

01 Dec 1995

Design guide for cold-formed steel trusses

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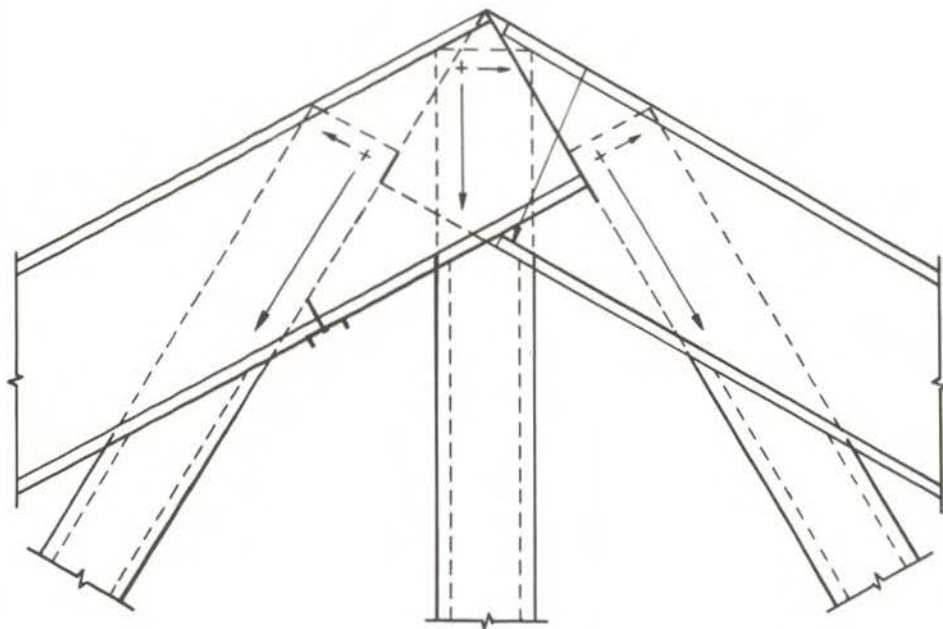
Truss

DESIGN GUIDE FOR COLD-FORMED STEEL TRUSSES RG-9518

technical data

DESIGN GUIDE FOR COLD-FORMED STEEL TRUSSES

PUBLICATION RG-9518
DECEMBER 1995



**Steel in Residential
Construction Advisory Group**

American Iron and Steel Institute
1101 17th Street, NW
Washington, DC 20036-4700

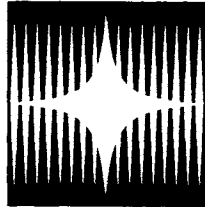
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1101 17th Street, NW
Washington, D.C. 20036-4700

For more information call 1 800 79 STEEL.

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Design Guide for Cold-Formed Steel Trusses
December 1995



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INTRODUCTION

This publication was developed by the American Iron and Steel Institute with guidance from the AISI Residential Advisory Group. Special appreciation is given to Dr. Roger LaBoube as the author and primary researcher, and to the Light Gauge Structural Engineers Association for their valuable input. The development of this publication was funded by the American Iron and Steel Institute and the National Science Foundation. This document is intended to provide designers with guidance on design of cold-formed steel roof and floor trusses. AISI believes the information contained in this publication substantially represents industry practice and related scientific and technical information, but the information is not intended to represent an official position of AISI or to restrict or exclude any other construction or design techniques.

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INTRODUCTION

The objective of this design guide is to assist in the design, and encourage innovative development of cold-formed steel roof and floor trusses. This design guide prescribes minimum strength and serviceability requirements for the design of cold-formed steel trusses. The guidelines have been established to complement the Specification for the Design of Cold-Formed Steel Structural Members. For guidance regarding design responsibility, see Appendix A.

GENERAL

This design guide is limited to the design of cold-formed steel truss assemblies that are designed in accordance with the above Specification. The design recommendations contained herein assume that the web of the member contains no web punchouts. The term truss in this design guide refers to open web load carrying assemblies that support a roof or floor system.

Common definitions as related to truss design are as follows:

Bracing - a structural element that is always required to achieve the necessary strength and stability of the structure.

Chord member - top and bottom members of a truss.

Eaves - portion a sloping roof that projects beyond the walls.

Gable - the vertical portion of the end wall of a building from the level of the eaves to the ridge of the roof.

Heel - connection region between the top and bottom truss chords of non-parallel chord trusses.

Ridge - the junction of the upper edges of two sloping roof surfaces.

Span - center to center distance between supports.

Truss - open web load carrying assemblies that support roof or floor surfaces.

Truss panel points - intersection of truss chords and web members.

Web member - vertical or diagonal force carrying truss element connected to the top and bottom chords.

Specification - Specification for the Design of Cold-Formed Steel Structural Members.

Structural Submittal - drawings and calculations prepared by the specialty component engineer the intent of which is to document compliance with the structural design.

DESIGN LOADS

A roof and floor truss, as a structural component of a building, must be designed to support the applied loads that may occur during the life of a building. In addition to dead load, these applied loads are generally live load, snow load, wind load and seismic load.

Load intensities are generally specified by a building code. In the absence of a building code, loads and load combinations shall be determined in accordance with acceptable engineering practice as stipulated by the Minimum Design Loads for Buildings and Other Structures (ASCE 7).

Dead Load

Dead load consists of the weight of the truss and material permanently attached to the truss. The actual dead load should be applied on a horizontal projection. Attached material may consist of sheathing, purlins, insulation, ceiling drywall, etc. For additional information, refer to ASCE 7.

Roof Live Load

Roof live loads are usually created by maintenance activities, and represent workers, equipment and materials. Live loads do not include wind, snow, dead, or seismic loads. Minimum magnitudes for roof live load may be specified by the applicable building code or ASCE 7.

Floor Live Load

Floor live loads are produced by use of the building. Typical requirements for live loads on floors for different occupancies are summarized by building codes and ASCE 7.

Snow Load

Snow load is the vertically induced weight of the snow, and is assumed to act on the horizontal projection of the roof of a structure. The appropriate building code or ASCE 7 may be consulted regarding the magnitude and application of the roof snow loads.

Wind Load

Wind creates a pressure that acts perpendicular to the surface of the roof and can be inward or outward. The intensity of the wind pressure, which is a random dynamic load, depends on the wind velocity, area of contact surface, air density, and



building geometry. To alleviate the burden of defining the dynamic wind load, an equivalent static load is used for structural design. The applicable building code or ASCE 7 may be used to define the minimum load intensity.

Rain Load

Rain loads only become a design consideration if adequate drainage systems are not provided. In such cases where such drainage systems are not provided, rain loads must be addressed. For guidance refer to ASCE 7.

Seismic Load

Design seismic load requirements attempt to convey the complicated dynamic earthquake forces into simplified equivalent static lateral forces. Definition of the minimum static lateral forces is given by building codes or ASCE 7.

Other Load Considerations

In addition to the above commonly considered loads, the design engineer must consider other load conditions. Such conditions may be unsymmetrical loads or hanging concentrated loads.

Load Combinations

One or more of the above loads may occur during the life of a building. It is the responsibility of the design engineer to determine the applicable loads and combination of loads that are to be considered. Design loads are to be combined based on their probability of occurrence. Such combinations are specified by building codes or ASCE 7.

STRENGTH PERFORMANCE

The members and connections of a truss must possess adequate strength to safely support the design loads. Strength determinations shall be in accordance with the Specification for the Design of Cold-Formed Steel Structural Members. For situations not addressed by the Specification, design criterion shall be determined by test or rational analysis.

Analysis

Applied forces and deflections are to be determined by acceptable structural engineering procedures. In lieu of a rigorous analysis to define joint flexibility, the following analysis model assumptions may be used:

Chord - Assume the member is continuous, except at the member's ends, assume pin ends. A splice must be designed for the forces applied to it.

Webs - Assume the member connections to be pins at each end.

Member Design Issues

The following design guidelines are based on available information pertaining to the behavior of cold-formed steel truss

assemblies. These guidelines do not preclude to use of more rigorous analysis or design assumptions as determined by rational analysis and/or testing.

Unbraced Length

The unbraced length of a compression member is defined as either the center-to-center distance between truss panel points, or connection spacing interval as prescribed by the member design.

The effective length factor, K , may be determined by rational analysis and/or testing. In the absence of such analysis, either of the following design alternatives may be used because they give similar results:

(1) Where a continuous compression chord, i.e. over one intermediate panel point, is used from heel to ridge of the truss, K_x , K_y , and K_t may be taken as 0.75 when sheathing is attached directly to the top flange of the top chord. For other compression chords applications, K_x , K_y , and K_t may be taken as unity.

For web members which are assumed to be pinned at both ends, K_x , K_y and K_t may be taken as unity.

(2) For chords or web members in compression, the effective length may be taken as the distance between two adjacent points of contraflexure. The effective length factor is to be taken as unity.

C_m and C_b

The end moment coefficient, C_m , maybe taken as 0.85, unless a more rigorous analysis is performed to justify another value.

For an unbraced segment, the strength amplification factor C_b should be computed in accordance with Section C3.1.2 of the Specification.

Compression Chord

The compression chord should be evaluated for combined axial load and bending behavior using Section C5 of the Specification (1986): at panel points, Specification Equation C5-2 applies and between panel points, use Specification Equation C5-1.

Between panel points, the compression chord should be evaluated for axial load, and major axis bending. Specification Equation C5-1 applies with L_x and L_t equal to the distance between the panel points. L_y is taken as the distance between sheathing connectors to the top chord, or the distance between braces.

Tension Chord

The tension chord is to be designed for both axial loaded and bending. The axial load may be taken as acting through the centroid of the section.

Tension Web Members

For a web member connected to the web of the chord members, or connected to gusset plates, the axial tension load may



be taken as acting through the centroid of the web member's cross section.

Compression Web Members

For a web member connected to the web of the chord members, or connected to gusset plates, the axial compression load may be taken as acting through the centroid of the web member's cross section.

The design strength may be determined using Section C4 of the Specification (1986). When computing the design strength, the unbraced lengths, L_x , L_y and L_t , may be taken as the distance between the center of the member's end connection patterns. The effective length factor K may be taken as unity.

Connection Design Issues

In the design of the truss connections, care should be taken to minimize eccentricities. In such cases where eccentricities occur, they should be considered in the analysis and design of the truss members.

It is suggested that the design engineer give special attention to the heel and ridge connections of the truss to ensure structural integrity of the truss. At the ridge, coped members may need to be reinforced to prevent web plate buckling. Lateral bracing is also important to stabilize the ridge from overall buckling. At the heel, web stiffeners may be needed to preclude web crippling. Lateral bracing at the heel may be necessary to prevent rotation of the heel connection.

Bolt and weld capacities shall be defined by the appropriate Specification provisions. For the design of screw connections, refer to the CCFSS Technical Bulletin (1993).

For the design of connecting elements, such as plates, gussets, and brackets, refer to Section J4 of the American Institute of Steel Construction's (AISC) specification for the design of structural steel buildings. In lieu of AISC, design may be based on test or rational analysis.

Bracing

Inadequate bracing is the reason for most erection failures. Proper installation is a vital step for a safe and quality roof structure.

All trusses must be securely braced, both during erection and after permanent installation. Because individual trusses are designed only as structural components, the function of bracing is to cause all elements of the roof system to act as a unit to resist applied loads.

There are two types of bracing:

Temporary bracing is used during erection to hold the trusses until permanent bracing, sheathing and ceilings are in place. Construction loads, for example stacked roofing material, must never be placed on unbraced trusses because trusses are laterally unstable until adequate bracing is installed.

Permanent bracing makes the truss component an integral part of the roof and building structure.

Temporary and permanent bracing includes diagonal bracing,

cross bracing and lateral bracing. Sheathing may also be used to provide stability, but reliance on sheathing material must be documented in the structural submittal.

Lateral bracing, as may be required by the truss design to reduce the buckling length of individual truss members, is part of the truss design and is the only bracing specified on the truss design drawings. This bracing must be sufficiently anchored or restrained by diagonal bracing to prevent its movement.

SERVICEABILITY PERFORMANCE

Midspan deflection of the bottom chord of a truss resulting from gravity load, excluding dead load, should not exceed the following:

- Span/360 for plaster ceilings
- Span/240 for flexible ceilings
- Span/180 for no finished ceiling
- Span/480 for floor systems

HANDLING AND INSTALLATION

All trusses should be installed straight, plumb and aligned at the specified spacing. Trusses should also be inspected and repaired if damage is found.

It is most important to secure the first truss to the end of the building and provide temporary lateral support for the truss at the end of the building. This can be accomplished by guys, braces, or other means.

Adjacent trusses should be set, connecting each to continuous lateral bracing system on the top chord. Long spans also may require diagonal bracing on the top chords. This top chord bracing may be removed as the plywood sheathing is applied.

FULL SCALE CONFIRMATORY LOAD TEST

The following load test procedure may be performed to verify the design methodology.

This Guide is intended for use in the testing of truss assemblies fabricated using cold-formed steel structural members and connections. Either a confirmatory test demonstrating adequate load capacity, or a test to destruction may be conducted.

This Guide does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this Guide to establish appropriate safety and health practices and determine the applicability of regulatory limitation prior to use.

A full-scale truss test is the test of a structural assembly. The integrity of a structural assembly is governed by the strength of the weakest element, i.e. compression member, tension member, or connection. Therefore, when determining the appropriate factor of safety for design, the selection of the factor of safety should reflect the failure mechanism or the weakest ele-



ment. Based on the factors of safety that are prescribed by the Specification for the Design of Cold-Formed Steel Structural Members the following values are suggested:

Structural Element	Factor of Safety
Member	1.92
Fastener Type	
Screw in simple lap connection	3.0
All other fasteners	2.5

Definitions

Truss - A coplanar system of structural elements joined together at their ends usually to construct a series of triangles that form a stable beam-like framework.

Static load - A load or series of loads that are supported by or are applied to a structure so gradually that forces caused by change in momentum of the load and structural elements can be neglected and all parts of the system at any instant are essentially in equilibrium.

Member - Structural elements joined together at their ends, to include the body of the connection.

Fastener - Structural elements, screw, welds, etc., used to provide load transfer between two or more members.

Purpose

This Guide outlines the procedures to be followed in the static load testing of load carrying truss assemblies. While the procedure tells what to do, it does not tell the testing agency how to do it. This leaves the selection of the test fixture and loading medium to the discretion of the testing agency.

If desired, either type of test may be extended to include a determination of the magnitude and distribution of the stresses in the members and connections in order to permit a more comprehensive analysis of the truss performance.

Significance

This Guide provides direction to any individual, group, agency, or code body on the methods of test for truss assemblies fabricated using cold-formed steel construction materials. Information obtained includes strength and stiffness data, and if assemblies are tested to their ultimate load carrying capacity, the failure method or mechanism.

Precautions

Full-scale load tests of any large size specimen such as a truss can be hazardous to the individuals performing or observing the tests, and also can damage the testing fixtures or the structure housing the test setup due to a sudden release of stored energy at failure. Care should be exercised in the preparation of the test setup to ensure that the failure of a test speci-

men will not result in a secondary collapse of a structural element not involved in the test.

Number of Test Specimens

The number of similar trusses that should be tested will vary with the desired precision and reliability of the information to be obtained and with the purpose of the test. As implied by Section F2 of the Specification for the Design of Cold-Formed Steel Structural Members, a confirmatory test may consist of a single load test. The final number will be controlled by the purpose of the tests, and as agreed upon by the sponsor, testing agency or regulatory agency.

Materials

Truss assembly elements, connectors, and connections, which can affect the performance of the test assembly, shall be typical of those intended for use in the final product or as required to satisfy the intent of the test.

Physical and material properties of the truss components may be determined according to Section F3 of the Specification for the Design of Cold-Formed Steel Structural Members.

Fabrication

Fabrication of the test specimens shall be typical of that intended for the finished product.

Connections shall be made in accordance with good practice following the recommendations of the manufacturer of the connectors or the design engineer.

Test Apparatus

A truss test may consist of a single truss or a pair of trusses.

A single truss may be tested in either a vertical position (normal or inverted) or in a horizontal position. Additional loadings must be applied to trusses tested in an inverted or horizontal position to compensate for the effect of dead loads and gravity. Regardless of the orientation of the truss in the test fixture, the fixture and load application means shall be designed with an adequate strength and stiffness to ensure that it is the test specimen that is being tested and not the test fixture.

A pair of trusses may be tested, and shall be supported and attached to supports consistent with the design assumptions.

Reaction supports shall provide sufficient clearance above the ground or restraint frame to allow for normal displacements, ease of loading, instrumentation, and provide room for observations and measurements. Supports shall have adequate strength and stiffness to resist deformations during tests.

Support reaction hardware shall be typical of that planned for use in the completed structure or as required to satisfy the intent of the tests. In a single truss test, frequently the support at one end will allow rotation but not translation (a rocker) and the other will allow both rotation and translation (a roller) so



as not to induce additional unintentional secondary stresses into the test truss as it deforms under load.

Where lateral support is used, it shall not interfere with the free in-plane displacement of the truss assembly. The test trusses shall not be laterally supported in a manner that will exceed that intended in a typical installation. Lateral bracing between trusses tested in pairs shall be installed in a manner to prevent both trusses from buckling together. Care shall be taken when testing a single truss horizontally to keep the test truss flat to minimize any adverse lateral displacement caused by gravity.

The loading devices shall result in the desired truss loading situation regardless of whether uniform, concentrated, or a combination of both. The loading system shall be such as to allow the application of loads during the test to approximate the overall intended in-service load distribution. Care should be taken to avoid eccentrically applied loads unless this type of loading is desired.

When loads are to be applied using dead weight, such as sand, masonry units, or water, the arrangement of dead load material shall be such as to prevent any arching action that can seriously alter the intended load pattern. When water is used, care shall be taken to compartmentalize the water in cells to prevent a non-uniform load as the truss and elements deflect.

Uplift forces such as those caused by wind loads may be simulated by reversing the direction of the applied gravity loads; or if the fixture will permit it, testing the truss upside down. It is preferable to test the truss in its normally installed orientation in order to more typically allow for the uplift forces working against gravity forces.

Load and Deflection Measuring Devices

Loads may be measured using one or more of the following devices. Pressure gages or hydraulic load cells can be incorporated into a hydraulic loading system. These devices must be calibrated with the jacks or cylinders at different positions of piston travel to ensure a true loading history. Spring dynamometers, electronic load cells, or the weighing tables of universal testing machines have also been successfully used. The load measuring device or devices used shall be capable of measuring loads to an accuracy of $\pm 2\%$ of design load.

Deflection readings may be taken in a variety of ways. One of the simplest methods is by the use of a taut wire or monofilament line stretched between supports in combination with a mirror-scale located at the desired deflection measuring points. Such a device avoids any magnification of deflection readings due to a settlement of supports during loading. When the taut wire method is used, care must be taken to ensure that the wire will remain under tension during the entire test. This can be accomplished by incorporating a spring into the line or by letting one end run over a pulley with a weight attached to the

line. Deflections are read on a scale with a mirror backing. The mirror-scale deflection measuring device is read by visually lining up the top of the wire with its image on the mirror and then reading the scale.

Other commonly used deflection measuring devices are such things as direct reading micrometer dial gages, optical levers used to read scales attached to the truss, linearly variable differential transformers (LVDT), or a combination of flexible wire attached at deflection points and monitored remotely through a system of pulleys attached to dial gages. Deflection readings and measuring devices shall have an accuracy of $\pm 2\%$ of design load deflection.

Strain measurements may be taken on truss elements using electrical or mechanical strain gages. Approximate stress distribution and magnitude may be observed by the application of special brittle lacquers made by personnel experienced in the application and operation of the methods employed on the material being tested.

Loading Procedures

Both dead and superimposed load must be considered when performing a load test. Because these loads are independent load types, they must be introduced independently.

Initially the design dead load must be applied. This load should be held for no less than 5 minutes, at which time deflection readings should be recorded. These deflections are to be considered the dead load deflections. The design dead load must be maintained during the duration of the load test.

As a minimum, the dead load and total design load deflections should be measured along the bottom chord at midspan and at quarter points. When testing trusses in pairs, the deflections of two trusses at corresponding locations may be averaged.

When deflection measuring systems that do not compensate for support settlement are used, measurement of support displacement under load is needed to obtain an accurate load-deflection response.

Although the superimposed load increments may vary with the intent of the test, satisfactory load-response data can usually be obtained if each of the first four increments of load does not exceed 25% of the total design live/snow load. Load shall be slowly applied to the truss assembly so as to provide a static loading condition. The above mentioned load increments apply to both uniform and concentrated loads.

The confirmatory test load may be achieved by applying load in equal increments of 0.10 times the calculated nominal load. Nominal load is the design load multiplied by the implied design factor of safety. If the confirmatory test load is achieved without failure of the truss, the test may be halted.

Interpretation of Test Results

Evaluation of the test results shall be made in accordance with F2 Tests for Confirming Structural Performance of the Specification for the Design of Cold-Formed Steel Structural Members.



Report

The report shall consist of a description of all specimen components, including drawings defining actual and nominal geometry, material specifications, material properties test results describing the actual physical properties of each component, and the sources of supply. Differences between the actual and the nominal dimensions and material properties shall be noted in the report.

The test report shall also contain a sketch or photograph of the test setup, the latest calibration date and accuracy of the equipment used, the signature of the person responsible for the test, and a tabulation of all raw and evaluated test data.

All graphs resulting from the test evaluation procedure shall be included in the test report.



APPENDIX A STANDARD PRACTICE FOR COLD-FORMED STEEL TRUSS DESIGN RESPONSIBILITIES

1.0 SCOPE AND DEFINITIONS

1.1 This standard defines the design responsibilities of the individuals and organizations involved in the preparation, submittal, review and approval of each truss design drawing and truss placement plan associated with the use of cold-formed steel trusses. These guidelines are presented as industry standard practice. The guidelines are not intended to preclude alternate provisions as agreed upon by the parties involved.

1.2 The following definitions shall apply:

1.2.1 “Architect” shall mean the individual registered architect responsible for the architectural design of the structure and who produces the architectural drawings included in the construction design documents.

1.2.2 “Building Designer” is the individual or organization having responsibility for the overall building or structure design in accordance with the state’s statutes and regulations governing the professional registration and certification of architects or engineers. This responsibility includes but is not limited to foundation design, structural member sizing, load transfer, bearing conditions, and the structure’s compliance with the applicable building codes. Also referred to as registered architect or engineer, building designer, and registered building designer, but hereinafter will be referred to as building designer.

1.2.3 “Construction Design Documents” are the architectural drawings, structural drawings, mechanical drawings, electrical drawings, and any other drawings, specifications, and addenda which set forth the overall design of the structure and issued by the building designer

1.2.4 “Contractor” shall mean the individual or organization responsible for the field storage, handling, and installation of trusses including, but not limited to, temporary bracing, permanent bracing, anchorage, connections and field assembly. The term “Contractor” shall include those subcontractors who have a direct contract with the Contractor to perform all or a portion of the storage, handling, and installation of the trusses.

1.2.5 “Engineer-of-Record” shall mean the registered professional engineer for the structural design of the structure and who produces the structural drawings included in the construction design documents.

1.2.6 “Owner” shall mean the individual or organization for whom the structure is designed.

1.2.7 “Truss” is an individual cold-formed steel open web structural component manufactured by the truss manufacturer.

1.2.8 “Truss Designer” is the design professional, individual or organization, having responsibility for the design of the cold-formed steel truss. This responsibility shall be in accordance

with the state’s statutes and regulations governing the professional registration and certification of architects or engineers. Also referred to as truss engineer, design engineer, registered engineer, and engineer, but hereinafter will be referred to as truss designer.

1.2.9 “Truss Design Drawing” shall mean the graphic depiction of an individual Truss prepared by the truss designer.

1.2.10 “Truss Manufacturer” shall mean an individual or organization regularly engaged in the manufacturing of trusses.

1.2.11 “Truss Placement Plan” is the drawing identifying the location assumed for each Truss based on the truss manufacturer’s interpretation of the construction design documents.

2.0 OWNER RESPONSIBILITIES

2.1 Directly or through its representatives, which may include the contractor and/or building designer: (a) review and approve each truss design drawing; (b) review and approve the truss placement plan; (c) resolve and approve all design issues arising out of the preparation of each, truss design drawing and truss placement plan; and (d) coordinate the return of each approved truss design drawing and truss placement plan to the truss manufacturer prior to truss manufacturing.

3.0 BUILDING DESIGNER RESPONSIBILITIES

3.1 Design a structure suitable to ensure that the intended function of each truss is not affected by adverse influences including, but not limited to, moisture, temperature, corrosive chemicals and gases;

3.2 Prepare the construction design documents, showing all trussed areas, which must provide as a minimum the following:

3.2.1 All truss orientations and locations;

3.2.2 Information to fully determine all truss profiles;

3.2.3 Adequate support of the truss and all truss bearing conditions;

3.2.4 Permanent bracing design for the structure including the trusses, except as provided in 3.4 and 6.2.11.

3.2.5 The location, direction and magnitude of all dead and live loads applicable to each truss including, but not limited to, loads attributable to: roof, floor, partition, mechanical, fire sprinkler, attic, storage, wind, snow drift and seismic;

3.2.6 All truss anchorage designs required to resist uplift, gravity, and lateral loads;

3.2.7 Allowable vertical and horizontal deflection criteria;

3.2.8 Proper transfer of design loads affecting the truss; and

3.2.9 Adequate connections between truss and non-truss components, except as noted in Section 6.2.8.

3.3 Review and approve the truss placement plan and each truss design drawing for conformance with the requirements and intent of the construction design documents, the effect of each truss design drawing and truss placement plan on other parts of the structure, and the effect of the structure on each truss.



3.4 Specify permanent lateral bracing where indicated by the truss designer on the truss design drawings, to prevent buckling of the individual truss members due to design loads. The building designer shall specify how the permanent lateral bracing is to be anchored or restrained to prevent lateral movement if all truss members, so braced, buckle together. This shall be accomplished by: (a) anchorage to solid end walls; (b) permanent diagonal bracing in the plane of the web members; or (c) other means when demonstrated by the Building Designer to provide equivalent bracing.

4.0 CONTRACTOR RESPONSIBILITIES

4.1 Provide to the truss manufacturer the construction design documents and all revisions and supplements thereto.

4.2 Review and approve the truss placement plan and each truss design drawing for conformance with the requirements and intent of the construction design documents, and the effect of the truss placement plan and each truss design drawing on other trades involved in the construction of the structure and the effect of the other trades on the trusses.

4.3 Coordinate the review, approval and return of each truss design drawing and the truss placement plan by the owner and building designer.

4.4 Provide the approved truss design drawings, approved truss placement plans, and any supplemental information provided by the truss manufacturer to the individual or organization responsible for the installation of the trusses.

4.5 Comply with the field storage, handling, installation, permanent bracing, anchorage, connection and field assembly requirements of the construction design documents.

4.6 Determine and install the temporary bracing for the structure, including the trusses.

5.0 TRUSS MANUFACTURER RESPONSIBILITIES

5.1 Communicate the design criteria from the construction design documents to the truss designer.

5.2 Where required by the construction design documents, prepare the truss placement plan, providing as a minimum, the location assumed for each truss based on the truss manufacturer's interpretation of the construction design documents.

5.3 Submit to the contractor the truss placement plan, as may be required, and each truss design drawing for review and approval.

6.0 TRUSS DESIGNER RESPONSIBILITIES

6.1 Prepare the truss design drawings using the "DESIGN GUIDE FOR COLD-FORMED STEEL TRUSSES".

6.2 For each truss design drawing, set forth as a minimum the following:

- 6.2.1 Slope or depth, span and spacing;
- 6.2.2 Location of all joints;
- 6.2.3 Required bearing widths;
- 6.2.4 Design loads as applicable;
 - 6.2.4.1 Top chord live load (including snow loads);

- 6.2.4.2 Top chord dead load;
- 6.2.4.3 Bottom chord live load;
- 6.2.4.4 Bottom chord dead load;
- 6.2.4.5 Concentrated loads and their points of application; and
- 6.2.4.6 Controlling wind and earthquake loads;
- 6.2.5 Each reaction force and direction;
- 6.2.6 Joint connector type (gusset plate, etc.), size, thickness;
 - 6.2.6.1 Type of fastener and allowable capacity;
- 6.2.7 Chord and web member type designator including thickness, yield and coating for each member;

6.2.8 Connection requirements for:

- (a) Truss to truss girder;
- (b) Truss member to member; (i.e., chord to web) and
- (c) Field splices;

6.2.9 Calculated vertical and horizontal deflection ratios and/or maximum deflection for live and total load;

6.2.10 Maximum axial compression forces in each of the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces may be shown on the truss design drawing or on supplemental documents; and

6.2.11 Required permanent truss member bracing location.

7.0 OTHER RESPONSIBILITIES

7.1 Any party who cuts or damages a truss shall be responsible for securing the engineering required for the repair and for subsequent costs.

REFERENCES

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Harper, M. M., LaBoube, R. A., and Yu, W. W. (1995), "Behavior of Cold-Formed Steel Roof Trusses," Summary Report, Civil Engineering Study 95-3, Cold-Formed Steel Series, Center for Cold-Formed Steel Structures, Department of Civil Engineering, University of Missouri-Rolla, Rolla, MO

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