Test Cleaning of Travertine and Limestone Façade Panels at The World Bank

By Margaret H. Mitnick, P.E.

The World Bank property at 1818 H Street, NW in Washington, D.C. consists of three separate buildings. The E Building is located at the southwestern portion of the property and was completed in 1967. The E Building is 11 stories and the exterior walls were constructed with limestone wall panels and vertical windows. The D Building is located at the southeastern portion of the property and was completed in 1968. The D Building is 13 stories and the façade was constructed with travertine wall panels and recessed windows. The third building at the property abuts the D and E Buildings to the north, and it was constructed more recently than the other two buildings.

Exterior renovations were performed below the third floor on both the D and E Buildings in 1991. The work included reconfiguration of the loading dock area, addition of a canopy above the first floor on the majority of both buildings, and the addition of limestone to portions of the façade on the E Building. Below the third floor, the façade is comprised of precast concrete and aluminum elements.

Test cleaning was performed on the travertine and limestone panels in advance of a proposed façade restoration project. The restoration contractor employed selected wall cleaning systems at sample locations at both the D and E Buildings. The intent of the sample cleaning was to determine appropriate cleaning products and methods to be included in specifications for restoration of the façade. The sample cleaning locations were coordinated with The World Bank and included the limestone wall panels and the travertine panels.

Figure 1: D Building façade elevation

The travertine panels on the D Building exhibited dirt accumulation and staining from rain and atmospheric pollution. The dirt and staining were most notable on the inset panels around the windows. Flexible sealant joints existed between travertine panels. Two weep holes were located at the head of each window at the exterior face of the travertine panels. There was one weep at the base of the wall panels (below the third floor) for each window bay. The pattern of staining and efflorescence was indicative that the weeps were functioning.

Three travertine panels were cleaned to provide three different levels of cleaning. After the test panels were completed, The World Bank reviewed the work. Sample cleaning on the travertine was performed by the restoration contractor using a pressure washer with the water pressure at approximately 1,000 to 1,500 psi. The cleaning was performed on the D Building at three locations at window insets above the loading dock. Each of the three locations was cleaned with a different restoration cleaning system manufactured by the same restoration cleaning systems manufacturer.

The sample cleaning products used on the D Building travertine varied in effectiveness. The systems used, from least to most effective, were: limestone and marble cleaner and brightener; heavy-duty limestone and marble precleaner; and polished marble and granite cleaner. The World Bank selected the most effective cleaning system. This system most closely restored the travertine to its original appearance.

The limestone panels on the E Building exhibited dirt accumulation and staining from rain and atmospheric pollution. The façade consists of vertical tiers that extend beyond the face of the building alternating with tiers consisting of flush windows and vertical panels at each floor. The

limestone panels extend vertically the height of the building from the third floor to the parapet wall. Below the third floor, the façade consists primarily of flush limestone panels with precast concrete and aluminum elements added during the 1991 façade renovation. It was noted that no mortar joints, only flexible sealant joints, exist between limestone panels. Two weep holes were located at the base of each limestone tier. The pattern of staining at the base of each tier was indicative that the weeps functioned. Staining/efflorescence was also observed at the top of the tiers at the parapet wall. In the area below the third floor where the limestone panels were installed in 1991, there were stains on the limestone panels adjacent to the panel joints. The stains were oriented in a pattern that indicates that they are most likely associated with a product used during the installation of the pins used to keep the panels in plane from panel to panel.

One limestone panel was cleaned above the third floor. After the test panel was completed, The World Bank reviewed the work. Sample cleaning on the limestone was performed by the restoration contractor using a pressure washer with the water pressure at approximately 1,000 psi. Sample cleaning was performed on the E Building on the inside face of a tier on the west elevation, near the southwest building corner.

The cleaning product used successfully on the E Building limestone was a limestone and marble cleaner and brightener. The World Bank approved the sample cleaning system. This system most closely restored the limestone to its original appearance.

The next phase of the sample cleaning process was to attempt to address the stains on the newer limestone panels in the area below the third floor. The first step was to attempt to determine the material causing the staining. If the material was known, then it would be easier to find a product that could clean the panel without damaging the limestone adjacent to it. Upon review of available contacts from the renovation in 1991 and the available construction documents, it was determined that no specific information was available as to how the limestone was configured at the panel joints. Therefore, the test cleaning was initiated cautiously.

The first attempts at cleaning were performed by sales representatives of the cleaning system manufacturer. The initial attempt was performed using solvent paint remover and epoxy and urethane paint remover. These products appeared to stain the limestone further. While only small areas were affected, this was not acceptable. The second attempt was performed by another representative. Three sample cleaning systems were applied to the stains. Each cleaning system started with presoaking the wall with warm water followed by a series of chemicals applied to the limestone panel, worked into the panel with a brush, allowed to set for between 5 and 15 min., and finally rinsed with warm water. The final step in the cleaning was pressure washing. The first system consisted of application of a heavy-duty limestone and marble precleaner followed by a limestone and marble cleaner and brightener. The second sample system consisted of a grease and oil emulsifier, followed by a heavy-duty limestone and marble precleaner, a limestone and marble cleaner and brightener, and finally an epoxy and urethane paint remover. The third sample system consisted of two applications of an

Figure 2: Dirt accumulation and staining of the D Building travertine

Figure 3: The E Building limestone panels at third floor

epoxy and urethane paint remover, followed by a heavy-duty limestone and marble precleaner and then limestone and marble cleaner and brightener. The last product applied to the limestone panel for each system, a limestone and marble cleaner and brightener, was intended to neutralize any residues left from the previously applied chemicals. The final step in each cleaning was to rinse the area with water. Because a restoration contractor was not involved, the building engineering department provided a power washer for cleaning the chemicals off the limestone. The results of each sample cleaning were more staining, over larger areas, and some apparent damage from the power washer.

After consultation with the corporate offices of the cleaning system products, and the help of a local restoration contractor, another attempt was made to address removal of the new stains and to return the limestone panels to the condition prior to the commencement of test cleaning. The engineer, manufacturer, and restoration contractor were all involved in this attempt at cleaning the limestone panels. The cleaning system used was meticulously applied to the newly stained areas. The first step was to presoak the limestone with water, then a heavy duty limestone and marble precleaner was applied to the panel. The material was scrubbed into the limestone to loosen foreign material and allowed to set for 5 min. The material was rinsed from the limestone panel using approximately 1,000-psi pressure from the power washer. The next step was to apply a limestone and marble cleaner and brightener to neutralize any material left on the limestone. After 5 min., this was rinsed off with approximately 1,000-psi pressure from a power washer. The limestone panels were saturated after the cleaning was performed and required a day to dry out. Returning to the site the next day, it was determined that the staining caused by previous test cleaning had been removed; however, the original stains were not. After the test cleaning, it was determined that the source of the stains was likely attributed to a material inside the limestone panels that is bleeding through the stone at the pin locations. Due to the nature of the source of the staining, it is probably not possible to permanently clean the panels.

It was decided by The World Bank and the engineer that the stains on the limestone panels below the third floor were not easily removed. Removal of the stains would not be included in the scope of work for the façade restoration.

The local restoration contractor, with direction from the product manufacturer and engineer, was able to remove stains on the limestone caused by poor cleaning techniques. The techniques used by the restoration contractor followed the guidelines of the product manufacturer. Additionally, the restoration contractor's equipment operators had experience with various stone types and their specific properties with respect to cleaning and restoration. When cleaning delicate materials such as stone panels, consideration must be taken to understand that proper technique is required to achieve a good final result. In this case it was fortunate that the damage caused by not using trained restoration specialists was reversible.

The World Bank Cleaning

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Restoration Contractor
Consolidated Waterproofing Contractors, Inc.
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Figure 4: Stains on newer limestone panels below the third floor of the E Building

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