SAINT JOHN HERITAGE CONSERVATION AREAS

Masonry

SAINT JOHN Héritage

INTRODUCTION

Saint John has a rich variety of masonry buildings that help form the character of our city. Many of them are excellent examples of particular styles of architecture.

The heritage value of any building is a product of its history, its architecture, and its contribution to the character of our neighbourhoods. The best approach to conserving this heritage value is to:

- Conserve the original historic fabric. Repair, rather than replace deteriorated architectural features. When replacement is necessary, match the original. Replacement of missing features should be based upon historical accuracy.
- Do not remove or alter original material or distinctive architectural features. Recognize buildings as products of their own time, and avoid alterations without historical basis or that create an earlier appearance.
- Recognize that some changes during the history of a building may have significance that should be respected as evidence of the history and development of the building.

The first step in any conservation project is to understand the building. Find out as much as you can about it. Identify its style, its approximate date of construction. Learn about the materials and methods used to build it.

TYPES OF MASONRY

A masonry wall consists of stone, brick, or concrete units bonded with mortar. Mortar is a mixture of lime, sand, water and, more recently, cement.

Masonry, if properly constructed and well maintained will last for centuries. The mortar joints will normally require repointing every 40 years or so. Alternatively, if allowed to deteriorate, or if improperly renovated or repaired, masonry can be costly to repair. Inspect masonry periodically, and carry out necessary maintenance as quickly as possible. Avoid renovation or cleaning techniques that will damage the masonry.

The performance of a masonry wall is dependent on proper design, materials, and artisanship. The introduction of water through wind-driven rain or melting snow and ice, can have an adverse effect on a masonry wall. When water enters the wall, deterioration can take place from:

- the expansion and contraction of the materials due to wetting and drying;
- the stresses set up by the formation of salt crystals just beneath the surface; or
- the freezing and thawing action of the water in the masonry. The Saint John climate is one of the harshest in Canada for masonry. The wet winters with repeated cycles of freezing and thawing accelerate deterioration of masonry wall assemblies.

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Stone

Building stones have been commonly used in Saint John for foundations and entry steps, and as decoration and structural support around door and window openings. Carved stone decoration was frequently used on Saint John buildings. Stone facades are less common, being found mainly on government buildings, churches and bank buildings.

Granite and sandstone have been quarried in the Maritimes for building purposes since early in the nineteenth century. The local limestones are of limited suitability for building purposes, so any limestone used here was probably imported. The limestones from the Saint John area have been used mainly for lime production.

Crystalline limestones (marbles) have been quarried around Saint John, and were used for foundations and rough building stone. These limestones were used for Trinity Church and the Cathedral of the Immaculate Conception (a Brookville stone).

The Maritime sandstones are olive-green, blue, brown or red in colour, and were exported widely across North America.

Granites were quarried in Charlotte County for use in monuments. St. George was the centre of the New Brunswick granite industry at the turn of the century. Spoon Island stone (granite) was widely used in Saint John for curbs and paving blocks, and also provided the bases for the Tilley and Champlain monuments.

Brick

Brick is manufactured from clay, by moulding it, and then firing it in a kiln. The methods used have evolved over the years, and affect the appearance and quality of the brick.

The clay used in brick manufacture is either from surface clay (loam) or shales. Techniques were developed in the 19th century to crush or pulverize shale for use in brick manufacture, and most Canadian bricks are now made from shale. Shaw's Chipman brick is made from shale, and has been manufactured since the 1930's.

The clay is moulded, either manually, by dry press, or by extrusion. The manual method produced two to four bricks at a time, by tamping the clay into wooden moulds pre-wetted with water or sprinkled with sand. The bricks produced were very irregular, and the surface texture was either sandy or smooth depending on whether sand or water was used on the mould.

Dry presses were used from about 1870, and could produce up to 30,000 bricks a day. The moulds were often shaped to create a hollow depression in one side of the brick, to develop a better bond between brick and mortar in a wall. Dry-pressed bricks had a more regular appearance.

The extrusion process is the method currently used for moulding bricks. The brick "mud" is extruded under pressure through a die, and is sliced by steel wire into brick sizes. The die permitted the manufacture of bricks with hollows in them, and with one textured surface.

The moulded brick is then air-dried and fired in a kiln. Early kilns were made of unfired bricks, stacked and covered with earth.

The sizes of bricks have changed over the years. This explains why it is complicated to repair or replace masonry using new bricks. Older (1875) brick was 7-3/4" x 3-3/4" x 2-3/8", usually with a thin 1/8" mortar joint on front facades. Until metrication Canadian bricks for side facades were sized so that the brick plus the mortar

Brick house on Germain Street

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joint was approximately 8" long, 4" deep, and 2-5/8" high (or 1/3 of the 8" length). The brick itself measured 7-5/8" x 3-5/8" x 2-1/4", with a 3/8" mortar joint. Brick is now produced by all Canadian manufacturers in metric sizes and measures 190mm (7-1/2") x 90mm (3-1/2") x 57mm (2-1/4).

Concrete Block

Concrete blocks have been used both as facing and as backup in masonry. For use as a facing, the blocks were often moulded to imitate stone textures and carved stone detailing. Hydrostone was a concrete block that was finished to approximate the appearance of cut-stone construction. Blocks intended for use as back-up often contain coarse aggregate and are very porous. These backup blocks will rapidly deteriorate if exposed.

Concrete castings were also used for decorative mouldings such as belt courses, window sills and lintels.

Terracotta

Terracotta has had limited use in Saint John, primarily as ornamentation on brick facades. The Imperial Theatre on King Square is decorated with terra cotta. Terracotta is fired clay, like brick, either cast or extruded, and the surface was often coloured and/or glazed. It offered an inexpensive alternative to carved stone ornament.

MORTARS

Mortar is used to bond the masonry units together. Although mortar is classified by compressive strength, its bond strength, workability and flexural (bending) strength are most important. Walls move and the ability of the wall to accommodate movement will affect its performance. The mortar must be weaker than the bricks so that wall movement stresses will only result in cracks in the mortar joints, which can easily be repaired, rather than damage to the bricks.

Lime-based mortars were prevalent until late in the nineteenth century when Portland cement mortars began to appear. Lime mortars are the most resistant to water penetration, but have a lower structural strength and lower resistance to frost action. Lime mortars are self-healing as rainwater leaches lime out of the mortar.

Cement mortars with little or no lime produce high strength rapid-setting mortars with good resistance to frost action. However, they establish a poor and uncertain bond that is further weakened by wetting and drying in service. Because these mortars are too hard, they damage the bricks.

Masonry cement is a pre-blended mixture of Portland cement, lime and various additives. Characteristics vary considerably, depending on the content. Lime-cement mortars can offer varying characteristics depending on the relative proportions of lime and cement. The lower the cement content, the greater the ability of the mortar to expire moisture and the greater the ability of the brick wall to flex and move.

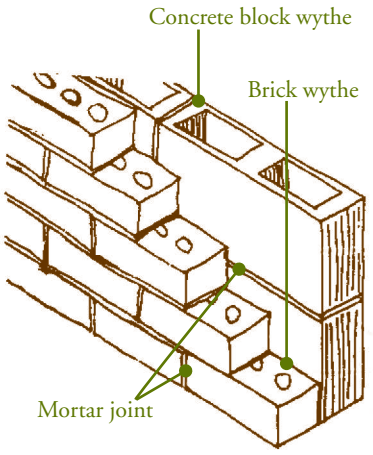
Mortars used for pointing should have high water retention to prevent rapid water loss to the masonry, and to ensure a good bond with the old mortar and masonry. Avoid mixes that will shrink excessively when drying. Match the existing mortar if its characteristics are known. Otherwise use the Traditional mortar mix.

Mortar Mixes

Traditional

For the repointing of most masonry buildings in Saint John, a traditional lime-based mortar is recommended, consisting of:

- 1 part White Portland (type 10- grey is not acceptable)
- 2 parts hydrated lime (high calcium soaked minimum 24 hours)
- 8 parts screened sand



Masonry wall section

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The lime and sand are first mixed to create roughage, or "rough stuff". White Portland is then added just prior to use.

Other Mixes

The following mortar mixes, types 'M', 'S', 'N' and 'O', should include sand at 2-1/4 to 3 times, by volume, the amounts of cement and lime used.

Type 'M' mortar with its high compressive strength (2500psi) is recommended for foundations and consists of:

- 4 parts White Portland and 1 part hydrated lime (or 4 parts masonry cement)

Type 'S' mortar, also with a relatively high compressive strength (1800psi), is recommended in loadbearing walls, and where a tensile bond is needed. It consists of:

- 2 parts White Portland and 1 part hydrated lime (or 3 parts masonry cement)

Type 'N' has a medium compressive strength (750 psi) and consists of:

- 1 part White Portland and 1 part hydrated lime

Type 'O' mortar has a low compressive strength (350 psi). It is suitable for solid non-load-bearing masonry, for walls constructed of solid units, located in weather protected areas and consists of:

- 1 part White Portland and 2 parts hydrated lime

Traditional stucco consists of 1 part lime, 2 parts sand, and water. *Contemporary stucco* consists of 1 part White Portland cement, 1/10 part hydrated lime, 3 parts sand, and water.

CURRENT ADVANCES IN THE MASONRY TRADE

Masons used lime-based mortars when constructing the heritage buildings in Saint John. Although it takes more time to prepare than Portland-based masonry cement, traditional lime-based mortar provides joints with more elasticity, allowing the building to 'flex'. Lime-based mortar joints become the weak link in the chain and prevent damage to the brick. Stronger Portland-based mortar is harder than the brick, and when the building 'flexes', the brick cracks instead of the mortar. For these reasons, conservation-minded masons are returning to traditional mortars.

MAINTENANCE

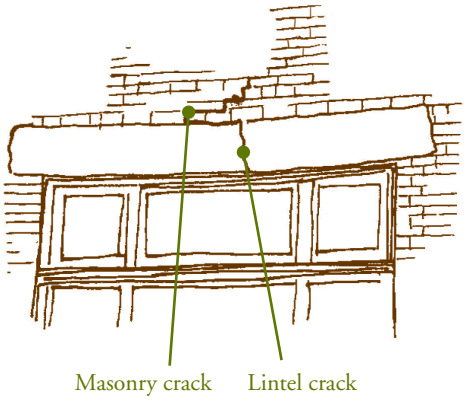
Regular maintenance will ensure that the wall functions properly, and will conserve it in good condition. Regular washing and pointing protects the wall from the elements, and provides an opportunity for periodic inspection and repairs. Repairs can usually be accomplished without disrupting, altering or scarring the surface.

The biggest problems with masonry are moisture-related. In most cases the weakest part of the wall is the joints. Crumbling mortar, deeply recessed joints, mould and discoloration are signs of water damage.

The top of the wall, and openings in the wall for windows are the common entry points for excess water in the wall. Regularly check roofs, gutters and eaves, cornices, flashings and sills for signs of deterioration. Caulk and repair as necessary. Replace or repair broken or missing downspouts to avoid a concentrated flow of water over the wall.

Cracks

Movement or settlement will cause cracks in masonry walls. Before fixing the cracks, determine why the movement occurred, and whether or not it's likely to re-occur.



Exterior wall crack

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Bulging Or Leaning

Seek professional advice if your wall appears to be tilted or bulging. A common cause is lack of or failure of ties between the exterior layer of masonry and the inner wall.

Caulking

Use caulking to seal gaps between materials and different building elements, and in joints where movement is expected. Caulking must be able to adhere to the surfaces and should accommodate movement in the joint. Large joints should first be filled with a foam backer rod to provide a bed for the caulking. Rubber butyl and polyurethane caulking will last 15- 20 years in exterior applications, and can be painted. Silicone caulk will last over 20 years but cannot be painted.

Caulking should never be used in mortar joints.

Repointing (& Rotary Grinders)

Ideally, only hand tools should be used to remove old mortar. Irreparable damage to brick on numerous heritage buildings has been caused by inexperienced operators of rotary grinders. Property owners have lost their grants in these cases.

The deteriorated mortar in vertical joints should be cleaned out by using a chisel and maul. DO NOT USE GRINDERS ON VERTICAL JOINTS. The use of grinders may only be considered when starting work on wide horizontal joints: then, cut out only the middle 1/3 of the deteriorated mortar. Remove the remainder with hand tools. Any attempt to remove a greater portion of the mortar with grinders will damage the edges of the masonry.

Note: If the mortar is intact and cannot easily be removed with hand tools, then it should be left in place.

Raked out joints should not exceed the original joint width. Cut out the joint to a depth of 2 to 3 times its width (usually about 1 inch deep), or deeper if the mortar is badly deteriorated. Clean out the joint with a jet of air.

Pack the joints with a traditional lime-based mortar, in successive layers of about 1/4", carefully matching the colour and texture of the original mortar. When the mortar has sufficiently set, "tool" the joint to shape it, matching the existing profile. One or two hours later, scrub or scrape off any excess mortar. Do not clean the joints with muriatic acid which destroys the lime. Instead, wash down the masonry wall using a masonry restoration cleaner.

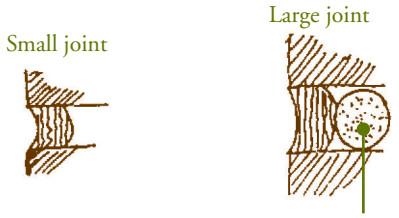
Note: Measures or precautions need to be undertaken to ensure mortar is allowed to cure a minimum of 28 days at no less than 10 degrees Celsius ambient temperature.

Brick Repair And Replacement

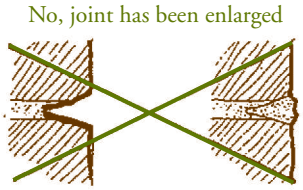
Minor repairs can be accomplished by replacing damaged material. Avoid using salvaged brick from an unknown source, or of inferior quality. Poor quality bricks were commonly used for interior walls, or the unexposed wythes, and will deteriorate rapidly if exposed to the elements.

Sandstone Repair

Repair a damaged portion of sandstone only if required to prevent water infiltration or to maintain the structural integrity of the element. This repair is done by removing the damaged material, squaring up the removal site and inserting a 'dutchman'. A 'dutchman' is a piece (of sandstone) cut precisely to fit the



Proper caulking



Proper repointing

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repair site. Surface repair techniques which claim to rebuild the stone generally look like patches.

Flashings

The joints between walls and adjacent materials or surfaces, such as low roofs over porches, are the weakest point in most exterior building envelopes. Any search for the source of leaks should start with a thorough examination of the protective flashings used in these areas. Flashing materials include various metals, roll roofing, sheet plastic and rubber. Avoid using dissimilar metals together. Chemical reactions between dissimilar metals can accelerate deterioration of the flashing materials and compromise their ability to protect the joints.

Cleaning

Cleaning of masonry is often undertaken for aesthetic reasons. However, cleaning a thick build-up of dirt can, by exposing porous masonry units to greater absorption, inadvertently increase the effects of atmospheric pollution or of frost on the masonry. When cleaning masonry, always use the gentlest means possible, starting with a mild detergent, water and brushes.

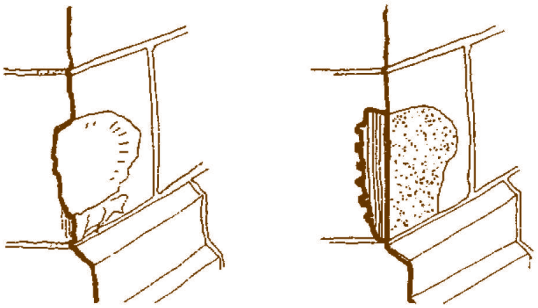
Painting / Parging Over Masonry

Masonry is best left uncoated. The exterior face of the brick is glazed during the kiln firing process and acts as a protective covering against moisture. When coated with paint or parging, moisture or water can get trapped within the brick. When this trapped water freezes, it expands until it reaches ±4 degrees C. The expansion occurs in the path of least resistance, usually outward, spalling, or fracturing, off the exterior face of the brick at the same time.

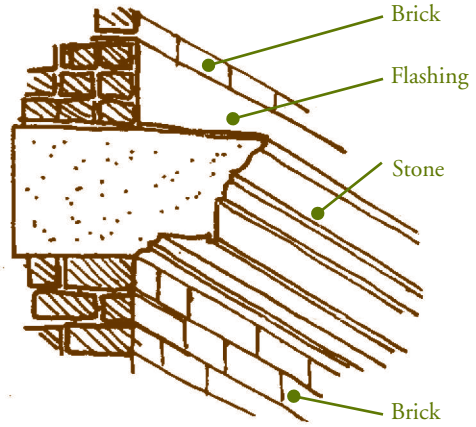
Once this exterior glazing 'spalls' off, the porous inner portion of the brick absorbs considerably more water and the process of deterioration advances rapidly. Brick is particularly vulnerable in the spring, when there are numerous freeze/thaw cycles. Paint/parging should be removed using the gentlest means possible so the exterior face of the brick is not damaged. Brick must NEVER be sandblasted to remove paint since this aggressive process removes the glazed face. The brick then becomes like a sponge, absorbing water and eroding at its outer face.

Water Repellent Coatings

If the wall appears patchy after paint or parging is removed, the wall can be 'repainted' with a pigmented, breathable coating which will cover the damaged material, and provide a uniform appearance. These coatings must allow any accumulated water vapour to expire, or breathe, similar to a 'gortex' coat.



Sandstone patch



Wall section

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FOR MORE INFORMATION

The Practical Conservation Guidelines, application forms for Grants and Certificates of Appropriateness and other useful information for fixing up your older building is available from:

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