CANADIAN SHEET STEEL BUILDING INSTITUTE

The Lightweight Steel Frame House Construction Handbook

CSSBI 59-05

Acknowledgements

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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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The Lightweight Steel Frame House Construction Handbook

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.

The Lightweight
Steel Frame
House Construction
Handbook

Chapter One

Getting Started

Introduction

Lightweight steel framing is increasing in popularity amongst homebuilders. Framing techniques and details are now available that largely eliminate the need for engineering services. **The purpose of this Handbook is to provide the builder with general design guidelines, common practices and insights concerning successful lightweight steel construction. This Handbook describes a method for framing the floors and walls of single family residential buildings and other small buildings using lightweight steel members. This Handbook can be used only in conjunction with lightweight steel framing (LSF) products evaluated under the CCMC Technical Guide for Lightweight Steel Framing Components**. Engineering design services are required for all other LSF construction applications.

Code Compliance and CCMC Reports

The Canadian Construction and Material Centre (CCMC), a part of the National Research Council of Canada's Institute for Research in Construction, offers the construction industry a national evaluation service for new and innovative materials, products and services in all types of construction.

A CCMC evaluation is an impartial, technical opinion on the suitability of a product for its intended use, usually with respect to the requirements of the National Building Code of Canada and, in many cases to provincial codes including the Ontario Building Code. CCMC ensures that its evaluations are based on the latest technical research and expertise. CCMC Reports and Listings are utilized throughout the country by building officials and other authorities as a basis for determining the acceptability of products.

Please check with your local building official with respect to the acceptability of CCMC reports in establishing Code compliance.

The prescriptive span and height tables, along with floor and wall opening details contained in this document have been evaluated by CCMC for conformance to Part 9 of the NBCC 1995. Therefore, construction using CCMC certified framing elements in accordance with this Handbook will conform to Part 9 of the NBCC 1995.

Lightweight Steel Framing: An Alternative Framing System

Generally speaking, the process of building lightweight steel framed homes does not differ significantly from the methods used for wood framed construction. Walls, floors and ceilings are built by a repetition of light frame members. Typical wood framed truss assemblies or built-up wood roof systems can be used directly over steel frame walls and floors. Steel solutions for these systems exist, but require the input of a design professional and are beyond the scope of this document.

Despite the similarities between LSF and wood framing, there are important differences that must be understood and considered during design and construction. Confidently addressing these differences will allow for trouble-free construction. Specific troubleshooting issues are addressed in Chapter 9.

Building Science Insight: Advantages of Steel Framing

Advantages of Lightweight Steel Framing (LSF)

Steel framing offers a number of advantages that increase design and construction flexibility over traditional framing materials.

Member length: Steel joists can be manufactured to any practical length, thereby enabling the entire width of the typical residential building to be spanned continuously. This eliminates the need for interior lap joints, thus speeding up construction and reducing potential for cracking or roughness in floor finishes over interior supports. Member length is limited only by shipping and transportation restrictions.

High strength to weight ratio: LSF members are lighter per unit length than traditional framing members. LSF is easier for framers to lift on the job site. This may lead to faster and less costly building construction with fewer lifting-related injuries.

Member thickness: The inherent strength of cold formed steel provides a great deal of flexibility in the layout of framing members. Due to the low self-weight per unit length and the strength of steel, steel joists can span longer distances than traditional framing materials of the same depth and width. By increasing the base steel thickness, the strength and therefore the design span of the framing member is increased. In some cases these longer spans allow the designer to eliminate interior supporting beams or walls. This means more open and unobstructed interior spaces for the end user and potentially lower construction costs for the builder.

Moisture-related problems: Steel does not absorb water, so the moisture-related problems of warping, shrinking and twisting that are common to more traditional framing products are not a problem with LSF. The use of LSF can drastically reduce or eliminate the incidence of squeaking subfloors, warped walls, nail pops and cracked drywall since these problems are generally caused by the moisture-related movement of the framing. To correct these defects requires costly post-construction repair work, and so the absence of these problems in a LSF building illustrates another cost-saving benefit of LSF construction. Also, since steel does not warp and twist due to moisture, LSF members are delivered to the site straight and true, eliminating the time needed to sort and crown traditional framing members

Vermin and rot resistance: Steel framing is immune to termite attack or damage from insects, rodents, or other vermin. As well, since steel framing does not absorb moisture, it does not support the growth of destructive, parasitic and biohazardous moulds and fungi.

Electrical and plumbing services: Steel framing is typically supplied with pre-punched holes in the webs of floor joists and wall studs. The installation of electrical and plumbing services is quickly and easily accomplished when the pre-punched holes are used for running these services. The Canadian Standards Association (CSA) has approved plastic grommets that snap into these pre-punched holes, thereby allowing the use of the standard plastic coated wiring familiar to residential builders, rather than the more expensive metal-armoured cable used in commercial and industrial applications. Similar grommets are used to insulate the plumbing from the steel framing to prevent any chaffing, vibration, or electrolytic action between the LSF and pipes.

Sagging: Steel members provide the strength and stiffness to accommodate heavy floor toppings (loads) without long-term sagging or creep.

Non-combustible construction: Steel is non-combustible and therefore does not contribute fuel to a fire. LSF has long been a popular choice for non-combustible construction in commercial applications because of both the non-combustible and durable nature of steel framing.

Indoor air quality: Steel is an inert building material that does not emit fumes, gases, vapours or support the growth of toxic moulds and fungi. The water-based lubricants used during the roll forming process dissipate in the open environment present during the framing stage.

Environmental impact: Steel is the only construction material that is 100% recyclable without degradation in material properties. Steel framing has a recycled steel content not less than 30% and can be as much as 100%.

Working with Other Trades

Construction of a new home requires the co-ordination of various trades. Later chapters in this book describe specifically how other trades may be affected by working on an LSF house. As a general rule, let the trade know beforehand that they will be working on a steel framed house and what additional tools and accessories may be required.

During the design process remember to configure members which promote arrangements for ease of installing wiring, insulation and services.

Common Practices

The framing methods presented in this Handbook are a sample of those used in current practice and as such, are not necessarily intended to represent the best or only methods available. Other details and engineered designs are available that are equally suitable and may be more efficient for particular building geometries. For additional framing details, refer to the CSSBI publication “Low Rise Residential Construction Details”.

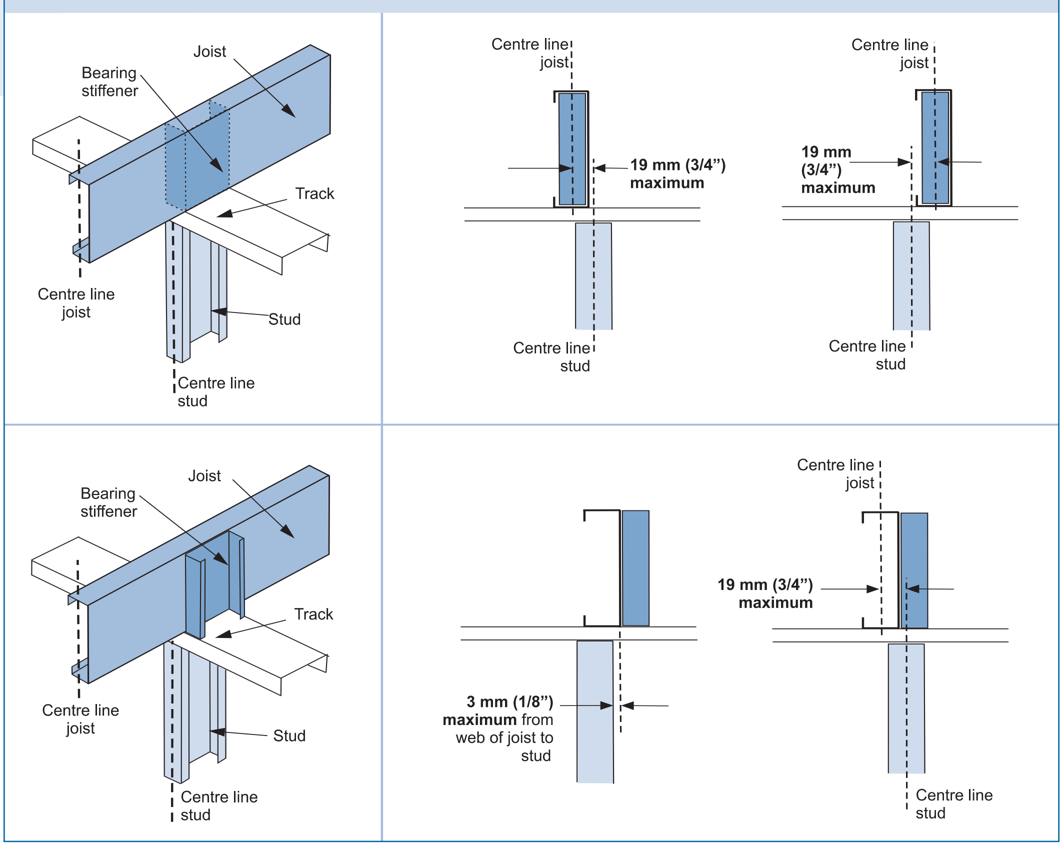
In-line Framing

When supported by steel framed walls in accordance with this manual, a steel framed floor shall be constructed with floor joists in-line with loadbearing studs located below the joists. Generally, the maximum distance between the centre lines of the joist and the stud shall be limited in accordance with Figure 1.1.

Figure 1.1

In-line Framing Tolerance Limits

To qualify as “in-line”, each joist, rafter, truss, and structural wall stud must be aligned vertically, according to the limits depicted here. The alignment tolerance is not required when a structural load distribution member is specified in accordance with an approved design.



Scope and Limitations of this Handbook

This manual applies to the construction of lightweight steel framed walls and floors for detached single family dwellings and multi-family row houses up to three storeys in height that would fall within the scope of Part 9 of the National Building Code of Canada (NBCC 1995). For applications outside this scope, or for building projects not constructed under CCMC certifications, design and construction must conform to the requirements of NBCC Part 4. Involvement of a design professional is required for all design and construction not specifically described in this manual. Consult your local building official for advice in this area.

The CSSBI does not assume any professional liability for the adequacy of these provisions. Professional advice should be sought if there is some question of the appropriate application.

The methods identified in this manual apply to buildings that conform to the application limits identified in Figure 1.2. This Handbook includes Member Selection Tables (Appendix A).

Figure 1.2

Applicability Limits

Applicability Limits

Application	**Limitation** metric (imperial)		
Building Area	600 m^2 (6460 sq ft) maximum		
Number of Stories	3 storey maximum		
Building width	13.4 m (40 ft) maximum from eave to eave including 0.6 m (24 in) x 2 overhang		
Building Length	18.3 m (60 ft) maximum		
Hourly Wind Pressure, q (1/30)	Up to 0.6 kPa (12.5 psf)		
Specified Roof Snow Load	Up to 2.5 kPa (52.2 psf)		
Seismic Parameters	Z_a	V	Z_z
	1	0.05	0
	2	0.05	1
	4	0.10	2

NOTE: Only metric values are official, imperial values are for convenience only.

Manufacturing Standards

Lightweight steel framing members are manufactured in Canada to the requirements of ASTM C645 and ASTM C955. These standards specify framing member minimum dimensions and establishes material and structural requirements for both loadbearing and non-loadbearing members. To ensure a high level of production quality, CSSBI manufacturers also follow the CSSBI publication Quality Policy Manual for the Fabrication of Residential Lightgauge Steel Framing.

The design of LSF members is well refined and has benefited from many years of research and development. The design of all cold formed steel structural products in Canada, including loadbearing steel framing members described in this document, must conform to the requirements of CSA Standard S136 North American Specification for the Design of Cold- Formed Steel Structural Members, as referenced by the NBCC.

Loadbearing LSF members must be cold formed to shape from structural quality sheet steel complying with the requirements of one of the following material specifications:

a) ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; or
b) ASTM A792/A792M, Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

The minimum yield strength of all loadbearing steel members and connected accessories with a design thickness 1.146 mm (0.0451 in) or less shall be 230 MPa (33,000 psi). For design thicknesses 1.438 mm (0.0566 in) and greater, a minimum yield strength of 340 MPa (50,000 psi) is specified. For framing members supplied as part of a CCMC certified building project, each loadbearing steel framing member will have a legible label, stamp or embossment with the following information as a minimum:

1. Manufacturer's identification, and
2. CCMC certification number.

The manufacturer may also include additional information such as a member size and material designation.

LSF members and accessories must have a minimum metallic coating complying with Figure 1.3. Other metallic coatings are permitted provided it can be demonstrated they have a corrosion resistance that is equal to or greater than the corresponding coatings listed and provide protection at cut edges, scratches, etc. by cathodic sacrificial protection.

Figure 1.3

Minimum Metallic Coating Requirements

Minimum Metallic Coating Requirements		
Steel Component	Reference ASTM Standard	
	A653/ A653M Galvanized	A792 / A792M Aluminum-Zinc Alloy
Loadbearing	G60 / Z180	AZ50 / AZM150
Non-Loadbearing	G40 / Z120	AZ50 / AZM150

Similar to traditional framing materials, LSF members shall be located within the building envelope and adequately protected from direct contact with moisture from the ground or the outdoor environment. The coating designations shown in Figure 1.3 assume normal exposure conditions and construction practices. It is recommended that the aluminum-zinc alloy coated steel not be used in contact with fresh concrete.

Codes and Regulations

All construction must conform to the requirements of local building codes, or in their absence, to the requirements of the National Building Code of Canada. All construction must be acceptable to the authority having jurisdiction.

Non-loadbearing lightweight steel framing is covered by Section 9.24 of the National Building Code of Canada 1995.

Loadbearing lightweight steel framing as discussed in this Handbook has been evaluated by the Canadian Construction Materials Centre for conformance to the provisions in Part 9 of the National Building Code of Canada, as permitted under NBCC 1995 Section 2.5 "*Equivalents*"

The design of member capacities for structural members are in accordance with Part 4 of the NBCC.

Framing Members

Lightweight steel framing members are manufactured using a cold forming process that shapes sheet steel into a "C" shape profile, as shown in Figure 1.4. Stringent profile and length tolerances are typical of products manufactured from steel. The manufacturer of the steel framing members may be consulted for details.

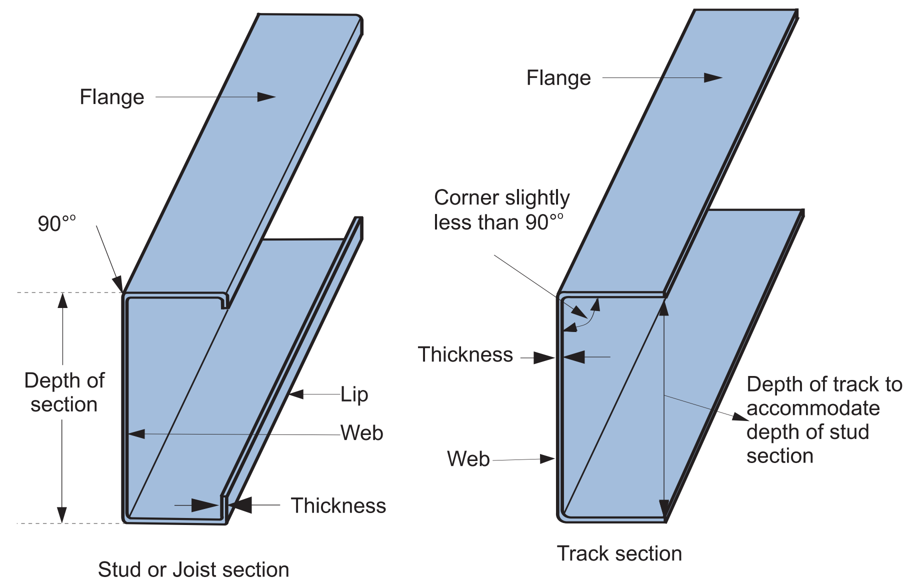
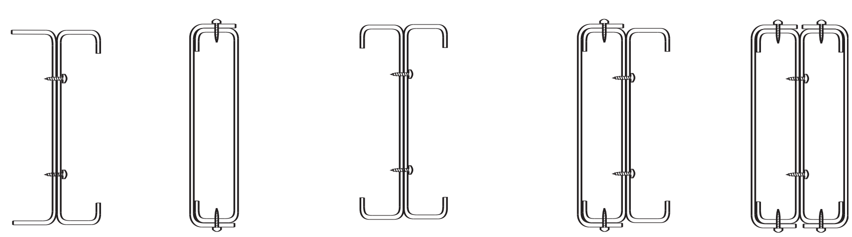


Figure 1.4

Framing Member Cross-Sections

The stud and joist sections have flanges stiffened with a lip to increase member strength (Figure 1.4). Track sections are made with unstiffened flanges that are angled slightly inward to temporarily hold the studs in place before being secured with a fastener, and also to allow the studs to bear directly on the track web. Figure 1.5 illustrates cross-sections of some of the various configurations of stud and track that may be assembled to create built-up sections for headers, jambs, and lintels.



These combinations must be engineered for built-up beams. The diagrams illustrate how to combine various members.

Figure 1.5

Built-up Sections

Standard Loadbearing Members

The standard loadbearing residential steel framing members used in Canada are listed in Figure 1.6. These sections, spaced up to 610 mm (24 in) on centre (o.c.), can be used for a variety of floor and wall loading conditions. The Member Selection Tables (Appendix A) and LSF manufacturers' catalogues should be consulted for section properties and availability. Non-standard sections are also available or can be manufactured by special request, but standard sizes are recommended to ensure ready supply and to enable standardized load tables. A list of LSF manufacturers is available from the CSSBI.

Figure 1.6

Standard Loadbearing Member Sizes

Standard Loadbearing Member Sizes (nominal dimensions)				
Commonly Used Application	**Web Depth mm (in)**	**Flange Width mm (in)**	**Design Thickness mm (in)**	**MinimumThickness mm (in)**
Studs (nominal 2 x 4)	92.1 (3-5/8) 92.1 (3-5/8) 92.1 (3-5/8)	41.3 (1-5/8) 41.3 (1-5/8) 41.3 (1-5/8)	0.879 (0.0346) 1.146 (0.0451) 1.438 (0.0566)	0.836 (0.0329) 1.087 (0.0428) 1.367 (0.0538)
Studs, Headers & Joists (nominal 2 x 6)	152 (6) 152 (6) 152 (6)	41.3 (1-5/8) 41.3 (1-5/8) 41.3 (1-5/8)	0.879 (0.0346) 1.146 (0.0451) 1.438 (0.0566)	0.836 (0.0329) 1.087 (0.0428) 1.367 (0.0538)
Joists, Headers & Lintels (nominal 2 x 8)	203 (8) 203 (8) 203 (8) 203 (8)	41.3 (1-5/8) 41.3 (1-5/8) 41.3 (1-5/8) 41.3 (1-5/8)	0.879 (0.0346) 1.146 (0.0451) 1.438 (0.0566) 1.811 (0.0713)	0.836 (0.0329) 1.087 (0.0428) 1.367 (0.0538) 1.720 (0.0677)
Joists & Headers (Nominal 2 x 10)	254 (10) 254 (10) 254 (10)	41.3 (1-5/8) 41.3 (1-5/8) 41.3 (1-5/8)	1.146 (0.0451) 1.438 (0.0566) 1.811 (0.0713)	1.087 (0.0428) 1.367 (0.0538) 1.720 (0.0677)
Joists & Headers (Nominal 2 x 12)	305 (12) 305 (12) 305 (12)	41.3 (1-5/8) 41.3 (1-5/8) 41.3 (1-5/8)	1.146 (0.0451) 1.438 (0.0566) 1.811 (0.0713)	1.087 (0.0428) 1.367 (0.0538) 1.720 (0.0677)

Standard Non-loadbearing Members

The standard non-loadbearing framing members sizes commonly used in Canada are listed in Figure 1.7. Any loadbearing stud may also be used in a non-loadbearing application; however, non-loadbearing members (studs or track) may never be used in a loadbearing (axial and/or wind loading) applications.

Figure 1.7

Standard Non-Loadbearing Member Sizes

Standard Non-Loadbearing Member Sizes (nominal dimensions)			
Commonly Used Application	**Web Depth mm (in)**	**Flange Width mm (in)**	**Minimum Uncoated Thickness mm (in)**
Interior Bulkhead Construction	41.3 (1-5/8)	31.8 (1-1/4)	0.455 (0.0179)
Miscellaneous Interior Framing	63.5 (2-1/2)	31.8 (1-1/4)	0.455 (0.0179)
Interior Non-Loadbearing Studs	92.1 (3-5/8 or 3-1/2) 152 (6)	31.8 (1-1/4) 31.8 (1-1/4)	0.455 (0.0179) 0.455 (0.0179)

Standard Track Sections

Standard track sections (see Figure 1.4) are available to accommodate all sizes of joists and studs. It is important to note that track sections are not designed to carry structural loads without the in-line placement of loadbearing framing members. Engineered design is necessary when in-line framing is not used.

Built-up Sections

Track sections can be combined with C- sections to form built-up sections (see Figure 1.5) to use as floor beams, headers, lintels, trimmers, jamb or jack studs, and at other locations requiring extra strength. All built-up sections should be made from members of equal thickness, and fastened together at least every 610 mm (24 in) o.c. The sections used in these built-up members must be continuous lengths, unless their purpose is non-structural (i.e. closing off rough openings).

Tables are shown in this Handbook which provide the capacity of several types of built-up members most commonly used in the construction of steel framed homes. Other configurations may be assembled, but their capacity must be determined by a design professional in accordance with CSA Standard S136.

Accessories

Manufacturers of lightweight steel framing also produce a range of accessories required for residential construction, including flat strap bridging, web stiffeners, and clip angles.

Horizontal Wall Bridging

Horizontal flat strap bridging is used to provide rotational restraint for loadbearing studs and is attached to both faces of the stud (see Figure 1.8). Flat strap bridging is at least 38 mm wide and 0.879 mm thick (1-1/2 x 0.0346 in) sheet steel material. The design of the stud will dictate the maximum spacing of these straps as shown in the Member Selection Tables (Appendix A) or the manufacturers' catalogues. If exterior structural sheathing (e.g. OSB or plywood attached directly to the stud) is used, the flat strap bridging is not needed on that side of the stud, however it still must be installed on the interior stud flange.

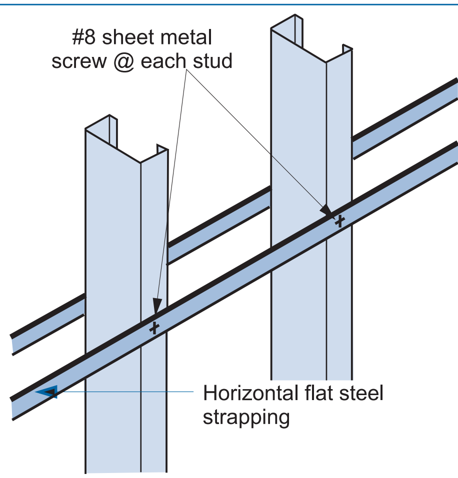


Figure 1.8

Horizontal Flat Strap Wall Bridging

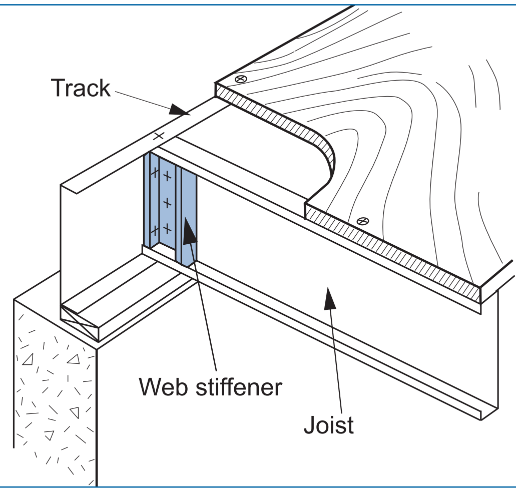
Web Stiffeners

A web stiffener (as shown in Figure 1.9) is used in all locations where a concentrated load acts on a floor joist or track section. A web stiffener is a short piece of loadbearing stud with a thickness at least 0.879 mm (0.0346 in). The stiffener has a 38 mm (1-1/2 in) wide flange to allow it to fit within the

41 mm (1-5/8 in) flanges of the joist. The minimum length of the stiffener shall be the depth of the member being stiffened minus 9 mm (3/8 in). Stiffeners can be installed on either side of the joist web, fastened to the joist with at least 3 - #8 screws. The LSF fabricator normally supplies these stiffeners as part of the floor joist package.

Figure 1.9

Web Stiffener

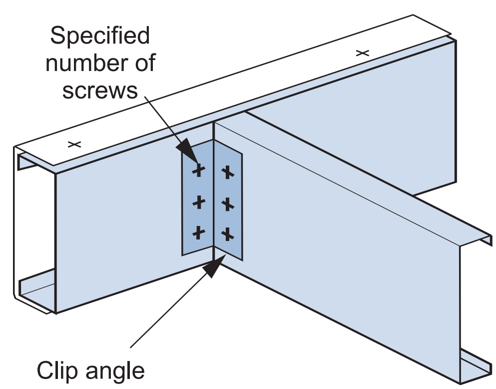


Clip Angles

Clip angles are needed to connect floor joists to headers, lintels to king studs, or headers to trimmers (see Figure 1.10). Clip angles shall be at least 1.438 mm (0.0566 in) thick and the length must be no less than the depth of the joist minus 25 mm (1 in). The number of screws connecting the clip angle depends on the size of the members being connected.

Figure 1.10

Clip Angle



Fasteners

Screws are used almost exclusively in lightweight steel framing. A self-drilling sheet metal screw (SMS) can drill the hole and securely fasten materials together. These screws come in a variety of sizes and head types to fit a full range of requirements. In special circumstances, or for highly repetitive installations, specialized tools and other forms of mechanical fasteners such as pneumatic pins or welding may be more economical. The LSF fabricator, fastener supplier or tool supplier can provide additional information. The connections in this guide are limited to screw fastening only.

Note that the #8 screws often specified in this Handbook are minimums and that larger screws may be needed for thicker members.

Screw Head Types

Self-drilling screws are manufactured in a variety of head configurations to meet specific installation needs and installers' preferences. The most common driving recesses for the screw head are the No. 2 Phillips and No. 2 Robertson. The following list describes the various types of screw heads available, which are illustrated in Figure 1.11.

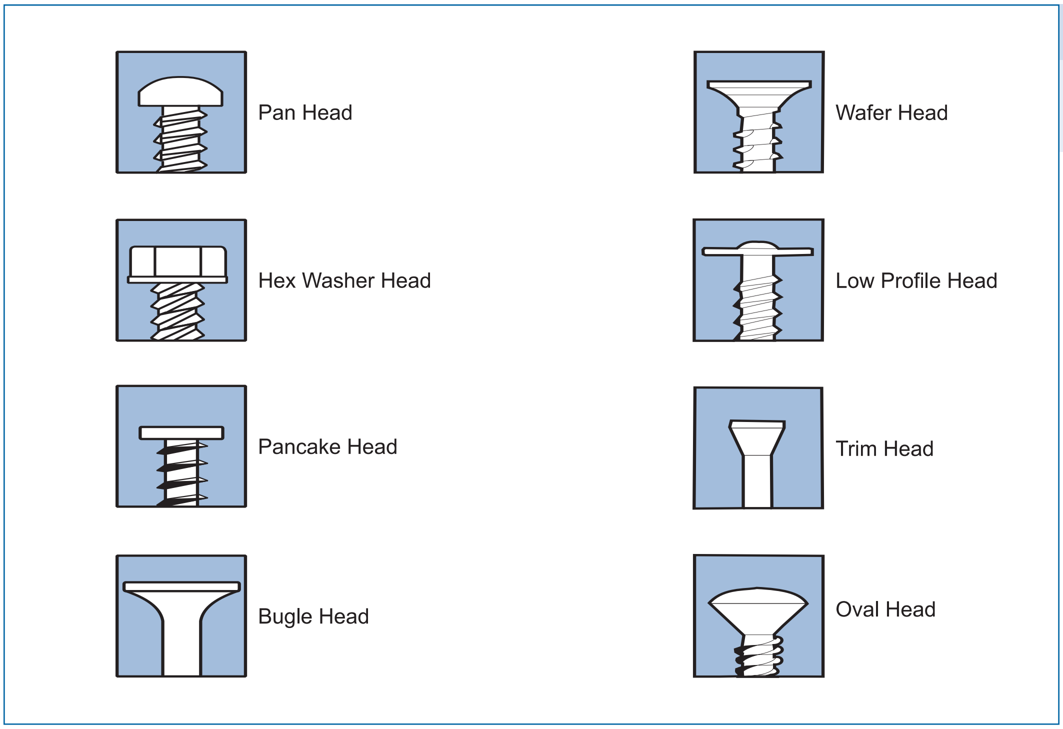


Figure 1.11

Screw Head Types

Pan Head: This head configuration generally fastens studs to track, connects steel bridging, strapping or furring channels to studs or joists, and steel door frames to studs.

Hex Washer Head: This head style is commonly used for fastening thicker framing components and accessories, exterior connections and connections that do not interfere with finishes. The washer face provides a bearing surface for the driver socket, assuring greater stability during driving. The 8 mm (5/16 in) size head is most common.

Pancake Head: An extremely low profile head commonly used for attaching metal lath to steel framing or in areas where rigid finish material is to be installed over the tops of the screws. These are also sometimes referred to as wafer head screws.

Bugle Head: This head style is designed to slightly dimple gypsum wallboard, plywood sheathing or other finishing materials without crushing the material or tearing the surface. It leaves a flat, smooth surface for easy finishing.

Wafer Head: Larger than the flat or bugle head, the wafer head is used for connecting soft material to steel studs. The large head provides an ample surface yet sits flush to achieve a clean, finished appearance.

Low-Profile Head: This head style is commonly used for connecting LSF components when rigid finishing materials are to be used

Trim Head: Used for fastening wood trim or thicker dense material to steel studs. The small head sinks into the trim material, allowing easy finishing with minimal disturbance of the material surface.

Oval Head: Used when an accessory that will be attached to the framing has oversized holes (e.g. electrical boxes) and for attaching cabinets and brackets to framing.

Screw Point Type and Thread Configuration

There are two common screw point designations used in residential steel framing: sharp point and drill point (see Figure 1.12). Sharp points are for steels up to 0.879 mm (0.0346 in) thick and may have a sharp needle or piercing point similar to that currently used for sheet metal in HVAC systems. Drill points are designated for individual sheets up to 12.7 mm (0.5 in) thick and have a shorter, fluted tip specifically designed for drilling.

Figure 1.12

Sharp Point and Drill Point

There are two main types of screws used for lightweight steel framing, sharp point and drill point. Drill point is often referred to as a sheet metal screw (SMS).

Sharp Point
Sharp point screws can be used on steel up to 0.879 mm (0.0346 in) thick

Drill point or SMS
SMS should be used for members thicker than 0.879 mm (0.0346 in)

Depending on the thickness of the material being connected, the threads along the shank are held back from the point of the screw to prevent the threads from engaging the steel until the drilling process is complete. This prevents over-drilling the first ply or stripping the threads after partial penetration. At the other end of the screw, the threads do not continue to the screw head. When connecting wood or other rigid material to steel, this allows the screw to draw the plies together with minimal lift-up of the wood or rigid material.

Minimum Screw Sizes

Most connections in residential steel framing are required to carry loads dictated by the structural design of the building. Figure 1.13 specifies the minimum screw size depending on the total sheet thickness being connected. Connections of non-structural elements such as drywall, trim, cabinets, and insulating sheathings can use any appropriate fastener type or size.

Figure 1.13

Screw Sizes for Steel-to-Steel Connections

Screw Sizes for Steel-to-Steel Connections			
Screw Size	Point Type	Nominal Screw Diameter mm (in)	Total Thickness of Connected Steel mm (in)
#8	#2 (sharp point)	4.2 (0.164)	0.879 to 2.54 (0.0346 to 0.100)
#8	#3 (drill point)	4.2 (0.164)	2.79 to 3.56 (0.100 to 0.140)
#10	#3 (drill point)	4.8 (0.190)	2.79 to 4.45 (0.110 to 0.175)
#12	#3 (drill point)	5.5 (0.216)	2.29 to 5.33 (0.090 to 0.210)

Tools

Many of the procedures and tools used in framing with LSF members are similar to those used with wood. In addition to the tools normally used in wood frame construction, those required for LSF construction are listed below.

- 184 mm (14 in) chop saw c/w abrasive saw wheels (metal cutting wheels with tooth pattern also available)
- variable speed, reversible (VSR) screw gun with clutch (2500 rpm max)
- 8 mm (5/16 in) hex driver tip
- #2 Phillips and #2 Robertson screw tips
- vice grip clamps - 11R
- vice grip clamps - 6R
- metal snips
- felt tip permanent markers
- minimum 1.2 m (4 ft) magnetic level, 1.8 m (6 ft) preferred

Optional tools might also include:

- power shear or nibbler
- metal hole hand punch

The tools used most often are metal snips, VSR screw guns and circular or chop saws. Ensure that these are in good working order before beginning the project.

Ordering Material and Site Storage

House plans utilizing wood framing can be converted to steel framing using this manual and the Member Selection Tables (Appendix A). As well, LSF fabricators may be able to provide guidance on converting a wood design to steel. Engineering services may be required for aspects of the construction falling outside the scope of this manual.

Local LSF fabricator representatives or building supply distributors who carry steel framing components can provide current information on framing availability, pricing, and local applications. As well, some fabricators may provide guidance for design, on-site training, and proper tool selection and use.

Colour Coding

The Canadian manufacturers of residential steel framing colour code one end of the loadbearing section (joists and studs) so that the thickness of the steel can easily be identified in the field. The standard base steel nominal design thicknesses and corresponding colour codes are shown in Figure 1.14. Note that these are the common colours, but others are also used. To avoid confusion, the preferred method of ordering is by decimal thickness (mm or inches).

Figure 1.14

Colour Codes for Standard Thicknesses

Colour Codes for Standard Thicknesses		
Colour	Minimum Thickness*	
	mm	in
White	0.836	0.0329
Yellow	1.087	0.0428
Green	1.367	0.0538
Orange	1.720	0.0677
Red	2.454	0.0966

* Note: The minimum thickness of 95% of the design thickness.

Cut Lists and On-Site Cutting

Pre-cut steel framing members delivered from the LSF fabricator make the construction of stick-built steel houses somewhat different from those framed out of wood. Pre-planning and proper assembly become particularly important. Pre-planning establishes the framing member thicknesses and lengths that become a

cut list, which is used to order from the LSF fabricator. The LSF fabricator normally provides most cut-to-length studs, joists and accessories. Members of varying lengths are then carefully assembled on-site as per the drawings.

Lead-time for delivery of cut-to-length steel sections is usually very short: consult the LSF manufacturer for an exact schedule. Some standard sizes and lengths may be stocked by the LSF manufacturer. Typically, lengths under 1.2 m (48 in) are cut on-site. Check with the LSF manufacturer for their cutting practice. Manufacturers may pre-cut sections for web stiffeners, bridging, lintels, and cripple studs used around windows and doors. Track is normally sold in standard lengths, and can be ordered in special lengths for specific residential applications. The standard track lengths used in residential construction are different than those commonly used in commercial construction to accommodate structural applications where splicing is not allowed.

Cutting lightweight steel non-loadbearing studs can easily be done with metal snips. For occasional cutting of thicker loadbearing studs or joists, electric shears or nibblers are convenient. When a considerable amount of field cutting is necessary, a chop saw with an abrasive blade speeds up the construction process.

Framing Overview

There are three basic ways to frame a house: stick-built on-site (platform or balloon framing), panelized, or modular construction.

Each of these methods is used to build homes across the country today, but stick-built construction remains the most popular method. For multiple-unit projects or projects utilizing a repetitive design, panelization (prefabrication) may be used in a cost-effective manner. Wall, floor and roof panels that are pre-assembled in a factory can be shipped directly to the construction site and quickly erected. Manufactured housing, where an entire home or construction unit is assembled in a factory, may be employed to good advantage, particularly when the unit is required in an area not well serviced by the residential construction industry (e.g. remote or undeveloped locations).

In-line Framing

When supported by steel framed walls in accordance with this manual, a steel framed floor shall be constructed with floor joists in-line with loadbearing studs located below the joists, within the lilmits set out in Figure 1.1.

Screw Connections

Minimum screw sizes for steel-to-steel connections shall comply with Figure 1.13. Self-drilling sheet metal screws (SMS) are required when the total thickness of steel exceeds 0.879 mm (0.0346 in). Sharp point screws are acceptable for steel thicknesses of 0.879 mm (0.0346 in) or less. The minimum corrosion protection for screws shall be 0.008 mm (0.0003 in) of zinc or equivalent. Other types of connectors can be used with LSF such as power actuated pins, metal press joining or welding. For specific requirements for these alternative connectors, consult a design professional.

Requirements for Screwed Connections

The size and number of screws required for a sound connection are specified in the appropriate sections of this manual. The following requirements also apply:

- Head Styles, Threads and Point Types: Application conditions and manufacturer recommendations shall determine the head style, thread and point type to be used. These features are not structural properties of the screw.
- Screw Size: Figure 1.13 specifies the minimum size of screws to use.

- Penetration: All screws must extend through the steel a minimum of three (3) exposed threads.
- Edge Distance: The minimum distance from a screw to a free edge of the steel member shall be 1.5 screw diameters.
- Spacing: The minimum centre-to-centre spacing of screws shall be 2.5 screw diameters.
- Corrosion Resistance: All screws shall be coated with 0.008 mm (0.0003 in) of zinc, or another coating that provides equal or better corrosion protection.

Procedures for Screwed Connections

A variable speed (0-2500 rpm), reversible industrial strength screw gun equipped with a clutch assembly and a minimum 4.5 amp motor should be used for driving screws into steel framing. The gun should be run slowly to start the screw, then faster to finish. Once the screw goes through the steel sheets, the clutch should disengage so that the screw does not strip or break. If a screw is stripped, or continues to rotate, another screw must be installed. Pre-clamping members with locking C-clamps reduces the tendency of the framing elements to separate during screw installation. For best results use a screw gun that has a torque clutch that can be adjusted to the required setting.

Wood to Steel Connections

When connecting a wood subfloor to steel joists, #10 wafer head plymetal reamer self-drilling fasteners are suggested, although #8 bugle head screws are also often used. There are collated screws available for this purpose to use with screw guns that have extension handles to make the job easier. Space the screws at 152 mm (6 in) o.c. along the sheet edges and 305 mm (12 in) o.c. in the field. The minimum edge distance must be at least 10 mm (3/8 in). When fastening thicker wood members, refer to your fastener manufacturer for the proper fastener.

Ensure compatibility of fasteners with treated lumber. Contact screw manufacturer for details.

Adhesives are often used in addition to screws to attach the subfloor to the joists. The use of adhesives improves the stiffness of the structural system and prevents differential movement between the floor joists and the subfloor that might result in annoying squeaks later on.

Steel to Wood Connections

When connecting steel sections to wood sections, #10 wood screws are used. The screw threads need to penetrate at least 25 mm (1 in) into the wood to provide sufficient anchorage. It may be necessary to pre-drill clearance holes through thicker steel sections since the wood screws do not have a drill point.

Screwing Non-Loadbearing Framing

The standard fastener for interior non-loadbearing framing is the #6 x 11 mm (7/16 in) pan head sharp point screw. These screws are easily driven through the track and flanges of non-loadbearing steel studs with a cordless screwdriver. The pan head provides a finish suitable for drywall sheeting. Clinching can also be used for this type of framing.

Screwing Drywall

For steel thickness up to 0.879 mm (0.0346 in), drywall should be applied with a #6 x 31 mm (1-1/4 in) sharp point drywall screw. For heavier steel thickness, a drill point drywall screw is available .

Finish Work

An air nailer is most commonly used to fasten baseboards, mouldings, and other finish elements to steel framing. Finishing screws are also available.

Safety

Simple safety practices can eliminate most injuries and are an important aspect of daily work on a job site. Each province has their own health and safety act and this should be adhered to at all times. Working with steel presents specific health and safety risks that you should be aware of, some of these include:

- Steel becomes very slippery when wet or covered with ice.
- Steel exposed to sunlight or freezing temperatures may become extremely hot or cold to the touch.
- It is important to always remember that, unlike wood, steel conducts electricity. Always pay attention that steel members are not in contact with an electrical source in order to prevent the risk of electrocution.
- Joists are not stable until they have been properly braced by a subfloor. Similarly, workers should not stand on the top track of a steel wall. The steel track may deform under the weight of a person.

This is by no means a comprehensive list. Consult your local Ministry of Labour and inform yourself of all necessary precautions to protect yourself and others on site.

Design, Drawings, Permits and Cut Lists

There may be any number of details that must be designed by a design professional, and these must be included in the building permit application.

Once architectural drawings have been prepared they should be sent to the truss manufacturer, or to the design professional if they are designing the roof. Truss and roof drawings must also be part of the building permit application.

The builder must create a cut list from the plans, which lists all the members required for the job. Often, the manufacturer will help you with this task.

Getting Started Checklist			
		Y	N
Pre-Planning	Set up meeting with building official		
	Set up meeting with manufacturer		
	Set up meeting with designer		
	Set up meeting with electrical inspector		
Manufacturer	Cut list		
	Delivery Schedule		
	Accessories - clip angles, web stiffeners, strapping, blocking, fasteners, grommets, standoffs		
Trades	Qualify all trades for steel construction		
	Ensure proper layout for HVAC and plumbing stacks, toilet traps		

Chapter Two
Foundations

Introduction

This chapter provides an overview of the fundamental issues relating to foundations supporting lightweight steel framed houses. Typically foundations for lightweight steel framed houses are constructed as they would be to accommodate a wood-framed structure and no special requirements are necessary.

As with any foundation, it must be designed and constructed to resist all loads acting upon it. Structural loads, occupant loads as well as wind and snow loads all must be transferred down through the foundation onto the soil or rock below it. The foundation must also resist lateral loads such as soil and water pressures that may be exerted against it. It must transfer all of these loads onto the footing which rests on suitable soil or rock.

The proper design and construction of the foundation affects the rest of the structure that rests on it. The foundation must provide a level surface to support the frame. A poorly built, out-of-square foundation often translates into a poorly built, out-of-square home.

Foundations should not settle significantly over time or be affected by freezing and thawing of soils. Controlling moisture and heat flow in basements should be considered in order to create a comfortable living space.

In many instances, foundations are also expected to control potentially harmful soil gases, such as radon, from entering the basement. In a number of regions in Canada specific measures must be adopted. Refer to your local building code and construction guides for specific information applicable to your area.

Footings

Footings must be designed to properly transfer and distribute the loads they support. Footings must be located under all walls, pilasters, columns, piers, fireplaces and chimneys. Most building codes will dictate a maximum supported span of floor joists and/or live loads beyond which the foundation must be sized by a design professional.

In general, footing sizes depend upon the amount of load carried and the bearing capacity of the soil. The larger the load or the weaker the soil, the larger the footings required. Figures 2.1 and 2.2 can be used to size conventional strip footings where the bearing capacity of the soil is at least 75 kPa (1500 psf).

Building Science Note

Protecting basement wall tracks from freshly poured concrete

To prevent the bottom wall track of basement walls from coming into contact with fresh concrete as the floor slab is poured, the track can be wrapped in polyethylene (See Figure 2.2).

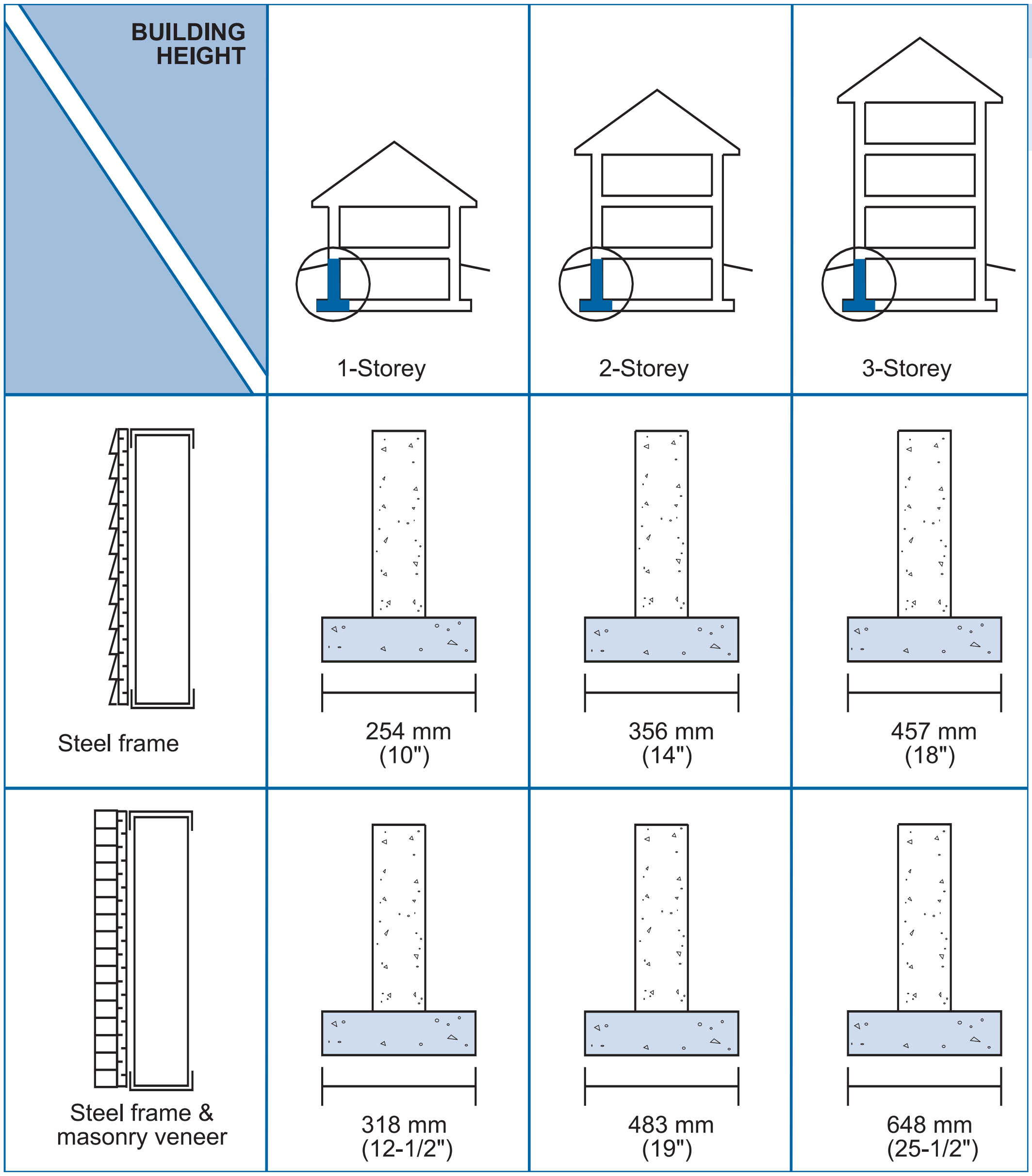
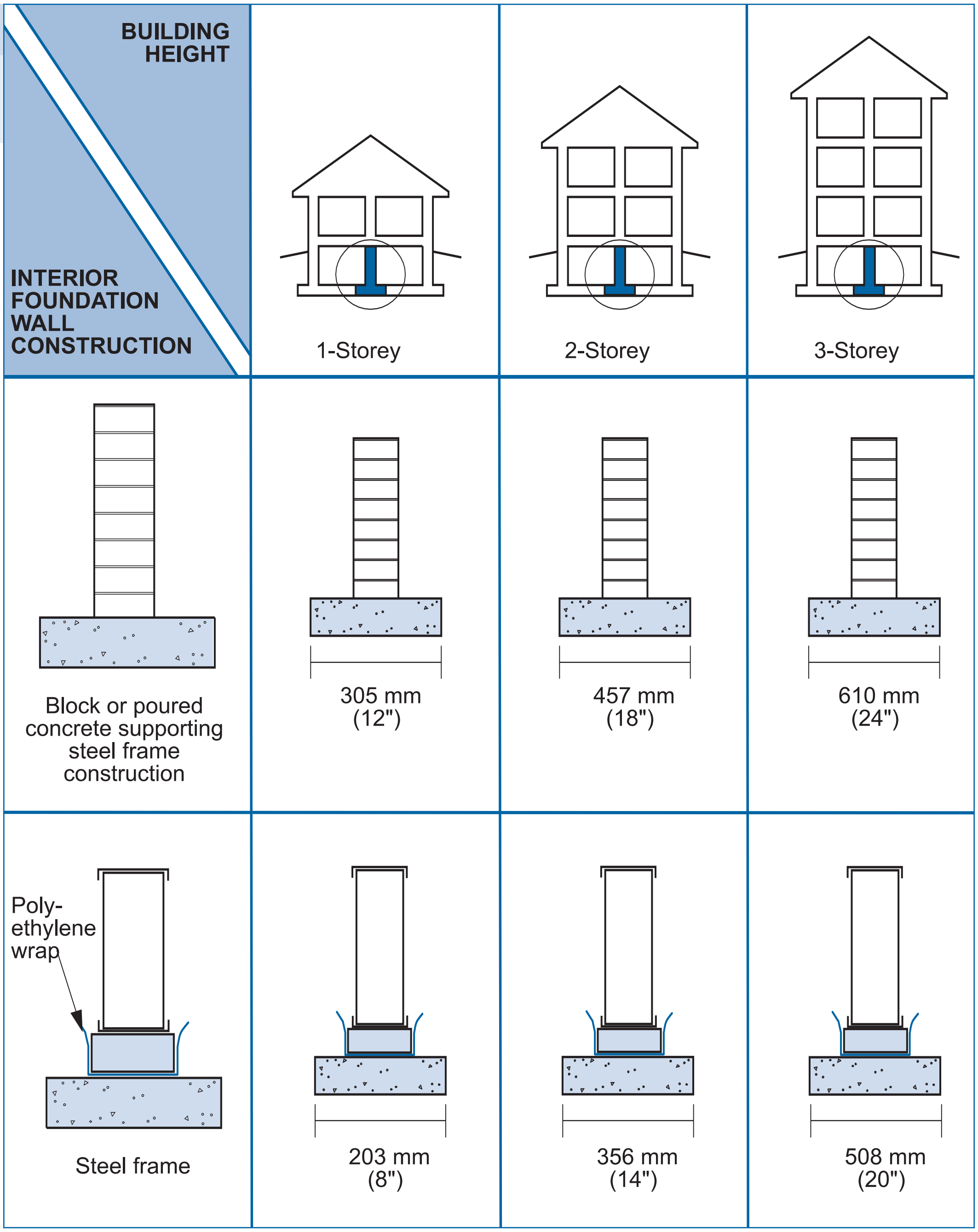


Figure 2.1

Footing Sizes Under Exterior Walls

Figure 2.2

Footings Under Interior Walls



Once the footing width is determined, the footing thickness can be calculated. The thickness is never less than the projection beyond the footing's supported element. For column footings, the projection is typically measured from the edge of the column's steel base plate to the edge of the footing. See Figure 2.3

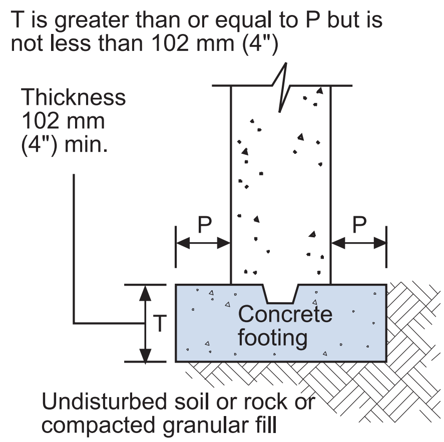


Figure 2.3

Requirements Common to all Footings

It is important that the excavation is done to the correct elevation and that the bottom of the excavation is level. Footing framing must also be level and square. Concrete strength for footings must conform to all of the requirements of local codes. Typically concrete for house footings must have a strength of at least 15 MPa (2200 psi) at 28 days, refer to NBCC article 9.3.1.6.

Foundation Walls

Foundation walls supporting steel frames are typically made of poured concrete or masonry but can also be of insulated concrete forms (ICF) and preserved wood.

Foundation walls must safely support all loads transferred from the building above as well as withstand any external loads from earth, water or earthquakes. When foundation walls are made of poured concrete proper practice includes attending to proper curing time, appropriate use of admixtures and proper care in extreme weather conditions.

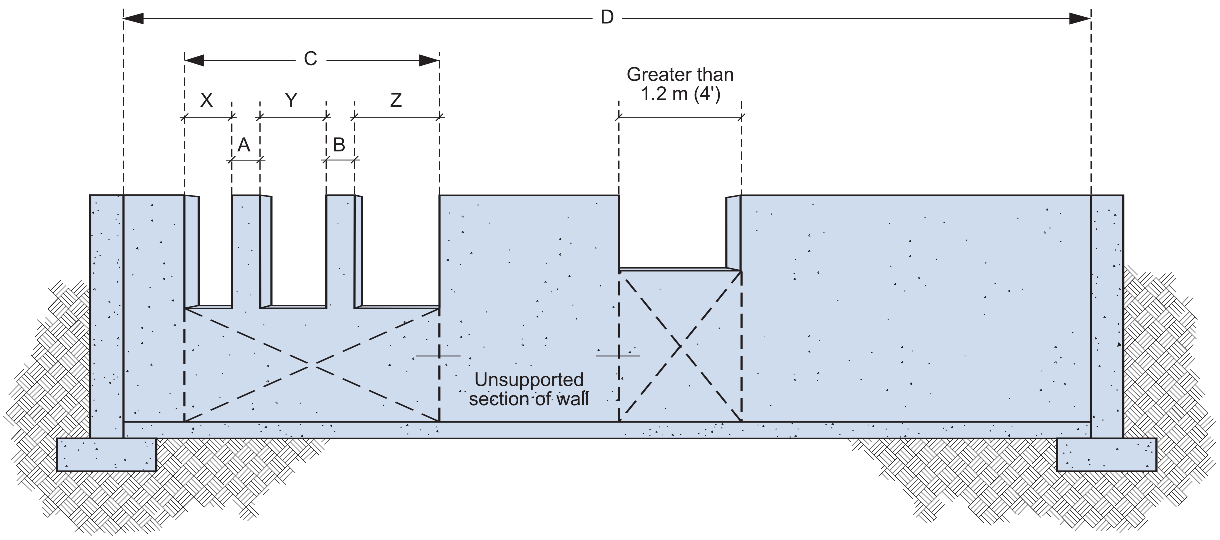
Exterior foundation walls can be considered laterally supported or unsupported. A wall is considered laterally supported if the floor system is anchored to the foundation wall regardless of floor joist direction. The same wall would be considered laterally unsupported if large window or door openings are installed. See Figure 2.4 for more specific information.

Whether foundation walls support a steel frame structure or a wood frame structure, the same issues need to be addressed, namely: crack control, parging and finishing, dampproofing, foundation and surface drainage, waterproofing, backfilling and soil gas control.

Inevitably irregularities at the top of the foundation may occur. Steel framing is usually able to tolerate the same variations from level, plumb and square as wood framing. It is important, nonetheless that exterior framing bear directly on the foundation. If a foundation is so uneven that the sill gasket cannot accommodate it, it must be properly repaired with grout or chiseled and chipped.

Figure 2.4

Laterally Unsupported Walls



If A is less than X+Y divided by 2, then opening equals X+A+Y, and
If B is less than Y+Z divided by 2, then opening equals X+A+Y+B+Z, and
If C is more than 25% of D or 1.2 m (4'), then wall below is unsupported

When a foundation wall contains an opening more than 1.2 m (4') in length or contains openings in more than 25% of its length, that portion of the wall beneath such openings shall be considered laterally unsupported, unless the wall around the opening is reinforced to withstand the earth pressure.
(9.15.4.2 (3))

When the length of solid wall between windows is less than the average length of the windows, the combined length of such windows shall be considered as a single opening for the purposes of Sentence (3) above.
(9.15.4.2 (4))

Attachment to Foundation Walls

There are various methods of floor system anchorage for a steel frame house:

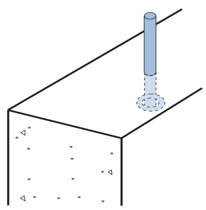
1. Use a wood sill plate in the same manner as in a wood frame house; or
2. Attaching the closure channel directly to the foundation; or
3. Use a nested stud and track. This technique employs a piece of steel track in combination with stud to replace the wood sill plate.

It is important to remember that any steel close to or in contact with concrete must be corrosion resistant. With every type of system a sill gasket, a double bead of non-hardening caulking, or a mortar bed must be provided under the sill plates (or under the closure channel if a sill plate is not used) as required by local building codes, this prevents direct contact between the steel and concrete.

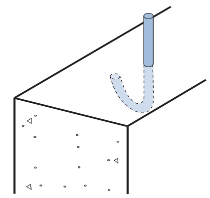
Foundation Anchors

Foundation anchors that connect the foundation and the house frame are usually sunk into the concrete before it cures. If the foundation wall is made of concrete block the anchors are embedded in the mortar which fills the top course of block. The size and spacing of anchor bolts must follow the requirements of local building codes.

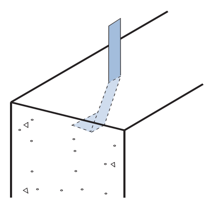
Several different types of foundation anchors exist, see Figure 2.5. Critical for all types of anchor is that a proper bond is achieved between the anchor and the foundation to resist 'pull-out'. J-bolts and threaded rods are embedded in the foundation with a threaded portion protruding for the attachment of the sill plate or rim joist. Embedded into the foundation wall is either a J-section or a nut and bolt that provide added resistance. Both J-bolts and threaded rods are commercially available.



Threaded rod
Threaded rods should be spaced at a maximum of every 2400 mm (94") o.c. They should be placed in the foundation so that they will go through the centre of the sill plate and should not interfere with joist placement.



J-bolt
J-bolts should be spaced maximum every 2400 mm (94") o.c. They should be placed in the foundation so that they will go through the centre of the sill plate and should not interfere with joist placement.



Anchor tie
Anchor ties should be spaced according to manufacturer's specifications. Anchor ties can only be used when fastening the closure channel directly to the foundation. They should be placed in a foundation so that they can be screwed to the back of the closure channel.

Figure 2.5

Foundation Anchor Types

Epoxied anchor bolts can be used if the contractor does not want to embed anchors. Once the concrete has cured and the holes have been cleaned, appropriately sized holes are drilled into the concrete and fitted with a threaded rod. An epoxy resin is injected into the hole to form a strong bond.

Anchor ties, as described in later sections, are another way of fastening a steel frame to the foundation. The size and spacing of the anchor bolts is specified by the building code as a minimum diameter of 13 mm (1/2 in) bolts spaced at a maximum 2400 mm (94 in) o.c. Anchor bolt placement is illustrated in Figure 2.6.

Figure 2.6

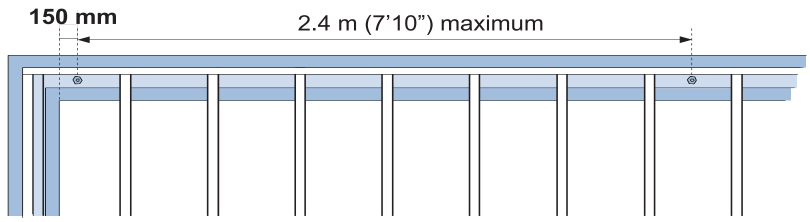
Anchor Bolt and Joist Spacing

Looking Ahead

Anchor Bolts Interfering with Joist Placement

If anchor bolts are interfering with joist attachment, the anchor bolts can be cut off at the top of the foundation and a new anchor bolt can be epoxied into place close to it. It is best, however, to plan ahead so that this will not happen.

Anchor bolts must be spaced at most 2.4 m (7'-10") o.c. according to the National Building Code of Canada. It is important that the anchor bolts do not interfere with the joists. To avoid such interference the first anchor bolt should be approximately 150 mm (6") from the inside of the foundation wall.



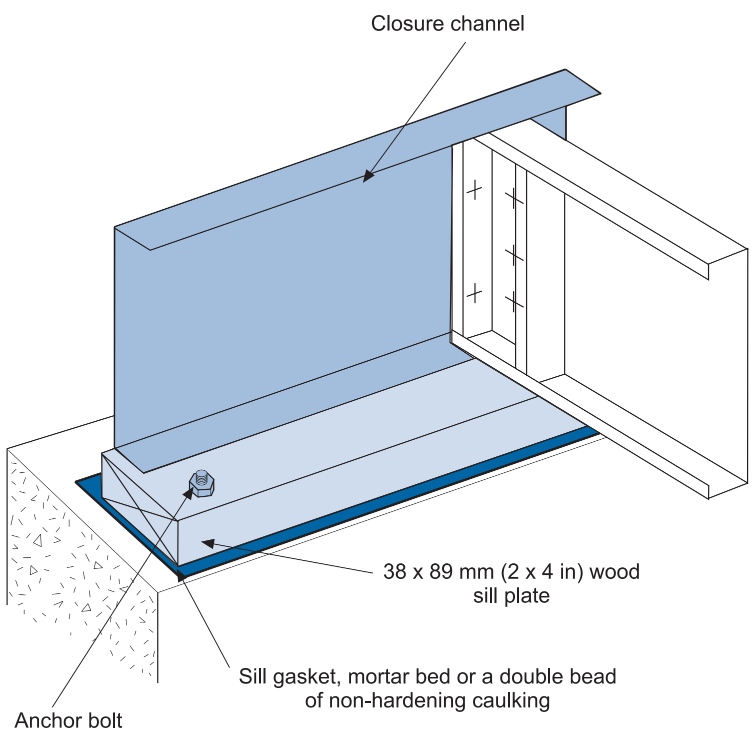
Wood Sill Plate Anchorage

In the wood sill plate anchorage technique a wooden member, usually 38 x 89 mm (2 x 4 in), is fastened to the foundation via anchor bolts. As depicted in Figure 2.7 a sill gasket, a double bead of non-hardening caulking, or a mortar bed must be provided between the sill plate and the foundation.

The closure channel or rim joist must be securely fastened to the wood sill plate by means of a steel plate, as shown in Figure. 2.8, or through the flange of the closure channel into the plate.

Figure 2.7

Wood Sill Plate



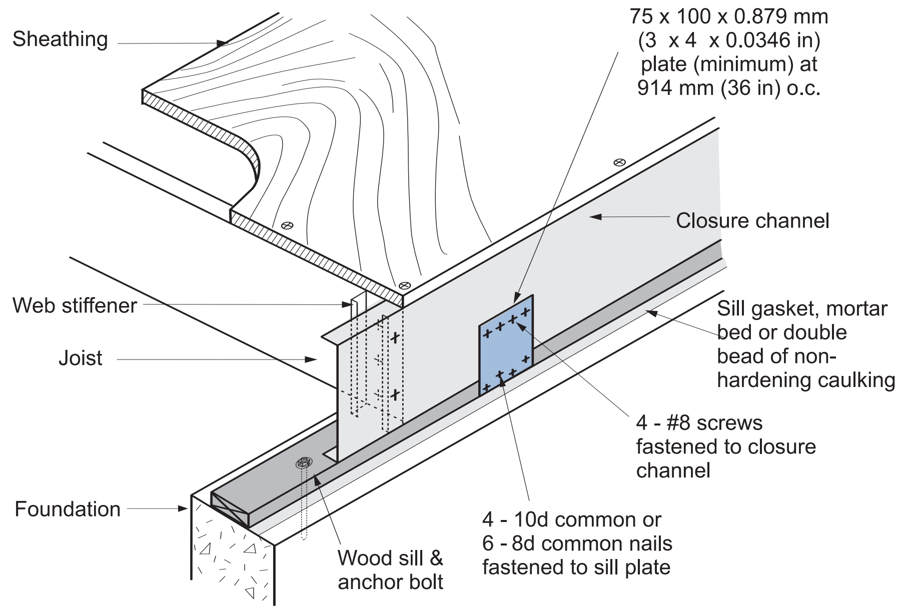


Figure 2.8

Floor to Wood Sill Connection

If the location of the anchor bolts interferes with the placement of the closure channel, the lower channel flange can be notched to accommodate the bolt. In no case, however, should the anchor bolts interfere with the connection of the joist to the closure channel: joists may never be notched. As an alternative, the holding nuts can be counter sunk and the anchor bolts trimmed so that sill plate surfaces remain smooth.

When using a wood sill plate it is recommended that the wood be kiln dried to decrease moisture and shrinkage issues.

Direct Bearing Anchorage

Using direct bearing anchorage the closure channel/rim joist can be anchored directly to the foundation without the use of a sill plate. This eliminates issues of shrinkage experienced with wood but could be problematic if the foundation is not even. As with the wood sill plate method a sill gasket, a double bead of non-hardening caulking, or a mortar bed must be provided between the foundation and the rim joist.

There are two ways to connect the rim joist to the foundation: by means of a clip angle or with an anchor tie.

A clip angle is used in conjunction with an anchor bolt. The clip angle is fastened with 8- #8 screws to the rim joist and bolted to the foundation, they are spaced according to the required anchor bolt spacing, at least every 2400 mm (94 in) o.c. See Figure 2.9.

Anchor ties are cast directly into the foundation and then fastened to the exterior side of the closure channel, as shown in Figure 2.10. The ties must be spaced in accordance with the layout of the x-bracing used for wind and racking resistance, see Chapter 4. Anchor ties are proprietary systems and therefore information about spacing and fasteners is normally available from the manufacturer or specified by a design professional. As with all fastening systems, the spacing may be no greater than 2400 mm (94 in) o.c. as per building code.

Figure 2.9

Clip Angle without Sill Plate

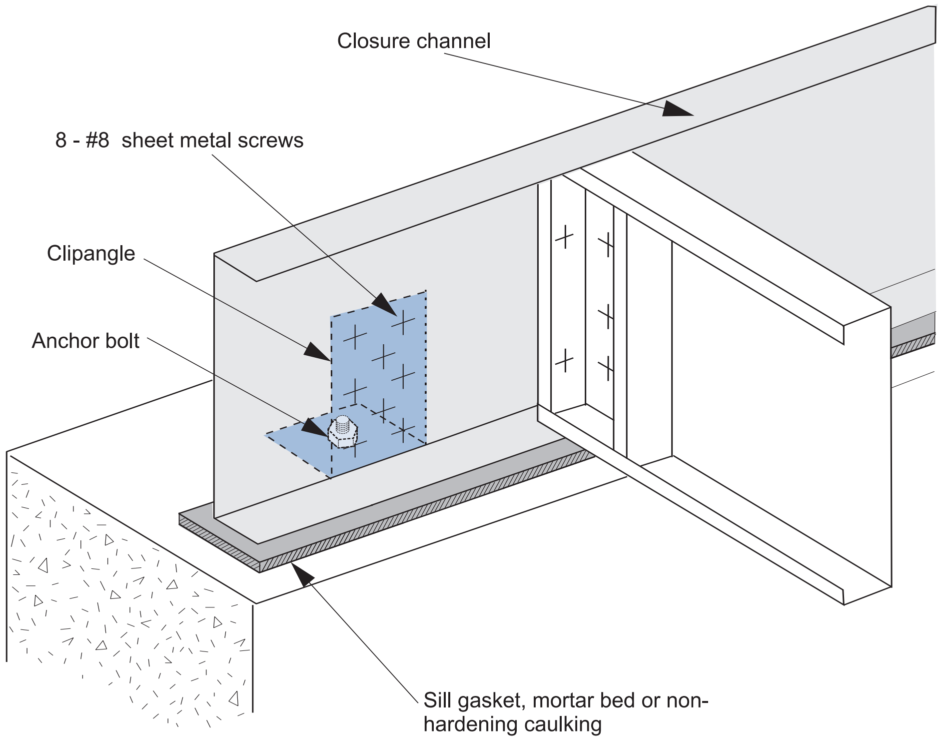
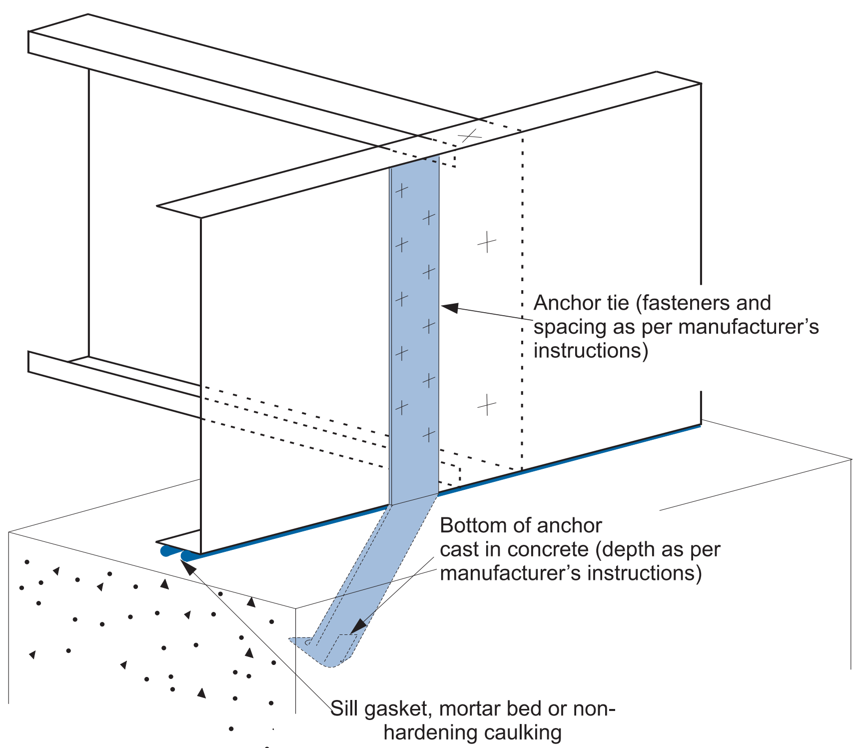


Figure 2.10

Anchor Ties



Nested Track and Stud Sill Plate

This anchorage takes advantage of the ability of a steel sill plate to create a level surface while avoiding the shrinkage issues of wood. A nested track and stud are used as a sill plate, anchored with anchor ties. A closure channel is screwed onto the track and stud. Figure 2.11 illustrates this system. Attachment of the closure channel to the sill plate and the sill plate to the foundation is the same as described under the wood plate attachment requirements.

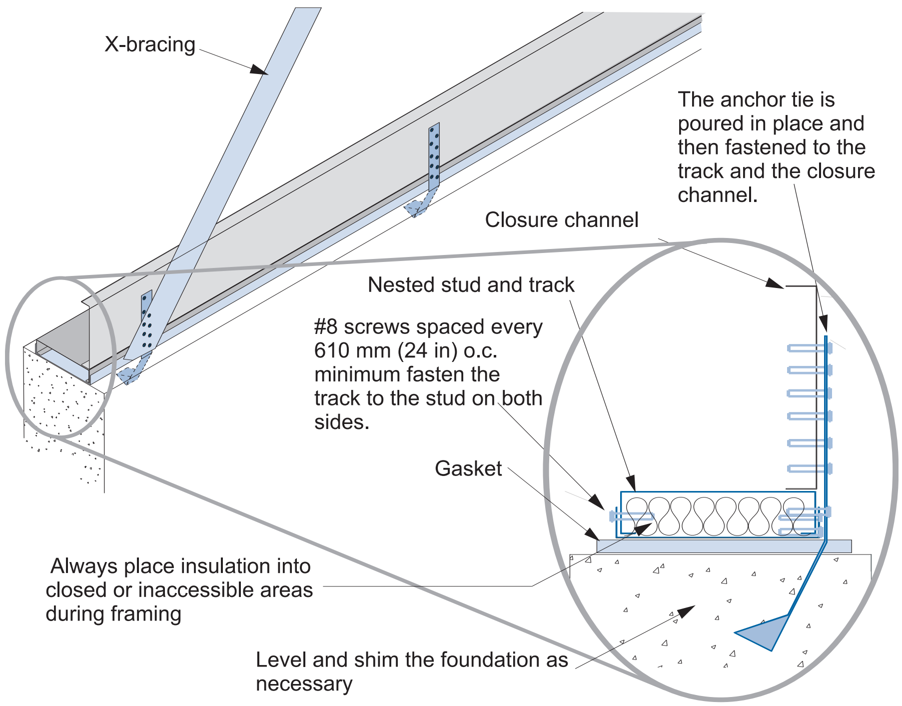


Figure 2.11

Nested Track and Stud Detail

Other Foundation Types

Other foundation types may include proprietary systems such as insulated concrete forms. These systems should include specific instructions for the attachment of steel framing.

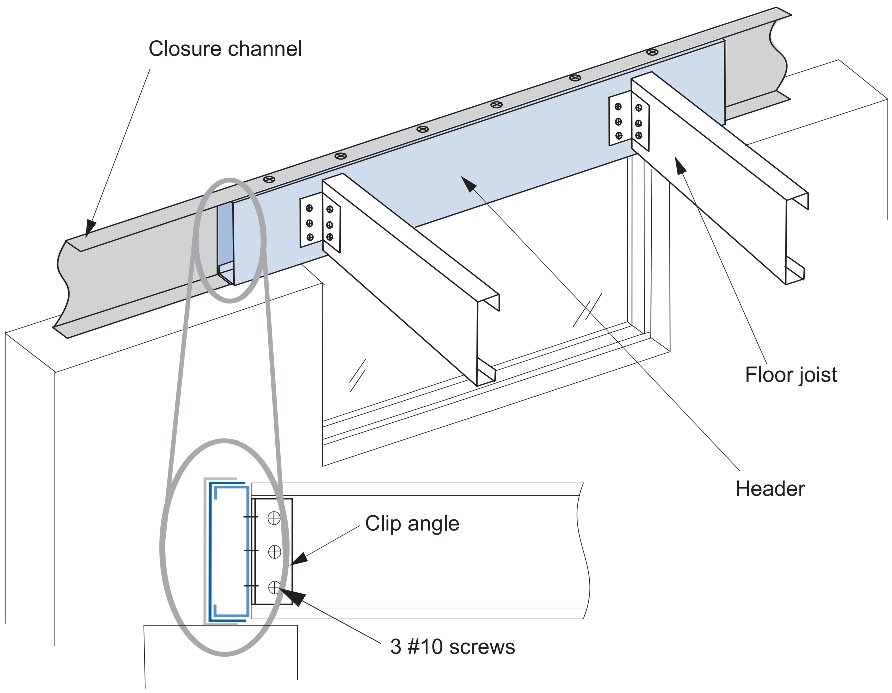
Accommodating Window and Door Openings in Foundation Walls

Where openings occur in basement walls to accommodate windows, a header is required to support the loadbearing walls and floor joists as shown in Figure 2.12. Note that in these areas the floor joists must be shorter since they attach to the header rather than the closure channel. Header and header selection are discussed in detail in Chapter 4.

Loadbearing basement window frames are available for small windows, which can eliminate the need for a header. Refer to your window supplier.

Figure 2.12

Framing Over Basement Openings



Loadbearing basement window frames are available for small windows which can eliminate the need for a basement window headerl. Refer to your window supplier.

Special Considerations

At this stage the final cut list should be considered. Although the cut list should be prepared before construction, the final order should only be made once the foundation has been poured and field measurements made. If the foundation is not placed as planned, joist lengths need to be adjusted in order to accommodate the new dimensions. Double span joists can be adjusted by increasing their lap.

Looking Ahead

Anchor ties and X-bracing

If using anchor ties remember that their layout should correspond with the layout for the x-bracing in the walls.

Looking Ahead

Exterior Finishes

Remember to plan your foundation wall with your exterior finish in mind. Sometimes it is necessary that the foundation be wider than the required minimum in order to adequately support a finish such as brick veneer.

Foundations Checklist			
		Y	N
Top of Foundation Walls	Top of foundation walls are level, or have been chipped and grouted to provide a level surface		
	A sill gasket, mortar bed or double row of non-hardening caulking has been installed between all framing members and the foundation		
Wood Sill Plate	Anchor bolts are a minimum diameter of 13 mm (1/2 in) bolts spaced at a maximum 2400 mm (94 in) o.c.		
	If closure channel is fastened to the wood sill plate by means of a steel plate, the steel plate is fastened with 4-#8 screws to the closure channel and 4- 10d or 6-8d common nails connect the steel plate to the wood sill		
	The closure channel can be fastened with screws through the flange to the sill plate		
Direct Bearing Anchorage	If using anchor bolts and clip angles, the clip angle is fastened with 8- #8 screws to the rim joist and bolted to the foundation, they are spaced according to the required anchor bolt spacing, at most every 2400 mm (94 in) o.c.		
	If using anchor ties, they have been installed and spaced according to manufacturer's directions, at a spacing no greater than 2400 mm (94 in) o.c.		
Nested Track and Stud Sill Plate	Anchor bolts are a minimum diameter of 13 mm (1/2 in) bolts spaced at a maximum 2400 mm (94 in) o.c.		
	If closure channel is fastened to the wood sill plate by means of a steel plate, the steel plate is fastened with 4-#8 screws to the closure channel and 4-#8 screws connect the steel plate to the sill plate		
	The closure channel can be fastened with screws through the flange to the sill plate		
Openings in Foundation Walls	All openings have had a header designed from the appropriate Member Selection Tables (Appendix A) or have structural windows installed		

The Lightweight Steel Frame House Construction Handbook

Chapter Three

Floor Systems

Introduction

Floors must be designed and built to resist all superimposed loads and transfer these loads to the exterior walls and foundations. Floors support not only their loads but often the loads from roofs and other floors as well, before ultimately transferring the loads to the foundation. Floors must resist deflection and minimize vibration. They must also provide an acceptable surface for finished flooring materials. Components of the floor system such as floor joists, flat strap bracing, web stiffeners, intermediate support beams and clip angles can all be selected without additional engineering. This chapter describes the construction of lightweight steel floors for houses. It shows how the various components of the floor system are assembled to meet the needs of today's home buyers.

A cut list, used for ordering material, needs to be created. It specifies the quantities of each size of joist, by thickness and exact length. In some cases, short framing members (i.e. less than 1.2 m (4 ft)) may need to be cut on-site. In general, the floor system is built with steel floor joists that frame into closure channels that act as conventional rim joists in wood frame construction. The closure channels are attached to sill plates or anchored directly to the foundation. The subfloor is attached to the top of the steel floor joists. Floor finishes are installed conventionally on the subfloor.

Review & Re-evaluate - Screw Sizes

Minimum screw sizes for steel-to-steel connections shall comply with the table below. There are two common screw point designations used in residential steel framing: sharp point and drill point (also known as self-drilling sheet metal screws). Self-drilling sheet metal screws (SMS) are required when the total thickness of steel exceeds 0.879 mm (0.0346 in) and are designated for individual sheets up to 2.8 mm (0.112 in). Sharp point screws are acceptable for steel thicknesses of 0.879 mm (0.0346 in) or less.

Screw Sizes for Steel-to-Steel Connections

Screw Size	Point Type	Nominal Screw Diameter mm (inches)	Total Thickness of Connected Steel mm (inches)
#8	#2 (sharp point)	4.2 (0.164)	Up to 0.879 (0.0346)
#8	#3 SMS (drill point)	4.2 0.164	2.79 to 3.56 (0.100 to 0.140)
#10	#3 SMS (drill point)	4.8 (0.190)	2.79 to 4.45 (0.110 to 0.175)
#12	#3 SMS (drill point)	5.5 (0.216)	2.29 to 5.33 (0.090 to 0.210)

Loads & Framing

In-line Framing

Lightweight steel framing members must always be placed in-line, that is, wall studs must sit directly on floor joists, see Figure 3.1. The maximum distance between the centre lines of the joist and the stud is defined in Figure 1.1.

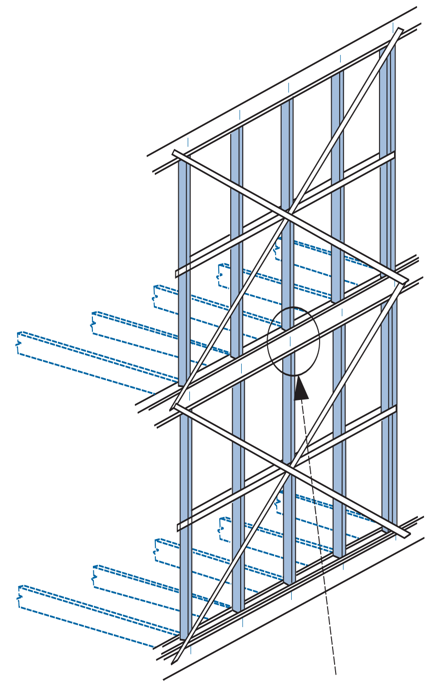


Figure 3.1

In-line Framing

Loads and Deflections

There are many different types of loads acting on floors. Dead loads are the loads imposed by all permanent elements of the building including floors, walls, partitions, ceilings and roofs. Live loads are any non-static load such as those from people and furniture as well as from rain, snow, wind and earthquakes. Information regarding loads that act on your buildings can be found in your local building code.

Floors are also subject to deflection and vibration and must be adequately designed to specific limits for each. Selecting the appropriate thickness and depth of structural members will counteract sagging and prevent problems like bouncy floors. Proper member selection will also help to protect ceiling finishes from cracking because of excessive movement.

Usually it is best to orient floor joists in such a way that they span the shortest possible distance. This optimizes the load carrying abilities of the floor and reduces vibration and deflection. Of course, this isn't always possible. Floor joist orientation is normally a compromise among economics, material and design.

Joists can have a span that is either single or continuous, see Figure 3.2. Single span joists span between two points without any intermediate support. A continuous span joist is a floor joist that spans without cut or splice between two points and has one or more intermediate supports. Continuous span joists often require less depth and thickness than single span joists because the intermediate supports decrease both the bending moment and the total deflection.

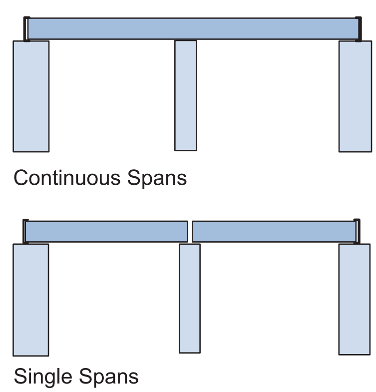


Figure 3.2

Continuous vs. Single Spans

Looking Ahead

When planning your joist spacing remember that it will have to correspond to your stud and rafter spacing.

Determining Loads and Selecting Members

Drawings are required to establish the floor framing layout and the member sizes to be used. The layout should incorporate the most efficient direction for the joists to span with joist sizes selected from the Member Selection Tables (Appendix A).

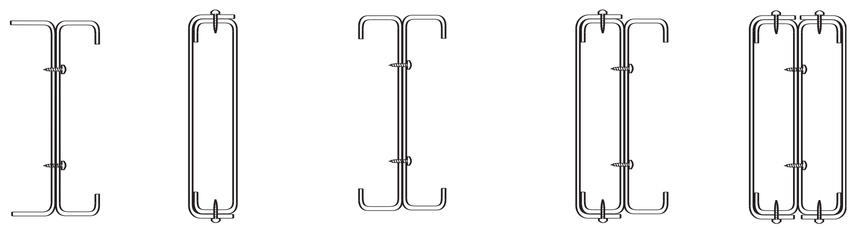
This chapter outlines how to determine the relevant loads for floor systems and how to select framing members. These can be used to produce detailed house plans that show the size, direction and span of floor joists and locations of floor openings.

Beams

Beams for lightweight steel construction normally consist of structural steel beams or built-up joist and track members. Built-up lightweight steel members must be engineered. However, the Member Selection Tables (Appendix A) do provide beam configurations for headers and trimmers required for floor openings (discussed later in this chapter). The built-up members are fastened together with screws at 610 mm (24 in) o.c. as shown in Figure 3.3. An alternative method of connecting built-up members is by welding. If welding is used, consult a design professional for specifications and requirements.

Figure 3.3

Built- Up Sections

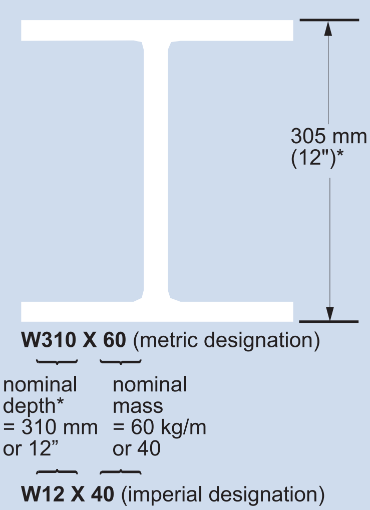


These combinations must be engineered for built-up beams. The diagrams illustrate how to combine various members.

Figure 3.4

Steel Beam Designations

Steel Beam Designations



*In some cases the nominal depth may be significantly different from the actual depth. Consult your supplier for exact dimensions or the Canadian Institute for Steel Construction Handbook of Steel Construction

Selection of Structural Steel Beams

Structural steel beams (as opposed to built-up lightweight steel beams) are selected in the same fashion as in wood framing. To select the appropriate beam consult Figures 3.4 and 3.5.

Installation of Structural Steel Beams

Structural steel beam sizes are selected from the appropriate building code requirements.
In cases where lapped joists are supported on a steel beam, as illustrated in Figure 3.6, if joists are next to one another the webs are placed back-to-back. The clip angle is inserted between the two joists connecting them to each other and to the beam. For fastening to the steel beam, #5 drill point self-drilling screws can be used instead of pins. When the supported joist is continuous a clip angle sits under it to fasten it and a web stiffener is inserted (see web stiffener section and Figure 3.7).

Figure 3.8 shows how joists can be framed flush with steel beams.

Figure 3.5	NBCC Table 9.23.4.3 Maximum Spans for Steel Beams Supporting Floors in Dwelling Units						
Section	**Supported Joist Length, m (Half the sum of joist spans on both sides of the beam)**						
	2.4	3	3.6	4.2	4.8	5.4	6
	One Storey Supported						
W150 x 22	5.5	5.2	4.9	4.8	4.5	4.3	4.1
W200 x 21	6.5	6.2	5.7	5.3	5.0	4.7	4.5
W200 x 27	7.3	6.9	6.6	6.3	6.1	5.8	5.5
W200 x 31	7.8	7.4	7.1	6.8	6.6	6.4	6.1
W250 x 24	8.1	7.5	6.9	6.4	6.0	5.7	5.4
W250 x 33	9.2	8.7	8.3	8.0	7.6	7.2	6.9
W250 x 39	10.0	9.4	9.0	8.6	8.3	8.9	7.6
W310 x 31	10.4	9.6	8.8	8.2	7.7	7.3	7.0
W310 x 39	11.3	10.7	10.2	9.8	9.2	8.7	8.3
	Two Storeys Supported						
W150 x 22	4.7	4.2	3.9	3.6	3.4	3.2	3.0
W200 x 21	5.2	4.7	4.3	4.0	3.7	3.5	3.4
W200 x 27	6.3	5.7	5.2	4.8	4.5	4.3	4.1
W200 x 31	6.9	6.2	5.7	5.3	5.0	4.7	4.5
W250 x 24	6.2	5.6	5.1	4.8	4.5	4.2	4.0
W250 x 33	7.9	7.1	6.5	6.0	5.7	5.4	5.1
W250 x 39	8.7	7.8	7.2	6.7	6.3	5.9	5.6
W310 x 31	8.0	7.2	6.6	6.1	5.8	5.4	5.2
W310 x 39	9.5	8.6	7.9	7.3	6.9	6.5	6.2

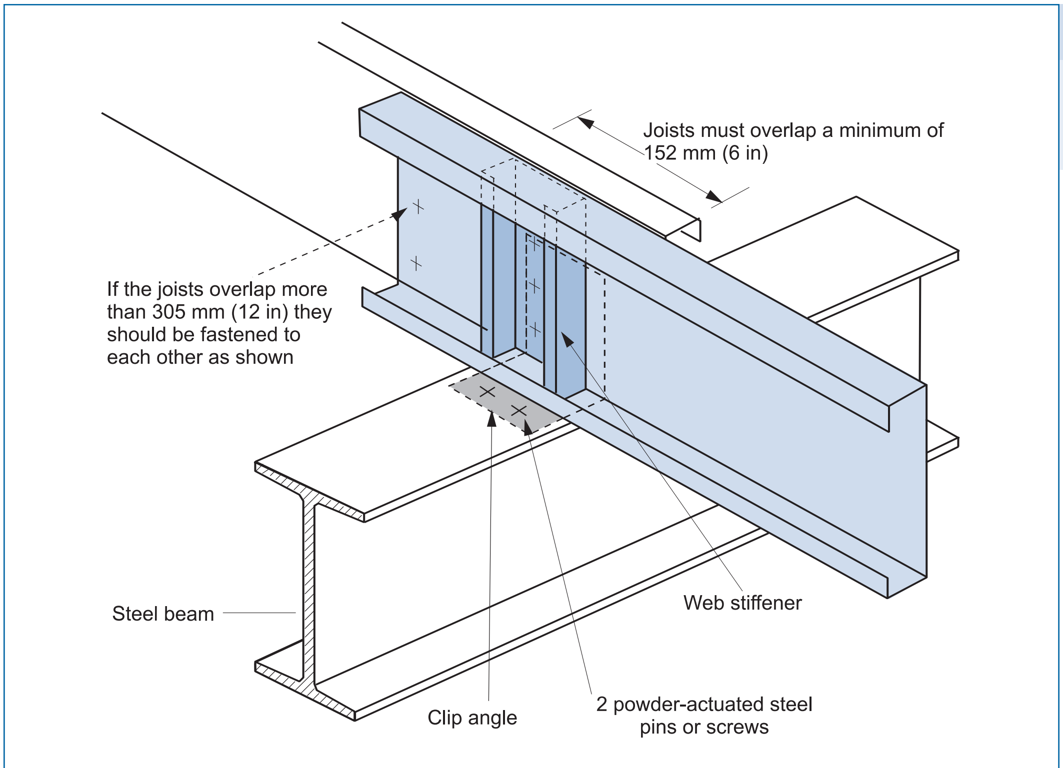


Figure 3.6

Lapped Joists Supported on a Steel Beam

Figure 3.7

Continuous Joist Supported on a Steel Beam

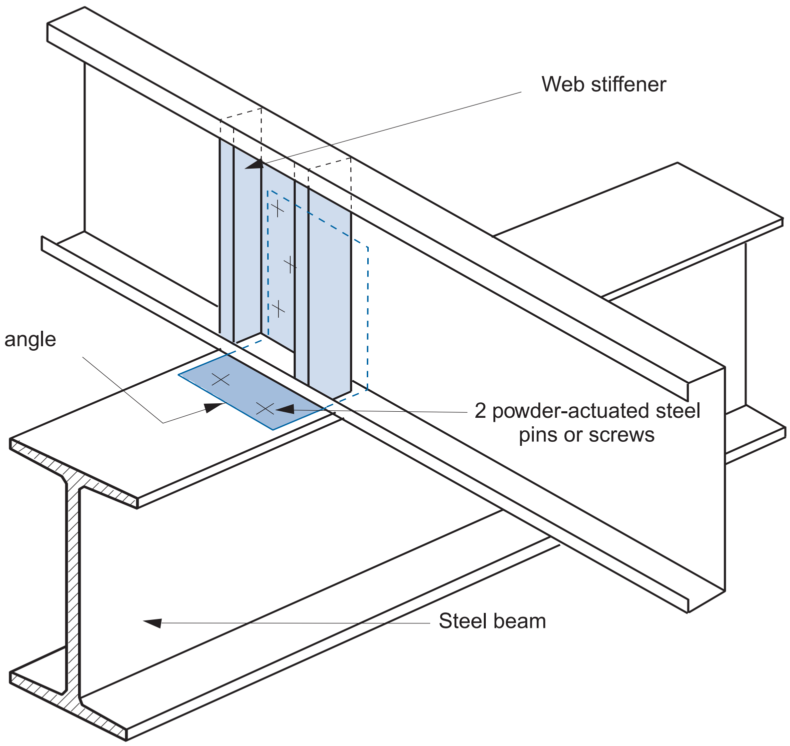
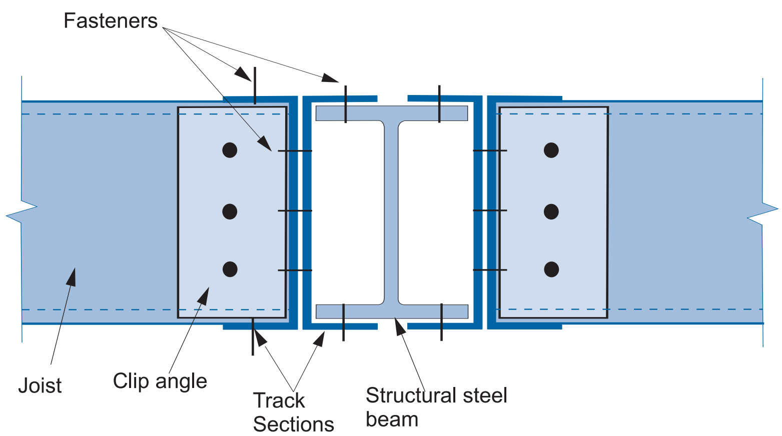


Figure 3.8

Flush-in-Floor Joists with Steel Beam

This illustrates a typical approach to framing a flush beam. Please note that this is only illustrative. Proprietary systems are available or the detail must be engineered.



Beam Bearing Length

As required by the NBCC steel beams must bear no less than 89 mm (3 1/2 in) at end supports. Beams must also be level and bear evenly in order to adequately transfer all loads to the support. See Figure 3.9.

Joists

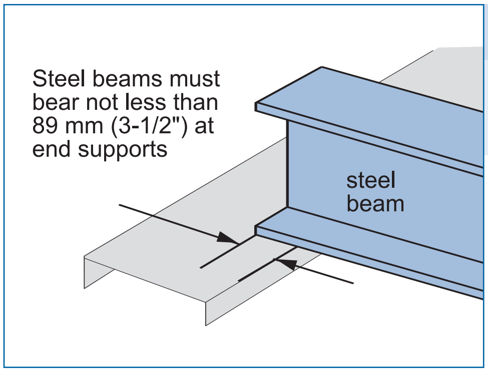


Figure 3.9

Beam Bearing Length

Closure Channel Selection

Closure channels, made of track sections (see Figure 3.10), are available to accommodate all sizes of joists. The depth of the closure channel is determined by the joist depth (e.g. if using 203 mm (8 in) joists then the closure channel must also be 203 mm (8 in). The standard thickness of closure channels is 1.146 mm (0.0451 in). For joists deeper than 254 mm (10 in) a 1.438 mm (0.0566 in) thick channel is recommended. It is important to note that track sections are not designed to carry structural loads without the in-line placement of loadbearing framing members. Engineered design is necessary when in-line framing is not used.

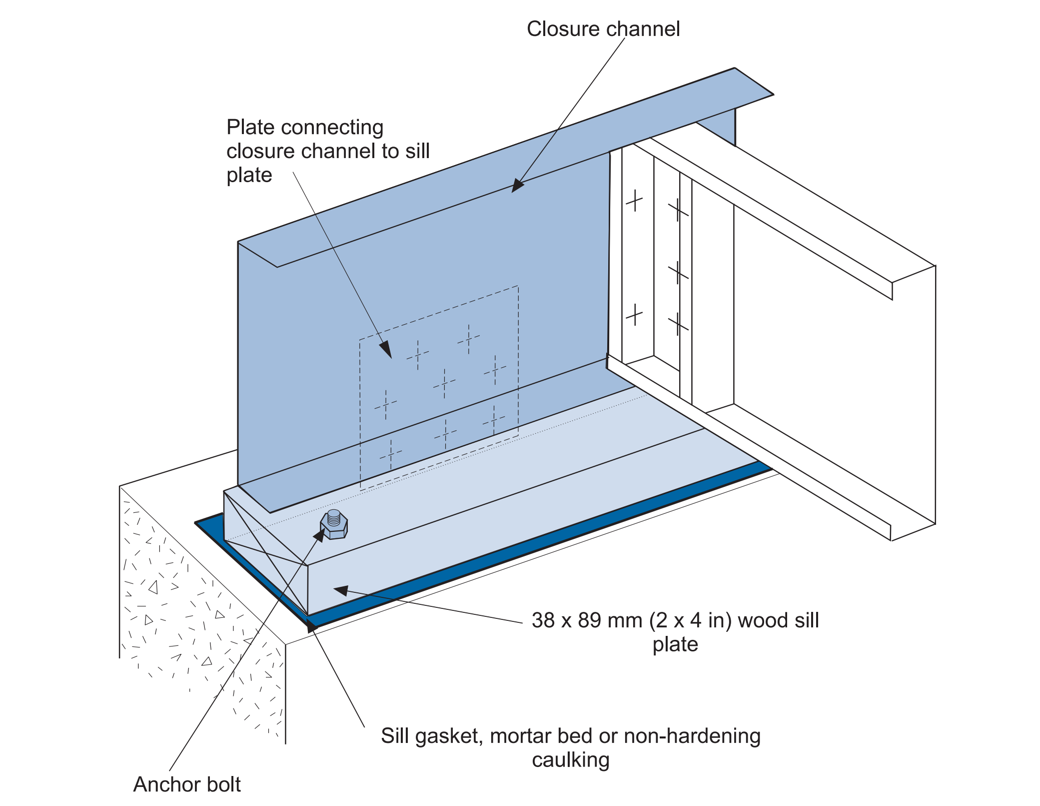


Figure 3.10

Closure Channel

Closure Channel Placement

Closure channels are attached to the sill plate or to the anchors as discussed in Chapter 2. Closure channels can be spliced with short sections of floor joist placed inside the channel as illustrated in Figure 3.11. Closure channels must not be spliced within 75 mm (3 in) of a floor joist.

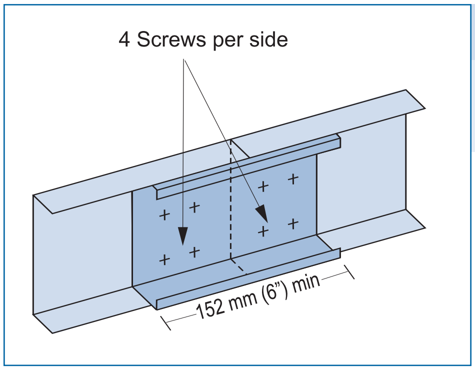


Figure 3.11

Closure Channel Splice

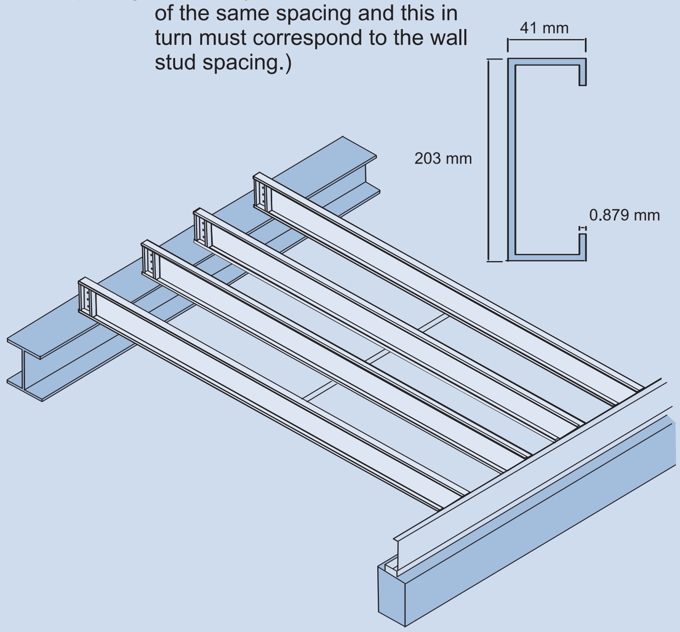
Joist Selection

Joists are selected from the Member Selection Tables (Appendix A) according to thickness and span. The frame below gives step-by-step instructions on how to select floor joists. Figure 3.12 provides a worked example of joist selection.

Figure 3.12

Joist Selection Worked Example

Required Span Length: 3.2 m
Room Type: living quarters
Vibration Control Limit: modified ATC with glued subfloor
Joist Spacing: 400 mm (Note: Joists must all be of the same spacing and this in turn must correspond to the wall stud spacing.)



Once the vibration control limit and room type are ascertained, look at the appropriate member selection table.

In this case Table 2A-3 is used to determine span lengths for living quarters complying with the modified ATC with glued subfloor vibration limit.

With the span length there are several options for member size and spacing, however, remember it is best if all joists are of the same depth and thickness. In this case the joists will be 41 x 203 x 0.879 mm (1-5/8 x 8 x 0.0346 in).

Reading across from the member size one can see that joists of this size spaced at 400 mm o.c. can accommodate spans up to 3.59 m. This size is the closest longer span and therefore the appropriate choice.

All steel members must be framed in-line. Studs must bear directly onto the joists. Joist spacing will therefore inevitably be the same as the spacing of your wall studs.

To simplify construction, joists should be of same depth for each floor. Joist thickness may need to vary to accommodate varying joist spans.

When selecting joist sizes it is important to remember that space will be required for heating ducts and other services and that the floor treatment may affect the spacing (for instance, ceramic tiles require a stiffer floor than wood or carpet).

How to Select Floor Joists

There are floor joist span tables provided that correspond to two different vibration control limits. One uses an L/480 mid-span deflection criteria which is widely accepted throughout North America as a control of vibration. The other is a more conservative treatment for the longer span joists following the guidelines developed by the Applied Technology Council (ATC) for wood construction, as modified for steel floor joist assemblies. Member selections following the Canadian Construction Materials Centre (CCMC) guidelines must refer to the tables with “Modified ATC Method with Glued Sub-floor” vibration control. Engineered designs would more commonly use the L/480 limit.

Step 1: If the design is using an L/480 vibration control limit, use Tables 2A-1, 2A-2, or 2B-1. If the design is following the CCMC requirements, use Tables 2A-3, 2A-4, 2B-2 or 2B-3.

Step 2: For the different floor areas on the plans, determine the maximum clear spans for each area and the joist spacing.

Step 3: For living quarters look at Tables 2A-1 to 2A-4 as appropriate (see Step 1). Find the appropriate column in the Table based on the joist spacing. For each floor area that is not a bedroom, compare the maximum clear spans on the drawings to the spans in the Table. Select the joist size from the Table that has a span at least as long as the joist span on the plans. There may be a number of joist sizes that satisfy the span requirement. Generally, the lighter member is less expensive. At the same time verify that the depth of the selected joist does not exceed any restriction on the drawings.

Step 4: Record the steel floor joist member size on the plans for the appropriate area.

Step 5: Repeat Steps 3 and 4 for each area that is not a bedroom.

Step 6: For bedrooms, look at Tables 2B-1 to 2B-3 as appropriate (see Step 1). Find the appropriate column in the Table based on the joist spacing. For each bedroom floor area, compare the maximum clear spans on the drawings to the spans in the Table. Select the joist size from the Table that has a span at least as long as the joist span on the plans. There may be a number of joist sizes that satisfy the span requirement. Generally, the lighter member is less expensive. At the same time, verify that the depth of the selected joist does not exceed any restriction on the drawings.

Step 7: Record the steel floor joist member size on the plans for the appropriate area.

Step 8: Repeat Steps 6 and 7 for each bedroom area.

Joist Installation

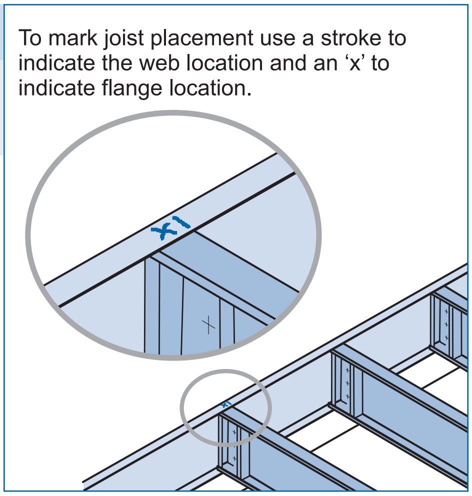
If supported by a loadbearing wall, it is important that the web of the floor joists line up so that the centre lines of the members are within the limits set out in Figure 1.1. This will ensure that loads are transferred properly from the floor joists to the wall studs.

Outside to outside dimensions of the closure channels must be correct. Floor joists may not be spliced.

Beginning at any corner of the foundation, mark the joist locations on the closure channel using a felt tip marker. Use a stroke to indicate the web location and an “X” to the side of the stroke to indicate the flange location. See Figure 3.13.

Figure 3.13

Marking Joist Placement

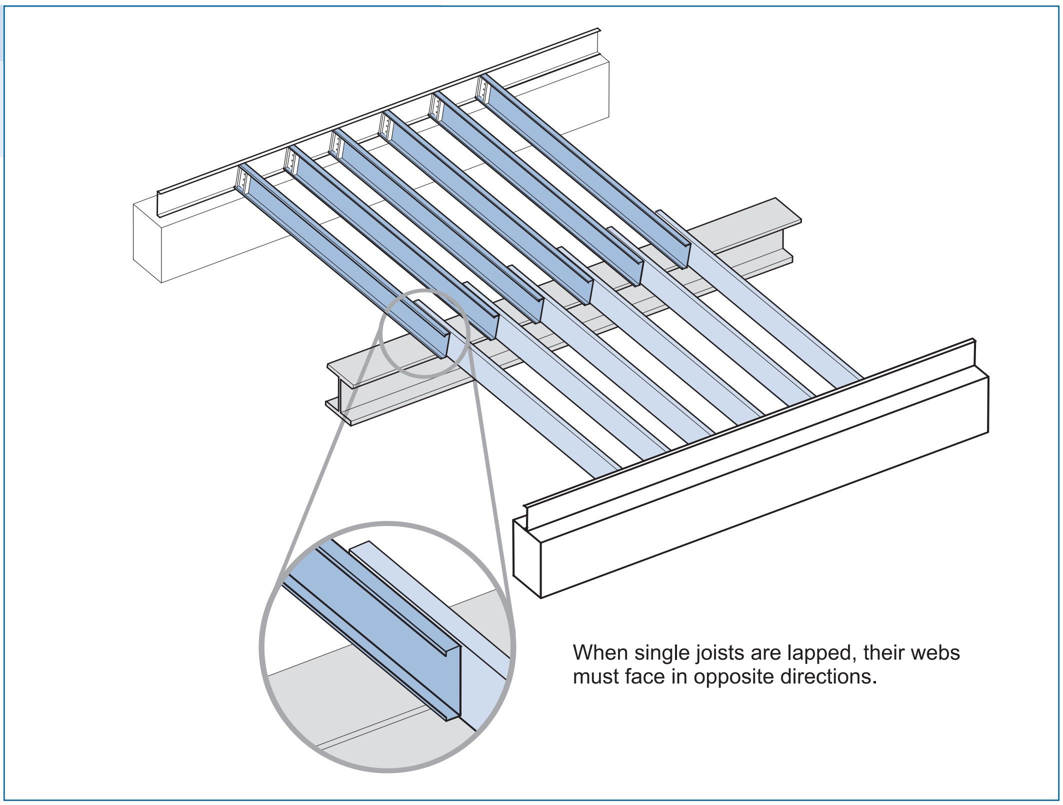


All webs should face the same direction. The only exceptions to this are cases where joists are single spans supported on an intermediate beam. In this case the joists must be lapped with the webs back-to-back as shown in Figure 3.14.

At each foundation wall running parallel to the joist direction, two joists may be used to support the stud wall as shown in Figure 3.15. The outer joist is attached to the sill plate as discussed in Chapter 2 before the inner joist is placed in position. If the two joists create a closed box, insulation must be added between them before the cavity is closed in. The insulation should be covered so that it is protected from rain. Mark the location of the second joist accordingly. If a single perimeter joist is used, it must be fitted with web stiffeners to support each wall stud above it, as shown in Figure 3.16. Using a single perimeter joist allows the inside of the joist to be insulated later, when the rest of the insulation in the house is installed.

Figure 3.14

Web Direction of Lapped Joists



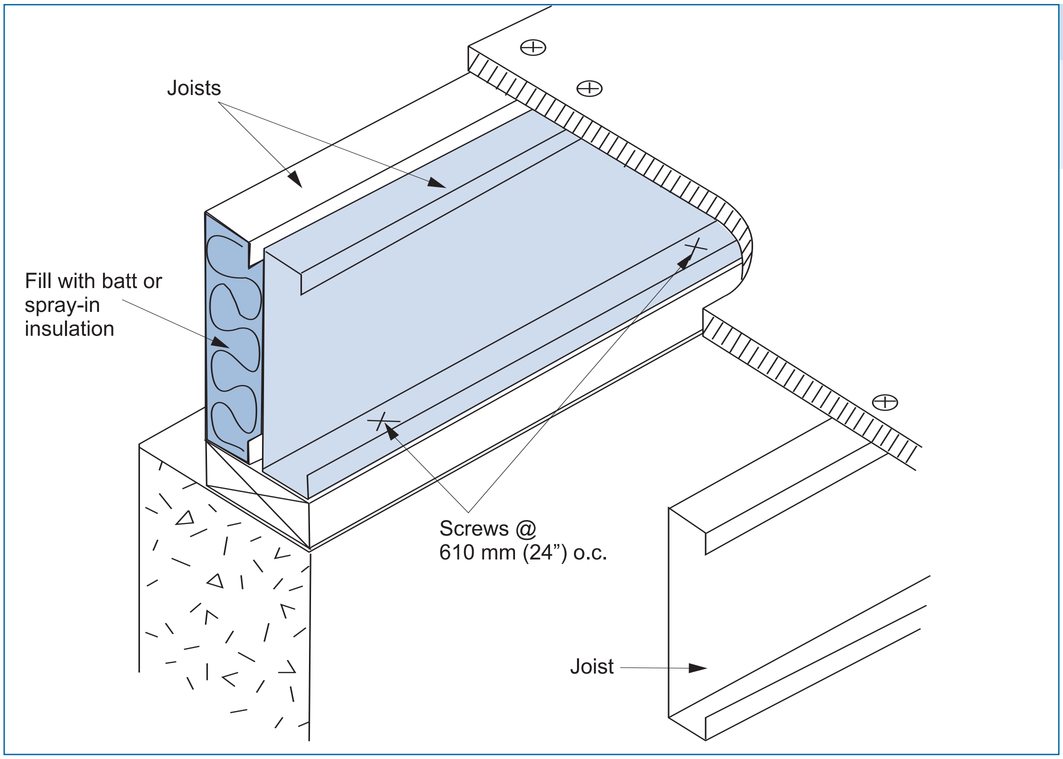


Figure 3.15

Perimeter Joist Placement

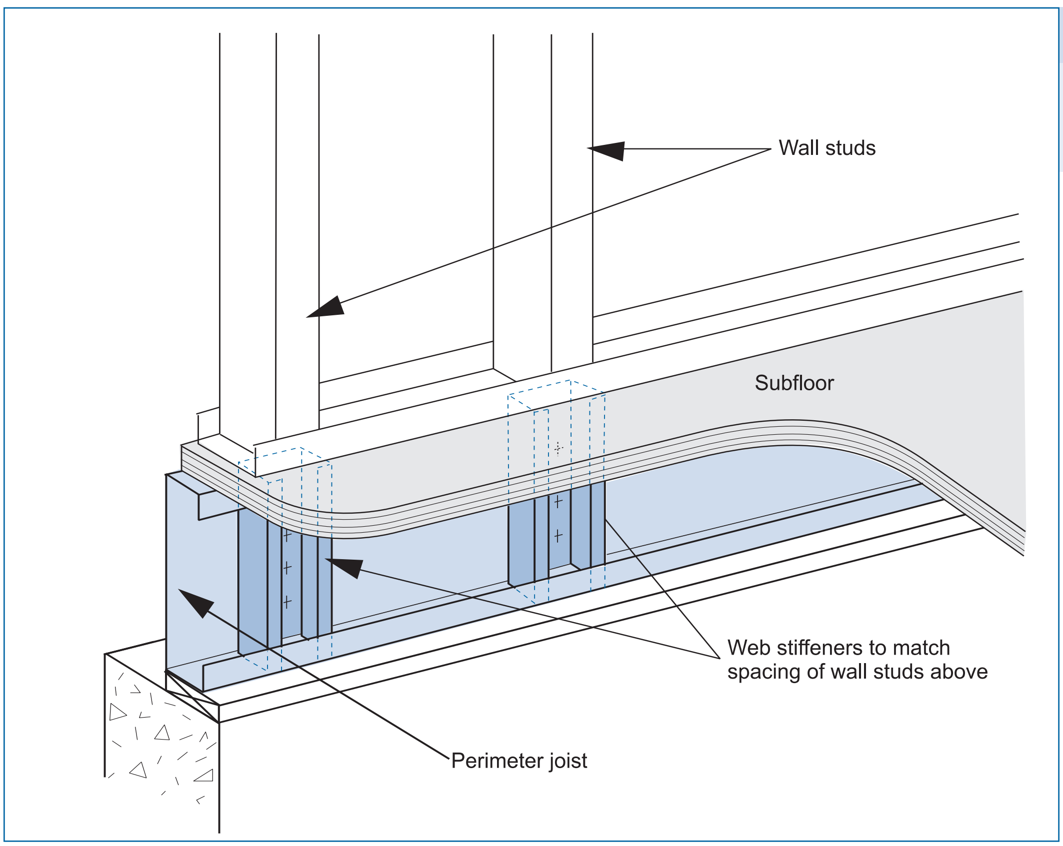


Figure 3.16

Web Stiffeners in a Perimeter Joist

Looking Back

Sill Plate Anchorage

Refer back to Chapter 2: Foundations for information regarding installation of the sill plate. Closure channels are installed in one of three ways: wood sill plate, direct bearing or nested stud and track. For further detail refer back to Chapter 2. Whether the closure channel is fastened to the sill plate with an anchor tie, plate or directly to the foundation it must be securely fastened. It is very important to ensure that no anchor bolts will interfere with the placement of floor joists.

Looking Ahead

Web stiffeners and bridging are discussed in detail in later sections of this chapter. Please refer to them for more information.

Looking Ahead

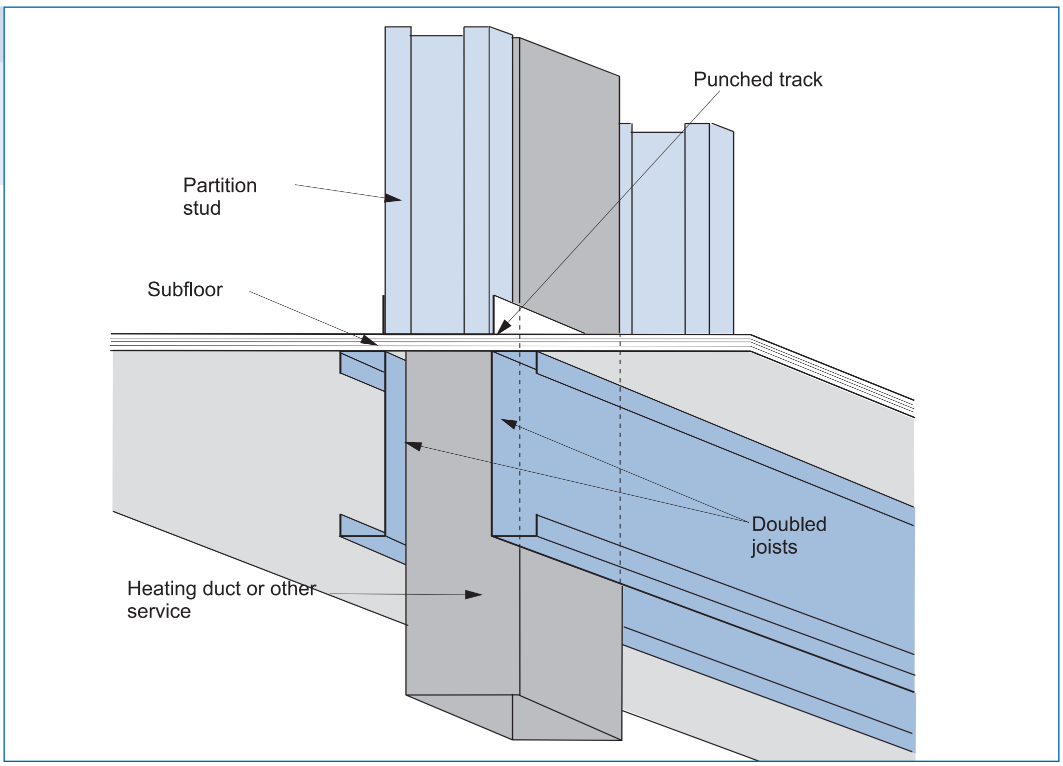
Framing the Bathroom

The framer should carefully examine the plans and locate all toilet flanges, tub and shower drains and other plumbing services that may require alteration of the floor joist placement. By doing this ahead of time cutting of joists can be prevented.

Double joists must be placed under partition walls running parallel to the direction of joists. This helps to accommodate future services. See Figure 3.17.

Figure 3.17

Supporting Partition Walls on Double Floor Joists



Check the drawings for the location of all openings in the floor. Note the size and number of members required to frame the openings.

Once all the floor joist locations have been marked on the closure channel, installation can begin. Web stiffeners should be ready and at hand.

A web stiffener should be slid into the open end of the joist. Each joist should then be set into the closure channel with the flanges facing in the same direction and the web knock-outs aligned. Alignment becomes important when services are installed. Alignment is verified if the coloured ends of each joist are at the same end of the span.

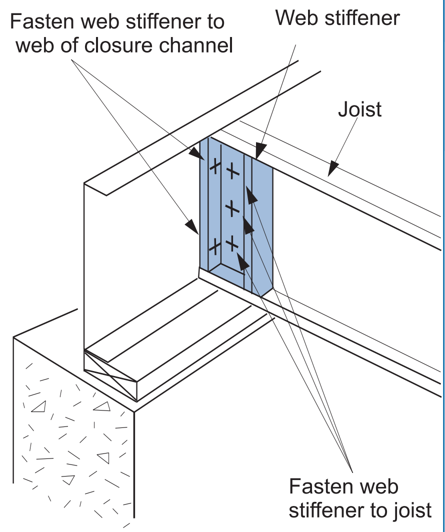


Figure 3.18

Joist to Closure Channel Connection

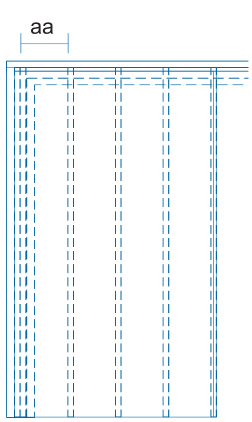
Unlike wood construction, aligning crowns is not an issue for lightweight steel frame construction. Square each joist to check that it is properly aligned. After placing joists at each marked location and checking alignment, two screws should be used to fasten through the closure channel into the joist web stiffener, and three more fasten the web stiffener to the joist. See Figure 3.18.

Alternatively, preinstall web stiffeners before setting joists into closure channel. Allowing the stiffener to protrude from the end of the joist by approximately 3 mm (1/8 in) will create a small gap between the joist end and closure channel. This can prevent squeaks if any movement occurs in the joist.

Looking Ahead

Joist Spacing to save Subfloor Material

If using 406 mm (16 in) o.c. spacing of joists the first joist in should be marked at 379 mm (15-3/16 in) on the rim joist. This will ensure that the edge of the subfloor panel is at a joist, eliminating extra cutting and material waste. For 305 mm (12 in) spacing, the first joist would be at 279 mm (11-3/16 in) and for 610 mm (24 in) framing spacing, the first would be installed at 579 mm (23-3/16 in).



Joist Spacing	aa
305 mm (12 in)	284 mm (11-3/16 in)
406 mm (16 in)	386 mm (15-3/16 in)
610 mm (24 in)	589 mm (23-3/16 in)

By altering the joist spacing slightly the subfloor edges will always be supported by joists. For example, when using 305 mm (12 in) o.c. joist spacing, if the first joist is placed at 279 mm (11-3/16 in) instead of 305 mm the subfloor edge will be perfectly centred above the joist.

Figure 3.19

Subfloor Joist Spacing

Looking Ahead

Floor Requirements for Ceramics

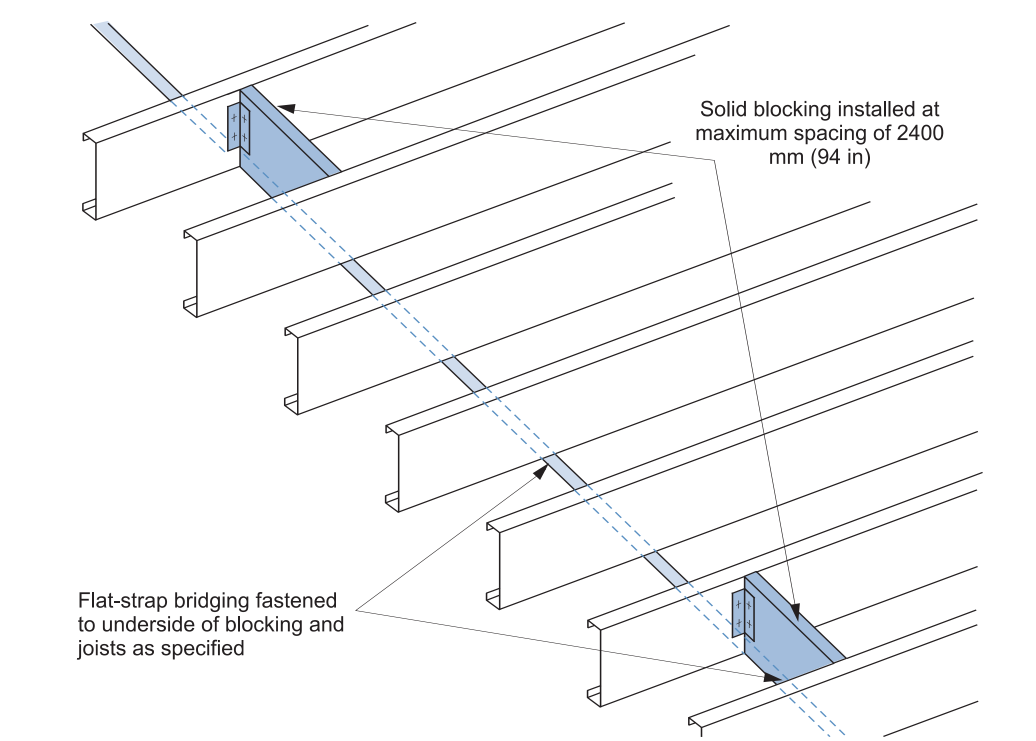
In areas that require a stiffer floor, such as under ceramics, the floor can be stiffened by adjusting the thickness of the subfloor or by using an underlay. Note that changing the joist spacing to provide a stiffer floor is not recommended since it requires altering the stud spacing as well. If necessary, the joist thickness can be increased or the joists doubled up in critical areas.

Blocking and Bridging

Floor joist bridging (in the form of flat strap, notched channel or through-the-knockout channel bridging) and blocking (solid C-channel or track) must be installed in all steel framed floors as shown in Figure 3.20.

Figure 3.20

Floor Bridging and Blocking Layout



It is necessary to brace floor joists to prevent the rolling or shifting of individual members out from under the load. During construction, avoid walking on floor joists until the subfloor is screwed in place. Before applying heavy loads, such as those from storing of materials (e.g. drywall) the bottom flange of each floor joist must be braced.

Solid blocking is typically made from C-sections that are the next size smaller than the joists being braced (See Figure 3.20). For example, a 152 mm (6 in) section is used to block a 203 mm (8 in) joist. This allows the blocking to be connected to the joists with clip angles using 2 screws per angle leg as illustrated in Figure 3.21.

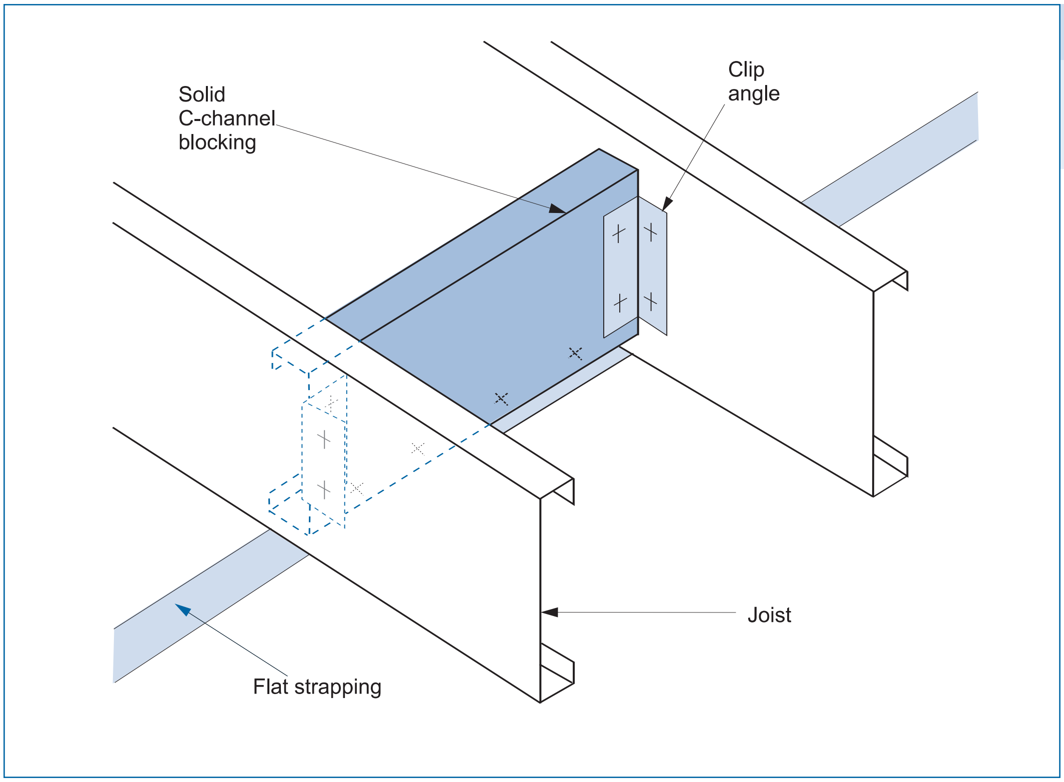


Figure 3.21

Solid C-Channel Blocking

Blocking is installed between joists at a maximum spacing of 2400 mm (94 in), usually every fifth joist space is adequate, and at the termination of all bridging straps.

Flat strap or notched channel bridging is fastened to the underside of joists and to the blocking to provide lateral support to the joists. The bridging must be fastened to the bottom flange of each joist using at least 1 - #8 screw.

Bridging straps should be at least 38 mm wide by 0.879 mm (1-1/2 in x 0.0346 in) thick and spaced not more than 2400 mm (7 ft -10 in) from each support or other rows of bridging. The ends of the steel strapping should be fastened to the blocking with at least 4 - #8 screws. Alternatively, the strap can be anchored directly to the exterior wall. For flat strap bridging to be effective it must be fastened without slack. Strapping should be pulled taught as it is fastened. If a splice is made in the strapping, it must be overlapped and screwed to a blocking section.

Using low profile screws for the blocking and bridging will prevent the screws from interfering with the installation of the drywall for the ceiling.

Second Floor Joists

Once all loadbearing walls on the first floor have been framed, erected, and all bracing is securely in place, framing of the second floor can proceed.

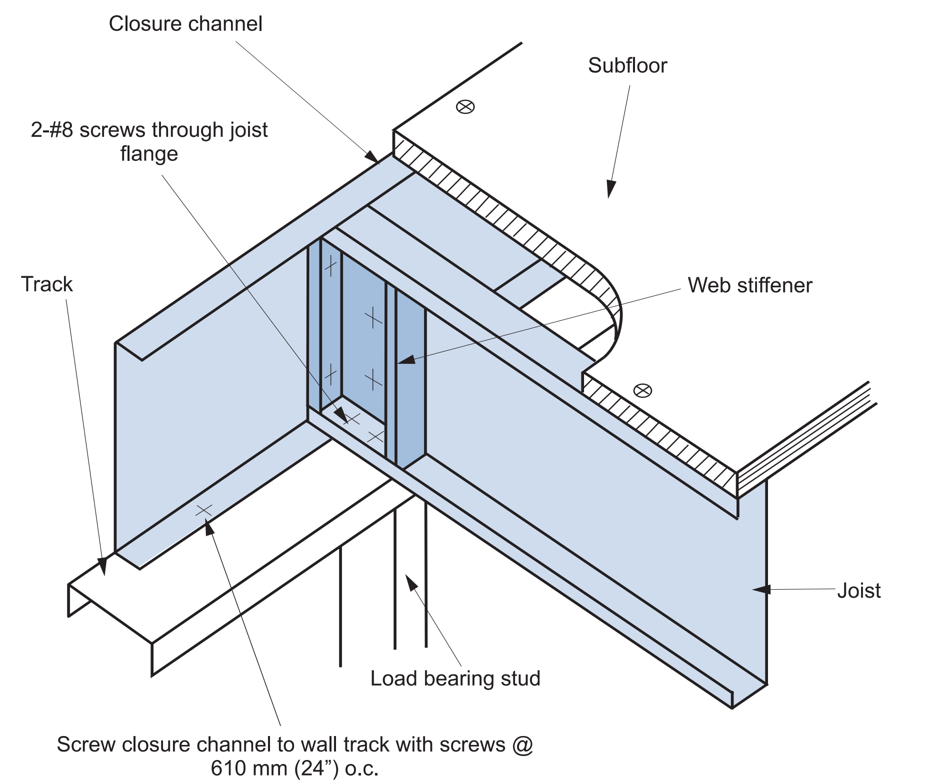
When marking the location of second floor joists remember that the webs of the second floor joist must be aligned with the first floor joists as specified earlier in the “In-line Framing” section. In cases where joists are out of line please refer to “Troubleshooting” in Chapter 9.

Second floor joists are installed in the same manner as the first floor with a few exceptions and modifications. Joists must be installed from below using scaffolds. Free standing stud walls or joists without a subfloor in place should not be used to support work. The second floor closure channel is

attached to the top track of the loadbearing wall below as shown in Figure 3.22. The webs of the second floor joists must be aligned with the webs of the first floor loadbearing studs (within the tolerances specified in the in-line framing section).

Figure 3.22

Supporting Floor Joists on Loadbearing Walls



Where floor joists are parallel to an exterior wall, two joists can be used to transfer loads to the top track of the lower wall similar to Figure 3.15. Each joist can be fastened to the top track using #10 screws at 406 mm (16 in) o.c. through each joist flange. If a single joist is used, the web must be stiffened at each stud location similar to Figure 3.16.

The second floor joists must be braced as required with appropriate bridging and blocking similar to a first floor as described in a later section.

The installation of second floor joists supported by an interior loadbearing wall is very similar to situations where joists are supported by beams. If the joists are continuous they must be fastened to the track below and the web stiffener in the same manner as a continuous joist supported by a beam. If the joists are single spans, they must be lapped over the interior bearing wall just like single spans lapped over a beam. See Figures 3.23 and 3.24.

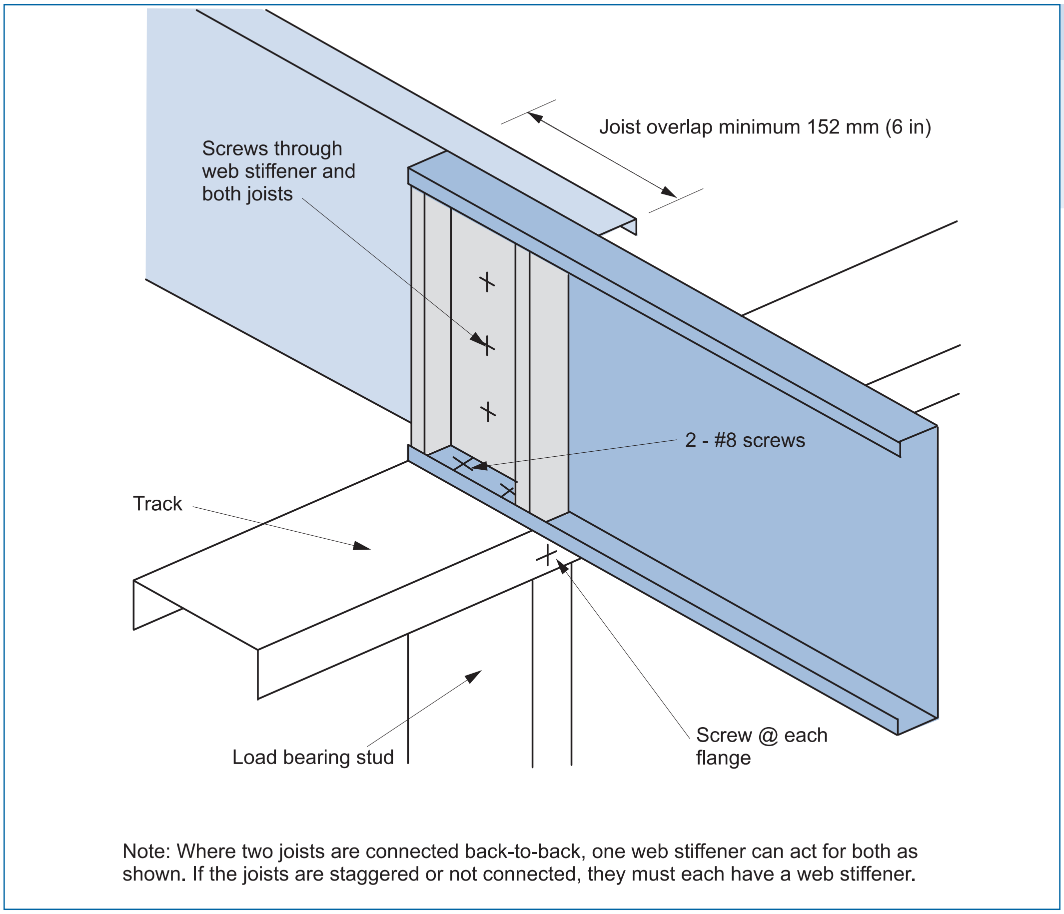


Figure 3.23

Lapped Joists Supported on a Loadbearing Stud Wall

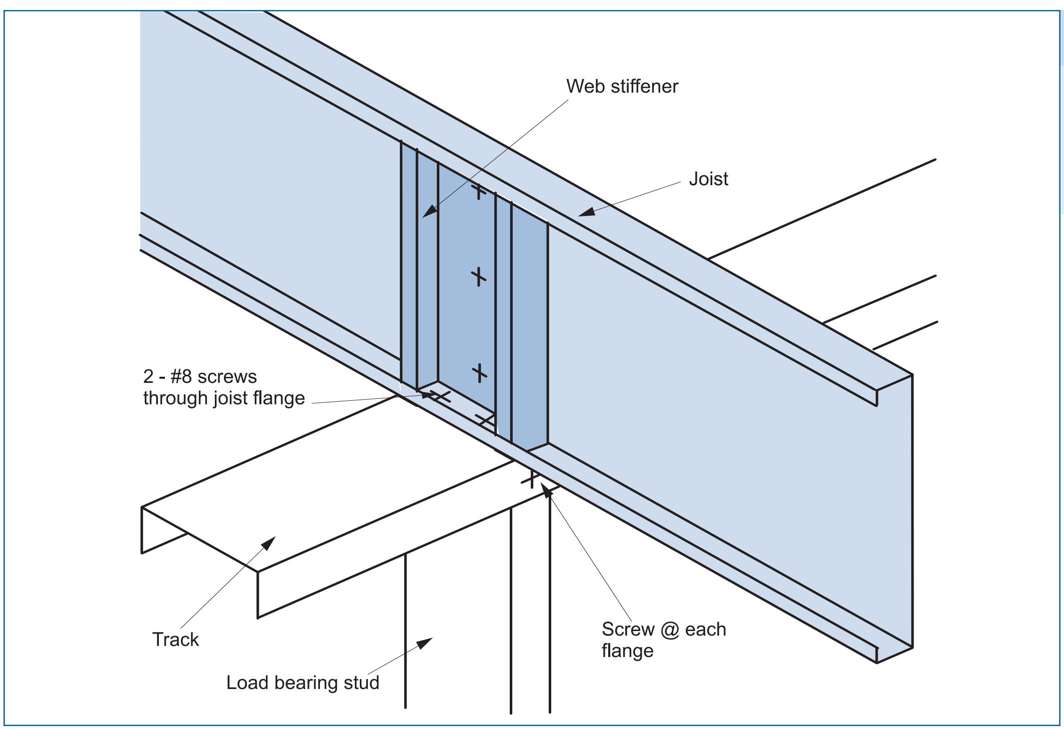
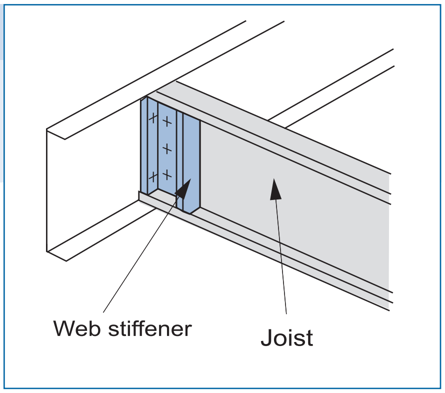


Figure 3.24

Continuous Joist Supported on a Loadbearing Stud Wall

Figure 3.25

Web Stiffener



Web Stiffeners

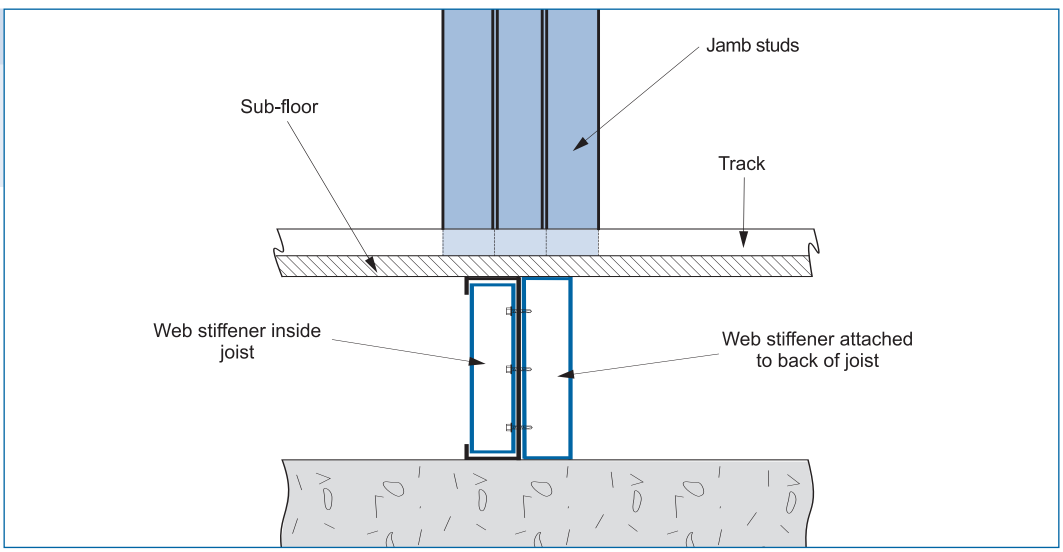
Web stiffeners act as extra support in all locations where a concentrated load acts on a floor joist. Stiffeners are required at each location along the joist where it rests on a loadbearing stud wall or foundation, and at joist locations supporting loadbearing walls or concentrated loads from above. Where a joist passes over, or is spliced at, an interior beam, web stiffeners must be added at the bearing locations as shown in Figures 3.6, 3.7, 3.23 and 3.24. A web stiffener is a short piece of loadbearing stud with a thickness at least 0.879 mm (0.0346 in) or a track section at least 1.146 mm (0.0451 in) thick. Figure 3.23 illustrates a web stiffener supporting a joist where it meets the foundation. The LSF fabricator normally supplies these stiffeners as part of the floor joist package, alternately they can be cut on site from stock using a chop saw. Web stiffeners can be placed either inside or on the outside of the web. The stiffener has a 31 mm (1-1/2 in) wide flange to allow it to fit within the 41 mm (1-5/8 in) flanges of the joist. Stiffeners should be not less than 9 mm (3/16 in) shorter than the depth of the joist and can be installed on either side of the joist web, fastened to the joist with at least 3 - #10 screws and to the closure channel (where present) with 2 - #10 screws as shown in Figure 3.25.

To reduce the possibility of squeaking, it is important that stiffeners installed inside the joist are sized so that they do not touch the flanges. If stiffeners are field cut they must be installed on the back side of the joist.

In most situations only one web stiffener is required, but where a joist is located under a built-up jamb assembly of more than two studs, two stiffeners are required: one on each side of the joist as depicted below in Figure 3.26

Figure 3.26

Web Stiffeners under Built-up Jambs



Joist Bearing Length

As illustrated in Figure 3.27, joists must bear no less than 38 mm (1 1/2 in). Like steel beams they must be installed level and bear evenly.

Connections

Normally pan head screws of the appropriate size (refer to Chapter 1) are used for all connections of steel bridging, strapping or furring channels to studs or joists etc. as discussed in Chapter 1. In some

cases it may be preferable to use a low profile screw to avoid interference with subfloors or ceiling drywall.

Planning Ahead

Web stiffeners can be placed either on the inside or outside of the joist. In cases where the web stiffener is to be placed on the inside of the joist it must be slid into place from the end of the joist before positioning the joist inside the closure channel.

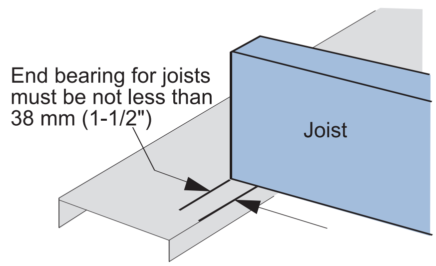


Figure 3.27

Joist Bearing Length

Cantilevers

Where floor joists cantilever out beyond a support, such as in the case of balconies or bay windows, engineering services are required. No offset loadbearing walls are permitted without an engineered detail. The engineer must determine joist sizes, connection details as wells as ensure adequate blocking and resistance to thermal bridging.

Looking Ahead

Air Barrier Continuity around Cantilevers

It is important to consider the air barrier integrity when installing cantilevered joists. If you are using an exterior air barrier, it will not be affected by the cantilever. However, if you are using an interior air barrier (combined air/vapour barrier such as 6 mil polyethylene) you will need to take some steps during the framing stage to ensure that your air barrier will be continuous. The header needs to be wrapped with a flap left to the exterior, similarly an air barrier flap needs to be left between the top plate of the wall below the cantilever.

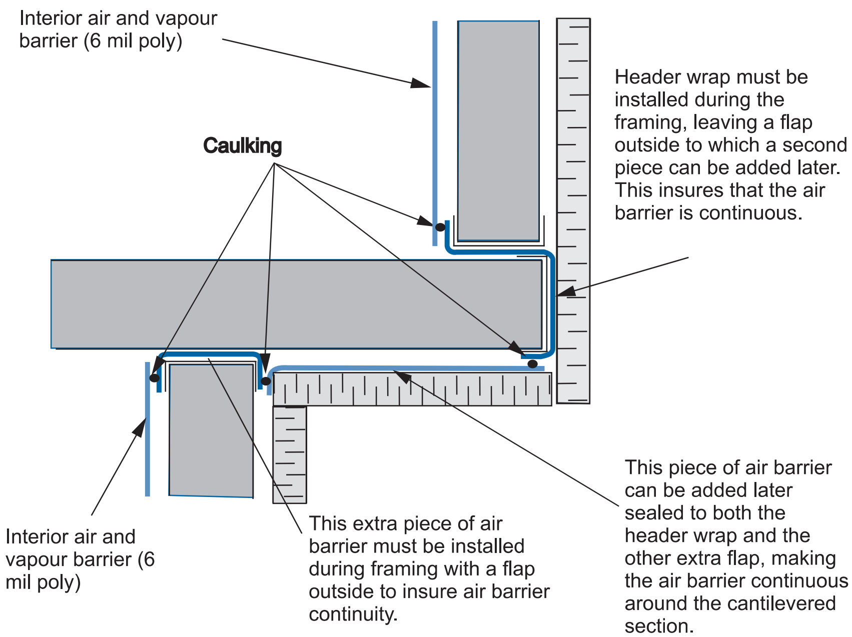


Figure 3.28

Air Barrier Continuity Around a Cantilevered Floor

Subfloors

The subfloor acts as bracing for the top flanges of the floor joists. Installation of the subfloor in a steel framed house is very similar to the installation of a subfloor in a wood frame house.

The subfloor is fastened to the flanges of joists using #8 x 31 mm (1-1/4 in) bugle-head screws spaced 152 mm (6 in) o.c. along the sheet edges and 305 mm (12 in) o.c. in the field. The minimum edge distance must be at least 10 mm (3/8 in). Waterproof construction adhesive (the same type as for wood framing) is recommended to improve the connection. Do not walk on top of joists without the subfloor being fastened down. Floor finishes are installed conventionally over the subfloor.

To speed up the installation, the subfloor can be glued and an air nailer used to tack the sheets in position with threaded air driven fasteners specific for steel. Back-screwing is then done at a later time for the entire floor area.

Subfloors must conform to the NBCC Table 9.23.14.5.A in Figure 3.29. The thickness will depend on the material used for subflooring and the spacing of the joists.

Figure 3.29

NBCC
Table 9.23.14.5A

Thickness of Subflooring

Maximum Spacing of Supports mm (in)	Minimum Thickness mm (in)			
	Plywood and OSB, 0-2 Grade	OSB, 0-1 Grade, and Waferboard, R-1 Grade	Particle Board	Lumber
400 (16)	15.5 (0.62)	15.9 (0.636)	15.9 (0.636)	17.0 (0.68)
500 (20)	15.5 (0.62)	15.9 (0.636)	19.0 (0.76)	19.0 (0.76)
600 (24)	18.5 (0.74)	19.0 (0.76)	25.4 (1.016)	19.0 (0.76)

The first area of the subfloor will have to be installed from below. This sheathed area can then be used as a platform from which to install the rest of the subfloor.

It is very important that workers only walk or work on subfloors that have been securely fastened to the joists.

Floor Openings

Openings in Floors

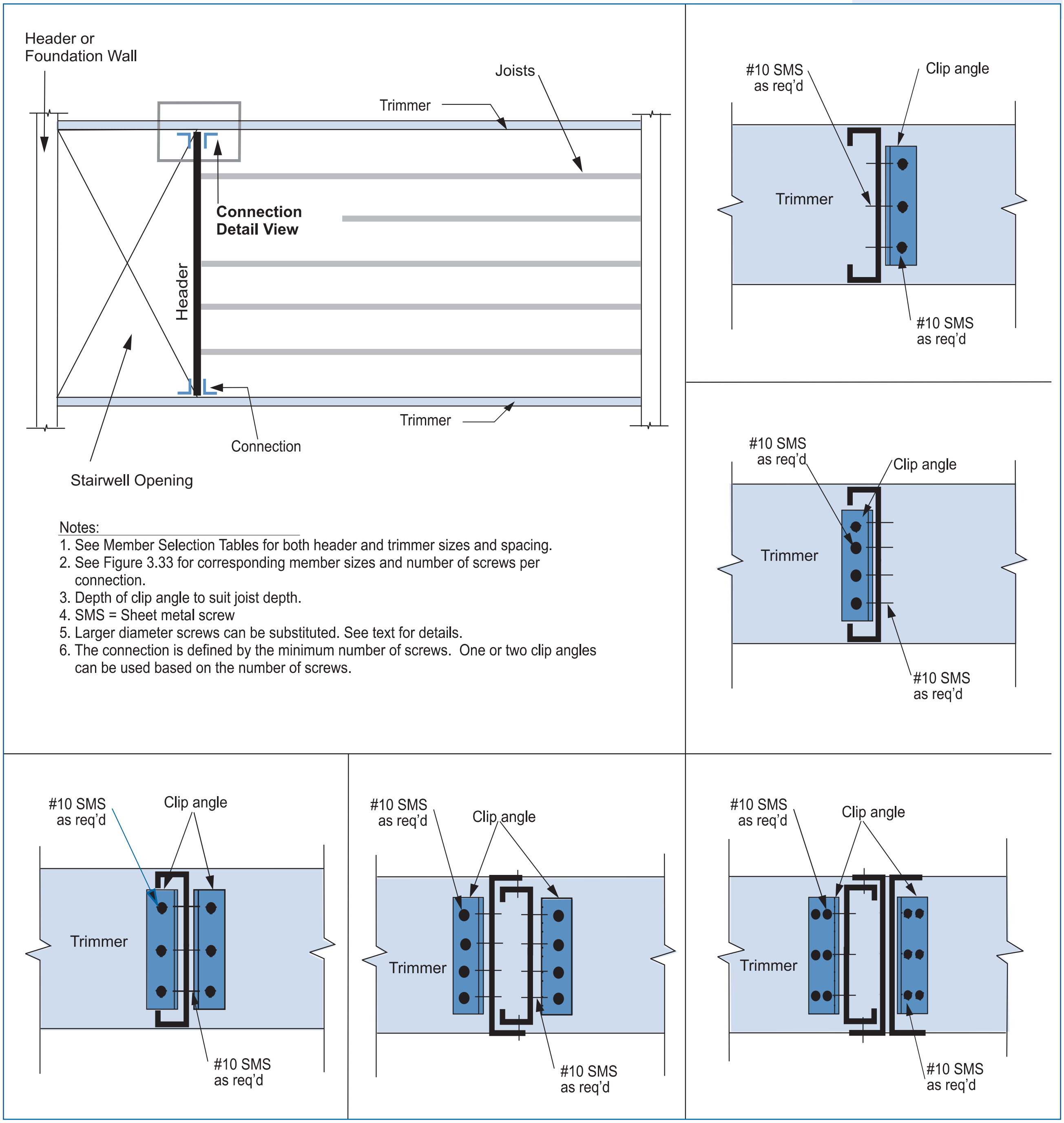
Floor openings are framed, as in wood construction, with the use of header and trimmer joists. Track and joist sections making up the trimmer joists must be full length and cannot be spliced. Floor openings should be measured and marked. Trimmer joists for each opening should form a closed box section (similar to those shown in Figure 3.3) at the opening providing a flat surface to connect headers as shown in Figure 3.30.

Member Selection Tables (Appendix A) can be used to select the appropriate header section for the opening size involved. The frame below describes how to select the header and trimmer joists for floor openings.

To determine header and trimmer joist length for floor openings, follow the the step-by-step instructions in the frame, and see Section 3 of the Member Selection Tables (Appendix A). Note that the Trimmer Joist Tables distinguish between openings Type A and B. While the size of Type A openings is not limited in width, that of Type B must not be less than 1 m (3 ft -3 in). See Figure 3.31, as well as the worked example at the end of this section, Figure 3.34.

Figure 3.30

Header to Trimmer Connections for Floor Openings



How to Select Members for Floor Openings

Step 1: From the sketches in the Notes to Trimmer Joist Tables (see Appendix A, Section 3), determine whether the openings are Type A or B. Mark this designation on the plans.

Step 2: Check the floor joist member selection procedures discussed above and determine if the vibration control is the modified ATC method with glued sub-floor, or the L/480 method. This will determine which header and trimmer tables to use as indicated in the titles. Header Joist Tables 1 to 2 and Trimmer Joist Tables 1 to 4 are based on the L/480 criterion. Header Joist Tables 3 to 4 and Trimmer Joist Tables 5 to 8 are based on the ATC criterion.

Step 3: For the floor opening being considered, determine the size and spacing of the floor joists framing into the opening as well as the opening size. Use the sketch in the Notes to the trimmer joist tables to determine the lengths of the header and trimmer joists.

Step 4: From appropriate Header Joist Table, Find the row corresponding to the floor joist size and spacing. Move across the table to the first header span that is larger than the header length determined in Step 3. The sketch at the top of the table shows the built-up member configuration. The header joists and track are the same depth and thickness as the floor joists.

Step 5: Consult the appropriate Trimmer Joist Table, according to vibration control criterion, and the opening Type A or B. Find the row corresponding to the floor joist size and spacing. Move across the table to the first span that is larger than the header joist length determined in Step 3. The sketch at the top of the table shows the built-up member configuration. The trimmer joists and track are the same depth and thickness as the floor joists.

Step 6: Record the header and trimmer joist member sizes on the plans for the appropriate area.

Step 7: Repeat Steps 1 and 6 for each floor opening.

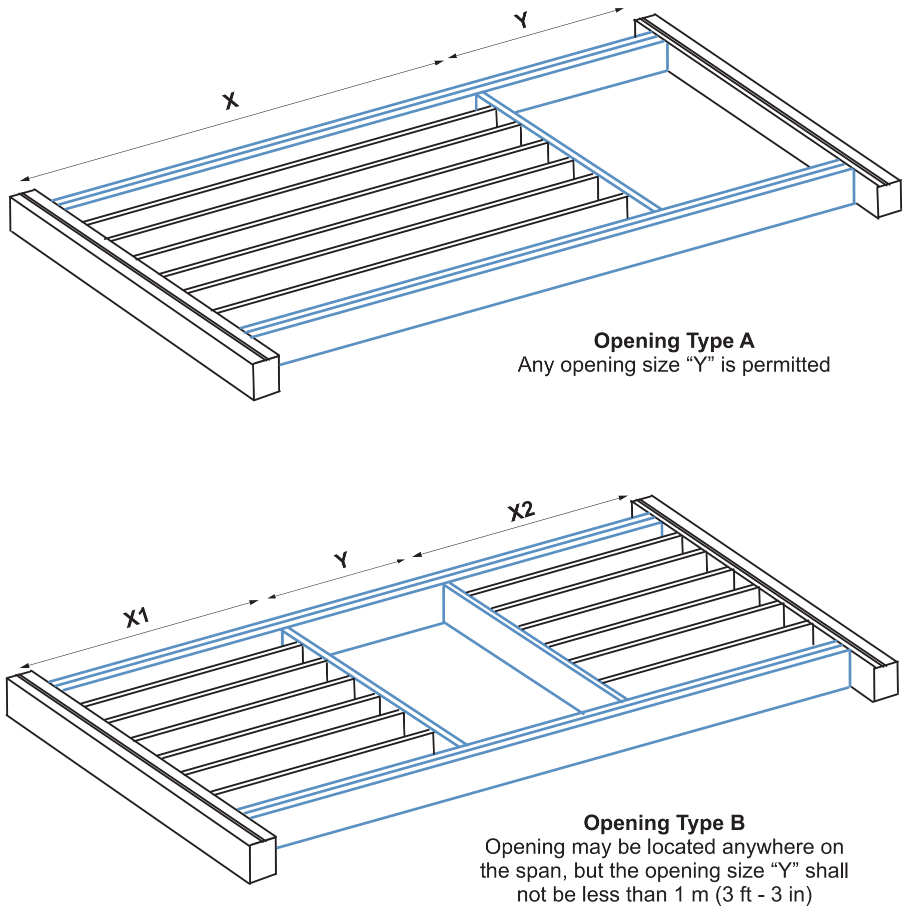


Figure 3.31

Floor Opening Types

An opening of Type A requires only one header because it frames into the foundation or bearing wall, Type B requires two headers. The trimmer joist assembly is similar to other built-up members as illustrated by Figure 3.3.

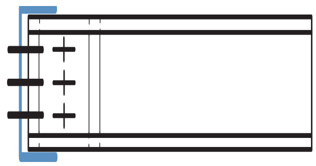
Track sections can be combined with "C" sections to form built-up sections to use as floor beams, headers, lintels, trimmers, jamb or jack studs, and at other locations requiring extra strength. All built-up sections should be made from members of equal thickness, and fastened together at least every 610 mm (24 in) o.c. The sections used in these built-up members must be continuous lengths, unless their purpose is non-structural (i.e. closing off rough openings).

The structural capacity of these built-up sections must be determined by analysis in accordance with CSA Standard S136. The Member Selection Tables (Appendix A) give the capacity for common sections.

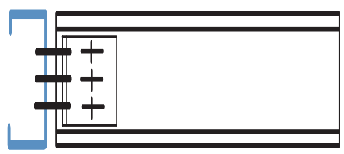
Trimmer joists at an opening should form a closed box section to provide a flat surface for connection to headers as illustrated in Figure 3.32.

Figure 3.32

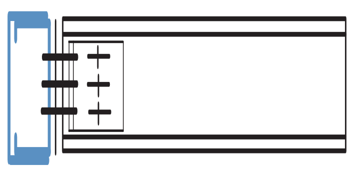
Tail Joist Attachment to Different Header Types



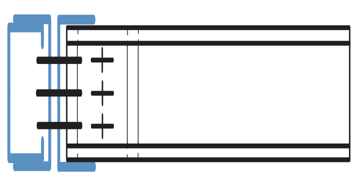
When the header is a single track orient so that the joist can be framed into it using a web stiffener.



When the header is a single joist turn it so that the floor joist can be fastened using a clip angle.



When the header forms a closed box section, fasten the floor joist using a clip angle.



When the header consists of a built up section with an open track section frame into it using a web stiffener.

A simple method of creating a built-up member is to nest a joist in track. Joists and track sections used to construct both headers and trimmers are normally the same depth and thickness as the floor joists. It is often more economical in the long run to maintain the same joist dimensions throughout. Trimmer joists and track sections must span full length and may not be spliced. Tail joists are fastened to stairwell headers using a clip angle connector with 3 - #10 screws per angle leg (see Figure 3.32).

Connecting the header to the trimmer is done using standard clip angles as shown is Figure 3.30. The number of screw needed in **each leg of the clip angle** depends on the size of members being connected and whether the floor has a concrete topping. The minimum numberof screws are listed in Figure 3.33. These connections assume that #10 screws are being used. To reduce the number of screws in the connection, #12 or 1/4 inch screws could be substituted. If these larger screws are used, the total number can be reduced by the multiplier shown in the following table.

Screw Size	Joist Thickness mm (in)	
	0.879 to 1.438 (0.346 to 0.0566)	1.811 (0.0713)
#12 screws	0.94	0.87
1/4" screws	0.87	0.76

Floor joists can be connected to headers either by clip angle or if a track section forms part of the header, floor joists can be framed into the header using web stiffeners. See Figure 3.32.

In some cases even if a track section is not part of the header assembly it may be easier to add one then use clip angles since the assembly can then be performed by only one person rather then two.

If using clip angles, one person will have to hold the joist in place while the other screws the assembly together. Remember, in order to use clip angles the header will have to be oriented so that it is presenting a closed face to the joists.

When creating the built-up members, use low profile head screws on all top flanges so that the subfloor has an even surface to sit on.

Figure 3.33

Screw Requirements for Header to Trimmer Connections

Header to Trimmer Connections for Floor Openings - Floors WITHOUT Concrete Topping					
Loading: LL = 1.90 kPa DL = 0.50 kPa		**Number of #10 Screws Required in *each leg of the clip angle* connecting the Header to Trimmer (See Figure 3.30)**			
Joist Designation (mm)	**Spacing mm (in)**	**Single Track**	**Single Joist**	**Joist + Track**	**Joist + 2 Tracks**
41 x 152 x 0.879	305 (12)	4	4	6	7
	406 (16)	4	4	6	6
	488 (19.2)	3	4	5	6
	610 (24)	3	4	5	6
41 x 152 x 1.146	305 (12)	3	4	5	6
	406 (16)	3	4	5	6
	488 (19.2)	3	4	5	5
	610 (24)	3	4	5	5
41 x 152 x 1.438	305 (12)	3	3	4	4
	406 (16)	3	3	3	4
	488 (19.2)	3	3	3	4
	610 (24)	3	3	3	3
41 x 203 x 0.879	305 (12)	3	3	6	9
	406 (16)	3	3	6	8
	488 (19.2)	3	3	6	8
	610 (24)	3	3	6	7
41 x 203 x 1.146	305 (12)	4	5	7	8
	406 (16)	4	5	6	7
	488 (19.2)	4	5	6	7
	610 (24)	4	5	6	7
41 x 203 x 1.438	305 (12)	3	4	5	6
	406 (16)	3	4	5	5
	488 (19.2)	3	4	5	5
	610 (24)	3	4	4	5
41 x 203 x 1.811	305 (12)	4	4	5	6
	406 (16)	3	4	5	5
	488 (19.2)	3	4	4	5
	610 (24)	3	4	4	5
41 x 254 x 1.146	305 (12)	4	4	7	9
	406 (16)	4	4	7	9
	488 (19.2)	4	4	7	8
	610 (24)	4	4	7	8
41 x 254 x 1.438	305 (12)	4	4	6	7
	406 (16)	4	4	6	7
	488 (19.2)	4	4	6	7
	610 (24)	4	4	6	6
41 x 254 x 1.811	305 (12)	4	5	6	7
	406 (16)	4	5	6	7
	488 (19.2)	4	5	6	7
	610 (24)	4	5	6	6
41 x 305 x 1.146	305 (12)	3	3	6	9
	406 (16)	3	3	6	9
	488 (19.2)	3	3	6	9
	610 (24)	3	3	6	9
41 x 305 x 1.438	305 (12)	4	4	7	9
	406 (16)	4	4	7	8
	488 (19.2)	4	4	7	8
	610 (24)	4	4	7	8
41 x 305 x 1.811	305 (12)	5	6	8	9
	406 (16)	4	6	7	9
	488 (19.2)	4	6	7	8
	610 (24)	4	5	7	8

Figure 3.33 continued

Header to Trimmer Connections for Floor Openings - Floors WITH Concrete Topping					
Loading: LL = 1.90 kPa DL = 0.50 kPa		Number of #10 Screws Required in *each leg of the clip angle* connecting the Header to Trimmer (See Figure 3.30)			
Joist Designation (mm)	**Spacing mm (in)**	**Single Track**	**Single Joist**	**Joist + Track**	**Joist + 2 Tracks**
41 x 152 x 0.879	305 (12)	4	5	7	8
	406 (16)	4	5	7	8
	488 (19.2)	4	5	6	7
	610 (24)	4	5	6	7
41 x 152 x 1.146	305 (12)	4	5	6	7
	406 (16)	4	4	6	6
	488 (19.2)	4	4	5	6
	610 (24)	4	4	5	6
41 x 152 x 1.438	305 (12)	3	4	4	5
	406 (16)	3	3	4	5
	488 (19.2)	3	3	4	5
	610 (24)	3	3	4	4
41 x 203 x 0.879	305 (12)	4	4	7	10
	406 (16)	4	4	7	10
	488 (19.2)	4	4	7	10
	610 (24)	4	4	8	9
41 x 203 x 1.146	305 (12)	5	5	8	9
	406 (16)	5	5	7	9
	488 (19.2)	5	5	7	8
	610 (24)	4	5	7	8
41 x 203 x 1.438	305 (12)	4	5	6	7
	406 (16)	4	4	6	6
	488 (19.2)	4	4	5	6
	610 (24)	3	4	5	6
41 x 203 x 1.811	305 (12)	4	5	6	7
	406 (16)	4	4	6	7
	488 (19.2)	4	4	6	6
	610 (24)	4	4	5	6
41 x 254 x 1.146	305 (12)	4	4	6	11
	406 (16)	4	4	6	11
	488 (19.2)	4	4	7	10
	610 (24)	4	4	8	10
41 x 254 x 1.438	305 (12)	4	4	6	8
	406 (16)	4	4	6	8
	488 (19.2)	4	4	6	8
	610 (24)	4	4	6	7
41 x 254 x 1.811	305 (12)	5	6	8	9
	406 (16)	5	5	7	8
	488 (19.2)	5	5	7	8
	610 (24)	4	5	7	8
41 x 305 x 1.146	305 (12)	4	4	7	10
	406 (16)	4	4	7	10
	488 (19.2)	4	4	7	11
	610 (24)	4	4	8	11
41 x 305 x 1.438	305 (12)	4	4	7	10
	406 (16)	4	4	7	9
	488 (19.2)	4	4	7	9
	610 (24)	4	4	7	9
41 x 305 x 1.811	305 (12)	6	6	9	10
	406 (16)	6	6	8	10
	488 (19.2)	5	6	8	10
	610 (24)	5	6	8	9

Figure 3.34

Floor Opening Worked Example

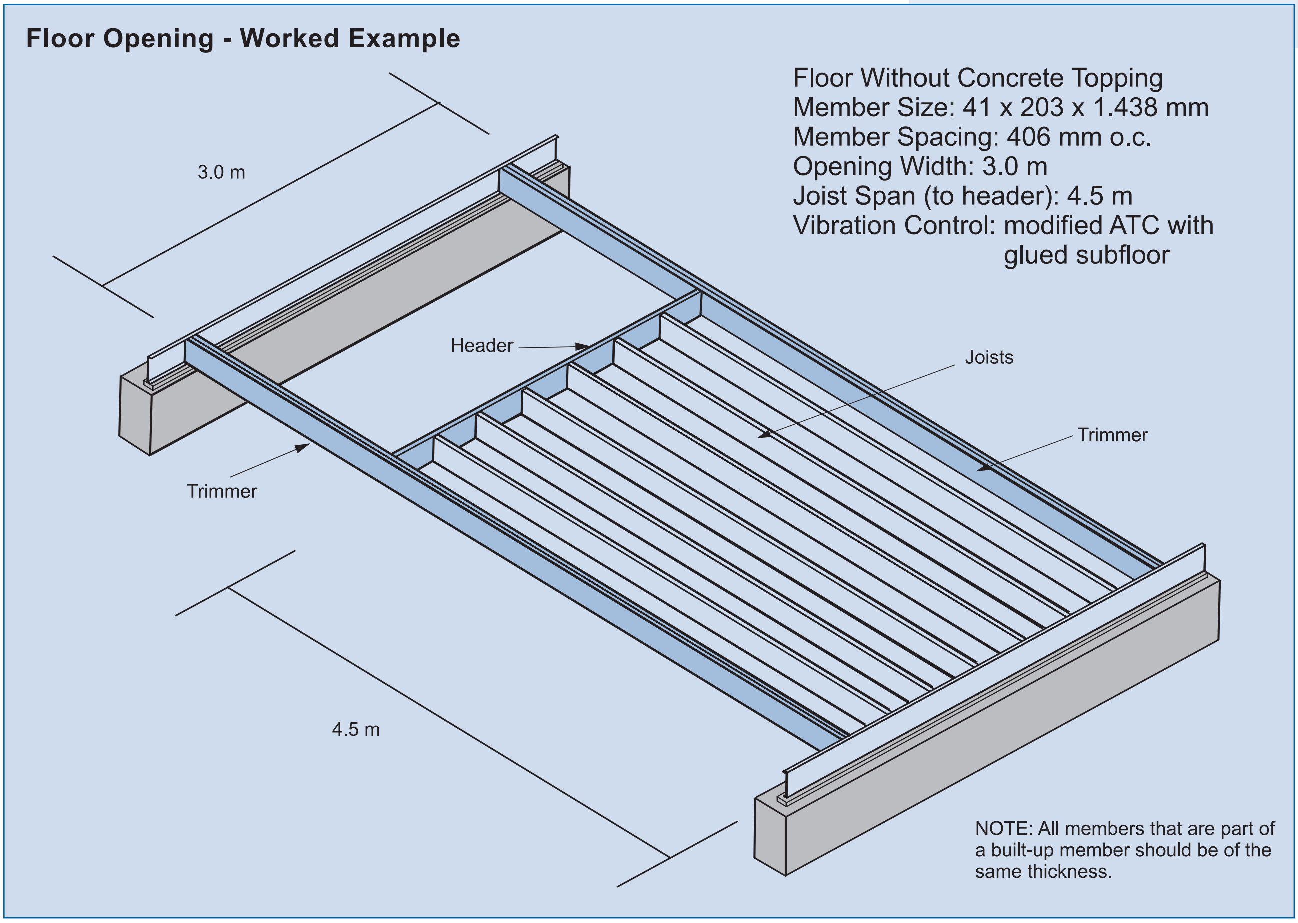
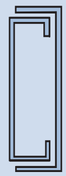


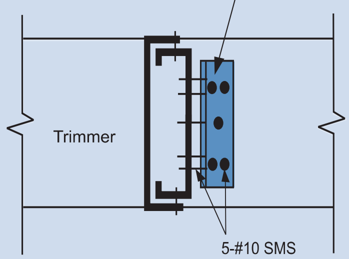
Figure 3.34 continued

Header Selection:


Header Type C:
joist + track

From Header Joist Table 3 built up member configuration is determined by reading across from member size and spacing and finding a header length equal or larger than the one required (i.e larger than 3.0). In this case a header of up to 3.1 m can be used with a combined joist + track.

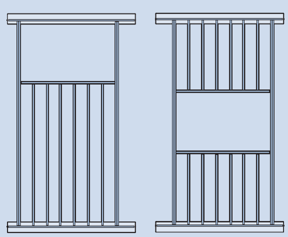
Header Connection Selection:



From Figure 3.33 (floors without concrete toppings), read across from the appropriate joist designation and spacing, and down header configuration column to find the number of #10 screws required in each leg of the clip angle connecting the header to the trimmer.

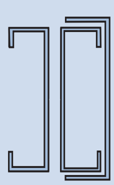
For a member size of 41 x 203 x 1.438 with 406 spacing and Type C header, the connection requires 5 screws on each clip angle leg. The corresponding connection detail is given in Figure 3.30. This connection must be used at either end of the header to fasten it to the trimmer.

Trimmer Selection:



Opening Types

To select the appropriate trimmer you must first determine the opening type. In this case the opening type is a type "A" because it frames into a header on one side and the foundation on the other. From Trimmer Joist Table 5 read across from the appropriate member size and spacing until you find a header size greater then the one being used. From this you can determine the trimmer configuration.


Trimmer Type C:
2 joists + 1 track

In this case for a header of 3.5 m (the next largest from the actual opening size) the trimmer must consist of 2 joists + 1 track.

Looking Ahead

Accommodating Services in Floor Systems
When possible the framer/ designer should discuss the frame and service layouts ahead of time with the sub-trade in order to provide adequate space and minimize potential problems. Framers should ensure that all pre-punched joist holes are lined up. It is often helpful to increase the spacing of floor joists in bathroom floors to 483 mm (19 in) o.c. or 610 mm (24 in) o.c. instead of the normal 406 mm (16 in) o.c. To avoid having to increase joist depth, use thicker members. These changes may also require a thicker subfloor sheathing.

Joists are normally supplied with pre-punched holes in their webs for the installation of services. When installing floor joists, care should be taken to ensure that these holes are aligned. Chapter 6 discusses what to do when further holes are needed.

Figure 3.35 illustrates how doubled joists can be used to support partition walls while allowing services (e.g. heating ducts) to pass through the floor into the wall.

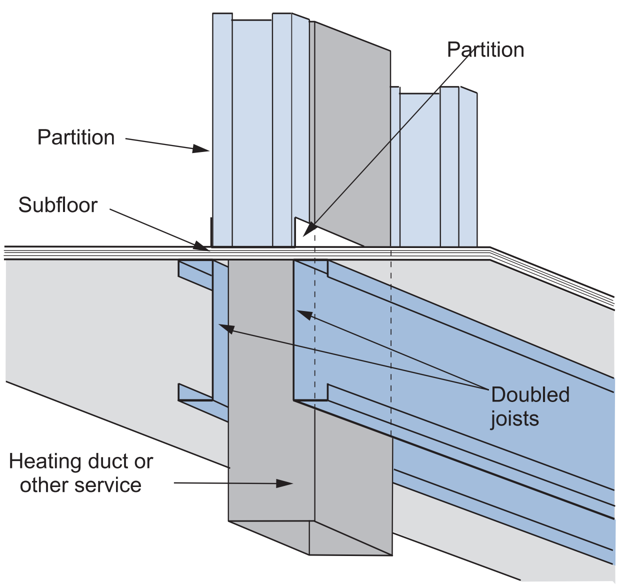


Figure 3.35

Ducts Through Partition Walls

Floors Checklist		Y	N
Beams	All built-up lightweight steel beams (excluding header and trimmer configurations for openings) have been engineered		
	All structural steel beams have been selected according to building code		
	Steel beams bear no less than 89 mm (3 1/2 in) at end supports		
	Supports for steel beams meet Part 9 requirements, or have been engineered		
	Web stiffeners are installed in all joists where they bear on a beam below		
	Continuous joists supported by steel beams have been fastened with a clip angle screwed to the joist web and attached with 2 fasteners to the beam		
	Lapped joists supported on a steel beam have a clip angle installed between them fastened to through both joists with screws and to the beam below with 2 fasteners		
Closure Channels	The closure channel is of the same depth as the joists		
	The closure channel is at least 1.09 mm thick		
Joist Installation	Floor joists have been selected from the appropriate Member Selection Table		
	All floor joists are in-line with the studs below		
	The closure channel is not spliced within 75 mm (3 in) of a joist		
	Each joist is installed with a web stiffener at each end fastened with 2 -#10 screws to the closure channel and 3-#10 screws to the joist web		
	Any inaccessible spaces, such as double perimeter joists have had insulation added during framing		
	Knockouts line up		
	All joist webs face the same direction		
	Joists are installed from below and not walked on until the subfloor has been secured		
Web Stiffeners	Web stiffeners are installed at each location along the joist where it rests on a loadbearing stud wall, beam or foundation, and at joist locations supporting loadbearing walls or concentrated loads from above		
	Web stiffeners are fastened on either side of the joist with 3-#10 screws to the joist web and 2-#10 screws to the closure channel (where present)		
Blocking and Bracing	Solid blocking is installed between joists at a maximum spacing of 2400 mm (94 in)		
	Flat strap or notch channel bridging must be fastened to the bottom flange of each joist using at least 1 - #8 screw		
	Bridging straps should be at least 38 mm wide by 0.879 mm thick (1-1/2 in x 0.0346 in) and spaced not more than 2400 mm (94 in) from each support or other rows of bridging		
	The ends of the steel strapping should be fastened to the blocking with at least 4 - #8 screws. Alternatively, the strap can be anchored directly to the exterior wall		

Floors Checklist			
		Y	N
Cantilevers	Where floor joists cantilever out beyond a support such as in the case of balconies or bay windows details have been engineered		
	Ensure air barrier continuity is maintained at all floor cantilevers		
	Exterior insulation in place to prevent thermal bridging		
Subfloor	The subfloor is fastened to the flanges of joists using #8 x 1-1/4 in (31 mm) bugle-head screws spaced 152 mm (6 in) o.c. along the sheet edges and 12 305 mm (12 in) o.c. in the field		
	Subfloors must conform to the NBCC Table 9.23.14.5.A		
Floor Openings	All header and trimmer members have been selected from the appropriate Member Selection Tables		
	All built-up sections should be made from members of equal thickness, and fastened together at least every 610 mm (24 in) o.c.		
	The sections used in built-up members must be continuous lengths, unless their purpose is non-structural (i.e. closing off rough openings).		
	Headers are fastened to trimmer joists using clip angle connections selected from Figure 3.30 "Header Connections for Floor Openings" and Figure 3.33 "Connections for Floor Openings"		
	Tail joists are fastened to stairwell headers using a clip angle connector with 3 - #10 screws per angle leg		

Chapter Four

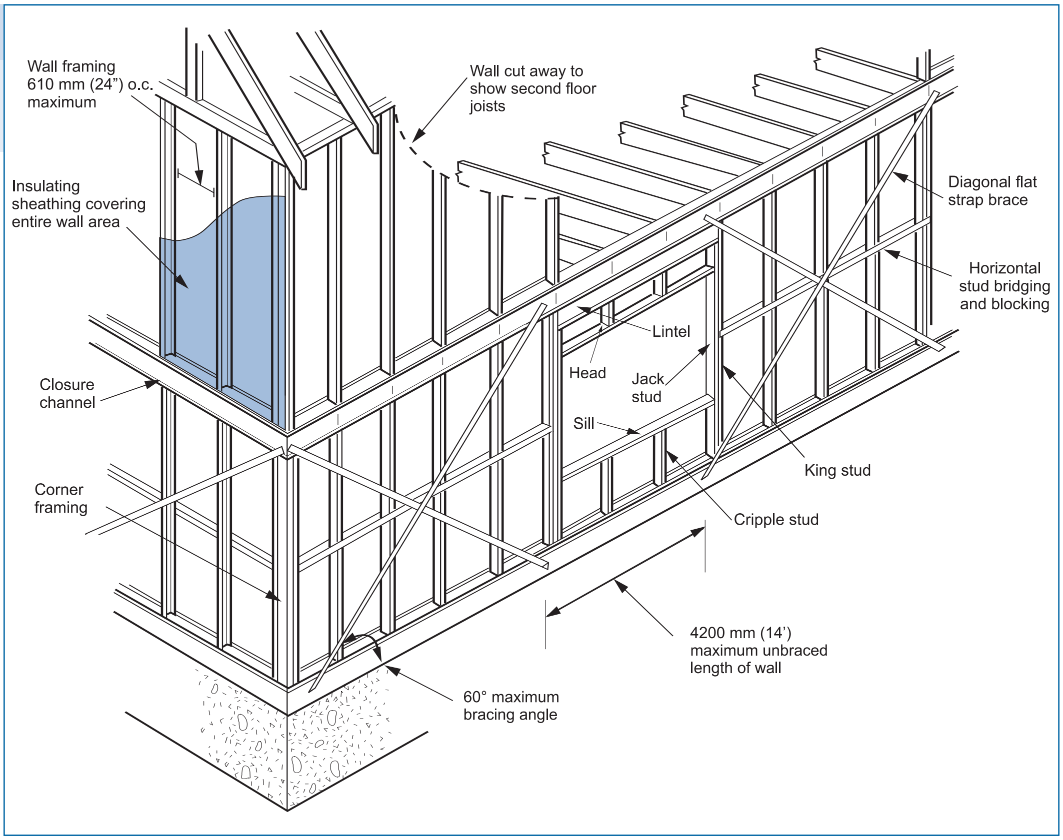
Walls

Introduction

This chapter provides the framing requirements for exterior loadbearing, interior loadbearing and non-loadbearing partition walls, including the requirements for wall framing components such as lintels and lateral bracing. Figure 4.1 illustrates the typical components of a wall frame.

Figure 4.1

Wall Framing

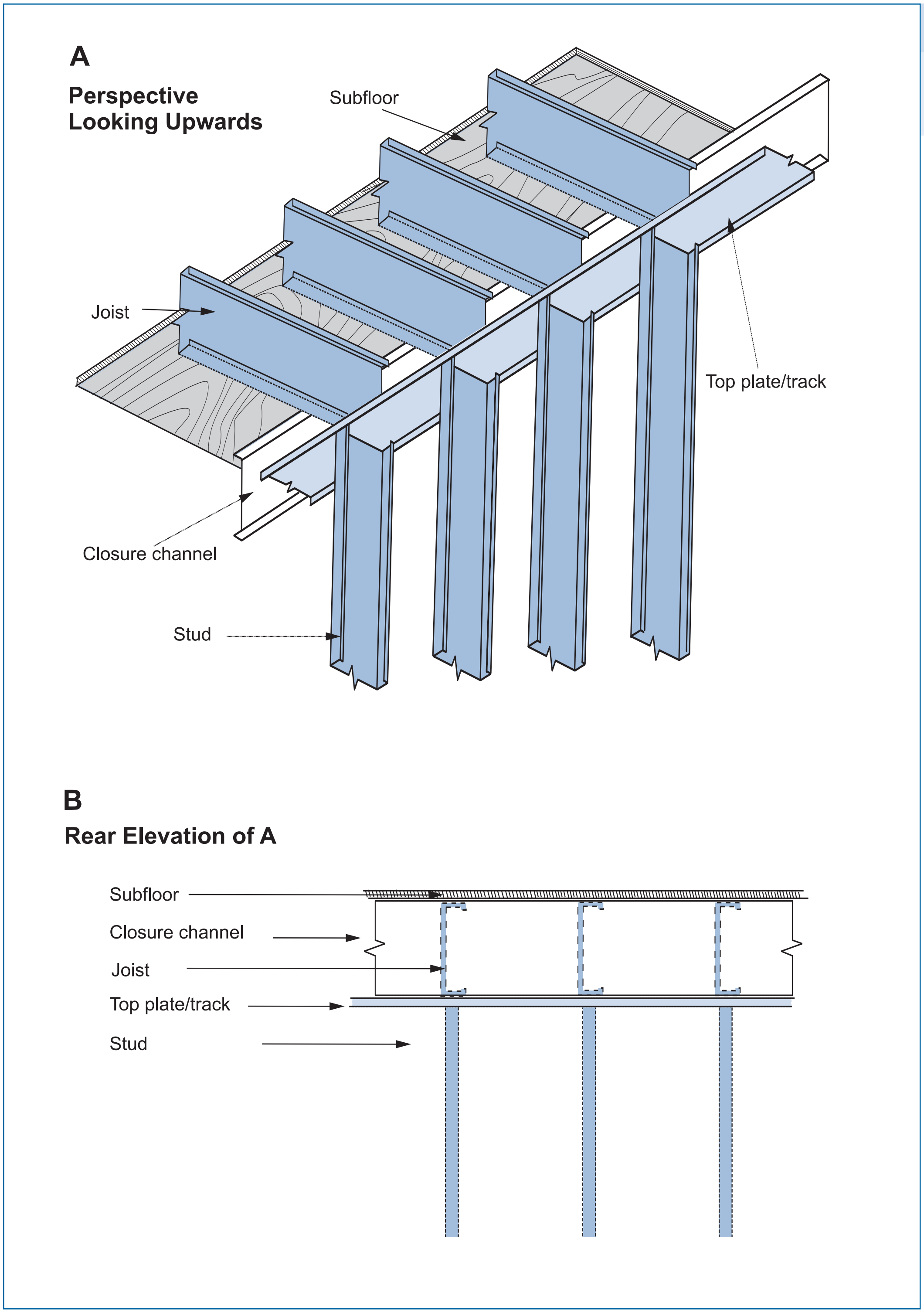


Wall systems must be designed and constructed to transfer loads from roofs and floors to the foundation. They must be able to resist racking from wind and earthquakes. As discussed in later chapters, walls must also provide backing for interior and exterior finishes and control the flow of heat, moisture and air into and out of the dwelling. This chapter explains the structural requirements of walls as part of the design process. It also explains the method of assembly for the various wall components.

As discussed in Chapter 3, loadbearing lightweight steel frame walls should always be framed ‘inline’. This means that the studs must bear directly on top of the joists and studs below because the track section is not a loadbearing element. The centre lines of the stud and joist can be off set no more than set out in Figure 1.1. From a design point of view, this means that the studs and joists throughout the house must have the same spacing, which can have impact on the member selection. It is essential to consider the in-line framing requirements when planning the wall layout. Figure 4.2 illustrates the inline framing principle.

Figure 4.2

In-line Framing



Looking Back:

Colour Codes for Standard Thicknesses		
	Minimum Thickness	
Colour	mm	inches
white	0.836	0.0329
yellow	1.087	0.0428
green	1.367	0.0538
orange	1.720	0.0677
red	2.454	0.0966

The most common method of wall erection for steel framing is the tilt-up method, which is similar to the method used to erect wood frame walls. Walls are framed on the platform created by each floor and then tilted into place. It is more efficient to install the wind bracing, bridging and exterior rigid insulation to the assembly before the wall is tilted up. There is no limit to the length of an individual wall section that can be framed in this manner.

Review & Re-evaluate - Screw Sizes

Minimum screw sizes for steel-to-steel connections shall comply with the table below. There are two common screw point designations used in residential steel framing: sharp point and drill point (also known as self-drilling sheet metal screws). Self-drilling sheet metal screws (SMS) are required when the total thickness of steel exceeds 0.879 mm (0.0346 in) and are designated for individual sheets up to 2.8 mm (0.112 in). Sharp point screws are acceptable for steel thicknesses of 0.879 mm (0.0346 in) or less.

Screw Sizes for Steel-to-Steel Connections

Screw Size	Point Type	Nominal Screw Diameter mm (inches)	Total Thickness of Connected Steel mm (inches)
#8	#2 (sharp point)	4.2 (0.164)	Up to 0.879 (0.0346)
#8	#3 SMS (drill point)	4.2 0.164	2.79 to 3.56 (0.100 to 0.140)
#10	#3 SMS (drill point)	4.8 (0.190)	2.79 to 4.45 (0.110 to 0.175)
#12	#3 SMS (drill point)	5.5 (0.216)	2.29 to 5.33 (0.090 to 0.210)

Determining Loads

The loads that act on floors, and which are subsequently transferred to walls, were first discussed in Chapter 3: Floor Systems. Loadbearing walls are subjected to all of the same dead and live loads as floors. Furthermore they are subjected to wind and earthquake loads as well as rain and snow loads transferred from the roof. These loads vary from region to region. Design data for all loads is available

from both the national as well as your local building code. To calculate wind and snow loads see below. Earthquake loads affect bracing requirements and are discussed in further detail later in this chapter.

Non-loadbearing walls carry their own weight (studs and drywall) only, and are often interior partition walls that divide an area into rooms. These walls are generally installed after the loadbearing floors, walls, and roof members have been properly braced and fastened in place. Because non-loadbearing walls do not perform a structural function, the in-line framing requirement previously described is not applicable, although they may be desirable for mechanical, plumbing etc.

How to Determine the Design Snow and Wind Loads

Climatic data is available in the National Building Code of Canada (Appendix C), or the appropriate Provincial building code, for locations across the country. The roof snow load and the q(1/30) hourly wind pressure are needed for the member selections. This information should also be available from the local building official.

Snow Load

Find the values of the ground snow load, S_s, and rain load, S_r, for the location nearest to the building site. This information is available from the Building Code or local building official.

Determine the roof snow load as follows (as per The National Building Code of Canada):

$$\text{Roof snow load} = 0.6 \times S_s + S_r$$

No allowance is included here for snow accumulation due to drifting, unbalanced snow loading, snow sliding from steep roofs, or reductions due to wind effects as allowed under Part 9 of the National Building Code of Canada. Professional advice should be consulted if there is any question about the appropriate loading to use.

Wind Load

Find the values of the 1/30 hourly wind pressure for the location nearest to the building site. This information is available from the Building Code or local building official.

Member Selection

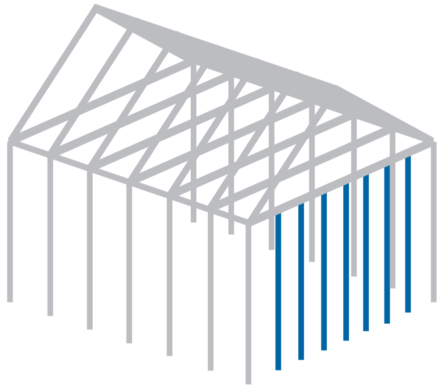
Loadbearing stud sizes are selected using the Member Selection Tables (Appendix A). As is the case with joists, studs should be ordered to the required length to minimize on-site cutting. Loadbearing studs must be accurately cut to length to provide proper bearing. Track sections are typically the same thickness as the wall studs.

The member selection tables for studs are organized by load type and wind load. The different load types are illustrated in Figure 4.3

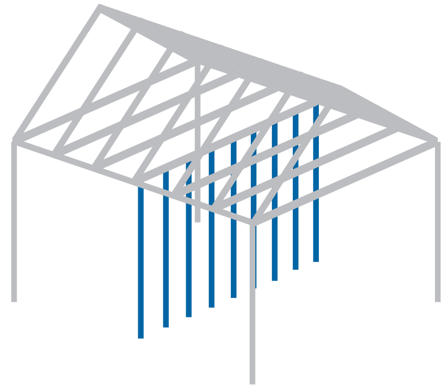
The complete Member Selection Tables can be found at the back of this book in Appendix A and have their own numbering system. Referring to Section 4 Tables, these studs are subjected only to wind loads, such as gable end walls (see Figure 4.3). Tables 4-IA and 4-IB are for standard stud to track connections, which do not use web stiffeners and are therefore categorized as 'web crippling type end connections'. Tables 4-IIA and 4-IIB refer to studs with end connections not susceptible to web crippling, i.e. use web stiffeners. The method for selecting wind bearing studs is given below.

Figure 4.3

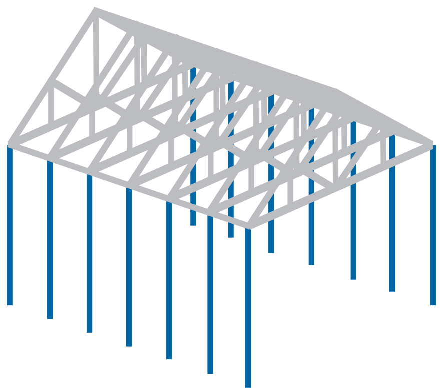
Load Types for Studs Selection and Wall Stud Tables



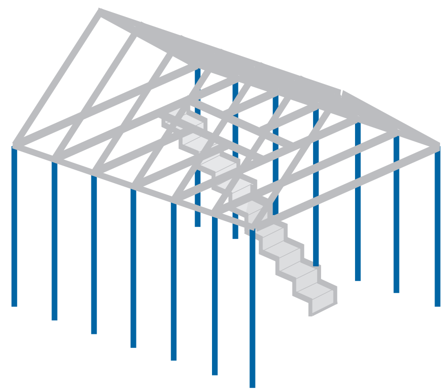
Wind Bearing Studs
Member Selection Tables (Appendix A) : Section 4



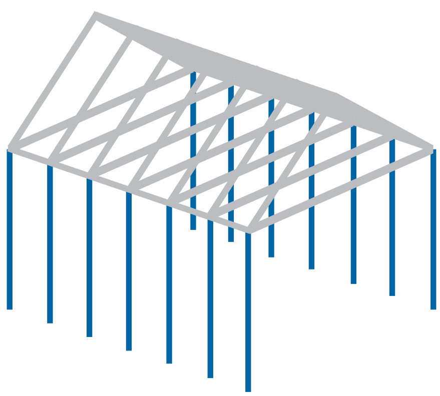
Interior Axial Load Bearing Studs
Member Selection Tables (Appendix A) : Section 5a



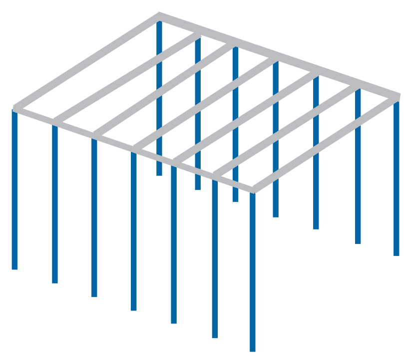
Axial Loadbearing Studs - Clear Span Trusses
Member Selection Tables (Appendix A) : Pages 5b-2 to -6, 5c-2 to -6, 5d-2 to -6, 5e-2 to -6



Axial Loadbearing Studs - Roof Rafter & Accessible Attic
Member Selection Tables (Appendix A) : Pages 5b-7 to -9, 5c-7 to -9, 5d-7 to -9, 5e-7 to -9



Axial Loadbearing Studs - Roof Rafter & Inaccessible Attic
Member Selection Tables (Appendix A) : Pages 5b-10 to -12, 5c-10 to -12, 5d-10 to -12, 5e-10 to -12



Axial Loadbearing Studs - Roof Joists
Member Selection Tables (Appendix A) : Pages 5b-13 to -14, 5c-13 to -14, 5d-13 to -14, 5e-13 to -14

How to Select Wind Bearing Studs

In some types of construction, there are wall studs that carry wind load only and no axial load. An example would be the wall under a clear span truss gable end. Selection tables for these members are given in Section 4 of the Member Selection Tables (Appendix A).

Step 1: Determine the maximum hourly wind pressure (described above).

Step 2: For the different wall areas on the plans, determine the maximum stud height and stud spacing.

Step 3: Using Table 4-IA, -IB, -IIA or -IIB go to the appropriate column corresponding to the wind pressure and stud spacing. Go down the column and find the smallest stud size that has a maximum height at least equal to the wall height.

Step 4: Record the wall stud member size on the plans for the appropriate area.

Step 5: Repeat Steps 3 and 4 for each wind bearing wall area.

Section 5A Tables are used for selecting studs for interior loadbearing walls. These tables are categorized by wall height and load type. Member sizes depend on whether or not the wall supports a clear span truss, the ceiling joists supporting an attic are accessible by stairway, or the wall supports roof joists. To select interior axial loadbearing studs see the method described below:

How to Select Interior Axial Loadbearing Studs

In some types of construction, there are interior axial loadbearing walls. Selection tables for these members are given in Section 5a of the Member Selection Tables.

Step 1: Determine the roof snow load (described above).

Step 2: For the different interior axial load bearing wall areas on the plans determine the following:

- stud spacing,
- number of floors supported by the wall,
- type of roof or ceiling joist supported,
- tributary width of the ceiling or floor joist (the tributary width is one half of the span).

Step 3: Find the appropriate table in Section 5a, according to ceiling height. If the wall is to support roof joists, select the appropriate roof snow load.

Step 4: Go to the appropriate section corresponding to the ceiling or floor joist tributary width.

Step 5: Go across the row corresponding to the stud spacing to the column appropriate to the number of supported floors. Read off the stud designator. The size of stud corresponding to the designator is given at the bottom of the page.

Step 6: Record the wall stud member size on the plans for the appropriate area.

Step 7: Repeat Steps 3 to 6 for each interior axial loadbearing wall area.

The remaining tables apply to exterior loadbearing studs. They are organized by wind load, beginning with tables for maximum hourly wind loads up to 0.40 kPa and ending with tables for up to 0.80 kPa. Within this general order, tables are divided by the type of roof they are supporting as described above and depicted in Figure 4.3. To select exterior axial loadbearing studs see the method described below.

How to Select Exterior Axial Loadbearing Studs

The exterior stud walls that support both vertical loads as well as wind loads are covered by Tables 5b through 5e.

Step 1: Determine the maximum hourly wind pressure and roof snow load (described above).

Step 2: For the different exterior load bearing wall areas on the plans determine the Following:

- stud spacing,
- number of floors supported by the wall,
- type of roof or ceiling joist supported,
- tributary width of the ceiling or floor joist, and
- tributary width of the roof truss or rafter (the tributary width is one half of the span).

Step 3: Select the appropriate section of the Member Selection Tables depending on wind pressure:

Section 5b - q(1/30) = 0.40 kPa
Section 5c - q(1/30) = 0.50 kPa
Section 5d - q(1/30) = 0.60 kPa
Section 5e - q(1/30) = 0.80 kPa

Step 4: Within this section, choose the appropriate table according to ceiling height and framing type (clear span truss, clear span rafters and accessible attic joist etc.).

Step 5: Under the proper roof snow load, go across the row corresponding to the ceiling or floor joist tributary width, roof truss or rafter tributary width, and stud spacing to the column appropriate to the number of supported floors. Read off the stud designator. The size of stud corresponding to the designator is given in Section 5f: Axial Loadbearing Stud Tables Interior and Exterior Notes.

Step 6: Record the wall stud member size on the plans for the appropriate area.

Step 7: Repeat Steps 3 to 6 for each exterior load bearing wall area.

Beyond knowing the wind load and roof type that is to be supported by the studs, additional design information is required, primarily:

- floor to ceiling wall height
- tributary width of joists on the second floor (e.g., one-half the floor width supported by the joists);
- tributary width of the roof trusses (e.g., one-half the roof truss plus roof overhang); and
- wall stud spacing

These measurements are illustrated in the stud selection worked example (Figure 4.4). It is important to remember that values must always be rounded up to the values shown in the tables.

Figure 4.4

Worked Example-stud selection

Stud Selection - Worked Example

To choose the appropriate table, one must know:

- **Wind Pressure**
- **Roof type**
- **Floor to ceiling height**

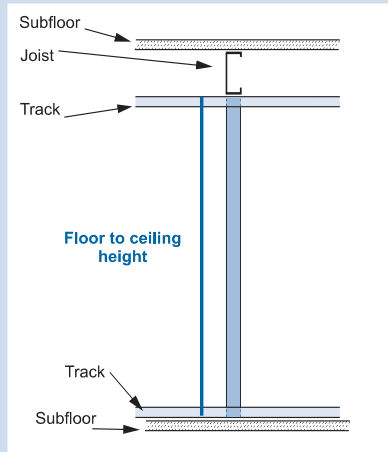
The example is in Sackville, New Brunswick. Hourly wind pressure (1/30): 0.52 kPa This must be rounded up to 0.6 kPa.

Wall Type: Exterior axial loadbearing

Roof Type: Clear span truss

Floor to ceiling height: 3073 mm (10'-1") See figure.

These pieces of information refer to the table on page 5d-4 of the Member Selection Tables.



Once the appropriate table is found, calculate the roof snow load to be able to use the table.

Roof Snow Load

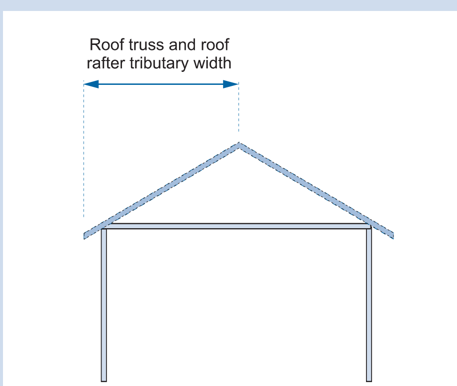
To calculate the roof snow load, find the ground snow load in the building code. Sackville, New Brunswick's ground snow load: S_s= 2.3 S_r= 0.5

Roof snow load= 0.6 x S_s + S_r
= 0.6 x 2.3 + 0.5
= 1.68
This load will have to be rounded up to the next closest figure on the table, 2.0 kPa.

Next, determine the roof truss and roof rafter tributary width. This is measured as shown below.

The roof measures from ridge to eaves 5.2 m so round it up to the next closest value on the table: 5.4 m

The final category is the stud spacing. Remember that this is dictated by the joist spacing which must conform with the in-line principle. If the spacing is 406 mm o.c. and there is only one floor supported above then we are left with the choice of two members: A3 and B2. This final choice will depend on factors such as desired wall cavity depth. It is recommended to keep all of the members as similar as possible in depth and thickness.



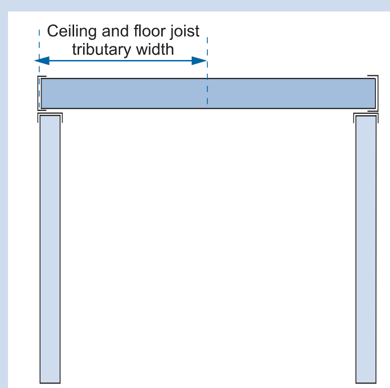


Figure 4.4

Continued

EXTERIOR AXIAL LOADBEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY - NO CEILING JOISTS Roof Snow Load = 1.0 kPa					
Joist Tributary Width (m)	Truss Tributary Width (m)	Member Spacing (Mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B1	A3, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	**A3, B2**	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3

Conversion Chart
305 mm = 12 in
406 mm = 16 in
488 mm = 19 in
610 mm = 24 in

A0, B0 = no stud selection is available
A1 = 41 x 89(or 92) x 0.879
A2 = 41 x 89(or 92) x 1.146
A3 = 41 x 89(or 92) x 1.438
B1 = 41 x 152 x 0.879
B2 = 41 x 152 x 1.146
B3 = 41 x 152 x 1.438

There is often a tradeoff between design efficiency and construction practicality - that is, selecting the many stud sizes versus selecting just one size that would fit all. It is often reasonable to use 41 x 89 x 1.146 mm (1-5/8 x 3-5/8 x 0.0451 in) studs for the ground floor exterior walls and partitions and 41 x 89 x 0.879 mm (1-5/8 x 3-5/8 x 0.0346 in) studs for the second floor exterior walls, and for the second floor loadbearing partitions. Partitions on the ground floor may be a mixture of loadbearing and non-loadbearing walls. For simplicity, all partition studs on the ground floor may be constructed as loadbearing walls.

Track sections, used as top and bottom plates, should, as a minimum, have the same thickness as the wall studs and must fit around the studs snugly. In the example above, the track section for all walls would be 30 x 89 x 1.146 mm (1-1/4 x 3-5/8 x 0.0451 in).

Splicing

LSF members can be manufactured to any desired length, but the practical limit depends on manufacturer handling, local transportation restrictions, and the number of framers available to handle the material on site. A wall should be a length that can be expediently handled by a two to three person framing crew. Track sections can be spliced to complete a full length wall as shown in Figure 4.5. It is important that there is no splice within 75 mm (3 in) of a stud. Splices should be attached with 4 screws on each side.

No splicing of the wall stud is permitted without details by a design professional.

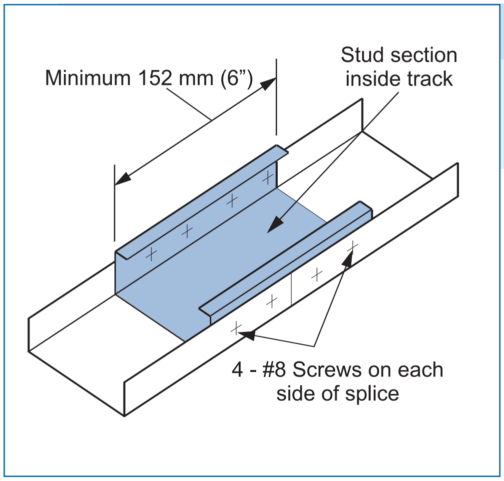


Figure 4.5

Track Splice

Framing Exterior Loadbearing Walls

This section discusses layout, assembly and erection of exterior loadbearing walls. Lintels, horizontal flat strap bridging and wind bracing are discussed later in this chapter.

There are two different approaches to framing lightweight steel walls. Walls can either be laid out and assembled on a horizontal surface (normally the floor) and then tilted into place (typical platform construction), or can be constructed using panelization. Panelization is the process of pre-assembling floors, walls and trusses in a factory or on-site and then installing them into the house. Special panel tables exist to make pre-assembly on site easier.

Layout

As mentioned above, a wall should be no longer that what can be handled by a two to three person crew. Marking the locations of track, stud and openings can make the layout and assembly of walls more efficient and accurate. Use a permanent marker for all markings. The following steps outline a layout method:

1. Mark the location of the bottom plate/track on the subfloor.
2. Place both the bottom and top plates along the mark where the wall is to go and temporarily clamp them together web to web. If possible the bottom and top tracks should be cut to equal length.
3. Mark the location of the studs on the flanges of both tracks. Each stud should be located directly above a joist below so that the spacing corresponds.
4. As with floor joist layout, write an ‘x’ on the side of each line indicating the direction in which the stud should face (they should all face in the same direction).

5. In addition to stud location, mark all wall openings, including the number of king and jack studs. (See Wall Opening section of this chapter).
6. If any double studs are necessary at connection points for diagonal bracing, mark these as well. (See Bracing section in this chapter).
7. If the wall runs to the edge of the subfloor where it meets a corner, mark the location for the corner stud. (Framing corners is discussed later in this section)

Looking Ahead

When laying out walls with the roof, 406 mm (16 in) o.c. stud spacing with 406 mm (16 in) o.c. truss spacing requires no special considerations. However, if the truss spacing will be larger than the stud spacing, for example 406 mm (16 in) studs and 610 mm (24 in) trusses, then either a double wood top plate or an engineered loadbearing steel top plate is required. This decision must be made well before the cut-list, as adding a double wood top plate may change the wall height, thereby affecting drywall, exterior finishes, window height etc.

Wall Assembly

The following steps outline one possible wall assembly method:

1. The bottom track should be tilted on its side and secured by toe-nailing through its corner into the subfloor.
2. Place a stud at each end of the wall into the top and bottom tracks.
3. Tap the top track with a hammer to seat the stud firmly in the track.
4. Clamp the flange of the stud to the flange of the track with locking C-clamps.
5. Fasten the studs to the track using a hex #8 screw for the exterior through the track flange and stud flange. See Figure 4.6.
6. Continue adding studs, fastening them top and bottom as you go, and checking that they are all facing in the same direction (coloured ends to the bottom) and the punch-outs line up. Pre-punched or field cut openings must not be closer than 305 mm (12 in) from the top or bottom of the stud. All the studs are first fastened on the exterior side.
7. Fasten king studs at the rough openings with the web side of the stud facing the opening and punch-outs aligned.
8. When all the studs have been fastened check that the studs are perpendicular to the top and bottom track by measuring diagonally across. If the distances are equal then the wall is square.
9. Lintels, jack and cripple studs, head and sill tracks, horizontal flat strap bridging, wind bracing (diagonal flat strap and/or sheathing) and rigid exterior insulation are all added before the wall is tilted into place.
10. After the wall has been tilted into place and temporary braces attached, fasten the studs to the track on the interior side. Loadbearing walls require screws on both sides of the stud to track connection.
11. Fasten inside flat strap bridging.
12. Once the wall is in place, and both sides are fastened, the bottom track must be fastened through the subfloor to the closure channel below using at least 1 - #8 screw at 305 mm (12 in) o.c. as shown in Figure 4.6.

Studs and track members need to fit snugly to effectively transfer loads. Damaged members often prevent loads from transferring effectively and should not be used. All studs in a wall should be aligned in the same direction.

Pre-punched or field cut openings must not be closer than 305 mm (12 in) from the top or bottom of the stud. Holes in wall studs must be located in the middle of the web and not exceed 38 mm (11/2 in) in width or 102 mm (4 in) in length. If larger holes are needed, or if they're located within 305 mm (12 in) of the end of the stud, the holes need to be properly reinforced, and may need to be engineered. Refer to Figure 4.7.

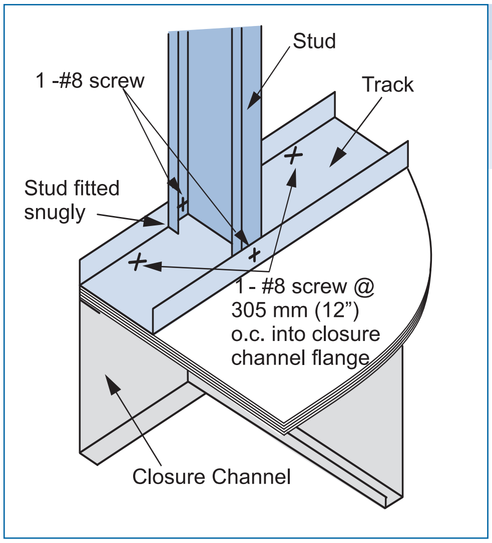


Figure 4.6

Connecting Studs to Track

Framing Bay Windows or Walls with Multiple Angles

In cases where walls have multiple angles, it is essential that the studs are still in-line with joists below. In some cases, the wall might be at an angle that requires additional studs to maintain the required minimum stud spacing. In all cases, joists must be supported in-line by wall studs.

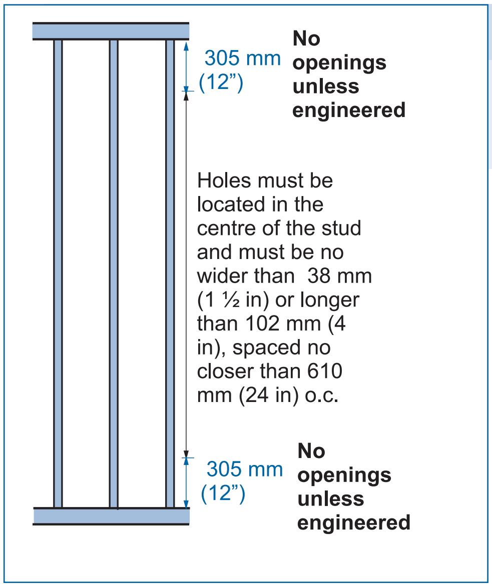


Figure 4.7

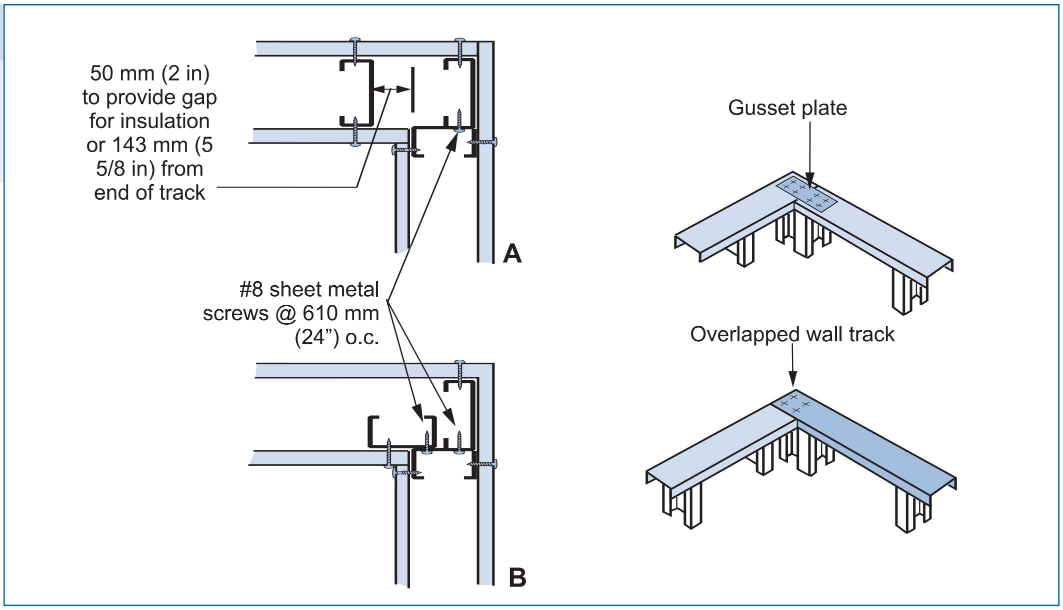
Holes in Studs

Framing Corners and Intersections

All corners and intersections require additional studs as backing for drywall. These additional studs must be placed so that there is access to insert insulation. Grommets should be inserted in corner studs to facilitate wiring later, when the studs may be hard to access. Two possible corner configurations are shown in Figure 4.8, please note that the lower one (B) may make wiring around the corner difficult. To use the upper configuration (A), place a mark 143 mm (5 5/8 in) (this may vary depending on stud width) back from the edge of the track so that there is enough room between studs for insulation. Use #8 screws at 610 mm (24 in) o.c. to connect adjoining studs. When joining the ends of two walls, cut one of the top tracks and lap it over the other top track (note that when building the wall this extra length required in the track must be accounted for). Fasten the lap with 4 - #8 screws as shown in Figure 4.8. Another option is to use a gusset plate, of the same thickness as the track, may be used instead of a lap. The gusset is fastened with 4 - #8 screws on each side of the gusset over the top track as shown in Figure 4.8.

Figure 4.8

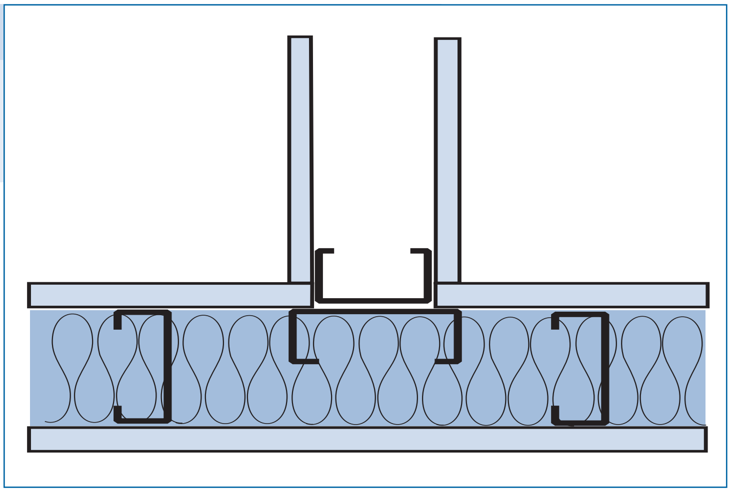
Framing Corners



A possible stud configuration for the intersection of two loadbearing walls is illustrated in Figure 4.9. In this case, a stud of a larger depth is used as a means of connecting the two walls while providing support for the drywall.

Figure 4.9

Framing Wall Intersections



As with all inaccessible stud spaces it is crucial that insulation is placed during the framing. Insulation needs to be placed in the jamb studs, lintels, corners and any cavity in the wall assembly that will not be easily accessible after all the walls have been erected. If you are using an interior air & vapour barrier then strips of polyethylene must be installed where interior walls meet exterior walls to ensure a continuous air barrier.

Wall Bracing

There are two main types of permanent bracing for LSF walls: horizontal and diagonal. Figure 4.1 provides a good overview. Horizontal flat strap bracing prevents the studs from twisting and is required for all loadbearing walls. Diagonal bracing resists wind and seismic loading (racking) and is required on all exterior walls. Before installing bracing check that the wall is square.

As the walls are installed, temporary bracing is required to resist loads during construction. This requirement is similar to that for wood frame walls. This can be provided by studs, using ground stakes as anchors.

Horizontal Flat Strap Bridging

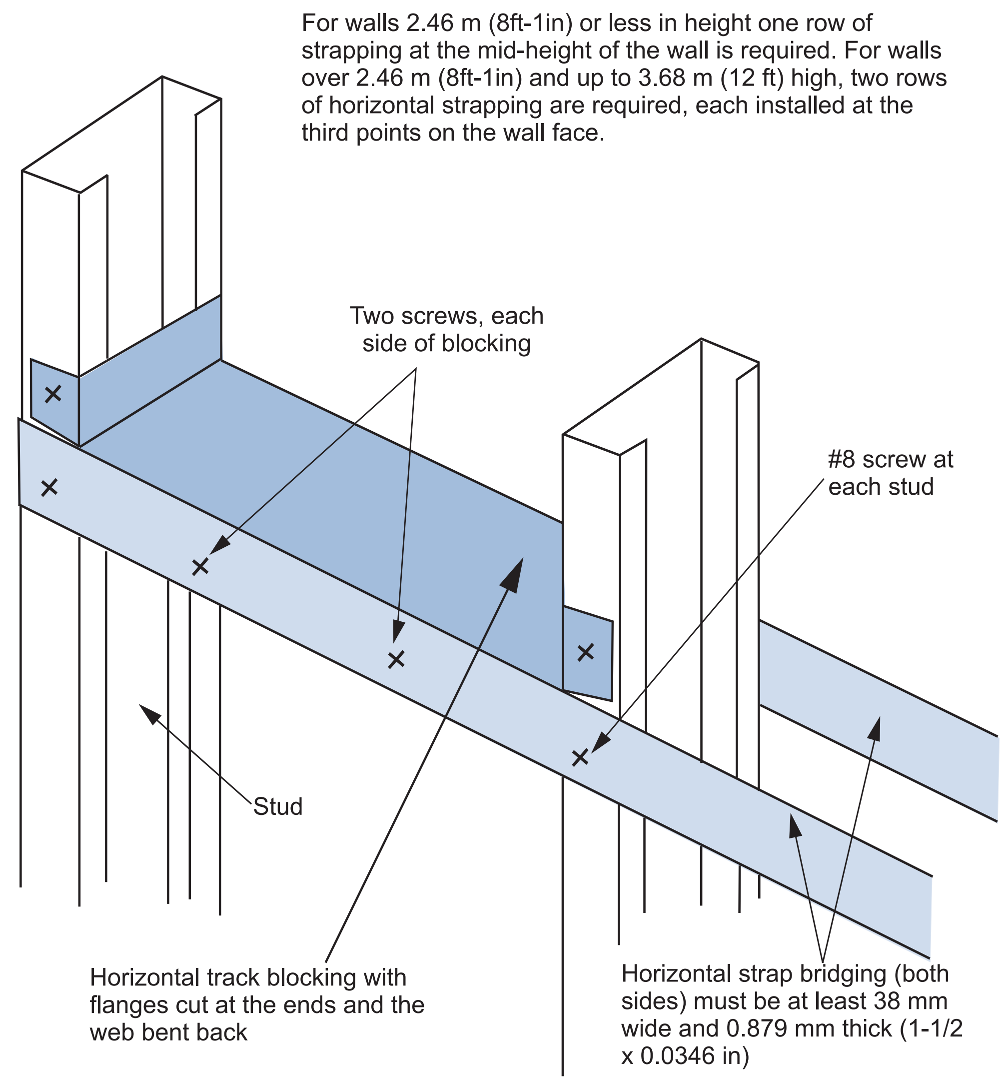
Like floors, loadbearing walls require horizontal strapping and bridging to prevent the twisting of members. Flat strapping is at least 38 mm wide and 0.879 mm thick (1-1/2 x 0.0346 in) sheet steel material. If exterior structural sheathing (e.g. OSB or plywood attached directly to the stud) is used, the flat strap bridging is not needed on that side of the stud, however it must still be installed on the interior stud flange.

Horizontal flat strap bridging must be installed on each side of all loadbearing walls. The strapping must be attached to every stud flange with at least 1 - #8 screw. For walls 2.46 m (8 ft-1 in) or less in height, one row of strapping installed at the mid-height of the wall is required. For walls over 2.46 m (8 ft-1 in) and up to 3.68 m (12 ft) high, two rows of horizontal strapping are required, each installed at the third points on the wall face. The top of every member selection table will remind you how many rows of bridging are required for the stud length you are considering.

The end of each horizontal strap must be anchored either to blocking installed between studs at either end of the wall or to the corner studs. The blocking illustrated in Figure 4.10 can be fashioned from wall track. At least 2 - #8 screws are used to fasten the strapping to the blocking or to the corner studs. See Figures 4.10 and 4.11. Strapping should be pulled taut as it is fastened.

Figure 4.10

Wall Blocking Detail



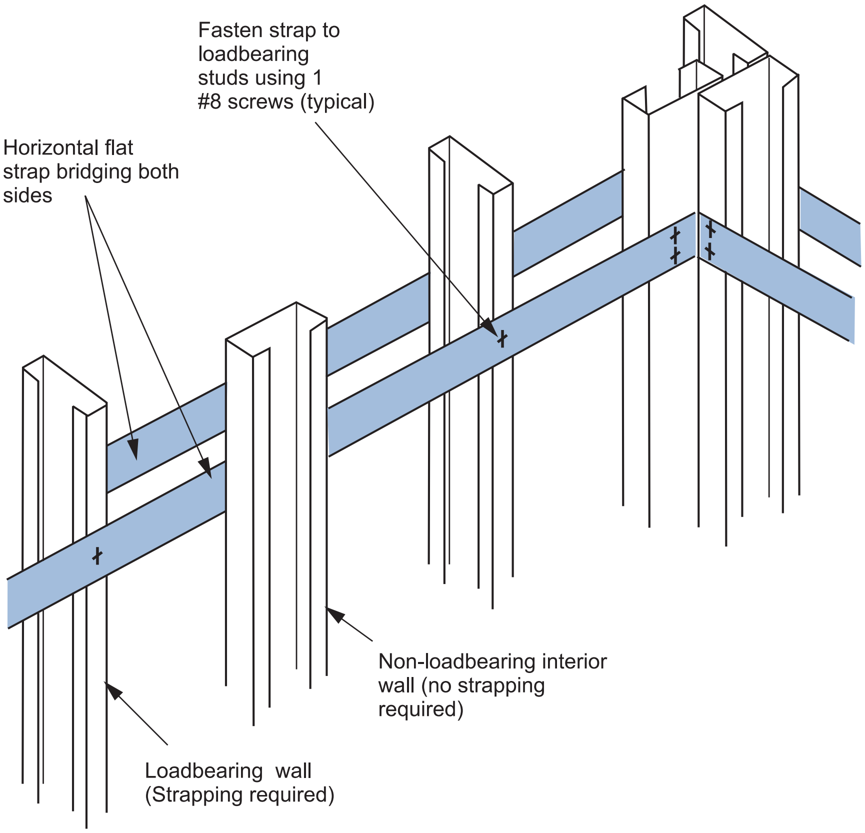


Figure 4.11

Wall Bridging Anchorage

Looking Ahead:

On walls of 2.46 m (8 ft-1 in) where the drywall will be installed horizontally, place your strapping either above or below the 1200 mm (4 ft) mark to avoid having the strapping interfere with drywall installation.

Note: Because the drywall cannot be used as bracing, it can be installed vertically. For more information see Chapter 8.

Diagonal Bracing

Diagonal bracing to resist wind pressures and to provide racking resistance under seismic loading is required at every storey on all exterior walls. Refer to Bracing Requirements for Walls (Appendix B) for a listing of the number of braces needed per wall according to wind and seismic loading. The worst case of earthquake or wind loading will determine the number of braces required. The local climatic conditions for the building site need to be consulted to determine the appropriate wind pressure and seismic parameters. Figure 4.12 illustrates a worked example for bracing walls.

In the high seismic areas it will be necessary to retain professional advice and investigate using structural sheathing instead of diagonal bracing.

Figure 4.12

Bracing Walls
Worked Example

Bracing Walls - Worked Example

Consider the example below to determine the required bracing for walls. The wind loads and seismic loads which the building may be subjected to will be needed and can be determined from Appendix C of the National Building Code of Canada (or your provincial code), which lists the climatic information for Canadian cities.

For the example below, for Guelph, Ontario:

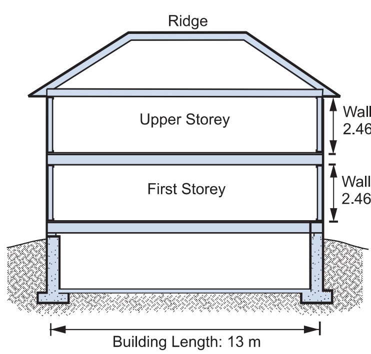
Hourly wind pressure (1/30): 0.30 kPa
Zonal velocity ratio: 0.05

Roof Snow Load:
(See in Chapter 4, *How to Determine the Design Snow and Wind Loads*)

$= 0.6 \times S_s + S_r$
$= 0.6 \times 1.7 + 0.4$
$= 1.42$ **kPa (Round up to 1.5 kPa)**

Now refer to Appendix B: Bracing Requirements for Walls. Tables X-1 refer to wind loads, and Tables X-2 refer to seismic loads. One must consult both tables and plan for the worse of the two.

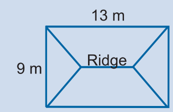
Location: Guelph, Ontario
Building Type: 2-storey, detached
Building Dimensions: 9 x 13 m (29'-6" x 42'-8")
Floor to Ceiling Wall Height: 2.464 m (8'-1")



In this case, under Table X-1, choose the appropriate wall height of 2.464 m and wind pressure of 0.4 kPa. Round the longest building dimension to the next largest size, which is 14 m. Read across the row to find that the upper storey, supporting no floors, requires two strap braces per wall. The first story, which supports one floor, requires four strap braces per wall.

Table X-2 refers to building dimensions in relation to the ridge of the roof. In this case, the building dimension perpendicular to the ridge is 9 m (rounded up to 10 m), while that parallel to the ridge is 13 m (rounded up to 14 m).

Roof (aerial view):



Under the heading "Single Storey or Upper Floor of a Multi Storey", read across the rows that correspond to zonal velocity of 0.05, and roof snow load of 1.5 kPa. Read down the appropriate building dimension column to find that one bracing strap per wall is required for the upper storey of the building.

Repeating these steps under the heading "First Storey of a Two Storey or Second Storey of a Three Storey", determines that 2 bracing straps per wall are required for the first storey of the building.

Table X-1 provides the worse case scenario, since the wind loads require more strap braces per wall than the seismic loads. Therefore, in this example, the building requires two strap braces per wall on the upper storey and four strap braces per wall on the first storey.

All climatic data can be found in both the NBCC (Appendix C), as well as your local building code. The Determining Loads section of this chapter describes how to calculate wind and seismic loads.

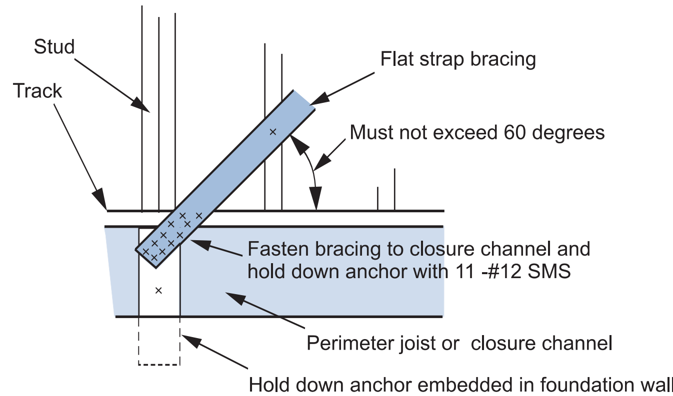
Diagonal strapping is 75 x 1.146 mm (3 x 0.0451 in) attached to every crossing stud with at least 1 - #8 screw (see Figure 4.13). Diagonal bracing must be located at each wall end and the angle to the horizontal of the bracing must not exceed 60 degrees. Double studs are needed when the strap is not connected to the closure channel or perimeter joist. Double studs should always face web to web (back to back) so that all space is insulated.

Diagonal straps must be anchored with 11 - #12 screws at each end to a double stud at the upper ends and to the closure channel at the lower end. Figure 4.13 illustrates how to anchor diagonal bracing. All straps must be drawn taut before attaching. Structural sheathing (OSB or plywood) is an acceptable alternative to horizontal and diagonal bracing, for garage walls where insulating sheathing is not required.

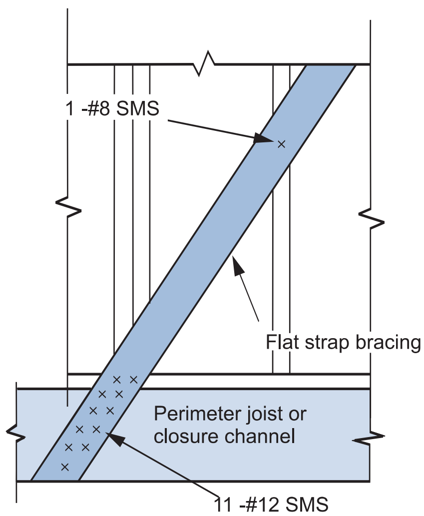
Figure 4.13

Anchoring of Diagonal Bracing

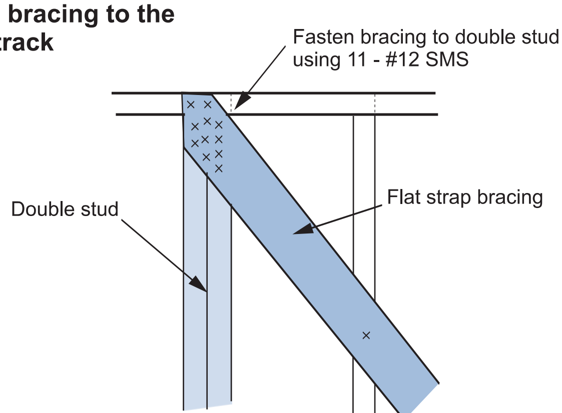
Fastening bracing to the foundation



Fastening bracing to second floor perimeter joist or closure channel



Fastening bracing to the top plate/track

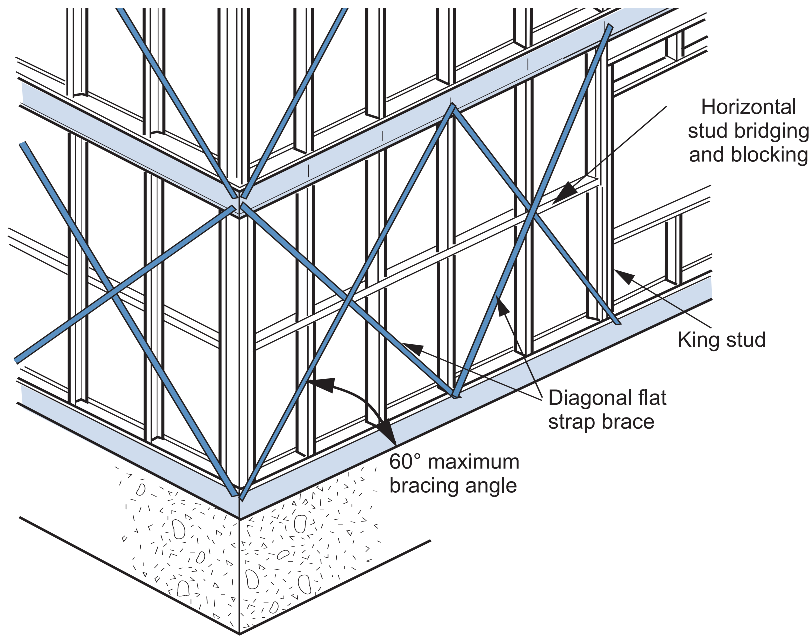


Note: Gusset plates may be used where space limitations prevent secure installation. Details for attachment of bracing using gusset plates must be engineered.

The "X" pattern of bracing is required because horizontal wind and earthquake loads can be exerted on a wall from either direction parallel to the wall. It is important that the strapping attached to the floor above and below the wall being braced.

Figure 4.14

X-Pattern Diagonal Bracing



Structural Sheathing

Structural sheathing (e.g., OSB or plywood) can serve as a substitute for horizontal and diagonal bracing. Sheathing should be installed with the longer axis (length) parallel to the stud framing. The sheathing may be attached to the wall either while on the assembly surface or after the wall is tilted up into place. In either case, it should be fastened tightly to the steel frame with #8 screws or pneumatic pins.

During fastening, the sheathing should be held tightly against the steel frame using a clamp or a coworker's help. The use of a screw gun with an adjustable-depth nosepiece will help prevent drilling too deep through the sheathing layers. If the sheathing layers are over-drilled, the connection will be less effective.

If structural sheathing is intended to carry the lateral loads due to wind or earthquake, a design professional will need to be involved.

Second Floor Loadbearing Walls

After the first floor walls and second floor has been framed and the subfloor installed it is time to install the second floor walls. Second floor loadbearing walls are installed in the same manner as the first floor. Second floor walls must be erected after all of the second floor subfloor is in place and fastened. The subfloor provides necessary bracing for the floor joists. The loadbearing walls must be placed over supporting elements such as loadbearing walls or double joists. The bottom track of the wall must be fastened through the subfloor to the closure channel below with one #8 screw at 305 mm (12 in) o.c. In cases where first and second floor members and openings are not aligned a lintel

needs to be created for the floor below so that there is never a stud or jack stud bearing onto a track without something below to pick up the load. If a second floor window has a jack stud which bears over a first floor lintel then an engineered detail is required, since that first floor lintel has not been designed to carry point loads from the second floor.

Interior Loadbearing Walls

Interior loadbearing walls are constructed in a manner similar to exterior walls. Interior loadbearing walls must bear directly onto a floor beam, loadbearing wall or other engineered supporting element. As with the exterior walls, blocking and horizontal flat strap bracing is required on both sides of interior loadbearing walls, but diagonal bracing is not required. Openings are framed in the same manner as described in a later section.

Where a loadbearing interior wall intersects an exterior wall, backing is needed for the drywall finish. The framing method is similar to that of intersecting non-loadbearing walls described below.

Non-Loadbearing Walls

Non-loadbearing walls are framed in a fashion similar to loadbearing walls, although the members are thinner and easily cut with only hand snips.

Non-loadbearing walls are not part of the structural system of the house. They are only required to support their own weight and as such are exempt from in-line framing rules. However, in-line framing can be desirable to simplify installation of plumbing and mechanical services. Non-loadbearing lightweight steel construction is governed by section 9.24 of the National Building Code of Canada (NBCC) which provides rules for stud size, spacing, fastening systems, maximum height and deflection, bracing, installation, sheathing and other requirements. Figure 4.15 provides an overview of some of these requirements. Section 9.24 of the NBCC has been included for reference, please see Figure 4.16.

Steel Studs for Non-Loadbearing Walls (9.24.2.1) (9.24.2.5)

Minimum Stud Size mm (in)	Minimum Metal Thicknesses mm (mil)	Maximum Stud Length, m (ft)		
		Spacing of Studs		
		305 mm o.c. (12 in o.c.)	406 mm o.c. (16 in o.c.)	610 mm o.c. (24 in o.c.)
30 x 40 (1-3/16 x 1-9/16)	0.46 (18)	-	3.0 (9' 10")	2.7 (8' 10")
30 x 63 (1-3/16 x 2-1/2)	0.46 (18)	-	4.0 (13' 1")	3.6 (11' 10")
30 x 91 (1-3/16 x 3-5/8)	0.46 (18)	-	5.2 (17' 0")	4.9 (16' 0")

Figure 4.15

Code Overview for Non-loadbearing Walls

Figure 4.16

NBCC Section 9.24

Section 9.24. Sheet Steel Stud Wall Framing

9.24.1. General

9.24.1.1. Application
(1) This Section applies to sheet steel studs for use in non*loadbearing* exterior and interior walls.
(2) Where *loadbearing* steel studs are used, they shall be designed in conformance with Part 4.

9.24.1.2. Material Standards
(1) Steel studs and runners shall conform to CAN/CGSB- 7.1-M, "Cold Formed Steel Framing Components".

9.24.1.3. Metal Thickness
(1) Metal thickness specified in this Section shall be the minimum base steel thickness exclusive of coatings.

9.24.1.4. Screws
(1) Screws for the application of cladding, sheathing or interior finish materials to steel studs, runners and furring channels shall conform to ASTM C1002, "Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases".

9.24.1.5. Cladding, Sheathing and Interior Finish Required
(1) Cladding or sheathing, and interior finish shall be installed on steel stud framing and shall be fastened with screws
(a) spaced at the appropriate spacing described in Section 9.29, and
(b) penetrating not less than 10 mm (3/8 in) through the metal.

9.24.2. Size of Framing

9.24.2.1. Size and Spacing of Studs in Interior Walls
(1) Except as required in Articles 9.24.2.3. and 9.24.2.4., the size and spacing of steel studs for non-*loadbearing* interior walls shall conform to Table 9.24.2.1.

9.24.2.2. Thickness of Studs
(1) Except as required in Article 9.24.2.4., steel studs in nonloadbearing interior walls shall have a metal thickness of not less than 0.46 mm (0.018 in).

9.24.2.3. Runners
(1) Runners for interior and exterior non-*loadbearing* walls shall have a thickness of not less than the thickness of the corresponding studs and shall have not less than 30 mm (1 3/16 in) flanges.

9.24.2.4. Openings in Fire Separations
(1) Where openings for doors in *non-loadbearing fire separations* required to have a *fire-resistance rating* do not exceed 1 200 mm (4 ft) in width,
(a) the width of steel studs shall be not less than 63 mm (2 ½ in) and
(b) the steel thickness shall be not less than 0.46 mm (0.018 in).

(2) Where openings described in Sentence (1) exceed 1 200 mm (4 ft) in width,
(a) the width of steel studs shall be not less than 91 mm (3 5/8 in) , and
(b) the metal thickness shall be not less than 0.85 mm (0.034 in).

(3) The distance to the first stud beyond the jamb of any door opening in a *fire separation* required to have a *fire-resistance rating* shall not exceed 400 mm (16 in).

(4) Where the distance between the framing over the opening referred to in Sentence (1) and the top runner exceeds 400 mm (16 in) in such walls, intermediate support shall be installed at intervals of not more than 400 mm (16 in) above the opening.

9.24.2.5. Size and Spacing of Studs in Exterior Walls
(1) The size and spacing of non-*loadbearing* steel studs for exterior walls shall conform to Table 9.24.2.5.

9.24.3. Installation

9.24.3.1. Installation of Runners
(1) Runners shall be provided at the tops and bottoms of walls.
(2) Runners required in Sentence (1) shall be securely attached to the *building* at approximately 50 mm (2 3/8 in) from the ends, and at intervals of not more than 600 mm (24 in) o.c. for interior walls and 300 mm (12 in) o.c. for exterior walls.
(3) Fasteners used for attachment described in Sentence (2) shall consist of the equivalent of 63 mm (2 1/2 in) nails or 25 mm (1 in) screws.
(4) Studs at openings and which are not full wall height shall be supported by a runner at the ends of the studs, securely fastened to the full length studs at the sides of the opening.

9.24.3.2. Fire-Rated Walls
(1) Steel studs used in walls required to have a *fire-resistance rating* shall be installed so that there is not less than a 12 mm (1/2 in) clearance between the top of the stud and the top of the runner to allow for expansion in the event of fire.
(2) Except as provided in Article 9.24.3.6., studs in walls referred to in Sentence (1) shall not be attached to the runners in a manner that will prevent such expansion.
(3) Framing above doors with steel door frames in non-*loadbearing fire separations* required to have a *fire-resistance rating* shall consist of 2 runners on the flat fastened back to back. (See Appendix A)
(4) The lower runner required in Sentence (3) shall be cut through the flanges and be bent at each end to extend upwards at least 150 mm (6 in) and fastened to the adjacent studs.

9.24.3.3. Orientation of Studs
(1) Steel studs shall be installed with webs at right angles to the wall face and, except at openings, shall be continuous for the full wall height.

9.24.3.4. Support for Cladding Materials
(1) Corners and intersections of walls shall be constructed to provide support for the cladding materials.

9.24.3.5. Framing around Openings
(1) Studs shall be doubled on each side of every opening where such openings involve more than 1 stud space, and shall be tripled where the openings in exterior walls exceed 2400 mm (8 ft) in width.
(2) Studs described in Sentence (1) shall be fastened together by screws, crimping or welding to act as a single structural unit in resisting transverse loads.

9.24.3.6. Attachment of Studs to Runners
(1) Studs shall be attached to runners by screws, crimping or welding around wall openings, and elsewhere where necessary to keep the studs in alignment during construction.
(2) Where clearance for expansion is required in Article 9.24.3.2., attachment required in Sentence (1) shall be applied between studs and bottom runners only.

9.24.3.7. Openings for Fire Dampers
(1) Openings for *fire dampers* in non-*loadbearing fire separations* required to have a *fire-resistance rating* shall be framed with double studs on each side of the opening.
(2) The sill and header for openings described in Sentence (1) shall consist of a runner track with right angle bends made on each end so as to extend 300 mm (12 in) above the header or below the sill and fastened to the studs.
(3) The openings described in Sentence (1) shall be lined with a layer of gypsum board at least 12.7 mm (1/2 in) thick fastened to stud and runner webs.

Member Selection

Non-loadbearing studs must have a minimum thickness of 0.46 mm (0.018 in). Studs can be the same size as loadbearing studs, and are typically 32 x 89 x 0.438 (1-1/4 x 3-5/8 x 0.0566 in) and may be 32 x 89 x 0.879 (1-1/4 x 3-5/8 x 0.0346 in) for residential partition walls. This maintains a nominal 102 mm (4 in) wall thickness. It is important to remember that which ever stud thickness you choose, the track section must have the same thickness.

Layout and Assembly of Non-Loadbearing Walls

The layout and assembly of non-loadbearing walls is similar to that of loadbearing walls, although non-loadbearing walls can be either tilted up (as described for loadbearing wall assembly) or framed in place. Bear in mind that the studs for non-loadbearing walls which require a fire rating need to be cut and installed so that a 12 mm (1/2 in) clearance is left between the top of the stud and the underside of the closure channel (see Clearances for Movement).

After measuring and marking the location of the wall, cut the track to match the floor layout and mark the track as described in previous sections. Identify locations for closet doors, passage doors, and other wall openings. Chase walls should also be identified; these may require studs with a larger web (normally 152 mm (6 in)) to accommodate plumbing and HVAC ducts. Unlike loadbearing walls, studs do not need to bear tightly against the web of the track. Nor do they need to be 'in-line', however, it maybe helpful for members to be in-line when it comes to installing services. Diagonal and lateral braces are not required.

If a non-loadbearing wall is assembled and tilted up into place, secure the bottom and top track with screws spaced no more than 610 mm (24 in) apart, with a fastener not more than 50 mm (2 in) from each end. For steel up to 0.879 mm (0.0346 in) thick #6 may be used, for greater thicknesses use #8 self-piercing screws.

When non-loadbearing walls are framed 'in place' the top and bottom tracks are first screwed into the floor and ceiling with screws or nails spaced no more than 610 mm (24 in) apart, with a fastener not more than 50 mm (2 in) from each end. A magnetic level on a stud can be used to locate the top track location on the ceiling joists, while a plumb bob on a string can be used to mark the location of the top track for sloped walls or cathedral ceilings that are higher than normal walls. Once the top and bottom tracks are in place, the studs can be fit into the tracks with all webs facing in the same direction. The studs are twisted into place and the flanges secured on both sides of the track with #6 or #8 self-piercing screws at the top and bottom, alternatively they can be clinched. It is best to install the screw close to the web of the stud (where there is more rigidity in the flange) when working with non-loadbearing steel.

Non-loadbearing interior walls at right angles to the floor joists are not restricted as to location. Where a non-loadbearing wall runs parallel to the joists above and is located between two joists, a short section of stud must be attached at 610 mm (24 in) o.c. between the bottom flanges of the joists above to secure the top track (see Figure 4.17). The blocking should be cut 50 mm (2 in) longer than the distance between the joists, and the flanges should have 25 mm (1 in) clipped off on each end to allow the webs to lap over the joist flanges. Two # 8 self-drilling screws at each end of the blocking can be used to connect it to the joists. The top track of the wall can then be attached to the ceiling using #8 self-drilling screws at 610 mm (24 in) o.c.

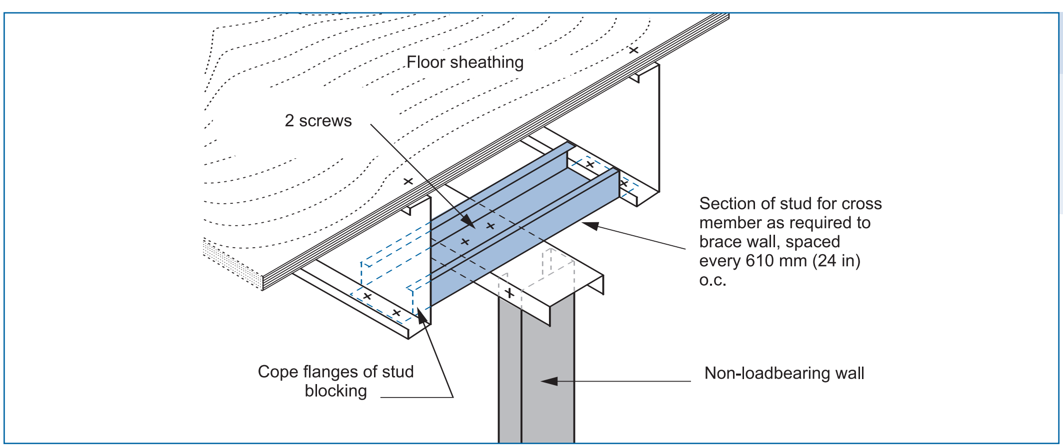


Figure 4.17

Top of Non-Loadbearing Wall Parallel to Joists

Wall Openings in Non-Loadbearing Walls

Door openings and other wall openings should be marked. At door openings, a 32 mm (11/4 in) space should be left along the edge of rough openings so that doors can be wrapped with wood jambs as shown in Figure 4.18. NBCC Article 9.24.3.5. dictates that studs must be doubled on each side of any opening wider than one stud space. The studs must be tied together by screws, crimping or welding to act as a single unit for resisting loads. See Figure 4.19.

Figure 4.18

Assembly for Door Opening in Non-loadbearing Wall

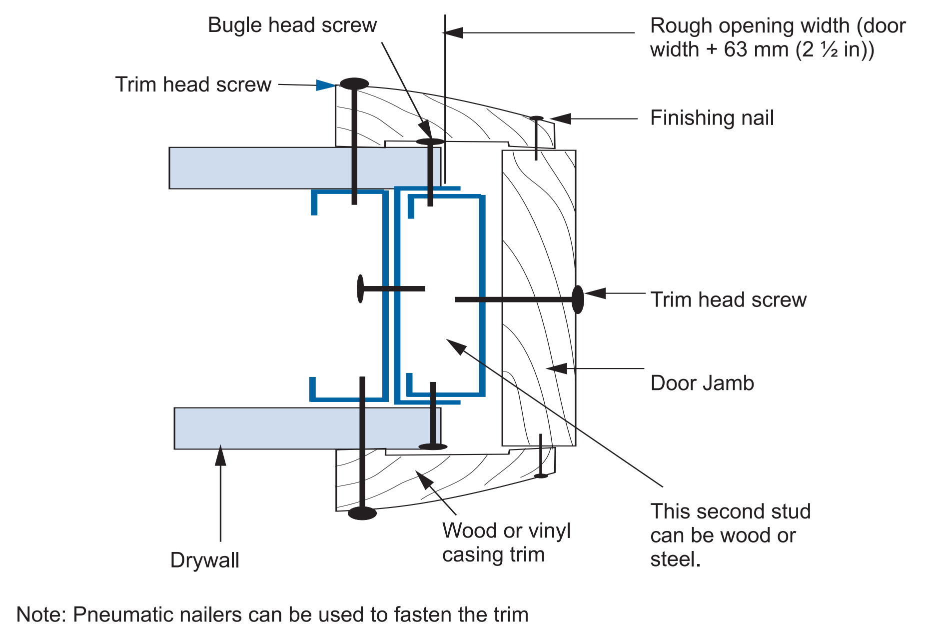
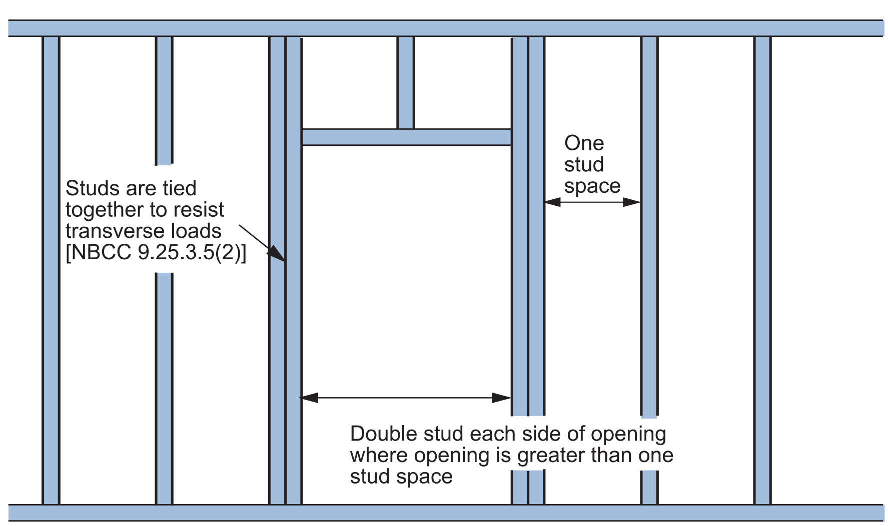


Figure 4.19

Openings in Non-loadbearing Walls



Intersecting Walls

Where a non-loadbearing wall intersects a loadbearing wall, the exterior wall requires either an extra stud (see Figure 4.20) or blocking (see Figure 4.21). The stud or blocking provides a means of attaching the non-loadbearing wall, and acts as backing for drywall. With both methods, it is essential that the exterior wall is properly insulated.

In the extra stud method, a 152 mm (6 in) or larger stud is installed with its web side against the inside edge of the exterior wall track. The stud web is then a connecting surface for both the non-loadbearing wall and drywall.

In the blocking method, minimum 89 mm (3 5/8 in) blocking spaced at 610 mm (24 in) o.c. is installed between the exterior wall studs, and the non-loadbearing wall is attached to it. The blocking may be made from joist or track material. If drywall is being applied horizontally, one piece of blocking should straddle the drywall joints.

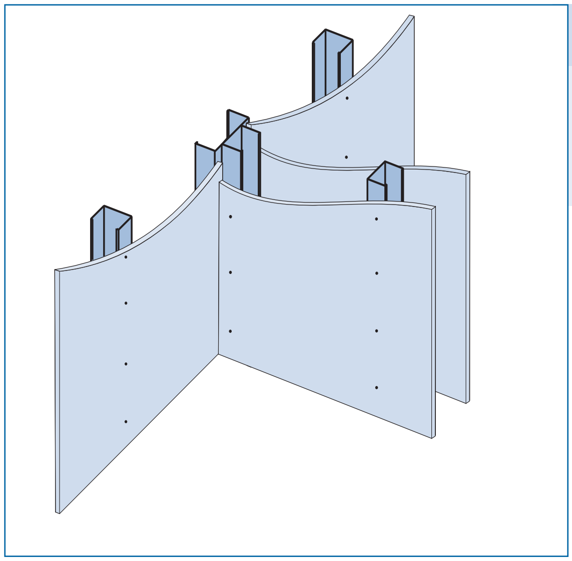


Figure 4.20

Stud Backing for Drywall at Intersecting Walls

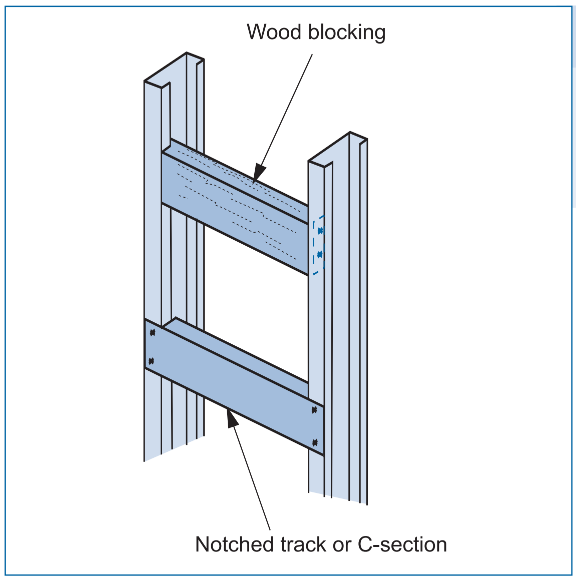


Figure 4.21

Blocking for Non-Loadbearing Walls

Clearances for Movement

For non-loadbearing walls that require a fire resistance rating, studs must be installed in such a manner that a 12 mm (1/2 in) clearance is left between the top of the stud and the underside of the track. This gap allows the stud to expand should it be exposed to elevated temperatures due to fire.

Openings in Loadbearing Walls

Member Selection

The framer should obtain exact dimensions for openings from the architectural drawings, and verify with the actual sizes of doors and windows if delivered to the site.

There are three main structural elements that must be selected to frame a window:

- jamb studs
- window sills/heads
- lintels

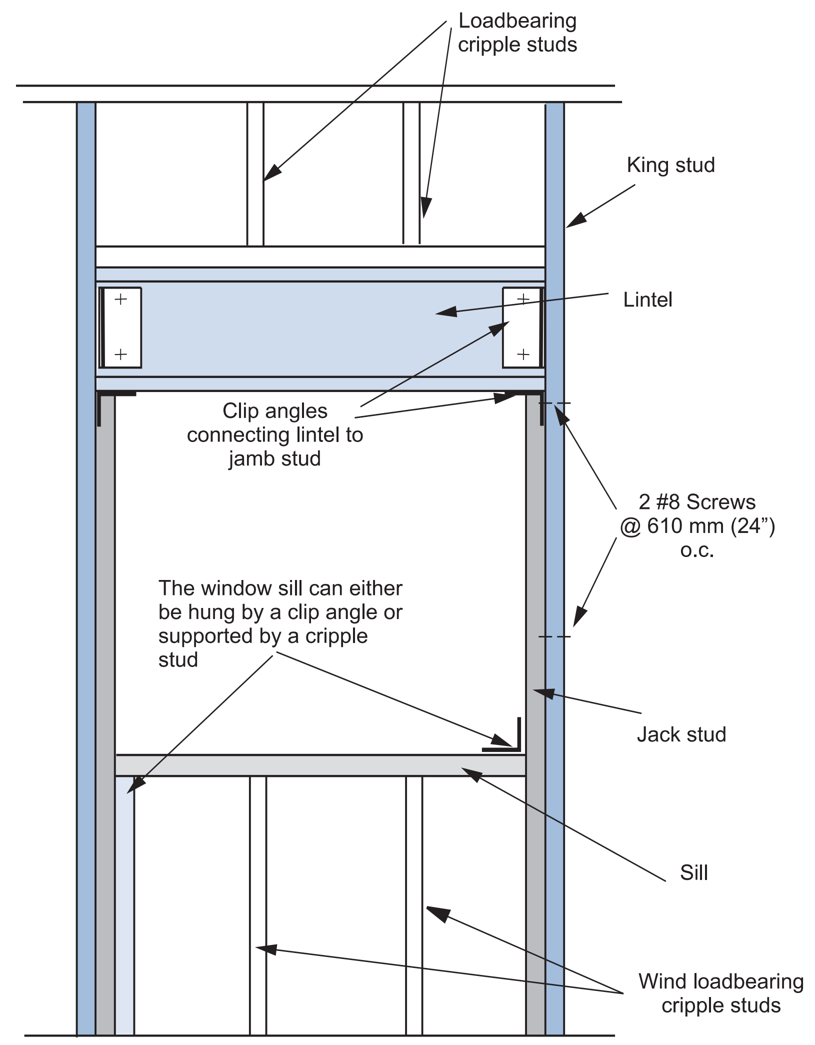
Jamb studs are a combination of stud and track sections making up the jack and king studs. Figure 4.22 illustrates these different components. King and jack studs should be the same size and thickness as the wall studs. Lintel sizes may be standardized for simplicity, but cut-to-length delivery by the

LSF fabricator is preferred. Built-up jack and king studs made from a combination of stud and track sections may also be necessary. The required king and jack stud combinations are determined by the opening size and the loads. These members can be selected from the Member Selection Tables (Appendix A). Figure 4.23 illustrates a worked example for wall openings.

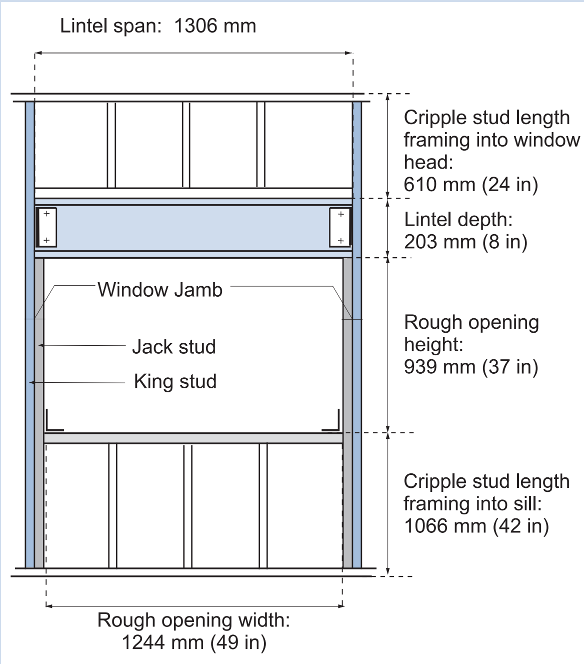
The jamb stud configuration depends on the stud spacing and the size of the rough opening. The rough opening size is usually, depending on manufacturer recommendations, 12 mm (1/2 in) larger on every side than the window itself as illustrated in Figure 4.24. the frame below describes how to select jamb configurations using Table 6A of the Member Selection Tables (Appendix A).

Figure 4.22

Framing Wall Openings

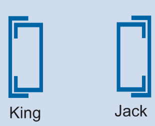


Loadbearing Wall - Worked Example



Jamb Selection - Appendix A:Table 6a
Stud spacing: 406 mm (16 in) o.c.
Rough opening: to calculate the rough opening width add 12.7 mm (½ in) to every side of the window as described in Figure 4.24.
In this case the window is 1219 x 914 mm (48 x 36 in). The rough opening is then:
1219 + 12.7 + 12.7 = 1244.4 mm
914 + 12.7 + 12.7 = 939.4 mm
So the rough opening = 1.24 m x 0.93 m

Jamb selection is based on the rough opening width. Read down the “400 mm Typical Stud Spacing” column to the equal or next largest value for the required opening width. In this case it is 1.38 m. The columns to the left provide the required king and jack configuration. For an opening 1.24 m wide with stud spacing of 406 mm o.c., both the king and jack must have a built-up stud and track configuration.



Window Sill - Appendix A:Section 6b
Wind Pressure: 0.6 kPa (see stud selection)
Length of Stud Framing into sill (measured from sill to floor): 1066 mm (42 in)
Stud Size: 41 x 89 x 1.146 (from stud selection)

By reading down to the appropriate wind pressure, over to the length of studs (rounding up to 1200 mm as the next closest value) and over to the correct stud size, it is clear that a single track can be used for this window sill up to a length of 1.73 m.

Lintel Selection- Appendix A:Section 6c Exterior Loadbearing Wall
Type of Roof Supported: Clear span truss
Roof Snow Load: 2.0 kPa (from stud selection)
Tributary Width of Floor Joist: 3.8 m
Roof Truss Tributary Width: 5.4 m
Lintel span: rough opening + jack studs= 1224 + 41 + 41= 1306 mm
Number of Floors supported: one

Member Selection Tables pages 6c-6 to 6c-12 cover exterior loadbearing lintels. They are divided by roof type and snow load. The table on page 6c-7 is for clear span trusses with a snow load of 2.0 kPa. Reading across the row for floor joist tributary width of 3.8 m, and a roof truss tributary width of 5.4 m with one supported floor, there are six choices of lintels.

Lintel	Maximum Lintel Span (m)
L1	0.76
L2	1.51
L3	1.94
L4	1.20
L5	2.21
L6	2.00

While the L1 option is too short (less than the required span of 1.24 m) the remaining five of these lintels will work. The L2 lintel is probably the most cost effective solution.

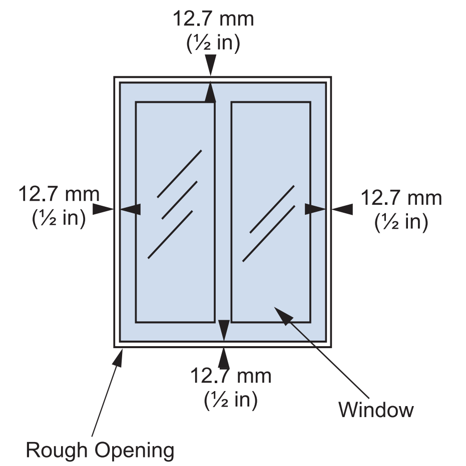
L2 = 2 - 41 x 203 x 1.438 joists (perforated)

Figure 4.23

Worked Example for Wall Openings

Figure 4.24

Sizing Rough Openings



Looking Ahead

If you plan to wrap your rough openings with wood to provide a nailing surface for trim, doors and windows, do not forget to add the dimensions of the wood to your rough opening size.

Window sills and heads are chosen depending on the wind pressure and the length and size of the cripple studs framing into it. Further explanation is provided in the steps framed below and in the Table 6B of the Member Selection Tables (Appendix A).

How to Select Built-up Jamb Stud Configurations

Step 1: For the different wall openings on the plans determine the following:
- stud spacing, and
- rough opening size.

Step 2: From Section 6a, go down the column appropriate to the stud spacing to the first span that is at least as large as the rough opening size. The jamb configuration is shown in the left hand column.

Step 3: Record the jamb stud configuration on the plans for the appropriate area.

Step 4: Repeat Steps 2 and 3 for each wall opening.

How to Select Window Sill or Head Configurations

Step 1: For the different wall openings on the plans determine the following:
- typical stud size,
- hourly wind pressure, and
- length of cripple studs framing into the window sill or head.

Step 2: Go to the appropriate table of Section 6b corresponding to the wind pressure, length of cripple studs framing into member and size of typical stud. Choose the sill/head configuration that has a maximum length at least as large as the window opening.

Step 3: Record the sill or head configuration on the plans for the appropriate area.

Step 4: Repeat Steps 2 and 3 for each sill and head of each window opening.

Six types of lintels are listed in the Member Selection Tables (Appendix A): L1 - L6. All six involve two joist sections from 203 mm (8 in) to 305 mm (12 in) deep, fastened with 2 - #8 screws at a maximum spacing of 610 mm (24 in) o.c.

Lintels for interior loadbearing stud wall openings are chosen from Section 6C of the Member Selection Tables. Just as in stud selection, one must know the type of roof or ceiling joist being supported, the tributary width of the ceiling or floor joist and the number of floors being supported. For more information on how to determine these factors refer back to the section on stud selection. C-section lintel members normally have punch-outs, making them perforated. See the frame below for a step by step selection procedure.

How to Select Lintels for Interior Loadbearing Stud Wall Openings

Step 1: For the different interior loadbearing wall openings on the plans determine the following:

- type of roof or ceiling joist supported,
- tributary width of the ceiling or floor joist (the tributary width is one half of the span),
- Number of floors supported.

Step 2: Go to the appropriate table in Section 6c corresponding to the roof framing type, ceiling or floor joist tributary width, and number of floors supported by the lintel.

Step 3: Go down the column to the configuration that has a maximum length at least as large as the wall opening. Read off the lintel type (i.e. L1 to L6). The size of the lintel corresponding to the designator is given at the bottom of the page.

Step 4: Record the lintel member size on the plans for the appropriate area.

Step 5: Repeat Steps 2 to 4 for each exterior loadbearing wall opening.

Lintels used in exterior loadbearing walls are subject to additional loads. To choose a lintel for an exterior loadbearing wall additional information is required beyond that described for interior lintels. This includes the roof snow load and the roof truss or rafter tributary width. See the frame for the step by step procedure. These calculations/measurements have been described in the wall stud selection section.

How to Select Lintels for Exterior Loadbearing Stud Wall Openings

Step 1: For the different exterior loadbearing wall openings on the plans determine the following:

- Type of roof or ceiling joist supported (clear span truss, roof rafters, roof joists),
- roof snow load,
- tributary width of the ceiling or floor joist (the tributary width is one half of the span),
- roof truss or rafter tributary width,
- number of floors supported.

Step 2: Go to the appropriate Section 6c table corresponding to the roof framing type, roof snow load, tributary widths, and number of floors supported.

Step 3: Go down the column to the configuration that has a maximum length at least as large as the wall opening. Read off the lintel type (i.e. L1 to L6). The size of the lintel corresponding to the designator is given at the bottom of the page.

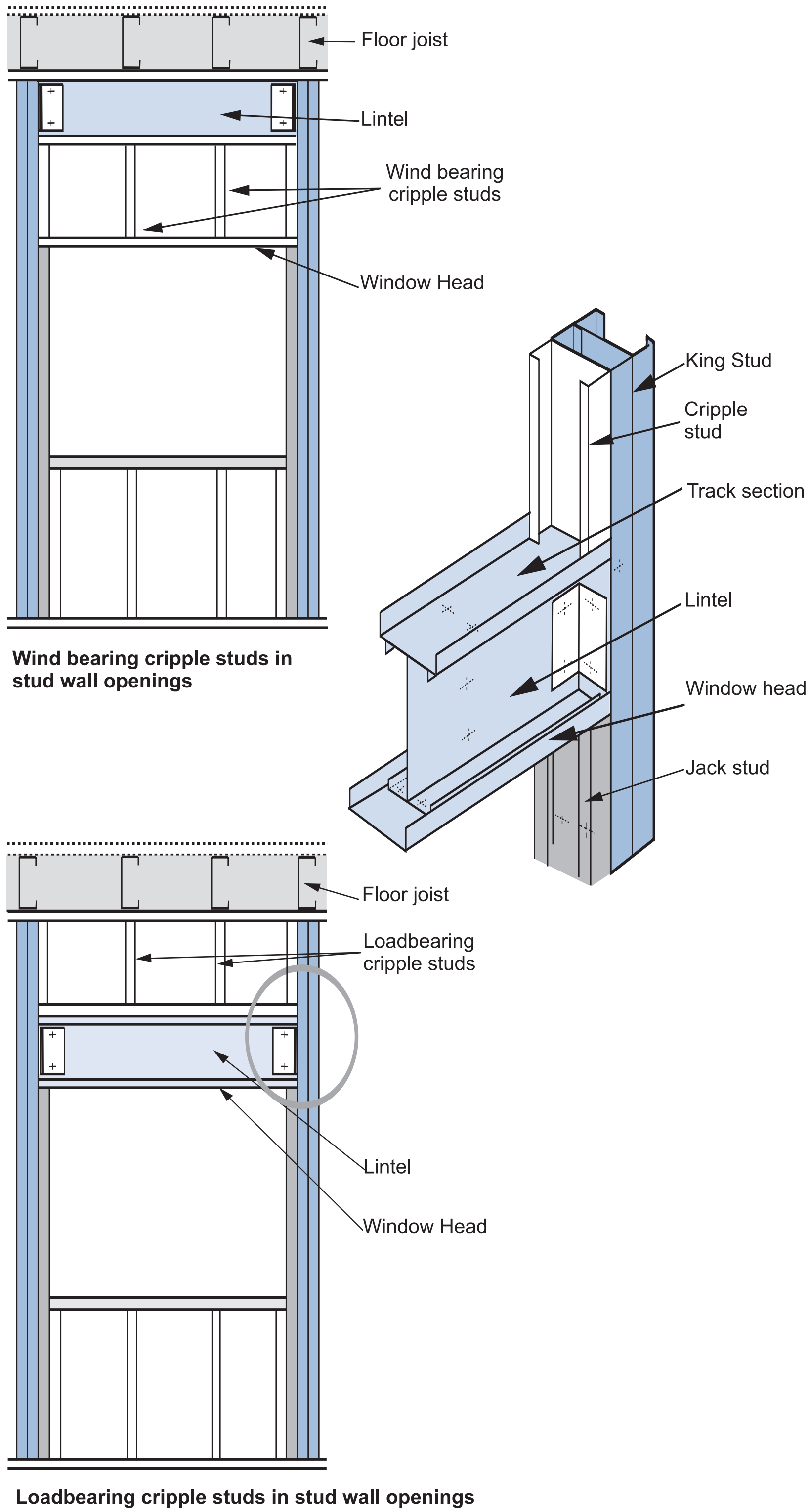
Step 4: Record the lintel member size on the plans for the appropriate area.

Step 5: Repeat Steps 2 to 4 for each exterior load bearing wall opening.

When lintels are framed directly into the top track, all cripple studs are wind bearing only. In situations where there are cripple studs above the lintel, such as when the lintel is positioned directly above the opening, the cripple studs are loadbearing and should be selected and framed as such, in-line with joists above and with the same dimensions and spacing as the other studs in the wall. See Figure 4.25.

Figure 4.25

Loadbearing Cripple Studs vs. Wind Bearing Cripple Studs



When designing window placement it is important that second floor king studs do not bear over first floor lintels. Lintels are designed to pick up the loads of normal studs and cannot accommodate additional loads such as those transferred down from second floor openings.

Layout

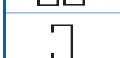
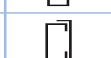
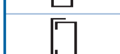
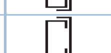
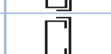
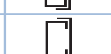
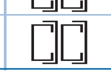
To layout wall openings check architectural drawings for opening sizes and locations. Choose and cut all members as described above. Mark both the centre of each opening as well as the outer edges on the top and bottom tracks of the wall.

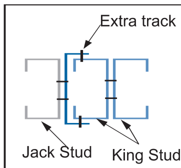
Installation

Assemble jamb studs first. A jamb of a single jack and a single king can be assembled web to web. Jambs with built up kings or jacks may require an additional track section so that the king and jack can be connected. For example, a king made of two members will be connected web to web and require a track section to be connected to the jack, as in Figure 4.26. Each jack stud must be adequately attached to the king stud to properly share the load. Connect the members together with 2 fasteners side by side at a maximum spacing of 610 mm (24 in) o.c., and ensure that insulation has been placed within the cavity before it is closed off. If necessary, a track section is installed on the inside of the opening to provide a fastening surface for the window.

Lintels can be assembled as either back-to-back lintels, as in Figure 4.27, or box lintels, as in Figure 4.28.

Maximum Allowable Rough Opening Widths based on Built-up Jamb Configurations (metres)

Jamb Configuration		Typical Stud Spacing (mm)			
King	Jack	305	406	483	610
		0.75	1.05	1.30	1.66
		0.97	1.38	1.70	2.19
		0.87	1.22	1.49	1.91
		0.99	1.38	1.69	2.15
		1.52	2.11	2.58	3.29
		1.64	2.27	2.78	3.53
		1.86	2.60	3.18	3.71
		2.29	3.16	3.71	3.71
		2.51	3.49	3.71	3.71



Occasionally the king stud is a built up member that requires an extra member to be fastened correctly to the jamb.

Legend

 = stud matching the depth and thickness of the typical wall stud

 = stud and track matching the depth and thickness of the typical wall stud

Insulation should be added during framing to all areas that will be inaccessible after framing.

Figure 4.26

Built-up Jamb Assemblies

Figure 4.27

Framing Lintels

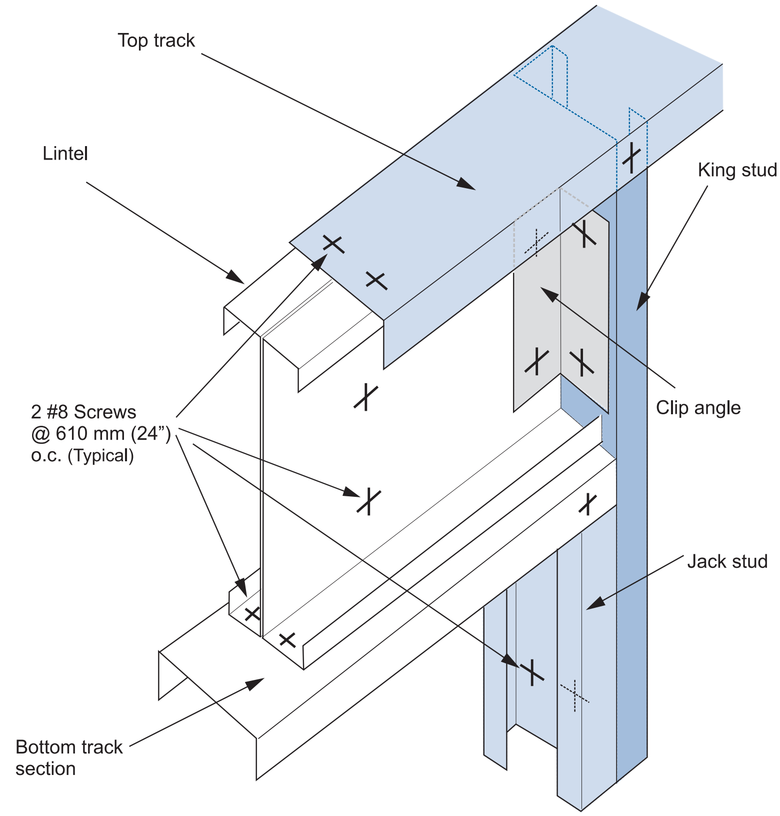
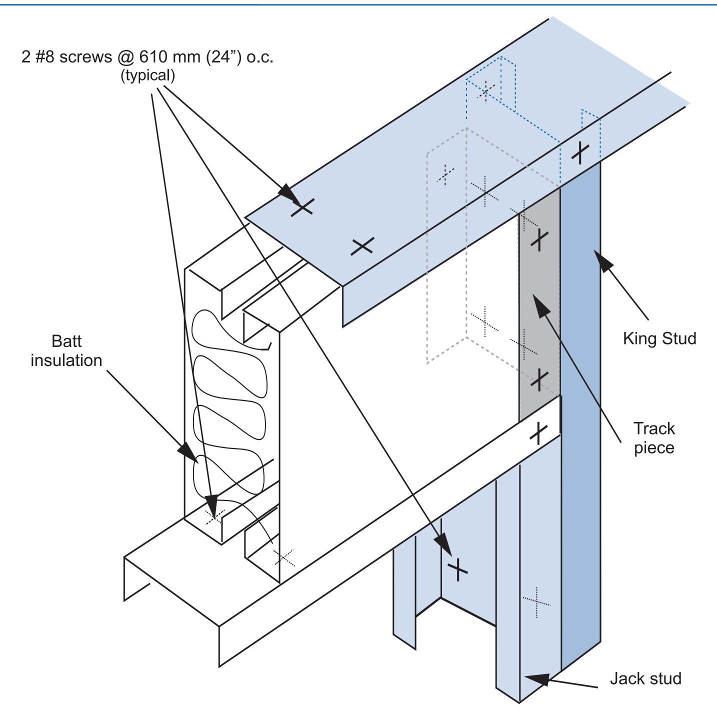


Figure 4.28

Framing Box Lintels



Looking Ahead

It is important that insulation be added during framing to all areas that will be inaccessible after framing.

To install a back-to-back lintel, fasten the two members together with 2-#8 screws at 610 mm (24 in) o.c. The bottom flange of the lintel is fastened to the window head also with 2-#8 screws every 610 mm (24 in) o.c. The lintels are fastened to the king studs using 2 clip angles slightly smaller than the depth of the lintel installed on each side of the lintel. The number of fasteners required in the clip angle depends on the lintel span as outlined in Figure 4.29.

Box lintels must have insulation inserted before they are connected. Two track sections are used to fasten a box lintel to the king stud (see Figure 4.28). The flanges of the track section are screwed to the lintel webs using #8 screws. The track section is fastened to the king stud according to the requirements outlined in Figure 4.29 The bottom flanges of the lintel are connected to the window head with 2- #8 screws every 610 mm (24 in) o.c.

If the lintels are directly above the opening and will have loadbearing cripple studs above, a track section needs to be attached to the top of the lintels as in Figure 4.30.

All cripple studs should be fastened into the window assembly. Those between the lintel and window head are fastened into the track below the lintel and then attached to the window head. The window head can be fastened with a clip angle to the jack stud. Alternately the track used for the window head can be cut 76 mm (3 in) longer than the opening; the flanges of the track cut 38 mm (1 1/2 in) back from each end and the track bent 90 degrees down and fastened to the jack, as in Figure 4.31.

Studs above the lintel should be fastened to the track section above the lintel as normal. Cripple studs below the window sill are fastened to the sill as in Figure 4.32.

Finally, all the cripple studs and jamb studs are fastened to the top and bottom tracks. Lintels that are directly below the top track are fastened through the track and their flanges as in Figures 4.27 and 4.28.

If desired, 38 by 89 mm (2 x 4 in) wood framing members can be attached inside the rough opening to accommodate finish carpentry. The wood member can be screwed directly into the back of the jack stud or through a piece of track that closes the open face of the jack stud. Similar wood pieces can be attached to the sill and head framing.

Lintel to King Stud Connection Requirements		
	Back-to-Back Lintel	Box Lintel
Lintel Span	Number of screws in each Clip Angle Leg	Number of screws connecting track to king stud
Less than 2.4 m (8 ft)	2 - #8	4 - #8
2.4 to less than 3.7 m (8 to 12 ft)	3 - #8	6 - #8
3.7 to less Than 4.9 m (12 to 16 ft)	4 - #8	8 - #8

Figure 4.29

Lintel to King Stud Connection Requirements

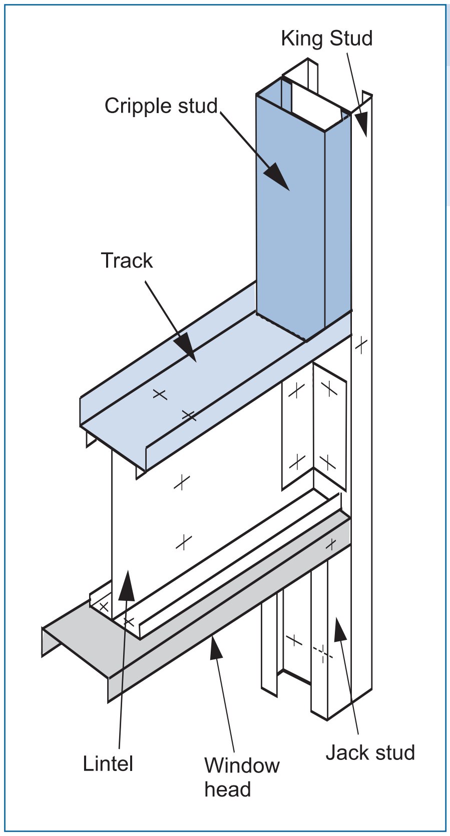


Figure 4.30

Loadbearing Cripple Studs

Figure 4.31

Window Head Framing

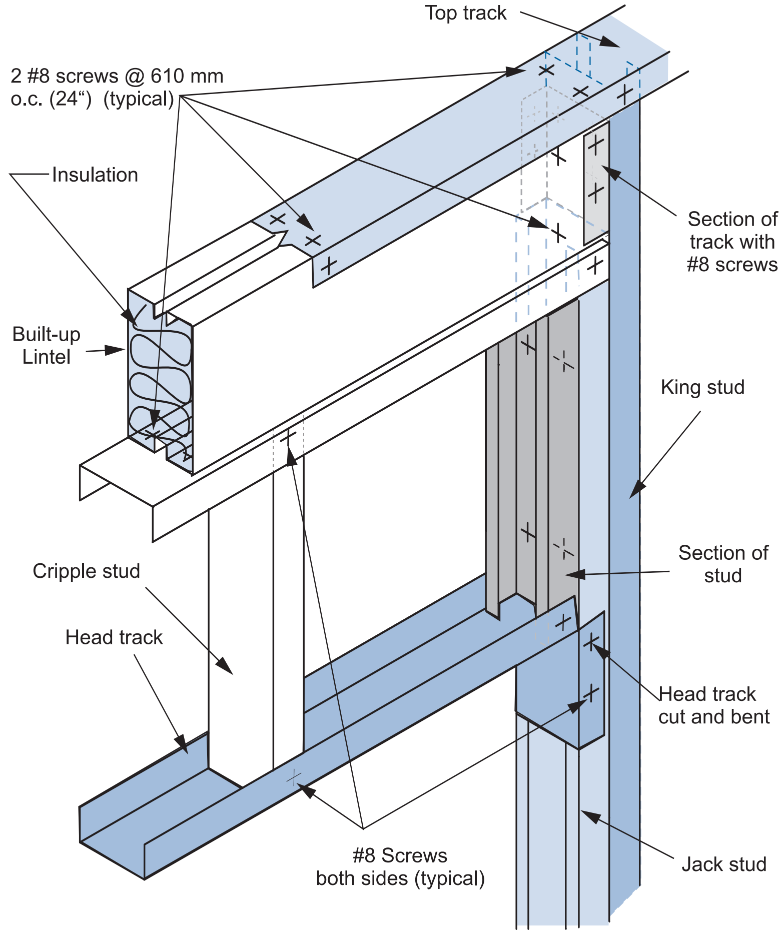
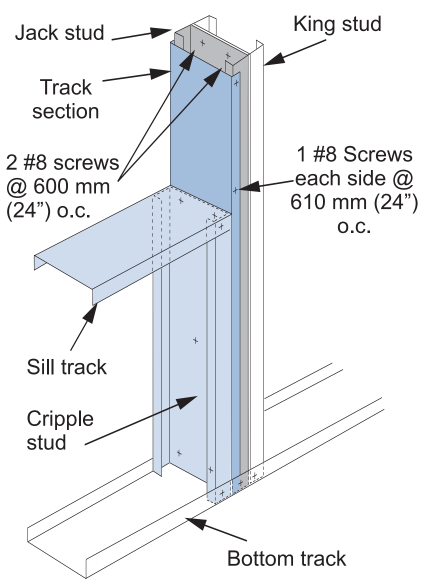


Figure 4.32

Window Sill Framing



Fire Safety and Sound Control

Fire Safety & Sound Control Key Points

Fire and sound control are often interrelated. At this time the National Building Code of Canada only addresses non-loadbearing LSF wall assemblies, when in doubt consult an engineer or your local building official.

Residential buildings must be designed and constructed to contain the spread of any fire that might break out within the dwelling.

Protection and containment are the aspects of fire safety which directly impact the builder, since they dictate how the building is designed and built. Sound control requirements are normally only necessary for multi-unit dwellings such as semi-detached and row houses.

It is important to note that the requirements for loadbearing and non-loadbearing wall assemblies are different.

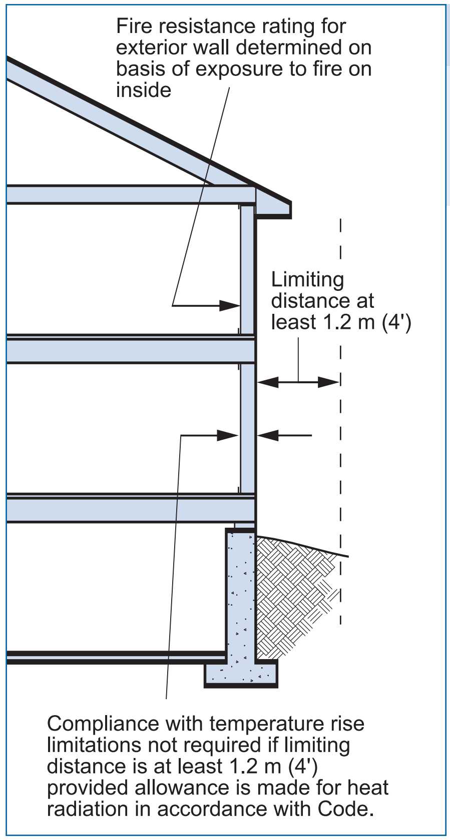


Figure 4.33

Rating Exterior Walls

Fire Protection/ Prevention

The ability of a wall assembly to withstand exposure to a fire is defined by its fire resistance rating. This is measured by the period of time over which a material or assembly will withstand the passage of heat or flame when exposed to a fire. Exterior walls that are fire rated must be rated from inside the dwelling unit as shown in Figure 4.33. Whereas firewalls, party walls and fire separations inside a building must be rated on both sides for fire exposure. In some cases roofs may require a fire rating as illustrated in Figure 4.34.

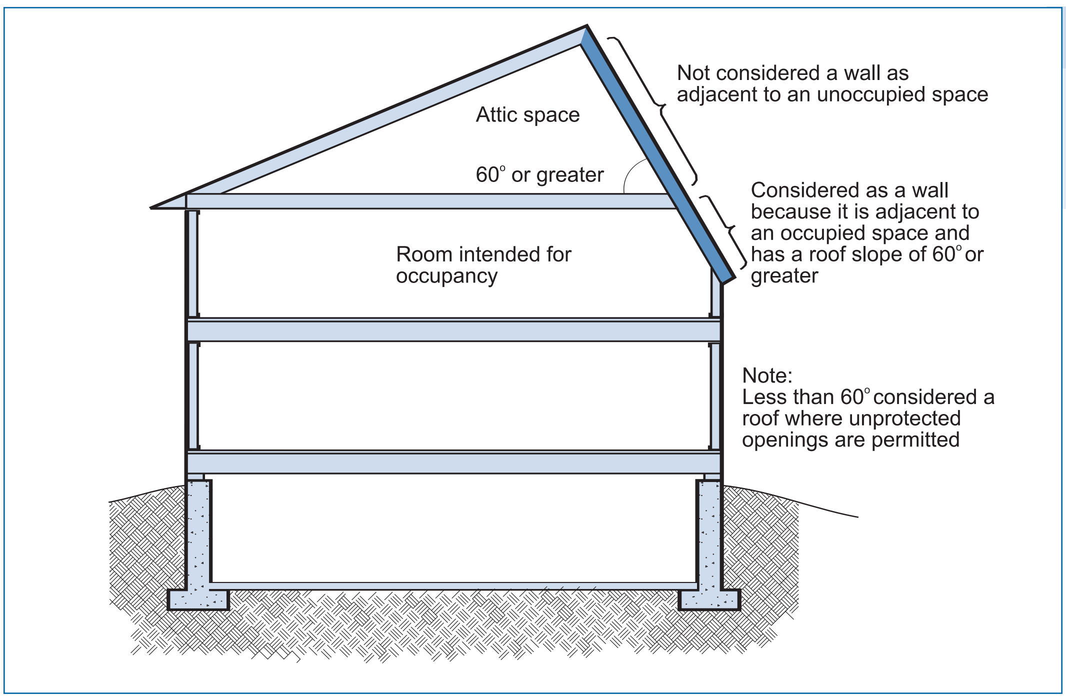


Figure 4.34

Roofs as Walls

Other issues of fire protection, that are common to all types of framing include flame spread ratings of interior finishes, fire protection for foamed plastics, fire protection for gas and electric ranges and fire protection for crawl spaces used as warm air plenums, (please refer to the building code for further information on these issues).

Fire Rated Non-Loadbearing Walls

Non-loadbearing steel stud walls are covered by Section 9.24 of the National Building Code of Canada. Article 9.24.3.2 deals with fire rated walls specifically. For more detail please refer to the NBCC.

Steel studs that are used in non-loadbearing walls that are required to have a fire rating must be installed so that a 12 mm (1/2 in) clearance between the top of the stud and the track is maintained. This will allow for expansion of the stud in the event of fire. The stud must not be attached to the track in a way that would prevent it from expanding. See Appendix A of the National Building Code for fire rated non loadbearing LSF wall assemblies.

Fire Rated Loadbearing Walls

Fire rated loadbearing steel stud walls are not yet covered by the building code, as such, the requirements for non-loadbearing walls can not apply to loadbearing walls.

Figure 4.35 shows loadbearing lightweight steel frame wall assemblies with lists of particular materials that have been tested for fire endurance and Sound Transmission Class (STC) by the National Research Council of Canada. Fire endurance is rated in the number of minutes a particular assembly will withstand temperature rise or passage of flame. These ratings are used for wall assemblies that must be constructed with a minimum fire resistance rating. For additional assemblies that may be available, consult CSSBI and NBCC.

Containment of Fire

Multi-unit dwellings, semi-detached and row houses require fire walls and party walls to properly contain fire.

Fire Stops

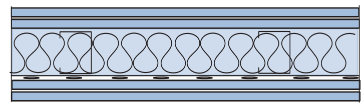
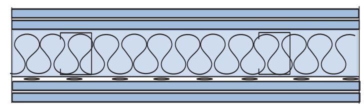
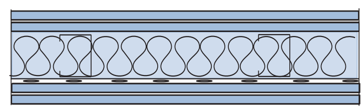
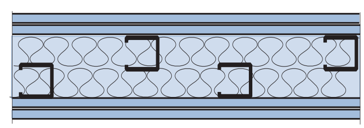
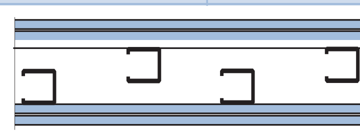
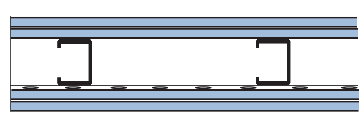
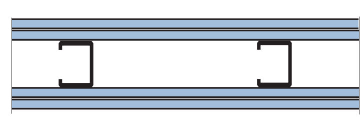
Fire stopping is only required at vertical and horizontal intersections of spaces within an assembly where the flame spread ratings of the materials within the concealed space exceed 25. Steel framing having a flame spread rating of less than 25 does not require fire stopping. Note that if the width of the concealed space does not exceed 25 mm (1 in) then fire stopping is not required.

Fire stops prevent the spread of fire through the walls and other concealed spaces by limiting the oxygen available to the fire. To achieve this requirement concealed spaces such as wall and ceiling assemblies, attics and crawlspaces must be sealed. As can be seen from Figures 4.36 and 4.37 most of this sealing happens as a normal part of construction with steel members such as top and bottom plates acting as the seal. Further details are illustrated in Figures 4.38, 4.39 and 4.40.

Figure 4.35

Fire Endurance and STC Tables

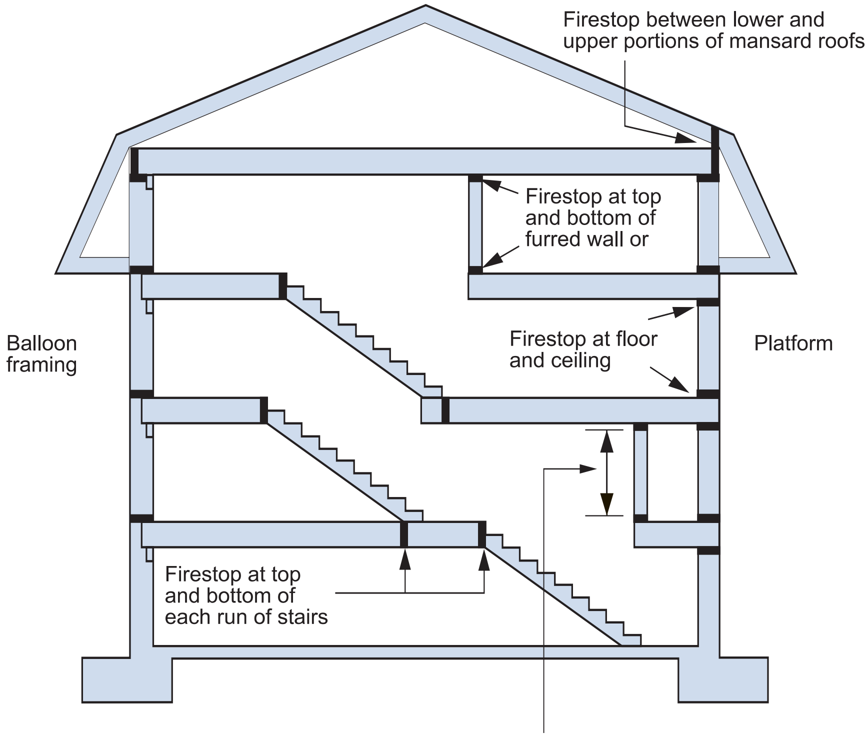
Fire Endurance & Sound Transmission for Loadbearing Wall Assemblies

Source	Description	Fire Endurance	Sound Transmission Class (STC)
NRCC A4222.2 F28	• 92 mm deep steel stud with 0.91 mm thickness spaced at 610 mm o.c. • Steel resilient channels spaced at 406 mm o.c. • 90 mm mineral fibre insulation • 2 layers of 12.7 mm Type X gypsum board on each side	 74 min	57
NRCC A4222.2 F35 F36	• 92 mm deep steel stud with 0.84 mm thickness spaced at 406 mm o.c. • Steel resilient channels spaced at 406 mm o.c. • 90 mm mineral fibre insulation • 2 layers of 12.7 mm Type X gypsum board on each side	 F35 = 68 min F36 = 63 min	55
NRCC A4222.2 F27 F31 F38	• 92 mm deep steel stud with 0.91 mm thickness spaced at 406 mm o.c. • Steel resilient channels spaced at 406 mm o.c. • Insulation (see below) • 2 layers of 12.7 mm Type X gypsum board on each side F27 - 90 mm glass fibre insulation F31 - 90 mm cellulose insulation F38 - 90 mm mineral fibre insulation	 F27 = 56 min F31 = 71 min F38 = 59 min	55 53 54
NRCC A4222.2 F26	• Double wall system with 92 mm deep x 0.91 mm thick steel spaced at 406 mm o.c. • 90 mm mineral fibre insulation • 2 layers of 12.7 mm Type X gypsum board on each side	 84 min	64
NRCC A4222.2 F30 F30R	• double wall system with 92 mm deep x 0.91 mm thick steel spaced at 406 mm o.c. • 2 layers of 12.7 mm Type X gypsum board on each side NOTE: F30R used to measure the repeatability of the results.	 F30-100 min F30R-102 min	56
NRCC A4222.2 F37	• 92 mm deep steel stud with 0.91 mm thick steel spaced at 406 mm o.c. • steel resilient channels spaced 406 mm • 2 layers of 12.7 mm Type X gypsum board on each side NOTE: F30R used to measure the repeatability of the results.	 77 min	46
NRCC A4222.2 F39	• 92 mm deep steel stud with 0.91 mm thick steel spaced at 406 mm o.c. • 2 layers of 12.7 mm Type X gypsum board on each side	 83 min	39

***Note: See Appendix A of the NBCC, or CSSBI for additional assemblies available.**

Figure 4.36

Firestop Locations and Materials



If wall or partition is of combustible construction, the vertical dimension of any concealed space shall not exceed 3.0 m (9' 10")

Firestop Materials
0.38 mm (0.015") sheet steel
12.7 mm (1/2") gypsum wallboard
12.7 mm (1/2") plywood
strandboard or waferboard
6 mm (1/4") asbestos board
2 layers of 19 mm (3/4") lumber with staggered joints
38 mm (1-1/2") lumber

Note:
Stud spaces used as return ducts shall be firestopped

Note that if the width of the concealed space does not exceed 25 mm (1 in) then fire stopping is not required.

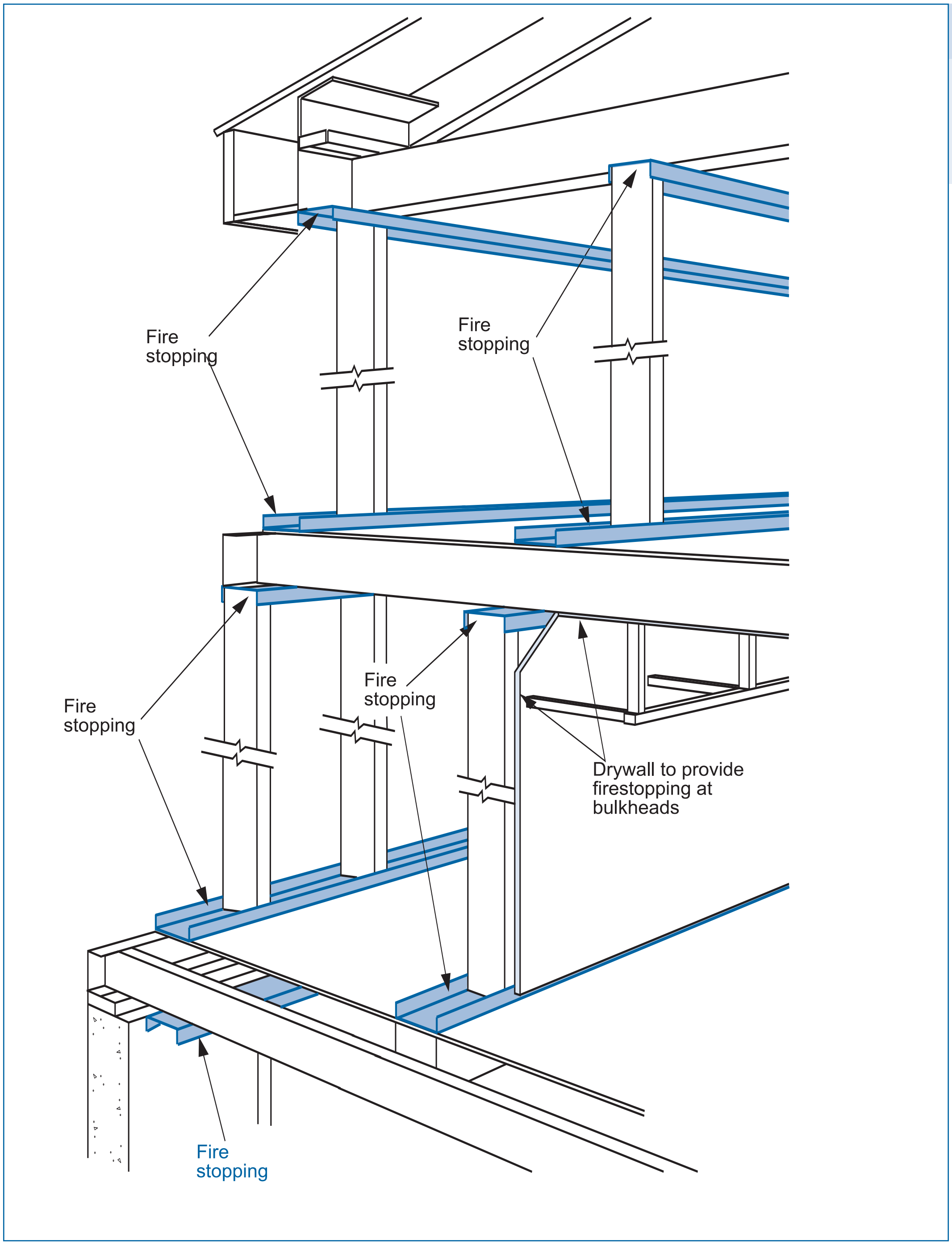


Figure 4.37

Steel Framing as Fire Stopping

Figure 4.38

Firestops for Coved Ceiling

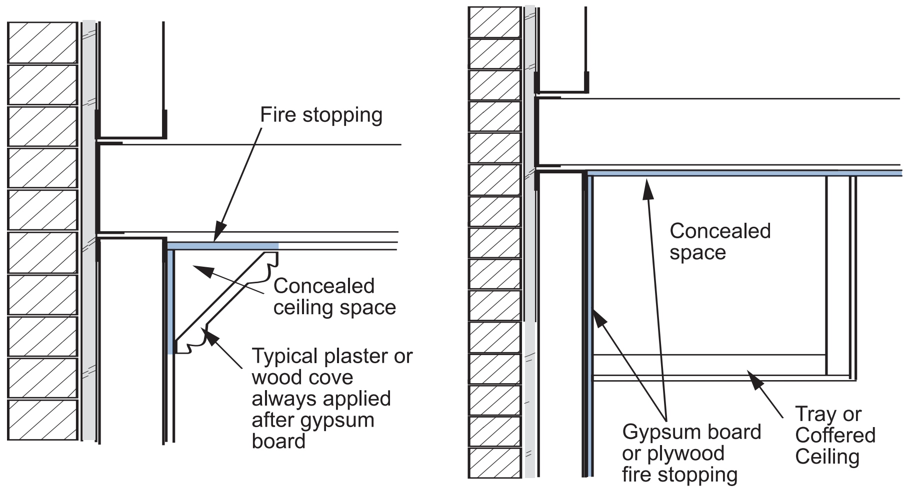
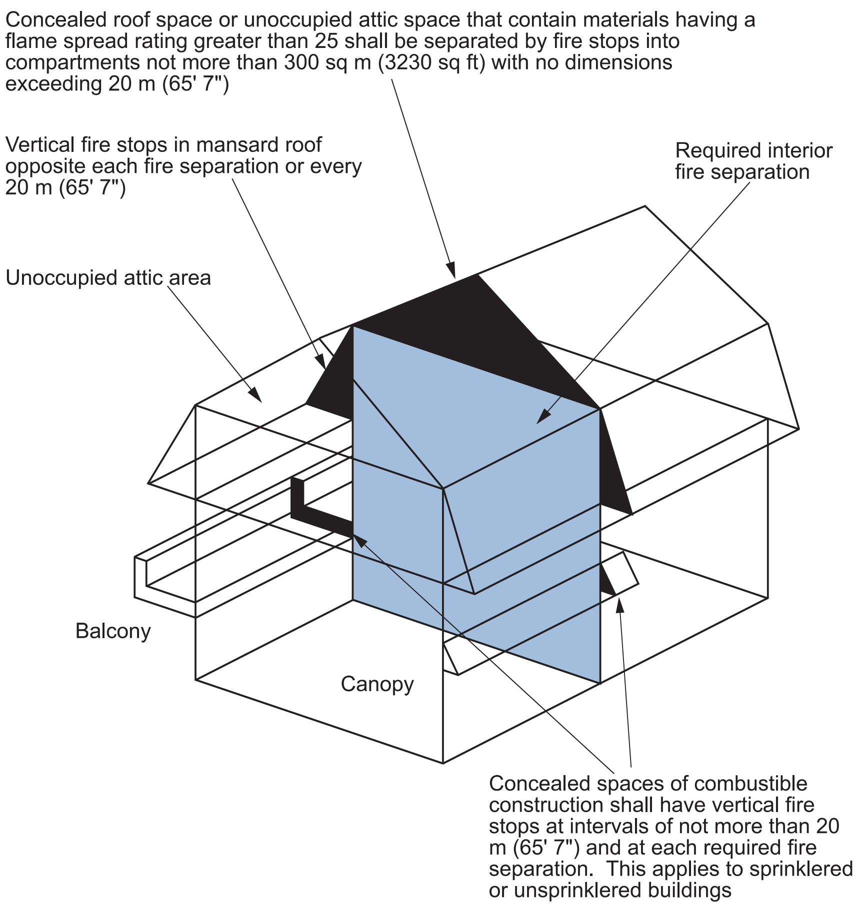


Figure 4.39

Firestops in Concealed Spaces



Opening and Service Penetrations in Fire Separations

Openings in fire separations must be tested and rated to maintain the integrity of the separation. Service penetrations require special consideration; please refer to your local code. Electrical boxes are the only exception provided they fit snugly or are caulked with a fire retardant material and are no greater than 160 cm square (24.8 in square) in area (the size of a 4-gang electrical box.

When electrical boxes are located on opposite sides of the wall they must be separated by the studs as illustrated in Figure 4.41

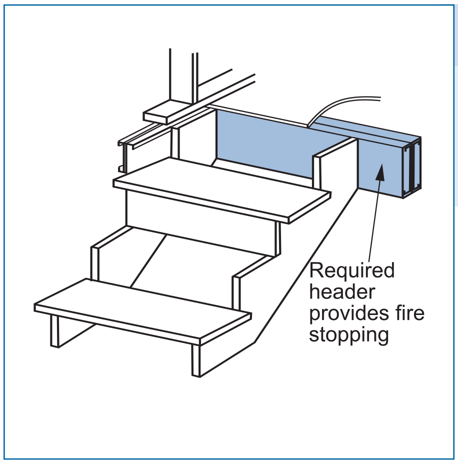


Figure 4.40

Stair Fire Stopping

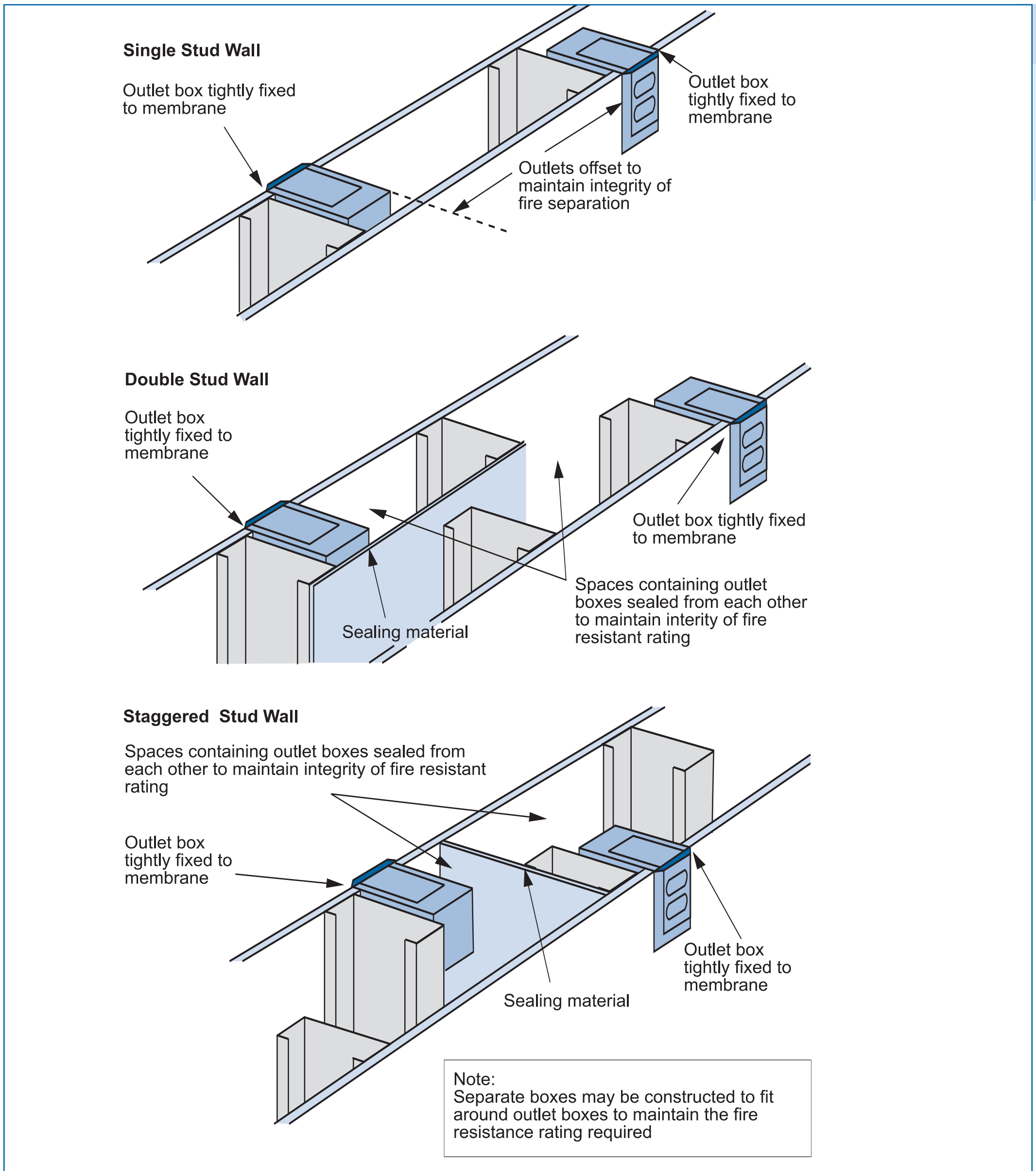


Figure 4.41

Outlet Boxes in Fire Separations

Sound Transmission Class Ratings

Sound transmission class (STC) is a numerical rating which describes how well an assembly prevents transmission of sound. The higher the rating, the more resistant to transmission an assembly is. Within the scope of residential construction, only semi-detached and row housing would require consideration of the STC of shared partition walls. Sound ratings listed in Figure 4.35 assume no voids or cracks, and require that sound absorptive materials (rock, slag or glass fibre) fill at least three-quarters of the cavity space. STC ratings for NBCC steel frame assemblies can be found in Appendix A of the NBCC.

Wall Checklist			
		Y	N
Member Selection	Wall studs align with each other from one floor to another and with the floor joist or rafter above and/or below		
	Size, thickness and spacing of studs have been selected and installed as specified in the appropriate Member Selection Table (Appendix A)		
	Track sections are at least as thick as studs		
Splices	No loadbearing studs have been spliced without an engineered detail		
	No track sections have been spliced within 75 mm (3 in) of a stud.		
	All track section splices are attached with 4 screws on each side of the splice.		
Fasteners	The track acting as bottom plate has been fastened through the subfloor into the closure channel below with 1 -#8 screw at 305 mm (1 in) o.c.		
	Each stud fits snugly into the track and bears on the web of the track		
	Each stud is fastened with 1 -#8 screw per flange at top and bottom		
Holes	All pre-punched holes in studs are aligned		
	No pre-punched or field cut openings are located within 305 mm (12 in) of the top or bottom of the stud without an engineered detail		
	All holes in studs are located in the middle of the web		
	No hole in a stud is larger than 38 mm (1 1/2 in) wide and 102 mm (4 in) long without an engineered detail		
Inaccessible studs spaces	All inaccessible stud spaces (jamb studs, lintels, corners, etc.) have had insulation installed during framing		
Corners	Corner studs have been properly connected and framed		
Second Floor	The subfloor is secured before the second floor walls are framed		
Horizontal Strapping	The horizontal flat strapping is attached to every stud flange with at least 1 - #8 screw.		
	There is at least one row of strapping for every 1200 mm (48 in) of wall height on every loadbearing wall		
Diagonal Bracing	All exterior walls have the appropriate number of braces and have been installed according to Figure 4.12		
	Braces are located at each wall end and the angle to the horizontal does not exceed 60 degrees.		
	Braces are fastened to every crossing stud with at least 1-#8 screws		
	Braces are anchored to double studs at the upper end and the closure channel at the lower end with 11 -#12 screws at each		

Wall Checklist		Y	N
Wall Openings	King and jack studs as well as lintels have been selected from the Member Selection Tables (Appendix A)		
	King and jack studs are the same size and thickness as the wall studs		
	The lintel members are fastened together with 2-#8 screws at 610 mm (24 in) o.c.		
	Jack and king studs have been fastened together with 2 fasteners side by side at a maximum spacing of 610 mm (24 in) o.c.		
Interior Loadbearing Walls	All interior loadbearing walls bear directly on to a floor beam, loadbearing wall or other engineered element		
	All interior loadbearing wall have the appropriate number of rows of horizontal bridging		
Non-loadbearing walls	The bottom track has been fastened with screws or nails spaced not more than 610 mm (24 in) with a fastener within 50 mm (2 in) of each end of the track		
	Fire-rated steel studs in non-loadbearing walls are installed so that a 12 mm (1/2 in) clearance between the top of the stud and the track is maintained		

The Lightweight
Steel Frame
House Construction
Handbook

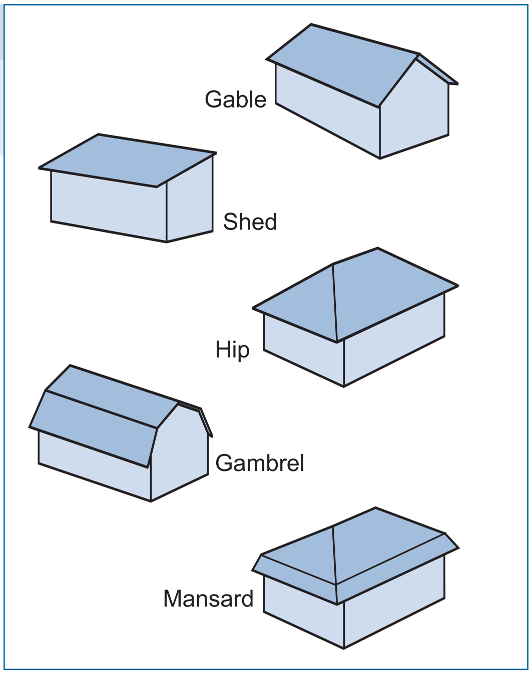
Chapter Five
Roofs

Introduction

This chapter describes the construction of roofs for lightweight steel frame houses. It gives an overview of the different roofing options for a lightweight steel framed house and discusses the member selection and installation of ceiling and roof joists.

Figure 5.1

Common Roof Styles



Roofs are required to protect the building from exterior elements. The frame of the roof must withstand wind and snow loads and provide support for components such as sheathing and finishes to shed rain and snow away from the building.

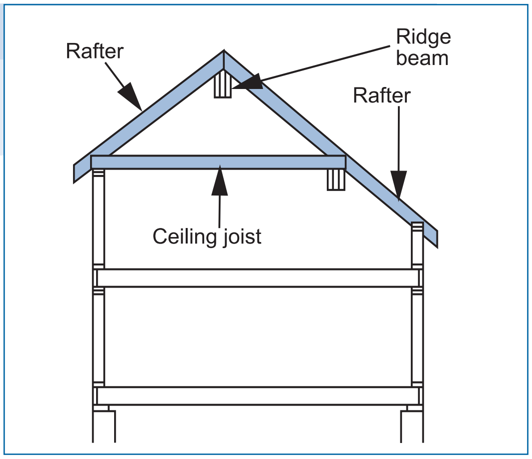
A wide variety of roof styles exist, Figure 5.1 illustrates a few of the most common styles.

Roofs can be framed using one of two different methods: rafter framing and truss framing. Rafter framing uses the 'stick built' approach in which each member is selected and framed individually. Figure 5.2 illustrates the basic components of such a system.

Trusses are assemblies made of members which form the top and bottom chords, and webs that link the chords together. See Figure 5.3.

Figure 5.2

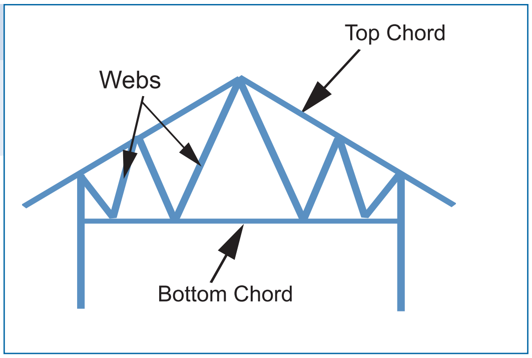
Roof Rafter Framing



The bottom chords can be either horizontal, and act as a ceiling joist, or angled, depending on the specifications. The angle of the top chord matches the pitch of the roof. Most trusses span between exterior walls, thus eliminating any need for intermediate support. The chord and web members act together to carry all the loads imposed on the roof structure and transfer them to the loadbearing walls. Roof trusses come in a variety of types, to fit each specific circumstance.

Figure 5.3

Truss Members



Currently, member selection tables exist only for ceiling and roof joists (Appendix A). Lightweight steel stick framed roofs must be designed by an engineer or competent designer. Pre-engineered lightweight steel truss systems are now being distributed more widely and can be used with the assistance of an engineer. Figure 5.4 shows different possible roof types and identifies those that can be selected from the Member Selection Tables (Appendix A) and which must be engineered.

Any type of wood roof framing available for house construction can be used on a steel

framed house. All relevant provisions of applicable building codes apply, including those that relate to structure, exterior finishes and roof ventilation.

Wind and Snow Loads

Wind and snow loads vary from region to region as denoted in your local building code. Member selection tables for lightweight steel frame houses can be used in regions of the country with snow loads up to 2.5 kPa, see Figure 5.5. In regions with greater snow loads, an engineer or qualified designer will be required to select member sizes.

Ceiling and Roof Joists

Member Selection Tables (Appendix A) exist for ceiling and roof joists, see Figures 5.2 and 5.4. A joist is a ceiling joist if the attic above it is not accessible by stairway. If the attic is accessible by stairway it is considered a living space and members must be selected as floor joists. There are different member selection tables for ceiling and roof joists.

All lightweight steel ceiling joists must have their top flange braced. Ceiling joist tables are based on three spacings for the top flange bracing: 1200 mm (4 ft) (Table 2C-1); 1800 mm (6 ft) (Table 2C-2); or 2400 mm (8 ft) (Table 2C-3). Typically, more tightly spaced bracing allows longer spans but, with little added cost.

Member selection for ceiling joists is fairly straightforward, once the bracing is determined members are selected using spans that are rounded up to the closest value shown in the Member Selection Tables (Appendix A). Normally there are several options, and usually the lightest member is the most economical. For more details see the notes beside Member Selection Tables 2C-1 through 2C-3.

Ceiling joists are framed in exactly the same manner as floor joists. They are also required to be in-line with the studs below. For further directions on how to frame ceilings refer to the description of how to frame floors in Chapter 3.

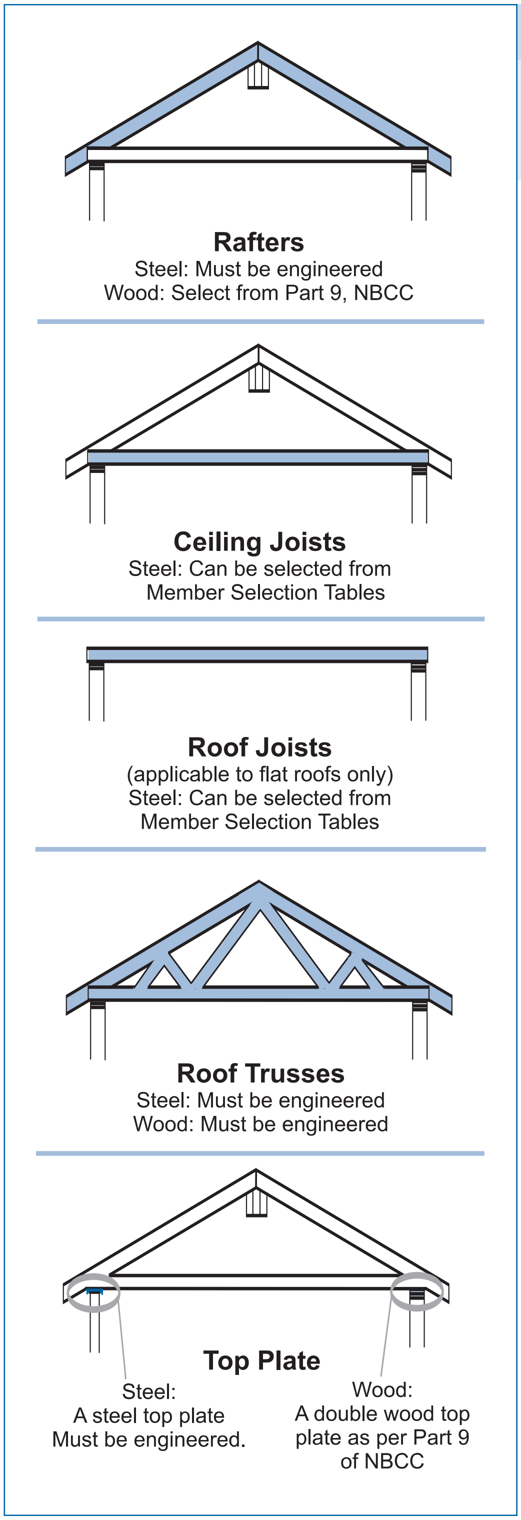


Figure 5.4

Possible Roofs for Lightweight Steel Framing

Roof joists, used for flat ceilings, can also be selected from the Member Selection Tables (See Member Selection Tables 2D-1 through 2D-4, Appendix A). Tables vary with design snow loads and the appropriate table must be used consistent with local snow conditions. Chapter 4 shows how to calculate the snow load for specific applications.

All steel connection details for roofs must be engineered.

Figure 5.5

Applicability Limits

Applicability Limits	
Application	**Limitation** metric (imperial)
Building Area	600 m^2 (6458.4 sq ft) maximum
Number of Stories	3 storey maximum
Building Width	13.4 m (40 ft) maximum from eave to eave including 0.6 m (23-5/8in) x 2 overhang
Building Length	18.3 m (60 ft) maximum
Hourly Wind Pressure, q (1/30)	Up to 0.6 kPa (12.5 psf)
Specified Roof Snow Load	Up to 2.5 kPa (52.2 psf)
Seismic Parameters	Z_a V Z_z 1 0.05 0 2 0.05 1 4 0.10 2
NOTE: Only metric values are official, imperial values are for convenience only.	

How To Select Ceiling Joists

Attics not accessible by a stairway, and with roof rafter framing, will normally require the selection of ceiling joists. If the attic is accessible by a stairway, the space must be designed as living or bedroom area and the joists designed as floor joists (using Tables 2B-1 to 2B -3 from Appendix A as described in Chapter 3). There are no vibration control limits for ceiling joists that support attics not accessible by stairway, since these areas are not considered to be living areas.

Step 1: For the different ceiling areas on the plans, determine the maximum clear spans for each area and the spacing.

Step 2: Select the spacing of the bracing for the top flange of the ceiling joists: 1200 mm (4 ft), 1800 mm (6 ft) or 2400 mm (8 ft). Joist spans increase as bracing spacing decreases.

Step 3: Look in Table 2C-1, 2C-2 or 2C-3 as appropriate for the bracing spacing. Find the appropriate column in the Table based on the joist spacing. For each ceiling area compare the maximum clear spans on the drawings to the spans in the Table. Select the joist size from the Table that has a span at least as long as the joist span on the plans. There may be a number of joist sizes that satisfy the span requirement. Generally, the lighter member is less expensive. At the same time, verify that the depth of the selected joist does not exceed any restriction on the drawings.

Step 4: Record the steel ceiling joist member size on the plans for the appropriate area.

Step 5: Repeat Steps 3 and 4 for each ceiling Area.

Installation

Attachment to Walls

The roof system must be attached to the wall system via a top plate. This top plate can be made of wood or steel members depending on the builder's preference and the type of roof framing system being used. Some builders prefer to use an entirely steel system including the roof; wood, of course, can also be used. If using a wood roof, a double wood top plate facilitates installation of wood trusses by drawing on traditional wood frame construction methods. Where single wooden plates are used, these need to be engineered.

If a double wood top plate is used, the requirements for in-line framing of the roof members and wall studs are no longer necessary.

Double wood top plates can be fastened to the top track with 50 mm (2 in) long wood screws at 406 mm (16 in) o.c. from below. The uppermost wood plate is then nailed to the first with nails of a minimum length of 76 mm spaced at 610 mm (24 in) o.c. per the NBCC. The end joints of the two wood plates should be staggered. The roof system is attached conventionally to the wooden top plate. See Figure 5.6

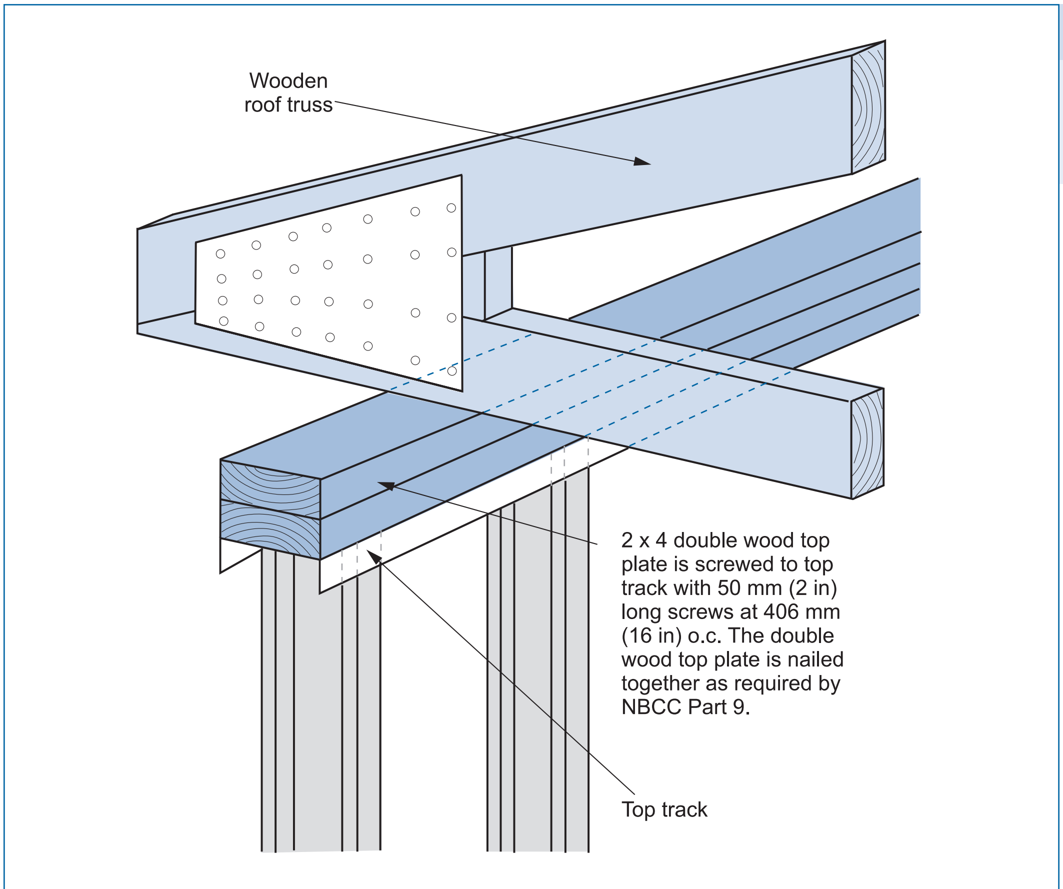


Figure 5.6

Double Top Plates Supporting Roof Framing

If using lightweight steel framing members as top plates, issues of thermal bridging must be addressed (see the Building Insight in this chapter). LSF top plates should be designed as part of the roof: member selection and installation need to be engineered.

Wood Roofs

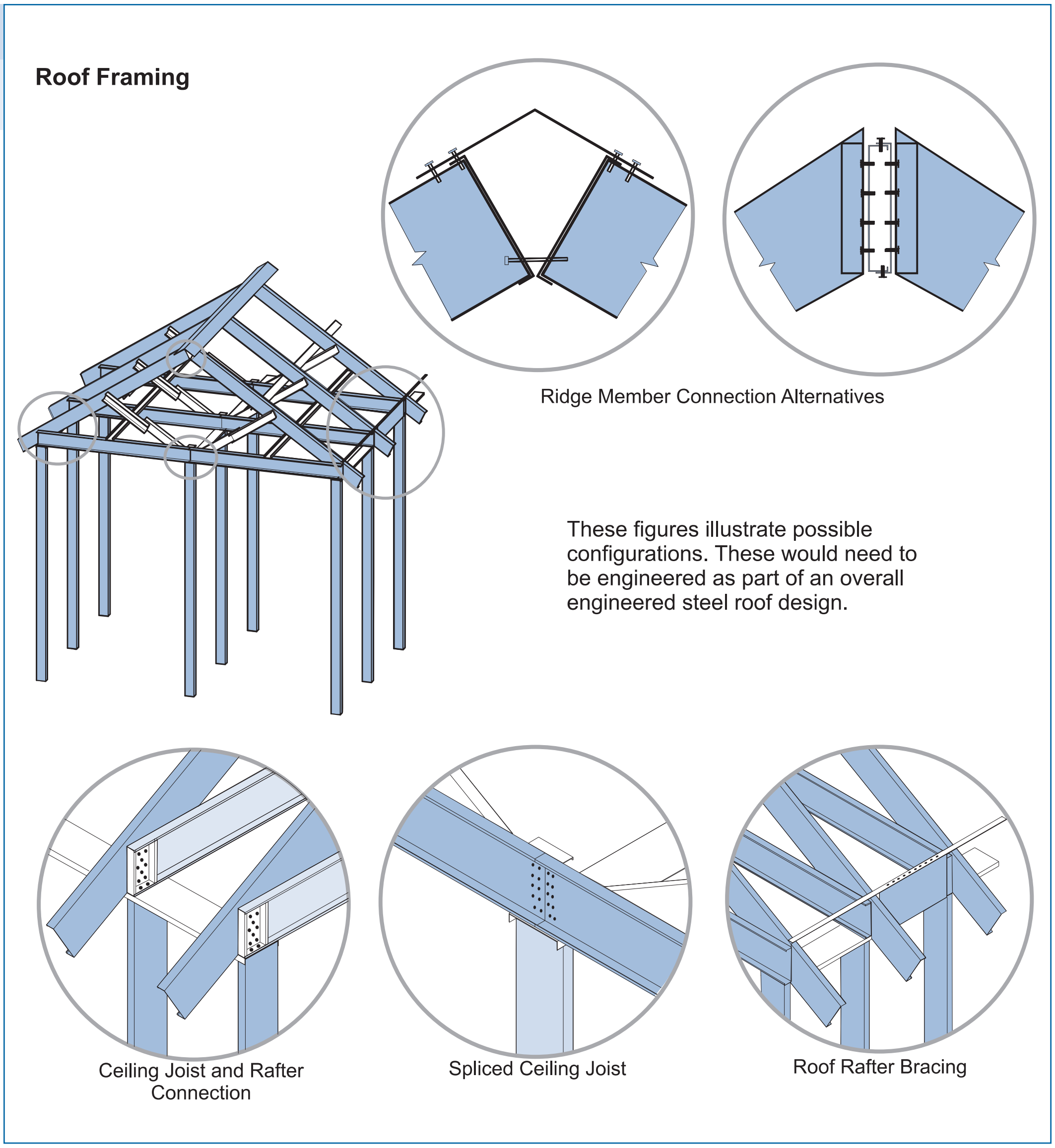
Whether using a wooden rafter or truss system the roof is built as it would be on any conventional wood frame house once the double wood top plate has been installed.

Steel Rafter Framing

Stick built steel roofs, with the exception of ceiling and roof joists, must be engineered. Figure 5.7 illustrates some typical details used in a stick built framing approach. Please note that these details are provided as guides only since no member selection tables exist at this time and the roof must be engineered.

Figure 5.7

Steel Roof Framing



Steel Truss Systems

Steel framed roofs are similar to conventional wood frame roofs. Like wood roofs, steel roofs can be ordered as pre-engineered, prefabricated truss systems that are designed by a design professional for specific applications and to meet building code requirements.

Installation of Steel Trusses

Whether installing a wooden or LSF truss system, the procedure is much the same. Roof trusses are normally pre-assembled off site and delivered to site when they are needed. Often they are hoisted directly off the truck onto the structure. The truss manufacturer/supplier should include a set of drawings and a schedule which indicate the truss types and locations within the roof structure, it is important to follow these directions to ensure the structural integrity of the roof. These drawings are normally checked by building officials.

Each truss has a specific location and orientation as specified by the layouts or truss drawings. With the possible exception of one of the gable trusses, trusses are oriented according to their webs which should normally face in the same direction. The location and orientation of each truss should be marked on the top plate according to the roof truss shop drawings.

The framer is responsible for ensuring proper installation according to schedule, drawings and building code. When trusses arrive on site verify the order carefully. Check that the code/identifying mark on each truss assembly corresponds with what is listed in the drawings. The trusses should be counted and the span lengths measured. Any discrepancies must be reported to the supplier and designer. There are several different methods commonly used to install trusses. Truss manufacturer instructions must be carefully followed. These will govern how trusses need to be properly installed. Bracing guidelines should be provided in the drawings. Figure 5.8 illustrates truss bracing. All temporary bracing must be kept in place until the permanent bracing and sheathing is installed.

Bracing Trusses
Trusses are fragile building components that without care can be severly damaged. Damage most often occurs when trusses are lifted into place and loaded in a manner never intended.

Once in place trusses should be sheathed to prevent lateral buckling of the top chord. Where this is not possible, temporary bracing at the ridge and spaced every 2.4 m (8') should be installed. The illustrations show typical bracing patterns.

Temporary bracing should be installed on the underside of the truss in a manner that does not interfere with the installation of roof sheathing.

Truss webs should be braced with diagonal bracing. The bottom chord can be braced with continuous lateral bracing spaced at about 2.4 m (8') along the full length of the building. Diagonal bracing applied to this lateral bracing will give the system stability.

Always remember to carefully follow all truss manufacturer installation instructions.

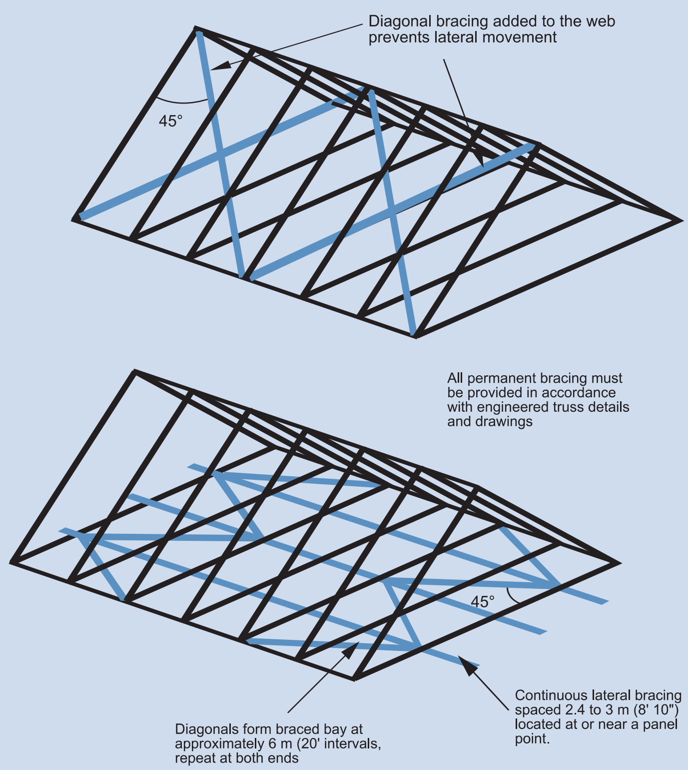
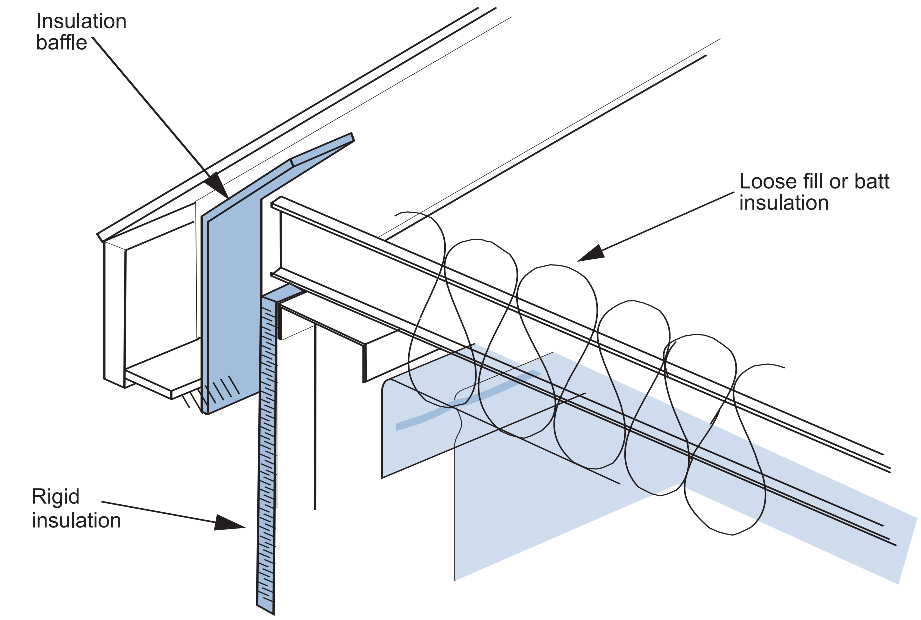


Figure 5.8

Truss Bracing Figure

Figure 5.9

Roof Wall Intersection



Building Science Insight

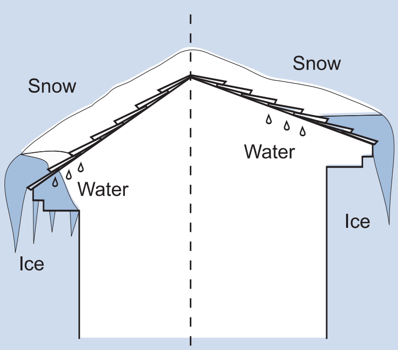
Preventing Ice Damming

Ice damming can be seen throughout the country during winter. The large icicles which form present a safety risk to people passing by below the eave. In some severe cases, leakage of melted ice and snow into the building can occur.

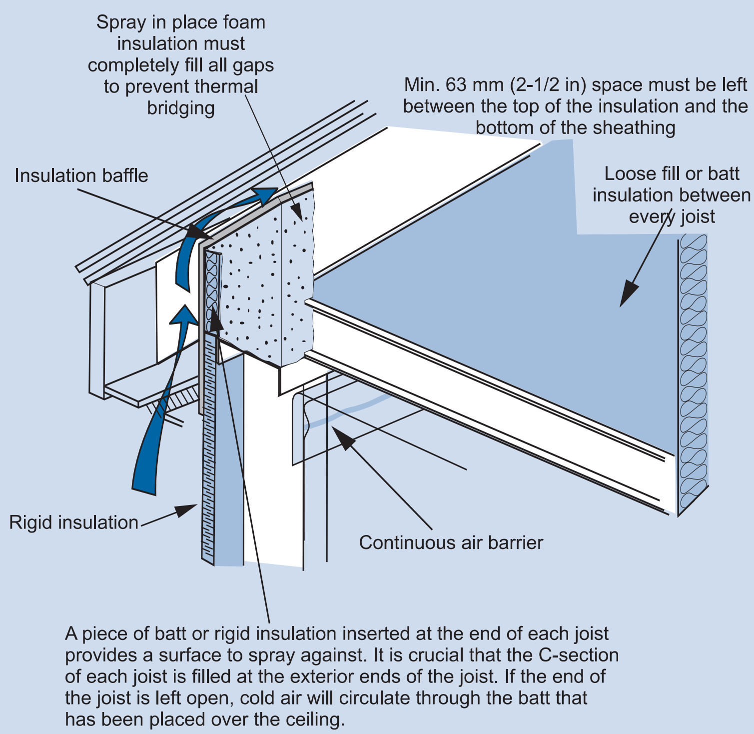
Heat loss into the attic from air leakage contributes significantly to the problem. Ice dams develop from melting snow on snow-covered roofs. Heat loss from thermal bridging at poorly insulated wall top plates can melt snow during mild, near freezing weather. The water from the snow moves down the roof to the colder area of the roof at the eaves. As it runs over this colder roof area, it can refreeze. The newly frozen water acts as a dam to thesnow which continues to melt at the roof/ wall intersection. Large ice dams, in some instances, can back water up under shingles beyond the eave protection which is normally installed in houses. Staining of interior finishes, deterioration of wood roof sheathing and ice accumulation in attics can result from this problem. In severe cases, they can impose a significant structural load at the eaves.

Because steel is susceptible to thermal bridging it is particularly important in a lightweight steel frame house that the roof/wall intersection is properly detailed and insulated. Full ceiling insulation over top plates at exterior walls helps prevent ice damming. This generally requires attention to framing and truss details. Adequate space must be provided in this area to accommodate the additional insulation. The exterior rigid insulation must be extended as far up the wall as possible. The insulation can be cut to fit around each rafter. Alternately the exterior space between the roof and the bottom of the rafter can be insulated with an expanding foam (as shown below). This technique has the advantage of filling each rafter cavity and sealing between the rafters, preventing air from blowing through.

Carefully seal the air barrier which separates the attic space from the building. Any penetrations into the attic should be checked and sealed. Roof and attic ventilation will prevent heat build-up within the attic and will also help to avoid the problems ice damming can bring.



Formation of Ice Dams



Roof Checklist			
		Y	N
Ceiling Joists	Ceiling joists have been selected from the appropriate Member Selection Table		
	All ceiling joists are in-line with the studs below		
	Top flanges of all ceiling joists are braced with bracing spaced according to the Member Selection Tables		
	Each joist is installed with a web stiffener at each end, fastened to the rafter and wall top plate		
	Any inaccessible spaces have had insulation added during framing		
	All knockouts line up		
Top Plates	Any combination or type of top plate other than a double wood top plate has been engineered		
Rafters	Wood rafters have been selected and installed according to building code		
	Steel rafters have been selected and installed according to engineered details		
	Rafters are "in-line", if not using a wooden double top plate		
Roof Joists	Steel roof joists have been selected from the appropriate Member Selection Tables and installed according to engineered details		
	Wood roof joists have been selected and installed according to building code		
Roof Trusses	(Wood or steel) Have been selected and installed according to manufacturer's or engineer's instructions		

The Lightweight Steel Frame House Construction Handbook

Chapter Six

HVAC, Plumbing & Electrical Systems

Introduction

Building services including heating, ventilation, air conditioning, electrical and plumbing systems, need to be considered early in the design process and integrated in construction. This chapter describes how lightweight steel framing accommodates building services. It outlines how to plan ahead when designing and framing the house. It shows how knowing where services are intended to go ahead of time helps avoid costly inconveniences.

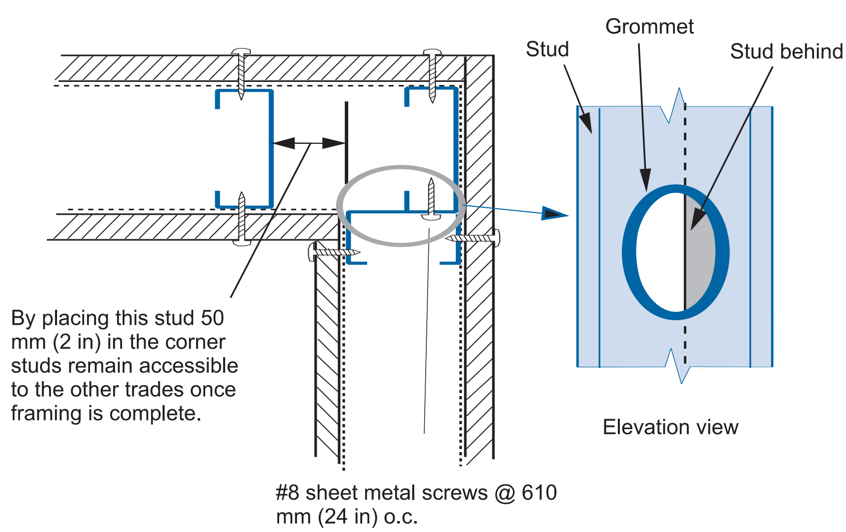
While the principles and layouts of these systems remain the same as in a conventional wood-frame house, steel does, however, demand specific considerations. For the most part, trades will find, after the initial adjustment, that working in a lightweight steel framed house is not particularly different than a conventional house. As lightweight steel framing is still new to the homebuilding market, many of the trades may not have encountered it before. It is therefore crucial that the builder inform the trades ahead of time of any special equipment they may need.

Cutting Holes to Accommodate Services

Lightweight steel framing members have pre-punched holes to allow wiring and pipes to pass through. It is the framer's responsibility as discussed in chapters 3 and 4 to line up all the pre-punched holes to facilitate easier installation of services. Holes, either pre-punched or cut above and below openings, such as windows, can help accommodate services. Similarly, using back-to-back rather than box lintels can also be helpful. Corner stud configurations should be accessible with punch-outs lined up, see Figure 6.1. Any studs that will be inaccessible after framing should have grommets installed in the punch-outs before the studs are secured.

Figure 6.1

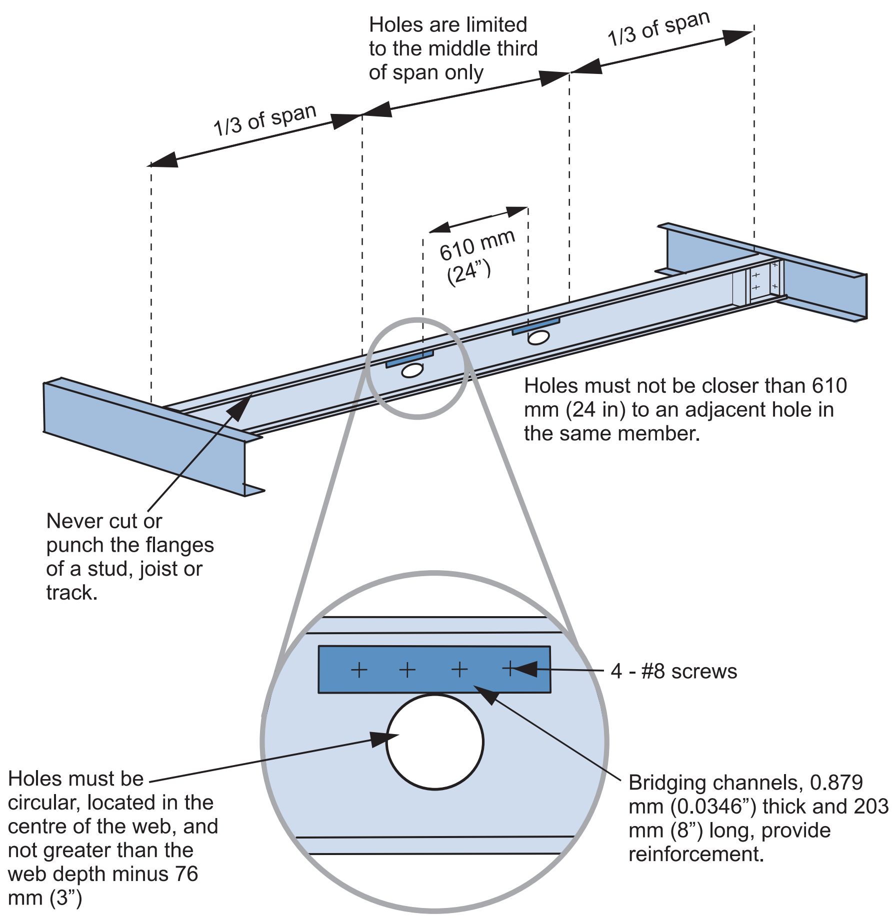
Framing Corners



Where the pre-punched holes are not sufficient, custom holes can be cut within the following limits:

- must not have a diameter more than the member depth minus 76 mm (3 in);
- must not be cut with a torch;
- must be located in the middle of the web;
- must be located no closer than 305 mm (12 in) from the end or bearing support; and
- must be reinforced.

Figure 6.2 illustrates the requirements for cut holes. Holes larger than this maximum must engineered.



Note: Not observing the limitations on holes, notching and cutting could seriously compromise the strength and rigidity of structural members.

Figure 6.2

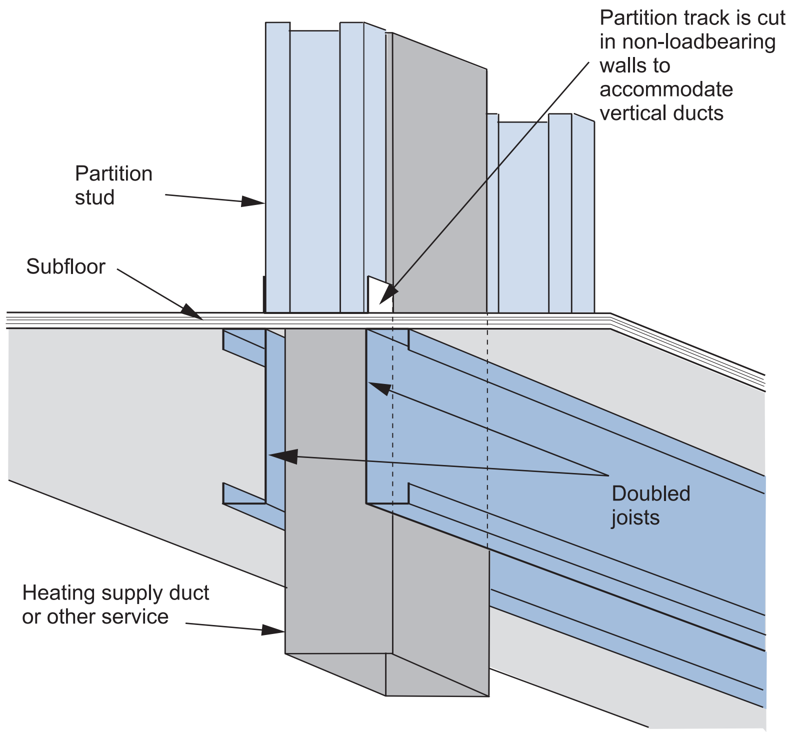
Hole Requirements

Heating Ventilation and Air Conditioning

The mechanical system of any building must supply adequate heating, cooling and ventilation to the house as provided by the building code. The sizing and layout of the heating, ventilation and air conditioning (HVAC) system for a lightweight steel frame house is no different than for a conventional house. The steel frame does, however, affect the method of installation. Mechanical equipment must be located so that it is easily accessible for repairs and maintenance. Horizontal ducts can be installed into joist spaces while vertical ducts can be accommodated through cut-outs in bottom and top tracks (see Figure 6.3). These differences should be taken into account when planning the system. Where HVAC ducts must be boxed in, use furring angles or cut light gauge track sections to form continuous horizontal edges.

Figure 6.3

Supply Ducts through Partition Walls



The builder should discuss with the supplier and designer the layout of the mechanicals before the framing begins. For example, the direction in which joists run can be used to advantage in the layout if properly planned, but conversely can create many difficulties when poorly planned. Screws instead of nails are used for fastening HVAC systems and components to framing members. The installer of the HVAC system will need to know that screws of the appropriate size will need to be used rather than nails, as well as appropriate tools.

Where possible, furnaces and ancillary equipment can be located and installed according to normal practice and manufacturer's directions. It is best practice to use isolation collars to reduce noise and vibration from the furnace cabinet to the ducts.

Furnaces, humidifiers and air cleaners should be located centrally to minimize runs, save on energy and materials and properly distribute air.

Just as in a wood framed house, heat plenums can be hung below floor joists with metal straps and warm air branch ducts can be run between joists.

Cold air returns can be constructed using the joist and stud cavities. Screw a piece of metal sheet to the bottom flanges of adjacent floor joists and wall studs as part of the 'box'. It is important to remember that unlike wood members, lightweight steel framing members have holes that must be sealed when used as a cold air return. The holes can be sealed using aluminium tape. The tape must be attached to the outside of the box so that it cannot be drawn into the return system. As illustrated in Figure 6.4, sections of the closure channel of non-loadbearing walls can be removed to make space for vertical ducts.

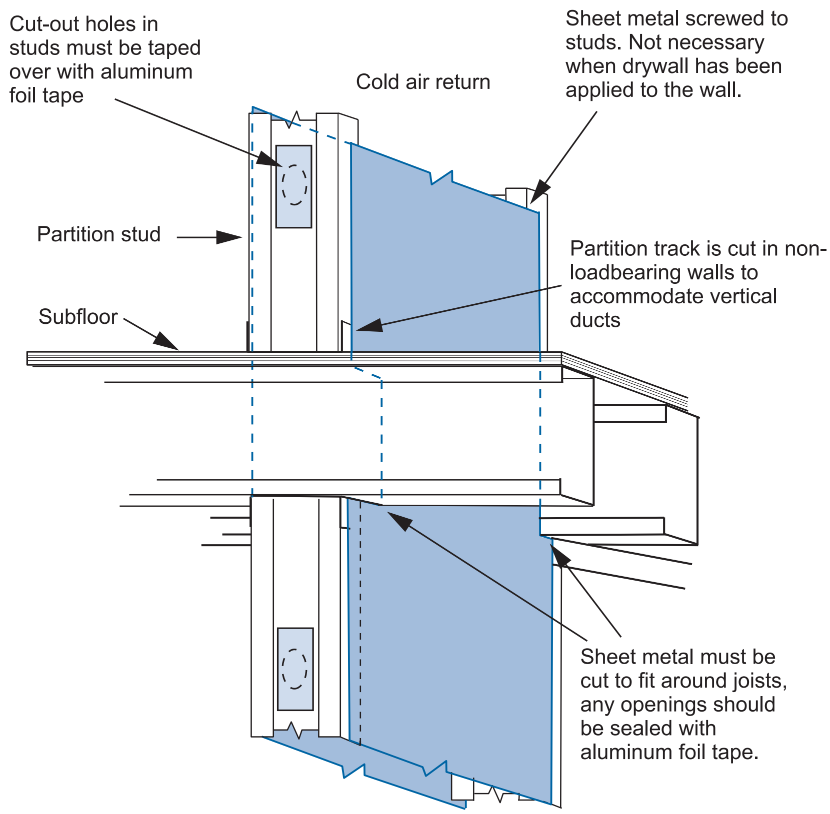


Figure 6.4

Cold Air Return

Plumbing Systems

The plumbing system of a house must provide both hot and cold potable water and discharge waste to the sewage system, and like other services they must be integrated into the framing system of the house.

When fittings and shower valves require a larger space than is available in a floor or loadbearing wall cavity, floor and wall openings as described in earlier chapters need to be designed to accommodate them. When shower valves are located in non-loadbearing walls the studs can be repositioned. All holes in a loadbearing stud or joist larger than the web depth minus 76 mm (3 in) need to be engineered.

Looking Ahead

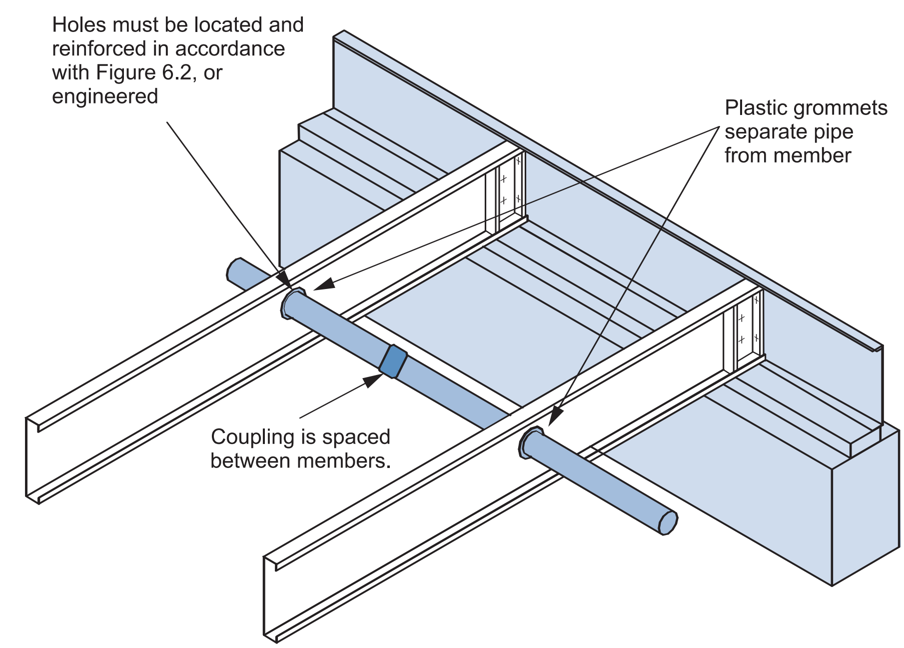
Plumbing fittings often require more space than one floor or wall cavity. The framer can plan ahead for this in a number of ways. Using a wider joist and stud spacing such as 480 mm or 610 mm (19 in or 24 in) in the walls and floors of bathrooms and utility rooms often provides enough space. Increasing the member thickness in such situations will prevent having to increase member depth (see Chapters 3 and 4). Subfloors and drywall thicknesses need to be appropriate for the member spacing where it is increased. Deeper studs, such as 152 mm (6 in) in the walls of these rooms can provide additional space for drainage stacks. Deeper wall cavities may also be helpful for HVAC chases. Pre-planning avoids the need to provide on-site changes including furring out walls.

Fixtures including pedestal sinks, grab bars and wall hung urinals require strong support such as blocking or sheet metal between supports if they cannot be attached directly to the stud. Installation of one-piece showers and tubs may require the temporary removal of studs to avoid damage and to permit proper installation. Alternatively, tubs can be placed prior to framing.

Pipes are accommodated using the knock-outs provided in steel studs and joists. These are punched into the webs at regular intervals, often at 610 mm (24 in) o.c. Plastic grommets should be used in all holes through studs and joists to protect plastic pipe and to protect metal pipe from exposure to dissimilar metals (i.e. copper and galvanized steel) which can lead to corrosion. When cutting holes the plumber must take into account the size of the grommet as well as the pipe. The added thickness of an ABS coupling or hub may not fit within a web hole. This may mean that the pipe must be installed so that the coupling/hub is spaced between the steel members. See Figure 6.5. The building code requires that the holes for pipes be large enough to allow for movement due to thermal expansion and contraction.

Figure 6.5

Installing Plumbing Pipes



Pipes must be supported to limit the loading on the pipes themselves and their joints. Standoffs are used for piping running parallel to framing members and grommets or suspension types are used when the piping runs through or below joists. Horizontal piping should be supported as dictated by your local plumbing code. Pipe supports should be attached with #8 drill point screws on all loadbearing studs and joists. Copper hangers must not be attached directly to galvanized steel members. Isolate all copper hangers from all galvanized steel with plumbers tape or use plastic hangers.

Sound transmission can become an issue when noise from pumps and other pressure systems is not addressed. Fixtures and pumps must be adequately supported and isolated from the steel frame. Insulation or expanding insulation (foam) can be used to isolate fixtures and pumps from the frame. Direct contact of pumps with framing should be avoided.

Electrical Systems

Electrical systems in residential construction are governed by the Canadian Electrical Code. The design and installation of an electrical system must ensure safe connections to utility services and provide lighting and access to outlets that are safe and convenient for occupants. Wiring a lightweight steel frame house is very similar to wiring a conventional house. While the location of electrical fixtures, switches and outlets are determined at the planning stage, the actual location of runs for the wiring is usually done on site by the electrician. Normally the pre-punched holes should be sufficient for wiring needs, but where they are not, the electrician can drill holes according to the requirements outlined in the section above. Since the electrician and electrical inspector may be unfamiliar with steel framing, it is important that the builder prepare them both for the differences that arise. As with any electrical system it is important that all parts are CSA approved for use as required by local codes.

It should be stressed that plastic insulated wire, is acceptable and CSA approved for use in an LSF house but does require shielding from contact with metal. If using plastic insulated wiring, the wire must be protected from contact with the edges of holes by use of a grommet (See Figure 6.6). Different manufacturers use different kinds of knockouts, which in turn fit different types of grommets. Most LSF suppliers will also supply the appropriate grommets. It is important that the builder inform the electrician ahead of time which type of grommet is required if they are not already on site. Universal grommets are available, but are less economical. Grommets must be CSA approved for electrical use. It is important that the code limit for the number of wires that may be passed through a grommeted hole be observed.

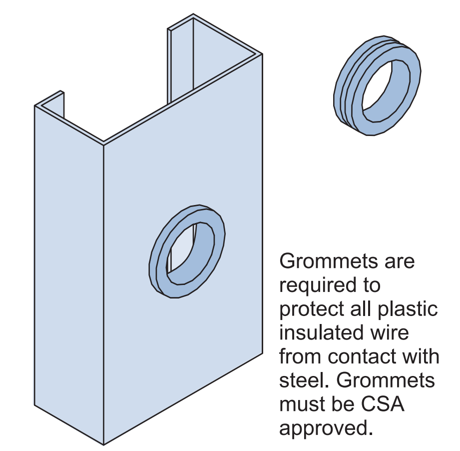


Figure 6.6

Grommet

Standoffs, as shown in Figure 6.7, prevent contact of the electrical wire with the stud and must be used when the wire runs parallel to studs. Many types are commercially available and approved by CSA for electrical use. A standoff should be placed within 305 mm (12 in) of the electrical box and at 1500 mm (60 in) centre to centre along the stud.

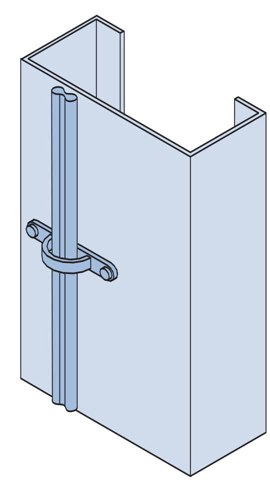


Figure 6.7

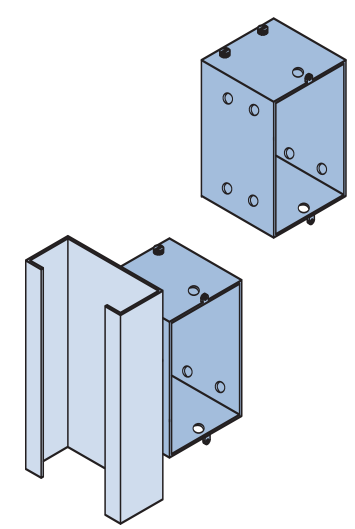
Standoff

Alternately, armor-sheathed cable can be used, which does not require protection from steel and therefore does not call for the use of grommets.

Electrical boxes should be attached according to the manufacturer's instructions. Where no instructions are provided, the box should be attached in at least two locations with self drilling screws, see Figure 6.8. Electrical boxes must be fastened to the web of studs. It is important that the box have adequate support and be attached to a stud or blocking.

Figure 6.8

Electrical Box

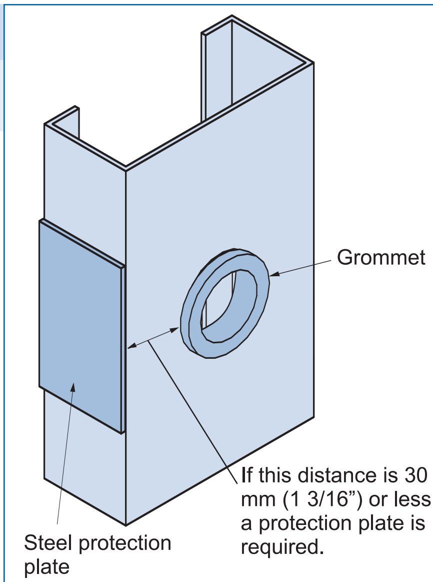


Service panels can be attached using either steel or wood blocking for additional support. Blocking above the panel also provides support for wires entering the panel.

When holes are drilled closer than 30 mm (1 1/4 in) from the edge of the stud a steel protection plate is required as illustrated by Figure 6.9. Protection plates are attached with screws to the flange of the stud to prevent the wiring from being damaged by screws from attached drywall, cabinet installation and other applications. Studs having a web depth of 92 mm (3 5/8 in) or greater do not require protection plates if the holes are centred in the web and are less than the web depth minus 76 mm (3 in). Protection plates are commercially available for some sizes of studs.

Figure 6.9

Protection Plate



Planning Ahead

It is important to tell the electrician before he/she arrives on site that they will be working on steel framed houses and therefore require the appropriate:

- screws,
- tools, and
- grommet type.

HVAC, Plumbing & Electrical Systems Checklist			
		Y	N
Builder	Open lintels		
	Accessible corners		
	Grommets installed in inaccessible corners		
	Framing members adequately deep to accommodate plumbing and ducts		
	No holes cut greater than the web depth minus 76 mm (3 in)		
	No holes within 305 mm (12 in) of bearing		
	All large holes are located in the centre of the web and are reinforced		
HVAC	Installed with screws not nails		
	Any cold air returns constructed in stud cavities have had the stud knock-outs sealed on the outside with aluminium tape		
	Only tracks in non-loadbearing walls have been cut to accommodate ducts		
Plumbing	Fixtures (i.e. wall hung urinal) have adequate support such as blocking		
	Plastic grommets have been used in all holes to separate pipes from framing members		
	Pipe supports have been fastened with #6 self piercing screws in non-loadbearing walls and #8 self-drilling screws in loadbearing walls		
	Pumps and other noisy systems have been isolated from framing		
Electrical	All plastic insulated wiring is insulated from framing with CSA approved grommets and stand-offs		
	All installations conform to local electrical Code		
	Protection plates have been installed where holes have been drilled within 30 mm (1 1/4 in) of the edge of the stud		

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Chapter Seven

Insulation, Air & Vapour Barriers

Introduction

Insulation, air barriers and vapour retarders are the primary building envelope elements used to control the flow of heat, air and moisture to provide a comfortable indoor environment for the occupants and prevent condensation on the interior surface of the envelope. This chapter discusses the design and construction of lightweight steel framed houses to avoid problems associated with uncontrolled heat, moisture and air movement.

Thermal insulation should be selected appropriate to the region a building is located in. A well insulated and air tight envelope helps maintain comfortable indoor temperature and contributes to occupant comfort, see Figure 7.1. A well insulated building means that less energy is needed by the heating and cooling equipment to maintain indoor temperature.

Air barriers reduce the flow of air through the building envelope and reduce air leakage and drafts. They help prevent the leakage of moisture-laden air that could cause condensation within the envelope.

Vapour retarders reduce the amount of water vapour that enters the wall cavity by vapour diffusion.

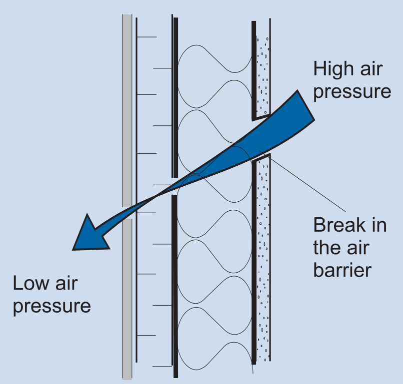
Building Science Insight

Air Barriers vs. Vapour Barriers

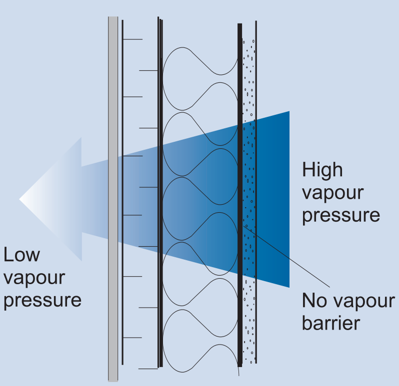
It is important to recognize the difference between air barriers and vapour barriers. Iin cases where the air barrier and vapour barrier are different materials, the different functions and requirements of each should be clear. Even where polyethylene could perform both functions, it's treatment would differ if acting solely as one or the other.

Air barriers reduce the movement of air in and out of the building envelope and at the same time keep moisture from being carried by the air and condensing within the building envelope. They also prevent drafts from short circuiting the insulation. Air barriers must be located in any insulated floor, wall or ceiling and must always be continuous and structurally supported. Air barriers can be installed at any location within the assembly.

Vapour barriers retard the diffusion of water vapour. They must always be installed on the warm side of the insulation. Vapour barriers should cover as much of the insulated surface as possible but unlike air barriers need not be continuous.



Air Leakage



Vapour Diffusion

A major difference between conventional wood and steel frame construction is that mould and fungal growth, often the consequences of uncontrolled moisture in wall, floor, or ceiling cavities; is less likely with steel construction since the wood substrate which acts as food for the fungal organisms is largely not present. However, other building materials, such as floor sheathing or paper backing on drywall, could support fungal growth. Antifungal drywall is now available to help prevent such growth.

Methods of Heat Transfer

Heat is transferred through the building envelope in three principal ways: conduction, convection and air leakage.

Conductive heat flow is heat conducted at the molecular level through the envelope materials. The rate at which the heat is transferred depends on the materials present; each material conducts heat slightly differently. The capacity of a material to resist conductive heat flow is expressed as a Resistance System International (RSI) value (metric) or a Resistance (R) value (imperial). The value of the RSI value increases as the thickness of the material increases.

The second type of heat flow is convection. Wherever there are convective currents, heat is being transferred from one place to another. In spaces such as cavities in exterior walls, convective currents play an important role in heat loss. The larger the currents of air flowing through the space, the greater the heat loss. Eliminating voids in the insulated wall cavities will control heat loss by convection.

Air leakage is the third type of heat flow; it is simply the loss of heat directly to the exterior through air leaks in the assembly. To reduce the probability of air leakage, an effective air barrier system must be installed.

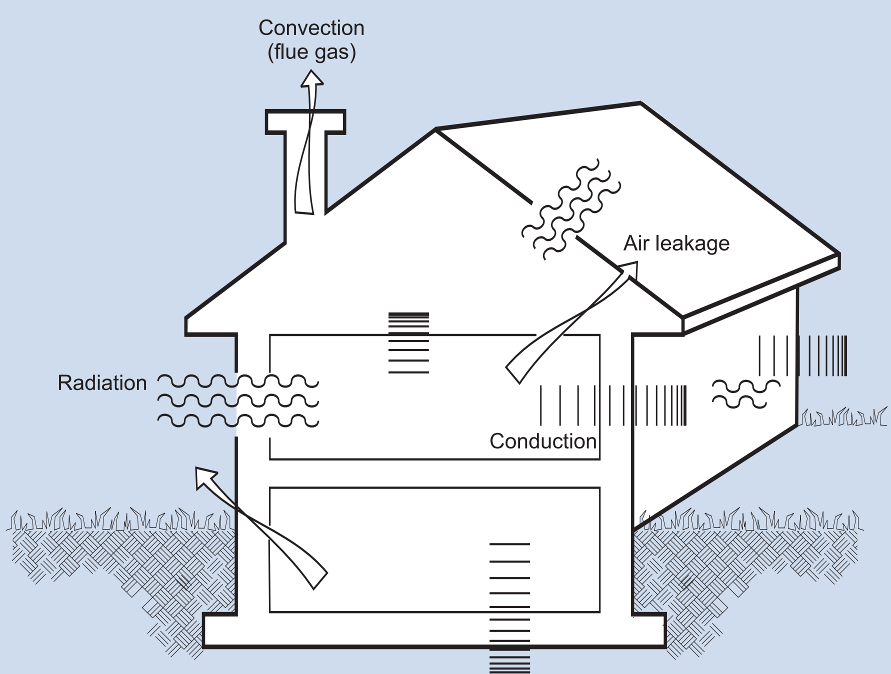


Figure 7.1

Methods of Heat Transfer

Insulation

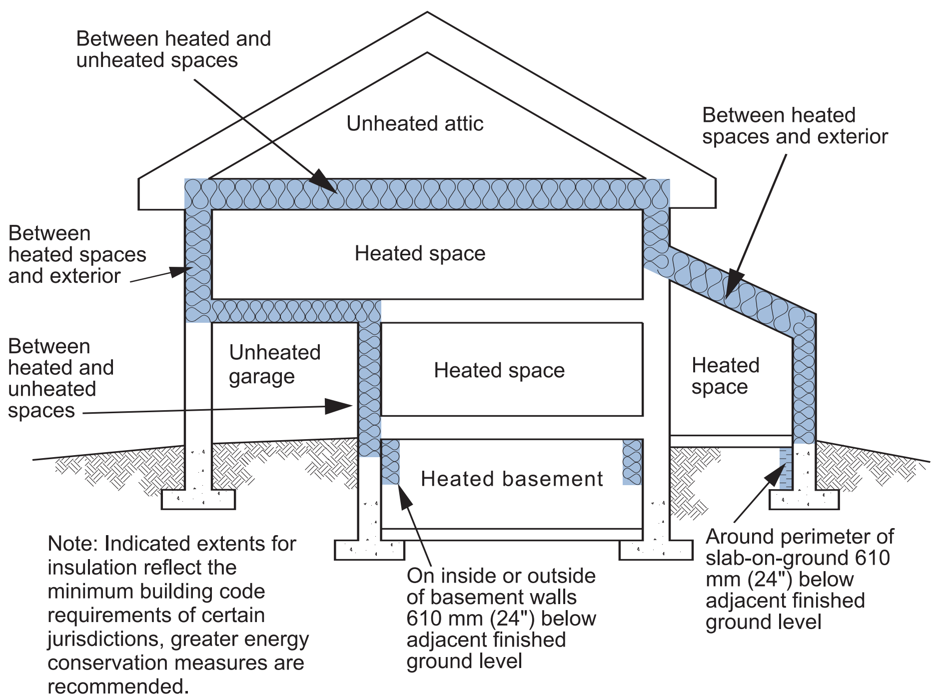
Thermal resistance is the ability to resist heat transfer by conduction, convection and radiation. This resistance is expressed as an "RSI" value (the imperial equivalent being R value). The higher the RSI (or R) value, the greater the insulating capabilities of the material or assembly.

The National Building Code of Canada (NBCC) requires that insulation be installed in walls, ceilings and floors that separate heated space from unheated space (see Figure 7.2).

Local building codes will specify the required thermal resistance of the insulated wall, floor or roof assembly for the specific building location. Different insulation levels are specified for different climates, different parts of the house and different types of heating. The required thermal resistance can come from a combination of batt insulation, rigid insulating sheathing or spray applied insulating foam. The thermal resistance of each insulation is added together to determine the over-all nominal thermal resistance of the assembly (considering the effects of the insulating materials only).

Figure 7.2

Locations Requiring Insulation



Technically all of the components in the building assembly contribute to the overall thermal resistance of the assembly. However, most of the thermal resistance of an assembly is generally attributable to the insulation material.

Steel as a material is a very good conductor of heat. As such, lightweight steel framed houses need to incorporate details that limit the transfer of heat through the frame, particularly where the frame bridges directly across the entire envelope assembly and connects the indoors to the outdoors. This is known as thermal bridging and, if not addressed, will lead to substantial heat loss, condensation and staining on interior surfaces. Properly installed exterior insulation can provide the necessary thermal break to reduce thermal bridging. In order for the thermal break to be effective, at least 25% of the

insulation required must be located on the cold side of the steel frame. This keeps the frame and cavity warmer, reduces the potential for condensation and improves the overall envelope durability regardless of the framing system.

The same types of insulation as used in wood framing can be selected for lightweight steel framing. Section 9.25 of the National Building Code of Canada lists different types of insulation that can be used.

Building Science Insight

Thermal Bridging

Without proper insulating techniques or without employing thermal breaks lightweight steel members conduct heat much more easily than wood members.

Without exterior insulation, studs create thermal bridges that conduct heat to the exterior creating cold spots on the drywall. Not only does this seriously reduce the R-value of the wall, it can also create moisture problems when warm inside air comes into contact with the cold areas and condensation may result.

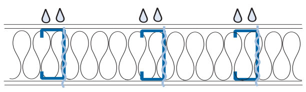
In addition, a phenomenon called “ghosting” can occur, which is the result of air-borne dirt/smoke particles accumulating over colder surfaces of the wall and delineating the framing members.

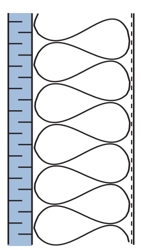
To mitigate these conditions, exterior insulating sheathing is required by building code and CCMC to reduce thermal bridging. Exterior insulating sheathing reduces the effect of thermal bridging by increasing resistance to heat flow at the framing member. This keeps the member warm and significantly reduces the risk of condensation forming on the stud or wall.

For those areas in Canada with heating seasons up to 5000 degree days, 25% of the required R-value of the assembly must be located on the cold side of the steel framing to act as an effective thermal break. The layer of insulation keeps the studs warm. Beyond 5000 degree days an insulation scheme conforming to Part 5 of the NBCC is required.

For a wall with a total R-value of RSI 3.0 (R17) this could be accomplished with RSI 0.88 (R5) extruded polystyrene (typically 25 mm (1”) or 30 mm (1.2”) thick) over a 89 mm (3”) Thick fibreglass batt of RSI 2.11 (R12).

This is just one example of a possible combination of insulations. Make sure to compare each alternative and check for impacts on items like foundation wall thickness before proceeding.





Exterior Walls

Cavity insulation is normally used in combination with rigid insulating sheathing to develop the required insulation values for the entire assembly.

Cavity Insulation

There are various options for insulating cavities including friction fit batt and blown in cellulose, with friction fit batt being most common. The batts are installed between the studs and run the full height of the wall. The batt must fill the entire cavity including the inside of the C-section of the wall studs in order for it to be effective. The open C-profile of the steel members creates a space between studs that is larger than that of a wood frame. Batt insulation must therefore be wider than that used for the same spacing in a wood frame. Batt insulation is available in 406 mm and 610 mm (16 and 24 in) widths made for steel stud construction and are commonly used in commercial applications. See Figure 7.3. Batts intended for wood frame construction should not be used in lightweight steel frame houses.

Figure 7.3

Proper Installation of Batt Insulation

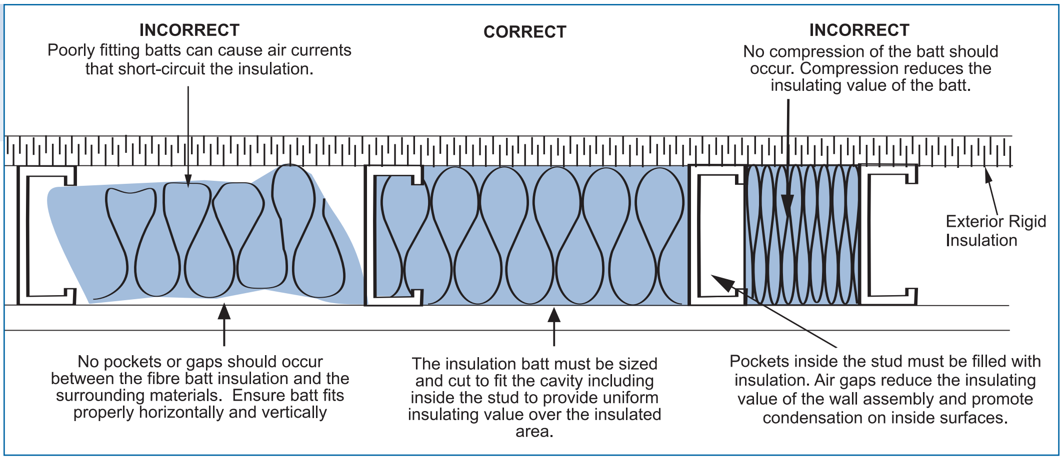
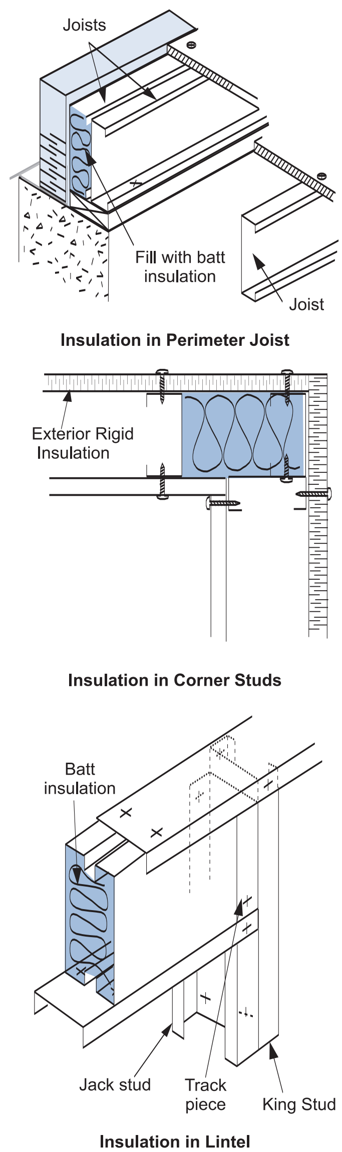


Figure 7.4

Insulation Installed during Framing



Spray-applied foams, of various compositions, are another effective means of insulating as are some blown in cellulose, glass and mineral fibre products. These products have the advantage of filling completely the C-sections of each stud. Spray foam is also useful for filling the cavities around doors and windows and in normally inaccessible areas of the steel frame.

There will be parts of the steel assembly which are restricted or inaccessible. Insulation must be placed in these areas during the construction of the steel frame. Adding insulation to these areas after the frame is up is much more difficult and often more costly. Examples of closed assemblies include box lintels, corner studs and jamb assemblies. See Figure 7.4.

Ensure that all voids around windows and doors, at corners and between floor joists are also filled with insulation. Sprayed foam or hand-cut batt insulation can be used to fill other problem areas, such as spaces behind electrical boxes and gaps between window and door inserts into the steel frame.

Planning Ahead

It is important to remember that insulation must be protected from rain. Insulation depends on trapped air. If insulation is allowed to get wet, it loses its ability to insulate. This is particularly a problem if the insulation does not have an opportunity to dry out.

Exterior Insulation

Since steel is a good conductor of heat, all steel framing in exterior walls or floors over unconditioned spaces must have a thermal break to control thermal bridging. Rigid insulating sheathing must be attached to the outside of exterior studs and the outside of exposed floors framed with lightweight steel members. The insulation needs to be continuous to provide the needed thermal break. For those areas of Canada with heating seasons up to 5000 Celsius degree days, **at least 25% of the required R-value of the total insulation through the cavity must be located on the cold side of the steel framing to act as an effective thermal break**. For colder regions additional exterior insulation may be needed and professional guidance should be obtained to determine the appropriate amount in conformance with Part 5 of the NBCC.

Exterior rigid insulating sheathing, often extruded or expanded polystyrene, is normally attached during the framing of the wall. Figure 7.5 illustrates the location of batt and rigid insulation within an exterior wall.

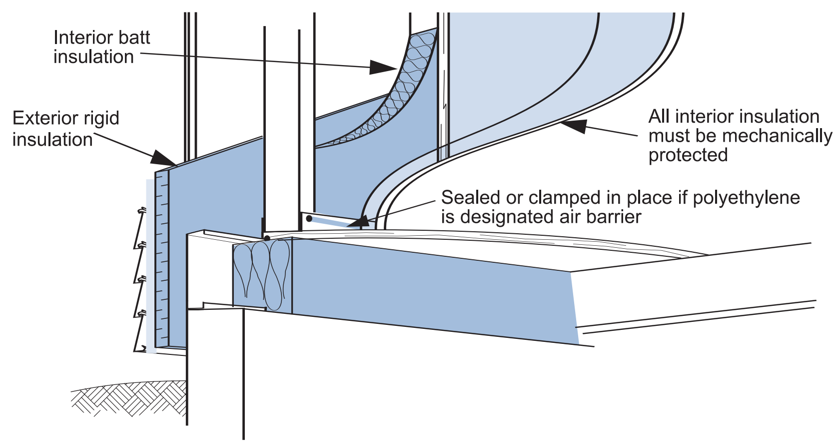


Figure 7.5

Insulation of Exterior Walls

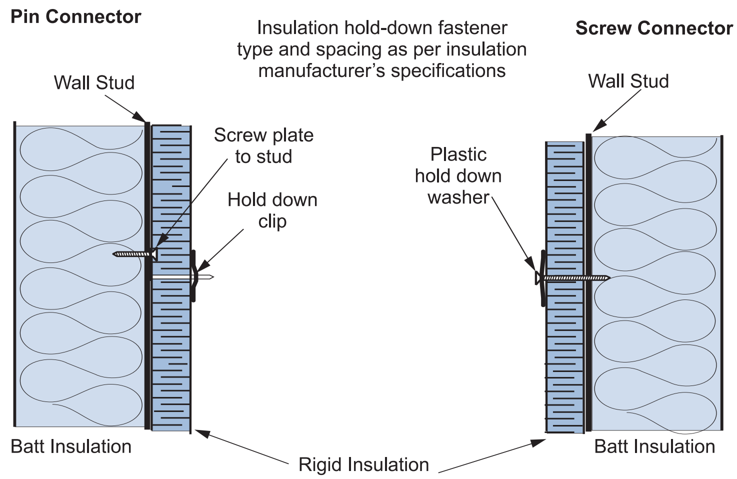
Figure 7.6 shows methods of installing exterior insulating sheathing. Rigid insulation can be attached to the frame with either screws or pins. For the pin method, fastener plates are screwed to the outside of the stud flanges. The rigid insulation is pressed over the pins and held in place by hold down clips. Alternatively, use #8 x 75 mm (3 in) drill point screws through a 75 mm (3 in) diameter plastic disk, the insulation and into the stud. The screw must be long enough to leave at least three exposed threads on the back side of the steel. These plastic disks are normally purchased separately from the screws. It may also be possible to purchase fasteners that have the plastic or corrosion-resistant washers that are sold separately, or that are already attached. If an exterior structural sheathing is used, the insulation can be screwed or air nailed directly to the structural sheathing. The insulation manufacturer should be consulted for appropriate fastening methods and fastener spacing.

Floor Headers

Floor headers need to have batt insulation on their inside and rigid insulation (just as on the rest of the exterior wall) on the outside. Where the rigid insulation is exposed to the elements, it should be clad with cement board, cement parging on wire lath, or another hard finish to protect it from weather as well as physical damage. See Figure 7.7.

Figure 7.6

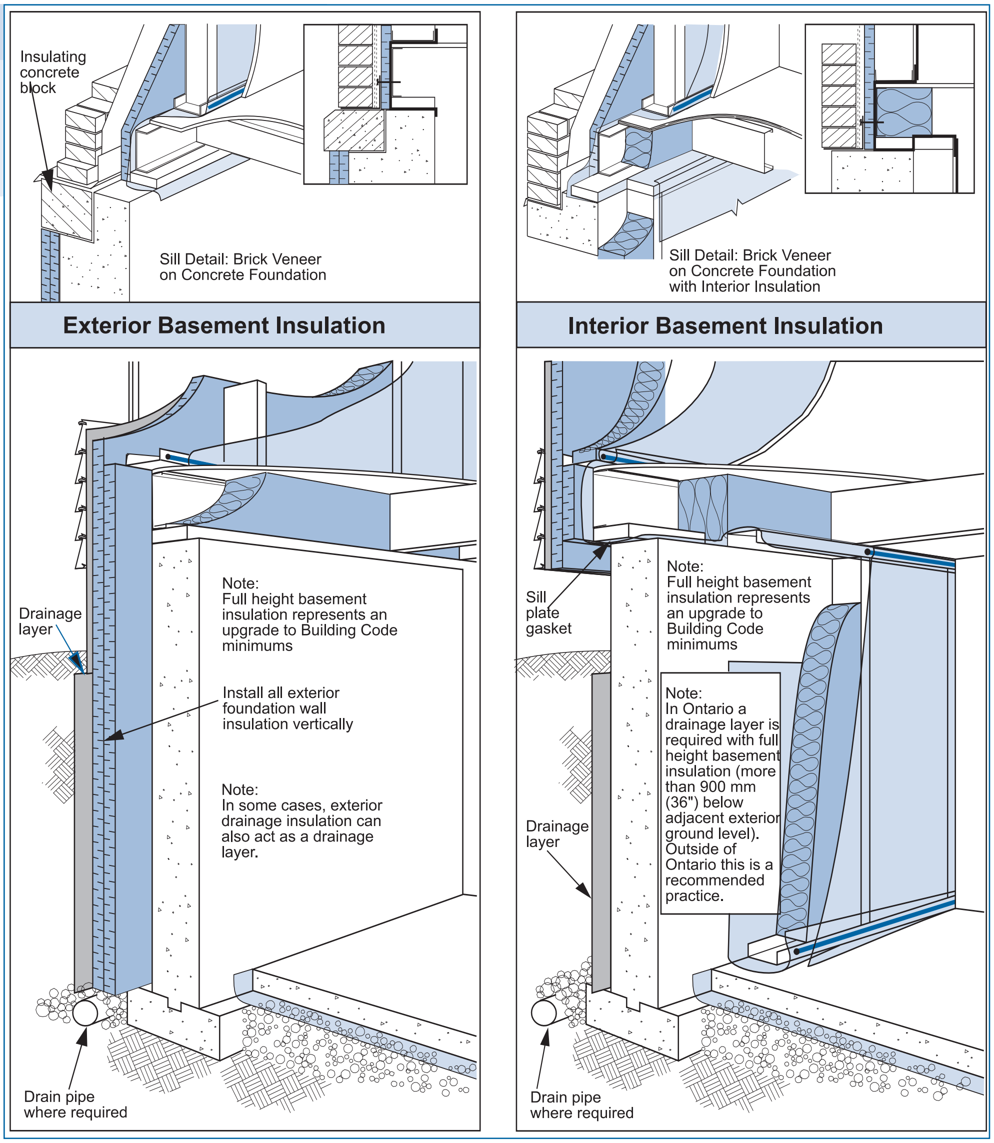
Fastening Exterior Insulation Sheathing



Ensure that 25% of R-value is located on the cold side of the frame

Figure 7.7

Exterior and Interior Insulation of Basements



Voids within any perimeter or joint assembly, as well as small spaces between rim joists and parallel floor joists must be insulated. Both spray in-place and batt insulation work well for these areas. Insulation should also be placed between floor joists at the rim joist, to the same required R-value as the above grade walls.

Floors Over Unheated Space

The NBCC requires insulation in floors over unheated spaces including unheated garages, crawl spaces and exterior cantilever floors. Friction fitting batts placed between the floor joists with insulating sheathing clad to the underside of the floor assembly can satisfy code requirements. Batts can be secured with wire ties, stapled housewrap or wire mesh to ensure that they stay in place. See Figure 7.8.

Rigid exterior insulating sheathing can be attached to the cold side of the floor joists where the floor is accessible.

Insulations that are sprayed in place can be a good choice for these areas since they provide good coverage and eliminate issues of securing the insulation to the assembly.

A hard finish should be applied to protect the insulation from mechanical damage and act as thermal barrier protection. In garages, this surface, usually drywall, also provides gas proofing. In crawl spaces and under cantilevered floors the hard finish should provide some weatherproofing such as cement board or an exterior sheathing.

Each floor assembly is expected to incorporate vapour barrier protection and a continuous air barrier plane, just as in conventional construction.

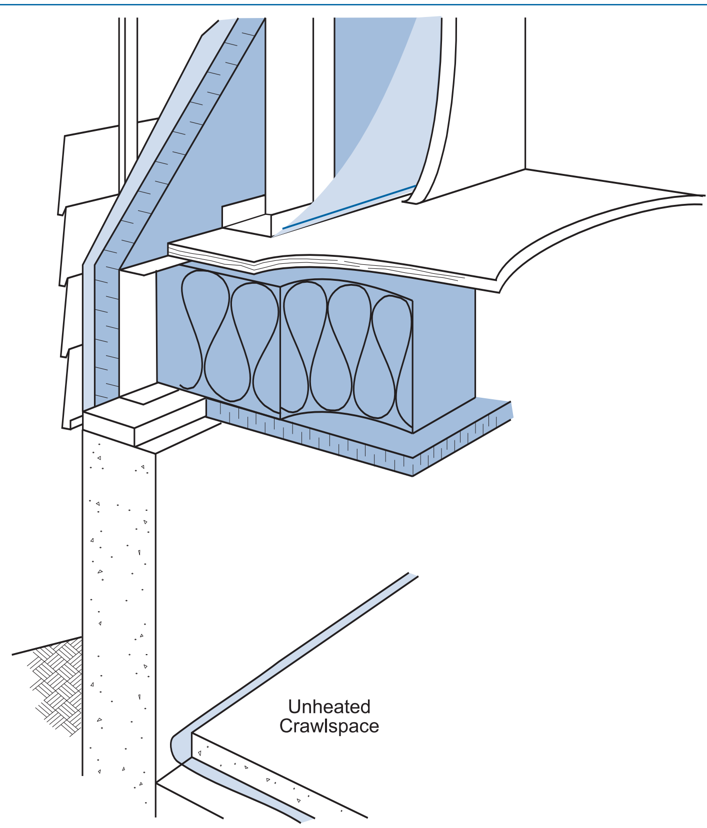


Figure 7.8

Insulation Detail for Floor over Unheated Basement

Ceilings Under Unheated Attic or Roof Spaces

Friction fitting batts or blown loose fill insulation is placed between and over ceiling or roof joists. When using this type of insulation care must be taken not to block soffit vents. Alternatively, spray insulation can be used.

Roof-Wall Intersection

The roof-wall intersection is a critical detail in preventing thermal bridging. Insulation is placed between every joist, rafter and truss. This insulation can be batt, loose fill, spray foam or cellulose.

The exterior insulating sheathing on the walls should extend as high as possible. The builder may choose to cut the rigid insulation so that it extends up between each joist. Alternately, a less time consuming method is to use spray foam insulation around the end of each joist. A piece of batt should be inserted at the outer edge of the cavity (see Figure 7.9) against which the foam is sprayed.

Figure 7.9

Insulation Detail for Roof-Wall Intersection

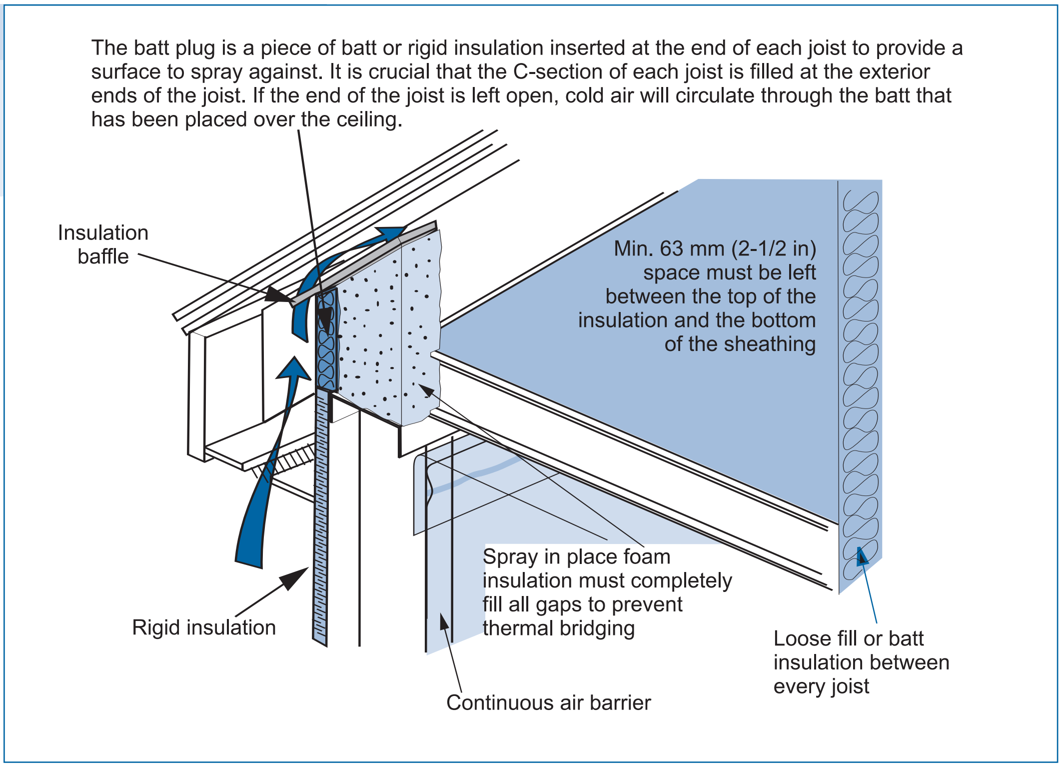


Figure 7.9 illustrates the roof/wall intersection and describes how to achieve proper ventilation under the roof.

Cathedral-Type Roof and Ceiling

To mitigate thermal bridging a lightweight steel framed cathedral ceiling requires purlins and insulation below the joists so that the joists cannot bridge directly to the drywall. Figure 7.10 illustrates this detail. As noted in the illustration the insulation below the joists can be either batt or spray foam. This bottom layer of insulation should be at least 38 mm (1 1/2 in) deep.

Spray foam insulation over the top plate eliminates gaps around the joist to minimize thermal bridges through the wall. It is applied by spraying against a piece of batt inserted at the outer edge of the top plate.

Cathedral ceilings must be continuously vented and have a clear space of 63 mm (2 1/2 in) between the top of the insulation and the underside of the sheathing. Friction-fitting batts or spray insulation should be used rather than blown loose fill insulation to ensure the continuity of the 63 mm (2 1/2 in) clearance. The roof spaces must be designed to allow uniform circulation of air throughout the roof. This can be achieved with cross purlins or each roof space can be separately vented (see figure 7.10).

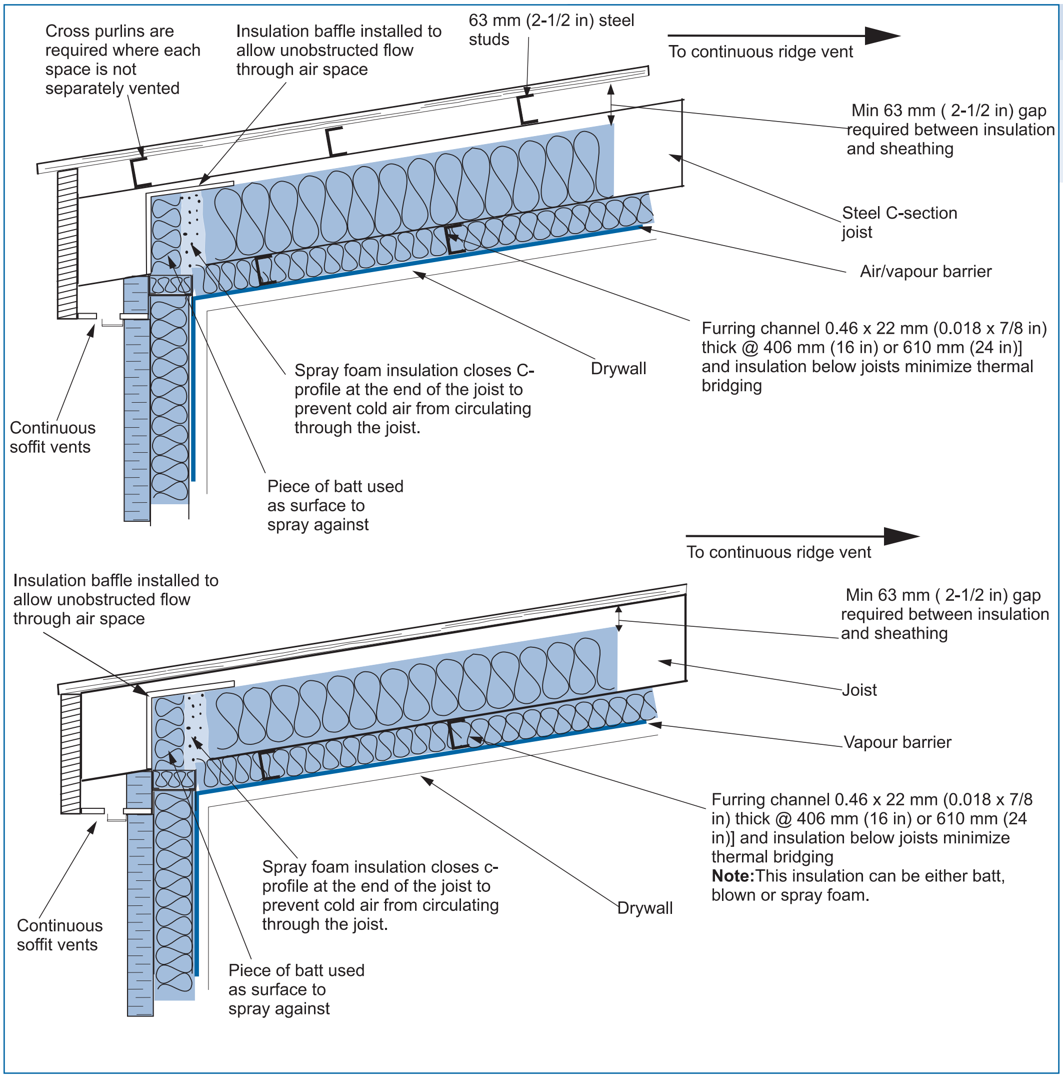


Figure 7.10

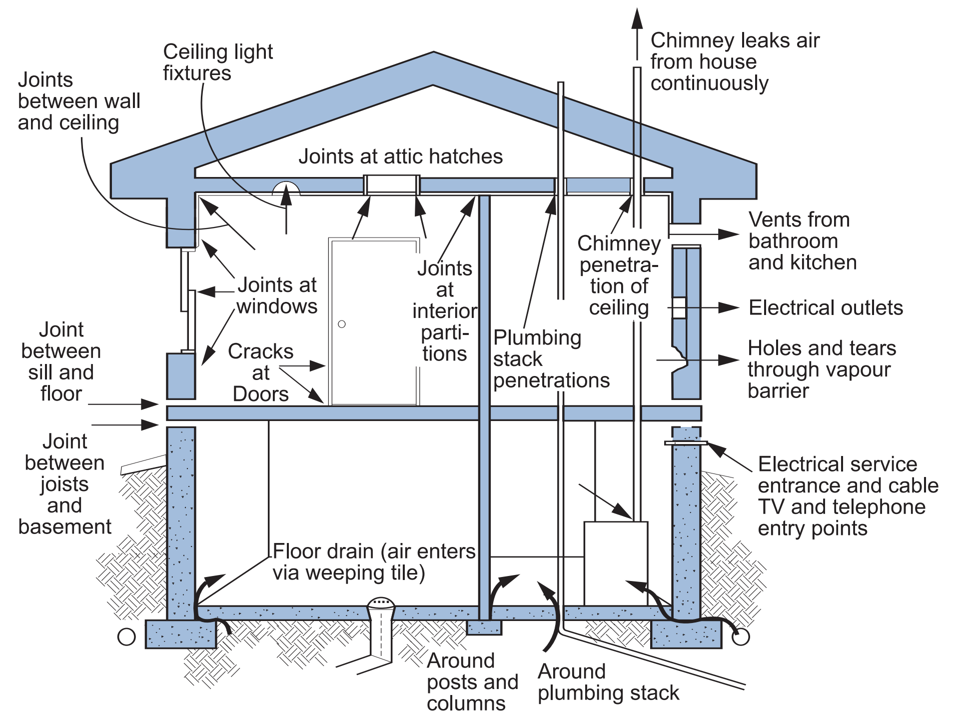
Insulation Detail for Cathedral Ceiling

Air Barriers

All wall, ceiling and floor assemblies which are thermally insulated must provide a continuous barrier to the leakage of air from the interior of the building into wall, ceiling, floor, or roof spaces. The consequences of an improper air barrier can include drafts, condensation in insulated envelope cavities, loss of energy, and occupant discomfort. Figure 7.11 highlights areas that require attention to detailing in order to avoid air leakage.

Figure 7.11

Air Leakage



The materials and installation of air barrier systems shall follow the requirements specified in NBCC Part 9. Suitable air barrier materials must be able to prevent air movement. Part 9 of the NBCC specifies the materials that can be used and their proper installation method.

The installation of air barriers in lightweight steel frame houses is no different than in wood framed houses. The air barrier must be continuous in order for it to be effective. This means all penetrations and intersections, such as doors, windows, electrical wiring, or piping must be sealed. See Figures 7.12 and 7.13.

Vapour Barriers

The principal function of a vapour barrier is to provide a high resistance to the diffusion of water vapour to avoid condensation within the envelope.

Vapour barriers for lightweight steel framing are no different than for wood framing. Please refer to the local building code for its vapour barrier requirements.

Because lightweight steel framing requires at least 25% of the insulation to be located on the cold side of the frame, the permeability of the exterior insulated sheathing becomes important. The National Building Code of Canada requires that where sheathings with low water vapour permeance are used on the exterior of the building envelope (low permeability foam plastic sheathing), the vapour barrier must have a permeance not greater than 15 ng/Pa•s•m^2 (e.g. polyethylene). The lower the vapour barrier's permeability, the less water is able to travel through the material. A vapour barrier must ensure that less water is allowed into the wall cavity than is allowed to escape. If the exterior insulated sheathing has a low permeability then the vapour barrier on the warm side of the assembly must have a permeability lower still to avoid trapping moisture. More vapour must always escape out of the exterior side of the wall than enters from the interior side of the wall. This is particularly true when using specific foamed plastics. Figure 7.14 further illustrates this concept.

All other inboard and outboard rules as defined by the NBCC and that are standard practice for wood-frame construction also apply to steel frame houses.

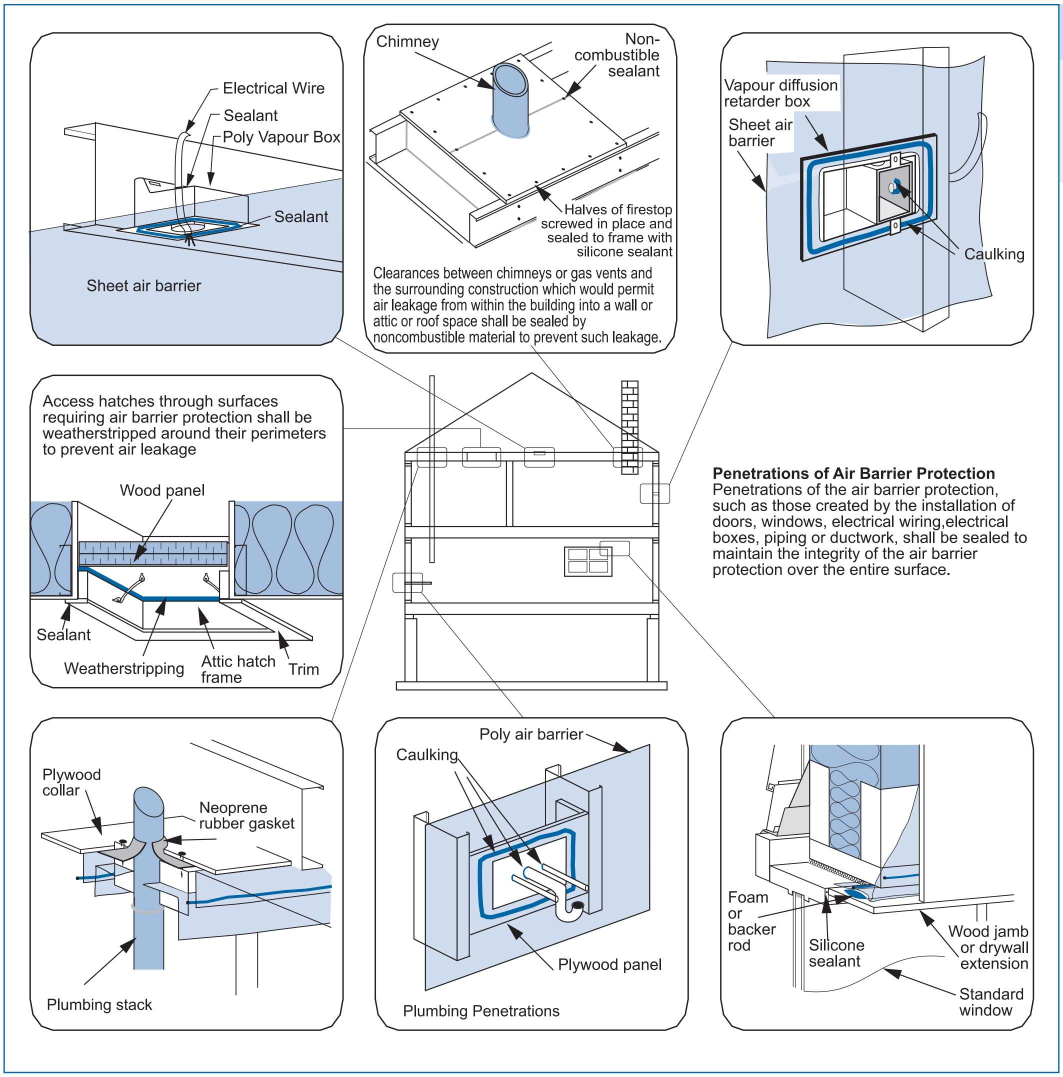


Figure 7.12

Air Sealing Penetrations

Figure 7.13

Air Sealing Intersections

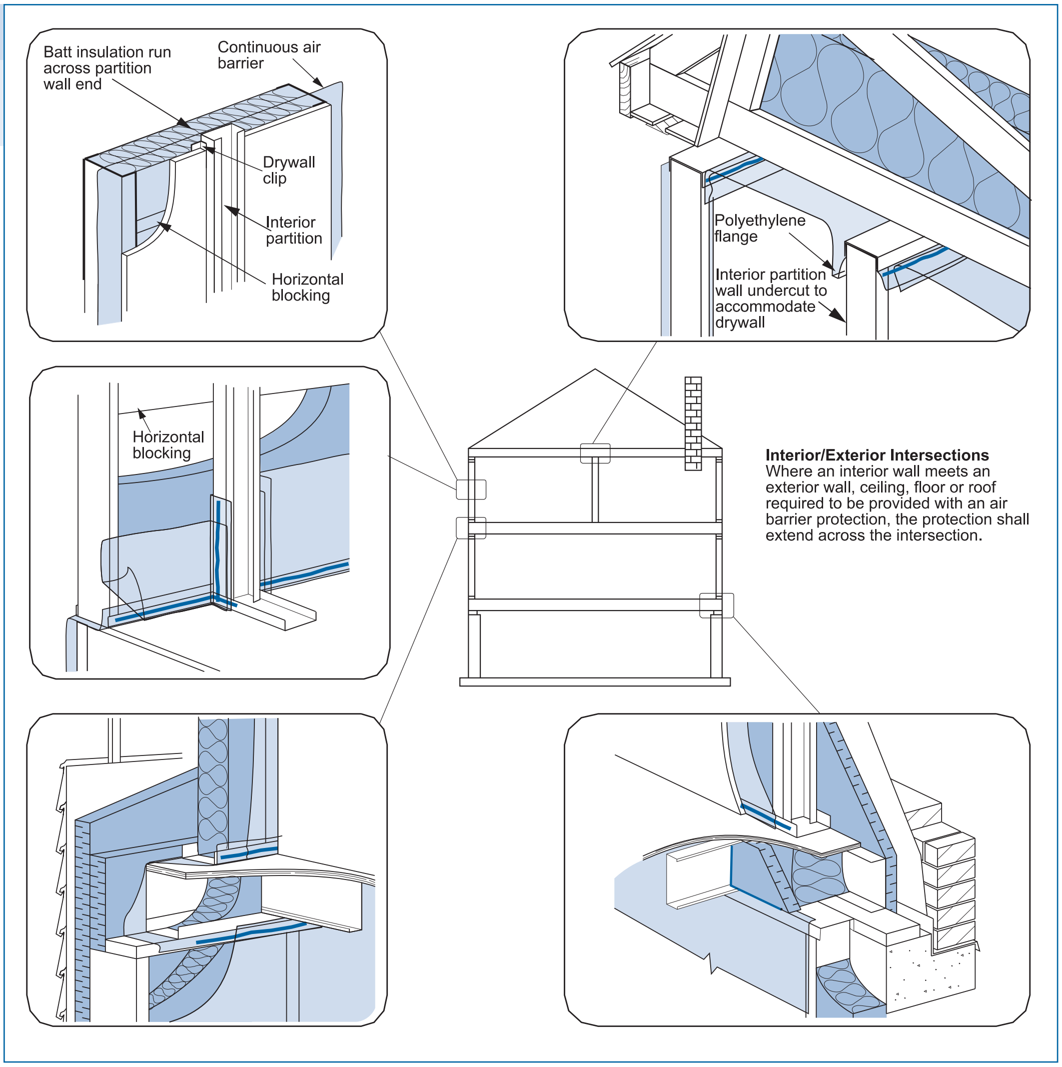
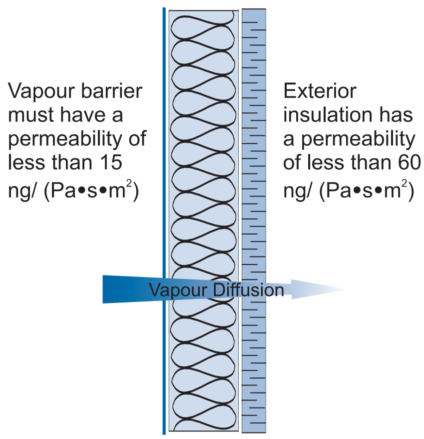


Figure 7.14

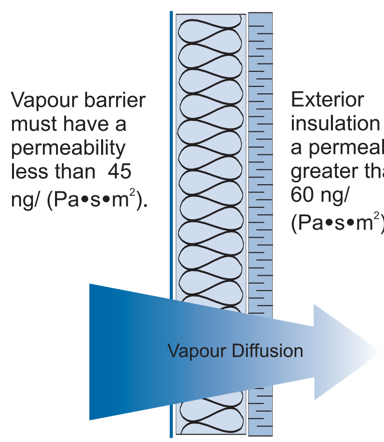
Low vs. High Permeability of Exterior Insulation

If the exterior insulation has a low permeability then the vapour barrier on the warm side of the assembly must have an even lower permeability. More vapour must always escape out the exterior side of the wall than enters the interior side of the wall.

Exterior Insulation with Low Permeability



Exterior Insulation with High Permeability



Insulation, Air & Vapour Barriers Checklist			
		Y	N
Insulation	Insulation has been installed in every wall, floor and ceiling separating heated space from unheated space		
	Insulation levels meet any requirements from local building code and climate		
	At least 25% of the required R-value of the assembly is located on the exterior of the frame		
	Cavity insulation properly fills the C-profile of each stud		
	All closed box assemblies have been filled with insulation		
	All floor headers have insulation within the C-profile and rigid insulation on the exterior		
	All voids in perimeter assemblies and around windows and doors have been filled		
Air Barriers	The materials and installation of air barrier systems shall follow the requirements specified in NBCC Part 9		
	All wall, ceiling and floor assemblies which are thermally insulated must have a continuous air barrier		
	All penetrations such as doors, windows, electrical wiring or piping must be sealed		
Vapour Barriers	The materials and installation of vapour barrier systems shall follow the requirements specified in NBCC Part 9		
	All inboard/ outboard ratios have been carefully adhered to in cases where exterior rigid insulation has a water vapour permeance of less than 60 ng/Pa•s•m^2		

The Lightweight Steel Frame House Construction Handbook

Chapter Eight

Interior & Exterior Finishes

Introduction

This chapter discusses the application of interior and exterior finishes for lightweight steel frames. It identifies the materials and methods that differ from those used for a conventional wood frame construction. Typically, the differences are to be found in the fastening methods.

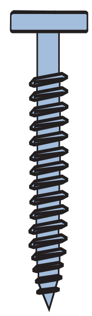
Fasteners for Finishes

There are two common screw point designations used in residential steel framing: sharp point and drill point. Sharp points are for steels up to 0.879 mm (0.0346 in) thick and may have a sharp needle or piercing point similar to that found on wood screws, or it may be fluted to aid in the drilling process. Drill points are designated for individual sheets up to 2.8 mm (0.112 in) thick and have a shorter, fluted tip specifically designed for drilling. See Figure 8.1.

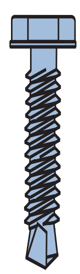
Figure 8.1

Sharp Point and Drill Point Screws

There are two main types of screws used for lightweight steel framing, sharp point and drill point. Drill point is often referred to as a sheet metal screw (SMS).



Sharp Point
Sharp point screws can be used on steel up to 0.879 mm (0.0346 in) thick



Drill point or SMS
SMS should be used for members thicker than 0.879 mm (0.0346 in)

Depending on the thickness of the finishing material being connected, the threads along the shank are held back from the point of the screw to prevent the threads from engaging the steel until the drilling process is complete. This prevents over-drilling the first ply or stripping the threads after partial penetration. At the other end of the screw, the threads do not continue to the screw head. When connecting wood or other rigid material to steel, this allows the screw to draw the plies together with minimal lift-up of the wood or rigid material. For further information regarding fasteners please see Chapter 1.

Interior Wall and Ceiling Finishes

Nail popping that results from drying of conventional framing materials is virtually eliminated since steel framing is not subject to the dimensional instability due to moisture.

It is important to note that neither drywall nor furring are ever structural when used in conjunction with lightweight steel framing.

Furring

Occasionally furring is required to strap out a wall or ceiling or provide a surface for some finishes. Furring is applied with drill-point or sharp point screws directly into the steel studs. Both steel and wood furring is available. Steel furring, normally 22 mm (7/8 in) channels, is spaced according to manufacturer's instructions, see Figure 8.2. Once the furring is in place, the wall or ceiling finish can be applied to it with the regular methods of attachment, according to the type of finish.

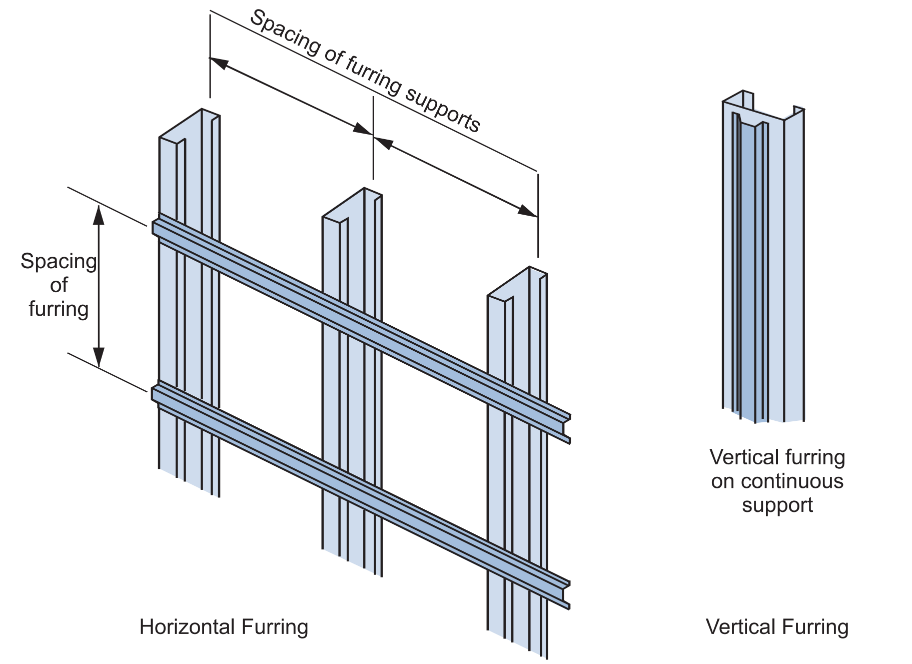


Figure 8.2

Furring

Gypsum Board and Drywall

Gypsum board and drywall are attached to steel framing in almost the same manner as wood framing. Drill point screws are used to attach both the drywall and corner bead. Lightweight steel framing allows the drywall to be applied either parallel or perpendicular to the studs since the diagonal bracing eliminates the need for drywall to act as bracing. Sharp pointed drywall screws are used to attach the drywall to the steel members up to 0.879 mm (0.0346 in) thick. For thicker steel members, drill point screws are needed.

Drywall is typically attached to the steel studs with #6 self-piercing bugle head screws. Screws should be attached using a depth-sensitive nosepiece and screw gun to avoid damaging the drywall surface. The spacing of drywall fasteners is no different from wood-frame construction. Refer to the manufacturer's instructions, for more detailed information.

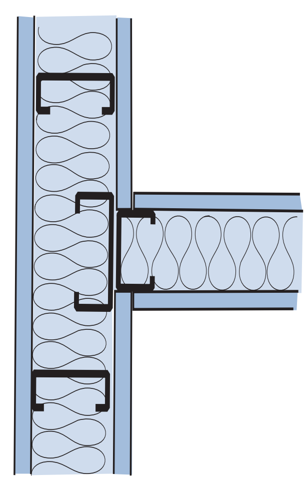


Figure 8.3

Drywall at Wall Intersections

The joints of gypsum board are finished as they would be for conventional wood-frame construction. Figure 8.3 illustrates one possible solution for drywall application for interior non-loadbearing walls in corners.

Plastering, Board and Wall Tile Finishes

Plastering follows the same methods that are used in wood-frame construction. Board finishes are applied to steel frames with sharp-point screws instead of nails, unless wood furring is used. Follow the manufacturer's instructions for their installation.

As per NBCC section 9.29 ceramic, plastic and metal tile, sheet vinyl, tempered hardboard, laminated thermosetting decorative sheets or linoleum are finishes that can be used as waterproof interior finishes. These are applied in the same manner as in wood-frame houses, following manufacturer's installation instructions.

Cabinets

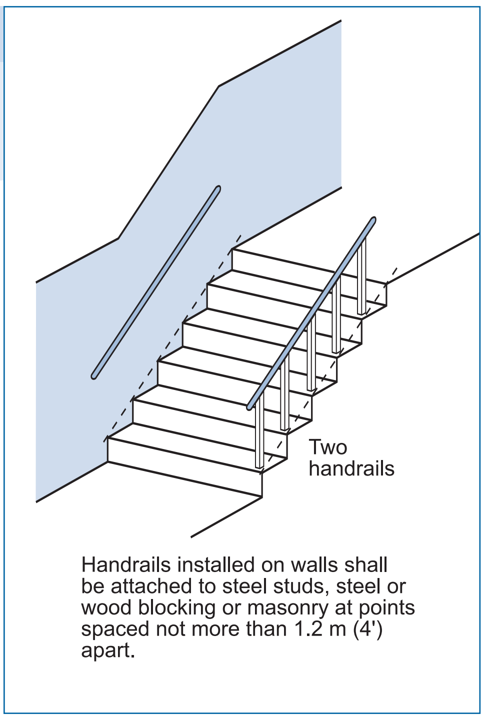
Cabinets are attached directly to loadbearing studs using screws. The recommended fastener is a #8 50 mm (2 in) drill point screw. Several methods are available to fasten the shelves or cabinets:

a. screw the cabinets to loadbearing wall studs, or
b. screw the cabinets to steel or wood blocking placed between loadbearing wall studs prior to drywall application, or
c. screw the cabinets to sheet steel or strapping 0.46 mm (0.018 in) thick that is secured to loadbearing walls prior to drywall application.

Only shelving for closets, fastened with sharp point screws may be attached to non-loadbearing studs, all other cabinets etc. must be fastened to loadbearing studs. If shelving in closets is being fastened to loadbearing studs use drill point screws.

Figure 8.4

Stairs, Guards and Railings



Stairs, Guards and Railings

Stairs, guards and railings should be installed as dictated by the local building code. Any connection to steel members must be made with appropriate screws. In all other regards, the installation is the same as for wood. See Figure 8.4.

Baseboard, Door and Window Trim

There are three different approaches to attaching baseboard to walls in a steel framed house: adhesive, pneumatic nails or trim screws.

Construction adhesive should be used in conjunction with air driven finishing nails to hold the bond between the drywall and trim until the glue has cured.

To nail baseboard, door and window trim to steel framing use hardened nails in pneumatic nailer.

Finishing screws with small heads (approximately 3 mm (1/8 in) wide) can also be used to fasten trims to steel members. Putty or wood filler can be applied over nail and screw heads to leave a smooth finish. Figure 8.5 illustrates a typical steel jamb assembly.

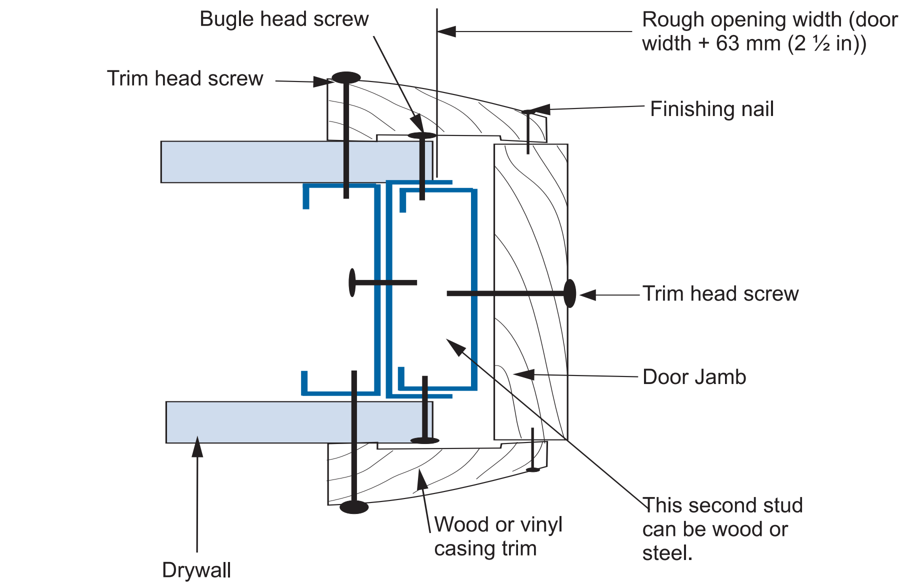


Figure 8.5

Jamb Assembly

Some framers prefer to screw wood blocking to the inside of rough door and window openings to allow for nail-fastening of trim, doors and windows. Remember to add the wood dimensions to the opening size when choosing the appropriate lintel. When rough openings have had wood bucks added trim around doors, windows and openings can be nailed or screwed into the wood frame.

Other Fixtures

Towel racks and grab bars must be fastened to steel or wood blocking to support any weight that they may be required to hold.

Subfloors, Underlay and Finish Flooring

Chapter 3 describes how to select and install the subfloor. Panel-type underlay is required for some subflooring and finish flooring combinations. There is no change in practice from wood-frame construction.

Finish flooring is installed in the same manner as in wood-frame housing. Care must be taken to ensure that when the finish flooring is nailed to the subflooring that none of the nails come into contact with the steel joists to avoid squeaking. Ceramic floors may require blocking as additional support just as in wood framing.

Sheathing, Sheathing Membrane and Flashing

As already discussed, rigid insulating sheathing is always required on a lightweight steel framed house, whether a second sheathing is added depends on the requirements of the exterior finish.

Non-Insulating Sheathing

The recommended fastener is a #8 screw minimum, drill point bugle head. While drilling, ensure that the sheathing is held tightly against the steel frame using a clamp or a co-worker's help while screwing in the first few fasteners. The use of a drill with a depth sensitive nosepiece prevents drilling

too deeply through the sheathing layers. If the sheathing layers are over-drilled, the connection will be less effective.

Rigid Insulating Sheathing

Insulating sheathing acts as additional insulation that is attached to the outside of the steel studs of the house. The sheathing is intended to provide at least 25% of the insulation value of the wall assembly, as discussed in Chapter 7. The sheathing does not replace horizontal or diagonal bracing. The insulating sheathing is located on the cold side of the steel framing to act as a thermal break.

Sheathing Membrane

One layer of sheathing membrane should be applied under stucco, siding and masonry veneer. The application of sheathing membrane on a lightweight steel frame house is no different than the application on a wood frame house.

Flashing

Flashing allows water that has penetrated the exterior finish to drain back out of the wall system. Generally, flashing should be located at the horizontal intersection of two different finishing types unless the upper finish overlaps the lower. Many different materials can be used for flashing, depending on whether it will be concealed or exposed, refer to your building code for acceptable materials and thicknesses. In cases where the flashing might come into contact with the steel frame, attention should be paid to possible reactions of dissimilar metals. Galvanized and aluminum are the most commonly used flashing materials and can be used with steel framing. Copper flashing is not compatible with steel framing, and should therefore be avoided.

Exterior Finishes

The application of exterior finishes to steel framed houses follows the same procedures as for wood frame buildings. All exterior cladding must conform to the requirements of NBCC Part 9. All the exterior finishes or claddings that can be applied to a wood frame house can be applied to a steel frame house. The only difference lies in the method of attachment. Screws are typically used to attach the cladding material to the studs and must be long enough to extend through the exterior insulation and screw securely into the stud. If structural sheathing is used over the steel studs, the exterior cladding can be fastened to it. Wood strapping can also be applied vertically over the insulating sheathing in-line with the studs. The cladding can then be nailed to the strapping. Electrical services can be installed without the use of protector plates prior to the brick ties since the brick tie screws are not long enough to reach the electrical cables.

Regardless of the type of exterior finish and fastener used, the manufacturer's specifications and recommendations for fastening systems and installation instructions take precedence. All exterior cladding must conform to the requirements of the NBCC Part 9.

Brick Veneer

For brick veneer care should be taken when installing the ties against compressible sheathing not to crush the sheathing. Ties should be zinc coated in order to increase resistance to corrosion from exposure to weather. Conventional brick veneer ties and spacing can be used. Brick ties must be fastened with screws which must penetrate both the insulating sheathing and the stud, see Figure 8.6. It may be helpful to mark the stud locations on the outside of the insulating sheathing to ensure that the brick ties are fastened to the studs.

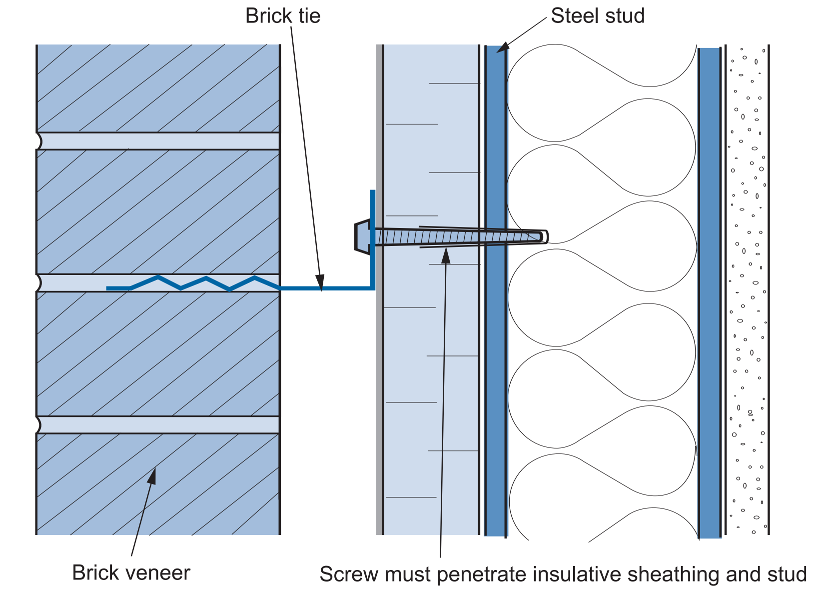


Figure 8.6

Fastening Brick Veneer

Stucco Finishes

There are two types of stucco which can be used with steel frame construction, a synthetic stucco system and Portland cement plaster. The synthetic system, Exterior Insulation Finishing Systems (EIFS), is applied in the same manner as in wood frame construction, refer to your local building code as well as the manufacturer's instructions.

Stucco is typically applied to a galvanized lath. To fasten the lath to the steel frame, drill through the sheathing and the insulation using #8 self-drilling screws and plastic washers. If the rigid insulation was mounted using pins and hold-down clips, the lath can be attached in the same way.

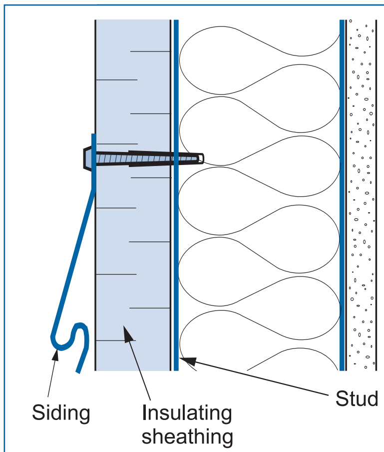


Figure 8.7

Fastening Siding to Steel Studs

Metal and Vinyl Siding

The fastener required to attach the various types of siding will depend on the manufacturer's specifications and whether there is structural sheathing present. In the absence of wood sheathing, the siding has to be fastened to the steel studs (through the building paper and rigid insulation) with self-drilling screws. Refer to Figures 8.7.

When both rigid insulating sheathing and structural sheathing are present, longer fasteners are required. Check with the siding manufacturer to verify which type of fastener to use. The siding manufacturer's directions will dictate the number and spacing of fasteners, and whether the siding should be attached to the structural sheathing or directly to the steel frame.

Lumber, Hardboard, Plywood, Waferboard, and OSB

As with metal and vinyl siding, the fastener used will depend on the manufacturer's specifications and on the presence of structural sheathing. The directions will state how many fasteners to use, the spacing and whether the wood siding can be fastened directly to strapping, the studs or to the structural sheathing.

Lumber boards and hardboard can be fastened to wood strapping (fastened through the rigid insulating sheathing to the steel frame), or to structural sheathing (if present) fastened to the steel studs using corrosion resistant nails or screws. At least three screw threads must be exposed in the interior.

Plywood and panel-type sidings are attached in a similar manner as above, while particular care must be taken with the joints in the plywood and panels. Panel connections are usually designed and dictated by the manufacturer. One type that may be used is an aluminum Z-flashing that 'seals' the exposed joints. Corrosion resistant nails and screws of sufficient length must be used.

Wood Shingles and Machine Grooved Shakes

Shingles and shakes must be installed as per manufacturer's recommendations.

Roof Finishes

Roof finishes are applied to steel framing using the same methods as with wood framing.

Roof Sheathing

Roof sheathing must be fastened using #8 screws instead of nails. Proprietary pneumatic fasteners are available, which are specially made for steel rafters and help speed up the application of sheathing. In all other respects application of the roof sheathing is the same whether for a steel frame or a wood frame.

Roof Surfacing

If the roof structure is built of steel trusses and rafters, as opposed to wood, the nails used to fasten the roof surfacing should not come in contact with the roof joists or rafters. This requires careful spacing of the shingles and fasteners. All fasteners should be galvanized to avoid any potential galvanic action.

Building Science Insight

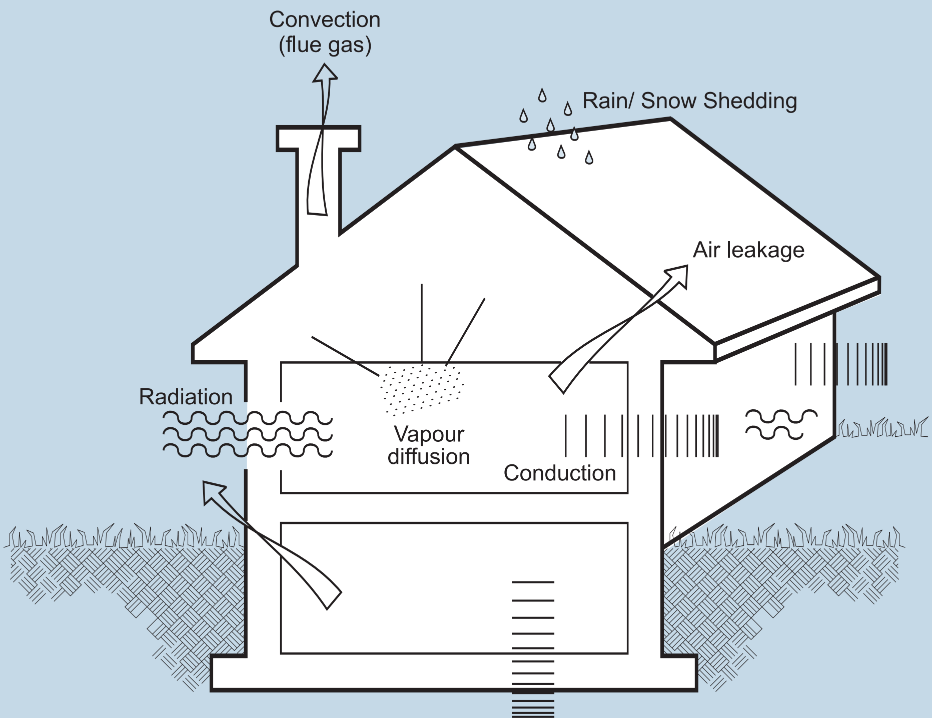
The Building Envelope as Environmental Separator

Comfortable conditions inside the dwelling are maintained by separating the interior from the outdoors.

The basic function of all walls, exposed floors and roofs is to separate the interior and exterior environments while fulfilling other functions such as structural integrity and durability.

To provide occupant comfort the building envelope must control wind, rain, sun, noise and fire. Modern buildings employ sophisticated strategies to deal with each of these.

Modern buildings also control heat flow, air leakage and moisture migration. It is important to ensure that adequate levels of thermal insulation, a continuous air barrier and an integral vapour barrier are provided throughout the envelope of the building.



Interior and Exterior Finishes Checklist			
		Y	N
Furring	All wood furring is selected and installed as per NBCC Part 9		
	All steel furring is selected and installed as per manufacturer's instructions		
Board Finishes	Sharp pointed drywall screws can be used to attach the drywall to the steel members up to 0.879 mm (0.0346 in) thick		
	For members thicker than 0.879 mm (0.0346 in), drill point screws are used to fasten drywall		
	The spacing of fasteners should be as per manufacturers instructions		
	Drywall is not used as bracing, therefore it can be installed either horizontally or vertically		
	Board finishes are applied to steel frames with sharp point or drill point (depending on member thickness) screws instead of nails, unless wood furring is used		
Cabinets	Cabinets may be fastened directly to loadbearing members, to wood or steel blocking fastened to loadbearing studs or to strapping fastened to loadbearing studs		
	Only shelving for closets may be attached to non-loadbearing studs		
	Cabinets are attached directly to loadbearing studs using #8 50 mm (2 in) self-drilling screws		
Other Fixtures	Any fixtures (towel racks, grab bars) must be fastened to blocking		
Flooring	Finish flooring is installed as per Part 9 of the NBCC and manufacturer's instructions		
Sheathing, Sheathing Paper and Flashing	Rigid insulating sheathing is required on every lightweight steel framed house (see Chapter 7), and installed using #8 drill point screws and washers		
	Structural sheathing and sheathing paper should be installed as dictated by Part 9 of the NBCC and as required for the exterior finishes being used		
	Flashing must be installed as per Part 9 of the NBCC		
	Flashing can be made of galvanized sheet steel or aluminum		
Exterior Finishes	All finishes should be installed without crushing the insulating sheathing		
	Finishes should be fastened with screws that penetrate the loadbearing studs or can be nailed to structural sheathing or wood strapping applied over the insulating sheathing		

The Lightweight Steel Frame House Construction Handbook

Chapter Nine

Final Items

Introduction

This chapter discusses final items, including avoiding common problems and troubleshooting.

A complete set of chapter checklists has been included as a reference guide. These checklists reference Part 9 of the Building Code and have been modelled on municipal guidelines. While care has been taken to ensure accuracy, these guidelines are for convenience only, and **do not**, replace the Building Code. The CSSBI is not liable for errors or oversights resulting from the checklist information. It is the builder's responsibility to consult the Building Code, in order to ensure safe and proper construction.

Avoiding Common Problems

It is always recommended that problems be avoided in the first place through careful planning and best practice. Solutions are sometimes available to remedy problems, but these are often far costlier than avoiding problems at the outset.

Damaged or Bent Materials

Damaged or bent materials must never be used for loadbearing applications. Cut or bent flanges, bends, holes and any other type of damage may significantly weaken members. Always discard loadbearing members which have been damaged. In cases where a material is non-loadbearing and the damage does not affect its capacity to perform as it should, it is up to the builder's discretion whether the material is acceptable.

Chemical Reactions with Metals

Certain metals, when in contact with each other, may produce a chemical reaction. This can cause corrosion of the less active metal, which will diminish its performance. All steel framing members contain a metallic coating of zinc or 55% aluminum + zinc. However, to avoid galvanic reactions with dissimilar metals, steel framing should not come into contact with copper. This includes all flashing and all plumbing pipes. Copper plumbing pipes must always be isolated from steel framing with grommets and standoffs. It is also important to avoid contact between galvanized metal and fresh concrete or mortar. Galvanized coatings contain zinc, which is highly reactive with alkalis and will deteriorate to some degree upon contact with fresh concrete or mortar. The reaction is limited, due to a corrosive film that forms on the outer layer of the zinc. Zinc will not react with dry, seasoned concrete or mortar.

Construction with Wood and Steel

When framing with steel it is possible that wood may still be used for some applications. Always remember when combining wood and steel that wood will shrink but steel will not.

Members Out-Of-Line

If, for some reason, a stud and joist do not line up within the limits stipulated in Figure 1.1, then there are two possible solutions both illustrated in Figure 9.1:

- Add a horizontal piece of stud below the out-of-line joist to act as lintel to transmit the load to the two neighbouring studs; or
- Add a stud below the out-of-line joist to carry the load down to the foundation. In this case, if the joist is a second or third storey floor joist it is necessary to continue adding studs and web stiffeners below each other down to the foundation. Do not simply add one stud and transfer the problem to the track of the floor below.

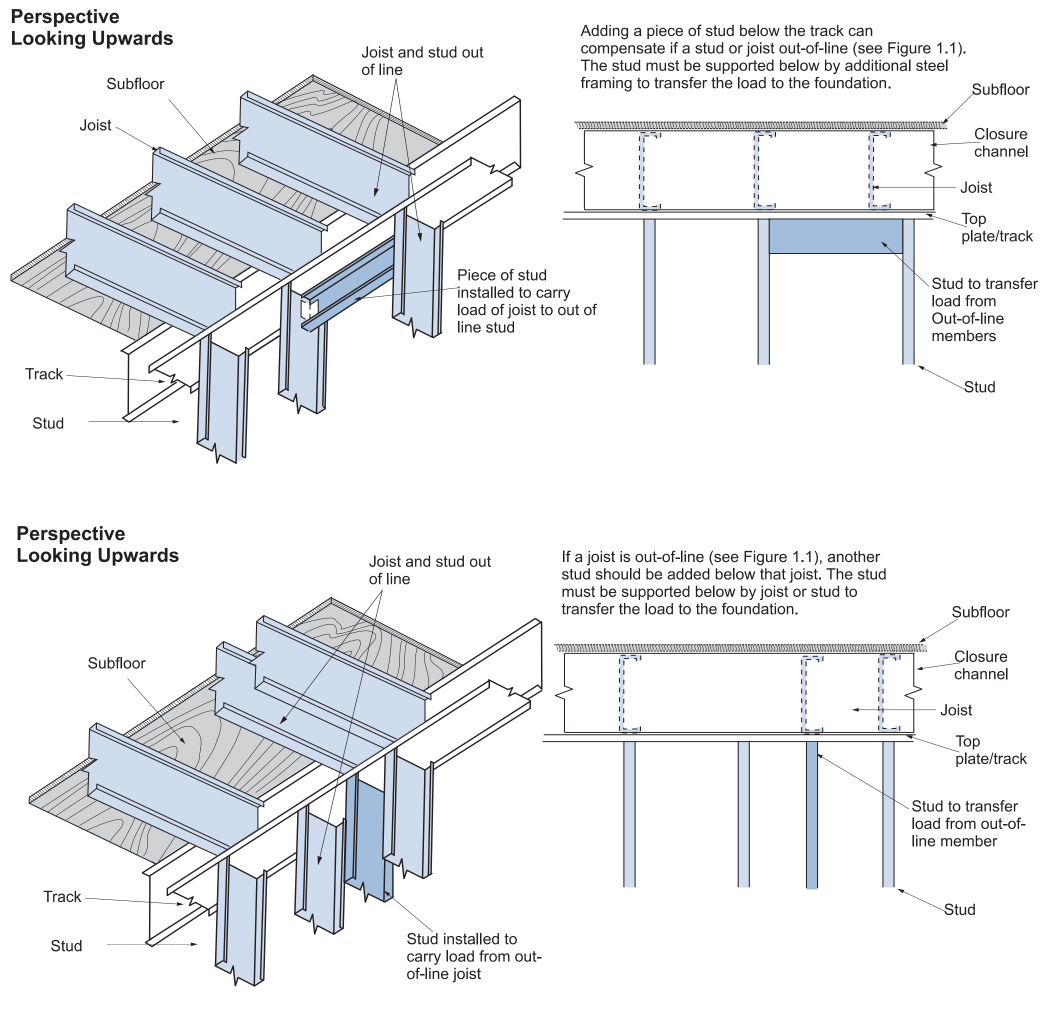
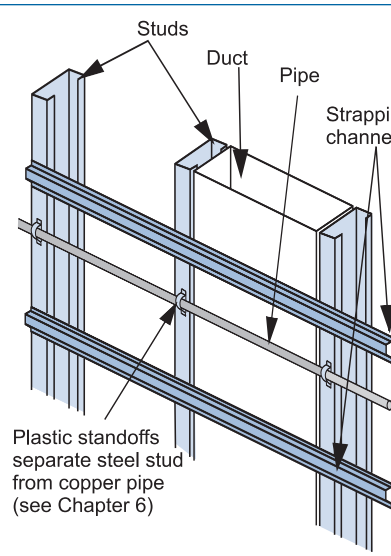


Figure 9.1

Out-of-line Members

Strapping out Walls

In some cases, there may not be sufficient space for a pipe to run through a wall. For instance, in cases where a vertical duct and a horizontal pipe need to run through the same wall section. Usually this type of problem can be avoided by planning ahead. One solution is to 'strap out' to create some additional space in which the pipe can run. See Figure 9.2



Strapping out a wall to create extra space. For more information on strapping refer to Chapter 8.

Figure 9.2

Strapping out Walls

Chapter 1: Getting Started Checklist			
		Y	N
Pre-Planning	Set up meeting with building official		
	Set up meeting with manufacturer		
	Set up meeting with designer		
	Set up meeting with electrical inspector		
Manufacturer	Cut list		
	Delivery Schedule		
	Accessories - clip angles, web stiffeners, strapping, blocking, fasteners, grommets, standoffs		
Trades	Qualify all trades for steel construction		
	Ensure proper layout for HVAC and plumbing stacks, toilet traps		

Chapter 2: Foundations Checklist			
		Y	N
Top of Foundation Walls	Top of foundation walls are level, or have been chipped and grouted to provide a level surface		
	A sill gasket, mortar bed or double row of non-hardening caulking has been installed between all framing members and the foundation		
Wood Sill Plate	Anchor bolts are a minimum diameter of 13 mm (1/2 in) bolts spaced at a maximum 2400 mm (94 in) o.c.		
	If closure channel is fastened to the wood sill plate by means of a steel plate, the steel plate is fastened with 4-#8 screws to the closure channel and 4- 10d or 6-8d common nails connect the steel plate to the wood sill		
	The closure channel can be fastened with screws through the flange to the sill plate		
Direct Bearing Anchorage	If using anchor bolts and clip angles, the clip angle is fastened with 8- #8 screws to the rim joist and bolted to the foundation, they are spaced according to the required anchor bolt spacing, at most every 2400 mm (94 in) o.c.		
	If using anchor ties, they have been installed and spaced according to manufacturer's directions, at a spacing no greater than 2400 mm (94 in) o.c.		
Nested Track and Stud Sill Plate	Anchor bolts are a minimum diameter of 13 mm (1/2 in) bolts spaced at a maximum 2400 mm (94 in) o.c.		
	If closure channel is fastened to the wood sill plate by means of a steel plate, the steel plate is fastened with 4-#8 screws to the closure channel and 4-#8 screws connect the steel plate to the sill plate		
	The closure channel can be fastened with screws through the flange to the sill plate		
Openings in Foundation Walls	All openings have had a header designed from the appropriate Member Selection Tables (Appendix A) or have structural windows installed		

Chapter 3: Floors Checklist			
		Y	N
Beams	All built-up lightweight steel beams (excluding header and trimmer configurations for openings) have been engineered		
	All structural steel beams have been selected according to building code		
	Steel beams bear no less than 89 mm (3 1/2 in) at end supports		
	Supports for steel beams meet Part 9 requirements, or have been engineered		
	Web stiffeners are installed in all joists where they bear on a beam below		
	Continuous joists supported by steel beams have been fastened with a clip angle screwed to the joist web and attached with 2 fasteners to the beam		
	Lapped joists supported on a steel beam have a clip angle installed between them fastened to through both joists with screws and to the beam below with 2 fasteners		
Closure Channels	The closure channel is of the same depth as the joists		
	The closure channel is at least 1.09 mm thick		
Joist Installation	Floor joists have been selected from the appropriate Member Selection Table		
	All floor joists are in-line with the studs below		
	The closure channel is not spliced within 75 mm (3 in) of a joist		
	Each joist is installed with a web stiffener at each end fastened with 2 -#10 screws to the closure channel and 3-#10 screws to the joist web		
	Any inaccessible spaces, such as double perimeter joists have had insulation added during framing		
	Knockouts line up		
	All joist webs face the same direction		
	Joists are installed from below and not walked on until the subfloor has been secured		
Web Stiffeners	Web stiffeners are installed at each location along the joist where it rests on a loadbearing stud wall, beam or foundation, and at joist locations supporting loadbearing walls or concentrated loads from above		
	Web stiffeners are fastened on either side of the joist with 3-#10 screws to the joist web and 2-#10 screws to the closure channel (where present)		
Blocking and Bracing	Solid blocking is installed between joists at a maximum spacing of 2400 mm (94 in)		
	Flat strap or notch channel bridging must be fastened to the bottom flange of each joist using at least 1 - #8 screw		
	Bridging straps should be at least 38 mm wide by 0.879 mm thick (1-1/2 in x 0.0346 in) and spaced not more than 2400 mm (94 in) from each support or other rows of bridging		
	The ends of the steel strapping should be fastened to the blocking with at least 4 - #8 screws. Alternatively, the strap can be anchored directly to the exterior wall		

Chapter 3: Floors Checklist			
		Y	N
Cantilevers	Where floor joists cantilever out beyond a support such as in the case of balconies or bay windows details have been engineered		
	Ensure air barrier continuity is maintained at all floor cantilevers		
	Exterior insulation in place to prevent thermal bridging		
Subfloor	The subfloor is fastened to the flanges of joists using #8 x 1-1/4 in (31 mm) bugle-head screws spaced 152 mm (6 in) o.c. along the sheet edges and 12 305 mm (12 in) o.c. in the field		
	Subfloors must conform to the NBCC Table 9.23.14.5.A		
Floor Openings	All header and trimmer members have been selected from the appropriate Member Selection Tables		
	All built-up sections should be made from members of equal thickness, and fastened together at least every 610 mm (24 in) o.c.		
	The sections used in built-up members must be continuous lengths, unless their purpose is non-structural (i.e. closing off rough openings).		
	Headers are fastened to trimmer joists using clip angle connections selected from Figure 3.30 "Header Connections for Floor Openings" and Figure 3.33 "Connections for Floor Openings"		
	Tail joists are fastened to stairwell headers using a clip angle connector with 3 - #10 screws per angle leg		

Chapter 4: Wall Checklist			
		Y	N
Member Selection	Wall studs align with each other from one floor to another and with the floor joist or rafter above and/or below		
	Size, thickness and spacing of studs have been selected and installed as specified in the appropriate Member Selection Table (Appendix A)		
	Track sections are at least as thick as studs		
Splices	No loadbearing studs have been spliced without an engineered detail		
	No track sections have been spliced within 75 mm (3 in) of a stud.		
	All track section splices are attached with 4 screws on each side of the splice.		
Fasteners	The track acting as bottom plate has been fastened through the subfloor into the closure channel below with 1 -#8 screw at 305 mm (1 in) o.c.		
	Each stud fits snugly into the track and bears on the web of the track		
	Each stud is fastened with 1 -#8 screw per flange at top and bottom		
Holes	All pre-punched holes in studs are aligned		
	No pre-punched or field cut openings are located within 305 mm (12 in) of the top or bottom of the stud without an engineered detail		
	All holes in studs are located in the middle of the web		
	No hole in a stud is larger than 38 mm (1 1/2 in) wide and 102 mm (4 in) long without an engineered detail		
Inaccessible studs spaces	All inaccessible stud spaces (jamb studs, lintels, corners, etc.) have had insulation installed during framing		
Corners	Corner studs have been properly connected and framed		
Second Floor	The subfloor is secured before the second floor walls are framed		
Horizontal Strapping	The horizontal flat strapping is attached to every stud flange with at least 1 - #8 screw.		
	There is at least one row of strapping for every 1200 mm (48 in) of wall height on every loadbearing wall		
Diagonal Bracing	All exterior walls have the appropriate number of braces and have been installed according to Figure 4.12		
	Braces are located at each wall end and the angle to the horizontal does not exceed 60 degrees.		
	Braces are fastened to every crossing stud with at least 1-#8 screws		
	Braces are anchored to double studs at the upper end and the closure channel at the lower end with 11 -#12 screws at each		

Chapter 4: Wall Checklist			
		Y	N
Wall Openings	King and jack studs as well as lintels have been selected from the Member Selection Tables (Appendix A)		
	King and jack studs are the same size and thickness as the wall studs		
	The lintel members are fastened together with 2-#8 screws at 610 mm (24 in) o.c.		
	Jack and king studs have been fastened together with 2 fasteners side by side at a maximum spacing of 610 mm (24 in) o.c.		
Interior Loadbearing Walls	All interior loadbearing walls bear directly on to a floor beam, loadbearing wall or other engineered element		
	All interior loadbearing wall have the appropriate number of rows of horizontal bridging		
Non-loadbearing walls	The bottom track has been fastened with screws or nails spaced not more than 610 mm (24 in) with a fastener within 50 mm (2 in) of each end of the track		
	Fire-rated steel studs in non-loadbearing walls are installed so that a 12 mm (1/2 in) clearance between the top of the stud and the track is maintained		

Chapter 5: Roof Checklist			
		Y	N
Ceiling Joists	Ceiling joists have been selected from the appropriate Member Selection Table		
	All ceiling joists are in-line with the studs below		
	Top flanges of all ceiling joists are braced with bracing spaced according to the Member Selection Tables		
	Each joist is installed with a web stiffener at each end, fastened to the rafter and wall top plate		
	Any inaccessible spaces have had insulation added during framing		
	All knockouts line up		
Top Plates	Any combination or type of top plate other than a double wood top plate has been engineered		
Rafters	Wood rafters have been selected and installed according to building code		
	Steel rafters have been selected and installed according to engineered details		
	Rafters are "in-line", if not using a wooden double top plate		
Roof Joists	Steel roof joists have been selected from the appropriate Member Selection Tables and installed according to engineered details		
	Wood roof joists have been selected and installed according to building code		
Roof Trusses	(Wood or steel) Have been selected and installed according to manufacturer's or engineer's instructions		

Chapter 6: HVAC, Plumbing & Electrical Systems Checklist			
		Y	N
Builder	Open lintels		
	Accessible corners		
	Grommets installed in inaccessible corners		
	Framing members adequately deep to accommodate plumbing and ducts		
	No holes cut greater than the web depth minus 76 mm (3 in)		
	No holes within 305 mm (12 in) of bearing		
	All large holes are located in the centre of the web and are reinforced		
HVAC	Installed with screws not nails		
	Any cold air returns constructed in stud cavities have had the stud knock-outs sealed on the outside with aluminium tape		
	Only tracks in non-loadbearing walls have been cut to accommodate ducts		
Plumbing	Fixtures (i.e. wall hung urinal) have adequate support such as blocking		
	Plastic grommets have been used in all holes to separate pipes from framing members		
	Pipe supports have been fastened with #6 self piercing screws in non-loadbearing walls and #8 self-drilling screws in loadbearing walls		
	Pumps and other noisy systems have been isolated from framing		
Electrical	All plastic insulated wiring is insulated from framing with CSA approved grommets and stand-offs		
	All installations conform to local electrical Code		
	Protection plates have been installed where holes have been drilled within 30 mm (1 1/4 in) of the edge of the stud		

Chapter 7: Insulation, Air & Vapour Barriers Checklist			
		Y	N
Insulation	Insulation has been installed in every wall, floor and ceiling separating heated space from unheated space		
	Insulation levels meet any requirements from local building code and climate		
	At least 25% of the required R-value of the assembly is located on the exterior of the frame		
	Cavity insulation properly fills the C-profile of each stud		
	All closed box assemblies have been filled with insulation		
	All floor headers have insulation within the C-profile and rigid insulation on the exterior		
	All voids in perimeter assemblies and around windows and doors have been filled		
Air Barriers	The materials and installation of air barrier systems shall follow the requirements specified in NBCC Part 9		
	All wall, ceiling and floor assemblies which are thermally insulated must have a continuous air barrier		
	All penetrations such as doors, windows, electrical wiring or piping must be sealed		
Vapour Barriers	The materials and installation of vapour barrier systems shall follow the requirements specified in NBCC Part 9		
	All inboard/ outboard ratios have been carefully adhered to in cases where exterior rigid insulation has a water vapour permeance of less than 60 ng/Pa•s•m^2		

Chapter 8: Interior and Exterior Finishes Checklist			
		Y	N
Furring	All wood furring is selected and installed as per NBCC Part 9		
	All steel furring is selected and installed as per manufacturer's instructions		
Board Finishes	Sharp pointed drywall screws can be used to attach the drywall to the steel members up to 0.879 mm (0.0346 in) thick		
	For members thicker than 0.879 mm (0.0346 in), drill point screws are used to fasten drywall		
	The spacing of fasteners should be as per manufacturers instructions		
	Drywall is not used as bracing, therefore it can be installed either horizontally or vertically		
	Board finishes are applied to steel frames with sharp point or drill point (depending on member thickness) screws instead of nails, unless wood furring is used		
Cabinets	Cabinets may be fastened directly to loadbearing members, to wood or steel blocking fastened to loadbearing studs or to strapping fastened to loadbearing studs		
	Only shelving for closets may be attached to non-loadbearing studs		
	Cabinets are attached directly to loadbearing studs using #8 50 mm (2 in) self-drilling screws		
Other Fixtures	Any fixtures (towel racks, grab bars) must be fastened to blocking		
Flooring	Finish flooring is installed as per Part 9 of the NBCC and manufacturer's instructions		
Sheathing, Sheathing Paper and Flashing	Rigid insulating sheathing is required on every lightweight steel framed house (see Chapter 7), and installed using #8 drill point screws and washers		
	Structural sheathing and sheathing paper should be installed as dictated by Part 9 of the NBCC and as required for the exterior finishes being used		
	Flashing must be installed as per Part 9 of the NBCC		
	Flashing can be made of galvanized sheet steel or aluminum		
Exterior Finishes	All finishes should be installed without crushing the insulating sheathing		
	Finishes should be fastened with screws that penetrate the loadbearing studs or can be nailed to structural sheathing or wood strapping applied over the insulating sheathing		

The Lightweight
Steel Frame
House Construction
Handbook

Appendix A:
Member Selection Tables

TABLE OF CONTENTS

COMMENTARY

1. SCOPE

This commentary is intended as an aid to the structural design of houses (detached, single family dwellings) using the member selection tables in this Appendix for studs and joists. The commentary should be used in conjunction with the provisions of NBC/95 Part 9 *(Ref. 1)* and chapters 1 through 9 of this Handbook.

2. UNITS

The tables are based on metric units with the exception that hard imperial dimensions or properties have been used for the following:

Member geometries *(1.625" flange widths, 0.50" lip lengths and 3.625", 6", 8", 10", 12" or 14" depths)* with metric equivalents shown in the tables *(41 mm flange widths, 12.7 mm lip lengths, 92, 152, 203, 254, 305 or 356 mm depths)*.
Member Spacings *(12", 16", 19.2" and 24" o.c.)* with metric equivalents shown in the tables *(300, 400, 480 and 600 mm o.c.)*.
Spacings for top flange braces for ceiling joists *(4', 6' or 8' o.c.)* with metric equivalents shown in the tables *(1200, 1800, 2400 mm o.c.)*.
Material thicknesses (see Commentary Item 5.3).
Material yields *(33 ksi and 50 ksi)* with metric equivalents shown in the tables *(228 and 345 MPa)*.
Spacing of perforations *(24" o.c.)*
Distance from centreline of the last perforation to the end of the stud or joist *(12")*.
Bearing length for factored web crippling resistance, P_r *(1" or 3.5")*.

Hard metric values (see Commentary Item 3) have been used for all loads.

3. LOADS

The loads in this section have been used to generate the load and span tables. Where these loads are exceeded, additional engineering is required.

Live and dead loads for joists, rafters and trusses apply over the horizontal projection of those members. Dead load includes the self weight of the joists, rafters or trusses. The bottom chord live load for trusses is assumed to be zero.

3.1 Specified Floor and Ceiling Loads

Floor or Ceiling Type	Live Load (kPa)	Dead Load** (kPa)
Floor Joists for Living Quarters	1.9	0.5 *(without concrete topping)*
	1.9	1.3 *(with concrete topping)*
Floor Joists for Bedrooms and Accessible Attics	1.4	0.45
Ceiling Joists - Attic not Accessible by Stairway	0.5	0.3

** Dead load includes the self weight of the joists

3.2 Specified Roof Loads

Roof Type	Live Load *(Roof Snow Load)* (kPa)	Dead Load (kPa)
Roof Joists	1.0, 1.5, 2.0, 2.5	0.50
Roof Rafters	1.0, 1.5, 2.0, 2.5	0.424
Roof Trusses	1.0, 1.5, 2.0, 2.5	0.724 *(top plus bottom chord)*

The tables show roof snow loads (specified) which are derived from the NBC/95 ground snow load data that is appropriate for the geographic location under consideration. To derive the roof snow loads, multiply the ground snow load and associated rain load by the coefficients from NBC/95 4.1.7. Choose the matching or next highest roof snow load from the tables.

Roof snow loads are assumed to be uniformly distributed. If non-uniform snow loads apply, additional engineering is required.

3.3 Wall/Partition Dead Load

Wall and partition dead loads = 0.25 kN/m^2 of wall area.

3.4 Lateral loads due to Wind and Interior Pressure Differences

Design wind loads on exterior walls are based on the following coefficients:

$C_{pi}C_g$ = 0.0 or -0.3 *(Category 1 buildings NBC/95 Commentary B (Ref. 2) Par. 37)*

C_e = 0.9 *(For roof slopes ≥ 10°, mean roof height ≤ 6 m required)*

(For roof slopes < 10°, eaves height ≤ 6 m required)

C_pC_g = -2.1, +1.8 *(Corner coefficients Fig. B-8 NBC/95 Commentary)*

$q_{(1/30)}$ Hourly Wind Pressure (kPa)	Corresponding Specified Design Wind Load for Strength Limit States (kPa)
0.40	0.756
0.50	0.945
0.60	1.134
0.80	1.512

Wind loads for strength are based on q(1/30) wind pressures. Wind loads for deflection are based on q(1/10) hourly wind pressures which are approximated by using 80% of the q(1/30) value. Interior partitions are assumed to resist a nominal lateral pressure of 0.25 kPa (specified).

The tables show q(1/30) hourly wind pressures. Choose the matching or next highest q(1/30) that is appropriate for the geographic location under consideration.

3.5 Seismic Loads
Seismic loads are not included. Where seismic loading is a consideration, additional engineering is required.

4. TRIBUTARY WIDTHS Maximum Floor to Ceiling Heights

4.1 For interior axial load bearing stud walls

- Ceiling, floor and roof joist tributary widths are equal to half the sum of the joist spans on both sides of the wall.

  When using the tables, choose the matching or next highest tributary width.

4.2 For exterior axial load bearing stud walls

- Ceiling and floor joist tributary widths are equal to half the joist spans.
- Roof truss and roof rafter tributary widths are equal to the horizontal distance from ridge to eaves assuming a symmetrical roof with the ridge at the centre of the roof span. For unsymmetrical roofs, the tributary width is equal to the horizontal distance from centre of roof span to eaves.
- Roof joist tributary widths are equal to the horizontal distance from the centre of the joist span to the eaves.

  The distance to the eaves includes any roof overhang. When using the tables, choose the matching or next highest tributary width.

5. STUD, JOIST AND TRACK SECTION PROPERTIES TABLES

5.1 Structural properties are computed in accordance with the requirements of CSA Standard S136-94 *(Ref. 3)* with the exception of the web crippling values discussed in Commentary Item 5.8.

5.2 Steel meets the requirements of ASTM A 653/A653 M *(Ref. 4)*. Minimum grades are:

- Grade 230, (33 ksi minimum yield), for 1.146 mm (.0451") material and thinner.
- Grade 340, (50 ksi minimum yield), for 1.438 mm (.0566") material and thicker.

5.3 Section properties are computed on the basis of the following imperial base steel thicknesses:

Imperial Thicknesses Used in Section Property Calculations (in.)	Metric Equivalent Shown in Tables (mm)
0.0346	0.879
0.0451	1.146
0.0566	1.438
0.0713	1.811

5.4 Perforations are assumed to be spaced at a minimum of 610 mm (24") o.c. The distance from the centreline of the last perforation to the end of a wall stud or joist is assumed to be 305 mm (12") minimum.

No specific provisions are presently included in S136-94 for the design of flexural members with large web perforations. The moment and shear capacities for perforated studs and joists have therefore been reduced in accordance with Reference 5 except that the limit of less than or equal to 200 imposed in Sections B2.4 and C3.2.2 in Reference 5 has been waived. The following sections exceed this limit.

41 x 203 x 0.879	H = 225
41 x 254 x 1.146	H = 216
41 x 305 x 1.146	H = 260
41 x 305 x 1.438	H = 206

5.5 The factored moment resistance, Mrx, is derived using effective section properties. The increase in yield from the cold work of forming has been conservatively neglected. The section is assumed to be fully braced.

5.6 The factored moment resistance, Mry, is derived using effective section properties. For perforated web elements in compression, local buckling has been calculated assuming that the flat web elements adjacent to the perforations behave as completely unstiffened elements. The increase in yield from the cold work of forming has been conservatively neglected. The section is assumed to be fully braced.

5.7 The deflection inertia, Ix, is derived using effective section properties calculated at the stress level resulting from specified live loads (0.6 x Fy). This inertia is only appropriate for checking serviceability limit states.

5.8 No specific provisions are presently included in S136-94 for the design of steel stud flexural members with stud to track connections susceptible to web crippling. The web crippling capacities for studs have therefore been adjusted in accordance with the design recommendations from Reference 6. These recommendations are based on the following assumptions:

- Stud depth 92 to 152 mm
- Stud Thickness from 0.84 to 1.91 mm
- Minimum bearing length = 25 mm (1")
- A screw connects each flange of the stud to the track
- The stud is at least 200 mm (8") from the end of the track
- The track is adequately connected to the primary structure
- The thickness of the track matches the thickness of the studs.

5.9 The web crippling provisions for floor joists conform to the requirements of S136-94 with the exception of the sections listed below. For these sections, Maximum Floor to Ceiling Height exceeds 200 *(S136-94 Table 9 Note 2)* and their web crippling values should be considered as approximate only.

41 x 203 x 0.879	H = 225
41 x 254 x 1.146	H = 216
41 x 305 x 1.146	H = 260
41 x 305 x 1.438	H = 206

Factored web crippling, Pr, assumes 88.9 mm (3.5") of end bearing with one flange loaded.

5.10 For the 89 mm deep stud, the shear and web crippling values for both the 89 mm and 92 mm stud have been calculated and the smaller values shown in the tables.

5.11 See Commentary Item 11 for definitions of symbols used in the stud, joist and track section property tables.

6. FLOOR, CEILING AND ROOF JOIST SPAN TABLES

6.1 All Tables

6.1.1 Joist and track material, geometry and properties conform to the Joist and Track Section Properties Tables and Commentary Item 5.

6.1.2 The span tables are computed in accordance with the requirements of the Na-

tional Building Code of Canada 1995 and S136-94 Cold Formed Steel Structural Members (Limit States Design).

6.1.3 Joists are analyzed as simply supported members with web stiffeners provided at the location of end reactions. Spans are not limited by web crippling. Design web stiffeners in accordance with the requirements of S136-94.

6.1.4 Spans limited by strength are checked for factored loads with a 1.5 live load factor and a 1.25 dead load factor. Spans limited by deflection are checked for specified (unfactored) live loads only.

6.1.5 All joists are assumed to be loaded with uniformly distributed loads. Point loads in the span of the joists may require additional engineering and web stiffeners. Particular care is required with joists with H>200 *(see S136-94 and Commentary Item 5.9)*. In Clause 6.4.7, S136-94 requires that "Webs of members in bending for which H is greater than 200 shall be provided with adequate means of transmitting concentrated loads or reactions directly into the web(s)."

6.2 Tables A-1, A-2, A-3, A-4, B-1, B-2 & B-3

6.2.1 Spans are limited by moment, shear, deflection and vibration.

6.2.2 Vibration control is based on a deflection limit of L/480 or the ATC modified vibration limit. For purposes of the modified ATC approach, a “ceiling below” is defined as _” drywall directly screw attached to the underside of the floor joists.

6.2.3 Sheathings providing full lateral support on both sides of the joists are assumed. The sheathings are to have adequate strength and stiffness to prevent the joists from buckling laterally and to resist the torsional component of loads not applied through the shear centre.

Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed 2400 mm. Design the strap bracing in accordance with the requirements of S136-94. Provide periodic anchorage and/or blocking-in for the strap bracing.

6.2.4 See notes accompanying the tables.

6.3 Table C-1, C-2 & C-3

6.3.1 Tables C-1, C-2 & C-3 are based on top flange braces Spacinged at 1200 mm, 1800 mm or 2400 mm o.c.

6.3.2 Spans are limited by moment, shear and deflection. Moment resistance is based on a laterally unsupported span length equal to the Spacing of the top flange braces.

The secondary effects due to torsion are assumed to be negligible. The bottom flange of the joists is assumed to be fully supported by sheathing with adequate strength and stiffness. The top flange is braced at discrete points by braces with adequate strength and stiffness. Design the bracing in accordance with the requirements of S136-94. Braces require periodic anchorage.

6.3.3 See notes accompanying the table.

6.4 Tables D-1, D-2, D-3 & D-4

6.4.1 Roof joist spans are limited by moment, shear and deflection. Since no axial load is permitted, the tables are not suitable for sizing roof rafters.

6.4.2 Sheathings providing full lateral support on both sides of the joists are assumed. The sheathings are to have adequate strength and stiffness to prevent the joists from buckling laterally and to resist the torsional component of loads not applied through the shear centre.

Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Spacing the strap bracing so that the unsupported length of the bottom flange does not exceed 2400 mm. Design the strap bracing in accordance with the requirements of S136-94. Provide periodic anchorage and/or blocking-in for the strap bracing.

6.4.3 See notes accompanying the tables.

7. FLOOR OPENINGS

The size of floor openings is limited by the strength and stiffness of the header joists *(see Header Joist Tables)* and the trimmer joists *(see Trimmer Joist Tables).*

7.1 Header Joist Table

7.1.1 Header joist moment, shear and deflection is approximated by considering the end reactions from tail joists to be equivalent to a uniformly distributed load on the header. The tail joist is assumed to have a maximum span length equal to the floor joist span length. See Figure C-1.

The uniformly distributed load on the header is calculated by taking one half the maximum span length for the tail joist times the factored live and dead loads. The worst case combination of span length and loads is taken from the associated floor joist tables (see notes accompanying the tables).

7.1.2 In addition, the following assumptions apply:

- Header joists and track are the same depth and thickness as the floor joists.
- Joist and track Members are continuous over the length of the built-up header joist.
- Built-up header joists are adequately interconnected to share the applied load.
- All Members of built-up header joists have adequate end connections to transfer shear.

- Header joists are checked for moment and shear at factored loads and for deflection at specified live load with a deflection limit of L/480. Vibration is assumed to be controlled by the deflection limit. Web crippling has not been checked and web crippling end connections are, therefore, not permitted.
- The fully braced factored moment resistance applies.
- Joist components in built-up header joists have perforated webs, track components have unperforated webs.
- Point loads in the span of the headers may require additional engineering and web stiffeners. Particular care is required with header joists with H>200 *(see Commentary Item 5.9)*. In Clause 6.4.7, S136-94 requires that "Webs of members in bending for which H is greater than 200 shall be provided with adequate means of transmitting concentrated loads or reactions directly into the web(s)."

7.1.3 See notes accompanying the table.

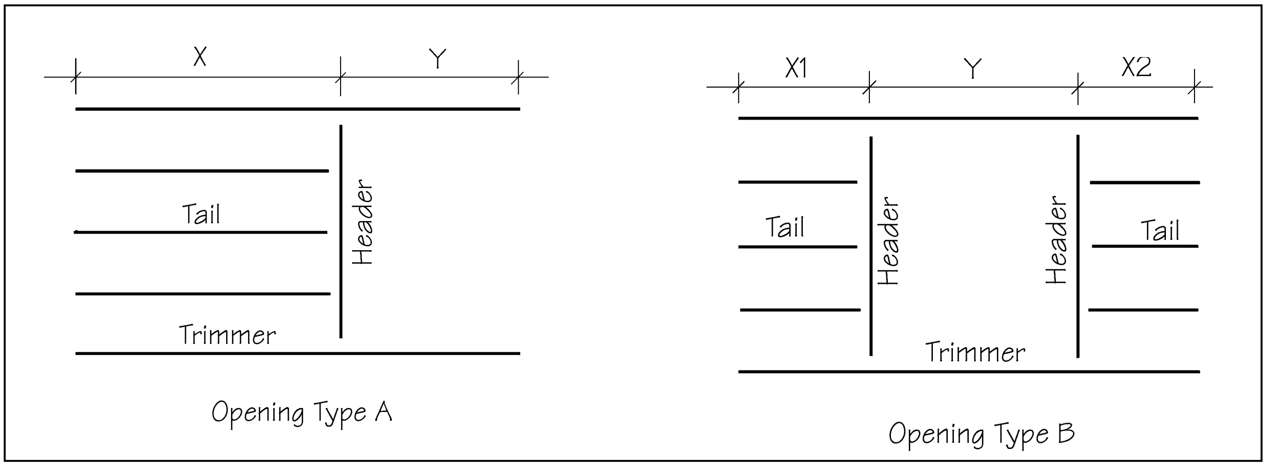


Figure C-1

7.2 Trimmer Joist Tables

7.2.1 Trimmer joists are checked for their share of the uniformly distributed floor loads plus the end reaction from the header joist(s) framing in.

7.2.2 For Opening Type A, the worst case opening size "Y" is checked for moment, shear and deflection. The tables are, therefore, valid for any opening size "Y".

7.2.3 For Opening Type B, opening size Y is not permitted to be smaller than 1m (3'-3"), approximately the width of a typical rough stair opening. The opening may be located anywhere on the span.

7.2.4 In the tables, loads on trimmer joists are controlled by limiting the length of the header joist(s). Maximum allowable header joist lengths are based on the following:

- Trimmer joists and track match the floor joists.
- Joist and track members are continuous over the length of the built-up trimmer joist.
- Trimmer joists have a span length less than or equal to the maximum allowable span length from the associated floor joist tables *(see notes accompanying the tables)*.
- Built-up trimmer joists are assumed to be adequately interconnected to share the applied load.
- Trimmers have web stiffeners provided at the location of end reactions. Spans are not limited by web crippling. Design web stiffeners in accordance with the requirements of S136-94.
- Trimmer joists are checked for moment and shear at factored loads and for deflection at specified live load with a deflection limit of L/480.Vibration is assumed to be controlled by the deflection limit. The fully braced factored moment resistance is assumed to apply.
- Joist components in built-up trimmer joists have perforated webs, track components have unperforated webs.
- All trimmers are assumed to be loaded with uniformly distributed loads with the exception of the header end reaction. The header end reaction is assumed to be transmitted to the trimmer through a web to web shear type connector. Other point loads in the span of the trimmers may require additional engineering and web stiffeners. Particular care is required with trimmers with H>200 *(see Commentary Item 5.9)*. In Clause 6.4.7, S136-94 requires that "Webs of members in bending for which H is greater than 200 shall be provided with adequate means of transmitting concentrated loads or reactions directly into the web(s)."

7.2.5 See notes accompanying tables.

8. WIND BEARING STUDS MAXIMUM ALLOWABLE HEIGHT TABLES

8.1 The allowable heights are computed in accordance with the requirements of the National Building Code of Canada 1995 and CSA S136-94 Cold Formed Steel Structural Members (Limit States Design).

Loads are assumed to be uniformly distributed and are based on q(1/30) hourly wind pressures for strength and q(1/10) hourly wind pressures for deflection. The q(1/10) hourly wind pressures are approximated by taking 80% of the q(1/30) hourly wind pressures. See also Commentary Item 3.4.

8.2 Stud and track material, geometry and properties conform to the Stud and Track Section Properties Tables and Commentary Item 5.

8.3 Strength allowable heights are limited by end shear, midspan moment and web crippling where indicated in the tables. The factored shear resistance and factored moment resistance are both based on the perforated section. Web crippling is based on an unperforated section. The distance from the centreline of the last perforation to the end of a wall stud or joist is assumed to be 305 mm (12") minimum.

Sheathings providing full lateral support on both sides of the studs are assumed. The sheathings are to have adequate strength and stiffness to prevent the studs from buckling laterally and to resist the torsional component of loads not applied through the shear centre.

Alternatively, provide bridging at 1500 mm o.c. (5'-0") or less. Design the bridging to prevent stud rotation and translation about the minor axis in accordance with the requirements of S136-94. Provide periodic anchorage and/or blocking-in for the bridging.

8.4 Allowable heights are also checked for an L/360 deflection limit.

8.5 See notes accompanying tables.

9. AXIAL LOAD BEARING STUD TABLES

9.1 All Tables

9.1.1 Legend

A1	=	41 x 89 x 0.879 stud (or 41 x 92 x 0.879 stud)
A2	=	41 x 89 x 1.146 stud (or 41 x 92 x 1.146 stud)
A3	=	41 x 89 x 1.438 stud (or 41 x 92 x 1.438 stud)
B1	=	41 x 152 x 0.879 stud
B2	=	41 x 152 x 1.146 stud
B3	=	41 x 152 x 1.438 stud
A0, B0	=	No stud selection is available
"-"	=	No wall is required

9.1.2 Stud material, geometry and properties conform to the Stud Section Properties Table and Commentary Item 5.

9.1.3 Stud selections are based on the requirements of the *National Building Code of Canada 1995 and S136-94* Cold Formed Steel Structural Members (Limit States Design) with the exception of the C_b value discussed in Commentary Item 9.1.9. Both strength and serviceability limit states are included.

9.1.4 Load Combinations for Strength

The following factored load combinations are checked:

1.5L + 1.25D
0.70 (1.5W + 1.5L) + 1.25D
1.5W + 1.25D

where:

L = axial load due to specified live loads (snow and/or occupancy)
D = axial load due to specified dead loads
W = lateral load due to specified wind or interior pressure differences

Wind loads for strength are based on q(1/30) hourly wind pressures.

9.1.5 Load Combinations for Serviceability

Deflections are checked using specified wind load only. Selected studs satisfy a deflection limit of L/360.

Wind loads for deflection are based on q(1/10) hourly wind pressures which are approximated by using 80% of the q(1/30) hourly wind pressures.

9.1.6 Lateral loads are assumed to be uniformly distributed.

9.1.7 Sheathing is not relied on to restrain the studs. Lateral support is assumed to be provided by bridging. The number of lines of equally spaced bridging is specified in the following:

Wall Height (Stud Length)	Number of Lines of Equally Spaced Bridging
2464 (8'-1")	1
2769 (9'-1")	2
3073 (10'-1")	2
3683 (12'-1")	2
4293 (14'-1")	3

Bridging is assumed to have adequate strength and stiffness for the accumulated torsion between bridging lines in combination with 2% of the factored compressive force in each stud. Design bridging in accordance with the requirements of S136-94. Bridging requires periodic anchorage.

9.1.8 Stud selections are limited by the interaction of axial load and major axis flexural bending due to wind or lateral load. The secondary effects due to torsion are assumed to be negligible. End shear due to wind alone is checked. Web crippling is not checked. The perforated section is used to calculate factored resistances for moment, shear and axial load.

Factored compressive resistances for studs are based on the following assumptions:

- K_x, K_y and K_t = 1
- L_x = the length of the stud
- L_y, L_t = the distance between lines of bridging
- ϕ_a = 0.75
  Axial loads are concentrically applied to studs with respect to the X and Y axes.

Studs are treated as compressive members in frames that are braced against joint translation. Provide the necessary bracing to adequately control the sidesway of the overall structure either due to wind, seismic loads or P-delta effects.

Studs subject to web crippling have not been flagged in the tables. Refer to the Wind Bearing Stud Tables for limiting stud heights in situations where web crippling applies. Where web crippling is critical, bearing stiffeners at the top and bottom track may be required. Refer to S136-94.

9.1.9 No provisions are presently included in S136-94 to allow C_b values greater than one for the design of steel stud members under combined wind and axial load. See S136-94 Clause 6.4.3. The coefficient C_b has therefore been adjusted in accordance with References 7 and 8.

9.2 Interior Axial Load Bearing Stud Wall (Selection Tables)

9.2.1 A specified lateral load of 0.25 kPa is assumed.

9.2.2 Gravity loads are defined in Commentary Item 3. Tributary widths are defined in Commentary Item 4.

9.3 Exterior Axial Load Bearing Stud Wall (Selection Tables)

9.3.1 Specified gravity loads and lateral loads due to wind are defined in Commentary Item 3. Tributary widths are defined in Commentary Item 4.

9.4 See notes accompanying tables.

10. WALL OPENINGS

The allowable rough opening widths are limited by the strength and stiffness of the built-up jamb *(see Maximum Allowable Rough Opening Widths Based on Built-up Jamb Stud Configuration)*, the window sill/head *(see Window Sill/Head Maximum Allowable Span Table)* and the lintel *(see Maximum Lintel Span Tables)*.

10.1 Jamb Stud Tables

10.1.1 Jamb studs are built-up members comprising single or built-up jack studs plus single or built-up king studs.

10.1.2 The allowable rough opening widths are based on the following assumptions:

- Jamb members are built-up from studs and/or from studs reinforced with track. Studs and track match the depth and thickness of the typical wall stud.
- King studs extend from the bottom track to the top track and seat in the top and bottom track for bearing. Track reinforcing for king studs is assumed to be cut shorter than the king studs by an amount equal to the flange width of the track at the top and at the bottom.
- Jack studs extend from the bottom track to the underside of an 203 - 305 mm deep lintel which is located at the underside of the floor, roof, or ceiling joist above. Jack studs seat in the bottom track and against the lintel above for bearing and are 203 - 305 mm shorter than the king studs. Track reinforcing for jack studs is assumed to be cut shorter than the jack studs by an amount equal to the flange width of the bottom track.
- Detailing of the interconnection of the built-up jamb members (stud to stud, track to stud and stud to track) is such that the entire jamb member behaves as a built-up member. (In the absence of engineering analysis, connect members together with 2 fasteners side by side at a maximum Spacing of 400 mm o.c. Refer to CSA S136 for fastener loads and resistances.)
- Detailing of the lintel end connection and the interconnection of the jamb members is such that each jack and king member carries a proportionate share of the total axial load and bending moment applied to the built-up jamb.
- The built-up jamb is tied to the wall bridging.
- The maximum allowable rough opening widths have not been limited by web crippling although web crippling of the king and jack members is critical for some opening geometries, stud sizes and combinations of wind and axial load. Additional engineering analysis is necessary and web stiffeners or other end connections not susceptible to web crippling may be required.

10.1.3 See notes accompanying tables.

10.2 Window Sill/Head Maximum Allowable Span Tables

10.2.1 The window sill/head members span horizontally to the built-up jamb studs and are subject to wind load alone. Sill/head members may be single track sections or built-up sections.

10.2.2 The distribution of wind loads to the window head/sill is assumed to be as follows (no gravity loads):

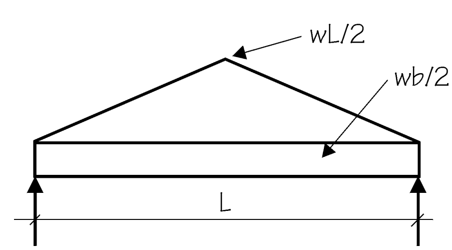


FIGURE C-2

where:
w = wind load per unit area
L = window rough opening horizontal width
b = length of studs framing into the window head or sill

10.2.3 Window sill/head maximum allowable span lengths are based on the following assumptions:

- Window sill/head maximum allowable span lengths are checked for moment, shear and deflection under wind load alone.
- Moment and shear are checked using q(1/30) hourly wind pressures. Deflection is checked using q(1/10) hourly wind pressures which are approximated by taking 80% of the q(1/30) hourly wind pressures.
- Web crippling has not been checked - web to web shear type end connections are assumed.
- Window head/sill members (built-up or single) match the depth and thickness of the typical stud and/or track.
- Built-up head/sill members are adequately interconnected to share the applied load.
- Track members are unperforated and stud members are perforated.

10.2.4 See notes accompanying tables.

10.3 Maximum Lintel Span Tables

10.3.1 Lintel members span horizontally to the built-up jamb studs and are subject to gravity loads alone. The tables have a format similar to the axial load bearing stud tables.

10.3.2 Specified gravity loads are defined in Commentary Item 3. Tributary widths are defined in Commentary Item 4.

10.3.3 Legend

L1 = 2 - 41 x 203 x 1.146 joists (perforated)
L2 = 2 - 41 x 203 x 1.438 joists (perforated)
L3 = 2 - 41 x 203 x 1.811 joists (perforated)
L4 = 2 - 41 x 254 x 1.438 joists (perforated)
L5 = 2 - 41 x 254 x 1.811 joists (perforated)
L6 = 2 - 41 x 305 x 1.811 joists (perforated)

Joist material, geometry and properties conform to the Joist Section Properties Table and Commentary Item 5.

10.3.4 Maximum allowable lintel span lengths are from centre of bearing to centre of bearing. The resulting window or door rough opening width may be smaller than the lintel span.

10.3.5 Lintels have been sized on the assumption that they resist uniformly distributed gravity loads only. Moment and shear have been checked for the 1.25D + 1.5L load case. Deflection has been checked for specified live load with a deflection limit of L/360. Web crippling has not been checked, therefore, web stiffeners or end connections not susceptible to web crippling are required.

10.3.6 Point loads in the span of the lintels may require additional engineering *(primarily combined bending and web crippling)* and web stiffeners.

10.3.7 The top of the lintels is assumed to be restrained against lateral instability by connection to the top track which in turn is connected to the underside of the floor assembly above.

10.3.8 See notes accompanying tables.

11. SYMBOLS FOR STUD, JOIST AND TRACK SECTION PROPERTIES TABLES

t	= base steel thickness (mm)
Fy	= yield strength (MPa)
A	= out to out depth of stud (mm) = depth of track inside of flange to inside of flange (mm)
B1, B2, B	= out to out width of flange (mm)
c	= out to out depth of lip stiffener (mm)
r	= inside bend radius (mm)
D	= height of mid-depth web perforation (mm)
E	= length of mid-depth web perforation (mm)
WGHT	= weight per metre based on uncoated, unperforated steel (kg/m)
AREA	= fully effective (unreduced for local buckling) area (mm^2)
Xcg	= distance to centroid from back of web for the fully effective section (unreduced for local buckling) (mm)
m	= distance from centreline web to the shear centre (mm)
xo	= distance from shear centre to centroid (mm)
Cw	= warping torsional constant (mm^6)
J	= Saint Venant torsional constant (mm^4)
j	= torsional-flexural buckling parameter for singly symmetric beam-columns (mm)
Ix	= fully effective (unreduced for local buckling) moment of inertia about the major axis (mm^4)
Iy	= fully effective (unreduced for local buckling) moment of inertia about the minor axis (mm^4)
rx	= fully effective (unreduced for local buckling) radius of gyration about the major axis (mm)
ry	= fully effective (unreduced for local buckling) radius of gyration about the minor axis (mm)
Sxc	= fully effective (unreduced for local buckling) section modulus (mm^3)
Wn1	= normalized unit warping parameter at the end of the lip (mm^2)

Wn2	= normalized unit warping parameter at the intersection of the lip and the flange (mm^2)
Wn3	= normalized unit warping parameter at the intersection of the flange and the web (mm^2)
Mrx	= fully braced factored moment resistance about the major axis (kN.m)
Lu	= maximum unbraced length of flexural members which precludes lateral buckling (mm)
Mry	= fully braced factored moment resistance about the minor axis with the web in compression or with the lips in compression (kN.m)
Vr	= factored shear resistance (kN)
Pr	= factored web crippling resistance (kN)
Ix (Deflec)	= effective moment of inertia about the major axis for checking deflections with specified (unfactored) loads (mm^4)

References:

1. *National Building Code of Canada 1995, Issued by the Canadian Commission on Building and Fire Codes, National Research Council of Canada, with 3rd Revisions and Errata to June, 2001*

2. *User's Guide - NBC 1995 Structural Commentaries (Part 4), Issued by the Canadian Commission on Building and Fire Codes, National Research Council of Canada*

3. *CSA S136-94, Cold Formed Steel Structural Members, Canadian Standards Association, with General Instruction No. 2 to May 1995.*

4. *ASTM A 653/A653 M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.*

5. *American Iron and Steel Institute July 30, 1999 Supplement No. 1 to the Specification for the Design of Cold-Formed Steel Structural Members, 1996 Edition.*

6. *Fox, S.R. and R. M. Schuster, Lateral Strength of Wind Load Bearing Wall Stud-to-Track Connection, Fifteenth International Conference on Cold-Formed Steel Structures, St Louis Missouri U.S.A, October 19-20, 2000.*

7. *North American Specification for the Design of Cold-Formed Steel Structural Members, 2001.*

8. *Kirby, P. A. and D. A. Nethercot (1979), Design for Structural Stability, John Wiley and Sons, Inc., New York, NY, 1979.*

The Lightweight
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Appendix A:

Section 1
Stud, Joist and Track
Section Property Tables

STUD SECTION PROPERTIES TABLE • LIMIT STATES DESIGN								
DIMENSIONS								
Stud Designation	THICKNESS t (mm)	DEPTH A (mm)	FLANGE B1 (mm)	FLANGE B2 (mm)	LIP c (mm)	RADIUS r (mm)	PERF D (mm)	PERF E (mm)
41 x 89	0.879	88.900	41.275	41.275	12.7	1.76	38.1	101.6
	1.146	88.900	41.275	41.275	12.7	2.29	38.1	101.6
	1.438	88.900	41.275	41.275	12.7	2.88	38.1	101.6
41 x 152	0.879	152.400	41.275	41.275	12.7	1.76	38.1	101.6
	1.146	152.400	41.275	41.275	12.7	2.29	38.1	101.6
	1.438	152.400	41.275	41.275	12.7	2.88	38.1	101.6

STUD SECTION PROPERTIES TABLE • LIMIT STATES DESIGN									
UNPERFORATED PROPERTIES									
Stud Designation	THICKNESS t (mm)	WGHT (kg / m)	AREA (E+03 mm^2)	Xcg (mm)	m (mm)	xo (mm)	Cw (E+06 mm^6)	J (mm^4)	j (mm)
41 x 89	0.879	1.31	0.167	13.90	20.2	33.6	74.3	42.9	52.6
	1.146	1.68	0.215	13.80	20.0	33.3	94.1	93.9	52.7
	1.438	2.09	0.266	13.80	19.9	32.9	114.0	183.0	52.9
41 x 152	0.879	1.75	0.222	10.50	17.2	27.2	231.0	57.3	84.7
	1.146	2.26	0.287	10.50	17.0	26.9	294.0	126.0	85.8
	1.438	2.80	0.357	10.50	16.9	26.6	359.0	246.0	87.1

STUD SECTION PROPERTIES TABLE • LIMIT STATES DESIGN									
UNPERFORATED PROPERTIES									
Stud Designation	THICKNESS t (mm)	Ix (E+06 mm^4)	Iy (E+06 mm^4)	rx (mm)	ry (mm)	Sxc (E+03 mm^3)	Wn1 (E+03 mm^2)	Wn2 (E+03 mm^2)	Wn3 (E+03 mm^2)
41 x 89	0.879	0.212	0.0410	35.7	15.7	4.77	1.630	0.888	0.890
	1.146	0.271	0.0517	35.5	15.5	6.09	1.610	0.881	0.879
	1.438	0.331	0.0626	35.3	15.3	7.45	1.590	0.874	0.868
41 x 152	0.879	0.748	0.0485	58.0	14.8	9.81	2.460	1.760	1.300
	1.146	0.958	0.0613	57.8	14.6	12.60	2.440	1.750	1.290
	1.438	1.180	0.0742	57.5	14.4	15.50	2.410	1.740	1.270

STUD SECTION PROPERTIES TABLE • LIMIT STATES DESIGN									
UNPERFORATED PROPERTIES									
Stud Designation	THICKNESS t (mm)	YIELD Fy (MPa)	Mrx (kN.m)	Lu (mm)	Mry Web comp (kN.m)	Mry lips comp (kN.m)	Shear Vr (kN)	Web Cripp Pr (kN)	Ix Deflec E+06 mm^4)
41 x 89	0.879 1.146 1.438	228 228 345	0.941 1.250 2.250	984 983 795	0.289 0.377 0.693	0.306 0.386 0.707	6.90 11.90 22.90	1.45 2.31 5.21	0.212 0.271 0.331
41 x 152	0.879 1.146 1.438	228 228 345	1.750 2.460 4.490	948 944 762	0.293 0.384 0.706	0.323 0.407 0.747	4.07 9.11 18.20	1.40 2.24 5.08	0.730 0.957 1.180

STUD SECTION PROPERTIES TABLE • LIMIT STATES DESIGN								
PERFORATED PROPERTIES								
Stud Designation	THICKNESS t (mm)	AREA (E+03 mm^2)	Xcg (mm)	Ix (E+06 mm^4)	Iy (E+06 mm^4)	rx (mm)	ry (mm)	Sxc (E+03 mm^3)
41 x 89	0.879 1.146 1.438	0.133 0.171 0.211	17.30 17.20 17.20	0.208 0.265 0.325	0.0334 0.0421 0.0508	39.5 39.4 39.2	15.8 15.7 15.5	4.68 5.97 7.30
41 x 152	0.879 1.146 1.438	0.189 0.244 0.302	12.30 12.30 12.20	0.744 0.953 1.170	0.0445 0.0562 0.0681	62.7 62.5 62.3	15.4 15.2 15.0	9.76 12.50 15.40

STUD SECTION PROPERTIES TABLE • LIMIT STATES DESIGN							
PERFORATED PROPERTIES							
Stud Designation	THICKNESS t (mm)	YIELD Fy (MPa)	Mrx (kN.m)	Mry Web comp (kN.m)	Mry lips comp (kN.m)	Shear Vr (kN)	Ix Deflec E+06 mm^4)
41 x 89	0.879 1.146 1.438	228 228 345	0.869 1.190 2.160	0.269 0.350 0.643	0.285 0.358 0.654	3.36 4.22 6.22	0.212 0.271 0.331
41 x 152	0.879 1.146 1.438	228 228 345	1.750 2.460 4.490	0.274 0.360 0.663	0.315 0.397 0.727	4.07 7.91 12.40	0.730 0.957 1.180

JOIST SECTION PROPERTIES TABLE • LIMIT STATES DESIGN								
DIMENSIONS								
Stud Designation	THICKNESS t (mm)	DEPTH A (mm)	FLANGE (B1) (mm)	FLAMGE (B2) (mm)	LIP c (mm)	RADIUS r (mm)	PERF D (mm)	PERF E (mm)
41 x 152	0.879	152.400	41.275	41.275	12.7	1.76	38.1	101.6
	1.146	152.400	41.275	41.275	12.7	2.29	38.1	101.6
	1.438	152.400	41.275	41.275	12.7	2.88	38.1	101.6
41 x 203	0.879	203.200	41.275	41.275	12.7	1.76	38.1	101.6
	1.146	203.200	41.275	41.275	12.7	2.29	38.1	101.6
	1.438	203.200	41.275	41.275	12.7	2.88	38.1	101.6
	1.811	203.200	41.275	41.275	12.7	3.62	38.1	101.6
41 x 254	1.146	254.000	41.275	41.275	12.7	2.29	38.1	101.6
	1.438	254.000	41.275	41.275	12.7	2.88	38.1	101.6
	1.811	254.000	41.275	41.275	12.7	3.62	38.1	101.6
41 x 305	1.146	304.800	41.275	41.275	12.7	2.29	38.1	101.6
	1.438	304.800	41.275	41.275	12.7	2.88	38.1	101.6
	1.811	304.800	41.275	41.275	12.7	3.62	38.1	101.6

JOIST SECTION PROPERTIES TABLE • LIMIT STATES DESIGN									
UNPERFORATED PROPERTIES									
Stud Designation	THICKNESS t (mm)	WEIGHT (kg/m)	AREA (E+03 mm^2)	Xcg (mm)	m (mm)	xo (mm)	Cw E+06 mm^6)	J (mm^4)	j (mm)
41 x 152	0.879	1.75	0.222	10.50	17.2	27.2	231.0	57.3	84.7
	1.146	2.26	0.287	10.50	17.0	26.9	294.0	126.0	85.8
	1.438	2.80	0.357	10.50	16.9	26.6	359.0	246.0	87.1
41 x 203	0.879	2.10	0.267	8.82	15.4	23.8	438.0	68.8	127.0
	1.146	2.71	0.346	8.81	15.3	23.5	557.0	151.0	129.0
	1.438	3.38	0.430	8.80	15.1	23.2	682.0	296.0	132.0
	1.811	4.21	0.536	8.79	14.9	22.8	831.0	586.0	135.0
41 x 254	1.146	3.17	0.404	7.62	13.8	20.9	921.0	177.0	188.0
	1.438	3.95	0.503	7.63	13.7	20.6	1130.0	347.0	192.0
	1.811	4.93	0.628	7.64	13.5	20.2	1380.0	687.0	198.0
41 x 305	1.146	3.63	0.462	6.74	12.7	18.8	1390.0	202.0	261.0
	1.438	4.52	0.576	6.75	12.5	18.5	1700.0	397.0	267.0
	1.811	5.65	0.720	6.78	12.3	18.2	2080.0	787.0	276.0

JOIST SECTION PROPERTIES TABLE • LIMIT STATES DESIGN									
UNPERFORATED PROPERTIES									
Stud Designation	THICKNESS t (mm)	Ix (E+06 mm^4)	Iy (E+06 mm^4)	rx (mm)	ry (mm)	Sxc (E+03 mm^3)	Wn1 (E+03 mm^2)	Wn2 (E+03 mm^2)	Wn3 (E+03 mm^2)
41 x 152	0.879	0.748	0.0485	58.0	14.8	9.81	2.460	1.760	1.300
	1.146	0.958	0.0613	57.8	14.6	12.60	2.440	1.750	1.290
	1.438	1.180	0.0742	57.5	14.4	15.50	2.410	1.740	1.270
41 x 203	0.879	1.490	0.0523	74.8	14.0	14.70	3.210	2.530	1.560
	1.146	1.920	0.0660	74.5	13.8	18.90	3.180	2.510	1.540
	1.438	2.370	0.0800	74.2	13.6	23.30	3.150	2.500	1.520
	1.811	2.920	0.0961	73.8	13.4	28.80	3.120	2.480	1.500
41 x 254	1.146	3.320	0.0694	90.7	13.1	26.20	3.980	3.320	1.750
	1.438	4.110	0.0841	90.4	12.9	32.40	3.940	3.300	1.730
	1.811	5.080	0.1010	90.0	12.7	40.00	3.900	3.280	1.700
41 x 305	1.146	5.250	0.0720	107.0	12.5	34.50	4.810	4.170	1.920
	1.438	6.510	0.0871	106.0	12.3	42.70	4.770	4.140	1.900
	1.811	8.060	0.1050	106.0	12.1	52.90	4.720	4.110	1.870

JOIST SECTION PROPERTIES TABLE • LIMIT STATES DESIGN									
UNPERFORATED PROPERTIES									
Stud Designation	THICKNESS t (mm)	YIELD Fy (MPa)	Mrx (kN.m)	Lu (mm)	Mry web comp (kN.m)	Mry lips comp (kN.m)	Shear Vr (kN)	Web Cripp Pr (kN)	Ix Deflec (E+06 mm^4)
41 x 152	0.879	228	1.750	948	0.293	0.323	4.07	1.56	0.730
	1.146	228	2.460	944	.0384	0.407	9.11	2.63	0.957
	1.438	345	4.490	762	0.706	0.747	18.20	6.11	1.180
41 x 203	0.879	228	2.400	925	0.294	0.330	3.02	0.00	1.400
	1.146	228	3.410	919	0.386	0.417	6.75	2.35	1.860
	1.438	345	6.250	742	0.711	0.764	13.50	5.57	2.300
	1.811	345	8.410	736	0.879	0.918	27.20	8.67	2.910
41 x 254	1.146	228	4.360	896	0.387	0.422	5.36	0.00	3.100
	1.438	345	8.000	722	0.714	0.775	10.70	5.10	3.860
	1.811	345	10.900	715	0.883	0.932	21.50	8.06	4.930
41 x 305	1.146	228	5.310	873	0.388	0.427	4.45	0.00	4.710
	1.438	345	9.750	703	0.715	0.783	8.85	0.00	5.860
	1.811	345	13.400	696	0.886	0.942	17.80	7.51	7.550

JOIST SECTION PROPERTIES TABLE • LIMIT STATES DESIGN PERFORATED PROPERTIES								
Stud Designation	THICKNESS t (mm)	AREA (E+03 mm^2)	Xcg (mm)	Ix (E+06 mm^4)	Iy (E+06 mm^4)	rx (mm)	ry (mm)	Sxc (E+03 mm^3)
41 x 152	0.879	0.189	12.30	0.744	0.0445	62.7	15.4	9.76
	1.146	0.244	12.30	0.953	0.0562	62.5	15.2	12.50
	1.438	0.302	12.20	1.170	0.0681	62.3	15.0	15.40
41 x 203	0.879	0.234	10.00	1.490	0.0496	79.9	14.6	14.70
	1.146	0.302	10.00	1.910	0.0626	79.6	14.4	18.80
	1.438	0.375	9.98	2.360	0.0759	79.3	14.2	23.30
	1.811	0.467	9.95	2.910	0.0912	79.0	14.0	28.70
41 x 254	1.146	0.360	8.48	3.320	0.0670	96.0	13.6	26.10
	1.438	0.448	8.47	4.110	0.0811	95.7	13.4	32.30
	1.811	0.559	8.47	5.080	0.0975	95.3	13.2	40.00
41 x 305	1.146	0.418	7.38	5.250	0.0701	112.0	12.9	34.40
	1.438	0.521	7.39	6.500	0.0849	112.0	12.8	42.60
	1.811	0.651	7.40	8.050	0.1020	111.0	12.5	52.80

JOIST SECTION PROPERTIES TABLE • LIMIT STATES DESIGN PERFORATED PROPERTIES							
Stud Designation	THICKNESS t (mm)	YIELD Fy (MPa)	Mrx (kN.m)	Mry web comp (kN.m)	Mry lips comp (kN.m)	Shear Vr (kN)	Ix Deflec E+06 mm^4)
41 x 152	0.879	228	1.750	0.274	0.315	4.07	0.730
	1.146	228	2.460	0.360	0.397	7.91	0.957
	1.438	345	4.490	0.663	0.727	12.40	1.180
41 x 203	0.879	228	2.400	0.275	0.325	3.02	1.400
	1.146	228	3.410	0.362	0.410	6.75	1.860
	1.438	345	6.250	0.667	0.752	13.50	2.300
	1.811	345	8.410	0.831	0.903	21.50	2.910
41 x 254	1.146	228	4.360	0.363	0.418	5.36	3.100
	1.438	345	8.000	0.669	0.767	10.70	3.860
	1.811	345	10.900	0.835	0.922	21.50	4.930
41 x 305	1.146	228	5.310	0.364	0.424	4.45	4.710
	1.438	345	9.750	0.671	0.777	8.85	5.860
	1.811	345	13.400	0.837	0.935	17.80	7.550

TRACK SECTION PROPERTIES TABLE • LIMIT STATES DESIGN											
DEPTH A (mm)	FLANGE B (mm)	THICKNESS t (mm)	WEIGHT (kg/m)	AREA (E+03 mm^2)	Ix (E+06 mm^4)	Iy (E+06 mm^4)	rx (mm)	ry (mm)	Sxc E+03 mm^3)	Xcg (mm)	xo (mm)
89	30	0.879	1.01	0.129	0.154	0.0106	34.6	9.04	3.40	6.39	15.8
		1.146	1.32	0.168	0.201	0.0136	34.6	9.00	4.40	6.49	15.7
		1.438	1.65	0.210	0.251	0.0168	34.6	8.95	5.47	6.61	15.6
152	30	0.879	1.45	0.185	0.559	0.0120	55.0	8.04	7.25	4.59	12.1
		1.146	1.89	0.240	0.726	0.0154	54.9	8.00	9.39	4.70	12.0
		1.438	2.36	0.301	0.908	0.0190	54.9	7.95	11.70	4.82	11.9
203	30	0.879	1.80	0.230	1.146	0.0126	70.6	7.40	11.20	3.79	10.2
		1.146	2.34	0.299	1.489	0.0162	70.6	7.36	14.50	3.90	10.1
		1.438	2.94	0.374	1.861	0.0200	70.5	7.32	18.10	4.02	10.1
		1.811	3.69	0.470	2.333	0.0248	70.5	7.27	22.60	4.18	10.0
254	30	1.146	2.80	0.357	2.637	0.0167	86.0	6.85	20.60	3.36	8.8
		1.438	3.51	0.447	3.297	0.0207	85.9	6.81	25.70	3.48	8.7
		1.811	4.41	0.562	4.134	0.0257	85.8	6.76	32.10	3.64	8.6
305	30	1.146	3.26	0.415	4.245	0.0171	101.0	6.42	27.60	2.97	7.8
		1.438	4.08	0.520	5.310	0.0212	101.0	6.39	34.50	3.09	7.7
		1.811	5.13	0.654	6.660	0.0263	101.0	6.34	43.20	3.26	7.6

TRACK SECTION PROPERTIES TABLE _ LIMIT STATES DESIGN										
DEPTH A (mm)	FLANGE B (mm)	THICKNESS t (mm)	Fy (MPa)	Cw (E+06 mm^6)	J (mm^4)	j (mm)	Lu (mm)	Mrx (kN.m)	Vr (kN)	Ix Deflec (E+06 mm^4)
89	30	0.879	228	15.3	33.3	50.2	560	0.517	7.00	0.136
		1.146	228	19.9	73.4	50.3	562	0.752	11.90	0.188
		1.438	345	24.8	144.0	50.4	457	1.450	23.00	0.238
152	30	0.879	228	53.1	47.6	109.0	538	0.971	4.02	0.477
		1.146	224	68.7	105.0	110.0	538	1.530	8.97	0.684
		1.438	345	85.4	207.0	110.0	436	2.970	17.90	0.867
203	30	0.879	228	103.0	59.1	181.0	517	1.330	3.00	0.922
		1.146	228	133.0	131.0	182.0	516	2.130	6.67	1.350
		1.438	345	165.0	258.0	183.0	418	4.160	13.30	1.710
		1.811	345	205.0	513.0	184.0	417	6.080	26.70	2.310
254	30	1.146	228	220.0	156.0	277.0	495	2.740	5.31	2.260
		1.438	345	273.0	308.0	278.0	401	5.350	10.60	2.880
		1.811	345	338.0	614.0	279.0	400	7.920	21.20	3.940
305	30	1.146	228	330.0	182.0	393.0	475	3.340	4.42	3.450
		1.438	345	410.0	358.0	395.0	385	6.540	8.76	4.400
		1.811	345	509.0	715.0	396.0	383	9.770	17.60	6.080

The Lightweight
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Appendix A:

Section 2

Floor, Ceiling and Roof Joist Span Tables

TABLE 2A-1 • FLOOR JOISTS – LIVING QUARTERS				
Maximum Allowable Span Length (metres)				
Member Size	Joist Spacing			
(mm)	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.36 d	3.04 d	2.78 m	2.48 m
x 1.146	3.68 d	3.34 d	3.13 d	2.90 d
x 1.438	3.95 d	3.58 d	3.37 d	3.12 d
41 x 203 x 0.879	4.16 m	3.59 m	3.27 m	2.76 s
x 1.146	4.61 d	4.18 d	3.92 m	3.50 m
x 1.438	4.96 d	4.50 d	4.23 d	3.92 d
x 1.811	5.37 d	4.87 d	4.58 d	4.25 d
41 x 254 x 1.146	5.49 d	4.88 m	4.45 m	3.97 m
x 1.438	5.91 d	5.36 d	5.04 d	4.67 d
x 1.811	6.42 d	5.83 d	5.48 d	5.08 d
41 x 305 x 1.146	6.24 m	5.39 m	4.91 m	4.11 s
x 1.438	6.81 d	6.18 d	5.81 d	5.39 d
x 1.811	7.42 d	6.73 d	6.33 d	5.87 d

NOTES:
1. LL = 1.9 kPa
   DL = 0.5 kPa (without concrete topping)
2. Deflection Limit = L/480
3. Vibration control = Deflection Limit
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed 2400 mm.
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

TABLE 2A-2 • FLOOR JOISTS – LIVING QUARTERS				
Maximum Allowable Span Length (metres)				
Member Size	Joist Spacing			
(mm)	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.11 m	2.68 m	2.44 m	2.17 m
x 1.146	3.68 d	3.20 m	2.91 m	2.59 m
x 1.438	3.95 d	3.58 d	3.37 d	3.12 d
41 x 203 x 0.879	3.66 m	3.15 m	2.68 s	2.12 s
x 1.146	4.38 m	3.78 m	3.44 m	3.07 m
x 1.438	4.96 d	4.50 d	4.23 d	3.92 d
x 1.811	5.37 d	4.87 d	4.58 d	4.25 d
41 x 254 x 1.146	4.97 m	4.29 m	3.91 m	3.48 m
x 1.438	5.91 d	5.36 d	5.04 d	4.67 d
x 1.811	6.42 d	5.83 d	5.48 d	5.08 d
41 x 305 x 1.146	5.49 m	4.74 m	3.99 s	3.17 s
x 1.438	6.81 d	6.18 d	5.81 d	5.25 m
x 1.811	7.42 d	6.73 d	6.33 d	5.87 d

NOTES:
1. LL = 1.9 kPa
   DL = 1.3 kPa **(with concrete topping)**
2. Deflection Limit = L/480
3. Vibration control = Deflection Limit
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed 2400 mm.
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

TABLE 2A-3 • FLOOR JOISTS – LIVING QUARTERS				
Maximum Allowable Span Length (metres)				
Member Size	Joist Spacing			
(mm)	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.36 d	3.04 d	2.78 m	2.48 m
x 1.146	3.68 d	3.34 d	3.13 d	2.90 d
x 1.438	3.95 d	3.58 d	3.37 d	3.12 d
41 x 203 x 0.879	4.16 m	3.59 m	3.27 m	2.76 s
x 1.146	4.61 d	4.18 d	3.92 m	3.50 m
x 1.438	4.90 v	4.50 d	4.23 d	3.92 d
x 1.811	5.12 v	4.83 v	4.58 d	4.25 d
41 x 254 x 1.146	5.25 v	4.88 m	4.45 m	3.97 m
x 1.438	5.49 v	5.19 v	5.02 v	4.67 d
x 1.811	5.75 v	5.43 v	5.25 v	5.05 v
41 x 305 x 1.146	5.79 v	5.39 m	4.91 m	4.11 s
x 1.438	6.02 v	5.69 v	5.51 v	5.30 v
x 1.811	6.32 v	5.96 v	5.76 v	5.54 v

NOTES:
1. LL = 1.4 kPa
   DL = 0.45 kPa
2. Deflection Limit = L/480
3. **Vibration control = modified ATC with glued sub-floor**
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed 2400 mm.
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs
   v = vibration governs

TABLE 2A-4 • FLOOR JOISTS – LIVING QUARTERS				
Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacing			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.36 d	3.04 d	2.78 m	2.48 m
x 1.146	3.68 d	3.34 d	3.13 d	2.90 d
x 1.438	3.95 d	3.58 d	3.37 d	3.12 d
41 x 203 x 0.879	4.16 m	3.59 m	3.27 m	2.76 s
x 1.146	4.61 d	4.18 d	3.92 m	3.50 m
x 1.438	4.96 d	4.50 d	4.23 d	3.92 d
x 1.811	5.35 v	4.87 d	4.58 d	4.25 d
41 x 254 x 1.146	5.49 d	4.88 m	4.45 m	3.97 m
x 1.438	5.74 v	5.36 d	5.04 d	4.67 d
x 1.811	6.01 v	5.69 v	5.51 v	5.08 d
41 x 305 x 1.146	6.04 v	5.39 m	4.91 m	4.11 s
x 1.438	6.29 v	5.97 v	5.79 v	5.39 d
x 1.811	6.60 v	6.25 v	6.05 v	5.83 v

NOTES:

1. LL = 1.9 kPa
   DL = 0.5 kPa (without concrete topping)
2. Deflection Limit = L/480
3. Vibration control = **modified ATC with glued sub-floor and ceiling below**
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed 2400 mm.
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

TABLE 2B-1 FLOOR JOISTS – BEDROOMS AND ACCESSIBLE ATTICS				
Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.72 d	3.38 d	3.17 d	2.85 m
x 1.146	4.08 d	3.70 d	3.48 d	3.22 d
x 1.438	4.39 d	3.98 d	3.74 d	3.46 d
41 x 203 x 0.879	4.65 d	4.12 m	3.75 m	3.34 m
x 1.146	5.12 d	4.64 d	4.36 d	4.01 m
x 1.438	5.51 d	4.99 d	4.69 d	4.35 d
x 1.811	5.96 d	5.41 d	5.08 d	4.71 d
41 x 254 x 1.146	6.09 d	5.52 d	5.09 m	4.54 m
x 1.438	6.55 d	5.95 d	5.59 d	5.18 d
x 1.811	7.12 d	6.46 d	6.07 d	5.63 d
41 x 305 x 1.146	7.01 d	6.17 m	5.63 m	5.02 m
x 1.438	7.55 d	6.85 d	6.44 d	5.97 d
x 1.811	8.22 d	7.46 d	7.02 d	6.51 d

NOTES:
1. LL = 1.4 kPa
DL = 0.45 kPa
2. Deflection Limit = L/480
3. Vibration control = Deflection Limit
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed 2400 mm.
8. See Commentary.
9. m = moment governs
d = deflection governs
s = shear governs

TABLE 2B-2 FLOOR JOISTS – BEDROOMS AND ACCESSIBLE ATTICS				
Miaximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.72 d	3.38 d	3.17 d	2.85 m
x 1.146	4.08 d	3.70 d	3.48 d	3.22 d
x 1.438	4.24 v	3.98 d	3.74 d	3.46 d
41 x 203 x 0.879	4.50 v	4.12 m	3.75 m	3.34 m
x 1.146	4.72 v	4.47 v	4.33 v	4.01 m
x 1.438	4.90 v	4.64 v	4.49 v	4.32 v
x 1.811	5.12 v	4.83 v	4.68 v	4.50 v
41 x 254 x 1.146	5.28 v	4.99 v	4.84 v	4.54 m
x 1.438	5.49 v	5.19 v	5.02 v	4.84 v
x 1.811	5.75 v	5.43 v	5.25 v	5.05 v
41 x 305 x 1.146	5.79 v	5.47 v	5.30 v	5.02 m
x 1.438	6.02 v	5.69 v	5.51 v	5.30 v
x 1.811	6.32 v	5.96 v	5.76 v	5.54 v

NOTES:
1. LL = 1.4 kPa
DL = 0.45 kPa
2. Deflection Limit = L/480
3. Vibration control = **modified ATC with glued sub-floor.**
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed 2400 mm.
8. See Commentary.
9. m = moment governs
d = deflection governs
s = shear governs
v = vibration governs

TABLE 2B-3 FLOOR JOISTS - BEDROOMS AND ACCESSIBLE ATTICS				
Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.72 d	3.38 d	3.17 d	2.85 m
x 1.146	4.08 d	3.70 d	3.48 d	3.22 d
x 1.438	4.39 d	3.98 d	3.74 d	3.46 d
41 x 203 x 0.879	4.65 d	4.12 m	3.75 m	3.34 m
x 1.146	4.93 v	4.64 d	4.36 d	4.01 m
x 1.438	5.13 v	4.86 v	4.69 d	4.35 d
x 1.811	5.35 v	5.07 v	4.91 v	4.71 d
41 x 254 x 1.146	5.51 v	5.24 v	5.09 m	4.54 m
x 1.438	5.74 v	5.44 v	5.28 v	5.18 d
x 1.811	6.01 v	5.69 v	5.51 v	5.31 v
41 x 305 x 1.146	6.04 v	5.74 v	5.63 m	5.02 m
x 1.438	6.29 v	5.97 v	5.79 v	5.58 v
x 1.811	6.60 v	6.25 v	6.05 v	5.83 v

NOTES:
1. LL = 1.4 kPa
DL = 0.45 kPa
2. Deflection Limit = L/480
3. Vibration control = **modified ATC with glued sub-floor and ceiling below.**
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed 2400 mm.
8. See Commentary.
9. m = moment governs
d = deflection governs
s = shear governs
v = vivration governs

TABLE 2C-1 CEILING JOISTS – ATTIC NOT ACCESSIBLE BY A STAIRWAY				
Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	5.83 d	5.29 d	4.83 m	4.31 m
x 1.146	6.39 d	5.79 d	5.45 d	5.05 d
x 1.438	6.86 d	6.22 d	5.85 d	5.42 d
41 x 203 x 0.879	7.16 m	6.19 m	5.64 m	5.04 m
x 1.146	7.99 d	7.25 d	6.70 m	5.98 m
x 1.438	8.59 d	7.80 d	7.33 d	6.80 d
x 1.811	9.29 d	8.44 d	7.93 d	7.36 d
41 x 254 x 1.146	9.50 d	8.28 m	7.55 m	6.75 m
x 1.438	10.22 d	9.27 d	8.72 d	8.09 d
x 1.811	11.09 d	10.07 d	9.47 d	8.79 d
41 x 305 x 1.146	10.53 m	9.10 m	8.30 m	7.42 m
x 1.438	11.76 d	10.68 d	10.04 d	9.32 d
x 1.811	12.81 d	11.63 d	10.94 d	10.15 d

NOTES:
1. LL = 0.5 kPa
   DL = 0.3 kPa
2. Deflection Limit = L/360
3. Vibration control = none
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the bottom flanges with adequate sheathing and the top flanges with strap bracing. Space the strap bracing so that the unsupported length of the top flange does not exceed **1200 mm**
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

TABLE 2C-2 CEILING JOISTS – ATTIC NOT ACCESSIBLE BY A STAIRWAY				
Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	5.47 m	4.72 m	4.30 m	3.84 m
x 1.146	6.37 m	5.50 m	5.01 m	4.47 m
x 1.438	6.86 d	6.22 d	5.85 m	5.22 m
41 x 203 x 0.879	6.34 m	5.48 m	5.00 m	4.46 m
x 1.146	7.43 m	6.43 m	5.86 m	5.23 m
x 1.438	8.59 d	7.50 m	6.84 m	6.11 m
x 1.811	9.29 d	8.44 d	7.73 m	6.90 m
41 x 254 x 1.146	8.31 m	7.19 m	6.55 m	5.85 m
x 1.438	9.67 m	8.36 m	7.62 m	6.81 m
x 1.811	11.05 m	9.55 m	8.71 m	7.78 m
41 x 305 x 1.146	9.05 m	7.83 m	7.14 m	6.37 m
x 1.438	10.49 m	9.07 m	8.27 m	7.39 m
x 1.811	12.04 m	10.42 m	9.50 m	8.49 m

NOTES:
1. LL = 0.5 kPa
   DL = 0.3 kPa
2. Deflection Limit = L/360
3. Vibration control = none
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the bottom flanges with adequate sheathing and the top flanges with strap bracing. Space the strap bracing so that the unsupported length of the top flange does not exceed **1800 mm**
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

TABLE 2C-3 CEILING JOISTS – ATTIC NOT ACCESSIBLE BY A STAIRWAY				
Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	4.36 m	3.77 m	3.43 m	3.06 m
x 1.146	5.03 m	4.34 m	3.96 m	3.53 m
x 1.438	5.63 m	4.86 m	4.43 m	3.95 m
41 x 203 x 0.879	5.04 m	4.35 m	3.96 m	3.54 m
x 1.146	5.90 m	5.10 m	4.65 m	4.15 m
x 1.438	6.66 m	5.76 m	5.25 m	4.69 m
x 1.811	7.44 m	6.44 m	5.87 m	5.24 m
41 x 254 x 1.146	6.58 m	5.69 m	5.18 m	4.63 m
x 1.438	7.54 m	6.51 m	5.94 m	5.30 m
x 1.811	8.47 m	7.33 m	6.68 m	5.97 m
41 x 305 x 1.146	7.15 m	6.18 m	5.63 m	5.03 m
x 1.438	8.22 m	7.11 m	6.48 m	5.79 m
x 1.811	9.41 m	8.14 m	7.42 m	6.63 m

NOTES:
1. LL = 0.5 kPa
   DL = 0.3 kPa
2. Deflection Limit = L/360
3. Vibration control = none
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the bottom flanges with adequate sheathing and the top flanges with strap bracing. Space the strap bracing so that the unsupported length of the top flange does not exceed **2400 mm**
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

TABLE 2D-1 ROOF JOISTS - DESIGN ROOF SNOW LOAD 1.0 kPa				
Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	4.56 m	3.93 m	3.58 m	3.20 m
x 1.146	5.05 d	4.58 d	4.27 m	3.81 m
x 1.438	5.42 d	4.92 d	4.62 d	4.28 d
41 x 203 x 0.879	5.35 m	4.62 m	4.21 m	3.75 m
x 1.146	6.32 d	5.53 m	5.04 m	4.50 m
x 1.438	6.80 d	6.17 d	5.80 d	5.38 d
x 1.811	7.36 d	6.68 d	6.28 d	5.82 d
41 x 254 x 1.146	7.25 m	6.26 m	5.71 m	5.10 m
x 1.438	8.09 d	7.34 d	6.90 d	6.40 d
x 1.811	8.79 d	7.97 d	7.50 d	6.96 d
41 x 305 x 1.146	8.01 m	6.92 m	6.31 m	5.63 m
x 1.438	9.32 d	8.46 d	7.95 d	7.37 d
x 1.811	10.15 d	9.21 d	8.66 d	8.03 d

NOTES:
1. DL = 0.5 kPa
2. Deflection Limit = L/360
3. Vibration control = none
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed **2400 mm.**
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

TABLE 2D-2 ROOF JOISTS - DESIGN ROOF SNOW LOAD 1.5 kPa				
Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.91 m	3.37 m	3.07 m	2.73 m
x 1.146	4.40 d	3.99 d	3.65 m	3.26 m
x 1.438	4.73 d	4.28 d	4.03 d	3.73 d
41 x 203 x 0.879	4.58 m	3.96 m	3.61 m	3.22 m
x 1.146	5.49 m	4.74 m	4.32 m	3.85 m
x 1.438	5.93 d	5.38 d	5.06 d	4.69 d
x 1.811	6.42 d	5.82 d	5.47 d	5.07 d
41 x 254 x 1.146	6.22 m	5.37 m	4.90 m	4.37 m
x 1.438	7.06 d	6.40 d	6.02 d	5.58 d
x 1.811	7.66 d	6.96 d	6.54 d	6.06 d
41 x 305 x 1.146	6.87 m	5.94 m	5.41 m	4.83 m
x 1.438	8.13 d	7.37 d	6.93 d	6.43 d
x 1.811	8.85 d	8.03 d	7.56 d	7.01 d

NOTES:
1. DL = 0.5 kPa
2. Deflection Limit = L/360
3. Vibration control = none
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed **2400 mm.**
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

TABLE 2D-3 ROOF JOISTS - DESIGN ROOF SNOW LOAD 2.0 kPa				
Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.47 m	2.99 m	2.72 m	2.43 m
x 1.146	3.99 d	3.56 m	3.24 m	2.89 m
x 1.438	4.28 d	3.88 d	3.65 d	3.38 d
41 x 203 x 0.879	4.07 m	3.52 m	3.20 m	2.64 s
x 1.146	4.88 m	4.21 m	3.84 m	3.42 m
x 1.438	5.38 d	4.88 d	4.58 d	4.25 d
x 1.811	5.82 d	5.28 d	4.96 d	4.60 d
41 x 254 x 1.146	5.53 m	4.78 m	4.35 m	3.88 m
x 1.438	6.40 d	5.81 d	5.46 d	5.06 d
x 1.811	6.96 d	6.31 d	5.93 d	5.50 d
41 x 305 x 1.146	6.11 m	5.28 m	4.81 m	3.93 s
x 1.438	7.37 d	6.69 d	6.29 d	5.83 d
x 1.811	8.03 d	7.29 d	6.86 d	6.36 d

NOTES:
1. DL = 0.5 kPa
2. Deflection Limit = L/360
3. Vibration control = none
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed **2400 mm**.
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

TABLE 2D-4 ROOF JOISTS - DESIGN ROOF SNOW LOAD 2.5 kPa Maximum Allowable Span Length (metres)				
Member Size (mm)	Joist Spacinging			
	300 mm	400 mm	480 mm	600 mm
41 x 152 x 0.879	3.15 m	2.71 m	2.47 m	2.20 m
x 1.146	3.70 d	3.23 m	2.94 m	2.62 m
x 1.438	3.97 d	3.60 d	3.38 d	3.13 d
41 x 203 x 0.879	3.70 m	3.19 m	2.74 s	2.18 s
x 1.146	4.43 m	3.83 m	3.48 m	3.11 m
x 1.438	4.99 d	4.52 d	4.25 d	3.94 d
x 1.811	5.40 d	4.90 d	4.60 d	4.26 d
41 x 254 x 1.146	5.02 m	4.34 m	3.95 m	3.53 m
x 1.438	5.94 d	5.39 d	5.06 d	4.69 d
x 1.811	6.45 d	5.85 d	5.50 d	5.10 d
41 x 305 x 1.146	5.55 m	4.80 m	4.08 s	3.24 s
x 1.438	6.84 d	6.21 d	5.83 d	5.31 m
x 1.811	7.45 d	6.76 d	6.36 d	5.90 d

NOTES:

1. DL = 0.5 kPa
2. Deflection Limit = L/360
3. Vibration control = none
4. Table shows maximum allowable clear span in metres. Span used for calculation purposes equals clear span plus 0.092 m.
5. For all joists, provide web stiffeners at supports.
6. Point loads may require additional engineering and web stiffeners.
7. For the length of the joists, brace the top and bottom flanges with adequate sheathing. Alternatively, brace the top flange with adequate sheathing and the bottom flange with strap bracing. Space the strap bracing so that the unsupported length of the bottom flange does not exceed **2400 mm.**
8. See Commentary.
9. m = moment governs
   d = deflection governs
   s = shear governs

Appendix A:

Section 3

Floor Openings - Header & Trimmer Tables

Section 3

Floor Openings
Header and Trimmer Tables

HEADER JOIST TABLE 1

Openings in Floors without Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Header Type A *Single Track*	*Header Type B* *Single Joist*	*Header Type C* *Joist + Track*	*Header Type D* *Joist + 2 Tracks*
41 x 152 x 0.879	300	1.14	1.36	1.90	2.22
	400	1.19	1.50	2.00	2.33
	480	1.25	1.63	2.09	2.43
	600	1.32	1.77	2.21	2.57
x 1.146	300	1.36	1.73	2.21	2.59
	400	1.43	1.82	2.31	2.72
	480	1.48	1.88	2.39	2.81
	600	1.53	1.95	2.48	2.91
x 1.438	300	1.84	2.15	2.59	2.91
	400	1.93	2.22	2.67	3.00
	480	1.99	2.27	2.72	3.06
	600	2.06	2.33	2.79	3.14

HEADER JOIST TABLE 1

Openings in Floors without Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Header Type A *Single Track*	*Header Type B* *Single Joist*	*Header Type C* *Joist + Track*	*Header Type D* *Joist + 2 Tracks*
41 x 203 x 0.879	300	0.81	0.82	1.63	2.34
	400	0.94	0.95	1.88	2.52
	480	1.03	1.04	2.06	2.63
	600	1.21	1.22	2.43	2.86
x 1.146	300	1.45	1.65	2.33	2.74
	400	1.52	1.82	2.44	2.88
	480	1.57	1.94	2.52	2.97
	600	1.65	2.09	2.67	3.14
x 1.438	300	1.95	2.39	3.00	3.38
	400	2.04	2.50	3.10	3.49
	480	2.10	2.58	3.17	3.56
	600	2.18	2.68	3.24	3.65
x 1.811	300	2.26	2.63	3.20	3.61
	400	2.37	2.72	3.30	3.73
	480	2.45	2.77	3.37	3.81
	600	2.54	2.84	3.45	3.90
41 x 254 x 1.146	300	1.09	1.11	2.20	2.85
	400	1.23	1.25	2.47	3.02
	480	1.34	1.36	2.68	3.16
	600	1.50	1.52	2.84	3.34
x 1.438	300	2.02	2.05	3.20	3.79
	400	2.12	2.25	3.36	3.92
	480	2.19	2.39	3.46	4.00
	600	2.27	2.58	3.59	4.10
x 1.811	300	2.37	2.78	3.60	4.06
	400	2.48	2.91	3.71	4.20
	480	2.56	3.00	3.79	4.28
	600	2.66	3.12	3.88	4.39

HEADER JOIST TABLE 1

Openings in Floors without Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Header Type A *Single Track*	*Header Type B* *Single Joist*	*Header Type C* *Joist + Track*	*Header Type D* *Joist + 2 Tracks*
41 x 305 x 1.146	300	0.80	0.81	1.61	2.42
	400	0.93	0.93	1.86	2.79
	480	1.02	1.02	2.04	3.06
	600	1.21	1.22	2.43	3.63
x 1.438	300	1.46	1.48	2.94	3.90
	400	1.61	1.62	3.23	4.09
	480	1.71	1.73	3.44	4.22
	600	1.84	1.86	3.70	4.38
x 1.811	300	2.45	2.73	3.77	4.47
	400	2.57	3.01	3.96	4.62
	480	2.65	3.10	4.08	4.71
	600	2.75	3.22	4.23	4.83

HEADER JOIST TABLE 2

Openings in Floors with Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Header Type1 *Single Track*	*Header Type 2* *Single Joist*	*Header Type 3* *Joist + Track*	*Header Type 4* *Joist + 2 Tracks*
41 x 152 x 0.879	300	1.04	1.14	1.74	2.03
	400	1.12	1.31	1.87	2.18
	480	1.17	1.44	1.96	2.28
	600	1.24	1.61	2.07	2.42
x 1.146	300	1.20	1.53	1.94	2.29
	400	1.29	1.64	2.08	2.45
	480	1.35	1.71	2.18	2.56
	600	1.43	1.81	2.31	2.71
x 1.438	300	1.62	1.99	2.57	2.91
	400	1.70	2.09	2.67	3.00
	480	1.75	2.15	2.72	3.06
	600	1.82	2.23	2.79	3.14
41 x 203 x 0.879	300	0.71	0.72	1.43	2.15
	400	0.83	0.83	1.66	2.36
	480	0.97	0.98	1.94	2.56
	600	1.21	1.22	2.43	2.86
x 1.146	300	1.31	1.35	2.11	2.48
	400	1.40	1.56	2.26	2.66
	480	1.47	1.71	2.37	2.79
	600	1.55	1.91	2.51	2.95
x 1.438	300	1.72	2.10	2.71	3.21
	400	1.80	2.21	2.85	3.37
	480	1.85	2.27	2.93	3.47
	600	1.93	2.36	3.05	3.60
x 1.811	300	1.99	2.35	3.08	3.61
	400	2.09	2.46	3.23	3.73
	480	2.16	2.54	3.33	3.81
	600	2.24	2.63	3.45	3.90

HEADER JOIST TABLE 2

Openings in Floors with Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Header Type1 *Single Track*	*Header Type 2* *Single Joist*	*Header Type 3* *Joist + Track*	*Header Type 4* *Joist + 2 Tracks*
41 x 254 x 1.146	300	0.93	0.95	1.88	2.63
	400	1.08	1.10	2.18	2.83
	480	1.18	1.20	2.38	2.96
	600	1.32	1.35	2.66	3.14
x 1.438	300	1.57	1.59	2.82	3.34
	400	1.73	1.75	2.96	3.50
	480	1.84	1.86	3.05	3.61
	600	1.98	2.00	3.17	3.75
x 1.811	300	2.09	2.45	3.21	3.83
	400	2.19	2.57	3.37	4.02
	480	2.25	2.65	3.48	4.14
	600	2.34	2.75	3.61	4.30
41 x 305 x 1.146	300	0.71	0.71	1.42	2.13
	400	0.82	0.82	1.64	2.46
	480	0.97	0.97	1.94	2.91
	600	1.21	1.22	2.43	3.63
x 1.438	300	1.14	1.15	2.28	3.42
	400	1.25	1.26	2.51	3.61
	480	1.33	1.34	2.67	3.72
	600	1.47	1.48	2.95	3.91
x 1.811	300	2.10	2.12	3.32	3.96
	400	2.26	2.34	3.49	4.16
	480	2.33	2.48	3.59	4.28
	600	2.42	2.67	3.73	4.45

HEADER JOIST TABLE 3

Openings in Floors without Concrete Topping
Vibration Control = Modified ATC Method with Glued Sub-floor (no ceiling below)

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Header Type A *Single Track*	*Header Type B* *Single Joist*	*Header Type C* *Joist + Track*	*Header Type D* *Joist + 2 Tracks*
41 x 152 x 0.879	300	1.14	1.36	1.91	2.22
	400	1.19	1.50	2.00	2.33
	480	1.25	1.63	2.09	2.43
	600	1.32	1.77	2.21	2.57
x 1.146	300	1.36	1.73	2.21	2.59
	400	1.43	1.82	2.31	2.72
	480	1.48	1.88	2.39	2.81
	600	1.53	1.95	2.48	2.91
x 1.438	300	1.84	2.15	2.59	2.91
	400	1.93	2.22	2.67	3.00
	480	1.99	2.27	2.72	3.06
	600	2.06	2.33	2.79	3.14
41 x 203 x 0.879	300	0.81	0.82	1.63	2.34
	400	0.94	0.95	1.88	2.52
	480	1.03	1.04	2.06	2.63
	600	1.21	1.22	2.43	2.86
x 1.146	300	1.45	1.66	2.33	2.74
	400	1.52	1.82	2.45	2.88
	480	1.57	1.94	2.52	2.97
	600	1.65	2.09	2.67	3.14
x 1.438	300	1.96	2.40	3.01	3.39
	400	2.04	2.50	3.10	3.49
	480	2.10	2.58	3.17	3.56
	600	2.18	2.68	3.24	3.65
x 1.811	300	2.31	2.67	3.24	3.66
	400	2.37	2.72	3.30	3.73
	480	2.45	2.77	3.37	3.81
	600	2.54	2.84	3.45	3.90

HEADER JOIST TABLE 3

Openings in Floors without Concrete Topping
Vibration Control = Modified ATC Method with Glued Sub-floor (no ceiling below)

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Header Type A *Single Track*	*Header Type B* *Single Joist*	*Header Type C* *Joist + Track*	*Header Type D* *Joist + 2 Tracks*
41 x 254 x 1.146	300	1.14	1.16	2.30	2.91
	400	1.23	1.25	2.47	3.02
	480	1.34	1.36	2.68	3.16
	600	1.50	1.53	2.84	3.34
x 1.438	300	2.10	2.19	3.31	3.89
	400	2.15	2.30	3.39	3.95
	480	2.19	2.39	3.46	4.00
	600	2.27	2.58	3.59	4.10
x 1.811	300	2.49	2.92	3.72	4.21
	400	2.56	3.00	3.79	4.28
	480	2.60	3.05	3.83	4.33
	600	2.66	3.12	3.88	4.39
41 x 305 x 1.146	300	0.86	0.87	1.73	2.59
	400	0.93	0.93	1.86	2.79
	480	1.02	1.02	2.04	3.06
	600	1.21	1.22	2.43	3.63
x 1.438	300	1.63	1.65	3.28	4.12
	400	1.72	1.74	3.45	4.23
	480	1.78	1.80	3.57	4.31
	600	1.85	1.87	3.71	4.39
x 1.811	300	2.63	3.08	4.05	4.69
	400	2.70	3.17	4.16	4.78
	480	2.75	3.23	4.24	4.84
	600	2.81	3.29	4.33	4.91

HEADER JOIST TABLE 4

Openings in Floors with Concrete Topping
Vibration Control = Modified ATCMethod with Glued Sub-floor and Ceiling Below

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Header Type1 *Single Track*	*Header Type 2* *Single Joist*	*Header Type 3* *Joist + Track*	*Header Type 4* *Joist + 2 Tracks*
41 x 152 x 0.879	300	1.14	1.36	1.91	2.22
	400	1.19	1.50	2.00	2.33
	480	1.25	1.63	2.09	2.43
	600	1.32	1.77	2.21	2.57
x 1.146	300	1.36	1.73	2.21	2.59
	400	1.43	1.82	2.31	2.72
	480	1.48	1.88	2.39	2.81
	600	1.53	1.95	2.48	2.91
x 1.438	300	1.84	2.15	2.59	2.91
	400	1.93	2.22	2.67	3.00
	480	1.99	2.27	2.72	3.06
	600	2.06	2.33	2.79	3.14
41 x 203 x 0.879	300	0.81	0.82	1.63	2.34
	400	0.94	0.95	1.88	2.52
	480	1.03	1.04	2.06	2.63
	600	1.21	1.22	2.43	2.86
x 1.146	300	1.45	1.66	2.33	2.74
	400	1.52	1.82	2.45	2.88
	480	1.57	1.94	2.52	2.97
	600	1.65	2.09	2.67	3.14
x 1.438	300	1.95	2.39	3.00	3.38
	400	2.04	2.50	3.10	3.49
	480	2.10	2.58	3.17	3.56
	600	2.18	2.68	3.24	3.65
x 1.811	300	2.26	2.63	3.20	3.61
	400	2.37	2.72	3.30	3.73
	480	2.45	2.77	3.37	3.81
	600	2.54	2.84	3.45	3.90

HEADER JOIST TABLE 4

Openings in Floors with Concrete Topping
Vibration Control = Modified ATCMethod with Glued Sub-floor and Ceiling Below

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Header Type1 *Single Track*	*Header Type 2* *Single Joist*	*Header Type 3* *Joist + Track*	*Header Type 4* *Joist + 2 Tracks*
41 x 254 x 1.146	300	1.09	1.11	2.20	2.85
	400	1.23	1.25	2.47	3.02
	480	1.34	1.36	2.68	3.16
	600	1.50	1.53	2.84	3.34
x 1.438	300	2.02	2.05	3.20	3.79
	400	2.12	2.25	3.36	3.92
	480	2.19	2.39	3.46	4.00
	600	2.27	2.58	3.59	4.10
x 1.811	300	2.37	2.78	3.60	4.07
	400	2.48	2.91	3.71	4.20
	480	2.56	3.00	3.79	4.28
	600	2.66	3.12	3.88	4.39
41 x 305 x 1.146	300	0.80	0.81	1.61	2.41
	400	0.93	0.93	1.86	2.79
	480	1.02	1.02	2.04	3.06
	600	1.21	1.22	2.43	3.63
x 1.438	300	1.46	1.48	2.94	3.90
	400	1.61	1.62	3.23	4.09
	480	1.71	1.73	3.44	4.22
	600	1.84	1.86	3.70	4.38
x 1.811	300	2.46	2.76	3.79	4.49
	400	2.57	3.01	3.96	4.62
	480	2.65	3.10	4.08	4.71
	600	2.75	3.22	4.23	4.83

Notes to Header Joist Tables:

1. For these tables, header joist lengths are limited by the strength and stiffness of the header joists themselves. Maximum allowable header joist lengths may also be limited by the trimmer joists. See the Trimmer Joist Tables.

2. Header Joist Tables 1 - 4 are valid for openings in floors as described in the following:

Table No.	LL/DL (kPa)	Concrete Topping	Associated Floor Joist Tables Vibration Control	Associated Floor Joist Tables
1	1.9/0.5 or 1.4/0.45	No	L/480	A-1 or B-1
2	1.9/1.3	Yes	L/480	A-2
3	1.9/0.5 or 1.4/0.45	No	Modified ATC *(glued subfloor)*	A-3 or B-2
4	1.9/0.5 or 1.4.0.45	No	Modified ATC *(glued subfloor + ceiling)*	A-4 or B-3

3. For header joist lengths exceeding the maximum allowable header joist length, header joist size shall be determined by calculation.

4. Maximum allowable header joist lengths are based on the following:
   - Header joists and track are same depth and thickness as the floor joists.
   - Header joists are assumed to support floor joists with a span length less than or equal to the maximum allowable span length from the associated floor joist span table. For the appropriate associated floor joist span table, see Item 2 above.
   - Built-up header joists are assumed to be adequately interconnected to share the applied load.
   - All members of built-up header joists are assumed to have adequate end connections to transfer shear.
   - Header joists are checked for moment and shear at factored loads and for deflection at specified live load with a deflection limit of L/480. Vibration is assumed to be controlled by the deflection limit. Web crippling has not been checked and web crippling end connections are, therefore, not permitted.
   - The fully braced factored moment resistance is assumed to apply.
   - Joist components in built-up header joists have perforated webs, track components have unperforated webs.
   - Joist and track members are continuous over the length of the built-up header joist.

5. See Commentary.

TRIMMER JOIST TABLE 1

Opening Type "A"
Floors without Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A Joist + Track	*Trimmer Type B* 2 Joists	*Trimmer Type C* 2 Joists + Track	*Trimmer Type D* 2 Joists + 2 Tracks
41 x 152 x 0.879	300	0.94	1.45	2.08	2.71
	400	1.18	1.79	2.56	3.33
	480	1.40	2.12	3.05	3.97
	600	1.75	2.43	3.80	4.93
x 1.146	300	1.14	1.64	2.48	3.31
	400	1.41	2.03	3.03	4.04
	480	1.63	2.33	3.47	4.61
	600	1.93	2.74	4.07	5.39
x 1.438	300	1.28	1.63	2.61	3.59
	400	1.71	2.18	3.48	4.78
	480	2.05	2.61	4.18	5.74
	600	2.57	3.27	5.23	7.18
41 x 203 x 0.879	300	0.88	1.12	1.91	2.48
	400	1.17	1.35	2.29	3.23
	480	1.40	1.52	2.55	3.58
	600	1.76	1.83	3.04	4.25
x 1.146	300	1.05	1.50	2.25	3.00
	400	1.31	1.86	2.77	3.67
	480	1.52	2.13	3.16	4.19
	600	1.89	2.66	3.95	5.23
x 1.438	300	1.29	1.63	2.62	3.61
	400	1.73	2.18	3.50	4.82
	480	2.07	2.62	4.20	5.78
	600	2.59	3.28	5.25	7.23
x 1.811	300	1.36	1.64	2.69	3.75
	400	1.81	2.18	3.58	4.99
	480	2.18	2.62	4.31	6.00
	600	2.72	3.27	5.37	7.48

TRIMMER JOIST TABLE 1 Opening Type "A" Floors without Concrete Topping Vibration Control = L/480 Deflection Limit					
Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A *Joist + Track*	*Trimmer Type B* *2 Joists*	*Trimmer Type C* *2 Joists + Track*	*Trimmer Type D* *2 Joists + 2 Tracks*
41 x 254 x 1.146	300	0.99	1.39	2.07	2.76
	400	1.27	1.65	2.64	3.50
	480	1.52	1.85	3.16	4.19
	600	1.90	2.13	3.64	5.14
x 1.438	300	1.30	1.64	2.63	3.63
	400	1.73	2.18	3.50	4.83
	480	2.07	2.62	4.21	5.81
	600	2.44	3.19	5.18	7.02
x 1.811	300	1.37	1.64	2.70	3.77
	400	1.82	2.18	3.60	5.02
	480	2.19	2.62	4.32	6.02
	600	2.74	3.27	5.40	7.53
41 x 305 x 1.146	300	0.95	1.11	1.92	2.63
	400	1.27	1.34	2.27	3.19
	480	1.50	1.51	2.53	3.54
	600	1.82	1.83	3.04	4.25
x 1.438	300	1.30	1.64	2.64	3.64
	400	1.70	2.03	3.51	4.85
	480	1.95	2.21	3.92	5.58
	600	2.30	2.47	4.31	6.15
x 1.811	300	1.38	1.64	2.71	3.78
	400	1.84	2.18	3.62	5.05
	480	2.20	2.62	4.33	6.05
	600	2.74	3.27	5.42	7.56

TRIMMER JOIST TABLE 2

Opening Type "B"
Floors without Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Header Joist Length (m)			
		Trimmer Type A  *Joist + Track*	*Trimmer Type B*  *2 Joists*	*Trimmer Type C*  *2 Joists + Track*	*Trimmer Type D*  *2 Joists + 2 Tracks*
41 x 152 x 0.879	300	0.92	1.42	2.04	2.66
	400	1.17	1.79	2.55	3.32
	480	1.40	2.14	3.05	3.97
	600	1.75	2.66	3.80	4.94
x 1.146	300	1.08	1.39	2.17	2.95
	400	1.39	1.93	2.98	3.96
	480	1.62	2.31	3.45	4.58
	600	1.93	2.74	4.07	5.39
x 1.438	300	`1.07	1.35	2.12	2.89
	400	1.48	1.87	2.94	4.01
	480	1.81	2.29	3.62	4.95
	600	2.35	2.98	4.72	6.46
41 x 203 x 0.879	300	0.83	1.25	1.77	2.29
	400	1.11	1.66	2.36	3.06
	480	1.35	2.04	2.91	3.78
	600	1.73	2.63	3.75	4.87
x 1.146	300	0.97	1.30	2.01	2.69
	400	1.23	1.73	2.56	3.39
	480	1.45	2.02	2.98	3.94
	600	1.80	2.51	3.70	4.89
x 1.438	300	1.02	1.27	1.99	2.70
	400	1.40	1.74	2.73	3.72
	480	1.70	2.13	3.34	4.56
	600	2.17	2.72	4.28	5.84
x 1.811	300	1.06	1.25	2.00	2.75
	400	1.43	1.70	2.73	3.76
	480	1.75	2.08	3.34	4.06
	600	2.23	2.65	4.27	5.89

TRIMMER JOIST TABLE 2

Opening Type "B"
Floors without Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Header Joist Length (m)			
		Trimmer Type A Joist + Track	*Trimmer Type B* 2 Joists	*Trimmer Type C* 2 Joists + Track	*Trimmer Type D* 2 Joists + 2 Tracks
41 x 254 x 1.146	300	0.87	1.21	1.78	2.35
	400	1.14	1.58	2.31	3.05
	480	1.37	1.90	2.78	3.66
	600	1.76	2.44	3.59	4.74
x 1.438	300	1.00	1.23	1.92	2.62
	400	1.35	1.67	2.61	3.55
	480	1.64	2.03	3.18	4.34
	600	2.09	2.59	4.06	5.54
x 1.811	300	1.03	1.21	1.94	2.66
	400	1.40	1.64	2.63	3.62
	480	1.70	2.00	3.21	4.42
	600	2.15	2.54	4.08	5.62
41 x 305 x 1.146	300	0.83	1.13	1.65	2.17
	400	1.10	1.51	2.21	2.91
	480	1.34	1.85	2.71	3.56
	600	1.72	2.38	3.49	4.61
x 1.438	300	0.98	1.20	1.87	2.55
	400	1.32	1.63	2.54	3.46
	480	1.60	1.97	3.09	4.21
	600	2.03	2.51	3.93	5.35
x 1.811	300	1.02	1.19	1.90	2.61
	400	1.37	1.61	2.57	3.54
	480	1.66	1.94	3.11	4.29
	600	2.10	2.46	3.95	5.44

TRIMMER JOIST TABLE 3

Opening Type "A"
Floors with Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Header Joist Length (m)			
		Trimmer Type A *Joist + Track*	*Trimmer Type B* *2 Joists*	*Trimmer Type C* *2 Joists + Track*	*Trimmer Type D* *2 Joists + 2 Tracks*
41 x 152 x 0.879	300	0.88	1.33	1.91	2.48
	400	1.17	1.72	2.54	3.31
	480	1.40	1.92	3.05	3.96
	600	1.75	2.22	3.81	4.96
x 1.146	300	0.95	1.35	1.99	2.64
	400	1.26	1.78	2.62	3.47
	480	1.51	2.13	3.16	4.18
	600	1.89	2.67	3.95	5.23
x 1.438	300	1.29	1.64	2.62	3.60
	400	1.72	2.19	3.50	4.81
	480	1.98	2.61	4.18	5.74
	600	2.34	3.24	4.97	6.71
41 x 203 x 0.879	300	0.88	1.03	1.74	2.45
	400	1.17	1.24	2.07	2.89
	480	1.45	1.46	2.43	3.40
	600	1.82	1.83	3.04	4.25
x 1.146	300	0.95	1.33	1.98	2.62
	400	1.26	1.78	2.64	3.49
	480	1.52	2.14	3.17	4.20
	600	1.89	2.52	3.95	5.24
x 1.438	300	1.29	1.64	2.63	3.62
	400	1.60	2.18	3.38	4.57
	480	1.83	2.51	3.85	5.19
	600	2.17	2.95	4.51	6.07
x 1.811	300	1.36	1.64	2.70	3.76
	400	1.82	2.19	3.60	5.01
	480	2.17	2.62	4.31	6.00
	600	2.55	3.27	5.25	7.19

TRIMMER JOIST TABLE 3

Opening Type "A"
Floors with Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Header Joist Length (m)			
		Trimmer Type A *Joist + Track*	*Trimmer Type B* *2 Joists*	*Trimmer Type C* *2 Joists + Track*	*Trimmer Type D* *2 Joists + 2 Tracks*
41 x 254 x 1.146	300	0.95	1.25	1.98	2.62
	400	1.27	1.50	2.58	3.50
	480	1.52	1.69	2.87	4.06
	600	1.90	1.95	3.28	4.61
x 1.438	300	1.20	1.64	2.54	3.44
	400	1.49	2.03	3.12	4.20
	480	1.71	2.32	3.55	4.77
	600	2.03	2.61	4.16	5.58
x 1.811	300	1.37	1.64	2.70	3.77
	400	1.77	2.18	3.60	5.01
	480	2.03	2.61	4.15	5.69
	600	2.40	3.07	4.86	6.64
41 x 305 x 1.146	300	0.95	1.02	1.72	2.43
	400	1.22	1.23	2.05	2.86
	480	1.45	1.46	2.43	3.40
	600	1.82	1.83	3.04	4.25
x 1.438	300	1.13	1.45	2.37	3.20
	400	1.41	1.67	2.90	3.91
	480	1.62	1.83	3.15	4.44
	600	1.99	2.09	3.56	5.02
x 1.811	300	1.35	1.64	2.71	3.78
	400	1.67	2.14	3.41	4.68
	480	1.92	2.45	3.88	5.31
	600	2.27	2.88	4.54	6.20

TRIMMER JOIST TABLE 4

Opening Type "B"
Floors with Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A Joist + Track	*Trimmer Type B* 2 Joists	*Trimmer Type C* 2 Joists + Track	*Trimmer Type D* 2 Joists + 2 Tracks
41 x 152 x 0.879	300	0.87	1.33	1.90	2.46
	400	1.17	1.79	2.55	3.32
	480	1.42	2.17	3.10	4.04
	600	1.84	2.82	4.05	5.27
x 1.146	300	0.92	1.30	1.91	2.53
	400	1.25	1.76	2.60	3.44
	480	1.51	2.13	3.15	4.18
	600	1.90	2.69	3.98	5.27
x 1.438	300	1.12	1.41	2.22	3.03
	400	1.54	1.96	3.09	4.23
	480	1.90	2.40	3.81	5.22
	600	2.33	3.12	4.94	6.66
41 x 203 x 0.879	300	0.85	1.28	1.83	2.37
	400	1.17	1.77	2.53	3.29
	480	1.54	2.38	3.43	4.48
	600	2.39	3.82	5.60	7.38
x 1.146	300	0.88	1.23	1.81	2.38
	400	1.22	1.70	2.51	3.32
	480	1.49	2.09	3.09	4.09
	600	1.89	2.66	3.94	5.22
x 1.438	300	1.05	1.31	2.05	2.80
	400	1.43	1.79	2.82	3.85
	480	1.71	2.19	3.46	4.72
	600	2.06	2.79	4.25	5.70
x 1.811	300	1.08	1.28	2.06	2.83
	400	1.47	1.75	2.82	3.89
	480	1.80	2.14	3.45	4.76
	600	2.29	2.73	4.41	6.10

TRIMMER JOIST TABLE 4

Opening Type "B"
Floors with Concrete Topping
Vibration Control = L/480 Deflection Limit

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A *Joist + Track*	*Trimmer Type B* *2 Joists*	*Trimmer Type C* *2 Joists + Track*	*Trimmer Type D* *2 Joists + 2 Tracks*
41 x 254 x 1.146	300	0.86	1.19	1.75	2.30
	400	1.18	1.65	2.42	3.20
	480	1.45	2.02	2.98	3.94
	600	1.86	2.61	3.86	5.11
x 1.438	300	1.01	1.25	1.96	2.67
	400	1.32	1.71	2.68	3.60
	480	1.54	2.06	3.11	4.16
	600	1.86	2.48	3.73	4.98
x 1.811	300	1.05	1.23	1.98	2.72
	400	1.42	1.67	2.69	3.70
	480	1.73	2.04	3.28	4.52
	600	2.14	2.59	4.18	5.77
41 x 305 x 1.146	300	0.84	1.16	1.70	2.24
	400	1.16	1.61	2.36	3.12
	480	1.61	2.19	3.39	4.51
	600	2.48	3.12	5.46	7.34
x 1.438	300	0.95	1.22	1.91	2.57
	400	1.21	1.61	2.42	3.23
	480	1.42	1.87	2.80	3.73
	600	1.78	2.35	3.53	4.70
x 1.811	300	1.03	1.20	1.93	2.65
	400	1.39	1.63	2.62	3.61
	480	1.63	1.98	3.18	4.35
	600	1.97	2.47	3.83	5.18

TRIMMER JOIST TABLE 5

Opening Type "A"
Floors without Concrete Topping
Vibration Control = Modified ATC Method with Glued Sub-floor (No Ceiling Below)

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A Joist + Track	*Trimmer Type B* 2 Joists	*Trimmer Type C* 2 Joists + Track	*Trimmer Type D* 2 Joists + 2 Tracks
41 x 152 x 0.879	300	0.94	1.45	2.08	2.71
	400	1.18	1.79	2.56	3.33
	480	1.40	2.12	3.05	3.97
	600	1.75	2.43	3.80	4.93
x 1.146	300	1.14	1.64	2.48	3.31
	400	1.41	2.03	3.03	4.04
	480	1.63	2.33	3.47	4.61
	600	1.93	2.74	4.07	5.39
x 1.438	300	1.29	1.64	2.62	3.60
	400	1.71	2.18	3.48	4.78
	480	2.05	2.61	4.18	5.74
	600	2.57	3.27	5.23	7.18
41 x 203 x 0.879	300	0.88	1.12	1.91	2.48
	400	1.17	1.35	2.29	3.23
	480	1.40	1.52	2.55	3.58
	600	1.76	1.83	3.04	4.25
x 1.146	300	1.05	1.50	2.25	3.00
	400	1.31	1.86	2.77	3.67
	480	1.52	2.13	3.16	4.19
	600	1.89	2.66	3.95	5.23
x 1.438	300	1.33	1.68	2.70	3.72
	400	1.73	2.18	3.50	4.82
	480	2.07	2.62	4.20	5.78
	600	2.59	3.28	5.25	7.23
x 1.811	300	1.50	1.81	3.01	4.21
	400	1.82	2.19	3.60	5.01
	480	2.18	2.62	4.31	6.00
	600	2.72	3.27	5.37	7.48

TRIMMER JOIST TABLE 5

Opening Type "A"
Floors without Concrete Topping
Vibration Control = Modified ATC Method with Glued Sub-floor (No Ceiling Below)

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A *Joist + Track*	*Trimmer Type B* *2 Joists*	*Trimmer Type C* *2 Joists + Track*	*Trimmer Type D* *2 Joists + 2 Tracks*
41 x 254 x 1.146	300	1.05	1.46	2.24	2.98
	400	1.27	1.65	2.64	3.50
	480	1.52	1.85	3.16	4.19
	600	1.90	2.13	3.64	5.14
x 1.438	300	1.53	1.94	3.17	4.39
	400	1.83	2.31	3.73	5.15
	480	2.07	2.62	4.21	5.81
	600	2.44	3.19	5.18	7.02
x 1.811	300	1.75	2.11	3.56	5.01
	400	2.10	2.52	4.22	5.91
	480	2.38	2.85	4.74	6.63
	600	2.74	3.27	5.40	7.53
41 x 305 x 1.146	300	1.05	1.17	2.04	2.90
	400	1.27	1.34	2.27	3.19
	480	1.50	1.51	2.53	3.54
	600	1.82	1.83	3.04	4.25
x 1.438	300	1.63	1.95	3.55	4.94
	400	1.88	2.14	3.86	5.55
	480	2.07	2.28	4.06	5.84
	600	2.32	2.48	4.33	6.18
x 1.811	300	1.95	2.35	4.00	5.64
	400	2.34	2.81	4.74	6.67
	480	2.64	3.18	5.35	7.51
	600	2.94	3.65	6.11	8.48

TRIMMER JOIST TABLE 6

Opening Type "B"
Floors without Concrete Topping
Vibration Control = Modified ATC method with glued subfloor (no ceiling below)

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A Joist + Track	*Trimmer Type B* 2 Joists	*Trimmer Type C* 2 Joists + Track	*Trimmer Type D* 2 Joists + 2 Tracks
41 x 152 x 0.879	300	0.92	1.42	2.04	2.66
	400	1.17	1.79	2.55	3.32
	480	1.40	2.14	3.05	3.97
	600	1.75	2.66	3.80	4.94
x 1.146	300	1.08	1.39	2.17	2.95
	400	1.39	1.93	2.98	3.96
	480	1.62	2.31	3.45	4.58
	600	1.93	2.74	4.07	5.39
x 1.438	300	1.12	1.41	2.22	3.03
	400	1.48	1.87	2.94	4.01
	480	1.81	2.29	3.62	4.95
	600	2.35	2.98	4.72	6.46
41 x 203 x 0.879	300	0.83	1.25	1.77	2.29
	400	1.11	1.66	2.36	3.06
	480	1.35	2.04	2.91	3.78
	600	1.73	2.63	3.75	4.87
x 1.146	300	0.97	1.34	2.03	2.69
	400	1.23	1.73	2.56	3.39
	480	1.45	2.02	2.98	3.94
	600	1.80	2.51	3.70	4.89
x 1.438	300	1.07	1.34	2.11	2.88
	400	1.43	1.79	2.82	3.85
	480	1.75	2.19	3.46	4.72
	600	2.17	2.72	4.28	5.84
x 1.811	300	1.19	1.43	2.31	3.20
	400	1.47	1.75	2.82	3.89
	480	1.80	2.14	3.45	4.76
	600	2.29	2.73	4.41	6.10

TRIMMER JOIST TABLE 6

Opening Type "B"
Floors without Concrete Topping
Vibration Control = Modified ATC method with glued subfloor (no ceiling below)

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A *Joist + Track*	*Trimmer Type B* *2 Joists*	*Trimmer Type C* *2 Joists + Track*	*Trimmer Type D* *2 Joists + 2 Tracks*
41 x 254 x 1.146	300	0.94	1.31	1.94	2.57
	400	1.15	1.60	2.34	3.09
	480	1.41	1.96	2.88	3.80
	600	1.76	2.44	3.59	4.74
x 1.438	300	1.19	1.50	2.39	3.28
	400	1.45	1.81	2.86	3.91
	480	1.68	2.08	3.27	4.46
	600	2.14	2.66	4.19	5.72
x 1.811	300	1.34	1.60	2.64	3.67
	400	1.64	1.95	3.18	4.41
	480	1.88	2.23	3.62	5.01
	600	2.20	2.59	4.18	5.77
41 x 305 x 1.146	300	0.92	1.28	1.89	2.51
	400	1.13	1.56	2.28	3.01
	480	1.38	1.91	2.81	3.71
	600	1.72	2.38	3.49	4.61
x 1.438	300	1.29	1.61	2.60	3.58
	400	1.57	1.96	3.12	4.28
	480	1.79	2.23	3.53	4.83
	600	2.05	2.59	4.08	5.56
x 1.811	300	1.45	1.73	2.88	4.03
	400	1.77	2.10	3.47	4.84
	480	2.04	2.41	3.96	5.51
	600	2.38	2.81	4.58	6.36

TRIMMER JOIST TABLE 7

Opening Type "A"
Floors without Concrete Topping
Vibration Control = Modified ATC method with glued subfloor and ceiling below

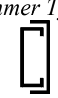
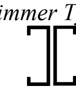
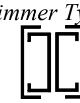
Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A Joist + Track	*Trimmer Type B* 2 Joists	*Trimmer Type C* 2 Joists + Track	*Trimmer Type D* 2 Joists + 2 Tracks
41 x 152 x 0.879	300	0.94	1.45	2.08	2.71
	400	1.18	1.79	2.56	3.33
	480	1.40	2.12	3.05	3.97
	600	1.75	2.43	3.80	4.93
x 1.146	300	1.14	1.64	2.48	3.31
	400	1.41	2.03	3.03	4.04
	480	1.63	2.33	3.47	4.61
	600	1.93	2.74	4.07	5.39
x 1.438	300	1.28	1.63	2.61	3.59
	400	1.71	2.18	3.48	4.78
	480	2.05	2.61	4.18	5.74
	600	2.57	3.27	5.23	7.18
41 x 203 x 0.879	300	0.88	1.12	1.91	2.48
	400	1.17	1.35	2.29	3.23
	480	1.40	1.52	2.55	3.58
	600	1.76	1.83	3.04	4.25
x 1.146	300	1.05	1.50	2.25	3.00
	400	1.31	1.86	2.77	3.67
	480	1.52	2.13	3.16	4.19
	600	1.89	2.66	3.95	5.23
x 1.438	300	1.29	1.63	2.62	3.61
	400	1.73	2.18	3.50	4.82
	480	2.07	2.62	4.20	5.78
	600	2.59	3.28	5.25	7.23
x 1.811	300	1.36	1.64	2.69	3.75
	400	1.81	2.18	3.58	4.99
	480	2.18	2.62	4.31	6.00
	600	2.72	3.27	5.37	7.48

TRIMMER JOIST TABLE 7

Opening Type "A"

Floors without Concrete Topping

Vibration Control = Modified ATC method with glued subfloor and ceiling below

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A  *Joist + Track*	*Trimmer Type B*  *2 Joists*	*Trimmer Type C*  *2 Joists + Track*	*Trimmer Type D*  *2 Joists + 2 Tracks*
41 x 254 x 1.146	300	0.99	1.39	2.07	2.76
	400	1.27	1.65	2.64	3.50
	480	1.52	1.85	3.16	4.19
	600	1.90	2.13	3.64	5.14
x 1.438	300	1.30	1.64	2.63	3.63
	400	1.73	2.18	3.51	4.84
	480	2.07	2.62	4.21	5.81
	600	2.44	3.19	5.18	7.02
x 1.811	300	1.37	1.64	2.70	3.77
	400	1.82	2.18	3.60	5.02
	480	2.19	2.62	4.32	6.02
	600	2.74	3.27	5.40	7.53
41 x 305 x 1.146	300	0.95	1.11	1.92	2.63
	400	1.27	1.34	2.27	3.19
	480	1.50	1.51	2.53	3.54
	600	1.82	1.83	3.04	4.25
x 1.438	300	1.30	1.64	2.64	3.64
	400	1.70	2.03	3.51	4.85
	480	1.95	2.21	3.92	5.58
	600	2.30	2.47	4.31	6.15
x 1.811	300	1.40	1.67	2.77	3.87
	400	1.84	2.18	3.62	5.05
	480	2.20	2.62	4.34	6.05
	600	2.74	3.27	5.42	7.56

TRIMMER JOIST TABLE 8

Opening Type "B"
Floors without Concrete Topping
Vibration Control = Modified ATC method with glued subfloor and ceiling below

Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A *Joist + Track*	*Trimmer Type B* *2 Joists*	*Trimmer Type C* *2 Joists + Track*	*Trimmer Type D* *2 Joists + 2 Tracks*
41 x 254 x 1.146	300	0.99	1.39	2.07	2.76
	400	1.27	1.65	2.64	3.50
	480	1.52	1.85	3.16	4.19
	600	1.90	2.13	3.64	5.14
x 1.438	300	1.30	1.64	2.63	3.63
	400	1.73	2.18	3.51	4.84
	480	2.07	2.62	4.21	5.81
	600	2.44	3.19	5.18	7.02
x 1.811	300	1.37	1.64	2.70	3.77
	400	1.82	2.18	3.60	5.02
	480	2.19	2.62	4.32	6.02
	600	2.74	3.27	5.40	7.53
41 x 305 x 1.146	300	0.95	1.11	1.92	2.63
	400	1.27	1.34	2.27	3.19
	480	1.50	1.51	2.53	3.54
	600	1.82	1.83	3.04	4.25
x 1.438	300	1.30	1.64	2.64	3.64
	400	1.70	2.03	3.51	4.85
	480	1.95	2.21	3.92	5.58
	600	2.30	2.47	4.31	6.15
x 1.811	300	1.40	1.67	2.77	3.87
	400	1.84	2.18	3.62	5.05
	480	2.20	2.62	4.34	6.05
	600	2.74	3.27	5.42	7.56

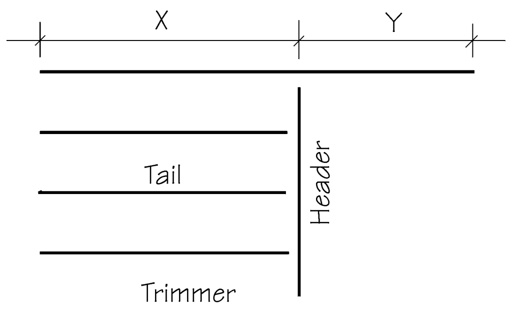
TRIMMER JOIST TABLE 8

Opening Type "B"
Floors without Concrete Topping
Vibration Control = Modified ATC method with glued subfloor and ceiling below

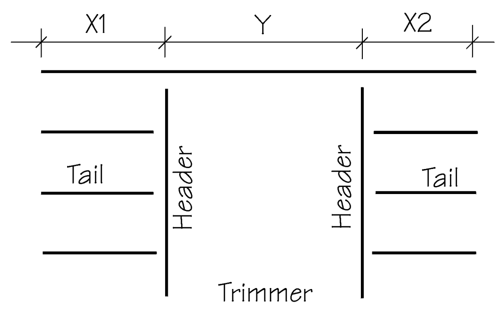
Floor Joist	Joist Spacing (mm)	Maximum Allowable Header Joist Length (m)			
		Trimmer Type A *Joist + Track*	*Trimmer Type B* *2 Joists*	*Trimmer Type C* *2 Joists + Track*	*Trimmer Type D* *2 Joists + 2 Tracks*
41 x 254 x 1.146	300	0.87	1.21	1.78	2.35
	400	1.14	1.58	2.31	3.05
	480	1.37	1.90	2.78	3.66
	600	1.76	2.44	3.59	4.74
x 1.438	300	1.01	1.25	1.96	2.67
	400	1.38	1.71	2.68	3.66
	480	1.64	2.03	3.18	4.34
	600	2.09	2.59	4.06	5.54
x 1.811	300	1.05	1.23	1.98	2.72
	400	1.42	1.67	2.69	3.70
	480	1.73	2.04	3.28	4.52
	600	2.15	2.54	4.08	5.62
41 x 305 x 1.146	300	0.83	1.13	1.65	2.17
	400	1.13	1.56	2.28	3.01
	480	1.34	1.85	2.71	3.56
	600	1.72	2.38	3.49	4.61
x 1.438	300	0.99	1.22	1.91	2.60
	400	1.34	1.66	2.59	3.53
	480	1.63	2.01	3.16	4.30
	600	2.03	2.55	4.01	5.48
x 1.811	300	1.05	1.23	1.97	2.71
	400	1.39	1.63	2.62	3.61
	480	1.69	1.98	3.18	4.38
	600	2.14	2.51	4.04	5.57

Notes to Trimmer Joist Tables

1. Trimmer Type Designation



Opening Type A



Opening Type B

2. For these tables, header joist lengths are limited by the strength and stiffness of the trimmer joists. Maximum allowable header joist lengths may also be limited by the header joists themselves. See the Header Joist Table.
3. Trimmer Joist Tables 1 - 8 are valid for openings in floors as described in the following:

Table No.	Opening Type	LL/DL kPa	Concrete Topping	Associated Floor Joist Tables Vibration Control	Associated Floor Joist Tables
1	A	1.9/0.5 or 1.4/0.45	No	L/480	A-1 or B-1
2	B	1.9/0.5 or 1.4/0.45	No	L/480	A-1 or B-1
3	A	1.9/1.3	Yes	L/480	A-2
4	B	1.9/1.3	Yes	L/480	A-2
5	A	1.9/0.5 & 1.4/0.45	No	Modified ATC *(glued subfloor)*	A-3 or B-2
6	B	1.9/0.5 & 1.4/0.45	No	Modified ATC *(glued subfloor)*	A-3 or B-2
7	A	1.9/0.5 & 1.4/0.45	No	Modified ATC *(glued subfloor + ceiling)*	A-4 or B-3
8	B	1.9/0.5 & 1.4/0.45	No	Modified ATC *(glued subfloor + ceiling)*	A-4 or B-3

4. For header joist lengths exceeding the maximum allowable header joist length, trimmer joist sizes shall be determined by calculation.

5. Maximum allowable header joist lengths are based on the following:
   - Trimmer joists and track are same depth and thickness as the floor joists.
   - Trimmer joists have a span length less than or equal to the maximum allowable span length from the associated floor joist table.
   - Built-up trimmer joists are assumed to be adequately interconnected to share the applied load.
   - All members of built-up trimmer joists are assumed to have adequate end connections to transfer shear.
   - Trimmer joists are checked for moment and shear at factored loads and for deflection at specified live load with a deflection limit of L/480. Vibration is assumed to be controlled by the deflection limit. Web crippling has not been checked. The fully braced factored moment resistance is assumed to apply.
   - Joist components in built-up trimmer joists have perforated webs, track components have unperforated webs.
   - Joist and track members are continuous over the length of the built-up trimmer joists

6. For Opening Type "A", any opening size "Y" is permitted. For Opening Type "B", the opening may be located anywhere on the span but the opening size Y shall not be less than 1 m (3'-3").

7. See Commentary.

Appendix A:

Section 4
Wind Bearing Stud Tables

WIND BEARING STUDS – EXTERIOR WALLS								
TABLE 4IA – MAXIMUM ALLOWABLE SINGLE SPAN HEIGHT IN METRES (with web crippling type end connections)								
Max. Hourly Wind Pressure q(1/30)	0.40 kPa				0.50 kPa			
STUD SPACING (mm)	300	400	480	600	300	400	480	600
MEMBER SIZE								
41 x 89 x 0.879	3.68	3.34	3.15	2.92	3.42	3.10	2.92	2.71
x 0.146	3.99	3.63	3.41	3.17	3.70	3.37	3.17	2.94
x 1.438	4.27	3.88	3.65	3.39	3.96	3.60	3.39	3.15
41 x 152 x 0.879	5.56	5.05	4.75	4.05	5.16	4.69	4.05	3.24
x 0.146	6.08	5.52	5.20	4.83	5.64	5.13	4.83	4.48
x 1.438	6.52	5.92	5.58	5.18	6.05	5.50	5.18	4.80

WIND BEARING STUDS – EXTERIOR WALLS								
TABLE 4IIA – MAXIMUM ALLOWABLE SINGLE SPAN HEIGHT IN METRES (with end connections not susceptible to web crippling)								
Max. Hourly Wind Pressure q(1/30)	0.40 kPa				0.50 kPa			
STUD SPACING (mm)	300	400	480	600	300	400	480	600
MEMBER SIZE								
41 x 89 x 0.879	3.68	3.34	3.15	2.92	3.42	3.10	2.92	2.71
x 0.146	3.99	3.63	3.41	3.17	3.70	3.37	3.17	2.94
x 1.438	4.27	3.88	3.65	3.39	3.96	3.60	3.39	3.15
41 x 152 x 0.879	5.56	5.05	4.75	4.41	5.16	4.69	4.41	4.03
x 0.146	6.08	5.52	5.20	4.83	5.64	5.13	4.83	4.48
x 1.438	6.52	5.92	5.58	5.18	6.05	5.50	5.18	4.80

NOTES:

1. Allowable heights in Table 4IA are checked for moment, shear, web crippling and a deflection limit of L/360. Allowable heights in Table 4IIA are checked for moment, shear and a deflection limit of L/360.

2. Moment, shear and web crippling allowable heights are calculated using wind loads based on q(1/30) hourly wind pressures. Deflection allowable heights are calculated using wind loads based on q(1/10) hourly wind pressures. The q(1/10) hourly wind pressures are approximated by taking 80% of the q(1/30) hourly wind pressures.

3. For standard stud to track end connections use Table I.

4. See Commentary.

WIND BEARING STUDS – EXTERIOR WALLS TABLE 4IB – MAXIMUM ALLOWABLE SINGLE SPAN HEIGHT IN METRES (with web crippling type end connections)								
Max. Hourly Wind Pressure q(1/30)	**0.60 kPa**				**0.80 kPa**			
STUD SPACING (mm)	**300**	**400**	**480**	**600**	**300**	**400**	**480**	**600**
MEMBER SIZE								
41 x 89 x 0.879	3.21	2.92	2.75	2.55	2.92	2.65	2.50	2.10
x 0.146	3.49	3.17	2.98	2.77	3.17	2.88	2.71	2.51
x 1.438	3.73	3.39	3.19	2.96	3.39	3.08	2.90	2.69
41 x 152 x 0.879	4.85	4.05	3.38	2.70	4.05	3.04	2.53	2.03
x 0.146	5.31	4.83	4.54	4.22	4.83	4.38	4.05	3.24
x 1.438	5.70	5.18	4.87	4.52	5.18	4.70	4.43	4.11

WIND BEARING STUDS – EXTERIOR WALLS TABLE 4IIB – MAXIMUM ALLOWABLE SINGLE SPAN HEIGHT IN METRES (with end connections not susceptible to web crippling)								
Max. Hourly Wind Pressure q(1/30)	**0.60 kPa**				**0.80 kPa**			
STUD SPACING (mm)	**300**	**400**	**480**	**600**	**300**	**400**	**480**	**600**
MEMBER SIZE								
41 x 89 x 0.879	3.21	2.92	2.75	2.55	2.92	2.65	2.50	2.24
x 0.146	3.49	3.17	2.98	2.77	3.17	2.88	2.71	2.51
x 1.438	3.73	3.39	3.19	2.96	3.39	3.08	2.90	2.69
41 x 152 x 0.879	4.85	4.41	4.11	3.67	4.41	3.90	3.56	3.18
x 0.146	5.31	4.83	4.54	4.22	4.83	4.38	4.13	3.77
x 1.438	5.70	5.18	4.87	4.52	5.18	4.70	4.43	4.11

NOTES:

1. Allowable heights in Table 4IB are checked for moment, shear, web crippling and a deflection limit of L/360. Allowable heights in Table 4IIB are checked for moment, shear and a deflection limit of L/360.

2. Moment, shear and web crippling allowable heights are calculated using wind loads based on q(1/30) hourly wind pressures. Deflection allowable heights are calculated using wind loads based on q(1/10) hourly wind pressures. The q(1/10) hourly wind pressures are approximated by taking 80% of the q(1/30) hourly wind pressures.

3. For standard stud to track end connections use Table I.

4. See Commentary.

The Lightweight Steel Frame House Construction Handbook

Appendix A:

Section 5a

Axial Load Bearing Stud Tables - Interior

INTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' – 1") Lateral Load = 0.25 kPa					
ROOF OR CEILING JOIST SUPPORTED: NO CEILING JOISTS & NO ROOF LOADS (CLEAR SPAN TRUSS LOADS EXTERIOR WALL ONLY)					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	-	305	_	A1, B1	A1, B1
		406	_	A1, B1	A1, B1
		488	_	A1, B1	A1, B1
		610	_	A1, B1	A2, B1
4.8	-	305	_	A1, B1	A1, B1
		406	_	A1, B1	A1, B1
		488	_	A1, B1	A2, B1
		610	_	A1, B1	A3, B2
6.1	-	305	_	A1, B1	A1, B1
		406	_	A1, B1	A2, B1
		488	_	A1, B1	A3, B2
		610	_	A2, B1	A3, B3

INTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' – 1") Lateral Load = 0.25 kPa					
ROOF OR CEILING JOIST SUPPORTED: NO CEILING JOISTS & NO ROOF LOADS (CLEAR SPAN TRUSS LOADS EXTERIOR WALL ONLY)					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	-	305	_	A1, B1	A1, B1
		406	_	A1, B1	A1, B1
		488	_	A1, B1	A1, B1
		610	_	A1, B1	A2, B1
4.8	-	305	_	A1, B1	A1, B1
		406	_	A1, B1	A1, B1
		488	_	A1, B1	A2, B1
		610	_	A1, B1	A3, B2
6.1	-	305	_	A1, B1	A1, B1
		406	_	A1, B1	A2, B1
		488	_	A1, B1	A3, B2
		610	_	A2, B1	A3, B2

INTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' – 1") Lateral Load = 0.25 kPa					
ROOF OR CEILING JOIST SUPPORTED: ACCESSIBLE ATTIC JOISTS – NO ROOF LOADS					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	-	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A1, B1	A2, B2
		610	A1, B1	A2, B1	A3, B2
4.8	-	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A1, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A0, B3
6.1	-	305	A1, B1	A1, B1	A2, B2
		406	A1, B1	A2, B1	A3, B3
		488	A1, B1	A3, B2	A0, B3
		610	A1, B1	A3, B3	A0, B3

INTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073mm (10' – 1") Lateral Load = 0.25 kPa					
ROOF OR CEILING JOIST SUPPORTED: ACCESSIBLE ATTIC JOISTS – NO ROOF LOADS					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	-	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A1, B1	A2, B2
		610	A1, B1	A2, B1	A3, B2
4.8	-	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A1, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A0, B3
6.1	-	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B2	A0, B3
		610	A1, B1	A3, B2	A0, B3

INTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' – 1") Lateral Load = 0.25 kPa					
ROOF OR CEILING JOIST SUPPORTED: INACCESSIBLE ATTIC JOISTS – NO ROOF LOADS					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	-	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A1, B1
		488	A1, B1	A1, B1	A2, B1
		610	A1, B1	A1, B1	A3, B2
4.8	-	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B2
		488	A1, B1	A1, B1	A3, B2
		610	A1, B1	A2, B1	A3, B3
6.1	-	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A1, B1	A3, B2
		488	A1, B1	A2, B1	A3, B3
		610	A1, B1	A3, B2	A0, B3

INTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' – 1") Lateral Load = 0.25 kPa					
ROOF OR CEILING JOIST SUPPORTED: INACCESSIBLE ATTIC JOISTS – NO ROOF LOADS					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	-	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A1, B1
		488	A1, B1	A1, B1	A2, B1
		610	A1, B1	A1, B1	A3, B2
4.8	-	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A1, B1	A3, B2
		610	A1, B1	A2, B1	A3, B2
6.1	-	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A1, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A0, B3

INTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' – 1") Lateral Load = 0.25 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	3.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A1, B1	A2, B1
		610	A2, B1	A2, B1	A3, B2
4.8	4.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B2
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A2, B2	A0, B3
6.1	6.1	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B2	A0, B3
		610	A1, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	3.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A1, B1	A2, B2
		610	A1, B1	A2, B1	A3, B2
4.8	4.8	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A1, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A0, B3
6.1	6.1	305	A1, B1	A1, B1	A2, B2
		406	A1, B1	A2, B1	A3, B3
		488	A1, B1	A3, B2	A0, B3
		610	A1, B1	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	3.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A2, B2	A3, B3
4.8	4.8	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B2	A3, B3
		610	A1, B1	A3, B2	A0, B3
6.1	6.1	305	A1, B1	A2, B1	A3, B2
		406	A1, B1	A3, B2	A0, B3
		488	A1, B1	A3, B2	A0, B3
		610	A2, B1	A0, B3	A0, B0
Roof Snow Load = 2.5 kPa					
3.8	3.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B2
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A0, B3
4.8	4.8	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B2	A0, B3
		610	A2, B1	A3, B3	A0, B3
6.1	6.1	305	A1, B1	A2, B1	A3, B2
		406	A1, B1	A3, B2	A0, B3
		488	A2, B1	A3, B3	A0, B3
		610	A2, B2	A0, B3	A0, B0

INTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' – 1") Lateral Load = 0.25 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0	1	2
			W+L+D	W+L+D	W+L+D
3.8	3.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A1, B1	A2, B1
		610	A1, B1	A2, B1	A3, B2
4.8	4.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A2, B1	A0, B3
6.1	6.1	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B2	A0, B3
		610	A1, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	3.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A1, B1	A3, B2
		610	A1, B1	A2, B1	A3, B2
4.8	4.8	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A1, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A0, B3
6.1	6.1	305	A1, B1	A1, B1	A2, B2
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B2	A0, B3
		610	A1, B1	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	3.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A2, B2	A0, B2
4.8	4.8	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B2	A0, B3
		610	A1, B1	A3, B2	A0, B3
6.1	6.1	305	A1, B1	A2, B1	A3, B2
		406	A1, B1	A3, B2	A0, B3
		488	A1, B1	A3, B2	A0, B3
		610	A2, B1	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	3.8	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A0, B3
4.8	4.8	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B2	A0, B3
		610	A2, B1	A3, B2	A0, B3
6.1	6.1	305	A1, B1	A2, B1	A3, B2
		406	A1, B1	A3, B2	A0, B3
		488	A2, B1	A0, B3	A0, B3
		610	A2, B1	A0, B3	A0, B3

The Lightweight Steel Frame House Construction Handbook

Appendix A:

Section 5b

Axial Load Bearing Stud Tables - Exterior

$q_{(1/30)} = 0.40$ kPa

Section 5B

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL
Maximum Floor to Ceiling Height = 2464 mm (8' – 1")
q(1/30) = 0.40 kPa
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS
EXTERIOR WALLS ONLY – NO CEILING JOISTS

Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS 0 W+L+D	1 W+L+D	2 W+L+D
Roof Snow Load = 1.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B1	A3, B2
3.8	5.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A3, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A2, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A3, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B1	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B1	A3, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B3
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3

Section 5B

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL
Maximum Floor to Ceiling Height = 2769 mm (9' - 1")
q(1/30) = 0.40 kPa

ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS
EXTERIOR WALLS ONLY – NO CEILING JOISTS

Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS 0 W+L+D	1 W+L+D	2 W+L+D
Roof Snow Load = 1.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B1	A3, B2
3.8	5.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3

Section 5B

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10'- 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B2
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3

Section 5B

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3683 mm (12' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	**1 W+L+D**	**2 W+L+D**
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A0, B2
		488	A0, B1	A0, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B1	A0, B2	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B1	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A3, B1	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A3, B1	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A0, B2
		406	A3, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A0, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A0, B2
		406	A3, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS 0 W+L+D	1 W+L+D	2 W+L+D
EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 4293 mm (14' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS Roof Snow Load = 1.0 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B1
		406	A0, B1	A0, B1	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A0, B1	A0, B1	A0, B1
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B1
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A2, B1	A3, B3	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A2, B1	A3, B3	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B1	A3, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B1	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A2, B2	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B0
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A2, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A2, B2	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B2	A3, B2
		406	A2, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A3, B3	A0, B3	A0, B0

Section 5B

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height =2769 mm (9' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1 B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A3, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A3, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A3, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B2	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B3

Section 5B

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A0, B3
		488	A3, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3

Axle Load Bearing Stud Tables

Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A3, B3
3.8	5.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A2, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A2, B1	A3, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A2, B1	A3, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A1, B1	A2, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A2, B1	A3, B3	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A2, B1	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B3

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
3.8	5.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A3, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A3, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3

Section 5B

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A2, B1	A3, B2
Roof Snow Load = 1.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B1	A3, B3
Roof Snow Load = 2.0 kPa					
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B1
		610	A1, B1	A3, B1	A3, B2
Roof Snow Load = 1.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B1	A3, B2
Roof Snow Load = 2.0 kPa					
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
Roof Snow Load = 2.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B3

Axle Load Bearing Stud Tables
Exterior $q_{(1/30)}$ = 0.40 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.40 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS **Roof Snow Load = 1.0 kPa**					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B1	A0, B2
Roof Snow Load = 1.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B2
Roof Snow Load = 2.0 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3

The Lightweight Steel Frame House Construction Handbook

Appendix A:

Section 5c

Axial Load Bearing
Stud Tables - Exterior
$q_{(1/30)} = 0.50$ kPa

Section 5C

Axial Load Bearing Stud Tables
Exterior q(1/30) = 0.50 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL
Maximum Floor to Ceiling Height = 2464 mm (8' - 1")
q(1/30) = 0.50 kPa

ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS
EXTERIOR WALLS ONLY – NO CEILING JOISTS

Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
Roof Snow Load = 1.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B2	A3, B2
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3

Section 5C

Axial Load Bearing Stud Tables
Exterior q(1/30) = 0.50 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.4	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A3, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B2	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3

Section 5C

Axial Load Bearing Stud Tables
Exterior q(1/30) = 0.50 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL
Maximum Floor to Ceiling Height = 3073 mm (10' - 1")
q(1/30) = 0.50 kPa

ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS
EXTERIOR WALLS ONLY – NO CEILING JOISTS

Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS 0 W+L+D	1 W+L+D	2 W+L+D
Roof Snow Load = 1.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A3, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3683 mm (12' - 1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A0, B1	A0, B1	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B1
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B1
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B1
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B1
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B1
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B2
		406	A0, B1	A0, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A3, B1	A3, B2	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 4293 mm (14' - 1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A0, B1	A0, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	5.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A0, B3	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B2	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B0
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B2	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B2	A3, B2
		406	A2, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0

Section 5C

Axial Load Bearing Stud Tables
Exterior q(1/30) = 0.50 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL
Maximum Floor to Ceiling Height = 2769 mm (9' - 1")
q(1/30) = 0.50 kPa

ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS

Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS 0 W+L+D	1 W+L+D	2 W+L+D
Roof Snow Load = 1.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B2	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A3, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B2	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL
Maximum Floor to Ceiling Height = 3073 mm (10' - 1")
q(1/30) = 0.50 kPa

ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS

Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS 0 W+L+D	1 W+L+D	2 W+L+D
Roof Snow Load = 1.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A3, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B3	A0, B3
oof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A3, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B1	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9'-1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A3, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A1, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A1, B1	A3, B1	A3, B2
Roof Snow Load = 1.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B3
Roof Snow Load = 2.0 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B1	A3, B2
Roof Snow Load = 1.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
Roof Snow Load = 2.0 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.50 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.2	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A0, B2	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.2	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3

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Appendix A:

Section 5d

Axial Load Bearing Stud Tables - Exterior

$q_{(1/30)} = 0.60$ kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A0, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LEADS EXTERIOR WALLS ONLY – NO CEILING JOISTS Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B2
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 1.5kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B1	A3, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A3, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3683 mm (12' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS					
Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A3, B1	A3, B1	A3, B1
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A3, B1	A3, B1	A3, B1
		406	A0, B1	A0, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A3, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A3, B1	A3, B1	A3, B2
		406	A0, B1	A0, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A3, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A3, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A3, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A3, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A3, B1	A3, B2	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A3, B1	A3, B1	A0, B2
		406	A0, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	5.4	305	A3, B1	A3, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A3, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 4293 mm (14' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS Roof Snow Load = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	**1 W+L+D**	**2 W+L+D**
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	5.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
Roof Snow Load = 1.5 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	5.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
Roof Snow Load = 2.0 kPa					
3.8	4.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	5.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B3	A0, B0	A0, B0
Roof Snow Load = 2.5 kPa					
3.8	4.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	5.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A0, B1	A0, B2	A0, B3
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B3	A0, B0	A0, B0

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B3
		610	A3, B1	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B2	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B0
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B2	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B2	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0

Axial Load Bearing Stud Tables
Exterior q(1/30) = 0.60 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B2	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B2	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B2	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A3, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A3, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A3, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A3, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A3, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B1	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B3
		488	A3, B2	A3, B3	A0, B3
		610	A3, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B2	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B2	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A3, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A3, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height =2464 mm (8' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.2	305	A1, B1	A1, B1	A1, B1
		406	A1, B1	A2, B1	A2, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A3, B2
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A1, B1	A2, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A1, B1	A3, B1	A3, B2
		610	A2, B1	A3, B2	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A2, B1	A3, B2	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height =2769 mm (9' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A2, B1	A3, B2
		610	A3, B1	A3, B2	A3, B2
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.60 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A2, B1	A2, B1	A3, B1
		488	A3, B1	A3, B1	A3, B2
		610	A0, B1	A0, B2	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.2	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B1	A0, B2
		610	A0, B1	A0, B2	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.2	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B1	A0, B2	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.2	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B2	A0, B3	A0, B3

The Lightweight
Steel Frame
House Construction
Handbook

Appendix A:

Section 5e

Axial Load Bearing
Stud Tables - Exterior
$q_{(1/30)} = 0.80$ kPa

Axial Load Bearing Stud Tables
EXTERIOR $q_{(1/30)}$ = 0.80 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3

Axial Load Bearing Stud Tables
EXTERIOR $q_{(1/30)}$ = 0.80 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	**1 W+L+D**	**2 W+L+D**
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A2, B1	A3, B2
		488	A3, B1	A3, B1	A3, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B2	A0, B2	A0, B3
OOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B2	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A3, B2
		488	A3, B2	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A3, B2
		488	A3, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	**1 W+L+D**	**2 W+L+D**
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A3, B2
		488	A0, B1	A0, B2	A0, B2
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A3, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A3, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL
Maximum Floor to Ceiling Height = 3683 mm (12' - 1")
q(1/30) = 0.80 kPa

ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS
EXTERIOR WALLS ONLY – NO CEILING JOISTS

Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
ROOF SNOW LOAD = 1.0 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	5.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A0, B1	A0, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A0, B1	A0, B1	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	5.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	5.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B3	A0, B0	A0, B0
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	5.4	305	A0, B1	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
3.8	6.7	305	A0, B1	A0, B2	A0, B3
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B3	A0, B0	A0, B0

Axial Load Bearing Stud Tables
EXTERIOR $q_{(1/30)}$ = 0.80 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 4293 mm (14' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	**1 W+L+D**	**2 W+L+D**
3.8	4.4	305	A0, B2	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B0	A0, B0	A0, B0
3.8	5.4	305	A0, B2	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B0	A0, B0	A0, B0
3.8	6.7	305	A0, B2	A0, B2	A0, B2
		406	A0, B3	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B0	A0, B0	A0, B0
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A0, B2	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B0	A0, B0	A0, B0
3.8	5.4	305	A0, B2	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B0	A0, B0	A0, B0
3.8	6.7	305	A0, B2	A0, B2	A0, B3
		406	A0, B3	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B0
		610	A0, B0	A0, B0	A0, B0
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A0, B2	A0, B2	A0, B2
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B0	A0, B0	A0, B0
3.8	5.4	305	A0, B2	A0, B2	A0, B3
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B0	A0, B0	A0, B0
3.8	6.7	305	A0, B2	A0, B2	A0, B3
		406	A0, B3	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B0
		610	A0, B0	A0, B0	A0, B0
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A0, B2	A0, B2	A0, B3
		406	A0, B2	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B3
		610	A0, B0	A0, B0	A0, B0
3.8	5.4	305	A0, B2	A0, B2	A0, B3
		406	A0, B3	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B0
		610	A0, B0	A0, B0	A0, B0
3.8	6.7	305	A0, B2	A0, B3	A0, B3
		406	A0, B3	A0, B3	A0, B3
		488	A0, B3	A0, B3	A0, B0
		610	A0, B0	A0, B0	A0, B0

Axial Load Bearing Stud Tables
EXTERIOR $q_{(1/30)}$ = 0.80 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL
Maximum Floor to Ceiling Height = 2464 mm (8' - 1")
q(1/30) = 0.80 kPa

ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS

Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS 0 W+L+D	1 W+L+D	2 W+L+D
ROOF SNOW LOAD = 1.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B2	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B2	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B2	A0, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B2	A3, B2
		406	A3, B2	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0

Section 5E

Axial Load Bearing Stud Tables
EXTERIOR $q_{(1/30)}$ = 0.80 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A3, B2
		488	A3, B2	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A3, B2
		488	A3, B2	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A3, B2
		488	A3, B2	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A3, B2
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B2	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B2	A3, B2
		406	A3, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A3, B1	A3, B2	A3, B2
		406	A3, B2	A0, B3	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B0

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B2
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A3, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A3, B2	A0, B3	A0, B3
		610	A0, B2	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B1	A0, B2	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B2
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B1	A0, B2	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A3, B2
		488	A3, B2	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A1, B1	A2, B1	A3, B1
		406	A2, B1	A3, B2	A3, B2
		488	A3, B1	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A3, B2
		488	A3, B2	A3, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A3, B2
		488	A3, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A3, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A3, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B2
		488	A0, B2	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
3.8	5.4	305	A2, B1	A3, B1	A3, B2
		406	A3, B1	A3, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3
3.8	6.7	305	A2, B1	A3, B1	A3, B2
		406	A3, B2	A0, B2	A0, B3
		488	A0, B2	A0, B3	A0, B3
		610	A0, B3	A0, B3	A0, B3

Axial Load Bearing Stud Tables
EXTERIOR $q_{(1/30)}$ = 0.80 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2464 mm (8' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B1
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B1	A3, B2
		610	A3, B1	A3, B2	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.2	305	A1, B1	A2, B1	A2, B1
		406	A1, B1	A2, B1	A3, B2
		488	A2, B1	A3, B2	A3, B2
		610	A3, B1	A3, B2	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.2	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A2, B1	A3, B2	A0, B2
		610	A3, B1	A0, B2	A0, B3

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 2769 mm (9' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 W+L+D	1 W+L+D	2 W+L+D
3.8	4.2	305	A1, B1	A1, B1	A2, B1
		406	A2, B1	A2, B1	A3, B1
		488	A3, B1	A3, B1	A3, B2
		610	A0, B1	A0, B2	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.2	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B1	A0, B2	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.2	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B1	A0, B2	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.2	305	A1, B1	A2, B1	A2, B1
		406	A2, B1	A3, B1	A3, B2
		488	A3, B1	A3, B2	A3, B2
		610	A0, B2	A0, B3	A0, B3

Axial Load Bearing Stud Tables
EXTERIOR $q_{(1/30)}$ = 0.80 kPa

EXTERIOR AXIAL LOAD BEARING STUD WALL Maximum Floor to Ceiling Height = 3073 mm (10' - 1") q(1/30) = 0.80 kPa					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Member Spacing (mm)	NUMBER OF SUPPORTED FLOORS		
			0 **W+L+D**	**1** **W+L+D**	**2** **W+L+D**
3.8	4.2	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A3, B2
		488	A0, B1	A0, B2	A0, B2
		610	A0, B2	A0, B2	A0, B3
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.2	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B1	A3, B2
		488	A0, B1	A0, B2	A0, B2
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.2	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A3, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.2	305	A2, B1	A2, B1	A3, B1
		406	A3, B1	A3, B2	A0, B2
		488	A0, B1	A0, B2	A0, B3
		610	A0, B2	A0, B3	A0, B3

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Appendix A:

Section 5f

Axial Load Bearing
Stud Tables - Notes

Section 5F

Axial Load Bearing Stud Tables
Interior and Exterior Notes

AXIAL LOAD BEARING STUD NOTES

1. Legend

A1	=	41 x 89 x 0.879 stud (or 41 x 92 x 0.879 stud)
A2	=	41 x 89 x 1.146 stud (or 41 x 92 x 1.146 stud)
A3	=	41 x 89 x 1.438 stud (or 41 x 92 x 1.438 stud)
B1	=	41 x 152 x 0.879 stud
B2	=	41 x 152 x 1.146 stud
B3	=	41 x 152 x 1.438 stud
A0, B0	=	No stud selection is available
"-"	=	No wall is required

2. Sheathing is not relied on to restrain the studs. Lateral support is assumed to be provided by bridging. The number of lines of equally spaced bridging is specified in the following:

Wall Height (Stud Length)	Number of Lines of Equally Spaced Bridging
2464 (8'-1")	1
2769 (9'-1")	2
3073 (10'-1")	2
3683 (12'-1")	2
4293 (14'-1")	3

Bridging is assumed to have adequate strength and stiffness for the accumulated torsion between bridging lines in combination with 2% of the factored compressive force in each stud. Design bridging in accordance with the requirements of S136-94. Bridging requires periodic anchorage.

3. Lateral Loads due to Wind and/or Interior Pressure Differences

3.1 Wind loads for strength are based on $q_{(1/30)}$ hourly wind pressures. Choose the matching or next highest $q_{(1/30)}$ that is appropriate for the geographic location under consideration.

3.2 Wind loads for deflection are based on $q_{(1/10)}$ hourly wind pressures which are approximated by using 80% of the $q_{(1/30)}$ hourly wind pressures. Selected studs satisfy an L/360 deflection limit.

3.3 Interior partitions are assumed to resist a nominal lateral pressure of 0.25 kPa.

4. Gravity Loads

4.1 Floor Loads

See tables for assumed floor live loads and dead loads (specified). Note that dead load includes the self weight of the joists.

4.2 Roof Loads

The tables show roof snow loads (specified) which are derived from the NBC/95 ground snow load data that is appropriate for the geographic location under consideration. To derive the roof snow loads, multiply the ground snow load data by the coefficients from NBC/95 4.1.7.

Choose the matching or next highest roof snow load from the tables.

Snow loads are assumed to be uniformly distributed. If non-uniform snow loads apply, additional engineering is required. Note that dead load includes the self weight of the roof rafters, joists or trusses.

Note that the bottom chord live load for trusses is assumed to be zero.

4.3 Wall/Partition Dead Load

The dead load of the stud wall under consideration is not included in the analysis. The dead load of supported walls above is included only if the walls above are load bearing. Wall dead loads are assumed to be 0.25 kN/m^2 of wall area.

5. Tributary Widths - Description

5.1 For interior axial load bearing stud walls

Ceiling, floor and roof joist tributary widths are equal to half the sum of the joist spans on both sides of the wall. Choose the matching or next highest tributary width from the tables.

5.2 For exterior axial load bearing stud walls

Ceiling and floor joist tributary widths are equal to half the joist spans.

Roof truss and roof rafter tributary widths are equal to the horizontal distance from ridge to eaves assuming a symmetrical roof with the ridge at the centre of the roof span. For unsymmetrical roofs, the tributary width is equal to the horizontal distance from centre of roof span to eaves.

Roof joist tributary widths are equal to the horizontal distance from centre of joist span to the eaves.

The distance to the eaves includes any roof overhang.

Choose the matching or next highest tributary width from the tables.

6. See Commentary

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Appendix A:

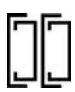
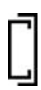
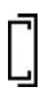
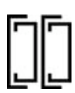
Section 6a

Wall Openings - Jamb Stud Tables

Section 6A

Wall Openings
Jamb Stud Tables

MAXIMUM ALLOWABLE ROUGH OPENING WIDTHS BASED ON BUILT-UP JAMB CONFIGURATION
(metres)

Jamb Configuration			Typical Stud Spacinging (mm)			
Designation Number	King	Jack	305	406	488	610
1			0.75	1.05	1.30	1.66
2			0.97	1.38	1.70	2.19
3			0.87	1.22	1.49	1.91
4			0.99	1.38	1.69	2.15
5			1.52	2.11	2.58	3.29
6			1.64	2.27	2.78	3.53
7			1.86	2.60	3.18	3.71
8			2.29	3.16	3.71	3.71
9			2.51	3.49	3.71	3.71

BUILT-UP JAMB NOTES

1. Legend

 = jamb stud matching the depth and thickness of the typical wall stud

 = jamb stud + track both matching the depth and thickness of the typical wall stud

2. Allowable rough opening sizes are based on the following assumptions:

   - Jamb members are built-up from studs and/or from studs reinforced with track. Studs and track match the depth and thickness of the typical wall stud.
   - King studs extend from the bottom track to the top track and seat in the top and bottom track for bearing. Track reinforcing for king studs is assumed to be cut shorter than the king studs by an amount equal to the flange width of the track at the top and at the bottom.
   - Jack studs extend from the bottom track to the underside of an 203 - 305 mm deep lintel which is located at the underside of the floor, roof, or ceiling joist above. Jack studs seat in the bottom track and against the lintel above for bearing and are 203 - 305 mm shorter than the king studs. Track reinforcing for jack studs is assumed to be cut shorter than the jack studs by an amount equal to the flange width of the bottom track.
   - Detailing of the interconnection of the built-up jamb members (stud to stud, track to stud and stud to track) is such that the entire jamb member behaves as a built-up member. *(In the absence of engineering analysis, connect members together with 2 fasteners side by side at a maximum spacing of 400 mm o.c. Refer to CSA S136 for fastener loads and resistances.)*
   - Detailing of the lintel end connection and the interconnection of the jamb members is such that each jack and king member carries a proportionate share of the total axial load and bending moment applied to the built-up jamb.
   - The built-up jamb is tied to the wall bridging.
   - The maximum allowable rough opening widths have not been limited by web crippling although web crippling of the king and jack members is critical for some opening geometries, stud sizes and combinations of wind and axial load. Additional engineering analysis is necessary and web stiffeners or other end connections not susceptible to web crippling may be required.

3. Opening widths may also be limited by lintel requirements *(see Maximum Allowable Lintel Span Tables)* or window sill/head member requirements *(see Window Sill/Head Maximum Allowable Span Tables)*.

4. For wind bearing walls (no axial loads), use the jamb configuration above or provide king studs only. The number of king studs shall equal the required number of king plus jack studs.

5. See Commentary.

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Appendix A:

Section 6b

Wall Openings - Window Sill/Head Tables

WINDOW SILL / HEAD MAXIMUM ALLOWABLE SPAN TABLE (SPANS LIMITED BY WIND LOAD ONLY)				
MAXIMUM HOURLY WIND PRESSURE q(1/30) = 0.40 kPa				
			Maximum Allowable Window Sill / Head Span Length (m)	
Length of Stud Framing into Window Sill or Head (mm)	Typical Stud		For Single Track	For Single Stud Plus 2 Tracks
300	41 x 89	x 0.879	2.08	3.11
		x 1.146	2.37	3.35
		x 1.438	2.59	3.55
	41 x 152	x 0.879	2.59	4.13
		x 1.146	3.04	4.66
		x 1.438	3.62	4.94
750	41 x 89	x 0.879	1.90	2.96
		x 1.146	2.19	3.20
		x 1.438	2.45	3.40
	41 x 152	x 0.879	2.41	3.93
		x 1.146	2.84	4.50
		x 1.438	3.47	4.78
1200	41 x 89	x 0.879	1.75	2.84
		x 1.146	2.03	3.07
		x 1.438	2.33	3.27
	41 x 152	x 0.879	2.25	3.74
		x 1.146	2.68	4.35
		x 1.438	3.33	4.64

WINDOW SILL / HEAD MAXIMUM ALLOWABLE SPAN TABLE (SPANS LIMITED BY WIND LOAD ONLY)				
MAXIMUM WIND PRESSURE q(1/30) = 0.50 kPa				
			Maximum Allowable Window Sill / Head Span Length (m)	
Length of Stud Framing into Window Sill or Head (mm)	Typical Stud		For Single Track	For Single Stud Plus 2 Tracks
300	41 x 89	x 0.879	1.92	2.94
		x 1.146	2.19	3.17
		x 1.438	2.44	3.35
	41 x 152	x 0.879	2.40	3.82
		x 1.146	2.81	4.39
		x 1.438	3.42	4.66
750	41 x 89	x 0.879	1.74	2.79
		x 1.146	2.01	3.02
		x 1.438	2.30	3.20
	41 x 152	x 0.879	2.21	3.62
		x 1.146	2.62	4.18
		x 1.438	3.27	4.51
1200	41 x 89	x 0.879	1.60	2.67
		x 1.146	1.86	2.89
		x 1.438	2.18	3.07
	41 x 152	x 0.879	2.06	3.44
		x 1.146	2.46	4.00
		x 1.438	3.13	4.37

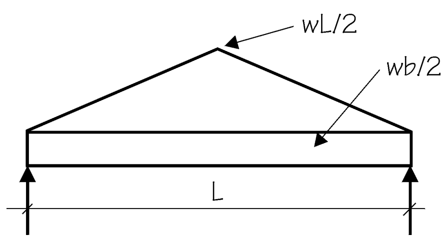
WINDOW SILL / HEAD MAXIMUM ALLOWABLE SPAN TABLE (SPANS LIMITED BY WIND LOAD ONLY)				
MAXIMUM HOURLY WIND PRESSURE q(1/30) = 0.60 kPa				
			Maximum Allowable Window Sill / Head Span Length (m)	
Length of Stud Framing into Window Sill or Head (mm)	Typical Stud		For Single Track	For Single Stud Plus 2 Tracks
300	41 x 89	x 0.879	1.80	2.80
		x 1.146	2.06	3.02
		x 1.438	2.33	3.20
	41 x 152	x 0.879	2.25	3.59
		x 1.146	2.64	4.12
		x 1.438	3.26	4.45
750	41 x 89	x 0.879	1.62	2.66
		x 1.146	1.88	2.87
		x 1.438	2.19	3.05
	41 x 152	x 0.879	2.07	3.39
		x 1.146	2.45	3.92
		x 1.438	3.11	4.30
1200	41 x 89	x 0.879	1.48	2.49
		x 1.146	1.73	2.75
		x 1.438	2.07	2.92
	41 x 152	x 0.879	1.91	3.21
		x 1.146	2.29	3.74
		x 1.438	2.96	4.16

WINDOW SILL / HEAD MAXIMUM ALLOWABLE SPAN TABLE (SPANS LIMITED BY WIND LOAD ONLY)				
MAXIMUM HOURLY WIND PRESSURE q(1/30) = 0.80 kPa				
			Maximum Allowable Window Sill / Head Span Length (m)	
Length of Stud Framing into Window Sill or Head (mm)	Typical Stud		For Single Track	For Single Stud Plus 2 Tracks
300	41 x 89	x 0.879	1.62	2.58
		x 1.146	1.86	2.80
		x 1.438	2.16	2.97
	41 x 152	x 0.879	2.03	3.25
		x 1.146	2.38	3.73
		x 1.438	3.01	4.14
750	41 x 89	x 0.879	1.45	2.39
		x 1.146	1.68	2.66
		x 1.438	2.02	2.82
	41 x 152	x 0.879	1.85	3.05
		x 1.146	2.20	3.53
		x 1.438	2.82	3.98
1200	41 x 89	x 0.879	1.32	2.23
		x 1.146	1.54	2.53
		x 1.438	1.91	2.70
	41 x 152	x 0.879	1.70	2.88
		x 1.146	2.04	3.35
		x 1.438	2.65	3.84

Window Sill/Head Notes

1. The window sill/head members span horizontally to the built-up jamb studs and are subject to wind load alone. Sill/head members may be single track sections or built-up sections.

2. The distribution of wind loads to the window head/sill is assumed to be as follows (no gravity loads):



where:
w = wind load per unit area
L = window rough opening horizontal width
b = length of studs framing into the window head or sill

3. Window sill/head maximum allowable span lengths are based on the following assumptions:

- Window sill/head maximum allowable span lengths are checked for moment, shear and deflection under wind load alone.
- Moment and shear are checked using $q_{(1/30)}$ hourly wind pressures. Deflection is checked using $q_{(1/10)}$ hourly wind pressures which are approximated by taking 80% of the $q_{(1/30)}$ hourly wind pressures.
- Web crippling has not been checked - web to web shear type end connections are assumed.
- Window head/sill members (built-up or single) match the depth and thickness of the typical stud and/or track.
- Built-up head/sill members are adequately interconnected to share the applied load.
- Track members are unperforated and stud members are perforated.

4. Opening widths may also be limited by lintel requirements *(See Lintel Tables)* or jamb stud requirements *(See Jamb Stud Tables).*

5. See Commentary

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Appendix A:

Section 6c

Wall Openings - Lintel Tables

MAXIMUM LINTEL SPAN (m) INTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: NO CEILING JOISTS & NO ROOF LOADS (CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY)					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	0.0	L1	-	2.03	1.11
		L2	-	2.75	2.03
		L3	-	3.19	2.35
		L4	-	3.11	1.76
		L5	-	3.64	2.68
		L6	-	4.03	2.94
4.8.	0.0	L1	-	1.62	0.89
		L2	-	2.45	1.77
		L3	-	2.84	2.10
		L4	-	2.56	1.40
		L5	-	3.23	2.40
		L6	-	3.59	2.34
6.1	0.0	L1	-	1.27	0.70
		L2	-	2.17	1.40
		L3	-	2.52	1.87
		L4	-	2.01	1.11
		L5	-	2.87	2.13
		L6	-	3.18	1.86

MAXIMUM LINTEL SPAN (m) INTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: ACCESSIBLE ATTIC JOISTS – NO ROOF LOADS					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	0.0	L1	2.32	1.11	0.76
		L2	3.14	2.03	1.52
		L3	3.62	2.35	1.95
		L4	3.56	1.76	1.21
		L5	4.15	2.68	2.22
		L6	4.60	2.94	2.02
4.8.	0.0	L1	2.07	0.89	0.61
		L2	2.80	1.77	1.22
		L3	3.24	2.10	1.75
		L4	3.16	1.40	0.97
		L5	3.70	2.40	1.95
		L6	4.10	2.34	1.61
6.1	0.0	L1	1.66	0.70	0.49
		L2	2.48	1.40	0.97
		L3	2.88	1.87	1.54
		L4	2.63	1.11	0.77
		L5	3.28	2.13	1.55
		L6	3.63	1.86	1.28

MAXIMUM LINTEL SPAN (m) INTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: INACCESSIBLE ATTIC JOISTS – NO ROOF LOADS					
Joint Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	0.0	L1	3.57	1.46	0.91
		L2	4.72	2.33	1.82
		L3	5.10	2.70	2.13
		L4	5.47	2.32	1.45
		L5	6.08	3.08	2.43
		L6	7.01	3.41	2.41
4.8.	0.0	L1	3.18	1.17	0.73
		L2	4.30	2.08	1.46
		L3	4.72	2.42	1.91
		L4	4.87	1.85	1.16
		L5	5.62	2.75	2.18
		L6	6.30	3.05	1.94
6.1	0.0	L1	2.82	0.93	0.58
		L2	3.82	1.86	1.17
		L3	4.36	2.15	1.71
		L4	4.32	1.47	0.92
		L5	5.04	2.45	1.86
		L6	5.59	2.46	1.54

MAXIMUM LINTEL SPAN (m) INTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	3.8	L1	2.60	1.21	0.81
		L2	3.52	2.12	1.62
		L3	4.05	2.46	2.01
		L4	3.98	1.92	1.28
		L5	4.65	2.80	2.29
		L6	5.15	3.11	2.14
4.8.	4.8	L1	2.31	0.97	0.65
		L2	3.13	1.89	1.30
		L3	3.63	2.20	1.80
		L4	3.54	1.53	1.03
		L5	4.14	2.50	2.05
		L6	4.58	2.56	1.71
6.1	6.1	L1	2.05	0.77	0.52
		L2	2.78	1.53	1.03
		L3	3.22	1.96	1.60
		L4	3.14	1.22	0.82
		L5	3.67	2.23	1.65
		L6	4.07	2.03	1.36
ROOF SNOW LOAD = 1.5 kPa					
3.8	3.8	L1	2.24	1.08	0.75
		L2	3.02	2.00	1.49
		L3	3.51	2.32	1.93
		L4	3.42	1.70	1.18
		L5	4.00	2.64	2.20
		L6	4.43	2.84	1.97
4.8.	4.8	L1	1.96	0.86	0.60
		L2	2.69	1.71	1.19
		L3	3.12	2.07	1.73
		L4	3.05	1.36	0.95
		L5	3.56	2.36	1.91
		L6	3.94	2.27	1.58
6.1	6.1	L1	1.54	0.68	0.47
		L2	2.39	1.36	0.95
		L3	2.77	1.84	1.51
		L4	2.44	1.08	0.75
		L5	3.15	2.10	1.51
		L6	3.50	1.80	1.25

MAXIMUM LINTEL SPAN (m) INTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS ROOF SNOW LOAD = 2.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	3.8	L1	1.96	0.97	0.69
		L2	2.69	1.89	1.38
		L3	3.13	2.19	1.86
		L4	3.05	1.53	1.09
		L5	3.56	2.50	2.11
		L6	3.95	2.55	1.83
3.8	4.8	L1	1.55	0.77	0.55
		L2	2.40	1.54	1.10
		L3	2.78	1.96	1.66
		L4	2.45	1.22	0.88
		L5	3.17	2.23	1.77
		L6	3.51	2.03	1.46
3.8	6.1	L1	1.22	0.61	0.44
		L2	2.13	1.22	0.88
		L3	2.47	1.74	1.40
		L4	1.93	0.96	0.69
		L5	2.81	1.95	1.40
		L6	3.11	1.61	1.16
ROOF SNOW LOAD = 2.5 kPa					
3.8	3.8	L1	1.62	0.88	0.65
		L2	2.45	1.75	1.29
		L3	2.84	2.09	1.79
		L4	2.57	1.39	1.02
		L5	3.24	2.38	2.04
		L6	3.59	2.31	1.70
3.8	4.8	L1	1.29	0.70	0.52
		L2	2.18	1.39	1.03
		L3	2.53	1.87	1.60
		L4	2.03	1.11	0.82
		L5	2.88	2.13	1.65
		L6	3.20	1.84	1.36
3.8	6.1	L1	1.01	0.55	0.41
		L2	1.94	1.10	0.82
		L3	2.25	1.66	1.30
		L4	1.60	0.87	0.65
		L5	2.56	1.76	1.30
		L6	2.67	1.46	1.08

MAXIMUM LINTEL SPAN (m) EXTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	4.4	L1	2.27	1.07	0.74
		L2	3.07	1.99	1.47
		L3	3.57	2.31	1.92
		L4	3.48	1.70	1.17
		L5	4.06	2.64	2.18
		L6	4.50	2.84	1.95
3.8	5.4	L1	2.05	0.98	0.69
		L2	2.77	1.91	1.38
		L3	3.22	2.21	1.86
		L4	3.14	1.55	1.10
		L5	3.67	2.52	2.12
		L6	4.05	2.59	1.83
3.8	6.7	L1	1.68	0.88	0.64
		L2	2.49	1.76	1.28
		L3	2.89	2.09	1.79
		L4	2.65	1.39	1.01
		L5	3.29	2.39	2.04
		L6	3.65	2.32	1.69
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	L1	1.95	0.95	0.68
		L2	2.68	1.87	1.35
		L3	3.11	2.18	1.84
		L4	3.04	1.50	1.07
		L5	3.55	2.48	2.09
		L6	3.93	2.51	1.79
3.8	5.4	L1	1.59	0.86	0.63
		L2	2.42	1.71	1.25
		L3	2.81	2.06	1.77
		L4	2.51	1.35	0.99
		L5	3.20	2.35	2.00
		L6	3.55	2.26	1.66
3.8	6.7	L1	1.28	0.76	0.57
		L2	2.17	1.51	1.14
		L3	2.52	1.94	1.69
		L4	2.02	1.20	0.91
		L5	2.87	2.21	1.83
		L6	3.18	2.00	1.51

MAXIMUM LINTEL SPAN (m) EXTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN TRUSS LOADS EXTERIOR WALLS ONLY – NO CEILING JOISTS ROOF SNOW LOAD = 2.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	4.4	L1	1.57	0.85	0.63
		L2	2.41	1.70	1.25
		L3	2.80	2.06	1.76
		L4	2.49	1.35	0.99
		L5	3.19	2.35	2.00
		L6	3.53	2.25	1.65
3.8	5.4	L1	1.28	0.76	0.57
		L2	2.18	1.51	1.14
		L3	2.53	1.94	1.69
		L4	2.03	1.20	0.91
		L5	2.88	2.21	1.83
		L6	3.19	2.00	1.51
3.8	6.7	L1	1.03	0.66	0.52
		L2	1.95	1.32	1.03
		L3	2.27	1.82	1.61
		L4	1.63	1.05	0.82
		L5	2.58	2.07	1.65
		L6	2.72	1.75	1.37
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	L1	1.32	0.77	0.58
		L2	2.21	1.54	1.16
		L3	2.56	1.96	1.70
		L4	2.09	1.22	0.92
		L5	2.92	2.23	1.85
		L6	3.24	2.03	1.53
3.8	5.4	L1	1.07	0.68	0.53
		L2	1.99	1.36	1.05
		L3	2.31	1.84	1.62
		L4	1.70	1.08	0.84
		L5	2.63	2.10	1.68
		L6	2.84	1.80	1.39
3.8	6.7	L1	0.87	0.59	0.47
		L2	1.73	1.18	0.94
		L3	2.08	1.72	1.50
		L4	1.37	0.93	0.75
		L5	2.37	1.88	1.51
		L6	2.29	1.56	1.25

MAXIMUM LINTEL SPAN (m) EXTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	4.4	L1	1.42	0.81	0.61
		L2	2.29	1.62	1.22
		L3	2.66	2.01	1.74
		L4	2.24	1.29	0.96
		L5	3.03	2.29	1.95
		L6	3.36	2.15	1.61
3.8	5.4	L1	1.28	0.77	0.58
		L2	2.18	1.53	1.16
		L3	2.53	1.95	1.70
		L4	2.03	1.21	0.92
		L5	2.88	2.23	1.86
		L6	3.19	2.02	1.54
3.8	6.7	L1	1.14	0.71	0.55
		L2	2.05	1.42	1.10
		L3	2.38	1.88	1.66
		L4	1.80	1.13	0.87
		L5	2.71	2.15	1.76
		L6	3.01	1.88	1.46
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	L1	1.21	0.74	0.57
		L2	2.11	1.48	1.13
		L3	2.45	1.92	1.68
		L4	1.91	1.17	0.90
		L5	2.79	2.19	1.81
		L6	3.10	1.95	1.50
3.8	5.4	L1	1.07	0.69	0.54
		L2	1.99	1.37	1.07
		L3	2.31	1.85	1.63
		L4	1.70	1.09	0.85
		L5	2.64	2.11	1.71
		L6	2.84	1.81	1.41
3.8	6.7	L1	0.94	0.63	0.50
		L2	1.86	1.26	1.00
		L3	2.16	1.77	1.58
		L4	1.49	1.00	0.79
		L5	2.46	2.01	1.60
		L6	2.48	1.66	1.32

MAXIMUM LINTEL SPAN (m) EXTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & ACCESSIBLE ATTIC JOISTS ROOF SNOW LOAD = 2.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	4.4	L1	1.05	0.68	0.53
		L2	1.97	1.35	1.06
		L3	2.29	1.84	1.63
		L4	1.67	1.07	0.84
		L5	2.61	2.09	1.69
		L6	2.78	1.79	1.40
3.8	5.4	L1	0.93	0.62	0.50
		L2	1.85	1.24	0.99
		L3	2.15	1.76	1.57
		L4	1.46	0.99	0.78
		L5	2.45	1.99	1.58
		L6	2.44	1.64	1.31
3.8	6.7	L1	0.80	0.56	0.46
		L2	1.60	1.12	0.91
		L3	2.00	1.68	1.46
		L4	1.26	0.89	0.72
		L5	2.27	1.80	1.46
		L6	2.11	1.49	1.21
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	L1	0.93	0.63	0.50
		L2	1.86	1.25	0.99
		L3	2.16	1.77	1.58
		L4	1.48	0.99	0.79
		L5	2.46	2.00	1.59
		L6	2.46	1.65	1.32
3.8	5.4	L1	0.81	0.57	0.46
		L2	1.62	1.14	0.92
		L3	2.01	1.68	1.47
		L4	1.29	0.90	0.73
		L5	2.29	1.82	1.47
		L6	2.14	1.50	1.22
3.8	6.7	L1	0.70	0.51	0.42
		L2	1.39	1.02	0.84
		L3	1.86	1.59	1.34
		L4	1.10	0.81	0.67
		L5	2.12	1.63	1.35
		L6	1.84	1.35	1.11

MAXIMUM LINTEL SPAN (m) EXTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	4.4	L1	2.03	0.99	0.70
		L2	2.75	1.91	1.40
		L3	3.19	2.22	1.87
		L4	3.11	1.56	1.11
		L5	3.63	2.52	2.13
		L6	4.03	2.60	1.85
3.8	5.4	L1	1.77	0.92	0.67
		L2	2.56	1.83	1.33
		L3	2.97	2.14	1.82
		L4	2.80	1.45	1.06
		L5	3.38	2.44	2.08
		L6	3.75	2.42	1.76
3.8	6.7	L1	1.51	0.84	0.63
		L2	2.36	1.68	1.25
		L3	2.74	2.05	1.77
		L4	2.39	1.33	0.99
		L5	3.12	2.33	2.00
		L6	3.46	2.22	1.65
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.4	L1	1.64	0.88	0.65
		L2	2.46	1.76	1.29
		L3	2.85	2.09	1.80
		L4	2.59	1.39	1.02
		L5	3.25	2.39	2.04
		L6	3.60	2.32	1.71
3.8	5.4	L1	1.40	0.81	0.61
		L2	2.28	1.61	1.21
		L3	2.64	2.01	1.74
		L4	2.21	1.28	0.96
		L5	3.01	2.28	1.94
		L6	3.33	2.13	1.60
3.8	6.7	L1	1.18	0.73	0.56
		L2	2.09	1.45	1.12
		L3	2.42	1.91	1.67
		L4	1.87	1.15	0.89
		L5	2.76	2.17	1.79
		L6	3.06	1.92	1.48

MAXIMUM LINTEL SPAN (m) EXTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: CLEAR SPAN RAFTERS (LOADS EXTERIOR WALLS ONLY) & INACCESSIBLE ATTIC JOISTS ROOF SNOW LOAD = 2.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	4.4	L1	1.36	0.79	0.60
		L2	2.25	1.59	1.20
		L3	2.61	1.99	1.73
		L4	2.16	1.26	0.95
		L5	2.97	2.27	1.91
		L6	3.29	2.10	1.58
3.8	5.4	L1	1.16	0.72	0.56
		L2	2.07	1.44	1.11
		L3	2.40	1.89	1.66
		L4	1.83	1.14	0.88
		L5	2.73	2.16	1.77
		L6	3.03	1.90	1.47
3.8	6.7	L1	0.97	0.64	0.51
		L2	1.89	1.28	1.01
		L3	2.19	1.79	1.59
		L4	1.53	1.01	0.80
		L5	2.50	2.04	1.62
		L6	2.55	1.69	1.34
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.4	L1	1.17	0.72	0.56
		L2	2.08	1.45	1.11
		L3	2.41	1.90	1.67
		L4	1.85	1.15	0.88
		L5	2.75	2.16	1.78
		L6	3.05	1.91	1.47
3.8	5.4	L1	0.99	0.65	0.51
		L2	1.91	1.30	1.02
		L3	2.22	1.80	1.60
		L4	1.56	1.03	0.81
		L5	2.52	2.05	1.64
		L6	2.60	1.72	1.35
3.8	6.7	L1	0.82	0.57	0.46
		L2	1.63	1.14	0.93
		L3	2.02	1.69	1.48
		L4	1.30	0.91	0.73
		L5	2.30	1.83	1.48
		L6	2.16	1.51	1.22

MAXIMUM LINTEL SPAN (m) EXTERIOR AXIAL LOAD BEARING STUD WALL					
ROOF OR CEILING JOIST SUPPORTED: ROOF JOISTS – NO CEILING JOISTS					
ROOF SNOW LOAD = 1.0 kPa					
Joist Trib Width (m)	Truss Trib Width (m)	Lintel Type	NUMBER OF SUPPORTED FLOORS		
			0	**1**	**2**
3.8	4.2	L1	2.47	1.17	0.79
		L2	3.35	2.08	1.58
		L3	3.88	2.41	1.98
		L4	3.79	1.85	1.25
		L5	4.42	2.75	2.26
		L6	4.90	3.05	2.09
ROOF SNOW LOAD = 1.5 kPa					
3.8	4.2	L1	2.13	1.03	0.72
		L2	2.88	1.95	1.44
		L3	3.34	2.26	1.90
		L4	3.26	1.63	1.14
		L5	3.80	2.58	2.16
		L6	4.21	2.72	1.91
ROOF SNOW LOAD = 2.0 kPa					
3.8	4.2	L1	1.77	0.92	0.67
		L2	2.56	1.83	1.33
		L3	2.97	2.14	1.82
		L4	2.81	1.45	1.06
		L5	3.39	2.44	2.08
		L6	3.75	2.43	1.76
ROOF SNOW LOAD = 2.5 kPa					
3.8	4.2	L1	1.47	0.83	0.62
		L2	2.33	1.66	1.23
		L3	2.71	2.03	1.76
		L4	2.32	1.31	0.98
		L5	3.08	2.32	1.98
		L6	3.42	2.19	1.63

Lintel Notes

1. Legend

   L1 = 2 - 41 x 203 x 1.146 joists (peforated)
   L2 = 2 - 41 x 203 x 1.438 joists (peforated)
   L3 = 2 - 41 x 203 x 1.811 joists (peforated)
   L4 = 2 - 41 x 254 x 1.438 joists (peforated)
   L5 = 2 - 41 x 254 x 1.811 joists (peforated)
   L6 = 2 - 41 x 305 x 1.811 joists (peforated)

   Joist material, geometry and properties conform to the Joist Section Properties Table and Commentary Item 5.

2. Maximum allowable lintel span lengths are from centre of bearing to centre of bearing. The resulting window or door rough opening width may be smaller than the lintel span.

3. Lintels have been sized on the assumption that they resist uniformly distributed gravity loads only. Moment and shear have been checked for the 1.25D + 1.5L load case. Deflection has been checked for specified live load with a deflection limit of L/360. Web crippling has not been checked, therefore, web stiffeners or end connections not susceptible to web crippling are required.

4. Point loads in the span of the lintels may require additional engineering *(primarily combined bending and web crippling)* and web stiffeners.

5. The top of the lintels is assumed to be restrained against lateral instability by connection to the top track which in turn is connected to the underside of the floor assembly above.

6. Opening widths may also be limited by window sill/head member requirements *(See Window Sill/Head Tables)* or jamb stud requirements *(See Jamb Stud Tables)*.

7. See Commentary

Appendix B:
Bracing Requirements for Walls

Table X-1: Number of Strap Braces per Wall – Wind Loads

Wind q (1 in 30) (kPa)	Longest Building Dimension (m)	**Wall height 2.464 m (8'-1")**		
		Number of floors supported		
		0	1	2
0.4	6	1	2	3
	10	1	3	5
	14	2	4	7
	18	2	5	8
0.5	6	1	2	4
	10	2	4	6
	14	2	5	8
	18	3	6	10
0.6	6	1	3	4
	10	2	4	7
	14	2	6	10
	18	3	8	12
0.8	6	2	4	n/a
	10	2	6	n/a
	14	3	8	n/a
	18	4	10	n/a

Wind q (1 in 30) (kPa)	Longest Building Dimension (m)	**Wall height 2.769 m (9'-1")**		
		Number of floors supported		
		0	1	2
0.4	6	1	2	3
	10	2	3	5
	14	2	5	7
	18	2	6	9
0.5	6	1	3	4
	10	2	4	7
	14	2	6	9
	18	3	7	12
0.6	6	1	3	n/a
	10	2	5	n/a
	14	3	7	n/a
	18	3	9	n/a
0.8	6	2	4	n/a
	10	3	6	n/a
	14	3	9	n/a
	18	4	11	n/a

Wind q (1 in 30) (kPa)	Longest Building Dimension (m)	**Wall height 3.073 m (10'-1")**		
		Number of floors supported		
		0	1	2
0.4	6	1	2	4
	10	2	4	6
	14	2	5	8
	18	3	6	10
0.5	6	1	3	n/a
	10	2	5	7
	14	2	6	10
	18	3	8	n/a
0.6	6	2	3	n/a
	10	2	5	n/a
	14	3	7	n/a
	18	4	9	n/a
0.8	6	2	4	n/a
	10	3	7	n/a
	14	4	10	n/a
	18	5	12	n/a

Wind q (1 in 30) (kPa)	Longest Building Dimension (m)	**Wall height 3.683 m (12'-1")**		
		Number of floors supported		
		0	1	2
0.4	6	1	3	4
	10	2	4	7
	14	2	6	10
	18	3	8	12
0.5	6	2	3	n/a
	10	2	5	n/a
	14	3	7	n/a
	18	4	9	n/a
0.6	6	2	4	n/a
	10	3	6	n/a
	14	3	9	n/a
	18	4	11	n/a
0.8	6	2	n/a	n/a
	10	3	n/a	n/a
	14	4	n/a	n/a
	18	5	n/a	n/a

Note: n/a identifies those cases where the wall length is insufficient to install the number of braces needed.

Table X-1 (Cont'd): Number of Strap Braces per Wall – Wind Loads

Wind q (1 in 30) (kPa)	Longest Building Dimension (m)	**Wall height 4.293 m (14'-1")**		
		Number of floors supported		
		0	1	2
0.4	6	1	3	n/a
	10	2	5	n/a
	14	3	7	n/a
	18	3	9	n/a
0.5	6	2	4	n/a
	10	2	6	n/a
	14	3	10	n/a
	18	4	n/a	n/a
0.6	6	2	n/a	n/a
	10	3	7	n/a
	14	4	10	n/a
	18	5	n/a	n/a
0.8	6	2	n/a	n/a
	10	4	n/a	n/a
	14	5	n/a	n/a
	18	6	n/a	n/a

Note: n/a identifies those cases where the wall length is insufficient to install the number of braces needed.

Table X-2: Number of Strap Braces per Wall – Seismic Loads

Single Storey or Upper Floor of Multi Storey																	
Max. Wall Height 4.293 m (14'-1")																	
Zonal Velocity v	Roof snow load (kPa)	Building dimension perpendicular to ridge (m)															
		6				10				14				18			
		Building dimension parallel to ridge (m)															
		6	**10**	**14**	**18**	**6**	**10**	**14**	**18**	**6**	**10**	**14**	**18**	**6**	**10**	**14**	**18**
0.05	**1.0**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
	1.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
	2.0	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2
	2.5	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2
0.1	**1.0**	1	1	1	1	1	1	1	2	1	1	2	2	1	2	2	3
	1.5	1	1	1	1	1	1	2	2	1	2	2	2	1	2	2	3
	2.0	1	1	1	1	1	1	2	2	1	2	2	3	1	2	3	3
	2.5	1	1	1	2	1	1	2	2	1	2	2	3	2	2	3	4
0.15	**1.0**	1	1	1	2	1	1	2	2	1	2	2	3	2	2	3	4
	1.5	1	1	1	2	1	2	2	3	1	2	3	3	2	3	3	4
	2.0	1	1	2	2	1	2	2	3	2	2	3	4	2	3	4	5
	2.5	1	1	2	2	1	2	2	3	2	2	3	4	2	3	4	5
0.2	**1.0**	1	1	2	2	1	2	2	3	2	2	3	4	2	3	4	5
	1.5	1	1	2	2	1	2	3	3	2	3	3	4	2	3	4	5
	2.0	1	2	2	2	2	2	3	4	2	3	4	5	2	4	5	6
	2.5	1	2	2	3	2	2	3	4	2	3	4	5	3	4	5	7

First Storey of a Two Storey or Second Storey of a Third Storey																	
Max. Wall Height 4.293 m (14'-1")																	
Zonal Velocity v	Roof snow load (kPa)	Building dimension perpendicular to ridge (m)															
		6				10				14				18			
		Building dimension parallel to ridge (m)															
		6	**10**	**14**	**18**	**6**	**10**	**14**	**18**	**6**	**10**	**14**	**18**	**6**	**10**	**14**	**18**
0.05	**1.0**	1	1	1	2	1	1	2	2	1	2	2	3	2	2	3	3
	1.5	1	1	1	2	1	1	2	2	1	2	2	3	2	2	3	3
	2.0	1	1	1	2	1	2	2	2	1	2	2	3	2	2	3	3
	2.5	1	1	1	2	1	2	2	2	1	2	2	3	2	2	3	4
0.1	**1.0**	1	2	2	3	2	2	3	4	2	3	4	5	3	4	5	6
	1.5	1	2	2	3	2	2	3	4	2	3	4	5	3	4	5	6
	2.0	1	2	2	3	2	3	3	4	2	3	4	5	3	4	5	6
	2.5	1	2	2	3	2	3	3	4	2	3	4	5	3	4	5	7
0.15	**1.0**	2	2	3	4	2	3	4	5	3	4	5	7	4	5	7	8
	1.5	2	2	3	4	2	3	4	5	3	4	6	7	4	5	7	9
	2.0	2	3	3	4	3	4	5	6	3	5	6	7	4	6	7	9
	2.5	2	3	3	4	3	4	5	6	3	5	6	8	4	6	8	10
0.2	**1.0**	2	3	4	n/a	3	4	5	7	4	5	7	9	5	7	9	11
	1.5	2	3	4	n/a	3	4	6	7	4	6	7	9	5	7	9	11
	2.0	2	3	4	n/a	3	5	6	7	4	6	8	10	5	7	10	12
	2.5	2	3	4	n/a	3	5	6	8	4	6	8	10	5	8	10	n/a

Note:
1) n/a identifies those cases where the wall length is insufficient to install the number of braces needed.
2) For seismic loading cases where $Z_a/Z_v = 1.0$ the number of braces can be reduced by 30%, and when $Z_a/Z_v < 1.0$ the number of braces can be reduced by 45%.

Table X-2 (Cont'd): Number of Strap Braces per Wall – Seismic Loads

First Storey of a Three Storey																	
Max. Wall Height 4.293 m (14'-1")																	
Zonal Velocity v	Roof snow load (kPa)	Building dimension perpendicular to ridge (m)															
		6				**10**				**14**				**18**			
		Building dimension parallel to ridge (m)															
		6	**10**	**14**	**18**	**6**	**10**	**14**	**18**	**6**	**10**	**14**	**18**	**6**	**10**	**14**	**18**
0.05	**1.0**	1	2	2	2	2	2	3	3	2	3	3	4	2	3	4	5
	1.5	1	2	2	2	2	2	3	3	2	3	3	4	2	3	4	5
	2.0	1	2	2	2	2	2	3	3	2	3	3	4	2	3	4	5
	2.5	1	2	2	2	2	2	3	3	2	3	3	4	2	3	4	5
0.1	**1.0**	2	3	3	4	3	4	5	6	3	5	6	7	4	6	7	9
	1.5	2	3	3	4	3	4	5	6	3	5	6	7	4	6	7	9
	2.0	2	3	3	4	3	4	5	6	3	5	6	8	4	6	8	9
	2.5	2	3	4	4	3	4	5	6	4	5	6	8	4	6	8	10
0.15	**1.0**	3	4	n/a	n/a	4	5	7	n/a	n/a	7	8	10	n/a	n/a	10	n/a
	1.5	3	4	n/a	n/a	4	5	7	n/a	n/a	7	9	n/a	n/a	n/a	n/a	n/a
	2.0	3	4	n/a	n/a	4	5	7	n/a	n/a	7	9	n/a	n/a	n/a	n/a	n/a
	2.5	3	4	n/a	n/a	4	6	7	n/a	n/a	7	9	n/a	n/a	n/a	n/a	n/a
0.2	**1.0**	3	n/a	n/a	n/a	n/a	7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	1.5	3	n/a	n/a	n/a	n/a	7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2.0	3	n/a	n/a	n/a	n/a	7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	2.5	4	n/a	n/a	n/a	n/a	7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Note:
1) n/a identifies those cases where the wall length is insufficient to install the number of braces needed.
2) For seismic loading cases where $Z_a/Z_v = 1.0$ the number of braces can be reduced by 30%, and when $Z_a/Z_v < 1.0$ the number of braces can be reduced by 45%.