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Study of Pre-Stressed Concrete Girders Planning on Flyover Project Overpass Bridges Mahakam IV Samarinda City

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Abstract—**A pre-stressed concrete bridge is a construction structure that connects a place to another place that is made by giving a voltage opposite the voltage caused by an external load. The process of giving tension can be carried out before the concrete is printed (pre-pull) or after the concrete is printed (post-pull).On pre-stressed concrete bridges, the strength and reliability of a bridge are greatly influenced by the type and quality of the girder beam used. Structural analysis is carried out by calculating the initial prestressing force, determining the trajectory of the pre-stressed tendon, calculating the loss of pre-stressing, and controlling the stress that occurs in the cross section of the girder using strands of 12,7 - 0,5 STA 162. The purpose of this study is to plan pre-stressed concrete girder which refers to the Concrete Structure Planning for Bridges (SNI T-12-2004), and pre-stressed for bridges (SNI T-02-2015) with U-Box Girder type and VSL Standard. The analysis obtained, the use of tendons and strands were 8 tendons and 150 strands with loss of pre-stressed styles, namely anchorage friction of 46.31%, jack friction of 44.92%, elastic shortening of 41.85% and tendon relaxation of 33% and control deflection into a safe area.**

Index Terms—Girder, Pre-Stressed Concrete, girder U-Box, tendon, strands

I. INTRODUCTION

The high level of congestion in Samarinda is the main prob-lem that must be resolved immediately. Bridge of Mahakam IV (Twin Mahakam Bridge) was built to be one solution to overcome the high volume of vehicles.

However, to build the Mahakam IV Bridge, the approaching road builder from the side of the city and the opposite side of the Fly Over concept needs to be built first in order to build a bridge that is quite high from the river surface, can connect the plate between pier/ segments needed a good girder.

The development of technology in engineering, there are many types of girder that can be applied to bridges. One of them is the presence of pre-stressed concrete as the solution to these problems. In terms of dimensions, for the same span the pre-stressed concrete cross section is smaller than ordinary reinforced concrete. By using a bridge girder from pre-stressed concrete, it can be used on long span bridges.

In carrying out the erection of the bridge girder, there are several methods of implementing the installation. The bridge girder erection system is carried out directly in a full span on a pedestal, or commonly called a full span system.

To the treatment of the installation of bridge girder system, it certainly creates a difference in structural behavior. Therefore, an analysis of the bridge girder structure will be carried out based on each installation system.

II. LITERATURE REVIEW

A. The bridge girder

Girder is a beam that extends extensively and transversely which functions to receive and spread the load that works from above the bridge and pass it to the bottom structure of the bridge [1] The type of girder bridges are as follows:

1) Wood girder
2) Girder T, I, and reinforced concrete box.
3) Girder Steel.
4) Girder Composite.
5) Girder Pre-Stressed Concrete T,I (I girder), box girder), and V.

In accordance with the RSNI T-12-2004 article of 6.5, plan-ning of prestressed concrete structures needs to be based on the way Planning is based on Factor Loads and Strengths (PBKT). However, for planning pre-stressed concrete com-ponents, especially full pre-stressed concrete, with respect to bending which prioritizes a limitation of working stress, both in compressive and tensile stresses, or in relation to other aspects that are deemed appropriate for deformation behavior requirements, can be used in the way of Planning based on Service Limit (PBL) [2] - [3]

B. Girder Planning

According to SK-SNI-03-1726-2002 article of 3.11.4, the concrete permit voltage for flexible structural components and pre-stressed tendons are as follows.

1. The concrete permit voltage at transfer for flexible structures should not exceed the following values:
   a. the outermost fibers experience compressive stress (f_{ci}) ≤ 0,60 . f'ci
   b. The outermost fibers experience tensile stress (f_{ti}) ≤ 0,25 . $\sqrt{f'ci}$
2. The final concrete permit voltage for flexible structures should not exceed the following values:
   a. the outermost fibers experience compressive stress (f_{cs}) ≤ 0,45 . f'c
   b. the outermost fibers experience compressive stress (f_{ts}) ≤ 0,5 . $\sqrt{f'c}$
3. Allowable stress tensile prestressing tendons (f_{ps}) not exceed the following values:
   a. The tendon deflect style ≤ 0,94 . f_{py}, but not greater than 0,85. f_{ps}.
   b. After the prestressed style transfer ≤ 0,82. f_{py}, but not greater than 0,74. f_{pu}
   c. Post-pull tendons in the anchor and connection area shortly after the force distribution ≤ 0,70 $f_{pu.}$

III. METHOD

In this study, we carried out several stages as shown in the figure 1.

IV. RESULTS AND DISCUSSION

A. Data on Bridge Floor Plates

Planning data of fly over Bridge of Mahakam Samarinda City as a follows:

1) Plate thickness, ts of 0,3 m
2) Thick asphalt layer, ta of 0,05 m Thick puddles, th of 0,05 m
3) Distance between girder, s of 2,7 m
4) Bridge width, b of 17,58 m
5) long span bridge, L of 34,15 m

   Materials structure used as:

   a) Concrete Quality, K-300 of 24,9 MPa
   b) Steel Quality, U-39 of 390 MPa

TABLE I
PAPAMETERS OF THE SAP 2000 PROGRAM

Flexible bone	Combination	Slide Field	Moment Field
Negative	Combination 4	320,831 kN	244,36 kNm
Positive	Combination 4	328,984 kN	120,264 kNm

B. Analysis of stress

Tables 4 and 5 show the combination of ultimate moments on the girder.

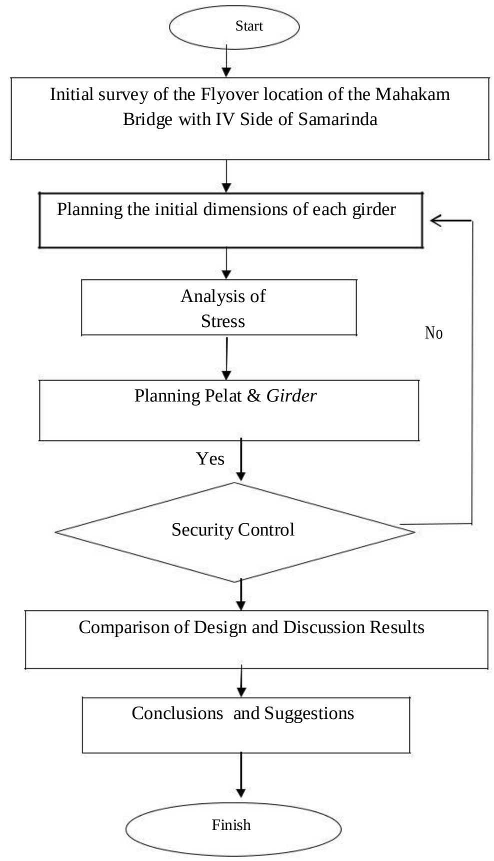

Fig. 1. The research stages.

V. CONCLUSION

In planning the girder used type V-deck or U-Box girder with a span length of 28.8 m with 6 pieces and the width of the upper part is 1.6 m and the bottom width of 1 m and the distance between girder is 2.7 m. Planning girder using K-500 quality concrete with the type of Uncoated stress relieve seven wires ASTMA 12,7 - 0,5 STA 162 and the required number of cables is 8 Tendons and 150 Strands inside.

TABLE II
THE COMBINATION OF ULTIMATE MOMENTS ON THE GIRDER

Type of Load	load Factor	M (kNm)	Combination
Own weight (MS)	1,3	8972,1	11663,736
Additional burden (MA)	2	625,9	1251,79
Lane load(TD)	1,8	5695,39	10251,7
Brake force (TB)	1,8	66,88	120,38
Wind load (EW)	1,2	107,97	129,57
Temperature Influence (ET)	1,2	126,79	152,15
Earthquake load (EQ)	1	1234,54	-
Total			23569,32

TABLE III
THE COMBINATION OF ULTIMATE MOMENTS ON THE GIRDER

Type of Load	load Factor	M (kNm)	Combination
Own weight (MS)	1,3	1050,84	1366,1
Additional burden (MA)	2	73,31	146,61
Lane load(TD)	1,8	564,13	1015,44
Brake force (TB)	1,8	3,92	7,05
Wind load (EW)	1,2	12,65	15,18
Temperature Influence (ET)	1,2	3,71	4,46
Earthquake load (EQ)	1	144,59	-
Total			2554,83

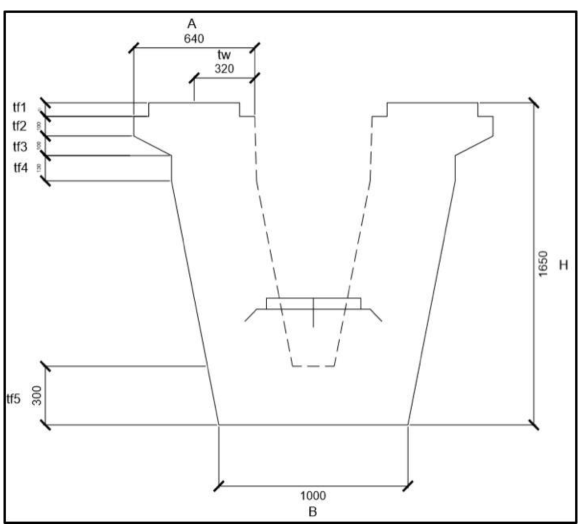

Fig. 2. Cross section U girder.

REFERENCES

[1] L. Deng and C. S. Cai,"Development of dynamic impact factor for performance evaluation of existing multi-girder concrete bridges," Eng. Struct., vol. 32, no. 1, pp. 21-31, Jan. 2010.

[2] Nawy, Edward. 2001. Beton Prategang Suatu Pendekatan Mendasar. Jakarta: Erlangga

[3] Supriyadi, Bambang dan Agus Setyo Muntohar. 2007. Jembatan. Yo-gyakarta : Beta Offset

[4] Badan Standarisasi Nasional. Standar Pembebanan Untuk Jembatan (SNI T-02-2005)

[5] Departemen Pekerjaan Umum. 1992. Peraturan Perencanaan Teknik Jembatan (Bridge Management System)