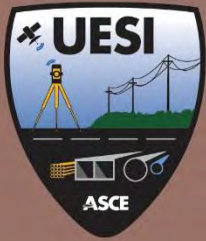


# ASCE



## PIPELINES 2017 CONFERENCE

Phoenix, Arizona | August 6 - 9

Failing to Flawless in a Day:

How Pre-chlorinated Pipe Bursting  
Invigorates Arlington Water Utilities  
Main Replacement Program

Jessie Allen, City of Arlington, Texas

Todd Grafenauer, Murphy Pipelines

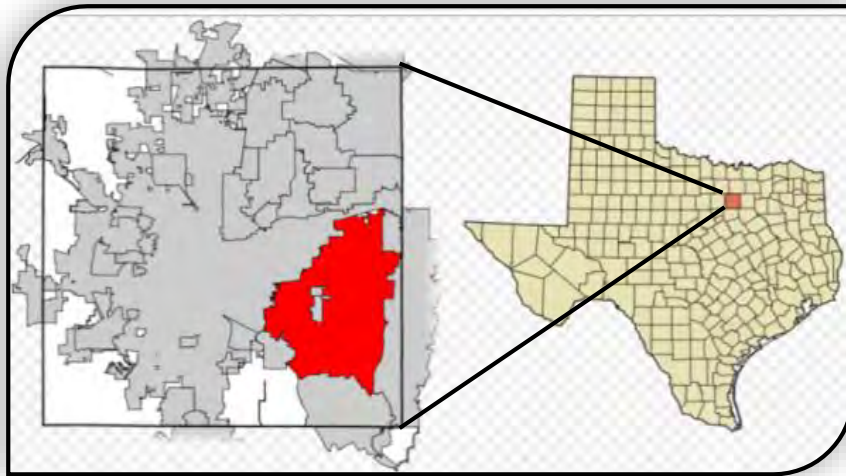
Alan Ambler, AM Trenchless



*Reliability and Resiliency through Sustainable Design and Construction*

# City of Arlington

- Population over 370,000 (50th Largest in USA)
- Daily Water Demands 35 MGD to 115 MGD
- 1,425 miles of public water main
  - 588 miles of asbestos cement (AC) mains
- Average 450 water main breaks annually
  - 2015 – 72% of 533 water main breaks were on AC pipe



UNIVERSITY OF TEXAS  ARLINGTON



# Economics of Water Main Failure

- Water main break with small footprint
- 1-4 connections without water service (under 20 psi)
- 6" or smaller potable water main size
- Adequate isolation valve controls
- Less than 5 foot diameter earth disruption
- Response requires 4 crew members, 2 service trucks, 1 mini excavator, 2 megalug adapters, 4 LF of new pipe
  - 20 crew hours @ \$20/hr - \$400
  - 10 truck hours @ \$75/hr - \$750
  - 4 mini excavator hours @ \$100 / hr - \$400
  - Sod, fill - \$200
  - Mega lug adapters - \$225
  - Replacement pipe \$50

**TOTAL = \$2,025**  
**Does not include:**  
**Water loss, social**  
**impact, environment**  
**al impact**  
**Cost per LF - \$500!**

# Economics of Water Main Failure

- Water main break with medium footprint
- ¼ neighborhood 40 connections without water service
- 8"-10" potable water main size
- Substandard isolation valve controls
- 10'-15' diameter earth disruption
- 5'x25' road impact
- Significant time before water could be shut off
- Earth erosion
- Landscape damage
- Water damage to 4-6 town homes
- Significant social and environmental damage



# Economics of Water Main Failure

- 10 crew members 20 hours = 200 hrs @ \$20/hr - \$4,000
- 4 service trucks 20 hours = 80 hrs @ \$75/hr = \$6,000
- 1 backhoe 20 hours = 20 hrs @ \$125/hr = \$2,500
- 1 vac truck 6 hours = 6 hours @ \$25/hr = \$750
- 1 loader 10 hours = 10 hours @ \$100/hr = \$1,000
- Water loss 30 min 2,500 GPM – 75,000 gallons = \$300
- Restoration – import backfill, compaction, landscaping, asphalt, curb and gutter - \$22,500
- Water damage to 4-6 town homes - \$15,000

TOTAL = \$52,050

Cost per LF at 15 LF Replaced - \$3,470 Per LF!

# Economics of Water Main Failure

- Scientific research completed for large diameter water main failures
- Evaluated social, environmental and economic costs
  - Lost product
  - Repair and return to service
  - Travel delay
  - Supply outage and substitution
  - Health risk
  - Property damage

**\*"Empirical Analysis of Water-Main Failure Consequences" by Kaylan Piratla**

# Economics of Water Main Failure

UCLA Campus, Los Angeles, California – 30 inch steel

- 93 year old steel pipe
- Substandard isolation valve controls – 4 hours!
- Flooded athletic fields, underground garages and various walkways on the University of California in Los Angeles.
- 160 firefighters responded and searched 200 cars
- 75,000 GPM = 48 Million Gallons of water lost
- Significantly increased travel delay due to repair time – 238 hours to repair the 30” steel main!

TOTAL = \$36,100,000

Cost per LF at 75 LF Replaced - \$481,333 per LF!!

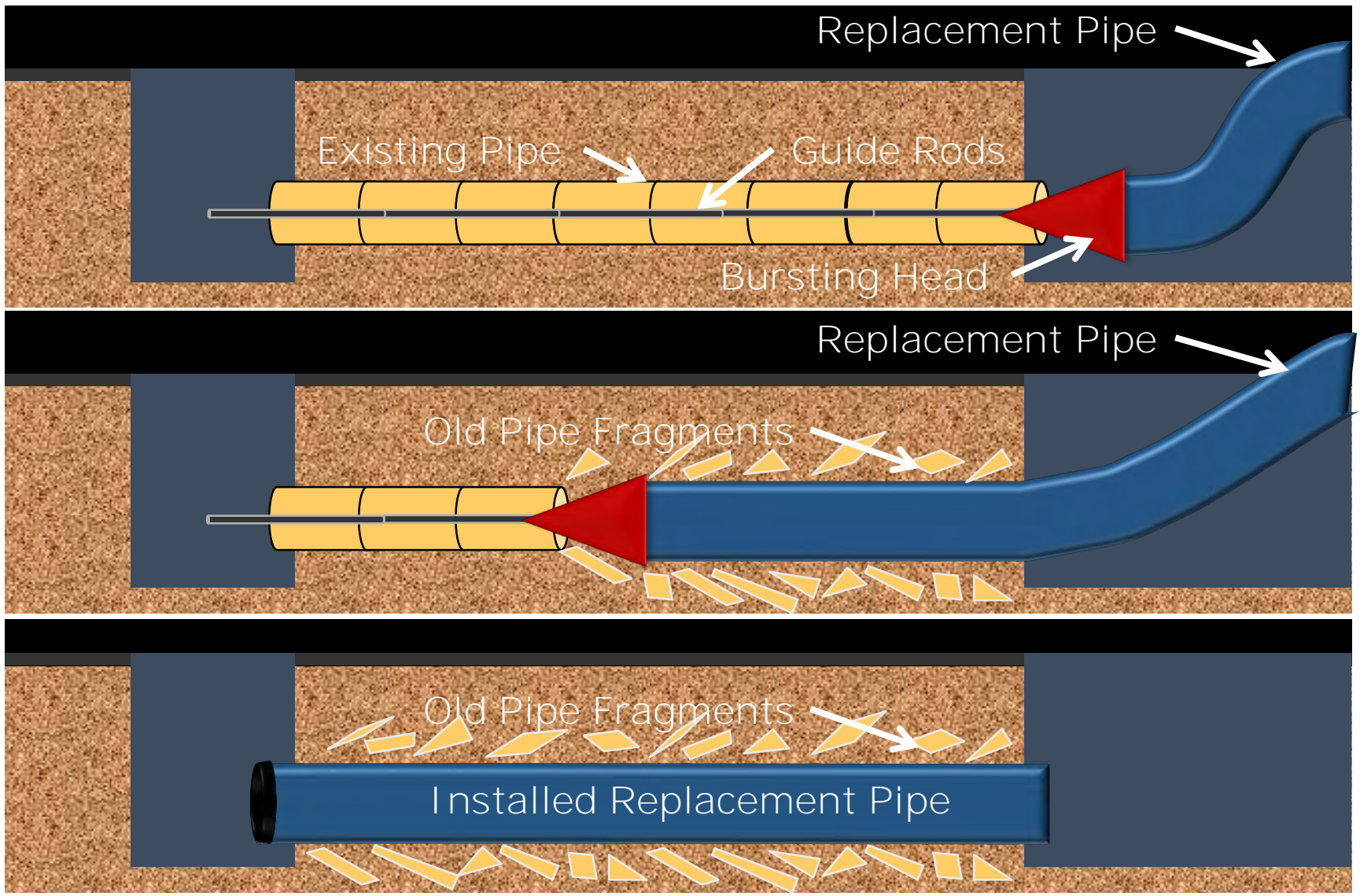
# Economics of WM Failure - UCLA





# Definition of Pipe Bursting

- Pipe bursting is an eco-friendly trenchless method which replaces existing host pipes by displacing their fragments into the surrounding soil while simultaneously pulling in new protection or utility pipe of the same or larger diameter into the void created. \* Vulkan Handbook of Bursting Practices
- Replacement of the host pipe by fragmenting the existing pipe and installing a new pipe of equal or larger diameter in its place.
- The new pipe is placed in the same alignment as the existing pipe, reducing potential utility conflicts.



# Benefits of Pipe Bursting

- Faster
- Provides a replacement rather than a repair
- Avoids need for new easement
- Maintains or increases hydraulic capacity
- Minimizes excavation
- Reduces adverse impacts (noise, dust, traffic re-routing)
- Lower environmental impact

# Benefits of Pipe Bursting: Economic Benefits

- Reduced design and survey costs
- In developed urban areas, restoration costs can easily exceed pipeline costs
- Reduced third party utility relocation costs
- Less risk equals fewer change orders
- Some states don't require a water main permit to perform the rehabilitation work



# Benefits of Pipe Bursting: Social Benefits

- Dramatically reduced construction schedule reduces impact to residents/customers
- Minimized excavations reduces impact to established urban landscaping
- Pipe bursting can replace 300+ linear feet of pipe between 8:30 am and 3:30 pm, some residents don't even notice impact

***Happy Customers = Happy City Hall***

# Program Overview

- Manage the city's infrastructure assets in the most proactive, efficient way possible
- Replace high maintenance AC water mains
- Utilize Trenchless Technology where feasible
- Utilize in-house design

2016 Pilot: Pre-chlorinated Pipe bursting to replace AC water mains in residential neighborhoods

- 13,125 feet of 6-inch AC replaced with 8-inch HDPE
- Cost effective
- Reduce customer impact
- Utilize HDPE pipe

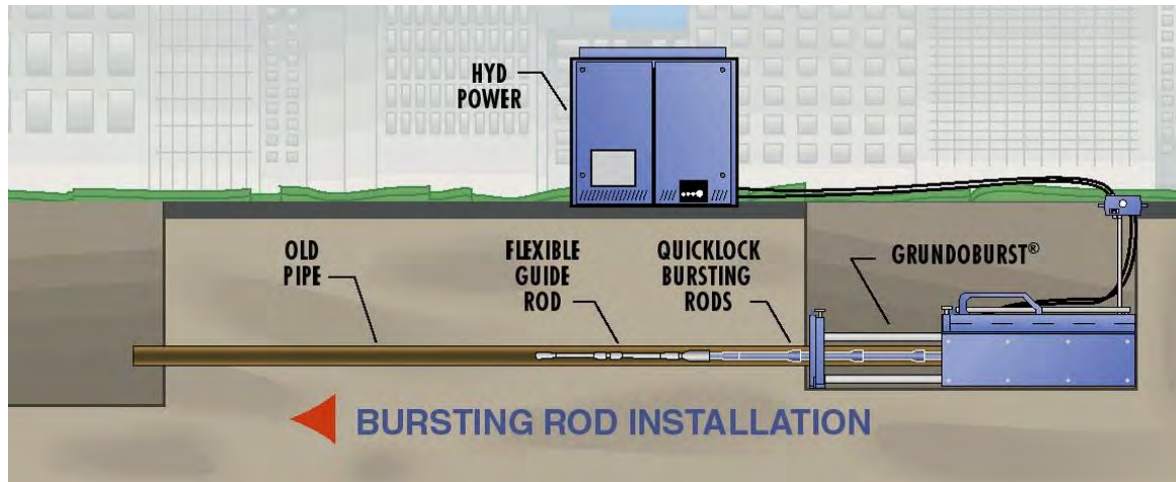
# Fusing & Pre-chlorination of HDPE

- Staging area located away from burst locations to minimize site impact
- Butt fusion is used to connect pipe sections to corresponding burst lengths
- Pressure testing
- Lines capped and disinfected with hypochlorite solution of at least 25 mg/L
- Two consecutive days of samples, taken 24 hours apart



# Pipe Bursting Operations 8:00 AM

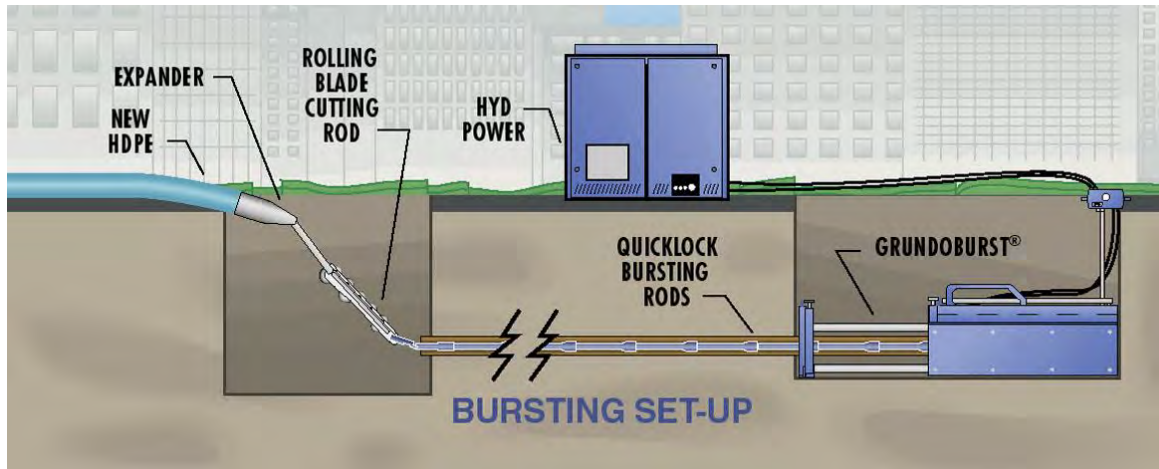
- Entry and exit pits excavated 4' x 12'
- Service connections pits 3' x 3'
- 8:00 AM – Decommission Main
- Bursting equipment is set in pit and rods are shuttled through host pipe





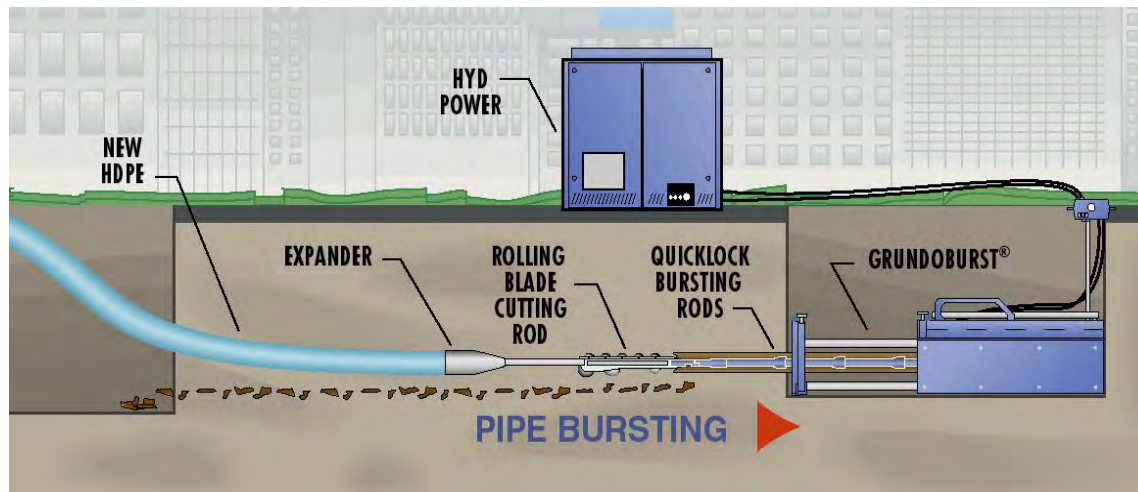
# Pipe Bursting Operations 10:30 AM

- 10:30 AM – Bursting head (or ductile splitter) and expander are attached to the rods which have reached the entry pit
- Pre-chlorinated and sealed HDPE pipe attached to the expander
- Pull back begins



# Pipe Bursting Operations Noon

- Rods are removed from the exit pit as pipe is pulled into place
- Noon – New pipe is installed





# Pipe Bursting Operations Noon to 3:00PM

- Noon to 3:00 PM – Connections made
- Ductile Iron fittings, mega lugs, stainless steel inserts, mechanical service saddles





# Pipe Bursting Operations 3:00 PM

- 3:00 PM – Post Chlorination Process
- Hypo-chlorus solution sprayed on all connections
- Super-chlorinate new pipeline with slug of chlorine to 300ppm
- 4:00 PM – New main back live









# Failing to Flawless in a Day: How Pre-chlorinated Pipe Bursting Invigorates Arlington Water Utilities Main Replacement Program

