Chapter

6.9

Frost Damage and Restoration of Limestone Domes and Spheres in a Heritage Building

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Introduction

Domes and spheres have been used extensively in heritage buildings during baroque and rococo periods as well as in 19th-century buildings. Used as ornaments and as coverings and roofs, these curved elements add to the monumental character of imposing buildings, which are presently considered a part of the cultural heritage. The number of historic buildings containing domes and spheres is impressive and includes some of the world's most famous structures. Most of these ornaments and coverings are made of limestone because of its excellent quality and durability. However, because limestone is a sedimentary rock, consisting mainly of calcium carbonate, it may deteriorate due to acid rain and frost. The latter introduces cracking, allowing water ingress and subsequent further cracking. Depending on the crack width, further moisture ingress is fostered, and cracks grow. In the present paper, this progressive effect is being assessed by numerical simulation. Obviously, all types of limestone blocks and ornaments are prone to degradation due to frost. However, a brief survey of various degradations shows that curved shapes are more vulnerable. The reason for this is yet to be found. The ratio of exposed surface to volume of a sphere is not significantly different from the value for an equivalent cube. However, if rainfall is considered from a single direction, for instance, vertical, the relative exposure ratio of spheres is three times larger than that of cubes. This might give some indication of the larger degradation of curved surfaces.

Southern Pressure House, Antwerp

The Southern Pressure House, in Antwerp, consists mainly of two long buildings, the first of which contains the machine room and the steam hall and parallel storage depots for coal and oil.[1] The boiler room and the warehouses are separated by a corridor that opens to a courtyard. The second building houses offices, homes for personnel, a repair workshop and a forgery house. Of all these, the imposing unit containing the accumulators for water pressure (*Fig. 1*) is the most valuable. This is mainly a brickwork building decorated with limestone façade blocks,

DOI: https://doi.org/10.2749/sed015.101