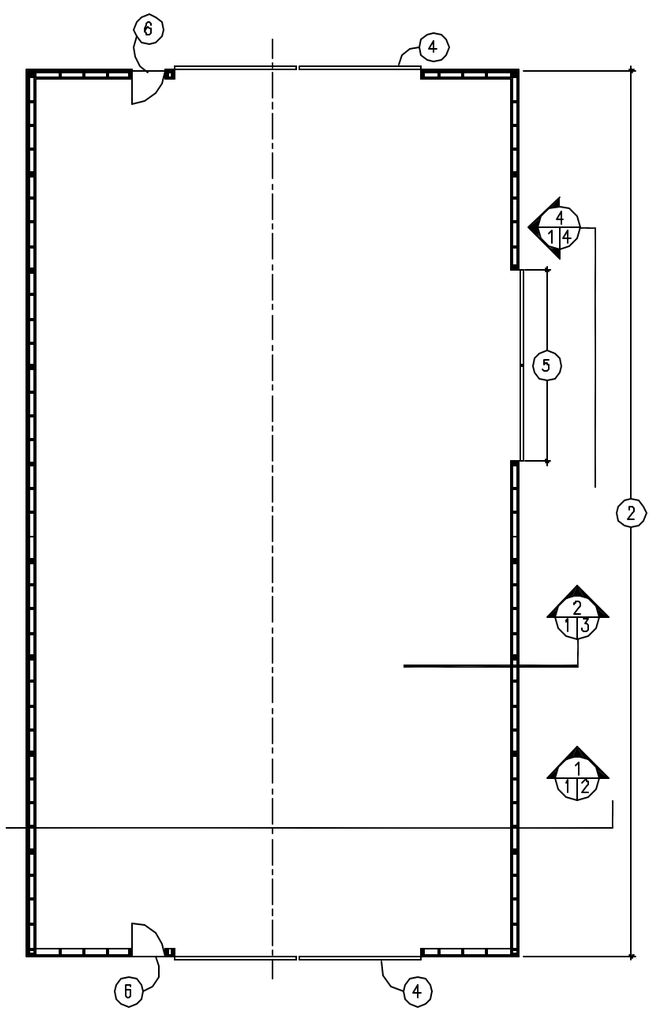


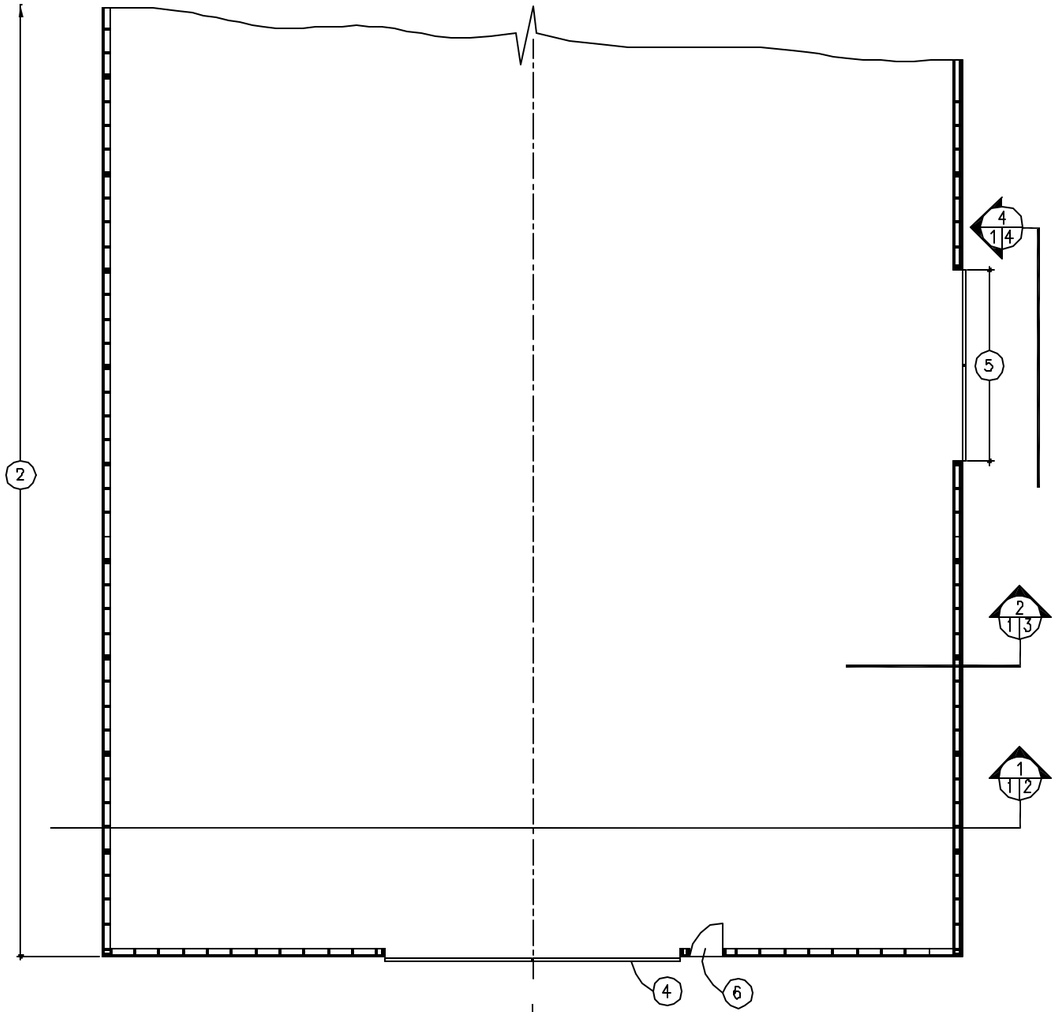


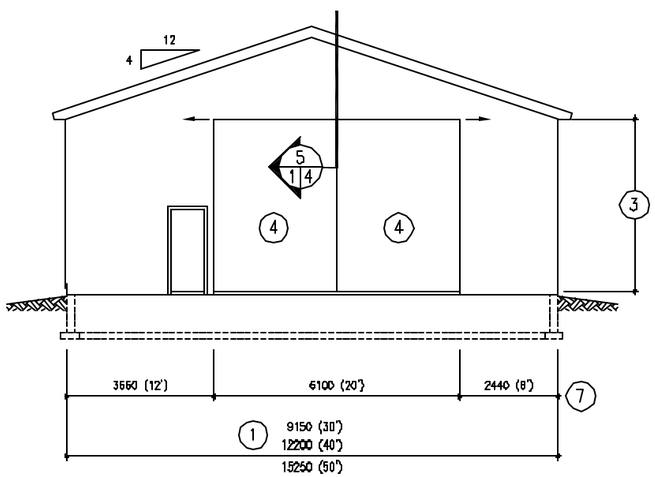


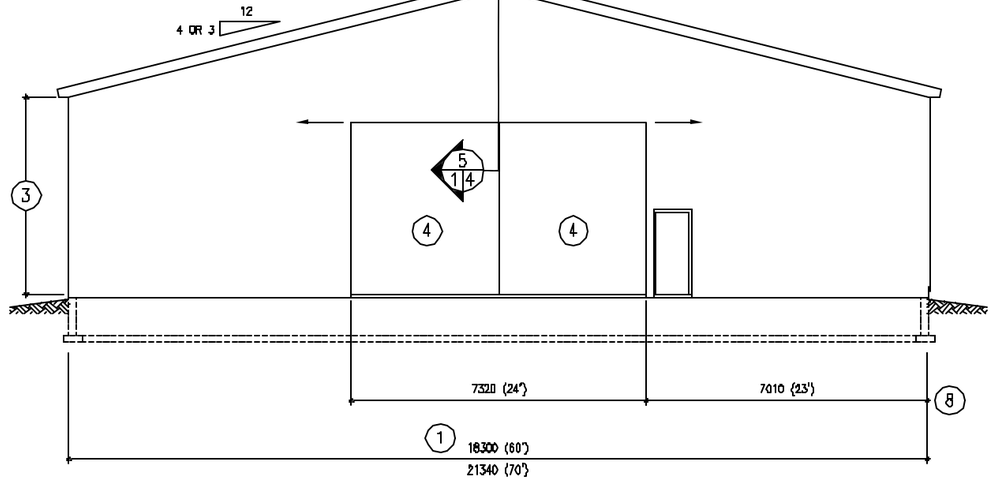


1. Optional roof truss spans 9150 to 21350mm in 3050mm increments (30' to 70' in 10' increments); see truss manufacturer for truss design and spacing to suit local snow + rain + roof dead load (see National Building Code of Canada 1995)
2. Length in 2440mm (8') increments
3. Truss height above foundation wall 3050, 3660 or 4270mm (10', 12' or 14')
4. Sliding doors, see CPS Plan M9341 for door designs to resist wind forces
5. Optional sidewall doors up to 4880mm (16') nominal width; see spacial door jamb and steel lintel details, Sheet 4
6. Man door/fire exit 3' 7"
7. Dimensions correspond only to the 12200mm (40') roof span
8. Dimensions correspond only to the 21340mm (70') roof span

## MATERIALS

Cast-in-place concrete to be min. 25MPa @ 28 days, 6% air entrained.

Reinforcing steel to be min. 400MPa deformed bars; provide 50mm (2") concrete cover over reinforcing steel, and 75mm (3") cover between steel and earth.

All wood indicated 'pressure treated' is CCA pressure-treated to 'ground contact specification', CSA-080 Wood Preservation.

All nails exposed to weather, treated wood, concrete or soil to be hot-dip galvanized.

All framing lumber is No.1/No.2 S-P-F species group.

Exterior cladding steel to be minimum 0.34mm (29ga.)base metal thickness (ASTM-A-446, grade A, Z275 (G-90)); profiles to be as intended for farm roofing/siding as appropriate.

## APPLICATION

This plan conforms to the requirements of the National Farm Building Code of Canada 1995. The user of this plan must ensure that the design criteria indicated herein will meet all local design conditions, building regulations and special requirements. The user is responsible to ensure that all required changes are made.

## WARNING

DOORS - This structure is designed assuming all doors are closed and remain intact in the event of a severe wind.

TRUSS BRIDGING & BRACING - Install all bridging and bracing as specified by truss manufacturer.

Funding for this project has been provided under the Canada-Ontario Agreement for the Ice Storm Economic Recovery Assistance Program, Annex A, Assistance for the Agricultural Sector and Rural Communities in Eastern Ontario. This program is jointly funded by the Government of Canada and the Government of Ontario.

| SYM | REVISIONS | CHECKED | DATE | APPROVED |
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CANADA PLAN SERVICE

**Stud Wall Machinery Storage**
**Knee Braced For Wind**

| | | | |
|---|---|---|---|
| DESIGNED | JET | DATE | DEC. 1998 |
| DRAWN | JBA | REVISED | |
| SCALE | NO SCALE | DETAIL NUMBER A, ORIGINATES ON SHEET B, DRAWN ON SHEET C | |
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PLAN **8314**

TABLE 1

Total Factored Roof Load, w = snow + rain + dead (kPa)

| Gable Roof Slope | Wind – Sheltered | Wind – Exposed |
|---|---|---|
| 4/12 (18.4°) | $w = 0.75S_S + 1.2S_R + 0.3$ | $w = 0.56S_S + 1.2S_R + 0.3$ |
| 3/12 (14.0°) | $w = 0.96S_S + 1.2S_R + 0.3$ | $w = 0.71S_S + 1.2S_R + 0.3$ |

Notes to Tables 2 and 4

1. Ground snow (Ss) and rain (Sr) are tabled in the National Building Code of Canada, 1995.
2. For 4/12 roof slope, a slippery metal roof without obstructions to snow sliding is assumed; for roof areas above roof valleys, ice guards or other obstructions to snow sliding, use only the 3/12 (14.0°) adjustment formulas.

TABLE 2

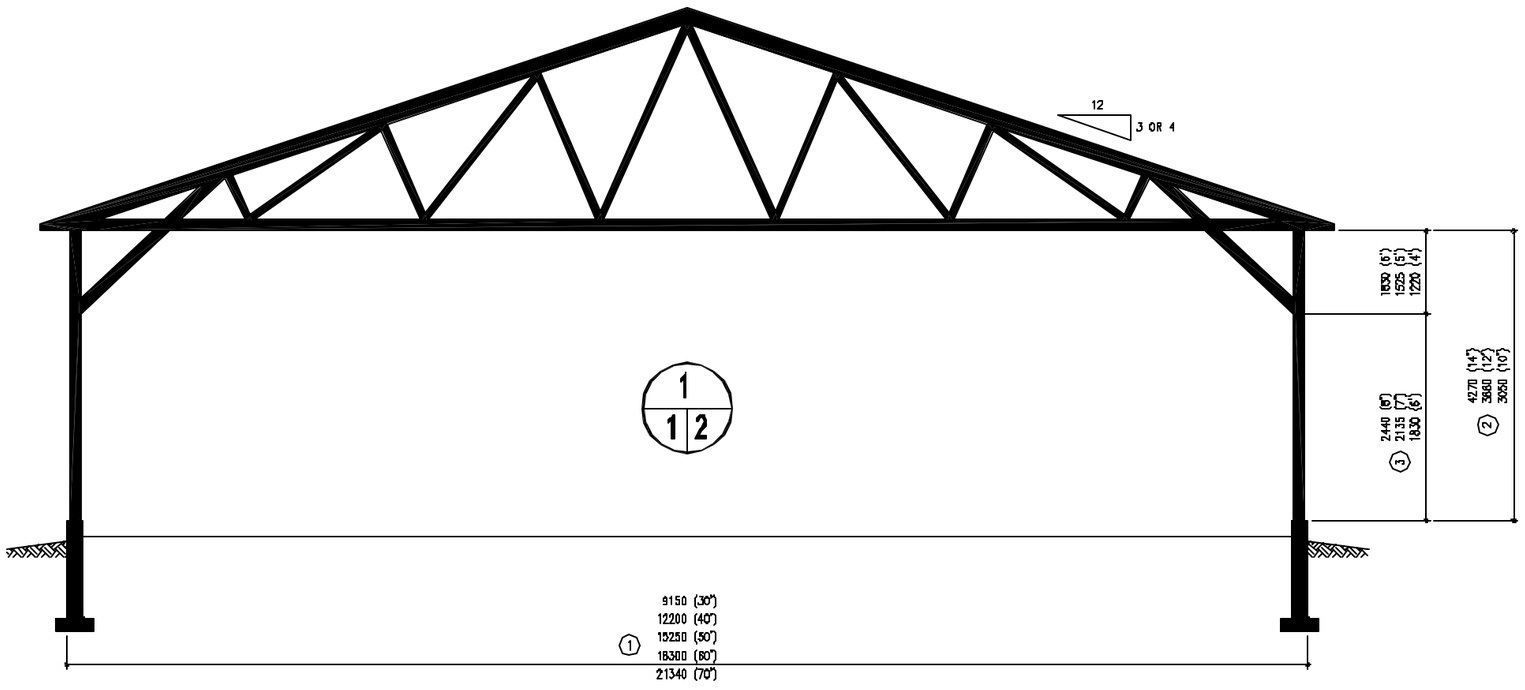
Selection of Double Studs at Knee Brace, 2440mm (8'–0") c/c

| Stud Wall Height, mm (ft) ② | Maximum 1/10 Hourly Wind Force, q (kPa) | | | |
|---|---|---|---|---|
| | 2 x 38 x 89 (2 x 2 x 4) | 2 x 38 x 140 (2 x 2 x 6) | 2 x 38 x 184 (2 x 2 x 8) | 2 x 38 x 235 (2 x 2 x 10) |
| 3050 (10) | 0.29 | 0.59 | 0.88 | --- |
| 3660 (12) | 0.21 | 0.42 | 0.63 | 0.94 |
| 4270 (14) | | 0.32 | 0.47 | 0.70 |

TABLE 3

Selection of Intermediate Studs Not Knee-Braced

| Roof Truss Span, m (ft) | Stud Wall Height, mm (ft) | Maximum Factored Roof Snow + Rain + Dead Load | | | | | |
|---|---|---|---|---|---|---|---|
| | | Studs @ 610 mm (24") | | Studs @ 813 mm (32") | | Studs @ 1220 mm (48") | |
| | | 38 x 89 (2 x 4) | 38 x 140 (2 x 6) | 38 x 89 (2 x 4) | 38 x 140 (2 x 6) | 38 x 140 (2 x 6) | 38 x 184 (2 x 8) |
| 9150 (30) | 3050 (10) | 4.50 | | 3.08 | | 6.44 | |
| | 3660 (12) | 2.88 | | 1.97 | 7.26 | 4.85 | |
| | 4270 (14) | 1.92 | | 1.31 | 5.45 | 3.64 | |
| 12200 (40) | 3050 (10) | 3.38 | | 2.31 | 7.24 | 4.83 | |
| | 3660 (12) | 2.16 | | 1.47 | 5.45 | 3.64 | 6.81 |
| | 4270 (14) | 1.44 | | | 4.09 | 2.73 | 5.59 |
| 15250 (50) | 3050 (10) | 2.70 | | 1.85 | 5.79 | 3.86 | 6.52 |
| | 3660 (12) | 1.73 | 7.05 | | 4.36 | 2.91 | 5.45 |
| | 4270 (14) | | 5.27 | | 3.27 | 2.18 | 4.47 |
| 18300 (60) | 3050 (10) | | 7.79 | | 4.83 | 3.22 | 5.44 |
| | 3660 (12) | | 5.88 | | 3.64 | 2.43 | 4.54 |
| | 4270 (14) | | 4.39 | | 2.73 | 1.82 | 3.73 |
| 21350 (70) | 3050 (10) | | 6.68 | | 4.13 | 2.75 | 4.65 |
| | 3660 (12) | | 5.03 | | 3.11 | 2.07 | 3.89 |
| | 4270 (14) | | 3.76 | | 2.33 | 1.55 | 3.19 |




1. Optional roof truss spans; see truss manufacturer for truss design and spacing to suit local snow + rain + roof dead load (see National Building Code of Canada 1995)
2. Optional wall heights
3. Corresponding knee brace dimensions

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EXAMPLE:

To select doubled studs to resist wind forces on a knee-braced stud wall, and to select a corresponding intermediate single stud spacing to resist total roof load.

Given – storage building at London, Ontario with knee-braced stud walls 4270mm (14–0") high; roof truss span is 18300mm (60').

– building is near a windbreak row of spruce trees, therefore 'wind sheltered'.

STEP 1:

Determine roof and wind loads for London, Ontario from the National Building Code of Canada 1995:

ground snow Ss = 2.4 kPa

1–day rain Sr = 0.4 kPa

1/10 hourly wind q = 0.34 kPa

STEP 2:

Determine size of doubled knee-braced studs @ 2440mm (8'–0") c/c, based on wind.

Go to Table 2, stud wall height 4270mm (14'–0") first column. The third column gives a maximum safe wind force q = 0.32 kPa, which is not quite safe for London (q = 0.34). Therefore, go to the fourth column which gives q = 0.47, which is safe. The fourth column specifies 2–38x184mm (2–2x8) doubled studs at each knee brace.

STEP 3:

Determine spacing of intermediate studs between knee bracing.

Go to Table 1 and calculate total roof load. The applicable formula is: $w = 0.75\ Ss + 1.2\ Sr + 0.3$

From Step 1, Ss = 2.4 and Sr = 0.4

Therefore, $w = 0.75\ (2.4) + 1.2\ (0.4) + 0.3$

$= 1.8 + 0.48 + 0.3$

$= 2.58$ kPa

Intermediate studs should be the same width as the knee-braced studs (Step 2),therefore use 38x184mm (2x8) studs.

Go to Table 3. Studs 38x184mm (2x8) are safe up to 3.73 kPa total roof load when spaced at 1220mm (48") c/c. Note also that studs and trusses should align vertically. Note that studs should be spaced at 610mm (24") c/c if the building is to be insulated now or later.

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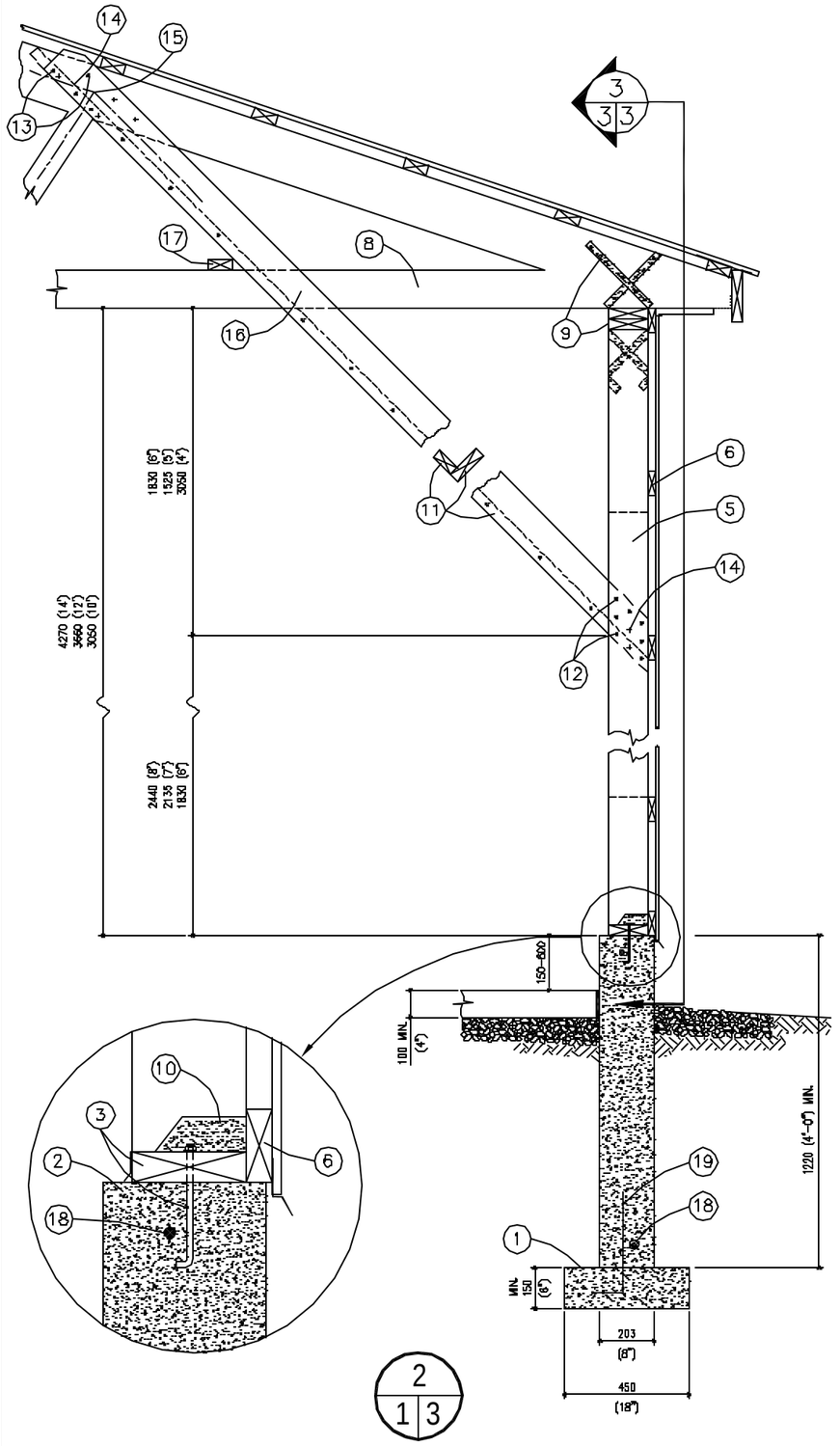
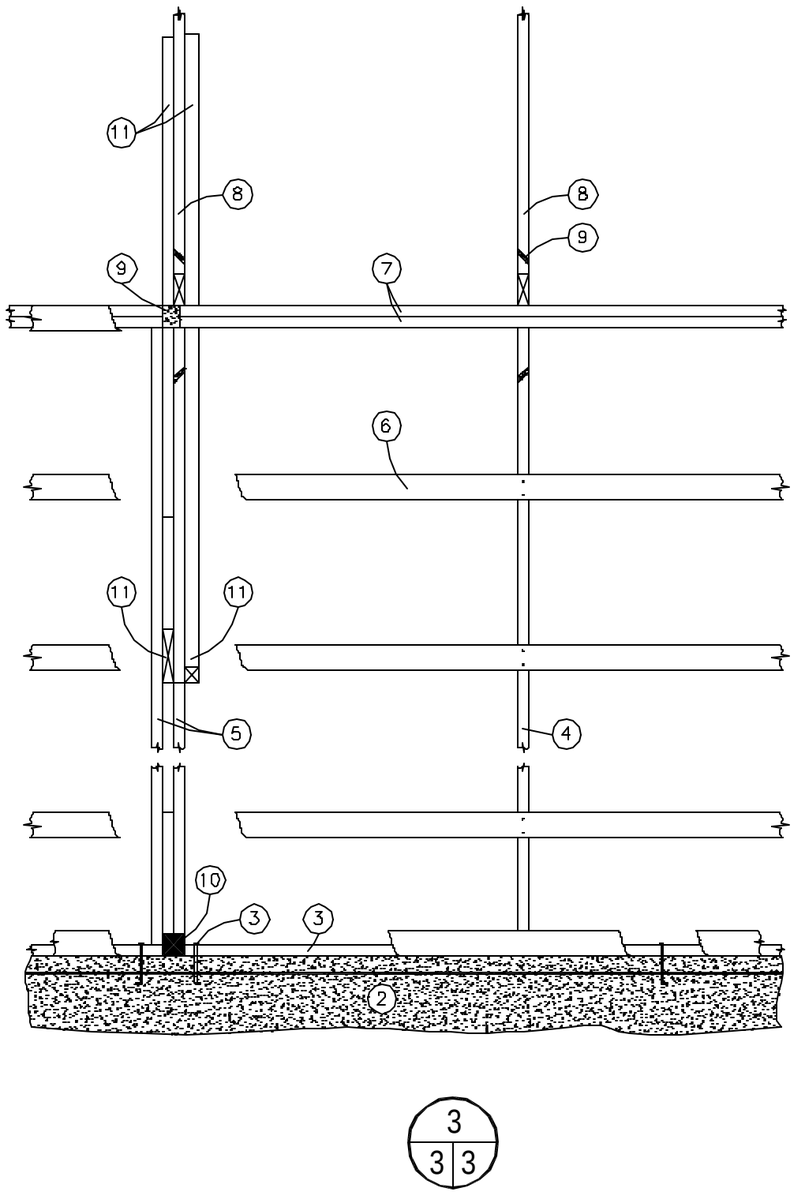
CANADA PLAN SERVICE

**Section**
**Structural Details**

| | | | |
|---|---|---|---|
| DESIGNED | JET | DATE | DEC. 1999 |
| DRAWN | JBA | REVISED | |
| SCALE | NO SCALE | DETAIL NUMBER ___ A, ORIGINATES ON SHEET ___ B, DRAWN ON SHEET ___ C | |
| CHECKED | BEM | | |

PLAN **8314**




1. Concrete footing, to below frost if soil is susceptible to frost heave
2. 200mm (8") concrete foundation
3. 38mm (1 1/2") sill; 1/2" anchor bolts both sides of doubled studs @ 2440mm (8'–0") c/c and midway between
4. Single studs under each truss (8); see Sheet 2 for stud design tables and example of stud selection
5. Double studs at each knee brace 440mm (8'–0") c/c; 38mm (1 1/2") spacers between at top and bottom
6. 20x89mm (1x4) strapping @ 610mm (2'–0") c/c; increase to 38x89 (2x4) strapping if studs are 1220mm (4'–0") c/c
7. 2–38mm (1 1/2") plate, joints staggered 2440mm (8'–0") c/c
8. Manufactured wood roof trusses at 4880, 813 or 610mm (48", 32" or 24") c/c; see manufacturer for spacing, lateral support and other requirements
9. Double–joist hanger with arms spread 45° to plate, truss and stud, 1 1/2" special concrete nails all pre–punched holes to framing; use two (2) crossed at each knee–braced double stud 2440mm (8'–0") c/c; use one (1) from inside only at intermediate trusses
10. Double–joist hanger doubled stud to sill @ 2440mm (8'–0") c/c
11. 38x140mm (2x6) knee brace and 38x89mm (2x4) stiffener at double studs (5); notch stiffener 38mm (1 1/2") in way of one stud and corresponding truss chords; 102mm (4") spiral nails @ 300mm (12") c/c from knee brace to stiffener
12. No. of 102mm (4") spiral nails (double–shear) through studs and knee brace as follows:

| Doubled stud size (see Table 3, Sheet 2) | No. of nails from each side |
|---|---|
| 2–38x 89 (2–2x4) | 2 |
| 2–38x140 (2–2x6) | 3 |
| 2–38x184 (2–2x8) | 4 |

13. No. of 102mm (4") spiral nails through knee brace and clinched to truss upper chord, as follows:

| Doubled stud size (see Table 3, Sheet 2) | No. of nails from this side & clinched |
|---|---|
| 2–38x 89 (2–2x4) | 4 |
| 2–38x140 (2–2x6) | 7 |
| 2–38x184 (2–2x8) | 10 |

14. 2–102mm (4") spiral nails from stiffener (other side) to truss upper chord
15. Centerlines of knee brace and two truss members to coincide at one point
16. No nails, knee brace to lower chord
17. Add truss lower chord stiffener touching knee brace
18. 15M rebar continuous
19. 10M x 300mm (12") dowels @ 500mm (20") c/c

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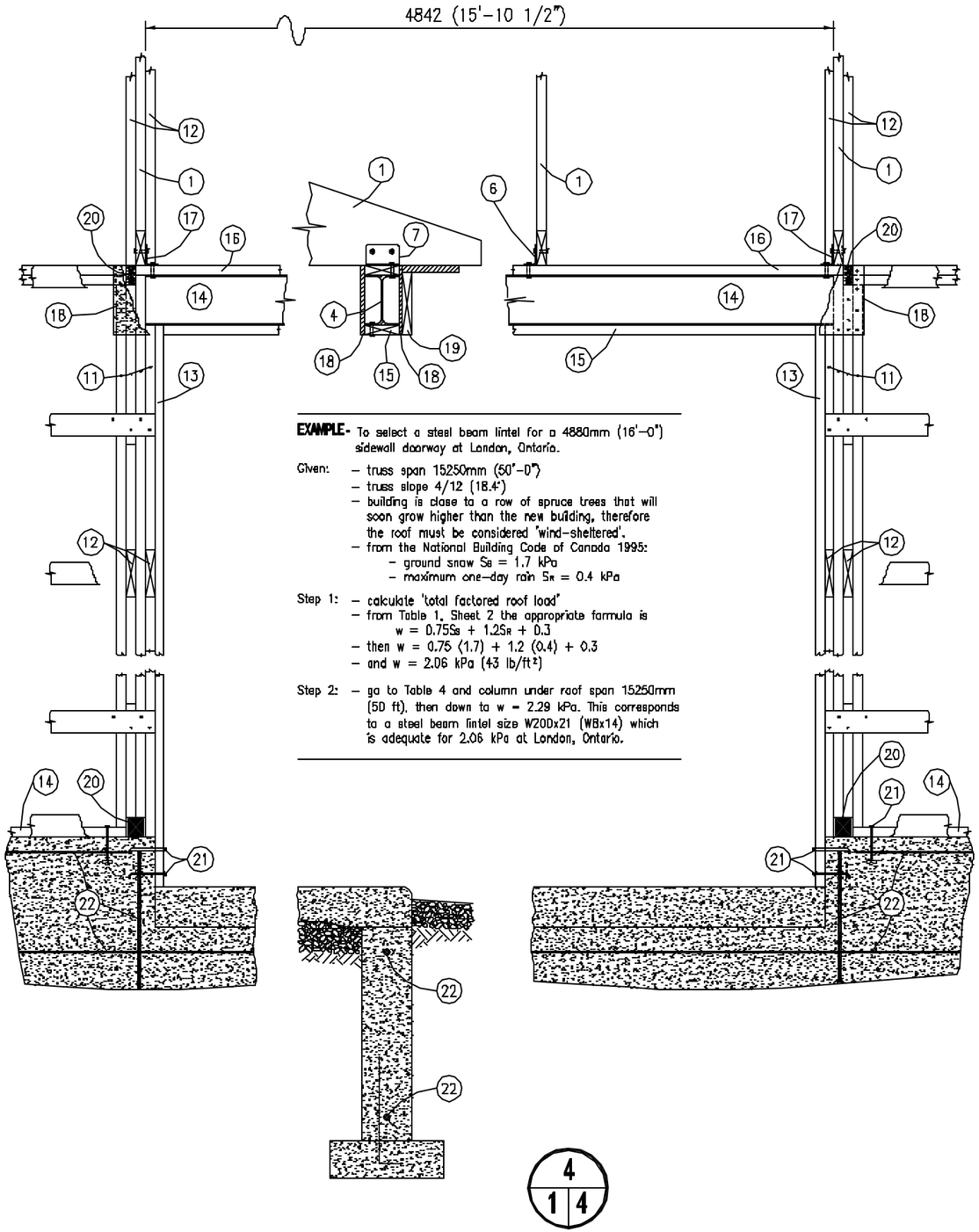
PLAN 8314

SHEET 3 OF 4




**EXAMPLE-** To select a steel beam lintel for a 4880mm (16'-0") sidewall doorway at London, Ontario.

Given:
- truss span 15250mm (50'-0")
- truss slope 4/12 (18.4°)
- building is close to a row of spruce trees that will soon grow higher than the new building, therefore the roof must be considered 'wind-sheltered'.
- from the National Building Code of Canada 1995:
  - ground snow $S_S$ = 1.7 kPa
  - maximum one-day rain $S_R$ = 0.4 kPa

Step 1:
- calculate 'total factored roof load'
- from Table 1, Sheet 2 the appropriate formula is $w = 0.75S_S + 1.25S_R + 0.3$
- then w = 0.75 (1.7) + 1.2 (0.4) + 0.3
- and w = 2.06 kPa (43 lb/ft²)

Step 2:
- go to Table 4 and column under roof span 15250mm (50 ft), then down to w = 2.29 kPa. This corresponds to a steel beam lintel size W200x21 (W8x14) which is adequate for 2.06 kPa at London, Ontario.

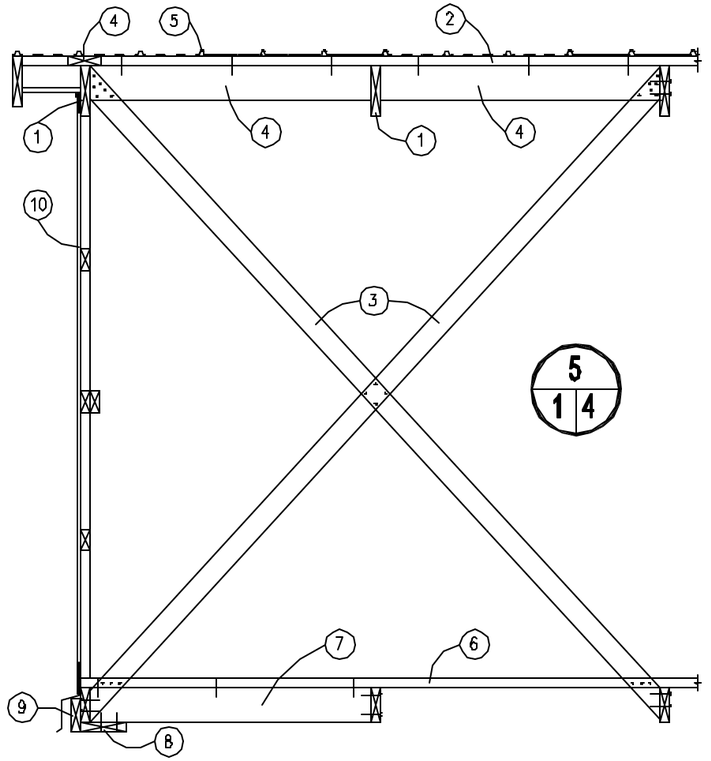



TABLE 4
Steel Beam Total Factored Roof Loads, w (kPa)*

| Steel Beam Size – metric (Imperial) | Roof Span, mm (ft) | | | | |
|---|---|---|---|---|---|
| | 9150 (30 ft) | 12200 (40 ft) | 15250 (50 ft) | 18300 (60 ft) | 21350 (70 ft) |
| **W250x39 (W10x26) | --- | --- | 6.13 | 5.10 | 4.37 |
| W200x42 (W8x28) | --- | --- | 5.29 | 4.40 | 3.78 |
| W250x33 (W10x22) | --- | 6.28 | 5.03 | 4.18 | 3.59 |
| W200x36 (W8x24) | --- | 5.68 | 4.54 | 3.78 | 3.24 |
| W200x31 (W8x21) | 6.84 | 4.98 | 3.99 | 3.32 | 2.84 |
| W200x27 (W8x18) | 5.53 | 4.15 | 3.32 | 2.76 | 2.37 |
| W250x24 (W10x16) | 5.39 | 4.05 | 3.24 | 2.70 | 2.31 |
| W200x21 (W8x14) | 3.82 | 2.87 | 2.29 | 1.91 | 1.64 |

NOTE: For steel beam spans not greater than 4880mm (16'-0")

*based on nominal doorway width 4880mm (16')

**means 'Wide Flange', 250mm deep by 39 kg/m of length (10" deep by 26 lb/ft of length)

1. Trusses @ 1220, 813 or 610mm (48", 32" or 24") c/c
2. 38x89mm (2x4) roof purlins, 4880mm (16'-0") lengths, end joints staggered 2440mm (8'-0") at trusses; nail each purlin to each truss with 2–102mm (4") spiral nails
3. 38x89mm (2x4) permanent X-bracing at each truss stiffener (2) but not more than 2440mm (8'-0") c/c
4. 38x140mm (2x6) blocking between purlins at gable trusses (1); nail to (1) with 102mm (4") spiral nails @ 150mm (6") c/c
5. Steel roofing is galvanized sheet, minimum thickness 0.34mm (29ga), screw-fastened; typical Canadian profiles
6. 38x89mm (2x4) truss lower chord stiffener, spaced as per truss manufacturer but not more than 2440mm (8'-0") c/c
7. 38x140mm (2x6) blocking between trusses at each X-brace (3) bevel upper blocking to meet roof purlin (2) and nail (2) to blocking
8. 38x184mm (2x8) door head jamb
9. Track board and galvanized steel flashing to suit endwall door and hardware
10. Exterior steel wall cladding
11. 4–38mm (1 1/2") studs, same width as double studs at knee brace (Table 3, Sheet 2); two of the studs are cut in way of knee brace (12)
12. 3–38x140mm (2x6) special knee brace; 2 outer members sandwich truss (1) and one stud (11); one inside member is cut in way of truss chords and stud; nail knee brace through truss upper chord and one stud, from 2 sides as in table below:

| Stud Size (Table 2, Sheet 2) | No. of 102mm (4") spiral nails from each side (double shear) |
|---|---|
| 38x89mm (2x4) | 2 |
| 38x140mm (2x6) | 4 |
| 38x184mm (2x8) | 6 |

13. 38mm (1 1/2") side door jamb is 102mm (4") wider than studs (11); cut jamb and one stud to give 76mm (3") end-grain bearing for steel beam (14); set outer edge of jamb flush with track board (19)
14. Steel beam, see Table 4 for size; drill for bolts (15) and (17)
15. 38mm (1 1/2") door head jamb same width as studs (11); 3/8" carriage bolts to (14) and (16) @ 1220mm (48") c/c or less
16. Top plate, continuous at each side of doorway
17. Truss anchors cut from steel angle 50x76x6mm (2 x 3 x 1/4"); 3–3/8" bolts to beam (14), top plate (16) and trusses (1)
18. 95mm (3/8") plywood or waferboard beam box; nail to plate (16), studs (11) and head jamb (15) to resist wind uplift
19. 38mm (1 1/2") optional track board, for sliding doors
20. Double-joist hangers, 38mm (1 1/2") special concrete nails
21. 1/2" x 8" L-bolts, side jamb and sill to concrete
22. 15M rebar continuous

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**Details of Optional Sidewall Door Frame and Structural Details**

| | | | |
|---|---|---|---|
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| DRAWN | JBA | REVISED | |
| SCALE | NO SCALE | | |
| CHECKED | BEM | | |

DETAIL NUMBER ____ A ORIGINATES ON SHEET__ B DRAWN ON SHEET____ C

PLAN **8314**

SHEET 4 OF 4