



Trenchless Tunnel Projects: Owner's Guide to Risk Management

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Why Trenchless?

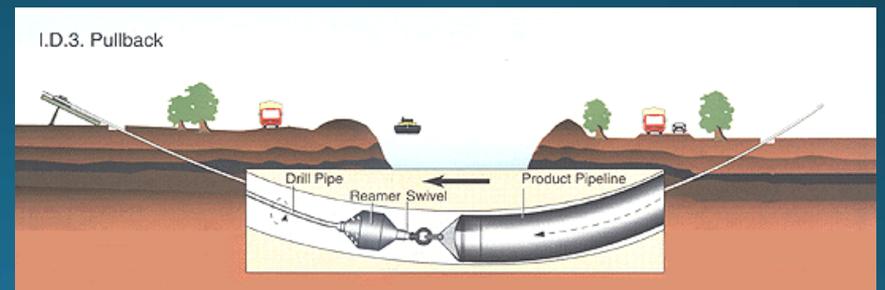
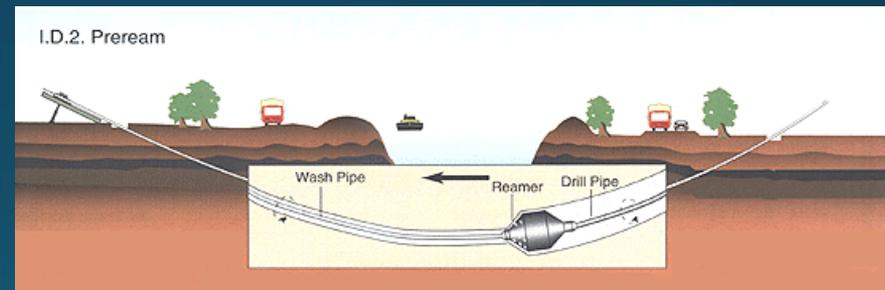
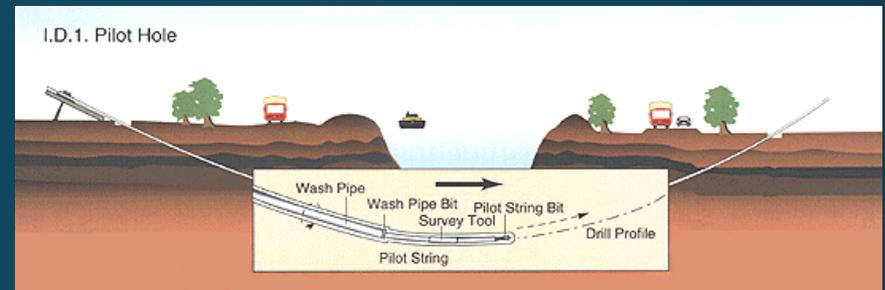
- “The least risky way to build a trenchless crossing is to build it by open cut”
 - Anonymous (but actual) trenchless engineer
- Purpose of presentation - share options on how to mitigate legal liability risk for trenchless crossings
- The main legal risk = Differing Site Condition litigation
- Main options to mitigate this risk:
 - Geotechnical Baselines
 - Equipment Specifications
 - Bidder Qualification Standards

Trenchless Methods

- Horizontal Directional Drilling
- Microtunneling
- Open Shield Pipe Jacking
- Auger Boring
- Pipe Ramming

Horizontal Directional Drilling

- Surface to surface installation
- Start with a “Pilot Bore”
- Drilling fluids used to keep Pilot Bore from collapsing in on itself
- Permanent pipe installed with “pullback” by reaming through the Pilot Bore



Microtunneling

- Closed face pipe jacking process
 - Slurry Supported Face
- Requires shafts
- Steerable and guided with laser



Variety of Microtunneling Head Configurations



Microtunneling

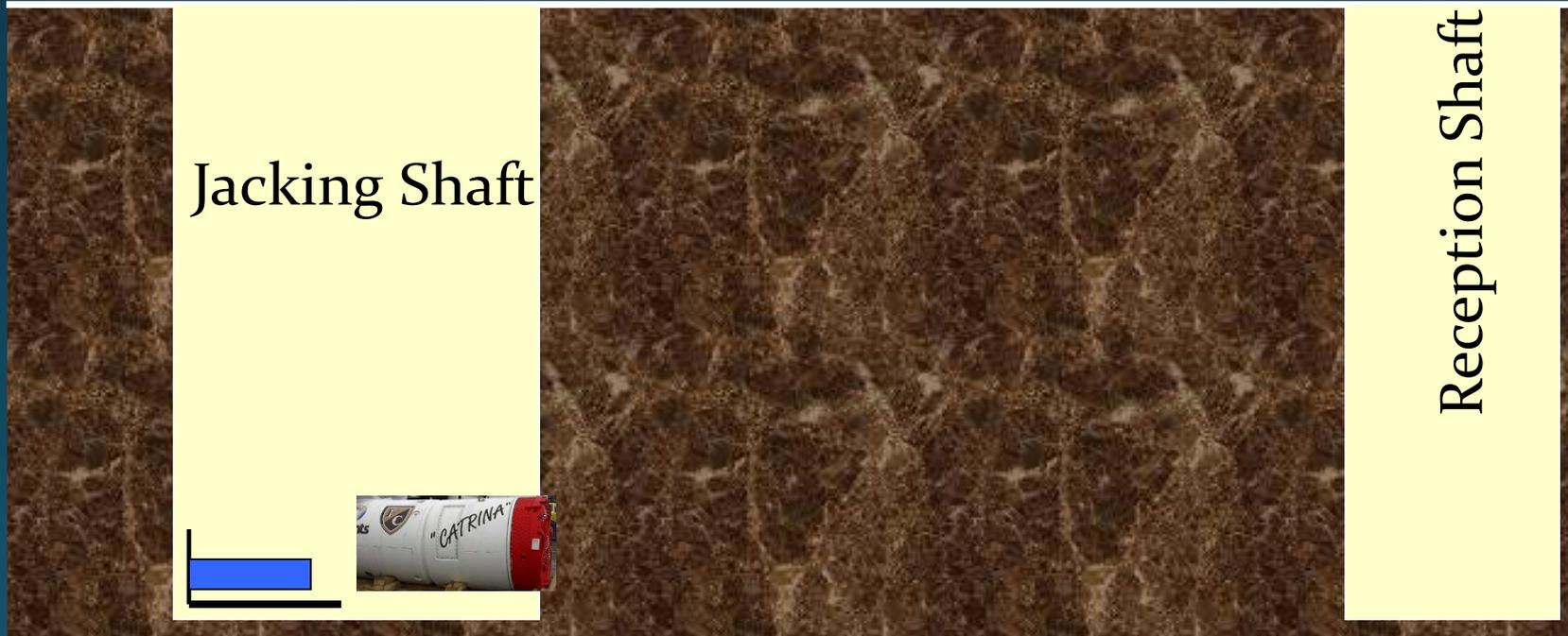
- Remote controlled
- Pipe jacking operation
- Positive support to face
- Laser guided
- Slurry excavation
- No people in the tunnel

Ground Surface



Microtunneling Process

Ground Surface



Microtunneling Process

Ground Surface



Microtunneling Process

Ground Surface



Microtunneling Process

 Machine retrieval

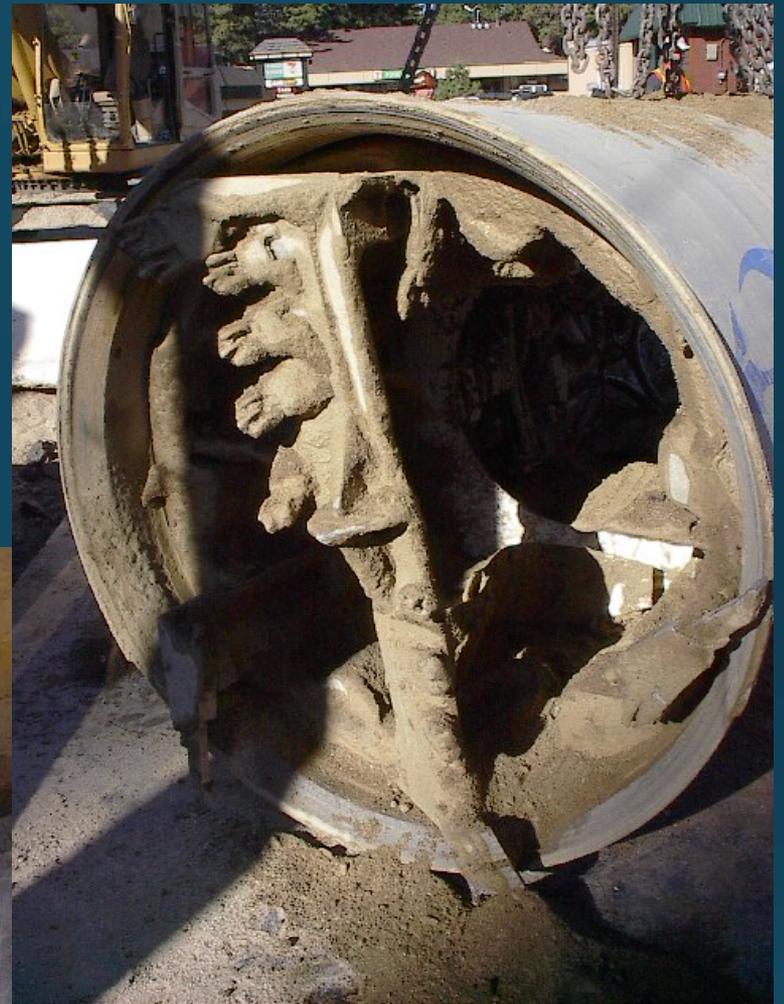
 Pipe in place

Ground Surface



Open Shield Pipe Jacking

- Open face requires stable soils
 - Need to control groundwater, if any
 - Dewatering wells along alignment
- Operator in Pit and Heading
- Steerable with laser controlled line and grade
- Construction from shafts like microtunneling



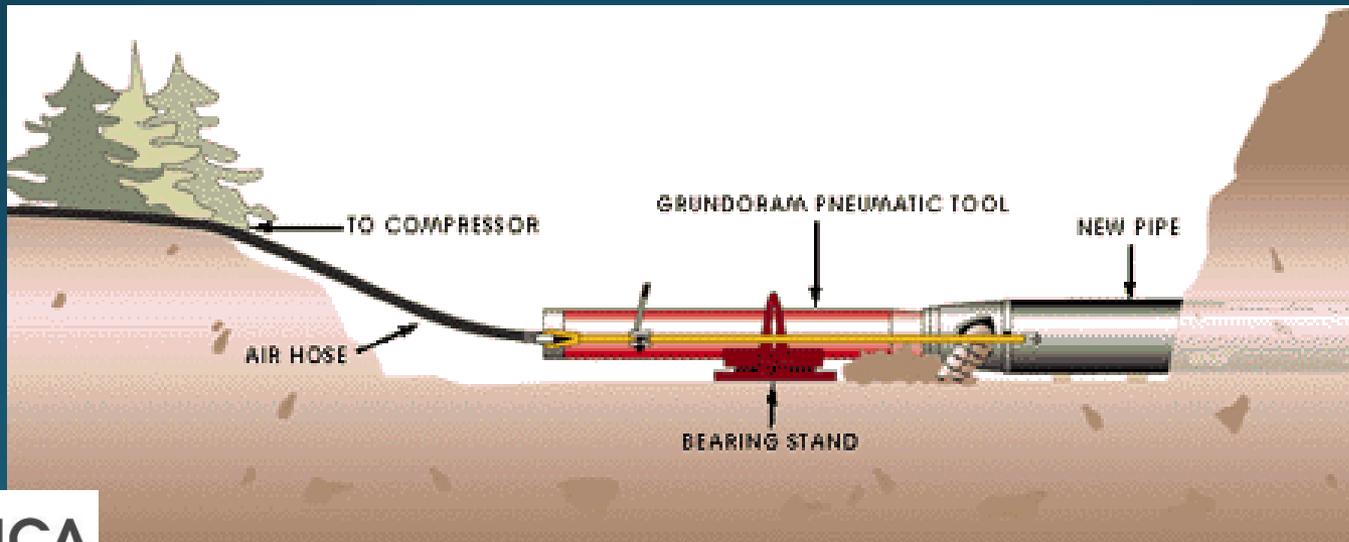
Auger Boring

- Soil removed with augers
- Face partially stabilized with augers
- Length limitations due to torque capacity
- Control water above pipe crown
- Line and grade accuracy 1%



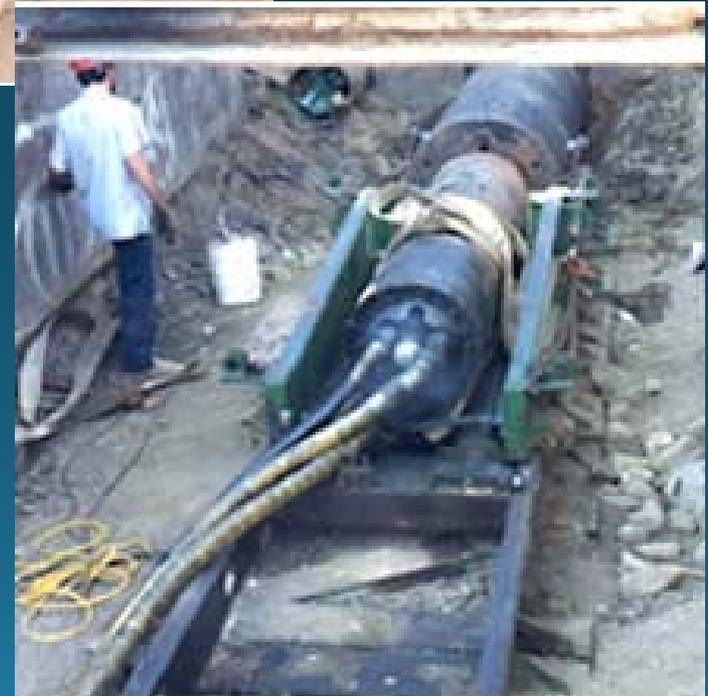
Pipe Ramming

- Pneumatic Ramming Device
- No Excavation Head
- Length limitations due to friction
- No line and grade control





- Normally use engineered “plug” at lead edge of pipe to contain any flowing / groundwater conditions
- Stiff soils can create a soil plug



Sequence of Presentation

- Introduction to Key Concepts
 - Claims / Litigation
 - Geotechnical Reports
- Why these Projects Can Be Risky
 - General Challenges
 - Case Study
- Options for Avoiding Large Claims
 - General Options
 - Case Study

Key Concepts

- Litigation / Claims
 - Differing Site Condition
 - Defective Specification
 - Superior Knowledge
- Geotechnical Reports
 - Geotechnical Engineering Report
 - Geotechnical Data Report
 - Geotechnical Baseline Report
- Tunnel Methods
 - HDD
 - MTBM
 - Pipe Ram
 - Open Shield
 - Auger Bore

Differing Site Condition Claim

- This is the most common claim on these Projects
- Basic test = do the conditions encountered “differ materially” from those *“indicated”* in the Contract?
- What is actually *“indicated”* in the Contract - and *how*?
 - **Comment:** This is the single most important DSC risk management issue for a trenchless project
 - **Comment:** Claims can be averted or minimized if more attention is paid to what is *“indicated”* by the Contract
 - **Comment:** Owners need to be more proactive in working with consultants to set *“indications”* for each Project

Defective Specification Claim

- Often see this hand-in-hand with DSC claim
- Based on notion that tunneling method specified by Owner in bid documents will work, if Contractor follows the design
 - Sometimes referred to as a *Spearin* claim
- Typical Owner defenses to this type of claim:
 - Contractor did not follow the Owner's design
 - Rehash of the DSC claim
 - Cause of failure was due to Contractor's error or omission

“Superior Knowledge” Claim

- Rarely used in past
- We see increased use of this theory
- Claim hinges on “withholding” information from bidders
- Normally requires bidder to prove:
 - “willful concealment” from bidders
 - of “facts” that are
 - “peculiarly within Owner knowledge” and
 - “not ready obtainable elsewhere”
- Not going to talk much about this today, but...
 - **Comment:** important risk mitigation issue here is *what to disclose* to bidders and – equally important - how

Geotechnical Reports

- This is a vital issue on trenchless projects
 - What reports should the owner commission?
 - What issues should they address?
 - Should they all be provided to bidders?
- **Comment:** some Owners don't pay enough attention to this issue. They just assume the consultants know what to do
- **Comment:** some consultants don't do enough to engage the Owner in a discussion about the pros and cons of using various reports
- **Comment:** Owners should be more active in understanding the issues presented and in deciding basic direction

Main Types of Reports

- Geotechnical Engineering Report
 - Used for design purposes
 - Lots of vague, hedgy, imprecise “indications”
- Geotechnical Data Report (GDR)
 - Data only, no interpretation
 - Geotechnical Borings – Blow Counts, Soil Classification
- Geotechnical Baseline Report (GBR)
 - Establishes a baseline on which the contractors are instructed to base their bid
 - Baseline is set to evaluate a Differing Site Condition
 - Works hand-in-hand with the DSC clause

Why These Projects Can Be Risky

- In Part 1, we covered Key Concepts
- Now we will look at why these Projects can be risky
 - NW geological conditions
 - Poorly written contract documents
 - Limitations on technology
 - Bidder environment
- We will also look at a case study to illustrate how a large claim arose
 - MTBM choked on cobbles and gravel
 - No clear *"indications"* in Contract

NW Glacial Geology

- Highly variable conditions
 - Glacial till, till-like, outwash soils can be present on single site
 - Cobbles and boulders are common but often not “detected” in bores and can be difficult if not impossible to quantify
 - Groundwater control is key to tunnel success with certain methods
 - Soils are “abrasive”
 - Randomly deposited organics / wood
- Example # 1: 2,000’ rock bore under major river
 - Only two bores – and showed dramatically different rock strengths
- Example # 2: auger bore project in area known to be cobble heavy
 - But the geotech bores don’t “hit” cobbles and thus “logs” don’t seem to *“indicate”* cobbles to be present

Poorly Written Contract Documents

- Biggest problem is that Contract does not clearly set forth subsurface *"indications"* – three recurring issues
- **Inconsistent** indications
 - Bore logs not uniform (river rock bore)
- **Ambiguous** indications
 - "may occur"
 - "may range from 5% to 15%"
 - "likely to encounter"
 - "contractor should anticipate"
- **Order of precedence** not clear
 - If both Baseline and bore logs provided to bidders, which controls?

Technology

- Tunnels generally small in diameter and typically less than 100”
- TBMs used for these projects not comparable to large-bore TBMs in power
 - Power of TBM limited by its smaller size
- Limited or no access to face to repair cutter wheel or remove obstructions

Bid Environment

- Bidders tend to use the TBMs they already have
 - Very little special procurement for specific job
- Minimal innovative procurement to date
 - No GC/CM
 - No Design-Build
 - Normally hard money/low bid
- Bidder pool itself is limited regionally

Case History #1

- Several Thousand Feet of 36” and 42” Microtunnel
- Contract Documents included both a GDR and a GBR
- GBR included the following:
 - “Maximum boulder unconfined compressive strength *equal to or less than* 30,000 psi”
 - But no cobble strength provided
- *And Cobbles not clearly indicated*

Contractor Chose Iseki Unclemole – Soft Ground Machine

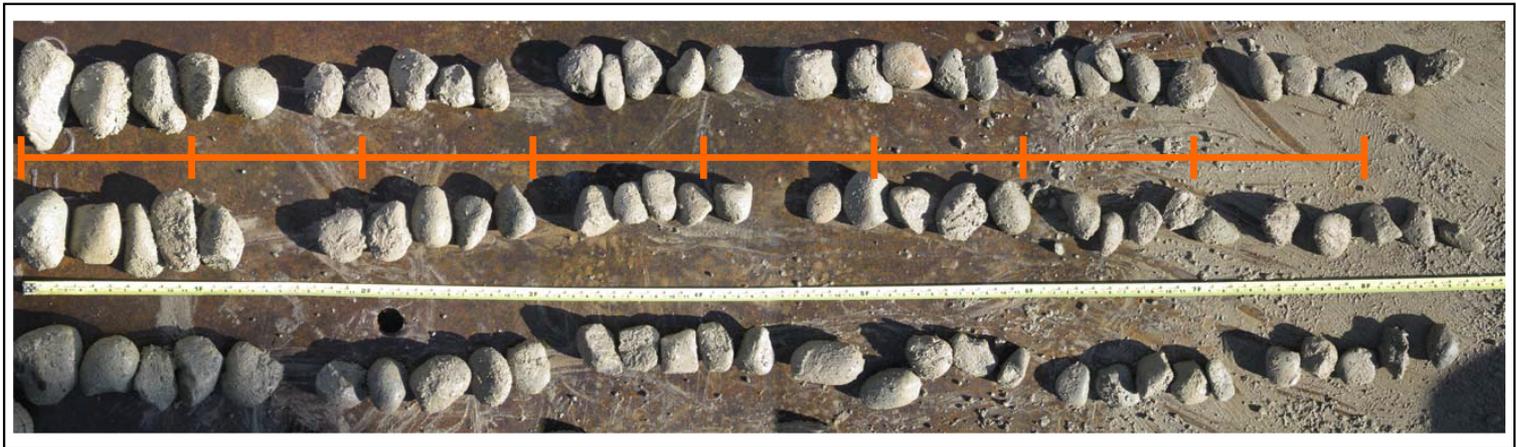


Contractor Gets Stuck after 40 feet

- Attempts to dig up in front of the machine
 - Unsuccessful
- Had to pull machine back to launch shaft to “see” the face
- Found the face clogged with material







A total count of ninety (90) rocks greater than 3 inches as measured along their longest axis. Tick marks denote 1ft increments. Three random but equal sized rock piles representing Owner, Joint, and FCCC. FCCC's randomly selected row is the bottom row.



FCCC row selected randomly and labeled with a unique identifying number. A total count of thirty (30) rocks. Tick marks denote 1ft increments.

Contractor Filed RCO

- Argued that it had encountered DSC:
 - “Nested” Cobbles
 - Cobble Counting
- Also argued Baseline strength for Boulders also applied to Cobbles
 - Rock tested several Cobbles – some over 30,000 psi
- Settled in Mediation
 - Clearly written Cobble *indication* (i.e., Baseline) would have saved Owner \$\$\$ in settlement

Options for Avoiding Large Claims

- Clear “indications” in Contract
 - Use of Baselines where appropriate
- Improved Specifications
 - Setting minimum equipment requirements where appropriate - Cutterheads
- Bidder qualifications
 - Verifying equipment & key personnel *at bid time*

Baselines

- Baselines originated with large tunnel projects, now increasingly used with smaller bores
 - Defined as : “assumptions expressed as contractual representations of anticipated geotechnical conditions” (per ASCE Guidelines – The “Yellow Book”)
- An accepted way to allocate risk and achieve clarity
- Typical issues / problems include:
 - Murky, hedgy, ambiguous baselines
 - Failure to establish precedence of baselines
 - Baselines that cannot be administered

Avoid Murky Baseline Language

- No ambiguity:
 - Cobbles “likely” to be encountered
 - Cobble quantity “may range” from 5% to 15% of total tunnel volume
- Court may hold that ambiguous geotech language will be construed against drafter
- Use Defined Terms and exact language
- Keep the baselines as concise as possible – write as if an average person with limited specialized knowledge needs to understand it

CONTRACTUAL GEOTECHNICAL BASELINES

**CONTRACTOR is instructed to assume that gravel and
Cobbles will be encountered along the alignment.
Under no circumstances will Gravel and Cobbles,
regardless of quantity, compressive strength,
arrangement or distribution, constitute a Differing Site
Condition**

...encountered or not and regardless of compressive strength, and that all costs associated
with tunneling through such **Gravel and Cobbles (including abrasive wear and
mechanical wear and tear on the MTBM)** shall be included in the
CONTRACTOR'S bid or the Project

**(including abrasive wear and mechanical
wear and tear on the MTBM)**

Under no circumstances will Boulders that measure less than 1/3 of the outside diameter of the casing pipe when the Boulder is measured in its longest dimension (Baseline Boulders) constitute a Differing Site Condition.

~~circumstances will Boulders that measure less than 1/3 of the outside diameter of the casing pipe when the Boulder is measured in its longest dimension (Baseline Boulders) constitute a Differing Site Condition.~~ The CONTRACTOR is instructed that the MTBM shall be capable of excavating, breaking up and ingesting any and all quantities of Baseline Boulders actually encountered, whether nested or not and regardless of compressive strength, and that all costs associated with tunneling through such Baseline Boulders (including abrasive wear and

To be considered for additional payment under the Differing Site Condition clause, the CONTRACTOR must prove (in addition to other requirements set forth in the Differing Site Condition clause) that the Boulder

- (i) has a longest dimension measuring greater than 1/3 of the outer diameter of the casing and**
- (ii) stopped the forward progress of the MTBM in spite of diligent best efforts to overcome the Boulder.**

Precedence

- Sometimes the raw data doesn't match with the Baselines
 - Cobbles typically not extracted in course of drilling a narrow test bore
- Sometimes the raw data is extremely variable
 - Rock strengths all over the map – no consistency
- Per ASCE, WSDOT and courts, it is OK to write a Baseline that varies from data given that data incomplete and variable
- Important to make the Baseline contractually superior to raw data
- Otherwise can subvert potential for summary judgment and lead back into the “boring wars” and similar interpretive disputes over the raw data

Equipment Specs

- Cutter head openings
- Rock cutters
- Particle size

DESIGN REQUIREMENTS

The Cutterhead shall have soil entry openings that restrict the largest particle that can enter the machine to 4 inches in the longest dimension

be fitted with BOTH Roller Cutters and Scraper Tools as those terms as defined herein. The CONTRACTOR shall determine the configuration of the excavation tools to suit the ground conditions presented in the Geotechnical Data Report and in the Contractual Geotechnical Baseline Section 1.10 herein. Particles larger than 4 inches in the longest dimension shall be kept at the working face until crushed sufficiently to pass through the soil entry openings

Roller Cutters and Scraper Tools as defined herein, consistent with a rock cutting head or mixed ground cutting head.

Report and the Contractual Baselines set forth in Contractual Geotechnical Baseline Section



07/15/2005



2013/2/4 11:22

SECTION B1.2 — SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA

1. OVERVIEW

A. Bid evaluation will include evaluation of bidder's compliance with the Supplemental Bidder Responsibility Criteria as provided for in this Section.

G. To qualify as a responsible bidder under these supplemental criteria, the apparent low bidder must demonstrate its ability and intention to comply with these minimum requirements as a condition of award of the Contract. Consequently, if the Bidder is requested by OWNER within 48 hours after bid opening to furnish supplemental bidder criteria documentation, that **documentation must include**

documentation must include the following information in detail to the satisfaction of Owner:

- 1. The specific TBM with Cutterhead and Excavation Tools complying with Section 02315; and**
- 2. The bidder guarantee**

**SOOS CREEK WATER & SEWER DISTRICT
LIFT STATION 11B
CONTRACT 04-2007S
BIDDER EQUIPMENT GUARANTY**

I, _____, in my capacity as President of bidder _____ (bidder) hereby certify and guaranty that the tunnel boring machine (IBM), inclusive of Cutterhead and Excavation Tools, submitted by Bidder in order to satisfy the Supplemental Bidder Responsibility Criteria
(1)complies with Section 02315 — Microtunneling and
(2)will be mobilized to the Work Site and utilized by Bidder and/or its TBM Subcontractor to perform and complete the Project.

DATE: 5/23/12

BIDDER:

NAME:

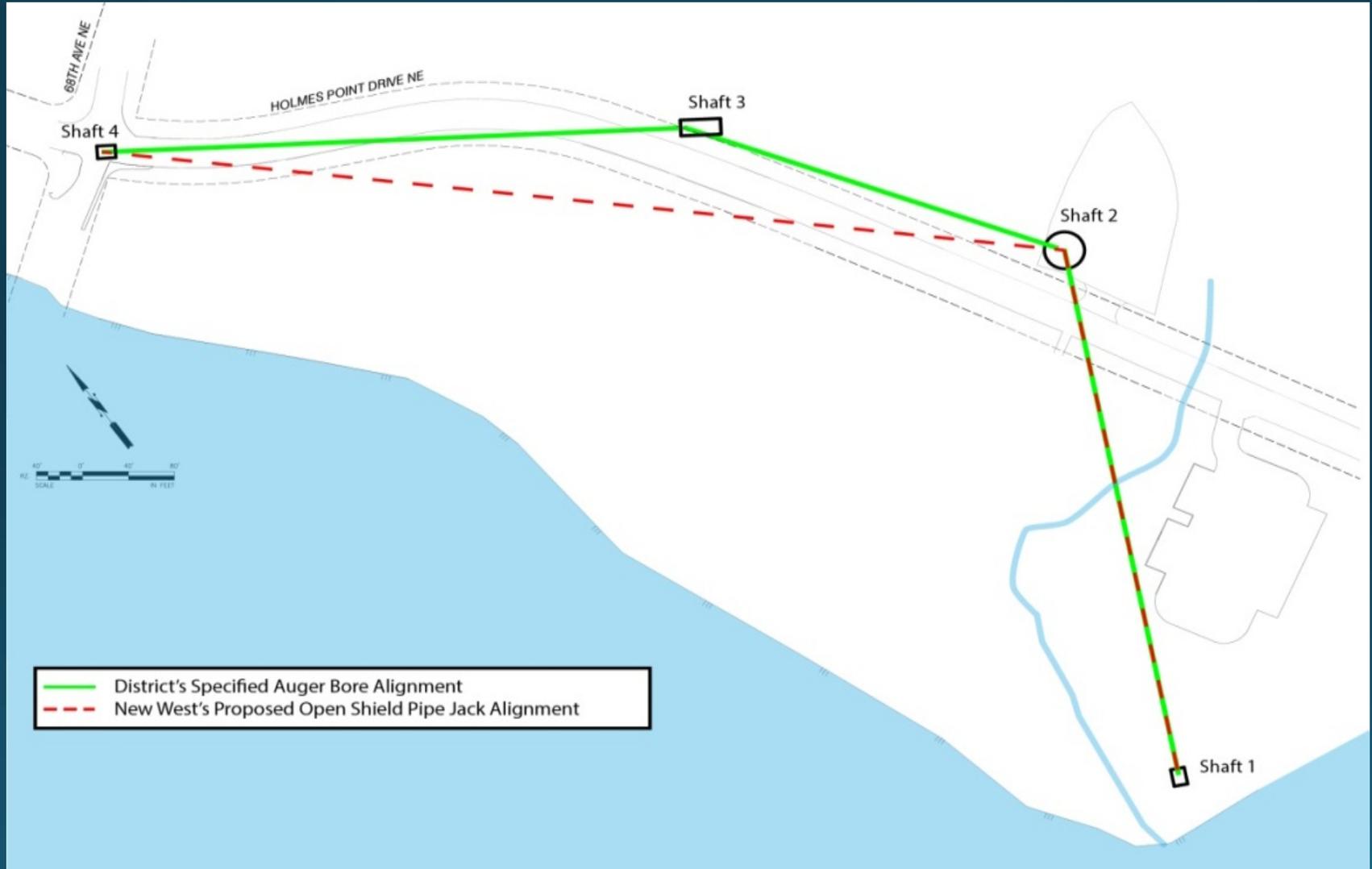
Cost Limitation Clauses

- DSC claims normally contain:
 - Labor costs
 - Material costs
 - Equipment costs
 - Site and Home Office Overhead
- Owners have had to overpay these claims due to poorly written remedy sections in their contracts
- The main issue is contractor – owned EQUIPMENT (i.e., TBM and ancillary support equipment)
 - Almost always owned by the contractor
 - But charged at inflated Blue Book / rental rates unless contract forbids it
 - Change contract to “actual cost” methodology (not WSDOT)

Case History #2

- Client needed to install a gravity sewer line in a city park area close to a lake
- Aware that numerous cobbles would be encountered
- But bore logs did not physically extract them because the bore auger is too small in diameter to remove them whole
- Included cobble baseline -- “any and all” -- language in specifications
- Contractor hit cobbles and they stopped TBM.
- Filed DSC claim.
- Summary judgment in favor of owner

Project Alignment



Contractual baseline: Cobbles

- The auger boring equipment shall be capable of excavating and ingesting all cobbles as defined by the United Soil Classification System (USCS). Due to the glacial origin of the soils, for the purpose of preparing the bid for this project the Contractor is instructed to assume that gravel and cobbles will be encountered along the alignment. While the District is not baselining a specific quantity of gravel or cobbles, the Contractor is instructed that its auger boring equipment must be capable of excavating and ingesting any and all quantities actually encountered.



420 EX
620 lbs

Boring

11/30/2011 11:50



12/05/2011 09:02



01/31/2012 10:41

Baseline Enforceable: DSC Claims Dismissed

[T]he thing I look to first is the contract. **And the baselines in the contract are both broad and clear.** They require the contractor to be capable of excavating and ingesting any and all cobble actually encountered and limits the District's payment for boulders to those over 36 inches.

So with regard to whether we have a DSC claim based on encountering cobbles -- cobbles and boulders or cobbles and boulders and groundwater, the answer to that question is no. **The District advised the parties that cobbles and boulders and groundwater were going to be part of the site conditions.**

-- King County Superior Court Judge Catherine Shaffer