***Strength Assessment and Restoration of RC Structures by Structural Health Monitoring Techniques***

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**Abstract**

Fundamentally, concrete is extensively used as structural material because of the truth of its exorbitant quality cost extent in various applications. Significant improvements usually are foreseen to deftly inconvenience-free providers over the range of its inferred arrangement life. Regardless, these wants are not perceived in multiple revisions given the truth of assistant insufficiency, material rot, unanticipated loadings or physical wickedness, and subsequently, Civil structures like structures, dams, ranges, etc. are presented to steady deterioration all through the long haul. This level of damage or disintegrating depends on the unimagined substances and artistry at each the structure stage. The breaking down of advancements can be a last result of the extent of factors far-reaching radiator hurt, ice movement, substance attack, utilization of steel, etc. at some stage in the structure's lifestyle scope. The adequacy assessment is consequently essential for finding the construction's contemporary convenience and its expansion for future developments or alterations in its utilization. Such an evaluation can be finished using the methodologies: a) Visual evaluation, b) Non-Destructive Testing c) Partial Destructive Testing. Also, it changes into essential for structures hit with the guide of a seismic quake, a bomb sway, or any exceptional calamity. All around, Soundness evaluation to be executed for improvements which are navigated 15 years of age.

**I. Introduction**

Therefore, concrete is wholly used as a structural material due to the truth of its exorbitant quality cost extent in various applications. Healthy advancements are naturally foreseen to inconvenience-free providers all through its inferred arrangement life deftly. Regardless, these wants are not perceived on multiple promotions because of the truth of essential need, material debilitating, sudden over loadings, or physical harm. Subsequently, Civil structures like structures, dams, ranges, etc. are presented to consistent rot all through the long haul. This mischief level or disintegrating depends upon the unfathomable substances and artistry at each structure stage. The disintegrating of advancements can be a last result of the extent of factors far-reaching radiator hurt, ice movement, manufactured attack, the disintegration of steel, etc. at some stage in the structure's lifestyle length. The sufficiency assessment is essential for finding the system's current usefulness and degree for future unforeseen developments or the change in its utilization. Such an evaluation should be possible to utilize the going with methodologies: a) Visual evaluation, b) Non-Destructive Testing, C) Partial Destructive Testing. Besides, it changes into essential for structures hit with a seismic quake guide, a bomb sway, or any unprecedented catastrophe. Soundness evaluation to be executed for advancements that are navigated 15 years of age.

**II. Methodology**

**Visual Inspection or Field Condition Survey**

Cracks: The sorts and width of the splits must be recorded. On the off chance that a break is accepted to be dynamic, uncovering might be mounted to record any development.

- Joints: The designs and specifications, all things considered, must be recorded close by with any prominent insufficiencies.
- Delamination: Areas of delamination must be recognized by the method of type and their profundity recorded.
- Spalling: Locations, profundities, and state of spall should be recorded.
- Water Infiltration: Signs of water penetration must be recorded, close by with whether the holes had been fiery at the hour of the review. Invasion related to rust recoloring or flowering should be recognized appropriately.
- Exposed steel: The degree and condition of the presented steel should be recorded.
- Corrosion: Noted consumption may comprise surface recoloring because erosion of the inserted metal and
Risk of Corrosion against the Potential Difference Readings

Table 2 Risk of Corrosion against the Potential Difference Readings

| Potential difference levels (mV) | Chance of re-bar being corroded |
|----------------------------------|---------------------------------|
| less than -500                   | visible evidence of corrosion   |
| -350 to -500                     | 95%                             |
| -200 to -350                     | 50%                             |
| More than -200                   | 5%                              |

Non Destructive Test Results and Discussion

Fig 1 Image of the Water Tank
Result of the Test Conducted
Test Result for Half Cell Potential Difference

The Water tank was constructed in the year 1985. The capacity of Water tank was 15000 litres. The water tank is rested on four Columns, where columns are connected by Braces of size 250mmx250mm.

Fig 2 Image of Spalled Column of the Water Tank

Fig 3 Image of the Spalled Brace of the Water Tank

Tests Conducted on Water Tank

Fig 4 Half Cell Potential Difference Test being conducted on Column of the Water Tank
Table 4 Result for Half Cell Potential Difference Test Conducted at column and Braces of the Water tank

| Member  | Point 1 (in mV) | Point 2 (in mV) | Point 3 (in mV) | Average (in mV) | Probability of Corrosion |
|---------|----------------|----------------|----------------|----------------|--------------------------|
| Column 1| -460           | -420           | -397           | -426           | 90%                      |
| Column 2| -405           | -426           | -415           | -415           | 90%                      |
| Column 3| -396           | -411           | -387           | -398           | 90%                      |
| Column 4| -368           | -391           | -361           | -367           | 90%                      |

Test Result for Rebound Hammer

Table 5 Result for Rebound Hammer Test conducted at the column and Braces

| S. No | Concrete Member | Rebound Number | Degree with Horizontal, in degrees | Average Rebound number |
|-------|-----------------|----------------|----------------------------------|------------------------|
| 1.    | Column 1        | 27             | 0                                | 26.00                  |
|       |                  | 25             | 0                                |                        |
|       |                  | 26             | 0                                |                        |
| 2.    | Column 2        | 24             | 0                                | 22.33                  |
|       |                  | 21             | 0                                |                        |
|       |                  | 22             | 0                                |                        |
| 3.    | Column 3        | 24             | 0                                | 22.67                  |
|       |                  | 23             | 0                                |                        |
| 4.    | Column 4        | 27             | 0                                | 27.33                  |
|       |                  | 29             | 0                                |                        |
|       |                  | 26             | 0                                |                        |
| 5.    | Brace 1         | 25             | 0                                | 24.67                  |
|       |                  | 23             | 0                                |                        |
|       |                  | 26             | 0                                |                        |
| 6.    | Brace 2         | 26             | 0                                | 23.67                  |
|       |                  | 28             | 0                                |                        |
|       |                  | 27             | 0                                |                        |
| 7.    | Brace 3         | 24             | 0                                | 25.33                  |
|       |                  | 27             | 0                                |                        |
|       |                  | 25             | 0                                |                        |
| 8.    | Brace 4         | 23             | 0                                | 23.33                  |
|       |                  | 26             | 0                                |                        |
|       |                  | 21             | 0                                |                        |
Tests conducted on Ration Shop Building in Kenjanur

Fig 4 Half Cell Potential Difference test being conducted on the Ration Shop building

Test Result for Half Cell Potential Difference

Table 6 Result for Half Cell Potential Difference Test Conducted on Ration Shop

| Member Plinth | Half Cell potential Difference between Reinforcement and Concrete in mV |
|---------------|---------------------------------------------------------------------|
| Beam          |                                                                    |
| Point 1       | -223                                                                |
| Point 2       | -209                                                                |
| Point 3       | -159                                                                |
| Point 4       | -169                                                                |
| Point 5       | -185                                                                |
| Point 6       | -168                                                                |
| Point 7       | -207                                                                |
| Point 8       | -185                                                                |
| Point 9       | -221                                                                |
| Average       | -192                                                                |

Table 6 Result for Half Cell Potential Difference Test Conducted on Ration Shop

| Member-Main Roof | Half Cell potential Difference between Reinforcement and Concrete in mV |
|------------------|-----------------------------------------------------------------------|
| Main Roof        |                                                                       |
| Point 1          | -271                                                                  |
| Point 2          | -307                                                                  |
| Point 3          | -289                                                                  |
| Point 4          | -321                                                                  |
| Point 5          | -332                                                                  |
| Point 6          | -296                                                                  |
| Point 7          | -281                                                                  |
| Point 8          | -312                                                                  |
| Point 9          | -290                                                                  |
| Point 10         | -312                                                                  |
| Point 11         | -261                                                                  |
| Point 12         | 293                                                                   |
| Average          | -298                                                                  |
Test Result of Rebound Hammer Test

### Table 7 Result for Rebound Hammer test conducted on Staff Quarters

| S. No | Concrete Member | Rebound Number | * Degree with Horizontal, in degrees | Average Rebound number |
|-------|----------------|----------------|--------------------------------------|------------------------|
| 1.    | Sunshade 1      | 17             | 90                                   | 16.00                  |
|       |                 | 15             | 90                                   |
|       |                 | 18             | 90                                   |
|       |                 | 14             | 90                                   |
| 2.    | Sunshade 2      | 28             | 90                                   | 26.00                  |
|       |                 | 23             | 90                                   |
|       |                 | 25             | 90                                   |
|       |                 | 27             | 90                                   |
| 3.    | Main Roof slab  | 32             | 90                                   | 33.00                  |
|       |                 | 35             | 90                                   |
|       |                 | 30             | 90                                   |
|       |                 | 37             | 90                                   |
|       |                 | 31             | 90                                   |
|       |                 | 36             | 90                                   |
|       |                 | 34             | 90                                   |
|       |                 | 30             | 90                                   |
|       |                 | 38             | 90                                   |
|       |                 | 36             | 90                                   |
|       |                 | 29             | 90                                   |
|       |                 | 31             | 90                                   |
| 4.    | Water tank Slab | 28             | 90                                   | 28.00                  |
|       |                 | 31             | 90                                   |
|       |                 | 25             | 90                                   |
| 5.    | Portico Slab    | 34             | 90                                   | 34.00                  |
|       |                 | 36             | 90                                   |

### III. Conclusion

To finish the NDT tests in the picked adventure domains, we found that the water tank at Sunnambukarayur was in defenseless condition. Its fundamental people were devoured to 90%. It gets mismatched for use, while the Ration shop working at Kenjanur and Staff quarters at Bhavanisagar are in worthy condition anyway, some minor disfigurements had been mitigated. The damages arranged in the Ration shop and staff quarters can be adjusted by grasping sensible fixing methods. The proper fixing techniques for remedying the minor injuries in the structures had been proposed.

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