



Heritage Problems. Causes. Solutions



Erasmus+

Heritage Problems. Causes. Solutions

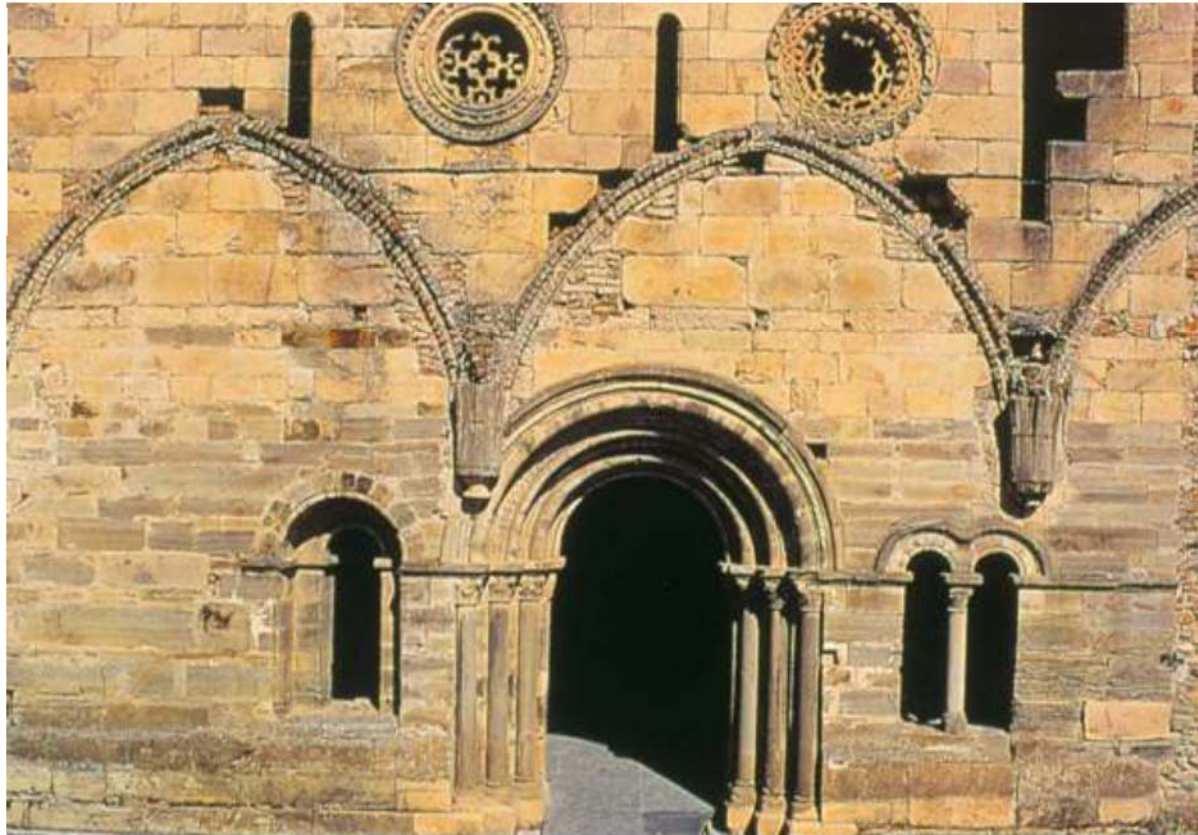
3 ECTS

SH

Sustainable Heritage

EC

Elective Courses



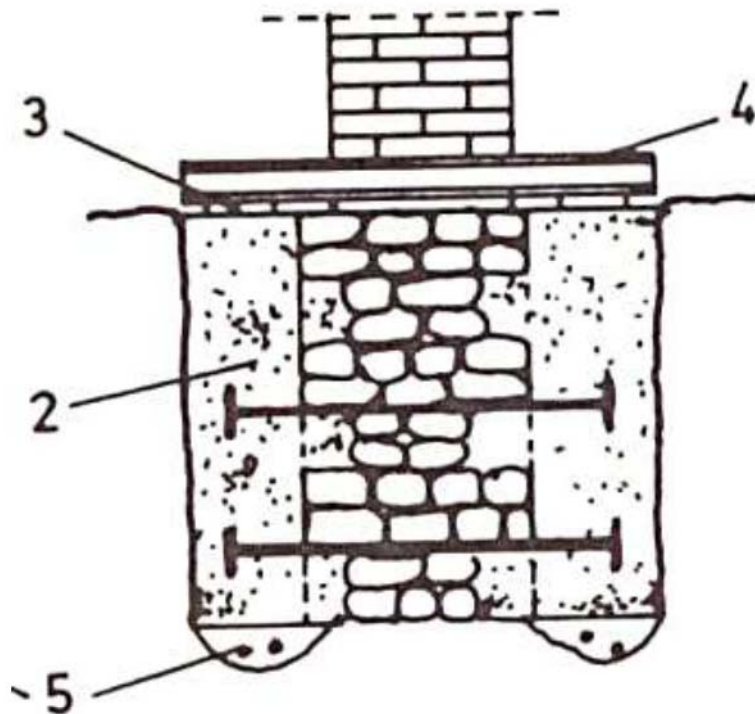
1. INTRODUCTION
2. FOUNDATIONS: DAMAGES
3. **FOUNDATIONS: REPAIR SOLUTIONS**
4. WALLS: CONSTRUCTIVE SYSTEM
5. WALLS II: PROBLEMS AND CAUSES
6. WALLS III: SOLUTIONS
7. VAULTS: CONSTRUCTIVE SYSTEM
8. VAULTS II: PROBLEMS AND CAUSES
9. VAULTS III: SOLUTIONS
10. FLOORS
11. WOOD
12. ROOFS: CONSTRUCTIVE SYSTEM, PROBLEMS
AND CAUSES
13. ROOFS II: SOLUTIONS
14. OTHER TRADITIONAL STRUCTURES
15. SURFACE FINISHES, INTERIOR WOODWORK

CURRICULAR CONTENTS

HERITAGE PROBLEMS. CAUSES. SOLUTIONS

Heritage Problems. Causes. Solutions

3 ECTS



03 FOUNDATIONS: REPAIR SOLUTIONS

1. DAMAGES AND BACKGROUND
2. ANALYSIS OF OBSERVED PATHOLOGY
3. VERIFICATION OF THE HYPOTHESES
- 4. SELECTION OF REPAIR SOLUTIONS**
- 5. EXECUTION OF THE WORKS**

03 FOUNDATIONS

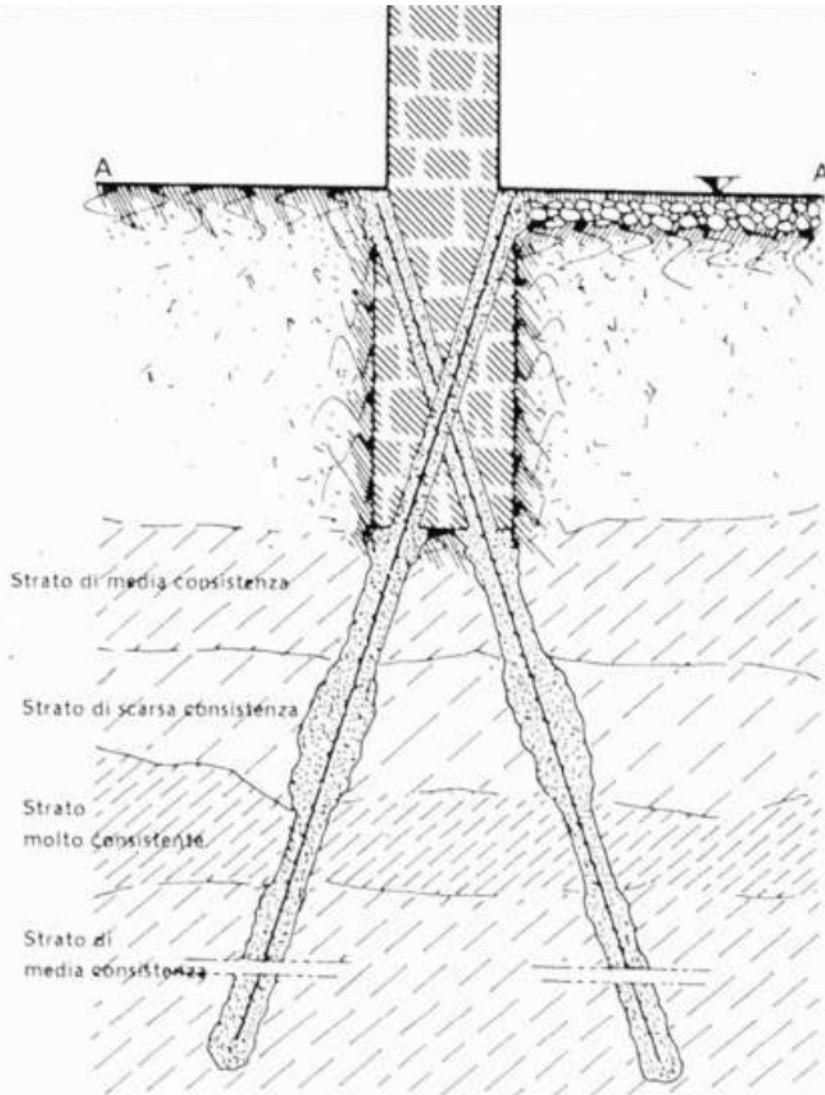
METHODOLOGICAL APPROACH

4. SELECTION OF REPAIR SOLUTIONS

- REINFORCES
- REPLACEMENT
- EXTERIOR REINFORCES
- INJECTIONS

03 FOUNDATIONS

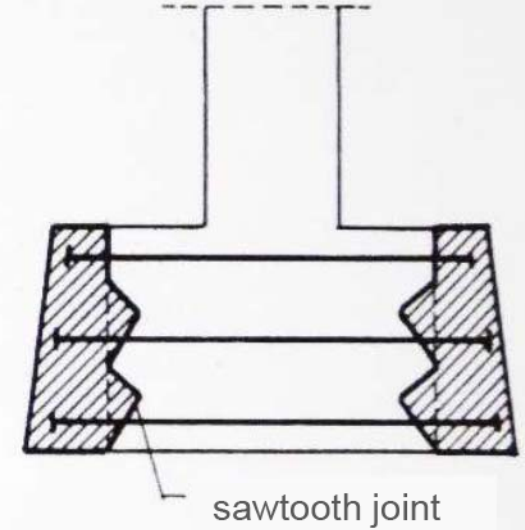
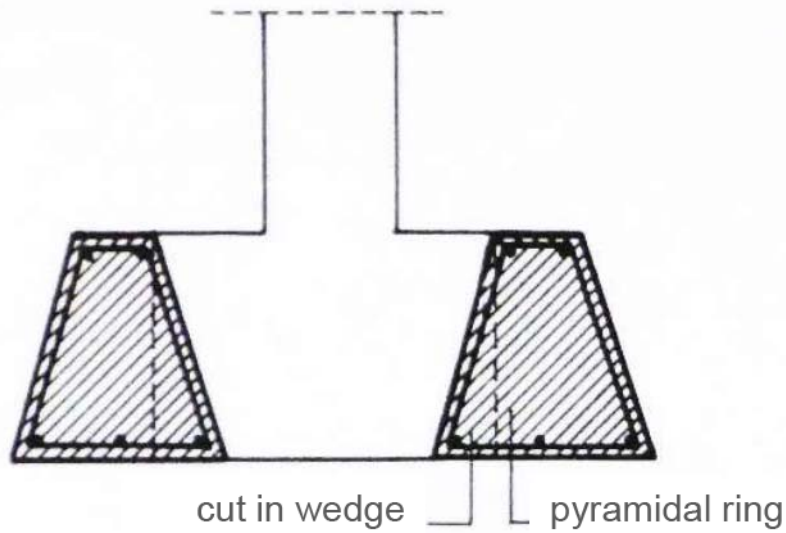
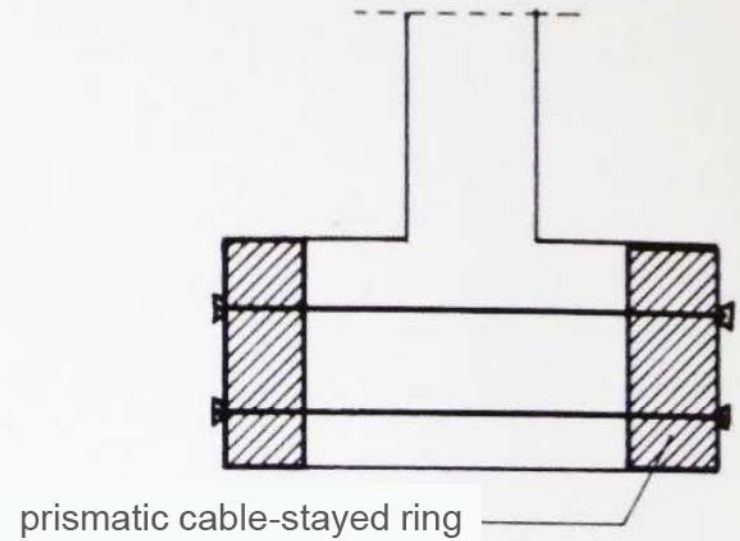
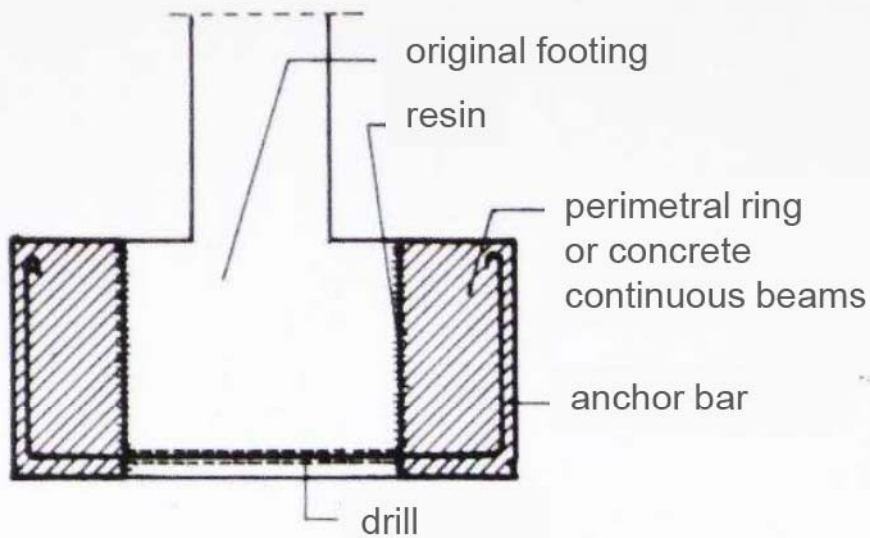
METHODOLOGICAL APPROACH



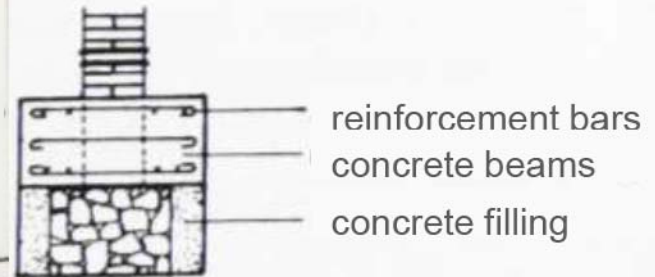
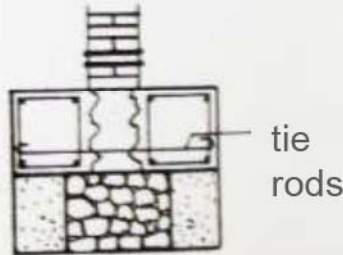
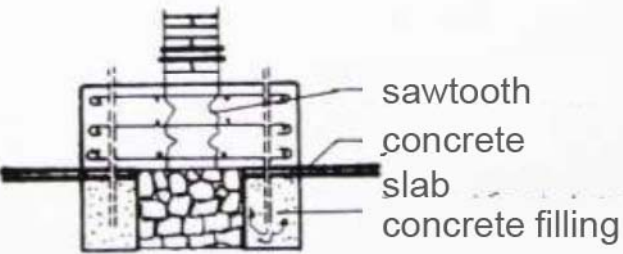
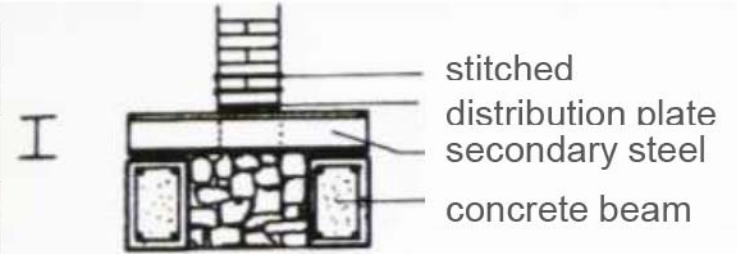
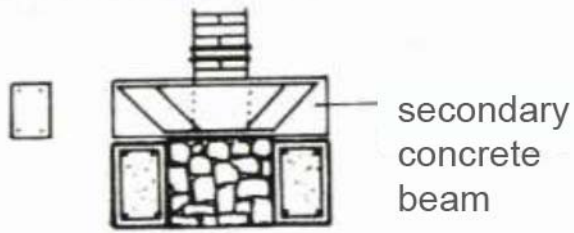
- WIDER FOOTINGS
- BRIDGING AND ENLARGE FOOTINGS
- NEW FOUNDATION OVER THE PREVIOUS
- MICROPILES
- JET GROUTING

Work of consolidation, repair or reconstruction that is made in the foundations of a wall or a building, without damaging the superstructure.

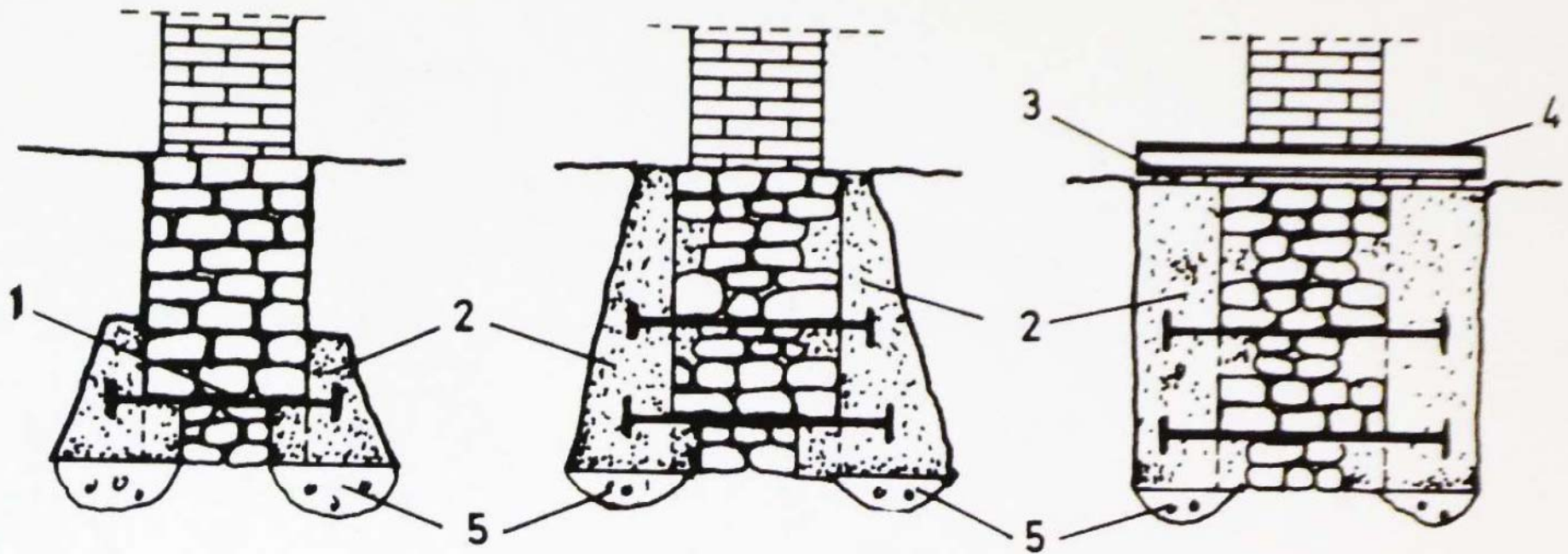
03 FOUNDATIONS SOLUTIONS REINFORCES



WIDER FOOTINGS SOLUTIONS

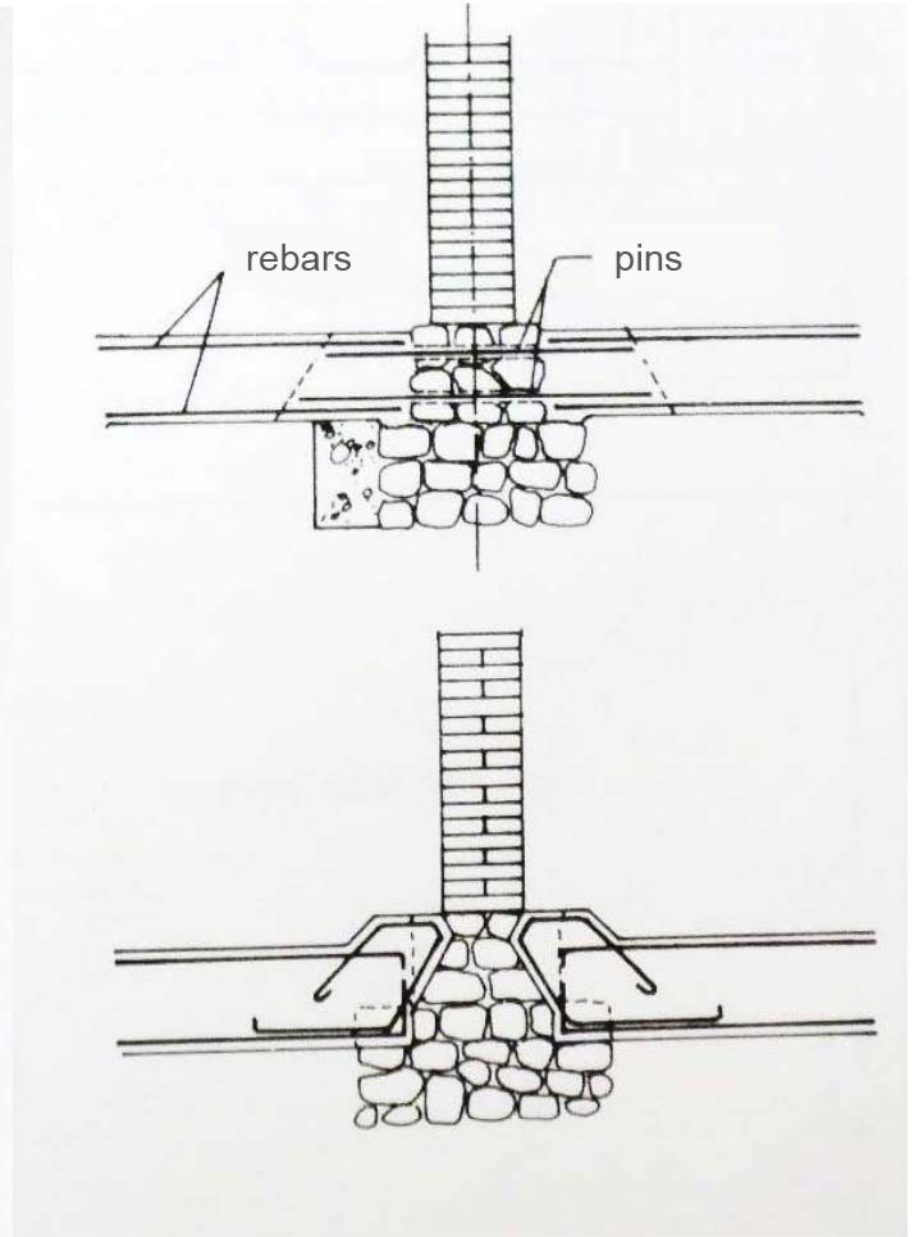
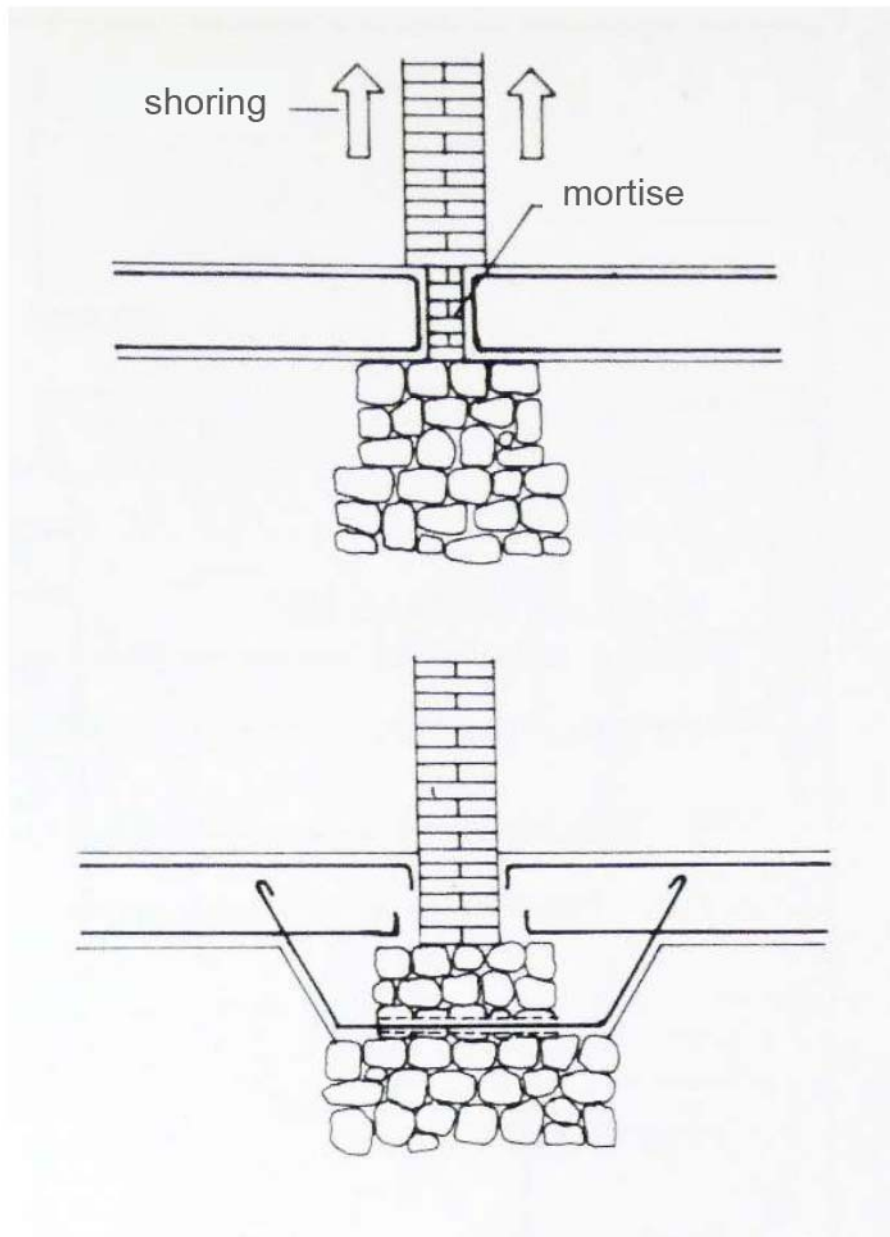


BRIDGING AND ENLARGE FOOTINGS SOLUTIONS



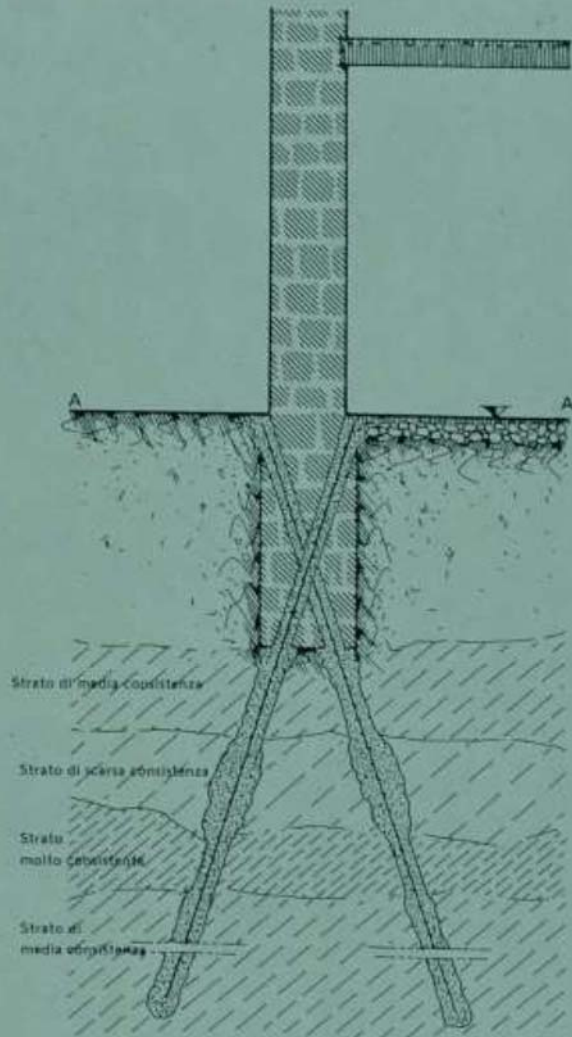
1. tie rods
2. concrete
3. wedges
4. secondary beam
5. compacted or injected soil

ENLARGE FOOTINGS SOLUTIONS WITH LOCAL GROUND IMPROVEMENT



NEW FOUNDATION PLACED OVER THE PREVIOUS

a) VERTICAL CROSS-SECTION



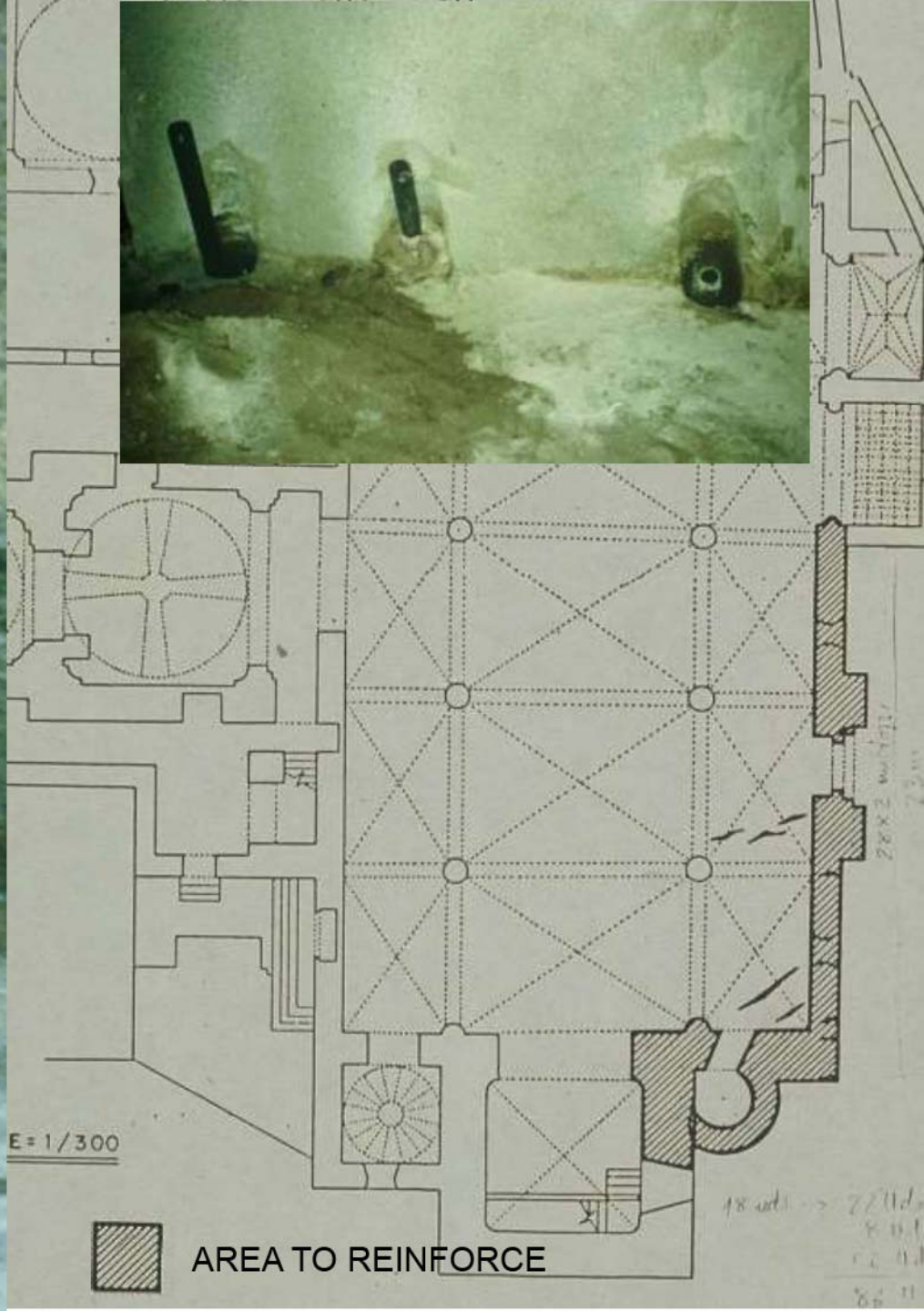
b) HORIZONTAL CROSS-SECTION A-A



MICROPILES

Micropiles are a deep foundation element constructed using high-strength, small-diameter steel casing and/or threaded bar.

03 FOUNDATIONS SOLUTIONS REINFORCES



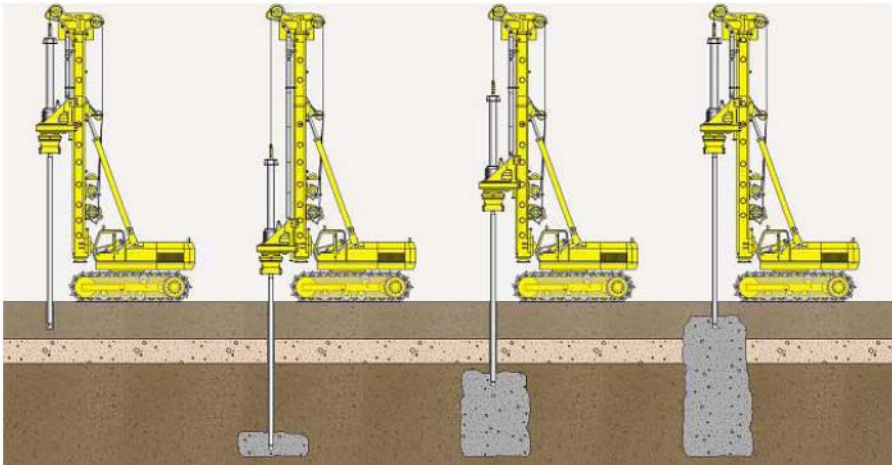


SAYED HEMEDA

***Pali radice (Root pile,
Micro pile) Technology
for Preservation of
Historical Islamic
Monuments in Cairo
Egypt.***

https://www.researchgate.net/profile/Sayed_Hemeda/publication/271833136_Pali_radice_Root_pile_Micro_pile_Technology_for_Preservation_of_Historical_Islamic_Monuments_in_Cairo_Egypt/links/54d326920cf28e0697279c2f/Pali-radice-Root-pile-Micro-pile-Technology-for-Preservation-of-Historical-Islamic-Monuments-in-Cairo-Egypt.pdf

- JET GROUTING

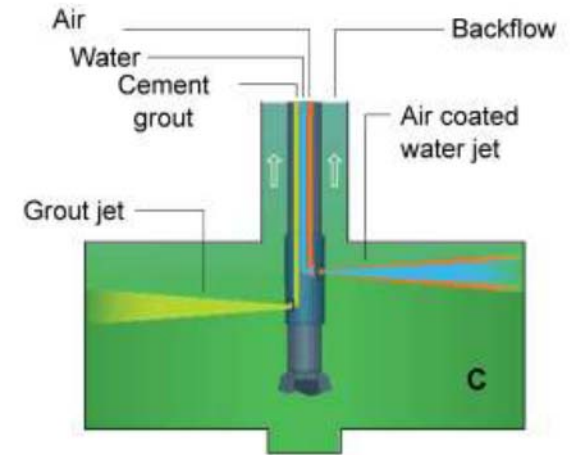
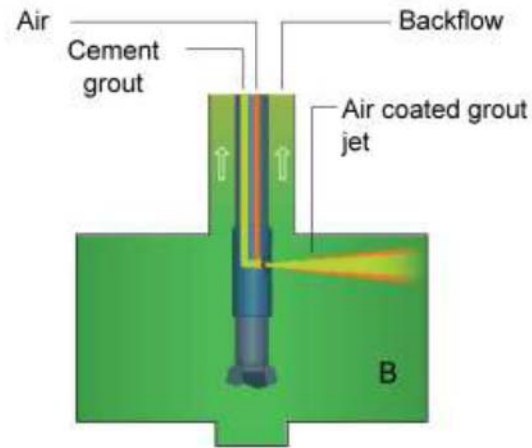
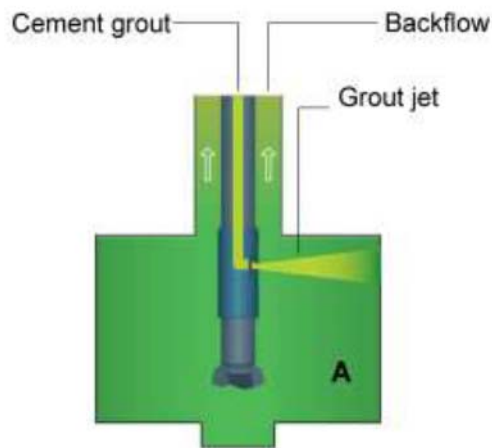
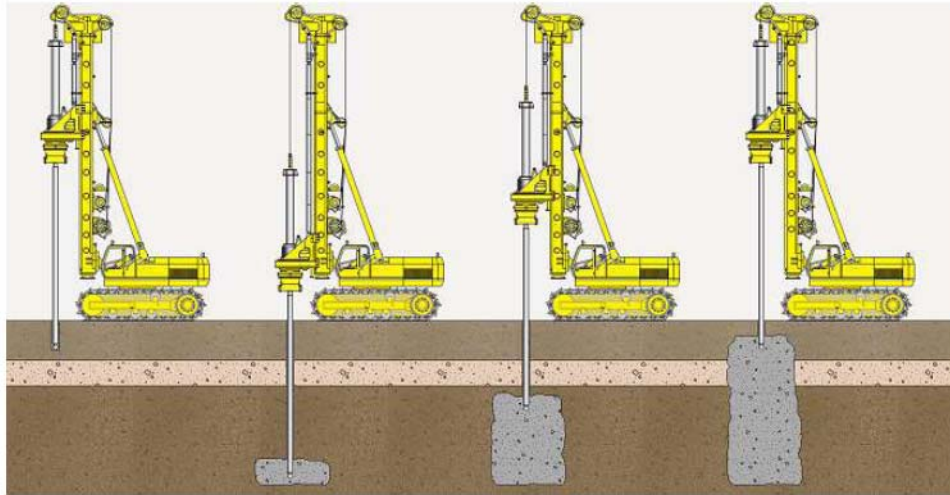


Jet grouting involves inserting a cement bond material (usually cement grout) using one or more high-speed jet pumps. The energy from the jets break up the ground and restructure it, mixing it with the injected material to produce an improved ground. Any surplus material rises to the surface as spoil return.

03 FOUNDATIONS
SOLUTIONS
REINFORCES



Jet Grouting uses high velocity fluid jets to construct cemented soil of varying geometries in the ground.



Single Fluid Jet Grouting (A)
Double Fluid Jet Grouting (B)
Triple Fluid Jet Grouting (C)

JET GROUTING

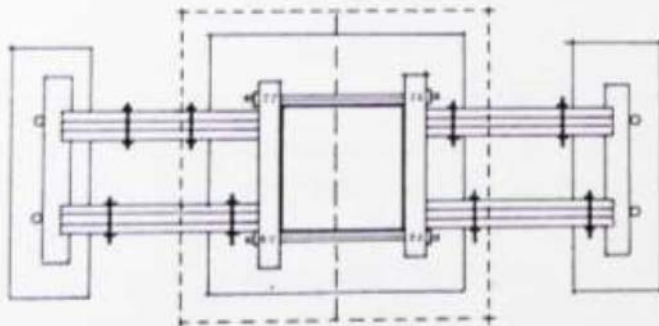
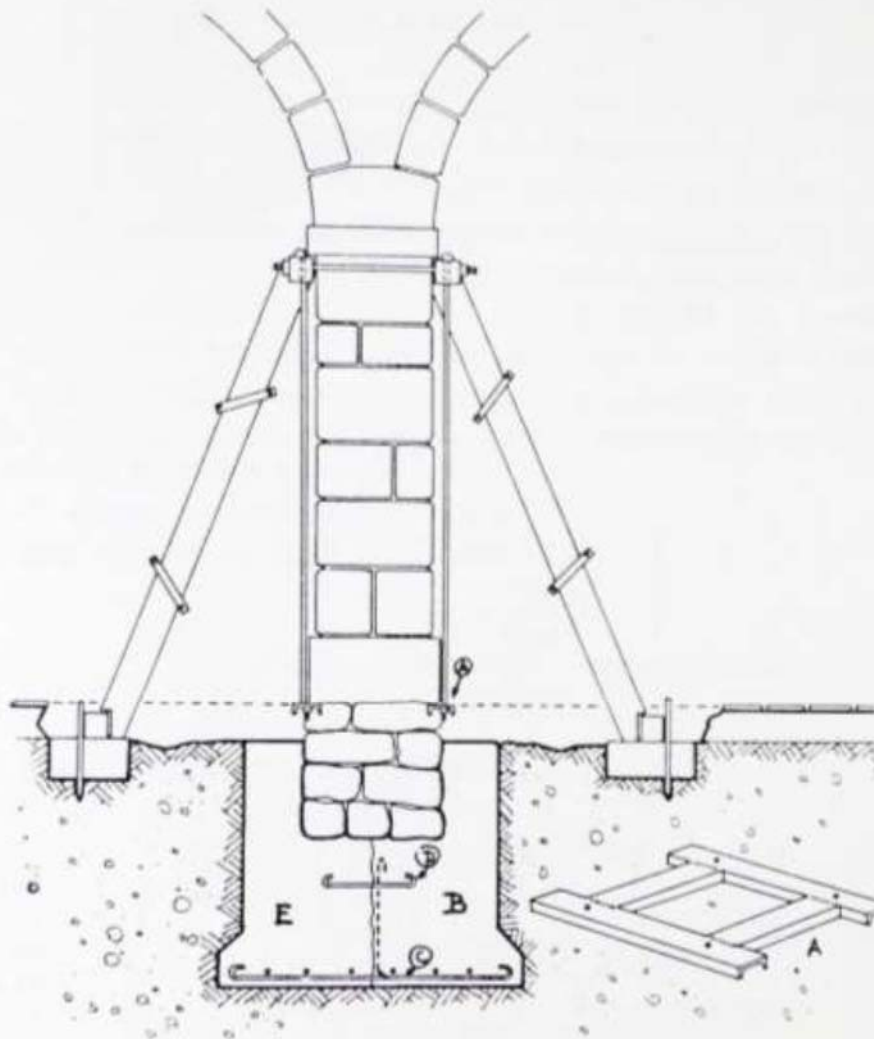
JET GROUTING application in restoration:

- strengthening the foundation of existing buildings
- treatment the foundation of buildings near excavations
- improving the ground foundation under increased loads or settlement
- strengthening and consolidation the bottom of excavations
- strengthening of the soil



COMPLETE SHORING OF THE PILLAR FOR REPLACEMENT OF THE FOUNDATION

with shoring and hanging of
the pillar

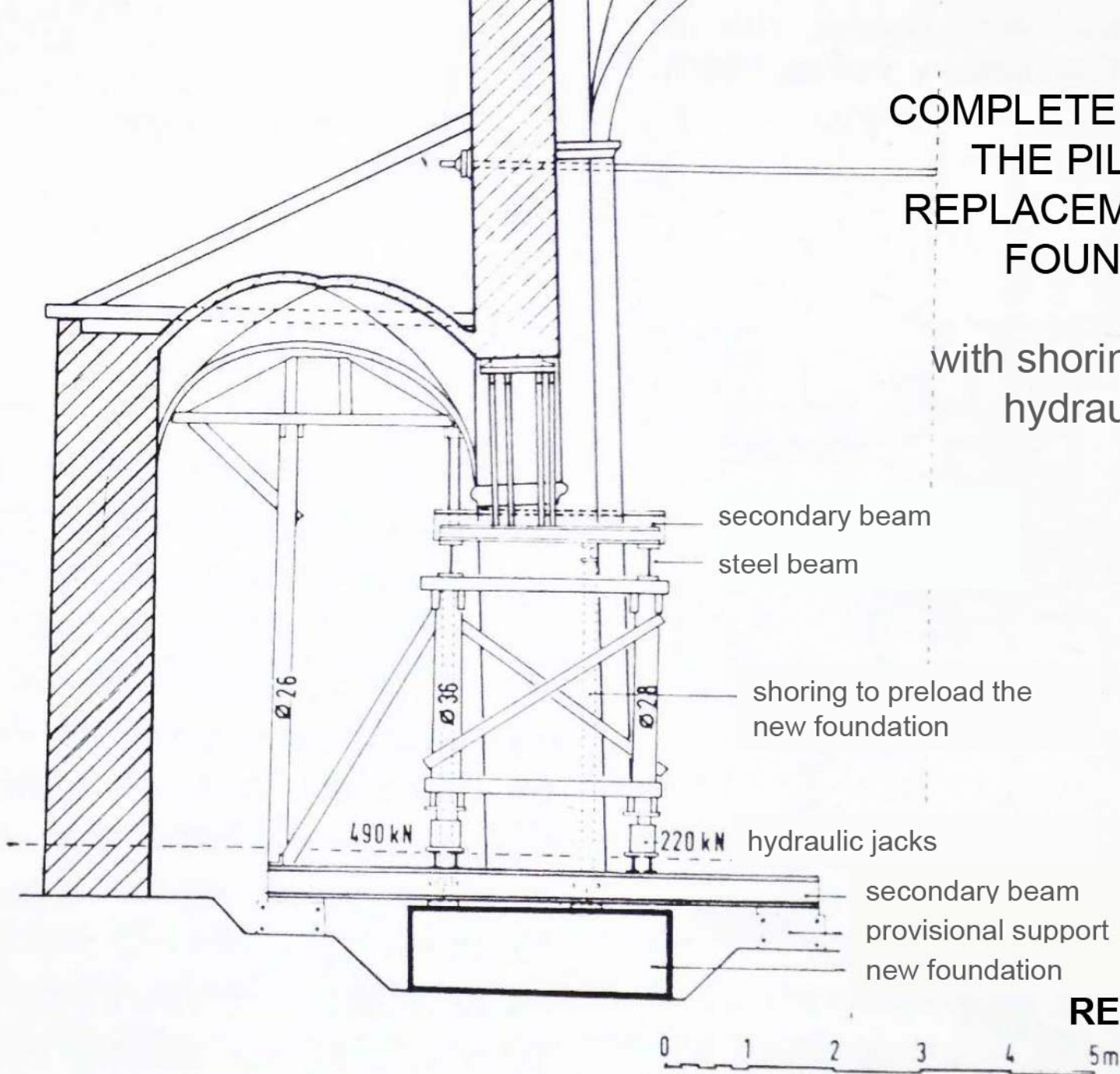


- A) metallic frame
- B) half the foundation trench
- C) footing reinforcement
- D) rebar nailed on the ground

REPLACEMENT

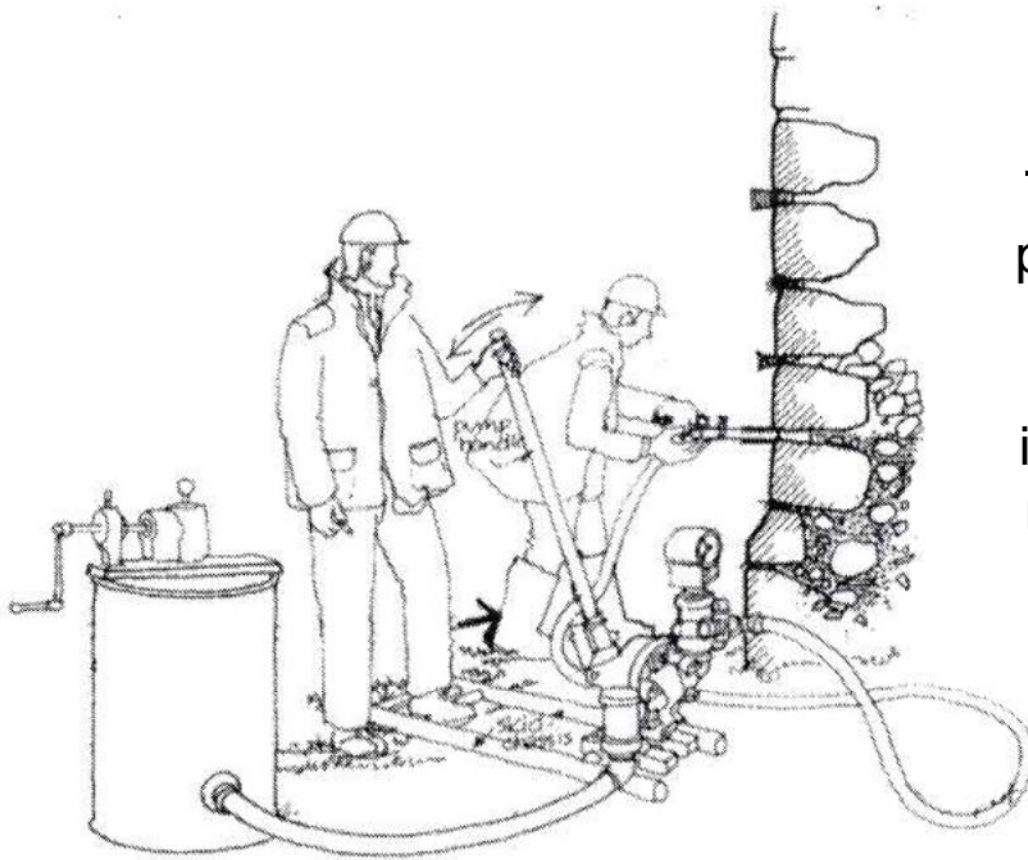
COMPLETE SHORING OF THE PILLAR FOR REPLACEMENT OF THE FOUNDATION

with shoring frames on
hydraulic jacks





EXTERIOR REINFORCES



The objective is to improve the properties in terms of continuity and resistance.

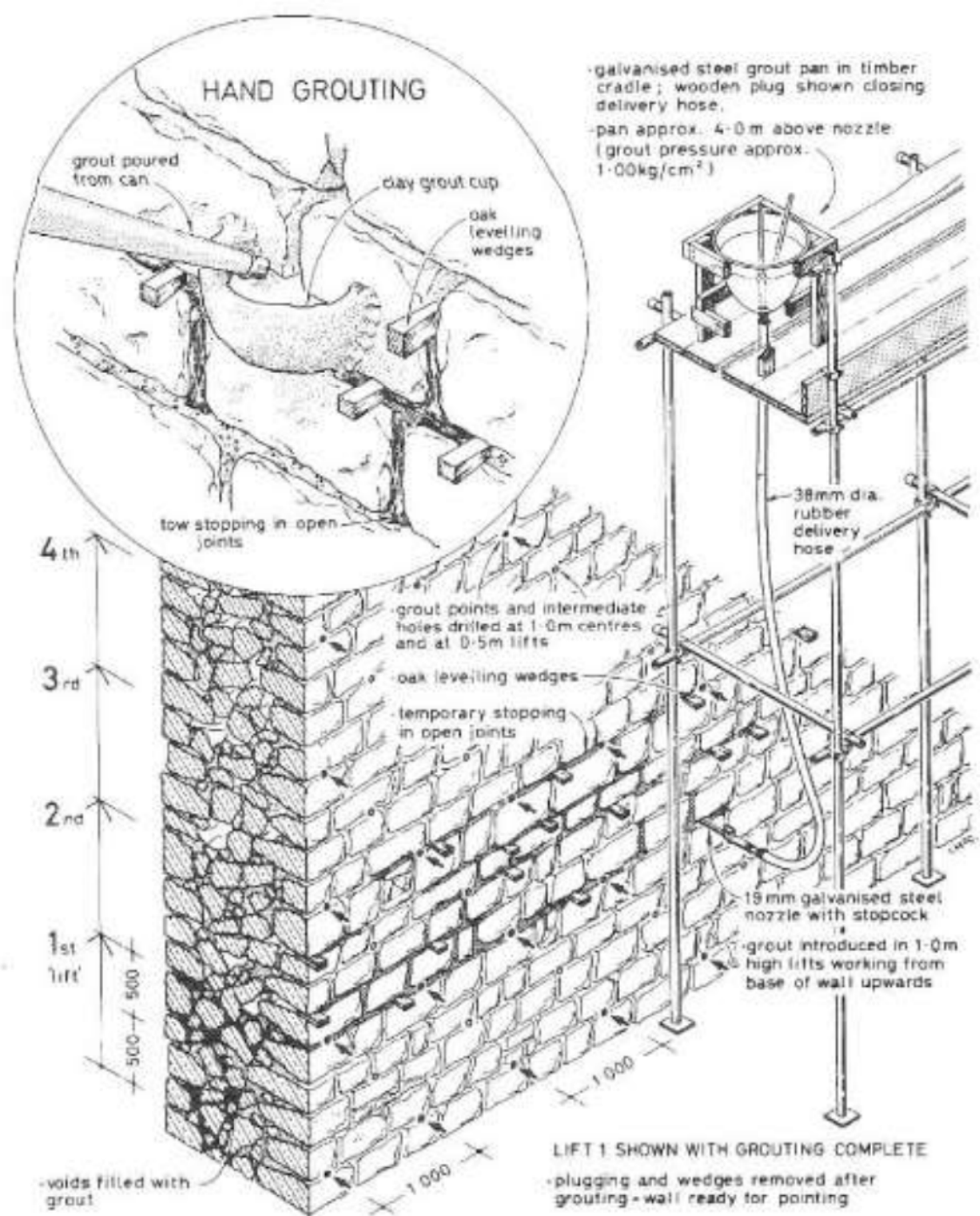
The technique consists in the injection of a liquid consistency mortar, in order to fill gaps and fissures, returning the mechanical capacity to the foundation.

- BY GRAVITY
- BY PRESSURE
- REINFORCED

03 FOUNDATIONS SOLUTIONS **INJECTIONS**

INJECTIONS BY GRAVITY

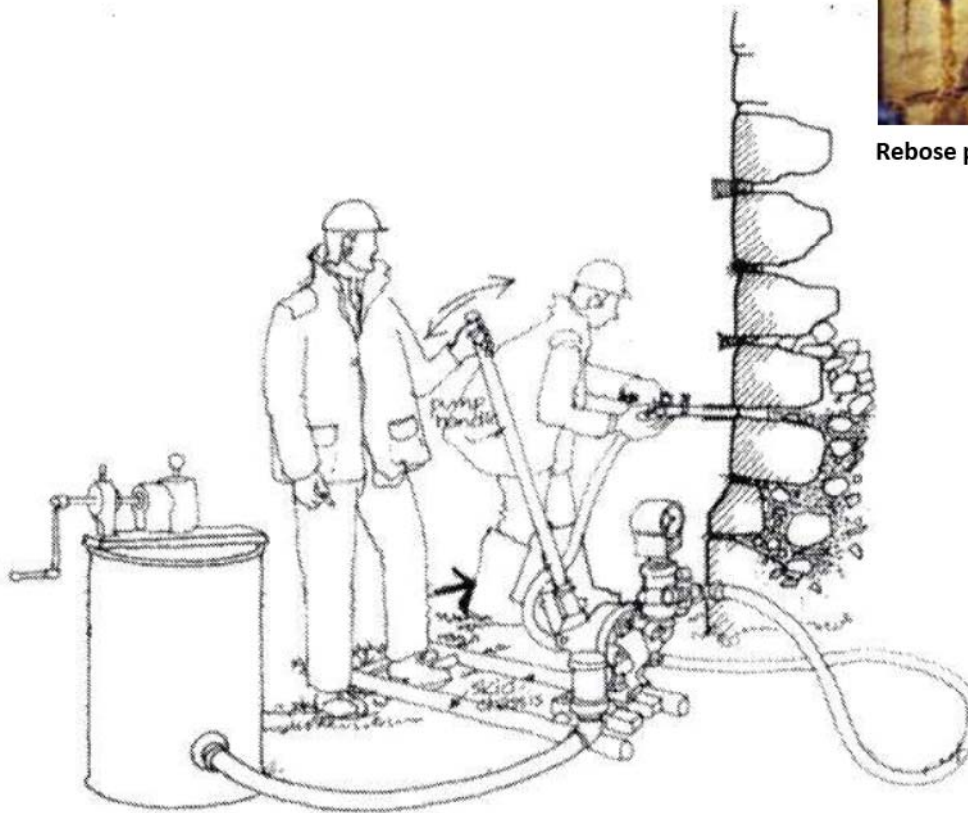
- Injection control
- Grout density
- Washing inner leaf



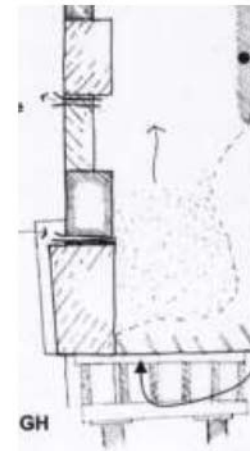
INJECTIONS BY PRESSURE



Rebose por orificios superiores

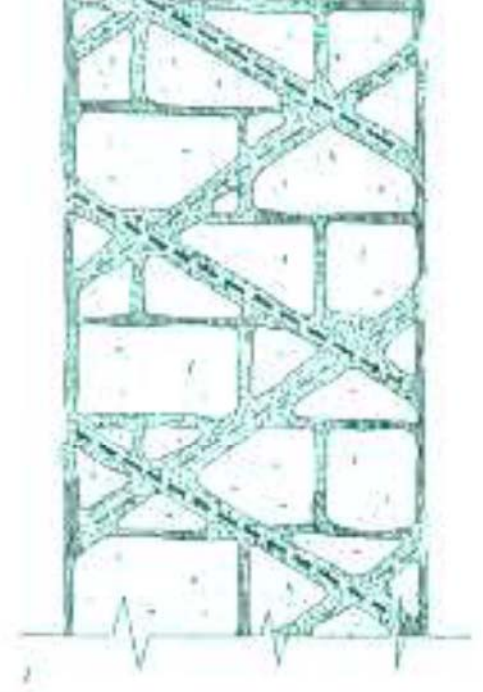


Desde la parte
inferior



PROBLEMS

- Constructive system changes
- Static / Hyperstatic
- Expulsion of the bars
- Homogeneous systems
- Compatibility



INJECTIONS
REINFORCED



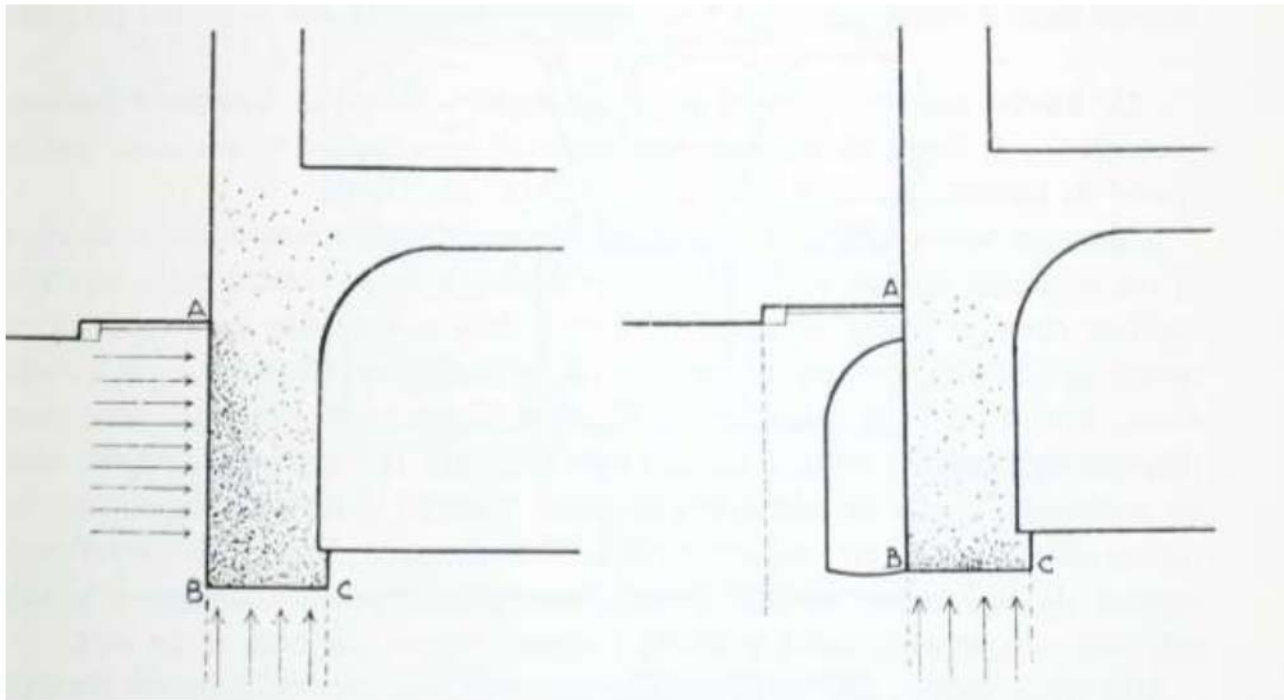
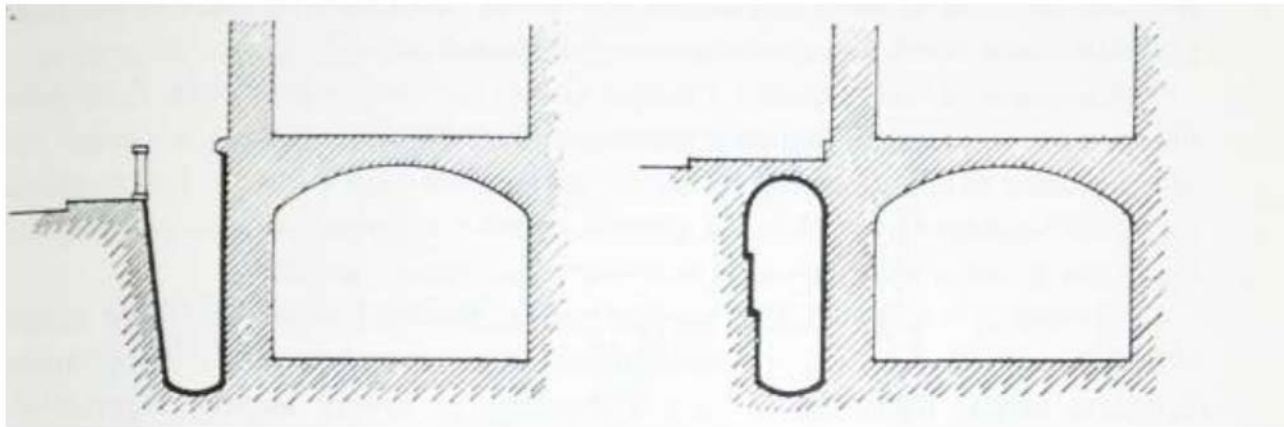
- CAVITY WALL
- SIPHONS
- WALL SECTIONS
- WATERPROOFING
- ELECTROOSMOSIS

The objective is ensuring good ventilation and allowing for permeability in the wall surfaces.

03 FOUNDATIONS

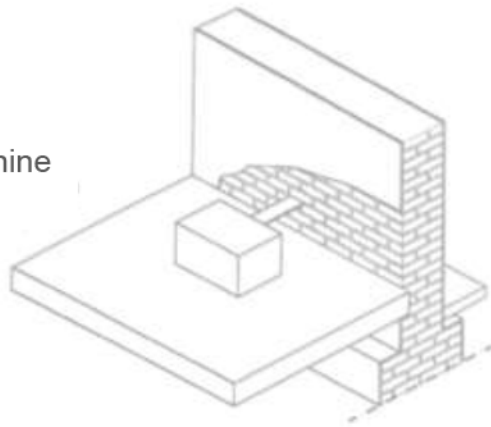
SOLUTIONS

SOIL MOISTURE

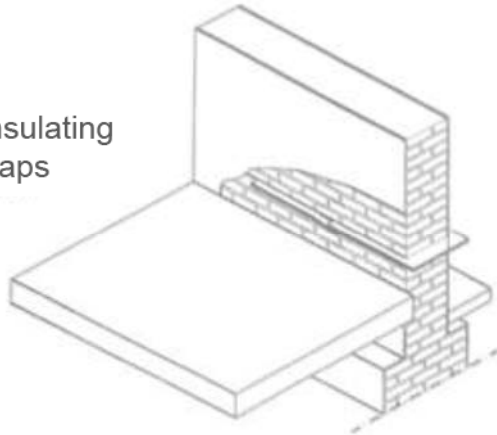


VENTILATION GALLERIES

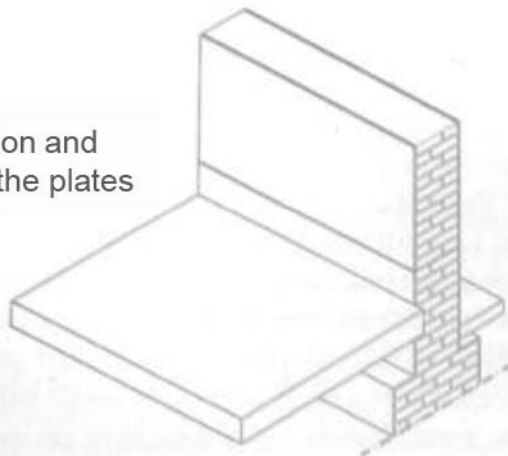
wall cutting machine
at progress



introduction of insulating
plates with overlaps

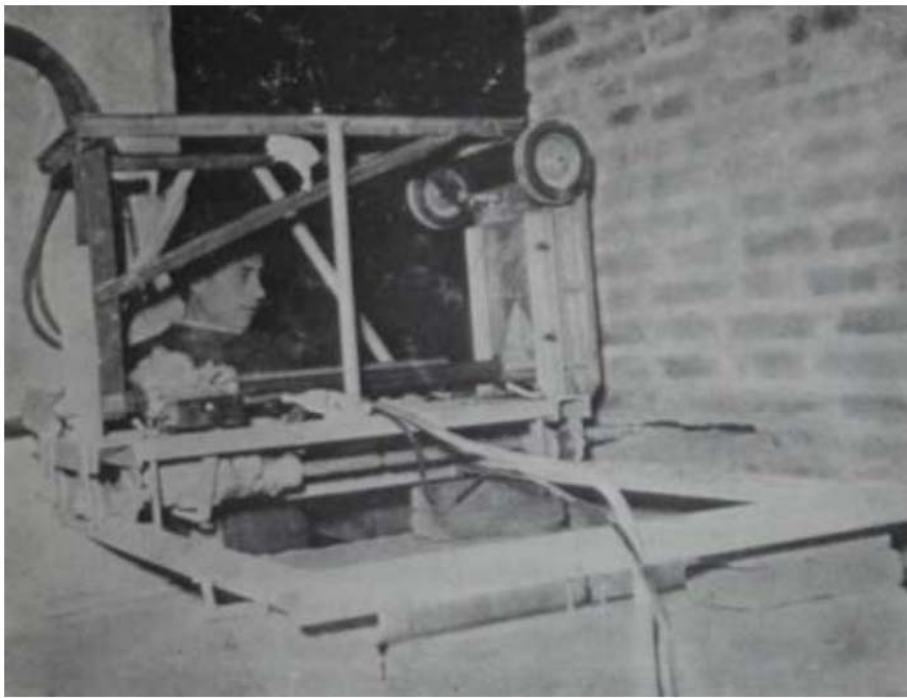


plaster restoration and
flush cutting of the plates



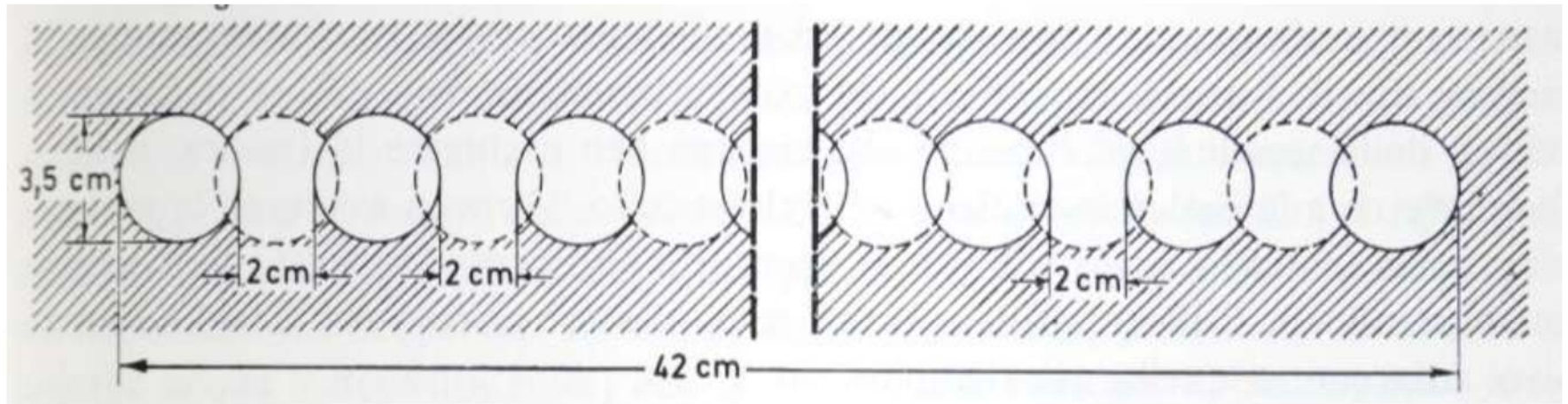
Mechanical cutting of the wall for the
insertion of insulating plates

INSULATING PLATES



core drill in operation on a brick wall

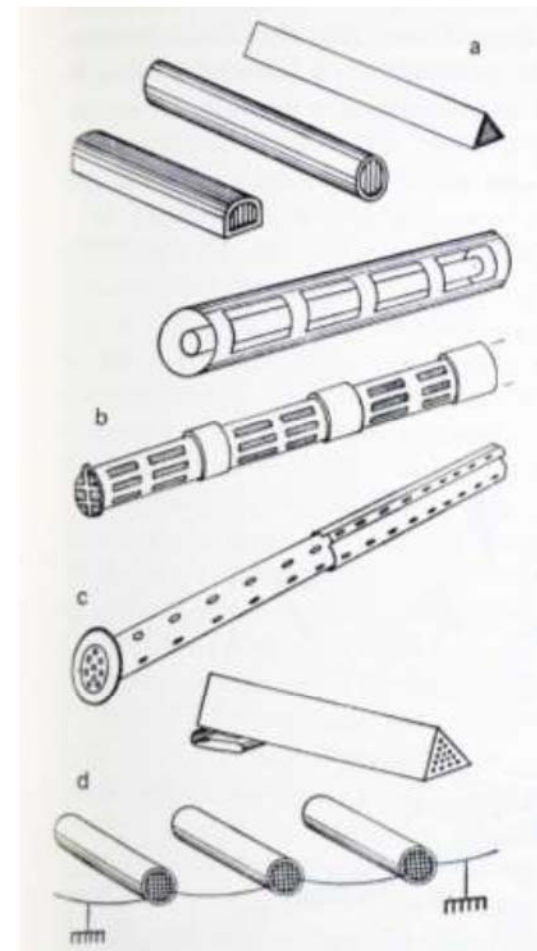
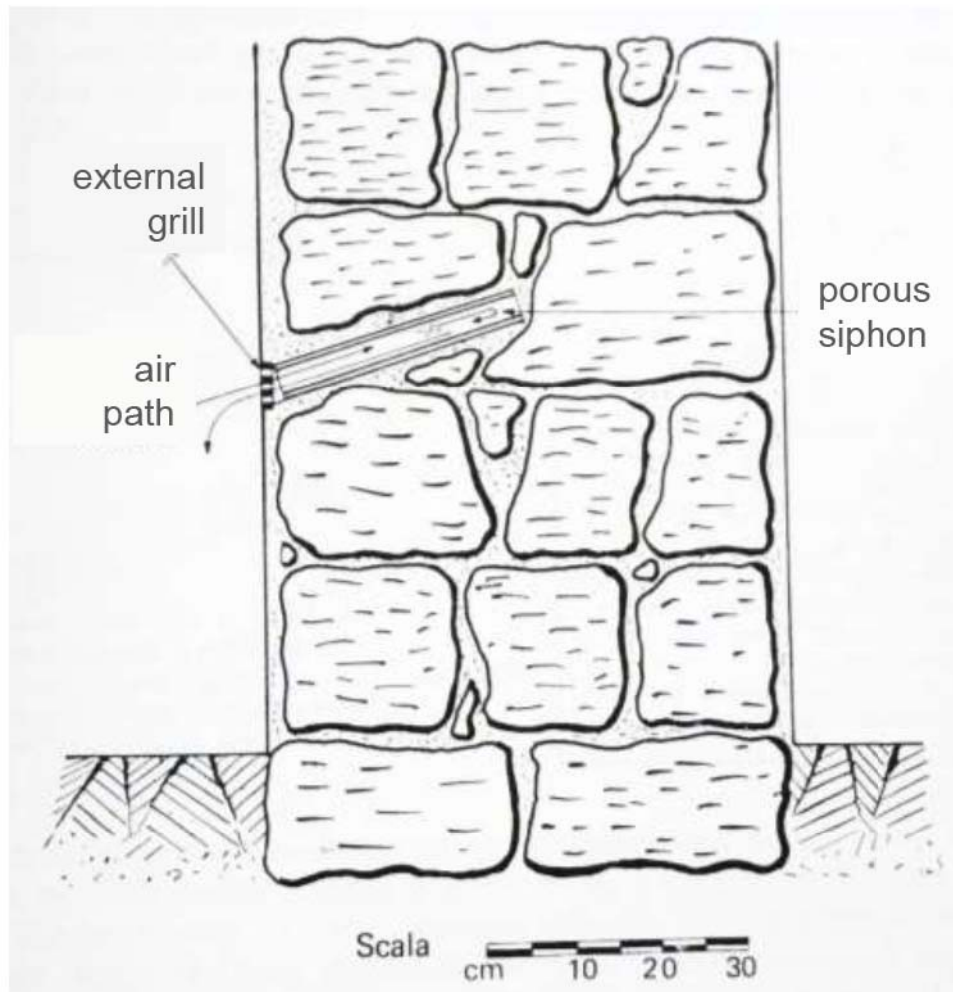
Method against the capillary rising of water: execution of a double series of partially overlapping holes for the insertion of insulating material



front view of the cut

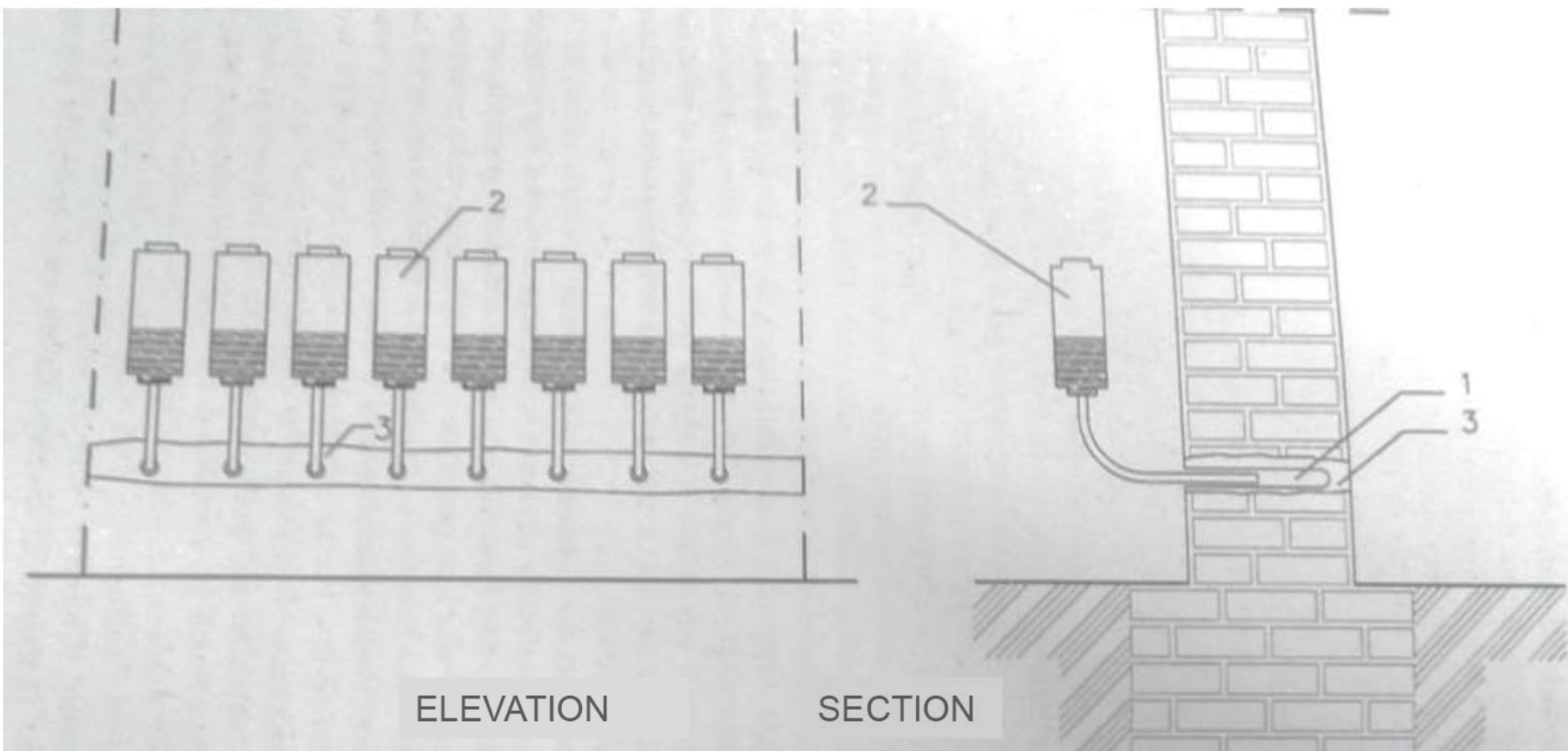
WALL SECTIONS

The atmospheric knapen siphons, placed in the walls to be treated, attract humidity and evacuate it outside by an air circuit ensuring a permanent and effective functioning.



Each siphon, in its radius of action, attracts moisture, and this, impregnating its porous wall, saturates the drier outside air that enters the siphon channel.

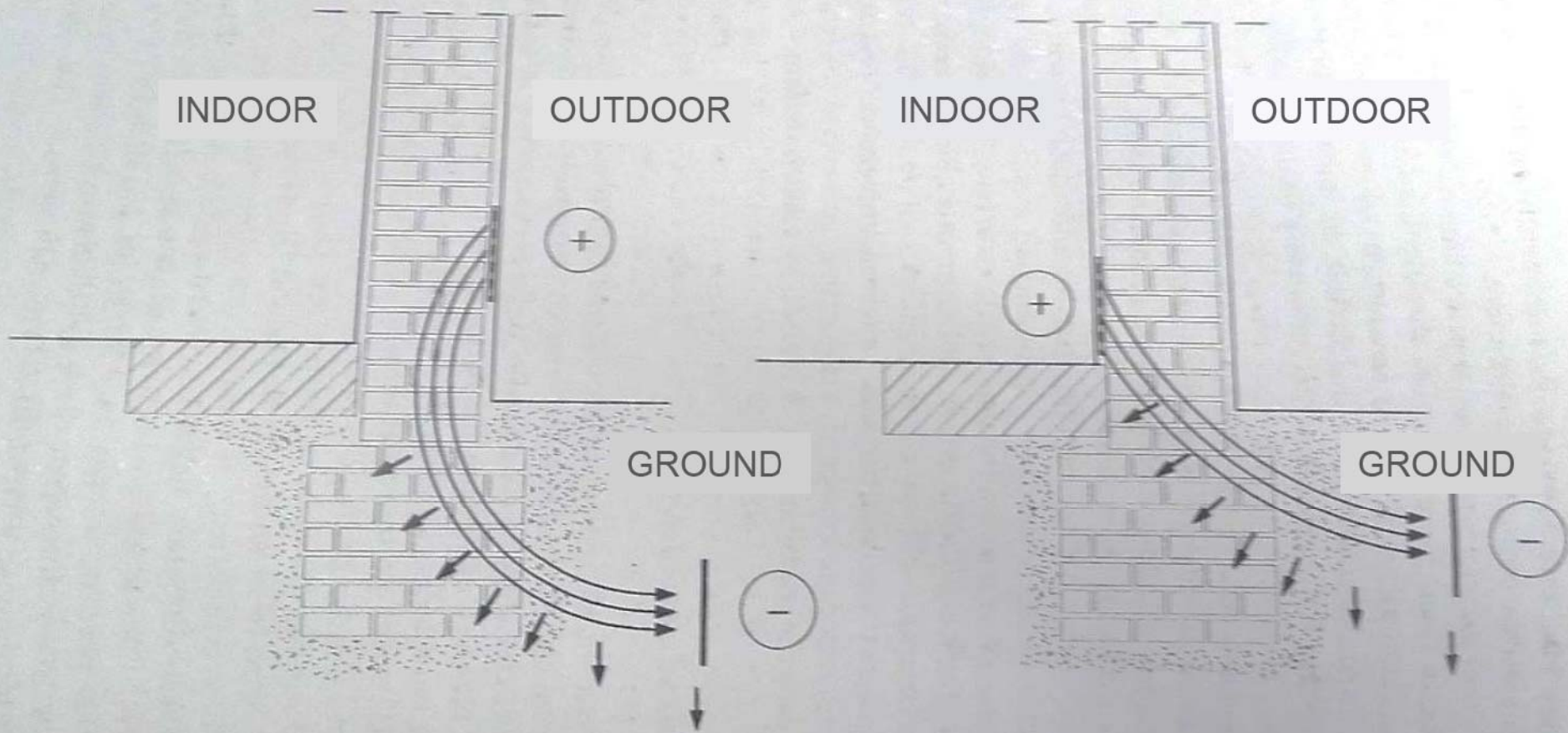
KNAPEN ATMOSPHERIC SIPHON



- 1 hole
- 2 containers of fluid resin
- 3 spread of the waterproofing

Horizontal barrier of slow diffusion waterproofing product

WALL SECTIONS



The device emits small pulses from electrodes inserted in the wall to the ground. In this way the polarity between the soil and the wall is inverted, causing the ionized water to descend through the wall to the ground.

ACTIVE ELECTROOSMOSIS



**Project "SURE - Sustainable Urban Rehabilitation in Europe"
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Key Action 2: Strategic Partnership Projects
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