

EXHIBIT 8



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Granite: Characteristics, Uses And Problems

CSI Division:

Division 4- Masonry

Section:

Granite

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Disclaimer

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Prior to inclusion in GSA's library of procedures, documents are reviewed by one or more qualified preservation specialists for general consistency with the Secretary of Interior Standards for rehabilitating historic buildings as understood at the time the procedure is added to the library. All specifications require project-specific editing and professional judgement regarding the applicability of a procedure to a particular building, project or location. References to products and suppliers are to serve as a general guideline and do not constitute a federal endorsement or determination that a product or method is the best or most current alternative, remains available, or is compliant with current environmental regulations and safety standards. The library of procedures is intended to serve as a resource, not a substitute, for specification development by a qualified preservation professional.

Rewrite

We've reviewed these procedures for general consistency with federal standards for rehabilitating historic buildings and provide them only as a reference. Specifications should only be applied under the guidance of a qualified preservation professional who can assess the applicability of a procedure to a particular building, project or location. References to products and suppliers serve as general guidelines and do not constitute a federal endorsement nor a determination that a product or method is the best alternative or compliant with current environmental regulations and safety standards.

This standard includes general information on the characteristics and common uses of granite and identifies typical problems associated with the material. See also 04400-01-S for guidance on inspecting stone masonry failures.

Introduction:

Granite is one of the most durable stones used in artistic and architectural applications, including outdoor sculpture. Granite is defined by the American Society for Testing and Materials (ASTM) as a "visibly granular, igneous rock generally ranging in color from pink to light or dark grey, and consisting mostly of quartz and feldspars, accompanied by one or more dark minerals". The definition goes on to point out that "some dark granular igneous rocks, though not properly granite, are included in the definition." Some dark colored igneous rocks which are actually basalt, gabbro, diorite, diabase and anorthosite are quarried and sold as "black granite." These stones contain little or no quartz or alkali feldspars, but, for all practical purposes, they are used interchangeably

with true granites.

In addition to the quartz and feldspars, granite may also contain other minerals such as mica, hornblende and occasionally pyroxene. Compared to calcareous sandstones, marble and limestone, granite is not an acid soluble stone and is much more resistant to the effects of acidic solutions, rainwater or cleansing agents. In general, igneous building stones, such as granite, have a more inert composition; show much lower rates of deterioration; have lower water absorption, and are harder than marbles, limestones and sandstones.

Typical Uses

Granite, like other building stones, is used for a variety of structural and decorative purposes. Typical exterior uses for granite include:

1. Sculpture
2. Sculpture bases
3. Structural and veneer building stone
4. Architectural trim
5. Paving and curbstones, and
6. Grave markers.

Some applications, especially the simpler or more limited ones, can be monolithic, however most uses will require the joining of smaller pieces through various mechanical methods. Joining methods and techniques must be identified and evaluated as an integral part of the evaluation of the system of construction, because of the integral role of the joint in maintaining the soundness of the system.

Problems and Deterioration

Problems may be classified into two broad categories: 1) Natural or inherent problems based on the characteristics of the material and the conditions of the exposure, and 2) Vandalism and human-induced problems.

Natural or Inherent Granite Problems:

Blistering:

A swelling on the surface followed by a rupturing of a thin, uniform skin. Although most common on sandstone, this problem may occur with granite. It is typically caused by de-icing salts and/or ground water, therefore it is usually localized near ground level.

This condition may stabilize and remain constant, however it frequently precedes additional problems such as spalling or exfoliation. There is currently no established treatment other than rectifying the conditions that cause the blisters, spalling, or delamination. When this symptom is observed, it should be noted in assessment or inspection reports and reported to the Regional Historic Preservation Officer (RHPO).

Chipping:

The separation of small pieces or larger fragments from a masonry unit, frequently at the corners, edges or mortar joints is called "chipping." These fractures are generally caused by the impact of deterioration and repairs, especially the use of too hard a pointing mortar, or by accident or vandalism.

For specific guidance on repairing chips in granite, see 04465-10-R.

Cracking:

Visual symptoms of cracking include appearance of narrow fissures ranging from less than 1/16 to 1/2 inch or more wide in the stone. It results from a variety of causes, for example, structural overloading due to settlement, the use of too hard a mortar mix or

a flaw in the material. Minor cracking may be no problem in and of itself, but it can also be an important early indication of structural problems. Cracks can be a point of entry of water into the interior of the stone, promoting salt migration. Repairs include patching and replacement.

For specific guidance on repairing cracks in granite, see 04455-03- R.

Detachment:

This is not a failure within the material per se but a failure of the construction system, i.e. the connectors and/or joints. The definition implies that the failed component survives intact and may be re-installed using appropriate mechanical techniques.

The failure of structural anchors or metal connectors which lead to detachment may be caused and/or accelerated by the penetration of water into the structure behind the stone, causing rust and corrosion. Adequate pointing and caulking will prevent leakage and penetration of water into the structural system.

For specific guidance on repairing detached granite, see 04465-11-R and 04465-24-R.

Efflorescence:

The appearance of a whitish deposit locally or uniformly over the surface may be efflorescence, the surface deposition of soluble salts. There are numerous sources for the soluble salts which create the hazy appearance; salts can originate from mortar, improper cleaning agents, rising damp, de-icing salts, chemical landscaping treatments or air pollution.

Efflorescence can be a salt residue resulting from improper chemical cleaning, i.e. too strong a chemical cleaner or inadequate rinsing. Since it can be an indication of water problems, salt migration and/or sub-florescence, efflorescence should be considered a symptom which should be investigated to identify the source of the soluble salts and/or the moisture. Corrective action should then be taken to eliminate both if possible.

Some efflorescence may occur naturally with new stones, mortar and installation materials. Normally, this efflorescence will be removed by natural rain and weathering processes and/or by regular washing. The new or continued appearance of efflorescence is a stronger indicator of problems like rising damp or inappropriate cleaning methods, all of which should be referred to the RHPO.

For specific guidance on removing efflorescence from granite, see 04500-02-R.

Erosion:

Erosion is the wearing away of the material surface by the natural action of wind, windblown particles and water. It can occur with granite as well as any exposed material. This is a less serious problem with granite than with other stones, however inspections should include examination for any apparent loss of detail and edge sharpness which could be due to erosion.

Erosion may have less serious implications on rock-faced or other base applications, but more serious impact on granite sculpture and ornament with finer detail. Little can be done to correct this problem once it occurs, other than to protect the surface from further exposure. This may stop or at least retard the process.

Flaking:

This is an early stage of more serious problems such as peeling, exfoliation, delamination or spalling and is evidenced by the detachment of small flat thin pieces of the outer layers of stone from a larger piece of stone. Flaking is usually caused by capillary moisture or freeze-thaw cycles which occur within the masonry. Applications of water-repellent coatings may result in flaking by trapping moisture beneath the surface.

The problem can also occur due to sub-florescence, so that if flaking occurs, the area should be inspected closely to determine if salt crystallization is occurring in the flaked areas. The symptom will be a thin coating of a whitish deposit where the sub- surface is

exposed. Observations should be made as soon as possible or inspection be directed to where flakes have not yet separated, because evidence of sub-florescence may be washed away after the subsurface is exposed.

For specific guidance on repairing exfoliated granite, see 04465-15-R.

Peeling:

Peeling is flaking away of the surface from the substrate in strips or layers. It can result from the improper application of masonry coatings which result in failure of the coating and/or stone surface.

Encrustation of the surface caused by chemical reactions with environmental elements may also peel or flake along the plane of interface with stone.

Rising Damp:

Rising damp is the suction of ground water into the base of masonry through capillary action. Moisture is drawn up into the stone and the level may rise and fall due to conditions of temperature; humidity; site grading; absence or failure of damp courses, and/or treatments to the masonry surfaces which affect evaporation.

During active wet periods, rising damp may be visible as a darkening of the stone along the base at ground level. Due to the continuous changing of the moisture level due to varying exposure conditions, staining or efflorescence may be visible at a range of several feet up from the ground. Continued rising damp can lead to more severe problems of flaking, peeling and/or spalling, but the correction of the problem requires the elimination of the source of water or the interruption of its path into the stone by physical or chemical damp-proofing.

Spalling:

Spalling is the separation and breaking away of layers or small pieces of stone due to sub-florescence; freeze-thaw; improper repointing with too hard a mortar mix or portland cement, or structural overloading of the stone.

Spalling is less common with granite than with softer sedimentary stones. Granite is hard enough to resist internal forces which would cause spalling in other natural stones or fabricated masonry.

For specific guidance on repairing spalling granite, see 04400-03-R.

Sub-Florescence:

This is a potentially harmful internal accumulation of soluble salts deposited under or just beneath the masonry surface as moisture in the wall evaporates.

The source of the salts can be de-icing salts; chemical cleaners or landscaping products; mortar and/or air pollution. The salts get into the stone dissolved in rainwater or groundwater via natural absorption, rising damp or poor joints. The build-up of salts and their subsequent crystallization can create substantial pressures with the masonry, eventually causing pieces to break off along the planes of deposition. Efflorescence at the surface is an important early indication that sub-florescence is a possible hazard. Techniques for mitigating the problem include poulticing, removal of identified salt sources, elimination of moisture in the stone and damp-proofing.

Staining:

A variety of stains may appear on stone, each having different characteristics and requirements for removal. Staining can be caused from such sources as:

1. bird droppings
2. corroded iron or steel connectors within the masonry
3. salt crystallization (efflorescence)
4. run-off from bronze or metal sculpture/ornament
5. accretion of particulates (dirt, soot, etc.), and
6. graffiti.

Identification of the type of staining is necessary prior to planning for the removal of stains. For specific guidance on stain removal, see the following:

1. Bird droppings, see 0510-02.
2. Dirt/soot, see 440001, 0440002-P, 04400-03 and 04465-03
3. Copper/bronze stains, see 0446502
4. Graffiti, see 04455-12 and 04455-13
5. Rust stains from corrosion, see 0446501

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