UTC Project Information	
Project Title	Torsional Safety of Highway Traffic Signal and Signage Support Structures
University	Oregon State University
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Funding Source(s) and Amounts Provided (by each agency or organization)	University of Washington PacTrans $20,000 Oregon Department of Transportation $20,000
Total Project Cost	$40,000
Agency ID or Contract Number	DTRT13-G-UTC40
Start and End Dates	September 16, 2015– September 15, 2016
Brief Description of Research Project	The goal of this research is to study the load transfer of axially loaded drilled shafts in torsion and to evaluate existing methods used to design drilled shaft under torsional loading. This work will provide necessary data for tuning the design methods as the torsional capacity of these shafts will be evaluated, including torsional load transfer. Existing design procedures will be investigated, as will some of the newer approaches that have been developed but not yet validated. The project focuses on traffic structures such as signal and sign poles. These structures, combined with longer arm lengths, have seen an increase in the torsional to bending moment forces that they support. This has led to torsion loading controlling the foundation design for some of these structures, which had not been the case before for these types of structures. This focus means that our research is particularly relevant to PacTrans theme #3: Technological Impacts of Safety.

Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	A matlab-driven executable has been developed allowing design of torsioanlly-loaded drilled shafts within an easy to use guided-user interface. The software is freely available upon written request.
Publications resulting from support of this and other grants on the topic:	Li, Q., **Stuedlein, A.W.**, and Barbosa, A.R. (2018). "Role of Torsional Shear in Combined Loading of Drilled Shaft Foundations." *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 145, No. 4, 06019001. Li, Q., **Stuedlein, A.W.** and Barbosa, A.R. (2017). "Torsional Load Transfer of Drilled Shaft Foundations." *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 143, No. 8, 04017036.
Impacts/Benefits of Implementation (actual, or anticipated)	The advances made in the numerical simulation of torsionally-loaded drilled shafts is exceptional, allowing for state-dependent load transfer to be accurately modeled. The parametric study conducted using the software has shed significant light on the role of softening on the large-rotation response of drilled shafts.
Web Links • Reports • Project Website	**Stuedlein, A.W.**, Barbosa, A.R., and Li, Q., (2016) "Evaluation of Torsional Load Transfer for Drilled Shaft Foundations" Final Report, SPR 304-701, Oregon Department of Transportation and Federal Highway Administration, Salem, OR, 159pp.