LOGIC
Journal of Engineering Design and Technology
Vol. 22 No. 2 July 2022; p.97 - 102

p-ISSN : 1412-114X
e-ISSN : 2580-5649
http://ojs2.pnb.ac.id/index.php/LOGIC

ANALYSIS OF TYPE L JOINT PRECAST BEAM CONCRETE

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Abstract. Research precast beam type L shape has produced strength of flexure where it was jointed at middle of span with L shape. Problem was about strength and deflection with joint of Type L shape. Method of this research was applicated of load to two point of the beam. Data from data logger was noted. Aim of this research was determined strength of flexure such deflection and maximal load would be apllicated. Precsat beam type L shape consist of two beam P1 and P2 were tested at two point load was applicated. This research have produced of data of precast beam P1 and P2. Precast beam P1 has deflection 28,44 mm at maximum load 11,21 Ton. Precast beam P2 has deflection 26,71 at maximum load 11,76 Ton. Except that data, has produced also chart of load versus deflection where precast beam type L shape has behavior less for ductility approximately δu/δy 1,17, where deformation inelasticity was not seem. That occur because overlapping at joint of precast concrete at middle of span..

Keywords : precast, flexure, concrete.

1. INTRODUCTION

Development about building construction is so fast for decade eventually. Precast construction is a project building construction will be developed later. Innovation precast concrete construction will be needed for development at construction industry. For that reason, therefor research about precast element has developed with observation to element precast beam L shape joint. Many research of precast beam were investigated by expert for many years ago. Investigation of closure-strip details for connecting prefabricated deck systems by Alexander Au, Clifford Lam, Bala Tharmabala at 2011. This research was described about joint of two part element precast slab concrete. To connected between two element slab precast was required lap splices rebar of two element precast slab. Between two element of precast slab has void. Void will be filled by grouting material non shrinkage. Research Seismic behavior of a type of welded precast beam concrete-column connection by Mario E. Rodríguez, Miguel Torres-Matos at 2013 was described about connecting of two element precast beam at joint of beam column. Connecting between two element was required plat and reinforcement with welded to connecting of two element precast beam and void of top beam will be filled by topping concrete. Research precast concrete deck to girder mechanical connection by George Morcous and Raed Tawadrous at 2020, describe about connecting between half slab precast and girder.

Research of joint type L shape was required plat type L and connected by Sika grout 215 for filled section with void at middle of precast beam. L shape that is mean, joint of element precast have shape such as word of L and easier to adjusting. For connecting between element of precast has welded and used Sika grout 215 to cover its void. Sika grout 215 was material for grouting between element concrete has welded and casted. Specification of material sika grout have compressive strength for 3 days approximately 40 N/mm2 and for 7 days approximately 52 N/mm2. This joint was needed plat with thick 5 mm and welded was needed for connect of two of plat from respectively element. For this research have compressive strength 42,13 N/mm2. This joint was needed plat with thick 5 mm and welded was needed for connect of two of plat from respectively element.

The question for this research is how about strength of flexural precast beam concrete type L joint if any load were applicated and how about deflection occur.

Aim of this research was determined of strength of flexural precast beam concrete type L joint beam P1,P2

and deflection occur.

Result of research, It is evidence that result all of specimen indicate have equal performance for ultimate strength so for behavior of pattern of failure, precast beam concrete type L joint was behavior less for ductility. Ductility of precast beam P1 and P2 was has less behavior ductility δu/δy at least approximately 1,17. Strength of flexural precast beam concrete type L joint P1 at ultimate was value 11,21 Ton at deflection 28,44 mm. Strength of flexural precast beam concrete type L joint P2 at ultimate was value 11,76 Ton at deflection 26,71 mm.

Because of that result of tested precast beam concrete type L joint which good performance then joint of beam by type L joint was needed to applicated and needed sustainable research to be perfect performance.

2. METHODS

Location for testing element precast beam was at Laboratory Bina Teknik Permukiman dan Perumahan Direktorat Jenderal Cipta Karya Kementerian PUPR Jl. Panyaungan, Cileunyi Wetan Kab. Bandung. Material was used for manufacture precast beam consist of concrete, reinforcement D13 and d8. This Research was required Universal Testing Machine to loading precast beam. Method of loading was applicated two of load P to respectively point at top of beam. To control and note a deflection and load applicated, used LVDT which it connected by Data Logger. Two support have applicated for support loading of two load at precast beam while loading. For furher information could be see figure 1 at below.

Figure 1: UTM machine

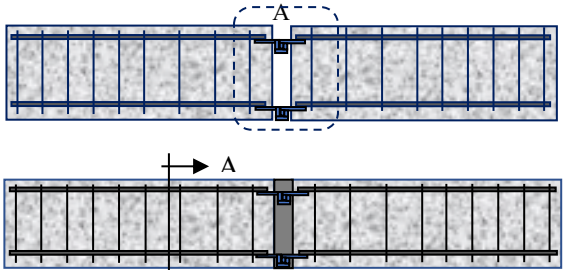

Figure 2. Prototype element precast type L Joint concrete beam

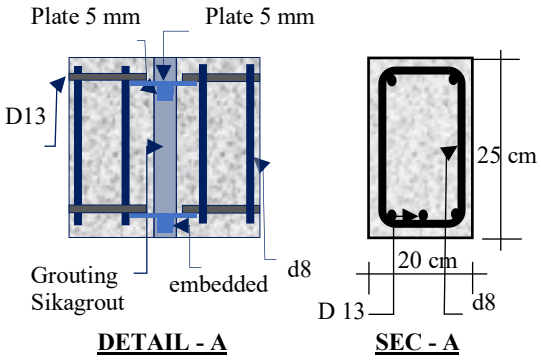

Figure 3. Detail and Section of element precast type L Joint concrete beam

Figure 2 describe of prototype of precast beam concrete type L joint. Figure 3 describe of detail and section of element precast type L Joint concrete beam. Method or step to get the data was describe at bellow.By Ultimate Testing Machine (UTM) at figure 1 was tested the specimen of beam with reinforcing or framework at figure 2 and figure 3. The Load was applicated at two point of the beam. UTM was tested the beam until rupture or collapse and datalogger was noted a result of that loading. Output data from data lodger was computed and take some conclusion.

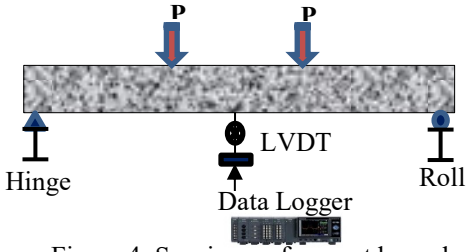

Figure 4: Specimen of precast beam has

3. RESULTS AND DISCUSSION

Research of precast beam concrete type L joint for all specimens were indicated that precast beam concrete type L joint was capable for resistance under loading until at least more than 11 T, accordingly all specimens were indicated that strength of flexural and deflection was not different respectively between specimens and will be explained at below. For pattern of crack, all of specimens have pattern of crack were equal crack due to moment, indicate that all specimen have not different behavior. Specimen precast type L joint have embedded with long width enough at the below then concrete was extruded of embedded at below (figure 4). Average of compression strength of specimens were 311,89 kg/cm2 and 421,33 kg/m2 for sika grout 215 at 9 days.

Results of strength of flexural precast beam P1 at ultimate was achieved 11,21 T at deflection 28,44 mm. Strength of flexural precast beam P2 at ultimate was achieved 11,76 T at deflection 26,71 mm.That indicate, specimens precast type L have strength ultimate was good enough nevertheless have behavior less for ductility. Table 1 showing result of flexural test of loading test.


Figure 5: Specimen of precast beam has

Table 1: Result of Flexural

No	Element	Load	Deflection.
		Ton	mm
1	P1	0,00-2,62	0,00-0,90
		2,77-3,92	0,94-1,71
		3,93-4,96	1,75-3,43
		5,01-5,76	3,66-6,04
		5,75-6,65	6,30-9,13
		6,83-8,93	9,47-17,39
		9,66-11,21	18,52-28,44
2	P2	0,00-2,13	0,00-1,2
		2,23-3,72	1,27-2,83
		3,87-5,46	2,92-6,42
		5,55-7,53	6,58-12,23
		7,71-19,55	12,48-17,73
		9,60-11,65	17,81-15,14
		11,70-11,76	25,40-26,71

Figure 6 showing chart of result of loading versus deflection of specimen beam P1. Figure 7 showing chart of result of loading versus deflection of specimen beam P2. It is evidence that result all of specimen indicate have equal performance for ultimate strength and not different for behavior of pattern of failure, precast beam concrete type L joint was behavior less for ductility. For further information could be see chart at below.

For figure 8 showing of result of loading versus deflection of specimen entirely beam P. If refer to figure 8, showing indeed behavior of precast beam P1 and P2 was has less behavior ductility δu/δy at least approximately 1,17. The benefit of precast beam concrete type L joint is more effective for construction than conventional beam (cast in site) and minimize cost of construction, cost of all element will be cheaper and can be applicated at location with difficult to rotate and difficult for availability of materials for mixing concrete.

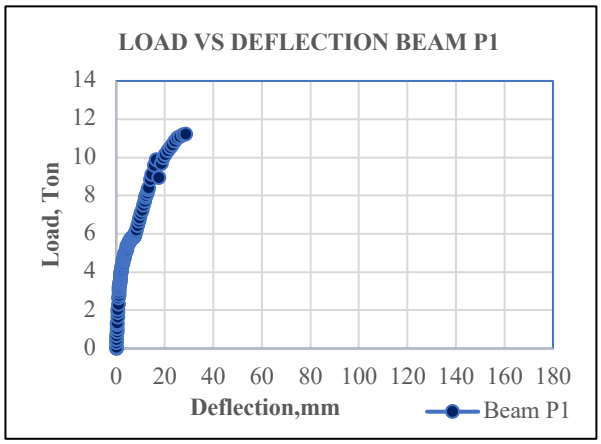

Figure 6. Chart of Result Beam P1

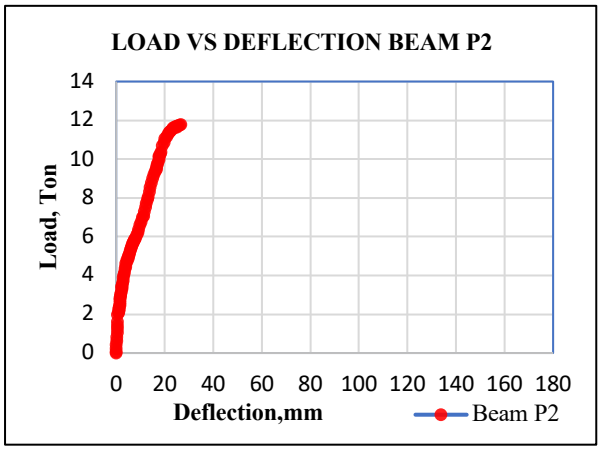

Figure 7. Chart of Result Beam P2

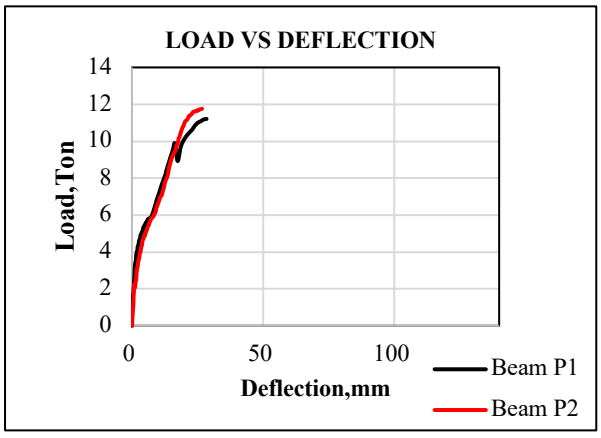

Figure 8. Chart of Result Beam P1, P2

Mario E. Rodríguez and Miguel Torres-Matos was researched of seismic behavior of type of welded precast beam concrete beam-column connection. The beam-column connections with welded longitudinal reinforcement showed local embrittlement of the steel, resulting in brittle failure of the connection.

That research was given that joint with welded system was showed local embrittlement of the steel, resulting in brittle failure of the connection and equally with this research (figure 5).

Recommendation from this research is precast beam concrete with type L joint can be applicated at constructions of building or other construction was needed joint at moment maximum.

4. CONCLUSION

Result of precast beam concrete type L joint (P, P2) were strength of flexural beam at ultimate and deflection of beam at ultimate. Strength of flexural precast beam concrete type L joint P1 at ultimate was value 11,21 T at deflection 28,44 mm. Strength of flexural precast beam concrete type L joint P2 at ultimate was value 11,76 T at deflection 26,71 mm. Result all of specimen indicate have equal performance for ultimate strength and not different for behavior of pattern of failure, precast beam concrete type L joint was behavior less for ductility $\delta u/\delta y$ at least approximately 1,17 and result all of specimen indicate have same as performance.

5. REFERENCES

[1] ACI Committee 318, 2014, Building Code Requirments for Structure and Commentary,American Concrete Institute, Detroit

[2] Rodríguez,Torres M, Summer 2013 , “Seismic Behavior of type of welded precast beam concrete- colum connection, PCI Journal Paper,Vol.58**,** Issue: **3,** Page number**:** 81-94.

[3] Ameli,JPark,Joel E, March - April 2015,” Seismic evaluation of grouted splice sleeve connections for reinforced precast concrete column–to–cap beam joints in accelerated bridge construction”, PCI Journal Paper, Volume: 60 Issue: 2 Page number: 80 – 103

[4] Nabi Goudarzi, Yasser Korany, March-April 2016,”Characterization of the shear behavior of Z-shaped steel plate connectors used in insulated concrete panels”, PCI Journal Paper, Volume: 61,Issue: 2, Page Number: 23-37

[5] Lesley H. Sneed, Kristian Krc, Samantha Wermager, and Donald Meinheit,” Interface shear transfer of lightweight-aggregate concretes with different lightweight aggregates”, PCI Journal Paper**,** March-April 2016,Volume: 61,Issue: 2,Page Number: 38-55

[6] Elide Pantoli,Tara C. Hutchinson, July-August 2016,”Seismic-drift-compatible design of architectural precast concrete cladding: Tieback connections and corner joints”, PCI Journal Paper, Volume: 61, Issue: 4, Page Numbers: 38-52

[7] Farnoud Rahimi Mansour, Suhaimi Abu Bakar, Mohammadreza Vafaei, and Sophia C. Alih,2017, “Effect of substrate surface roughness on the flexural performance of concrete slabs strengthened with a steel-fiber-reinforced concrete layer”, PCI Journal Paper, January-February 2017,Volume: 62, Issue: 1,Page Numbers: 78-89

[8] Matthew K. Swenty and Benjamin A. Graybeal,2017, Characterization of materials used in field-cast precast concrete connections, PCI Journal Paper, Volume: 62,Issue: 6,Page Numbers: 32 - 44

[9] Raafat El-Hacha and Hothifa Rojob,2018, Flexural strengthening of large-scale reinforced concrete beams using near-surface-mounted self-prestressed iron-based shape-memory alloy strips,2018, PCI Journal Paper, Volume: 63,Issue: 6,Page Numbers: 55 - 65

[10] SNI 03-2847-2019, Standar Nasional Indonesia, Tata Cara Perhitungan Struktur Beton Untuk Bangunan Gedung, Bandung, 2019

[11] George Morcous,Raed Tawadrous, May -June 2020,”Precast concrete deck-to-girder mechanical connection for accelerated bridge construction”, PCI Journal Paper,Volume: 65,Issue: 3,Page Numbers: 37 – 52

[12] Otgonchimeg Davaadorj, Paolo M. Calvi, and John F. Stanton,2020, Experimental response of headed stud connections subjected to combined shear and bending actions, PCI Journal Paper,Volume: 65,Issue: 5,Page Numbers: 38 – 50

[13] Theresa C. Aragon,Yahya C. Kurama, and Donald F. Meinheit, July - August 2020,” Behavior of ductile short-grouted seismic reinforcing bar–to–foundation connections under adverse construction conditions”, PCI Journal Paper,Volume: 65,Issue: 4,Page Numbers: 33 – 50

[14] Rafal Anay,Lateef Assi et.Al, November - December 2020,”Development of a double-tee flange connection using shape memory alloy rods’, PCI Journal Paper,Volume: 65,Issue: 6,Page Numbers: 81 – 96

[15] George Morcous and Raed Tawadrous,2020, Precast concrete deck-to-girder mechanical connection for accelerated bridge construction,PCI Journal Paper,Vol.65,Page Number:37-52

[16] Theresa C. Aragon, Yahya C. Kurama, and Donald F. Meinheit,2020, Behavior of ductile short-grouted seismic reinforcing bar–to–foundation connections under adverse construction conditions,PCI Journal Paper,Vol.65,Page Number:33-50
[17] Nabi Goudarzi, Yasser Korany, Samer Adeeb, and Roger Cheng,2020, Multistep elastic analysis of the nonlinear out-of-plane load-deflection behavior of precast concrete insulated sandwich panels,PCI Journal,Vol.65,Page Number:57-73
[18] Xiao Liang; Sritharan, Sri, May-Jun 2021," Use of unstressed strands for connections of precast concrete members " PCI Jurnal Paper, Volume 66, Issue**:** 3, p49-66. 18p
[19] Jae HyunKimaSeung-HoChoiaJin-HaHwang,et al, 2021, Experimental study on lateral behavior of post-tensioned precast beam-column joints, PCI Journal Paper,Vol.33**,** Page number**:** 841-854
[20] Xiao Liang and Sri Sritharan,2021, Use of unstressed strands for connections of precast concrete members,PCI Journal Paper,Vol.66,Page Number: 49-66
[21] Ryan T. Whelchel, Christopher S. Williams, and Robert J. Frosch,2021, Live-load distribution of an adjacent box-beam bridge: Influence of bridge deck,PCI journal,Vol.66,Page Number: 51-71