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Behavior Of Collapse Of Normal Quality Concrete Beam With Confinement

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Normal Quality Concrete; Maximum Load, Deformation, Distance Variation Stirrup

ABSTRACT
Concrete is a widely used construction material now compared to other materials such as wood and steel. This is because the constituent material is easy to obtain, has enough strength, good durability, the making process is easy and in terms of economic price is affordable. Concrete is generally classified into two classes, namely normal quality and high quality. Both of them are now widely used in construction activities. Normal quality concrete has a quality of 20 Mpa up to 58 Mpa, while high quality concrete ranges above 58 Mpa. One of the applications in the structure is collapse behavior concrete beam on the normal quality of norms with the confinement on the pressure area. To analyze the effect of collapse behavior of normal quality concrete beam and varied with Finite Element Analysis (FEA) by using ANSYS Ed.9.0 with stirrup variation space in the respective spans (40,80,120,150) mm and stirrup variation distance in the respective field, (40,80,120,125,150,100,75,50) mm with 15/20 beam size. The steel material used has stress power of 400 each Mpa, stirrup stress 200 Mpa, normal quality stress 25 Mpa. Based on manual analysis and FEA the magnitude of ultimate capacity that occurs in the model of the beam with the dense stirrup on the stress area the ultimate moment value will rise both in the moment span area and in the field. The deformation is decreasing and the crack behavior on the pressure area can be minimized.

INTRODUCTION

Concrete is a widely used construction material to date compared to other materials such as wood and steel. This is because the constituent material is easy to obtain, has enough strength, good durability; the making process is easy and in terms of economic the price is affordable.

Concrete is generally classified into two classes, namely normal quality and high quality. Normal quality concrete has a quality of 20 *M*pa up to 58 *M*pa and made from natural aggregates that are broken down or unbroken. While high quality concrete is a concrete that has a quality above 58 Mpa

and is made from natural aggregate that is split or artificial aggregate with a mixture of additive materials and an implementation method tailored to the need of its compressive strength (SNI/Indonesian National Standart-03-2847-2002).

In this study, the formulation problem analysis on the effect of the variation of the stirrup distance variation on the pressure area, to determine the collapse behavior of the structure of the beam. The analysis was performed by modeling the beams based on the results of the prior experimental test using finite element analysis with ANSYS Ed.9.0 computing program. The objectives of the research were to determine the strength and ductility of curvature due to restraint of the pressure area on the normal quality beam model, so that it can be determined the ultimate triangular capacity and usable use value, the cracking and deformation behavior.

METHOD

This research was conducted by modeling the variation of the stirrup distance arrangement in the pressure area by using the three dimensional element finite element analysis with ANSYS Ed.9.0 computation aid. The results of the analysis will be obtained in the form of deformation images and beam crack patterns with the model variations listed in the Table 1.

Table 1. Number of models to be analyzed by using ANSYS computing program. Ed.9.0

No	Model Number	b (mm)	H (mm)	Φlentur (mm)	Φs (mm)	f c (Mpa)	f y (Mpa)	Fys (Mpa)	ST (mm)	SL (mm)
1	TT40.40.01	150	200	7,44	4	20,38	252	240	40	40
2	TT80.80.02	150	200	7,44	4	20,38	252	240	80	80
3	TT120.120.03	150	200	7,44	4	20,38	252	240	120	120
4	TT150.150.04	150	200	16	8	25	400	240	150	150
5	TT150.125.05	150	200	16	8	25	400	240	150	125
6	TT150.100.06	150	200	16	8	25	400	240	150	100
7	TT150.75.07	150	200	16	8	25	400	240	150	75
8	TT150.50.08	150	200	16	8	25	400	240	150	50

Explanation of TTX.Y.Z:
TT = The square block model uses the author's name
X = Distance variation of stirrup in pedestal area (mm)
Y = Variation of stirrup distance in the field
Z = Model serial number

RESULTS AND DISCUSSIONS

Result validation of variation of stirrup distance arrangement using ANSYS Ed.9.0 with previous experimental results. The initial analysis of this modeling is a square block modeling consistent with the test of previous experimental with the beam model for the stirrup reinforcement spacing 40 mm and the reinforcement stirrup field 40 mm distance which taken from one example of TT 40.40.01 model that can seen on Figure 1.

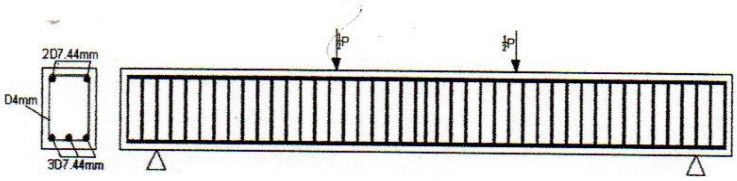

Fig 1. *Cross-section and longwise beam type variation TT40.40.01 (mm) for experimental validation by Basuki (Basuki, N.H, 2006)*

The result of model by using ANSYS Ed.9.0 computation program will be compared with the experimental result to obtain an ultimate moment near the experimental test result taken from one sample model TT40.40.01 which can be seen in Figure 2.

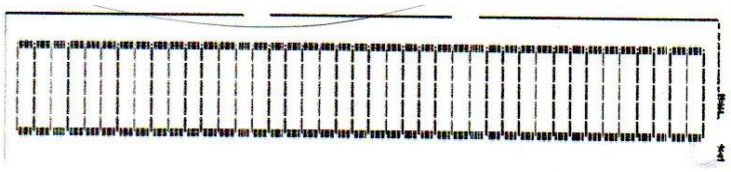

Fig 2. *Longwise pieces of TT40.40.01 beam model with meshing volumes in ANSYS Ed.9.0 computer program*

From figure. 3 and 4, voltage contour is indicated by the color indicator. The blue color indicates the minimum voltage and red indicates the maximum voltage that occurs. Based on the stress concentration analysis on each model, for the TT40.40.01 and TT150.50.08 validation models with tight space of stirrup in the span pressure area, the tension occurred tend to decreased. This indicated that the area of the span stress is still strong with the load that occurred with a load value pressure ratio of 2.00 or 18 kN. Behavior of the beam model becomes stronger as well for the load value pressure ratio of 4.00 or 36.00 kN. Voltage that occurred also tends to fall so that from the second picture indicated the behavior of the beam model becomes stronger.

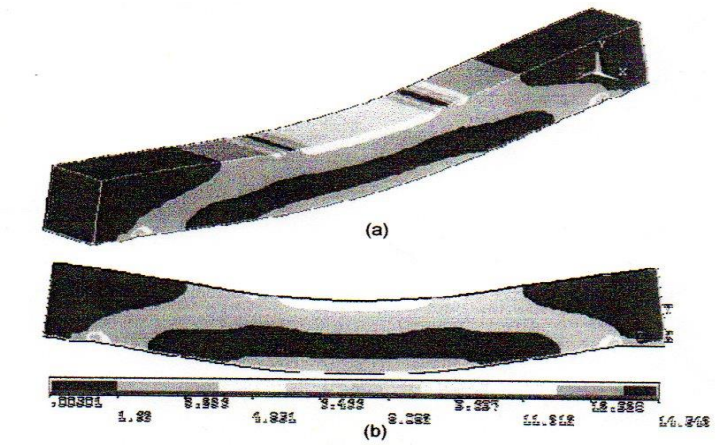

Fig 3. *Stress Concentration Beam Model TT40.40.01 with Load Value =2,0; (a) Perspective Piece (b) Elongated piece*

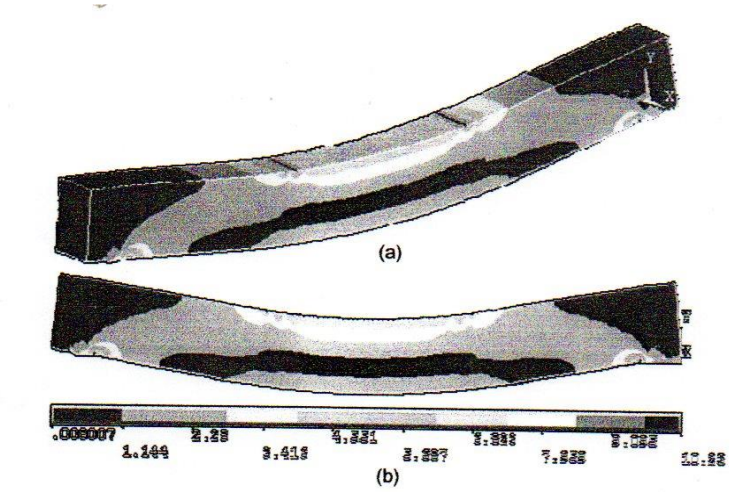

Fig 4. *Stress Concentration Beam Model TT150.50.08 with Load Value = 4,0; (a) Perspective Piece (b) Elongated piece*

From Figure. 5 and Figure.6 cracks occurred on validation model TT40.40.01 and TT150.50.08 with the dense stirrup on the middle area of span, cracks occurred can be minimized. This indicates that the middle area of the span still strong to hold the load using *load value pressure rasio* with the force 2,00 or as big as 18 kN. The behavior of beam model become stronger along with the *load value pressure rasio* with the force 4,00 or as big as sebesar 36,00 kN. The stress takes place also decreasing which from the two figures indicating behavior from the beam model become stronger and the moment can be endured is higher and the middle area of beam span can be minimized.

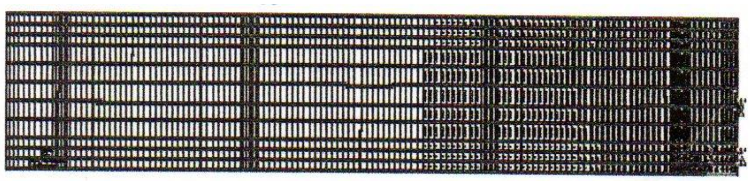

Fig 5. *Elongated Piece of Crack Pattern on Beam Model TT40.40.01 with Load Value = 2,0*

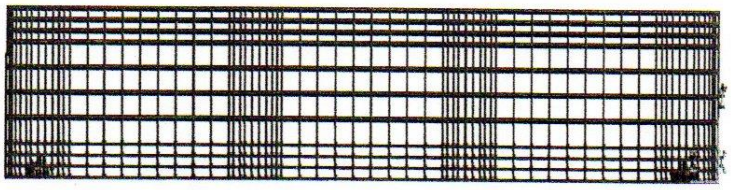

Fig 6. *Elongated Piece of Crack Pattern on Beam TT150.50.08 dengan Load Value = 4,0*

Table 2. Value Conversion of Load on Beam Model Based Result Analysis Using ANSYS Ed.9.0

No	Model Number	Load Value Pressure	Load Value Ratio (Load Value x 1,0 N/mm^2)	Load Area	Load P		Type of load
			(N/mm^2)	(mm^2)	(N)	(kN)	
1	TT40.40.01	2,00	2,00	9000,00	18000,00	18,00	Pressure
2	TT80.80.02	2,00	2,00	9000,00	18000,00	18,00	Pressure
3	TT120.120.03	2,00	2,00	9000,00	18000,00	18,00	Pressure
4	TT150.150.04	4,00	4,00	9000,00	36000,00	36,00	Pressure
5	TT150.125.05	4,00	4,00	9000,00	36000,00	36,00	Pressure
6	TT150.100.06	4,00	4,00	9000,00	36000,00	36,00	Pressure
7	TT150.75.07	4,00	4,00	9000,00	36000,00	36,00	Pressure
8	TT150.50.08	4,00	4,00	9000,00	36000,00	36,00	Pressure

CONCLUSION AND SUGGESTION

To analyze the influence of behavior collapse of normal quality of concrete beam and varied with Finite Elemen Analysis FEA) using ANSYS Ed.9.0 by distance stirrup on pressure area respectively (40,80,120,150) mm and stirrup distance on the field respectively (40,80,120,125,150,100,75,50) mm using beam size 15/20. Steel material used has the main stress each is 400Mpa, stirrup plank 200 Mpa, normal quality stress 25 Mpa. Based on manual analysis and FEA the magnitude of ultimate capacity that occurs in the model of the beam with the dense stirrup on the stress area the ultimate moment value will rise both in the moment span area and in the field. The deformation is decreasing and the crack behavior on the pressure area can be minimized.

REFERENCES

[1] ANSYS Release 11. 2007. Programmer's Manual for ANSYS. ANSYS Incorporations and ANSYS Europe, Ltd.

[2] Chang 1998, Bond in Reinforced Concrete Behavior and Design Criteria, ACI Journal January-

February 1986.
[3] American Concrete Institute (ACI) 1999 SLAB DESIGN In Accordance with ACI 318-77 Supplement To: Design Handbook in Accordance with the strength Design Method ACI PUBLICATION SP-17(73)(S).
[4] B. Army Perilaku Pelat Lantai Jembatan Beton Komposit Pracetak dan Cast In Place Tanpa Tulangan Geser Horizontal Akibat Beban Statis Terpusat. Jurnal Ilmiah Poli Rekayasa Volume 1, Nomo r 2, Maret 2006 ISSN : 1858 - 3709.
[5] Bridge Management System (BMS) 1992 Direktorat Jenderal Bina Marga Departemen Pekerjaan Umum.
[6] Basuki, N. H, 2006 (Eksperimental Model Balok)
[7] Badan Peneliti dan Pengembangan, Departemen Pekerjaan Umum, Standard dan Pedoman Bahan Konstruksi Bangunan dan Rekayasa Sipil. Edisi 2009.
[8] Matsui 1997 Tinjauan perilaku tegangan lekat pada struktur beton bertulang dengan Metode Semi Beam dan Pull Out.
[9] Purwono, R . 2005. Tata Cara Perhitungan Struktur Beton Bertulang Tahan Gempa (SN103-1726-2002). Edisi ketiga ITS Press. Surabaya. Indonesia
[10] Purwono, R. Tavio,Iswandi I, I.Gusti Putu R. Tata Cara Perhitungan Struktur Beton Untuk Bangunan Gedung. (SNI 03-2847-2002) Dilengkapi Penjelasan [S-2002]. ITS Press. Surabaya. Indonesia
[11] R. Park, W. L. Gamble 1993 Reinforced Concrete Slabs
[12] Chu-Kia Wang Charles G.Salmon Reinforced Concrete Design, Fourth Edition.
[13] Ese Soedarsono HS, Design and Detailing of Flat Slab, 27 February 2002.
[14] Jack C. Mc Cormac. Desain Beton Bertulang Edisi Kelima Jilid 2 Penerbit Erlangga Jakarta.
[15] Kodur, V.K.R. Bisby, L.A. Evaluation of Fire Endurance of Concrete Slabs Reinforced With FRP Bars. Journal of Structural Engineering. ASCE. 131 (1). 2005. Pp 34-43 (http://link.aip.org diakses tanggal 4 Agustus 2009).
[16] Mac Gregor, J. G. 1997. “Reinforced Concrete: Mechanics and Design 3rd Ed.” Prentice-Hell International, Inc.
[17] http://www.gussuta.com/teknik/perpustakaan-teknik-sipil.html
[18] Neville, A. Aitcin, P. C. High Performance Concrete-an overview Journal of Material and Structure. 31. March 1998. pp 111-117.
[19] Parvanova, Sonia. L., et al. 2004. Modeling The Nonlinear Behaviour of R/C Beams With Moderate Shear Span and Without Strirrups Using Ansys. National Science Fund.Bulgaria
[20] Shah, S. P. Ahmad, S.H. 1994. High Performance Concrete: Properties and Applications. McGraw-Hill Companies, (http://linkinghub.elsevier.com diakses Tanggal 4 Agustus 2009)
[21] Tri Mulyono, Ir, MT. Teknologi Beton, CV. ANDI OFFSET Yogyakarta Indonesia 2003.
[22] Zhenhua, Wu. 2006. Behaviour of High-Strength Concrete Members Under Pure Flexure and Axial - Flexural Loadings. Disertation Civil Engineering North Carolina Statte University. Raleigh, North Carolina.