

공학박사학위논문

Evaluation of Ultimate Compressive Strength  
of Flanges Stiffened with U-ribs  
in Wide Steel Box-girder

U리브로 보강된 광폭 강박스거더 플랜지의  
극한압축강도 평가

2015년 8월

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## **ABSTRACT**

This study proposes a method to evaluate the in-plane ultimate compressive strength of stiffened flanges with U-ribs in a wide steel box-girder. When a primary bending moment and/or an axial force are applied to the steel box-girder, the main load component of top or bottom flanges is longitudinal in-plane axial compression. For the reason above, the stiffened flanges with U-ribs are separated from the box-girder and modeled by finite elements with idealized boundary conditions.

Generally, the stiffened flanges between diaphragms are designed to behave as if simple support conditions were applied. If the diaphragms are stiff (thick) enough in the out of plane direction, loaded edges of the stiffened flanges will have the same displacement in longitudinal direction. This condition can be analyzed by displacement control. However, if the diaphragms are flexible (thin) enough in the out of plane direction, all parts of the loaded edges of the stiffened flanges will have different displacements in the longitudinal direction. This condition has to be analyzed by force control. Thus, the ultimate compressive strengths of the stiffened flanges are evaluated considering effects of the bending stiffness of the diaphragms on in-plane behaviors of the stiffened flange. This study shows that the effect of the diaphragm is negligible under the practical thickness. Thus, the force control is considered to be more appropriate than the displacement control for

evaluation of the ultimate compressive strength of flanges stiffened with U-ribs. Based on the ultimate compressive strengths in the force control, a strength formula is proposed.

The FHWA (Federal Highway Administration) provisions are reviewed and evaluated in terms of the finite element solution in this study. The FHWA provisions accurately estimate the ultimate compressive strengths of the stiffened flanges in the force control. The ultimate compressive strengths from the FHWA provisions are nearly the same as those from the proposed strength formula.

Thus, this study recommends the proposed strength formula or the FHWA provisions for evaluation of the ultimate compressive strength of stiffened flanges with U-ribs. Either way, the ultimate compressive strengths are almost same.

Key Words:

Wide steel box-girder, Ultimate compressive strength, Stiffened flange, U-rib, Bending stiffness of diaphragm, Force control, Displacement control, FHWA provisions

**Student Number: 2009-30938**