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# Water Leakages in Transmission Power Projects

**Atiq Ahmad Aldosari[1], Baranidaran Santhanam[2]**

[1]Bacholers (Civil Engineering), Engr Trans Civil, Transmission Engineering Department

[2]Masters (Construction Project Management), Sr. Engr Trans Civil, Transmission Engineering Department

## 1. Introduction

United Arab Emirates have a very strong infrastructure setup, thus it is very important to main water tightness for the building structures since any kind of water leak can be costly to rectify in gulf countries. Ground Water is crucial resource for municipal and rural supplies wherein most of the ground water in UAE region is brackish which needs to be avoid in direct contact with the structure foundations to maintain the durability and life span of the building. Thus, preventing water leakages becomes very important.

UAE Spends large amount of money to control the errors and maintain quality during the construction & maintenance of buildings structures. Natural ground water leakage through substructure is one of the prime challenge faced in this region, these leaks can easily go undetected for long periods of time as they are hard to detect. Over time, these small leaks can become big if the main causes of leakage are not properly treated.

## 2. Main Factors

Water leakages happening in developing countries pointing to a potential reason of underdeveloped and old infrastructure. Building substructures can have water leakage at any stage both during and after construction. The substructure failures and leaks cause economic losses as not only it consumes a lot of time and money to fix but also impacts industrial output which indirectly affects the economy of the country. Also, if the water leakage is big, it can even cause damage to the surrounding infrastructure. UAA has approximately 10-15% water leakage issues in the Middle East. Some common factors which cause water leakage list below. Design issues-it is an important aspect where design can affect the quality of the final outage of the construction.

1) **Lack of proper supervision**–Improper construction is one of the prime cause in substructure water leaks. The civil contractor shall have expertise like proper knowledge, training and skilled resources in construction field. Deploying right resource for construction and insulation works minimize the errors and failures during the project cycle.
2) **Use of low-quality material**-Sometimes the leaks happen because the quality of material used in making underground foundation, insulation and other substructures like basement is not of appropriate standards. It develops cracks easily under harsh conditions and pressure underground.
3) **Improper usage of quality of the materials**-several projects contains high quality materials that are being misused in wrong structures. It is important to have manufacturer recommendation prior to proceed with construction especially for substructure waterproofing works.
4) **Lack of leak detection systems**-Currently not all places have a leak detection system in place. In absence of a leak detection system, it is very difficult to identify if a leak has happened. A leak detection system helps in identifying the leaks quickly before causing major water loss and substructure failure. Some places have made installing a leak detection system mandatory.
5) **Other Factors** – There are certain other factors like seasonal variations in natural ground water, leak in service lines, flooding due to neighbor plot issues, back flow water from surroundings, high demand constraint on the network etc and so on can cause water leakages.

There are several scenarios that causes water leakages resulting water ingress inside the basement of various substation projects and cable projects even though proper waterproofing works carried out to avoid ingress of water. Few scenarios list below:

1) **Scenario one** – water leakage is observed in 400/132kV substation basement spreading in different locations of the substation. It is been observed in the following locations
   - Raft where screed have been overlaid
   - Expansion joint
   - Stair case area
   - Duct bank sleeves

The leak was characterized and been identified at the affected spots by realizing the damp spots, paint delamination, and in some locations flowing water incidents.

**a) Raft where screed have been overlaid:**

From visual observations, water leakages may appear along the construction joints or through nearby expansion joint. The retaining wall construction consists of cast-in-situ concrete. Retaining wall was casted, after the raft construction, with blind side water proofing application on the shoring. In blind side application of water proofing, membrane was applied on to the prepared shoring wall before casting of concrete. Once the water proofing membrane is in place, shutter will be casted and concrete will be poured. In such cases, it is common occurrence for water proofing membrane to be damaged during steel erection which can allow water ingress to happen or if the waterproofing membrane is not installed properly the water can enter into the breaches and results in leakages.

**Figure 1:** Basement

**b) Expansion joints:**
The water ingress from the basement expansion joint is due to some breaches in the waterproofing system or due to installation of improper waterproofing detail in the joint

**Figure 2:** Basement expansion joint area

**c) Staircase area:**
There is no access to assess the source of leakage, the source of leakage may be due to breaches in the waterproofing system along the kicker joint.

**Figure 3:** Basement staircase area

**d) Duct bank sleeves:**
The source of leakage may be due to breaches in the waterproofing system along the kicker joint.

**Figure 4:** Basement cable entry ducts

The rectification methodology details of the above cases observed:

- Screed to be removed along the kicker joint for minimum 500mm to ensure whether water ingress is flowing through kicker joint or through cracks in the raft.
- Curtain wall injection to be done between the screed and the raft, or the screed to be removed completely and crack injection to be adopted using low viscosity PU resin

- After injection, the injected location should be observed for one week to check the effectiveness of the rectification methodology.

The rectification of the above cases are as per codes and standards which states-any cracks greater than 200 microns is required to be injected and closed so that the durability of the structure is maintained. This aspect is proposed to cover all aspects related to the durability of the structure as well as any temporary issue outlined above in the observations.

2) **Scenario two –** It was observed during the maintenance stage that the flush type link boxes manholes have some issues due to several circumstances that lead to water leakage/ingress inside flush type link boxes manholes of cable projects, few issues listed below:

- Surface water flooding
- Street irrigation
- Humidity
- Use of inappropriate insulation on the cable entry sleeves
- Non-usage of water tight manhole covers.
- Manufacturer instructions not followed in installation of manhole covers & frames.

Street irrigation, surface water flooding and humidity arecommon causes that resulted to the water leakage in the flush type link boxes manholes due to failure of the waterproofing around the manholes.

**Figure 5:** Flush type link box manhole

Apart from that, the failure of water proofing around the cable entry sleeves is another issue and mainly due to chemical used to seal the entry sleeves from inside of manholes.

**Figure 6:** Flush type link box manhole

The rectification methodology of the above cases started with the coordination of all the stakeholdes such as manufacturers and contractors. It is important to resolve the issue without affecting the cable circuit line since it is in live. Following rectifications done to avoid water ingress

- New design of manhole cover with 100% water tightness proper insulation shall be done along with manufacturer representative.
- Proper installation of waterproof system have been done around manholes.
- Mechanical sealant used to seal all the cane entry sleeves
- A mock up was done for one manhole and kept under two months observation for make sure the effectiveness of the system.

## 3. Conclusion

Water leakage is a very common issue in UAE. However, it can be prevented by use of appropriate waterproof systems carried out by skilled workman from approved applicators under the supervision / instructions of the manufacturer. The need of the hour is to take proactive steps for prevention of water leaks. This includes installing water leakage detection systems, upgrading the infrastructure against the sudden leaksand providing proper training to the stakeholders in this industry. Prevention of water leaks by adopting appropriate methodology and involving relevant stakeholders during the construction stage is the one of the best things and prime objective that we can do for our future generations.