Experimental and analytical study on seismic behaviour of RCC portal frame using ETABS

A Project Work submitted to

Visvesvaraya Technological University

in partial fulfilment of the requirements

for the award of degree of

Bachelor of Engineering

Submitted by

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Abstract

Many intra-tectonic plate regions are considered to have low to moderate seismic risk. However, devastating earthquakes can occur in these regions and result in high consequences in terms of casualties and damage. This project presents an experimental and analytical investigation to understand the seismic capacity and properties of scaled Reinforced cement concrete portal frames. The experimental programme included a series of progressively increasing earthquake simulator tests, using base motion with shake table and with the help of sensors, Behaviour and characteristics like displacements, velocity and acceleration are studied. In this analysis part of the study scaled RCC portal frame were analysed to determine the magnitude of earthquake to cause displacement using ETABS. The main objective of this project is to compare both experimental and analytical results to know the seismic behaviour of RCC portal frame.

Seismic behaviour refers to the way a RCC portal frame reacts to seismic forces or earth quake. RCC portal frame are commonly used in construction for multi-story buildings, Warehouses, and other structure. during an earthquake, the ground shakes, leading to the generation of seismic waves. these waves create forces that can cause a portal frame to vibrate and deform, putting the structure at risk of damage or collapse.

To ensure that the RCC portal frame remains stable and safe during an earthquake, it should be designed and constructed in compliance with seismic codes and standards.

This includes ensuring that the frame is strong enough to resist the forces generated by the earthquake and has adequate ductility to absorb these forces without failing. Appropriate detailing of reinforcement and joint connection is also critical to ensuring that the frame can accommodate the seismic forces.

The results of this analysis are used to ensure the RCC portal frame is properly designed and constructed to withstand earthquake and ensure occupant safety.

EXPERIMENTAL STUDY OF SEISMIC BEHAVIOR ON SCALED MASONRY STRUCTURE

A Project Work submitted to

Karnataka state council for scienece and technology

Vivesvaraya technology university

In partial fulfillment of the requirements For the award of degree of
Bachelor Of Engineering
in
Civil Engineering

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Abstract

Due to the poor seismic performance, strengthening of masonry structures is always a significant problem worthy to study. It has been proven that the bearing capacity of existing masonry buildings can be enhanced greatly with efficient strengthening measures.

It is well known that masonry buildings suffer a great deal of damage during earthquakes, leading to significant loss of lives. Almost 75% of the fatalities, attributed to earthquake in last century, is caused by collapse of buildings of which the greatest portion (more than 70%) is due to collapse of masonry buildings. A majority of the tenements in India are Unreinforced Masonry (URM) buildings that are weak and vulnerable even under moderate earthquakes. On the other hand, a cursory glance through the literature on earthquake resistant structures reveals that a bulk of research efforts is on RC structures.

Materials for the construction of the structure with a mortar proportion of 1:3 is used. The experimental approach based on the shake table test was adopted in this work to study the seismic behaviour of a scaled masonry structure based on concrete block masonry with and without horizontal mesh, aiming at validating its seismic behaviour. With a dimension of 3 x 3 feet.

The scaled masonry structure of different typologies, unreinforced and reinforced masonry, was tested under cyclic loading in a seismic testing manner to study the seismic performance of both structures. Two tests are conducted, with and without horizontal reinforcement. with the same initial features. The observations made on the test data collected were different. This gives the acceleration, velocity, and displacement with respect to time in both structures.

These experimental results show that acceleration velocity displacement is higher in reinforced masonry structures compared to unreinforced masonry structures. From the test results, it is observed that the compressive strength of mortar for 1:3 for 7 days is 20.50 N/mm^2 and for 28 days it is 40 N/mm^2. This gives the mortar strength.

Experimental Investigations on Low Strength Translucent Concrete Blocks

A Project Work submitted to

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24/05/2023

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Abstract

Recently, research attention has been drawn to the application of novel, unique, and innovative types of construction materials to fulfil diverse objectives associated with the ground-breaking concept of “Greener Architecture”, in order to improve the overall economic value and quality of construction. Among these revolutionary structural building materials is light-transmitting concrete, also referred to as translucent concrete. This material is based on the concept of Nano-optics, which allows exterior light to transmit through internal spaces in which light elements, namely optical fiber, are incorporated during the material’s manufacture. Earlier investigators had adopted strength of the cement blocks in excess of 30 MPa and studied the light transmitting characteristics of translucent concrete by incorporating various diameters of optical fiber and its spacing. In the current experimental investigation, strength of the cement mortar used in preparing translucent blocks is considered as 10.00 MPa thereby rendering them as low strength translucent blocks. From the available literature survey, the selection of optical fibers for achieving optimum efficiency in terms of cost and light transmitting characteristics is made by incorporation of 0.75 mm diameter optical fibers, used as 4 strands and 2 strands. From the investigation, it is seen that providing 4 strands of optical fibers with a spacing of 10 mm C/C along both ways was found to be more effective in terms of light transmitting property as compared to 2 strands and it also reduces the use of artificial lights during the day time thereby rendering translucent block as eco-friendly material.

Experimental Investigation on Mechanical Properties of Self-Healing concrete by using Bacillius Subtilis

A Project Work submitted to

Visvesvaraya Technological University

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Abstract

Crack formation is very common phenomenon in concrete structure which allows the water and different type of chemical into the concrete through the cracks and decreases their durability, strength and which also affect the reinforcement when it comes in contact with water, CO_2 and other chemicals. For repairing the cracks developed in the concrete, it requires regular maintenance and special type of treatment which will be very expensive. So, to overcome from this problem autonomous self-healing mechanism is introduced in the concrete which helps to repair the cracks by producing calcium carbonate crystals which block the micro cracks and pores in the concrete. The selection of the bacteria was according to their survival in the alkaline environment such as Bacillus pasteurii, Bacillus subtilis and Bacillus spharicus which are mainly used for the experiments by different researchers for their study. The condition of growth is different for different types of bacteria. For the growth, bacteria were put in a medium containing different chemical at a particular temperature and for a particular time period. Bacteria improves the structural properties such as tensile strength, water permeability, durability and compressive strength of the normal concrete which was found by the performing different type of experiment on too many specimens had varying sizes used by different researchers for their study of bacterial concrete in comparison with the conventional concrete and from the experiment it was also found that use of light weight aggregate along with bacteria helps in self-healing property of concrete. For gaining the best result a mathematical model was also introduced to study the stress-strain behaviour of bacteria which was used to improve the strength of concrete. The most popular treatment for concrete structure is self-healing method to enhance the durability of concrete. The relevance between cracks and conceivable self-healing method is sophisticated and environmentally considered. The data introduced in current study as huge substantial for bioprocess and biotechnologists engineer to provide useful details on present condition of self-healing concrete.

Experimental Investigation On Enhancement Of Flexural Strength Of Rc Beam By Wrapping Of Low-Cost Glass Fibre Reinforced Polymer.

A Project Work submitted to

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Abstract

The strengthening of existing damaged structures is one of the leading studies in civil engineering. The purpose of retrofitting is to structurally treat the number with the aim to restore the structure to its original strength.

In the past few years, Glass Fibre has been high in retrofitting reinforced concrete beams due to their properties over strength and durability. Glass fibre reinforced polymer (GFRP) is broadly used as external bonding material over RC beams for retrofitting and strengthening purposes. The main objective is to study the improvement in the flexural strength of concrete beams by using GFRP. The concrete of M30 grade and binder is used as Fly Ash and Silica Fume for the study. Six beams were cast of size 2.1x0.2x0.15m were cast and tested for flexural strength capacity. The beams with fly ash silica fume show flexural strength of 20% more than conventional concrete beams before retrofitting. In addition, the study focused on improvement in the flexural strength by the addition of low-cost GFRP in three different configurations. The configuration was U Shaped throughout the beam, Bottom of the beam (between L/3 distance), Inclined to the beam pattern (between L/3 distance).

The improvement of load carrying capacity for Non-conventional beam has 60.71% higher than the conventional beam for inclined fiber. The improvement of load carrying capacity for Non-conventional beam has 41.61% higher than the conventional beam for Bottom face fiber.

The improvement of load carrying capacity for Non-conventional beam has 25.00% higher than the conventional beam for U shaped.

STUDIES ON EARLY AGE CHARACTERISTICS OF SELF-CURED GGBFS BASED CONCRETE MIXES.

A Project Work submitted to

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Abstract

The most popular and commonly used material in the construction of infrastructure projects is concrete. Large amounts of potable water are needed for concreting and curing, although access to this is not always possible. Use of self-curing concrete is one of the greatest alternate solutions to this issue. As water is becoming a scarce material day-by-day, there is an urgent need to do research work pertaining to saving of water in making concrete and in constructions. Curing of concrete is to maintain satisfactory moisture content in concrete during its early stages and to develop the desired properties. However, good curing is not always practical in many cases. Curing of concrete plays a major role in developing the concrete microstructure and pore structure and hence improves its durability and performance. In the current project, an attempt has been made to develop internal-curing of concrete by using Polyethylene Glycol (PEG-400). In this experimental work, the mechanical characteristics of hardened concrete were investigated using M25 concrete grade with partial cement replacements of 0, 50 and 70% GGBFS and self-curing agents of 0.5, 1 and 1.5 % polyethylene glycol. At 7 and 28 days old, cubes and cylinders are cast and evaluated for compressive strength and split tensile strength. For M25 concrete, the test results of normal concrete are compared with those of concrete containing GGBFS and Polyethylene glycol 400. The test findings showed that adding 1.5% of a self-curing agent increased strength when replacing 50% of cement with GGBFS, while adding 1% of a self-curing agent improved strength when replacing 70% of M25 grade concrete.

Experimental Study on Sustainable Thermal Blocks For Trombe Walls To Condition Buildings

A Project Work submitted to

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Abstract

Sustainable construction is the use of environmentally friendly materials to construct, operate, and maintain building structures. It reduces the consumption of electricity for heating and cooling buildings, creates a healthy indoor environment, and also makes use of recycled materials in its construction. Sustainable construction is crucial for creating a more sustainable future and reducing the carbon footprint of buildings, which is a major contributor to global greenhouse gas emissions.

Trombe walls are popular among sustainable building constructions. They are known as storage walls a solar heating wall. A trombe wall is a simple wall in which air gap is created in the wall, which decreases the heat transfer from outside to inside or vice versa. The brick or block used to construct the trombe wall is known as thermal block. The performance of the trombe wall depends on the thermal block used for construction.

In this project, a modified thermal block of size 340x140x195 mm was implanted with plastic water bottles filled with water. This block is manufactured using plain cement concrete in the ratio 1:5. The ratio was fixed after checking the compressive strength of various mix proportions. The casting of thermal blocks is done using a mould, and a plastic bottle filled with water is embedded in the centre of the block with the cap facing upward. Thermocouples connected to a thermocouple reader are used to measure the variation in temperature between the outside and inside surfaces of the block, when exposed to sunlight. The thermocouple will be inserted into the block. The thermal block is then cured for a period of 7 days. A room of size 1 x 1 x 1 m constructed and exposed to outdoor climate conditions. An infrared thermometer is used to note the surface temperature difference between the two sides of the wall.

This adaptation of modified thermal block in the construction of a trombe wall can reduce the indoor temperature during hot days while also adding sustainable benefits such as a reduced carbon footprint, less consumption of electricity to condition the building.

Fire Safety Audit for Multi-storey Buildings

A Project Work submitted to

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Abstract

Since Roman and Harappan civilization, dwelling and commercial requirements have led the humans to create the unique buildings. Whether it's residential, commercial, medical, entertainment, shopping or industrial building, a fire safety is the most essential requirement.

Due to the development of technology and materials, engineers are able to build taller and bigger structures. Also, the development in mechanical and electrical facilities such as, lifts, heat, ventilation and air-conditioning systems, the risk of fire and other hazards are also increasing. In India alone, about 18,450 fire incidents were occurred in 2019. Around 17,700 people were killed and about, 1193 were injured. In view of this, stakeholders' responsibility is to prevent such incidents and mitigate the losses. The Governments and other regulatory bodies have formulated new polices and guidelines for the construction industry. National Building code has been formulated to improve the construction quality and also to protect the public lives and property from risks such as earthquake, fire and other risks. This study focus mainly on fire risk.

In this study, the public buildings such as educational building, Hostel building and mercantile buildings were selected for fire Risk Assessment. National Building code and other standards were followed for this study and a check list was prepared before the site inspection was carried out. During site inspection, existing fire protection system was checked and noted if there were any deviations or non-compliance with NBC and other standard practices. Recommendations were made to prevent or reduce the fire risk. A drawing was also prepared for the proposed recommendation which include active fire protection system such as smoke detectors, fire alarm, hose reels, sprinkler system etc.

EXPERIMENTAL STUDY ON EFFECT OF LONG-TERM LOADING ON BEAM.

A Project Work submitted to

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Name and Signature of Examiner-2

Abstract

Ordinary Portland cement (OPC) is the most important material used in the manufacturing of concrete. But in manufacturing of OPC it has many disadvantages like reduction of raw materials like Limestone, Clay etc. The deflection or the deformation that occurs over time due to shrinkage and temperature. It is also influenced by the condition of the cracking before loading, then creeping, which depends on the time passed to the time of the first loading, the environment, and other factors.

Creep is the gradual increase in a strain of a structural member which is subjected to certain loading over a period of time.

Shrinkage is the contraction that occurs in concrete when it dries and hardens due to moisture content evaporation.

literature was studied to know the works done by various researchers on long term loading on beams it was found that the comparison of creep and shrinkage parameters for beams with and without fibres were not done. Hence in the present study an attempt was made to study the effect of long-term loading on beams with and without fibres.

Long term properties such has Deflection in Beam with fibres has started to Deflect from 0.26mm to 1.57mm.Then Beam without fibres has started to Deflect 6.742 to 7.202.

Long term properties such has Strain in Beam with fibres has started from 0.107 to 4.697.Then Beam without fibres has started from 0.154 to 7.202.

Long term properties such has Deflection and Strain for Beams with fibres shown better results.

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Experimental Study on Durability Properties of Glass Fibers On Reinforced Concrete

A Project Work submitted to

Visvesvaraya Technological University in partial fulfillment of the requirements for the award of degree of

"Bachelor of Engineering"
In
"Civil Engineering"

Submitted by

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CERTIFICATE

This is to certify that project work entitled "Experimental Study on Durability Properties of Glass Fibers on Reinforced Concrete is a bonafide work carried out by

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In partial fulfillment for the award of Bachelor of Engineering in Civil Engineering of Visvesvaraya Technological University, Belagavi, during the year 2022-2023.It is certified that all the suggestions indicated during internal assessment have been incorporated in the report and this report satisfies the academic requirement with respect to project work (18CVP83) prescribed for the degree.

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Abstract

Glass fiber reinforced concrete (GRC) is a composite material made of a cementitious matrix reinforced with glass fibers. The use of glass fibers in concrete can enhance its strength, durability, and impact resistance, making it suitable for a wide range of applications in the construction industry.GRC is known for its lightweight and high strength-to-weight ratio, making it an ideal choice for architectural and decorative elements such as cladding panels, balustrades, and columns. GRC can also be used for load-bearing applications such as bridge decks and façade systems.In addition to its mechanical properties, GRC offers a range of aesthetic options, including texture, color, and surface finish. The material can be molded into complex shapes and designs, allowing architects and designers to achieve intricate and innovative designs. Overall, GRC is a versatile and durable material that offers a range of benefits in the construction industry. With proper attention to detail and expertise, it can be an excellent choice for achieving both aesthetic and structural goals in building design. GRC has good fire resistance properties. Due to the glass fibers, GRC can withstand high temperatures without losing its strength, making it a suitable material for fire-resistant applications such as fireproof cladding and structural elements.

In my present research work total 72 specimens are casted and the tests are carried out for Compression strength test, Split tensile strength test and Sorptivity & Rapid Chloride strength test for M25 grade concrete matrix having proportion of 1 : 1.88 : 3.28, where the concrete was reinforced with different various percentages like 0%, 0.5%, 1%, 1.5%, 2% and 2.5% of Glass fibers by the volume of cement and strengths were found out for 28 days respectively.

The end result shows that the Glass fibers increases up to 1.5% will increase the strength and decreases beyond. It shows considerable increase in compressive strength, but there was a great strength achievement in tensile strength and Sorptivity & Rapid Chloride strength for 1% of Glass fibers.

Thus addition 1.5% of Glass fiber is the best quantity for mechanical strength to achieve the maximum strength.

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