Original Article
International Journal of Scientific Research in Civil Engineering
Available online at : www.ijsrce.com
© 2023 | IJSRCE | Volume 7 | Issue 4 | ISSN : 2456-6667
doi : https://doi.org/10.32628/IJSRCE23746

# Case Study for Underground Basement Wall Leakage and Measures

**Manikandan Srinivasan**
Transmission Engineering Department, Dubai Electricity and water Authority, Dubai, United Arab Emirates

ARTICLEINFO

**Article History:**
Accepted: 05 July 2023
Published: 24 July 2023

**Publication Issue**
Volume 7, Issue 4
July-August-2023

**Page Number**
91-95

ABSTRACT

Underground basement structure is one of the key structures in substation building, which constructed 5.00-6.00m below ground level. Due to high ground water table, in most of the cases, basement structures located submerged in water. As the underground basement constructed mainly to accommodate the incoming / outgoing cables and other services, protecting the structure from water dampness and seepages is vital process. Even though all the precaution measure taken during constructions, some project may occur water seepage. Hence, in this article, we explore the case study of water dampness, causes, corrective and preventive measures obtained in one of the project.

Keywords: Case Study - Civil Engineering.

## I. INTRODUCTION

The main purpose of the article to share an awareness about water dampness issue occurred in underground basement wall which contractor encounters extra cost and time for repair / reworks for arresting dampness.

Identified basement area built as two separate wall, and soil filled in between with adequate incoming / outgoing sleeve duct, and externally protected by 4mm thick SBS water proofing membrane. Water dampness found in the exposed basement wall after completion of first coat painting works.

## II. CASE STUDY

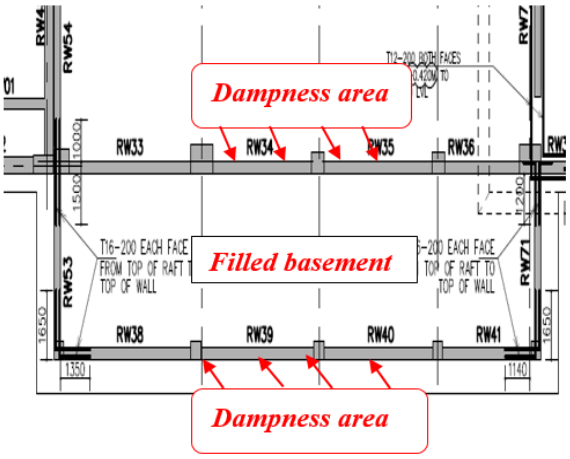
In order to get the root cause of the problem addressed in this article, referring below document

- Existing soil investigation report and
- Approved drawings.

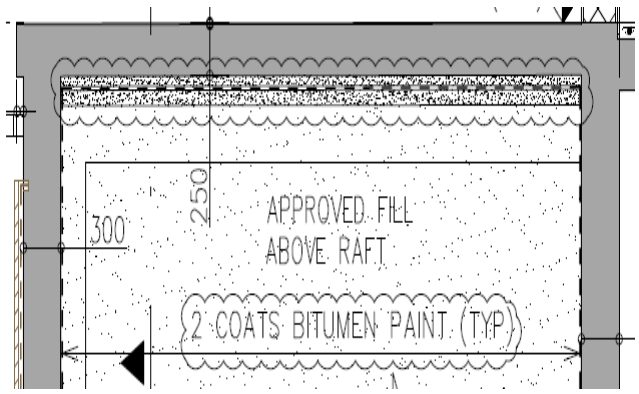
It is found that the existing water table was much deeper from ground level and basement walls located between soil filled basement walls.

Hence, it is clearly evidencing that, the source of water dampness not from the ground water and water seepage occurs due to lack of experience in

construction of basement RCC wall / soil filling / duct bank / water proofing works.




Basement Plan




Basement section

In order to mitigate the identified quality issues, specialized agency was involved to study the root-cause and recommend the remedial and preventive measures to overcome the concerns.

## III. INVESTIGATION

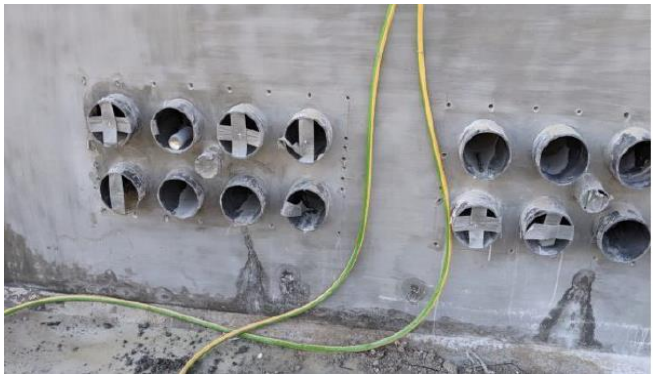
Special agencies investigated the basement wall inside /outside area and damp spot and paint delamination at the affected spot characterize the leak. Hair crack identified in top of basement Ground slabs and in some particular locations, flowing water incidents and AC water accumulation observed.

### A. Findings

Water leakage observed in the following locations

- Around the duct bank
- Through the sleeves
- Along the kicker joints
- Along slab-wall joints

Dampness at inside basement wall



Dampness at outside basement wall

Loading platform slab

## B. Root Cause

As the pipe encased completely between the retaining walls and ground slab already casted, driving exact root cause challenging, however the water ingress may occurred due to the following reasons

- Water is being accumulated inside the soil from the AC service units / Curing water;
- Excess water may poured during soil filling and compaction for ground slab works
- Encased pipe was damage during filling or concreting; the water may enter into the pipes and leads to water leakage through the pipes.
- The leakage from the kicker joints may be due to the breaches in the waterproofing applied inside the pit.
- Breaching of ground slab water proofing through hair crack, which allows water from the loading platform slabs.

## C. Remedial measures

Basement top slab crack width and depth identified through ultrasound pulse velocity method and type of crack identified as minor crack.

In order to stop identified water seepages, Soft Elastic sealing – Injection Resign methodology used at the external side of raft/wall joints and around the pipe sleeves. Continues monitoring done in injected area until water seepage stop in entire area.

### (i) Material

- MC INJEKT GL 95 (PART A & PART B)
- INJECTION PACKER

### (ii) Components

- Part A1
- Part A2
- Part A3
- Part B
- Part B1

### (iii) Mixing Procedure

- A1, A2 and A3 mixed at ratios of 27.5: 0.5: 1. (Pre batched in same proportions).
- Part B is dissolved in water
- The pot life of these individual mixtures is approximately 24 hours.
- The concentration of the Part B solution determines the reaction time.
- In addition, reaction time may affect by the ambient and material temperatures.

| Approximate reaction times in seconds | | | |
|---|---|---|---|
| | 1% | 0.5% | 0.2% |
| 20° C | 3m 15s | 9m 35s | 29m |
| 35° C | 47s | 1m 57s | 4m 30s |

### (iv) Equipment's:

- Two component injection pump – 01 no.
- Heavy duty electric percussive drill – 01 no. or
- Pneumatic rotary-percussive drill – 01 no.
- Wood paddles / stirrers – 04 nos.
- Plastic containers – 02nos.

Note: Ensure that the correct number of static mixers uses during injection works. Sufficient spare parts should be available on site to ensure continuation of work in the event of equipment failure.

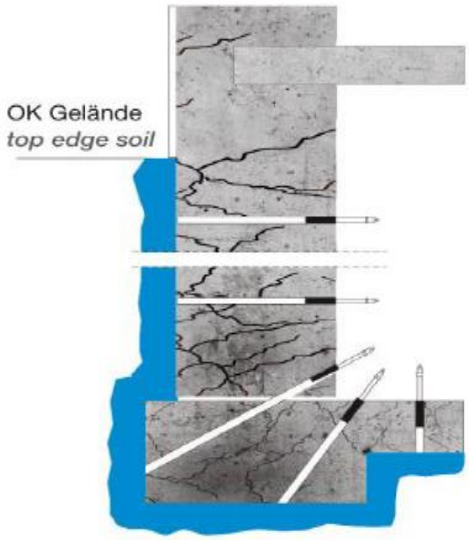
**(v) Sequence of work:**

- Drilling of injection packers around the sleeves
- Drilling of packers along the kicker joints
- Proceeding with the Curtain wall injection process

**(vi) Injection Methodology:**

- The injection will start around the perimeter of the pipe to seal the perimeter from flowing material while injecting in the centre of the sleeves.
- Once the perimeter injection is completed, the contact injection will start in the remaining packers in a sequential method.
- Finally, entire packer injection shall be completed and cure for 24hrs.
- Next day all the packers can be removed, and the packer hole area fill by approved epoxy grout.

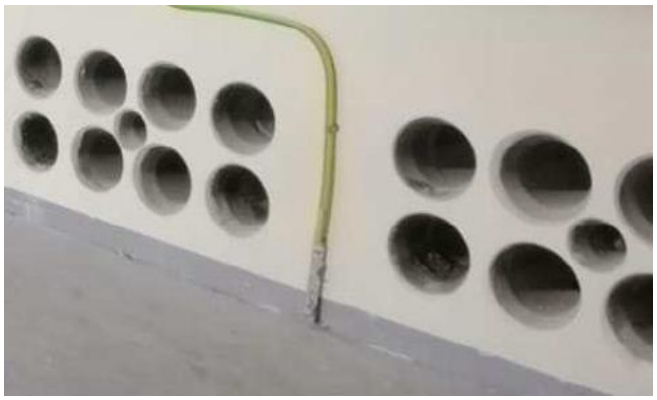
**(vii) Typical section**





**(viii) Injection snaps and final finishing**

Injection snaps



Finshed area after injection

MC INJEKT GL 95 injected in all identified locations as per above methodology. The area is completely monitored even after completed the injection and grouting. No seepage observed and successfully all the seepage arrested.

Once the seepage arrested, external basement wall 4mm thick SBS water proofing membrane and internal wall paint works completed.

## IV. PREVENTIVE MEASURES

To avoid repeating the same error occurrence in future projects, below preventive measures derived as brief, however it is not limited as per actual conditions

- Limit the water pouring to control the water moisture level during basement soil filling.
- 4mm thick waterproof membrane system shall implement inside the filled basement to protect the entire basement as tanking system
- Pre and post concrete check shall be strictly checked during duct bank encasement and before filling.
- Vibrated roller compaction directly over duct bank concrete to be avoided to null the concrete damages.
- Suspended slab with open basement system may implement instead filled basement.
- Strict implementation of fuddle flange basement sleeves during duct works.
- Strict supervision shall ensure especially during basement concrete and water proofing works.

## V. CONCLUSION

As stated above, in any building, basement acts as vital structure. Considering the importance of substructure structures and its long life, ensuring adequate quality during construction plays main role to confirm and verify the structures without any future concerns. Failure of substructure works cause the delay in constructions progress or may failure the entire project. Hence utmost care shall ensure during construction of RCC basement wall, cable duct, soil filling and ground slab works.

Safety in the construction is very important and it must be maintained during entire construction works. Usage of proper sign boards and access/egress in basement construction and repair works is essential. Considering the chemical hazards and avoid any inevitable accidents, during injection and grouting works, technicians must wear the safety coverall, safety shoes, hand gloves and goggles. Temporary eye wash must be available at the injection location to wash the eyes if any spillage over the goggles.

## VI. REFERENCES

[1]. BS 1881 Part 203: 1986: AMD 6659: 1991 – Estimation of concrete crack depth

[2]. DIN En 1504-5 Classification U (S2) W (1) (2/3/4) (1/40) – Area of application MASTER INJEKT

**Cite this article as :**

Manikandan Srinivasan, "Case Study for Underground Basement Wall Leakage and Measures", International Journal of Scientific Research in Civil Engineering (IJSRCE), ISSN : 2456-6667, Volume 7, Issue 4, pp.91-95, July-August.2023

doi : https://doi.org/10.32628/IJSRCE23746