For a detailed discussion of the CSA Masonry Standards see the full MIBC Technical Manual at www.masonrybc.org . The following standards are reviewed in this section:

CSA A165.1-04	Concrete Block	p.1
CSA A82-06	Clay Brick	p.3
CSA A179-04	Mortar	p.4
CSA A179-04	Grout	p.6
CSA A 370-04	Masonry Connectors	p.7
CSA A371-04	Masonry Construction	p.9

For information on CSA S304.1-04 Design of Masonry Structures see MIBC Tech. Man. *Section 1.2.1.*

This update is based upon the 2004 editions of the masonry standards referenced by the 2005 National Building Code, and the 2006 B.C. Building Code. The clay brick standard was issued in 2006 and must be referenced by project specifications,

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CONCRETE BLOCK **- CSA A165.1-04** (MIBC Tech. Man. Sec. 2.2)

Covers:	Compressive Strength Density (Weight) Drying & Curing Dimensions & Tolerances Major Defects	Not covered:	Minor chipping & cracks Texture or Profile Colour Fire, Sound or Thermal values

For a detailed Guide Specification see MIBC Technical Manual section 3.2

- **Typical spec - H/15/A/M**

  H = hollow

  15 = compressive strength

  15 MPa standard inventory strength (net area)

  20 to 30 available at a small cost premium

  A = standard (heavy) weight - sand and gravel, 18 kg (40 lbs) /unit

  Other options are: B & C: semi-light weight - partially pumice

  D: light weight - mostly pumice - fire block

  M = moisture controlled - cured, dried

Sample Spec: Concrete masonry units to CSA A165.1-04 requirements Classification H/15/A/M

- **Quality control**

  Test data or Letter of Assurance from supplier if deemed necessary. Job site tests only if specified for critical high strength applications.

- **Fire ratings** (See Section 2.6.1 in MIBC Tech. Manual)

  Two Methods:

  1. Building Code
  - applies to block from any supplier
  - based on equivalent thickness and aggregate type from Table D-2.1.1 in B.C. Building Code
  - typical 20 cm block – **1** ½ hrs.
  - can be increased by filling cores with grout or adding drywall etc.

  2. U.L.C.
  - available from certified suppliers based on tests and plant checks
  - higher values for same thickness
  - typical 20 cm ULC block - **2** hrs.; 20 cm pumice - 4 hrs.
  - small cost premium to cover ULC charge to manufacturer

- **Sound Ratings (STC)** (See Section 2.6.2 in MIBC Tech. Manual)

  - based on wall weight - check with suppliers or MIBC

- **Thermal values** (See Section 2.6.3 in MIBC Tech. Manual)

  - based on R value for block weights, and core fill or external insulation
  - heavy mass moderates temperature swings to provide superior performance for a given R value compared to lightweight systems.
  - Check with supplier or MIBC for values

CLAY BRICK - **CSA A82-06** (MIBC Tech. Man. Sec. 2.1)

Covers:	Compressive Strength Absorption, Durability Dimensions and Tolerances Colour and Texture Sampling Defect Tolerances	Not covered:	Fire, Sound or Thermal values

- **Typical spec**

  Size, Colour, Texture, Manufacturer(s)

  Type S – standard tolerances; tighter tolerances for project job lots.

  Grade EG - "Exterior Grade" always required for our freeze/thaw climate.

  Reclaimed brick can be damaged by freeze/thaw or may not meet current standards - confirm suitability before exterior use. New, Grade EG brick are available in textures similar to reclaimed units.

  Structural clay units also are covered by CSA A82-06.

Sample Spec: Clay Face Brick [and Structural Brick] to meet CSA A82-06 requirements.
Grade EG, Type S

- **Quality control:**

  Test data or Letter of Assurance from supplier if deemed necessary

- **Fire ratings:** (See Section 2.6.1 in MIBC Tech. Manual)

  From B.C. Code based on equivalent thickness.

  Typical face brick - 1 hr.

- **Sound and thermal ratings:** (See Section 2.6.2 & 3 in MIBC Tech. Manual)

  Check with supplier or MIBC

  Cavity insulation preferred over stud space insulation due to elimination of thermal bridging and protection of membranes.

MORTAR - **CSA A179-04** (MIBC Tech. Man. Sec. 2.3.1)

Covers:	Raw Materials Mortar Types - S & N Mixing Process Proportion or Property Specification	Not covered:	Mortar for stonework Colour Installation

- **Typical spec**

Two distinct methods for strength:

1. PROPORTION METHOD

- typical for Site-mixed mortar
- applies unless Property Method is specified
- "RECIPE" for volumes of sand and cementitious materials from CSA A 179 tables
- quality control by inspection of mix proportions at site - not by cube tests

2. PROPERTY METHOD

- typical for Pre-mixed dry or wet mortar
- must be specifically specified
- cube tests to meet strengths in CSA A179 Table 5 (MPa @ 28 days)

	Job / Plant Mixed (laying consistency)	Lab Prepared
Type S	**8.5**	**12.5**
Type N	**3.5**	**5**

- job and lab strengths are different due to different water contents.
- suppliers of pre-mixed mortar can provide current test results for quality control.

Sample Spec: Mortar to: CSA A179-04 requirements
Type S, mortar for structural masonry
Type S, mortar for veneer masonry
Proportion specification shall apply to field mixed mortar
Property specification shall apply to mortar manufactured off-site.

- **Mortar type & composition**

  - Mortar types are defined by their relative amounts of sand and cementitious materials.

  - Bond is a key property of mortar, and is associated with good workability, adhesion, cohesion and water retention - all of which improve with a higher proportion of lime or mortar cement in the mix.

  - Compressive strength is <u>not</u> the most important property for mortar, although reasonable strength is required for durability. A balance of strength and bond is, therefore, required for good mortar.

  Type 'S'

  Typically used for both structural and veneer block and brick. It provides moderately high strength with good bond.
  Provides simple jobsite mixing where both structural and veneer masonry units are being installed.

  Type 'N'

  Once used for veneer brick and block, but now usually replaced by Type S.

  Types 'O' and 'K'

  Mortars with high lime contents used for historical restoration. Cement/Lime mortars were historically recommended because their raw materials and resulting properties were well established. The Masonry Cements and Mortar Cements now commonly used are proprietary products, which replace separate cement and lime bags for site mixing. Current versions are now the most commonly used materials to meet Type S mortar strengths, without the addition of Type GU (10) cement. See manufacturers' data for further information.

***GROUT** (Block Fill)* - **CSA A179-04** (MIBC Tech. Man. Sec. 2.3.2)

Covers:	Raw Materials Grout Type – coarse or fine Property or Proportion Spec Slump	Not covered: Installation (see A371-04)

- **Typical spec**

  Most masonry grout (block fill) is "Coarse Grout", with a maximum aggregate size of 12 mm. "Fine Grout" would only be used in small core units such as reinforced brick. Grout is usually supplied and pumped from ready-mix trucks, with quality control data available from the supplier. Field test cylinders may also be taken.

  Grout strength specification is an area of some confusion. Because grout must flow for substantial distances through small core openings, it must be placed at a very high slump of 200 to 250 mm. This extra water is then absorbed into the units to provide a concrete mix with a lower water content - and higher final strength. Grout tested using standard non-absorptive plastic or metal cylinders will still contain the extra water, and will therefore show lower apparent strength results.

  The latest CSA A179 recognizes this situation by referencing a 12.5 MPa grout strength when cylinders are used. The actual strength in the wall will be much higher, and will exceed the 15 MPa strength of typical concrete blocks. This grout strength is compatible with the f'_m design strengths contained in S304.1 for Masonry design. Many existing structural notes and specs call for 20 or 25 MPa grout - and do not recognize the non-absorptive cylinders situation. A 25 MPa high slump grout designed for cylinder testing may actually be 40 MPa in the wall. However, a 20 MPa grout may be preferred for pumping reasons in any case. If Structural Notes do not recognize the 12.5 MPa strength minimum, then a project cylinder test result

below a 20 or 25 MPa specified strength should not treated as a cause for concern.

Sample Spec: Grout to CSA A179-04 requirements
Minimum compressive strength 12.5 MPa at 28 days by cylinder test under the property specification
Maximum aggregate size 12 mm diameter
Grout slump 200 to 250 mm

MASONRY CONNECTORS - CSA A370-04

(MIBC Tech. Man. Sec. 2.5)

Covers: Brick Ties
Anchors
Fasteners
Repair Connectors
Corrosion Protection

- **Corrosion Protection**

The 1994 edition introduced a requirement for stainless steel ties for walls over 11 m for high wind-driven rain areas such as coastal B.C. The 2004 edition has increased the threshold to 13 m, to recognize typical 4-storey low-rise buildings in B.C. Hot-dipped galvanized ties are the minimum requirement for lower walls, and for all walls in drier climates such as the B.C. interior. Climatic locations are defined in terms of an Annual Driving Rain Index (aDRI) in the standard.

CSA A370-04 REQUIREMENTS		
	Coastal B.C.	Interior B.C.
≤ 13m	Hot Dipped Galvanized	Hot Dipped Galvanized
> 13m	Stainless Steel	Hot Dipped Galvanized

BRICK TIES

- Wide range of two-piece adjustable types are available
- Must meet strict strength, free-play and deflection requirements
- Type and spacing determined by designer calculations based on manufacturer's tie test data, not from the standard. The tie designer may be specified to be retained by the contractor. Structural tie design is based on the B.C. Building Code requirements for wind and seismic affects on building elements and components.
- **Maximum spacing 600 mm vertically by 820 mm horizontally**
- Tie spacing may be greater for stiff back-up systems such as concrete block, compared to flexible systems such as wood or metal studs.
- **Ties now may be staggered, must be a top tie at every stud line.**
- Typically two piece ties for adjustability and ease of installation.
- Fasteners (Screws) - as per specifications for type of tie used.

"PRESCRIPTIVE" TIES

Old style strip and Z ties are no longer commonly used for commercial work due to their limited strength, cavity width and adjustability. Under Clause 10.2.2, their maximum prescriptive spacings in CSA A370 do not apply in higher seismic zones (seismic hazard index = 0.35, or high wind areas (q = 0.55 kN/m^2), and would have to be reduced by design analysis.

Sample Spec: Masonry connectors to CSA A370-04 requirements
Veneer ties shall be [hot dipped galvanized]
[stainless steel]
Veneer tie spacing shall be [ ] by [ ]
Acceptable veneer ties(s) [ ] manufactured by [ ]
Acceptable fastener(s) [ ] manufactured by [ ]

OR

Veneer tie type and spacing shall be provided from an engineer retained by the masonry contractor.

CONSTRUCTION **- CSA A371-04**

Covers:	Construction installation practices & tolerances Reinforcement & Grouting Movement Joints & Flashing Cold and Hot Weather Ties & Building Envelope	Not covered:	Masonry Design Tie Design Mortar & Grout Masonry units

- **Quality control**

By contractor supervision, and inspection by designer

- **Key items**

- CSA A371 applies to larger buildings – may differ from the NBC Part 9 for housing.

- MORTAR JOINTS

    - ± 3 mm tolerance, starting course bed joint max. 20mm

- ALIGNMENT TOLERANCES

    - now defined as tolerance “envelope”. If back-up is out of position to meet tolerances, mason should notify general and designer.

- JOINT REINFORCEMENT – Structural Masonry

    - maximum spacing 600 mm in running bond and 400 mm in stack bond. Typically specified at 400 mm for running bond in higher seismic zones.

- BRICK TIES

    - place wire component in centre of veneer wythe(± 13) mm at specified spacing.

- THIN VENEERS (SLICES)

    - now limited to 3 m height with regular masonry mortar.

- MOVEMENT JOINTS
    - locations as per drawings - if not shown mason should ask designer (see MIBC Tech. Man. Sec. 2.4.2)
    - joints in brick should be clear of mortar, particularly for joints below shelf angles.
    - less difference between concrete and clay movements than previously thought.
- SUPPORT OF MASONRY BY WOOD
    - now allowed if specifically designed – design for durability.
- GLASS BLOCK
    - non-loadbearing, mortar type and joints, reinforcement and anchoring (also see manufacturers' literature)
- VENEER WALLS
    - airspace to be "reasonably clear of mortar fins and droppings."
    - beveling back of mortar bed helpful
    - airspace minimum 25 mm - accommodate building tolerances - up to ± 13 mm
    - notify designer if tolerances can't be met due to field conditions.
- FLASHINGS
    - type and location as specified and shown
    - peel and stick types provide good lap seals and corner details
    - turn-up at ends to form end dams
    - notify designer if drawings do not show flashing where "good practice" would suggest
    - metal cap flashing at tops of walls should slope back to roof to prevent dirt run-down on wall face, and extend 75 mm down over masonry units
- COLD AND HOT WEATHER
    - treatment of mortar materials and wall protection covered for various temperature ranges (seldom a concern for B.C. coastal areas).

- GROUTING

    - complete filling of reinforced cores and bond beams is essential for high lift grouting
    - requires clean cores, high slump grout
    - cleanouts (inspection holes) called for if total pour height over 1.5 m (5 ft.) May be waived by engineer under Clause 8.2.3.2.2 for non-critical walls or based on demonstrated good workmanship.