

# **An Investigation into the Behavior and Strength of Retrofitted Ferrocement-Concrete Columns**

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## **Abstract**

In any structure columns are key structural elements. Any kind of physical damage to the columns can bring the wellbeing of the structure and the people using it in jeopardy. This emphasizes the importance of columns retrofitting. The aim of this project work is to observe the influence of using Ferrocement jacketing in enhancing the properties of reinforced concrete columns subjected to repairable damages.

The project work compares the behavior of retrofitted columns (damaged and intact) with that of plain Reinforced concrete columns to determine the benefits of jacketing of concrete columns by ferrocement. The experimental programme broadly includes following activities:

1. Casting RCC columns
2. Inducing damages in a set of samples
3. Jacketing with ferrocement to damaged and intact set of columns
4. Comparing their behavior in terms of axial deformation and ultimate load carrying capacity for different configurations by subjecting them to axial compression

At the end of experimental programme it was observed that ferrocement jacketing not only escalates the ultimate load carrying capacity of the column samples, but also induces ductility to the column samples such that there is sufficient warning before ultimate failure of column as compared to RCC columns.

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# **Dynamic Analysis and Design of Concrete Block Foundation for Francis Turbine**

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## **ABSTRACT**

The analysis of machine foundation is quite complex than that of a foundation which supports only static load. Until recently, the practice in design offices for the design of machine foundation has been almost entirely based on empirical rules, since dynamic analysis of foundation was quite cumbersome. With the development in the field of soil and structural dynamics, the design principles got gradually established without dependence on mere empirical methods.

Turbines are the examples of high-speed rotating machinery. Inertia forces are generated by the eccentricity of unbalanced masses about centre of rotation. These forces act radially and rotate with the shaft. But they do have oscillatory vertical and horizontal components which tend to excite the corresponding modes of vibration.

When the operating frequency of the machine coincides with either of the natural frequencies of the system, a resonance is formed. It is recommended that the frequency of the disturbing force should be less than half or greater the twice the natural frequency. In order to avoid other harmonics being close to the natural frequency it is preferable to design a stiff foundation whose lowest natural frequency is always higher than the highest disturbing frequency.

The concrete block absorbs the vibrations generated by turbines in hydroelectric power unit. Due to continuous vibrations, because of high speed of turbines, the concrete block should be massive enough to dampen these vibrations. Hence, while designing such blocks it becomes necessary to check for dynamic response. In this work, most recommended Barkan's method for analysis of foundation block for turbine is briefly discussed. It is further applied for block foundation for Francis turbine of Pench Hydroelectric project.

This project deals with dynamic analysis and design of turbine foundation. This analysis has been done with the help of ANSYS WORKBENCH. Total analysis process has been divided into two sections ie. Runner Foundation and Generator Foundation. For analysis of Runner Foundation Pseudo Static Analysis, Modal Analysis and Harmonic Analysis is carried out. For analysis of Generator Foundation Modal Analysis and Harmonic Analysis is carried out. Design of various components of turbine foundation is also done using Pseudo Static Loads.

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# Design of Precast Building for Rapid Construction

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## Abstract

A study of rapid construction technique using precast members is proposed in which design of hybrid structural frame, consisting of cast-in-situ footing and column, partially precast and partially prestressed beam, and prestressed precast hollow core slab is undertaken. The site under construction at Bavdhan, Pune is considered for study purpose. The project aims to study the construction of Precast and cast-in-situ building and designing the same to compare the results.

More specific aims are:

- To study the feasibility of precast system over conventional system
- To reduce time required for construction by using precast method of rapid construction
- To study the behaviour of precast members and their design
- To study the behaviour of precast members' connections and their design
- To verify the design of hollow core slab and partially precast prestressed beam
- To compare the cost of the hybrid precast structural with that of the same frame designed in a conventional manner

The outcome of this project is-

1. Though the cost of the hybrid structure is high when compared to the conventional structure, it can be justified and is attractive when compared to overall consumption of construction, savings in overhead charges and early returns.
  2. The design of hybrid structure is different from the conventional structure. It requires additional loading conditions (from manufacturing to erection) which have influenced the overall design.
  3. There is scope to revise the design of beam in hybrid structure to reduce the cost and the weight of the structure.
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# Road Safety Audit- A Case Study

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## Abstract

In safety audits "The main objective is to ensure that all new highway schemes operate as safely as is practicable. This means that safety should be considered throughout the whole preparation and construction of any project".

More specific aims are:

- To minimize the number and severity of accidents that will occur on the new or modified road;
- To avoid the possibility of giving rise to accidents elsewhere in the road network; and
- To enable all kinds of users of the new or modified road to perceive clearly how to use it safely.

The outcome of this project is-

- 1) To check whether the road user is safe or not.
  - 2) To implement the necessary changes needed on the road.
  - 3) To check Signal timing adequacy.
  - 4) To check whether parking facilities are feasible or not.
  - 5) To check whether facilities for pedestrians, two wheelers, four wheelers are sufficient or not.
  - 6) To check whether the geometric parameters follow the standards.
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# A SOLUTION FOR VOLATILE ORGANIC COMPOUND MITIGATION FOR AIR POLLUTION CONTROL

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## **Abstract**

Volatile Organic Compounds are produced as a result of various industrial processes. VOC's in air react with Nitrogen Oxides to produce ozone which has adverse effects on human and animal health, as well as affects growth of vegetation. Ground level ozone has an oxidizing effect and due to this degrades materials such as rubber, dyes, etc. Human health effects manifest in the form of various neurological symptoms, exacerbation of existing respiratory disorders and may eventually lead to permanent lung damage in healthy individuals. Some studies also blame Volatile Organic Compounds for causing cancer in humans and animals. Volatile Organic Compounds retained in soil may lead to necrosis in leaves and also migrate into sources of ground water. Volatile Organic Compounds in ground water and other drinking water sources are retained for long periods of time as natural processes of degradation and bioremediation are slow, and thus may have harmful effects on human, animal and crop health.

Existing approaches to the VOC problem may be broadly divided into two categories. The first deals with reducing VOC's in the production stage, while the second approach focuses on developing add on control devices to recover or destroy the VOC's. While it is possible to reduce the amounts of Volatile Organic Compounds produced in industrial processes, they cannot be completely eliminated and hence the second approach gains significance. Various existing technologies to handle volatile organic compounds have been studied and explained in this report. Existing solutions have their shortcomings. The first one is that while they destroy Volatile Organic Compounds, they convert them into carbon dioxide and water. Carbon dioxide is a harmful greenhouse gas. Other secondary pollutants are also produced which require further control devices. The second problem lies in the scale of the control units. Studies have demonstrated that indoor levels of Volatile Organic Compounds are five times as high as outdoor levels. Therefore, scalable solutions are required to deal with smaller structures.

From the understanding gained through the study of existing solutions, we have developed a scalable solution that not only captures Volatile Organic Compounds, but stores them effectively for further use. Since all Volatile Organic Compounds have an inherent calorific value, one possible usage that interests us is the use of these as fuel.

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# Evaluation of Free Shrinkage Properties of Coconut Coir Fibre Reinforced Mortar

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## ABSTRACT

One of the most objectionable defects in concrete is presence of cracks, particularly in floors, pavements and water tanks. One of the important factors contributing to the cracks in concrete is shrinkage. Shrinkage cracking of concrete is still a major problem in concrete members with large surface area. When the rate of evaporation exceeds the rate of bleed water rising to the surface, the concrete mixture will begin to shrink. If the shrinkage is restrained, tensile stress develops and can cause cracks. Shrinkage cracks become critical weak points for concrete members because aggressive substances can more easily penetrate into the internal portion of the concrete along the cracks, which leads to the acceleration of concrete deterioration. Consequently, the performance, serviceability, durability, and aesthetic qualities of concrete structures are reduced. Controlling shrinkage cracking in concrete is essential for developing more durable and longer-lasting structures at a minimum life-cycle cost. Drying shrinkage is predominantly observed in thin structural elements made from cement mortar. Use of short discontinuous fibre in concrete or cement mortar is one of the solution to reduce shrinkage. Coconut coir is eco-friendly natural fibre material available economically. The effectiveness of coconut coir fibres to control the shrinkage cracking of cement mortar is investigated in this study. In this investigation, rectangular panels were casted to determine the extent of shrinkage for concrete specimens when allowed to shrink freely. Thirty six test specimens of rectangular panels of size 900 mm x 600 mm with thickness of 20 mm were manufactured using 43 Grade OPC cement. Cement mortar of 1:3, 1:4 and 1:5 proportions using natural sand with water cement ratio equal to 0.45 were used. Coconut Coir Fibre (CCF) of length equal to  $50 \pm 10$  mm with 0%, 1%, 1.5% and 2% of the total cement weight were considered to observe the free shrinkage in panels. The contributions of fibres in shrinkage reduction were evaluated by measuring free shrinkage of all panels at different locations of panels. It was found that the introduction of the fibre content has resulted in reduction in strains due to drying shrinkage.

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# **Analysis of Structures using ANSYS**

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## **Abstract**

ANSYS is FEM based software which is extremely useful in civil, mechanical, aeronautical, marine engineering for various types of analyses such as static, free vibration, forced vibration and thermal. Present work consists of static analysis of structures; skeletal as well as continuum using - ANSYS. It contains an exhaustive library of finite elements which includes one dimensional (beam elements), two dimensional (shell element) and three dimensional (brick) elements. Initially we used ANSYS for analysis of skeletal structures like continuous beams, plane trusses, space trusses and plane frames using 1D element. Subsequently using 4 node shell element a rectangular simply supported plate is analysed and result for central deflection is compared with the analytical result. It is observed that the result is in close agreement with the analytical results. The basic aim of our project is to model and analyze Continuum Structures. Continuum Structures are nothing but structures of continuous extent, succession or whole, no part of which is a distinguished except for arbitrary division. We have modelled and analysed an elevated water tank in ANSYS using various methodologies. Many trials were taken at the modelling stage few of which include: Pressure Vessels, Importing model from Auto-Cad, Drawing model in APDL, Solid modelling, Line modelling, Modelling in work bench, Separate centre line for Beam and Slab using command window. Work done in the last phase of the project includes several models which we have modelled in ANSYS using above mentioned methods. We have also modelled and analysed a Practical problem which is a 15 Lakh Litre Capacity Tank, constructed in R.C.C. and located at Mamurdi, Pimpri. The elements which were used in this phase are 4 Node Shell 181 and Beam element- 2 node 188.

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# **An Investigation into the Behavior and Strength of Concrete with Partial Replacement of Natural Fine Aggregates by Waste Foundry Sand**

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## **ABSTRACT**

Solid waste management has become one of the global environmental issues, as there is continuous increase in industrial byproducts and waste materials. Due to lack of land filling space and its ever increasing cost, utilization of waste material and by products has become an attractive alternative to disposal. Waste foundry sand (WFS) is one of such industrial by products which could be used in various applications including construction materials such as concrete. Waste foundry sand represents the highest amount of solid waste generated by foundries. The beneficial use of such by products in construction materials results in reducing the cost of construction materials ingredients, and also helps in reducing disposal problem.

The most important aspects to be considered in selecting the construction materials are easy availability, environmental compatibility and financial constraints. Therefore the study and research work are going on throughout the world especially in the developing countries with large populations for finding out the alternative materials for replacement of conventional construction materials.

In the present study, effect of waste foundry sand as a partial replacement of natural fine aggregates on compressive strength, split tensile strength, modulus of elasticity of concrete was investigated. The percentage of replacement will be 10, 20% by weight of natural fine aggregate. A comparative study using one time used sand (silica sand) and multiple times recycled sand (green sand) as partial replacement of natural sand will be done. The tests will be performed for compressive strength, split tensile strength, and modulus of elasticity for all replacement levels of WFS for curing period of 28 days. An attempt will be made to obtain the compressive strength of at least 25 MPa.

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# **Design of Water Distribution System and Rain Water Harvesting of CoEP Hostel Campus**

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## **ABSTRACT**

Water is essential for life. Without water, human beings cannot survive. This is the reason why civilization has always sprung up on river banks. In olden days, water was carried in pots for domestic use from wells for the family needs. But as the community developed and with the concentration of population in cities, the demand of water increased. Also with the rapid industrialization taking place, a vast amount of water is required to run industries. The community has to be protected from fire hazards. For all these needs it is no longer possible to depend on private individual sources of supply. Hence, it is important that water is supplied to the community from a public source and it should be safe for drinking & industrial purposes. To supply water to the community and industrial areas water distribution network is used, so it has great importance to know the distribution network and their components in details.

The distribution system is a critical component of every drinking water utility. Its primary function is to provide the required water quantity and quality at a suitable pressure. Water distribution systems carry drinking water from a centralized treatment plant or well supplies to consumer's taps. These systems consist of pipes, pumps, valves, storage tanks, reservoirs, meters, fittings, and other hydraulic appurtenances. Public water supplies and their distribution systems range in size from those that can serve as few as 25 people to those that serve several million.

A distribution system consist of pipelines of various sizes for carrying the water to the streets; valves for controlling the flow in the pipes, hydrant for providing connections with the water mains for realizing water during fires; meters for measuring discharge; service connection to the individual homes; pumps for lifting and forcing the water into distribution pipes, distribution or service reservoirs for storing the treated water to be fed into distribution pipes.

Analysis of water distribution system includes determining quantities of flow and head losses in the various pipe lines, and resulting residual pressures. Water distribution network must satisfy that there can be no discontinuity in pressure and the law of continuity in flow must be satisfied.

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# Lean Processes for Green Buildings in Pune

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## ABSTRACT

Construction industry is a huge industry that provides employment opportunities to about 7% people worldwide and consumes 50% of the world's resources, mostly in the form of water.<sup>(1)</sup> However, construction practices consume energy and generate waste and pollution in the form of noise, contaminants released in the atmosphere etc. Unless we control this rate of consumption, our future generations will not be able to cope up with satisfying the increasing demands. Sustainable construction practices are the need of the hour to deliver services that are eco-friendly and which do not compromise the ability of the future generations to meet their own needs. Applying the process of "lean" construction to green buildings will help us in meeting current demands in construction sector at affordable prices with long-term benefits, which will also be environment friendly. The results of a survey in the form of questionnaire in the construction sector provided an insight into how popular the concept of lean construction is amongst the various construction firms. The survey identified the most sensitive parameter for Lean Construction and Green Construction. It can help the construction industry working in and around Pune to focus on parameters which will help reduce and manage waste at construction sites, thereby giving eco-friendly and economical construction. The extent of survey has been specifically limited to the Pune area.

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# Hydraulic Design of Swimming Pool

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## **ABSTRACT**

The invention of swimming pool is not a recent invention. It was started in 3 B.C. which was constructed in Mohenjo-Daro. From then onwards there was a great demand for swimming pool because it was been used for both leisure and athletic purposes.

In our project we have studied the planning and design of a residential swimming pool.

The design includes both hydraulic and structural design. The various parameters considered in the hydraulic design like surveying, hydraulic properties like pipe networking, filtration rate, and treatment of water are considered.

The basic parameters for structural design like bearing capacity, type of soil, load considerations, RCC work and detailing are taken into account.

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# **Seismic Analysis of Hospital Building using ETABS.**

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## **ABSTRACT**

This report aims to study the analysis of structure using ETABS. It presents all the basic three methods used for analysis namely seismic coefficient method, response spectrum method and time history method. This process is an integration and extension of the existing methods of analysis. The report also presents the implementation code as per the algorithm based on this analysis technique. Comparison of results obtained by all the three methods was made which was the main purpose of our study. Finally, the report presents the conclusions obtained from the study and presents the scope of the future work that can be carried out for further analysis and comparison

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# **Study of Effect of Rice Husk Ash (RHA) on Mechanical Properties of Concrete**

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## **ABSTRACT**

Nowadays, the rapidly increasing construction industry has inspired to multiple research about new construction materials and new construction technologies to fulfill the high demand of the construction industry. Many researchers have carried out on partial cement replacement material which can produce high quality of concrete. The Rice Husk Ash (RHA) is one promising replacement material for cement.

Rice husk is an agricultural residue abundantly available in rice producing countries. The annual rice husk produce in India amounts to approximately 12 million tons. Rice husk is generally not recommended as cattle feed since cellulose and other sugar contents are low. Furfural and rice bran oil are extracted from rice husk. Industries use rice husk as fuel in boilers and for power generation.

RHA is one of the most silica rich raw materials containing about 90-98 % amorphous silica after complete combustion. Husk contains 75 % organic volatile matter and 25 % is converted into ash. The raw materials are directly or indirectly mined each year for cement manufacturing and it is time to look into the use of agricultural waste by-products in replacing cement. RHA has the Pozzolonic properties is a way forward. An intensive study on RHA was conducted to determine its suitability. From the various grade of concrete (Grade M:30,M:40) studied, it shows that up to 20 % replacement of OPC with RHA has the potential to be used as partial cement replacement, having good compressive strength performance and durability, thus have the potential of using RHA can contribute to economy in construction.

Therefore, the main objective of this experimental work is to study the effect of RHA as a supplementary material to cement in concrete and its effect on mechanical properties of concrete. In this work designed mixes of M30 and M40 grade of concrete are used. Modulus of internal size 150 x 150 x 150 mm for cube test, internal diameter 150 mm & height 300 mm for cylinder test and beam of 100 x 100 x 500 mm are used to test the sample for compression, split tensile and flexural strength test. Respectively samples are tested at the age of 7, 14, 28 and 56 days.

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# To Demonstrate an Urban Storm Water Management Technique- Bioretention Filter

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## **ABSTRACT**

This project demonstrated an Urban Storm Water Management Technique by Bioretention Filter. As the cities develop and grow, benefits from important natural water ways/areas are often ignored and overlooked as a result of which natural areas are degraded. This has resulted in increase in impermeable areas, flooding in some areas while drought in some areas. This necessitates adoption of sustainable storm water management practices in cities. The project demonstrated runoff could be harvest using bio retention media and water could be utilised for domestic secondary use.

**AM:** The aim of this project is to harvest and utilize runoff water using bio retention media prepared by engineered soil.

### **OBJECTIVES:**

1. To collect and assess the water available from rain.
2. Make water to percolate through soil and natural filtration through soil media.
3. To test obtained water for different quality parameters and propose its reuse accordingly.
4. Provide high enough infiltration rates to meet desired surface water drawdown.
5. Provide infiltration rates that are not too high in order to optimize pollutant removal capability.
6. Provide a growth media that supports long-term plant and soil health.

This project results shown that important aspects for the design and successful application of bioretention are the soil mix and plants that, working together, provide flow control and a highly effective filter media.

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# **Redevelopment of slum with special emphasis on low cost construction techniques and materials: Case study of Pune City**

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## **ABSTRACT**

Increasing urbanization is emerging as the most pervasive and dominant challenge as well as opportunity today. As a result, they are increasingly facing the negative consequences of rapid urbanization, such as polarization of population in large cities, high density, slums and squatter settlements, acute shortage of housing and basic civic amenities, degradation of environment, traffic congestion. People are forced to live in slums and squatter settlements, in inhuman conditions that deny their dignity, shelter, security, and right to basic civic amenities. Therefore slum redevelopment in urban areas is the need of the hour.

In city of Pune, on the basis of survey conducted by MASHAL, 32.5% of total population were residing in slums within old city limits in 2011. According to projections, an additional 33 lacs of people in Pune will need 3.5 lac homes by the year 2027. Considering the current scenario and the need for slum redevelopment the case study area from Pune City was selected. The project emphasises on the use of low cost construction techniques and materials for Slum redevelopment projects for affordable and speedy construction. A redevelopment plan (RDP) for TADIWALA SLUMS near Railway Station, Pune is proposed. Through this study it can be concluded that the burden on the Government agencies can be reduced from 50% to 5% of the total cost of the project or there may be no share or financial assistance from Government agencies. The subsidy thus saved could be used for other projects.

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# **Plate Load Test on Undisturbed Soil Sample**

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## **ABSTRACT**

As we know Foundation is that part of the structure which is in direct contact with soil. Which transfers the forces and moments from superstructure to soil below to keep the stresses within limit for maintaining stability of the structure. Bearing capacity is the power of foundation soil to hold the forces from the superstructure without undergoing shear failure or excessive settlement. Bearing capacity plays very important role deciding the type of foundation and depth of footing.

There are various methods for determining bearing capacity of foundation. But field methods give more accurate results than that of analytical methods. Standard Penetration Test and Standard Plate Load test are the normally used field methods. Though these methods gives accurate results but they prove to be costlier than analytical methods .Considering the large space requirement and complex loading required for these methods there is need of some other method removing all the faults in old methods.

So we thought of one another test similar to plate load test. For this test we are going to take the undisturbed soil sample of particular size and we are going to test that sample. This test can be performed very easily having loading arrangement very simple one. In our test we are going to test the soil sample by placing it on base plate and applying loading by using reaction frame method .We basically designed the reaction frame for loading of about 300 kN, 150 kN and 50 kN which includes design of beam , design of columns ,design of base plate and design of soil box. This apparatus is similar to CBR test apparatus. This apparatus can be used in lab also and on site also. Loading is applied by using hydraulic jack. We changed the position of bearing plate to achieve good failure surface of soil.

We also used an apparatus for measuring the bearing capacity of soil which uses lever arm arrangement for application of loading. The apparatus is same as that used for large shear box test .The only disadvantage of this test is that, we can perform this test in lab only. The

main task that we have to do is to collect the undisturbed soil sample from site .We have also gone for standard penetration test at the same site to get the bearing capacity of soil.

Then we compared the values of bearing capacity that we got from both the tests i.e. SPT test and Plate load test on undisturbed soil sample .Though there are some faults in this new method, this method can give superior results considering the corrections required to be made in design of new system.

So finally came to the conclusion that the plate load test on undisturbed soil sample prove to be more simple and efficient than that of standard plate load test.

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