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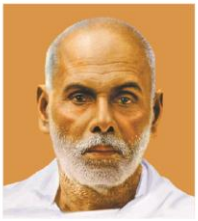

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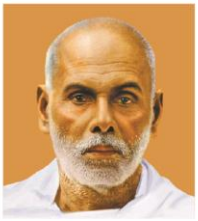

2022-2023

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

Structural Performance of Steel Encased Composite Multilayered Concrete Beam

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Abstract- In this paper, a composite multilayered concrete beam is analyzed by using ANSYS workbench software. An I section which is partially encased with Ultra-High Performance Concrete [UHPC] and Ultra-Light weight Cement Concrete [ULCC]. These composite materials had been arranged horizontally and vertically along the I Section. Compressive strength of various multilayered composite beams has been compared. Instead of using conventional steel or reinforced concrete members, this form of beams offers greater strength and stiffness.

Keywords:- Ultra-High Performance Concrete [UHPC], Ultra-Light weight Cement Concrete[ULCC]

I. INTRODUCTION

Structural steel which is partially enclosed or fully enclosed with concrete are frequently used in building construction. Instead of using conventional steel or reinforced concrete members, this form of beam offers greater strength and stiffness. The steel section is protected from fire, the compression flange is kept from buckling locally, and the resistance of the beam to lateral-torsional buckling is increased by the concrete encasement. Where standard beams are insufficiently serviceable, composite beams are used. We can somewhat minimize the cross-sectional area of the beams by using composite ones made of greater stiffness materials. They are utilized to make the construction stronger. Large areas can be covered by composite beams without the need for an intermediary structure.

UHPC is a cementitious composite material made up of a high proportion of discontinuous internal fiber reinforcement, a water-to-cementitious materials ratio less than 0.25, and an optimized gradation of granular elements. A brand-new category of concrete called UHPC has recently been created due to its extraordinary strength and endurance. The first UHPC bridge in North America was built in Canada in 1997 as a pedestrian bridge. Compressive strength of UHPC is ten times greater than that of conventional concrete. Portland cement, fine sand, pulverised quartz, accelerating admixtures, steel fibres, and water are the main ingredients in UHPC. With low densities of less than 1400 kg/m3 and compressive strengths of up to 60 MPa, ultra-lightweight cement composites (ULCC) are the perfect choice for usage in buildings where material weight is important. In structural applications with low weight and permeability requirements, lightweight aggregate concrete (voids are primarily in aggregates) is often used in place of conventional aggregate. Lightweight concrete is especially beneficial for long-span constructions, high-rise structures, and sandwich structures that must have minimal self-weight.

II. OBJECTIVES

- To study the partially encased composite beams.
- The effect of different composite materials.
- The effect of number of layers.
- The effect of arrangement [Horizontal/ Vertical]

III. SCOPE OF THE WORK

The scope of this study is to develop a high strength multi-layered composite beam instead of using steel or conventional reinforced concrete beams.

IV. PARAMETRIC STUDY

Multiple aspects were taken into consideration when conducting the investigation on the partially encased multi-layered concrete beam. The beams measure 2000mm in length, 250mm in depth, and 200mm in breadth overall. All examples are constructed using WB 225 hot-rolled wide-flange beams. Vertical and horizontal arrangements had been made with the composite cementitious materials. A single beam included three layers of cementitious material, each with an identical layer thickness.

Code of references: Indian Standard codes IS 808(1989)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

Progressive Collapse Mitigation Study on Box Column and Steel Beam with Corrugated Web RBS

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***Abstract*:- Steel frame constructions using traditional weld connections frequently experience brittle breakdowns. To mitigate this issue,steps were taken to incorporate plastic hinges and improve the ductility of the steel connections.The beam-to-column connection has been identified as a key element for steel frame structures to maintain the structural integrity during progressive collapse phenomenon. In this study box column and steel beam subjected to progressive loading are considered with corrugated web RBS connection, called the curved cell web RBS (CW-RBS) which increases the moment capacity and the time of progressive collapse. In the case of RBS a portion of beam is being cut from the web and flanges so that plastic hinge gets relocated to the portion which is weak and this prevents welding failure at the end of beam and failure in column but this reduces the stiffness of beam. In this case CW-RBS is implemented on the beam that is web of the beam is cut in an area near the column and the cut-out section is replaced by a cell made with two curved corrugated plates,this increases the stiffness which inturn increases the moment capacity and time of progressive collapse. Thus failures on box column completely gets relocated to CW-RBS and makes the box column and joint safe thereby we can prevent this portion from weakening. These are done according to FEMA 350. Modelling and analysis is carried out using ANSYS software .In this study we obtain ultimate load capacity, moment capacity, drift angle.**

Keywords: Progressive Collapse Mitigation, RBS, CW-RBS Corrugated Web RBS

1.INTRODUCTION

Steel frame structures with ordinary weld connections often suffers from brittle fracture situation in which a local failure causes a major collapse, with the magnitude being disproportionate to the initial event. For steel frame structures, the beam-to-column connection has been identified as a crucial component for maintaining structural integrity during the progressive collapse phenomenon.

Progressive collapse refers to a situation in which a local failure causes a major collapse, with the magnitude being disproportionate to the initial event. New strategies were necessary to improve the ductility of the steel connections, such as weakening the beam section at an appropriate distance from the column face. In steel moment frames, reduced beam section (RBS) connections have been widely used, with parts of the beam flanges near the beam to column connections being removed [Fig 1].The yielding zone can be transferred from the column face to the beam span using RBS connectors, and thereby it prevents initial damage from occurring directly at the weld joints of the beams and columns.

In addition to the RBS beam approach, another strategy is to introduce openings in beam webs to form a plastic hinge away from the connections to make beams more ductile . Web-openings in beams can be used to improve the spatial efficiency of buildings and provide access to pipelines. Engineers create web openings for pipelines in steel frame structures, air-conditioning, heating, and water supply systems that require special pipelines. Connections with flange- or web-reduction may change the mechanical characteristics and increase structure deflection when large deformation occurs. It is extremely important to consider the bearing capacity, deflection, and cracking of beams with flange- and web-reductions, which can be indirectly evaluated by the ability to resist progressive collapse.

In this study box column and steel beam are considered with corrugated web RBS connection, called the curved cell web RBS (CW-RBS) which increases the moment capacity and the time of progressive collapse. Modelling and analysis is carried out using ANSYS software.

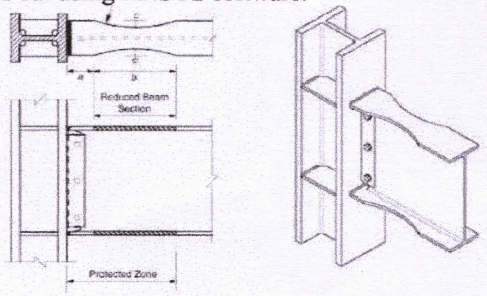

Figure 1. Reduced Beam Section (RBS)

Figure 2. Application of Reduced Beam Section (RBS) Connection

Fig 1 RBS

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International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

Performance of Integrated Orthogonal Columns with and Without FRP Wrapping Subjected to Localized Corrosion

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Abstract- A numerical model was created with the aid of the commercial finite element programme ANSYS in order to investigate the impact of local corrosion on the ability of orthogonal concrete filled steel tube (CFST) columns to support loads under axial and eccentric loads. To fulfil the structural design requirements, a T-shaped column is utilised. Construction of bridges frequently makes use of it. Non-symmetrical columns include those in the L and T shapes. The likelihood of corrosion is considerable if a column is damaged since they are not symmetrical. All of the columns' faces and corners are examined for corrosion effects. Analogously, determining how the damage manifests itself in the column when corrosion is at the middle. A decrease in the load-bearing capability of an orthogonal CFST column was demonstrated with the same corrosion rate. Look into how the CFST column will ultimately behave under corrosion and coupled sustained load. The structure can be strengthened by layering a carbon fibre reinforced polymer (CFRP) system around it. The test's findings indicate that using CFRP boosts a column's ability to support loads.

Keywords-CFST, L- shaped column, T- shaped column, Localized corrosion, ANSYS software, CFRP.

I. INTRODUCTION

The concrete filled steel tubular (CFST) structure has advantages of high bearing capacity, good plasticity and toughness, convenient construction and high economic benefit. It is widely used in high-rise buildings, long-span highways, high-speed railway bridges, offshore platforms, boiler towers, TV stations and other civil engineering structures. At the same time, the CFST column in service is exposed to environment, which induces different corrosion damage. Corrosion could weak the cross-sectional area of steel tube and steel mechanical properties; Pit corrosion could also penetrate steel tube walls, allowing harmful corrosive media to penetrate into concrete, and further causing concrete damage. These lead to structural resistance degradation over time, affecting the safety, durability and applicability of in-service structure, and even trigger engineering accidents in serious cases, resulting in huge losses of people's lives and property. Therefore, the study of corrosion on the mechanical properties of CFST structures is required in academic value and practical engineering reference significance for accurate evaluation of the reliability of CFST structures. Rectangular cross-sectional columns in traditional frame structures, with extended corners to indoor space, normally have larger cross-sectional depths than those of adjacent infilled walls, leading to reduction of usable indoor space and disturbance to indoor environment. Recently, special-shaped columns, as an improved architectural approach, have been increasingly introduced into residential and official buildings. Smooth connection between special-shaped columns and adjacent infilled walls guarantees increased efficiency of indoor space and availability to furniture arrangement [1-5].

Special-shaped columns have been widely applied as the load carrying portion at corner of rooms in multi-story buildings in recent years. The special-shaped columns have satisfied the requirement of the architects and save more space to earn economic benefits. As the reinforced concrete (RC) structures are the most widely used in buildings, the special-shaped RC columns are firstly applied in structures. The action of L-shaped columns under the static load have been studied according to the extensive researches. The special-shaped RC columns possessed low load capacity and poor ductility according to the researches. As concrete filled steel tubes (CFSTs) can take good use of the concrete and the steel tube, special-shaped composite columns have been developed to avoid the weakness of special-shaped RC columns [6].

L- shaped columns may be the most frequently encountered reinforced concrete columns, since they can be used as a corner column in framed structures. Commonly L-shaped column is utilized in the corners of the boundary wall and has similar characteristics of rectangular or square column. L- shaped column has the advantages such as high bearing capacity, good ductility and high utilization rate of internal space. L-shaped columns are specially shaped concrete structures with asymmetric sections so the internal forced state is even more complex and creating large bending moments.

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International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

Performance Of 3d Printed Pre Twisted Aesthetic Structural Duplet Columns

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Abstract:- The commercial finite element programme ANSYS is used to create a numerical model in order to examine the structural performance of 3d printing on attractive structural duplet columns. To create three-dimensional shapes, material is consecutively stacked while being controlled by a computer during 3D printing. It is highly useful for creating prototypes and geometrically challenging components. In this study, two I-shaped columns that are set up in series and parallel are taken into consideration. Let's examine the behaviour of the column at various rotational radii in both series and parallel arrangements. The ANSYS software was used to create 18 models (nine parallel and nine perpendicular). After the performance study is completed, strengthen the chosen model to determine which of these models has the best structural performance. Both inside and externally, steel plates and engineered cement concrete can be used to strengthen structures.

Keywords- ANSYS software

I. INTRODUCTION

Three-dimensional concrete printing (3DCP) technology appears to have generated the most attention among the currently available additive manufacturing (AM) techniques for concrete since both its overall technological level and economic value have been established. The implementation of typical demonstration projects has occurred with the advancement of 3DCP technology. The Eindhoven University of Technology printed a concrete structure in 2015 that was 11 metres long, 5 metres wide, and 4 metres high. A 3DCP office established in Dubai opened its doors in 2016. A 7.2-metre-tall, two-story office building was printed in 2019 by China Construction Second Bureau LTD. The office block was constructed on-site using 3DCP technology rather than printed concrete components. In 2017, the Institute of Advanced Architecture of Catalonia (IAAC) printed a 12-meter-long concrete pedestrian bridge. A team from Tsinghua University produced a concrete pedestrian arch bridge in Shanghai in 2019 using 3D printing technology. 44, 68, and 64 precast printing components made up the bridge's arch, railing, and deck, respectively.
However, there are several difficulties in using 3D-printed concrete buildings in actual technical applications. With a strong resistance to compression and a moderate resistance to tensile and flexural pressures, concrete is a common quasi-brittle material. The strengthening technique used when concrete serves as a material for AM is crucial for enhancing its mechanical qualities. To construct a building using 3DCP technology, freshly mixed concrete is extruded from the nozzle along a specified path and layered on top of one another. As a result, installing vertical reinforcement on printed concrete walls is challenging. Additionally, printed plain concrete walls have a low ultimate bearing capacity, limited cracking resistance, and are brittle.

3D printing

3D printing is the process of stacking material gradually while being guided by a computer to create 3D forms. Manufacturing geometrically challenging components and prototyping both benefit greatly from it. It can be accomplished using a number of processes that include layering materials (such as polymers, liquids, or powder grains) before using computers to regulate deposition, joining, or solidification.

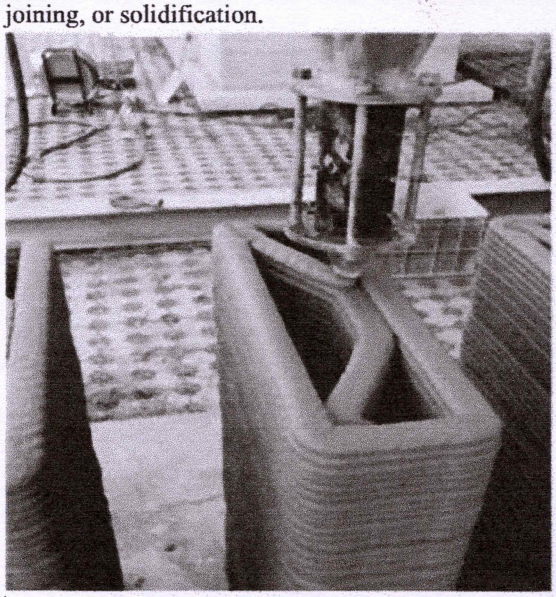

Fig 1- 3D Printing [1]

The term "3D concrete printing," sometimes known as "concrete printing," describes digital fabrication techniques for cementitious materials based on a variety of 3D printing technologies. These procedures are used in the building sector to create building components, building elements, civil infrastructure, and street furniture. Concrete printing can be used to create the finished object directly or indirectly by creating the formwork that will hold the concrete while it is being cast or sprayed. address for 3-dimensional formworks

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

Adaptation of Corrugation Web in Cellular Beams with Hollow Flange

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Abstract:- Nowadays Cold Formed Steel (CFS) sections are extensively used in structural engineering works replacing the conventional hot-rolled sections. It is due to the inherent advantages of the CFS. In industrial buildings and also in multi-storey buildings it is mandatory to provide web openings and they are generally provided in CFS roof and flooring systems to accommodate the pipelines and the building services, which leads to the reduction of floor heights. The disadvantage of placing web openings are, it will influence the shear behaviour reduce the strength and shear capacity significantly. The beam stiffness will decrease when web openings are placed, so it will buckle the beam easily when high seismic force or working loads are acted. Also shear failure will takes place. To prevent these hollow flanges are provided with straight beams. So very limited research studies have been conducted on hollow flange CFS beam with web openings. In this study to avoid shear buckling, use the method of implementation of corrugated webs. This study is about how strength and the shear capacity are improvising by implementing corrugated design in cellular beams. Two methods are used for improvising. First is with different type of corrugated shapes. They are square type corrugation, rectangular type corrugation and trapezium type corrugation. Second is with varying the thickness of the web. In this method instead of stiffening the web externally, they are inbuilding it by these corrugation design. The test conducting are shear and flexural test. By this it is expected that the moment of inertia of web and strength will increase, also the possibility of shear buckling decreases. The complete study is carried out using a finite element method in ANSYs software. The results details that the corrugated web hollow flange cellular beams has less weight and more strength than the flat web hollow flange. So the corrugated web cellular hollow flange beams have better performance than the flat web cellular hollow flange beams.

Keywords: Hollow Flange Beam, Web Openings, Corrugated Web, Cellular Beams

1. INTRODUCTION

The installation of Cold-Formed Steel (CFS) components in contemporary construction is growing as a result of its benefits, including its light weight, high strength, flexibility, affordability, and ease of prefabrication. In Early in the 21st millennium, One Steel Australian Tube Mills (OATM) created a Hollow Flange Channel (HFC) section known as the Lite Steel Beam (LSB) by employing traditional cold rolling and then an electrical resistance welding technique. The hot-rolled conventional portions are heavier than the HFC sections, which are said to have a comparable bending strength. The LSBs are generally employed as structural components in structures for commercial, residential, and industrial buildings. Rectangular Hollow Flange Beams (RHFBs), a recently introduced steel member appropriate for extended span in many applications, are among the various open and hollow sections of CFS members.

Doubly symmetric RHFBs have better structural efficiency and buckling capacities than conventional CFS sections (Z-section and C-section) and hot-rolled I section. They consist of a central flat web plate with rectangular hollow flanges on the bottom and top of the section, as shown in Fig.1. Due to reduced web width and the absence of open edges, the section exhibits better local buckling capacity. Rigid hollow flanges further avoid distortional buckling caused by torsional effect. Fig.2. shows the hollow flange beam with circular web opening.

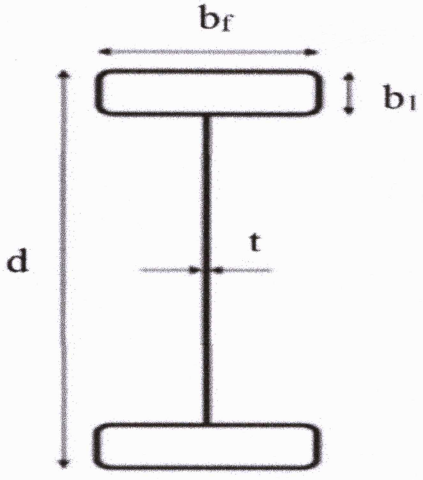

Fig.1. Doubly symmetric hollow flange beam [1]

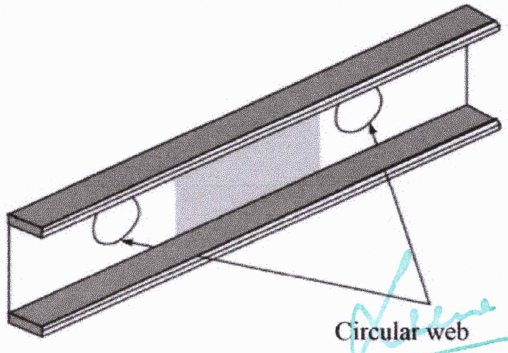

Fig.2. Monosymmetric hollow flange beam with circular web openings [1]

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 12 Issue 05, May-2023

Structural Performance of Grooved Gusset Plate Damper in Concentrically Braced Frame

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***Abstract*- The purpose of this study is to modify the braces by installing some energy dissipating device, which is added to the braces to absorb the energy and protects the structures from severe earth quake. Here we use Concentrically Braced Frame (CBF) with a metallic plate. It prevents all other member including beam, column, connection, and also braces from seismic damages and improves seismic performance of structure. The proposed device includes a gusset plate which is grooved so that it yields in several places and also prevents the plastic action or buckling in the braces. These types of device are known as Grooved Gusset Plate Damper (GGPD). The damper is a small plated metallic element. It can be installed in a braced frame then it act as an energy dissipater. It dissipates the energy from seismic through inelastic deformation at its steel strips and absorbs the complete shear. The finite element models of the braces are analysed using ANSYS and its structural performance is checked when the dampers are installed in different manner in a 3-bay 6-storied frame and three parameters are observed. Base shear, total acceleration and storey displacement.It is concluded that base shear of the structure is considerably reducing when the damper is installed in the frame. From the studies, it is concluded that lesser time period is produced for the model which occupied with complete braces and damper.**

Keywords: Grooved Gusset Plate Damper, Concentric Braced Frame, Seismic performance.

1. INTRODUCTION

Concentrically Braced Frame (CBF) is a type of bracings. They are mostly used in high rise building structures as lateral load resisting systems. A vertical concentric truss system with member axes aligned concentrically at the joints forms the CBF class of structures, which withstand lateral loads. Due to its great strength and stiffness, CBFs are typically effective in resisting lateral stresses. Recently, various studies have been planned to be conducted to enhance the braced frame's performance

Initially, simple braced frames were used. But by adding a few energy dissipation devices, additional adjustments are gradually made. Cost-effective steel energy dissipation devices were found to be applicable for minimal-damage seismic design of steel frames. To anticipate the fracture deformation capability of this device, more research is necessary. It can reduce damage repair costs and downtime, and, can be further enhanced by using rate-dependent dampers in parallel to steel devices to achieve drift reduction and protection of drift-sensitive non-structural elements [1].

Firstly damper plate connections were used by J.J Rogger Cheng et al. and where the ultimate load of the structure increased linearly proportional to the gusset plate thickness and decreases with increasing plate size [2]. The slit damper is introduced by Sang Hoon Oh et al. The proposed connection showed an excellent hysteretic behaviour[3]. A Low Yield Point steel gusset plate was proposed by Sheng Jin Chen and placed in to the frame. Then the energy dissipation capacity of the gusset plate is also increased substantially [4]. Based on the buckling analysis, utilizing Block Slit Damper (BSD) was proposed by Hossein Ahmadie Amiri et al. The BSD devices, one can decreases the costs and make sure that the utilized device is resistant to buckling while the energy dissipation efficiency is not decreased [5].After that Block Slit Dampers (BSD) were introduced by Mohemmad Reza Shirinkam et al. BSD is a box made of several steel plates which is mounted along diagonal members of a braced frame [6]. Unlike many existing seismic dampers, the stiffness and strength of the Box Shaped Damping device are not interdependent parameters and the designer can choose the required stiffness while keeping the strength constant. Also Application of Slit Beam in Eccentrically Braced Frame and An Innovative C-Shaped Yielding Metallic Dampers for Steel Structures are studied [7,8].At the same time a Modified Bar-Fuse Damper in Gusset Plate is introduced by Ramin Tabatabaei and found that it will be improve the seismic behaviour of the system[9].The structural performance of a concentrically braced frame is improved by installing an innovative shear damper and which effectively protects the structures[10]. A new brace type damper consists of two slit damper and it comprises a few perforated webs and two flanges (Perforated Web H-type Braced Damper PWHBD) was proposed by Baocheng Zhao et al. which are designed for protecting structure from earth quakes[11]. Improving the CBF Brace's behaviour using I-Shaped Dampers [12] and Torsional Hysteretic Damper for Frames (THDF), is introduced [13]. Gradually it changes to some gusset plates. But gusset plates will cause fracture because of post buckling deformation of the braces. So that strong brace member and weak gusset plates are used by M. Almohamad Albakkar et al.. Hence slits are provided in the gusset plate [14].

The slit dampers are a type of metallic damper. In this study a grooved gusset plate damper is installed in CBF and the complete performance of the structure will be checked. The complete study will be carried out by ANSYS software.

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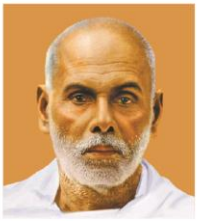

2021-2022

Seismic Resilience Evaluation of Steel Frames With Y-Shaped Braces Equipped with Cost Effective Damper

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***Abstract*— The steel frames are mainly installed in construction in order to resist the lateral force developed during the earthquake. They are having high stiffness and strength to resist the lateral systems, most of them do not have enough ductility and architectural performance. Y shaped bracing can deal with the architectural performance whereas the ductility of the braces is not sufficient. Due to the long length and sufficient compressive force in the members buckling occurs. The use of Steel Dual-Ring Damper (SDRD) in the frame of structure properly can solve the buckling risk. In this research, an innovative cost-effective Steel Dual-Ring Damper (SDRD) was used on the long member of the Y bracing to increase ductility capacity and reduce the buckling risk. A single-story single-span frame with Y shaped bracing was considered and subjected to lateral seismic load analytically. Using the nonlinear finite element method, the complete analytical model and parametric studies have been carried out using ANSYS work bench software.**

Keywords*— *Steel Dual-Ring Damper, Ductility, Compressive force, long length

I INTRODUCTION

The simple diagonal bracing to a bracing system consisting of several members are the different bracings used in the construction. Based on the structural and architectural demands the bracings are selected. Generally, the braced frames can be classified into two groups, concentrically braced frames (CBFs) and eccentrically braced frames (EBFs). In the case of concentrically braced frames, beams, braces, and columns intersect at a common point. This type of system has inappropriate behaviour and poor performance in terms of energy absorption during intense seismic loads due to the buckling of the braces and inadequate ductility. Y-shaped concentric bracing, which is commonly used to solve architectural problems, while this bracing does not have ad- equate ductility. Seismic energy-absorbing systems are used in structures in the form of steel dual ring damper, metallic yielding dampers, friction dampers, viscoelastic dampers, and viscous fluid dampers. The use of steel rings as dampers in controlling displacement and ductility as well as significant energy dissipation in concentrically braced frames systems (CBFs). The study on steel ring dampers as ductile and energy-absorbing elements in concentrically braced frames have shown good ductility, hysteresis-stable loops and energy dissipation. The main aim in the present study is to develop a full-scale model for a steel structure with braced configuration and perform the lateral loading testing on a braced steel frame with and without damper. Finding the optimum size of the damper in a full-scale model. The parametric study is carried by changing the parameters of the SDRD dimensions to find the optimum size that is bests suited for the seismic performance of the structure. To evaluate hysteresis performance and the energy dissipation capacity by placing SDRD damper in a Y shaped bracing system.

II OBJECTIVES

- To develop a full-scale model for a steel structure with braced configuration
- To perform the lateral loading testing on a braced steel frame with and without damper.
- To finding the optimum size of the damper in a full-scale model.
- The parametric study is carried by changing the parameters of the SDRD dimensions to
- find the optimum size that is bests suited for the seismic performance of the structure.
- To evaluate hysteresis performance and the energy dissipation capacity by placing SDRD damper in a Y shaped bracing system.
- Stiffness, Total dissipated energy, Hysteresis behavior

III SCOPE OF THE WORK

- An Innovative Cost-Effective Steel Dual-ring Damper (SDRD) was utilized on the member.
- Ductility capacity is enhanced and decrease the risk of buckling.
- Performing the effective model under cyclic testing to evaluate hysterias performance and the energy dissipations capacity of structure.

IV SUMMARY OF LITERATURE

The strengthening and retrofitting of the existing structure the steel bracing is one of the advantageous concepts. The concentric inverted V braced model gave better values for storey drifts when compared to other models and gives a better result. Steel frame with X knee bracing having less displacement and having high load carrying capacity compared to other bracing system. Y-HSS-EBFs (Y Shaped High Strength Steel Eccentrically Braced Frame) possess high elastic stiffness, good deformability, and excellent energy dissipation capacity. In the case of Y-shaped braces, the greater the distance between the junctions of the three

Effect of Bracing Location in PEB Under LTERAL Loads

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Abstract— **In Industrial building to cover and shelter a large area without supports, different steel structural roofing system becomes the most effective and economical instead of a concrete structure. Pre engineering building (PEB) is new type of building framing system adopted in the industrial building, the concepts is steel framing system, supporting members and roof covering are connected each other. The aim of this research work is to optimize the bracings for Pre Engineering Building (PEB) and analyse the behaviour of structure under different loads by using Etabs software. Present study is to analyse and design a PEB structure for different bracing location and finding the best location using Etabs software.**

Keywords— PEB, Bracing

I. INTRODUCTION

Industrial buildings, a subset of low-rise buildings is normally used for steel plants, automobile industries, utility and process industries, thermal power stations, warehouses, assembly plants, storage, garages, small scale industries, aircraft hangar, etc. . Mostly industrial buildings are constructed with steel material. Ordinary steel structure are made up of truss as a roofing system with roof top covering, it is called as conventional steel building (CSB). Technological improvement over the year has contributed immensely to the enhancement of quality of life through various new products and services. One such revolution was the pre-engineered buildings.

Pre engineering building (PEB) is new type of building framing system adopted in the industrial building, the concepts is steel framing system, supporting members and roof covering are connected each other. Pre-engineered steel buildings can be fitted with different structural accessories including mezzanine floors, canopies, fascias, interior partitions, etc. and the building is made waterproof by use of special mastic beads, filler strips, and trims. This is a very versatile building's systems and can be finished internally to serve many functions and accessorized externally to achieve attractive and unique designing styles. It is very advantageous over conventional buildings and is helpful in the low-rise building design. They PEB sections are used according to the bending moment requirement and are generally built up sections.

II. OBJECTIVES

The industrialization leads to the development of new advancement in the construction of industries. Large column free area and lower cost enhance the use of PEB in industrial building construction. The main objectives of the study are

- To analyse and design a pre-engineered building
- To analyze PEB structure under wind load.
- To optimize the bracing for lateral loads.
- To compare and evaluate the effectiveness of steel brace at different location.

III. SUMMARY OF LITERATURE REVIEW

From literature review, it is found that PEB have better performance compared to conventional steel structure and addition of bracing provide stability to the structure. They have good aesthetic view. In PEB the excess steel is avoided by tapering the section and is done as per the bending moment requirements in the structure. It is also seen that the weight of PEB depends on the Bay Spacing, with the increase in Bay Spacing up to certain spacing, the weight reduces and further makes the weight heavier.

IV. METHODOLOGY

The structure contain single storey PEB industrial warehouse. The plan is prepared using auto CADD. All the supports are pinned. Two types of models are analysed using ETABS software. The specification of structure are

Building Dimensions	40m x 100m
Type Of Roofing	G.I Sheet
Location Of Building	Bangalore
Bay Spacing for centre	7.727 m
Bay Spacing for gable end	7.500 m
Number of bays	13 No.
Wind Speed	33 m/s
Roof Slope	1in10
Clear eave height	5 m
Max eave height	7 m
Purlin Spacing	1.5 m c/c
Column Section(PEB)	Tapered
Rafter Section(PEB)	Tapered

3D Steel Truss Bridge with GFRC Deck

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Abstract— **In this paper, a 3D bridge truss is to be analyzed in (ANSYS Workbench) The floor material of the Bridge was changed to Glass fiber reinforced concrete. Compared to a normal concrete structure, GFRC Erection is simple due to the relative lightness of members. GFRP offers the designer a new combination of properties not available from other materials and effective rehabilitation systems. The high amount of glass fibers leads to high tensile strength while the high polymer content makes the concrete flexible and resistant to cracking. Because of the high early strength of GFRC, in part provided by the fibers, it can be demolded quickly. Most GFRC works can be demolded in 24 hours. Site details including span are taken from Vengara- Pazhayangadi (Major District Road) in which the bridgework (Box girder bridge) is going on.**

Keywords—GFRC; GFRP

I. INTRODUCTION

Truss structures that are comparatively simple to assemble and are more economical are used for many purposes such as crossing areas, railroads, and other transportation bridges. Steel truss bridges have more flexibility than concrete bridges. In this paper, a 3D truss bridge is to be provided with GFRP deck portions and is to be analyzed and designed in ANSYS WORKBENCH software. The truss component makes up reinforcement for the bridge. The truss dissipates the load through the structure as a result, the middle of the beam experiences less compression and tension. A truss is typically made up of a large number of triangles. The triangle is the strongest shape, when subjected to force it evenly distributes the weight without changing its proportions and maintains its shape in position. Deck portions are provided with the GFRP deck. GFRP possesses low weight compared to concrete It requires a short erection time through pre-assembly, and easy handling on site GFRP possesses more corrosion resistance When rectangular sections are subjected to forces, they will easily deform but if it is provided with diagonal or triangle members are provided, the stability of the structure will get enhanced. Squares are made up of four-sided but we can change the angle to any quadrilateral shape with the same sides. But triangles are different having 3 sides with valid lengths and we can't change the angles to get a new triangle with the same sides as there is exactly one triangle that we can make from those sides. This is how triangles hold their shape. And by interconnecting carry relatively heavy loads in truss bridges.

II. OBJECTIVES

- To conduct a literature review about 3D bridge Truss
- To familiarize with ANSYS workbench software
- To plan and model a 3D truss bridge with h GFRP deck by considering the requirements in Vergara
- To analyze 3D bridge truss.

III. SCOPE OF THE WORK

- The scope of the study has been limited to the analysis of a 3D bridge truss in Vergarara by the method of finite element software.
- The scope of GFRP is to be analyzed
- To achieve sound knowledge related to 3D bridge truss, ANSYS workbench software
- The aesthetic and structural advantages of composite bridge truss were a highlight
- The main components of the steel truss were analyzed using ANSYS workbench software.
- Models are prepared considering the relevant site conditions.

IV. SITE DETAILS

The total span of the bridge is 321.6 m, which consists of 5 number 25 m Span 3 number of 15.5 m Span 3 number of 9.5 m Span 1 number of 22 m 1 number of 21 m 1 number of 20.4 m 1 number of 27 m and Railway over bridge portion - 31.2 m Box girder bridge is the proposed one. Deferent crocross-sections are provided for support sections and mid-span sections. Box girders are connected with a pier with an elastomeric bearing.

The cross-sections in the support and midspan portions are shown below:

Disposable Knee Bracing in Combined Bracing System- Improvement in Seismic Design of Steel Frame using ETABS

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***Abstract*— Now a days, the use of braced frame systems has been expanded to achieve high stiffness and ductile structures in high seismic zones. Among the various types of bracing systems, such as x-brace ,diagonal etc. the knee bracing system has been mostly considered for seismic design in steel structures. In this system, the diagonal member provides the system's stiffness, and the knee member as a fuse provides the ductility and prevents the buckling of diagonal member; thus, it is expected that the stiffness and ductility of the structures will be remained strongly. In this study knee brace is integrated in the steel building with various bracing configuration and types of combined arrangement of different bracing (x type, diagonal inverted, chevron in frame is implied to test under Nonlinear Static Pushover (NSP) analyses, seismic analysis is carried out to compared with the corresponding concentric and eccentric frames. The output results like base shear, story drift, time period, and limit state check are compared and evaluated in ETABS.**

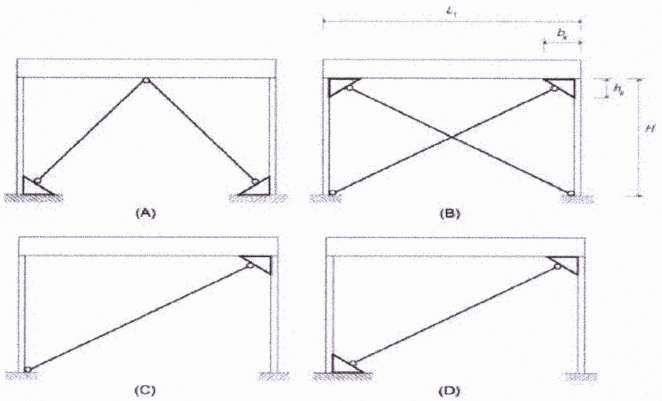
***Keywords*— Disposable knee brace,**

I. INTRODUCTION

The great strength, uniformity, light weight and many other desirable properties makes steel the material of choice for numerous structures such as steel bridges, high rise buildings, towers and other structures. Steel bracing provides an effective solution for resisting lateral forces in a framedstructures.

Knee braced steel frame has got excellent ductility and lateral stiffness. Since the knee element is properly fused, yielding occurs only to the knee element and no damage to major elements In recent years, the use of braced frame systems has been expanded to achieve stiff and ductile structures in high seismic zones. Among the various types of bracing systems, the knee bracing system has been specially considered for seismic design in steel structures. In this system, the diagonal member provides the system's stiffness, and the knee member as a fuse provides the ductility and prevents the buckling of diagonal member; thus, it is expected that the stiffness and ductility of the structures will be remainedsimultaneously.
In this study knee brace is integrated in the steel building with various bracing configuration types of combined arrangement of different bracing (x type, diagonal inverted, chevron)in frame is implied to test under Nonlinear Static Pushover (NSP) analyses, seismic analysis is carried out to compared with the corresponding concentric and eccentric frames.

2. OBJECTIVES



To develop and compare models of knee brace typein combined system in the steel frame against seismic force.

- Knee brace is integrated in the steel building with various bracingconfiguration.
- Combined arrangement of different bracing in frame taken such as X- type, diagonal, and chevron.
- The analysis carried out with and without DKB.
- Performing the nonlinear static pushover analysis to evaluate, yielding, ultimate displacement, lateral load, ductility and plastic hinge.
- Seismic analyses are carried out using nonlinear time history.
- The output results like bases hear, ductility, story drift, time period, limit state check are compared and evaluated in ETABS.
- Introducing new type of bracings, such as k-type knee brace, arch knee brace.

3. SUMMARY OF LITERATURE REVIEW

From the literature review the following conclusions were observed The knee-braced frames (KBF) include relatively simple connections for ease of construction and reparability after an earthquake and less obstruction as compared to conventional bracing systems. Lesser sway,

Structural Optimisation of Non-Seismically Detailed RC Beam-Column Joints using Prestressed and Prefabricated Steel Encasement

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***Abstract*— Beam–column joints in reinforced concrete moment resisting frames are key components to guarantee integrity and overall stability when the frame is subjected to seismic loading. Poor reinforcement detailing at critical locations such as beam-column joint core can have detrimental consequences as it may lead to a global failure mechanism. An innovative and practical seismic retrofit method is proposed for non- seismically detailed external beam– column joints of existing concrete structures that do not meet current seismic design requirements. The objective of the study includes proposing a retrofit method based on two-dimensional enlargement of the beam–column joint using steel angles that are mounted on the prestressed cross-ties. The exterior reinforced concrete beam- column joints are tested under lateral loading with a constant axial load on the column and the analytical study is expected to show significant enhancement in seismic capacity of non-seismically detailed beam column joint. The proposed retrofitting method effectively prevent the brittle joint shear failure, relocate beam plastic hinges to outside the joint panel zone, increase the joint strength and energy dissipation. The complete analytical study is carried out using nonlinear analysis method in ANSYS software.**

Keywords: External beam–column joints, brittle joint failure, ANSYS software

I. INTRODUCTION

Beam column joint is defined as the portion of the column within the depth of the deepest beam that frames into the column. It is the Crucial zone and weakest link in a reinforced concrete (RC) moment resisting frame. Beam- column joint will enable adjoining members to develop and sustain their ultimate capacity. It is subjected to large forces during severe ground shaking and should have adequate strength and stiffness to resist the internal forces induced by framing members. Behavior of beam-column joint has a significant influence on the response of the structure. Catastrophic failures with Turkey and Taiwan Earthquake in 1999 is attributed to beam- column joint failure. Constituent material used for the construction of reinforced concrete structure have limited strength. So the joints have limited force carrying capacity when forces larger than these are coming on the joint. During earthquake, joints are severely damaged and repairing damaged joints are difficult. Thus beam-column joints must be retrofitted to resist earthquake effects. Seismic retrofitting is the modification of existing structures to make them more resistant to seismic activity, ground motion or soil failure due to earthquakes. The main aim of the present study is to determine the behaviour of RC beam-column joints retrofitted with steel plates and angles. Retrofitting is carried out based on two dimensional joint enlargement with steel angles that are mounted using prestressed cross ties.

II. BJECTIVES

- To model a beam- column joint
- To propose a retrofitting method for non-seismically detailed RC beam-column joints of existing concrete structures based on two dimensional enlargement of the beam- column joints using steel angles that are mounted using prestressed cross ties.

III. SUMMARY OF LITERATURE REVIEW

Various literatures are reviewed including the base journal [1]. There exist different methods for seismic retrofitting of RC beam-column joints. It includes retrofitting based on steel plates and angles, carbon and glass fibre reinforced polymer, concrete jacketing etc. Seismic retrofitting based on steel angles and plates is an effective method which will increase strength, energy dissipation etc. Overall performance of the structure under seismic loading can be improved through this method.

IV. JOINT ENLARGEMENT USING PRESTRESSED STEEL ANGLE CONCEPT

Seismic retrofitting is the modification of existing structures to make them more resistant to seismic activity, ground motion or soil failure due to earthquakes. One of the methods of retrofitting is based on joint enlargement using prestressed steel angle concept. Two steel angles and one plate is associated with each joint retrofit. Three steel elements are fixed in place using high tensile strength bars and the retrofitting is completely done using bolted connection. The

Structural Performance of Partially Precast Steel Reinforced Green Concrete Columns

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***Abstract*— Steel reinforced concrete (SRC) column has been used because of its good structural performance and have high stiffness high load bearing capacity etc. This project includes study of behavior of partially precast steel reinforced concrete (PPSRC) column subjected to axial loading with demolished concrete lumps (DCL) . The objective is to investigate the performance (PPSRC) columns with green concrete (demolished concrete) and by varying the cross-section of core steel and core concrete. Factors like axial load - deflection curves ,failure modes, the strains of the steel section and the concrete were investigated using ANSYS.**

Keywords- partially precast column, green concrete, demolished concrete lumps

I. INTRODUCTION

Steel reinforced concrete (SRC) column has received much attention of structural engineers and researches because of its good structural behavior. The main advantages of this composite column are high load bearing capacity, great stiffness and inherent ductility. The concrete encasement not only improves the stability of the structural steel but also prevents the steel section from chemical corrosion and fire damage. Therefore, SRC column has been widely employed in the high-rise buildings and long-span bridges in recent years. However, it is generally admitted that the construction procedure is complex, particularly in assembling reinforcement and pouring concrete at beamcolumn connections. The PPSRC column is composed of a precast outer part and a cast-in-place part; precast outer-part consists of the steel shape, longitudinal reinforcement, stirrups and high performance concrete, which are prefabricated in the precast shop. After transporting the outer-part to the construction site, the inner concrete is simultaneously cast with the concrete in beam and slab. Here the inner concrete in PPSRC column can be cast by the normal concrete, lightweight aggregate concrete or recycled concrete. For hollow precast steel reinforced concrete (HPSRC) column, the inner part can be kept hollow to reduce the self-weight or filled with the fire resistive material to improve the fire resistance.

This study includes the behavior of partially precast steel reinforced concrete (PPSRC) column subjected to axial loading The main objective is to study the performance (PPSRC) columns with green concrete (demolished concrete) and by varying the cross-section of core steel and core concrete. Parameters like the failure modes, axial load versus deflection curves as well as the strains of the steel section and the concrete were investigated using ANSYS.

II . OBJECTIVES

- Study the performance of PPSRC with green concrete (demolished concrete) under axial loading
- Study the following parametric changes by varying cross sections of steel and
- Study the following parametric changes by varying infill DCL material

III. SUMMARY OF LITERATURE REVIEW

PSRC specimen with core shows a better deformation capacity under axial load. Partially precast members reduces transportation time and weight problems. Compared to traditional concrete, it produces less carbon dioxide, and is considered cheap and more durable. Green concrete has reduced environmental impact with reduction of the concrete industries CO_2 commissions by 30%.Green concrete is having good thermal and fire resistant

IV .FINITE ELEMENT MODELLING

The model is a 350*350 mm column of 1800 mm length. The modeling is done using Ansys software. Three demolished lumps of different compressive strength is used and analysed. The DCL having higher ultimate load is used for further study by varying the core section as octagonal, circular and square.

A. SECTIONAL PROPERTIES

The sectional properties are cross shaped structural steel of total height 200mm and width of steel shape are 200 mm and 100 mm, respectively, and the thickness of the web and flange are 5.5 mm and 8 mm, respectively. Four pattern plates are used .The stirrups of diameter of 8 mm spaced at 50 mm, arranged at the middle height of the column, and stirrups of diameter 8 mm spaced at 25mm were arranged at both ends of the column. Four longitudinal reinforcements, steel bars with diameter of 20 mm were also placed in the specimens. Shear studs of shank diameter 10mm and 30mm height is used

Strengthening of the Deficient Steel Sections Using Hybrid Composites under Various Loading Scenarios

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Abstract— **Recently ,the strengthening of steel sections using various fiber reinforced polymer (FRP) has come to the attention of several researchers. For different reasons, this type of structures may be placed under combination of loads. The deficiency in steel members may be due to errors caused by construction, corrosion, fatigue cracking, and other reasons. This study investigated the behavior of deficient tubular hollow section (THS) steel members strengthened by HYBRID composite FRP under two types of combined loads. To study the effect of HYBRID composite FRP strengthening on the structural behaviour of the deficient steel members, various parametric studied were conducted by varying damage level, various strengthening methods were analysed. To analyse the steel members, three dimensional (3D) modelling and nonlinear static analysis methods were applied, using ANSYS software. The results expected that HYBRID composite FRP strengthening had an impact on raising the ultimate capacity of deficient steel members and could recover the strength lost due to deficiency.**

Keywords— Fiber Reinforced Polymer, Tubular Hollow Sections, Non Linear Static Analysis.

I. INTRODUCTION

Strengthening of the steel structures can be done using Fiber-reinforced polymer (FRP) FRP, also Fibre-reinforced plastic, is a composite material made of a polymer matrix reinforced with fibres. The fibres used are usually glass, carbon, or aramid. It is actually a stronger material than steel, making it a much stronger system whilst maintaining being a very lightweight material. Hence FRP is able to maintain its high strength even being a very lightweight material. Fiber reinforced polymer (FRP) composites or advanced composite materials are very attractive for use in civil engineering applications due to their high strength-to-weight and stiffness-to-weight ratios, corrosion resistance, light weight and potentially high durability. FRP outperforms wood and concrete structures, while holding up to decades of wear and tear. Fiber-Reinforced Polymer (FRP) composites offers five major benefits for any infrastructure , faster installation time, Lightweight material, Resistance to corrosion & very little maintenance, Cost savings, Design flexibility. Fiber Reinforced Polymer (FRP) includes a system of both carbon fibres and the bonding epoxy. The carbon fibres themselves are great in fire as they will not lose strength, even while glowing red hot. One drawback of FRP materials is their relatively high cost compared to other materials. Other drawbacks include: The need for various saw blades and drill bits than those used with wood or steel. Attention if irritation persists, or if severe coughing or breathing difficulty occurs. This provides the raw materials used for economical alternatives to conventional construction materials such as steel and wood. Most important in the context of sustainability, FRP manufacturing represents a radically low environmental impact over the traditional material preparation methods. Fiberglass reinforced plastics (FRP), are indeed initially more overpriced than traditional materials. However, it offers huge merits over these materials and has a lower overall cost of ownership and many other benefits. FRP panels are normally 0.09 inch in thickness and weigh about 12 ounces per square foot. Variations in material removal rates and hardness between the matrix and filler materials create difficulties in preparation such as polishing relief or rounding. These problems can cause wrong measurements, disguise problems or create artificial damage. Fiber Reinforced Plastics or Fiber Reinforced Panels (FRP) are plastics that contains fiber such as glass, carbon, aramid, or basalt. The deficiency in steel members may be due to errors caused by construction, corrosion, fatigue cracking, and other reasons. The use of externally bonded FRP has become increasingly popular for civil infrastructure applications. CFRP, GFRP, AFRP, BFRP etc. are some of the types of FRP. CFRP contains carbon as the fibre component, whereas GFRP contains glass as the fiber component. Moreover, CFRP is highly expensive, which limits the use of this material in many applications. BFRP – It is a composite material containing rigid polymer resin bounding unidirectional basalt fibers. Basalt Fibre Reinforced polymer bars have the advantage of corrosion resistance, high strength, light weight, good dielectric properties. AFRP- Aramid Fibre Reinforced Polymer is made up of aramid fibers, and have excellent corrosion resistance. The most common FRP systems for concrete strengthening applications are carbon based (CFRP). Carbon has high mechanical properties and higher tensile strength, stiffness, and durability compared with glass fiber based systems. Prefabricated FRP elements are typically stiff and cannot be bent on site to wrap around columns or beams. FRP fabric, on the other hand, is available in continuous unidirectional sheets supplied on rolls that can be easily tailored to fit any geometry and can be wrapped round

Comparative Analysis and Seismic Performance Improvement of RCC Post Tensioned Flat Slab with Steel Composite PT Flat Slab System using ETABS

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***Abstract*- Looking at the modern trend of construction, RCC post tensioned flat slab are widely adopted in commercial and residential sectors due to its low cost of construction and aesthetic view. Post- tensioning, which is a form of prestressing, has several advantages over standard reinforcing steel (rebar's): It reduces or eliminates shrinkage cracking- therefore no joints, or fewer joints, are needed and Cracks that do form are held tightly together ,It allows us to build slabs on expansive or soft soil and It lets us design longer spans in elevated members, like floors or beams. Post-tensioning, or PT, has become increasingly popular over the past 30 years or so as the technology has been perfected. . While using PT method more precautions has to be made for shear and deflection criteria for the slabs since RCC post tensioning slabs are weak against lateral force. Post-tensioned slab structures have weak resistance to lateral loads. So to provide stiffness to structures against lateral forces steel columns are used. A study is carried out to compare the structure by replacing some of the RCC column with steel column to improve the stiffness of structure against lateral force. For this purpose a 15 storey RCC post tensioned flat slab in modeled using ETABS and analyzed for high seismic zone then improve the performance with different arrangements of RCC and Steel columns and the model is analyzed against the base shear, story drift, and story displacement. Also the cost analysis of RCC PT flat slab is compared with the composite PT flat slab**

Key words- Post Tensioned Flat Slab, Steel RCC composite structure, StoreyDisplacement, Drift, Stiffness

I INTRODUCTION

As the floor system plays an important role in the overall cost of a building, a post- tensioned floor system is invented which reduces the time for the construction and finally the cost of the structure. In some countries, including .The U.S., Australia, South Africa, Thailand and India, a great number of large buildings have been successfully constructed using post-tensioned floors. The reason for this lies in its Decisive technical and economical advantages.In modern construction high tensile steel reinforcement known as tendons are widely adopted in post-tensioned flat slabs. Post- tensioned slab helps in reducing tensile stresses and cracks of the member. Post- tensioned slabs have proved to be economical and effective compared to normal RCC beam-slab and RCC flat slab.

PT Flat Slab: Post-tensioned (PT) slabs are **typically flat slabs, band beam and slabs or ribbed slabs**. PTslabs offer the thinnest slab type, as concrete is worked to its strengths, mostly being kept in compression. Longer spans can be achieved due to prestess, which can also be used to

counteract deflections. Post-tensioned slabs use high-strength tensioned steel strands to compress the slabs, keeping the majority of the concrete in compression. This gives a very efficient structure which minimizes material usages and decreases the economic span range when compared to reinforced concrete.

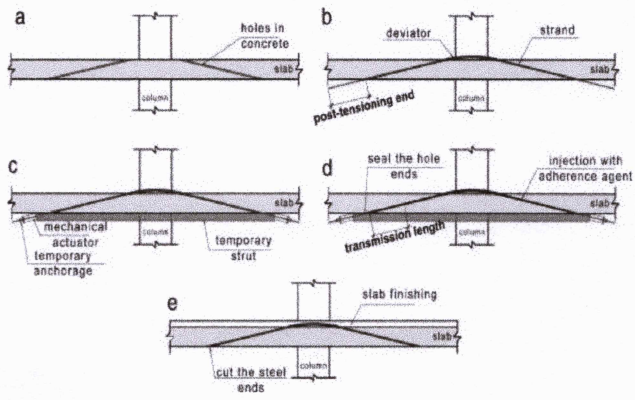

Fig.1.Post Tensioning Process

II OBJECTIVES

- To Model and Analyze RCC PT Flat slab for non linear time history analysis using Etabs
- To check the Storey Performance against real time PGA earth quakedata LOMAP
- To improve the stiffness of post tensioned flat slab by replacing theRCC column with steel column

Cyclic Performance of Cross Slanted Corrugated Steel Plate Shear Wall with Beam Only Connected Infill Plates

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***Abstract*— Corrugated Steel Plate Shear Walls have gained significance and repute for being effective lateral force withstanding systems. Corrugated plates are characterized by higher out of plane stiffness and buckling stability than flat plates, assuring their enhanced hysteretic actions. In ordinary Steel Plate Shear Walls infill plates are fixed to beams and columns. But, detaching the infill plate from columns and connecting it to the beams only is assumed here as a system for reducing column demands. The current study explores the cyclic performance of Cross Slanted CSPSWs with beam only connected infill plates. The design of a one story single-bay specimen was done and its finite element model was developed by using ABAQUS software. Parametric studies have targeted CSPSWs with different geometric variables, including the orientation of the infill plate.**

Keywords*— Corrugated steel plate shear wall, Cross slanted infill plate, Out of plane stiffness

I. INTRODUCTION

Steel Plate Shear Walls are frequently employed as lateral force resisting systems in building structures owing to their high stiffness, strength, and ductility. Steel Plate Shear Walls are either stiffened or unstiffened in type. Stiffened Steel Plate Shear Walls enjoy greater initial stiffness, higher shear strength, and bigger ductility than unstiffened ones. Corrugated steel plate shear wall which consists of a steel boundary frame and a corrugated steel wall panel with the corrugation in the horizontal or vertical direction, is a new sort of lateral load resisting system within the family of steel plate shear walls. Compared with the unstiffened special plate shear walls, Corrugated Steel Plate Shear Wall would have greater elastic buckling capacity and more resistance to the gravity loads transferred to the wall panel or avoid them, depending on the corrugation direction. Corrugated plates are characterized by higher out of plane stiffness and buckling stability than flat plates, ensuring their enhanced hysteretic behavior. In ordinary Steel Plate Shear Walls, infill plates are fixed to beams and columns. Detaching the infill plate from columns and connecting to the beams only is assumed here as a way for reducing column demands. The current study explores the cyclic performance of Corrugated SPSWs with beam only connected infill plates. Besides reducing column demands, beam only connected Steel Plate Shear Walls have other advantages. In beam-only-connected SPSWs, panels can be fabricated so that there would be a gap between panel edges and the columns, or several panels are often fabricated with a little panel aspect ratio installed parallel to each other during a span. In both cases, a gap space could also be easily given adjacent to the column without perforating the infill plate. Moreover, connecting the corrugated infill plate, especially a light-gauge one, to the boundary frame members was found challenging and difficult due to its thickness and geometry, that is, a matter that could prolong the construction time. In the case of beam only connected Steel Plate Shear Walls, the infill panel can be attached to the frame beams only, while the attachment between the infill panel and columns is ignored. However, the behavior of Corrugated SPSWs with beam only connected infill plates has not been studied before. This study investigates the feasibility of using corrugated plates as infill plates in beam only connected Steel Plate Shear Walls. We modeled and analyzed a one story single bay specimen using the commercially available software package ABAQUS. A parametric analysis was employed to research the mentioned model by varying its geometry. The parametric study incorporated corrugated plate orientation (horizontal, vertical, and cross slanted) and thickness of the corrugated plate.

II. OBJECTIVES

- Provide an efficient and accurate finite element model to understand the cyclic performance of Cross-Slanted CSPSWs with beam-only connected infill plates in the ABAQUS software.
- Parametric studies have targeted CSPSWs with different geometric variables, including orientation of the corrugated plate and infill plate thickness.

III. SUMMARY OF LITERATURE REVIEW

Corrugated Steel Plate Shear Walls have good seismic performance with higher buckling capacity, lateral stiffness, and out-of-plane stiffness than Steel Plate Shear Walls while offering additional advantages in construction convenience and serviceability. Subsequent experimental and numerical studies of Steel Plate Shear Walls with beam-only-connected infill plates demonstrated that these systems had good initial stiffness and lateral strength and considerable

Analysis and Design of Mono Column Building

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***Abstract*— Mono column structure are the structures supported on a single column. They are the most suitable structures that can be constructed at the flood occurring regions. The structure provides large serviceable area as compare to RCC and steel frame structures. They provide large serviceable floor space compared to framed structures with many columns. They require less area for providing foundation and gives more space for parking. In this project describes planning, structural analysis, design and drawing. The mono column supports whole structure and other members will act as cantilevers. Structural analysis by ETABS.**

***Keywords*— Mono column**

I. INTRODUCTION

Mono column building is the structure supported on a single column which provides large serviceable area as compare to RCC and steel frame structure. Mono column building supported on a single column has more aesthetic view compared to other frame structures. The requires less area for providing foundation and gives more space for parking. They are also unique. Mono column structures are constructed with RCC or Steel. Mono column structures are complicated one, compare with the other framed structures, mono column supports entire structure, all other members will act as cantilevers and mono column structure is the individual one. Eccentric loading will cause failure of structure. These structures provide more proper spaces for offices and parking. Mono column provides maximum serviceability. They are also good at the place where flood occurs. Mono column buildings decrease the excavation area of the land and saving money. This project describes planning, structural analysis, design and drawings with various components of the whole building.

In India the state like Kerala facing flood in the monsoon season. The water level reaches approximately to the first floor of the building. The best solution of this problem is rising the living area higher from the ground level. Mono column buildings are very effective to control flood. Some of the two mono column structures are Astra Tower, Hamburg. Germany and L & T's Construction Headquarters at Manapakkam in Chennai.

II. OBJECTIVES

Rise in population have increased the demand of high-rise structures in the cities. Multistorey buildings aim to increase the floor area of the building without increasing the area of the land and saving money. These multi storey buildings, sky scrapers are built not just for economy of space they are considered icons of a city's economic power and the city's identity. Thousands of multi storey building is being built all over the world with steel as well as reinforced concrete. The main objectives of the study are

- To analyse and design a mono column building
- To compare the different shaped mono columns like rectangular and circular etc.
- To compare the serviceable floor space with structure supported on many column

III. SUMMARY OF LITERATURE REVIEW

From literature review, it is found that Mono column buildings has unique structure. They have good aesthetic view. Mono column structure can withstand all loads including earthquake loads and wind loads. Mono column building save ground space as requires less area for proving foundations and providing more space for parking.

IV. METHODOLOGY

The building contains four stories including the mono column. The plan is prepared using auto CADD. All the supports are fixed. The ground storey is designed and analysed. The height of mono column is 3m from the ground level. Each storey is 3m height. Two types of models are analysed using ETABS software. The first one is rectangular type mono column which support the entire structure. Another one is a circular mono column with same cross-section as that of the rectangular column. The structure is a residential building with four stories. The four stories supported by the 3m height mono column. The mono column extends to bottom to the top of the building.

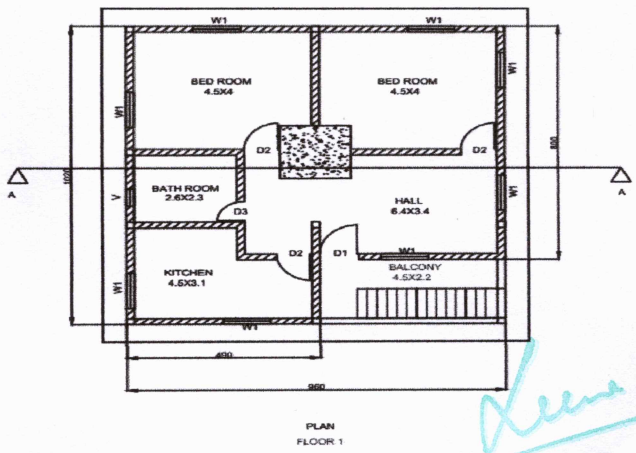

Fig.1. Plan of floor 1

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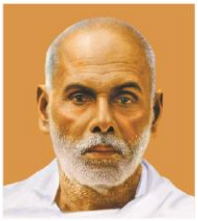

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International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

Soft Storey Mitigation Behaviour of Combined Hexa, Octa and Penta Bracing System

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Abstract - *The greatest challenge for structural engineer is to design the structure to be earthquake resistant. When a structure is designed for seismic resistance, various systems are embedded into structure so as to resist the lateral force. One of the systems adopted for resisting lateral forces, is to provide the structure with different types of bracings. There are many conventional types of bracings. Bracing is the best method to overcome soft storey effect. In this project a combined Hexa, Octa and Penta bracing system is investigated. An innovative bracing system is introduced in a G+20 building with soft storey to improve its seismic performance. G+20 building with different bracing configurations are analysed to check soft storey mitigation behaviour. To study linear and nonlinear behaviour of structure, dynamic analysis and push over analysis are performed. ETABS is used for modelling and analysing the building in this project.*

Key Words: **Bracing system, Dynamic analysis, Push over analysis, Soft storey, ETABS.**

1. INTRODUCTION

Steel structures generally need less construction time, have larger span feasibility and have better seismic resistance than reinforced concrete structures, and thereby popularity of steel structures are increasing nowadays. A Soft storey is defined as the storey in a building structure which has substantially less resistance, or stiffness, than the storeys above or below it. It has inadequate shear resistance and inadequate ductility to resist the earthquake – induced building stress. A Soft storey is one within which the lateral stiffness is smaller than 70% of storey above or less than 80% of the average lateral stiffness of the three storeys above, as per IS 1893:2002. Soft storeys may be located at top, bottom or intermediate points, so that the floor above or below may become stiffer compared to itself. In order to reduce lateral deflection, a bracing system is introduced in the structure. Bracings increase the stability of the structure by transferring lateral load sideways down to the ground and thereby preventing sway of the structure. In Seismic design of structure and in high rise structure, the provision of bracing system makes them more effective. In this project a combined Hexa, Octa and Penta bracing is introduced as shown in Fig 1, Fig 2 and Fig 3 respectively. The Main aim of the present study is to know the effect of bracings on soft storey multi-storied building. The project aims to study the overall performance of the building which different size of bracing system. Also to identify the suitable bracing system for resisting the seismic load efficiently. The simple parameters to determine the stiffness of frames are storey displacement, storey drift and storey shear. Storey displacement is defined as the displacement of a storey with respect to the base of the structure. Storey drift is the lateral displacement of one level of multi-storied building relative to the level below. The Seismic force applied at each floor level is defined as storey shear. Bracings are economical method to laterally stiffen the framed structures against wind and gravity loads. As the trend of construction of tall buildings is increasing, it is utmost importance to find cost effective bracing system.

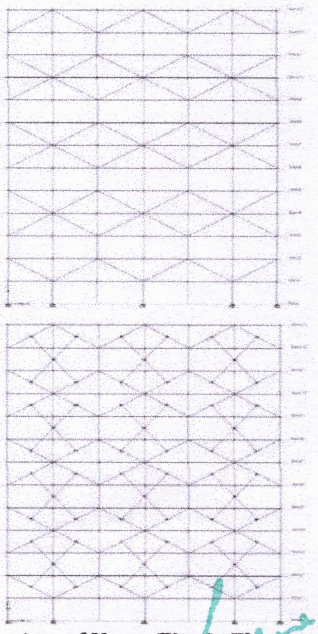

Fig-1: Elevation of Hexa, **Fig-2:** Elevation of Penta

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International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

Seismic Performance of Innovative Strengthened Hollow Corrugated Column in Multi-Storey Steel Building

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Abstract - *In many situations, lighter steel structures are used to the heavier alternatives such as reinforced concrete or prestressed concrete. With the growth of steel as a construction material, varieties of steel sections were also increased. Among these sections, the Hollow structural sections (HSS) or Structural hollow sections were the foremost reliable one. Hollow structural section is manufactured from a type of metal profile which consist of a hollow tubular cross section. The wide use of thin-walled steel structural systems in the construction industry is greatly indebted for their high strength to weight ratio attributes and remarkable fabrication versatility. Corrugated plates comes under this category have a wide range of application in various engineering fields. They are lightweight, economical, and have much higher load carrying capacities than flat plates, which make sure their popularity and have attracted research interest since they were introduced. In current project, corrugated columns are placed in different positions to determine the best and worst model in performance wise and then the worst model is strengthened externally and internally to improve their seismic performance. This project is done by using ETABS software.*

Key Words: **Hollow structural section, flat plate, corrugated column, ETABS**

1. INTRODUCTION

Nowadays steel structures becomes more popular than concrete structures. Light weight steel or cold-formed steel seeks more attention from researchers as it is easy to handle, economic and have higher load carrying capacity than concrete. With the increased use of steel, the varieties of steel sections are used. The Hollow structural sections (HSS) or Structural hollow sections were most valid one. Members of hollow structural sections can be circular, square, or rectangular in sections. Corrugated plates fall under this category and also have a wide range of application in various engineering fields. The main advantages of corrugated plates are, they are lightweight, economical, and have much higher load carrying capacities than flat plates, which ensure their acceptance and have attracted research interest since they were introduced. The corrugation shape provides stable and continuous stiffening which permits the use of thinner plates. A corrugated plate can be effortlessly bent in one direction, whereas it keep its rigidity in the other direction. Corrugated steel is a type of building material composed of sheets of hot-dip galvanized mild steel, cold-rolled to produce a linear corrugated pattern in them. The corrugation shape increase the bending strength of the sheet in the direction perpendicular to the corrugations, but not parallel to them. Corrugated steel is lightweight and can easily be transported.

1.1 Corrugated plate

Corrugated steel is a building material consists of sheets of hot-dip galvanized mild steel, which is cold-rolled to produce a linear corrugated pattern. The corrugated plates are also known as self-strengthened plates. They are regularly produced from flat plates. The corrugation shape increases the bending strength of the sheet in the direction which is perpendicular to the corrugations, but not parallel to them. Normally each corrugated sheet is manufactured longer in its strong direction. The profile of a corrugated plate may have different shapes: triangular, trapezoidal, sinusoidal and rectangular

1.2 Trapezoidal Corrugated Plate Cross Section and Dimension Notation

The corrugated plates are regularly produced from flat plates. The most common profiles used for corrugation are trapezoidal and sinusoidal profiles. In this research, trapezoidal profile is chosen because it exhibits more ductility and higher bearing capacity compared to sinusoidal profile. Trapezoidal corrugated plates used in this study. The geometry dimension of corrugated plate is given in Table 1

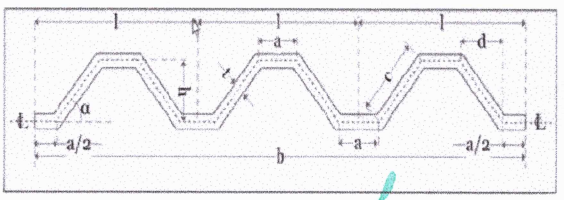

Fig 1: Cross section of corrugated plate

Table -1: Dimension notation

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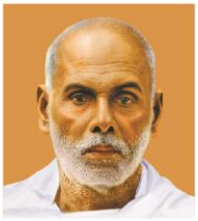

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International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

Experimental Study on the Use of Magnetised Water in Basalt Fiber Reinforced Concrete

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Abstract - *Concrete is a composite material which is made from a mixture of cement, aggregates, water and sometimes admixtures in required proportion. Water is the main ingredient in concrete for the various process including hydration process, proper curing etc. Magnetised water technology initiated in Russia, was found to be a new technique for increasing the strength characteristics of concrete. Conventional concrete has limited ductility, low impact, less abrasion resistance and little resistance against cracking. The addition of fibers can improve the strength of concrete. In this study the effect of magnetised water on the strength characteristics of basalt fiber reinforced concrete (M20) with MSand was studied. Cubes, cylinders and beams were casted to determine the compressive, split tensile and flexural strength test of concrete. The fibers were added at different percentages varying from 1 to 5 % by weight of cement. The optimum percentage addition of fiber was obtained at 3 % by weight of cement. In this project magnetised water was used in mixing of concrete. The result of research work showed that incorporation of basalt fiber and magnetised water effectively enhances the strength properties of concrete. Use of magnetized water has promising potentials in saving the amount of water used in concrete construction.*

***Key Words*: 1) Magnetised water,2) basalt fiber, 3) compressive strength, 4) split tensile strength, 5) flexural strength**

1. INTRODUCTION

Concrete is the construction material which is used worldwide. Therefore, it comes as no surprise that enormous amount of research has been undertaken to enhance its performance. The major disadvantage is that micro crack develop in concrete during curing. These micro cracks developed are responsible for the low tensile strength of concrete Hence fibers are incorporated to concrete to overcome these disadvantages. The addition of fibers in the concrete mix has many important effects. Water plays a major role in the concrete preparation. Water plays an important role in workability and strength of concrete. Water is the main ingredient in concrete for the different process including hydration process, proper curing etc. When water is mixed with cement,it forms a paste which binds the aggregate. Water helps in the hardening of concrete by the process known as hydration. Water consumption is increasing tremendously as the population and human needs increases. Water consumption in agricultural sector is around 70% and in industrial sector it is 20%. In concrete production there is more than one billion tons of water consumed each year. Replacing normal tap water with magnetised water during concrete preparation can enhance the split tensioe strength as well the flexural strength of concrete. Water after passed through the surroundings of a magnetic field of certain strength is called magnetic field treated water (MFTW) or magnetised water.

1.1 Basalt Fiber

Many fibers are used in the construction industry such as glass polyethylene, carbon fiber etc., one of the new fiber called Basalt rock fiber is added to this list. Basalt is a rock ,which is brown or dark in color formed from volcanic lava after solidification. It has better strength characteristics such as good hardness and thermal properties. Basalt rock fibers impart high strength and low cost high performance to solve the problem in the large project like cracking, structural failure of concrete. The structure of Basalt fiber is shown in figure below (Figure 1.1)

Fig 1.1: Basalt Fiber

1.2 Magnetised water

When water passes through a magnetic field, it is known as magnetised water. After magnetisation, the bond angle

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

STUDY OF MECHANICAL PERFORMANCE OF CONCRETE WITH THE ADDITION OF GRAPHENE OXIDE AS ADMIXTURE

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Abstract *- As the consumption of concrete increases, the production of cement is growing day by day. Portland cement process is a highly energetic process, and emits carbondioxide during calcination which has a crucial effect on global warming. Concrete, being the most widely used cement composite since it bears many advantages such as low cost, easy availability of constituents along with high strength and durability. However, disadvantages such as low tensile and flexural strength coupled with brittleness have promoted the addition of nanomaterials such as carbon nanotubes, graphene oxide, graphene nan flakes etc. The graphene oxide is chemically known as 'r-GO' ,atomically composite carbon, oxygen and hydrogen, a three-dimensional structure composed of millions of layers of graphite; existing in all body cast plain concrete or reinforced and which is possible to peel in the water, creating highly resistant layers in the material in which you are dispersed. This paper presents the strength properties of GO in cement- based composites such as compressive strength, flexural strength and tensile strength .*

Key Words: *Graphene Oxide*

1.INTRODUCTION

1.1 Introduction to Graphene Oxide

Cementitious materials are the most common construction materials used worldwide. They are generally brittle and have very low tensile strength and strain capacity. The concept behind such a transition to fiber-reinforced cement is that the resulting tensile strength is developed from many individual fibers rather than a few pieces of steel. Thus, use of discrete fibers results in greater uniform distribution of stress within cementitious materials Recently, carbon nanostructures such as carbon nanotubes (CNTs, both single and multiwalled), carbon nanofibers (CNFs), and Graphene have attracted attention from many concrete researchers due to their exceptional mechanical, chemical, thermal, and electrical properties, and good performance as polymeric reinforcement materials .Graphene is a single layer sp^2-bonded carbon sheet forming a honeycomb crystal lattice. Exfoliated graphene nanoplatelets have the same chemical structure as Carbon Nanotubes (CNT), and their edges are easily chemically modified for enhanced dispersion in polymeric composites [5]. Such nanoplatelets are typically less than 5 nm thick and can be synthesized with lateral dimensions ranging from <1 to 100 microns. Use of graphene oxide powder could open up many new applications such as high tensile strength and high compressive strength.

Fig - 1: Graphene Oxide

2. OBJECTIVES

The main objectives of this study are as follows.

- To study the behavior of concrete with Graphene oxide.
- To determine the compressive strength and flexural strength of Graphene oxide concrete.
- To find out the optimum quantity of Graphene Oxide required to achieve maximum compressive and flexural strength of concrete.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

SEISMIC ANALYSIS OF MULTI STOREY BUILDING WITH FLOATING COLUMNS USING ETABS

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Abstract - *In recent years, multi-storey and commercial buildings are constructed with architectural complexities. The floating columns buildings in seismically active areas are very dangerous. This paper studies the analysis of a G+10 storey normal building and G+10 storey floating column building for external lateral forces. The main objectives of this project are, to study the behaviour of multi storey buildings with floating columns under earthquake excitations, to find whether the structure is safe or unsafe with floating column when built in seismic zone III, to find the most critical and best position of floating column in G+10 building. Floating column building with shear wall also considered for the study.*

***Key Words*: Floating column, ETABS software, Zone III, G+10 storey, Earthquake, etc...**

1. INTRODUCTION

In Modern construction technology major concern is given for architectural and other features, most of the multi storied buildings having open ground storey as an obligatory feature to afford parking area, reception lobbies and for other architectural needs. Now a days multi-storey building construction for residential, industrial or commercial purpose has become a common feature, These multi-storey building need more parking or open spaces below. This open ground storey concept leads to interruption of columns called floating columns, which makes the building lateral irresistible. This concept of floating column is driven from the architectural needs to bring out aesthetic view to building, and also to overcome FSI (Floor Space Index) restrictions. Even in commercial building there might be a need for conference hall or banquet hall on the floors below. For these purposes we prefer to have open space rather than having columns in between. In this case floating columns come into the picture. Floating columns gives the liberty to change the floor plans above. Like in any other structure, the load from the floors above is transferred to the column. The entire load is then transferred to the beam on which the floating column rest. The floating column is designed as a regular column. The beam on which the floating column rests is designed as a beam carrying all the load of the column as a single point load. This beam referred to as girder beam or transfer beam usually having big cross section with heavy steel. This girder beam is also subjected to torsion. The design and detailing of this girder beam is very crucial in the construction of floating columns buildings. During earthquakes the behaviour of a building depends critically on its overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground. The earthquake forces developed in a building need to be brought down along the height to the ground by the shortest path. Any deviation or discontinuity in this transfer load results in poor performance of the building.

1.1 Floating Column

A column is a vertical member starting from foundation level and transferring the load to the ground. The floating column is also a vertical element which (due to architectural design/ site situation) at its lower level (termination Level) rests on a beam which is a horizontal member. The beams transfer the load to other columns below it. Usually columns rest on the foundation to transfer load from slabs and beams. But the floating column rests on the beam. The floating column is designed as a regular column. The beam on which the floating column rests is designed as a beam carrying all the load of the column as a single point load.

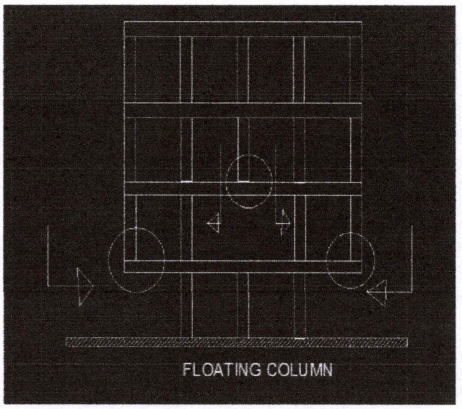

Fig -1: Floating column

Floating columns are adopted in many projects, especially above the ground floor, where transfer girders are employed, so that more open space is available in the ground floor. These open spaces may be used for assembly hall or parking purpose. The transfer girders have to be designed and detailed properly, especially in case of earthquake zones.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

Design and Analysis of a Typical Grid Fin for Aerospace Application

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Abstract *- Grid fins (or lattice fins) are a type of flight control surface used on rockets and bombs, which consist of lattice shaped structure attached together to form a fin. The major advantage of such fin is that, they can be easily assembled to the launch vehicle and can be operated for stipulated time duration whenever required. The deployment mechanism imparts more dynamic loads on to the fin and so the structural dynamics play a vital role in its design. To get maximum stability, the fin mass should be minimum as possible by the functional point of view. But the structure should withstand all the static and dynamic loads for the operation period. The lattice structure makes the structure more complex as per the realization aspects. A limit state design methodology is attempted for this Titanium grid fin structure to arrive at an optimum structural configuration. The design optimization and validation through finite element analysis is carried out using in house developed finite element FEAST (Finite Element Analysis of Structures) software by Vikram Sarabhai Space Centre (VSSC).*

Key Words: **Grid Fin, Flight control surface, Deployment mechanism, stipulated time, limit state design, methodology, optimum, finite element, FEAST software**

1.0 INTRODUCTION

The grid fin is a lattice structure. It is used to provide the stability and control of launch vehicle and missiles. Advantages of the grid fin over the conventional planar fins are higher strength to-weight ratio and lower hinge moment. Therefore it can contribute to mitigate the requirements for a control actuator of the fin. On the other hand, its higher drag is a significant disadvantage. Grid fins are widely used in Crew Escape Systems (CES) of manned space missions of many countries.

During the normal launch phase grid fins function as aero stabilizers. Then they are stowed against the cylindrical body which helps to reduce overall dimension of the vehicle and minimize aerodynamic disturbance. In case of launch abort situation for effective functioning the grid fins deploy to achieve the required static margin for the control of the crew escape systems.

In the current study, grid fin is configured with Titanium alloy. The structural design of the grid fin is carried out for the aero loads and moments. The design is validated through analysis. The FEAST software developed by VSSC is used for the analysis of grid fin. A typical grid fin configuration is shown in Figure 1.

1.1 Scope and Objectives of the Study

The main objectives and scope of the study are

- To design the Grid fin structure using Limit State Method.
- To analyze Titanium Grid fin structures of an Advance Launch Vehicle using FEAST software in house developed by VSSC.
- Design Optimization of grid fin for the different materials subjected to design constraints.

2.0 DESIGN OF GRID FIN

The Grid fin structure is designed using Limit State Method. Yield stress of Titanium is considered as 880 N/mm² and Partial safety factor of Titanium against yielding as 1.035, which is derived from tested yield and ultimate strength properties. Design forces are evaluated from the simplified beam model of the grid fin structure with assumed section dimensions. Detailed design computation for the grid fin panel sections are given in Table 1. The section requirement of each lattice panel of grid fin subjected to axial load and bending moments are calculated and the calculation of one typical panel of 8 X 150 mm cross section is shown below:

CASE 1-MAXIMUM AXIAL FORCE CONDITION

- Maximum axial force = 2486.1 N
- Bending Moment (BM1) = 523.75 Nmm
- Bending Moment (BM2) = 2370.25 Nmm
- Factored axial force (N) = 3729.15 N
- Factored Bending Moment (BM1) My = 785.62Nmm
- Factored Bending Moment (BM2) Mz = 3555.375Nmm
- Breadth = 8mm
- Depth = 150mm
- Design strength in tension (N_d) = $A_g f_y/\gamma_0$

where, A_g = gross section area of cross section
f_y = yield stress
γ_0 = partial safety factor in yielding
N_d = 8x150x880/1.035 = 1020290 N

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

PERFORMANCE AND OPTIMIZATION OF OUTRIGGER WITH BELT TRUSS SYSTEM IN MULTISTORIED BUILDING

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Abstract *- The outrigger system is one of the most common and efficient systems that can be used to improve the performance of tall buildings under wind and seismic forces. An Outrigger is a horizontal projection attached to any member and helps in increasing its stability. When the height of the structure increases, the building stiffness becomes more important and introduction of the outrigger beams between shear walls and external columns is often used to provide sufficient lateral stiffness to the structure. The objective of the study is to optimize outrigger and outrigger with belt truss system location and to access the efficiency of each outrigger used in the structure and different types of bracings adopted at optimum position. The analysis is done by considering the models of normal building, symmetric setback building and asymmetric setback building. The analysis is carried out in ETABS 16.0.2*

Key Words: Outriggers, Lateral loads, Displacement, Base Shear, Lateral Stiffness, Belt truss system.

1.INTRODUCTION

The outrigger and belt truss system acts very important role to resist the lateral loads in the structure. In this structure the external columns are tied to the central core wall with stiffened outriggers and belt truss at one or different levels. The outrigger beam and belt truss system is the lateral loads resisting system in which the central core is tied to the external columns with very stiff outriggers beam and belt truss at one or more levels. The belt truss tied the peripheral column of the building while the outriggers engage them with main core or central shear wall. The core may be centrally located with outriggers extending on both sides or it may be located on one side of the building with outriggers extending to the building columns on one side. The outrigger and belt truss system effectively control the excessive drift due to lateral load and minimize the risk of structural and non-structural damage. Outriggers are stiff elements connected to a structure core to outer columns. The outrigger with belt truss system improves the structural stiffness of building against overturning moment by developing a tension-compression couple in perimeter columns when a central core tries to bend, generating restoring moment acting on the core at the outrigger level.

The concept of the conventional outrigger is the outrigger trusses are directly connected to the shear walls or braced frames at the core of the structures. The basic principle is the same as when belt trusses are used as virtual outriggers. Some of the moment in the core is transformed into a horizontal couple and transferred to the truss chords in the floors at the top and the bottom of the diaphragm and it finally converted into vertical forces at the exterior columns. The fundamental idea behind the virtual outrigger system is to use rigid floor diaphragms, which are very stiff and stronger in their own plane, to transfer moment in the form of a horizontal couple moment from the core to trusses and trusses to exterior column. Basement walls and belt trusses are appropriate to use as virtual outriggers. The way in which overturning moment in the core is converted into a vertical couple at the exterior columns in case of conventional outrigger, rotation of the core is resisted by floor diaphragms at the top and bottom of the belt trusses; thus, part of the moment in the core is converted into a horizontal couple in the floors. The horizontal couple, transferred through two floors to the truss chords, is converted by the truss into vertical forces at the exterior columns.

2.SCOPE

The main scopes of this study are follows.

- The building models are compared by changing the soil interaction or types of soil to provide better information about the response of the system.
- The behavior of building for other types of irregular building can be studied. The base isolation or spring technique may be used with outrigger structural system.
- The behaviour of building for other types of braces can be studied

3. OBJECTIVES

The main objectives of this study are follows.

- To find out the optimum location of outrigger in normal building, symmetric setback building and asymmetric setback building.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

SEISMIC BEHAVIOUR OF MULTISTORIED BUILDING WITH OBLIQUE COLUMN AND IT'S HEIGHT OPTIMIZATION

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Abstract *- As earthquakes are one of the greatest damaging natural hazards to the building, the design and construction of tall structures which is capable of resisting the adverse effects of earth quake forces is the most important. Nowadays various construction techniques are adopted in order to increase the seismic performance of the building. Here the new method is to use the oblique columns instead of normal columns. Oblique columns are columns at an angle to the specified line. The Oblique Columns are neither parallel nor at right angles to a specified line means they are slanted or Rotated at an angle. Oblique columns are provided up to various height of the building. The analysis is carried out in ETABS16.0.2.*

Key Words: *Lateral load, Oblique column, Normal column, Earthquake force, ETABS.*

1.INTRODUCTION

The new construction method to increase the seismic performance of multi-storied buildings is the use of oblique columns instead of normal columns. Oblique column is a column which is not constructed vertical. The position, arrangement, and angle of the inclined columns are makes different types oblique columns in buildings. The angle may vary and this affects the performance of the building. It affects the lateral stiffness of the buildings. But the seismic responses may vary in each case. The seismic performance should be studied to know whether these new construction techniques adaptable or not. Because, the performance of the high-rise, mid-rise and low-rise building will be different from each other for different angles under seismic loading.

In recent years, many buildings are constructed in irregular structure system with inclined columns. It effects on the structural behaviour of the joints. The Oblique Column is the column, which neither parallel nor at right angles to a specified line means they are slanted or rotated at an angle. Since the external loads leads to shear and flexural forces on the inclined column, the performance of the building is differs from the conventional method of construction. Oblique columns are stiffer as RC frames, and therefore, the initial stiffness of the RC frames largely depends upon the stiffness of oblique column

2.SCOPE

The building models are compared by changing the soil interaction or types of soil to provide better information about the response of the system. The behavior of building for other types of irregular building can be studied

3.OBJECTIVES

- To analyze seismic performance of multi-storey symmetrical and asymmetrical structural building with oblique columns.
- To analyses seismic performance of symmetrical and asymmetrical structural building with oblique columns at various height.
- To compare the performance of multi-storey structural building with normal and oblique column.
- To optimize the height of oblique column.

4.METHODOLOGY

4.1 Modeling and model analysis

Etabs software is used for modeling and model analysis. Building configuration and loading data's for models are given. In this project the models are normal building, building symmetrical to both axis, building symmetrical to one axis and building asymmetrical to both axis. Building with oblique column up to various heights are also modeled and analyzed. Time history analysis is done

4.2 Loading consideration

- Live load : 3kN/m^2
- Floor finish : 1kN/m^2
- Seismic loading (IS : 1893 (Part I) -2002)
- Zone factor : 0.16
- Medium soil
- Response reduction factor– 3

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

Economic Evaluation and Comparison of Green Building with Conventional Building using Carbon Footprint and Embodied Energy Calculator developed using MATLAB

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Abstract- *The idea of Green architecture, also known as "Sustainable architecture" or "Green building," is the design and construction of buildings in accordance with environmentally friendly principles. Green house strives to minimize the number of resources consumed in the building's construction, use and operation, as well as lessening the harm done to the environment through the emission, pollution and waste of its components. Embodied energy is the amount of energy consumed to extract, refine, process, transport and fabricate a material or product (including buildings). It is often measured from cradle to grave. Likewise, embodied carbon footprint is the amount of carbon (CO_2 or CO_2e emission) to produce a material.*

This paper aims to develop a MATLAB program to estimate the carbon footprint and embodied energy of the building and suggest simple economical way of constructing a green home. Also, the structural stability of conventional building and green building is compared using ETABS Software.

In an effort to improve the accuracy of embodied energy and carbon footprint calculations, this paper presents a tool that estimates the total carbon footprint and embodied energy of buildings by taking into consideration various project characteristics (e.g size, location, material choices).

Key words: *Green architecture, Embodied energy, Carbon footprint, MATLAB, ETABS*

1. INTRODUCTION

Various researches prove that construction industry consumes large quantity of environmental resources and it is one of the largest polluter of the environment that is it contributes approximately 30% to total global GHG emissions. We know, every year millions of new buildings are being constructed and new construction materials are being introduced.

Now, green construction practice has gained tremendous popularity these days due to the increased population and pollution. It is the application of processes that are environmentally responsible and resource-efficient. Green building is considered as a way for the building industry to move towards protecting the environment. Main aim of this construction practice is to obtain a balance between economic, social and environmental performance in implementing construction projects.

Every building has a life time. If we consider this as a cycle, the building has its life cycle from cradle to grave. Therefore, in order to study the emissions caused from a building, a complete life cycle analysis is needed. This is an internationally standardized method. So once the carbon footprint and embodied energy of the building is known, a strategy can be developed to reduce its impact on the environment.

2. SCOPE

The scope of this paper highlights the benefits of green construction. We know, overall benefits of a green home includes energy efficiency, design flexibility, resource conservation, better indoor environmental quality etc. Also, reducing a buildings carbon footprint reduces its running cost, raises property values , improves LEED scores etc., thus the buildings become environmentally responsible, profitable and better place to live and work in.

Research on green building design and materials is already firmly established. There are many global platforms that discusses on environmental protection which aims to create a better earth. Green buildings when compared to conventional buildings are same in building use but differ in operational savings and takes into account for human comfort, indoor quality and environment and also enjoys the benefit of saving energy.

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

ALUM SLUDGE - A PARTIAL REPLACEMENT TO CEMENT IN CONCRETE

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Abstract - *A method to use sludge waste from water treatment plant and to reduce the environmental pollution by it has initiated the studies on possibility of integrating this waste in concrete production. The aim of this research work is to use alum sludge powder as a partial replacement of cement in concrete. In this research study an experimental investigation was conducted on varying percentages of (0%, 5%, 10%, 15%, and 20%) alum sludge powder as cement replacement for M20 grade of concrete to produce alum sludge concrete. Different tests were conducted to find the properties of materials used in concrete. Properties of concrete were obtained by strength test and durability test. The optimum percentage of replacement of alum sludge powder as cement in M20 grade of concrete was obtained as 15%. The results of the research work show that alum sludge powder is an effective alternative for partial replacement of cement in concrete, which also results in a good method of using this waste material in concrete.*

Key Words: **Concrete, Alum sludge, Strength test, Durability.**

1. INTRODUCTION

Among all other materials, concrete is the most widely used in construction industry. From a small residential building to large infrastructure projects like dams, tunnels, multi storey buildings etc, concrete is being used. Being a multipurpose material, it is difficult to replace concrete with other construction materials. The main ingredients used for concrete production are cement, fine aggregates, coarse aggregates and water. Each and every material in concrete has its important role in overall performance of concrete. During the production of cement, our natural resources are being consumed and CO_2 is emitted in to the atmosphere. The heat of hydration also leads to increase in temperature of environment and this heat is also responsible for cracks in a structure after hardening of concrete. So there is a need to find some alternative material to reduce the production of cement and its use in concrete.

The sludge generated in water treatment plants consists of organic and inorganic compounds in solid, liquid, and gaseous states, and varies in terms of physical, chemical, and biologic characteristics. The remaining volumes that are wasted depend on the characteristics of the operational units involved and the quality of the raw water. Several chemicals have been used for water treatment, some of them include aluminum salts ($Al_2(SO_4)_3.18H_2O$), ferric ion salts (such as $FeCl_3.6H_2O$), and ferrous iron salts (such as $FeCl_2$, $FeSO_4.7H_2O$). The addition of these chemical substances during water treatment may result in iron- or aluminum-rich sludge. These salts may be present in high concentrations that can be toxic to aquatic biota. To avoid this toxicity, the salts should be properly treated before disposal. Sludge from water treatment plants may also contain other heavy metals from raw water or from contaminants resulting from the addition of coagulants. All the chemicals mentioned above are harmful to the environment if it is not properly disposed. So using the sludge waste as a partial replacement for cement in concrete is a good idea for reusing the waste material.

In this research work alum sludge powder was used as a partial replacement for cement in concrete. Alum sludge (AS) is actually a by-product of water treatment plants that use aluminum salts as a primary coagulant, and is the most widely generated water treatment residual/sludge worldwide. It usually contains colloidal alum hydroxides which are often amorphous species. Aluminum sulfate ($Al_2SO_4.18H_2O$) is the most commonly used coagulant in drinking water treatment plants and as a result, tons of aluminum hydroxide containing sludge is unsafely disposed into the open environment daily. Alum sludge as waste materials are commonly sent to landfill.

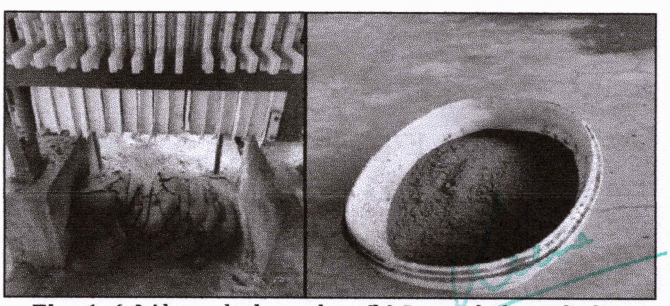

Fig -1: (a)Alum sludge cakes (b)Ground alum sludge

International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

CYCLIC ANALYSIS AND BENDING PERFORMANCE OF SPLICE CONNECTION ASSEMBLY OF FRP COLUMNS IN MODULAR BUILDINGS

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Abstract *Extensive research has been carried out in recent years on the use of fibre-reinforced polymer (FRP) composites in the rehabilitation and strengthening of existing structures. This paper provides a concise review of Investigation on the bending performance of splice connection for modular buildings. Tubular FRP members having shapes square, hexagon and rectangle are considered. The aspect ratio of splicing having bond length 170mm, 150 mm and 190 mm has been investigated. Also investigation has been carried on the splice connection FRP column assembly under axial loading and eccentric loading and pushover analysis of FRP column assembly under full scale frame. The results also show that splice connection of tubular FRP member under axial loading and eccentric loading shows more moment capacity and strength*

Key Words: Fiber reinforced polymer (FRP); Tubular section member; Splice connection; Bolted flange joint; bonded sleeve joint; Ductilitys ; ANSYS WORKBENCH 19.0

1. INTRODUCTION

The past two decades have seen increasing application of fiber reinforced polymer (FRP) composites in civil engineering structures. The use of fibre-reinforced polymer (FRP) composites for strengthening reinforced concrete (RC) structures was first investigated as an alternative to steel plate bonding for beam strengthening at the Swiss Federal Laboratory for Materials Testing and Research (EMPA). These lightweight and corrosion-proof materials have gained recognition worldwide through applications in the rehabilitation and strengthening of existing structures. Due to the moderate cost of glass fibers and advances in the pultrusion manufacturing technique , FRP composites also have great potential as load-bearing members in new construction. Examples include bridge decks, beams, columns, and floor systems.

Connection designs for these members should consider the brittle and anisotropic nature of FRP materials provided major references for FRP composite connections, primarily for plates and I- section members. Additional studies may be needed for tubular section members which have the added advantage of efficient resistance against torsional and global buckling. Various types of bolted connections have been developed and compared for FRP beam-to-column assemblies with tubular sections. In a recent study, full adhesive FRP beam-column connections were shown to be more advantageous in stiffness and moment capacity than bolted connections. Splice connections consists of a steel bolted flange joint between two tubular steel-FRP bonded sleeve joints. These splice connection to be more advantageous in stiffness and moment capacity than bolted connections. This bonded sleeve connection was later adapted for all FRP beam-to-column assemblies and evaluated under static and cyclic loadings. The steel-FRP bonded sleeve joint (BSJ) can be adapted to provide a splicing solution that is needed to apply tubular section FRP members in building structures and in long-span scenarios.

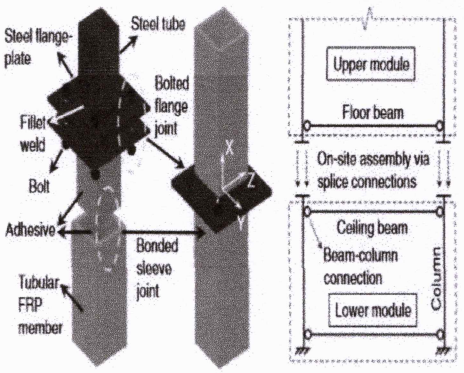

Fig 1.1: schematic representation of splice connection

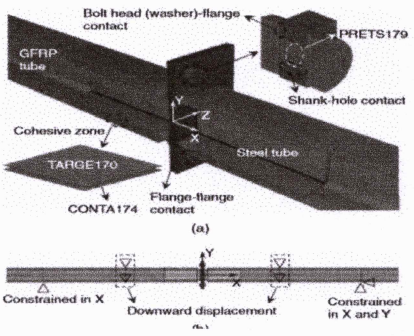

fig 1.2 : diagramatic representation of splice connection

2. SCOPE

The scope of this paper highlights the benefits of splice connection in modular buildings. We know, overall benefits of a fiber reinforced polymer includes high strength and stiffness, reduced mass, low thermal conductivity, high corrosion and weather resistance, durability, but also the

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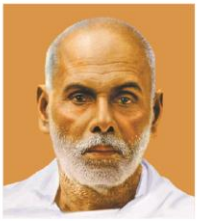

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2018-19

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Experimental Investigation on Use of Cockle Shell as Partial Coarse Aggregate Replacement in Concrete

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Abstract— *Preserving natural coarse aggregate for future generation and reducing cockle shell waste has initiated studies on possibility of integrating this waste in concrete production. The main of this research work is to encourage the use of waste products such as cockle shell construction materials in low-cost building. In this research study an experimental investigation was conducted on varying percentages of (0%, 7%, 14%, 21%, and 28%) cockle shell as coarse aggregate replacement for M20 grade of concrete to produce an environment friendly concrete. Tests were conducted to analyse the properties of materials used in concrete. Properties of fresh and hardened concrete were obtained by workability test, strength test, durability test and non-destructive test (NDT). The optimum percentage of replacement of cockle shell as coarse aggregate in M20 grade of concrete was obtained as 21%. The results of the research work show that cockle shell is an effective alternative for partial replacement of coarse aggregate in concrete, which may produce workable and eco-friendly concrete with high strength on optimum percentage of replacement.*

Keywords— *Concrete, Cockleshell, Strength test, Workability, Durability, Non destructive test.*

I. INTRODUCTION

The increase in construction works in the country has increased demand for the construction materials. The insufficiency of the conventional construction materials such as granites, sand, cement etc increases the demand of these construction materials. This increases cost of constructions such as buildings, roads, pavements etc. It is very necessary to make meaningful efforts to save the nation from the housing problem. Scientists, engineers and technologists are continuously are searching for the materials, which can act as substitute for conventional materials in concrete and possess the required properties leads to reduction in the cost of construction.

The growing construction industry had caused the destruction of natural aggregates. The natural sources of aggregates will soon decrease. Aggregates are obtained from two primary sources, viz. quarries and river beds. Environmental issues occur when there is extraction of sand and gravel. The aggregate extraction and processing are the principal causes of environmental problems.

The need for replacement of natural aggregates is a growing requirement to meet the demand for aggregates in concrete. Recent studies aim on the locally available waste to be used as aggregates instead of natural aggregate materials. Such a waste is the seashells obtained from coastal areas, freshwater lakes and riverine areas. Recent investigation of sea shells has indicated greater scope for their utilization as a replacement to cement and aggregate in concrete. Cockleshell is a hard, protective layer, a calcareous exoskeleton which supports and protects the soft parts of an animal. As they grow old, the shells increase in size which becomes a strong compact casing for the mollusc inside. The hard shells are regarded as waste material, which are accumulated in many parts of the country, when dumped and left untreated may cause unpleasant smell .Cockle shell as one of the mixing ingredient in concrete production thus opening a new innovation in concrete research and at the same time offering. Therefore cockle shells are a viable option as partial replacement to coarse aggregate because they contain a large amount of calcium carbonate. Also the calcium carbonate can help improve resistance against heat and chemicals. Cockle shell obtained from dumbing site are washed and cleaned before use as shown in fig. 1. The partial replacement of coarse aggregate with cockle in concrete mix potentially reduces the cost of constructions and makes the concrete industry more environmentally sustainable.

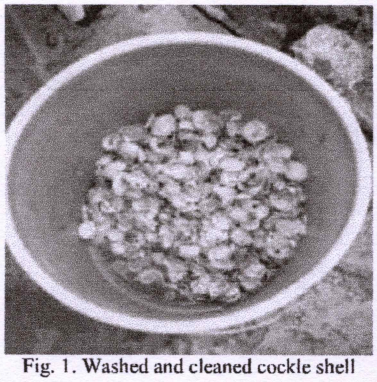

Fig. 1. Washed and cleaned cockle shell

II. OBJECTIVES AND SCOPE OF STUDY

The main objectives of this research work are listed below

- To evaluate the possibility of reducing the quantity of natural coarse aggregate in concrete by partial replacement of coarse aggregate with cockle shell.

Raseela M K P and B. Mary Sonia George, "Experimental Investigation on Use of Cockle Shell as Partial Coarse Aggregate Replacement in Concrete," *International Research Journal of Advanced Engineering and Science*, Volume 4, Issue 2, pp. 504-510, 2019.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Analytical Study on Thermal Behaviour of RC Beam Retrofitted with Rubberised Concrete and GFRP using Ansys Workbench

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Abstract— *Strengthening of existing damaged structures is one of the ongoing studies in civil engineering. The purpose of retrofitting is to structurally study the member with an aim to restore the structure to its original strength. The focus of this study is the retrofitting of a partially damaged RC beam. The damage may be due to physical damage, chemical attack, structural movement and material degradation on exposure to severe environment conditions. In this study RC beam of M25 grade concrete and Fe 415 grade steel is retrofitted with rubberized concrete and GFRP (Glass Fiber Reinforced Polymer) sheet. ANSYS Workbench software is used for this study. A fire damaged reinforced concrete beam will lose its strength and may not satisfy the load bearing capacity and serviceability conditions. Also it is necessary to study the effect of high temperature on concrete structure to understand its behaviour and reduce the losses due to fire hazards. In this study, structural and thermal analysis is conducted for the retrofitted beam. The retrofitting materials selected for the study are rubberized concrete and the GFRP. These materials have good strength and thermal resistance. The analysis is carried out in ANSYS Workbench software.*

Keywords— *Retrofitting, Rubberised concrete, GFRP, ANSYS Workbench.*

I. INTRODUCTION

Failure of a civil structure refers to the loss of structural integrity due to loss of the load-carrying capacity. In a well-designed system, a localized failure should not cause immediate or even progressive collapse of the entire structure for any kind of loading. Various factors affect the deterioration of a structural member. Apart from structural deterioration due to ageing, errors made during design, construction phase and increased load, all contribute to the deficient behavior of structures. In recent years, lot of research was focused on strengthening of under-designed and deficient RC structures. The useful application of waste materials such as scrap tires within the construction industry allow for their use as a resource material thus solving disposal problems. Many studies have been conducted on rubberised concrete containing crumb rubber as a replacement of fine aggregate at different percentages. The findings of these studies indicated that although the compressive and flexural strength of the rubberized concrete decreased as the percentage of fine aggregate replacement increased.

Conventional materials for strengthening include Fiber Reinforced Polymer, Ferrocement, High Strength Fiber Reinforced Concrete, Steel plate bonding etc. Apart from low maintenance cost and improvement in the service life of buildings, Fibre Reinforced polymer (FRP) wrapping has several benefits like high strength, light weight, resistance to corrosion, low cost, and versatility. Also the interaction between concrete and fiber will increase the concrete strength and ultimate strain. FRP are composite materials made up of fibers and polymer matrix. FRP are of different types such as GFRP, CFRP, and AFRP. FRP materials are widely used in construction of bridges and aerospace industries.

Although reinforced concrete structures are extensively used due to their thermal resistance, deterioration after exposure to fire include a loss in strength and elastic modulus, cracking, and spalling of the concrete. The performance of structures during a fire has been studied by researchers using material experiments, structural tests and finite element (FE) analyses. The material properties, such as specific heat, conductivity, density and thermal expansion of concrete have been studied under high temperatures. The rubberised concrete and the GFRP have the thermal insulating property.

Rubberisd concrete is a type of concrete in which fine aggregate or coarse aggregate is replaced with tyre rubber particles. Chipped rubber is used for replacing coarse aggregate and crumb rubber is used for fine aggregate. In this study, the rubberised concrete with 10% of crumb rubber is used for the retrofitting of the beam.

Fiber Reinforced Polymer is a composite material made up of a polymer matrix reinforced with fibers. The usually used fibers are glass, carbon, aramid, or basalt. Rarely, other fibers like paper, wood, or asbestos have been used. The polymers usually used are epoxy, vinylester or polyester thermosetting plastic, though phenol formaldehyde resins are still in use. In this study glass fiber reinforced polymer is used for the retrofitting of beam.

II. SCOPE AND OBJECTIVES OF THE STUDY

The rubberised concrete and the GFRP have the thermal insulating property. Retrofitting of RC beam using rubberised concrete and GFRP sheets. Strengthening and fire resistance

Manju P and Saritha Sasindran, "Analytical Study on Thermal Behaviour of RC Beam Retrofitted with Rubberised Concrete and GFRP using Ansys Workbench," *International Research Journal of Advanced Engineering and Science*, Volume 4, Issue 2, pp. 498-501, 2019.