UTC Project Information	
Project Title	MPC 439 – Precast Bridge Girder Details for Improved Performance
University	South Dakota State University
Principal Investigator	Nadim Wehbe
PI Contact Information	Department of Civil and Environmental Engineering South Dakota State University Brookings, SD 57007 Phone: (605)688-4291 Email: nadim.wehbe@sdstate.edu
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Project Cost	$160,000
Start and End Dates	January 1, 2013- December 31, 2013
Project Duration	1 Year
Brief Description of Research Project	Many bridges on the local highway system need replacement. Local governments rely on the South Dakota Department of Transportation (SDDOT) to help replace the deficient bridges. With limited resources, SDDOT can only help replace about 30 bridges statewide each year, causing a backlog of local bridges in need of replacement. The current standard bridge used in these replacements is the double tee precast girder bridge for its relatively low construction cost, outsourced design, and short construction duration. The expected design life of these bridges was 50 to 70 years, but some built less than 40 years ago already need replacement. The most common problem is that longitudinal joints become damaged over time, most likely due to inadequate shear transfer between the girders, allowing water and debris to enter the joints. It is only a matter of time before the joint begins to spall, creating a path for moisture to reach the prestressing steel, initiate corrosion, and degrade the structural capacity of the bridge. It should also be noted that the double tee should be designed for girder continuity, often achieved by a reinforced concrete overlay or transverse post tensioning. Many local bridges are not designed for girder continuity, however, resulting in longitudinal joint deterioration and a non-redundant structure. Precast bridge elements are routinely used in bridge construction, general concerns for performance of these bridges is focused on the joints. Longitudinal joint performance has been noted by engineers to be one of the most commonly encountered problems especially in precast girder bridges without cast-in-place decks. This problem can be

	alleviated through improved joint connection details or transvers post tension. Hanna et al. (2009) presents a review of the various practices in the transverse design and detailing of adjacent-box-girder bridges and discussed the basis for calculating the transverse post-tensioning force according to PCI's Precast Prestressed Concrete Bridge Design Manual. In a previous SDDOT study (SD2010-02), a bridge near Sioux Falls, SD was inspected and this longitudinal joint problem was found to be severe for simply supported double tee girders with asphalt overlay on deck also. Li et al. (2010 a, b, c) conducted a series of studies on applying improved longitudinal joint details in decked bulb tee girders. The proposed detail relays mainly on grout and steel connectors to provide the joints with strength to resist transverse bending. In Li's study, the proposed details were tested using small specimens, which did not completely simulate the true load and deformation demands at these joints under realistic boundary conditions. Numerical studies were also used to evaluate similar problems, such as a joint spring model developed by Smitha et al. (2011). Routine maintenance of these bridges does increase the life span, but is not a feasible long-term solution. The amount of routine maintenance required to keep the joints sealed is too costly for local governments. Other methods, such as asphalt overlays, are also expensive and can cause increased damage over time by trapping moisture that eventually reaches the prestressing steel. Research Objectives: 1) Identify alternatives to the double tee precast girder for improved shear transfer between longitudinal joints and reduced joint degradation. 2) Perform load testing on alternative girder(s) and double tee girder, and compare results.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The monolithic joint provides substantially improved serviceability and strength performance characteristics over the discrete welded joint at no significant increase in initial construction cost. The joint service life may well exceed the bridge design life of 75 years. The joint is water-tight, exhibits negligible stiffness degradation, leads to better distribution of the support reaction to the girder stems, and engages adjacent girders at the strength limit state.
Impacts/Benefits of Implementation (actual, not anticipated)	The monolithic joint detail developed in this study was adopted by South Dakota Department of Transportation for the design of new precast double tee girder bridges.
Web Links • Reports • Project Website	https://www.ugpti.org/resources/reports/details.php?id=895