Subject: Effect of Mortar on Water Permeance of Masonry

r is the bonding agent that integrates a nry wall. It must be strong, durable, able of keeping the wall intact, and it create a water-resistant barrier.

ause portland cement concretes and masonry ars contain the same principal ingredients, e designers assume that what is good prac- e for concrete will also be good practice mortars. In reality, mortars differ from crete in working consistencies, in methods placement, and in the structural elements h utilize each. Mortar bonds structural onry units into a single element, while crete is usually a structural element in lf. With portland cement concretes, most the important physical properties are ength characteristics, usually functions ts compressive strength. The principal ction of masonry mortars, however, is to elop a complete, strong and durable bond masonry units. For these reasons the uirements for masonry mortars are vastly ferent from those for portland cement retes. Contrary to common practice in rete, with mortar it is advisable to use lowest" cement content consistent with strength requirements of the structure. do not use Type S when Type N will do!

ughout the past few years a number of search projects have been conducted re- rding the subject of water permeance. The st results were published by Dr. Russell Brown, Associate Professor Civil Engineer- and Engineering Mechanics, Clemson Uni- ity, Clemson, South Carolina. The study conducted as a result of a feeling of d for additional information of this type group of Chicago contractors.

er permeance of masonry walls is a major ern of the masonry industry. The mason tractor is generally blamed for water meance of walls due to poor workmanship, mortar quality, or improperly tooled nts. However, on-site inspection of walls t leak often reveals excellent workmanship strict compliance with plans and speci- ations. A number of factors, in addition orkmanship, are thought to affect the permeance of masonry walls: masonry ign and detailing, compatibility of mortar masonry units, initial rate of absorp- of brick, and the proper composition proportion of masonry cement or Portland t/lime mortars.

A survey of masonry contracting firms in the Chicago area was conducted to establish the frequency and characteristics of water permeable walls that they had encountered. The most notable common denominator of problem walls reported appeared to be the use of masonry cement mortar. A research program was then undertaken to compare the permeance of walls made with several masonry cements to that of walls using Portland cement/lime mortars of different compositions, proportions and types. Using the services of an independent testing laboratory, 48 wall panels were tested for permeance according to ASTM E514-74.

Four masonry cements were selected, each from different manufacturers. A single type of brick, concrete block and sand were used throughout the test program. Three replications of the water permeance test were performed on each of three mortar types (N, S, M) for each brand of masonry cement and Portland cement/lime mortar. An additional series of 3 tests was performed using Type O, Portland cement/lime mortar resulting in the testing of a total of 48 walls. The basic constituent materials, mortar, brick, sand, and concrete block were tested for physical properties by applicable ASTM test methods.

The walls were constructed on the site of the independent testing laboratory using experienced journeyman masons using workmanship which might be considered nearly "perfect." Care was exercised to ensure full mortar bedding. Ends and tops of panels were filled with mortar. The mortar was proportioned by volume using sand, Portland cement, lime, and masonry cement in compliance with applicable ASTM Standards. Mortar was mised for 5 minutes after all ingredients were in the mixer. Some mortars were retempered as required to maintain a workability acceptable to the mason. All mortar joints were tooled with a round jointer when thumbprint hard. Walls were washed according to the recommendation of BIA Tech Note 20, Cleaning Dark Brick, Procedure B. Nominal dimensions of the wallettes were 49" lengths, 59" height and 8" thickness.

All wall specimens cured in laboratory air for at least 28 days prior to testing. Eight test chambers were constructed to facilitate a more rapid testing program.

Each wall was subjected to a 24-hour precon-itioning period, a 24-hour minimum drying period, and a 72-hour test period. An estimate of the extent of damp wall area was ade at the end of each 24-hour interval of the test period as well as after preconditioning.

Test results lead to the following conclusion of the materials tested.

A) Walls constructed of Portland cement/lime mortars are more resistant to water permeance than those constructed of masonry cement mortars.

) For the masonry cement mortars tested, Type S is slightly superior to Type M mortar and significantly superior to Type N mortar n resisting water penetration.

C) For the Portland cement/lime mortars test-d, Type N and S mortars ranked approximately the same, both being superior to Type M mortar in resisting water permeance.

D) Retempering of mortar has no adverse effect on water permeance.

E) An increase in mortar flow improves the resistance to water permeance.

F) Water permeance increases with air content of mortar.

G) Even with excellent quality workmanship some leakage should be expected in the typ of walls tested.

H) Resistance to rain penetration varies significantly for different masonry cement tested.

The testing program was conceived by the Mason Contractors Association of DuPage County, Illinois, and joined and supported the Chicago Masonry Institute Promotion Tr the Masonry Advancement Council of DuPage County, Illinois, Mason Contractors Associ tion of Greater Chicago and the Masonry In dustry Fund of Northwest Indiana.

Complete copies of Dr. Brown's report regarding this investigation may be obtained by contacting the Minnesota Masonry Instit Cost per copy is $5.00.

If you have further questions regarding th topic or any other masonry related questio of interest that should be the subject of MASONRY TECH TALK, please contact the Minnesota Masonry Institute.

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