A REVIEW ON BUILDING BY MANUALLY METHOD AND SOFTWEAR

Mr. Rakesh Ramesh Mahato, Mr. Shubham Manohar Sathwane, Mr. Shubham Satishrao Kene, Mr. Anuj Ajay Jain, Mr. Piyush Suresh Titarmare, Prof. Ashtashil Bhambulkar

Final Year Student, Civil Engineering department, SCET, Nagpur
Prof. Civil Engineering department, SCET, Nagpur

Abstract Structural design is the primary aspect of civil engineering. The foremost basic in structural engineering is the design of simple basic components and members of a building viz., Slabs, Beams, Columns and Footings. In order to design them, it is important to first obtain the plan of the particular building. Thereby depending on the suitability; plan layout of beams and the position of columns are fixed. Thereafter, the vertical loads are calculated namely the dead load and live load.

Index Terms- Buildings, Softwear Analysis, Manual Analysis.

I. INTRODUCTION

A structure refers to a system of two or more connected parts use to support a load. It is an assemblage of two or more basic components connected to each other so that they serve the user and carry the loads developing due to the self and super-imposed loads safely without causing any serviceability failure. Once a preliminary design of a structure is fixed, the structure then must be analyzed to make sure that it has its required strength and rigidity. To analyze a structure a structure correctly, certain idealizations are to be made as to how the members are supported and connected together. The loadings are supposed to be taken from respective design codes and local specifications, if any. The forces in the members and the displacements of the joints are found using the theory of structural analysis. The whole structural system and its loading conditions might be of complex nature so to make the analysis simpler, we use certain simplifying assumptions related to the quality of material, member geometry, nature of applied loads, their distribution, the type of connections at the joints and the support conditions. This shall help making the process of structural analysis simpler to quite an extent.

When the number of unknown reactions or the number of internal forces exceeds the number of equilibrium equations available for the purpose of analysis, the structure is called as a *statically indeterminate structure*. Most of the structures designed today are statically indeterminate. This indeterminacy may develop as a result of added supports or extra members, or by the general form of the structure. While analyzing any indeterminate structure, it is essential to satisfy equilibrium, compatibility, and force-displacement requisites for the structure. When the reactive forces hold the structure at rest, equilibrium is satisfied and compatibility is said to be satisfied when various segments of a structure fit together without intentional breaks or overlaps. Two fundamental methods to analyze the statically indeterminate structures are discussed below.

Originally developed by James Clerk Maxwell in 1864, later developed by Otto Mohr and Heinrich Muller-Breslau, the force method was one of the first methods available for analysis of statically indeterminate structures. As compatibility is the basis for this method, it is sometimes also called as *compatibility method* or the *method of consistent displacements.* In this method, equations are formed that satisfy the compatibility and force- displacement requirements for the given structure in order to determine the redundant forces. Once these forces are determined, the remaining reactive forces on the given structure are found out by satisfying the equilibrium requirements.

II. LITERATURE REVIEW

Charles H.Henage (1976) developed an analytical method based on ultimate strength approach, which has taken into account of bond stress, fibres stress and volume fraction of fibres. After his investigations, he concluded that the incorporation of steel fibres significantly increases the ultimate flexural strength, reduces crack widths and first crack occurred at higher loads.

Shah and Naaman (1976) had conducted tensile flexural and compressive tests on mortar specimens reinforced with different lengths -*and volumes of steel and glass fibres. The flexural tensile strength of the reinforced samples was 2 to 3 times that of plain mortar while corresponding strains or deflections were as much as ten times that of mortar. The stresses and strains at first cracking were not notably diverse from those of plain mortar. The values of the modulus of elasticity and the extent of nonlinearity were observed to depend on the method of deformation measurement. Extensive micro cracking was observed on the surfaces of failed flexural specimens indicating a significant contribution of the matrix even after the first cracking. For steel fibre reinforced specimens, the peak loads and deformations appear to be linearly related to the fibre parameter Vf*L/D. After breakdown, steel fibres pulled out while a large amount of the glass fibres broke.

Naaman and Shah (1976) reported that for a large number of fibres, the fibre contribution depends significantly on the capacity of the matrix to withstand the forces enclosed by the fibres bridging the cracked surfaces. They observed that spalling and disruption of the mortar matrix leads to a substantial of the steel fibres in concrete matrices necessary to increase both the bond properties of the fibre and the matrix.

Hughes and Fattuhi (1976) carried out experimental investigations on the workability of fresh fibrous concrete. They concluded that the workability depends upon the properties and proportions of the ingredients and also the workability decreases with increase in sand content, volume fraction of fibres, aspect ratio, and length of the fibres and with lesser water/cement ratio.

Krishna Raju et al. (1977) after conducting experimental investigation on the compressive strength and bearing strength of steel fibre reinforced concrete with fibre content varying from to 0% to 3%, they concluded that, both compressing and bearing strength increases with increase in fibre content. Also the experimental results were predicted by theoretical method.

Kormeling, Reinhardt and Shah (1980) after carrying out investigations on the influence of using steel fibres on the static and dynamic strength of RCC beams using hooked straight and raddled fibres, they concluded that incorporation of above type of fibres increased the ultimate moment and reduces the crack width and average crack spacing.

Ramakrishnan et al. (1980) carried out experimental investigations on properties of concrete like, flexural fatigue, static flexural strength, deflection, modulus of rupture, load deflection curves, impact strength to first crack, ultimate tensile, compressive strength, plastic workability including vee-bee, slump and inverted cone time by reinforcing two types of steel fibres (straight and fibre with deformed ends) in the concrete. From the investigations, they concluded that no balling of fibres occurred in the cone of hooked fibres, the compressive strength is slight higher than the normal
concrete, excellent anchorage by hooked fibres resulting in ultimate flexural strength. Also the hooked end fibres have greater ability to absorb impact than straight fibre reinforced concrete.

Kukreja, C.B. et al. (1980) carried out experimental investigations on the direct tensile strength, indirect tensile strength and flexural tensile strength of the fibrous concrete and compared with the various aspect ratios of the fibres as 100, 80 and 60 respectively. They observed that maximum increase in direct tensile strength obtained by fibres of aspect ratio 80 with 1% as volume fraction. Finally they concluded that indirect tensile cracking stress is an inverse function of fibre spacing and fibre reinforcement is more effective in improving the post cracking behaviors, than the first cracking.

Narayanan and Palanjian (1982) carried out experimental investigation on the properties of fresh concrete like workability in terms of vee-bee time by incorporative crimped steel fibres of circular cross-section. They concluded that vee-bee time increases when the aspect ratio (l/b) of fibres is increased. Balling would occur with smaller fibre content of larger aspect ratio. Also they concluded that optimum fibres content increases linearly with increase in fine aggregate content.

Narayanan and Kareem-palanjian (1984) have studied the effect of addition of crimped and un-crimped steel fibres on the compressive strength, splitting tensile strength and modulus of rupture of concrete. They concluded that fibres with higher aspect ratio exhibited greater pull – out strength and more effective than fibres with smaller aspect ratios. Crimped fibres possess higher bond strength than un-crimped steel fibres, finally they concluded that the strength of concrete after adding steel fibres, is related to the aspect ratio of fibres, fibre volume fraction and bond characteristics the fibres. But these factors are accounted by a single parameter

calledas fibre factor „F", Increase in the Compressive strength, splitting tensile strength, and modulus rupture of concrete are shown by an equation in terms of fibre factor „F" and strength of normal concrete.
S.P. Shah, et al. (1986) have found the impact resistance of steel fibre reinforced concrete using modified charpy impact testing machine. The size of the specimens was 76mm x 25mm x 230mm and compressive strength was found using 76mm x 152mm cylinders. They used brass-coated steel fibres at different volume fractions of 0.5%,1% and 1.5% were used. They observed that the impact resistance improved with fibre additions.
Nagarkar, et al. (1987) after conducting experimental investigation on concrete reinforced with steel and nylon fibres, they concluded that the increase in compressive strength, splitting tensile strength and flexural strength of concrete is more prominent in case of addition on steel fibres than nylon fibres. They observed that compressive strength is increased in the range of 5 to 7%, split tensile strength in the range of 15 to 45% and flexural strength in the range of 20% to 60% respectively.
Nakagawa et al. (1989) carried out experimental investigation on the compressive strength of concrete by incorporating short discrete carbon fibres, Aramid fibres and high strength vinyl on fibres. They concluded that compressive strength decreased as the volume fraction of fibres is increased.
Ramakrishna et al. (1989a) conducted experiments to compare the first cracking strength and static flexural strength of plain concrete and steel fibre reinforced concrete. They used hooked end fibres upto 1% by volume. They concluded that hooked - end fibres gave maximum increase in the above mentioned properties when compared to straight steel fibres. Rachel Detwiler and Kumar Mehta (1989)22 concluded that silica fume concrete showed the greatest improvement in strength due to combination of cement hydration and the pozzolanic reaction between 7 and 28 days.
Ghosh et al.(1989) after conducting experiments on cylinder split tensile strength and modulus of rupture of concrete by using low fibre content (0.4% to 0.7%) with straight steel fibres, they concluded that split cylinder testing method is recommended for determining the tensile strength of fibre - reinforced concrete as in the case of normal concrete.
Kukreja and Chawla (1989) After conducting experimental investigations on concrete by using straight bent and crimped steel fibres with aspect ratio 80, they published a paper on "flexural characteristics of steel fibre reinforced concrete". They concluded that, based on steel fibre content, its type and orientation, behaviour can range from brittle to very ductile, all for the same range of flexural strength.

Parviz Soroushian & Ziad Bayasi (1999) carried out experimental investigations on the relative effectiveness of straight, crimped rectangular, hooked - single and hooked - collated with aspect ratio of about 60 to 75. They observed slightly higher slumps with crimped fibres and hooked fibres are found to be more effective in enhancing the flexural and compressive behavior of concrete than the straight and crimped fibres.
Ezeldin and howe (1991) investigated the flexural strength properties of rapid - set
cement incorporated with four types of low carbon steel fibres (two were hooked, one was crimped at ends and one was crimped though out at ends). They concluded that the flexural strength is controlled by the fibre surface deformation, aspect ratio and volume fraction. They further concluded that steel fibres are very effective in improving the flexural toughness of rapid-set materials.
S.K. Saluja et al. (1992) carried out experimental investigations on the compressive strength of concrete by incorporating straight steel fibres of aspect ratios 75, 90 and 105. They concluded that steel fibres are effective in increasing the compressive strength to a maximum of 13.5% at 1.50% fibre content. Also an equation was developed to predict the experimental results.
Sameer, E.A., and Balarguru P.N. (1992) experimentally investigated the stress-strain behavior of steel fibre reinforced concrete with and without silica fume. They proposed a simple equation to predict the complete stress-strain curve. They observed a marginal increase in the compressive strength, the strain corresponding to peak stress and the secant modulus of elasticity. Also they concluded that increase of silica - fume content renders the fibre reinforced concrete more brittle than non-silica fume concrete.
Balaguru and Shah (1992) said that fibre geometry (aspect ratio) plays of vital role in the performance of straight fibres. They said that ductility increases with the increase in aspect ratio, with the condition, that fibres should be mixed uniformly with the concrete. The matrix composition contributes in at least two ways to strength and energy absorption. The first is its bonding characteristics with the fibre and the second is the brittleness of the matrix itself, which plays an important role in the behavior of steel fibre reinforced concrete.

Balaguru and Shah (1992) In their state of art report say that, the other factors to be considered in the design are, modulus of elasticity, strain at peak load and post peak behavior. They said that the addition of fibres increases the strain at peak load and results in a less steep and more gradual descending branches. Finally, fibre reinforced concrete has been found to absorb much more energy before failure when compared to normal concrete.

Faisal F Wafa and S.A. Ashour, (1992) carried out experimental investigations on properties like, cube compressive strength, splitting tensile strength and modulus of rupture of concrete by incorporating hooked - end steel fibres with 0% to 1.5% as volume fraction. They concluded that addition of 1.50% by volume of hooked end fibres resulted in 4.6% increase in compressive strength, 59.80% increase in split tensile strength and 67% increase in modulus of rupture of plain cement concrete. Also they developed equations for predicting the experimental results.

Bayasi and Zeng (1993) proposed that flexural behavior of polypropylene fibres be characterized by the post-peak flexural resistance. They found that long fibres were more favorable for enhancing the post-peak resistance. The effect of silica fume on the compressive properties of synthetic fibre-reinforced concrete by using fibrillated polypropylene and polyethylene erphalate polyester fibres was studied by bayasi celik. He concluded that both types of fibres improved the compressive behavior by enhancing the toughness and also, both the fibres increased the strain at peak compressive stress.

Agrawal, A.K. Singh and Singhal D. (1996) studied the effect of fibre reinforcing index on the compressive strength and bond behavior of steel fibre reinforced concrete by using straight circular Galvanized Iron fibres with aspect ratios of 60, 80 and 100. The maximum fibre content was taken as 1.50% by volume of concrete. The results show an increase in compressive and bond strength of steel fibre reinforced concrete when compared to normal concrete. They also developed relationships to relate compressive and bond strength with fibre reinforcing index (FRI).

Gupta A.P., et al. (1998) carried out experimental study on compressive strength of concrete by using crimped steel fibres of circular in cross-section with three volume fractions of 0.5%, 1.0%and 1.5% and with two aspect ratios 55 and 82. They proposed an equation to quantify the effect of fibre addition on compressive strength of concrete in terms of reinforcing index (RI) based on regression analysis.

Singh, A.P. & Dr. Singhal, D., (1998) After studying the permeability of steel fibre reinforced concrete by using plain steel fibres at various percentages (0% & 4%) they observed that permeability is decreasing significantly with the addition of fibres and it continued to decrease with the increase in fibre content. Also linear relation ship was observed between permeability and compressive and tensile strength for plain cement concrete.

III. CONCLUSION

1. Designing using Software’s like STAAD reduces lot of time in design work.
2. Details of each and every member can be obtained using STAAD pro.
3. quivalent static method is easier and simple than the response spectrum method.
4. The value of the base shears is more in equivalent static method than response spectrum method.
5. Static analysis is not sufficient for high rise building and it’s necessary to adopt dynamic analysis (because of specific non-linear distribution of forces).

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