

EXAMPLE 2-007

Steel Composite Beam under Four-Point Loading

1. EXAMPLE DESCRIPTION

Figure 1 shows a steel composite beam subjected to four-point loading. Dimensions and reinforcement details are shown in Fig. 1.a, while loading setup is shown in Fig. 1.b.. The mesh discretization used in ELS is shown in Fig.1.c.

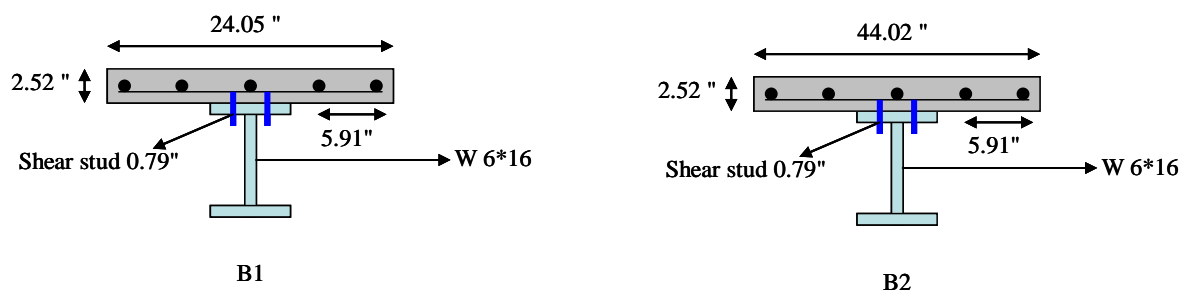


Fig. 1.a Problem geometry [Ref. 1]

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* DATA FILE NAM: 2-007-b.ELS

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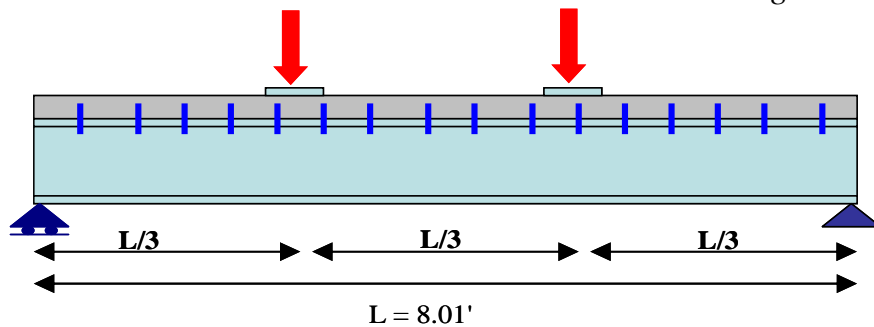


Fig. 1.b loading Setup [Ref. 1]

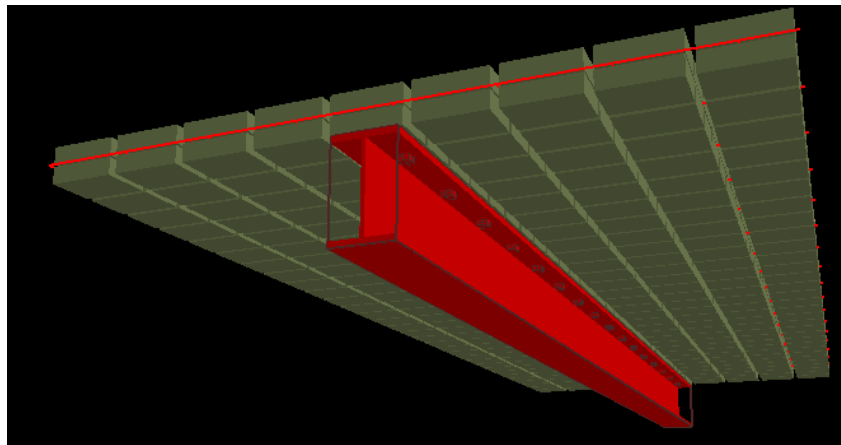


Fig. 1.c ELS mesh

2. MATERIAL PROPERTIES

The compressive strength of the concrete is 5.22 ksi (0.0365 kN/mm²), while the yield stress of the steel section is 51.34 ksi (0.359 kN/mm²). The studs' material is steel with yield stress of 58 ksi (0.406 kN/mm²). .

The applied element method follows a discrete crack approach, in which, the material is represented by a group of springs located at the surfaces of the element. The springs represent the axial and shear behavior of the material. For more details about material constitutive models refer to the ELS® technical manual.

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3. RESULTS

Figure 2 illustrates the load-deflection analytical results compared to the experimental ones. As can be obviously seen, the results are very close to the experiments. The behavior is well predicted in the elastic stage and in the post-yielding stage. In other words, the overall response could be successfully obtained by ELS.

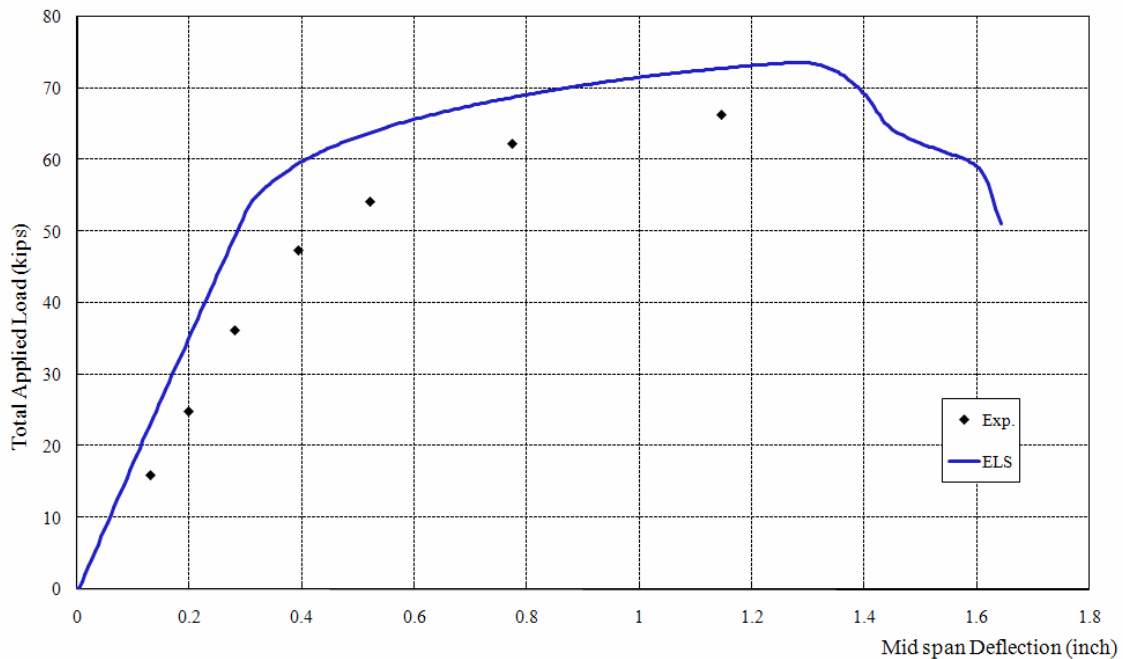


Fig. 2.a Load-deflection predicted by ELS in a comparison to the experimental results for Specimen B1

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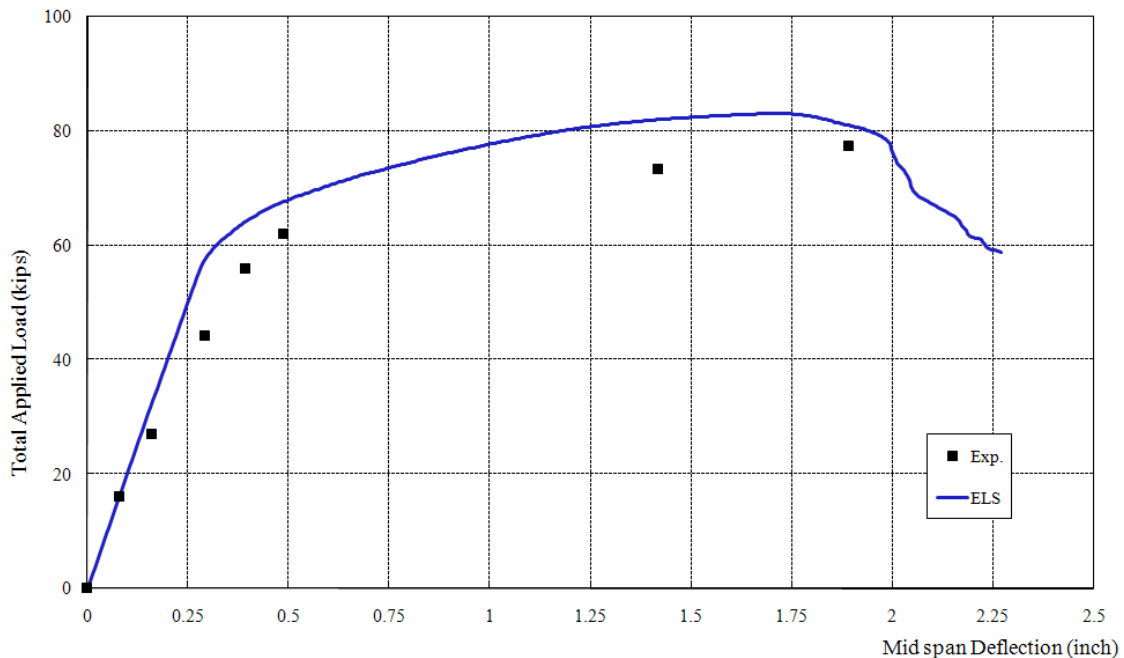


Fig. 2.b Load-deflection predicted by ELS in a comparison to the experimental results for Specimen B2

4. CONCLUSIONS

Based on the analytical and experimental results, it can be concluded that the ELS can successfully analyze and predict a close-to-reality behavior of composite structures in the elastic, post-cracking and post-yielding stages.

5. REFERENCES

- 1- Abu-amra, T., and Nassif, H., "Effect of flange width on the deflection of steel composite beams", Proc. of the 9th Arab Structural Engineering Conf., Nov. 29 – Dec. 1, 2003, Abu Dhabi, UAE, pp.65-72
- 2- Technical Manual of Extreme Loading for Structures.

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