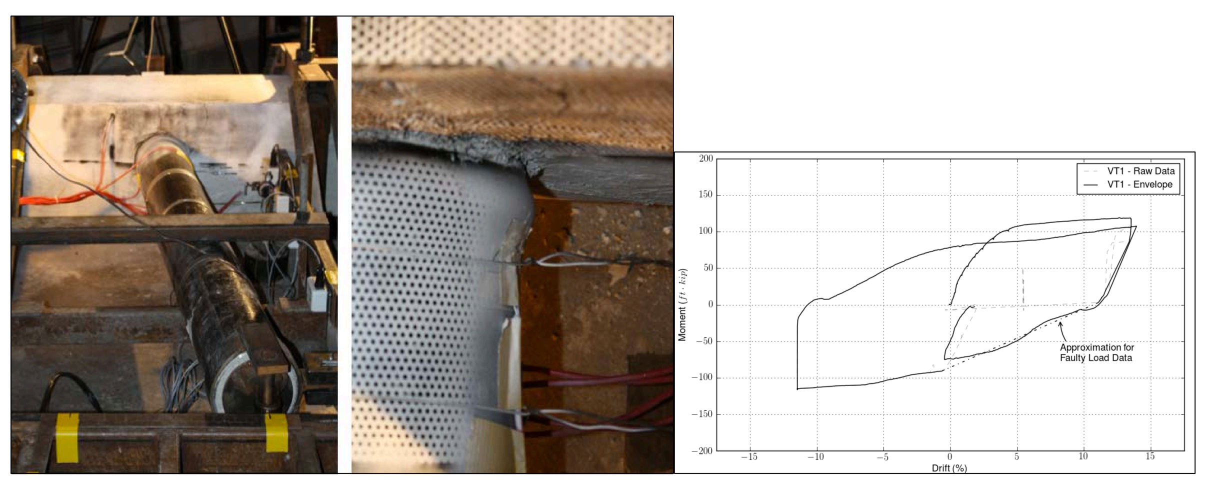
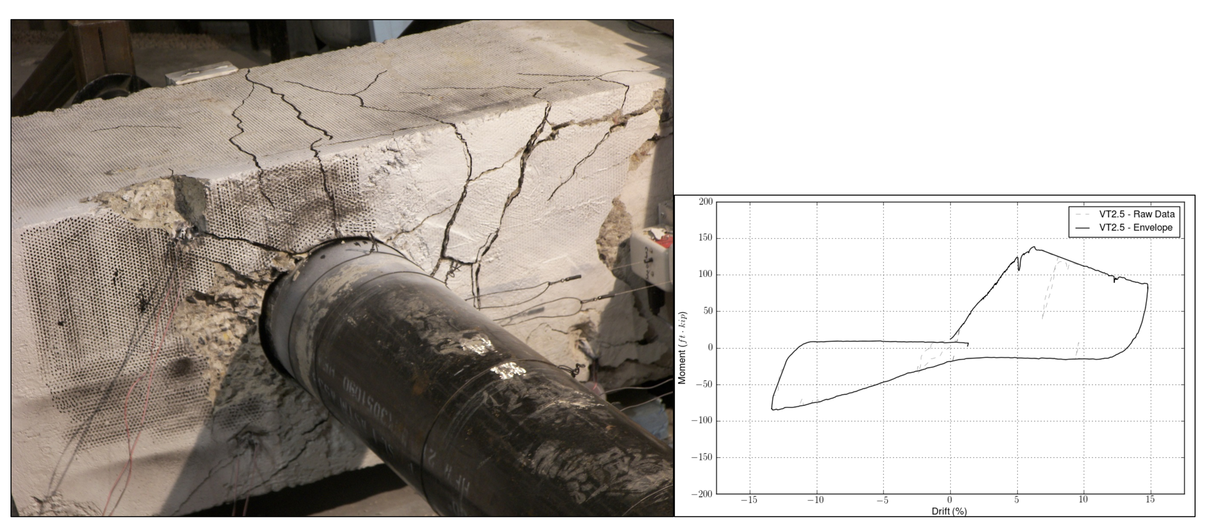
# Steel Pipe Pile/Concrete Pile Cap Bridge Support Systems: Confirmation of Connection Performance

## Background

**Typical Bent Configuration and Advantages:**

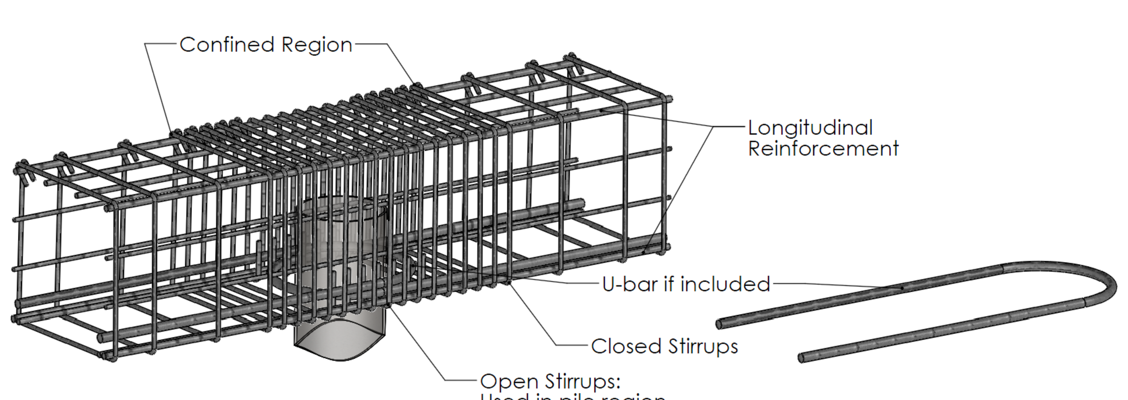
**Benefits of Concrete-Filled Steel Tube (CFT):**





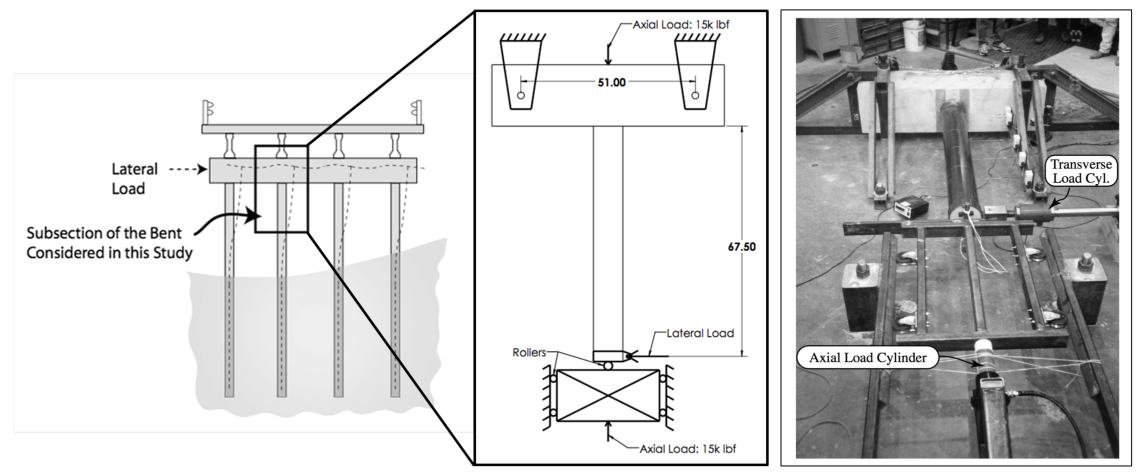
## Research Objective and Scope

**Focus of Research:**

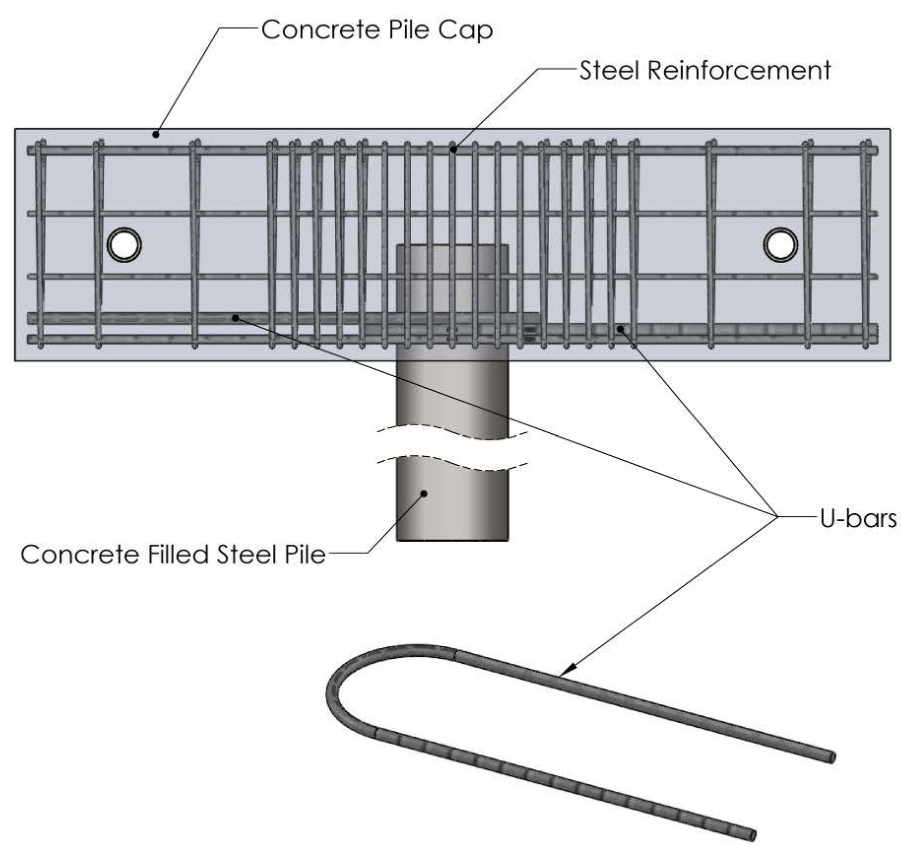



## Approach Methodology

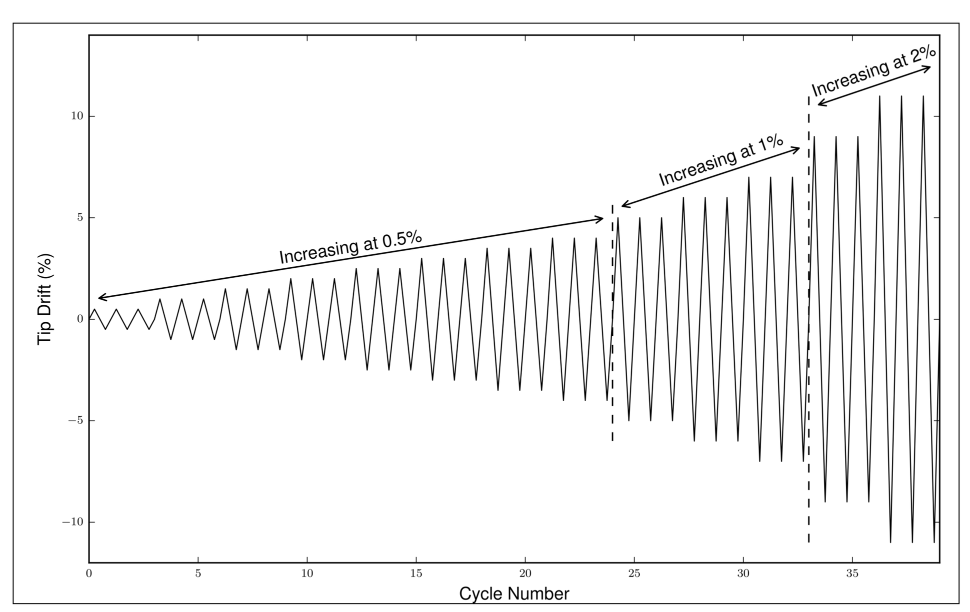
**Test Setup:**




**Overall:**



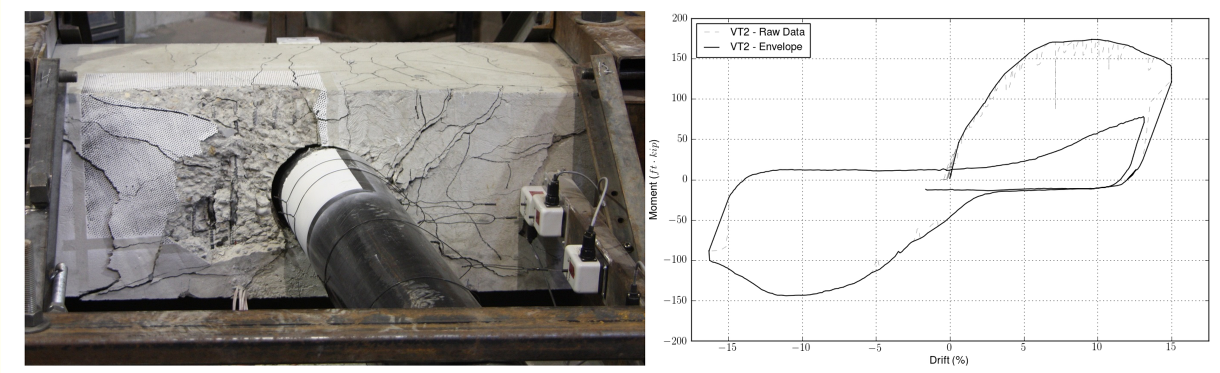

**Test Methods:**

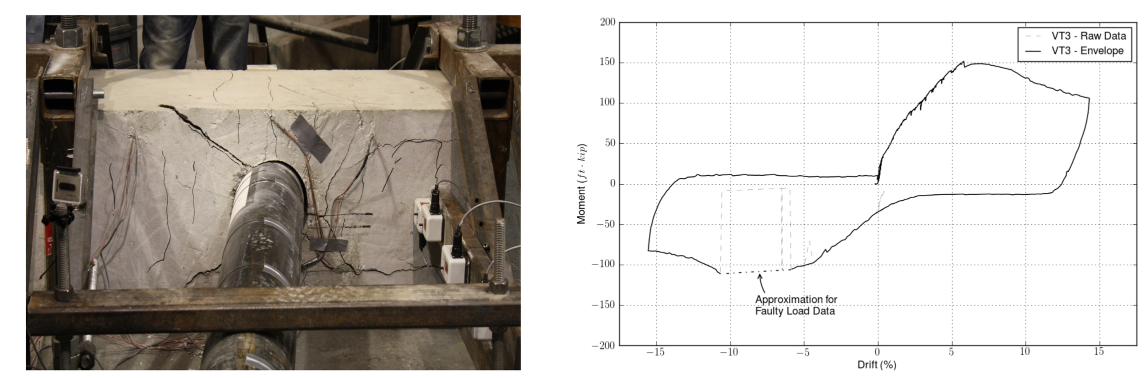



## Test Results

**Observed Limit States:**

**Results Focus:**





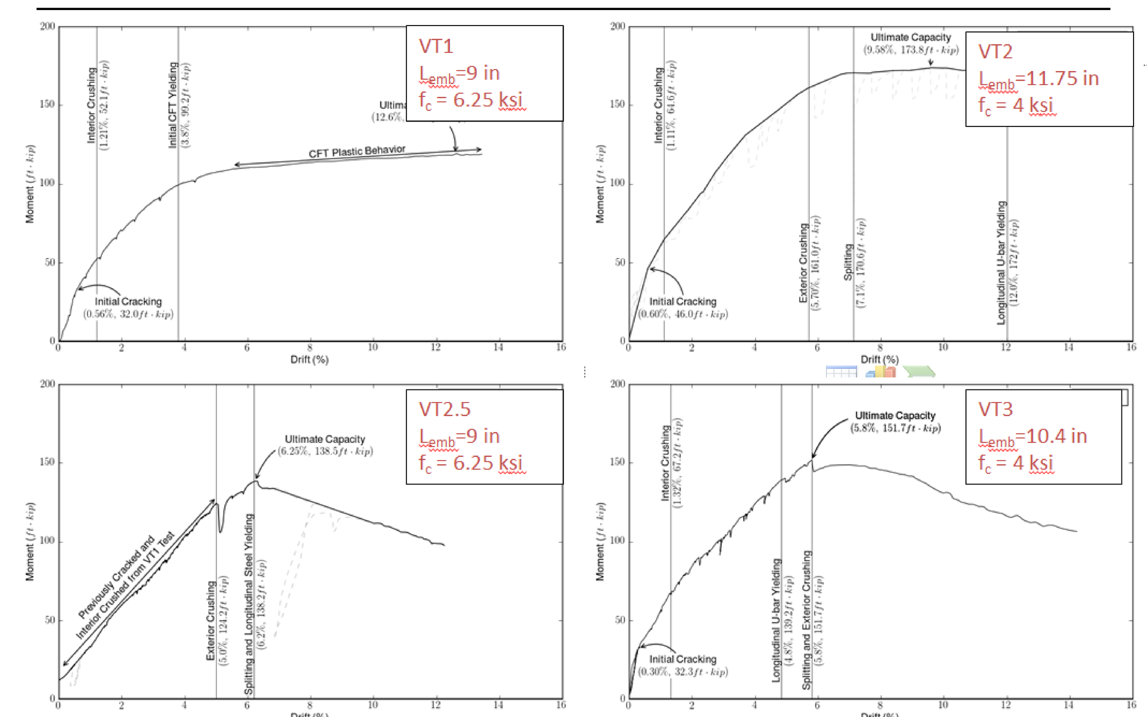
**Summary of Results For All Tests:**

| | Test | U-bar Configuration | U-bar Location | Pile Embedment Length | Concrete Strength | Failure Mechanism | Maximum Moment at Failure | |
|---|---|---|---|---|---|---|---|---|
| Monotonic | PC-1 | None | NA | 9.0 in | 4832 psi | Fracture/Cracking of the concrete pile cap | 82 ft-kip | Design Sized Pile Used |
| | PC-2 | None | NA | 9.0 in | 5326 psi | Fracture/Cracking of the concrete pile cap | 74 ft-kip | |
| | PC-3 | None | NA | 9.0 in | 3150 psi | Fracture/Cracking of the concrete pile cap | 76 ft-kip | |
| | PC-3a | None | NA | 9.0 in | 3945 psi | Fracture/Cracking of the concrete pile cap | 102 ft-kip | |
| | PC-4 | Single #7 U-bar in each direction | Exterior Only | 9.0 in | 4682 psi | **Plastic hinge in steel pipe pile** | 121 ft-kip | |
| | VT1 | Single #7 U-bar in each direction | Exterior Only | 9.0 in | 6250 psi | **Plastic hinge in steel pipe pile** | 119.2 ft-kip | |
| | VT2 | Single #4 and #5 U-bar in each direction | Exterior Only | 11.75 in | 3800 psi | Fracture/Cracking of the concrete pile cap | 173.8 ft-kip | Oversized Pile Used |
| | VT2.5 | Single #7 U-bar in each direction | Exterior Only | 9.0 in | 6250 psi | Fracture/Cracking of the concrete pile cap | 138.5 ft-kip | |
| | VT3 | Single #7 U-bar in each direction | Exterior Only | 10.375 in | 4100 psi | Fracture/Cracking of the concrete pile cap | 151.7 ft-kip | |
| Cyclic | CT1 | Single #4 and #5 U-bar in each direction | Exterior Only | 11.75 in | 4200 psi | Fracture/Cracking of the concrete pile cap | 172.4 ft-kip | |
| | CT2 | Single #4 and #5 U-bar in each direction | Interior and Exterior | 11.75 in | 4200 psi | Fracture/Cracking of the concrete pile cap | 181.8 ft-kip | |

**Test Observations:**

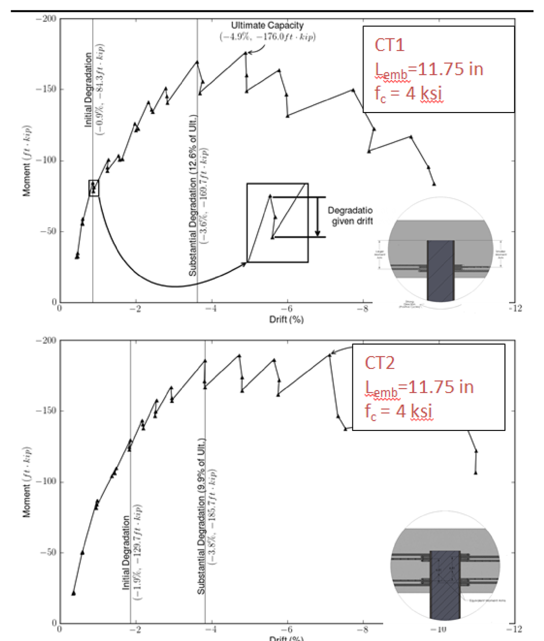
## Summary and Conclusions

### Pushover Results



**U-bar Benefits:**

### Cyclic Test Results

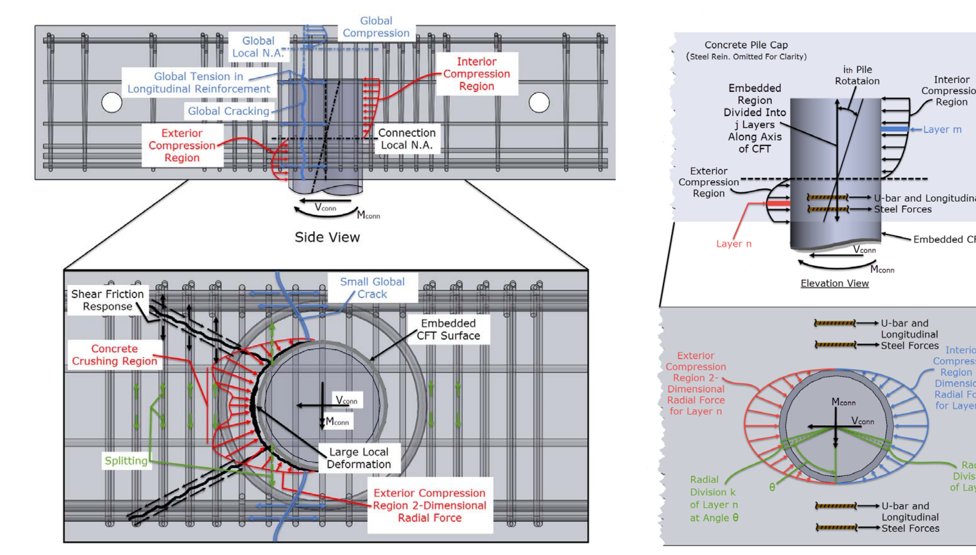


**Yielding of the CFT:**

**Concrete degradation/crushing:**

**Yielding of the steel reinforcement:**

**Splitting of the cap:**



## Supporting Documents