PROTOTYPE MODELING OF T-BEAM OF STANDARD BINA MARGA BY STEEL PLATE AS FLEXURAL STIFFENING

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ABSTRACT

Modeling the strengthening of external T-beam bridge of Bina Marga standard by steel plate in the attracting side was done by applying finite elements based program, that is FEA LUSAS. As many as 12 T-beam bridge models were modeled by applying two dimension elements with the length of span 10, 15, 20, and 20 meters. Every span of T-beam was modeled into three finite element model, one model was without steel plate which is used as a control model and two other models were with steel plate.

Three points loading with a simple supported (pin-roll) was conducted to T-beam model, it is based on the roles of BMS. The strengthened beam was analyzed using four type of plate thickness 4,0 mm, 6,0 mm, 8,0 mm and 10,0 mm with consistence of gluing thickness of 3,0 mm. Beam modeling, glue and plate was modeled by surface element, while beam reinforcement was modeled by bar element. Deflection behavior was investigated in the rate of loading states, that is from the first loading 1 kN by increasing the loading as big as 1 kN until it reached permitted down buckling L/800. The result of down loading-deflection relation was plotted in the form of diagram while crack pattern was shown in the form of drawing of cracked pattern.

The result of the analysis showed that, the beam with steel plates was able to increase stiffness and strength of beam. Compared with control beam, the beam with steel plates model MP10$\underline{4}$ and MP10$\underline{6}$ respectively underwent the increase of the first crack loading 8,3% and 13,9%, while the increase of loading that caused the accomplishment of permitted down buckling for model MP10$\underline{4}$ and MP10$\underline{6}$ was 11,7% and 17,6%. For the beam with steel plates model MP15$\underline{4}$ and MP15$\underline{6}$ respectively underwent the first increasing of crack loading 9,1% and 15,9%, while the increase of loading that caused the accomplishment of permitted down buckling for model MP15$\underline{4}$ and MP15$\underline{6}$ was as big as 12,6% and 18,7%. For the beams with the steel plates model MP20$\underline{6}$ and MP20$\underline{8}$ respectively underwent the increase of the first crack loading 17,5% and 21,1%, while the increase of loading that brought about the accomplishment of permitted down buckling for model MP20$\underline{6}$ and MP20$\underline{8}$ was around 19,3% and 22,5%. And for the beams with the steel plates model MP25$\underline{8}$ and MP 25$\underline{10}$ underwent the increase of the first crack loading 21,7% and 26,9%, while the increase of loading that caused the accomplishment of the permitted down buckling for model MP25$\underline{8}$ and MP25$\underline{10}$ was 25,9% and 27,2%.

It is recommended that the plate dimension for the bridge with 10 meter span is 6000 mm long, width 320 mm with the choice of plate thickness is 4,0 mm and 6,0 mm. For the bridge with 15 meter span, the plate dimension is length 10200 mm, width 350 mm with the choice of plate thickness is 4,0 and 6,0 mm. For the bridge with 20 meter span, the plate dimension is length 13200 mm, width 460 mm with the choice of plate thickness 6,0 and 8,0 mm. For the bridge with 25 meter span, the plate dimension is length 16200 mm, width 680 mm with the choice of plate thickness 8,0 and 10,0 mm.

Keywords : T-beam bridge of Bina Marga standard, Strengthening, Steel plate, FEA LUSAS modeling.