ICC-ES Evaluation Report

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This report also contains:

- City of LA Supplement
- FL Supplement w/ HVHZ

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DIVISION: 04 00 00—MASONRY Section: 04 05 19.16—Masonry Anchors	REPORT HOLDER: HILTI, INC.	EVALUATION SUBJECT: KWIK BOLT TZ2 MASONRY ANCHORS IN CRACKED AND UNCRACKED GROUTED CONCRETE MASONRY UNIT WALLS	

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2024, 2021, 2018, and 2015 *International Building Code®* (IBC)
- 2024, 2021, 2018, and 2015 *International Residential Code®* (IRC)

Main references of this report are for the 2024 IBC and IRC. See Table 6 and Table 7 for applicable sections of the code for previous IBC and IRC editions.

Property evaluated:

Structural

2.0 USES

The Hilti Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors are used as anchorage in cracked and uncracked concrete masonry unit (CMU) walls to anchor building components to grouted lightweight, medium weight, or normal-weight concrete masonry wall construction. The anchor system is designed to resist static, wind, and earthquake (Seismic Design Categories A through F) tension and shear loads.

The anchor system is an alternative to cast-in-place anchors described in Section 8.1.4 (2022 edition) of TMS 402 as referenced in Section 2107.1 of the IBC. The anchor systems may also be used where an engineered design is submitted in accordance with Section R301.1.3 of the IRC.

3.0 DESCRIPTION

3.1 Kwik Bolt TZ2:

KB-TZ2 anchors are torque-controlled, mechanical expansion anchors. KB-TZ2 anchors consist of a stud (anchor body), wedge (expansion elements), nut, and washer. The anchor (carbon steel version) is illustrated in Figure 2. The stud is manufactured from carbon steel or AISI Type 304 or Type 316 stainless steel materials. Carbon steel KB-TZ2 anchors have a 5 µm (0.0002 inch) zinc-nickel plating. The expansion elements for the carbon steel KB-TZ2 anchors are fabricated from carbon steel or stainless steel. The expansion elements for the stainless steel KB-TZ2 anchors are fabricated from stainless steel. The hex nut for the carbon steel KB-TZ2 conforms to ASTM A563-04, Grade A, and the hex nut for the stainless steel KB-TZ2 conforms to ASTM F594.

The anchor body is comprised of a high-strength rod threaded at one end and a tapered mandrel at the other end. The tapered mandrel is enclosed by a three-section expansion element that freely moves around the mandrel. The expansion element movement is restrained by the mandrel taper at the bottom and by a collar at the top of the mandrel. The anchor is installed in a predrilled hole with a hammer. When torque is applied to

the nut of the installed anchor, the mandrel is drawn into the expansion element, which is in turn expanded against the wall of the drilled hole.

3.2 Grout-filled Concrete Masonry:

Grouted concrete masonry must comply with Chapter 21 of the IBC. The compressive strength of masonry, f'_m, at 28 days, must be a minimum of 1,500 psi (10.3 MPa). Grouted concrete masonry must be constructed from the following materials:

3.2.1 Concrete Masonry Units (CMUs): Grouted concrete masonry walls must be constructed from minimum lightweight, medium-weight or normal-weight concrete masonry units (CMUs) conforming to ASTM C90. The minimum allowable nominal size of the CMU is 8 inches (203 mm) wide by 8 inches (203 mm) high by 16 inches (406 mm) long.

3.2.2 Grout: Grout must comply with IBC Section 2103.3 or IRC Section R606.2.12, as applicable. Alternatively, the grout must have a minimum compressive strength, when tested in accordance with ASTM C1019, equal to its specified strength, but not less than 2,000 psi (13.8 MPa).

3.2.3 Mortar: Mortar must be Type N, S, or M, prepared in accordance with IBC Section 2103.2.1or IRC Section R606.2.8, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Strength Design of anchors in Grouted Concrete Masonry Unit Construction:

4.1.1 General: Sections 4.1 and 4.2 provide strength design requirements for anchors used in grouted concrete masonry unit construction, where anchors are used to transmit structural loads by means of tension, shear, or a combination of tension and shear.

Strength design of mechanical anchors in fully grouted concrete masonry unit construction shall be conducted in accordance with the provisions for the design of mechanical anchors in concrete in *ACI 318-19 Chapter 17*, and TMS 402-22 as modified by the sections that follow. Design in accordance with this report cannot be conducted without reference to *ACI 318-19* with the deletions and modifications summarized in Table 1A and TMS 402-22 Eq. 9-5.

This report references sections, tables, and figures in both this report and ACI 318, with the following method used to distinguish between the two document references:

- References to sections, tables, and figures originating from ACI 318 are *italicized*. For example, Section 2.2 of ACI 318-19, will be displayed as *ACI 318-19 Section 2.2*.
- References to sections, tables, and figures originating from this report do not have any special font treatment, for example Section 4.1.2.

Where language from ACI 318 is directly referenced, the following modifications generally apply:

- The term “masonry” shall be substituted for the term “concrete” wherever it occurs.
- The modification factor to reflect the reduced mechanical properties for mixtures with lightweight aggregate and lightweight units, λ_a, shall be taken as 1.0.

The following terms shall be replaced wherever they occur:

ACI 318 (-19 or -14) term	Replacement term
f'_c	f'_m
N_{cb}, N_{cbg}	N_{mb}, N_{mbg}
V_{cb}, V_{cbg}	V_{mb}, V_{mbg}
V_{cp}, V_{cpg}	V_{mp}, V_{mpg}

4.1.2 Restrictions for anchor placement are noted in Table 2 and shown in Figure 1. For CMU construction with closed-end blocks and hollow head joints, in addition to the ends and edges of walls, the nearest head joint on a horizontal projection from the anchor shall be treated as an edge for design purposes. The minimum distance from the nearest adjacent head joint shall be the $c_{min,HJ}$ value provided in Table 2, which is measured from the centerline of the head joint in CMU construction with hollow head joints. For anchor groups installed in CMU construction with solid head joints, the nearest head joint outside of the group on a horizontal projection to the group shall be treated as an edge. If open-ended units are employed, only the ends and edges of walls

shall be considered for edge distance determination. For horizontal ledgers in fully-grouted CMU walls with hollow head joint applications, see Section 4.2.22.

4.2 ACI Modifications Required for Design: Table 1A provides a summary of all applicable *ACI 318* sections for the design of mechanical anchors in fully grouted masonry. Where applicable, modifying sections contained within this report are also provided.

4.2.1 *ACI 318-19 Section 17.1.1 and 17.1.3* apply with the general changes prescribed in Section 4.1.1.

4.2.2 In lieu of *ACI 318-19 Section 17.1.2*: Design provisions are included for post-installed expansion (torque-controlled) anchors that meet the assessment criteria of AC01.

4.2.3 *ACI 318-19 Section 17.1.4, 17.2.1, 17.4.1, and 17.5.1.3.1* apply with the general changes prescribed in Section 4.1.1.

4.2.4 In lieu of *ACI 318-19 Section 17.4.2*: The design of anchors in structures assigned to Seismic Design Category (SDC) C, D, E, or F shall satisfy the requirements of this section.

4.2.4.1 The design of anchors in plastic hinge zones of masonry structures under earthquake forces is beyond the scope of the acceptance criteria.

4.2.4.2 The anchor or group of anchors shall be designed for the maximum tension and shear obtained from the design load combinations that include *E,* with E_h increased by Ω_o. The anchor design tensile strength shall satisfy the tensile strength requirements of Section 4.2.4.3.

4.2.4.3 The anchor design tensile force for resisting earthquake forces shall be determined from consideration of (a) through (c) for the failure modes given in Table 1B assuming the masonry is cracked unless it can be demonstrated that the masonry remains uncracked.

(a) ϕN_{sa} for a single anchor or for the most highly stressed individual anchor in a group of anchors

(b) $0.75\phi N_{mb}$ or $0.75\phi N_{mbg}$

(c) $0.75\phi N_{pn}$ for a single anchor or for the most highly stressed individual anchor in an anchor group

where ϕ is in accordance with Section 4.2.9.

4.2.5 *ACI 318-19 Section 17.3.1* applies with the general changes prescribed in Section 4.1.1.

4.2.6 In lieu of *ACI 318-19 Section 17.5.2*: The design of anchors shall be in accordance with Table 1B. In addition, the design of anchors shall satisfy Section 4.2.4 for earthquake loading.

4.2.7 *ACI 318-19 Section 17.5.2.3* applies with the general changes prescribed in Section 4.1.1.

4.2.8 *ACI 318-19 Section 17.5.1.2* applies with the general changes prescribed in Section 4.1.1.

4.2.9 In lieu of *ACI 318-19 Section 17.5.3*: Strength reduction factor ϕ for anchors in masonry shall be as follows when the LRFD load combinations of ASCE 7 are used:

a. For steel capacity of ductile steel elements as defined in *ACI 318-19 Section 2.3*, ϕ shall be taken as 0.75 in tension and 0.65 in shear. Where the ductility requirements of ACI 318 are not met, ϕ shall be taken as 0.65 in tension and 0.60 in shear.

b. For shear crushing capacity, ϕ shall be taken as 0.50.

c. For cases where the nominal strength of anchors in masonry is controlled by masonry breakout or pullout strength in tension, ϕ shall be taken as 0.65 for anchors qualifying for Category 1 and 0.55 for anchors qualifying for Category 2.

d. For cases where the nominal strength of anchors in masonry is controlled by masonry failure modes in shear, ϕ shall be taken as 0.70.

4.2.10 *ACI 318-19 Section 17.6.1* applies with the general changes prescribed in Section 4.1.1.

4.2.11 In lieu of *ACI 318-19 Section 17.6.2.1*: The nominal breakout strength in tension, N_{mb} of a single anchor or N_{mbg} of a group of anchors, shall not exceed:

a. For a single anchor:

$$N_{mb} = \frac{A_{Nm}}{A_{Nmo}} \Psi_{ed,N,m} \Psi_{c,N,m} N_{b,m} \qquad (17.6.2.1a)$$

b. For a group of anchors:

$$N_{mbg} = \frac{A_{Nm}}{A_{Nmo}} \Psi_{ec,N,m} \Psi_{ed,N,m} \Psi_{c,N,m} N_{b,m} \qquad (17.6.2.1b)$$

Factors $\Psi_{ec,N,m}$, $\Psi_{ed,N,m}$, and $\Psi_{c,N,m}$ are defined in *ACI 318-19 Section 17.6.2.3-17.6.2.5*. A_{Nm} is the projected masonry failure area of a single anchor or group of anchors that shall be approximated as the base of the rectilinear geometrical figure that results from projecting the failure surface outward $1.5h_{ef}$ from the centerlines of the anchor, or, in the case of a group of anchors, from a line through a row of adjacent anchors. A_{Nm} shall not exceed $n \cdot A_{Nmo}$, where n is the number of anchors in the group that resist tension. A_{Nmo} is the projected masonry failure area of a single anchor with an edge distance equal to or greater than $1.5h_{ef}$.

$$A_{Nmo} = 9{h_{ef}}^2 \qquad (17.6.2.1.4)$$

4.2.12 In lieu of *ACI 318-19 Section 17.6.2.2*: The basic masonry breakout strength of a single anchor in tension in cracked masonry, $N_{b,m}$, shall not exceed:

$$N_{b,m} = k_m \sqrt{f'_m} {h_{ef}}^{1.5} \qquad (17.6.2.2.1)$$

where

k_m = effectiveness factor for breakout strength in masonry
= $\alpha_{masonry} \cdot k_c$

k_c = effectiveness factor for breakout strength in concrete
= 17; and

$\alpha_{masonry}$ = reduction factor for the inhomogeneity of masonry materials in breakout strength determination.
= 0.7

4.2.13 *ACI 318-19 Section 17.6.2.1.2 & 17.6.2.3-17.6.2.4* apply with the general changes prescribed in Section 4.1.1.

4.2.14 In lieu of *ACI 318-19 Section 17.6.2.5*: The basic masonry breakout strength of a single anchor in tension, $N_{b,m}$, must be calculated using the values of $k_{m,cr}$ and $k_{m,uncr}$ as described in Table 4. Where analysis indicates no cracking is anticipated, $N_{b,m}$ must be calculated using $k_{m,uncr}$ and $\Psi_{c,N,m} = 1.0$.

4.2.15 *ACI 318-19 Section 17.6.2.6* need not be considered since the modification factor for post installed anchors, $\Psi_{cp,N}$, is not included in Eq. 17.6.2.1a & 17.6.2.1b.

4.2.16 In lieu of *ACI 318-19 Section 17.6.3.1*: The nominal pullout strength of a single post-installed anchor in tension shall not exceed:

$$N_{pn} = \Psi_{m,P} N_p \qquad (17.6.3.1)$$

where $\Psi_{m,P}$ is defined in ACI 318-19 Section 17.6.3.3.

4.2.17 In lieu of *ACI 318-19 Section 17.6.3.2.1*: The nominal pullout strength of a single anchor in cracked and uncracked masonry, $N_{p,cr}$ and $N_{p,uncr}$, respectively, is given in Table 4 of this report, and shall not exceed the breakout strength calculated in accordance with Section 4.2.12 associated with f'_m.

4.2.18 The following apply with the general changes prescribed in Section 4.1.1:

1. *ACI 318-19 17.6.3.3*
2. *ACI 318-19 Section 17.7.1 excluding Sections 17.7.1.2a & 17.7.1.2c*
3. *ACI 318-19 Section 17.7.2.1-17.7.2.2.1*
4. *ACI 318-19 Sections 17.7.2.1.2 & 17.7.2.3-17.7.2.4*
5. *ACI 318-19 Section 17.7.2.6*
6. *ACI 318-19 Section 17.7.3*
7. *ACI 318-19 Section 17.8-17.9*
8. *ACI 318-19 Section 17.2.5*

4.2.19 In lieu of *ACI 318-19 Section 17.7.2.5*: For anchors located in a region of masonry construction where cracking is anticipated, $\Psi_{m,V}$ shall be taken as 1.0. For cases where analysis indicates no cracking at service levels, it shall be permitted to take $\Psi_{m,V}$ as 1.4.

4.2.20 In lieu of *ACI 318-19 Section 17.9*: Minimum edge distances and spacings shall be as given in Table 2 of this report.

4.2.21 [In addition to the ACI 318 provisions] Masonry crushing strength for anchors in shear shall be calculated in accordance with TMS 402-22 Eq. 9-5. The nominal strength of an anchor in shear as governed by masonry crushing, V_{mc}, shall be calculated using Eq. (4-1).

$$V_{mc} = 1750 \cdot \sqrt[4]{f'_m A_{se,V}} \qquad (4\text{-}1)$$

4.2.22 [In addition to the ACI 318 provisions] Determination of shear capacity for anchors in horizontal ledgers in fully grouted CMU walls with hollow head joint applications with an assumed masonry unit length of 16 inches, standard:

Where six or more anchors are placed at uniform horizontal spacing in continuous wood or steel ledgers connecting floor and roof diaphragms to fully grouted CMU walls constructed with hollow head joints (using closed-end block), the horizontal and vertical shear capacity of the anchors may be permitted to be calculated in accordance with Eq. (4-2) and Eq. (4-3), respectively, in lieu of Section 4.1.2.

$$v_{mb,horiz} = 0.75 \cdot V_{gov,horiz} \cdot \frac{12}{s_{horiz}} \qquad (4\text{-}2)$$

$$v_{mb,vert} = 0.75 \cdot V_{gov,vert} \cdot \frac{12}{s_{horiz}} \qquad (4\text{-}3)$$

where

s_{horiz} = horizontal anchor spacing in the ledger, (in.). For anchor spacings that are multiples of 8 inches, locate the first anchor in the ledger at least 2 inches from the head joint and the center of the block. For other anchor spacings, minimum edge distance as specified in the evaluation report shall apply.

$V_{gov,horiz}$ = min(V_{sa}, $V_{mb,4}$, V_{mc}, $V_{mp,4}$), (lb)

$V_{gov,vert}$ = min(V_{sa}, $2 \cdot V_{mb,4}$, V_{mc}, $V_{mp,4}$), (lb)

V_{sa} = shear capacity for a single anchor calculated in accordance with *ACI 318-19 Section 17.7.1.2, (lb)*

$V_{mb,4}$ = breakout capacity for a single anchor with edge distance of 4 inches, (lb)

V_{mc} = crushing capacity for a single anchor calculated in accordance with Eq. (4-1), (lb)

$V_{mp,4}$ = pryout capacity for a single anchor with edge distance of 4 inches, (lb)

Where anchors are spaced at 8 inches on center or another multiple of 8 inches on center, multiply the calculated $V_{mb,horiz}$ and $V_{mb,vert}$ by $\frac{4}{3}$.

4.2.23 Interaction shall be calculated in compliance with *ACI 318-19 Section 17.8* as follows:

1. If $\frac{V_{ua}}{\phi V_n} \leq 0.2$ for the governing strength in shear, then full strength in tension shall be permitted: $\phi N_n \geq N_{ua}$.
2. If $\frac{N_{ua}}{\phi N_n} \leq 0.2$ for the governing strength in tension, then full strength in shear shall be permitted: $\phi V_n \geq V_{ua}$.
3. For all other cases:

$$\frac{N_{ua}}{\phi N_n} + \frac{V_{ua}}{\phi V_n} \leq 1.2 \qquad (17.8.3)$$

4.2.24 Satisfying the parabolic equation complying with *ACI 318-19 Section R17.8* may be used in lieu of satisfying Section 4.2.23. The parabolic equation is given as:

$$\left(\frac{N_{ua}}{\phi N_n}\right)^{5/3} + \left(\frac{V_{ua}}{\phi V_n}\right)^{5/3} \leq 1.0$$

4.3 Strength Design of Anchors in Partially Grouted Concrete Masonry Unit Construction:

4.3.1 In all cases, the minimum distance from hollow head joints shall be the $c_{min,HJ}$ value provided in Table 2, measured from the centerline of the head joint.

4.3.2 Anchors located in grouted cells shall be designed in accordance with Sections 4.1 and 4.2, whereby the distance to the edge of the ungrouted cell shall be taken as a free edge.

4.4 Conversion of Strength Design to Allowable Stress Design (ASD):

For mechanical anchors designed using load combinations in accordance with IBC Section 1605.1 (Allowable Stress Design), allowable loads shall be established using the equations below:

$$T_{allowable,ASD} = \frac{\phi N_n}{\alpha} \quad (4\text{-}4)$$

and

$$V_{allowable,ASD} = \frac{\phi V_n}{\alpha} \quad (4\text{-}5)$$

where

$T_{allowable,ASD}$ = Allowable tensile load (lb)

$V_{allowable,ASD}$ = Allowable shear load (lb)

N_n = Lowest design strength of an anchor or anchor group in tension as determined in accordance with this report, as applicable, and 2024 IBC Section 1905.7, (lb)

V_n = Lowest design strength of an anchor or anchor group in shear as determined in accordance with this report, as applicable, and 2024 IBC Section 1905.7, (lb)

α = Conversion factor calculated as a weighted average of the load factors for the controlling load combination. In addition, α shall include all applicable factors to account for non-ductile failure modes and required overstrength; and

ϕ = relevant strength reduction factor for load case and Anchor Category.

4.5 Installation:

Installation parameters are provided in Table 2 and Figures 1, 3, and 4. Anchor locations must comply with this report and plans and specifications approved by the code official. The Hilti KB-TZ2 must be installed in accordance with manufacturer's published instructions (MPII) as described in Figure 6 and this report. In case of conflict, this report governs. Installation in head joints shall only be permitted in fully grouted walls constructed with open-ended units. Anchors must be installed in holes drilled into the masonry using carbide-tipped masonry drill bits complying with ANSI B212.15-1994. Nominal drill bit diameters must be equal to the nominal diameter of the anchors, and holes shall be drilled to a depth allowing proper embedment. It is permitted to utilize Hilti Dust Removal System (DRS) attachments to clean the drilling dust from the concrete surface while drilling. 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.

4.6 Special Inspection:

At a minimum, periodic special inspection under the IBC and IRC must be provided in accordance with Sections 1704 and 1705 of the IBC. Under the IBC, additional requirements as set forth in Sections 1705 and 1706 must be observed, where applicable. The special inspector shall be on the jobsite initially during anchor installation to verify anchor type and dimensions, masonry type, masonry compressive strength, anchor identification, hole dimensions, hole cleaning procedures, spacing, edge distances, masonry unit dimensions, anchor embedment, tightening torque, and adherence to the Manufacturer's Printed Installation Instructions (MPII).

The special inspector shall verify the initial installations of each type and size of mechanical anchor by construction personnel on site. Subsequent installations of the same anchor type and size by the same construction personnel are permitted to be performed in the absence of the special inspector. Any change in the anchor product being installed or in the personnel performing the installation requires an initial inspection. For ongoing installations over an extended period, the special inspector must make regular inspections to confirm correct handling and installation of the product.

5.0 CONDITIONS OF USE:

The Kwik Bolt TZ2 Masonry Anchors described in this report are suitable alternatives to what is specified in the codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The Kwik Bolt TZ2 Masonry Anchors must be installed in accordance with the manufacturer's printed installation instructions (MPII) and this report. In case of conflict, this report governs.

5.2 Anchors have been evaluated for use in cracked and uncracked grouted concrete masonry unit (CMU) construction with a minimum compressive strength of 1,500 psi (10.3 MPa) at the time of anchor installation.

5.3 Anchor sizes, dimensions, and minimum embedment depths must be as set forth in this report.

5.4 Construction documents prepared or reviewed by a registered design professional, where required by the statutes of the jurisdiction in which the project is to be constructed, specifying the Kwik Bolt TZ2 Masonry Anchors must indicate compliance with this evaluation report, applicable codes, and must be submitted to the code official for approval.

5.5 Anchors installed in the face or the top of fully grouted CMU masonry may be used to resist short-term loading due to wind or seismic forces in structures assigned to Seismic Design Categories A through F under the IBC.

Loads applied to the anchors must be adjusted in accordance with IBC Section 1605.1 for strength design and allowable stress design

5.6 Strength design values shall be established in accordance with Sections 4.1, 4.2, and 4.3 of this report.

5.7 Allowable design values shall be established in accordance with Section 4.4 of this report.

5.8 Design of anchors in fully grouted CMU construction must avoid location of anchors in hollow head joints.

5.9 Since an ICC-ES acceptance criteria for evaluating data to determine the performance of mechanical anchors subjected to fatigue or shock loading is unavailable at this time, the use of these anchors under these conditions is beyond the scope of this report.

5.10 Anchors are not permitted to support fire-resistive construction. Where not otherwise prohibited by the code, anchors are permitted for installation in fire-resistive 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 gravity load–bearing structural elements are within a fire-resistive envelope or a fire-resistive membrane, are protected by approved fire-resistive materials, or have been evaluated for resistance to fire exposure in accordance with recognized standards.
- Anchors are used to support nonstructural elements.

5.11 The design of anchors must be in accordance with the provisions for cracked masonry where analysis indicates that cracking may occur ($f_t > f_r$) in the vicinity of the anchor due to service loads or deformations over the anchor service life.

5.12 Use of carbon steel Kwik Bolt TZ2 anchors must be limited to dry, interior locations.

5.13 Use of stainless steel Kwik Bolt TZ2 anchors as specified in this report are permitted for exterior exposure and damp environments.

5.14 Use of stainless steel Kwik Bolt TZ2 anchors as specified in this report are permitted for contact with preservative-treated and fire-retardant-treated wood.

5.15 Special inspection must be provided in accordance with Section 4.6 of this report.

5.16 Anchors are manufactured by Hilti, Inc., under a quality control program with inspections conducted by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Mechanical Anchors in Cracked and Uncracked Masonry Elements (AC01) (24) 2nd Edition, published April 2025.

7.0 IDENTIFICATION

7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-4561) along with the name, registered trademark, or registered logo of the report holder must be included in the product label.

7.2 In addition, the anchors are identified by packaging labeled with the manufacturer's contact information, anchor name, and anchor size. The anchors have the letters KB-TZ2 embossed on the anchor stud and a notch or multiple notches embossed into the anchor head. The letters are visible after installation for verification as depicted in Figure 5 of this report. The number of notches indicate the steel type as described in Figure 5. The letter system indicating length embossed on the head of the anchor is described in Table 3.

7.3 The report holder's contact information is the following:

HILTI, INC.
7250 DALLAS PARKWAY, SUITE 1000
PLANO, TEXAS 75024
(800) 879-8000
www.hilti.com

TABLE 1A — ACI 318-19 AND -14 SECTIONS APPLICABLE OR MODIFIED BY THIS REPORT

ACI 318-19 Section	*(ACI 318-14 Section)*	Modified by this Report Section:
2.2	*(2.2)*	Unchanged*
2.3	*(2.3)*	
17.1.1, 17.1.3	*(17.1.1 – 17.1.2)*	
17.1.2	*(17.1.3)*	Section 4.2.2
17.1.4, 17.2.1, 17.4.1, & 17.5.1.3.1	*(17.1.4 – 17.2.2)*	Unchanged*
17.4.2	*(17.2.3)*	Section 4.2.4
17.3.1	*(17.2.7)*	Unchanged*
17.5.2	*(17.3.1.1)*	Section 4.2.6
17.5.2.3	*(17.3.1.3)*	Unchanged*
17.5.1.2	*(17.3.2 excluding 17.3.2.1)*	
17.5.3	*(17.3.3)*	Section 4.2.9
17.6.1	*(17.4.1)*	Unchanged*
17.6.2.1	*(17.4.2.1)*	Section 4.2.11
17.6.2.2	*(17.4.2.2)*	Section 4.2.12
17.6.2.1.2 & 17.6.2.3 – 17.6.2.4	*(17.4.2.3 – 17.4.2.5)*	Unchanged*
17.6.2.5	*(17.4.2.6)*	Section 4.2.14
17.6.2.6	*(17.4.2.7)*	Section 4.2.15
17.6.3.1	*(17.4.3.1)*	Section 4.2.16
17.6.3.2.1	*(17.4.3.2)*	Section 4.2.17
17.6.3.3	*17.4.3.6*	Section 4.2.18
17.7.1 excluding 17.7.1.2a & 17.7.1.2c	*(17.5.1. excluding 17.5.1.2a & 17.5.1.2c)*	Unchanged*
17.7.2.1-17.7.2.2.1	*(17.5.2.1-17.5.2.2)*	
17.7.2.1.2 & 17.7.2.3 – 17.7.2.4	*(17.5.2.4 – 17.5.2.6)*	
17.7.2.5	*(17.5.2.7)*	Section 4.2.19
17.7.2.6	*(17.5.2.8)*	Unchanged*
17.7.3	*(17.5.3)*	
17.8-17.9	*(17.6-17.7)*	
R17.8	(R17.6)	
17.2.5	*(17.8.1)*	

*Sections marked as unchanged adopt the general changes prescribed in Section 4.1.1.

TABLE 1B — REQUIRED STRENGTH OF ANCHORS IN FULLY GROUTED CMU

Failure Mode	Single Anchor	Anchor Group[1]	
		Individual Anchor in a Group	Anchors as a Group
Steel Strength in Tension	$\phi N_{sa} \geq N_{ua}$	$\phi N_{sa} \geq N_{ua,i}$	
Masonry Breakout Strength in Tension	$\phi N_{mb} \geq N_{ua}$		$\phi N_{mbg} \geq N_{ua,g}$
Pullout Strength in Tension	$\phi N_{pn} \geq N_{ua}$	$\phi N_{pn} \geq N_{ua,i}$	
Steel Strength in Shear	$\phi V_{sa} \geq V_{ua}$	$\phi V_{sa} \geq V_{ua,i}$	
Masonry Breakout Strength in Shear	$\phi V_{mb} \geq V_{ua}$		$\phi V_{mbg} \geq V_{ua,g}$
Masonry Crushing Strength in Shear	$\phi V_{mc} \geq V_{ua}$	$\phi V_{mc} \geq V_{ua,i}$	
Masonry Pryout Strength in Shear	$\phi V_{mp} \geq V_{ua}$		$\phi V_{mpg} \geq V_{ua,g}$

[1]Required strengths for steel, pullout, and crushing failure modes shall be calculated for the most highly stressed anchor in the group.

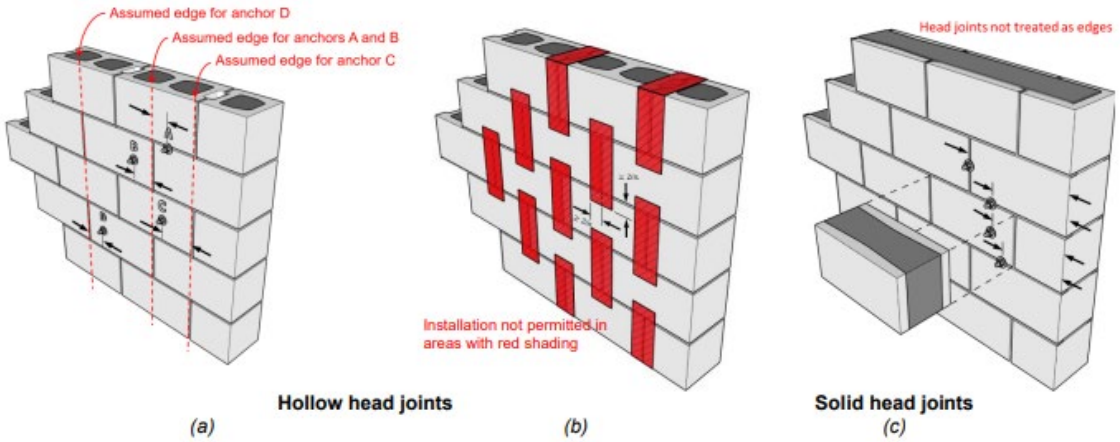

FIGURE 1—(a) Edge distance considerations in fully grouted CMU construction with hollow head joints (see Section 1.4.14.1), (b) exclusion zones in fully grouted construction with closed head joints, and (c) edge distance considerations in fully grouted CMU construction with solid head joints (see Section 1.4.14.2). (Note: dimensions to upper and lower edges omitted for clarity.)

TABLE 2—SETTING INFORMATION

Design Information		Symbol	Units	Nominal Anchor Diameter (in.)								
				1/4	3/8		1/2		5/8		3/4	
Nominal Bit Diameter		d_o	in.	1/4	3/8		1/2		5/8		3/4	
Effective Min. Embedment		h_{ef}	in.	1 1/2	1 1/2	2 1/2	2	3 1/4	2 3/4	4	3 1/4	4 3/4
			(mm)	(38)	(38)	(64)	(51)	(83)	(70)	(102)	(83)	(121)
Nominal Embedment		h_{nom}	in.	1 3/4	1 7/8	3	2 1/2	3 3/4	3 1/4	4 1/2	4	5 1/2
			(mm)	(44)	(48)	(76)	(64)	(95)	(83)	(114)	(102)	(140)
Min. Hole Depth		h_o	in.	2	2	3 1/4	2 3/4	4 1/4	3 3/4	4 3/4	4 1/4	5 3/4
			(mm)	(51)	(51)	(83)	(70)	(108)	(95)	(121)	(108)	(146)
Installation Torque - Carbon Steel		T_{inst}	ft-lb	4	15		25		30		50	
			(Nm)	(5.4)	(20.3)		(33.9)		(40.7)		(67.8)	
Installation Torque - Stainless Steel		T_{inst}	ft-lb	6	15		15		35		50	
			(Nm)	(8.1)	(20.3)		(20.3)		(47.5)		(67.8)	
Min. Dia. of Hole in Fastened Part		d_h	in.	5/16	7/16		9/16		11/16		13/16	
			(mm)	(7.9)	(11.1)		(14.3)		(17.5)		(20.6)	
Minimum Masonry Thickness		h_{min}	in.	7 5/8								
			(mm)	(194)								
Minimum Distance to Hollow Head Joint[1]		$c_{min,HJ}$	in.	2 1/2	2 1/2		2 1/2		2 1/2		2 1/2	3
			(mm)	(64)	(64)		(64)		(64)		(64)	(76)
Face of Wall	Minimum Edge Distance	c_{min}	in.	4	4	4	4	4	4	4	4	4
			(mm)	(102)	(102)	(102)	(102)	(102)	(102)	(102)	(102)	(102)
	Minimum Anchor Spacing	s_{min}	in.	4	5	4	5	5	7	6	6	6
			(mm)	(102)	(127)	(102)	(127)	(127)	(178)	(152)	(152)	(152)
Top of Wall	Minimum Edge Distance[2]	$c_{min,top}$	in.	-	1 3/4	1 3/4	1 3/4	1 3/4	2 3/4	2 3/4	-	
			(mm)		(44)	(44)	(44)	(44)	(70)	(70)		
	Minimum Anchor Spacing	$s_{min,top}$	in.	-	6	6	6	6	6	6	-	
			(mm)		(152)	(152)	(152)	(152)	(152)	(152)		

For **SI**: 1 inch = 25.4 mm | 1 ft-lbf = 1.356 Nm

[1] The minimum distance from the center of an anchor to the centerline of a hollow head joint (vertical mortar joint) is $c_{min,HJ}$ as shown in Figure 1. See Section 4.1.2.
[2] The minimum end distance from the center of an anchor to the end of the top of the CMU wall is 4 inches. Edge and end distances are illustrated in Figure 4.

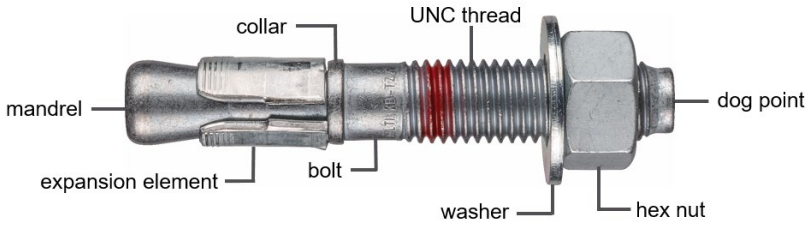

FIGURE 2—HILTI CARBON STEEL KWIK BOLT TZ (KB-TZ2)

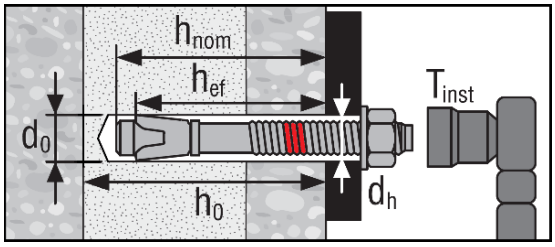

FIGURE 3—HILTI KB-TZ2 INSTALLED

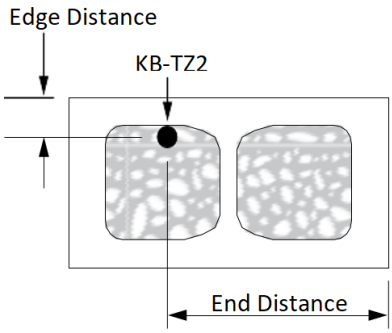

FIGURE 4 – EDGE & END DISTANCES FOR TOP OF WALL INSTALLATION

TABLE 3—LENGTH IDENTIFICATION SYSTEM (CARBON STEEL AND STAINLESS STEEL ANCHORS)

Stamp on Anchor		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Length of Anchor (inches)	From	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	11	12	13	14	15
	Up to but not including	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	7 1/2	8	8 1/2	9	9 1/2	10	11	12	13	14	15	16

For **SI:** 1 inch = 25.4 mm.

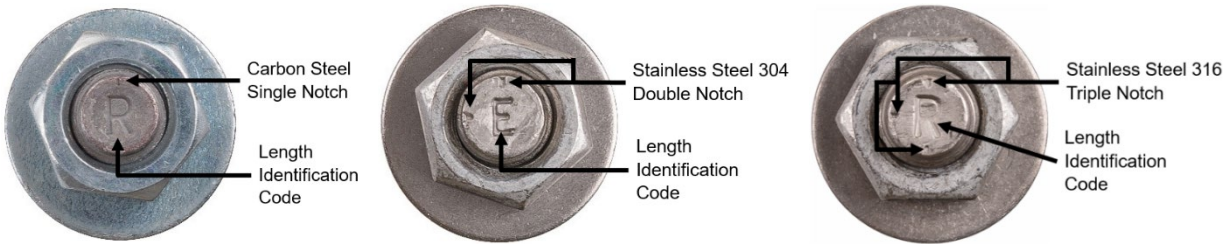

FIGURE 5—ANCHOR HEAD WITH LENGTH IDENTIFICATION CODE AND KB-TZ2 HEAD NOTCH EMBOSSMENT

TABLE 4 — HILTI CARBON STEEL AND STAINLESS STEEL KB-TZ2 DESIGN INFORMATION – TENSION

Design Information		Symbol	Units	Nominal Anchor Diameter (in.)								
				1/4	3/8		1/2		5/8		3/4	
Effective Min. Embedment[1]		h_{ef}	in. (mm)	1 1/2 (38)	1 1/2 (38)	2 1/2 (64)	2 (51)	3 1/4 (83)	2 3/4 (70)	4 (102)	3 1/4 (83)	4 3/4 (121)
Tension - Steel Failure Mode												
Strength Reduction Factor for Steel - Tension[2,3]		ϕ	-	0.75	0.75		0.75		0.75		0.75	
Effective Tensile Stress Area, Neck		$A_{se,N}$	in.^{2} (mm^2)	0.024 (15.4)	0.051 (33.2)		0.099 (63.6)		0.164 (106.0)		0.239 (154.4)	
Carbon Steel	Min. Specified Yield Strength	f_y	lb/in^2 (N/mm^2)	100,900 (696)	100,900 (696)		96,300 (664)		87,000 (600)		84,700 (584)	
	Min. Specified Ult. Strength	f_{uta}	lb/in^2 (N/mm^2)	122,400 (844)	126,200 (870)		114,000 (786)		106,700 (736)		105,900 (730)	
	Steel Strength in Tension	N_{sa}	lb (kN)	2,920 (13.0)	6,490 (28.9)		11,240 (50.0)		17,535 (78.0)		25,335 (112.7)	
Stainless Steel	Min. Specified Yield Strength	f_y	lb/in^2 (N/mm^2)	100,900 (696)	96,300 (664)		96,300 (664)		91,600 (632)		84,100 (580)	
	Min. Specified Ult. Strength	f_{uta}	lb/in^2 (N/mm^2)	122,400 (844)	120,100 (828)		120,400 (830)		114,600 (790)		100,500 (693)	
	Steel Strength in Tension	N_{sa}	lb (kN)	2,920 (13.0)	6,180 (27.5)		11,870 (52.8)		18,835 (83.8)		24,045 (107.0)	
Tension - Masonry Failure Modes												
Anchor Category		-	-	2	1		2		1		1	
Strength Reduction Factor for Masonry Breakout and Pullout Failure - Tension[3]		ϕ	-	0.55	0.65		0.55		0.65		0.65	
Effectiveness Factor for Uncracked Masonry[4]		$k_{m,uncr}$	-	17	17		17		17		17	
Effectiveness Factor for Cracked Masonry[4]		$k_{m,cr}$	-	12	12		12		12		12	
Face of Wall	Pullout Strength Uncracked Masonry[5]	$N_{p,uncr}$	lb (kN)	450 (2.0)	935 (4.2)	1,725 (7.7)	1,415 (6.3)	1,890 (8.4)	2,200 (9.8)	2,435 (10.8)	2,965 (13.2)	4,870 (21.7)
	Pullout Strength Cracked Masonry[5]	$N_{p,cr}$	lb (kN)	305 (1.4)	675 (3.0)	1,245 (5.5)	1,345 (6.0)	1,795 (8.0)	1,320 (5.9)	1,460 (6.5)	2,405 (10.7)	3,945 (17.6)
	Pullout Strength Seismic[5]	$N_{p,eq}$	lb (kN)	305 (1.4)	675 (3.0)	1,245 (5.5)	1,345 (6.0)	1,615 (7.2)	1,165 (5.2)	1,420 (6.3)	2,405 (10.7)	3,945 (17.6)
Top of Wall	Pullout Strength Uncracked Masonry[5]	$N_{p,top,uncr}$	lb (kN)	-	935 (4.2)	1,725 (7.7)	1,070 (4.8)	1,890 (8.4)	2,200 (9.8)	2,435 (10.8)	-	
	Pullout Strength Cracked Masonry[5]	$N_{p,top,cr}$	lb (kN)	-	675 (3.0)	1,245 (5.5)	1,020 (4.5)	1,795 (8.0)	1,320 (5.9)	1,460 (6.5)	-	
	Pullout Strength Seismic[5]	$N_{p,top,eq}$	lb (kN)	-	675 (3.0)	1,245 (5.5)	1,020 (4.5)	1,615 (7.2)	1,165 (5.2)	1,420 (6.3)	-	
Tension - Axial Stiffness												
Axial Stiffness in Service Load Range		β_{uncr}	lb/in.	52,525	211,640	131,765	91,210	70,750	123,795	119,740	58,480	39,190
		β_{cr}	lb/in.	29,960	54,560	47,690	38,300	33,685	88,065	32,755	37,180	41,560

For **SI:** 1 inch = 25.4 mm | 1 lbf = 4.45 N | 1 psi = 0.006895 MPa.

[1] Figure 3 of this report illustrates the installation parameters.
[2] The KB-TZ2 is considered a ductile steel element in accordance with *ACI 318-19 Section 2.3*.
[3] The tabulated values of ϕ apply when the LRFD load combinations of ASCE 7 are used.
[4] For all design cases, $\psi_{c,N,m} = 1.0$. The appropriate effectiveness factor for cracked masonry ($k_{m,cr}$) or uncracked masonry ($k_{m,uncr}$) must be used.
[5] For all design cases, $\psi_{m,P} = 1.0$. Tabular value for pullout strength is for a masonry compressive strength of 1,500 psi (10.3 MPa).

TABLE 5 — HILTI CARBON STEEL AND STAINLESS STEEL KB-TZ2 DESIGN INFORMATION – SHEAR

Design Information		Symbol	Units	Nominal Anchor Diameter (in.)								
				1/4	3/8		1/2		5/8		3/4	
Anchor O.D.		d_a	in. (mm)	0.250 (6.4)	0.375 (9.5)		0.500 (12.7)		0.625 (15.9)		0.750 (19.1)	
Effective Min. Embedment[1]		h_{ef}	in. (mm)	1 1/2 (38)	1 1/2 (38)	2 1/2 (64)	2 (51)	3 1/4 (83)	2 3/4 (70)	4 (102)	3 1/4 (83)	4 3/4 (121)
Shear - Steel Failure Mode												
Strength Reduction Factor for Steel - Shear[2,3]		ϕ	-	0.65	0.65		0.65		0.65		0.65	
Carbon Steel	Steel Strength in Shear	V_{sa}	lb (kN)	1,050 (4.7)	1,600 (7.1)		3,285 (14.6)		4,960 (22.1)		7,895 (35.1)	
Carbon Steel	Steel Strength in Shear, Seismic	$V_{sa,eq}$	lb (kN)	1,050 (4.7)	835 (3.7)		2,365 (10.5)		2,280 (10.1)		3,395 (15.1)	
Stainless Steel	Steel Strength in Shear	V_{sa}	lb (kN)	795 (3.5)	1,635 (7.3)		2,675 (11.9)		5,125 (22.8)		6,430 (28.6)	
Stainless Steel	Steel Strength in Shear, Seismic	$V_{sa,eq}$	lb (kN)	795 (3.5)	850 (3.8)		1,925 (8.6)		2,355 (10.5)		2,765 (12.3)	
Shear - Masonry Failure Modes												
Strength Reduction Factor for Masonry Breakout and Pryout Failure - Shear[3]		ϕ	-	0.70	0.70		0.70		0.70		0.70	
Strength Reduction Factor for Masonry Crushing Failure - Shear[3]		ϕ	-	0.50	0.50		0.50		0.50		0.50	
Load Bearing Length of Anchor in Shear		l_e	in. (mm)	1 1/2 (38)	1 1/2 (38)	2 1/2 (64)	2 (51)	3 1/4 (83)	2 3/4 (70)	4 (102)	3 1/4 (83)	4 3/4 (121)
Coefficient for Pryout Strength		k_{cp}	-	1	1	2	1	2	2	2	2	2

For **SI:** 1 inch = 25.4 mm | 1 lbf = 4.45 N.

[1] Figure 3 of this report illustrates the installation parameters.
[2] The KB-TZ2 is considered a ductile steel element in accordance with *ACI 318-19 Section 2.3*.
[3] The tabulated values of ϕ apply when the LRFD load combinations of ASCE 7 are used.

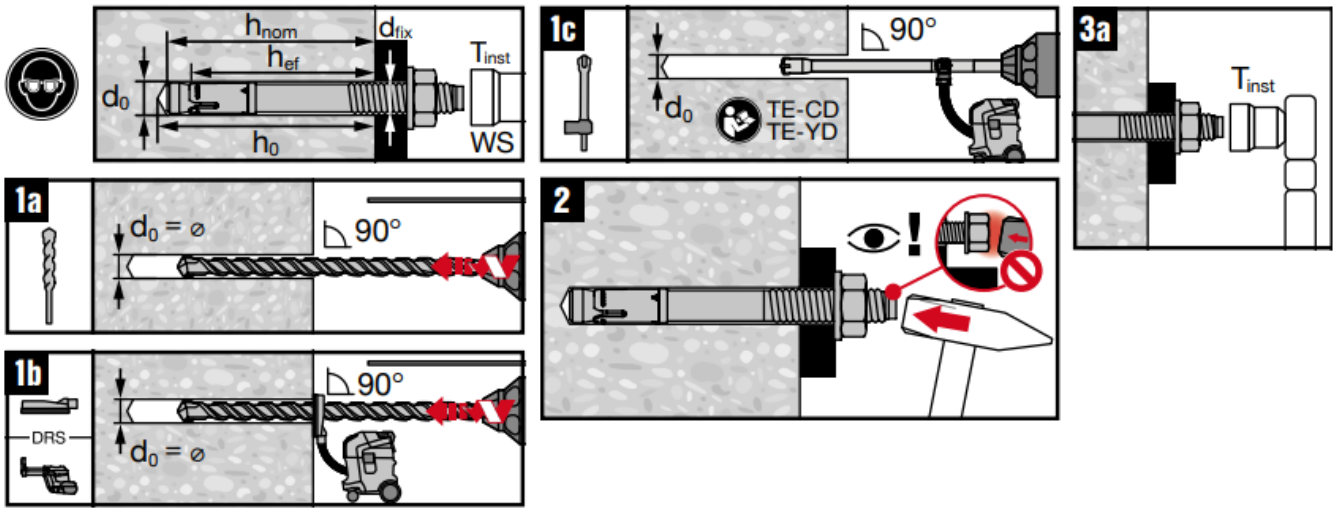

FIGURE 6—MANUFACTURERS PRINTED INSTALLATION INSTRUCTIONS

TABLE 6— APPLICABLE SECTIONS OF THE IBC CODE UNDER EACH EDITION OF THE IBC AND IRC

IBC			
2024 IBC	**2021 IBC**	**2018 IBC**	**2015 IBC**
Section 1605.1		Section 1605.2 or 1605.3	
Section 1704			
Section 1705			
Chapter 21			
Section 2103.2.1			
Section 2103.3			
IRC			
2024 IRC	**2021 IRC**	**2018 IRC**	**2015 IRC**
Section R301.1.3			
Section R606.2.8			Section R606.2.7
Section R606.2.12			Section R606.2.11

TABLE 7— APPLICABLE SECTIONS OF TMS 402 UNDER EACH EDITION OF THE IBC

2024 IBC	**2021 IBC**	**2018 IBC**	**2015 IBC**
TMS 402-22	TMS 402-16		TMS 402-13
Section 8.1.4	Section 8.1.3		Section 8.1.4
Eq. 9-5	Eq. 9-7		

DIVISION: 04 00 00—MASONRY
Section: 04 05 19.16—Masonry Anchors

REPORT HOLDER:

HILTI, INC.

EVALUATION SUBJECT:

KWIK BOLT TZ2 MASONRY ANCHORS IN CRACKED AND UNCRACKED GROUTED CONCRETE MASONRY UNIT WALLS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors, described in ICC-ES evaluation report ESR-4561, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- *2023 City of Los Angeles Building Code (LABC)*
- *2023 City of Los Angeles Residential Code LARC)*

2.0 CONCLUSIONS

The Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors, described in Sections 2.0 through 7.0 of the evaluation report ESR-4561, comply with LABC Chapter 21, and the LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-4561.
- The design, installation, conditions of use and identification of the Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors are in accordance with the 2021 *International Building Code*® (IBC) and 2021 *International Residential Code*® (IRC) provisions, as applicable, noted in the evaluation report ESR-4561.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, and the City of Los Angeles Information Bulletin P/BC 2023-092, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.
- The allowable and strength design values determined from the evaluation report and tables are for the connection of the anchors to fully grouted masonry. The connection between the anchors and the connected members shall be checked for capacity (which may govern).
- For use in wall anchorage assemblies to flexible diaphragm applications, anchors shall be designed per the requirements of City of Los Angeles Information Bulletin P/BC 2023-071.

This supplement expires concurrently with the evaluation report, reissued December 2025.

DIVISION: 04 00 00—MASONRY
Section: 04 05 19.16—Masonry Anchors

REPORT HOLDER:

HILTI, INC.

EVALUATION SUBJECT:

KWIK BOLT TZ2 MASONRY ANCHORS IN CRACKED AND UNCRACKED GROUTED CONCRETE MASONRY UNIT WALLS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors, described in ICC-ES evaluation report ESR-4561, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2023 *Florida Building Code—Building*
- 2023 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The Kwik Bolt TZ2 (KB-TZ2) Masonry Anchors, described in Sections 2.0 through 7.0 of ICC-ES evaluation report ESR-4561, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential*. The design requirements must be determined in accordance with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, as applicable. The installation requirements noted in the ICC-ES evaluation report ESR-4561 for the 2021 *International Building Code®* meet the requirements of the *Florida Building Code—Building* and the *Florida Building Code—Residential*, as applicable.

Use of the Kwik Bolt TZ2 (KB-TZ2) carbon steel and stainless steel masonry anchors have also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential*, with the following conditions:

a) Design and installation must meet the requirements of Section 2122.7 of the *Florida Building Code—Building*.

b) For anchorage to wood members, the connection subject to uplift, must be designed for no less than 700 pounds (3114 N).

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official, when the report holder does not possess an approval by the Commission). Florida Rule 61G20-3 is applicable to products and/or systems which comprise the building envelope and structural frame for compliance with the structural requirements of the Florida Building Code.

This supplement expires concurrently with the evaluation report, reissued December 2025.