Proposal for a method to place the masonry products

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STONEMASONRY SCHOOL

2nd consortium meeting in Rodez - France

April 25th and 26th 2013
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

Method to place the masonry products
- Material and product standards (petrographic examination, porosity, density, strength...) are taken from EU norms and also product standard for ashlars

- There are no method standards only common practise

<table>
<thead>
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<th>Singular elements</th>
<th>Material standard</th>
<th>Product standard</th>
<th>Method standard</th>
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<tr>
<td>Balusters</td>
<td>-</td>
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<td>Code of practise</td>
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LAYOUTS

- Balusters
- Balconies
- Ashlars
- Cornice
- Arches
- Columns

Method to place the masonry products
Some examples of balusters

A- balustar
B - pilaster

Method to place the masonry products
Balconies & Masonry

- Balusters
- Balconies & Masonry
- Ashlars
- Cornices
- Arches
- Columns

Balcony consoles & balcony slabs

Method to place the masonry products
Ashlars

Cornice

Arches

Columns

Some layout examples

Method to place the masonry products
Some layout examples

- Cornice
- Balusters
- Balconies
- Ashlars
- Cornice
- Arches
- Columns
- Flooring cornice
- Roof cornice

Method to place the masonry products
Method to place the masonry products

- Balusters
- Balconies & Masonry
- Ashlars
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- Arches

Two common arches types

- Round (roman) arch
- Pointed (gothic) arch
- Columns

Method to place the masonry products
<table>
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<th>PLACING TECHNIQUES</th>
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Method to place the masonry products
Balusters

In general 2 codes of practise

1. Traditional - With usage of stone dowels

2. Dowels made of non corrosive metals

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

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
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

- Balusters
- Balconies & Masonry
- Ashlars
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Section view - balcony plate - console

Section view – red=carbon fibre

Console fixed with carbon fibre
Method to place the masonry products

- Ashlars

Examples of cross section of walls made of dressed stone:
- with clamps
- wedged (docked) ashlars
Method to place the masonry products

- 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 made of ashlers

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

Method to place the masonry products
THE MORTARS AND THE GLUES

- Balusters
- Balconies
- Ashlars
- Cornice
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Method to place the masonry products
THE TRADITIONAL MORTARS

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

**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.

Method to place the masonry products
ADHESIVE MORTARS AND GROUTING PRODUCTS

- **Balusters**

- **Balconies**

- **& Masonry**

- **Ashlars**

- **Cornice**

- **Arches**

- **Columns**

**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.

**Method to place the masonry products**
METHODS FOR FIXING THE STONE ELEMENTS

- Balusters
- Balconies & Masonry
- Ashlars
- Cornice
- Arches
- Columns
Elements for fixing and anchoring

- Balusters
- Balconies
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Elements for fixing and anchoring:
- Dowels
- Clamps
- Anchors

Example of iron dowel which was connecting two elements of stone on Zagreb’s cathedral.

Method to place the masonry products
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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 (Nowadays it is not an issue because we are using non-corrosive metals)

Method to place the masonry products
### Advantage of lead anchoring

- The primary reason for use of lead is that it adds to flexibility of overall 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, particularly that caused by earthquakes.

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Thank you for your attention

Authors:
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