



KLESARSKA
ŠKOLA

STONEPLACING



XX. SIMPOZIJ
KAMENARA

EU PROJEKTI

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SAFEQU

Pučišća, 9., 10, i 11.
svibnja 2013.

KLESARSKA ŠKOLA
STONEMASONRY SCHOOL



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CILJ
aim

Poboljšanje kvalificiranosti i
zapošljivosti radnika na ugradnji
kamena, s ciljem poboljšanja kvalitete
proizvoda, primjenom zajedničkog
evropskog kurikuluma podržanog ICT
alatima

*Increasing the skills of workers and
their employment in the field of
placing the stone, in order to
increase the quality of the final
work, with application of common
EU curriculum and ICT tools*

Predviđeno **trajanje** projekata – 2 GODINE – odnosno do kraj 2014.



Motivi za izradu projekta

some motives
for the project

❑ Prirodni kamen – konstrukcijski materijal koji se održao u širokoj upotrebi usprkos revolucionarnim promjenama tehnologije i dizajna tijekom godina

❑ *Natural stone - one of the most sustainable construction materials inspite of the changes of technology and design across the years it lasts as the main construction materials*

❑ Vrijednost i trajnost osim od proizvodnje uvelike zavisi o o načinu ugradnje

❑ *Value and duration tatally depend on the quality of manufacturing and quality of placement*

❑ do danas: studije, pravila, zakoni usredotočeni su na vađenje i proizvodnju

❑ *To date, most studies, comuniti directives ... focus on the extraction and manufacturing*



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Partneri na projektu partners on the project

EUROROCK - EU i međunarodno udruženje industrije prirodnog kamena

EU Natural stone organization



Koordinator projekta – konzultantska kuća - Španjolska

Colsuntancy, Spain



Tehnološki centar za mramor - Španjolska

Marble and Natural Stone Technology Center, Spain



Strukovno udruženje i udruženje svih strukovnih škola – Institut za kamen - Francuska

Non-profit-making state approved organization for education in the building and other trades



Stenforsaskolan – viša strukovna škola - Švedska

Educational Center with uper secondary and adult education, Sweden



Konzultantska kuća - Rumunjska

Colsuntancy, Romania



Izvor ideje projekta the idea of the project

❑ način i uspješnost ugradnje kamena određuje je li kamen (proizvod)

❑ *placing method has a big influence in the market and order is it stone*



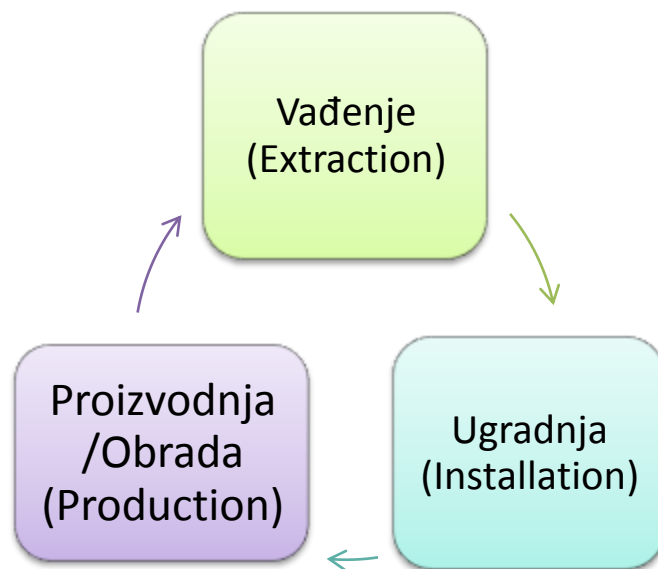
❑ Ugradnja kamena – važan izvor radnih mjesta

❑ *Placing of the stone – important source of employment*

Dodatni zahtjevi additional requirements

❑ Podržavanje EU strategije zasnovanu na konceptu “ukupni vijek prirodnog kamena”

❑ *it sustains EU strategy on the concept of “natural stone full cycle”*



Najviši standardi
kvalitete i održivosti

*The highest
requirements of
quality and
sustainability*

❑ Ugrađeni kamen – trajan, energetski učinkovit; uporaba i reciklaža

❑ *Stone used in construction and public spaces– durable, energy efficient; reused & recycled*



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Faze projekta

Phases of the project

1. Istraživanje postojećih standarda i metoda ugradnje u zemljama sudionicama

(Researching on the existing norms and methods and procedures used to place stonemasonry products in the involved countries)

2. Razvoj kurikuluma i multimedijских edukacijskih materijala za "obuku klesara montažera"

Development of the curriculum and multimedia training material for a "stonemasonry placing course"

3. Testiranje kurikuluma i edukacijskih materijala

(testing and validating the curriculum and training material)

4. Diseminacija i korištenje rezultata

(dissemination and exploitation of results)

5. Samoprocjena i vanjsko vrednovanje projekta

(self-assessment i outside evaluation)



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

Doprinos

1. fazi

Contribution to
the 1st phase

Klesarska škola: Prijedlog metoda ugradnje klesarskih proizvoda

Stonemasonry school: Proposal for a method to place the masonry products



➤ **Balusters**

➤ **Balconies**

& Masonry

➤ **Ashlars**

➤ **Cornice**

➤ **Arches**

➤ **Columns**

**STANDARDI I
PRAVILA STRUKE**

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

- There are no method standards only common practise

Preuzeto iz EU

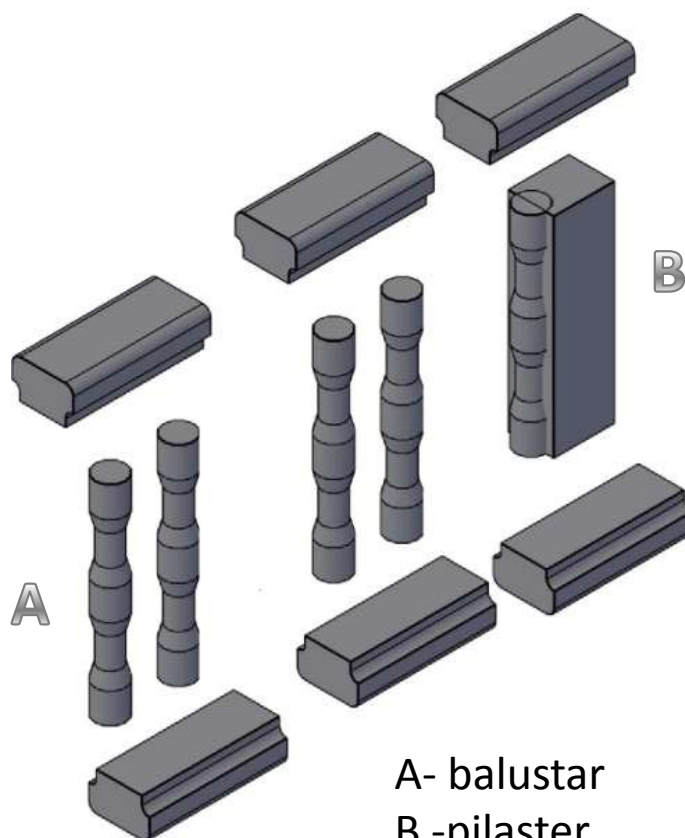
Nema

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

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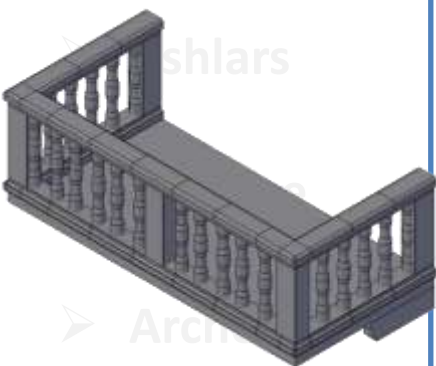


Some examples of balusters



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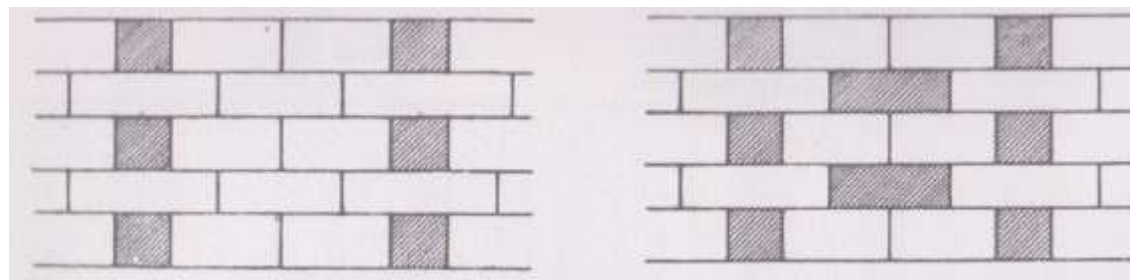
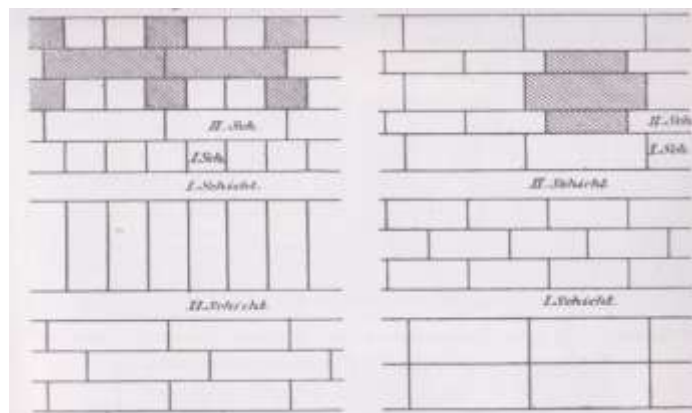
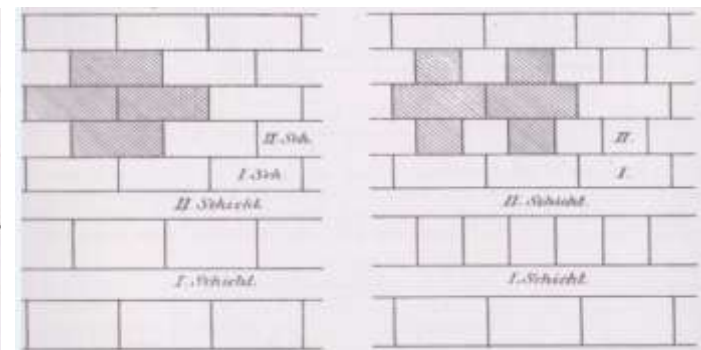
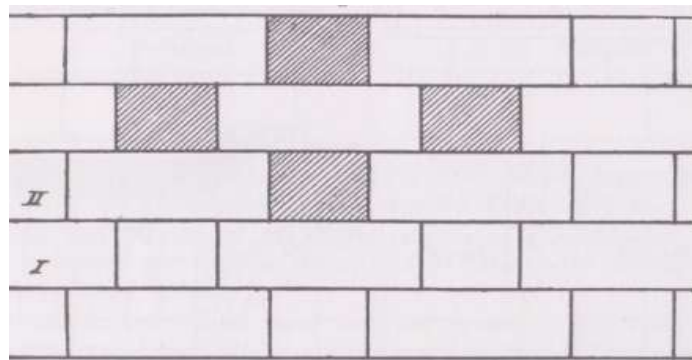
➤ Balconies & Masonry



Balcony consoles & balcony slabs



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➤ Ashlars

➤ Cornice

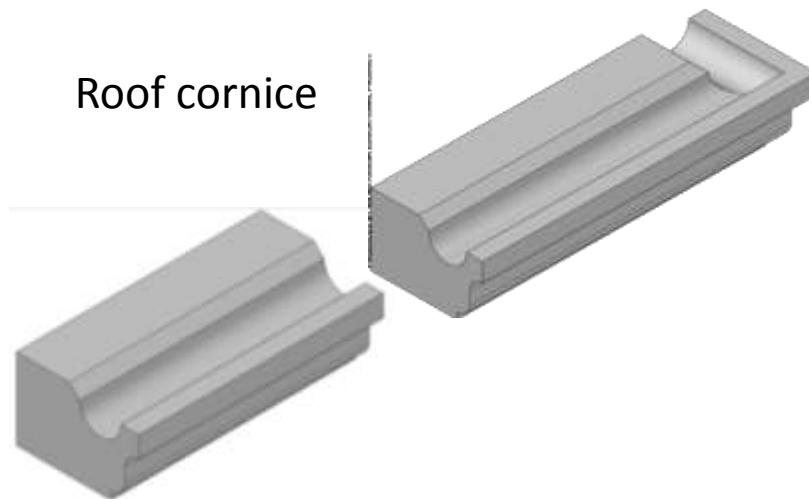
➤ Arches

➤ Columns

Some layout examples



Roof cornice

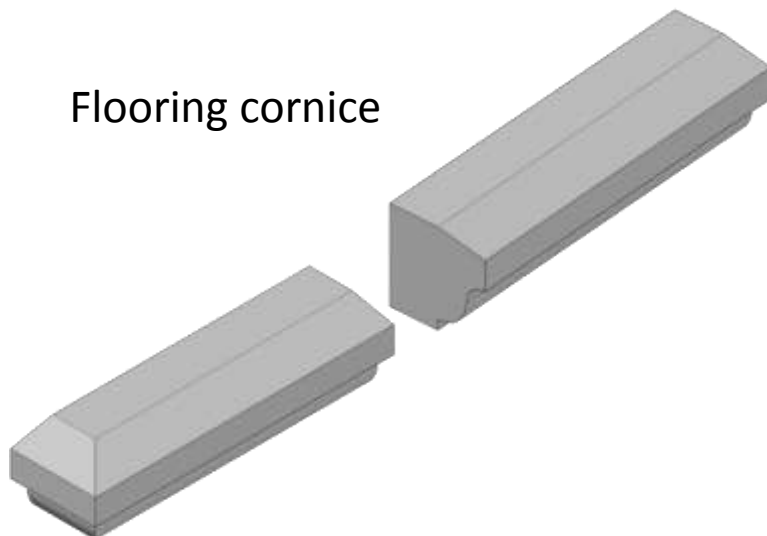


Some layout examples

➤ **Cornice**



Flooring cornice



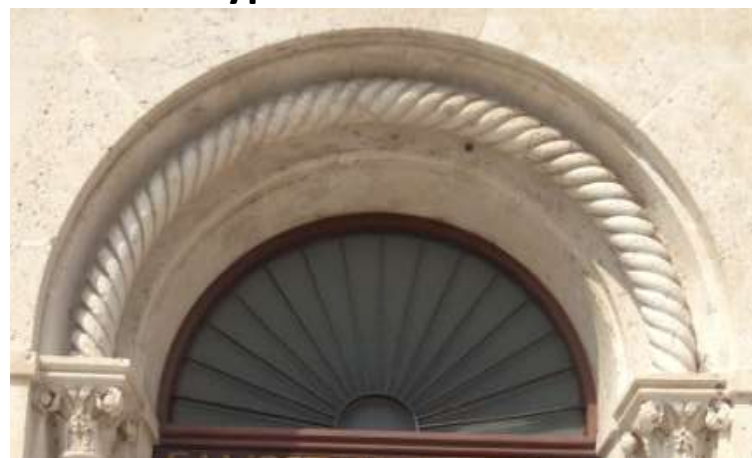


Two common arches types

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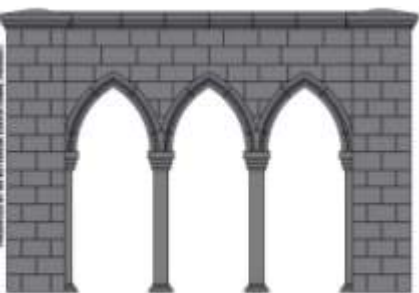


Round (roman) arch



Pointed (gothic) arch

➤ Arches





➤ Columns



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

PRIJEDLOG TEHNIKA MONTAŽE

PLACING TECHNIQUES

➤ Balusters

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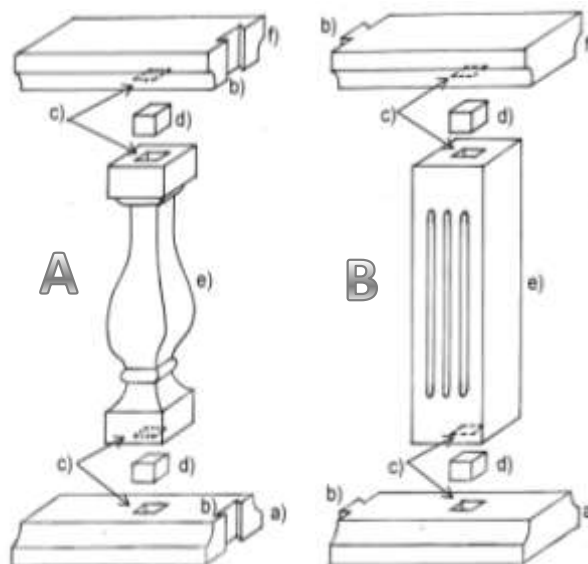
In general
2 codes of
practise

1. Tradicionalni-
upotrebom
"kojuna"

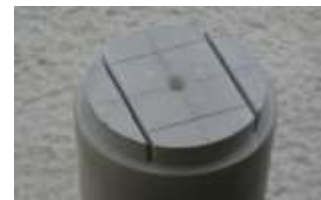
*1. Traditional -With
usage of stone dowels*

2. Upotrebom
pera od
nehrđajućeg
metala

*2. Dowels made of
non corosive metals*

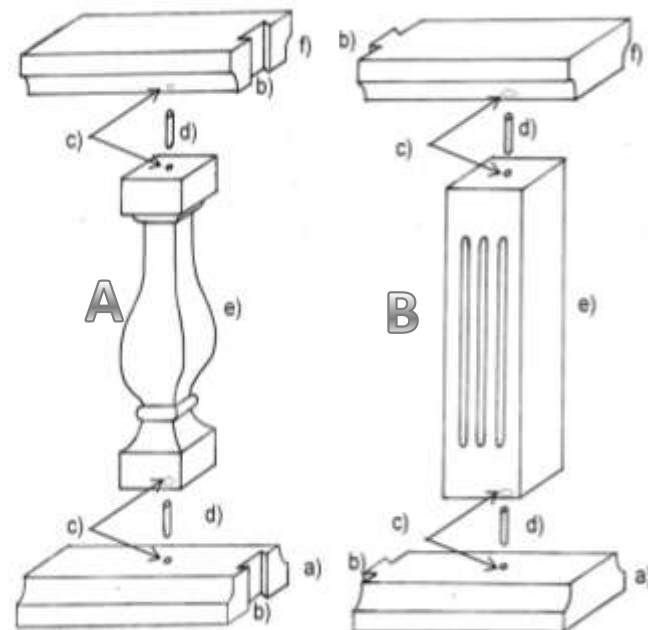


a) base plate
b) dovetail joint
c) insertion slots for stone dowels
d) stone dowel -"kojun"
e) baluster
f) cover plate



A- baluster
B -pilaster

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

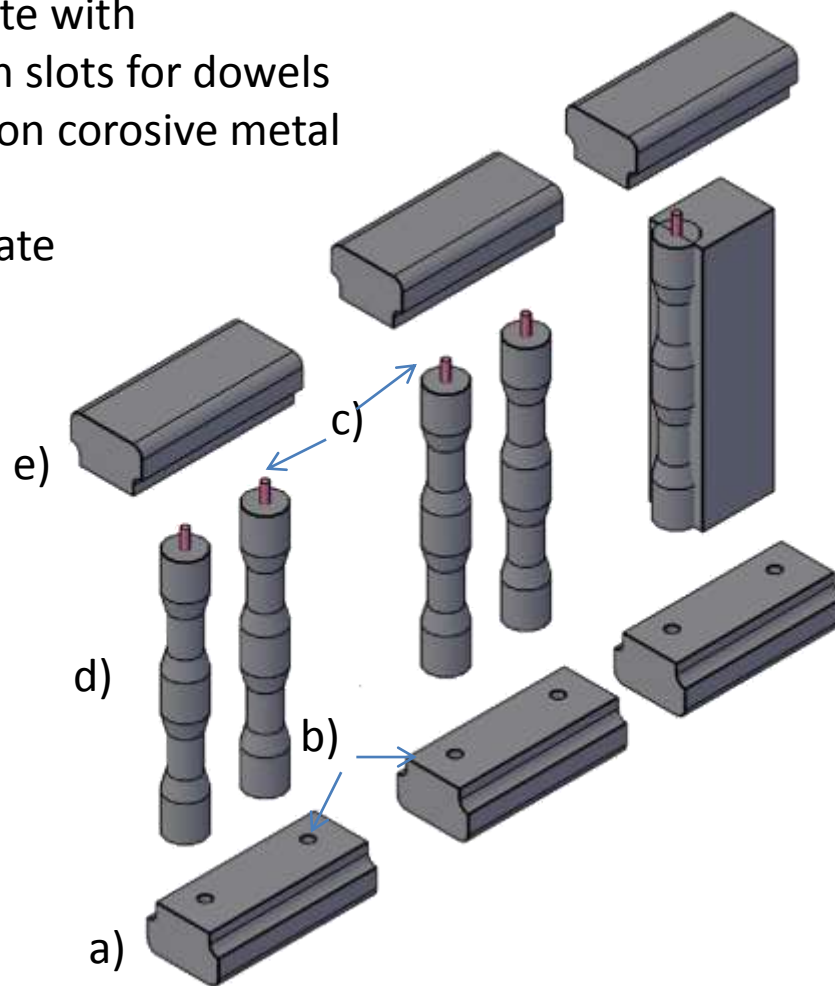


➤ Balusters

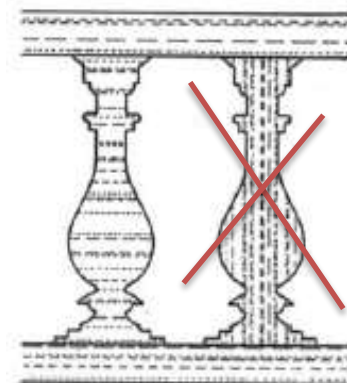
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Because of cost issue and necessity of additional work on location, more common practice is to place cover plates without dovetail –it may only be used on critical points like direction change points

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



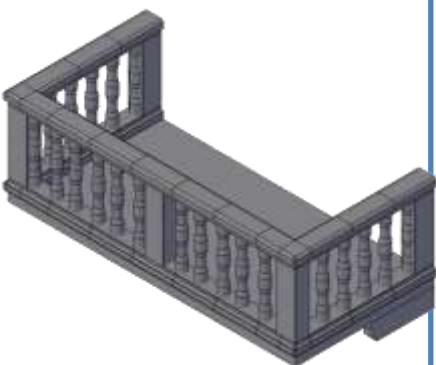
A- baluster
B - pilaster





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➤ Balconies & Masonry



Presjek
- balkonska
ploča
- konzola

*Section view
- balcony plate
- console*

Presjek – crveno = karonska
traka

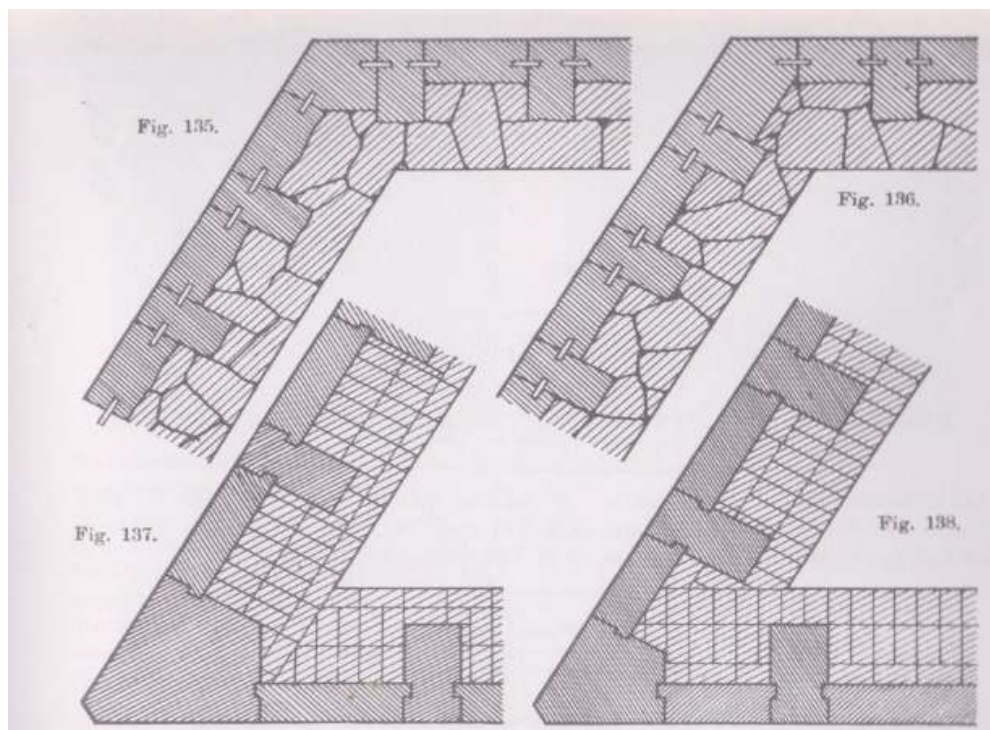
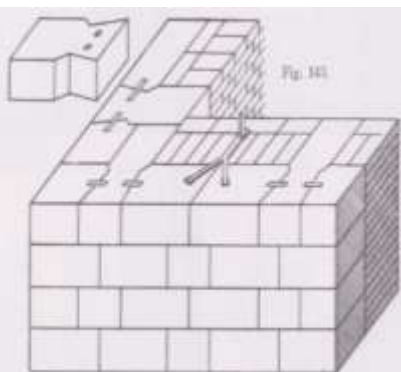
*Section view –
red = carbon fibre*

Konzola
učvršćena
karbonskom
trakom

*Console fixed with
carbon fibre*



➤ Ashlars



Presjek zida od obrađenog kamena:

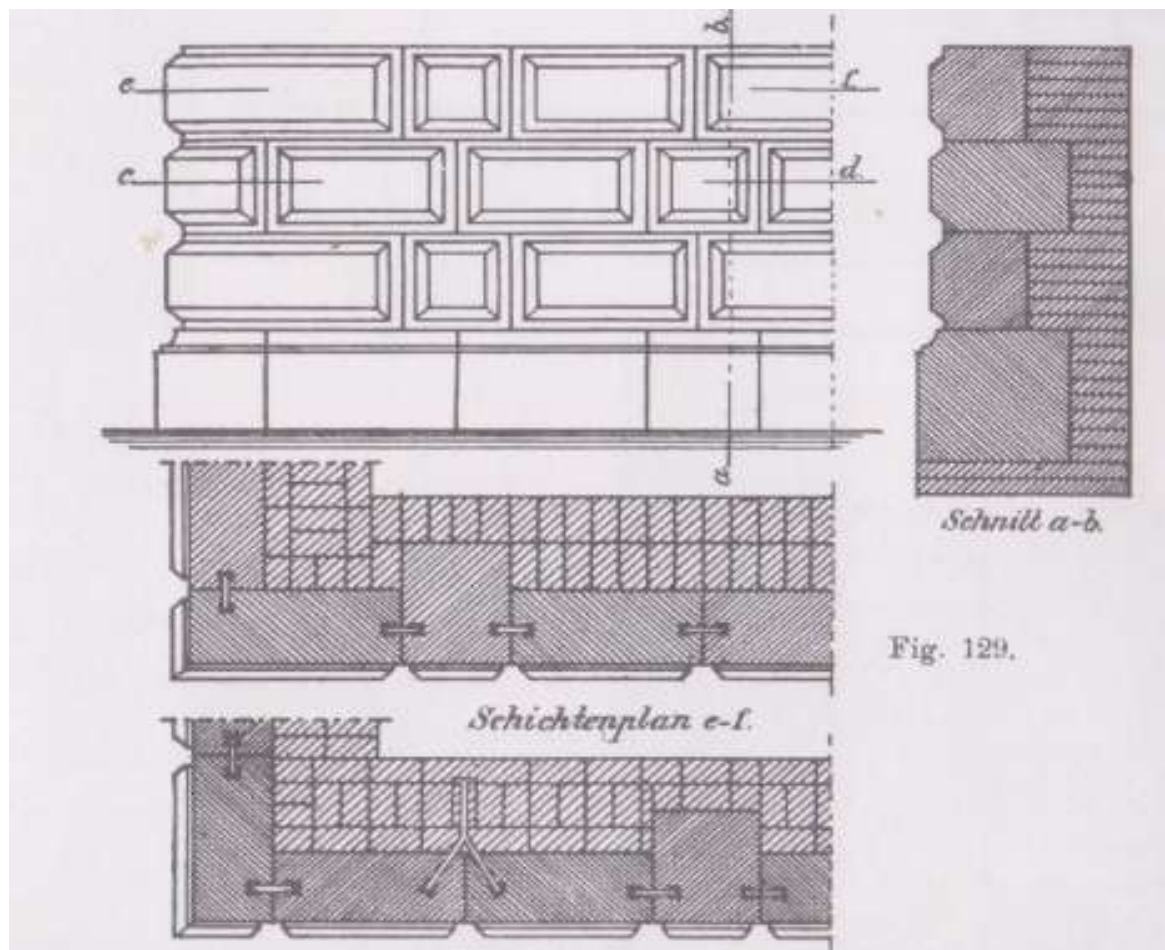
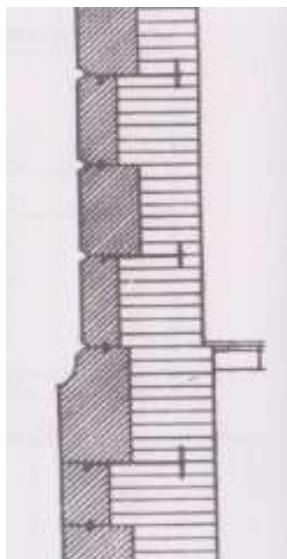
- Sa klamfama
- Uglavljenim klesancima

Examples of cross section of walls made of dressed stone:

- with clamps*
- wedged (docked) ashlars*

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➤ Ashlars



Example of cross section of wall made of dressed stone:
- Upotrebom klamfi i sidara (*with clamps and anchors*)



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➤ Arches

Primjer montaže luka
- bez ankerovanja

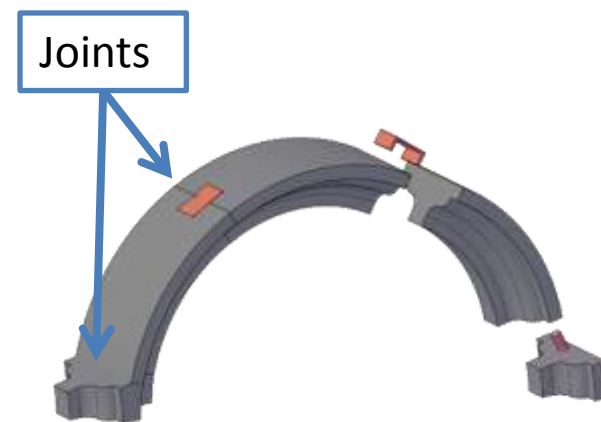
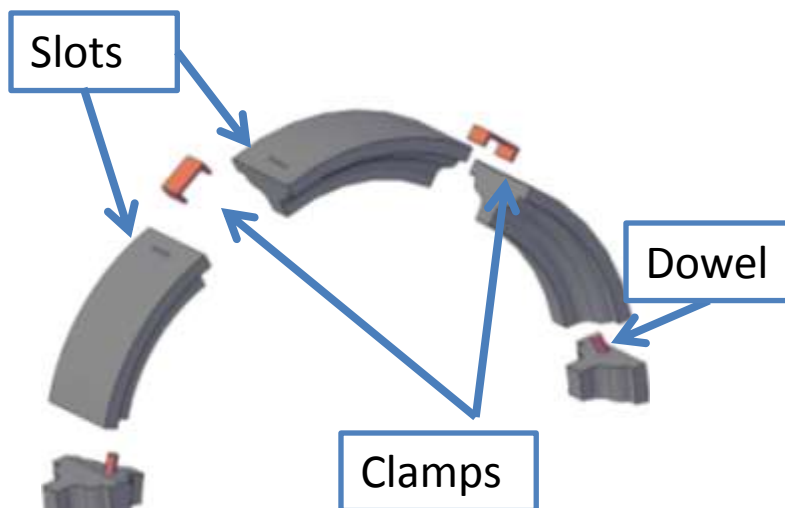
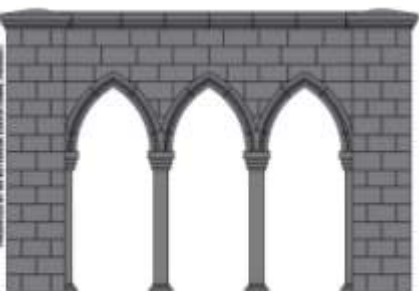
Example of arch placing technique
-without anchors



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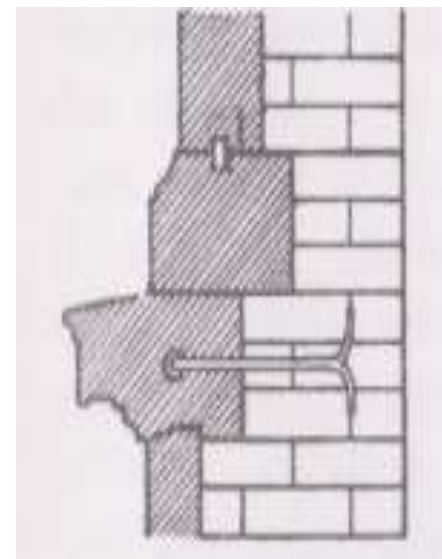
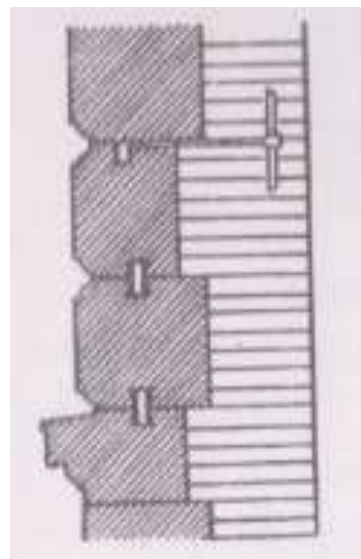
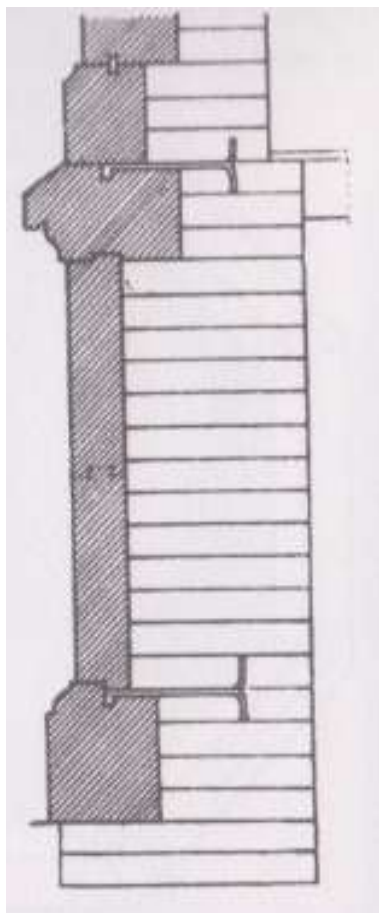
➤ Arches



Example of arch placing technique with dowels, clamps and anchors



➤ **Cornice**

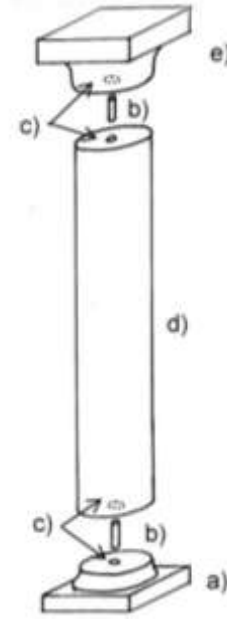
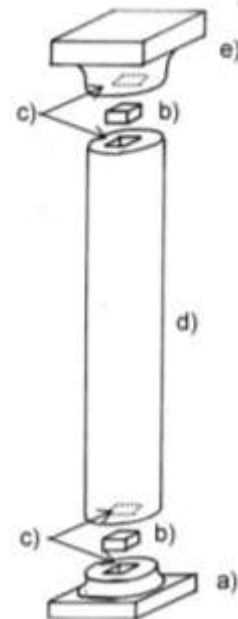


Primjeri presjeka-
Različite tehnike ankerovanja vijenaca

*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

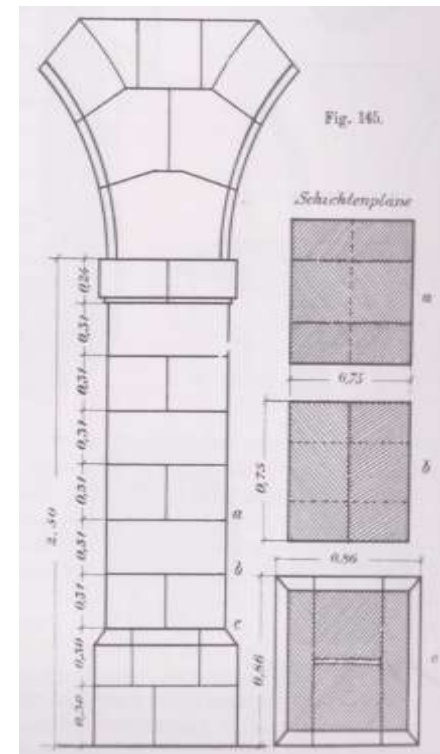


Column made of a series of solid stone cylinders or “drums”, connected on the same way as monolithic column is connected with base and capital.

➤ Columns



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- Bez sidrenja (*without anchoring*)
- Sa sidrenjem i uglavljenim klesancima (*with anchoring and wedged (docked) ashlar*s)
- sa čeličnim sajlama (ashlar's connected with steel tie rod and anchored in construction)



➤ **Balusters**

➤ **Balconies**

& Masonry

➤ **Ashlars**

➤ **Cornice**

➤ **Arches**

➤ **Columns**

- DA BI SE UDOVOLJILO ZAHTJEVIMA OKOLIŠA (ZAŠTITA
KAMENA I MOGUĆNOST OPORABE I RECIKLAŽE)

- *BECAUSE OF ENVIRONMENT PROTECTION
REQUIREMENTS (STONE PROTECTION AND POSSIBILITY OF
REUSE AND RECYCLING)*

MORTOVI I LJEPILA

THE MORTARS AND THE GLUES



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

THE TRADITIONAL MORTARS

Vapneni mort (*Lime mortar*)

lime:sand/aggregate = 1 to 3 ratio

Cementni mort (*Cement mortar*)

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

Produžni mort (*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.



LJEPILA I MASE ZA FUGIRANJE

ADHESIVE MORTARS AND GROUTING PRODUCTS

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.

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



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

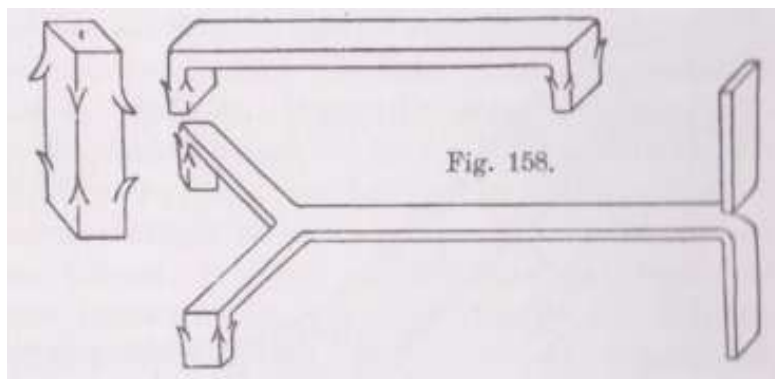
NAČINI UČVRŠČIVANJA KAMENIH ELEMENATA

METHODS FOR FIXING THE STONE ELEMENTS

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

Elementi za učvršćivanje i sidrenje

Elements for fixing and anchoring



-Primjer željeznog pera sa
Zagrebačke katedrale

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

-Pera

-Klamfe

-Sidra

-Dowels

-Clamps

-Anchors



Prednosti lijevanja olova

Advantage of lead anchoring

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



-inhibits water penetration and consequent corrosion
- flexibility: allows fractional and organic movement of the structure under the stress, particularly that caused by earthquakes

-Štiti od korozije
- konstrukciji daje elastičnost posebno važnu u slučaju potresa







CILJ aim

Promoviranje upotrebe mjera zaštite i sigurnog načina rada u kamenolomima kroz izradu inovativnih edukacijskih materijala temeljenih na 3D animacijama

Promotion the use of risk prevention measures in the quarries through the production of innovative training material based on 3D animations.

Predviđeno **trajanje** projekata – 2 GODINE – odnosno do kraj 2014.



Motivi za izradu projekta

some motives
for the project

☐ Zdravlje i zaštita na radu jedna je od najvažnijih pitanja politike EU vezane za zapošljavanje i socijalna pitanja

☐ *Health and safety in the workplace is currently one of the most important aspects of developing an EU policy in regard to employment and social affairs.*

☐ Postotak ozljeda i profesionalnih oboljenja još je uvijek vrlo visok

☐ *The rates of accidents and work-related illnesses are still very high accross EU countries*

☐ Stanje je posebno izraženo u industiji kamena i to u kamenolomima

☐ *This situacion is particularly relevant in natural stone indistry, especially in the stone quarrying sector*



Tehnološki centar za mramor - Španjolska

Marble and Natural Stone Technology Center, Spain



Finsko udruženje za prirodni kamen

Finnish Natural Stone Association, Finland



Klesarska škola – Freiburg, Njemačka

Stonemasonry school FWG– Freiburg, Germany



Sveučilište primjenjenih znanosti - Finska

Saimaa University- Finland



Konzultantska kuća - Španjolska

Consalting firm- Spain



Partneri
na
projektu
partners on
the project



Faze projekta

Phases of the
project

1. Prikupljanje regulative u uključenim zemljama i na razini EU

(A compilation of EU and country-specific regulations related to safety at work)

2. Izvješća o stanju u sektoru

(A report related to stone quarrying sector)

3. Izrada multimedijских edukacijskih materijala

(A multimedia learning tool)

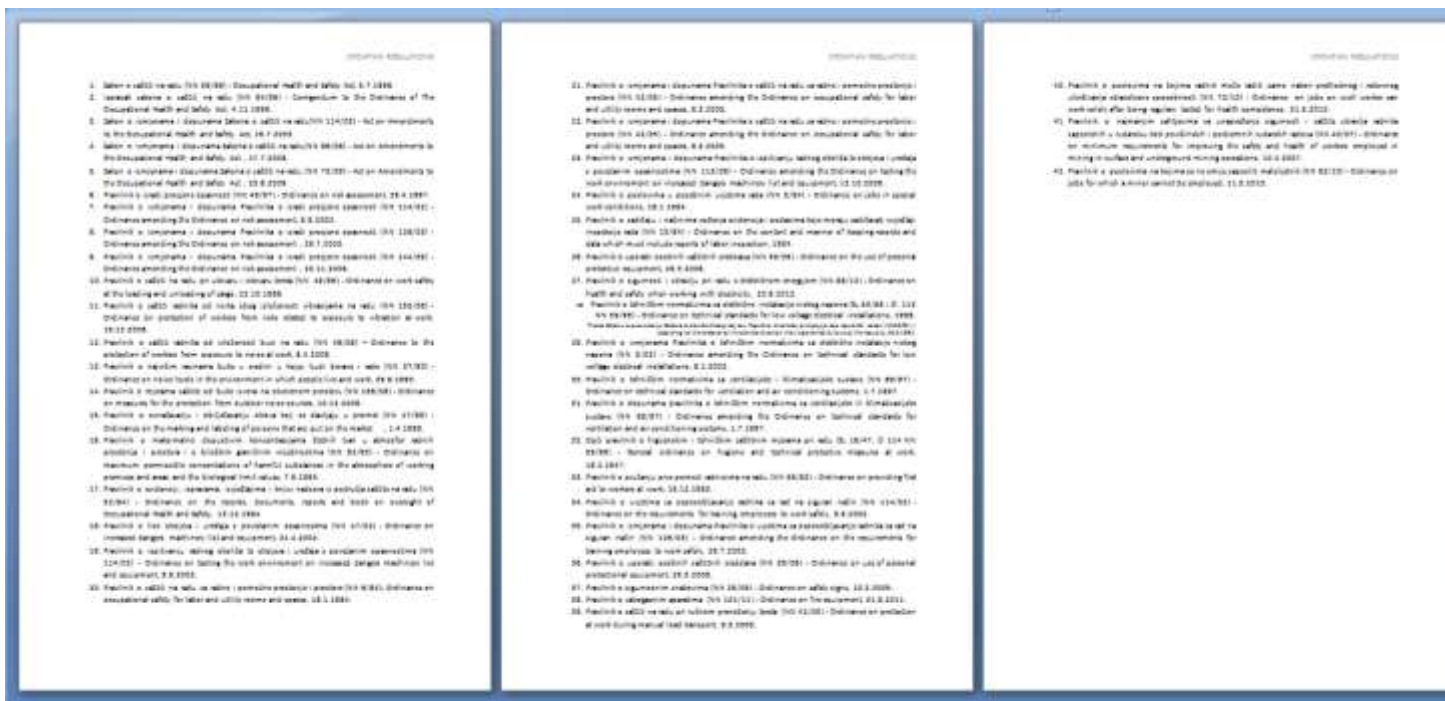
4. Izrada web stranice projekta

(A website for the project and its products)



Doprinos 1. fazi Contribution to the 1st phase

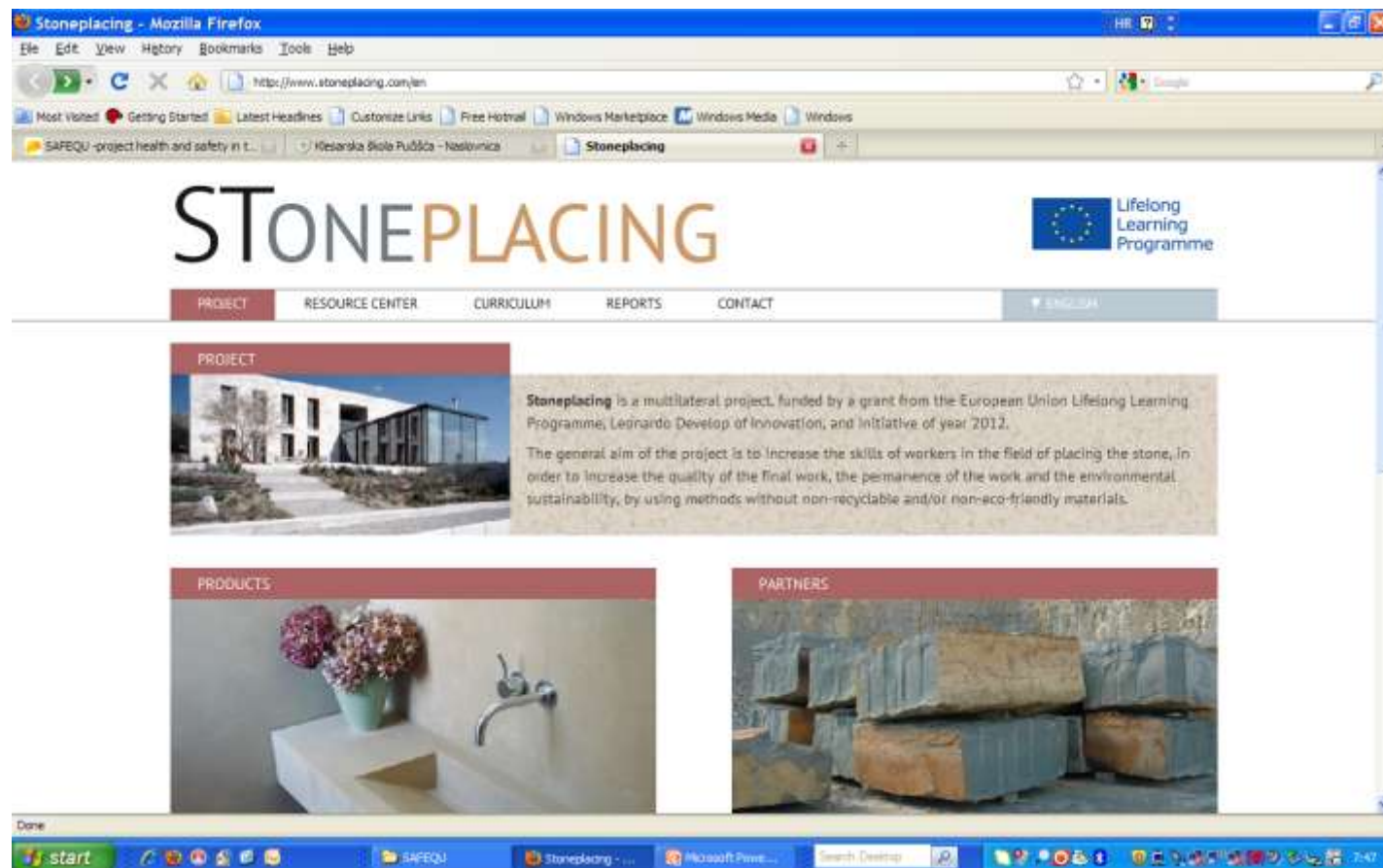
Propisi vezani uz zaštitu na radu i prevenciju rizika *Regultions related to safety at work and risks' prevention*





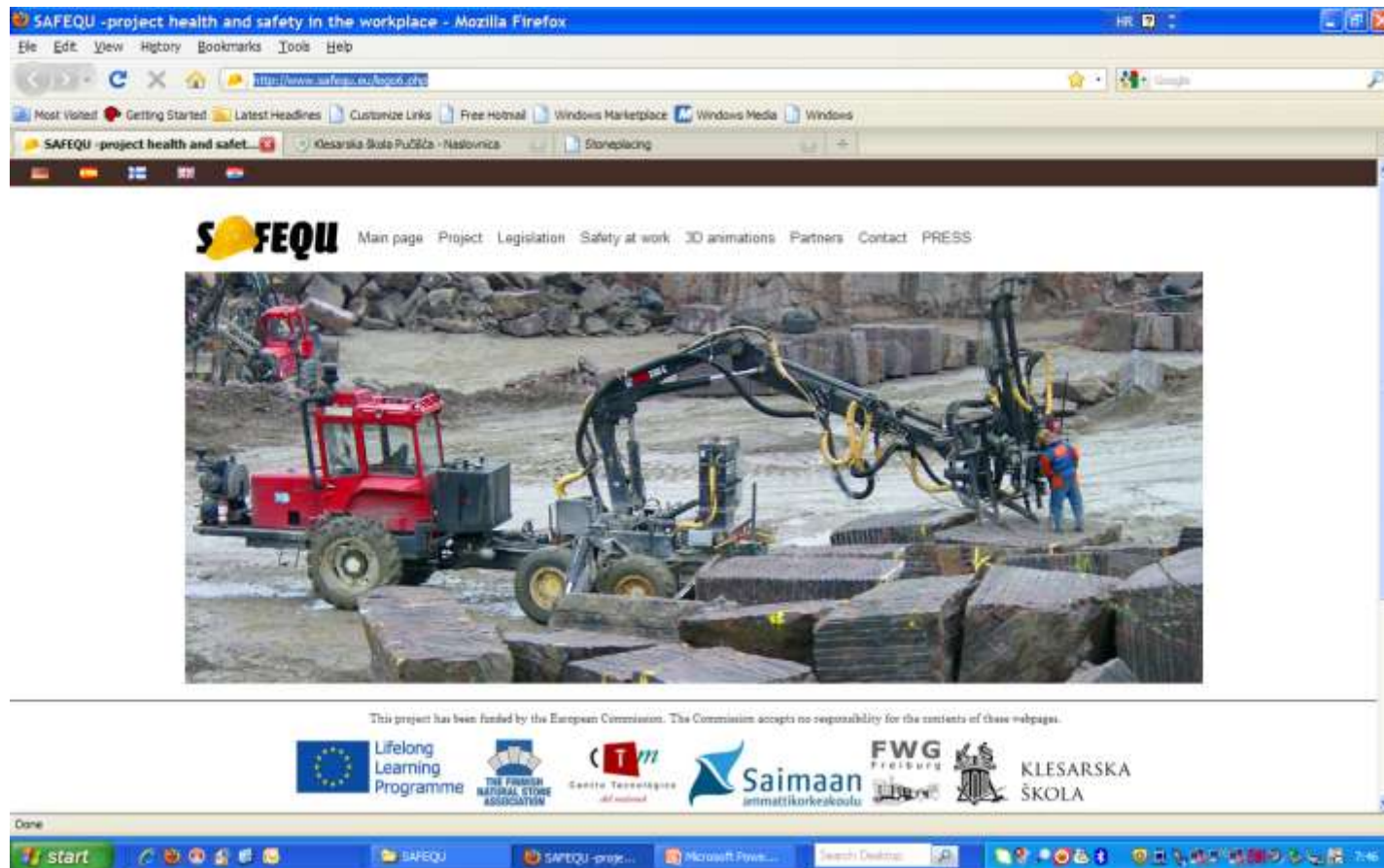
<http://www.stoneplacing.com/en>

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<http://www.safequ.eu/>





Klesarska škola Pučišća

WEBMAIL KNJIŽNICA SPAJALICA OnLine TEČAJEVI FORUM KONTAKTI PROJEKTI



:: Naslovnica ::

Naslovnica	
O školi	
Lokacija	
Projekti	
Nastava	
Razredi	
Kutak za roditelje	
Kutak za učenike	
Dokumenti	
Izdavaštvo	
Naši bivši učenici	
Foto-galerija	

vijesti

RAZDIJOBA TJEDNIH RASPOREDA ZA 2. POLUGODIŠTE

Radi rasporeda privatne prakse koju pohađaju klesari (IIIb razred) nastava se odvija kombinirano po tjednima. U tablici je prikazana razdioba tjedana za 2. polugodište. Raspored možete naći u rubrici Razredi.

11.2. - 15.2.	I TJEDAN
18.2. - 22.2.	II TJEDAN
26.2. - 1.3.	III TJEDAN
4.3. - 8.3.	IV TJEDAN
11.3. - 15.3.	I
18.3. - 22.3.	II
25.3. - 29.3.	IV (bez IIb - privatna praksa 40 sati)
2.4. - 5.4.	III
8.4. - 12.4.	I
15.4. - 19.4.	II

Projekti i partneri



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Done



Hvala na pažnji
Thank you for your attention

Autor:
Tamara Plastić, Klesarska škola