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Pipe-filling method for stabilizing empty ducts via a manhole

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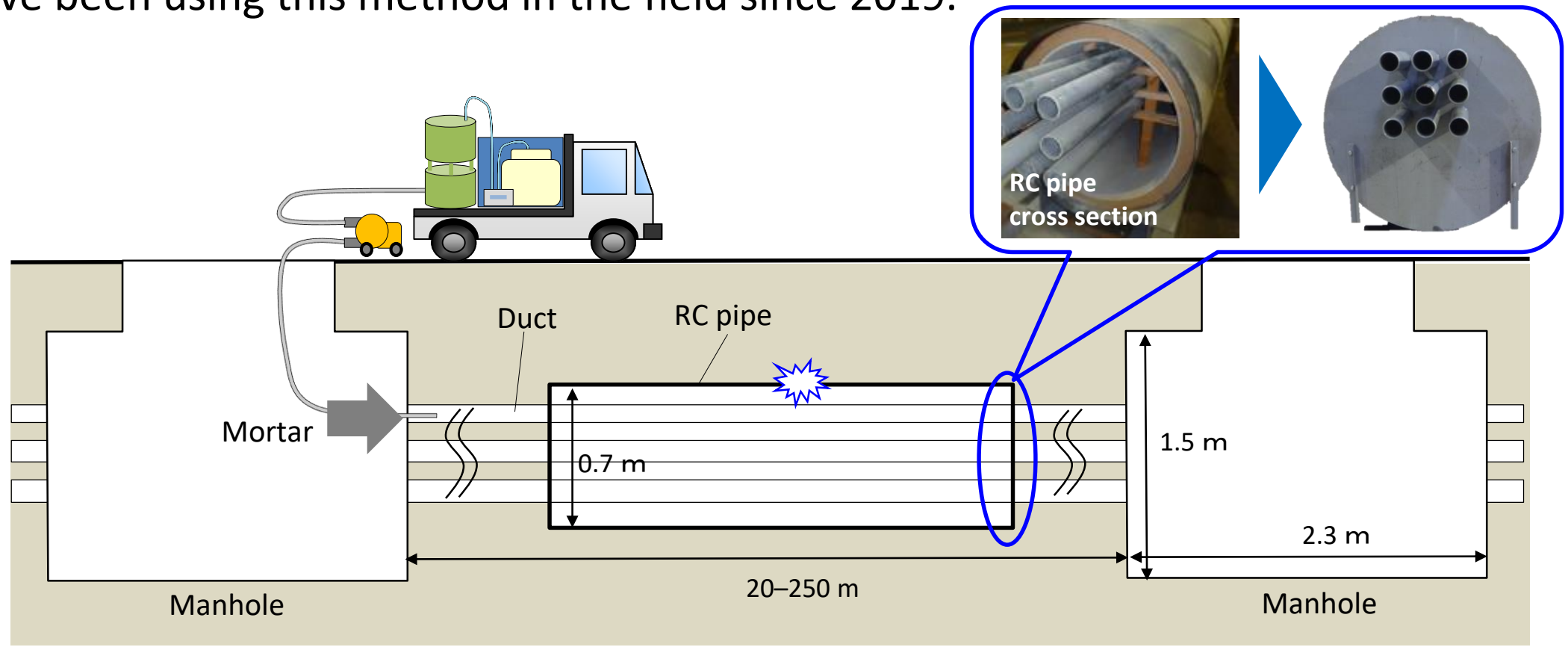
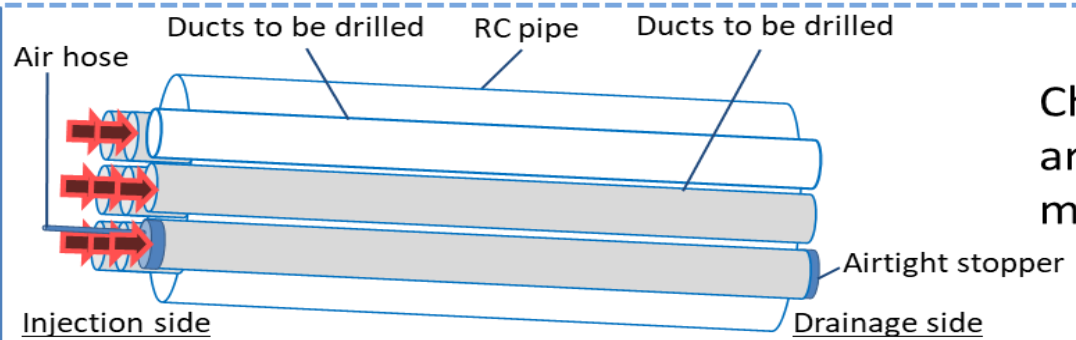
Introduction

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.



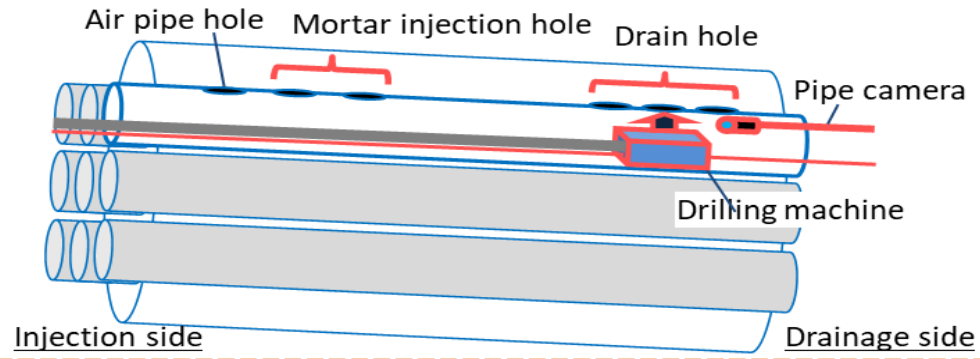
Non-cut-and-fill work procedure

Duct inspection



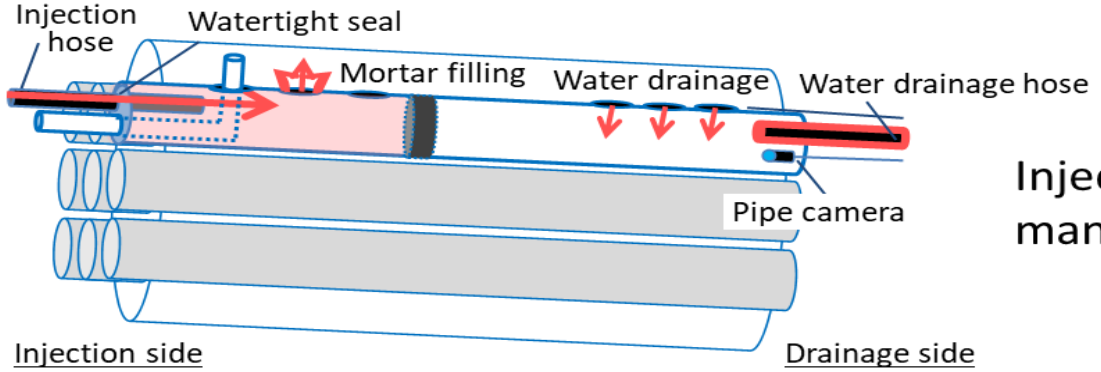
Check that the ducts inside the RC pipe are airtight (to prevent ingress of mortar into the ducts)

Drill holes



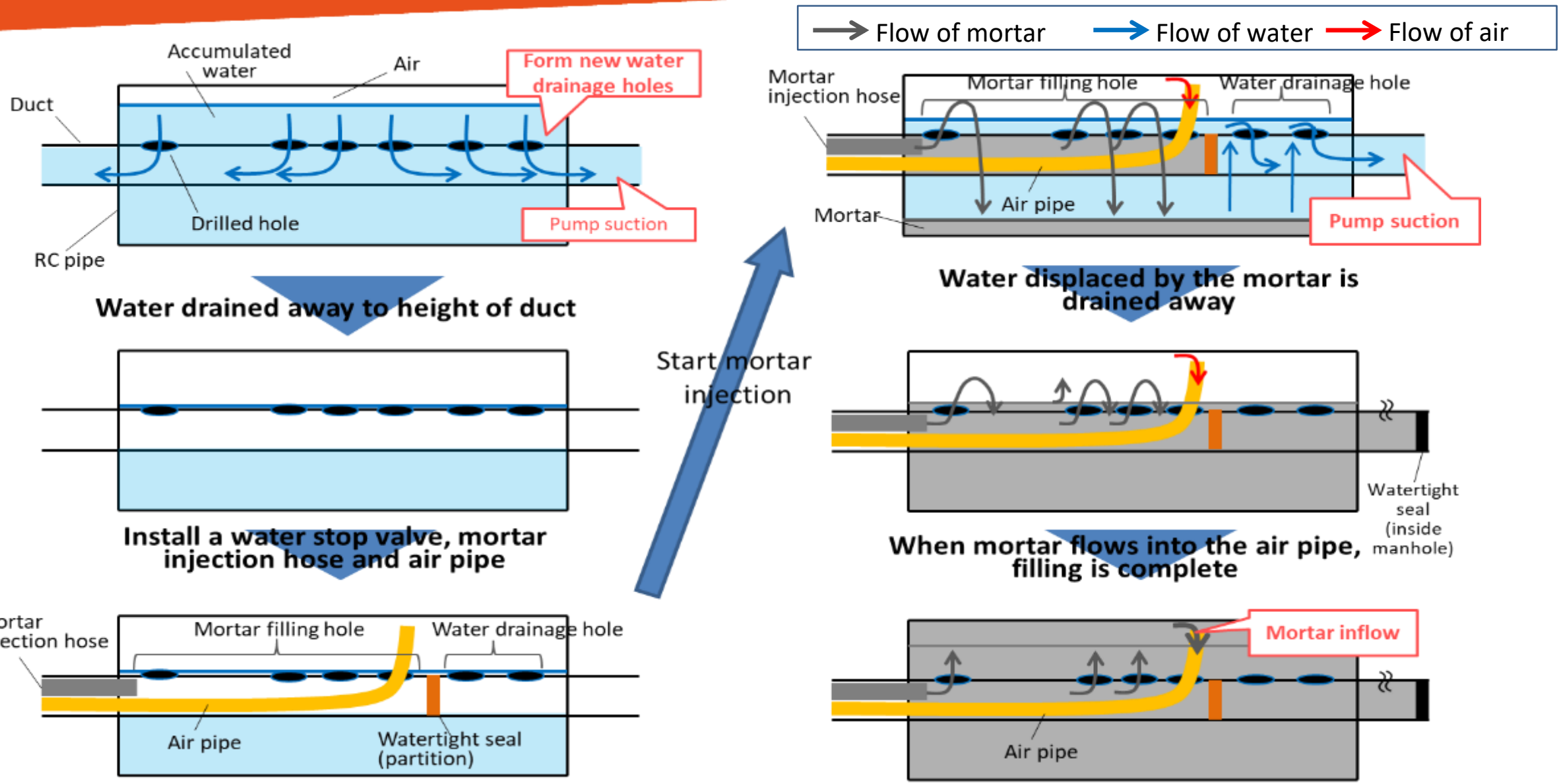
Insert a dedicated machine into the duct from the manhole, and drill holes for mortar filling and water drainage

Filling



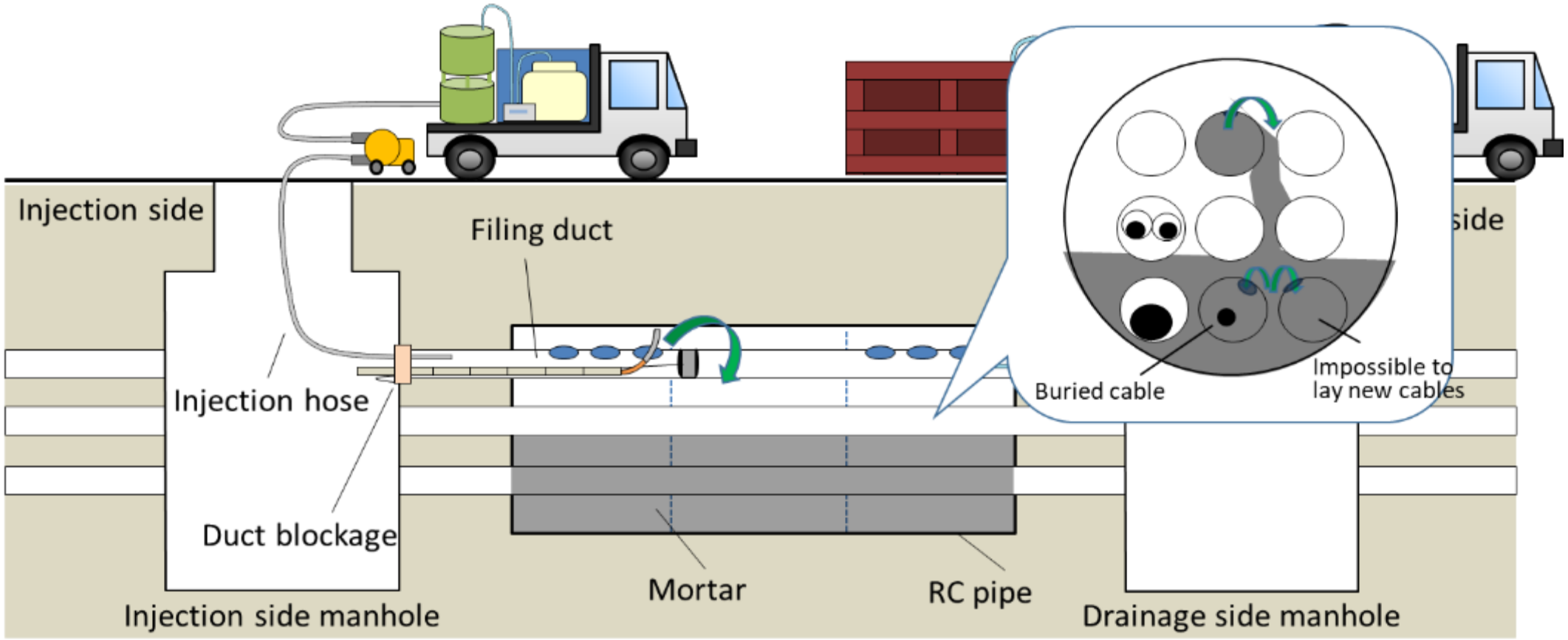
Inject mortar into the drilled duct via the manhole and fill in the RC pipe.

Mortar filling mechanism



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

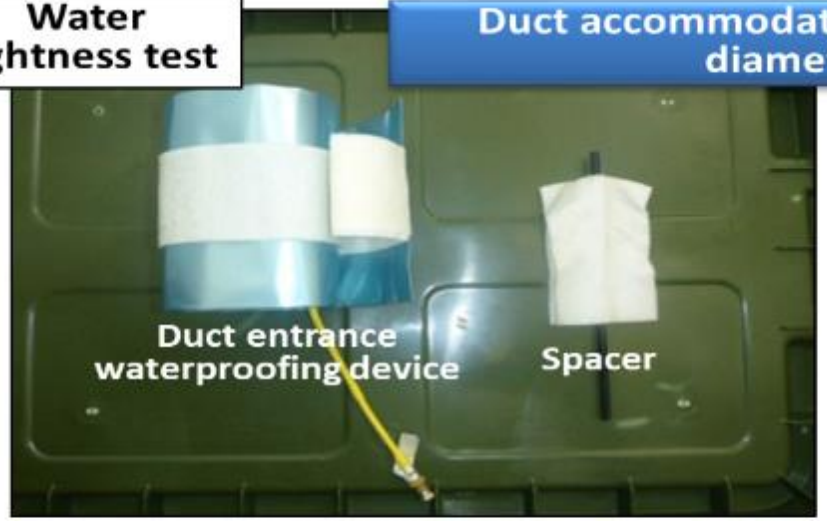
- The ducts laid inside the RC pipe are check for air tightness. If a duct has a hole, mortar will flow in through this hole and cause a blockage inside the duct.
- We developed a new method for checking the air tightness of ducts that already contain cables.



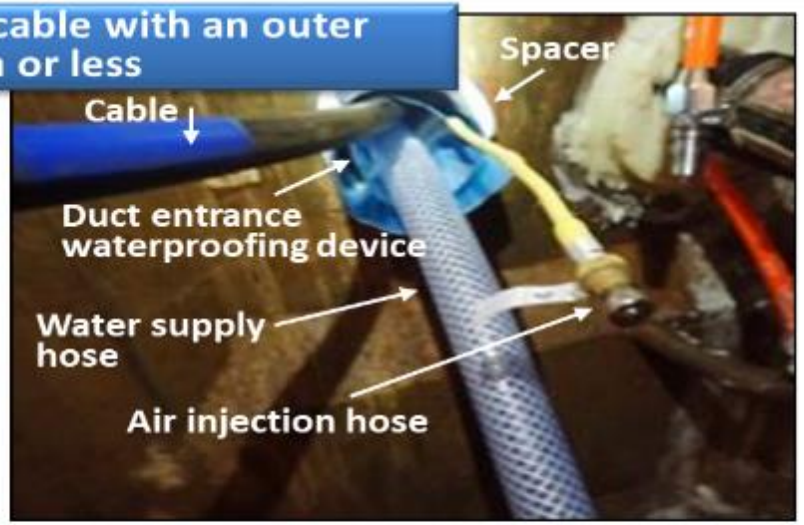
New technology:
Checking the air tightness of ducts (2)

Water tightness test

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



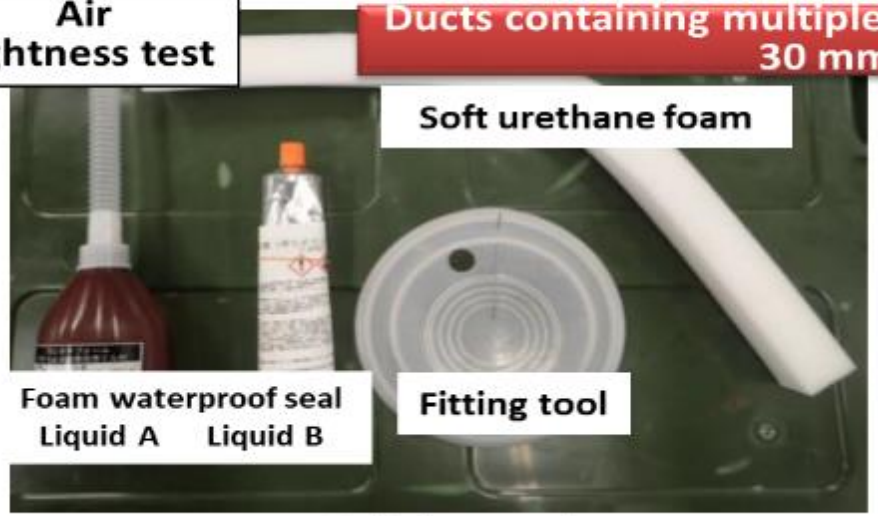
Articles used



Checking for leaks

Air tightness test

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

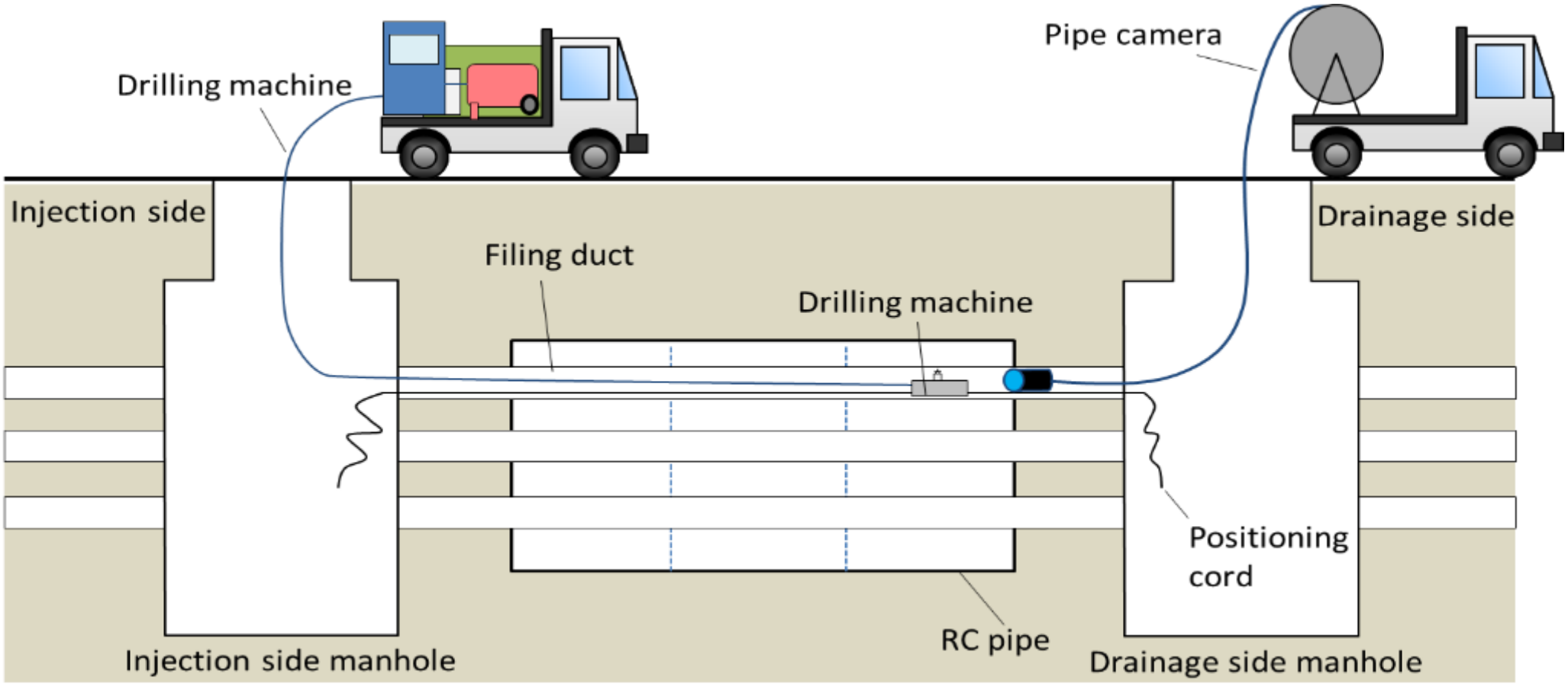


Articles used

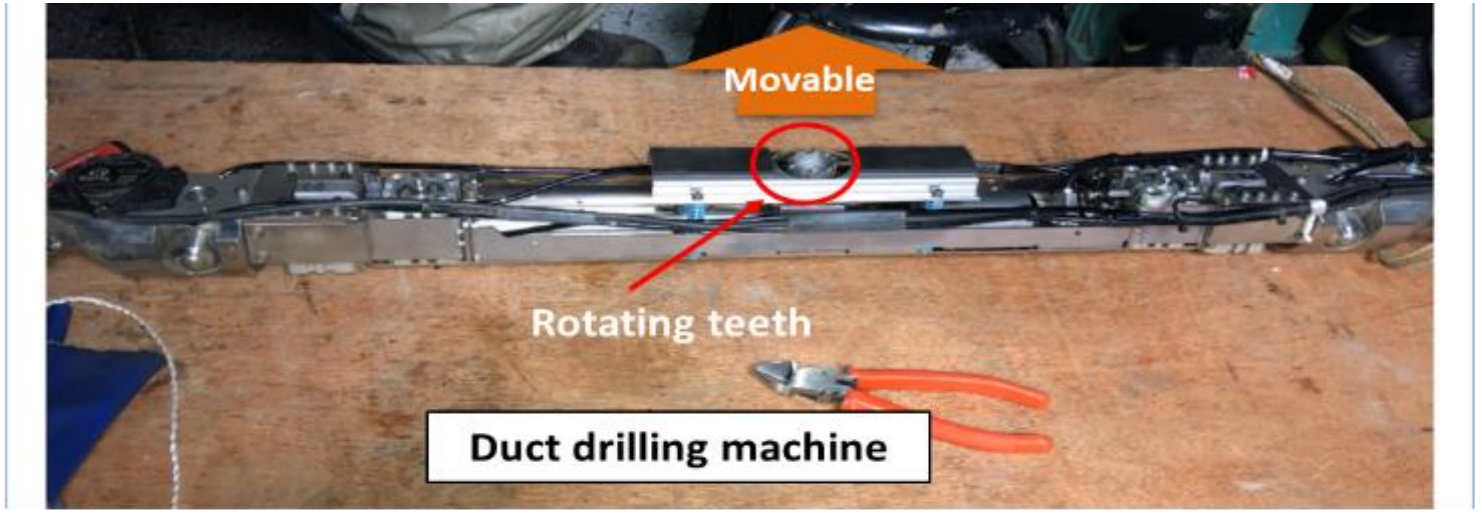
Checking for leaks

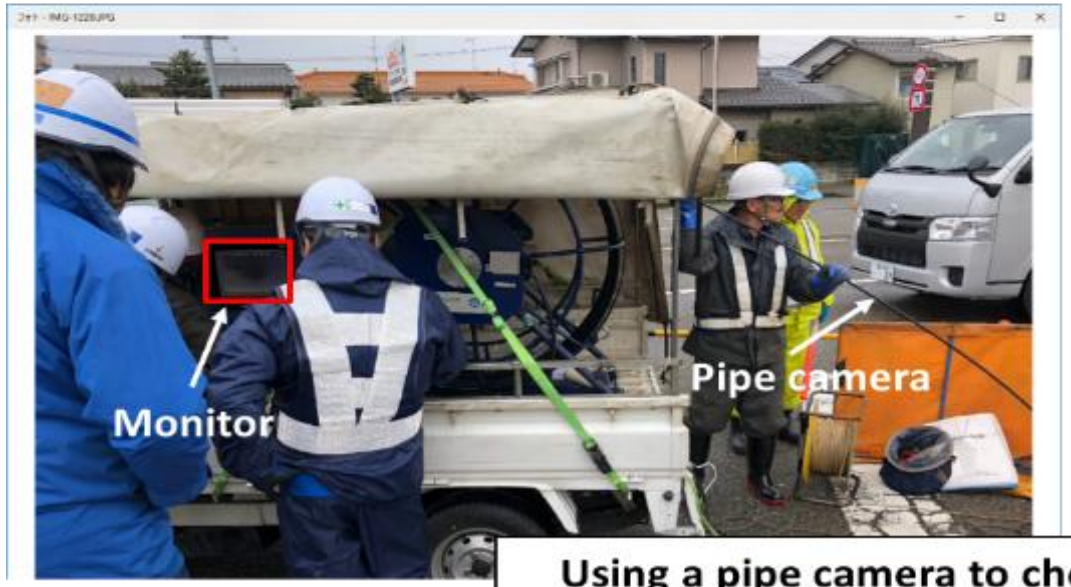
New technology: Duct drilling (1)

- 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)

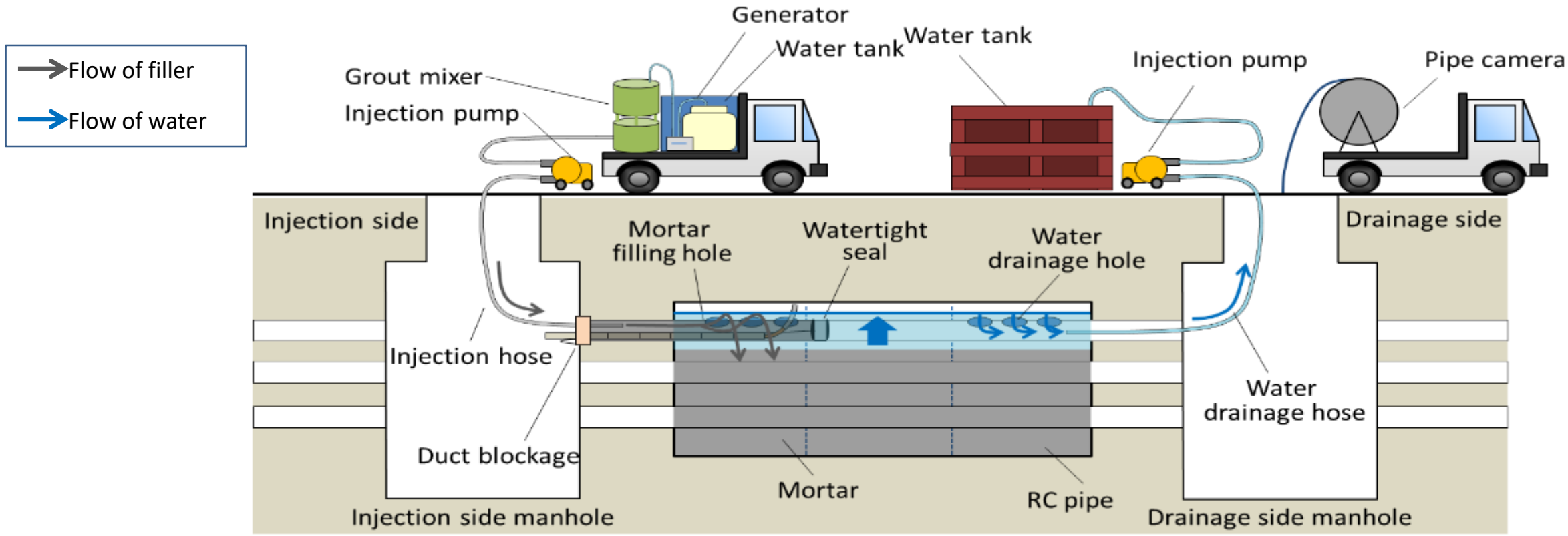




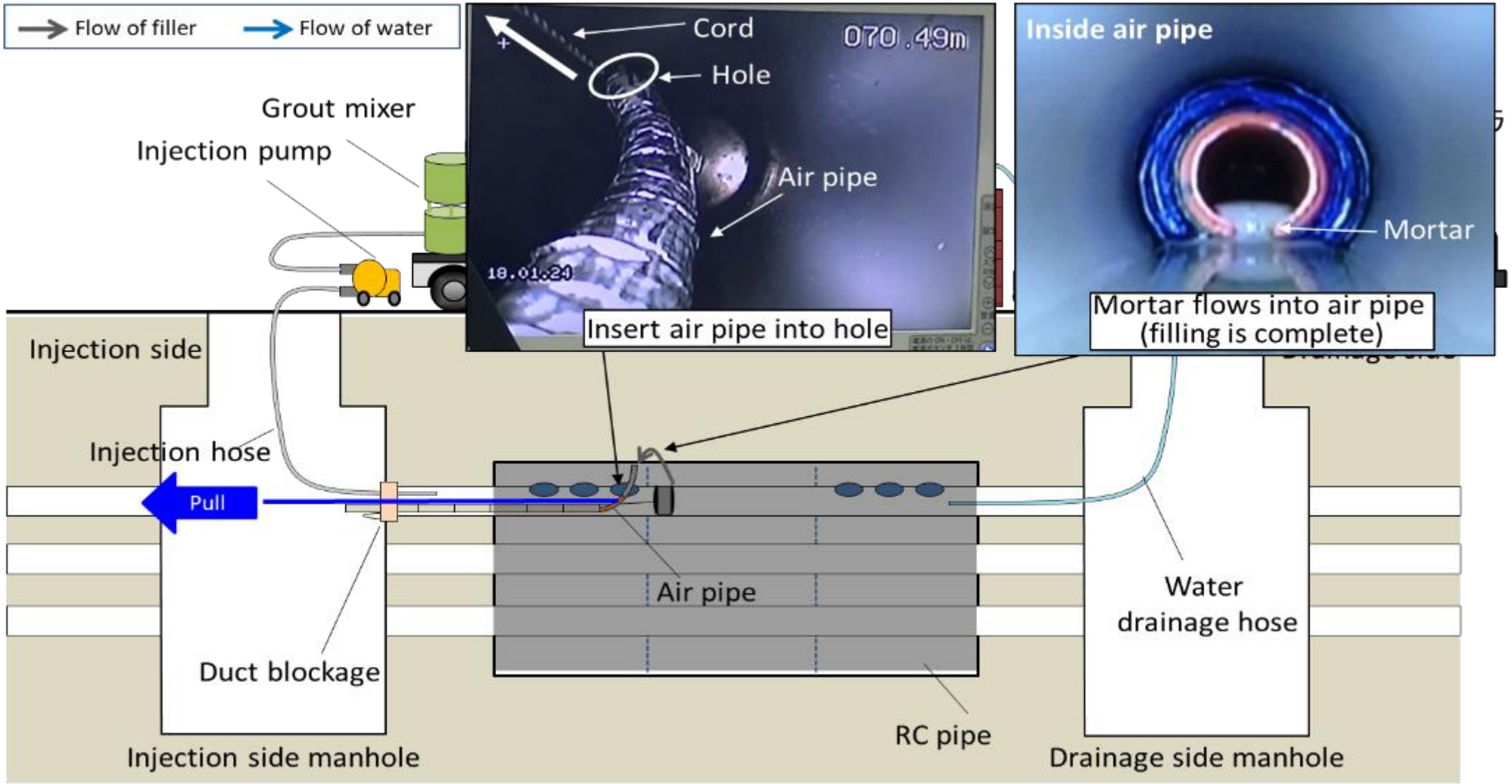
Using a pipe camera to check the progress of drilling

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.

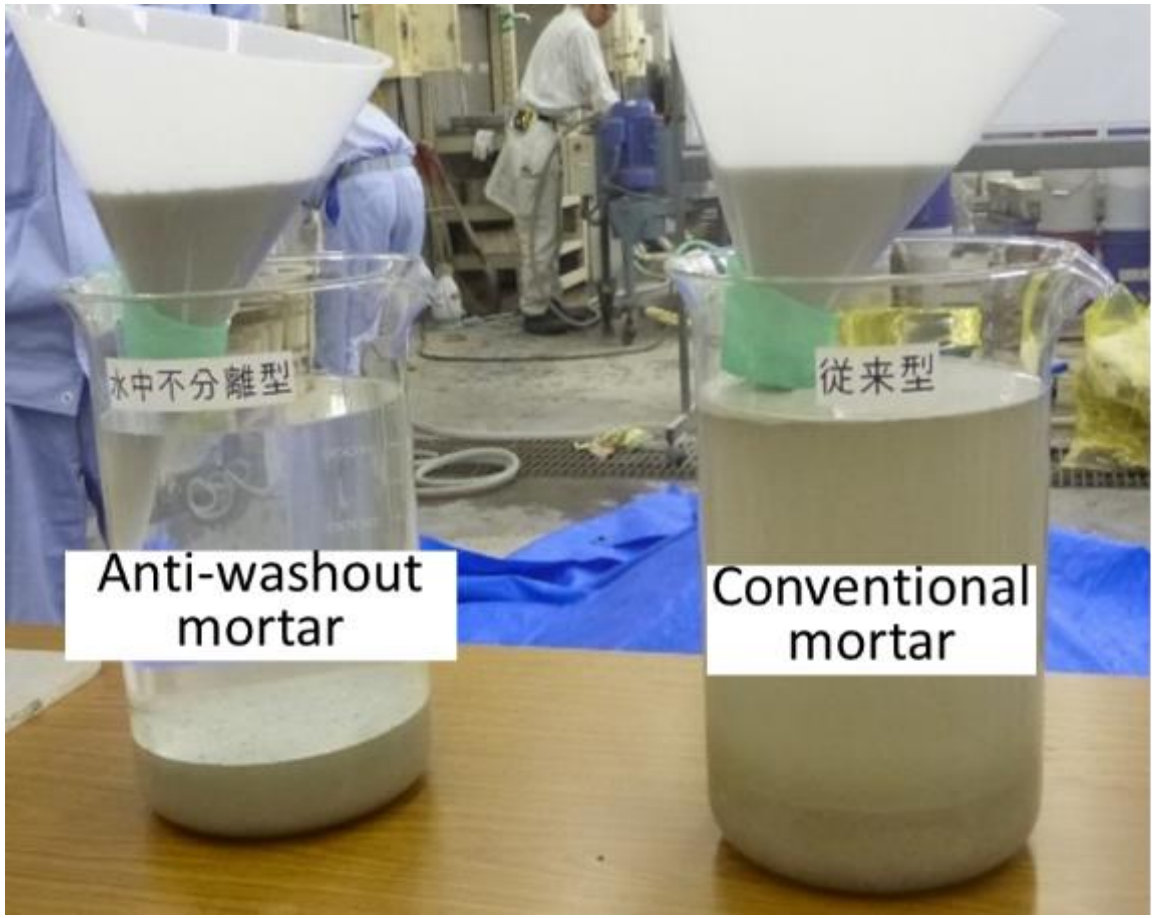


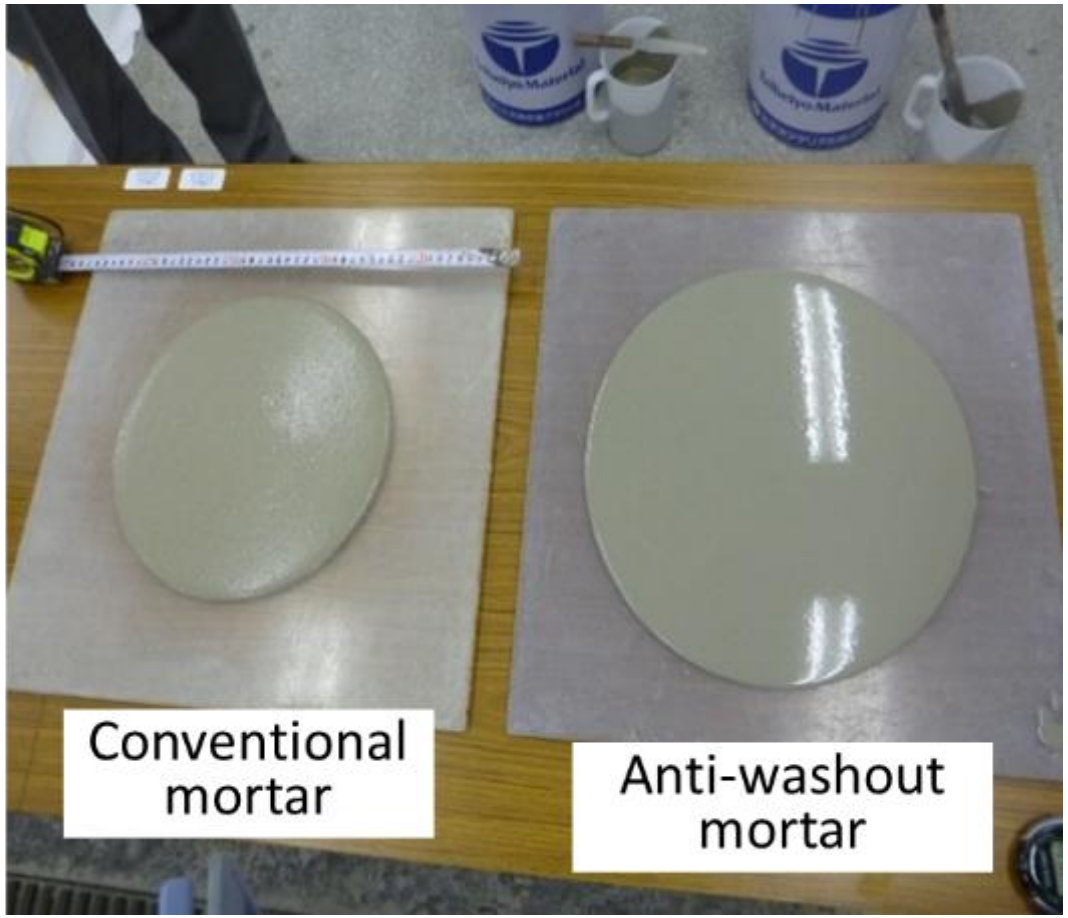
New technology:
Filling RC pipes with mortar (2)



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.

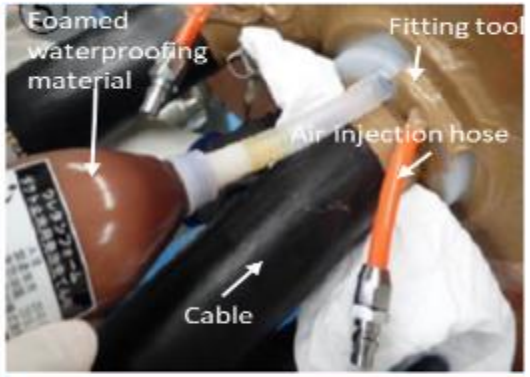


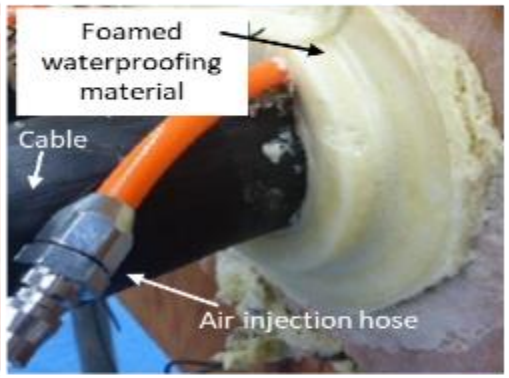


Summary

- 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.

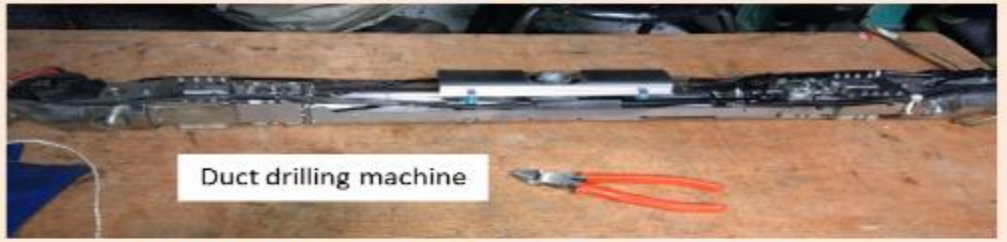
1) A method for checking the air tightness of cable ducts



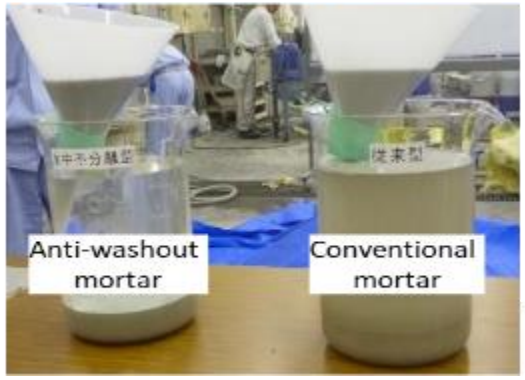


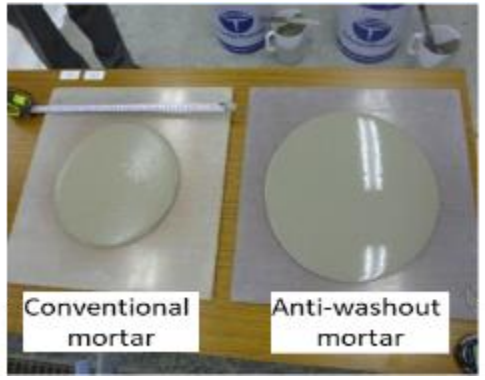
(2) A duct drilling machine

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