



## *Methodological approach to conservation*



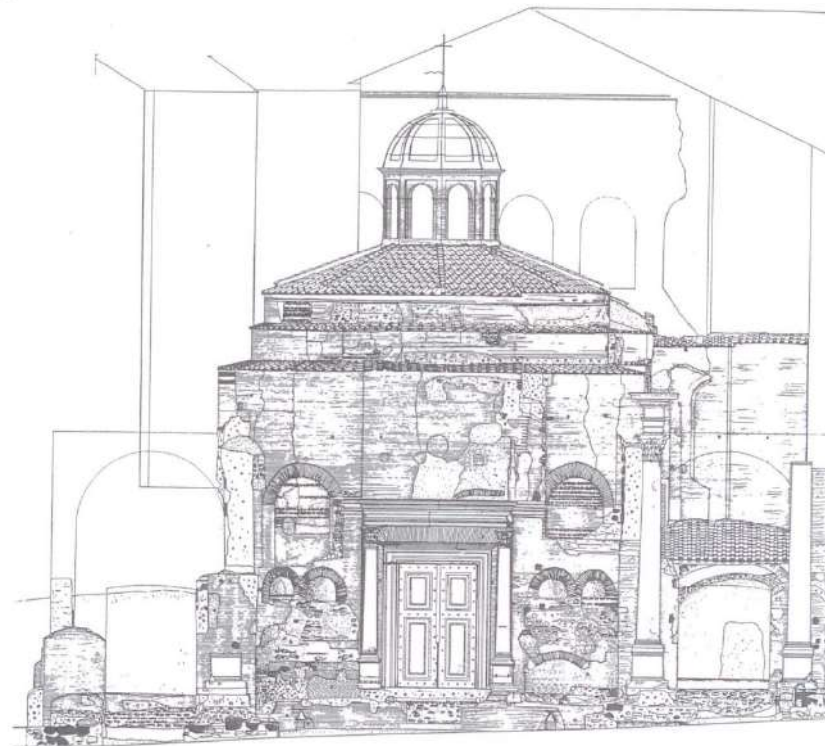
Erasmus+

# Methodological Approach to Conservation: Physical Approach

**2 ECTS**

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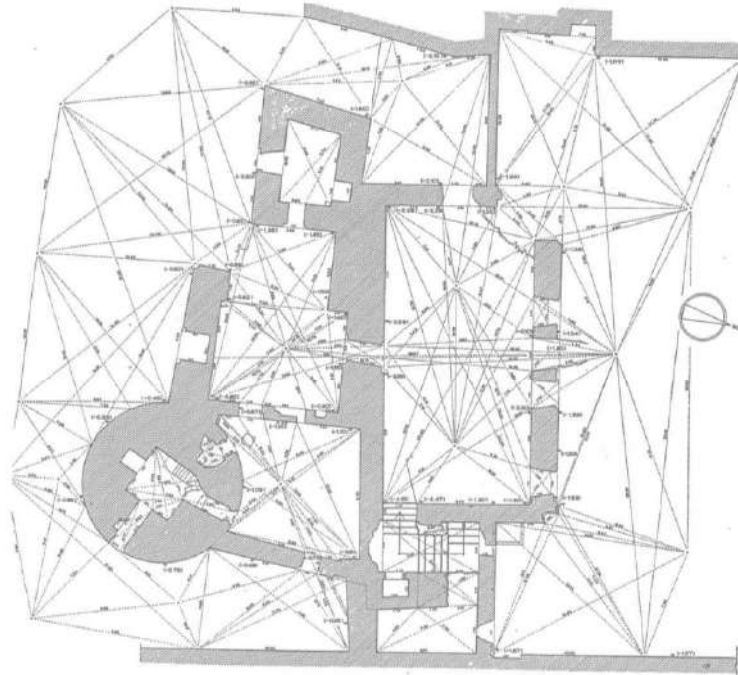
Sustainable Heritage



# Methodological Approach to Conservation: Physical Approach

1. Introduction to Methodological Approach
2. Geometrical Survey
3. **Geometrical Survey: traditional method**
4. Geometrical Survey: new tools
5. Material Survey.
6. Mechanical Survey.
7. Damage maps I: degradation problems
8. Degradation types.
9. Damage maps II: fissure and crack problems
10. Damage maps III: moisture problems
11. Damage tests on masonry constructions I
12. Damage tests on masonry constructions II
13. Survey, maps and tests on wooden construction.
14. Archaeology.
15. Stratigraphy.

# Methodological Approach to Conservation: Physical Approach



## LESSON 03. GEOMETRICAL SURVEY: TRADITIONAL METHOD

# MEASURE METHODS

The measurement systems can be grouped according to the complexity of the instruments used.

**A. Direct or simple methods**

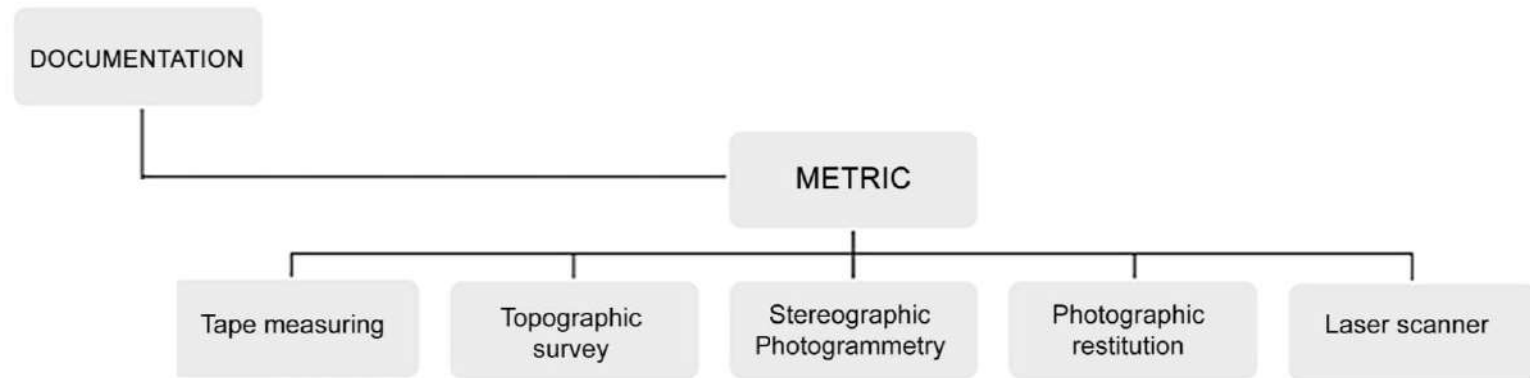
B. Topographic methods

C. Photographic methods

D. Photogrammetric methods

# MEASURE METHODS

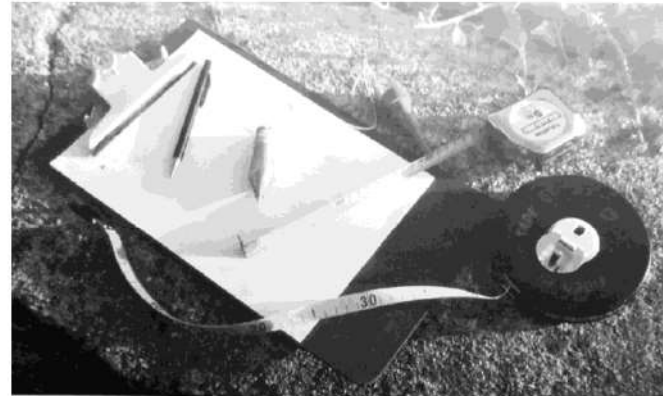
The measurement systems can be grouped according to the complexity of the instruments used.



A. DIRECT OR SIMPLE METHOD  
TRADITIONAL SURVEY

## SIMPLE METHOD

The measurement systems can be grouped according to the complexity of the instruments used. In the first place we would have the simplest instruments and among them the tape measure, the plumb line and the level.



Paper, pencil and measuring tape



Water level



## SIMPLE METHOD: DIRECT AND DIFFERED METHOD

In the simple surveys there are two types:

- **Direct survey**

Direct survey that is carried out in the place and that does not require further elaboration than in any case the putting in clean of the drawing.

It usually requires the placement of auxiliary elements of reference, such as strings arranged in grids for the drawing of the plants or plumb lines with marks at fixed intervals in the elevations.

- **Deferred survey.**

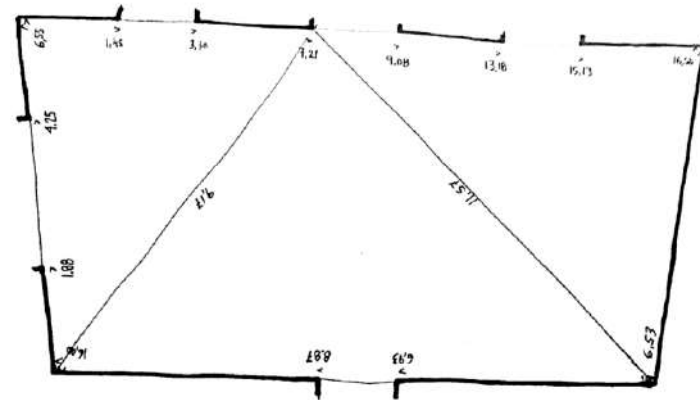
In most of the architectural survey work carried out with simple instruments, the deferred survey method is used. That is to say, the necessary data are taken in the place with which later, in the office or study, the drawings are elaborated; therefore, far from the building or object.



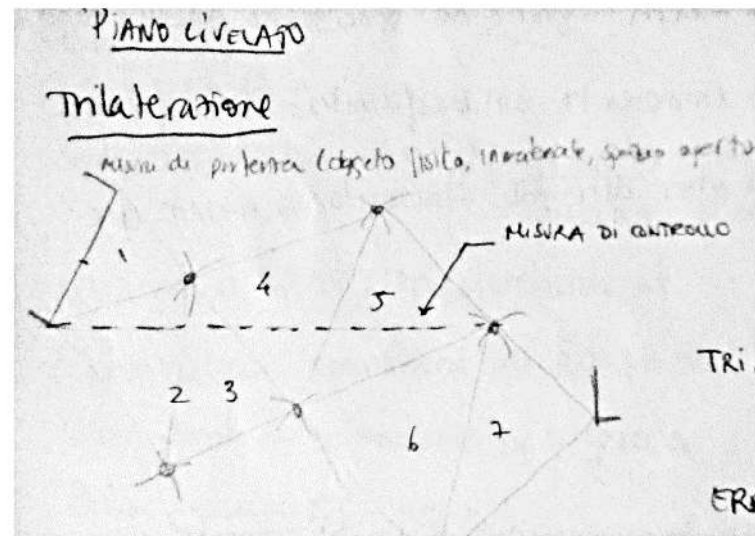
Direct measuring work in place

# SIMPLE METHOD: TRILLATERATION

The basis of this method is always the trilateration or measurement of the sides of triangles. This method starts from the principle that the triangle is the only flat figure geometrically definable univocally with the single measurement of its sides and without needing to know the measure of its angles. If we know the three sides of a triangle, your solution is unique; There is only one correct solution.



CHAIN TRILATERATION:  
Set the control points  
Triangulation of the plant  
Establish control measures  
Taking system measurements  
Elaboration of sketches



## SIMPLE METHOD: MEASURE RULES

Golden rules of all measurement with tape The trilateration.

1. Every linear measurement that we take must always correspond to the side of a triangle from which we will have to measure three sides. The other more complex geometric shapes must be decomposed to triangular shapes.
2. The triangles must be arranged so that their dimensions are the maximum possible, as long as they can be measured with the instrument with which we have. At the same time, they should approximate equilateral triangles, since triangles with very unequal sides generate higher position errors of their vertices.
3. Although it is always convenient that there is redundancy in the measurements, it is also not advisable to multiply the number of triangles, as this produces a greater complication in the realization of the drawing.
4. The measurement by triangulation makes it possible to establish respect for the irregularity of the object, for which reason we must reject any presupposition of regularity, orthogonality or symmetry.
5. Special care must be taken in that the vertices are always measured in the same place, since the existence of small crashes may cause errors.

## SIMPLE METHOD: MEASURE RULES

Another rule to apply in this method is that all the measures to be taken in the same direction must be taken from a common origin and never as the sum of several partial measurements. In this way, the accumulation of small errors in the reading of the tape is avoided, as well as the fact that a partial measurement with a gross error influences the determination of all the elements that follow.

# SIMPLE METHOD: MEASURE RULES

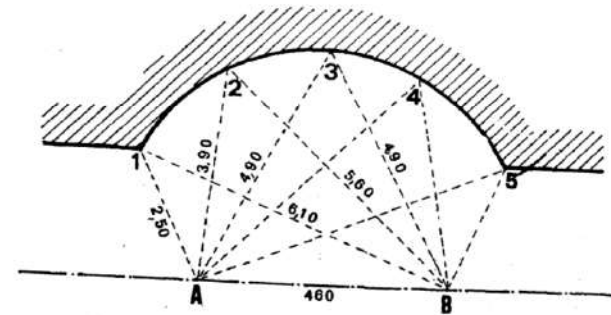
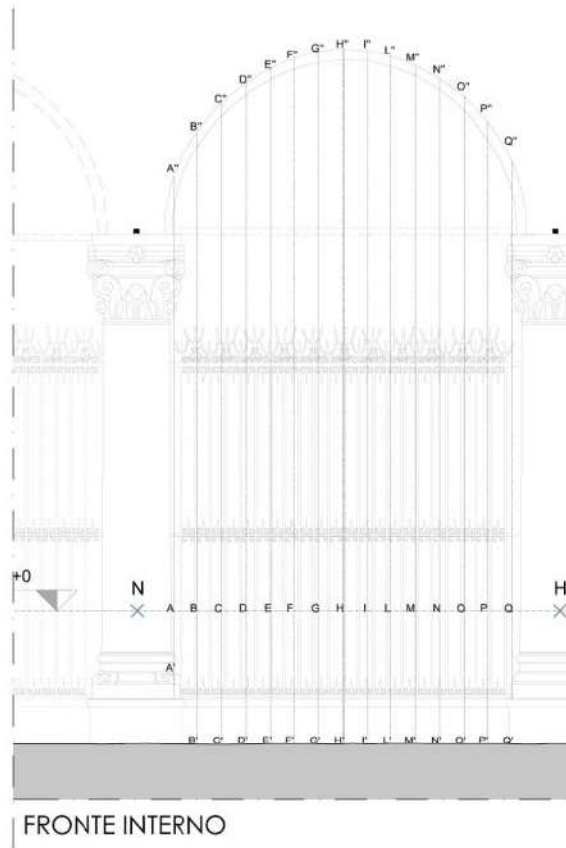


Fig. 7. Medición de formas curvas por trilateración (Ducci-Maestri).

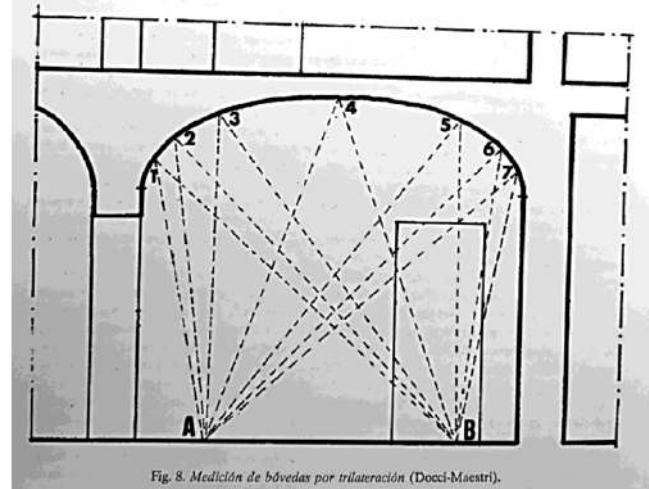
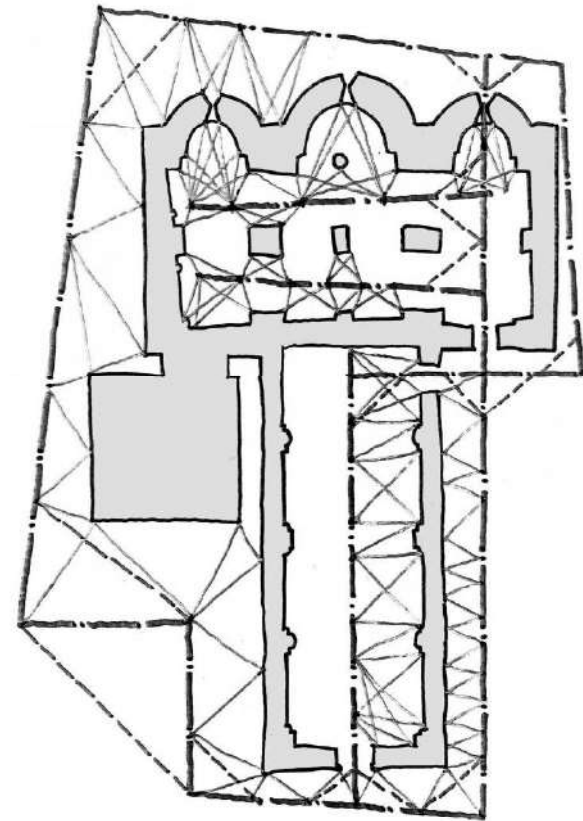


Fig. 8. Medición de bóvedas por trilateración (Ducci-Maestri).

## SIMPLE METHOD: SKETCHES

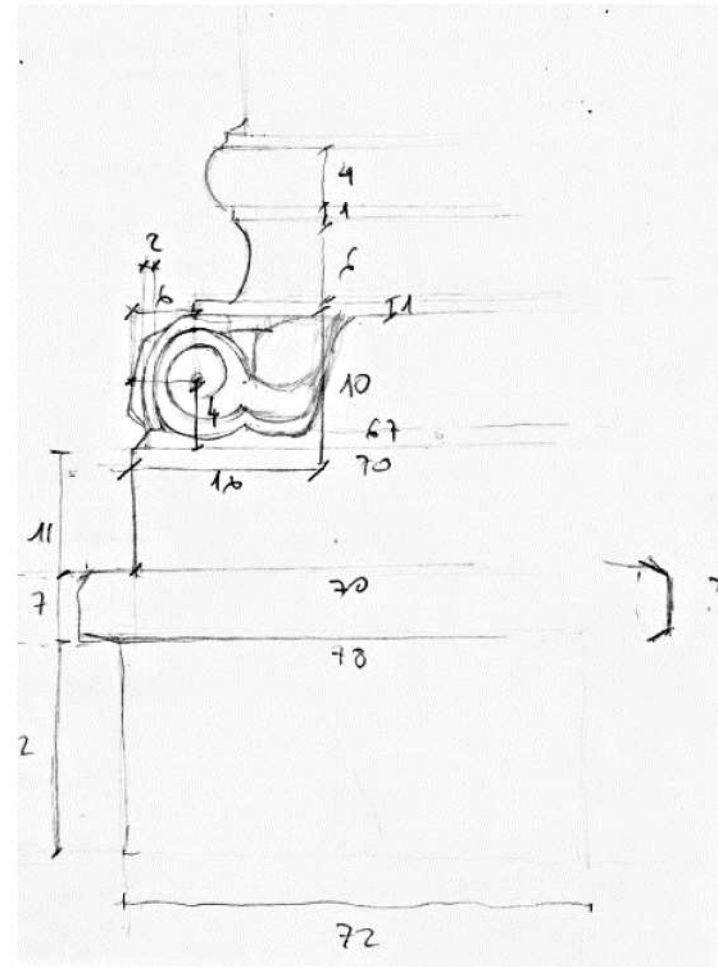
The importance of good sketches must not be forgotten in this method, since many of the building's information will also be reflected in them. The sketch must be an anticipation of the final drawing, which although it does not need to be on a precise scale, it must contain all the information that will later appear on the final map. The sketches will be drawn to the largest possible size and will be labeled and marked clearly.



Ground plan survey.  
Ground plan including external and internal polygonal lines.

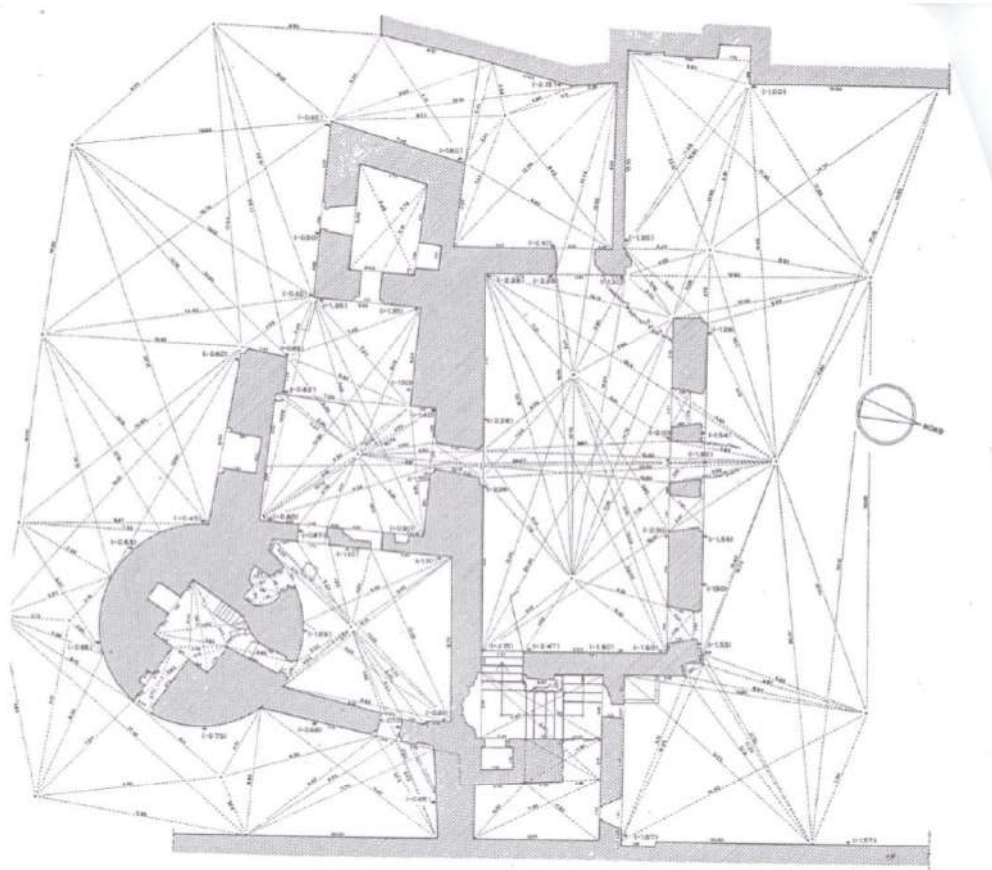
## SIMPLE METHOD: DETAILS

When necessary, extended partial sketches should be made, so that no dimension or detail is omitted. In any case, we must consider that the time spent on making a good sketch will always be a saving in the long run by avoiding mistakes, lack of definition and, finally, the need to redo some of the work



## SIMPLE METHOD: SURVEY EXAMPLES

Geometrical survey. External and internal polygonal lines.



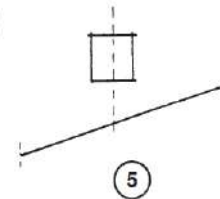
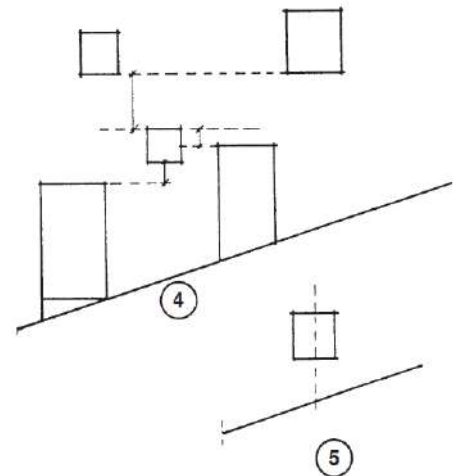
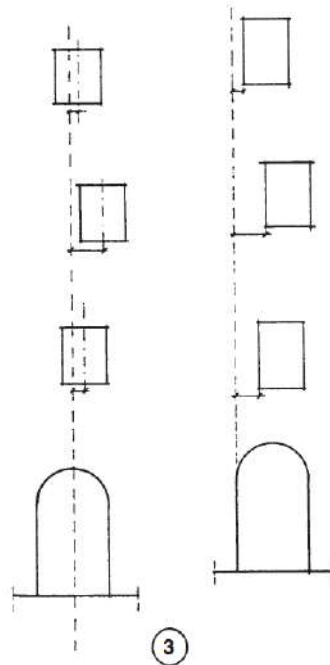
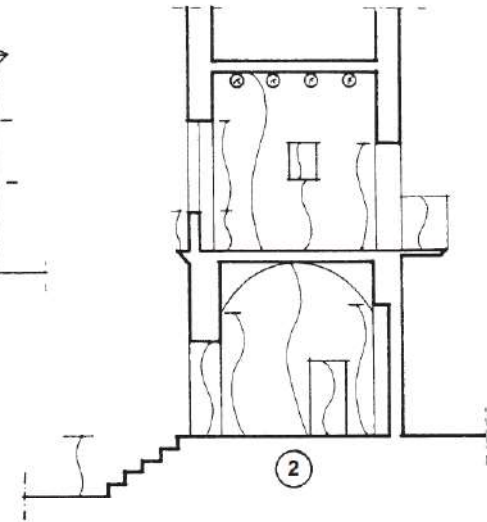
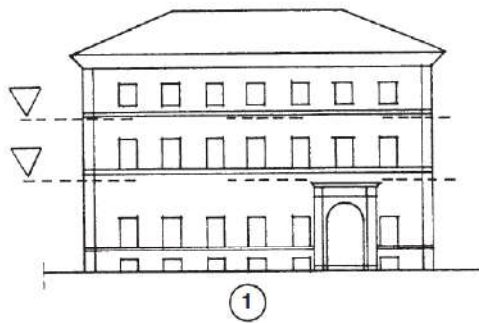
Ground plan triangulation. By C.B. and G. Carbonara.



# SIMPLE METHOD: ELEVATIONS

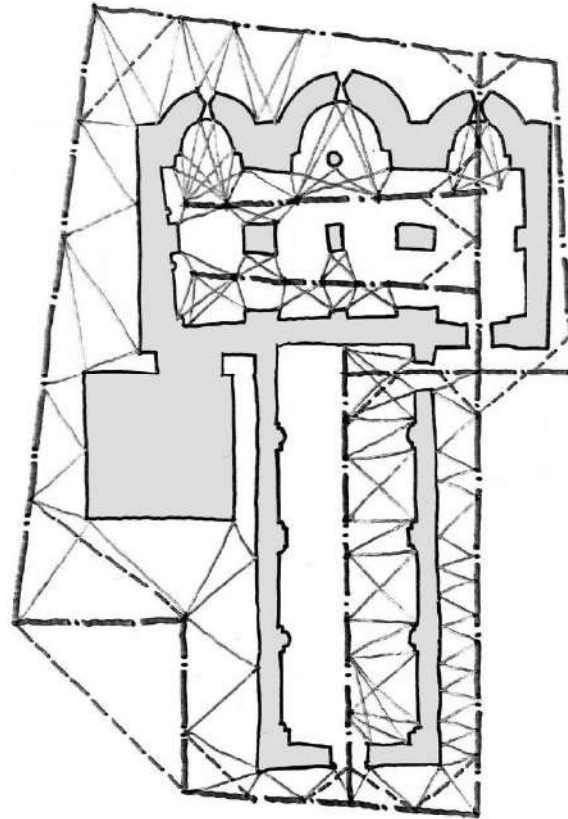
## OPERATIONS ON ELEVATIONS:

1. Internal levels referring to external envelope.
2. Sizes to be taken from the section.
3. Identification and determination of the off-axis areas.
4. Dimensions to be taken for the relative positions of the openings.
5. Windows positioning on the ground floor: dimensions measured on the axis.

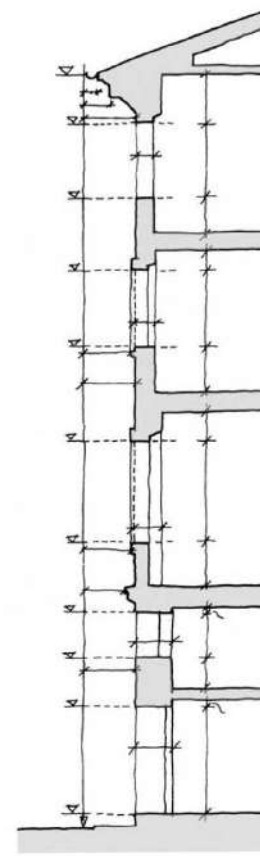


## SIMPLE METHOD: ELEVATIONS

Geometrical sketch. External and internal polygonal lines.



Ground plan survey.  
Ground plan including external and  
internal polygonal lines.



Sections survey.  
Section plan including levels.

# GEOMETRICAL SURVEY. TRILATERATIONS.



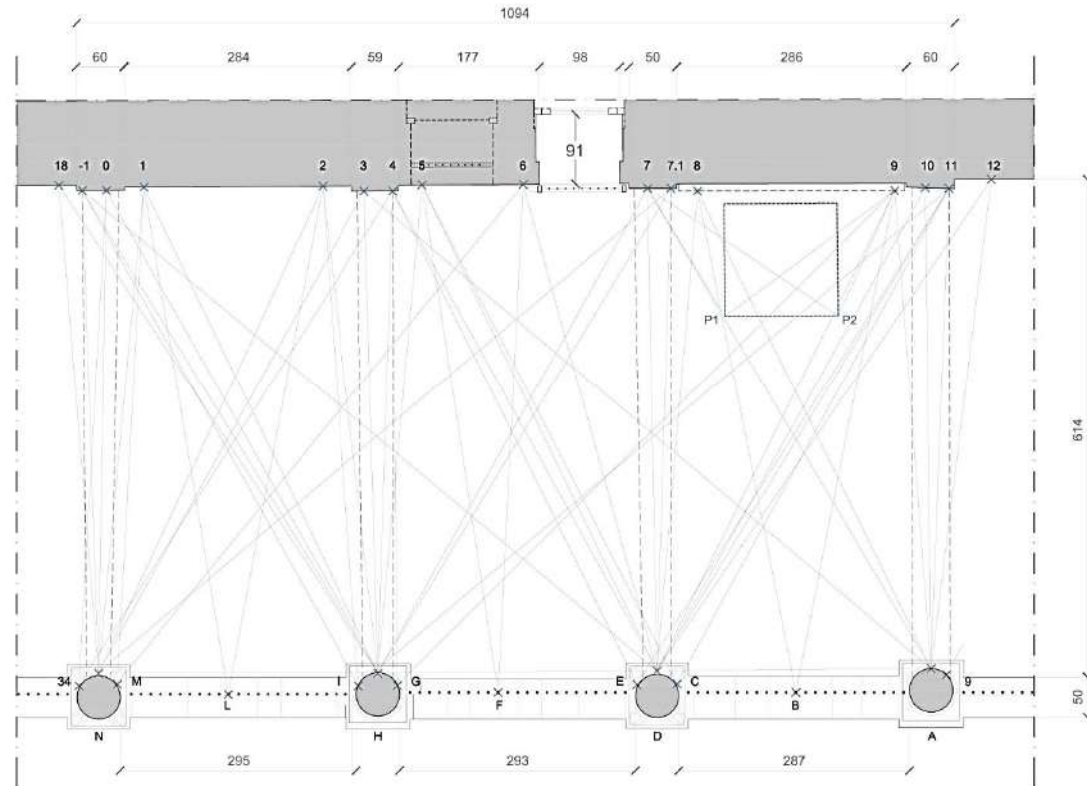
RILIEVO GEOMETRICO \_ TRILATERAZIONI



TRILATERAZIONI	
Rif	Lungh.
C:11	703,5 [cm]
C:5	697,5 [cm]
E:11	729,0 [cm]
E:4	685,5 [cm]
G:4	615,0 [cm]
G:9	872,5 [cm]
I:1	706,0 [cm]
I:2	622,5 [cm]
M:1	617,0 [cm]
M:6	801,5 [cm]
N:0	600,5 [cm]
H:0	690,0 [cm]
N:1	607,0 [cm]
I:2	223,7 [cm]
L:1	639,5 [cm]
L:2	643,0 [cm]
H:2	610,0 [cm]
N:3	685,0 [cm]
H:3	600,0 [cm]
3:4	35,8 [cm]
H:4	600,2 [cm]
D:4	682,0 [cm]
H:5	610,0 [cm]
F:5	641,0 [cm]
D:5	672,0 [cm]
5:6	126,0 [cm]
F:6	634,5 [cm]
D:6	628,2 [cm]
H:7	690,5 [cm]
D:7	601,0 [cm]
A:7	694,5 [cm]
D:8	599,5 [cm]

A:8	662,0 [cm]
B:8	634,0 [cm]
D:9	667,0 [cm]
B:9	634,7 [cm]
A:9	597,0 [cm]
D:10	688,0 [cm]
A:10	599,0 [cm]
D:11	702,0 [cm]
A:11	598,5 [cm]
N:H	349,0 [cm]
H:D	347,5 [cm]
D:A	341,0 [cm]
H:7.1	705,0 [cm]
D:7.1	601,0 [cm]
7:7.1	29,5 [cm]
N:1	600,5 [cm]
O:1	29,2 [cm]
H:1	705,0 [cm]
N:7.1	936,0 [cm]
A:3	924,0 [cm]
I:11	960,0 [cm]
D:1	935,0 [cm]
H:1	671,5 [cm]
N:2	667,0 [cm]
A:1	614,0 [cm]
D:1	740,0 [cm]
4:34	730,0 [cm]
O:34	617,0 [cm]
H:18	725,0 [cm]
N:18	608,5 [cm]

PAVIMENTO	
Rif	Lungh.
P1:7	186,0 [cm]
P2:7	285,0 [cm]
P1:9	282,5 [cm]
P2:9	170,0 [cm]

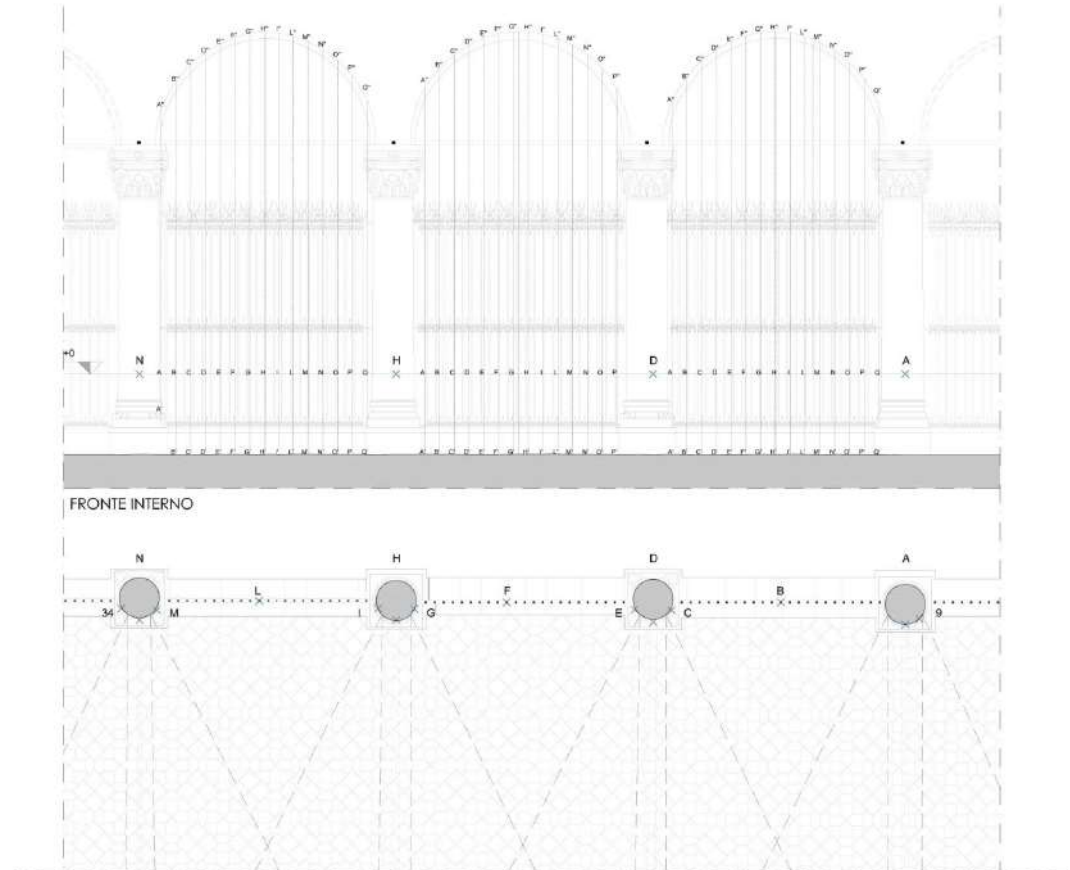
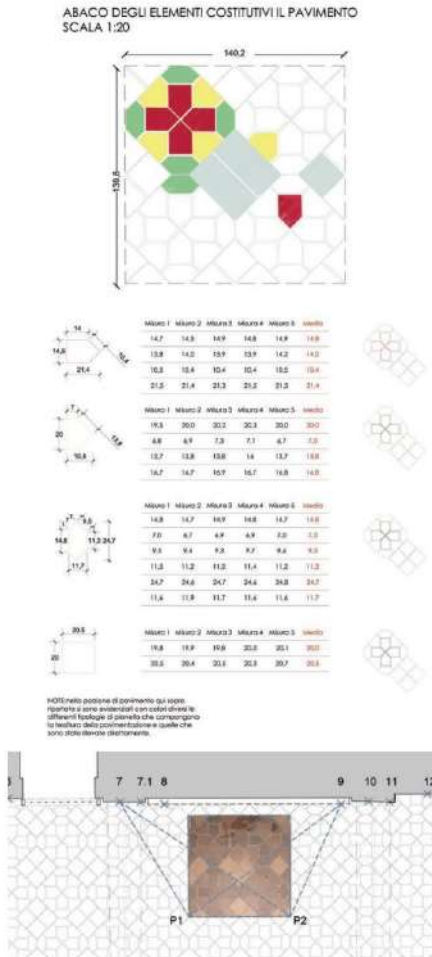


TRILATERAZIONI

Detail of triangulation. Internal polygonal lines.

Milan (Italy)  
By Pablo F. Cueto

# GEOMETRICAL SURVEY. PAVEMENT DETAILS

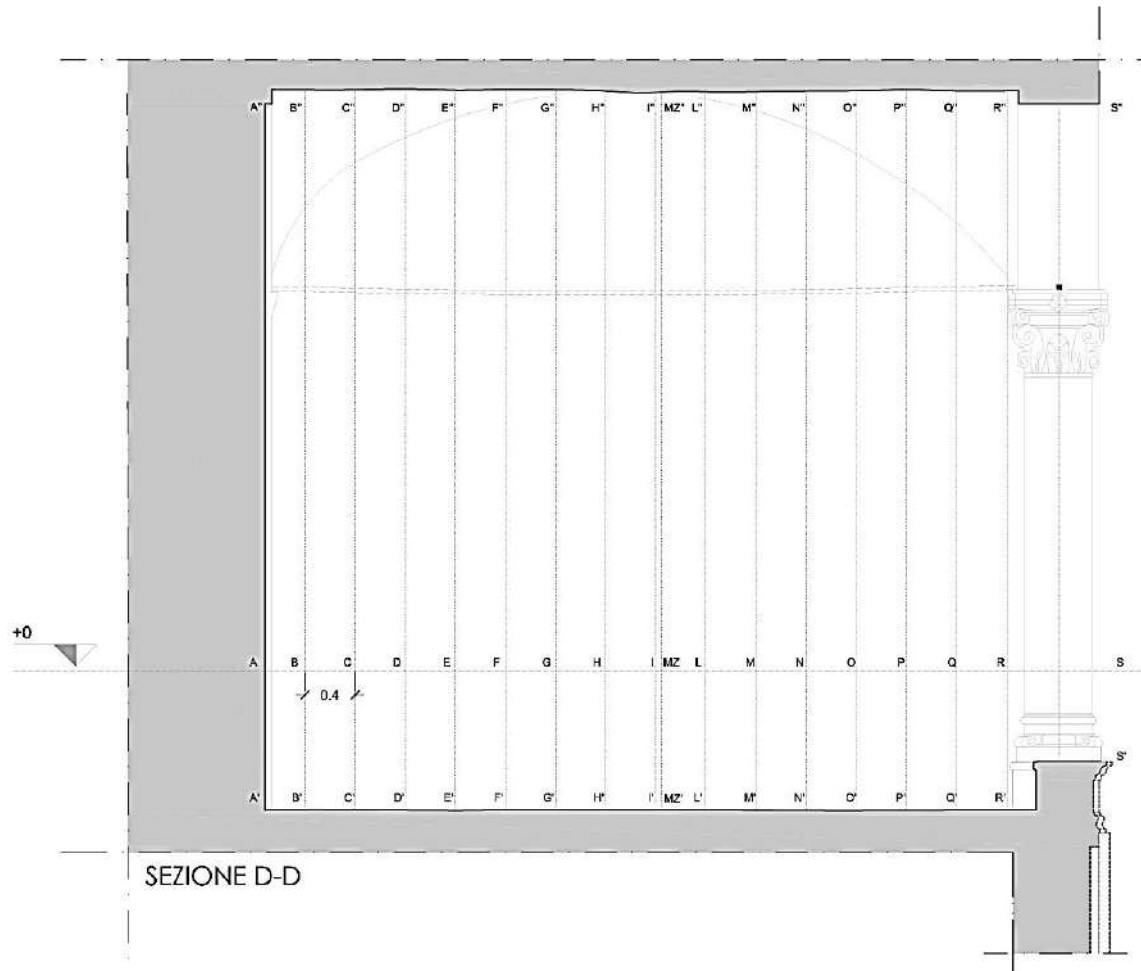


Approach to detail. Elevation and floor plan.

Milan (Italy)

By Pablo F. Cueto

# GEOMETRICAL SURVEY. SECTION

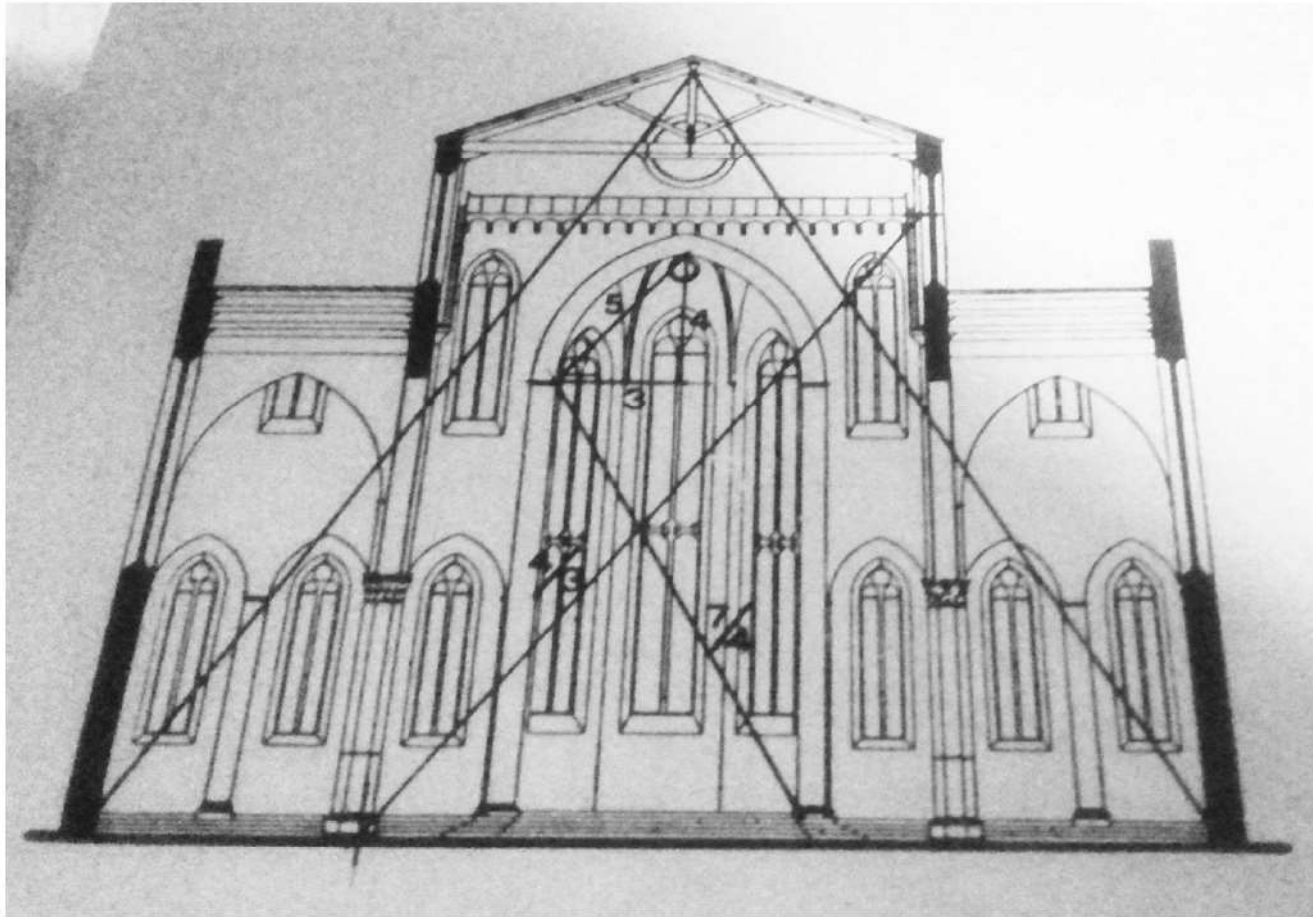


Approach to detail. Cross Section.

Milan (Italy)  
By Pablo F. Cueto

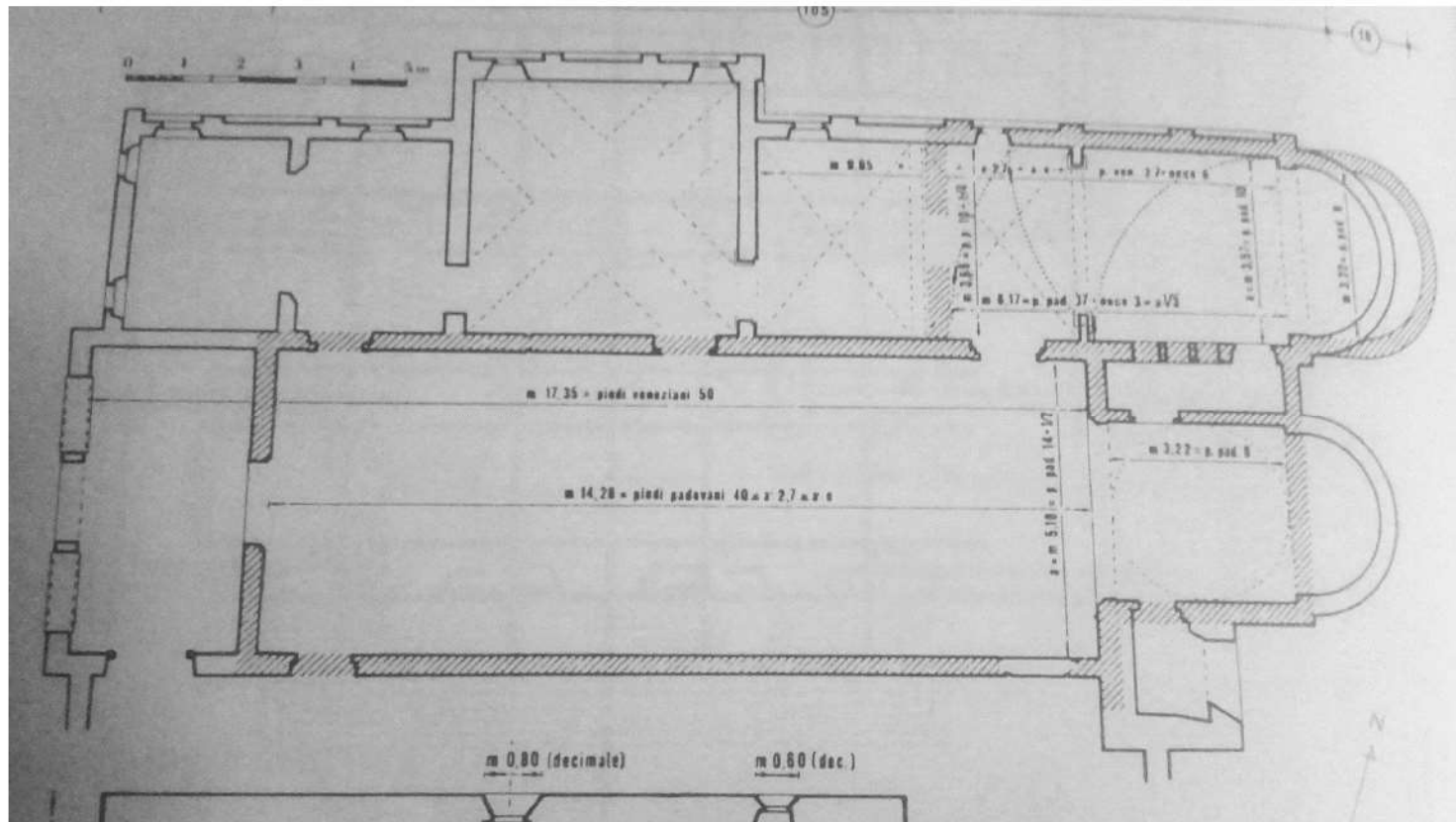
# METROLOGY

Metrology. Proportions.



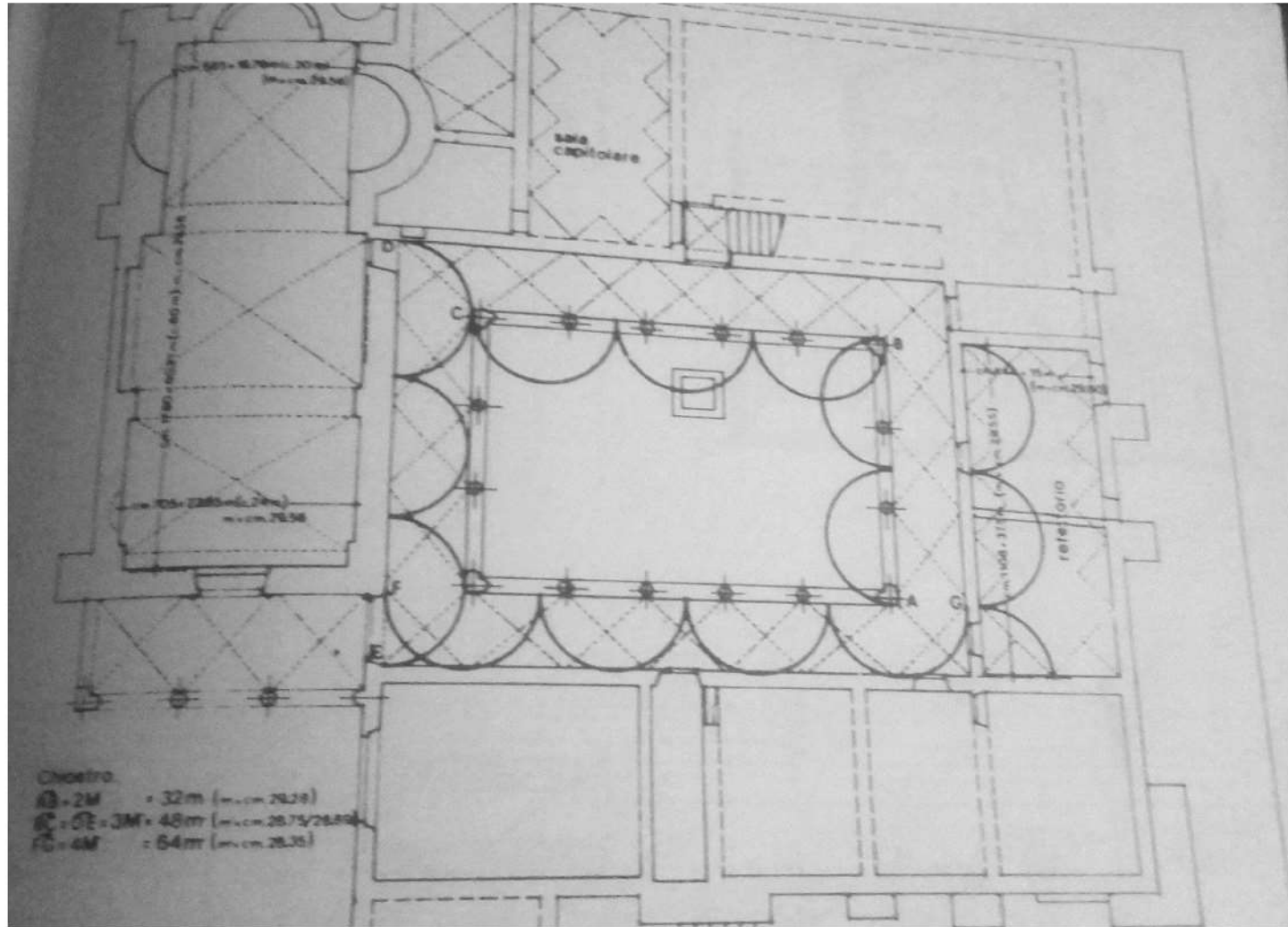
From C. Bando y G. Carbonara.

## Metrology. Proportions.





## Metrology. Proportions.







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