DEFINING THE UPPER VISCOSITY LIMIT FOR MINERAL SLURRIES USED IN DRILLED SHAFT CONSTRUCTION




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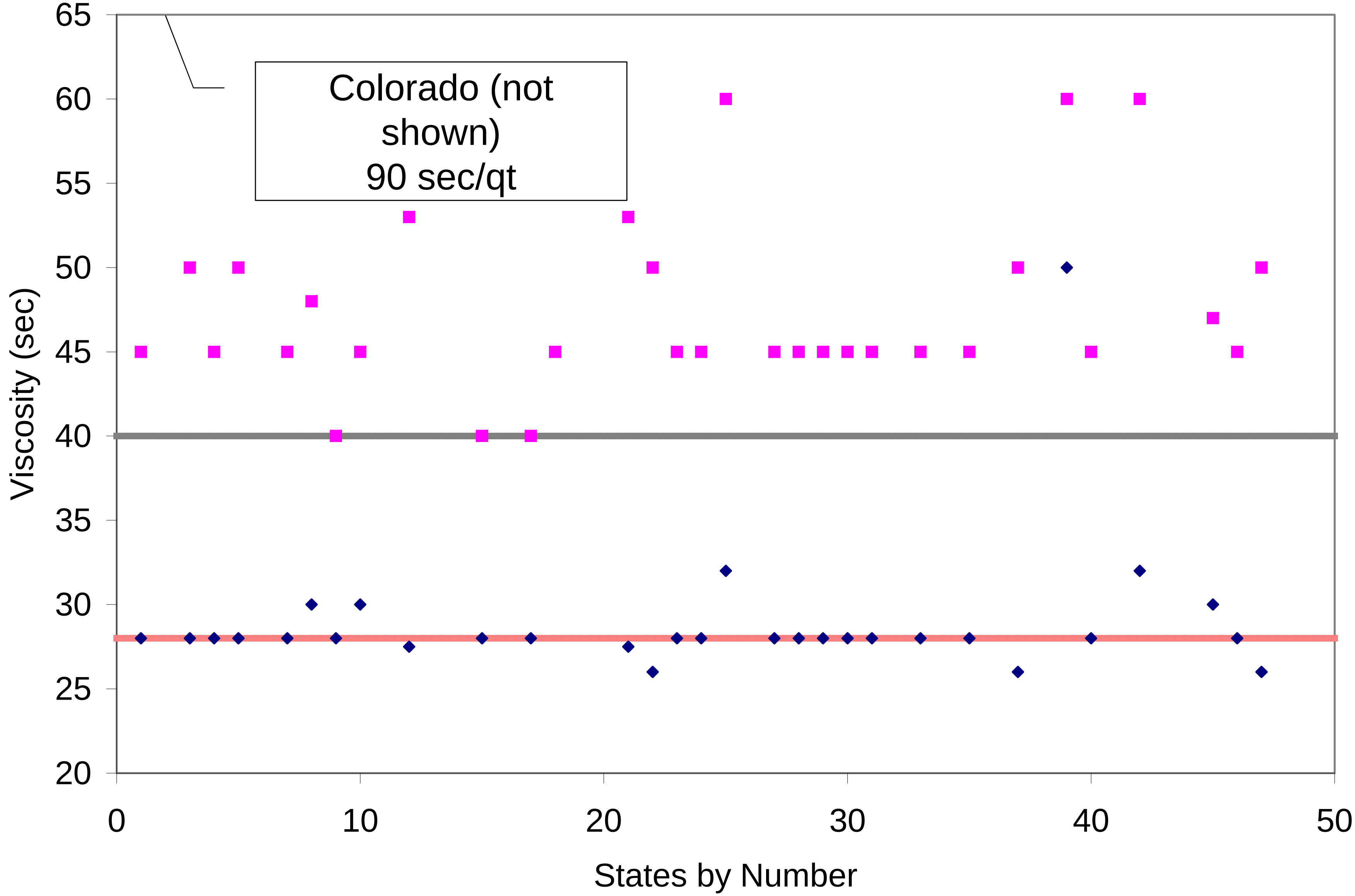
Problem Statement

- Nationwide the lower viscosity limit for mineral slurries used in drilled shaft are generally consistent ranging from 28-32. However, the upper limits range widely from 40 to 90 sec/qt.
- A recent study quantified the basis for selecting the lower limit which was recently changed from 28 to 30 sec/qt; this study aims to provide similar rationale for the upper limit.

Viscosity Limits Nationwide



Two Primary Concerns

- At what point does increased viscosity become too thick to easily displace during concreting?

- At what point does increased viscosity affect side shear capacity?

If it ain’t broke don’t fix it ????

When is higher viscosity acceptable?

- Mineral content or gel strength is needed to provide a suitable filter cake. Marsh funnel tests are the primary indicator.
- Marsh funnel results can increase without increased mineral content / likewise insufficient mineral content could exist within acceptable viscosity limits.
- Silt contents increase viscosity with no gel strength but are not detected by sand content. Is that bad?

Slurry/Soil Encapsulation Near Cage

Access tube continuing beyond identified defective zone.

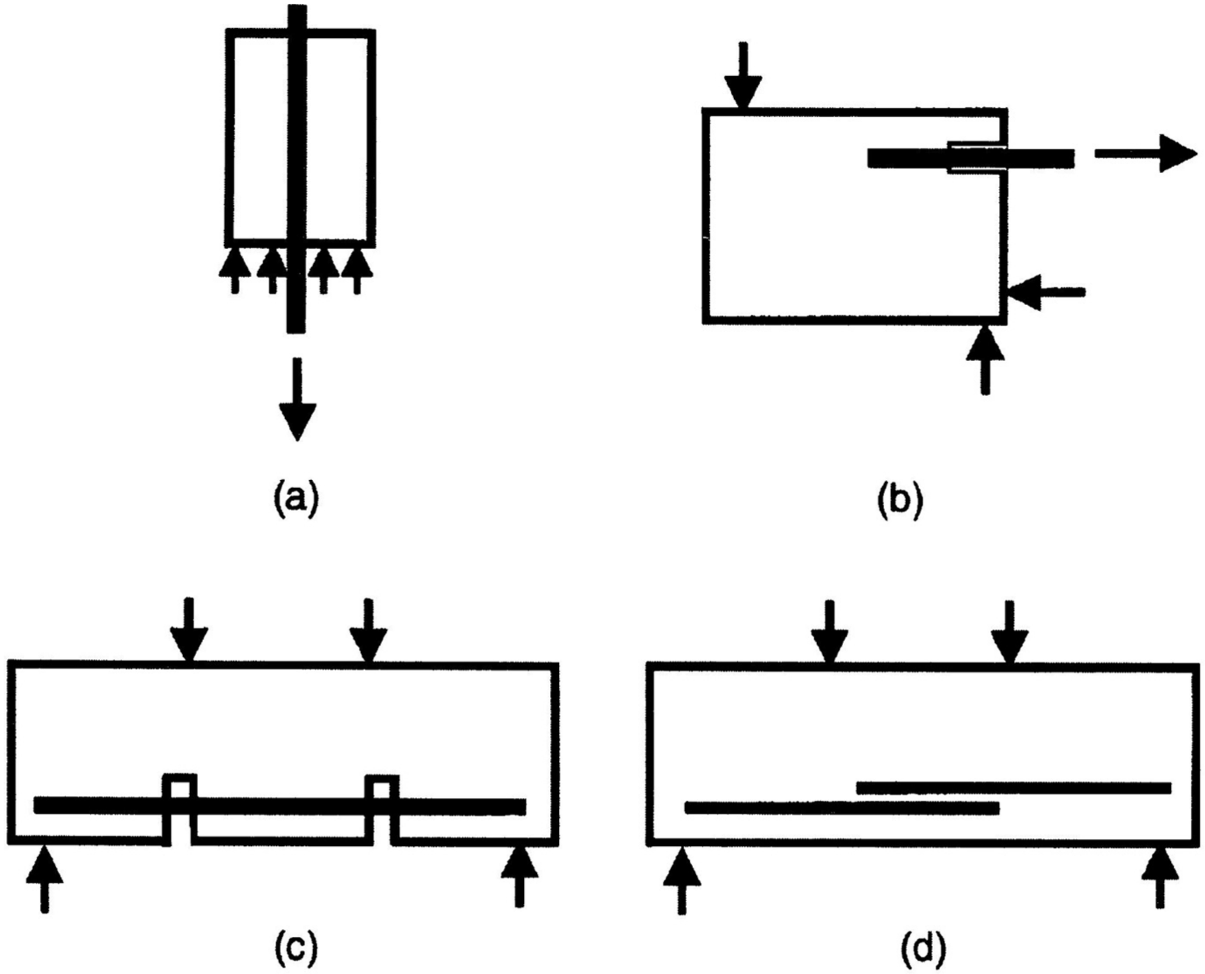
Stirrup defining outer edge of reinforcing cage

FHWA, 2010

Research Approach

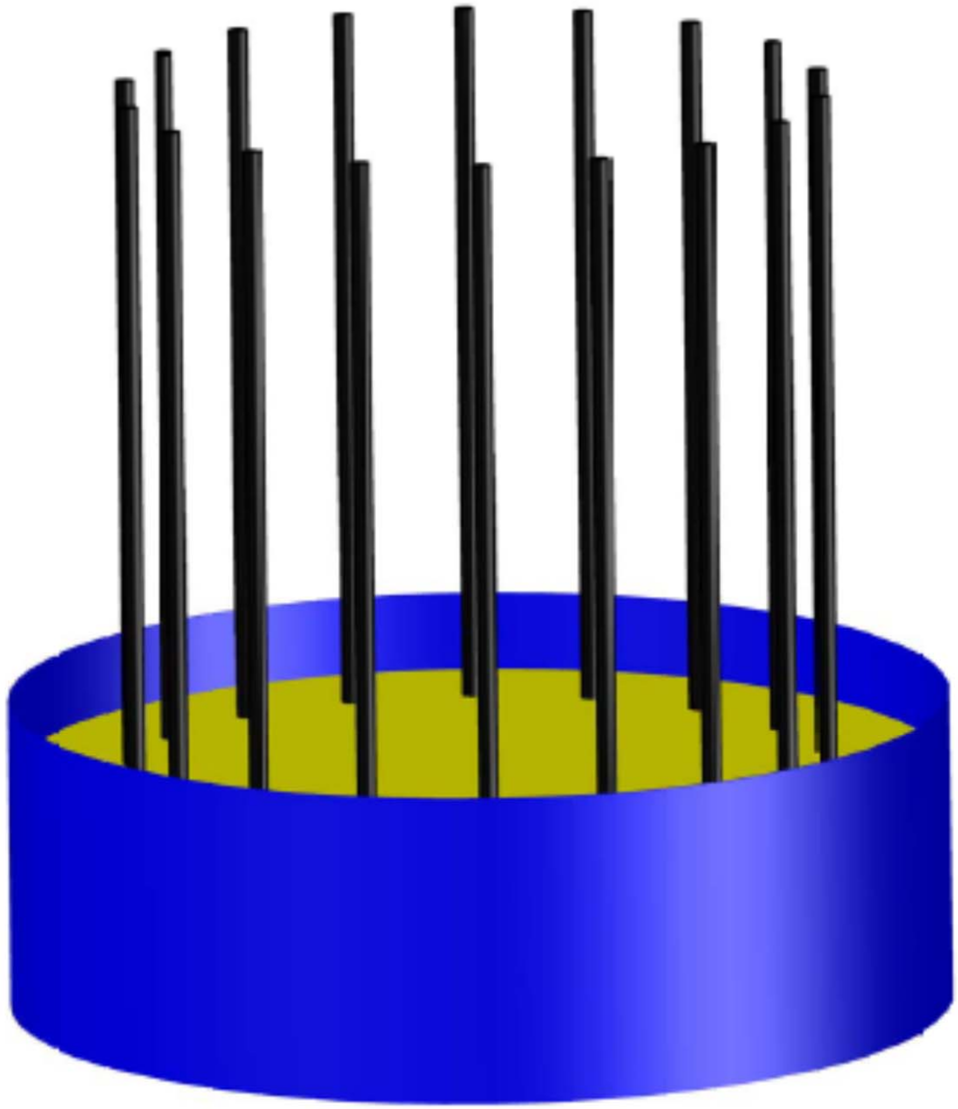
- Task 1 Literature Review
- Task 2 Rebar Pull-out Testing
- Task 3 Laboratory Side Shear Testing
- Task 4 Full Scale Side Shear Testing
- Task 5 Reporting

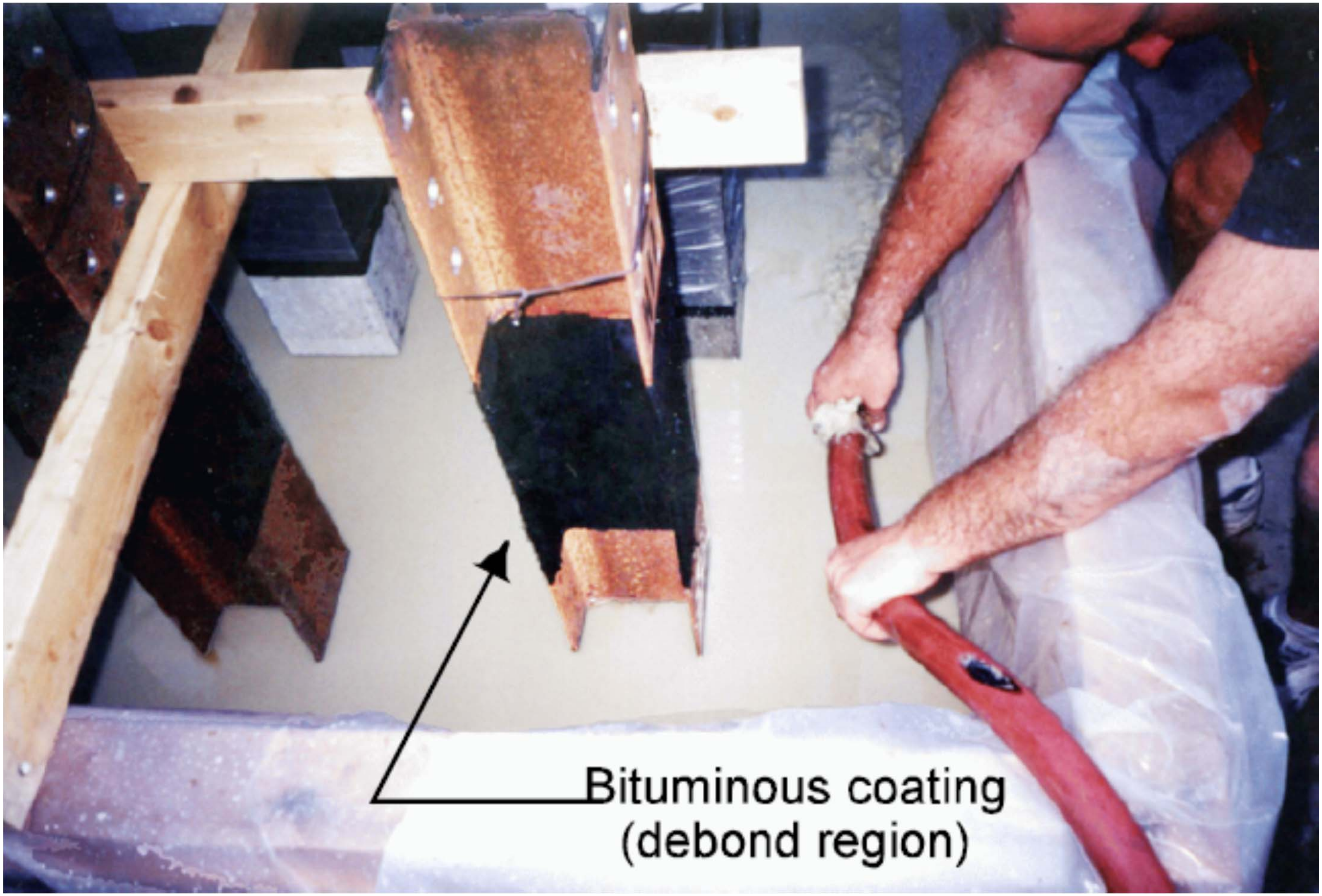
Task 2: Rebar Pull-out Tests



ACI, 2003

Rebar Pull-out Scheme




Bituminous coating
(debond region)

Task 3:Lab-Scale Pull-out Testing

- Identify effects of silt on viscosity and capacity
- Quantify gel strength / viscosity from viscometers and Marsh funnel.
- Conduct small scale side shear tests (compression) in frustum
- Establish test matrix for full scale tests.

Laboratory Side Shear Testing

Laboratory Side Shear Testing

Task 4: Full-Scale Pull-out Testing

- Site Characterization: CPT soundings at each locations.
- Cast 15ft long,18in diameter shafts cast with varied viscosities.
- Conduct tension / pull out tests
- Fully extract shafts and quantify exact surface area and shape contributing to capacity.

Pull-out Frame

Baseline Tests Performed at 40sec/qt

MANITEX 870
United Re
1-800-UR-RENTS


MANITEX 1870
United Re
1-800-UR-RENTS


United Rentals
1-800-UR-RENTS


MANITEX 870


MANITEX 870