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من جامعة هيوستن - الولايات المتحدة الأمريكية

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Technical Reports

Results of Pullout Test

Performed on Plastering Mortar Incorporating the Material "Super Soft"
Prepared on the surfaces of Wall and Concrete Slab
Located at
Hasiendabay Village – Northern Coast

1. Introduction:

This report includes the results of pullout tests that were performed at selected locations of the plastering mortar covering arbitrary areas of wall and concrete slab at Hasiendabay Village (under construction). Plastering mortar was made using the traditional mortar mixed with the pre-packed additive material (Super Soft).

Pullout tests were performed at the site on the 18th of May 2008 with the attendance of:

- Eng. Ahmad Salah, representing Palmhills,
- Eng. Ahmad Mokhtar, representing the internal QC Group.

The application of the mixed mortar was made by the material provider. The age of the plastering mortar exceeds 20 days at the day of testing.

The report is prepared according to the request of Eng. Khaled Basuouni representing Quick-Mix Company; the additive provider.

2. Objective of Testing:

The main objective of this work is to find experimentally the pullout strength of the applied mortar and to ensure good bond between the mortar and the substrate. The obtaining strength value shall be the least of:

1- The bond strength between the applied mortar and the wall or concrete.
2- The tensile strength of the applied mortar itself.

It should be pointed out that the primary concern is to ensure that the bond strength between the applied mortar and the substrate is reliable.

3. Description of the Used Additive "Super Soft":

According to the technical data sheet provided by the client, the used additive (Super Soft) enhances the workability and bonding when it is added to the traditional mortar that is usually made of cement and sand. The ingredients of Super Soft include superplasticizer, silica fume, and bonding agent. A 150 gm- bag of Super Soft is to be added to each 50 kg-sack of cement.

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4. Test Method and Relevant Standards:

Tests were performed in accordance with the American Standard **ASTM C780**. Tests were simply performed according to the following steps:

1. Holes of diameters 5.0 cm were drilled in the in-place plaster mortar to depths exceeding the thickness of the plaster that was about 20 to 25 mm. The test locations were selected arbitrary.
2. Special metal plates were then bonded to the in-place plaster surface at the locations of every tested point using an adequate special adhesive as shown in Figures 1 and 2.
3. After few days, the plates were pulled out using a special device (PosiTest Pull-off Adhesion Tester) that is shown in Figure 3. This tester was designed to fully meet the intentions of **ASTM D4541**, **ASTM D7234**, and **ISO 4624**. The calibration sheet of the tester was checked.
4. The pullout forces were recorded hence the pullout strengths were calculated automatically by dividing the pullout force over the contact area of the plate. The results appeared on the screen in MPa.
5. Many tests were performed on a bottom surface of concrete slab and on a wall surface. Six test results were considered.

5. Acceptance Criteria:

According to **ACI 524R-93**, the structural value of plaster is not included in the building design; there are no physical requirements of in-place plaster. Lacking a standard specifically designed for plaster, past experience may be used to provide guidance in the evaluation of materials to be used in plaster, in the analysis of hardened plaster, and what to look for in the field. The following points should be considered:

1- Applying hard plaster on either wall or concrete may not be preferable to avoid delaminating.
2- Good bond with the substrate is the key of acceptance.

Therefore, it is strongly believed based on past experience that the test would be accepted if the bond strength exceeds the mortar tensile strength, and also if the pullout strength (average of three tests) exceeds 0.50 MPa.

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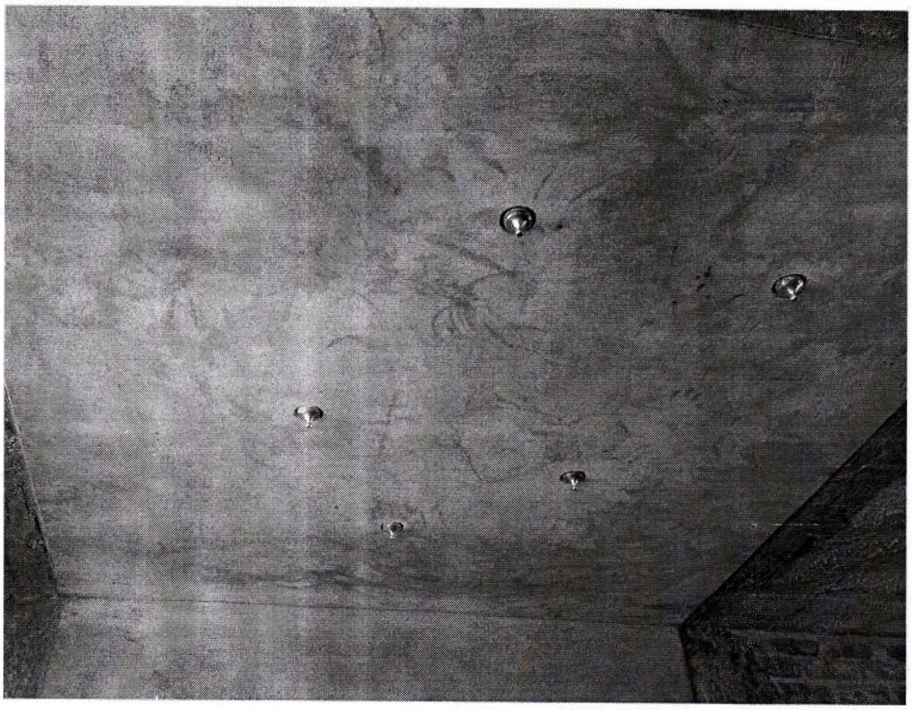

Fig. 1- Special metal plates bonded to the in-place plaster surface on a concrete slab

Fig. 2- Special metal plates bonded to the in-place plaster surface on a wall

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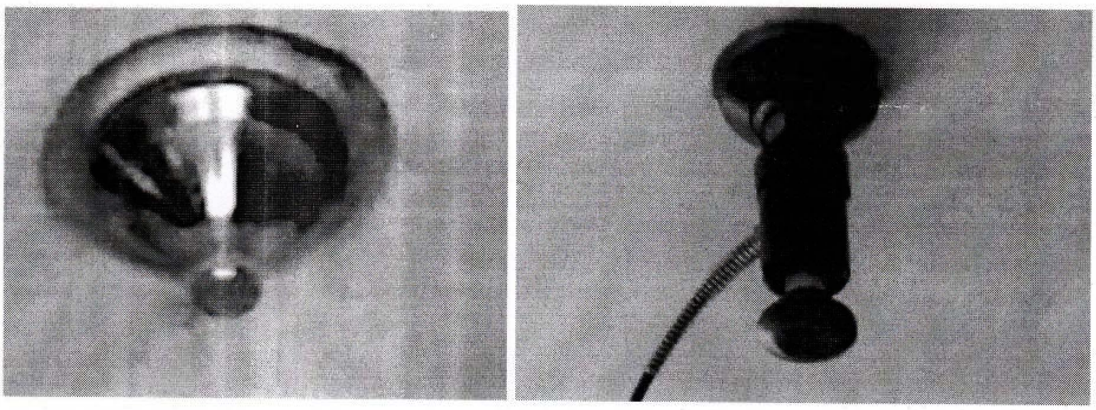

Fig. 3- Close view to a metal plate prior to and during testing

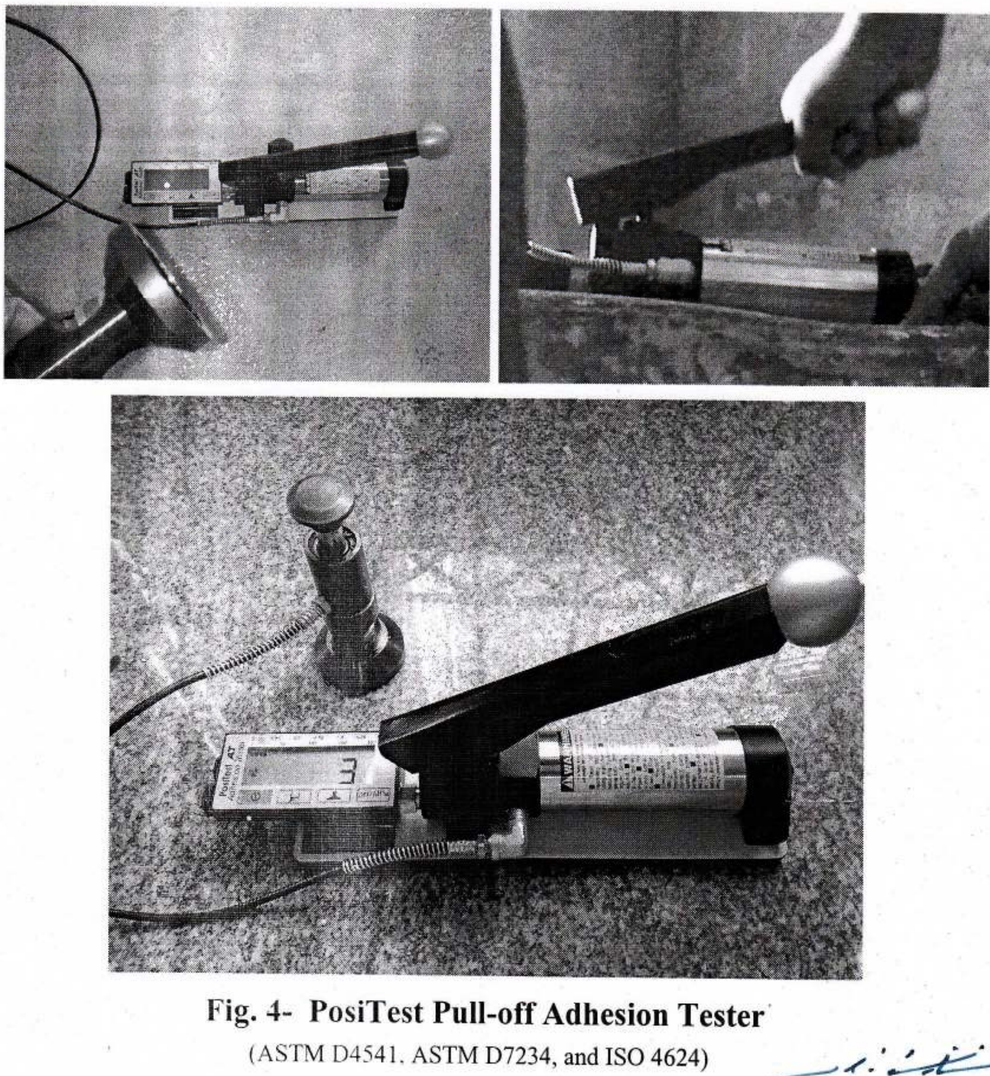

Fig. 4- PosiTest Pull-off Adhesion Tester
(ASTM D4541, ASTM D7234, and ISO 4624)

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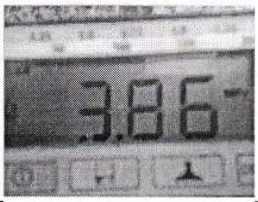
6. Results of Pullout Tests:

Results of pullout tests performed at six locations of the prescribed plaster are given below in Table 1. Approximate thicknesses of the plaster at testing locations varied from 2.0 to 2.5 cm.

Table 1- Results of pullout tests using 5.0 cm- metal plates

Test No.	*Diameter of pulled-out plates, cm*	*Contact area, cm^2*	*Test Results*		*Mode of Failure*
			Strength, psi	*Strength, MPa*	
(1)	5.0	19.63	120	0.83	Mortar failure
(2)	5.0	19.63	561	3.86	Mortar failure
(3)	5.0	19.63	18	0.12	Mortar failure
(4)	5.0	19.63	87	0.60	Mortar failure
(5)	5.0	19.63	90	0.62	Mortar failure
(6)	5.0	19.63	105	0.72	Mortar failure



7. Technical Comments:

1. The modes of failure in all tests were governed by failure through the mortars. No bonding failure between plaster and concrete or wall was observed in any test as shown in the photographs given in Fig. 5.
2. Above finding clearly indicates that the bond strength between the subject mortar and the wall or concrete slab at any tested location is higher than the recorded values for pullout strength given above.
3. The average value for pullout strength (6 data) is 1.1 MPa.
4. The noticeable variations in the test results are mainly due to the strength variation of the subject mortar during application. In addition, the result of test No. 2 (0.3.86 MPa) is be overestimated, and also the result of Test No. 3 (0.12 MPa) is underestimated probably due to the improper adjustment of the device. These two dada seems to be undependable. Results of remaining tests are very reliable.
5. Considering the results of remaining four tests only, the pullout strengths varies from 0.60 and 0.0.83 MPa with an average value of 0.69 MPa.
6. From general prospective, the current test results and observations imply that the use of the additive **(Super Soft)** improves the performance of the traditional plastering mortar.

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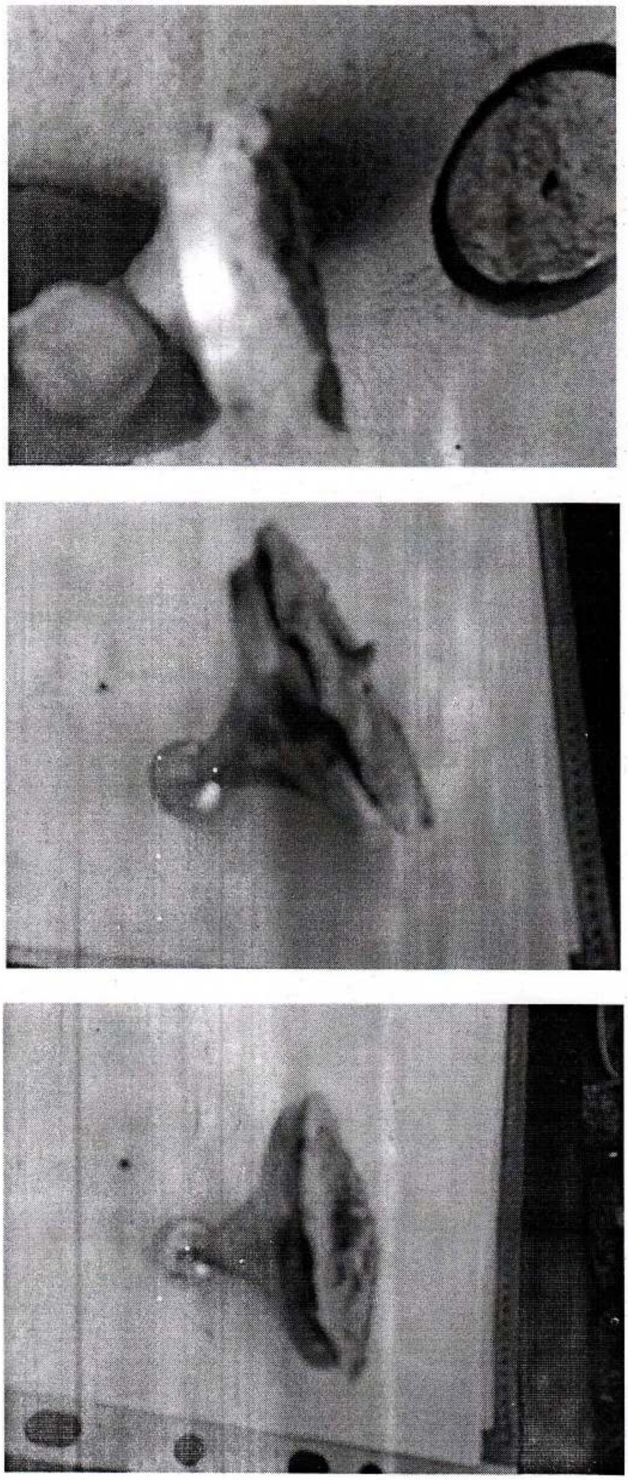

Fig. 5- Tests were terminated by mortar failure

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Conclusions

Results of pullout tests performed at selected locations of plastering mortar covering arbitrary areas of wall and concrete slab at Hasiendabay Village (under construction) are reported herein. Plastering mortar was made using the traditional mortar mixed with the pre-packed additive material (Super Soft). The report is prepared according to the request of Eng. Khaled Basuouni (representing Quick-Mix Company, the provider).

Based on the obtained data, the average pullout strength between the subject plastering mortar and the underneath concrete and wall is 0.69 MPa. No bonding failure between the plaster and the substrate was observed in any test. The plaster-concrete or plaster-wall bond strength is higher than the obtained values. Results are generally accepted. Additional tests are required to compare between the main properties of mortar with and without the additive (Super Soft). However, from general prospective, it may be concluded that the subject additive (Super Soft) may improve the performance of the traditional plastering mortar.

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