



Proposal for a method to place the masonry products

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**2nd consortium
meeting in Rodez -
France**

**April 25th and 26th
2013**



- **Balusters**
- **Balconies
& Masonry**
- **Ashlars**
- **Cornice**
- **Arches**
- **Columns**

Proposal for a method to place the masonry products:



➤ **Balusters**

➤ **Balconies**

& Masonry

➤ **Ashlars**

➤ **Cornice**

➤ **Arches**

➤ **Columns**

STANDARDS AND CODE OF PRACTISE IN HRVATSKA



- **Balusters**
- **Balconies**
- & Masonry**
- **Ashlars**
- **Cornice**
- **Arches**
- **Columns**

- Material and product standards (petrographic examination, porosity, density, strenght...) are taken from EU norms and also product standard for ashlar

- There are no method standards only common practise

Singular elements	Material standard	Product standard	Method standard
Balusters	-	-	Code of practise
Balconies	HRN EN 12407:2008	-	Code of practise

Masonry	Material standard	Product standard	Method standard
Ashlars	HRN EN 1936:2008 HRN EN 14581:2008 HRN EN 1925:1999 HRN EN 12371:2010	HRN EN 13373:2003	Code of practise
Cornice	HRN EN 12407:2008 HRN EN 14146:2004	-	Code of practise
Arches	HRN EN 12372:2008	-	Code of practise
Columns	HRN EN 1926:2008	-	Code of practise



➤ **Balusters**

➤ **Balconies**

& Masonry

➤ **Ashlars**

➤ **Cornice**

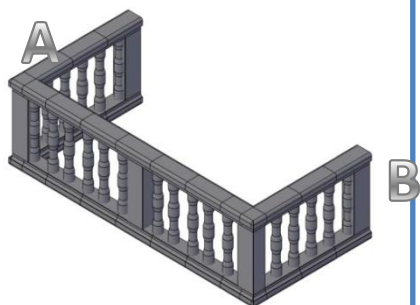
➤ **Arches**

➤ **Columns**

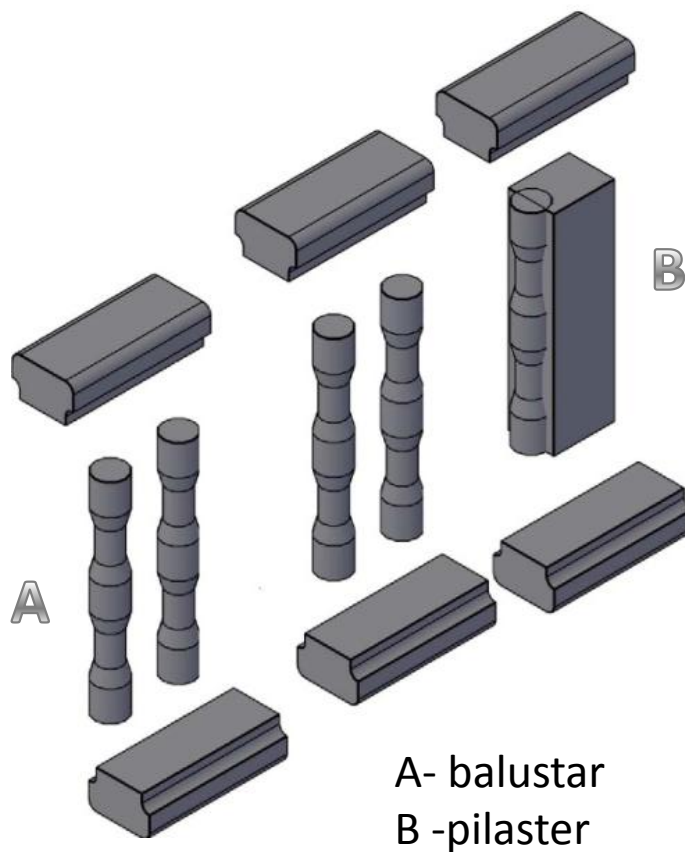
LAYOUTS

➤ Balusters

➤ Balconies



➤ Cornice



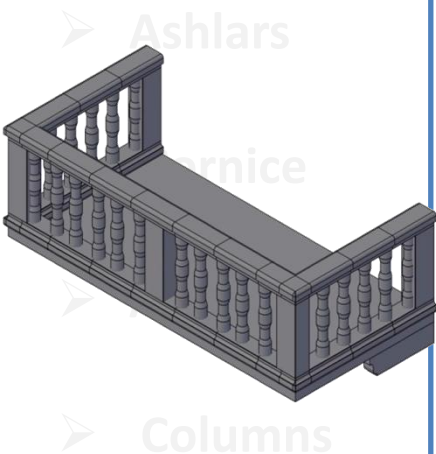
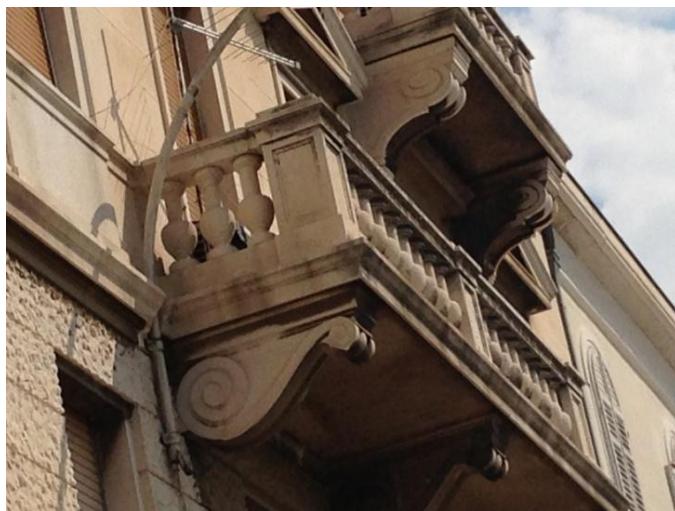
A- balustar
B -pilaster



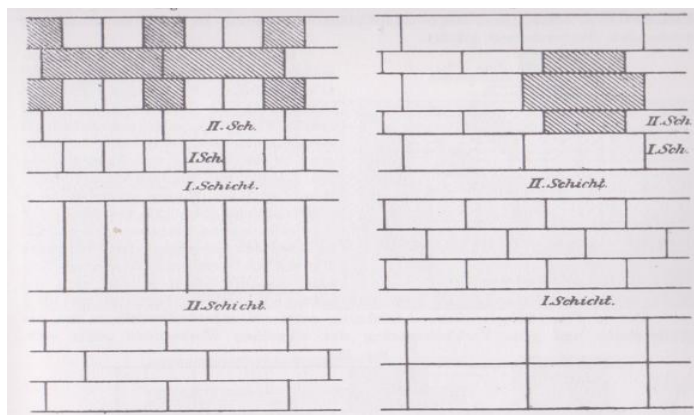
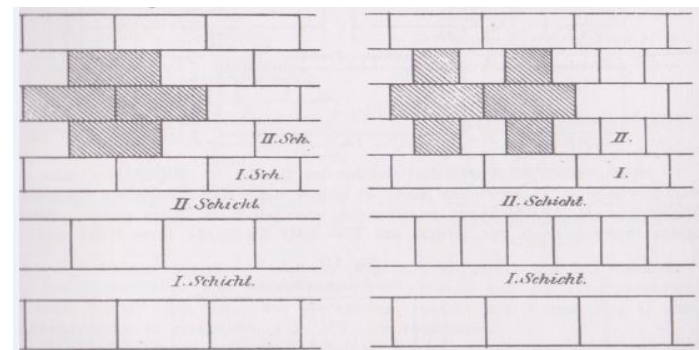
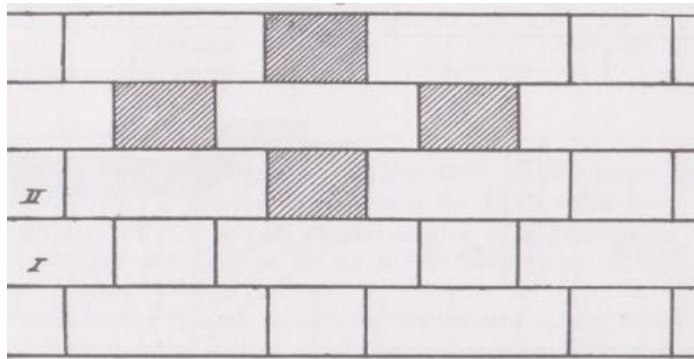
Some examples of balusters



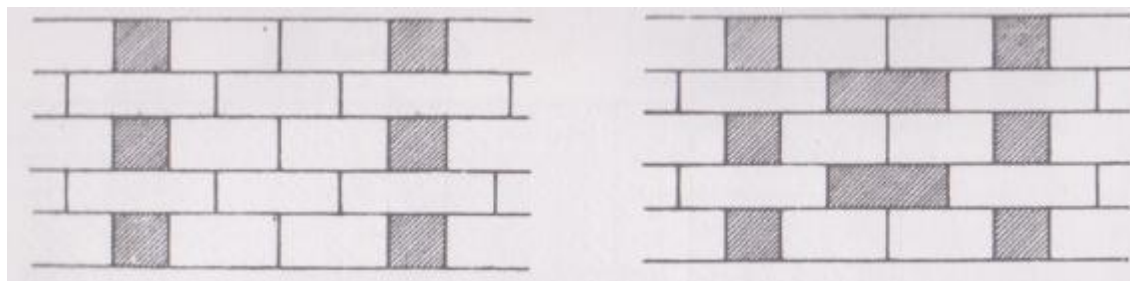
➤ Balconies & Masonry



Balcony consoles & balcony slabs



Some layout examples

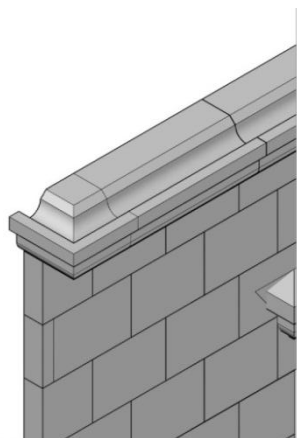


➤ **Ashlars**

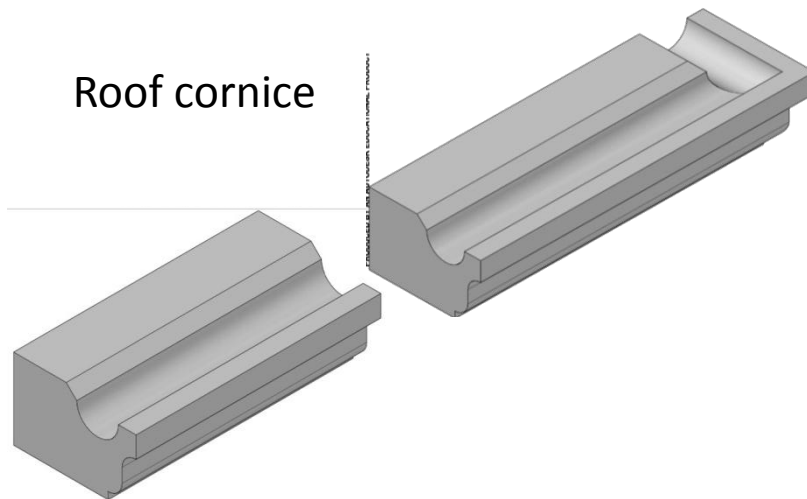
➤ **Cornice**

➤ **Arches**

➤ **Columns**

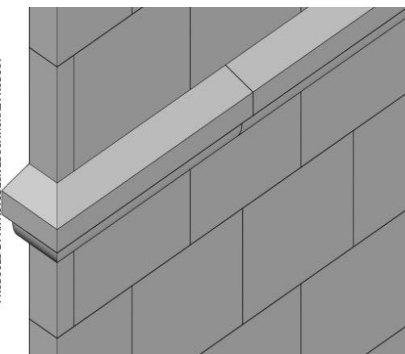


Roof cornice

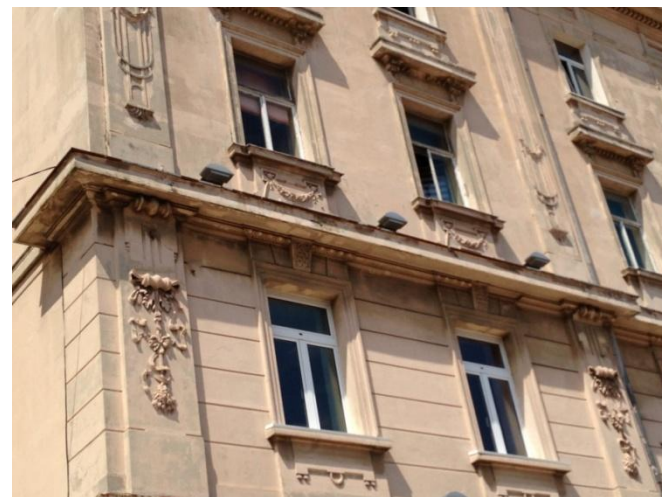
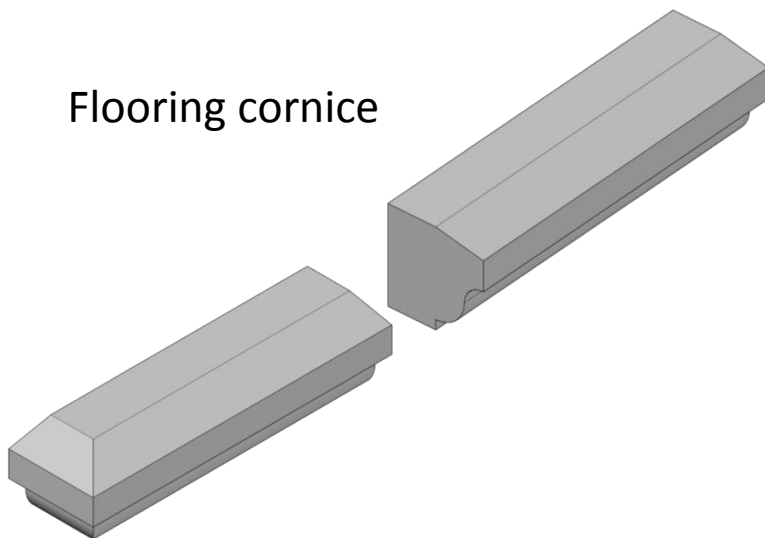


Some layout examples

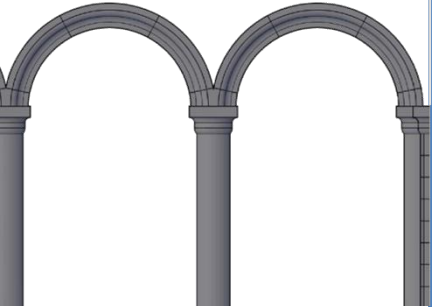
➤ Cornice



Flooring cornice



Two common arches types

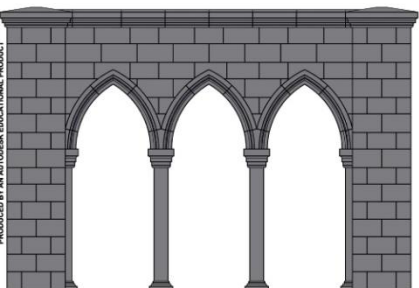


Round (roman) arch



Pointed (gothic) arch

➤ Arches





➤ Columns



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PLACING TECHNIQUES

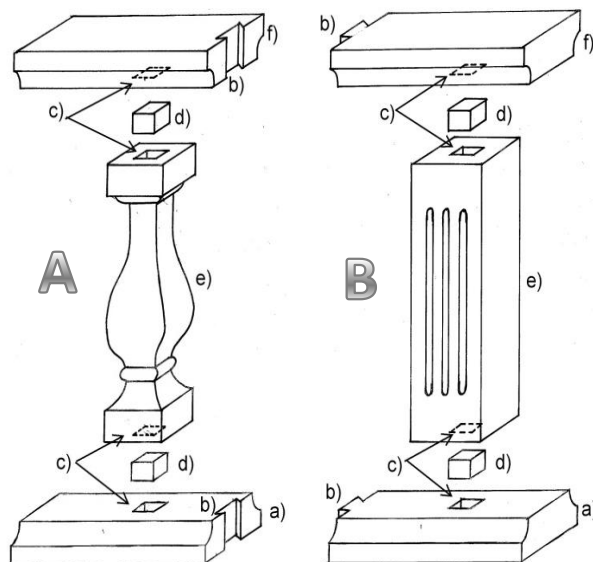


➤ Balusters

In general
2 codes of
practise

1. Traditional -
With usage of
stone dowels

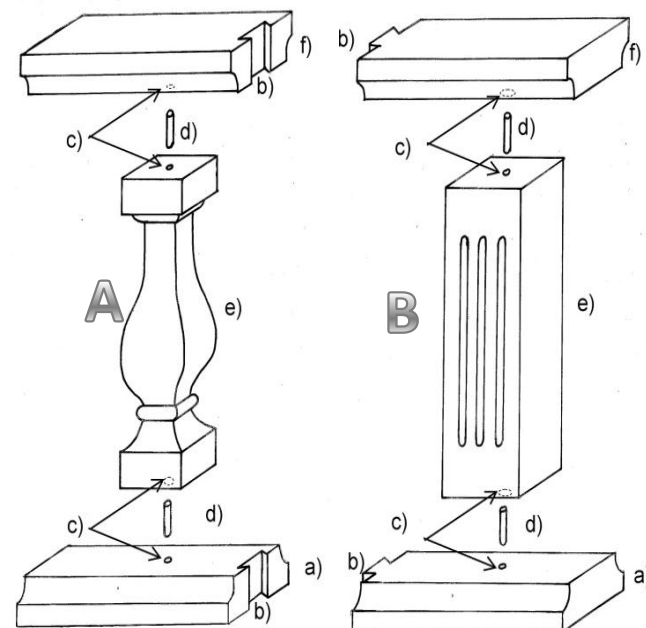
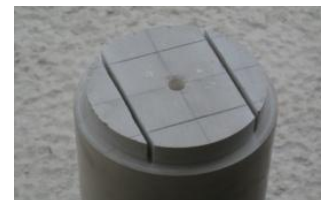
2. Dowels made
of non corrosive
metals



A- baluster
B -pilaster

a) base plate
b) dovetail joint
c) Insertion slots for dowels
d) dowel-non corrosive metal
e) baluster
f) cover plate

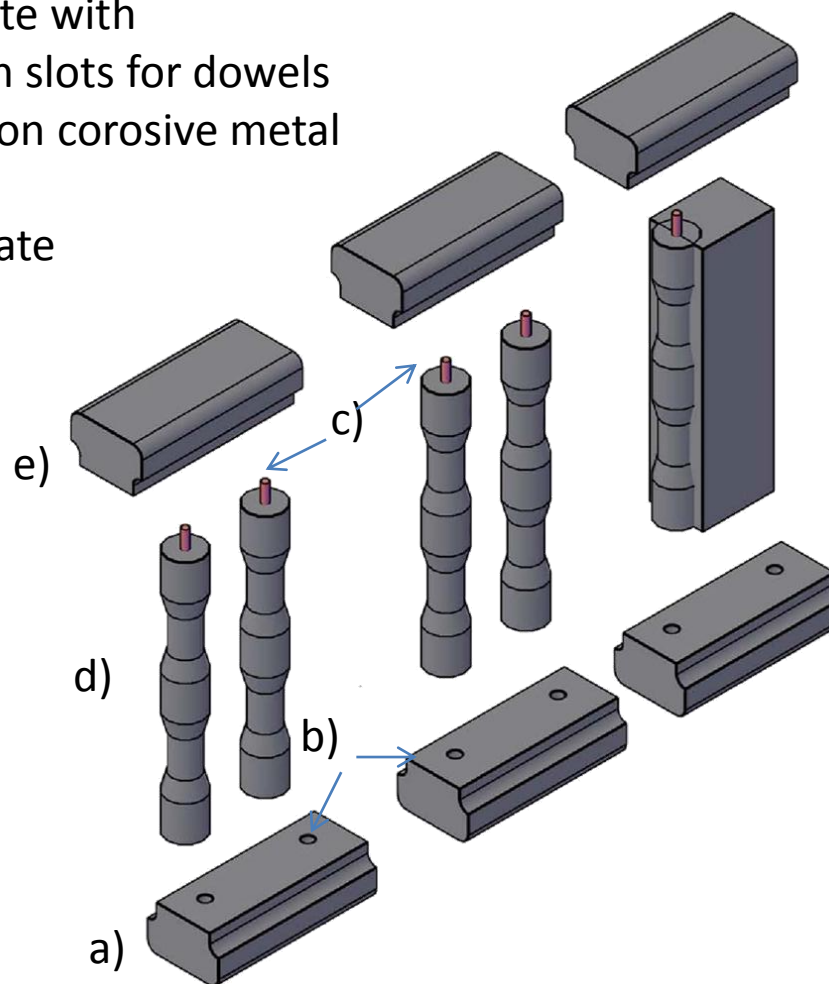
a) base plate
b) dovetail joint
c) insertion slots for stone dowels
d) stone dowel -"kojun"
e) baluster
f) cover plate



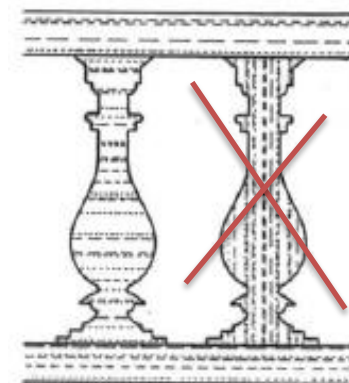
➤ Balusters

Because of cost issue and necessity of additional work on location, more common practice is to place cover plates without dovetail –it may only be used on critical points like direction change points

- a) base plate with
- b) insertion slots for dowels
- c) dowel-non corrosive metal
- d) baluster
- e) cover plate

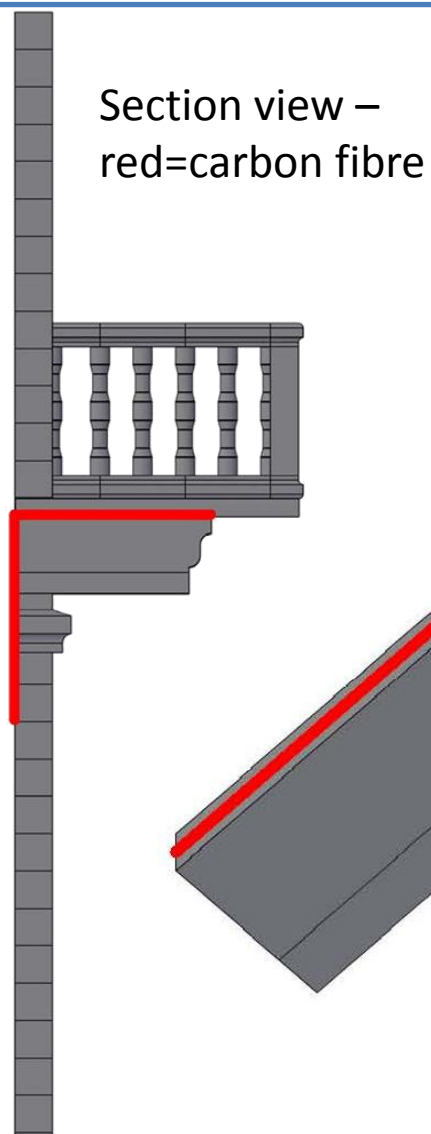
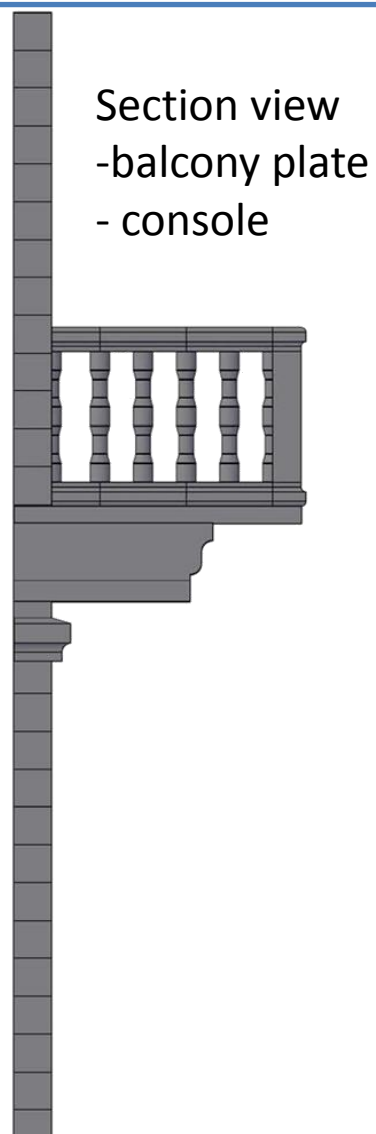


A- baluster
B - pilaster



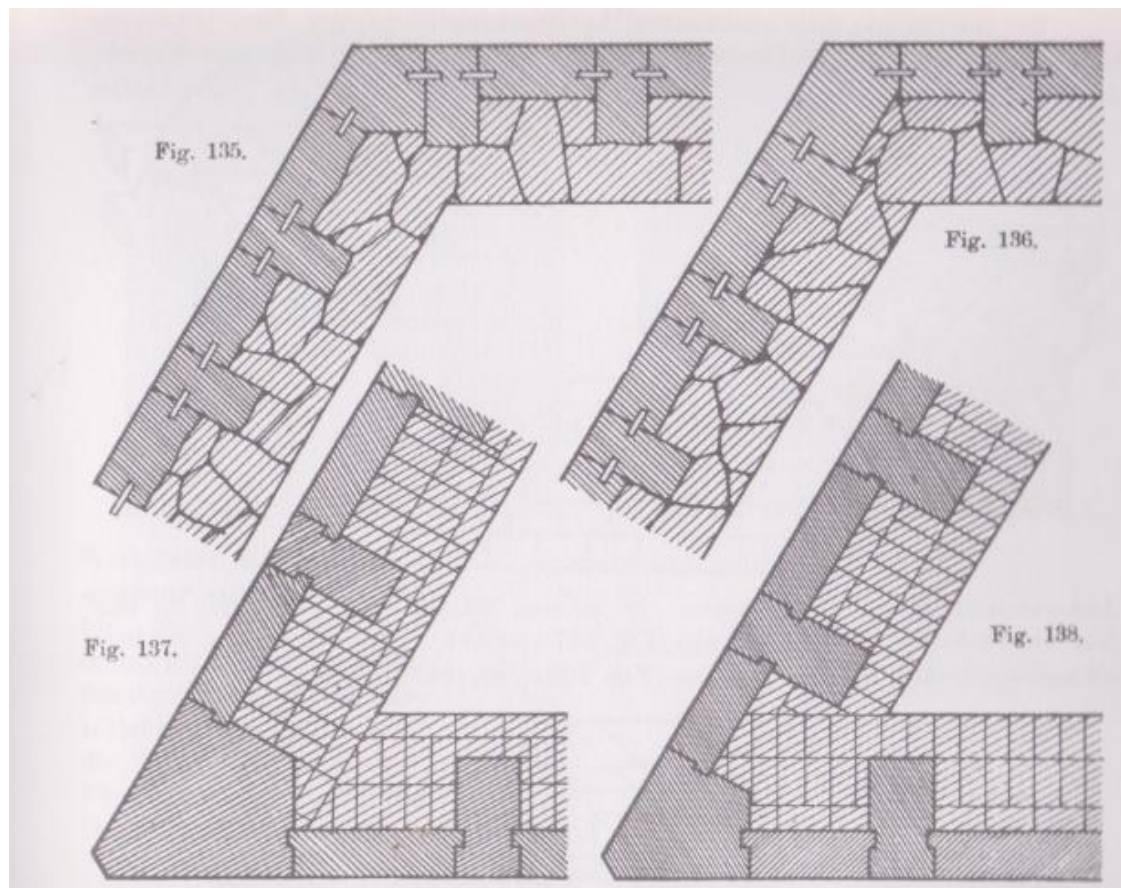
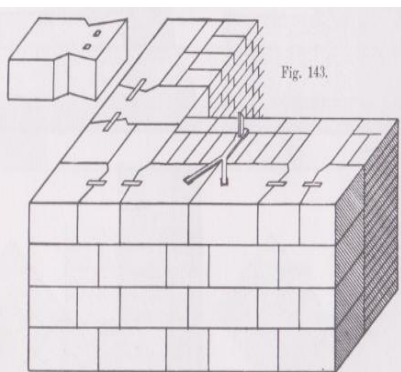


➤ Balconies & Masonry



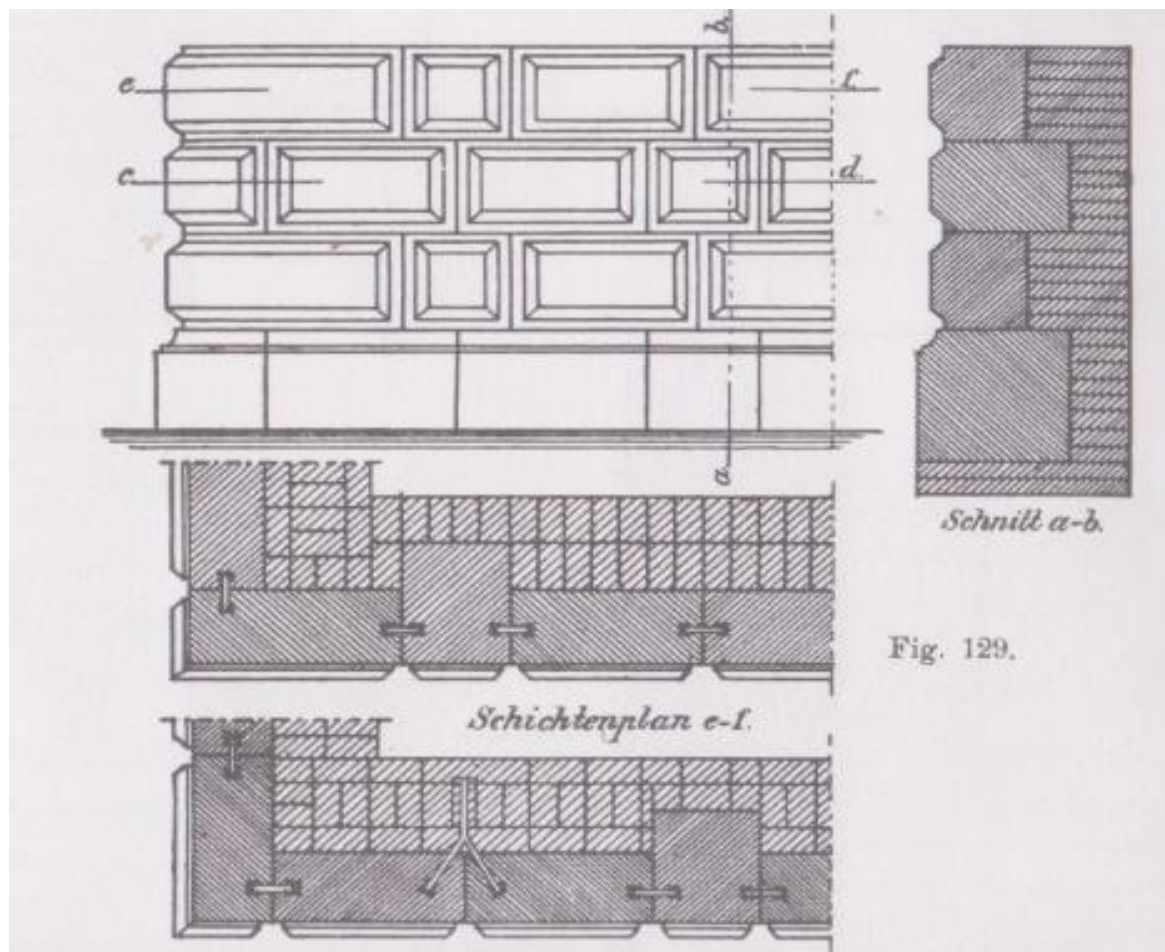
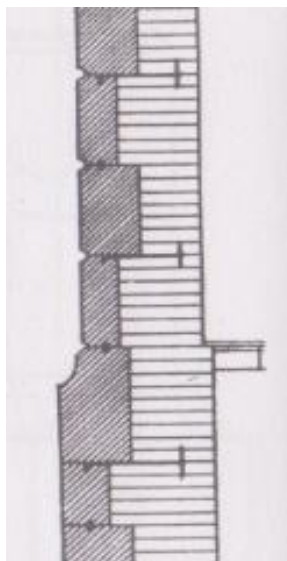


➤ Ashlars



Examples of cross section of walls made of dressed stone:
-with clamps
-wedged (docked) ashlars

➤ Ashlars

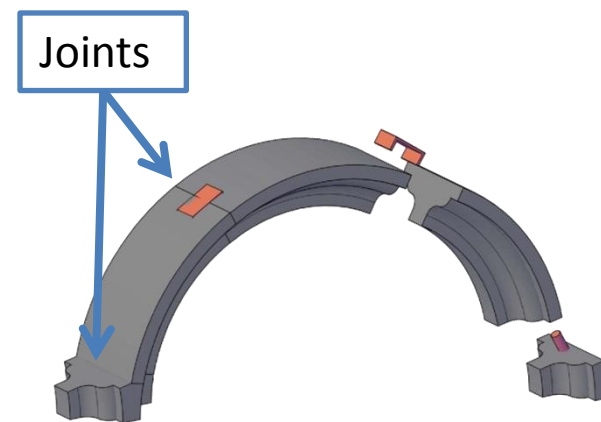
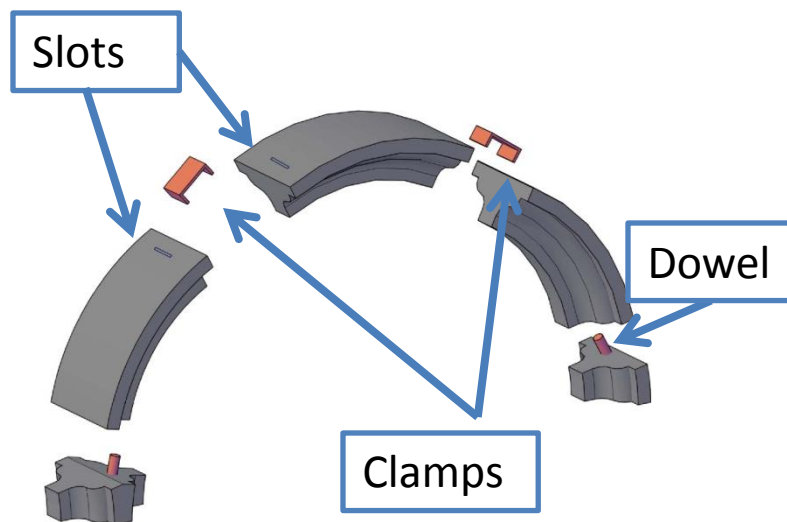


Example of cross section of wall made of dressed stone:
- with clamps and anchors



➤ Arches

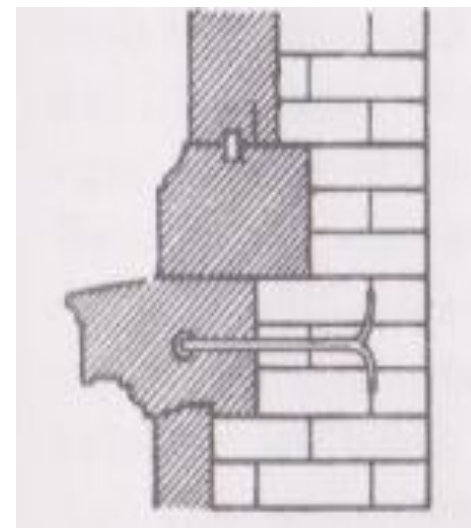
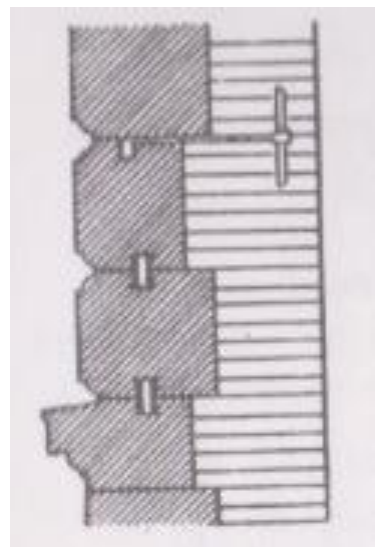
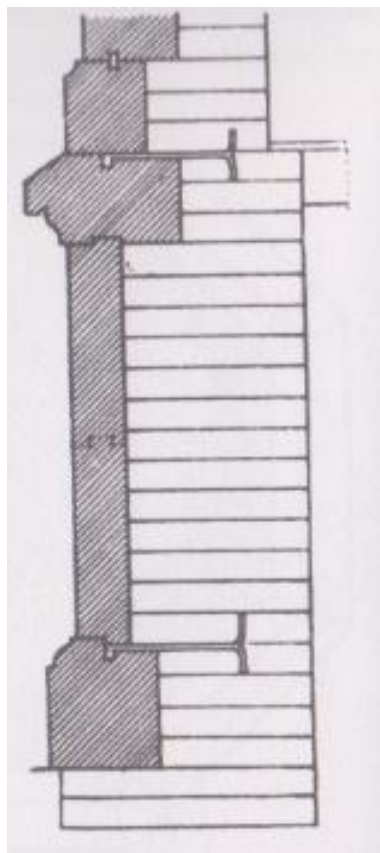
Example of arch placing technique
-without anchors



➤ Arches

Example of arch placing technique with dowels, clamps and anchors

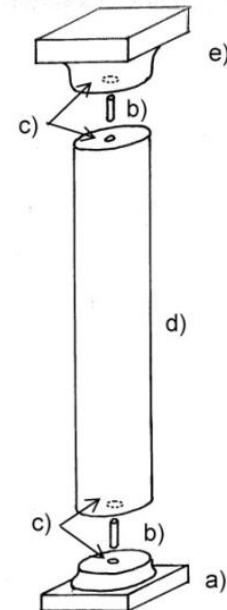
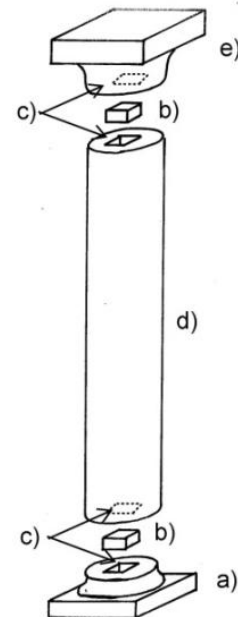
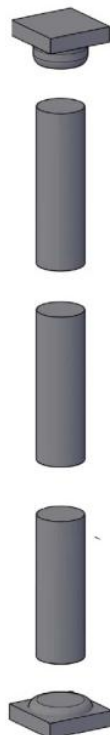
➤ **Cornice**



Examples of cross section through walls-
different technique of cornice anchoring

Monolithic column:

- a) base
- b) dowel-stone or metal
- c) slots for dowel
- d) column
- e) capital

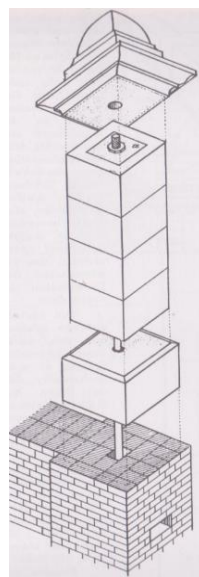
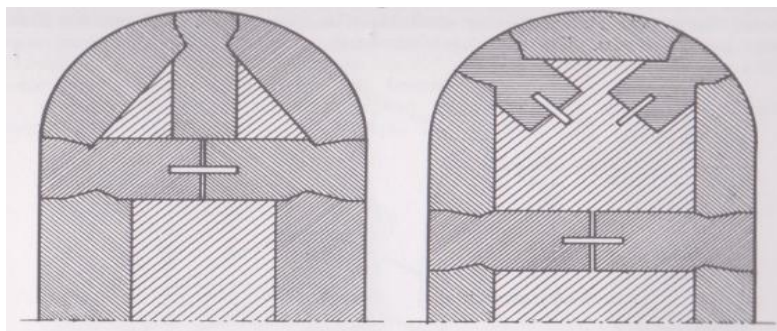


Column made of a series of solid stone cylinders or “drums”, connected on the same way as monolithic column is connected with base and capital.

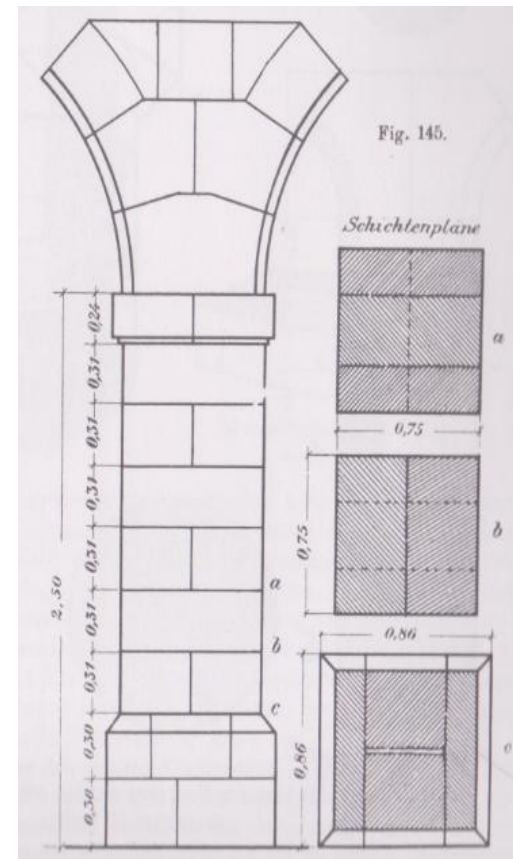
➤ Columns



Columns made of ashlar



Cross section of columns
-without anchoring
-with anchoring and wedged (docked) ashlars
-ashlars connected with steel tie rod and anchored in construction



➤ Columns



➤ **Balusters**

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THE MORTARS AND THE GLUES



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THE TRADITIONAL MORTARS

Lime mortar

lime:sand/aggregate = 1 to 3 ratio

Cement mortar

cement:sand/aggregate = 1 to 3, 1 to 4 ratio with the addition of lime

Cement-lime mortar

cement:lime:sand/aggregate = 1:1:6 or 1:2:5 ratio

Grain of aggregate must not be larger than 1/3 of the size of joint width.



ADHESIVE MORTARS AND GROUTING PRODUCTS

- **Balusters**
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Flex adhesive mortar

Water and frost proof, high hardening, hydraulic setting flex adhesive mortar. 3 to 20mm layer thickness.

Quick flex adhesive mortar

Water and frost resistant, highly refined, hydraulically binding flex acoustic mortar for installing up to a 20 mm adhesive bed thickness.

Joint (grouting) mortar on trass basis

Frost and thawing salt resistant, water-proof, refined, hydraulically setting joint mortar with trass additive to prevent blooming forming. 4 to 30 mm joint width.

Silicon for natural stone

For lasting, elastic sealing joints. For a grout width of 5 mm.

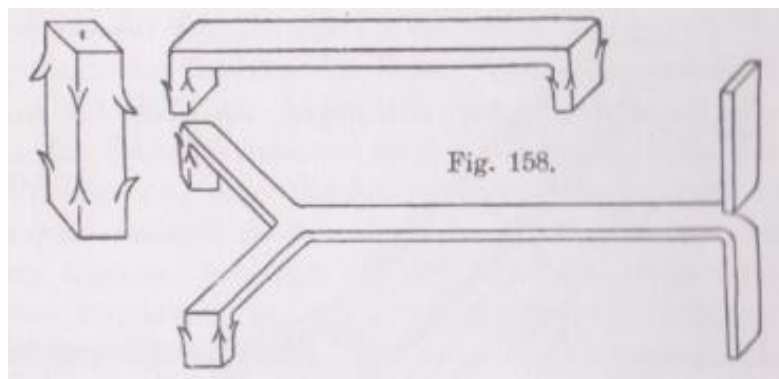


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METHODS FOR FIXING THE STONE ELEMENTS

- **Balusters**
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- **Columns**

Elements for fixing and anchoring



- Dowels
- Clamps
- Anchors

-Example of iron dowel which was connecting two elements of stone on Zagreb's cathedral



Elements for fixing and anchoring



Iron clamps and dowels are embedded in cuttings below the surface of stone elements and sealed into place by lead.



The lead inhibits water penetration and consequent corrosion of the iron (Nowdays it is not an issue because we are using non-corrosive metals)

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Advantage of lead anchoring

The primary reason for use of lead is that it adds to flexibility of overal clamp,dowel or anchor fastening.



The ductile properties of metal fastener encased in lead allows fractional and organic movement of the structure during time of stress,particulary that caused by earthquakes



Thank you for your attention

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Mirko Nižetić, external expert