Remediation of Bridge Scour using Jet Grouting

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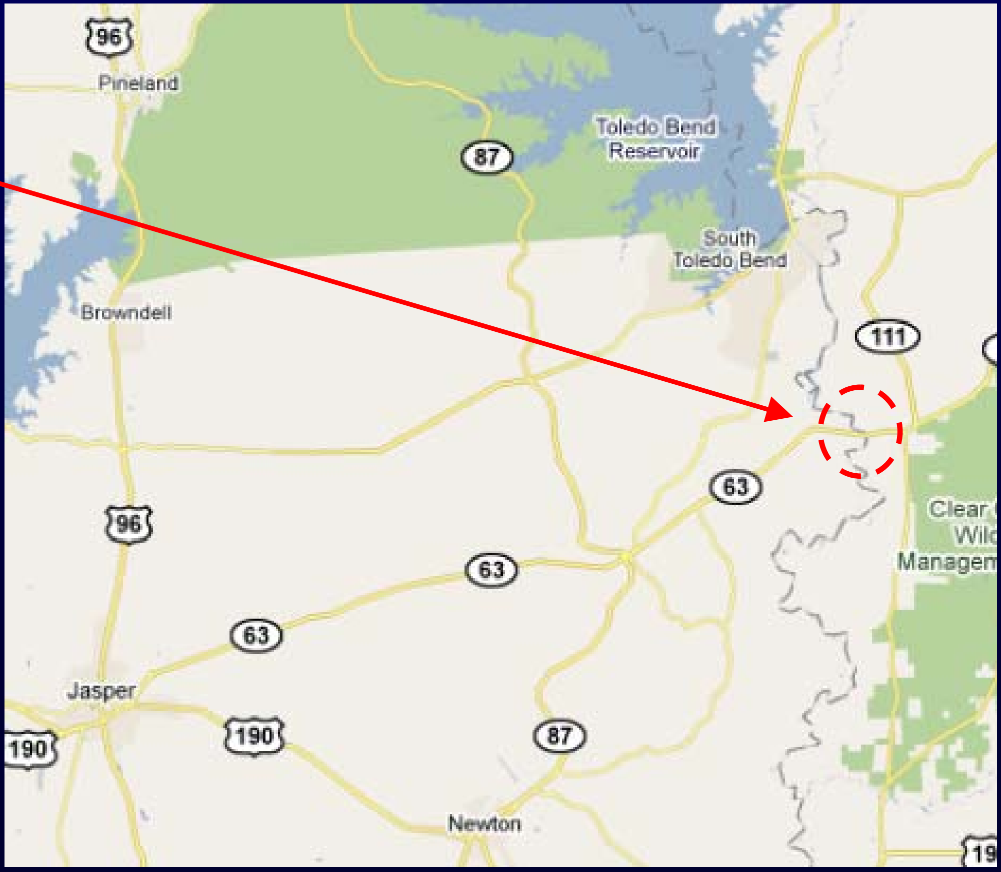
Outline

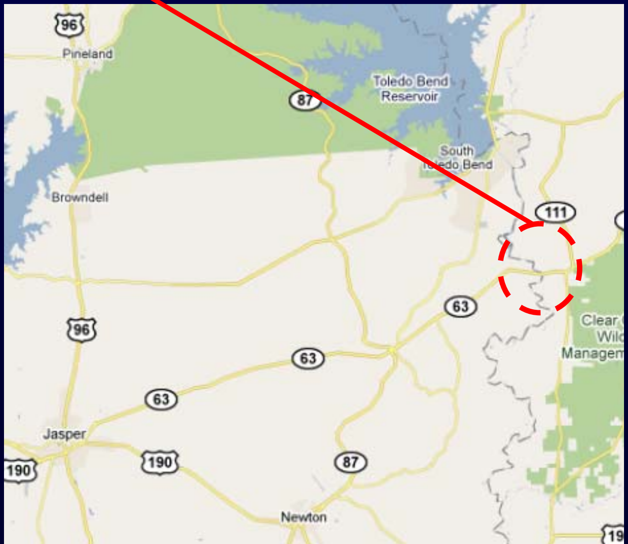
- Burr’s Ferry Bridge (SH 63) Scour at Sabine River
- Jet Grouting Background
- Field Installation of Jet Grouting Column

Burr’s Ferry Bridge at Sabine River

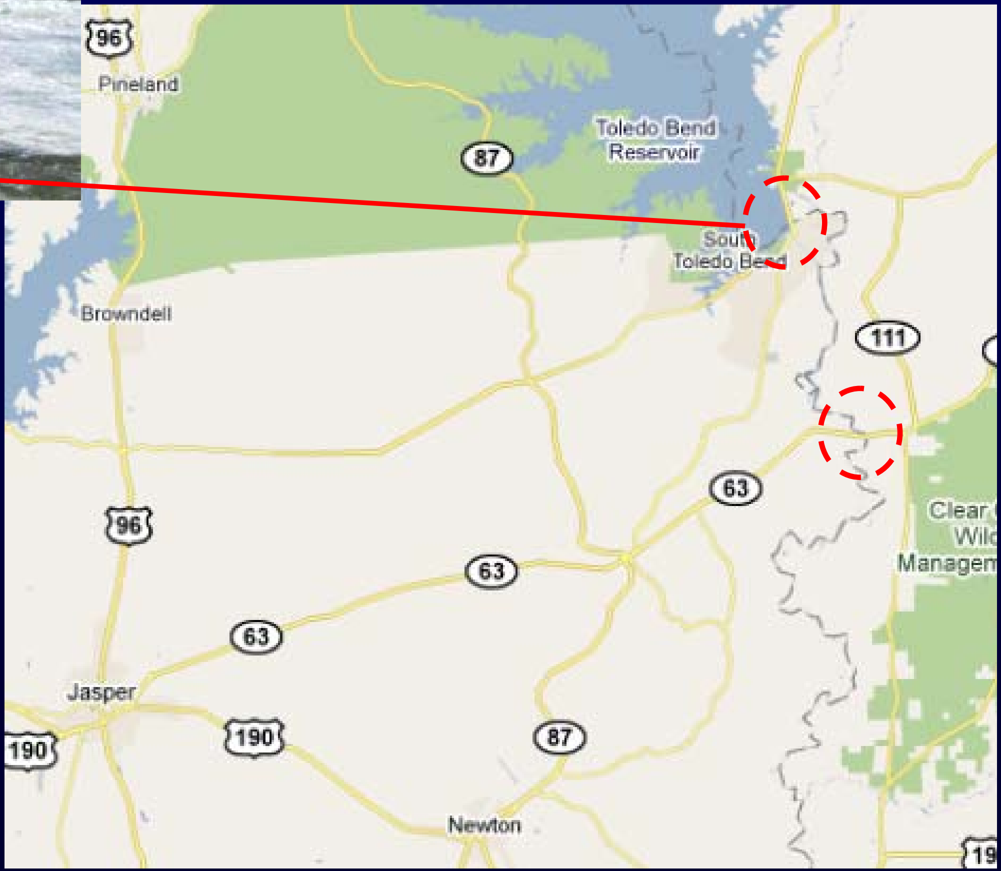


Burr’s Ferry Bridge at Sabine River

<Burr’s Ferry Bridge built in 1937>

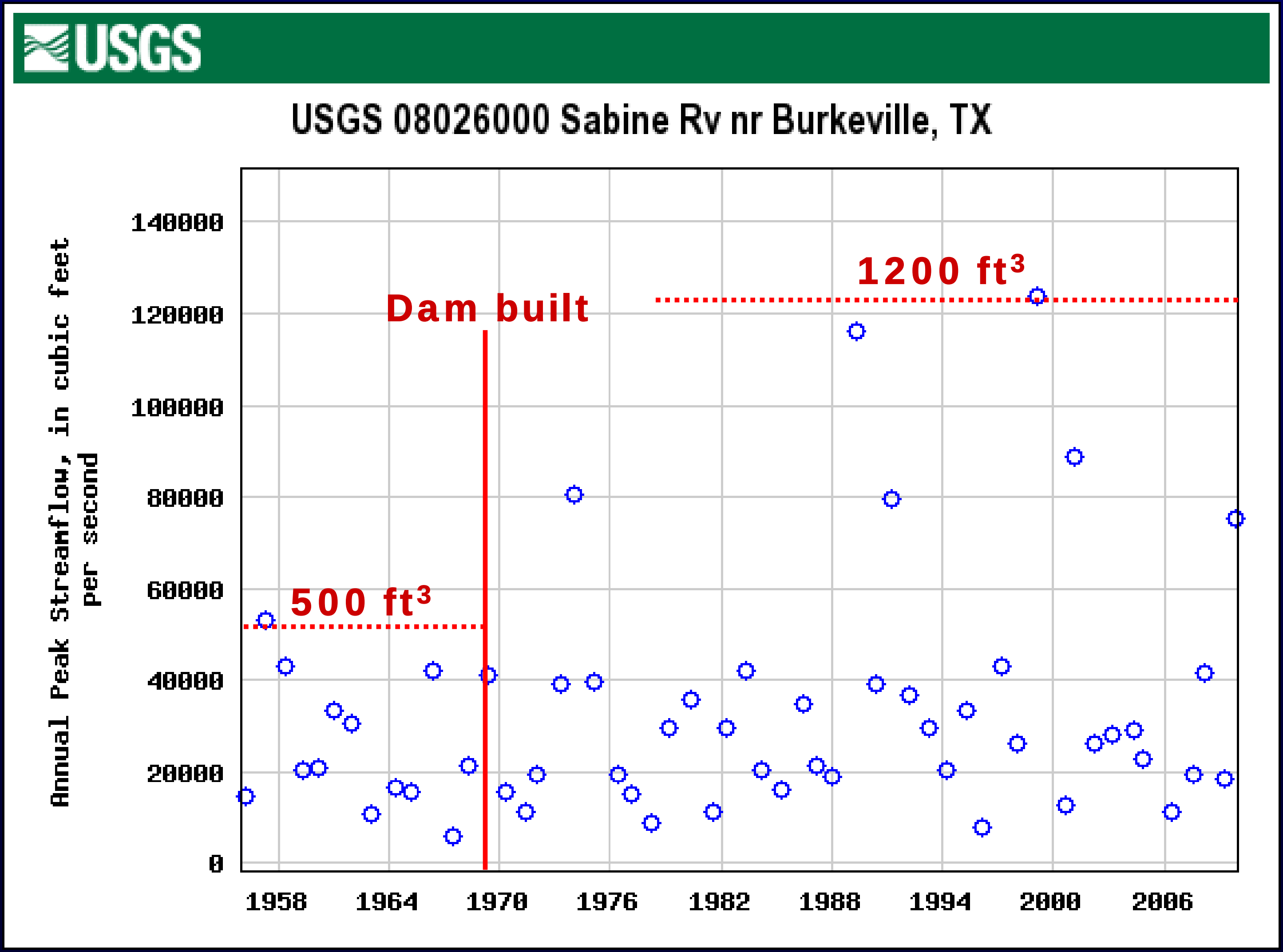


Toledo Bend Dam at Sabine River

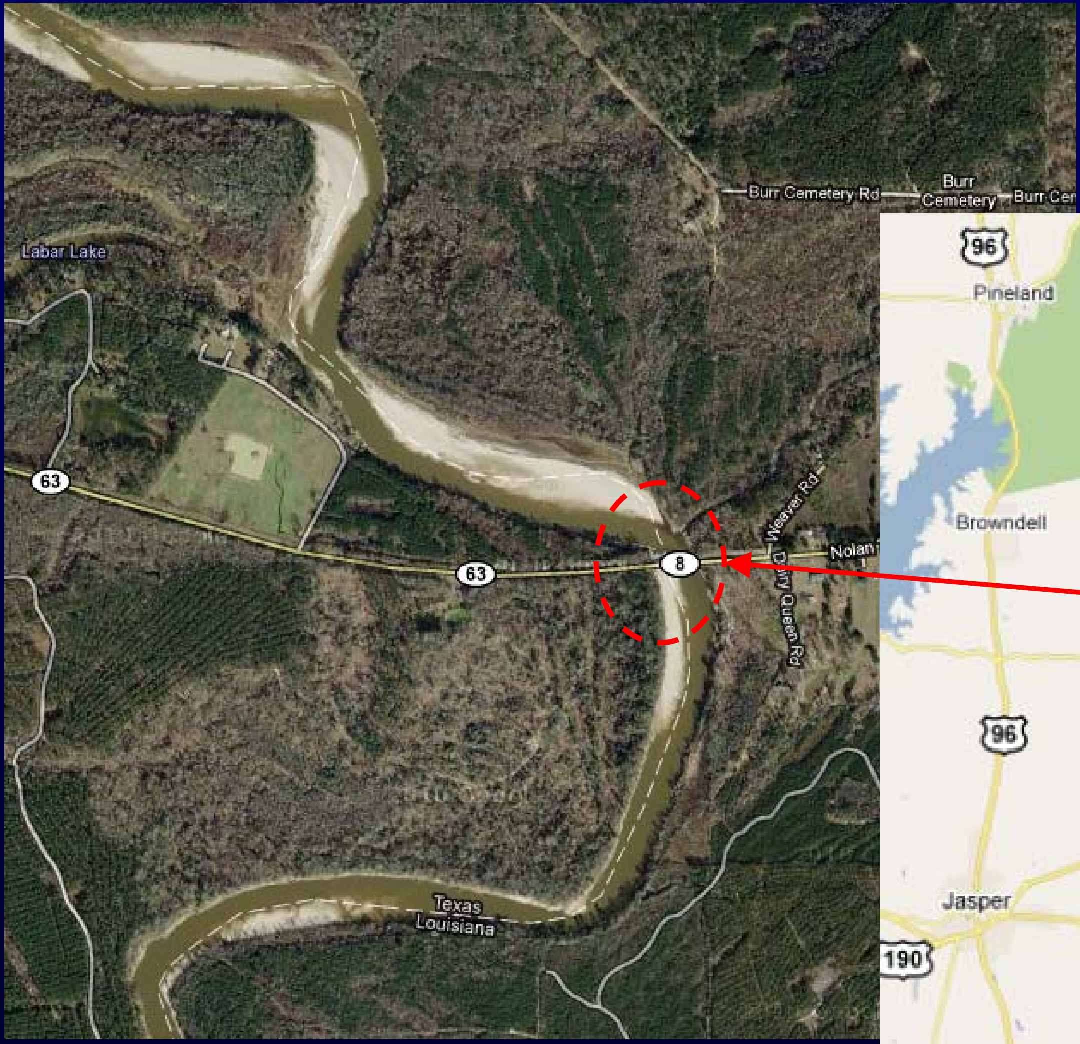


<Toledo Bend Dam built in 1969>

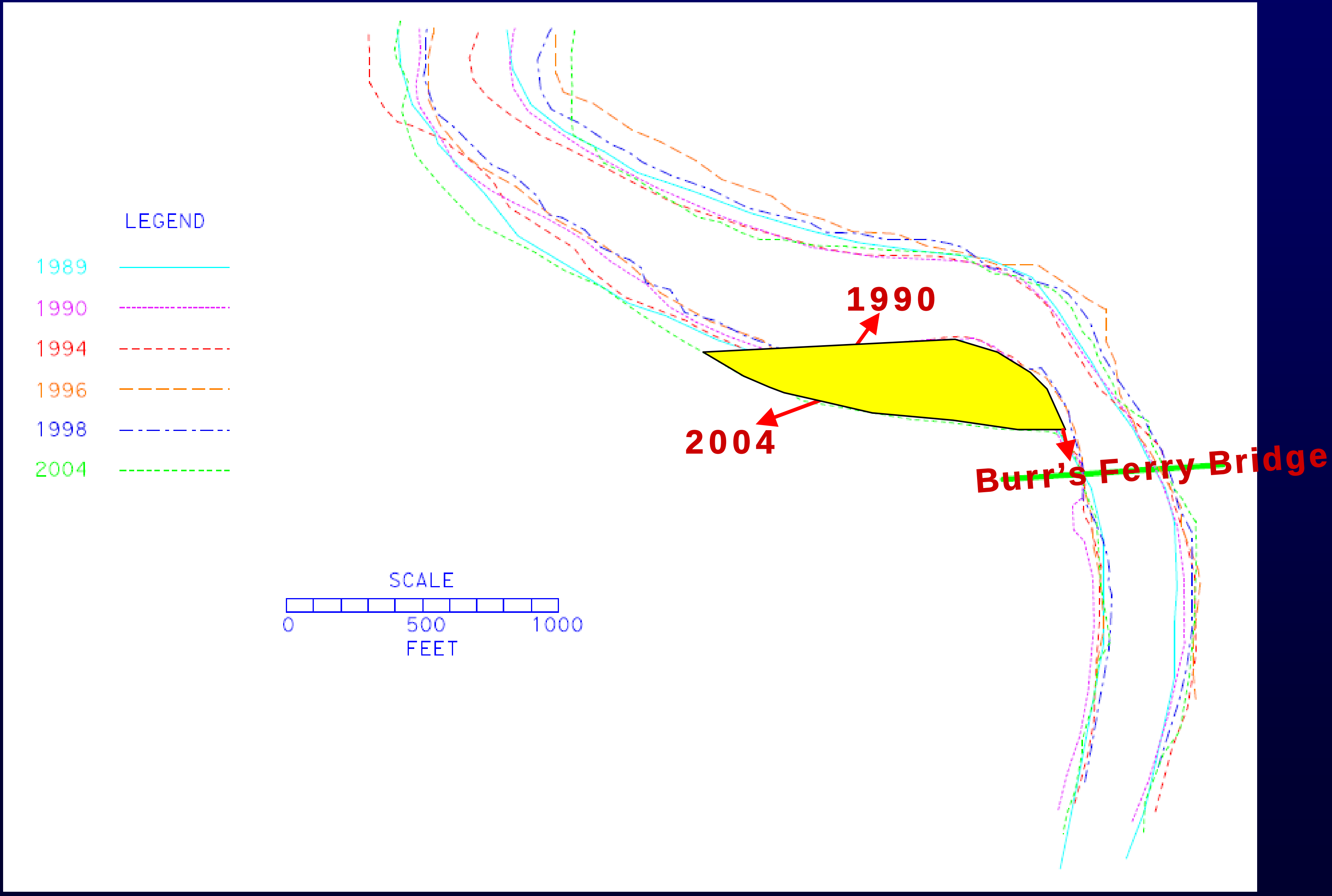
Peak Stream flow at the Bridge



Burr’s Ferry Bridge at Sabine River



Migration of Sabine River

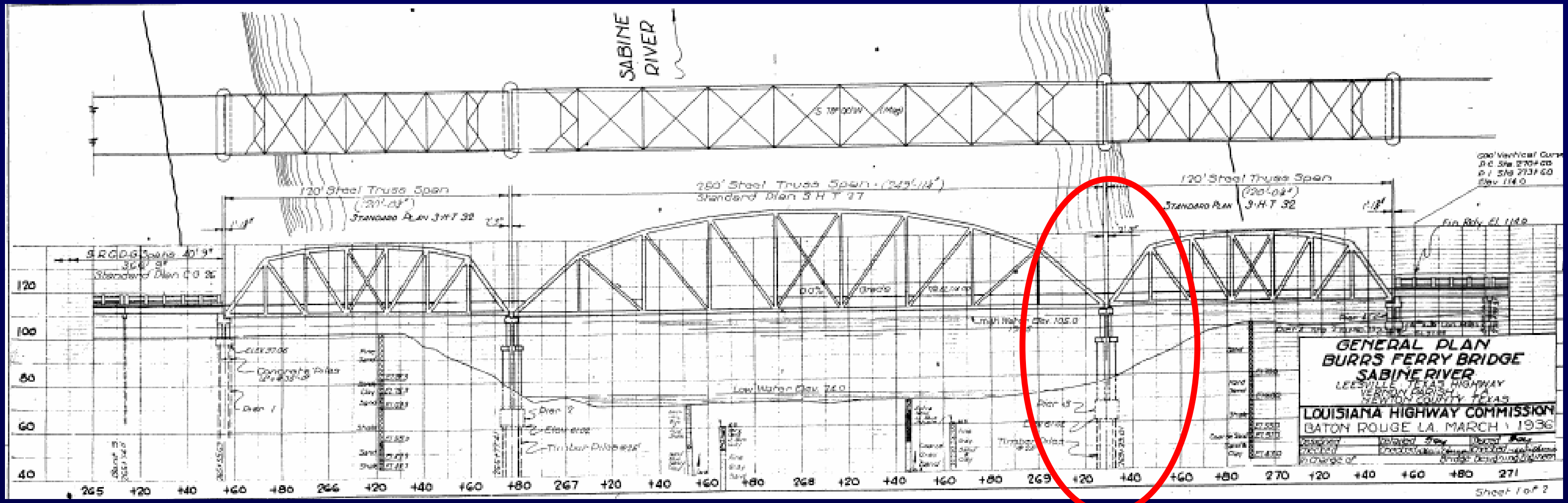


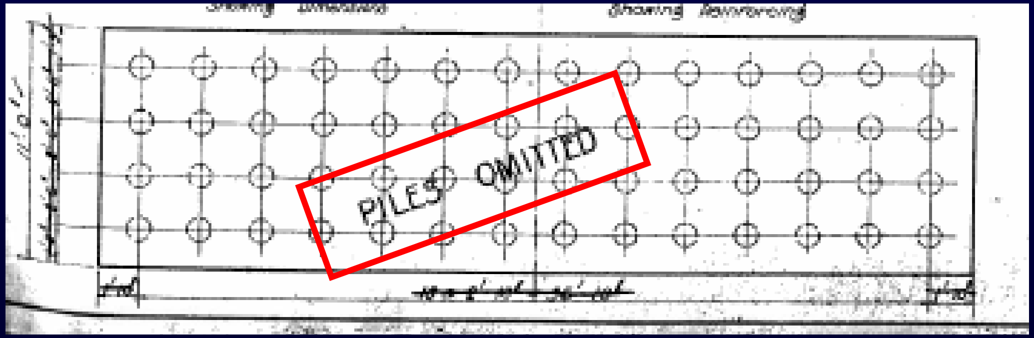
Migration of Sabine River

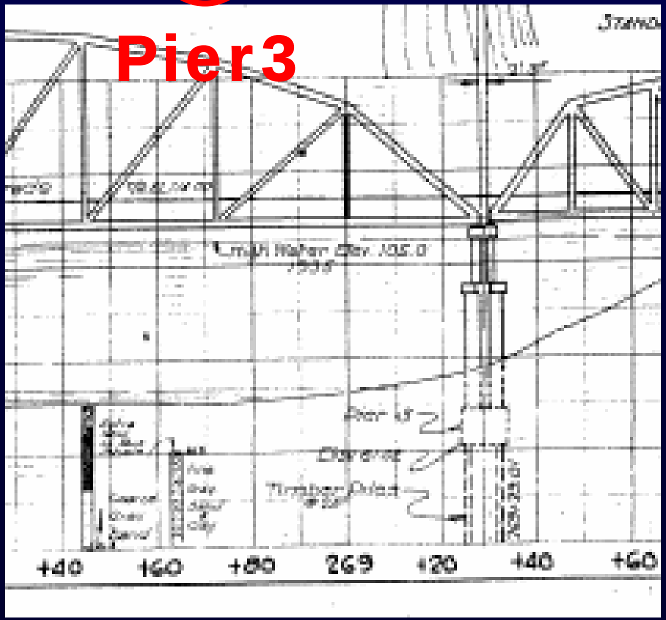
<1999>

<2005>

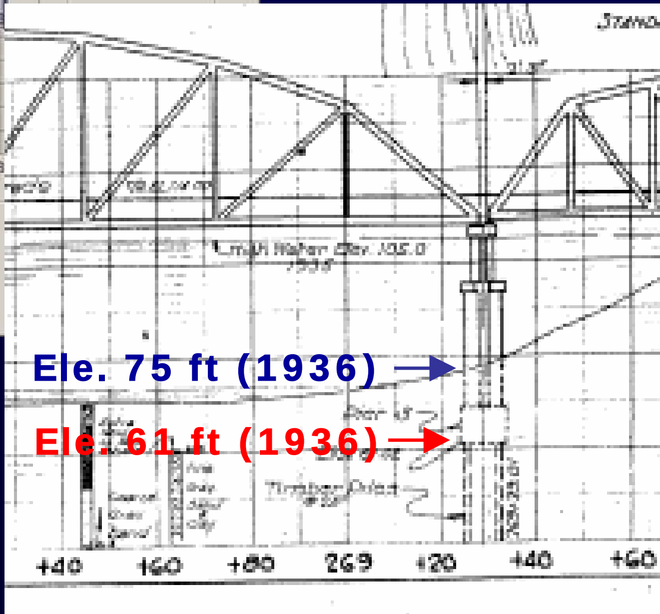
Bridge Scour







Bridge Scour



< Cross-Section at downstream >

Bridge Scour

End of History Lecture, Let’s Talk about Geotech!

Methods for Soil Improvement

Ground Reinforcement

- Stone Columns
- Soil Nails
- Deep Soil Nailing
- Micropiles
- Jet Grouting
- Ground Anchors
- Geosynthetics
- Fiber Reinforcement
- Lime Columns
- Vibro-Concrete Column
- Mechanically Stabilized Earth

Ground Improvement

- Deep Dynamic Compaction
- Drainage/Surcharge
- Electro-osmosis
- Compaction Grouting
- Blasting
- Surface Compaction

Ground Treatment

- Soil Cement
- Lime Admixtures
- Flyash
- Dewatering
- Heating/Freezing

Jet Grouting

- In-situ mixing of soils with a stabilizer (cement grout) to form columns of soilcrete or soilcement.
- Application: Structural underpinning, Excavation Support, Soil Stabilization, Seepage Barrier/Cutoff walls
- Jet-grouting Animation

Jet Grouting

Jet Grouting Injection Methods

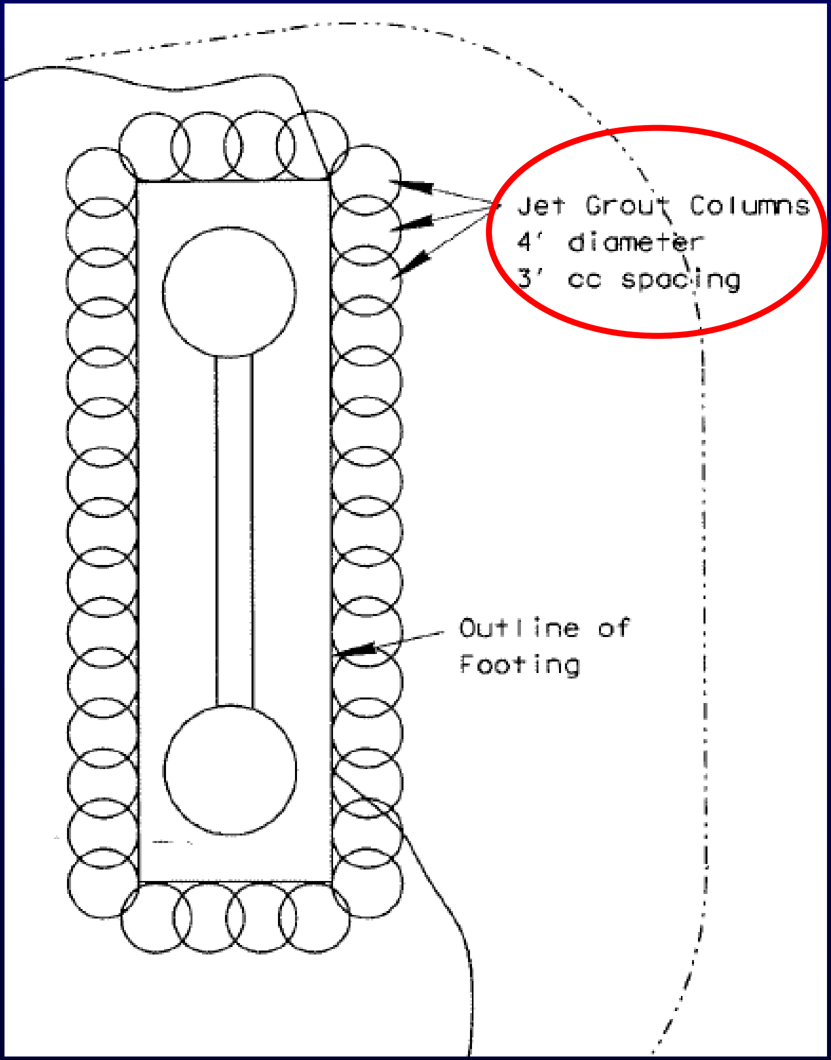
	Single Jet Grouting		Double Jet Grouting		Triple Jet Grouting	
	Sand & Gravel	Clay	Sand & Gravel	Clay	Sand & Gravel	Clay
Column Dia. (ft)	2 - 4	2 - 3	3 - 6	3 - 5	5 - 8	3 – 6
Soilcrete Strength (psi)	1000-3000	250-1000	500-2000	150-1000	500-1500	150-750

- Compare weak rock (700 psi) or concrete strength (3500 psi)

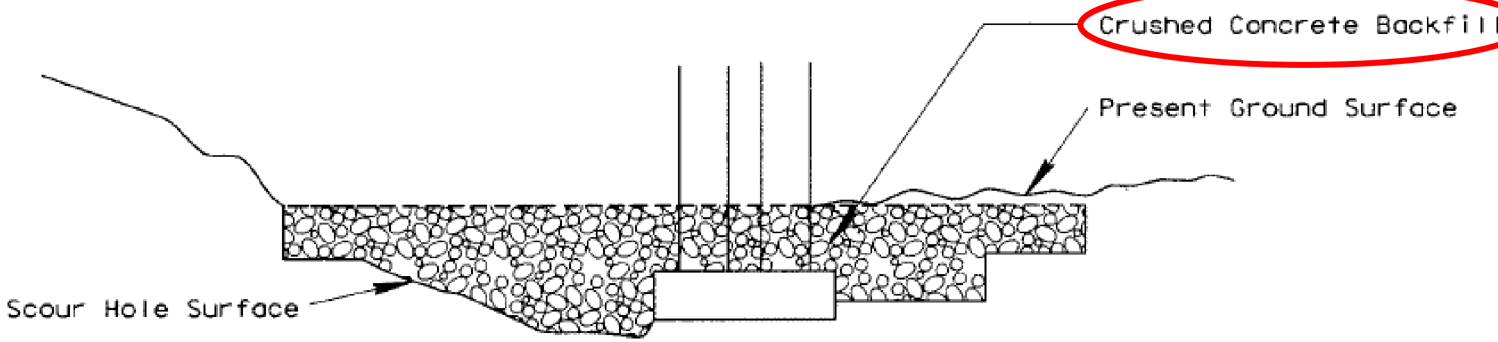
Field Installation

Jet Grouting Design

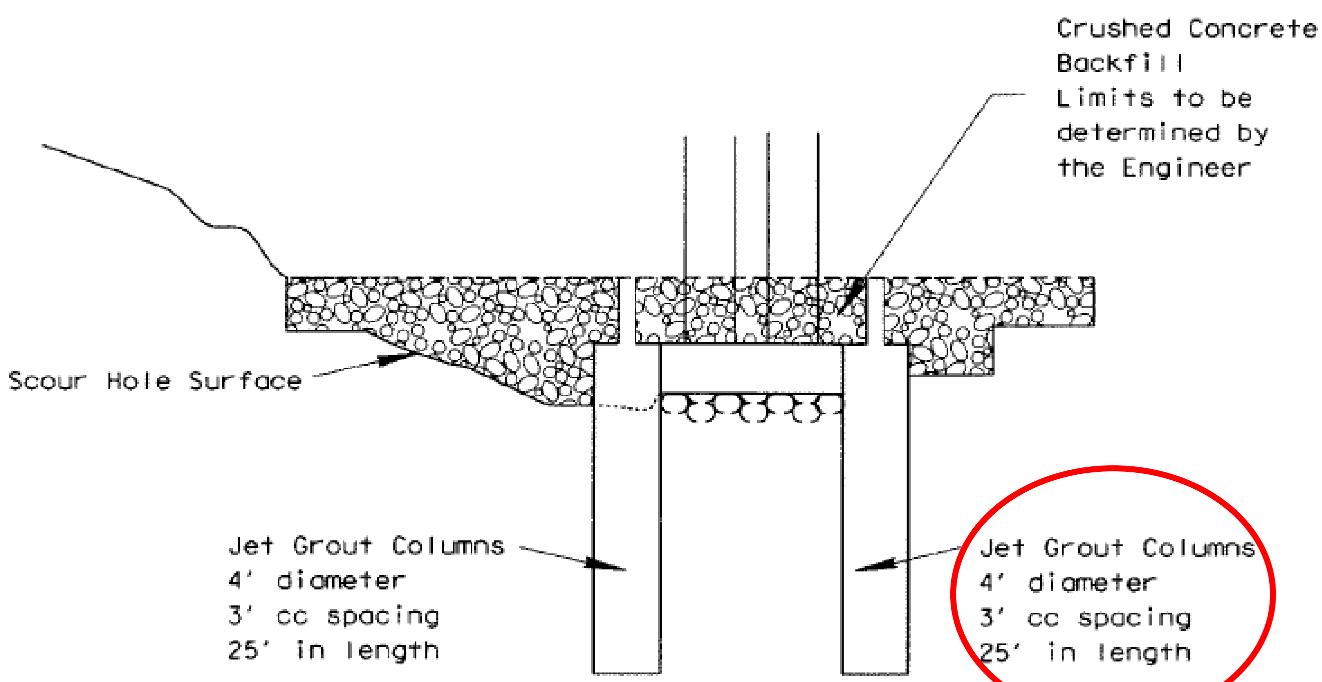
- Diameter: 4ft
- Center to Center Spacing: 3ft
- Total # of Jet Grouting Column: 38
- Column Length: 25ft



Jet Grouting Design



Step 1 -- Fill in the scour hole with cement stabilized backfill. Excavate out the soil on the river side of the bent and replace with cement stabilized backfill.



Step 2 -- Install the Jet Grout Columns around the footing. The columns are 4' diameter, spaced at 3' centers, and are 25' feet in length.

Jet Grouting

PVC pile to guide grouting

Concrete Backfill

Jet Grouting

Jet Grouting

High pressure jet grout through drill rod

Single Jet Drill Rod

Single Fluid Jet
Grouting Nozzle

Grout Spoil Return

Grout spoil return

Spoil Pond

Slurry Mixer and Pump

Slurry Mixer

Grout Pump (Monitor quantity used)

Slurry Mixer

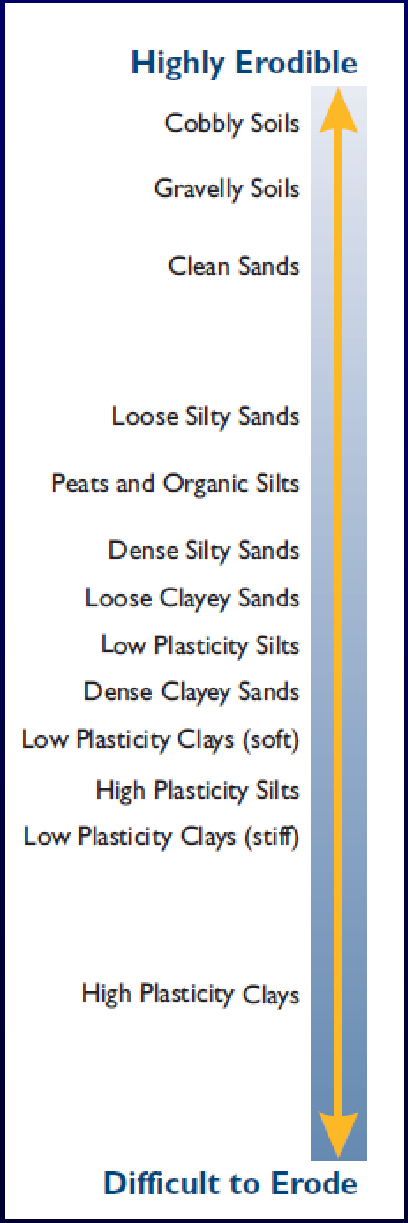
Grouting Pump

Final Repair

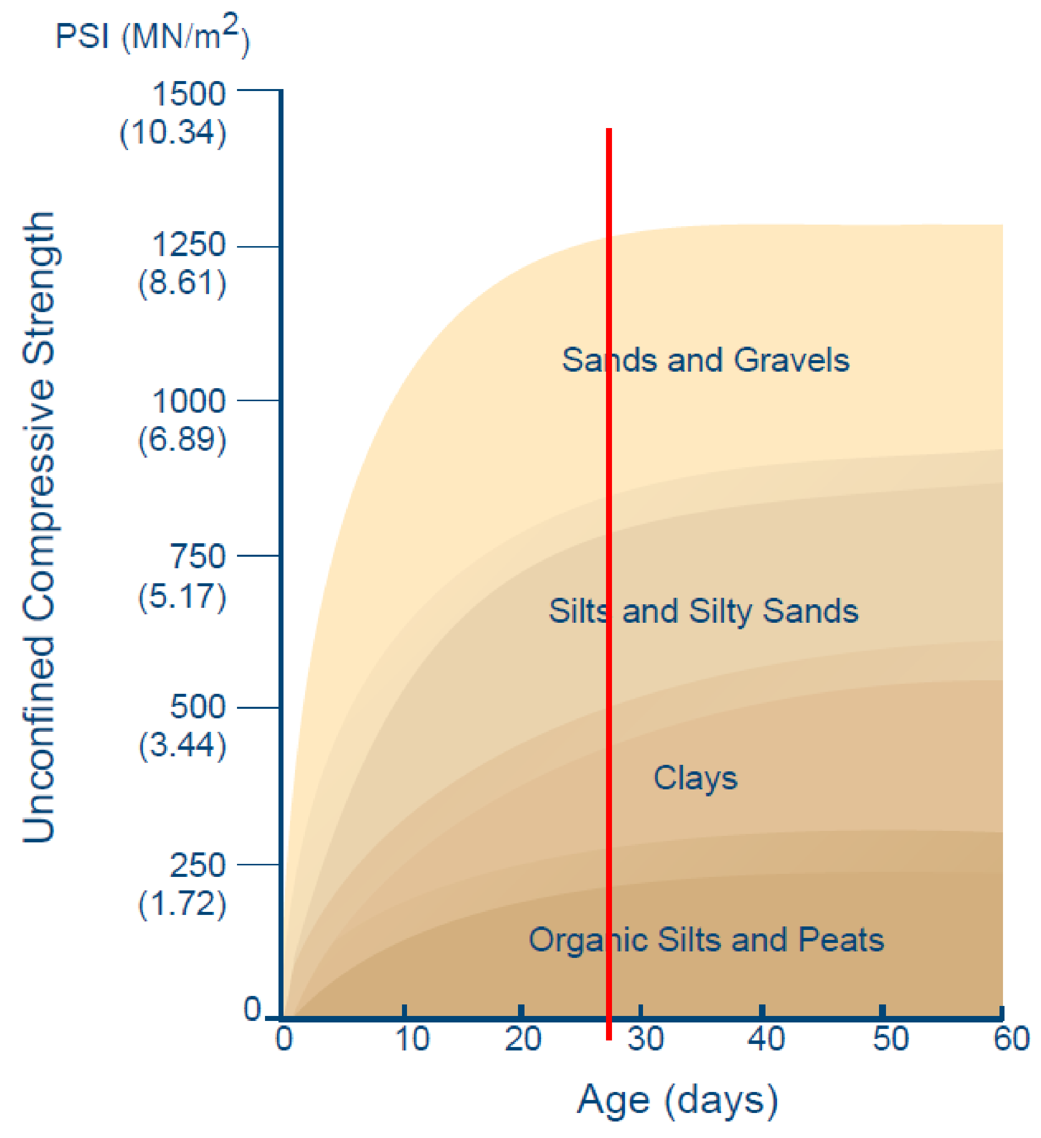
Thank you!

Quality Control

QUALITY CONTROL INSPECTION ITEMS	
Drilling	Location, angle, depth, methods to maintain repeatability
Batching	Preparation of grout slurry for consistency in material content and physical and chemical properties
Jetting	Checking of drill parameters (lift, speed, rotation rate) and injection parameters (pressure and flow of all components)
Documentation	Accurate documentation for each element constructed. Construction times and correlation to any sampling performed
Sampling and Testing	Retrieval of representative samples for external testing



Strength Gain with Age



Advantage & Disadvantage

System	Advantages	Disadvantages
Single Fluid	-Simplest system and equipment -Good to seal vertical joints -Good in cohesionless soil	-Smallest geometry created -Hardest to control heave -Difficult to control quality in cohesive soils
Double Fluid	-Most utilized system -Availability of equipment and tooling -High energy, good geometry achieved -Most experience -Often most economical	-Very difficult to control heave in cohesive soils -Spoil handling can be difficult -Not usually considered for underpinning
Triple Fluid	-Most controllable system -Highest quality in difficult soils -Best underpinning system -Easiest to control spoil and heave	-Complex system and equipment -Requires significant experience
SuperJet	-Lowest cost per volume treated -Best mixing achieved	-Requires special equipment and tooling -Difficult to control heave in cohesive soils -Spoil handling difficult -Cannot work near surface without support -Highest logistical problems
X-Jet	-Confidence of geometry -Controllable materials cost -Best for soft cohesive soils	-Very specialized equipment that requires daily calibration -Limited experience available