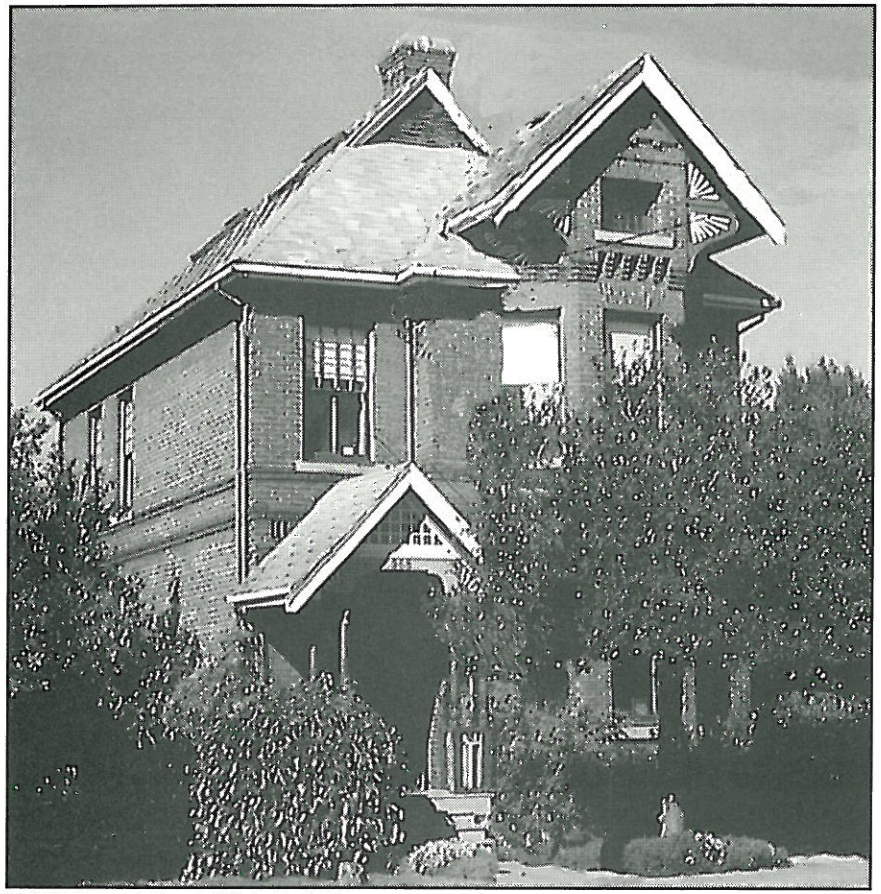
Your Old House

Masonry

Robert M. Patterson, P. Eng.



968 Balmoral Road, Victoria, BC

Victoria Heritage Foundation

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Bibliography:

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Fort Fraser Brick Yard, Fort Fraser, BC: first kiln of bricks, c1914. Photographer unknown. BCA HP065360

Maintaining Historic Masonry

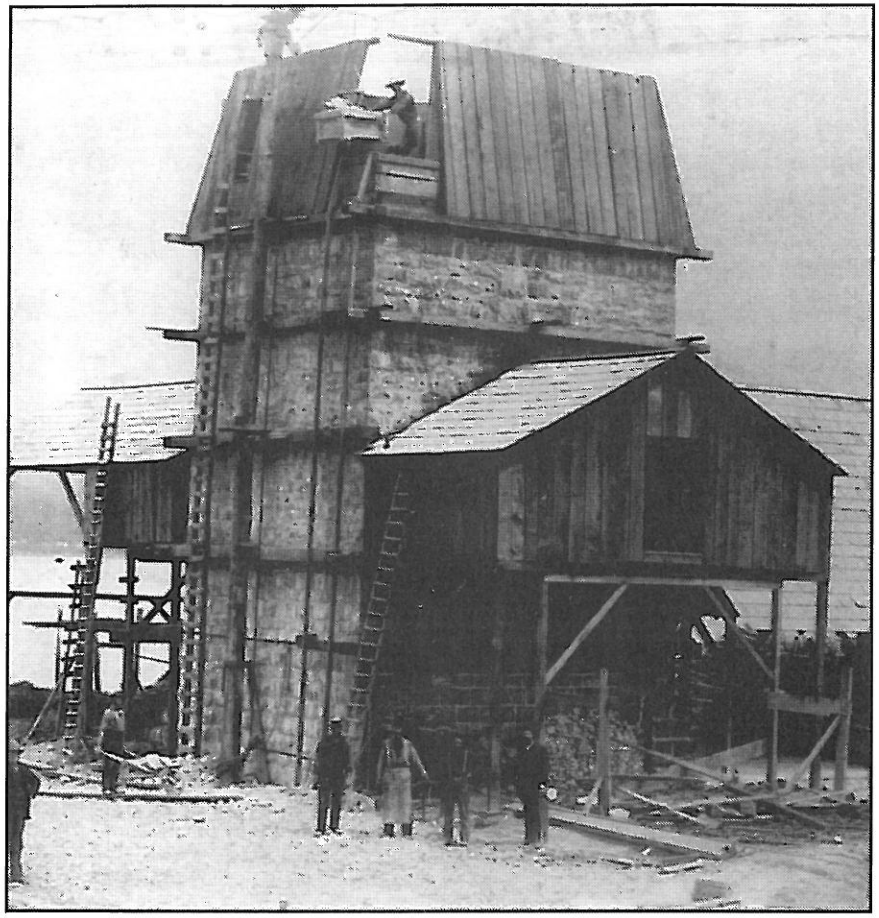
The durability and appearance of brick and stone buildings set them apart from the many timber structures in British Columbia. Masonry buildings are often easier to maintain than their wooden counterparts, but when repair is required, it can be problematic and expensive. This brochure is written to provide an overview of masonry construction and of some of the most common problems that occur in brick and stone buildings.

Historical Context

European settlers arriving in British Columbia brought the building traditions of their homelands and quickly adapted those traditions to local conditions. Readily available fieldstone was used, and it was not long before local brick manufacture started. By the 1870s, substantial masonry buildings had been erected in many parts of the province.

The early brickworks employed simple methods: clay was excavated, mixed with sand and moulded by hand in forms. Kilns were made of the unfired brick itself. The bricks were of varying quality, ranging from unfired "salmons" to overfired "clinkers." A fair proportion of the brick was good enough to be used as face brick on the exteriors of buildings. The substandard brick was put to good use in the interior wythes [partitions] of the solid brick walls. The lower firing temperatures were responsible for the rosy hue of the brick made during this period. New technology introduced in the 20th century has resulted in bricks that are more consistent in size and quality and in a greater variety of colours, but without the warm colour and appealing texture of the earlier product.

Because stone is a natural material, the development of its use in BC focused on the discovery of suitable deposits and the employment of tools for extraction and cutting. As larger and more sophisticated buildings were proposed, many quarries were opened in the 1890s and first decades of the 20th century. Granite and sandstone were among the most common stones for residences. Many BC stones are durable, but sandstone from the Gulf Islands is soft and problematic. Most quarries in BC have closed, and stone is now often recycled from old buildings or purchased elsewhere.



Vancouver, BC: San Juan Lime Company Kiln: many such works were erected in the colonial period to burn limestone and make quicklime (CaO) from which lime mortar was produced. Photo c1888. BCA HP009184

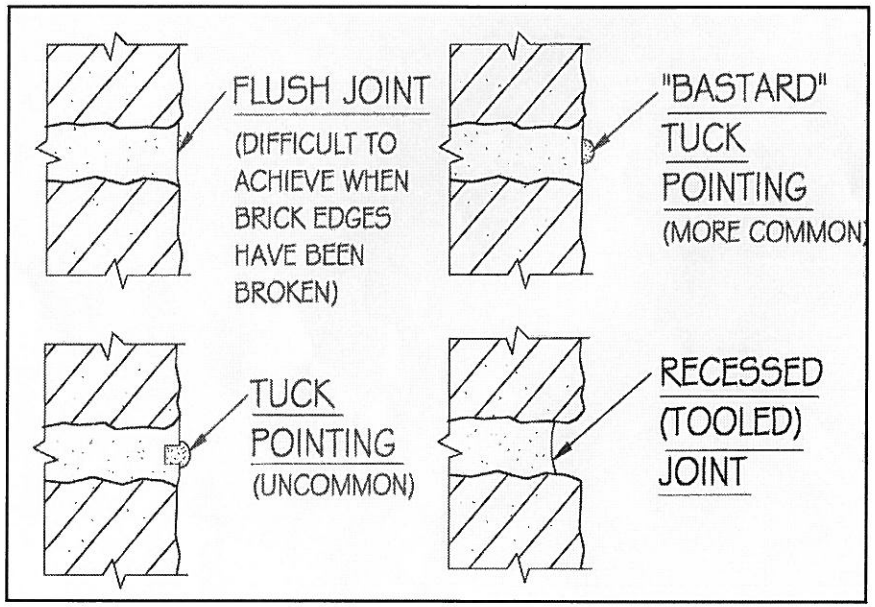
Mortar for Brick and Stone

Mortar is made of sand and one or more binding agents. To provide the binding agent, early settlers burned limestone or sea shells in kilns to produce the quicklime from which lime mortar was made. This type of lime produced a soft, weak and slow-hardening mortar still found today in buildings of the 1890s and earlier. The locally produced lime was inferior to naturally occurring deposits of hydraulic lime that masons had been accustomed to in Europe. Hydraulic lime had the property of hardening more quickly (even under water) and producing a stronger, more workable and weather-resistant material.

When Portland cement became available in the late 1800s, it was found that mixing a small portion of this material with lime mortar produced much the same effect as hydraulic lime. Buildings after 1900 generally employed this formula. In recent years, building codes have specified the use of higher proportions of Portland cement, producing mortar that is stronger than the old brick and softer stones. Use of such mortars can cause serious deterioration.

Jointing Styles in Brick and Stone

Jointing is the process of finishing the exposed mortar between successive courses of brick or stonework. Victorian brickwork in BC almost invariably employed a flat or flush joint. This was often embellished with some form of tuck pointing in imitation of a higher class of brickwork that, in its true form, would require bricks of higher quality than those that were available. The flush joint often employed coloured mortar to match the brick. After the turn of the century, under the influence of new esthetic trends, recessed mortar joints became more popular. These types of joints are easily identified and should, of course, be replicated in any repair work.



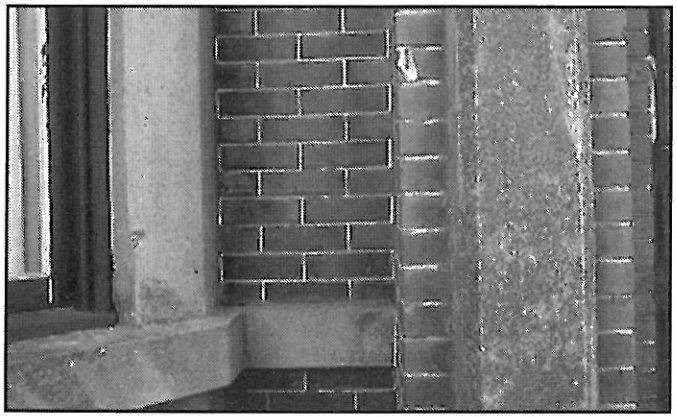
Inspecting & Analyzing Masonry Problems

A basic principle of correcting any building problem is to determine the root cause; otherwise, damage will continue in spite of cosmetic repairs. The most common causes for damage in masonry are settlement of foundations, water penetration, wind erosion and air pollution. The latter is a relatively small problem in BC.

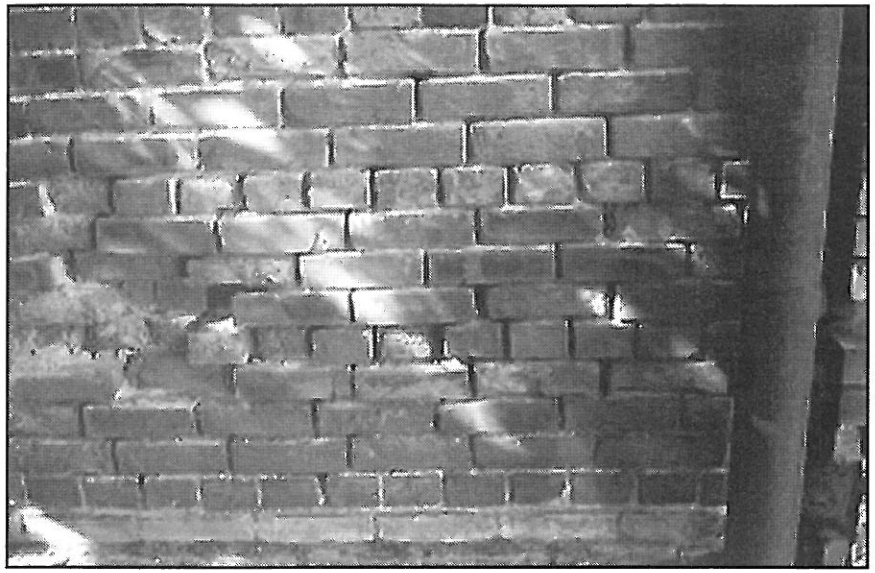
Major foundation settlement is a problem for a structural or geotechnical engineer, but it is useful to determine if the movement is active or has been stable for many years. Some cracks may date from the early years of a building's lifetime and not pose an ongoing problem.

Water is most often the cause of active and serious damage to masonry. One source is rain or snow, which can usually be traced to roof leaks, malfunctioning gutters and rainwater leaders. Uncontrolled water infiltration results in deterioration of the mortar, the leaching of salts out of the masonry (leaving deposits on the surface - efflorescence) and increased susceptibility to freeze-thaw damage. A less-common cause of water damage is so-called rising damp, where water rises by capillary action from the foundations. Rising damp can be controlled by improvements to the perimeter drain system, control of surface water close to the building, or by installation of a damp-proof course within the wall, a complicated procedure.

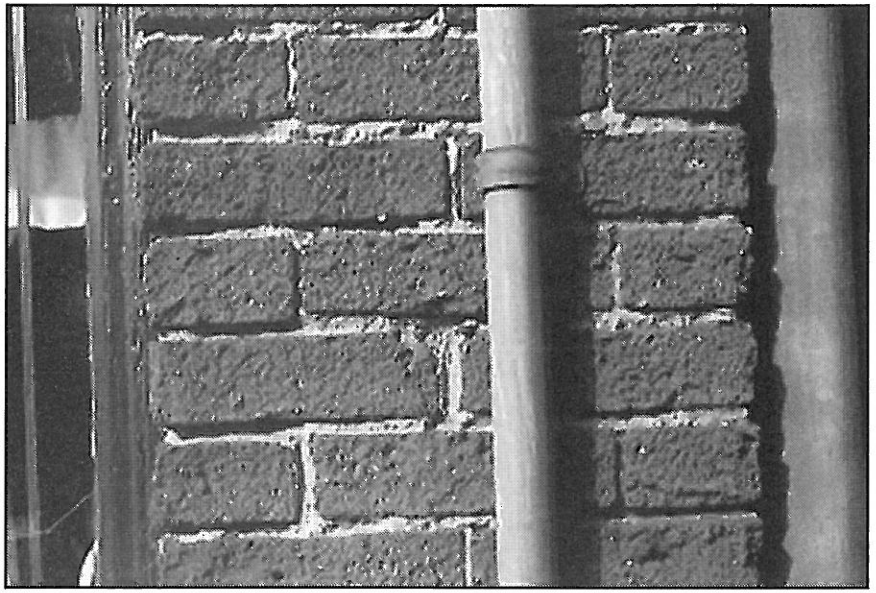
Wind erosion can occur with soft brick, stone and mortar in exposed locations. Similar damage is caused by sandblasting, which is not an acceptable treatment for masonry. Chemical stripping is generally the best method for paint removal.



Traces of tuck pointing: the lime mortar has been struck flush and coloured to match the brick, and fine lines of "bastard" pointing have been applied.



Deterioration of pure lime mortar: weathering by rain and wind has removed much of the soft mortar. In the lower part of the wall, the bricks have actually been displaced, and rebuilding is required. The brickwork in the upper part can be repointed.



Brick damaged by sandblasting: the smooth surface of this locally made brick has been removed by sandblasting, producing a rough open surface that is not only unattractive but is also more vulnerable to weathering and water penetration and difficult to clean.

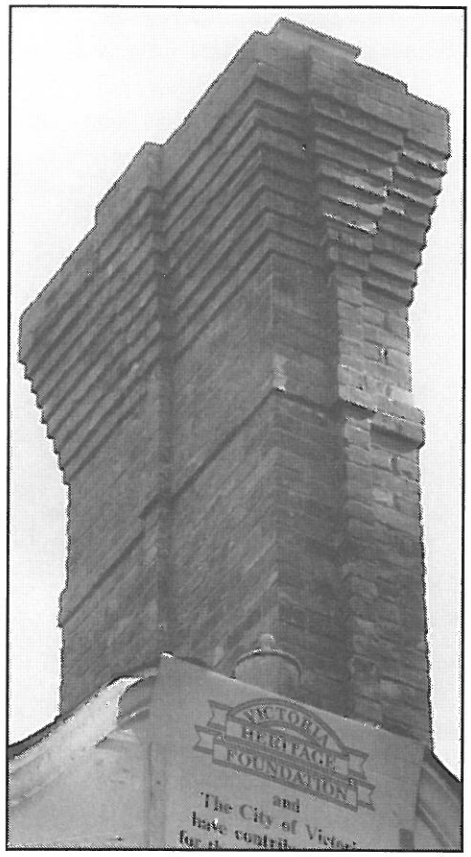
Masonry Repair Procedures

Repair and maintenance procedures for masonry surfaces include rebuilding, repointing, cleaning and the application of proprietary coatings. But first consider: Is this procedure really necessary?

Certainly, some repairs are essential. Damaged or collapsed work will need rebuilding, for example. Proposals for cleaning or the application of coatings, on the other hand, need to be considered carefully. Potentially, there are deleterious effects from such treatments, which are also quite costly. Cleaning of stone, for example, results in the loss of some original material and is generally only justified where pollution deposits are actively causing deterioration.

Rebuilding

Whether brick or stone, the objective is to have the new work nearly indistinguishable from the old. Masonry units should be recycled where possible, and replacement units should match closely. Often, these can be obtained from demo sales or recycling yards. For the home-owner, a common project is the rebuilding of a chimney top, which is used here as an example.



Rebuilding of an elaborate chimney: the design of this chimney was recorded prior to dismantling, then carefully replicated using original or matching old brick and appropriate mortar and jointing style.

The colour and texture of the mortar will be determined by the kind of sand that is used, the proportions of sand:lime:cement (S:L:C) and the type of Portland cement (see Repointing, below). Before proceeding to get estimates, check with the local fire department and building inspector to see if they have any requirements, as this can affect the scope of work substantially. Use competent and well-recommended masons for your bids, remembering that this repair should last 50 years. If replacement units are required, ask for samples. Discuss the kind of mortar the mason intends to use. Advise your mason not to turn bricks sooty-face out. (This happens!) For complicated chimneys, take photographs and measurements and ensure that they are followed during reconstruction.

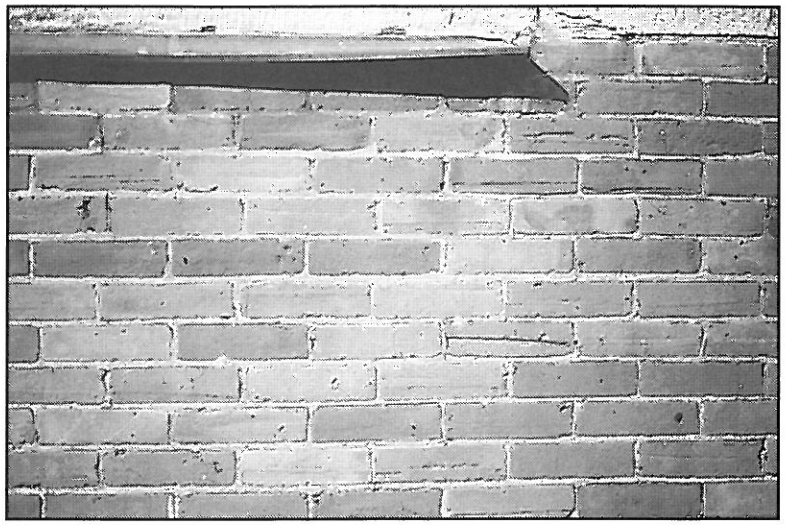
Repointing

Repointing is the process of raking out one to two centimetres of mortar from the joints of brick or stone and replacing it with new mortar. It is required where mortar has deteriorated by weathering (often due to uncontrolled rainwater) or when structural movement has opened up the joints. Repointing should be applied only where necessary. Removal of sound mortar for the sake of doing an entire wall, for example, is structurally unnecessary and can lead to damage of the masonry units. Instead, effort should be put into closely matching the pointing mortar to the colour and texture of the existing mortar.

Extremely poor repointing showing many errors: the new mortar, which has a high cement content, does not match the original in colour or strength. The application has been smeared onto face of brick and cannot be removed. The jointing style is also inappropriate.

Samples of sand from the existing mortar can be examined under a magnifying glass, and a reasonable match can be made. Ordinary Portland cement colours the mortar a cold gray in contrast to the creamy tone of original lime mortars. This gray colour can be offset by using a portion of white cement. For critical work, samples should be made and allowed to weather enough to show the true effect of the sand colour.

In addition, the strength of the mortar mix is important. The least strong Building Code mix is type K with a S:L:C ratio of (12:2:1), which has a nominal strength of 60 psi (0.4 kPa). For most historic brickwork, this mix is satisfactory. For most stones, the strength issue is less critical, and the higher portion of cement is acceptable.



An excellent example of repointing: the repairs are virtually undetectable, and the colour and jointing style match the original exactly, with no excess mortar on the face of the brick.

Conclusion

Most masonry projects have unique aspects that cannot be covered in this brief overview. Building owners undertaking masonry projects should therefore consider obtaining professional assistance from consultants who specialize in heritage restoration work and/or be prepared to undertake further study, trial samples, etc. The results of careful research, planning and preparation will be rewarding and worth the effort.

Robert Patterson has a background in architecture and engineering design, with special skills and experience in survey and inspection of older structures. Providing consulting services in heritage restoration and adaptive use of heritage buildings, he specializes in incorporating current standards while solving unique problems associated with older structures, and emphasizes the importance of research, careful observation and knowledge of traditional building materials and techniques. Phone: 250-381-5752

Victoria Heritage Foundation (VHF) was established in 1983 by the City of Victoria to administer a program of grants for exterior and structural restoration of legally protected heritage houses. Of 267 such properties, more than 200 have received VHF grants, and 45 owners have won Hallmark Society Awards for superb restoration. VHF's Education Committee conducts a variety of projects aimed at raising heritage awareness among citizens and visitors to Victoria, and educating owners of heritage structures on sympathetic methods and materials for restoration.

Vancouver Heritage Conservation Foundation (VHCF) is a private, non-profit, charitable organization created by the City of Vancouver in 1992 to assist in the conservation of Vancouver's built heritage, in recognition of its public benefit. The Foundation has a professional staff and is governed by a citizen board appointed by Vancouver City Council. In 1999, the Foundation commenced a building grants project, *True Colours*, that assists owners of designated houses with exterior maintenance, while emphasizing the importance of authentic period colour schemes.

Heritage Society of British Columbia (HSBC) is a non-profit umbrella organization that represents more than 300 group, individual and corporate members from all parts of BC. Incorporated in 1981, the society's purpose is to provide leadership and encouragement for heritage conservation in BC.

British Columbia Heritage Trust (BCHT) has provided financial assistance to this project to support the conservation of our heritage resources, gain further knowledge and increase public understanding of the complete history of the province of British Columbia.

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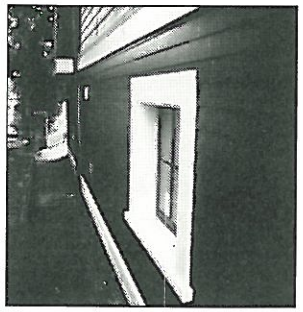

YOUR OLD HOUSE
WOOD WINDOWS

YOUR OLD HOUSE
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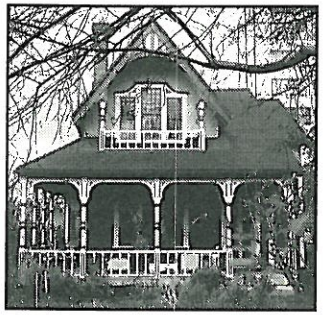

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