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Case Study: Leakage Issue in Residential Premises

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Abstract: ***The case study revolves around finding the source of leakage and seepage in an internal wall of the subject premises which has no pipelines or water outlets connected to it. Lots of moisture and runny water has been noticed in one of the internal walls of a high-rise residential building, although there is no water connection or water source connected directly to the wall. This case study explores and studies different suspected sources of leakage and moisture studies each source in-depth to zero-in the source of water. The study explores potential causes, including structural anomalies and concealed pipelines, and proposes comprehensive waterproofing and repair strategies to mitigate the problem. The findings emphasize the importance of proper maintenance and timely intervention to prevent long term structural and health hazards in residential buildings.***

Keywords: leakage issues, building maintenance, waterproofing, residential buildings

1. Executive Summary

Leakages due to design or structural anomaly of buildings has dangerous consequences. Constant leakage slowly erodes the metal used in columns and beams at the time of constructing the building, which in-turn, weakens the building to a critical extent and reduces the life span of the building/premises. Other than structural hazard, leakage results in health hazard for occupants. The outbreak of SARS for example, is very closely related to leakage and seepage problems in residential premises [1].

The issue of leakage in buildings in the Mumbai is a widespread problem, irrespective of the age or location or the size or the price or the locality of the buildings or flats. Mumbai is located near the sea, and by default there is salinity in the air, which reduces the life of steel. Due to cracks and leaks, the water penetrates RCC (Reinforced Cement Concrete) slabs and impacts the steel, leading to erosion of the metal, weakening the structure. On top of that the multi-storey society system makes it difficult to detect sources of leakages in such type of a set up. In such a scenario, though inter-flat co-operation from society members/owners is immensely required, there are uncountable cases where the flat above the subject premises needs to be repaired for the leakage to stop from the subject flats/premises.

2. Purpose Statement

The purpose of this case study is to identify the source of an unexplained leakage in a residential flats internal wall and to propose effective solutions to prevent further damage.

2.1 Significance

This study is significant as it addresses a common but critical issue in urban residential buildings, particularly in coastal cities like Mumbai, where structural integrity and occupant health are at risk due to persistent leakage problems.

3. Introduction

This case study explores issue of leakage in an internal wall of a residential flat located on the 2nd floor of a 21 floor, high rise building in posh Andheri Lokhandwala area of Mumbai City. The case study revolves around finding the source of leakage and seepage in an internal wall of the subject premises which has no pipelines or water outlets connected to it. The case study also attempts at finding solutions of the same. After finding the source(s) our task involved eliminating the source of leakage. After blocking incoming water into the premises, our work involved repairing all the damage that arises from the leakage and repair work.

4. Case Evaluation and Findings

We first made a plan in Autocad software to understand the structure properly (Figure 1). The following is the plan that helped us identify suspected sources of water. Following are the points that help us understand this Autocad plan:

1) The internal wall marked in blue is the subject wall that was covered in moulds due to moisture from leakage/seepage.
2) The leakage in the wall was more at the base of the wall, while it reduced as it went towards the ceiling, i.e., leakage issue was less towards the ceiling and more expanded near the flooring.
3) A very peculiar finding made was that leakage and moisture collected more near the concealed switchboards in the den area (subject room) as well as in the Den's washroom.

Figure 1: Seepage near Concealed electrical wiring

4) The den is covered in wooden flooring. The wooden flooring is laid upon a framed structure made of wooden sticks, of 4 inches thickness. This wooden framed structure is laid upon Italian marbled flooring. So, effectively, the area between the Italian marble and the wooden flooring doesn't have any blockage for water seepage.

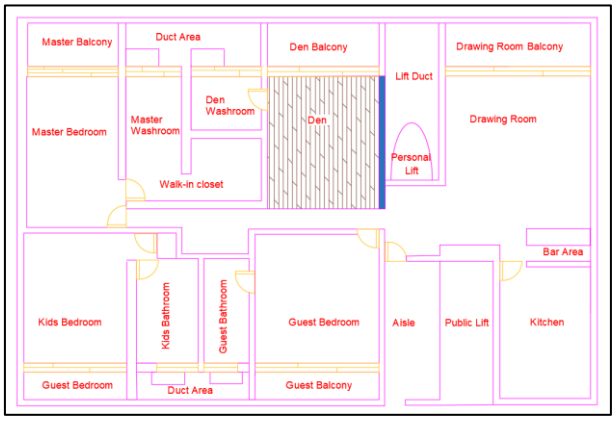

Figure 2: Complete Layout of the Subject Flat

5. Discussion

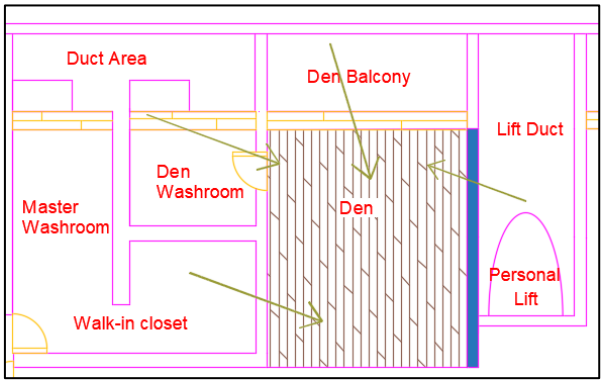

Figure 3: Complete Layout of the Subject Flat

Most suspected leakage, seepage and moisture driven sources for the subject wall:

1) The area behind the subject wall, that's between the shell of the lift and the subject wall, could have broken pipes or ducts or could be open on the terrace, from where water could be seeping into wall through any cracks and damages. This cause was ruled out, as we checked the terrace of the building, right from the ground floor to the terrace, it's all seal packed, waterproofed area, there are no pipes or ducts running anywhere close by. Once this was surveyed and examined, there was no water or leakage sources. Even when inspected during heavy rainfall, this lift duct was completely dry to touch. We could do this inspection as the lift was made of glass and the survey could be done by opening it from one side, the duct that's meant for maintenance.

2) The drawing room balcony has a pipe that runs from top of the building to the ground, carrying rain drainage water from the balconies of each floor. This could be leaking and providing water to the wall. Also, the floor trap on our balcony could be miss fit or broken, which could be a source of water to the subject wall. This source was quickly ruled out as there is a considerable distance between the wall and the suspected drainage pipe. Also, the connection of that drainage pipe is separate from the balcony that touches the subject wall and has no contact with the subject wall.

3) The next source of water leakage could be the balcony that is attached to the subject room. When we checked the drainage pipe of this balcony, we found that the balcony's rain water drainage pipe is joined into the den's bathroom and from there is can be seen going to the lower floor. This drainage pipe is flawlessly joined and is exposed, so no question of leakage arises from this drainage pipe. Since it goes out into the duct down and has no connection with the flooring of the den or the subject bathroom as far as discussed with the plumber, this source of water cannot be the reason for seepage into the subject wall.

4) Next, we examined the balcony attached to the subject room, i.e. the den. We discovered that the grouting of the balcony was in proper condition and the balcony's roof is also protruding to the extent of atleast 2 feet from the railing, which reduces the chances of incoming rains considerably. Also, the sliding door was completely sealed with transparent sealant, so any incoming leakage/seepage from the balcony was completely ruled out.

5) The next source of leakage could be the concealed pipes laid in the adjoining bathroom, which could be leaking. Now these pipes have not been checked, upgraded or repaired ever since the building has been constructed over 18-20 years ago. These pipes are said to be made of galvanised iron and could be rusted, due to which they could be leaking. This was one of the issues that could not be ruled out.

Figure 4: Rusted underground GI pipes

Also the question of why only some areas have shown moisture in the den can be directly co-related to the materials used in concealed wiring by the electricians. That cement and sand has a lot of mud content in it, which has more ability to soak water into it. Thus, only those areas which have major electrical connections running underneath are showing more moisture.

There is a very huge chance that there is a considerable amount of seepage under the den's wooden flooring.

6) The duct behind the den's bathroom had to be checked because the switchboard inside the bathroom also showed signs of seepage. This seepage could not be coming from under the flooring, since it was nearer to the ceiling and this leakage was coming from above. We went to the flat above the subject one and inspected the bathroom in the flat above the subject premises. The owners informed us that they had done their repairs not very long ago and the waterproofing membrane has been upgraded recently during repairs. So the above flat leaking is out of question. Another reason to rule out leakage from the above bathroom is that the subject room leaks more during rains which is no direct co-relation with the usage of the bathroom in the flat above.

6. Recommendations

The way to save that wall is to remove the wooden skirting and do grouting, which is waterproofing between the floor and the wall.

However, our team suggested that if we focus on the bathroom seepage from outside and work on internal bathroom pipelines side by side, we don't have to worry about anything more then.

We hadn't initially seen what's under the wooden flooring, to understand how much and how fast the water travelled to the opposite wall. Upon inspecting through a hole which had termites, it was wet inside and we couldn't touch any kind of flooring nearby underneath. The white flooring we could see was atleast 2.5-3 inches deep. If the wooden flooring is thin, I suspect what's between the wooden flooring and the tile flooring could be a strong water soaking agent. Upon further inspection we discovered the wooden framed structure that was built to lay the wooden panels of flooring upon.

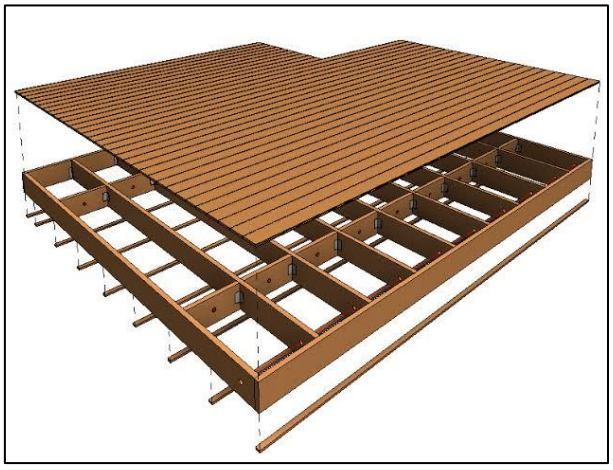

Figure 5: Framed Wooden Structure under wooden panelled flooring

We also recommended waterproofing the area outside the subject bathroom, where the AC outputs are installed, water could be going into the bathroom from that joint also, in the flooring, from where it then seeps into the den

6.1 Work approved and carried out

Following of our suggestions were approved and we worked like-wise:

1) Break the bathroom flooring and inspect the concealed pipes and fittings for suspected leakages and upgrade all pipes and fixture to PVC from GI ones.
2) Remove the stone and plaster from the external bathroom walls and add a waterproofing membrane before putting tiles.
3) Cover and waterproof the complete duct area so no water enters the bathroom through the duct and the overhead bathroom area that protrudes and touches the duct from above.
4) Remove the plaster from the walls of the den and install waterproofing membrane and then repair the plaster and paint.

Figure 6: Work in Progress

5) Remove the plaster from the pathways created for concealed pipes for electrical wires to ruin through and install a thick waterproofing membrane around the pathways.
6) Along with waterproofing the den walls, remove the skirting between the wall and the wooden flooring and completely seal that area with the mixture of cement and

waterproofing chemical, so that any water leakage doesn't seep into the wall in future.

6.2 Findings During Work Progress

We began with removing the plaster from the walls of the den. As work progressed, we noticed that the content of mud mixed in sand and cement is much more than it should ideally be in good quality cement. We also noticed that the layer of POP was thicker than usual, which could be one of the main reasons of seepage attacking the wall. Plaster of Paris (POP) has very high potential of soaking water.

Secondly, when we removed the stone from the bathroom's walls that were adjacent to the duct, we noticed that the concealed wiring that connected the geyser and the switchboard has been concealed through and through by making a huge hole in the bathroom ceiling. This hole is in close proximity to the duct, which is open at the terrace and is susceptible to throwing water inside the bathroom ceiling. So the decision of partially covering the duct area with a slanting sheet of metal and sealing it with waterproofing chemical where it touches the wall was taken. Doing this prevents any water to fall on the overhead bathroom area where the geyser is placed and also rules out any water that would seep into the bathroom ceiling from the duct area.

Figure 7: Water Seeping into the concealed switchboard from the duct area

Thirdly when we broke open the flooring from the bathroom, we discovered two flaws: one that the waterproofing membrane from the underfloor sunk was missing, specially from the wall between the room and the bathroom, and secondly the plumbing fixtures were not sealed and some of them were wrongly used. S bSo the water, when leaking from these old GI pipes swept into the room in absence of any waterproofing membetween the room and the bathroom, spread across the flooring, facilitated by the wooden framing. When this water reached the walls, the thick layer of POP and muddy sand plaster sucked the water with great intensity and facilitated it to climb heights. That's why the content of moisture is more around switchboards and on the lower parts of the walls.

7. Conclusion

After implementing the recommended repair and waterproofing measures, we monitored the premises through the monsoon season to ensure the effectiveness of the interventions. The successful resolution of the leakage issue highlights the importance of thorough inspections, timely repairs, and the use of appropriate materials in maintaining the structural integrity and safety of residential buildings.

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