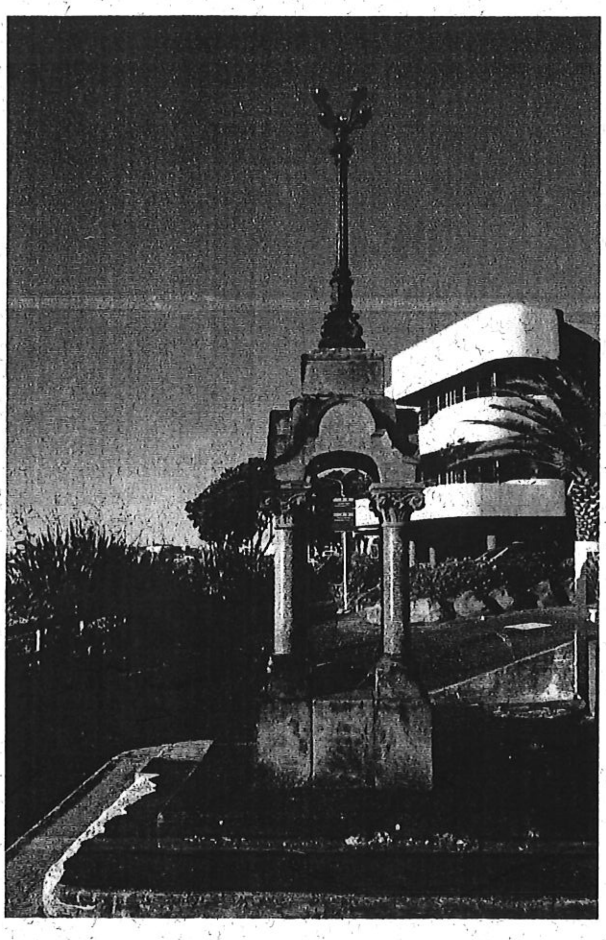
Honeyfield Fountain, New Plymouth

CONDITION AND REMEDIAL ACTION REPORT



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2003

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1.0 INTRODUCTION

This commission to prepare a condition report on the Honeyfield Drinking Fountain Memorial, New Plymouth, was requested by Kelvin Shooter of the District Council.

The inspection and reporting methodology are those described in lecture notes by Alejandro Alva Balderrama, Condition Survey and Inspection of Historic Structures, ICCROM. The inspection was carried out on 13 June, 2003.

1.1 Heritage significance of the monument

The Fountain is registered as a Category II Historic Place and was built in 1907.

2.0 CONSTRUCTION OF THE MONUMENT

The structure appears to be constructed of a sandstone (probably Sydney sandstone), polished granite columns with concrete and cement rendered steps. The base above the steps appears to be a stone of volcanic origin, probably New Plymouth andesite. The lamp standard is of painted cast iron while the remaining base of the drinking fountain is glazed ceramic.

3.0 INSPECTION PROCESS

The inspection was visual only of accessible areas and elements and did not include destructive testing of fabric. Therefore the inspection and conclusions cannot guarantee that all defects have been defined.

The building was inspected from the ground and from all available points. The inspection proceeded from the top to the bottom, north, east, south and west.

4.0 SUMMARY OF VISIBLE DETERIORATION

4.1 Definitions

The stone deterioration mechanisms are described according to international standard definitions of "CNR Centri di Studio di Milano e Roma Sulle di Deperimento e sui Metodi di Conservanzione delle Opere d'Arte - ICR Istituto Centrale per il Restauro - Normal - 1/88 Alterazione Macroscopische dei Materiali Lapidei:Lessico". These comprise:

Alveolisation	weathering caused by wind abrasion and salt crystallisation which enlarges natural pores and creates a coarse open texture on the surface of the stone.
Crusts	formation of a hardened outer surface of the stone, from natural or artificial deterioration or attempts at consolidation. The crusts have a tendency to spall. Another hardened outer skin can form and the process continues.

Deformation	where the original position of the stone has been altered. Causes of deformation include rusting steelwork and earthquake damage.
Efflorescence	crystallisation of soluble salts within the stone or on the exterior of the stone. Mechanical damage can be caused to the stone by the increase in size of the salt from liquid to crystal.
Exfoliation	usually occurring in a sedimentary stone where the stone splits in layers in the plane of sedimentation. This form of deterioration is often seen where the stone has been incorrectly laid.
Fractures	splitting or cracking of the stone, usually caused by mechanical action such as rusting steelwork, earthquakes, or frost.
Mechanical damage	stone which has been mechanically removed.
Staining	discolouration of the stone caused by material within the stone or another material. The colour of the stain will often indicate the source.
Skin damage	where the surface only of the stone has isolated areas of decay similar to but not as extensive as alveolisation. Decay may be along planes of sedimentation.
Pitting	deep isolated small holes in the stone surface.
Presence of vegetation	vegetation on the stonework.
Swelling and blistering	layers of stonework flaking off the surface, not necessarily in the plane of sedimentation, or over the whole of the surface of the stone.
Piecing in	(Dutchman repair) where small sections of stone are inserted to effect a repair.
Plastic repair	cementitious or lime based repairs to stonework
Pressure chipping	where there are chips or small cracks on edges of the stone caused by an insufficient depth of joint resulting in the stones touching. The weight of stonework above causes a pressure point at the point of stone contact with resultant damage.

Surface reworking	where the surface of the stone has previously been retooled by combs, disc sanders or other mechanical means.

4.2 General areas of deterioration

The cast iron lamp standard is rusting, has missing lights and damaged and broken fittings. The sandstone is dirty, has microbiological growth, mechanical damage especially at corners and capital volutes, fractures of capital mouldings, alveolisation especially of the interior, skin damage and swelling and blistering. There is evidence of efflorescence. The monument has been pointed with cement pointing which has eroded and has cracked along joints and cement has been used for plastic repairs of the andesite base. The andesite base has pitting from removal of inclusions. The cement and concrete base has mechanical damage, fractures and surface crazing.

5.0 INDICATIONS OF POSSIBLE CAUSES OF DETERIORATION

5.1 Stonework

5.1.1 Mortar joints

The base of the structure has hard cement mortar. Cement pointing is excessively hard and shrinks on drying, allowing small cracks between the stonework and pointing to open up. The base pointing is in variable condition with some loose, missing and fractured, allowing moisture into the mortar joint. Moisture passes easily through small cracks by capillary action and soluble salts, mainly sulphates, are put into solution with the saturation of the stone. Efflorescence and sub florescence result. Where the salt recrystallisation occurs between the inner core of the stone and a hard outer surface, such as cement pointing or plastic repair, the whole of the surface can spall resulting in the loss of mortar joints.

5.1.2 Soluble salts

The action of soluble salts is perhaps the most common means of deterioration of masonry. Soluble salts such as chlorides, sulphates, nitrites and nitrates can come from the ground, atmosphere, from within the stone itself, or from the materials used to construct the structure such as sulphates from cement.

Air borne sulphur dioxide is the most important source of sulphates. Sulphur dioxide can originate from volcanic eruption, sea spray, biogenic emissions, combustion of fossil fuels, rain, and from dry depositions (in general man-made sources comprise 37%, and natural sources comprise 63%, however in urban areas the percentage of sulphur dioxide is many times greater). Air borne sulphates are deposited on the surface of the stone by dry deposition (airborne pollutants transported by wind and turbulence) and are retained on smooth surfaces by diffusion, thermophoresis effects (a temperature gradient causing gas molecules to migrate towards the stone surface), and wet deposition by condensation and rainfall.

The monument is very close to the sea and chloride salts are very likely to be deposited on the monument from sea spray. It is likely that the salts have damaged the cementing material in the matrix of the stone, dislodging large fragments. Chloride salts deposited on the exterior, put into solution can also attack the steel pins in the stone and steel reinforcing in the concrete.

Salts absorbed into the stone or already within the stone are transported by moisture to the outer surface of the masonry where they crystallise. Where the crystallisation occurs on the exterior, termed efflorescence, generally no damage occurs, however where the crystallisation occurs in the interior of the masonry, termed cryptofloresence or subflorescence, damage is likely. Cryptofloresence causes disaggregation of conglomerates such as andesites and alveolisation of the sandstone. Where there is a hard outer skin on the stone, efflorescence occurs between the softer and harder layers of stone, which causes the same damage as cryptofloresence. Harder layers can be caused by accumulation of aggressive pollutants such as train and vehicle fumes.

5.1.2 Rusting steel pins and reinforcing

It is not known how the structure was constructed, however, the most common form of fixing stones to a base was by use of steel pins or dowels. Where moisture is allowed into the structure, the steel pins rust, splitting the stone as rust can expand up to eight times its original size.

Chlorides are very damaging to reinforcing steel as oxidation can continue without the presence of moisture. It is likely that rusting of steelwork has caused the fracturing visible on the external cement surfaces.

5.2 Vegetation

5.2.1 Micro-biological growth

There is extensive green, white and yellow lichen growth, with algae and moss growth.

Potential biodeterioration threats include: mechanical damage from roots and thalli; chemical damage from organic and inorganic acids, production of chelating agents, and the introduction of soluble salts. All mosses, lichens, algae, and higher plants retain moisture.

Lichen thalli (roots) deteriorate stone by their action during wetting and drying - shrinkage of the roots detach small sections of stone.

One acid forming compound produced by all aerobic organisms, through cellular respiration, is carbon dioxide (Co2), which forms carbonic acid. Other acids formed include nitrous, nitric, sulphuric, and oxalic acids which are likely to cause deterioration in the stonework.

5.3 Causes of deterioration of concrete

The following is a general discussion of likely deterioration of the concrete base to the monument and walls of the surrounding fence.

5.3.1 Location

The structure is located near the sea. The atmosphere is clearly one with a high salt level about which little can be done. Rusting steelwork and cracking in the concrete is due to the high salt level, as discussed above, and efflorescence caused by salts.

5.3.2 Chloride ions

Aggressive ions such as chlorides can reduce the passivity of the steel. Electric cells, called galvanic cells, form in concrete and which operate in water containing dissolved substances whose ions conduct electricity. There must be some oxygen present and some of the normal protective film on the steel must be destroyed. Chlorides are known to reduce the protective film as can carbon dioxide. Sources of chlorides include admixtures in the concrete or moist salt air. Soluble chlorides can be expected to contribute to the corrosion process wherever sufficient moisture and oxygen are present.

5.3.3 Carbonation

All calcareous cements react with water in concrete mixes to produce a highly alkaline environment (pH 12-13) in wet conditions which affords protection to steel reinforcement. Carbon dioxide and acid in air and rain neutralises the alkalinity of the concrete and reduces the corrosion protection of embedded steels. While this effect is generally superficial (5 mm - 8 mm after 10 years and up to 15 mm in 50 years), cracks in the concrete will allow the carbonation process to take place at deeper levels and water to gain access to the steel reinforcement followed by disintegration as the rusting steel undergoes an expansion in volume.

5.3.4 Concrete cover

Good construction practice ensures that reinforcing steel has at least 50 mm cover. It is not known what steel or concrete cover the monument has been constructed with.

5.4 Cast iron

Cast iron has a high carbon content, up to 5% and is not able to be worked like wrought iron as it is brittle, being vulnerable to mechanical damage.

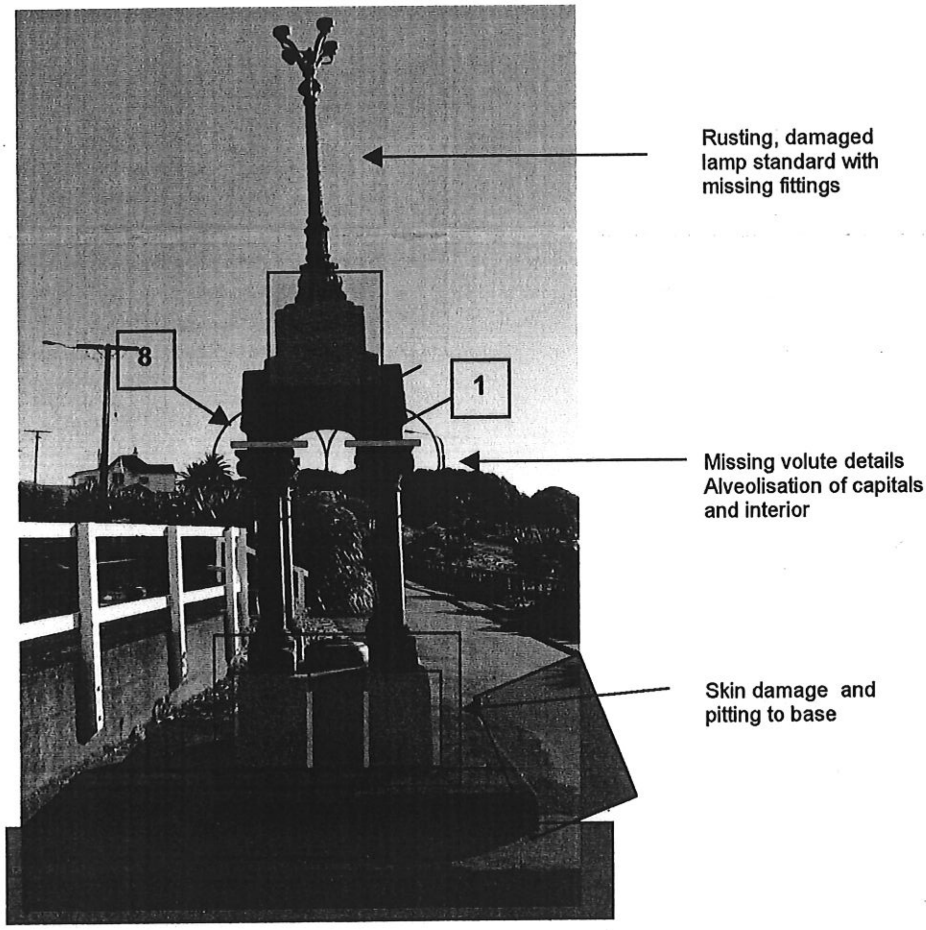
Cast iron is normally very resistant to rusting, however, water in the presence of oxygen is the key cause of deterioration of all forms of iron, causing rust. This is especially so when cast iron is in the presence of saltwater even when oxygen is not present. This is called graphitisation and is evidenced by a black, often blistered, surface, under which is crumbly material. Water can also freeze and crack iron. Other potential defects include in the quality of the material used its and manufacture while age can further enhance the brittleness of the metal.

6.0 OBSERVATIONS OF MONUMENT CONDITION

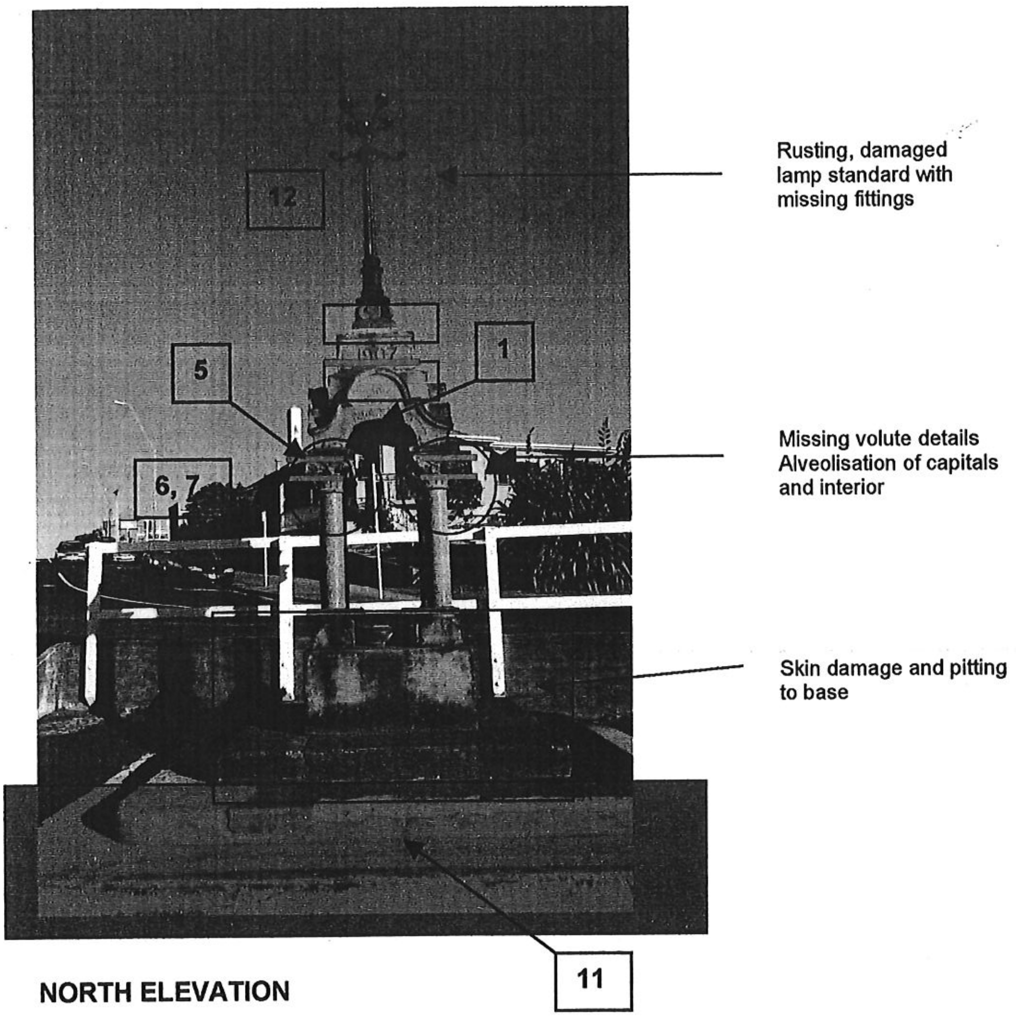
The condition of the exterior is illustrated with photographs with written descriptions.

LEGEND

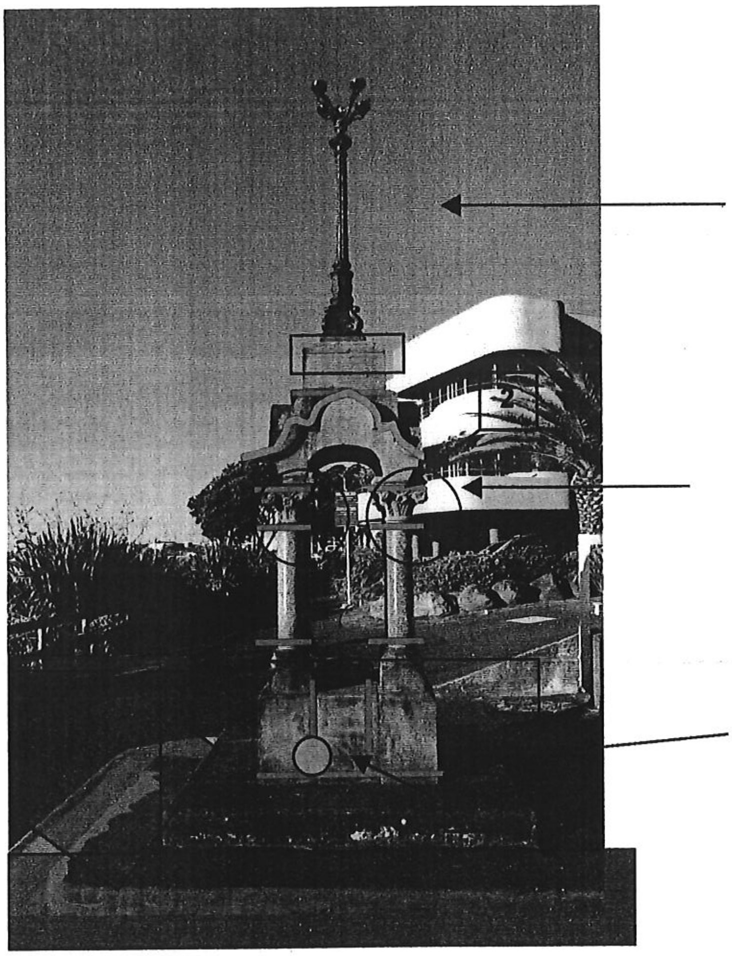
(line)	Cracked render and stone		
(circle)	Cement plastic repair	(light grey box)	Microbiological growth
2	Detail no	(dark box)	Cement damage



EAST ELEVATION



NORTH ELEVATION

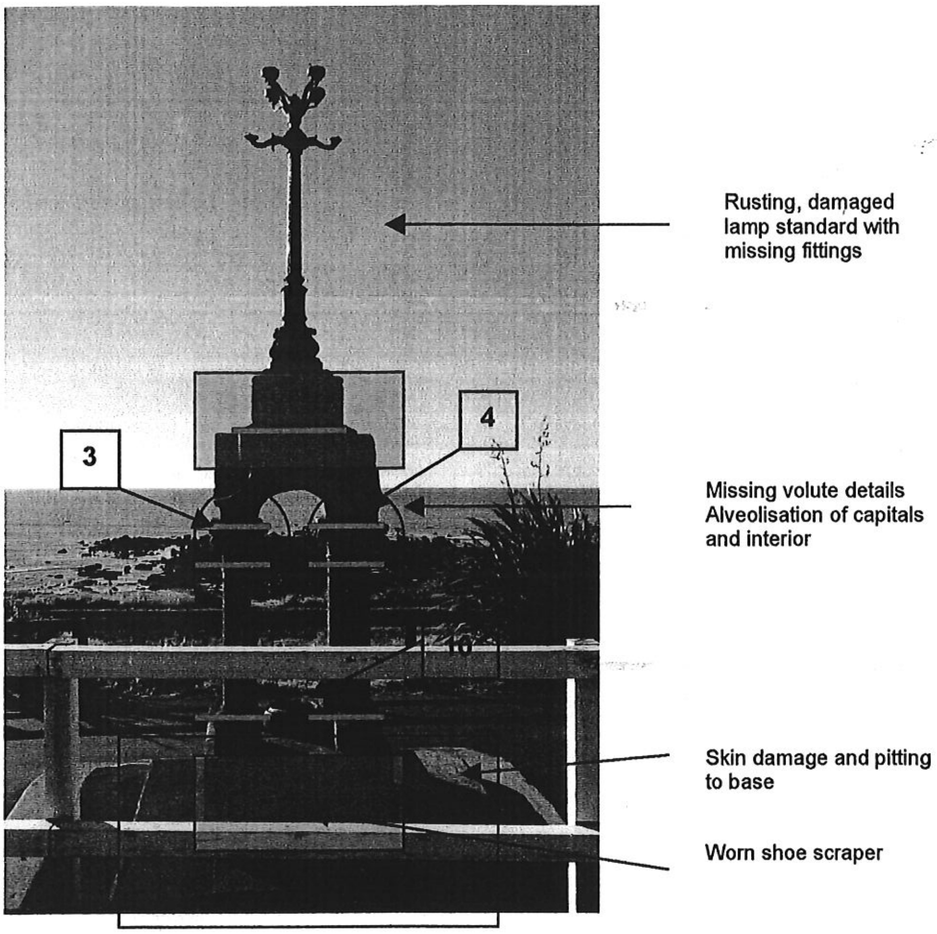


Rusting, damaged lamp standard with missing fittings

Missing volute details
Alveolisation of capitals and interior

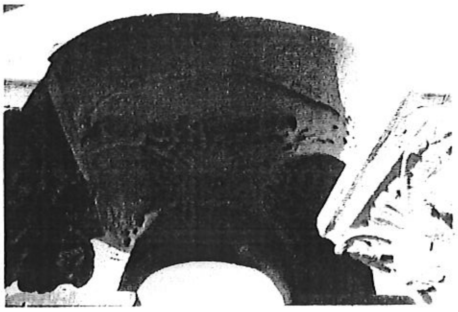
Skin damage and pitting to base

WEST ELEVATION



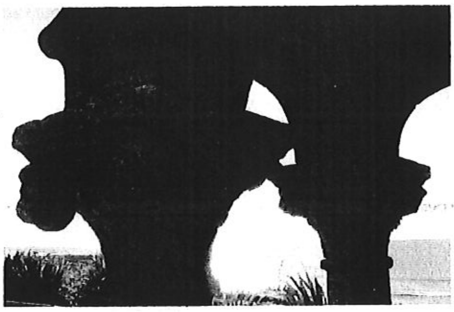
SOUTH ELEVATION

DETAILS

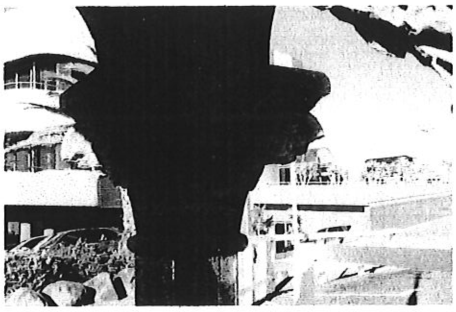


1 interior showing alveolisation

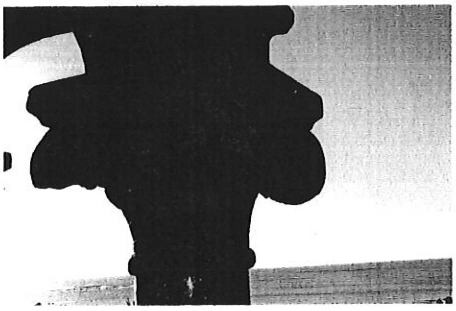
2 SW capitals showing volute damage and alveolisation



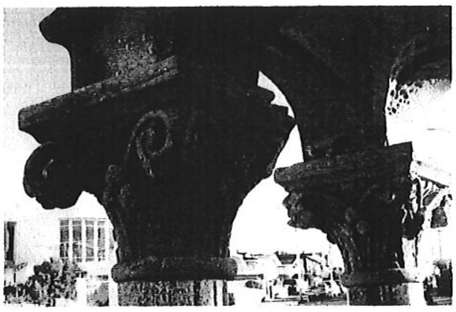
3 SW and NW capitals showing alveolisation cracking and volute damage



4 SE capitals showing volute damage and alveolisation



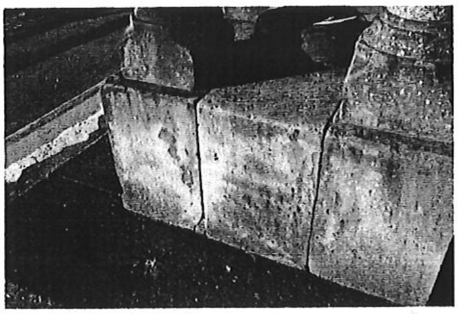
5 NE capital showing alveolisation cracking and volute damage



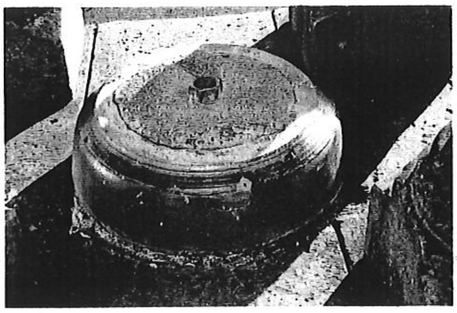
6 NW and NE capitals showing volute damage and alveolisation

7 NE capitals showing alveolisation cracking and volute damage

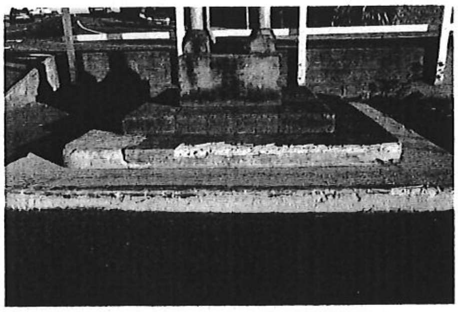
8 NE and SE capitals showing volute damage and alveolisation



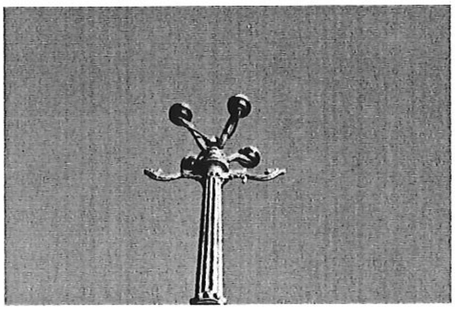
9 West showing plastic repair, pitting and skin damage to base



10 Ceramic base



11 Damage to cement base



12 Lamp standard showing rust and paint damage

7.0 GENERAL RECOMMENDATIONS

Recommended remedial repairs and priorities are described, although it is likely that most, if not all the work will be carried out at one time. When the work is to be carried out it is recommended that appropriate drawings and specification be prepared and the work observed by a person appropriately trained and experienced in building conservation. Appropriately skilled people for this project include:
a qualified architect and architectural conservator experienced in stone structure repairs who will prepare the contract documentation, observe and administer the contract;
a competent mason with previous experience in heritage stone structure repairs.

When carrying out remedial work, maintaining authenticity of materials, design, and workmanship should be of paramount importance. The maximum of original material should be retained, and repairs should be harmonious in colour, texture, form, and scale. Note when allowing to replace or repair items a contingency of 20% should be allowed.

The priorities are defined below:

immediate	as soon as possible
urgent	required to prevent further deterioration, within 3 months
necessary	required to ensure good standard of maintenance, within one to three years
desirable	whenever possible, or to enhance heritage values

7.1 Remedial measures

The whole monument will need to be poulticed to remove soluble salts from all sources. This includes sulphates and chlorides. Appropriate media for poulticing includes cellulose paper pulp, diatomaceous earths and talc;	necessary
Carefully remove all cement mortar and cement plastic repair, Repoint and repair in lime based mortar;	necessary
Remove all micro-biological growth with biocide and, where necessary, by hand;	necessary
Remove crazed render on concrete steps and rerender	necessary
Apply long acting biocide	necessary
Clean down and recoat cast iron, treating for rust with appropriate marine environment resistant paint systems	necessary
Reinstate missing lights and decorative elements based on accurate documentation	desirable
Reinstate damaged or missing decorative stone elements such as missing volute ends	desirable
Gently clean monument with non-ionic detergent and low pressure water wash	necessary

7.2 Upgrading

Fountain
It is presumed that the monument drinking fountain was located on the ceramic base. Without accurate documentation on the design of the fountain, it cannot be reconstructed. If accurate documentation of the fountain cannot be found, alternatives could include a modern drinking fountain, a water based sculpture or leaving the monument as it stands. Reconstruction of the original or other water fountains would have to consider issues such as vandalism and further damage from moisture in close proximity to the stone.

Light standard
Reconstruction of the light standard and lighting to the original design, also requires accurate documentation. If this is not available, it is recommended that vandal resistant clear globes are installed and lighting cables be reinstalled. Lighting the monument may reduce potential vandalism.