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CODE OF PRACTICE FOR MAINTENANCE AND PRESERVATION OF STONES IN BUILDINGS

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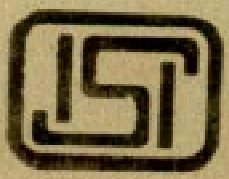

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CODE OF PRACTICE FOR MAINTENANCE AND PRESERVATION OF STONES IN BUILDINGS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 November 1977, after the draft finalized by the Stones Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The durability of stones depends mainly upon its physical structure and chemical composition. The deterioration takes place when their inherent properties are changed by the action of various unavoidable external agencies. It is always desirable, therefore, to use a good durable stone in the very first instance.

0.3 This code of practice has been framed to enumerate those principal factors which cause decay of stone in buildings and to suggest preventive measures for their least decay. The preventive measures included are based on the practice being followed in this country and are applicable to sedimentary rocks, particularly porous stones which are not plastered. The Indian Standards on some of the preservatives recommended in this standard are given in Appendix A.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard lays down the practice for maintenance and preservation of stones in buildings.

*Rules for rounding off numerical values (*revised*).

2. GENERAL

2.0 Generally atmospheric agencies bring about physical and chemical changes in building stones and cause its deterioration. For maintenance and preservation of stones in building it is desirable, therefore, to know the agencies which deteriorate the stones in buildings. The following are the main agencies which cause deterioration of stone.

2.1 Rain — The stone is subjected to alternate wetting and drying due to rain and sun, causing temperature stresses and weathering. The rain water contains different gases and acids which also disintegrate stone.

2.2 Temperature Variation — At places where the temperature of atmosphere changes, the stones are subjected to alternate heating and cooling due to variation in the ambient temperature. At such places stresses are induced in the stone which cause its disintegration or cracking. In thinner walls of single stone, temperature variation may not be much.

2.3 Wind — Stones subjected to strong winds suffer abrasion due to grit and dust. Strong winds also accelerate weathering due to variation in moisture content and help in consequent disintegration of stones.

2.4 Frost — In very cold places moisture present in atmosphere gets deposited on stones and fills the pores. On reaching the freezing temperature, the water in the pores expands and causes disruption.

2.5 Atmospheric Impurities — In an industrial town the atmosphere is generally polluted with smoke and acid gases. Limestones, calcareous sand stones and those containing carbonate of lime are greatly affected when used in such places.

2.6 Movement of Chemicals — If limestone and sandstone are laid close to each other in a structure, the chemical formed by the reaction of the atmospheric gases with the limestone, enters the sandstone and causes its disintegration.

2.7 Binding Material — The nature of certain binding material is such that they adversely affect the stones.

2.8 Vegetable Growth — Certain trees and creepers penetrate their roots in the joints of stones in search of food and for their stability.

2.9 Damage Due to Iron Fixtures — Some damage occurs to buildings with the use of iron or steel clamps and dowels. These get rusted and in the process expand and fracture the stone. Hence anti-corrosive paint or other suitable coating should be applied to these fixtures for prevention of rust.

3. MAINTENANCE OF STONE

3.0 The principal factors in the decay of stone being the action of atmospheric agencies, the preventive measures must aim at denying access to the stone of these destructive agencies. The use of preservatives is to check their action by:

a) filling the pores of the stone,
b) providing a coating to the surface of the stone to prevent the access of moisture to its interior, and
c) reacting with constituents of the stone to form a hard and durable surface.

3.1 Surface Coating Preservatives — These are applied to the surface, after expelling the moisture by sun-drying from the surface of the stone. The preservatives should be applied before sunset. The usual types are:

a) Coal tar, bitumen, colourless paraffin oil, linseed oil either mixed or unmixed with paint. These interfere with the pleasing appearance of the stone and require constant attention.
b) A solution of silicate of potash or soda which hardens the surface of the stone.

3.2 Preservatives Which Impregnate the Stone Without Chemical Action — The important type is silicone based products which repels water by soaking into the capillary pores of stones and providing water repellent film both on the surface and in depth. It is diluted in a toluene or white spirit mixture and applied either by brushing, dipping or spraying. This method has given successful results on museum exhibits kept indoors under dry conditions. Polyvinyl acetate and polymethyl methacrylate are also used.

3.3 Preservatives Which Act by Chemical Action with Stone — These include barium hydroxide and magnesium fluosilicate.

3.3.1 Silicon ester has no more than a temporary influence on the normal processes of weathering and decay. Impregnation with silicon ester may be helpful on occasion for consolidating special features, if these can be dismantled for saturation by immersion or can be dealt with by feeding the solution through holes drilled through the friable zone into the core.

3.3.2 Silicones water-repellent treatments used are, either a solution of a silicone in an organic solvent or a solution of a metallic siliconate (usually sodium siliconate) in water. The siliconate decomposes on exposure to the air, releasing the silicone with the formation of sodium carbonate (or sulphate) as a by-product. In appropriate circumstances silicones promise to be useful for reducing grain penetration through leading walls and on occasion for controlling staining of stone work from various causes.

3.4 Paints — Painting and other remedial measures afford useful measure of protection but are inacceptable for monumental and historical buildings because they mask the colour and texture of stones.

3.5 Limewash — Limewash though widely used in the belief that it would help to preserve the stone, is not recommended as it spoils the appearance of old buildings.

3.6 Limewater — Appreciable strengthening effects are now reported to have been obtained on friable stone by repeated applications of clear limewater. The intention is to deposit calcium carbonate by reaction with carbondioxide in the air, though under present conditions of air pollutions some part of the product may be expected to be calcium sulphate. Lime is so slightly soluble in water, that 30 to 40 applications are needed. This would not be practicable on a large scale and it has not yet been proved that the ultimate effects warrant the time and effort required.

3.7 Cleaning of Stones — The cleaning of stones also forms an important part of maintenance. Cleaning is essential to restore the natural look and to remove the unwanted deposition which may subsequently cause the deterioration of stones. This is done by washing the stone with water or steam, sand blasting or using suitable chemicals.

APPENDIX A

(*Clause* 0.3)

INDIAN STANDARDS ON PRESERVATIVES

IS :	
75-1973	Linseed oil, raw and refined (*second revision*)
212-1961	Crude coal tar for general use (*revised*)
381-1972	Sodium silicate (*first revision*)
702-1961	Industrial bitumen (*revised*)
1083-1975	White oil, light technical
4654-1968	Paraffin wax
6015-1970	Barium hydroxide