Concrete and Masonry Wall Failure Analysis

By

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Failures of concrete and masonry walls occur for a variety of reasons. Identification of the failure mode helps determine the status of coverage for the particular loss. The following are examples of typical concrete and masonry wall failures along with some ideas on how to identify the cause of failure.

Figure 1

Figures 1 and 2 are views of a failure of a newly poured concrete basement wall. The building contractor back-filled the wall prior to framing of the residential home. Almost

Figure 2

immediately after back-filling was completed, heavy rains occurred. This resulted in a saturated soil condition and severe hydraulic pressure against the wall. Since the walls were not supported by the building structure or a slab, severe cracking and failure occurred at the highest stressed areas: about halfway between the corners of the building. In this case, it is better practice to wait until the building structure is complete and floor slab installed before back-filling at the foundation wall.

Figure 3

Figure 3 is a view of a severe deflection failure of a concrete retaining wall. This wall was designed without a support structure such as a pilaster, bracing or tie back system. The back fill was clay soil, without a gravel back fill, which aggravated the drainage near the wall. During heavy rains, hydraulic pressure increased, causing failure of the newly poured wall.

Figure 4

Figure 4 shows a similar failure of an older existing wall. It suffered from similar deficiencies with the exception of water drainage. There apparently had been good drainage around the base of the wall, but over the years the tiles had failed and became blocked. Eventually, as is typically so during a heavy rain, the wall gave way. Although the inspection of the wall was several months later during a dry spell, the shearing of moisture laden clay as indicated by the arrow is quite apparent.

Figure 5

Figure 5 is a view of an un-reinforced concrete block wall that is failing as a result of soil and hydraulic pressure. The wall is deflecting inward into the basement as shown by the large crack. As the wall deflects more, a cavity develops on the outside that allows soil and water to back fill, resulting in more pressure and more deflection. This failure is a result of insufficient support of the wall. Pilasters and reinforcing rod significantly reduce this type of deformation. Some municipalities do not allow concrete block construction of this type without reinforcement.

Figure 6

Figure 6 is a view of an interior partition wall in a warehouse that failed when large loading doors were left open during a sudden storm. Although the wind pressure against the wall was low, the total force against the wall was substantial, causing a bending failure to the un-reinforced wall.

Concrete wall failures due to soil and hydraulic pressure are not unusual. Many of these failures could have been prevented through better design (use of pilasters, tie backs, or reinforcing rod), better construction practices (postponing back-filling until support structures are complete), and better maintenance (keeping drainage systems functional).

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