



The Grizzly Paw Brewing Company

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Photo: Canadian Timberframes Limited

Cover Photo: Steve Nagy Photography

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Introduction

In 1996, The Grizzly Paw Brewing Company began brewpub restaurant operations in Canmore, Alberta, at the doorstep of Banff National Park. Since then, the business has attained microbrewery status, and success and growth have led to the need for a brewery building to meet present and future needs for supplying beer and carbonated drinks to Canmore, Banff, Calgary, and other communities across Alberta.

The purpose of the new brewery is to augment the capacity of the existing brewpub by a factor of 8 to 10 to meet increasing demand for the Grizzly Paw brands. The new building will also have hospitality space suited to tours and receptions once the brewing facility is running smoothly.

The building is located on a one-acre site in a commercial zone at the gateway to Canmore (**Figure 1**). The brewery was initially designed to be a steel building, but preliminary cost estimates were over-budget. An alternative conceptual design was made based on exposed heavy timber construction. The resulting timber building met all the building science challenges, saved money, and better met the Rocky Mountain architectural design motif of Canmore. It provides a pleasing appearance that will attract additional publicity and be very conducive to guided tours through the brewery.

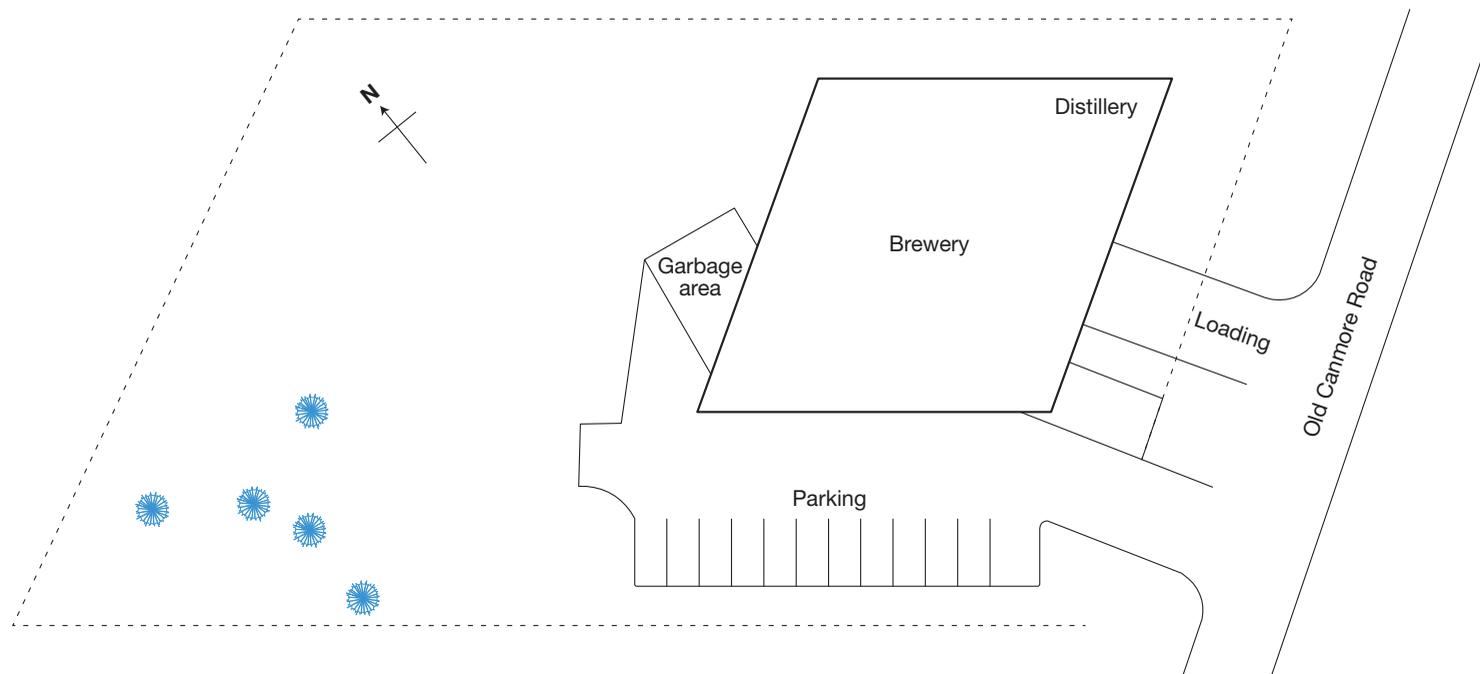


FIGURE 1 Site plan

Building Description

The design intent was to create a functional, compact brewery that complimented its scenic location. The serrated roof profile accommodates large windows which provide natural light to the interior and sightlines into the brewery from the adjacent highway. The additional height provided by the roofline accommodates the brewery hopper and equipment.

The main level of the building (**Figure 2**) houses mechanical and brewing equipment as well as the maturation, cold storage, bottling and shipping areas. There is a separate distillery area intended for future use that is separated from the brewery by a firewall.

The middle level is currently undeveloped but will be used in the future for packaging and administration. The brewing vessels are showcased on the third level, visible not only from the adjacent highway through the upper-level windows but also from the future tasting room. The grain for the brewing process is delivered to the third level from the outdoor grain storage silo via an auger conveyor.

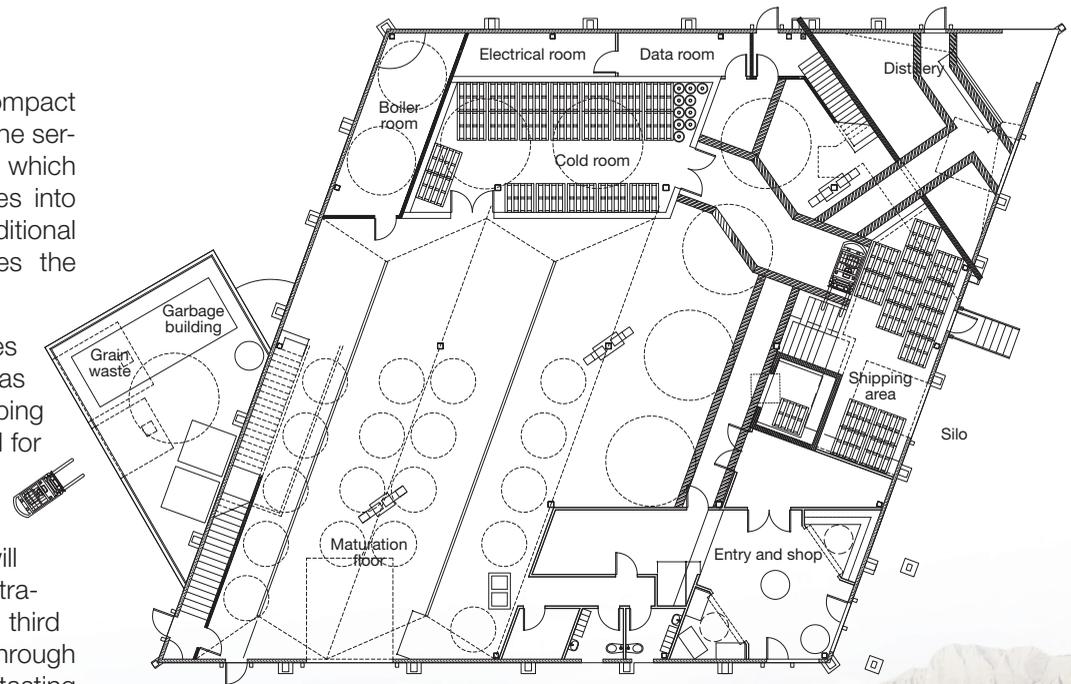


FIGURE 2 Main floor plan



The serrated roof profile mimics the Rocky Mountain backdrop in Canmore
Photo: Canadian Timberframes Limited

Design

The Grizzly Paw Brewery is a post-and-beam structure (**Figure 3**) comprised of dimensional and glulam Douglas fir timber. The largest glulam beams are 1-m (40-in.) deep. The roof, supported by wood beams and purlins, is comprised of:

- slate-appearance roof tile made of recycled rubber
- peel-and-stick membrane;
- 11 mm (7/16 in.) OSB sheathing;
- air space with 38 x 140 mm (2x6) wood strapping and counter-strapping;
- ISO board insulation;
- 29 mm (1-1/8 in.) fire-retardant-treated plywood; and
- heavy-timber structure.

The timber structure is mostly situated on the exterior of the building envelope and protected by wide overhangs. In addition, the timber was designed with details that do not trap water, and the connectors are galvanized. The infill panels are site-fabricated steel frame-walls, surfaced with a painted metal skin, and insulated with spray foam. The timber structure supports the roof loads and secures the infill panels. The infill panels transfer the weight of the windows to the frame and support the cladding.

Beginning at the redesign concept stage and throughout design and fabrication, the timber manufacturer/supplier used building information modeling (BIM) to create a 3-D model indicating member sizes and connection arrangements. This was a valuable tool for coordinating the entire design team. Model information was easily used to produce shop drawings and to control the computer numerical control (CNC) router used to fabricate the timber components.

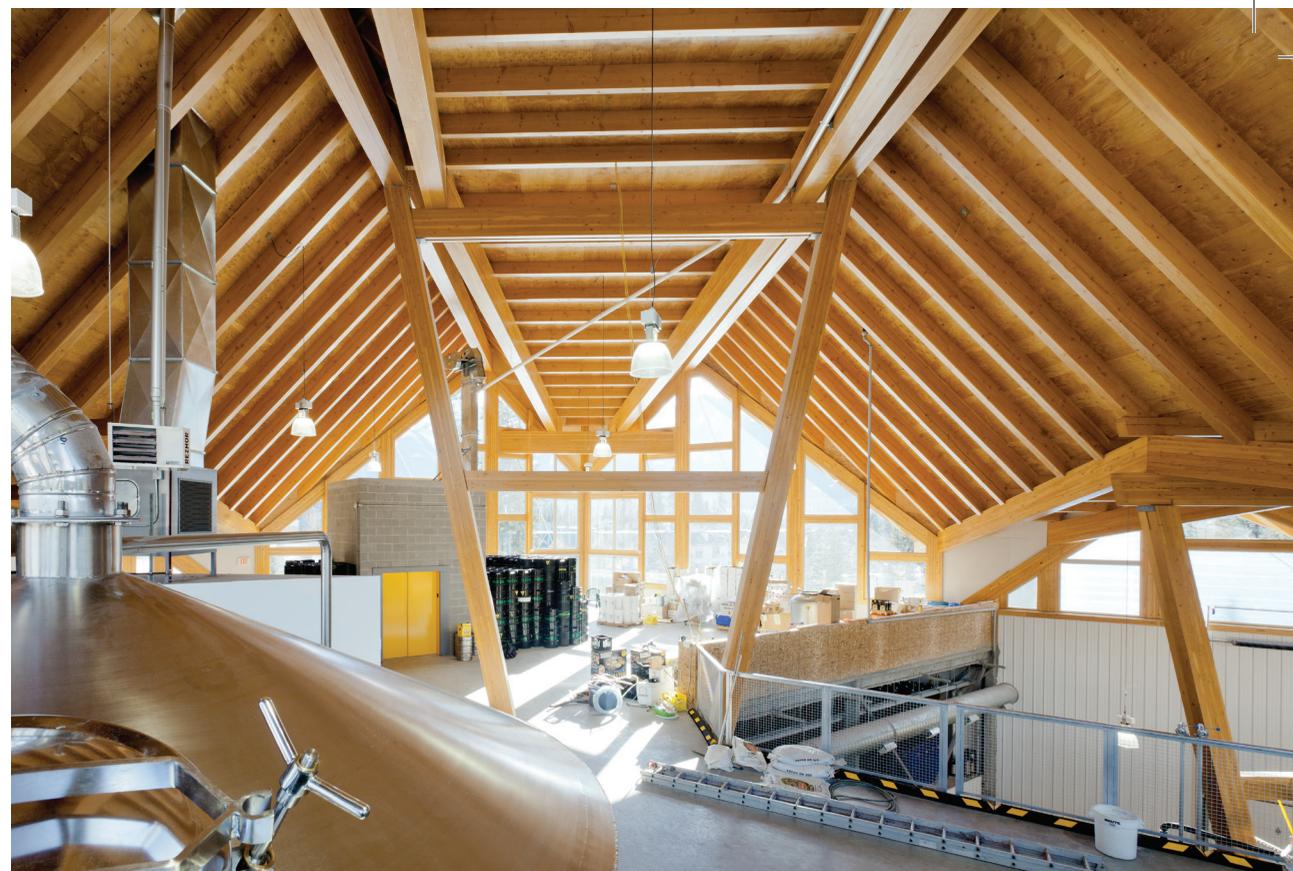


Photo: Steve Nagy Photography

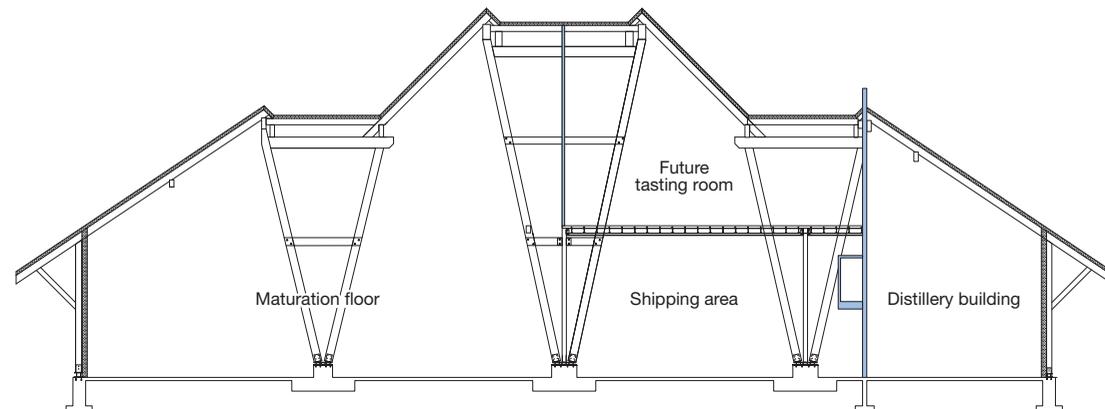


FIGURE 3 Diagonal section through the building



Photo: Steve Nagy Photography

Cost is based on the volume of lumber, the number of pieces and the number of connections; all of which can be calculated by means of the 3-D modelling. This facilitated assessing the cost of changes to the design. The model was valuable for avoiding conflicts and visualizing how the framing intersected (see **Figure 4b**).

During the design phase, there was close communication between the structural engineer, the architectural team and the timber supplier regarding the design and appearance of connections and the timber specifications. All connections were reviewed for constructability to avoid installation problems. The use of computer controlled modelling, design and fabrication vastly reduced the labour and cost for fabricating complicated designs.

RISA 3-D structural engineering software was used for structural analysis and WoodWorks® software was used to check member sizes and connection capacities. Structural steel was used in some locations due to very high loads and the durability requirements of the brewery floor.

Canadian Timberframes' extensive experience in timber selection and processing, utilization of design software, and computerized manufacturing equipment facilitated the production of the timber and connections.

Although the contractor had not previously taken on a timber building of this size, he had experience building large timber frame homes so the timber and the connections were assembled easily, keeping the project on schedule and on budget.

Builder Troy Weatherhog noted "The building was a positive experience. There were no surprises. The wood construction was 10% more economical than the steel options priced. The assembly of the pre-manufactured members and connections went smoothly. In those rare cases where small adjustments were required on site, they were easy to do. The project could have been completed ahead of schedule but there was a delay in acquiring some of the brewing equipment."

Canadian Timberframes sources, 90% of its timber (Douglas fir) locally, from sustainable and ethically managed forest stands within a 2-hour drive of the plant. The timber is milled at one of its two sawmills. Checking is limited by using two-year old logs that have been cant-cut to promote drying. Logs are milled to first obtain the largest and best quality products. Secondary products (boards and slabs) are sorted by grade and quality for use in stairs, trim, siding and decking and other products. Shavings and sawdust from manufacturing are provided free to local farmers. The remaining bark slabs and offcuts (less than 5%) are ground and trucked to a burner/steam unit in Golden, BC, to generate electric power for Kicking Horse Mountain Resort.

Cost

The Grizzly Paw Brewery was originally designed as a steel structure (**Figure 4a**). The cost of steel, the complexity of the serrated roof-line, and the parallelogram layout caused the preliminary cost estimate to exceed the budget. Canadian Timberframes was consulted and preliminary timber designs and cost estimates were developed. The cost for the timber building was significantly less than the steel quotes. It was concluded that a wood structure could meet the budget and all other performance requirements. In fact, the complicated roofline which had been problematic for steel fabricators was a natural fit for the timber supplier's experience and computerized shaping equipment (**Figure 4b**). In addition, the timber structure better suits the Rocky Mountain architectural style typical of the area, and will be an appealing aesthetic feature during public tours.

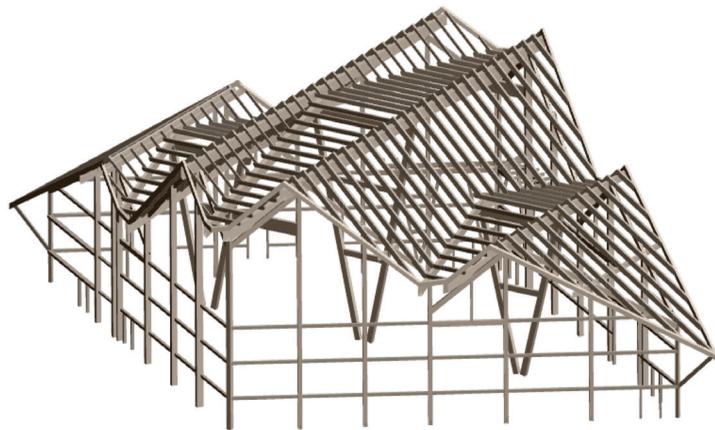


FIGURE 4a 3-D model of the original steel design

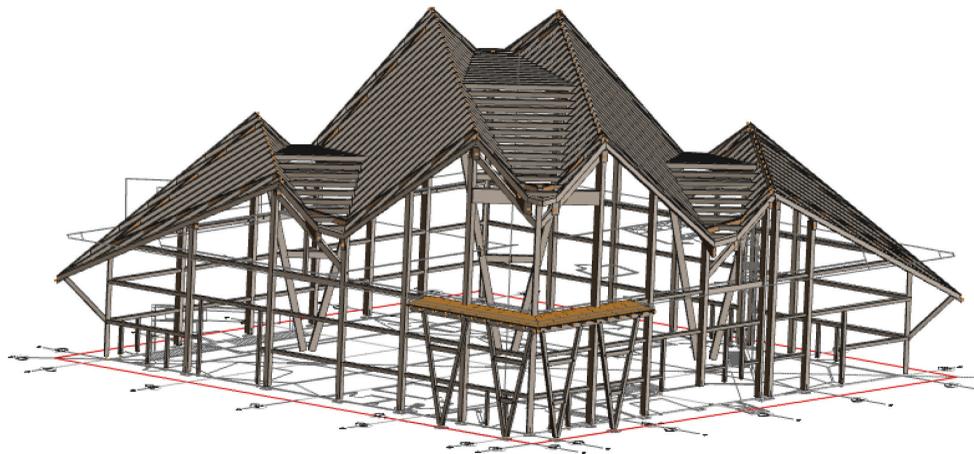


FIGURE 4b 3-D model of the wood design

Timber Specifications

This page describes the timber loads, specifications and other information for the structural timber.



PROJECT DESCRIPTION

Project Name : The Old Canmore Road Brewery
 City : Canmore
 Province : AB
 Legal Lot Description :
 Applicable Building Code : ABC 2006

Timber Frame Engineer



Head Office: 100 Ave 100 Street, Canmore, AB T1P 2A7 | 403.298.2210
 Calgary Office: 1115 - 10th Street SE, Calgary, AB T2G 2P6 | 403.298.2210

DESIGN LOADS

Roof:
 Dead Loads : Framing, Decking & Insulation : 0.47kPa
 Ceiling, Mechanical & Electrical : 0.25kPa
 Total Dead Loads : 0.72kPa
 Live Loads : Ground Snow Load (Ss) : 3.50kPa
 Rain Load (Sr) : 0.10kPa

Floors:
 Dead Loads : Partition : 1.00kPa
 Mechanical & Finished : 0.50kPa
 4" Concrete Topping : 2.40kPa
 Hambro Joist Selfweight : 0.95kPa
 Total Dead Loads : 4.85kPa
 Live Loads : Floor : 4.80kPa

Wind Loads : Hourly Wind Pressure (1/50) : 0.50kPa
 Seismic Data : Sa (0.2) = 0.24
 Sa (0.5) = 0.70
 Sa (1.0) = 0.07
 Sa (2.0) = 0.04
 FGA = 1.2

TIMBER FRAME NOTES

- TF. 1: Timber Frame Drawings are to be read in conjunction with architectural and structural drawings.
- TF. 2: Temporary support and temporary bracing of the timber and other elements during construction is the responsibility of the contractor.
- TF. 3: Timber Frame has been designed for gravity and lateral loads.
- TF. 4: Joinery is cut to a tolerance not to exceed +/-1/16" of specified dimensions.
- TF. 5: Refer to specific joinery details where specified.
- TF. 6: Provide mechanical anchorage, by others, of timber frame posts to the foundation or substructure by means of a framing strap, knife plate, or similar.
- TF. 7: Where beam pockets are noted, structural support is to be designed and provided by others.

MATERIAL SPECIFICATIONS

Timber u.n.o. on drawings : (NLGA visual grading rules)
 > Species : D.FIR
 > Grade : No.1 or better
 > Finish Size : 1/2" under nominal dimension of X-section prior to seasoning. (EG. shown 7-1/2"x7-1/2" = called 8x8)

Glulam (To CAN/CSA 0122-06)
 > Species : D.FIR
 > Grade : 24F-E for single span beam
 24F-EX for 2 or more span continous beams
 16C-E for columns

Hardware

- > Bolts : ASTM A307
- > Threaded Rod : ASTM A307 u.n.o.
- > Lag Bolt : ASTM A307
- > Clevis : ASTM A668 Class 'F'
- > Drift Pin : ASTM A307 or CSA CAN3-G40.21 300W
- > Screws : GRK RSS or Assy
- > Washers : Maleable cast iron
- > Split Rings : ø=2-1/2" or ø=4" as specified
- > Shear Plates : ASTM A45 grade 32510
- > Tension Rod : ASTM A449

Custom Hardware

- > Fabricated to CAN/CSA S16.1
- > Steel to CSA CAN3-G40.21-04 with the following grades

Structural shapes :	350W
Hollow structural sections:	350W
Column base plates :	300W
Clevises :	300W
Gussets :	300W
Plates :	300W
Miscellaneous plates :	300W
Pipe sections :	ASTM A53, 241W

Hot dip galvanize all hardware permanently exposed to weather or where staining of timbers is a concern. All finishes to client or architects specifications.

WELD NOTES

- 1: Welding to be metal arc welding to CSA W59-M1989 by welders approved by the Canadian Welding Bureau to the requirements of CSA W47.1
- 2: Weld reinforcement steel to CSA W185. Use weldable reinforcement to CSA G30.18 Grade 400. use E49XX electrodes.
- 3: Minimum size of field weld, 2mm less than the thickness of the material but not less than 6mm.
- 4: Touchup all field welds with primer after slag has been removed.
- 5: All fabricated plates to be welded with a minimum 10 continuous fillet weld u.n.o.

JOINERY SPECIFICATIONS

Tenons :

- > u.n.o. 2" wide tenons in members greater than 6" and 1-5/8" in members equal or less than 6" wide.
- > u.n.o. 2" wide tenons are 4-1/2" long and the 1-5/8" wide tenons are 3-1/2" long
- > depth may be reduced in cases of tenon interference (see details)
- > both side walls of mortises shall be greater than or equal to the mortise width.

Housings :

- > 5/8" housings for braces and struts
- > min. 1" housings or sloped shoulders for beams, rafters, purlins, jpoists and all other members. -Larger housings may be specified.
- > min. relish below housings on receiving member to be 1/4 of the receiving member depth. Larger distance may be specified.

Pegs :

- > 1" pegs for all connections except when both male and female members are smaller than 6" (in smaller direction).
- > pegs are kiln-dried, clear, straight-grain, defect free white oak, slope of grain less than 1:15.
- > Min. peg end distance (from center of peg to the end of the tenon) is 2x peg diameter.
- > Min. peg edge distance (from center of peg to the face of the mortised member) is 2.5x peg diameter.
- > peg spacing is 2.5x peg diameter O.C. u.n.o.
- > pegs to be located as close to the bearing surface as possible without exceeding above specification.
- > 3 or more pegs on a joint, move pegs by 1/2 x pegø perpendicular to grain direction (not more than 2 pegs in the same grain line)

Wedges, Splines, and free Tenons :

- > fabricated from a clear, straight-grain, defect free wood stock with a specific gravity equal to or exceeding that of the receiving members.

Common Rafters :

- > house rafters 1" where flush framed
- > or birdsmouth with 1-1/2" minimum seat
- > birdsmouth depth not to exceed 1/4 of the rafter height
- > attach with spikes or ø=3/8" GRK RSS (min. 3" penetration in supporting member)

Purlins and Joists :

- > house 1" into supporting member u.n.o.
- > attach with ø=3/8" GRK RSS (opposing screws set at 45° angle)

Hold Downs, Hangers and Strips :

- > simpson strong-tie as specified on foundation or framing plans (by others unless specifically detailed on these drawings).

NOTES

- 1) Do not scale these drawings.
- 2) All measurements are rounded to 1/8".
- 3) All measurements have to be checked with site measurements.
- 4) These drawings are only for the timber frame of the project.
- 5) Use these drawings only with the approval from the engineer.
- 6) Compare drawings with architectural and site measurements.

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**The Old Canmore
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SHEET TITLE :

**Project
 Information
 Sheet**

SHEET NO.:

1 OF 18

Fire Safety

The Grizzly Paw Brewery was designed as two separate buildings in accordance with the Alberta Building Code. The first building, the brewery (brewhouse, maturation floor, storage, and packaging areas), is classified as a Group F, Division 2 – Medium Hazard Industrial occupancy. It has a subsidiary occupancy (the tasting area and function room), which is a Group A, Division 2 – Assembly occupancy. The second building, the distillery, is classified as a Group F, Division 1 – High Hazard Industrial occupancy. The 4-hour firewall separation between the two occupancies was achieved with a core-filled, concrete block wall.

Access for fire-fighting equipment is provided on two sides. The building area and number of storeys for both buildings did not necessitate the installation of automatic fire sprinkler protection. The building floor areas are as follows:

Brewery (main level)	693.5 m ²	(7,333 ft. ²)
Middle level (undeveloped)	432 m ²	(4,647 ft. ²)
Upper level	170 m ²	(1,827 ft. ²)
Total (developed)	1,295.5 m²	(13,807 ft.²)
Distillery (single-storey, undeveloped)	50.0 m ²	(535 ft. ²)

The majority of the structure is constructed of timber. Some of the timber members were slightly upsized to meet the minimum size required to qualify as heavy timber construction. This permitted it to be used where the Code permits combustible construction with a 45-minute fire rating. Structural steel was used to support some of the heaviest process equipment. The 45-minute rating for the steel was achieved with a spray-applied cementitious layer.

The plywood roof construction meets the minimum requirements for heavy timber construction, providing a 45-minute fire resistance rating by using a thicker (1-1/8 in.) tongue-and-groove plywood custom-made for the project. Type X gypsum wallboard was used to provide the minimum fire-resistance rating for partition walls between the brewery, the tasting room and zones of safety.

There are two fire egress stairs that can be connected to the middle level once it is completed. While the staff required for the brewhouse and packaging area is less than 10 people, the fire exits are designed to accommodate the additional people who will patronize the upper-level tasting room in the future.

More Reasons for Using Wood

The United Nations' Intergovernmental Panel on Climate Change (IPCC) deems buildings to be the greatest opportunity for making considerable reductions in carbon dioxide emissions. The IPCC also recognizes the tremendous role forests and wood products can play in mitigating climate change by both avoiding limiting the amount of harmful greenhouse gas emissions, while sequestering atmospheric carbon in wood.

Carbon Dioxide

Carbon dioxide is a key driver of global warming and carbon is a major ingredient of wood. As trees grow, they draw carbon dioxide from the atmosphere and, using solar energy, breakdown the component elements, converting the carbon into wood fibre (50% of wood is carbon) and releasing oxygen back into the atmosphere. If trees in sustainably managed forests are harvested before they decay or burn and used in construction, the carbon is stored for the duration of service life of the wood products, while new trees are being planted to begin the carbon cycle again.

Wood products remove more carbon dioxide from the air than the amount that is emitted during the harvesting, transportation and manufacturing processes. This means wood products actually have a negative carbon (greenhouse gas) footprint. As well, for every tonne of wood grown, more than 0.7 tonne of life-giving oxygen is produced.

Specifying wood in public procurement can help fulfill national and local climate change programmes. Encouraging the use of wood products can act as a greener alternative to more

Carbon Summary



Results



Volume of wood products used:
300 cubic meters (10594 cubic ft) of lumber and sheathing



U.S. and Canadian forests grow this much wood in:
1 minutes



Carbon stored in the wood:
239 metric tons of carbon dioxide



Avoided greenhouse gas emissions:
509 metric tons of carbon dioxide



Total potential carbon benefit:
748 metric tons of carbon dioxide

Equivalent to:



143 cars off the road for a year



Energy to operate a home for 64 years

Project Name: Grizzly Paw Brewery carbon calculation
Date: January 24, 2013

Results from this tool are estimates of average wood volumes only. Detailed life cycle assessments (LCA) are required to accurately determine a building's carbon footprint. Please refer to the References and Notes' for assumptions and other information related to the calculations.



Photo: Steve Nagy Photography

fossil-fuel intensive materials. Substituting a cubic metre of wood for other construction materials (concrete, masonry blocks or clay bricks) results in a significant average savings of 0.75 to 1.0 tonnes of CO₂. (International Institute for Environment and Development <http://www.iied.org>)

Carbon Footprint

The use of wood products has positive impacts on a building's carbon footprint in two ways:

1. The wood acts as a carbon store for as long as the building exists; and,
2. The high emissions associated with the use of other materials are avoided.

The wood volumes used to construct the Grizzly Paw Brewery were:

Glulam columns and beams	130.4 m ³
Solid sawn columns and beams	102.2 m ³
Plywood: 1-1/8 and 1/2 in. sheets	49.2 m ³
OSB: 7/16 in. sheets	18.2 m ³
Total	300 m³

The on-line Carbon Calculator tool (<http://www.cwc.ca/index.php/en/resources/electronic-tools>) can be used to calculate the amount of amount of carbon sequestered in the wood products as well as the carbon dioxide emissions avoided when wood components are used. For the Grizzly Paw Brewery, equivalent carbon dioxide stored in the wood is about 239 tonnes. In addition, the emissions avoided by using wood rather than other structural materials are estimated to be about 509 tonnes, resulting in a net carbon benefit of 748 tonnes. This is about the same impact as removing 143 vehicles from the road for a year or avoiding the CO₂ emissions from operating a home for 64 years. The amount of wood in this building is grown by managed forests in Canada and the United States in less than one minute!

For more information about the benefits of using Canadian forest products visit: www.feel-good.ca

As environmental awareness grows, building professionals are finding wood is an excellent choice for green construction designs that minimize the use of energy, water and materials, and reduce negative impacts on human health and the environment. Wood is a high-performance and versatile choice for any new construction or renovation. Wood is light in weight, yet strong. It has excellent load-bearing and thermal properties, is easy to work with, and is well suited for large or small projects. Wood adds warmth and beauty to any building and has been shown to enhance the well-being of occupants.

Conclusion

The Grizzly Paw brewery was originally designed as a steel building. Wood construction saved cost and resulted in a building that better suits the Rocky Mountain style typical of Canmore. It provides a highly functional accommodation for the brewing and manufacturing processes, and a superior ambiance for future special functions.



Photo: Steve Nagy Photography

Project Team

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islengineering.com

Electrical and Mechanical Engineer

Hatch Mott MacDonald
Hemisphere Engineering
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Calgary, AB T2R 0E5
Tel: 403-245-6446
www.hemisphere-eng.com

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Tel: 403-609-3992
www.mcelhanney.com

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www.canadiantimberframes.com

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Photo: Canadian Timberframes Limited

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 Atlantic Wood WORKS!: 1-902-667-3889
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