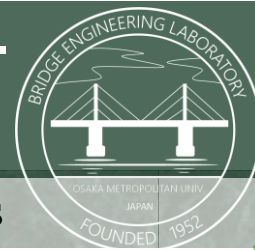


Study on the Applicability of Steel Deck Plate Splices with High-Strength Countersunk Head Bolted Single Frictional Joints

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Flattening of Steel Deck Plate Joints using high-strength countersunk head bolts

BACKGROUND

As shown in Fig.1, the protrusion of bolt heads may lead to reduced corrosion resistance and pavement durability. Therefore, the use of single-surface friction-type joints employing countersunk bolts, as shown in Fig.2, is being considered.

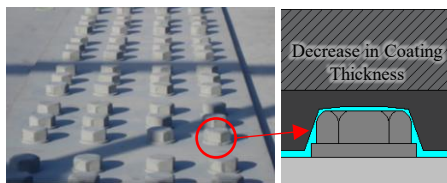


Fig.1 Steel Deck Plate Joints

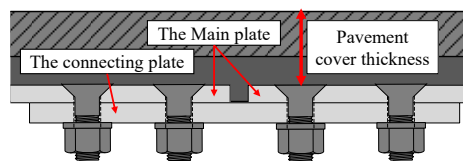


Fig.2 High-Strength Countersunk Head Bolted Single Frictional Joints

Purpose:

To investigate the performance and fatigue durability of countersunk high-strength bolts under wheel loads.

METHOD

The analysis model is shown in Fig.3. The deformation performance and stress range under wheel loading at the longitudinal joint were compared for each joint configuration.

Parameters:

Bolt type (Fig.4) and number of connection surfaces

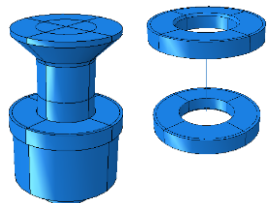


Fig.4 Bolt Model

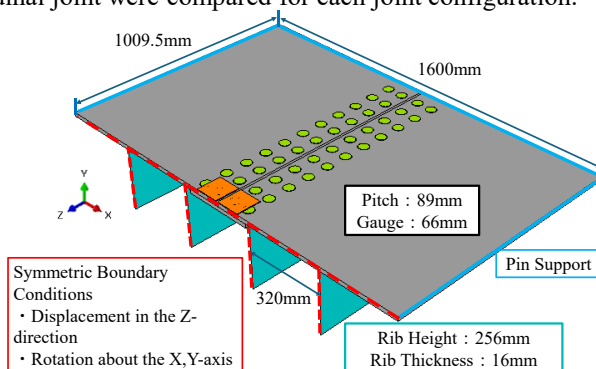


Fig.3 Analysis Model

KEYWORDS

High-Strength Countersunk Head Bolt, Single Frictional Joints

RESULTS

➤ Fig.5 shows the vertical displacement increment at the deck's central section. The countersunk bolt joint's vertical displacement decreased by 4.4% (single friction) and 3.3% (double friction) compared to the hexagonal bolt joint.

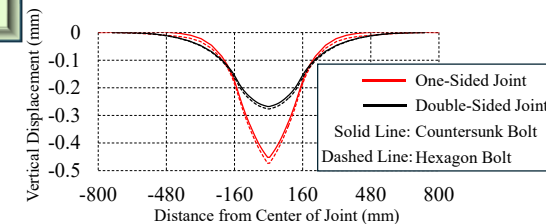


Fig.5 Deck Vertical Displacement Increment

➤ Fig.6 shows that the maximum stress range of the countersunk bolt joint decreased by 9 N/mm² compared to the hexagonal bolt joint, and the one-sided joint increased by 10 N/mm² compared to the double-sided joint.

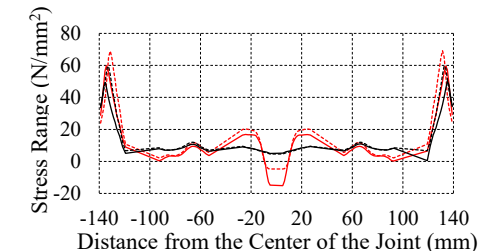


Fig.6 Principal Stress Increment

➤ Fig.7 shows that the stress range in the countersunk machined area and bolts is greater for the one-sided joint than the double-sided joint. No significant stress concentration was observed, with the maximum stress range around 20 N/mm² for the one-sided joint.

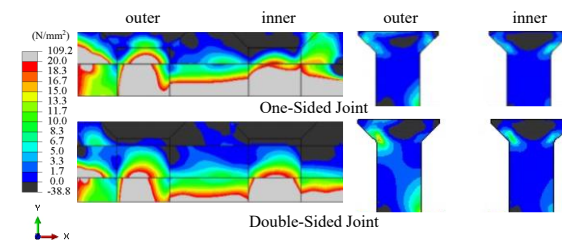


Fig.7 Principal Stress Increment Contour of Countersunk Area and Countersunk Bolt

SUMMARY

- 3–4% reduction under wheel loading regardless of connection surface number.
- 15% lower maximum stress at deck joint with countersunk bolts.
- 20 N/mm² stress in machined area and bolt.
- No significant stress concentration.