purposes
- 15/04 • • Placing concrete in mould-pipes, pile tubes, boreholes, or narrow shafts
- 15/06 • • Placing concrete under water
- 15/08 • Sinking workpieces into water or soil
- 15/10 • Placing gravel or like material under water

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

- 17/02 • Foundation pits
- 17/04 • • Bordering or stiffening the sides of foundation pits
- 17/06 • Foundation ditches or narrow shafts
- 17/08 • • Bordering or stiffening the sides of ditches or narrow shafts for foundations
- 17/10 • • Covering trenches for foundations

- 17/12 • • Back-filling of foundation trenches or ditches
- 17/13 • Foundation slots; Implements for making these slots
- 17/16 • Loosening of soil or rock, under water (for correcting streams E02B 3/02; by dredgers or excavators E02F)
- 17/18 • Making embankments (E02D 17/20 takes precedence)
- 17/20 • Securing of slopes or inclines
- 19/00 Keeping dry foundation sites or other areas in the ground** (sheet piles or bulkheads E02D 5/02)
  - 19/02 • Restraining of open water
  - 19/04 • • by coffer-dams
  - 19/06 • Restraining of underground water
  - 19/08 • • by employing open ditches arranged below the level of the water
  - 19/10 • • by lowering level of ground water
  - 19/12 • • by damming or interrupting the passage of underground water
  - 19/14 • • • by freezing the soil (in connection with sinking shafts E21D 1/12)
  - 19/16 • • • by placing or applying sealing substances (consolidating by placing solidifying or pore-filling substances in the soil E02D 3/12)
  - 19/18 • • • by making use of sealing aprons (sealings or joints for engineering work E02B 3/16)
  - 19/20 • • • by displacing the water, e.g. by compressed air
  - 19/22 • Lining sumps in trenches
- 23/00 Caissons; Construction or placing of caissons** (tunnels submerged into or built in open water E02D 29/063) [6]
  - 23/02 • Caissons able to be floated on water and to be lowered into water in situ
  - 23/04 • Pneumatic caissons
  - 23/06 • • Bringing persons or material into, or out of, compressed air caissons
  - 23/08 • Lowering or sinking caissons
  - 23/10 • • Caissons filled with compressed air
  - 23/12 • • Inclined lowering
  - 23/14 • • Decreasing the skin friction while lowering
  - 23/16 • Jointing caissons to the foundation soil, specially to uneven foundation soil
- 25/00 Joining caissons or like sunk units to each other under water**
- 27/00 Foundations as substructures**
  - 27/01 • Flat foundations
  - 27/02 • • Flat foundations without substantial excavation (E02D 27/04, E02D 27/08 take precedence)
  - 27/04 • • in water or on quicksand
  - 27/06 • • • Floating caisson foundations
  - 27/08 • • Reinforcements for flat foundations
  - 27/10 • Deep foundations
  - 27/12 • • Pile foundations
  - 27/14 • • • Pile framings
  - 27/16 • • • Foundations formed of separate piles
  - 27/18 • • Foundations formed by making use of caissons
  - 27/20 • • Caisson foundations combined with pile foundations
  - 27/22 • • Caisson foundations made by starting from fixed or floating artificial islands by using protective bulkheads
  - 27/24 • Foundations constructed by making use of diving-bells (equipment for dwelling or working under water B63C 11/00)
- 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-E02D 3/12)
- 27/28 • Stressing the soil or the foundation structure while forming foundations
- 27/30 • Foundations made with permanent use of sheet pile bulkheads, walls of planks, or sheet piling boxes
- 27/32 • Foundations for special purposes
- 27/34 • • Foundations for sinking or earthquake territories (building constructions with protection arrangements against earthquakes E04H 9/02)
- 27/35 • • Foundations formed in frozen ground, e.g. in permafrost soil [3]
- 27/36 • • Foundations formed in moors or bogs
- 27/38 • • Foundations for large tanks, e.g. oil tanks
- 27/40 • • Foundations for dams across valleys or for dam constructions
- 27/42 • • Foundations for poles, masts, or chimneys
- 27/44 • • Foundations for machines, engines, or ordnance (special layout of foundations with respect to machinery to be supported F16M 9/00)
- 27/46 • • Foundations for supply conduits or other canals
- 27/48 • • Foundations inserted underneath existing buildings or constructions
- 27/50 • • Anchored foundations
- 27/52 • • Submerged foundations
- 29/00 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** [6]
  - 29/02 • Retaining or protecting walls (piers or quay walls E02B 3/06)
  - 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 [6]
  - 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 [6]
  - 29/055 • • • further excavation of the cross-section proceeding underneath an already installed part of the structure, e.g. the roof of a tunnel [6]
  - 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) [6]
  - 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) [6]
  - 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 [6]
  - 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) [6]
  - 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 [6]

## E02D

- 29/09 • Constructions or methods of constructing, in water, not otherwise provided for [6]
- 29/12 • Manhole shafts; Other inspection or access chambers; Accessories therefor (for underground tanks B65D 90/10; for sewerage E03F 5/02) [6]
- 29/14 • • Covers for manholes or the like; Frames for covers [6]
- 29/16 • Arrangement or construction of joints in foundation structures (sealing joints not restricted to foundation structures E04B 1/68)
- 31/00 Protective arrangements for foundations or foundation structures; 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)
- 31/02 • against ground humidity or ground water
- 31/04 • • Watertight packings for use under hydraulic pressure

- 31/06 • against corrosion by soil or water
- 31/08 • against transmission of vibrations or movements in the foundation soil
- 31/10 • against soil pressure or hydraulic pressure
- 31/12 • • against upward hydraulic pressure
- 31/14 • • against frost heaves in soil [3]
- 33/00 Testing foundations or foundation structures** (testing methods or apparatus, see the relevant subclasses of class G01; testing structures or apparatus as regards function, in general, G01M; investigating or analysing materials by determining their chemical or physical properties, in general G01N)
- 35/00 Straightening, lifting, or lowering of foundation structures or of constructions erected on foundations**
- 37/00 Repair of damaged foundations or foundation structures**