

DURABILITY OF CERAMIC FACADE CLADDING - PROCEDURES FOR DIAGNOSING ON-SITE PATHOLOGIES

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1. CONTENTS

This paper will analyse the way in which pathologies reduce the life-span of facades covered with ceramic elements. This study is part of a more extensive project, the development of a system for diagnosing, preventing and recuperating facades presenting these pathologies and establishing the durability of this type of wall covering under tropical conditions.

There are many studies from around the world, which examine durability and service life, but most of them refer to temperate countries. It is our opinion that there is a blind spot as far as tropical countries are concerned and, apart from this, very few studies have been undertaken to analyse ceramic cladding in tropical climates. There are many cities in Brazil where this type of wall covering is used, and no scientific studies have been undertaken to establish the parameters for using ceramic elements for this purpose.

2. EXPERIMENTAL PROCEDURE

The systematic study of a pathology requires the use of a holistic procedure for data collection during on-site inspections. These inspections are normally a result of consumer dissatisfaction with the ceramic cladding performance at some point during its service life. Therefore the analytical phase of data collection may require the use of one or more basic sources of information: on site inspections, a study of previous problems with the building, complementary examinations and scientific research.

3. RESULTS

The following analyses refer to on-site observations and studies relating to the case histories of four buildings which presented ceramic tile detachment pathologies. The owners requested that the names of the buildings not be revealed so these buildings will be represented by fictitious names.

BUILDING "A"

The building in question is a residential block of 15 floors and a duplex penthouse. It was built using reinforced concrete filled in with ceramic blocks and covered with white glazed extruded ceramic with teeth on the back, fixed on conventional adhesive cement mortar using a fine layer over cured mortar. The building took 36 months to build and the first indications of pathology began one year after completion (1990) and went on until 1999, periodically during the autumn, which leads us to believe that we are facing a case of faults caused by thermal amplitude which are typical at this time of year in this region of Brazil.

The detachment happened on the north and south faces, being more apparent on the southern side which has the largest faces and which has no discontinuities either from openings or working joints (none at all on this building). The problem was worse at higher levels of the south face and lower levels of the north face. The main cause of detachment happened between the tiles and the fixing mortar, and signs were also found of bad filling of the back of the tile, which leads us to believe that the fixing was badly carried out and the fixing mortar was not well chosen.



Building "A"

BUILDING "B"



Building "B"

This building, with kitchenette style apartments, is located in a densely populated region, has 20 floors and was built using reinforced concrete filled in with ceramic blocks and covered with high absorption (30% in test results) unglazed extruded ceramic "Cotto". Although it took 53 months to complete the building there were no work stoppages. However, the schedule was extremely irregular, and the first news of detachment came two years after completion (1997). Fixing was carried out using conventional cement mortar, applied on a plaster base, which was left exposed to the weather for 5 months, by the sub-contractor.

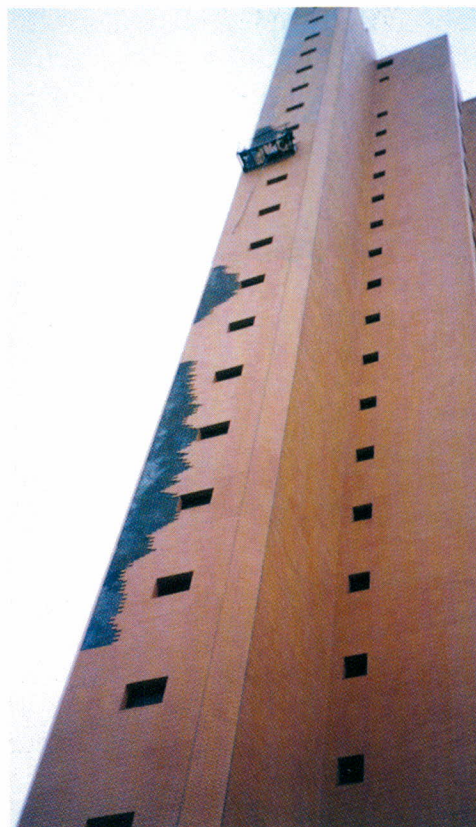
The detachments occurred after showers on a very hot day, specifically on the north and west faces which receive the most sunlight. Possible causes range from inadequate material (high absorption ceramic and inflexible mortar), to project ina-

dequacies (lack of working joints) and even deficiencies in the production process (no filling of the back of the tile) and the labour skills (sub-contracted for price reasons).

BUILDING "C"

A residential building with 21 floors located in a densely populated region, was built using reinforced concrete, filled in with ceramic blocks and covered with unglazed extruded ceramic "Cotto". The construction took 24 months with no work stoppages, the first appearance of detachment coming one year after completion. (1998), most notably on the west face at mid-level. Tile fixing was carried out using cement mortar on cured mortar by subcontractors.

In this case we saw that the building had a very flexible structure, with small pillars and thin floor slabs (8cm) which, when associated with the type of mortar used (low flexibility) could be one of the causes of detachment., which happened after a "summer shower". The lack of working joints on these faces could also help to explain what happened. Apart from this, we also noticed bad filling of the back of the tiles, associated with insufficient spreading of the mortar lines, which could be due to tile fixing on dried mortar.



Building "C"

BUILDING "D"



Building "D"

The fourth case is a residential building 15 floors high built of reinforced concrete filled in with ceramic blocks and covered with porcelain stoneware, fixed using traditional techniques with conventional cement mortar and the construction company's own labour. This building took 30 months to complete and the first occurrence of detachment came 3 years later (1997). The worst sides of the building were the north and west faces at the mid and upper levels. In this case the detachments happened in autumn, a period of hot days and cold nights.

Once again we have a combination of factors to explain the pathology, i.e. the use of inadequate material, fixing mortar unable to stand any deformities

caused by temperature change, bad production process (no double bonding - applying mortar to the wall base and to the back of the tile). Apart from this, the lack of working joints could also have contributed to the problem.