The IBC defines:

- **APPROVED SOURCE** – “An independent person, firm or corporation, approved by the building official, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.”

DrJ’s building construction professionals meet the competency requirements as defined in the IBC and can seal their work. DrJ is regularly engaged in conducting and providing engineering evaluations of single-element and full-scale building systems tests. This TER is developed from test reports complying with IBC Section 104.11.1 Research reports, which states, “Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.”
3. Performance Evaluation:

3.1. TimberLOK® fasteners were evaluated, using their tested allowable design values, as an alternate means of attaching wood trusses, drag struts and rafters to the top of the wall below to provide uplift and lateral load resistance. The following conditions were evaluated:

3.1.1. Withdrawal strength of TimberLOK® fasteners for use as an alternative to toe-nail connections, metal hurricane and seismic clips/straps or nails in tension (uplift) loaded applications.

3.1.2. Shear strength of TimberLOK® fasteners for use as an alternative to toe-nail connections, hurricane and seismic clips/straps or nails in shear (lateral) loaded applications either parallel or perpendicular to wood grain.

3.1.3. Head pull through strength of TimberLOK® fasteners for use as an alternative to toe-nail connections, hurricane and seismic clips/straps or nails in tension (uplift) loaded applications.

3.2. Connections other than those addressed in Section 3 are outside the scope of this TER.

4. Product Description and Materials:

4.1. TimberLOK® fasteners are manufactured of carbon steel 1022 or 10B21 wire conforming to ASTM A510.

4.2. TimberLOK® fasteners are manufactured using a standard cold-formed process followed by a heat-treating process.

4.3. Fasteners are approved for use in interior and exterior conditions and in chemically treated or untreated lumber.

4.3.1. The proprietary coating has been tested and found to exceed the protection provided by code-approved hot-dipped galvanized coatings meeting ASTM A153 (IBC 2304.9.5 and IRC 317.3), which allows for its use in pressure-treated (ACQ) wood.

4.4. Fasteners are approved for use in fire-retardant-treated lumber, provided the conditions set forth by the fire-retardant-treated lumber manufacturer are met, including appropriate strength reductions.

4.5. In-plant quality control procedures, under which the TimberLOK® fasteners are manufactured, are audited through an inspection process performed by an approved agency.

4.6. The fasteners evaluated in this report are set forth in Table 1.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Fastener Designation</th>
<th>Head Marking</th>
<th>Overall Length</th>
<th>Thread Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>TimberLOK® 4”</td>
<td>TLOK04</td>
<td>F4.0</td>
<td>4”</td>
<td>2”</td>
</tr>
<tr>
<td>TimberLOK® 6”</td>
<td>TLOK06</td>
<td>F6.0</td>
<td>6”</td>
<td>2”</td>
</tr>
</tbody>
</table>

Table 1: Fastener Description

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Footnotes:

2 2009 IBC Section 2304.9.5 Fasteners in preservative-treated and fire-retardant-treated wood. Fasteners for preservative treated and fire-retardant-treated wood shall be of hot dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153.

3 2009 IRC Section R317.3 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood. Fasteners and connectors in contact with preservative-treated wood and fire-retardant-treated wood shall be in accordance with this section. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153.

4 IBC Section 1702 Approved Agency. An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.

5 Fastener designations are found on the product packaging. Individual fasteners may be marked according to Table 1.
5. Applications:

5.1. Wood-Framed Construction

5.1.1. TimberLOK® fasteners are used to attach minimum 1 1/2"-wide drag strut wood truss bottom chords to wood walls that meet the requirements of IRC Section R602 or IBC 2308 or wood structural framing members. The fasteners provide resistance to uplift and lateral loads applied parallel and/or perpendicular to the wall or structural framing member. The fasteners also provide a load path for transferring the drag loads into the shear walls below.

5.1.2. Walls shall consist of either a single or double top plate designed in accordance with IRC Section R602.3.2 or IBC Section 2308.9.2.1

5.1.3. See Table 2 for the design procedure and TimberLOK® allowable design values.

5.1.4. See Section 6 for installation requirements.

5.1.5. TimberLOK® fasteners are used in buildings requiring wind analysis in accordance with IRC Section R301.2.1, or design in accordance with IBC Section 1609.

5.1.6. Use of TimberLOK® fasteners in buildings requiring seismic analysis in accordance with IRC Section R301.2.2 is outside the scope of this TER.

5.2. Design Concepts and Allowable Design Loads

5.2.1. Allowable design loads for uplift and lateral resistance [parallel (F1) and perpendicular (F2) to the plane of the wall or structural member, Figure 3] are provided in Table 2 for TimberLOK® fasteners. Allowable design loads are listed for selected load durations and specific gravities and are applicable to fasteners installed in accordance with the procedures described in Section 6.
5.2.2. Allowable loads (plf) along the wall are listed in Table 3 for the given fastener spacing.

<table>
<thead>
<tr>
<th>Fastener Designation</th>
<th>Minimum Penetration into Truss/Rafter/Wood Structural Support (in)</th>
<th>Species Group (Specific Gravity)</th>
<th>Uplift (lbf)</th>
<th>Lateral (lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>So. Pine (0.55)</td>
<td>390</td>
<td>520</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Douglas Fir-Larch (0.50)</td>
<td>340</td>
<td>450</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spruce-Pine-Fir/ Hem-Fir (0.42)</td>
<td>260</td>
<td>350</td>
</tr>
</tbody>
</table>

1. Wood truss and rafter members shall be a minimum of 2” nominal thickness.
2. Equivalent specific gravity of SCL shall be equal to or greater than the specific gravities provided in this table. Refer to product information from SCL manufacturer.
3. Tabulated loads based on ICC-ES Report ESR-1078 with additional testing to ASTM D1761 used to confirm adequate minimum edge and end distances. Uplift and F2 lateral load values have been adjusted using Hankinson’s equation per NDS.
4. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.
5. Allowable uplift and lateral loads for applications in which the controlling load duration is two months (i.e., 115%) or seven days (i.e., 125%) may be obtained by multiplying the corresponding tabular value in the column marked “1.0” by 1.15 or 1.25, respectively.

Table 2: Allowable Loads for Uplift & Lateral Resistance for Selected Load Durations & Wood-Specific Gravities Using TimberLOK® Fasteners

<table>
<thead>
<tr>
<th>Wood Species</th>
<th>Specific Gravity</th>
<th>On-Center Spacing Between Fasteners (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4”</td>
</tr>
<tr>
<td>Southern Pine</td>
<td>0.55</td>
<td>1235</td>
</tr>
<tr>
<td>Douglas Fir-Larch</td>
<td>0.50</td>
<td>1150</td>
</tr>
<tr>
<td>Spruce Pine-Fir/</td>
<td>0.42</td>
<td>1015</td>
</tr>
<tr>
<td>Hem-Fir</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Wood truss and rafter members shall be a minimum of 2” nominal thickness.
2. A load duration factor of 1.6 has been applied to these tables for wind loading per NDS Table 2.3.2. Adjustments to lower this factor may be made at the engineer’s discretion. No further increases are allowed.
3. Table values are based on the weakest loading direction (i.e., parallel to wall).
4. Equivalent specific gravity of SCL shall be equal to or greater than the specific gravities provided in this table. Refer to product information from SCL manufacturer.
5. Tabulated loads based on ICC-ES Report ESR-1078 with additional testing to ASTM D1761 used to confirm adequate minimum edge and end distances.
6. For applications involving members with different specific gravities, use the allowable load corresponding to the lowest specific gravity.

Table 3: Allowable Loads per Lineal Foot by Fastening Pattern

5.2.3. Where it is anticipated that loads will be applied to a single fastener simultaneously in more than one direction, additional evaluation may be required to account for the combined effect of these loads using accepted engineering practice.

5.2.3.1. Consult a professional engineer as needed for complex design conditions.
5.2.4. Design example to transfer lateral loads to a shear wall below:

5.2.4.1. Drag force – 5000 lbs

5.2.4.2. Drag strut truss – 24’ long

5.2.4.3. Shear walls are partial – 5’ on one end, 7’ on other end

5.2.4.4. Load on top chord of drag strut truss is 208.33 plf (5000/24).

5.2.4.5. Resistance is supplied by the two shear walls (5’ + 7’ = 12’).

5.2.4.6. Resistance capacity required is 416.67 plf (5000/12).

5.2.4.7. Assuming the top plate of the wall is Spruce Pine-Fir, Table 3 indicates that the fasteners must be spaced at 0'-8" o.c. (475 plf allowable load).

6. Installation:

6.1. TimberLOK® fasteners

6.1.1. Select the appropriate length of fastener so that the 2" of thread is fully embedded into the main member(s). See Figure 4 for guidance.
6.1.2. Install the required number of fasteners to achieve the required lateral capacity and the uplift loads using the TimberLOK® design capacities for resistance to the uplift and lateral loads from Table 2 and Table 3.

6.1.3. When installed from the top down, center the screw on the truss chord and drive vertically until the head of the fastener is flush to the top of the chord. Do not overdrive.

6.1.4. When installed upward from the bottom of a single or double top plate, measure ¾” in from the outer edge of the plate(s) and drive the fastener vertically until the head of the fastener is flush to the underside of the top plate(s). Do not overdrive.

7. Test and Engineering Substantiating Data:

7.1. FastenMaster TimberLOK® data for determining:

7.1.1. Comparative equivalency for use as an alternative material in accordance with IRC Section R104.11 and IBC Section 104.11.

7.1.2. Uplift capacity of TimberLOK® fasteners as evaluated for head pull through and withdrawal of fasteners.

7.1.3. TimberLOK® heavy-duty wood screw performance when used as a truss hold-down.

7.1.4. TimberLOK® heavy-duty wood screw performance when loaded laterally.


7.3. Testing to ASTM D1761 for verifying edge and end distances.

7.4. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate as it undertakes its engineering analysis.

7.4.1. DrJ does not assume responsibility for the accuracy of data provided by testing facilities, but relies on each testing agency’s accuracy and accepted engineering procedures, experience, and good technical judgment.

7.5. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through the codes and standards (e.g., IRC, WFCM, IBC, SDPWS, etc.), to undertake the review of test data that is comparative or shows equivalency to an intended end-use application.

7.5.1. DrJ does not assume responsibility for the accuracy of any code-adopted design values but relies upon their accuracy for engineering evaluation.

7.5.2. DrJ also relies on the fact that manufacturers of code-adopted products stand behind the legally established design values that have been created by the associations that publish code-defined design values for a given commodity product.

7.5.3. DrJ evaluates all equivalency testing and related analysis using this code-defined engineering foundation.

8. Findings:

8.1. When used and installed in accordance with this TER and the manufacturer’s installation instructions, TimberLOK® fasteners can be used as an acceptable alternative to toe-nail connections, metal hurricane and seismic clips/straps or nails to resist the uplift and lateral loads as provided for in Table 2.

8.2. IBC Section 104.11 and IRC Section R104.11 specifically state that:

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, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code.
8.3. When used and installed in accordance with this TER and the manufacturer's installation instructions, TimberLOK® fasteners can be used as an acceptable alternative to provide resistance to uplift loads due to wind pressure applied from the drag strut truss above lifting up on the top plate of the wall, per Table 2.

8.4. When used and installed in accordance with this TER and the manufacturer's installation instructions, TimberLOK® fasteners can be used as an acceptable alternative to provide resistance to lateral loads due to wind pressure applied parallel or perpendicular to the wall, per Table 2.

8.5. For joist/rafter and truss to top plate connections, see TER No. 1105-02: Use of FastenMaster TimberLOK® Fasteners to Provide Uplift & Lateral Resistance to Trusses & Rafters Attached to the Tops of Walls.

9. Conditions of Use:

9.1. The TimberLOK® fasteners covered in this TER shall be installed in accordance with this report and the manufacturer's installation instructions.

9.1.1. For conditions not covered in this TER, connections shall be designed in accordance with generally accepted engineering practice.

9.1.2. Manufacturer's installation instructions shall be followed as provided in Section 6 and at fastenmaster.com/details/product/TimberLOK-heavy-duty-flathead-fastener.html.

9.2. Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.

9.3. Manufacturer’s installation instructions shall be shipped to the jobsite with the materials or otherwise be available on the jobsite for inspection.

9.4. Structural framing members (e.g., wood, masonry, concrete, steel, etc.) connected with TimberLOK® fasteners shall be designed in accordance with the requirements of their specific design standards/specifications as referenced in the building code adopted by the jurisdiction in which the project is to be constructed.

9.5. Loads applied shall not exceed those recommended by the manufacturer or as defined in this TER.

9.6. FastenMaster products are produced by OMG, Inc. at its facility located in Agawam, Massachusetts.

9.7. TimberLOK® fasteners are produced under a quality control program subject to periodic inspections in accordance with IBC Section 1703.5.2.

9.8. Design

9.8.1. Building Designer

9.8.1.1. The Construction Documents shall be prepared by a Registered Design Professional (RDP) for the Building and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show, in detail, conformance to the building code.

9.8.1.2. The Construction Documents shall provide information sufficiently accurate and reliable to be used for facilitating the supply of TimberLOK® fasteners and shall provide the following:

9.8.1.2.1. The location, direction and magnitude of all dead, live and lateral loads applicable to TimberLOK® fasteners and any other loads that are going to be applied to TimberLOK® fasteners.

9.8.1.2.2. All foundation anchorage designs required to resist uplift, gravity, and lateral loads.

9.8.2. Construction Documents

9.8.3. Construction Documents shall be submitted to the Building Official for approval prior to construction.

9.8.4. Construction Documents shall contain the plans, specifications and details needed for the Building Official to approve such documents.
10. Identification:
   10.1. The fasteners are identified by the designation, “TimberLOK®” on the packaging. The head of each fastener is marked with an “F6.0” corresponding to the length of the fastener (i.e., 6”) to be used for the applications described in this TER.
   10.2. The packaging shall include OMG’s name and address, the fastener size, third-party inspection agency, and TER number.
   10.3. Additional technical information can be found at fastenmaster.com.

11. Review Schedule:
   11.1. This TER is subject to periodic review and revision.
   11.2. For information on the current status of this report, contact DrJ.

Responsibility Statement

The information contained herein is a product, engineering or building code compliance research report performed in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering procedures, experience and good technical judgment. Product, design and code compliance quality control is the responsibility of the referenced company. Consult the referenced company for the proper detailing and application for the intended purpose. Consult your local jurisdiction or design professional to assure compliance with the local building code. DrJ (driengineering.org) research reports are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. There is no warranty by DrJ, express or implied, as to any finding or other matter in this report or as to any product covered by this report.
Appendix A:
TERs Are Comparable to, Compatible with, and Equivalent to the Purpose of an ICC-ES ESR

1. Technical Evaluation Reports (TERs), drafted and maintained by DrJ (professional engineering firm and ISO/IEC 17025 applicant through ANSI/ACLASS), assess how specific products comply with the provisions of the building code. DrJ is a code-defined "approved source," and DrJ employs professional engineers and follows state professional engineering rules and regulations.

2. TERs are comparable to, compatible with, and equivalent to the purpose of an ICC Evaluation Service (ICC-ES) Evaluation Service Reports (ESRs).  
   2.1. ICC Evaluation Service does not provide an engineer’s seal on any of its ESRs. 
   2.2. Furthermore, the ICC-ES Evaluation Report Purpose is defined as follows:

   ICC EVALUATION SERVICE, LLC,  
   RULES OF PROCEDURE FOR EVALUATION REPORTS

1.0 PURPOSE  
These rules set forth procedures governing ICC Evaluation Service, LLC (ICC-ES), issuance and maintenance of evaluation reports on building materials and products, methods of construction, prefabricated building components, and prefabricated buildings. ICC-ES evaluation reports assist those enforcing model codes in determining whether a given subject complies with those codes. An evaluation report is not to be construed as representing a judgment about aesthetics or any other attributes not specifically addressed in the report, nor as an endorsement or recommendation for use of the subject of the report. Approval for use is the prerogative and responsibility of the Code Official; ICC-ES does not intend to assume, nor can ICC-ES assume, that prerogative and responsibility.

2.3. ICC ESR Disclaimer:

ICC-ES Evaluation Reports are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. There is no warranty by ICC Evaluation Service, LLC, express or implied, as to any finding or other matter in this report, or as to any product covered by the report.

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6 ICC Evaluation Service, LLC and the ICC-ES Evaluation Reports logo are registered trademarks of ICC-ES.  
8 Page 1 footer of each ICC-ES report that can be found at www.icc-es.org/reports/index.cfm.
3. DrJ Sealed Engineering

3.1. DrJ engineers have undertaken the rigorous engineering and analysis work to determine the subject of this report’s compliance with the codes and standards referenced in Section 2.

3.2. DrJ work:

3.2.1. Complies with accepted engineering procedures, experience and good technical judgment.

3.2.2. Is the work of an independent person, firm or corporation who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

3.3. A Technical Evaluation Report generated by DrJ is in all “code-compliance-evaluation-processing” respects equivalent to an ICC-ES ESR, as ICC-ES defines its approach, with one material difference.

3.3.1. DrJ will seal all TERs, as needed, so that responsibility for the work is well-defined.

3.3.2. The DrJ responsibility statement is identical to that provided in ICC-ES ESRs.

DrJ (drjengineering.org) research reports are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. There is no warranty by DrJ express or implied as to any finding or other matter in this report or as to any product covered by this report.
Appendix B: Legal Aspects of Product Approval

1. Product Approval
   1.1. In general, the model and local codes provide for the use of alternative materials, designs and methods of construction by having a legal provision that states something similar to:

   The provisions of this code/law 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/law, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the compliance official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code/law, and that the material, design, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code/law.

   1.2. In concert with preserving “free and unfettered competition as the rule of trade”, should this alternative material, design or method of construction not be approved, the building official shall respond in writing, stating the specific reasons for non-code-compliance and/or for non-professional engineering regulation compliance.

   Congress passed the first antitrust law, the Sherman Act, in 1890 as a "comprehensive charter of economic liberty aimed at preserving free and unfettered competition as the rule of trade." In 1914, Congress passed two additional antitrust laws: the Federal Trade Commission Act, which created the FTC, and the Clayton Act. With some revisions, these are the three core federal antitrust laws still in effect today.

   ...Yet for over 100 years, the antitrust laws have had the same basic objective: to protect the process of competition for the benefit of consumers, making sure there are strong incentives for businesses to operate efficiently, keep prices down, and keep quality up....

   The Sherman Act outlaws "every contract, combination, or conspiracy in restraint of trade," and any "monopolization, attempted monopolization, or conspiracy or combination to monopolize." For instance, in some sense, an agreement between two individuals to form a partnership restrains trade, but may not do so unreasonably, and thus may be lawful under the antitrust laws. On the other hand, certain acts are considered so harmful to competition that they are almost always illegal.

   The penalties for violating the Sherman Act can be severe. Although most enforcement actions are civil, the Sherman Act is also a criminal law, and individuals and businesses that violate it may be prosecuted by the Department of Justice.9

2. Legal Validity of this TER
   2.1. This TER is a code-defined (e.g., 2009 IBC and IRC Section 104.11.1 and 2009 IBC Section 1703.4.2) “research report” that provides supporting data to assist in the approval of materials, designs or assemblies not specifically provided for in this code.

   Therefore, this TER is a valid research report from a professional engineering company that complies with the code definition of “approved source.” If required by the authority having jurisdiction, this TER can also be sealed to comply with professional engineering laws and regulations.

9 http://www.ftc.gov/bc/antitrust/antitrust_laws.shtm