UCT The Underground Utilities Event
25 YEARS
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# Risk and Rewards: Completing a Design Build Tunneling Project

Presented by:

Breff Cooling, BRH-Garver Construction L.P.

Troy Stokes, Akkerman, Inc.

BRH GARVER

AKKERMAN

# Presentation Outline

Project Overview

Design Considerations

Construction

Outcomes

# Project Overview

**Project Name:**
Canal Water Treatment Plant
Discharge Main Tunnel Project

**Location:** El Paso, TX

**Owner:** El Paso Water

**Engineers:** CDM Smith & Parkhill, Smith & Cooper

**Design-Build Partners:**
Parkhill, Smith & Cooper & Killduff Underground Engineering

# Project Overview

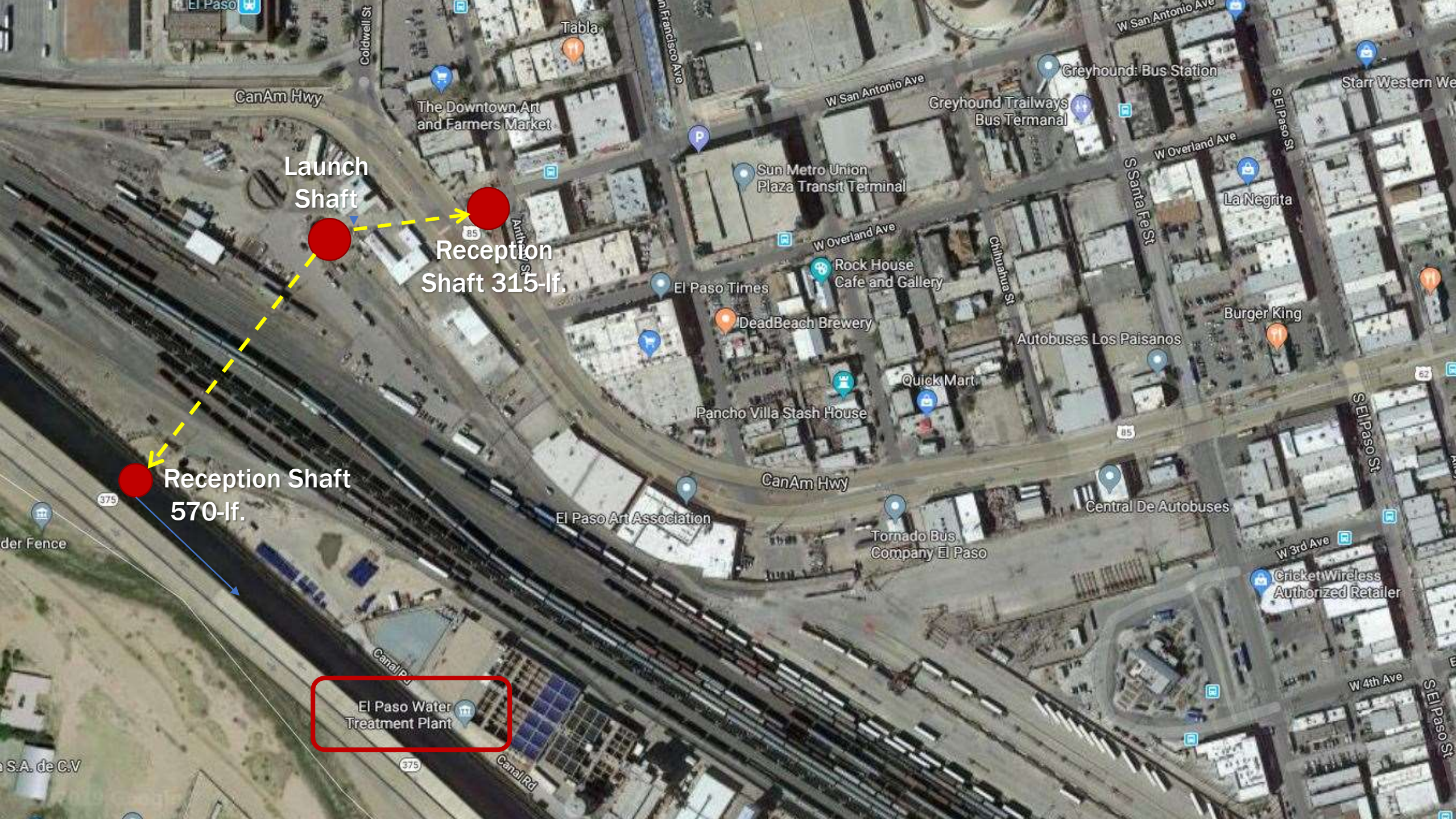
**Purpose:** Convey treated water from Rio Grande to downtown El Paso

**General Contractor:**
BRH-Garver Construction L.P.

**Construction Costs:**
$5,134,330

# Project Overview

- Robertson Umbenhauer WTP located between Rio Grande River and BNSF rail yard
- Originally opened in 1943 as Robertson Plant, Umbenhauer Plant added in 1967
- Produces 40 MGD treated/distributed
- Serves Central and West El Paso


Launch Shaft
Reception Shaft 315-lf.
Reception Shaft 570-lf.
El Paso Water Treatment Plant
CanAm Hwy
W San Antonio Ave
W Overland Ave
S El Paso St
S Santa Fe St
Chihuahua St
Coldwell St
Tabla
The Downtown Art and Farmers Market
Greyhound Bus Station
Greyhound Trailways Bus Termanal
Starr Western We
Sun Metro Union Plaza Transit Terminal
La Negrita
El Paso Times
Rock House Cafe and Gallery
DeadBeach Brewery
Burger King
Autobuses Los Paisanos
Quick Mart
Pancho Villa Stash House
El Paso Art Association
Tornado Bus Company El Paso
Central De Autobuses
W 3rd Ave
Cricket Wireless Authorized Retailer
W 4th Ave
Canal Rd
85
375
62

# Project Overview

**Ground Conditions:**
Standing sand with cobbles and large boulders

**Pipe:** 66-in. OD Permalok®

**Total Length/Longest Run:**

885-lf./570-lf.

**TBM Equipment:**

- TBM 480 Tunnel Boring Machine w/ Closed-Face Cutter Head
  - TBM named “Robbie” in honor of 75th anniversary of the WTP
- P6000E Electric Power Pack
- Intermediate Jacking Station (IJS) for 570-lf. run

# Design Considerations

- TBM versus MTBM installation
  - Limited staging areas
  - TBM lower cost of operation
- Value-engineered design initiated both bores from one shaft in the BNSF rail yard, limiting the total shaft count to three

# Design Considerations

- Travel under Highway I-85
- Installation under 18 BNSF rail yard tracks
- Soft ground = many opportunities for settlement
- Water table prone to seasonal variability due to proximity to the Rio Grande
- 100-year old rail yard = likelihood of contaminated ground

# Design Considerations

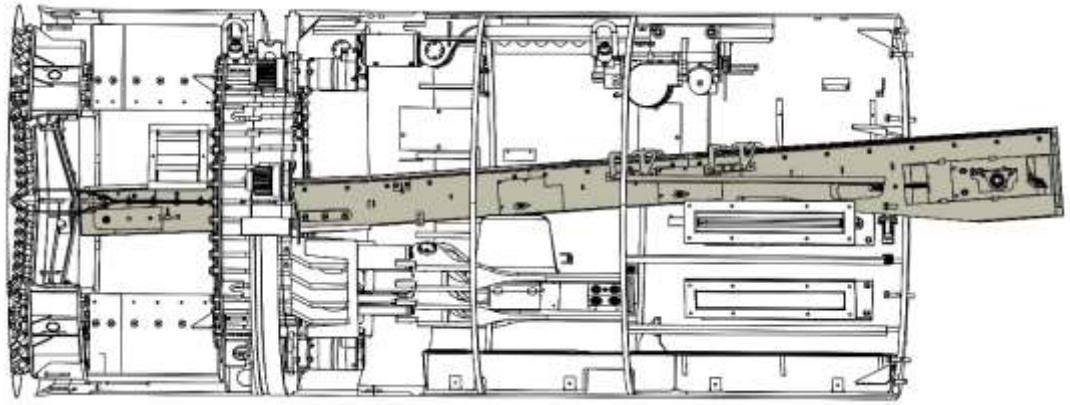
- Abandoned pipelines mixed with existing active utilities in tunnels' zone of influence
- Potential for obstructions
- Launch shaft located in active BNSF rail yard

# Construction

- 570-lf. Tunnel
  - Proceeded from BNSF rail yard launch shaft in SW direction
- 315-lf. Tunnel
  - Launch from same shaft in BNSF rail yard to the east shaft located between intersection of I-85 and San Antonio Ave.

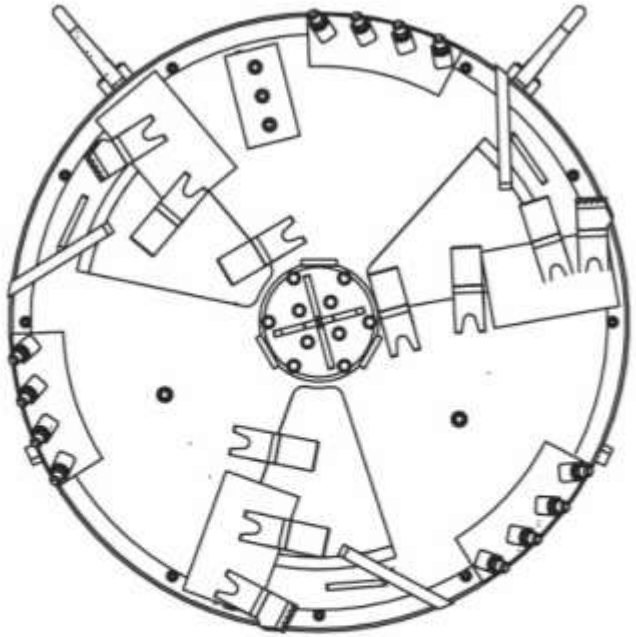
# Construction

- TBM 480 – Manned Entry Tunnel Boring Machine
  - High-torque, two-speed hydraulic motors rotate inner drum and cutter-face
  - 61,000 lbf-ft. rotational torque
  - Three-point steering control
  - Sealed steering joint
  - Torque wings
  - 16-in. belt conveyor for spoil removal



# Construction

- TBM 480 – Manned Entry Tunnel Boring Machine
  - Equipped with increase kit for 66-in. Permalok®
  - Configured with closed-face cutter head



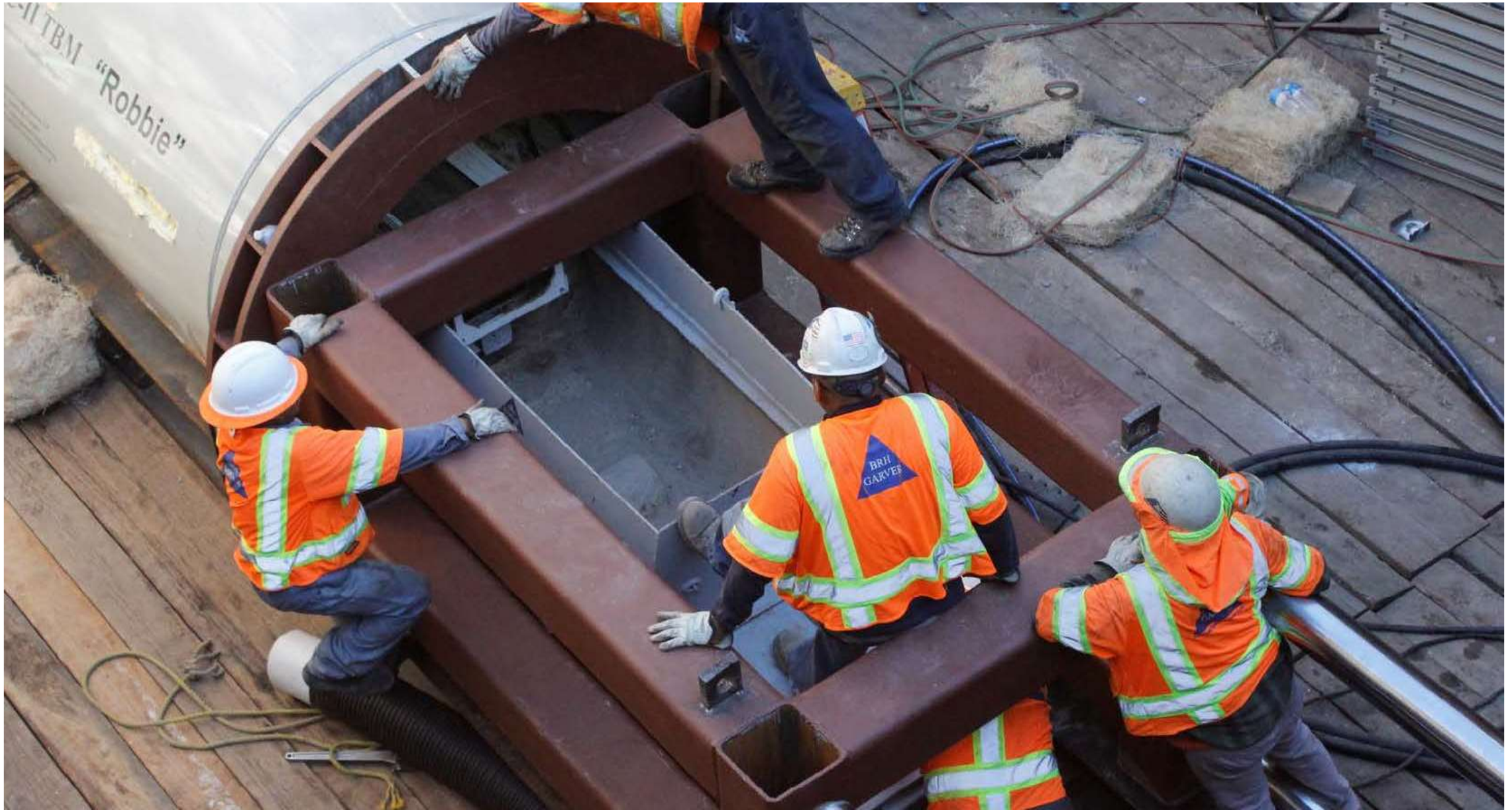
CLOSED FACE
CUTTER HEAD

For unstable ground to prevent subsidence
Bullet bit and spade tooling

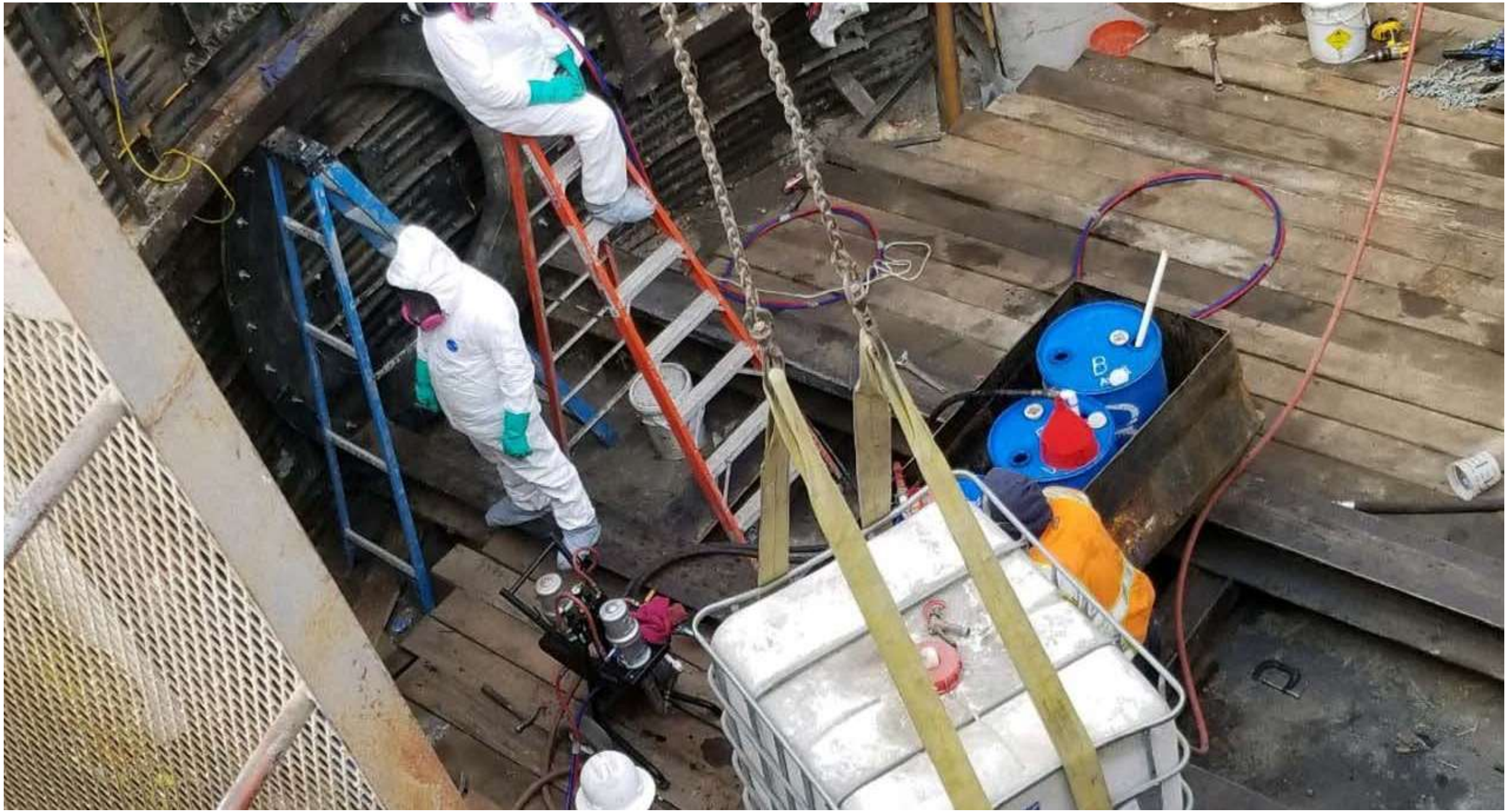
# Construction

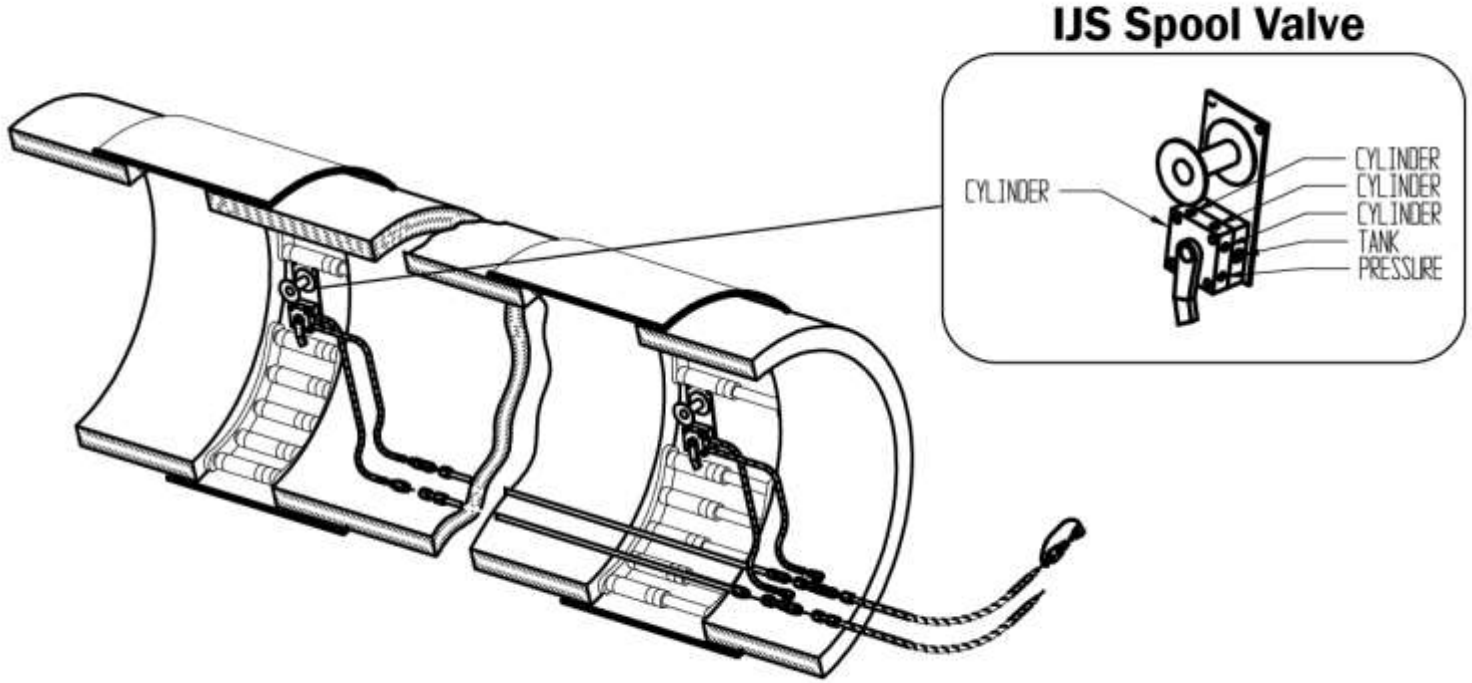
- P6000E Electric Power Pack
  - Provides low- and high-pressure hydraulic power to supply oil to the TBM, conveyor and jacking frame cylinders

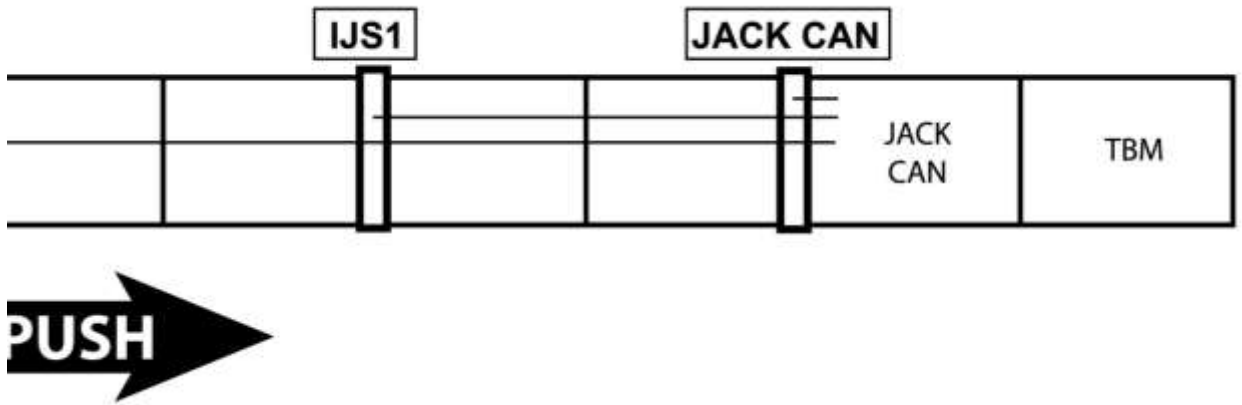

VOLVO


TBM "Robbie"
BRH
GARVEE


MAX LITE




IJS Spool Valve
CYLINDER
CYLINDER
CYLINDER
CYLINDER
TANK
PRESSURE


IJS1
JACK CAN
JACK
CAN
TBM
PUSH

# Outcomes

- Unforeseen cobles required halt to production
  - solution to introduce chemical grout for stabilization
- PPCA ground condition
  - solution to equip crew with full-face mask filtration systems

# Outcomes

- TBM outfitted with closed-face cutter head to handle unstable ground also provided benefit of hydraulic doors for obstruction access and removal
- Downsized casing from 72- to 66-in. presented cost savings
- Normally expect need for deep well dewatering, addressed with closed face cutter head

# Outcomes

- Successful installation of 885-lf. for water conveyance
- Significant 570-lf. installation
- Design-Build Partnership proved to be very effective
- Exceptional cooperation from BNSF

# Questions?

## For more information please contact:

**David Ellett, Project Executive**
**Breff Cooling, Design/Build Manager**
**BRH-Garver Construction L.P.**
**davidellett@brhgarver.com | breffcooling@brhgarver.com**
**(713) 921-2929**

**Troy Stokes, Territory Sales Manager**
**Akkerman, Inc.**
**tstokes@akkerman.com**
**(800) 533.0386 ext. 0055**