

BCA – HDB Research Eliminate Leakage Problems through Floor Pipes

In a residential apartment, one of the most commonly and widely used facility are the toilets. It is an essential place within the dwelling unit where one have to visit and spend a considerable amount of time in our daily life. As toilets are usually a wet area, any flaws in the toilet during construction will be shown up below the dwelling unit after completion. Toilet leakages are common occurrences and such problems always poses a challenge for most building maintenance personnel to resolve.



Figure 1: Typical Toilet Leakage Around Floor Pipes

This R&D project on eliminating leakage problems at floor pipes penetration is to :

- establish the factors that cause the leakages around pipes penetrations.
- to develop system or products that can reduce these maintenance problems.
- to recommend guidelines and standards for improving the water tightness around the pipes penetrations in wet areas.

Investigations were carried out by casting existing pipe sleeves and modified ribbed pipe sleeve (prototype triple flange pipe sleeve) into full scale slab samples.



*Figure 2: Pipe Sleeves Used in the Flexural Load Test
(The Control Pipe Sleeve is on the Left and the Prototype Pipe Sleeve is on the right)*

The full scale tests consist of the following specimens :

- (a) precast concrete half-slabs with the pipe sleeves which were cast together with the concrete topping as composite slab or
- (b) concrete slab cast together with the pipe sleeves in single operation, and
- (c) Precast concrete full slab produced with pre-formed floor openings and later infill with the pipe sleeves in second operation.

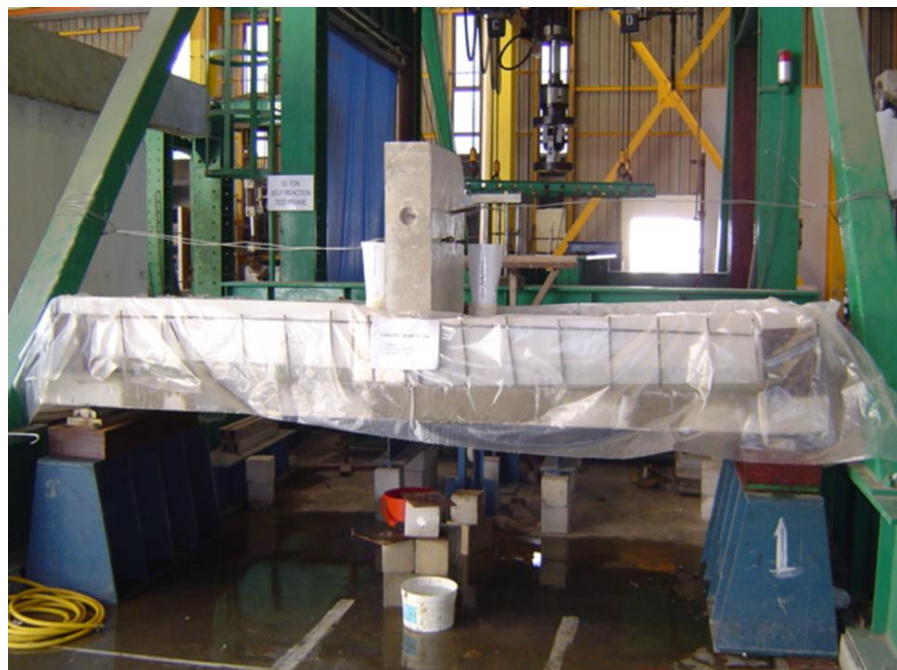


Figure 3: Cyclical Flexural Load Test with Concrete Block, Weights and Water

The full scale slab samples were then subjected to loads (or weights) simulating the dead and live loads during service conditions of the toilet slab. Water was used as the live load and cyclic loading and unloading of the water load was used to flex and stretch the slab so as to assess the watertightness performance of the pipe sleeves. This is to simulate the loading conditions on the twin toilets floor slabs during construction and service life.

Results from the study indicates that :

- Casting Pipe sleeves together with the concrete slab provide better performance in watertightness than preformed openings and with second operation post cast pipe infill method.
- Post cast pipe infill to pre-formed openings is a source of leakage and should be avoided as far as possible during construction.
- If second operation post cast infill method for the installation of the pipes or pipe sleeves is unavoidable, high strength non-shrinkage infill materials shall be used.
- Workmanship and quality of work carried out to prepare the preformed floor openings plays an important aspect and affecting the watertightness of the post cast pipe sleeve eg. using well prepared, watertight and leak-proof formwork, adequate preparation of the surface of the preformed floor and good compaction during casting or infilling the preformed floor openings.

From the study, the following construction work improvements are recommended :

- Pipe sleeves are to be cast together with the concrete floor slab
- Precast concrete trays can be adopted for toilet floor slabs
- Adopting the “Triple Flange” pipe sleeves for forming floor openings for pipes.
- Proper care to be taken for compaction during concreting of wet areas

A “Triple Flange” pipe sleeve prototype was developed in collaboration with one of the PVC pipe supplier. The above product can be easily manufactured by any PVC pipes manufacturer.



Figure 4: A Triple Flange Pipe Sleeve Prototypes (Bottom of the Pipe Sleeve is shown on the left and Top of the Pipe Sleeve is shown on the right)

It is hope that through the above recommendations and the use of the “Triple Flange” pipe sleeve for the formation pipe openings through floor slabs, the pipe sleeve will provide excellent watertight performance in wet areas and reduces such leakage problems significantly. Leakage defects due to such type of pipe penetration through floor pipes will hopefully become a thing of the past.

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