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# To Study Rehabilitation of Old Elevated Water Tank and to Generate Non-Conventional Energy

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***Abstract:*** ***Many of the existing reinforced concrete structures around the world are in urgent need of reinforcement, repair, or reconstruction due to structural damage that occurs for a variety of reasons. The main purpose of this project is the restoration of an existing ancient water tank (Panyacha Khajina) on Old Mahadwar Road in Kolhapur, Maharashtra. Therefore, it is necessary to store water for daily use, the water storage tank should be in good condition and should be repaired if damaged. To find defects in the aquarium, first perform a visual inspection such as photography, checking for the effects of cracks and corrosion, and then inspect the existing aquarium structure, including collecting information on repair work. In this plot, you can install the solar system on top of the existing water tank to increase the efficiency of the plot. Since we are not using a surface water tank, the project`s idea is to install solar panels on the roof of the tank to generate electricity so that it can be used for various purposes. Next, you can deploy 113 solar panels and find a total of about 146 units of energy per day. Due to the limitations and impacts of non-renewable energy sources, people around the world need to pay attention to renewable energy sources.***

***Keywords: Renewable energy, Non-renewable energy, Restoration, aquarium.***

## I. INTRODUCTION

Rehabilitation of structure:- Water tanks are used to store daily water, and the water tanks need to be kept in good condition. Elevated water tanks are mainly used for water supply and fire protection. Clean water is essential for a healthy and safe life. Buildings built usually lose their strength as the building ages {i.e: Usually after 20 or 30 years.} Over time, these buildings have lost strength due to material deterioration, unexpected overloads, structural defects, and cracks in water tanks. The structure is weakened due to the reduced durability. If the cause of the cracking or deterioration of the concrete is not identified in time, the aquarium may fall or an accident may occur. Therefore, repair and rehabilitation are very important. That means updating the structure by repairing and repairing the damage. Helps improve structural stability and maintainability. Instead of demolishing or pouring the entire structure, we suggest remediation measures that can re-inspect the structure, be economical and save money. Before trying the repair method, a planned approach is needed to examine the condition of the concrete and rebar. The first step in repair and refurbishment is the correct diagnosis for a successful refurbishment operation. It deals with non-destructive evaluation techniques, laboratory tests and conditions. Commonly used non-destructive testing such as rebound hammer test, ultrasonic pulse velocity test (UPV), pullout test, core test, chloride test, carbonization test, pH measurement, resistance test, differential thermal analysis (DTA), etc.

Non-Conventional Energy:- Not only is energy essential to human survival, its availability is seen as the backbone of national growth and development. India has experienced rapid urbanization and industrialization over the past few decades.

Today, with the declining amount of renewable energy sources, the last decade has become increasingly important to the cost per watt of solar energy devices. It will definitely be economical and will grow as a better technology in terms of cost and applications over the next few years. The earth receives sunlight from above every day (about 1366W). This is an unlimited source of energy available for free. The great advantage of solar energy over other traditional generators is the ability to convert sunlight directly into solar energy using small photovoltaic (PV) solar cells. There has been a lot of research activity to combine solar energy processes by developing high conversions from solar cells / modules / panels. The biggest advantage of solar energy is that it is freely available and available in large quantities to the general public, compared to the prices of various fossil fuels and oils over the last decade. In addition, solar energy requires significantly less personnel than traditional power generation technologies. Unconventional energy has the potential to minimize pollution, reduce global warming, create new industries and jobs, and drive the country towards a cleaner and healthier energy future.

 

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## II. OBJECTIVES

*1)* Review of current status and literature research on the generation and further utilization of solar energy.
*2)* By installing a solar system, we will rehabilitate the water tank of the old structure and improve the efficiency of the property.
*3)* Perform structural tests on existing water tanks to determine current strength through NDT testing
*4)* Determine the number of solar panels in the roof water tank.
*5)* Generate electricity and send it to charging stations and street lights. Calculate how much energy you can harvest from your equipment to get the maximum performance of area and street lighting.
*6)* Investigate the current state of water storage tanks and make proposals for structural conservation.

## III. METHODOLOGY

### *A. Tank Details*

The storage tank on which rehabilitation is to perform is situated, in heart of the Kolhapur city near mangalwar peth, which is known as "PANYACHA KHAJINA". This tank stands on the ground, the total height of the tank is 3.4 m and the diameter of the water tank is 31.70m. Construction of the tank began in 1875 and was completed in 1877, with a water tank capacity of 170,000 liters. Water tanks are also built in the minority of Chhatrapati Shahu Maharaj. Below are the steps taken in a water tank to find defects in the water tank.

FIG 1. Water Tank (Panyacha Khajina)

*1) Initial Visual Examination*
*a)* Carrying out the reconnaissance survey of project area to check the feasibility of the project.
*b)* Checking of cracks and corrosion impact.
*c)* Check any alternation and addition in the structure.
*d)* Taking photographs.

*2) Audit of the Existing tank Structure*
*a)* Gathering information about repair work.
*b)* Analyze the actual structure to determine:
- Structural strength
- Usable space.

*3) Field Testing*
*a)* Field tests are performed to verify the strength and integrity of the structure.

*4)* Designing the solar panels:
*a)* Location and free space
*b)* Load estimate
*c)* Estimated number of solar panels
*d)* Battery bank quote
*e)* Estimating system costs
*f)* Gathering information about energy production.

*5) Interpretation* of Result
*a)* Keep the documentation and interpret the results by performing all the necessary tests.

 

*B. Non- Destructive Test*

*C. Rebound Hammer Test*

The rebound hammer test is a non-destructive inspection method for concrete, which can conveniently and quickly show the compressive strength of concrete. A rebound hammer, also known as a Schmidt hammer, consists of a spring-loaded mass that slides over a piston in a tubular housing. The figure below shows how the rebound hammer works. When the piston of the rebound hammer is pressed against the concrete surface, the constant energy mass of the spring load impacts the concrete surface and rebounds. The amount of rebound, which is a measure of surface hardness, is measured on a gradual scale. This measurement is called the number of rebounds (rebound index). Low-strength, low-rigidity concrete absorbs more energy and achieves lower rebound values.

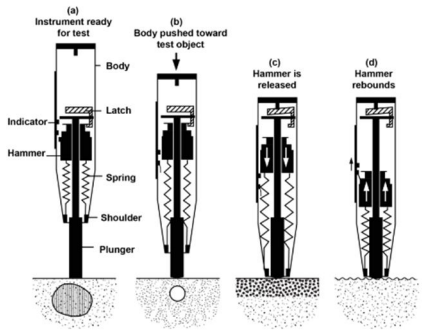


FIG 2 Rebound Hammer (WORK)

FIG 3 Rebound Hammer

*D. Ultrasonic Pulse Velocity Test*

Ultrasonic testing of concrete is recognized as a non-destructive inspection to assess the homogeneity and integrity of concrete. In this ultrasonic test of concrete, the following can be evaluated: Qualitative assessment of concrete strength, gradation at various points of components, and their uses.

Cross-sectional discontinuity such as cracks and delamination of upper concrete, depth of surface cracks.

This test basically measured the travel time T of an ultrasonic pulse of 50-54 kHz generated by an electroacoustic converter in contact with the surface of the concrete component under test and contacted the surface. It consists of receiving from a similar converter. At the other end. The pulse rate (V = L / T) is calculated using the path length L (that is, the distance between the two probes) and the transit time T. The higher the modulus of elasticity, density and integrity of the concrete, the higher the impact velocity. The ultrasonic pulse rate depends on the density and elastic properties of the material to be tested. Impact velocities are related to the extreme strength of concrete, but statistical correlations cannot be applied. The impact velocity of concrete can be affected by:

*1)* Path length
*2)* Side dimensions of test piece
*3)* Presence of reinforcing bars
*4)* Moisture content of concrete

The effect of route length can be ignored in the following cases. When using a 20 mm aggregate, it is 100 mm or more, and when using a 40 mm aggregate, it is less than 150 mm. If the minimum lateral dimension (that is, the dimension measured perpendicular to the pulse path) is greater than or equal to the wavelength of the pulse vibration, the pulse velocity is not affected by the shape of the specimen. For pulses with a frequency of 50 Hz, this corresponds to a minimum lateral dimension of about 80 mm. Impulse velocities of steel bars are generally faster than concrete. For this reason, pulse velocity measurements near the rebar are high and may not represent concrete. When the bar crosses the impulse path, the effect of reinforcement is generally small and the amount of steel is small relative to the length of the path. The moisture content of concrete can have a small but large effect on pulse rate. In general, the speed increases with increasing moisture content, and the effect is more pronounced in low quality concrete.

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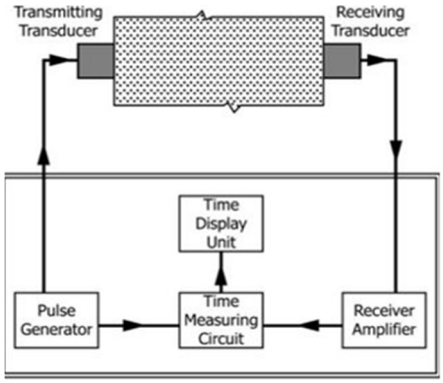


FIG 4 Ultrasonic Pulse Velocity: Test set-up according to ASTM C597

Table- 1: Interpretation of Results.

| Sr. No | Pulse velocity | Concrete quality grading |
|---|---|---|
| 1 | Above 4.5 | Excellent |
| 2 | 3.5 To 4.5 | Good |
| 3 | 3.0 To 3.5 | Medium |
| 4 | Below 3.0 | Doubtful |

*E. Non Conventional Energy*

The sun is the source of all energy on earth. It is the richest, most inexhaustible and most universal source of energy. All other energy sources draw power from the sun. Solar energy can be used directly or indirectly for human well-being. Direct solar energy is radiant energy, and indirect solar energy is obtained from materials such as biomass in which solar radiant energy is absorbed by plants. Globally, 15 days of solar energy is about the same as the energy stored in all known fossil fuel stockpiles on Earth. The continuous energy input from the sun is 167,000 times the current consumption. Therefore, many countries are currently striving to use solar energy for residential, commercial, or industrial purposes. Solar energy can be used for direct heating. Alternatively, heat can be converted to electricity – thermal power generation. Solar cells-Solar cells or solar cells directly convert solar energy into electricity.

*F. Working Process Solar Power Plant*

The principle of operation is to use the energy of photons to draw a drift current through the circuit using a reverse-biased p-n junction diode (a combination of p-type and n-type silicon). When the solar cell is exposed to sunlight, a large number of photons hit the p-shaped region of silicon. After absorbing the energy of the photon, the electron and the entire pair are separated. Electrons move from the p-type region to the n-type region due to the influence of the electric field at the p-n junction. In addition, the diode is reverse biased to increase this electric field. Therefore, this current begins to flow in the circuits of the individual solar cells. Combine the currents from all the solar cells in the solar panel to get a lot of power.

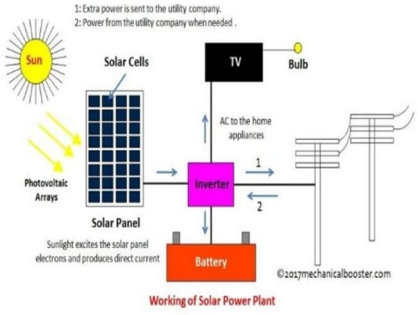


FIG 5 Working Process Of Solar Power Plant

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*G. Design Of Solar System*

We have installed solar power plant system on a top of water tank. The total area of water tank is 789.238 Sq. m

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Table- 2: solar power plant system

| Solar Panel | |
|---|---|
| Size | 1 X 2 M |
| Cost ( Per Head ) | 9000 RS |
| Energy | 1.3 Unit/Day |
| Weight | 20 To 22 Kg |
| Solar Inverter | |
| Price | 1.5l ac |
| Capacity of Solar Inverter | 38 KW |
| Battery | |
| Price | 22000 |
| Number of Batteries | 91 |
| Fabrication structure | |
| Price | 6000/Kg |
| Weight | 25-30 Kg (Approximate) |

## IV. RESULTS AND DISCUSSION

Table- 3: Results of REBOUND HAMMER TEST

| POINT | COMPRESSIVE STRENGTH ($N/MM^2$) | AVERAGE ($N/MM^2$) |
|---|---|---|
| 1 | 28 | 28 |
| 2 | 22 | |
| 3 | 28 | |
| 4 | 24 | |
| 5 | 32 | |
| 6 | 22 | |
| 7 | 34 | |
| 8 | 32 | |
| 9 | 22 | |
| 10 | 34 | |
| 11 | 26 | |
| 12 | 30 | |
| 13 | 28 | |
| 14 | 27 | |
| 15 | 28 | |
| 16 | 34 | |

Table- 3: Results of ULTRA SONIC PULS VELOCITY TEST

| SR. NO | LOCA-TION | ULTRASONIC PULSE VELOCITY TEST | | | | | |
|---|---|---|---|---|---|---|---|
| | | Structural Member | Method of Transmission | Path Length in mm | Time in µs | Pulse velocity (k m/sec) | Con-crete Quality Grading |
| Water Tank | | | | | | | |
| 1 | Location-1 | Water Tank | Surface | 400 | 110 | 3.63 | Good |
| 2 | Location-2 | Water Tank | Surface | 400 | 106 | 3.77 | Good |
| 3 | Location-3 | Water Tank | Surface | 400 | 114 | 3.50 | Good |
| 4 | Location-4 | Water Tank | Surface | 400 | 102 | 3.92 | Good |

As explained in the methodology, the tank should first be visually inspected for efflorescence, minor leaks, or uneven adjustments, but the tank is in good condition. After conductingvarious tests on the aquarium, repairs and refurbishment work will be required. If the structure cracks or corrodes, proper treatment is required to restore the strength of the aquarium. Studies on non-conventional energy production show opportunities for renewable energy sources. It does not use theupper area of the water tank. After installing the solar panel in the upper area of the water tank, you can save that area. For most people who know non-renewable energy sources, solar energy is becoming more and more popular because of its economic benefits by battery backup. Solar energy can even supply electricity 24 hours a day, 365 days a year. There are more advantages compared to other forms of energy such as fossil fuels and petroleum deposits.

## V. CONCLUSION

*1)* The RCC water tank or structure has been damaged by various attacks. Therefore, damaged tank structures need to be repaired and refurbished for maintainability. If the structure is affected by cracks or corrosion, proper treatment is required to restore its strength. Tests performed on water tanks helped find the compressive strength of concrete.

*2)* From the above results, it was judged that it is not necessary to dismantle the entire structure.

*3)* A total of 113 solar panels are installed for power generation, and the total power generation is 146.9 units / day.

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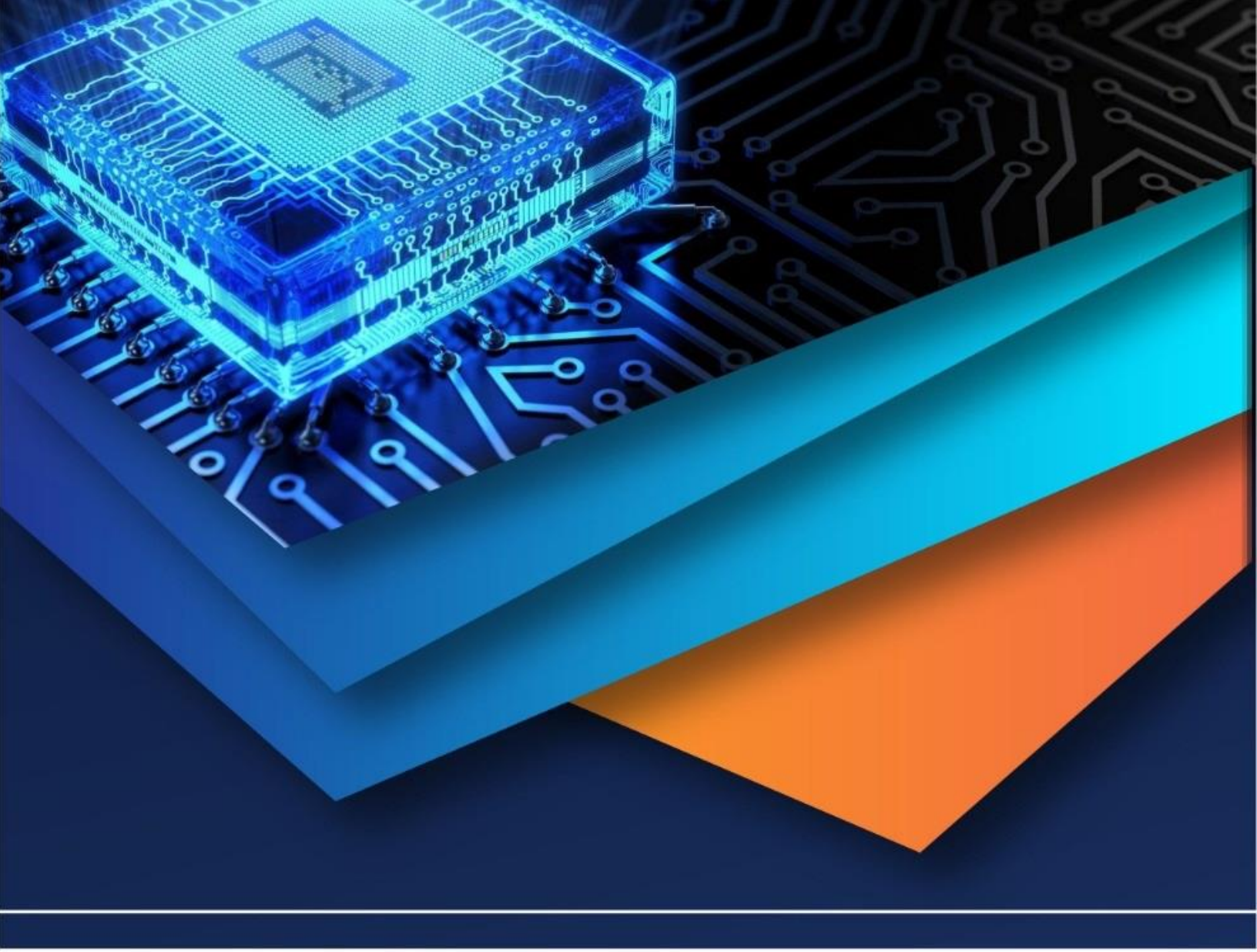

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