

Analysis or Design of Composite Column by Using Etabs Software

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Abstract

As the world business enlarging day by day, and designing of the buildings are getting complex and demanding more technology to enhance its stability, performances, cost, duration and its uniqueness of designing. At the later part of development in civil engineer majority of the work was transformed from conventional system to a well organized and computerized system, most of the time the company employees and owners were in live risk, due to non availability of technology. As time goes technology develops, having this in mind we had also suggested using Etabs software in our design. Etabs is a 3D analysis and designing of the buildings, it is engineering software which is used in construction and designing or analysis of complex multi stored buildings. Composite column is actually the amalgamation of two traditionally methodologies structure steel and structure concrete, their design could be based on concrete or steel methodology. Any method can be used to develop composite column approach. Composite columns are designed by applying different components of structure steel and concrete in according to use the advantages and property of each material. The outer and inner behavior of the concrete and structural steel ingredients make the Composite column is very unbending, enough squashy, cost effective and generally makes it efficient partner of the building and bride constructions. Normally three kinds of composite column sections are using in high risky building construction. The building was analyzed by using Etabs and designed according to the needed requirement. Composite

column technology for construction of building is now a day's very popular and has more advantages over the conventional designing of buildings, currently we see tall buildings with great advantages such as less space more accommodation, parking, and many more, these all can only be achieved if we implement the concept and idea of composite construction. This is why composite construction is so good; the one line reason behind this is that it combines both steel and concrete into one unit. By combining these materials can strengthen and provide best result in extremely enough and light weight design. Composite by column can also save our time and we can construction the complex buildings in short term. One of the biggest achievement if is done in construction by composite column is the cost reduction, because most of the constructions companies are being lost and dropped its position due to non profitability.

Keywords

Etabs Software, Composite Column, Encased Steel, Construction.

Introduction

Composite column construction is getting popular day by day, due its outstanding benefits and cost reductions, furthermore slender floor depth and fast construction. In early 1900's, concrete was used to enclose steel columns and beams, and as a filler material for floor systems. In 1907, the first experimental test was carried out by (Emperger) on built up composite columns under concentric load. We had applied the composite construction idea in constructing (Jawad Tower in Peshawar). The building was first designed by using the software Etabs and then that model was constructed by using the concepts of composite column design. The most essential and much repeatedly encountered merging of construction materials is steel and concrete, with its usages in multistory, bridges, and commercial buildings. These important distinguish material are totally well-matched and complementary to each other. They have nearly the similar thermal expansion, it should be added that the combination of concrete cores, steel frame and composite floor construction has become the standard construction method for multistory commercial buildings in several countries (Jery, 2002). Composite construction had become the international standard construction method in different countries in short period of time, because of its brilliant benefits. Enough progress has been done, in Japan composite construction has become the standard system for all tall buildings. It is the most acceptable system to resist in earthquake ladings. Most of the countries are willing to use the composite construction; the method is yet to become the most popular. The present paper is concerned with composite column weather steel or concrete a column and building frame which contains composite column or steel beams (Benery, 2009). The

software used in this design is Etabs software, which is made for 3D looks of buildings. Most of the times people refer to used Etabs software due to its outstanding results.

Analysis of Composite Column

Composite column is actually the merger of two conventional methodologies structure steel and structure concrete, in more simple term, it is the combination of steel and concrete and their design could be based on concrete or steel methodology. Any method can be used to develop composite column approach. Composite columns are designed by applying different components of structure steel and concrete in according to use the advantages and property of each material (Jefty, 2010). The outer and inner behavior of the concrete and structural steel ingredients make the Composite column is very unbending, enough squashy, cost effective and generally makes it efficient partner of the building and bridge constructions. As far the world construction is concerned composite column construction had brought enough revolution in the field of construction, as being said demands are vast and designing is shuffle due to modernization of construction, the conventional way of designing is totally failed to face these challenges, despite that composite column made all the wishing of design possible by using simple and attractive techniques.

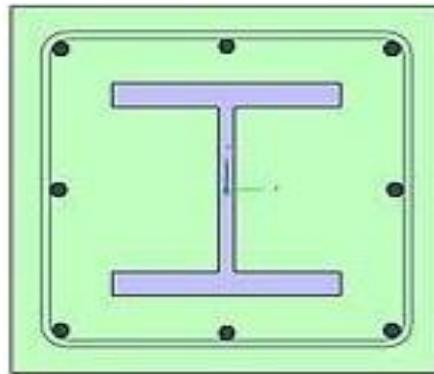


Figure 1 Composite column

Benefits of Composite Columns

- To enlarge the accessible workable floor space area for the given power.
- It has outstanding corrosion and fire resistance where in the concrete rigid columns.
- By using composite column, it has enormous advantages for economical purposes over the conventionally used structural steel or reinforced concrete.
- Due to constant outer dimensions architecture becomes easier over a number of floors.

- No requirement of extra reinforcement steel in composite columns, for large constructions, such as industrial, workshops, and bridge.

Kinds of Composite Columns

Concrete Filled Steel Tube

Concrete filled steel tube (CFST) is an important for use as personage sector of elements. CFST are the composition members which containing steel tube unfilled with concrete. In present international exercises, CFST columns are being given priority to be used in the main imaginative resistance systems for both types unbraced and braced building structures (Menry, 2003). CFST is suggested to be used in areas where there are more chances of earthquake and the land is naturally weak in terms of constructions.

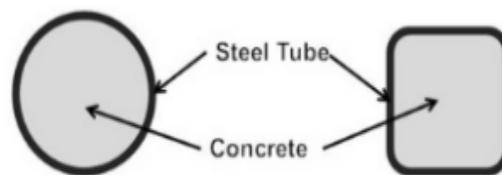


Figure 2 Concrete filled steel tube

Advantages of Using Concrete Filled Steel Tube (CFST)

Concrete filled steel tube has many advantages as compare to reinforced concrete system or ordinary system.

- The incidence of the local resist of the steel tube is deferred and the power of worsening after the confined bucking is restrained.
- The power of concrete is enlarged because of the confining consequence provided by the steel tube; similarly the potency worsening is not so complex since the Spalding created is being prohibited by the tube.
- Creep of concrete and drying shrinking are quite smaller then the ordinary reinforced concrete.
- The use of concrete-filled tubular columns gives a great benefit saving by growing the region of the floor by way of a discount within the necessary cross-section dimension.
- This is very critical when constructing high-rise towers in cities where the appeal of letting areas is extremely high.
- Concrete, packed tubular columns in two orthogonal directions will offer excellent monotonic and seismic resistance.

Concrete Encased Steel (CES)

The use of concrete encased steel has been increased significantly for both normal buildings and higher buildings, it has the stiffness and rigidity of the concrete not only this but also has the strength and ductility of steel selections (Deny, 2001). It also minimize the cross sectional magnitude which in return makes it more simple and easy to rigid. Composite columns can be categorized in to hollow sections and filled with concrete or steel sections sheathed in concrete.

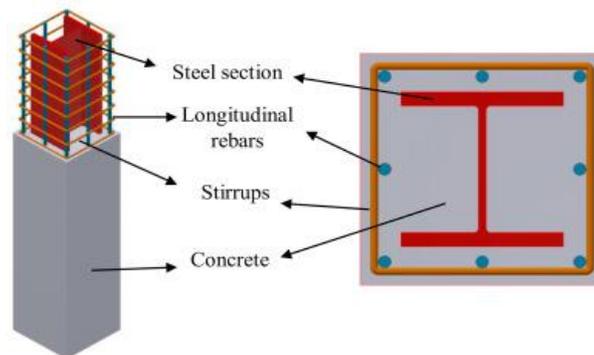


Figure 3 Concrete encased steel

Components Analysis of Composite Column Structure

Following are the components which can be used in composite column constructions.

Composite Slab

A composite slab is actually a slab in which steel sheets are associated towards the composite beam with the support of shear connectors. At the beginning steel sheets roles as a permanent shutter and also plays role as bottom reinforcement for steel decorate slab but later it is connected with unsentimental concrete.

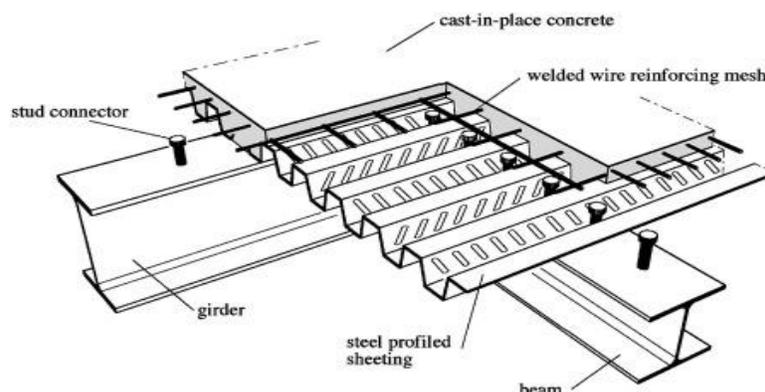


Figure 4 Composite slab

Shear Connector

Shear connectors are actually the connectors that are used to connect concrete and structural steel. It also gives the enough power and stiffness to the composite members. World widely used form of shear connector is called headed stud or shear stud. There are others type's of shear connectors are hoop and block and channel connectors. Channel, block and hoop connectors are generally used where larger shear transfers are needed as substitute to closely spaced shear studs.

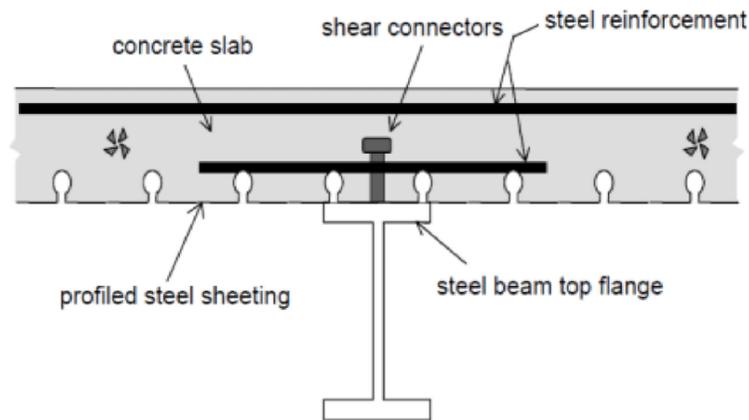


Figure 5 Shear connector

Advantages Shear Connector

- Welding and installation procedure is sharp and easy.
- Gives less obstruction to the slab reinforcement.
- Permits more satisfaction compaction of the concrete surrounding the connectors.
- It supplies similar shear power in all dimensions.

Composite Beam

A composite beam is normally a steel beam or could be partially encased beam, which is normally subjected to bending and it helps the composite deck slab. It is also a structural partner which is composed of two or more distinguish materials joint together as act of unit. There are different types of composite beam such as steel-wood, wood-concrete and also plastic-concrete. The main advantage of composite beam is that first it rigid the joining parts together, as a result the system is enough stronger then the individuals ones as before. Composite beam is one of the most popular and economical composite structure systems which can be used for both multistory steel buildings and steel bridges.

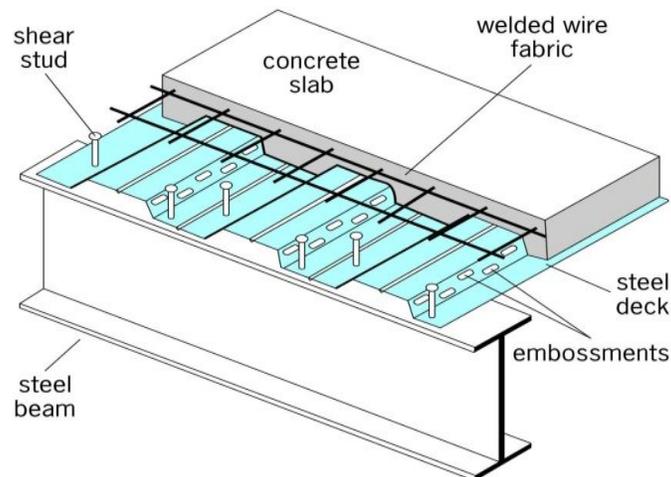


Figure 6 Composite beam

Objective

The main objectives of this research has been modified as followings

- To carry out dynamically analysis of multistory buildings which are having the concept of composite column for distinguish seismic areas in the city.
- To test and justify the characteristics of composite column under the seismic situation.
- To compare the behavior of different buildings using the concept of RCC columns and also composite columns.
- To identify which type of column returns the outstanding results.

3D Designing of Buildings with Etabs Software

Etabs-Extended 3D analysis of Building Systems”, it is application software which is used in civil engineering for 3D modeling of the buildings. It has preferred as an efficient structural analysis and designing applications such as multi story buildings. It is opening with an integrated environment which has all the modeling tools and templates, all sort of designing and modeling of buildings can be easy drawn in Etabs software, it is the advanced technology in the construction section. Etabs can be used for complex and large buildings and can handle its modeling and configurations. Etabs software has the following impacts on constructions.

- It analysis and checks the load bearing capability of the building design.
- It provides great accuracy and easy access for modification and changes according to the requirement.

- It provides fast and necessary information about the projects and saves the times as well as prevents the cost too.
- Etabs software provides the best and accurate numerical result by which future decisions can be taken easy.

Methodology

As we have discussed that composite column has enormous advantages over conventional construction, but it needs a systemic and well organized methodology for its clear confirmation. Thus we had planned a team survey of the engineers to visit different constructor companies who are designing multi story buildings in Pakistan; the team survey of engineers was carried out with the purpose to clearly state how effective composite construction is. According to the team survey of engineers different sort of questions were asked from the different members to access the future of composite construction. According to the team survey distinguish buildings were visited and meaningful information were collected, which can analysis and illustrates the functionality of composite column construction. During the survey the comparison task was also carried out, that how conventional construction is different from composite construction. According to the team survey of engineers 300 construction companies were visited. The survey states among 300 companies 240 were agreed and had intended to implement the idea of composite construction in their future constructions. 60 companies were not interested and they were willing to continue with the normal and conventional way of designing. The main objective of the survey was to motivate and convince the constructors to fully implement the idea of composite construction, because it has enough advantages over the rest of construction methodologies, such as fast development, less expensive, accurate, and sustainable. According to the survey composite construction is extremely important in such zones where there is always a change of earthquake, and the areas which are near to the mountains. We have thoroughly studied the content of analysis of the related activities to implement the concept and principles of composite construction in companies located in Pakistan, Peshawar, Karachi, and Lahore. The pillar objective of survey is to show relationship between the implementation of composite construction and the competitive position in the business marketing. This was leaded by factor analysis that supported us to choose the main factories since we worked with a great deal of data. The survey was carried out in **15 April 2020 to 20 September 2020**; the anthology of question answer session was the source of primary data. Mainly for the reason which is significant that construction sector does pay a lot to the GDP of Pakistan, as having the idea of composite construction which is based on fast development, hence will proved health GDP to treasury of Pakistan.

Result

After the deepest study and research, we have reached out to the result of composite construction. Composite construction had brought a huge revolution in construction environment, as well as in Construction Company, the implementation of composite construction had totally changed the environment of the company, we have also concluded that composite construction does influence upon the strategy of the company. According to the survey little idea of the people was concerned with composite construction, the survey also clarified that composite construction has more reliability than the conventional ones. In survey we had visited 300 companies, and also 2500 members of the different companies were involved, having distinguished seat positions. Among 2500 members 1500 were concerned and had the knowledge of composite column construction and relying on its advantages. During the survey two types of buildings were tested one which was based on composite construction ideology and other one was based on conventional methodology, interesting thing to be noticed both buildings were constructed on the same time, but one which was uncomposed was totally damaged but the composed one still able for living.

The main objective of the survey was to motivate and convinced the owners of construction companies to implement the idea of composite construction. Experimental work as also done during the survey by using different material as a unit and also used as an individual to illustrate the differences, The stiffness and rigid was also tested and had proved positively. The research states composite construction is the key selection in such areas where earthquake chances are more. Below table shows some of the characteristics of composite construction.

Table 1 Similarly Concrete filled steel tube was also used to make more strength to life of building

Building type	Stability	Performances	Cost	Duration	Designing
Single story buildings	better	Excellent	Less	Fast	Excellent
Multi-story buildings	Good	Best	less	Fast	Best
Complex buildings	Good	Better	Less	Fast	Nice
Living houses	Best	Excellent	Less	Fast	Good
Commercial buildings	Excellent	Excellent	Less	Fast	Excellent

We had analysis the behavior of steel and concrete and its combination which really helps to build tall and complex buildings. During the survey we had compared the conventional construction with composite construction and huge distinguish was calculated based on the survey.

<p>Composite beam</p>		<p>Bare steel beam</p>	
Load resistances	100 %	100 %	100 %
Steel weight	100 %	160 %	215 %
Overall height	100 %	130 %	95 %
Stiffness	t_o - 100 % $t_{o\sigma}$ 70 %	70 %	45 %

Figure 7 Comparison of composite construction vs conventional construction

As being said, in the process we used Etabs software. It is one of the most prominent and reliable software for all civil engineering activities. Not only can this Etabs software do but also the usable procedure to analysis the 3D modeling of buildings. According to research facts Etabs software gives enough knowledge to the civil engineers.

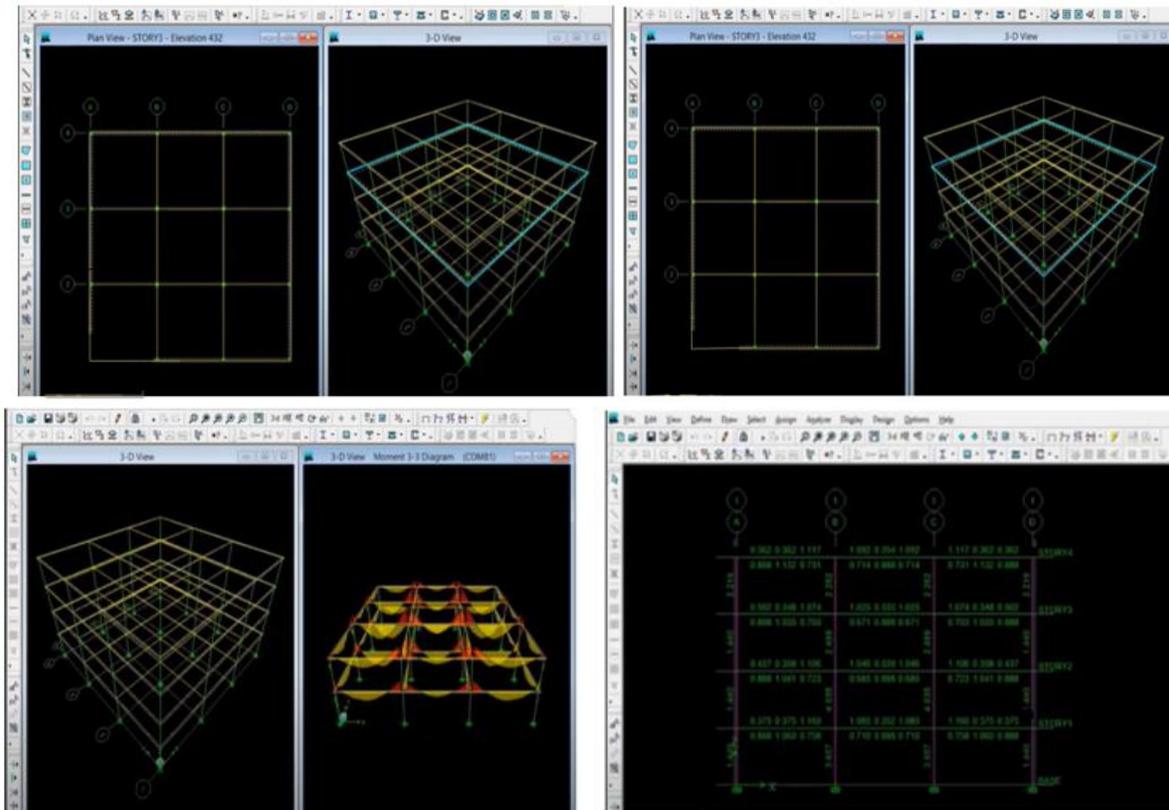


Figure 8 Etabs 3D design of building

Challenges for Composite Column

- As composite construction the process of joining distinguish parts into one unit, thus the joining process is very difficult and congested.
- Analysis and understanding of composite construction is difficult.
- To reuse and disposal the material might be tough process.
- Transverse property might be poor.
- Curing takes time.

Conclusion

To sum off all the perspectives of composite column construction, we had reached out to say statistically that composite construction has enough advantages over the conventional ones, furthermore composite construction is key to challenges the complexity and uniqueness of designing. Composite construction is the process of combining both steel and concrete into one unit, due to strengthen its performances. Composite column process in this paper is done by using the one of most valuable and usable software called Etabs. We had constructed the Jawad tower in Peshawar, but before implementing the real work we had developed a design by using Etabs software, and that design was transformed to real work. The advantage of this work is simplicity and feasibility to access all the angles of the building (Mondary, 2013). The depth analysis of composite Coolum construction illustrates that future of the construction is totally relaying on technology based designing. Composite column technology for construction of building is now a day's very popular and has more advantages over the conventional designing of buildings, currently we see tall buildings with great advantages such as less space more accommodation, parking, and many more, these all can only be achieved if we implement the concept and idea of composite construction. It is the most acceptable system to resist in earthquake ladings. Most of the countries are willing to use the composite construction; the method is yet to become the most popular. The present paper is concerned with composite column weather steel or concrete a column and building frame which contains composite column or steel beams. As far the world construction is concerned composite column construction had brought enough revolution in the field of construction, as being said demands are vast and designing is shuffle due to modernization of construction, the conventional way of designing is totally failed to face these challenges, despite that composite column made all the wishing of design possible by applying simple and astonishing techniques. Superior firm performances cab be achieved by promoting and keeping competitive advantages, it is partly related to the structural characteristics such type as market power, attention to workers requirements and delivering trusted services to the customers. The successful

company which is based on composite construction and is always in mood to complete all the needs and desires of its customers through its remarkable services, during the survey we had compared composite construction with others and enormous differentiation was resulted, which indicates that composite column has a role to play in the future for all sort of buildings designing.

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