

# A Two-Stage Approach to Damp Investigation in One Bedroom Residential Building in Aundh, Pune

Ashutosh Taware<sup>1</sup>, Vikram Rathod<sup>2</sup>, Bhavesh Dervankar<sup>3</sup>, Soham Dabhade<sup>4</sup>, Raj Bhosale<sup>5</sup>

Students, Department of Civil Engineering, JSPM's Rajarshi Shahu College of Engineering, Pune<sup>1</sup>  
Assist. Professor, Department of Civil Engineering, JSPM's Rajarshi Shahu College of Engineering, Pune<sup>2</sup>

**Abstract:** *Rising damp is widely referred to in Victorian literature and the Public Health Act of 1875 introduced the requirement for a damp-proof course in walls to prevent rising damp. An entry in the British Medical Journal from 1872 describes the phenomenon of rising damp as "Next we look, but in vain, for any signs of a damp proof course, or for any gratings to show that ventilation to the ground floor joists has not been forgotten. The results of the first two defects are visible enough in the house as it now exists, in the damp and green stains which are everywhere to be seen from the level of the ground to some two or three feet up the walls." Helps To Health, Sir Henry Burdett (1885). Even if the rising damp be arrested by what is technically called an impervious damp-proof course, it will be frequently found that this is built in the wall too near the ground line, so that the heavy rain bespatters the ground and splashes above it. As time rolls on the surface of the ground also becomes elevated, and this damp course is soon lost to sight. Attempts have been made to remedy this evil of porous bricks by the substitution of the hard blue bricks of Staffordshire; and then it may often be noticed that the wet has only struck, sailor-like, across the mortar-joints and cheque the inside walls like a tartan plaid. There's no permanent solution for dampness, it's every remedy is temporary but can last longer if done properly or chosen an adequate solution depending on the site, location & the reason behind it, proper maintenance is needed & it's mandatory to keep an eye on it after certain intervals to be associated with the condition & a note that every time the maintenance cost may differ depending on the issue, site, raw-materials & their availability, or the product cost depending on the method. The cost for DPC, Surface treatment & Water-proofing is estimated depending upon the coverage area of wherever it is to be done. Most economical way is water-proofing, it's not a prevail way amongst these methods. Best method for weather treatment or solution for aftermath of dampness is DPC. But if the catchment area is higher, one should go for DPC itself. Whereas Surface treatment is lowkey, a liability.*

**Keywords:** Dampness, Residential Buildings, Walls, Moisture Content, etc.

## I. INTRODUCTION

Dampness occurs where there is an interrelation with moisture such as water-taps, AC, Ducts, etc.

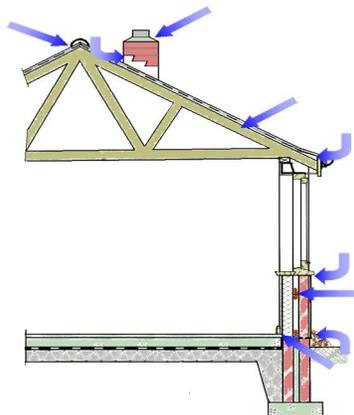
**Dampness:** The excess entry of penetration of moisture inside a building through it

1. Floor
2. Walls
3. Roof

The damage is dangerous for both Inmates & Building. Due to dampness, the building becomes unhygienic. Dampness in building is a risk factor for health effects. Buildings are composites of different materials and forms of construction and each has its own specific performance characteristics. Despite the lasting qualities of buildings, they are all susceptible to natural and man-made mechanisms of deterioration, one of which is dampness. This study employed a holistic approach to dampness investigation involving a two-stage protocol which sought to identify and document areas in the walls of a three-bedroom residential facility severely affected by dampness.

The results from the visual inspection showed that blistering of paint, flaking of mortar, cracks, mould growth and surface efflorescence were symptoms identified on the walls of the building. Also, the results from the moisture content measurements (non-destructive tests) showed that though the walls located in all the four orientations experienced dampness, it was very pronounced in the walls located in the western, eastern and southern directions. The results further showed that with the exception of rising dampness, no other source(s) of dampness existed. Further detailed destructive tests are recommended for the confirmation of the source of dampness present and this will help to put in place appropriate intervention mechanisms to address the problem. This study should provide the necessary platform for construction professionals in Ghana and other tropical countries with similar geological settings like Ghana to educate themselves on this common but dangerous problem.

This study should provide the necessary platform for construction professionals in Ghana and other tropical countries with similar geological settings like Ghana to educate themselves on this common but dangerous problem.



**Figure 1: Sources of Damp in A Building**

### **Causes Of Dampness**

Following are the main causes of dampness in a building:

- i. Rainfall penetration
- ii. Level of site
- iii. Drain-ability of soil
- iv. Climatic conditions
- v. Defective orientation
- vi. Entrapped moisture in the building
- vii. Defective construction material
- viii. Defective construction.
- ix. Moisture originates in the building.

### Effects of Dampness

Following are the harmful effects of dampness in a building

- i. Building becomes aesthetically poor.
- ii. Causes dry rot to the wooden members provided in a building.

Causes corrosion of metals used in a building.

- iii. Plaster gets peeled off
- iv. Paint gets blistered & bleached & disfigured the surface
- v. Holes & pits are formed in topping of floors
- vi. Efflorescence occurs & bricks disintegrate & turn into powder

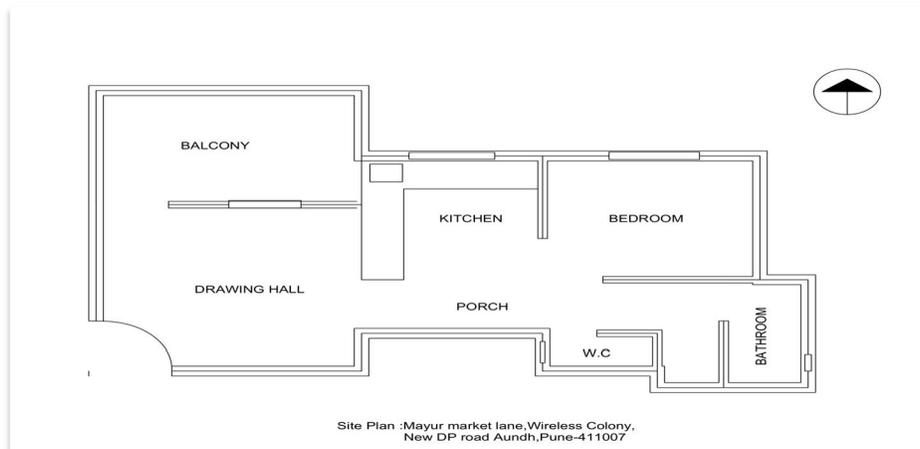
### Remedial Measures

Following are the preventive measures for dampness in a building:

- i. DPC (Damp Proofing course)
- ii. Surface treatment
- iii. Water-proofing construction
- iv. Special devices/technique

There's no permanent solution for dampness, it's every remedy is temporary but can last longer if done properly or chosen an adequate solution depending on the site, location & the reason behind it, proper maintenance is needed & it's mandatory to keep an eye on it after certain intervals to be associated with the condition & a note that every time the maintenance cost may differ depending on the issue, site, raw-materials & their availability, or the product cost depending on the method.

The cost for DPC, Surface treatment & Water-proofing is estimated depending upon the coverage area of wherever it is to be done. Most economical way is water-proofing, it's not a prevail way amongst these methods. Best method for weather treatment or solution for aftermath of dampness is DPC. But if the catchment area is higher, one should go for DPC itself. Whereas Surface treatment is lowkey, a liability.



**Figure 2**

## II. RESULT AND DISCUSSION

### Result from Site Inspection

The site inspection carried out led to the identification of several symptoms exhibited by the building. These symptoms included cracks in columns (Figure 3), greenish stains on walls (Fig. 2), blistering of paint & brownish yellow stains on wall (Figure 4), flaking of mortar, etc. Dampness on the walls located in the Southern, Western and Northern, orientations reached heights of 900 mm respectively. These symptoms provided a basis for the second stage of the investigation to be conducted. The problem of dampness was very severe in both external and internal walls.



**Figure 3:** This figure shows green stains on external wall



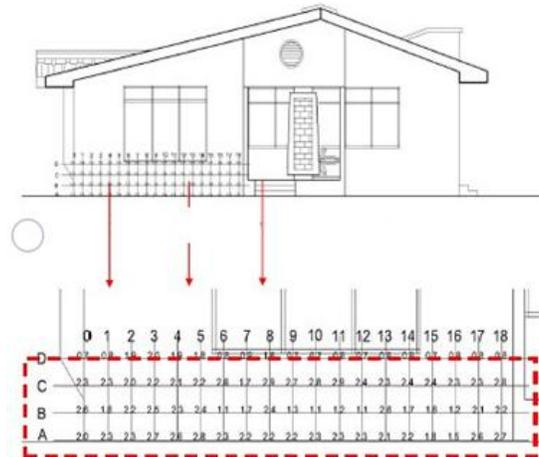
**Figure 4:** This fig. shows blistering of yellow stains



**Figure 5:** This figure shows cracks in the column.

**Moisture Content Distribution in External Walls:**

Although both internal and external walls were affected, only the external walls were considered in this study. The distribution of moisture contents along and across the faces of the affected external walls are shown in Figures 2 & 3. Results from the moisture content measurements on the external walls located in the western orientation (Figure 6) showed that dampness was dominant in the zones highlighted in red (in rectangles). This is because for most of these grid points the moisture contents measured were greater than 2.0, indicating high levels of dampness in those zones.



**Figure 6:** Areas Affected Due to Damp.

**III. CONCLUSION**

This study sought to identify and document areas in a residential building severely affected by dampness. The complete building was sick because every part of it experienced dampness in one way or the other. Both internal and external walls showed signs of the problem of dampness, but it was very pronounced externally. Visually, symptoms such as blistering of paint, flaking of mortar, cracks, mold growth and surface efflorescence were identified on the walls of the building. These symptoms point to the possibility of rising damp. Areas in the walls severely affected by the problem have been identified with the help of the moisture meter.

The foundation was constructed with no damp proof course in place and this could have affected the way water had risen in the walls though the occurrence of dampness is not solely due to the use of DPCs. Notwithstanding these findings, there is still a clear case of poor construction methods, inappropriate technology, non-involvement of construction professionals during the construction process, etc. which contributed to this problem and a further study is recommended in this area. Though these symptoms are so clear for any surveyor to judge, it is still important to conduct further studies using the stages 3 and 4 approaches (detailed laboratory investigations) to identify the lead source of the problem and the possible ions that could be present. This will provide clear evidence of the true cause of the problem which could lead to the recommendation of appropriate interventions.

**REFERENCES**

[1] Yu, Q., & Cai, M. (2015). Experimental analysis of a compressed air engine. *Journal of Flow Control, Measurement & Visualization*, 3(04), 144.  
 [2] Organ, A. J. (2007). *The air engine: Stirling cycle power for a sustainable future*. Elsevier.  
 [3] Yadav, J. P., & Singh, B. R. (2011). Study and fabrication of compressed air engine. *SAMRIDDHI: A Journal of Physical Sciences, Engineering and Technology*, 2(01), 01-08.

- [4] Korbut, M., & Szpica, D. (2021). A review of compressed air engine in the vehicle propulsion system. *actamechanica et automatica*, 15(4), 215-226.
- [5] Yu, Q., Cai, M., Shi, Y., & Fan, Z. (2014). Optimization of the energy efficiency of a piston compressed air engine. *Strojniški vestnik-Journal of Mechanical Engineering*, 60(6), 395-406.
- [6] Shin, K.G. and McKay, N.D. (1984) 'Open Loop Minimum Time Control of Mechanical Manipulations and its Applications', Proc.Amer.Contr.Conf., San Diego, CA, pp. 1231-1236.
- [7] Abases, K. (2009), "A regional geography of Ghana for senior high schools and undergraduates" Picts Publications, Acerra ISBN: 978-9988-02796-6.
- [8] WHO LARES survey of eight European cities". In proceedings: ENHR Conference Housing in an expanding Oxley, T.A. & Gobert, E.G. (1989),
- [9] "Dampness in buildings, 2<sup>o</sup> edn, Oxford: Butterworth Heinemann, Revised Oliver, A.C. (1988). "Dampness in Buildings" BSP Professionals Books, ISBN:0-632-01932-8, England.
- [10] Europe", theory, policy, participation and implementation, Ljubljana, Slovenia, 2-5 July, 2006. Civil and Environmental Research
- [11] Riley, M. & Cotgrave, A. (2005). "Dampness in Buildings. Division of Sustainable Development". Available <http://folders.nottingham.edu.cn>. Rirsch, F. & Zhang,
- [12] Z. (2010). "Rising damp in masonry walls and the importance of mortar properties" USTE; ISSN 2224-5790 (Paper) ISSN 2225-01514 (Online) Vol.3, No.9.2013
- [13] Asamoah, A.S., Forson, A.G. & Boakye, D.A. (2012), "A review of epidemiological studies of asthma in Ghana", *Ghana Medical Journal*, 46,23-28
- [14] Beall, C. (2000). "Water penetration in building envelopes". Available [www.rci-online.org/interface/2000-10/beall.pdf](http://www.rci-online.org/interface/2000-10/beall.pdf).
- [15] Ground-sourced rising damp by the Bircumshaw Test Method. *Journal of Building Survey, Appraisal and Valuation*, 1, 1-15. Ahmad, A.G. & Abdul Rahman, H.F. (2010).
- [16] "Treatment of Salt Attack and Rising Dump in Heritage Buildings Literature review papers.
- [17] Latta, J.K. (2005), " Water and building materials". National Research Council, Canadian Building Digest, CBD. 30, 1-6.
- [18] Civil and Environmental Research - ISSN 2224-5790 (Paper) ISSN 2225-01514 (Online) Vol.3, No.9, 2013USE
- [19] Melville, I.A. & Gordon, I.A. (1998). "The repair and maintenance of houses". The Estates Gazette ltd, 1988. *cdn. Construction and Building Materials*, 24, 1815-1820. doi: 10.1016/j.conbuildmat.2010.04.024
- [20] Bircumshaw, R. (2010), "The rising damp tests of Camber well Pier: Potential height of moisture rise in Civil and Environmental Research.
- [21] Brickwork and the effectiveness of a modern chemical injection cream damp coursing application. *Journal of Asamoah, A.S., Forson, A.G. & Boakye, D.A. (2012), "A review of epidemiological studies of asthma in Ghana", Ghana Medical Journal*, 46,23-28
- [22] *Building Appraisal*, 6, 5-19, Doi: 10.1057/jba.2010.13: Bircumshaw, R. & Parrett, M. (2004), "Diagnosing damp", Coventry: RICS BOOK, ISBN-13: 978-1842190975.
- [23] Burns, G. (2010). "What is rising damp"? Burns Property care Services Available. [Burnspropertycare.com](http://Burnspropertycare.com) (accessed 12/02/13).
- [24] Curtis, R. (2007), "Damp Causes and Solution Published by Technical Conservation, Research and Education Group. Historic Scotland, Longmore House, Salisbury Place, Edinburgh EH 91 SH. Available [www.historic-scotland.gov.uk](http://www.historic-scotland.gov.uk) Hollis, M. (2000), "Surveying Building", Coventry, RB-RICS Books.
- [25] Idrus, A., Sodangi, M., & HaqHusin, M. (2011). "Prioritizing project performance criteria within client perspective". *Research Journal of Applied Sciences, Engineering and Technology*, 3, 1142-1151.

- [26] Dickson, K.B. & Bennch, G. (1988). "A new geography of Ghana". London: Longman.
- [27] Trotman, P., Sanders, C & Harrison, H. (2004), "Understanding Dampness". BRE Bookshop. U.S. Environmental Protection Agency (1991). Building Air Quality.
- [28] A Guide for Building Owners and Facility Managers. ISBN: 0-16-035919-8. [www.statsghana.gov.gh/docfiles/Ghana 20in% 20Figures.pdf](http://www.statsghana.gov.gh/docfiles/Ghana%20in%20Figures.pdf)
- [29] Newton, J. (n.d), "The guide to diagnosing and treating damp permanently". John Newton and Company Limited (EST 1848), Nicol, S. (2006), "The relationship between housing conditions and health.
- [30] Gunnbjornsdottir, M.L., Franklin, K.A., Norback, D., Bjornsson, E., Gislason, D., Lindberg, E. Svanes, C.
- [31] Omenaas, E., Norman, E., Jogi, R., Jensen, E.J., Dahlman-Heylund, A. & Janson, C. (2006), "Prevalence of respiratory symptoms in relation to indoor dampness": The Rhine Study. *Thorax*, 61, 221-22.