



Designation: ~~C1675–21~~ C1675 – 22

## Standard Practice for Installation of Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers<sup>1</sup>

This standard is issued under the fixed designation C1675; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

### 1. Scope

1.1 This practice covers the installation of precast reinforced concrete box sections cast monolithically and intended to be used for the conveyance of storm water, industrial wastes and sewage, and for passageways.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

[C822 Terminology Relating to Concrete Pipe and Related Products](#)

[C1433 Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers](#)

[C1433M Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers \(Metric\)](#)

[C1577 Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers Designed According to AASHTO LRFD](#)

[D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort \(12,400 ft-lbf/ft<sup>3</sup> \(600 kN-m/m<sup>3</sup>\)\)](#)

[D2487 Practice for Classification of Soils for Engineering Purposes \(Unified Soil Classification System\)](#)

#### 2.2 ASCE Standard:<sup>3</sup>

[ASCE 26 Standard Practice for the Direct Design of Buried Precast Concrete Box Sections](#)

#### 2.3 AASHTO Standards:<sup>4</sup>

[AASHTO Standard Specifications for Highway Bridges, Div. II, Section 27](#)

[AASHTO LRFD Bridge Construction Specifications, Section 27](#)

[AASHTO LRFD Bridge Design Specifications](#)

[AASHTO M145 Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes](#)

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.05 on Special Projects. Current edition approved Jan. 1, 2021/Oct. 1, 2022. Published January 2021/October 2022. Originally approved in 2011. Last previous edition approved in 2019 as C1675 – 19-21. DOI: 10.1520/C1675-21.10.1520/C1675-22.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191, <http://www.asce.org>.

<sup>4</sup> Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, <http://www.transportation.org>.

3. Terminology

3.1 For definitions of terms relating to precast box sections, see Terminology C822.

3.2 For terminology related to soil classifications, see Practice D2487.

3.3 For terminology and definitions of terms relating to structural design, see ASCE 26.

3.4 Fig. 1 illustrates the installation terminology.

4. Significance and Use

4.1 This practice is useful as a reference by an owner and the owner’s engineer in preparing project specifications.

5. General

5.1 The precast reinforced concrete box section/soil system shall be constructed to conform to the dimensions and requirements specified or shown on the plans and to this practice. Additionally, for highway projects, the precast reinforced concrete box section/soil system shall conform to requirements of Section 27 of AASHTO Standard Specifications for Highway Bridges or AASHTO LRFD Bridge Construction Specifications as appropriate. The owner is advised to provide or require adequate inspection of the box section installation at the construction site.

6. Excavation

6.1 Trenches shall be excavated to the dimensions and grade specified on the plans or as ordered by the owner. The width of trenches shall be kept to the minimum required for installation of the box sections and proper compaction of the sidefill.

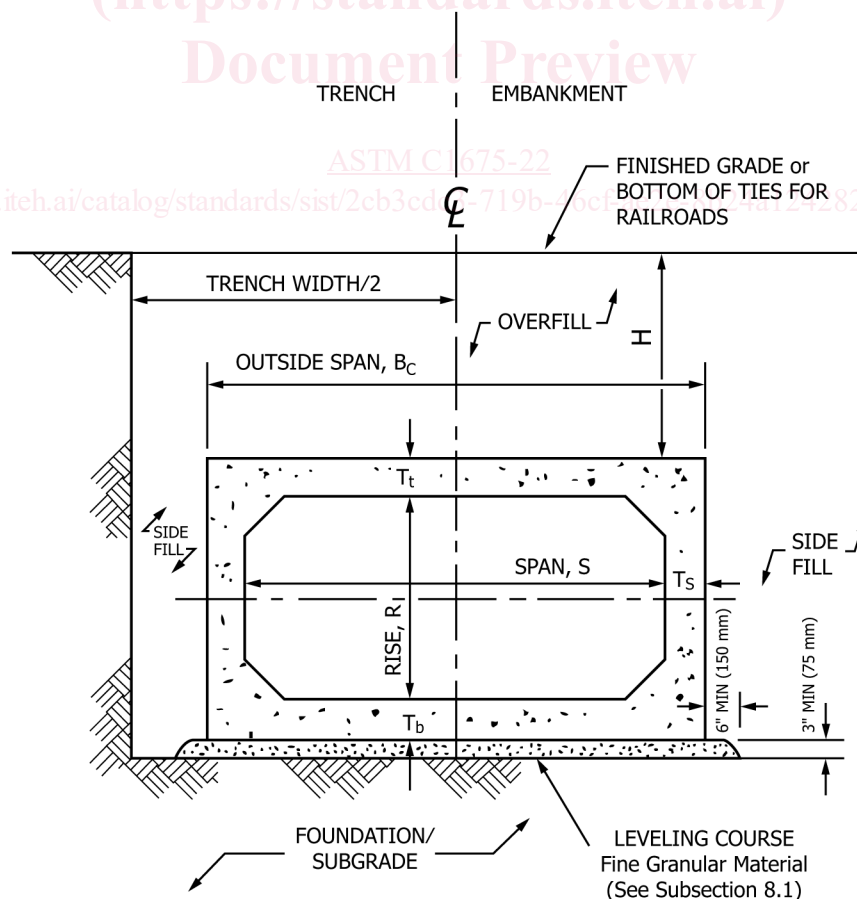


FIG. 1 Box Section/Installation Terminology

6.2 When ~~ledge rock, compacted rocky, rock~~ or other unyielding foundation material is encountered, it shall be removed to the requirements shown on the plans. Over-excavated areas shall be backfilled with approved materials specified for the leveling course.

6.3 The contractor shall make such provisions as required to ensure adequate drainage of the trench to protect the leveling course during the construction operations. Where surface water or groundwater conditions exist, the site and trench shall be dewatered.

## 7. Foundation

7.1 The foundation shall be moderately firm to hard in situ material, stabilized soil, or compacted fill material.

7.2 When unsuitable or unstable material is encountered, the foundation shall be stabilized or removed and replaced with firm and stable foundation material.

7.3 Where groundwater and soil characteristics contribute to the migration of soil fines into or out of the foundation, leveling course, or ~~overfill~~ sidefill materials, methods to prevent migration shall be provided.

7.4 Box sections installed over an unyielding foundation, including concrete, shall be cushioned so as to prevent non-uniform bearing in accordance with Section 8.

## 8. Leveling Course

8.1 A minimum 3 in. (75 mm) leveling course, as shown in Fig. 1, shall be constructed of clean coarse grained soils: USCS SW, SP, GW, GP or any soil beginning with one of those symbols and with 12 % or less passing a #200 (75  $\mu$ m) sieve (AASHTO M145, A-1, A-3). The nominal maximum aggregate size shall not be greater than 1 in. (25 mm) (#57 aggregate). In the event that the leveling course consists of layers with the upper layer being clean, uncompacted sand, that layer shall be a maximum thickness of 2 in. (50 mm) to prevent non-uniform settlement from personnel and equipment during the installation process.

8.2 In situ material that provide a suitable leveling course in accordance with this practice shall be acceptable.

8.3 If rock strata or boulders are encountered under the box section within the limits of the required leveling course, the rock or boulders shall be removed and replaced with additional leveling course material.

8.4 A concrete slab is not an appropriate leveling course.

## 9. Box Section Placement and Joining

9.1 Box sections shall be installed to the line and grade shown in the contract documents. Joining shall be in accordance with the box section manufacturer's recommendations.

NOTE 1—(Advisory): Work should be started at the lowest end of the box section line, and with the bell or groove end pointing upstream, laying spigots into bells where applicable.

9.2 Adjustments in grade by exerting force on the box section with excavating equipment or by lifting and dropping the box section shall be prohibited. If the installed box section is not on grade, the box section shall be completely unjoined, the grade corrected, and the box section then rejoined.

9.3 Proper facilities and equipment shall be provided for hoisting and lowering the box sections without disturbing the leveling course and the sides of the excavation or damaging the box sections.

9.4 The ends of the box sections shall be free of any deleterious materials that would prevent proper joining or sealing of adjacent sections.

9.5 The box section shall be joined so that when laid on the leveling course, it shall form a smooth, uniform line of sections.

NOTE 2—(Advisory): Proper equipment, such as a come-along or puller, should be utilized to join the sections together.

9.6 Unless designed otherwise, multiple box sections in parallel multi-cell installations require positive lateral bearing between the sides of adjacent box sections. Compacted granular backfill, flowable fill, or grouting between the sections are considered means of providing positive bearing.

NOTE 3—(Advisory): Continuous, uniform contact between the backfill material and the sides of adjacent boxes is necessary to achieve positive lateral bearing. The designer should define and detail the appropriate spacing between the multiple cells to facilitate the installation and compaction, if necessary, of the specified material that is to be placed between the sides of the adjacent boxes.

9.7 Precast reinforced concrete box sections shall be handled with reasonable care. If dragging sections causes damage, then this practice shall be discontinued. Care shall be taken to prevent box sections from striking rock or other hard objects during placement.

NOTE 4—(Advisory): Depending on the means and methods used, handling and installation may generate loads beyond those considered within the standard design tables of Specification C1433, C1433M, or C1577. The installer is cautioned to verify with the concrete box manufacturer that handling and installation methods utilized will not create loading conditions that exceed the design capacity of the furnished box section.

9.8 Each joint shall be sealed to prevent migration of soil fines as specified in the project specifications and installed in accordance with the manufacturer's recommendations.

9.9 If required by the contract documents, each joint shall meet the specified infiltration and exfiltration requirements.

9.10 Unless otherwise approved by the owner, surcharge loads and loads from construction equipment transferred to a box section before, during, or after fill placement, either directly or through the fill, shall not be greater than the loads assumed in the design (see Section 14, Adequate Protection from Surcharge and Construction Loads).

## 10. Sidefill

10.1 When the soil-structure interaction factor used in the design is based on compacted fill at the sides of the box, the sidefill shall be as required by the contract documents, but not less than clean, coarse-grained soils (USCS SW, SP, GW, GP or AASHTO M145, A-1, A-3), or coarse-grained soils with fines (USCS GM, GC, SM, SC or AASHTO M145, A-2-4, A-2-5, A-2-6) compacted to at least 85 % Standard Proctor (see Test Methods D698). The sidefill shall be brought up on both sides of the box section such that placement will not disjoin or create lateral movement of the box section.

10.2 When the soil-structure interaction factor used in the design is not based on compacted fill at the sides of the box section, the use of native soils is acceptable. Sidefill shall be free of debris, organic matter, frozen material or large stones with a diameter greater than 3 in. (75 mm).

10.3 Ponding or jetting to compact the sidefill shall be permitted only where soil conditions permit free drainage and only with the approval of the owner.

## 11. Overfill

11.1 Overfill shall be constructed as specified. Overfill material shall be placed in layers with no greater than the maximum thickness specified and compacted to the required density.

11.2 The soil shall be approved material containing no debris, organic matter, frozen material, or large stones with a diameter greater than one-half the thickness of the compacted layers being placed or 3 in. (75 mm), whichever is less.

11.3 When impact or vibratory equipment is used for compaction, care shall be taken in accordance with the manufacturer's recommendations, to avoid damaging the box sections.