Parameters effecting the in-plane rotation of skewed integral abutment bridges under thermal expansion

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Introduction

The study of skewed integral abutment bridges (IABs) has shown that skewed IABs experience rotation in the horizontal plane under thermal expansion. This causes a redistribution of the soil pressure acting on the abutment walls and so a non-uniform soil pressure behind the walls in the horizontal plane. Therefore the deformation pattern for skewed IABs may differ substantially from that of non-skewed IABs and can produce unanticipated local cracking.

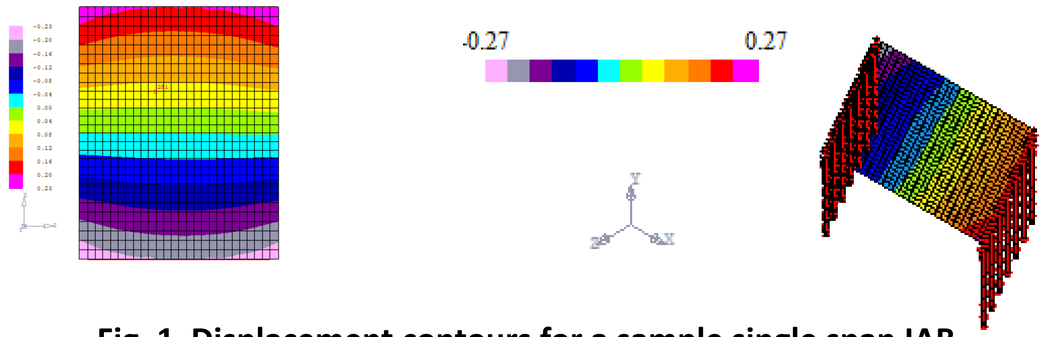

Fig. 1 Displacement contours for a sample single span IAB

Behavior of skewed IABs under thermal loading

The objective of this study was to identify the parameters contributing to the in-plane rotation and the variation in the soil pressure developed near the deck level behind the abutment walls, for skewed IABs under thermal expansion.

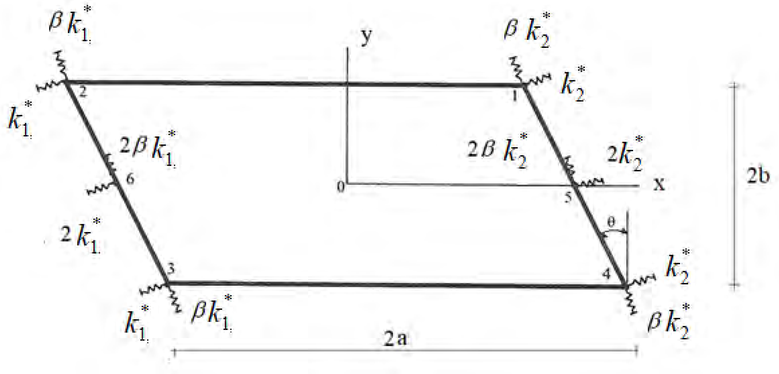

Fig. 2 Geometry of a skew rigid plate

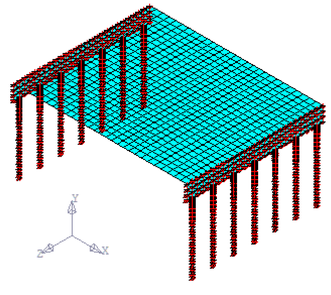

Fig. 3 3-D model of a sample single span skewed IAB

Results

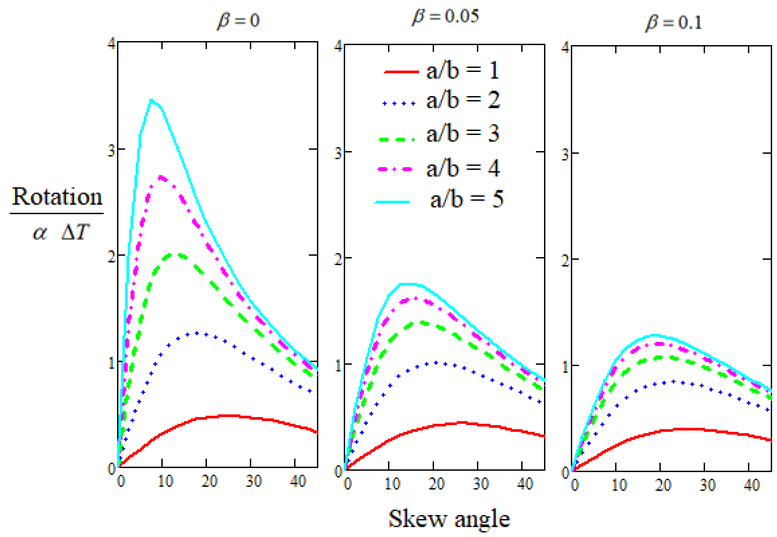

Fig. 4 Variation of in-plane rotation

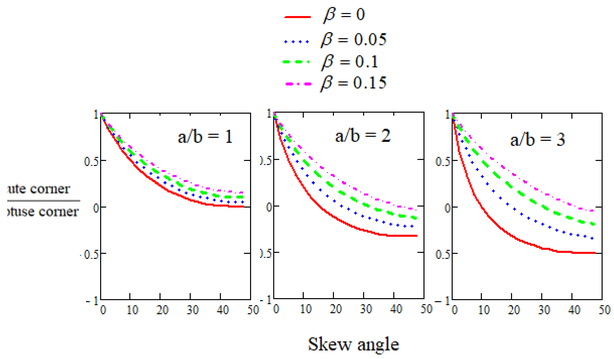

Fig. 5 Variation of the ratio of normal displacements

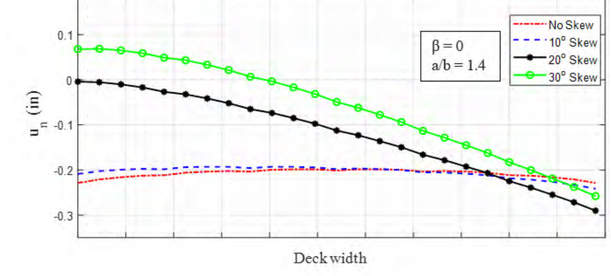

Fig. 6 Abutment displacement at deck level

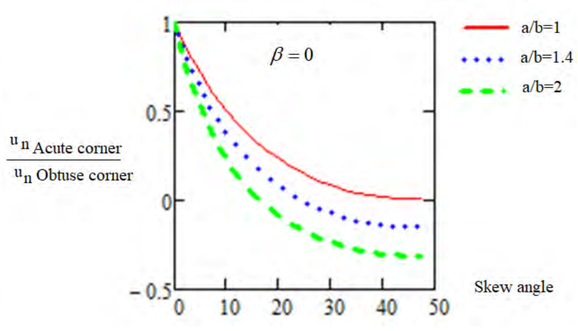

Fig. 7 Variation of the ratio of normal displacements

Conclusion

The analytical study reveals that under thermal expansion, the rotation of the skewed rigid plate is a function of the skew angle, the length to width ratio of the plate, and the relative stiffness parameter, (the ratio of the tangential to the normal restraining springs stiffnesses). The verification of findings of the analytical study by means of a parametric study, using 3-D models of sample skew IABs, is in progress.

Acknowledgments

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