



**CERTIFICATION**



**Approved. Sealed. Code Compliant.**

## **Technical Evaluation Report**

### **TER 2102-04**

**CAMO® 5/16" Structural Series Screw  
for Use in Multi-Ply Truss, Sawn Lumber  
and Structural Composite Lumber (SCL)  
Assemblies**

**National Nail Corporation DBA  
CAMO®**

### **Products:**

**CAMO® 5/16" Structural Series  
Screws**

Issue Date:

July 20, 2022

Revision Date:

September 20, 2022

Subject to Renewal:

October 1, 2023



COMPANY  
INFORMATION:

---

National Nail Corporation DBA CAMO®  
2964 Clydon Ave SW  
Grand Rapids, MI 49519  
P: (800) 968-6245 F: (616) 531-5970

[camofasteners.com](http://camofasteners.com)  
[nationalnail.com](http://nationalnail.com)

---

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

SECTION: 06 05 23 - Wood, Plastic, and Composite Fastenings

---

## 1 Product Evaluated<sup>1</sup>

1.1 CAMO® 5/16" Structural Series Screws

## 2 Applicable Codes and Standards<sup>2,3</sup>

### 2.1 Codes

- 2.1.1 *IBC—15, 18, 21: International Building Code®*
- 2.1.2 *IRC—15, 18, 21: International Residential Code®*
- 2.1.3 *FBC-B—17, 20: Florida Building Code – Building<sup>4</sup>*
- 2.1.4 *FBC-R—17, 20: Florida Building Code – Residential<sup>4</sup>*
- 2.1.5 *LABC—17, 20: Los Angeles Building Code<sup>5</sup>*
- 2.1.6 *LARC—17, 20: Los Angeles Residential Code<sup>5</sup>*

### 2.2 Standards and Referenced Documents

- 2.2.1 *AISI S904: Standard Test Methods for Determining the Tensile and Shear of Screws*
- 2.2.2 *ANSI/AWC NDS: National Design Specification (NDS) for Wood Construction*
- 2.2.3 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*
- 2.2.4 *ASTM A510: Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*
- 2.2.5 *ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus*
- 2.2.6 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*
- 2.2.7 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*

---

<sup>1</sup> For more information, visit [drjcertification.org](http://drjcertification.org) or call us at 608-310-6748.

<sup>2</sup> Unless otherwise noted, all references in this TER are from the 2021 version of the codes and the standards referenced therein. This material, design, or method of construction also complies with the 2000-2018 versions of the referenced codes and the standards referenced therein.

<sup>3</sup> All terms defined in the applicable building codes are italicized.

<sup>4</sup> All references to the *FBC-B* and *FBC-R* are the same as the 2018 *IBC* and 2018 *IRC*, respectively, unless otherwise noted in the supplement at the end of this TER.

<sup>5</sup> All references to the *LABC* and *LARC* are the same as the 2018 *IBC* and 2018 *IRC*, respectively, unless otherwise noted in the supplement at the end of this TER.

2.2.8 *ASTM G85: Standard Practice for Modified Salt Spray (Fog) Testing*

2.2.9 *ASTM G198: Standard Test Method for Determining the Relative Corrosion Performance of Driven Fasteners in Contact with Treated Wood*

### 3 Performance Evaluation

- 3.1 CAMO® 5/16" Structural Series Screws were evaluated for their ability to provide multi-ply attachment in trusses, sawn lumber and structural composite lumber (SCL) applications.
- 3.2 Corrosion resistance was evaluated in accordance with *ASTM B117*, *ASTM G85*, and *ASTM G198*.
- 3.3 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this TER
- 3.4 Any code compliance issues not specifically addressed in this section are outside the scope of this TER.
- 3.5 Any engineering evaluation conducted for this TER was performed within DrJ's ANAB accredited ICS code scope and/or the defined professional engineering scope of work on the dates provided herein.

### 4 Product Description and Materials

- 4.1 CAMO® structural series wood screws are threaded fasteners manufactured using standard cold-forming processes and are subsequently heat-treated and coated.
- 4.2 CAMO® structural series wood screws are available with a proprietary coating system designated at PROTECH™ Ultra 4.
- 4.3 CAMO® 5/16" Structural Series Screws have a round flat head with a T40 star drive and are partially threaded. The CAMO® 5/16" Structural Series Screws evaluated in this TER are shown in Figure 1.



Figure 1. 5/16" Flat Head Screw

#### 4.4 Fastener Material

- 4.4.1 CAMO® 5/16" Structural Series Screws are made of hardened carbon steel grade 10B18, 1022, or 10B21 wire conforming to *ASTM A510* and/or Grade 17MnB3 or 19MnB4 wire conforming to *DIN 1654*.
- 4.4.2 The CAMO® 5/16" Structural Series Screws evaluated in this TER are set forth in Table 1.

Table 1. CAMO® 5/16" Structural Series Screws Properties<sup>1</sup>

Fastener Designation	Head				Length (in)		Diameter (in)			Bending Yield Strength <sup>4</sup> , f <sub>yb</sub> (psi)	Allowable Steel Strength (lbs)	
	Style	Drive System	Diameter (in)	Height (in)	Fastener <sup>2</sup>	Thread <sup>3</sup>	Shank	Minor	Major		Tensile	Shear <sup>5</sup>
5/16" x 27/8"	Flat Head	T40 Star Drive	0.738	0.079	2.875	1.437	0.220	0.197	0.307	175,000	1,580	1,150
5/16" x 3 1/2"					3.500	2.000						
5/16" x 4"					4.000	2.370						
5/16" x 4 1/2"					4.500	2.370						
5/16" x 5"					5.000	2.752						
5/16" x 6"					6.000	2.752						
5/16" x 6 3/4"					6.750	2.752						

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1 psi = 0.00689 MPa

1. Tabulated fastener dimensions are measured on uncoated fasteners. Finished dimensions are different due to the proprietary coating added.
2. Nominal fastener length is measured from the underside of the head to the tip.
3. Thread length includes tapered tip.
4. Bending yield strength, F<sub>yb</sub>, is determined in accordance with ASTM F1575 using minor thread diameter when fastener is tested in threaded section.
5. Shear strength is determined in accordance with AISI S904 using minor thread diameter when fastener is tested in threaded section.

#### 4.5 Corrosion Resistance

- 4.5.1 CAMO® structural series wood screws may be used where screws are required to exhibit corrosion resistance when exposed to adverse environmental conditions and/or in chemically treated wood, which are subject to the limitations of this report, and are alternatives to hot-dipped galvanized screws with a coating weight in compliance with ASTM A153, Class D.
- 4.5.2 The CAMO® structural series wood screws having the proprietary PROTECH™ Ultra 4 coatings are equivalent to the protection provided by code-approved hot-dipped galvanized coatings meeting ASTM A153, Class D (*IBC Section 2304.10.6*<sup>6</sup> and *IRC Section R317.3*) when recognized for use by the American Wood Protection Association (AWPA) in untreated wood and Ground Contact – General Use pressure treated wood for exterior, freshwater, general construction applications (e.g., Ground Contact – General Use AWPA UC1-UC4A).
- 4.5.3 *Fire Retardant Treated (FRT) Wood Applications:*
  - 4.5.3.1 CAMO® structural series wood screws having the proprietary PROTECH™ Ultra 4 coatings are recognized for use in FRT lumber, provided the conditions set forth by the FRT lumber manufacturer are met, including appropriate strength reductions.

#### 4.6 Wood Material

- 4.6.1 Wood main and side members must be solid-sawn lumber or boards having an assigned specific gravity as given in the respective tables of this TER.

### 5 Applications

- 5.1 CAMO® 5/16" Structural Series Screws are used for attaching multi-ply wood members including trusses, sawn lumber, and SCL products.
- 5.2 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

<sup>6</sup> 2018 IBC Section 2304.10.5

5.3 Design

- 5.3.1 Design of CAMO® 5/16" Structural Series Screws is governed by the applicable code and the provisions for dowel type fasteners in *NDS*.
- 5.3.2 Unless otherwise noted, adjustment of the design stresses for duration of load shall be in accordance with the applicable code.

5.4 Multi-ply Connection Design Values

5.4.1 CAMO® 5/16" Structural Series Screws for Multi-ply Truss and Sawn Lumber Assemblies

- 5.4.1.1 Sawn lumber design values are provided for assemblies with two, three, or four plies in Table 2. Assembly conditions are detailed in Figure 2.

Table 2. Allowable Lateral Design Values (plf) for Multi-ply Truss and Sawn Lumber Assemblies<sup>2,3,4,5,6</sup>

Fastener	Assembly	Members	Fastener Length <sup>1</sup> (in)	SPF/HF (0.42)						DF/SP (0.50)					
				12" o.c.		16" o.c.		24" o.c.		12" o.c.		16" o.c.		24" o.c.	
				Number of Fasteners per Row											
				2	3	2	3	2	3	2	3	2	3	2	3
5/16" x 2 7/8"	A	2-ply 1 1/2"	2 7/8"	1320	1980	990	1485	660	990	1680	2520	1265	1900	840	1260
5/16" x 4"	B	3-ply 1 1/2"	4"	990	1485	745	1120	495	745	1260	1890	945	1420	630	945
5/16" x 4 1/2"	B	3-ply 1 1/2"	4 1/2"	990	1485	745	1120	495	745	1260	1890	945	1420	630	945
5/16" x 6"	C	4-ply 1 1/2"	6"	1575	2365	1185	1780	790	1185	2040	3060	1535	2305	1020	1530

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

1. Fastener length is measured from the topside of the head to the tip.
2. Wood framing shall be any species with specific gravity, SG, of 0.42 or greater. For wood species with an assigned specific gravity between 0.42 and 0.50, use the tabulated values for specific gravity of 0.42. For wood species with an assigned specific gravity greater than 0.50, use the tabulated values for specific gravity of 0.50.
3. Allowable design values are based on a load duration factor  $C_D = 1.0$  and shall be multiplied by all applicable adjustment factors per the *NDS*.
4. The tabulated allowable design loads may be applied to either side of the beam (head or point side of the fastener). Where loads are applied to both sides of the beam simultaneously, the total load applied to the beam shall not exceed the tabulated load.
5. For top-loaded members with even loading across the width of the entire assembly, fasteners shall be installed in two (2) rows with a maximum distance of 32" o.c. (on-center) between fasteners in the same row.
6. Tabulated loads are for the connection strength. Beams and framing members shall be independently checked by a registered design professional.

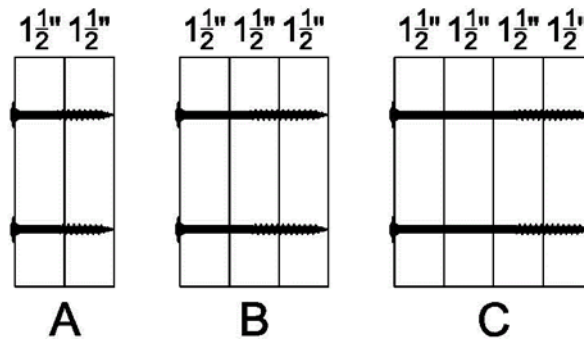


Figure 2. Truss and Sawn Lumber Assembly Configuration

5.4.2 CAMO® 5/16" Structural Series Screws for Multi-ply Structural Composite Lumber (SCL) Assemblies.

- 5.4.2.1 SCL is a family of engineered wood products which includes, but is not limited to, laminated veneer lumber (LVL), laminated strand lumber (LSL), parallel strand lumber (PSL), and oriented strand lumber (OSL).
- 5.4.2.2 CAMO® 5/16" Structural Series Screws SCL design values are provided for assemblies with two, three, or four plies in Table 3. Assembly conditions are detailed in Figure 3.

Table 3. Allowable Lateral Design Values (plf) for Multi-ply Truss and SCL Assemblies<sup>2,3,4,5,6</sup>

Fastener	Assembly	Members	Fastener Length <sup>1</sup> (in)	12" o.c.		16" o.c.		24" o.c.	
				Number of Fasteners per Row					
				2	3	2	3	2	3
5/16" x 3 1/2"	A	2-ply 1 3/4"	3 1/2	1680	2520	1265	1900	840	1260
5/16" x 5"	B	3-ply 1 3/4"	5	2295	3445	1725	2590	1150	1725
5/16" x 6 3/4"	C	4-ply 1 3/4"	6 3/4	2040	3060	1535	2305	1020	1530
5/16" x 5"	D	2-ply 1 3/4" & 3 1/2"	5	2295	3445	1725	2590	1150	1725
5/16" x 6 3/4"	E	3-ply 1 3/4" & 3 1/2"	6 3/4	2040	3060	1535	2305	1020	1530
5/16" x 6 3/4"	F	2-ply 3 1/2"	6 3/4	3060	4590	2300	3450	1530	2295

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

1. Fastener length is measured from the underside of the head to the tip.
2. SCL shall have a specific gravity, SG, of 0.50 or greater. Thicknesses listed in Figure 3 are a minimum.
3. Allowable design values are based on a load duration factor of  $C_D = 1.0$  and shall be multiplied by all applicable adjustment factors per the *NDS*.
4. The tabulated allowable design loads may be applied to either side of the beam (head or point side of the fastener). Where loads are applied to both sides of the beam simultaneously, the total load applied to the beam shall not exceed the tabulated load.
5. For top-loaded members with even loading across the width of the entire assembly, and a depth of 18" or less, fasteners shall be installed in two (2) rows with a maximum distance of 24" o.c. between fasteners in the same row. Use three (3) rows for members deeper than 18".
6. Tabulated loads are for the connection strength. Beams and framing members shall be independently checked by a registered design professional.

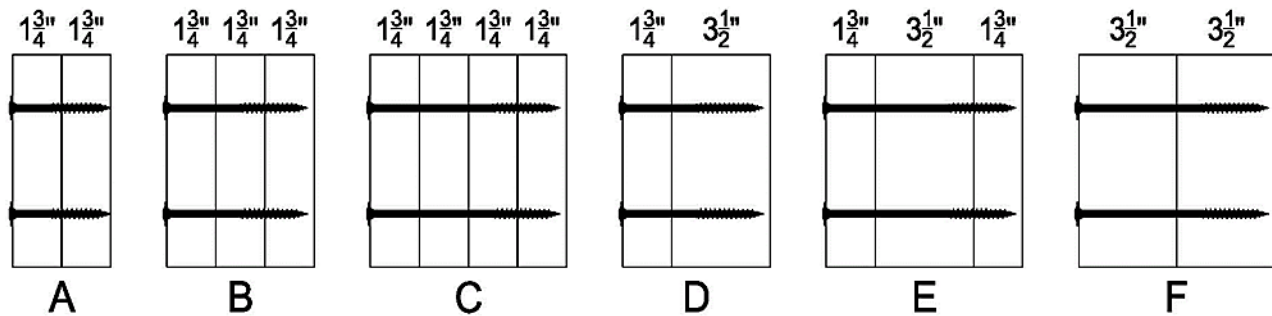


Figure 3. SCL Assembly Configurations

5.5 Spacing, Edge Distance, and End Distance

5.5.1 CAMO® 5/16" Structural Series Screws spacing, edge distance, and end distances shall be as specified in Table 4.

Table 4. Screw Spacing, Edge Distance, and End Distance Requirements<sup>1,2</sup>

Connection Geometry	Minimum Spacing (in)
Edge Distance – Load in any direction	5/8
End Distance – Load parallel to grain, towards end	3 3/8
End Distance – Load perpendicular to grain, away from end	2 1/4
End Distance – Load perpendicular to grain	2 1/4
Spacing between Fasteners in a Row – Parallel to grain	3 3/8
Spacing between Fasteners in a Row – Perpendicular to grain	2 1/4
Spacing between Rows of Fasteners – In-line	1 1/8
Spacing between Rows of Fasteners – Staggered <sup>2</sup>	5/8

SI: 1 in = 25.4 mm

- Edge distances, end distances, and spacing of fasteners shall be sufficient to prevent splitting of the wood or as shown in this table, whichever is the more restrictive.
- Values for "Spacing between Rows or Fasteners-Staggered" apply where the screws in adjacent rows are offset by one-half of the "Spacing between Fasteners in a Row".

6 Installation

- Installation shall comply with the manufacturer's installation instructions and this TER. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.
- Fasteners shall be installed with a 1/2" (12.7 mm), low rpm/high torque electric drill (450 rpm).
- Fasteners shall be installed with manufacturer's supplied bits.
- Fasteners shall be installed with the underside of the head flush to the surface of the wood member. Fasteners shall not be overdriven.
- Fasteners shall not be struck with a hammer during installation.
- Lead holes are not required but may be used where lumber is prone to splitting.
- Installer shall use appropriate/required personal protection equipment during installation and must not place fastener in mouth.

7 Substantiating Data

- Connection design value calculations by DrJ Engineering, LLC in accordance with *NDS* and accepted engineering practice.
- Properties for CAMO® 5/16" Structural Series Screws from [TER 2102-01](#).
- Information contained herein is the result of testing and/or data analysis by sources which conform to [IBC Section 1703](#) and/or [professional engineering regulations](#). DrJ relies upon accurate data to perform its ISO/IEC 17065 evaluations.

- 7.4 Where appropriate, DrJ's analysis is based on provisions that have been codified into law through state or local adoption of codes and standards. The providers of the codes and standards are legally responsible for their content. DrJ analysis may use code-adopted provisions as a control sample. A control sample versus a test sample establishes products as being equivalent to that prescribed in this code in quality, strength, effectiveness, fire resistance, durability, and safety. Where the accuracy of the provisions provided herein is reliant upon the published properties of materials, DrJ relies upon the grade mark, grade stamp, mill certificate, and/or test data provided by material suppliers to be minimum properties. DrJ analysis relies upon these properties to be accurate.

## 8 Findings

- 8.1 When used and installed in accordance with this TER and the manufacturer's installation instructions, the product(s) listed in Section 1.1 are approved for the following:
- 8.1.1 To provide multi-ply attachment in trusses, sawn lumber, and SCL assemblies.
- 8.2 Building codes require data from valid research reports be obtained from approved sources (i.e., licensed registered design professionals [RDPs]).
- 8.2.1 Building official approval of a licensed RDP is performed by verifying the RDP and/or their business entity is listed by the licensing board of the relevant jurisdiction.
- 8.3 Agencies who are accredited through ISO/IEC 17065 have met the code requirements for approval by the building official. DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131 and employs RDPs.
- 8.4 Through ANAB accreditation and the IAF MLA, DrJ certification can be used to obtain products approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – “certified once, accepted everywhere.”
- 8.5 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10<sup>7</sup> are similar) states:

**104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code...Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.

## 9 Conditions of Use

- 9.1 Moisture content shall be less than or equal to 19% for sawn lumber and less than 16% for SCL products.
- 9.2 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this evaluation report.
- 9.3 Where required by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed, this TER and the installation instructions shall be submitted at the time of permit application.
- 9.4 Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the AHJ for review and approval.
- 9.5 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (e.g., owner or RDP).
- 9.6 At a minimum, this products shall be installed per Section 6 of this TER.
- 9.7 This products has an internal quality control program and a third-party quality assurance program in accordance with IBC Section 104.4 and Section 110.4 and IRC Section R104.4 and Section R109.2.

---

<sup>7</sup> 2018 IFC Section 104.9





- 9.8 The actual design, suitability, and use of this TER, for any particular building, is the responsibility of the owner or the owner's authorized agent.
- 9.9 This TER shall be reviewed for code compliance by the AHJ in concert with IBC Section 104.
- 9.10 The implementation of this TER for this products is dependent on the design, quality control, third-party quality assurance, proper implementation of installation instructions, inspections required by IBC Section 110.3, and any other code or regulatory requirements that may apply.

## 10 Identification

- 10.1 The products listed in Section 1.1 is identified by a label on the board or packaging material bearing the manufacturer's name, product name, TER number, and other information to confirm code compliance.
- 10.2 Additional technical information can be found at camofasteners.com and nationalnail.com.

## 11 Review Schedule

- 11.1 This TER is subject to periodic review and revision. For the most recent version, visit drjcertification.org.
- 11.2 For information on the current status of this TER, contact DrJ Certification.



Issue Date: July 20, 2022  
Subject to Renewal: October 1, 2023

## FBC Supplement to TER 2102-04

REPORT HOLDER: National Nail Corporation DBA CAMO®

### 1 Evaluation Subject

- 1.1 CAMO® 5/16" Structural Series Screws

### 2 Purpose and Scope

#### 2.1 Purpose

- 2.1.1 The purpose of this Technical Evaluation Report (TER) supplement is to show CAMO® 5/16" Structural Series Screws, recognized in TER 2102-04, has also been evaluated for compliance with the codes listed below as adopted by the Florida Building Commission.

#### 2.2 Applicable Code Editions

- 2.2.1 *FBC-B—17, 20: Florida Building Code – Building*
- 2.2.2 *FBC-R—17, 20: Florida Building Code – Residential*

### 3 Conclusions

- 3.1 CAMO® 5/16" Structural Series Screws, described in TER 2102-04, complies with the *FBC-B* and *FBC-R* and is subject to the conditions of use described in this supplement.
- 3.2 Where there are variations between the *IBC* and *IRC* and the *FBC-B* and *FBC-R* applicable to this TER, they are listed here.
  - 3.2.1 *FBC-B* Section 104.4 and Section 110.4 are reserved.
  - 3.2.2 *FBC-R* Section R104 and Section R109 are reserved.

### 4 Conditions of Use

- 4.1 CAMO® 5/16" Structural Series Screws, described in TER 2102-04, must comply with all of the following conditions:
  - 4.1.1 All applicable sections in TER 2102-04.
  - 4.1.2 The design, installation, and inspections are in accordance with additional requirements of *FBC-B* Chapter 16 and Chapter 17, as applicable.

## LABC and LARC Supplement to TER 2102-04

REPORT HOLDER: National Nail Corporation DBA CAMO®

### 1 Evaluation Subject

- 1.1 CAMO® 5/16" Structural Series Screws

### 2 Purpose and Scope

#### 2.1 Purpose

- 2.1.1 The purpose of this Technical Evaluation Report (TER) supplement is to show CAMO® 5/16" Structural Series Screws, recognized in TER 2102-04, has also been evaluated for compliance with the codes listed below as adopted by the Los Angeles Department of Building and Safety (LADBS).

#### 2.2 Applicable Code Editions

- 2.2.1 LABC—17, 20: Los Angeles Building Code
- 2.2.2 LARC—17, 20: Los Angeles Residential Code

### 3 Conclusions

- 3.1 CAMO® 5/16" Structural Series Screws, described in TER 2102-04, complies with the LABC and LARC and is subject to the conditions of use described in this supplement.
- 3.2 Where there are variations between the IBC and IRC and the LABC and LARC are applicable to this TER, they are listed here.
  - 3.2.1 LABC Section 91.104.2.6 and LARC Section 91.104.2.6 replace IBC Section 104.11 and IRC Section R104.11, respectively.
  - 3.2.2 LABC Section 91.104.2.2 and LARC Section 91.104.2.2 replace IBC Section 104.4 and IRC Section R104.4, respectively.
  - 3.2.3 LABC Section 91.108 and LARC Section 91.108 replace IBC Section 110.4 and IRC Section R109.2, respectively.
  - 3.2.4 LABC Section 91.104 replaces IBC Section 104
  - 3.2.5 LABC Section 91.108.5 replaces IBC Section 110.3.

### 4 Conditions of Use

- 4.1 CAMO® 5/16" Structural Series Screws, described in TER 2102-04, must comply with all of the following conditions:
  - 4.1.1 All applicable sections in TER 2102-04.
  - 4.1.2 The design, installation, conditions of use, and identification of CAMO® 5/16" Structural Series Screws are in accordance with the 2018 *International Building Code (IBC)* provisions noted in TER 2102-04.
  - 4.1.3 The design, installation, and inspections are in accordance with additional requirements of LABC Chapter 16 and 17, as applicable.