Moisture penetration of masonry walls

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SUBJECT Moisture Penetration of Masonry Walls

One of the baffling things about moisture penetration is that in many buildings we find sections of wall that leak and other sections that do not, although there would seem to be no difference in masonry unit, mortar or workmanship. In many of these cases the sections of wall are to all intents and purposes identical as to flashing, window openings, spandril beams or other factors which might affect moisture penetration.

If no other cause of failure can be found, the general tendency is to assume that the absorptive quality of the masonry unit is too high. There are very good reasons for considering that this assumption is unsound.

In the 1920's it was fairly general practice to specify that bricks for exterior use were to have an absorption of not less than 6% nor more than 12%. Lack of adhesion with the very hard brick and mortar difficulties with the soft brick were the main reasons for this stipulation. This was proven to be well founded, but by experiment and observation, a condition was found which may have a more direct bearing on the cause of moisture penetration.

It was found that while the high absorption brick absorbed water much faster, it also dried out much faster than the low absorption unit.

For example, in 1906 to select a brick for a small church in Toronto absorption tests were made on low absorption cement-lime bricks and on John Price Stock clay bricks. In 36 hours the clay brick had reached maximum weight whereas the cement-lime brick took over ten days to reach maximum weight. The saturated bricks were then exposed outside to wind and sun. The clay brick dried out to original weight in less than 48 hours, but it was about ten days before the cement-lime bricks were dry.

It was decided to use the cement-lime bricks. The north wall was built with brick buttresses projecting about five feet at ground level and three feet at eaves at 12 foot centres. The eaves projected about three feet six inches and were eight or nine feet high.

Shortly after the church was completed and before the north wall had dried out, serious leakage occurred along this wall. No leaks occurred in the south wall and it appeared to have become quite dry. Nothing was done to correct the condition as the owners refused to approve any expenditure. The wall was inspected at intervals during the following two years and it was found that it did not dry out during that time and that the wall leaked very soon after the start of a heavy rain storm. It is significant that no leaking occurred in the south east or west walls. The following example is cited to show that masonry can carry a large quantity of water for a very long time.

The ground floor of a (Ladies Coats and Gowns) Store on Bloor Street, Toronto, was built with steel beams and terra cotta tile arch construction, the tiles being three cells (12") deep. The basement ceiling below was plastered. The floor of the store was for the most part carpetted.

Some six to ten months after the store was opened the proprietor decided to use part of the basement for Fur Storage, and to that end the walls and ceiling were covered with 4 inches of cork. The plant was in operation for not more than a month or two before water started to leak through the ceiling in a great many places. When the area had been cleared, pools of water were found in various places on the floor. When the ceiling was opened up it was found that the water was seeping through cracks in the terra cotta floor blocks, and when these were broken into, literally barrels of water poured out. A rough calculation indicated that these tile blocks had been about one third full. There is no doubt that this water had seeped into the tiles during construction approximately one and one half years before the failure.

There is no reason to doubt that the same thing can happen in a wall constructed of brick face and terra cotta tile backup. This may occur only in parts of a wall. A driving rain would probably cause leakage in a very short time in a section of wall that is already saturated, although it might only penetrate a comparatively short distance into a dry wall.

A similar action may take place in a stone wall. For example, in a residence in Toronto built of cut stone a serious condition developed. A two day driving rain penetrated at least 8 inches into the stone. This was best seen at the dormer windows which were faced with stone. Here the window jambs were of stone, eight inches in thickness and with a dressed return of about 6 inches on the inside somewhat in the Georgian manner. All of the stones in these dormers were set in mastic compound and therefore the water could not go through the joints. Moreover, when examined the day following the storm the whole of the outside face was still wet whereas the inside face was wet only for a distance of about two inches <u>above</u> each joint. The water had been running

down the inside face in streaks. After a lengthy discussion it was decided that the explanation of the representative of Oakley's - the supplier of the stone - seemed to be the most reasonable of those suggested. He claimed that Credit Valley Stone when freshly quarried is full of sap and that water will soak through it quite readily until the sap has dried out. This might take three to six months depending on the season and weather. To test this theory a ladder and garden hose were procured, a man was posted inside and the gardener from the top of the ladder poured the water (no nozzle) over the face of the wall. In less than five minutes water commenced to run down the inside face of the wall.

It would seem that if a wall is saturated whether with sap as in the case of the stone or with water a driving rain will cause the water in the wall to move to the inside and leakage will develop.

It is common knowledge that bricks should not be soaked before laying as such practice may result in poor adhesion, but the more important effect may be that too much water is sealed within the wall.

Therefore, it would seem, that, during construction a masonry wall should be thoroughly protected from rain. The usual strips of tar paper and boards is not enough. The top of the wall and all freshly laid brickwork should be properly shrouded. It would not be unreasonable to require such protection over weekends and at night when there is any probability of rainfall. Thorough flashing should be provided at all spandril beams and on foundation walls and seepage holes in the mortar joint on top of such flashing is good insurance.

Inside spaces should be well ventilated as soon as the building is closed in and all other measures that would hasten the drying out of the masonry should be taken.