USE STUDY ON SLIGHT BEAM REINFORCED CONCRETE FLOOR PLATE IN LIEU OF SCONDARY BEAM

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Abstract-*Use of false beams on reinforced concrete slab instead of the joist is an innovation in the construction of reinforced concrete slab. Where the study was made by using 4 samples of precast concrete slab specimens (PBP). Ie: P1 type - plate only, type P2 - plate with joists, type P3 - small plates with slight beams, type P4 - plate with big apparent beam. The fourth specimen samples made using the Batu Raja cement, sand from Gunung Sugih, and local split Bandar Lampung in the Civil Engineering Laboratory of UBL. The fourth test specimen samples was conducted at the Laboratory of Civil Engineering Unila using method one point load that is placed in the center - the center span in order to get the load and the maximum deflection and crack patterns. The data obtained are used to verify the theoretical calculations. Conclusions will be given at the end of writing.*

Keywords: *artificial beam, maximum load, maximum deflection, crack patterns.*

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INTRODUCTION

In the modern era many young architects to design buildings with a minimalist style that minimal design but most notably on the function of the lower level floor (split level). In this case the Civil Engineer must be able to tolerate the design of the architect, of course, within limits - limits the rules of civil engineering criteria. The case that the joists should be discarded because they interfere with the aesthetic design of the ceiling. To anticipate that it is made apparent as the study of beam replacement joist with experimental methods carried out in the laboratory of civil engineering. As for making false beams can also be beneficial in terms of economics, time, construction of buildings (building height may be lower due to the lower floor level). The purpose of this paper to obtain data on the extent to which the apparent beam reinforced concrete construction can be used.

LITERATURE REVIEW

1.Formula Speciment Planning Analysis

In planning specimen authors use the basic formula calculation of reinforced concrete beams without taking into account the conversion factors Whitney voltage block as shown in Figure 1

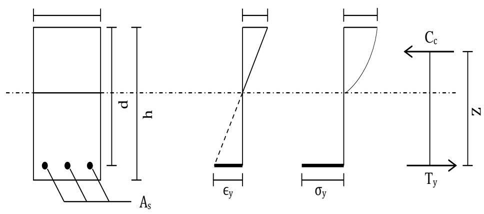

Figure 1: The diagram of distribution of strain and stress

Balance equation the horizontal force and moments:

1. The resultant compression force concrete the magnitude must be equal to the resultant force on the tensile steel.

$$\sum H = 0$$

$$C_c = T_y \quad \text{where } T_y = A_s \sigma_y$$

Calculation applies to the calculation of the collapse of state planning balanced, then apply$T_y = A_s f_y$

2. Exter σ al moments must be equal to the moment internal.

$$M_{ext} = M_{int} = M_{ultimat}$$

$$M_u = A_s f_y \, Z \quad \text{where } Z = (\,0{,}8 - 0{,}9\,)\, d$$

$$\mathbf{A_s = \frac{M_u}{f_y\, Z}}$$

$$\boldsymbol{\rho = \frac{A_s}{b\, d}}$$

Requirement : $\boldsymbol{\rho_{min}} < \rho < \boldsymbol{\rho_{max}}$

2.Testing the formula

In this experiment the specimen is placed on two simple placement following the 1.20 m long with a center to center distance of 1 m pedestal, then given the gradual loading (incremental load) through the actuator load to the crack that is placed on the center span as shown in theFigure 2.

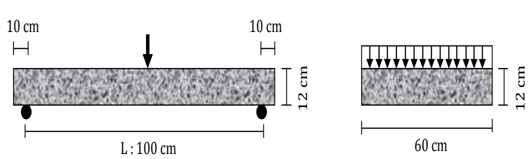

Figure 2. schematic of loading

Based on Figure 2, the load line can be considered as a concentrated load as the specimen just riveted on the two sides so that it can be considered as engineering mechanics calculations beam. Engineering mechanics calculations: (See figure 3)

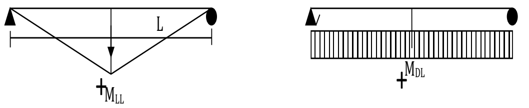

Figure 3: Moment diagram

$$-M_{LL} = \frac{1}{4}\, P\, L$$

$$-M_{DL} = \frac{1}{8}\, Q\, L^2$$

$$\text{So } M_u = M_{LL} + M_{DL} = \frac{1}{4}\, P\, L + \frac{1}{8}\, Q\, L^2$$

3. Studi EksperimenModul Benda Uji

Specimens were made with several types, namely: P1 type - plate only, type P2 - plate with joists, type P3 - plates with small apparent beams, type P4 - plate with big apparent beam. Each - each specimen using plain reinforcement (BJTP) Ø8 mm in diameter and quality of steel fy: 2400 kg/cm2, wherein each - each rebars placed 2 cm from the outermost layer of concrete. Module will test object given in table 1.

Table 1: Module test specimens

Tipe	Jenis	Ukuran Pelat (cm)	Ukuran Balok
P1	pelat saja	120x60x12	_
P2	pelat dengan balok anak	120x60x12	12x17
P3	pelat dengan balok semu kecil	120x60x12	12x12
P4	pelat dengan balok semu besar	120x60x12	21,5x12

Figure 4 shows the images - photos of the four types of the test specimens (formwork and reinforcement).

Figure 4.formwork and reinforcement

specimen

Tanggal Pengecoran	Tanggal Pengujian	Berat Jenis (kg/m^3)	Kuat Tekan (kg/cm^2)
11/11/2008	10/12/2008	2321,302	181,17
11/11/2008	15/12/2008	2192,593	177,78
11/11/2008	15/12/2008	2283,557	220,81
11/11/2008	15/12/2008	2251,852	182,22

4. Concrete Process

Manufacture of concrete for test specimens conducted at the Laboratory of Civil Engineering UBL according to Procedure of Making Plans Mixed Concrete Normal accordance with SNI 03-2834 -2000. The use of cement in making concrete the King Stone, Sand Gunung Sugih, and local split Bandar Lampung. Manufacture of fresh concrete mixtures with compressive strength fc plan: 225 kg/cm2 for 1 m3 of fresh concrete required:

- Cement = 323 kg
- Sand (keadaan SSD) = 811,14 kg
- Split = 982 kg
- Watter = 153,86 ltr

5. Concrete Compressive Strength Test Results

Compressive strength testing of concrete cubes for the four specimens held after the age of concrete at 28 days. Tests carried out at LTS - UBL and data testing results are shown in Table 2.

Tabel 2 : concrete compressive strength test results

RESULTS AND DISCUSSION

1. Analysis of Specimens

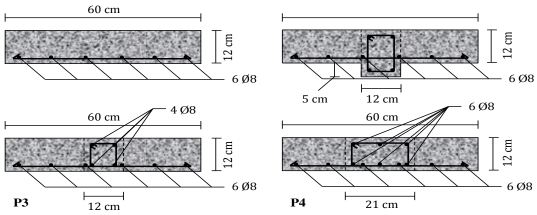

Figure 5: section of the test specimen

Calculations for the plate only

$$M_u = n\,\pi\,r^2 f_y\ 0{,}9d = 6 \times 3{,}14 \times 0{,}4^2 \times 2400 \times 0{,}9(9{,}6)$$

$$M_u = 62506{,}60 \text{ kgcm}$$

$$M_{DL} = \frac{1}{8}\,Q\,l^2 = \frac{1}{8} \times 1{,}73 \times 100^2 = 2162{,}50 \text{ kgcm}$$

$$M_{LL} = M_u - M_{DL} = 62506{,}60 - 2162{,}50 = 60344{,}10 \text{ kgcm}$$

$$\rightarrow P_{LL} = \frac{4\,M_{LL}}{l} = \frac{4 \times 60344{,}10}{100} = 2413{,}76 \text{ kg}$$

Calculation plate with scondary beam

$$M_u = M_{u1} + M_{u2} = \left(n_1\,\pi\,r^2 f_y\ 0{,}9d_1\right) + \left(n_2\,\pi\,r^2 f_y\ 0{,}9d_2\right)$$

$$M_u = \left(6 \times 3{,}14 \times 0{,}4^2 \times 2400 \times 0{,}9(9{,}6)\right) + \left(2 \times 3{,}14 \times 0{,}4^2 \times 2400 \times 0{,}9(14{,}6)\right)$$

$$M_u = 94193{,}97 \text{ kgcm}$$

$$M_{DL} = \frac{1}{8}\,Q\,l^2 = \frac{1}{8}(\,1{,}73 + 0{,}144\,)100^2 = 2342{,}50 \text{ kgcm}$$

$$M_{LL} = M_u - M_{DL} = 94193{,}97 - 2342{,}50 = 91851{,}47 \text{ kgcm}$$

$$\rightarrow P_{LL} = \frac{4\,M_{LL}}{l} = \frac{4 \times 91851{,}47}{100} = 3674{,}05 \text{ kg}$$

Calculation plate with small apparent beam

$$M_u = n\,\pi\,r^2 f_y\ 0{,}9d = 8 \times 3{,}14 \times 0{,}4^2 \times 2400 \times 0{,}9(9{,}6)$$

$$M_u = 83342{,}13 \text{ kgcm}$$

$$M_{DL} = \frac{1}{8}\,Q\,l^2 = \frac{1}{8} \times 1{,}73 \times 100^2 = 2162{,}50 \text{ kgcm}$$

$$M_{LL} = M_u - M_{DL} = 83342{,}13 - 2162{,}50 = 81179{,}63 \text{ kgcm}$$

$$\rightarrow P_{LL} = \frac{4\,M_{LL}}{l} = \frac{4 \times 81179{,}63}{100} = 3247{,}18 \text{ kg}$$

Calculation of the plate with large apparent beams

$$M_u = n\,\pi\,r^2 f_y\ 0{,}9d = 10 \times 3{,}14 \times 0{,}4^2 \times 2400 \times 0{,}9(9{,}6)$$

$$M_u = 104177{,}66 \text{ kgcm}$$

$$M_{DL} = \frac{1}{8}\,Q\,l^2 = \frac{1}{8} \times 1{,}73 \times 100^2 = 2162{,}50 \text{ kgcm}$$

$$M_{LL} = M_u - M_{DL} = 104177{,}66 - 2162{,}50 = 102015{,}16 \text{ kgcm}$$

$$\rightarrow P_{LL} = \frac{4\,M_{LL}}{l} = \frac{4 \times 102015{,}16}{100} = 4080{,}60 \text{ kg}$$

2 Testing Analysis Test Specimen

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Specimens were concentrated on two simple pedestal pressure gradually until the cracks with hydraulic jack in tengah2 span steel through solid concrete slab width of a rigid specimens. Any increase in the burden of proving ring reading on mounted on hydraulic jacks and any deflection that occurs is read on the dial gauge mounted in the bottom center specimens. Load and deflection results are shown in Figure 6.

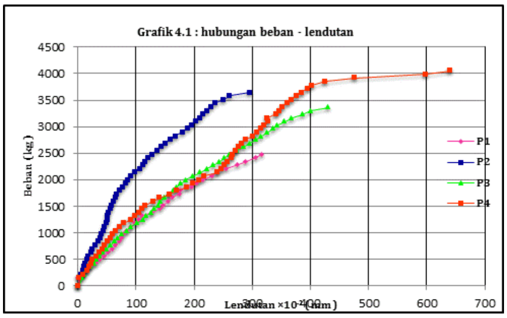

Figure 6. Load vs. deflection graph

Based on the analysis of the load vs. deflection relationship, then substantial rigidity of each specimens can be seen in Figure 7. Stiffness = load is achieved when specimens divided by the crack deflection occurs.

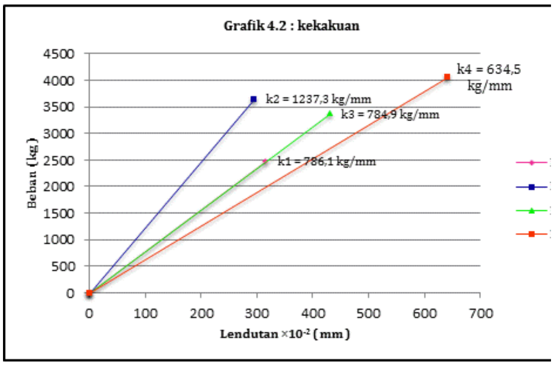

Figure 7 Graph shows the stiffness of each specimen.

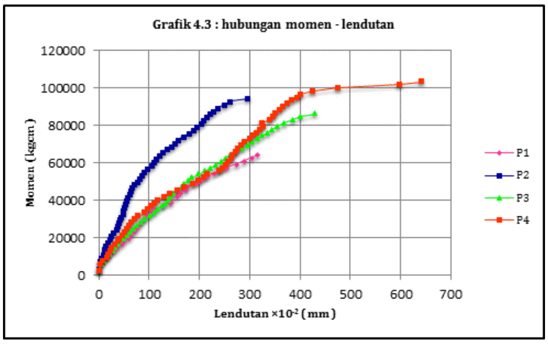

Figure 8. Graph shows the moment vs. deflection relationship of each specimen

Cracking pattern of each specimen is shown in Figure 9.

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Figure 9: crack pattern test specimens

CONCLUSION

1. Of the four specimens used in this study, a concrete slab with beams apparent 21.5 × 12 cm (P4) is most effectively used as an alternative in the planning of a concrete slab. Specimen P4 able to bear the load of 4061 kg before the collapse. The maximum moment capacity reached 103,687.5 kgcm, while the nominal moment capacity is only 101 525 kgcm.
2. In the chart 4.2: Relationship load - deflection for specimens P1, P2, P3, P4 on the linear line P2 has seen test specimen stiffness k2 = 1237.3 kg / mm which means much more rigid than the P4 specimens having rigidity k4 = 634.5 kg / mm, but specimens P4 is able to bear the greatest burden before developing cracks. So a rigid structure that can not be said to be as strong as the test specimen P2. In other words specimen P4 is more ductile than the specimen so that the specimen P2 P4 stronger withstand impact loads and load creep.

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