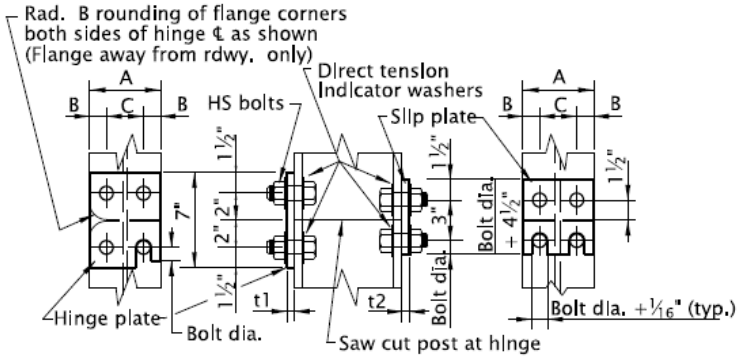
Research Problem Statement

Project Title:	**Evaluation of Multi-Post Large Sign Supports with Slip Base and Slip Hinge (2024-03-BD)**
Project Synopsis:	Investigate MASH compliance of multi-support breakaway sign support systems that incorporate both a four-bolt slip base mechanism and a slip hinge rather than fuse plate below the sign panel. The slip hinge may provide more consistent activation than the fuse plate and does not rely on mechanical properties of the plate, which can vary significantly.  POST HINGE DETAILS https://www.oregon.gov/ODOT/Engineering/202301/TM600.pdf https://www.oregon.gov/ODOT/Engineering/202301/TM601.pdf
Project Goal(s):	The goal of this research is to evaluate the MASH TL-3 impact performance of multi-post sign support systems that incorporate a slip base and slip hinge.
Project Background:	Full-scale testing experience of large guide sign systems in accordance with MASH criteria is limited. Testing to date has been performed on systems that incorporate a fuse plate below the sign panel to permit rotation of the impacted post relative to the sign assembly. In some tests, the fuse plate has not ruptured and activated a hinge mechanism as intended. The activation of the fuse plate relies on variables such as plate thickness, cross-sectional area, and the mechanical properties of the steel (e.g., ultimate tensile strength). The activation of the fuse plate is also dependent on the stiffness of the sign panel and the strength of the connections between the sign panel and support posts. A survey of Pooled Fund members under another project noted differences in the thickness and cross-sectional area of the fuse plates in their multi-post sign support standards. Other types of hinge mechanisms are used by some states. For example, Oregon DOT has had good field experience with a slip-style hinge mechanism. The slip hinge functions similarly to a slip base system. A clamping force is provided through the tension developed in the slip bolts when they are tightened. Such a system may provide more consistent and reliable activation compared to fuse plates. Testing has also shown that the sign assembly can be damaged and require extensive and expensive repair if the impacted lower portion of the support post remains hinged to the upper portion of the support post. If the hinge connection between the upper and lower portions of the support post can be designed to readily disengage, the level of repair may be significantly reduced. A slip hinge design may offer such an advantage. Research is needed to evaluate the performance of multi-post sign support systems with slip hinges to determine if they comply with MASH criteria and offer performance advantages compared to fuse plate hinge mechanisms.

Proposed Work Plan:	Task 1: Literature Review and State Survey *The research team will review previous and ongoing research projects to determine multi-post sign support systems that have met MASH requirements with various base and hinge types. A survey instrument will be distributed to the Roadside Safety Pooled Fund members to identify the characteristics of their multi-post sign support systems.* Task 2: Engineering Analysis *The research team will the data obtained in Task 1 to determine features and critical configurations of the multi-post sign support systems to evaluate through this research. For example, it is anticipated such features might include extruded aluminum sign panels, W-section posts, and 4-bolt slip base. The hinge design may vary as a focal point of the research effort. The analysis will result in recommendations for full-scale crash testing.* Task 3: Full-scale Crash Testing *The research team will evaluate two critical configurations of multi-post sign support systems according to MASH criteria. Critical tests will be identified and performed to evaluate the impact performance of the selected configurations. The results will be used to evaluate MASH compliance and assess performance differences between slip hinge and fuse plate hinge designs.*
Deliverables:	Final report to document research effort, including literature review, crash testing, and performance differences observed between the slip hinge and fuse plate hinge designs.
Urgency and Expected Benefit:	This project will assess MASH compliance and overall impact performance of multi-post sign support systems with slip hinge mechanisms. The slip hinges may activate more consistently and result in less damage to the sign support system than fuse plate hinges. If this is verified through research, it can provide states with a cost-effective option for multi-post sign support systems.
Problem Funding and Research Period:	Task 1 Lit Review $11,394 Task 2 Analysis $18,347 Task 3 Full-Scale Crash Testing $183,675 **Total Estimated Cost All Tasks $213,416** **Estimated Research Period = 18 months**
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