CANADIAN SHEET STEEL BUILDING INSTITUTE

The Lightweight **Steel Frame** House Construction Handbook

CSSBI 59-05

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Illustrations

Many of the illustrations presented in this handbook have been adapted from the Code and Construction Guide for Housing, issued by the Ontario Ministry of Municipal Affairs and Housing, and the Tarion Warranty Corporation (formerly New Home Warranty Program). The original wood frame details have been refashioned to illustrate their treatment where lightweight steel framing is used. The Ontario Ministry of Municipal Affairs and Housing and the Tarion Warranty Corporation are gratefully acknowledged for permitting the use of their original figures.

Disclaimer

The Lightweight Steel Frame House Construction Handbook is a convenience document only, and not a substitute for the provincial and National Building Codes. While care has been taken to ensure accuracy, the examples and explanations in this guide are for the purposes of illustration and constitute opinion only. Neither the Canadian Sheet Steel Building Institute nor its members warrant or assume any liability for the suitability of the material contained herein for any general or particular use.

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Definitions

Accessories: Various steel products that are used in the construction of lightweight steel framed assemblies. These include flat strap wall bracing and floor bridging, clip angles, floor joist web stiffeners and various types of fasteners.

Axial: Force acting longitudinally on a member. Examples are gravity loads carried by columns or studs.

Base Steel: The steel substrate of a sheet steel product that has been coated with a metallic layer such as zinc or aluminum-zinc alloy.

Bearing Stiffener: See Web Stiffener.

Blocking: A form of bridging, usually a solid piece of joist or stud material fastened in place between the framing members.

Bracing: Methods used to resist twisting of the framing members (joists or studs) and to control racking (diagonal movement) of the frame in its plane.

Bridging: A method used to resist twisting of the framing members, for example: blocking, flat strap or notched channel.

Building Codes: Minimum standards that federal, provincial and municipal or regional jurisdictions adopt for building construction to assure human safety.

CCMC (Canadian Construction Materials Centre): The organization that provides a registry of construction materials accepted by the regional or municipal building authorities. A CCMC Evaluation Number on a steel framing member indicates that it meets certain specifications for residential steel framing.

CSSBI (Canadian Sheet Steel Building Institute): The national association of companies involved in the structural sheet steel industry. The CSSBI is the main advocate for residential steel framing in Canada. For further information, visit www.cssbi.ca.

C-Section: Description of the cross-sectional shape of cold formed steel member used for studs, joists, headers, rafters, etc. These members have a "lipped" or stiffened flange to provide extra strength.

C-Shape: See C-Section.

Channel: C-section without lipped or stiffened flange. See Track.

Ceiling Joist: Horizontal structural framing member that supports ceiling and attic loads. See Track.

Clip Angle: L-shaped metal component (normally formed with a 90 degree bend) used for connecting webs of framing members together (i.e. to studs, joists, and rafters).

Closure Channel: A section of track (see definition) that is placed on edge, perpendicular to the ends of the floor joists, and connected to each joist.

Cold Formed Steel (CFS): Steel that has been formed into a specific profile by a process of roll forming or press braking at ambient temperature. While hot rolled section members, such as I-beams, are formed or rolled while red hot, the forming process for lightweight steel framing takes place when the steel is at normal room temperature, hence the term cold forming. The sheet steel is typically supplied to the manufacturer in large coils, and these coils feed into the forming machinery directly, thereby enabling a continuous forming process to occur.

Colour Code: Method of identifying the base steel thickness. The colour is factory-applied to one end of the framing member.

Cripple Stud: A short stud that is placed between a lintel and a top sill, a bottom sill and a bottom track, or a top track and lintel at an opening, and which provides backing for wallboard or sheathing material. A loadbearing cripple stud normally has the same base steel thickness as a loadbearing wall stud.

Dead Load: Load created by the weight of floors, walls, partitions, ceilings, roofs and other permanent elements of the structure.

Design Professional: Architect or engineer registered and licensed to practice by a provincial authority. Currently, steel roof structures (rafters or trusses) are beyond the scope this Handbook, and a professional is needed to design this part of the structure. The designer should be familiar with the design of LSF structural members.

Design Thickness: The thickness of the base steel that is used in the structural design of loadbearing lightweight steel framing members.

Detail: Small drawing on the plans that illustrates how a connection is made or how framing members are assembled.

DWV (Drains, Waste, Vent): The complete plumbing system containing all waste water drainage and venting.

Earthquake: Seismic event that introduces horizontal (seismic) loading on a structure. Earthquakes can cause significant and sometimes permanent shifting or "racking" of the walls. The severity of earthquake loading has been predetermined for various areas of Canada and is accounted for in the NBCC. This Handbook provides exterior wall bracing requirements for a range of seismic conditions. It is necessary to retain a design professional for areas of high seismic activity.

Flange: Part of a C-section that is perpendicular to the web (see C-section definition).

Flat Strap: Sheet steel cut to a specified width without any bends. Flat straps are typically used for wall and floor bracing and transfer loads by tension.

Floor Joist: A C-section (i.e. lipped) that is used in a horizontal orientation to frame floor assemblies.

Galvanized Steel: A steel product with a metallic coating, in this case pure zinc, for the purpose of resisting corrosion. An alternative is Galvalume™, a metallic coating of 55% aluminium and 45% zinc, for the same purpose. The level of protection is determined by the coating weight. Metallic coatings for residential steel framing members have minimum coating weight requirements.

Header Joist: A single or built-up member used to frame openings in floors. The header joist runs perpendicular to the span of the floor joists and supports the ends of the shorter floor joists (tail joists) adjacent to the opening. A header is usually the same depth as other joists in the floor, and can be a single joist or a built-up member of joist and track sections depending on the size of the floor opening.

In-Line Framing: Framing method where all vertical and horizontal load carrying members are aligned.

Jack Stud: A member framing a wall opening on which the lintel bears.

Jamb Studs: An assembly of jack and king studs that frame the sides of a wall opening.

Joist: See Floor Joist, Ceiling Joist.

King Stud: Structural wall member forming part of the jamb studs at an opening such as a window or door. The king stud extends full height of the wall between top and bottom tracks, is attached to the jack stud, and matches the wall stud size and base steel thickness.

Knock-Out: See Punchout.

Lintel: Horizontal framing member (normally built-up of two C-section members) spanning a window or door opening and supporting the structure above by transmitting the load across the opening to adjacent wall framing members (the jamb studs).

Lip: Part of a C-section that extends from the flange at the open end. The lip increases the strength of the member and acts as a stiffener to the flange.

Live Load: Load created by transient or sustained forces such as occupancy of the structure and the natural forces of wind, snow, rain and seismic activity.

Loadbearing Wall: A wall that is designed to carry an axial load, a wind load, or a combination of both loads. For the purposes of this document, loadbearing means axial loadbearing and/or wind loadbearing, which differs from the definition used in the National Building Code of Canada (NBCC).

Lightweight Steel Framing (LSF): An assembly of lightweight steel members spaced not more than 610 mm (24 in) apart, and accessories. Such assemblies include loadbearing walls and floors, non-loadbearing walls and other rough framing details such a bulkheads and vent-pipe chases. The term lightweight refers to a base steel thickness of less than 2.67 mm (0.105 in).

Member Identification: Steel framing members are identified with respect to size and manufacturer name or CCMC Evaluation Number. The identification is applied at regular intervals along the length of the member.

Member Size: Steel framing members have web depth, flange width, and material thickness all defining the member size.

Minimum Thickness: The minimum allowable thickness of the base steel exclusive of the metallic coating expressed in millimetres (mm) or 1/1000 of an inch (mils). This thickness cannot be less than 95% of the design thickness. The minimum thickness is normally part of the member identification.

Multiple Span: The span made by a continuous horizontal member having intermediate supports (see also Span).

NBCC: An acronym used in this publication to refer to the National Building Code of Canada, 1995.

Non-Loadbearing Wall: A wall that is not designed to carry an axial load, wind load, or any combination of either load. It acts as a partition wall only and is expected to carry only its own dead weight, the weight of wall coverings, and some modest internal air pressure differential.

Performance Method: Design method that uses engineering principles, material characteristics, and calculations to determine framing member thickness and size in a structure. Currently, the supporting roof structure in a residential building must be designed using the performance method by a design professional to meet the requirements of Part 4 NBCC.

Prescriptive Method: Design method that uses pre-engineered, tabular values to determine size and thickness of a member in the structure. Whereas Part 9 NBCC is a prescriptive method for wood construction, this Handbook contains the CCMC approved prescriptive method for steel framing of floors and walls. Both the NBCC and CSSBI prescriptive methods are limited with respect to building size.

Punchout: Hole in the web of a steel framing member for the installation of bridging, plumbing, electrical, or other utilities.

Racking: Movement of part of a wall, floor or roof assembly from its original "square" alignment. Bracing in the form of flat straps or sheathing prevents racking.

Rafter: Structural framing member that supports roof loads.

Rim Joist: See Closure Channel.

Shearwall: Vertical wall assembly capable of resisting lateral forces to prevent racking from wind or seismic loads acting parallel to the plane of the wall.

Span: Distance between the centres of support of a structural member. The centre of a support is the midpoint of the support width. A single span is a member without intermediate support. A continuous span has two or more supports. A clear span is the distance between edges of support and therefore is less than the span.

Structural Sheathing: Covering attached directly to structural members to distribute loads, brace walls and floors, and strengthen the assembly.

Stud: A stiffened (i.e. lipped) C-section that is used in a vertical orientation to frame wall assemblies. While the profile of both studs and floor joists are that of a stiffened C-section, joists generally have a greater web depth, reflecting the different intended function of each member. The terms stud and joist, therefore, refer to the intended use of the members, and not to some specific physical property.

Track: A C-section that is commonly used as the top and bottom plates of a wall assembly and as closure channels.

Trimmer Joist: A built-up member used to frame openings in floors. The trimmer joist runs parallel to the joist span, and is the member into which the header joist frames.

Web: Part of a C-section or track section that connects the two flanges.

Web Crippling: The localized permanent deformation of the web member subjected to concentrated load or reaction at bearing supports.

Web Stiffener: Additional material that is attached to the web to strengthen the member against web crippling. Also called bearing stiffener.

Wind Load: Horizontal loading created by air movement past a structure. The amount of wind loading depends on exposure (largely a function of building height), wind speed, and geographic location, and is expressed as a pressure. This Handbook contains bracing requirements for exterior walls for a 1 in 30-year wind load.

Yield Strength: Highest unit stress in pounds per square inch (psi) or megapascals (MPa) that a material can endure before permanent deformation occurs as measured by testing. Yield strength for steel framing material is indicated by the "Grade" in the material specification.