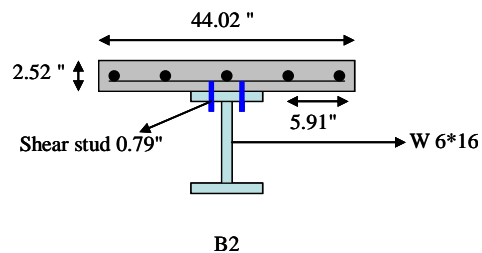
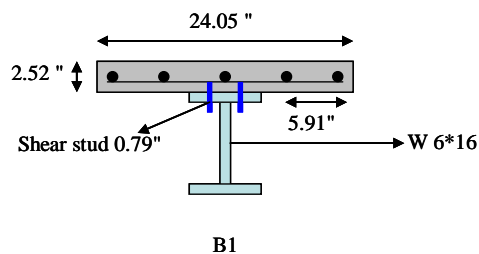


EXAMPLE 2-007

Steel Composite Beam under Four-Point Loading

1. EXAMPLE DESCRIPTION

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



* DATA FILE NAME: comp slab.ELS

* DATA FILE NAM: comp_slab_b3.ELS

Example 2-007

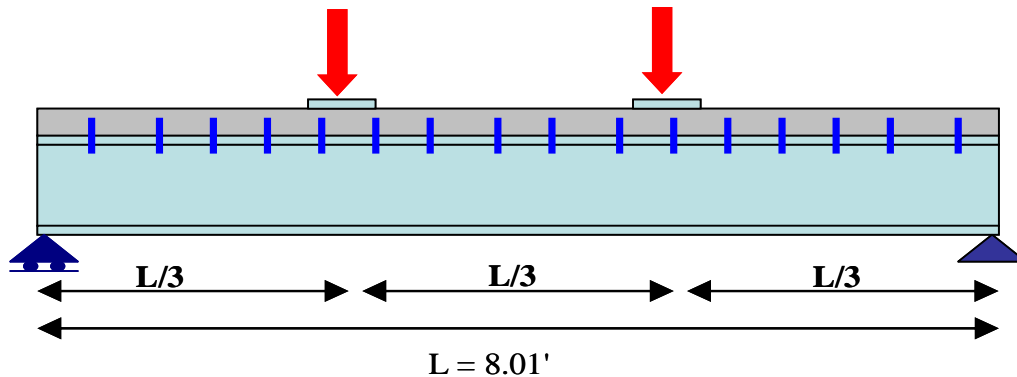


Fig. 1.a Problem geometry [Ref. 1]

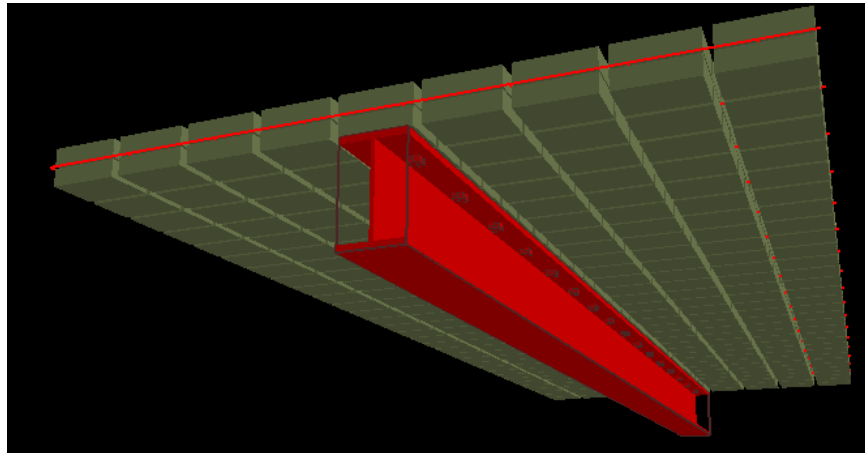


Fig. 1.b ELS mesh

Fig. 1 CFT girder under four-point loading

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 was 51.34 ksi (0.359 kN/mm²). The studs material is steel with yield stress of 58.02 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.

* DATA FILE NAME: comp slab.ELS

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Example 2-007

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. Figs. 3 and 4 show the Failure Pattern predicted by the ELS.

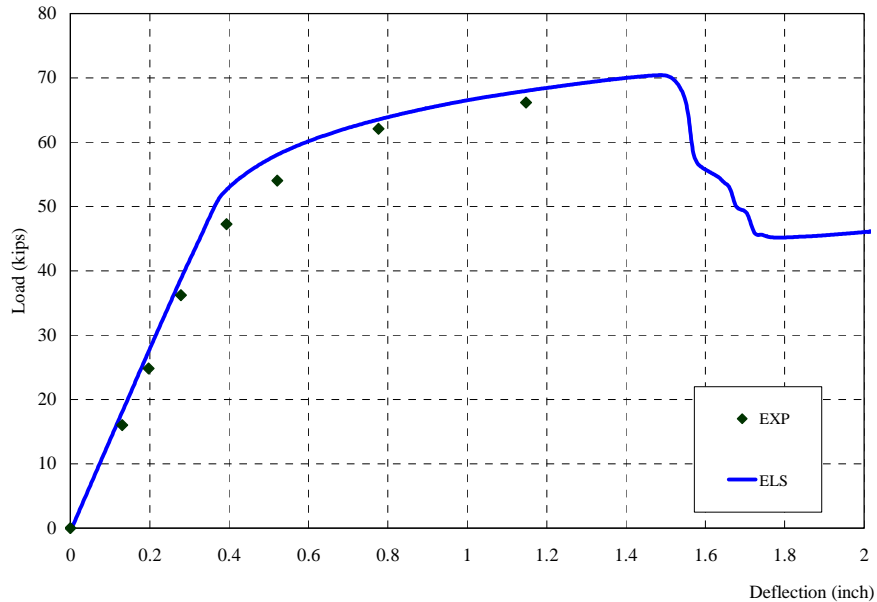


Fig. 2.a Specimen B1

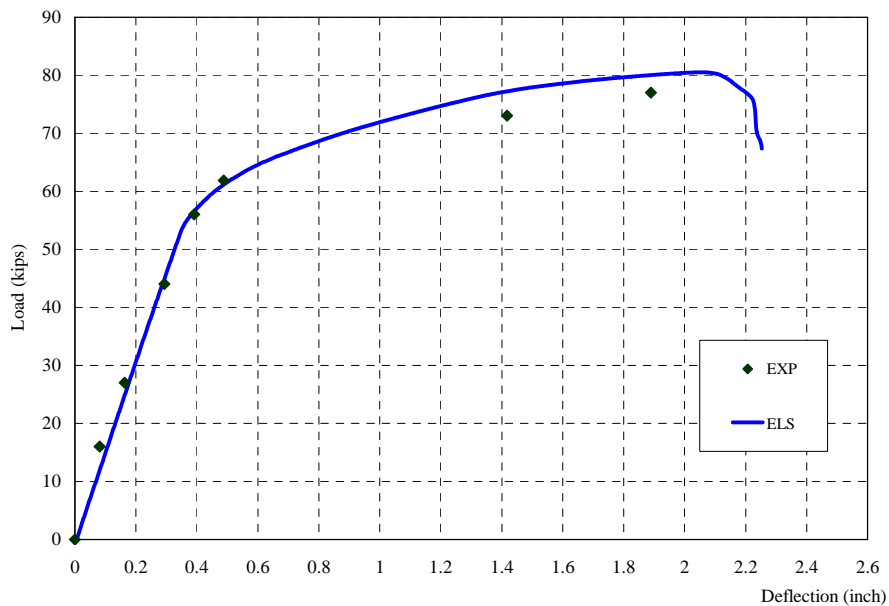


Fig. 2.b Specimen B2

* DATA FILE NAME: comp_slab.ELS

* DATA FILE NAM: comp_slab_b3.ELS

Example 2-007

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

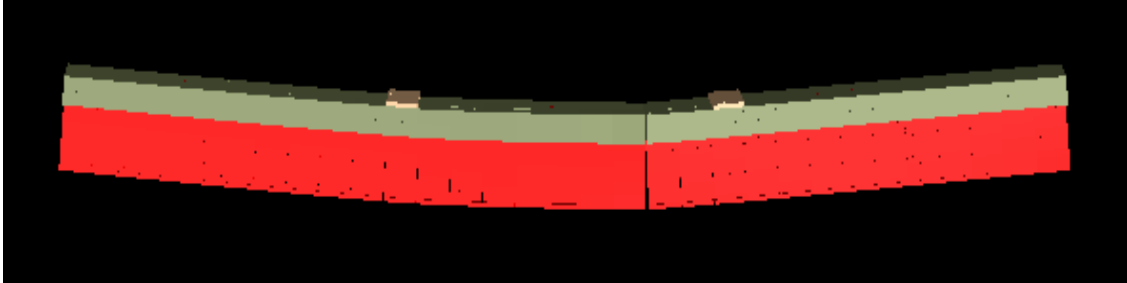


Fig. 3 Failure Pattern obtained by ELS for B1

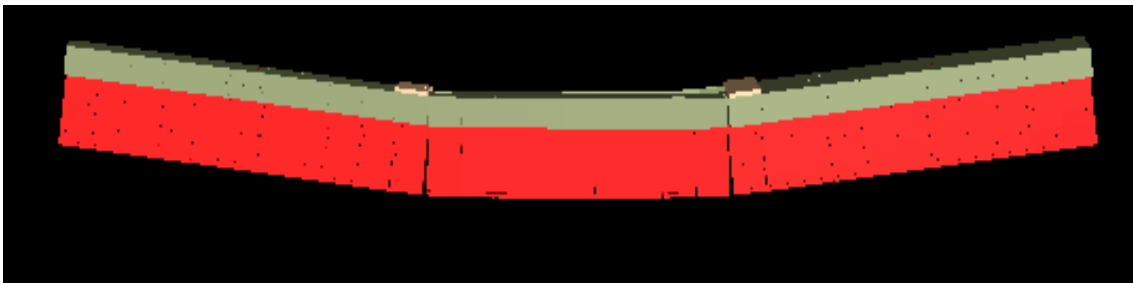


Fig. 4 Failure Pattern obtained by ELS for B2

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.

* DATA FILE NAME: comp slab.ELS

* DATA FILE NAM: comp_slab_b3.ELS

Example 2-007