NOTE TO SPECIFICATION WRITER: This guide specification for the use of gravity segmental retaining walls (with no soil reinforcement) was developed based on the use of an aggregate or unreinforced concrete leveling pad. This guide specification must be edited to suit specific conditions of the project. The design of the retaining wall based on specific site conditions should be prepared by a civil engineer in accordance with local procedures regarding the calculation of segmental retaining walls. The calculation guidelines and requirements concerning segmental retaining walls, mostly for commercial and private projects, can be found in the manual entitled “Design Manual for Segmental Retaining Walls” from the National Concrete Masonry Association.

PART 1: GENERAL

1.1. Description

.1 Work shall consist of designing and constructing a Segmental Retaining Wall (SRW) system, including furnishing of all materials, labor, equipment, testing and inspection, in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown on the project construction drawings. No other wall system will be considered.

.2 Work includes excavation and foundation soil preparation, furnishing and placement of the leveling pad, drainage fill, drain pipe, retained (backfill) soil, and geotextile filter to the lines and grades shown on the project construction drawings [and in the contractor prepared retaining wall construction drawings].

1.2. Related Sections

.1 Section 01 33 00 – Submittals Procedures
.2 Section 31 00 00 – Earthwork
.3 Section 33 46 26 – Geotextiles Subsurface Drainage Filtration

1.3. Reference Documents

.1 National Concrete Masonry Association (NCMA)


.2 American Society for Testing and Materials (ASTM) / American Association of State Highway and Transportation Officials (AASTHO).

A. Segmental Retaining Wall Units

.2 ASTM C140/C140M-[15] Standard Test Methods for Sampling andTesting Concrete Masonry Units and Related Units
.3 ASTM C1372-[14a] Standard Specification for Dry-Cast Segmental Retaining Wall Units
.4 ASTM C1262-[10] Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units
.5 ASTM D6916-[06c] Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units (Modular
### GRAVITY SEGMENTAL RETAINING WALL

<table>
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<tr>
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<th>Reference</th>
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**B. Soils**

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<thead>
<tr>
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<tr>
<td>3.7</td>
<td>ASTM D422-[63e2] (ASTM D422)</td>
<td>Standard Test Method for Particle-Size Analysis of Soils</td>
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<tr>
<td>3.8</td>
<td>ASTM D6913-[04] (ASTM D6913)</td>
<td>Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis</td>
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<td>3.9</td>
<td>ASTM D698-[12e2] (AASHTO T-99)</td>
<td>Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))</td>
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<td>3.10</td>
<td>ASTM D1557-[12e1] (AASHTO T-180)</td>
<td>Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56 000 ft-lbf/ft³ (2 700 kN-m/m³))</td>
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<td>3.13</td>
<td>ASTM D6938-[15]</td>
<td>Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)</td>
</tr>
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<td>3.18</td>
<td>ASTM D448-[12]</td>
<td>Standard Classification for Sizes of Aggregate for Road and Bridge Construction</td>
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**C. Drainage Pipe**

<table>
<thead>
<tr>
<th>Section</th>
<th>Reference</th>
<th>Description</th>
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**D. Geotextile Filter**

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<th>Section</th>
<th>Reference</th>
<th>Description</th>
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</table>
1.4. Submittals/ certification

1. Submit [ ] sets of shop drawings and design calculations for the retaining wall system prepared by a professional Engineer registered in the state of the project. Design shall meet all requirements established in NCMA’s “Design Manual for Segmental Retaining Walls”.

2. Submit the technical data sheet of the retaining wall components according to section [01 33 00 - submittals].

3. Submit a manufacturer’s certification, at least [30] days before start of SRW construction, attesting that the retaining wall system components meet the requirements in Part 2 of this specification.

4. Submit the manufacturer retaining wall installation guide.

5. Submit test report documenting characteristics for aggregates to be used for the wall leveling pad, the unit fill, the drainage fill and backfill.

[NOTE TO SPECIFICATION WRITER: Retain paragraph to suit the project]

1.5. Quality Assurance

1. The Contractor shall provide a list of [ ] successful completed projects by the wall installer of similar scope and size with references, at least [30] days before the start of the SRW construction.

2. [The Contractor shall provide evidence that the design engineer has a minimum of [5] year of documental experience in the design for reinforced soil structures. The design engineer shall provide proof of current professional liability insurance with an aggregate coverage limit of not less than [$ 2 000 000]].

[NOTE TO SPECIFICATION WRITER: Retain paragraph to suit the project]

1.6. Delivery, Storage, and Handling

1. The Contractor shall inspect the materials upon delivery to assure that proper type, grade, color, and certification have been received.

2. The Contractor shall store and handle all materials in accordance with manufacturer’s recommendations and in a manner to protect all materials from damage due to job site conditions. Damaged materials shall not be incorporated into the SRW.

3. The Contractor shall prevent chipping and cracking of SRW units, and protect against any damage the connectors between the SRW units. Replace damaged SRW units as directed by [the Consultant].
PART 2: MATERIALS

2.1. Definitions

.1 Segmental Retaining Wall (SRW) system: a system where the basic components are the foundation soil, the leveling pad, the Techo-Bloc units, the retained soil, the drainage fill and the drain pipe.

.2 Techo-Bloc wall unit: a concrete block manufactured by Techo-Bloc, designed specifically for the task of earth retention and used as the facing system of SRW systems.

.3 Shear Connector: a specially shaped piece that are specifically designed to align, connect and span Modular Facing Units.

.4 Leveling pad: a level compacted granular soil or an unreinforced concrete pad, which distributes the weight of Techo-Bloc wall units over a wider foundation area and provides a working surface for starting SRW construction.

.5 Drainage fill: a free-draining aggregate material placed within the cores of, directly behind and between, the Techo-Bloc wall units to facilitate compaction of soils and remove groundwater to minimize buildup of hydrostatic pressure behind the wall face.

.6 Retained (backfill) fill: an undisturbed native soil or fill soil placed directly behind the drainage fill.

.7 Drainage Collection pipe: a perforated PVC or PE pipe used to collect and convey water to an outlet, preventing buildup of water which infiltrates the soils behind the wall.

.8 Geotextile filter: a material comprised of textiles usually made from polypropylene or polyester yarns. It allows the water to flow through it while preventing migration of soil particles that might clog the granular material.

.9 Cap unit: a concrete unit used to finish the top of the SRW.

2.2. Concrete Segmental Retaining Wall units

.1 Techo-Bloc [BALTIMORE] [BOREALIS] [BRANDON] [GRAPHIX] [MANCHESTER] [MINI-CRETA] [PRESCOTT] [RAFFINATO] [RÖCKA] [SEMMA] [SUPREMA] retaining wall units shall conform to the minimum requirements of [ASTM C1372] [ASTM C94/C94M] and the following:

1. Face color: [The Owner may specify standard manufacturer’s color]
2. Face finish: [The Owner may specify standard manufacturer’s finish]
3. [Air-entrained: 6% +/- 1.5%]

4. Compressive Strength: 5050 psi (35 MPa) (minimum)

5. Durability to freeze-thaw cycles:
   Mass loss: 1% (maximum) after 100 cycles and 1.5% (maximum) after 150 cycles.

6. Water absorption: 9 pcf (144 kg/m³) (maximum)

7. Dimension tolerances:
   (not applicable to split facings or other architectural finish):
   Height: +/- 1/16" (1.5 mm)
   Width: +/- 1/8" (3 mm)
   Length: +/- 1/8" (3 mm)

8. Finish and appearance:
   Exposed surfaces of units are not to show cracks or other imperfections when viewed from a distance of not less than 20 ft. (6.1 m) under diffused lighting.

9. Unit size:
   - **Baltimore 90**: 3 9/16" (H) x 10 5/8" (D) x variable (L)
   - **Baltimore 180**: 7 1/16" (H) x 10 5/8" (D) x variable (L)
   - **Borealis**: 6" (H) x 8" (D) x 48" (L)
   - **Brandon 90**: 3 9/16" (H) x 9 13/16" (D) x variable (L)
   - **Brandon 180**: 7 1/16" (H) x 9 13/16" (D) x variable (L)
   - **Graphix**: 2 15/16" (H) x variable (D) x 20" (L)
   - **Manchester**: 3 15/16" (H) x 7 7/8" (D) x 11 13/16" (L)
   - **Mini-Creta 3"**: 2 15/16" (H) x 9 13/16" (D) x variable (L)
   - **Mini-Creta 6"**: 5 7/8" (H) x 9 13/16" (D) x variable (L)
   - **Prescott 2.25"**: 2 1/4" (H) x 9 13/16" (D) x variable (L)
   - **Prescott 4.5"**: 4 1/2" (H) x 9 13/16" (D) x variable (L)
### GRAVITY SEGMENTAL RETAINING WALL

- **Raffinato 90 (polished):** 3\(^{9/16}\)" (90 mm) (H) x 9\(^{3/4}\)" (248 mm) (D) x variable (L)
- **Raffinato 180 (polished):** 7\(^{1/16}\)" (180 mm) (H) x 9\(^{3/4}\)" (248 mm) (D) x variable (L)
- **Raffinato 90 (smooth):** 3\(^{9/16}\)" (90 mm) (H) x 9\(^{13/16}\)" (249 mm) (D) x variable (L)
- **Raffinato 180 (smooth):** 7\(^{1/16}\)" (180 mm) (H) x 9\(^{13/16}\)" (249 mm) (D) x variable (L)
- **Röcka:** 6" (152 mm) (H) x 7\(^{3/4}\)" (197 mm) (D) x variable (L)
- **Semma (split face):** 5\(^{7/8}\)" (150 mm) (H) x 11" (279 mm) (D) x 16" (406 mm) (L)
- **Suprema:** 8" (203 mm) (H) x 12" (305 mm) (D) x 18" (457 mm) (L)

10. **Facing batter:**
- **Baltimore:** 0\(^{0}\) or 4.4\(^{0}\);
- **Borealis:** 0\(^{0}\);
- **Brandon:** 0\(^{0}\) or 4.4\(^{0}\);
- **Graphix:** Variable;
- **Manchester:** 0\(^{0}\);
- **Mini-Creta:** 0\(^{0}\) or 5.0\(^{0}\);
- **Prescott:** 0\(^{0}\) or 4.5\(^{0}\);
- **Raffinato:** 0\(^{0}\) or 4.4\(^{0}\);
- **Röcka:** 0\(^{0}\);
- **Semma:** 0\(^{0}\) or 7.6\(^{0}\);
- **Suprema:** 0\(^{0}\) or 4.5\(^{0}\);

11. **Maximum Total Height (including embedment):**
- **Baltimore:** Inclined Position: 2.95 ft. (0.90 m) Vertical Position: 2.36 ft. (0.72 m)
- **Borealis:** Vertical Position: 2.0 ft. (0.61 m)
- **Brandon:** Inclined Position: 2.95 ft. (0.90 m) Vertical Position: 2.36 ft. (0.72 m)
- **Graphix:** Variable inclination: 1.97 ft (0.60 m)
- **Manchester:** Vertical Position: 1.64 ft. (0.50 m)
- **Mini-Creta:** Inclined Position: 2.95 ft. (0.90 m) Vertical Position: 2.46 ft. (0.75 m)
Prescott: Inclined Position : 3.00 ft. (0.91 m) Vertical Position: 2.25 ft. (0.69 m)

Raffinato: Inclined Position : 2.95 ft. (0.90 m) Vertical Position: 2.36 ft. (0.72 m)

Röcka : Vertical Position: 2.0 ft. (0.61 m)

Semma : Inclined Position : 3.50 ft. (1.07 m) Vertical Position: 2.49 ft. (0.76 m)

Suprema : Inclined Position : 3.35 ft. (1.02 m) Vertical Position: 2.66 ft. (0.81 m)

[NOTE TO SPECIFICATION WRITER: ASTM C94/C94M and air-entrained requirements apply to wet cast concrete wall products. Techo-Bloc wet cast concrete wall products are manufactured to be used in a moderate climate exposure, where they will not be continuously exposed to water for long periods prior to freezing and will not be exposed to de-icing salts. Techo-Bloc line of wet cast concrete wall products include, but are not limited to, the following: Borealis, Prescott and Röcka wall units. The maximum wall height recommended above is based on the following conditions:

- The retained soil type considered is gravel with an internal friction angle of at least 36°.
- There is no surcharge load applied on top of the wall
- There is no slope on top of the wall
- An adequate drainage system is provided at the back of the wall.

The maximum wall height will be reduced if any of the above mentioned conditions are not fulfill.]

2.3. Shear Connectors

.1 [High Density Polyethylene (HDPE)] [Precast Concrete] connectors shall be used to provide a wall alignment as shown on the construction drawings.

[NOTE TO SPECIFICATION WRITER: Wall units requiring HDPE connectors include, but are not limited to, the following: Baltimore, Brandon, Graphix, Mini-Creta, Prescott, Raffinato Semma and Suprema block. Delete this section if no connector is used (ex. Borealis, Manchester and Röcka block)]

2.4 Leveling Pad Material

.1 The leveling pad material shall be non-frost susceptible, well-graded sand and gravel with unified soil classification GW with dimensions as shown on the construction drawings. [The aggregate leveling shall meet the requirements of ASTM D1241, gradation C:]

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<thead>
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<tr>
<td>No. 4</td>
<td>35-62</td>
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<td>No. 10</td>
<td>25-50</td>
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<tr>
<td>No. 40</td>
<td>15-30</td>
</tr>
<tr>
<td>No. 200</td>
<td>5-15</td>
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</tbody>
</table>

.2 The leveling pad material shall consist of a non-reinforced concrete base with dimensions as shown on the construction drawings. Unreinforced concrete leveling pad shall be cured a minimum
of [12] hours prior to placement of the precast modular block wall retaining units and exhibit a minimum 28-day compressive strength of [2,500 psi (17.2 MPa)].

[NOTE TO SPECIFICATION WRITER: Retain paragraph to suit the project]

2.5 Drainage fill

.1 The drainage fill material shall be a clean crushed stone meeting the requirements of ASTM D448, size [No 5] [No 56] [No 57] [No 6] [No 67] [No 7].

[NOTE TO SPECIFICATION WRITER: The aggregate gradation may be defined based on locally available materials, consistent with the design. The drainage fill material generally consists of a uniform particle size smaller than 1 in. and greater than ¼ in.]

2.6 Drainage Pipe

.1 The drainage collection pipe shall be perforated or slotted Poly Vinil Chloride (PVC), or corrugated polyethylene (PE) pipe.

.2 The drain pipe shall be manufactured in accordance with ASTM F758 and/or ASTM F667.

2.7 Geotextile Filter

.1 The geotextile filter fabric shall be as specified on the construction drawings.

2.8 Concrete Adhesive

.1 Concrete specific construction adhesive shall provide sufficient strength and shall be used to permanently secure the Cap unit on the uppermost course of the SRW.

PART 3: CONSTRUCTION

3.1 Responsibility for Construction

.1 The Contractor is solely responsible for performing the work to meet the requirements of this specification.

.2 The Contractor’s field construction supervisor shall have demonstrated experience and be qualified to direct all work at the site. The material supplier shall provide sufficient construction assistance to contractors unfamiliar with the Techo-Bloc SRW system.

.3 The Contractor shall formulate and execute a quality control program to ensure the SRW system is installed according to this specification. The Contractor shall copy the [Owner’s Representative] on all test results and observations made as part of their quality control program.

.4 [The Owner’s Representative] may independently verify that the materials supplied and installed by the contractor meet all the requirements of the specification. This includes all submittals and proper installation of the SRW system. The Owner shall share the results of this Quality Assurance testing program with the Contractor.
3.2 Excavation

.1 Contractor shall excavate to the lines and grades shown on the construction drawings.

.2 Contractor shall take precautions to minimize over-excavation and assure that safe excavations and embankments are maintained throughout the course of the project.

.3 Contractor shall verify location of existing structures and utilities prior to excavation and shall ensure all surrounding structures are protected from the effects of wall excavation. Any new utilities proposed for installation in the vicinity of the SRW shall be installed concurrent with retaining wall construction. The Contractor shall coordinate the work of subcontractors affected by this requirement.

.4 Excavation support, if required, shall be designed by the Contractor.

.5 All excavation shall be done in full accordance with the prevailing trench and excavation safety laws applicable to the project site.

3.3 Foundation Preparation

.1 Following the excavation, the foundation soil shall be examined by the [Owner’s Geotechnical Engineer] to assure the actual foundation soil strength meets or exceeds the assumed design bearing strength. Soils not meeting the required strength shall be removed and replaced with soil meeting the design criteria, as directed by the [Owner’s Geotechnical Engineer].

.2 Should testing and observations of the foundation soil by the [Owner’s Geotechnical Engineer] verify that actual foundation soil strength is deficient, foundation soil correction work will be considered extra and performed under a separate change order to the contract.

.3 Contractor shall obtain approval from the [Owner’s Geotechnical Engineer] for the foundation bearing surface prior to proceeding with construction.

3.4 Geotextiles

.1 If specified in the construction drawings, the approved geotextile shall be set [over the prepared foundation soil extending towards the back of the excavation, up the excavation face and eventually over the top of the drainage fill to the back of the SRW units near the top of the wall.] [as shown in the construction drawings.]

3.5 Leveling Pad Preparation

.1 A minimum of [6 inch (150 mm)] thick layer of compacted granular material shall be placed for use as a leveling pad up to the grades and locations as shown on the construction drawings. The leveling pad shall extend laterally a minimum of [6 inch (150 mm)] in front and behind the Techo-Bloc wall unit.

.2 The granular leveling pad material shall be compacted to a minimum of [95 % of the maximum standard Proctor density (ASTM D698)] [92 % of the maximum modified Proctor density (ASTM D1557)]. The leveling pad shall provide a firm, level bearing surface on which to place the first course of the Techo-Bloc units.
.3 A leveling pad consisting of [4 inch (100mm)] unreinforced concrete shall be placed for use as leveling pad up to the grades and locations as shown on the construction drawings. The leveling pad should extend a minimum of [4 inch (100mm)] from the toe and from the heel of the SRW unit.

[NOTE TO SPECIFICATION WRITER: Retain paragraph to suit the project]

3.6 Techo-Bloc SRW Unit Installation

.1 The first course of Techo-Bloc SRW units shall be placed on the prepared leveling pad at the proper elevation and orientation as shown on the project and/or SRW construction drawings or as directed by the [Owner’s Representative]. Alignment and level shall be checked in all directions and insure that all units are in full contact with the base and properly seated.

.2 Place the front of the Techo-Bloc units side-by-side. No gaps shall be left between the fronts of adjacent units.

.3 Place and compact drainage fill in and between adjacent units, and to a minimum depth of [12 inches (300 mm)] directly behind the units. Place and compact backfill soil behind drainage fill. Drainage fill shall be separated from other soils by the specified geotextile filter.

.4 The top of each Techo-Bloc unit shall be cleaned and free of foreign material before adding successive courses.

.5 Install shear connectors per manufacturer’s recommendations.

.6 [One course] of Techo-Bloc units shall be the maximum-stacked vertical height prior to drainage fill and backfill placement and compaction.

.7 Layout of corners and curves shall be in accordance with the construction plans or in general accordance with manufacturer’s recommendations.

3.7 Pipe Placement

.1 The drainage pipe shall be installed as shown on the project/SRW construction drawings and in accordance with the overall drainage plan for the site.

.2 The drainage collection pipe, used with the column of drainage fill located just behind the Techo-Bloc units, shall be sloped to [2 % minimum] and shall be installed to drain infiltrated surface water and to drain the retained backfill.

.3 The drainage collection pipe shall daylight into a storm sewer system or along a slope at an elevation lower than the lowest point of the pipe within the aggregate drain, every [50 feet (15 m)] maximum.

3.8 Backfill placement

.1 Frozen materials shall not be incorporated into the work. Material shall not be placed over frozen ground, ice or snow.

.2 Backfill material placed immediately behind the drainage aggregate shall be compacted [to 95% of standard Proctor density (ASTM D 698) at a moisture content between -1% to +3% of optimum.]
.3 Backfill shall be placed and compacted in lifts not to exceed 6 inches (150 mm) where hand compaction is used, or 8 (200 mm) to 10 inches (250 mm) where heavy compaction equipment is used.

.4 Only lightweight hand-operated compaction equipment shall be allowed within 3 feet (0.90 m) of the back of the Techo-Bloc wall units.

.5 At the end of each day’s operation, the contractor shall slope the last level of backfill away from the Techo-Bloc units to direct runoff away from the wall face. In addition, the contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

3.9 Cap Unit Installation

.1 Cap units shall be properly aligned into the desired position, and secured with a concrete adhesive on top of the cleaned surface of the underlying Techo-Bloc Unit.

3.10 Construction Tolerances for Completed Wall

.1 The Techo-Bloc SRW shall be installed at the plan location shown on the drawings within the following tolerances:

- Vertical Plan Location: ± 1.25 ins. (30 mm) max over any 10 ft. (3 m) distance; 3 ins. (76 mm) maximum
- Horizontal Plan Location: ± 1.25 ins. (30 mm) max over any 10 ft. (3 m) distance; 3 ins. (76 mm) maximum

.2 The Techo-Bloc SRW system shall be installed such that the as-built facing alignment is within the following tolerances:

- ROTATION: maximum 2.0 degrees, from established plan wall batter.
PART 4: MEASUREMENT AND PAYMENT

4.1 Measurement

.1 The unit of measurement for furnishing and installing the Techo-Bloc SRW System shall be the vertical square foot of wall surface from the top of the leveling pad to the top of wall or coping block/cap. The quantity to be paid shall be considered full and complete compensation for the [design,] supply of materials, installation of materials, excavation to facilitate wall construction, testing for quality control, and all labor, management, tools, equipment, overhead, and insurance to accomplish the work. Excavation of unsuitable materials and replacement with select fill, as directed and approved in writing by the [Owner’s Representative] shall be compensated separately.

4.2 Payment

.1 The accepted quantities of Techo-Bloc SRW system will be paid for vertical square foot in place as measured from the top of the leveling pad to the top of wall or coping block/cap. The quantities of the Techo-Bloc SRW system as approved by the [Owner’s Representative] shall be used to determine the area actually supplied. Payment will be made under:

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<thead>
<tr>
<th>PAY ITEM</th>
<th>PAY UNIT</th>
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<tr>
<td>Techo-Bloc SRW</td>
<td>Sq. Ft.</td>
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