37TH INTERNATIONAL NO-DIG FLORENCE 2019

Fortezza da Basso • FLORENCE (Italy)

30th September • 2nd October 2019

# Pipe-filling method for stabilizing empty ducts via a manhole

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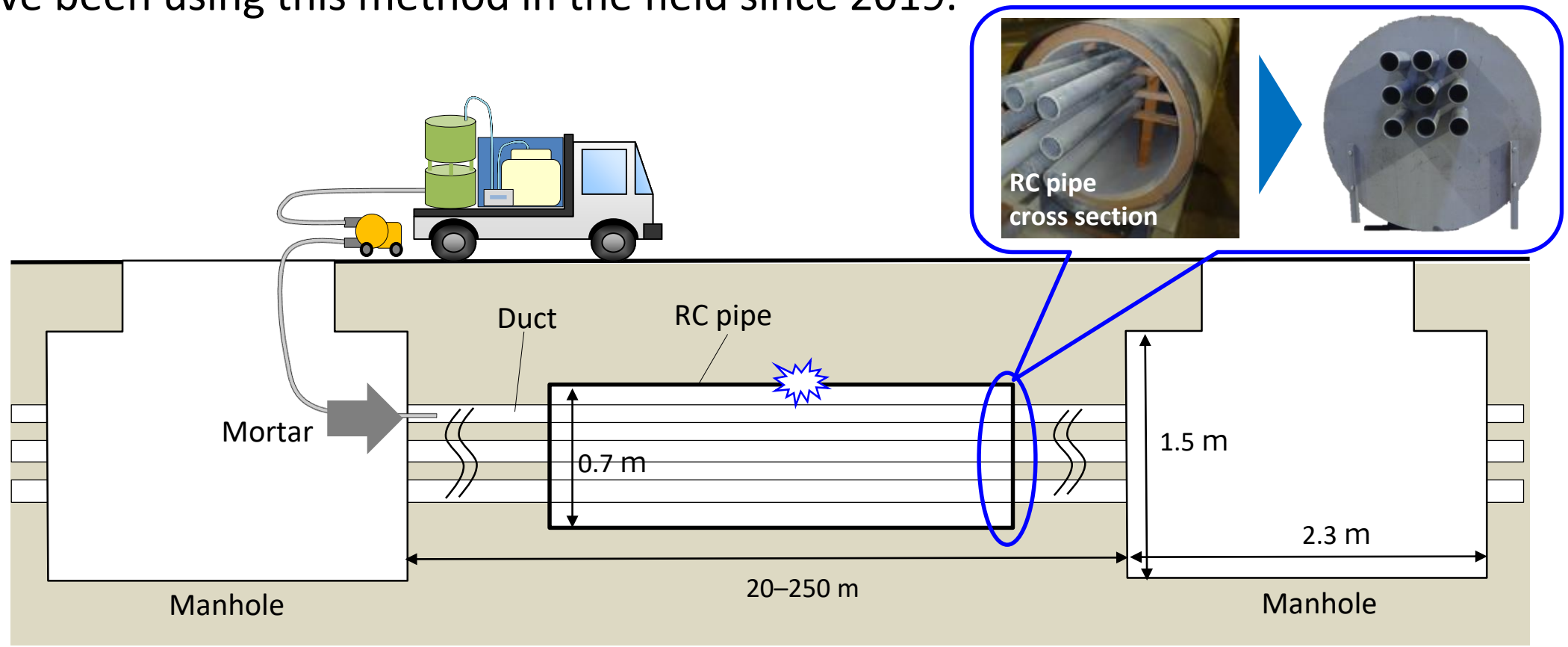
# Introduction

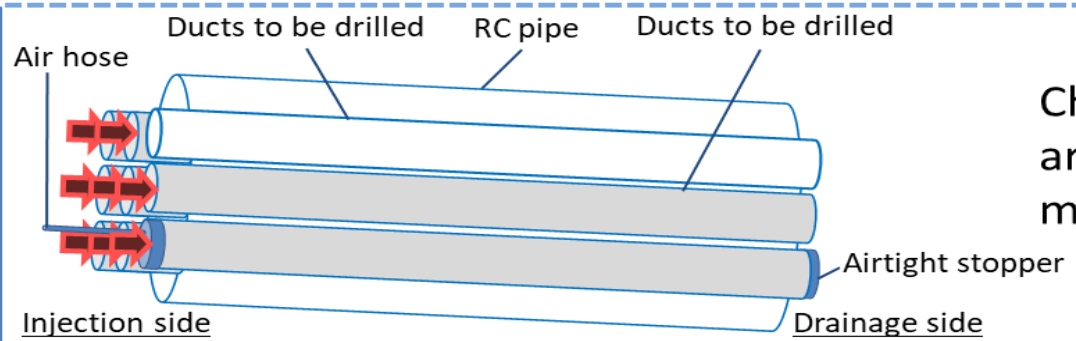
We have devised and implemented an economical non-cut-and-fill method for reinforcing dilapidated reinforced concrete pipes by filling them with mortar via an existing manhole. We have been using this method in the field since 2019.



# Non-cut-and-fill work procedure

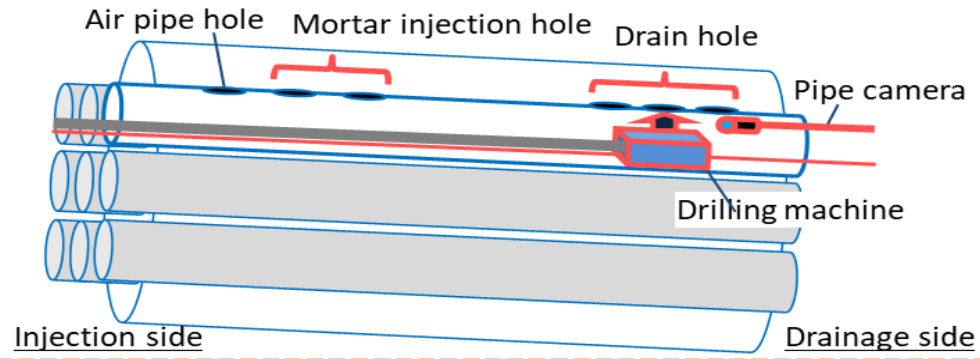


## Duct inspection



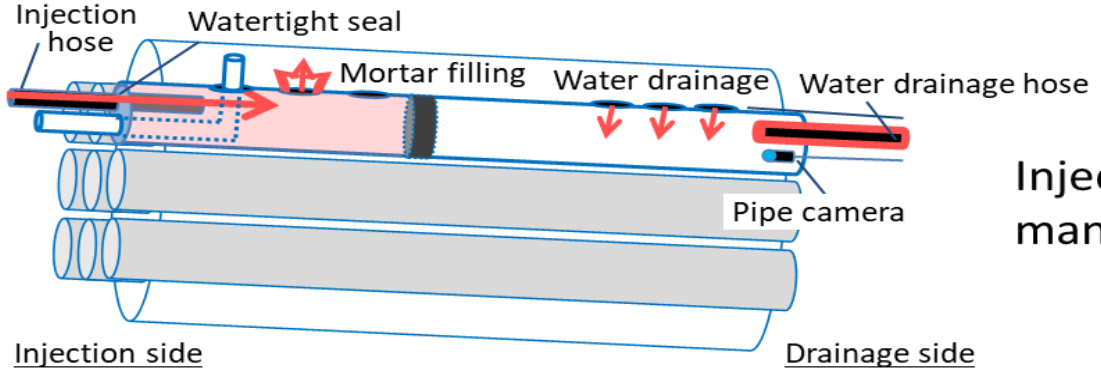

Check that the ducts inside the RC pipe are airtight (to prevent ingress of mortar into the ducts)

## Drill holes




Insert a dedicated machine into the duct from the manhole, and drill holes for mortar filling and water drainage

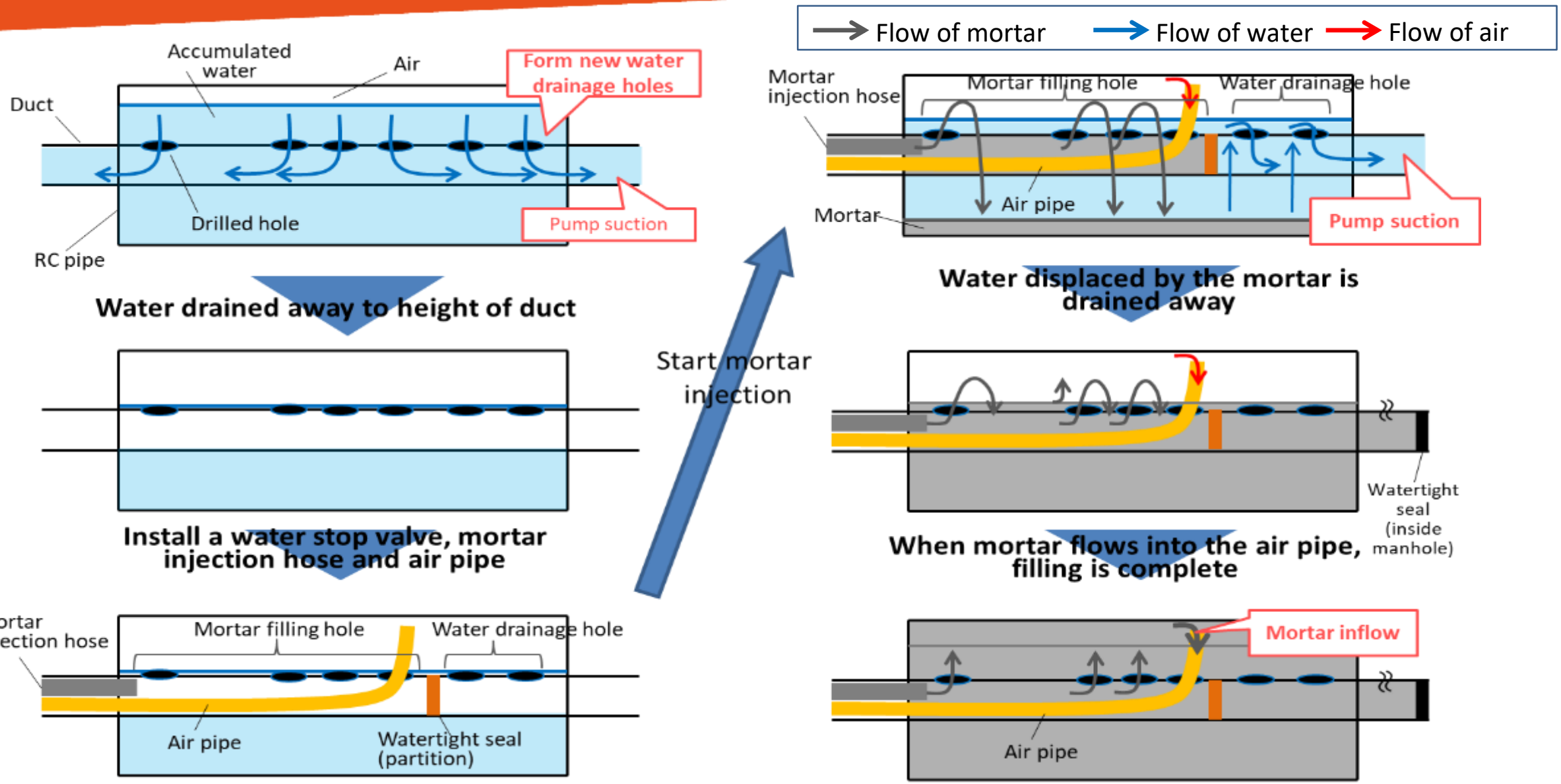
## Filling




Inject mortar into the drilled duct via the manhole and fill in the RC pipe.

# Mortar filling mechanism

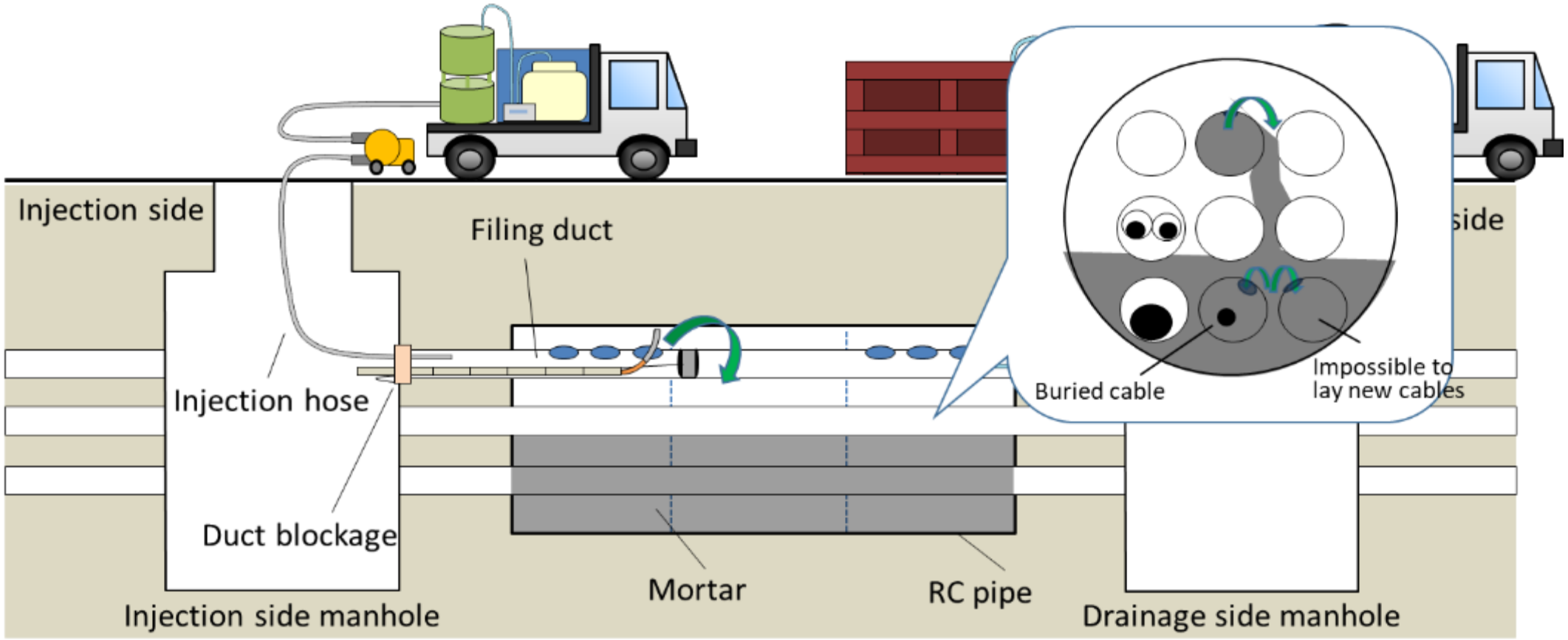




# New technology:
# Checking the air tightness of ducts (1)



- The ducts laid inside the RC pipe are check for air tightness. If a duct has a hole, mortar will flow in through this hole and cause a blockage inside the duct.
- We developed a new method for checking the air tightness of ducts that already contain cables.

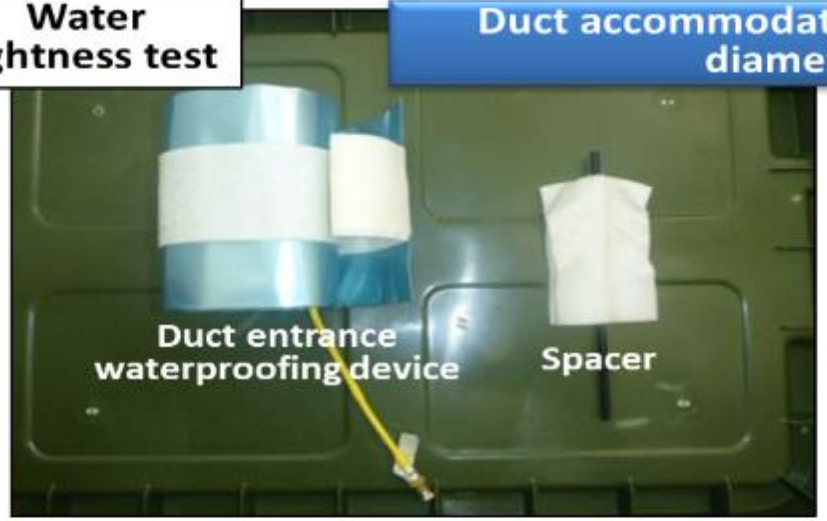


# New technology:
# Checking the air tightness of ducts (2)

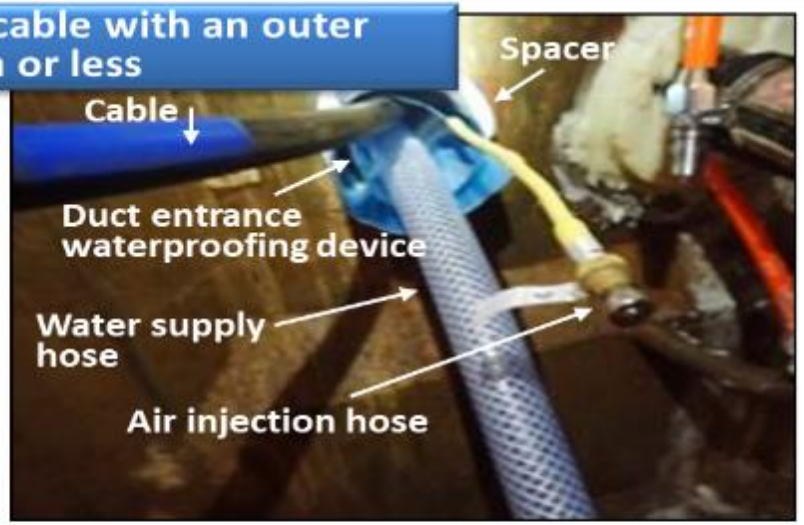


**Water tightness test**

**Duct accommodating a single cable with an outer diameter of 30 mm or less**



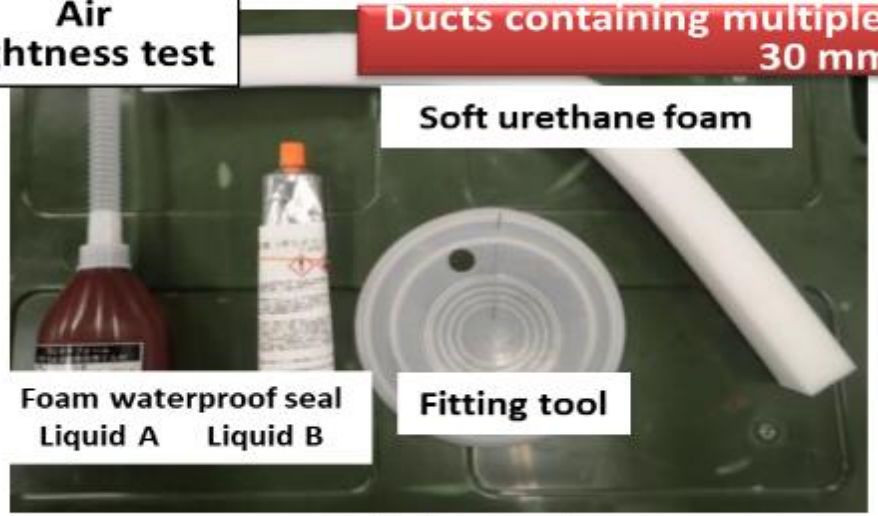

Articles used




Checking for leaks

**Air tightness test**

**Ducts containing multiple cables, or a single cable of over 30 mm in diameter**



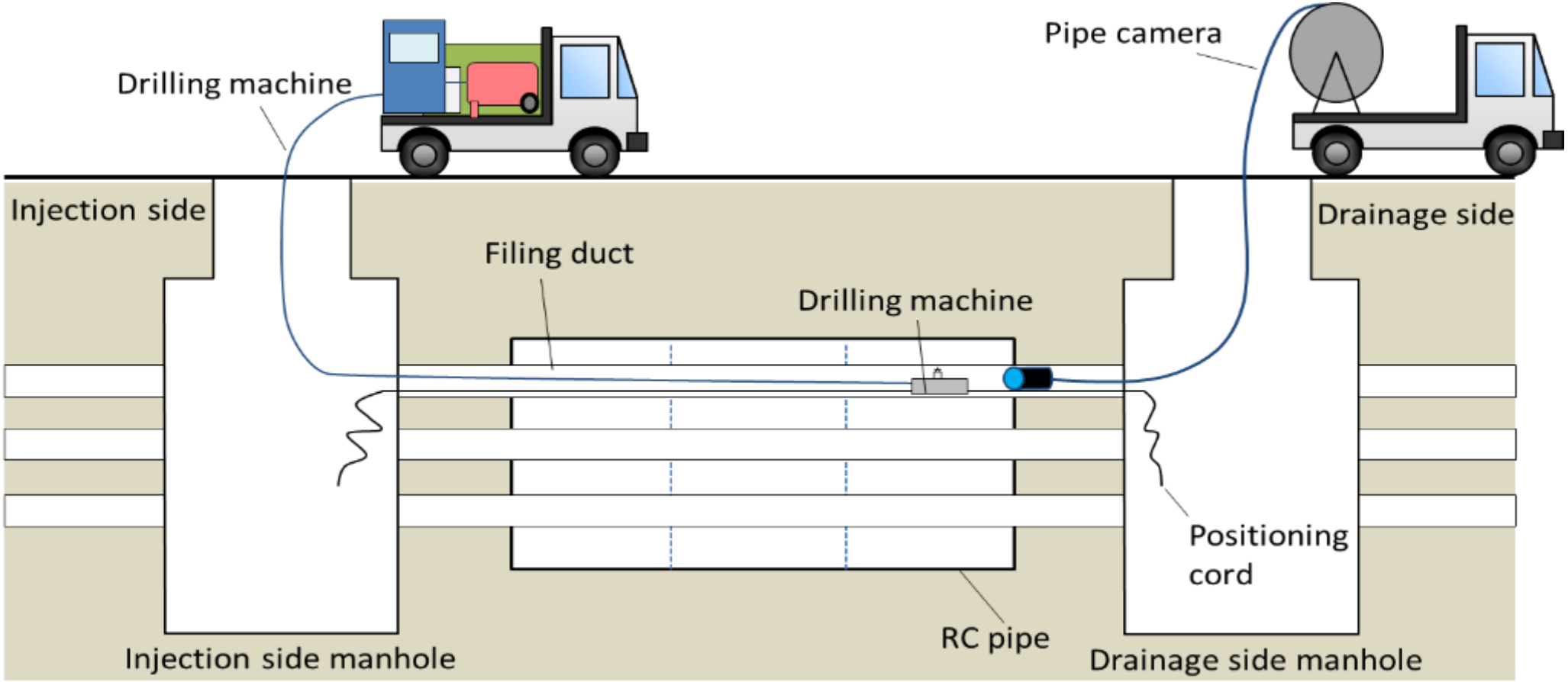

Articles used


Checking for leaks

# New technology: Duct drilling (1)

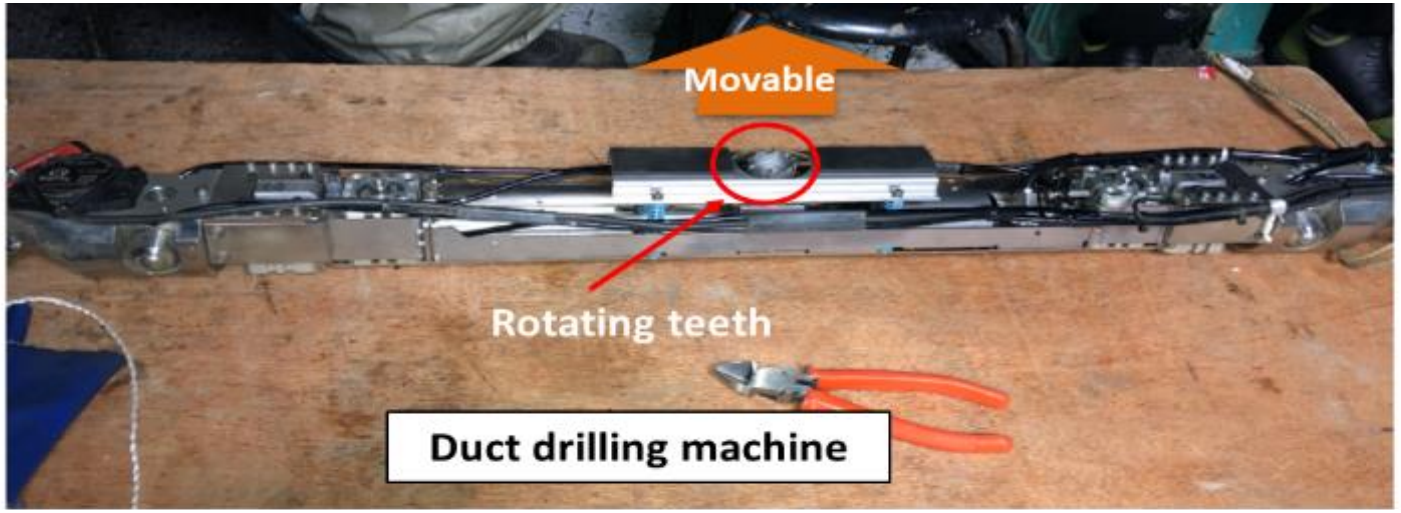


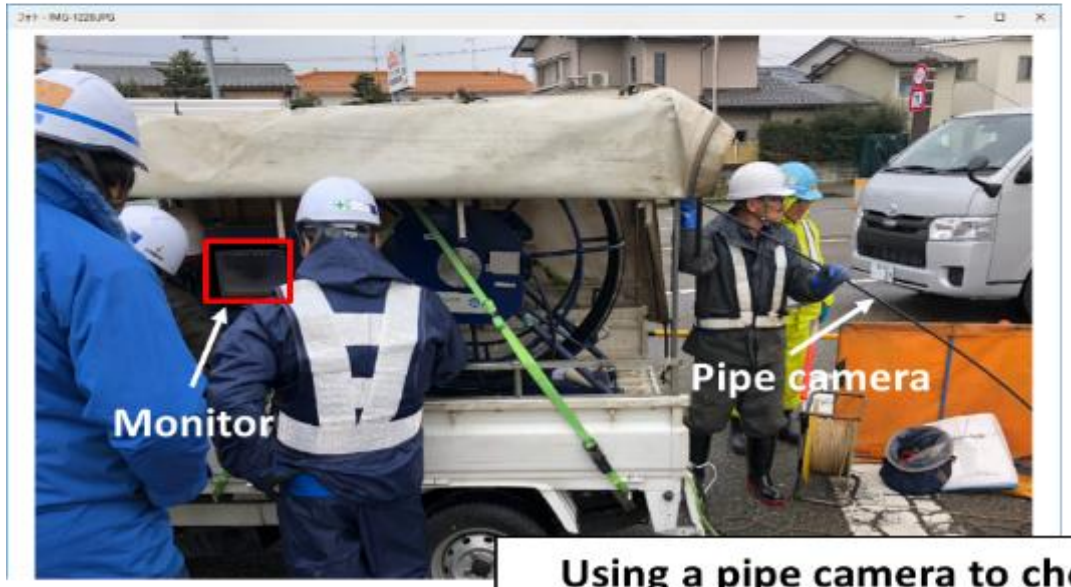
- The holes for mortar filling and drainage in ducts are drilled using a dedicated drilling machine.
- The position of the drilling machine and the state of the hole drilling can be checked with a pipe camera, so reliable construction can be achieved.



# New technology: Duct drilling (2)





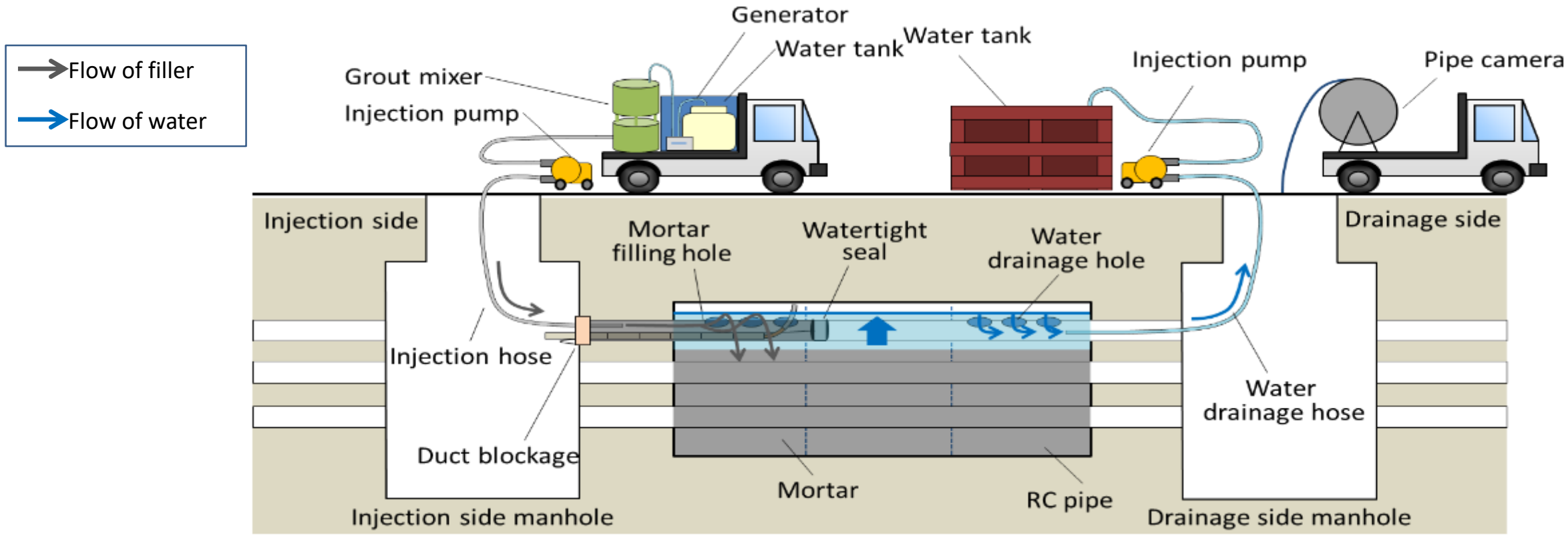


Using a pipe camera to check the progress of drilling

# New technology:
# Filling RC pipes with mortar (1)

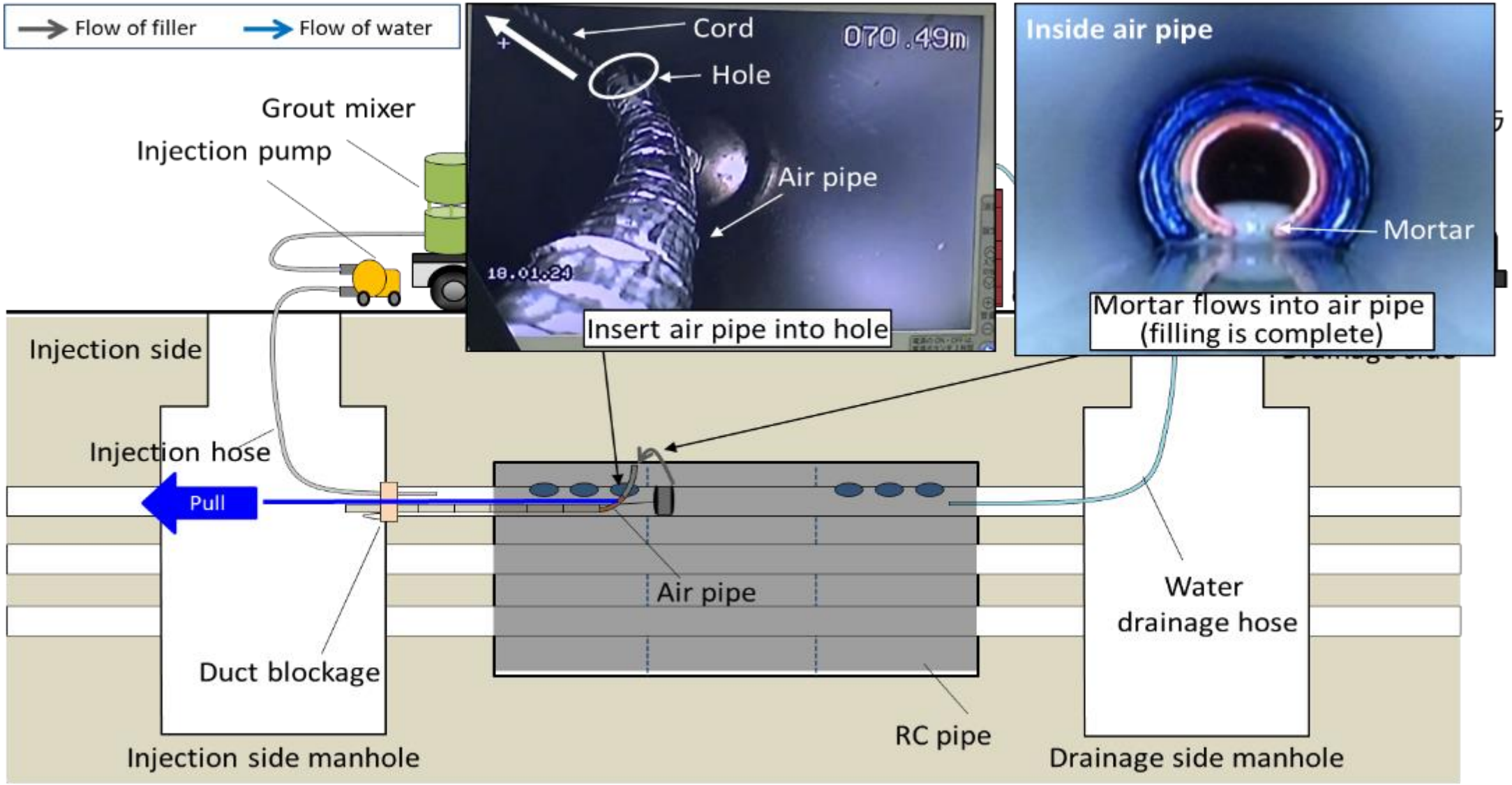


- Before filling begins, insert a watertight seal to separate the mortar filling holes from the water drainage holes,  and an air pipe to maintain constant pressure inside the RC pipe.
- After working the mortar with a grout mixer, pump it into the filling duct so that it fills the RC pipe through the holes drilled earlier.



# New technology:
# Filling RC pipes with mortar (2)

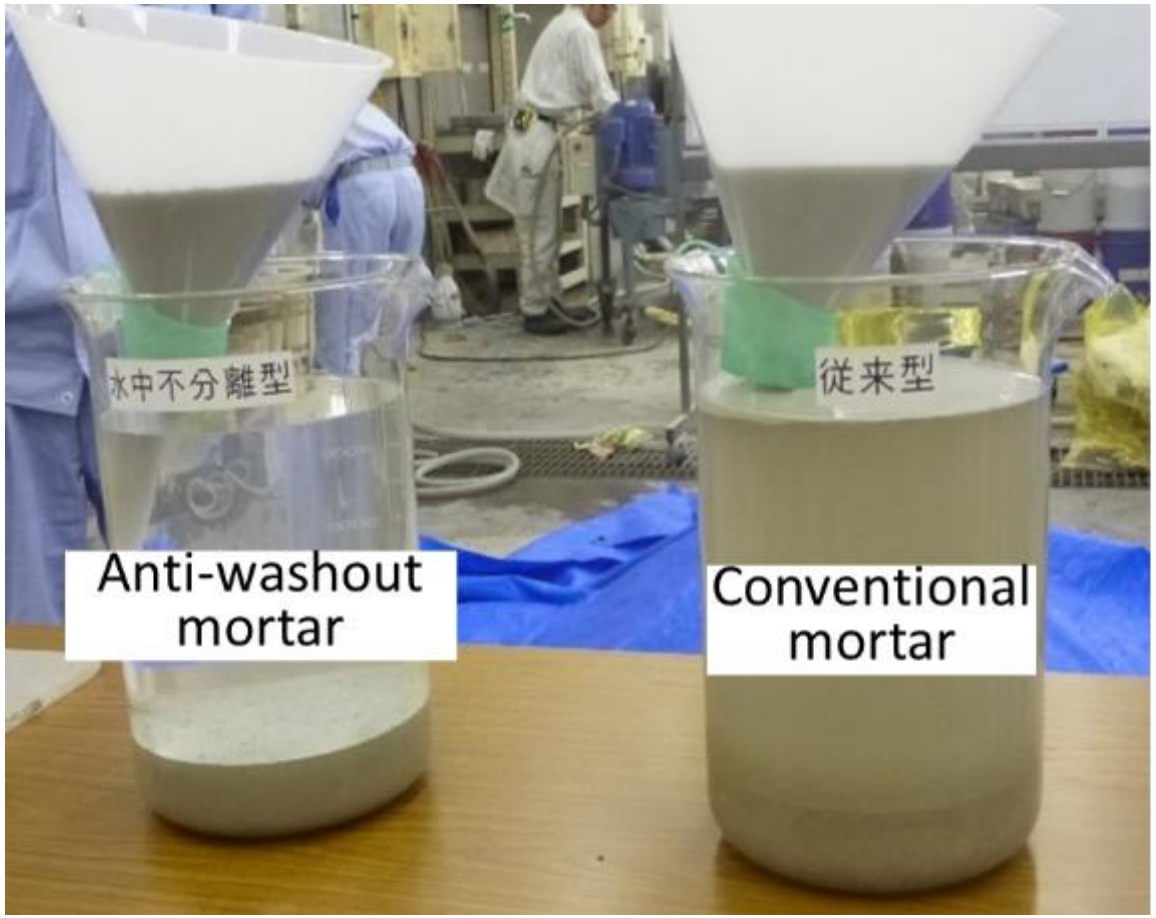


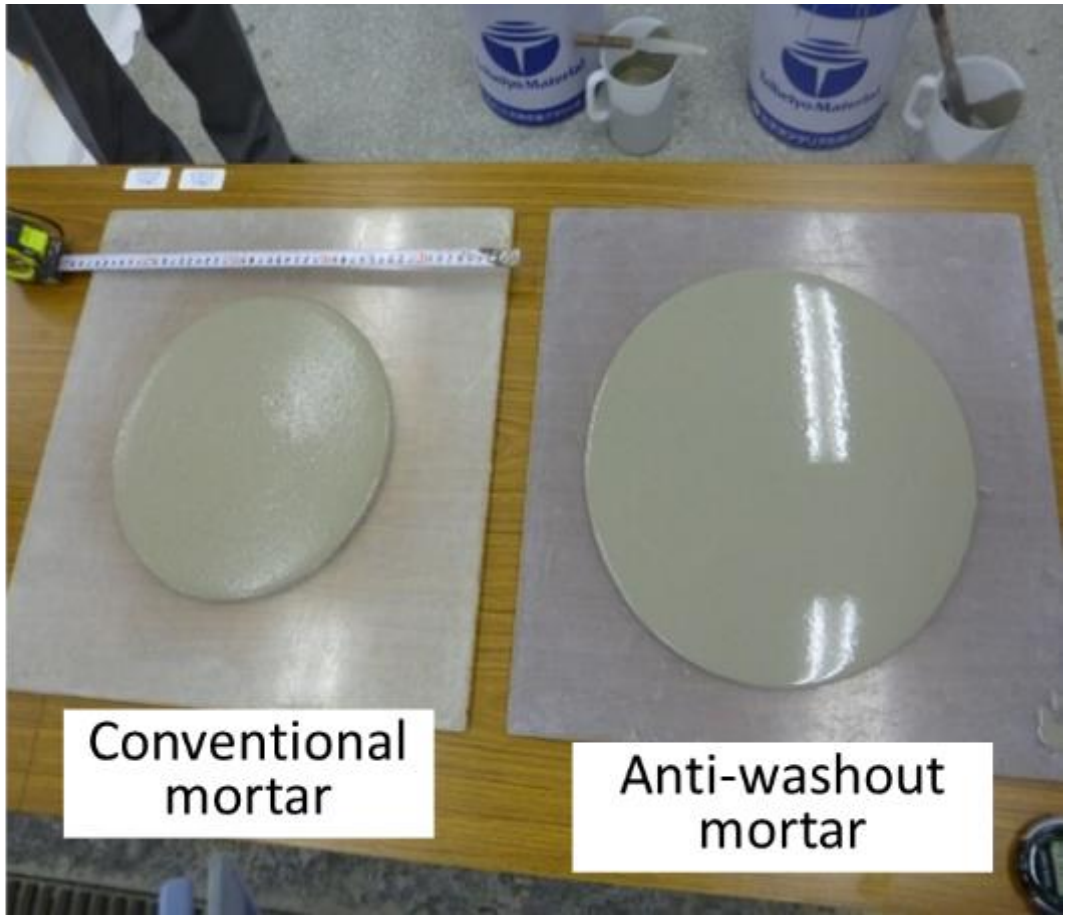


# New technology:
# Filling RC pipes with mortar (3)



Our new anti-washout mortar settles and hardens without mixing with water, allowing RC pipes to be filled even if they contain water.



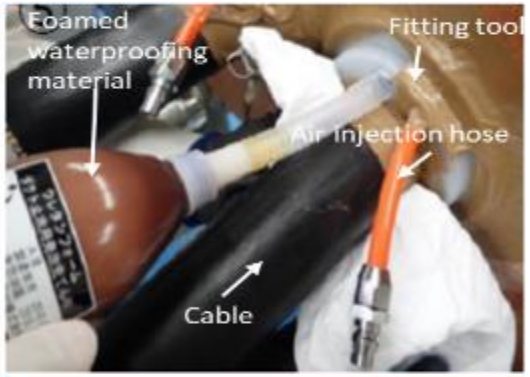



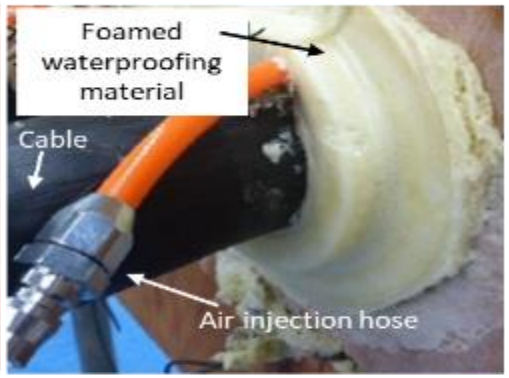
# Summary



- This non-cut-and-fill method has been established based on the technical developments listed below.
- By applying this method, it is possible to maintain the reliability of facilities at lower cost with minimal impact on the surroundings.

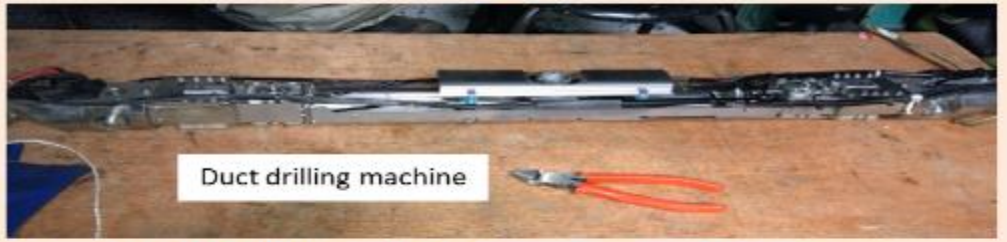
## (1) A method for checking the air tightness of cable ducts



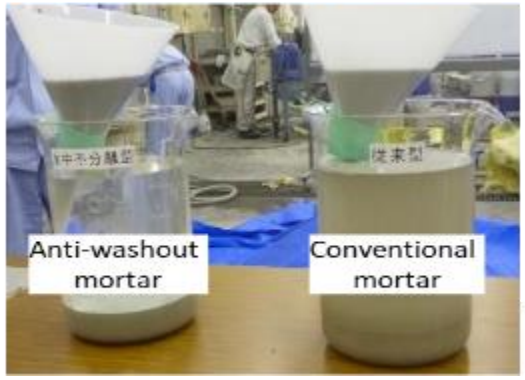



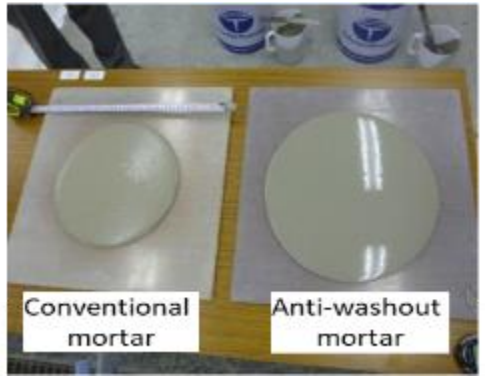

## (2) A duct drilling machine

We have devised a non-cut-and-fill method for using a duct to fill a pipe with mortar




## (3) Anti-washout mortar




## (4) Establishment of work procedures and a visual work progress inspection method