Sustainable Urban Rehabilitation in Europe

Heritage Problems. Causes. Solutions

Erasmus+

Sustainable Urban Rehabilitation in Europe

3rd Semester

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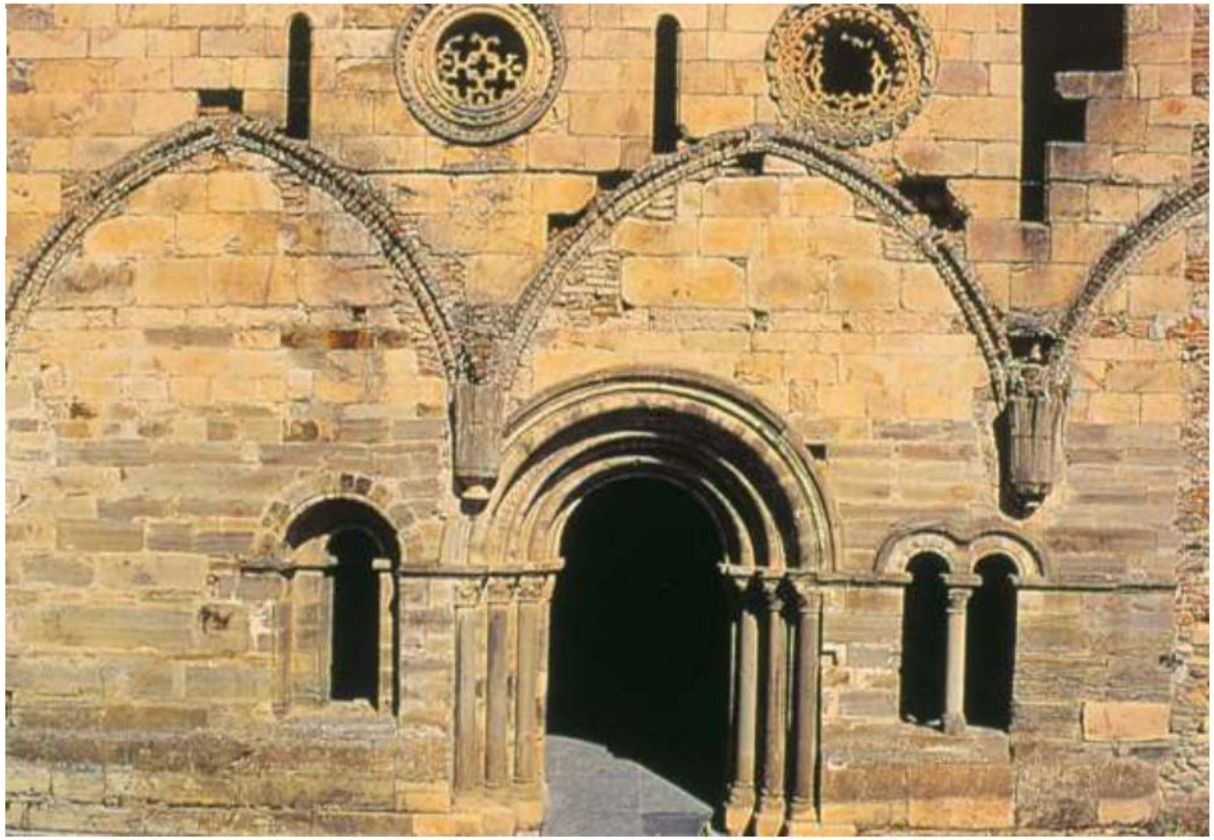
Camila Burgos Vargas

Heritage Problems. Causes. Solutions

3 ECTS

SH
Sustainable Heritage

EC
Elective Courses



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SURE
SUSTAINABLE URBAN REHABILITATION IN EUROPE

UNIVERSIDAD POLITÉCNICA DE MADRID

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

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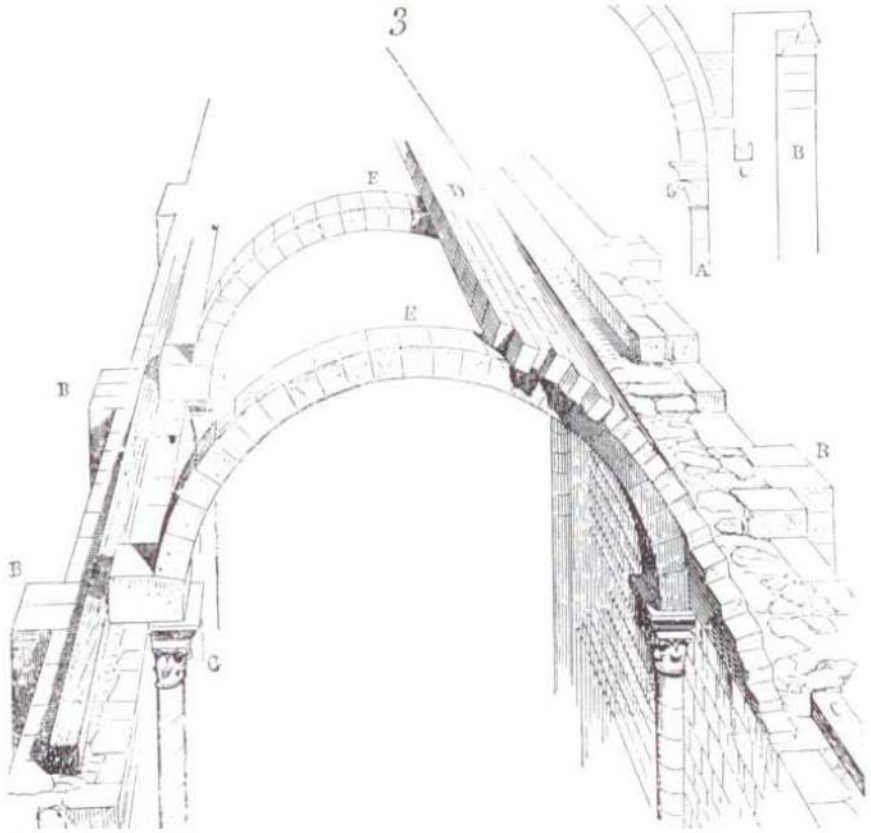


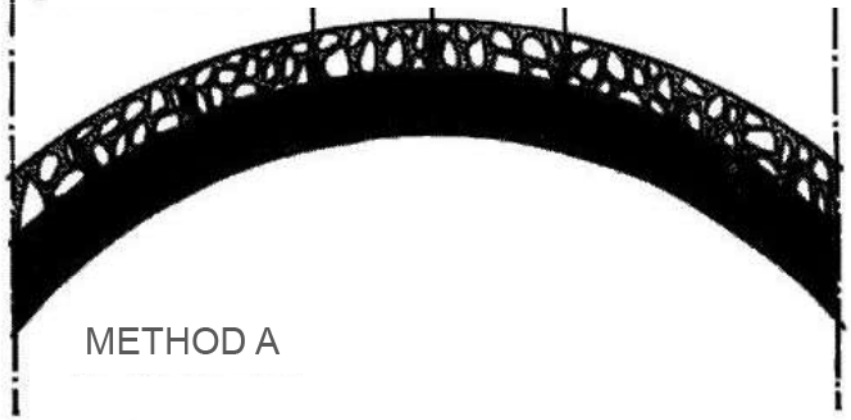
09 VAULTS III:
SOLUTIONS

CONSOLIDATION OF VAULTS

- RECONSTRUCTION OF LACUNAE
- SEALING OF CRACKS
- OVERLAY:
    - UPPER REINFORCEMENT
    - UPPER STRUCTURE
- ANCHORING
- RETURN THE SHAPE TO THE VAULT
- SHORING

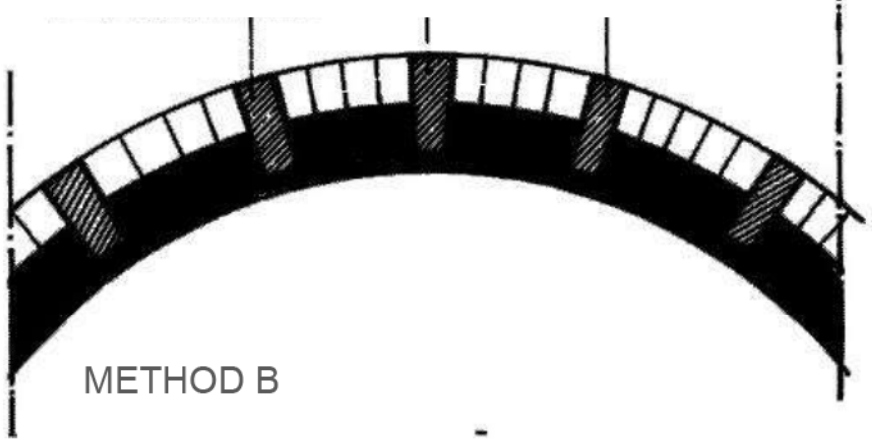
SEALING OF CRACKS

ITEMS INSERTED BY FORCE (wedges, etc.)



METHOD A

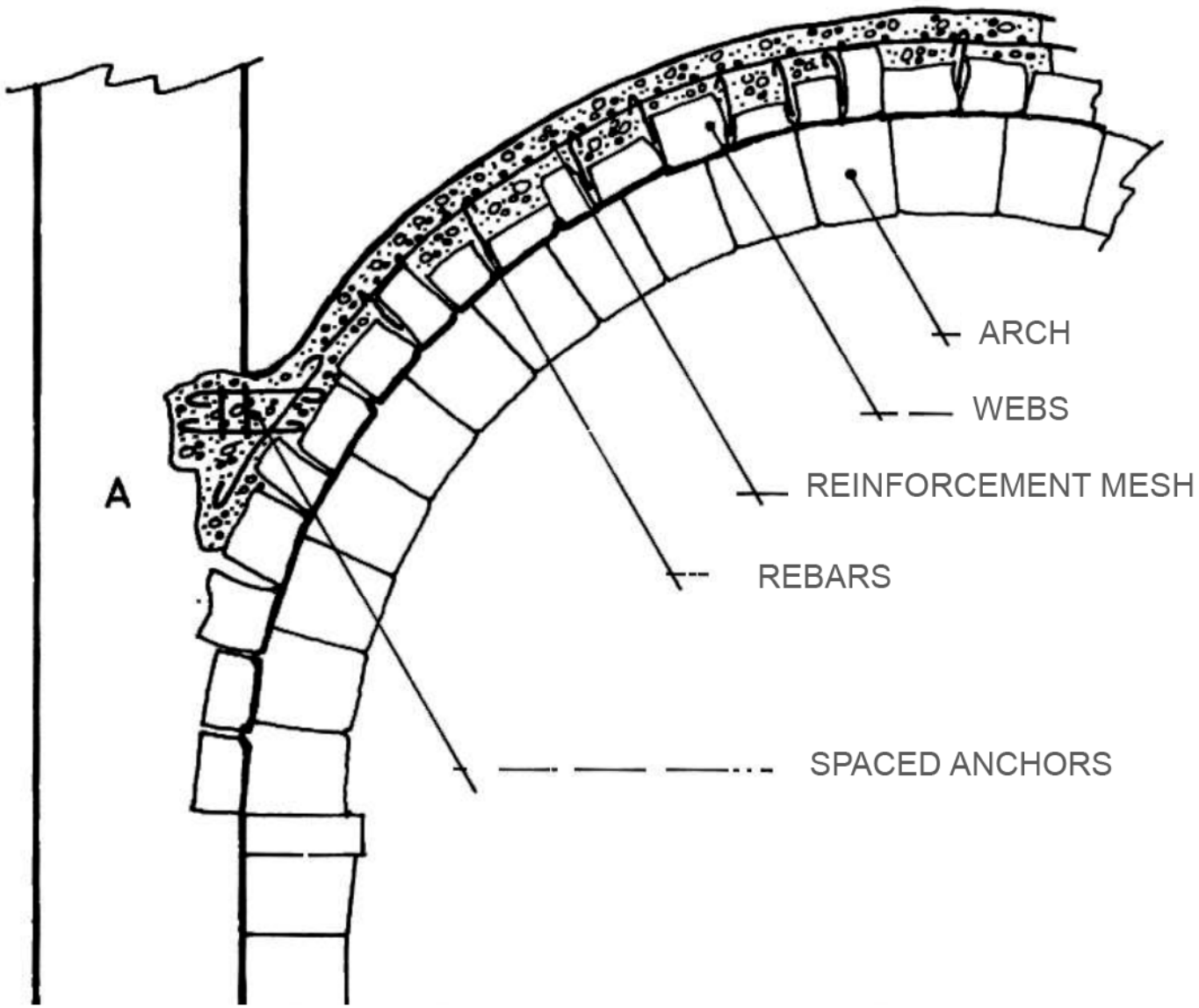
ASHLARS OUTSIDE FROM THE EXTRADOS LINE



METHOD B

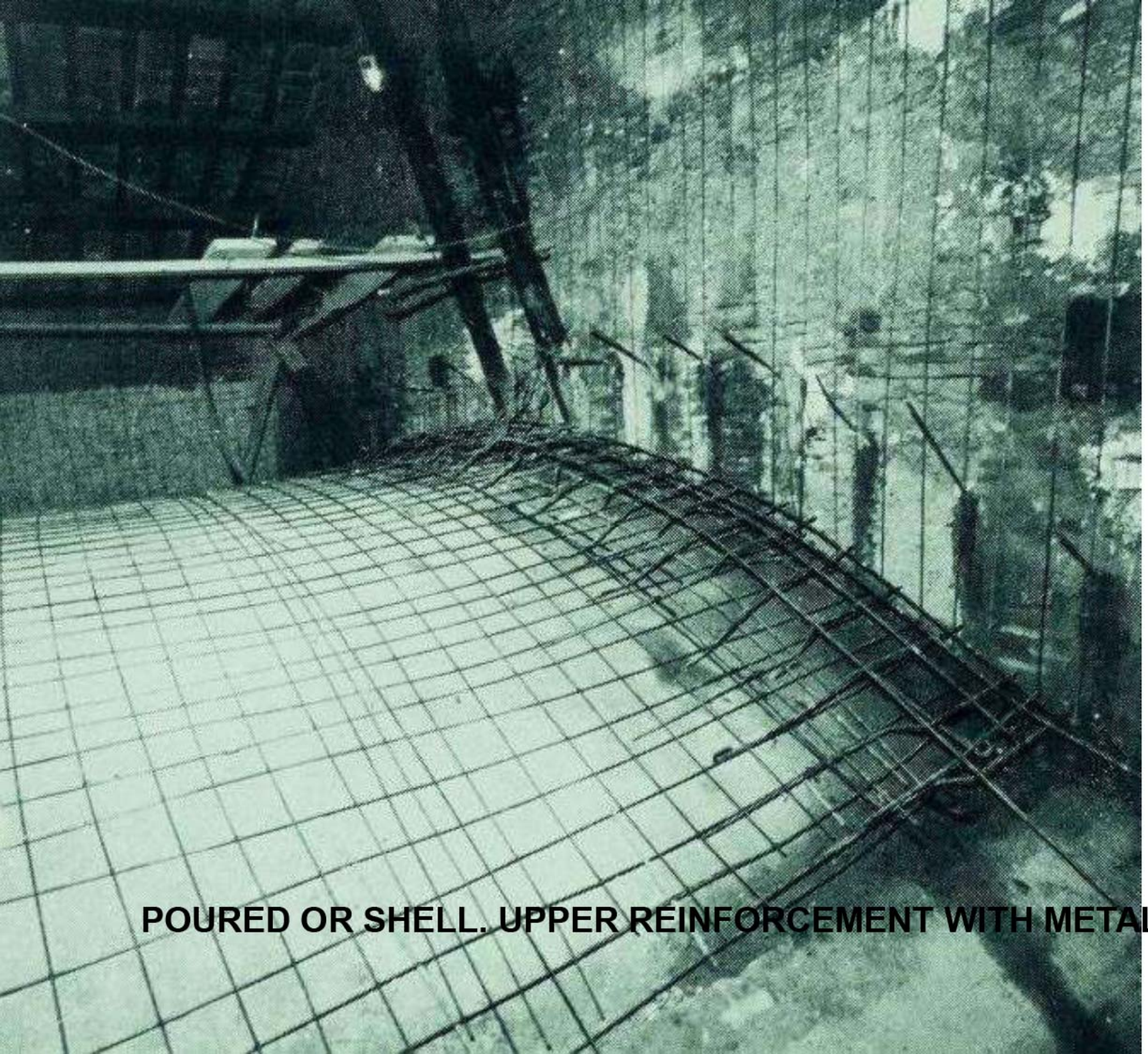
POURED OR SHELL

OVERLAY. UPPER REINFORCEMENT



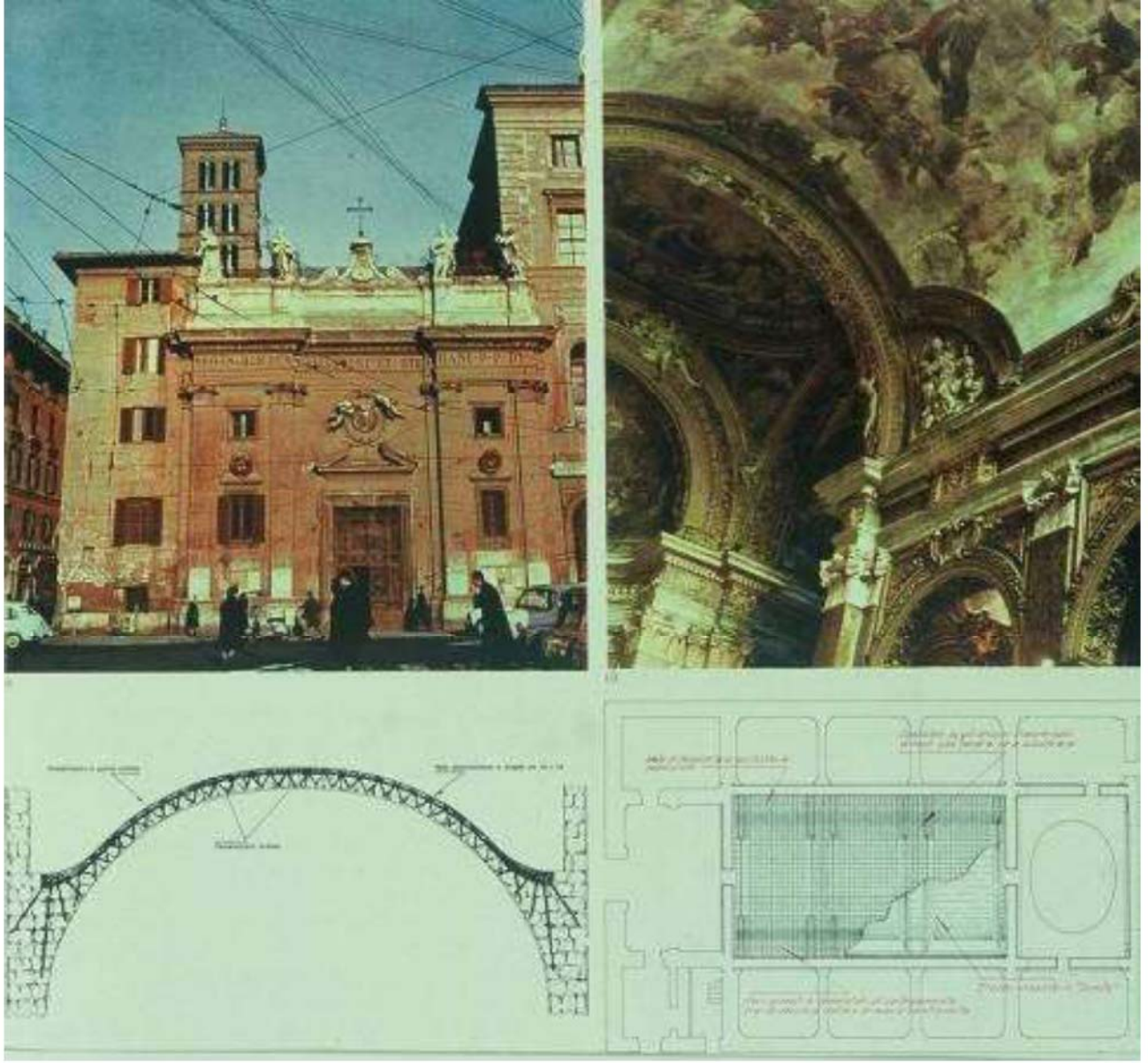
UPPER REINFORCEMENT WITH METALLIC / GLASS FIBER FRAME

OVERLAY. POURED OR SHELL



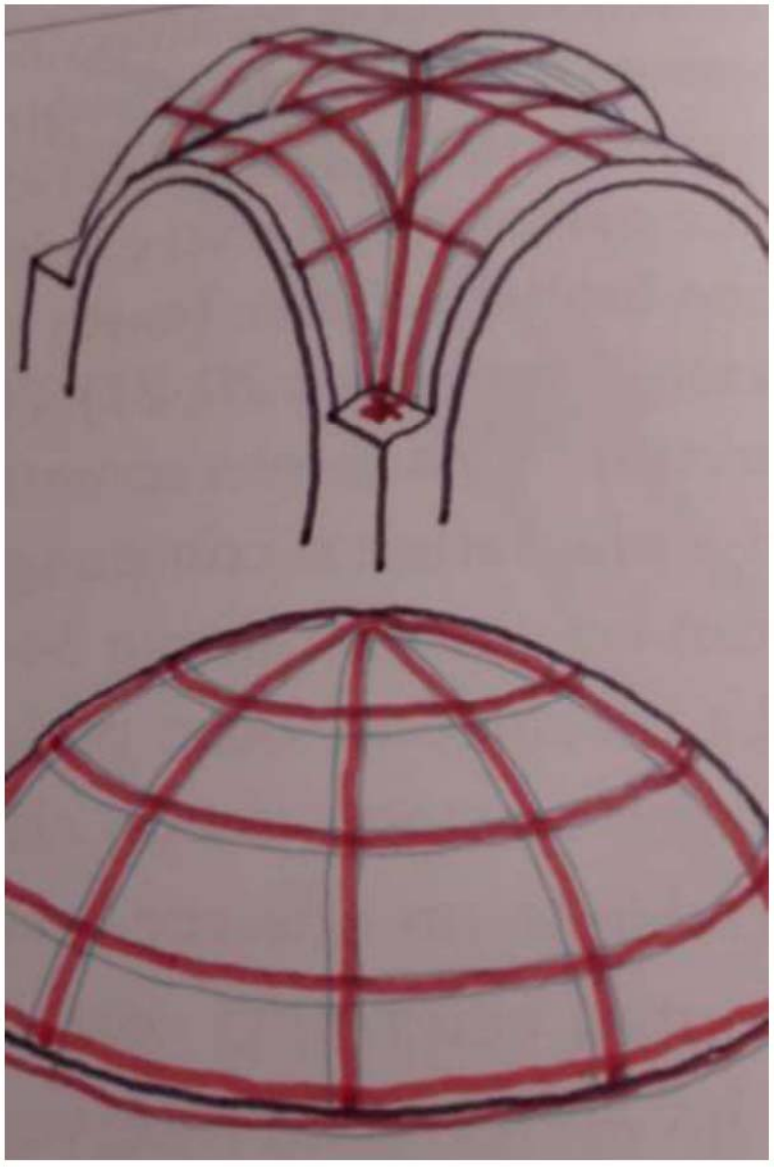
POURED OR SHELL. UPPER REINFORCEMENT WITH METALLIC FRAME

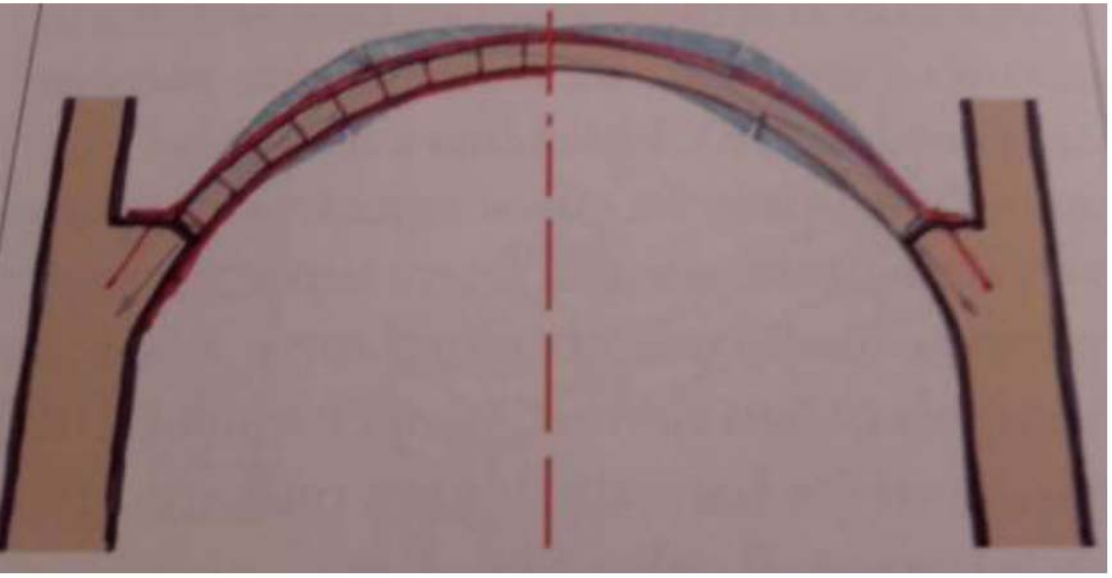
OVERLAY



POURED OR SHELL. UPPER REINFORCEMENT WITH METALLIC FRAME

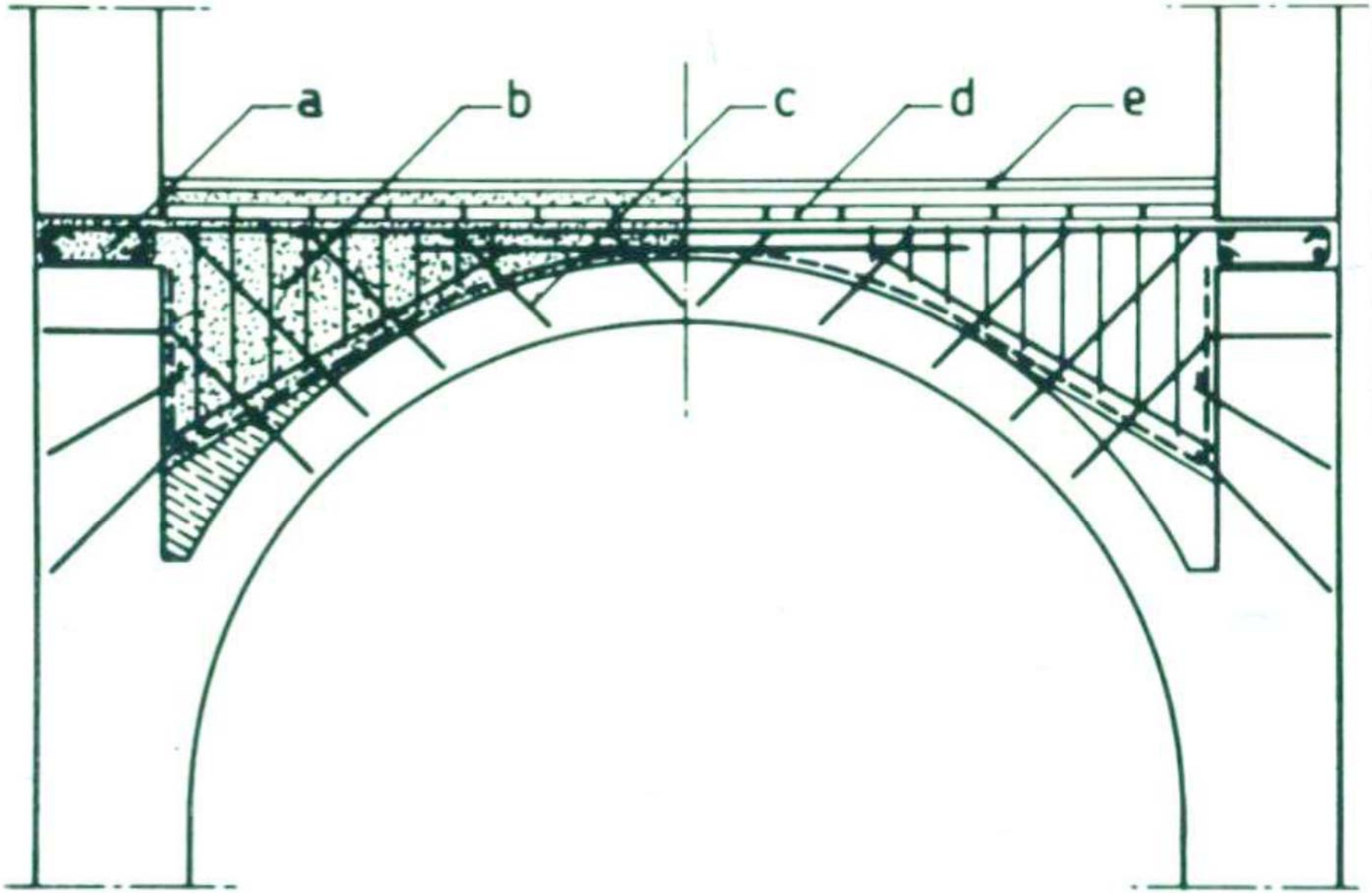
OVERLAY





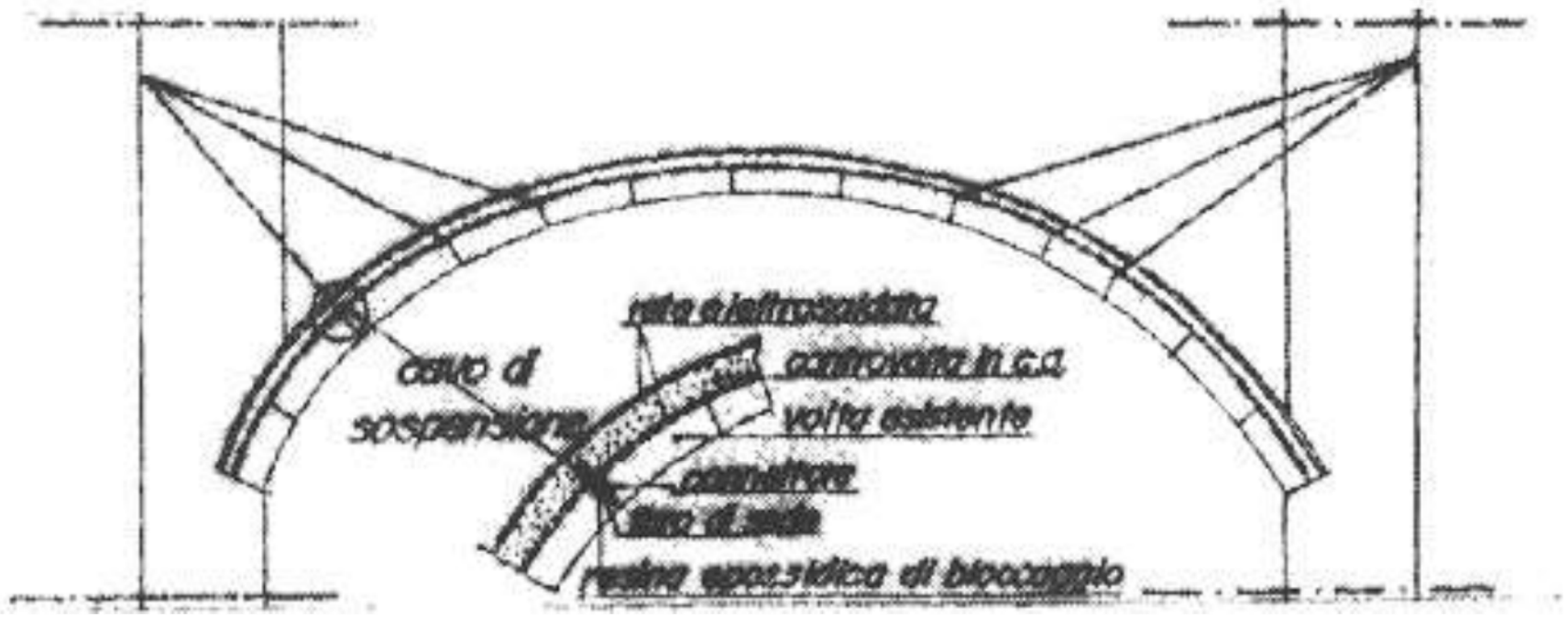
CARBON FIBERS

UPPER REINFORCEMENT



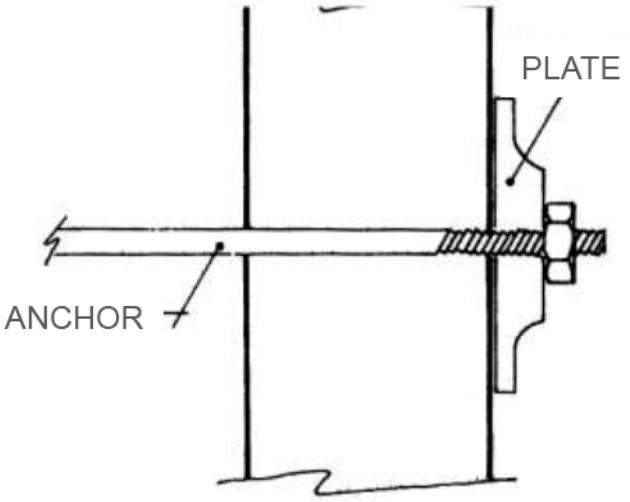
UPPER STRUCTURE

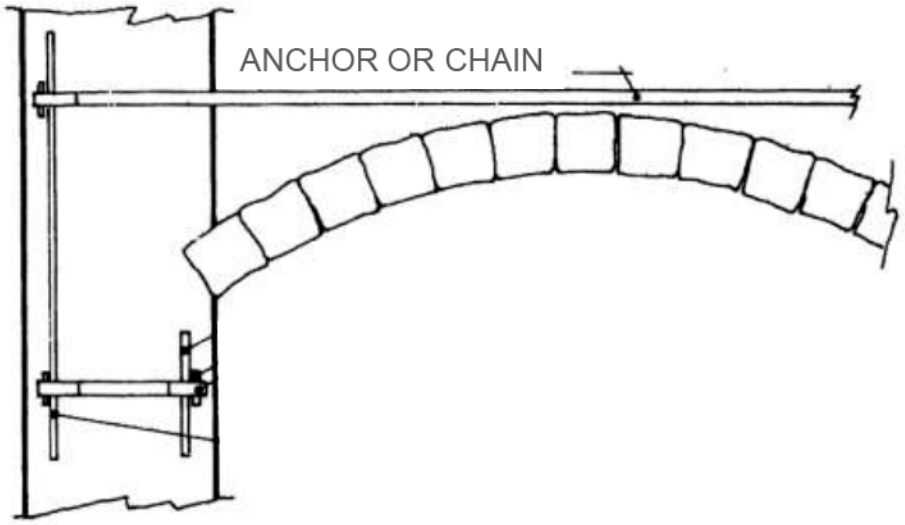
OVERLAY

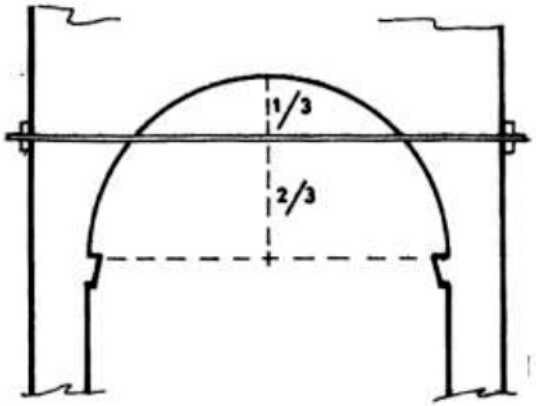


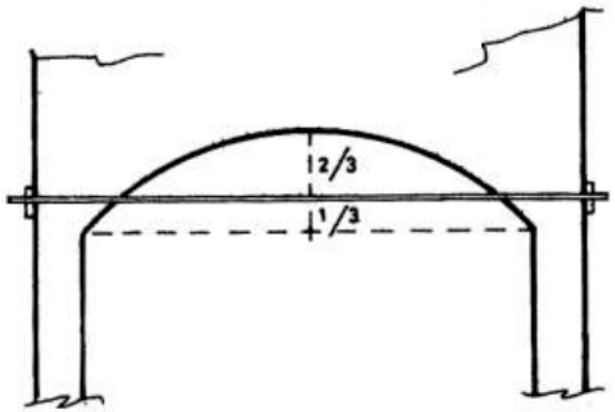
UPPER STRUCTURE. HANGING

OVERLAY

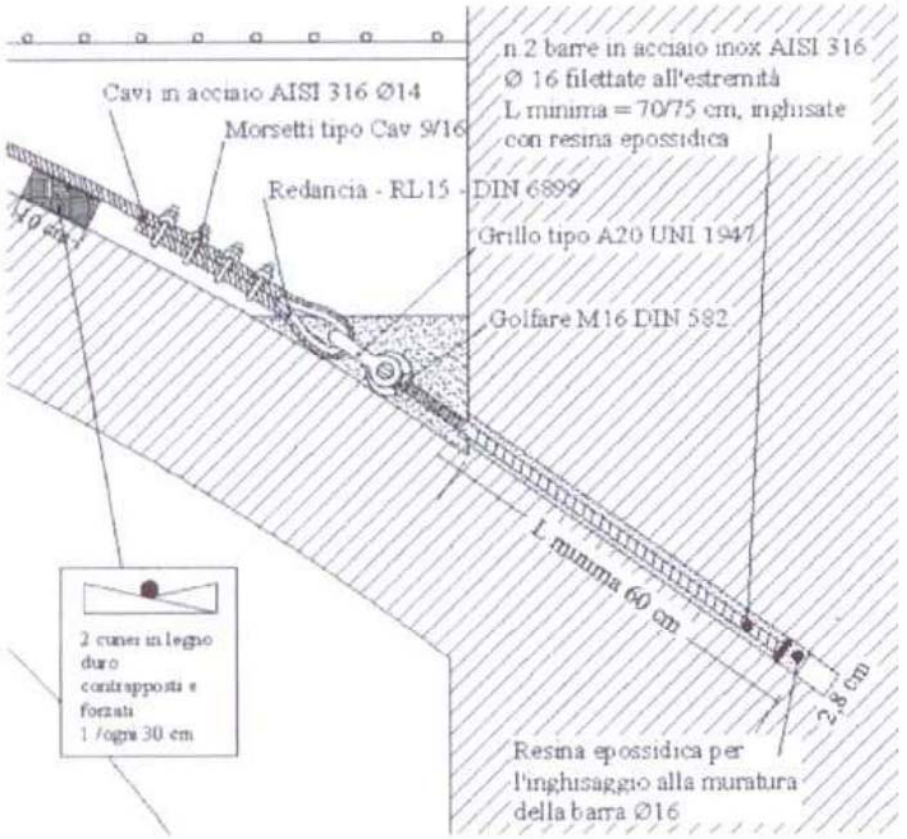








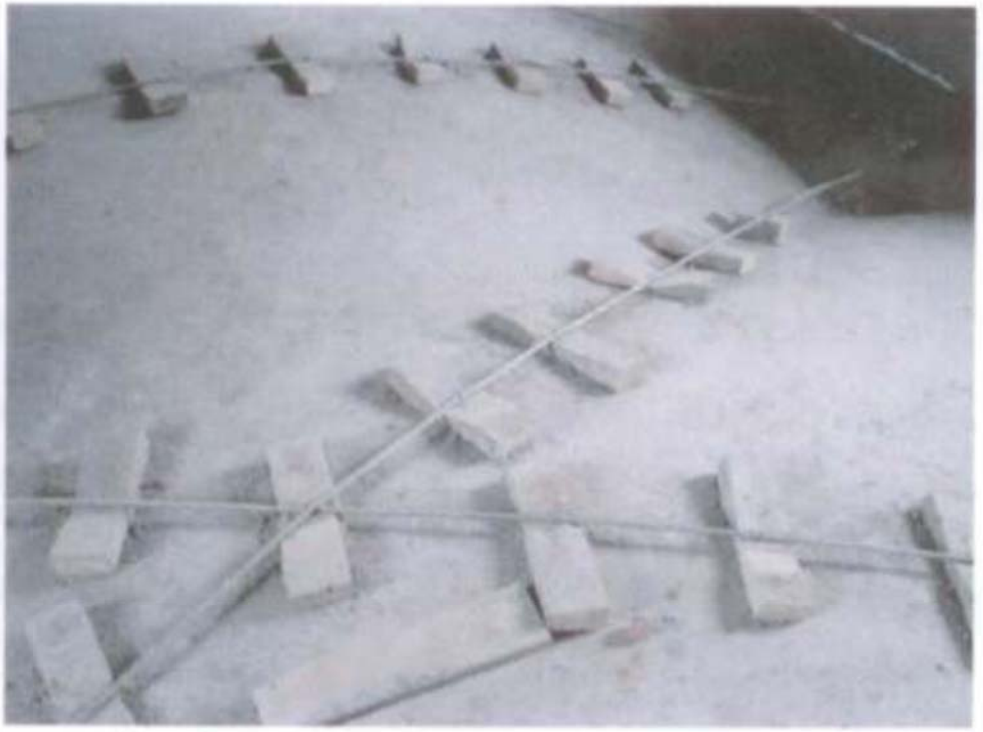
ANCHORING



Castello Mediceo. Intervention carried out by Lorenzo Jurina using the “reinforced arch” method, applied to the extrados of the vault. Details of the anchoring of the ties to the masonry, with post-tensioned by wooden wedges.

“REINFORCED ARCH”

RETURN THE SHAPE TO THE VAULT



Monasterio Olivetano. Intervention carried out by Lorenzo Jurina using the “reinforced arch” method, applied to the extrados of the vault. Details of the anchoring of the tie-rods to the masonry and of a crossing of tie-rods, with post-tensioned by wooden wedges.

“REINFORCED ARCH”

RETURN THE SHAPE TO THE VAULT

THE "REINFORCED ARCH METHOD": A NEW TECHNIQUE IN STATIC CONSOLIDATION OF ARCHES AND VAULTS

Lorenzo Jurina
Politecnico di Milano, Italy
www.jurina.it

Abstract

The principles of a new technique developed by the author for structural consol
arches and vaults, called "Reinforced Arch Method", are illustrated along with
scale experimental tests carried out and some applications in conservation int
Technological and structural aspects are illustrated in relation to some recent applications.

Introduction

The current debate about restoration and consolidation of historical constructions assumes that an historical building is the primary source of knowledge, a significant testimony in its full complexity. Thus, it is essential to deal with the individual object as a unique, unrepeatable instance, assigning equal value, dignity, importance, and right to protection to all the components of the building and all the material evidence contained in it. Hence, a strengthening project has to be preceded by a scientific diagnostic approach and has to minimise the impact of the intervention, by choosing the most compatible solution with respect to the building's current state, with the aim of preserving it as better is possible.
Therefore, the actual approach to restoration leads to the requirement of new "active" reinforcement technologies, able to work in parallel and in cooperation with the existing structures, and moreover characterized by the fact to be light, durable and possibly removable.
The "reinforced arch method" acts in this direction, by using stainless steel cables as additional consolidation element, thus providing durability and considerable strength with minimum increase of mass. Moreover it represents an easy, quick and quite cheap innovative instrument for remouvable consolidation.
The method was tested with experimental full-scale investigations and a certain number of applications in restoration works were performed. Theoretical investigation and practical aspects could therefore be correlated.

The "reinforced arch method": principal aims and technical aspects

As well known, arches a vaults collapse by a collapse mechanism of four hinges (Figure 1).
The different blocks that form the arch transmit a compression force one to the other, and as long as it stays within a certain "core" of the section, all the stresses across the section will be compressive. If the resultant load moves out the central zone, the voussoirs attempt to separate as they are enable to transmit tensile stresses. Thus the cracked section represents a hinge-point. In other words, the point through which the thrust transmits between the voussoirs approaches one of the side surfaces.
While a three-pin arch is still a statically determinate

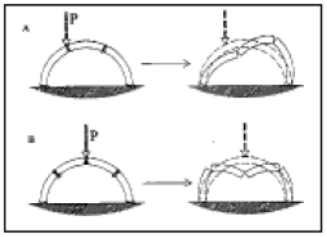
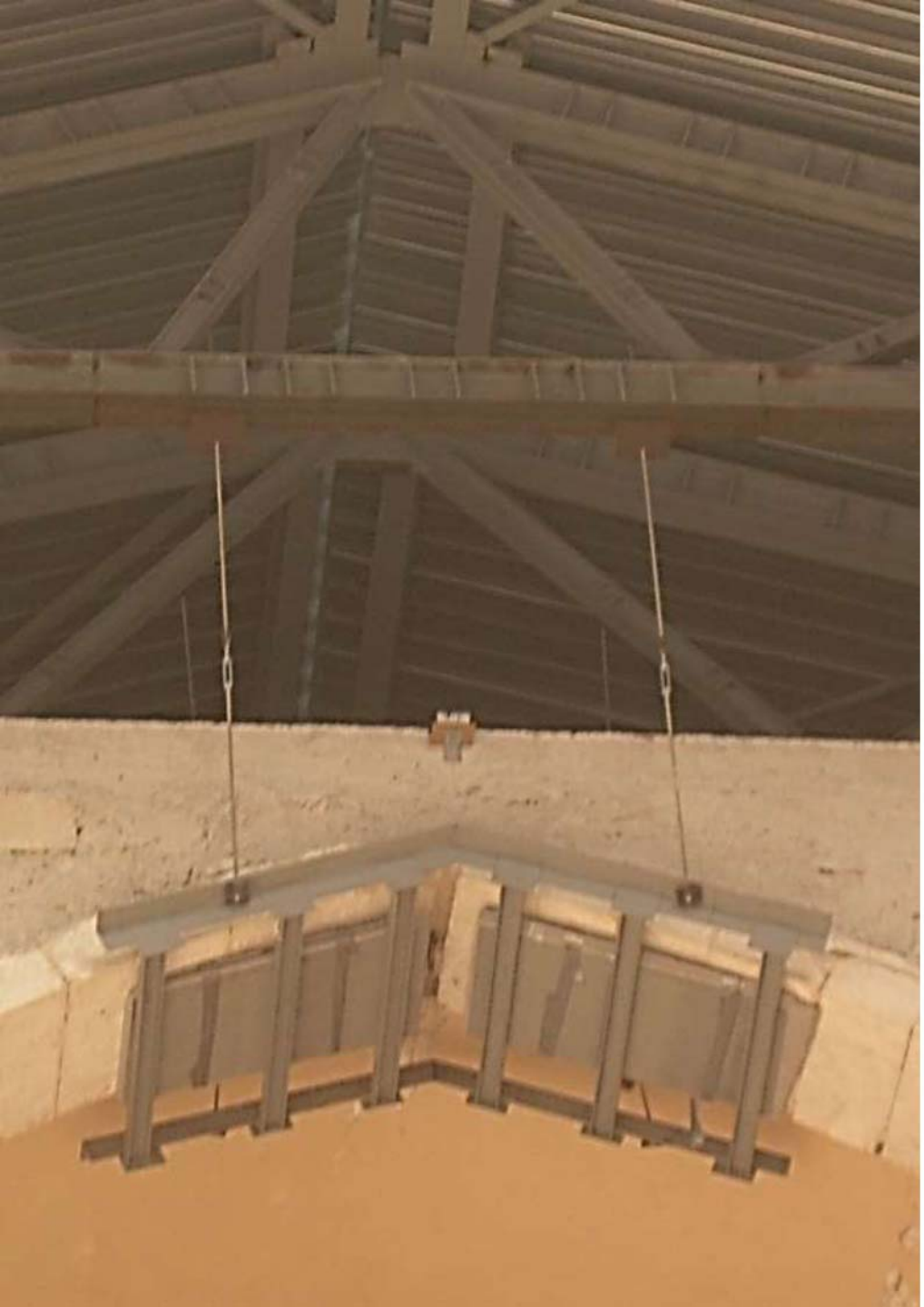


Figure 1

http://www.jurina.it/10/2012/02/2003_The-rinforced-arch-method-a-new-technique-in-static-consolidation.pdf



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

09 VAULTS III
SOLUTIONS
SHORING

SHORING

SHORING

SHORING



**Project "SURE - Sustainable Urban Rehabilitation in Europe"
implemented in frames of Erasmus+ Programme
Key Action 2: Strategic Partnership Projects
Agreement n° 2016-1-PL01-KA203-026232**

This publication has been funded within support from the European Commission.

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Co-funded by the
Erasmus+ Programme
of the European Union