3.1.1 General: Strong-Bolt 2 wedge anchors are torque-controlled, mechanical expansion anchors consisting of an anchor body, expansion clip, nut, and washer. A typical anchor is shown in Figure 1 of this report. The anchor body has a tapered mandrel formed on the installed end of the anchor and a threaded section at the opposite end. The taper of the mandrel increases in diameter toward the installed end of the anchor. The three-segment expansion clip wraps around the tapered mandrel. Before installation, this expansion clip is free to rotate about the mandrel. The anchor is installed in a predrilled hole. When the anchor is set by applying torque to the hex nut, the mandrel is drawn into the expansion clip, which engages the drilled hole and transfers the load to the base material.

3.2.1 Strong-Bolt 2 Carbon Steel: Anchor bodies are manufactured from carbon steel material with zinc plating conforming to ASTM B633, Service Condition SC1 (Fe/Zn 5), Type III. Expansion clips are fabricated from carbon steel and conform to ASTM A568. Hex nuts conform to ASTM A563, Grade A. Washers conform to ASTM F844. Anchor diameters recognized in this report are ¼ inch, ⅜ inch, ½ inch, ⅜ inch and ¾ inch (6.4 mm, 9.5 mm, 12.7 mm, 15.9 mm and 19.1 mm).

3.2 Materials

3.2.1 Grout-filled Concrete Masonry: When prism tests are required, the compressive strength of masonry, $f'_m$, at 28 days shall be a minimum of 1,500 psi (10.3 MPa). Concrete masonry shall be fully grouted and constructed from the following materials:

3.2.1.1 Concrete Masonry Units (CMUs): CMUs shall be lightweight, medium-weight, or normal-weight conforming to ASTM C90. Minimum allowable nominal size of the CMU shall be 8 inches (203 mm) wide by 8 inches (203 mm) high by 16 inches (406 mm) long (i.e., 8×8×16).

3.2.1.2 Grout: Grout shall comply with IBC Section 2103 or IRC Section R606 (2018 and 2015 IRC) or R609 (2012, 2009, 2006 and 2003 IRC), as applicable. Alternatively, the grout shall have a minimum compressive strength when tested in accordance with ASTM C1019 equal to its specified strength, $f'_g$, but not less than 2,000 psi (13.8 MPa).

3.2.1.3 Mortar: Mortar shall be minimum Type N in compliance with IBC Section 2103 or IRC Section R606 (2018 and 2015 IRC) or R607 (2012, 2009, 2006 and 2003 IRC), as applicable.
4.0 DESIGN AND INSTALLATION

4.1 Design

4.1.1 General: Strong-Bolt® 2 wedge anchor capacities in this report are allowable load values for use in allowable stress design as set forth in Section 2107 of the IBC. For use under the IRC, an engineered design in accordance with IRC Section R301.1.3 shall be submitted to the building official.

4.1.2 Design of Strong-Bolt 2 Wedge Anchors Installed in Fully Grouted Concrete Masonry: For installations in fully grouted uncracked concrete masonry, Strong-Bolt 2 wedge anchors are recognized to resist dead, live, wind, and earthquake loads.

Allowable tension and shear capacity values, embedment depths, critical and minimum edge and end distances, and critical and minimum spacing requirements for anchors installed in fully-grouted concrete masonry unit construction are noted in Table 2 of this report. Allowable load reduction factors for anchors installed at distances less than critical edge distance or critical spacing are noted in Table 3 of this report. Allowable loads for anchors installed within 1/16 inches (3.17 mm) of the vertical head joint between CMU of the concrete masonry unit construction are outside the scope of this report. Figures 2 and 3 of this report provide additional details.

Allowable loads for the Strong-Bolt 2 wedge anchors installed in fully-grouted concrete masonry subjected to combined tension and shear forces shall be determined by the following equation:

\[
\left(\frac{P_s}{P_t}\right)^{5/3} + \left(\frac{V_s}{V_t}\right)^{5/3} \leq 1.0
\]

where:

- \(P_t\) = Applied service tension load.
- \(P_s\) = Allowable service tension load.
- \(V_t\) = Applied service shear load.
- \(V_s\) = Allowable service shear load.

4.2 Installation: Installation parameters are provided in Table 2 of this report and in Figures 2 and 3 of this report. Anchor locations shall comply with this report and the plans and specifications approved by the code official. Strong-Bolt 2 wedge anchors shall be installed in accordance with the manufacturer’s published instructions and this report. Anchors shall be installed in holes drilled into the base material using carbide-tipped drill bits conforming to ANSI B212.15. Nominal drill bit diameters shall be equal to the nominal diameter of the anchors and holes shall be drilled to a depth allowing proper embedment. Drilled holes shall be cleaned, with all dust and debris removed using compressed air. Anchors, nuts, and washers shall be assembled so that the top of the nuts are flushed with the top of the anchors. Anchors shall be driven into the hole using a hammer until the proper embedment depth is achieved. Nuts and washers shall be tightened against the base material or material to be fastened until the appropriate installation torque value specified in Table 2 of this report is achieved.

4.3 Special Inspection: Periodic special inspection is required in accordance with IBC Sections 1704.4 (2018 and 2015 IBC), 1705.3 (2012 IBC), 1704.15 (2009 IBC) or 1704.13 (2006 or 2003 IBC), provided the masonry construction is under Level 2 Quality Assurance in accordance with Table 3.1 of TMS 402-16 (2018 IBC); or Level B Quality Assurance in accordance with Section 3.1 of TMS 402-13 (2015 IBC); or Section 1.19 of TMS 402-11 (2012 IBC); Level 1 or Level 2 under Section 1704.5 of the 2009 IBC; or Section 1704.5 of the 2006 or 2003 IBC, special inspector shall be present as often as required by the “statement of special inspection.” Special inspector shall make periodic inspections during anchor installation to verify anchor type, anchor dimensions, masonry unit type and compliance with ASTM C90; grout and mortar compressive strengths; and (when required) masonry prism compressive strength; drill bit size and compliance with ANSI B212.15; and anchor type, size, embedment depth, spacing, edge distance and end distance. Special inspector shall inspect and verify that anchor installation complies with this evaluation report and the manufacturer’s published installation instructions. Additional requirements as set forth in Sections 1704, 1705, 1706 and 1707 of the IBC shall be observed, where applicable.

5.0 LIMITATIONS

Strong-Bolt 2 wedge anchors described in this report comply with, or are a suitable alternative to what is specified in, those codes listed in Section 1.1 of this report, subject to the following limitations:

5.1 Anchors are identified and installed in accordance with this report, the codes listed in Section 1.1 of this report, and the manufacturer’s published installation instructions. Where conflicts occur, the more restrictive governs.

5.2 Design of Strong-Bolt® 2 wedge anchors installed in fully grouted concrete masonry unit construction to resist dead, live, wind and earthquake load applications shall be in accordance with Section 4.1 of this report.

5.3 When using the alternative basic load combinations from Section 1605.3.2 of the IBC that include wind or earthquake loads, the allowable tension and shear loads given in Table 2 for Strong-Bolt 2 wedge anchors installed in fully grouted concrete masonry may be adjusted in accordance with Table 1 of this report.
5.4 Anchors shall be installed in accordance with Section 4.2 of this report, and the holes for the anchors shall be predrilled with carbide-tipped masonry drill bits complying with ANSI B212.15, and have the same diameter as the nominal diameter of the anchor.

5.5 Since an acceptance criteria for evaluating data to determine the performance of anchors subjected to fatigue or shock loading are unavailable at this time, the use of these anchors under these conditions is outside the scope of this report.

5.6 Fire-resistive Construction: Where not otherwise prohibited in the applicable code, anchors are permitted for use with fire-resistance-rated construction provided that at least one of the following conditions is fulfilled:

- Anchors are used to resist wind or seismic forces only.
- Anchors that support fire-resistance-rated construction or gravity load-bearing structural elements are within a fire-resistance-rated envelope or a fire-resistance-rated membrane, are protected by approved fire-resistance-rated materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Anchors are used to support nonstructural elements.

5.7 Since acceptance criteria for evaluating the performance of expansion anchors in cracked masonry are unavailable at this time, the use of anchors is limited to installation in uncracked masonry. Cracking occurs when \( f_t > f_r \) due to service loads or deformations.

5.8 Calculations demonstrating that the applied loads are less than the allowable loads described in this report shall be submitted to the code official at the time of permit application. Calculations shall be prepared by a registered design professional where required by the statues of the jurisdiction in which the project is to be constructed.

5.9 Periodic special inspection shall be provided in accordance with Section 4.3 of this report.

5.10 Use of zinc-plated anchors is limited to dry, interior locations.

5.11 Strong-Bolt® 2 wedge anchors are manufactured by Simpson Strong-Tie under a quality control program.

6.0 EVIDENCE SUBMITTED

Testing and analysis data in accordance with the ICC-ES Acceptance Criteria for Expansion Anchors in Masonry Elements (AC01), approved March 2018. Test results are from laboratories in compliance with ISO/IEC 17025.

7.0 IDENTIFICATION

Simpson Strong-Tie Company Inc., Strong-Bolt® 2 wedge anchors are identified in the field by dimensional characteristics and packaging. The packaging label notes the name and address of Simpson Strong-Tie Company Inc.; the manufacturing location; the anchor type, size, and length; the IAPMO UES evaluation report number (ER-240) and one of the IAPMO UES Marks of Conformity below. The threaded end of each Strong-Bolt 2 wedge anchor is stamped with a length identification code letter as indicated in Table 4 of this report.
FIGURE 1—STRONG-BOLT® 2 WEDGE ANCHOR

TABLE 1—PERCENT ALLOWABLE LOAD INCREASE FOR WIND AND EARTHQUAKE LOADING CONDITIONS\textsuperscript{1,2}

<table>
<thead>
<tr>
<th>ANCHOR</th>
<th>SUBSTRATE</th>
<th>Tension</th>
<th>Shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong-Bolt\textsuperscript{®} 2 Wedge Anchor</td>
<td>Fully Grouted CMU</td>
<td>33(\frac{1}{3})</td>
<td>33(\frac{1}{3})</td>
</tr>
</tbody>
</table>

\textsuperscript{1}When using the basic load combinations for allowable stress design in accordance with IBC Section 1605.3.1, allowable loads shall not be increased for wind or earthquake loading.

\textsuperscript{2}When using the alternative basic load combinations for allowable stress design in IBC Section 1605.3.2 that include wind or earthquake loads, the allowable shear and tension loads for anchors may be increased by the tabulated percentage increases. As an option, the alternative basic load combinations for allowable stress design may be reduced by multiplying them by 0.75 when using IBC Section 1605.3.2, as applicable.
TABLE 2—ALLOWABLE TENSION AND SHEAR LOADS FOR THE STRONG-BOLT® 2 WEDGE ANCHORS INSTALLED IN FULLY GROUTED CMU CONSTRUCTION\(^1,2,3\)

<table>
<thead>
<tr>
<th>ANCHOR LOCATION(^5,6) (inches)</th>
<th>ALLOWABLE LOADS FOR ANCHORS INSTALLED AT DISTANCES ≥ CRITICAL EDGE DISTANCE, (c_{\text{crit}}), AND CRITICAL SPACING, (s_{\text{crit}}) (lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Edge / End Distance</strong></td>
<td><strong>Tension(^5,7)</strong></td>
</tr>
<tr>
<td>Critical, (c_{\text{crit}})</td>
<td>Minimum, (c_{\text{min}})</td>
</tr>
<tr>
<td><strong>Spacing</strong></td>
<td></td>
</tr>
<tr>
<td>¾</td>
<td>2</td>
</tr>
<tr>
<td>1/16</td>
<td>12/16</td>
</tr>
<tr>
<td>1/2</td>
<td>3/4</td>
</tr>
<tr>
<td>1/8</td>
<td>4/8</td>
</tr>
<tr>
<td>3/16</td>
<td>1/2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ANCHOR LOCATION(^8) (inches)</th>
<th>ALLOWABLE LOADS FOR ANCHORS INSTALLED AT MINIMUM EDGE DISTANCE, (c_{\text{Edg}}) (lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>End Distance</strong></td>
<td><strong>Tension(^7,8)</strong></td>
</tr>
<tr>
<td>Critical, (c_{\text{crit}})</td>
<td>Minimum, (c_{\text{min}})</td>
</tr>
<tr>
<td><strong>Spacing</strong></td>
<td></td>
</tr>
<tr>
<td>1/16</td>
<td>12/16</td>
</tr>
<tr>
<td>1/8</td>
<td>4/8</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 psi = 6.89 kPa, 1 lbf = 4.48 N.

\(^1\) Tabulated loads are for anchors installed in fully grouted CMU wall construction consisting of materials in compliance with Section 3.2 of this report. The specified compressive strength of masonry, \(f'_{\text{cm}}\), at 28 days shall be a minimum of 1,500 psi.

\(^2\) Allowable loads are based on periodic special inspection being provided during anchor installation. Special inspection requirements shall comply with Section 4.3 of this report.

\(^3\) Allowable loads may be increased in accordance with Section 5.3 and Table 1 of this report, where permitted by the IBC or its referenced standards.

\(^4\) Embedment depth is measured from the outside face of the masonry to the end of the mandrel.

\(^5\) Critical and minimum edge distances and critical and minimum spacing shall comply with this table. Figure 2 of this report illustrates permitted and prohibited anchor positions. Critical edge distance and critical spacing are valid for anchors resisting the tabulated allowable tension or shear loads. Table 3 of this report tabulates allowable tension and shear load reduction factors for anchors installed between critical and minimum edge distances and spacing.

\(^6\) Anchors shall be installed a minimum of 1 1/4 inches from vertical head joints and T-joints. Figure 2 of this report illustrates permitted and prohibited anchor installation positions. Section 4.3 of this report provides additional installation details.

\(^7\) Tabulated allowable loads are based on a factor of safety of five (5).

\(^8\) Critical and minimum end distances, critical and minimum spacing, and minimum edge distance shall comply with this table and Figure 3 of this report. Critical end distance and critical spacing are valid for anchors resisting the tabulated allowable tension or shear loads. Table 3 of this report contains allowable tension and shear load reduction factors for anchors installed between critical and minimum end distances and spacing.

\(^9\) Embedment depth is measured from the top of the masonry wall to the end of the mandrel.
TABLE 3—LOAD REDUCTION FACTORS FOR STRONG-BOLT® 2 WEDGE ANCHORS INSTALLED IN FULLY GROUTED CMU CONSTRUCTION\(^{1,2,3}\)

<table>
<thead>
<tr>
<th>ANCHOR DIAMETER (in.)</th>
<th>EMBEDMENT DEPTH(^4) (in.)</th>
<th>Critical Edge Distance, (c_{crit})</th>
<th>Minimum Edge/End Distance, (c_{min})</th>
<th>Critical Spacing Distance, (s_{crit})</th>
<th>Spacing</th>
<th>Minimum Spacing, (s_{min})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Edge Distance</td>
<td>Tension or Shear</td>
<td>Tension</td>
<td>Shear</td>
<td>Tension or Shear</td>
</tr>
<tr>
<td>(\frac{1}{4})</td>
<td>(2\frac{3}{8})</td>
<td>1.0</td>
<td>1.0</td>
<td>0.88</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>(\frac{3}{8})</td>
<td>(3\frac{1}{2})</td>
<td>1.0</td>
<td>1.0</td>
<td>0.71</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>(\frac{1}{2})</td>
<td>(4\frac{1}{8})</td>
<td>1.0</td>
<td>1.0</td>
<td>0.60</td>
<td>1.0</td>
<td>0.93</td>
</tr>
<tr>
<td>(\frac{3}{4})</td>
<td>(5\frac{1}{4})</td>
<td>1.0</td>
<td>0.97</td>
<td>0.28</td>
<td>1.0</td>
<td>0.80</td>
</tr>
</tbody>
</table>

ANCHORS INSTALLED IN THE FACE OF FULLY GROUTED CMU CONSTRUCTION

| ANCHOR DIAMETER (in.) | EMBEDMENT DEPTH\(^5\) (in.) | Critical End Distance, \(c_{crit}\) | Minimum End Distance, \(c_{min}\) | Critical Spacing Distance, \(s_{crit}\) | Minimum Spacing, \(s_{min}\) |
|-----------------------|-----------------------------|----------------------------------|---------------------------------|----------------------------------|---------|------------------|
|                       |                             | End Distance                      | Tension or Shear | Tension | Shear Perp. To Wall | Shear Parallel to Wall | Tension or Shear | Tension | Shear Perp. or Parallel to Wall | Tension or Shear |
| \(\frac{1}{2}\)       | \(3\frac{1}{2}\)            | 1.0                               | 1.0                | 0.90    | 0.53  | 1.0              | 0.93      | 1.0   | 1.0              |
| \(\frac{3}{8}\)       | \(4\frac{1}{8}\)            | 1.0                               | 1.0                | 0.83    | 0.50  | 1.0              | 0.86      | 1.0   | 1.0              |

For SI: 1 inch = 25.4 mm.

1The load reduction factors in this table are applicable to the allowable loads shown in Table 2 of this report.
2Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge distance are calculated separately and multiplied together.
3Load reduction factors for anchors loaded in tension or shear with edge distances, end distances and spacing between critical and minimum are obtained by linear interpolation.
4Embedment depth is measured from the outside face of the masonry to the end of the mandrel.
5Embedment depth is measured from the top of the masonry wall to the end of the mandrel.

TABLE 4—LENGTH IDENTIFICATION HEAD MARKS ON STRONG-BOLT® 2 WEDGE ANCHORS (CORRESPONDS TO LENGTH OF ANCHOR – INCHES)

<table>
<thead>
<tr>
<th>Mark</th>
<th>Units</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>in</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Up to But Not Including</td>
<td>in</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Mark</td>
<td>Units</td>
<td>N</td>
<td>O</td>
<td>P</td>
<td>Q</td>
<td>R</td>
<td>S</td>
<td>T</td>
<td>U</td>
<td>V</td>
<td>W</td>
<td>X</td>
<td>Y</td>
<td>Z</td>
</tr>
<tr>
<td>From</td>
<td>in</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>Up to But Not Including</td>
<td>in</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
</tbody>
</table>
FIGURE 2—STRONG-BOLT® 2 WEDGE ANCHOR INSTALLED IN THE FACE OF FULLY GROUTED CMU CONSTRUCTION

FIGURE 3—STRONG-BOLT® 2 WEDGE ANCHOR INSTALLED IN THE TOP OF FULLY GROUTED CMU CONSTRUCTION
CITY OF LOS ANGELES
SUPPLEMENT

Simpson Strong-Tie Company Inc.
5956 West Las Positas Boulevard
Pleasanton, California 94588
(800) 999-5099
www.strongtie.com

STRONG-BOLT® 2 WEDGE ANCHORS IN MASONRY

CSI Division:
  04 00 00—MASONRY
CSI Section:
  04 05 19.16—Masonry Anchors

1.0 RECOGNITION
The Simpson Strong-Tie® Strong-Bolt® 2 Wedge Anchors recognized in ER-240 have been evaluated for use to resist dead, live, wind, and seismic tension and shear loads in fully grouted uncracked, concrete-masonry unit (CMU) construction. The structural performance properties of the Simpson Strong-Tie® Strong-Bolt® 2 Wedge Anchors were evaluated for compliance with the following codes:

- 2017 City of Los Angeles Building Code (LABC)
- 2017 City of Los Angeles Residential Code (LARC)

2.0 LIMITATIONS

The Simpson Strong-Tie® Strong-Bolt® 2 Wedge Anchors described in IAPMO UES ER-240 complies with the 2017 LABC Chapter 21 and LARC subject to the following limitations:


2.2 Prior to installation, calculations and details demonstrating compliance with this approval report and the 2017 Los Angeles Building Code or 2017 Los Angeles Residential Code shall be submitted to the structural plan check section for review and approval. The calculations and details shall be prepared by a registered engineer, licensed in the State of California.

2.3 The design and installation of the Simpson Strong-Tie® Strong-Bolt® 2 Wedge Anchors shall be in accordance with LABC Chapters 16 and 17 or Section 2114, as applicable.

2.4 Periodic special inspection shall be provided by the Registered Deputy Inspector in accordance with Section 1705 of the 2017 LABC during installations of the Simpson Strong-Tie® Strong-Bolt® 2 Wedge Anchors.

2.5 Under the LARC a design in accordance with Section R301.1.3 shall be submitted.

2.6 When using the alternative basic load combinations from Section 1605.3.2 of the 2017 LABC that include wind or earthquake loads, the allowable tension and shear loads given in Table 2 of ER-240 may be increased by one-third only.

2.7 The Simpson Strong-Tie® Strong-Bolt® 2 Wedge Anchors are not approved for unreinforced masonry walls.

This supplement expires concurrently with ER-240.

For additional information about this evaluation report please visit www.uniform-es.org or email us at info@uniform-es.org