# Pneumatic Hammers for Culvert Replacement

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# CASE STUDY

# Pagaso Springs Colorado

# CONTRACTOR

- BTrenchless (a division of BT Construction), Henderson, Colo
- 25 years of utility construction experience
- Progressed from smaller diameter pipe rams to larger diameter projects
- 24-inch (610mm) and 30-inch (760mm) diameter casings
- Then to 42-inch & up to 84-inch (2,135mm)

# PROJECT BACKGROUND

- Pagosa Springs Project
- 84-inch (2,135mm) diameter, 80-foot (25m) long pipe ram
- Under Highway 160
- Highway 160 is a busy two-lane highway
- Main artery between Pagosa Springs and Durango, Colo

# PROJECT BACKGROUND

- Objective:
- Ram 84-inch casing over (consume) an existing 60-inch (1,525mm) Corrugated Metal Pipe (CMP) culvert
- Encase it & remove the CMP culvert
- Replace with new 60- inch (1,525mm) reinforced concrete pipe (RCP)
- Fill annular space with fly ash

# PROJECT BACKGROUND

- CMP multi-plate culvert installed in 1958
- Culvert Collapsed

# CHALLENGES

- Elevation: Pagosa Springs sits at 7,100 feet (2,165m) above sea level
- Direct impact on the capacity of the air compressor system
- Consideration must be given to the amount of CFMs required to operate pneumatic equipment
- Utilized (2) 1600 cfm air compressors instead of 1200 cfm compressors

# CHALLENGES

- Maintaining drainage flow through the existing culvert while ramming
- At times: low flow- non-issue
- Twice during the project crews were flooded out because of rain
- Work was halted until flow returned to manageable levels

# CHALLENGES

- Well constructed pit, w/ solid base, crushed stone, plates set on top of stone for stability allowed the water to flow
- Sometimes at a very high capacity
- Without jeopardizing the integrity of the pit

# RAMMING OPERATIONS

- Ramming pit excavated on the south side of the road
- Ramming prepared pad by layering 18 inches (450mm) of inch-and-a-half rock in the bottom of the pit
- 60-inch (1,525mm) jack and boring machine assembled

# RAMMING OPERATIONS

- Rails of the jack & bore machine used to support and guide the new 84-inch casing
- Casing was placed in position
- Connection made between the 84-inch (2,135mm) casing and the 24-inch (610mm) pipe rammer
- Made through a tapered ram cone and 84-inch (2,135mm) cotter segments

# RAMMING OPERATIONS

- Casing rammed in 20-foot long sections
- Ramming speed averaged about 8-inches per min
- Weld time varied between 7 and 9 hours for each joint
- Ramming the 80-foot (25mm) long run took 3-days and welding time about 24 hours

# CULVERT REMOVAL

- Removing the existing CMP pipe was  challenging
- Crews encountered some 30-inch (760mm)  rocks
- Rocks were pushed into the existing CMP
- Ground was compressed around the existing CMP multi plate

# CULVERT REMOVAL

- An acetylene torch used to cut the CMP into 10-foot (3m) sections
- Sections were pulled out with the boring machine
- Removing the soil, rocks and old 60-inch (1,525mm) CMP took crews 2-days

# CULVERT INSTALLATION

- After the old CMP pipe was removed
- Spoil was cleaned out
- New 60-inch (1,525mm) RCP culvert was jacked into place
- Installation took 2-days total
- Fly ash was used to fill the annular space

# Questions?

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