University of Connecticut

Shear Capacity of Girders with Sub-sized Transverse Stiffeners in Bridges

Group 1: Luke Pepin, Zacharias Hellwinkle, Antoine El Hani, Sebastian Pichardo
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Professor Kevin Zmetra
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Abstract

This report investigates the Shear Capacity of Girders with Sub-sized transverse stiffeners in Bridges, an innovative approach to …

Small Summary of Report (Length: 3 Blocks around 2-3 Sentences Each) - **To be written last**

I. Introduction

This report delves into the intricacies of sub-sized transverse stiffeners on the shear capacity of bridge girders. Unlike building girders, bridge girders are constructed from steel plates, resulting in deeper girders with thinner webs, necessitating the use of transverse stiffeners for reinforcement.

Transverse stiffeners effectively transform plate girders into pseudo-trusses, leveraging tension field action (TFA) to withstand substantial loads during ultimate conditions. However, the success of TFA relies heavily on the ability of stiffeners to resist web buckling. Consequently, engineering codes prescribe limits on stiffener size and strength to ensure structural safety and performance. Stiffeners meeting these criteria allow for the utilization of TFA, while undersized ones necessitate a reduction in shear capacity.

Real-world scenarios encountered during bridge load rating assessments have highlighted the critical importance of adhering to stiffener standards. Instances of slightly undersized stiffeners have resulted in significant reductions in shear capacity, potentially compromising bridge structural integrity. This observation has prompted a thorough investigation into the correlation between stiffener undersizing and shear capacity reduction.

Drawing from experiences in previous load rating evaluations, where stiffeners marginally failed to meet specifications, this research seeks to comprehensively understand the implications of stiffener sizing on shear capacity. By elucidating these relationships, the study aims to provide valuable insights for bridge engineers and policymakers, facilitating informed decision-making in bridge design, evaluation, and maintenance practices.

II. Literature Review

A. Introduction

At the start of his administration President Biden made it clear that improving and growing public infrastructure was a priority. Consequently, there has been a large increase in demand for bridges and by extension bridge girders. These girders are crucial elements within bridge structures, the performance of these girders directly reflect the performance and safety of the entire bridge system. One key aspect that significantly influences the implementation of bridge girders is the presence of transverse stiffeners.

Transverse stiffeners are reinforcements for steel plate girders. They serve to transform the plate girders into pseudo-trusses by utilizing tension field action (TFA). Which enhances the structural capacity of the girders. However the effectiveness of TFA is contingent upon the ability of stiffeners to resist web buckling. Transverse stiffeners must be carefully designed and implemented or its critical role of structural integrity and performance may be compromised.

The purpose of this literature review is to provide a comprehensive overview of existing research and scholarly works relevant to the influence of transverse stiffeners on the shear capacity of bridge girders. It intends to investigate the connections between various design parameters of stiffeners and their effects on shear capacity. Additionally, the review will analyze the consequences of undersized stiffeners on structural behavior by drawing insights from real-world case studies and experimental investigations.

B. Overview of Shear Capacity and Transverse Stiffeners

Definition and Significance of Shear Capacity

Functionality of Transverse Stiffeners in Enhancing Shear Capacity

Key Factors Influencing Shear Capacity in Girders with Sub-sized Stiffeners

C.Historical Context

Evolution of Bridge Girder Design and Construction

Development of Transverse Stiffener Standards and Regulations

Previous Studies on Shear Capacity and Stiffener Sizing

D. Literature Review

A. Study 1: [Title]

1. Objective and Scope

2. Relevance to Current Research
3. Major Findings and Insights
4. Implications for Shear Capacity Analysis

B. Study 2: [Title]
1. Objective and Scope
2. Relevance to Current Research
3. Major Findings and Insights
4. Implications for Shear Capacity Analysis

C. Study 3: [Title]
1. Objective and Scope
2. Relevance to Current Research
3. Major Findings and Insights
4. Implications for Shear Capacity Analysis

D. Study 4: [Title]
1. Objective and Scope
2. Relevance to Current Research
3. Major Findings and Insights
4. Implications for Shear Capacity Analysis

E. Study 5: [Title]
1. Objective and Scope
2. Relevance to Current Research
3. Major Findings and Insights
4. Implications for Shear Capacity Analysis

E. Synthesis of Literature
A. Common Themes and Trends Across Studies
B. Variations and Contradictions in Findings
C. Gaps in Existing Literature

F. Conclusion
A. Summary of Key Insights from Literature Review
B. Implications for the Current Study
C. Recommendations for Future Research VII. References

III. Model Design

This section will detail the model we constructed. Dimensions, element type, interactions, boundary conditions, and parameters we are investigating

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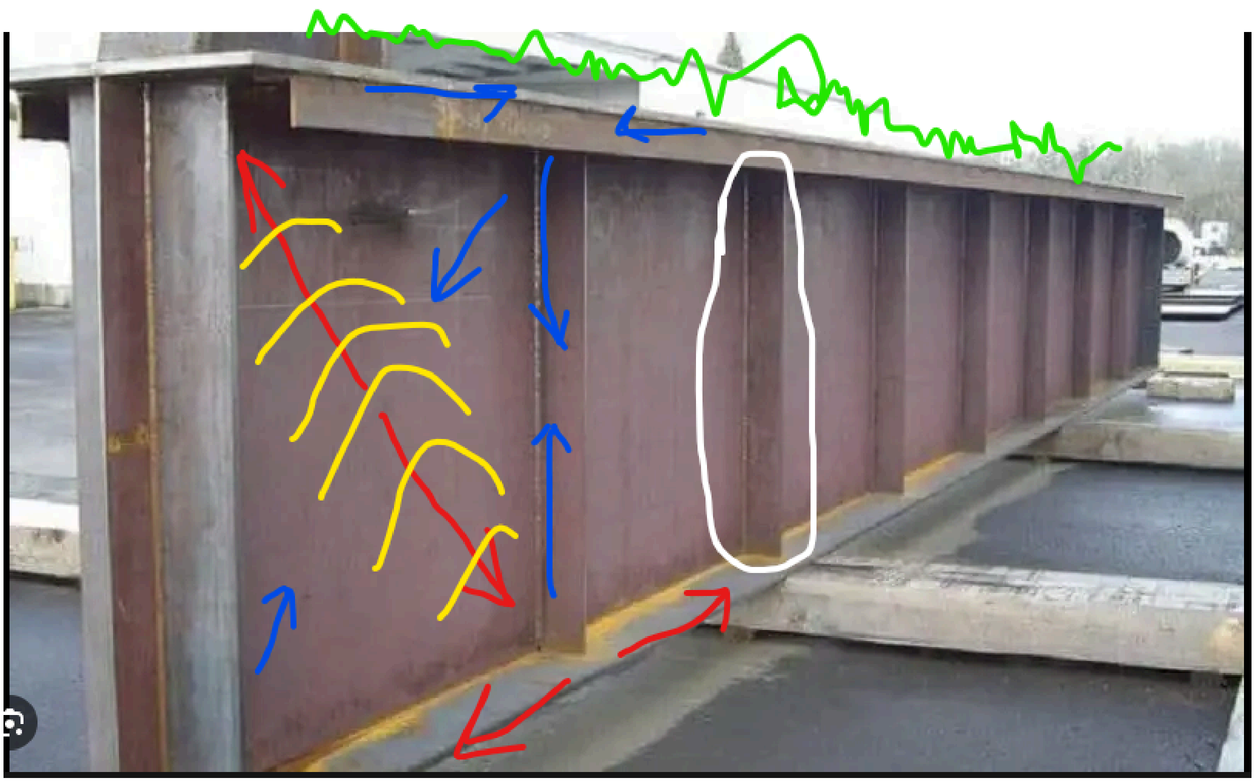

IV. Experimental Data

This section will go over the data we collected from the experiments, save the discussion of what the data means for the next section

V. Results

This section will discuss the results from the previous section. What they mean, trends, etc

Example_trends_image.jpg:

The plate buckling coefficient, k_v, for panels subject to pure shear having simple supports on all four sides is given by the following (Ziemian, 2010).

$$k_v = \begin{cases} 4.00 + \dfrac{5.34}{(a/h)^2} & \text{for } a/h \le 1 \\ 5.34 + \dfrac{4.00}{(a/h)^2} & \text{for } a/h > 1 \end{cases} \qquad \text{(C-G2-1)}$$

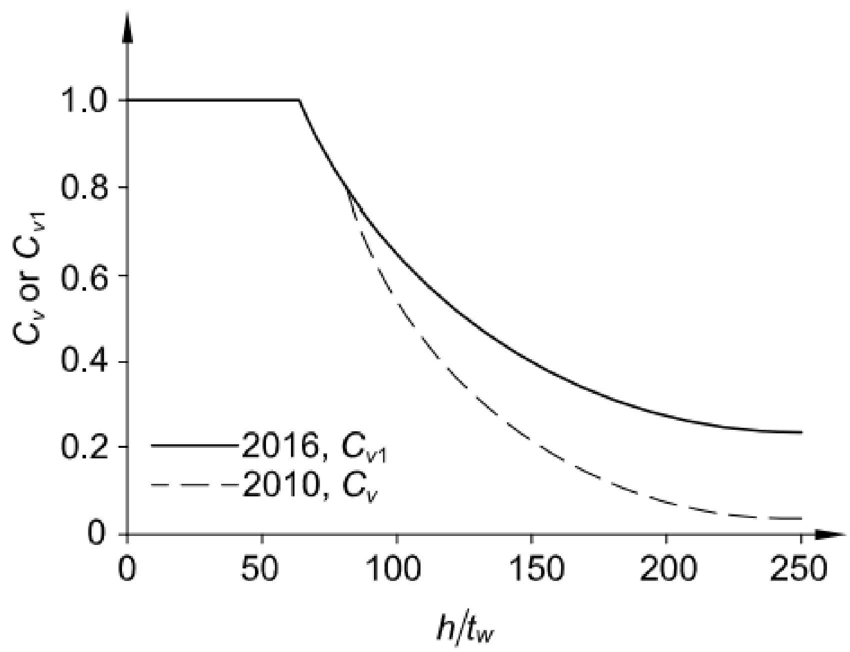

Fig. C-G2.1. Shear buckling coefficient for F_y *= 50 ksi (345 MPa).*

VI. Recommendations and Conclusions

This section will discuss the recommendation and conclusions we make with regard to the results of the experiments that were discussed in the previous section

REFERENCES

AASHTO (2002), *Standard Specifications for Highway Bridges,* 17th Ed., American Association of State Highway and Transportation Officials, Washington, DC.

Example Format:
https://docs.google.com/document/d/1NTdbnJ4mJtVQhg7l2dT7UD_TXAT0jQv2Kavjytipphs/edit?usp=sharing