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A White paper on "The Infrastructure Audit" [IA]

.... answering FAQs on The Infrastructure AUDIT of Structures
wrt. Quality of construction, waterproofing, plumbing &
Structure Rehabilitation
by **Aayka Waterproofers Pvt. Ltd.**



Question no. 1: What is Infrastructure Audit of Structures?

Answer: Infrastructure audit of structures is:

1. Visual inspection:
 - 1.1 Visual inspection to judge the overall health of the structure, e.g.: Presence of cracks and their nature, probable cause/s of development of crack, their future implication/s if left unattended or without taking preventive measures.
 - 1.2 Visual inspection to check for the settlement of foundation, flooring, wall etc., if any.
2. Carbonation test of concrete.
3. Inspection to check the presence of residual moisture content in various components of structures. While each aspect is important, residual moisture content plays the major role in causing conditions like spalling of plasters, settlement of walls/ foundation, flooring and etc. leading to the development of cracks in walls and sometimes in columns, beams and slabs causing reduction in **actual usable life/ service life** of structures due to onset of carbonation of concrete, corrosion of reinforcing Steel etc.

Question No.02- What is The Infrastructure Audit for Residual Moisture Content?

Answer - A yearly audit/ recording of **The Residual Moisture Content** on surface of walls, columns, beams of a structure of RCC etc. like a medical check up of different parameters of a human body done on yearly basis.

This is the **first** on site comprehensive feedback on health of structures. The moisture audit shall give a warning signal on health of structures by giving the feedback of **Residual Moisture Content** to the engineer/ client who can work, thereafter, to eradicate the cause of high moisture content/ source of leakage that is the cause of high moisture content and work for further reduction of **Entrapped dampness to lower Residual Moisture Content** using non-invasive methodologies now available in the industry.

Question No. 03- What is Residual Moisture Content?

Answer - Water forms an integral part of the concrete during construction, like making of cement sand mortar for work or making of concrete mix for construction of foundation, columns and beams etc. Theoretically, after the completion of structure this water should evaporate completely and leave the structural component in a dry state. But this does not happen, as the water from the exposed surface evaporates and the water present in the inner portion of structural component evaporates only partially and some of the water resides inside the component, this water entrapped inside may be defined as "Residual Moisture Content".

Every structure/ material has a **Residual Moisture Content** that is needed for its stable constitution. The **Residual Moisture Content** standards are documented in various BIS Guidelines/ standards and international references. The **residual moisture content (RMC)** below or above the BIS Standards impacts the material/ structure constitution in the long run. The desirable limits, code standards, guidelines and the harmful effects of high residual moisture contents are elaborated further. Also, once adopted, Infrastructure audit will be a **transparent parameter**, as a reference value for the clients linking the (RMC) to **completion certificate** in contracts. This will be a **motivation/ demotivation** for contractors for adopting right construction practices. This will also help consultants/ clients/ agencies to **grade the contractors**. The law / standards guidelines on this shall be written formed by the specialists in the industry i.e., BIS.

E.g.: - The **RMC** in RCC above the BIS Standards/Limits will be the cause of corrosion related early distress and therefore, a client/ agency will **not accept** construction with high residual moisture content and **Infrastructure Audit** will act as a transparent grading tool.

Question No. 04- Why do we have high Residual Moisture Content?

Answer – The high **Residual Moisture Content** is mainly attributed to the incorrect or incomplete:

PAINPOINTS

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| <ol style="list-style-type: none">1. Plumbing.2. Waterproofing3. Wrong specifications of insulation leading to excessive crack/ funnel development in roof surface leading to ingress of water in the rains or overflow from the water tanks.4. Toilet Leakages.5. Undersize rain water spouts in roofs/ balconies leading to temporary stagnation of water which leads to water ingress through tiles/ surface etc.6. Use of extra hard / chloride & fluoride water.7. Almost 100% failure of waterproofing.8. Rising Dampness- A phenomenon unresolved for centuries. | <p>Leakage in basement: Entrapped Dampness is also created by Waterproofing of basements & tunnels from <u>negative side</u> by entrapping moisture by products / methods</p> <p>E.g.: Guniting, stone boxing, PU injection etc. which block the water leakages/ moisture between RCC & the false layer/ masking leaving active capillaries inside thus created from inside/ negative side.</p> <ol style="list-style-type: none">9. Leakage from water tanks.10. Wrong (not as per BIS) DPC / plinth beam finishing or detailing.11. Demolition of buildings due to early distress.12. Increase in expenditure on rehabilitation due to early distress. |
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ROOT CAUSE	A. Lack of theoretical experience In majority of field staff.	B. Lack of field experience In majority of academicians.
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Question No. 05- What is the financial impact of high Residual Moisture content?
Answer- The corrosion related early distress is an epidemic impacting the health of structures worldwide. The financial loss for Indian infrastructure alone is around INR 500 Lac crore in last 43 years (POST ASIAD ERA) and 4-6 % of GDP i.e., 6-8 lacs crore annually, Plus, the cost of frequent repairs & repainting.

Question No. 06- How do we reduce High residual Moisture Content?
Answer- By sealing the source of leakages, correction of design / construction faults and adopting **EDMP- Entrapped Dampness Management Protocol** as per specifications.

Aayka welcomes you to "The Infrastructure Audit for Residual Moisture Content "revolution
..... please join the biggest rendezvous of the construction industry

Question No. 07- Does leakages and **Residual Moisture Content** in soil attribute to land subsidence/ Differential Settlement of Structures/ hills etc.?

Answer- YES, it has been observed that Heritage Structures, even framed structures, hills and new / old structures are under differential settlement due to reduction of load bearing capacity of soil by wetting thus, creating high moisture content. The reduction of moisture content will also lead to settlement of soil strata as, some soils lose cohesiveness on drying.

Example: Settlement of Joshi math, Uttarakhand, India.

Question No. 08- Why do we need **The Infrastructure Audit for Residual Moisture Content**?

Answer- We need **The Infrastructure Audit for Residual Moisture Content** to give us a real time assessment transparent feedback of the status of our plumbing, quality of water and concrete used and waterproofing etc. Anyone, even a non-engineer can relate to the problem, and will be confident/ have clarity of the work to be done to eradicate the **#High residual moisture content**. The client/ engineers can take corrective action to rectify the faults accordingly. Due to Speed & meeting targets of delayed projects the quality of construction has been on a consistent decline during the last 4-5 decades. This has led to liberal construction – not constructing as per BIS norms, use of extra hard water and fine sands (not as per BIS), faulty plumbing and casual water proofing has resulted into construction of weak structures with leakages/ seepages, chloride ION impact on RCC. This faulty construction without checks finally leads to the onset of corrosion related early distress in RCC. **The significance is recent award of dismantling of SIGNATURE towers Chintel Towers, Judicial Society, Dwarka and other buildings.**

Our research has directly linked high residual moisture to:

1. Faulty plumbing and above*
2. Faulty waterproofing and above
3. Use of hard water in construction etc.
4. Use of extra fines sands / substandard sand.

Therefore, the IA will create as

Check on construction industry & the contractor & the engineer shall takes a conscious call on quality of:

1. Plumbing
2. Waterproofing
3. Water
4. Sand, thereby, delivery good Sustainable structures.

Question No. 09 -How shall **The Infrastructure Audit for Residual Moisture Content** help the industry and the nation?

Answer: The annual moisture audit shall act as a transparent indicator of construction quality and therefore, the contractors and all stakeholders shall deliver good construction. This shall help in increasing the National wealth by **increasing the life/ actual usable life** of structures. The Nation shall save around INR 500 lac crore till 2050 on this account.

The other indirect savings are: a. Big Carbon credits: Example: 500 trucks (2000) cum debris was dismantled from a building for carrying out waterproofing. This must have created a big carbon foot print. Therefore, we further appeal to NITI Aayog, NGT, and other government regulators to take notice of this big national loss and issue necessary guidelines to stop the unnecessary dismantling for waterproofing & structure rehabilitation. This will also a Boon for industry during GRAP restrictions by adopting non-invasive technologies.

The audit engineers shall be contributing to the national economy which no other industry can presently give. This shall also help generate jobs for 10,000 more than skilled workers who shall help in saving the national structures and other building by helping in conducting the infrastructure audit and serving the nation.

Benefits of Infrastructure Audit:

1. 1st onsite transparent quality check of construction, not dependent on laboratories etc.
2. No unprofessional (-) 30-40 % **abnormally low quoted rates in tenders**. This is menace & root cause of substandard construction on which even the government is helpless, as have to accept Lowest [L1], despite knowing that a substandard structure, will be created.
3. The contractors after implementation of Infrastructure audit mandatory standard shall ensure good construction by:

A. Following BIS guidelines

B. Good waterproofing

C. Good plumbing, as, the above will finally give residual moisture content parameters within limits for obtaining CC: **completion certificate**.
4. Eventually we will be able to deliver sustainable structures with **longer service life/ actual usable life**.
Example: Tunnels & Underground structures can be planned for few 100 years instead of 100 years now.
5. Big carbon credits.
6. Ultimately, we may create wealth >500 Lac crores in the next 30 years on basis of savings by extending the service life of structures.
7. No further demolition- due to early distress.

FALL BACK:

1. Shorter service life of structures will create:

a. Burden on non-plan expenditure will expensively repair.

b. Higher carbon footprints due to demolition & reconstruction.

c. Increase in financial losses which are at 4-6% of GDP annually already.

About the Author



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About the Author

- Inventor/scientist
1. The author is an innovation awardee for 3 consecutive years by Institution of Engineers.
2. Recognition certification by Indian Building Congress for his Entrapped Dampness Engineering & its contribution to the construction industry.
3. The convenor of sectional committee of BIS on this.
4. 3 process patents & 4 product patents to his credit and solving most complicated/extreme engineering waterproofing/rehabilitation solutions for Bharat Mandapam, IIT's, DMRC, CPWD, MES, NBCC, BSNL, ICICI, Shri Mata Vaishno Devi Shrine Board, AIIMS- Deoghar etc. using his SIGNATURE-without DISMANTLING techniques and solutions. It is worthwhile to mention that the Evacuation of 41 labours from SILKYARA TUNNEL was done on SOP's given by Aayka.
- The Author is currently working for last 8 years on Infrastructure audit for residual moisture content & the author's ask is a mandatory standard on "Infrastructure audit for residual moisture content" in construction industry for waterproofing, structure rehabilitation & construction. It should be the 1st onsite standardization tool for construction industry & contain the unprofessional practices in the country in construction industry.

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Profile PPT



Website