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Study of Concrete Pillar using linear Analysis

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ABSTRACT: In this project work, an attempt is made to predict the shear strength for concrete deep beams at ultimate state, using ANSYS12.1 software. Two test beams will be accounted to predict their shear strength at ultimate state using ANSYS 12.1 software. The accuracy of the predicted values of shear strength based on ANSYS 12.1 software for the two test beams will be compared with their corresponding experimental results. In addition, the predicted values of shear strength for the two test beams using ANSYS 12.1 software will be compared with the results obtained by shear strength prediction models proposed by various researchers. The prediction of shear strength using ANSYS 12.1is found to be reasonably in good agreement with the corresponding experimental results.

KEYWORDS: **Reinforced Concrete Deep Beams, Shear Strength**

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I. INTRODUCTION

Beams having larger depth are known as deep beams. Such beams are used as the wall of the water tanks, bunkers and also used as load distributing structural elements such as transfer girders, pile caps, foundation walls and in offshore structures. Deep beams are structural elements, in which significant amount of load is transferred to the supports by a compression strut joining the load and the reaction. The basic assumption of the plane section assumed to remain plane after bending is not valid for deep beams. It has a nonlinear stress distribution along the depth of the beam.

Because of their geometric proportions, the strength of reinforced concrete deep beams is usually controlled by shear, rather than by flexure if normal amount of longitudinal reinforcement is used. The shear action in the beam web leads to diagonal compression and tension in a direction perpendicular thereto. The deep beams do not fail immediately due to the formation of diagonal cracks. After diagonal cracking, the concrete between the diagonal cracks can serve as a concrete compression strut. The external shear is assumed to be transferred by the concrete compression strut. By detailing the end anchorage of longitudinal bars and bearing zones of deep beams, premature failures such as shear tension failure (due to insufficient anchorage of reinforcing bars) and bearing failure can be effectively avoided. The usual failure mode of deep beams is crushing of the concrete strut as shown in Fig.1.1.

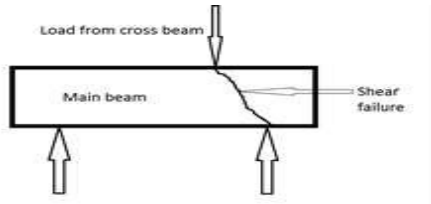

Fig. 1: Typical failure of deep beams

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According to ACI-318 (2008), deep beams are defined as structural beams loaded on top face and supported on the opposite bottom face, so that compression struts develops between the load and the support. The concrete beams having clear span to depth ratio less than or equal to 4.0 or shear span to depth ratio(a/d) less than or equal to 2.0 are considered as deep beams (ACI-318 2008).But IS 456(2000) stipulates that a beam is said to be deep, if effective span to overall depth of is less than 2.0. Due to the small value of span to depth ratio, the failure of deep beams is controlled by shear rather than flexure.

II. AIM AND OBJECTIVES

The aim and objectives of the project work is to predict the shear strength at ultimate state using ANSYS 12.1 software for the two concrete beams reinforced with steel bars subjected to two point loading and to compare the predicted results obtained by ANSYS 12.1 software with the corresponding theoretical shear strength values obtained from the strength prediction models proposed by various researchers The objectives in this research work are summarized as follows.

To carry out analytical study using ANSYS12.1 software in order to predict the shear strength of two concrete beams reinforced with steel bars
To compare the exiperimental shear strength values and analytical shear strength values obtained using ANSYS 12.1 software for the concrete test beams.
To compare the predicted shear strength values of two test beams obtained by ANSYS12.1 software with the corresponding results obtained by the models proposed by various researchers namely Zsutty1968, Mau and Hsu 1989, Siao 1994, Matamoros and wong 2003 and Russo, Venir and Pauletta 2005.

III. EXPERIMENTAL DETAILS

The experimental program reported in Dileep et al.(2012) has been considered. It comprised the testing to failure of 2 reinforced concrete deep beam specimens designed with various shear span- to-depth ratios and longitudinal reinforcement ratio. All beams were 1590 mm long, effective span is 990 mm, 500 mm deep and 170 mm wide. The beams were loaded at two point on the top face.

Table –1 Preliminary details of Beams

Specimen no.	f_{ck}	*b(mm)*	*d(mm)*	*D(mm)*	*a/d*	*Main bars ratio*
0.3/0.5	*50*	*170*	*416*	*500*	*0.5*	*0.3*
0.3/1.0	*50*	*170*	*416*	*500*	*1*	*0.3*

Table –2 Results obtained by experimental work

Beam	f_{ck} *(avg)*	*a/d*	*First cracking load*	*Failure load*	*Max Shear load*	*Mode of failure*
0.3/0.5	*44.0*	*0.5*	*275*	*500*	*250*	*Diagonal shear*
0.3/1.0	*42.7*	*1.0*	*240*	*400*	*200*	*Flexural failure*

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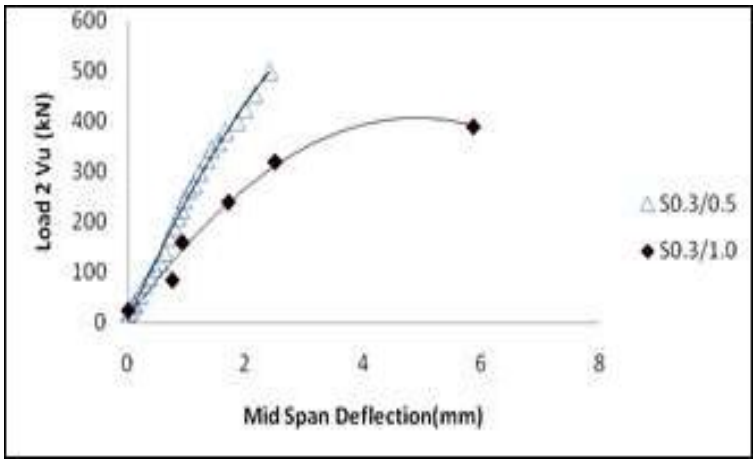

Fig. 2: Load versus mid span deflection graph

IV. ANSYS SOFTWARE MODEL

ANSYS is a finite element analysis (FEA) code widely used in the computer-aided engineering (CAE) field. ANSYS software allows engineers to construct computer models of structures, machine components or systems; apply operating loads and other design criteria; and study physical responses, such as stress levels, temperature distributions, pressure, etc. It permits an evaluation of a design without having to build and destroy multiple prototypes in testing.

Major steps involved in the analysis:
1) Preference (structural)
2) Pre-processor
3) Solution
4) General postprocessor

V. PREDICTED SHEAR STRENGTH OF BEAM COMPARISION

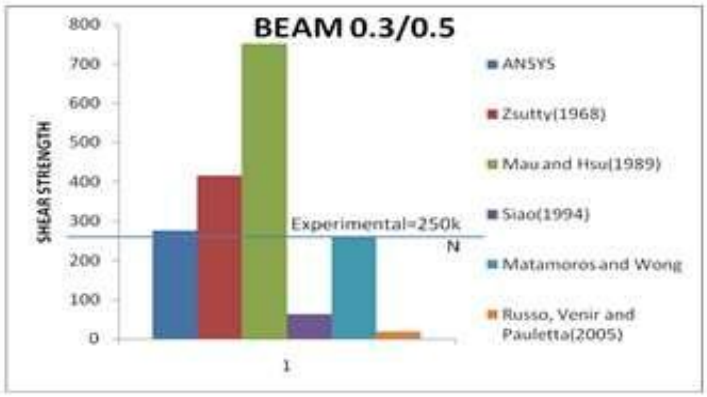

Fig. 3: Predicted shear strength of beam 0.3/0.5

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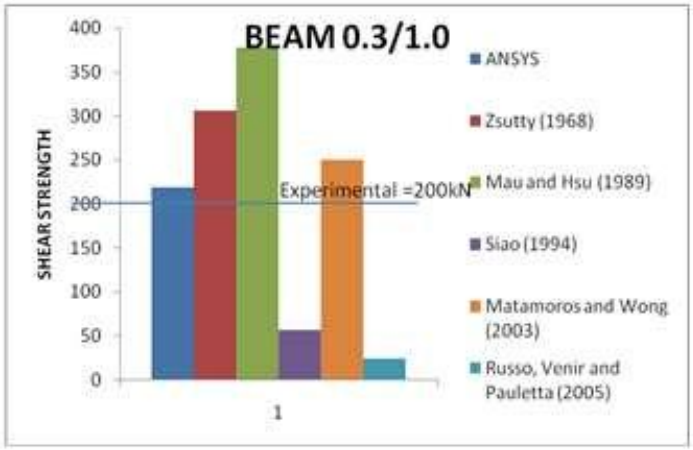

Fig. 4: Predicted shear strength of beam 0.3/1.0

Fig: 3 and 4 are showing the predicted shear strength values proposed by various researchers on beam 0.3/0.5 and 0.3/1.0 respectively. The shear strength of beam predicted using the model proposed by

- Zsutty (1968) was found to be 66.16% higher in magnitude when compared with the corresponding experimental result for beam 0.3/0.5 and 9.655% higher in magnitude when compared with the corresponding experimental result for beam 0.3/1.0
- Mau and Hsu (1989) was found to be 200.92% higher in magnitude when compared with the corresponding qexperimental result for beam 0.3/0.5 and 88.8% higher in magnitude when compared with the corresponding experimental result for beam 0.3/1.0
- Siao(1994) was found to be 34.84% lower in magnitude when compared with the corresponding experimental result for beam 0.3/0.5 and 21.4% lower in magnitude when compared with the corresponding experimental result for beam 0.3/1.0
- Matamoros and Wong (2003) was found to be 4.2% higher in magnitude when compared with the corresponding experimental result for beam 0.3/0.5 and 25% higher in magnitude when compared with the corresponding experimental result for beam 0.3/1.0.

VI. CONCLUSION

- The shear strength at ultimate state was predicted using ANSYS 12.1 software for the two concrete beams reinforced with steel bars subjected to two point loading and compare the predicted results obtained by ANSYS 12.1 software with the corresponding theoretical shear strength values obtained by the models proposed by various other researchers
- Carried out analytical study using ANSYS 12.1 software for the prediction of the shear strength of two concrete beams reinforced with steel bars.
- Compared the exiperimental shear strength values and analytical shear strength values obtained using ANSYS 12.1 software for the concrete test beams.
- Compared the predicted shear strength values of two test beams obtained by ANSYS software with corresponding results
- obtained by the models proposed by various researchers namely Zsutty1968, Mau and Hsu 1989, Siao 1994, Matamoros and wong 2003 and Russo, Venir and Pauletta 2005

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- Model proposed by Matamoros and Wong (2003) gives the better result for shear strength. Mau and Hsu (1989) gives the over estimated value for shear strength and by Russo, Venir and Pauletta (2005) gives the under estimated value for shear strength of concrete deep beams.
- A detailed experimental study is to be conducted for identifying the appropriate ranges for which model proposed by ANSYS 12.1 and IS 456 are recommended.
- The scope of the study extended to study the behaviour of concrete deep beams with openings reinforced with steel bars.

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