Vidya Vikas Education Trust's
Universal College of Engineering
Gujarati Linguistic Minority Institution

The Benchmark

Issue 011: June 2019 Edition

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We are pleased to announce the June 2019 Edition of Benchmark. In this edition, you'll find an article on Eiffel Tower & Department of Civil Engineering best and finest final year projects which were executed by the final year students. In the season of examination students gets stressed out due to vast syllabus, so in this edition we have reflected our student's hard work.

Department Vision

- To excel in every area of Civil Engineering, inculcate research oriented study to explore hidden talent.
- Providing Opportunity to display creativity, out of the box thinking & innovativeness, aimed at providing cutting edge technology for sustainable development.

Department Mission

- Providing qualified, motivated faculties to deliver the content using updated teaching methodology, inviting industry experts from various areas to disseminate subject knowledge in Civil Engineering.
- Motivating students to undertake the Research Oriented studies, participate in competitions at all levels, grasping new techniques and methods which can be improved on further.
- Conducting and participating in seminars, workshops and training programs with a view to make the students industry ready and improve their employability factor for global career ahead.
- To create quality professionals capable of planning, designing and analytical skills for better infrastructural development in the field of Civil Engineering.

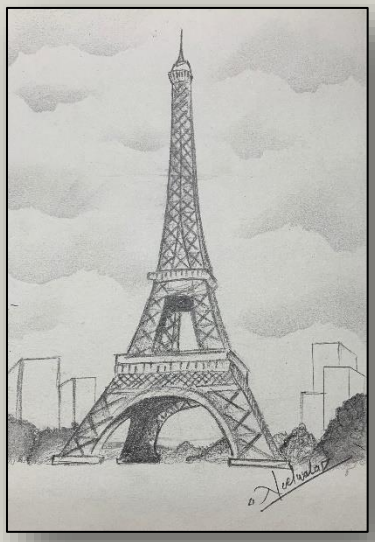
Eiffel Tower

Overview

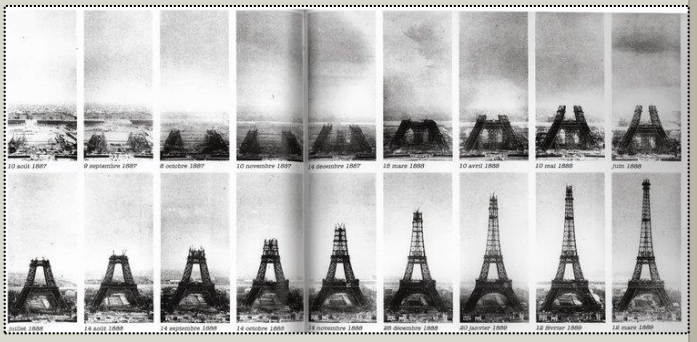
The **Eiffel Tower** is a wrought-iron lattice tower on the Champ de Mars in Paris, France. It is named after the engineer Gustave Eiffel, whose company designed and built the tower. Constructed from 1887 to 1889 as the entrance to the 1889 World's Fair. The tower is 324 meters (1,063 ft.) tall, about the same height as an 81-storey building, and the tallest structure in Paris. Its base is square, measuring 125 meters (410 ft.) on each side. During its construction, the Eiffel Tower surpassed the Washington Monument to become the tallest man-made structure in the world, a title it held for 41 years until the Chrysler Building in New York City was finished in 1930. It was the first structure to reach a height of 300 meters. Due to the addition of a broadcasting aerial at the top of the tower in 1957, it is now taller than the Chrysler Building by 5.2 meters (17 ft). Excluding transmitters, the Eiffel Tower is the second tallest free-standing structure in France after the Millau Viaduct. When the project came to being, it had been established that the licensing rights linked to the convention for the tower's construction would last only 20 years, followed by imminent destruction. However, two million people visited the Tower during the Universal Exposition. Following this incredible success, the building became a symbol of French industrial power. The Tower was as equally as successful during the 1900 Universal Exposition. Determined to avoid the Tower's destruction, Gustave Eiffel went to great lengths to prove its scientific utility. Scientific experiments were conducted in the fields of astronomy and physiology but what would really save the Tower in the end was its use as a radio antenna tower, first for military communications and then for permanent, radiotelegraphy communications; in fact, the Tower served many a purpose during the First World War. The Eiffel Tower is part of the French History.

Construction: Work on the foundations started on 28 January 1887.[15] Those for the east and south legs were straightforward, with each leg resting on four 2 m (6.6 ft.) concrete slabs, one for each of the principal girders of each leg. The west and north legs, being closer to the river Seine, were more complicated: each slab needed two piles installed by using compressed-air caissons 15 m (49 ft.) long and 6 m (20 ft.) in diameter driven to a depth of 22 m (72 ft.) to support the concrete slabs, which were 6 m (20 ft.) thick. Each of these slabs supported a block of limestone with an inclined top to bear a supporting shoe for the ironwork. Each shoe was anchored to the stonework by a pair of bolts 10 cm (4 in) in diameter and 7.5 m (25 ft.) long. The foundations were completed on 30 June, and the erection of the ironwork began. The visible work on-site was complemented by the enormous amount of exacting preparatory work that took place behind the scenes: the drawing office produced 1,700 general drawings and 3,629 detailed drawings of the 18,038 different parts needed. The task of drawing the components was complicated by the complex angles involved in the design and the degree of precision required: the position of rivet holes was specified to within 1 mm (0.04 in) and angles worked out to one second of arc. At first the legs were constructed as cantilevers, but about halfway to the first level, construction was paused in order to create a substantial timber scaffold.

Photos



- Neelkumar wala s.e. civil

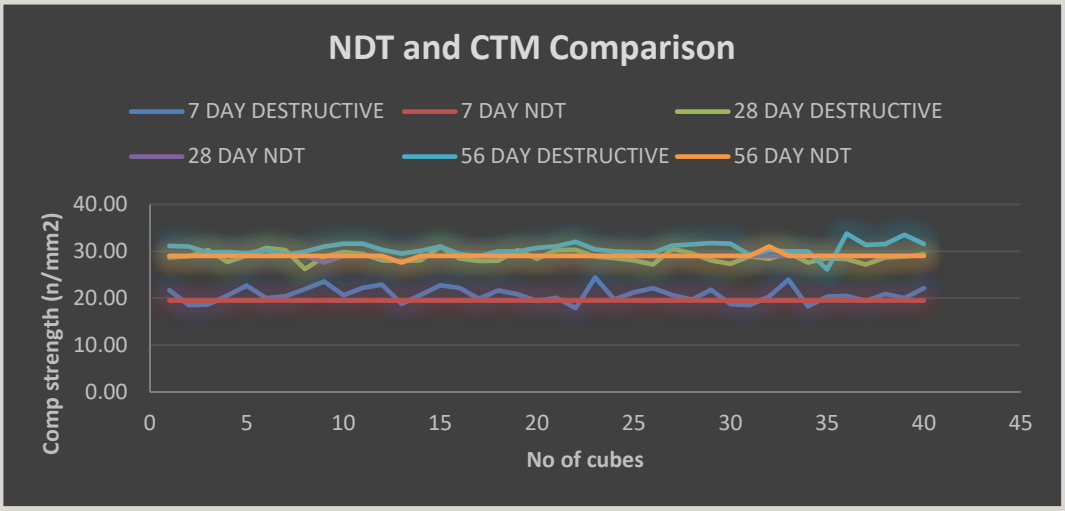


The Eiffel Tower was inaugurated on March 31, 1889. Gustave Eiffel walked the 1,710 steps to the top of the Tower to place the tricolored French flag at its summit. At the time, the Tower was 312 meters high.

To know more about it,

Scan the QR Codes

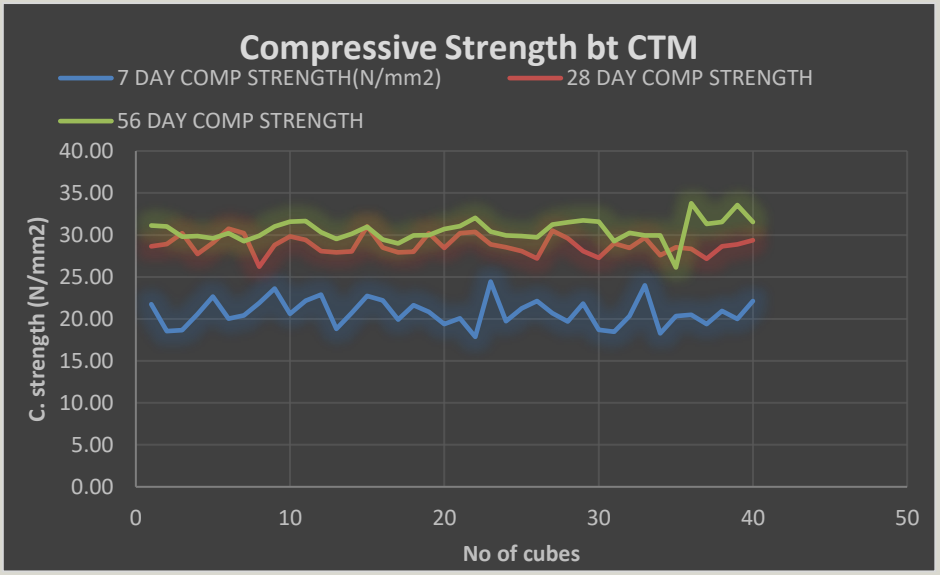
Comparison Between (DT) And (NDT) For Strength of Concrete



Concrete is most widely used construction material worldwide. It has been the basic ingredient of any RC structure for ages. There have been many advancements in different types of structures but concrete cannot be neglected. Strength of a concrete structure may have to be assessed without causing physical damage to it, due to various reasons. Simultaneously it is also necessary to check the quality of materials and type used.

In an attempt to meet the above demand, comparison between Destructive Test (DT) and Non Destructive Test (NDT) were carried out.

A total of 120 concrete cubes (150 mm x 150 mm x 150 mm) were cast with concrete mix ratio of 1:2:2.72:0.5. These cubes were tested destructively for compressive strength with compression machine and were also tested non-destructively with Schmidt Rebound Hammer. This paper discussed each of these methods in detail and compares them with each other giving out advantages of one over the other.



Testing of the concrete specimen plays and important role to know about the strength, quality, durability and condition of the structure. The work will present a detailed comparison of destructive tests and non-destructive methods.

This work focuses on comparing the destructive and non-destructive testing which can determine the potential durability of the concrete. This work helped us to reach a conclusion where we can further find the best testing method system that shall be applicable for various concrete structures as well as in the concrete industry.

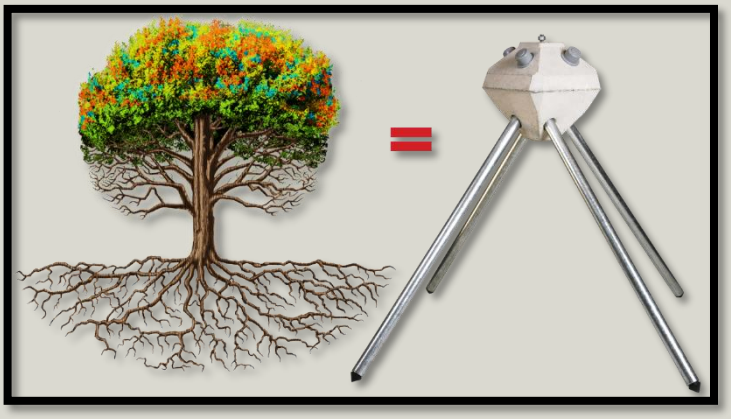
Conclusion

- Increased number of test sample cubes is suggested to for better results of both rebound hammer test as well as compressive strength test values
- The Schmidt rebound hammer is recommended for the compressive strength of hardened concrete to rule out difficulties (delayed feedbacks on laboratory analysis, power supply for running tests on concrete cubes.) in testing cubes for their strength using compression testing machine.
- The difference between the values of resistance obtained by destructive and non-destructive tests decreased considerably at the age of 28 days. The rebound hammer test can be used to evaluate the compressive strength of old concrete and also young concrete
- The UPV decreases with the increase of W/C ratio, which promotes a very important capillary porosity. Instead, UPV increases with the age of the concrete.
- UPV results were quite good as the test was done on fresh concrete.

Project by –
Abhinay Ashara, Raj Patel, Jatin Bhuta

Analysis & Design of Pin foundation

The Diamond Pier foundation a patented foundation system for small to medium sized structures, founded on a variety of soils. The foundation system is comprised of a concrete footing with 4 batter (or inclined) "pins" that serve to resist vertical and lateral loads. Since this system makes use of the internal reinforcement mechanism provided by the combination of the pins and the surrounding soil, it has the potential to eliminate the need for larger sized concrete foundations thereby saving the need for additional materials, and minimizing the footprint of the foundation.



The internal reinforcement mechanism provided by the combination of the pins and the surrounding soil is complex and as such the design methods of such systems are in their infancy. The current method used by Pin Foundations, Inc. is to analyze the Diamond Pier foundation system as a shallow footing. Pin Foundation, Inc. currently uses a bearing capacity analysis, which uses the A-frame shape of two pins to bear on the soil and create a "coherent soil mass...around the pins and propagates the applied load downward and radiating outward" (Pin Foundations, Inc., 2004). Additionally, an arching factor is used to describe this propagation of load by multiplying the bearing width of the pin by a factor of 2-3 (Pin Foundations, In., 2004).). This analysis requires simplifications in the design process for the foundation to be analyzed as a shallow footing, such as neglecting the contribution of the micropiles due to pile friction and tip resistance.

The mechanics and the function of the diamond pier foundation are reminiscent of the system of reticulated micropiles pioneered since the early 1950s. Since then micropile technology has advanced significantly both as an effective retrofitting tool and as a low impact foundation. The term micropile used to describe a small diameter (≤12in.) pile that can either be driven or drilled into the ground. When used in new foundations, or retrofitting of existing foundations, the construction equipment has a lighter footprint on the soil compared to traditional pile driving or drilling rigs, and thus, micropile foundations are considered low impact foundations. The increased capacity of the micropile group due to the "knot effect" of the soil-pile system. This can be seen by the larger mobilized area of soil in Fig. 2. However, Xanthakos, et al. (1994) was sure to note that this increased capacity was not being accounted for in current design practice.

This study proposes analysis methods that consider the foundation systems as the group action of small diameter piles but with allowance for increased strength and stiffness properties resulting from the internal reinforcement mechanism.

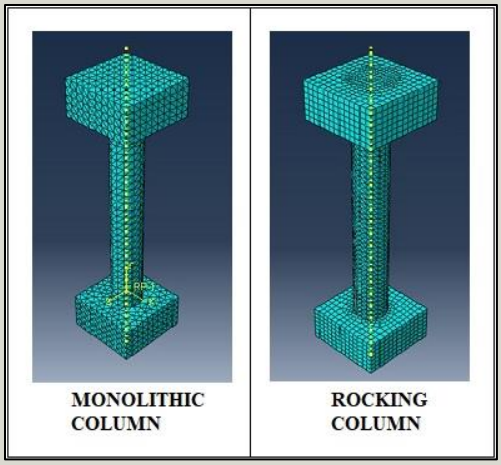
The analysis method for micropiles will be outlined following the methods proposed for driven, ungrouted piles, as this will provide an accurate representation of micropile behavior for both vertical and lateral loads. The analysis first presents the method to analyze a single pile and then extended to a group of piles under both vertical and lateral loads. A method for determining the force distribution in a pile group is also proposed. Finally, the results of the proposed pile group analysis are compared to the results obtained by Pin Foundations, Inc. for their Diamond Pier DP-50 foundation system.

Conclusion

- A Soil of low SBC was selected by creating a grid showing various SBC in the area at an interval of 10 m.
- Soil of quite high SBC were available in our area so we used Marine Clay or Sand which had a SBC of 75 KN/m^2.
- Instead of the standard concrete head used, we used MS steel which proved to be very effective giving us the desired results.
- The best angle for the pins varied between 40^0 to 45^o wherein we used 450 for our model.
- Pin foundation proved to be great alternative as it was capable of withstanding 3370.63 kg for a settlement of 50mm.

Project by –
Vatsal Shah, Vaibhav Tank, Devesh Solanki

COMPARATIVE STUDY OF DYNAMIC RESPONSE OF MONOLITHIC AND ROCKING COLUMNS UNDER EARTHQUAKE ACCELERATIONS USING FINITE ELEMENT ANALYSIS

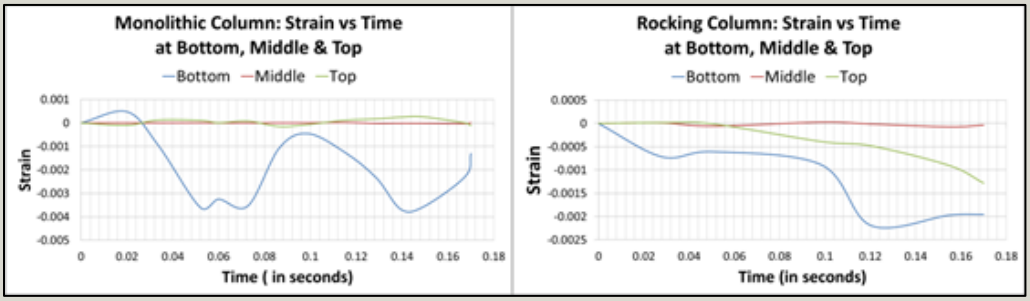


Since the world has experienced numerous devastating earthquakes over the past few decades, resulting in increased loss of human life due to collapse of buildings and severe structural damages, the structures like residential buildings, lifeline, historical and industrial structures need to be designed very carefully to protect from earthquakes. Structural design approach using seismic response control is now widely accepted and is frequently applied in Civil Engineering. In many applications, elastic performance during large earthquakes is economically feasible and the methodology permits performance-based design criteria, now required in many modern seismic design codes. Seismic Isolation is a concept in which an isolation bearing is used to isolate the superstructure from ground movement. . It is governed by a fundamental period shift to higher periods which brings a reduction in forces attracted by the structure but at the cost of increased isolator displacements. However, relative displacement of superstructure, which is primarily responsible for damage in the superstructure, is decreased achieving intended response.

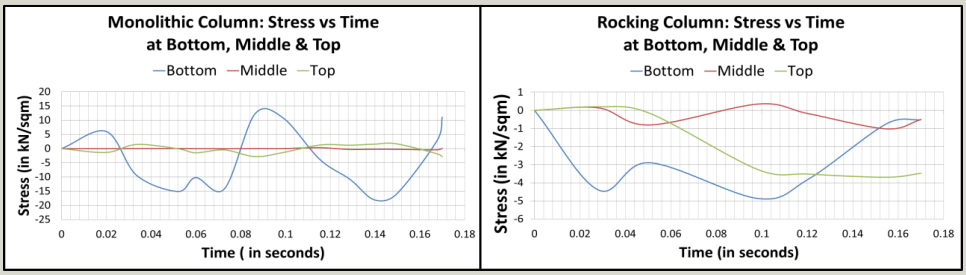
Rocking column is one of the types of Seismic Isolation system (also known as Kinematic Base Isolator), which is a high grade, either free standing or centrally post tensioned, concrete column with curved faces of column which are discontinuous in nature.

In the present work, a comparative study of dynamic response is carried out between Monolithic and Rocking columns using ABAQUS Software.

The main objective of the work is to analyse a monolithic RCC column and free standing rocking RCC column under cyclic horizontal accelerations and then compare the results depending upon the stress & strain characteristics. ABAQUS is Finite Element Analysis (FEA) software used for modelling and analysis of structural components.



The problem of the situation in earthquake loading involves use of horizontal acceleration data against the time period. For such data, quasi-static & dynamic analysis is required. ABAQUS provides a good environment for such analysis in various applications of Civil Engineering like structural health monitoring.



From the simulation analysis, it is evident that monolithic column undergoes cyclic loading of narrow, elongated and multiple looped nature throughout the height of the column; hence showing extreme, unsteady and rapid stress variations, with respect to time, induced in the column, indicative of higher probabilities of reduced durability, internal as well as surface cracks and structural failure. However, the rocking column undergoes cyclic loading of broad and half-looped nature throughout the height of the column; hence showing steady and slow stress variations, with respect to time, induced in the column, indicative of sustained durability, structural integrity and lower probabilities of internal and surface cracks. However, due to extreme stresses developed at the face edges of the column indicate signs of crushing. This can be dealt with and overcame by provision of High Strength Steel Plates of prescribed curvature at the faces of the column and is included as the future scope of work along with analysis of rocking columns post-tensioned along the vertical centroid axis proven to improve its re-centering capabilities.

Project by –
Rudra Chauhan, Ratik Chavan, Sureil Gupte

Generation of Electricity using Vertical Axis Wind Turbine at a Median of Roads

Energy plays a vital role in everyday life. The non-renewable energy resources such as oil, coal, and gas are commonly used. It is a known fact that these non-renewable energy resources are limited, unsustainable and also contribute to global warming. The only solution is adopting an effective renewable energy sources. The renewable energy resources such as solar, wind, tidal and biogas are available in abundant thus can be utilized for the fulfilment of requirement. Wind energy is the purest form of renewable energy which is available highly for the production of electricity. Wind energy is readily available in nature. The vertical axis wind turbine (VAWT) and horizontal axis wind turbine (HAWT) are sources for converting wind energy into electrical energy.

Considering the above situation, the project idea of designing and constructing a Vertical Axis Wind Turbine was initiated. This idea was put forth before the Institute of Engineers (India) (IEI). The idea was positively responded with a sponsorship for completion of the project by IEI.

VAWT is used for a domestic purpose and is preferred for low volume production. It occupies less space and relatively cheaper than the HAWT. The wind impacts normal to the blades of VAWT. Unlike the HAWT, the VAWT do not need high wind speed to operate. The maintenance of a VAWT is quite easy compared to a HAWT. A vertical axis wind turbine can generate electricity at the ground level and the installation is simple compared to a horizontal axis wind turbine. For a large volume of production of electrical energy, HAWT is used. HAWT requires a large amount of space for its uninterrupted performance and requires a huge investment compared to VAWT. The axis of rotation of HAWT is parallel to wind flow in order to generate electrical energy. Large towers and blades are required in HAWT and its transportation cost is almost 20 % of the equipment cost. For installation of HAWT highly skilled labors are required.

However, the production cost is low when generating a higher volume of electricity. The efficiency of a HAWT is high than the VAWT. These are generally used in sea shores, hilltops etc. For roads generally, VAWT is used because it requires less space, less wind speed and can generate electricity for road lighting, signals etc.

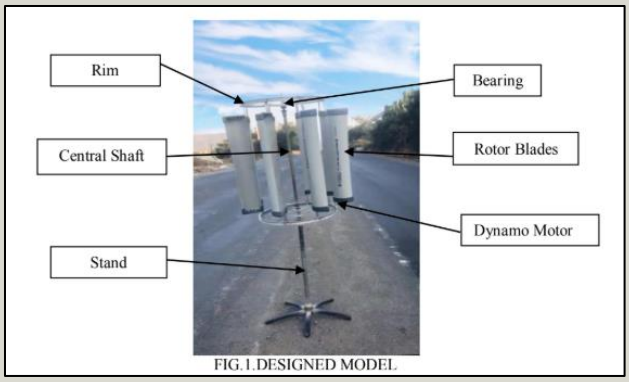


FIG.1.DESIGNED MODEL

The main focus of the study is how to utilize wind energy and convert it into usable electrical energy. As per the report, world's energy consumption is increasing at a rate of 2.3% per annum. In India, total energy consumption is 346.62 GW out of which, 116.46 GW (33.60%) is found to be generated through renewable source of energy. However, to increase the use of renewable energy source, Government of India is planning to generate 175 GW of renewable energy by year 2022 out of which 60 GW shall be contributed through wind energy. It should be noted that in India, the wind has energy potential of generating 302 GW of energy.

The experiment was performed using the wind tunnel apparatus. In this apparatus, different wind speeds were generated which results in respected rotation (rpm) per minute and voltage (V) generation in wind turbine. For various wind speed generated by the apparatus, the rotation per minute of the blades was observed. The wind speed was detected by same instrument anemometer. The voltage generation for each wind speed was measured by milliammeter.

Basic and important part of VAWT is its rotor blades. They are essentially made of aluminum poly vinyl chloride (pvc), fiberglass or carbon fiber since they give better strength to weight ratio. The blades are so designed that it gives a highest efficiency and each blade affect the overall design. Rotor blades capture the energy out of the wind and convert its kinetic energy into the rotation of the hub. There are two types of blades used in VAWT: Drag force type blades (Savonius wind turbine) and Lift force type blades (Darrieus and Giromill wind turbine). The pvc blades is connected to cycle wheels with the help of angles and it is fixed around a shaft. The blade rotates about the shaft. It, in turn, is connected to the generator within the turbine. The material used for designing the central shaft is galvanized metal rod. The bearing is used to smoothen the movement of turbine. Bearing is a part between wheels and central shaft. The mechanical energy is converted into electrical energy using a dynamo motor. Wind turbines are directly connected to dynamo motor.

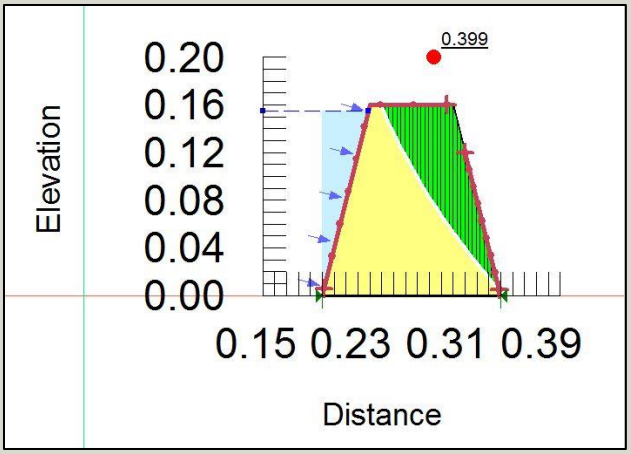
The experiment was performed on the old model as well as the modified model which included GI sheets. By introducing GI sheets the projected area of turbine against wind increases results in higher rotation per minute. It was observed that the modified model i.e. with the GI sheets had an increase in the rotation by 14%. The modified model with GI sheets showed an increase in voltage by 12%.

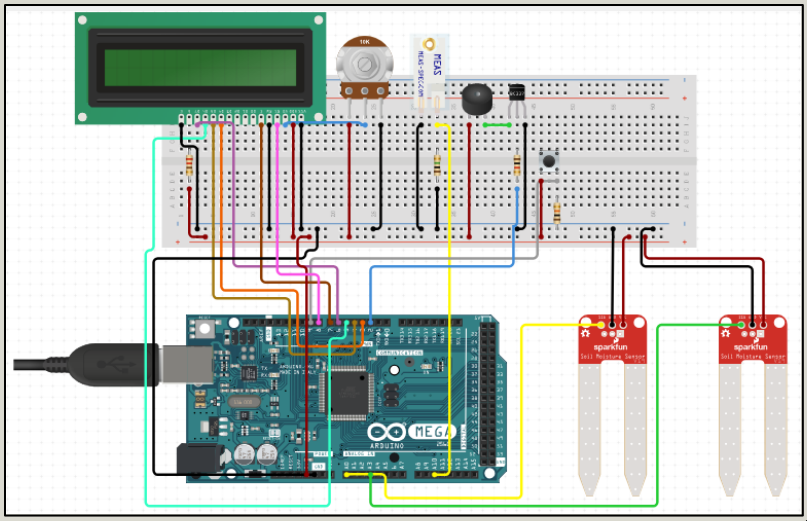
The above project is a partially sponsored R&D project funded by Institution of Engineers India (IEI) and the Authors are thankful to IEI for funding the project.

Project by –
Sumit Gupta, Kishan das, Yash tiwari

Slope failure

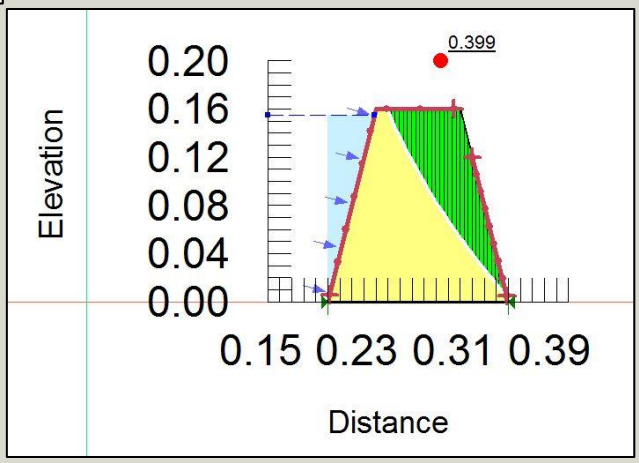
Slope failure / mass wasting / landslides / avalanche all refer to the same engineering problem i.e. sliding of land which are triggered due to increase in moisture content : excessive rainfall, addition of excessive weight above the slope, unstable slope : digging at mid or foot of slope, surface and to erosion, induced vibrations : earthquakes and due to man-made activity : construction activity etc. Slope failure on average costs hundreds and millions to any country for its mitigation, repair or study. Not only economy but life also suffers due to this natural disaster. Slope failures are most prominent in hilly regions facing heavy downpour of water. This leads to blockage of roads, loss of life and economy, etc.



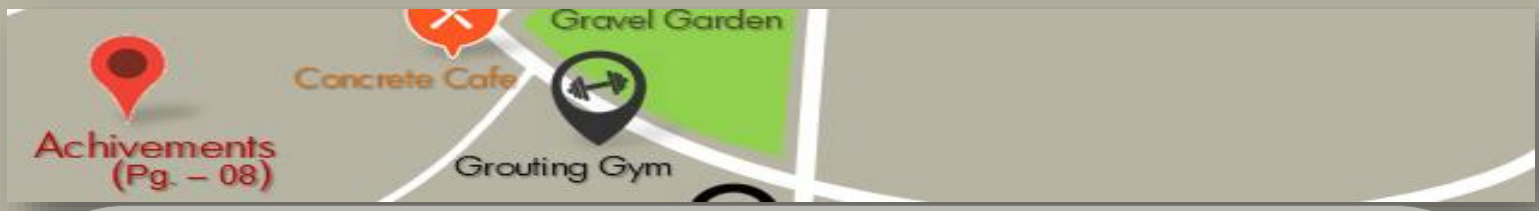


This can be detected prior to its commencement by using an array of sensors integrated with a microcontroller by precise programming and calibration. But implementation of such a system in real world is extremely difficult due to unpredictable conditions. We were successful in predicting failure of the designed slope under conditions maintained with the help of Arduino and Moisture sensors. Telemetry program was used to plot data on graph. Moisture, one of the major causes of slope failure can be measured by using moisture sensors. At a certain moisture content, the slope tends to fall under the effect of gravity.

Similarly, movement of earth is also the reason for failure or is accompanied once slope fails. These moisture content and earth movement can be known by collecting and analyzing the data of prior landslides in nearby area. By installing sensors which measure these limiting values an alarm can be triggered right before the slope fails. This can be achieved by programming Arduino with an array of moisture sensors and accelerometers / vibration sensors. A sign board showing Danger Ahead or Stop sign can be installed at least 5 km prior to the site of landslide for a buffer zone to react accordingly.



Project by –
Pritesh Mewada, Sakshi Singh,
Prathamesh Mundye



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PLACEMENTS

It gives us an immense pleasure to inform you that seven students got selected in Placement drive 2018-19. The following are the shortlisted candidates:

In NEWMAT construction Pvt Ltd as Assistant Project Engineer with a package of 2.65LPA.

VIkram M Dongare

Nikita Kharat

Akash Jadhav

Satyaprakash Dubey

In Sanjay constructions as Site engineer with a package of 2.24lpa

Akash Jadhav

Akash Makwana

Piyush Bhijawani

Reaction Test

We have developed this app for Undergrad students of Civil engineering, which solves problems of structural analysis subjects you face throughout your course. Our app solves Beams, Frames, and Trusses providing you with AFD, SFD, BMD and DEFLECTION diagrams at the click of a button.

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Developed by – Pritesh Mewada, Sakshi Singh, Prathamesh Mundye, Sagar Mistry

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