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RESEARCH REPORT: RR 25992
(CSI #03 16 00)

BASED UPON ICC-ES EVALUATION
REPORT NO. ESR-2266

REEVALUATION DUE

DATE: January 1, 2018

Issued Date: December 1, 2015

Code: 2014 LABC

GENERAL APPROVAL – Reevaluation- USP Structural Connectors Proprietary STB and
STBL Anchor Bolt Series Cast in Place Anchor Bolts

DETAILS

When in compliance with the use, description, design, installation, conditions of approval, and identification of Evaluation Report No. 2266 issued March, 2015 of the ICC-ES Evaluation Services, Incorporated. The report, in its entirety, is attached and made part of this general approval.

The approval is subject to the following conditions:

1. Periodic special inspection is required for installation of connectors that are used as part of the seismic or wind force-resisting system.
2. The products described in this report are identified as described in the attached ESR-2266.
3. The allowable loads specified in this approval are for the wood fastening devices and its fasteners and does not include supporting members.

RR 25992
Page 1 of 2

USP Structural Connectors, A MiTek® Company

RE: USP Structural Connectors Proprietary STB and STBL Anchor Bolt Series Cast in Place Anchor Bolts

DISCUSSION

This report is in compliance with the 2014 City of Los Angeles Building Code.

The approval is based on tests and analyses in accordance with ICC-ES AC 399, dated October 2008 (editorially revised July 2012).

This general approval will remain effective provided the Evaluation Report is maintained valid and unrevised with the issuing organization. Any revision to the report must be submitted to this Department for review with appropriate fee to continue the approval of the revised report.

Addressee to whom this Research Report is issued is responsible for providing copies of it, complete with any attachments indicated, to architects, engineers and builders using items approved herein in design or construction which must be approved by Department of Building and Safety Engineers and Inspectors.

This general approval of an equivalent alternate to the Code is only valid where an engineer and/or inspector of this Department has determined that all conditions of this Approval have been met in the project in which it is to be used.

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Attachments: ICC-ES Evaluation Report No. ESR-2266 (5 Pages).

ICC-ES Evaluation Report

ESR-2266

Issued March 2015

This report is subject to renewal March 2017.

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DIVISION: 03 00 00—CONCRETE
Section: 03 16 00—Concrete Anchors

REPORT HOLDER:

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EVALUATION SUBJECT:

**USP STRUCTURAL CONNECTORS® PROPRIETARY STB
AND STBL ANCHOR BOLT SERIES CAST-IN-PLACE
ANCHOR BOLTS**

1.0 EVALUATION SCOPE

Compliance with the following codes:

- * ■ ~~2012, 2009 and 2006 International Building Code® (IBC)~~
- * ■ ~~2012, 2009 and 2006 International Residential Code® (IRC)~~
- * ■ ~~2013 Abu Dhabi International Building Code (ADIBC)†~~

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

Structural

2.0 USES

USP Structural Connectors proprietary STB series and STBL series cast-in-place anchor bolts are used to transfer wind- and earthquake-induced uplift forces (tension) in light-frame wood and cold-formed steel structures from their lateral force-resisting elements into their foundations. These anchor bolts may be used to transfer wind and earthquake forces (Seismic Design Categories A through F) in accordance with Section 1604.8.1 of the IBC, and may also be used to resist hold-down forces for braced walls in accordance with Section R602.10 of the IRC, Section R602.12 of the 2009 IRC, or Section R703.7 of the 2012 and 2006 IRC, as applicable. For wall bracing applications, the allowable load capacities in this report must be used to develop allowable design capacities equal to or exceeding the required load capacity in the applicable sections of the IRC. The STB series and STBL series anchor bolts are acceptable alternatives to cast-in-place anchors described in Sections 1908 and 1909 of the 2012 IBC or corresponding Sections 1911 and 1912 of the 2009

and 2006 IBC for resisting uplift forces (tension), when used in buildings of light-frame wood and cold-formed steel construction, as applicable. For structures regulated under the IRC, the anchors may be used where an engineered design is submitted in accordance with Section R301.1.3, or may be used when approved by the building official as authorized in Section R104.1.

3.0 DESCRIPTION

3.1 General:

3.1.1 STB Series Anchor Bolt: The STB series anchor bolts are cast-in-place ductile steel anchor bolts, installed into concrete stem-walls or concrete slab foundations to transfer tensile (uplift) forces only. The anchor bolt has a 3³/₄-inch-long (95 mm), cold rolled threaded upper portion, a straight unthreaded vertical shank with an embossed embedment line, and a triple radius deformed hook at the lower (embedded) end. The rolled threads are either 7⁷/₈ x 9 Unified National Coarse (UNC) or 5⁵/₈ x 11 UNC compliant. The deformed hook extends several inches off the vertical axis of the shank. The STB series anchor bolt must be installed into the concrete foundation up to the embedment line to achieve the allowable tension loads shown in Table 1. These loads are transferred through the bolt and into the foundation through a combination of bond and interlocking mechanical forces between the steel and the concrete. Table 1 also provides product geometry and Figures 1 to 5 provide installation details and other relevant information. An embossed angle guide (see Figures 1, 3 and 5) is located on the top of the exposed anchor to provide easy verification of the correct orientation of the triple radius deformed hook.

3.1.2 STBL Series Anchor Bolt: The STBL series anchor bolt is identical to the STB series anchor bolt except that it has a 5¹/₂-inch-long (140 mm) threaded upper portion for use with 3-by sill plates. Load values for the STBL series anchor bolt are identical to those for the STB series.

3.2 Material:

3.2.1 STB and STBL Anchor Bolts: The STB and STBL series anchor bolts are produced from steel that conforms to the requirements in ASTM F1554 Grade 36, having a minimum yield strength of 36 ksi (248 MPa) and a minimum tensile strength of 58 ksi (400 MPa). The steel has a tensile elongation over 14 percent and an area reduction greater than 30 percent, and is classified as ductile per the requirements of Section 1.4.3 of ICC-ES AC308 and Section D.1 of ACI 318. STB and STBL Anchor Bolts are also available in a hot-dipped galvanized (HDG) finish having an average coating weight of 1.25 ounces of

zinc per square foot of surface area (381 g/m²) as prescribed for ASTM A153 Class C. This finish is indicated by the addition of "HDG" to the end of the stock number, as in STB34-HDG. The allowable load values in this report are also applicable to anchors with an HDG coating.

Anchor bolts used in contact with preservative-treated or fire-treated lumber must comply with Section 2304.9.5 of the IBC, Section R317.3 of the 2012 and 2009 IRC, or Section R319.3 of the 2006 IRC, as applicable. The lumber treater, the report holder (USP Structural Connectors), or both, must be contacted for recommendations on minimum corrosion resistance used with specific proprietary preservative-treated or fire-retardant-treated lumber.

3.2.2 Concrete Foundation: The concrete must be normal-weight and comply with the provisions of Chapter 19) of the IBC or Section R402.2 of the IRC, as applicable. The concrete must have a minimum compressive strength, f_c , of 2500 psi (17.24 MPa) and must also meet the strength requirements of Section 1904 of the IBC or Section 402.2 of the IRC, or as specified by the design professional, as applicable. Materials used to make the concrete, and the mixing and placement of the concrete, must comply with Chapter 3 and Chapter 5 of ACI 318, as applicable.

3.2.3 Steel Reinforcement Bars (Rebar): Steel reinforcement must be at least one No. 4 rebar and must comply with Section 3.5.3 of ACI 318.

4.0 DESIGN AND INSTALLATION

4.1 Design:

Allowable Stress Design (ASD) tension loads for the cast-in-place STB Series and STBL Series anchor bolts are shown in Table 1. The table reflects allowable tension loads for three different anchor locations (End Wall, Mid Wall and Corner) for wind or seismic loading conditions. ASD of concrete anchors is not permitted for load combinations involving earthquake loads, per Section 1908 of the IBC. Consequently, the ASD seismic loads in Table 1 must be converted to strength design (LRFD). This is done by multiplying the tabulated ASD loads in Table 1 by the factored load combination value of 1.4 (for seismic) as prescribed in Section 9.2 of ACI 318. Detached one- and two-family dwellings, assigned to Seismic Design Category A, B or C, are exempt from the requirements of seismic design based on the first exception in Section 1613.1 of the IBC.

When LRFD is required and protection against non-ductile tension failure is applicable in AC318 Appendix D, governing failure mode must be determined as concrete brittle failure.

4.2 Installation:

Installation of the STB Series and STBL Series anchor bolts must be in accordance with this evaluation report and the manufacturer's published installation instructions. In the event of a conflict, this report governs.

The anchor bolts are to be installed into normal-weight concrete of continuous foundation stem walls with minimum thicknesses of, respectively, 6 inches (152 mm) and 8 inches (203 mm) for $\frac{5}{8}$ -inch-diameter (15.9 mm) anchors and $\frac{7}{8}$ -inch-diameter (22 mm) anchors. The anchor bolts may also be installed into a monolithic concrete foundation slab with an integral footing. A horizontal cold joint is not allowed within the anchor's required minimum embedment depth, unless provisions are made to transfer the load. One No. 4 steel reinforcing rebar must be installed adjacent to the anchor bolt, placed longitudinally to the stem wall, 3 to 6 inches below the top

of the stem wall. It is not required to be tied to the anchor bolt but must extend a minimum distance of $2 \times L_e$ (minimum anchor embedment) past the anchor bolt as shown in Figures 3, 4 and 5. The anchor bolts and the No. 4 steel reinforcing rebar must be secured in place to prevent movement during placement of the concrete.

The steel reinforcement in a reinforced concrete foundation may be used in lieu of the No. 4 steel reinforcing rebar provided it is located 3 to 6 inches below the top of the stem wall.

STB Series and STBL Series anchor bolts must be installed before the concrete is poured, with the lower triple radius deformed hook portion placed approximately 45 degrees from the longitudinal axis of the foundation wall. This is to be verified by the alignment indicator stamped on the exposed top end of the bolt. The anchor bolts must be embedded with the embedment line flush with the concrete surface and must have a $1\frac{3}{4}$ -inch (45 mm) minimum edge distance and a 5-inch (127 mm) minimum end distance. To achieve full tension capacity, the minimum on-center spacing of anchor bolts expected to be loaded in tension simultaneously must be equal to or greater than three times the required embedment depth for the anchor bolts. See Figures 1 to 5 for typical installation details.

4.3 Special Inspection:

Special inspections must be conducted in accordance with Section 1705.3 of the 2012 IBC ~~or Section 1704.4 of the 2009 and 2006 IBC~~, as applicable, when required by the code official. Special inspections are not required for foundations that qualify for the exceptions set forth in Section 1704.2 and Section 1705.3 of the 2012 IBC ~~and Section 1704.1 and Section 1704.4 of the 2009 and 2006 IBC, as applicable.~~

When the STB Series anchor bolts are used to resist wind forces, special inspections must be conducted in accordance with Section 1705.10 of the 2012 IBC, ~~Section 1706.1 of the 2009 IBC or Section 1705.4 of the 2006 IBC, as applicable.~~ Special inspections are not required for foundations that qualify for the exceptions set forth in Section 1704.2, Section 1705.10.1 and Section 1705.10.2 of the 2012 IBC; ~~Section 1704.1, Section 1706.2 and Section 1706.3 of the 2009 IBC; or Section 1704.1 of the 2006 IBC.~~

When the STB Series anchor bolts are used to resist seismic forces in Seismic Design Category C, D, E or F, special inspections must be conducted in accordance with Section 1705.11 of the 2012 IBC or Section 1707 (Specialized Inspections for Seismic Resistance) of the 2009 and 2006 IBC, as applicable.

Special inspections are not required for foundations that qualify for the exceptions set forth in Section 1705.11.2 or Section 1705.11.3 of the 2012 IBC; ~~Section 1704.1, Section 1705.3 or Section 1707.3 of the 2009 IBC and 2006 IBC, or Section 1707.4 of the 2009 IBC.~~

For installations under the IRC, special inspection is not normally required. However, for an engineered design where calculations are required to be signed by a registered design professional, special inspection requirements and exemptions are as stated above, as applicable for installations under the IRC.

5.0 CONDITIONS OF USE

The USP Structural Connectors STB Series and STBL Series anchor bolts described in this report comply with, or are suitable alternatives to what is specified in, those

codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Proprietary bolt sizes, dimensions, minimum embedment depths, spacing and edge distances are as set forth in this report.
- 5.2 Calculations showing compliance with this report must be submitted to the code official. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be considered.
- 5.3 The anchor bolts are limited to resisting tension forces only.
- 5.4 Use of the anchor bolts with preservative- or fire-retardant-treated lumber must be in accordance with Section 3.2.1 of this report.
- 5.5 Special inspection is provided in accordance with Section 4.3 of this report.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Cast-in-place Propriety Bolts in Concrete for Light-

frame Construction (AC309), dated October 2008 (editorially revised July 2012).

7.0 IDENTIFICATION

The STB and STBL series anchor bolts are identified with the letter "U" followed by a number correlating to the stock number and length (for example U28) alongside an orientation symbol indicating proper installation angle, stamped onto the exposed top of the anchor bolt. This means of identification is shown in Figure 1. The anchor bolts are shipped in cartons or containers which must be labeled with the manufacturer's name (USP Structural Connectors, *MiTek*® USA, Inc., or USP Structural Connectors, a *MiTek*® Company, or USP Structural Connectors), the stock number, and the evaluation report number (ESR-2266).

TABLE 1—ALLOWABLE STRESS DESIGN (ASD) LOADS FOR STB and STBL SERIES CAST-IN-PLACE ANCHOR BOLTS^{1,8}

STB ANCHOR BOLT			INSTALLATION ^{2,3,4}			ALLOWABLE TENSION LOADS ^{5,6,7} (lbs.) BASED ON ANCHOR LOCATION:								
Model No.	Major Thread Dia. (in.)	Total Length (in.)	Min. Stem-Wall Width (in.)	H ²	Min. Anchor Embed., l _e (in.)	Continuous Concrete Foundation Stem Wall ⁶ (See Figure 3)			Corner of Concrete Foundation Stem Wall ⁶ (See Figure 4)			End of Concrete Foundation Stem Wall ⁶ (See Figure 5)		
						Seismic Design Categories		Wind	Seismic Design Categories		Wind	Seismic Design Categories		Wind
						A, B	C, D, E, F		A, B	C, D, E, F		A, B	C, D, E, F	
STB16	5/8	17 ¹³ / ₁₆	6	5	12 ¹³ / ₁₆	4,230	3,525	4,230	4,230	3,525	4,230	4,230	3525	4,230
STBL16		19 ¹³ / ₁₆		6 ³ / ₄	12 ¹³ / ₁₆	4,230	3,525	4,230	4,230	3,525	4,230	4,230	3525	4,230
STB20		21 ¹³ / ₁₆		5	16 ¹³ / ₁₆	5,120	4,265	5,115	4,740	3,555	4,230	4,740	3,555	4,230
STBL20		23 ⁹ / ₁₆		6 ³ / ₄	16 ¹³ / ₁₆	5,120	4,265	5,115	4,740	3,555	4,230	4,740	3,555	4,230
STB24		25 ¹³ / ₁₆		5	20 ¹³ / ₁₆	5,990	4,990	5,990	5,915	4,675	5,570	5,915	4,675	5,570
STBL24		27 ⁹ / ₁₆		6 ³ / ₄	20 ¹³ / ₁₆	5,990	4,990	5,990	5,915	4,675	5,570	5,915	4,675	5,570
STB28	7/8	31	8	5	26	10,100	7,650	9,110	9,490	7,650	9,110	9,490	7,650	9,110
STBL28		32 ³ / ₄		6 ³ / ₄	26	10,100	7,650	9,110	9,490	7,650	9,110	9,490	7,650	9,110
STB34		36		6	30	11,415	9,515	11,390	10,525	8,770	10,525	10,250	7,900	9,405
STB36		38		8	30	11,415	9,515	11,390	10,525	8,770	10,525	10,250	7,900	9,405

For SI: 1 in. = 25.4 mm, 1 lb. = 4.45 N, 1 psi = 6.895 kPa.

¹STB Series anchor bolts have 3³/₄-inch thread lengths. STBL Series anchor bolts have 5¹/₂-inch thread lengths for use with 3x sill plates. One No. 4 rebar must be installed approximately 3 to 6 inches from the top of the foundation stem wall.

²H is the length of anchor bolt exposed above embedment line, used for inspection.

³Allowable loads are based on a minimum edge distance of 1³/₄ inches and a minimum end distance of 5 inches. Per Sections D.8.2 and 7.7.1 of ACI 318, use Hot Dip Galvanized (HDG) anchor when unprotected concrete will be exposed to earth or weather.

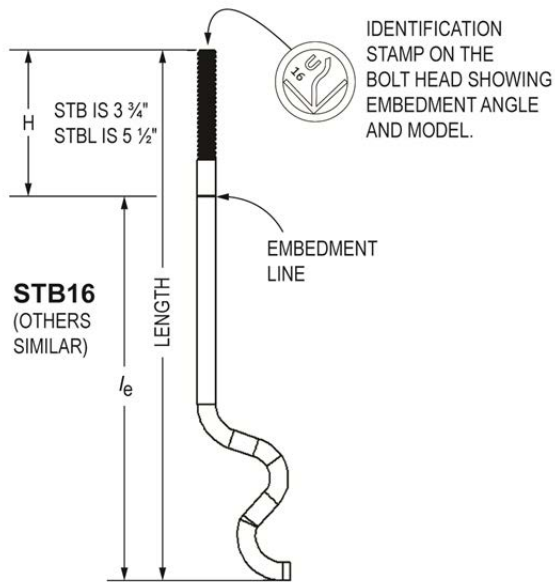
⁴Allowable loads are based on a minimum center-to-center spacing of 3 times minimum anchor embedment for bolts loaded simultaneously.

⁵For compliance with 2012 IBC Section 1909 or 2009 and 2006 IBC Section 1912, the allowable (ASD) seismic or wind loads must be converted to strength design (LRFD) load values by multiplying the tabulated Allowable Stress Design (ASD) load values by 1.4 or 1.6, respectively. The tabulated ASD loads are adjusted nominal strength values and include a strength reduction factor, $\Phi = 0.75$, for tension (uplift) loads. Consequently, when using the load combinations of 2012 IBC Section 1605.2 or 2009 and 2006 IBC Section 1605.2.1, it is not necessary to apply a strength reduction factor, Φ , because it is already incorporated into the derived strength design (LRFD) load values.

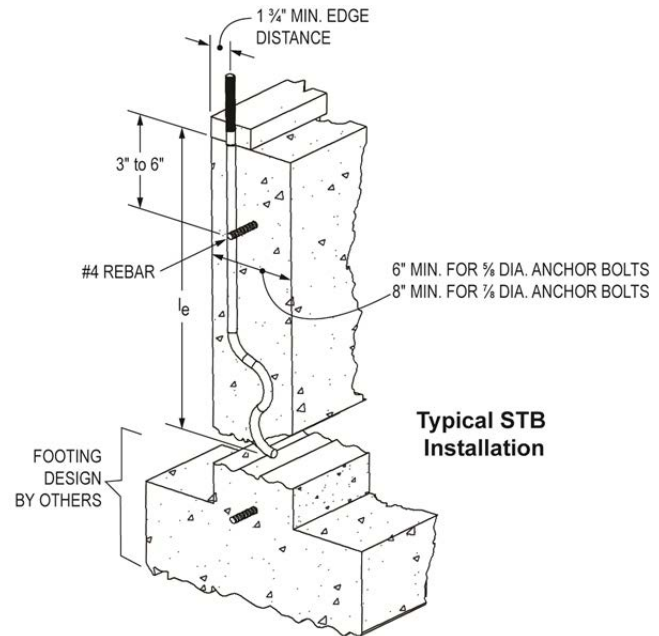
⁶Minimum specified concrete compressive strength, f'_c , must be 2,500 psi, unless required otherwise by the applicable Code.

⁷Allowable Stress Design (ASD) of concrete anchors is not permitted for load combinations involving earthquake loads, per Section 1908 (Anchorage to Concrete—Allowable Stress Design) of the IBC. Use the LRFD Tension Loads for compliance.

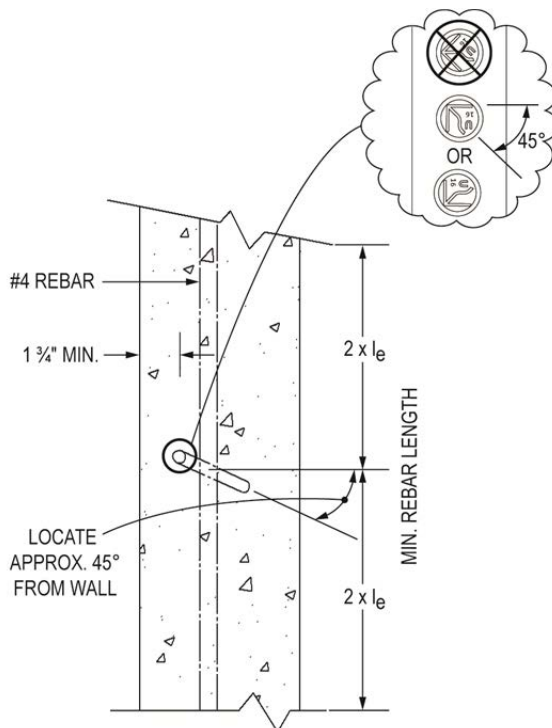
⁸Detached one- and two-family dwellings, assigned to Seismic Design Category (SDC) A, B, or C are exempt from the requirements of seismic design per the first exception in Section 1613.1 (Scope) of the IBC.



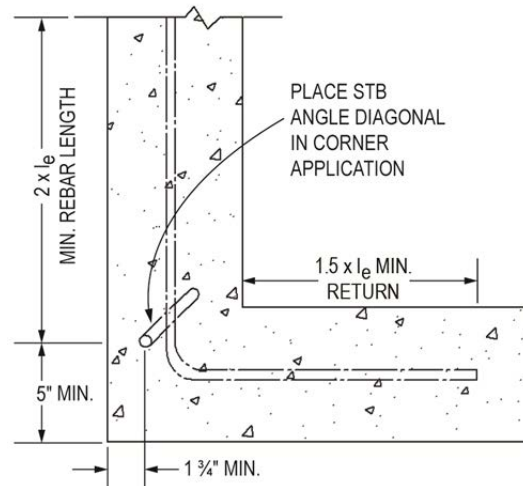
**FIGURE 1 – TYPICAL
STB ANCHOR BOLT**
(Identification on bolt head,
minimum anchor embedment, l_e)



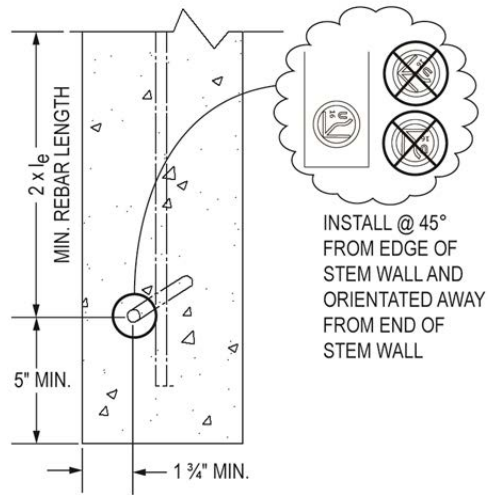
**FIGURE 2 – TYPICAL STB
ANCHOR BOLT INSTALLATION**
(No. 4 Rebar in Breakout Zone,
Min. $1 \frac{3}{4}$ " Edge Distance)



**FIGURE 3 – STB ANCHOR
BOLT INSTALLATION – ALONG
CONTINUOUS STEM WALL**
(No. 4 Rebar Min. Length = $4x l_e$,
Min. $1 \frac{3}{4}$ " Edge Distance)



**FIGURE 4 – STB ANCHOR
BOLT INSTALLATION –
CORNER OF STEM WALL**
(Min. $1.5 x l_e$ Return Rebar Length,
Min. 5" End Distance)



**FIGURE 5 – STB ANCHOR
BOLT INSTALLATION –
END OF STEM WALL**
(Min. 5" End Distance, and
No. 4 Rebar Min. Length)