Document	NBC 2005 CNB	Document
Provision	Table 9.23.3.4.	Exigence
Committee	Housing and Small Buildings • Maisons et petits bâtiments	Comité
Minutes	TG Lateral Loads, HSB 2005-04.06.16; HSB 2005-05.06.18	Procès-verbaux

EXISTING PROVISION

Table 9.23.3.4.
Nailing for Framing
Forming Part of Sentence 9.23.3.4.(1)

Construction Detail	Minimum Length of Nails, mm	Minimum Number or Maximum Spacing of Nails
Floor joist to plate – toe nail	82	2
Wood or metal strapping to underside of floor joists	57	2
Cross bridging to joists	57	2 at each end
Double header or trimmer joists	76	300 mm (o.c.)
Floor joist to stud (balloon construction)	76	2
Ledger strip to wood beam	82	2 per joist
Joist to joist splice (see also Table 9.23.13.8.)	76	2 at each end
Tail joist to adjacent header joist	82	5
(end nailed) around openings	101	3
Each header joist to adjacent trimmer joist	82	5
(end nailed) around openings	101	3
Stud to wall plate (each end) toe nail	63	4
or end nail	82	2
Doubled studs at openings, or studs at walls or wall intersections and corners	76	750 mm (o.c.)
Doubled top wall plates	76	600 mm (o.c.)
Bottom wall plate or sole plate to joists or blocking (exterior walls)(1)	82	400 mm (o.c.)
Interior walls to framing or subflooring	82	600 mm (o.c.)
Horizontal member over openings in non-*loadbearing* walls – each end	82	2
Lintels to studs	82	2 at each end
Ceiling joist to plate – toe nail each end	82	2
Roof rafter, roof truss or roof joist to plate – toe nail	82	3
Rafter plate to each ceiling joist	101	2
Rafter to joist (with ridge supported)	76	3
Rafter to joist (with ridge unsupported)	76	see Table 9.23.13.8.
Gusset plate to each rafter at peak	57	4
Rafter to ridge board – toe nail – end nail	82	3
Collar tie to rafter – each end	76	3
Collar tie lateral support to each collar tie	57	2
Jack rafter to hip or valley rafter	82	2
Roof strut to rafter	76	3
Roof strut to *loadbearing* wall – toe nail	82	2
38 mm × 140 mm or less plank decking to support	82	2
Plank decking wider than 38 mm × 140 mm to support	82	3
38 mm edge laid plank decking to support (toe nail)	76	1
38 mm edge laid plank to each other	76	450 mm (o.c.)

Notes to Table 9.23.3.4.:
(1) See Sentence 9.23.3.4.(2).

PROPOSED CHANGE

Replace Table 9.23.3.4. as follows:

Other Code Provisions Affected: see PCF NBC05-Div.A-01.04.01.02.(01)-HSB-panel

Table 9.23.3.4.
Nailing for Framing
Forming Part of Sentence 9.23.3.4.(1)

Construction Detail	Minimum Length of Nails, mm	Minimum Number or Maximum Spacing of Nails
Floor joist or blocking perpendicular to sill plate or top wall plate below – toe nail	82	2 per floor joist or blocking
Rim joist, trimmer joist or blocking–supporting walls with required *braced wall panels*–to sill plate or top wall plate – toe nail	82	150 mm o.c.
Wood or metal strapping to underside of floor joists	57	2
Cross bridging to joists	57	2 at each end
Double header or trimmer joists	76	300 mm (o.c.)
Floor joist to stud (balloon construction)	76	2
Ledger strip to wood beam	82	2 per joist
Joist to joist splice (see also Table 9.23.13.8.)	76	2 at each end
Tail joist to adjacent header joist	82	5
(end nailed) around openings	101	3
Each header joist to adjacent trimmer joist	82	5
(end nailed) around openings	101	3
Stud to wall plate (each end) toe nail	63	4
or end nail	82	2
Doubled studs at openings, or studs at walls or wall intersections and corners	76	750 mm (o.c.)
Doubled top wall plates	76	600 mm (o.c.)
Bottom wall plate or sole plate to floor joists, *rim joists* or blocking (exterior walls)(1)	82	400 mm (o.c.)
Bottom wall plate or sole plate–in required *braced wall panels*–to floor joists, *rim joists* or blocking (exterior walls)(1)	82	150 mm o.c.
Interior walls to framing or subflooring	82	600 mm (o.c.)
Required *braced wall panels*–in interior walls–to framing above and below	82	150 mm (o.c.)
Horizontal member over openings in non-*loadbearing* walls – each end	82	2
Lintels to studs	82	2 at each end
Ceiling joist to plate – toe nail each end	82	2
Roof rafter, roof truss or roof joist to plate –toe nail(2)	82	3
Rafter plate to each ceiling joist	101	2
Rafter to joist (with ridge supported)	76	3
Rafter to joist (with ridge unsupported)	76	see Table 9.23.13.8.
Gusset plate to each rafter at peak	57	4
Rafter to ridge board – toe nail – end nail	82	3
Collar tie to rafter – each end	76	3
Collar tie lateral support to each collar tie	57	2
Jack rafter to hip or valley rafter	82	2
Roof strut to rafter	76	3
Roof strut to *loadbearing* wall – toe nail	82	2
38 mm × 140 mm or less plank decking to support	82	2
Plank decking wider than 38 mm × 140 mm to support	82	3
38 mm edge laid plank decking to support (toe nail)	76	1
38 mm edge laid plank to each other	76	450 mm (o.c.)

Notes to Table 9.23.3.4.:
(1)See Sentence 9.23.3.4.(2).
(2) See Sentence 9.23.3.4.(3)-2010.

RATIONALE

Problem

General – Addressing Lateral Loads due to Wind and Earthquake

The existing Sentence 9.4.1.1.(2) states that structures complying with the prescriptive solutions provided in Part 9 are deemed to meet the structural requirements of the Code. Appendix Note A-9.4., however, states that lateral loads such as wind and earthquake must be considered, even though these are not addressed by any calculations that may have been used in the development of the Part 9 prescriptive solutions.

Evidence from earthquakes in California and Japan indicate that light wood-frame buildings must incorporate certain construction details in order to provide an acceptable minimum level of performance when subject to earthquake loads.

In general, changes to the Code are considered where a problem has been identified, sometimes after a failure has occurred, or where approaches to design or construction have changed.

- The existing prescriptive structural requirements provided in Part 9 reflect building design that was typical in the 1950s and 1960s. In the case of housing, for example, openings in exterior walls for windows and doors were generally modest, large double-height spaces were rare, and most openings in interior walls between spaces did not exceed 2.4 m wide. Changes in building design and construction mean that the validity of the simple prescriptive structural requirements in Part 9 need to be reviewed with respect to both wind and earthquake.
- In the case of earthquake loads, failures have not occurred but it is understood that the "big one" has not yet hit the west coast. With better understanding of what does and does not effectively resist earthquake loads, the Part 9 requirements warrant review.

Proposed changes were developed for NBC 2005 Part 9 to address lateral loads due to wind and earthquake. The changes were deferred by the Canadian Commission on Building and Fire Codes (CCBFC) in response to a request from the Province of British Columbia, which requested more time to conduct studies of the proposed changes and their potential impact. The CCBFC requested that these changes be considered again in the current code development cycle taking into account the results of the BC studies. This proposed change is one of a series developed in response to the CCBFC request.

Technical

Terminology and Application

Table 9.23.3.4. addresses nailing of floor joists to a plate below. It is not clear whether the criteria apply to sill plates or top plates of the wall below or both. It is also not clear whether the reference to floor joists includes rim joists or rim boards.

Similarly, the Table addresses, for exterior walls, nailing of the bottom wall plate or sole plate to joists or blocking but it is not clear whether floor joists includes rim joists or rim boards.

Fastening in High Load Locations

The need for tie-down of framing to the foundation is not related to wind or seismic loads. The Table requires the same number of fasteners per floor joist and does not recognize the additional fastening needed in higher wind or seismic load locations.

Toe-nailing of roof rafters, joists or trusses to the wall framing below provides adequate lateral resistance to wind and earthquake loads but does not provide sufficient resistance to wind up-lift in high wind load locations.

Justification - Explanation

Terminology and Application

Proposed Table – Row 2

The proposed row 2, along with the proposed addition of a definition for "rim joist," makes clear that the criteria apply to the fastening of floor joists, rim joists or blocking to the sill plate or top wall plate below.

Proposed Table – Row 18

The proposed row 18, along with the proposed addition of a definition for "rim joist" and the proposed change to Sentence 9.23.3.4.(2), makes clear that the criteria apply to the fastening to floor joists, rim joists or blocking.

Fastening in High Load Locations

Proposed Table – Rows 3

The proposed new row 3 provides criteria for fastening floor joists, rim joists and blocking to sill plates or top plates below where the floor joists, rim joists or blocking support braced wall panels to resist lateral loads in higher wind or seismic load locations. The proposed decrease in spacing of fasteners reflects results of engineering calculations to address higher wind and seismic load locations.

Proposed Table – Rows 19 and 21

The proposed insertion of new rows 19 and 21 provide criteria for fastening where braced wall panels are installed to resist lateral loads in higher wind or seismic load locations. The proposed decrease in spacing of fasteners for fastening elements in buildings required to have braced wall panels reflects results of engineering calculations to address higher wind and seismic load locations.

The more stringent fastening criteria would affect buildings in 52 of the 640 locations identified in Appendix C of the Code.

With respect to wind, the criteria would apply to buildings in 19 locations:

• Cape Race	NF	1.05 kPa
• Cardston	AB	1.02 kPa
• Cowley	AB	1.00 kPa
• Coral Harbour	NU	0.99 kPa
• Nottingham Island	NU	0.99 kPa
• Pincher Creek	AB	0.97 kPa
• Harrington-Harbour	QC	0.92 kPa
• Povungnituk	QC	0.91 kPa
• Fort MacLeod	AB	0.90 kPa
• Isachsen	NU	0.90 kPa
• Inukjuak	QC	0.90 kPa
• Clyde River	NU	0.90 kPa
• Claresholm	AB	0.87 kPa
• St Anthony	NF	0.87 kPa
• Holman	NW	0.85 kPa
• Percé	QC	0.85 kPa
• Kuujjuarapik	QC	0.83 kPa
• Lethbridge	AB	0.82 kPa
• St John's	NF	0.80 kPa

With respect to earthquake, the criteria would apply to buildings in 33 locations:

• Victoria (Mt Tolmie)	BC	1.20
• Victoria (Gonzales Hts)	BC	1.20
• Victoria	BC	1.20
• Ucluelet	BC	1.20
• Tofino	BC	1.20
• Sidney	BC	1.20
• Rivière-du-Loup	QC	1.10
• Langley	BC	1.10
• Ladner	BC	1.10

• Duncan	BC	1.10
• Crofton	BC	1.10
• Youbou	BC	1.00
• Surrey (88 Ave & 156 St.)	BC	1.00
• Richmond	BC	1.00
• Nanaimo	BC	1.00
• Cloverdale	BC	1.00
• New Westminster	BC	0.99
• St-Georges-de-Cacouna	QC	0.98
• Haney	BC	0.97
• Vancouver (Granville & 41 Ave)	BC	0.95
• Vancouver	BC	0.94
• Burnaby (Simon Fraser Univ.)	BC	0.94
• Mission City	BC	0.93
• Abbotsford	BC	0.92
• Montmagny	QC	0.89
• West Vancouver	BC	0.88
• North Vancouver	BC	0.88
• Tadoussac	QC	0.84
• Qualicum Beach	BC	0.82
• Port Alberni	BC	0.75
• Alberni	BC	0.75
• Chilliwack	BC	0.73
• Squamish	BC	0.72

Cost implications

Terminology and Application

No costs are attributed to the addition of terms to make clear the intended application of the requirements.

Fastening in High Load Locations

Additional costs for fastening will apply only in high wind locations and high seismic load locations – 52 of 640 locations identified in Appendix C.

Row (3)

Additional nailing at 150 mm o.c. = $0.35 per linear foot

Row (19)

Decrease in maximum spacing from 400 mm o.c. to 150 mm o.c. = $ 0.15 additional per linear foot

Row (21)

Decrease in maximum spacing from 600 mm o.c. to 150 mm o.c. quadruples the number of fasteners = $ 0.18 additional per linear foot

Enforcement implications

Can be enforced by the available infrastructure.
In municipalities with high wind or seismic loads, will require some additional building permit application and site review to confirm that the proper design and construction approach has been taken.

Who is affected

Designers and builders with respect to design and construction.
Building officials with respect to determination of compliance.

Building owners would bear any increase in costs but would benefit from a reduced probability or degree of property loss in the case of an earthquake.

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISION

Provision: Table 9.23.3.4. **Analysis: N/A**

Comment **Commentaires**