



## ***Heritage Problems. Causes. Solutions***



**Erasmus+**

# Heritage Problems. Causes. Solutions

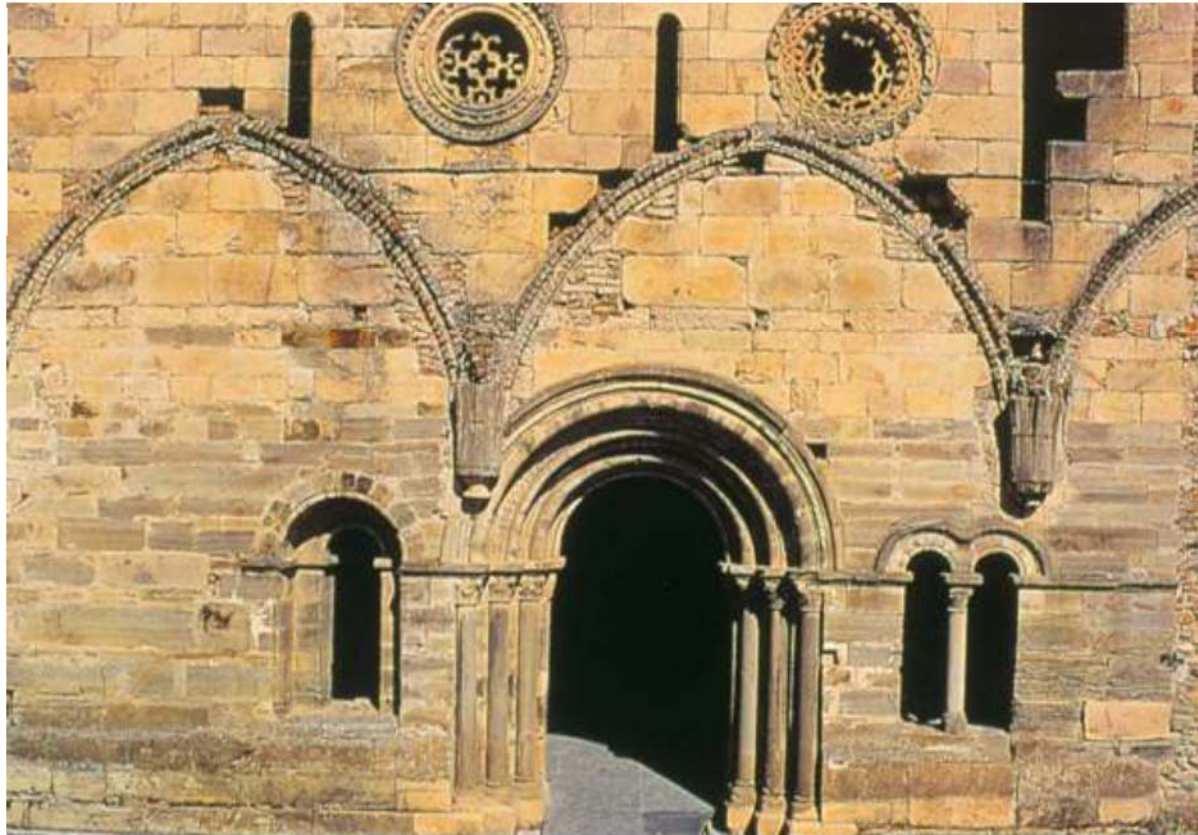
3 ECTS

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

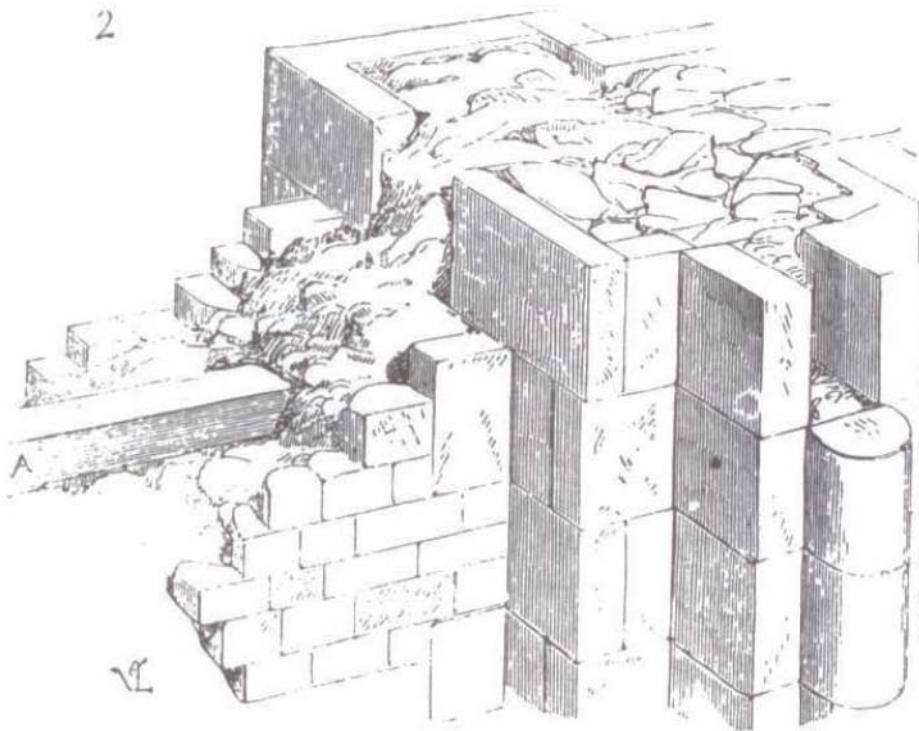
CURRICULAR CONTENTS

**HERITAGE PROBLEMS. CAUSES. SOLUTIONS**

# Heritage Problems. Causes. Solutions

3 ECTS

2



## 06 WALLS III: 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**

06 WALLS III

**METHODOLOGICAL APPROACH**

## 4. SELECTION OF REPAIR SOLUTIONS

- CLEANING
- SURFACE CONSOLIDATION
  - PROTECTION
- WATERPROOFING
  - DRAINAGE
  - VENTILATION
  - BARRIERS
- SUBSTITUTION
- CONSOLIDATION OF JOINTS
  - *RETACADO*
  - GROUTING
  - SEALING
- EDGES CONSOLIDATION
- STRUCTURAL CONSOLIDATION
  - EXTERNAL REINFORCEMENTS
  - INJECTIONS
- REINTEGRATION
- SHORING
- ANASTYLOSIS

06 WALLS III

**METHODOLOGICAL APPROACH**





Fundamental solution to consolidate a wall. It must be cleaned the joints to where the masonry is fixed, eliminating the mortar in bad conditions. Generally is used a similar material or similar characteristics of hardness, porosity, elasticity, etc. But it may be aesthetically very different looking for its formal differentiation. Sometimes it is delimited when it is carried out on a surface to be considered.

06 WALLS III  
SOLUTIONS  
***RETACADO & GROUTING***





## **SEALING OF CRACKS**

Mortar

Epoxy resins





## **EDGES CONSOLIDATION**

Slope mortar  
Sacrificial layer  
Stone gabions

- EXTERNAL REINFORCEMENTS

- BUTTRESS
- CLADDING
- CABLE-STAYED
- BRACING
- FIBERS
- ANCHORING

- INJECTIONS

- BY GRAVITY
- BY PRESSURE
- REINFORCED

06 WALLS III  
SOLUTIONS

**STRUCTURAL CONSOLIDATION**





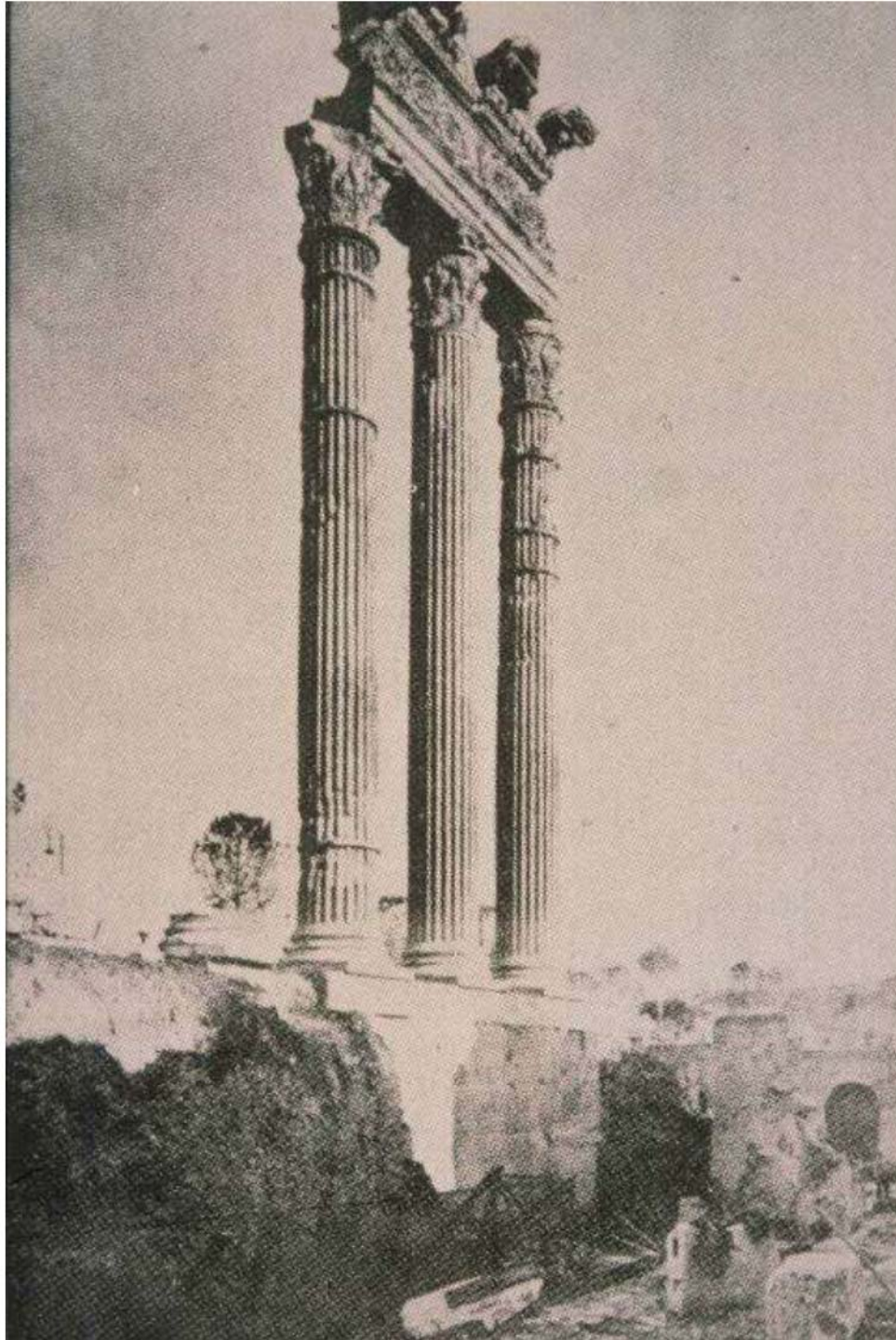
**BUTTRESS  
EXTERNAL REINFORCEMENTS**



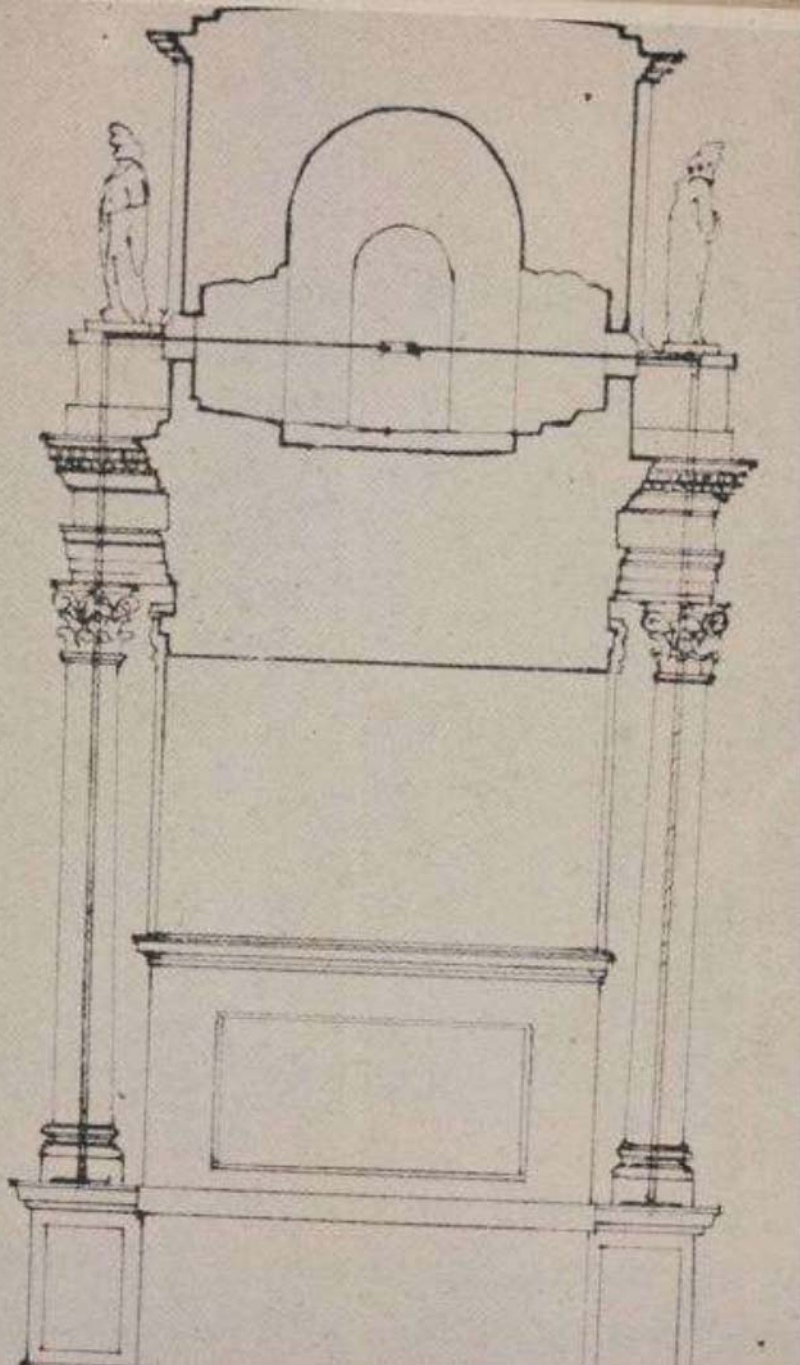


**CLADDING**  
**EXTERNAL REINFORCEMENTS**



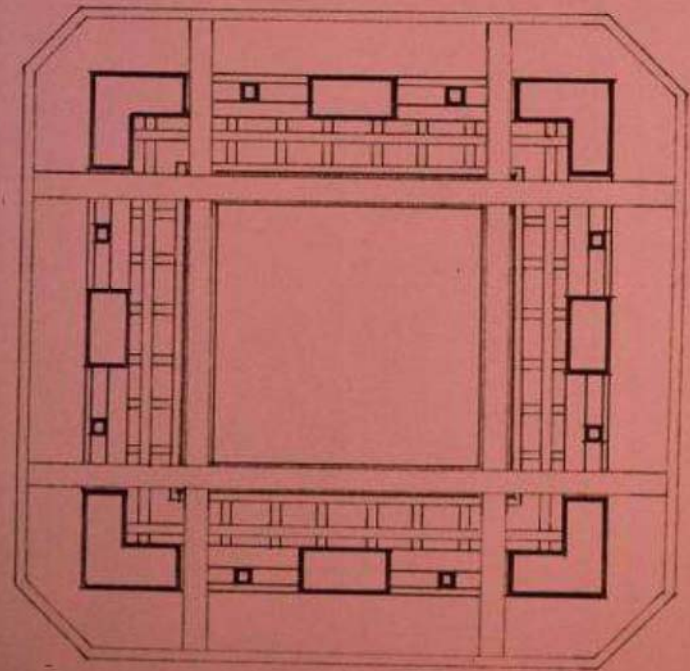
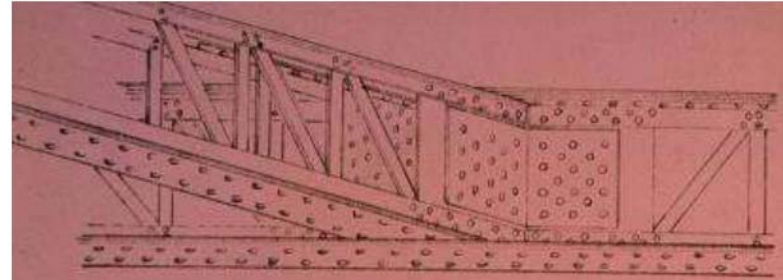
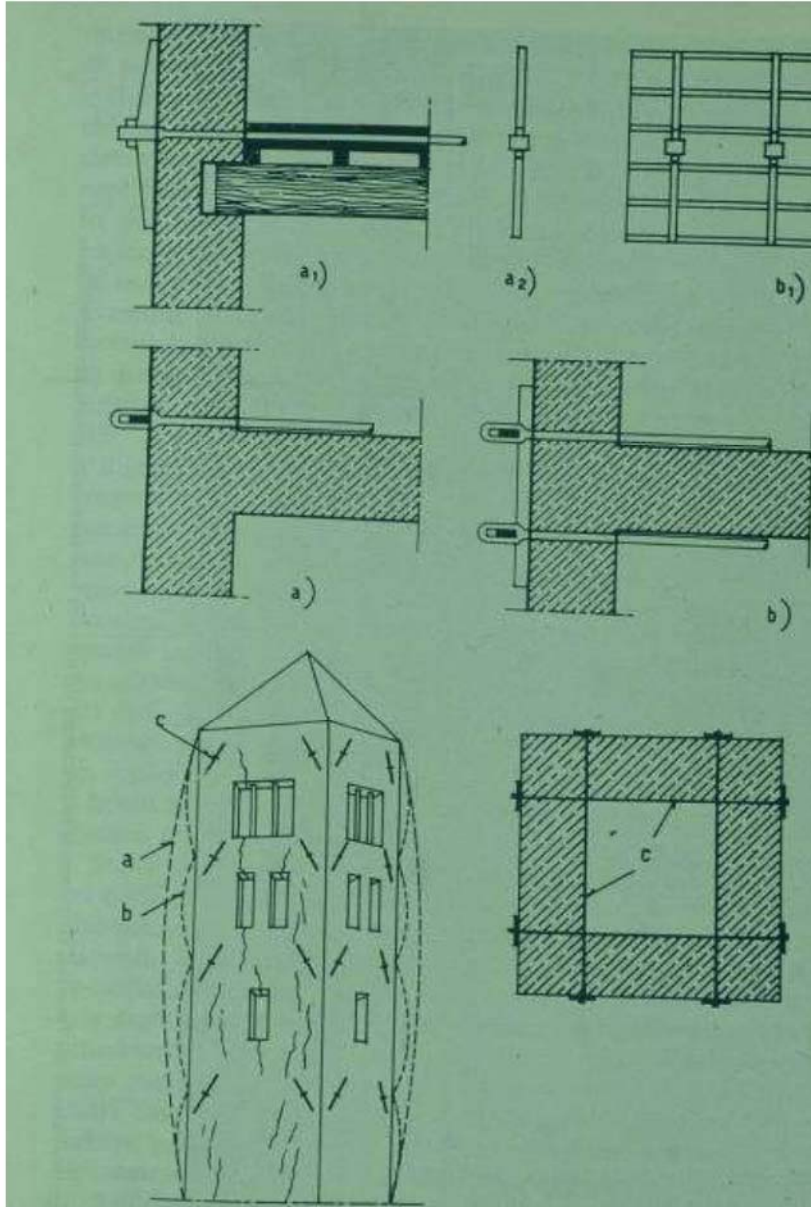


***EXTERNAL REINFORCEMENTS***  
**ANASTYLOSIS**



**HIDDEN REINFORCEMENTS**





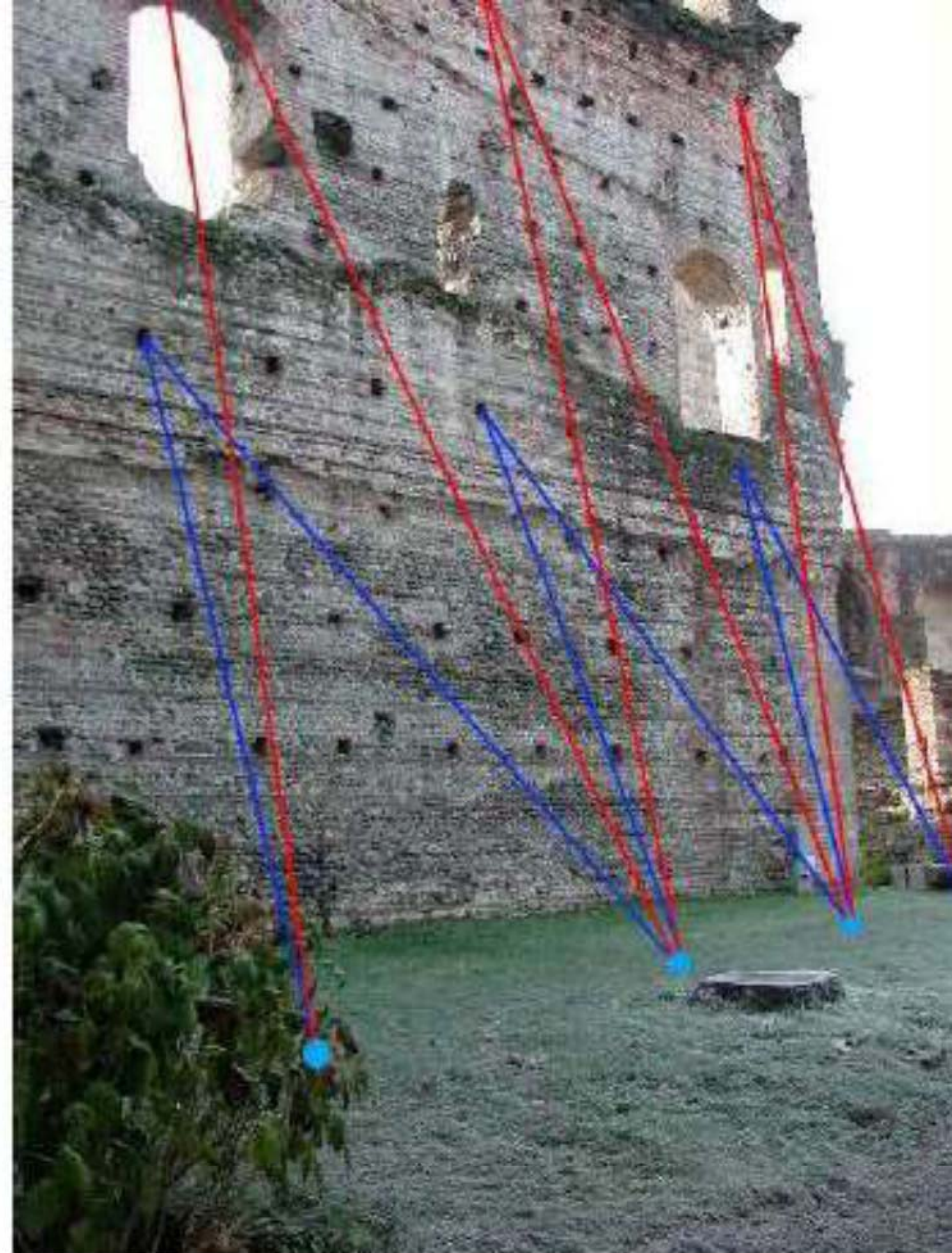
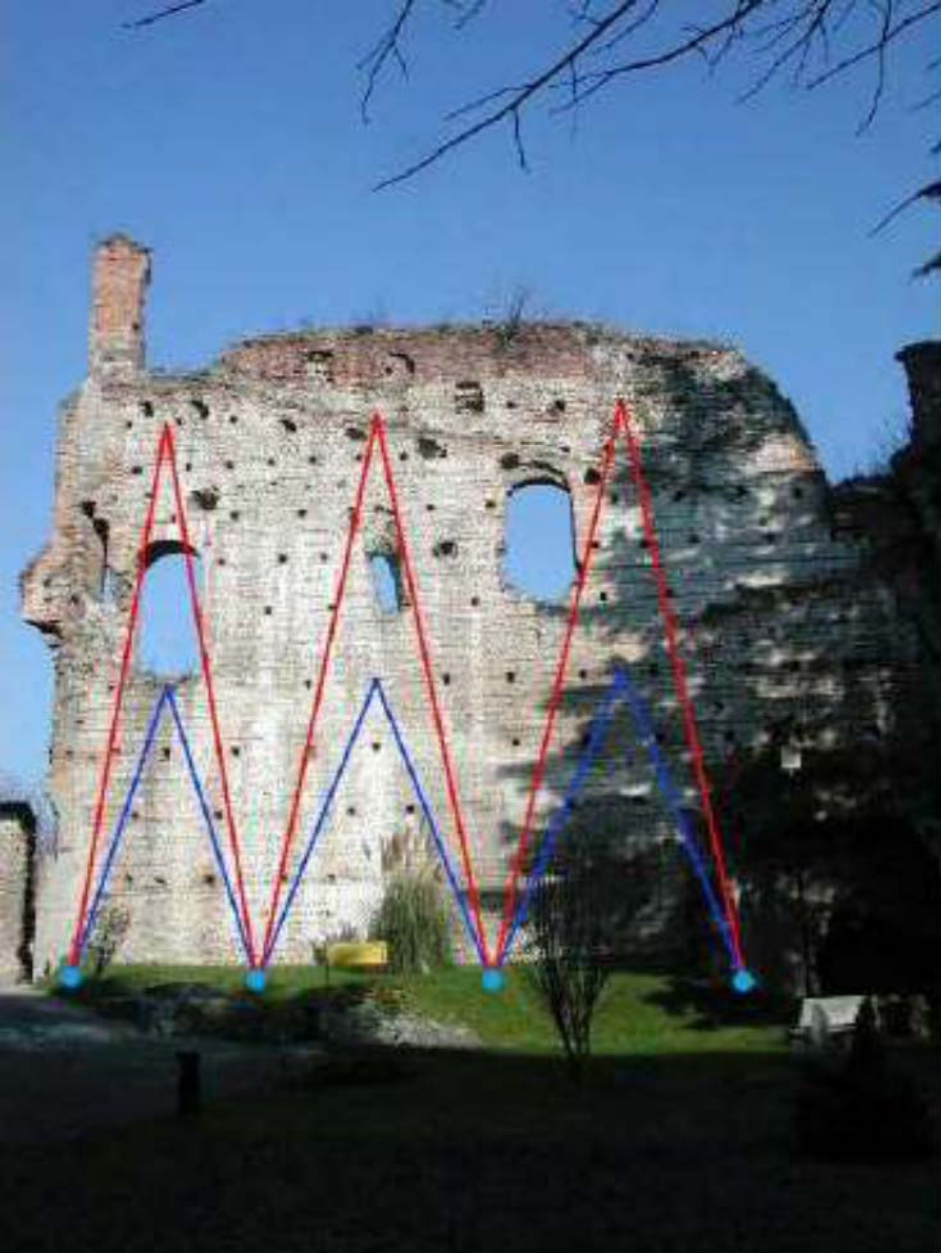
**CLADDING**  
EXTERNAL REINFORCEMENTS





**CABLE-STAYED  
EXTERNAL REINFORCEMENTS**





**BRACING**  
**EXTERNAL REINFORCEMENTS**



Use of carbon fiber as laminates in reinforcements for pillars and walls

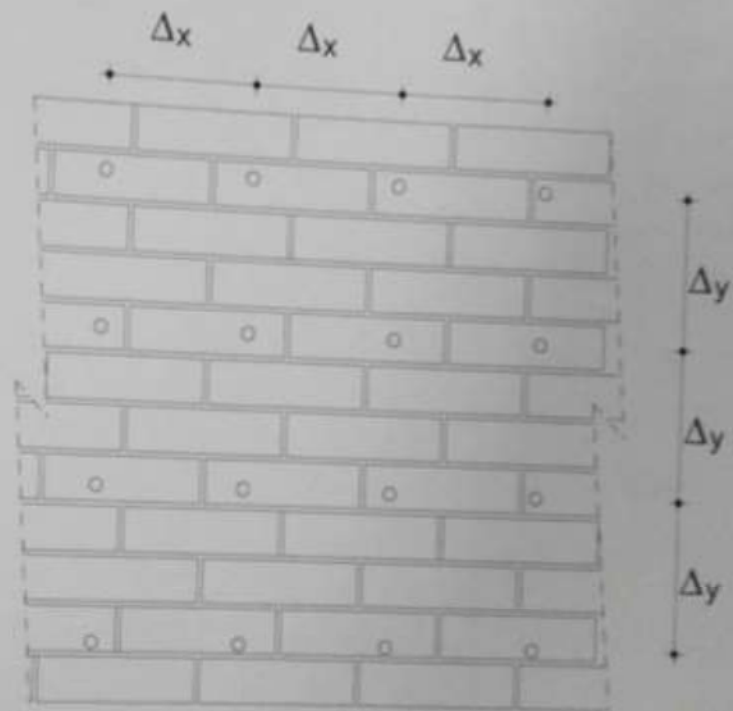
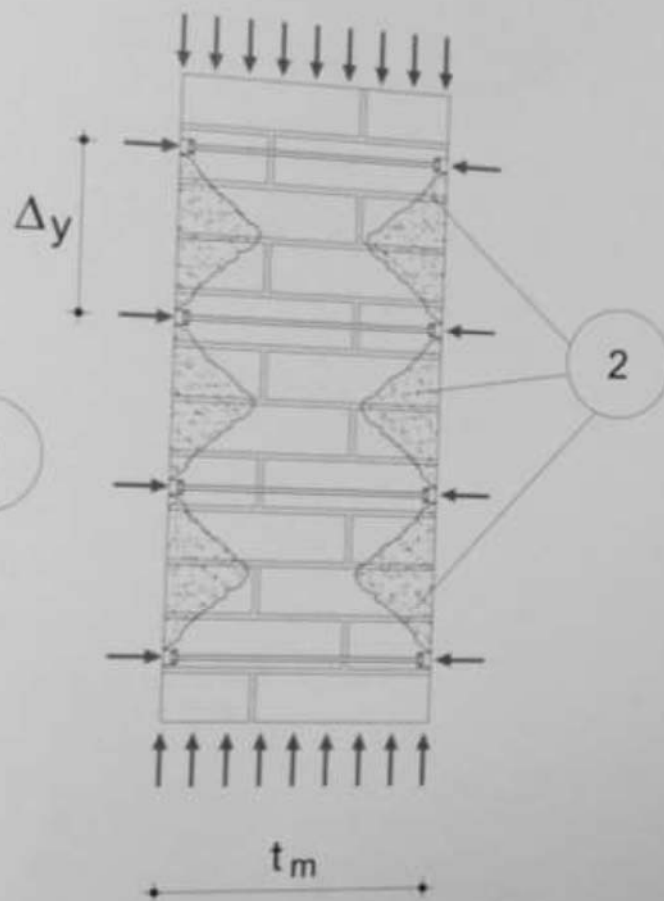


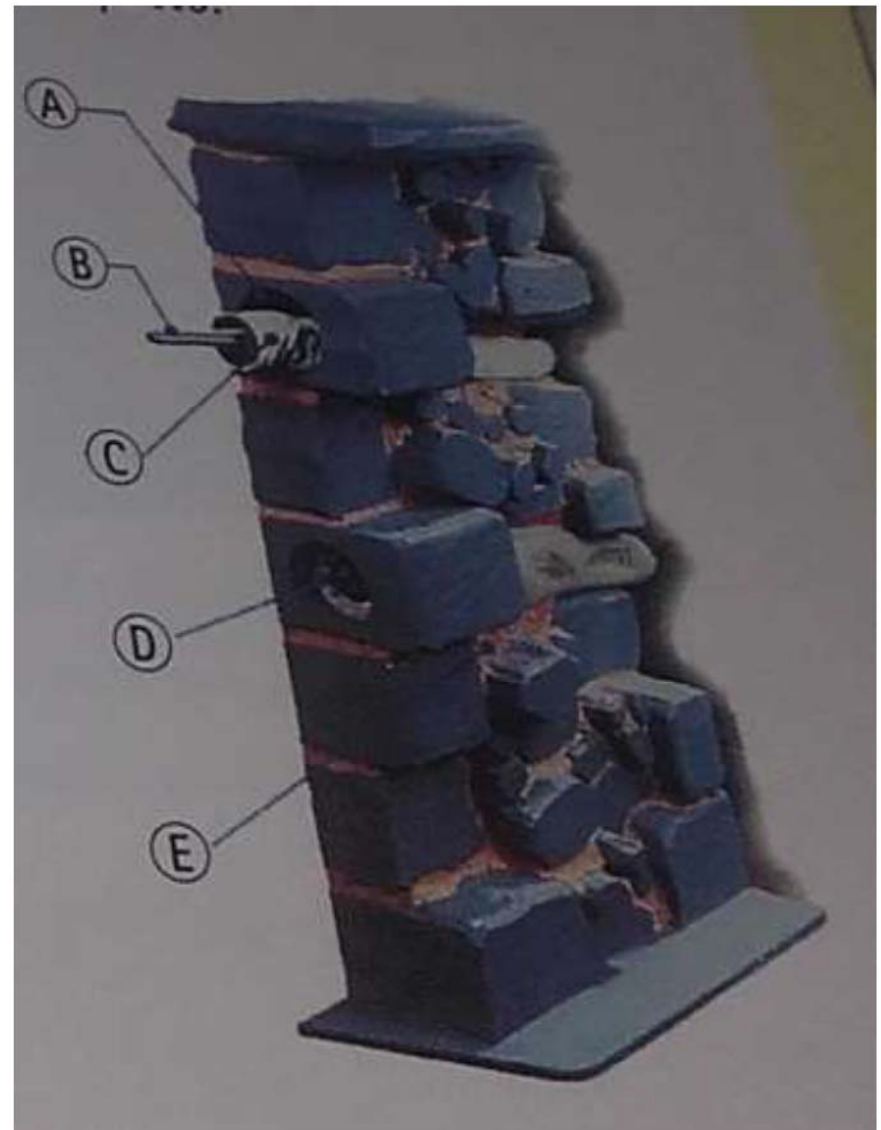
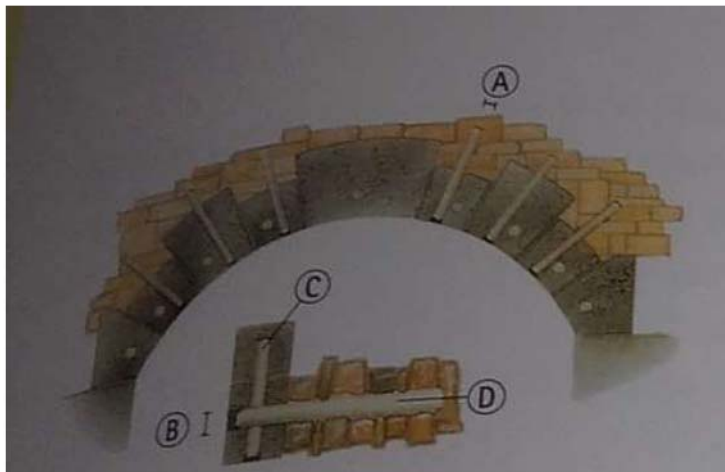
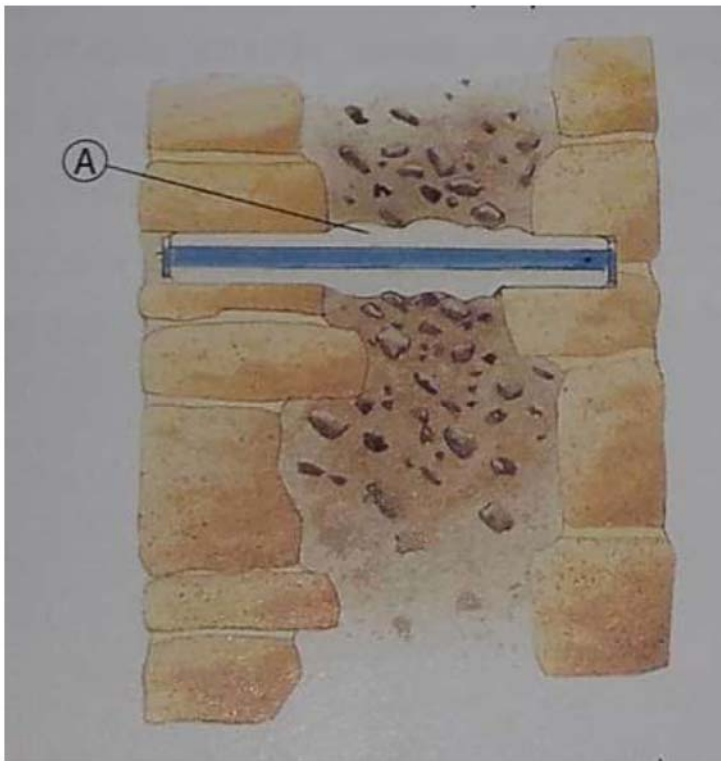
**FIBERS**  
**EXTERNAL REINFORCEMENTS**

a)



b)

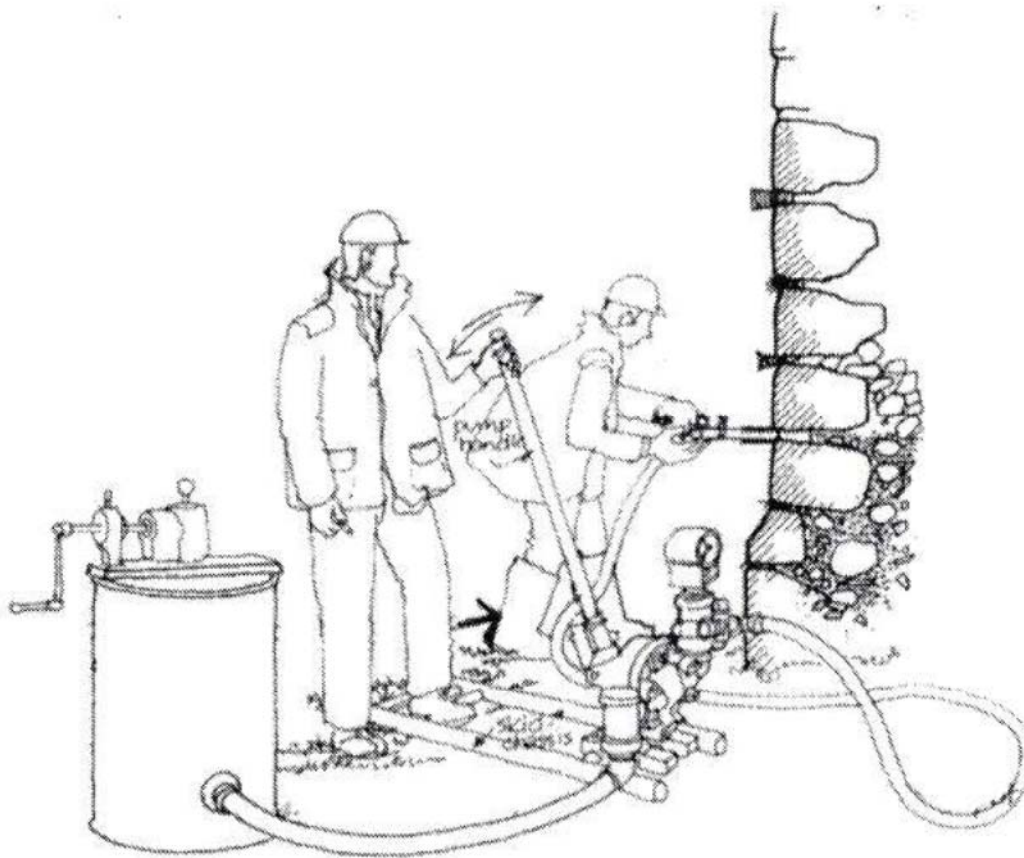




## ANCHORING EXTERNAL REINFORCEMENTS

Anchors for masonry consolidation





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

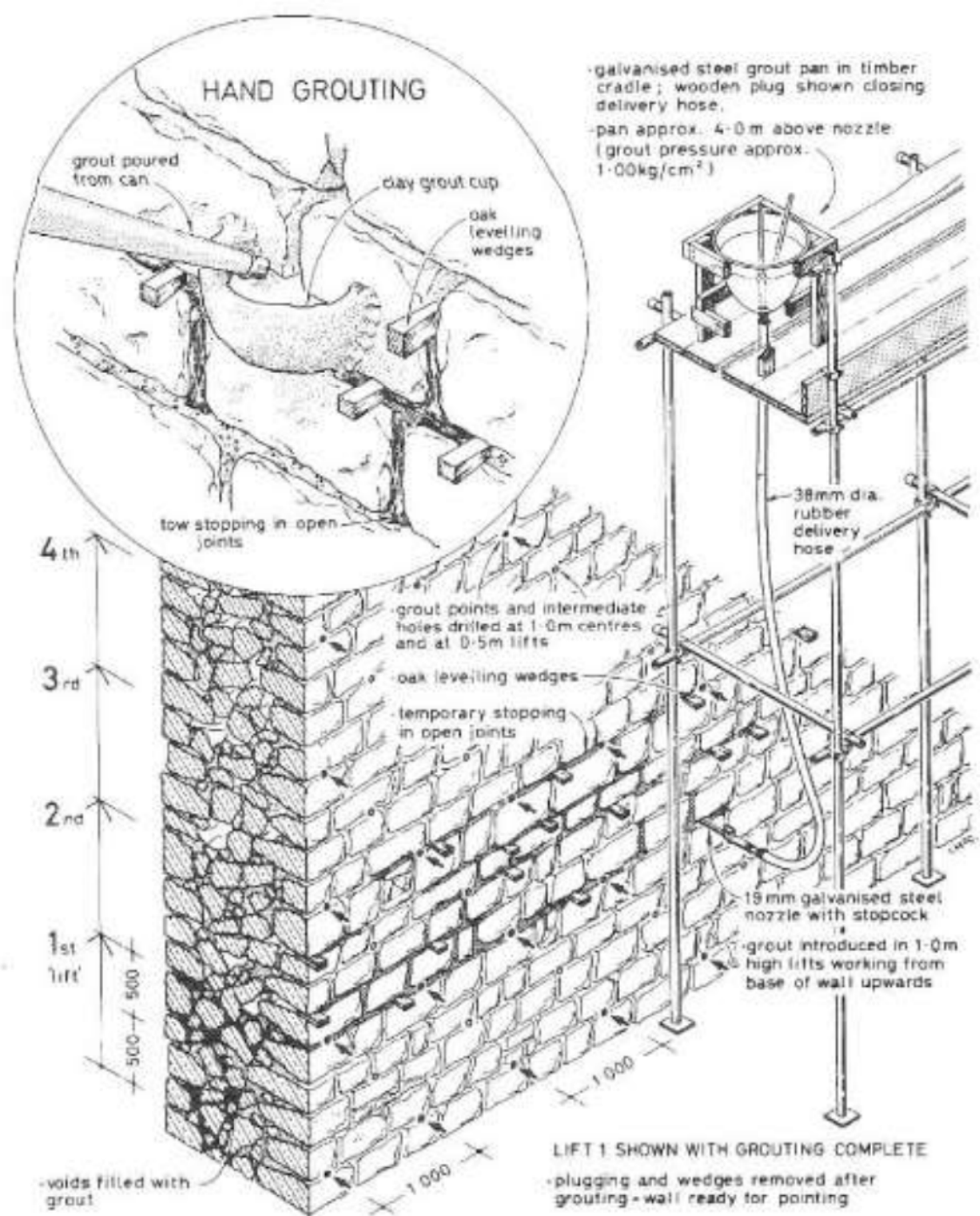
The technique consists in the injection of a liquid consistency mortar, in order to fill gaps and fissures, returning the mechanical capacity to the foundation.

- BY GRAVITY
- BY PRESSURE
- REINFORCED

06 WALLS III  
SOLUTIONS  
**INJECTIONS**

# INJECTIONS BY GRAVITY

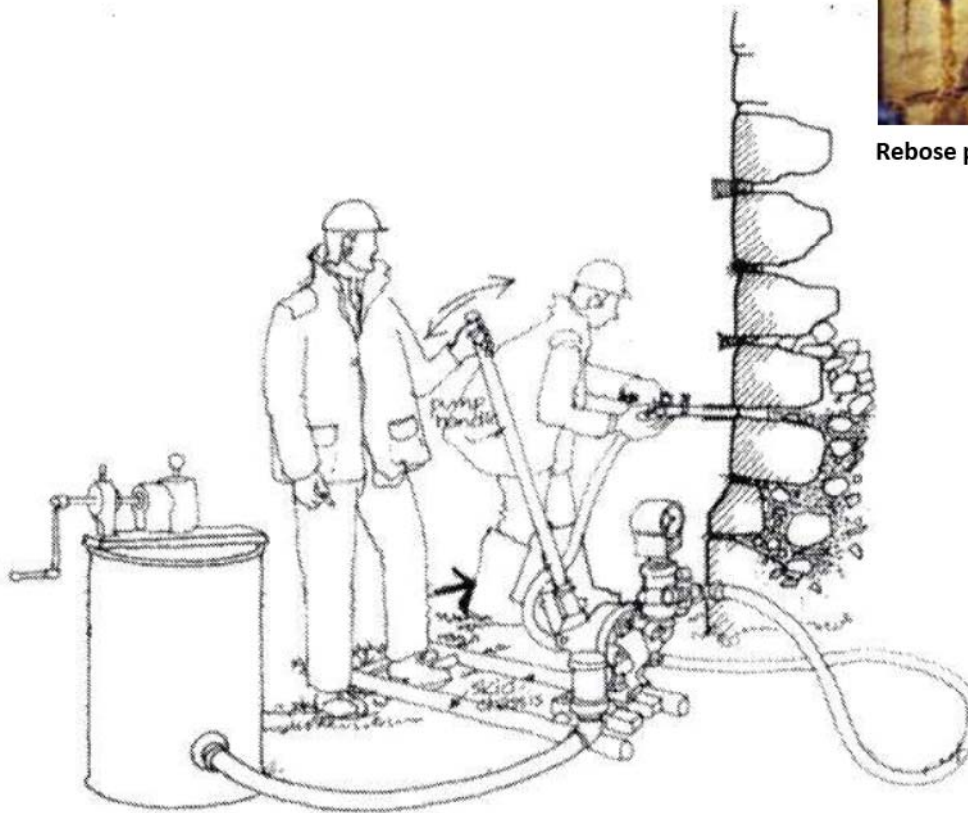
- Injection control
- Grout density
- Washing inner leaf



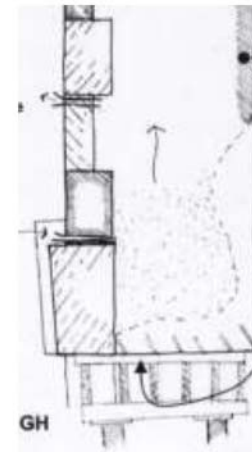
# INJECTIONS BY PRESSURE



Rebose por orificios superiores

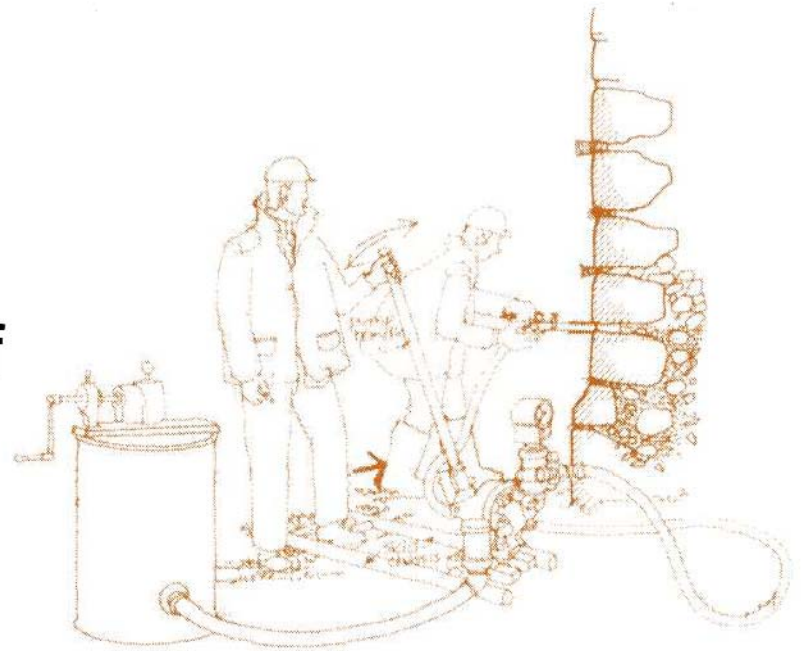


Desde la parte  
inferior

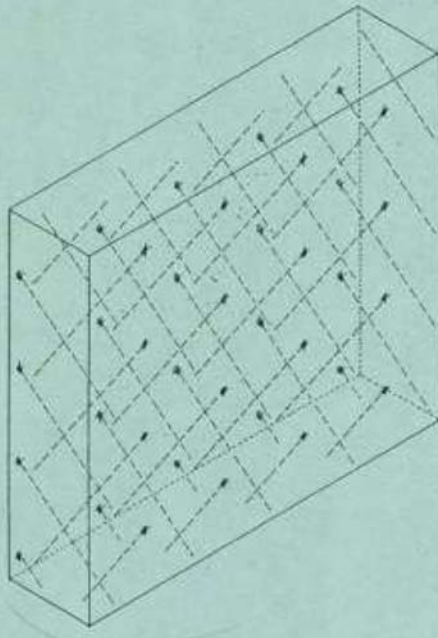
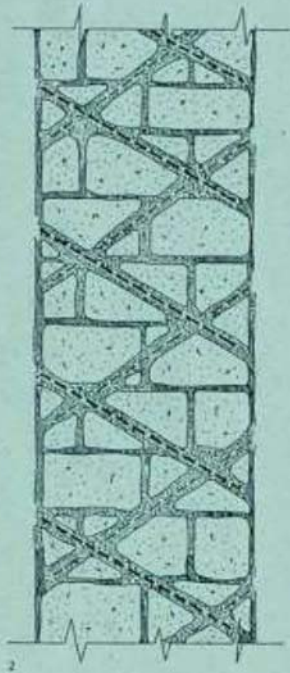


# INJECTIONS **BY PRESSURE**

- Constructive system
- Pressure
- Injection control
- Grout density
- Washing inner leaf



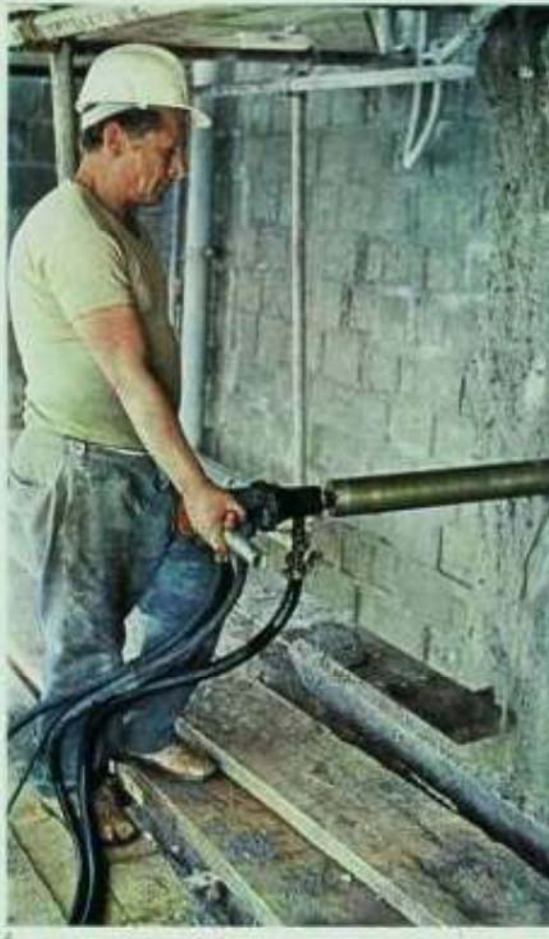




## MATERIALS

- Stainless steel
- Vitro/resin bars
- Synthetic resin bars
- Carbon fibers
- Polymeric fiber
- Synthetic ropes

INJECTIONS  
**REINFORCED**



## PROBLEMS

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

INJECTIONS  
**REINFORCED**





Technique that allows aesthetically integrate a work completing its losses. To reduce the visual impact of damage and lacunae on a work, thus increasing its artistic and iconographic legibility. Should be clearly distinguishable when viewed at close proximity. Materials to be employed should be compatible with the original and reversible. A distinction is to be drawn between lacunae that can be reconstructed and those that cannot, as they require different methods of reintegration.

## 06 WALLS III

### SOLUTIONS

# REINTEGRATION



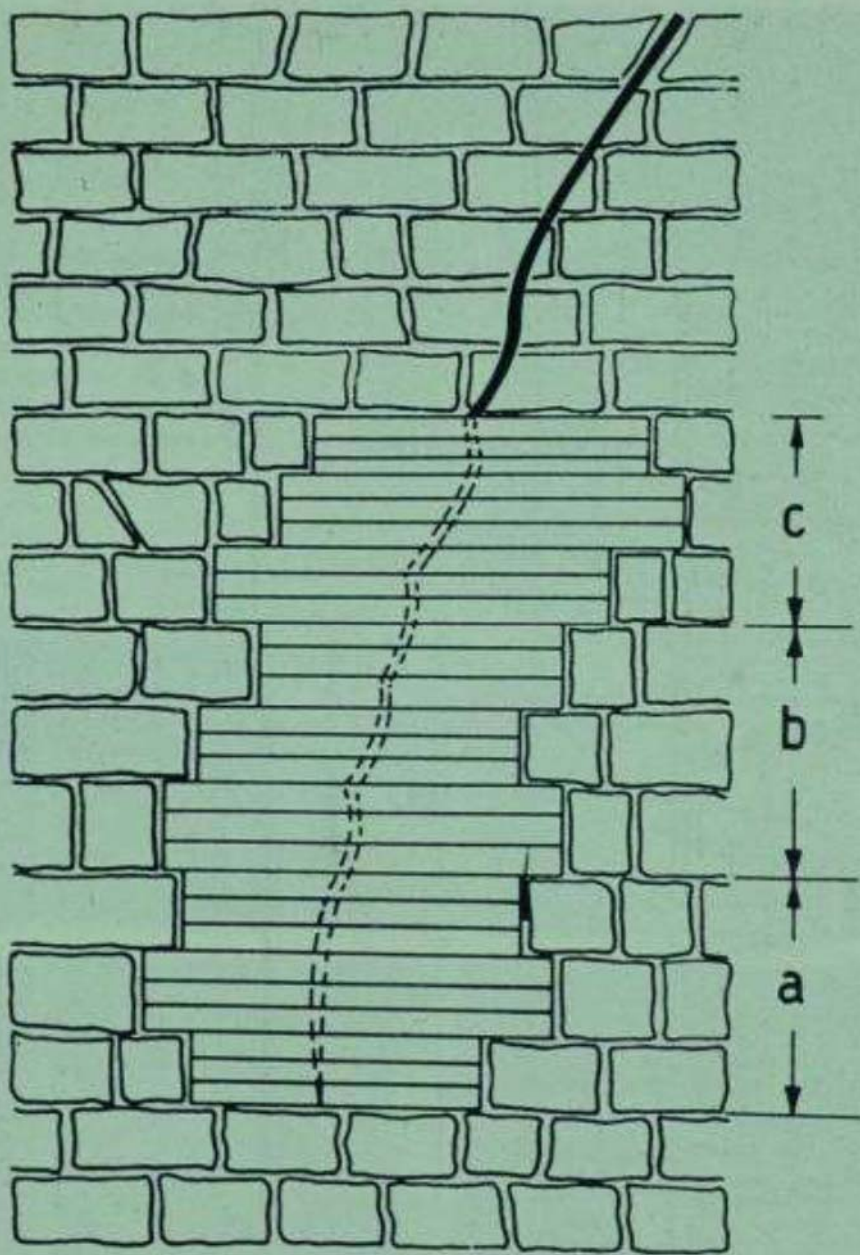


**SIMILAR MATERIAL  
REINTEGRATION**





**DIFFERENT MATERIAL  
REINTEGRATION**



***CUCCI-SCUCCI***  
REINTEGRATION





Support constructions or parts  
of constructions in order to  
structurally stabilize and  
transfer loads to the ground.

## 06 WALLS III SOLUTIONS **SHORING**



Placement of pieces and/or elements demolished in the place that originally occupied.

Can help with metallic elements, buttress, etc. or from another neutral material to place them.

## 06 WALLS III SOLUTIONS **ANASTYLOSIS**





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