UF | Center for Infrastructure Protection and Physical Security (CIPPS)
UNIVERSITY of FLORIDA

US Army Engineer Research and Development Center

Assessment of Direct Shear Behavior in Normal and Ultra-High Performance Concretes – Part 1

Introduction and Objectives

The focus of this study was to characterize the direct shear behavior of normal strength concrete (NSC), Cor-Tuf1 and Cor-Tuf2 ultra-high performance concretes (UHPC) under static and impact loading conditions.

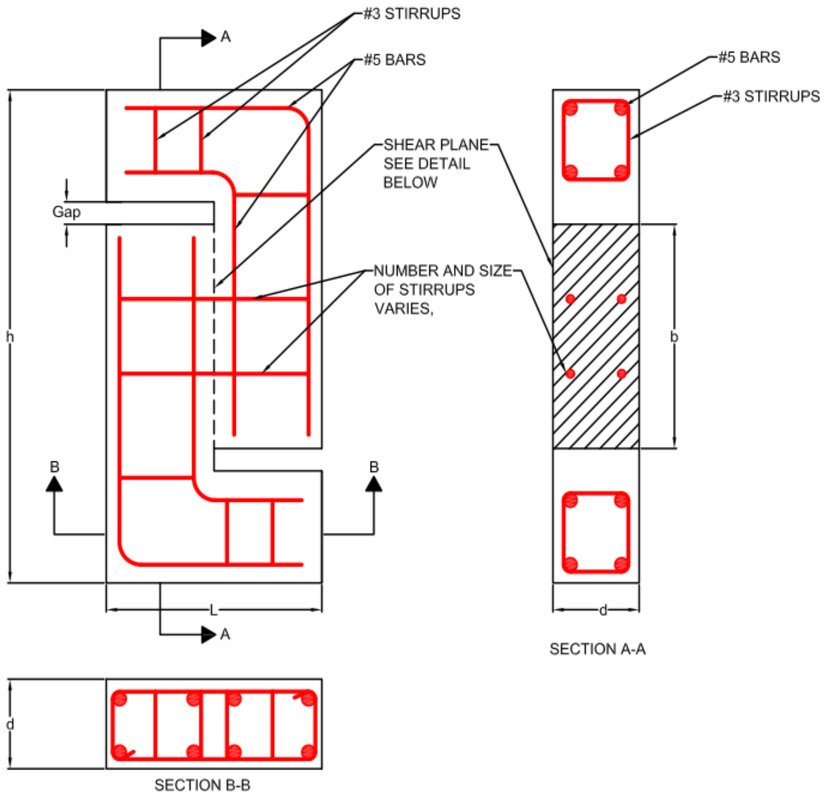
Objectives

- Perform precision testing on NSC, Cor-Tuf1 and Cor-Tuf2 push-off specimens
- Compare test data to Hawkins Direct Shear Model
- Propose changes to the Hawkins Direct Shear Model if required

Research Approach

- Push-off specimen quasi-static testing recording relative slip with high-accuracy lasers
- Push-off specimen impact testing with 300 to 5715 lb drop hammers
- Post-test analysis
- Propose changes to direct shear model

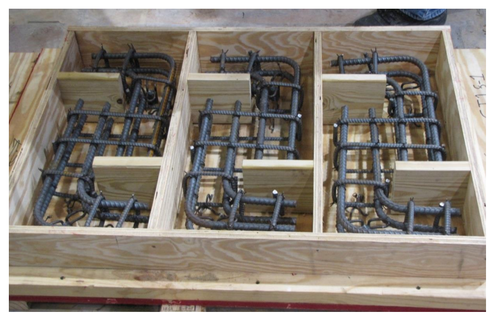
Push-Off Specimen Design



Static Tests

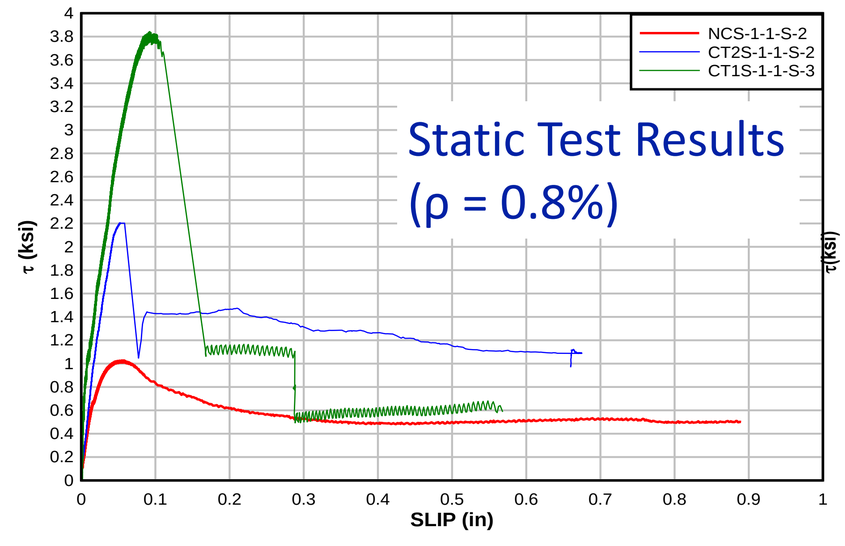
Impact Tests

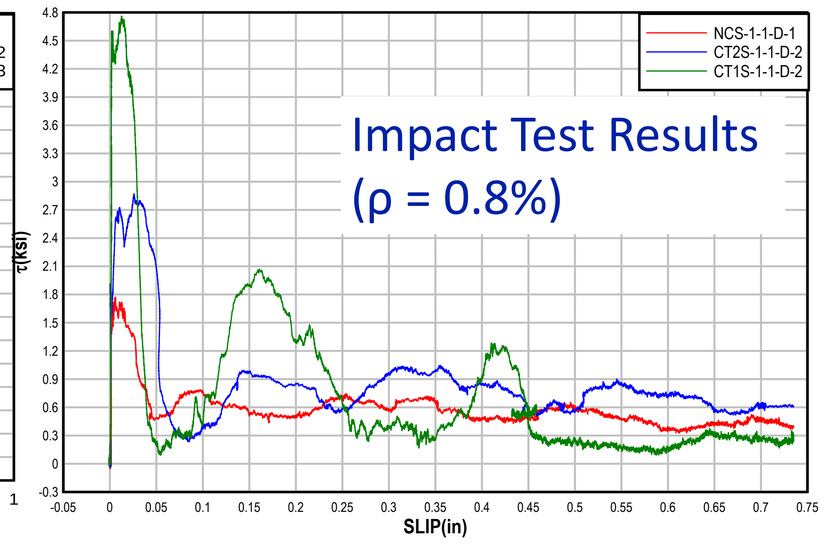
Specimen Preparation



Specimen Matrix

Specimen	f`c (ksi)	Reinforcement Ratio, ρ	Number of Stirrups	Stirrup Size
NC-1A-0	4.5	0.0%	0	NA
NCS-1-1	4.5	0.8%	4	#3
NCS-1-2	4.5	1.6%	8	#3
CT1-1A-0	29	0.0%	0	NA
CT1S-1-1	29	0.8%	4	#3
CT1S-1-2	29	1.6%	8	#3
CT2-1A-0	29	0.0%	0	NA
CT2S-1-1	29	0.8%	4	#3
CT2S-1-2	29	1.6%	8	#3





NSC | Cor-Tuf1 | Cor-Tuf2

Conclusions

- Comparison of CT1 and CT2 specimens shows that the addition of fibers to UHPC greatly enhances its direct shear capacity in both peak shear stress and associated slips
- The increase in residual capacity at the higher reinforcement ratio for CT1 suggests that a higher maximum ρf_y can be utilized
- The static and impact Modified Direct Shear model fairly accurately predict direct shear behavior of NSC and UHPC push-off specimens

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